# Supplementary Material

Table 1 The Cumulative Effects Assessment (CEA) evaluation framework used to score each CEA in this review. Attributes are aggregated into three categories; Procedure, Space and Time and Cumulative Effects. Columns define the evidence required to be identified in the CEA relative to that attribute score (adapted from Willsteed et al., 2018). Att = attribute.

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| --- | --- | --- | --- | --- | --- | --- |
| **Attribute Category** | **Att** | **Description** | **Very weak (1)** | **Weak (2)** | **Strong (3)** | **Very strong (4)** |
| **Procedure** | **1** | *The CEA explicitly defines cumulative in context of the CEA, reflecting the three components of cumulative environmental change* | Cumulative not defined | Cumulative' implicitly defined for the CEA | Cumulative' explicitly defined for the CEA | Cumulative explicitly defined for the CEA. Definition recognises the three attributes of cumulative environmental change |
| **2** | *The purpose and scope of the CEA specifically are clearly set out in the supporting documentation* | CEA purpose and scope not defined | CEA purpose and scope not explicitly defined, but can be inferred from EIA/CEA methodology | Explicit CEA purpose and scope documented | Explicit CEA purpose and scope documented. Expanded spatial and temporal boundaries and interaction of effects between activities referenced |
| **3** | *The CEA documents and applies a clear, systematic CEA methodology, from scoping through to mitigation* | Assessment methodology is not clear or systematic | Assessment methodology is systematic but the processes within each step are not clear | Assessment methodology is systematic and processes within each step are clear | Assessment methodology is systematic and processes within each step are clear. Time, space and activity components of CEA are clearly accounted for |
| **4** | *The assessment makes use of appropriate data, tools and analytical methods, makes use of quantitative and qualitative methods where data allows. Assumptions and uncertainties are clearly stated and incorporated into the assessment* | The assessment is purely qualitative and lacks transparency. Linkages between data presented and the assessment outcomes are not clear | Assessment process is qualitative and makes use of appropriate data where available. Assessment outcomes are not transparent | Assessment process is qualitative and quantitative based on appropriate data. Analytical tools are used and described resulting in a transparent assessment process | The assessment makes use of appropriate data, tools and analytical methods, makes use of quantitative and qualitative methods where data allows. Assumptions and uncertainties are explicitly stated |
| **5** | *The conclusions of the CEA are accessible and are compiled in a document that clearly states predicted impacts before and after proposed mitigation measures, assumptions and uncertainties* | The conclusions of the CEA are difficult to access and supporting assumptions are unstated | The conclusions of the CEA are scattered and supporting assumptions are unstated or are unclear | The conclusions of the CEA are compiled and easy to access. Supporting assumptions and uncertainties are partly addressed or are unclear in the conclusion section | The conclusions of the CEA are compiled and easy to access. Supporting assumptions and uncertainties are explicitly addressed and are presented within the conclusion section |
| **Space and Time** | **7** | *The temporal extent of pressures associated with other activities included in the CEA are identified by a scoping process and documented* | Temporal extent of 'other' activities or pressures are not documented | Temporal extent of 'other' activities leading to pressures are described without a clear process to scope/screen which 'other' activities are described | Temporal extent of pressures arising from 'other' activities are described | Temporal extent of pressures arising from 'other' activities are described following a clear scoping/screening process to identify pressures to take forward in the EIA/CEA |
| **9** | *The spatial extent of pressures associated with other activities included in the CEA are identified by a scoping process and documented* | Spatial extent of 'other' activities or pressures are not documented | Spatial extent of 'other' activities leading to pressures are described without a clear process to scope/screen which 'other' activities are described | Spatial extent of pressures arising from 'other' activities are described | Spatial extent of pressures arising 'other' activities are described following a clear scoping/screening process to identify pressures to take forward in the EIA/CEA |
| **10** | *The CEA applies appropriate temporal boundaries relative to the receptor selected for assessment in the CEA* | Temporal boundaries not defined | Temporal boundaries defined but relate to duration of activity or subactivity, not to receptor | Temporal boundaries defined and supported by rationale for decision relative to receptors | Temporal boundaries defined, supported by rationale for decision and clearly relate to temporal pressures relative to the receptors |
| **11** | *The CEA applies appropriate spatial boundaries relative to the receptors selected for assessment in the CEA* | Spatial boundaries not defined | Spatial boundaries defined but relate to spatial scale of the activity, not a receptor appropriate scale | Spatial boundaries defined and supported by rationale for decision relative to receptors | Spatial boundaries defined, supported by rationale for decision and clearly relate to spatial pressures relative to the receptors |
| **Cumulative Effects** | **17** | *The effects of multiple stressors from the proposed activity on receptors are assessed* | Effects of multiple stressors not considered | Effects of multiple stressors from proposed activity on receptors are assessed, but rationale for combination of stressors not clear | Effects of multiple stressors from proposed activity on receptors assessed supported by clear rationale for selection of stressors relative to receptors | Effects of multiple stressors from proposed activity on receptors assessed supported by clear rationale for selection of stressors relative to receptors. Assumptions and uncertainties clearly stated |
| **18** | *The effects of multiple stressors from the proposed activity and other activities on receptors are assessed* | Effects of multiple stressors not considered | Effects of multiple stressors from proposed activity and other activities on receptors are assessed, but rationale for combination of stressors not clear | Effects of multiple stressors from proposed activity and other activities on receptors assessed supported by clear rationale for selection of stressors relative to receptors | Effects of multiple stressors from proposed activity and other activities on receptors assessed supported by clear rationale for selection of stressors relative to receptors. Assumptions and uncertainties clearly stated |
| **20** | *A clear rationale for determining impact significance is presented and conclusions clearly relate to predicted change against an appropriate measure of population change* | Method used to determine impact significance unclear | Method to determine impact significance is clear, however relies on qualitative decision making and/or without reference to measure of population change (threshold, PBR, etc) | Quantitative and/or qualitative methods used to determine impact significance supported by appropriate use of tools and with reference to a measure of population change | Quantitative methods used to determine impact significance supported by tools and with clear reference to thresholds, PBR or other measure of population change |
| **21** | *Uncertainty is explicitly considered and clearly identified* | Uncertainty not explicitly considered | Uncertainty referenced in the CEA methodology but not defined. The process of considering uncertainty is not clear | Uncertainty referenced in the CEA methodology and is defined. The process of considering uncertainty is clear | Uncertainty referenced in the CEA methodology and is defined. Uncertainty clearly included in assessment sections |