Brickworks Plant 2 Upgrade SSD-9601 MOD 1

Biodiversity Development Assessment Report

prepared for

Brickworks Land & Development

écologique | environmental consulting

Brickworks Plant 2 Upgrade SSD-9601 MOD 1 – DRAFT Biodiversity Development Assessment Report

prepared for

Brickworks

Certification

I, Kat Duchatel (BAAS17054), certify that this biodiversity development assessment report has been prepared on the basis of the requirements of (and information provided under) the current biodiversity assessment method (OEH 2017).

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03/05/2021

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Revision Schedule

Rev No	Date	Description	Issued to
1	03/05/2021	Biodiversity Development Assessment Report	Brickworks

Executive Summary

Brickworks Land & Development was granted State Significant Development (SSD-9601) approval on the 18th May 2020 for upgrades to Plant 2 at the Horsley Park Brickworks. The approved upgrade involves the demolition of parts of an existing factory and upgrades to existing buildings, construction of new structures and hardstand areas, and clearing of native vegetation.

The SSD-9601 application was supported by a Biodiversity Development Assessment Report (BDAR) prepared by Cumberland Ecology (2019) in accordance with Section 7.9 of the NSW *Biodiversity Conservation Act 2016* (BC Act).

Offsetting obligations conditioned by the SSD 9601 consent required three ecosystem credits be retired to offset the clearing of 0.14 ha of native vegetation, which have been fulfilled.

Since the SSD-9601 approval was granted additional clearing of native vegetation has been identified to facilitate the following:

- Upgrade works to the kiln (bigger fans and ductwork with more burners) to increase the capacity from brick production per annum; and
- Expansion of hardstand needed to store product from the increased production capacity.

The MOD 1 proposal will directly impact on approximately 0.46 ha of native vegetation (commensurate with three PCTs) and approximately 0.9 ha of exotic vegetation. The PCTs identified within the subject land include the following:

- Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 835);
- Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion planted (PCT 849); and
- Cumberland Swamp Oak riparian forest (PCT 1800).

PCT 849 is identified in the TBDC a serious and irreversible impact (SAII) entity and has been assessed in accordance with the criteria set out in Subsection 9.1.1 of the Biodiversity Assessment Method (BAM).

This assessment has found that the cumulative impacts (as a result of the approved SSD-9601 and the proposed MOD 1 development) will not contribute to further irreversible impacts on PCT 849, on the basis that:

- Within the subject land, PCT 849 is either of planted or derived origins, e.g. PCT 849 constituent species either planted or that have colonised constructed bund walls. The latter environment is not commensurate with habitat for PCT 849 and comprises hostile subsoils and heavily weed infested ground layer;
- PCT 849 within the subject land does not contribute to the existing mapped and known extent of the SAII; and
- PCT 849 within the subject land (and that which will be impacted as a result of the approved SSD 9601 and proposed MOD 1 development) is highly degraded, located within an active operational plant and quarry, and isolated from larger and better condition areas of PCT 849.

This assessment has determined that eight ecosystem credits must be retired to offset the direct impacts on the three allocated PCTs within the subject lands.

No species credit species have been identified as requiring an offset and no prescribed or uncertain have been identified.

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1. Introduction

1.1 Background

Brickworks Land & Development (Brickworks) was granted State Significant Development (SSD-9601) approval on the 18th May 2020 for upgrades to Plant 2 at the Horsley Park Brickworks, 780 Wallgrove Road, Horsley Park. The Horsley Park Brickworks site is located on Lots 7 and 8 of DP 1059698, which is bounded by the M7 and Wallgrove Road to the west, Ferrers Road to the east, the Warragamba pipelines to the north and privately owned land to the south (see Figure 1-1 for context).

The approved upgrade to Plant 2 involves the demolition of parts of an existing factory and upgrades to existing buildings, construction of new structures and hardstand areas, and clearing of native vegetation.

The SSD-9601 application was supported by a Biodiversity Development Assessment Report (BDAR) prepared by Cumberland Ecology (2019) in accordance with Section 7.9 of the NSW *Biodiversity Conservation Act 2016* (BC Act).

Offsetting obligations conditioned by the SSD 9601 consent required three ecosystem credits be retired to offset the clearing of 0.14 ha of native vegetation. Offset obligations have been fulfilled.

Since the SSD-9601 approval was granted, and consent conditional offsetting obligations met, additional clearing of native vegetation has been identified to facilitate the following:

- Upgrade works to the kiln (bigger fans and ductwork with more burners) to increase the capacity from brick production per annum; and
- Expansion of hardstand needed to store product from the increased production capacity.

Consequently, Brickworks are seeking approval for a modification (MOD 1) to the approved SSD-9601. This BDAR has been prepared to assess the impacts on biodiversity values that will result from the MOD 1 proposed works.

During the preparation of this BDAR, it became apparent that additional vegetation clearing approval is required as follows:

- Vegetation clearing required for approved SSD-9601 construction activities was inadvertently not assessed in the BDAR prepared by Cumberland Ecology (2019), which includes the following plant community types (PCTs):
    - 167m^2 of PCT 1800, located within the approved stormwater basin, and
    - 156 m^2 of PCT 835, located within the approved basin spillway.
- Vegetation clearing required to facilitate works under an existing Development Approval (DA 145/20/33), which includes;
    - 1,392m^2 of PCT 849, located on an earthen bund wall along the west of the plant and yard.

Approval for clearing of the above listed PCTs is being sought within the proposed MOD 1 and this BDAR.

1.2 Subject land

Plant 2 is located on that part of Lot 7 DP 1059698 to the east of Eastern Creek (see Figure 1-1), with the proposed extent of MOD 1 development area comprising approximately six hectares (ha). Figure 1-2 shows the extent of the proposed MOD 1 works, which has allowed for the following:

- A 10 m buffer zone around the design footprint (where vegetated) to allow for construction disturbance;
- A 2 m buffer zone around the turning bay on the main access road, which will not require the same level of disturbance; and
- No buffer zone where the design footprint does not impact on vegetated areas (i.e. hardstand or previously cleared land).

1.2.1 Site history

Aerial historical photography sourced from the NSW Spatial Services historical imagery viewer provides a reasonable indication of the site's development history.

Plant 1 and the land to the west of Eastern Creek was developed in the early 1960s and in operation by 1965, whereas Plant 2 is not evident until 1970. At this time Plant 2 occupied less than half of the land to the east or Eastern Creek. The remaining land was progressively developed between 1978 up until 2002, at which time the current extent of land clearing was completed.

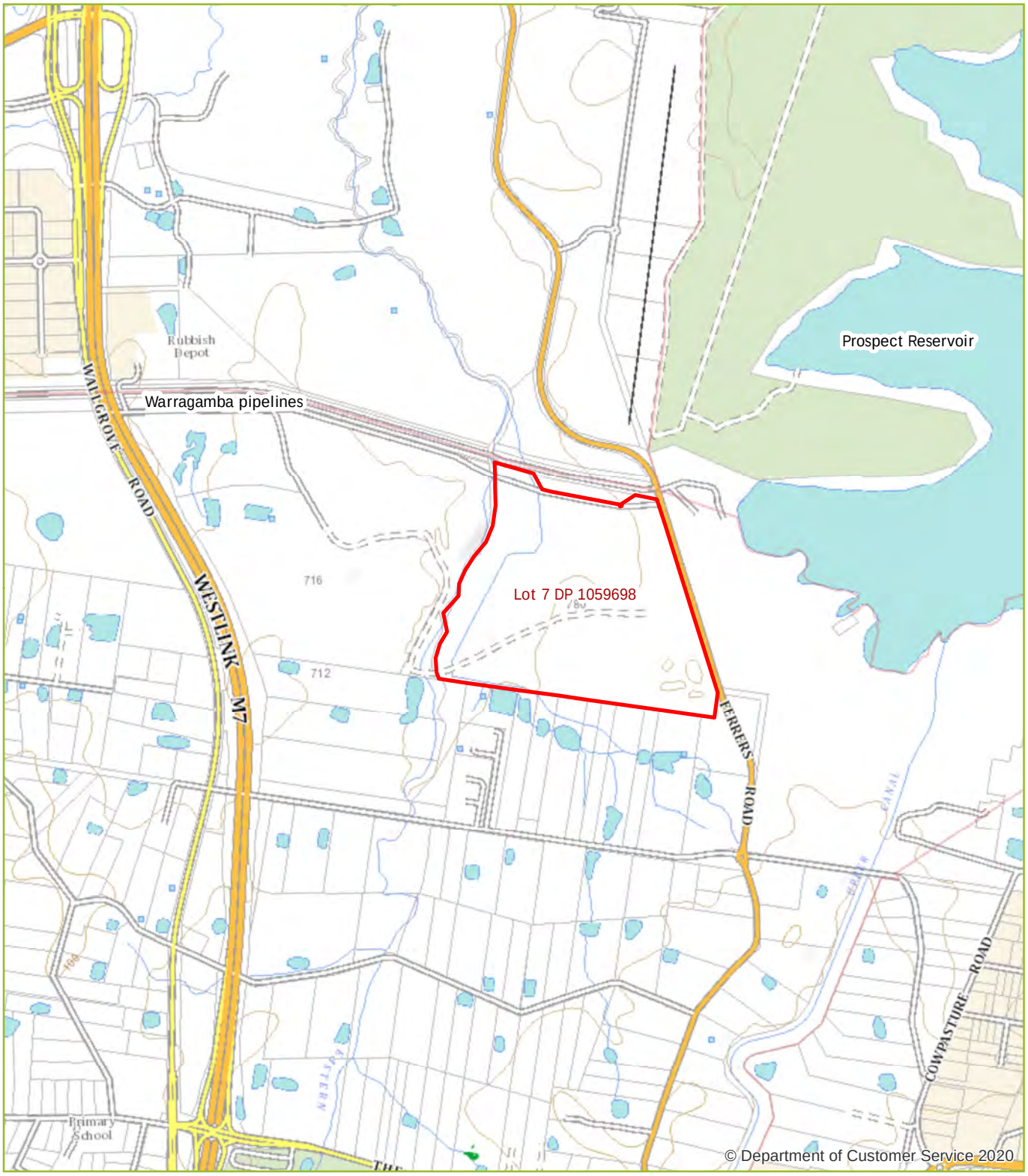
Prior to the development of the site, between 1930 and 1956, over 50% of both Lots 7 and 8 had been cleared for what appears to be agricultural land use. Between 1961 and 1965 large areas of vegetation were further cleared on the land to the east of Eastern Creek. Between 1989 and 2002 and most of the tributary to Eastern Creek and associated riparian vegetation was cleared and the current reservoir created.

1.2.2 Current day

The current subject land is largely cleared with constructed bund walls surrounding the hardstand areas of the plant and constructed drainage swales running east to west along the outside of the southern bund and along the main entrance road off Wallgrove Road.

With the exception of the existing riparian corridor associated with Eastern Creek and the remaining section of its tributary, all other vegetated areas have been planted or comprise regrowth of both native and weed species (refer Section 3 for further discussion on existing native vegetation).

Much of the subject land outside of the bunded hardstand areas comprises artificial water bodies, and areas of open earth consisting of quarry areas and unsealed roads.



Coordinate System: MGA Zone 56 (GDA 94)

Brickworks Plant 2 Upgrade SSD-9601 MOD1

Subject_land_2021

Figure 1-1. Site context

N

0 0.2 0.4 0.8 1.2

km

Brickworks Plant 2
SSD-9601 MOD1

Legend

Lot 7 DP 1059698

Development approval

SSD 9601

MOD 1 (proposed)

DA earthworks

N

0 15 30 60 90 120
m

Coordinate System: MGA Zone 56 (GDA 94) | Image source: Nearmap 27 December 2020

Figure 1-2.
Proposed MOD 1, approved SSD 9601 and DA areas

Date: 22.02.2021

1.3 Information sources

The following information sources were used in the preparation of this report:

- Imagery:
  - Aerial imagery: NearMap (October 2020, December 2020 and January 2021)
- Australian Government Department of the Environment and Energy
  - Protected Matters Search Tool http://www.environment.gov.au/epbc/pmst/index.html
  - Species Profiles and Threats Database (SPRAT) http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl
  - Significant Impact Guidelines 1.1 - Matters of National Environmental Significance (Department of the Environment, Water, Heritage and the Arts, 2013 EPBC Act Policy Statement)
  - Interim Biogeographic Regionalisation for Australia (IBRA) version 7.0
- NSW Department of Planning, Industry and Environment (DPIE), Environment, Energy and Science (EES) Group, formerly the Office of Environment and Heritage (OEH)
  - NSW (Mitchell) Landscapes - version 3.1
  - BVMap_V102_SEED.gdb
  - Biodiversity Values Map and Threshold Tool (updated 2020)
  - Remnant Vegetation of the western Cumberland subregion, 2013 Update. VIS_ID 4207
  - The Native Vegetation of the Sydney Metropolitan Area - Version 3 (OEH, 2016) VIS_ID 4489
  - BioNet Vegetation Classification
  - BioNet Threatened Biodiversity Data Collection
  - Biodiversity Investment Opportunities Map: Mapping Priority Investment Areas for the Cumberland Subregion (2018)
  - Department of Environment and Climate Change, 2008, Soil and Land Resources of the Hawkesbury-Nepean Catchment, Department of Environment and Climate Change, Sydney.
- NSW Department of Industry (2018) Hydro Line spatial data
- NSW Spatial Services Historical Imagery Viewer: https://www.spatial.nsw.gov.au/products_and_services/aerial_and_historical_imagery
- Cumberland Ecology (2019) Brickworks Plant 2 Upgrade – 780 Wallgrove Road - Horsley Park.

2. Landscape Context

2.1 General description

The subject land is relatively flat ranging between 60 to 69m above sea level (ASL), with minor variations in elevation to the east of the site along Ferrers Road and that associated with constructed bunds.

The subject land overlies both Blacktown and South Creek soil landscapes and disturbed terrain. The Blacktown soil landscape is a residual (erosional) landscape with potential localised hazards such as: foundation; salinity; low fertility; and sheet and gully erosion.

However as can be seen in Figure 2-1 the mapped Blacktown soil landscape within the proposed MOD 1 site has been modified and more appropriately described as disturbed terrain.

2.2 Landscape features

Landscape features relevant to the proposed MOD 1 development have been assessed from within a 1500m buffer zone (the BDAR assessment area) around the proposed MOD 1 development site (subject land).

In accordance with Sections 3.1 and 3.2 of the BAM (2020) assessment and mapping of the following landscape features are required:

- IBRA bioregions and subregions
- NSW (Mitchell) landscapes
- Rivers and streams classified according to stream order;
- Wetlands within, adjacent to and downstream of the site;
- Connectivity of different areas of habitat;
- Geological features such as karst, caves, crevices, cliffs, rocks and other geological features of significance and for vegetation clearing proposals, soil hazard features;
- Areas of outstanding biodiversity value occurring on the subject land and assessment area; and
- Percent native vegetation cover in the assessment area.

2.2.1 IBRA bioregions and IBRA subregions

The subject land and BDAR assessment area are located within the Sydney Basin IBRA region and Cumberland IBRA subregion (Figure 2-2).

2.2.2 NSW landscape regions (Mitchell Landscapes)

The subject site is located within the Cumberland Plain landscape.

The BDAR assessment area is predominantly Cumberland Plain landscape with the exception of Estuary/Water landscape associated with the Prospect Reservoir (Figure 2-3).

2.2.3 Rivers / streams

Lot 7 DP 1059698 is traversed by Eastern Creek and the subject land contains a modified section of an Eastern Creek tributary.

Both Eastern Creek and its tributary are second order Strahler streams where they traverse Lot 7 DP 1059698.

Figure 2-4 shows the former alignment of the tributary (sourced from the NSW Department of Industry's Hydro Line spatial data, 2018). By 2002, much of the tributary was modified through construction of Plant 2's reservoir (refer historical aerial photography provided in Appendix C).

The only other watercourse within the BDAR assessment area is the Upper Canal that feeds directly into Prospect Reservoir. The Upper Canal is located to the south east of the subject land (see Figure 2-4).

2.2.4 Wetlands

No wetlands of local, regional, national or international significance are located within the subject land or BDAR assessment area.

A portion of Prospect Reservoir occurs within the BDAR assessment area, however neither Eastern Creek or its tributary to the reservoir.

2.2.5 Connectivity

Lot 7 DP 1059698 contains riparian land associated with Eastern Creek and additional non-riparian vegetation that are collectively mapped as Cumberland Subregion BIO Map Biodiversity Corridors of Regional Significance in the Biodiversity Investment Opportunities Map (OEH 2018).

As evident in Figure 2-5 a large proportion of Plant 2's operational area is included in this mapping while not representative of a vegetated area supporting this corridor. Consequently the small areas of disturbed vegetation that would be cleared under the proposed MOD 1 works are unlikely to negatively impact on this corridor.

The wider Horsley Park Brickworks site is also located within the Western Sydney Parklands (the Parklands). The Parklands contain a substantial area of native remnant vegetation, bush regeneration sites, wetland ecosystems and wildlife corridor. Brickworks are actively working to support the Western Sydney Parklands Trust's objectives through the riparian rehabilitation works and wildlife nest box installations within the Eastern Creek riparian corridor.

2.2.6 Geological features

No karsts, caves, crevices, cliffs or areas of geological significance have been identified within the BDAR assessment area.

2.2.7 Outstanding biodiversity values

No outstanding biodiversity values occur within the BDAR assessment area.

2.3 Native vegetation in BDAR assessment area

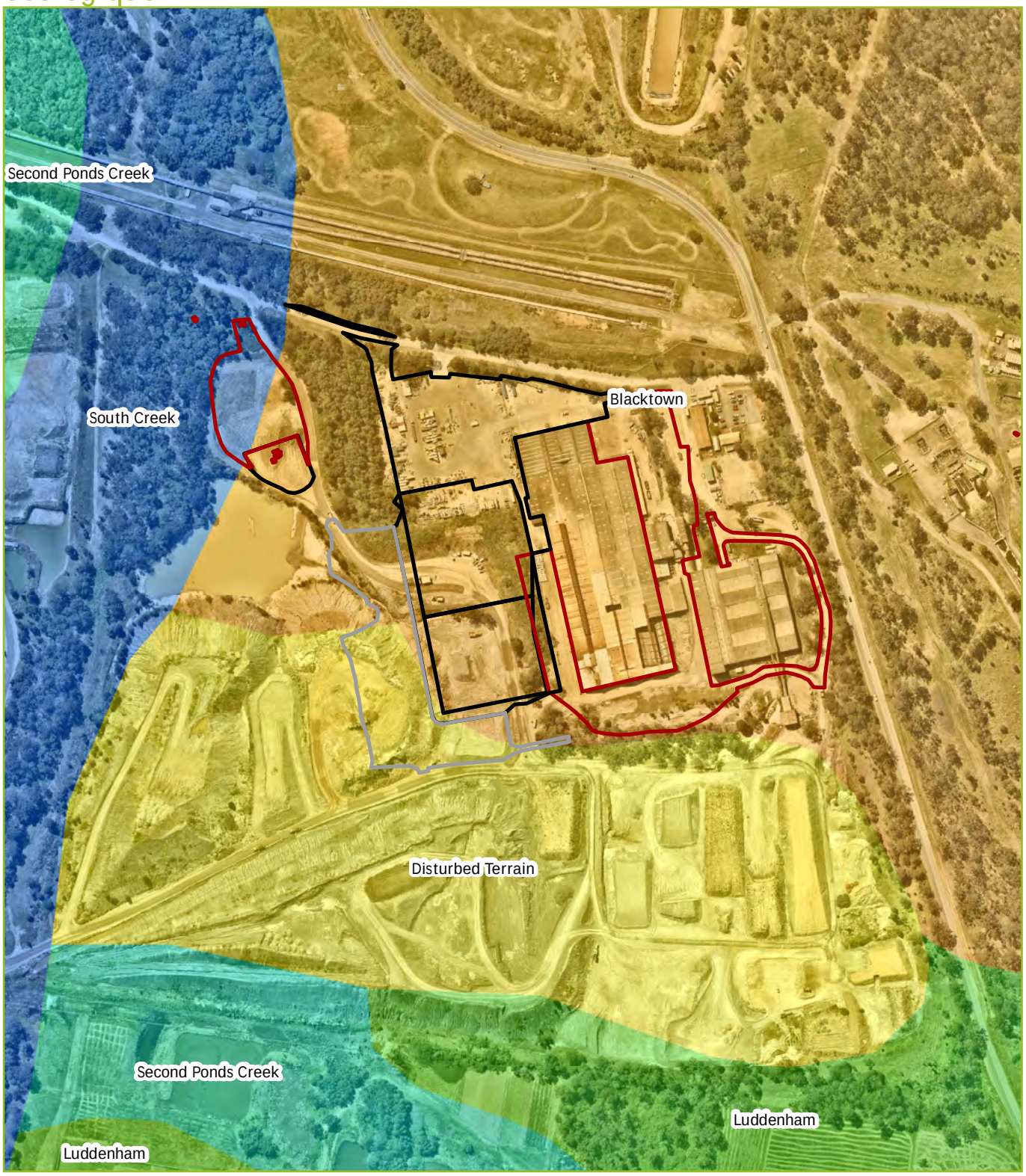
Native vegetation cover on the subject land must be assessed in relation to native vegetation cover across a broader area.

The cover of native vegetation within the BDAR assessment area is required to determine the context of the site. As there are two vegetation mapping layers that cover the BDAR assessment area, the cover of native vegetation was assessed as follows:

- Clipping the extent of Cumberland Plain Vegetation Mapping (OEH 2013) and Sydney Metropolitan Vegetation Mapping (2016) within the BDAR assessment area using ArcMap v10.8.1;
- Merging the two clipped layers to create a shapefile (20210219_NV_ec.shp); and
- Editing the shapefile to to remove areas of vegetation no longer evident and increase the extent of vegetation, along with the addition of polygons identifying areas of vegetation not represented in mapping.

Figure 2-6 illustrates the extent of native vegetation within the BDAR assessment area.

The BDAR assessment area including the subject land is 933.7 ha. The total of native vegetation cover within the BDAR assessment area is estimated at 372.8 ha, which equates to 39.9% and an assignment to the >30 - 70% cover class (in accordance with the BAM Section 3.2).



Brickworks Plant 2 Upgrade SSD-9601 MOD1

Figure 2-1. Subject land soils

Legend

- SSD (approved)
- MOD 1 (proposed)
- DA (approved

N

0 45 90 180 270 360

m

Coordinate System:
MGA Zone 56 (GDA 94)

Image sources:
Nearmap 2 October 2020

Data sources:
HNP_SLR100K_v1_1_GDA94

Brickworks Plant 2 Upgrade SSD-9601 MOD1

Legend

- BDAR assessment area
- Subject land
- Cumberland subregion

N

0 187.5 375 750 1,125 1,500

m

Figure 2-2. IBRA subregions

Coordinate System:
MGA Zone 56 (GDA 94)

Image sources:
Nearmap 2 October 2020

Data sources:
IBRA7_subregions

Brickworks Plant 2 Upgrade SSD-9601 MOD1

Figure 2-3. NSW (Mitchell) landscapes

Legend

- Subject land
- BDAR assessment area
- Hawkesbury - Nepean Channels and Floodplains
- Estuary/Water landscape
- Cumberland Plain landscape

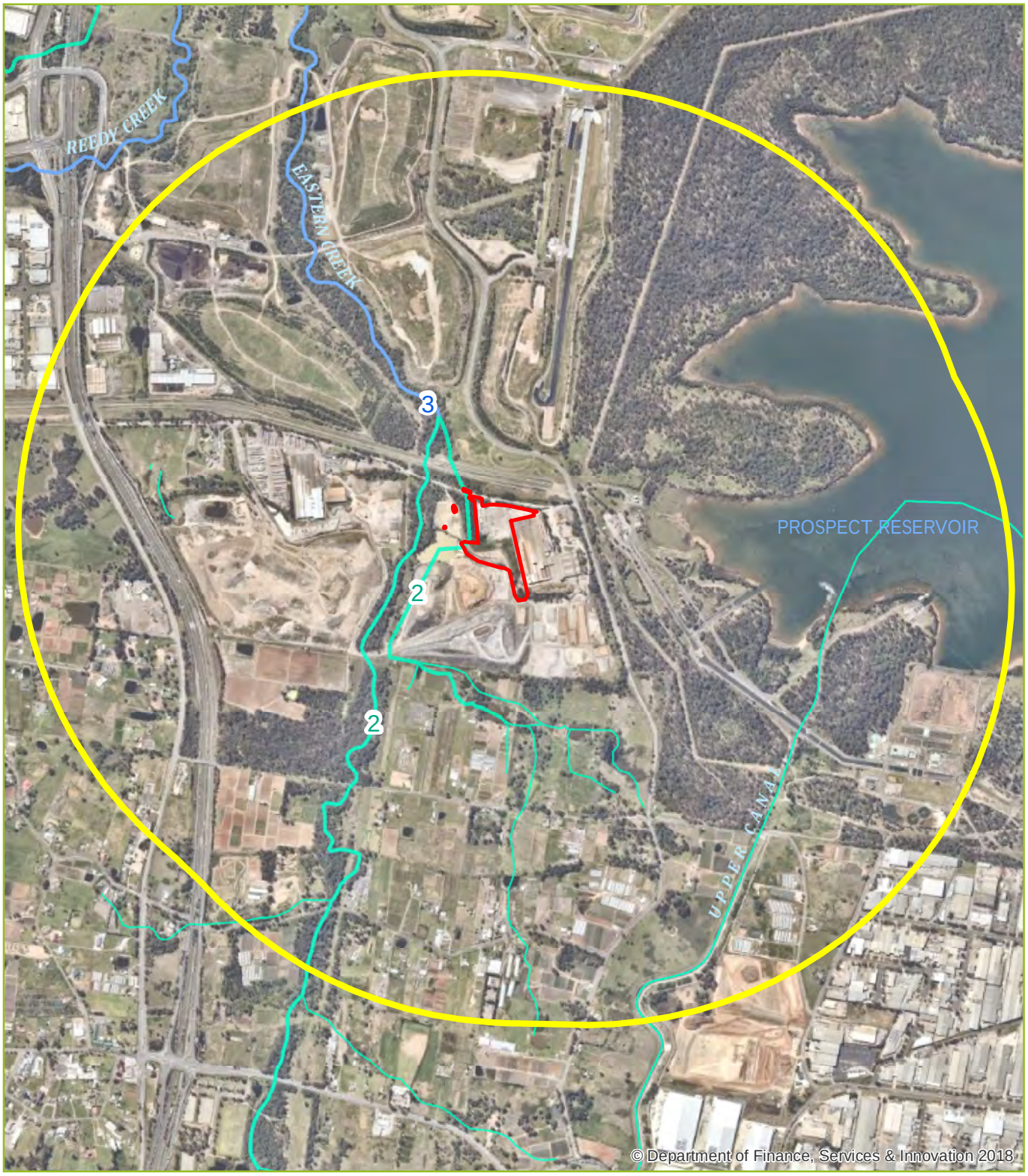
N

0 187.5 375 750 1,125 1,500
m

Coordinate System:
MGA Zone 56 (GDA 94)

Image sources:
Nearmap 2 October 2020

Data sources:
Mitchell_Landscapes_v3



Brickworks Plant 2 Upgrade SSD-9601 MOD1

Figure 2-3. Rivers and streams

Legend

- BDAR assessment area
- Subject land
- 2 2nd order stream
- 3 3rd order stream

N

0 187.5 375 750 1,125 1,500
m

Coordinate System:
MGA Zone 56 (GDA 94)

Image sources:
Nearmap 2 October 2020

Data sources:
Public/NSW_Hydrography

Coordinate System: MGA Zone 56 (GDA 94)

Legend

- MOD 1 Construction footprint
- BioMap Cumberland Subregion Corridors
- High Biodiversity Values

Brickworks Plant 2 Upgrade SSD-9601 MOD1

Figure 2-5. High Biodiversity Mapping & Subregional Corridors

Imagery sourc: Nearmap October 2020

Data sources:
BioMap Cumberland Subregion Corridors (OEH 2018);
BVMap_V102_SEED.gdb

N

0 0.125 0.25 0.5 0.75 1

km

Brickworks Plant 2 Upgrade SSD-9601 MOD1

Figure 2-6. Native vegetation

Legend

- BDAR assessment area
- Subject land
- BDAR native vegetation

N

0 187.5 375 750 1,125 1,500

m

Coordinate System:
MGA Zone 56 (GDA 94)

Image sources:
Nearmap 2 October 2020

Data sources:
SydneyMetroArea_v3_E_4489
CumberlandPlainWest_E_4207

3. Native Vegetation

3.1 Native vegetation extent

Preliminary site mapping was prepared during the assessment of native vegetation cover within the BDAR assessment area (see Section 2.3). This mapping was ground-truthed during site surveys and later amended to illustrate the current extent of exotic, planted and remnant vegetation within the subject land.

Due to the highly modified nature of the subject land, historical aerial photography was also used to identify remnant native vegetation, planted native vegetation and other derived native vegetation assemblages, for example:

- Areas of existing vegetation along the main entrance road is evident as plantings in 2002;
- Most bunds were denuded of vegetation up until the late 90s;
- The haul road was not evident until 2002;
- *Casuarina glauca* (swamp oak) has colonised the edges of the main reservoir (post-2002) during times of lower water levels but has had periods of die-off when reservoir levels are higher.

Photographic plates showing historical changes are provided in Appendix C.

3.2 Plant community types

Identification of plant community types (PCTs) within the subject land was confirmed during site surveys with reference to the BioNet Vegetation Classification database and data collected from floristic and site integrity plot/transects in accordance with Section 2 of the BAM (2020).

Three PCTs have been allocated to the native vegetation present within the subject land:

1. Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 835);
2. Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 849); and
3. Cumberland Swamp Oak riparian forest (PCT 1800)

The location of floristic and site integrity plots and transects are shown in Figure 3-1 and Figure 4-1 and plot/transect data provided in Appendix A.

3.2.1 PCT 835: Forest Red Gum - Rough-barked Apple grassy woodland

Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 835) is the dominant PCT mapped within the subject land (associated with the riparian zones of Eastern Creek).

Historical clearing between 1961 and 1970 and later between 1989 and 2002 has removed large areas of remnant PCT 835. The latter clearing involved (but not limited to) the construction of the subject land's reservoir, the haul road into the quarry areas, the existing yard entrance, and a drainage swale running from east to west along the main access road. Much of these activities required the construction of bund walls, which relative to PCT 835 are located along the eastern side of Eastern Creek's riparian zone and west side of the haul road and the plant's yard.

Within the subject land, PCT 835 exists as two condition states, with that associated with the riparian zone of Eastern Creek considered in better condition than the areas that would be impacted as a result of the proposal.

All areas of PCT are degraded due to historical disturbance to the landform and dominance of weed species in the shrub and ground layers. Areas that would be impacted (as a result of the proposal) are considered to be in a lower condition state due to the following:

- Location away from the more continuous areas of riparian vegetation;
- Past construction disturbance (earthen bund walls and drainage swales;
- Edge effects from main road, haul road and plant areas; and
- Mix of planted vegetation along main road areas (including mown grassed understorey).

One broad condition state (Mod-low) has been allocated to the areas that will be impacted.

Table 3-1 summarises the criteria used for allocation of native vegetation to PCT 835 and site photos are provided in photo plates 1 and 2 and the location of PCT 835 within the subject land shown in Figure 3-1.

Table 3-1. Selection process for PCT 835

Criteria	Description
IBRA Region/ Subregion	Sydney Basin / Cumberland Plain
Mitchell Landscape	Cumberland Plain
Keith Formation and Class	Grassy Woodland / Coastal Valley Grassy Woodlands
Confirmed in vegetation mapping	CumberlandPlainWest_2013_E_4207 (OEH 2013)
Landscape position	Riparian corridor to Eastern Creek
Percent cleared values	93%
TEC Status	Endangered Ecology Community (EEC) – River-flat Eucalypt Forest
Native species present	*Eucalyptus tereticornis* (dominant), *Casuarina glauca* (subdominant), *Acacia parramattensis, Melaleuca stypheloides* (scattered), *Dichondra repens*

Photo 1. PCT 835 viewed from east to west and where new yard entry proposed

Photo 2. Isolated PCT 835 in operational area adjacent existing haul road.

3.2.2 PCT 849 - Grey Box - Forest Red Gum grassy woodland

Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 849) is the subdominant PCT mapped within the subject land (OEH 2013), which is associated with the constructed bund areas, the main access road and within the yard. Within the subject land, PCT 849 occurs as planted vegetation along the main access road and as colonising vegetation on the earthern bunds to the south and west of the plant. The assemblage of native species along the southern bund is more diverse in terms of species richness. Plot/transect data

collected from this location has been used to conservatively calculate offsetting obligations for all areas of this PCT. Table 3-2 summarises the criteria used for allocation of native vegetation to PCT 849 and site photos are provided in photo plates 3 to 6 and the location of PCT 849 within the subject land shown in Figure 3-1.

Table 3-2. Selection process for PCT 849

Criteria	Description
IBRA Region/ Subregion	Sydney Basin / Cumberland Plain
Mitchell Landscape	Cumberland Plain
Keith Formation and Class	Grassy Woodland / Coastal Valley Grassy Woodlands
Confirmed in vegetation mapping	CumberlandPlainWest_2013_E_4207 (OEH 2013)
Landscape position	Colonised constructed bunds,
Percent cleared values	93%
TEC Status	Critically Endangered Ecology Community (CEEC) – Cumberland Plain Woodland
Native species present	*Eucalyptus tereticornis, Eucalyptus moluccana, Eucalyptus crebra, Eucalyptus fibrosa, Bursaria spinosa, Ozothamnus diosmifolius, Oxalis perannens, Dichondra repens*

Photo 3. PCT 849 along base of bund (west of the plant)

Photo 4. Isolated PCT 849 in adjacent existing haul road.

Photo 5. PCT 849 (planted) along main access road

Photo 6. PCT 849 location shot with crusher in background

3.2.3 PCT 1800 – Cumberland Swamp Oak riparian forest

Cumberland Swamp Oak riparian forest (PCT 1800) was not formally recognised until after OEH (2013) mapping was completed. However, large extents of this community have been mapped in SydneyMetroArea_v3_2016_E_4489 mapping (OEH 2016) immediately east and southeast of the BDAR assessment area along Prospect Creek and surrounding Prospect Reservoir.

It is noted that Cumberland Ecology (2019) identified PCT 1232 – Swamp Oak floodplain swamp forest as a planted vegetation community within the yard under the approved SSD.

This was based on: the canopy being dominated exclusively by *Casuarina glauca* (Swamp Oak); with the only broad vegetation community in NSW (consisting of a canopy almost exclusively of Swamp Oak being the TEC Swamp Oak Floodplain Forest); and within Western Sydney on Shale occurrences of the TEC corresponding with the PCT 1232, which occurs with lagoons associated with "poorly drained shale depressions on the Cumberland Plain".

A distinguishing feature of PCT 1800 is also prominent stands of Swamp Oak PCT 1800, which is found on the river flats (along or near streams) of the Cumberland Plain in Western Sydney.

Historical photographs show only drainage lines associated with Eastern Creek and no evidence of lagoons or other poorly drained shale depressions within the subject land. Therefore, the location of this vegetation within the subject land (assessed under MOD 1) is considered more appropriately attributed to PCT 1800.

Most areas of PCT 1800 comprise vegetation that has colonised bunded areas, with colonisation of the edges of the reservoir during times of lower water levels (see photo plate 10). The exception being an area of PCT 1800 adjacent to the Plant 2 yard (see Figure 3-1) which is more floristically diverse. Plot/transect data collected from this location has been used to conservatively calculate offsetting obligations for all areas of this PCT.

Table 3-3 summarises the criteria used for allocation of native vegetation to PCT 1800 and site photos are provided in photo plates 7 to 10.

Table 3-3. Selection process for PCT 1800

Criteria	Description
IBRA Region/ Subregion	Sydney Basin / Cumberland Plain
Mitchell Landscape	Cumberland Plain
Keith Formation and Class	Forested Wetlands/Coastal Floodplain Wetlands
Confirmed in vegetation mapping	n/a (PCT added to BioNet Vegetation Classification database after mapping completed)
Landscape position	Riparian corridor to Eastern Creek and colonised bunds
Percent cleared values	60%
TEC Status	Endangered Ecology Community (EEC) – Swamp Oak Floodplain Forest
Native species present	*Casuarina glauca* (dominant), *Eucalyptus tereticornis* (subdominant), *Melaleuca stypheloides* (scattered)

	
Photo 7. PCT 1800	**Photo 8.** PCT 1800
	
Photo 9. PCT 1800	**Photo 10.** PCT 1800

3.2.4 Exotic-Weeds

The remaining areas within the subject land comprises cleared land for haul roads and quarry areas and hard stand areas.

Approximately 0.9 ha of the MOD 1 area contains exotic vegetation, with a further 4.2 ha of cleared land and hardstand.

In accordance with Section 5.1.1.5 of the BAM, these areas do not require further assessment, unless they provide habitat for threatened species.

Photo plates 11 to 14 illustrate typical weed infested areas within the subject land.

Photo 11. Weed growth on bund west of plant

Photo 12. Weed growth on crest of bund

Photo 13. Typical weed growth environment surrounding yard

Photo 14. Weed growth beneath isolated patch of native vegetation with weed growth on bund in background

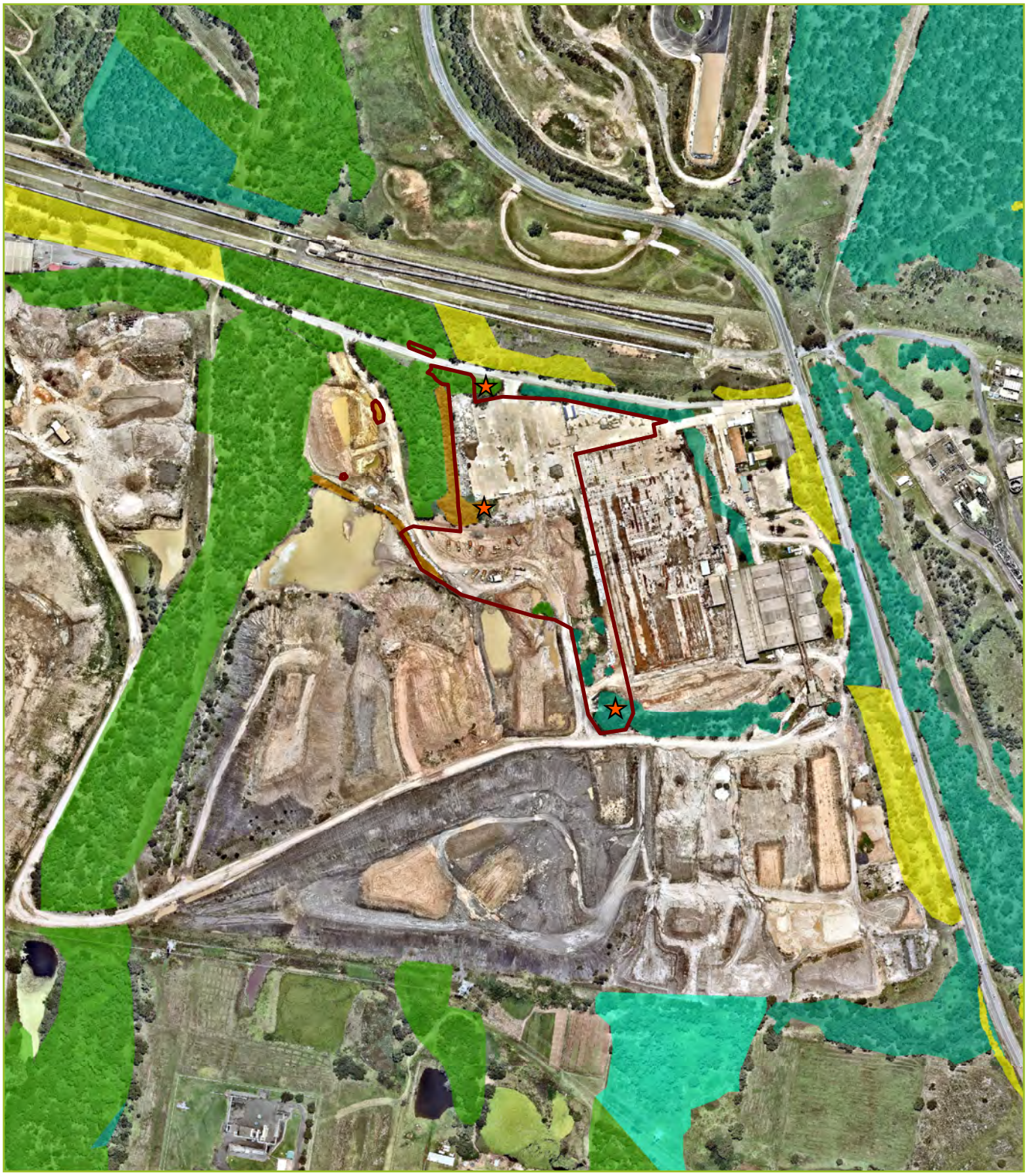
3.3 Patch size

A patch is an area of native vegetation that occurs on the subject land and includes native vegetation that has a gap of less than 100 m from the next area of native vegetation (or ≤ 30 m for non-woody ecosystems). A patch may extend onto adjoining land.

For each vegetation zone, the assessor must determine the patch size in hectares and assign it to one of the following classes:

a. <5 ha, or
b. 5-<25 ha, or
c. 25-<100 ha, or
d. ≥100 ha.

Each of the PCTs assessed in this BDAR were determined to have a patch size ≥100 ha.



Legend

- Plot_locations
- Subject area
- Not assessed
- PCT 835, TEC River-flat Eucalypt Forest
- PCT 849, TEC Cumberland Plain Woodland
- PCT 850, TEC Cumberland Plain Woodland
- PCT 1800, TEC Swamp Oak Floodplain Forest

N

0 37.5 75 150 225 300

m

Brickworks Plant 2 Upgrade SSD-9601 MOD1

Figure 3-1. PCTs and TECs within the subject land

Coordinate System:
MGA Zone 56 (GDA 94)

Image sources:
Nearmap 27 December 2020

Data sources:
CumberlandPlainWest_2013_E_4207 (modified)
SydneyMetroArea_v3_2016_E_4489 (modified)

4. Threatened species

4.1 Assessing habitat suitability for threatened species

The Threatened Biodiversity Data Collection (TBDC) identifies the threatened species that are likely to occur on or use the subject land and thereby predicts the species that require assessment. This is automatically populated in the BAM-C based on the information collected from assessing the subject land.

Threatened species are categorised in the BAM-C as ecosystem, species, or dual, credit species.

4.1.1 Ecosystem credit species

Ecosystem credit species are those threatened species where the likelihood of occurrence of a species or elements of the species' habitat can be predicted by vegetation surrogates and landscape features, or for which targeted survey has a low probability of detection.

The TBDC identifies the threatened species assessed for ecosystem credits. A targeted survey is not required to identify or confirm the presence of ecosystem credit species.

4.1.2 Species credit species

Species credit species are threatened species for which vegetation surrogates and/or landscape features cannot reliably predict the likelihood of their occurrence or components of their habitat. These species are identified in the TBDC. A targeted survey or an expert report is required to confirm the presence of these species on the subject land. Alternatively, for a development, activity, clearing or biodiversity certification proposal only, the proponent may elect to assume the species is present.

4.1.3 Dual credit species

Dual credit species are threatened species that the TBDC identifies as both ecosystem credits and species credit species. Dual credit species are generally highly mobile species that rely on particular habitat components for breeding or require particular areas in the landscape important for their survival. For dual credit species, part of the habitat is assessed as a species credit. The remaining habitat components for the species are assessed as an ecosystem credit (e.g. foraging habitat).

4.2 Identify candidate species for further assessment

The BAM-C returned a total of 69 threatened entities, which includes the following:

- 20 ecosystem credit species;
- 34 species credit species (including 4 endangered populations); and
- 15 dual ecosystem / species credit species.

4.2.1 Ecosystem credit species

Table 4-1 provides a list of the ecosystem credit species derived from the BAM-C and identifies the following:

- The PCTs in which each species is predicted to occur in;
- The ecosystem credit type, i.e. ecosystem (foraging) indicates the species is a dual species and also considered in Section 4.2.2;
- Whether they have been retained within the assessment (yes or no); and
- Justification for the species not retained within the assessment (i.e. following consideration of any habitat constraints, absence of habitat, geographic limitations and habitat quality.

Table 4-1. Ecosystem credit species

Species Name	PCTs	Credit type	Retained?	Justification if not retained
Bats				
Falsistrellus tasmaniensis	835, 849, 1800	Ecosystem	Yes	
Miniopterus australis	835, 849, 1800	Ecosystem (foraging)	Yes	
Miniopterus orianae oceanensis	835, 849, 1800	Ecosystem (foraging)	Yes	
Micronomus norfolkensis	835, 849, 1800	Ecosystem	Yes	
Pteropus poliocephalus	835, 849, 1800	Ecosystem (foraging)	Yes	
Saccolaimus flaviventris	835, 849, 1800	Ecosystem	Yes	
Scoteanax rueppellii	835, 849, 1800	Ecosystem	Yes	
Birds				
Anthochaera phrygia	835, 849, 1800	Ecosystem (foraging)	Yes	
Artamus cyanopterus cyanopterus	835, 849, 1800	Ecosystem	Yes	
Botaurus poiciloptilus	835	Ecosystem	No	Habitat degraded, areas of permanent water lack dense vegetation for roosting, shelter and breeding
Callocephalon fimbriatum	835, 849	Ecosystem (foraging)	Yes	
Chthonicola sagittata	835, 849, 1800	Ecosystem	Yes	
Circus assimilis	849	Ecosystem	Yes	
Climacteris picumnus victoriae	835, 849, 1800	Ecosystem	Yes	
Daphoenositta chrysoptera	835, 849, 1800	Ecosystem	Yes	
Glossopsitta pusilla	835, 849, 1800	Ecosystem	Yes	
Grantiella picta	835, 849, 1800	Ecosystem	No	Habitat constraint: i.e. mistletoes not present at greater than 5/ha.
Haliaeetus leucogaster	835, 849, 1800	Ecosystem (foraging)	Yes	
Hieraaetus morphnoides	835, 849, 1800	Ecosystem (foraging)		
Ixobrychus flavicollis	835, 1800	Ecosystem	No	Habitat degraded: i.e. areas of permanent water lack dense vegetation for roosting, and overhanging branches for nesting absent.

Species Name	PCTs	Credit type	Retained?	Justification if not retained
Lathamus discolor	835, 849, 1800	Ecosystem (foraging)	Yes	
Lophoictinia isura	835, 849, 1800	Ecosystem (foraging)	Yes	
Melanodryas cucullata cucullata	835, 849, 1800	Ecosystem	Yes	
Melithreptus gularis gularis	835, 849, 1800	Ecosystem	Yes	
Neophema pulchella	835, 849, 1800	Ecosystem	Yes	
Ninox connivens	835, 849, 1800	Ecosystem (foraging)	Yes	
Ninox strenua	835, 849, 1800	Ecosystem (foraging)	Yes	
Pandion cristatus	835, 1800	Ecosystem (foraging)	No	Habitat constraint: i.e. no clear, open water for foraging and no trees present within one kilometre of the ocean.
Petroica boodang	835, 849, 1800	Ecosystem	Yes	
Petroica phoenicea	835, 849, 1800	Ecosystem	Yes	
Stagonopleura guttata	835, 849, 1800	Ecosystem		
Tyto novaehollandiae	835, 849, 1800	Ecosystem (foraging)	Yes	
Marsupials				
Dasyurus maculatus	835, 849, 1800	Ecosystem	No	Habitat degraded/insufficient patch size: females occupy home ranges of 200-500 ha, while males occupy very large home ranges from 500 to over 4000 ha.
Petaurus australis	849	Ecosystem	No	Habitat constraint: i.e. tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils, including: mixed coastal forests to dry escarpment forests in the north; moist coastal gullies and creek flats to tall montane forests in the south. No distinctive scarring on trees observed within subject land.
Phascolarctos cinereus	835, 849, 1800	Ecosystem (foraging)	No	Habitat absent/degraded: species requires large areas of habitat which are not present within the subject land and species not recorded from within the Bionet database locality search.

4.2.2 Species credit species

Table 4-2 provides a list of the species credit species derived from the BAM-C, and identifies the following:

- The PCTs in which each species is predicted to occur in;
- The species credit type, i.e. species (breeding) indicates the species is a dual species and also considered in Section 4.2.1;
- Whether they have been retained within the assessment (yes or no); and
- Justification for the species not retained within the assessment (i.e. following consideration of any habitat constraints, absence of habitat, geographic limitations, and habitat quality.

Table 4-2. Species credit species

Species name	PCTs	Credit type	Retained	Justification if not retained
Amphibians				
Litoria aurea	835, 849, 1800	Species	No	Habitat degraded/absent: microhabitats within the subject land are degraded, such that the species is unlikely to utilise the habitat. Permanent or semi-permanent water bodies proximal to the proposed works do not contain emergent vegetation or proximal terrestrial habitat. Eastern gambusia is also widespread in the locality's waterways and dams. Numerous surveys within the locality have failed to detect the species and it is likely to be locally extinct in the area.
Bats				
Chalinolobus dwyeri	835, 849, 1800	Species	No	Habitat constraint: i.e. no cliffs and not within 2 km of rocky areas containing caves, overhands, escarpments, outcrops, or crevices, or within 2 km of old tunnels or mines.
Miniopterus australis	835, 849, 1800	Species (breeding)	No	Habitat constraint: i.e. no caves, tunnels, mines, culverts or other known structures known or suspected to be used for breeding present.
Miniopterus orianae oceanensis	835, 849, 1800	Species (breeding)	No	Habitat constraint: i.e. no caves, tunnels, mines, culverts or other known structures known or suspected to be used for breeding present.
Myotis macropus	835, 849, 1800	Species	No	Habitat constraint: no hollow bearing trees, bridges, cave, or suitable artificial structures located within 200 m of riparian zone.
Pteropus poliocephalus	835, 849, 1800	Species (breeding)	No	Habitat constraint: i.e. breeding camps absent.
Birds				
Anthochaera phrygia	835, 849, 1800	Species (breeding)	No	Geographic constraint: i.e. subject land not within a mapped breeding area for the species (which is only known to breed at three locations).
Burhinus grallarius	835, 849, 1800	Species	No	Habitat constraint: inhabits open forests and woodlands with a sparse grassy groundlayer and fallen timber/standing dead timber including logs. Fallen timber is limited within the subject land and where found is located within an active operational area, which would preclude habitat for this species.
Callocephalon fimbriatum	835, 849	Species (breeding)	No	Habitat constraints: i.e. no hollow bearing trees with hollows greater than 9 cm diameter present.

Species name	PCTs	Credit type	Retained	Justification if not retained
Callocephalon fimbriatum - endangered population	835, 849	Species	No	Geographic limitation: subject land not located within Hornsby and Ku-ring-gai LGAs
Haliaeetus leucogaster	835, 849, 1800	Species (breeding)	No	Habitat constraint: no nests located and no large trees present likely to be suitable for nesting by the species present.
Hieraaetus morphnoides	835, 849, 1800	Species (breeding)	No	Habitat constraint: no nests located and no large trees present likely to be suitable for nesting by the species present.
Lathamus discolor	835, 849, 1800	Species (breeding)	No	Habitat constraint: i.e. site is not within mapped breeding area
Lophoictinia isura	835, 849, 1800	Species (breeding)	No	Habitat constraint: no nests located and no large trees present likely to be suitable for nesting by the species present.
Ninox connivens	835, 849, 1800	Species (breeding)	No	Habitat constraint: i.e. living or dead trees with hollow greater than 20 cm diameter absent.
Ninox strenua	835, 849, 1800	Species (breeding)	No	Habitat constraint: i.e. living or dead trees with hollow greater than 20 cm diameter absent.
Pandion cristatus	835, 1800	Species (breeding)	No	Habitat constraint: i.e. no stick nests in living or dead trees or artificial structures within 100 m of a floodplain
Tyto novaehollandiae	835, 849, 1800	Species (breeding)	No	Habitat constraint: i.e. hollow bearing trees or hollows greater than 20 cm diameter.
Invertebrates				
Meridolum corneovirens	835, 849	Species	Yes	
Pommerhelix duralensis	849	Species	No	Habitat constraint/degraded: No significant occurrences of leaf litter or bark and no rocky areas.
Marsupials				
Cercartetus nanus	835, 849	Species	No	Habitat absent/degraded: species has a preference for heathy habitats, which is not present. Key food source absent and the species is not recorded from within the Bionet database locality search.
Petaurus norfolcensis	835, 849, 1800	Species	No	Habitat degraded/absent: species requires mature or old growth woodland or forest with abundant hollows for refuge and nest sites.

Species name	PCTs	Credit type	Retained	Justification if not retained
Phascolarctos cinereus	835, 849, 1800	Species (breeding)	No	Habitat absent/degraded: species requires large areas of habitat which are not present within the development site and not recorded from within the Bionet database locality search.
Epiphytes / Climbers				
Cynanchum elegans	835, 849, 1800	Species	No	While known from Forest Red Gum Eucalyptus tereticornis aligned open forest and woodland, the species usually occurs on the edge of dry rainforest vegetation. Flowering occurs between August and May, with a peak in November. The species was not located during surveys by both Cumberland Ecology (2019) and écologique (2020) during floristic surveys pre- BAMC generation of Candidate Species Report.
Ferns and Cycads				
Pilularia novae-hollandiae	835, 849, 1800	Species	Yes	
Herbs and Forbs				
Deyeuxia appressa	1800	Species	No	Habitat absent: known to grow in moist conditions (flowering in spring to summer). The species is a highly restricted NSW endemic known only from two pre-1942 records in the Sydney area (first collected in 1930 at Herne Bay, Saltpan Creek, off the Georges River, and thereafter in 1941 from Killara, near Hornsby). Has not been collected since and may now be extinct in the wild due to the level of habitat loss and development that has occurred within these areas. An erect perennial grass to 0.9 m high which was not located during surveys by both Cumberland Ecology (2019) and écologique (2020) during floristic surveys pre- BAMC generation of Candidate Species Report.
Maundia triglochinoides	1800	Species	No	This species is restricted to coastal NSW and extends into southern Queensland. The current southern limit is Wyong; former sites around Sydney are now extinct. Regardless, the species was not observed within the watercourses and reservoir with the subject land (noting that the author of this BDAR, as a wetland specialist for over ten years is very familiar with this species).
Persicaria elatior	-	Species	Yes	Habitat degraded: the subject land does not contain the vegetation types the species is reported from within the species profile and not recorded from within the Bionet database locality search.

Species name	PCTs	Credit type	Retained	Justification if not retained
Thesium australe	849	Species	No	Habitat degraded: the subject land is substantially degraded to the extent that native grasses are mostly absent and most common host Themeda triandra is not present. Not recorded from within the Bionet database locality search
Wahlenbergia multicaulis - endangered population	849	Species	No	Geographic limitation/habitat degraded: There are 13 known sites, none that occur in the subject land's LGA. While there are likely to be more sites, Western Sydney most sites are closely aligned with poorly drained, yellow podsolic extensively permeated with fine, concretionary ironstone (laterite) soils (which are not representative of the subject land). Typically occurs in damp, disturbed sites (with natural or human disturbance of various forms), typically amongst other herbs rather than in the open (the subject land lacks a herb understorey). The species responds favourably to disturbance of soil in some situations with high exposure to sunlight (however, too much disturbance can eventually exhaust the seedbank and lead to local extinctions). The level of disturbance within the subject land is considered to be 'too much disturbance' with very few herbs and forbs contributing to the groundlayer.
Orchids				
Caladenia tessellata	849	Species	No	Known only from old records in the Sydney area. Not recorded from within the Bionet database locality search. Generally found in grassy sclerophyll woodland on clay loam or sandy soils. While the subject land contains grassy woodland formations, the areas that will be impacted from the proposal are highly modified with subsoil strata replacing topsoils and depauperate recolonisation by canopy species and windblown groundlayer species. Regardless, no orchids were observed during surveys undertaken in late September 2020, which coincides with this species flowering season.
Pterostylis saxicola	849	Species	No	Habitat degraded/absent: most commonly found growing in small pockets of shallow soil in depressions on sandstone rock shelves above cliff lines. The vegetation communities above the shelves where the species occurs are sclerophyll forest or woodland on shale/sandstone transition soils or shale soils. While the subject land contains shale soils, sandstone rock shelves are absent and habitat considered too degraded for the species to occur (i.e. considerable modification to the natural ground surface where vegetation will be impacted as a result of the proposal).

Species name	PCTs	Credit type	Retained	Justification if not retained
Shrubs				
Acacia bynoeana	849	Species	No	Habitat absent: Species requires sandstone soils, occuring in heath or dry sclerophyll forest on sandy soils. The subject land is situated on Wianamatta derived shale clays. Associated overstorey species include Red Bloodwood, Scribbly Gum, Parramatta Red Gum, Saw Banksia and Narrow-leaved Apple, which are also not present on the subject land.
Acacia pubescens	849	Species	No	While known from Cumberland Plain Woodland, the species is a conspicuous shrub which was not located during surveys by both Cumberland Ecology (2019) and écologique (2020) during floristic surveys pre- BAMC generation of Candidate Species Report.
Callistemon linearifolius	835	Species	No	Recorded from the Georges River to Hawkesbury River in the Sydney area. For the Sydney area, recent records are limited to the Hornsby Plateau area near the Hawkesbury River. A conspicuous shrub (up to 3-4 m tall) which was not located during surveys by both Cumberland Ecology (2019) and écologique (2020) during floristic surveys pre- BAMC generation of Candidate Species Report.
Dillwynia tenuifolia	849	Species	No	Habitat absent: The core distribution of this species is the Cumberland Plain from Windsor and Penrith east to Dean Park near Colebee, with other populations recorded from Voyager Point and Kemps Creek in the Liverpool LGA, Luddenham, Penrith LGA and South Maroota, the Hills Shire. In western Sydney, the species is thought to potentially be locally abundant within scrubby/dry heath areas within Castlereagh Ironbark Forest and Shale Gravel Transition Forest on tertiary alluvium or laterised clays; and also where these communities adjoin Castlereagh Scribbly Gum Woodland. The subject land does not fall within any of these areas, and the species is not recorded from within the Bionet database locality search. No Dillwynia species were recorded by both Cumberland Ecology (2019) and écologique (2020) within the subject land.
Dillwynia tenuifolia - endangered population	849	Species	No	As above
Grevillea juniperina subsp. juniperina	849	Species	No	Species is a conspicuous shrub not located during surveys by both Cumberland Ecology (2019) and écologique (2020) during floristic surveys pre- BAMC generation of Candidate Species Report.

Species name	PCTs	Credit type	Retained	Justification if not retained
Gyrostemon thesioides		Species	No	Within NSW, the species has only ever been recorded at three sites, to the west of Sydney, near the Colo, Georges and Nepean Rivers. The most recent sighting was of a single male plant near the Colo River within Wollemi National Park. The species has not been recorded from the Nepean and Georges Rivers for 90 and 30 years respectively, despite searches.
Hibbertia sp. Bankstown	835	Species	No	This species is currently known only from tertiary alluvial soil along Airport Creek on Bankstown Airport and is not recorded from within the Bionet database locality search. No Hibbertia species found on the subject land by both Cumberland Ecology (2019) and écologique (2020) during floristic surveys pre- BAMC generation of Candidate Species Report.
Marsdenia viridiflora subsp. - endangered population	849	Species	No	Habitat absent: i.e. grows in vine thickets and open shale woodlands, open scrub and forest. This species is a climber with twining stems to 4m high, which was not identified by both Cumberland Ecology (2019) and écologique (2020) during floristic surveys pre- BAMC generation of Candidate Species Report.
Persoonia bargoensis	849	Species	No	Habitat absent: Found on sandy soils in dry sclerophyll open forest, woodland and heath on sandstone. A conspicuous shrub distinguished by its hairiness and not found on the subject land by both Cumberland Ecology (2019) and écologique (2020) during floristic surveys pre- BAMC generation of Candidate Species Report.
Persoonia hirsuta	835	Species	No	This species is restricted to a small area south-west of Sydney on the western edge of the Woronora Plateau and the northern edge of the Southern Highlands. The historical limits are Picton and Douglas Park (northern), Yanderra (southern), Cataract River (eastern) and Thirlmere (western). The subject land is located outside of these areas. No Persoonia species were located within the subject land by both Cumberland Ecology (2019) and écologique (2020) during floristic surveys pre- BAMC generation of Candidate Species Report.
Pimelea curviflora var. curviflora	849	Species	No	Habitat absent: A much-branched subshrub or shrub 20 to 120cm high, which occurs on shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes amongst woodlands. Site is outside of the species' known range from North Sydney to Maroota and species is not associated with shale soils.
Pimelea spicata	849	Species	Yes	

Species name	PCTs	Credit type	Retained	Justification if not retained
Pomaderris brunnea	835, 849, 1800	Species	No	The species is found in a very limited area around the Colo, Nepean and Hawkesbury Rivers, including the Bargo area and near Camden. A conspicuous shrub to 3 m tall that has distinctively hairy stems and not found on the subject land by both Cumberland Ecology (2019) and écologique (2020) during floristic surveys pre- BAMC generation of Candidate Species Report.
Pultenaea pedunculata	849	Species	No	Habitat absent/degraded: While one of three three disjunct populations is known from the Cumberland Plain all sites have a lateritic influence with ironstone gravel (nodules) present and recorded from the the shale-soil form of Shale Sandstone Transition Forests and Cooks River/Castlereagh Ironbark Forest (which are absent from the subject land). The species is a conspicuous sub-shrub not located during surveys by both Cumberland Ecology (2019) and écologique (2020) during floristic surveys pre- BAMC generation of Candidate Species Report.
Trees				
Eucalyptus benthamii	835, 849, 1800	Species	No	The species is a conspicuous tree not identified by both Cumberland Ecology (2019) and écologique (2020) during floristic surveys pre- BAMC generation of Candidate Species Report. The species is not recorded from within the Bionet database locality search and only known from a number of specific locations along the Nepean River and tributaries (outside of the subject land).

4.3 Targeted field surveys

4.3.1 Threatened flora species

Two threatened flora species, *Pilularia novae-hollandiae* and *Pimelea spicata* were not discounted from requiring targeted surveys to determine species presence.

Pilularia novae-hollandiae

Pilularia novae-hollandiae (Austral Pillwort) is a semi-aquatic fern, which grows in shallow swamps and waterways, often among grasses and sedges. It is most often recorded in drying mud as this is when it is most conspicuous and is likely to be ephemeral, appearing when soils are moistened by rain.

The only area in which habitat for this species will be disturbed potentially occurs within drying mud surrounding the main reservoir within the operational area of the quarry.

The main reservoir was inspected in December 2019 and September 2020. Parallel transects (to determine the species presence of absence), were not possible due to relatively steeply sloping nature of the reservoir's topography. However, inspection around the periphery enabled sufficient visual access, which determined the presence of isolated and scattered (introduced) sedges only and colonisation of Swamp Oak.

Austral Pillwort is a small rhizomatous creeping fern, which is distinguished by: young, coiled fronds; small, pill-like spore containers and by dense mats formed by older plants. Often found growing often among grasses and sedges, the species also resembles a very small and fine leaved grass.

No evidence of any growth forms commensurate with that of Austral Pillwort were observed during inspections of potential habitat for this species.

Most records of the species are from the NSW South Western Slopes dated from 1951,1952 and the late 90s, with one from 2000 and one from 2005. A further three records from between 1999 to 2000 are from the Riverina (NSW), with only one record from the Sydney Region (in Blacktown) from 1966.

Pimelea spicata

Pimelea spicata (Spiked Rice-flower) is a shrub to 50 cm tall that may be erect or somewhat spreading in habit, which occurs on well-structured clay soils.

Random meanders conducted by Cumberland Ecology (2019) failed to find any native shrubs. The areas assessed by écologique (2020) comprise scattered areas of native vegetation. The largest area of impact being approximately 0.12ha, with the adjacent vegetation surveyed by random meander by Cumberland Ecology (2019).

Native shrubs found by écologique (2020) included *Bursaria spinosa, Ozothamnus diosmifolius* and *Atriplex semibaccata*. No shrubs of, or similar to, the *Pimelea* genus were found.

Figure 4-1 illustrates the areas in which threatened species surveys were undertaken.

4.3.2 Threatened fauna species

Based on geographic limitations, habitat constraints or vagrancy, *Meridolum corneovirens* Cumberland Plain Land Snail is the only species considered to have the potential to occur within the subject land.

Active searches were undertaken by Cumberland Ecology on 10 December 2018 and 8 November 2019, within searches consisted of checking within 1 m of the base of all Eucalypts that had a diameter at breast height greater than 10 cm and had leaf litter present at the base. Searches included disturbance (via raking) of the fallen bark and/or leaf litter to search for live snails or snail shells. Further active searches were undertaken by écologique on the 30th September 2020, which were consistent with the methods employed by Cumberland Ecology, but included searches beneath any LWD further than 1m away from trees (and able to be lifted) and other materials (under which snails may take shelter). No snail species were found.

Brickworks Plant 2
SSD-9601 MOD1

Legend

- Plot_locations
- Austral pillwort
- Flora & snail searches
- Cumberland Ecology surveys

Impacted vegetation

- MOD 1 Exotic vegetation
- MOD 1 PCT 835
- MOD 1 PCT 849
- MOD 1 PCT 1800

N

0 12.5 25 50 75 100
m

Coordinate System: MGA Zone 56 (GDA 94) | Image source: Nearmap 27 December 2020

Figure 4-1.
Vegetation and species surveys

Diagram date: 26.03.2021

5. Prescribed Impact Identification

Prescribed additional biodiversity impacts (prescribed impacts) must be assessed as part of the BOS, as per clause 6.1 of the BC Regulation. Prescribed impacts include those impacts on the habitat of threatened species or ecological communities from development that is not directly caused as a result of vegetation clearing.

Table 5-1 lists the prescribed impacts, which are identified in Clause 6.1 of the *Biodiversity Conservation Regulation 2017* and the relevance of each prescribed impact in relation to the proposed MOD 1 works.

Table 5-1. Prescribed and Uncertain Impacts

Will there be impacts on any of the following	Yes/No	If Yes, address the assessment questions from section 9.2.1 of the BAM
(a) Development on the habitat of threatened species or ecological communities associated with: i. karst, caves, crevices, cliffs, rock outcrops and other geological features of significance; ii. human-made structures; iii. non-native vegetation;	NO	i. no karst, caves, crevices, cliffs and other features of geological significance occur on or near the subject land. ii. no human-made structures would be disturbed as a result of the proposed MOD 1. iii. Non-native vegetation within the subject land is unlikely to provide habitat for threatened species or ecological communities.
(b) on areas connecting threatened species habitat, such as movement corridors	NO	The subject land is mapped within the Cumberland Subregion BIO Map Biodiversity Corridors of Regional Significance in the Biodiversity Investment Opportunities Map (OEH 2018). The proposed MOD 1 will not remove vegetation from these areas
(c) that affect water quality, water bodies and hydrological processes that sustain threatened entities (including from subsidence or upsidence from underground mining)	NO	Stormwater runoff from the subject land has been managed historically via drainage swales and capture in reservoirs before discharge to Eastern Creek. The design of the approved SSD and proposed MOD 1 is anticipated to improve on stormwater management. Therefore it is considered unlikely that water quality and hydrological processes as a result of the proposed MOD 1 would cause further impacts providing appropriate construction and operational management mitigation measures are implemented.
(d) on threatened and protected animals from turbine strikes from a wind farm	NO	No wind turbines are proposed
(e) on threatened species or fauna that are part of a TEC from vehicle strikes	NO	The approved SSD and proposed MOD 1 are anticipated to maintain similar vehicular routes.

6. Avoid or Minimise Impacts

6.1 Avoiding or minimising impacts on biodiversity values

6.1.1 Direct impacts

The proposed MOD 1 development has sought to avoid and minimise direct impacts on native vegetation and habitat through the following:

- Locating most of the proposed yard extension in areas already cleared or comprising exotic vegetation; and
- Avoiding areas of remnant native vegetation, in particular those areas of native vegetation located within the Cumberland Subregion BIO Map Biodiversity Corridors of Regional Significance (OEH 2018); and
- Minimising clearing of native vegetation to under 0.5ha comprising several scattered locations of native vegetation in poor condition (i.e. isolated and/or highly degraded vegetation growing in existing modified areas of the plant, yard and quarry and which do not contain habitat for threatened species).

6.1.2 Indirect impacts

The proposed MOD 1 development has sought to prevent indirect impacts on retained native vegetation and habitat, including the riparian and downstream aquatic environment of Eastern Creek, through the following:

- A new stormwater detention/sediment basin, which has been designed to prevent sediment impacts on water quality and moderate impacts from altered hydrology to Eastern Creek; and
- The implementation of a range of avoidance and minimisation measures, which include:
    - Staging of construction to minimise material stockpiling, cleaning (water suppression) of haul roads and speed restrictions for management of potential dust impacts;
    - An Erosion and Sediment Control Plan, which applies best management practices to prevent indirect impacts on retained native vegetation, less mobile terrestrial fauna (such as invertebrates) and the downstream aquatic environment of Eastern Creek;
    - Pre-clearance and clearance processes, which aim to achieve the following, but not limited to:
        - protection of retained native vegetation and habitat
        - prevention of injury/mortality to all fauna
        - prevention of the spread and/or introduction of weeds and pathogens

Refer Sections 7 and 8 for further detail on the avoidance, minimisation and mitigation measures of indirect impacts.

6.2 Avoiding and minimising prescribed impacts

Not applicable as no prescribed impacts would result from the MOD 1 proposal.

7. Assessing the impacts of the proposal on biodiversity values

7.1 Impacts on native vegetation and habitat

7.1.1 Direct impacts

The MOD 1 proposal will directly impact on approximately 0.462 ha of native vegetation (commensurate with three PCTs) and approximately 0.955 ha of exotic vegetation, as summarised in Table 7-1 and shown in Figure 7-1.

Table 7-1. Native vegetation clearing

PCT	Area (m^2)	Area (ha)	Location
Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 835)	686	0.069	Proposed new yard entrance
	222	0.022	Haul road
	24	0.002	Main access road easement
	28	0.003	Main access road easement
	39	0.004	New basin spillway
	86	0.009	New basin spillway
	26	0.003	New basin spillway
Subtotal PCT 835	**1,111**	**0.111**	
Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion planted (PCT 849)	338	0.034	Western earthen bund
	164	0.016	Western earthen bund
	165	0.017	Western earthen bund
	150	0.015	Main access road easement
	61	0.006	Western earthen bund
	1,392	0.139	Southern earthen bund
	110	0.011	Adjacent existing crusher
Subtotal PCT 849	**2,380**	**0.238**	
Cumberland Swamp Oak riparian forest (PCT 1800)	539	0.054	Yard expansion
	418	0.042	Haul road
	143	0.014	New basin
	24	0.002	New basin
Subtotal PCT 1800	**1,124**	**0.112**	
Total all PCTs	**4,615**	**0.462**	
MOD 1 Exotic vegetation	8,696	0.870	Western earthen bund
MOD 1 Exotic vegetation	383	0.038	New basin spillway
MOD 1 Exotic vegetation	467	0.047	Western earthen bund
	9,546	**0.955**	

Legend

- Subject area
- MOD 1 PCT 835
- MOD 1 PCT 849
- MOD 1 PCT 1800
- MOD 1 Exotic vegetation
- SSDA_BDAR_approved_clearing

N

0 20 40 80 120 160

m

Brickworks Plant 2 Upgrade SSD-9601 MOD1

Figure 7-1. Approved and proposed clearing

Coordinate System:
MGA Zone 56 (GDA 94)

Image sources:
Nearmap 27 December 2020

7.1.2. Change in Vegetation Integrity Score

Table 7-2 provides a summary of the changes in vegetation integrity scores for each PCT management zone, as calculated in the BAM-C.

Table 7-2. Change in vegetation integrity scores

Zone	PCT ID	PCT name	Management zone	Vegetation integrity score		
				Current	Future	Change
1	835	Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	835_Low-mod	22.3	0	-22.3
2	849	Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	849_Low	36.2	0	-36.2
3	1800	Cumberland Swamp Oak riparian forest	1800_Low	44.7	0	-44.7

7.1.3 Indirect impacts

Indirect impacts are generally those that affect areas outside of the development footprint but occur as a result of the development, and which impact on native vegetation, threatened ecological communities, threatened species and their habitat.

The BAM requires that the following aspects be assessed:

a. the nature, extent, frequency, duration and timing of indirect impacts of the proposal, inclusive of the following:
    i. during construction
    ii. during operation
    iii. arising from a change in land-use patterns
b. the consequences of indirect impacts on biodiversity values;
c. any limitations to data, assumptions and predictions about impacts on biodiversity; and
d. reduced viability of adjacent habitat due to noise, dust or light spill.

The cumulative impacts of the approved SSD and proposed MOD 1 development will not result in any significant impact on land use above that which already exists.

The proposed MOD 1 development is largely contained within the existing cleared plant and quarry operational areas.

The exception to this is the basin spillway approved under SSD 9601, which required the removal of 0.016ha of PCT 835 and the proposed new yard entrance, which will require the removal of approximately 0.076 ha of PCT 835.

While not directly located within the existing cleared plant and quarry operational areas, both areas are located immediately adjacent the main road access to both the haul road (and quarry) and existing plant yard and cumulatively contribute to negligible edge effects to existing remnant and planted vegetation.

Table 7-3 provides a summary of indirect impacts identified in the BAM that must be considered:

Table 7-3. Assessment of indirect impacts

Indirect impact	Duration	Biodiversity values impacted	Consequence
Inadvertent impacts on adjacent habitat or vegetation, such as:			
• Increased sedimentation	Short term during construction	River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin & SE Corner Bioregions (RFEF) Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin & SE Corner Bioregions (SOFF) Eastern Creek	Vegetation clearing and earthworks can expose soils and subsoils, which following rainfall may erode and mobilise soils in runoff, potentially smothering ground layer vegetation (in turn affecting health through a decrease in photosynthesis) or impact on water quality in Eastern Creek (in turn affecting aquatic organisms that may provide a food resource for native fauna). Providing that best practices in erosion and sedimentation management are implemented in accordance with the project's Erosion and Sediment Control Plan (ESCP) the consequence of this impact is considered to be a low risk.
• Introduction of weeds and pathogens	Short term during construction	RFEF, SOFF and Cumberland Plain Woodland in the Sydney Basin Bioregion (CPW) Eastern Creek	Construction activities have the potential to both spread existing weed infestations, introduce new weed species, and introduce or spread soil borne pathogens on machinery and equipment. As a consequence, the condition (e.g. site integrity values) of retained and neighbouring vegetation could be decreased.
• Trampling or other damage to remnant vegetation, including threatened species	Short term during construction	RFEF, SOFF and CPW	Remnant vegetation and other vegetation that is to be retained on the subject land are predominantly located outside of accessible areas (i.e. outside of works zones or on earthern bunds) and consequence considered low risk.
• Fertiliser drift	N/A	N/A	Fertiliser will not be used
• Rubbish dumping, wood collection, removal and disturbance of rocks, including bush rock	N/A	N/A	The subject lands are not accessible by the public and consequence considered low risk.

Indirect impact	Duration	Biodiversity values impacted	Consequence
Reduced viability of adjacent habitat due to:			
Edge effects	Long term	RFEF, SOFF and CPW	The proposal would not result in a significant reduction in existing remnant vegetation extent, nor result in a significant increase in edge effects above that which already exists and risk of consequence considered low.
Noise, dust or light spill	Long term (noise or light spill) Short term during construction (dust)	RFEF, SOFF and CPW	The existing operations and surrounding road network all generate a relatively high level of noise and light. Dust generation during construction activities will be managed under the project's Air Quality Impact Assessment guidelines: • Construction staging, • Minimising material stockpiles, • Cleaning (water suppression) of haul roads, • Speed restrictions, and • Implementation of the project's ESCP. The proposal is considered unlikely to reduce viability of any adjacent native vegetation or habitat due to noise, dust or light spill and risk of consequence considered low.
Increased risk of starvation, exposure, loss of shade or shelter	N/A	N/A	The proposal would not result in any significant changes to existing food resources, shade or shelter.
Loss of breeding habitat	N/A	N/A	Breeding habitat for threatened species absent from subject land
Habitat connectivity			
Habitat connectivity	N/A	N/A	The proposal would not result in a significant reduction in existing remnant vegetation extent or significantly impact on existing habitat connectivity.
Water bodies, water quality and hydrological processes			
Water bodies, water quality and hydrological processes	Short and long term	Eastern Creek	The risk of any significant impacts to the adjacent Eastern Creek and riparian corridor as a result of reduced water quality or altered hydrological processes is considered low. Potential impacts on water quality during construction and operation will be avoided/minimised through the implementation of the project's (ESCP) and Stormwater Detention/ Sediment Basin (respectively).

8. Mitigating and managing impacts

As described in Section 7, the proposal would result in a direct and permanent impact on 0.462 ha of native vegetation. The following range of mitigation and management measures shall be implemented to avoid and minimise any unintentional direct impacts and indirect impacts on the subject land's retained biodiversity values.

8.1 Vegetation and Habitat Clearing

8.1.1 Pre-clearance

The pre-clearing process provides a final check for the presence of flora and fauna species and habitat on a site immediately before clearing begins. Pre-clearing surveys are required to:

- Delineate the extent of clearing permitted and prepare site map(s) identifying exclusion zones;
- Identify and record the details of all habitat features (including where applicable: GPS location; species or type of habitat feature) for inclusion on site map(s);
- Mark habitat features that will be cleared, using suitable methods;
- Locate nearby habitat suitable for the release of fauna that may be encountered during the pre-clearing or clearing stages; and
- Locate suitable areas for relocation of habitat features if any (e.g. large woody debris, bush rock).

8.1.2 Clearing

Where habitat features are identified in pre-clearing surveys, a two-staged clearance process shall be undertaken and an experienced ecologist present to supervise the process, act as a fauna spotter and relocate any fauna captured. This shall include sufficient notification to proximal veterinarian surgeons and wildlife carers of the intent to commence clearance works and determine nearby locations where any injured or otherwise immature and susceptible fauna may be taken to.

8.1.3 Post-clearing

Following clearing, a post-clearing assessment will be prepared and must include at minimum the following results:

- Details of native fauna captured and relocated, injured or deceased;
- Photos of rescued fauna;
- Number of habitat features felled;
- Analysis of the effectiveness of clearing and fauna rescue methods; and
- Details of any woody debris, bushrock or hollow bearing trees that have been retained for habitat and where relocated.

8.2. Adaptive management for uncertain impacts

Not applicable as the MOD 1 proposal is considered unlikely to result in any uncertain impacts that require adaptive management.

9. Thresholds for Assessment

Section 9 of the BAM sets out the impact thresholds that must be applied, which include:

1. Impacts on an entity that is at risk of a serious and irreversible impact;
2. Impacts for which the assessor is required to determine an offset requirement;
3. Impacts for which the assessor is not required to determine an offset requirement; and
4. Impacts that do not require further assessment by the assessor.

9.1. Impacts on serious and irreversible impacts

Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 849) is identified in the TBDC a serious and irreversible impact (SAII) entity.

PCT 849 is one of two grassy woodland communities that are included in the critically endangered Cumberland Plain Woodland (CPW). The other community being Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion (PCT 850).

CPW along with Broad-leaved Ironbark – Grey Box – Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin (PCT 724) comprise the nationally listed Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest, which is also a critically endangered community under the EPBC Act.

The following information addresses the criteria set out in Subsection 9.1.1 of the BAM, which must be provided to assist the decision maker to evaluate the extent and severity of the impact on the SAII. Much of the following information is described in the following documentation:

- The native vegetation of the Cumberland Plain, western Sydney: systematic classification and field identification of communities (Tozer, 2003);
- Recovering Bushland on the Cumberland Plain: Best practice guidelines for the management and restoration of bushland (DEC, 2005);
- The final determination to list CWP as a critically endangered ecological community (DPIE, 2008-2010);
- Tozer et al (2010) Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands; and
- The approved CPW recovery plan (DECCW, 2011).

(1) The action and measures taken to avoid the direct and indirect impact on the potential entity for an SAII

The actions and measures taken to avoid impacts to PCT 849 as described by Cumberland Ecology (2019) for SSD 9601 include amendments to the location of construction footprints, amending the design of construction footprints and wholly containing disturbance to within the development footprint or cleared land.

The actions and measures taken for the proposed MOD 1 development include limiting clearing of low condition areas of PCT 849 to areas within the operational area of the plant and quarry, including artificially constructed earthern bund walls, and the main road easement (which has been identified as 'planted' vegetation).

Mitigation measures proposed to be undertaken during construction have also been designed to minimise indirect impacts to retained areas of PCT 849 (refer Sections 7 and 8).

(2) Current status of the SAII

(a) Evidence of reduction in geographic distribution (Principle 1. Clause 6.7(2)(a) BC Reg. as the current total geographic extent of the TEC in NSW and the estimated reduction since 1970 (excluding impacts from proposed development):

Table 9-1 summarises estimates of pre-European and later dated extent sourced from relevant CPW literature.

At the time of preparing this BDAR, an estimate of reduction since 1970 was not available.

Table 9-1. Evidence of geographic distribution

PCT	Estimated extent (ha)		Percent reduction	Source/year of estimate
	Pre-European	Current		
849	87,175	6,745 (±968)	7.7% (1.1)	Tozer (2003) /1997
850	38,274	4,309 (±596)	11.3% (1.5)	
849 + 850	**125,449**	**11,054** (±1,564)	**8.8%** (±1.2)	
CPW (A,B & C)[1]		10,612		DECCW (2011) CPW recovery plan / assume circa.1997
CPW (TX & TXR)[2]		13,918		
CPW (all)	**125,449**	**24,530**	**8%**	
849		6,800	5-25%	Tozer et al (2010)
850		4,400	10-25%	
849 + 850		**11,200**		
CPW		29,813		Cumberland Ecology (2019) / 2010-2016[3]
CPW		**29,813**		
849	44,000	6,800	7%	Bionet Vegetation Classification / 2020 [4]
850	27,200	4,400	12%	
849 + 850	**71,200**	**11,200**	**8%**	

[1] A,B & C: relatively intact canopy

[2] TX & TXR: scattered canopy

[3] Derived from mapped areas included within OEH (2016), OEH (2013), and Tozer et al. (2010).

[4] The measured or estimated current extent of the plant community within NSW is stated as based on the best available information including mapping, modelling.

As shown in Table 9-1, the pre-European and later dated estimates provided are inconsistent, but the percent reduction remains relatively constant and provides evidence of the reduction of geographic extent.

(b) Extent of reduction in ecological function (describing the degree of environmental degradation or disruption of biotic processes (Principle 2. Clause 6.7(2)(b) BC Reg.

Table 9-2 provides a response to the biotic processes listed in Subsection 9.1.1 of the BAM.

Table 9-2. Evidence of reduced ecological function

Indicator	Extent /degree of reduction in ecological function
Change in community structure	Changes in structure contribute to a very large reduction in the ecological function of CPW. Almost all of the remaining area of CPW is regrowth forest and woodland from past clearing activities. Mean tree densities in contemporary stands of the community have been found to be substantially higher than historical estimates and tree sizes thought to be smaller. Large trees approximating the stature of the community prior to European settlement occur very sparsely within remnant patches of vegetation or remain as isolated individuals within paddocks or urban areas (DPIE, 2008-2010). Other structural changes to the community include the removal of fallen woody debris and standing dead trees, the removal of woody understorey plants, or conversely the development of regrowth stands with very high densities of eucalypt saplings or shrubs, notably *Bursaria spinosa*, which may suppress the ground flora (DPIE, 2008-2010).
Change in species composition	Changes in species composition are referred to in the above structural changes and the below invasion and establishment of exotic species and degradation of habitat. In particular: • Increased native shrub layer; • Weed infestations of exotic shrub and ground layers; • Pastural grasses; and • Reduced genetic diversity through disruption to pollination and dispersal of fruits or seeds.
Invasion and establishment of exotic species	The characteristics of a grassy understorey, relatively fertile soils and past land uses make many of the Cumberland Plain plant communities highly vulnerable to weed invasion. Weeds such as African Lovegrass, Rhodes Grass, Bridal Veil Creeper, Paddy's Lucerne, African Olive and Boxthorn, have been able to establish widely (DEC, 2005). Weed species have established themselves widely in CPW, displacing native plants and affecting the regeneration of communities (DECCW, 2011).
Degradation of habitat	Clearing for rural and residential developments, industry, and agricultural land uses has led to increasingly isolated small remnants which are more susceptible to degradation, provide less habitat values and support fewer species (DECCW, 2011). The integrity and survival of small, isolated stands is impaired by the small population size of many species, enhanced risks from environmental stochasticity, disruption to pollination and dispersal of fruits or seeds, and likely reductions in the genetic diversity of isolated populations (DPIE, 2008-2010).
Fragmentation of habitat	CPW is severely fragmented, with more than half of the remaining tree cover mapped by Tozer (2003) and based on 1997 data occurring in patches of less than 80 ha and half of all mapped patches being smaller than 3 ha.

(c) Evidence of restricted geographic distribution (Principle 3. Clause 6.7(2)(c) BC Reg. based on the TEC's geographic range in NSW according to the:

i. extent of occurrence
ii. area of occupancy
iii. number of threat-defined locations

CPW as the name implies is restricted to the Cumberland Plain IBRA subregion. The geographic location of the Cumberland Plain encompasses a 275,693-ha area containing a broad shale basin in western Sydney and across 16 local government areas (pre-amalgamation of many local government areas).

The CPW geographic location also coincides with major growth centres within the region, including the South West and North West growth areas, the Wilton Growth Area, the Greater Macarthur Growth area, the Western Sydney Employment Area (WSEA) and the Western Sydney Aerotropolis.

In accordance with Clause 4.21 of the BC Reg. the NSW Scientific Committee (the Committee) published guidelines for interpreting listing criteria for species, populations and ecological communities under the BC Act.

Subclause 4.10f of the BC Reg. requires an estimate of the number of threat-defined locations that are occupied relative to the extent of serious plausible threats. For the purpose of interpreting Clause 4.10f, the Committee has recommended the thresholds used by the IUCN (Bland et al., 2017) be used (see Table 9-3)

Table 9-3. Corresponding thresholds for threat defined locations

Category of threat	No. of locations required under Clause 4.10f of BC Reg.	No. of locations threshold under IUCN Red List for ecosystems criteria
Critically endangered	Extremely low	One location
Endangered	Very low	No more than 5 locations
Vulnerable	Low	No more than 10 locations

For the purpose of this assessment, it is assumed that all threats to CPW as identified above in (a) and (b) have and continue to impact on CPW, with the potential exception of those areas of CPW retained in conservation areas.

As CPW is critically endangered one threat-defined location applies.

(d) Evidence that the TEC is unlikely to respond to management (Principle 4. Clause 6.7(2)(d) BC Reg.

Management of CPW loss is now regulated under the BC Act and BC Reg. and is also a major consideration under the DRAFT Cumberland Plain Conservation Plan (DPIE 2020). The Draft Cumberland Plain Conservation Plan (CPCP, DPIE 2020) has been prepared for the specific purpose of arresting further development impacts on CPW and other PCTs within the Cumberland Plain. This is intended to be done through a combination of bio-certification and the reservation of additional dedicated areas in which CPW will be conserved.

To this end, it is currently difficult to provide evidence that CPW is unlikely to respond to management, given the NSW government's current incentives that aim to do otherwise.

(3) Record where the TBDC indicates data is 'unknown' of 'data deficient' for a TEC for a criterion.

The TBDC currently indicates that the SAII thresholds and condition of CPW is still in progress.

4. In relation to the impacts from the proposal on the TEC at risk of an SAII, the following data and information is required:

(a) The impact on the geographic extent of the TEC (Principles 1 and 3) by estimating the total area of the TEC to be impacted by the proposal:

i. in hectares, and
ii. as a percentage of the current geographic extent of the TEC in NSW.

Collectively up to 0.35 ha of PCT 849 (in three separate locations) will be directly impacted as a result of the approved SSD 9601 and the proposed MOD 1 development (as shown in Figure 7-1).

This equates to a minimum and maximum of 0.001% and 0.003% (respectively) of the minimum (11,200 ha) and maximum (29,813 ha) of estimated geographic extent of the TEC in NSW (refer Table 9-1).

The retained (and similar PCT 849) vegetation is comprised of:

- Planted tree species located along the main access road easement; and
- Species that have colonised hostile subsoil strata on constructed earthern bunds.

This vegetation is considered to be a derived assemblage of vegetation that has been assigned to PCT 849 in accordance with the BAM (2020).

The potential for indirect impacts on this vegetation is considered to be a low risk and it is considered highly unlikely that any indirect impacts on this vegetation would contribute to a loss of flora and/or fauna species characteristic of the TEC (refer Section 8)..

b. the extent that the proposed impacts are likely to contribute to further environmental degradation or the disruption of biotic processes (Principle 2) of the TEC by:

i. estimating the size of any remaining, but now isolated, areas of the TEC; including areas of the TEC within 500 m of the development footprint or equivalent area for other types of proposals

Cumberland Ecology (2019) estimated approximately 266 ha and approximately 1,547 ha of mapped CPW within a 1,000 ha and 10,000 ha extent surrounding the SSD subject area (respectively), with the condition of CPW within the 1,000 ha extent expected to be in a similar condition (or better) and larger remnant CPW anticipated to be a much better condition.

These findings are supported. As shown in Figure 9-1, CPW extant to the subject land is largely contained within the Prospect Reservoir with smaller but substantial patches contained within the Cumberland Biodiversity Corridors of Regional Significance (OEH 2018). Most of the latter is managed by the Western Sydney Parkland Trust (WSPT) within the Western Sydney Parklands.

The subject land is located within 500 m of Prospect Reservoir.

Given the extent and ongoing conservation management of native vegetation within Prospect Reservoir and the Western Sydney Parklands it is highly likely that the condition of CPW in these areas will be in a much higher condition.

It should be noted that the subject land is also mapped within the boundaries of the Western Sydney Parklands. As a privately operated plant and quarry, the management of the subject land is not managed by the WSPT for conservation or recreational. Although Brickworks engage in conservation initiatives in consultation with the WSPT. To date these initiatives have included rehabilitation activities and a fauna nest box installation project within the Eastern Creek riparian corridor.

ii. describing the impacts on connectivity and fragmentation of the remaining areas of TEC measured by:
    - distance between isolated areas of the TEC, presented as the average distance if the remnant is retained AND the average distance if the remnant is removed as proposed, and
    - estimated maximum dispersal distance for native flora species characteristic of the TEC, and
    - other information relevant to describing the impact on connectivity and fragmentation, such as the area to perimeter ratio for remaining areas of the TEC as a result of the development

As shown in Figure 9-1, there will be negligible if any impact on the distance between isolated areas of the TEC or dispersal distance for native flora species (characteristic of the TEC), and any impact on

connectivity, fragmentation or perimeter ratio for the remaining areas of the TEC as a result of the development.

iii. describing the condition of the TEC according to the vegetation integrity score for the relevant vegetation zone(s)

Vegetation integrity scores for each zone for PCT 849 are as follows:

- SSD (Cumberland Ecology, 2019): 29.2, comprising planted vegetation; and
- MOD 1 (this BDAR): 36.2, comprising planted and colonised vegetation.

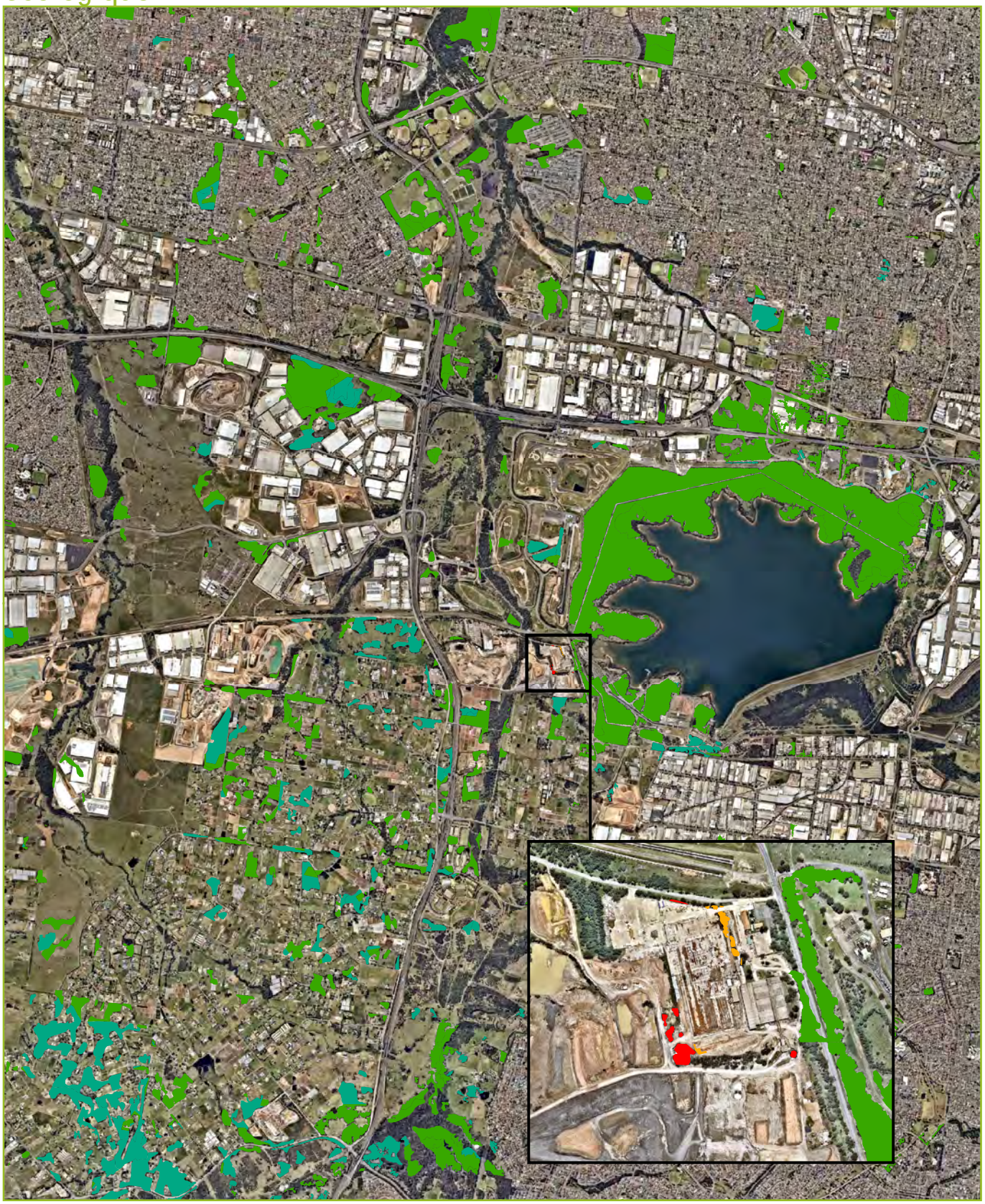
Table provides a summary of the attributes that contributed to the integrity scores compared against PCT 849's benchmark data.

Table 9-4. Vegetation integrity scores for PCT 849

Attribute	Benchmark	Cumberland Ecology	écologique
Composition			
Tree Richness	5	6#	3
Shrub Richness	8	1	3
Grass and Grass Like Richness	12	3	4
Forb Richness	14	2	2
Fern Richness	2	0	0
Other Richness	5	1	2
Structure			
Tree Cover	53	39	43
Shrub Cover	16	0.1	0.5
Grass and Grass Like Cover	58	8.1	4.4
Forb Cover	9	0.4	2.6
Fern Cover	1	0	0
Other Cover	4	0.1	0.3
Total length of fallen logs	40	0	0
Litter Cover	40	27	27
Number of Large Trees	3	0	0
High Threat Weed Cover		72.6	33.4
#higher than benchmark due to presence of planting non-CPW tree species			

(5) Accuracy of risk to SAII

The assessor has not elected to provide new information that demonstrates that the principle identifying that the TEC is at risk of an SAII is not accurate.



Legend

- MOD 1 PCT 849
- SSD approved clearing
- 849
- 850

N

0 0.5 1 2 3 4

km

Brickworks Plant 2 Upgrade SSD-9601 MOD1

Figure 9-1. Extent of SAII

Coordinate System: MGA Zone 56 (GDA 94)

Image sources: Nearmap 27 December 2020

Data sources:
CumberlandPlainWest_2013_E_4207 (modified)
SydneyMetroArea_v3_2016_E_4489 (modified)

9.2 Impacts that require an offset

9.2.1 Ecosystem credits

Table 9-3 summarises the impacts that the proposed MOD 1 development requires an offset for and BAM-C credit summary report provided in Appendix B.

Table 9-5. Ecosystem credit offsetting requirements

PCT	TEC	Area of impact (ha)	Credits required
1800 - Cumberland Swamp Oak riparian forest	Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and SE Corner Bioregions	0.1	1
849 - Cumberland shale plains woodland	Cumberland Plain Woodland in the Sydney Basin Bioregion	0.2	5
835 - Cumberland riverflat forest	River-flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and SE Corner Bioregions	0.1	2

9.2.2 Species credits

No species credit species have been identified as requiring an offset.

9.3. Impacts that do not require an offset

All areas identified as 'exotic vegetation' that occur within the subject land and that will be cleared as a result of the proposed MOD 1 development do not require an offset. These areas comprise approximately 0.9 ha (as shown in Figure 7-1) and do not provide habitat for threatened species.

10. References

Cumberland Ecology (2019) Brickworks Plant 2 Upgrade – 780 Wallgrove Road, Horsley Park, BDAR prepared for Brickworks Land & Development, 6 December 2019

Department of Environment and Conservation (DEC) (2005) Recovering Bushland on the Cumberland Plain: Best practice guidelines for the management and restoration of bushland. Department of Environment and Conservation (NSW), Sydney.

Department of Environment, Climate Change and Water (DECCW) (2011) Cumberland Plain Recovery Plan

Department of Planning, Industry and Environment (DPIE) (2008-2010) Cumberland Plain Woodland in the Sydney Basin Bioregion - critically endangered ecological community listing. Accessed from:

https://www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species/nsw-threatened-species-scientific-committee/determinations/final-determinations/2008-2010/cumberland-plain-woodland-critically-endangered-ecological-community-listing

Department of Planning, Industry and Environment (DPIE) (2020) DRAFT Cumberland Plain Conservation Plan – A Conservation Plan for Western Sydney to 2056. August 2020

Tozer (2003) The native vegetation of the Cumberland Plain, western Sydney: systematic classification and field identification of communities. *Cunninghamia* (2003) 8(1): 1–75

Tozer M.G, Turner K, Keith D.A, Tindall D, Pennay C, Simpson C, MacKenzie B, Beukers P and Cox S (2010) Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands *Cunninghamia* 11(3): 359-406

Appendix A. Transect/plot data

Survey Name: Brickworks Plant 2 MOD 1

Zone ID: New yard access **Plot no:** ec 1 **Area (ha):** 0.09

Location:	Zone	Easting	Northing	Bearing
	56	302652	6255305	270

Vegetation formation:	Vegetation class:	PCT (if known)
Forested Wetlands	Coastal Floodplain Wetlands	PCT 835

CONDITION (400m^2 plot)

Composition:	Tree	Shrub	Grass grasslike	Forb	Fern	Other
Native Richness count:	3	1	1	2	0	0

Structure:	Tree	Shrub	Grass grasslike	Forb	Fern	Other
Cover of each group:	30	0.1	70	0.3	0	0

High Threat Weed cover: 4.3

FUNCTION (1,000m^2 plot)

Tree regeneration (<5cm)		Stem classes	
Present		5-9	YES
		10-19	YES
Absent	X	20-29	YES
		30-49	YES

No large trees (>50cm DBH)	No. of HBTs	Length of LWD (m):
1	0	0

FUNCTION (50m transect)

Litter cover	5m	15m	25m	35m	45m	Average
	10	5	35	40	5	19

Sign and date: 30/09/2020 (signed on original)

BAM Site – Field Survey Form

400 m2 plot: Sheet 1 of 1

Site ID: New Yard Access éc.1 **Date:** 30/09/2020

GF Code	Species name	Common name	N, E or HTE	Cover	Abund	stratum	Outside plot
TG	Acacia binervia	Coast myall	N	3	1	OS	
TG	Casuarina glauca	Swamp oak	N	2	2	OS	
TG	Eucalyptus tereticornis	River red-gum	N	25	8	OS	
TG	Eucalyptus moluccana	Grey gum	N			OS	YES
SG	Atriplex semibaccata	Creeping saltbush	N	0.1	1	US	
GG	Cynodon dactylon	Common couch	N	70	>1000	US	
FG	Dichondra repens	Kidney weed	N	0.2	5	US	
FG	Einadia nutans subsp. linifolia	Climbing saltbush	N	0.1	3	US	
FG	Ageratina adenophora	Crofton weed	HTE	0.1	5	US	
FG	Plantago lanceolatum	Lambs tongue	E	2	50	US	
SG	Lantana camara	Lantana	HTE	3	10	MS	
FG	Bidens pilosa	Cobblers pegs	HTE	1	50	US	
GG	Cyperus eragrostis	Umbrella sedge	HTE	0.2	12	US	
FG	Modiola caroliniana	Red-flowered mallow	E	0.1	20	US	
FG	Arctotheca calendula	Capeweed	E	0.1	17	US	
FG	Trifolium repens	White clover	E	1	100	US	
FG	Lysimachia arvensis	Scarlet pimpernel	E	0.1	30	US	
FG	Senecio pterophorus		E	1	20	US	
FG	Conyza sp.	Fleabane	E	0.1	2	US	
FG	Lactuca serriola	Prickly lettuce	E	0.5	50	US	
FG	Cirzium vulgare	Spear thistle	E	1	10	US	
FG	Melilotus indicus	Hexham scent	E	2	20	US	
FG	Lotus ulginosus	Birds-foot trefoil	E	0.1	25	US	
FG	Soliva sessilis	Jo-jo, Bindyi, Lawn Burweed	E	0.1	20	US	
GG	Poa annua	Winter grass	E	1	100	US	
GG	Lolium perenne	Perennial ryegrass	E	1	100	US	
FG	Lepidium africanum	African peppercress	E	0.1	20	US	
FG	Medicago polymorpha	Burr medic	E	0.1	20	US	

Survey Name: Brickworks Plant 2 MOD 1

Zone ID: South and western berms **Plot no:** éc.2 **Area (ha):** 0.238

Location:	Zone	Easting	Northing	Bearing
	56	302656	6255181	260

Vegetation formation:	Vegetation class:	PCT (if known)
GW	Coastal Valley Grassy Woodlands	PCT 849

CONDITION (400m^2 plot)

Composition:	Tree	Shrub	Grass grasslike	Forb	Fern	Other
Native Richness count:	4	3	4	3	0	2

Structure:	Tree	Shrub	Grass grasslike	Forb	Fern	Other
Cover of each group:	44	0.5	4.4	2.6	0	0.3

High Threat Weed cover: 33.4

FUNCTION (1,000m^2 plot)

Tree regeneration (<5cm)		Stem classes	
Present	YES	5-9	YES
		10-19	YES
Absent		20-29	YES
		30-49	YES

No large trees (>50cm DBH)	No. of HBTs	Length of LWD (m):
0	0	0

FUNCTION (50m transect)

Litter cover	5m	15m	25m	35m	45m	Average
	55	25	0	45	10	27

Sign and date: 30/09/2020 (signed on original)

BAM Site – Field Survey Form

400 m2 plot: Sheet 1 of 1

Site ID: Berms éc.2 **Date:** 30/09/2020

GF Code	Species name	Common name	N, E or HTE	Cover	Abund	stratum	Outside plot
TG	Casuarina glauca	Swamp oak	N	0.2	2	OS	
TG	Eucalyptus tereticornis	River red-gum	N	42	27	OS	
TG	Eucalyptus mollucana	Grey box	N	1	1	OS	
TG	Eucalyptus crebra	Narrow-keaved ironbark	N	1	3	OS	YES
TG	Eucalyptus fibrosa	Broad-leaved ironbark	N			OS	YES
SG	Acacia parramattensis	Parramatta green wattle	N	0.2	5	MS	
SG	Atriplex semibaccata	Creeping saltbush	N			US	YES
SG	Bursaria spinosa	Native blackthorn	N	0.2	4	MS	
SG	Ozothamnus diosmifolius	Riceflower, white dogwood	N	0.1	1	MS	
GG	Aristida vagans	Threeawn speargrass	N			US	YES
GG	Botriochola decipiens	Pitted bluegrass	N	1	50	US	
GG	Cynodon dactylon	Common couch	N	3	100	US	
GG	Rytidosperma caespitosum	Wallaby grass	N	0.2	20	US	
GG	Sporobolus creber	Slender rats tail grass	N	0.2	20	US	
FG	Dichondra repens	Kidney weed	N	2	50	US	
FG	Einadia nutans	Climbing saltbush	N	0.5	10	US	YES
FG	Oxalis perannens	Native oxalis	N	0.1	5	US	
OG	Glycine tabacina	Variable glycine	N	0.2	50	US	
OG	Hardenbergia violacea	False sarsparilla	N	0.1	3	US	
OG	Amyema miquelii	Box mistletoe	N			US	YES
SG	Lantana camara	Lantana	HTE	5	20	MS	
SG	Ricinus communis	Castor oil plant	HTE	1	5	MS	
GG	Eragrostis curvula	African lovegrass	HTE	5	100	US	
GG	Avena barbata	Bearded oats	E	1	50	US	
GG	Cenchrus clandestinus	Kikuyu	HTE	1	50	US	
GG	Chloris gayana	Umbrella sedge	HTE	20	1000	US	
GG	Paspalum dilatatum	Paspalum	HTE	0.5	50	US	
FG	Ageratina adenophora	Crofton weed	HTE	0.5	50	US	
FG	Anagallis arvenisis	Scarlet pimpernel	E	0.1	10	US	
FG	Bidens pilosa	Cobblers pegs	HTE	0.3	30	US	
FG	Brassica fruticolosa	Twiggy turnip	E	1	25	US	
FG	Lactuca serriola	Prickly lettuce	E	0.5	5	US	
FG	Lotus ulginosus	Birds-foot trefoil	E	0.1	20	US	
FG	Modiola caroliniana	Red-flowered mallow	E	0.1	5	US	
FG	Plantago lanceolatum	Lambs tongue	E	0.2	50	US	
FG	Senecio madagascariensis	Fire weed	HTE	0.1	10	US	
FG	Sida rhombifolia	Paddys lucerne	E	0.2	10	US	
FG	Vittadinia cuneata	Fuzzweed	E	0.1	2	US	

Survey Name: Brickworks Plant 2 MOD 1

Zone ID: Yard-tributary **Plot no:** éc3 **Area (ha):** 0.11

Location:	Zone	Easting	Northing	Bearing
	56	302656	6255181	260

Vegetation formation:	Vegetation class:	PCT (if known)
Forested Wetlands	Coastal Floodplain Wetlands	PCT 1800

CONDITION (400m^2 plot)

Composition:	Tree	Shrub	Grass grasslike	Forb	Fern	Other
Native Richness count:	2	0	0	2	0	0

Structure:	Tree	Shrub	Grass grasslike	Forb	Fern	Other
Cover of each group:	40	0	0	0.4	0	0

High Threat Weed cover: 57.2

FUNCTION (1,000m^2 plot)

Tree regeneration (<5cm)		Stem classes	
Present	YES	5-9	YES
		10-19	YES
Absent		20-29	YES
		30-49	YES

No large trees (>50cm DBH)	No. of HBTs	Length of LWD (m):
0	0	5

FUNCTION (50m transect)

Litter cover	5m	15m	25m	35m	45m	Average
	80	75	60	50	20	57

Sign and date: 30/09/2020 (signed on original)

BAM Site – Field Survey Form

400 m2 plot: Sheet 1 of 1

Site ID: Yard tributary éc. 3 **Date:** 30/09/2020

GF Code	Species name	Common name	N, E or HTE	Cover	Abund	stratum	Outside plot
TG	Casuarina glauca	Swamp oak	N	35	22	OS	
TG	Eucalyptus tereticornis	River red-gum	N	5	5	OS	
SG	Acacia parramattensis	Parramatta green wattle	N				YES
SG	Melaleuca stypheloides	Prickly-leaf paperbark	N				YES
GG	Cynodon dactylon	Common couch	N			US	YES
FG	Dichondra repens	Kidney weed	N	0.2	10	US	
FG	Einadia nutans	Climbing saltbush	N	0.2	5	US	
SG	Lycium ferrocissium	African boxthorn	HTE				YES
SG	Lantana camara	Lantana	HTE	5	20	MS	
SG	Olea europaea subsp. cuspidata	African olive	HTE				YES
SG	Rubus subsp. fruticosus	Blackberry	HTE	2	10	MS	
GG	Avena barbata	Bearded oats	E	5	100	US	
GG	Cenchrus clandestinus	Kikuyu	HTE	5	100	US	
GG	Chloris gayana	Rhodes grass	HTE				YES
GG	Cyperus eragrostis	Umbrella sedge	HTE	0.1	3	water	
FG	Ageratina adenophora	Crofton weed	HTE	45	>500	US	
FG	Anagarlis arvenisis	Scarlet pimpernel	E	0.1	10	US	
FG	Bidens pilosa	Cobblers pegs	HTE	2	>50	US	
FG	Brassica fruticolosa	Twiggy turnip	E	1	25	US	
FG	Conyza sumatrensis ?	Tall fleabane	E	2	>50	US	
FG	Cyclospermum leptophyllum	Slender celery	E	0.1	3	US	
FG	Lactuca serriola	Prickly lettuce	E	0.5	5	US	
FG	Plantago lanceolatum	Lambs tongue	E	0.2	50	US	
FG	Senecio madagascariensis	Fire weed	HTE	0.1	10	US	
FG	Senecio pterophorus		E	1	20	US	
FG	Vittadinia cuneata	Fuzzweed	E	0.1	2	US	

Appendix B. BAM summary report

BAM Credit Summary Report

Proposal Details

Assessment Id
00023952/BAAS17054/21/00023953

Proposal Name
Brickworks Plant 2 Upgrade SSD-9601 MOD 1

BAM data last updated *
29/03/2021

Assessor Name
Kat Duchatel

Report Created
27/04/2021

BAM Data version *
38

Assessor Number
BAAS17054

BAM Case Status
Open

Date Finalised
To be finalised

Assessment Revision
0

Assessment Type
Major Projects

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Zone	Vegetation zone name	TEC name	Current Vegetation integrity score	Change in Vegetation integrity (loss / gain)	Area (ha)	BC Act Listing status	EPBC Act listing status	Species sensitivity to gain class (for BRW)	Biodiversity risk weighting	Potential SAII	Ecosystem credits

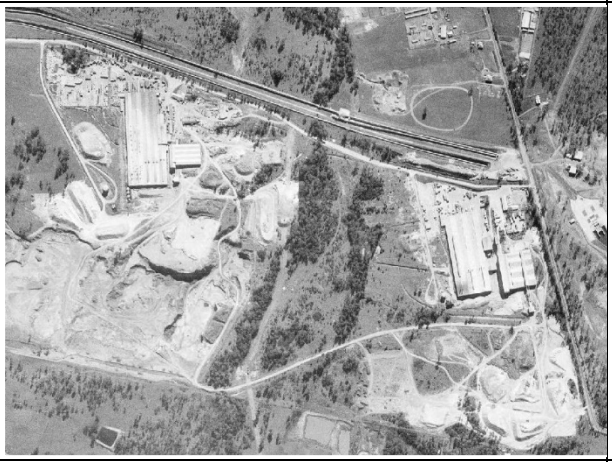
Cumberland riverflat forest											
3	835_Low-mod	River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	44.7	44.7	0.11	Endangered Ecological Community	Not Listed	High Sensitivity to Potential Gain	2.00		2
										Subtotal	**2**
Cumberland shale plains woodland											
2	849_Low	Cumberland Plain Woodland in the Sydney Basin Bioregion	36.2	36.2	0.24	Critically Endangered Ecological Community	Critically Endangered	High Sensitivity to Potential Gain	2.50	TRUE	5
										Subtotal	**5**

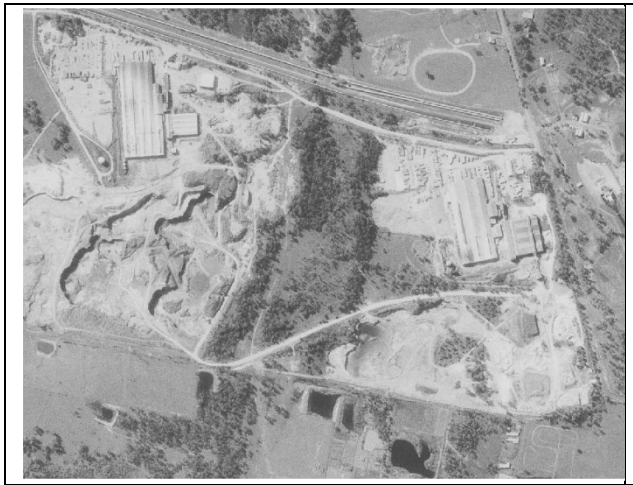
Cumberland Swamp Oak riparian forest											
1	1800_Low	Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	22.3	22.3	0.11	Endangered Ecological Community	Endangered	High Sensitivity to Potential Gain	2.00		1
										Subtotal	**1**
										Total	**8**

Species credits for threatened species

Vegetation zone name	Habitat condition (Vegetation Integrity)	Change in habitat condition	Area (ha)/Count (no. individuals)	BC Act Listing status	EPBC Act listing status	Biodiversity risk weighting	Potential SAII	Species credits

Appendix C. Historical aerial photography

		
1956	1961	1965
		
1970	1975	1978

		
1983	1989	2002
		
	2004	2005