# 4 High Conservation Value Flora, Fauna and Communities

## *4.1 Assessment of Candidate EEC Mapping Undertaken by Telfer and Kendall (2006) Within the Macleay Estuary Floodplain*

### 4.1.1 Background Information

Native Vegetation and Candidate Endangered Ecological Community (EEC) mapping over the eastern portion of the Kempsey Shire Council (KSC) local government area (LGA) using Geographic Information Systems (GIS) has previously been undertaken by Telfer and Kendall (2006). This area encompassed the majority of the Macleay River Estuary Management Plan (MREMP) study area. The methodologies used are detailed in *Native Vegetation and Candidate Endangered Ecological Community Mapping Report, Kempsey LGA East* (Telfer and Kendall 2006). The following structural attributes were also identified for most mapped vegetation polygons:

- canopy density;
- canopy forest age class;
- mid strata type; and
- disturbance intensity.

The candidate EEC mapping focussed on communities listed under the *Threatened Species Conservation Act 1995* (TSC Act). Extremely limited ground surveying was undertaken, with vegetation mainly being assessed through aerial photograph interpretation and review of existing mapping. The author acknowledges this and states that "*actual determination of an ecological community as an Endangered Ecological Community requires considerably more detailed investigation*" and "*the Candidate EEC mapping should be considered to be indicative of the potential occurrence of an EEC in any geographic area rather than indicating the actual occurrence of an EEC at that site*" (Telfer and Kendall 2006).

Pockets of rainforest and littoral rainforest within the MREMP study area (encompassing all relevant SEPP 26 – Littoral Rainforest) have previously been mapped by ID Landscape Management (2005). These areas constitute the TSC Act EECs, Littoral Rainforest in the NSW North Coast, Sydney Basin and South East Corner bioregions or Lowland Rainforest in NSW North Coast and Sydney Basin Bioregion. These areas have previously been identified as high conservation value areas within the study area (ID Landscape Management 2005). Some of these areas may also constitute the Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act) listed critically endangered community Littoral Rainforest and Coastal Vine Thickets of Eastern Australia, though further investigations would be required to determine this.

It should be acknowledged that relatively small areas in the western fringes of the MREMP study area floodplain are located outside of the Telfer and Kendall (2006) mapping project. Vegetation mapping by GHD (2007) was undertaken over the

western portion of the Kempsey LGA (Phillips and Hopkins 2009a) including this area. Review of the GIS layers identified that this vegetation mapping appears to have been undertaken using the Forest Ecosystems Classification system, though the supporting report was not reviewed. A "*Potential EEC B Region*" GIS layer was provided by KSC while undertaking this project. This layer appears to have been derived from the GHD (2007) vegetation mapping. The reliability of this mapping was not comprehensively investigated as part of this project due to the project time and budget constraints, and because it only covers relatively small portion of the MREMP study area floodplain.

### 4.1.2 Aims

The primary aim of this component of the ecological process study is to assist in the identification of high conservation value areas, specifically in areas not currently confirmed as EECs on the Macleay River estuary floodplain within the MREMP study area. This report provides supplementary information which will enhance the understanding of the presence/ absence data and extent of candidate EECs identified by the Telfer and Kendall (2006) mapping within the subject area. Specifically, the objectives of this component of the study are to:

- assess the accuracy of the Telfer and Kendall (2006) candidate EEC mapping within the MREMP study area floodplain through field sampling;
- assess the value of this mapping with regards to its use to devise management objectives and identify high conservation value EEC habitat areas; and
- provide a general condition assessment of the vegetation at the sample sites correlating to the relevant structural attributes identified by the Telfer and Kendall (2006) mapping.

Achieving the above objectives should help enable the MREMP to be based on more comprehensive information and assist with the identification of high conservation value habitat areas on the Macleay River Estuary floodplain. Areas dually mapped as *SEPP 14 - Coastal Wetlands* were not sampled as these areas are already considered high conservation value habitat areas within the study area and the conservation significance of these areas and protective measures associated with this SEPP have already been identified in previous studies. Additionally *SEPP 14 - Coastal Wetlands* within the Macleay River estuary floodplain contain attributes which strongly correlate to TSC Act coastal floodplain EECs (NSW Scientific Committee 2004a, 2004c, 2004e), particularly:

- Freshwater Wetlands on Coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions;
- Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner bioregions;
- Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions; and/or
- Swamp Oak Floodplain Forest of the NSW North Coast North Coast, Sydney Basin and South East Corner bioregions.

Similarly, areas identified as *SEPP 26 - Littoral Rainforest* and/or "*pockets of rainforest*" by ID Landscape Management (2005) have previously been identified and mapped as high conservation value habitat EEC areas, thus do not require further investigations. Land within conservation reserves (e.g. Fishermans Bend Nature Reserve) were also excluded from this assessment as these areas are already managed for conservation purposes.

It is acknowledged that Telfer and Kendall (2006) states that "*it is likely that the mapping misidentifies some ecological communities as Candidate EECs when more detailed investigation would show otherwise, whilst in other cases does not identify some ecological communities as Candidate EECs when more detailed investigation would show that they should be*". The latter is particularly considered likely as only polygons 0.5 ha or greater were mapped as part of the project. Additionally, the final determination for the relevant floodplain communities state that "*partial clearing may have reduced the canopy to scattered trees*" (NSW Scientific Committee 2004a, 2004b, 2000d), hence some EEC examples are considered unlikely to have been identified. The primary focus of this study is to assist in the identification of high conservation value habitat areas that constitute EECs and such areas may provide the initial focus of conservation and management actions. Areas currently not mapped as candidate EECs are likely to be highly degraded or very small sites (hence not high priority sites).

### 4.1.3 Methods

The methodology undertaken for this component of the project is as follows:

- review Telfer and Kendall (2006) mapping and report;
- review GIS layers relevant to the Macleay River estuary floodplain (e.g. 1:100 year flood level, MREMP study area, SEPP 14 mapping, etc);
- review TSC Act and EPBC Act EEC listings;
- identify appropriate field sample sites;
- undertake field sampling focusing on floristic attributes and vegetation condition;
- analyse the accuracy of the Telfer and Kendall (2006) EEC candidate mapping specific to the MREMP study area floodplain and identify relevant outcomes applicable to the MREMP; and
- analyse the accuracy of the Telfer and Kendall (2006) structural attribute mapping correlating the vegetation mapping of the floodplain and identify relevant outcomes applicable to the MREMP.

It should be noted that geomorphologic attributes specific to the relevant candidate EECs (e.g. location, soil types, etc) were not intensely reviewed as they were considered during the candidate EEC probability rating stage of the Telfer and Kendall (2006) project.

**Field Sample Sites**

Potential field sample sites were identified by reviewing existing available GIS layers from KSC and the Telfer and Kendall (2006) candidate EEC mapping. Specifically the locations of sample sites were based on the following components:

- located on the Macleay River estuary floodplain (i.e. below the 1:100 m ARI), within the MREMP study area boundary;
- located in areas identified as candidate EECs by Telfer and Kendall (2006);
- located outside conservation areas (e.g. Fishermans Bend Nature Reserve);
- located outside of areas previously identified as '*floodplain rainforest pockets'* by ID Landscape Management (2005); and
- located outside *SEPP 14 - Coastal Wetlands*.

The majority of the study area is located on private land; therefore accessibility was a limitation when selecting sample sites. Samples were only undertaken on private land where permission was granted by the landowner. Sampling was therefore mainly undertaken on public land (e.g. crown land, road reserves). Due to time and budget constraints, sample sites within proximity of local roads were prioritised. In total, 35 sample sites were identified. The location of the sample sites are shown in **Figure 4.1**. Candidate EEC areas mapping by Telfer and Kendall (2006) and "*Potential EEC B Region*" (outside the Telfer and Kendall (2006) mapped areas) are also shown.

**Field Survey Parameters**

At each sample site, rapid point sampling was undertaken within a 20 m radius of the sample point. Measured parameters were as follows:

- vegetation structural form and dominant canopy species;
- whether the floristic assemblage correlated with the final determination of any relevant EECs;
- canopy cover;
- canopy forest age class;
- mid/lower strata type;
- disturbance intensity; and
- weed invasion.

Codes or classes for each parameter are detailed below. Parameters were assessed using codes or classes used by Telfer and Kendall (2006) or other existing literature relevant to the MREMP (e.g. Macleay Estuary Data Compilation Study, Flora and Fauna Habitat Study, ID Landscape Management Pty Ltd, 2005) to enable unity of assessment methods used for data relevant to the MREMP.

Structural form classes were identified following the Walker and Hopkins (1990) classes. Dominant canopy species were also identified using the rapid point sampling method.

Canopy cover is the percentage of the sample site within the vertical projection of the periphery of the crowns (Walker and Hopkins 1990). This component was assessed

by assigning one of the five classes used by Telfer and Kendall (2006), listed in **Table 4.1**.

**Table 4.1** Canopy Cover Classes

| *Class* | *Canopy Cover (%)* |
|---|---|
| 1 | <10% |
| 2 | 10-20% |
| 3 | 21-50% |
| 4 | 51-80% |
| 5 | >80% |

Canopy age was assessed using the classes detailed in Telfer and Kendall (2006) for vegetation communities with a wooded component. These classes are listed in **Table 4.2**.

**Table 4.2** Canopy Forest Age Classes

| *Class* | *Upper Strata Proportion* |
|---|---|
| T | Regrowth trees comprise <10% of the upper strata |
| S | Regrowth trees comprise 11 to 30% of the upper strata |
| E | Regrowth trees comprise >31% of the upper strata |
| | |
| A | Senescent trees comprise >31% of the upper strata |
| B | Senescent trees comprise 11 to 30% of the upper strata |
| C | Senescent trees comprise <10% of the upper strata |

A generalised mid/lower strata type was recorded at each sample site using classes used by Telfer and Kendall (2006). These classes are listed in **Table 4.3**.

**Table 4.3** Mid/Lower Strata Type Classes

| *Class* | *Mid/lower Strata Type* |
|---|---|
| g grassy | Grasses native or introduced but not cultivated |
| h heath | Epacridaceae, protaceae etc |
| m mesic | Rainforest species not continuous canopy |
| d shrubby dry | Dry shrubs |
| r rock | Rock |
| s sedge | Sedges and rushes |
| a absent | Lower strata absent |
| w weed | Dominated by introduced species |
| p pasture | Cultivated pasture |
| r rainforest | Continuous canopy of rainforest species |

The disturbance attribute was assigned to indicate relative disturbance, roughly following the class system adopted by Telfer and Kendall (2006). These classes are listed in **Table 4.4**.

**Table 4.4** Disturbance Intensity Classes

| *Class* | *Disturbance Intensity* | *Description* |
|---|---|---|
| 0 | Negligible | Disturbance not visible or confined to very small isolated points |
| 1 | Low | Some disturbance is visible but covers only small portion |
| 2 | Moderate | Disturbance is widespread but natural vegetation retains some structural and floristic integrity |
| 3 | High | Disturbance severe, natural vegetation significantly denuded both structurally and floristically |
| 4 | Very high | Disturbance severe, natural vegetation absent |

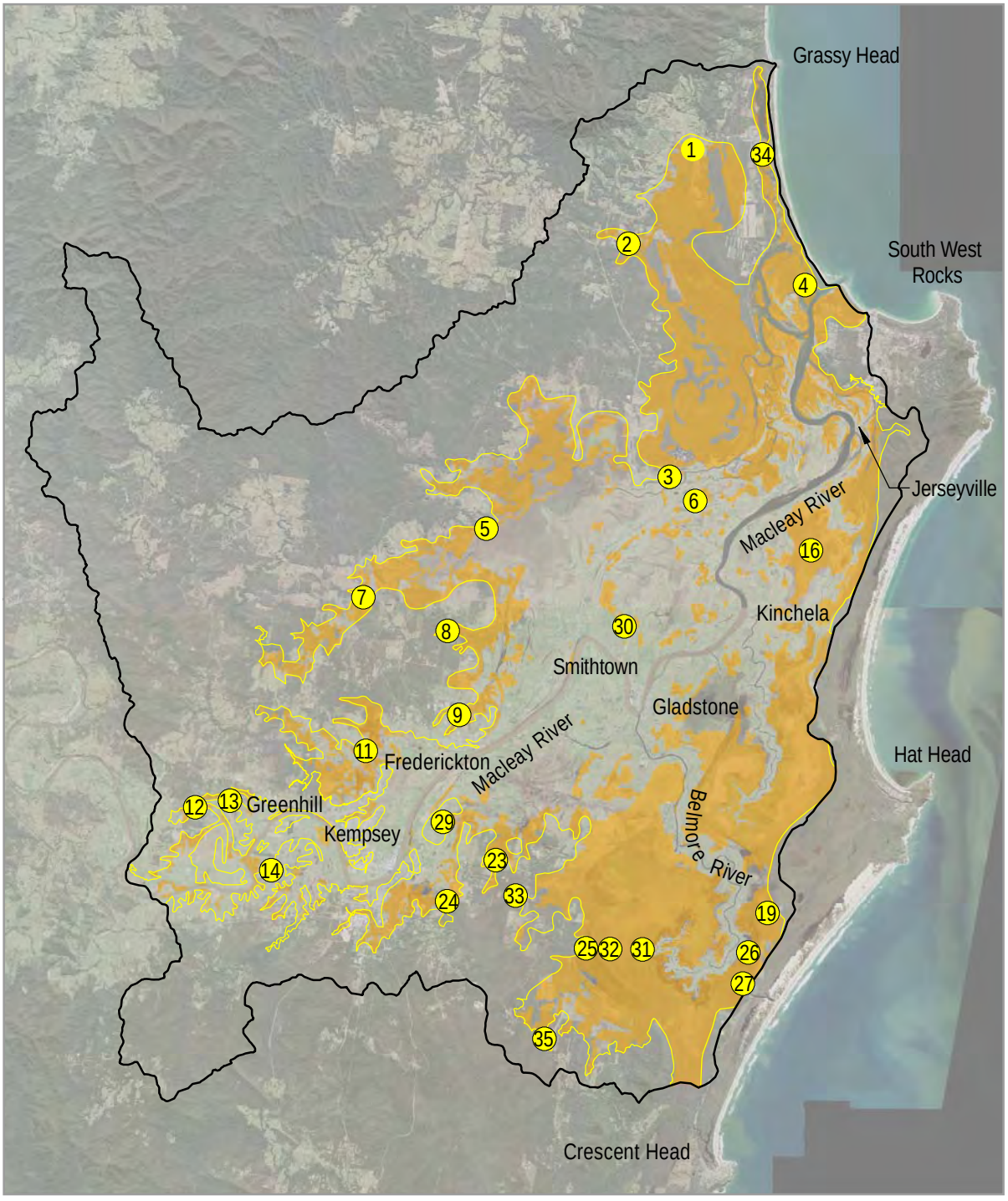
Weed invasion was assessed using the abundance codes used by ID Landscape Management (2005) who assessed the abundance of weeds within the riparian vegetation along the MREMP study area. In brief, this assesses the occurrence of Category 1, 2 or 3 Significant Environmental Weeds. **Table 4.5** lists the code rating.

**Table 4.5** Weed invasion classes

| ***Code*** | ***Abundance Code*** | ***Definition*** |
|---|---|---|
| Not applicable | N/A | No category 1, 2 or 3 weed species noted during field survey |
| Rare | R | Single or very few isolated plants, or single isolated small clumps |
| Rare – Occasional | R – O | |
| Occasional | O | Infrequent, but dispersed plants and small clumps |
| Occasional – Common | O – C | |
| Common | C | Plants and small clumps readily located sometimes uniformly distributed other times clustered. Occasional large clumps |
| Common – Heavy | C – H | |
| Heavy | H | Continuous infestations or extensive large clumps or combinations of numerous propagules and established plants |

Information shown is for illustrative purposes only

Drawn by: RE Reviewed by: MVE Date: May 2010
Source of base data: Kempsey Shire Council and Topographic Map NSW




LEGEND

- Study area
- MREMP Study Area Floodplain
- GHD, Telfer and Kendall candidate EECs
- 1 EEC Sampling Sites Events

0 5 km

North

Candidate EEC Mapping within the MREMP Study Area Floodplain and Field Sample Sites

GeoLINK environmental management and design

Macleay Ecological Study
1484362

Figure 4.1

### 4.1.4 Results and Discussion

**Review of Telfer and Kendall (2006) candidate EEC mapping and NSW Scientific Committee Final Determinations**

Review of Telfer and Kendall (2006) mapping specifically within the MREMP study area floodplain identified the following candidate EECs:

- Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions (referred to herein as Freshwater Wetlands);
- Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner bioregions (referred to herein as Coastal Saltmarsh);
- Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions (referred to herein as Swamp Sclerophyll Forest);
- Swamp Oak Floodplain Forest of the NSW North Coast North Coast, Sydney Basin and South East Corner bioregions (referred to herein as Swamp Oak Floodplain Forest);
- Subtropical Coastal Floodplain Forest of the NSW North Coast Bioregion (referred to herein as Subtropical Coastal Floodplain Forest);
- Littoral Rainforest in the NSW North Coast, Sydney Basin and South East Corner bioregions (referred to herein as Littoral Rainforest);
- Lowland Rainforest in NSW North Coast and Sydney Basin bioregion (referred to herein as Lowland Rainforest);
- River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions (referred to herein as River-Flat Eucalypt Forest);
- Themeda Grassland on Seacliffs and Coastal Headlands in the NSW North Coast, Sydney Basin and South East Corner bioregions (referred to herein as Themeda Grassland); and
- Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast bioregions (referred to herein as Hunter Lowland Redgum Forest).

Upon review of the final determination listings, the following EECs are considered unlikely occurrences:

- Themeda Grassland. This EEC is considered unlikely to occur within the subject floodplain environment as this EEC is restricted to seacliffs and coastal headlands as specified in the final determination (NSW Scientific Committee 2005). Other areas within the MREMP study area outside the floodplain may still constitute this EEC, though such areas are outside the scope of this study; and
- Hunter Lowland Redgum Forest. This EEC is considered unlikely to occur as this community is restricted to the Hunter Valley (NSW Scientific Committee 2002). Consequently it is also considered unlikely to occur elsewhere within the MREMP study area.

However all areas identified as candidate Themeda Grassland or Hunter Lowland Redgum Forest within the study area were dually identified as candidates for other EECs that may have some overlapping floristic attributes (e.g. Subtropical Coastal Floodplain Forest). Hence the subject mapped areas may still provide an indication of the location of EECs.

**Field Survey: Candidate EEC Sampling Review**

The field sampling was undertaken on 7, 8 and 9 January 2010. The results of the field survey EEC identification component are presented in **Table 4.6**. Vegetation communities at 34 of the 35 sample sites (97 %) were identified to constitute EECs, based on the presence of a species assemblage associated with the relevant listing. As mentioned previously, the presence of appropriate geomorphology was previously assessed during the Telfer and Kendall (2006) Candidate EEC mapping. The only site not constituting an EEC contained Mangrove Forest, which is protected under the *Fisheries Management Act 1994*. Vegetation at three of the sample sites (15, 20 and 23) contained ecotonal attributes of two EECs.

The Telfer and Kendall (2006) highest likelihood nominated candidate EEC was the same as the field survey identified EEC at 21 of the 35 sample sites (i.e. 60%). This includes sites with strong ecotonal attributes of two EECs, where one of the dominant ecotonal EECs were nominated as highest likelihood Telfer and Kendall (2006) mapped candidate EEC. Inconsistencies were identified at 14 of the 35 sites (i.e. 40%) between the Telfer and Kendall (2006) mapped highest likelihood candidate EEC and the field survey results.

**Table 4.6** Field Sample Site Result in Comparison

| Sample Site | Easting (GDA 94) | Northing (GDA 94) | Vegetation type from Telfer and Kendall (2006) 'Label Field' | Telfer and Kendall (2006) Candidate EEC | | Survey Results | | Consistency between Telfer and Kendall (2006) Mapping and Survey Results |
|---|---|---|---|---|---|---|---|---|
| | | | | Highest Likelihood EEC (and Likelihood Rating) | 2nd Highest Likelihood | Vegetation Result | EEC Floristics | |
| 1 | 497921 | 6589885 | Banksia | Subtropical Coastal Floodplain Forest (Very High) | - | Broad-leaved Melaleuca Swamp Sclerophyll Forest | Swamp Sclerophyll Forest | No |
| 2 | 494360 | 6586406 | Dry Grassy Tallowwood-Grey Gum | Subtropical Coastal Floodplain Forest (Moderate) | - | Swamp Mahogany/ Broad-leaved Melaleuca Swamp Sclerophyll Forest | Swamp Sclerophyll Forest | No |
| 3 | 495901 | 6577211 | Paperbark | Swamp Sclerophyll Forest (Very High) | Swamp Oak Floodplain Forest (Moderate) | Swamp Oak/ Broad-leaved Melaleuca Swamp Sclerophyll Forest | Swamp Sclerophyll Forest | Yes |
| 4 | 501982 | 6583740 | Saltmarsh | Saltmarsh (Very High) | - | Mangrove Forest | N/A | No |
| 5 | 488791 | 6575010 | Rainforest | Lowland Rainforest (Very High) | - | Broad-leaved Melaleuca/ Swamp Oak Swamp Sclerophyll Forest | Swamp Sclerophyll Forest | No |
| 6 | 497114 | 6575937 | Paperbark | Swamp Sclerophyll Forest (Very High) | Swamp Oak Floodplain Forest (Moderate) | Swamp Oak Swamp Forest | Swamp Sclerophyll Forest | Yes |
| 7 | 484157 | 6572038 | Swamp Oak | Swamp Oak Floodplain Forest (Very High) | - | Swamp Oak Swamp Forest | Swamp Sclerophyll Forest | No (no apparent saline influences) |
| 8 | 486957 | 6570730 | Paperbark | Swamp Sclerophyll Forest (Very High) | Swamp Oak Floodplain Forest (Moderate) | Broad-leaved Melaleuca/ Swamp Oak Swamp Sclerophyll Forest | Swamp Sclerophyll Forest | Yes |

| Sample Site | Easting (GDA 94) | Northing (GDA 94) | Vegetation type from Telfer and Kendall (2006) 'Label Field' | Telfer and Kendall (2006) Candidate EEC | | Survey Results | | Consistency between Telfer and Kendall (2006) Mapping and Survey Results |
|---|---|---|---|---|---|---|---|---|
| | | | | Highest Likelihood EEC (and Likelihood Rating) | 2nd Highest Likelihood | Vegetation Result | EEC Floristics | |
| 9 | 487910 | 6567460 | Sedgeland (c) | Freshwater Wetland (High) | - | Broad-leaved Melaleuca/ Swamp Oak Swamp Sclerophyll Forest | Swamp Sclerophyll Forest | No |
| 10 | 484086 | 6566283 | Sedgeland (c) | Freshwater Wetland (High) | - | Freshwater Wetland | Freshwater Wetland | Yes |
| 11 | 484091 | 6566017 | Sedgeland (c) | Freshwater Wetland (High) | - | Freshwater Wetland | Freshwater Wetland | Yes |
| 12 | 477349 | 6563798 | Eastern Red Gums | Hunter Lowland Red Gum Forest (High) | Subtropical Coastal Floodplain Forest (Low) | Wet Sclerophyll Forest | Subtropical Coastal Floodplain Forest | No to highest likelihood; yes to second highest likelihood |
| 13 | 478880 | 6563826 | Coastal Flooded Gum | Subtropical Coastal Floodplain Forest (Low) | - | Wet Sclerophyll Forest | Subtropical Coastal Floodplain Forest | No |
| 14 | 480267 | 6561274 | Water surfaces | Freshwater Wetland (High) | - | Freshwater Wetland | Freshwater Wetland | Yes |
| 15 | 500471 | 6573549 | Swamp Oak | Swamp Oak Floodplain Forest (Very High) | - | Pastoral Woodland/ Swamp Sclerophyll Forest/ Rainforest ecotone | Lowland Rainforest/ Swamp Sclerophyll Forest Ecotone | No |
| 16 | 500863 | 6573543 | Swamp | Freshwater Wetland (Very High) | - | Sedgeland | Freshwater Wetland | Yes |
| 17 | 500561 | 6571386 | Paperbark | Swamp Sclerophyll Forest (Very High) | Swamp Oak Floodplain Forest | Broad-leaved Melaleuca Swamp Sclerophyll Forest | Swamp Sclerophyll Forest | Yes |

| Sample Site | Easting (GDA 94) | Northing (GDA 94) | Vegetation type from Telfer and Kendall (2006) 'Label Field' | Telfer and Kendall (2006) Candidate EEC | | Survey Results | | Consistency between Telfer and Kendall (2006) Mapping and Survey Results |
|---|---|---|---|---|---|---|---|---|
| | | | | Highest Likelihood EEC (and Likelihood Rating) | 2nd Highest Likelihood | Vegetation Result | EEC Floristics | |
| | | | | | (Moderate) | | | |
| 18 | 501897 | 6571129 | Paperbark | Swamp Sclerophyll Forest (Very High) | Swamp Oak Floodplain Forest (Moderate) | Broad-leaved Melaleuca/ Swamp Oak Swamp Sclerophyll Forest | Swamp Sclerophyll Forest | Yes |
| 19 | 499550 | 6559985 | Sedgeland (c) | Freshwater Wetland (High) | - | Freshwater Wetland | Freshwater Wetland | Yes |
| 20 | 496809 | 6563875 | Paperbark | Swamp Sclerophyll Forest (Very High) | Swamp Oak Floodplain Forest (Moderate) | Swamp Oak Pastoral Woodland | Swamp Sclerophyll Forest/ Freshwater Wetland ecotone | Yes |
| 21 | 497086 | 6563868 | Sedgeland (c) | Freshwater Wetland (High) | - | Freshwater Wetland | Freshwater Wetland | Yes |
| 22 | 489103 | 6562053 | Paperbark | Swamp Sclerophyll Forest (Very High) | Swamp Oak Floodplain Forest (Moderate) | Broad-leaved Melaleuca/ Swamp Oak Swamp Sclerophyll Forest | Swamp Sclerophyll Forest | Yes |
| 23 | 488949 | 6561595 | Swamp Oak | Freshwater Wetland (High) | - | Pastoral Swamp Mahogany Woodland | Swamp Sclerophyll Forest (highly degraded) | No |
| 24 | 487273 | 6560241 | Lowland Red Gum | Subtropical Coastal Floodplain Forest (Very High) | Hunter Lowland Red Gum Forest (High Likelihood) | Broad-leaved Melaleuca Swamp Sclerophyll Forest | Swamp Sclerophyll Forest | No |
| 25 | 492917 | 6558063 | Sedgeland (c) | Freshwater Wetland | - | Freshwater | Freshwater | Yes |

| Sample Site | Easting (GDA 94) | Northing (GDA 94) | Vegetation type from Telfer and Kendall (2006) 'Label Field' | Telfer and Kendall (2006) Candidate EEC | | Survey Results | | Consistency between Telfer and Kendall (2006) Mapping and Survey Results |
|---|---|---|---|---|---|---|---|---|
| | | | | Highest Likelihood EEC (and Likelihood Rating) | 2nd Highest Likelihood | Vegetation Result | EEC Floristics | |
| | | | | (High) | | Wetland | Wetland | |
| 26 | 499080 | 6558003 | Sedgeland (c) | Freshwater Wetland (High) | - | Freshwater Wetland | Freshwater Wetland | Yes |
| 27 | 499199 | 6556522 | Paperbark | Swamp Sclerophyll Forest (Very High) | Swamp Oak Floodplain Forest (Moderate) | Broad Leaved Melaleuca Swamp Sclerophyll Forest | Swamp Sclerophyll Forest | Yes |
| 28 | 501749 | 6583472 | Banksia | Subtropical Coastal Floodplain Forest (Very High) | Themeda Grassland (Very High) | Banksia Forest/ disturbed Littoral Rainforest | Littoral Rainforest | Yes |
| 29 | 487068 | 6563472 | Sedgeland (c) | Freshwater Wetland (High) | - | Freshwater Wetland | Freshwater Wetland | Yes |
| 30 | 494242 | 6571174 | Swamp Oak | Swamp Oak Floodplain Forest (Very High) | - | Swamp Oak Forest | Swamp Sclerophyll Forest | No |
| 31 | 495074 | 6558030 | Sedgeland (c) | Freshwater Wetland (High) | - | Freshwater Wetland | Freshwater Wetland | Yes |
| 32 | 493642 | 6558168 | Sedgeland (c) | Freshwater Wetland (High) | - | Freshwater Wetland | Freshwater Wetland | Yes |
| 33 | 489688 | 6560113 | Dry Sclerophyll Forest | Subtropical Coastal Floodplain Forest (Moderate) | - | Swamp Sclerophyll Forest | Swamp Sclerophyll Forest | No |
| 34 | 499768 | 6589990 | Saltmarsh | Saltmarsh (Very High) | - | Saltmarsh | Saltmarsh | Yes |
| 35 | 491008 | 6554530 | Coastal Flooded Gum | Subtropical Coastal Floodplain Forest (Moderate) | - | Wet Sclerophyll Forest | River-Flat Eucalypt Forest | No |

The Telfer and Kendall (2006) nominated candidate EECs were generally more accurate at identifying wetland communities than forest communities. Differences between the Telfer and Kendall (2006) mapping the field sampling was expected at some sites given:

- limitations associated with broad scale vegetation mapping based essentially on aerial photograph interpretation;
- mapped vegetation polygons encompassed larger areas than the single sample site, and slight differences in floristics and condition were subjectively identified within some of the individually mapped polygons during the field work; and
- similarities in floristic attributes of relevant EECs. For example, Swamp Oak (*Casuarina glauca*) is a characteristic species for both Swamp Sclerophyll Forest (NSW Scientific Committee 2004a) and Swamp Oak Floodplain Forest (NSW Scientific Committee 2004c).

Determining between two EECs therefore would be difficult using broad scale vegetation mapping. Additionally some geomorphological attributes that distinguish certain EECs would not be able to be identified during broad scale vegetation mapping based on aerial photograph interpretation. For example, at sample sites 7, 15 and 30, the floristic association of the vegetation present was consistent with the relevant final determination listings for both Swamp Sclerophyll Forest and Swamp Oak Floodplain Forest. However Swamp Oak Floodplain Forest is restricted to sites where the groundwater is saline or sub-saline (NSW Scientific Committee 2002c), which was not apparent during the field survey (e.g. absence of groundcover species adapted to saline or sub-saline conditions, site is not proximate to the estuary, etc). Consequently these sample sites were determined to constitute Swamp Sclerophyll Forest.

Overall, the results of this component of the study suggest the Telfer and Kendall (2006) mapping is not considered accurate enough for site specific identification of particular EECs. However on a landscape level, as in the MREMP study area floodplain, the mapping is considered useful as an indicative tool for identifying broader areas constituting known or highly likely EECs. This was somewhat expected as:

- the study area is a coastal floodplain hence generally satisfying the geomorphologic features of the relevant coastal floodplain EECs;
- all native coastal floodplain communities in NSW are listed as EECs under the TSC Act (NSW Scientific Committee 2004c); and
- Telfer and Kendall (2006) candidate EEC mapping within the MREMP study area floodplain encompasses areas of relatively intact native floodplain vegetation communities.

These factors also suggest the areas mapped as candidate EECs in the *'Potential EEC B Region*' (as mentioned in **Section 4.1**) GIS layer provided by KSC, which encompass the western fringes of the MREMP study area floodplain, may also provide a reasonable indication of the presences of EECs in this area.

To achieve some management objectives (e.g. identifying specialist species habitat), identifying the type of EEC is obviously important. Hence the Telfer and Kendall (2006) candidate mapping would be of limited reliability in such situations. However

for broad scale management approaches that are relevant to the management of all of the subject EECs (e.g. managing threats such as livestock grazing) the Telfer and Kendall (2006) candidate EEC mapping provides a useful tool. Additionally the NSW Scientific Committee (2004c) states that the relative coastal floodplain EECs:

- *are dynamic and species composition of a site will be influenced by the size of the site, recent rainfall or drought conditions and by its disturbance (including fire, grazing, flooding and land clearing) history*;
- *may adjoin or intergrade with several other endangered ecological communities, which collectively cover all remaining native vegetation on the coastal floodplains of New South Wales*;
- *the boundaries between these communities are dynamic and may shift in response to changes in hydrological regimes, fire regimes or land management practices*; and
- *determinations for these communities collectively encompass the full range of intermediate assemblages in transitional habitats*.

Some changes in landuse practices whether positive or negative, may also not affect the mapping as a presence/absence guide to larger EECs within the MREMP study area floodplain. For example, area which originally constitute Swamp Sclerophyll Forest that may have been cleared for grazing may constitute Freshwater Wetlands in its current form (e.g. provide wet pastures with indicator species of Freshwater Wetlands such as Common Rush (*Juncus usiatus)* and Water Pepper (*Persicaria hydropiper)*, occurring as dominant or co-dominant species). Suppression of the grazing may enable the vegetation to change back to the original Swamp Sclerophyll Forest. Regardless, the vegetation still constitutes an EEC.

Incidental observations made of the floodplain during the field survey identified small areas with floristic attributes consistent to those of the floodplain EECs (e.g. Freshwater Wetlands), though not mapped by Telfer and Kendall (2006). However it has been acknowledged previously that due to the scale of the mapping, smaller units (<0.5 hectares), were not included. Hence it is important for Council, land owners and other relevant stakeholders to be aware that other areas on the floodplain may still constitute an EEC. However the larger EEC areas identified as part of this project are considered a higher priority for conservation and management purposes.

**Field Survey: Condition Assessment and Comparison**

Results of the structural and condition assessment between the Telfer and Kendall (2006) mapping and the current field surveys are provided in **Table 4.7**. Each condition assessment parameter was not able to be measured at each site due to vegetation at some sites lacking the measured attribute (e.g. canopy forest age class was not measurable at wetland sites).

The condition assessment identified that the condition of vegetation at each sample site within the study area was variable.

**Table 4.7** GeoLINK sample site field survey condition assessment results and Telfer and Kendall (2006) condition assessment results comparison

| Sample Site | Telfer and Kendall (2006) Vegetation Condition Assessment Results | | | | | GeoLINK Field Sample Site Vegetation Condition Assessment Results | | | | | | Comparison of Results between Telfer and Kendall (2006) Vegetation Condition Assessment and GeoLINK Field Survey Result | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Canopy / Cover | Disturbance Intensity Classes | Mid/ Lower Strata Type | Regrowth Canopy Forest Age Class | Senescent Canopy Forest Age Class | Canopy / Cover | Disturbance Intensity Classes | Mid/ Lower Strata Type | Regrowth Canopy Forest Age Class | Senescent Canopy Forest Age Class | Weed Abundance | Canopy / Cover | Disturbance Intensity Classes | Mid/ Lower Strata Type | Regrowth Canopy Forest Age Class | Senescent Canopy Forest Age Class |
| 1 | 3 | 2 | h | e | C | 3 | 1 | s | e | C | R | Yes | No | No | Yes | Yes |
| 2 | 1 | 3 | gh | t | C | 3 | 2 | g | e | A | R - O | No | No | Yes | No | No |
| 3 | - | - | - | - | - | 3 | 2 | w | e | C | C | N/A | N/A | N/A | N/A | N/A |
| 4 | 5 | 1 | sm | s | C | 4 | 0 | a | e | B | N/A | No | No | No | No | No |
| 5 | 4 | 2 | m | t | C | 3 | 2 | g | s | C | C | No | Yes | No | No | Yes |
| 6 | 1 | 3 | g | t | C | 1 | 3 | g | t | B | O | Yes | Yes | Yes | Yes | No |
| 7 | 3 | 2 | sg | e | C | 3 | 2 | g | e | C | O | Yes | Yes | Yes | Yes | Yes |
| 8 | 4 | 2 | s | t | C | 4 | 2 | g | e | C | O | Yes | Yes | No | No | Yes |
| 9 | - | - | - | - | - | 4 | 2 | s | e | C | R - O | N/A | N/A | N/A | N/A | N/A |
| 10 | - | - | - | - | - | N/A | 2 | s | N/A | N/A | R | N/A | N/A | N/A | N/A | N/A |
| 11 | - | - | - | - | - | N/A | 2 | gs | N/A | N/A | R | N/A | N/A | N/A | N/A | N/A |
| 12 | 3 | 2 | gs | s | C | 3 | 2 | gs | e | C | C | Yes | Yes | Yes | No | Yes |
| 13 | 4 | 2 | mw | s | C | 4 | 2 | mw | s | B | C | Yes | Yes | Yes | Yes | No |
| 14 | - | 4 | - | - | - | N/A | 3 | s | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 15 | 1 | 3 | g | s | C | 1 | 3 | g | t | A | C | Yes | Yes | Yes | No | No |
| 16 | - | 2 | - | - | - | N/A | 2 | s | N/A | N/A | O | N/A | Yes | N/A | N/A | N/A |
| 17 | 3 | 3 | g | t | C | 3 | 2 | g | t | C | O | Yes | No | Yes | Yes | Yes |
| 18 | 1 | 3 | g | t | C | 3 | 3 | g | t | B | R - O | No | Yes | Yes | Yes | No |
| 19 | - | - | - | - | - | 1 | 1 | s | t | C | N/A | N/A | Yes | N/A | N/A | N/A |
| 20 | 1 | 3 | g | t | C | 1 | 3 | g | t | A | R | Yes | Yes | Yes | Yes | No |
| 21 | - | - | - | - | - | N/A | 1 | s | N/A | N/A | R | N/A | N/A | N/A | N/A | N/A |
| 22 | - | - | - | - | - | 3 | 2 | g | t | C | O - C | N/A | N/A | N/A | N/A | N/A |
| 23 | 1 | 3 | g | e | C | 1 | 4 | s | t | C | O | Yes | No | No | No | Yes |
| 24 | 1 | 3 | g | t | B | 3 | 2 | g | t | C | R | No | No | Yes | Yes | No |
| 25 | - | - | - | - | - | N/A | 2 | s | N/A | N/A | R - O | N/A | N/A | N/A | N/A | N/A |
| 26 | - | - | - | - | - | N/A | 2 | s | N/A | N/A | R | N/A | N/A | N/A | N/A | N/A |
| 27 | - | - | - | - | - | 3 | 1 | Mid/ Lower Strata Type | e | A | C | N/A | N/A | N/A | N/A | N/A |
| 28 | 3 | 2 | g | - | - | 3 | 2 | g | t | A | C - H | Yes | Yes | Yes | N/A | N/A |
| 29 | - | - | - | - | - | N/A | 2 | s | N/A | N/A | R | N/A | N/A | N/A | N/A | N/A |
| 30 | 2 | 3 | g | s | C | 1 | 3 | p | t | C | O | No | Yes | No | No | Yes |
| 31 | - | - | s | - | - | N/A | 1 | s | N/A | N/A | N/A | N/A | N/A | Yes | N/A | N/A |

| Sample Site | Telfer and Kendall (2006) Vegetation Condition Assessment Results | | | | | GeoLINK Field Sample Site Vegetation Condition Assessment Results | | | | | | Comparison of Results between Telfer and Kendall (2006) Vegetation Condition Assessment and GeoLINK Field Survey Result | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Canopy / Cover | Disturbance Intensity Classes | Mid/ Lower Strata Type | Regrowth Canopy Forest Age Class | Senescent Canopy Forest Age Class | Canopy / Cover | Disturbance Intensity Classes | Mid/ Lower Strata Type | Regrowth Canopy Forest Age Class | Senescent Canopy Forest Age Class | Weed Abundance | Canopy / Cover | Disturbance Intensity Classes | Mid/ Lower Strata Type | Regrowth Canopy Forest Age Class | Senescent Canopy Forest Age Class |
| 32 | - | - | s | - | - | N/A | 0 | s | N/A | N/A | R - O | N/A | Yes | N/A | N/A | N/A |
| 33 | - | - | - | - | - | 2 | 1 | g | t | A | N/A | N/A | N/A | N/A | N/A | N/A |
| 34 | - | - | - | - | - | N/A | 0 | s | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 35 | 4 | 2 | mw | s | C | 5 | 1 | mw | t | C | C | No | No | Yes | No | Yes |

Canopy cover results obtained from forested/woodland field sample sites appeared to be influenced by disturbance regime. This was a particular influence at isolated or smaller mapped polygons subject to livestock grazing.

Evidence of disturbance was obvious at most sites, predominantly at moderate levels. The main disturbances affecting the vegetation at each sample site included clearing/partial clearing, grazing and pastoral improvement, edge effects and/or weed invasion. Most of the sites were located on land subject to agricultural management practices, with intensity of agricultural practices appearing to correlate with disturbance intensity.

Mid/lower strata type at most sites were dominated by sedges or grasses (the latter including natives and exotic pastoral species). Again, disturbances, in particular agricultural practices and landuse appeared to be a major influence on the mid/lower strata type at most sites, with more disturbed sites supporting a higher portion of pastoral and/or exotic species than at less disturbed sites.

Regrowth and senescent canopy forest age class were variable, though senescent trees were generally an uncommon occurrence. This is considered likely to be attributed to the vegetation at many of the sample sites largely being cleared at some stage in the past, resulting in an even aged canopy. Regrowth trees were also uncommon in the canopy at many sites, particularly at the more disturbed forest sites. At such sites, the development of regrowth appeared to be inhibited by grazing and associated practices (e.g. slashing). This is considered a particular threat, as it inhibits the growth of recruitment canopy species, potentially resulting in the loss or retraction of some forested EEC areas.

The weed abundance results were highly variable. The following factors appeared to relate to sites with no or low abundances of weeds:

- agricultural practices suppressed weed growth at specific sites, though pastoral species were dominant in the groundcover;
- the vegetation present was indicative of low disturbance intensity in recent times; and/or
- abiotic factors at the specific site suppressed or prevented weed growth at the sample sites (e.g. some wetlands site contained reasonably deep surface water up to approximately 0.5 metres at the time of the survey).

A summary of the comparison of the field sampling results and the Telfer and Kendall (2006) condition assessment results are provided in **Table 4.8**.

**Table 4.8** Results comparison between GeoLINK sample site condition assessment results and Telfer and Kendall (2006) mapping

| ***Result Consistency Comparison*** | ***Canopy/ Cover*** | | ***Disturbance Intensity Classes*** | | ***Mid/Lower Strata Type*** | | ***Regrowth Canopy Forest Age Class*** | | ***Senescent Canopy Forest Age Class*** | |
|---|---|---|---|---|---|---|---|---|---|---|
| | ***Number of Sample Sites*** | ***%*** | ***Number of Sample Sites*** | ***%*** | ***Number of Sample Sites*** | ***%*** | ***Number of Sample Sites*** | ***%*** | ***Number of Sample Sites*** | ***%*** |
| **Yes** | 14 | 82 | 14 | 67 | 13 | 68 | 8 | 47 | 9 | 53 |
| **No** | 3 | 18 | 7 | 33 | 6 | 32 | 9 | 53 | 8 | 47 |
| **Total Comparable Sites** | 17 | 100 | 21 | 100 | 19 | 100 | 17 | 100 | 17 | 100 |

As mentioned previously, each condition assessment parameter was not able to be measured at each site due to the vegetation lacking the subject attributes (e.g. canopy forest age class was not measurable at wetland sites). At other sites, the Telfer and Kendall (2006) mapping had not assessed particular attributes at the mapped polygon overlapping the sample site.

As indicated in **Table 4.8**, the field sample results and Telfer and Kendall (2006) mapping revealed consistent results for Canopy/ Cover (82%), Mid/Lower Strata Type (68%) and Disturbance Intensity Classes (67%) at most of the sample sites. Regrowth Canopy Forest Age Class and Senescent Canopy Forest Age Class revealed the same results at only 47 and 53% respectively at the comparable sites. Where inconsistencies in results were identified, the nominated fields often differed by a single attribute class or code. Such differences were largely attributed to:

- subjective nature of these assessments;
- difficulties in undertaking vegetation condition assessments from aerial photograph interpretation;
- the mapped vegetation polygons encompassed larger areas than the single sample site, and slight differences in vegetation condition were anecdotally identified within some of the individually mapped polygons; and
- changes in landuse practice between the date of the aerial photographs used by Telfer and Kendall (2006) and the GeoLINK sampling that

may affect the vegetation condition (e.g. changes to grazing intensity may affect regrowth development).

Overall the Telfer and Kendall (2006) vegetation condition assessment results are considered to provide a reasonable general guide for the state of the EECs within the study area. It may therefore provide a tool to assist in the development of management measures at a broad scale. Further investigations are however considered necessary for identifying vegetation condition and associated management implications at a site specific level.

**EPBC Act Listed EECs**

As mentioned previously, ID Landscape Management (2005) mapped '*floodplain rainforest pockets*' which encompass *SEPP 26 – Littoral Rainforest* as well as the results of this study have identified that some areas of Littoral Rainforest and Lowland Rainforest occur within the MREMP study area floodplain. Some of these areas may dually constitute the EPBC Act listed EECs Littoral Rainforest and Coastal Vine Thickets of Eastern Australia, though this would require more detailed investigations. Protection of SEPP 26 mapped Littoral Rainforest and of TSC Act listed Littoral Rainforest and Lowland Rainforest should provide dual protection of any areas constituting the EPBC Act listed Littoral Rainforest and Coastal Vine Thickets of Eastern Australia EEC.

Review of the EPBC Act EEC listings identified no other EPBC Act listed EECs are considered likely to occur in the MREMP study area floodplain.

**High Conservation Values Areas: EECs**

**Figures 4.2**, **4.3 and 4.4** show the location of areas on a broad landscape scale within the MREMP study area floodplain that are considered known or likely to constitute TSC Act listed EECs. This includes:

- Telfer and Kendall (2006) mapped candidate EECs;
- SEPP 14 – Coastal Wetlands;
- SEPP 26 – Littoral Rainforest Wetlands;
- other areas mapped by ID Landscape Management (2005) as '*floodplain rainforest pockets*'; and
- the '*Potential EEC B Region*' GIS layer provided by KSC.

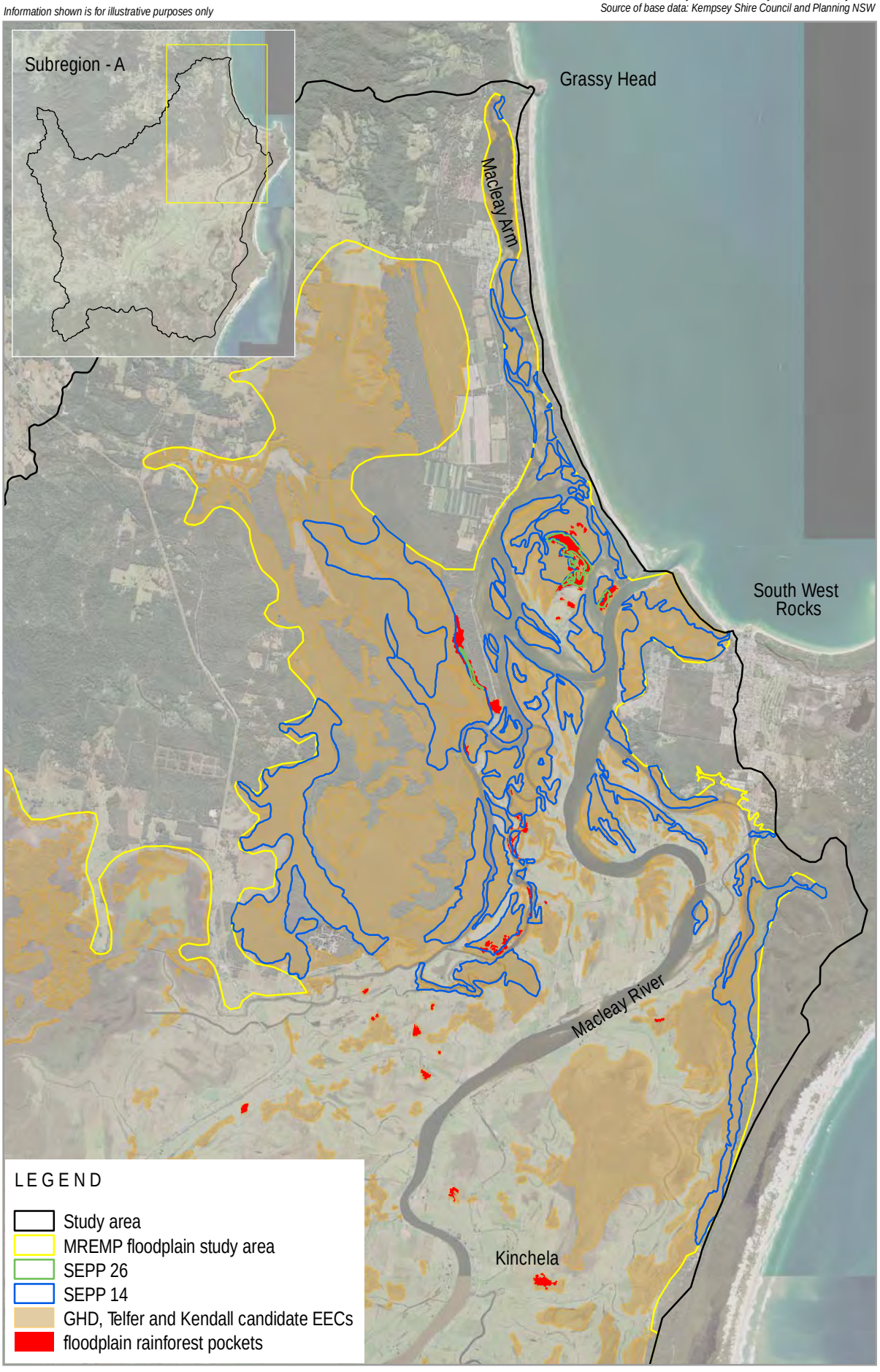
The condition assessment undertaken as part of the Telfer and Kendall (2006) mapping and this study shows however that not all areas are necessarily of high ecological or conservation value due to historic disturbances. Further analysis and filtering of this information is therefore required to identify high conservation value or priority areas for protection, regeneration or restoration management efforts. When prioritising sites, consideration should be given to the following principles:

- habitat condition - prioritising less disturbed sites;
- size of vegetation - prioritising larger sites;
- proximity and connectivity - prioritising sites that are connected or in close proximity to the same or similar EECs, SEPP 14 – Coastal Wetlands, SEPP 26 – Littoral Rainforests, and conservation areas;
- prioritising areas of dual legislative protection, (e.g. SEPP 14 – Coastal Wetlands and SEPP 26 – Littoral Rainforest;

- other values of the habitats, such as wildlife corridors and threatened species habitat values;
- existing landuse regime, for example, prioritising sites currently subject to grazing though provide low quality/carrying capacity grazing land;
- site vulnerability; and
- representativeness (though remembering the dynamic and intergrading nature of floodplain EECs, as detailed previously - NSW Scientific Committee 2004c).

Drawn by: RE Reviewed by: MVE Date: May 2010
Source of base data: Kempsey Shire Council and Planning NSW

*Information shown is for illustrative purposes only*




0 2 km

North

Known and High Probability EEC within the MREMP Study Area Floodplain - Subregion A

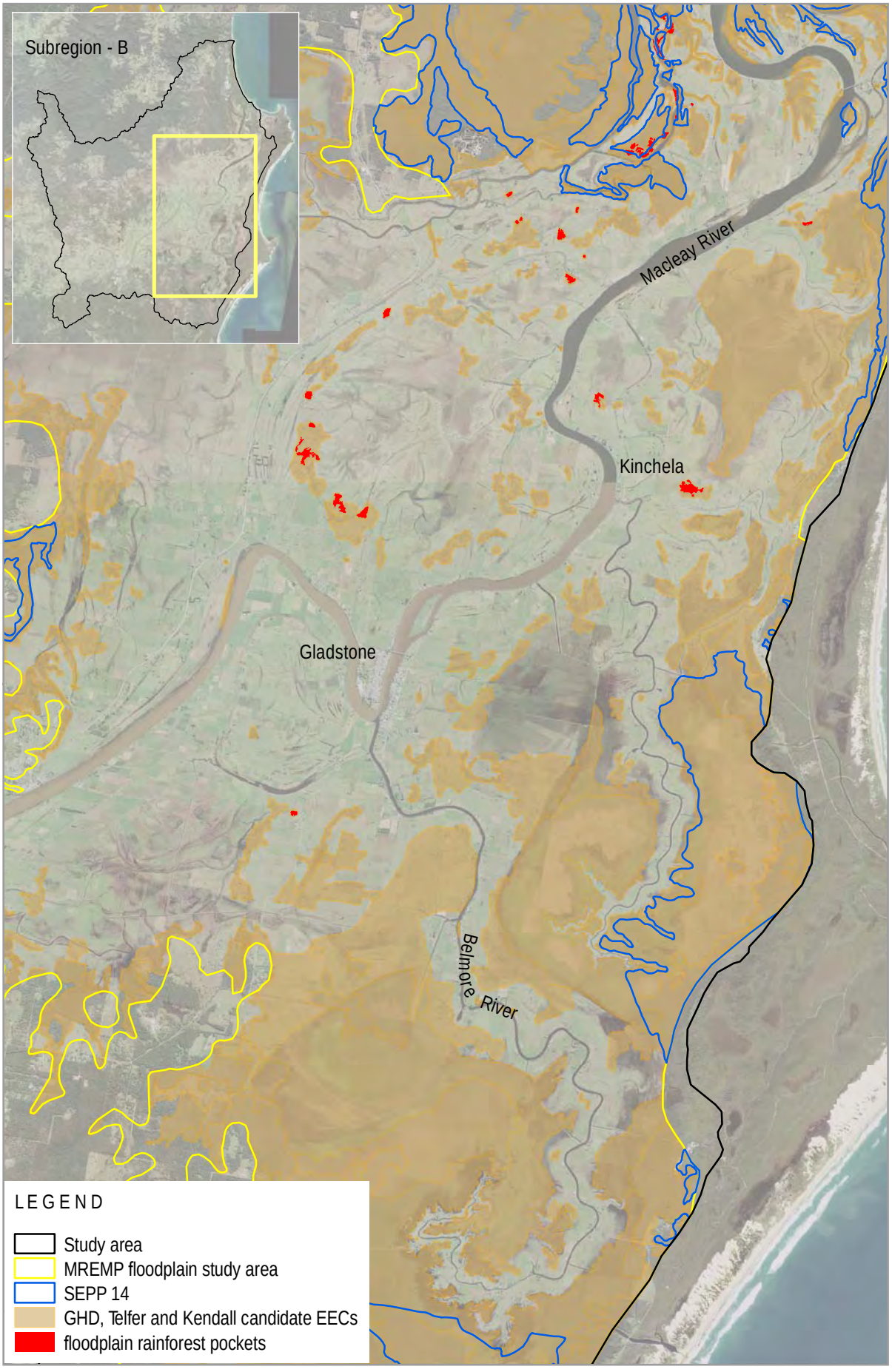
GeoLINK environmental management and design

Macleay Ecological Study
1484239

Figure 4.2

*Drawn by: RE Reviewed by: MVE Date: May 2010*
*Source of base data: Kempsey Shire Council and Planning NSW*

*Information shown is for illustrative purposes only*




0 2 km

North

Known and High Probability EEC within the MREMP Study Area Floodplain - Subregion B

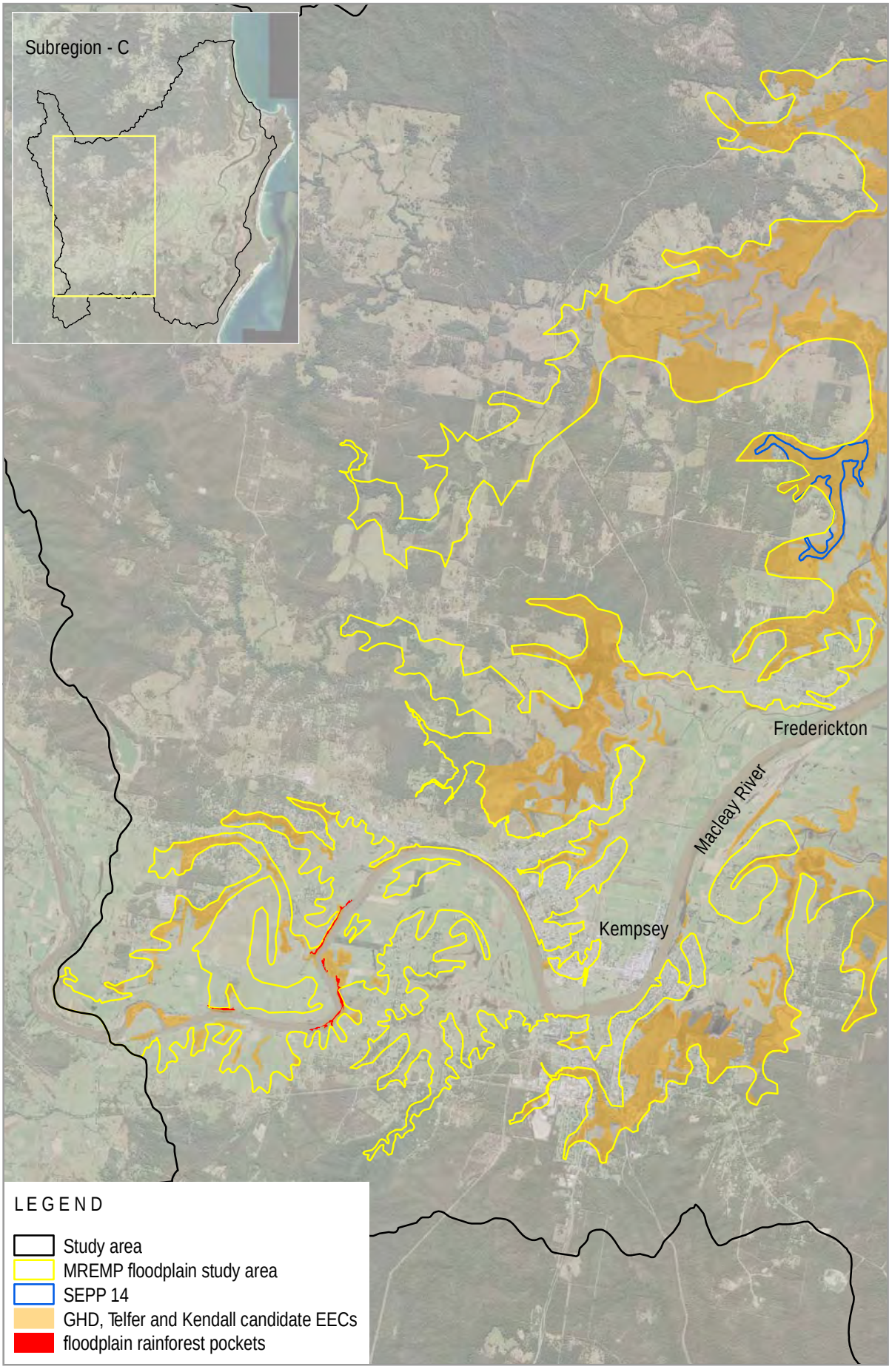
GeoLINK environmental management and design

Macleay Ecological Study
1484251

Figure 4.3

*Information shown is for illustrative purposes only*

*Drawn by: RE Reviewed by: MVE Date: May 2010*
*Source of base data: Kempsey Shire Council and Planning NSW*




0 2 km

North

Known and High Probability EEC within the MREMP Study Area Floodplain - Subregion C

### 4.1.5 Conclusion

The results of this assessment have identified that the following TSC Act listed EECs are known occurrences within the MREMP study area floodplain:

- Freshwater Wetlands;
- Coastal Saltmarsh;
- Swamp Sclerophyll Forest;
- Swamp Oak Floodplain Forest;
- Subtropical Coastal Floodplain Forest;
- Littoral Rainforest;
- Lowland Rainforest; and
- River-Flat Eucalypt Forest.

The field survey sampling assessment and review of the Telfer and Kendall (2006) candidate EEC mapping identified that 34 of the 35 sample sites constituted EECs. Some inconsistencies with regards to the Telfer and Kendall (2006) nominated EECs were identified, particularly with regards to forest communities. On a broad landscape level the Telfer and Kendall (2006) mapping is considered useful for identifying areas constituting EECs, however the use of the mapping for site specific identification of particular EECs is not always reliable.

The condition assessment identified that condition of vegetation at the sample sites was variable, though most sites showed signs of moderate disturbance. Weeds were also present at most sites, though their frequency was variable. Further analysis of condition at candidate EEC sites is therefore required when priority areas for protection, regeneration and restoration works.

Comparison of these sampling results and the Telfer and Kendall (2006) vegetation condition assessment identified that the Telfer and Kendall (2006) mapping was considered to provide a reasonable general guide for the state of the EECs within the study area at a broad landscape scale. It may therefore provide a tool to assist in the identifying priority sites and developing management opportunities at a broad landscape scale. Further investigations are however considered necessary for identifying vegetation condition and associated management implications at a site specific level.

The EPBC Act listed EECs Littoral Rainforest and Coastal Vine Thickets of Eastern Australia is considered a potential occurrence within the MREMP study area floodplain in areas currently known to constitute Lowland Rainforest or Littoral Rainforest. Further investigations however would be required to determine the actual occurrence of this specific community. No other EPBC Act EECs were considered potential occurrences.

On a broad landscape scale, areas within the MREMP study area floodplain that are considered known or likely to constitute TSC Act listed EECs were identified by collaborating the Telfer and Kendall (2006) candidate EECs, "*Potential EEC B Region*" layer, SEPP 14 – Coastal Wetlands mapping, SEPP 26 – Littoral Rainforest mapping and other areas mapped by ID Landscape Management (2005) as '*floodplain*