REAL MATERIAL ETHEREAL

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Solar Lighting Namoi and Gingie Reserves: Exploring socio-technical relations through outdoor lighting

Figure 1. Gingie Reserve, 2018

Abstract

This paper is an evaluation of an in-progress, action research project centred on the design and implementation of forty solar street lights within Namoi and Gingie Aboriginal reserves. Investigating socio-technical relations within the context of discrete Indigenous communities,[1] this research explores the capacity of urban infrastructure to provide benefits to remote Aboriginal communities. Funded by the Department of Justice and carried out in partnership with the Walgett Local Aboriginal Land Council, the research is being conducted through a comparative, longitudinal study. It sets out to evaluate the ability of solar outdoor lighting to be responsive to community needs, and tests the potential of outdoor lighting to increase wellbeing by decreasing vandalism, theft, snake bites, emergency services visitation, and call-out times.

Whilst action research is the primary method for conducting the research, a range of supplementary research methods have been incorporated to evaluate the social impacts of the lighting implementation, including semi-structured interviews with

residents and emergency services; the intent is to compare emergency services data pre- and post-installation.

Exploring the interconnections between people and objects, the data collected is interpreted through a socio-material perspective that seeks to reveal insights into the interactions and entanglements between urban infrastructure and social formation. Through the examination of human/non-human networks in Namoi and Gingie Reserves, the research aims to extend socio-technical discourse whilst developing new knowledge and transferable design methodologies and processes for further implementation and advancement of discrete Indigenous communities of Australia.

The Project: Solar Lighting of Namoi and Gingie Reserves

In 2018, an opportunity arose to investigate the socio-material relations between urban infrastructure and social formation within the remote Aboriginal communities of Namoi and Gingie Reserves. Funded by the Department of Justice under the 'Safe Community Grants', the project is centered on the implementation and evaluation of new off-grid solar lighting across the two reserves, and seeks to explore the capacity of urban infrastructure to provide benefits to remote Aboriginal communities at large.

The opportunity to carry out the research had come about through a pre-existing relationship forged between the Walgett Local Aboriginal Land Council and The University of Technology, founded upon a series of undergraduate design studios focused on participatory design methodologies and community revitalisation through the adaptive reuse of existing buildings and infrastructure.[2]

Figure 2. Gingie Reserve

The Site Context _ Namoi and Gingie Reserves

Namoi and Gingie Reserves are two discrete Aboriginal communities situated on the periphery of the township of Walgett in North Western New South Wales. Located near the junctions of the Barwon and Namoi rivers at the cross-roads of the Castlereagh and Kamilaroi Highways, Walgett takes its name from an Aboriginal word meaning 'the meeting place of two waters'.[3] Namoi, Gingie and Walgett are all located in Gamilaraay country, a 1.5 hour drive south of the Queensland border, and nine hour drive north-west of Sydney.

Gingie and Namoi Reserves are situated on Aboriginal land; 'Gingie Village (171 ha) is situated 10 kms west of Walgett and Namoi Village (42.9 ha) is 3 kms north of Walgett. Both of these communities are home to up to 100 Indigenous families.'[4]

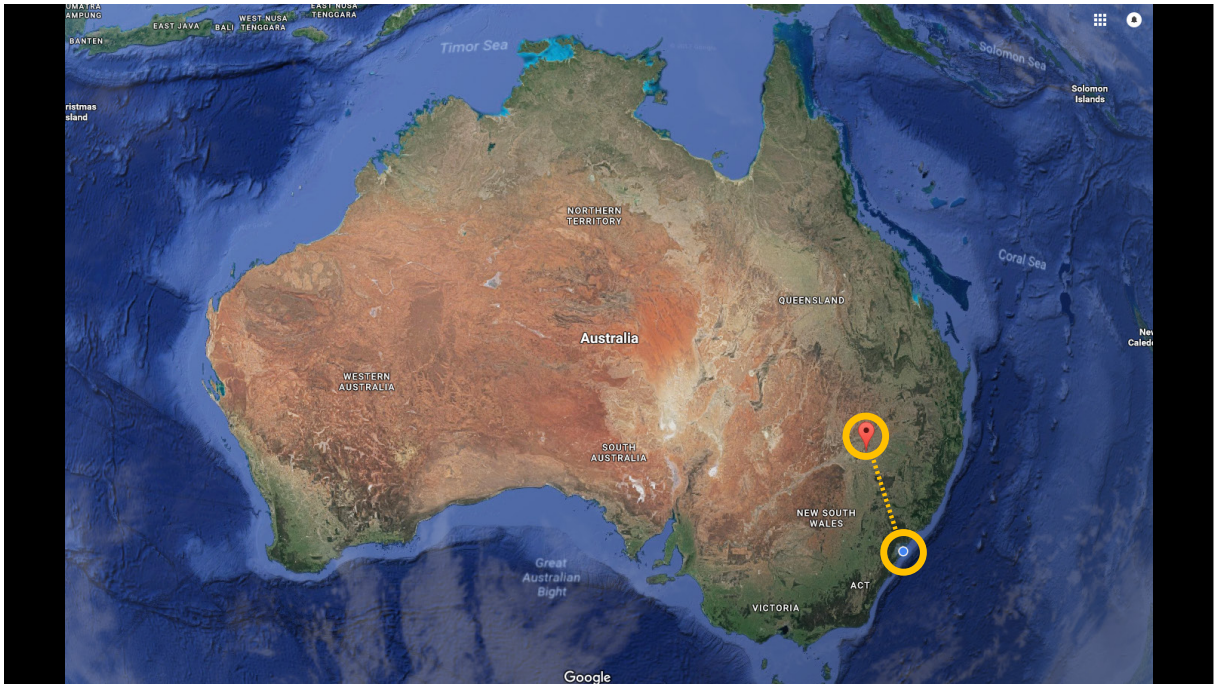

Figure 3. Gingie and Namoi Reserves (Location Map)

Historically, Aboriginal reserves such as Namoi and Gingie (together with missions and stations) were areas of land established by the British colonial administration, onto which Aboriginal people were forcibly relocated as part of government policies of segregation and assimilation.

Many Aboriginal people who were relocated on reserves such as Gingie, were removed from their traditional lands and 'lost the right of freedom of movement and work, control over their personal property and the custody of their children.'[5]

Today, the ownership of land within Namoi and Gingie reserves, as well as the housing and associated infrastructure, sits under the auspices of the Walgett Local Aboriginal Land Council (LALC). Founded in 1984, The Walgett LALC is a statutory body constituted under the Aboriginal Land Right Act[6]; its purposes include providing land rights, providing for the acquisition of land, management of land and other assets, and the provision of community benefit schemes and financial stewardship.

Figure 4. Namoi Reserve, 2018

In regard to implementing solar lighting in Namoi and Gingie, the Walgett Shire Council currently provides basic street lighting to both reserves; however, the electrical expense is passed onto the Walgett LALC. The implementation of 20 solar street lights in each Reserve is an anticipated cost saving of $1400-1600 per year. Whilst the monetary savings are an attractive dividend for implementing solar lighting, the core aim of the project from the outset is to provide benefits to the residents of Namoi and Gingie by decreasing vandalism, theft, snake bites, emergency services visitation, and call-out times.

In summary, the intended outcomes of this research are as follows:

- Codesign and install appropriate lighting responses in Namoi and Gingie.
- Develop new and transferable technologies and working processes that advance discrete indigenous communities' safety and wellbeing.
- Develop skills capacity and employment opportunities of Indigenous communities for solar lighting installation and maintenance.
- Develop new technical knowledge and set benchmarks relevant to the lighting of remote Aboriginal communities.

Socio-Political Context: The Challenge of the Gap

'We've been in the dark too long'[7]

In March 2008, Australian governments and Aboriginal and Torres Strait Islander people signed a historic statement of intent 'to work together to achieve equality in health status and life expectancy between Aboriginal and Torres Strait Islander peoples and non-Indigenous Australians by the year 2030.'[8] Termed *Closing the Gap*, this government strategy came about in response to the 2005 *Social Justice Report*[9] and the Close the Gap social justice campaign, and 'aims to reduce disadvantage among Aboriginal and Torres Strait Islander people with respect to life expectancy, child mortality, access to early childhood education, educational achievement, and employment outcomes.'[10]

To monitor change, the Council of Australian Governments (COAG) set measurable targets to monitor improvements in the health and wellbeing of the Aboriginal and Torres Strait Islander population. Each year since the strategy's inception, successive governments have released a Prime Minister of Australia's Closing the Gap report detailing progress (or lack of) against established targets. In the ten years since the strategy was ratified, the revolving door of Australian leadership has seen ten reports issued by six different prime ministers from either side of the party divide. Whilst the report has been used as a platform for cross- and inter-party slanging matches, it provides a durable and transparent record of the statistical reality that the gap between Indigenous and non-Indigenous Australians is in fact widening, with only two of the stated targets on track.

In 2018, on the tenth anniversary of the strategy, the Close the Gap Campaign Steering Committee released a report titled *10 Year Review: The Closing the Gap Strategy and Recommendations for Reset.*[11] In the opening paragraph, the report states that 'Ten-years after its commencement, it is time to critically reflect on why Australian governments have not yet succeeded in closing the health gap to date, and why they will not succeed by 2030 if the current course continues.'[12]

The review points out that the strategy was founded on an understanding that 'outcomes are fundamentally the result of underlying structural factors, such as social determinants, institutional racism, the quality of housing, and access to appropriate primary health care.'[13] The review also points out that in order to make progress in closing the gap, 'governments must address the underlying structural factors – treating the causes rather than focusing on symptoms.'[14]

Despite such recommendations, the 2019 Closing the Gap Report released by the recently re-elected Prime Minister Scott Morrison appears to be focused on treating symptoms rather than causes. Evidence of this is the concluding chapter of Morrisons report titled 'Safe and Strong Communities', in which he outlines six areas that relate to making communities safer: (1) investment in family violence prevention legal *services*, (2) therapeutic *services* for children, (3) child protection *services,* (4) Government funded community night patrol *service*, (5) custody notification *services* and (6) alcohol and other drug treatment *services.*

All six action points listed are service oriented, focusing on symptoms, rather than addressing underlying structural factors such as a deficiency in 'health enabling infrastructure.'[15] This research, in an attempt to shift the emphasis from treating social symptoms to addressing the environmental and (infra)structural causes of disadvantage, turns to a post-humanist, socio-material perspective to reconsider the agency of human and non-human entities via a questioning of the presumed neutrality of technologies in human affairs.

Seeking to 'challenge the often taken for granted division between humans and the material things of our world,'[16] we draw on Heidegger's argument that 'the essence of technology is not, in itself, technological. Rather, it is a way of grasping the world.'[17] Embracing a post-humanist position, the research seeks to destabilise the traditional binaries between *the social* and *the technical* in order to discover new ways to 'talk about the social and the technical all in one breath.'[18]

According to Adams and Thompson, 'our evolution is supported by, and is contingent with, the development and use of our technologies and built environments';[19] by adopting a post-humanist, socio-material approach, this research seeks to address 'our intimate and co-constitutive entanglements with our technologies'[20] to reveal insights into the interactions and entanglements between urban infrastructure and social formation within discrete Aboriginal communities of Australia.

The Approach — Socio-Material Perspective (Methodology)

Influenced by Donald Schon, the action research methodology undertaken within this project is understood as an evolving, reflective, and responsive process, where the unpredictable outcomes, critical reflections, and limitations of one research phase prompt a critical refinement and re-orientation of a specific research question that is used to interrogate a targeted aspect of the field under investigation.[21] Whilst action research is the primary method

for evaluating the social impacts of infrastructural upgrades, a range of supplementary research methods have also been incorporated to explore the interconnections between people and objects, including semi-structured interviews with residents and emergency services workers as well as the intent to compare emergency services data,[22] pre- and post-installation.

Foregrounding a participatory and consultative approach, the research is structured in four interrelated stages, as follows :

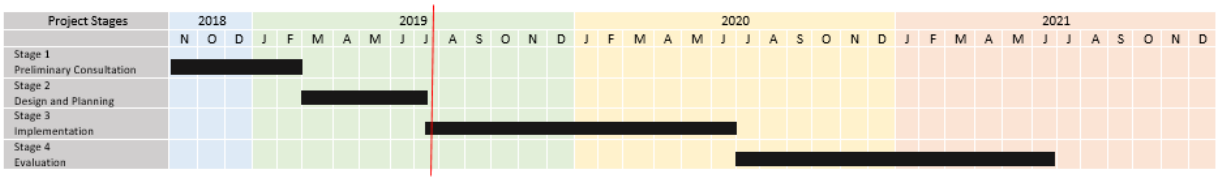

Figure 5. Project Program (July 2019)

Stage 1: 'Preliminary Consultation'

The first stage centers on a site visit to Namoi and Gingie Reserves, in which the researchers consulted with community members and emergency services workers about the proposed roll-out of the lights.

Community members were shown a map of the proposed layout and were invited for a recorded interview and discussion around a series of pre-prepared questions relating to the prevalence of snakes, vandalism and theft, emergency services call-out times, and cultural connections to dark sky in relation to light pollution.

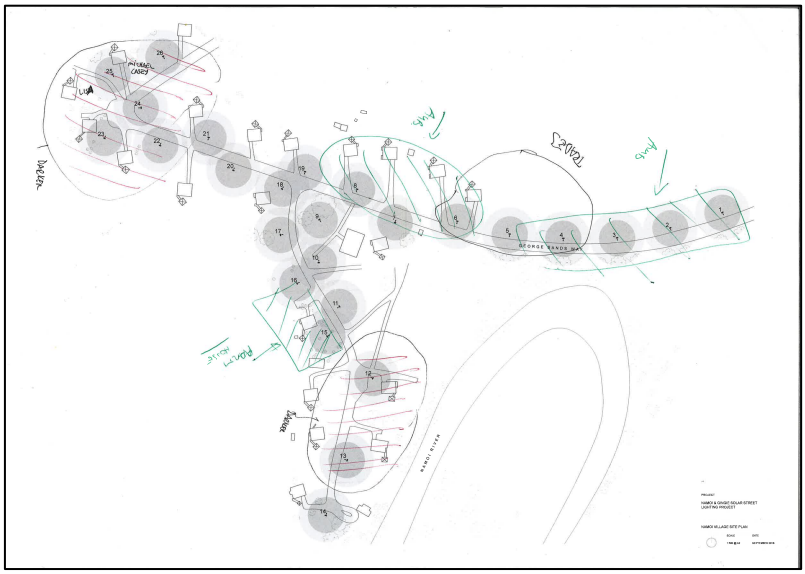

Figure 6. Namoi Community Consultation Mapping
Markups by community identifying areas needing lighting.

When asked if community members wanted outdoor lighting the response was unanimous that additional lighting was wanted in both reserves and in Namoi, there was a suggestion that the kids who hang around in Walgett would be more likely to hang out in Namoi if there was additional lighting.

The initial proposal submitted to Department of Justice was to light the road. In response to community consultation on where the lights would best be located, the positioning of the lighting changed to be within the property boundaries to light the yards. This was firstly to respond to the needs highlighted, but also in the hope that residents would take ownership of the infrastructure, and through passive surveillance, the lighting could have the potential to negate the vandalism that has been inflicted on other funding initiatives such as the playgrounds and community buildings.

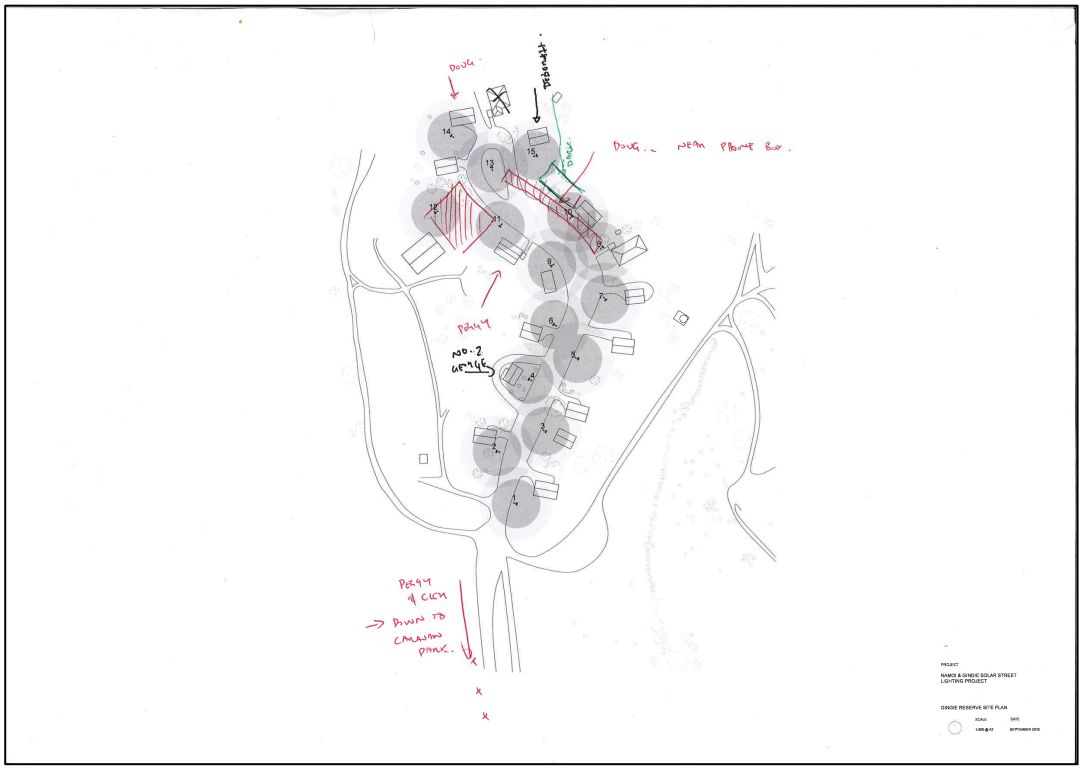

Figure 7. Gingie Community Consultation Mapping
Markups by community identifying areas needing lighting.

Perhaps the most telling outcome of preliminary consultation was the revelation that theft within the two communities was virtually non-existent, and whilst snakes such as brown snakes were common, especially in Namoi, due to the proximity of the river, no resident could recall a snake bite incident. They did note, however, that some snakes often do come out at night and the lighting would enable them to move about in their front yards with more comfort, as they would be able to see better and identify any snakes that might be around.

Prior to carrying out interviews, demonstrating our city-based naivety, we had a preconception that the lighting might impact on a cultural connection to the night sky. When asked if having lights on during the night would be an issue, a humorous response from one of the interviewees was 'its there all the time, we know its (the stars) there,'[23] pointing to the sky with a smile.

In a final question about whether local communities would be interested in participating in the installation as a form of skills training and employment opportunity, the response was an expression of distrustful interest, perhaps a consequence of numerous 'work for dole' schemes.

In addition to community members, we also conducted interviews with emergency services representatives from the Walgett police force and ambulance workers. Emergency services

workers reported difficulty in seeing the house numbers due to lack of good signage, especially at night, and consequent potential extension to call-out time for emergency services. Emergency services personnel noted that lighting would indeed make their job easier at night, since most call-outs are at nighttime. However, they also argued that it would have little impact on the callout time for continuing staff, because they had become familiar with the house numbers very quickly and do not need lighting to guide them to the right address.

Review of Existing Lighting

Night visits were undertaken to both Namoi and Gingie Reserves, and readings were collected. The following was noted in evaluating the existing lighting:

- Lamps used appear to be HID type (old technology)
- Lighting appears to have a neutral white correlated colour temperature of 4200K
- Lighting is mounted on timber light poles which also carry supply distribution systems
- Current infrastructure does not provide adequate levels of night-time illumination; illuminance levels are low and coverage is limited
- Despite the above shortcomings and their limited benefit to the community, the current lighting appears to have been maintained well and should be retained regardless of the solar lighting initiative.

The researchers also visited the location where a solar light was installed near the WLALC office in Fox Street, Walgett. The poor condition of this light, despite being installed only two years prior, was noted. It has since emerged that this light has recently failed, most probably due to the battery.

Figure 8. Solar Light outside of Walgett LALC Offices

Stage 2 _Design, Master Planning & Tendering

Informed by the knowledge and opinions of community members in Namoi and Gingie as well as the safety concerns of Emergency services workers based in Walgett, a second stage was undertaken focusing on master planning, lighting specifications & tendering**.**

Design of Lighting Specifications

The extreme climatic conditions of Namoi and Gingie Reserves present a combined set of environmental and technical challenges. These challenges result in key determinants for the performance specifications of the equipment.

Heat, Sunlight and Dust

Weather temperatures in Namoi and Gingie can fluctuate significantly, causing stress on the equipment. Daytime temperatures in particular (reaching up to 49°C)[24] pose a great risk to electrical components (in particular the batteries). Along with the changes in temperature, continuous and long-term exposure to sunlight also exposes the equipment to high risk of overheating as well as damage caused by UV radiation. Dust is also a key consideration, as

over time, the combined effect of heat and dust may result in ingress. Adequate protection against weather is critical.

Flood

Namoi and Gingie Reserves are situated within a floodplain and are susceptible to water inundation from local rivers. While Gingie is surrounded by a levy to mitigate damage from flood, Namoi is exposed to flood waters. Walgett Shire Council, in which Namoi and Gingie reserves are located, requires the lighting equipment to withstand up to 3 months immersion in water. The parts of the equipment that may be subject to flooding have to have protection at a level of IP68.[25]

Expected Equipment Life (Particularly Batteries)

An inherent technical challenge is the design life of the equipment. It is expected that of all components, the batteries will suffer from aging and will need to be replaced before any of the other parts. It is important that the batteries be durable, but also easy to access and replace.

Vandalism

The specifications of the equipment need to ensure a high degree of resistance to various forms of physical interference (e.g. attempting to break the equipment with impact, putting it under stress, causing accelerated rusting by scratching, applying paint, disassembling and removal of parts or all of the equipment etc.). A simplistic approach to tackling vandalism may result in an unpleasant design outcome (big armours/cages/locks etc.). The necessity to provide protection and robustness in this instance needs to be approached with care, sensitivity and respect. In addition to equipment specifications, it is anticipated, from a planning perspective, that positioning the lighting within front yards of each dwelling, as requested by residents, may carry less risk than positioning on the street.

Master Planning

It became obvious through reviewing the outcomes of the preliminary consultation that, whilst a basis[26] for the lighting performance requirements for the project had to be agreed upon, the design approach (and hence how metrics are applied) would need to be tailored to address the specifics of the nighttime environment within the Namoi and Gingie Reserves. Hence, the design would most likely divert from common urban lighting methodologies.

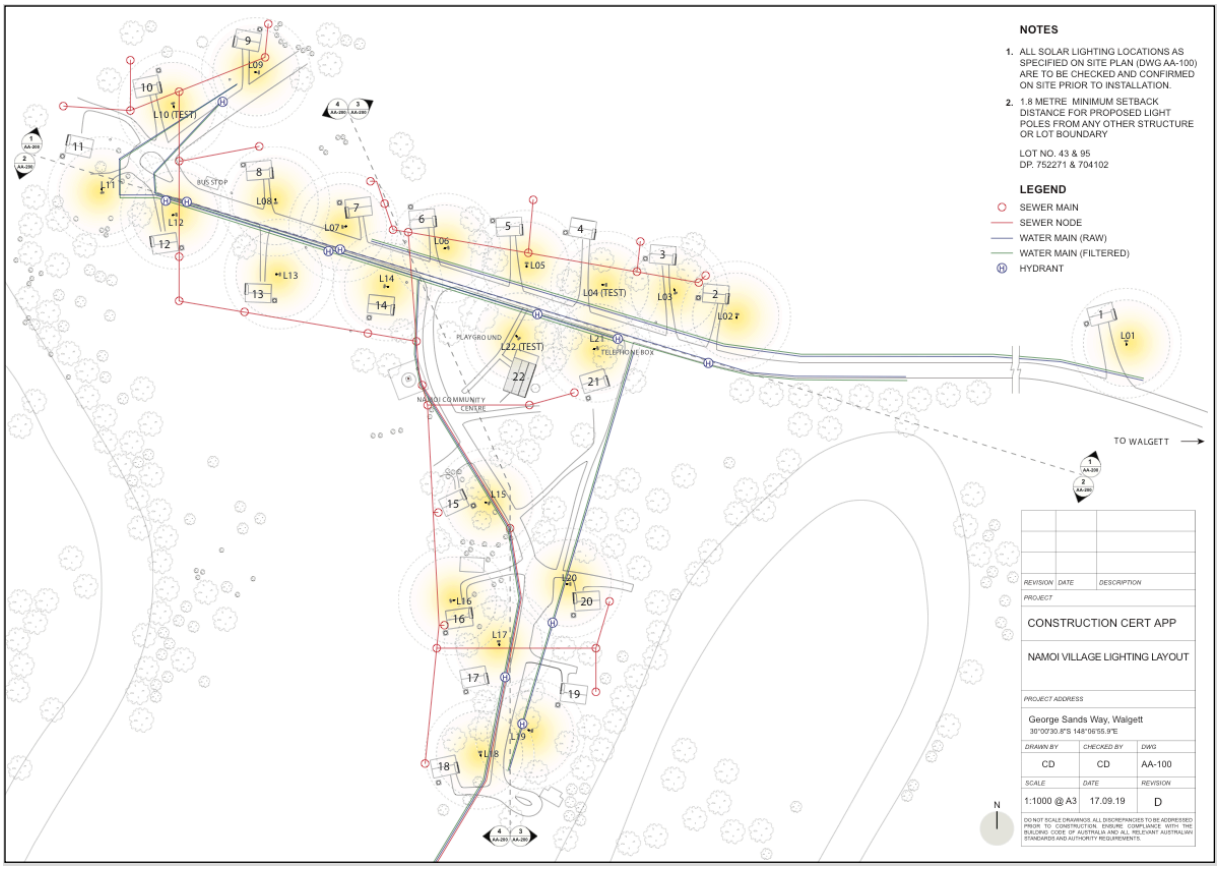

Figure 9. Master Plan of Namoi (Sept 2019)

Considering the layout of the streets and various orientations and positioning of dwellings, it was agreed that the project would be of most benefit in meeting its objectives if the lighting was provided within close proximity to dwellings, rather than on the street. This would offer a better degree of spill light near the dwellings, rather than lighting the streets.

As a basis, Australian Standard AS1158 can be considered most relevant to the project. Considering that solar exterior lighting of Gingie and Namoi reserves predominantly aims to provide pedestrian amenity and not vehicular amenity, the relevant part of this standard would be the AS1158.3.1.[27] This standard sets out lighting requirements for roads and other outdoor public areas, primarily to provide a safe and comfortable visual environment for pedestrian movement at night. Generically, such lighting is described in this Standard as Category P lighting.

The Standard AS1158.3.1 is intended predominantly for urban or suburban contexts. It provides a multi-level specification of lighting performance according to the degree of activity (of pedestrians and vehicles or cyclists), the risk of crime, and the need to enhance the prestige of the locality. These criteria do not directly translate to concerns specific to this project.

Considering the various P categories within the standard and the existing conditions of the locality, it is considered that the minimum average illuminance level stipulation (0.85 Lux) as per Category P4 should be adopted as the minimum point illumination for the intended base level lighting within 15 m radius of each light pole.

Uniformity requirements and minimum point illuminance requirements of Category P4 are omitted, as the lighting infrastructure does not intend to provide a continuous and even outlay that is P4 compliant across the reserve, but only aims to create islands of light in a tailored fashion, responding to budgetary considerations while addressing the objectives as effectively as possible.

With respect to the height of lighting structures, it was calculated that a pole height of 6.5 to 7.5 m would provide adequate lighting distribution,[28] while maintaining a degree of human-scale and proportion to the dwellings. Light poles are positioned within 15 m of dwellings. Additional lights are positioned at locations such as near the bus shelters.

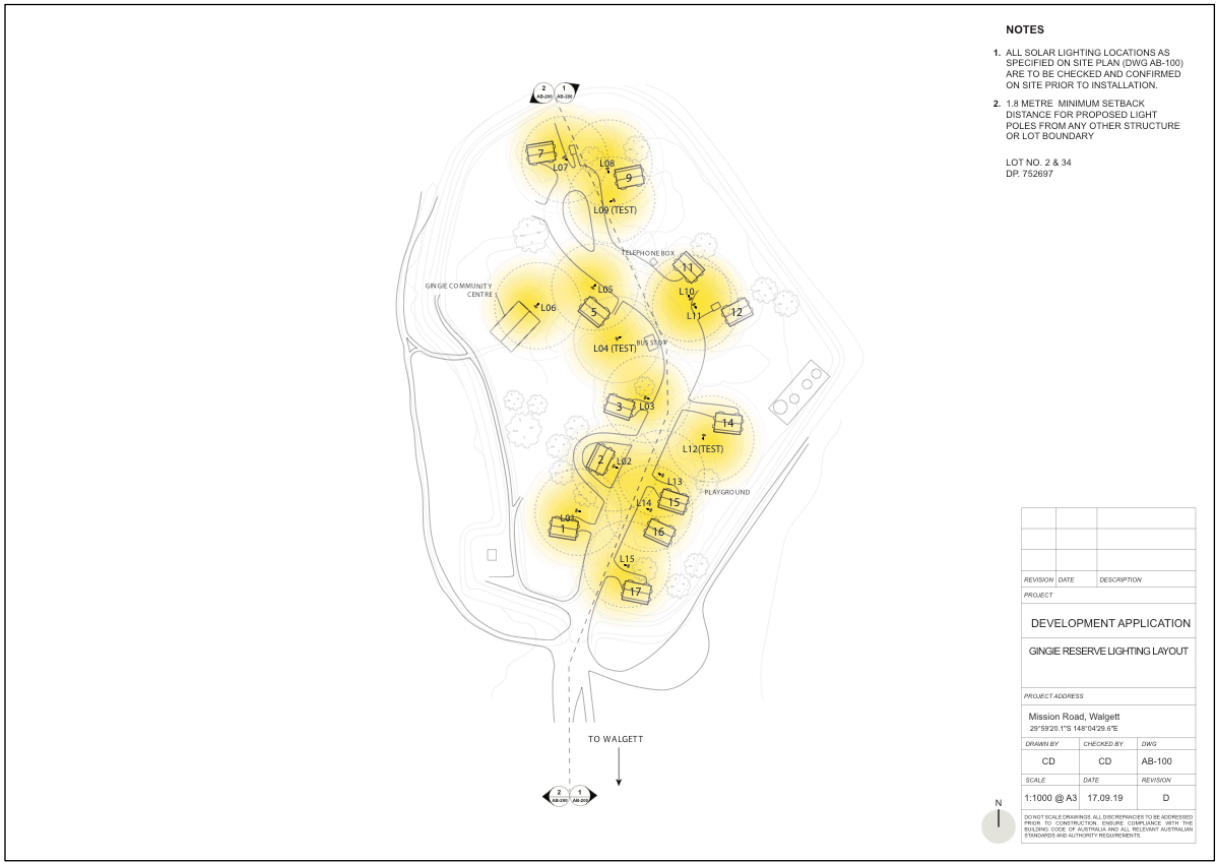

Figure 10. Master Plan of Gingie (Sept 2019)

Tendering

Following the establishment of the parameters of the master planning and lighting specifications, the market was canvassed, and four parties[29] were shortlisted to tender on the project. The tender response resulted in product offerings with significant differences. The disparity between cost and quality of proposed products became a major concern. Tender responses did not provide sufficient clarity for the researchers to make a confident recommendation.

The outcome of the tender review was to add a trial phase in which four lighting types from three suppliers will be installed in Gingie and Namoi for further evaluation. Whilst the primary objective of the trial phase is to gather more reliable information in evaluating the true performance of the lights and provide a cost-benefit analysis, the trial phase also offers an opportunity to gauge the residents' response to the initiative, and will provide information that may improve the masterplan. During this phase, visual inspections, photometric light measurements, and electrical readings will be undertaken, along with additional consultation with the residents. Following a 6-month trial period, the installed solar lights and the masterplan will be evaluated to proceed with Stage 3: Implementation[30] followed by a final Stage 4: Post-Implementation Evaluation[31].

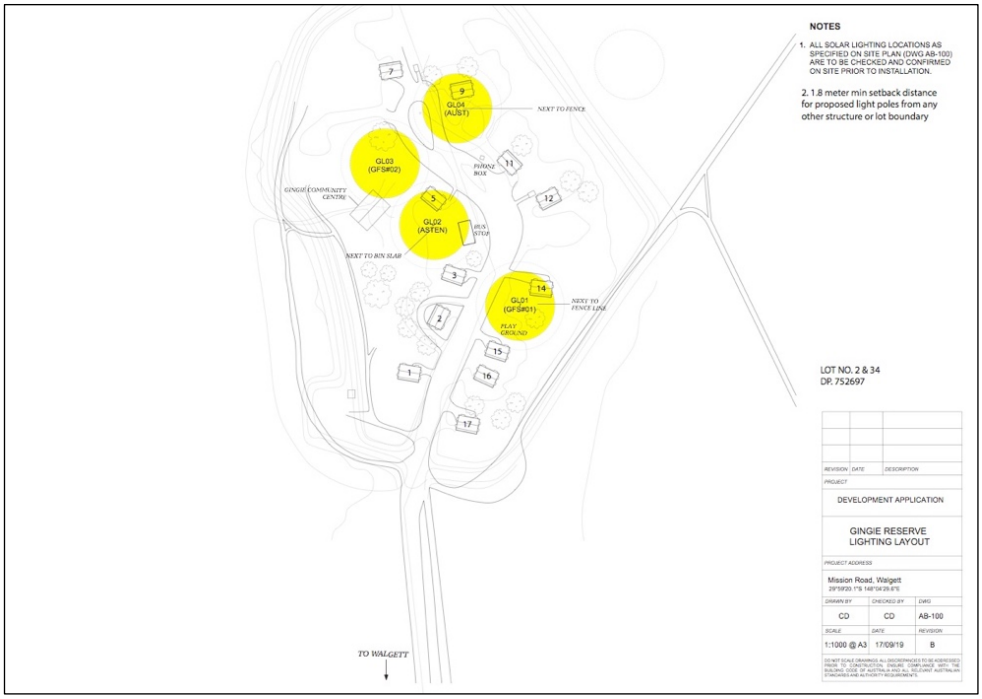

Figure 11. Gingie Trial Phase Master Plan showing positions of four lighting types

Concluding Remarks: Lessons Learnt from Project so Far (Stages 1 & 2)

Having completed only two of four stages, the project outcomes are far from conclusive or definitive, and in the context of Aboriginal affairs in Australia, the question still remains: What makes this project any different from many other infrastructure projects that have failed within Aboriginal communities of Australia?

The difference of this project lies with the emphasis on a socio-material perspective and the expressed need to address systemic causes rather than symptoms. Seeking to redistribute the structural inequalities of Indigenous and non-indigenous Australians the project adopts an open ended, flexible research framework able to adapt and respond to economic, technical and social constraints. Evidenced through the adjustment of master planning to reposition lighting within community yards rather than lighting the road, and the addition of a trial phase within the research program, the action research advocates an evolving, reflective, and responsive process, where the unpredictable outcomes, critical reflections, and limitations of one research phase prompt a critical refinement and re-orientation of a targeted aspect of the field under investigation.

Figure 12. Testing Lights at Walgett LALC Offices, Sept 2019

Building upon a pre-existing relationship with community and an emphasis on embedding the knowledge and opinions of local community members within the design process, the foundations of the participatory approach demand continuous consultation and engagement frameworks with community members to ensure buy-in and ongoing support.

Whilst currently inconclusive, the research seeks to provide insights into the interactions and entanglements between urban infrastructure and social formation in remote Aboriginal communities. With scope for value-add efficiencies such as training and ongoing maintenance for local community members, the implementation of solar street lighting in Namoi and Gingie, could go some way to helping reduce the disadvantages faced within Aboriginal communities.

While the immediate benefits of the project are attributed to lighting the communities of Namoi and Gingie, the transferability of the codesign methodology, the community-led implementation and technological findings has the potential to contribute not only for Gingie and Namoi, but also to various discrete Indigenous communities nationwide.

Figure 13. Setting Trial Light Positions in Gingie, Sept 2019

Endnotes

[1] A discrete Indigenous community refers to a geographic location, bounded by physical or cadastral (legal) boundaries, and inhabited or intended to be inhabited by predominantly Indigenous people, with housing or infrastructure that is either owned or managed on a community basis. https://meteor.aihw.gov.au/content/index.phtml/itemId/269732

[2] For more information see https://www.uts.edu.au/about/faculty-design-architecture-and-building/news/bridging-gap-walgett-where-design-and-community

[3] Commonwealth of Australia, 'Working Together to Close the Gap in Walgett', Remote Service Delivery Local Implementation Plan' (2010), 21

[4] Commonwealth of Australia, 'Working Together to Close the Gap in Walgett,' 21

[5] Bain Attwood and Andrew Markus, *The struggle for Aboriginal rights: A documentary history* (Crows Nest, N.S.W. Allen & Unwin, 1999).

[6] The Aborigines Welfare Act ended the system of reserves in 1969; this was followed by the establishment of the Aboriginal Lands Trust in 1973, which assumed the corporate ownership of all Aboriginal reserves for the benefit of Aboriginal people. In 1983, the Aboriginal Land Rights Act abolished The Aboriginal Lands Trust, and the reserves were transferred to the Minister for Aboriginal Affairs and from there to Aboriginal Land Councils.

[7] Namoi Community Member, extract from interview conducted 6/11/18

[8] ,Human Rights and Equal Opportunity Commission, *Close the gap: Indigenous health equality summit, statement of intent* (Canberra: Human Rights and Equal Opportunity Commission, 2008).

[9] Aboriginal and Torres Strait Islander Social Justice Commissioner, *Social justice report 2005* (Sydney: Human Rights & Equal Opportunity Commission, 2005).

[10] Council of Australian Governments, *National Indigenous reform agreement (closing the gap)* (Canberra: Council of Australian Governments, 2009). https://healthinfonet.ecu.edu.au/learn/health-system/closing-the-gap/

[11] Close the Gap Campaign Steering Committee, *A ten-year review: The Closing the Gap Strategy and Recommendations for Reset* (2018).

[12] Close the Gap Campaign Steering Committee, *A ten-year review,* 3

[13] Close the Gap Campaign Steering Committee, *A ten-year review,* 3

[14] Close the Gap Campaign Steering Committee, *A ten-year review,* 3

[15] Close the Gap Campaign Steering Committee, *A ten-year review,* 6

[16] C. Adams, T.L. Thompson, 'Introduction to Posthuman Inquiry', in *Researching a Posthuman World*, ed. [names], 7 (place of publication: Palgrave McMillan, 2016).

[17] Stuart Elden, *The Birth of Territory,* Chicago : University of Chicago Press, 2013, 16

[18] C. Adams, T.L. Thompson, 'Introduction to Posthuman Inquiry', 8.

[19] C. Adams, T.L. Thompson, 'Introduction to Posthuman Inquiry', 5

[20] C. Adams, T.L. Thompson, 'Introduction to Posthuman Inquiry', 5

[21] Donald Schön, *The Reflective Practitioner: How Professionals Think in Action* (Aldershot, England: Arena,1995).

[22] At the time of writing this paper, the researchers are in the process of requesting police and ambulance data for visitation and call out times to Namoi and Gingie Reserves.

[23] Gingie Community Member, extract from interview conducted 6/11/18

[24] Based on Walgett Climate Data from Australian Bureau of Meteorology http://www.bom.gov.au/climate/averages/tables/cw_052088_All.shtml

[25] As per International Electrotechnical Commission Standard 60529.

[26] Australian Standards AS1158.3.1 Pedestrian area (Category P) lighting—Performance and installation design requirements.

[27] AS1158.3.1. Pedestrian area (Category P) lighting—Performance and installation design requirements.

[28] Determined through photometric study on Dialux Evo Ver 8.1 Software.

[29] The tenderers have not been disclosed since the project procurement process is yet to be finalised.

[30] Stage 3: Implementation is scheduled for April 2020. Following the six-month trial phase, lighting will be selected and implemented within the two reserves. The implementation stage foregrounds employment opportunities for local community members that are yet to be determined.

[31] Stage 4: Post-Implementation Evaluation is scheduled for 2020-21. Following the implementation of the lighting, the final stage seeks to monitor and evaluate the impact of the lighting infrastructure on reducing crime, increasing wellbeing, and supporting ongoing employment opportunities for community members. Stage 4 will be carried out through a combination of semi-structured interviews and comparative analysis of data provided by emergency services pre- and post-lighting installation, as well as an inspection of the lights within one year after installation.