Hanson Construction Materials Pty Ltd.

Sancrox Quarry Expansion Project

Environmental Impact Statement

ERM Ref: 0418291

October 2019

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CERTIFICATION OF ENVIRONMENTAL IMPACT STATEMENT FOR THE SANCROX QUARRY EXPANSION PROJECT.		
This Environmental Impact Statement (EIS) was prepared by Environmental Resources Management Pty Ltd (ERM) supports an application by Hanson Construction Materials (Hanson) for the Sancrox Expansion under Part 4 of the Environmental Assessment and Planning Act 1979.		
PROPONENT:	Hanson Construction Materials Pty Ltd (Hanson)	
Applicant's Address:	C/o Environmental Resources Management Australia Pty Ltd. Locked Bag 3012, Australia Square NSW 1215	
Proposed Development:	Sancrox Quarry Expansion	
EIS COMPILATION BY:	Thomas Buchan	Murray Curtis
Qualifications:	BEnv.S (ACU)	BEng (UNE)
Address:	Environmental Resources Management Pty Ltd Locked Bag 3012, Australia Square NSW 1215	
CERTIFICATION	We certify that we have prepared the contents of this EIS to the best of our knowledge. The EIS has been prepared in accordance with Schedule 2 of the *Environmental Planning and Assessment Regulation 2000* and contains all available information that is relevant to the environmental assessment of the development. The EIS draws on the work undertaken by a number of technical specialists engaged as part of the Project Team with the information contained in the EIS neither false nor misleading.	
Signature:		
Name:	**Thomas Buchan**	**Murray Curtis**
Date:	1 October 2019	

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EXECUTIVE SUMMARY

E.1 BACKGROUND

Hanson Construction Materials Pty Ltd (Hanson) currently operates a hard rock quarry, known as Sancrox Quarry, on Sancrox Road, Sancrox, located approximately 8 km west of Port Macquarie. The Sancrox Quarry is within the Port Macquarie Hastings Council (PMHC) local government area on the Mid North Coast of NSW. The current Sancrox Quarry comprises Lot 2 DP 574308, Lot 353 DP 754434, Lot 1 DP 720807 and Lot 1 DP 704890. The quarry is considered a major economic resource for regional and state development.

E.2 PROPOSED ACTIVITY (THE PROJECT)

Hanson proposes to extend the life of the quarry by expanding the approved extraction boundary and increase the annual extraction limit. In addition to the quarry expansion, Hanson also proposes to establish a concrete batching plant, an asphalt production plant and a concrete recycling facility. These proposed activities are herein referenced as 'the Project'. The Project will facilitate the extraction, production and distribution of high quality construction materials for the use in civil infrastructure and road construction projects. A summary of the Project and associated developments is provided in the Project Description Summary (*Table 1*) below.

Table 1 Project Description Summary

Project Components/Aspects	Currently Approved Sancrox Quarry	Proposed Project
Quarry Life	20 years	30 years
Limits on production	455,000 tpa	750,000 tpa
Quarry Footprint	17.18 ha	48.61 ha
Final Quarry Depth	RL – 14m AHD	RL – 40m AHD
Product Processing Plant and Stockpile Area	Located in north-east corner of site	To be relocated to the south of quarry pit
Site Office, Weighbridge and Workshop	Located near site entrance	To remain in the same location
Water Holding Dams (WHD)	Two located in the south-east corner of site	To remain in same location. Additional WHDs will be constructed throughout the various stages of the Project to manage sediment.
Concrete Batching Plant	Not currently operating	20,000 tpa To be located in north-east corner of site
Concrete Recycling Facility	Not currently operating	20,000 tpa To be located in north-east corner of site
Asphalt Production Plant	Not currently operating	50,000 tpa To be located south of quarry pit

Project Components/Aspects	Currently Approved Sancrox Quarry	Proposed Project
Hours of Operation	Quarry operates: - 7am – 5pm Monday to Friday - 7am – 1pm Saturday Truck movements and equipment loading: - 7am-11pm Monday – Friday -7am – 1pm Saturdays, Sundays and Public Holidays. Operations are permitted between 11:00pm and 7:00am on a maximum of 20 occasions within a year.	Quarry operations (incl. production and maintenance): 24 hours a day, 7 days a week Truck movements and equipment loading: 24 hours 7 days Blasting: 8am – 5pm Monday to Friday
Employee numbers	15 full-time employees (with casual and contractors on an as needed basis)	10 additional full-time employees, resulting in 25 full-time employees.

The proposed quarry expansion will be completed in five separate stages, over the 30 year lifetime of the Project. Existing quarry operations will continue as much as possible during construction of the proposed infrastructure.

It should be noted that during the preparation of this Environmental Impact Statement (EIS) the original quarry footprint that was submitted in the Preliminary Environmental Assessment (Hanson 2015) was modified. The modification was a reduction in the footprint in the north western corner to avoid the risk of flooding, as identified throughout the Hydrology Assessment prepared as part of this EIS. The updated footprint is presented in *Chapter 2* of this EIS. The original proposed footprint and the reduced footprint are demonstrated in *Figure 8.1*. Where potential impacts were considered to be reduced by the decrease in quarry footprint, the assessment retained the original footprint, providing the worst case scenario for the assessment. This worst case approach using the original footprint was utilised in the following assessments:

- Biodiversity;
- Noise and Vibration; and
- Air Quality.

E.3 STRATEGIC JUSTIFICATION / STATUTORY CONTEXT

The Project Proposal is to extract more than 500,000 tonnes of material per year and to access greater than 5M tonnes of reserves. Therefore the development meets the criteria listed by clause 7 (1)(a) and (b), Schedule 1, State Environmental Planning Policy (State and Regional Development) 2011 for assessment as a 'state significant development' (SSD), under section 89C (2) of the Environmental Planning and Assessment Act 1979 (the EP&A Act).

The Project will be assessed as State Significant Development (SSD) as defined under the *State Environmental Planning Policy (State and Regional Development) 2011*, and will require development consent under Part 4, Division 4.1 of the EP&A Act. The Department of Planning, Industry and Environment (DPI&E, formerly the Department of Planning and Environment; DP&E) will be the determining authority.

Consideration of Project with Regional and Local Planning Provisions

The proposed increase in production at the quarry is consistent with the objectives of the Port Macquarie-Hastings Local Environmental Plan RU1 zone. Extractive industries are permitted within the zone with development consent. It is therefore considered that the Project would not fragment or alienate any land or result in conflict with adjoining land uses. The Project would result in the employment of 10 additional staff members (resulting in 25 full-time employees across the entire project) and result in positive local economic benefits.

The continued and additional supply of a valuable resources in the form of aggregate, concrete and asphalt to the local construction industry as well as a facility for recycling of a waste concrete will meet the strategic goals of boosting the local economy and providing the materials to allow for infrastructure and housing developments. The quarry is ideally located away from substantial residential development, and located directly adjacent to the recently upgraded Sancrox Interchange and Pacific Highway, allowing for safe distribution of materials to the surrounding region to facilitate strategic urban growth.

E.4 CONSULTATION

Consultation was undertaken with relevant stakeholders through the environmental impact assessment process as requested throughout the Secretary's Environmental Assessment Requirements (SEAR's), in order to identify key environmental issues relevant to the proposed project. Relevant Government Agencies and Local Aboriginal Land Council Representatives were consulted during preparation of the EIS, and have been outlined in *Chapter 4* of this EIS.

Additionally community consultation was undertaken by the Proponent, which included the development of a Community Consultative Committee (CCC) in accordance with the SEAR's, and has been outlined in more detail in Chapter 4.

Evidence of consultation and associated responses have been compiled and included as *Annex B* of this EIS (Consultation Log).

E.5 APPROACH TO THE ASSESSMENT

In accordance with the NSW Department of Environment and Planning Guidelines for Preparing an Environmental Impact Assessment (DP&E, 2017) environmental factors associated with the project have been categorised into either Key Issues or Other Issues, which in turn dictates the level of assessment undertaken for the aforementioned issues. The separation into either group is primarily based on the potential impacts to each environmental factor, which was highlighted throughout the Preliminary Environmental Assessment (Hanson, 2015) and the SEAR's prepared for the proposed development (SSD 7293).

Key Issues Assessment

A Key Issue Assessment is the highest level of assessment and requires a supporting specialist report, along with a summary of the assessment included as a section within the EIS. Each of the following Key Issues below have been prepared in accordance with the former DPE guidelines (and relevant industry guidelines and standards) and associated specialist reports are provided as annexures throughout the EIS.

The Key Issues Assessments prepared for the EIS include:

- Biodiversity (*Chapter 5, Annex C*);
- Heritage (*Chapter 6, Annex D*);
- Surface Water (*Chapter 7, Annex E*);
- Groundwater (*Chapter 8, Annex F*);
- Soil and Land Resource (*Chapter 9*);
- Noise and Vibration (*Chapter 10, Annex G*); and
- Air Quality and Greenhouse Gas (*Chapter 11, Annex H*).

Other Issues Assessment

An Other Issue Assessment does not typically require a supporting specialist report as the impacts are generally less significant, and can be routinely managed using standard mitigation and management measures. As the Other Issues Assessments do not necessarily require a specialists report, all information regarding the assessment have been provided in the relevant section of the EIS.

The Other Issues Assessments prepared for the EIS include:

- Traffic and Access (*Chapter 12* and *Annex I*);
- Visual Amenity (*Chapter 13*);
- Socio-economic (*Chapter 14);*
- Hazards and Risks (*Chapter 15*);
- Waste Management (*Chapter 16*); and
- Quarry Closure and Rehabilitation (*Chapter 17*);

E.6 *BIODIVERSITY*

SLR Consulting Australia (SLR) were engaged to prepare a BioBanking Assessment Report (BAR) to support an application by Hanson Construction Materials Pty Ltd seeking project approval for expansion of the existing Sancrox Quarry. The SEAR's for the EIS, as issued by the Secretary of the former DP&E, require the preparation of a Biodiversity Assessment Report (BAR) in accordance with the *Framework for Biodiversity Assessment* (FBA). Refer to *Chapter 5* and *Annex C* for further information.

Direct Impacts

Direct impacts to biodiversity values are described within the FBA as 'an impact on biodiversity values that is a direct result of vegetation clearance from a development'. The final development footprint will involve the following direct impacts to biodiversity:

- clearing of 43.1 ha of native forest vegetation, which includes 0.55 ha of the Subtropical coastal floodplain forest Threatened Ecological Community;
- loss of hollow-bearing trees, some of which may provide potential roost sites and breeding habitat for a selection of bird, arboreal mammal, reptile and microchiropteran bat species; and
- removal of foraging habitat for locally occurring native fauna, in particular for threatened microchiropteran bats species, ground mammals, arboreal mammals and a range of bird species.

Impacts requiring Offsets

According to Section 9.3 of the FBA, impacts on native vegetation that require an offset include:

- impacts on EECs and CEECs, unless specifically nominated in the SEARs as an impact requiring further consideration; and
- impacts on PCT's associated with threatened species habitat and in a vegetation zone that has a site value score of >= 17

All vegetation zones mapped within the site have current site value scores of over 17 (refer to *Section 6.5.1* of the BAR) (SLR, 2018) and represent habitat for at least one threatened species; hence any clearing in these vegetation zones would require an offset.

In the attachments to the SEARs (see Appendix A of the BAR), the Office of Environment and Heritage (OEH) identify impacts that require further consideration. OEH states "Impacts on the following species, populations and ecological communities will require further consideration and provision of the information specified in S.9.2 of the Framework for Biodiversity Assessment:

- Biconvex Paperbark (*Melaleuca biconvexa*);
- Spider Orchid (*Dendrobium melaleucaphilum*); and
- Southern Swamp Orchid (*Phaius australis*)."

No evidence for the threatened plant species provided above was recorded during field surveys undertaken as part of the BAR. It is noted that targeted searches for threatened plants were conducted across the site on several occasions during 2015 and 2016, including during the known flowering period of the two orchid species and no individuals of these species were recorded.

Preferred Offset Strategy

The preferred offsetting option for the proposed development is a combination of the offset Options provided in Section 7.3 of the BAR (SLR, 2018), being:

Ecosystem credits:

- Generate available ecosystem credits from the proposed Offset Site – create a BioBanking Agreement over the Offset Site in consultation with OEH. This action will only provide some of the ecosystem credits required – most of the ecosystem credits required will need to be purchased.

- Purchase remaining like-for-like ecosystem credits from Credit Register (or approach potential credit sellers through the Expressions of Interest register).

- Purchase 'variation credits' by applying variation rules, in the scenario that like-for-like credit cannot be found after apply "reasonable steps". An Expression of Interest for the required credits will be published on the Office of Environment and Heritage (OEH) BioBanking 'Credits Wanted' register.

Species credits:

- No species credits required.

Supplementary measures:

- Identify and revegetate lands within the Sancrox Quarry that could form part of a north-south biodiversity corridor link through the site, in accordance with the 'notional linkage' identified for the Greater Sancrox Structure Plan (Phillips and Hopkins 2011).

The results of the BAR (SLR, 2018) suggest that there will be minor impacts to biodiversity (mainly vegetation) as a result of the proposed development. However the Biodiversity Offset Strategy (BOS) prepared for the proposed development proposes to offset approximately 49 ha of native vegetation by investing in a nearby parcel of land (creating an estimated 502 ecosystem credits), with the remainder of the ecosystem credits being purchased in due course.

E.7 HERITAGE

ERM was engaged by Hanson to undertake a Heritage Assessment to inform the EIS for the Project, which considered both Aboriginal and non-Aboriginal historic heritage values.

The objective of the Heritage Assessment was to meet the requirements of the SEARs, The Heritage Council of NSW and the NSW Office of Environment and Heritage. It provides a combined assessment of the tangible and intangible heritage values relating to the Project site, as identified during desk based assessment and field surveys undertaken in November 2017.

The assessment was undertaken using desktop analysis, archival research, field survey and Aboriginal stakeholder consultation. The assessment was undertaken in accordance with relevant legislative requirements and guidelines as listed in the assessment.

Searches of the local and state heritage registers were conducted in order to identify any historic heritage sites located within the Project site. A search of the Aboriginal Heritage Information Management System (AHIMS) site register was also conducted, to determine the location of any Aboriginal heritage sites within or surrounding the Project site.

Significance Assessment

Based on the desktop assessment, any surviving sites and features of non-Indigenous cultural heritage value within the Project site would be limited to portable domestic and rural artefacts, or features associated with grazing and timber extraction activities.

The archaeological survey did not result in the identification or recording of Aboriginal archaeological or cultural sites within the proposed extraction area, except for one potential scar tree located to the north of a small farm dam at the western extent.

The significance assessment prepared as part of the Heritage Assessment has been reproduced as *Table 2* below:

Table 2 Significance Assessment

Element	Significance Criterion	Assessment	Level of Significance
Potential Scarred Tree	Scientific	Has not been confirmed as a scarred tree.	Low
	Cultural	No further comments provided by the RAPS	Low
Potential Ceremonial Site	Scientific	Location cannot be confirmed. No physical evidence.	Low
	Cultural	Ceremonial sites are highly significant to local communities.	High

Mitigation Measures

Mitigation measures have been outlined throughout *Chapter 6* and *Annex D* of this EIS, and have been summarised below:

- In the unlikely event that historic or Aboriginal heritage items are found during works, the Unexpected Finds Protocol outlined in *Chapter 6* will be followed.

- In order to comply with best practice principles, all employees and subcontractors will undergo environmental awareness training as part of the site induction to ensure they understand their obligations and responsibilities.

E.8 *SURFACE WATER/HYDROLOGY*

Environmental Resources Management Australia Pty Ltd (ERM) was engaged by Hanson Construction Materials Pty Ltd (Hanson) to conduct a Hydrology Assessment to inform the Environmental Impact Statement (EIS) for the proposed Sancrox Quarry Expansion Project (the Project) (refer to Chapter 7 and *Annex E* of this EIS for additional information).

The Hydrology Assessment was prepared to address, and meet the requirements of relevant guidelines and legislation, as listed in the assessment.

In order to undertake the assessment, an investigation of the site was undertaken to understand the existing hydrological aspects of the surrounding area, and the current sediment controls.

To further inform the understanding gained from the site inspection, ERM undertook the following desktop activities:

- review of previous reports prepared for the quarry site;

- review and interpretation of:

  - aerial photography;

  - site survey; and

  - Proponent and PMHC supplied Geographical Information System (GIS) data.

Additionally, site hydrological data was obtained from an Intensity-Frequency-Duration (IFD) table developed for the site using the process outlined in Australian Rainfall and Runoff (Pilgrim, 1987).

Assessment

Potential impacts have been outlined throughout the Hydrology Assessment (ERM, 2018b) and summarised in *Table 3* below.

Conclusion

The hydrology assessment identified the potential soil and water impacts and constraints related to the Project. An erosion hazard assessment was undertaken using the RUSLE to determine the potential impacts of the Project, and this in turn was utilised to design the predominant mitigation measure for managing sediment-laden run-off generated by the site - the conceptual sediment basins.

The water balance for site operations demonstrates that surface water is available to meet the demands of the Project. The additional input provided by groundwater entering in to the quarry void will further supplement the water supply available for use. An aquifer interference approval will be required for the consumption of this groundwater (refer to *Groundwater Assessment* for further details).

A surface water monitoring program has been prepared and the site Environmental Protection Licence (EPL) will need to be varied to incorporate the proposed revision to current water monitoring. The program outlines the proposed surface water monitoring regime for the sediment basins that will be installed as the staged expansion progresses. With the implementation of sediment basins, the utilisation of the mitigation measures and the development of a Surface Water Monitoring Program (SWMP) and Progressive Erosion and Sediment Control Plans (PESCPs), the potential soil and water impacts of the Project can be effectively managed so that there is no significant, negative impact to the environment.

Table 3 Potential Hydrological Impacts

Construction Activities	Potential Impacts	Duration of Impact	Significance
Unsealed road network	• Creation of fugitive dust emissions due to vehicle movements. • Mud tracking at confluence of internal access roads with public road network.	Persistent during establishment of new stages and lifetime of quarrying operations. Internal road network will progressively increase as new stages are developed.	Low - access tracks created during stage establishment will be managed by sediment basins. Internal quarry roads during operation will runoff towards basins. Dust suppression measures proposed.
Establishment of future quarry stages	• Erosion of large disturbed areas during staged/progressive establishment and subsequent sedimentation of run-off. • Creation of fugitive dust emissions due to land and vegetation clearing activities. • Mulch stockpiles generating leachate run-off that may enter the surrounding surface water network.	Progressively increasing with life of quarry. Each basin for each stage will be functional until the quarrying excavates such that the run-off falls into the quarry void. This has been assumed to be no longer than three years per basin.	High – Significant area (greater than 38 ha is to be disturbed to allow for future quarry stages). It will be effectively managed by sediment basins until quarry void engulfs the catchment. Improvements to current site water management will be achieved by the establishment of the basin in the processing area and improved management in the proposed asphalt plant catchment via the conveyance of runoff to existing WHD 1.
Dewatering of site sediment basins and water accumulation points	• Introduction of contaminated water to natural surface waters, including release of water with high suspended solids.	Persistent during establishment of new stages and quarry operations.	Medium – Industry Standard procedure to dewater will manage risk. Surface water monitoring program and EPL variation will outline criteria for discharges/overflows from site water holding bodies.
Stockpile management	• Erosion of stockpiles and loss of soil resource. • Introduction of contaminated water to natural surface waters.	Persistent during quarry operational activities.	Low – dust suppression and management of moisture content, along with progressive stabilisation of topsoil to be used for rehabilitation limits risk.

Construction Activities	Potential Impacts	Duration of Impact	Significance
Concrete Batching Plant	• Contamination of waterways from water impacted by cement (washouts, cement storage areas, immediate vicinity of batch plant). • Release of water to soil and/or water bodies with increased pH, total suspended solids (TSS) and potentially other contaminants.	Lifetime of concrete batching plant	Medium – control measures as per *Section 7.5* to be implemented to manage risk and prevent negative impacts.
Asphalt Production Plant	• Introduction of hydrocarbon contamination to plant pad site, and subsequent potential contamination of run-off.	Lifetime of asphalt production	Low – industry standard practice limits potential for impacts
General site activities	• Hydrocarbon spills from machinery (burst hoses, mechanical failures, leaking machinery, etc.). • Contamination of waterways from hazardous substances due to incorrect storage (including drums and containers and spent oil filters). • Increased refuse in streams due to littering. • Contamination of soils and waterways from poor refuelling practices. • Discovery of previously contaminated sites.	Persistent throughout establishment of each stage and quarry operation	Low – risk is comparable to other construction activities. Within quarry void have very low potential for off-site contamination or surface water due to the topographical separation provided by the excavated void.
Water supply from within site	• Over-extraction of surface water or groundwater resulting in reduced environmental flows, reduced water availability for existing licensed users and impacts on water–dependent ecosystems.	Water required throughout entire lifetime of quarrying and concrete batching operations. Minimal volumes required during construction for dust suppression.	Low- Water balance undertaken to determine available water from existing and proposed water holding bodies. See *Section 7.*

E.9 GROUNDWATER

In order to meet the objectives of the groundwater related aspects of the SEARs, ERM conducted the following scope of works:

- a desktop assessment to describe the environmental site setting, including a search for groundwater users (both registered groundwater bores and groundwater dependant ecosystems) using publically available database sources;

- a groundwater field program to undertake aquifer parameter testing and groundwater and surface water sampling to characterise the aquifer system underlying the Project site; and

- groundwater modelling to evaluate groundwater inflow rates into the expanded quarry as well as potential groundwater drawdown proximal to the quarry and the potential magnitude of drawdown at identified groundwater users.

Groundwater Modelling

A numerical groundwater flow model (Model) was created to simulate the current hydrogeological conditions and at final quarry expansion. The Model was undertaken to address the impact assessment requirements of the NSW Aquifer Interference Policy. This included:

- estimating water take through groundwater inflows to the pit; and

- predicting groundwater level drawdown associated with pit development at groundwater user locations (both registered groundwater bores and the closest identified groundwater dependent ecosystem).

While the Project will include the expansion of the existing pit in multiple stages, the modelling was undertaken for a steady state scenario taking into consideration the full extent of the final planned pit void (at which stage steady state groundwater flow to the pit will be greatest and potential groundwater level drawdown proximal to the quarry will be greatest).

Results

The groundwater flow modelling indicates a steady state groundwater inflow rate of approximately 40 to 60 m^3/day to the final pit void, which equates to approximately 15 to 22 ML/year. The predicted steady state inflows are modest for a pit void of the proposed size, and the relatively low predicted inflow rates align with observations from the existing quarry where no active dewatering takes place and groundwater seepage into the pit is reportedly negligible.

Taking into consideration the impact assessment requirements of the NSW Aquifer Interference Policy, the predicted 2 m level drawdown contour for the stabilised cone of depression is of particular significance (as the minimal impact considerations specify a maximum of a 2 m decline at any water supply network). The modelling indicates that at its furthest extent (from the outer perimeter of the final pit) the 2 m drawdown contour may extend to approximately 800 to 1,100 m from the final pit (based on the base case and sensitivity run scenarios respectively).

Potential impacts may vary from negligible (if drawdown does not affect the operation and use of the bore) to significant if water level drawdown is such that it affects the useability of the bore.

Mitigation Measures

The NSW Aquifer Interference Policy specifies that monitoring requirements need to be developed that allow for the monitoring of actual impacts compared to predicted impacts, allowing for contingency plans to be enacted in a timely manner if actual impacts are higher than predicted and these impacts are found to be significant. It is recommended that a groundwater monitoring plan be developed that includes specifics of such a monitoring program, including threshold trigger values as well as a contingency strategy if triggers are exceeded.

While the development of such a plan falls outside the scope of this assessment, recommendations for monitoring requirements to be included in the Groundwater Monitoring Program would consider Water Take, Water Levels and Water Quality, which have been discussed in detail throughout *Chapter 8*.

Based on the findings presented throughout this chapter, and the results outlined throughout the Sancrox Quarry Expansion Groundwater Assessment (ERM, 2018c), it is concluded that impacts to groundwater as a result of the proposed development are expected to be minimal. This conclusion is based under the assumption that the mitigation measures outlined throughout *Chapter 8* (and throughout the Groundwater Assessment) are adhered to during and post-construction.

E.10 SOIL AND LAND RESOURCE

Existing Landform and Geology and Soil Characteristics

The Project site is situated in remnant open sclerophyll forest that is not currently used for agricultural production. An unsealed access track is located in the west of the Project site that provides access to the adjacent areas that have previously been cleared of vegetation and are used for cattle grazing.

The topography of the Study Area is characterised by floodplains and low lying hills up to approximately 60 m Australian Height Datum (m AHD), which is the highest point of the Study Area.

The 1:250,000 Hastings Geological Map Series SH 56-14 indicates that the Project site is situated over the Byabbara Beds Formation of the Carboniferous Period and Palaeozoic Era. The Byabbara Beds are characterised by lithic sandstone, siltstone, tuff, shale and limestone.

The soils at the Project site have predominately been removed prior to the excavation of the quarry in search of 'hard rock'. The highly disturbed extraction area is characterised by exposed rock and crushed particles of rock and clays. According to the soil landscapes described by Atkinson (1999), the majority of undisturbed portions of the Project site are part of the Cooperabung Soil Landscape. The western and southern extent of the Project site extends into the Euroka Soil Landscape. A small portion of the western extent of the Project site comprises the Kundabung Landscape. Additional information on each soil landscape group and dispersibility is outlined throughout *Chapter 9* of this EIS.

Assessment

Land and Soil Capability Assessment

None of the land within the Project site is in the highest land and soil capability (LSC) classes of land that is capable of a wide range of land uses. The largest percentage of the land within the Project site is LSC Class 6, low capability land that is capable of limited land uses. The next largest area is LSC Class 5 land that is moderate to low capability land. The small area of land in the western portion of the Project site is LSC Class 4 land of moderate capability. More information is provided in *Chapter 9* of this EIS.

Strategic Regional Land Use and Compatibility with Other Land Uses

Clause 12 of the *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007* requires assessment of compatibility of the Project with other land uses in the vicinity, particularly agricultural land use. The investigation of the agricultural mapping databases above identified that there is no conflict with the Project site and adjacent agricultural lands.

The Project site is zoned as primary production under the 2011 Port Macquarie Hastings Local Environmental Plan, though historic aerial imagery reveals has remained predominately unchanged (with the exception of an access track construction, a small dam and small plot of clearing between 1969 and 1989) as native open forest vegetation for approximately 58 years. Significant public benefit will be provided by the alteration of this currently unutilised land by the Project, with a longer term, reliable supply of rock for local development projects becoming available.

Contamination

No contamination risk is present or will be introduced by the Project that would warrant not undertaking the activity. Chemical and hydrocarbon management, spill prevention and control mitigation measures as outlined in *Chapter 7* to be implemented.

A site walkover will be undertaken prior to clearing activities taking place to ensure that any refuse is identified and can be removed from site and disposed of at an appropriate licenced location.

Should unexpected contamination be identified, works will cease and an appropriately experienced contamination specialist engaged to develop a strategy to manage the contamination.

Mitigation Measures

A number of mitigation measures have been outlined in Chapter 9 addressing impacts to soils, contamination, erosion and sediment and land slippage and will be implemented as required to ensure impacts are reduced where practicable.

E.11 NOISE AND VIBRATION

Environmental Resources Management Australia Pty Ltd (ERM) on behalf of Hanson Construction Materials Pty Ltd (Hanson) has completed a noise and vibration impact assessment (NVIA) for the expansion of the Sancrox Quarry, located on Sancrox Road, Sancrox New South Wales (NSW).

The NVIA has been prepared to document the findings of the assessment of environmental (noise, overpressure and vibration) factors, that was conducted in response to the assessment requirements specified for key issues as presented in the revised Secretary's Environmental Assessment Requirements (SEARs), dated 18 September 2017 for the Sancrox Quarry Extension Project (SSD 7293).

It should be noted that during the preparation of this report the quarry pit layout was modified in the north western corner, due to the risk of flooding identified in the Hydrology Assessment (ERM, 2018b). The updated staging layout is presented in *Chapter 2* of this EIS. Based on these minor changes to the pit layout, it is not anticipated that noise impacts will alter significantly. Therefore the original noise modelling results have been retained for this report.

The assessment was conducted to achieve a scope of works that allowed for the successful identification of potential receptors situated in the vicinity and potential area of influence of site emission sources and identification of significant noise and vibration generating plant, equipment and/or activities associated with the quarry and their likely/known emissions. The overall assessment methodology is presented in Chapter 2 of the NVIA (ERM, 2018d).

Potential impacts associated with construction road traffic and ground-borne noise, and impacts associated with construction and operational vibration were qualitatively assessed.

The assessment has identified that both construction and operational noise levels have the potential to exceed the applicable criteria, limits and thresholds of the *NSW Environment Protection Authority (EPA) – NSW Environmental Noise Management – Industrial Noise Policy (INP), January 2000* and the *NSW Interim Construction Noise Guideline 2009* (ICNG) if they are not suitably mitigated. The assessment also identified the blasting overpressure and vibration levels have only a limited potential to exceed the applicable AS2187 criteria and thresholds, as long as normal blast design planning and consideration for potential environmental impacts occurs.

Based on the NVIA findings noise mitigation, management measures and/or monitoring options were established as considered suitable to the magnitude and extent of the predicted construction and operational impacts.

Construction noise levels will be reduced and impacts (if any) minimised with the successful implementation of the recommendations provided in *Section 10.5*. Construction noise impacts may not be reduced to imperceptible or negligible levels for all receptors during all construction activities; however the recommendations presented in *Section 10.5* will ensure that any residual impacts are minimised as far as is commonly achievable.

Operational noise levels were predicted to exceed the applicable INP operational noise criteria and limits for all modelled conditions. As such, noise reducing mitigation and management measures were established to assist achieve compliance with the INP. The recommended mitigation and management measures have been provided in detail in *Section 10.5*.

E.12 AIR QUALITY AND GREENHOUSE GAS

This Air Quality and Greenhouse Gas (GHG) Assessment has been prepared in accordance with the latest version of Secretary's Environmental Assessment Requirements (SEARs) for the preparation of an EIS for the Sancrox Quarry Extension Project (Department of Planning and Environment, 2017) and forms the air quality assessment for the EIS to be submitted to the NSW Department of Planning and Environment (DP&E). The following scope of works has been undertaken:

- Assessment of potential for ambient air quality impacts and greenhouse gas emissions from construction and operation of the Proposed Project;
- Provision of mitigation measures to minimise impacts to the surrounding land use; and
- Recommendations for ambient monitoring to ensure compliance with legislation.

The Project has the potential for ambient air quality impacts and greenhouse gas emissions from the construction and operation of the following activities as listed in *Table 4*.

Table 4 ***Project Activities likely to cause Air Quality Impacts***

Quarry, including:	Concrete Batching Plant, including:	Concrete Recycling Plant, including:	Asphalt Plant, including:
• Drilling;	• Dry product delivery;	• Product delivery;	• Bitumen delivery and storage;
• Blasting;	• Product storage;	• Product storage;	• High quality aggregate delivery and storage;
• Product handling;	• Product transfer;	• Product handling;	• Dryer emissions;
• Rock processing;	• Pneumatic unloading of moist product;	• Crushing, using primary crusher; and	• Truck load out; and
• Wheel generated dust; and	• Weight hopper and mixer unloading; and	• Wheel generated dust.	• Wheel generated dust.
• Wind generated dust.	• Wheel generated dust.		

The criteria for all the emitted species were established through consideration of relevant legislation and guidelines, as listed in the assessment.

Assessment

The assessment of ambient air quality impacts identified that:

- The cumulative annual mean concentrations of PM10 are below the Approved Methods criterion at all sensitive receptors;

- Contemporaneous analysis identified that the cumulative (background plus project contribution) PM10 24-hour average predicted concentrations indicate exceedances of the Approved Methods Criterion at 13 sensitive receptors.

- Where exceedance of the Approved Methods Criterion occurs, a State Significant extractive development may be assessed against the criteria contained in the Voluntary Land Acquisition and Mitigation Policy for State Significant Mining, Petroleum and Extractive Industry Developments (the Policy) (NSW Government, 2018). Impacts predicted for the Project demonstrate an acceptable level of PM10 24 hour concentrations under the Policy;

- The cumulative annual mean concentrations of PM2.5 are below the Approved Methods criterion at all sensitive receptors;

- Contemporaneous analysis of the PM2.5 24-hour average predicted concentrations are below the Approved Methods Criterion at all sensitive receptors;

- The predicted concentrations for all other species are below the adopted criteria at all sensitive receptor locations.

The Project over its entire life cycle is estimated to release approximately 48.4 million tonnes of CO_2-e into the atmosphere with scope 1 and scope 2 emissions accounting for 74% and 26% respectively of the total emissions. The main GHG emission sources over the life of the project representing 99% of all emissions are:

- Operations – Diesel for transport related purposes (38%)

- Operations – Electricity (26%)

- Operations – LNG (16%)

- Construction – Vegetation clearing (12%)

- Operations – Diesel for stationary energy purposes (6%)

Mitigation Measures

This air quality impact assessment considered all reasonable and feasible mitigation measures to minimise the emissions from the proposed activities at the site, including:

- Roads, which are likely to remain unchanged throughout the Project stages and to be frequently used by machinery, will be sealed using asphalt and swept daily to minimise wheel-generated dust emissions;

- Full dust extraction system for drilling;

- Utilisation of water sprays during truck rear dumping;

- The use of mobile sprinkler systems during the operation of front-end loaders (FELs);

- Dust suppression measures such as water sprays in place at the crushers and screeners;

- Water sprays used on all conveyor transfer points;

- The conveyor loading to be enclosed by a shroud;

- Level 2 watering (more than 2 litres/m^2/hour) applied to unsealed roads to minimise impact from hauling;

- Water sprays to be utilised to minimise wind erosion from stockpiles during wind speeds of over 5.4 metres per second;

- The dry product delivered to the concrete batching and recycling plant and asphalt plant to be stored in aggregate storage bins enclosed on three sides. The walls to extend one metre above the height of the maximum quantity of raw material, and two metre beyond the front of the stockpile. The aggregate storage bins to be fitted with water sprays to keep the stored material damp at all times;

- Cement and cement supplement to be delivered to the concrete batching plant in the agitator trucks and pneumatically fed to the bottom-loaded silos;

- Concrete batching loading point to be totally enclosed with all particulate matter emissions generated by the facility captured by one bag filter located above the pan mixer;

- Concrete recycling facility outloading to be directly to processed material storage bins enclosed on three sides. The walls to extend one metre above the height of the maximum quantity of raw material, and two metre beyond the front of the stockpile. The recycled concrete storage bins to be fitted with water sprays to keep the stored material damp at all times;

- Vapour balancing system to be installed for the delivery of bitumen at the asphalt plant;

- Asphalt plant loading point will be totally enclosed. All particulate matter emissions generated at the loading point will be captured by one fabric filter associated with the natural-gas fired dryer; and

- Vapour recovery system to be employed for transfer of asphalt to trucks.

It is recommended that the Site additionally employs real-time ambient air quality monitoring system. This will allow staff to identify when additional mitigation measures are to be implemented to minimise impact from the onsite activities on days when the background concentrations of PM10 and PM2.5 exceed the criteria set by the Approved Methods.

E.13 TRAFFIC AND ACCESS

This Traffic and Access Assessment was prepared using the following guidelines and information:

- Austroads (2005) Guide to Traffic Engineering Practice- Part 5: Intersections at Grade;

- TTM (2013) Hanson Quarry Expansion Traffic Impact Assessment

- Accident data supplied by Transport for New South Wales;
- Traffic volumes provided by Hanson;
- Road safety information (heavy vehicle traffic etc.) taken from the recent Sancrox Interchange and Pacific Highway upgrades

Assessment

Construction

It is likely that the clearing for the first stage and the establishment of one or potentially both of the plants will occur simultaneously. Truck trips associated with the delivery of quarry product will also continue during these activities. The establishment of the plants and the clearing activities represents construction traffic at its maximum.

The design capacity, intersection types and standard of the recently completed Sancrox Interchange and Pacific Highway (as described in Section 12.3.4 of the Traffic and Access Assessment) is sufficient to accommodate existing traffic on Sancrox Road (including quarry product delivery trucks that will continue during construction) and the short-term increase in:

- light vehicles delivering construction staff to site; and
- heavy vehicles delivering infrastructure and floating clearing plant.

Operation

The typical daily traffic movements would include:

- light vehicle trips transporting staff to and from site concentrated at the start and end times of shifts;
- truck trips delivering quarried product and asphalt;
- concrete agitator trips to deliver concrete to construction sites;
- import of concrete constituents (sand and cement); and
- truck trips delivering waste concrete to site for recycling.

The Project activities will result in additional employees causing a minor increase in light vehicle movements for staff entering and exiting the site during their shifts.

The Project has proposed truck movements and equipment loading 24 hours/day for 365 days a year. Should approval be granted, it will allow for operational traffic to utilise the road network outside of the daytime period. Thus reducing the cumulative impact on traffic during higher volume periods. Based on night time road traffic noise criteria, the total number of truck trips permissible on a local road during the night time period is 18 truck trips (36 movements). The total number of trips permissible within any hour during the night time period is 12 trips/ hour (24 movements/hour), noting that the truck trip limit for the total night time period cannot be exceeded.

Traffic volumes, particularly heavy vehicles such as truck and dog, and concrete agitator vehicles, will increase due to the Project. The operational traffic volume increase, including truck type, has been estimated for each Project activity and is provided in *Chapter 12* and *Annex I* of this EIS.

E.14 VISUAL AMENITY

A qualitative Visual Impact Assessment has been undertaken to assess the potential for the Project to impact the visual amenity of private landowners in the vicinity of the development and key viewpoints in the public domain, such as roads.

The proposed stages of the Project will progress into the peak of the hill to the west of the existing quarry and along the ridgeline further to the west. For the rural residential properties located to the north, south and west of the Project site, the landform and vegetation will still obscure and screen views of the Project site during expansion activities, resulting in no change in visual amenity.

Nearby commercial and industrial areas with potential to be affected by the Project are located to the east of the quarry. The removal of the narrow vegetative buffer to the east of the Project site to accommodate the proposed industrial development will result in greater exposure of the Project site to passing traffic along the Pacific Highway and the Cassegrain Winery. Given the speed of the traffic and the already interrupted view across the highway, no substantial change in visual amenity is anticipated.

The Project is unlikely to have visual amenity impacts due to the topography and vegetation obscuring and screening views from most directions. Retaining the vegetative buffer and the implementation of standard light spill management measures is recommended to ensure negligible impacts.

E.15 SOCIO-ECONOMIC

The Project is not expected to result in any significant negative economic or social impacts for the local and wider communities upon the implementation of the mitigation measures proposed. The Project will facilitate numerous construction projects within the region, which in addition to the jobs created by the project, will result in economic benefits for the community. Given the expected population increase in the future, construction materials proposed for production at the Sancrox Quarry will be vital for the sustainable expansion and growth of the area. The proposed concrete waste recycling will generate a beneficial reuse of this waste stream and lessen the burden on limited landfill volume in the region.

E.16 *HAZARDS AND RISKS*

A hazard analysis and risk screening assessment has been undertaken for the Project, which evaluates the likely risks to public safety, focusing on the transport, handling and use of hazardous materials and bushfire risk. The assessment also determines whether the Project should be considered a hazardous or potentially hazardous industry under *State Environmental Planning Policy 33 – Hazardous and Offensive Development (SEPP 33).*

Assessment

The risk screening process for the storage of hazardous materials at the Project site and the transportation of hazardous materials to/from the site demonstrates that in all cases, types and quantities would be below the Applying SEPP 33 thresholds. For storage, this demonstrates that operational inventories would not pose a significant risk of harm beyond the site boundary. For transportation, this also demonstrates that risks are unlikely to be significant.

It can be concluded that the risks associated with storage and transportation of hazardous materials are unlikely to be significant or pose a risk to public safety. Given that Applying SEPP 33 thresholds are not exceeded, the Project is not considered to be a hazardous or potentially hazardous industry under SEPP 33. Therefore a Preliminary Hazard Analysis is not required to be undertaken for the Project.

Bushfire

The nature of the proposed Project activities will not increase the potential for or severity of bushfires in the locality, however the risk that a fire may start in the surrounding area and threaten the quarry will be addressed within the overall Emergency Response Plan. The existing site layout already provides an area of defendable space around all administration and workshop buildings, and the proposed clearing of land mapped as Vegetation Category 1, will result in further reduction of bushfire fuel loads.

Nevertheless, due to the existence of the Project site within a bushfire prone area, associated bushfire prevention and mitigation measures are provided in *Chapter 15* to minimise bushfire risks should they occur within and/or adjacent to the Project site.

E.17 *WASTE MANAGEMENT*

The waste assessment was prepared to provide guidance on the classification and removal of wastes generated as a result of the construction and operation of the Project.

Hanson provided an estimation of waste types and volumes based on the understanding of waste generated by current operations on the site. Where such information was unavailable for the site, Hanson provided waste volumes based on waste generation estimates for the proposed Brandy Hill Quarry, which has a similar extraction rate to this Project. An understanding of the process of operating a concrete batching and recycling facility and an asphalt production plant were utilised to generate likely waste streams from these activities.

Relevant regulatory guidelines and legislation were referred to in the preparation of the waste assessment.

The Waste Management Hierarchy will be incorporated into the waste reduction and resource recovery strategies for the construction and operation of the Project. Hanson prioritizes waste avoidance and strives for best practice with extraction and processing of materials. This ensures the most efficient use of the available resource with minimal waste generation.

E.18 QUARRY CLOSURE AND REHABILITATION

Final Land Use Options

The 30 year life of the proposed quarry operations expose the project and its final land use to potential changes in stakeholder expectations, requirements and preference for the final land use options at the quarry. There is also the possibility for updated guidelines from government that outline rehabilitation requirements and methodologies. Hanson commit to regular consultation with community and relative government agencies to ensure the final land use/rehabilitation of the quarry is acceptable. The current conceptual rehabilitation and final land use options are discussed in detail throughout *Chapter 17.* The rehabilitation of the site with native endemic plant species, and inundation of the void over time by surface and groundwater being considered a suitable Conceptual Closure Plan for use during feasibility, development and detailed design.

Rehabilitation Objectives

General rehabilitation objectives as outlined in the *Mine Rehabilitation – Leading Practice Sustainable Development Program for the Mining Industry* (CDIIS 2016a) are dependent on which rehabilitation option is chosen:

- rehabilitation to a new landform, land capability or final land use. This general rehabilitation objective will be applied should the option to use the quarry void for the storage of treated effluent be chosen; and

- restoration or reclamation of the area so that the pre-mining conditions are replicated (75% of mines in Australia use native plant species because the establishment of native ecosystems gives the greatest chance of self-sustainability). This general objective will be applied should the option to revegetate the site with native, endemic species be chosen.

Beneath the overarching general rehabilitation objective are more specific temporal social and financial objectives requiring consideration. These specific objectives are outlined in the *Strategic Framework for Mine Closure* (ANZMEC/MCA, 2000) and include to:

- enable all stakeholders to have their interests considered during the closure process;

- ensure the closure process occurs in an orderly, cost-effective and timely manner;

- ensure the cost of closure is adequately represented in company accounts and that the community is not left with a liability;

- ensure there is clear accountability, and adequate resources, for the implementation of the closure plan;

- establish a set of indicators which will demonstrate the successful completion of the closure process; and

- reach a point where the company has met agreed completion criteria to the satisfaction of the responsible authority.

These objectives will form the basis of the Quarry Closure and Rehabilitation Plan to be prepared post-approval. The Plan will be prepared to the preferred option of rehabilitation with native endemic plant species and inundation over time by surface and groundwater.

Measuring success against rehabilitation outcomes will be assessed through the inclusion of specific performance indicators and monitoring strategies. The Quarry Closure and Rehabilitation Plan will be regularly reviewed to ensure that outcomes and performance indicators are being met, and whether the need exists to modify the plan to better suit the current environment. The proposed rehabilitation outcomes are provided in *Chapter 17*.

Progressive Rehabilitation

Sancrox Quarry currently practices progressive rehabilitation on site. Hanson's opportunistic and progressive rehabilitation would continue throughout the Project life, as part of a planned program of activities to achieve an acceptable final landform. Rehabilitation will be carried out progressively following each stage of extractive operations to ensure a stable landform and to control soil erosion.

The progressive approach helps minimise the liability falling on the operator by rehabilitating the quarry during the operation rather than undertaking the larger task of rehabilitating the quarry following the closure of the quarry, when there is no direct income from quarrying activities (CDITR 2006).

The progressive approach will be beneficial to the overall structure of the ecosystem following the conclusion of quarrying activities. The diversity of the ecosystem will be enhanced by the stands of vegetation of differing ages, heights and depths from the staggered timing of the revegetation activities.

Maintenance of Rehabilitated Areas

Rehabilitated areas are to be maintained as follows:

- following planting, plants will be watered daily for the first week and once a week for the following three months;
- preceding this establishment stage, watering will be undertaken on an as needed basis, with increased watering in dry periods;
- weed control measures will be implemented on a three monthly basis for the first two years following planting; and
- erosion control devices will be regularly inspected (monthly) and particularly after heavy rainfall to ensure proper operation.

Regular monitoring of the revegetated areas will be required during the initial vegetation establishment period and beyond to demonstrate that the objectives of the rehabilitation strategy are being achieved and that a sustainable, stable landform has been provided. The adjacent remaining vegetation may provide a suitable reference site for comparison.

E.19 MITIGATION MEASURES

All mitigation measures outlined throughout each assessment chapter (both key issues and other issues) have been collated and are provided within *Chapter 18* of this EIS.

E.20 CONCLUSION

This EIS has assessed the potential environmental impacts associated with the proposed expansion and increase in annual extraction rates at Sancrox Quarry alongside the proposed establishment of the concrete batching plant, asphalt production plant, and concrete recycling facility The EIS was prepared having regard to biophysical, economic and social considerations and the principles of ESD. There were no significant environmental impacts identified during the preparation of the EIS that cannot be mitigated by appropriate mitigation measures and management strategies.

The environmental assessment process has been used to drive the development of the site and ensure operations will be sustainable and create minimal disruption to the local community. Proposed operations have been designed to ensure sustainable water use and management, minimise traffic impact on local roads, ensure acceptable noise and dust emissions, effective management of waste and to minimise visibility of the operations. All of the potential environmental impacts of the Project have been considered and mitigation measures developed to minimise any impacts as detailed throughout the EIS.

The Project will provide a viable supply of construction materials to the surrounding region. The Project can be implemented with minimal adverse environmental impacts as demonstrated throughout this assessment and is justified in terms of the overall economic benefits to the local, state and national economies. The construction materials, such as those produced at Sancrox Quarry, will be used to meet a fundamental community need for the construction of roads, other infrastructure and major development projects in the region.

The Project will allow for the sourcing of construction materials to be produced at a site that is already highly disturbed. The construction materials produced will be used throughout the region and will have positive flow on effects throughout the local economy through the creation of jobs in associated industries.

ABBREVIATIONS

Abbreviation	Description
AAAA	Aerial Agriculture Association of Australia
ABS	Australian Bureau of Statistics
ACMA	Australian Communications and Media Authority
AGL	Above Ground Level
AHD	Australian Height Datum
AHIMS	Aboriginal Heritage Information Management System
AHIP	Aboriginal Heritage Impact Permit
AM	Amplitude Modulation
ANZECC	Australian and New Zealand Environment Conservation Council
APZ	Asset Protection Zone
ASS	Acid Sulfate Soil
BAR	Biodiversity Assessment Report
BCA	Building Code of Australia
BC Act	*Biodiversity Conservation Act 2016*
BGS	Below Ground Surface
BoM	Bureau of Meteorology
CB	Citizens' Band Radio
CCC	Community Consultative Committee
CEF	Community Enhancement Fund
CEMP	Construction Environmental Management Plan
CHA	Cultural Heritage Assessment
CLM Act	*Contaminated Land Management Act 1997*
CNMP	Construction Noise Management Plan
CO_2 –e	Carbon dioxide equivalent
CoRTN	United Kingdom (UK) – Calculation of Road Traffic Noise
Council	Port Macquarie – Hastings Council
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CTMP	Construction Traffic Management Plan
dB	decibel
DCP	Development Control Plan
DECC	Department of Environment and Climate Change
DNVGL	Derived Native Grassland
DoD	Commonwealth Department of Defence
DoEE	Commonwealth Department of Environment & Energy (formally Commonwealth Department of Environment (DOE))
DPI&E	NSW Department of Planning, Industry and Environment (formerly NSW Department of Planning and Environment)
DP&E	Former NSW Department of Planning and Environment
DP&I	NSW Department of Planning & Infrastructure
DTI	NSW Department of Trade and Investment
EEC	Endangered Ecological Community
EIS	Environmental Impact Statement
EMP	Environmental Management Plan
EMR	Electromagnetic Radiation
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPA	NSW Environment Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
EPI	Environmental Planning Instrument
EPL	Environmental Protection Licence
ERA	Environmental Risk Assessment
ERM	Environmental Resources Management Australia Pty Ltd
ESD	Ecologically Sustainable Development

EVC	Ecological Vegetation Class
FDI	Fire Danger Index
FEL	Front-end loader
FM Act	*Fisheries Management Act 1994*
FTE	Full time equivalent
GHG	Greenhouse Gas
GIS	Geographic Information System
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
GWh	Gigawatt hours
ha	hectares
Hanson	Hanson Construction Materials Pty Ltd
Hz	Hertz
IEC	International Electro technical Commission
INP	NSW Environmental Noise Management – Industrial Noise Policy
ISEPP	*State Environmental Planning Policy (Infrastructure) 2007*
ISO	International Standards Organisation
km	kilometre
kV	Kilovolt
LEP	Local Environment Plan
LGA	local government area
m	metres
MNES	Matters of National Environmental Significance
MOS	Manual of Standards
Mt	Million tonnes
MW	Megawatt
nm	Nautical Miles
NP&W Act	*National Parks and Wildlife Act 1974*
NPI	NSW Environmental Noise Management – Noise Policy for Industry (new noise policy)
NSW	New South Wales
NW Act	*Noxious Weeds Act 1993*
OEH	NSW Office of Environment and Heritage
OH&S	Occupational Health and Safety
ONMP	Operational Noise Management Plan
PA	Project Area
PAC	NSW Planning and Assessment Commission
PAD	Potential Archaeological Deposit
PBP	Planning for Bushfire Protection
PCT	Plant Community types
PEA	Preliminary Environmental Assessment
PHA	Preliminary Hazard Analysis
PMHC	Port Macquarie – Hastings Council
POEO Act	*Protection of the Environment Operation Act 1997*
RAP	Registered Aboriginal Party
RAV	Restricted Access Vehicles
RBL	Rating Background Level
REAP	Renewable Energy Action Plan
RECs	Renewable Energy Certificates
REF	Review of Environmental Factors
RET	Renewable Energy Target
RFS	NSW Rural Fire Service
RMS	Roads and Maritime Services (formerly the Roads and Transport Authority)
RNP	Road Noise Policy
Roads Act	*Roads Act 1993*
SEARs	Secretary's Environmental Assessment and Requirements

Secretary	NSW Secretary for Planning and Environment
SEE	Statement of Environmental Effects
SEPP	State Environmental Planning Policy
SIS	Species Impact Statement
SRD SEPP	*State Environmental Planning Policy (State and Regional Development) 2011*
SSD	State Significant Development
SWL	Standing Water Level
The Proponent	Hanson Construction Materials Pty Ltd
TSC Act	*Threatened Species Conservation Act 1995*
vpd	Vehicles per day
WHD	Water Holding Dam
WM Act	*Water Management Act 2000*

1 INTRODUCTION

This Chapter describes the background to the proposed development, a description of existing operations, Project objectives and alternatives and the Environmental Impact Statement (EIS) structure.

1.1 BACKGROUND AND PROJECT OVERVIEW

Hanson Construction Materials Pty Ltd (Hanson) currently operates a hard rock quarry, known as Sancrox Quarry, on Sancrox Road, Sancrox, located approximately 8 km west of Port Macquarie. The Sancrox Quarry is within the Port Macquarie Hastings Council (PMHC) local government area on the Mid North Coast of NSW. The current Sancrox Quarry comprises Lot 353 DP 754434, Lot 1 DP 720807 and Lot 1 DP 704890.

The quarry is considered a major economic resource for regional and state development. Hanson propose to extend the life of the quarry by expanding the approved extraction boundary and increase the annual extraction limit to facilitate the extraction and distribution of high quality construction materials for the use in civil infrastructure and road construction projects. The proposed extraction limit will increase the current annual maximum extraction limit from approximately 455,000 tonnes per annum (tpa) to 750,000tpa.

Additionally the proposed Project includes the establishment of a concrete batching plant and recycling facility and an asphalt production plant, as further described in *Chapter 2*.

The Project will comprise the lots listed above as well as extending the lateral extent of the quarry westwards, into Lot 2 in DP 574308, which is also owned by Hanson. Lot 2 in DP 574308 to the north of the proposed expansion area will also be utilized as a biodiversity offset area, as outlined in the Biodiversity Assessment Report (Annex C of this EIS). The existing quarry extent and the Project site consisting of Hanson owned lots and occupied Crown land are shown in *Figure 1.1*.

1.2 PROJECT HISTORY

Sancrox Quarry has been owned and operated by Hanson since 1998. Hanson currently has ownership of approximately 145 ha, of which approximately 12 ha is currently used in the extraction, processing and storage of high quality aggregate materials (Hanson, 2015a). The current approval is for extraction of 175,000 cubic metres (m^3) per annum, equating to approximately 450,000 tpa.

Sancrox Quarry currently operates to the approvals as outlined in *Section 1.2.1*, an Environmental Management Plan and Environmental Protection Licence (EPL) (EPL 5289) issued by the Environment Protection Authority (EPA) under the *Protection of the Environment Operations Act 1997* (POEO Act).

The current approved hours of operation and activities are provided in *Table 1.1*.

Table 1.1 Current Approved Activities and Hours of Operation

Hours	Day	Approved Activity
7am to 5pm	Monday to Friday	Normal operations
7am to 1pm	Saturday	Normal operations
7am to 11pm	Every day of the year	Additional activities including truck movements into, around and out of the Sancrox Quarry, as well as equipment loading
11pm to 7am	Up to 20 occasions	Additional operations

Source: Hanson (2015a)

1.2.1 *Approval History*

Sancrox Quarry operations are currently approved in accordance with three concurrent development consents, which have been modified by Section 96 of the *Environment Planning and Assessment Act 1979* (EP&A Act) at various stages as detailed in *Table 1.2*. Conditions exist within the development consents that should be read in conjunction with one another. The current extraction rate of 455,000 tpa was approved as a modification to development consent (DA 1995/0193) under section 96(2) of the EP&A Act.

All existing conditions of consent will be surrendered within six months of project approval, should this project be approved.

Table 1.2 Project Approval History

Development Consent	Original approval date	Modification date(s)	Approval and Modification Details
DA No. 1995/193	19 November 1995[1]	5 June 2007[1] 7 January 2008[1] 18 November 2009[1] 12 March 2014[2]	1995 - an application was made to PMHC to continue gravel extraction at the site (DA 1995/193) which was approved on 19 November 1996 subject to conditions of development consent. 2007 - a modification was sought to alter operating hours to accommodate demands for quarry materials for infrastructure works during evening and night periods. This modification was granted approval subject to amended conditions on 5 June 2007. 2008 – a modification was sought to allow the movement of trucks into the site, operation of loading equipment, loading of trucks and movement of trucks out of the site during evening a night time periods and on weekends. This modification was granted approval subject to amended conditions on 7 January 2008. 2009 - a modification was sought to update conditions of consent relating to blasting to bring them in line with current industry practice. This modification was granted approval subject to on conditions on 18 November 2009. 2014 – a modification was sought to temporarily increase the quarry extraction limits. This modification was granted approval subject to amended conditions on 12 March 2014.
DA No. 2004/609	12 January 2005[1]	4 July 2007[1]	2004 - development consent was sought to extend the eastern boundary of the approved extraction area and was subsequently approved with a new DA 2004/609, subject to conditions of development consent by PMHC on 12 January 2005. 2007 - a modification was sought to expand the western extraction limit of the quarry, as well as amending the conditions which related to the upgrade of Sancrox Road and operating hours at the quarry. The modification was granted approval subject to amended conditions on 4 July 2007.
DA No. 2006/497	11 December 2006[2]	Not yet modified	2006 – development consent was sought to install and operate a temporary asphalt plant. The application was approved on 11 December 2006, subject to conditions of development consent.

1. Hanson (2015a); and
2. PMHC (2018)

1.2.2 *Adjacent Projects*

Sancrox Interchange and Pacific Highway

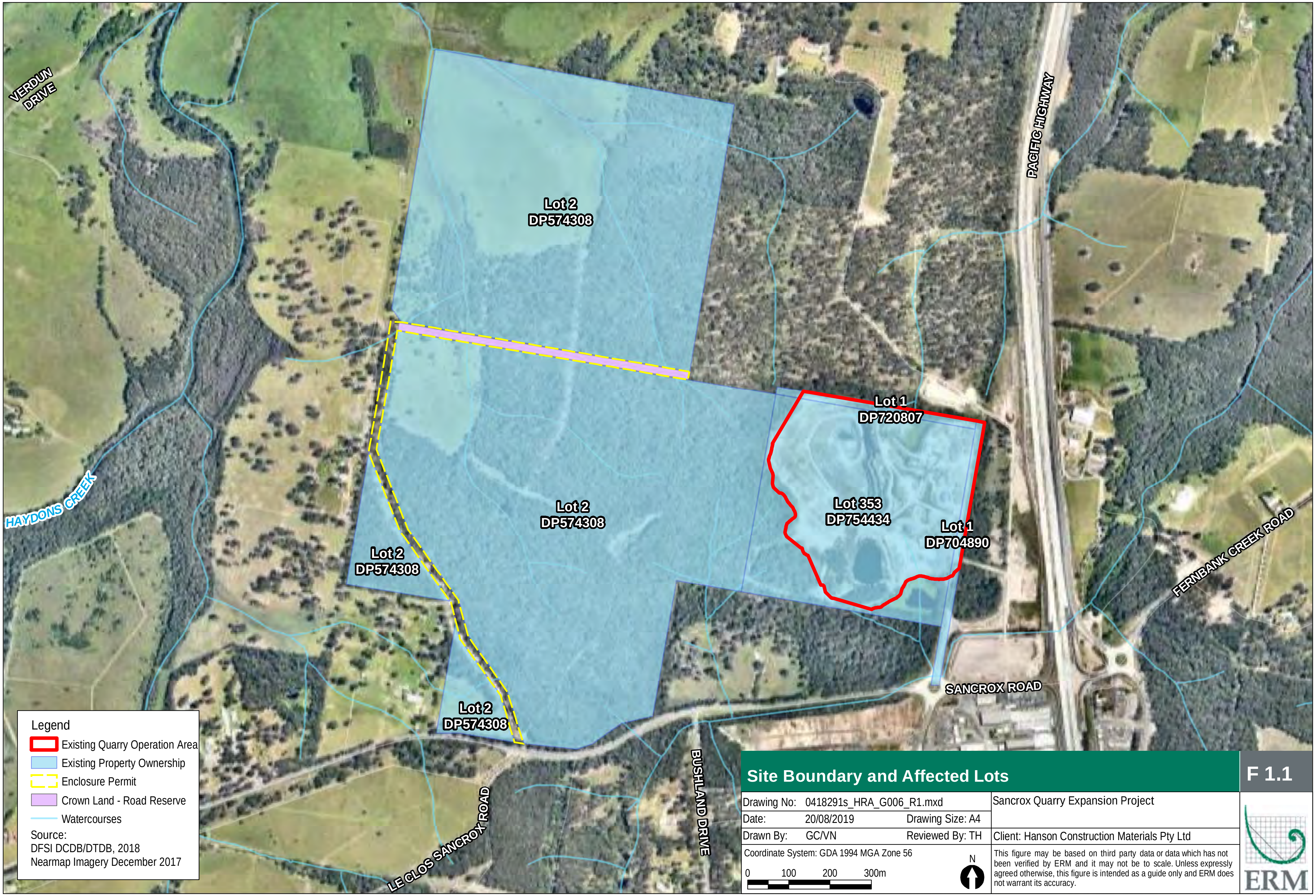
The road infrastructure directly adjacent to the Sancrox Quarry has recently undergone redevelopment and improvement.

The Sancrox Interchange connects to the Pacific Highway which services northern, southern and eastern movements from the quarry and was opened to the public on 30 November 2015. The Interchange was designed to cater for the existing industry and businesses in the area, as well as servicing the area which is planned for development as an industrial precinct.

The Pacific Highway in the vicinity of the quarry has recently been upgraded, as part of the Oxley Highway to Kempsey Pacific Highway Upgrade Project. The Highway is now dual carriageway, 110km/hr Motorway class road.

Sancrox Employment Precinct

To the east of the quarry, construction has commenced the development of an estate zoned for light industry. The *Greater Sancrox Structure Plan 2014-2034* (PMHC, 2015) outlines future development options including rural residential to the west of the quarry and south of Sancrox Road.



Site Boundary and Affected Lots

F 1.1

Drawing No: 0418291s_HRA_G006_R1.mxd

Sancrox Quarry Expansion Project

Date: 20/08/2019 Drawing Size: A4

Drawn By: GC/VN Reviewed By: TH

Client: Hanson Construction Materials Pty Ltd

Coordinate System: GDA 1994 MGA Zone 56

This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

ERM

1.3 *PROJECT OBJECTIVES*

Cement, Concrete and Aggregates Australia (CCAA) estimates that a typical house requires 110 tonnes of crushed rock and 53 m^3 of concrete, which in the case of the Sancrox Quarry, would amount to 90 tonnes of concrete aggregates, totalling 200 tonnes of hard rock quarry products per dwelling built (CCAA, 2015). With an estimated 59,600 new homes predicted by the *Mid North Coast Regional Strategy 2009*, an estimated 12 million tonnes of hard rock quarry products will be required.

Regional roads are predominately sealed with high quality aggregate which is produced at Sancrox Quarry. As a building product, concrete is still the cheapest and most widely used building material available. Due to the low embodied energy of concrete, it is a more sustainable product than many other building materials.

This demand sets the context for the primary objectives of the Project, which are to:

- deepen and extend the lateral extents the extraction area, and extend the life of the quarry to maximise winning of a hard rock aggregate and fill materials for supply to construction projects in the region. This will enable Hanson to continue to produce a range of high quality aggregate and road construction materials to supply development within the region;

- construct a concrete batching plant and asphalt production plant at the quarry site. The development of these plants within the site will limit the requirement to haul aggregate as feedstock to these processes, thus reducing emissions associated with road haulage; and

- construct a concrete recycling facility at the quarry site, which will allow for the beneficial reuse of concrete washout material in the local area. Recycling of the concrete washout material will meet the objectives of ecological sustainable development (ESD).

It is also noted that in order to eliminate property fragmentation over Hanson owned land, Hanson is proposing the closure and purchase of a parcel of Crown owned land (*Figure 1.1*), under the Roads Act 1993. Hanson currently holds an Enclosure Permit (number: 49229) under this Act.

The extension of an existing quarry is considered ESD, as it consolidates disturbance to an existing quarrying location, avoiding disturbance of a new area currently undisturbed by quarrying. The establishment of the new infrastructure will predominately be within the disturbed area of the existing quarry footprint, and is also considered ESD as it avoids establishment of infrastructure on previously undeveloped land.

1.4 *Project Alternatives*

In accordance with Clause 7 of Schedule 2 of the EP&A Regulation, a number of alternatives to the Project assessed in this EIS were considered by Hanson in the development of the project description and are considered below, including alternative sourcing of materials, alternative locations, siting of ancillary infrastructure, hours of operation and the do nothing options.

1.4.1 *Alternative sourcing of material*

Sancrox is the only Hanson owned quarry in the Port Macquarie region. By road, the nearest Hanson owned hard rock quarry to Sancrox is Brandy Hill Quarry, located 200km south of Port Macquarie. Delivering products to the region from this quarry would be unviable due to excessive transport costs. Increasing prices to mitigate this would make Hanson less competitive within the region and lead to increases in construction costs for all industries.

Purchasing materials from other companies would mean paying higher costs for aggregates resulting in less profit. Hanson would become reliant upon external companies resulting in a loss of control in the production of aggregates and consequently increasing the risk of being unable to attain the required quantities of aggregates.

1.4.2 *Alternate Location*

The Sancrox Quarry has been investigated geologically with percussion drill holes and additional diamond drill holes in the extended areas as detailed in Hanson (2015). The investigation determined that Ordovician metasediments outcrop in the immediate area south and south west of the site (Hanson, 2015). The presence of this outcrop predicates that the site is underlain by these sediments (Hanson, 2018). The surrounding outcrops were determined to be either sand or schist (Hanson, 2018).

The schist which Port Macquarie is built on is a moderate grade metamorphic rock (Hanson, 2018). This rock type is a melange that is considered unsuitable for use as hard rock aggregate (Hanson, 2018). The sand surrounding the town has been identified as Quarternary alluvial dune deposits, and is also considered unsuitable for hard rock applications (Hanson, 2018).

There are other isolated pockets of Metamorphic and volcanic rocks, whether these would be suitable as aggregate is unknown, however the extent and changeability of the pockets would make it an unreliable option (Hanson, 2018).

Sancrox is located just over the Cowarra fault into the Hastings Block, which is made up of an expanse of Lithic sandstone with predominant metamorphic fragments (Hanson, 2018). This is considered the most appropriate, consistent rock in close proximity to Port Macquarie for the generation of hard rock aggregates, and as such the Quarry is located in the most viable location (Hanson, 2018).

Finding other suitable hard rock resources close to Port Macquarie is considered a difficult prospect (Hanson, 2018). Land holdings with adequate area to open a new quarry would be expensive to acquire and develop, and are unlikely to be readily available (Hanson, 2018). The processes involved in establishing a new quarry have potential to cause greater environmental impact than expanding the existing quarry site at Sancrox.

The existing quarry has operated and co-existed with the surrounding environment for 20 years (Hanson, 2018). The resource at Sancrox is readily accessible with functioning extraction and processing infrastructure in place, hence expanding the existing site was identified as the option with the lowest environmental impact.

Siting of Ancillary Infrastructure

The proposed quarry expansion seeks to undertake new ancillary activities, including concrete batching and recycling, and asphalt production. The siting of this ancillary infrastructure was undertaken with the objective of consolidating infrastructure, minimising environmental impacts to the extent feasible and maximising the recently established Sancrox interchange for safer access to the Pacific Highway.

The consolidation of the concrete batching within the quarry site has associated environmental benefits from the reduced haulage. The quarried rock, a constituent in the concrete batching process, does not have to be transported from the site as would have been the case had a separate concrete batching plant been proposed.

The consolidation of the activities to one site rather than the possible alternative of up to four separate sites simplifies the process of environmental compliance management for Hanson's environmental management team.

The consolidation of the infrastructure to the quarry site allows for direct access to the Sancrox interchange that was constructed to provide safe access to the Pacific Highway and service the broader industrial estate in the location. The facilities consolidation at the quarry limits the interaction of local traffic to road users within the Sancrox area in comparison to the much larger population of road users within Port Macquarie should the facilities have been established within Port Macquarie's Lake Road industrial estate.

The concrete batching and recycling infrastructure is proposed to be located within the north – east portion of the site in an area heavily disturbed by previous quarrying activities, thereby reducing the footprint of new disturbance and specifically reducing potential ecological and heritage impacts.

1.4.3 Alternative Footprint

The proposed quarry has been designed, where practicable, to incorporate land already devoid of vegetation (SLR 2018). This limits the clearing of native vegetation where possible. Consequently, approximately 29% of the proposed quarry footprint includes cleared areas and areas of non-native vegetation (SLR 2018).

Extending the proposed footprint in other directions would not have been viable as exploration identified either unsuitable or unreliable deposits. The Preliminary Environmental assessment proposed a larger quarry footprint, extending into the north west beyond current proposed design. The quarry extent in this location was reduced in order to avoid the risk of flooding, which was identified to encroach on the originally proposed footprint. The updated footprint is presented in Chapter 2 of this EIS. The original proposed footprint and the reduced footprint are demonstrated in Figure 8.1. Where potential impacts were considered to be reduced by the decrease in quarry footprint, the assessment retained the original footprint, providing the worst case scenario for the assessment.

1.4.4 Hours of Operation

The quarry seeks approval for quarry activities and ancillary facility operations to occur 24 hours a day, 7 days a week.

Key factors to justify the 24 hour, seven days/week operations are outlined below.

(1) Construction projects, particularly road construction projects, can require delivery of materials outside standard construction hours. This is required to expedite the road construction process, or to limit disturbance to road users. To enable Hanson to supply such projects, 24 hours/seven days a week operation is required to enable products to be prepared and trucks to leave site during the night time period. Should 24 hours/seven days a week operation not be sought, Hanson would not be able to bid on such projects, thus limiting competition in the market. Reduced competition could potentially have negative flow on consequences, such as reduced time and cost efficiency of night time construction works, thus potentially generating negative economic impacts to the broader community.

(2) 24 hour/seven day a week operation allows for the transportation of material during the night time period. This reduces day time road congestion by limiting non-essential truck movements during the day time period. This has a positive impact on efficiency of the road network and reduced traffic waiting times.

(3) To allow for construction projects to remain within their own construction operating hours, the ability for concrete and asphalt to be transported outside of normal construction hours, thus maximising external project construction hours reduces the likelihood of construction projects exceeding standard construction hours and thus impacting the broader community.

The *Mid North Coast Regional Strategy* (DoP 2009) recognises the importance of the Mid North Coast Region's natural resources base to the continued sustainable growth and development of the region. In particular, the Sancrox Quarry was identified in the Strategy as important for extractive resources. By 2031, the Mid North Coast population is expected to grow by 28% (DoP, 2009), with an annual average growth rate of approximately 1.1% over the next 25 years, among the highest regional growth rates in regional NSW (DoP, 2009). This population growth will stimulate housing development, which in turn will increase demand on hard rock aggregates and batched products such as cement and asphalt.

Hanson considered not increasing the hours of operation at the site, and maintaining the existing approved hours of operations. However, maintaining the status quo with respect to operating hours would limit Hanson's ability to service future demand, with forecast population growth as detailed in the *Mid North Coast Regional Strategy*, identifying an estimated 59,600 new homes, together with the construction and maintenance of the regional road network.

The continued and additional supply of the valuable aggregate, concrete and asphalt resources to the local construction industry as well as a facility for recycling of a waste concrete will meet the strategic goals of boosting the local economy and providing the materials to allow for infrastructure and housing developments. The increase in operating hours will enable the forecast future demand to be serviced form the site.

1.4.5 Not undertaking the Project

Not undertaking the quarry expansion component of the Project would prevent the utilisation of the hard rock resource identified adjacent to the existing quarry.

Not undertaking the construction of the concrete batching plant and asphalt production plant would similarly reduce competition in the area, thus limiting the potential economic benefits for local users of asphalt and concrete.

Not establishing the concrete recycling facility would limit the options for locals to recycle waste concrete, thus limiting the number of waste concrete recycling options and preventing competition, and its associated economic benefits.

The economic benefits to the local and regional community provided directly and indirectly by employment associated with the Project would be lost, should it not be undertaken.

The 24 hour operation of the site would allow for more efficient dispersal of products to individual project development sites, thus improving efficiencies and productivity within the local construction industry.

1.5 SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS (SEARS)

Revised SEARs were issued by DP&E on 18 September 2017 which supersede the SEARs previously issued for the Project, and form the basis of the environmental impact assessment for the Project (refer to *Annex A*).

Table 1.3 provides a summary of the SEARs and includes a reference to where each requirement has been addressed in the EIS and corresponding technical assessments.

Table 1.3 Secretary's Environmental Assessment Requirements (SSD 7293)

Requirement	Location within EIS
General Requirements	
The Environmental Impact Statement (EIS) for the development must comply with the requirements in Clauses 6 and 7 of Schedule 2 of the *Environmental Planning and Assessment Regulation 2000.*	Chapter 0

In particular, the EIS must include:
- a stand-alone executive summary;
- a full description of the development, including:
    - the resource to be extracted, including the amount, type and composition;
    - the site layout and extraction plan, including cross-sectional plans;
    - the production process and processing activities, including the in-flow and out-flow of materials and points of discharge to the environment;
    - surface infrastructure and facilities (including any infrastructure that would be required for the development, but the subject of a separate approvals process);
	Chapter 2

- a waste (overburden, rejects, tailings etc.) management strategy;	Chapter 16
- a water management strategy;	Chapter 7 (and subsequent SWMP post approval)
- a rehabilitation strategy to apply during, and after completion of, extraction operations, and proposed final use of site;	Chapter 17

Requirement	Location within EIS
- the likely interactions between the development and any existing, approved or proposed development in the vicinity of the site;	Chapter 1
- a strategic justification of the development focusing on site selection and the suitability of the proposed site;	Chapter 3
- a list of any approvals that must be obtained before the development may commence;	Chapter 3
- an assessment of the likely impacts of the development on the environment, focussing on the key issues identified below, including: - a description of the existing environment likely to be affected by the development, using sufficient baseline data; - an assessment of the likely impacts of all stages of the development, including any cumulative impacts, taking into consideration any relevant laws, environmental planning instruments, guidelines, policies, plans and industry codes of practice; - a description of the measures that would be implemented to avoid, minimise, mitigate and/or offset the likely impacts of the development, and an assessment of: - whether these measures are consistent with industry best practice, and represent the full range of reasonable and feasible mitigation measures that could be implemented; - the likely effectiveness of these measures; and - whether contingency measures would be necessary to manage any residual risks; and - a description of the measures that would be implemented to monitor and report on the environmental performance of the development;	Chapter 4 and associated impact assessment chapters
- a consolidated summary of all the proposed environmental management and monitoring measures, identifying all the commitments in the EIS;	Chapter 18
- consideration of the development against all relevant environmental planning instruments (including Part 3 of the *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007);*	Chapter 3
- the reasons why the development should be approved, having regard to: - relevant matters for consideration under the *Environmental Planning and Assessment Act 1979,* including the objects of the Act; - the biophysical, economic and social impacts of the project, including the principles of ecologically sustainable development; - the suitability of the site with respect to potential land use conflicts with existing and future surrounding land uses; - feasible alternatives to the development (and its key components), including the consequences of not carrying out the development;	Chapter 3 Chapter 1
- a signed declaration from the author of the EIS, certifying that the information contained within the document is neither false nor misleading.	Chapter 0

Requirement	Location within EIS
In addition to the matters set out in Schedule 1 of the Environmental Planning and Assessment Regulation 2000, the development application must be accompanied by a signed report from a suitably qualified expert that includes an accurate estimate of the capital investment value (as defined in Clause 3 of the Environmental Planning and Assessment Regulation 2000) of the development, including details of all the assumptions and components from which the capital investment value calculation is derived.	Annex J
Key Issues	
Noise & Blasting - including: - a detailed assessment of the likely construction, operational and off-site transport noise impacts of the development in accordance with the Interim Construction Noise Guideline, NSW Industrial Noise Policy and the NSW Road Noise Policy respectively, and having regard to the Voluntary Land Acquisition and Mitigation Policy; - - if a claim is made for specific construction noise criteria for certain activities, then this claim must be justified and accompanied by an assessment of the likely construction noise impacts of these activities under the Interim Construction Noise Guideline; - proposed blasting hours, frequency and methods; - a detailed assessment of the likely blasting impacts of the development (including noise, vibrations, overpressure, visual and odour) on people, animals, buildings, infrastructure and significant natural features, having regard to the relevant ANZEC guidelines; - reasonable and feasible mitigation measures to minimise noise emissions; and - monitoring and management measures, in particular real-time and attended noise monitoring;	Chapter 10 Annex G
Air Quality - including: - a detailed assessment of potential construction and operational impacts, in accordance with the *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW*, and with a particular focus on dust emissions including $PM_{2.5}$ and PM_{10}, and having regard to the *Voluntary Land Acquisition and Mitigation Policy;* - an assessment of potential dust and other emissions generated from processing, operational activities and transportation of quarry products; - reasonable and feasible mitigation measures to minimise dust and emissions; and - monitoring and management measures, in particular, real-time air quality monitoring;	Chapter 11 Annex H
Water - including: - a detailed site water balance, including a description of site water demands, water disposal methods (inclusive of volume and frequency of any water discharges), water supply infrastructure and water storage structures; - identification of any licensing requirements or other approvals under the *Water Act 1912* and/or *Water Management Act 2000*; - demonstration that water for the construction and operation of the development can be obtained from an appropriately authorised and reliable supply in accordance with the operating rules of any relevant Water Sharing Plan (WSP); - a description of the measures proposed to ensure the development can operate in accordance with the requirements of any relevant WSP or water source embargo;	Chapters 7 and 8 Annex's E and F (Surface Water/Hydrology and Groundwater, respectively)

Requirement	Location within EIS
- an assessment of any likely flooding impacts of the development; an assessment of the likely impacts on the quality and quantity of existing surface and ground water resources, including a detailed assessment of proposed water discharge quantities and quality against receiving water quality and flow objectives; - an assessment of the likely impacts of the development on aquifers, watercourses, riparian land, water-related infrastructure, and other water users; and - a detailed description of the proposed water management system (including sewage), water monitoring program and other measures to mitigate surface and groundwater impacts;	
Biodiversity - including: - accurate predictions of any vegetation clearing on site; - a detailed assessment of the likely biodiversity impacts of the development, paying particular attention to threatened species, populations and ecological communities and groundwater dependent ecosystems, and having regard to the *NSW Biodiversity Offsets Policy for Major Projects and the Framework for Biodiversity Assessment*; and - a strategy to offset any residual impacts of the development in accordance with the NSW Biodiversity Offsets Policy for Major Projects, including evidence that the appropriate type and quantum of offsets will be available;	Chapter 5 Annex C
Heritage - including: - an assessment of the potential impacts on Aboriginal heritage (cultural and archaeological), including evidence of appropriate consultation with relevant Aboriginal communities/parties and documentation of the views of these stakeholders regarding the likely impact of the development on their cultural heritage; and - identification of historic heritage in the vicinity of the development and an assessment of the likelihood and significance of impacts on heritage items, having regard to the relevant policies and guidelines listed in Attachment 1;	Chapter 6 Annex D
Traffic & Transport – including: - accurate predictions of the road traffic generated by the construction and operation of the development, including a description of the types of vehicles likely to be used for transportation of quarry products; - a detailed assessment of potential traffic impacts on the capacity, condition, safety and efficiency of the local and State road network (as identified above}, including a road safety audit; and - a description of the measures that would be implemented to mitigate any impacts, including concept plans of any proposed upgrades, developed in consultation with the relevant road and rail authorities (if required);	Chapter 12 Annex I
Land Resources - including a detailed assessment of: - potential impacts on soils and land capability (including potential erosion and land contamination) and the proposed mitigation, management and remedial measures (as appropriate); - potential impacts on landforms (topography), paying particular attention to the long term geotechnical stability of any new landforms (such as overburden dumps, bunds etc); and - the compatibility of the development with other land uses in the vicinity of the development in accordance with the requirements in Clause 12 of *State Environmental Planning Policy (Mining, Petroleum*	Chapter 9

Requirement	Location within EIS
Production and Extractive Industries) 2007, paying particular attention to the agricultural land use in the region	
Waste - including estimates of the quantity and nature of the waste streams that would be generated or received by the development and any measures that would be implemented to minimise, manage or dispose of these waste streams;	Chapter 16
Hazards - including an assessment of the likely risks to public safety, paying particular attention to the transport, handling and use of any hazardous or dangerous goods;	Chapter 15
Visual - including a detailed assessment of the likely visual impacts of the development on private landowners in the vicinity of the development and key vantage points in the public domain, paying particular attention to any new landforms, and to minimising the lighting impacts of the development;	Chapter 13

Social & Economic- including:
- a detailed assessment of the likely social impacts of the development on the local and regional community in accordance with the *Social impact assessment guideline for State significant mining, petroleum production and extractive industry development;* and
- a detailed assessment of the likely economic impacts of the development, paying particular attention to:
  - the significance of the resource;
  - the costs and benefits of the project; identifying whether the development as a whole would result in a net benefit to NSW, including consideration of fluctuation in commodity markets and exchange rates; and
  - the demand for the provision of local infrastructure and services
	Chapter 14

Rehabilitation - including the proposed rehabilitation strategy for the site having regard to the key principles in the *Strategic Framework for Mine Closure,* including: - rehabilitation objectives, progressive rehabilitation commitments, methodology, monitoring programs, performance standards and proposed completion criteria; - nominated final land use, having regard to any relevant strategic land use planning or resource management plans or policies; and - the potential for integrating this strategy with any other rehabilitation and/or offset strategies in the region.	Chapter 17
Consultation	
During the preparation of the EIS, you must consult with relevant local, State and Commonwealth Government authorities, service providers, Aboriginal stakeholders, community groups and affected landowners. Consultation to be undertaken with: - affected landowners; - community groups; - Port Macquarie-Hastings Council; - Office of Environment and Heritage (including the Heritage Branch); - Environment Protection Authority; - Division of Resources and Geoscience within the Department; - Department of Primary Industries (including the DPI Water, NSW - Forestry, Agriculture and Fisheries sections and Crown Lands division); - North Coast Local Land Services; - Roads and Maritime Services; - NSW Rural Fire Service; and	Chapter 4 and Annex B

Requirement	Location within EIS
establish a Community Consultative Committee for the project in accordance with the *Community Consultative Committee Guidelines for State Significant Projects,* and consult with the committee during the preparation of the EIS.	

1.6 STRUCTURE OF THE EIS

This EIS has been prepared to ensure that the Project is described adequately; addresses the SEARs, assesses the potential environmental impacts; and identifies proposed mitigation measures. The overall structure of the EIS is outlined in *Table 1.4*.

Table 1.4 Structure of the EIS

EIS Chapter	Description
Introduction	Provides an overview of the Proposed project and introduces the Proponent, project history and alternatives.
Project Description	Provides a detailed description of the proposed development including the key components for both the construction and operational phases of the Project.
Strategic and Statutory Context	Provides a strategic justification of the proposed development focusing on site selection and the suitability of the proposed site; Describes the SSD Planning Approval Process and relevant Commonwealth, State and local legislative frame work in relation to the Project.
Community and Stakeholder Engagement	Summarises the consultation activities undertaken with key external stakeholders (including government agencies, authorities and the local community).
Environmental Impact Assessment, including: - Biodiversity - Heritage - Hydrology/Surface Water - Groundwater - Soil and Land Resources - Noise and Vibration - Air Quality and Greenhouse Gas - Traffic and Access - Visual Amenity - Socio-economic - Hazards and Risk - Waste Management - Quarry Closure and Rehabilitation	Describe the physical, biological, cultural, social and economic environments within and in the vicinity of the PA, the potential risks and impacts (including cumulative impacts) of the proposed Project upon the existing environment, and the mitigation and management measures that would be undertaken to minimise these risks and impacts.

EIS Chapter	Description
Mitigation Measures	Provides an overview of the environmental management framework to be developed for the Project, including a summary of the mitigation measures and commitments made throughout the EIS to be implemented during the construction, operation and decommissioning of the Project.
Evaluation and Conclusion	Presents the conclusions of the EIS.
References	Consolidates all references contained within the EIS.

1.7 *THE PROPONENT*

Sancrox Quarry is owned and operated by Hanson Construction Materials Pty Ltd (Hanson), which forms part of the HeidelbergCement Group. Hanson is a major supplier of aggregates, sands and premixed concrete to the civil, industrial, residential, and commercial construction industries. Hanson and its subsidiaries operate over 70 quarries and more than 300 concrete plants throughout Australia, employing over 3,000 people nationwide. Hanson operate twelve quarries in NSW, ranging from sand to hard rock quarries.

Hanson operates to ISO/AS 14001 to reduce the impact its operations have on the environment. Sancrox Quarry has an Environmental Management System in place and strives for continual improvement in all aspects of its environmental performance.

REFERENCES

CCAA (2015) **Providing the essential materials to build our nation – Policy priorities for Australia's extractive industry**. Cement Concrete and Aggregates Australia.

Hanson (2015) **Geology, drill results and Resources 2015 – Sancrox Quarry, Stubbs Extension.** Hanson Construction Materials Pty Ltd.

Hanson (2015a) **Preliminary Environmental Impact Statement – Sancrox Quarry Expansion Project**. Hanson Construction Materials Pty Ltd.

Hanson (2018) **Sancrox Project need, justification and alternatives considered**. Hanson Construction Materials Pty Ltd.

PMHC (2018) **Application Tracker**. Port Macquarie Hastings Council. Sourced on 30 April 2018 from https://datracker.pmhc.nsw.gov.au/Application/ApplicationDetails

2 *PROJECT DESCRIPTION*

This Chapter describes all construction and operation aspects of the proposed quarry expansion, including the establishment of new ancillary infrastructure comprising a concrete batching, concrete recycling facility and asphalt production plant, for which the development approval is being sought.

2.1 PROPOSED ACTIVITY

The proposed activity, herein referred to as the Project, incorporates the following key components:

- increased annual extraction to 750,000 tonnes per annum (tpa);
- construction and operation of a concrete batching plant with an output of 20,000 tpa;
- construction and operation of a concrete recycling facility to process 20,000 tpa; and
- construction and operation of an asphalt production plant with an output of 50,000 tpa.

Concurrent to the proposed activities is the closing and purchasing a section of Crown owned land to facilitate the development of the biodiversity offset area to the north of the proposed quarry expansion area.

A Project description summary is provided in *Table 2.1.* The proposed extraction footprint and location of the new concrete batching plant, concrete recycling facility and asphalt production plant and the relocated product processing plant (herein referred to as ancillary infrastructure) are shown in *Figure 2.1* and *Figure 2.2*. Existing quarry operations will continue as much as possible during construction of the proposed infrastructure.

Table 2.1 Project Description Summary Table

Project Components/Aspects	**Currently Approved Sancrox Quarry**	**Proposed Project**
Quarry Life	20 years	30 years
Limits on production	455,000 tpa	750,000 tpa
Quarry Footprint	17.18 ha	48.61 ha
Final Quarry Depth	RL – 14m AHD	RL – 40m AHD
Product Processing Plant and Stockpile Area	Located in north-east corner of site	To be relocated to the south of quarry pit
Site Office, Weighbridge and Workshop	Located near site entrance	To remain in same location

Project Components/Aspects	Currently Approved Sancrox Quarry	Proposed Project
Water Holding Dams (WHD)	Two located in the south-east corner of site	To remain in same location. Additional WHDs will be constructed throughout the various stages of the Project to manage sediment.
Concrete Batching Plant	Not currently operating	20,000 tpa To be located in north-east corner of site
Concrete Recycling Facility	Not currently operating	20,000 tpa To be located in north-east corner of site
Asphalt Production Plant	Not currently operating	50,000 tpa To be located south of quarry pit
Hours of Operation	Quarry operates: - 7am – 5pm Monday to Friday - 7am – 1pm Saturday Truck movements and equipment loading: - 7am-11pm Monday – Friday -7am – 1pm Saturdays, Sundays and Public Holidays. Operations are permitted between 11:00pm and 7:00am on a maximum of 20 occasions within a year.	Quarry operations (incl. production and maintenance): 24 hours a day, 7 days a week Truck movements and equipment loading: 24 hours 7 days Blasting: 8am – 5pm Monday to Friday
Employee numbers	15 full-time employees (with casual and contractors on an as needed basis)	10 additional full-time employees, resulting in 25 full-time employees.

2.2 *SITE CONTEXT*

2.2.1 *Land Tenure*

Hanson owns the four lots that encompass the Project footprint:

- Lot 2 DP 574308;
- Lot 353 DP 754434;
- Lot 1 DP 704890; and
- Lot 1 DP 720807.

In order to eliminate property fragmentation over the site, Hanson is proposing the closure and purchase of a parcel of Crown owned land under the Roads Act 1993. Hanson currently holds an Enclosure Permit (number: 49229) under this Act.

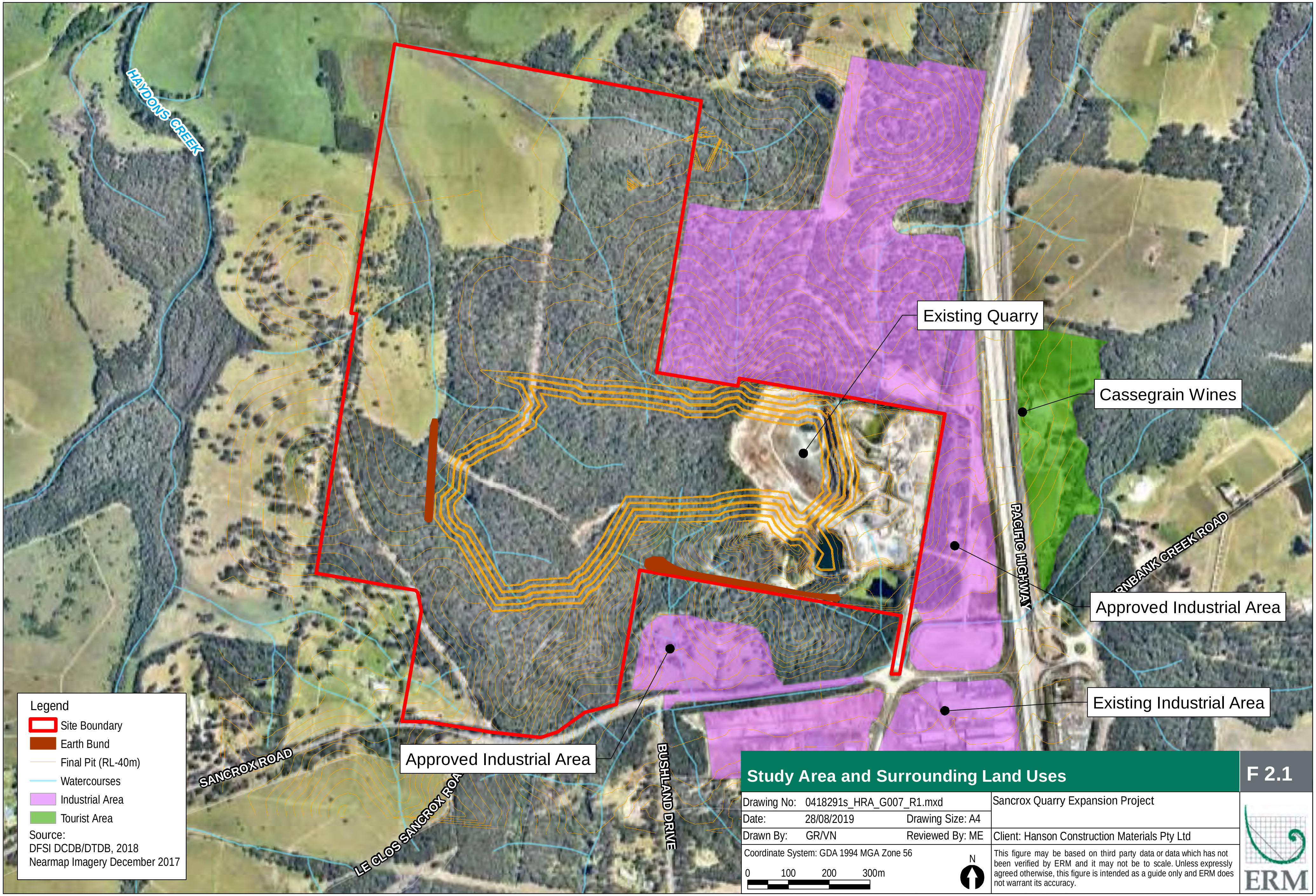
Hanson have operated a quarry at the site since 1998.

2.2.2 *Surrounding Land Use*

The environment surrounding the quarry site includes remnant woodland vegetation immediately adjacent to the north, west and south. A narrow strip of vegetation is present along the eastern boundary, with partially cleared land located 100m to the east. The Pacific Highway and Cassegrain Winery are located approximately 175m and 210m to the east, respectively. Sancrox Road is located approximately 230m to the south of the site, with a suite of industrial facilities beyond.

The closest residence to the site is located approximately 150 m to the south-west, along Sancrox Road. A number of rural residential residences are also located along Bushland Drive to the south-west of the site, the closest being approximately 650m to the south-west. A further rural residential residence is located approximately 1km to the west.

The future development of commercial infrastructure is proposed along the Pacific Highway, adjacent to the existing Sancrox Quarry, as identified in *Figure 2*.1, and detailed in *Section 1.2.2*.


HAYDONS CREEK
Existing Quarry
Cassegrain Wines
PACIFIC HIGHWAY
FERNBANK CREEK ROAD
Approved Industrial Area
Existing Industrial Area
Approved Industrial Area
SANCROX ROAD
LE CLOS SANCROX ROAD
BUSHLAND DRIVE
Legend
Site Boundary
Earth Bund
Final Pit (RL-40m)
Watercourses
Industrial Area
Tourist Area
Source:
DFSI DCDB/DTDB, 2018
Nearmap Imagery December 2017
Study Area and Surrounding Land Uses
F 2.1
Drawing No: 0418291s_HRA_G007_R1.mxd
Date: 28/08/2019
Drawing Size: A4
Drawn By: GR/VN
Reviewed By: ME
Sancrox Quarry Expansion Project
Client: Hanson Construction Materials Pty Ltd
Coordinate System: GDA 1994 MGA Zone 56
0 100 200 300m
N
This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.
ERM

Ancillary Infrastructure
F 2.2

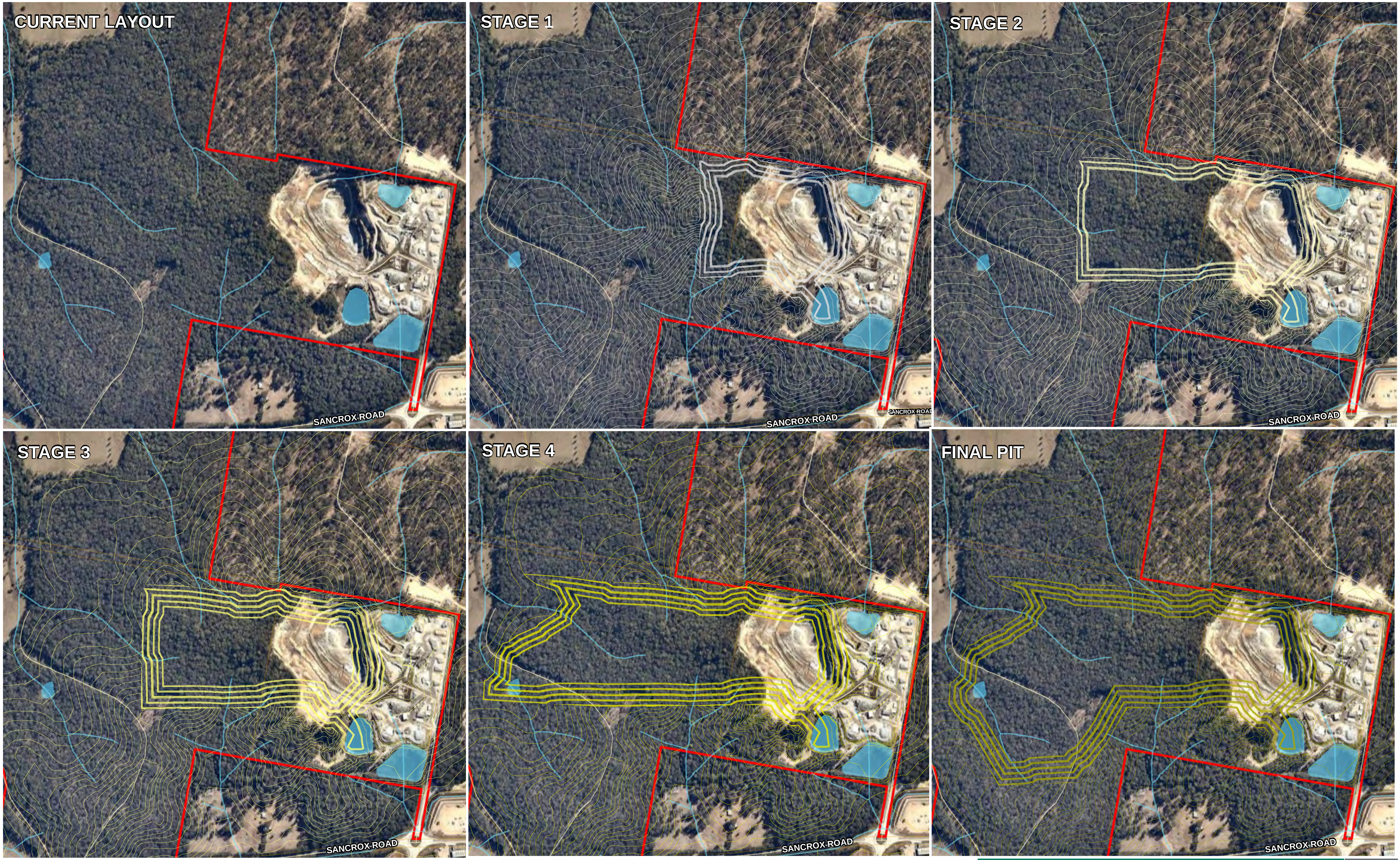
2.3 *EXPANDED QUARRY OPERATIONS*

The resource being quarried comprises a range of rock types, including conglomerates with some associated mudstones, shales and coal as identified by geological investigations undertaken by Hanson (2015). The resource is considered high quality, hard rock aggregate, which has historically been utilized throughout major construction projects within the locality, including the most recent Pacific Highway Upgrade. Refer to *Chapter 3* for further details on the Project's strategic context.

2.3.1 *Project Staging*

The proposed quarry expansion will be completed in five separate stages, over the 30 year lifetime of the Project. Each stage is described below and shown in *Figure 2.3*. Cross-sections for each stage are provided in *Figure 2.4* to *Figure 2.8*.

With the exception of Stage 3, all stages will require clearing of vegetation to allow for the development to progress. The cleared vegetation will be mulched and removed from site where it cannot be beneficially reused on-site for erosion and sediment controls. Clearing will be undertaken by plant such as a bulldozer, one to two excavators, a mulcher and haul trucks to convey the mulch off-site. It is expected that each stage requiring clearing will take three to four weeks to clear and mulch.



Legend

- Existing Property Ownership
- Lot Boundary
- Road Network
- Watercourses

Quarry Staging:

- Stage 1 (RL-14m)
- Stage 2 (RL-14m)
- Stage 3 (RL-40m)
- Stage 4 (RL-40m)
- Final Pit (RL-40m)

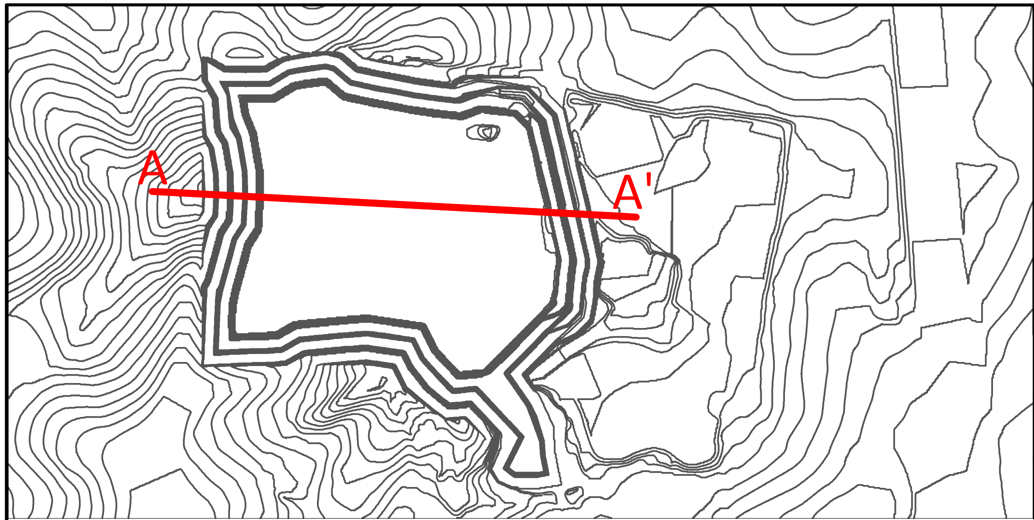
Source:
Spatial Data: DFSI DCDB, DTDB 2017
Imagery Data: nearmap August 2017

Quarry Staging

F 2.3

Drawing No: 0418291s_EIS_G002_R2.mxd	Sancrox Quarry Expansion Project
Date: 27/07/2018 Drawing Size: A4	
Drawn By: LT Reviewed By: ME	Client: Hanson Construction Materials Pty Ltd
Coordinate System: GDA 1994 MGA Zone 56 0 100 200m N	This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

ERM



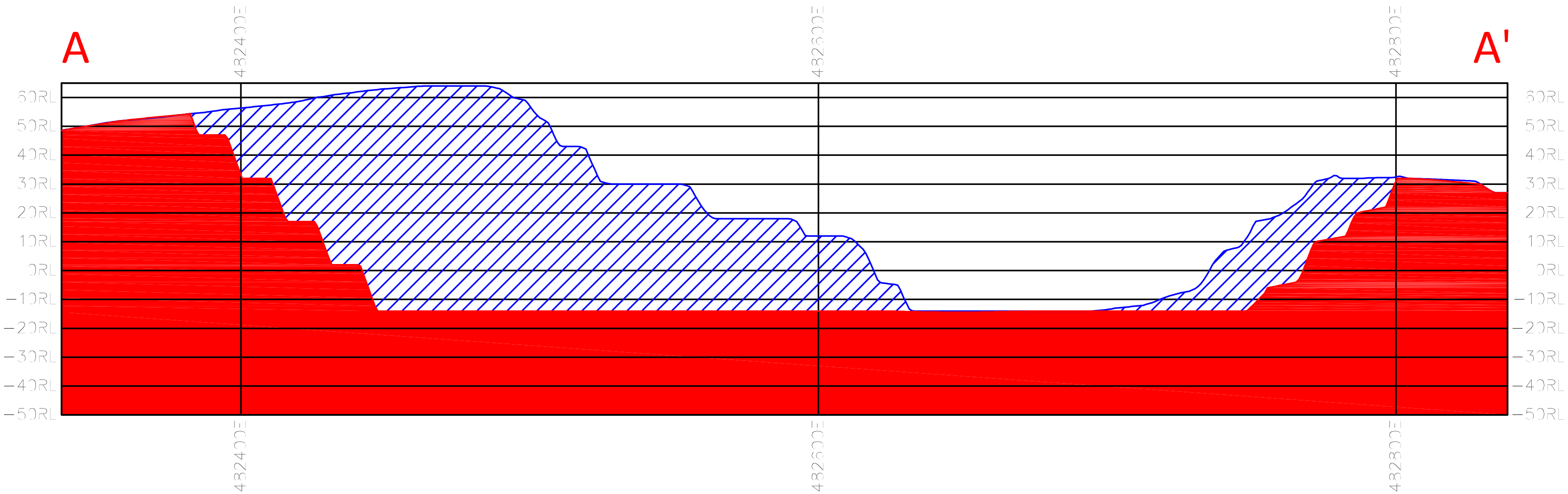
Sancrox Quarry - Extension Project

Staged Development Plan - Cross-Sections

Date: May '17	Stage 1

2017 flyover surface

Stage 1 pit design



Source:

Cross-section supplied by Client June 2018.
max-40st x-section loc.dwg

Cross-Section A-A'

F2.4

Drawing No: 0418291s_HRA_C001_R0.cdr		**Sancrox Quarry Expansion Project**
Date: 19/07/2018	Drawing size: A4	
Drawn by: GC	Reviewed by: TB	Client: Hanson Construction Materials Pty Ltd
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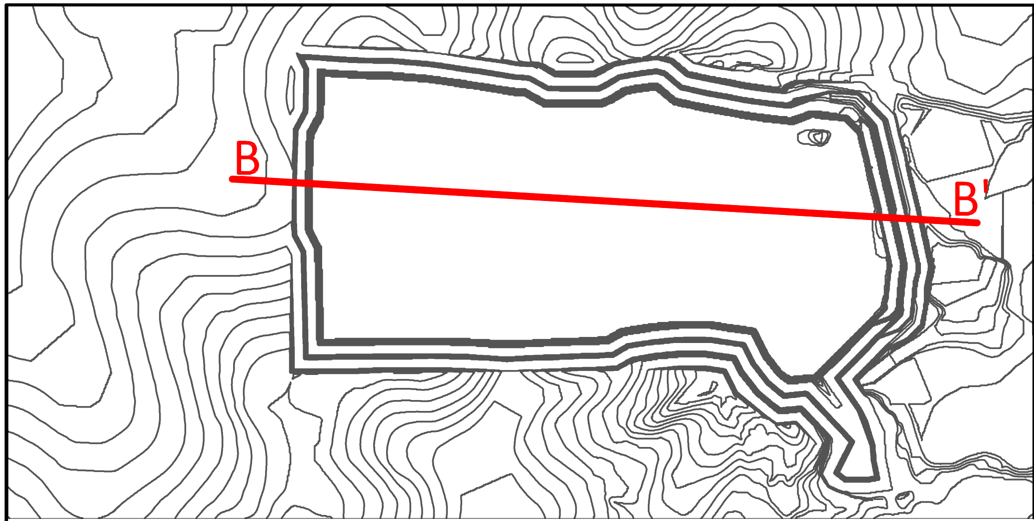
ERM



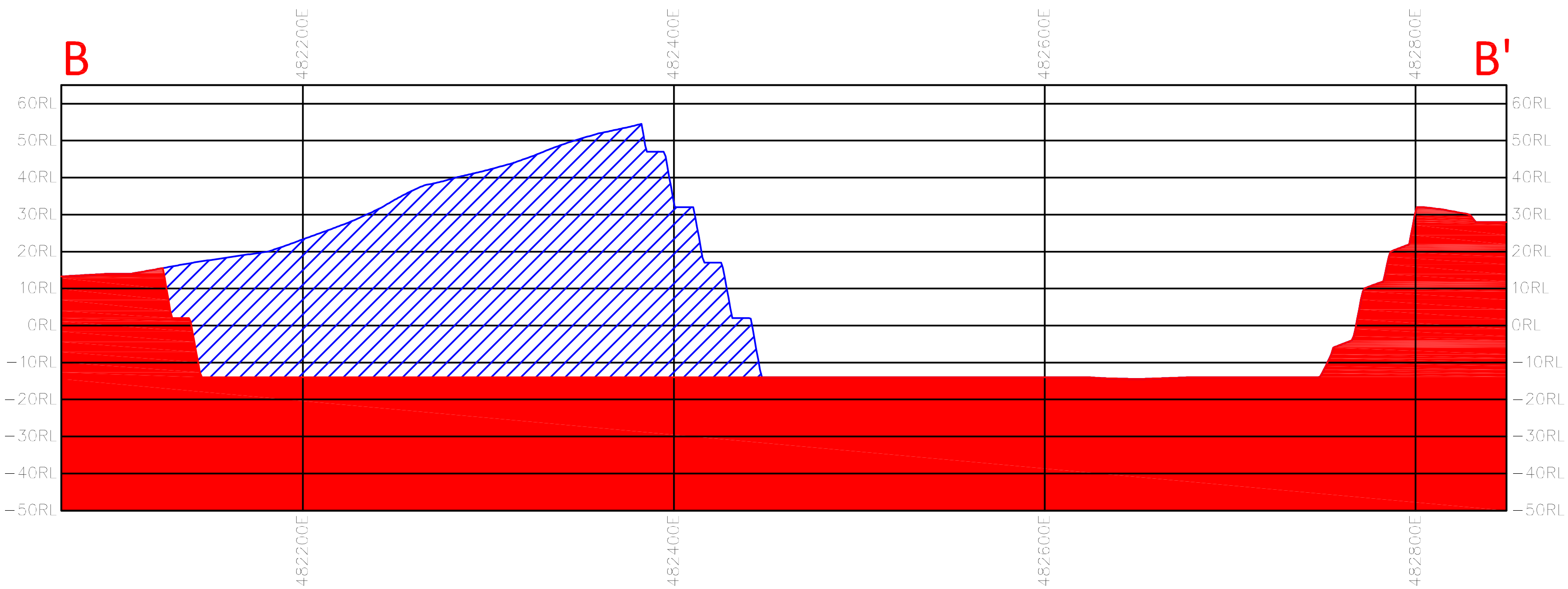
Sancrox Quarry - Extension Project

Staged Development Plan - Cross-Sections

Date: May '17	Stage 2

Stage 1 pit design

Stage 2 pit design



Cross-Section B-B'

F2.5

Drawing No: 0418291s_HRA_C002_R0.cdr		**Sancrox Quarry Expansion Project**
Date: 19/07/2018	Drawing size: A4	
Drawn by: GC	Reviewed by: TB	Client: Hanson Construction Materials Pty Ltd
0 50 100m	N	This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

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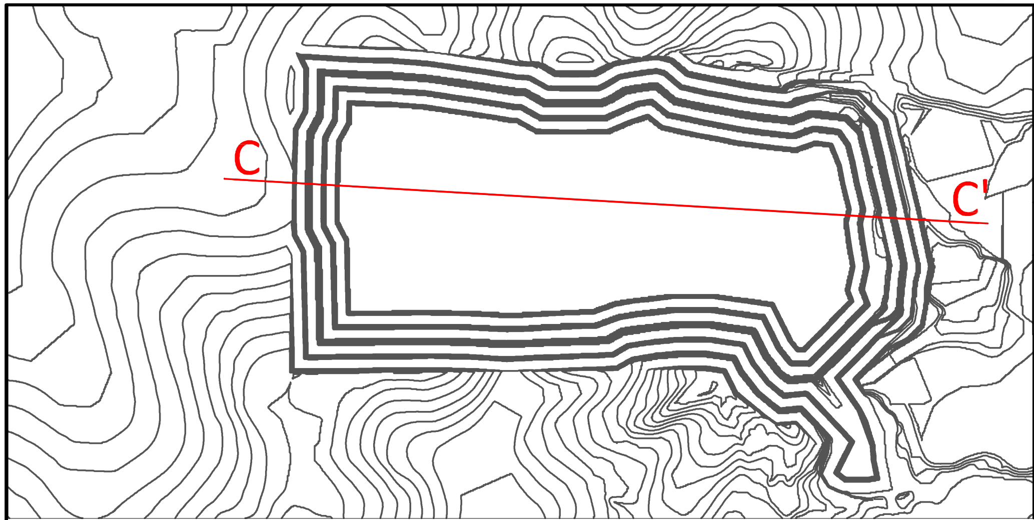
Source:

Cross-section supplied by Client June 2018.
max-40st2 x-section loc.dwg



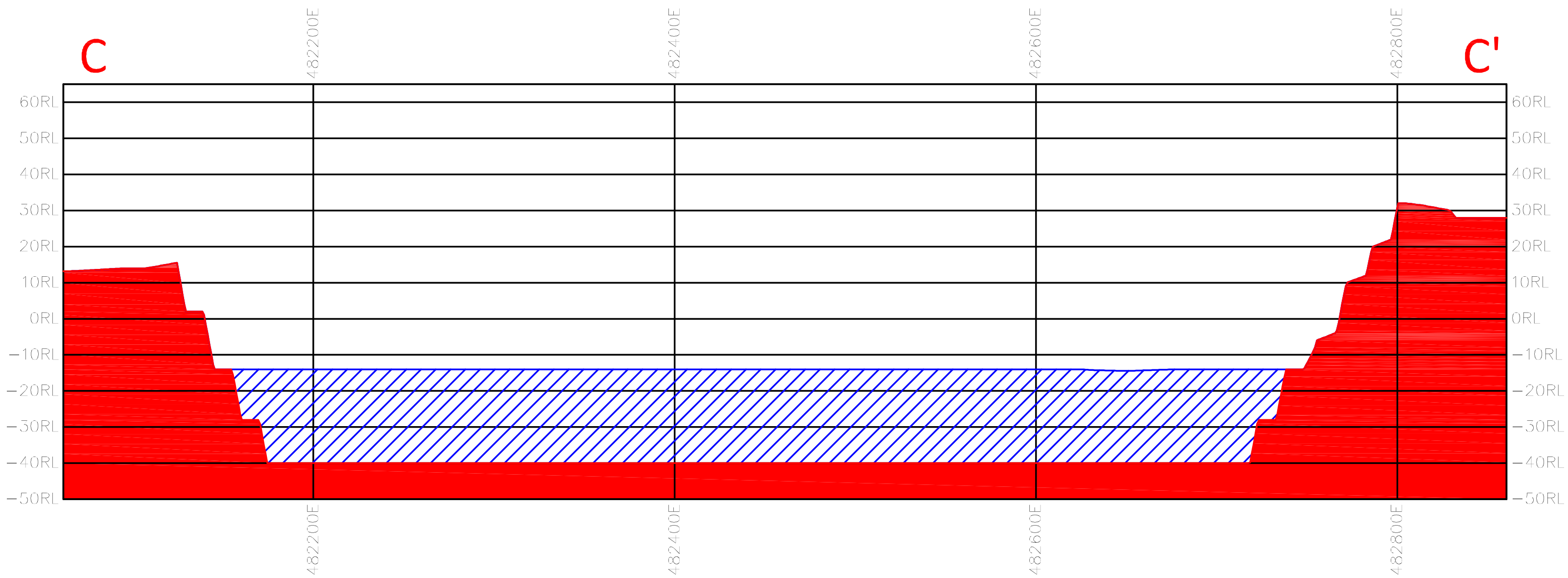
Sancrox Quarry - Extension Project

Staged Development Plan - Cross-Sections

Date: May '17	Stage 3

Stage 2 pit design

Stage 3 pit design



Cross-Section C-C'

F2.6

Drawing No: 0418291s_HRA_C003_R0.cdr		Sancrox Quarry Expansion Project
Date: 19/07/2018	Drawing size: A4	
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Source:
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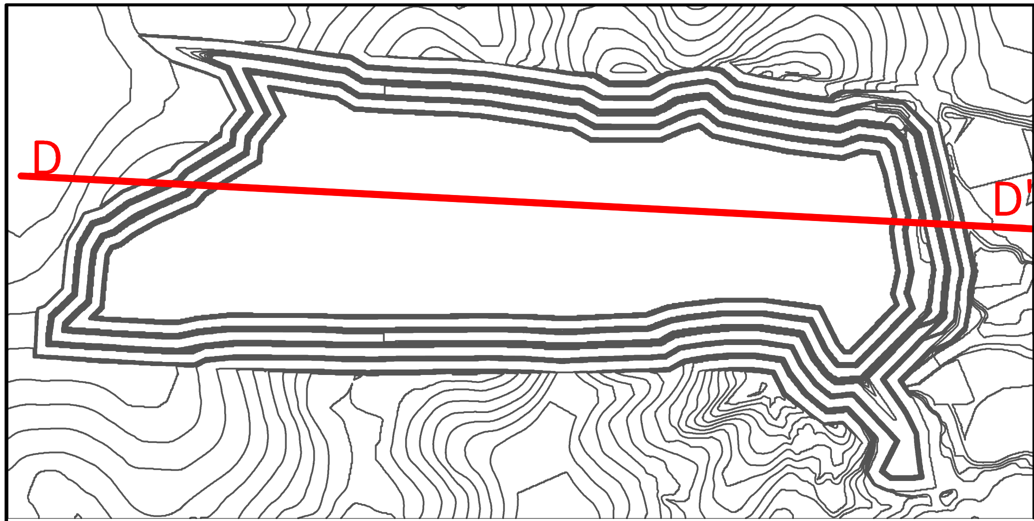


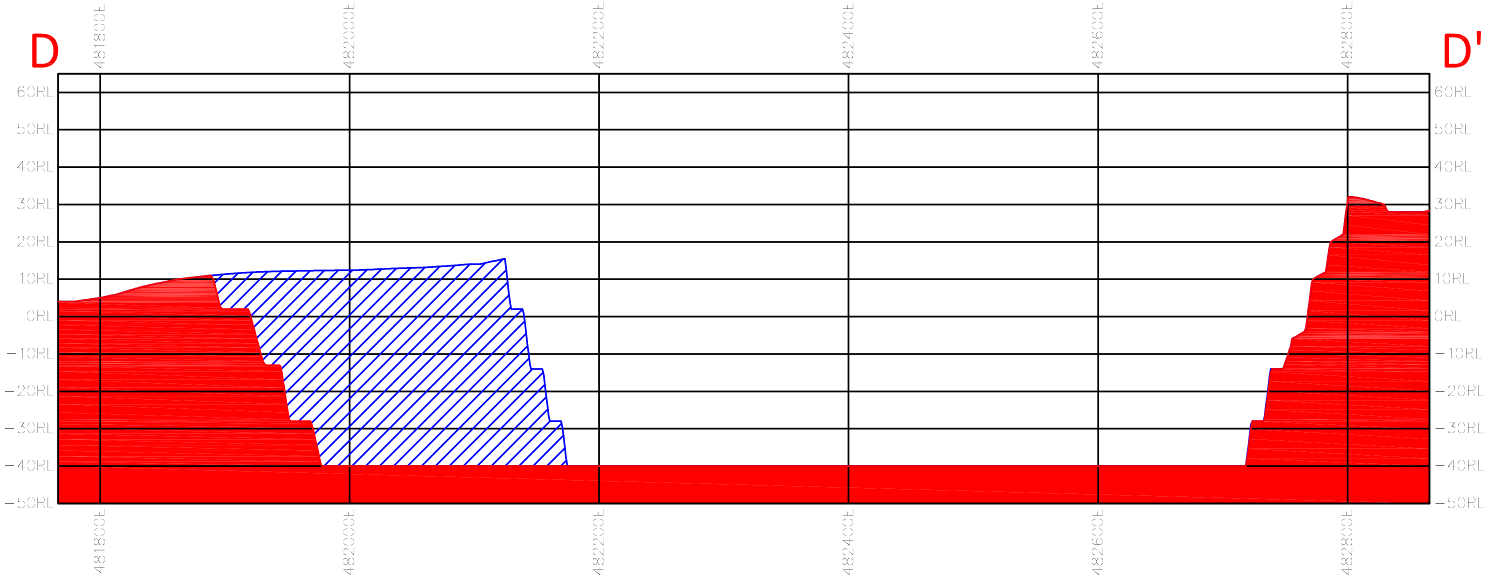
Sancrox Quarry - Extension Project

Staged Development Plan - Cross-Sections

Date: May '17	Stage 4

Stage 3 pit design

Stage 4 pit design



Source:
Cross-section supplied by Client June 2018.
max-40st4 x-section loc.dwg

Cross-Section D-D’

F2.7

Drawing No: 0418291s_HRA_C004_R0.cdr		**Sancrox Quarry Expansion Project**
Date: 19/07/2018	Drawing size: A4	
Drawn by: GC	Reviewed by: TB	Client: Hanson Construction Materials Pty Ltd
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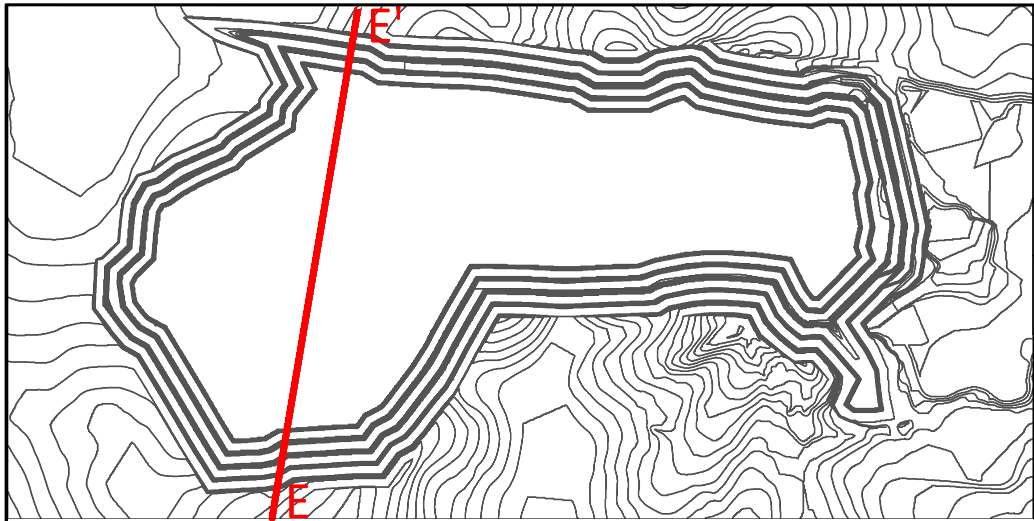
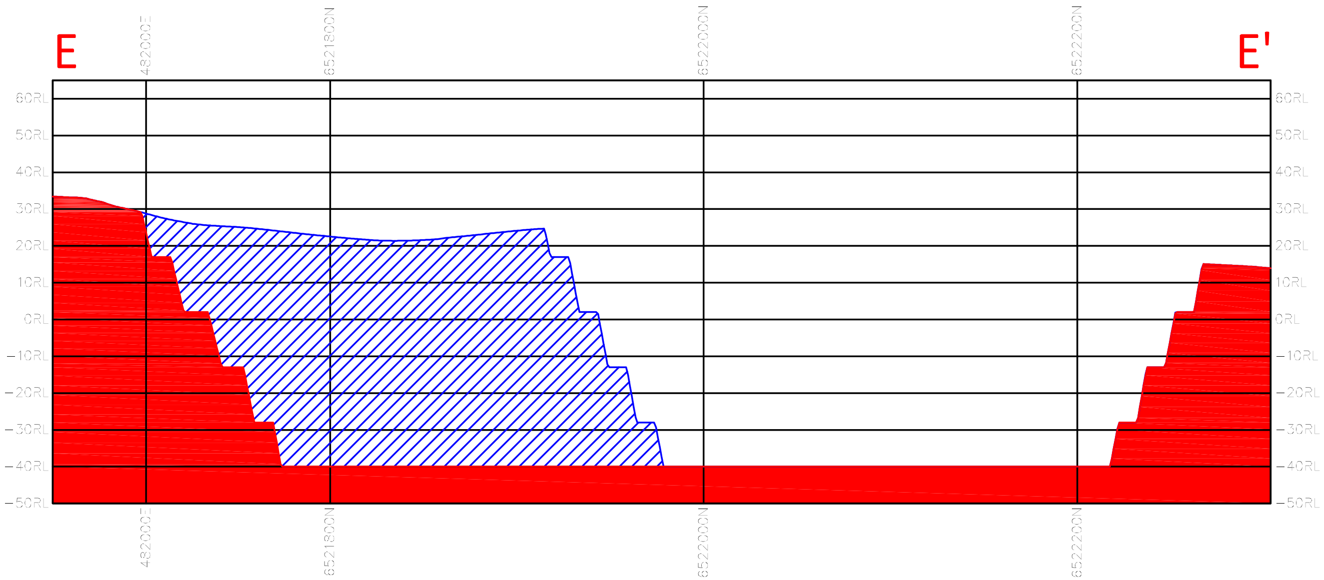
ERM



Sancrox Quarry - Extension Project

Staged Development Plan - Cross-Sections

Date: May '17	Stage 5
Stage 4 pit design	
Stage 5 pit design	



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Cross-section supplied by Client June 2018.
max-40st5 x-section loc.dwg

Cross-Section E-E’

F2.8

Drawing No:	0418291s_HRA_C005_R0.cdr		Sancrox Quarry Expansion Project
Date:	19/07/2018	Drawing size: A4	
Drawn by:	GC	Reviewed by: TB	Client: Hanson Construction Materials Pty Ltd

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Stage 1

Stage 1 involves the expansion of the western side of the quarry into the uncleared area to a depth of RL-14 (AHD). To allow for the construction of the ancillary facilities, vegetation clearing and development of pads will be undertaken during this stage.

Stage 2

Stage 2 will further expand the existing western side of the quarry at the same depth of RL-14 (AHD).

Stage 3

Stage 3 will widen and deepen the benches towards the western extraction boundary. At this stage there will be up to four benches (dependant on the topography at the pit void), some of which will be active and others at progressive or final stages of rehabilitation. The quarry pit floor will be lowered from RL – 14 (AHD) to RL - 40m (AHD).

Stage 4

Stage 4 involves the expansion of operations to the west to the extraction boundary at the same depth of RL – 40 (AHD).

Stage 5

The final stage will expand the quarry along the southern extraction boundary at the same depth of RL – 40 (AHD).

2.3.2 Extraction Process

Quarrying

The basic methodology for quarrying at Sancrox Quarry will involve the following processes:

- ripping and stockpiling of material in-pit;
- drilling and blasting at greater depths where rock is significantly harder and ripping is no longer feasible;
- internal hauling of material to the processing plant;
- loading, transport and distribution of product to customers; and
- progressive rehabilitation (refer to *Chapter 17* for further details on quarry rehabilitation).

Following ripping and/or blasting, an excavator will be located on the rock heap, and will load material into internal haul trucks to deliver to the processing plant. An excavator or front end loader will be used to load product into haul trucks following processing. Some material will be stockpiled on-site as required in order to meet demand requirements during peak extraction periods.

Overburden Management

Overburden will be removed and stored, predominantly at the perimeter of the quarry at each stage. This material will be utilised to provide cover for the batters and the quarry floor upon completion of quarrying.

Stockpile Management

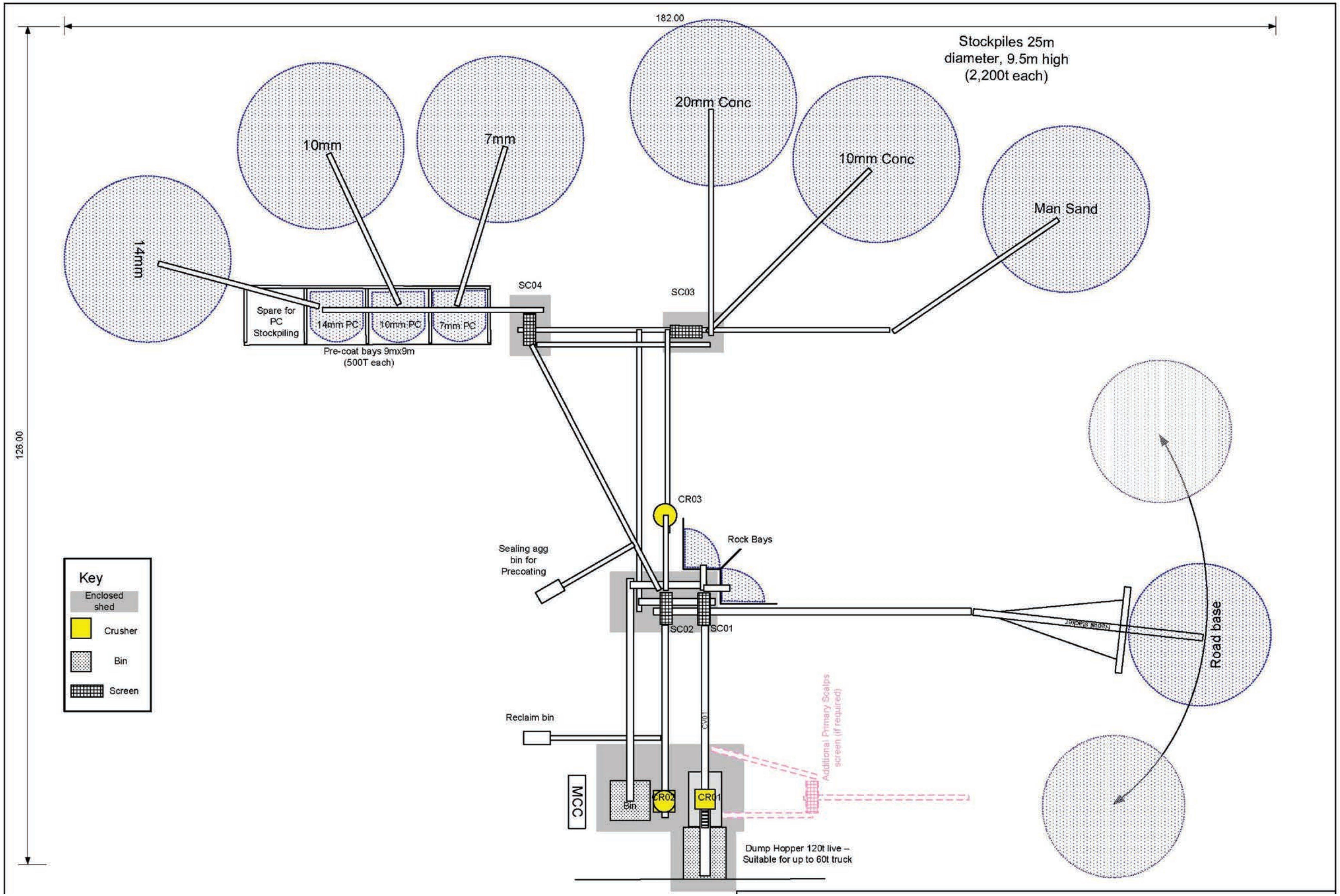
The site currently has an area of approximately 2.2 ha for aggregate stockpiling. The stockpiles are located towards the eastern portion of the site adjacent to the main crusher and screen and in the southern portion of the site between the two WHDs and the site office and workshop. The extracted materials are processed and stockpiled on-site, before being loaded with a front end loader into road trucks to be delivered to customers.

The Project proposes to include the development of new stockpile areas, south of the existing pit as shown in *Figure* 2.2.

The internal access road to the proposed stockpiles from the front gate will be asphalt sealed to limit dust generation.

2.3.3 Processing Plant

The proposed processing plant will comprise a crusher and screener for the crushing, grinding and separating of rock into various sizes of aggregate. The processing plant will be located within the proposed 'Infrastructure Area', at the southern end of the existing lot (Lot 353 DP 754434), as shown in *Figure 2.2*. A typical layout for the processing plant is shown in *Figure 2.9*.



Typical Layout for Processing Plant

F2.9

Drawing No: 0418291s_QE_C001_R0.cdr		Sancrox Quarry Expansion Project
Date: 19/10/2018	Drawing size: A3	
Drawn by: GC	Reviewed by: TH	Client: Hanson Construction Materials Pty Ltd
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ERM

2.3.4 *Water Management*

A summary of conceptual water flow and quality management is provided in *Chapter 7,* with further detail provided in the Hydrology Assessment (*Annex E*). The primary water flow management method will be drains/bunds to prevent non-project related, upslope run-off entering the quarry void. The primary water quality management method will be progressive rehabilitation and clearing to manage erosion and WHDs to capture and treat sediment laden site run-off. Water for input into production and dust management will be sourced from these new and existing WHDs, with a water balance identifying a sufficient supply as described in *Chapter 7*.

The EPL will require modification to allow for the proposed WHDs to discharge from site upon meeting water quality criteria, verified by water quality sampling. The EPL will also need to be updated to incorporate the increased extraction rate.

Dust Suppression

Dust suppression at Sancrox Quarry utilises both fixed sprinklers and a water cart. Site staff are informed of dust being an important environmental management issue through induction and training. Sancrox Quarry maintains a complaints register to ensure all community complaints are recorded and dealt with in a timely manner. All drivers are aware that by law, any potential dust generating load leaving Sancrox Quarry must be covered.

The water cart is utilised on an as needed basis dependent upon weather conditions. The water cart is utilized during warm and windy conditions to ensure minimal dust leaves the site.

Sprinklers are located along bund walls areas that see lots of traffic movement. This allows regular dust suppression to occur in the busiest areas of the quarry. The sprinklers operate on a timer which is set to meet the needs of that season.

Chapter 11 provides further information on proposed dust suppression measures during construction and operation of the Project.

2.3.5 *Traffic Movements and Haulage Routes*

The quarry is serviced by the Sancrox Interchange, which is a loop road comprising of Sancrox Road off the quarry access road, Frogs Road and Fernbank Creek Road. There is an overpass bridge providing passage for Frogs Road over the Pacific Highway. The Sancrox Interchange provides for north, south and eastern traffic movements from the quarry by linking to the Pacific Highway and Winery Drive linking with Hastings River Drive towards Port Macquarie. Both the Pacific Highway and the Sancrox Interchange have recently opened to traffic, hence have been constructed to modern design requirements. Western movements from the quarry are recommended on the Oxley Highway which is serviced by an interchange from the southbound Pacific Highway carriageway.

The expanded quarry operation will increase average truck volumes to approximately 200 truck trips per day (a 'trip' is a two movements – in and out of site).

Further information in relation to traffic and access associated with construction and operation aspects of the Project is provided in *Chapter 12*.

2.4 PROPOSED ANCILLARY INFRASTRUCTURE

Hanson proposes to construct an asphalt production plant, and relocate the existing processing plant and stockpiles to the Infrastructure Area, south of the existing pit, as shown in *Figure* 2.2. The concrete batching plant and concrete recycling facility will be constructed in the north eastern portion of Lot 353 DP 754434 as shown in *Figure* 2.2.

It is expected that the demolition and removal of existing structures will take approximately 1-2 months to complete, while the construction of the proposed ancillary infrastructure will take approximately 12 months. Further detail is outlined for each section of proposed ancillary infrastructure below.

2.4.1 Concrete Batching Plant and Recycling Facility

Hanson is seeking consent to construct and operate a concrete batching plant and recycling facility, capable of producing 20,000 tpa of cement and receiving up to 20,000 tpa of concrete material for recycling. It will be located in the north-east corner of the site (refer to *Figure 2.2*). The plant will batch wet cement in agitators for use in regional construction projects. The recycled concrete aggregate will be beneficially reused as a substitute for virgin aggregates in products such as road base and drainage materials. Crushing may be required to size recycled concrete aggregates such that it is suitable for the intended use.

Three main types of commercial vehicles will operate at the plant:

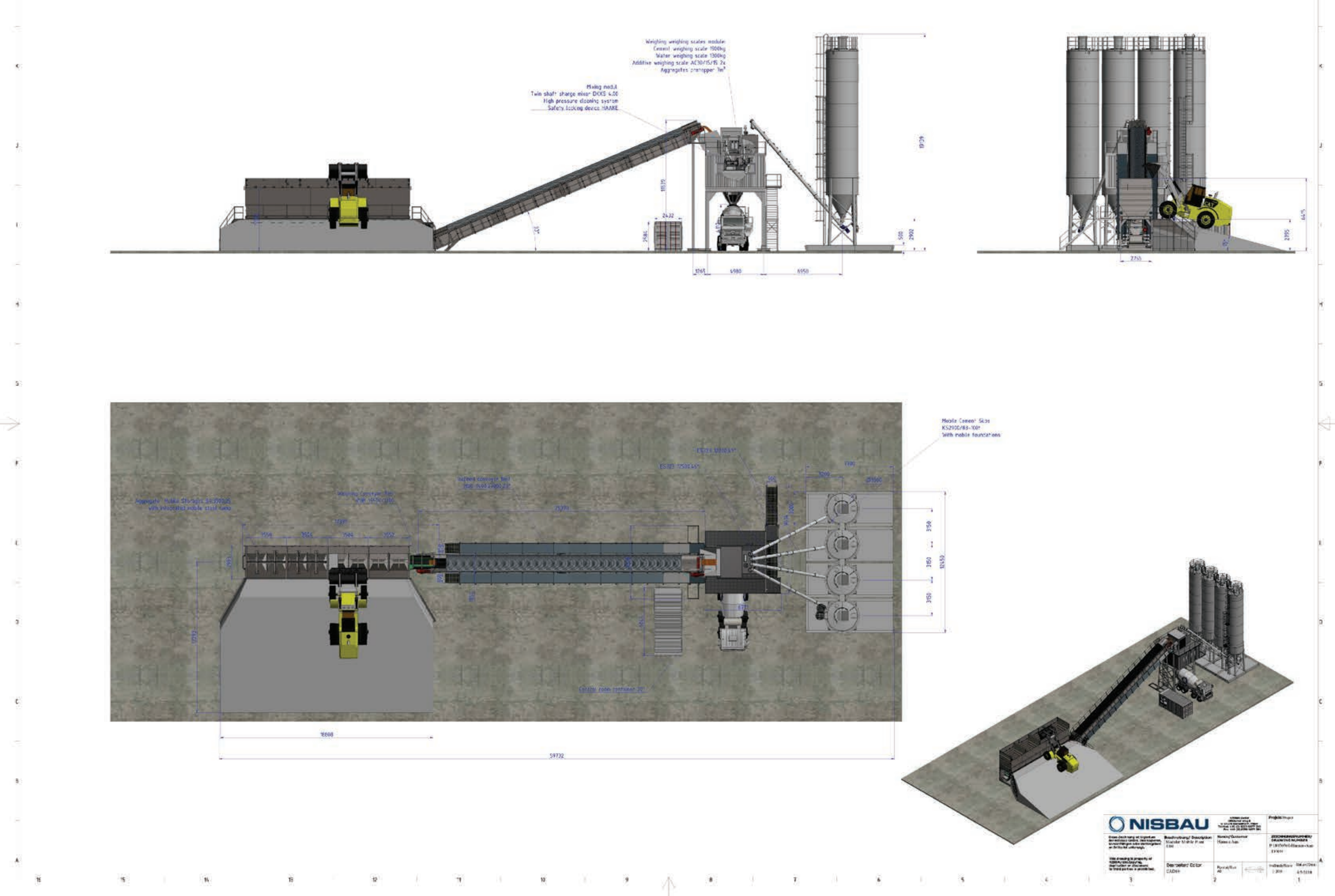
- agitator trucks – delivering concrete mixed to regional construction projects.
- cement tankers – delivering cement to the Site.
- aggregate trucks – delivering sand aggregates to the Site for use in the batching process.

Other on-site vehicles will include a front end loader, which will be used to transfer basalt aggregates from the quarry stockpiling area for use in the batching process.

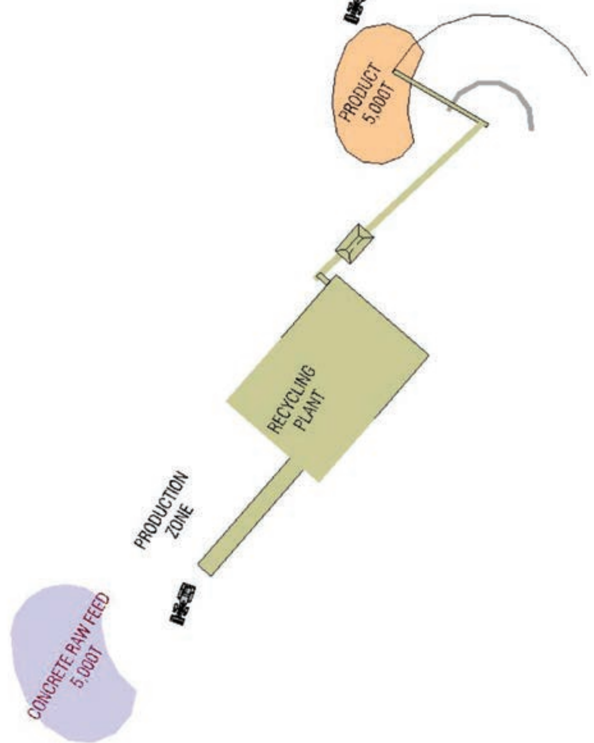
All batching activities will be totally enclosed with fabric filters and material storage bins will be enclosed on three sides.

A typical layout for the concrete batching plant and recycling facility is shown in *Figure 2.10.*

CONCRETE BATCHING PLANT



RECYCLING FACILITY



Typical Layout for Concrete Batching Plant and Recycling Facility

F2.10

Drawing No: 0418291s_QE_C002_R0.cdr		Sancrox Quarry Expansion Project
Date: 19/10/2018	Drawing size: A3	
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Construction

Construction of the concrete batching plant and concrete recycling facility will take approximately three months and involve the following activities:

- earthworks to establish a level pad for the construction of the plant and environmental controls;
- construction of a concrete hardstand area;
- delivery of components by heavy vehicles;
- configuration and construction of plant components; and
- pre-commissioning tests.

Equipment laydown areas will be provided within the existing quarry footprint, preventing additional clearing or use of land beyond the Project boundary.

Operation

The operation of the concrete batching plant and concrete recycling facility will be comprised of:

- cementitious materials silos;
- aggregate storage bins with dust suppression systems;
- weigh hoppers for aggregates and cementitious materials;
- conveyor belt (with cover) from aggregate bins to pan mixer;
- pan mixer;
- dust extractor for capturing of cementitious materials located above the pan mixer;
- water holding tank;
- admixture/additives storage facility;
- first flush system; and
- a truck/concrete agitator washout bay.

The raw, hard rock aggregate materials will be delivered to the concrete batching plant from the processing plant and cementitious materials will be imported from off-site. The raw materials will be stored in silos or holding bins and used in the batching process by an automated, computerised control system. The cementitious materials will be pneumatically fed from the delivery trucks to the storage silos to prevent potential dust emissions.

Aggregates will be transported along the conveyor to the mixer. Once released, the raw materials will enter a pan mixer which will homogenise the feed materials to produce the readymade concrete. All discharge to the pan mixer will be via enclosed system to ensure adequate containment of materials. After a set duration and completion of quality control checks of the product, the concrete batch will be pneumatically loaded to the concrete agitator trucks, for off-site delivery.

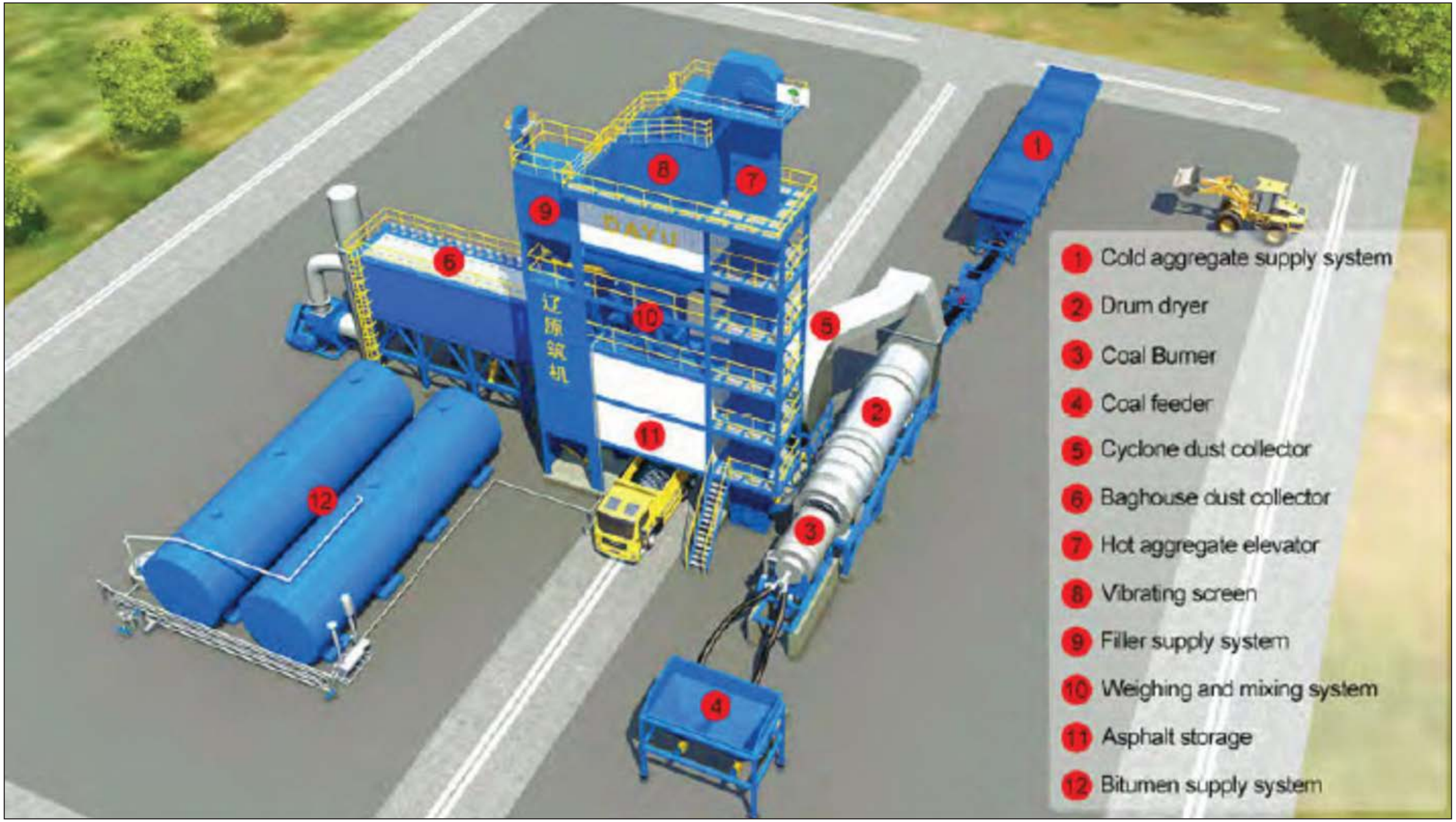
A first flush system will be constructed within the concrete batching plant and recycling facility area to manage cement laden washout water generated from the area. Sediment collected in the first flush system will be regularly removed to ensure the on-going efficiency of the system. Removed sediment will be dried and recycled at the concrete recycling facility.

Concrete agitator trucks will be washed out into a dedicated concrete washout bay. Similar to the first flush system, any accumulated sediment will be regularly removed, following drying and recycled at the recycling plant.

The concrete batching plant will generate approximately 11 agitator trips per day during operation. The concrete recycling facility will generate approximately eight truck trips per day.

2.4.2 *Asphalt Production Plant*

The asphalt production plant will produce asphalt to be used for road construction. The asphalt production plant will be located within the Infrastructure Area as shown in *Figure 2.2*. A typical layout for the concrete batching plant and recycling facility is shown in *Figure 2.1.*



Typical Layout for Asphalt Production Plant

F2.11

Drawing No: 0418291s_QE_C003_R0.cdr		Sancrox Quarry Expansion Project
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Drawn by: GC	Reviewed by: TH	Client: Hanson Construction Materials Pty Ltd
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ERM

The asphalt production plant will be comprised of:

- aggregate hoppers;
- bitumen tanks;
- conveyor;
- mixer/batcher;
- pre-coat plant (tanks of hydrocarbon pre-coat product and stockpiles);
- baghouse filters; and
- boiler to heat bitumen.

The plant will be gas powered. A triple interceptor or similar pollution control device will be utilised as a "first flush" for the potential hydrocarbon contaminated areas in the plant site. The downslope WHD servicing the plant catchment will also be fitted with a floating hydrocarbon boom as a precautionary measure to contain any potential loss of hydrocarbons from the plant catchment.

A vapour balancing system will be installed for the delivery of bitumen on-site and a vapour recovery system will be utilised for transfer of asphalt to trucks to minimise odour and dust emissions. The access road from the front gate to the asphalt production plant will be asphalt sealed to limit dust generation.

Construction

Construction of the asphalt production plant will take approximately three months and involve the following activities:

- clearing of proposed Infrastructure Area that is currently vegetated;
- mulching cleared vegetation and removal of mulch from site;
- earthworks to establish a level pad for the construction of the plant and environmental controls;
- construction of a concrete hardstand area;
- delivery of components by heavy vehicles;
- configuration and construction of plant components; and
- pre-commissioning tests.

It is likely that the asphalting of internal roads will commence upon the operation of the asphalt production plant. Equipment laydown areas will be provided within the existing quarry footprint, preventing additional clearing or use of land beyond the Project boundary.

Operation

Operation of the asphalt production plant requires high quality aggregate and bitumen. The aggregate for asphalt production will be obtained from the rock processed at the processing plant and will be delivered directly to the aggregate storage bins at the asphalt production plant.

The produced asphalt will be loaded into trucks and taken off-site via the weighbridge. The production of asphalt will generate approximately 21 truck trips per day.

2.4.3 Pug Mill

A pug mill will be used to mix materials for application of road base, and will also be located within the proposed Infrastructure Area. A typical pug mill consists of a horizontal boxlike chamber with a top inlet and a bottom discharge at the other end, two shafts with opposing paddles and a drive assembly.

2.5 SITE FACILITIES AND SERVICES

Existing facilities and services established at the quarry include an administrative office with amenities including toilet, shower and lunch room, a workshop with refuelling area and hazardous material storage area, and parking spaces to accommodate both employees and visitors.

A weighbridge is located near the site entrance, which weighs material being transported to and from the quarry.

These existing facilities and services will remain in their current position during the site redevelopment, as shown in *Figure 2.2*.

The administrative office is serviced by tank water and a Council approved on-site effluent management system.

Electricity is supplied by the power lines traversing north-south on the eastern side of the site. The site redevelopment and construction of new ancillary infrastructure may require realignment of these poles or installation of new feeder lines to the infrastructure. All permits to develop these works will be obtained from the electricity provider, as required.

2.6 PLANT AND EQUIPMENT

A range of plant and equipment will be utilised during the operation of the Project, including:

- light vehicles to convey staff to and from, as well as around site;

- heavy vehicles (predominately truck and dogs) to convey materials within the site and deliver quarried materials, concrete and asphalt off-site. The delivery of concrete washout material to site will also be undertaken by heavy vehicles;
- crusher and screener (quarried material processing plant);
- front end loaders to load trucks and distribute product around site;
- excavators to separate rock stockpiles and load trucks;
- concrete batching plant and recycling facility components;
- asphalt production plant components;
- pug mill components;
- pumps for dewatering and distributing water around site. One such pump will also likely operate a standpipe to fill the water carts;
- water carts for product moisture and dust suppression;
- road sweeper;
- sprinklers for dust suppression;
- weighbridge; and
- concrete agitators.

Additional equipment will also be required for construction, as outlined throughout this section.

2.7 *WORKFORCE*

By extending the life of Sancrox Quarry to 30 years, the current workforce of 15 operators, supervisors and management will be retained. Should consent be granted to increase production to 750,000 tpa, a larger workforce of approximately 25 employees will be required for quarry operations, increasing existing workforce by 10.

In addition to the quarrying staff, the concrete batching plant will employ up to five concrete agitator truck drivers, one batcher and one concrete plant manager.

The asphalt production plant is expected to employ between four and five employees, potentially including:

- One plant manager;
- Two batchers / dispatchers;

- One loader;
- Two truck drivers; and
- One Lab Technician

Concrete waste recycling will employ two drivers to transport the unused concrete from Hanson concrete plants to Sancrox Quarry for stockpiling while waiting to be crushed. This recycled product will be used at Sancrox Quarry and may also be transported to other Hanson quarries to produce more environmentally sustainable road base materials throughout the region.

The Project is anticipated to provide important economic benefits into the local economy. Employment opportunities will be created in the labour and trade employment sectors. Additional benefits include employment opportunities during the construction and operation phases of the Project, and flow on effects to the local economy. Increasing Sancrox Quarry's workforce, due to rising production levels, along with the addition of the concrete batching and asphalt production plant and associated employment opportunities, is further discussed in the Socio-Economic Assessment, contained within *Chapter 14*.

2.8 DEMOBILISATION AND LAND REHABILITATION

Sancrox Quarry currently practices progressive rehabilitation on site. Hanson's opportunistic and progressive rehabilitation will continue throughout the Project life, as part of a planned program of activities to achieve an acceptable final landform. Rehabilitation will be carried out progressively following each stage of extractive operations to ensure a stable landform and to control soil erosion.

The progressive approach helps minimise the liability falling on the operator by rehabilitating the quarry during the operation rather than undertaking the larger task of rehabilitating the quarry following the closure of the quarry, when there is no direct income from quarrying activities (CDITR, 2006).

The progressive approach will allow for rehabilitation methods to be tested and consequently improved to ensure rehabilitation methods are effective (CDITR, 2006).

Quarry rehabilitation work will be undertaken in accordance with relevant guidelines and requirements of the SEARs.

Further information in relation to quarry closure and rehabilitation is provided in *Chapter 17*.

2.9 *WASTE STREAMS*

Waste streams to be generated during construction and operation are discussed in *Chapter 16*. The waste management hierarchy will be applied to limit the generation of waste that is to be directed to landfill and where practicable, resource recovery exemptions will be utilised.

The development of the waste concrete recycling facility is the creation of a commercial enterprise based on the principle of the beneficial reuse of a resource, hence is considered Environmentally Sustainable Development (ESD).

REFERENCES

Commonwealth Department of Industry Tourism and Resources (CDITR) (2006) **Mine Rehabilitation Handbook.**

Ecomak (2018) **Screw Conveyors and Pug Mill**. Accessed on 1 February 2017 from http://www.ecomak.co.in/en/products/dust-disposal-system/screw-conveyors-and-pug-mill.html

3 *STRATEGIC AND STATUTORY CONTEXT*

This Chapter identifies the relevant policies and plans which demonstrate the strategic planning context and need for the Project. It provides a description of how the Project complies with the relevant legislation, policies and plans, including an overview of the importance of the Project within the strategic planning context.

The Chapter has been prepared with due regard to guidance provided in the Guidelines for Preparing an EIS (DP&E, 2017), with the level of detail provided for each section of relevant legislation relating to the overall relevance to the Project.

3.1 *STRATEGIC CONTEXT*

The *Mid North Coast Regional Strategy* (Department of Planning [DoP], 2009) recognises the importance of the regions natural resources base to the continued sustainable growth and development of the region. By 2031, the Mid North Coast population is expected to grow by 28% to around 424,600 (DoP, 2009). This represents an annual average growth rate of approximately 1.1% over the next 25 years, among the highest regional growth rates in regional NSW (DoP, 2009). The population of the Port Macquarie-Hastings Region is projected to increase from 76,788 in 2012 to 104,589 by 2031, an increase of 27,801 people, or 36.2% (PMHC, 2013).

Population increases of this size stimulate housing development that has a requirement for hard rock aggregates and batched products such as cement and asphalt. Renovations and council infrastructure improvement projects will generate waste concrete and the provision of the proposed recycling allows for an additional local facility for processing of this material for beneficial reuse.

According to the *Mid North Coast Regional Strategy*:

"The Region's economy is now largely based on service, manufacturing, construction and primary industries. Many of the industries depend on environmental and natural resources such as extractive materials, forests, soils and water, which must be protected in the face of the growing population."

Additionally:

"Local environmental plans will protect land identified as having extractive resources of regional significance and their haulage routes"

The Sancrox Quarry was identified in the *Mid North Coast Regional Strategy* (DoP 2009) as important for extractive resources. DoP (2009) stressed the importance of protecting extractive resources for their optimal economic use and not sterilising land suitable for extractive purposes by enabling inappropriate land use.

3.2 COMMONWEALTH LEGISLATION

3.2.1 *Environment Protection and Biodiversity Conservation Act 1999*

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) relates to the protection of the environment and the conservation of biodiversity. The EPBC Act incorporates an assessment and approvals system for:

- actions that have a significant impact on matters of national environmental significance (NES);
- actions that have a significant impact on the environment of Commonwealth land; and
- actions carried out by the Commonwealth Government.

Matters of National Environmental Significance

A search using the Department of the Environment (DoE) Protected Matters Search Tool (PMST) was undertaken by SLR Consulting Australia Pty Ltd (SLR) on 22 December 2016. The search was conducted as part of a Biodiversity Assessment Report (BAR) (SLR, 2017) prepared for the Project and is provided in *Annex C* of this EIS. The results of the search are summarised in *Table 3.1* below.

Table 3.1 Relationship of the Project to Matters of National Environmental Significance

Matter of National Environmental Significance	Application to the Project	Relevant Section
World Heritage Areas	Not relevant	N/A
National Heritage Places	Not relevant	N/A
Great Barrier Reef Marine Park	Not relevant	N/A
Wetlands protected by international treaty (the Ramsar Convention)	Not relevant	N/A
Nationally listed threatened species and ecological communities	Yes – Two threatened ecological community and 57 threatened species have the potential to occur at the site.	*Chapter 5 & Section 8.1 of BAR*
Nationally listed migratory species	Yes – 55 nationally listed migratory species have the potential to occur at the site.	*Chapter 5 & Section 8.1 of BAR*
All nuclear actions	Not relevant	N/A
Commonwealth Marine Areas	Not relevant	N/A
Water resource, in relation to coal seam gas development and large coal mining development.	Not relevant	N/A

Other protected matters include the:

- environment, where actions proposed are on, or will affect Commonwealth land and the environment; and
- environment where Commonwealth agencies are proposing to take an action.

The action is not being undertaken by a Commonwealth agency. Commonwealth land in the locality includes Australian Postal Commission, Australian Telecommunications Commission and Defence Services Homes Corporation. The Project is not located on Commonwealth land and there is no Commonwealth land likely to be affected.

Implications for the Project

The potential impact of the Project on threatened species, migratory species and Endangered Ecological Communities has been assessed, with discussion of the determination of highly unlikely adverse impacts provided in *Chapter 5* and the BAR in *Annex C* of this EIS. Therefore, Commonwealth approval under the provisions of the EPBC Act is not required.

3.3 STATE LEGISLATION

3.3.1 *Environmental Planning and Assessment Act 1979*

The relevant State planning legislation is the *Environmental Planning and Assessment Act 1979* (EP&A Act). The EP&A Act institutes a system of environmental planning and assessment within New South Wales and is administered by the Department of Planning and Environment (DP&E).

State Significant Development

The proposed increase in production at the Sancrox Quarry to 750,000tpa is classified as 'state significant development' under Schedule 1, Clause 7 of *State Environmental Planning Policy (State and Regional Development) 2011* , as the Project will result in the extraction of more than 500,000 tonnes of extractive materials per annum. The total resource available is based on quarrying operations within the existing quarry footprint to RL - 40m, and benched quarry walls is approximately 3,220,000 tonnes.

The Project will be assessed as State Significant Development (SSD) and will require development consent under Part 4, Division 4.1 of the EP&A Act. DP&E will be the determining authority.

Integrated Development

The development is also classified as 'integrated development' as it requires an environment protection licence (EPL) under *Section 48* of the *Protection of the Environment Operations Act 1997* (POEO Act).

Other Provisions

The EP&A Act is supplemented by the EP&A Regulation, as well as a suite of Environmental Planning Instruments (EPIs), namely Local Environmental Plans (LEPs) and State Environmental Planning Policies (SEPPs). The EPIs implemented under the EP&A Act that are considered relevant to the Project are:

- *State Environmental Planning Policy (Mining, Petroleum and Extractive Industries) 2007;*
- *State Environmental Planning Policy 33 – Hazardous and Offensive Development;*
- *State Environmental Planning Policy 44 – Koala Habitat Protection;*
- *State Environmental Planning Policy (State and Regional Development) 2011; and*
- *Port Macquarie – Hastings Local Environmental Plan 2011.*

These provisions are considered further in *Table 3.3*.

3.3.2 *Biodiversity Conservation (Savings and Transitional) Regulation 2017*

The NSW legislation regarding biodiversity transitioned on 25 August 2017 with the commencement of the *Biodiversity Conservation Act 2016* (BC Act). The BC Act is now required to be considered regarding biodiversity impact assessment for future development applications.

The *Biodiversity Conservation (Savings and Transitional) Regulation 2017* contains guidance and legislative clarity regarding how the transition to the new BC Act applies to projects which were in the process of assessment or at the point of development application submission during this transition period.

Relevant to this project, the *Biodiversity Conservation (Savings and Transitional) Regulation 2017* (Clause 27(1)(b)) defines a "pending or interim planning application" as:

"an application for planning approval (or for the modification of a planning approval) made within 18 months after the commencement of the new Act if an environmental impact statement is to be submitted in connection with the application and the Secretary of the Department of Planning and Environment issued, before the commencement of the new Act, environmental assessment requirements for the preparation of the statement"

Further, relating to the above provision, clause 28 (2) states:

"For the purposes of paragraph (b) of the definition of pending or interim planning application in subclause (1), if the environmental assessment requirements referred to in that paragraph are re-issued, then the application is a pending planning application if the application is made within 18 months after the re-issue of the requirements (but only if the application is made within 3 years after the commencement of the new Act).

Clause 28(1) states that:

"The former planning provisions continue to apply (and Part 7 of the new Act does not apply) to the determination of a pending or interim planning application."

Implications for the Project

The SEARs for the project were originally issued on 19 October 2015 and subsequently re-issued on 18 September 2017. The project meets the definition of a pending or interim planning application under the provisions of Cl 27 (1)(b) of the *Biodiversity Conservation (Savings and Transitional) Regulation 2017.* As the SEARs have been re-issued, the provisions of Cl 28 (1) and Cl 28(2) provide a period of 18 months after the re-issue of the SEARs (ie 18 months after 18 September 2017) for the pending or interim planning application to be made utilising the provisions of the former planning provisions (ie *Threatened Species Conservation Act 1995)* and Framework for Biodiversity Assessment.

3.3.3 Protection of the Environment Operations Act 1997

The POEO Act establishes the NSW environmental regulatory framework and includes a licensing requirement for certain activities identified in *Schedule 1* of the Act. Section 48 of the POEO Act states that a licensing requirement applies for scheduled activities where Schedule 1 indicates that a licence is required at which the avidity is carried on.

Clause 16 of Schedule 1 of the POEO Act states:

> *(1) This clause applies to crushing, grinding or separating, meaning the processing of materials (including sand, gravel, rock or minerals, but not including waste of any description) by crushing, grinding or separating them into different sizes.*
>
> *(2) The activity to which this clause applies is declared to be a scheduled activity if it has a capacity to process more than 150 tonnes of materials per day or 30,000 tonnes of materials per year.*

Clause 19 of Schedule 1 of the POEO Act states:

> *"(1) This clause applies to the following activities:*
>
> *land-based extractive activity, meaning the extraction, processing or storage of extractive materials, either for sale or re-use, by means of excavation, blasting, tunnelling, quarrying or other such land-based methods.*
>
> *(3) Each activity referred to in Column 1 of the Table to this clause is declared to be a scheduled activity if it meets the criteria set out in Column 2 of that Table."*

Table 3.2 *Schedule 1 Clause 19 - Extractive Activities Table (POEO ACT 1997)*

Column 1	***Column 2***
Activity	***Criteria***
land-based extractive activity	*involves the extraction, processing or storage of more than 30,000 tonnes per year of extractive materials*

Implications for the Project

The Project is classified as a 'land-based extractive activity' and a crushing, grinding and separating operation. As the proposed increase in production at the Sancrox Quarry will involve the extraction and crushing/separating of more than 30,000 tpa, it is a scheduled activity and requires an EPL under Section 48 of the POEO Act.

The quarry currently operates under a premises-based EPL (EPL No. 5289) for "crushing, grinding or separation works" and "extractive industries". A variation to the EPL will be required as the Project will increase the production limit to 750,000 tpa.

3.3.4 *Water Management Act 2000*

The *Water Management Act 2000* (WMA) was introduced to provide a comprehensive singular piece of legislation to effectively manage and regulate access, and use of, the State's water resources. The objectives of the WMA include:

- to protect, enhance and restore water sources, their associated ecosystems, ecological processes and biological diversity and the water quality; and
- to recognise and foster the significant social and economic benefits to the state that result from the sustainable and efficient use of water.

The WMA also details activity approvals (permitting requirements) when an aquifer is penetrated or construction occurs within 40m of a watercourse.

Implications for the Project

Part 4 Division 4.7 Section 4.41 (1)(g) of the EP&A Act states that authorisations are not required should the Project be granted SSD approval, including:

a water use approval under section 89, a water management work approval under section 90 or an activity approval (other than an aquifer interference approval) under section 91 of the Water Management Act 2000.

Therefore the Project is exempt under Part 4 Division 4.7 Section 4.41 (1) (g) of the EP&A Act for the need to obtain:

- a controlled activity permit;
- a water supply work approval;
- a drainage work approval;
- a flood work; or
- a water use approval.

An aquifer interference approval will however be required, given that the proposed extraction will intercept an aquifer.

3.3.5 Additional State Legislation Applicable to the Project

State legislation with a lower relative relevance to the Project are summarised in *Table 3.3*.

Table 3.3 Statutory Context

Legislation	Description and objectives of Act	Consideration and Assessment	Location in EIS
Water Act 1912	Regulates new water licences and the trade of water licences and allocations. *Section 10* of the *Water Act 1912* requires that: *(1) Any occupier of land whereon any work to which this Part extends (not being a joint water supply scheme) is constructed or used, or is proposed to be constructed or used, for the purpose of:* *(a) water conservation, irrigation, water supply or drainage, or* *(b) (Repealed)* *(c) changing the course of a river* *May apply to the Ministerial Corporation in the form prescribed for a licence to construct and use the said work, and to take and sue for the purposes specified in the application the water, if any, conserved or obtained thereby, and to dispose of such water for the use of occupiers of land for any purpose.*	In addition to Section 10 of the Water Act 1912, the NSW Aquifer Interference Policy (*Section 3.3.4*) specifies that a water licence is required irrespective of whether water is taken for consumptive use (i.e. for water supply purposes) or whether water is taken incidentally in the course of undertaking the activity. Aquifer interference activities taking water outside of Water Sharing Plan (WSP) areas require a license under the *Water Act 1912* and the water take estimation provided by the groundwater modelling (refer to *Chapter 8*) should be taken into consideration during the water licence application process. Hanson currently holds a Water Access Licence (WAL42524) for water supply works undertaken on site. The predicted water take of the quarry extension should be compared to the current licence allowance prior to submitting a request for a revised or new licence.	*Chapter 8 & Groundwater Assessment (Annex F)*
National Parks and Wildlife Act 1974	Guides the management of conservation areas as well as the protection of native vegetation, native fauna and Aboriginal objects across NSW. Under the Act, it is illegal to move, damage, deface or destroy a relic without written permission from the NSW Office of Environment and Heritage (OEH).	A Heritage Assessment has been prepared as part of this EIS which identified a potential Aboriginal scar tree identified in western side of the proposed expansion area which is likely to be impacted by the Project. Mitigation measures and alternatives have been recommended to avoid impacts where practicable.	*Chapter 6 & Heritage Assessment (Annex D)*

Legislation	Description and objectives of Act	Consideration and Assessment	Location in EIS
Rural Fires Act 1997	The main objectives of the *Rural Fires Act 1997* are to: • prevent, mitigate and suppress bush and other fires in NSW; • co-ordinate bushfire fighting and bushfire prevention throughout the State; • protect people from injury or death and property from damage and as a result of bushfires; and • protect the environment.	The Project would not impede the protection of any nearby buildings or infrastructure from bushfire. No subdivision is proposed as part of the Project and therefore there is no requirement for a bush fire safety authorisation from the Commissioner of the NSW Rural Fire Service.	*Chapter 15*
Native Vegetation Act 2003	The *Native Vegetation Act 2003* was repealed on 25 August 2017. Current legislation governing the clearing of native vegetation is the *Local Land Services Act 2013* and the *Biodiversity Conservation Act 2016*.	N/A, see the *Local Land Services Act 2013* summary below.	N/A, see the *Local Land Services Act 2013* summary below.
Biosecurity Act 2015	To reduce the negative impact of weeds on communities, the economy and the environment by establishing control mechanisms	The BAR discusses weed management methods.	*Chapter 5 & BAR (Annex C)*
Local Land Services Act 2013 (LLSA)	The NSW legislation regarding regulation of native vegetation clearing, within land that has been classified Rural, transitioned on 25 August 2017 with the commencement of the amended *Local Land Services Act 2013*. This Act's purpose includes the establishment of a Native Vegetation Panel responsible for approving native vegetation clearing that does not require development consent, or assessment under Part 5 of the EP&A Act.	As the Project requires development consent under Part 4 of the EP&A Act, any native vegetation clearing required for the proposed works will fall under the regulations set out in the BC Act.	*Chapter 5 & BAR (Annex C)*
Fisheries Management Act 1994	This Act aims to conserve threatened species, populations and ecological communities of fish and marine vegetation, and to promote biological diversity through ecologically sustainable development.	No threatened aquatic fauna was identified in Haydon's Creek which is located to the west of the proposed expansion area, and therefore further consideration under this Act is not required.	*Chapter 5 & BAR (Annex C)*

Legislation	**Description and objectives of Act**	**Consideration and Assessment**	**Location in EIS**
Heritage Act 1977	This Act aims to develop an understanding of and encourage conservation of State heritage by enabling the identification and registration of items of State heritage significance.	A Heritage Assessment has been prepared as part of this EIS which identified a potential Aboriginal scar tree identified in western side of the proposed expansion area which is likely to be impacted by the Project. Mitigation measures and alternatives have been recommended to avoid impacts where practicable.	*Chapter 6 & Heritage Assessment (Annex D)*
Threatened Species Conservation Act 1995	The *Threatened Species Conservation Act 1995* was repealed on 25 August 2017. Current legislation governing the threatened species conservation is the Biodiversity Conservation Act 2016.	See Biodiversity Conservation Act 2016 below.	See Biodiversity Conservation Act 2016 below.
State Environmental Planning Policies (SEPP)			
SEPP 33 – Hazardous and Offensive Development	Assesses the potential hazards associated with the proposed development by providing definitions and guidelines for: • Hazardous Industry; • Offensive Industry; • Hazardous storage establishment; and • Offensive storage establishment.	A preliminary risk screening assessment has been undertaken in accordance with the SEPP 33 for the Project. The findings of the assessment determined that the Project is considered unlikely to be potentially hazardous or offensive, and as such a Preliminary Hazard Analysis (PHA) has not been prepared nor warranted.	*Chapter 15*
SEPP 44 – Koala Habitat Protection	Aims to conserve and manage areas of natural vegetation that provide habitat for koalas to promote abundance of koalas throughout their current present range and to reverse the current trend of koala population decline.	Detailed flora and fauna investigations were undertaken as part of the BAR to determine the potential for 'potential' and 'core' koala habitat to exist throughout the Project area. SEPP 44 does not apply to projects that are being assessed as State Significant Developments, however SEPP 44 definitions for koala habitats have still been incorporated and assessed.	*Chapter 5 & BAR (Annex C)*

Legislation	Description and objectives of Act	Consideration and Assessment	Location in EIS
SEPP State and Regional Development 2011 (SEPP SRD)	Identifies development to which the SSD assessment and determination process under Division 4.1 in Part 4 of the EP&A Act applies.	Schedule 1 of the SEPP SRD identifies development for the purpose of extractive industry as State Significant when more than 500,000 tpa of resource is proposed to be extracted. This is the case for this Project, and as a result it is classified as SSD pursuant to Section 89C of the EP&A Act and declared as such by the SEPP SRD.	*This Chapter*
SEPP (Mining, Petroleum Production and Extractive Industries) 2007	The policy aims to provide for the proper management and development of mineral, petroleum and extractive material resources for the purpose of promoting the social and economic welfare of the State (among other aims)	Under Clause 7(3)(a) of this SEPP, the Project is permissible with consent as an extractive industry being carried out on land for the purposes of agriculture or industry (i.e. Primary Production in the PMHC LEP 2011). To meet the requirements of Clause 12 of the SEPP, this EIS identifies land zoning and adjacent land uses, provides a land resource assessment, assesses the environmental impacts of the Project and provides mitigation measures to manage them. Options for final rehabilitation are also provided.	*This Chapter, Chapter 9 & Chapter 17*

3.4 *Local and Regional Plans*

The local and regional plans, strategies and key sections of legislation relevant to the Project are discussed below.

3.4.1 ***North Coast Regional Plan 2036***

The *North Coast Regional Plan 2036* (DP&E, 2017) has been prepared to guide the NSW Government's land use planning priorities and decisions to 2036, and provides an overarching framework to guide subsequent and more detailed land use plans, development proposals and infrastructure funding decisions.

3.4.2 ***Mid North Coast Regional Strategy 2031***

By 2031 the population of the NSW Mid North Coast is predicted to grow by more than 28% to around 424,000. The purpose of the *Mid North Coast Regional Strategy 2031* is to ensure that the Mid North Coast can continue to prosper over the next 25 years while protecting areas of high environmental, cultural and resource value (DP&E, 2009).

The strategy aims to encourage and facilitate industry and employment opportunities within the region. The regional strategy also encourages the completion of the upgrade of the Pacific Highway which will lead to greater efficiency and safety for residents and visitors when travelling both intra and inter-regionally.

3.4.3 ***Port Macquarie – Hastings Local Environmental Plan 2011***

The provisions of the *Port Macquarie – Hastings Local Environmental Plan 2011* (PMH LEP) apply to the Project.

The Sancrox Quarry site is zoned *RU1 Primary Production* under the PMH LEP. The objectives of the RU1 zone are:

- *To encourage sustainable primary industry production by maintaining and enhancing the natural resource base.*
- *To encourage diversity in primary industry enterprises and systems appropriate for the area.*
- *To minimise the fragmentation and alienation of resource lands.*
- *To minimise conflict between land uses within this zone and land uses within adjoining zones.*

3.4.4 *Urban Growth Management Strategy 2011-2031*

The *Mid North Coast Regional Strategy* requires PMHC to prepare an Urban Growth Management Strategy (UGMS) which identifies growth areas and achieves regional outcomes and targets. The UGMS was adopted in December 2010, and approved by the NSW Department of Planning in May 2011. The purpose of the UGMS is to provide a sound strategic planning framework for residential, rural residential, retail, industrial and tourism development in the Port Macquarie-Hastings LGA to 2031.

3.4.5 *Greater Sancrox Structure Plan 2014-2034*

PMHC has prepared the *Greater Sancrox Structure Plan 2014-2034* to guide future development of land in the Greater Sancrox area. The plan is identified in the UGMS as a key objective to ensuring adequate land is made available to facilitate growth for urban/residential, rural-residential, employment/industrial and tourist development in the Port Macquarie-Hastings LGA to 2031 in a planned and sustainable manner.

3.4.6 *Port Macquarie-Hastings Development Control Plan 2013*

The Port Macquarie-Hastings Development Control Plan (DCP) provides guidelines for local development which enhances natural and cultural heritage values consistent with the local amenity. It applies to all land zoned under the PMH LEP and should be applied in conjunction with the EP&A Act and other SEPPs which may apply to the land to which the DCP applies.

This document outlines the structure planning process and identifies a preferred land use strategy for the study area.

3.4.7 *Consideration of Project with Regional and Local Planning Provisions*

The proposed increase in production at the quarry is consistent with the objectives of the PMH LEP RU1 zone. Extractive industries are permitted within the zone with development consent. It is therefore considered that the Project would not fragment or alienate any land or result in conflict with adjoining land uses. The Project would result in the employment of 25 additional staff members and result in positive local economic benefits.

The continued and additional supply of a valuable resources in the form of aggregate, concrete and asphalt to the local construction industry as well as a facility for recycling of a waste concrete will meet the strategic goals of boosting the local economy and providing the materials to allow for infrastructure and housing developments. The quarry is ideally located away from substantial residential development, and located directly adjacent to the recently upgraded Sancrox Interchange and Pacific Highway, allowing for safe distribution of materials to the surrounding region to facilitate strategic urban growth.

REFERENCES

Department of Planning (2009). **Mid North Coast Regional Strategy**.

Geoscience Australia (2017) **Oil and Gas Pipelines of Australia**.

4 COMMUNITY AND STAKEHOLDER ENGAGEMENT

This chapter describes the development approval process used to involve the community and relevant government authorities in the proposed production increase.

4.1 GOVERNMENT AGENCY CONSULTATION

Consultation has been undertaken with numerous public authorities during the preparation of the EIS. The government agencies consulted as well as a summary of the consultation are provided in *Table 4.1*. All correspondence provided by ERM and responses received are provided in *Annex B* of this EIS.

Table 4.1 Government Agency Engagement Summary

Stakeholder	Correspondence Method	Issues raised by stakeholder	Response
Former Department of Planning and Environment (DPE); now the Department of Planning, Industry and Environment (DPI&E)	Correspondence provided on the 16 February 2018. ERM has engaged with the agency during the Soil and Land Resources Assessment and Groundwater Assessment.	Response received on 7 March 2018. Indicated that relevant items were provided in previous submission during preparation of SEARs and no additional items were required.	Previous submission received upon request for SEARS are addressed within this EIS
Office of Environment and Heritage (OEH)	Correspondence provided on the 14 February 2018.	Response received on 16 March 2018 with regards to Heritage. No additional issues raised. NSW OEH general correspondence did not receive a response.	No additional items raised, the EIS will address originally provided items with the submission provided with SEARs.
Environmental Protection Authority (EPA)	Correspondence provided on the 14 February 2018.	Response received on 5 March 2018. General statement about processing plant.	Assessment of and mitigation measures for processing plant have been included in the technical assessments (primarily the noise, and air quality, summarised in Section 10 and 11 respectively).
Department of Primary Industries	Correspondence provided on the 14 February 2018. ERM has engaged with the agency during Surface Water Assessment and Soil and Land Resources Assessment.	Response received on 3 April 2018. No issues raised.	No additional items raised, the EIS will address originally provided items with the submission provided with SEARs.
Roads and Maritime Services (RMS)	Correspondence provided on the 14 February 2018.	Response received on 8 March 2018. No issues raised.	No additional items raised, the EIS will address originally provided items with the submission provided with SEARs.
Port Macquarie Hastings Council	Correspondence provided on the 14 February 2018.	Response received on 16 February 2018. No issues raised.	No additional items raised, the EIS will address originally provided items with the submission provided with SEARs.

Stakeholder	Correspondence Method	Issues raised by stakeholder	Response
NSW Rural Fire Service	Correspondence provided on the 16 February 2018. ERM has engaged with them during preparation of the Hazard Assessment.	Response received on 22 February 2018. No issues raised.	No additional items raised, the EIS will address originally provided items with the submission provided with SEARs.
North Coast Local Land Services	Correspondence provided on the 16 February 2018. ERM has engaged with them during the Soil and Land Resources Assessment.	Followed up on the 3 April 2018. No issues raised.	No additional items raised, the EIS will address originally provided items with the submission provided with SEARs.

4.2 *LOCAL ABORIGINAL LAND COUNCIL CONSULTATION*

The development of the heritage assessment involved extensive consultation to develop with the Registered Aboriginal Parties (RAP), and ultimately included:

- Birpai Local Aboriginal Land Council;
- Birpai Traditional Owners;
- Yangaay; and
- Norm Archibald.

The extensive list of the consultation undertaken as part of the Heritage assessment aimed to keep indigenous communities and representatives informed and involved in the project. Consultation was undertaken from 4 September 2017 to 14 March 2018, with the full summary of consultation undertaken provided as Annex A of the Heritage Assessment (refer to *Annex C* of this EIS).

4.3 *COMMUNITY CONSULTATION*

Hanson have been proactive in consulting the community, including affected landowners, local businesses, industry and environmental groups and community associations throughout the proposed project. A summary of ongoing consultation with the community is provided in *Annex B* of this EIS.

Hanson contacted DPE (now DPI&E) to request the appointment of an Independent Chairperson and the formation of the Sancrox Quarry Extension Project Community Consultative Committee (SQEPCCC). On March 2 2018, Ms Lisa Andrews was appointed as the independent chairperson for the SQEPCCC. In accordance with the guidelines, Ms Lisa Andrews prepared advertisement for membership of the SQEPCCC, which was advertised within the local newspaper noting that applications are open for 28 days. Additionally Mr Simon Jones (Sancrox Quarry Manager) provided a copy of the advertisement via a letterbox drop along Sancrox Road and Fernbank Creek Road. Ms Lisa Andrews also wrote to Port Macquarie-Hastings Council, Birpai Local Aboriginal Land Council, Port Macquarie Chamber of Commerce and Residents Action Network Inc.

Following the closing date for advertisement on the 26 May 2018, Ms Lisa Andrews undertook membership interviews to complete the report to the Department of Planning and Environment including the assessment of all nominees against the selection criteria. On the 26 June 2018 the Department of Planning and Environment endorsed the committee members for the SQEPCCC.

The first SQEPCCC meeting was held on the 6 July 2018 at 11:00am with five of the seven members present for the meeting. Hanson representatives included:

- Andrew Driver;
- Jeremy Keefe;
- Simon Jones; and
- Belinda Pignone.

Two apologies were received from Tony Thorne and Jeff Gillespie.

4.3.1 Community Consultative Committee (CCC)

The SEARs require the establishment of a Community Consultative Committee for the project in accordance with the Community Consultative Committee Guidelines for State Significant Projects, and to consult with the committee during the preparation of the EIS.

Hanson was responsible for the community consultation for the project and developed the CCC. Details of the CCC members is outlined in *Table 4.2* below:

Table 4.2 Community Consultation Committee Meeting Member Details

Name	Membership Details
Lisa Andrews	Independent Chairperson
Maurice Driscoll	Community Representative
Maureen Churnside	Community Representative
Hilton King	Residents Action Network (RAN) stakeholder group Representative
Jeff Gillespie	Community Representative
John Cassegrain	Community Representative
Anthony Thorne	Port Macquarie Chamber of Commerce stakeholder group Representative
Geoff Freeman	Community Representative
	Council Representative
Simon Jones	Hanson, Sancrox Quarry Manager (person with direct responsibility for operational and environmental management)
Belinda Pignone	Hanson, Graduate Environment and Compliance Coordinator
Jeremy Keefe	Hanson, Area Manager
Andrew Driver	Hanson, Development Manager

Documents prepared for the CCC by the proponent are provided in *Annex B* of this EIS.

The dates of the CCC meetings and an outline of issues discussed are provided in *Table 4.3*.

Table 4.3 Community Consultation Committee Meetings

CCC meeting number	Dates	Outline of discussion topics
01	Friday 6 July, 2018	• Andrew Driver provided a description of the current project overview and proposed project overview – including concrete batching plant, asphalt plant and concrete recycling plant. • Complaints handling and the amount of complaints received in the past. • Environmental monitoring requirements for current and proposed project. • The type of materials that are produced at the current and proposed project. • Blasting procedure was described to CCC members. • The application process was described to CCC members.
02	During exhibition period	TBC

5 *BIODIVERSITY*

SLR Consulting Australia (SLR) was engaged by Hanson to prepare a Biodiversity Assessment Report (BAR) to inform the EIS for the Project.

The objective of the BAR was to meet the requirements of the SEARs and the NSW Office of Environment and Heritage (OEH) and undertake the assessment in accordance with the *Framework for Biodiversity Assessment* (FBA). It provides a detailed description of the ecological values of the Study Area, an assessment of potential impacts of the Project and recommended mitigation measures to minimise these impacts. This chapter provides a summary of the findings and recommendations of the BAR (SLR, 2019; refer to *Annex C* of this EIS).

It should be noted that this BAR assesses the original proposed quarry footprint area (as shown in *Figure 5.2*). The quarry footprint was decreased during the assessment phase by approximately three hectares (ha) in the north-western corner of the pit to avoid the mapped flood risk area. The assessment footprint was later increased to include noise attenuation structures (bunds) which conversely required an additional 1.26 ha of vegetation removal along the western margin of the site. As such, the offset credits derived from the assessment and proposed vegetation clearance are representative of the larger originally proposed quarry footprint. The reduction in the quarry footprint (by 1.94 ha in total) will ultimately reduce vegetation clearing, and as a result would reduce the offset credits, however Hanson have agreed to keep the original offset credit amount during the preparation of the Biodiversity Offset Strategy (BOS) and expansion of the Sancrox Quarry. Accordingly, the depiction of the quarry footprint and the vegetation zones described in this version of the BAR remain unchanged from the original version submitted with the EIS for adequacy review.

5.1 *METHODOLOGY*

5.1.1 *Information Sources*

The key information sources utilised in the assessment include:

- The OEH *Atlas of NSW Wildlife* for previous records of threatened species from the locality;
- The Protected Matters Search Tool for matters of national environment significance (as listed under the EPBC Act) predicted to occur within the locality;
- The Species Profile and Threats (SPRAT) Database , for detailed information on threatened species of relevance to the site and the locality;
- GIS data on Interim Biogeographic Regionalisation for Australia (IBRA) regions and Mitchell Landscapes;

- The BioBanking Credit Calculator, for lists of predicted ecosystem credit species and species credit species and for the Project credit requirements;

- Regional vegetation mapping, including GIS data that was utilised to prepare base vegetation maps and design field surveys;

- Data collected during field surveys; and

- Officers of OEH NSW Offsets Policy Team who provided assistance on particular matters relating to the FBA and the Credit Calculator.

Key documents that were reviewed and applied to inform this BAR include:

- Greater Sancrox Structure Plan 2014-2034 (PMHC 2015);

- Vegetation of the Port Macquarie Hastings LGA (Biolink 2013); and

- Greater Sancrox Ecological Assessment (Biolink 2011).

5.1.2 *Methods Summary*

The BAR was prepared according to the steps and processes detailed in the FBA, including the following key steps:

- Desktop review – database searches to identify listed threatened biota (species, populations and communities) of potential relevance to the Study Area; initial GIS mapping; survey design;

- Field survey of the Study Area (refer to Appendix B of the BAR (SLR, 2019) for details). The Study Area comprised Lot 2 DP574308 (the Project expansion), Lot 353 DP754434 (the existing quarry and proposed plant locations) and Lot 2 DP574308 (biodiversity Offset Site) to the north of the proposed expansion area (as shown in *Figure 1.1*);

- GIS mapping and data compilation;

- Using GIS and field survey results to complete the 'landscape assessment';

- Identification of vegetation zones and use of BioBanking plot/transect data and GIS mapping to assess 'site value';

- Applying the proposed development footprint in GIS to calculate vegetation removal;

- Application of the Credit Calculator, including identification of candidate threatened species and impact credit calculations; and

- Preparation of the BAR and BOS.

Annex C provides details of the field surveys, including methods, survey effort and weather conditions. The field surveys conducted as part of the BAR (SLR, 2019) are as follows:

- Targeted orchid survey on 16 October 2015, timed to coincide with the known flowering period of the threatened orchid *Dendrobium melaleucaphilum.* The track logs for the targeted survey are provided in the BAR in *Annex C*;
- Five-day, four-night survey for threatened fauna species conducted by two ecologists from 30 November to 4 December, 2015;
- Two-day survey by two ecologists to conduct plot/transect surveys according to the BioBanking methodology set out in the FBA; and
- One-night, one-day survey conducted by one ecologist between 14 and 15 December 2015, to address minimum recommended survey effort (when combined with the five-day four-night survey) for a selection of threatened species previously recorded in the locality.

The BAR (SLR, 2019) and associated fieldwork was undertaken by experienced ecological consultants. The Biobanking credit calculations were prepared by an experienced scientist, accredited under the Section 142B (1) (c) of the *Threatened Species Conservation Act 1995* (Biobanking accredited assessor #0107). Further details on the roles and qualifications of the ecologists responsible for undertaking the assessment and preparing the report has been provided in Section 1.7 of the BAR (SLR, 2019).

5.2 *EXISTING ENVIRONMENT*

The Study Area is a mosaic of forested areas, low-lying swampy terrain, cleared grazing land and areas of disturbance and infrastructure. The Study Area incorporates the existing quarry, with surrounding areas of cleared and disturbed terrain, open water in detention dams, roads and the buildings and infrastructure of the quarry administration centre. West of the existing pit, where the quarry expansion is proposed, lies a tract of bushland that extends over an elevated hill rising to 62 m above sea level. Further west, open grassland is interspersed with scattered trees across low-lying terrain that drains to the northwest. The Study Area and proposed clearing footprint are outlined in *Figure 5.1* below.

Several hundred metres (m) further northwest lies the Hastings River, which eventually drains to the coast at Port Macquarie several kilometres (km) east of the Study Area. The cleared grassy areas in the western parts of the Study Area are used for cattle grazing.

Similarly, in the north western parts of the Study Area (including the northern parts of Lot 2, which is proposed to set aside as a biodiversity offset) the land has been cleared and supports cattle grazing over grasslands. Adjoining these cleared grassy areas to the east are stands of swamp forest and paperbark swamp forest. Section 7.8 of the BAR (SLR, 2019) contains further details on the nature and condition of the proposed Offset Site.

5.2.1 Vegetation

Plant community types (PCTs) were mapped across the Study Area during the field survey, using vegetation mapping of the Port Macquarie-Hastings LGA as a base map. Three broad vegetation types mapped within the Study Area recorded in the site include:

- Flax-leaved Paperbark - Mixed Eucalypt Coastal Floodplain Wetlands Forest Complex;
- Spotted Gum Grassy Dry Forest; and
- White Stringybark - Tallowwood - Grey Gum Dry Forest.

Using the online NSW Vegetation Information System (VIS) database, these communities were converted into PCTs, as outlined in *Table 5.1*.

Table 5.1 Conversion of Council mapping units to PCTs

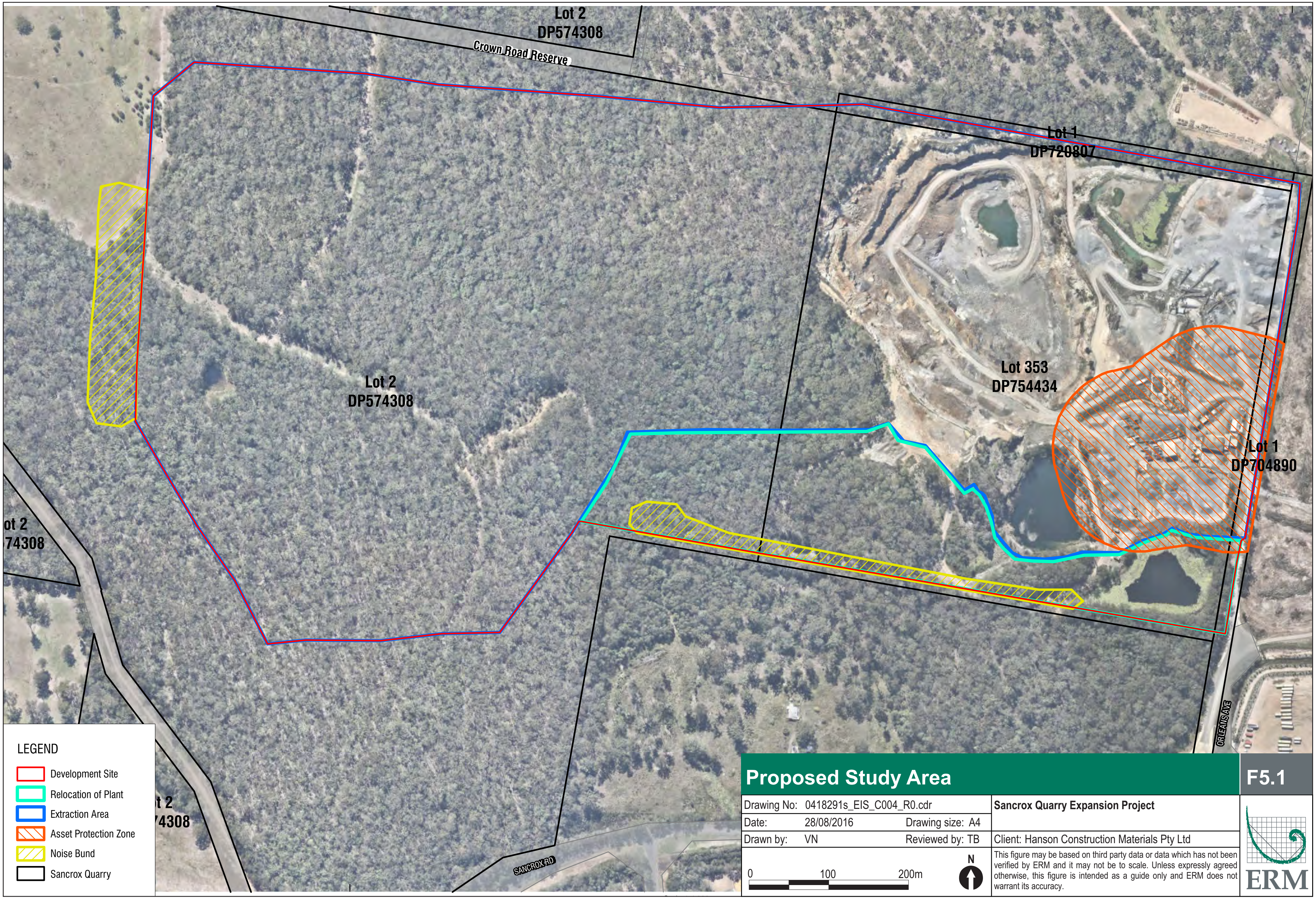
Council Vegetation Type	PCT ID No.	PCT Name
Flax-leaved Paperbark - Mixed Eucalypt Coastal Floodplain Wetlands Forest Complex	686	Blackbutt - Pink Bloodwood shrubby open forest of the coastal lowlands of the NSW North Coast Bioregion
Spotted Gum Grassy Dry Forest	1215	Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion
White Stringybark - Tallowwood - Grey Gum Dry Forest	1262	Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast

Table 5.2 lists the vegetation formation and vegetation class associated with each PCT mapped within the Study Area.

Table 5.2 Formations, classes and PCTs mapped within the Study Area

Vegetation Formation	Vegetation Class	PCT Name	Area (ha)
Forested Wetlands	Coastal Floodplain Wetlands	Blackbutt - Pink Bloodwood shrubby open forest of the coastal lowlands of the NSW North Coast Bioregion	0.6
Dry Sclerophyll Forests	Hunter - Macleay Dry Sclerophyll Forests	Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion	11.0
Dry Sclerophyll Forests	North Coast Dry Sclerophyll Forests	Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast	31.0
		Total Native Vegetation	**42.6**

The conversion, along with additional information about the mapped PCTs is provided in Section 3 of the BAR (SLR, 2019).



Lot 2
DP574308
Crown Road Reserve
Lot 1
DP720807
Lot 2
DP574308
Lot 353
DP754434
Lot 1
DP704890
SANCROX RD
ORLEANS AVE
LEGEND
Development Site
Relocation of Plant
Extraction Area
Asset Protection Zone
Noise Bund
Sancrox Quarry
Proposed Study Area
F5.1
Drawing No: 0418291s_EIS_C004_R0.cdr
Date: 28/08/2016
Drawing size: A4
Drawn by: VN
Reviewed by: TB
Sancrox Quarry Expansion Project
Client: Hanson Construction Materials Pty Ltd
This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.
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5.3 ASSESSMENT

5.3.1 *Summary of Impacts*

Biodiversity impacts associated with the Project have been divided into direct and indirect impacts, in accordance with the FBA.

Direct Impacts

Direct impacts to biodiversity values are described within the FBA as… '*An impact on biodiversity values that is a direct result of vegetation clearance from a development*'. The final development footprint will involve the following direct impacts to biodiversity:

- Clearing of 43.1 ha of native forest vegetation, which includes 0.55 ha of the *Subtropical coastal floodplain forest* threatened ecological community (TEC);
- Loss of hollow-bearing trees, some of which may provide potential roost sites and breeding habitat for a selection of bird, arboreal mammal, reptile and microchiropteran bat species; and
- Removal of foraging habitat for locally occurring native fauna, in particular for threatened microchiropteran bats species, ground mammals, arboreal mammals and a range of bird species.

Impacts to Native Vegetation

All native vegetation within the development footprint will be removed. The total area of vegetation removal required for construction and operation of the proposal is 43.1 ha, which represents 71 percent (%) of the development footprint. These areas of native vegetation will be replaced with permanent infrastructure for the proposed quarry, and therefore impacts on native vegetation (and associated habitats) would be permanent. *Figure 5.2* shows the proposed impacts on native vegetation zones within the site, which is described in *Table 5.3* below.

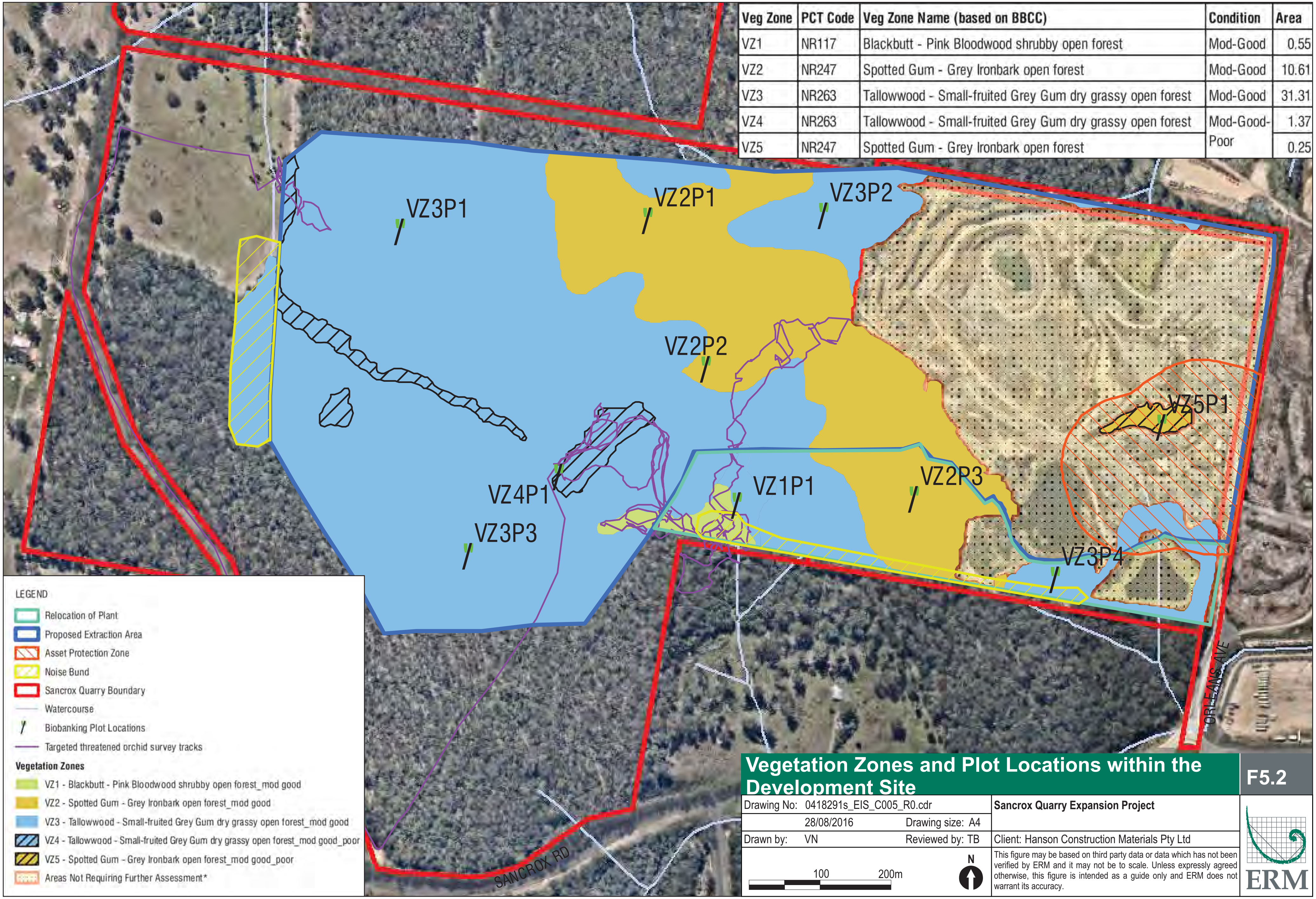
Table 5.3 Native vegetation impacts

Vegetation Type	Condition	Area of Clearing (ha)
Blackbutt - Pink Bloodwood shrubby open forest of the coastal lowlands of the NSW North Coast Bioregion[1]	Good/Mod	0.55
Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion	Good/Mod	10.61
Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast	Good/Mod	30.32
Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast	Good/Mod_Poor	1.37
Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion	Good/Mod_Poor	0.25
	TOTAL	**43.1**

[1] This vegetation type is a form of the threatened ecological community (TEC) *Subtropical coastal floodplain forest*, which is listed as endangered under Schedule 1 (Part 3) of the TSC Act.

Impacts to Fauna and Habitat

The removal of vegetation as discussed above, will have direct impacts to local fauna, with the loss of hollow-bearing trees, which may provide roost sites and breeding habitat for a selection of bird, arboreal mammal, reptile and microchiropteran bat species. In addition, there are direct impacts caused through the removal of foraging habitat for locally occurring native fauna, in particular for threatened microchiropteran bats species, ground mammals, arboreal mammals and a range of bird species.



Veg Zone	PCT Code	Veg Zone Name (based on BBCC)	Condition	Area
VZ1	NR117	Blackbutt - Pink Bloodwood shrubby open forest	Mod-Good	0.55
VZ2	NR247	Spotted Gum - Grey Ironbark open forest	Mod-Good	10.61
VZ3	NR263	Tallowwood - Small-fruited Grey Gum dry grassy open forest	Mod-Good	31.31
VZ4	NR263	Tallowwood - Small-fruited Grey Gum dry grassy open forest	Mod-Good-Poor	1.37
VZ5	NR247	Spotted Gum - Grey Ironbark open forest		0.25

LEGEND

- Relocation of Plant
- Proposed Extraction Area
- Asset Protection Zone
- Noise Bund
- Sancrox Quarry Boundary
- Watercourse
- Biobanking Plot Locations
- Targeted threatened orchid survey tracks

Vegetation Zones

- VZ1 - Blackbutt - Pink Bloodwood shrubby open forest_mod good
- VZ2 - Spotted Gum - Grey Ironbark open forest_mod good
- VZ3 - Tallowwood - Small-fruited Grey Gum dry grassy open forest_mod good
- VZ4 - Tallowwood - Small-fruited Grey Gum dry grassy open forest_mod good_poor
- VZ5 - Spotted Gum - Grey Ironbark open forest_mod good_poor
- Areas Not Requiring Further Assessment*

Vegetation Zones and Plot Locations within the Development Site

F5.2

Drawing No: 0418291s_EIS_C005_R0.cdr
28/08/2016 Drawing size: A4
Drawn by: VN Reviewed by: TB

100 200m

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Sancrox Quarry Expansion Project

Client: Hanson Construction Materials Pty Ltd

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Indirect Impacts

The FBA describes indirect impacts as: '*… development related activities [that] affect threatened species, threatened species habitat, populations or ecological communities in a manner other than direct impact'*. Indirect impacts in relation to the proposed development include:

- Potential for sedimentation and run-off to occur during construction and operation of the quarry and associated infrastructure. These are to be managed using appropriate sediment and erosion control measures and in accordance with an engineered stormwater management system (see *Chapter 7, 9* and *18*).

- There is some potential for animal strike (particularly macropods and birds) by increased traffic across the site. The speed limit will be reduced to 40 km/hr along the access road as animal strike is less likely at these speeds.

- Deposition of dust on vegetation adjoining the quarry, leading to reduced plant health and foraging quality for local native fauna.

- An increased presence of weeds is a possibility across the site. Weed management is to be integrated into the construction and operational management measures. Vehicle wash down is proposed and implementation of property maintenance will reduce the likelihood of weeds entering retained or adjacent areas of native vegetation.

- Rubbish and pollution may enter the site from staff or during the general day-to-day operation of the facility. To reduce the likelihood of waste entering the environment, all waste materials from the facility are proposed to be collected and transported off site for disposal or distribution. Skip bins will be provided and regularly maintained for other general waste.

Impacts Requiring Offsets

According to Section 9.3 of the FBA, impacts on native vegetation that require an offset include:

- Impacts on endangered ecological communities (EECs) and critically endangered ecological communities (CEECs), unless specifically nominated in the SEARs as an impact requiring further consideration; and

- Impacts on PCTs associated with threatened species habitat and in a vegetation zone that has a site value score of >= 17.

All vegetation zones mapped within the site have current site value scores of over 17 (refer to Section 6.5.1 of the BAR (SLR, 2019)) and represent habitat for at least one threatened species; hence, any clearing in these vegetation zones would require an offset. The PCTs requiring offset and the corresponding number of ecosystem credits required are listed in *Table 5.4* below.

Table 5.4 PCTs requiring offsets and credits required

PCT Code	PCT Name	TEC	Clearing Area (ha)	Credits Required
686	Blackbutt - Pink Bloodwood shrubby open forest of the coastal lowlands of the NSW North Coast Bioregion (NR117)	Yes	0.55	33
1215	Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion (NR247)	No	10.86	490
1262	Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast (NR263)	No	30.32	1926
		Total	**41.73**	**2449**

Additional information in regards to the application of Biobanking credits and the Credit Report for associated development impacts is provided in Sections 6.5 and 6.6, and Appendix I of the BAR (SLR, 2019).

In the attachments to the SEARs (see Appendix A of the BAR), OEH identify impacts that require further consideration. OEH states "Impacts on the following species, populations and ecological communities will require further consideration and provision of the information specified in s.9.2 of the FBA:

- Biconvex Paperbark (*Melaleuca biconvexa*);
- Spider Orchid (*Dendrobium melaleucaphilum*); and
- Southern Swamp Orchid (*Phaius australis*)."

No evidence for the threatened plant species provided above was recorded during field surveys undertaken as part of the BAR (SLR, 2019). It is noted that targeted searches for threatened plants were conducted across the site on several occasions during 2015 and 2016, including during the known flowering period of the two orchid species and no individuals of these species were recorded.

Section 6.4 of the BAR (SLR, 2019) provides additional information in regards to impacts requiring further consideration.

The results of the assessments determined that a biodiversity offset was required in accordance with the FBA and the *NSW Biodiversity Offsets Policy for Major Projects* (the 'Offsets Policy', NSW Government and OEH 2014). Additionally, a BOS is required to set out how the proponent intends to fulfil the project's offset requirement and is to be submitted to the Department of Planning & Environment with the project application, in accordance with the Offsets Policy.

Preferred Offset Strategy

The preferred offsetting option for the proposed development is a combination of the offset options provided in Section 7.3 of the BAR (SLR, 2019), being:

Ecosystem credits:

- Generate available ecosystem credits from the proposed Offset Site – create a Stewardship Agreement over the Offset Site in consultation with OEH. This action will only provide some of the ecosystem credits required – most of the ecosystem credits required will need to be purchased.

- Purchase like-for-like ecosystem credits from Credit Register (or approach potential credit sellers through the Expressions of Interest register).

- Purchase 'variation credits' by applying the variation rules under the FBA, in the scenario that like-for-like credit cannot be found after completing "reasonable steps". In this regard, an Expression of Interest for the required ecosystem credits will be published on the OEH BioBanking 'Credits Wanted' register.

- Pay the monetary value of the remaining credit obligation into the Biodiversity Conservation Fund (BCF).

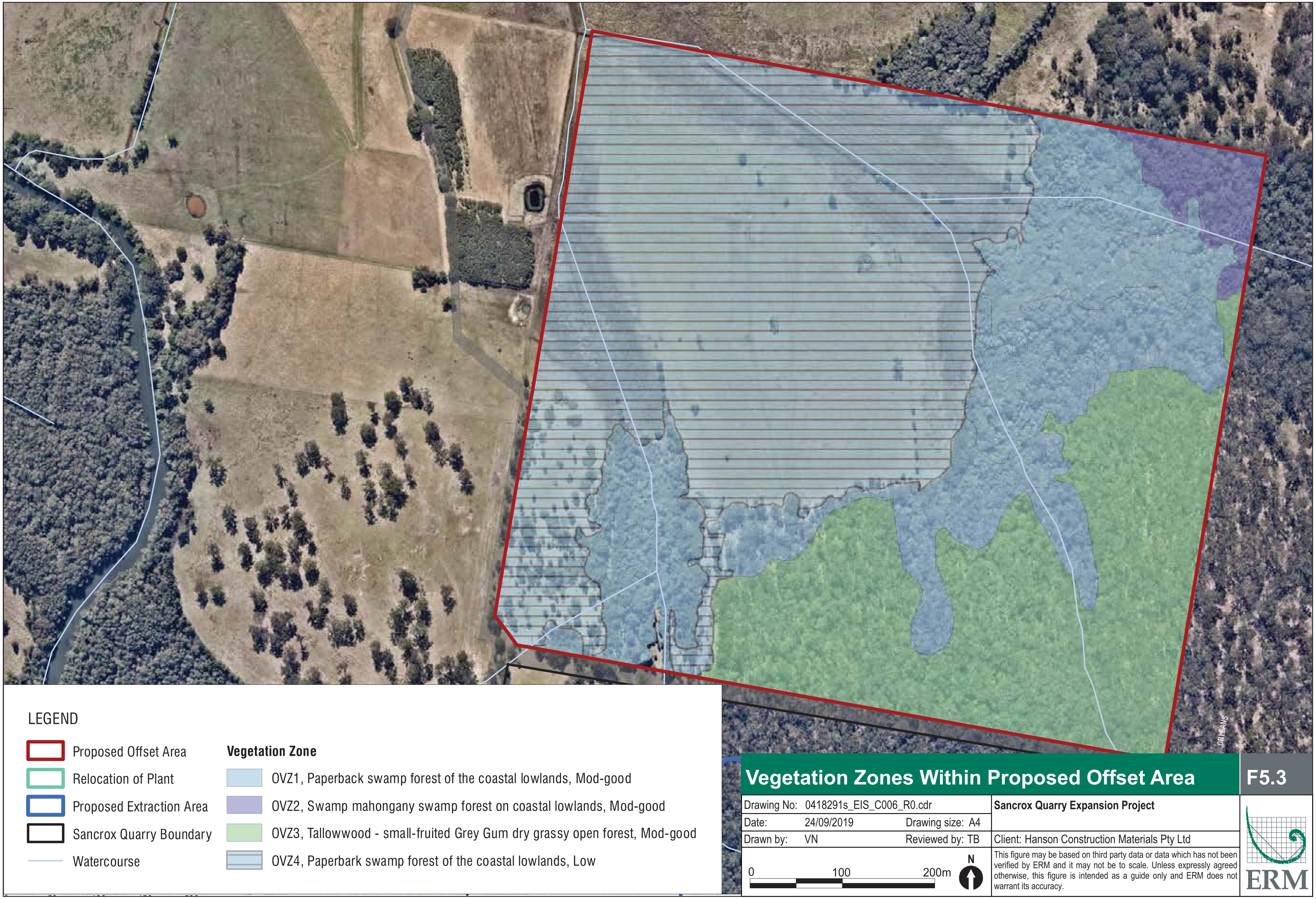
Species credits:

- No species credits required.

Proposed Offset Site

The proposed Offset Site is the northern portion of Lot DP 574308. The site is located immediately north of the proposed quarry expansion area, is approximately 49 ha and occupies low lying land containing swampy vegetation types and open cleared grassland that is used for cattle grazing, as outlined in Figure 12 of the BAR (reproduced as *Figure 5.3* below).

Table 5.5 below outlines the estimated credits calculated for the proposed Offset Site. It should be noted that the ecosystem credit estimates for the Offset Site will need to be re-calculated according to the *Biodiversity Assessment Method 2017* (BAM), including preparation of a Biodiversity Stewardship Site Assessment Report (BSSAR) to allow creation of a Stewardship Site and the associated credits. Additional information is provided in Section 7 of the BAR (SLR, 2019).



Vegetation Zones Within Proposed Offset Area

F5.3

Drawing No: 0418291s_EIS_C006_R0.cdr	**Sancrox Quarry Expansion Project**
Date: 24/09/2019 Drawing size: A4	
Drawn by: VN Reviewed by: TB	Client: Hanson Construction Materials Pty Ltd
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Table 5.5 ***Ecosystem credits created in the proposed Offset Site***

PCT	Biometric Code	Vegetation type name	BBAM[1] Credits Created
1064	NR217	Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion	353
1230	NR254	Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion	14
1548	NR263	Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast	135
		Total	**502**

[1] *BioBanking Assessment Methodology 2014* (BBAM)

A comparison of the ecosystem credits required for offsetting the proposed development and those potentially available in the Offset Site is provided in *Table 5.6* below.

Table 5.6 ***Ecosystem credit balance – credits required vs credits generated in offset***

Biometric Code	Vegetation Type Name	FBA Credits Required	Credits in Offset	Remaining Credits to purchase
NR117	Blackbutt - Pink Bloodwood shrubby open forest of the coastal lowlands of the NSW North Coast Bioregion	33	0	33
NR247	Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion	490	0	490
NR263	Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast	1926	135	1791
NR254	Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion	0	14	0
NR217	Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion	0	353	0
	Total	**2449**	**502**	**2314**

The ecosystem credits that form the offset obligation for the proposed development would either be sourced from the Offset Site or purchased from the BioBanking Credit Register (if available), with remainder converted into a monetary value using the Biodiversity Offset Payment Calculator (BOPC) and that value paid into the BCF. As the number and type of credits that will be available for purchase from the credit register following development approval is not known, the final payment into the Fund will be determined at the completion of the Expression of Interest (EOI) period.

No species credits are required for offsetting the proposed development. It is important to note that targeted threatened species surveys have not been conducted in the proposed Offset Site; however, given the habitats and vegetation type present, it is likely that a range of threatened species could be present in the Offset Site. Hence, the Offset Site is likely to generate species credit, although this will need to be confirmed through targeted surveys (during the appropriate season) as part of any future Stewardship Agreement application. For the purposes of the BOS, the number of species credits available in the Offset Site is presumed to be zero.

Impacts on Relevant Matters of NES

Taking into consideration all stages and components of the proposal, and all related activities and infrastructure, there is the potential for impacts, including indirect impacts, on matters of national environmental significance, being mainly loss of a potential foraging habitat for mobile threatened fauna species, including birds, bats and mammals. It is unlikely that any such species will be adversely impacted as a result of the proposed development, as:

- Suitable breeding habitat for most of the species is absent within the Study Area;
- The Study Area is not assessed as likely to contain habitat critical to the survival of a species;
- The Study Area is not likely to support an 'important population' (DoE, 2013) of any threatened species; and
- The proposed mitigation measures will mitigate or reduce impacts on threatened species.

Migratory Species

With regards to the terrestrial migratory species, the forested and open areas of the site represent potential foraging habitat. It is theoretically possible that these highly mobile species could utilise the subject temporarily during foraging, dispersal or migration. Conversely, the Study Area constitutes only a relatively small proportion of the large ranges of these species and does not contain breeding habitat for these species.

With reference to the criteria for migratory species in the *Significant Impact Guidelines 1.1*, the Study Area does not contain an area of 'important habitat' for any migratory species. Furthermore, the proposal is highly unlikely to disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.

5.4 *MITIGATION MEASURES*

A selection of best management practices and mitigation measures will be implemented as part of the proposed development to prevent, minimise and/or manage the potential for adverse impacts upon the local environment and surrounding populace (SLR, 2019).

A site-specific Operational Environmental Management Plan (EMP) will be prepared for the Project to ensure that the commitments made within this EIS, along with relevant statutory obligations and the conditions of development consent (including Environment Protection Licence (EPL) requirements), are fully implemented and complied with (SLR, 2019). Additionally, a Landscaping Strategy will be prepared and implemented to screen the development from neighbouring landholders and generally improve the visual and environmental amenity of the development site (SLR, 2019).

On-site mitigation measures to reduce direct and indirect impacts prior to, during and after construction measures are outlined in *Table 5.7* below.

Table 5.7 – Proposed mitigation measures to be implemented prior, during and post-construction.

Action	Outcome	Timing	Responsibility
Prior to Construction			
Pre-clearance surveys.	Fauna residing within or occupying the expansion area are safely and ethically salvaged and relocated.	Prior to tree felling or other related works.	Project Ecologist.
Protection of native vegetation.	Delineate quarry expansion limit (to ensure no native vegetation outside expansion area is cleared).	Prior to and for the duration of any works.	Construction contractor.
Erosion and sediment control measures.	Install and maintain erosion and sediment control measures in accordance with the requirements of the 'Blue Book' (Landcom 2004).	Prior to and for the duration of any works.	Construction Contractor.
During Construction			
Fauna management.	Supervision of tree felling to rescue and recover any fauna (as necessary).	During clearing.	Project Ecologist.
Weed management.	• Vehicle wash-down • Site weed control program • Prepare weed control plan	Prior to and for the duration of any works.	Project Ecologist.
Rubbish management.	Rubbish (such as food scraps and building waste) are to be properly managed during construction and must not be stockpiled on areas of native vegetation.	Ongoing.	Construction team.
Exposed soil surface management.	Revegetation – re-use topsoil and seeding of pasture grasses and legumes (or as directed in relevant revegetation guidelines or management plans).	Immediately following soil disturbances.	Construction team.
Traffic management.	• Speed limits of 40 km/hr (or less if lower speed limit imposed in other environmental assessments) to be imposed within site, reducing the likelihood of animal strikes. • Educate workers on possibility of animal strike through construction management program.	Ongoing.	Construction team.
Revegetation	Design and implement a planting plan for corridor of native vegetation east and west of proposed quarry pit, to maintain north-south corridor link of canopy trees, as per sub-regional corridor in Greater Sancrox Structure Plan (PMHC 2015).	During Construction.	Proponent (with assistance from Project Ecologist).

Action	Outcome	Timing	Responsibility
Post-Construction			
Traffic management.	Speed limits of 40 km/hr (or less if lower speed limit imposed in other environmental assessments) are proposed, reducing the likelihood of animal strikes.	Ongoing.	Site operator.
Weed Management.	Limit spread of weeds in accordance to the methods provided throughout the landscape maintenance program and weed control plan.	Ongoing, half-yearly minimum.	Site operator.
Increased artificial light.	Each luminaire will be aimed downwards and only switched on during loading-unloading and servicing activities outside of daylight hours and during heavy fog.	Ongoing.	Site operator.
Waste management.	Appropriate systems will be implemented to ensure that each waste stream generated by the development is effectively managed and/or disposed of off-site (see *Chapter 16*). There will not be any on-site stockpiling or disposal of waste materials.	Ongoing.	Site operator.
Revegetation.	Maintain and monitor plantings within proposed native vegetation corridors east and west of quarry pit.	Post-construction and throughout operational life of quarry.	Proponent (with assistance from the Project Ecologist).
Surface water and run-off	An engineered surface water drainage and management strategy is to be prepared and implemented. Techniques currently proposed to manage stormwater include bunding walls, swales, underground water capture systems and dams (see *Chapter 7*).	Ongoing.	Site operator.

Source: SLR (2019) Biodiversity Assessment Report (BAR)

5.5 *CONCLUSION*

The results of the BAR (SLR, 2019) suggest that there will be impacts to biodiversity (mainly in the form of vegetation and habitat removal) as a result of the proposed development. However, the BOS prepared for the proposed development proposes to offset approximately 42 ha of native vegetation by investing in a nearby parcel of land (creating an estimated 502 ecosystem credits), with the remainder of the ecosystem credits being purchased in due course.

Mitigation measures are provided in *Section 5 (*and within the BAR (SLR, 2019)), to manage and offset impacts to biodiversity within the 'expanded' Sancrox Quarry and surrounding areas.

REFERENCES

DoE (2013) **Matters of National Environmental Significance**. **Significant impact guidelines 1.1. Environment Protection and Biodiversity Conservation Act 1999**. Department of the Environment, Canberra, ACT.

NSW Government and OEH (2014) **Framework for Biodiversity Assessment. NSW Biodiversity Offsets Policy for Major Projects.** NSW Office of Environment and Heritage, Sydney.

NSW Government and OEH (2014b). **NSW Biodiversity Offsets Policy for Major Projects**. NSW Office of Environment and Heritage, Sydney.

PMHC (2015) **Greater Sancrox Structure Plan 2014-2034**. Port Macquarie-Hastings Council, Port Macquarie.

SLR, (2019) **Biodiversity Assessment Report. Sancrox Quarry Extension Project (SSD 7293)**. Prepared for: Hanson Heidelberg Cement Group.

6 *HERITAGE ASSESSMENT*

ERM was engaged by Hanson to undertake a Heritage Assessment to inform the EIS for the Project, which considered both Aboriginal and non-Aboriginal historic heritage values.

The objective of the Heritage Assessment was to meet the requirements of the SEARs, The Heritage Council of NSW and the NSW Office of Environment and Heritage. It provides a combined assessment of the tangible and intangible heritage values relating to the Project site, as identified during desk based assessment and field surveys undertaken in November 2017. This chapter provides a summary of the findings and recommendations of the Heritage Assessment (ERM, 2018a; refer to *Annex D* of this EIS).

6.1 *METHODOLOGY*

The assessment was undertaken using desktop analysis, archival research, field survey and Aboriginal stakeholder consultation. In addition to fulfilling relevant legislative requirements, the assessment was undertaken in accordance with the following guidelines:

- *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (OEH 2011);
- The Burra Charter (Australia ICOMOS 2013);
- *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (DECCW 2010) (Consultation Guidelines);
- *Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW* (DECCW 2010); and
- *Code of practice for archaeological investigation of Aboriginal objects in NSW* (DECCW 2010).

Searches of the local and state heritage registers were conducted in order to identify any historic heritage sites located within the Project site. A search of the Aboriginal Heritage Information Management System (AHIMS) site register was also conducted, to determine the location of any Aboriginal heritage sites within or surrounding the Project site.

Aboriginal Stakeholder consultation was undertaken in accordance with the Consultation Guidelines. Registration of interest in the Project was sought through public advertisement and provision of letters to relevant agencies and interested stakeholder groups. Four Aboriginal parties registered interest in the Project, including the Birpai Local Aboriginal Land Council (BLALC). Further information regarding the consultation process can be found in Chapter 3 and Annex A of the Heritage Assessment (ERM, 2018a).

The field survey was undertaken on Wednesday 15 November and Thursday 16 November 2017, by ERM Heritage Consultant Katherine Deverson and Jason Holten (representative of BLALC and Birpai Traditional Owners Indigenous Corporation). The survey focused on the identification of heritage values relating to archaeological sites, although discussion also included Aboriginal intangible values and the importance of Aboriginal sites to the local community.

6.2 *EXISTING ENVIRONMENT*

Interactions between people and their surroundings are of integral importance in both the initial formation and the subsequent preservation of the archaeological record. The nature and availability of resources, including water, flora, fauna, and stone materials had (and continues to have) a significant influence over the way in which people use the landscape. The following sections provide a brief description of the geology, topography and landscape, and flora and fauna resources of the Project site as it relates to potential heritage values only.

6.2.1 *Environmental Context*

The availability of water has significant implications for the range of resources present and the suitability of an area for human occupation. The Project site is bordered to the north and west by the alluvial flood plains of the Hastings River and Haydon's Creek. These riparian/wetland habitats would have provided food for Indigenous communities and predators such as snakes and lizards. Both the Hastings River and Haydon's Creek would have provided abundant aquatic resources and the woodland habitats of the Project site would have supported a rich and diverse resource base.

The Project site has been subject to significant land disturbances, most dramatically as a result of the hard rock quarrying. Farm dams, stock yards and abandoned farm machinery scattered within isolated clearings through the Project site provide further evidence of previous land use disturbance and indicates that much of the evidence of Aboriginal land use and occupation would no longer be visible. Few trees of suitable age to bear cultural scars remain within the Project site.

6.2.2 *Local Historic Context*

While much of the Port Macquarie hinterland was appropriated by European settlers during the first half of the 19th Century, based on the literature reviewed in the preparation of the assessment, the Project site itself experienced very little historical development. The closest historic site reported by GHD (2010) were eight hand cut sandstone kerb stones, although their original location and context were not known. Based on a review of parish maps and the historical context of the area, it is considered unlikely that relics or additional sites of historical significance will be located within the Project site.

6.2.3 *Local Aboriginal Archaeological Context*

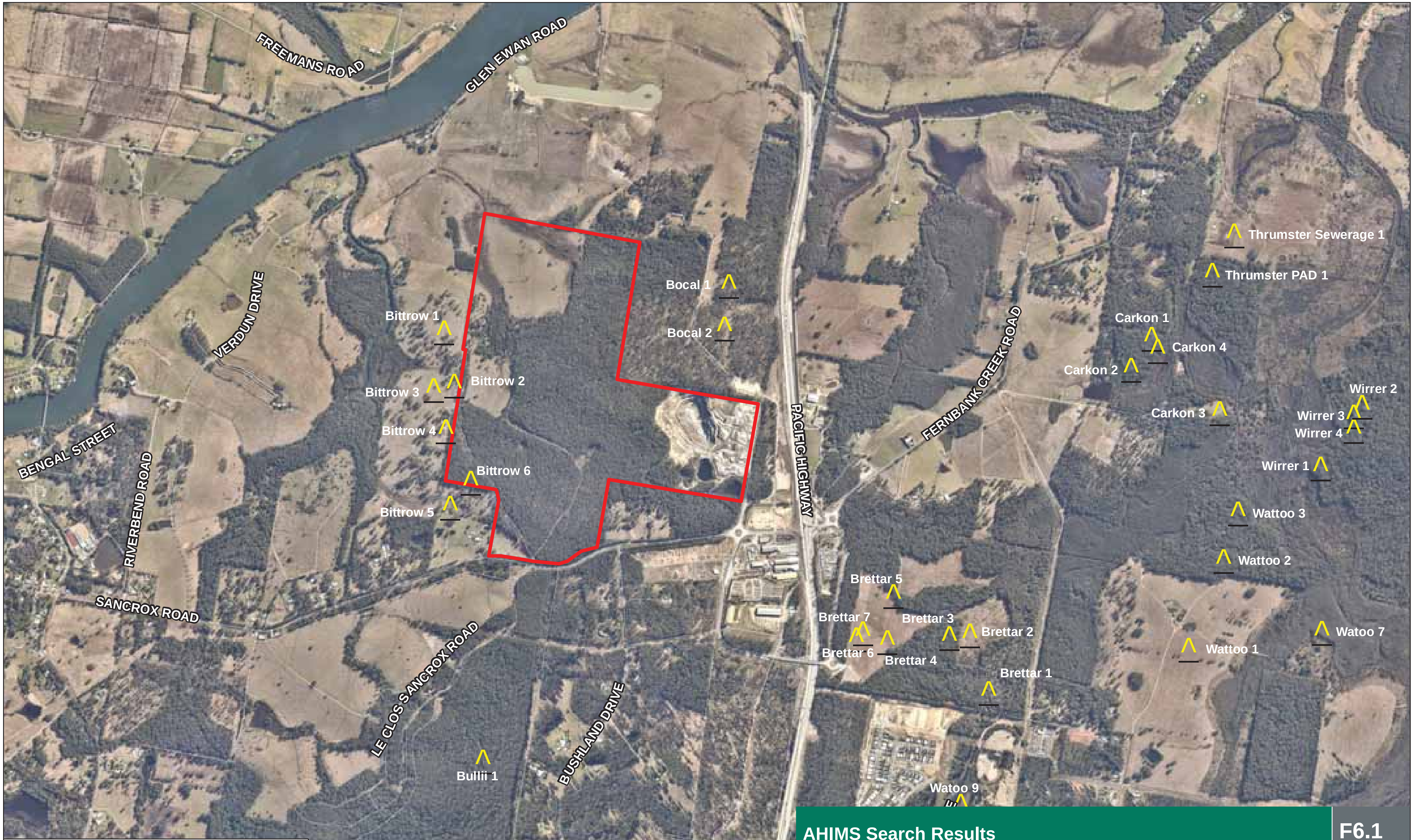
A number of archaeological investigations have been conducted in the Port Macquarie region over the last twenty years, including the current Project site. The available studies give a broad picture of the wider cultural landscape and the site types, frequencies and distribution patterns that have contributed to the current understanding of the archaeological record in the region. Studies most relevant to the Project are considered in the Heritage Assessment (ERM, 2018a; refer to *Annex D* of this EIS).

A search of the AHIMS register was conducted prior to the field survey. This search identified that 92 registered sites are located within a 10 square kilometre area, although none have been recorded within the Project site itself. The numbers of recorded sites by site type are provided in *Table 6.1* and their locations are shown *Figure 6.1*.

Table 6.1 - Results from AHIMS Search - Count by Site Types

Site Types	Number of Sites	Percentage
Restricted	4	5%
Isolated Artefact	23	28%
Middens	1	1.5%
Artefacts with Potential Archaeological Deposit	4	5%
Open Camp Site	47	56%
Stone Quarry	1	1.5%
TRE (Scarred or Carved Tree)	3	3%
Total	83	100%

In summary, and as noted by Collins (1995) Area 13, which includes the current Project site, is on the whole very well-watered, with all parts of it being within easy walking distance of a potential water source. Access to fresh water is reported to be important for site placement, with no cultural materials being detected further than 350 m from either a perennial or seasonal water source. It has been reported that a ceremonial ground once existed within the Project site and it is thought to have occupied the hill crest now being worked by the quarry. Aboriginal informants were told of the site many years ago by elderly European residents who described hearing the music and chanting and seeing the many large campfires (Collins 1995 and Appleton 1996). No evidence to support the existence of a ceremonial site has been found during any of the previous archaeological studies although it is noted that any such evidence would have been removed during the removal of overburden at the site.



Legend

AHIMS

Site Boundary

Source: Near Map 2017, Office of Environment and Heritage

AHIMS Search Results

F6.1

Drawing No: 0418291s_EIS_G009_R0.mxd		**Sancrox Quarry Expansion Project**
Date: 12/12/2017	Drawing Size: A4	
Drawn By: VN	Reviewed By: SDL	Client: Hanson Construction Materials Pty Ltd
Coordinate System: GDA 1994 MGA Zone 56		This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

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6.3 ASSESSMENT

The following provides a summary of the results of the field survey, an outline of the significance assessment undertaken for identified heritage values, and a summary of the impacts to identified cultural heritage within the Project site. For additional information, please refer to Chapters 6 and 7 of the Heritage Assessment in *Annex D*.

6.3.1 *Field Survey Results*

The conditions encountered in the Project site during the fieldwork resulted in limited ground surface visibility due to leaf litter, which defined the opportunistic nature of the field survey. Observations were recorded using digital photography, GPS recording, as well as written field notes.

Historic heritage

Based on the desktop assessment, any surviving sites and features of non-Indigenous cultural heritage value within the Project site would be limited to portable domestic and rural artefacts, or features associated with grazing and timber extraction activities. This was confirmed during the field survey with abandoned farm machinery, stock yards and isolated clearings noted throughout. Brick piers and timber floor bracing was also recorded within the Project site and is likely to represent an abandoned farm house. These items are not of any local heritage significance and cannot be attributed to any notable local figures. They do not show any evidence of or provide additional information on the early settlement of the Sancrox area.

Photograph 1 - Evidence of previous land use and farming activities approx. 750 m north-west of current quarry (ERM 2018)

Photograph 2 - Evidence of previous land use - brick piers and timber floor bracing (ERM 2018)

Aboriginal cultural heritage

The archaeological survey did not result in the identification or recording of Aboriginal archaeological or cultural sites within the proposed extraction area, except for one potential scar tree located to the north of a small farm dam at the western extent.

The tree is located approximately 3 m from the edge of a cleared track. The scar is symmetrical, extending from the ground to 3.5 m in height. No Potential Archaeological Deposit (PAD) was recorded in association with the tree. No tool marks were noted, although the tree is of sufficient age to bear an Aboriginal scar (refer to *Photograph 3 and 4*).

Photograph 3 - Potential Aboriginal scarred tree at the western extent of the proposed extraction area. The origin of the scar is difficult to determine based on the damage from recent fires (ERM 2018)

Photograph 4 - Potential Aboriginal scarred tree noted at the western extent of the proposed extraction area. The tree is of sufficient age to bear an Aboriginal scar (ERM 2018)

6.3.2 Significance Assessment

Historic heritage

Background research into the Project site showed no heritage values or connections to significant figures. As no items of historic heritage were identified during the field survey, no further significance assessment was required for non-Aboriginal historic heritage values.

Aboriginal cultural heritage

The heritage values significance assessment for the Project site has been assessed in accordance with the *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (OEH 2011) and encompasses the four values outlined in the *Burra Charter* (social, historical, scientific and aesthetic) (Australian ICOMOS 2013).

An assessment of the significance of the Project site according to scientific and cultural heritage values was undertaken. Social significance is determined by the Aboriginal community. The Project site has been assessed as having nil aesthetic significance based on previous land disturbance. The significance assessment is presented in *Table 6.2* below for ease of reference. Further information regarding the significance assessment can be found in Section 7.1 of the Heritage Assessment.

Table 6.2 – Significance Assessment

Element	Significance Criterion	Assessment	Level of Significance
Potential Scarred Tree	Scientific	Has not been confirmed as a scarred tree.	Low
	Cultural	No further comments provided by the RAPS	Low
Potential Ceremonial Site	Scientific	Location cannot be confirmed. No physical evidence.	Low
	Cultural	Ceremonial sites are highly significant to local communities.	High

6.3.3 Impact Assessment

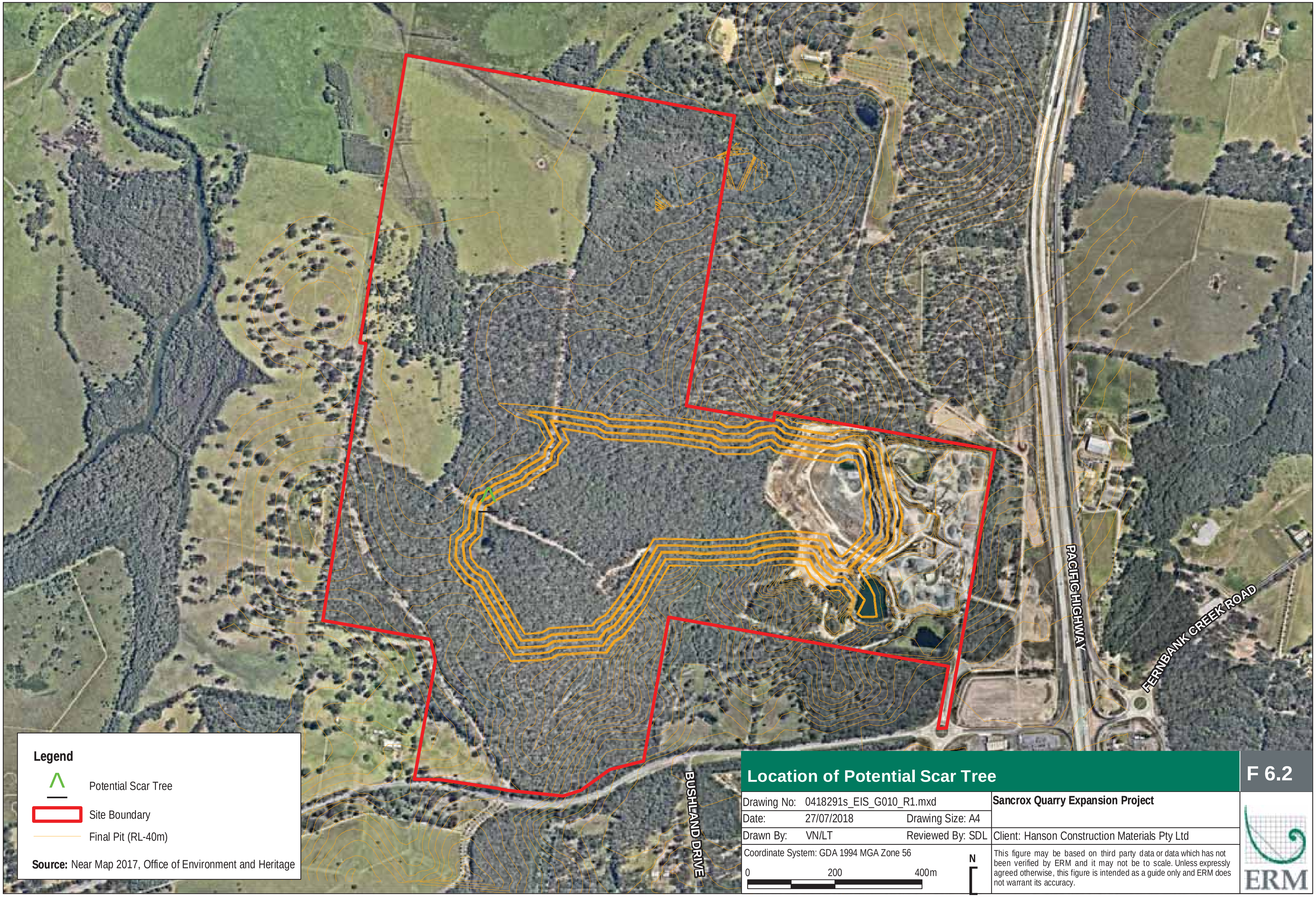
The proposed works involve the following actions that have the potential to impact on Aboriginal heritage sites and values:

- increased size of the extraction area;
- grading of roads and upgrading of existing access roads;
- vehicle movement across eroded tracks;
- development of new access roads;
- clearance of regrowth vegetation; and
- construction of ancillary facilities.

There are no historical heritage items known to occur within the Project site.

No archaeological evidence of the ceremonial site remains within the Project site.

The potential scar tree is located within the western extent of the proposed extraction area and is likely to be impacted as a direct result of the proposed extraction footprint. *Figure 6.2* shows the potential scarred tree in relation to the proposed works.



Location of Potential Scar Tree

F 6.2

Drawing No: 0418291s_EIS_G010_R1.mxd
Date: 27/07/2018
Drawing Size: A4
Drawn By: VN/LT
Reviewed By: SDL

Sancrox Quarry Expansion Project

Client: Hanson Construction Materials Pty Ltd

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6.4 MITIGATION MEASURES

6.4.1 Historic Heritage

No historic heritage items were found during the field survey, and there are no known non-Aboriginal heritage items located within the Project site. In the unlikely event that historic heritage items are found during works, the following Unexpected Finds Protocol will be followed.

- where a potential historic heritage item is found during works, all works within the vicinity of the item, or with the potential to impact the item will cease and a temporary exclusion zone established;
- an appropriately qualified heritage consultant will examine the item to assess its significance and further archaeological potential; and
- where a relic is found, the NSW Heritage Council will be notified and approval will likely be required prior to the continuation of works. Other archaeological deposits will be recorded and assessed for significance and potential salvage by an appropriately qualified heritage consultant.

6.4.2 Aboriginal Heritage

The potential scarred tree is located within the western extent of the proposed extraction area and is likely to be impacted as a direct result of extraction. It is recommended that BLALC is afforded the opportunity to retain the scar for educational and interpretive purposes (if requested).

The ceremonial site, although now completely destroyed, is considered to have high cultural significance and recognition of its location within the Sancrox area could be considered for display in the quarry site office. The development of any cultural information will be undertaken in consultation with the BLALC.

The Unexpected Finds Protocol provided below will be followed if further Aboriginal heritage sites are encountered during works.

Unexpected Finds Protocol

An Unexpected Finds Protocol will be implemented for any locations subject to soil disturbance activities, including vegetation clearing. In the event that site workers identify any potential Aboriginal heritage sites, the protocol shall be implemented in compliance with s89 of NP&W Act. The protocol is as follows:

1. STOP WORK IMMEDIATELY. Any person that observes or uncovers potential Aboriginal heritage objects during the works must notify machinery operators immediately. All activities and/or works in the immediate area must cease (DO NOT collect samples to show someone);

2. NOTIFY. Notify the site supervisor immediately. The site supervisor will contact, notify and consult with Registered Aboriginal Parties (RAPs) and an appropriately qualified heritage professional (archaeologist);

3. AVOID DISTURBANCE of the area at and adjacent to the cultural finds;

4. PROTECT THE SITE. Any sand/soils removed must be identified and set aside for assessment. The disturbed area needs to be cordoned off as an exclusion zone so that no further disturbance occurs (include an adequate buffer area);

5. ASSESS THE FIND. The RAPs and archaeologist will investigate the nature; extent and location of the find;

6. RECORD/SALVAGE THE FIND. The RAPs and archaeologist will, in consultation with the site supervisor, arrange recording of the objects and if required salvage; and

7. RESUME WORK. Subject to the archaeologist's assessment, work may be able to recommence under the terms once the site is assessed and appropriately salvaged. Alternatively, where possible, work methods or location may be altered to minimise further harm to the find, or objects associated with the find.

In the event of the discovery of human skeletal material (or suspected human skeletal material) during Project activities, the following steps will be followed:

1. STOP WORK IMMEDIATELY. Any person that observes or uncovers human skeletal material (or suspected human skeletal material) during the works must notify machinery operators immediately. All activities and/or works in the immediate area must cease (DO NOT collect samples to show someone);

2. NOTIFY. Notify the site supervisor immediately;

3. PROTECT THE SITE. Monitor the area and keep all personal out of the area until further notice. Inform site personnel of the restricted access to that area. The disturbed area needs a to be cordoned off as an exclusion zone so that no further disturbance occurs (include an adequate buffer area);

4. ASSESS THE FIND. If human remains are suspected the site supervisor is to notify the NSW Police and provide available details of the remains and their location. The site supervisor will also notify the RAPs, an archaeologist/anthropologist and OEH;

5. POLICE INVESTIGATION. NSW Police and the Coroner will determine the nature of the suspected remains and advise on further actions.

6. RECORDING AND MANAGEMENT OF ABORIGINAL ANCESTRAL REMAINS. The RAPs must be present where it is reasonably suspected that Aboriginal burials or human remains have been encountered. Recording of Aboriginal ancestral remains must be undertaken by, or be conducted under the direct supervision of, a specialist physical anthropologist or other suitably qualified person; and

7. RESUME WORK. Subject to the archaeologist's assessment, work may be able to recommence under the terms once the site is assessed and appropriately managed. Alternatively, where possible, work methods or location may be altered to minimise further harm to the find, or objects associated with the find. Reburial of the remains to a specific location may be requested by the RAPs.

Cultural Awareness Training

In order to comply with best practice principles, all employees and subcontractors will undergo environmental awareness training as part of the site induction to ensure they understand their obligations and responsibilities. This training will include basic Aboriginal heritage awareness across the following topics:

- legal responsibilities and statutory obligations for heritage under the NP&W Act and the Heritage Act;

- outline the location and type of archaeological sites within the Project site and give instructions not to disturb these sites;

- provide the detailed locations of all known Aboriginal objects within the Project site to all relevant personnel;

- outline the procedures for the discovery of previously unrecorded Aboriginal objects; and

- provide training on how to identify stone artefacts and other Aboriginal heritage sites.

It is important to note that only information endorsed for sharing by the BLALC should be included within the induction package, alternatively a representative of the BLALC could be employed to undertake an induction session for all major contractors prior to works commencing.

REFERENCES

Appleton, J. 1996. The archaeological investigation of the site of proposed quarry operations at Sancrox Road, Wauchope, Central Coast, NSW. Unpublished report for Anthony Thorne & Associates, for CTK Constructions Pty Ltd.

Australia ICOMOS, 2013. The Australia ICOMOS Charter for Places of Cultural Significance (Burra Charter).

Collins, J. 1995. Aboriginal Archaeology – Area 13 (Thrumster). Port Macquarie, NSW. Unpublished Technical Report.

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NSW NPWS, 1997. Aboriginal Cultural Heritage, Standards and Guidelines Kit.

7 *HYDROLOGY IMPACT ASSESSMENT*

Environmental Resources Management Australia Pty Ltd (ERM) was engaged by Hanson Construction Materials Pty Ltd (Hanson) to conduct a Hydrology Assessment to inform the Environmental Impact Statement (EIS) for the proposed Sancrox Quarry Expansion Project (the Project). The Project is a State Significant Development (SSD #7293) and therefore the planning approvals process is regulated under the *Environmental Planning and Assessment Act 1979* (the EP&A Act), which requires Department of Planning and Environment (DP&E) approval for development consent, supported by an Environmental Impact Statement (EIS).

The objective of this Hydrology Assessment is to meet the requirements of the Secretary's Environmental Assessment Requirements (SEARs). This chapter of the EIS provides a summary of the major findings throughout the Hydrology Assessment (ERM, 2018b; refer to *Annex E* of this EIS).

7.1 *METHODOLOGY*

The Hydrology Assessment was prepared to address, and meet the requirements of the following guidelines and legislation:

- SEARs;
- Environmental Protection Licence (EPL);
- Water Act 1912;
- Water Management Act 2000 (activity approvals and Water Sharing Plans);
- Landcom (2004) *Managing Urban Stormwater: Soils and Construction*; and
- NSW Water Quality and River Flow Objectives.

In order to undertake the assessment, an investigation of the site was undertaken to understand the existing hydrological aspects of the surrounding area, and the current sediment controls. The detail of this assessment can be found throughout Sections 2 – 4 of the Hydrology Assessment in *Annex E* (ERM, 2018b).

This assessment was prepared by an ERM Senior Environmental Scientist with previous experience in hydrology assessments for quarry expansions and industrial facilities.

7.1.1 *Investigation Methodology*

Site Investigation

A site investigation was undertaken to understand the site sub-catchments and discuss site water management with the Proponent's representative. Surface water quality sampling was also undertaken to gain an understanding of the current water quality on the site and inform the groundwater assessment (as to whether groundwater is infiltrating site surface water bodies). Surface water samples were taken from existing quarry water holding bodies and a suspected spring outside the quarry void.

Desktop Activities

To further inform the understanding gained from the site inspection, ERM undertook the following desktop activities:

- review of previous reports prepared for the quarry site; and
- review and interpretation of:
  - aerial photography;
  - site survey; and
  - Proponent and Port Macquarie Hastings Council (PMHC) supplied Geographical Information System (GIS) data.

Additionally, site hydrological data was obtained from an Intensity-Frequency-Duration (IFD) table developed for the site using the process outlined in Australian Rainfall and Runoff (Pilgrim, 1987). The BoM's web-based IFD application (BoM, 2017) was used to develop the table. A copy of the IFD table is provided in Annex A of the Hydrology Assessment (ERM, 2018b).

7.2 EXISTING ENVIRONMENT

The existing environment and environmental setting is outlined in Section 3 of the Hydrology Assessment (ERM, 2018b), and describes the local climate, temperature, rainfall, landform and elevation, surface water sources and soil and geology (including soil texture groups and dispersibility) within the surrounding area.

7.2.1 *Rainfall and Evaporation Data*

The mean annual rainfall recorded at Telegraph Point (060031) and mean annual rain days recorded at Port Macquarie is 1314.6 mm, and 100 days, respectively. The mean annual evaporation is 960.9mm. The evaporation and rainfall data is provided in *Table 7.1*.

Table 7.1 Monthly Precipitation and Evaporation Data

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean monthly rainfall (mm)[1]	138.1	175.1	167.2	127.2	104.4	109.2	66.7	58.5	59.7	83.6	109.0	114.1	1314.6
Mean monthly rain days[2]	8.9	10.4	11	9.3	8.0	7.5	6.3	5.6	5.5	7.4	10.6	9.2	99.7
Mean monthly evaporation (mm)[3]	105.4	81.2	77.5	63.0	49.6	42.0	46.5	71.3	93.0	111.6	102.0	117.8	960.9

1. Mean monthly rainfall from Telegraph Point (Farrawells Road, 060031) (1910 - present), Latitude 31.34°S, Longitude 152.79°E, Elevation 10m.
2. Mean monthly rain days from Port Macquarie Airport (060139) (1995-present), Latitude 31.43°S, Longitude 152.87°E, Elevation 4m.
3. Mean monthly evaporation from Yarras (Mount Seaview, 060085) (1970 – present), Latitude 31.39°S, Longitude 152.25°E, Elevation 155m.

7.2.2 *Landform and Elevation*

The topography surrounding the proposed Study Area is characterised by floodplains and low lying hills up to approximately 60m Australian Height Datum (mAHD), which is the highest point of the Study Area.

7.2.3 *Soil Landscapes*

The project will extend into three soil landscape groups, as named below:

- Cooperabung;
- Euroka; and
- Kundabung.

The soil landscapes are defined as being of a fine or dispersible sediment type, thus requiring wet sediment basins that require an active management (testing and dewatering) to ensure effective sediment management.

7.2.4 *Surface Water Resources*

Existing Quarry Site

Run-off from the majority of the existing quarry site flows into the pit which is pumped to existing water holding dams (WHDs) in the southeast corner of the site.

These WHDs also collect the majority of the run-off from the workshop and southern stockpile area. There is sediment basin in the northeast of the quarry site that captures surface run-off from part of the crushing and northern aggregate stockpile area (herein referred to as the 'Silt Retention Dam' and the upslope 'three tier sediment treatment train'). These features are demonstrated in *Figure 7.1*. The majority of the northern aggregate stockpile area drains to the southeast and has minimal current sediment controls, hence the proposal of a sediment basin within this catchment.

The quarry site is surrounded by a bund at its extents.

The future stages of the Project will progress into the peak to the west of the existing quarry and along the ridgeline further to the west. This will limit/avoid the requirement for upslope diversions to prevent clean run-on entering the excavation areas.


Quarry sump
Silt Retention Dam
Concrete Batching Plant
& Recycling Facility
Pit Floor
Three tier sediment
treatment train
Old Processing Plant
(to be relocated)
New
Processing
Plant
New Asphalt
Production Plant
New
Stockpile
Area
Water Holding Dam 1
(WHD1)
Existing Site Office,
Weightbridge & Workshop
Water Holding Dam
(WHD2)
Noise Bund
Legend
Existing Property Ownership
Lot Boundary
Infrastructure
Haul Road
Road Network
Source:
Spatial Data: DFSI DCDB/DTDB 2017
Imagery Data: nearmap August 2017
Ancillary Infrastructure
F 7.1
Drawing No: 0418291s_HRA_G002_R3.mxd
Date: 30/09/2019
Drawing Size: A4
Drawn By: GC
Reviewed By: ME
Sancrox Quarry Expansion Project
Hydrology Assessment Report
Client: Hanson Construction Materials Pty Ltd
Coordinate System: GDA 1994 MGA Zone 56
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This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.
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Fernbank Creek

The quarry site is located within the Fernbank Creek catchment. The quarry has the potential to discharge from two locations, the WHD 2 in the southeast and the sediment retention dam in the northern portion of the site. WHD 2 is the licenced discharge point and the sediment retention dam does not overflow as it is managed by pumps and has over designed capacity (see Section 2.3.3 of the Hydrology Assessment). Both locations would flow into separate first order streams which meet with Fernbank Creek (a third order stream), approximately 820 m and 690 m north east from each potential discharge point respectively. Fernbank Creek is located on the opposite (eastern) side of the Pacific Highway relative to the quarry site.

Haydon's Creek

Outside of the existing quarry site, the west and northwest portions of the Project site are located within the Haydon's Creek catchment. Haydon's Creek is situated approximately 360 m west from the western extent of the Project site and flows in to the Hastings River approximately 700 m to the northwest. The southern portion of the Project site is located within the Fernbank Creek catchment area, with surface flows likely to join a third order watercourse prior to meeting with those from the southern quarry site discharge location.

Hastings River

The Hastings River is one of two major rivers in the Camden Haven and Hastings River Catchment, the second being the Camden Haven River. The Hastings River rises in the Great Dividing Range and flows south east through a coastal floodplain to Port Macquarie, where it meets the Pacific Ocean. Fernbank Creek and Haydon's Creek both flow to the Hastings River.

"Due to the high density of rural settlement, the region's rivers and estuaries tend to be affected by changed runoff conditions caused by land clearing, agricultural use, human settlement and recreation. Most of the rivers and creeks in the Hastings River Basin are unregulated, without major storages to capture and control flows. Most water users rely on natural flows or small structures, such as weirs for their water supplies. As in most unregulated rivers, flows are most affected during relatively dry times, when water levels are low and demand high. In the lower reaches, important local users include livestock grazing, fishing, oyster farming grapes, tourism, and urban and rural residential. Local councils, water utilities, conservation and forestry are also major water users in the catchment" (WaterNSW, 2017).

Other Watercourses

With the exception of a third order watercourse in the far northern portion of the lot, that will not be affected by the Project, all other watercourses directly impacted by the Project are first or second order watercourses.

Previous Water Quality Monitoring

Background water quality data for nearby watercourses has been derived from The Hastings Catchment Ecohealth project (Ryder et. al., 2013) and a number of Construction Water Quality Monitoring Reports prepared by RMS for the Oxley Highway to Kempsey Upgrade Project (RMS, 2014-2017). Refer to the Hydrology Assessment (ERM, 2018b) for the surface water quality monitoring results and monitoring locations.

7.3 Assessment

7.3.1 Potential Impacts

Potential impacts have been outlined throughout the Hydrology Assessment (ERM, 2018b) and summarised in *Table 7.2*.

The potential impacts would be managed through implementation of appropriate mitigation and management measures. These would be outlined in a Soil and Water Management Plan (SWMP) prepared post approval and prior to implementing the project. *Section 7* of the Hydrology Assessment (ERM 2018b) outlines a range of management practices that would contribute to sound management of the sites soil and water resources that are also summarised in *Section 7.5*.

Table 7.2 Potential Soil and Surface Water Impacts

Construction Activities	Potential Impacts	Duration of Impact	Significance
Unsealed road network	• Creation of fugitive dust emissions due to vehicle movements. • Mud tracking at confluence of internal access roads with public road network.	Persistent during establishment of new stages and lifetime of quarrying operations. Internal road network will progressively increase as new stages are developed.	Low - access tracks created during stage establishment will be managed by sediment basins. Internal quarry roads during operation will runoff towards basins. Dust suppression measures proposed.
Establishment of future quarry stages	• Erosion of large disturbed areas during staged/progressive establishment and subsequent sedimentation of run-off. • Creation of fugitive dust emissions due to land and vegetation clearing activities. • Mulch stockpiles generating leachate run-off that may enter the surrounding surface water network.	Progressively increasing with life of quarry. Each basin for each stage will be functional until the quarrying excavates such that the run-off falls into the quarry void. This has been assumed to be no longer than three years per basin.	High – Significant area (greater than 38 ha is to be disturbed to allow for future quarry stages). It will be effectively managed by sediment basins until quarry void engulfs the catchment. Improvements to current site water management will be achieved by the establishment of the basin in the processing area and improved management in the proposed asphalt plant catchment via the conveyance of runoff to existing WHD 1.
Dewatering of site sediment basins and water accumulation points	• Introduction of contaminated water to natural surface waters, including release of water with high suspended solids during overflow events. It is noted that overflow events would only occur when rainfall exceeds the sediment basin design capacity (which would be of Blue book standard). Controlled discharges from basins following design rainfall events only following adequate management and testing of water quality, in accordance with Blue book standard.	Persistent during establishment of new stages and quarry operations. Overflow events will be intermittent only and duration / volume dependant completely on meteorological conditions. Controlled discharge events are also completely dependent on meteorological conditions, therefore the volume and frequency of water discharges (controlled or otherwise) cannot be specifically stated.	Medium – Industry Standard procedure to dewater will manage risk. Surface water monitoring program (as SWMP) and EPL variation will outline criteria for discharges/overflows from site water holding bodies, i.e. in accordance with POEO Act requirements.

Construction Activities	Potential Impacts	Duration of Impact	Significance
Stockpile management	• Erosion of stockpiles and loss of soil resource. • Introduction of contaminated water to natural surface waters.	Persistent during quarry operational activities.	Low – dust suppression and management of moisture content, along with progressive stabilisation of topsoil to be used for rehabilitation limits risk.
Concrete Batching Plant	• Contamination of waterways from water impacted by cement (washouts, cement storage areas, immediate vicinity of batch plant). • Release of water to soil and/or water bodies with increased pH, total suspended solids (TSS) and potentially other contaminants.	Lifetime of concrete batching plant	Medium – control measures as per *Section 7.5* to be implemented to manage risk and prevent negative impacts.
Asphalt Production Plant	• Introduction of hydrocarbon contamination to plant pad site, and subsequent potential contamination of run-off.	Lifetime of asphalt production	Low – industry standard practice limits potential for impacts
General site activities	• Hydrocarbon spills from machinery (burst hoses, mechanical failures, leaking machinery, etc.). • Contamination of waterways from hazardous substances due to incorrect storage (including drums and containers and spent oil filters). • Increased refuse in streams due to littering. • Contamination of soils and waterways from poor refuelling practices. • Discovery of previously contaminated sites.	Persistent throughout establishment of each stage and quarry operation	Low – risk is comparable to other construction activities. Within quarry void have very low potential for off-site contamination or surface water due to the topographical separation provided by the excavated void.
Water supply from within site	• Over-extraction of surface water or groundwater resulting in reduced environmental flows, reduced water availability for existing licensed users and impacts on water–dependent ecosystems.	Water required throughout entire lifetime of quarrying and concrete batching operations. Minimal volumes required during construction for dust suppression.	Low- Water balance undertaken to determine available water from existing and proposed water holding bodies. See *Section 7.5*.

7.3.2 *Erosion Hazard Assessment*

An Erosion Hazard Assessment (EHA) was also undertaken as part of the Hydrology Assessment (ERM, 2018b), which quantitatively assessed the potential surface water impacts based on the erosion hazard of the Project site, using the Revised Universal Soil Loss Equation (RUSLE). The RUSLE provides a prediction of the long-term average annual soil loss from erosion at a specific site according to specific management practices.

The RUSLE and the inputs utilised in this assessment are provided in Annex B of the Hydrology Assessment (ERM, 2018b). The conceptual basin designs generated by the RUSLE and location will be refined by a SWMP, with Progressive Erosion and Sediment Control Plans (PESCPs) upon approval of the Project.

7.3.3 *Flooding Potential*

PMHC provided 1 in 100 year and Probable Maximum Flood mapping data as shown in *Figure 7.2*. The quarry footprint is outside of the PMF boundary.

7.3.4 *Effluent Management*

Sewerage is treated in the council approved septic system south of the site office and workshop. Hanson has recently commissioned a new male toilet block and two concrete septic tanks. The toilet block comprises of two toilets, two hand basins, a urinal and a shower. The existing women's toilet has been plumbed into the new pump-out septic tank system, which comprises of one toilet and a hand basin. The septic tank specifications are as follows:

- 1 x 7100L Concrete Septic/Pump-out Tank
- 1 x 7100L Concrete Collection Holding Tank

The two tanks have a minimum holding capacity of 11,200L and installation was undertaken as per the relevant council approvals. Based on the site occupancy information and the AS/NZS 1547:2012 guidelines, the site wastewater management system is designed to manage a wastewater load of 1,250L/day (50L per person per day, with 25 site occupants equates to 1,250L/day).

7.4 WATER BALANCE

A water balance was undertaken for the site. The water balance assumed that the inputs to the production processes will be provided from on-site, non-potable water sources.

7.4.1 *Demand*

The approximate total water demand, as outlined for the purposes in *Table 7.3* is conservatively estimated at 131.1 ML/annum. Potable water will be required and will be sourced from council supply mains (and hence has not been included in the *Table 7.3*).

Table 7.3 Approximate Total Water Demand from On-site Sources

Activity	Approximate Volume of Water Required (ML) from on-site sources
Road dust suppression	45.9
Concrete manufacture	3.3
Concrete agitator washout	0.9
Crushing and screening dust suppression	75
Product moisture	4.5
Asphalt production	1.5
Total	**131.1**

7.4.2 *Supply*

Water supply has been calculated based on catchment yields in dry years (10-percentile), typical rainfall (median annual rainfall) and wet years (90-percentile). The volumes generated have been estimated across the life of the Project, as with on-going quarrying additional area will be available for capturing runoff. Groundwater will also contribute to supply, with modelled inflows for the final pit void estimated to generate approximately 15 to 22 ML/year. *Table 7.4* shows the volumes generated during the different rainfall years, for the progressive quarry stages.

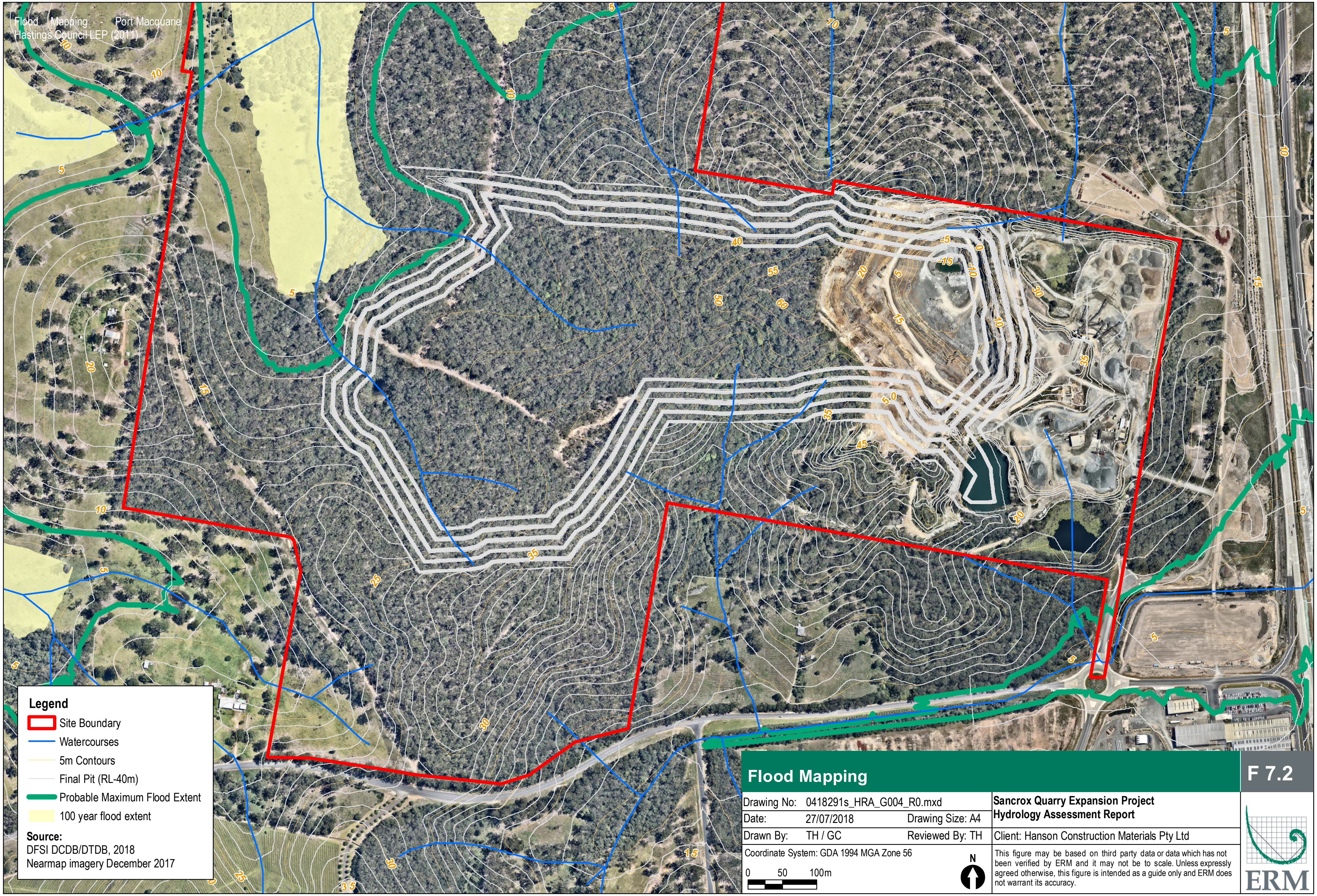
7.4.3 *Balance*

Current operations could provide 79 ML of water based solely on possible catchment yield with no restriction from available storage sizes during a low rainfall (10%ile year). The requirement for the Project at full operation and at final extent of disturbance is approximately 131.1 ML. With the implementation of the first stage of the Project, the additional catchment of disturbed area has the potential to generate 120.11 ML during a low rainfall (10%ile year). Hence, it is reasonable to assume that if site WHDs were managed such that all rainfall within the year could be captured, then sufficient water would be available for site activities and dust suppression as the quarrying stages progressively increase the disturbance footprint, even in a low rainfall (10%ile year). The implementation of the quarry void as an additional water holding body will provide additional buffer to the water management system, providing an additional storage for circulation of captured water throughout the site to prevent unnecessary loss and ensure available supply.

The water balance has solely been based on precipitation inputs. The groundwater assessment outlined that inputs to the quarry void (at final void stage) will be in the order of 15 to 22 ML/year. This input in addition to the surface water capture on-site could also be utilised for site water requirements and would further lessen the likelihood of the site being water deficient.

Table 7.4 Progressive Catchment Yields with On-going Quarrying

	Current Operations	Asphalt Plant and Stage 1	Stage 2	Stage 4	Final Stage
Included catchments	The current operations include: • existing pit; • Sediment Retention Dam; • Stockpile Yard and WHD; and • Asphalt Plant Catchment (currently an access track and storage area).	The asphalt plant and Stage 1 include: • Current operations; • new Processing Plant; and • all of Stage 1 catchments.	Stage 2 includes: • Asphalt plant and Stage 1; and • All of the Stage 2 catchments	Stage 4 includes: • Stage 2; and • All of the Stage 4 catchments	Final Stage includes: • Stage 4; and • All of the final stage catchments.
10%ile year (903.7 mm)	79	120.11	161.13	203.85	243.57
50%ile year (1210.8mm)	105.84	160.92	215.88	273.12	326.35
90%ile year (1825.7 mm)	159.6	242.65	325.52	411.82	492.08



Flood Mapping - Port Macquarie Hastings Council LEP (2011)
Legend
Site Boundary
Watercourses
5m Contours
Final Pit (RL-40m)
Probable Maximum Flood Extent
100 year flood extent
Source:
DFSI DCDB/DTDB, 2018
Nearmap imagery December 2017
Flood Mapping
F 7.2
Drawing No: 0418291s_HRA_G004_R0.mxd
Date: 27/07/2018
Drawing Size: A4
Drawn By: TH / GC
Reviewed By: TH
Coordinate System: GDA 1994 MGA Zone 56
0 50 100m
N
Sancrox Quarry Expansion Project
Hydrology Assessment Report
Client: Hanson Construction Materials Pty Ltd
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7.5 *MITIGATION MEASURES*

The mitigation measures proposed are outlined in *Table 7.5*. Key principles are outlined below:

1. Assess the soil and water implications of a project at the planning stage;

2. Plan for erosion and sediment control and assess site constraints during the design phase and before any earthworks begin;

3. Minimise the area of soil disturbed and exposed to erosion;

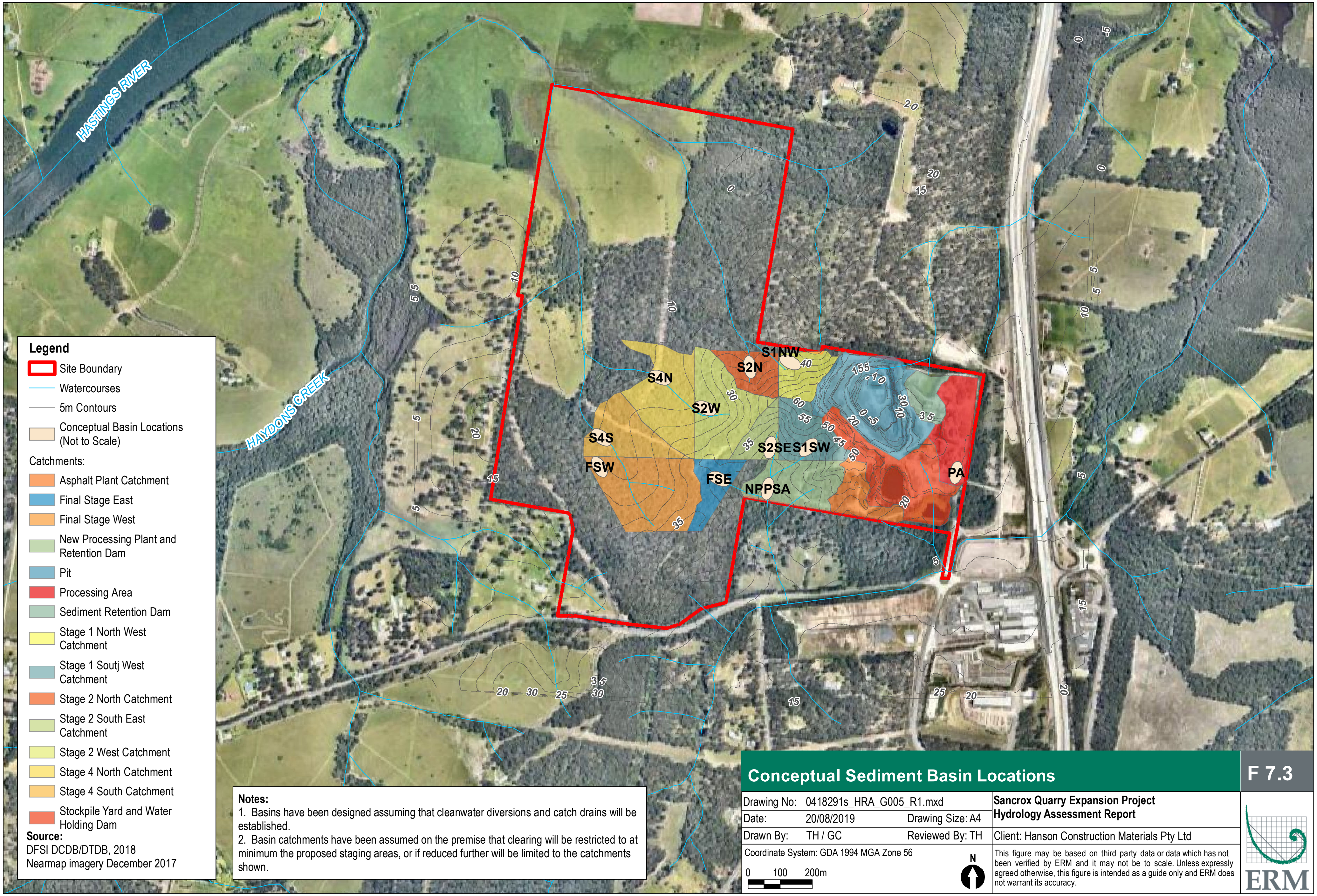
4. Conserve topsoil for later site rehabilitation/regeneration;

5. Control water flows from the top of and through the project area – divert up-slope 'clean' water away from disturbed areas and ensure concentrated flows are below erosive levels;

6. Rehabilitate disturbed lands quickly; and

7. Maintain erosion and sediment control measures for the duration of the project and until the site is successfully rehabilitated.

The predominant control method of sediment control during quarrying activities will be sediment basins, the conceptual basin locations are provided in *Figure 7.3*.



Legend

- Site Boundary
- Watercourses
- 5m Contours
- Conceptual Basin Locations (Not to Scale)

Catchments:

- Asphalt Plant Catchment
- Final Stage East
- Final Stage West
- New Processing Plant and Retention Dam
- Pit
- Processing Area
- Sediment Retention Dam
- Stage 1 North West Catchment
- Stage 1 Soutj West Catchment
- Stage 2 North Catchment
- Stage 2 South East Catchment
- Stage 2 West Catchment
- Stage 4 North Catchment
- Stage 4 South Catchment
- Stockpile Yard and Water Holding Dam

Source:
DFSI DCDB/DTDB, 2018
Nearmap imagery December 2017

Notes:
1. Basins have been designed assuming that cleanwater diversions and catch drains will be established.
2. Basin catchments have been assumed on the premise that clearing will be restricted to at minimum the proposed staging areas, or if reduced further will be limited to the catchments shown.

Conceptual Sediment Basin Locations

F 7.3

Drawing No: 0418291s_HRA_G005_R1.mxd
Date: 20/08/2019 Drawing Size: A4
Drawn By: TH / GC Reviewed By: TH
Coordinate System: GDA 1994 MGA Zone 56

Sancrox Quarry Expansion Project
Hydrology Assessment Report

Client: Hanson Construction Materials Pty Ltd

ERM

Table 7.5 Mitigation Measures

Aspect	Mitigation Measure
Stormwater Diversion	• stormwater diversion will be required within both clean and dirty catchments throughout the development of the Project; • diversions in the form of bunds or drains, as fitted to the topography of the specific catchment, will be implemented to allow for the diversion of sediment-laden run-off to sediment basins and in a few circumstances to divert clean run-off from entering the site; • diversions within clean catchments are to be stabilised quickly (through covering of the diversion channel with geofabric or revegetation); and • diversion measures within dirty catchments will incorporate rock check dams to reduce sediment loads within the run-off prior to reaching the basin (to maximise efficiency of the basin and reduce desilting requirements) and where possible have low grade to lower flow velocities.

Erosion Control	**Mulch**
	• the mulch will be mixed with topsoil and applied to batters and other locations requiring rehabilitation, acting as both an addition of organic matter to boost the soil quality (along with other ameliorants) and act as an erosion control measure;
	• mulch will be used as a replacement to sediment fences, by creating a bund of between 300 and 500 mm high; and
	• mulch can also be applied as a blanket, of approximately 150 mm thick, to cover disturbed areas and prevent erosion.
	Site Stabilisation and Rehabilitation
	• a progressive site rehabilitation approach will be adopted, whereby stabilisation works (either by revegetation, hard armouring or allowing hard rock finishes to remain where no sediment-laden run-off will be generated) is undertaken immediately following the completion of the activity. Key principles of progressive rehabilitation include:
	  • availability of acceptable soil materials;
	  • correct site preparation and replacement of topsoil;
	  • selection of the most suitable establishment technique;
	  • selection of appropriate plant species, fertilisers and ameliorants;
	  • application of sufficient water for germination and to sustain plant growth if rainfall is insufficient;
	  • an adequate maintenance program; and
	  • areas not satisfactorily revegetated will be investigated to determine the reason for failure. Appropriate remedial action will be undertaken, including replacing any lost topsoil and re-sowing the site.

Aspect	Mitigation Measure
Sediment Control	• sediment basins are required for the management of disturbed locations. Conceptual locations are shown in *Figure 7.3*, preliminary basin sizes are provided in the Hydrology Assessment (ERM, 2018b); • the Proponent must restore the design storage capacity to each basin within five days of the cessation of a rainfall event that causes run-off to occur on the site; • a basin register will be applied to the Environment Protection Licence (EPL 5289) to allow for progressive integration of the basins to the licence as each stage of work commences; and • sediment basins will be established prior to the removal of all vegetation across each stage, where practicable. Essentially, this will require clearing a path to the basin location, removing the vegetation, constructing the basin and then clearing the remainder of the catchment. **Basin Desilting** • all sediment basins will be inspected regularly for accumulated sediment. Graduated markers placed within the basin will assist in measuring sediment depths. sediment to be removed prior to reaching capacity. **Water Treatment and Flocculation** • water quality testing will determine compliance, and identify if pH modification (through use of products such as lime or hydrochloric acid) or TSS modification (through the use of gypsum) is required.
Pollution Control	• waste receptacles will be provided for the safe and efficient storage of all construction and miscellaneous wastes, as necessary; • recyclable materials will be separated and recycled where possible. Otherwise, disposable wastes will be removed from site regularly and disposed of by approved means; • spent chemical and hydrocarbon drums will be removed from site immediately to limit the potential for spills of the remnant product; • refuelling within active quarry areas will be carried out using a mobile fuel cart fitted with an electronic fuel pump; and • routine maintenance of all plant and machinery will be carried out in the designated maintenance area adjacent to the site office to minimise the potential of accidental contamination of water. **Spill Management** • spill kits will be provided at active work locations, the workshop area, refuelling areas and adjacent to pump locations. Training of site personnel in their use will ensure that in the event of any spills appropriate action can be taken rapidly to prevent and minimise impacts to surface waters; • Material Safety Data Sheets (MSDS) for all chemicals stored on-site are to be collected and maintained by the quarry manager and made available to site personnel. Site personnel will be informed of their location as a part of the site induction; • an impervious bund will be constructed to contain any spills of more than 110% of the volume of the largest container in the bunded area, should none be present in the workshop area. Any spillage will be immediately contained and absorbed with a suitable absorbent material; • storage and transport of Dangerous Goods, Flammable and Combustible Liquids will comply with AS 1940 1993 The Storage and Handling of Flammable and Combustible Liquids and National Code of Practice for the Storage and Handing of Workplace Dangerous Goods [NOHSC: 2017 (2001)].

Aspect	Mitigation Measure
Asphalt Production Plant Controls	• clean water diversions around the asphalt production plant site to limit catchment to smallest footprint possible and prevent clean water run-on; • the proposed sediment basin will be contrasted to capture sediment-laden run-off from the plant catchment area; • a triple interceptor or similar pollution control device will be utilised as a "first flush" for the potential hydrocarbon contaminated areas in the plant site; • all oils, fuels, lubricants, liquids and chemicals will be stored in appropriately bunded areas; • bitumen, diesel and other chemicals handling will be undertaken within a contained (bunded) area. Any spillages will be immediately ameliorated; and • the sediment basin servicing the plant catchment will be fitted with a floating hydrocarbon boom as a precautionary measure to contain any potential loss of hydrocarbons from the plant catchment.

Concrete Batching Plant Controls	• the footprint of the plant will be limited to the smallest extent practicable to reduce the area from which contaminated stormwater can be generated (EPA Victoria, 1998);
	• all contaminated stormwater and process wastewater will be collected and recycled at the earliest possible opportunity (EPA Victoria, 1998);
	• a dedicated, paved and bunded washout area will be established for the following locations:
	  • truck washing and agitator drum washout area;
	  • the concrete batching area; and
	  • any other location that will generate stormwater contaminated with cement dust or residues.
	• the stormwater from these locations will be directed to a first flush system. The OEH (2015) recommended design criteria for first flush containment systems utilised for concrete batching plants must be able to contain 10 mm of rainfall;
	• a bypass to the first flush system is to be created to allow for run-off from larger storm events (greater than 20mm) to bypass the collection system for when the first flush collection is full;
	• dry cement will be stored in an area where it cannot generate fugitive dust or be exposed to water and generate run-off;
	• the sediment collected in the first flush must be regularly cleaned out; and
	• whenever wet weather discharges occur from the catchment system within the plant, pH and total suspended solid monitoring will be undertaken (EPA Victoria, 1998). EPA Victoria (1998) also states run-off after heavy rainfall (more than 20 mm over 24 hours) contains very small quantities of wastes and is unlikely to pose a significant threat to the environment.

Monitoring	• site inspection of erosion and sediment controls will be undertaken at least monthly and always following rainfall events (greater than 20mm rainfall); and • the EPL 5289, and the surface water monitoring requirements within remain relevant to the Project, the following parameters for the proposed conceptual basins.

Aspect	Mitigation Measure				
	Pollutant	**Units of Measurement**	**100%ile Concentration Limit**	**Frequency**	**Method**
	Oil and Grease	milligrams/ Litre	10 and/or not visible	<24 hours prior to a controlled/scheduled discharge and daily for any continued controlled/scheduled discharge	Visual (grab sample to be taken if sheen observed)
	pH	-	6.5 – 8.5	<24 hours prior to a controlled/scheduled discharge and daily for any continued controlled/scheduled discharge	Grab sample / calibrated field probe
	Total Suspended Solids	milligrams/ Litre	50	<24 hours prior to a controlled/scheduled discharge and daily for any continued controlled/scheduled discharge	Grab sample

7.6 *CONCLUSION*

The hydrology assessment identified the potential soil and water impacts and constraints related to the Project. An erosion hazard assessment was undertaken using the RUSLE to determine the potential impacts of the Project, and this in turn was utilised to design the predominant mitigation measure for managing sediment-laden run-off generated by the site - the conceptual sediment basins.

The water balance for site operations demonstrates that surface water is available to meet the demands of the Project. The additional input provided by groundwater entering in to the quarry void will further supplement the water supply available for use. An aquifer interference approval will be required for the consumption of this groundwater (refer to *Groundwater Assessment* for further details).

A surface water monitoring program has been prepared and the site EPL will need to be varied to incorporate the proposed revision to current water monitoring. The program outlines the proposed surface water monitoring regime for the sediment basins that will be installed as the staged expansion progresses. With the implementation of sediment basins, the utilisation of the mitigation measures and the development of a SWMP and PESCPs, the potential soil and water impacts of the Project can be effectively managed so that there is no significant, negative impact to the environment.

REFERENCES

BoM (2017) **Rainfall IFD Data System**. Australian Government Bureau of Meteorology. Accessed on 3 December 2017 from http://www.bom.gov.au/hydro/has/cdirswebx/cdirswebx.shtml

EPA Victoria (1998) **Environmental Guidelines for the Concrete Batching Industry**. Environment Protection Authority State Government of Victoria.

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Landcom (2004) **Managing Urban Stormwater: Soils and Construction** Volume 1.

Pilgrim, D.H. (editor-in-chief) (1987) **Australian Rainfall and Runoff: A Guide to Flood Estimation**. Australian Institute of Engineers.

WaterNSW (2017), **Hastings Catchment** (website), available http://www.water.nsw.gov.au/water-management/basins-and-catchments/hastings-catchment, accessed 3/11/20

8 GROUNDWATER IMPACT ASSESSMENT

Environmental Resources Management Australia Pty Ltd (ERM) were engaged by Hanson Construction Materials Pty Ltd (Hanson) to conduct a Groundwater Assessment to inform the Environmental Impact Assessment (EIA) for the proposed Sancrox Quarry Expansion Project (the Project). The Project is a State Significant Development (SSD #7293) and therefore the planning approvals process is regulated under the *Environmental Planning and Assessment Act 1979* (the EP&A Act), which requires Department of Planning and Environment (DP&E) approval for development consent, supported by an Environmental Impact Statement (EIS).

The objective of this Groundwater Assessment is to meet the requirements of the Secretary's Environmental Assessment Requirements (SEARs), which have been outlined within *Section 1.2* of the Groundwater Assessment (ERM, 2018c).

8.1 METHODOLOGY

In order to meet the objectives of the groundwater related aspects of the SEARs, ERM conducted the following scope of works:

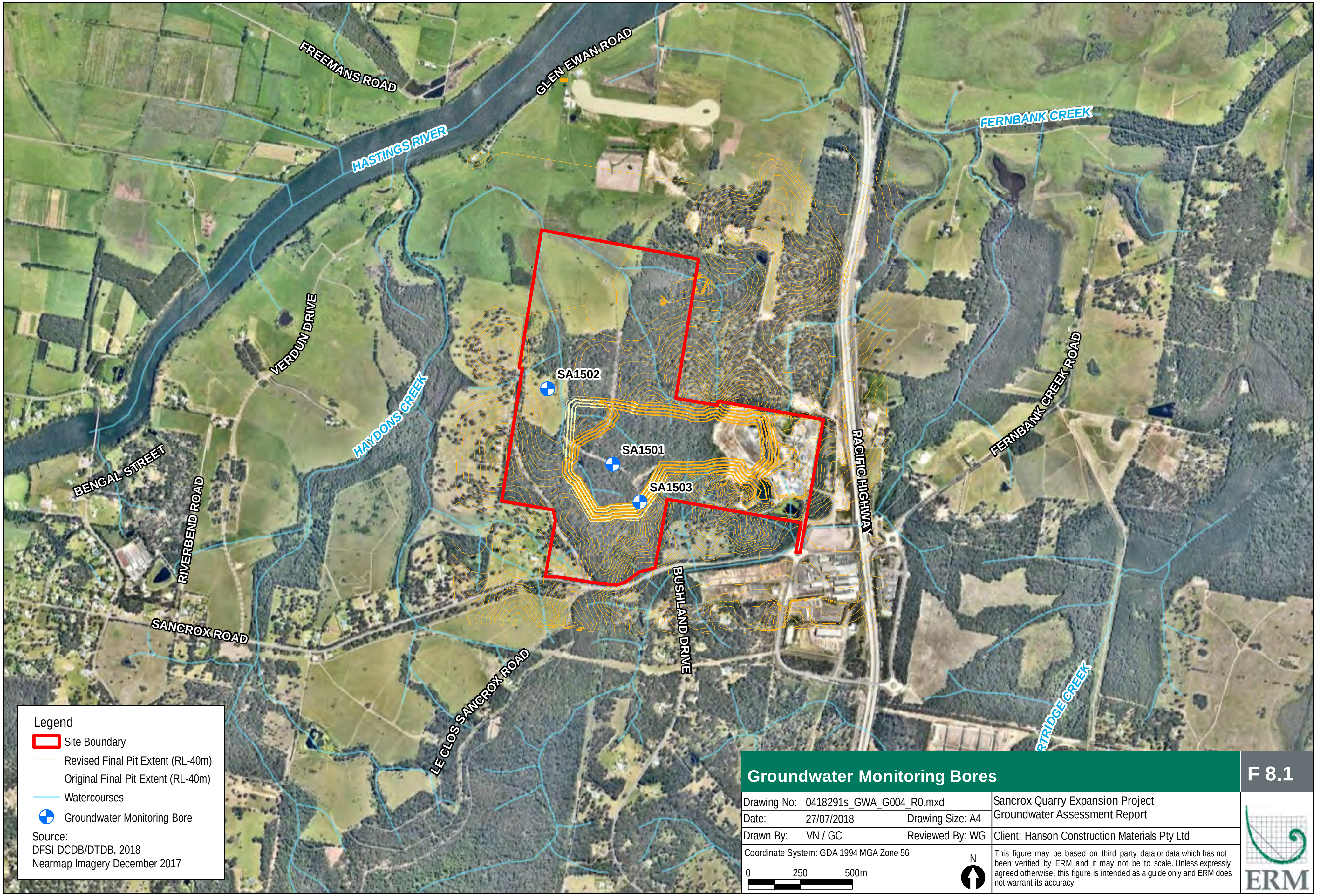
- a desktop assessment to describe the environmental site setting, including a search for groundwater users (both registered groundwater bores and groundwater dependant ecosystems) using publically available database sources;
- a groundwater field program to undertake aquifer parameter testing and groundwater and surface water sampling to characterise the aquifer system underlying the Project site; and
- groundwater modelling to evaluate groundwater inflow rates into the expanded quarry as well as potential groundwater drawdown proximal to the quarry and the potential magnitude of drawdown at identified groundwater users.

The field assessment and preparation of this report was undertaken by ERM Environmental Scientists, with the technical assessment being prepared and reviewed by hydrogeologists with extensive experience.

8.1.1 Field methodology

Pre-Pumping Test Groundwater Level Gauging

ERM undertook manual water level gauging of static water levels (SWLs) with a dip meter prior to the pumping tests commencing on 28 November 2017. In addition to the water level data gathered through manual gauging, Hanson deployed pressure transducers (automated level loggers) in three monitoring bores (SA1501 – SA1503) for the collection of long-term baseline groundwater levels. The locations of the monitoring bores are presented in *Figure 8.1*.



Legend

- Site Boundary
- Revised Final Pit Extent (RL-40m)
- Original Final Pit Extent (RL-40m)
- Watercourses
- Groundwater Monitoring Bore

Source:
DFSI DCDB/DTDB, 2018
Nearmap Imagery December 2017

Groundwater Monitoring Bores

F 8.1

Drawing No: 0418291s_GWA_G004_R0.mxd		Sancrox Quarry Expansion Project Groundwater Assessment Report
Date: 27/07/2018	Drawing Size: A4	
Drawn By: VN / GC	Reviewed By: WG	Client: Hanson Construction Materials Pty Ltd

Coordinate System: GDA 1994 MGA Zone 56

0 250 500m

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Based on data files made available by Hanson, the level loggers were deployed from:

- October 2015 to September 2017 for SA1501
- December 2016 to September 2017 for SA1502
- December 2016 to July 2017 for SA1503

At all three locations, the level loggers were programmed to collect water level measurements at 12 hour intervals.

Pumping Tests

Two short-term constant discharge pumping tests and associated recovery tests were undertaken at the site to estimate aquifer hydraulic properties. The pumping tests were undertaken on bores SA1501 and SA1502.

The constant discharge pumping test at SA1502 was undertaken on 28 November 2017 and the constant discharge test at SA1501 on 29 November 2017. Both constant discharge tests were run for a period of 3 hours, at pumping rates of 1 L/minute and 3 L/minute at SA1502 and SA1501 respectively. At this point in the pumping tests, respective groundwater level drawdowns of 28.02m and 4.89m had been achieved in SA1502 and SA1501. To maximise drawdown in the aquifer for the recovery tests, the pumping rate for the SA1502 test was increased to approximately 3 L/min for a duration of 15 minutes (achieving a total drawdown of 43.73 m), while the pumping rate for the SA1501 test was increased to 6 L/min for a further 2 hours (achieving a total drawdown of 22.49 m). From the total drawdown depths, the time period for 90% recovery to pre-test static water levels were approximately 30 minutes for the test conducted at SA1501 and 4 hours 20 minutes for the test conducted at SA1502.

Groundwater and Surface Water Sampling

Monitoring bores SA1501 and SA1502 were sampled during the pumping tests, with samples taken once field parameters measured during pumping (which included pH, electrical conductivity [EC], oxidation reduction potential [ORP], dissolved oxygen [DO] and temperature) had stabilised.

Due to a blockage encountered in SA1503, this monitoring bore could not be sampled with the submersible pump and this specific bore was sampled with a single use disposable bailer. Due to purging limitations posed by the bailer method, the sample taken with the bailer effectively represents a grab sample.

In addition to the groundwater monitoring bores, surface water samples were taken from the two surface water holding ponds on site, the in-pit sump, and a water seep located to the northeast of the existing aggregate processing and storage area.

8.1.2 *Groundwater Modelling Methodology*

Groundwater Modelling

A numerical groundwater flow model (Model) was created to simulate the current hydrogeological conditions and at final quarry expansion. The Model was undertaken to address the impact assessment requirements of the NSW Aquifer Interference Policy. This included:

- estimating water take through groundwater inflows to the pit; and
- predicting groundwater level drawdown associated with pit development at groundwater user locations (both registered groundwater bores and the closest identified groundwater dependent ecosystem).

While the Project will include the expansion of the existing pit in multiple stages, the modelling was undertaken for a steady state scenario taking into consideration the full extent of the final planned pit void (at which stage steady state groundwater flow to the pit will be greatest and potential groundwater level drawdown proximal to the quarry will be greatest).

The limitations and assumptions of the model are provided in ERM (2018c).

8.2 *ENVIRONMENTAL SETTING*

8.2.1 *Site Setting*

The Study Area includes the existing quarry site, the area identified for the quarry expansion and a 2 km radius from the perimeter of the final pit to identify groundwater users that may be impacted by the proposed activity. The eastern portion of the Study Area has been disturbed by active quarrying activities while the west and northwest portions of the Study Area are largely undisturbed and predominantly covered with remnant woodland vegetation and some smaller sections of ground covering pasture.

The Groundwater Assessment and Hydrology Assessment (ERM, 2018c and b) provide an outline of the environmental setting, including specific information in regards to climate, topography, geology, hydrogeology and hydrology. Please refer to *Section 3.2* of the Groundwater Assessment (ERM, 2018c) for additional information.

8.2.2 *Geology*

The regional geological map indicates that the Study Area is underlain by the Byabbara Beds of the Carboniferous Period. Regionally the Byabbara Beds consists of interbedded lithic sandstone, siltstone, tuff, shale and limestone. Towards the Hastings River, to the north and west of the Study Area, Quaternary age alluvial sediments consisting of sand, silt, mud and gravel overlie the Byabbara Beds (Brunker et al., 1970).

The existing pit has a defined fault line trending southwest to northeast, and the approximate location of the fault line (Hanson, 2015) is presented in *Figure 8.2* along with the regional surface geology as drawn from Brunker et al (1970). The Byabbara Beds geology has been inferred to comprise conglomerate, sandstone and siltstone to the north of the fault line and predominantly shale to the south of the fault line. Drilling completed at the Study Area further suggests that there are fault zones at depth as indicated by intervals of breccia identified in the rock core (Hanson, 2016).

8.2.3 Hydrogeology

The meta-sediments of the Byabbara Beds underlying the Study Area are considered to present a fractured rock aquifer, with groundwater storage and flow largely controlled by secondary porosity. While at a regional scale the groundwater flow direction would be expected to be similar to the slope of the topography. Influence on local groundwater flow directions would include the orientation and connectivity of the fracture network, as well as the influence of the existing open pit on hydrodynamics. Quarrying in the existing open pit has proceeded to below the groundwater level in the surrounding bedrock and groundwater flow in the immediate vicinity of the quarry workings would be towards the pit. According to site management, no active dewatering takes place at the pit with groundwater seepage into the pit being negligible, indicating that the permeability of the meta-sediments is low.

The Quaternary alluvial sediments overlying the Byabbara Beds sediments to the north and west of the Study Area (in proximity to the Hastings River) present an unconsolidated aquifer where water storage and flow is governed by the primary porosity of the sediments.

The alluvial sediments would be expected to be in direct hydraulic connection with surface water features such as the Hastings River, with the direction of water flow controlled by relative water levels in the surface water features and surrounding alluvial sediments. When compared the Quaternary alluvial sediments would be expected to present a significantly more productive aquifer than the consolidated meta-sediments.

Legend

- Site Boundary
- Revised Final Pit Extent (RL -40m)
- Original Final Pit Extent (RL -40m)
- Inferred Fault Line
- Qa - Quaternary Alluvial Sediments (Sand, Silt, Mud, Gravel)
- Cb - Byabbara Beds (Lithic Sandstone, Siltstone, Tuff, Shale, Limestone)

Sources:

- Geology map reference: Brunker R.L., Offenberg A.C. and Cameron R.G., 1970: Hastings 1:250 000 Geological Sheet SH/56-14, 1st edition, Geological Survey of New South Wales, Sydney.
- Reference for inferred fault line: Hanson, 2016: Geology Report - Geology, Drill Results and Resources 2015. Sancrox Quarry, NSW.

Regional Surface Geology

F8.2

Drawing No: 0418291s_GWA_C002_R0.cdr		Sancrox Quarry Expansion Project Groundwater Assessment Report
Date: 19/07/2018	Drawing size: A4	
Drawn by: GC	Reviewed by: WG	Client: Hanson Construction Materials Pty Ltd
Drawing Not to Scale	N	This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

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Groundwater Dependent Ecosystems

The Australian groundwater dependent ecosystems (GDE) toolbox (National Water Commission, 2011) identifies the following three types of GDEs:

- Type 1 – Aquifer and Cave Ecosystems (inhabited by subterranean fauna including troglofauna and stygofauna).
- Type 2 – Ecosystems Dependent on the Surface Expression of Groundwater (such as wetlands and creeks/rivers fed by baseflow).
- Type 3 – Ecosystems Dependent on the Subsurface Expression of Groundwater (with groundwater typically encountered within the rooting zone).

The BoM Atlas of GDEs (BoM, 2018) was used for the identification of groundwater environmental receptors in the Study Area. The Atlas was used to search a 2 km radius from the perimeter of the final pit and the following GDEs were identified:

- Type 2 – Ecosystems: The Hastings River, located approximately 1.3 km to the northwest of the perimeter of the final pit (at its closest distance from the pit).
- Type 3 – Ecosystems: Multiple ecosystems with high to moderate GDEs potential including:
  - several areas of Paperbark ecosystems with the closest located approximately 500 m to the west of the outer perimeter of the final pit (and adjacent to Haydon's Creek). Additional occurrences of Paperbark ecosystems have been mapped by BoM approximately 800 m to the north east, 900 m to the east north east and 1,700 m east south east of the perimeter of the final pit.
  - Low Relief Coastal Blackbutt ecosystems located approximately 1,100 m to the east and 1,300 m to the south east on the perimeter of the final pit.

No Type 1 ecosystems were identified through the BoM GDE Atlas.

While the Project does not currently fall within a gazetted Water Sharing Plan (WSP) area, a *Draft Water Sharing Plan for the Hastings Unregulated and Alluvial Water Sources 2016* (NSW Government, 2016) has been developed which includes a *High priority Groundwater-Dependent Ecosystem Map* (GDE011_Version 1). This map was reviewed as part of the groundwater assessment and no high priority GDEs were identified within a 2km radius of the perimeter of the final pit. Note that groundwater dependent culturally significant sites were under investigation at the time of the development of the draft WSP and the locations of any such sites had not been identified.

Existing groundwater use

A desktop search was conducted to identify existing groundwater users through the NSW Department of Primary Industries (DPI) Office of Water Groundwater Bore Database (NSW DPI, 2018). The search area included a 2 km radius from the perimeter of the final pit.

A total of 13 registered groundwater bores were identified. The locations of the bores relative to the quarry are presented in *Figure* 8.3.

8.3 ASSESSMENT

The results of the Groundwater Assessment have been outlined throughout *Section 4.2* of the Groundwater Assessment (ERM, 2018c). Summation of the results or conclusions drawn from monitoring are provided below.

8.3.1 Fieldwork assessment results

Pre-Pumping Test Groundwater Levels

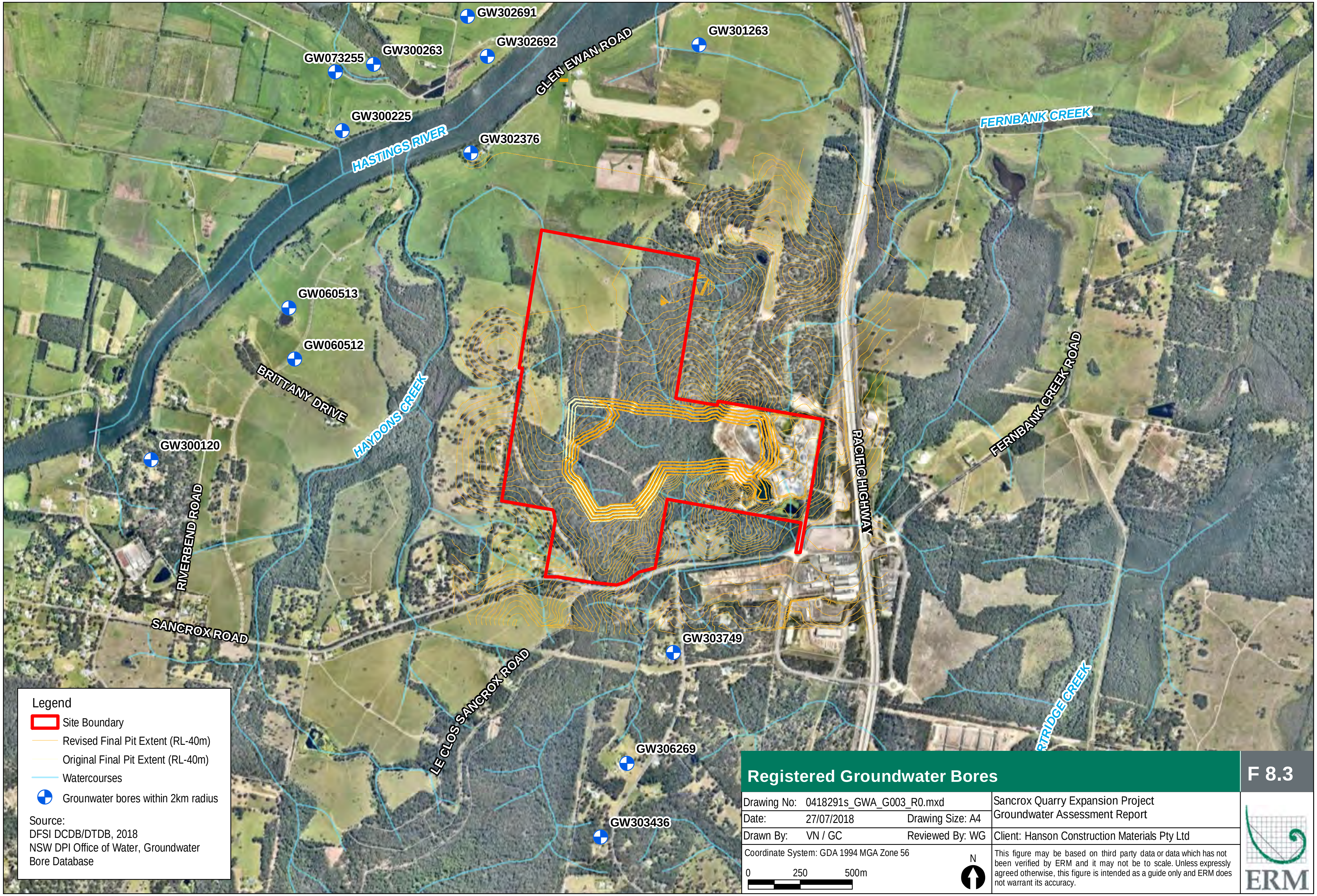
The baseline groundwater levels gauged by the level loggers are summarised in *Table 8.1* below.

Table* 8.1 *Level Logger Baseline Groundwater Levels

Monitoring Bore	Date Range	Groundwater Level					
		m BGL[1]			m AHD[2]		
		Min Depth	Max Depth	Av Depth	Min Depth	Max Depth	Av Depth
SA1501	10/2015 – 9/2017	9.69	10.67	10.52	12.81	11.83	11.98
SA1502	12/2016 – 9/2017	1.42	2.26	1.74	1.98	1.14	1.66
SA1503	12/2016 – 7/2017	0.39	12.11	9.69	32.61	20.89	23.31

1 = metres below top of casing

2 = metres Australian Height Datum (approximate values with an accuracy of ~1m).



Registered Groundwater Bores

F 8.3

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Date: 27/07/2018	Drawing Size: A4	
Drawn By: VN / GC	Reviewed By: WG	Client: Hanson Construction Materials Pty Ltd

Coordinate System: GDA 1994 MGA Zone 56

ERM

The available groundwater level elevation data indicate a groundwater flow direction towards the northwest. While monitoring bores SA1501 - SA1503 are located in a near straight line (see *Figure 8.1*), which is not ideal for tri-angulating and inferring groundwater flow direction, the inferred groundwater flow direction does align with general expectations of regional groundwater flow which would be from elevated elevations towards the Hastings River.

Pumping Test Results

Based on the recovery phase derived transmissivity values of 0.07 m^2/day and 0.01 m^2/day and assumed aquifer thicknesses of 70 m and 36 m for SA1501 and SA1502 respectively, the estimated hydraulic conductivity of the screened lithology at SA1501 would be 0.001 m/day and 0.0003 m /day at SA1502. In units of m/sec this would equate to hydraulic conductivities of approximately 1 X 10^{-8} m/sec and 3 X 10^{-9} m/sec for the tests conducted at SA1501 and SA1502 respectively. These low hydraulic conductivity values align with the observations from the existing pit where groundwater seepage to the pit is reportedly negligible with no active dewatering required according to site management.

Groundwater Quality

The water quality sampling results indicate that the geology intersected by the quarry and targeted during quarry expansion (based on sampling results from SA1501 – SA1503) is largely inert, with no acidity impact identified at the existing quarry operations and no exceedances of trace metals in any of the samples identified. Potential water quality impacts are considered to be associated primarily with salinity, with the groundwater sampling indicating that groundwater within the Byabbara Beds is brackish.

A simplified mass balance calculation was undertaken to determine the potential impact associated with brackish groundwater. The mass balance identified a relatively low TDS concentration (170mg/L) within the water captured within the pit. Brackish groundwater seeping into the pit is therefore expected to have limited impact on the overall quality of water that may be discharged from the Project.

8.3.2 *Groundwater Modelling Outcomes*

Estimated Water Take from Modelling

The groundwater flow modelling indicates a steady state groundwater inflow rate of approximately 40 to 60 m^3/day to the final pit void, which equates to approximately 15 to 22 ML/year. The predicted steady state inflows are modest for a pit void of the proposed size, and the relatively low predicted inflow rates align with observations from the existing quarry where no active dewatering takes place and groundwater seepage into the pit is reportedly negligible.

Drawdown

Taking into consideration the impact assessment requirements of the NSW Aquifer Interference Policy, the predicted 2 m level drawdown contour for the stabilised cone of depression is of particular significance (as the minimal impact considerations specify a maximum of a 2 m decline at any water supply network). The modelling indicates that at its furthest extent (from the outer perimeter of the final pit) the 2 m drawdown contour may extend to approximately 800 to 1,100 m from the final pit (based on the base case and sensitivity run scenarios respectively), as outlined in *Figure 8.4* below.

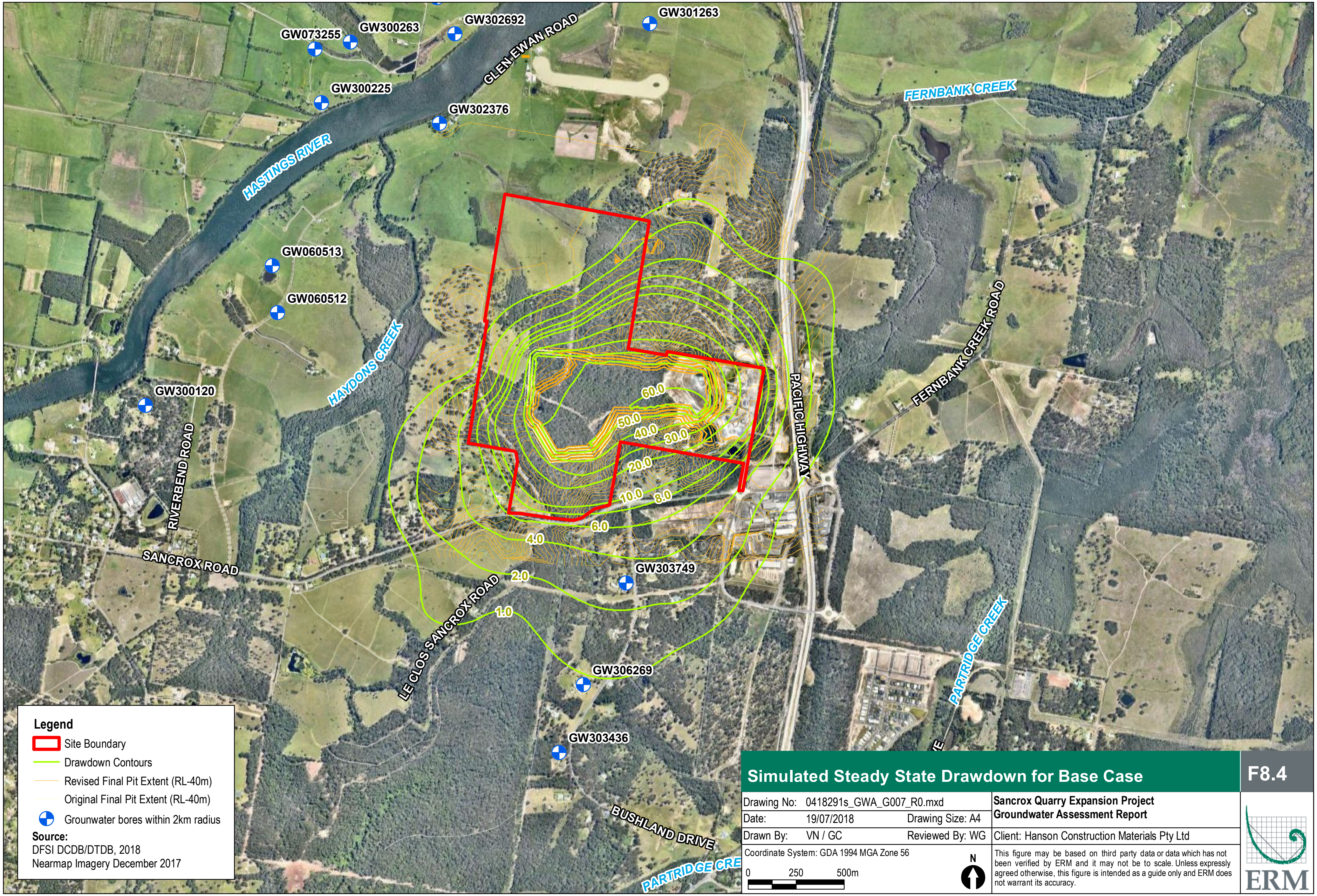
When considering the locations of the identified groundwater bores, 1 of the 13 bores fall within the footprint of the > 2 m drawdown contour for the base case scenario (GW303749), and 2 of the 13 bores for the sensitivity run scenario (GW303749 and GW306269). The modelling outputs indicate that the magnitude of drawdown may vary between approximately 3 m and 7 m at GW303749, and 1 m to 3 m at GW306269. The likely impacts of this potential drawdown would depend on the:

- pump installation specifics at each bore (specifically pump depth in relation to the pre-quarry water level and total bore depth);
- intensity of use of the bore (the rates the bore is pumped at and how frequently water is drawn from the bore); and
- remaining water column within the bore following potential drawdown.

Potential impacts may vary from negligible (if drawdown does not affect the operation and use of the bore) to significant if water level drawdown is such that it affects the useability of the bore.

Groundwater Dependant Ecosystems

The predicted drawdown at the GDE located closest to the Project is considered negligible.



Simulated Steady State Drawdown for Base Case

F8.4

Drawing No: 0418291s_GWA_G007_R0.mxd		**Sancrox Quarry Expansion Project** **Groundwater Assessment Report**
Date: 19/07/2018	Drawing Size: A4	
Drawn By: VN / GC	Reviewed By: WG	Client: Hanson Construction Materials Pty Ltd
Coordinate System: GDA 1994 MGA Zone 56		This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

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8.4 MITIGATION MEASURES AND RECOMMENDATIONS

8.4.1 *Licencing Requirements*

The NSW Aquifer Interference Policy specifies that all water taken during an activity must be accounted for, and that a water licence is required irrespective of whether the water is taken for consumptive use or whether water is taken incidentally in the course of undertaking the activity. In line with the WMA, aquifer interference activities taking water outside of water sharing plan areas require a license under the *Water Act 1912*. Hanson currently hold a Water Access Licence (WAL42524) for water supply works undertaken on site.

8.4.2 *Water Level Drawdown*

Mitigation measures for the potential impacts associated with drawdown on bores GW303749 and GW306269 will vary dependant on the extent of the impact, but would include (if deemed necessary):

- lowering the bore pump in the bore casing;
- drilling a deeper bore; or
- providing an alternative water source as part of "make good" arrangements.

Monitoring recommendations have been provided throughout the Groundwater Assessment (ERM, 2018c) and have been summarised below.

8.4.3 *Groundwater Monitoring Program*

The NSW Aquifer Interference Policy specifies that monitoring requirements need to be developed that allow for the monitoring of actual impacts compared to predicted impacts, allowing for contingency plans to be enacted in a timely manner if actual impacts are higher than predicted and these impacts are found to be significant. It is recommended that a groundwater monitoring plan be developed that includes specifics of such a monitoring program, including threshold trigger values as well as a contingency strategy if triggers are exceeded. While the development of such a plan falls outside the scope of this assessment, recommendations for monitoring requirements are outlined below.

Water Take

It is recommended that monitoring of inflows be undertaken to the extent feasible as part of water balance activities. This can be done by metering water being pumped from the in-pit sumps. An estimation of rainfall contribution to water being pumped from the in-pit sumps can then be made on an annual basis by factoring in rainfall data and the pit extent after which the groundwater component can be estimated. Groundwater take will be estimated and reported in this manner on an annual basis.

If geological/hydrogeological observations during quarry extension vary significantly from that considered for the groundwater flow model the groundwater flow model will be re-evaluated. The model re-evaluation may include running the existing groundwater model for different stages of pit development and including transient analysis in the modelling to evaluate contributions from aquifer storage (which may require additional pumping tests and observations bore installation).

Water Levels

The groundwater monitoring program will include monitoring of water levels at the potentially affected groundwater bores. In order to be able to identify over or under predictions by the modelling in a reasonable way, it is recommended that all bores showing a > 0.5 m of simulated drawdown be included in the monitoring program. This would include bores GW303436, GW303749 and GW306269.

As the predicted drawdown is based on steady state drawdown associated with the final stage of pit extension (the maximum drawdown expected over the life of the Project), initial monitoring of water levels can serve as a baseline against which to compare future water level measurements. Monitoring frequency should be adaptable (depending on trends observed and stages of the quarry development) with twice annual monitoring recommended for the first year of monitoring. Water level data will be reported on an annual basis along with the reporting of the water take estimates.

Water Quality

Water quality monitoring is recommended at the in-pit sump(s) and existing monitoring bores while they remain accessible. Parameters monitored will include standard field parameters (pH, EC, temperature, ORP and DO) and laboratory analysis of TDS. Monitoring frequency of these sampling locations should be adaptable (depending on trends observed) with twice annual monitoring recommended for the first year of monitoring. Water quality results will be reported on an annual basis along with the reporting of the water take estimates.

Monitoring water quality of water discharges from the site will continue as per the conditions specified in the site Environmental Protection Licence (EPL). In addition to the current suite of parameters, it is recommended that consideration be given to including EC and TDS in the EPL related compliance monitoring.

ERM (2018c) outlines that pit lake modelling may be required prior to closure of the quarry.

8.5 *CONCLUSION*

Based on the findings presented throughout this chapter, and the results outlined throughout the Sancrox Quarry Expansion Groundwater Assessment (ERM, 2018c), it is concluded that impacts to groundwater as a result of the proposed development are expected to be minimal. This conclusion is based under the assumption that the mitigation measures outlined above (and throughout the Groundwater Assessment) are adhered to during and post construction.

REFERENCES

BoM (2018) *Groundwater Dependant Ecosystems Atlas.* Bureau of Meteorology. Sourced from http://www.bom.gov.au/water/groundwater/gde/

Brunker R.L., Offenberg A.C. and Cameron R.G. (1970) *Hastings 1:250 000 Geological Sheet SH/56-14, 1st edition*, Geological Survey of New South Wales, Sydney

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ERM, 2018c. *Groundwater Assessment*. Sancrox Quarry Expansion. Prepared for Hanson Construction Materials Pty Ltd.

Hanson (2015). *Geology, drill results and Resources 2015 – Sancrox Quarry, Stubbs Extension***.** Hanson Construction Materials Pty Ltd.

9 SOIL AND LAND RESOURCES

9.1 METHODOLOGY

9.1.1 *Agricultural Land Capability*

The agricultural land capability of the Study Area (defined by the full extent of the void to be excavated upon completion of quarrying) was assessed using the most relevant available online databases as detailed in the Department of Primary Industries (DPI) *Agricultural Land Use Mapping Resources in NSW – Users guide* (2017). DPI resources utilised included:

- Land and Soil Capability mapping;
- Biophysical Strategic Agricultural Land mapping; and
- Regional Farmland mapping;

The DPI (2017) guidance document also references Important Agricultural Land and Critical Industry Cluster mapping, however neither are applicable to the Study Area as the mapping is only relevant to the Hunter Valley and regions to the south.

In addition to the land capability mapping outlined above, the following resources were also investigated.

- Soil Landscape mapping (Atkinson, 1999); and
- Local Environmental Plan (PMHC, 2011) zoning mapping.

9.1.2 *Soils, Geology and Landform*

The geology of the Study Area was described by previous geological assessments undertaken by the Proponent and publically available local geology and soil landscape mapping. Landform was assessed by review of topographical mapping, survey of the area and site visit.

9.1.3 *Contamination*

A desktop investigation of potential contamination sources was undertaken by:

- reviewing historic aerial imagery;
- conducting searches of contamination registers; and
- obtaining Planning Certificates for the two lots comprising the Study Area.

9.2 *EXISTING ENVIRONMENT*

9.2.1 *Landform and Elevation*

The topography of the Study Area is characterised by floodplains and low lying hills up to approximately 60 m Australian Height Datum (m AHD), which is the highest point of the Study Area.

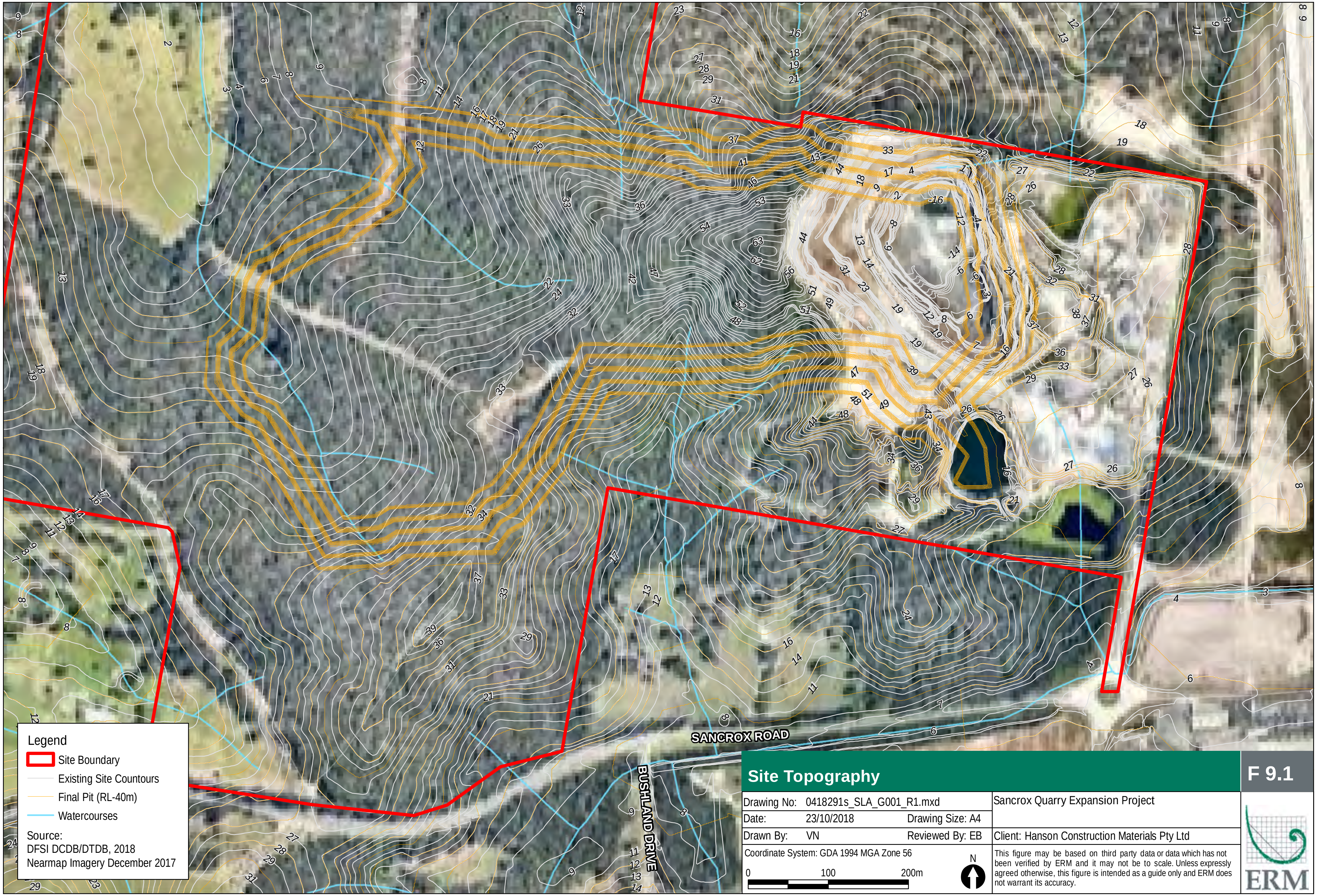
The eastern portion of the Study Area has been disturbed by quarrying activities, while the west and northwest portions of the Study Area are largely undisturbed and predominantly covered with remnant native open forest vegetation and some smaller sections of ground covering pasture.

Run-off from the majority of the existing quarry site flows into the pit which is pumped to existing dams in the south east corner of the site. These dams also collect the majority of the run-off from the workshop and southern stockpile area. There is a sediment basin in the northeast of the quarry site that captures surface run-off from part of the crushing and northern aggregate stockpile area. The majority of the northern aggregate stockpile area drains to the south east and has minimal current sediment controls, with improvements to be implemented outlined in the hydrology assessment (ERM 2018). The quarry site is surrounded by a bund at its extents.

The future stages of the Project will progress into the peak of the hill to the west of the existing quarry and along the ridgeline further to the west. This will limit/avoid the requirement for upslope diversions to prevent clean run-on entering the excavation areas.

The location of the Project site is such that only the upper extent of first order watercourses will be bisected. A farm dam is present in the western portion of the Study Area. This dam is within the footprint of the final stage of the quarry, so will be dewatered and removed as part of the Project.

The topography and surface water flow paths of the Study Area are presented in *Figure 9.1.*



Site Topography

F 9.1

Drawing No: 0418291s_SLA_G001_R1.mxd	Sancrox Quarry Expansion Project
Date: 23/10/2018 Drawing Size: A4	
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9.3 SOILS AND GEOLOGY

The 1:250,000 Hastings Geological Map Series SH 56-14 indicates that the Project site is situated over the Byabbara Beds Formation of the Carboniferous Period and Palaeozoic Era. The Byabbara Beds are characterised by lithic sandstone, siltstone, tuff, shale and limestone.

9.3.1 *Geological Assessments*

Previous geological assessment includes:

- 1997 - a geological assessment was undertaken by R. W. Corkery & Co. The assessment included three diamond drill boreholes and a number of shallow percussive boreholes.
- 2004 – Pells Sullivan Meynink performed a slope stability study of the central area of the existing pit, identifying a slope failure. The report provided a management plan to ameliorate the issue in the short and long term.
- 2009 – drilling was undertaken by Hanson with some of the boreholes undertaken in this assessment being located in the Project site.

Investigation of the potential resource for the quarry expansion was undertaken by Hanson in 2015. Hanson developed diamond drill bore holes and percussion drill bore holes at the Project site.

The Hanson (2015) report states 'the overburden has been modelled on the clay or deep weathering in the upper part of each drill hole. The depth varies over the site. The overburden volume based on the drill hole lithology depth is 1.4 million bank cubic metres'. Total available resource was calculated at 24.5 million bank cubic metres. The report also stated that the current pit has a defined fault line trending north east to south west and that there is also joint sets observed in the current pit. Hanson (2015) states that these joint sets cause wedges that need to be considered in the pit design and that another report has been prepared addressing this issue. The Hanson (2015) report outlines that the shale bands are softer than the more competent conglomerate and mudstone beds and this may contribute to geotechnical issues.

9.3.2 *Soil Properties*

The soils at the Project site have predominately been removed prior to the excavation of the quarry in search of 'hard rock'. The highly disturbed extraction area is characterised by exposed rock and crushed particles of rock and clays. Several stockpiles of crushed material were present across the Project site during the site inspection. The stockpiles are not covered to protect from erosive forces, though run-off generated from the stockpiles predominately drains towards sediment treatment devices.

According to the soil landscapes described by Atkinson (1999), the majority of undisturbed portions of the Project site are part of the Cooperabung Soil Landscape. The western and southern extent of the Project site extends into the Euroka Soil Landscape. A small portion of the western extent of the Project site comprises the Kundabung Landscape. Each of the soil landscapes are described below, along with limitations. The soil landscapes of the Study Area are shown in *Figure* 9.2.

Cooperabung Soil Landscape

Soils of the Cooperabung Soil Landscape range from shallow to moderately deep with well-structured red, brown and yellow clay subsoils. The Cooperabung Soil Landscape is under forested lands in the Study Area and State forests with minor areas cleared for grazing in the tributary valleys to the Hastings River. Under the present land use, the Cooperabung Soil Landscape is subject to minor sheet erosion, with evidence of gully erosion associated with roads and past clearing.

Atkinson (1999) details that the soils of this type are shallow, stony soils with moderate to high erodibility and are dispersible. The soils have low water holding capacity and low fertility.

Euroka Soil Landscape

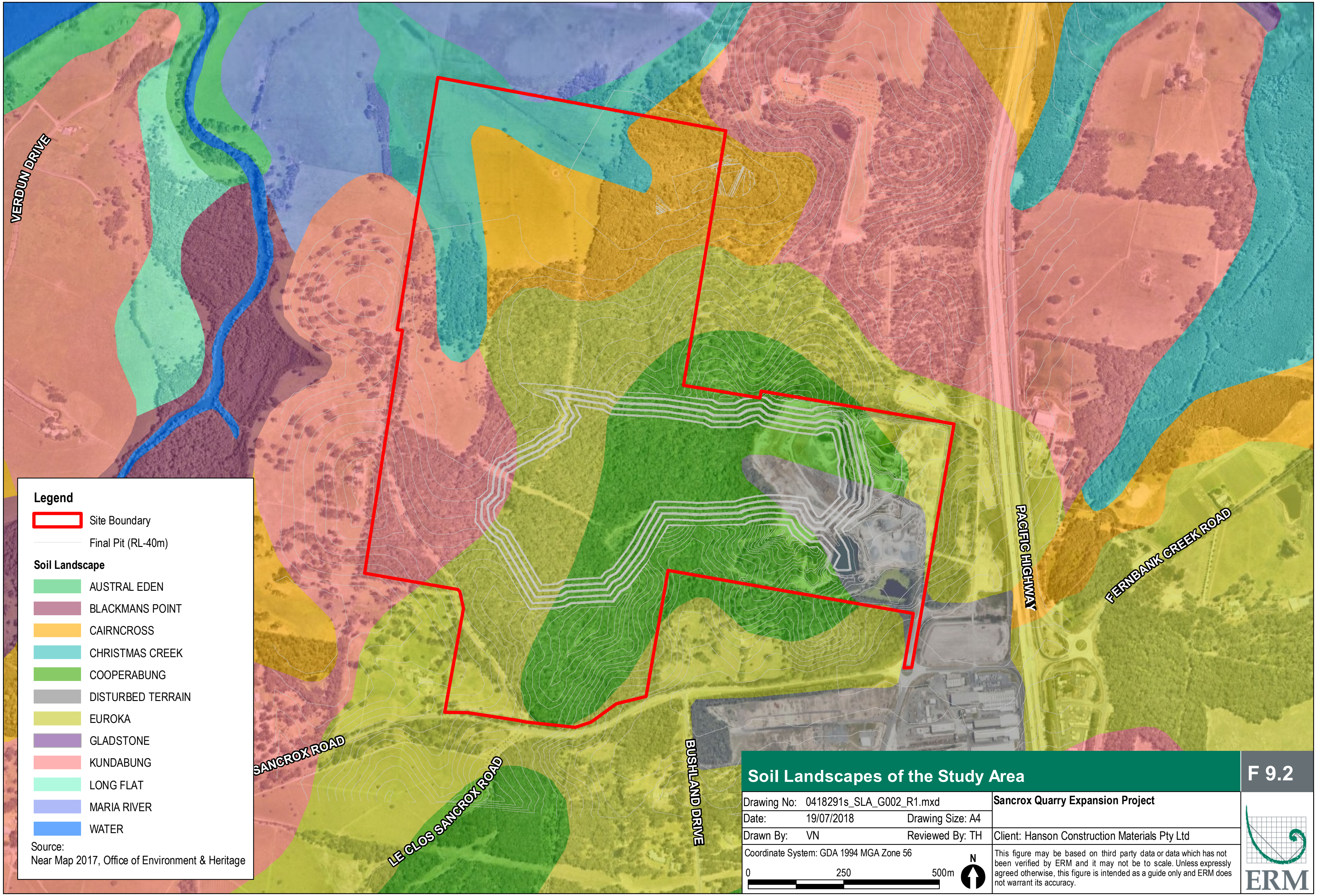
The Euroka soil landscape comprises shallow Red, Yellow and Brown Podzolic soils. The topography of the landscape is rolling low hills with slopes most commonly ranging from 10-15% at elevations of 20-90m. Within the Study Area the soil landscape is under open sclerophyll forest. The Euroka landscape grades into the Kundabung landscape on slopes less than 10% and to the Cooperabung landscape on steeper slopes.

Atkinson (1999) details that the soils are hard setting infertile soils with poor drainage. Very strong acidity is also a limiting factor for potential productivity and can cause high aluminium toxicity. Large applications of Lime will be required to address this acidity problem and improve permeability issues.

Kundabung Soil Landscape

Soils of the Kundabung landscape are Shallow to deep (<100 - >300cm), poorly drained hardsetting soloths and grey- brown, yellow and red podzolic soils. Gleyed podozolic soils with humic gleys in drainage depressions. The limitations of this soil landscape include:

- seasonal waterlogging;
- water erosion hazard;
- highly erodible, highly acidic soils with low permeability; and
- high aluminium toxicity potential



VERDUN DRIVE
PACIFIC HIGHWAY
FERNBANK CREEK ROAD
SANCROX ROAD
LE CLOS SANCROX ROAD
BUSHLAND DRIVE
Legend
Site Boundary
Final Pit (RL-40m)
Soil Landscape
AUSTRAL EDEN
BLACKMANS POINT
CAIRNCROSS
CHRISTMAS CREEK
COOPERABUNG
DISTURBED TERRAIN
EUROKA
GLADSTONE
KUNDABUNG
LONG FLAT
MARIA RIVER
WATER
Source:
Near Map 2017, Office of Environment & Heritage
Soil Landscapes of the Study Area
F 9.2
Drawing No: 0418291s_SLA_G002_R1.mxd
Date: 19/07/2018
Drawing Size: A4
Drawn By: VN
Reviewed By: TH
Coordinate System: GDA 1994 MGA Zone 56
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Sancrox Quarry Expansion Project
Client: Hanson Construction Materials Pty Ltd
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9.3.3 *Soil Texture Group and Dispersibility*

Cooperabung Soil Landscape

Landcom (2004) states that the Cooperabung soil landscape is characterised as the Type F or Type D sediment type; being fine and dispersible. The Revised Universal Soil Loss Equation (RUSLE) includes a factor for soil erodibility, the K-Factor. K-factors range from 0.075 (very high) to 0.005 very low. The range of K-factors observed for the Cooperabung landscape range between 0.024 to 0.05. The soil Hydrologic Group is Group B (low-moderate run-off potential) /Group C (moderate to high run-off potential).

Euroka Soil Landscape

Landcom (2004) states that the Euroka soil landscape is characterised as the Type F or Type D sediment type; being fine and/or dispersible. The K-factor for this landscape ranges between 0.011 to 0.037. The soil Hydrologic Group is Group C (moderate to high run-off potential).

Kundabung Soil Landscape

Landcom (2004) states that the Kundabung soil landscape is characterised as the Type F or Type D sediment type; being a fine/and or dispersible. The K-factor for this landscape ranges between 0.017 and greater than 0.094. The soil Hydrological Group is Group C/Group D (high to very high runoff potential).

9.3.4 *Acid Sulphate Soils*

Potential acid sulphate soils (PASS) are naturally occurring sediments and soils containing iron sulfides (principally pyrite) and/or their precursors or oxidation products. The exposure of the sulfides to oxygen by drainage or excavation leads to the formation of actual acid sulphate soils (ASS) and generation of sulphuric acid which can have many unacceptable environmental impacts, including acidification of waterways, major fish kills, habitat destruction, loss of agricultural productivity, geotechnical instability and corrosion of concrete and steel structures.

PASS are concentrated in coastal environments, typically within estuarine sediments of relatively recent (Holocene and Pleistocene) age and at elevations mostly less than 5m AHD. There is however potential for other acid sulphate materials (ASM) (e.g. rocks containing sulphide minerals) to have wider distribution in the landscape.

Reference to the PASS mapping in the area (DLWC, 1997) indicates there is a high probability of ASS occurring at or near to the ground surface along the low lying watercourses present within the northern portion of Lot 2 DP 574308. Department of Land and Water Conservation (DLWC) (1997) indicates potential for severe environmental risk if these materials are disturbed by activities such as shallow drainage, excavation or clearing. These areas are identified as alluvial backplain's at 1 – 2m above mean sea level (ASL). This location is outside of the proposed area of disturbance associated with the Project site.

Based on review of DLWC (1997) there are no known or expected occurrences of ASS thought to be present within the remainder of the Project site.

9.3.5 Naturally Occurring Asbestos

Review of naturally occurring asbestos mapping (NSW T&I, 2015) identified that no naturally occurring asbestos occurs in the Project site.

9.4 EXISTING LAND USE

The Project site is situated in remnant open sclerophyll forest that is not currently used for agricultural production. An unsealed access track is located in the west of the Project site that provides access to the adjacent areas that have previously been cleared of vegetation and are used for cattle grazing.

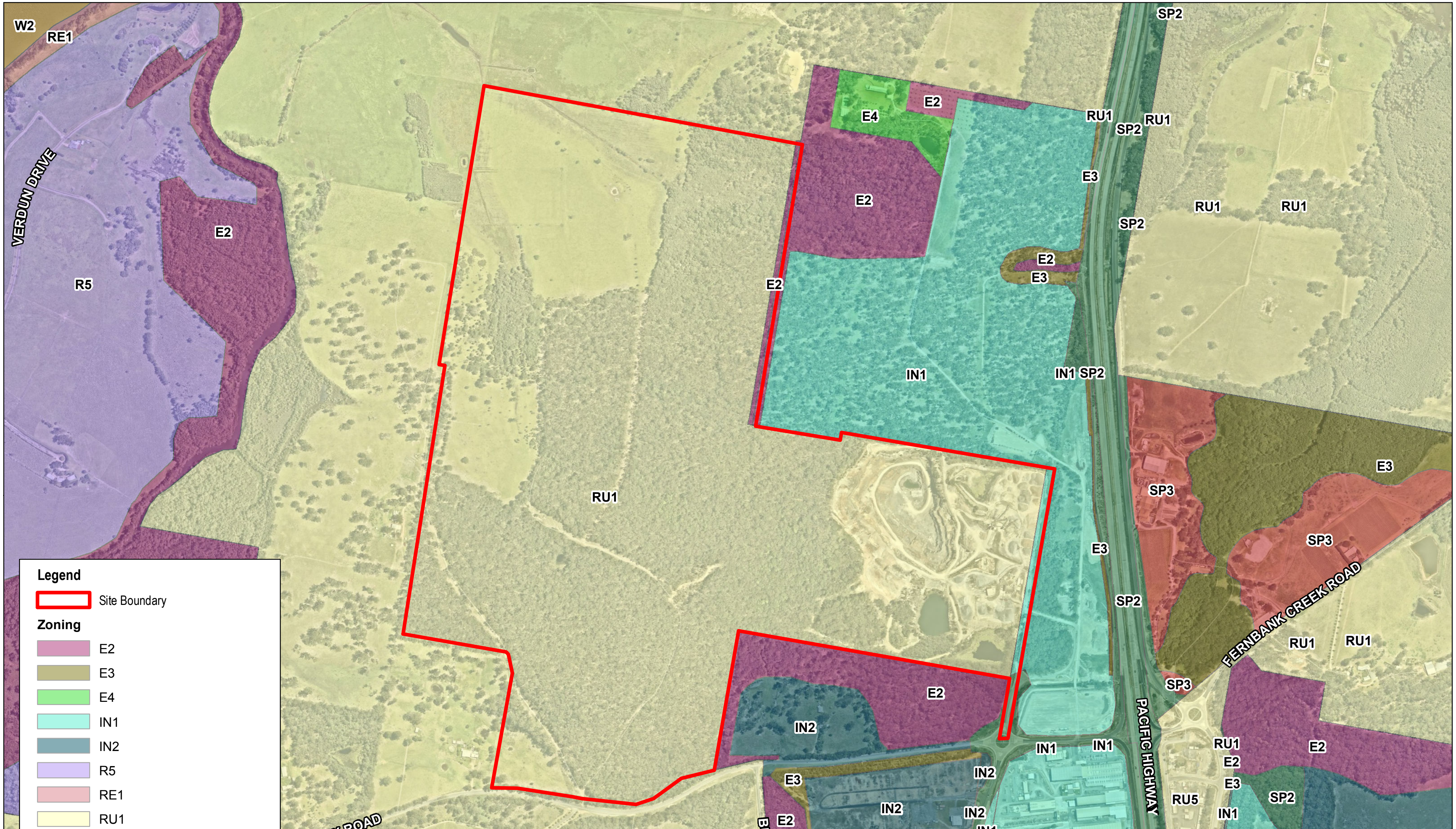
9.5 ASSESSMENT

9.5.1 Land Use Zoning

The Project site is zoned as RU1 - Primary Production under the 2011 Port Macquarie Hastings Local Environmental Plan. To the north and south of the Project site the land continues as RU1 – Primary Production. This is similar to the west, though there is also E2 - Environmental Conservation and R5 - Large Lot Residential with continued distance from the quarry. To the north and east of the Project site the land is classified as IN1 - General Industrial. Directly adjacent to the southern perimeter of the Project site is an area zoned as E2 - Environmental Conservation. The zoning is demonstrated in *Figure 9.3*.

The land to the east and north of the Project site is currently being filled to create level ground for the development of an industrial area. South of Sancrox Road the Expressway Spares Laydown/ Storage Yard is zoned as IN2 - Light Industrial, while the workshop area within the Sancrox Interchange is classed as IN1 - General Industrial. The current zoning is not restrictive to the Project.

Potential impacts to the existing and proposed industrial areas to the south, north and east of the Project site and the large lot residences to the west have been considered in the relevant technical studies for the EIS (refer to *Chapter 10* and *Chapter 11* for noise and air quality impacts respectively).



Local Environment Plan Zoning within the Study Area

F 9.3

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Date: 19/07/2018 Drawing Size: A4	
Drawn By: VN Reviewed By: TH	Client: Hanson Construction Materials Pty Ltd
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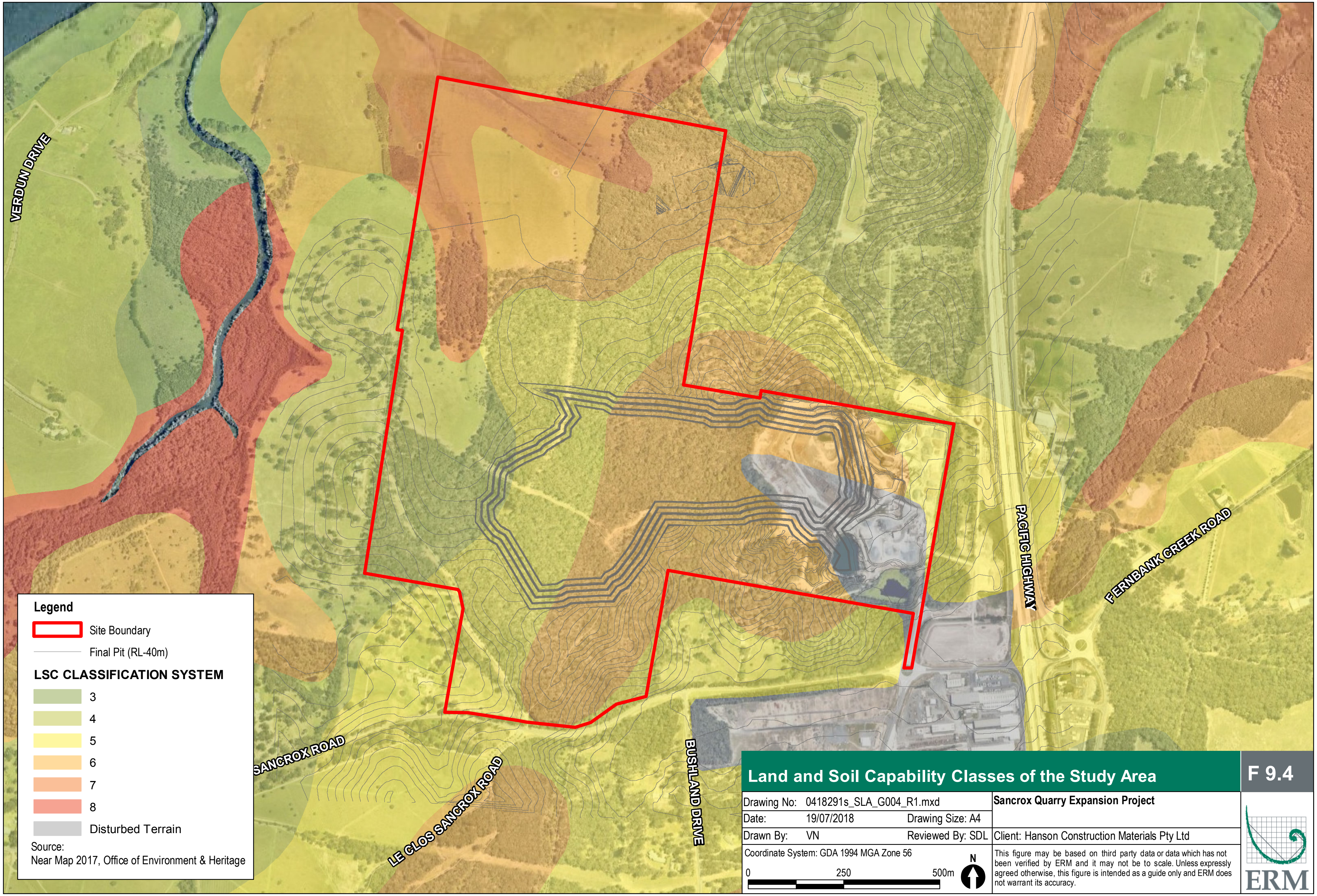
9.5.2 *Land and Soil Capability Assessment*

Table 9.1 provides the definition of Land and Soil Capability (LSC) classes based on the assessment scheme outlined in OEH *The Land and Soil Capability Assessment Scheme, Second Approximation* (2012). *Figure 9.4* shows the LSC classes of the Study Area.


VERDUN DRIVE
PACIFIC HIGHWAY
FERNBANK CREEK ROAD
SANCROX ROAD
LE CLOS SANCROX ROAD
BUSHLAND DRIVE
Legend
Site Boundary
Final Pit (RL-40m)
LSC CLASSIFICATION SYSTEM
3
4
5
6
7
8
Disturbed Terrain
Source:
Near Map 2017, Office of Environment & Heritage
Land and Soil Capability Classes of the Study Area
F 9.4
Drawing No: 0418291s_SLA_G004_R1.mxd
Date: 19/07/2018
Drawing Size: A4
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The classifications across the Study Area range from:

- the disturbed terrain of the existing quarry footprint;
- LSC Class 4 land for a small area at the western extent of the Project site that would be impacted by Stage 4 of the proposed quarry expansion;
- LSC Class 5 land of approximately 30% of the total Project site that would be impacted by Stage 4; and
- LSC Class 6 land approximately 50% of the Project site that would be impacted by Stages 1 and 2.

None of the land within the Project site is in the highest LSC classes of land that is capable of a wide range of land uses. The largest percentage of the land within the Project site is LSC Class 6, low capability land that is capable of limited land uses. The next largest area is LSC Class 5 land that is moderate to low capability land. The small area of land in the western portion of the Project site is LSC Class 4 land of moderate capability.

The land has not previously been used for agriculture and has remained under native open forest. The land is predominately moderate to low suitability and does not restrict utilising the land for quarrying activities. The stockpiling of topsoils will ensure that the soils mapped with higher capability (Class 4 and 5 lands) are given preference for storage. These higher capability soils are considered more likely to facilitate successful rehabilitation than the lower capability Class 6 lands.

Table 9.1 Land and Soil Capability Scheme Classification

LSC Class	General definition
Land capable of a wide variety of land uses (cropping, grazing, horticulture, forestry, nature conservation)	
1	**Extremely high capability land:** Land has no limitations. No special land management practices required. Land capable of all rural land uses and land management practices.
2	**Very high capability land:** Land has slight limitations. These can be managed by readily available, easily implemented management practices. Land is capable of most land uses and land management practices, including intensive cropping with cultivation.
3	**High capability land:** Land has moderate limitations and is capable of sustaining high-impact land uses, such as cropping with cultivation, using more intensive, readily available and widely accepted management practices. However, careful management of limitations is required for cropping and intensive grazing to avoid land and environmental degradation.
Land capable of a variety of land uses (cropping with restricted cultivation, pasture cropping, grazing, some horticulture, forestry, nature conservation)	
4	**Moderate capability land:** Land has moderate to high limitations for high-impact land uses. Will restrict land management options for regular

LSC Class	General definition
	high-impact land uses such as cropping, high-intensity grazing and horticulture. These limitations can only be managed by specialised management practices with a high level of knowledge, expertise, inputs, investment and technology.
5	**Moderate–low capability land:** Land has high limitations for high-impact land uses. Will largely restrict land use to grazing, some horticulture (orchards), forestry and nature conservation. The limitations need to be carefully managed to prevent long-term degradation.
Land capable for a limited set of land uses (grazing, forestry and nature	
6	**Low capability land**: Land has very high limitations for high-impact land uses. Land use restricted to low-impact land uses such as grazing, forestry and nature conservation. Careful management of limitations is required to prevent severe land and environmental degradation
Land generally incapable of agricultural land use (selective forestry and nature conservation)	
7	**Very low capability land**: Land has severe limitations that restrict most land uses and generally cannot be overcome. On-site and off-site impacts of land management practices can be extremely severe if limitations not managed. There should be minimal disturbance of native vegetation.
8	**Extremely low capability land**: Limitations are so severe that the land is incapable of sustaining any land use apart from nature conservation. There should be no disturbance of native vegetation.

1. Sourced from OEH (2012) *The Land and Soil Capability Assessment Scheme, Second Approximation.*

9.5.3 Strategic Regional Land Use Policy

Review of the Strategic Regional Land Use Policy (SRLUP) mapping (NSW Department of Planning and Infrastructure, 2013) available on the NSW Government Sharing and Enabling Environmental Data (SEED) website identified that the Study Area does not interact with any mapped Strategic Agricultural Land. The nearest mapped Strategic Agricultural Land is to the west of the Project site adjacent to the Hastings River and to the south, south of Frogs Road of the Sancrox Interchange. The SRLUP mapping in the vicinity of the Project site is shown in bright green in *Figure 9.5*.

Figure 9.5 ***Strategic Regional Land Use Policy Mapping in Vicinity of Project Site (DPE, 2013)***

The Study Area is located outside of mapped Strategic Agricultural Land, therefore no associated land use constraints apply to the Project.

9.5.4 *Regional Farmland Mapping*

The Project site and the industrial zoned land immediately to the north and east are mapped as 'proposed employment lands' within the Mid North Coast Regional Farmland Mapping. The Project site falls entirely within lands classed as 'other rural land'. To the east of the Project site towards Haydon's Creek, the land remains predominately mapped as other rural land, with a small area of rural residential. The closest Regionally Significant Farmland is approximately 740m to the north of the Project site. This Regionally Significant Farmland is a band that follows the Hastings River. The Project site is located outside of mapped regionally significant farmland, and activities will not affect the farmland, therefore no associated land use constraints apply to the Project.

9.5.5 *Compatibility with Other Land Uses*

Clause 12 of the *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007* requires assessment of compatibility of the Project with other land uses in the vicinity, particularly agricultural land use. The investigation of the agricultural mapping databases above identified that there is no conflict with the Project site and adjacent agricultural lands.

The Project site is zoned as primary production under the 2011 Port Macquarie Hastings Local Environmental Plan, though historic aerial imagery reveals it has remained predominately unchanged (with the exception of an access track construction, a small dam and small plot of clearing between 1969 and 1989) as native open forest vegetation for approximately 58 years.

Significant public benefit will be provided by the alteration of this currently unutilised land by the Project, with a longer term, reliable supply of rock for local development projects becoming available.

The Sancrox Employment Precinct is being established to the immediate east and north of the site. The proposed expansion of quarrying activities and production of concrete and asphalt is compatible with the industrial development within the Precinct. The recent road network upgrades servicing this Precinct and the Project are of the highest standard and thus sufficient for increased truck movements created by the Project and Precinct.

The Project site will extend to the west towards rural residential areas, with mitigation measures to minimise the impacts of the quarry expansion outlined in *Chapter 18.*

Table 9.2 includes the Clause 12 considerations and details of the proposed development.

Table 9.2 Clause 12 Considerations

Clause 12 Considerations	Proposed Development
(a) (i) Consider the existing uses and approved uses of land in the vicinity of the development	The Project expansion site is situated in remnant open sclerophyll forest that is not currently used for agricultural production. An unsealed access track is located in the west of the Project site that provides access to the adjacent areas that have previously been cleared of vegetation and are used for cattle grazing. The existing quarry operates in accordance with following approvals: DA 1995/193 as modified; DA 2004/206 as modified; and DA 2006/497. The Project site is zoned as RU1 – Primary Production. To the north and south of the Project site the land continues as RU1. This is similar to the west, though there is also E2 - Environmental Conservation and R5 – Large Lot Residential with continued distance from the quarry. To the north and east of the Project site the land is classified as IN1 - General Industrial. Directly adjacent to the southern perimeter of the Project site is an area zoned as E2 – Environmental Conservation. The proposed quarry development is consistent with the zoning provisions of the RU1 zone. Extractive industries are permitted within the zone with development consent. The land to the east and north of the Project site is currently being filled for the development of an industrial precinct. The Sancrox Interchange upgrades connecting to the Pacific Highway was strategically considered for the development of the area into an Employment Precinct, including the proposed quarry expansion.

Clause 12 Considerations		Proposed Development
(a)	(ii) Consider whether or not the development is likely to have a significant impact on the uses that, in the opinion of the consent authority having regard to land use trends, are likely to be the preferred uses of land in the vicinity of the development	The Sancrox Interchange upgrades connecting to the Pacific Highway was strategically considered for the development of the area into an Employment Precinct, which included the proposed quarry expansion. The trend for land use in the vicinity of the quarry expansion is towards developing an industrial precinct given the vicinity's location and strategic connection to the Pacific Highway. The proposed expansion of quarrying activities and production of concrete and asphalt is considered compatible with the industrial development within the Precinct.
(a)	(iii) Consider any ways in which the development may be incompatible with any of those existing, approved or likely preferred uses	There remains small allotments of Environmental Conservation zones to the northeast, south east and further west from the site boundary. However the land uses of these areas are not directly impacted by the proposal. The impacts to the rural residential land to the west are addressed Chapter 18, with mitigation measures identified to minimise the impacts of the quarry expansion, predominantly associated with noise and air quality impacts to these receptors and traffic impacts to road users.
(b)	evaluate and compare the respective public benefits of the development and the land uses referred to in paragraph (a) (i) and (ii), and	The proposed expansion of quarrying activities and production of concrete and asphalt offers additional employment opportunities to the Port Macquarie region and an on-going supply of high quality construction materials. The development of the concrete batching plant and asphalt production plant provides more competition in the market and a more local source of asphalt than is currently available. The consolidation of the concrete batching plant within the quarry significantly reduces transportation requirements for the aggregate constituents compared to an offsite plant. The reduced transportation requirements has a positive net effect on the associated fuel consumption and greenhouse gas emissions compared to a separate quarry and plant operations. Furthermore, the planned industrial development in the vicinity will become a consolidated industrial hub. Expansion of the quarry and consolidation of the proposed facilities within the site reduces the likelihood of greenfield disturbance to provide similar resources. An additional concrete recycling facility in the town of Port Macquarie increases competition and thus potential cost savings for consumers. The development of the facility to allow for recycling of concrete is considered to be ecologically sustainable development. The connected nature of the site, with the Sancrox interchange in close proximity, offers ease for access for vehicular transportation of quarry materials.
(c)	evaluate any measures proposed by the applicant to avoid or minimise any incompatibility, as referred to in paragraph (a) (iii).	Mitigation measures are outlined in Chapter 18.

9.5.6 *Land Slippage*

Geotechnical issues such as internal slope failure and slippages are an inherent risk to quarrying activities. The Project site has had a previous slope failure identified and specific actions developed for short and long-term management. Quarry operation management plans detail practices to be undertaken to manage such risks, including implementing the standard geotechnical stability controls outlined in *Section 9.6.4* and regular site inspections.

9.5.7 *Contamination*

Historical Aerial Imagery

Historical aerial imagery was obtained to ascertain the previous activities that have occurred at the Project site. The aerial imagery obtained were from:

- 8 April 1969; and
- 26 August 1989.

Historical aerial imagery available in Google Earth Pro was also reviewed, with imagery available from the following dates:

- 19 October 2009;
- 8 July 2011;
- 25 March 2013;
- 10 May 2016; and
- 15 May 2017.

The 1969, 1989 and a recent aerial are provided in *Figure 9.6.*

The review of the aerial imagery identified that the quarry site has evolved from a small area of disturbance in 1969 to a much larger operation in 1989. The dams in the south eastern and northern portions of the Project site are identifiable in the 1989 image. Evidence of quarrying is noted in the current water holding pond location. The quarry site office appears to be in a similar location as currently. The quarry void location had predominately been cleared, with quarrying undertaken in the southern most area of the current void location. Between 1969 and 1989, the area encompassed by the proposed expansion remained vegetated.

Comparison of the 1969 and 1989 images in the Study Area identified:

- the proposed expansion area remained heavily vegetated with limited human alteration;
- house paddocks as they exist today where created adjacent to Sancrox Road;

- access tracks that were present in 1969 evolved to the arc shaped more formalised track with the small cleared area at the apex of the arc (the northern part of the track and the cleared area fall within Stage four of the proposed quarry expansion and the final pit extent); and
- the dam at the western extent of the arc track was established between 1969 and 1989. The dam will be encompassed by stage four of the expansion.

There is negligible noticeable alteration to vegetation and the landscape from 1989 to the current day within the Project site.

The current level of disturbance in the proposed expansion area is limited to the creation of an unsealed access track, a dam, and small area of clearing. Limited additional vegetation clearing or human disturbance is noticeable throughout the historical aerial imagery and therefore a low likelihood for contamination exists.

There is the potential for waste materials to be present in 'dumps' within the Project site. Farmers sometimes discard unwanted items within gullies and headcuts on properties to avoid paying landfill fees. Hence, it is recommended that a site walkover be undertaken prior to clearing activities taking place to ensure that any refuse is identified and can be removed from site and disposed of at an appropriate licenced location.

Historic and Current Aerial Imagery F 9.6

Drawing No: 0418291s_SLA_G005_R1.mxd		Sancrox Quarry Expansion Project
Date: 19/07/2018	Drawing Size: A3	
Drawn By: VN	Reviewed By: ME	Client: Hanson Construction Materials Pty Ltd
Coordinate System: GDA 1994 MGA Zone 56		This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

ERM

Section 149 Certificates

Section 149 (s149) certificates were obtained from Port Macquarie Hastings Council for Lot 353 DP 754434 and Lot 2 DP 574308. The s149 certificate contamination information for each lot is provided in *Table 9.3*.

Table 9.3 Contamination Items Discussed in the s149 Certificates

Contamination item addressed in the s149 certificates	Lot 353 DP 754434 (existing quarry lot)	Lot 2 DP 574308 (lot that quarry expansion will encompass)
Is the land to which this certificate relates significantly contaminated land within the meaning of the Contaminated Land Management Act 1997?	No	No
Is the land to which this certificate relates subject to a management order within the meaning of the Contaminated Land Management Act 1997?	No	No
Is the land to which this certificate relates subject to a management order within the meaning of the Contaminated Land Management Act 1997?	No	No
Is the land to which the certificate relates subject to an ongoing maintenance order within the meaning of the Contaminated Land Management Act 1997?	No	No
Is the land to which this certificate relates the subject of a site audit statement within the meaning of the Contaminated Land Management Act 1997 that has been provided to Council?	No	No

1. Information sourced from Port Macquarie Hastings Council supplied s149 certificates.

The s149 Certificates identify that contamination is not present at either lot. In addition, neither lot is listed on the register that is maintained for properties with loose fill asbestos insulation.

NSW EPA Contaminated Land Register

The NSW EPA contaminated land record (accessed on 26 January 2018 at http://app.epa.nsw.gov.au/prclmapp/searchregister.aspx) identified that there were no contaminated land records for the suburb of Sancrox or the wider Port Macquarie Hastings LGA.

RMS Contamination Assessment (during construction of the Sancrox Interchange)

RMS carried out a targeted contamination investigation of the Sancrox Interchange prior to commencing works in the area. The investigation was completed by GHD (2013) and identified areas of hydrocarbon contamination within soils to the south of Sancrox Road at the Expressway Spares Facility and south of Fernbank Creek Road at the RMS depot. Works undertaken during the construction of the interchange removed the area of contamination within the interchange project footprint to the south of the north western roundabout, and the contamination at the north eastern roundabout of the interchange. Underground Storage Tanks (USTs) were also identified within the Expressway Spares site that had caused hydrocarbon and heavy metal contamination to local groundwater and soils. The extent of groundwater contamination was unknown when last reported (GHD 2013) and the current status of these USTs is also unknown.

9.6 MITIGATION MEASURES

9.6.1 Soils

The stockpiling of topsoils will ensure that the soils mapped with higher capability (Class 4 and 5 lands) are given preference for storage. These higher capability soils are considered likely to improve the success of rehabilitation.

Application of lime is required to address high levels of acidity and aluminium toxicity associated with the Euroka landscape. Amelioratives will be added to other soils to address issues associated with the other landscapes. A soil sampling program will be undertaken prior to topsoil stripping to understand acidity concentrations and receive advice from the laboratory on proposed liming and ameliorative application rates.

9.6.2 Contamination

No contamination risk is present or will be introduced by the Project that would warrant not undertaking the activity. Chemical and hydrocarbon management, spill prevention and control mitigation measures as outlined in *Chapter 7* and *18* to be implemented.

A site walkover will be undertaken prior to clearing activities taking place to ensure that any refuse is identified and can be removed from site and disposed of at an appropriate licenced location.

Should unexpected contamination be identified, works will cease and an appropriately experienced contamination specialist engaged to develop a strategy to manage the contamination.

9.6.3 *Erosion and Sediment Controls*

Erosion and sediment controls outlined in *Chapter 7* and *18* will be implemented to prevent loss of soil and impacts to adjacent watercourses.

9.6.4 *Land Slippage*

Standard geotechnical controls will be implemented as required to avoid or minimise impact of land slippage including:

- <u>Batter slope trimming</u> - The angle of batter slopes will be reduced to the extent considered safe based on localised geology and hazardous blocks of rock removed.

- <u>Bunds</u> - installed as necessary at batter bases to control falling rocks

- <u>Future bunds and material stockpiles</u> - will be located away from top of benches where they may be subject to instability.

- <u>Void progression</u> - will progress along a ridgeline such that any potential inflow of surface water runoff over batter faces will be minimal. Benching will also be implemented during quarry progression.

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10 NOISE AND VIBRATION

Environmental Resources Management Australia Pty Ltd (ERM) on behalf of Hanson Construction Materials Pty Ltd (Hanson) has completed a noise and vibration impact assessment (NVIA) for the expansion of the Sancrox Quarry, located on Sancrox Road, Sancrox New South Wales (NSW).

Hanson proposes to extend the life of the quarry by expanding the approved extraction boundary to facilitate the extraction and distribution of high quality construction materials for use in civil infrastructure and road construction projects. The project will provide vital construction resources to accommodate further regional development in the Port Macquarie Hastings region. A summary of the Project and its features relative to the noise and vibration assessment are presented in *Chapter 1* of the NVIA (ERM, 2018d).

The NVIA has been prepared to document the findings of the assessment of environmental (noise, overpressure and vibration) factors, that was conducted in response to the assessment requirements specified for key issues as presented in the revised Secretary's Environmental Assessment Requirements (SEARs), dated 18 September 2017 for the Sancrox Quarry Extension Project (SSD 7293).

It should be noted that during the preparation of this report the quarry pit layout was modified in the north western corner, due to the risk of flooding identified in the Hydrology Assessment (ERM, 2018b). The updated staging layout is presented in *Chapter 2* of this EIS. Based on these minor changes to the pit layout, it is not anticipated that noise impacts will alter significantly. Therefore the original noise modelling results have been retained for this assessment.

10.1 METHODOLOGY

The assessment was conducted to achieve a scope of works that allowed for the successful identification of potential receptors situated in the vicinity and potential area of influence of site emission sources and identification of significant noise and vibration generating plant, equipment and/or activities associated with the Project and their likely/known emissions. The overall assessment methodology is presented in *Chapter 2* of the NVIA (ERM, 2018d).

The existing ambient and background noise level of the area was measured and quantified via long-term unattended noise logging and short-term operator attended noise measurements. The existing conditions at and near the project site and the measured existing ambient and background noise levels are presented in *Chapter 3* of the NVIA (ERM, 2018d).

Noise and vibration criteria (refer to *Chapter 4* of the NVIA) were developed with due regard to and in accordance with recognised NSW standards and guidelines as applicable to the quarry activities. The focus of the assessment was establishing construction noise compliance with due regard to the NSW

Department of Environment and Climate Change (DECC) – *NSW Interim Construction Noise Guideline (ICNG), July 2009*, and then operational noise compliance with regard to the NSW Environment Protection Authority (EPA) – NSW Environmental Noise Management – *Industrial Noise Policy (INP), January 2000.* The relevant INP application notes were considered as applicable to the factors being assessed. The relationship between the INP (EPA 2000) and the EPA – *Noise Policy for Industry* (NPI) that was released in October 2017 is discussed in *Section 2.4* of the NVIA.

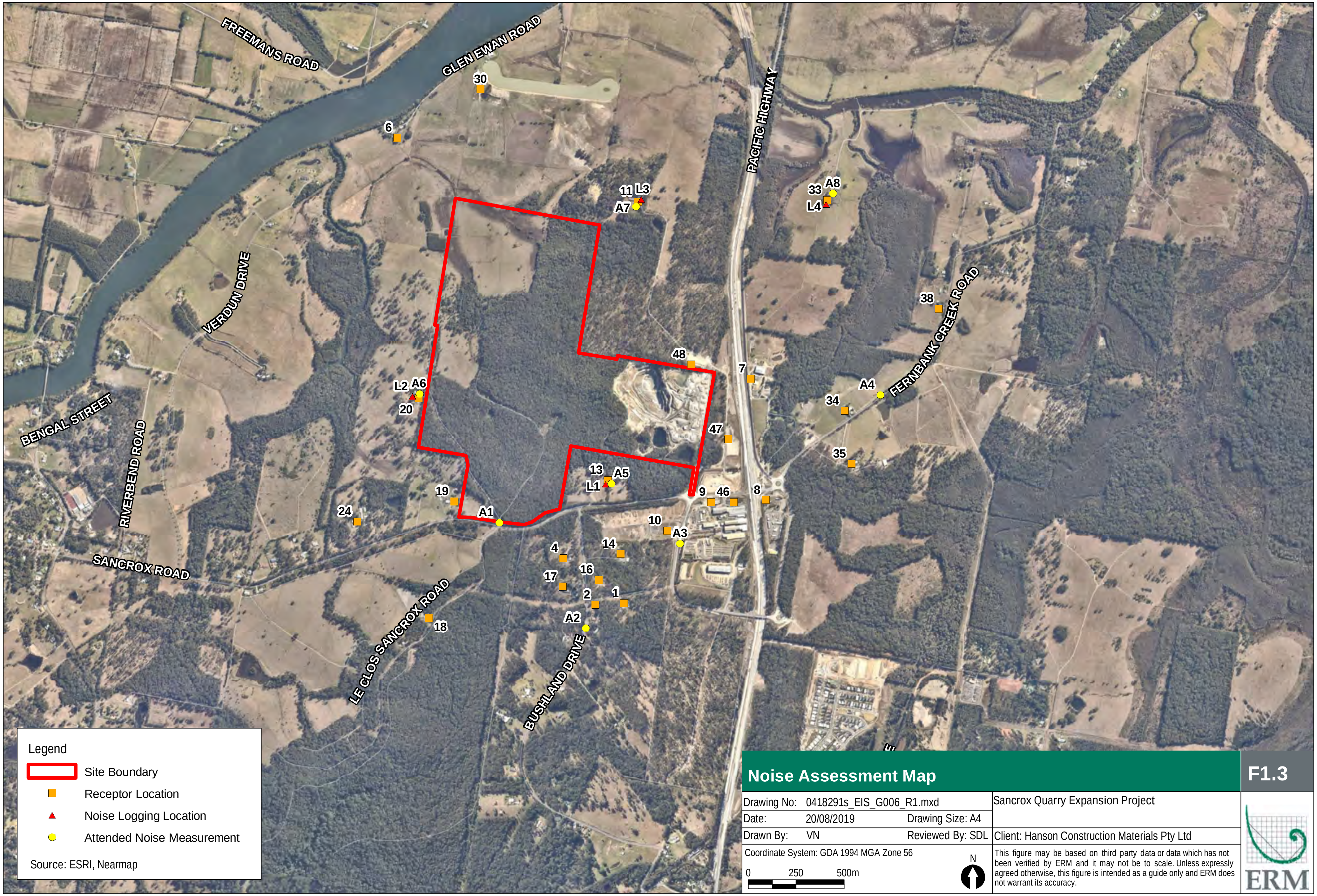
The focus of the (blasting) overpressure and vibration assessment was establishing compliance with regard to the **Standards Australia AS2187.2-2006™ (AS2187.2) – Explosives—Storage and Use Part 2: Use of Explosives.**

Applicable construction, operational and blasting assessment scenarios were developed based on project information provided by Hanson and likely noise, overpressure and vibration levels were predicted, and compared to criteria to establish compliance, evaluate potential impacts and establish potential mitigation measures if necessary to reduce levels and minimise impacts.

10.2 *EXISTING ENVIRONMENT*

A key element in assessing environmental noise impacts is an understanding of the existing ambient and background noise levels in the vicinity of the closest and/or potentially most affected receptors situated in proximity to the site, which are outlined in *Figure 10.1* below. The noise environment in the vicinity of the Project receptors is best described as 'rural' - defined by the INP as '*an area with an acoustical environment that is dominated by natural sounds, having little or no road traffic.*

Despite the predominantly rural setting of the Project site, the existing noise environment of the surrounding area is under the influence of traffic noise from the nearby Pacific Highway. The existing background noise levels considered in the assessment are therefore much higher than would typically be experienced in a rural environment.



Legend

- Site Boundary
- Receptor Location
- Noise Logging Location
- Attended Noise Measurement

Source: ESRI, Nearmap

Noise Assessment Map

F1.3

Drawing No: 0418291s_EIS_G006_R1.mxd		Sancrox Quarry Expansion Project
Date: 20/08/2019	Drawing Size: A4	
Drawn By: VN	Reviewed By: SDL	Client: Hanson Construction Materials Pty Ltd
Coordinate System: GDA 1994 MGA Zone 56		This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

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ERM

10.2.1 *Existing Background Noise Levels*

The results of long-term unattended noise logging conducted between Monday 6 November and Wednesday 22 November 2017 were analysed and compared to the short-term operator attended measurements conducted on Monday 6 November, Tuesday 7 November and Wednesday 22 November 2017. Results for both unattended and attended noise monitoring are provided in *Chapter 3.3* of the NVIA (ERM, 2018d).

In summary, the measured ambient and background noise levels presented in *Table 3.3* of the NVIA (ERM, 2018d) vary significantly, with background noise levels ranging between 36 and 48 dBA and ambient noise levels ranging between 42 and 60 dBA. However, most measurements were dominated by Pacific Highway traffic, wind-blown vegetation, some local traffic, birds and insects.

10.3 *ASSESSMENT*

10.3.1 *Preparation of Noise Management Levels and Criteria*

Both Construction and Operational Noise Management Levels (NML) were established as part of the NVIA (ERM, 2018d) based on the representative RBL values presented in Table 3.4 (where relevant) of the NVIA and in accordance with the ICNG and INP, respectively.

10.3.2 *Qualitative Assessments*

Potential impacts associated with **construction road traffic** and **ground-borne noise**, and impacts associated with **construction and operational vibration** were qualitatively assessed. Due to the type of equipment in use, activities that will be undertaken in the known sensitivity/distance offset to nearby receptors no impacts are anticipated and as such no further recommendations for noise and vibration mitigation, management measures or monitoring options are warranted. Further information regarding these qualitative assessments is presented in Chapter 5 of the NVIA (ERM, 2018d).

10.3.3 *Construction and Operational Noise Assessments*

A quantitative construction and operational noise impact assessment was then conducted by predicting noise levels via modelling. The predictions were completed for the applicable assessment scenarios and resultant noise levels compared to project-specific criteria and/or management levels at each receptor location, and any significant or characteristic features identified. These construction and operational noise assessments are the focus of the NVIA and the details of each assessment is presented in Chapter 6 (for construction) and Chapter 7 (for operation) of the NVIA. The predicted construction noise levels for each scenario and the comparison to the day time NML at each receptor location is reproduced from the NVIA as *Table 10.1* below.

The assessment has identified that both construction and operational noise levels have the potential to exceed the applicable criteria, limits and thresholds of the INP and ICNG if they are not suitably mitigated. The assessment also identified the blasting overpressure and vibration levels have only a limited potential to exceed the applicable AS2187 criteria and thresholds, as long as normal blast design planning and consideration for potential environmental impacts occurs.

Operational road traffic noise was assessed, which also included conservative calculations to determine additional permissible quarry truck trips per hour during the strictest night time road traffic noise criteria, beyond the typical operations.

Table 10.1 Predicted Construction Noise Levels – All Scenarios (SCN01 to SCN03, Lmax)

ID[1]	Type	Predicted Noise levels, $L_{eq, 15\ minute}$ in dBA						Comparison to Daytime NML					Sleep Disturbance
		SCN01	SCN02a	SCN02b	SCN03a	SCN03b	Lmax[2]	SCN01	SCN02a	SCN02b	SCN03a	SCN03b	
13	Residential[3]	41	37	**52**	36	**50**	38 - **57**	-7	-11	**4**	-12	**2**	**10**
14	Residential[3]	46	40	**49**	39	47	43 - **53**	-2	-8	**1**	-9	-1	**6**
1	Residential[3]	43	38	44	36	43	40 - **48**	-5	-10	-4	-12	-5	**1**
16	Residential[3]	44	39	46	37	45	41 - **51**	-4	-9	-2	-11	-3	**4**
2	Residential[3]	42	37	45	36	43	40 - **49**	-6	-11	-3	-12	-5	**2**
17	Residential[3]	43	38	46	36	44	40 - **50**	-5	-10	-2	-12	-4	**3**
4	Residential[3]	42	37	48	35	46	40 - **52**	-6	-11	0	-13	-2	**5**
18	Residential[3]	35	32	28	30	27	29 - 32	-11	-14	-18	-16	-19	-16
19	Residential[3]	37	36	36	34	35	30 - 40	-9	-10	-10	-12	-11	-8
24	Residential[3]	36	27	32	26	30	33 - 35	-10	-19	-14	-20	-16	-13
20	Residential[3]	27	25	36	24	34	24 - 28	-19	-21	-10	-22	-12	-20
6	Residential[3]	34	32	23	31	22	29 - 38	-17	-19	-28	-20	-29	-12
30	Residential[3]	38	35	26	34	25	26 - 38	-13	-16	-25	-17	-26	-12
11	Residential[3]	43	40	34	39	33	34 - 44	-8	-11	-17	-12	-18	-6
48	Potential Future Industrial	57	60	41	58	40	36 - 64	-18	-15	-34	-17	-35	-
33	Residential[3]	45	42	34	40	33	37 - 45	-7	-10	-18	-12	-19	-11
38	Residential[3]	44	40	34	39	33	36 - 43	-8	-12	-18	-13	-19	-13
7	Commercial	57	54	43	53	41	44 - 57	-13	-16	-27	-17	-29	-
47	Potential Future Industrial	56	49	46	48	45	47 - 53	-19	-26	-29	-27	-30	-
34	Residential[3]	50	46	41	44	39	41 - 50	-2	-6	-11	-8	-13	-6
35	Residential[3]	49	45	41	43	40	44 - 48	-3	-7	-11	-9	-12	-8
8	Industrial	52	48	48	46	46	48 - 52	-23	-27	-27	-29	-29	-

ID[1]	Type	Predicted Noise levels, $L_{eq, 15 minute}$ in dBA						Comparison to Daytime NML					Sleep Disturbance
		SCN01	SCN02a	SCN02b	SCN03a	SCN03b	Lmax[2]	SCN01	SCN02a	SCN02b	SCN03a	SCN03b	
46	Commercial	56	51	50	49	48	50 - 55	-14	-19	-20	-21	-22	-
9	Industrial	52	47	46	45	44	47 - 50	-23	-28	-29	-30	-31	-
10	Industrial	46	39	49	37	48	44 - 53	-29	-36	-26	-38	-27	-

1. Receptor ID's have been derived from the Air Quality and Greenhouse Gas Assessment (Annex G) to ensure consistency across receptors throughout the EIS.
2. Lmax noise level in dBA.
3. The HNAML ($L_{eq, 15 minute} \leq 75$ dBA) applies.
4. Sleep disturbance criterion not applicable for Commercial and Industrial receptors (i.e. not a residence/dwelling).
5. " – " indicates that an assessment of this feature does not apply for this circumstance/receptor.

10.4 POTENTIAL CUMULATIVE IMPACTS

10.4.1 *Construction*

As noted in *Chapter 4* of the NVIA (ERM, 2018d), the NML are based on existing noise levels measured at locations surrounding the site and focus on the direct impacts from the site under assessment. Furthermore, cumulative construction noise impacts are beyond the control of Hanson, are temporary in most circumstances and are best managed by local or state consent authorities for significant projects.

Although cumulative impacts are unlikely, as there are other construction projects proposed for the area, due care may be required of the local or state consent authorities to manage any works occurring concurrently. Where issues arise, Hanson will be able to assist by scheduling certain works or activities to minimise cumulative impacts. Given that the majority of predicted construction noise levels are compliant during the recommended standard hours of construction, cumulative impacts are highly unlikely to occur or to be dominated by this Project, if construction is limited to standard hours.

10.4.2 *Operation*

As noted in Section 4 of the NVIA (ERM, 2018d), the operational noise criteria (i.e. project specific noise level, PSNL) are based on existing noise levels measured at locations surrounding the Project site, such that existing conditions and industrial noise contributions are considered as part of the assessment approach. The criteria are designed to prevent any long-term increase in cumulative industrial noise. By complying with these PSNL the quarry's noise contribution, combined with that of the existing industrial noise of the area is unlikely to generate any significant cumulative noise impacts. Future cumulative impacts (i.e. due to other new developments approved in the future) are beyond the control of Hanson and are best managed by local or state consent authorities for significant projects.

10.5 MITIGATION MEASURES

Based on the findings summarised above noise mitigation, management measures and/or monitoring options were established as considered suitable to the magnitude and extent of the predicted construction and operational impacts. They are designed to reduce noise levels and minimise impacts as far as is commonly feasible and reasonable to do so and practical to implement. These measures and options are presented in Chapter 8 of the NVIA (ERM, 2018d).

Construction

Construction noise levels will be reduced and impacts (if any) minimised with the successful implementation of the recommendations provided in Section 8.1 of the NVIA. Construction noise impacts may not be reduced to imperceptible or negligible levels for all receptors during all construction activities; however the recommendations presented here will ensure that any residual impacts are minimised as far as is commonly achievable.

To ensure noise emissions associated with construction works and activities are kept to acceptable levels, the following noise mitigation and management measures are recommended:

- Noise generating work and activities will be carried out during the ICNG recommended standard hours (i.e. 7am to 6pm Monday to Friday and 8am to 1pm Saturdays), with no work on Sundays or public holidays. Any work that is required outside the recommended standard hours must be suitably managed with a goal of achieving compliant noise levels at all residential receptors or undertaken with agreement from any potentially affected neighbours.

- Where unforeseen works will occur in close proximity (<100m) to a receptor and these works are anticipated to generate high levels of noise e.g. >75 dBA, potential respite periods e.g. three hours of work, followed by one hour of respite will be considered. Respite will be implemented if it is the preference of the affected receptors and if it is feasible and reasonable to achieve during the works. In some circumstances, respite may extend the duration of works and inadvertently increase noise impacts, hence due care should be taken when considering this management measure.

- During construction planning, choose appropriate machines for each task and adopt efficient work practices to minimise the total construction period and the number of noise sources on the site. Select the quietest item of plant available where options that suit the design permit.

- During the works, avoid unnecessary noise due to idling diesel engines and fast engine speeds when lower speeds are sufficient.

- During the works, instruct drivers to travel directly to site and avoid any extended periods of engine idling at or near residential areas, especially at night.

- During any night works, any activity that has the potential to generate impulsive noise will be avoided. These types of events are particularly annoying; especially at night and have the limited potential to generate sleep disturbance or awakening impacts. Any impulsive or transient noise events expected to exceed the sleep disturbance criteria at residential receptors will be strictly avoided at night.

- During the works, ensure all machines used on the site are in good condition, with particular emphasis on exhaust silencers, covers on engines and transmissions and squeaking or rattling components. Excessively noisy machines will be repaired or removed from the site.

- During the works, ensure that all plant, equipment and vehicles movements are optimised in a forward direction to avoid triggering motion alarms that are typically required when these items are used in reverse.

- If any validated noise complaints are received, operator attended noise measurements will be undertaken to measure and compare the site noise level contributions ($L_{eq,\ 15\ minute}$ and L_{max} in dBA) to:

  - the predicted values; and

  - the NMLs presented in this report.

- All site noise levels will be measured in the absence of any influential source not associated with the site. If the measured site noise levels are below the predicted values and comply with the NMLs presented in this report, no further mitigation or management measures are required. If the measured site noise levels are above the predicted noise levels or NML presented in this report, further mitigation and/or management measures will be considered.

- Prior to commencement of works, a Construction Noise Management Plan (CNMP) will be prepared and implemented, and will consider all potential acoustical factors identified in this report including those addressed in Chapter 5 and Chapter 6 of the NVIA. The CNMP will detail any noise monitoring and take into consideration measures for reducing the source noise levels of construction equipment by construction planning and equipment selection where reasonable and feasible.

Operational

Based on preliminary noise modelling results, it was evident that operational noise levels have the potential to exceed the PSNL during daytime, evening, night time and morning shoulder periods at residential receptors to the south of the Project site across all stages of the proposed quarry expansion.

Following preliminary noise modelling Hanson was consulted to determine suitable mitigation that could be incorporated into the project design to assist in reducing noise impacts. Based on the consultation with Hanson, reasonable and feasible mitigation measures have been discussed and conceptual mitigation was modelled to achieve compliance with the PSNL for all operational assessment scenarios. This mitigation involves the following measures:

- Boundary Mitigation:
  - Earth Bunding (approximately 25 m in height, 450 m in length and 75 m in width) is required along the southern boundary of the site to provide additional shielding from the processing plant and asphalt production plant.
  - Earth Bunding (approximately 20 m in height, 250 m in length and 60 m in width) is also required at the western boundary of the pit to provide shielding from in pit activities from Stage 2 of the quarry expansion when in pit activities progress closer to Receptor 20 to the west.

- Plant / Equipment Procurement:
  - During the operational design, choose appropriate machines for each task and adopt efficient work practices to minimise the total number of noise sources on the site. Select the quietest item of plant available where options that suit the design permit, with consideration to offensive noise characteristics such as tonality, low frequency noise or impulsiveness.
  - The key items of plant/equipment are presented in Table 2.3 of the NVIA. Table 2.3 of the NVIA also details the required LW deductions for these specific items of equipment/plant and the LW required to meet most stringent night time PSNL.
  - Operational LW emissions should be at or below those presented in Table 2.3 and Table 7.1 of the NVIA. Where items of procured plant generate offensive noise characteristics, INP penalties would be applied prior to meeting the LW values presented above.
- At Source Mitigation:
  - Where LW values for plant/equipment outlined in Table 2.3 of the NVIA are not reasonable or feasible, the operational design will incorporate acoustic enclosures / barriers to assist in reducing the noise emission of identified plant/equipment. Design of acoustic enclosures / barriers would also consider offensive noise characteristics as tonality, low frequency noise or impulsiveness.

In addition to the mitigation measures outlined above, the following management measures are recommended to ensure noise emissions associated with the operation of the quarry are kept to acceptable levels:

- Avoid unnecessary noise due to idling diesel engines and fast engine speeds when lower speeds are sufficient.
- Instruct drivers to travel directly to site and avoid any extended periods of engine idling at or near residential areas, especially at night.
- During any night works, any activity that has the potential to generate impulsive noise will be avoided. These types of events are particularly annoying; especially at night and have the limited potential to generate sleep disturbance or awakening impacts. Any impulsive or transient noise events expected to exceed the sleep disturbance criteria at residential receptors will be strictly avoided at night.
- Ensure all machines used on the site are in good condition, with particular emphasis on exhaust silencers, covers on engines and transmissions and squeaking or rattling components. Excessively noisy machines will be repaired or removed from the site.
- Ensure that all plant, equipment and vehicles movements are optimised in a forward direction to avoid triggering motion alarms that are typically required when these items are used in reverse.
- Noisy plant and equipment will be located as far as possible from noise sensitive areas.

- The location of activities, plant and equipment will optimise attenuation effects through measures such as topography, natural and purpose built barriers.
- If any validated noise complaints are received, operator attended noise measurements will be undertaken to measure and compare the site noise level contributions (Leq, 15 minute and Lmax in dBA) to:
  - the predicted values; and
  - the PSNLs presented in the NVIA.

All site noise levels will be measured in the absence of any influential source not associated with the site. If the measured site noise levels are below the predicted values and comply with the PSNLs presented in the NVIA, no further mitigation or management measures are required. If the measured site noise levels are above the predicted noise levels or PSNLs presented in the NVIA, further mitigation and/or management measures will be considered.

A Detailed Design Noise Impact Assessment will be undertaken during the final stages of the project design to ensure that noise emissions from the Processing Plant and Asphalt Production Plant can be effectively reduced to compliant levels through plant / equipment procurement and construction of acoustic enclosures / barriers. An Operational Noise Management Plan (ONMP) will also be prepared based on the detailed design, which will detail any noise monitoring and take into consideration measures for reducing the source noise levels of operational equipment by equipment selection, management and mitigation where reasonable and feasible.

In accordance with the SEARs, this assessment has considered the characterisation of impacts and potential treatment as per the INP and with due regard to the principles presented in the Voluntary Land Acquisition and Mitigation Policy for State Significant Mining, Petroleum Production and Extractive Industry Developments (VLAMP, September 2018). As stated in Section 7.2 of the NVIA (ERM, 2018d), noise has been assessed at receptor locations in accordance with the INP i.e. the most-affected point on or within the property boundary or, if that is more than 30 m from the residence, at the most-affected point within 30 m of the residence. The objective of the noise assessment and broader EIS is to identify that emissions from the quarry will comply (with noise reducing mitigation implemented) at the most affected location for all receptors assessed. Hence, further assessment regarding the VLAMP as demonstrated in the Figure 2.1 of the NVIA, including assessment of noise exceedance over more than 25% of a property is not necessary.

Operational noise levels will be reduced and impacts (if any) minimised with the successful implementation of the recommendations provided in Section 8.2 of the NVIA (ERM, 2018d). Operational noise impacts may not be reduced to imperceptible or negligible levels for all receptors during all operations; however the recommendations presented here will assist to ensure that any residual impacts are minimised as far as is commonly achievable.

Operational road traffic noise levels were predicted to comply with the relevant RNP criteria. Conservative calculations to determine permissible night time truck volumes determined that the total number of truck trips permissible on a local road during the night time period is 18 truck trips (36 movements). The total number of trips permissible within any hour during the night time period is 12 trips/ hour (24 movements/hour), noting that the truck trip limit for the total night time period cannot be exceeded. The estimated allowable hourly night truck movements, based on road traffic noise criteria, is well in excess of the anticipated typical quarry vehicle trips used in the modelling on typical operating hours.

Operational road traffic noise from the quarry may be audible at times but noise levels will be reduced and impacts (if any) minimised with the successful implementation of the recommendations provided in Section 8.2 of the NVIA.

10.5.1 Potential Monitoring Options

Blast Monitoring

As outlined in Section 4.3.2 of the NVIA monitoring is required for all blast events carried out in or on the premises. Air-blast overpressure and ground vibration levels must be measured at any point within one metre of any affected residential boundary or other noise sensitive location, such as a school or hospital for all blasts carried out in or on the premises. In addition, the licensee must monitor all blasts carried out in or on the premises at or near the nearest residence or noise sensitive location that is likely to be most affected by the blast.

Construction / Operational Noise Monitoring

Construction and operational noise monitoring will also be undertaken for the Project however, the type and frequency could be adapted according to type of work. Noise monitoring would occur in the form of attended noise measurements and/or unattended real-time noise monitoring.

As stated above the details of these monitoring measures would be outlined in the Construction Noise Management Plan and the Operation Noise Management Plan.

Key Technical Features

All noise measurement procedures adopted for the Project will be conducted in accordance with the requirements of Australian Standard (AS) 1055:1997 *Acoustics - Description and Measurement of Environmental Noise*.

Attended noise measurements would be conducted by an operator using a hand held Type 1 or Type 2 'integrating-averaging' sound level meter. All measurements would be completed with the sound level meter mounted to a tripod (if possible) and with a windscreen fitted. The preferred measurement height is 1.2 m to 1.5 m above the ground.

The device will be calibrated prior to and after all measurement rounds, with any change in calibration levels noted. Instantaneous noise levels for all noted noise emission sources (extraneous or otherwise), meteorological conditions (average and maximum wind speeds, temperature, precipitation and cloud cover etc.) would be recorded during all measurements. The location of monitoring, time of measurement and all relevant measurement parameters (i.e. L_{eq}, L_{min}, L_{max}, L_1, L_{10} and L_{90}) would also be recorded. Noise monitoring would not be completed during periods where wind speeds exceed 5 m/s at the microphone or during any rain events.

Unattended noise measurements would be conducted using a Type 1 or Type 2 environmental noise logger. The device will be calibrated prior to and after installation, with any change in calibration levels noted. Measurements will be completed with a windscreen fitted.

Noise monitoring would not be completed within 3.5 m of any reflective structure or wall, if possible. Where it is not possible to measure more than 3.5 m from any reflective structure or wall, a reduction of up to 2.5 dB would be applied to the measured ambient and site noise contribution ($L_{eq, 15minute}$) to account for the likely increase in noise associated with reflective surfaces.

Monitoring will be conducted with due regard to AS1055; AS61672, AS1259 (or similar); IEC60942; or the NSW Vibration Guideline as relevant to the monitoring being conducted.

All noise samples would be recorded using the "fast" time response of the sound level meter or environmental noise logger. Site activity records would be maintained during any noise (or vibration) monitoring events.

Noise Monitoring Locations

Noise measurements would be undertaken at the potentially most affected receptor locations identified in this report (dependant on phase of works/scenario). Monitoring would occur at the following receptors at minimum to represent receptors surrounding the site: Receptors 13 and 14 to the south, receptor 20 to the west, receptor 11 to the north and receptor 34 to the east (refer *Figure 10.1*).

Recommendations

It is recommended that within the first three months of commercial operation, noise verification and compliance monitoring be conducted to measure and compare the site noise level contributions ($L_{eq, 15minutes}$ in dBA) to a) the predicted values, and b) the criteria presented in this report.

The same would occur if any validated noise complaints are received. All site noise levels would be measured in the absence of any influential sources not associated with the project. If the measured site noise levels are below the predicted values and noise levels comply with the criteria presented in this report, no further mitigation or management measures would be required. If the measured site levels are above the predicted noise levels and/or criteria presented in this report, further mitigation and/or management measures will be required.

10.6 *CONCLUSION*

The assessment has identified that both construction and operational noise levels have the potential to exceed the applicable criteria, limits and thresholds of the INP and ICNG if they are not suitably mitigated. The assessment also identified the blasting overpressure and vibration levels have only a limited potential to exceed the applicable *AS2187* criteria and thresholds, as long as normal blast design planning and consideration for potential environmental impacts occurs.

Based on the findings summarised above noise mitigation, management measures and monitoring options were recommended as considered suitable to the magnitude and extent of the predicted construction and operational impacts. They are designed to reduce noise levels and minimise impacts as far as is commonly feasible and reasonable to do so and practical to implement. These measures and options are presented in *Section 10.5*.

Construction noise levels will be reduced and impacts (if any) minimised with the successful implementation of the recommendations provided in *Section 10.5*. Construction noise impacts may not be reduced to imperceptible or negligible levels for all receptors during all construction activities; however the recommendations will ensure that any residual impacts are minimised as far as possible and commonly achievable via good construction management practices.

Preliminary operational noise levels were predicted to exceed the applicable INP operational noise criteria and limits for all modelled conditions. As such, noise mitigation and management measures were established to assist in achieving compliance with the INP. These measures are presented in *Section 10.5*.

REFERENCES

Australian and New Zealand Environment Council (ANZEC) – 1990, **Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration**, September 1990.

Department of Planning and Environment (DPE) - **Voluntary Land Acquisition and Mitigation Policy for State Significant Mining, Petroleum and Extractive Industry Developments**, September 2018.

Environmental Resources Management Australia (ERM) - **Sancrox Quarry Expansion Noise and Vibration Impact Assessment,** February 2018.

International Organisation for Standardisation (ISO) 9613-2:1996 (ISO9613:2) - **Acoustics - Attenuation of Sound during Propagation Outdoors - Part 2: General Method of Calculation.**

German Institute for Standardisation – DIN 4150 (1999-02) Part 3 (DIN4150-3) – **Structural Vibration - Effects of Vibration on Structures.**

NSW Environment Protection Authority – **NSW Environmental Noise Management – Industrial Noise Policy** (INP), January 2000 and relevant application notes.

NSW Department of Environment and Climate Change – **NSW Interim Construction Noise Guideline** (ICNG), July 2009.

NSW Department of Environment, Climate Change and Water – **NSW Road Noise Policy** (RNP), March 2011.

NSW Department of Environment and Conservation – **NSW Environmental Noise Management – Assessing Vibration: a Technical Guideline** (the NSW vibration guideline), February 2006.

NSW Government – Transport for NSW (TfNSW) **Construction Noise Strategy** (7TP-ST-157/2.0), dated April 2013.

Standards Australia AS1055–1997™ (AS1055) – **Description and Measurement of Environmental Noise**: Parts 1, 2 and 3 as applicable.

Standards Australia AS IEC 61672.1–2004™ (AS61672) – **Electro Acoustics - Sound Level Meters Specifications Monitoring** or Standards Australia AS1259.2-1990™ (AS1259) – **Acoustics – Sound Level Meters – Integrating Averaging as relevant to the devic**e.

Standards Australia AS/IEC 60942:2004/IEC 60942:2003 (IEC60942) – Australian Standard™ – **Electroacoustics – Sound Calibrators.**

Standards Australia AS2187.2-2006™ (AS2187.2) – **Explosives—Storage and Use Part 2: Use of Explosives.**

Standards Australia AS 2436–2010™ (AS2436) – **Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites.**

United Kingdom (UK) – **Calculation of Road Traffic Noise** (CoRTN) calculative methods, adapted to Australia conditions.

11 *AIR QUALITY AND GREENHOUSE GAS*

Environmental Resources Management Australia Pty Ltd (ERM) was commissioned by Hanson Construction Materials Pty Ltd (Hanson) to undertake specialist assessments to inform the Environmental Impact Statement (EIS) for the proposed Sancrox Quarry Extension Project (the 'Project').

The Air Quality and Greenhouse Gas (GHG) Assessment (*Annex G* of this EIS) has been prepared in accordance with the latest version of Secretary's Environmental Assessment Requirements (SEARs) for the preparation of an EIS for the Sancrox Quarry Extension Project (Department of Planning and Environment, 2017) and forms the air quality assessment for the EIS to be submitted to the NSW Department of Planning and Environment (DP&E).

The general scope of works undertaken throughout the assessment include:

- Assessment of potential for ambient air quality impacts and greenhouse gas emissions from construction and operation of the proposed Project;
- Provision of mitigation measures to minimise impacts to the surrounding land use; and
- Recommendations for ambient monitoring to ensure compliance with legislation.

This chapter summarises the methodology, results, adopted mitigation measures and recommendations outlined throughout the Air Quality and GHG Assessment (ERM, 2018e).

11.1 *METHODOLOGY*

The Project has the potential for ambient air quality impacts and greenhouse gas emissions from the construction and operation of the following:

Quarry, including:	**Concrete Batching Plant, including:**	**Concrete Recycling Plant, including:**	**Asphalt Plant, including:**
• Drilling;	• Dry product delivery;	• Product delivery;	• Bitumen delivery and storage;
• Blasting;	• Product storage;	• Product storage;	• High quality aggregate delivery and storage;
• Product handling;	• Product transfer;	• Product handling;	• Dryer emissions;
• Rock processing;	• Pneumatic unloading of moist product;	• Crushing, using primary crusher; and	• Truck load out; and

Quarry, including:	Concrete Batching Plant, including:	Concrete Recycling Plant, including:	Asphalt Plant, including:
• Wheel generated dust; and	• Weight hopper and mixer unloading; and	• Wheel generated dust.	• Wheel generated dust.
• Wind generated dust.	• Wheel generated dust.		

The following sections provide the summary of the methodologies adopted in Air Quality and GHG assessments.

11.1.1 *Air Quality Assessment*

The primary emissions from the sources considered in the assessment were TSP, PM_{10}, $PM_{2.5}$ and deposited dust. Concrete batching and asphalt plants however have the potential to emit additional species. All potential species emitted to atmosphere from the Project sources were identified through consideration of published emission factor databases including:

- NPI Emission Estimation Technique Manual for Mining Version 3.1 (Australian Government Department of Sustainability, Environment, Water, Population and Communities, 2012);
- NPI Emission Estimation Technique Manual for Mining and Processing of Non-Metallic Minerals Version 2.1 (Australian Government Department of the Environment, 2014);
- United States Environment Protection Agency AP-42 Air Emissions Factors and Quantification, Chapter 11: Mineral Products Industry, Section 11.12 Concrete Batching (United States Environmental Protection Agency, 2006); and
- United States Environment Protection Agency AP-42 Air Emissions Factors and Quantification, Chapter 11: Mineral Products Industry, Section 11.1 Hot Mix Asphalt Plants (United States Environmental Protection Agency, 2004).

The criteria for all the emitted species were established through consideration of the following legislation and guidelines:

- POEO Clean Air Regulation 2010 (New South Wales Government, 2017);
- Approved Methods for the Assessment of Air Pollutants in NSW (State of NSW and Environment Protection Authority, 2016);
- National Environment Protection Measures (Australian Government, 2016);

- Other international legislations:
  - Ontario Regulation 419/06: Air Pollution – Local Air Quality (Government of Ontario, 2017);
- Voluntary Land Acquisition and Mitigation Policy for State Significant Mining, Petroleum and Extractive Industry Developments (NSW Government, 2018); and
- Protocol for Environmental Management Mining and Extractive Industries (Environment Protection Authority Victoria, 2007).

Initially, a screening assessment was undertaken for the species other than particulate matter, using the 'UK Air emissions risk assessment for your environmental permit' guidance (UK Guidance). The species that could not be screened out using the criteria provided in the UK Guidance were further considered through the use of atmospheric dispersion modelling.

Atmospheric dispersion modelling was undertaken using the California Puff (CALPUFF) dispersion model for the latest five year period (2012 to 2016 inclusive). The dispersion modelling was completed using site-specific meteorology predicted using a two-step process:

- Prognostic modelling using TAPM (developed by CSIRO); and
- Diagnostic modelling using CALMET (the meteorological pre-processor for the CALPUFF dispersion model).

The configuration of the emission sources within the CALPUFF dispersion model comprised a combination of volume, point and road sources.

The assessment adopted background values for PM_{10} and $PM_{2.5}$ from Wyong air quality monitoring stations, which was considered to be the most representative of background concentrations for the project area from the data available.

11.1.2 *GHG Assessment*

GHG emissions from the Project have been estimated based on the methods outlined in the following documents:

- The World Resources Institute/World Business Council for Sustainable Development (WRI/WBCSD) The Greenhouse Gas Protocol – A Corporate Accounting and Reporting Standard Revised Edition ("the GHG Protocol") (World Business Council for Sustainable Development, World Resources Institute, 2015);
- The National Greenhouse and Energy Reporting (Measurement) Determination 2008 (Australian Government Department of the Environment and Energy, 2011);

- The Australian Government Department of Environment and Energy National Greenhouse and Energy Reporting Scheme Measurement – Technical Guidelines for the estimation of emissions by facilities in Australia (Australian Government Department of the Environment and Energy, 2017a);
- The Australian Government Department of Environment and Energy National Greenhouse Accounts (NGA) Factors July 2017 (Australian Government Department of the Environment and Energy, 2017b);
- The Mining Association of Canada Towards Sustainable Mining – Energy and GHG Emissions Management Reference Guide (The Mining Association of Canada, 2014); and
- Australia Transport Authorities Greenhouse Group, Greenhouse Gas Assessment Workbook for Road Projects (Transport Authorities Greenhouse Group Australia and New Zealand, 2013).

In the absence of Project specific requirement under the SEARs and in line with the NGER legislation, the estimation of GHG emissions from the Project was limited to Scope 1 and Scope 2 emissions, as defined in Australian GHG reporting and measurement methods (Australian Government Department of the Environment and Energy, 2011).

11.2 RESULTS

Air Quality Assessment

A summary of the air quality modelling predictions against all applicable criteria at each receptor location is presented in *Table 11.1* below. Sensitive receptors within the vicinity of the proposed project are outlined in *Figure 11.*1 below. Predicted concentrations for all other species other than PM_{10} and $PM_{2.5}$ are outlined in Section 8.3 of the Air Quality and GHG Assessment (ERM, 2018e).

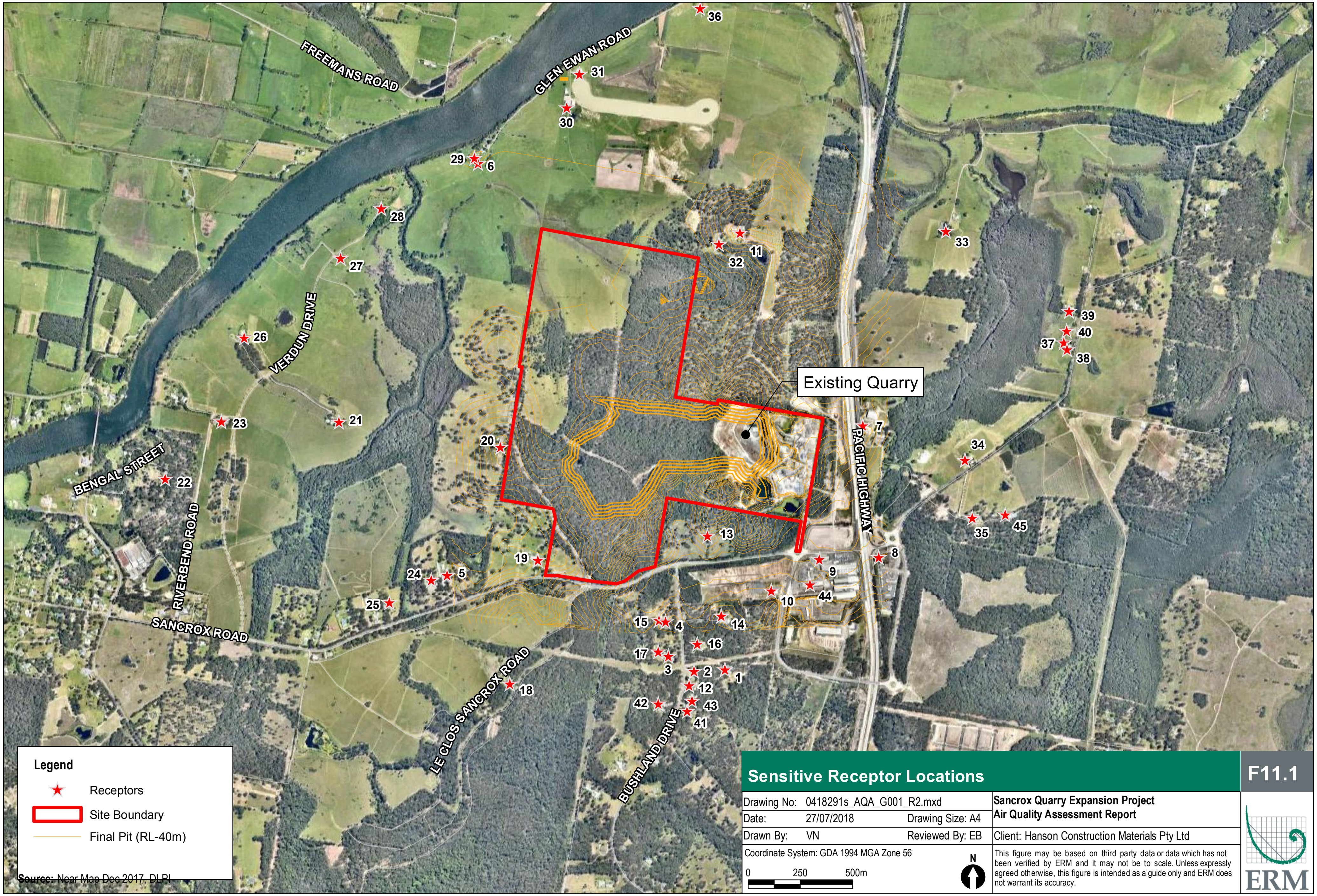
Table 11.1 Dispersion model results and comparison to assessment criteria.

Receptor ID	Level 1 Assessment of PM10 concentrations		Level 2 Assessment of PM10 concentrations		Level 1 Assessment of PM2.5 concentrations		Level 2 Assessment of PM2.5 concentrations	
	Predicted PM10 Concentrations (µg/m3) Maximum impact (increment)		Predicted 24 Hour PM10 Concentrations (µg/m3)		Predicted PM2.5 Concentrations (µg/m3) Maximum impact (increment)		Predicted 24 Hour PM2.5 Concentrations (µg/m3)	
	24 Hour Average	Annual Mean	Maximum Cumulative impact	Maximum Site Contribution (incremental impact)	24 Hour Average	Annual Mean	Maximum Cumulative impact	Maximum Site Contribution (incremental impact)
1	52.7 (3.4)	17.4 (0.76)	50.1	3.4	25.04 (0.9)	6.9 (0.2)	23.3	0.9
2	53.7 (4.2)	17.4 (0.78)	50.1	4.2	25.04 (0.9)	6.9 (0.2)	23.3	0.9
3	56.7 (7.2)	17.5 (0.91)	51.0	7.2	25.6 (2)	6.9 (0.2)	23.3	2.0
4	59.6 (10.1)	18 (1.37)	51.7	10.1	26.6 (4.2)	7 (0.3)	23.3	4.2
5	53.1 (3.6)	16.8 (0.22)	49.6	3.6	24.7 (1.1)	6.8 (0.1)	23.3	1.1
6	50.5 (1.2)	16.7 (0.05)	49.4	1.2	24.3 (0.3)	6.7 (0)	23.3	0.3
7	56.2 (6.7)	17.5 (0.97)	49.4	6.7	26 (2.6)	6.9 (0.2)	23.3	2.6
8	52.3 (3.7)	17.1 (0.65)	49.4	3.7	24.9 (1.1)	6.8 (0.2)	23.3	1.1
9	55.6 (6.1)	17.5 (1.07)	49.7	6.1	25.7 (2.3)	6.9 (0.3)	23.3	2.3
10	53.9 (4.4)	17.5 (1)	49.9	4.4	25.3 (1.1)	6.9 (0.2)	23.3	1.1
11	52.1 (3.5)	16.8 (0.28)	49.4	3.5	25.6 (2)	6.8 (0.1)	23.6	2.0
12	54.1 (4.6)	17.3 (0.65)	50.1	4.6	24.99 (0.8)	6.9 (0.2)	23.3	0.8
13	60.6 (16.8)	20.2 (4)	56.5	16.8	26.8 (3.1)	7.6 (1)	23.4	3.1
14	53 (3.8)	17.6 (0.98)	50.6	3.8	24.96 (0.8)	6.9 (0.2)	23.3	0.8
15	57.3 (7.8)	17.9 (1.33)	51.5	7.8	26.3 (3.7)	7 (0.3)	23.3	3.7
16	52.5 (3.3)	17.4 (0.83)	50.4	3.3	24.95 (0.8)	6.9 (0.2)	23.3	0.8
17	56.3 (6.8)	17.6 (0.97)	51.3	6.8	25.9 (2.9)	6.9 (0.2)	23.3	2.9
18	52.4 (3.6)	16.9 (0.35)	50.4	3.6	24.97 (1)	6.8 (0.1)	23.3	1.0
19	56.1 (14.5)	17.4 (0.76)	50.5	14.5	25.6 (2.3)	6.9 (0.2)	23.3	2.3
20	54.6 (7.3)	16.8 (0.25)	49.4	7.3	25.3 (1.8)	6.8 (0.1)	23.3	1.8

Receptor ID	Level 1 Assessment of PM10 concentrations		Level 2 Assessment of PM10 concentrations		Level 1 Assessment of PM2.5 concentrations		Level 2 Assessment of PM2.5 concentrations	
	Predicted PM10 Concentrations (µg/m3) Maximum impact (increment)		Predicted 24 Hour PM10 Concentrations (µg/m3)		Predicted PM2.5 Concentrations (µg/m3) Maximum impact (increment)		Predicted 24 Hour PM2.5 Concentrations (µg/m3)	
	24 Hour Average	Annual Mean	Maximum Cumulative impact	Maximum Site Contribution (incremental impact)	24 Hour Average	Annual Mean	Maximum Cumulative impact	Maximum Site Contribution (incremental impact)
21	50.8 (2.2)	16.7 (0.06)	49.4	2.2	24.5 (0.6)	6.7 (0)	23.3	0.6
22	49.97 (0.8)	16.6 (0.02)	49.4	0.8	24.3 (0.2)	6.7 (0)	23.3	0.2
23	49.98 (1.5)	16.6 (0.03)	49.4	1.5	24.4 (0.3)	6.7 (0)	23.3	0.3
24	52.4 (2.9)	16.8 (0.18)	49.5	2.9	24.6 (0.9)	6.7 (0)	23.3	0.9
25	51.2 (1.8)	16.7 (0.12)	49.5	1.8	24.5 (0.6)	6.7 (0)	23.3	0.6
26	50.4 (1.4)	16.6 (0.04)	49.4	1.4	24.4 (0.5)	6.7 (0)	23.3	0.5
27	50.6 (1.8)	16.6 (0.04)	49.4	1.8	24.4 (0.4)	6.7 (0)	23.3	0.4
28	50.8 (1.8)	16.6 (0.04)	49.4	1.8	24.3 (0.2)	6.7 (0)	23.3	0.2
29	50.4 (1.2)	16.7 (0.05)	49.4	1.2	24.3 (0.3)	6.7 (0)	23.3	0.3
30	51 (1.5)	16.7 (0.08)	49.4	1.5	24.9 (0.7)	6.7 (0)	23.3	0.7
31	50.8 (1.3)	16.7 (0.07)	49.4	1.3	24.9 (0.7)	6.7 (0)	23.3	0.7
32	52.4 (3.7)	16.9 (0.32)	49.4	3.7	25.7 (2.1)	6.8 (0.1)	23.8	2.1
33	50.8 (1.6)	16.8 (0.2)	49.4	1.6	24.8 (0.8)	6.8 (0.1)	23.3	0.8
34	52.1 (3.5)	17.2 (0.59)	49.4	3.5	24.9 (1.1)	6.8 (0.1)	23.3	1.1
35	51.8 (2.6)	17 (0.49)	49.4	2.6	24.8 (0.8)	6.8 (0.1)	23.3	0.8
36	50.5 (1)	16.7 (0.09)	49.4	1.0	24.6 (0.5)	6.7 (0)	23.5	0.5
37	51.1 (1.7)	16.8 (0.2)	49.4	1.7	24.6 (0.7)	6.8 (0.1)	23.3	0.7
38	51 (1.7)	16.8 (0.19)	49.4	1.7	24.6 (0.6)	6.8 (0.1)	23.3	0.6
39	51.3 (1.8)	16.8 (0.2)	49.4	1.8	24.6 (0.8)	6.8 (0.1)	23.3	0.8
40	51.1 (1.6)	16.8 (0.2)	49.4	1.6	24.6 (0.8)	6.8 (0.1)	23.3	0.8
41	52.8 (3.3)	17.1 (0.47)	49.99	3.3	24.8 (0.6)	6.8 (0.1)	23.3	0.6
42	51.9 (2.9)	17.1 (0.54)	50.5	2.9	25.1 (1.3)	6.8 (0.1)	23.3	1.3

Receptor ID	Level 1 Assessment of PM10 concentrations		Level 2 Assessment of PM10 concentrations		Level 1 Assessment of PM2.5 concentrations		Level 2 Assessment of PM2.5 concentrations	
	Predicted PM10 Concentrations (µg/m3) Maximum impact (increment)		Predicted 24 Hour PM10 Concentrations (µg/m3)		Predicted PM2.5 Concentrations (µg/m3) Maximum impact (increment)		Predicted 24 Hour PM2.5 Concentrations (µg/m3)	
	24 Hour Average	Annual Mean	Maximum Cumulative impact	Maximum Site Contribution (incremental impact)	24 Hour Average	Annual Mean	Maximum Cumulative impact	Maximum Site Contribution (incremental impact)
43	**53.1 (3.6)**	**17.1 (0.54)**	**49.98**	**3.6**	**24.8 (0.6)**	**6.8 (0.1)**	**23.3**	**0.6**
44	**53.3 (4.4)**	**17.4 (0.89)**	**49.6**	**4.4**	**25.1 (1.4)**	**6.9 (0.2)**	**23.3**	**1.4**
45	**51.7 (2.3)**	**17 (0.41)**	**49.4**	**2.3**	**24.8 (0.6)**	**6.8 (0.1)**	**23.3**	**0.6**
Criterion	**50[1]**	**25[1]**	**50[1]**	**50[2]**	**25[1]**	**8[1]**	**25[1]**	**-**

1. Source: (State of NSW and Environment Protection Authority, 2016)
2. Source: (NSW Government, 2018)



Sensitive Receptor Locations | **F11.1**

Drawing No: 0418291s_AQA_G001_R2.mxd		Sancrox Quarry Expansion Project Air Quality Assessment Report
Date: 27/07/2018	Drawing Size: A4	
Drawn By: VN	Reviewed By: EB	Client: Hanson Construction Materials Pty Ltd
Coordinate System: GDA 1994 MGA Zone 56		This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

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The results of the air quality modelling indicate the following:

- The cumulative annual mean concentrations of PM_{10} are below the Approved Methods criterion at all sensitive receptors;

- Contemporaneous analysis identified that the cumulative (background plus project contribution) PM_{10} 24-hour average predicted concentrations indicate exceedances of the Approved Methods Criterion at 13 sensitive receptors.

- Where exceedance of the Approved Methods Criterion occurs, a state significant extractive development may be assessed against the criteria contained in the Voluntary Land Acquisition and Mitigation Policy for State Significant Mining, Petroleum and Extractive Industry Developments (NSW Government, 2018). As the predicted incremental project impacts at the sensitive receptor locations do not exceed particulate matter mitigation criteria contained in the Policy, the level of impact to surrounding sensitive receptors is considered to be acceptable.

- The cumulative annual mean concentrations of $PM_{2.5}$ are below the Approved Methods criterion at all sensitive receptors;

- Contemporaneous analysis of the $PM_{2.5}$ 24-hour average predicted concentrations are below the Approved Methods Criterion at all sensitive receptors;

- The predicted concentrations for all other species are below the adopted criteria at all sensitive receptor locations.

11.2.1 GHG Assessment

The Project over its entire life cycle is estimated to release approximately 48.4 million tonnes of CO_2-e into the atmosphere with scope 1 and scope 2 emissions accounting for 74% and 26% respectively of the total emissions. The main GHG emission sources over the life of the project representing 99% of all emissions are:

- Operations – Diesel for transport related purposes (38%)

- Operations – Electricity (26%)

- Operations – LNG (16%)

- Construction – Vegetation clearing (12%)

- Operations – Diesel for stationary energy purposes (6%)

Peak Scope 1 and Scope 2 emissions from the Project (approximately 0.0054 Mt CO_2-e during Year 7/Year8) represent approximately 0.0010% of Australia's commitment for annual emissions under the Kyoto Protocol (550.2 Mt CO2-e/annum for 2016-17). In comparison to the 2015 GHG emissions in NSW, the project emissions account for approximately 0.0041%. When compared to the 2015 GHG emission levels from all Mining sources in Australia (74.5 Mt CO_2-e), the Project accounts to 0.0073%.

11.3 *MITIGATION MEASURES*

The Air Quality and GHG Assessment considered all reasonable and feasible mitigation measures to minimise the emissions from the proposed activities at the site, including:

- Roads, which are likely to remain unchanged throughout the Project stages and to be frequently used by machinery, will be sealed using asphalt and swept daily to minimise wheel-generated dust emissions;
- Full dust extraction system for drilling;
- Utilisation of water sprays during truck rear dumping;
- The use of mobile sprinkler systems during the operation of FELs;
- Dust suppression measures such as water sprays in place at the crushers and screeners;
- Water sprays used on all conveyor transfer points;
- The conveyor loading to be enclosed by a shroud;
- Level 2 watering (more than 2 litres/m^2/hour) applied to unsealed roads to minimise impact from hauling;
- Water sprays to be utilised to minimise wind erosion from stockpiles during wind speeds of over 5.4 metres per second;
- The dry product delivered to the concrete batching, concrete recycling and asphalt plants to be stored in aggregate storage bins enclosed on three sides. The walls to extend one metre above the height of the maximum quantity of raw material, and two metre beyond the front of the stockpile. The aggregate storage bins to be fitted with water sprays to keep the stored material damp at all times;
- Cement and cement supplement to be delivered to the concrete batching plant in the agitator trucks and pneumatically fed to the bottom-loaded silos;

- Concrete batching loading point to be totally enclosed with all particulate matter emissions generated by the facility captured by one bag filter located above the pan mixer;

- Concrete recycling facility outloading to be directly to processed material storage bins enclosed on three sides. The walls to extend one metre above the height of the maximum quantity of raw material, and two metre beyond the front of the stockpile. The recycled concrete storage bins to be fitted with water sprays to keep the stored material damp at all times;

- Vapour balancing system to be installed for the delivery of bitumen at the asphalt plant;

- Asphalt plant will be totally enclosed. All particulate matter emissions generated at the plant will be captured by one fabric filter associated with the natural-gas fired dryer; and

- Vapour recovery system to be employed for transfer of asphalt to trucks.

11.4 RECOMMENDATIONS

It is recommended that the Site additionally employs a real-time ambient air quality monitoring system. This will allow staff to identify when additional mitigation measures are to be implemented to minimise impact from the onsite activities on days when the background concentrations of PM_{10} and $PM_{2.5}$ exceed the criteria set by the Approved Methods.

Given the proximity of Receptor 13 to the site boundary and moderate occurrence of winds from the north-western and north-eastern directions (Figure 4.1 of *Annex G* of this EIS), it is recommended that one real-time monitor is placed along the southern boundary of the Site to capture the Site emissions and another monitor is placed along the northern boundary to obtain background concentrations when the winds are blowing from offsite.

Additionally, Table 10.1 of the Air Quality and GHG Assessment provides recommendations to ensure minimisation of air quality impact to the surrounding land use as a result of construction activities. These mitigation measures are to be considered in the event that a Construction Air Quality Management Plan (or similar) is required during construction of the proposed project.

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12 *TRAFFIC AND ACCESS*

12.1 *METHODOLOGY*

The Austroads (2005) *Guide to Traffic Engineering Practice- Part 5: Intersections at Grade* was referred to in the development of this traffic and access assessment.

A previous traffic assessment that included peak hour counts was undertaken by TTM in 2013 for the previous quarry expansion. Information from the TTM (2013) traffic assessment is used in this assessment where considered relevant. Port Macquarie Hastings Council identified that no traffic count data has been collected for the Sancrox Road in the vicinity of the quarry since the upgrade in the locality to the Sancrox Interchange. Local road traffic volume data was sourced from the aforementioned TTM (2013) report, with extrapolation as required.

Accident data was supplied by Transport for New South Wales.

Increases in traffic volumes associated with the proposed production increase were estimated by Hanson staff, and by extrapolation of truck count data collected over the course of one year by Hanson.

A road safety audit was not undertaken due to the recent upgrades of the Sancrox Interchange and the Pacific Highway, which were constructed to modern quality and safety requirements. The Sancrox Interchange design considered the increase in heavy vehicle traffic associated with the development of the area into an Employment Precinct, as well as the proposed quarry expansion.

The assessment was prepared by Senior Environmental Scientist Tim Haydon. Tim has over ten years consulting experience in the local region and has prepared numerous traffic and intersection assessments for proposed developments across NSW.

12.2 *EXISTING CONDITIONS*

12.2.1 *Current Road Conditions*

The existing road network surrounding the Project is provided in *Figure 12.1*.

Sancrox Interchange

The quarry is serviced by the Sancrox Interchange, which is a two lane (one in each direction) loop road comprising of Sancrox Road off the Orleans Road (herein referred to as the Quarry Access Road), Frogs Road, Wambuyn Drive and Fernbank Creek Road. There is an overpass bridge providing passage for Frogs Road over the Pacific Highway and three roundabouts at the intersections of:

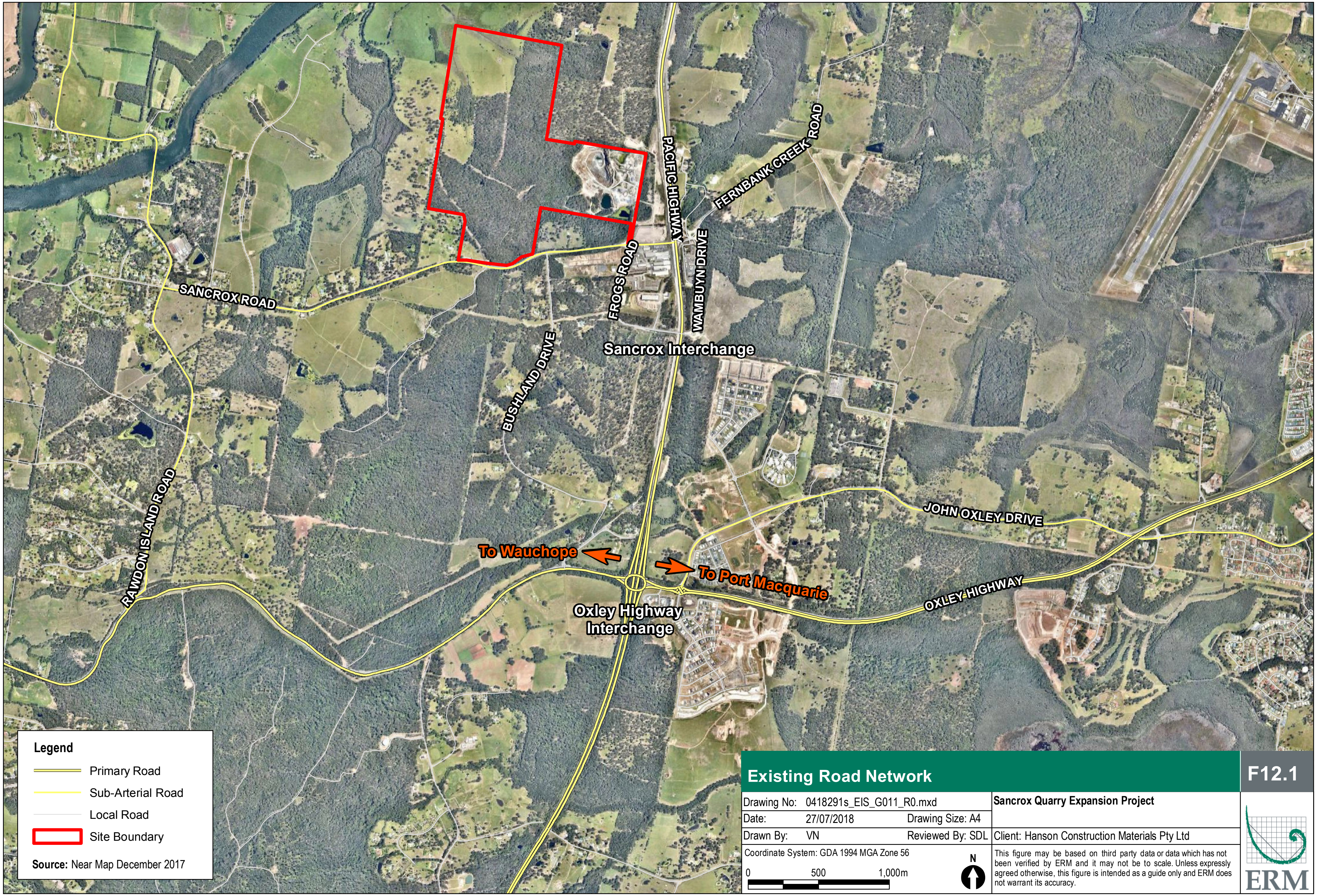
- Wambuyn Drive and Fernbank Creek Road in the north eastern portion of the interchange;

- Wambuyn Drive and undeveloped access points in the south eastern portion of the interchange; and

- the Quarry Access Road, Sancrox Road and Frogs Road in the north western portion of the interchange.

The Sancrox Interchange connects to the Pacific Highway which services northern, southern and eastern movements from the quarry and was opened to the public on 30 November 2015. The Interchange was designed to cater for the existing industry and businesses in the area, as well as servicing the area which is planned for development as an industrial precinct. As the industrial estate is developed, more vehicles will utilise the Interchange. A service road has recently been constructed and opened to the public (Winery Drive). Winery Drive and connects to the Sancrox Interchange at the north eastern roundabout, linking to the existing Hastings River Drive to the east of the new upgraded Pacific Highway. Winery Drive is the old Pacific Highway with minor additions and will provide a route for trucks to deliver product to the northern parts of Port Macquarie via Hastings River Drive. The location of the new service road (Winery Drive) is shown in *Figure 12.2.*

Hastings River Drive is a sealed, two way connector road that provides access to the Pacific Highway. Currently, the intersection of the old Pacific Highway and Hastings River Drive is a channelised T-intersection, where a deceleration lane is provided for traffic entering Hastings River Drive from the old Highway. Traffic on Hastings River Drive has to stop prior to accessing the old Pacific Highway. An acceleration lane is provided in both the southbound and northbound lanes of the old Pacific Highway.



Existing Road Network

F12.1

Drawing No: 0418291s_EIS_G011_R0.mxd
Date: 27/07/2018 Drawing Size: A4
Drawn By: VN Reviewed By: SDL
Coordinate System: GDA 1994 MGA Zone 56

Sancrox Quarry Expansion Project

Client: Hanson Construction Materials Pty Ltd

This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

ERM

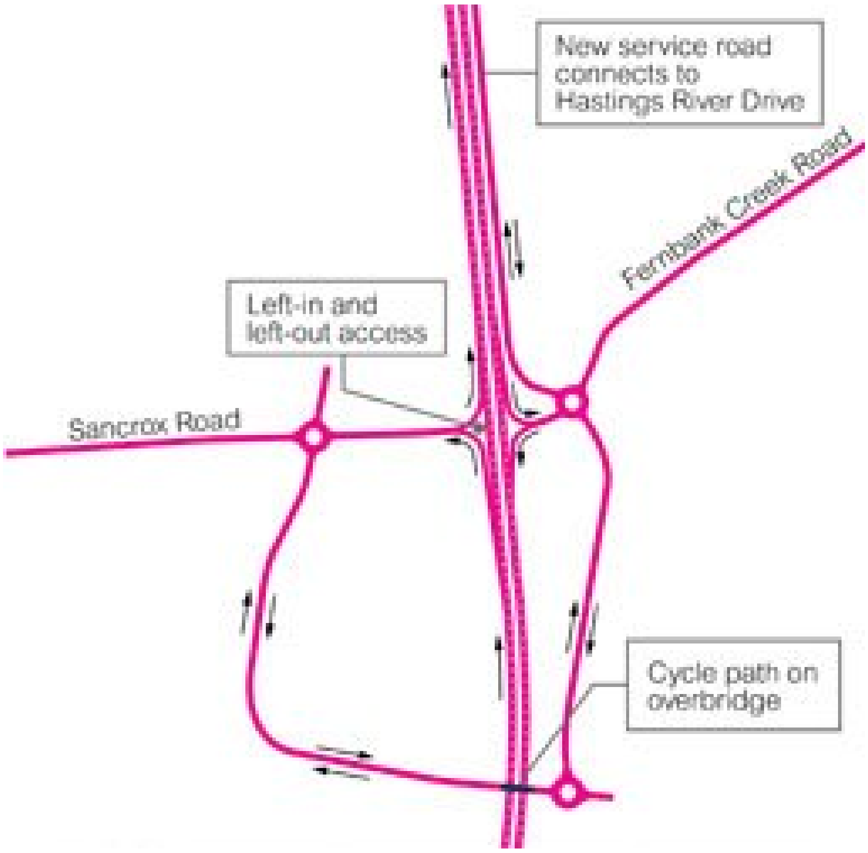


Figure 12.2 ***New Service Road (recently constructed and named Winery Drive) connecting to Hastings River Drive off North Eastern Roundabout of Sancrox Interchange (RMS 2018)***

Frogs Road Bridge is a service road overbridge that is 12m wide and 68m long (GHD, 2010). It spans the Pacific Highway and includes provision for pedestrian movements on the southern side.

The speed limit on the Sancrox Interchange is 60 km/hr. West of the western roundabout on Sancrox Road, the speed limit increases to 80 km/hr. East of the eastern roundabout on Fernbank Creek Road, the speed limit is not signposted, but is assumed to be 60 km/hr.

Pacific Highway

The confluence of Sancrox Road and Fernbank Creek Road with the Pacific Highway is at grade. Only left in and left out movements are provided at the confluence of Sancrox and Fernbank Creek Road with the Pacific Highway, respectively (GHD, 2010). The Pacific Highway in this location is dual carriageway. The speed limit on the Pacific Highway at the merge points is 110 km/hr. This section of the Pacific Highway upgrade was completed in 2017, constructed to the most recent quality and safety requirements for Motorway Standard roadways (Class M) as specified by the NSW Roads and Maritime Services (RMS).

An interchange roundabout from the Pacific Highway onto the Oxley Highway is located approximately 2.5 km from the southbound exit of the Sancrox Interchange. The Oxley Highway Interchange allows for truck movements to the east and west. The eastern exit allows delivery of product to the southern portion of Port Macquarie and coastal townships to the south, while the west exit allows product delivery to Wauchope and surrounds.

12.2.2 *Accident History*

Review of the Transport for NSW Crash and Casualty statistics for the Port Macquarie Local Government Area (for the 2012 to 2016 reporting period) detailed the accident statistics in the Project locality, as shown in *Figure 12.3* and detailed in *Table 12.1*.

Figure 12.3 Location of Accidents in vicinity of the Project Site

These statistics cover a 5 year reporting period from 2012 to 2016 and show there were 14 accidents reported. No fatal accidents occurred in the vicinity of the Project site. Approximately 60% of the accidents occurred in darkness. Approximately 36% of the accidents were at intersections (three at intersection of Sancrox Road with Pacific Highway and one at Bushland Drive and Sancrox Road to the west of the quarry). No crashes occurred at the intersection of the Sancrox Road and Quarry Road Access during the five year reporting period.

Table 12.1 Accident Statistics in the Vicinity of the Project Site

Date	Crash ID	Degree of Crash	Description	Type of Location	Light Conditions	Long.	Lat.	# injured
2016	1099889	Moderate Injury	Out of control on bend	2-way undivided	Daylight	152.80	-31.44	1
	1102572	Moderate Injury	Off road right	2-way undivided	Darkness	152.79	-31.44	1
2015	1064144	Non-casualty (towaway)	Object on road	2-way undivided	Darkness	152.82	-31.43	-
	1072335	Non-casualty (towaway)	Other opposing	X-intersection (Pacific Highway)	Daylight	152.82	-31.44	-
	1084328	Serious Injury	Off road to right	2-way undivided	Daylight	152.78	-31.44	1
	1093081	Non-casualty (towaway)	Other same direction	X-intersection (Pacific Highway)	Daylight	152.82	-31.44	-
2014	1003787	Moderate Injury	Rear end	2-way undivided	Daylight	152.82	-31.44	2
	1006981	Moderate Injury	Off right/left bend	2-way undivided	Daylight	152.78	-31.44	1
	1024413	Non-casualty (towaway)	Off left/left bend	2-way undivided	Darkness	152.82	-31.43	-
	1031606	Non-casualty (towaway)	Cross traffic	X-intersection (Pacific Highway)	Darkness	152.82	-31.44	-
2013	828422	Serious Injury	Off road right	T-junction (Sancrox Road and Bushland Drive)	Daylight	152.81	-31.44	1
	835574	Non-casualty (towaway)	Struck animal	X-intersection (Pacific Highway)	Darkness	152.82	-31.44	-
2012	796407	Serious Injury	Off road to left	2-way undivided	Darkness	152.81	-31.44	2
	805488	Non-casualty (towaway)	Off road right	2-way undivided	Darkness	152.82	-31.43	-

1. Source: (http://roadsafety.transport.nsw.gov.au/statistics/interactivecrashstats/lga_stats.html?tablga=4)

12.2.3 *Existing Truck Traffic Generated by the Quarry*

The Environmental Protection Licence (EPL 5289) and PMHC development consent approved annual extraction limit that currently applies to the quarry is 450,000 tpa.

During the period between 1 September 2016 and 31 August 2017, the Proponent counted the number of quarry truck trips to understand the traffic generated by the site. The number of trucks/day was counted by the weighbridge on-site. Trucks do not cross the weighbridge on ingress to the site, only upon egress from the site. Hence, the number of trucks counted by the weighbridge is representative of a 'trip' (i.e. a two way movement) comprising the ingress and egress of a truck from site. Over the course of this 12 month period, a total of 10,650 trips were counted, containing a total of 245,930 tonnes of product. These trips occurred over a total of 256 sales days.

Table 12.2 provides the maximum, average and median daily truck trips during the counted year.

Table 12.2 Daily Truck Count

Data type	Daily Truck Count
Average	42
Maximum	130
Median	38

1. Truck count data provided by Hanson. Extracted from weighbridge data.

The truck count data also included hourly breakdowns as shown in *Table 12.3*. The type of vehicle making these movements is outlined in *Table 12.4*. The entire years count data and a graph demonstrating daily truck count is provided in *Annex H*.

Table 12.3 Hourly Breakdown of Daily Truck Count

Ticketed time	Count	% of daily count
6am - 7am	161	1.5
7am - 8am	1,310	12.3
8am - 9am	1,228	11.5
9am - 10am	968	9.1
10am - 11am	1,395	13.1
11am - 12pm	1,404	13.2
12pm - 1pm	1,042	9.8
1pm - 2pm	1,107	10.4
2pm - 3pm	1,211	11.4
3pm - 4pm	691	6.5
4pm - 5pm	120	1.1
5pm - 6pm	11	0.1
Misc.	2	0.0
	10,650	**100**

1. Truck count data provided by Hanson. Extracted from weighbridge data.

Table 12.4 Truck Type

Total trucks over bridge by size	Count	% of deliveries
Cars or car and trailer for weighing service	120	1
Small truck 2 axle (> 6 tonne)	384	4
Rigid tri axle or smaller	3,023	28
Truck and tri axle or quad axle dog or semi-trailer	7,123	67
Total	**10,650**	**100**

1. Truck count data provided by Hanson. Extracted from weighbridge data.

The daily truck count breakdown demonstrates that the peak in movements from the quarry occurs from 10am to midday. This is outside the peak hour for non-Project related vehicles on Sancrox Road that occurs in the morning between 8 and 9am and in the afternoon between 4:30pm and 5:30pm.

The predominant vehicle types associated with the movements from the quarry are truck and dogs/semi-trailer (67%), followed by trucks with no trailers (28%).

12.2.4 *Current Road Use Statistics*

ERM contacted PMHC to enquire about traffic count data on Sancrox Road. PMHC indicated that no traffic counts have been undertaken in the past ten years and that count data has not been collected since the opening of the Sancrox Interchange. The upgrade of the Oxley Highway to Kundabung section of the Pacific Highway had been under construction since 2015 and was not fully operational until 2018. As such, previous traffic data collected by TTM for the quarry expansion approved in 2013 has been extrapolated to provide background traffic data for this assessment. Given the limited change in the surrounding residential and industrial areas since the completion of the TTM assessment, the data is considered valid.

TTM undertook a traffic impact assessment which included peak hour counts during late 2012 for a quarry modification submitted in the following year. The count was undertaken at the old intersection of the Quarry Access Road with Sancrox Road, prior to the upgrade of the Sancrox Interchange where the north western roundabout is now present. At the time of the count, the intersection was a T-intersection with Sancrox Road at 90° and to the south of the intersection was the heavy duty access track for Expressway Spares. This demonstrated in *Figure 12.4* below.

Figure 12.4 Previous intersection arrangement of Quarry Access Road and Sancrox Road (Sourced from Google Earth Pro – Historic Imagery from 25 March 2013)

The morning hourly peak at the Quarry Access Road and Sancrox Road intersection was between 8 and 9am. Movements on Sancrox Road were predominately eastbound and with a total count of 80 vehicles (composed of one heavy vehicle and 79 light vehicles). One of the light vehicles accessed the quarry from the eastbound traffic on Sancrox Road. There were 24 movements that were westbound on Sancrox Road (composed of two heavy vehicles and 22 light vehicles). One of the heavy vehicles turned into the quarry from westbound Sancrox Road. Two heavy vehicles and one light vehicle exited the quarry and all travelled east on Sancrox Road. One heavy vehicle accessed the heavy vehicle access into Expressway Spares from the west, and no vehicles left this access during the peak.

The afternoon peak is between 4.30pm and 5.30pm with traffic predominately travelling westbound. The traffic volumes are very similar to the morning data, with traffic travelling in the reverse direction (representing the return movement of the vehicle (i.e. the completion of the trip)). The traffic count data from this period is provided in *Table 12.5*.

Development of the residential area within the Sancrox locality has not significantly increased following the completion of the TTM assessment in 2013. Hence a highly conservative annual increase of 3 vehicles per year has been applied to the TTM data to provide for potential increase in background traffic volumes. This equates to an approximate 3-4% annual increase in background traffic volumes. This extrapolation is provided in *Table 12.5*.

The quarry expansion in 2013 indicated that the maximum hourly traffic count from the quarry due to increased operations would be 10 trucks per hour. As a conservative approach, this additional truck volume was added to both the morning and afternoon peak hours. For simplicity, it was assumed that all additional truck movements associated with the proposed 2013 expansion would head east (and hence have been added to the extrapolated eastbound morning and westbound afternoon peak Sancrox traffic volumes).

Table 12.5 Extrapolated Traffic Count Data on Sancrox Road (to provide current background estimated traffic volumes)

Traffic Direction	TTM 2012 Data		Extrapolated TTM 2012 data[2] for 2018 estimated volumes.	
	Morning peak hour	Afternoon peak hour	Morning peak hour	Afternoon peak hour
Eastbound on Sancrox	80 vehicles	29 vehicles	108 vehicles	47 vehicles
Westbound on Sancrox	24 vehicles	81 vehicles	42 vehicles	109 vehicles
Exit from quarry Road	3 vehicles	0 vehicles	13 vehicles	10 vehicles

1. Modified from TTM (2013) Hanson Quarry Expansion Traffic Impact Assessment
2. Extrapolated data includes peak truck volumes associated with approved expansion in 2013.

12.2.5 Intersection Sight Distances

Safe Intersection Sight Distance

Safe Intersection Sight Distance (SISD) is the minimum sight distance which should be available from vehicles on legs of an intersection which have priority to vehicles which could emerge from non-signalised legs (Austroads, 2005).

Desirable SISD ('desirable' is based on providing two seconds reaction time) for the intersections of the quarry with Sancrox Road and Wambuyn Road with Fernbank Creek Road (where the speed limit is 60km/hr) is 123m (for a level roadway) (Austroads, 2005).

Quarry Access Road and Sancrox Road Intersection

The Quarry Access Road joins Sancrox Road at the single lane (north western) roundabout of the Interchange. Sight distance to the east is greater than 250m, allowing for traffic entering from the northbound Pacific Highway auxiliary lane to be observed from the confluence point of the roundabout. The topography to the east of the quarry access track is flat; there is limited vegetation or other potential view obstructions, so business access points between the Pacific Highway auxiliary lane and the Quarry Access Road can be observed. To the west of the Quarry Access Road along Sancrox Road, the road is straight and flat with an available sight distance of approximately 125m.

Wambuyn Road and Fernbank Creek Intersection

The intersection of Wambuyn and Fernbank Creek Road is the north eastern roundabout of the Sancrox interchange with sight distance to the west all the way to the Pacific Highway (approximately 115 m to the west). Traffic can be seen on the Pacific Highway for the required sight distance from the entrance to the roundabout, and interactions with traffic to the west will be limited to the use of the roundabout for U-turns. To the east, Fernbank Creek has a moderate rise and a minor bend, though provides an available sight distance of approximately 135 m.

Sight distances on Winery Drive are expected to be of sufficient standard as the road was designed and constructed under the Pacific Highway upgrade project, as managed by Roads and Maritime Services.

Pacific Highway Access

The recent upgrade of the Pacific Highway provides acceleration and deceleration lanes for both ingress and egress movements to/from the Sancrox Interchange. The lanes provide greater than 500m sight distance along the Pacific Highway.

12.3 ASSESSMENT

12.3.1 *Traffic Generated during Construction*

Construction activities will include:

- heavy vehicle floating of plant for vegetation clearing and mulching;
- trucks removing mulch from site;
- the import of the processing plant, asphalt production and cement batch plant infrastructure by heavy vehicles; and
- light vehicles to deliver personnel to site to operate clearing/construction equipment and build the new infrastructure.

Clearing Activities

Clearing activities are expected to require heavy vehicles to float standard clearing plant such as a bulldozer, one to two excavators and a mulcher. Should clearing be undertaken to match the proposed quarry stages, it is expected that each stage would take three to four weeks to clear and mulch. The floating in of equipment would occur at the start and completion of the works (unless mechanical failure required the export of plant for repair).

Removal of mulch would occur in the last two weeks of the activity, if the mulch could not be beneficially reused on-site. The mulch removal activities would be a low priority activity and unlikely to be time constrained, so would likely involve a low volume of trucks (two to three) on a loop throughout the day to deliver the mulch to the approved location.

A maximum of four light vehicles would travel to and from site each day over the course of the activity to deliver personnel to operate the clearing equipment.

Import and Construction of New Ancillary Infrastructure

The construction of the new ancillary infrastructure is assumed to take approximately 12 weeks for each plant. The delivery of all the infrastructure for site would be delivered in approximately 40 heavy vehicle movements importing items to site over these 12 weeks. During this time, personnel will be transported to site via light vehicles (approximately 10 trips per day during construction).

Construction Impact

It is likely that the clearing for the first stage and the establishment of one or potentially both of the plants will occur simultaneously. Truck trips associated with the delivery of quarry product will also continue during these activities. The establishment of the plants and the clearing activities represents construction traffic at its maximum.

The design capacity, intersection types and standard of the recently completed Sancrox Interchange and Pacific Highway (as described in *Section 12.3.4*) is sufficient to accommodate existing traffic on Sancrox Road (including quarry product delivery trucks that will continue during construction) and the short-term increase in:

- light vehicles delivering construction staff to site; and
- heavy vehicles delivering infrastructure and floating clearing plant.

12.3.2 Traffic Generated during Operation

Traffic volumes, particularly heavy vehicles such as truck and dog, and concrete agitator vehicles, will increase due to the Project. The operational traffic volume increase, including truck type, has been estimated for each Project activity.

The typical daily traffic movements would include:

- light vehicle trips transporting staff to and from site concentrated at the start and end times of shifts;
- truck trips delivering quarried product and asphalt;
- concrete agitator trips to deliver concrete to construction sites;

- import of concrete constituents (sand and cement); and
- truck trips delivering waste concrete to site for recycling.

The Project activities will result in additional employees causing a minor increase in light vehicle movements for staff entering and exiting the site during their shifts.

The Project has proposed truck movements and equipment loading 24 hours/day for 365 days a year. Should approval be granted, it will allow for operational traffic to utilise the road network during periods outside of daytime periods. Thus reducing the cumulative impact on traffic during higher volume periods.

The location of the market for concrete and asphalt is considered to be similar for quarry products, so the trip distribution described in *Section 12.3.3* is applicable to all new products generated by the Project.

Quarried Product Delivery Trucks

The proposed increased extraction rate is 750,000 tpa. Comparison of the proposed extraction rate and the actual extraction rate that generated the 2016/17 truck count data demonstrates that the Project will generate approximately 3.05 times more truck trips than the counted year. As such, a linear multiplication by 3.05 has been applied to the count data to provide an estimate of additional trips generated by the proposed expansion.

Table 12.6 provides the estimated daily truck volume increase from the 2106/17 count data when applying the 3.05 multiplication factor.

Table 12.6 Proposed Daily Quarried Product Delivery Truck Trip Increase Generated by Project

Data type	2016/17 Daily Truck Trips	Proposed increase in Daily Truck Trips
Average	42	127
Maximum	130	396
Median	38	116

1. Truck movement data provided by Hanson. Extracted from weighbridge data.

It is noted that the proposed increase above assumes an increase in the same truck type, with the 2016/17 count data demonstrating an approximate split of 30% rigid and small trucks and 70% truck and dogs or larger.

Table 12.7 provides the proposed hourly truck count increases on an annual basis from the 2106/17 count data when applying the 3.05 multiplication factor.

Table 12.7 Proposed Hourly Quarried Product Delivery Truck Count Increase Generated by Project

Ticketed time	Total Annual Count	Estimated Increase in Total Annual Count
6am - 7am	161	491
7am - 8am	1,310	3,995
8am - 9am	1,228	3,745
9am - 10am	968	2,952
10am - 11am	1,395	4,254
11am - 12pm	1,404	4,282
12pm - 1pm	1,042	3,178
1pm - 2pm	1,107	3,376
2pm - 3pm	1,211	3,693
3pm - 4pm	691	2,107
4pm - 5pm	120	366
5pm - 6pm	11	34
Misc.	2	0
Total	**10,650**	**32,473**

1. Truck movement data provided by Hanson. Extracted from weighbridge data.

The data within *Table* 12.7 assumes that despite the Project having 24 hour operations, the majority of product deliveries will be to markets/sites that operate within standard hours of operation/typical construction hours. This assumption is the worst-case traffic scenario, as it is likely that the Project operational traffic would be able to be spread outside these hours, should approval for 24 operations be granted.

The noise assessment included conservative calculations to determine additional permissible quarry truck trips per hour during the strictest night time road traffic noise criteria, beyond the typical operations outlined above. With consideration to public traffic and the typical quarry trucks during night time hours outlined above, it was estimated that an additional six quarry truck trips per hour could operate on Sancrox Road (classed as a local road) during the night time period and not exceed Leq 1 hour criteria and an additional 12 truck trips could occur during the entire night time period (10pm – 7am) and not exceed the Leq, 9 hour criteria.

The total number of truck trips permissible on a local road during the night time period is 18 truck trips (36 movements). The total number of trips permissible within any hour during the night time period is 12 trips/ hour (24 movements/hour), noting that the truck trip limit for the total night time period cannot be exceeded.

The estimated allowable hourly night truck movements, based on road traffic noise criteria, is well in excess of the anticipated typical quarry vehicle trips used in the modelling on typical operating hours.

Extrapolated traffic data to represent current volumes on Sancrox Road (*Table 12.5*) indicates that the morning peak occurred at 8 to 9am, comprising 108 eastbound vehicles and 42 westbound vehicles. The afternoon peak hour on Sancrox Road occurred between 4.30 and 5.30pm and generated 47 eastbound vehicles and 109 westbound vehicles. The quarry traffic peaks occurred outside of the Sancrox Road peak hour traffic, occurring between 10am and midday. The worst-case scenario of assuming the predicted average increase in trucks due to the Project happened to coincide the morning and afternoon peak hour on Sancrox Road, with all trucks utilising Sancrox Road only, would generate a maximum total volume of traffic of 235 eastbound vehicles during the morning peak hour and 236 westbound vehicles during the afternoon peak.

Agitator Trucks

The following assumptions have been made with regard to agitator movements:

- the density of wet concrete is 2400 kg/m^3;
- the annual volume of concrete permitted to be produced at the site is 20,833 m^3 (50,000tpa);
- the capacity of the agitators delivering the materials is 6.5 m^3 (Maxi Agitator capacity as taken from Hanson (2017)); and
- the deliveries will occur over approximately 300 work days.

Based on the aforementioned assumptions, the introduction of the concrete batching plant is estimated to generate an average of approximately 11 agitator trips/day. As previously described, five concrete agitator truck drivers will be employed.

Asphalt Trucks

The following assumptions have been made with regard to the transport of asphalt:

- only rigid trucks (no dogs) will transport asphalt to sites (to allow for loading into paver);
- the load capacity of these trucks is eight tonne; and
- that deliveries will be made over 300 days throughout the year.

Utilising these assumptions, equates to 6,250 truck trips per annum and 21 truck trips per day.

Waste Concrete

The following assumptions have been made with regard to the delivery of waste concrete to site:

- only trucks will be used to transport the waste concrete (assumed that waste concrete collection sites will have limited space available and would not accommodate truck and dog);
- the capacity of these trucks is eight tonne; and
- the trips to collect the waste concrete will occur over 300 days.

Concrete waste recycling will employ two drivers to transport the unused concrete from Hanson concrete plants to Sancrox Quarry for stockpiling while waiting to be crushed. It is assumed that 8 truck trips/day will occur for concrete waste collection for recycling. There is the potential for waste concrete to be collected as a backload as trucks return from product deliveries, however this is expected to have minimal impact on reducing the total truck trips/day.

Import of concrete constituents

Sand and cement will need to occasionally be imported to supply the concrete batching process. This has been conservatively estimated as three truck trips per week.

Cumulative Daily Traffic Volume Increase due to Project Operation

The daily increase in traffic due to the additional activities associated with the Project operations are provided in *Table* 12.8.

Table 12.8 Cumulative Daily Traffic Volume Increase due to Project Operation

	Quarried Product	Asphalt delivery	Concrete delivery	Collection of Waste Concrete	Import of concrete constituents	Operational Workforce
Vehicle Type	Truck and Dog (mostly)	Truck	Agitator	Truck	Truck	Light vehicle
Average number of trips / day	127	12	11	8	1 (rounded up as assumed at 3 truck trips/ week)	25

The Project will generate approximately 158 additional heavy vehicle trips/day on Sancrox Road. The site currently generates an average of 42 heavy vehicle trips/day. Upon project operation the average number of truck trips will be approximately 200 truck trips per day.

The increase in light vehicle trips due to employees, will be concentrated around start and finish times of shifts and will have negligible impact due to being a minor input on the overall traffic volume. Light vehicle trips associated with the Project will likely coincide with peak times on Sancrox Road, however will be in the opposite direction of flow to that of other light vehicles utilising the Sancrox Road.

The design capacity, intersection types and standard of the recently completed Sancrox Interchange and Pacific Highway (as described further in Section *12.3.4*) are considered sufficient to accommodate this increase in light and heavy vehicle traffic volume.

12.3.3 Trip Distribution and Haulage Route

The main markets which the quarry will service are located east of the Pacific Highway, including Port Macquarie and other smaller coastal towns to the north and south. To the west there is considered to be less of a market demand, with the primary location to the west being the township of Wauchope (with a population of approximately 7,400 (Id.community (2016)) and smaller surrounding towns similarly generating little demand.

Access to the Pacific Highway for north and south market locations is provided by the Sancrox Interchange. The northern portion of Port Macquarie can also be accessed by Winery Drive off the north eastern roundabout of the Sancrox Interchange that links to Hastings River Drive. Access is provided to the Oxley Highway for east/west movements by the Oxley Highway Interchange to the south.

It is predicted that greater than 99% of the product trucks and agitators leaving the Quarry Access Road will travel either south or east at the north western roundabout of the Sancrox Interchange to gain access to these market locations. Trips to the west of the Quarry Access Road on Sancrox Road/Rawdon Island Road are not required due to the more suitable access options provided by the Interchanges and service roads described above. Hence western movements on the Sancrox Road from the Quarry Access Road would be strictly limited to supplying markets within the Sancrox locality, considered to be less than 1% of the total annual truck trips.

Movements on Fernbank Creek Road, east of the north eastern roundabout will be avoided given that the road is narrow and likely of limited structural capacity to receive regular fully loaded truck and dog movements. Similar to Sancrox Road, movements on this road would be strictly limited to local residents requiring product.

12.3.4 *Adequacy of Key Current Haul Roads*

The Sancrox Interchange opened to the public on the 30 November 2015. It was constructed to modern RMS road design standards and the design incorporated an understanding of future use of the road (GHD Highway Access Strategy, 2007) and cumulative impacts comprising:

- *the development of the Sancrox Employment Precinct adjacent to Sancrox Road;*
- *further development of the Cassegrains Vineyard property, including special events held on the grounds;*
- *expansion of the Sancrox Quarry;*
- *relocation of the Hanson asphalt production plant to land near Sancrox Road; and*
- *proposed relocation of Pearsons Transport to the north west of Sancrox Road intersection with the Highway.*

In light of these cumulative impacts, in addition to the Project's impacts outlined in this EIS, the Sancrox Road Interchange is considered to be of sufficient design and capacity to service the Project in its current state. No alterations to the current road and interchange layout are proposed. The Pacific Highway upgrade joining the Sancrox Interchange was completed in 2017, constructed to the most recent quality and safety requirements for Motorway Standard roadways (Class M) as specified by the RMS. Hence, no alterations are proposed due to the Project.

The Oxley Highway Interchange will provide for eastern and western trucks movements, allowing for delivery of product to Port Macquarie and Wauchope. Utilisation of the Oxley Highway Interchange eliminates the need for truck travel on Sancrox Road/Rawdon Island Road that ultimately joins to the Oxley Highway in the west. Truck movements on Sancrox Road and Rawdon Island Road will be avoided, except for rare delivery of product to sites within the Sancrox locality. Such a restriction would allow for truck movements to be entirely on major arterial/motorway class roads within the vicinity of the quarry and prevent truck and dogs from entering the Oxley Highway at the confluence with Rawdon Island Road, which has insufficient sight distances and is at higher speed than the Oxley Highway Interchange.

Winery Drive, exiting from the Sancrox Interchange north eastern roundabout is a recently constructed road, designed and constructed to modern standards. This will connect to the old Pacific Highway and Hastings River Drive. The old Pacific Highway will remain of sufficient standard to convey heavy vehicles, and will experience significantly lower traffic volumes due to the new Pacific Highway. Hastings River Drive is a connector road that will be sufficient to convey the heavy vehicles associated with the Project.

Austroads (2015) details the following with a regards to roundabouts. Roundabouts are the intersection controls on three of the Sancrox Interchange intersections prior to accessing the Pacific Highway from the quarry:

> 'a well-designed roundabout is the safest form of intersection control. Numerous 'before and after' type studies have shown that, in general, fewer motor vehicle crashes resulting in casualty crashes occur at roundabouts than at intersections containing traffic signals, stop, or give-way signs'.

Forecast Traffic Volumes

SLR (2016) provides forecast traffic data for the Sancrox Interchange in an Operational Noise Management Plan that was prepared for Roads and Maritime Services. The data includes projected 2016 data and 2026, a ten year forecast from the planned opening of the upgrade. The projected traffic volumes are provided in *Table 12.9*.

Table 12.9 Projected Traffic Volumes Forecast.

Location	2016 Projected Traffic (vehicles per day)		2026 Projected Traffic (vehicles per day)	
	Light Vehicles	Heavy Vehicles	Light Vehicles	Heavy Vehicles
Northbound on-ramp	510	190	2080	900
Northbound off ramp	2160	370	3660	590
Southbound on ramp	530	400	2110	1040
Southbound off ramp	1790	250	3590	510
Sancrox Overbridge	3600	230	9590	1880

1. Source : SLR (2016) Pacific Highway Upgrade – Oxley Highway to Kundabung Operational Noise Management

To demonstrate that the roundabout network will be sufficient based on the projected traffic volume, ERM have extrapolated a highly conservative design hour vehicle volume to compare with Austroads identified typical capacity limit for a one lane roundabout (Table 5.5 of Austroads 2005).

Austroads (2017) states that where peak hour percentages are not available, that design hour volume equals 11% to 16% of the AADT for rural situations. For the purpose of comparison, the projected daily traffic data has been utilised as AADT. Both light vehicles and heavy vehicle volumes have been added to provide total daily traffic volume. Design hour volume has been conservatively assumed as 16%. Applying 16% to the total daily vehicle volume of traffic on the Sancrox overbridge (at least one roundabout must be utilised to get to the overbridge), generates a highly conservative, worst case design hour vehicle volume of 1835 vehicles/hour.

Comparison of this extrapolated data with Austroads (2005) one lane roundabout typical limit of capacity of 2600 vehicles per hour, it is demonstrated that there is sufficient remaining capacity on all roundabouts providing access to the Pacific Highway. Hence, no further infrastructure upgrades are required.

12.3.5 *Other Road Users*

Pedestrians

No footpath is present for pedestrians along the Sancrox Interchange (except on the bridge and directly adjacent to the roundabouts), nor along Sancrox Road to the west or Fernbank Creek Road to the east of the Interchange. Sancrox is a rural residential/industrial area that would be unlikely to generate noteworthy volumes of pedestrian foot traffic.

Cyclists

The Sancrox Interchange has wide verges with sufficient space for bicycles, although Fernbank Creek Road is narrow east of the north eastern roundabout and Sancrox Road narrows west of the north western roundabout. The wide verges of the Sancrox Interchange provide sufficient space for bicycles to share the road reserve. Quarry trucks will very rarely utilise Fernbank Creek Road or Sancrox Road beyond the Interchange, so negligible impacts will be generated on other road users in these locations.

The Sancrox Quarry access roundabout caters for pedestrians and cyclists, with a cycling lane in most directions from the roundabout, excluding east along Sancrox Road. The road to the east continues for approximately 100m towards the Pacific Highway, which is a 'left-in/left-out' intersection.

Buses

Local school bus number 81 utilises Sancrox Road to the west of Bushland Drive (and the quarry) during school terms. The bus enters the Sancrox area via Rawdon Island Road and exits via Bushland Drive during the morning pick-up. The reverse trip is undertaken during the return leg in the afternoon. The mitigation measure of no truck movements to the west of the Sancrox Interchange (except for Sancrox only deliveries) will prevent the interaction of quarry trucks with school buses.

The regular town bus route does not service the Sancrox area.

It is considered that the quarry access and transport route has been constructed to ensure safe movement of pedestrians, bicycles and other vehicles through the roundabout, which was constructed to allow for heavy vehicle movements from the quarry, as well as the other industrial developments in the area.

12.3.6 *Car Parking*

Existing car parking is provided to the south of the workshop area. Car parking will remain in this locality, with ample area being available in the ancillary infrastructure area to allow for additional parking spaces to accommodate for the proposed increase in staff. No off-site parking will be required. Access to existing car parks and proposed future car parking will limit the interaction of quarry plant and staff vehicles that are not to quarry safety specifications.

12.3.7 *SEPP Mining, Petroleum Production and Extractive Industries 2007 – Clause 16 Consideration*

Consideration of SEPP Mining, Petroleum Production and Extractive Industries 2007 is provided in *Table 12.10*.

Table 12.10 SEPP Mining, Petroleum Production and Extractive Industries 2007 – Clause 16 Consideration

SEPP Mining, Petroleum Production and Extractive Industries 2007 – Clause 16 Consideration	Discussion
Require that some or all of the transport of materials in connection with the development is not to be by public road	The transport of materials to and from the quarry will be provided by the Sancrox Interchange. The Sancrox Interchange provides direct, motorway class access to the Pacific Highway. The Sancrox interchange was designed to service the industrial estate to the east and south of the quarry.
Limit or preclude truck movements, in connection with the development, that occur on roads in residential areas or on roads near to schools,	The mitigation measure of limiting movements west of the Sancrox Interchange and east of the north eastern roundabout of the interchange along Fernbank Creek Road, excluding local deliveries, will reduce movements through adjacent rural residential areas and school bus routes. No schools are present on the Sancrox Interchange that conveys quarry vehicles to the Pacific Highway.
Require the preparation and implementation, in relation to the development, of a code of conduct relating to the transport of materials on public roads.	A code of conduct is provided in *Section 12.4.1*.

12.4 *MITIGATION MEASURES*

The following mitigation measures are proposed to minimise impacts to road users and infrastructure:

- movements to the west of the Quarry Access Road on Sancrox Road will be strictly limited to supplying markets in the Sancrox area only. Access to Wauchope and other locations to the west will be provided by utilising the Oxley Highway Interchange. Sancrox Road to the west of the quarry will not be used as a regular product transport route;
- movements to the east of the Sancrox Interchange along Fernbank Creek Road will be strictly limited to supplying local residents/markets in the area. The road will not be used as a regular product transport route.
- limit compression braking;
- avoid bunching of quarry vehicles along product transport routes;

- cover loads entering and leaving the site;
- induct all drivers to the Hanson code of conduct and carry out regular tool box talks discussing road safety issues (see below for further details); and
- all loaded vehicles leaving the site are to be cleaned of materials on tail guards and body edges that may fall on the road.

12.4.1 Vehicle Operator Code of Conduct

A vehicle operator code of conduct has been developed by Hanson to set driver behaviour controls to minimise impacts on road users and the condition of the product transport route infrastructure. The code of conduct states that vehicles operators must:

- obey all the laws and regulations;
- ensure their vehicle complies with relevant State legislation in relation to roadworthiness and modifications;
- undergo regular vehicle checks and maintenance;
- ensure their vehicles have correctly fitted mufflers to minimise noise disturbance;
- not drive whilst under the influence of alcohol, drugs, nor any medication which may affect their ability to drive;
- be medically fit to drive at all times and must inform site co-ordinators if they have any medical condition which may affect their ability to drive;
- drive in a considerate manner at all times and respect the rights of others to use and share the road space;
- follow the haulage route and main roads near the Project site to minimise impact to local roadways;
- report all vehicle defects to their employer. Serious defects must be corrected immediately or an alternative vehicle supplied;
- report any vehicle accident resulting in injury/or damage to property must be reported to the police;
- report any near misses;
- securely fasten and cover loads, as appropriate; and
- keep their vehicle clean and in good mechanical condition to reduce the environmental impact.

The Operation and Construction Environment Management Plan will include the following with relation to this code of conduct:

- process of induction of vehicles operators, detailing the code of conduct to be followed;
- process for regular toolbox talks/meetings discussing driver safety/traffic management;
- a complaint resolution and disciplinary procedure;
- community consultation measures for peak haulage periods; and
- a map of primary haulage routes including critical locations.

REFERENCES

Austroads (2005) *Guide to Traffic Engineering Practice – Part 5: Intersections at Grade*.

Austroads (2015) Guide to Road Design Part 4B: Roundabouts

GHD (2010) *Oxley Highway to Kempsey Upgrading the Pacific Highway – Environmental Assessment*, Roads and Traffic Management Authority of NSW.

Id.community (2016) *Port Macquarie Hastings Council Community Profile* accessed on January 23 2018 from http://profile.id.com.au/port-macquarie-hastings/population?WebID=240.

SLR (2016) Operational Noise Management – IFC Design Documentation, Pacific Highway Upgrade Oxley Highway to Kundabung. Prepared for Lendlease.

RMS (2018) *Map- Oxley Highway to Kundabung*, Oxley Highway to Kundabung Project website. NSW Roads and Maritime Services. Accessed on January 30 2018 from http://www.rms.nsw.gov.au/images/projects/northern-nsw/oxley-highway-to-kempsey/oxley-kundabung-map-900.jpg

TTM (2013) *Hanson Quarry Expansion Traffic Impact Assessment*

13 VISUAL AMENITY

A Visual Impact Assessment has been undertaken to assess the potential for the Project to impact the visual amenity of private landowners in the vicinity of the development and key viewpoints in the public domain. The Project is unlikely to have visual amenity impacts due to the landform and topography and/or vegetation obscuring/screening views from most directions. Therefore a qualitative assessment based on desktop analysis and supporting photographic evidence was considered a suitable approach to assess the potential impacts and satisfy the SEARs.

13.1 METHODOLOGY

The analysis was undertaken by observation, description of existing conditions, and interpretation of changes to the landscape associated with the Project. The four main elements of landscape character which affect the extent to which the Project will impact on the landscape include:

1. topography;
2. vegetation cover;
3. degree of modification to the 'natural' landscape and dominance of built elements; and
4. distance.

The assessment approach involved describing the existing conditions and likely changes to the landscape associated with the Project, including:

- proposed Project layout and its visual components;
- project view shed based on the location of identified viewpoints;
- sensitivities of the land uses within the view shed;
- visual impacts of the key Project elements; and
- mitigation measures to minimise impacts.

ERM has prepared a theoretical, worst case visibility scenario model in ArcGIS. The model demonstrates the visibility of quarry features, modelled solely using topography and height of proposed new infrastructure. The model demonstrates the theoretical visibility of the current quarry and the theoretical visibility of the quarry and ancillary operations at the proposed Stage 5 conditions. This worst-case visibility scenario excludes screening provided by vegetation, bunding and other noise control features and existing or proposed buildings. The analysis utilised the five-metre Digital Elevation Model (DEM) available from Geoscience Australia in conjunction with the contours and infrastructure locations/heights provided by Hanson for the final Stage 5 conditions.

The model allows for the comparison of theoretical visibility of current and final proposed staging to determine the footprint of modelled impacts. With an understanding of site features based on the site inspection, the discussion around site screening features and their amelioration of modelled impacts can be provided.

13.1.1 Site Inspection

ERM undertook a site inspection of the Sancrox Quarry on 16 November 2017, which involved visiting surrounding residential properties, industrial and commercial areas and public roads to identify viewpoints and the potential for impacts to existing visual amenity as a result of the Project. Photographs were taken looking towards the Project site, and factors such as a lack of existing screening (vegetative or other) and contouring of the land between the receptors and the Project site were noted.

13.1.2 Authors

This assessment was prepared by ERM Environmental Scientists with experience in the preparation of qualitative Visual Impact Assessment for quarrying and industrial developments.

13.2 EXISTING ENVIRONMENT

13.2.1 Topography and Vegetation Cover

The topography of the area surrounding the Project site is characterised by floodplains and low lying hills up to approximately 60 mAHD (refer to *Figure 13.1* below). The eastern portion of the Project site has been disturbed by active quarrying activities, while the west and northwest portions are largely undisturbed and predominantly covered with remnant native open forest vegetation and some smaller sections of ground covering pasture. Lot 2 DP 574308 to the north of the quarry is the proposed biodiversity offset area and comprises of Tallowwood-small fruited grey gum dry grassy open forest closest to the quarry and Paperbark swamp forest of the coastal lowlands further from the quarry (SLR, 2019).

Remnant forest vegetation surrounds the north, west and south of the Project site. The land to the east and north of the Project site is being progressively cleared and filled to create a level ground for the development of an industrial area. Narrow strips of vegetation are still currently present along the northern and eastern boundaries of the Project site but will be cleared soon to allow for the construction of industrial development (refer to *Photograph 1*).

13.2.2 *Project View Shed*

Several rural residential properties are located to the north, south and west of the Project site. As noted above, the landform and vegetation obscure and screen views of the Project site from these residential properties (refer to *Figure 1* for the location of these properties).

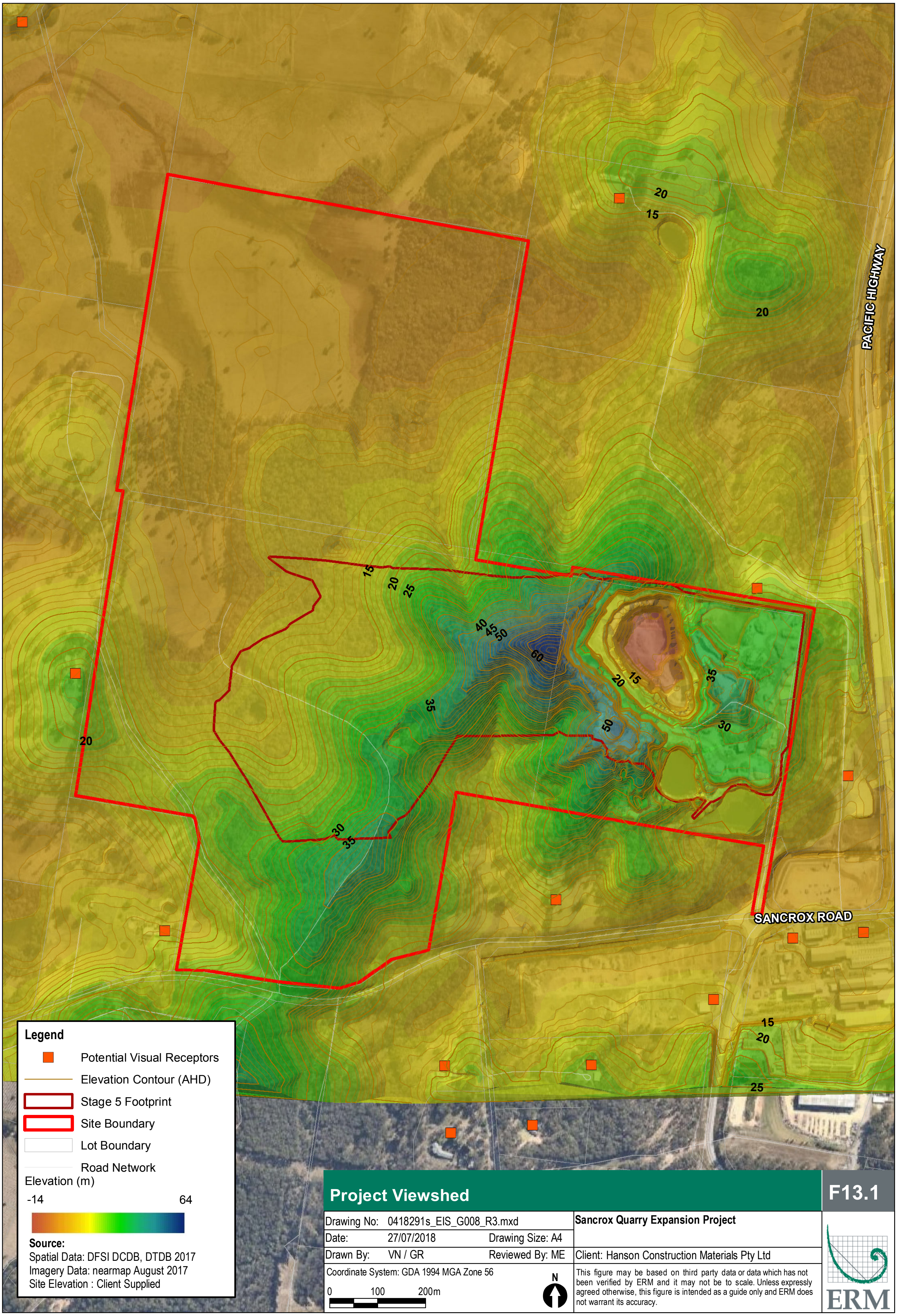
The Pacific Highway and the Cassegrain Winery are located approximately 175 m and 210 m to the east, respectively. Sancrox Road is located approximately 230 m to the south of the site, with a suite of industrial facilities beyond.

Photographs 2 to *6* show the obstructed views towards the Project site from some of these residential properties, the Pacific Highway and Cassegrain Winery.

The western receptor (residential property) exists approximately 1 km west of the existing quarry. The land between the receptor and the Project site is relatively flat, and views from parts of the residential property towards the quarry are currently screened by the forest (refer to *Photograph 7*).

13.2.3 *Current Lighting*

The Site is currently floodlit via high mast high-pressure sodium luminaires. Operation of the lighting systems is on an as-needed basis and is currently not operational during all nights.



PACIFIC HIGHWAY
SANCROX ROAD
20
15
20
20
15
20
25
40
45
50
60
35
20
15
35
30
50
30
35
15
20
25
Legend
Potential Visual Receptors
Elevation Contour (AHD)
Stage 5 Footprint
Site Boundary
Lot Boundary
Road Network
Elevation (m)
-14
64
Source:
Spatial Data: DFSI DCDB, DTDB 2017
Imagery Data: nearmap August 2017
Site Elevation : Client Supplied
Project Viewshed
F13.1
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Date: 27/07/2018
Drawing Size: A4
Drawn By: VN / GR
Reviewed By: ME
Coordinate System: GDA 1994 MGA Zone 56
0 100 200m
N
Sancrox Quarry Expansion Project
Client: Hanson Construction Materials Pty Ltd
This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.
ERM

Photograph 1 Narrow strips of vegetation currently present along the northern and eastern site boundaries.

Photograph 2 View looking north towards the Project site from Bushland Drive (residential area to the south).

Photograph 3 View looking north towards the Project site from Sancrox Road (residential property to the south).

Photograph 4 View looking north east towards the Project site from Sancrox Road (residential property to the south west).

Photograph 5 View looking southeast from the Project site at vegetative buffer obscuring vision of Pacific Highway.

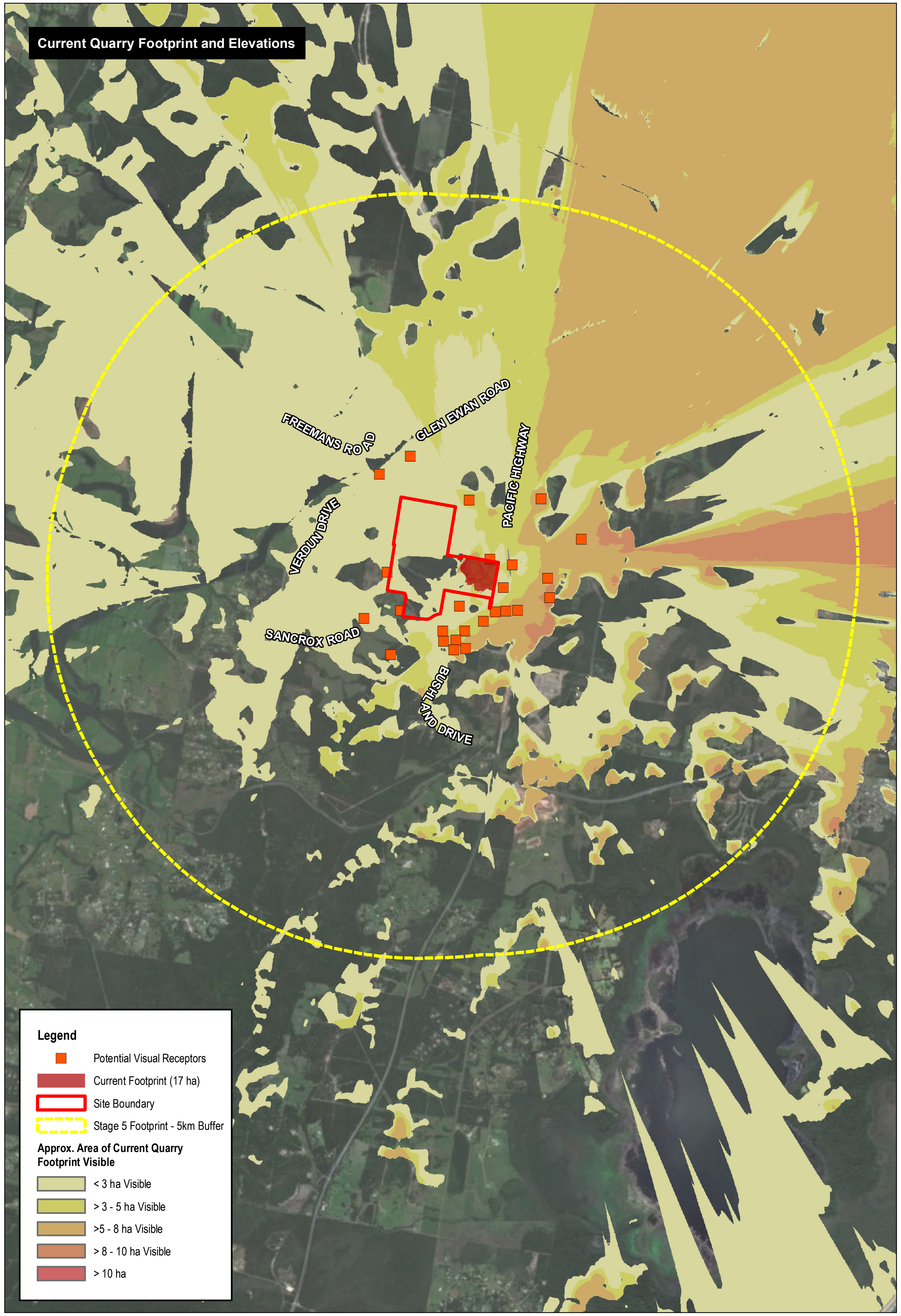
Photograph 6 View from Cassegrain Winery looking west towards the Project site across the Pacific Highway.

Photograph 7 View looking east towards the Project site from private land north-east of western most residential property.

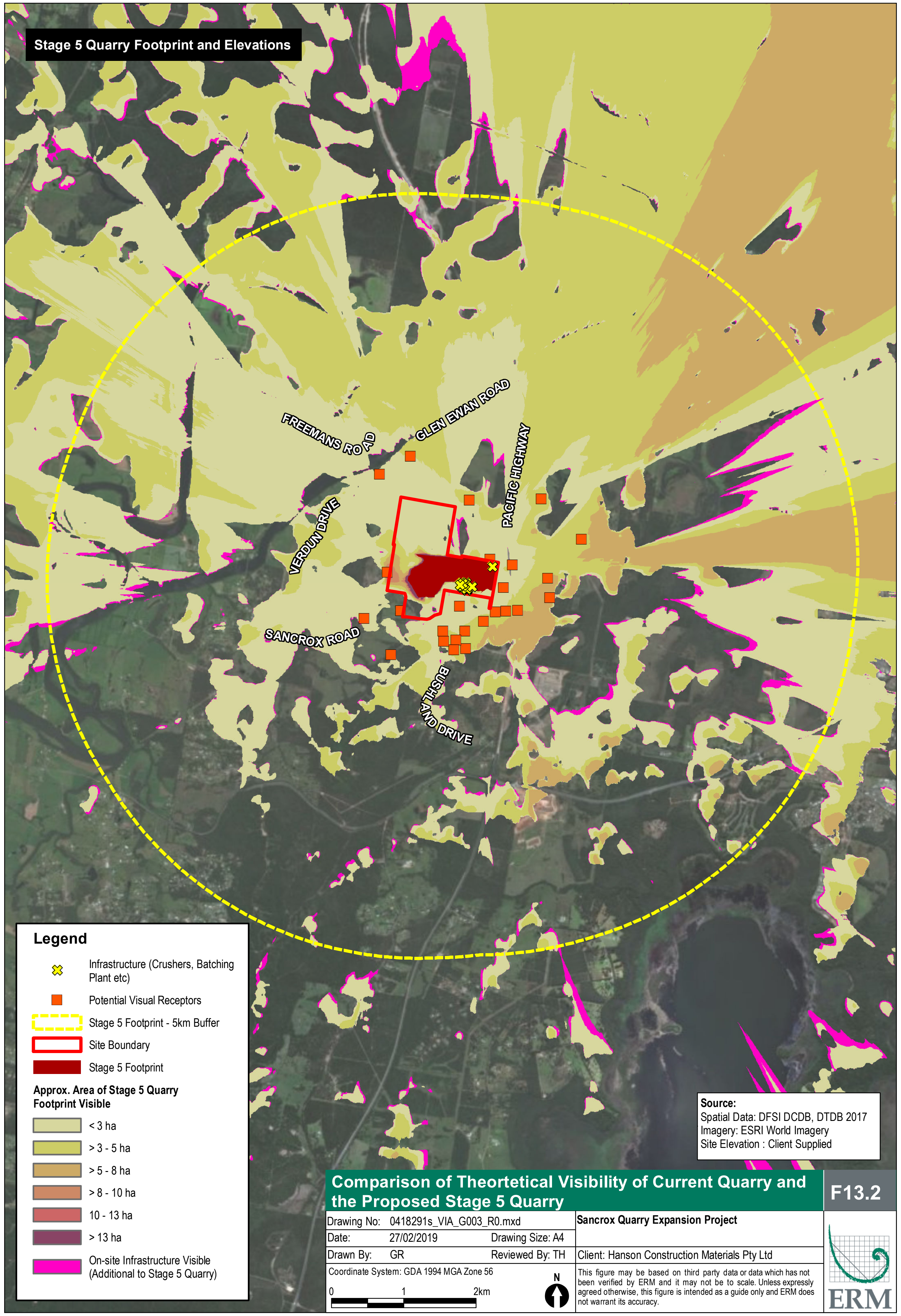
13.3 ASSESSMENT

13.3.1 Theoretical Visibility Model – (excluding consideration of screening features)

The theoretical visibility model is provided in *Figure 13.2* and demonstrates the theoretical visibility of the current quarry, and the theoretical visibility of the quarry/ancillary operations at the proposed Stage 5 conditions. It can be determined from the theoretical model that the footprint of theoretical visibility for the current quarry remains unchanged at proposed Stage 5 Conditions. However, the degree of impacts within the footprint does vary.



Current Quarry Footprint and Elevations
FREEMANS ROAD
GLEN EWAN ROAD
PACIFIC HIGHWAY
VERDUN DRIVE
SANCROX ROAD
BUSHLAND DRIVE
Legend
Potential Visual Receptors
Current Footprint (17 ha)
Site Boundary
Stage 5 Footprint - 5km Buffer
Approx. Area of Current Quarry Footprint Visible
< 3 ha Visible
> 3 - 5 ha Visible
>5 - 8 ha Visible
> 8 - 10 ha Visible
> 10 ha



Stage 5 Quarry Footprint and Elevations
FREEMANS ROAD
GLEN EWAN ROAD
PACIFIC HIGHWAY
VERDUN DRIVE
SANCROX ROAD
BUSHLAND DRIVE
Legend
Infrastructure (Crushers, Batching Plant etc)
Potential Visual Receptors
Stage 5 Footprint - 5km Buffer
Site Boundary
Stage 5 Footprint
Approx. Area of Stage 5 Quarry Footprint Visible
< 3 ha
> 3 - 5 ha
> 5 - 8 ha
> 8 - 10 ha
10 - 13 ha
> 13 ha
On-site Infrastructure Visible (Additional to Stage 5 Quarry)
Source:
Spatial Data: DFSI DCDB, DTDB 2017
Imagery: ESRI World Imagery
Site Elevation : Client Supplied
Comparison of Theortetical Visibility of Current Quarry and the Proposed Stage 5 Quarry
F13.2
Drawing No: 0418291s_VIA_G003_R0.mxd
Date: 27/02/2019
Drawing Size: A4
Drawn By: GR
Reviewed By: TH
Coordinate System: GDA 1994 MGA Zone 56
0
1
2km
N
Sancrox Quarry Expansion Project
Client: Hanson Construction Materials Pty Ltd
This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.
ERM

Variations in the degree of theoretical visibility in each quadrant demonstrated in the Stage 5 model include;

- the quarry facing hill slopes that would theoretically be able to view the Stage 5 infrastructure in all directions;
- in the northeastern quadrant, the approximate area of the stage 5 quarry visible footprint decreases, with the area of 8-10ha visibility no longer appearing and the proportion of 5-8ha visibility decreasing in the North, North East.
- in the southeastern quadrant, the approximate visible area in the range of 8-10 hectares no longer appears in the modelling;
- in the southwestern quadrant there is a minor increase in theoretical visibility along Sancrox Road, and the approximate visible area in the 5-8 hectare range no longer appearing in the model outside of the site boundary.
- in the northwestern quadrant, there is an increase in the 3-5 hectare visibility range.

This worst-case visibility scenario excludes screening provided by vegetation, bunding and other noise control features and existing or proposed buildings.

13.3.2 Consideration of Screening Features

The model allows for the comparison of theoretical visibility of current and final proposed staging. With an understanding of site features based on the site inspection, the discussion around site screening features and their amelioration of the modelled impacts can be provided.

North Western Quadrant

Actual impacts in the northwestern quadrant are unlikely as Lot 2 DP 574308 to the north of the quarry is the proposed biodiversity offset area. The offset area will be protected by conservation agreement and will not be cleared. The area comprises of Tallowwood and small-fruited grey gum in the upper storey vegetation closest to the quarry, both of which can grow up to 40m high (PlantNET, n.d.) and provide sufficient screening.

South Western Quadrant

The Tallowwood and small-fruited grey gum vegetation type is present to the west and south of the proposed future stages of the quarry within the site boundary. The vegetation stands are a minimum of 40m wide from the edge of the quarry to current cleared pastoral land. The presence of this vegetation is considered a sufficient screen to receptors in these directions. A noise attenuation bund/wall or combination of both is proposed to the west of the quarry. This bund will be vegetated to blend with the existing landscape and should use of noise attenuating fencing also be used in combination; it will be suitably matched to the landscape/setting.

Confirmation that the nearest receptor (and rest of this property) to the west would likely not be impacted was undertaken during the site inspection. The western receptor is located on a hill of approximately 23mAHD. The western extent of the quarry footprint ranges from 30-35mAHD in the south to approximately 10mAHD in the north-west. Despite the receptor height, the maintenance of a vegetative buffer around the quarry (and particularly adjacent to the lowest elevation areas of disturbance) will screen the quarry. It is noted that the vegetation around the residence will also provide screening. Photograph 8 demonstrates the view from the land from the residence, with the circled area demonstrating the vegetation that will remain and will shield the quarry activities in the lowest elevation areas.

Photograph 8 View looking east towards the Project site from private land north-east of western receptor and the circled vegetative buffer.

South Eastern Quadrant

Along the southern edge of the proposed ancillary facility area, vegetation is present in the adjoining lot to the south. The vegetation stand in this locality is a minimum of 60m wide. This vegetation provides a sufficient visual screen to current operations and will provide sufficient screen for the proposed future activities for receptors to the south. A noise attenuation bund/wall or combination of both is proposed to the west of the quarry and the south of the quarry. This bund will be vegetated to blend with the existing landscape and should use of noise attenuating fencing also be used in combination; it will be suitably matched to the landscape/setting.

Vegetation is present around the eastern edge of the water holding dam in the south eastern portion of the site. The width of this vegetation stand within the site boundary is narrow at 20m, however, will provide screening of the ancillary infrastructure for receptors in the east.

North Eastern Quadrant

Commercial and industrial areas with potential to be affected by the Project are located to the north and east of the quarry. The proposed industrial estate adjacent to the quarry is shown in *Figure 13.3*.

To the north a vegetative buffer of approximately 10m wide will remain in the site boundary to provide limited screening. The future development of industrial lots adjoining the quarry lot boundary will face east and north, with the buildings themselves to provide a visual buffer to the quarry.

The removal of the vegetative buffer to the east of the Project site to accommodate the proposed industrial development will result in greater exposure of the existing quarry and accordingly the Project site to the industrial estate, passing traffic along the Pacific Highway, and the Cassegrain Winery.

While the quarry and ancillary facilities will be more exposed to the industrial estate – the facades of the infrastructure on adjoining lots will face the east towards a proposed new access, away from the quarry. Lots on the opposite side of the proposed access track will be screened from the quarry and ancillary facilities by the infrastructure on the opposite side of the proposed access road.

The following screening and influencing factors are expected to limit the visibility of the quarry and ancillary facilities and negate any impacts to passing members of the public on the Pacific Highway:

- a portion of the highway in the vicinity of the quarry is a cut with vegetated batter slopes that would obstruct views of the quarry and ancillary facilities;
- the speed of the traffic passing in this location of 110 km/hr;
- the existing industrial setting of the locality; and
- the future industrial setting of the locality directly to the east of the quarry, and the screening effect to be provided by the industrial buildings.

The infrastructure at Cassegrain Winery faces the east south-east with the rear of buildings facing the quarry and the Pacific Highway. Hence impacts to the winery are considered to be negligible.

It is considered that due to the location of the quarry amongst extensive existing vegetation, surrounding topography, and the proposed long-term rehabilitation and revegetation activities, the visual impacts associated with the Project are negligible, under the assumption that the proposed mitigation measure outlined in *Section 13.4* are implemented.

Adjacent Industrial Area Undergoing Development

F 13.3

Drawing No:	0418291s_EIS_C002_R0.cdr		Sancrox Quarry Expansion Project
Date:	04/03/2019	Drawing size: A4	
Drawn by:	GC	Reviewed by: TH	Client: Hanson Construction Materials Pty Ltd
			This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

ERM

Source:
"Exhibit 4 - Proposed Subdivision", Sancrox Employment Precinct, Drawing No. 4802RMS Section Plan/01/F, King & Campbell, November 2011.

13.3.3 *Proposed Lighting Requirements*

The area requiring lighting for the 24 hour operation of the development is provided in *Figure 13.4*. The lighting performance requirements and recommended lighting technical parameters are:

- visitor and employee car parking bays to contain AS/NZS 1158.3 technical lighting parameter of category P11b;
- heavy vehicle circulation space to contain AS/NZS 1680.5 lighting technical parameters of general storage – pedestrian access with through traffic average illuminance (Eav) of 20lx, minimum illuminance (Emin) of 2.5lx, uniformity of illuminance (U_0) of 7, Glare Rating maximum (GRmax) of 50; and
- pedestrian circulation spaces around the building perimeter are to be covered by AS/NZS 1158.3 lighting technical parameter of category P4.

Luminaires located within the covered areas of the Site are considered shielded from external view, however these would also comprise of full cut-off luminaires.

All external lighting systems applied to the Site are to be assessed against AS 4282 Control of the obtrusive effects of outdoor lighting. The proposed lighting system is to fall below the recommended maximum values of light technical parameters for the control of obtrusive, as outlined within the Standard.

All external lighting systems applied to the Site are to be assessed against AS/NZS 1158.3 Classification of luminaires and associated criteria for control of glare and upward waste light. The proposed lighting system is to fall below the recommended Maximum Upward Waste Light Ratio (UWLR) percentage.

13.3.4 *Lighting Impacts and Light Spill*

Light spill due to 24 hour operations is unlikely to alter local light pollution levels, which are already influenced by the street lighting from the Pacific Highway to the east. The landform, vegetation and noise attenuation bunds/fencing (on the southern and western perimeters) will obscure and screen light spill at residential properties and the adjacent roadways located to the north, south and west of the Project site. Negligible light spill impacts are likely for users of the Pacific Highway due to the screening factors outlined in *Section 13.3.2* and the incorporation of proposed mitigation measures. It is noted that the level of lighting in the area to the east of the quarry will be increased with the establishment of the industrial estate.

In regards to luminaire specifications for light spill minimisation, numerous mitigating measures shall be adopted to reduce the possibility of obtrusive spill light beyond the Site boundaries and upward waste light. These mitigation measures are outlined in *Section 13.4*.

Legend

Lighting Area

Source:
Client provided June 2019.

Site Lighting Plan

F13.4

Drawing No: 0418291s_EIS_C003_R0.cdr		**Sancrox Quarry Expansion Project**
Date: 19/06/2019	Drawing size: A4	
Drawn by: GC	Reviewed by: TH	Client: Hanson Construction Materials Pty Ltd
0 100 200m	N	This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

ERM

13.4 *MITIGATION MEASURES*

The following mitigation measures are recommended to minimise visual amenity impacts:

- retain the vegetative buffer along the northwestern edge of the quarry pit to screen views from nearby private land;
- any combination of noise amelioration bunding/fencing is to be vegetated/match the landscape;
- the light spill will be minimised through detailed design and standard measures to contain lighting and include the following specific measures:
  - LED lens technology which allows for the precise aiming of light onto a designated location reducing spill light outside the Site boundaries. Luminaires are to be aimed within the confines of the Site. This includes stationary/fixed lighting to direct light away from the surrounding vegetation and all lighting within the processing and stockpiling area positioned in locations/elevations that would maximise the illumination of the operational area yet minimises the amount of reflected light and light directed off site;
  - luminaires comprising of full cut-off asymmetric lens optics shall be used throughout the Site. Luminaires to incorporate a flat glass visor, in order to minimise upward waste light;
  - luminaires mounted between 6m – 12m with a zero degree upward tilt;
  - the use of visors and physical obstructions;
  - consideration given to locating carpark pole mounted luminaires against the Site perimeter with the main light distribution directed within the Site;
  - direct stationary / fixed lighting downwards with the height of the light source minimised. Where appropriate, full cut-off fittings would be provided to ensure only localised areas are illuminated; and
  - light generation minimised through the selection of bulbs generating yellow light rather than blue/white light. The selection would be guided largely by safety considerations.

REFERENCES

PlantNET (The NSW Plant Information Network System) (n.d.). Royal Botanic Gardens and Domain Trust, Sydney. http://plantnet.rbgsyd.nsw.gov.au. Accessed 3 March 2019)

14 *SOCIAL & ECONOMIC ASSESSMENT*

This Chapter of the report has been prepared to describe the potential social and economic impacts associated with the Project, and the steps which will be followed to ensure that any risk is mitigated where possible.

14.1 *METHODOLOGY*

The SEAR's stipulate that the EIS must include:

- a detailed assessment of the likely social impacts of the development on the local and regional community by the (NSW DPE, 2017) *Social impact assessment guideline for State significant mining, petroleum production and extractive industry development*; and

- a detailed assessment of the likely economic impacts of the development, paying particular attention to:

- the significance of the resource;

- the costs and benefits of the project, identifying whether the development as a whole would result in a net benefit to NSW, including consideration of fluctuation in commodity markets and exchange rates; and

- the demand for the provision of local infrastructure and services.

The above requirements are addressed in the Social and Economic Impact Assessment prepared by Ethos Urban (2019) in accordance with NSW DPE. This report is summarised below and provided in Annex K. Ethos Urban (2019) characterised the Study Area for the social and economic assessment into Primary and Secondary Study Areas as shown in *Figure 1*.

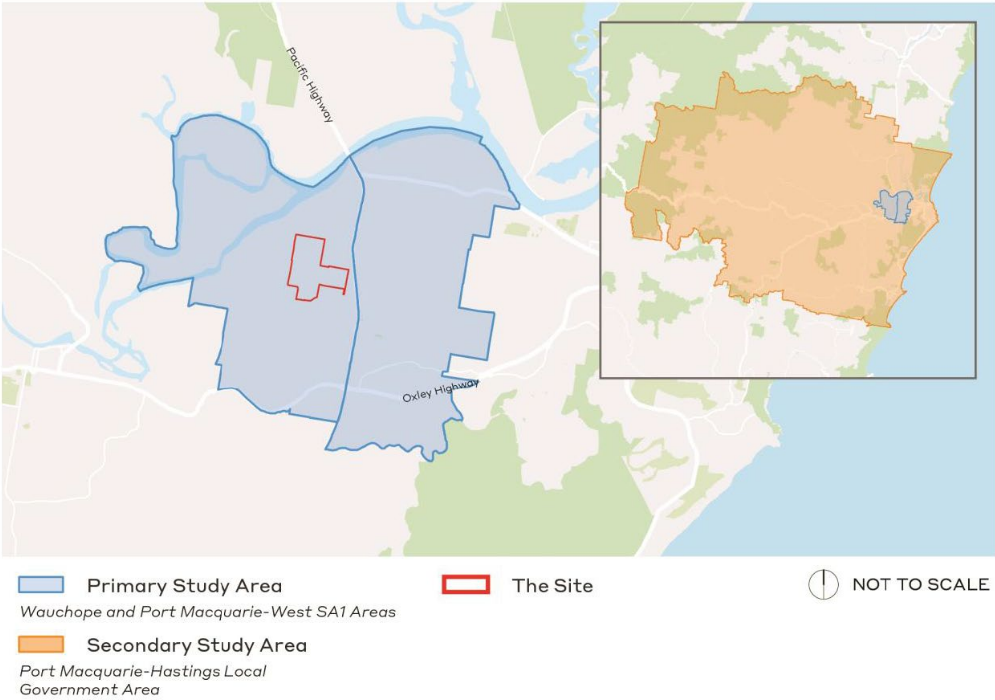


Figure 1 *Social and Economic Study Area (Ethos Urban (2019))*

14.2 ASSESSMENT

14.2.1 Social Considerations

Context

The environment surrounding the site includes remnant woodland vegetation immediately adjacent to the north, west and south. A narrow strip of vegetation is present along the eastern boundary, with partially cleared land located 100m to the east. The closest residence to the site is located approximately 200m to the south-west, along Sancrox Road. A number of rural residential residences are also located along Bushland Drive to the south-west of the site, the closest being approximately 650m to the southwest. A further rural residence is located approximately 1km to the west. The Pacific Highway and Cassegrain Winery are located approximately 175m and 210m to the east, respectively. Sancrox Road is located approximately 230m to the south of the site, with a variety of industrial uses beyond.

The road infrastructure directly adjacent to the Sancrox Quarry has recently undergone redevelopment and improvement. The Sancrox Interchange connects to the Pacific Highway which services northern, southern and eastern movements from the quarry and was opened to the public on 30 November 2015. The Interchange was designed to cater for the existing industry and businesses in the area, as well as servicing the area which is planned for development as an industrial precinct.

The Pacific Highway in the vicinity of the quarry has recently been upgraded, as part of the Oxley Highway to Kempsey Pacific Highway Upgrade Project. The Highway is a dual carriageway, 110km/hr Motorway class road.

To the east of the quarry, construction has commenced on the development of an estate zoned for light industry. The Greater Sancrox Structure Plan 2014-2034 outlines future development options including rural residential development opportunities to the west of the quarry and south of Sancrox Road.

The typical social impacts associated with activities as proposed by the Project include land use conflicts, noise and vibration, air quality, traffic and transport, soil and water and visual. These are discussed below.

Land Use Conflicts

Ethos Urban (2019) assessed whether the proposed development may have potential social impacts with relation to personal and property rights, including affectation of economic livelihoods, and personal disadvantage or affectation of civil liberties. This may be the result of the following:

- Potential environmental impacts related to water quality, noise and vibration and air quality that could affect surrounding landowners.

- Potential impacts on surrounding businesses and residents associated with increased congestion and traffic movements due to expanded operations.

Ethos Urban (2019) determined that potential impacts will be minimal as the quarry site is remote and rural with no social infrastructure within walking distance of the site that would be affected by the expansion of quarry operations. The site is located near major road; however, as expected for a rural quarry site, there is limited public and active transport accessible to the site. The mitigation measures provided throughout the relevant technical assessment within this EIS will ensure that any potential impacts to neighbouring lands are mitigated to the full extent possible, where practicable.

Noise and Vibration Impacts

A detailed noise assessment was undertaken as part of this EIS. Potential impacts associated with construction road traffic and ground-borne noise and impacts associated with construction and operational vibration were qualitatively assessed.

Potential negative social impacts can be associated with increased operational and construction noise. Increased noise and vibration has the potential to create annoyance, interfere with daily activities, interfere with concentration and memory particularly with regard to children's school performance and business activity that depends on quiet surroundings, disrupt sleep and rest patterns and create or exacerbate health concerns such as hearing impairments and cardiovascular health (elevated blood pressure).

Construction and operational noise levels have the potential to exceed the applicable criteria, limits and thresholds if not suitably mitigated. Construction noise impacts may not be reduced to imperceptible or negligible levels for all receptors during all construction activities. However, the recommendations presented in *Chapter 10.5* will minimise residual construction noise impacts. Operational noise levels are predicted to exceed the applicable INP operational noise criteria and limits. Therefore, noise reduction and mitigation measures have been established to assist in achieving compliance with relevant guidelines. These measures are outlined in *Chapter 10.5*.

The assessment also identified the blasting overpressure, and vibration levels have only a limited potential to exceed the applicable AS2187 criteria and thresholds, as long as normal blast design planning and consideration for potential environmental impacts occurs.

Mitigation measures considered suitable to the magnitude and extent of the predicted construction and operational impacts are designed to reduce noise levels and minimise impacts as far as is commonly feasible and reasonable to do so and practical to implement. The details of the assessment and the recommended mitigation measures are provided in *Chapter 10* and *Annex G*).

Air Quality Impacts

An Air Quality and Greenhouse Gas Assessment have been prepared to support this EIS, which considers all reasonable and feasible mitigation measures to minimise the emissions from the proposed activities at the site, including a range of mitigation measures identified in *Chapter 11*. This assessment identified that impacts were below applicable criteria, except for cumulative (background plus Site contributions) PM10 24-hour average predicted concentrations. It is however noted that the exceedance was below particulate matter mitigation criteria from the Voluntary Land Acquisition and Mitigation Policy for State Significant Mining, Petroleum and Extractive Industry Developments and consequently under this guidance, the level of impact to surrounding land use is considered to be acceptable.

The assessment considered all reasonable and feasible mitigation measures to minimise the emissions from the proposed activities at the site and provided recommendations for ambient monitoring to ensure compliance with legislation (refer to *Chapter 11* and *Annex H*).

Traffic and Transport Impacts

A Traffic and Transport Impact Assessment was undertaken as part of this EIS which concluded that the Project will not significantly impact on local traffic or transport networks. This conclusion was drawn due to the optimum, modern standard of design and construction of the recently upgraded Sancrox Interchange and Pacific Highway directly adjacent to the site (refer *Chapter 12* and *Annex I*).

The site currently generates an average of 42 heavy vehicle trips per day. The expanded quarry operations will increase average truck volumes to approximately 200 truck trips per day (a 'trip' is two movements – in and out of the site). This is an increase of approximately 158 additional heavy vehicle trips per day on Sancrox Road.

. During operation, typical daily traffic movements are likely to include:

- Light vehicle trips transporting staff to and from site concentrated at the start and end times of shifts;
- Truck trips delivering quarried product and asphalt;
- Concrete agitator trips to deliver concrete to construction sites;
- Import of concrete constituents (sand and cement); and
- Truck trips delivering waste concrete to site for recycling.

The mitigation measures provided throughout the traffic assessment are to be implemented during construction and operation of the Project to further ensure that driver behaviours and administrative controls, beyond the recently installed, high-quality infrastructure in place, minimise likelihood for impacts.

Soil and Water Impacts

Detailed soil and water assessment was undertaken as part of this EIS. These assessments concluded that soil and water management impacts could be effectively managed through the implementation of mitigation measures.

A surface water monitoring program has been prepared, and the site EPL will need to be varied to incorporate the proposed revision to current water monitoring. The program outlines the proposed surface water monitoring regime for the sediment basins that will be installed as the staged expansion progresses. With the implementation of sediment basins, the utilisation of mitigation measures and the development of an SWMP and PESCPs, the potential soil and water impacts of the Project can be effectively managed so that there is no significant, negative impact to the environment..

For soil-related mitigation measures, refer to *Chapter 9*. For water-related mitigation measures, refer to *Chapter 7* and *8*, and *Annex E* and *F* (Surface Water and Groundwater, respectively).

Visual Impacts

It is considered that due to the location of the quarry adjacent to areas of dense vegetation, surrounding topography, the proposed long-term rehabilitation/revegetation activities and lighting management measures that the visual impacts of the development are minimal (refer to *Chapter 13*).

14.3 *ECONOMIC CONSIDERATIONS*

14.3.1 Demand

The Mid North Coast Regional Strategy (Department of Planning, 2009) estimated a population increase throughout the Mid North Coast region that is among the highest in regional NSW. Ethos Urban (2019) detailed that the Primary Study Area (PSA) is forecast to undergo significant growth to 2036, generally associated with new development in the locality of Thrumster, close to the site. Between 2016 to 2036, the population of the PSA is forecast to increase by around 9,000 persons to 13,300 persons by 2036 (Ethos Urban, 2019). This implies an average annual growth rate of 5.9%, this projected growth rate is much higher than Port Macquarie-Hastings, which is forecast to be 1.3% over this same period (Ethos Urban, 2019). Most of this population growth is forecast to occur within the locality of Thrumster, which is directly south-east of the site (Ethos Urban, 2019).

In the PSA, the number of dwellings is projected to increase by around 720, to around 1,100 by 2036. The number of households are expected to increase by 700 (Ethos Urban, 2019). The average household size of the PSA is forecast to increase slightly to 2.84 by 2036, while the average expected household size of the LGA is expected to be 2.61 (Ethos Urban, 2019). The increase in average household size is driven by an increase in family households occurring in new developments within the PSA (Ethos Urban, 2019).

Between 2016 to 2036, the number of households in the Port Macquarie-Hastings LGA is forecast to increase from 34,100 households to 44,800 households (at a growth rate of greater than1.3% per annum), while the average household size is forecast to remain at 2.31 persons per household over the period (Ethos Urban, 2019).

The number of dwellings in the Port Macquarie-Hastings LGA is forecast to increase from 37,020 dwellings in 2016 to 47,500 dwellings in 2036, representing a dwelling growth rate of 1.3% per annum over the period (Ethos Urban, 2019). The dwelling occupancy rate over the 20 years is expected to remain constant at 92%, with 10,480 new dwellings required between 2016 to 2036 to meet population growth demand (Ethos Urban, 2019).

Between 2011 and 2016, the population increased by around 450 residents within the PSA, at an average annual growth rate of 16.2%. This was much greater than the average annual growth rate of Port Macquarie-Hastings LGA at 2.6%. This suggests that the area has transformed in recent years, coinciding with the development of rural areas to residential (Ethos Urban, 2019).

CCAA (2015) states that in Australia each year, Australia use the equivalent of 7 tonnes of aggregate per person. Furthermore, the construction of a new house requires approximately 110 tonnes of construction aggregates and 53m^3 of concrete. With this requirement, and the increased population and associated housing requirements in the region, a demonstrable demand is present and will continue to expand.

These resources will be important in supporting strong urban and infrastructure growth forecast in the Port-Macquarie-Hastings LGA and broader region over the coming decades (Ethos Urban, 2019). The role of Sancrox Quarry in supporting major projects is highlighted by the product provided for the now completed Sancrox Interchange and Oxley Highway to Kempsey Pacific Highway Upgrade projects (Ethos Urban, 2019).

Resource demand will be driven by increased sub-divisions for residential and industrial developments across the Mid-North Coast region, and major infrastructure projects (e.g. roads) (Ethos Urban, 2019). This will include concrete aggregate supply to Port Macquarie and Taree Concrete plants for construction, as well as road base and fill material (Ethos Urban, 2019)..

Ethos Urban (2019) provided current and potential development within the region, as follows:

- Port Macquarie: Ascot Park, Thrumster, Sovereign Hills, Ocean Drive upgrade, Port Macquarie Ring Road, Lake Cathie, Bonny Hills, Rainbow Beach development, Lakewood;
- Sancrox: Expressway, Spares industrial development, Le Clos and Freeman residential developments; and
- Wauchope: Crosslands and Beechwood residential developments, road developments to Walcha.

Additional production capability will provide improved efficiencies and allow Sancrox Quarry to support developments beyond Taree and Kempsey, with an estimated range of 100km (Ethos Urban, 2019).

14.3.2 *Key Markets*

Ethos Urban (2019) outlined that products from Sancrox Quarry are extensively used by public and private customers, especially for State/major projects and for commercial development projects. Combined, these two key markets accounted for approximately 70% of product sales in 2018.

Table 14-1 Sancrox Quarry - Key Markets (by share) 2017 and 2018

Customer	2017	2018
Private developers	30%	35%
State/major projects	31%	33%
Concrete aggregates	15%	15%
Port Macquarie- Hastings LGA	14%	8%
Wholesale/retail	10%	8%
Total	100%	100%

14.3.3 *Benefits*

The increased quarry production along with the proposed batching and recycling operations will result in considerable economic benefits at both the local and regional level. The principal economic benefits of the Project are related primarily to the local provision of:

- hard rock aggregates to regional projects;
- an additional option for the recycling of concrete for beneficial reuse;
- concrete for development projects throughout the region;
- asphalt for regional road construction projects;
- employment growth at the quarry and in the broader community – which also brings potential social benefits to the community associated with increased business expenditures and expanded employment opportunities;
- efficient and cost-effective delivery of the product to customers/end users; and
- environmental benefits through the diversion of used concrete from landfill.

The Project will provide surety of supply of construction materials to assist in meeting the urban growth resource needs, stimulated by ongoing population expansion and the proposed pipeline of major State Government infrastructure investment projects of the Mid North Coast region.

Sancrox Quarry is in a strong position to provide quality construction materials for the provision of vital road network infrastructure in the form of hard rock aggregate, fill materials and asphalt. The ongoing supply of these materials to the Mid North Coast market is critical in ensuring increased demand for construction materials is met, thus contributing to the affordability and overall capability of state and locally funded infrastructure projects.

Ethos Urban (2019) identified that the proposed development would have the following potential positive social impacts in relation to the way of life in the PSA and broader locality:

- increased employment opportunities associated with expanded operations at the quarry. The strategic policy context has identified that it is a state and local government priority to develop vibrant economies and enhance employment opportunities within the local area, and over a third of resident workers within the Port Macquarie-Hastings LGA are employed in construction-related employment; and

- increased diversity of employment opportunities. Currently, the economic profile of the area indicates that the largest sectors of industry employment for residents in the area construction, agriculture, fishing and forestry. This proposal is likely to generate new employment opportunities in the mining and resource extraction industry.

Employment generation will occur during both the construction and operational phases of the project, which is estimated as follows:

- Construction employment of 80 direct Full-Time Equivalent (FTE) jobs over the development phase. This is based on allocating 50% of investment on labour and applying an average of $80,000 per FTE construction job (ABS Average Weekly Earnings, Australia Nov 2018). In addition to direct employment, 130 further FTE jobs will be supported in the wider economy through the employment multiplier effect (based on the ABS multiplier for 'other construction' of 2.6). In total 210 FTE jobs will be generated through the construction phase of the project on a direct and indirect basis. Operational employment of greater than 10 new FTE jobs (compared to the existing situation); and

- In addition to direct employment, 35 further FTE jobs (rounded) will be supported in the wider economy through the employment multiplier effect (based on the ABS multiplier for 'other mining' of 4.3). It total 45 FTE jobs will be generated through the operational phase of the project on a direct and indirect basis.

An estimated $2.1 million pa in quarry operational expenditure is retained in the Port Macquarie-Hastings LGA economy through local wages and on costs ($1.0 million), and suppliers and services ($1.1 million). These figures relate to year ending 2018.

The expansion of Sancrox Quarry, as per the proposed project, will increase resource supply considerably at the facility over the coming years. While actual annual production levels will be subject to market conditions, Hanson estimate gross market value of available resource is estimated at approximately $24 million pa (2019 dollars), based on annual production of 750,000 tonnes.

14.3.4 Project Investment

Ethos Urban (2019) detail that project investment of $12.5 million will be required to complete the expansion of Sancrox Quarry, with this investment likely to benefit the regional economy in terms of employment, business contracts and supply chain impacts. This is evidenced by the strong construction-related business and workforce base available in Port Macquarie-Hastings LGA to service the project (Ethos Urban, 2019).

Based on similar projects undertaken by Hanson, the project has the potential to be 70%-90% locally sourced (90% represents a local company securing the contract to build and design the plant, using domestic steel) (Ethos Urban, 2019).

14.3.5 Macro-economic Considerations

As with all commodities, macro-economic factors such as economic growth, changes in market prices and movements in interest rates can affect demand for product. With regard to the types of product to be sourced from the expanded Sancrox Quarry, it is unlikely demand for these products will be impacted significantly by such macro-economic factors, with Ethos Urban (2019) providing the following reasons:

- products from the expanded quarry will be focused entirely on the domestic market (principally local/regional markets); therefore, output will not be subject to the type of volatility often associated with export-focused commodities (e.g. metals, coal);
- population and dwelling growth forecasts remain strong at a local and regional level, underpinning significant demand for quarry resources into the future – which includes infrastructure projects which support urban growth;

NSW economic growth remains strong, with the 2018-19 NSW Budget noting:

- "The New South Wales economy has been exceptionally strong over the last few years with the outlook for growth to remain above trend this year and for the next two years". The more recent 2018/19 NSW Budget Half-Yearly Review, forecasts employment to increase at between1.25% to 1.50% pa to 2021/22, while unemployment is expected to remain at approximately 4.5%. Gross State Product (GSP) is projected to remain steady (and above long-term trends) at 2.50% between 2018/19 and2021/22. The Half-Yearly Review also notes the State Government's infrastructure investment pipeline is $89.7billion over the next four years, which represents an upward revision of $2.5 billion since the Budget; and

- Interest rates have been at historical lows and stable for some time, with the Reserve Bank of Australia's official cash rate is 1.0% at July 2019. The RBA's outlook indicates further stability, with only minor movements in the base rate (up or down) likely in the short-medium term.

14.3.6 *Local Spending Stimulus*

The additional employment generation associated with the operations of the expanded quarry, represents a 75% uplift in labour (from 13 jobs to 23 jobs) which will have a flow on stimulus impact to the Port Macquarie-Hastings economy (assuming these new employees are resident workers) (Ethos Urban, 2019). Additionally, increased local purchases of goods and services are likely to occur due to the expanded operations.

Based on existing wage/purchase stimulus of $2.1 million pa and applying a 75% uplift, an additional $1.6 million pa (2019 dollars) will be generated in local stimulus through the operational phase of the project (Ethos Urban, 2019).

14.3.7 *Concrete Recycling*

The expansion of Sancrox Quarry will include the development of a recycled concrete processing plant which can produce up to 20,000 tonnes of concrete pa. The concrete recycling facility will, therefore, contribute to positive environmental benefits by diverting concrete waste product from landfill (Ethos Urban, 2019).

Providing such resources to road infrastructure projects provide benefits to communities and individuals at a local, state and national level by improving road conditions and reducing time spent travelling, which in turn has potential to reduce costs associated with travel and transport of materials and positively improving productivity.

14.4 MITIGATION MEASURES

The construction and operation of the Project are anticipated to have minimal negative socio-economic impacts. Individual technical assessment contained throughout this EIS that can potentially negatively impact on the local community (such as traffic, noise and vibration, air and water quality) include mitigation measures that must be implemented.

Community and stakeholder engagement has been outlined in *Chapter 4*, providing the local community with access to project information and the opportunity to raise any concerns with regard to the Project.

Ethos Urban (2019) outlined the following mitigation measures with regard to social and economic factors:

- maximise positive social impacts of increased employment opportunities within the PSA through practices that encourage the employment of local residents within the PSA, such as training programs to ensure that local residents have the skills required to take advantage of new employment opportunities;

- maintain the existing complaints register to continue to monitor issues raised by the community related to community composition, cohesion, character, how it functions and sense of place;

- plan community engagement to specifically address sense of place within the local community, to assist in defining sense of place to be reflected in future planning stages. For example, a community survey, or specific discussion of sense of place with the Community Consultative Committee established for the project;

- confirm ongoing operation of the Community Consultative Committee as a conduit between the broader community and Hanson; and

- Undertake consultation with the CCC and broader community regarding options for the potential future rehabilitation of the site when operations have ceased, to maximise the positive social benefits to the local community.

14.5 CONCLUSION

The Project is not expected to result in any significant negative economic or social impacts for the local and wider communities upon the implementation of the mitigation measures proposed. The Project will facilitate numerous construction projects within the region, which, in addition to the jobs created by the project, will result in economic benefits for the community. Given the expected population increase in the future, construction materials proposed for production at the Sancrox Quarry will be vital for the sustainable expansion and growth of the area. The proposed concrete waste recycling will generate beneficial reuse of this waste stream and lessen the burden on limited landfill volume in the region.

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15 HAZARDS AND RISK ASSSESSMENT

This chapter provides an assessment of environmental hazards and risks that could arise during the operation of the Project, and management strategies to address these hazards and risks.

A hazard analysis and risk screening assessment has been undertaken for the Project, which evaluates the likely risks to public safety, focusing on the transport, handling and use of hazardous materials and bushfire risk. The assessment also determines whether the Project should be considered a hazardous or potentially hazardous industry under *State Environmental Planning Policy 33 – Hazardous and Offensive Development* (SEPP 33).

15.1 ASSESSMENT METHODOLOGY

A desktop assessment was carried out to identify environmental hazards and risks that could arise during the construction and operation of the Project, as well as mitigation measures to address such issues.

The assessment focused on those hazards and risks with the potential to adversely affect the quality of the surrounding environment, land uses and communities, with consideration of the following relevant policies and guidelines:

- *State Environmental Planning Policy 33 – Hazardous and Offensive Development* (SEPP 33);
- *Hazardous and Offensive Development Application Guidelines: Applying SEPP 33* (Department of Planning, 2011);
- *International Standard (ISO / IEC 31010) Risk Management – Risk Assessment Technique;*
- *Australian Code for the Transport of Dangerous Goods by Road and Rail (7th edition)* (National Transport Commission, 2007);
- *Storage and Handling of Dangerous Goods Code of Practice* (WorkCover, 2005);
- The aims and objectives outlined throughout *Planning for Bushfire Protection 2006* (NSW RFS); and
- Bushfire prone land mapping developed and published by PMHC.

There may be additional health and safety hazards that are not specifically considered in this EIS and would be addressed by the construction contractor.

15.2 APPLICATION OF SEPP 33

Definitions

Industries or projects determined by a risk screening process to be hazardous or potentially hazardous would require the preparation of a Preliminary Hazard Analysis (PHA) in accordance with Clause 12 of SEPP 33. No further assessment under SEPP 33 is required for projects not considered potentially hazardous or offensive.

Definitions of 'potentially hazardous industry' and 'potentially offensive industry' are provided in SEPP 33:

'potentially hazardous industry' means a development for the purposes of any industry which, if the development were to operate without employing any measures (including, for example, isolation from existing or likely future development on other land) to reduce or minimise its impact in the locality or on the existing or likely future development on other land, would pose a significant risk in relation to the locality:

a. to human health, life or property, or

b. to the biophysical environment, and includes a hazardous industry and a hazardous storage establishment.

'potentially offensive industry' means a development for the purposes of an industry which, if the development were to operate without employing any measures (including, for example, isolation from existing or likely future development on other land) to reduce or minimise its impact in the locality or on the existing or likely future development on other land, would emit a polluting discharge (including for example, noise) in a manner which would have a significant adverse impact in the locality or on the existing or likely future development on other land, and includes an offensive industry and an offensive storage establishment.

15.3 ASSESSMENT

15.3.1 Hazard Analysis

In assessing the proposed Project, the emphasis is on preventing hazardous incidents on-site, such as fire and explosion, or the release of significant quantities of toxic or biologically harmful chemicals that could result in substantial off-site effects.

The assessment of the suitability of the Project site to accommodate existing or proposed development of a potentially hazardous nature is based on consideration of:

- the nature and quantities of hazardous materials stored and processed on the site;
- the type of plant and equipment in use;
- the adequacy of proposed technical, operational and organisational safeguards;
- the surrounding land uses or likely future land uses; and
- the interactions of these factors.

This information is incorporated into the Project's hazard analysis. The objective of hazard analysis is to develop a comprehensive understanding of the hazards and risks associated with the existing and proposed quarry operations and of the adequacy of safeguards.

15.3.2 *Potential impacts during Construction and Operation*

Potential hazards and risks during construction and operation include (but are not limited to):

- the on-site storage, use and transport of dangerous goods and hazardous substances;
- risk of damage to existing building basements and ground support structures due to ground movement and geotechnical uncertainty; and
- bushfire risks.

These hazards and risks are described further in the following sections. It is noted that bitumen that will feed the asphalt production process is a Class 9 dangerous good. Applying SEPP 33 states that this class poses little threat to people or property and are excluded from risk screening. As bitumen and bitumen emulsions will be present in volumes greater than 10,000kg, SafeworkNSW are to be notified and manifests and emergency plans developed.

Storage, Use and Transport of Dangerous Goods and Hazardous Materials

Hazardous materials are defined within *Hazardous and Offensive Development Application Guidelines: Applying SEPP 33* as substances falling within the classification of the Australian Code for Transportation of Dangerous Goods by Road and Rail (Dangerous Goods Code). As detailed in *Table 15.1* the hazardous materials that are currently stored or proposed to be stored on site are not subject to the provisions of SEPP 33.

An indicative list of the types of potentially hazardous materials anticipated to be used, stored and transported during construction and operation of the Project is provided in *Table 15.1* along with the relevant storage and transport thresholds established under Applying SEPP 33.

The thresholds in Applying SEPP 33 represent the maximum quantities of hazardous materials that can be stored or transported without causing a significant off-site risk.

In most instances, low volumes of potentially hazardous materials would be stored on site. The volume required to be stored on site would largely depend on the anticipated rates of consumption, with deliveries of dangerous goods coordinated to match consumption rates.

Construction site planning would ensure hazardous materials are stored appropriately and at the required distance from sensitive receptors, in accordance with the thresholds established under Applying SEPP 33. Should the minimum buffers be unable to be maintained, either due to space constraints, the close proximity of receptors, or a requirement to store volumes of hazardous materials in excess of storage thresholds, a risk management strategy would be developed on a case- by-case basis. Typical storage facility layouts are demonstrated in *Photographs 15.1 – 15.4*.

Environmental hazards and risks associated with the on-site storage, use and transport of chemicals, fuels and materials would be managed through standard mitigation measures to be developed as part of the construction environmental management documentation. These measures would include the storage and management of all hazardous substances in accordance with the *Work Health and Safety Act 2011*, the *Storage and Handling of Dangerous Goods Code of Practice* (WorkCover NSW, 2005) and Applying SEPP 33.

Table 15.1 Proposed Hazardous Material Storage at Sancrox Quarry (Construction and Operation)

Material	**Australian Dangerous Goods Class**	**Storage Location**	**Storage Method**	**Storage Quantity**	**Applying SEPP 33 Thresholds**		
					Storage Volume	**Minimum storage distance from sensitive receptors**	**Transport**
Diesel Fuel	Class C1[1]; or 3 PG III[2]	Above ground tank, located near Workshop Area	20 Litre drums / carry cans, self bunded tank	50,000 L	Greater than 5 tonnes, if stored with other Class 3 flammable liquids.	5 metres	Fortnightly transport of 35,000 L. Not applicable if not transported with Class 3 dangerous goods
Lubricating and hydraulic oils and grease	Class C2[1] or 3 PG III[2]	Workshop Area	20 litre drums	10,000 kg	N/A	N/A	Monthly Transport of 2000 L. Not applicable, if not transported with Class 3 dangerous goods
Precoat Supa 30 (bitumen emulsions)	Not classified under the ADG but is GHS classed as flammable liquid Cat 4 so to be stored as combustible liquid - Class C1[1] or 3 PG III[2]	On ground tanks, located near Workshop Area	Above ground storage tank (AST)	50,000 L	greater than 2 tonnes	N/A if not stored with other flammable items or ignition sources (will not be stored near the workshop, will be stored near the Asphalt production plant or in the new stockpile area). To be stored in accordance with AS 1940:2017 (The storage and handling of flammable and combustible liquids) which considers the separation and segregation issues to insure there is no fire escalation to be outlined in management plan).	Monthly transport of 27,000 L. Not applicable if not transported with Class 3 dangerous goods

Material	Australian Dangerous Goods Class	Storage Location	Storage Method	Storage Quantity	Applying SEPP 33 Thresholds		
					Storage Volume	Minimum storage distance from sensitive receptors	Transport
Industrial grade oxygen	Class 2.2	Workshop Area - G & E size cylinders	Cylinders (up to 55 kg) in rack	70 m^3	N/A	N/A	Not subject to Applying SEPP 33 transport thresholds
Industrial grade acetylene	Class 2.1	Workshop Area - G & E size cylinders	Cylinders (up to 55 kg) in rack	50 m^3	Greater than 0.1 tonnes (100kg)	N/A	Monthly transport of 4 X G size heavy duty gas cylinders, which falls below the minimum threshold and does not trigger SEPP 33.
LPG	Class 2.1	Workshop Area	50kg cylinder	50 kg	10 tonne or 16m^3	N/A	6 monthly transport of 50 kg. Below the minimum transport threshold and such does not trigger SEPP 33.
Unleaded Petrol	C1[1]; 3 PG III[2]	Workshop Area	20 litre drums	40 L	Greater than 5 tonnes, if stored with other Class 3 flammable liquids	5 metres	Not applicable if not transported with Class 3 dangerous goods.
Hydrochloric Acid	Class 8, PG II	Workshop Area	20 litre drums	60L	25 tonne (packing group II	Ensure segregation from incompatibles (AS3780 recommends 5m where storage is open)	Deliveries will likely be annually. Not subject to Applying SEPP 33 transport thresholds

1. Classified as C1 if not stored with other Class 3 flammable liquids.
2. Classified as 3PGIII if stored with other Class 3 flammable liquids.

Photograph 15-1 Typical Acetylene and Oxygen storage.

Photograph 15-2 Typical Self-bunded Diesel storage.

Photograph 15-3 Typical Lubricant and hydraulic oil storage standard used by Hanson.

Photograph 15-4 Typical Precoat Supa storage at Sancrox Quarry.

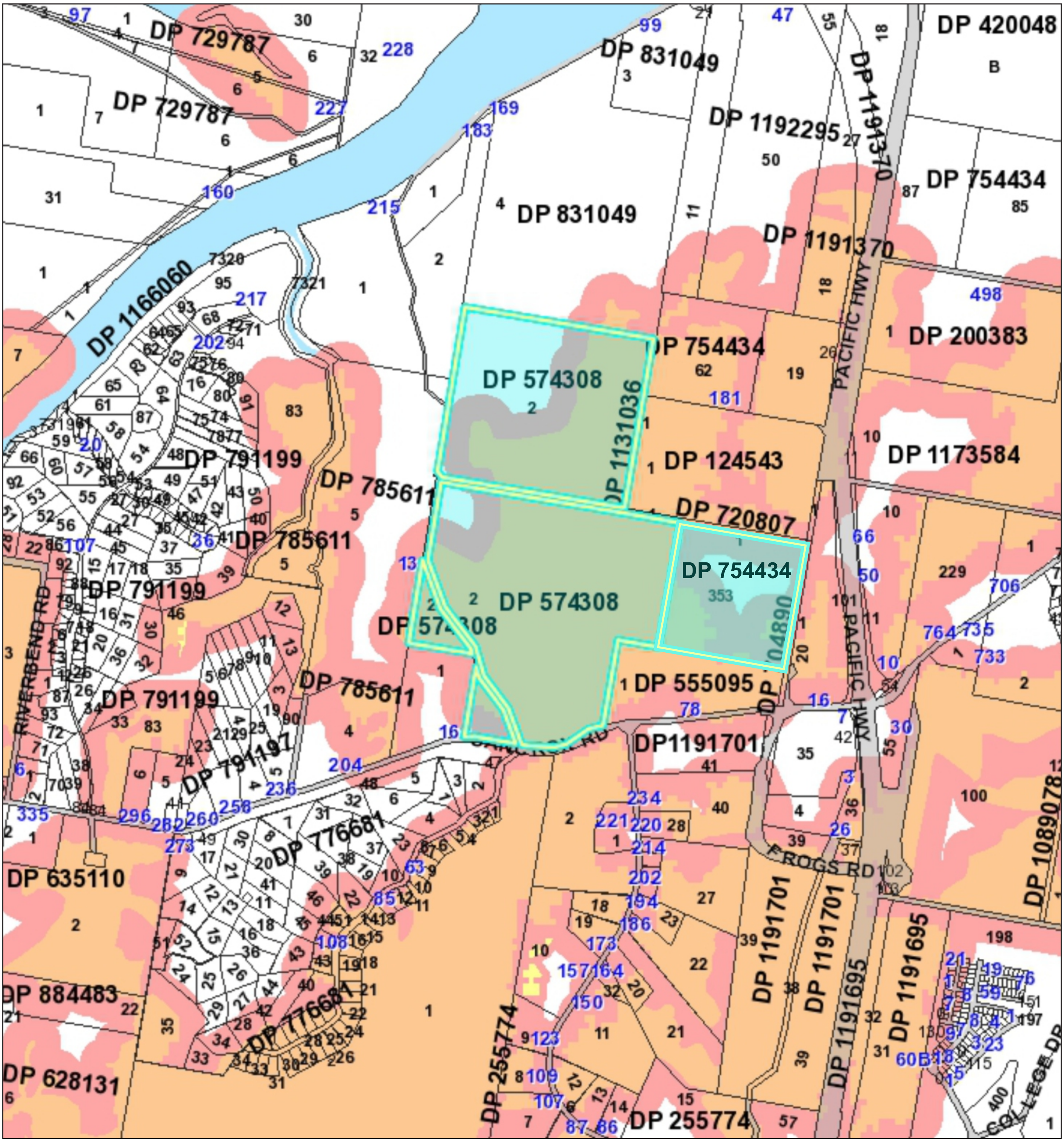
The risk screening process for the storage of hazardous materials at the Project site and the transportation of hazardous materials to/from the site demonstrates that in all cases, types and quantities would be below the Applying SEPP 33 thresholds. For storage, this demonstrates that operational inventories would not pose a significant risk of harm beyond the site boundary. For transportation, this also demonstrates that risks are unlikely to be significant.

It can be concluded that the risks associated with storage and transportation of hazardous materials are unlikely to be significant or pose a risk to public safety. Given that Applying SEPP 33 thresholds are not exceeded, the Project is not considered to be a hazardous or potentially hazardous industry under SEPP 33. Therefore a PHA is not required to be undertaken for the Project.

Bushfire Risk

A search of the NSW Rural Fire Service online bush fire prone land tool (NSW RFS, 2017) has indicated that the Project site exists within a designated bush fire prone area (refer to *Figure 15.1*). All development on bush fire prone land must satisfy the aim and objectives of *Planning for Bush Fire Protection 2009*. The aim is to provide for the protection of human life and minimise impacts on property from the threat of bush fire, while having due regard to development potential, site characteristics and protection of the environment.

The nature of the proposed Project activities will not increase the potential for or severity of bushfires in the locality, however the risk that a fire may start in the surrounding area and threaten the quarry will be addressed within the overall Emergency Response Plan. The existing site layout already provides an area of defendable space around all administration and workshop buildings, and the proposed clearing of land mapped as Vegetation Category 1, will result in further reduction of bushfire fuel loads. Nevertheless, due to the existence of the Project site within a bushfire prone area, associated bushfire prevention and mitigation measures are provided in *Section 15.4.2* below to minimise bushfire risks should they occur within and/or adjacent to the Project site.



LOT: 2	DP: 574308
LOT: 353	DP: 754434

BUSH FIRE NOTE:

Category 1, Category 2 and Buffer areas are defined as Bush Fire Prone Land

Mapping data certified by RFS on 6th July, 2010. Further enquiries can be made to Council's Duty Planner Monday to Thursday between the hours of 8.30am to 1pm

Legend

- Category 1
- Category 2
- Buffer

Source:

Port Macquarie-Hastings Council, 01/03/2018.

Bushfire Prone Land Map

F.15.1

Drawing No: 0418291s_HR_B_C001_R0.cdr		**Sancrox Quarry Expansion Project**
Date: 02/03/2018	Drawing size: A4	
Drawn by: GC	Reviewed by: TB	Client: Hanson Construction Materials Pty Ltd
Drawing Not to Scale	N	This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

ERM

15.3.3 *Potentially Offensive Assessment*

The assessment of the suitability of the Project site to accommodate existing or proposed development of a potentially offensive nature is based on consideration of:

- the nature and quantities of materials stored and processed on the site;
- the type of plant and equipment in use;
- the adequacy of proposed technical, operational and organisational safeguards;
- the surrounding land uses or likely future land uses; and
- the interactions of these factors.

The potential polluting discharges a development of this type that could generate that would be deemed offensive and cause adverse impacts if unmitigated are outlined in *Table 15.2*. Discussion of where these issues are addressed in the EIS and hence why they are considered to be mitigated is also outlined.

Table 15.2 Potentially Offensive Assessment

Potential Impacts	Discussion
Odour	Assessed in Chapter 11, and Annex H. Odour will be managed to prevent it from being offensive. A vapour balancing system will be installed for the delivery of bitumen on-site and vapour recovery system will be employed for transfer of asphalt to trucks to minimise odour and dust emissions. Moreover, the asphalt plant will be totally enclosed and particulate matter emissions will be mitigated using one fabric filter associated with the natural-gas fired dryer.
Noise	Assessed in Chapter 10 and Annex G. With the implementation of mitigation measures such as noise attenuation bunds and enclosures, noise has been modelled to be compliant with criteria and thus is considered unlikely to be offensive.
Air Emissions	Assessed in Chapter 11 and Annex H. With the implementation of mitigation measures, air emissions such as dust suppression and bag filters are not considered to be offensive.
Water Discharge/Runoff	Water discharges are assessed and discussed in Chapter 7 and Annex E. Mitigation measures in accordance with Landcom 2004 and DECC 2008 including sediment basins and progressive rehabilitation will manage potential impacts such that the water discharges can be deemed inoffensive.
Ground Contamination	Chapter 7 identifies a low likelihood of contamination exists in the proposed quarry expansion area. Chemical management and spill response measures are proposed to prevent future contamination and thus the proposed development is considered inoffensive with regards to ground contamination.

15.4 *MITIGATION MEASURES*

The mitigation measures to be implemented to address potential hazards and risks are provided below.

15.4.1 *Hazardous Materials Storage and Transportation*

Storage

The following mitigation measures will be implemented for the storage of hazardous materials to ensure compliance with the application of SEPP 33, including but not limited to:

- all hazardous substances that may be required for construction and operation would be stored and managed in accordance with the Storage and Handling of Dangerous Goods Code of Practice (WorkCover NSW, 2005) and Hazardous and Offensive Development Application Guidelines: Applying SEPP 33 (Department of Planning, 2011), including but not limited to the following:
  - diesel will not be stored with Class 3 materials;
  - lubricating and hydraulic oils and grease will not be stored with Class 3 materials; and
  - maximum stored inventories (250 kg) will be located more than 25 metres (m) away from the nearest site boundary, so as to not trigger the Applying SEPP 33 thresholds if considered in aggregate.

As bitumen and bitumen emulsions will be present in volumes greater than 10,000kg, SafeworkNSW are to be notified and manifests and emergency plans developed.

Transportation

Mitigation measures relating to the transport of potentially hazardous materials include:

- the method for delivery of explosives would be developed prior to the commencement of blasting in consultation with the DPI&E and be timed to avoid the need for on-site storage. No explosive storage on site is proposed.
- transportation routes outlined in the Traffic and Access Assessment (refer to *Chapter 12*) will be followed to ensure impacts to road systems will be minimised where practicable.

15.4.2 *Bushfire Prevention and Control*

Prevention

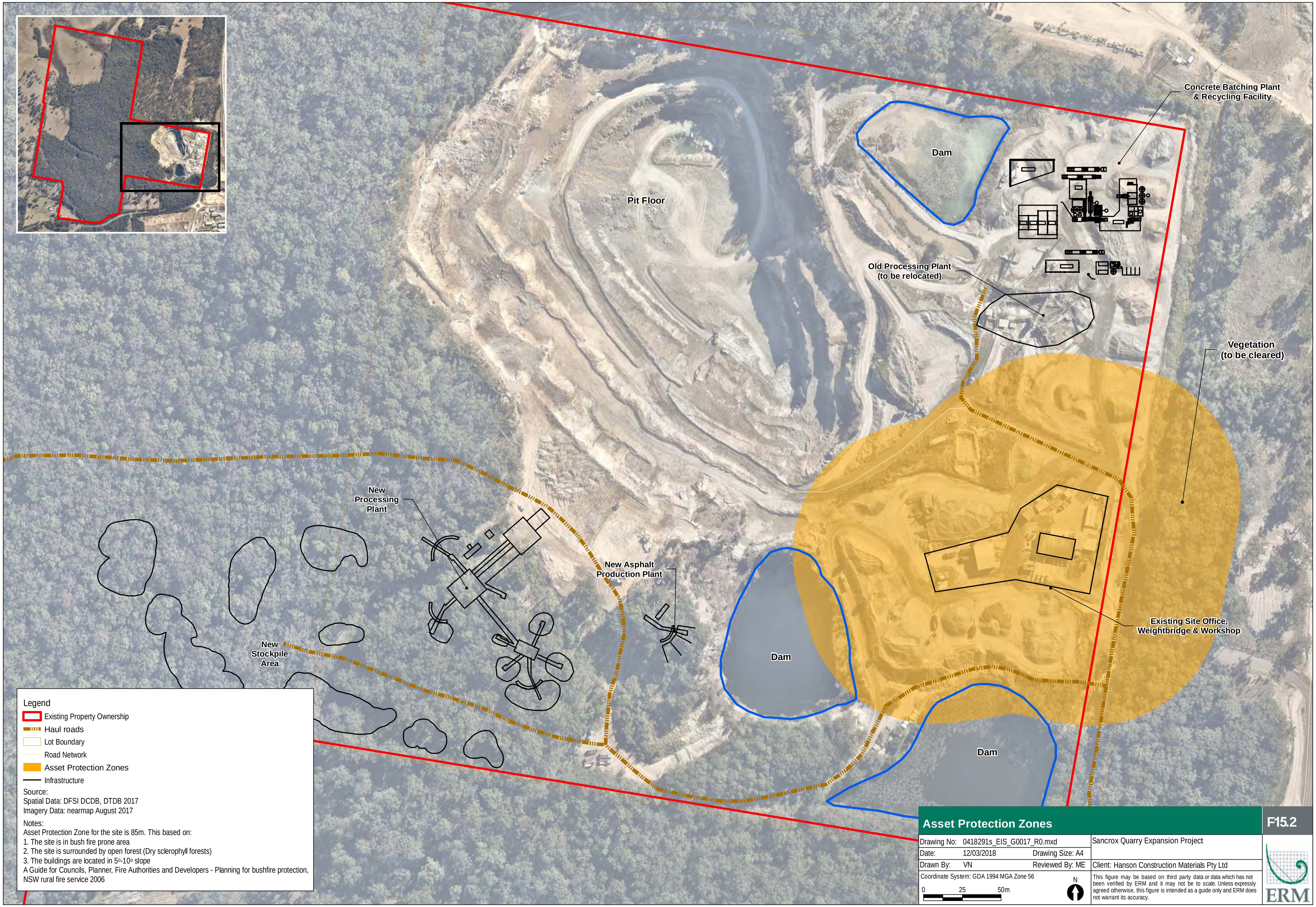
This section has been prepared to address the aims and objectives of *Planning for Bushfire Protection (2006)* as requested by the NSW Rural Fire Service.

For a bushfire to occur there are three factors which must be present, namely oxygen, fuel and an ignition source, along with several other factors which affect the probability and intensity of a bushfire. While exclusion of oxygen is not feasible, each of the remaining issues will be managed as follows.

- fuel loads within the Site will be managed through:
    - the maintenance of Asset Protection Zones (APZ) in accordance with the *Planning for Bushfire Protection Guidelines* (RFS, 2006) will be established and maintained around all administration buildings and the workshop areas, as outlined in *Figure 15.*2 below.
    - trees and shrubs will be maintained to prevent the spread of a fire towards the buildings, taking into account the requirement for an effective visual screen.
- company-controlled ignition sources and the associated management measures that will be implemented include the following:
    - all Project-related activities will be undertaken, where practicable, in cleared areas;
    - all mobile equipment will be maintained in good working order with appropriate exhaust and fire suppression systems;
    - all mobile equipment working in vegetated areas will be inspected to ensure that they do not pose a risk of starting a bushfire. This will include inspection of exhaust and electrical systems, including, in the case of vehicles using unleaded petrol, catalytic converters; and
    - mobile equipment working in vegetated areas will not be left unattended with the engine running.
- personnel, contractors and their employees will undergo site-specific training incorporating bush fire management awareness as part of the Project's induction program ensuring the following is outlined:
    - obligations toward prevention and notification;
    - all mobile equipment will be equipped with appropriate communication equipment, including two-way radios and/or mobile telephones;

- restriction of activities during periods of very high (or higher) bushfire danger rating;
- emergency response procedures;
- locations of fire-fighting equipment;
- adopt appropriate controls during re-fuelling; and
- ensure fire extinguishers are fitted to all site vehicles.
- welding or other hot works activities will, as far as practicable, be conducted and confined to the main workshop area

- fuel loads within the Project site will be managed in conjunction with Hanson's obligations in relation to rehabilitation of the Project site and biodiversity offset requirements.



Legend
- Existing Property Ownership
- Haul roads
- Lot Boundary
- Road Network
- Asset Protection Zones
- Infrastructure

Source:
Spatial Data: DFSI DCDB, DTDB 2017
Imagery Data: nearmap August 2017

Notes:
Asset Protection Zone for the site is 85m. This based on:
1. The site is in bush fire prone area
2. The site is surrounded by open forest (Dry sclerophyll forests)
3. The buildings are located in 5º-10º slope
A Guide for Councils, Planner, Fire Authorities and Developers - Planning for bushfire protection, NSW rural fire service 2006

Asset Protection Zones

F15.2

Drawing No: 0418291s_EIS_G0017_R0.mxd		Sancrox Quarry Expansion Project
Date: 12/03/2018	Drawing Size: A4	
Drawn By: VN	Reviewed By: ME	Client: Hanson Construction Materials Pty Ltd
Coordinate System: GDA 1994 MGA Zone 56		This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

Control

The ability to control a bushfire depends upon available fuel, control of ignition sources and good access and water supplies. The following fire management procedures will be adopted to assist with the control of any bushfire on or adjacent to the Project site:

- provision of access to strategic areas on the site;
- a static water supply is provided for firefighting purposes in areas where reticulated water is not available, this includes all weather access to the sedimentation dams;
- stockpiling of cleared vegetation with a minimum 10m cleared buffer zone; and
- creating suitable all weather access tracks (with suitable signage and turning circles if not a through road) and if required during a bushfire event, strategically located fire breaks.

Hanson will also incorporate bushfire management procedures in the overall Emergency Response Plan for the Project. A copy of the procedures, including a map of all fire-fighting equipment, access roads, communications protocol, emergency evacuation plans and any locked gates will be provided to the local RFS.

REFERENCES

Department of Planning (2011). Hazardous and Offensive Development Application Guidelines: Applying SEPP 33.

Hanson (2017a). *Brandy Hill Quarry Environmental Impact Statement – Hazard Impact Assessment*.

International Organisation for Standardisation and The International Electrotechnical Commission (2009). *Risk Management – Risk Assessment Technique* (ISO / IEC 31010:2009).

National Transport Commission (2007). *Australian Code for the Transport of Dangerous Goods by Road and Rail* (7th edition).

NSW Government (1992). *State Environmental Planning Policy 33 – Hazardous and Offensive Development* (SEPP 33);

NSW RFS (2018). Bush Fire Prone Land Mapping Tool. https://www.rfs.nsw.gov.au/plan-and-prepare/building-in-a-bush-fire-area/planning-for-bush-fire-protection/bush-fire-prone-land/check-bfpl

Port Macquarie – Hastings Council (2018). *Bushfire Prone Land Map* for the Sancrox Area.

WorkCover (2005). *Storage and Handling of Dangerous Goods Code of Practice*.

16 WASTE MANAGEMENT

16.1 METHODOLOGY

This waste assessment has been prepared to provide guidance on the classification and removal of wastes generated as a result of the construction and operation of the Project.

Hanson provided an estimation of waste types and volumes based on the understanding of waste generated by current operations on the site. Where such information was unavailable for the site, Hanson provided waste volumes based on waste generation estimates for the proposed Brandy Hill Quarry, which has a similar extraction rate to this Project. An understanding of the process of operating a concrete batching and recycling facility and an asphalt production plant were utilised to generate likely waste streams.

Regulatory guidelines referred to in the preparation of this assessment include:

- *Waste Classification Guidelines* (EPA 2014); and
- Resource Recovery Orders and Exemptions prepared by the New South Wales Environment Protection Agency (NSW EPA).

This assessment was prepared by ERM Environmental Scientists with experience in the preparation of waste impact assessments and management strategies for quarrying and industrial developments.

16.2 BACKGROUND

The requirements of the following legislation will be adhered to during construction and operation of the Project, to ensure the effective management of wastes on-site:

- *Protection of the Environment Operations Act 1997* (POEO Act)
- *Protection of the Environment Operations (Waste) Regulations 2005*
- *Waste Avoidance and Resource Recovery Act 2001*

The SEARs specify that waste management must be addressed in the EIS and include estimates of the quantity and nature of the waste streams that would be generated or received by the development and any measures that would be implemented to minimise, manage or dispose of these waste streams.

16.2.1 Management of Wastes

The NSW EPA is the state government agency responsible for initiating waste avoidance and resource recovery strategies as a method of ensuring ecological sustainability. These strategies will be implemented where possible for the construction and operation of the Project. The objectives of these strategies are to:

- minimise the consumption of natural resources;
- encourage resource recovery, including reuse, recycling and energy recovery;
- provide for continual reduction in waste generation; and
- minimise the final disposal of waste.

The Waste Management Hierarchy will be incorporated into the waste reduction and resource recovery strategies for the construction and operation of the Project. The principles of the hierarchy in order of priority are:

1. avoid;
2. reuse;
3. recycle/reprocess; and
4. dispose.

Hanson prioritizes waste avoidance and strives for best practice with extraction and processing of materials. This ensures the most efficient use of the available resource with minimal waste generation.

The guiding principle of the waste concrete recycling facility is the beneficial reuse of a resource in accordance with the Resource Recovery Order under Part 9, Clause 93 of the *Protection of the Environment Operations (Waste) Regulation 2014 – The recovered aggregate order 2014*.

Additionally, waste is to be managed in accordance with the requirements outlined throughout the POEO Act 1997, including the correct transportation of waste to a licenced facility (Section 143) and the disposal of waste in a manner that will not induce harm to the environment (Section 115).

16.2.2 *Identified Waste Streams*

Waste is classified in groups that pose similar risks to human health and the environment. This allows for correct management of these waste types and their disposal. The Waste Classification Guidelines (EPA 2014) identify six waste classes, including:

1. Special waste;
2. Liquid waste;
3. Hazardous waste;
4. Restricted solid waste;
5. General solid waste (putrescible); and
6. General solid waste (non-putrescible).

The anticipated waste types generated by the Project have been categorised into these waste streams, and provided in *Table 16.1*.

Table 16.1 Waste Streams generated by the Project

Waste Type	Classification
Employee generated waste	General solid waste (putrescible)
Sewage	General solid waste (putrescible)
Sediment	General solid waste (non-putrescible)
Overburden	General solid waste (non-putrescible)
Construction waste	General solid waste (non-putrescible)
Processing waste	General solid waste (non-putrescible)
Tyres	Special
Metal	General solid waste (non-putrescible)
Batteries	Hazardous Waste
Waste Concrete	General solid waste (non-putrescible). The Recovered Aggregate Resource Recovery Order (EPA 2014) applies.
Excess Asphalt	General solid waste (non-putrescible). The Reclaimed Asphalt Pavement Resource Recovery Order (EPA 2014)
Mulch	General solid waste (non-putrescible). The Mulch Resource Recovery Order (EPA 2016) applies.
Sediment entrained water	Liquid Waste
High alkalinity water	Liquid Waste
Oil and grease	Liquid Waste

16.3 *WASTE GENERATED AT SANCROX QUARRY*

16.3.1 Employee Generated Waste

Employee generated waste is classified as *General Solid Waste (putrescibles)* in accordance with EPA guidelines (EPA 2014). The waste is composed of everyday waste items such as food scraps, paper, aluminium cans, plastics, packaging and other materials generated by on-site staff. Collection bins are provided for recyclable materials (including paper and cardboard, glass bottles and aluminium cans). General domestic and recyclable waste generated by on-site staff will be appropriately managed and disposed of at an appropriately licenced landfill.

16.3.2 Sewage

Effluent from on-site staff amenities will be managed via the current, council approved on-site septic system.

16.3.3 Sediment

Sediment basins within the Project site require de-silting to ensure they have sufficient capacity to capture water during heavy rain events. The basins will have measuring guides installed to allow for measurement of sediment levels. De-silting occurs as needed and is often dependant on the volume of rainfall received. This waste material will be used for site revegetation.

16.3.4 Overburden

Overburden will be reused on-site. If required to be removed from site, it is considered a 'virgin excavated natural material' as classified by *Waste Classification Guidelines, Part 1: Classifying Waste* (EPA 2014). Overburden stripped during quarry operations will be used for earth bunds and water diversions on the perimeter of the quarry. Final reuse of the overburden will be for rehabilitation both progressively as quarrying is completed and towards the end of its life.

16.3.5 Construction Waste

The construction of the new quarry processing plant, concrete batching plant and other ancillary facilities proposed as part of the Project is expected to generate non-putrescible construction waste temporarily over the construction period. It is difficult to quantify the extent of the anticipated construction waste due to the unknown nature of how suppliers will package products. However a similar project undertaken by Hanson at Brandy Hills Quarry assumed 40m^3 of waste associated with construction activities of a concrete batch plant, concrete recycling facility and pre-coat plant. Skip bins will be used over the course of the construction period to manage this stream. The construction waste will be managed in accordance with the legislative requirements outlined above and where possible, construction waste materials will be recycled (e.g. pallets sent back to supplier or reused on-site).

16.3.6 *Mulch*

Vegetation clearing is required to allow for the expansion of the quarry footprint. This vegetation will be mulched. Where possible, any valuable timber will be harvested for alternative use prior to mulching. Mulch is suitable, when used appropriately, for sediment controls at the quarry site. Mulch is also suitable for off-site, beneficial reuse in accordance with the Resource Recovery Order under Part 9, Clause 93 of the *Protection of the Environment Operations (Waste) Regulation 2014 – The Mulch order 2016*.

Where mulch cannot be reused on-site, it will be taken to off-site locations that meet the exemption and order requirements for beneficial reuse, including the preparation of a risk management protocol. The volume of mulch likely to be produced has not been estimated, though all mulch produced by the Project is planned for beneficial reuse either on-site or in accordance with the resource recovery exemption.

16.3.7 *Product Processing Waste*

The majority of solid products from quarry processing are intended for construction projects, including the fines (fine materials/aggregates often with limited commercial value, such as clay and fine sand/fine aggregates) that have been traditionally regarded as waste. Fines will be blended with other extracted materials to produce a usable product where possible, or will be reused on-site.

The quantity of product processing waste is variable depending on the type of materials being generated (smaller size rock will produce more fines), and the fact that washing will not be required for all materials generated by the quarry. Ultimately, this waste stream can be beneficially reused or incorporated into product sold to market.

16.3.8 *Tyres*

Tyres are classified as special waste in accordance with the EPA Waste Guidelines (EPA 2014). Hanson currently operates Brandy Hill Quarry that extracts 700,000 tpa. Depending on tyre wear, this quarry uses between four and eight tyres per annum. Most mobile plant requires new tyres every three years and depending on wear can last much longer. Due to the similar extraction rate, the waste tyre generation rate from Brandy Hill Quarry is considered a suitable estimate for likely waste tyre generation rates from the Project.

The addition of new plant for the proposed concrete and asphalt operations will further add to the annual waste tyre generation rate. These operations are conservatively estimated to generate 1-2 tyres per annum.

Tyres are recycled onsite and used as barriers, however should tyres be taken off-site for disposal, the waste tracking requirements under *Protection of the Environment Operations (Waste) Regulation 2014* will be met. The trigger for load tracking of waste tyres is greater than 20 tyres or 200kgs within NSW.

16.3.9 Metal

Scrap metal is stored in a scrap metal bin on-site until a quantity sufficient for on-sale to a metal recycler is accumulated. The price available for scrap metal also determines the quantity accumulated on-site prior to selling.

The scrap metal is generated by routine maintenance activities to the site plant.

Brandy Hill Quarry generates approximately 26 m^3 of scrap metal per annum. This is removed from the site approximately every six weeks. With the additional plant required for concrete and asphalt operations, which will require maintenance and potentially generate scrap metal, a conservative estimate of double the likely scrap metal generation rate (52 m^3 of scrap metal per annum) has been predicted.

Where suitable, scrap metal is also currently reused on-site. This practice will continue with ongoing operations.

16.3.10 Batteries

Batteries are classified as hazardous waste. Spent batteries that have been removed from plant during maintenance activities are stored on-site within a bunded, covered area until they can be taken to an appropriate licenced disposal location. Batteries are very minor contribution to the overall waste stream generated at the Sancrox Quarry.

Based on waste battery generation rates at Brandy Hill Quarry, the increased quarrying activities are likely to generate approximately six batteries per annum. The additional concrete and asphalt operations may contribute 1-2 batteries per annum.

Employees are aware that transporting in excess of 200 kg of lead acid batteries is illegal without a licence to do so.

16.3.11 Waste Concrete

The Project includes the development of a concrete recycling facility. The facility is proposed to receive 20,000 tpa of waste concrete. Waste concrete is suitable for beneficial reuse in accordance with the Resource Recovery Order under Part 9, Clause 93 of the *Protection of the Environment Operations (Waste) Regulation 2014 – The recovered aggregate order 2014*. The waste concrete will be suitable for reuse following conformance with the testing to confirm the absence of potential contaminants as outlined in the Recovered Aggregate Order 2014. Small quantities of waste concrete may be generated by the concrete agitator washout bay and surplus from the batching process but will be recycled on-site.

16.3.12 Excess Asphalt

Excess asphalt generated by the production process will be reused on site where practicable. Should offsite disposal be required, the resource recovery exemptions will be implemented to ensure beneficial reuse rather than disposal to landfill.

16.3.13 Liquid Wastes

Sediment Laden Water

The water supply at Sancrox Quarry for operational purposes is planned to be self-sufficient and maximise water recycling practices within quarry operations. Measures will be implemented to ensure that all water demands are met, thereby limiting discharge to local receiving waters. The use of internally sourced water will be a method of managing stored volumes on-site and thus will likely limit the volume and regularity with which sediment basins on-site may have otherwise discharged.

All sediment basins will be licenced to discharge, with appropriate criteria relating to water quality and basin design size, to limit the impacts to receiving waters. The proposed design of the sediment basins means they will typically overflow at a frequency of six to eight times per year, which is in accordance with *Managing Urban Stormwater: Soils and Construction, Volume 2E Mines and Quarries* (DECC 2008).

Highly Alkaline Water

Highly alkaline water will be generated by concrete truck washout and the concrete batching activities. A first flush system will be developed to drop out any entrained sediment and the water will be recycled through the concrete batching operations.

Oil and Grease

Grease and lubricants are classified as Liquid Waste in accordance with the *Waste Classification Guidelines* (EPA 2014). Small quantities of these wastes may be generated by construction activities and plant maintenance during operation. To protect against any environmental harm, these wastes will be stored in designated drums for recycling at an appropriate off-site recycling facility. The waste oil will be collected by the licenced waste oil recycling contractor.

Waste oils arising from the maintenance of heavy machinery will be disposed of by maintenance contractors under their own licensing agreement. Contractors will be required to have spill protection protocols in place when working on the site. Spill response equipment will be stored on the site, in case of unforeseen spills.

Brandy Hill Quarry generates approximately 18,000 litres of oil per year that is sent off-site for recycling. The concrete and asphalt batching operations are estimated to contribute approximately 3,000 litres of oil per annum.

Oil filters will be sent off-site for recycling. Enclosed storage bins for filters will be provided by waste oil contractors.

16.4 *ESTIMATED WASTE GENERATION*

An estimate of the quantity and nature of the waste streams to be generated by the Project are provided in *Table 16.2* below.

Table 16.2 Estimated Waste Generation by the Project

Waste	Estimated Quantity
Employee generated waste	Similar project undertaken by Hanson at Brandy Hills Quarry assumed 405m^3 per year (site office, weighbridge and workshop) for a similar sized number of employees. This is considered a suitable, conservative estimate for the Project
Sewage / Effluent	Approximately 365,000L per year, based on 40L/day generated by proposed total of 25 operational employees
Sediment	Removed when required on-site, highly variable depending on final dam sizing and rainfall received
Overburden	Approximately 1.4 million bank cubic metres. It is noted that overburden may be used as commercial product for road base, general fill etc., where not kept on-site for later rehabilitation
Construction waste	Similar project undertaken by Hanson at Brandy Hills Quarry assumed 40m^3 of waste associated with construction activities
Processing waste	Variable depending on numerous factors
Tyres	5-10 per year
Metal	52 m^3 per year
Batteries	7-8 batteries per year
Waste Concrete	Any waste generated on-site by agitator washout and surplus from the batching process will be recycled within the concrete recycling facility (capacity for 20,000 tonnes per year)
Excess asphalt	To be reused in the process where practicable or implement a resource recovery exemption to ensure beneficial reuse rather than disposal to landfill
Mulch	Unknown. Resource recovery exemption to be implemented to ensure beneficial reuse
Sediment entrained water	Variable dependent on rainfall
High alkalinity water	Variable dependant on production and rainfall
Oil and Grease	21,000 litres per year

1. Data provided by Hanson

16.5 *MITIGATION MEASURES*

Mitigation measures to be implemented to minimise wastes generated by the Project include:

- separation of recyclable and non-recyclable materials will take place where possible and be stored in designated receptacles;
- waste receptacles will be collected on a regular basis by licensed contractors or Council collection service and transported for off-site disposal at an appropriately licensed landfill or recycling facility;
- beneficial reuse of suitable resources will be undertaken where practicable, in accordance with relevant requirements of the relevant resource recovery order and exemption;
- all waste disposal will be in accordance with the POEO Act and *Waste Classification Guidelines* (EPA 2014);
- waste tracking will occur for any types and quantities of waste that trigger the requirement for tracking; and
- waste management measures will be incorporated into the site Construction and Operation Environment Management Plan (or form its own separate sub-plan if requested by the DP&E) which will outline measures to avoid waste generation and promote reuse, recycling and reprocessing of waste where possible.

REFERENCES

Hanson 2017b. **Brandy Hill Expansion Project Environmental Impact Statement – Appendix 14A – Waste Impact Assessment**.

NSW Environmental Protection Authority 2014. **Waste Classification Guidelines Parts 1-4**.

NSW Department of Planning and Environment (2017). **Guidelines for preparing an Environmental Impact Statement.**

17 *QUARRY CLOSURE AND REHABILITATION*

This chapter outlines the anticipated closure and rehabilitation activities proposed to be undertaken post-quarry operations.

17.1 *CLOSURE AND REHABILITATION FRAMEWORK AND METHODOLOGY*

The effective closure and rehabilitation of the quarry site will incorporate key principles outlined in the following guidelines:

- *Mine Rehabilitation Handbook* (Commonwealth Department of Industry Tourism and Resources [CDITR], 2006);
- *Mine Rehabilitation – Leading Practice Sustainable Development Program for the Mining Industry* (Commonwealth Department of Industry, Innovation and Science [CDIIS], 2016a);
- *Mine Closure– Leading Practice Sustainable Development Program for the Mining Industry* (CDIIS, 2016b); and
- *Strategic Framework for Mine Closure* (Australian and New Zealand Minerals and Energy Council [ANZMEC] and Minerals Council of Australia [MCA] (ANZMEC/MCA, 2000).

The SEARs includes the following specific requirements relating to the rehabilitation of the quarry site:

- the proposed rehabilitation strategy for the site having regard to the key principles in the *Strategic Framework for Mine Closure*, including:
  - rehabilitation objectives, progressive rehabilitation commitments, methodology, monitoring programs, performance standards and proposed completion criteria;
  - nominated final land use, having regard to any relevant strategic land use planning or resource management plans or policies; and
  - the potential for integrating this strategy with any other rehabilitation and/or offset strategies in the region.

These rehabilitation requirements have been addressed in this chapter of the EIS.

This chapter has been prepared by ERM Environmental Scientists with previous experience in the preparation of rehabilitation strategies for quarry projects.

17.2 *FINAL LAND USE OPTIONS*

The 30 year life of the proposed quarry operations expose the project and its final land use to potential changes in stakeholder expectations, requirements and preference for the final land use options at the quarry. There is also the possibility for updated guidelines from government that outline rehabilitation requirements and methodologies. Hanson commit to regular consultation with community and relative government agencies to ensure the final land use/rehabilitation of the quarry is acceptable. The current conceptual rehabilitation and final land use options are outlined below, with rehabilitation of the site with native endemic plant species, and inundation of the void over time by surface and groundwater being considered a suitable Conceptual Closure Plan for use during feasibility, development and detailed design.

17.2.1 *Rehabilitation with Native Endemic Plant Species*

The industry standard approach to rehabilitation could be applied to the site, aiming to rehabilitate it to a self-sustaining, stable condition which is revegetated with native endemic plant species. Once established, this approach would provide habitat for native plants and create a vegetative corridor connecting habitat suitable for use by native fauna.

Such an approach would be consistent with the *Port Macquarie Hastings Biodiversity Strategy (2017 – 2030),* as discussed further in *Section 17.4*.

Final Landform

The final landform includes benched quarry walls and a quarry floor at RL –40m AHD. The benches above the inundated void (the void will naturally accumulate surface water and groundwater) will be topsoiled and revegetated with suitable native, endemic species. The benches will be constructed to drain and outlet to stabilised areas, or to the quarry void as determined by topography.

Diversions will be established, as the quarry stages progress, that divert clean water from undisturbed upslope catchments from entering the quarry and these will remain in place upon the completion of quarrying. The topography of the site and the depth of the quarry void will be such that it will accumulate surface and groundwater.

Unauthorised access will continue to be prevented by the maintenance of fencing established during the early phases of the Project. Prominent signage for warning against entry and informing of rehabilitation activities will be provided.

Infrastructure will be decommissioned and removed from site. This will allow for revegetation to commence, or the ongoing use of these pad sites for future proposed activities, depending on the final rehabilitation option that is chosen.

17.2.2 Treated Effluent Storage within the Quarry Void for Beneficial Reuse

A previously considered end use of the final quarry void is as a storage for treated effluent from PMHC's sewage treatment plants. The non-potable water source would be available for beneficial reuse for either agricultural, construction or wildlife purposes. The current EMP (ERM, 2014) outlines this treated effluent water storage as a rehabilitation strategy to be implemented.

The end use for the existing processing areas, stockpile areas and the additional cleared, flat site that will be created for the establishment of the asphalt plant, is yet to be determined. It is anticipated that these cleared, flat areas will be suitable for a wide range of industrial or transport uses, inclusive of infrastructure to assist in managing the beneficial reuse of the treated effluent (likely pumping station, potentially pipeline infrastructure, site sheds, etc.). The end use of these areas situated above the quarry void will be determined in consultation with relevant stakeholders during the progression of the quarry, with rehabilitation measures to be designed to suit this final end use.

The final landform will include benching that will be revegetated, where it is above the proposed treated effluent inundation levels within the void. This revegetation will occur as outlined in *Section 17.2.1*.

The proposed storage of treated effluent would require further assessment closer to the time of closure to consider the proposed expansion and revised final quarry void (volume, depth, groundwater interaction) to ensure that such an option remains viable. The quarry life has also been extended, meaning that the quarry cannot be used as storage for 30 years from any potential approval date, thus potentially affecting the viability of this option.

Implementation of this rehabilitation option would align with the *Hastings Effluent Management Strategy*, as discussed further in *Section 17.42*.

17.2.3 Rehabilitation Objectives

General rehabilitation objectives as outlined in CDIIS (2016a) are dependent on which rehabilitation option is chosen:

- rehabilitation to a new landform, land capability or final land use. This general rehabilitation objective will be applied should the option to use the quarry void for the storage of treated effluent be chosen; and

- restoration or reclamation of the area so that the pre-mining conditions are replicated (75% of mines in Australia use native plant species because the establishment of native ecosystems gives the greatest chance of self-sustainability). This general objective will be applied should the option to revegetate the site with native, endemic species be chosen.

In either case, the final rehabilitated site will meet the following criteria typically required by Australian regulatory agencies (CDIIS, 2016a):

- stable;
- incorporate native vegetation;
- non-polluting; and
- safe/secure to prevent negative impacts to humans and wild/domesticated fauna.

Beneath the overarching general rehabilitation objective are more specific temporal social and financial objectives requiring consideration. These specific objectives are outlined in the *Strategic Framework for Mine Closure* (ANZMEC/MCA, 2000) and include to:

- enable all stakeholders to have their interests considered during the closure process;
- ensure the closure process occurs in an orderly, cost-effective and timely manner;
- ensure the cost of closure is adequately represented in company accounts and that the community is not left with a liability;
- ensure there is clear accountability, and adequate resources, for the implementation of the closure plan;
- establish a set of indicators which will demonstrate the successful completion of the closure process; and
- reach a point where the company has met agreed completion criteria to the satisfaction of the responsible authority.

These objectives will form the basis of the Quarry Closure and Rehabilitation Plan to be prepared post-approval. The Plan will be prepared to the preferred option of rehabilitation with native endemic plant species and inundation over time by surface and groundwater.

The site's rehabilitation outcomes associated with these objectives are separated into short and long-term outcomes. Short-term outcomes concentrate on the opportunistic, progressive stabilisation as quarrying activities within each stage are completed. Long-term outcomes focus on the effective decommissioning and rehabilitation of the site to comply with environmental and legal requirements, along with satisfying the expectations of the local community and stakeholders.

Measuring success against rehabilitation outcomes will be assessed through the inclusion of specific performance indicators and monitoring strategies. The Quarry Closure and Rehabilitation Plan will be regularly reviewed to ensure that outcomes and performance indicators are being met, and whether the need exists to modify the plan to better suit the current environment. The proposed rehabilitation outcomes are provided in *Table 17.1* below.

Table 17.1 Rehabilitation Outcomes

Outcome	Completion Criteria	Performance Indicator	Management Monitoring Strategy
Short Term			
Safety - Ensuring quarry pit benches are stable.	The stabilised benches don't pose a security or safety risk.	The final quarry pit and associated infrastructure area is geotechnically stable.	Conduct periodic geotechnical assessments based on a risk assessment approach. Develop and undertake action plan based on findings and recommendations from geotechnical assessment. Geotechnical assessment of terminal benches on closure of quarry.
Conservation of soil resources, particularly topsoil during quarrying activities.	Rehabilitated areas are to have adequate soil depth and quality to support revegetation.	Topsoil has adequate nutrient levels to support revegetation.	Topsoil from stripping will be stockpiled separately and securely. The location is to be recorded by GPS and noted in the Quarry Clouse and Rehabilitation Plan to be prepared. Soil testing will be undertaken to determine requirement for ameliorants, to ensure suitable growth medium is provided to enhance likelihood of revegetation success.
Progressive stabilisation of areas where quarrying is complete, as soon as is reasonably practicable.	Stabilisation in accordance with (Landcom 2004) achieved such that erosion and subsequent sediment entrained run-off/fugitive dust are mitigated	Compliance with operational air quality criteria. No off-site sedimentation issues associated with revegetated areas.	Operational Air Quality Management Plan criteria, controls, and monitoring commitments to be implemented Operational erosion controls are outlined in Chapter 7 of the EIS. Management measures will be detailed in the Operational Erosion and Sediment Control Plan and in Progressive Erosion and Sediment Control Plans developed as opportunities arise for progressive rehabilitation.

Outcome	Completion Criteria	Performance Indicator	Management Monitoring Strategy
Long Term			
Legal requirements and standards	Relevant stakeholders to develop and propose standards that are both acceptable and achievable. Agreed standards are to be adopted into the Quarry Closure and Rehabilitation Plan.	Compliance with the Quarry Closure and Rehabilitation Plan.	Rehabilitation will be regularly reported on in the Project's Annual Review.
Environmental management requirements	Rehabilitated quarry will not present an ongoing environmental liability.	Rehabilitated quarry is consistent with the final landform approved in the project's Quarry Closure and Rehabilitation Plan. Successful achievement of the quarry rehabilitation will result in the NSW EPA allowing the relinquishment of the EPL.	Rehabilitation will be regularly reported on in the Project's Annual Review.
Decommissioning of plant, buildings and infrastructure	Demolition/removal of buildings no longer in use in accordance with Australian code of practice applicable at the time of quarry end of life.	Completed to the satisfaction of the regulating body (i.e. Port Macquarie Hastings Council and/or DPI&E).	Responsibility of the approved demolition contractor in conjunction with the relevant approval authorities.
	Maximise the recycling of building materials.	Buildings, plant, and structure materials are recycled and not disposed of in landfill.	Quarry Closure and Rehabilitation Plan to detail how building materials will be recycled.
	Identification of contaminated sites for remediation.	Remediation of any contaminated land.	Clearance certificates and validation reports. Records of off-site disposal of wastes.

Outcome	Completion Criteria	Performance Indicator	Management Monitoring Strategy
	All internal roads, car parks, office structures, auxiliary structures, the processing plant and concrete batching plant are removed should this be required to meet the desired final use.	Survey of infrastructure to be removed at the time of quarry closure.	Site assessment by a suitably qualified person.
Stakeholder involvement	Stakeholder identification, consultation, involvement and communication with the long-term rehabilitation process and final landform.	Compliance with the Quarry Closure and Rehabilitation Plan.	Included in the Community Consultative Committee meeting agenda. Maintenance of community consultation register.
Final landform planning	Quarry Closure and Rehabilitation Plan for use during feasibility, development and detailed design.	Closure planning is required to ensure that closure is technically, economically and socially feasible.	Quarry Closure and Rehabilitation Plan will be prepared to the preferred option of rehabilitation with native endemic plant species and inundation over time by surface and groundwater. The Plan will be modified as a result of any operational change, new regulations or new technology, and will be comprehensively reviewed on a regular and pre-determined cycle (e.g. every 3 to 5 years). The Plan will be flexible enough to cope with unexpected events, and will include the management of social and financial issues associated with rehabilitation, as well as environmental issues.
Financial costing and provisioning	A cost estimate for closure will be developed from the Quarry Closure and Rehabilitation Plan.	The relevance of closure costs for financial stewardship reporting purposes is recognised by the accounting profession.	Closure cost estimates will be reviewed regularly to reflect changing circumstances. Progressive rehabilitation will be undertaken to lessen the cost burden at the end of the Project when income from quarry activities has ceased.
	Adequate securities will protect the community from closure liabilities.	Financial surety instruments.	Financial securities accounted for and reconciled annually through the Project's Annual Review.

17.3 *REHABILITATION STRATEGY*

17.3.1 *Existing Rehabilitation*

Rehabilitation measures have already been undertaken at the Project site and have included planting of endemic species along the northern bank of the existing earth mound on the northern boundary adjacent to the stockpiles and the northern part of the active quarry area. These revegetated areas act as a visual screen to adjacent properties. Revegetation activities took place in 2001 and 2002 using the following endemic species:

- Callistemon (4 species);
- Eucalypt (3 species); and
- Acacia (4 species).

Rehabilitation of the northern face of the dam wall adjacent to the crushing plant occurred in 2009, which included the planting of endemic grasses and tree species to prevent erosion of topsoil and to effectively promote native revegetation opportunities throughout the site.

17.3.2 *Progressive Rehabilitation*

Sancrox Quarry currently practices progressive rehabilitation on site. Hanson's opportunistic and progressive rehabilitation would continue throughout the Project life, as part of a planned program of activities to achieve an acceptable final landform. Rehabilitation will be carried out progressively following each stage of extractive operations to ensure a stable landform and to control soil erosion.

The progressive approach helps minimise the liability falling on the operator by rehabilitating the quarry during the operation rather than undertaking the larger task of rehabilitating the quarry following the closure of the quarry, when there is no direct income from quarrying activities (CDITR 2006).

The progressive approach will allow for rehabilitation methods to be tested and consequently improved to ensure rehabilitation methods are effective (CDITR 2006).

The progressive approach will be beneficial to the overall structure of the ecosystem following the conclusion of quarrying activities. The diversity of the ecosystem will be enhanced by the stands of vegetation of differing ages, heights and depths from the staggered timing of the revegetation activities.

17.3.3 *Future Rehabilitation Requirements*

Quarry Faces

Batter slopes rehabilitation works are only required on those benches located above the final water level that will inundate the void (either if the void naturally accumulates surface water and groundwater or is used as storage of treated effluent).

The benches will be excavated with a cross fall towards the upper batter, forming a table drain at the foot of that batter. The benches will be constructed to drain to stable vegetated areas or the water filled void. Suitable sediment control and velocity impediments (hay bales, geofabric filter fences and/or rock weirs) will be employed to minimise potential for scouring of the table drain within the bench and subsequent sediment transportation. A clean water diversion drain will be constructed at the top of the batter/quarry footprint, where there is the potential for in-flow of upslope run-off.

The benches will be revegetated as follows:

- the benches are to be ripped and spread with topsoil (consisting of previously stockpiled topsoil, sediment collected from silt retention dams and crushing works). The bench will be planted in clumps with endemic species (e.g. species of Eucalypt, Acacia and Callistemon) or those as considered appropriated with the *Port Macquarie Hastings Biodiversity Strategy (2017-2030)* along its length;

- topsoil will be spread over the upper part of the batter and clump planted with endemic species; and

- native groundcovers will be introduced at 1.5 m intervals along the top and bottom of the un-vegetated sector of the batters.

Production, Processing and Stockpile Areas

Rehabilitation of the production, processing and stockpile areas will commence at the completion of extraction and removal of all stockpile products and infrastructure. The rehabilitation of these areas will involve re-grading the main processing and stockpile floor to even grades, where not already flat.

Topsoil is to be spread to a depth of 150 mm (using the sediment collected from silt retention dams and the processing works) over the stockpile floor and revegetating in a manner suitable to its determined end-use.

If an industrial/transport end-use is chosen, then the stockpile floor will be seeded with native grasses, outside of the footprint of any proposed infrastructure. If no such end-use has been determined, the stockpile floor will be clump planted with endemic species including Eucalypt, Acacia and Callistemon, or endemic species that align with the objectives of the *Port Macquarie Hastings Biodiversity Strategy (2017-2030).*

Funding for Rehabilitation Activities

Hanson is committed to the ongoing allocation of funds for the progressive rehabilitation of the quarry in determination of its operational budgets. The allocation of funds will be tied to demand and the output of the quarry. The allocated money will be accumulated pending the availability of areas to be rehabilitated. The budget allocation may also be increased over the lifetime of the quarry to reflect inflationary changes and rehabilitation needs as necessary.

Maintenance of Rehabilitated Areas

Rehabilitated areas are to be maintained as follows:

- following planting, plants will be watered daily for the first week and once a week for the following three months;
- preceding this establishment stage, watering will be undertaken on an as needed basis, with increased watering in dry periods;
- weed control measures will be implemented on a three monthly basis for the first two years following planting; and
- erosion control devices will be regularly inspected (monthly) and particularly after heavy rainfall to ensure proper operation.

Monitoring Rehabilitation Performance

Regular monitoring of the revegetated areas will be required during the initial vegetation establishment period and beyond to demonstrate that the objectives of the rehabilitation strategy are being achieved and that a sustainable, stable landform has been provided. The adjacent remaining vegetation would provide a suitable reference site for comparison.

Monitoring will be conducted periodically by independent, suitably skilled and qualified persons at locations which will be representative of the range of conditions on the rehabilitating areas. Annual reviews will be conducted of monitoring data to assess trends and monitoring program effectiveness. The outcome of these reviews will be included in Project's Annual Review.

17.4 INTEGRATION WITH EXISTING STRATEGIES

17.4.1 Port Macquarie Hastings Biodiversity Strategy (2017-2030)

The SEARs require the EIS to outline the potential for integration of this rehabilitation strategy with other existing rehabilitation/offset strategies within the PMHC region. PMHC has recently prepared a *Biodiversity Strategy (2017-2030)* which aims to guide and enable strategic growth and development while conserving biodiversity values throughout the region.

Rehabilitation of the Sancrox Quarry will be undertaken with due regard to the findings and information provided throughout the *Biodiversity Strategy (2017-2030)*, as it contains critical information in regards to the ecological value across the region. Such information will be used in conjunction with the rehabilitation strategies and objectives outlined throughout this plan to ensure effective rehabilitation of the landscape.

In the event that additional relevant strategies are prepared during the Project's lifetime, then effort will be made to align the operations being undertaken at Sancrox Quarry with the relevant guidelines identified throughout the relevant strategy.

17.4.2 Hastings Effluent Management Strategy

In 2006, PMHC confirmed that investigation into potential future use of Sancrox Quarry as a non-potable water source would occur. The proposal included possible use of the final quarry void as a storage for treated effluent from the Port Macquarie and Wauchope Sewage Treatment Plants. This storage would allow for the beneficial reuse of the treated effluent.

The treated effluent to be stored in the final void was for either agricultural, construction or wildlife purposes. Utilisation of the quarry for such a purpose aligns with the strategic planning of the PMHC.

REFERENCES

ERM (2014). *Sancrox Quarry Environmental Management Plan*. Prepared for Hanson Construction Materials Pty Ltd.

Commonwealth Department of Industry Tourism and Resources (CDITR) (2006) *Mine Rehabilitation Handbook.*

Commonwealth Department of Industry, Innovation and Science (CDIIS) (2016a). *Mine Rehabilitation – Leading Practice Sustainable Development Program for the Mining Industry.*

Commonwealth Department of Industry, Innovation and Science (CDIIS) (2016b). *Mine Closure – Leading Practice Sustainable Development Program for the Mining Industry* (Commonwealth).

Australian and New Zealand Minerals and Energy Council (ANZMEC) and Minerals Council of Australia (MCA) (ANZMEC/MCA, 2000). *Strategic Framework for Mine Closure*.

18 MITIGATION MEASURES

The SEAR's prepared for the proposed development require the preparation of:

- *a consolidated summary of all the proposed environmental management and monitoring measures, identifying all the commitments in the EIS;*

This chapters collates the mitigation measures identified throughout the impact assessment process and wider EIS prepared for the proposed development.

The mitigation measures are consolidated in *Table 18.1*.

Table 18.1 Summary of Mitigation Measures

Overarching Environmental Aspect	Specific Environmental Issue/timing	Mitigation Measure
Biodiversity	Pre-construction	Fauna residing within or occupying the expansion area are safely and ethically salvaged and relocated. Delineate quarry expansion limit (to ensure no native vegetation outside expansion area is cleared). Install and maintain erosion and sediment control measures in accordance with the requirements of the 'Blue Book' (Landcom 2004).
	During construction	Supervision of tree felling to rescue and recover any fauna (as necessary). • Vehicle wash-down • Site weed control program • Prepare weed control plan Rubbish (such as food scraps and building waste) are to be properly managed during construction and must not be stockpiled on areas of native vegetation. Revegetation – re-use topsoil and seeding of pasture grasses and legumes (or as directed in relevant revegetation guidelines or management plans). • Speed limits of 40 km/hr (or less if lower speed limit imposed in other environmental assessments) to be imposed within site, reducing the likelihood of animal strikes. • Educate workers on possibility of animal strike through construction management program. Design and implement a planting plan for corridor of native vegetation east and west of proposed quarry pit, to maintain north-south corridor link of canopy trees, as per sub-regional corridor in Greater Sancrox Structure Plan (PMHC 2015).
	Post-construction	Speed limits of 40 km/hr (or less if lower speed limit imposed in other environmental assessments) are proposed, reducing the likelihood of animal strikes. Limit spread of weeds in accordance to the methods provided throughout the landscape maintenance program and weed control plan. Each luminaire will be aimed downwards and only switched on during loading-unloading and servicing activities outside of daylight hours and during heavy fog.

Overarching Environmental Aspect	Specific Environmental Issue/timing	Mitigation Measure
		Appropriate systems will be implemented to ensure that each waste stream generated by the development is effectively managed and/or disposed of off-site (see *Chapter 16*). There will not be any on-site stockpiling or disposal of waste materials. Maintain and monitor plantings within proposed native vegetation corridors east and west of quarry pit. An engineered surface water drainage and management strategy is to be prepared and implemented. Techniques currently proposed to manage stormwater include bunding walls, swales, underground water capture systems and dams (see *Chapter 7*).
Heritage	Historic Heritage	In the unlikely event that historic heritage items are found during works, the following Unexpected Finds Protocol will be followed. • where a potential historic heritage item is found during works, all works within the vicinity of the item, or with the potential to impact the item will cease and a temporary exclusion zone established; • an appropriately qualified heritage consultant will examine the item to assess its significance and further archaeological potential; and • where a relic is found, the NSW Heritage Council will be notified and approval will likely be required prior to the continuation of works. Other archaeological deposits will be recorded and assessed for significance and potential salvage by an appropriately qualified heritage consultant.
	Aboriginal Heritage	The potential scarred tree is located within the western extent of the proposed extraction area and is likely to be impacted as a direct result of extraction. It is recommended that BLALC is afforded the opportunity to retain the scar for educational and interpretive purposes (if requested). The ceremonial site, although now completely destroyed, is considered to have high cultural significance and recognition of its location within the Sancrox area could be considered for display in the quarry site office. The development of any cultural information will be undertaken in consultation with the BLALC. The Unexpected Finds Protocol provided throughout the Heritage Assessment (Annex D) will be followed if further Aboriginal heritage sites, or suspected human skeletal remains are encountered during works. Cultural Awareness Training In order to comply with best practice principles, all employees and subcontractors will undergo environmental awareness training as part of the site induction to ensure they understand their obligations and responsibilities.

Overarching Environmental Aspect	Specific Environmental Issue/timing	Mitigation Measure
Surface Water / Hydrology	Stormwater Diversion	• stormwater diversion will be required within both clean and dirty catchments throughout the development of the Project; • diversions in the form of bunds or drains, as fitted to the topography of the specific catchment, will be implemented to allow for the diversion of sediment-laden run-off to sediment basins and in a few circumstances to divert clean run-off from entering the site; • diversions within clean catchments are to be stabilised quickly (through covering of the diversion channel with geofabric or revegetation); and • diversion measures within dirty catchments will incorporate rock check dams to reduce sediment loads within the run-off prior to reaching the basin (to maximise efficiency of the basin and reduce desilting requirements) and where possible have low grade to lower flow velocities.

	Erosion Control	**Mulch**
		• the mulch will be mixed with topsoil and applied to batters and other locations requiring rehabilitation, acting as both an addition of organic matter to boost the soil quality (along with other ameliorants) and act as an erosion control measure;
		• mulch will be used as a replacement to sediment fences, by creating a bund of between 300 and 500 mm high; and
		• mulch can also be applied as a blanket, of approximately 150 mm thick, to cover disturbed areas and prevent erosion.
		Site Stabilisation and Rehabilitation
		• a progressive site rehabilitation approach will be adopted, whereby stabilisation works (either by revegetation, hard armouring or allowing hard rock finishes to remain where no sediment-laden run-off will be generated) is undertaken immediately following the completion of the activity. Key principles of progressive rehabilitation include:
		  • availability of acceptable soil materials;
		  • correct site preparation and replacement of topsoil;
		  • selection of the most suitable establishment technique;
		  • selection of appropriate plant species, fertilisers and ameliorants;
		  • application of sufficient water for germination and to sustain plant growth if rainfall is insufficient;
		  • an adequate maintenance program; and
		  • areas not satisfactorily revegetated will be investigated to determine the reason for failure. Appropriate remedial action will be undertaken, including replacing any lost topsoil and re-sowing the site.

Overarching Environmental Aspect	Specific Environmental Issue/timing	Mitigation Measure
	Sediment Control	**General** • sediment basins are required for the management of disturbed locations. Conceptual locations are shown in Figure 1.3 of the Hydrology Impact Assessment Chapter, preliminary basin sizes are provided in the Hydrology Assessment (ERM, 2018b); • the Proponent must restore the design storage capacity to each basin within five days of the cessation of a rainfall event that causes run-off to occur on the site; • a basin register will be applied to the Environment Protection Licence (EPL 5289) to allow for progressive integration of the basins to the licence as each stage of work commences; and • sediment basins will be established prior to the removal of all vegetation across each stage, where practicable. Essentially, this will require clearing a path to the basin location, removing the vegetation, constructing the basin and then clearing the remainder of the catchment. **Basin Desilting** • all sediment basins will be inspected regularly for accumulated sediment. Graduated markers placed within the basin will assist in measuring sediment depths. Sediment to be removed prior to reaching capacity. **Water Treatment and Flocculation** • water quality testing will determine compliance, and identify if pH modification (through use of products such as lime or hydrochloric acid) or TSS modification (through the use of gypsum) is required.
	Pollution Control	**General** • waste receptacles will be provided for the safe and efficient storage of all construction and miscellaneous wastes, as necessary; • recyclable materials will be separated and recycled where possible. Otherwise, disposable wastes will be removed from site regularly and disposed of by approved means; • spent chemical and hydrocarbon drums will be removed from site immediately to limit the potential for spills of the remnant product; • refuelling within active quarry areas will be carried out using a mobile fuel cart fitted with an electronic fuel pump; and • routine maintenance of all plant and machinery will be carried out in the designated maintenance area adjacent to the site office to minimise the potential of accidental contamination of water.

Overarching Environmental Aspect	Specific Environmental Issue/timing	Mitigation Measure
		Spill Management • spill kits will be provided at active work locations, the workshop area, refuelling areas and adjacent to pump locations. Training of site personnel in their use will ensure that in the event of any spills appropriate action can be taken rapidly to prevent and minimise impacts to surface waters; • Material Safety Data Sheets (MSDS) for all chemicals stored on-site are to be collected and maintained by the quarry manager and made available to site personnel. Site personnel will be informed of their location as a part of the site induction; • an impervious bund will be constructed to contain any spills of more than 110% of the volume of the largest container in the bunded area, should none be present in the workshop area. Any spillage will be immediately contained and absorbed with a suitable absorbent material; • storage and transport of Dangerous Goods, Flammable and Combustible Liquids will comply with AS 1940 1993 The Storage and Handling of Flammable and Combustible Liquids and National Code of Practice for the Storage and Handing of Workplace Dangerous Goods [NOHSC: 2017 (2001)].
	Asphalt Production	• clean water diversions around the asphalt production plant site to limit catchment to smallest footprint possible and prevent clean water run-on; • the proposed sediment basin will be contrasted to capture sediment-laden run-off from the plant catchment area; • a triple interceptor or similar pollution control device will be utilised as a “first flush” for the potential hydrocarbon contaminated areas in the plant site;
	Plant Controls	• all oils, fuels, lubricants, liquids and chemicals will be stored in appropriately bunded areas; • bitumen, diesel and other chemicals handling will be undertaken within a contained (bunded) area. Any spillages will be immediately ameliorated; and • the sediment basin servicing the plant catchment will be fitted with a floating hydrocarbon boom as a precautionary measure to contain any potential loss of hydrocarbons from the plant catchment.

Overarching Environmental Aspect	Specific Environmental Issue/timing	Mitigation Measure
	Concrete Batching Plant Controls	• the footprint of the plant will be limited to the smallest extent practicable to reduce the area from which contaminated stormwater can be generated (EPA Victoria, 1998); • all contaminated stormwater and process wastewater will be collected and recycled at the earliest possible opportunity (EPA Victoria, 1998); • a dedicated, paved and bunded washout area will be established for the following locations: o truck washing and agitator drum washout area; o the concrete batching area; and o any other location that will generate stormwater contaminated with cement dust or residues. • the stormwater from these locations will be directed to a first flush system. The OEH (2015) recommended design criteria for first flush containment systems utilised for concrete batching plants must be able to contain 10 mm of rainfall; • a bypass to the first flush system is to be created to allow for run-off from larger storm events (greater than 20mm) to bypass the collection system for when the first flush collection is full; • dry cement will be stored where it cannot generate fugitive dust or be exposed to water and generate run-off; • the sediment collected in the first flush must be regularly cleaned out; and • whenever wet weather discharges occur from the catchment system within the plant, pH and total suspended solid monitoring will be undertaken (EPA Victoria, 1998). EPA Victoria (1998) also states run-off after heavy rainfall (more than 20 mm over 24 hours) contains very small quantities of wastes and is unlikely to pose a significant threat to the environment.

<table>
<tr><th>Overarching Environmental Aspect</th><th>Specific Environmental Issue/timing</th><th>Mitigation Measure</th></tr>
<tr><td></td><td>Monitoring</td><td>

site inspection of erosion and sediment controls will be undertaken at least monthly and always following rainfall events (greater than 20mm rainfall); and
the EPL 5289, and the surface water monitoring requirements within remain relevant to the Project, the following parameters for the proposed conceptual basins.

<table>
<tr><th>Pollutant</th><th>Units of Measurement</th><th>100%ile Concentration Limit</th><th>Frequency</th><th>Method</th></tr>
<tr><td>Oil and Grease</td><td>milligrams/ Litre</td><td>10 and/or not visible</td><td><24 hours prior to a controlled/scheduled discharge and daily for any continued controlled/scheduled discharge</td><td>Visual (grab sample to be taken if sheen observed)</td></tr>
<tr><td>Ph</td><td>-</td><td>6.5 – 8.5</td><td><24 hours prior to a controlled/scheduled discharge and daily for any continued controlled/scheduled discharge</td><td>Grab sample / calibrated field probe</td></tr>
<tr><td>Total Suspended Solids</td><td>milligrams/ Litre</td><td>50</td><td><24 hours prior to a controlled/scheduled discharge and daily for any continued controlled/scheduled discharge</td><td>Grab sample</td></tr>
</table>
</td></tr>
<tr><td>Groundwater</td><td>Licencing Requirements</td><td>The NSW Aquifer Interference Policy specifies that all water taken during an activity must be accounted for, and that a water licence is required irrespective of whether the water is taken for consumptive use or whether water is taken incidentally in the course of undertaking the activity. Hanson currently hold a Water Access Licence (WAL42524) for water supply works undertaken on site. Depending on specifics of licences currently held by Hanson, a new licence may need to be applied for.</td></tr>
<tr><td></td><td>Water Level Drawdown</td><td>Mitigation measures for the potential impacts associated with drawdown on bores GW303749 and GW306269 will vary dependant on the extent of the impact, but would include (if deemed necessary):

lowering the bore pump in the bore casing;
drilling a deeper bore; or
providing an alternative water source as part of “make good” arrangements.

</td></tr>
</table>

Overarching Environmental Aspect	Specific Environmental Issue/timing	Mitigation Measure
	Groundwater Monitoring Program	It is recommended that a groundwater monitoring plan be developed that includes specifics of such a monitoring program, including threshold trigger values as well as a contingency strategy if triggers are exceeded. While the development of such a plan falls outside the scope of this assessment, recommendations for monitoring requirements are outlined below. **Water Take** It is recommended that monitoring of inflows be undertaken to the extent feasible as part of water balance activities. This can be done by metering water being pumped from the in-pit sumps. An estimation of rainfall contribution to water being pumped from the in-pit sumps can then be made on an annual basis by factoring in rainfall data and the pit extent after which the groundwater component can be estimated. Groundwater take will be estimated and reported in this manner on an annual basis. If geological/hydrogeological observations during quarry extension vary significantly from that considered for the groundwater flow model the groundwater flow model will be re-evaluated. The model re-evaluation may include running the existing groundwater model for different stages of pit development and including transient analysis in the modelling to evaluate contributions from aquifer storage (which may require additional pumping tests and observations bore installation). **Water Levels** The groundwater monitoring program will include monitoring of water levels at the potentially affected groundwater bores. In order to be able to identify over or under predictions by the modelling in a reasonable way, it is recommended that all bores showing a > 0.5 m of simulated drawdown be included in the monitoring program. This would include bores GW303436, GW303749 and GW306269. As the predicted drawdown is based on steady state drawdown associated with the final stage of pit extension (the maximum drawdown expected over the life of the Project), initial monitoring of water levels can serve as a baseline against which to compare future water level measurements. Monitoring frequency should be adaptable (depending on trends observed and stages of the quarry development) with twice annual monitoring recommended for the first year of monitoring. Water level data will be reported on an annual basis along with the reporting of the water take estimates. **Water Quality** Water quality monitoring is recommended at the in-pit sump(s) and existing monitoring bores while they remain accessible. Parameters monitored will include standard field parameters (pH, EC, temperature, ORP and DO) and laboratory analysis of TDS. Monitoring frequency of these sampling locations should be adaptable (depending on trends observed) with twice annual monitoring recommended for the first year of monitoring. Water quality results will be reported on an annual basis along with the reporting of the water take estimates.

Overarching Environmental Aspect	Specific Environmental Issue/timing	Mitigation Measure
		Monitoring water quality of water discharges from the site will continue as per the conditions specified in the site Environmental Protection Licence (EPL). In addition to the current suite of parameters, it is recommended that consideration be given to including EC and TDS in the EPL related compliance monitoring. ERM (2018c) outlines that pit lake modelling may be required prior to closure of the quarry.
Soil and Land Resource	Soils	The stockpiling of topsoils will ensure that the soils mapped with higher capability (Class 4 and 5 lands) are given preference for storage. These higher capability soils are considered likely to improve the success of rehabilitation. Application of lime is required to address high levels of acidity and aluminium toxicity associated with the Euroka landscape. Amelioratives will be added to other soils to address issues associated with the other landscapes. A soil sampling program will be undertaken prior to topsoil stripping to understand acidity concentrations and receive advice from the laboratory on proposed liming and ameliorative application rates.
	Contamination	No contamination risk is present or will be introduced by the Project that would warrant not undertaking the activity. Chemical and hydrocarbon management, spill prevention and control mitigation measures as outlined in Chapter 7 to be implemented. A site walkover will be undertaken prior to clearing activities taking place to ensure that any refuse is identified and can be removed from site and disposed of at an appropriate licenced location. Should unexpected contamination be identified, works will cease and an appropriately experienced contamination specialist engaged to develop a strategy to manage the contamination.
	Erosion and Sediment Controls	Erosion and sediment controls outlined in Chapter 7 (Surface Water/Hydrology Assessment) will be implemented to prevent loss of soil and impacts to adjacent watercourses.
	Land Slippage	Standard geotechnical controls will be implemented as required to avoid or minimise impact of land slippage including: • Batter slope trimming - The angle of batter slopes will be reduced to the extent considered safe based on localised geology and hazardous blocks of rock removed. • Bunds - installed as necessary at batter bases to control falling rocks • Future bunds and material stockpiles - will be located away from top of benches where they may be subject to instability. • Void progression - will progress along a ridgeline such that any potential inflow of surface water runoff over batter faces will be minimal. Benching will also be implemented during quarry progression.

Overarching Environmental Aspect	Specific Environmental Issue/timing	Mitigation Measure
Noise and Vibration	Construction	To ensure noise emissions associated with construction works and activities are kept to acceptable levels, the following noise mitigation and management measures are recommended: • Noise generating work and activities will be carried out during the ICNG recommended standard hours (i.e. 7am to 6pm Monday to Friday and 8am to 1pm Saturdays), with no work on Sundays or public holidays. Any work that is required outside the recommended standard hours must be suitably managed with a goal of achieving compliant noise levels at all residential receptors or undertaken with agreement from any potentially affected neighbours. • Where unforeseen works will occur in close proximity (<100m) to a receptor and these works are anticipated to generate high levels of noise e.g. >75 dBA, potential respite periods e.g. three hours of work, followed by one hour of respite will be considered. Respite would be implemented if it is the preference of the affected receptors and if it is feasible and reasonable to achieve during the works. In some circumstances, respite may extend the duration of works and inadvertently increase noise impacts, hence due care should be taken when considering this management measure. • During construction planning, choose appropriate machines for each task and adopt efficient work practices to minimise the total construction period and the number of noise sources on the site. Select the quietest item of plant available where options that suit the design permit. • During the works, avoid unnecessary noise due to idling diesel engines and fast engine speeds when lower speeds are sufficient. • During the works, instruct drivers to travel directly to site and avoid any extended periods of engine idling at or near residential areas, especially at night. • During any night works, any activity that has the potential to generate impulsive noise will be avoided. These types of events are particularly annoying; especially at night and have the limited potential to generate sleep disturbance or awakening impacts. Any impulsive or transient noise events expected to exceed the sleep disturbance criteria at residential receptors will be strictly avoided at night. • During the works, ensure all machines used on the site are in good condition, with particular emphasis on exhaust silencers, covers on engines and transmissions and squeaking or rattling components. Excessively noisy machines will be repaired or removed from the site. • During the works, ensure that all plant, equipment and vehicles movements are optimised in a forward direction to avoid triggering motion alarms that are typically required when these items are used in reverse.

Overarching Environmental Aspect	Specific Environmental Issue/timing	Mitigation Measure
		• If any validated noise complaints are received, operator attended noise measurements will be undertaken to measure and compare the site noise level contributions (Leq, 15 minute and Lmax in dBA) to: o the predicted values; and o the NMLs presented in this report. • All site noise levels will be measured in the absence of any influential source not associated with the site. If the measured site noise levels are below the predicted values and comply with the NMLs presented in this report, no further mitigation or management measures are required. If the measured site noise levels are above the predicted noise levels or NML presented in this report, further mitigation and/or management measures will be considered. • Prior to commencement of works, a Construction Noise Management Plan (CNMP) will be prepared and implemented, which will consider all potential acoustical factors identified in this report including those addressed in Chapter 5 and Chapter 6. The CNMP will detail any noise monitoring and take into consideration measures for reducing the source noise levels of construction equipment by construction planning and equipment selection where reasonable and feasible.
	Operation	**Boundary Mitigation:** • Earth Bunding (approximately 25 m in height, 450 m in length and 75 m in width) is required along the southern boundary of the site to provide additional shielding from the processing plant and asphalt production plant. • Earth Bunding (approximately 20 m in height, 250 m in length and 60 m in width) is also required at the western boundary of the pit to provide shielding from in pit activities from Stage 2 of the quarry expansion when in pit activities progress closer to Receptor 20 to the west. **Plant/Equipment Procurement:** • During the operational design, choose appropriate machines for each task and adopt efficient work practices to minimise the total number of noise sources on the site. Select the quietest item of plant available where options that suit the design permit, with consideration to offensive noise characteristics such as tonality, low frequency noise or impulsiveness. • The key items of plant/equipment are presented in Table 2.3 of the NVIA. Operational LW emissions should be at or below those presented in Table 2.3 and Table 7.1 of the NVIA. Where items of procured plant generate offensive noise characteristics, INP penalties will be applied prior to meeting the LW values presented above.

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At Source Mitigation:

Where LW values for plant/equipment outlined in Table 2.3 are not reasonable or feasible, the operational design would incorporate acoustic enclosures / barriers to assist in reducing the noise emission of identified plant/equipment. Design of acoustic enclosures / barriers would also consider offensive noise characteristics as tonality, low frequency noise or impulsiveness.

General Operational Mitigation Measures:

Avoid unnecessary noise due to idling diesel engines and fast engine speeds when lower speeds are sufficient.
Instruct drivers to travel directly to site and avoid any extended periods of engine idling at or near residential areas, especially at night.
During any night works, any activity that has the potential to generate impulsive noise will be avoided. These types of events are particularly annoying; especially at night and have the limited potential to generate sleep disturbance or awakening impacts. Any impulsive or transient noise events expected to exceed the sleep disturbance criteria at residential receptors will be strictly avoided at night.
Ensure all machines used on the site are in good condition, with particular emphasis on exhaust silencers, covers on engines and transmissions and squeaking or rattling components. Excessively noisy machines will be repaired or removed from the site.
Ensure that all plant, equipment and vehicles movements are optimised in a forward direction to avoid triggering motion alarms that are typically required when these items are used in reverse.
Noisy plant and equipment will be located as far as possible from noise sensitive areas.
The location of activities, plant and equipment would optimise attenuation effects through measures such as topography, natural and purpose built barriers.
If any validated noise complaints are received, operator attended noise measurements will be undertaken to measure and compare the site noise level contributions (Leq, 15 minute and Lmax in dBA) to:

the predicted values; and
the PSNLs presented in this report.

All site noise levels will be measured in the absence of any influential source not associated with the site. If the measured site noise levels are below the predicted values and comply with the PSNLs presented in this report, no further mitigation or management measures are required. If the measured site noise levels are above the predicted noise levels or PSNLs presented in this report, further mitigation and/or management measures will be considered.

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Overarching Environmental Aspect	Specific Environmental Issue/timing	Mitigation Measure
		• A Detailed Design Noise Impact Assessment will be undertaken during the final stages of the Project design to ensure that noise emissions from the Processing Plant and Asphalt Production Plant can be effectively reduced to compliant levels through plant / equipment procurement and construction of acoustic enclosures / barriers. An Operational Noise Management Plan (ONMP) will be also prepared based on the detailed design, and will consider all potential acoustical factors identified in this report including those addressed in Chapter 5 and Chapter 7 of the Noise and Vibration Assessment. The ONMP will detail any noise monitoring and take into consideration measures for reducing the source noise levels of operational equipment by equipment selection, management and mitigation where reasonable and feasible.
	Monitoring	**Blast Monitoring** • As outlined in *Section 4.3.2* of the NVIA, monitoring is required for all blast events carried out in or on the premises. Air-blast overpressure and ground vibration levels must be measured at any point within one metre of any affected residential boundary or other noise sensitive location, such as a school or hospital for all blasts carried out in or on the premises. In addition, the licensee must monitor all blasts carried out in or on the premises at or near the nearest residence or noise sensitive location that is likely to be most affected by the blast. **Construction / Operational Noise Monitoring** • Construction and operational noise monitoring will also be undertaken for the Project however, the type and frequency would be adapted according to type of work. Noise monitoring would occur in the form of attended noise measurements and/or unattended real-time noise monitoring. • All monitoring measures will be outlined in the Construction Noise Management Plan and the Operation Noise Management Plan. • Noise measurements would be undertaken at the potentially most affected receptor locations identified in the NVIA. Monitoring would occur at the following receptors at minimum to represent receptors surrounding the site: Receptors 13 and 14 to the south, receptor 20 to the west, receptor 11 to the north and receptor 34 to the east.
Air Quality and Greenhouse Gas	General	The Air Quality and GHG Assessment considered all reasonable and feasible mitigation measures to minimise the emissions from the proposed activities at the site, including: • Roads, which are likely to remain unchanged throughout the Project stages and to be frequently used by machinery, will be sealed using asphalt and swept daily to minimise wheel-generated dust emissions; • Full dust extraction system for drilling; • Utilisation of water sprays during truck rear dumping;

Overarching Environmental Aspect	Specific Environmental Issue/timing	Mitigation Measure
		• The use of mobile sprinkler systems during the operation of FELs; • Dust suppression measures such as water sprays in place at the crushers and screeners; • Water sprays used on all conveyor transfer points; • Level 2 watering (more than 2 litres/m2/hour) applied to unsealed roads to minimise impact from hauling; • Water sprays to be utilised to minimise wind erosion from stockpiles during wind speeds of over 5.4 metres per second; • The dry product delivered to the concrete batching and recycling plant and asphalt plant to be stored in aggregate storage bins enclosed on three sides. The walls to extend one metre above the height of the maximum quantity of raw material, and two metre beyond the front of the stockpile. The aggregate storage bins to be fitted with water sprays to keep the stored material damp at all times; • Cement and cement supplement to be delivered to the concrete batching plant in the agitator trucks and pneumatically fed to the bottom-loaded silos; • Concrete batching loading point to be totally enclosed with all particulate matter emissions generated by the facility captured by one bag filter located above the pan mixer; • Vapour balancing system to be installed for the delivery of bitumen at the asphalt plant; • Asphalt plant loading point will be totally enclosed. All particulate matter emissions generated at the loading point will be captured by one fabric filter associated with the natural-gas fired dryer; and • Vapour recovery system to be employed for transfer of asphalt to trucks.
Traffic and Access	General	The following mitigation measures are proposed to minimise impacts to road users and infrastructure: • movements to the west of the Quarry Access Road on Sancrox Road will be strictly limited to supplying markets in the Sancrox area only. Access to Wauchope and other locations to the west will be provided by utilising the Oxley Highway Interchange. Sancrox Road to the west of the quarry will not be used as a regular product transport route; • movements to the east of the Sancrox Interchange along Fernbank Creek Road will be strictly limited to supplying local residents/markets in the area. The road will not be used as a regular product transport route. • limit compression braking;

Overarching Environmental Aspect	Specific Environmental Issue/timing	Mitigation Measure
		• avoid bunching of quarry vehicles along product transport routes; • cover loads entering and leaving the site; • induct all drivers to the Hanson code of conduct and carry out regular tool box talks discussing road safety issues; and • all loaded vehicles leaving the site are to be cleaned of materials on tail guards and body edges that may fall on the road. • Adhere to Vehicle Operator Code of Conduct outlined in *Section 12.4.1* of the Traffic Assessment.
Visual Amenity	General	The following mitigation measures are recommended to minimise visual amenity impacts: • Retain the vegetative buffer along the north western edge of the quarry pit to screen views from nearby private land. • Light spill will be minimised through detailed design and standard measures to contain lighting.
Socio-economic	General	The construction and operation of the Project is anticipated to have minimal negative socio-economic impacts and as such no additional socio-economic specific mitigation measures have been provided, other than those provided throughout each technical assessment contained throughout this EIS. Community and stakeholder engagement has been outlined in Chapter 4, providing the local community with access to project information and the opportunity to raise any concerns with regard to the Project.

Hazards and Risks	Hazardous Material Storage and Transportation	**Storage**
		The following mitigation measures will be implemented for the storage of hazardous materials to ensure compliance with the application of SEPP 33, including but not limited to:
		• all hazardous substances that may be required for construction and operation would be stored and managed in accordance with the Storage and Handling of Dangerous Goods Code of Practice (WorkCover NSW, 2005) and Hazardous and Offensive Development Application Guidelines: Applying SEPP 33 (Department of Planning, 2011), including but not limited to the following:
		  • diesel will not be stored with Class 3 materials;
		  • lubricating and hydraulic oils and grease will not be stored with Class 3 materials;
		  • maximum stored inventories (250 kg) will be located more than 25 metres (m) away from the nearest site boundary, so as to not trigger the Applying SEPP 33 thresholds if considered in aggregate.

Overarching Environmental Aspect	Specific Environmental Issue/timing	Mitigation Measure
		As bitumen and bitumen emulsions will be present in volumes greater than 10,000kg, SafeworkNSW are to be notified and manifests and emergency plans developed. **Transportation** Mitigation measures relating to the transport of potentially hazardous materials include: • the method for delivery of explosives would be developed prior to the commencement of blasting in consultation with the DP&E and be timed to avoid the need for on-site storage. No explosive storage on site is proposed. • transportation routes outlined in the Traffic and Access Assessment (refer to Chapter 12) will be followed to ensure impacts to road systems will be minimised where practicable.
	Bushfire Prevention and Control	**Prevention** For a bushfire to occur there are three factors which must be present, namely oxygen, fuel and an ignition source, along with several other factors which affect the probability and intensity of a bushfire. While exclusion of oxygen is not feasible, each of the remaining issues will be managed as follows. • fuel loads within the Site will be managed through: o the maintenance of Asset Protection Zones (APZ) in accordance with the Planning for Bushfire Protection Guidelines (RFS, 2006) will be established and maintained around all administration buildings and the workshop areas, as outlined in Figure 15.2 o trees and shrubs will be maintained to prevent the spread of a fire towards the buildings, taking into account the requirement for an effective visual screen. • company-controlled ignition sources and the associated management measures that will be implemented include the following: o all Project-related activities will be undertaken, where practicable, in cleared areas; o all mobile equipment will be maintained in good working order with appropriate exhaust and fire suppression systems; o all mobile equipment working in vegetated areas will be inspected to ensure that they do not pose a risk of starting a bushfire. This will include inspection of exhaust and electrical systems, including, in the case of vehicles using unleaded petrol, catalytic converters; and o mobile equipment working in vegetated areas will not be left unattended with the engine running.

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<tr><th>Overarching Environmental Aspect</th><th>Specific Environmental Issue/timing</th><th>Mitigation Measure</th></tr>
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personnel, contractors and their employees will undergo site-specific training incorporating bush fire management awareness as part of the Project’s induction program ensuring the following is outlined:

obligations toward prevention and notification;
all mobile equipment will be equipped with appropriate communication equipment, including two-way radios and/or mobile telephones;
restriction of activities during periods of very high (or higher) bushfire danger rating;
emergency response procedures;
locations of fire-fighting equipment;
adopt appropriate controls during re-fuelling; and
ensure fire extinguishers are fitted to all site vehicles.
welding or other hot works activities will, as far as practicable, be conducted and confined to the main workshop area

fuel loads within the Project site will be managed in conjunction with Hanson’s obligations in relation to rehabilitation of the Project site and biodiversity offset requirements.

Control
The ability to control a bushfire depends upon available fuel, control of ignition sources and good access and water supplies. The following fire management procedures will be adopted to assist with the control of any bushfire on or adjacent to the Project site:

provision of access to strategic areas on the site;
a static water supply is provided for firefighting purposes in areas where reticulated water is not available, this includes all weather access to the sedimentation dams;
stockpiling of cleared vegetation with a minimum 10m cleared buffer zone; and
creating suitable all weather access tracks (with suitable signage and turning circles if not a through road) and if required during a bushfire event, strategically located fire breaks.

Hanson will also incorporate bushfire management procedures in the overall Emergency Response Plan for the Project. A copy of the procedures, including a map of all fire-fighting equipment, access roads, communications protocol, emergency evacuation plans and any locked gates will be provided to the local RFS.
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Overarching Environmental Aspect	Specific Environmental Issue/timing	Mitigation Measure
Waste	General	Mitigation measures to be implemented to minimise wastes generated by the Project include: • separation of recyclable and non-recyclable materials will take place where possible and be stored in designated receptacles; • waste receptacles will be collected on a regular basis by licensed contractors or Council collection service and transported for off-site disposal at an appropriately licensed landfill or recycling facility; • beneficial reuse of suitable resources will be undertaken where practicable, in accordance with relevant requirements of the relevant resource recovery order and exemption; • all waste disposal will be in accordance with the POEO Act and Waste Classification Guidelines (EPA 2014); • waste tracking will occur for any types and quantities of waste that trigger the requirement for tracking; and • waste management measures will be incorporated into the site Construction and Operation Environment Management Plan (or form its own separate sub-plan if requested by the DP&E) which will outline measures to avoid waste generation and promote reuse, recycling and reprocessing of waste where possible.

19 CONCLUSION

This EIS has assessed the potential environmental impacts associated with the proposed expansion and increase in annual extraction rates at Sancrox Quarry alongside the proposed establishment of the concrete batching plant, asphalt production plant, and concrete recycling facility The EIS was prepared having regard to biophysical, economic and social considerations and the principles of ESD. There were no significant environmental impacts identified during the preparation of the EIS that cannot be mitigated by appropriate mitigation measures and management strategies.

The environmental assessment process has been used to drive the development of the site and ensure operations will be sustainable and create minimal disruption to the local community. Proposed operations have been designed to ensure sustainable water use and management, minimise traffic impact on local roads, ensure acceptable noise and dust emissions, effective management of waste and to minimise visibility of the operations. All of the potential environmental impacts of the Project have been considered and mitigation measures developed to minimise any impacts as detailed throughout the EIS.

The Project will provide a viable supply of construction materials to the surrounding region. The Project can be implemented with minimal adverse environmental impacts as demonstrated throughout this assessment and is justified in terms of the overall economic benefits to the local, state and national economies. The construction materials, such as those produced at Sancrox Quarry, will be used to meet a fundamental community need for the construction of roads, other infrastructure and major development projects in the region.

The Project will allow for the sourcing of construction materials to be produced at a site that is already highly disturbed. The construction materials produced will be used throughout the region and will have positive flow on effects throughout the local economy through the creation of jobs in associated industries.

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