

OTRANSFORMING A WASTE LANDFILL INTO A PARK: LANDSCAPE ARCHITECTURAL STRATEGIES FOR ECOLOGICAL RESTORATION AND URBAN RECONNECTION - CASE OF MEETHOTAMULLA WASTE LANDFILL, SRI LANKA

De Silva, S.C.J.^{1*},

Sungkyunkwan University, South Korea, Email ID: desilva.s.c.j@gmail.com^{1*}

Choi, H.²

Sungkyunkwan University, South Korea, Email ID: hyeyoung@skku.edu²

ABSTRACT

This paper investigates the potential of transforming the Meethotamulla waste landfill in Colombo, Sri Lanka, into a Living Landscape Museum Park through landscape architectural strategies. The Meethotamulla landfill, which operated for over three decades, collapsed in 2017, resulting in severe environmental damage, loss of life, and disruption to surrounding residential areas. Although post-collapse stabilization measures addressed immediate safety concerns, the site remains unused, environmentally vulnerable, and spatially disconnected from its urban surroundings. Drawing on global landfill-to-park precedents, including Nanjido Park (South Korea), Ariel Sharon Park (Israel), Freshkills Park (USA), and Okhla Landfill (India), this study explores how landscape architecture can guide the rehabilitation of post-industrial waste landscapes into ecologically resilient and socially meaningful public spaces. A mixed-method approach combining literature review, precedent analysis, and site-specific research informs the development of a design proposal that integrates landform restructuring, wetland-based leachate treatment, native planting, and public circulation. While the primary focus remains on ecological restoration and landscape-led design, the research also acknowledges the landfill's role as a disrupted urban node and highlights the importance of reconnecting the site through pedestrian, ecological, and hydrological networks. The proposed Living Landscape Museum Park demonstrates how landscape architecture can mediate environmental risk, public access, and collective memory, contributing to sustainable urban regeneration in rapidly urbanizing contexts.

KEYWORDS: Landscape Architecture, Landfill-to-Park, Ecological Restoration, Urban Nodes, Landscape Networks

INTRODUCTION

Urban waste landfills present significant environmental, health, and spatial challenges, especially in rapidly urbanising regions with limited waste infrastructure. The Meethotamulla landfill, located in the Colombo District, Western Province, Sri Lanka, and belongs to the Dahampura Ward of the Kolonnawa Urban Council area, and 6 km from Colombo's central business district, exemplifies these challenges.



Figure 1. Location of the Meethotamulla Waste Dump [Source: Compiled by the Author]

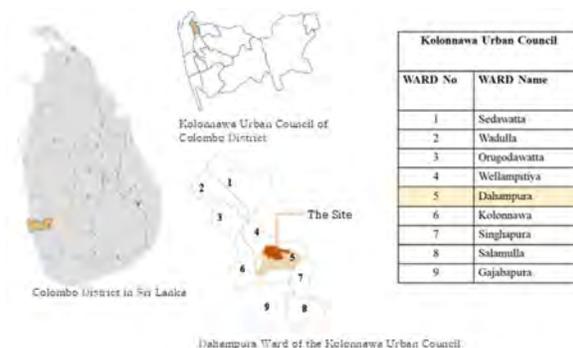


Figure 2. Administrative Boundaries of the Site [Source: Compiled by the Author Based on data from Survey Department]

The landfill used for over 30 years, it accumulated an estimated 1.2 million m³ of unsorted waste, producing leachate, landfill gas, and severe pollution. In April 2017, a catastrophic slope failure killed over 30 residents and destroyed nearby over 100 homes (Karunawardena, 2017), prompting public outrage and legal intervention to close the site. The Urban Development Authority reshaped the 48.8 m-high mound to 33 m, capped it with soil, and introduced basic drainage, leachate, and gas control measures. Although stabilization of the Meethotamulla site was mostly completed by 2020.



Figure 3. Existing Contour Map of the Waste Landfill after the Stabilization [Source: Urban Development Authority, Sri Lanka]

Long-term redevelopment plans were halted due to mainly funding issues. The site remains inactive, facing challenges like illegal dumping and poor management, which continue to pose environmental and safety concerns, while also presenting opportunities for future ecological and landscape restoration.



Figure 4. Formation of the Landfill [Source: Google Earth Historical Image]

Given Colombo's shortage of public green spaces, especially in the Kolonnawa Urban Council area-the landfill's location presents a critical opportunity for ecological restoration and community benefit as a public space.

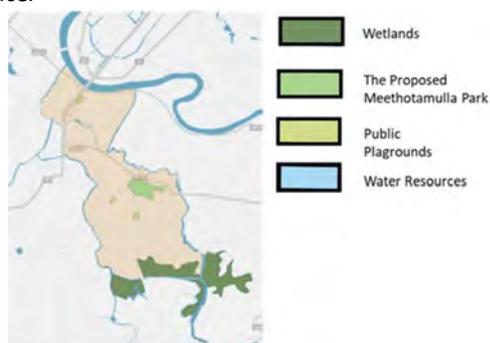


Figure 5. Limited Public Open Spaces in Kolonnawa Urban Council Area [Source: Compiled by the Author]

The site is identified in the Colombo City Development Plan 2019–2030 (Figure 6), highlighting its strategic importance within the urban framework. Despite its potential, the Kolonnawa Urban Council area lacks public open spaces (Figure 5) and recreational facilities, making the site a critical opportunity for transformation as a public park.

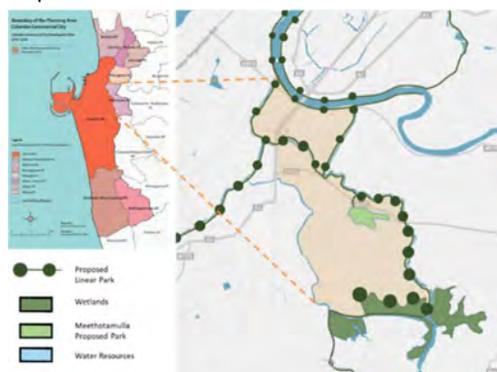


Figure 6. Meethotamulla Site in Colombo City Development Plan [Source: Compiled by the Author]

From an urban mobility perspective, Meethotamulla occupies a strategic location within a network of residential streets, canals (Figure 8), and arterial routes linking northern Colombo to the city center. Its continued

isolation reinforces spatial fragmentation, limits pedestrian permeability, and interrupts ecological and hydrological flows. Within this context, the site presents a critical opportunity for landscape architecture to intervene as a negotiating discipline, capable of reconciling infrastructural constraints, ecological processes, and human movement.



Figure 7. Urban Density and the land use map of Dahampura WARD area [Source: Compiled by the Author]



Figure 8. Regional Hydrology System [Source: Compiled by the Author]

AIM / PURPOSE

The aim of this research is to transform the Meethotamulla landfill site in Sri Lanka into a public park by identifying and analyzing existing case studies and approaches used in landfill redevelopment, in order to understand how these methods can be adapted to the site. The study proposes a design that promotes a balanced relationship between humans and nature by integrating ecological, recreational, and cultural functions to meet the needs of the surrounding community.

RESEARCH METHODOLOGY

This study adopts a mixed-method research approach comprising a literature review, comparative global case studies, and a site-specific analysis. First, relevant academic literature, government reports, and technical documents were reviewed to establish a theoretical foundation for landfill transformation and ecological restoration. Second, four global case studies, Nanjido (South Korea), Hiriya (Israel), Fresh-kills (USA), and Okhla (India), were examined. Data for these case studies were collected through published academic research, planning documents, institutional reports, and official project websites. Each case was analyzed using comparative analysis techniques focusing on ecological strategies, public space integration, long-term management approaches, and design outcomes. Third, a site-specific analysis of the Meethotamulla landfill was conducted

using field observations, satellite imagery interpretation, spatial mapping, and a review of available government and environmental reports. The collected data were synthesized to identify site constraints, ecological potentials, and design opportunities. Based on these analyses, a landscape design proposal was developed that emphasizes ecological restoration, public-use integration, and long-term sustainability.

Global and local perspectives on waste landfills

Waste is an unavoidable by-product of human activity (Brunner & Rechberger, 2014), and landfills remain the most common method of disposal worldwide (Bagban et al., 2016). Poorly managed landfills, especially open dumps, generate leachate and landfill gases (LFG), which contaminate soil, air, and groundwater. Landfills are commonly classified based on their engineering standards and environmental protection measures. This classification includes open dump landfills, controlled landfills, and engineered landfills (Ozbay et al., 2021). In Sri Lanka, most landfills remain open dumps, with limited closure or post-closure care. Closed sites, such as Bloemendhal and Meethotamulla, have received partial rehabilitation, but often lack engineered capping, gas capture, and leachate treatment. This gap highlights the need for integrated closure and reuse strategies.



Figure 9. Distribution of Landfills in Sri Lanka [Source: Compiled by the Author]

Case studies

The case studies - Nanjido Park (South Korea), Hiriya Landfill (Israel), Freshkills Park (USA), and Okhla Landfill (India), were selected for their relevance to transforming Meethotamulla into an ecological public park. Nanjido illustrates integration with adjacent water bodies, Hiriya highlights waste-to-resource strategies and public education, and Freshkills demonstrates large-scale, long-term ecological restoration. Okhla provides a comparable South Asian precedent in climate, socio-environmental conditions, and scale, with plant species suitable for Sri Lanka.

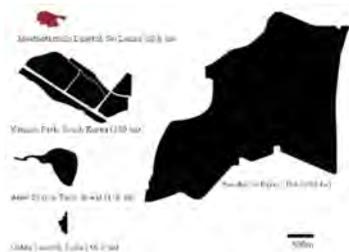


Figure 10. Size Comparison of the Case Study Sites [Source: Compiled by the Author]

Table 2. Application of Morphology, [Source: Compiled by the Author]

| Morphological Element | Design Application | Purpose | Source / Citation |
|---|---|---|------------------------------|
| Geometric Forms (axes, grids, circles) | Used to structure circulation paths, plazas, and memorial zones; symbolize the industrial past and human control over the site. | Organizes space for clarity and legibility; represents the landfill's artificial and controlled legacy. | Corner (1999); Berger (2006) |
| Organic, flowing shapes | Incorporated in planting layouts, wetlands, and landforms to represent natural processes and ecological succession. | Expresses resilience, renewal, and the site's transition to a living ecosystem. | Forman (2014) |
| Red circular motifs | Strategically placed as visual cues and focal points in gathering areas, memorial sites, and educational installations. | Acts as psychological markers to draw attention, create awareness, and encourage reflection. | Berger (2006) |
| Contrast between geometric and organic forms | Combines rigid and fluid spatial elements to create a dialogue between past human impact and future | Enhances visitor engagement and reinforces the concept of coexistence between memory and nature. | Corner (1999); Meyer (2008) |

| | | | |
|--|---|--|------------------------|
| | ecological healing. | | |
| Structured spatial organization | Guides visitor movement and experience through interpretive zones representing past, present, and future. | Facilitates storytelling through space and reinforces the temporal narrative of the Museum Park. | Kaplan & Kaplan (1989) |

Master Plan



Figure 11. Master Plan [Source: Drawn by the Author]

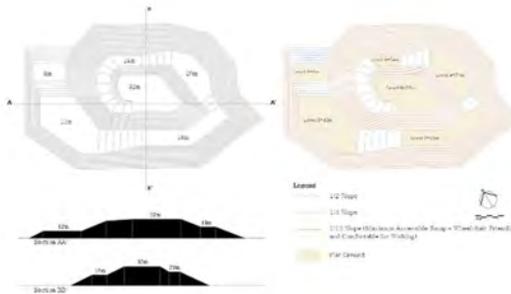


Figure 12. Proposed Landform [Source: Drawn by the Author] and Figure 13. Slope Variation [Source: Drawn by the Author]

The landform design strategy for the landfill area is based on the development of a new contour configuration informed by the stabilized landfill profile, while addressing limitations in the existing landform. The current stabilized contours lack spatial continuity at certain levels and do not provide sufficient flat areas to support public use or structured circulation. To overcome these constraints, the proposed design reshapes the landfill into a series of continuous terraced levels, organized with a vertical interval of 1 meter, allowing for improved spatial connectivity and functional use across the site. Steeper slopes of 1:2 and 1:4 are strategically applied to ensure slope stability and erosion control, while gentler 1:12 slopes are introduced to create accessible ramps that enable safe and comfortable pedestrian movement, including wheelchair access, between levels.



Figure 14. Zoning [Source: Drawn by the Author]- Enlarged Area 1-1: Terraces of Memory

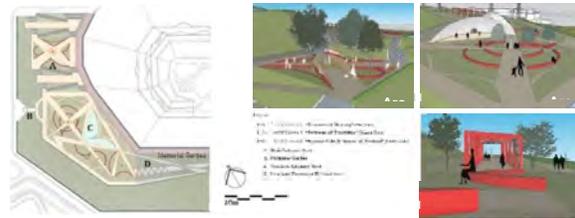


Figure 15. Enlarged Area 1-1: "Terraces of Memory" and perspectives [Source: Drawn by the Author]



Figure 16. Enlarged Area 1-2: Terraces of Transition and perspectives [Source: Drawn by the Author]- Enlarged Area 1-2: Terraces of Transition

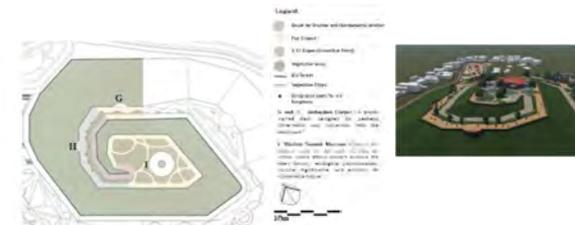


Figure 17. Enlarged Area 1-3: Horizon Walk & Summit of Wisdom and perspectives [Source: Drawn by the Author] Enlarged Area 1-3: Horizon Walk & Summit of Wisdom



Figure 18. Enlarged Area 2: Main Entrance Area and Perspectives of Reflection Garden Area [Source: Drawn by the Author]- Enlarged Area 3: Pollinator Garden



Figure 19. Perspective view of Pollinator Garden [Source: Drawn by the Author]- Enlarged Area 5: Southern Entrance Area



Figure 20. Perspective View of the Southern Entrance Area [Source: Drawn by the Author]- Enlarged Area 6: Leachate Treatment Wetland Area



Figure 21. Enlarged Area 6: Leachate Treatment Wetland Area [Source: Drawn by the Author]-



Figure 22. Surface Flow Constructed Wetland – Section CC' [Source: Drawn by the Author]

Site Circulation Plan



Figure 23. Vehicular Circulation [Source: Drawn by the Author]

Figure 24. Non-Vehicular Circulation [Source: Drawn by the Author]

The proposed circulation system reconnects the former landfill with surrounding neighborhoods through a continuous pedestrian network and multiple entrances from primary roads, transforming the site from a physical barrier into an active connector within Colombo’s urban mobility framework.

Site Drainage Strategy

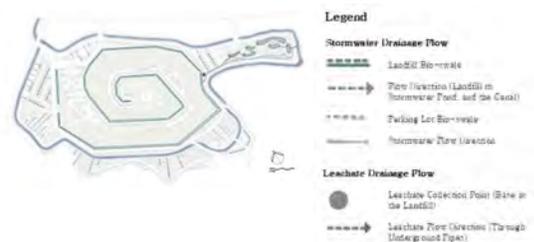


Figure 25. Site drainage plan [Source: Drawn by the Author]

The drainage system for the proposed ecological park is designed to manage two primary water flows: stormwater and landfill leachate. The strategy integrates nature-based treatment methods, including bioswales and constructed wetlands, to support environmental safety and long-term water management. These systems also contribute to reconnecting hydrological processes within the site, enabling the landfill landscape to function as part of a broader ecological network.

Planting Strategy



Figure 26. Planting plan [Source: Drawn by the Author]

Table 3. Planting Strategy for the Landfill Area [Source: Compiled by the Author]

| Slope Ratio | Plant Type | Tree Height (m) | Root Size | Comments |
|------------------------------------|--|------------------------------|-------------------------------|--|
| 1:2 (Steep Slope) | Ground Covers + Bushes | Up to 1.5 m | Shallow (< 0.5 m) | Dense, Shallow-Rooted to Stabilize Soil |
| 1:4 (Moderate Slope) | Ground Covers + Bushes + Small Trees | 2–4 m | Shallow to Moderate (0.5–1 m) | Individual Small Trees with Limited Rooting Depth, Not Planted in Clusters |
| 1:12 (Gentle Slope) and Flat Areas | Ground Covers + Bushes + Small & Tall Trees (Clusters) | 2–6 m (Small), 6–12 m (Tall) | Moderate to Deep (0.5–1.5) | Mixed layers: Clusters Enhance Microhabitats |



The topsoil layer is designed to support vegetation with root systems extending up to 1.5 meters, using mainly shallow-rooted plants to

Trees can be planted in clusters on gently sloping areas with a 1:12 gradient, more gradual slopes, or flat areas, along with a combination of ground covers and shrubs to create a stable and diverse planting design.



Slopes steeper than a 1:4 gradient should have only individual small trees planted, not clusters, as loose or poorly compacted topsoil in clustered planting can increase the risk of landslides. Planting ground covers and shrubs in combination is primarily recommended to stabilize these steep areas.



Slopes with a 1:2 gradient should be planted only with ground covers and shrubs to stabilize these steep areas.

Figure 27. Planting Strategies for the Landfill Area [Drawn by the Author]

CONCLUSION

This study demonstrates that the Meethotamulla landfill holds significant potential for transformation into a meaningful public landscape when addressed through landscape architectural strategies. The review of global landfill-to-park precedents confirms that the integration of landform restructuring, ecological systems, and public access is essential for the successful rehabilitation of post-closure landfill sites. These examples provide valuable insights into how degraded waste landscapes can evolve into resilient environments that support both ecological recovery and social use. The site-specific analysis indicates that the proposed design strategies—particularly the introduction of a new terraced landform, native planting systems, and constructed wetlands—are appropriate responses to the environmental, spatial, and safety challenges of the Meethotamulla site. By improving slope stability, managing stormwater and leachate, and creating accessible circulation across multiple levels, the design transforms the landfill from a fragmented and restricted area into a coherent and legible landscape structure. Overall, the proposed Living Landscape Museum Park illustrates the capacity of landscape architecture to mediate environmental risk, public access, and collective

memory within post-industrial urban sites. Through the careful integration of ecological restoration, circulation, and cultural interpretation, the project reconnects a formerly isolated landfill to its urban context while addressing long-term environmental performance. As one of the first comprehensive landfill-to-park proposals in Sri Lanka, this research provides a foundation for future landscape-led approaches to the sustainable reuse of closed landfills in rapidly urbanizing cities.

REFERENCES:

- Alon-Mozes, T. (2012). Ariel Sharon Park and the emergence of Israel's environmentalism. *Journal of Urban Design*, 17(2), 279–300.
- Bagban, M. A. S., & Prajakta, R. K. (2016). An Insight into Different Waste Types and Waste Segregation Methods. *International Research Journal of Engineering and Technology (IRJET)*, 3, 2060-2063.
- BBC News. (2017, April 15). Sri Lanka rubbish dump collapse kills 19. BBC News.
- Berger, A. (2006). *Drosscape: Wasting land in urban America*. New York: Princeton.
- Brunner, P. H., & Rechberger, H. (2015). Waste to energy—key element for sustainable waste management. *Waste management*, 37, 3-12.
- Central Pollution Control Board. (2018). *Status of landfill sites in Delhi: Environmental assessment and management*. Ministry of Environment, Forest and Climate Change, Government of India.
- Chathumani, D., Singhe, D. W., & Gunarathna, I. (2019). Decades to accumulate, seconds to fall: A case study on Meethotamulla garbage dump collapse in Sri Lanka. *International Journal of Trend in Scientific Research and Development*, 3(3), 847–850.
- Corner, J. (1999). *Recovering landscape: Essays in contemporary landscape theory*. Princeton Architectural Press.
- Delhi Pollution Control Committee. (2019). *Okhla landfill scientific closure and rehabilitation report*. Government of National Capital Territory of Delhi.
- Ghosh, A., Kumar, S., & Das, J. (2023). Impact of leachate and landfill gas on the ecosystem and health: Research trends and the way forward towards sustainability. *Journal of Environmental Management*, 336, 117708.
- Hiru News. (2017, April 22). Silent protests in Karadiyana against garbage disposal. Hiru News.
- Kaplan, R., & Kaplan, S. (1989). *The experience of nature: A psychological perspective*. Cambridge university press.
- Karunawardena, W. (2017). *Geotechnical assessment on the failure at Meethotamulla waste fill*. National Building Research Organisation, Ministry of Disaster Management.
- Maheshi, D. (2015). *Environmental and economic assessment of 'open waste dump' mining in Sri Lanka*. *Resources, Conservation and Recycling*, 102, 67-79.

- Mazzolini, E. (2017). *From landfill to landscape: The transformation of Fresh Kills*. *Landscape Architecture Magazine*, 107(4), 90-105.
- Meyer, E. K., Dripps, R., Phinney, L., Morris, A., Diamond, A. U., Team, G. D., ... & Zell, M. (2008). *Sustaining Beauty. The Performance of Appearance*. *Journal of Landscape Architecture*, 3, 6-23.
- Milken Innovation Center. (2021). *Ariel Sharon Environmental Park: A case study for transforming landfills into public resources*.
- Ministry of Environment, Forest and Climate Change. (2016). *Solid Waste Management Rules, 2016*. Government of India.
- National Building Research Organisation. (2017, April 14). *Disastrous failure at the solid waste disposal site at Meethotamulla*. National Building Research Organisation.
- National Building Research Organisation. (2025, July 4). *Meethotamulla revival development program*.
- New York City Department of Parks & Recreation. (n.d.). *Freshkills Park: History*. Retrieved June 10, 2025, from <https://www.nycgovparks.org/parks/freshkills-park/history>
- Ozbay, G., Jones, M., Gadde, M., Isah, S., & Attarwala, T. (2021). *Design and operation of effective landfills with minimal effects on the environment and human health*. *Journal of environmental and public health*, 2021.
- Palmer, P. (1992). *Green products by design* (No. OTA-E-541). U.S. Congress, Office of Technology Assessment. Washington, DC.
- Ramaiah, B. J., Ramana, G. V., Kavazanjian Jr, E., & Bansal, B. K. (2016). *Dynamic properties of municipal solid waste from a dump site in Delhi, India*. In *Geo-Chicago 2016* (pp. 121-130).
- Ravishan. (2017, April 24). *A brief history of the Meethotamulla garbage dump*. Roar Media.
- Rushbrook, P., & World Health Organization. (2001). *Guidance on minimum approaches for improvements to existing municipal waste dumpsites*. In *Guidance on minimum approaches for improvements to existing municipal waste dumpsites*.
- Seoul Institute. (2014). *[KSP Modularization] Nanjido Eco Park Restoration from Waste Dumping Site*. Seoul Solution.
- Seoul Solution. (2015, June 20). *Landfill recovery project: Transformation of landfill to ecological park*.
- Seoul Urban Solutions Agency. (2017, April 24). *Nanjido Ecological Park (J. M. Song, preparer)* [PDF]. Seoul Urban Solutions Agency.
- Sharma, V. (2024, September 20). *Target for levelling 3 landfills pushed back further — to 2028*. *The Times of India*.
- South Delhi Municipal Corporation. (2017). *Pre-feasibility report for redevelopment of Okhla landfill site*. Ministry of Environment, Forest and Climate Change.
- Studio MA. (2021). *Ariel Sharon Park – Main Entrance*. Retrieved from <https://studio-ma.co.il/project/ariel-sharon-park-main-entrance/>
- Tchobanoglous, G., Theisen, H., & Vigil, S. (1993). *Integrated Solid Waste Management: Engineering Principles and Management Issues*. *Water Science & Technology Library*, 8(1), 63-90.
- Theisen, H., & Vigil, S. A. (1993). *Integrated solid waste management: Engineering principles and management issues*. McGraw-Hill.
- Urban Development Authority, Meethotamulla Regeneration Project Unit. (2019). *Meethotamulla regeneration project*.