



WHLlist 2025_Murujuga Cultural Landscape (Australia)_Factual Errors Submission [SEC=OFFICIAL]

From **s 22(1)(a)(ii)** @dfat.gov.au>
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WHLlist 2025_Murujuga Cultural Landscape (Australia)_Factual Errors Submission.pdf;

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Dear Mr Eloundou Assomo, Dear colleagues

Please find enclosed Australia's factual errors submission for the ICOMOS evaluation of the **Murujuga Cultural Landscape** nomination (No 1709), in compliance with Paragraph 150 of the Operational Guidelines.

We have provided two versions of our submission—one in the template required under Annex 12 of the Operational Guidelines, and one providing our justification for each proposed correction. We recognise the second submission will not be made available in the papers for the 47th session of the World Heritage Committee (47COM) but believe this information to be important for consideration by ICOMOS in preparing their response. We trust it will also be a useful reference.

In addition to the submissions, we have included a cover letter from the State Party, and a formal statement from the Murujuga Aboriginal Corporation, who represent the Ngarda-Ngarli people. This statement ensures the views of the Ngarda-Ngarli are directly presented to the Centre and ICOMOS, consistent with the First Nations-led nature of this nomination and their enduring custodianship of this cultural landscape.

Should any further information be required, the contact is Ms Michelle Dumazel, Division Head, Heritage Division, Australian Government Department of Climate Change, Energy, the Environment and Water, at **s 22(1)(a)(ii)** @dcceew.gov.au.

With our warmest regards

The Permanent Delegation of Australia to UNESCO

Australian Embassy
4 rue Jean Rey
75015 Paris

s 22(1)(a)(ii)



**AMBASSADEUR, DÉLÉGUÉ PERMANENTE
DE L'AUSTRALIE AUPRÈS DE L'UNESCO**

**AMBASSADOR, PERMANENT DELEGATE
OF AUSTRALIA TO UNESCO**

Dear Mr Eloundou Assomo

RE: MURUJUGA CULTURAL LANDSCAPE WORLD HERITAGE NOMINATION.

Please find enclosed Australia's factual errors submission for the ICOMOS evaluation of the **Murujuga Cultural Landscape** nomination (No 1709), in compliance with Paragraph 150 of the Operational Guidelines.

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Should any further information be required, the contact is Ms Michelle Dumazel, Division Head, Heritage Division, Australian Government Department of Climate Change, Energy, the Environment and Water, at **s 22(1)(a)(ii)** [:@dcceew.gov.au](mailto:s22(1)(a)(ii)@dcceew.gov.au).

Yours sincerely,
s 22(1)(a)(ii)

Greer Alblas

Mr Lazare Eloundou Assomo
Director
World Heritage Centre
UNESCO, 7, place de Fontenoy, Paris, 75015

Encl: State Party Cover Letter, Murujuga Aboriginal Corporation Statement, Factual Errors Submissions

Copy: Murujuga Aboriginal Corporation; ICOMOS; Western Australian Department of Biodiversity, Conservation and Attractions



Australian Government
**Department of Climate Change, Energy,
the Environment and Water**

Mr Lazare Eloundou Assomo
Director
UNESCO World Heritage Centre
7, place de Fontenoy, 75352 Paris
FRANCE

Dear Mr Eloundou Assomo

RE: MURUJUGA CULTURAL LANDSCAPE WORLD HERITAGE NOMINATION.

Please find enclosed Australia's factual errors submission for the ICOMOS evaluation of the **Murujuga Cultural Landscape** nomination (No 1709), in compliance with Paragraph 150 of the Operational Guidelines.

Australia is pleased that the ICOMOS evaluation report recognises the Murujuga Cultural Landscape meets criteria (i), (iii) and (v), that its Outstanding Universal Value has been justified, demonstrates integrity and authenticity, is in a good state of conservation, and is supported by appropriate protection, management, and monitoring measures.

However, Australia is deeply disappointed by the draft decision to refer the nomination back to the State Party. This nomination has been First Nations-led throughout. Australia has worked in partnership with the Murujuga Aboriginal Corporation to identify the factual inaccuracies in the evaluation report.

In particular, we are concerned that the evaluation process has not taken into account the broader context in which the Murujuga Cultural Landscape is situated, and the care that has been taken throughout the nomination and evaluation process to communicate that coexistence between a World Heritage property and industry is possible.

We are troubled by the evaluation report's reliance on third party correspondence, provided at the at the last opportunity, when the Murujuga Aboriginal Corporation, the Australian Government and the Western Australian State Government have spent many years, with great care, to ensure that all the necessary information has been provided to ICOMOS to inform the evaluation.

It is deeply disappointing that the assertions of third-party sources have been given more weight in the evaluation report than the world leading Murujuga Rock Art Monitoring Program (MRAMP) and that Australia, as the State Party, was not given an opportunity to respond to this third-party correspondence as is the usual procedure. The State Party, in full transparency, provided a confidential copy of the most recent MRAMP report to ICOMOS in February 2025, before it was publicly available, so it could be considered during evaluation. The MRAMP has found no evidence of direct emission of acidic pollutants.

The Murujuga Cultural Landscape sits adjacent to industry that is important to both the state of Western Australia and the Australian economy. Industry is supportive of a World Heritage Listing for the Murujuga Cultural Landscape, have made commitments to its future management, and participated in the ICOMOS evaluation mission. Further, the Western Australian and Australian

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governments have strong regulatory processes in place that enable strict conditions on emissions, and the impacts of development at Murujuga.

Australia will urge the World Heritage Committee to place appropriate weight on the results and advice of the MRAMP, which is the only comprehensive, long-term, peer-reviewed study specific to this landscape and its environmental context. Accepting MRAMP science is essential to ensuring that Committee recommendations are informed by the best available evidence.

Australia is strongly committed to the protection of our World Heritage properties, and we will continue to work constructively with the Committee, the Advisory Bodies and the Centre to ensure this special place is protected now and for future generations.

The Murujuga Cultural Landscape deserves to be recognised and protected under the World Heritage Convention. In accordance with the wishes of the Ngarda-Ngarli, Australia will seek inscription at 47COM.

Should any further information be required, please contact me at

s 22(1)(a)(ii) [:@dcceew.gov.au](mailto:dcceew.gov.au).

Yours sincerely,

s 22(1)(a)(ii)

Michelle Dumazel
Division Head
Heritage Division
20 July 2025

MURUJUGA ABORIGINAL CORPORATION



Murujuga Aboriginal Corporation response to ICOMOS evaluation of the Murujuga Cultural Landscape nomination.

We acknowledge the ICOMOS evaluation report (the evaluation) found the Murujuga Cultural Landscape nomination is 'of great quality and sensitivity' and that the Outstanding Universal Value (OUV) has been justified as 'a cultural landscape whose exceptional value lies in the traditional system governing it, which manifests itself through cultural artefacts, particularly the petroglyphs'.

Further, that the 'conditions of integrity and authenticity of the nominated property have been met', that 'conservation and monitoring are ensured thanks to a comprehensive set of measures combining both customary and legislative tools', that 'the property is managed through an extensive set of management and legislative measures', and that 'financial sustainability is ensured through funding from the Western Australian and Australian governments'.

Given such an evaluation we are deeply disappointed by the recommendation to refer the Murujuga Cultural Landscape nomination back to the State Party.

Use of 'refer' provision

In leading the preparation of the nomination dossier, MAC has paid exceptionally close attention to the Operational Guidelines. In reviewing the evaluation report we are concerned that the recommendation to 'refer' the nomination back to the State Party is inconsistent with Paragraph 159 of the Operational Guidelines (2024) which provides the meaning of 'referral' as:

Referral means that the requested additional information is necessary to determine the OUV of the nominated property, which only occurs at the time a property is inscribed on the World Heritage List.

As noted, in the evaluation report 'ICOMOS considers that the nominated property meets criteria (i), (iii) and (v)', and in that context the OUV is determined. Further, none of the recommendations in the evaluation report require provision of additional information to determine the OUV.

Errors in the evaluation

Acidic emissions, the references to acidic emissions throughout the evaluation is incorrect. The independent and peer reviewed Murujuga Rock Art Monitoring Program Year 2 Annual Technical Report (MRAMP) advises that the notion of acid rain harming the petroglyphs is not supported by the pH data over the last three years. The MRAMP finds that neither current rainfall nor dry deposition are acidic, but rather they tend towards being basic/alkaline. The recommendation that '*the total removal of degrading acidic emissions caused by industrial processes is necessary to secure the conservation of the petroglyphs*' misconstrues the research findings of the MRAMP, including for the following reasons:

1. there is very limited conversion of Sulphur Dioxide and/or Nitrogen Dioxide to acids within the airshed, meaning neither the wet or dry deposition on the petroglyphs is acidic,
2. further mitigation would likely require a pollution control device that removes harmful pollutants from exhaust gases before they are released into the atmosphere. Such devices typically release

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ammonia, making the environment more alkaline, increasing the likelihood of harm to the ecosystem, and

3. excluding naturally occurring geological sources like rocks and soil, the overall air quality at Murujuga is good or very good by national and international standards.

Further, the acceptable air quality levels (EQC) finding in the MRAMP confirms that existing industry can coexist with the cultural landscape without ongoing impact.

Boundary, the reference to the boundary as proposed in the nomination dossier being defined in early 2007 is incorrect, the boundary was defined in 2022. As noted in the Australian Government's correspondence of 5 November 2024, the process used to define the proposed boundary considered: the presence of attributes within the cultural landscape; the integrity of the attributes and impacts of previous development; legislative protection and management; stakeholder consent; and the definition of a contiguous boundary.

Procedural concerns

MAC is deeply concerned that the recommendation has relied on a third-party correspondence, in this regard we note the correspondence:

- was not provided to the State Party or MAC for review or response,
- has several errors that are replicated, verbatim, in the evaluation, and
- relies on a small number of restricted data sets.

The over reliance on the third-party correspondence is exceptionally disappointing given the evaluation had access to the peer reviewed MRAMP, the world's largest air quality monitoring program, which was specifically designed to investigate the effects of industrial emissions on the petroglyphs.

We note that the third-party did not seek any involvement in the preparation of the nomination dossier nor request any briefing of the research that forms the basis of the submission.

Protecting Murujuga Cultural Landscape

Addressing the potential future vulnerabilities outlined in the evaluation report are of the highest priority to MAC, although the vulnerabilities are significantly less than claimed in the evaluation. We believe the best way to address the potential future vulnerabilities is through immediate inscription.

Under Australian law, inscription would commence the provisions of the *Environment Protection and Biodiversity Conservation Act 1999*, including the protection provisions outlined in Section 12 (Requirement for approval of activities with a significant impact on a declared World Heritage property). Most importantly the management and protection obligations outlined in the Australian World Heritage Management Principles, see Schedule 5 of the Environment Protection and Biodiversity Conservation Regulations 2000, would also commence.

In summary, we are deeply disappointed by the evaluation report's recommendation to refer the Murujuga Cultural Landscape nomination back to the State Party. We believe the recommendation, which seeks to address potential future vulnerabilities, is not valid (under the Operational Guidelines), is not justified (based on the evaluation report), has not given sufficient weighting to globally leading peer reviewed research, and prevents the immediate enhancement protection of the proposed property.

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Background on errors of fact in the ICOMOS Evaluation report – Murujuga Cultural Landscape

Page, column, line of the Advisory Body Evaluation	Sentence including the factual error (The factual error should be highlighted in bold)	Proposed correction by the State Party	JUSTIFICATION
Page 56, right column, line 28	with joint management arrangements established in 2022 to protect the heritage and cultural values of the land.	with joint management arrangements established in 2022 2013 to protect the heritage and cultural values of the land	Joint management agreement for Murujuga National Park signed 1 January 2013.
Page 57 left column, line 47	In the process, acidic and nitrate-rich pollutants are emitted	In the process, acidic and nitrate-rich pollutants are emitted	<p>The report references ‘acidic emissions’ throughout. The ongoing monitoring program has found no evidence of direct emission of acidic pollutants in the last three years. ‘Acidic’ should be deleted throughout.</p> <p>The correct term for Nitrogen Dioxide (NO₂) and Sulphur Dioxide (SO₂) is ‘reactive gases’ due to their potential reactivity. Under some conditions they may form acids after reaction with water, however there is limited evidence that this occurs at Murujuga and overall deposition within the region is not acidic.</p>
Page 57, left column, line 50	The articles point out in particular grave warnings from rock art scientists that Murujuga could be destroyed within a century	The articles point out in particular grave warnings from rock art scientists concerns raised by one person that Murujuga could be destroyed within a century	<p>The majority of media articles quote the same rock art researcher who has a small number of publications to support these claims.</p> <p>The Murujuga Rock Art Monitoring Program (MRAMP) is the largest and most robust</p>

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			study of its kind globally, it is statistically valid, involves a team of over 50 expert scientists and has been subject to a comprehensive peer review process. The results from the MRAMP do not support the claim that the petroglyphs will be destroyed within a century.
Page 57, right column, line 1	In its response in February 2025, the State Party submitted a draft copy of the Murujuga Rock Art Monitoring Program (MRAMP) . The document includes a confidential report which presents the first two years of results of monitoring studies and research	In its response in February 2025, the State Party submitted a draft copy of the Murujuga Rock Art Monitoring Program (MRAMP): Monitoring studies report 2024 (“Year two technical report”) . The document includes a confidential report which presents the first two years of results of monitoring studies and research	Clarification of the title of the document provided and its revised status. The MRAMP report provided in February 2025 marked ‘confidential’ was an advance copy. The final report was published on 23 May 2025. The report is no longer confidential as it has been publicly released.
Page 57, right column line 8	As the study is still being undertaken, the final results are yet to be made publicly available.	As the study is still being undertaken, the final results are yet to be made publicly available. This report was published on 23 May 2025. The research project is ongoing and further conclusions will be reported in future years.	This is a multi-year study, with final reporting on the research phase expected in 2027. The report referred is now public. It is intended to be read alongside the interim Environmental Quality Criteria (EQC) report that was not available until late March 2025.
Page 57, right column, line 9	Also attached was a summary from the Western Australia Department of Water and Environmental Regulation (DWER) on the Murujuga Rock Art Strategy,	Also attached was a covering letter from Curtin University outlining the key findings from the second year of studies, and a summary from the Western Australia Department of Water	The text neglects to mention that Curtin University provided a covering letter for the report that provided a summary of the key findings, including a clear statement that

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	as well as the existing controls, mitigation measures and regulation of industry emissions, along with the framework for future control of industry emissions based on the results of the MRAMP.	and Environmental Regulation (DWER) on the Murujuga Rock Art Strategy, as well as the existing controls, mitigation measures and regulation of industry emissions, along with the framework for future control of industry emissions based on the results of the MRAMP.	acid rain theory is not substantiated by the study results.
Page 57 right column, line 16	Information received by ICOMOS on 25 February 2025 from a third-party organisation reveals that the Australian government is currently considering approval of a major multi-decade extension to Woodside Energy Ltd’s Karratha Gas Plant	Information received by ICOMOS on 25 February 2025 from a third-party organisation stated that the Australian government is currently considering approval of a major multi-decade extension to Woodside Energy Ltd’s Karratha Gas Plant	The use of the term ‘reveals’ implies that this information had not been provided previously during the assessment of the nomination by the State Party. This is incorrect. The State Party provided detailed information on all projects currently under assessment in both written and verbal form during the evaluation mission, including a site visit to the Woodside lease where this proposal is planned to be developed.
Page 57 right column, line 20	the single most significant source of these acidic emissions, until at least 2070, and confirms the additional acidic industrial emissions,	the single most a significant source of these acidic emissions, until at least 2070, and confirms suggests the additional acidic industrial emissions,	As above, delete ‘acidic’. The third-party correspondence referenced in the ICOMOS evaluation report relies solely on one piece of research. The third-party would not have had access to the MRAMP year two report at the time of writing. The State Party provided this report to ICOMOS on 24 February 2025, in response to a request for additional information that accompanied the interim report provided in late December 2024. It concludes that there has been no evidence of acidic wet or dry

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			<p>deposition on the rocks at Murujuga during the last three years. The prior claim of acidic rain is based on a 2007 study showing 5 data points spanning 37 years, measured at an unreported location.</p> <p>The MRAMP is considering all sources of emissions including the Karratha gas plant. The MRAMP year two report concludes that emissions were much higher between 1971 and 1985, when the former Dampier Power Station operated on Heavy Fuel Oil. MRAMP measurements show a further reduction in average annual NO₂ emissions since 2014. Importantly, there is not an increase in annual emissions as this is an extension of an existing project under which the WA Government's approval requires reductions in annual emissions of Nitrogen Oxides (NO_x), Sulphur Oxides (SO_x) and Volatile Organic Compounds (VOCs) by 2030, and compliance with any standards set under MRAMP.</p>
Page 57 right column, line 28	Apparently , regulatory and technological mechanisms would be available to prevent on-site acidic emissions, however these measures do not seem to have been pursued.	Apparently , regulatory and technological mechanisms would be available to prevent on-site acidic emissions, and information provided by the State Party demonstrates how however these measures do not seem to have been pursued.	The State Party has provided substantial information relating to regulatory and technical mechanisms that have been pursued. This is detailed in Chapters 4 and 5 of the nomination dossier; was discussed during the evaluation mission; and provided

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			<p>in response to ICOMOS requests for additional information.</p> <p>Further, the State Party has provided detail on taking a precautionary approach in the use of mechanisms such as scrubbing technology, where there is the potential for harm to the petroglyphs before the MRAMP is able to assess the impact of measures that would increase the alkalinity of the cultural landscape, likely having a detrimental rather than beneficial effect.</p> <p>As above, delete 'acidic'.</p>
Page 57, right column, line 50	by industrial acidic emissions	by industrial acidic emissions	As above, delete 'acidic'.
Page 58 left column, line 1	acidic emissions, natural weathering	acidic emissions, natural weathering	As above, delete 'acidic'.
Page 58, left column, line 29	Severe pollution issues from chemical-producing industries outside the nominated property represent a significant adversely-affecting factor and a major threat against the petroglyphs within the site and their conservation in the next decades.	Third party sources have asserted that S severe pollution issues from chemical-producing industries outside the nominated property represent a significant adversely-affecting factor and a major threat against the petroglyphs within the site and their conservation in the next decades.	<p>The ongoing MRAMP is assessing the effects of pollution. This first statement therefore needs to be qualified as an assertion.</p> <p>The results of the MRAMP contradict the assertion that the current and projected industrial emissions are adversely affecting Murujuga.</p>

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			As demonstrated in the MRAMP year two report, provided by the State Party in February 2025, overall air quality at Murujuga is good to very good by national and international standards. The only parameters which exceed human health standards are dust (largely natural) and no parameters exceed the newly established EQC for rock art protection.
Page 58, left column, line 34	The ongoing monitoring programme (MRAMP), for which the preliminary draft report was submitted by the State Party in February 2025	The ongoing monitoring programme (MRAMP), for which the preliminary draft year 2 report was submitted by the State Party in February 2025	The version provided in February 2025 was the final draft (Rev 0, dated 20 December 2024) of the year two technical report. The findings of the report did not change, and edits made post this date relate to correction of errors and formatting. The report has now been finalised and was published on 23 May 2025.
Page 58 right column, line 11	Therefore the total removal of degrading acidic emissions	Therefore the total removal of degrading acidic emissions	The results of the MRAMP do not support the assertion that current emissions can be considered ‘degrading’. As above, delete ‘acidic’.
Page 61 left column, line 38	the nominated property is extremely vulnerable to industrial pollution.	the nominated property is extremely petroglyphs may be vulnerable to industrial pollution.	Peer reviewed research has found that there is no evidence to suggest that the nominated property is extremely vulnerable to industrial pollution. The MRAMP will determine the vulnerability of the petroglyphs to industrial pollution. It is incorrect to suggest the whole nominated property is vulnerable or to state

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			<p>that vulnerability is extreme, without this evidence.</p> <p>The MRAMP results provided by the State Party in February 2025 show that at a much higher level, reactive emissions may have an effect on the porosity of granophyre in direct proximity to industry. These levels are managed under existing frameworks.</p>
Page 61, right column, line 22	It undermines the long-term preservation of its attributes, particularly the petroglyphs, as acidic industrial emissions can lead to their rapid deterioration.	It would undermines the long-term preservation of its attributes, particularly of the petroglyphs, as acidic if industrial emissions can lead to were shown to cause their rapid deterioration.	<p>This threat is specific to the petroglyphs, not all attributes.</p> <p>The MRAMP report provided by the State Party show that reactive emissions may have an impact on the geology but only at significantly higher levels than is currently permitted under State and Commonwealth regulatory frameworks. The deterioration of rock art as a result of increased porosity has not been demonstrated and if occurring, is unlikely to be rapid. Evidence to date shows that most of the porosity has developed naturally and is only slightly elevated in a comparatively small region immediately adjacent to industry.</p> <p>As above, delete 'acidic'.</p>
Page 61, right column, line 26	ICOMOS considers that the integrity of the nominated property has been demonstrated but is highly	ICOMOS considers that the integrity of the nominated property has been demonstrated but is highly may be	As above, the MRAMP year two report provided by the State Party shows that reactive emissions may have an impact on

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	vulnerable due to its direct proximity to industries and exposure to their emissions.	vulnerable due to its direct proximity to industries and exposure to their industrial emissions.	the geology but only at significantly higher levels than is currently permitted under State and Commonwealth regulatory frameworks.
Page 62, left column, line 32	ICOMOS considers that the authenticity of the nominated property has been demonstrated, although the capacity of the petroglyphs to reflect the proposed Outstanding Universal Value and to activate the Ngarda-Ngarli traditional practices is vulnerable due to exposure to polluting industrial emissions.	ICOMOS considers that the authenticity of the nominated property has been demonstrated, although the capacity of the petroglyphs to reflect the proposed Outstanding Universal Value and to activate the Ngarda-Ngarli traditional practices is vulnerable due to exposure to polluting industrial emissions.	There is no factual basis for this assessment of the potential impacts of emissions on the condition of authenticity of the attributes of proposed OUV, particularly as it relates to the living essence of a cultural landscape with deeply rooted cultural traditions, creativity, spirituality and ecological knowledge spanning tens of thousands of years.
Page 62, right column, line 3	The boundary as proposed in the nomination dossier was defined in early 2007, when a heritage listing decision was deferred until a final boundary was discussed with several stakeholders, including industry partners. The boundary was subsequently revised to exclude several strategic industrial areas	The boundary as proposed in the nomination dossier was defined in early 2007, when a heritage listing decision was deferred until a final boundary was discussed with several stakeholders, including industry partners. The boundary was subsequently revised to exclude several strategic industrial areas In 2007 an area was defined and protected on the National Heritage List, under Australian legislation. This National Heritage area, with existing national protections, includes industrial areas and was the basis for	This is incorrect. There was no process for defining a World Heritage boundary in 2007. A boundary was defined for the National Heritage listed area in 2007, which is a different process relating to different heritage criteria. As outlined in the nomination dossier, and during the evaluation, the proposed World Heritage boundary was defined on the basis of: the presence of attributes within the cultural landscape; the integrity of attributes and impacts of previous development; legislative protection and management;

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		discussions with stakeholders about the definition of a proposed World Heritage property boundary. The proposed World Heritage property boundary, which encompasses a much larger area than National Heritage listed area and relates to a broader set of attributes, was defined in 2022.	stakeholder consent; and the definition of a contiguous boundary.
Page 62, right column, line 8	The proposed World Heritage boundary excludes these heavily impacted areas, focusing on protecting cultural features within 930 hectares (0.9 percent) of industrial lease land that remain undisturbed.	The proposed World Heritage boundary excludes these heavily impacted industrial areas, focusing on protecting cultural features within 930 hectares (0.9 percent) of industrial lease land that remain undisturbed.	For clarity.
Page 66, left column, line 40	However, the absence of a buffer zone remains a disadvantage in terms of management with regard to the industrial activities.	However, the absence of a buffer zone remains a disadvantage in terms of management with regard to the industrial activities.	As noted on page 63 of the ICOMOS evaluation report, “In its response, the State Party explained that the Environment Protection and Biodiversity Conservation Act (EPBC Act) requires any action potentially impacting a (sic) the values of a World Heritage property, even outside its boundaries, to be referred to the Australian Government Minister for the Environment and Water, acting as a legislative unlimited buffer zone.” The addition of a buffer zone would not have any material impact on how the impacts of industrial activities are assessed under the EPBC Act. That is,

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			actions that have potential significant impacts on the values of the property would need to be referred, whether or not they are within, directly adjacent to, or further away from the World Heritage property
Page 66, right column, line 51	Pollution from these industries, particularly from acidic emissions, puts the petroglyphs under serious threat and makes the integrity and the authenticity of key attributes of the nominated property highly vulnerable	Pollution from these industries; particularly from acidic emissions; may puts the petroglyphs under serious threat and may makes the integrity and the authenticity of key attributes of the nominated property highly vulnerable	As above, this is not substantiated by current evidence. As above, delete 'acidic'.
Page 67, left column, line 3	However, these, together with the absence of an actual buffer zone for the nominated property and	However, these, together with the absence of an actual buffer zone for the nominated property and	As above, the absence of a buffer zone for the nominated property would have no material impact on how the EPBC Act is used to assess the impacts on a property.
Page 67, left column, line 5	the recent information received regarding the approval of the multi-decade extension of Woodside Energy Ltd's gas plant in Karratha	the recent information received regarding the approval of the multi-decade extension of Woodside Energy Ltd's gas plant in Karratha	The State Party provided detailed information on all projects currently under assessment in both written and verbal form during the evaluation mission in August-September 2024, including a site visit to the Woodside lease where this proposal is planned to be developed.
Page 67 left column, line 10	of degrading acidic emissions	of degrading acidic emissions	As above, delete 'acidic'.
Page 67 left column, line 24	Finalise the ongoing studies on the impact of the industries on the	Finalise the Continue ongoing research studies and ongoing monitoring on the impact of the industries on the	The Murujuga Rock Art Strategy and the MRAMP are ongoing and are reviewed every five years.

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	petroglyphs and on the nominated property,	petroglyphs and on the nominated property,	The MRAMP includes regular public monitoring and reporting against interim Environmental Quality Criteria, guiding regulation of industrial emissions on the peninsula. This forms part of the robust protection and management measures of the nominated property which will ensure OUV is protected now and for future generations.
-Page 67 left column, line 27	Ensure the total removal of degrading acidic emissions, currently impacting upon the petroglyphs of the Murujuga Cultural Landscape	Ensure the total removal of degrading acidic emissions, currently impacting Maintain adequate management of industrial emissions to prevent impacts upon the petroglyphs of the Murujuga Cultural Landscape	This recommendation misconstrues the research findings of the MRAMP, including for the following reasons: <ol style="list-style-type: none"> 1. there is very limited conversion of SO₂ and/or NO₂ to acids within the airshed, meaning neither the wet nor dry deposition on the petroglyphs is acidic, 2. further mitigation would likely require a pollution control device that removes harmful pollutants from exhaust gases before they are released into the atmosphere. Such devices typically release ammonia, making the environment more alkaline, increasing the likelihood of harm to the ecosystem, and 3. excluding naturally occurring geological sources like rocks and soil, the overall air quality at Murujuga is good or very good by national and international standards

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Page, column, line of the Advisory Body Evaluation	Sentence including the factual error (The factual error should be highlighted in bold)	Proposed correction by the State Party	JUSTIFICATION
			<p>All existing industry has been approved on the basis of conditions that avoid impacts to cultural heritage and impose regulations on emissions.</p> <p>Any recommendation should allow for appropriate management responses to future results from MRAMP (including updated Environmental Quality Criteria)</p>
Page 67 left column, line 32	Develop an appropriate decommissioning and rehabilitation plan for existing industrial activities, as required.	Develop an appropriate In consultation with Ngarda-Ngarli, ensure compliance with existing decommissioning and rehabilitation plans for existing industrial activities, as required.	Decommissioning and rehabilitation planning is an essential component of environmental approvals under Western Australian and Australian legislation. There are already plans for the decommissioning and rehabilitation of all industrial activities that take place within and adjacent to the Murujuga Cultural Landscape.
Page 67 left column, line 35	Establish strengthened protection measures, subject to the free, prior and informed consent of, and developed in close consultation with, the Ngarda-Ngarli, ensuring the application of the precautionary principle	Establish strengthened protection measures, subject to Upon inscription, implement the Strategic Management Framework protection measures with the free, prior and informed consent of, and developed in close consultation partnership with, the Ngarda-Ngarli; ensuring the application of the precautionary principle	This nomination has been led by the Ngarda-Ngarli, traditional owners and custodians of the Murujuga Cultural Landscape, in partnership with government. As stated on page ix, of the dossier, the nomination has the free, prior and informed consent of Ngarda-Ngarli, as does the Strategic Management Framework. The protection measures supported by the Strategic Management Framework establish strong protections led by Ngarda-Ngarli and have

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Page, column, line of the Advisory Body Evaluation	Sentence including the factual error (The factual error should be highlighted in bold)	Proposed correction by the State Party	JUSTIFICATION
			the free, prior and informed consent of Ngarda-Ngarli. The precautionary principle is already a consideration of Australian Government Heritage legislation, outlined in the Strategic Management Framework.
Page 67 left column, line 30	Developing and implementing a Heritage Impact Assessment for development proposals	Developing and implementing Continue to implement the existing Heritage Impact Assessment process for development proposals	Heritage impact assessments are an existing component of all development proposal approval processes under both Western Australian and Australian Government legislation.

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Letter to Director General from Australian Ambassador [SEC=OFFICIAL]

From s 22(1)(a)(ii) @dfat.gov.au>
Date Thu 26/06/2025 2:49 AM
To s 47F(1) @unesco.org; s 47F(1) @unesco.org>; s 47F(1) @unesco.org>
Cc s 47F(1) @unesco.org>, Greer Alblas <Greer.Alblas@dfat.gov.au>, s 22(1)(a)(ii) @dfat.gov.au>

2 attachments (13 MB)

Australia letter to DG 250625.pdf, Australia_47COM_Information Note on Murujuga Cultural Landscape.pdf,

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Dear colleagues,

With apologies, please find attached the letter now accompanied by the relevant attachment for the attention of the Director General.

With our warmest regards

The Permanent Delegation of Australia to UNESCO

Australian Embassy
4 rue Jean Rey
75015 Paris
France

s 22(1)(a)(ii)

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AMBASSADEUR, DÉLÉGUÉ PERMANENTE
DE L'AUSTRALIE AUPRÈS DE L'UNESCO

AMBASSADOR, PERMANENT DELEGATE
OF AUSTRALIA TO UNESCO

Paris, 25 June 2025

Dear Director-General

I am writing to you regarding Australia's engagement with the upcoming 47th session of the World Heritage Committee (47COM).

As you are aware, Australia has an exciting nomination for consideration by the World Heritage Committee, the **Murujuga Cultural Landscape**. This nomination is led by the Ngarda-Ngarli, the Traditional Owners and Custodians of Murujuga, with the support of the Australian and Western Australian governments. Australia is currently engaging with ICOMOS, the World Heritage Centre and members of the World Heritage Committee toward its successful inscription at 47COM. I have attached an information note on the nomination for your information.

In this context, I am pleased to advise you that Australia is expecting Senator the Honourable Murray Watt, Australia's Minister for the Environment and Water, to travel to Paris as Head of the Australian Delegation to 47COM. I also am anticipating the participation of the Honourable Matthew Swinbourn, Minister for the Environment, Community Services and Homelessness for the Government of Western Australia.

Further, as this nomination is led by the Ngarda-Ngarli, 20 members of the Murujuga Aboriginal Corporation (MAC) will also participate as members of the Australian delegation including a number of senior Traditional Owners and Custodians. Minister Watt will be here to support the MAC with its engagement with the Committee, particularly during item 8.B on Friday 11 July when this nomination is scheduled for consideration.

I would be delighted to facilitate your engagement with Minister Watt and the Australian delegation as appropriate.

Yours sincerely,
s 22(1)(a)(ii)

Greer Alblas

Ms Audrey Azoulay
Director General of UNESCO
UNESCO, 7 place de Fontenoy, Paris, 75015

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Australian Government



Information Note: Murujuga Cultural Landscape

The nomination of the *Murujuga Cultural Landscape* (Murujuga) to the World Heritage List will be considered by the World Heritage Committee (Committee) during its 47th session in Paris, 6-16 July.

In Brief

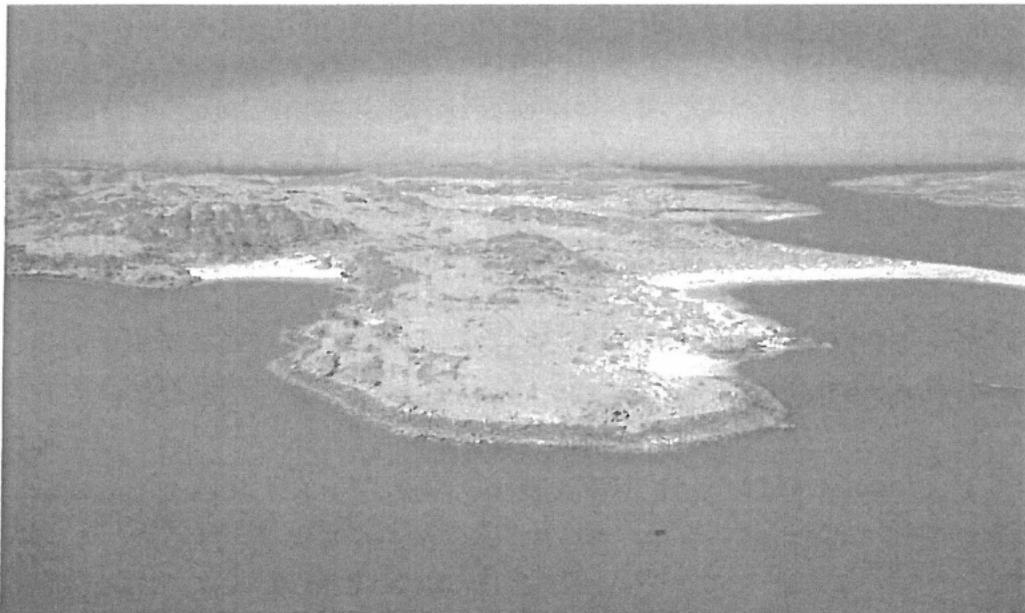
This nomination is led by the Ngarda-Ngarli, the Traditional Owners and Custodians of Murujuga, and has the full support of the Australian Government.

The ICOMOS evaluation found that Murujuga is a property of Outstanding Universal Value (OUV) (criteria (I), (iii) and (v)), has integrity and authenticity, is in a good state of conservation, and has appropriate protection, management and monitoring.

The Australian Government is working with Murujuga Aboriginal Corporation (MAC) to ensure the factual inaccuracies that influenced the draft decision are addressed. World-leading, peer-reviewed science should be the basis for all Committee decision making.

Murujuga deserves to be recognised and protected within the World Heritage system. Immediate inscription will ensure stronger protections under Australian legislation and will allow the world to celebrate this unique cultural landscape.

In demonstration of Australia's commitment to strengthen the management and protection of the property, Australia is seeking inscription along with a state of conservation report for consideration in 2027 to provide ongoing reporting on the Murujuga Rock Art Monitoring Program and associated environmental quality controls.



Located in the northwest of Western Australia, Murujuga has been home to the Ngarda-Ngarli, since the beginning of time.

About Murujuga

Murujuga is a richly storied cultural land and seascape of almost 100,000 hectares. It represents over 50,000 years of one of the world's oldest continuing cultures, demonstrating the Ngarda-Ngarli's continued custodianship and connection to culture, Country and traditional Law.



Australian Government



Murujuga bears testimony to the living cultural traditions of Ngarda-Ngarli, and the spiritual relationship between people and over millennia. Millions of petroglyphs, stone arrangements, archaeological and spiritual sites document complex social, ceremonial and spiritual activities and beliefs. They document ongoing management and protection of Country through climatic, ecological and social change.

Criteria under which inscription is proposed

Criterion (i): The petroglyphs of Murujuga demonstrate artistic achievement assembled over 50,000 years. The creative genius of Ngarda-Ngarli ancestors is evidenced in artistic quality, placement within the landscape, and the overwhelming visual quality of the entire ensemble of 1-2 million petroglyphs.

Criterion (iii): Murujuga bears testimony to the living cultural traditions of Ngarda-Ngarli and the spiritual relationship between people and landscape that is at least 50,000 years old. Ngarda-Ngarli knowledge, Lore, Law, and culture are expressed through the beliefs and practices of the Ngarda-Ngarli, the landscape, the sites and in rock art assemblage.

Criterion (v): Murujuga exemplifies the combined works of nature and humankind. The relationship between Ngarda-Ngarli and the landscape is evident in the petroglyphs, archaeological record and, importantly, contemporary knowledge and culture. Material evidence and Ngarda-Ngarli living culture attest to the adaptability of Law and the continued use of the landscape over millennia, including periods of significant environmental and climatic change.

Murujuga, a First Nations led nomination

This nomination is led by Ngarda-Ngarli, the Traditional Owners and Custodians of this landscape. Ngarda-Ngarli are the five Traditional Owner and Custodial groups of Murujuga and are represented by MAC. MAC is an Approved Body Corporate that represents the interests of the Yaburara, Marthudunera, Ngarulma, Yindjibarndi and Wong-Goo-Tt-Oo Aboriginal people who have cultural obligations for Murujuga. MAC is governed by a Board of 12 Aboriginal Directors, supported by a Circle of Elders providing guidance on matters relating to heritage and culture.

Ngarda Ngarli have led the preparation of this nomination in partnership with the Australian and Western Australian governments. Free, prior and informed consent has been an ongoing and meaningful process of Aboriginal decision making over every aspect of the nomination and how Murujuga is presented to the World. This nomination is an opportunity for them to share the extraordinary interconnectivity between people, country and culture that is inherent within Murujuga.

World Heritage consideration of Murujuga

MAC and the Australian Government have welcomed the ICOMOS evaluation that found Murujuga is a property of OUV with integrity and authenticity, being in a good state of conservation, with appropriate protection, management and monitoring. The evaluation report also stated:

ICOMOS considers that the nominated property has the potential to be inscribed on the World Heritage List, according to criteria (i), (iii) and (v). The petroglyphs, the living cultural traditions and spiritual connection of the Ngarda-Ngarli to their land through a relationship spanning at least 50,000 years, and the harmonious interplay between nature and humankind, all contribute to the intrinsic exceptional quality of the property, demonstrated through a meaningful and detailed comparative analysis. The authenticity and integrity of Murujuga Cultural Landscape are upheld through the continuity of Ngarda-Ngarli traditions, sacred sites, and ecological stewardship and the still vibrant dynamic relationships and cultural functions of the landscape.



Australian Government



However, the draft decision then recommends the Committee refer the nomination back to Australia, with a number of recommendations to be addressed to support inscription at a future meeting.

It is the view of MAC, supported by the Australian Government, that a decision to refer Murujuga -which seeks to address potential future vulnerabilities—is not valid (under the Operational Guidelines), is not justified (based on the inaccuracies in the evaluation report), has not given sufficient weighting to globally leading peer reviewed research, and prevents the immediate enhancement of protections for the property.

Factual errors identified in the ICOMOS evaluation report include recommendations based on scientific information which is not supported by the Murujuga Rock Art Monitoring Program, and not based in fact.

The Australian Government is working with MAC to ensure the factual inaccuracies that influenced the draft decision are addressed and the voices of the Ngarda-Ngarli are heard, in accordance with the process outlined in Paragraph 150 of the Operational Guidelines.

The draft decision to refer the nomination is also inconsistent with Paragraph 159 of the Operational Guidelines, which states: “Referral means that the requested additional information is necessary to determine the OUV of the nominated property, which only occurs at the time a property is inscribed on the World Heritage List”.

The ICOMOS evaluation indicates ‘the nominated property meets criteria (i), (iii) and (v)’, and in that context the OUV is determined’. None of the recommendations in the evaluation report require provision of additional information to determine the OUV.

Murujuga deserves to be recognised and protected within the World Heritage system. The Australian Government is seeking inscription at the 47th session of the Committee, in accordance with the wishes of the Ngarda-Ngarli.



Murujuga Aboriginal Corporation Circle of Elders



Australian Government



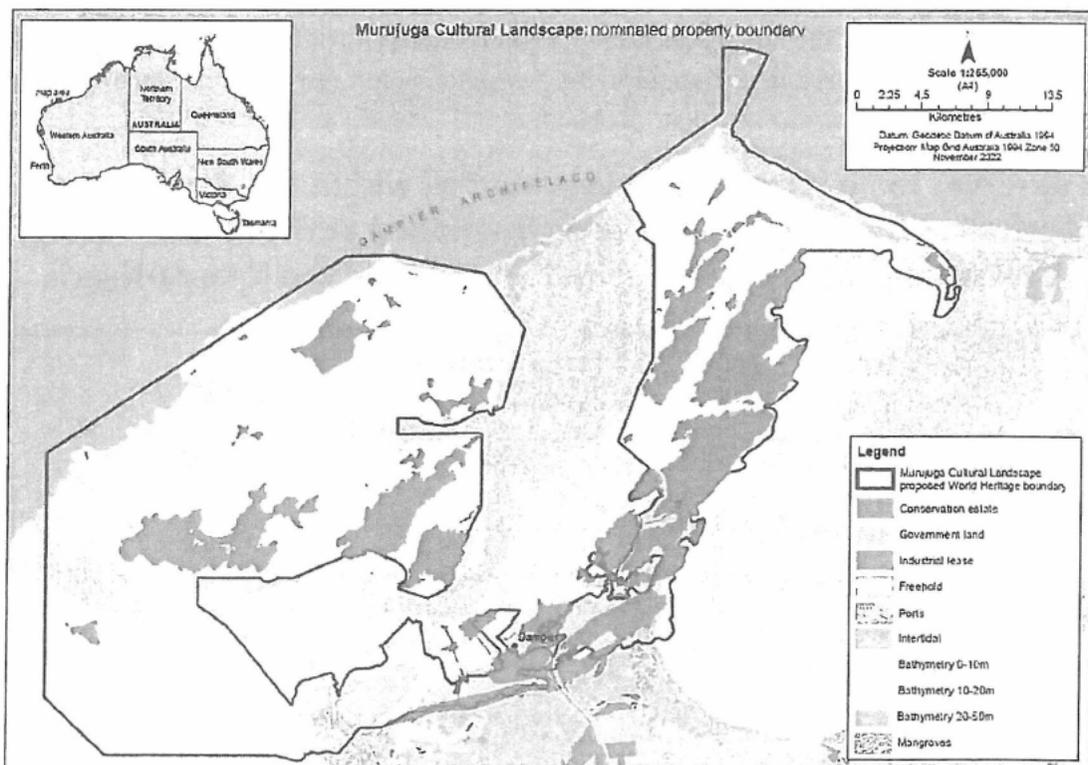
Comparative analysis

A study by the MAC and Curtin University compared emissions at Murujuga with 29 existing or proposed World Heritage properties. The findings ([Attachment B](#)) show Murujuga's levels of key pollutants (NO_2 , SO_2 , HNO_3) are significantly lower than most of the sites assessed, 19 of the 29 sites have higher SO_2 and HNO_3 levels, and 17 have higher NO_2 levels—yet air quality is not raised as a concern for any of them. This demonstrates air quality at Murujuga is well within acceptable thresholds for World Heritage listing.

Protection of Murujuga

Australia's environment and heritage legislation, the *Environment Protection and Biodiversity Conservation Act* is one of the only legal systems in the world that protects the heritage values of a property from both inside and outside the World Heritage boundary. It is also unique in its legislative protection of comprehensive value defined within the Statement of OUV. Inscribing Murujuga on the World Heritage List will improve protection for this property, for both tangible and intangible values.

In demonstration of Australia's commitment to strengthen the protection and management arrangements for this property, Australia will provide state of conservation report in 2027 to provide ongoing reporting on the Murujuga Rock Art Monitoring Program and associated environmental quality controls.



Video resources [In our own words: World Heritage nomination for the Murujuga Cultural Landscape](#)
[Murujuga Rock Art Monitoring Program Year 2 - YouTube](#)

Key documents [Attachment A: Factual Corrections Submission](#)
[Attachment B: Comparative analysis of other World Heritage properties](#)
[Attachment C: MRAMP Year 2 Summary Report](#)



Australian Government
**Department of Climate Change, Energy,
the Environment and Water**

Mr Lazare Eloundou Assomo
Director
UNESCO World Heritage Centre
7, place de Fontenoy, 75352 Paris
FRANCE

Dear Mr Eloundou Assomo

RE: MURUJUGA CULTURAL LANDSCAPE WORLD HERITAGE NOMINATION.

Please find enclosed Australia's factual errors submission for the ICOMOS evaluation of the **Murujuga Cultural Landscape** nomination (No 1709), in compliance with Paragraph 150 of the Operational Guidelines.

Australia is pleased that the ICOMOS evaluation report recognises the Murujuga Cultural Landscape meets criteria (i), (iii) and (v), that its Outstanding Universal Value has been justified, demonstrates integrity and authenticity, is in a good state of conservation, and is supported by appropriate protection, management, and monitoring measures.

However, Australia is deeply disappointed by the draft decision to refer the nomination back to the State Party. This nomination has been First Nations-led throughout. Australia has worked in partnership with the Murujuga Aboriginal Corporation to identify the factual inaccuracies in the evaluation report.

In particular, we are concerned that the evaluation process has not taken into account the broader context in which the Murujuga Cultural Landscape is situated, and the care that has been taken throughout the nomination and evaluation process to communicate that coexistence between a World Heritage property and industry is possible.

We are troubled by the evaluation report's reliance on third party correspondence, provided at the last opportunity, when the Murujuga Aboriginal Corporation, the Australian Government and the Western Australian State Government have spent many years, with great care, to ensure that all the necessary information has been provided to ICOMOS to inform the evaluation.

It is deeply disappointing that the assertions of third-party sources have been given more weight in the evaluation report than the world leading Murujuga Rock Art Monitoring Program (MRAMP) and that Australia, as the State Party, was not given an opportunity to respond to this third-party correspondence as is the usual procedure. The State Party, in full transparency, provided a confidential copy of the most recent MRAMP report to ICOMOS in February 2025, before it was publicly available, so it could be considered during evaluation. The MRAMP has found no evidence of direct emission of acidic pollutants.

The Murujuga Cultural Landscape sits adjacent to industry that is important to both the state of Western Australia and the Australian economy. Industry are supportive of a World Heritage Listing for the Murujuga Cultural Landscape, have made commitments to its future management, and participated in the ICOMOS evaluation mission. Further, the Western Australian and Australian

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governments have strong regulatory processes in place that enable strict conditions on emissions, and the impacts of development at Murujuga.

Australia will urge the World Heritage Committee to place appropriate weight on the results and advice of the MRAMP, which is the only comprehensive, long-term, peer-reviewed study specific to this landscape and its environmental context. Accepting MRAMP science is essential to ensuring that Committee recommendations are informed by the best available evidence.

Australia is strongly committed to the protection of our World Heritage properties, and we will continue to work constructively with the Committee, the Advisory Bodies and the Centre to ensure this special place is protected now and for future generations.

The Murujuga Cultural Landscape deserves to be recognised and protected under the World Heritage Convention. In accordance with the wishes of the Ngarda-Ngarli, Australia will seek inscription at 47COM.

Should any further information be required, please contact me at [s 22\(1\)\(a\)\(ii\) @dcceew.gov.au](mailto:s22(1)(a)(ii)@dcceew.gov.au).

Yours sincerely,

Michelle Dumazel
Division Head
Heritage Division
20 July 2025



COMPARATIVE ANALYSIS OF EMISSIONS – Nitrogen Dioxide (NO₂)

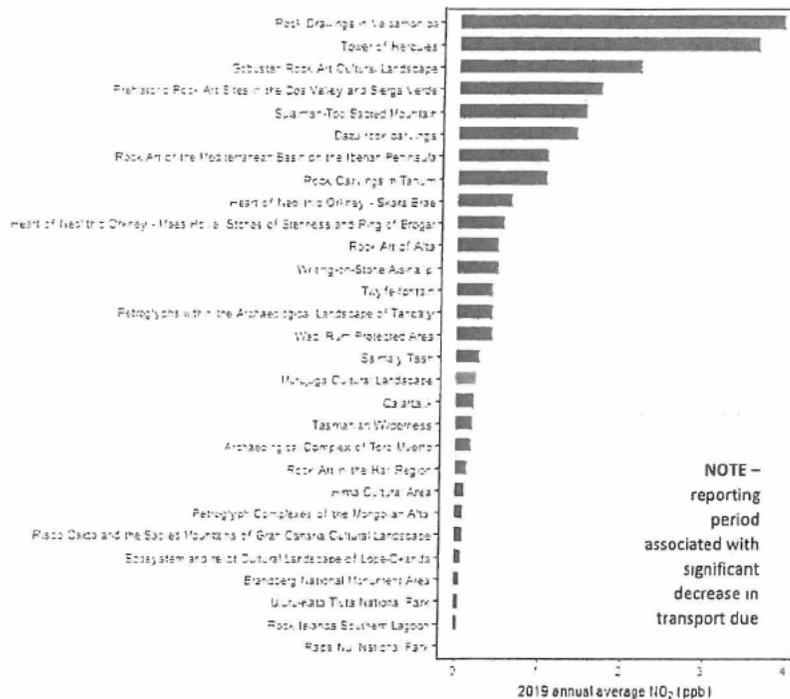


Figure 4: Comparison of annual average nitrogen dioxide (NO₂) in parts per billion (ppb) associated with the Murujuga Cultural Landscape relative to similar World Heritage listed rock art sites. Generated using Atmospheric Composition Analysis Group 2019¹. The Murujuga Cultural Landscape is highlighted in green.

- The Murujuga Cultural Landscape ranks 17th out of 29 sites in annual average NO₂ emissions.
- Average NO₂ levels measured at Murujuga in 2024 were 0.24 ppb.
- In 2019, the highest NO₂ emissions were 16.3 times higher, measured Rock Drawings in Valcamonica (3.9 ppb).
- None of the 16 World Heritage Sites with greater NO₂ emissions than the Murujuga Cultural Landscape are subject to air quality mitigation requirements, nor are any considered 'in danger'.
- The following inscribed sites have previously noted management issues regarding air quality in periodic cycle reporting:
 - Dazu Rock Carving – noted that dust precipitation and absorption cause surface pollution to carvings, acid rain accelerates dissolution of surface minerals leading to diminished artistic value set (SOC Periodic Cycle 3 III (2023)).
 - Twyfelfontein – reported negative and increasing air quality impacts (SOC Periodic Cycle 3 III (2023)).
 - Rock Drawings in Valcamonica – has flagged the need for geo-chemical analysis to examine the effects of air, however this has yet to be seen (SOC 2009).
 - Writing-on-Stone/Aisinai'pi – reported negative but stable air quality impacts (SOC Periodic Cycle 3 III (2023)).
 - Tasmanian Wilderness – reported negative and increasing air quality impacts (SOC Periodic Cycle 3 III (2023)).
 - Rock Carvings in Tanum – reported negative, current and inside origin air quality impacts (SOC Periodic Cycle 3 III (2024)).
- The Murujuga Cultural Landscape is subject to comparatively less NO₂ emissions than most other rock art sites that have already been inscribed, and 20% lower than the Saimaly-Tash Petroglyphs, which is awaiting inscription.
- Dazu Rock Carvings were 1.41 ppb during extensive covid lockdowns and industry/transport restrictions, compared to 33 ppb in 2023 and 2024. This represents a 24 times reduction vs a 4 times reduction at Murujuga. Since industry at Murujuga operated as usual during this period, it appears to suggest that complete deindustrialisation of the Burrup would only reduce local ground level NO₂ concentrations by 25% from an already low base.

¹Data has been extracted from Atmospheric Composition Analysis Group, [Surface NO₂ | Atmospheric Composition Analysis Group | Washington University in St. Louis](#) global datasets for ground level air quality. These data are derived from full air column satellite measurements and calculated using validated models that incorporate ground based measurements. This data has been validated against MRAMP measurements for Murujuga, however accuracy measurement cannot be guaranteed for sites located in areas where ground based public air quality monitoring datasets are unavailable.



COMPARATIVE ANALYSIS OF EMISSIONS – Nitrogen Dioxide (NO₂)

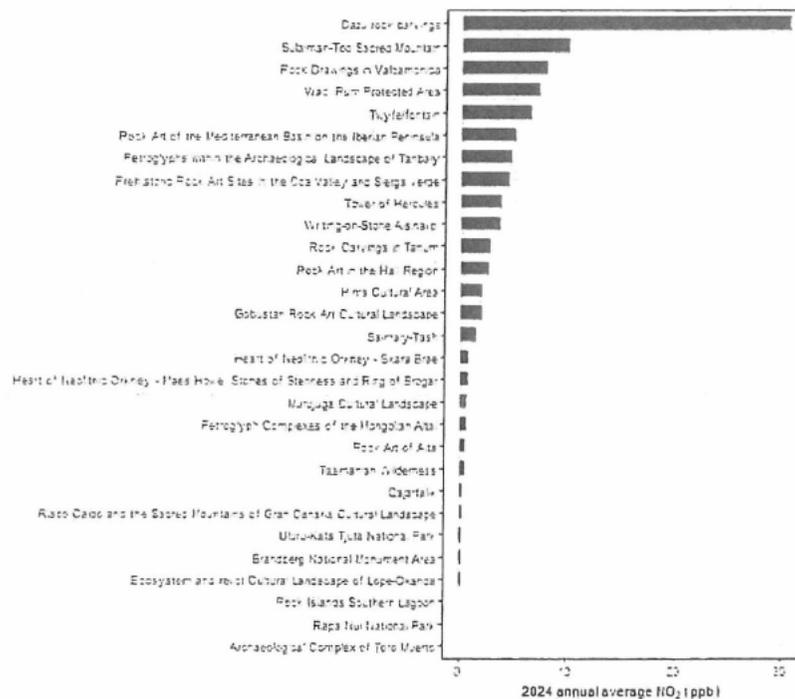


Figure 3: Comparison of annual average nitrogen dioxide (NO₂) in parts per billion (ppb) associated with the Murujuga Cultural Landscape relative to similar World Heritage listed rock art sites. Generated using Copernicus Atmosphere Monitoring Service Information 2024¹. The Murujuga Cultural Landscape is highlighted in green.

- The Murujuga Cultural Landscape ranks 18th out of 29 sites in annual average NO₂ emissions.
- Average NO₂ emissions measured at Murujuga in 2024 were 0.7 ppb (CAMS satellite) and 1.4 ppb (MRAMP passive sampler).
- In 2024, the highest NO₂ emissions were 24 times higher, measured at Dazu Rock Carvings (30.6 ppb)
- None of the 17 World Heritage Sites with greater NO₂ emissions than the Murujuga Cultural Landscape are subject to air quality mitigation requirements, nor are any considered 'in danger'.
- The following inscribed sites have previously noted management issues regarding air quality in periodic cycle reporting:
 - Dazu Rock Carving – noted that dust precipitation and absorption cause surface pollution to carvings, acid rain accelerates dissolution of surface minerals leading to diminished artistic value set (SOC Periodic Cycle 3 III (2023)).
 - Twyfelfontein – reported negative and increasing air quality impacts (SOC Periodic Cycle 3 III (2023)).
 - Rock Drawings in Valcamonica – has flagged the need for geo-chemical analysis to examine the effects of air, however this has yet to be seen (SOC 2009).
 - Writing-on-Stone/Aisinai'pi – reported negative but stable air quality impacts (SOC Periodic Cycle 3 III (2023)).
 - Tasmanian Wilderness – reported negative and increasing air quality impacts (SOC Periodic Cycle 3 III (2023)).
 - Rock Carvings in Tanum – reported negative, current and inside origin air quality impacts (SOC Periodic Cycle 3 III (2024)).
- The Murujuga Cultural Landscape is subject to comparatively less NO₂ emissions than most other rock art sites that have already been inscribed, and approx. 2 times less NO₂ than the Saimaly-Tash Petroglyphs (CAMS satellite) which is awaiting inscription.

¹Data has been extracted from Copernicus Atmospheric Monitoring Service (CAMS), <https://atmosphere.copernicus.eu/> global datasets for ground level air quality. These data are derived from full air column satellite measurements and calculated using validated models that incorporate ground based measurements. CAMS data has been validated against MRAMP measurements for Murujuga, however accuracy of the CAMS measurement cannot be guaranteed for sites located in areas where ground based public air quality monitoring datasets are unavailable.

COMPARATIVE ANALYSIS OF EMISSIONS – Particulate Matter (PM)



Figure 5: Comparison of annual average particulate matter (PM) in micrograms per cubic metre (µg/m³) associated with the Murujuga Cultural Landscape relative to similar World Heritage listed rock art sites. Generated using Copernicus Atmosphere Monitoring Service Information 2024¹. The Murujuga Cultural Landscape is highlighted in green.

- The Murujuga Cultural Landscape ranks 6th out of 29 sites in annual average dust Particulate Matter (PM).
- Dust recorded across the Pilbara region is largely regional and is comparatively lower than regional dust measured at Uluru -Kata Tjuta National Park.
- Average PM measured at Murujuga in 2024 was 8.65 µg/m³.
- In 2024, the highest PM measured were XX times higher, measured at Hima Cultural Area (71.40 µg/m³.)
- None of the 5 World Heritage Sites with greater PM than the Murujuga Cultural Landscape are subject to air quality mitigation requirements, nor are any considered 'in danger'.
- The following inscribed sites have previously noted management issues regarding air quality in periodic cycle reporting:
 - Dazu Rock Carving – noted that dust precipitation and absorption cause surface pollution to carvings, acid rain accelerates dissolution of surface minerals leading to diminished artistic value set (SOC Periodic Cycle 3 III (2023)).
 - Twyfelfontein – reported negative and increasing air quality impacts (SOC Periodic Cycle 3 III (2023)).
 - Rock Drawings in Valcamonica – has flagged the need for geo-chemical analysis to examine the effects of air, however this has yet to be seen (SOC 2009).
 - Writing-on-Stone/Aisinai'pi – reported negative but stable air quality impacts (SOC Periodic Cycle 3 III (2023)).
 - Tasmanian Wilderness – reported negative and increasing air quality impacts (SOC Periodic Cycle 3 III (2023)).
 - Rock Carvings in Tanum – reported negative, current and inside origin air quality impacts (SOC Periodic Cycle 3 III (2024)).
- The Murujuga Cultural Landscape is subject to comparatively less PM than some other rock art sites that have already been inscribed, and 1.8 times less PM than the Saimaly-Tash Petroglyphs, which is awaiting inscription.
- Dust is mostly natural and an important source of varnish materials.

¹Data has been extracted from Copernicus Atmospheric Monitoring Service (CAMS), <https://atmosphere.copernicus.eu/> global datasets for ground level air quality. These data are derived from full air column satellite measurements and calculated using validated models that incorporate ground based measurements. CAMS data has been validated against MRAMP measurements for Murujuga, however accuracy of the CAMS measurement cannot be guaranteed for sites located in areas where ground based public air quality monitoring datasets are unavailable.



COMPARATIVE ANALYSIS OF EMISSIONS – Sulphur Dioxide (SO₂)



Figure 1: Comparison of annual average sulphur dioxide (SO₂) in parts per billion (ppb) associated with the Murujuga Cultural Landscape relative to similar World Heritage listed rock art sites. Generated using Copernicus Atmosphere Monitoring Service Information 2024¹. The Murujuga Cultural Landscape is highlighted in green.

- The Murujuga Cultural Landscape ranks 20th out of 29 sites in annual average SO₂ emissions.
- Average SO₂ emissions measured at Murujuga in 2024 were 0.14 ppb (CAMS satellite) and 0.11 ppb (MRAMP passive samplers).
- In 2024, the highest SO₂ emissions were 181 times higher, measured at Dazu Rock Carvings (19.9 ppb)
- None of the 19 World Heritage Sites with greater SO₂ emissions than the Murujuga Cultural Landscape are subject to air quality mitigation requirements, nor are any considered 'in danger'.
- The following inscribed sites have previously noted management issues regarding air quality in periodic cycle reporting:
 - Dazu Rock Carving – noted that dust precipitation and absorption cause surface pollution to carvings, acid rain accelerates dissolution of surface minerals leading to diminished artistic value set (SOC Periodic Cycle 3 III (2023)).
 - Twyfelfontein – reported negative and increasing air quality impacts (SOC Periodic Cycle 3 III (2023)).
 - Rock Drawings in Valcamonica – has flagged the need for geo-chemical analysis to examine the effects of air, however this has yet to be seen (SOC 2009).
 - Writing-on-Stone/Aisinai'pi – reported negative but stable air quality impacts (SOC Periodic Cycle 3 III (2023)).
 - Tasmanian Wilderness – reported negative and increasing air quality impacts (SOC Periodic Cycle 3 III (2023)).
 - Rock Carvings in Tanum – reported negative, current and inside origin air quality impacts (SOC Periodic Cycle 3 III (2024)).
- The Murujuga Cultural Landscape is subject to comparatively less SO₂ emissions than most other rock art sites that have already been inscribed, and approx. 7.3 times less SO₂ than the Saimaly-Tash Petroglyphs, which is awaiting inscription.

¹Data has been extracted from Copernicus Atmospheric Monitoring Service (CAMS), <https://atmosphere.copernicus.eu/> global datasets for ground level air quality. These data are derived from full air column satellite measurements and calculated using validated models that incorporate ground based measurements. CAMS data has been validated against MRAMP measurements for Murujuga, however accuracy of the CAMS measurement cannot be guaranteed for sites located in areas where ground based public air quality monitoring datasets are unavailable.

COMPARATIVE ANALYSIS OF EMISSIONS – Weatherability

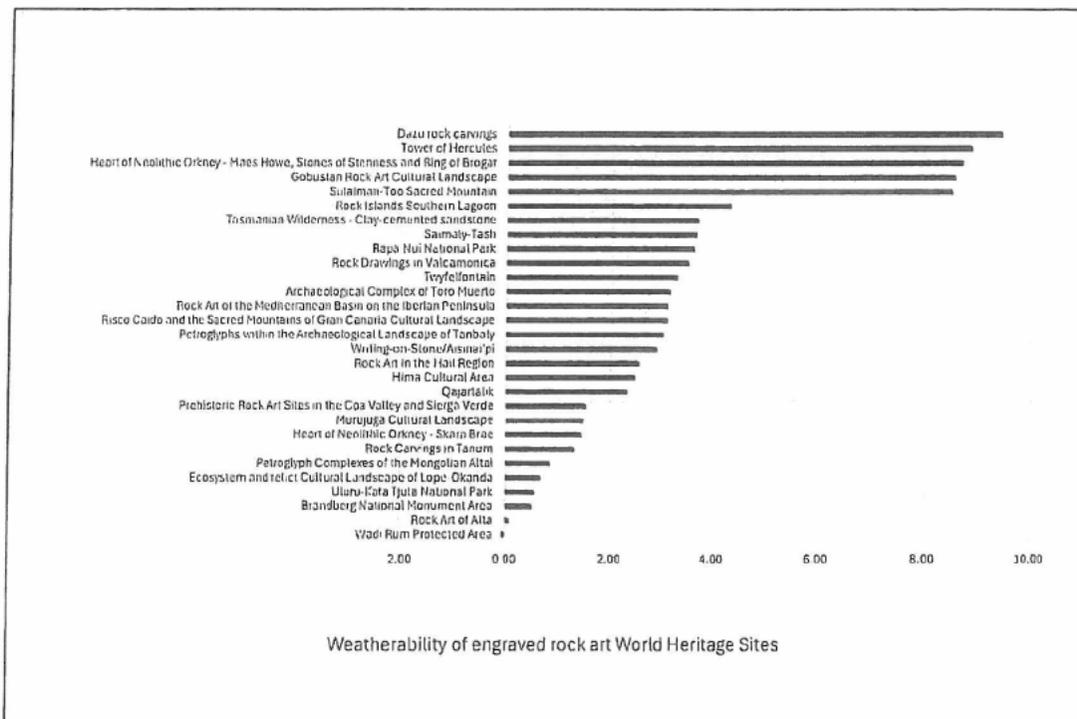


Figure 6: Comparison of weatherability of inscribed and to-be-inscribed rock art sites. Data sourced for 2024 from Copernicus Atmospheric Monitoring Service (CAMS)¹. The Murujuga Cultural Landscape is highlighted in green.

- The longevity of engraved rock art depends on the rate of weathering of the host rocks.
- A weatherability index was devised that integrates atmospheric gas concentrations, reaction of selected atmospheric gases with rain, mineral dissolution rates, and rock characteristics such as rock type and grain size, and precipitation.
- Rock types considered include carbonate-, clay-, silica- and hematite-cemented sandstones, limestone, basalt, granophyre, granite, gabbro, dolerite, and quartzite.
- This weatherability assessment enables comparison amongst 29 inscribed, referred, and tentative World Heritage Sites with engraved rock art.
- A high weatherability index indicates rapid weathering of the rocks that host art and vice versa; sites with a higher weatherability index are more susceptible to degradation.
- The weatherability of granophyre from the Murujuga Cultural Landscape ranks 21st out of 29 sites considered, in the bottom third of the weatherability ranking.
- This makes the Murujuga geology amongst some of the hardest and most resilient in the world.
- The comparatively low rate of emissions and the low weatherability of Murujuga’s geology must be considered in the consideration of its capacity to co-exist with industry.
- Most of the other sites considered have already been inscribed, and none of the 20 World Heritage Sites with higher weatherability than the Murujuga Cultural Landscape are subject to air quality mitigation conditions, nor are any considered ‘in danger’.

¹Data has been extracted from Copernicus Atmospheric Monitoring Service (CAMS), <https://atmosphere.copernicus.eu/global/datasets/for-ground-level-air-quality>. These data are derived from full air column satellite measurements and calculated using validated models that incorporate ground based measurements. CAMS data has been validated against MRAMP measurements for Murujuga, however accuracy of the CAMS measurement cannot be guaranteed for sites located in areas where ground based public air quality monitoring datasets are unavailable.