**Preliminary Assessment Extent**

**1). Identification of coal-bearing units in the Clarence-Moreton bioregion**

Major coal-bearing stratigraphic units in the Clarence-Moreton bioregion are the Walloon Coal Measures, the Ipswich Coal Measures (and equivalents) and the Nymboida Coal Measures (Figure 1 and 2).

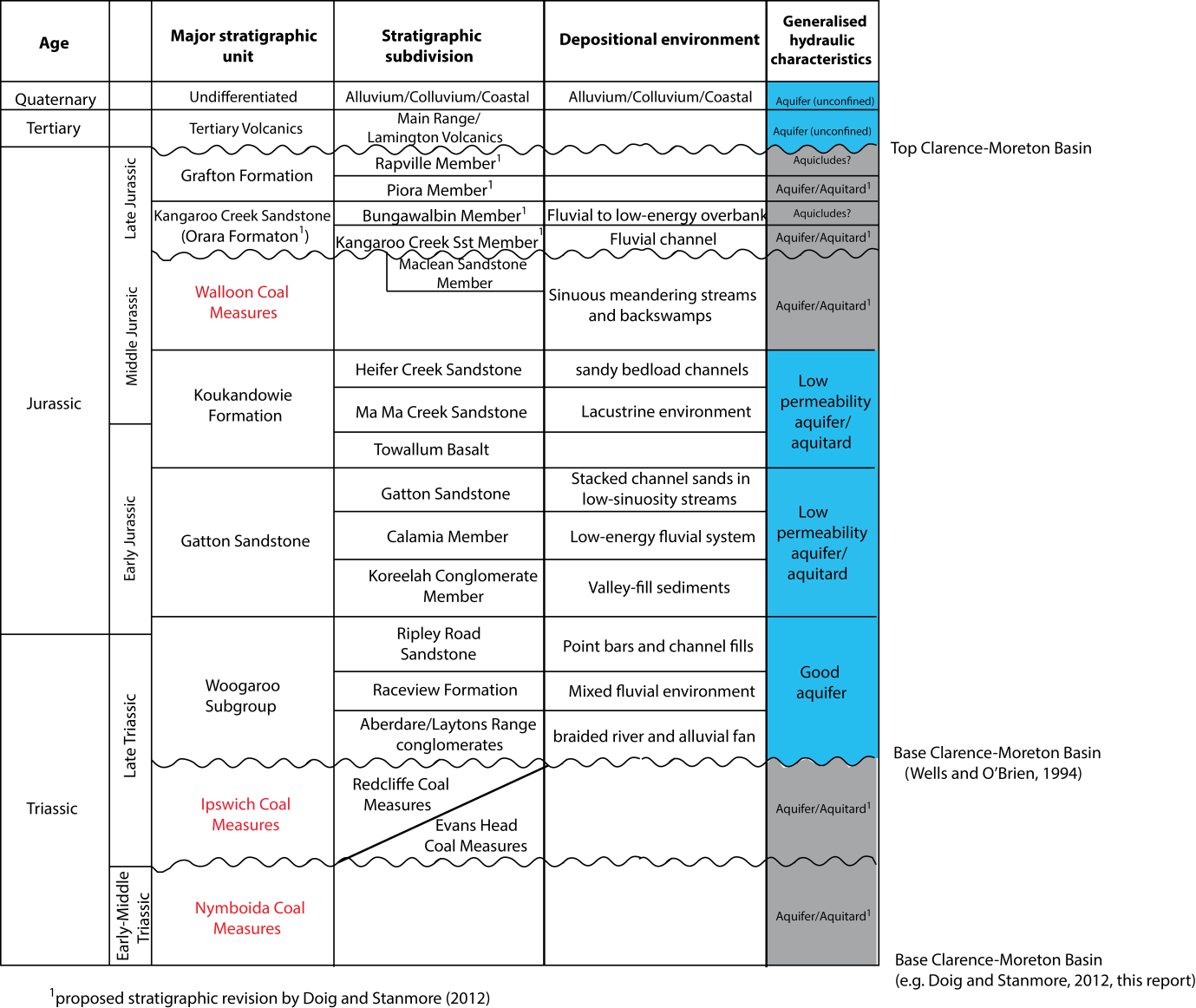


Figure 1 – Stratigraphic table Clarence-Moreton Basin. Major coal-bearing stratigraphic units are highlighted in red.

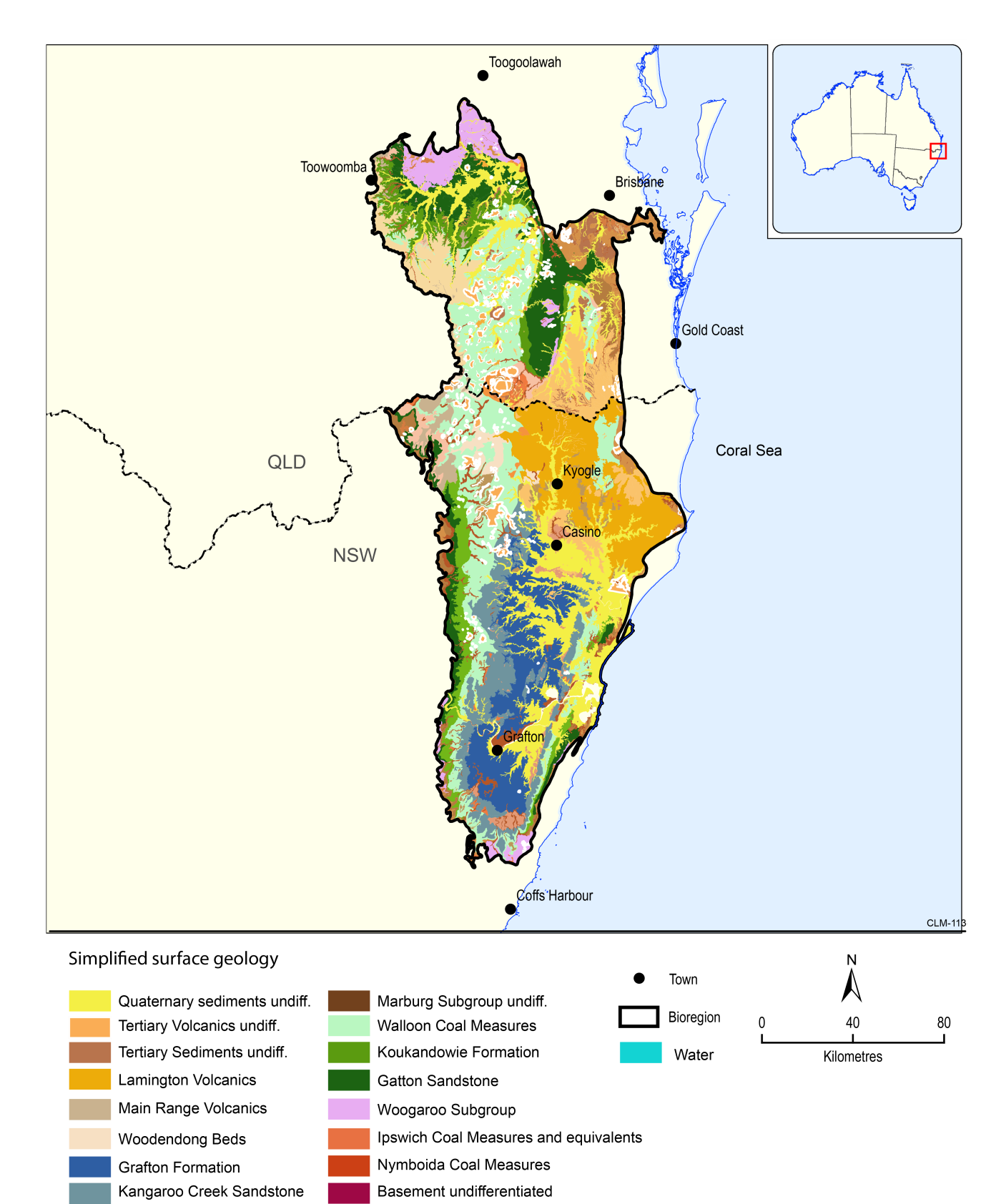


Figure 2 – Simplified surface geology of the Clarence-Moreton bioregion.

**2). Assessment of extent of coal-bearing units and areas of historical or current coal mining activities**

Economic coal occurrences in the Clarence-Moreton Basin have been reported primarily from the Walloon Coal Measures, where large near-surface deposits of thermal coal occur over large areas. Many historic records exist from different parts of the Clarence-Moreton Basin where the coals of the Walloon Coal Measures have been mined in both open pit and underground mining operations since the 1870s. However, the Ipswich Coal measures and Nymboida Coal Measures have also been mined for coal in the past in areas where the units are present at the surface or at shallow depths. The extent (surface and sub-surface) of the Walloon Coal Measures is shown in Figure 3. The Ipswich and Nymboida Coal Measures are present throughout much of the basin underneath typically more than 2000 m of younger Clarence-Moreton Basin sediments, and they are present in outcrop or at shallow depths near the basin margin in Qld and NSW (Figure 4).

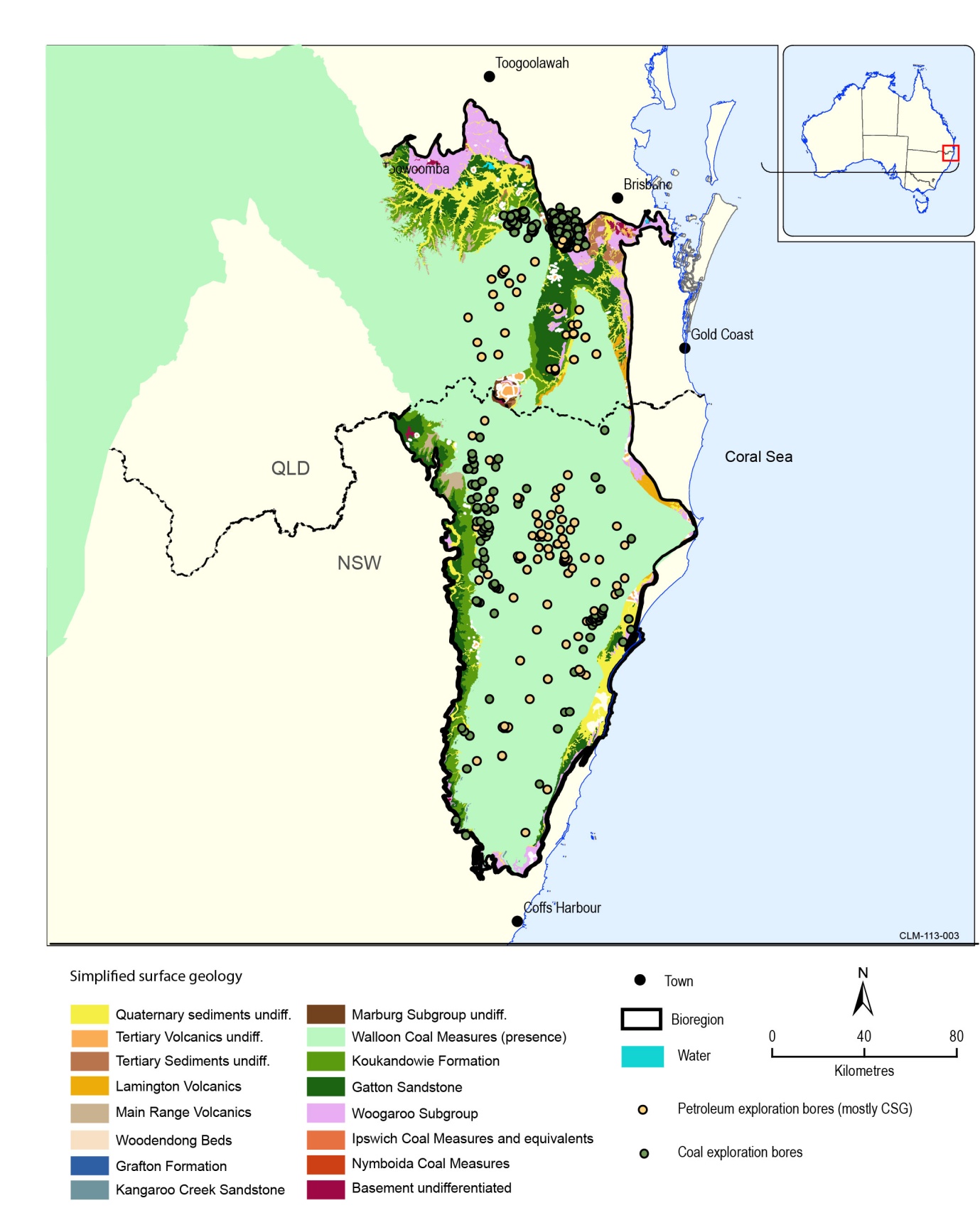


Figure 3 – Extent of Walloon Coal Measures in surface and subsurface in the Clarence-Moreton bioregion.

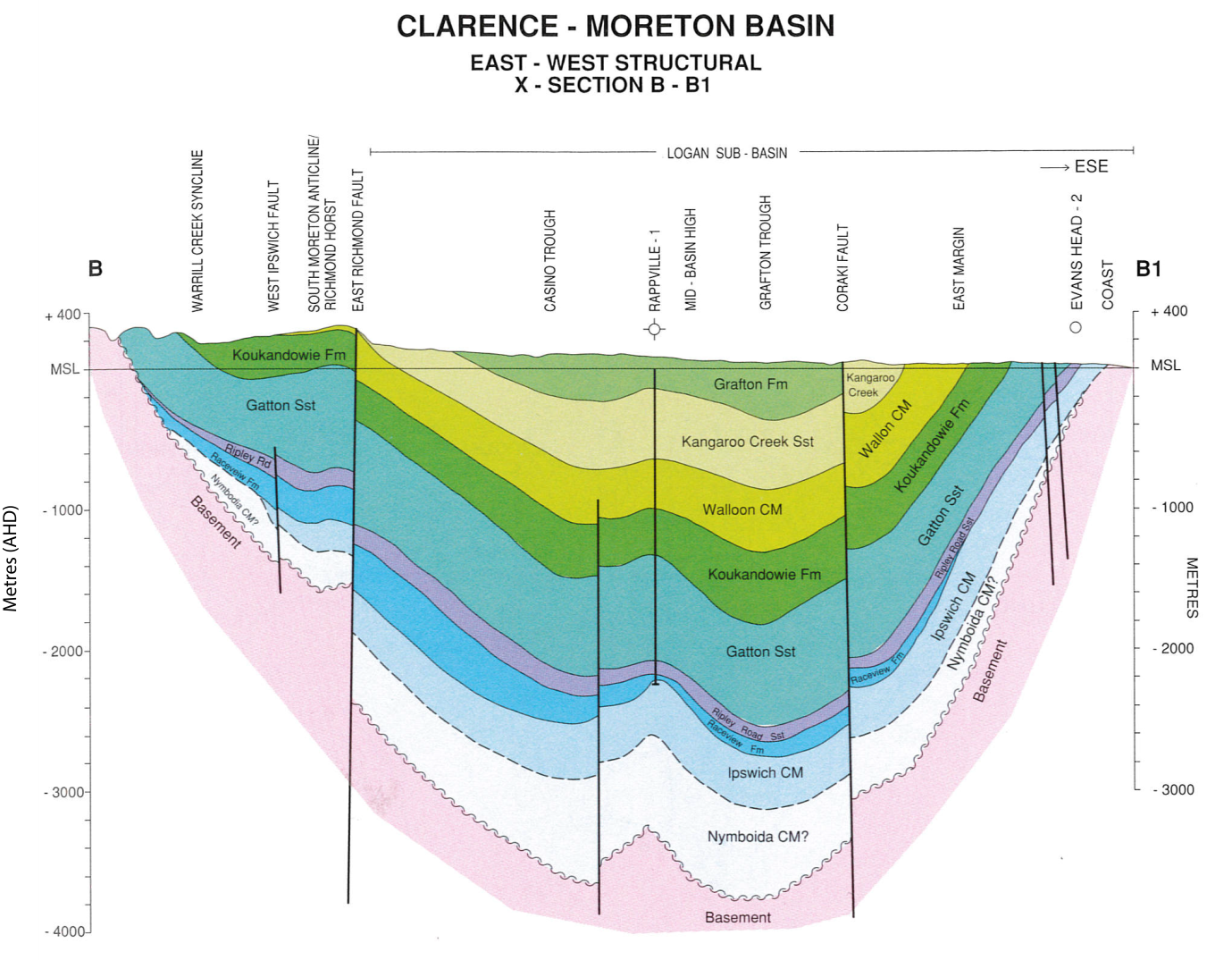


Figure 4 – Cross-section through the Clarence-Moreton Basin in NSW (Ingram and Robinson, 1996).

**3). Assessment of spatial distribution of coal and coal seam gas exploration bores**

The Walloon Coal Measures have been the primary target for CSG exploration in the Clarence-Moreton bioregion so far. Much of the exploration activity in NSW has focussed on the Walloon Coal Measures in the Casino and Grafton troughs (Figure 3, 4 and 5), and it is likely that these structural features are some of the first areas where development will occur, but it will not be limited to these areas as can be inferred from the distribution of exploration bores and licenses. For example, the Ipswich Coal Measures have also been targeted by Arrow Energy in Qld in areas where they are present at relatively shallow depths due to basement highs. The Walloon Coal Measures and older coal measures are absent throughout most of the Lockyer Valley (northern end of CLM bioregion, Figure 3), and therefore, no petroleum exploration permits exist in this area.

**4). Identification of current petroleum or coal mining titles, or petroleum applications**

Current petroleum exploration licenses in NSW cover the entire extent of the Clarence-Moreton bioregion (Figure 5), therefore extending beyond the presence of the Walloon Coal Measures. One of the petroleum exploration licenses located outside the area where the Walloon Coal Measures are present is PEL 478 (Figure 5). Exploration in this PEL will focus on conventional gas in the Woogaroo Subgroup and the Marburg Subgroup as well as coal seam gas in the older coal measures (Ipswich Coal Measures and Nymboida Coal Measures) (personal comment, ERM Power).

Potentially, therefore all areas within the Clarence-Moreton bioregion where coal or coal seam gas are present in economic quantities may be potential target areas where development could occur in the future. We will discuss the development time-frames with regards to the timing when different formations will be targeted in more detail with the CSG companies as part of the “Coal/CSG resource development pathways” product.

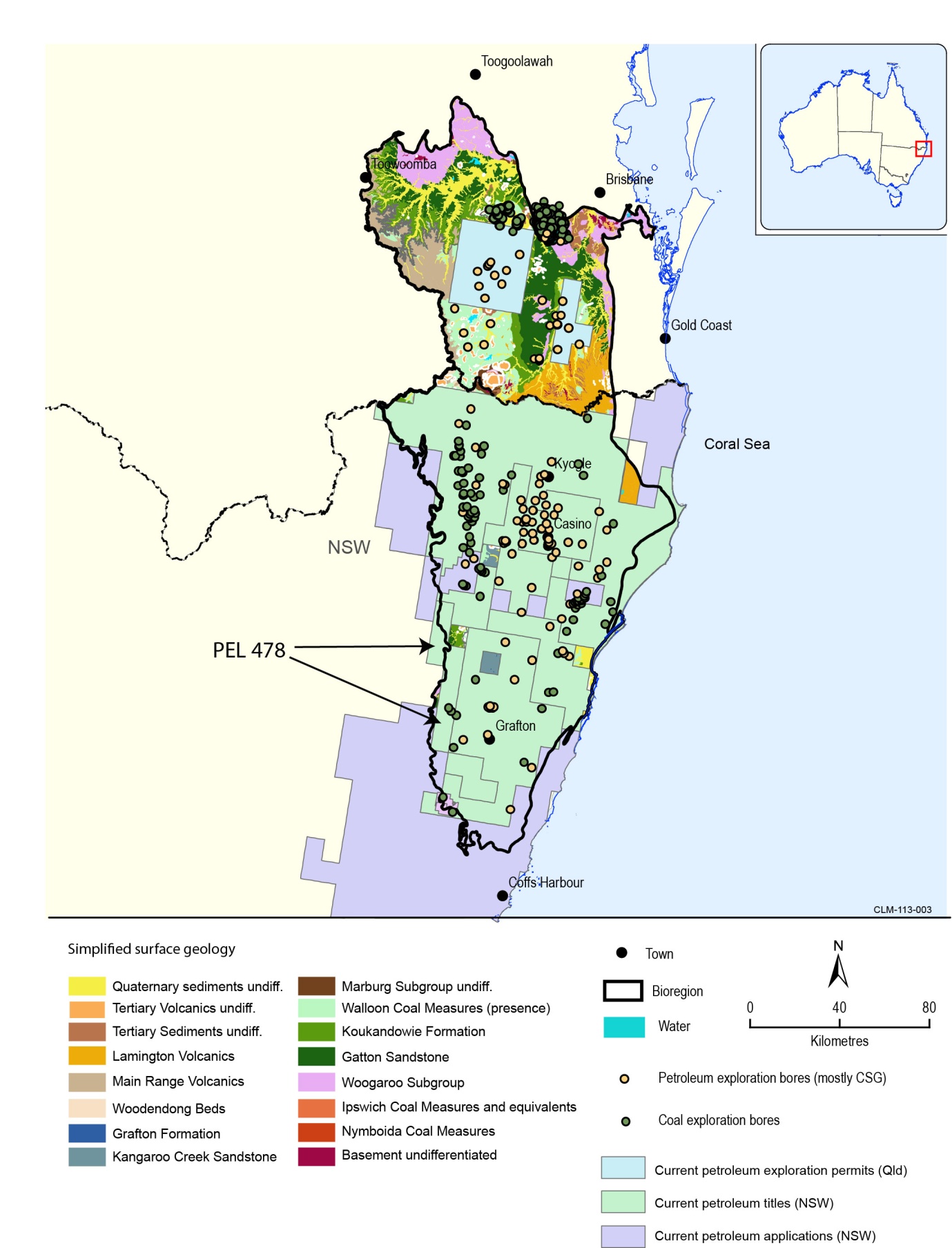


Figure 5 – Petroleum titles and exploration permits in Qld and NSW.

**5). Groundwater hydrology**

Figure 4 highlights the abundance of faults in the Clarence-Moreton Basin in NSW, with some of the faults extending to the surface. Faults are also abundant in the Qld portion of the basin. Along many of these faults, significant vertical offsets of stratigraphic units are inferred from seismic images, resulting in a substantial juxtaposition of aquifers of often contrasting properties. These faults can potentially form pathways for hydraulic connection, or the faults may act as hydraulic barriers causing a compartmentalisation of aquifers.

There is currently only a very limited understanding of the hydraulic connectivity between the basal Clarence-Moreton Basin aquifers and the basement aquifers. However, most rocks that form the hydraulic basement to the Clarence-Moreton Basin sedimentary sequences are part of the New England Orogen (e.g. Texas Block, Coffs Harbour Block and Beenleigh Block; Figure 6), which is dominated by granitic plutons, igneous complexes or metasedimentary rocks. These rock types are commonly considered as low-yielding aquifers. In addition, these areas are up-gradient form the proposed areas of CSG exploration/development. Hence, there is unlikely to be any significant connectivity between Clarence-Moreton Basin sequences and the underlying basement aquifers and it is unlikely that there could be any impacts of coal/CSG resource development outside the area of the bioregion.

Currently, the understanding on groundwater flow and groundwater-surface water interaction especially in the NSW part of the Clarence-Moreton bioregion is very limited due to a combination of the poor quality of data contained in the NSW groundwater database and the complexity of the geology. Prior to the construction of maps showing the water table/potentiometric surface, further meetings with the NSW Office of Water and other government agencies will be required that we include all available data in the assessment.

**Conclusion and proposed extent of PAE**

We propose the following extent for the PAE of the CLM bioregion (Figure 7):

* the entire Clarence-Moreton bioregion, with the exception of that part of the Lockyer Valley where no coal measures are present, should be included into the PAE until a more detailed assessment of groundwater hydrology, surface hydrology and coal resource development pathways has been conducted as part of upcoming products.
* in addition, the coastal areas east of the Clarence-Moreton basin bioregion boundary in the Richmond- and Clarence river catchments should be included in the PAE, as any changes of surface water quality or quantity can have considerable impact on the assets in these areas.
* as there is very likely no or only limited hydraulic connectivity between the Clarence-Moreton Basin sedimentary sequences and the underlying/adjacent basement rocks of the New England Orogen outside the Clarence-Moreton bioregion (Figure 6), there is no need to include any of these areas into the PAE.

During the “Coal resource development pathways”, after close discussion with CSG companies, NSW and Qld government authorities, ecologists and other experts, we would then be able to exclude areas which are less likely to be targeted for development in the near future and focus on those areas that are the primary targets. By then, we will also have a much better understanding on the availability of groundwater and surface water data in NSW which will be required in support of the impact modelling.

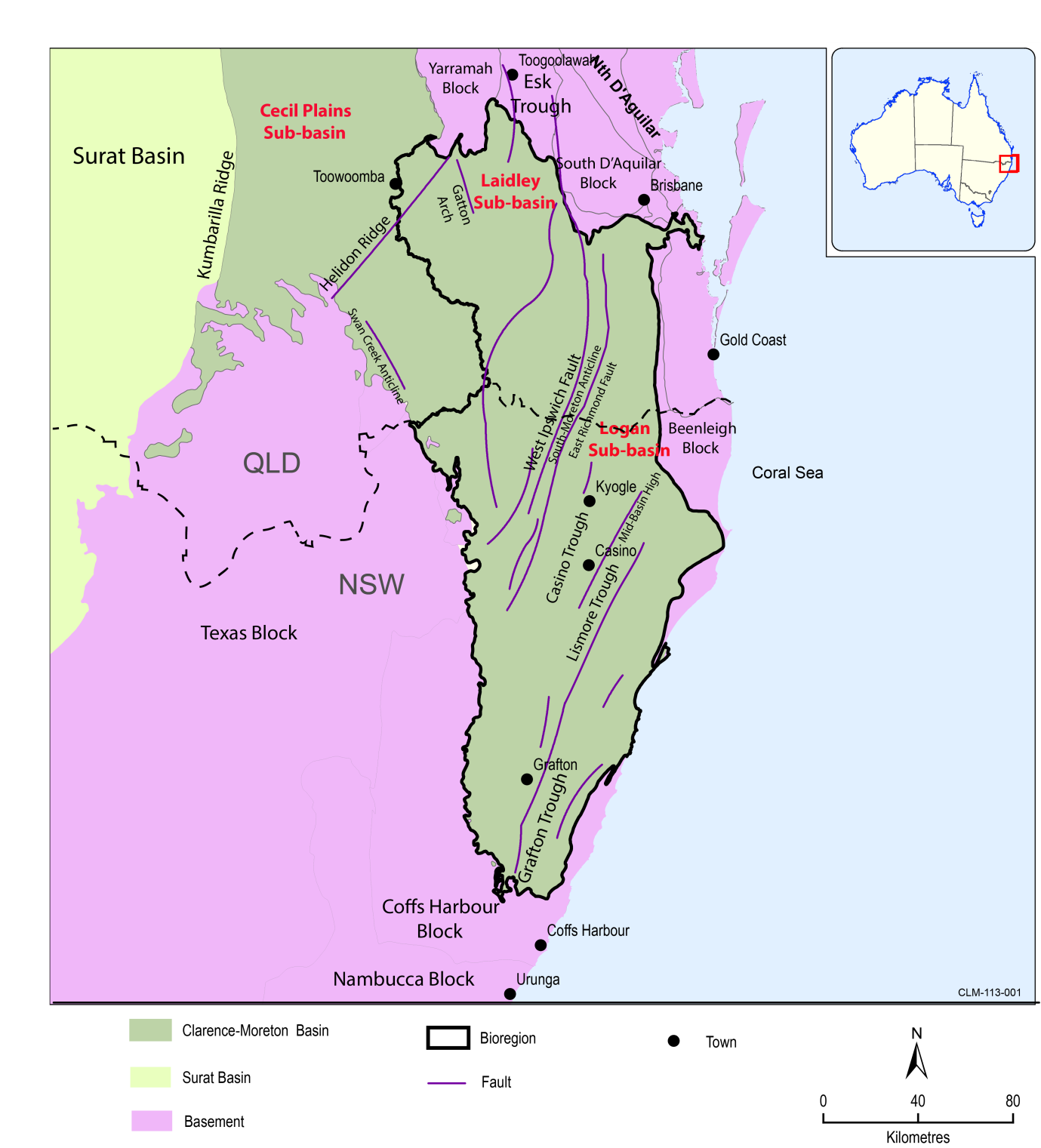


Figure 6 - Regional geological setting, major structural elements and sub-basins of the Clarence-Moreton Basin

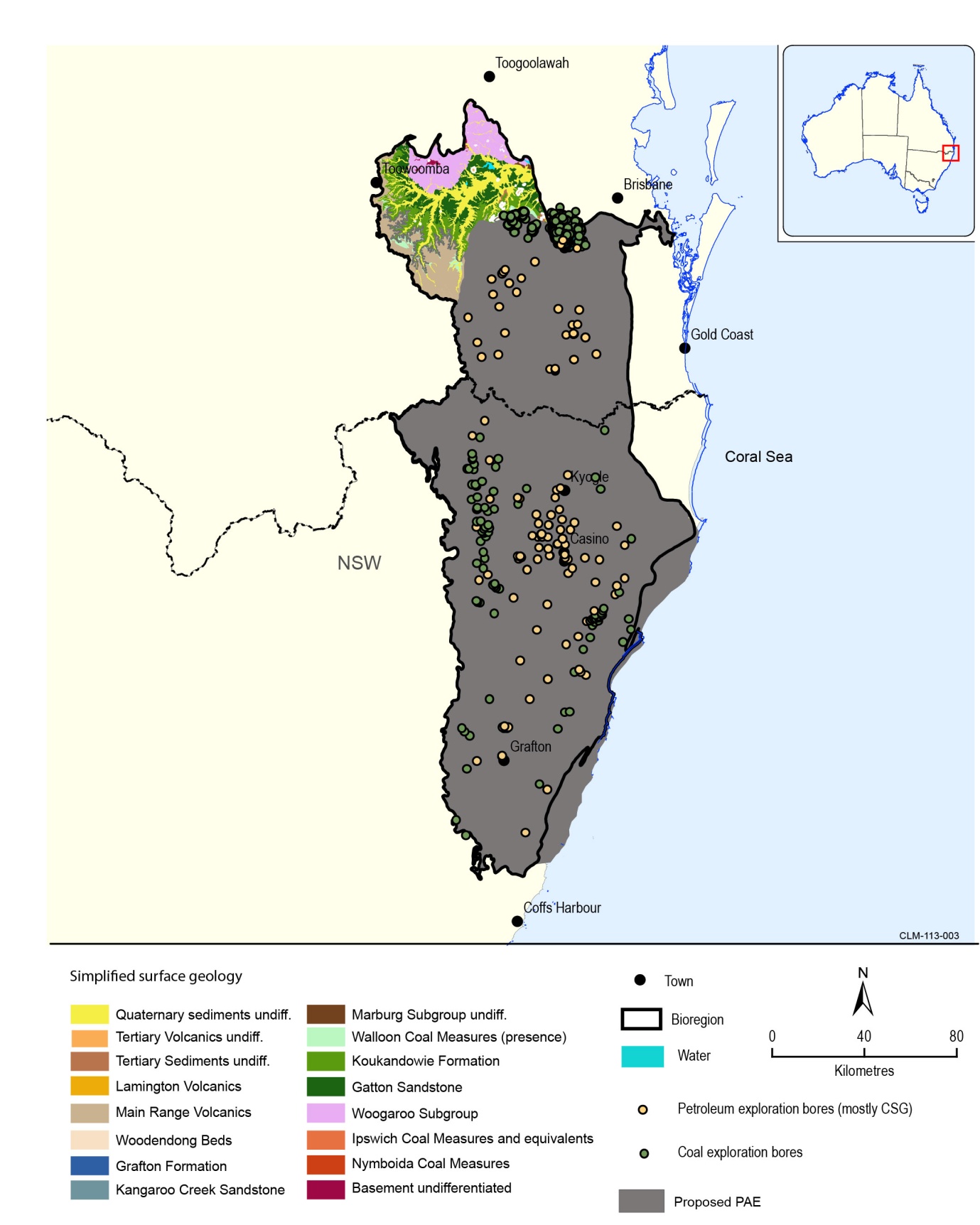


Figure 7 – Proposed extent for the PAE for the CLM bioregion

Reference

Ingram FT and Robinson VA (R.A.Facer, Editor) (1996)Petroleum prospectivity of the Clarence-Moreton Basin in New South Wales. New South Wales Department of Mineral Resources, Petroleum Bulletin 3, viii + 132 p.