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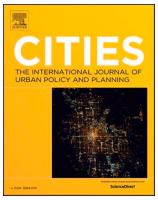

Urban greening for health and wellbeing in low-income communities: A baseline study in Melbourne, Australia

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ABSTRACT

Urban greening is a popular nature-led regeneration policy based on the assumption that provision of greenspace improves the health and wellbeing of proximate communities. Entangled within these objectives are environmental justice principles that seek to remedy historical and contemporary concerns related to contaminated areas of post-industrial cities. This paper draws upon findings from an evaluation study of an urban greening project in a socio-economically disadvantaged suburb with a history of toxic contamination. Our aim is to understand if better and more greenspace derives improved social outcomes over time. Central to this inquiry is an attention to resident perspectives of the environment before and after greening to understand if meeting expectations of regeneration and environmental justice impacts upon subjective wellbeing.

1. Introduction

There is a well-established evidence base dating back to the 1990s that links better health outcomes with direct contact with nature, demonstrating that frequent encounters can improve overall self-rated wellbeing for individuals and communities (Hartig et al., 1991; Kaplan, 1992, 1995; Kaplan & Kaplan, 1989; Leather et al., 1998; Authors; Parsons et al., 1998; Ulrich et al., 1991). Recent research has illuminated more nuanced understandings of the health benefits for individuals, including to mental health, showing decreased levels of anxiety, rumination and negative emotions (Bratman et al., 2015), increased perceptions of restoration (Marselle et al., 2016) and a sense of happiness and optimism as result of contact with nature (Sato et al., 2018). At the population level, the empirical basis associating nature contact with self-rated wellbeing and indicators, such as hospital presentation rates and instances of non-communicable disease, is also well defined (Russell et al., 2013); however, there is a growing recognition that opportunities to access nature vary widely across cities, meaning that benefits are not distributed evenly or equally (Astell-Burt et al., 2014a).

International research consistently raises concerns that there are significant demographic and geographical disparities in levels of access to urban nature – high-amenity and open greenspace – demonstrating that inequities in the distribution of greenspace disproportionately affects lower-income communities (Crawford et al., 2008; Kuo, 2001; Lee et al., 2016; Li & Liu, 2016; Authors; Vaughan et al., 2013). Areas with good access and closer proximity to greenspace have positive effects on the human populations that live there, producing relatively higher social, economic and health outcomes than areas with lower accessibly and proximity (Akpinar et al., 2016; Alcock et al., 2014; Groenewegen et al., 2006; Shanahan et al., 2015; Votsis, 2017). Conversely, areas with poorer access and provision of greenspace are more likely to have populations that are relatively disadvantaged across various socio-economic and public health measures (Dai, 2011; Hoffimann et al., 2017; Jennings et al., 2016; Li & Liu, 2016).

In non-western contexts, research that examines access to the natural environment, often focusses on the denial of resources and land that marginalised populations depend upon for economic and cultural means (Béné, 2003; Dikgang & Muchapondwa, 2016; López & Valdés, 2000; Posel & Rogan, 2009). In western contexts, research on access to nature tends to focus upon the health impacts of decreased physical activity and recreation on urban populations (Crawford et al., 2008; Giles-Corti et al., 2005; Authors), as well as emerging claims to environmental justice as result of social disparities in levels of access (Bhatia & Wernham, 2008; Boone et al., 2014; Claudio, 2007; Cole et al., 2017; Lowman et al., 2013; Authors). In this urban context, the benefits of nature have become correlated to access and provision, leading to the policy assumption that provision of greenspace alone will lead to better

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outcomes among residents. These assumptions advance interest among policy makers in policies that seek to address a lack of greenspace in lower-income areas of cities.

Recognising the benefits of contact with nature, urban greening transformations that include the creation of rooftop gardens, street verge revegetation, tree planting and the expansion of urban parkland have become popular urban regeneration strategies both globally and in Australia (Akers et al., 2019; Cooke, 2020). Policy makers anticipate that the regeneration of spaces that have fallen into patterns of disuse and/or have been environmentally degraded will result in better mental and physical health outcomes, as well as community cohesion and positive sociality (Coffey et al., 2020). Low amenity or neglected greenspaces that are regenerated by urban authorities, are also purported to significantly improve habitats for non-human animals (Authors; Threlfall et al., 2015) and mitigate local climate change effects such as urban heating (Ambrey et al., 2017; Bowler et al., 2010).

This urban greening policy paradigm is global (WHO, 2016) and exemplified in projects such as the European Union's *URBAN GreenUP* project, which aims to invoke a nature-centred urban planning shift "to mitigate the effects of climate change, improve air quality and water management and increase the sustainability of our cities" (URBAN GreenUP, 2020, n.p.). At a local level in Australia, the *Greening the West* (GTW) initiative advances such aims through increasing the quantity, quality and access to urban greenspaces in the western metropolitan region of Melbourne (Greening the West, 2013). This follows typical urban regeneration policies in contemporary cities that are targeted to socio-economically disadvantaged areas found to have poorer access to civic infrastructure and generally lower measures of health and wellbeing (Porter & Shaw, 2013; Ruming, 2018). Despite this policy discourse, there is a paucity of evidence supporting the notion that urban green-led regeneration of impoverished urban areas, has a marked upward effect on conventional indicators of social and health wellbeing for proximate residents.

While there are a number of studies that longitudinally examine access to greenspace on mental and physical health (Astell-Burt et al., 2014b; Cleary et al., 2019; Cohen-Cline et al., 2015; Feng & Astell-Burt, 2017), there are few studies that longitudinally examine health and wellbeing outcomes through greening-led urban regeneration (Tieges et al., 2020). Furthermore, there are no studies in Australia that evaluate the emplaced impacts of urban greening interventions on health and social outcomes for relatively disadvantaged populations, despite its policy popularity. Drawing on this gap, this paper reports on baseline findings of health and wellbeing in a community exposed to the regeneration and naturalisation of a degraded environment and urban greening intervention. We aim to test the policy assumption that the provision of higher-amenity greenspaces in lower disadvantaged communities correlates with higher levels of self-reported wellbeing, particularly in relation to health and wellbeing indicators and area level disadvantage. To do this, we use qualitative interviews and a quantitative survey to demonstrate the relationship between perceived conditions of the environment and self-evaluations of personal health and the local environment, with the intention to re-measure these results after the transformation has taken place.

2. Urban greening transformation context

2.1. Study site

The study site is a section of the Upper Stony Creek in the suburb of Sunshine North, 13 km west of the Melbourne Central Business District. There has traditionally been a deficit of high amenity and accessible greenspace in the suburb. Only 35% of residents live within 400 m of large public open space that is greater than 1.5 ha (Australian Urban Observatory, 2020). Two of the major areas of greenspace in the suburb are a 5.7 ha area of informal and unmaintained space that contains a concrete drainage tribune along Stony Creek and Lloyd Reserve (Fig. 1), and 1.8 ha of public open space with a sports field and a small playground managed by the local municipality.

2.2. Community context and socioeconomic disadvantage

Sunshine North is relatively disadvantaged when compared to Melbourne, Victorian and Australian indicators. The Australian Bureau of Statistics produces a Socio-Economic Indexes for Areas (SEIFA) which ranks statistical geographies according to their advantage or disadvantage relative to all other statistical geographies (ABS, 2016a). The statistical geography of Sunshine North (SA2) represents approximately 12,000 residents and the area has a SEIFA Index of Relative Disadvantage ranked in the lowest 4% of SA2 areas across Victoria and in the lowest 8% across Australia. Consequently, these results indicate that the area has very high levels of socio-economic disadvantage (ABS, 2016b).

The western metropolitan region of Melbourne is generally more culturally and linguistically diverse than the average, and in Sunshine North, members of the Vietnamese and Chinese community make up a high proportion of the population (ABS, 2016a). In 2016, 30.8% of the population reported being of Vietnamese ancestry, 9.4% Chinese and 78.5% of persons had two parents that were not born in Australia, informally indicating a very high concentration of first-generation migrants (ABS, 2016a). Approximately 75% of households spoke languages other than English and an overrepresented (over double the

Fig. 1. Upper Stony Creek site before transformation, January 2020.
Source: Authors.

metropolitan rate) 30% of the population did not have an education beyond year 9 (of 12) or middle high school (ABS, 2016a).

The municipality also has consistently high levels of gambling expenditure on electronic gaming machines when compared to all municipalities across Victoria. In the decade to 2020, over $140m was lost annually by residents to gaming machines in the City of Brimbank, on average over $150k was lost to each individual machine in the area during 2018/19 (VCGLR, 2020a). Brimbank had the second highest electronic gaming machine expenditure per capita in Victoria during 2019, at $840 per adult (VCGLR, 2020b). Gambling expenditure is a strong indicator for community harm (Rintoul et al., 2013) and it has been found that licenses for new electronic gaming machines in Australia are disproportionately granted in low socio-economic areas (Francis et al., 2017).

2.3. Urban greening transformation and environmental justice

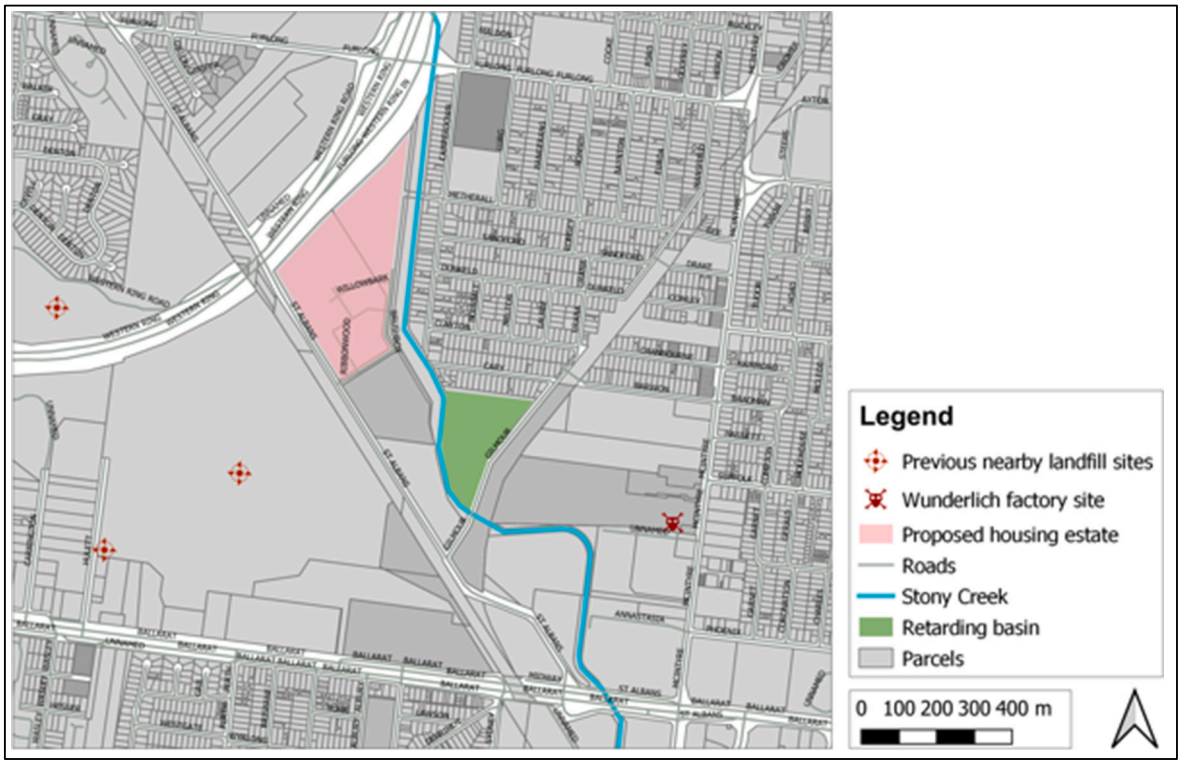
Since the 1920s the greenspace surrounding the study site has been used for informal recreation by nearby residents. Historically, the site has been surrounded by industrial factories and development, and local factories adjacent to the site used the area as dumping ground for various industrial waste up until the 1980s (Millar & Schneiders, 2016). The former Wunderlich Asbestos Factory was located adjacent to the Upper Stony Creek drainage basin (see Map 1). Toxic waste from its operations was discarded in the area surrounding the creek and anecdotal narratives of harmful human-asbestos interactions have occurred for a number of decades (Ackland, 2014).

The site is currently listed on the Priority Sites Register of the EPA (Ackland, 2014). Priority sites are legislatively defined as sites that the EPA has officially issued with a Clean Up Notice. They are typically sites where the accumulation of pollutants "presents a potential risk to human health or to the environment" (EPA Vic, 2020). Consequently, they are deemed as sites that are "not compatible with the current or approved use of the site without active management to reduce the risk to human health and the environment" (EPA Vic, 2020). Since 2014, a number of cases of death and ill-health have emerged, although the total number of people affected in the local area is currently unknown and will be for some time due to the protracted nature of the asbestos-related disease development over 50+ years (Lamperd & Hore, 2014).

In 2014, based on an investigation by a major newspaper, "16 people were known to have died and eight had fallen ill from mesothelioma, lung cancer and asbestosis simply from living near the Wunderlich factory" (Lamperd & Hore, 2014), another eight were known to be sick (Lamperd, 2014). There were another 17 possible deaths and seven further people sick as a result of exposure to the deadly asbestos fibres (Lamperd & Hore, 2014). The newspaper subsequently reported that "asbestos lawyer[s] said the firm had received a steady stream of inquiries from concerned residents about the legacy of the factory" (Lamperd & Hore, 2014). In 2014, the Chief Health Officer of Victoria opened an investigation into the purported presence of a cancer cluster in the area. Although no findings have been reported, the investigation has not been formally concluded and legal action by residents is ongoing (Ackland, 2014).

In the context of apparent environmental pollution in Sunshine North, as well as wider geographical contexts of socio-economic disadvantage and lack of high amenity greenspace in the metropolitan west of Melbourne, urban greening has emerged as a policy remedy in recent years. Initiated in 2016, the Upper Stony Creek Transformation Project (USCTP) aimed to transform a 1.2 km section of an unmaintained urban concrete drainage channel to a natural, revegetated creek (Melbourne Water, 2020). Surrounded by wetlands that harvest stormwater runoff to use in a parkland irrigation system, the project is anticipated to provide a community park and three kilometres of walking and riding trails.

The project is led by a diverse partnership of government and non-government agencies, including Brimbank City Council, City West Water, Melbourne Water, Development Victoria, the Victorian Government Department of Environment, Land, Water and Planning, and Greenfleet Australia. The outcomes sought were to improve residents'



Map 1. Transformation project site.
Source: Authors.

health and wellbeing through better greenspace provision as well as to increase local biodiversity. Various policy makers attribute the initiation of the project to the advocacy of GTW, particularly in the planting of trees in the six metropolitan local government areas (LGA) in Melbourne's west. The overall aim of GTW is 'to enable sustainable, liveable, healthy communities through urban greening' (Greening the West, 2013 p. 2). GTW endorse and support a number of urban greening projects, including the Upper Stony Creek Transformation Project, in order to improve quality and functionality of greenspace; increase the use and interaction of residents in greenspace; improve environmental quality; and maximise sustainable water supplies to establish and maintain greenspace.

Despite there being no explicit mention of environmental justice, or simply *justice*, in any of the associated policy documentation related to the USCTP, or indeed the strategic planning documentation related to GTW, it can be argued that the stated goals of GTW align with environmental justice considerations. Traditionally, environmental justice research has focussed upon the burdens that accumulate in populations that live in proximity to landfills, polluting industries and natural or unnatural hazards in the environment (Jennings et al., 2012). Only recently has this body of research begun to expand its purview to investigate issues of access and use of urban greenspaces, although this is predominantly framed as a distributional justice issue (Boone et al., 2014; Xing et al., 2020). Urban greening as a technical policy revision of urban greenspaces, particularly dilapidated land and waterways, has been scrutinised for its apparent lack of engagement with environmental justice considerations (Dooling, 2009; McKendry, 2017; Smardon et al., 2018; Verheij & Corrêa Nunes, 2020). Upon the collection of post-transformation data, this study will utilise the baseline data presented in the sections that follow to evaluate whether or not environmental justice goals have been realised for this population, as evidenced by any improvements to health and wellbeing outcomes post-transformation. The pre-transformation data comprised of interview and survey responses provide a valuable snapshot of resident perspectives on and relationship with their local environment, further contextualised by neighbourhood, demographic characteristics, and regional and national comparisons.

3. Methods and research design

A multidisciplinary research team including the authors conceived a longitudinal social and ecological study protocol for the site before transformation began. The research was designed over approximately 18 months with key input from USCTP partners to tailor and focus the study to their evidence needs. Overall, the research aimed to determine the impact of the transformation on the health and wellbeing of residents and to understand biodiversity changes in the area over time (see Authors). Another key aim was to understand and document the interactions between people and nature at the sites, and how these changed over time with the greening transformation (see Authors).

The research was phased using a pre- and post-greening design, drawing on ecological observation, qualitative interviews and quantitative survey based social research methodologies with each method described in detail below. This paper does not report on the ecological aspects of this research. Pre-greening data were collected from October 2016 until July 2017 and presented in this paper. Post-greening data collection following transformation of the creek are expected to be collected within two years of the USCTP project completion in 2020.

3.1. Interviews with residents

A maximum of fifty (50) in-person interviews were planned with residents living within close proximity (1 km) to the Upper Stony Creek intervention site. Residents were initially recruited using flyers delivered to their mailboxes, with participation requiring a Sunshine North residential address and a minimum of 18 years of age. In total, twenty interviews (20) with 23 participants were conducted with respondents. The interviews were primarily conducted in residents' homes using a semi-structured format to allow for a more informal, conversational tone. At the beginning of the interview participants were asked to complete a brief demographic questionnaire. Residents were also asked if they agreed to be interviewed again in a follow-up interview post-greening when the creek transformation had been completed. Interview data were transcribed and transferred to qualitative analysis (NVivo) software for analysis based on the aims stated above.

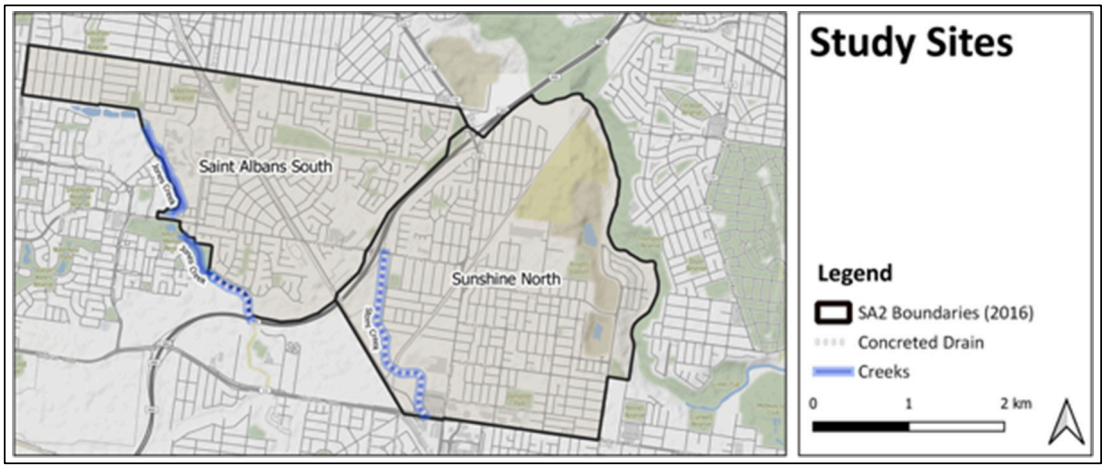
3.2. Geolocated social surveys of resident health and wellbeing

The findings from the qualitative interviews were used to inform the design of a broader social survey of residents in two locations: residents living in Sunshine North surrounding the Upper Stony creek transformation site; and residents living in a nearby comparison neighbourhood of St Albans South. The aim of the social survey was to measure social, physical and mental health in residents before the urban greening transformation began. The survey collected baseline information on multiple site use (and other outdoor spaces including residents' backyards), public open spaces used in the area, the local neighbourhood environment, physical activity, depression, stress and anxiety, subjective well-being, and connection to nature. Survey design was informed by a separate investigation into a playground upgrade that occurred within the same municipality but approximately 10 km away (Veitch et al., 2018). The survey was also designed to provide scope for recontact of participants over several years post-greening to measure changes over time and allow comparisons across and between sites.

The St Albans South control site was used to compare the findings with a natural experiment provided in the Sunshine North Stony Creek transformation site. To quantitatively detect social impacts, St Albans South (located to the north of the site) was used as a comparison site with comparable socio-demographic characteristics according to the Australian Bureau of Statistics Census data. St Albans South residents lived within close proximity of Jones Creek which was unnaturalised and concreted in the southern areas, with a major arterial highway separating Sunshine North and St Albans South (see Map 2). It is important to note that Jones Creek was concreted in the southern areas of the neighbourhood and in a more natural state in the northern area of the suburb. Residents living within 5 km of Upper Stony Creek or Jones Creek were geographically identified using the Geocoded National Address File (GNAF) and invited to participate in the survey.

Survey administration was conducted at Sunshine North and St Albans South between March and May 2017. Potential samples of 2500 residents aged over 18 years of age and living within 5 km of the sites were mailed contact letters inviting them to complete a postal survey or online survey. The survey and approach letters were also translated into Vietnamese with Census data revealing that 30% of residents spoke Vietnamese at home. Reminder calls were made to encourage participation in the survey and translation services were made available during these calls if residents did not speak English at home. Participants were selected and recruited from the City of Brimbank Local Government Area using the GNAF to target residents living within a 5 km radius of the Stony Creek transformation site in Sunshine North and the comparison site in St Albans South. Before analysis, data were geocoded for residential address and distance to Stony Creek (Sunshine North) or Jones Creek (St Albans South) to investigate proximity to the creeks and associations between the built environment that might influence health outcomes.

Demography-weighted population estimates accounting for age, gender, education and household structure were made based on the sample weighted percentages or means and group differences by SA2 region neighbourhood, accompanied by 95% confidence intervals (95% CI). Survey analyses were undertaken using Stata/SE 14 (StataCorp, 2015). Sample weights were employed using Stata's survey design commands with SA2 region strata, using a finite population correction of



Map 2. Study and control sites.

5299 households for St Albans South and 3640 households for Sunshine North (as per Table 1).

4. Results

Pre-greening social baseline data were collected to assess the impact of greening, waterway restoration and interactions with nature on resident health and wellbeing. This section reports on the thematic findings of the interviews and the survey data. Interview data are presented first, as these data were analysed for the purpose of informing the design of the qualitative survey. Themes, sentiments and concerns derived from these interviews were analysed using NVivo 12 software.

Themes that emerged in the interview data were reinforced by responses to the survey. Negative perceptions of usage were identified in the interviews and four main factors were established as key determinants of usage, these include maintenance, rubbish, accessibility and safety. These factors relate to both the environment – in its apparent degree of upkeep – and the relative health of people, which is influenced by personal evaluations of being physically able to access the greenspace and feelings of being unsafe or insecure. The results presented below are representative samples of the complete data sets, portraying how perceptions of the environment influence recreational and civic use (in the interview data) and how recreational and civic activity influences self-appraisals of health and wellbeing (in the survey data). The data presented below does not simply repeat themes but demonstrates how the perceived and actual conditions of 1) personal health and 2) provision of high-amenity greenspace, raise a series of questions that will be addressed in further longitudinal study.

4.1. Interviews

The response rate for interviews was 4% (23 participants). Interviews were 45 min in length on average and addressed residents' use of the Upper Stony Creek and their perceptions and experiences of other local greenspaces. Study participants included 12 men and 11 women with 10 having a university degree. Participants had lived in the area on average for 20 of years and therefore had a good knowledge of greenspaces in their area. Table 1 shows the participants' age groups. A majority of participants had an Australian or European cultural background and seven were able to speak a language other than English.

Table 1
Interview participants, age group.

Age groups	Number of participants
25–34 years old	2
35–44 years old	7
45–54 years old	7
55–64 years old	3
65–74 years old	2
75 years plus	2

4.1.1. Perceptions of Upper Stony Creek

> *It's just a bit of concrete. A slab of concrete several hundred metres long. I mean, to me that's urban rubbish.*
>
> (P3)

General concerns with the neighbourhood included an overall lack of pride expressed by participants, with names such as “Scumshine” and “Junky's Galore” used in place of the official Sunshine North designation. Unattractiveness was ascribed to the heavy industrial surrounds and numerous unmaintained informal greenspaces. Housing affordability was given as a primary reason for residents' choosing Sunshine North to buy or rent, and there were strong narratives of community connection and interactions with neighbours. However, there were also instances of crime, burglary, drug dealing and use, and antisocial activities highlighted, as well as concerns about air pollution and toxicity associated with chemical factories nearby and the lack of walking and cycling infrastructure.

In relation to greenspace in the area, the majority view of interviewed residents was that Sunshine North has a deficit of useable greenspace. Resident interviews revealed a lack of facilities and amenities for diverse age groups, and for the greenspaces that do exist there was an overemphasis on organised sports that inhibits other diverse recreation uses. As such, interview participants were more likely to utilise greenspaces outside of Sunshine North, travelling by car to more established parkland, rivers and gardens.

Overall perceptions of residents to the Upper Stony Creek site were negative. A majority of participants ($n = 19$) commented on undesirable features of the site in more than 100 instances coded in NVivo. Whereas less than half the participants commented on the positive and desirable attributes of the site in only 16 instances. Residents were asked to indicate whether they categorised the study site as parkland. A minority ($n = 3$) reported that they designate the greenspace as a park while others felt the area lacks the necessary features of greenspaces such as trees and benches,

> *Now I wouldn't call it a park. But with lots more trees, with benches, with maybe somewhere where you can park the car instead of on the street, if there was maybe a little playground, then yes, I would call it a park.*
>
> (P1)

The concrete channel has led several residents to misjudge the creek for rudimentary and banal infrastructure rather than a natural waterway,

> *Well to be honest with you I didn't even know it was an actual proper creek until we got all the maps and bits and pieces, because there was never any signs anywhere and I just thought it was a channel to divert excess water, rain water from the housing area and from the freeway and from the roads.*

(P1)

Participants were asked about the popular names in the neighbourhood for the creek and the nearby open space area. The sentiment of names reinforced that overall perceptions of the site were negative. Most names associated with the creek – 'Stony Creek drain', 'drains', 'concrete channel', 'urban rubbish', and the culvert – and the adjacent open space area ('paddock', 'flood basin' and 'the big hole') do not convey positive feelings towards the area. Drain was the most popular name ($n = 13$) among the participants,

> *I didn't even know it was called the Stony Creek, I just thought it was a drain. I never walked along the drain, I'd never had anything to do with the drain. It's just a plain, old, ugly drain.*

(P2)

4.1.2. Predominant themes

Four dominant themes in the interview data emerged from the apparent unpopular perception of the Upper Stony Creek area, and include the absence of maintenance, rubbish, accessibility and safety. The aesthetic unattractiveness of the site, vacancy, industrial pollution and lack of walkability were among the associated themes in regard to the site's unpopularity. Poor maintenance was the most commonly invoked reason residents gave for their lack of interest in using the site ($n = 11$). This mainly referred to the lack of frequent lawn mowing and grass cutting,

> *We don't go there anymore because of the weed problem and there's no pathway, really, once you get to that zone. It's deserted. There's no one really that maintains the area.*

(P4)

Poor maintenance was associated with a sense of unsafety, primarily around the presence of physical obstacles such as building debris and natural hazards such as venomous snakes. Participants referred to the area as not being safe for dogs as well as themselves,

> *If they cut the grass a bit more often, it will be a bit more friendly for usage. Up until recently, the grass was a bit high, so it wasn't possible to go there because of potential snakes.*

(P5)

Following poor maintenance, antisocial behavior such as rubbish dumping at the site and along the adjacent street was a main concern about the use of the open space. Residents frequently spoke of rubbish being dumped in the edges of the informal greenspace ($n = 10$),

> *It's called the 'dumping area', because everyone dumps their rubbish here. Everyone. I've seen countless amounts of rubbish dumped here.*

(P6)

The majority of those who interviewed perceived the neighbourhood as being unsafe and the crime rates as constantly rising ($n = 18$). Additionally, eight participants spoke of their perceptions of unsafety walking in the informal greenspace and the adjacent area. Natural hazards (such as snakes) and crimes such as drug deals and use were among the main concerns regarding safety,

> *You only have to come out night-time – there's no houses there, of course – and you'll see a car parked here and there. And, you know,* [*it's*] *all about drugs.*

(P7)

Residents also expressed concern that even after the greening transformation lack of safety may discourage residents to use the area, arguing the need for an intervention design without dark or hiding spots. Another reported problem was the access to the space. While the open area adjacent to the creek is publicly accessible, the creek itself is fenced off from the residential area,

> *I don't like taking* [*my daughter*] *down there as well. I've gotta go through the fence and she goes, 'Oh you can't go in there, it's a fenced off area', I said 'It's public land to me'. … if there's a fence there, and there's a hole in it, it means someone's cut the hole purposefully for doing something wrong. You know what I mean? She doesn't like doing the wrong thing.*

(P8)

The fences are frequently dismantled and taken apart by residents and locals who use the creek for various reasons such as dog walking or taking a shortcut to the train station. Another common view among residents was that the area is not attractive, inviting or people-friendly ($n = 8$),

> *Because even though we walk around there, there's not a great deal of anything to look at. It's pretty boring, pretty, you know, plain.*

(P9)

Perceptions of unattractiveness extended to the surrounding area beyond the transformation site, with some residents perceiving it as being industrial and unappealing ($n = 3$). Five participants ($n = 5$) alluded to notions of nothingness and vacancy, yet opinions differed as to whether this vacancy is considered as negative, such as encouraging litter dumping, or positive, such as presenting an opportunity for future development. As one interviewee put it, "people think no one cares about this stretch of road, so I might as well dump the rubbish 'cause it's a nothing area." (P10).

Some participants expressed concerns about different types of pollutions (sound, air, water and environmental pollution) associated with the site. Others ($n = 5$) explicitly referred to factories in the surrounding area as the source of pollution,

> *I don't know if there's the pollution smell from this one* [*referring the factory adjacent to the site*]*, but you smell something coming. Depending on the day you have an odour, and that's usually stronger during the evening.*

(P11)

Another reported problem was the lack of walking paths on the site. A few participants were particularly critical of the area getting wet and soggy ($n = 4$). In one case, a participant thought that the addition of wide walking paths to the site will minimise the risk of natural hazards such as snakes, since they are more easily detectable on hard, open surfaces,

> *If you're going to create the native area, you've got to be ready to expect maybe the snake or the lizards, yeah?… I wouldn't be out there trying to get rid of them because it's a part of this area. But on the paths … Shouldn't be like a normal footpath. It should be a little bit wider so if a snake or something is on the side, you're not going to step on top of it.*

(P12)

4.2. Survey

The survey had a response rate of 13%, with 332 respondents across both Sunshine North and St Albans South and 157 fully completed surveys in each location. Demographic characteristics of respondents were similar for the two neighbouring SA2 regions, and well matched to the socio-demographic characteristics of the selected areas (see Table 2), with the exception of language and ancestry (discussed in limitations). Respondents had an overall mean age of 52.5 years (standard deviation, SD 18.2), and an average time spent in neighbourhood of 23.0 years (SD 17.0).

4.2.1. Health, physical activity and civic engagement

Fewer residents of Sunshine North and St Albans South were estimated to rate their health as excellent or very good when compared to the national average (Table 3) and this trend continued across a range of health outcomes. Residents of both areas were estimated to have lower levels of Subjective Wellbeing, life satisfaction and higher rates of depression. However, residents were estimated to have higher levels of activity with fewer hours of sedentary behavior when compared to national and municipal averages, based on the socio-demographic characteristic-weighted survey responses. There were no statistically significant differences between Sunshine North and St Albans South residents on any of the key health outcomes variables presented in Table 3 or the attitudes to neighbourhood parks presented in Table 4.

4.2.2. Parks and associated activities

Fewer respondents from Sunshine North were satisfied with the quality of their local parks compared to those of St Albans South ($n = 72$, 46%, compared with $n = 90$, 55% respectively; see dataset https://doi.org/10.7910/DVN/UNQIR5 for full unweighted statistics). However, after accounting for sociodemographic characteristics there was no clear evidence for population difference in attitudes, nor direction of sentiment (i.e. approximately 50% agreement estimated for both suburbs' households). More respondents from St Albans South were concerned about gangs and reckless drivers in parks, however the differences were not of sufficient magnitude to provide evidence of a clear difference in perceptions of households in the two neighbourhoods. Also reflected in interviews, respondents were particularly concerned with drug and alcohol use in parks and rubbish being dumped (Table 4).

More than 60% of respondents from each SA2 reported visiting parks in the last 3 months, and 35% reported visiting in the previous week (see dataset https://doi.org/10.7910/DVN/UNQIR5). Only 31% of Sunshine North households were estimated to be located within 5-minute walk of their nearest park compared to 47% of residents living in St Albans South. Only three participants from Sunshine North (1.8%) reported that the Upper Stony Creek transformation site was their most visited local park and as the interviews revealed, the space was commonly referred to as “the drain” by residents surrounding the area.

5. Discussion

Interview and survey findings demonstrate that the greenspace surrounding the transformation site has been underutilised by residents. Perceptions of the space around maintenance, rubbish, accessibility and safety were deeply engrained. Along with the aesthetic unattractiveness, vacancy, industrial pollution and lack of walkability, the overly negative appraisals suggest that perceptions of the site impacted residents' willingness to use it. Residents reported that they did not frequently use any greenspace in their immediate neighbourhood. This is supported by the results of the survey data, which showed that only 35% of respondents felt they have many opportunities to be physically active in their neighbourhood.

Fewer survey respondents reported their health to be excellent or very good in Sunshine North and St Albans South when compared to the Victorian state average. The 2015 Victorian Population Health Survey found that 47% of Victorians reported their health to be excellent or very good, while much smaller proportions are noted in both Sunshine North (29%) and the comparison site in St Albans South (34%). Consistent with this finding, Subjective Wellbeing results for the two populations

Table 2
Sample demographics.

Variable	St Albans South		Sunshine North		Total	
	n	%, or *mean* (*sd*)	*n*	%, or *mean* (*sd*)	*n*	%, or *mean* (*sd*)
Respondents	169	100.0	163	100.0	332	100.0
Survey completion						
Full	157	92.9	157	96.3	314	94.6
Partial	12	7.1	6	3.7	18	5.4
Gender						
Male	65	38.5	78	47.9	143	43.1
Female	91	53.8	76	46.6	167	50.3
Other	1	0.6	2	1.2	3	0.9
Missing	12	7.1	7	4.3	19	5.7
Age (years)	146	52.52 (18.11)	151	52.53 (18.34)	297	52.53 (18.20)
<35	31	18.3	29	17.8	60	18.1
36 to 48	28	16.6	33	20.2	61	18.4
49 to 59	28	16.6	35	21.5	63	19.0
60 to 69	32	18.9	25	15.3	57	17.2
70 to 92	27	16.0	29	17.8	56	16.9
Missing	23	13.6	12	7.4	35	10.5
Years in neighbourhood	154	22.79 (15.97)	156	23.29 (18.01)	310	23.04 (17.00)
Highest level of education attained						
Some primary school	2	1.2	10	6.1	12	3.6
Completed primary school	4	2.4	3	1.8	7	2.1
Some high school	30	17.8	25	15.3	55	16.6
Completed high school (year 12)	31	18.3	32	19.6	63	19.0
TAFE or Trade Certificate or Diploma	36	21.3	32	19.6	68	20.5
Tertiary	46	27.2	50	30.7	96	28.9
Other	2	1.2	0	0.0	2	0.6
missing	18	10.7	11	6.7	29	8.7
Weight (kg)	147	74.71 (18.87)	142	73.33 (18.05)	289	74.03 (18.45)
Height (m)	145	1.65 (0.12)	142	1.66 (0.13)	287	1.66 (0.13)
Adults (18+) in household	152	2.16 (1.05)	152	2.45 (1.20)	304	2.31 (1.13)
1 adult	43	25.4	32	19.6	75	22.6
2 adults	64	37.9	60	36.8	124	37.3
3 or more adults	45	26.6	60	36.8	105	31.6
Missing	17	10.1	11	6.7	28	8.4
Children (0 to 15) in household	151	0.48 (0.95)	153	0.59 (1.08)	304	0.54 (1.02)
0 children	110	65.1	110	67.5	220	66.3
1 child	20	11.8	11	6.7	31	9.3
2 children	13	7.7	22	13.5	35	10.5
3 or more children	8	4.7	10	6.1	18	5.4
Missing	18	10.7	10	6.1	28	8.4
Relationship status						
Married	75	44.4	81	49.7	156	47.0
Divorced	16	9.5	7	4.3	23	6.9
De facto	9	5.3	11	6.7	20	6.0
Single, never married	38	22.5	38	23.3	76	22.9
Separated, not divorced	4	2.4	1	0.6	5	1.5
Widowed	14	8.3	17	10.4	31	9.3
Missing	13	7.7	8	4.9	21	6.3
Access to a private motor vehicle						
No	26	15.4	29	17.8	55	16.6
Yes	113	66.9	108	66.3	221	66.6
Missing	30	17.8	26	16.0	56	16.9

Table 3
Estimates of key health outcome variables for households of St Albans South and Sunshine North.

	St Albans South[a]	Sunshine North[a]	Brimbank (LGA)	Victoria (State)
	% or mean (95% CI)	% or mean (95% CI)	% or mean (95% CI)	% or mean (95% CI)
Self-reported health				
% excellent or very good	38.4 (27.6,49.2)	27.2 (17.7, 36.7)		56.4[c]
Subjective wellbeing (mean)	65.7 (61.8, 69.6)	66.5 (62.8, 70.2)	74.1[b]	77.3[b]
Satisfaction with life as a whole (mean)	7.5 (7.1, 7.9)	6.9 (6.4, 7.5)	7.6[b]	7.8[b]
Overweight or obese				
% overweight	25.4 (18.0, 34.6)	28.1 (20.7, 36.8)	28.5[b]	35.6[c]
% obese	22.0 (15.5, 30.4)	10.8 (6.3, 18.0)	19.6[b]	31.3[c]
Physical activity				
% adequate moderate	18.1 (11.0, 28.4)	18.1 (12.1, 26.1)		24.1[d]
% adequate vigorous	19.6 (13.5, 27.7)	23.7 (15.9, 33.7)		14.3[d]
% did not meet requirements	Not calculated	Not calculated		84.6[c]
Time spent sitting on a usual workday (hours)	4.13 (3.21, 5.06)	3.58 (2.77, 4.39)	4.2[b]	4.5[b]
Depression				
% depressed (CESD-10)	40.5 (31.4, 50.3)	40.6 (31.5, 50.4)		

[a] Stony Creek population weighted survey result (based on age, gender, education and household structure).
[b] VicHealth Indicators Survey 2015.
[c] ABS National Health Survey 2017–18.
[d] ABS National Health Survey 2014–15.

Table 4
Estimates of attitudes to neighbourhood parks for St Albans South and Sunshine North households.

	% agree or strongly agree (95% CI)	
	St Albans South	Sunshine North
Satisfied with quality of parks in neighbourhood	51.7 (41.7, 61.7)	52.1 (42.0, 62.2)
Neighbourhood parks are used by many people	68.4 (58.6, 78.2)	57.2 (46.8, 67.5)
Neighbourhood parks are attractive	46.5 (36.6, 56.4)	48.1 (37.8, 58.5)
Neighbourhood parks are safe	46.6 (36.1, 57.1)	44.4 (33.6, 55.2)
Neighbourhood parks are well maintained	47.1 (36.9, 57.3)	50.2 (39.8, 60.6)
Concern about the presence of gangs or 'hoons' in parks	63.1 (53.3, 73.0)	52.7 (42.3, 63.1)
Concern about drug and alcohol use in parks	64.1 (53.9, 74.3)	64.7 (54.3, 75.1)
Concern about rubbish being dumped in parks in my neighbourhood	74.9 (65.9, 84.0)	66.4 (55.8, 76.9)
Concern about graffiti/vandalism in parks	62.2 (52.2, 72.2)	57.4 (47.5, 67.4)

are also lower than expected. The Australian average for Subjective Wellbeing is consistently found to be around 75-76 out of a total possible score of 100 making the results overall for both Sunshine North and St Albans South, considerably lower than national and Victorian averages, albeit with considerable variation among respondents (mean 66.3, standard deviation 20).

Residents living in Sunshine North had poorer overall health outcomes than the Victorian and Australian average. Residents also have relatively poorer access to and provision of high-amenity greenspace than other metropolitan areas, and the informal greenspace that was set to be transformed was perceived negatively. Objectively, there was poorer health and access to greenspace; subjectively, there was a negative self-evaluation of both health and the greenspace pre-transformation.

Given that the transformation site also has a history of toxic contamination that has a contemporary legacy which has resulted in ill-health, it is also important to consider if the effect of living in contaminated landscapes has any bearing on self-appraisals of health and wellbeing, as well as a willingness to occupy those landscapes. In the interviews, negative perceptions of the site were at times attributed to pollution and contamination, and these perceptions may be difficult to overcome post-transformation. Jones et al. (2009) demonstrate that in deprived areas where residents live close to greenspace, perceptions of access impacted the desire to use spaces more so than real proximity. It should be considered how perceptions of environmental injustice may linger, and therefore impact usage, despite the urban greening transformation addressing issues related to the distribution of greenspace and providing more opportunities for contact with nature.

This is particularly important to consider given that this urban greening transformation project experienced significant sets backs during implementation. In mid-2019, the project was suspended due to the discovery of significantly more asbestos contamination than what was anticipated. During this period, a campaign led by Brimbank City Council to reignite the project gained support from members of the community, who were concerned that the project would be abandoned. After months of the site laying idle, Brimbank City Council made a public plea to state politicians, arguing "don't let this become an example of environmental injustice in the West" (Brimbank City Council, 2019). The project recommenced with a reduced budget and major aspects such as the removal of the concrete channel containing the creek were unable to be implemented. With the benefit of the baseline data reported in this paper, post-transformation research will need to contemplate if the environmental justice alluded to at the inception of the project were realised in the context of a scaled-back project, and if this has any bearing on residents' perceptions of the space and self-evaluated wellbeing.

While provision of and proximity to greenspace has been shown to correlate to better mental health treatment in urban areas (Nutsford et al., 2013), and promote physical activity and public health generally (Wolch et al., 2014), the direct benefits require longitudinal investigation. It is yet unclear whether low-income communities with negative perceptions of their environment and wellbeing, actually experience better health outcomes as result of urban greening transformation. Ambrey et al. (2017), for instance, have shown that residents of lower socio-economic areas are less likely to be encouraging of projects that promote greening than higher-income groups, and can be less likely to perceive the benefits of contact with nature. The perceptions of greenspaces among residents has also been found to impact the actual usage of greenspace and the subsequent attainment of health benefits (Kothencz et al., 2017).

Only 44% of Sunshine North residents were satisfied with their local parks and the transformation site was reported as the most visited park by less than 2% of residents. Negative perceptions of the physical environment are justified by the actual historical usage, which is averse to good health, and the contemporary lack of attention that the site has received by policy makers. Urban greening transformations explicitly aim to address these problems, and explicitly link the provision of greenspace to community health,

> A core driver for *Greening the West* is improving community health. Victorian Department of Health data suggest that, from a health

perspective, the people of the west are disadvantaged. The department recognises the provisioning of quality green space that allows for passive and active recreation as a critical strategy to tackle health conditions such as obesity, diabetes, heat stress and the deleterious effects of air pollution.

(Greening the West, 2020 p. 7)

Environmental justice is not explicitly mentioned within the urban greening policy context examined here, yet it is nevertheless an implicit concern related to providing better environments for disadvantaged communities that live in proximity to currently degraded nature spaces. The Upper Stony Creek transformation is nearing completion (Fig. 2) and further study is needed to re-test the baseline indicators presented in this paper to ascertain whether this urban greening policy has coincided with marked improvement, perceived or otherwise, in the health and wellbeing of residents.

With the benefit of data collected post-transformation, a key question guiding the overall evaluation study will answer whether the policy assumption that provision of greenspace leads to better population health and wellbeing outcomes is accurate, or if the space is 'just greener' as other research has suggested (Kabisch & Haase, 2014; Tozer et al., 2020; Wolch et al., 2014). Future research will also attend to whether the transformation constitutes a form of environmental justice that improves not only the natural environment, but also residents' perceptions of the space, self-evaluations of health and wellbeing, and objective improvement in population health.

5.1. Limitations

This study has several limitations. Although interview recruitment occurred via flyers delivered to mailboxes of 600 houses in proximity of Upper Stony Creek (distributed weekly for a month), handed out incidentally to residents walking in the area, and a snowball method, participants did not accurately represent the cultural and linguistic diversity of the area. The flyers were only distributed in English as it was assumed at least one household member would have sufficient English language skills to understand the content.

Despite translation of the survey approach letters into Vietnamese, survey participation rates were also low, resulting in small sample sizes in both Sunshine North and St Albans. Survey methodology also relied on the use of the Geocoded National Address File (GNAF) to identify location-based addresses of participants living within 5 km of the Stony Creek Transformation site in Sunshine North and the concreted, unnaturalised section of Jones Creek in St Albans South. GNAF was only made available in 2016 as an open data set and errors were later detected in the use of the data set for survey administration purposes. This is because GNAF relied on submission of land title changes and other administrative data which was not always consistent with people living at residential addresses. For example, subdivisions of residential blocks may have been processed creating new address locations, but houses might not have been built yet and residents might not be located on these addresses. This is likely to have influenced contact and participation rates in the survey, particularly in areas of experiencing densification and infill development including the neighbourhoods surveyed. Reduced participation rates from culturally and linguistically diverse areas also limit the survey results, similar to the interviews. However, weighting was applied to survey results to account for these differences.

Another limitation for post-transformation study is the impact of Covid-19 pandemic on residents' use of greenspaces. Working from home arrangements which may partially continue beyond the pandemic can impact use of local greenspaces and must be accounted for in the post-transformation study.

6. Conclusion

The acknowledgement by researchers and policy makers that contact with nature can have a positive impact on individual and community wellbeing has resulted in sustained attention to developing greening interventions which increase access to high-amenity greenspace, particularly in disadvantaged urban areas. It is anticipated that through urban greening, the regeneration of environmentally degraded spaces can catalyse better mental and physical health outcomes for nearby populations. Whist some studies provide longitudinal insights into the health and wellbeing benefits of contact with nature, there are curiously few longitudinal studies that examine these outcomes through greening-led urban regeneration and whether the disparities in access to greenspaces and their benefits can be effectively corrected. This research paper addresses this gap and has reported on baseline health and wellbeing findings in a community immediately prior to an urban greening transformation.

Drawing on interviews and a survey we found that residents who live in close proximity to the intervention site have lower self-rated health and wellbeing than metropolitan and national averages. Through establishing a control site nearby that will not undergo transformation, and by collecting post-transformation data at the control and study sites, we aim to test the policy assumption that the provision of higher-amenity greenspaces in lower disadvantaged communities will promote increases in self-reported health and wellbeing. We also seek to understand how the interruption of the asbestos contamination and the

Fig. 2. Upper Stony Creek site during transformation, November 2020.
Source: Melbourne Water.

rescoping of the project will impact residents' perceptions of the transformation and how it might therefore influence future reporting of subjective wellbeing.

Ultimately, we view this inquiry as one related to environmental justice objectives and signal the need for environmental interventions that aim to improve the livelihoods of disadvantaged communities to directly consider such projects in terms of environmental justice. Within the urban greening policy paradigm observed, there is a curious lack of reference to environmental justice as a key component of outcomes that are aspired to. This may prove to matter if residents who experience the transformation at Upper Stony Creek, perceive that their new circumstances do not adequately reconcile the history of environmental injustice, or that the scaling back of the transformation is itself an injustice. If there is a perception that environmental justice has indeed been delivered, then this may be observable in better health and wellbeing outcomes for low-income communities.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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