Project Summary:
Geomorphic Wetlands Cervantes Coolimba Coastal Stage 2 dataset

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CSR

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Project Summary: Cervantes Coolimba Coastal Wetland Mapping and Evaluation Project

This document summarises the methodology and results of the Cervantes Coolimba Coastal wetland mapping and evaluation project.

There are three components to the project:

1. Wetland desktop mapping with limited on-ground confirmation (identification of wetlands, boundary delineation of wetlands and classification of wetland using the geomorphic wetlands classification system)
2. Wetland desktop evaluation (Stage 2 wetland management categories)
3. Methodology for deriving a wetland management category for environmental impact assessment using desktop and on-ground information (Stage 3 wetland management categories)

The corresponding outputs are:

- ESRI shapefile: *Geomorphic Wetlands Cervantes Coolimba Coastal Stage 2 dataset* plus metadata statement
- Wetland mapping report: *Wetland identification, delineation and classification: Results for the Geomorphic Wetlands Cervantes Coolimba Coastal Stage 2 dataset* (Shanahan/DEC 2012)
- Applied evaluation: *Wetland evaluation:* Stage 2 results *for the Geomorphic Wetlands Cervantes Coolimba Coastal Stage 2 dataset* (Shanahan/DEC 2012)
- Evaluation methodology *Wetland evaluation methodology A Stage 3* evaluation methodology *for the Geomorphic Wetlands Cervantes Coolimba Coastal Stage 2 dataset* (Shanahan/DEC 2011)

The dataset and corresponding outputs have been endorsed by the Wetland Status Working Group (WSWG) and the State Wetland Coordinating Committee (WCC) as a Stage 2 mapping and evaluation output in accordance with *Framework for mapping, classification and evaluation of wetlands in Western Australia ('the state framework') (DEC a).*

The *Geomorphic Wetlands Cervantes Coolimba Coastal Stage 2* dataset is in the Midwest region of WA. It overlies the northern Swan Coastal Plain and southern Geraldton Sandplain and is located in the vicinity of Cervantes, Jurien Bay, Greenhead, Leeman and Coolimba in the shires of Dandaragan, Coorow and Carnamah. The project area is approximately 100,000ha (excluding oceanic area). The project area is largely intact and within conservation estate; however wetlands in the area are under increasing pressure from mining, urbanisation, clearing, phytophthora spp and climate change. It is important to note, the project area is part of the South West Botanical Province of WA, which is the most intensively cleared area in WA and also recognised as an international biodiversity hotspot (Conservation International 2007) making it part of a high value high threat landscape.

Wetland extent was identified and delineated and geomorphic types identified and classified using a range of information sources including Landsat satellite imagery, remote sensing techniques, digital orthophotos, hard copy stereoscopic aerial photographs, topography, soil types, remnant vegetation and hydrography.

A total of 315 wetlands were mapped in the project area and comprised approximately 21,280 ha of mapped wetland extent (approximately 21% of total project area). The wetland types mapped (and the relative extent) were Palusplains (25%), Floodplains (0.2%), Balkarra (20%), Damplands (6%), Sumplands (21%), Playa (8%), Lakes (10%), Rivers (0.8%), Creeks (0.3%), Wadis (1%), Self-emergent wetlands (2.5%), Springs (1%), Estuary-peripheral (0.7%) and Estuaries (0.1%).

The desktop mapping was verified for wetland extent at 8 investigation areas (2km x 2km), equating to 16 km^2 and for positional and attribute accuracy at 24 individual wetlands, providing a general measure of accuracy of the dataset. The area investigated for wetland extent represented 3.6% of the project area while the 24 wetlands investigated for positional accuracy represented approximately 8% of the total number of mapped wetlands and 7.6% of wetland area.

A total of 3,683 hectares were investigated for wetland extent. Prior to the field work, this area contained 689 ha of wetland (approx 19% of area), while post field work this area contained 643 ha of wetland (approx 17.5% of area), equating to 93% accuracy in terms of wetland extent.

Positional accuracy of boundaries calculated from groundtruthing at a limited number of wetlands (24) was determined to be approximately 20m (range 1 – 257m) and attribute accuracy was 90%. Positional accuracy per landform is: basins 11 metres; flats 41 metres; channels 24 metres and slopes 7 metres. These results include a distance of 247 m for the Lake Logue Indoon Flats. Eliminating that transect, the verification field work gives a positional accuracy of 14 m (range 1m to 65m, 40 transects) and flats have an accuracy of 15 m.

The temporal resolution of the information used to determine wetland boundaries and classification was 22 years and was biased towards more recent information sources. The mapping may therefore underestimate or overestimate wetland extent or water permanence over a longer climatic period.

The mapping is considered suitable to be used at a scale of 1:25,000. As the mapping was conducted at 1:25,000 scale some wetlands in the project area are not included in the dataset as they are too small in size to be detected as individual entities at this scale. Subterranean and artificial wetlands, beaches and wetlands on offshore islands were not included in the scope of the project.

Wetland evaluation was conducted using desktop techniques and each wetland was assessed against 7 automatic Conservation criteria and a further 27 ranked criteria (High, Intermediate and Low). Wetland values were identified using a range of information sources such as threatened and priority flora and fauna datasets, threatened ecological communities dataset, flora and fauna reports, System 5 report, Directory of Important Wetlands in Australia plus local information on the hydrology and functioning of the wetlands. Wetlands were assigned one of three management categories

1. Stage 2 Conservation management category
2. Stage 2 Rehabilitation Potential management category
3. Stage 2 Multiple Use management category

Stage 2 Conservation management category is assigned to 73% of wetlands mapped in the *Geomorphic Wetlands Cervantes Coolimba Coastal Stage 2* dataset, which equates to 15.5% of the project area. This is largely reflective of conservation estate coverage in the project area. A stage 2 Rehabilitation Potential management category is assigned to 2% (of the wetlands 0.5% of project area) and a stage 2 Multiple Use management category to 25% of wetlands (5% of the project area).

Significant wetlands identified in the project area are:

- Salt lakes from Jurien Bay to Coolimba including Leeman Lagoon and Eatha Claypan
- Springs connected to salt lakes including Eatha Spring, Diamond of the Desert Spring and Thetis Claypan springs.
- Large sumpland to the east of Leeman Lagoon (UFI269; Shanahan Sumpland)
- Other springs and self-emergent wetlands including Roman Forte wetland, Little Three Springs and South Little Three Springs
- Hill River and Hill River Estuary
- Lake Logue / Indoon system
- Cockleshell Gully
- Lake Thetis

A wetland evaluation methodology has been produced to facilitate assessment of an appropriate management category for environmental impact assessment process using both desktop and on-ground information, namely *Wetland evaluation: A Stage 3 evaluation methodology for the Geomorphic Wetlands Cervantes Coolimba Coastal Stage 2 dataset* (Shanahan/DEC 2012).

Introduction

The report, *Wetland identification, delineation and classification: methodology and results for the Geomorphic Wetlands Cervantes Coolimba Coastal Stage 2 dataset* (Shanahan/DEC 2012), describes wetland identification, delineation, and classification methodologies for the study area, and the outcomes of their application to the study area. The assessment of the conservation significance of wetlands in the project area is detailed in *Wetland evaluation: Stage 2 results for the Geomorphic Wetlands Cervantes Coolimba Coastal Stage 2* dataset (Shanahan/DEC 2012) The *Geomorphic Wetlands Cervantes Coolimba Coastal Stage 2* dataset (DEC 2012) presents the resulting data.

Form of inventory	Methodology	Application
Identification	✓	✓
Delineation	✓	✓
Classification	✓	✓
Evaluation	✓	✓

Funding

This project was managed and conducted by DEC Wetlands Section and funded by CSR Gyprock Cement as part of an offset package for Lake Gypsum (ministerial statement 730).

Study area

The project study area is approximately 100,000 hectares of the Midwest, within the shires of Dandaragan, Coorow and Carnamah as shown in Figure 1.

Wetland mapping stage

The Wetlands Coordinating Committee, with the advice of its Wetland Status Working Group, has determined that the mapping and evaluation methodologies plus their application to the study area fulfil the requirements of a Stage 2 project. Specifically the level of field sampling, the use of aerial photography, the scale, the approximate boundaries of individual wetlands, the geomorphic classification, the grouping of wetlands and the preliminary prioritisation of wetlands fulfilled the criteria of a Stage 2 project. The elements of aerial photography, the 1:25,000 scale, the geomorphic classification and evaluation of individual wetlands also meet aspects of a Stage 3 project. Table 1 outlines key aspects of Stage 2 mapping projects.

Table 1. Primary stages of wetland mapping identified in DEC (a).

Stage	**Purpose/ objective**	**Scale**	**Approach**	**Mapping**	**Mapped classification**	**Evaluation**	**Outcome**
1	Broad wetland distribution	Regional	Reconnaissance Desktop 'Drive by'	Satellite imagery, aerial photographs, topography Map 'centroid' or approximate	Wetland vs. dryland	Existing data only No further evaluations	Quantify wetland resource

				boundary 1:250,000 to 1: 100,000 scale			
2	Asset evaluation, priority setting	Group of wetlands	Field sampling of sub-set and extrapolation of information	Aerial photograph. Precise or approximate boundaries 1:50,000 to 1:10,000 scale	Geomorphic wetland type	Preliminary indication of conservation value	Preliminary evaluation and prioritisation for future detailed assessment
3	Protection, management, environmental impact assessment	Individual	Individual wetland assessment in field	Aerial photographs (stereoscopic analysis). Precise boundaries 1:25,000 to 1:5,000 scale	Geomorphic wetland type	Detailed assessment of conservation value	Identification of values of individual wetlands as basis for protection, management and/or nomination.

Scale

The scale of the dataset is considered to be 1:25,000 as the scale of orthophotography used for digitisation was 1:25,000.

Relevant wetland types

The identification, delineation and classification of all wetland types listed in Table 2 are within the scope of the project. During the project, the wetland types shaded in Table 2 have been identified within the study area.

Table 2. Geomorphic wetland types formed by combining landform and hydroperiod attributes (after Semeniuk & Semeniuk 1995)

Hydroperiod	**Landform**				
	Basin	**Channel**	**Flat**	**Slope**	**Highland**
Permanent inundation	Lake	River	-	-	-
Seasonal inundation	Sumpland	Creek	Floodplain	-	-
Intermittent inundation	Playa	Wadi	Barlkarra	-	-
Seasonal waterlogging	Dampland	Trough	Palusplain	Paluslope	Palusmont

Some wetlands are not designed to be classified using the geomorphic classification system (e.g. self-emergent wetlands). In addition to the above wetland types, self-emergent wetlands, springs, estuary-peripheral and estuary type wetlands have been identified. Wetlands on off-shore islands, beaches, subterranean and artificial wetlands are not included in the dataset.

Completeness (wetland types mapped)

All natural geomorphic wetland types (basins, slopes, flats, channels and highland) plus self-emergent wetlands, springs, estuary-peripheral and estuary type wetlands were attempted to be mapped. Beaches, wetlands on offshore islands, subterranean and artificial wetlands were not mapped.

Inclusiveness (percentage of wetland area mapped)

An indication of the precision of mapped wetland extent was gauged from field work. Random areas within the dataset were visited and tranversed to mark wetland extent. This was compared to the digital desktop mapping. In the 3,683 hectares investigated, prior to the field work it contained approximately 689 ha (19% of area) of mapped wetland extent, post field work the area contained 643 ha (approx 17.5% of area) of mapped wetland extent. This equates to 93% accuracy in mapped wetland extent and indicating wetland extent may be overestimated, especially for waterlogged flat wetlands. The number of wetlands stayed the same.

Of all wetlands areas (including positional accuracy and attribute accuracy areas) visited in the field, only one additional small wetland was identified, which was a dampland.

Wetlands may not have been identified as they are too small in size to be detected at the scale at which the mapping was undertaken, and may therefore be missing from the dataset entirely or combined with other wetland polygons. The minimum wetland polygon size is 0.01 ha, however this may not be consistent across wetland types.

Seasonally waterlogged wetlands are more likely to be underrepresented or have boundary imprecision because they are more difficult to detect using the methods applied.

Positional accuracy (boundary precision)

Boundaries of wetlands are approximate and to be used at a scale of 1:25,000. Positional accuracy for a sample of wetlands is provided for guidance only and boundary accuracy across the whole dataset may be larger or smaller than those sampled.

Ground truthing was conducted for a portion of boundaries at 24 of the 315 wetlands (7.6% of total number of wetlands) and indicated average positional accuracy per wetland was 20m (Range: 1m – 257m, 41 transects). The standard deviation is 39m with 95% confidence intervals [8%, 32%]. Positional accuracy per landform is: basins 11 metres; flats 41 metres; channels 24 metres and slopes 7 metres. These results include a distance of 247 m for the Lake Logue Indoon Flats. Eliminating that transect, the verification field work gives a positional accuracy of 14 m (range 1m to 65m, 40 transects) and flats have an accuracy of 15 m. GPS accuracy of field recorded locations was +/-5 m and may result in an underestimate or overestimate of the accuracy measure calculated.

Attribute Accuracy (accuracy of assigned wetland type and Stage 2 management category)

Ground truthing at a limited number of wetlands (N=24) found 90% accuracy in classification. However, this is not statistically significant due to the low sample size;

therefore in using the data, a site specific assessment is required. One wetland was found to be an artificial wetland and omitted from the dataset.

No ground truthing has been conducted to verify the accuracy of evaluation components of the dataset, including the Stage 2 management category. A methodology, namely *Wetland evaluation methodology: Stage 3 evaluation methodology for the Geomorphic Wetlands Cervantes Coolimba Coastal Stage 2 dataset* (Shanahan/DEC 2012) has been developed to confirm wetland management categories using both desktop and on-ground information. This should be conducted prior to any detailed land use planning of a site.

Statement of limitations

- The Stage 2 evaluation was conducted using desktop information. The Stage 2 wetland management categories have not been ground truthed and need to be verified using additional on-ground information prior to any detailed land use planning assessment of a site. *Wetland evaluation methodology: Stage 3 evaluation methodology for the Geomorphic Wetlands Cervantes Coolimba Coastal Stage 2 dataset* (Shanahan/DEC 2012) should guide this assessment.
- The evaluation of wetlands in the project area has not considered wetlands in the terms of their larger regional context (expect if stated in a specialist study) as wetland mapping has not been completed for the majority of the Geraldton Sandplains. Further evaluation should consider the wetlands in relations to other wetlands outside the project area.
- Evaluation of wetlands in the project area relies on the availability of information on wetland values, such as flora, fauna, and ecological communities. There is paucity of this type of information for the project area due to lack of detailed survey work. Re-evaluation of wetlands should include a search for new available data to be included in the assessment of wetland values.
- Representativeness assessment, using geomorphological units, for evaluation of wetlands in the project area will over or under estimate true representative for some units. A large percentage of the Bassendean, Indoon, Yeeramulla and Nylagarda units extend beyond the eastern boundary of the project area. No assessment of wetlands outside the project area was conducted.
- Both mapping and evaluation of wetlands in the project area is reliant on existing environmental data available in the project area. Each data source available in the project area has its their unique limitations and uses of this dataset should also be aware of these limitations. A list of data used for mapping and evaluation of wetlands is available in *Wetland identification, delineation and classification: Results for the Geomorphic Wetlands Cervantes Coolimba Coastal Stage 2 dataset* (Shanahan/DEC 2012) and *Wetland evaluation:* Stage 2 results *for the Geomorphic Wetlands Cervantes Coolimba Coastal Stage 2 dataset* (Shanahan/DEC 2012).
- The project sought to map all natural wetland types within the project area (including channel type, estuarine and self-emergent wetlands) however due to scale and other reasons there may be wetlands missing from the dataset. Mapping should be confirmed at time and use of data. It should be noted that beaches, wetlands on offshore islands, subterranean and artificial wetlands were not within the scope of the mapping and are not included in the dataset.

- The mapping has been conducted at a scale of 1:25,000 and hence is only accurate for use at a scale of 1:25,000. Some wetlands have not been included in the dataset as they are too small in size to be detected. In some cases these wetlands will have been incorporated into a larger wetland polygon and in other cases entirely missed from the dataset. Wetland extent is estimated to be 93% accurate but may over estimate the boundary of waterlogged and flat wetlands.
- The boundaries are considered approximate and the positional accuracy statement provides only an indication of boundary accuracy.
- The temporal resolution of the information used to determine wetland boundaries and classification was 22 years and was biased towards more recent information sources. The mapping may therefore underestimate or overestimate wetland extent or water permanence over a longer climatic period.
- Wetlands were classified according to the prevailing hydrological conditions at the time. This classification may need to be re-examined if hydrological conditions are altered by irreversible anthropological effects or by cyclic climatic variability.

Associated datasets

Two wetland datasets also are present in the project area. Those being the *Geomorphic Wetlands Cervantes South Stage 2* dataset (DEC 2010, mapped by ENV) and the *Geomorphic Wetlands Cervantes Eneabba Stage 1 dataset* (DEC 2011, mapped by VCSRG). These datasets contains spatial data (wetland polygons) with associated attributes. DEC is the custodian of both datasets. For further information contact the Wetlands Section, DEC on 9334 0333.

Associated Reports:

ENV Australia Pty Ltd (2010), *Wetland Mapping and Classification Cervantes South*, prepared for the Department of Environment and Conservation, Western Australia.

DEC (2011), Project summary: Geomorphic wetlands Cervantes Eneabba Stage 1 dataset

Endorsement

The *Geomorphic Wetlands Cervantes Coolimba Coastal Stage 2* dataset (DEC 2012) and associated documents have been endorsed by:

- Department of Environment and Conservation
- Wetland Status Working Group
- Wetlands Coordinating Committee

Recommended reference

The recommended reference for this publication is: DEC (2012) *Project Summary: Cervantes Coolimba Coastal Stage 2 dataset*, Department of Environment and Conservation, Western Australia.

References:
Conservation International 2007. Southwest Australia, Biodiversity Hotspots. Website accessed 18 august 2011 www.biodiversityhotspots.org

Department of Environment and Conservation a. Framework for mapping, classification and evaluation of wetlands in Western Australia. Unpublished

Figure 1: *Geomorphic Wetlands Cervantes Coolimba Coastal* project area.

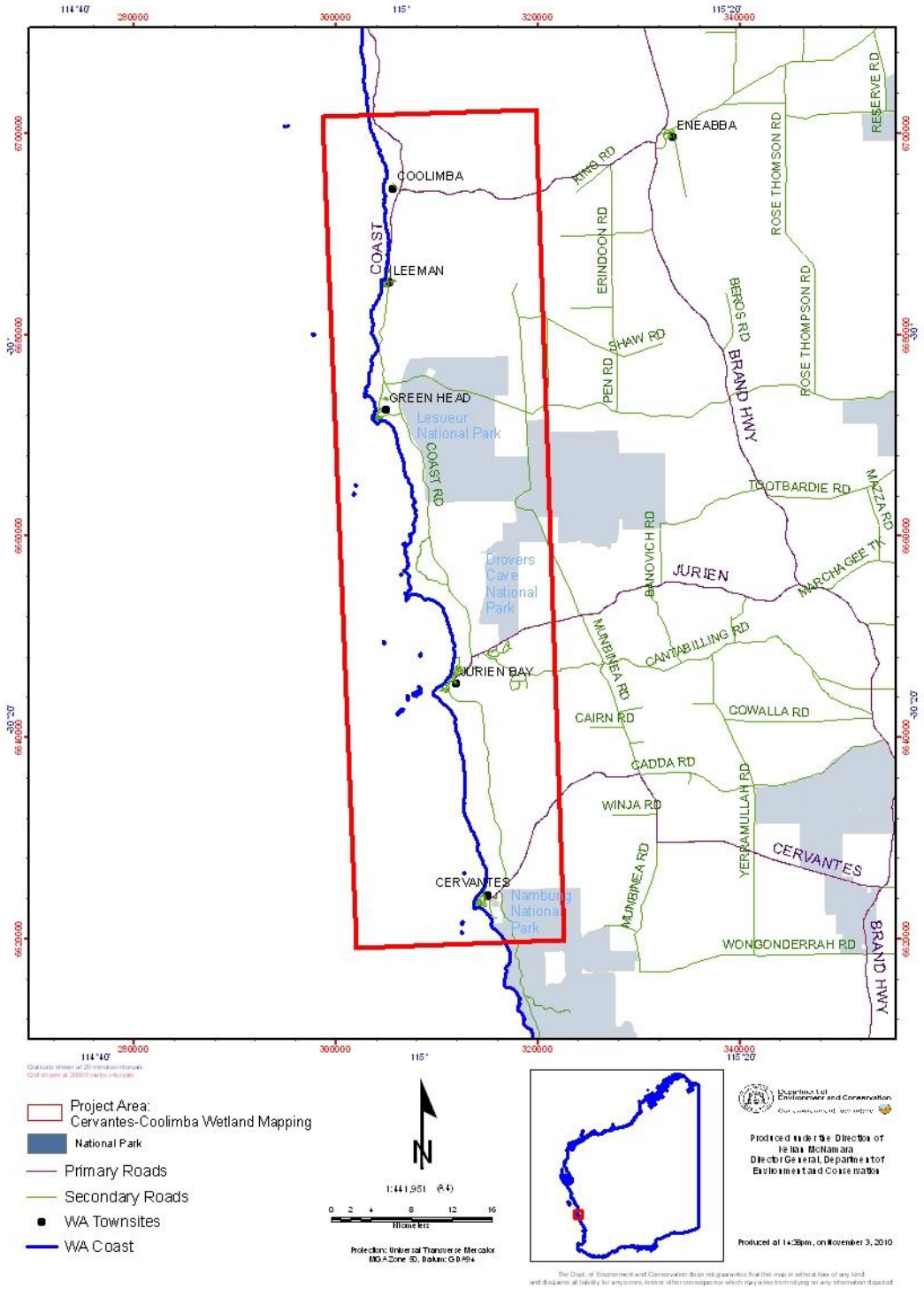

Figure 2: ***Geomorphic Wetlands Cervantes Coolimba Coastal Stage 2 dataset - CLASSIFICATION***

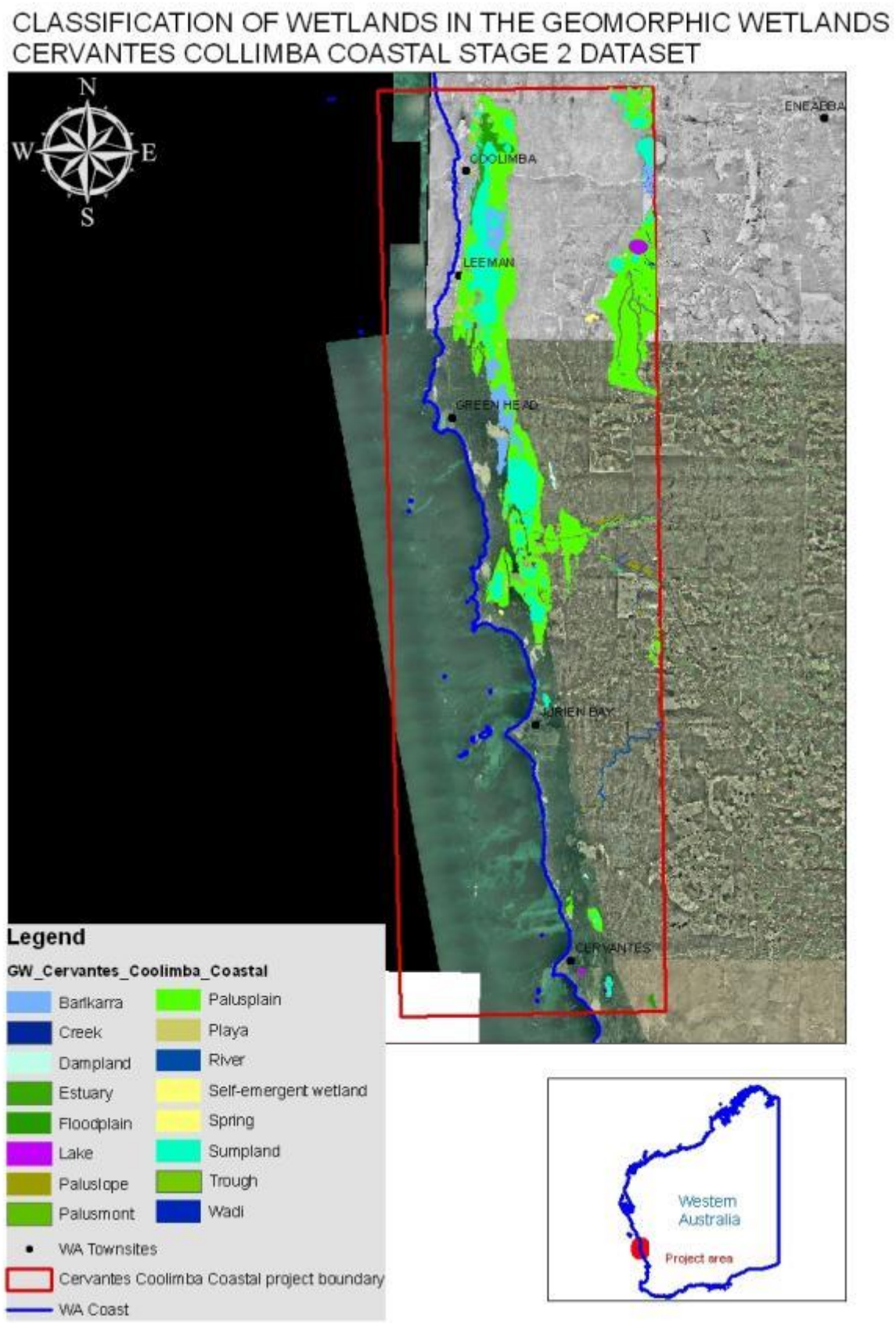

Figure 3: ***Geomorphic Wetlands Cervantes Coolimba Coastal Stage 2 dataset – STAGE 2 WETLAND MANAGEMENT CATEGORIES***