

Manila Bay Reclamation and Community Resilience: A Sustainability and Adaptive-Capacity Assessment for Coastal Urban Development in Metro Manila, Philippines

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Received 24th September 2025; Accepted 25th November 2025; Published Online 24th January 2026
DOI: 10.63941/DIT.ADSimrj.2026.2.1.21

ABSTRACT

Land reclamation has re-emerged as a strategic response to land scarcity, urban congestion, and infrastructure demand in coastal megacities. In Manila Bay—an internationally significant natural harbor and socio-ecological system—reclamation initiatives promise spatial expansion and economic development but may also intensify ecological degradation and climate risk exposure. This study reframes an MMEP capstone manuscript into a journal-format sustainability assessment aligned with the DIT.ADS IMRJ research-paper structure. Using a descriptive–analytical design and document-based impact assessment, the paper synthesizes (i) published coastal and climate science, (ii) Philippine environmental and reclamation governance instruments, and (iii) secondary case information on ongoing and proposed Manila Bay projects, including a focused case illustration of Horizon Manila. Findings indicate that reclamation risks are concentrated in four interlinked domains: (1) coastal-process alteration (sediment transport, wave dynamics) that can elevate erosion and flood susceptibility; (2) habitat and water-quality pressures that may reduce ecosystem services and fisheries livelihoods; (3) social equity concerns associated with displacement and livelihood disruption of coastal communities; and (4) governance and policy implementation challenges, including permitting complexity, transparency gaps, and institutional fragmentation. The study argues that reclamation can only be defensible within an integrated coastal management framework that (a) strengthens environmental impact assessment (EIA) and monitoring, (b) applies nature-based solutions and green architecture at the city-district scale, and (c) institutionalizes participatory, equity-centered safeguards. Recommendations include risk-sensitive zoning, ecosystem-service accounting, mandatory climate and sea-level-rise design thresholds, transparent public reporting, and benefit-sharing mechanisms for affected communities.

Keywords: *Manila Bay, Land Reclamation, Community Resilience, Environmental Sustainability, Adaptive Capacity, Coastal Urban Development, Green Architecture*

INTRODUCTION

The Philippine archipelago comprises more than 7,000 islands and an extensive coastline, situating many communities, infrastructure assets, and economic activities within coastal risk zones. Manila Bay is a major natural harbor on Luzon with an area of roughly 2,000 km² and a coastline/circumference of about 190 km, supporting trade, mobility, fisheries, recreation, and metropolitan growth. The bay's strategic role, however, coexists with persistent environmental pressures, including habitat degradation and water quality decline. In response to land scarcity and urban expansion needs, reclamation has been advanced as a mechanism to create new urban land and attract investment.

Within the Manila Bay context, reclamation is not a neutral engineering intervention. By reshaping shorelines and nearshore bathymetry, reclamation can disrupt coastal processes (e.g., sediment transport and wave dynamics), potentially increasing exposure to erosion, storm surge, and sea-level-rise impacts. These risks are especially relevant under climate change, where global mean sea level is projected to continue rising through this century (IPCC, 2021). In parallel, reclamation projects may impose social externalities: coastal communities dependent on fisheries and nearshore resources can

experience displacement, livelihood disruption, and psychosocial stress, all of which can erode community resilience.

This paper converts the author's MMEP capstone into a journal manuscript that aligns with the DIT.ADS IMRJ research-paper format (as exemplified by the journal's mixed-methods impact-assessment articles). It positions Manila Bay reclamation as a sustainability challenge requiring integrated assessment across environmental, social, economic, and governance dimensions.

The reclamation of Manila Bay and adjacent coastal areas presents a complex array of challenges and opportunities affecting community resilience and environmental sustainability. This study addresses the following research questions:

This study examines how the challenges and opportunities associated with the Manila Bay reclamation projects influence community resilience and environmental sustainability within the context of rapid urbanization and coastal development. With Metro Manila experiencing sustained population growth and continued rural–urban migration, coastal reclamation has been advanced as a potential response to land scarcity; however, its viability depends on how effectively environmental, social, and governance risks are managed (UN-Habitat, 2020).

The research assesses the socio-economic, cultural, and psychological dimensions of community resilience affected by reclamation, including displacement risks, livelihood disruption, and adaptive capacity, while also evaluating environmental sustainability outcomes related to water quality degradation, marine biodiversity loss, and coastal ecosystem health (IPCC, 2022; OECD, 2021). Particular attention is given to the role of institutional and stakeholder responsiveness in addressing governance challenges, regulatory enforcement, and long-term climate risks inherent in large-scale coastal modification.

Furthermore, the study investigates how resilient urban development strategies—such as integrated land-use planning, green infrastructure, and inclusive housing models—can enhance the sustainability of reclamation projects, alongside the application of green architecture principles that emphasize energy efficiency, renewable systems, climate-responsive design, and ecosystem-based adaptation (World Bank, 2021; UNEP, 2019).

By synthesizing empirical evidence and policy analysis, the research proposes evidence-based recommendations aimed at strengthening community resilience and advancing environmentally sustainable coastal reclamation practices applicable to rapidly urbanizing coastal cities in the Global South.

Land reclamation is used globally to address land scarcity and support urban growth, with prominent examples in highly urbanized coastal city-states and port cities. However, literature consistently documents trade-offs: reclamation can directly remove or bury coastal habitats and indirectly alter hydrodynamics, which may affect water quality and shoreline stability. Nature-based coastal systems such as mangroves, wetlands, seagrass beds, and coral reefs provide protective services that reduce storm impacts and erosion; their loss can increase hazard exposure and adaptation costs. Empirical work indicates mangroves can reduce flood and storm impacts when forests are of sufficient extent and condition (Sunkur, 2023), and combined coastal habitats can attenuate storm surge and wave energy (Guannel et al., 2016).

From a risk and climate perspective, sea-level rise and changing storm regimes heighten the vulnerability of low-lying reclaimed lands. Studies in reclamation zones show that storm tide-induced flooding risk can be amplified by low elevation and dense exposure, with climate change compounding impacts (Xu et al., 2021). Accordingly, reclamation proposals require robust climate-risk assessment and explicit sea-level-rise design thresholds.

Governance is central to sustainability outcomes. In the Philippines, the Environmental Impact Statement (EIS) System was established under Presidential Decree No. 1586, requiring impact assessment for projects that significantly affect environmental quality. Implementing rules and procedural requirements are set out through DENR issuances (e.g., DAO 2003-30). For Manila Bay specifically, the Supreme Court in *MMDA v. Concerned Residents of Manila Bay* (G.R. Nos. 171947-48, 2008) affirmed state agencies' duties to rehabilitate and protect the bay, reinforcing that development interventions must be consistent with the constitutional right to a balanced and healthful ecology.

These strands imply that Manila Bay reclamation must be evaluated as a coupled socio-ecological system intervention rather than only a land-creation project. Community resilience depends on livelihood security, social cohesion, institutional responsiveness, and procedural justice—each of which can be stressed by displacement, altered resource access, and governance deficits.

MATERIALS & METHODS

This study employs a descriptive–analytical research approach consistent with document-based impact assessment. The design mirrors journal impact-assessment reporting by integrating environmental-risk synthesis, governance/policy review, and structured case illustration.

The analysis draws on: (a) the author's capstone manuscript data and compiled project information, including a list of proposed reclamation projects; (b) Philippine environmental and reclamation governance instruments (PD 1586; DENR EIS/EIA procedural issuances; PRA approval process documentation); (c) peer-reviewed research on coastal habitat services and reclamation-related hazards; and (d) authoritative institutional reports on Manila Bay's physical characteristics and management context.

The study follows four analytical steps: (1) problem framing and objective alignment; (2) environmental sustainability assessment (coastal processes, habitat services, water quality pathways, climate risks); (3) community resilience assessment (livelihood impacts, displacement risk, social cohesion and cultural ties, psychosocial stressors); and (4) governance and adaptive-capacity assessment (institutional mandates, permitting pathways, transparency and public participation). Findings are organized as integrated Results and Discussion, and then translated into actionable recommendations for policy and design.

This manuscript is based on secondary sources and does not involve direct human-subject data collection. Where stakeholder perspectives are discussed, they are framed as policy-relevant considerations consistent with publicly documented concerns and the capstone's stakeholder analysis scope.

RESULTS AND DISCUSSION

1. Overview of Manila Bay Reclamation Initiatives

The capstone manuscript identifies multiple ongoing and proposed reclamation initiatives along Manila Bay, including large-scale developments and infrastructure-oriented projects. A compiled list includes, among others: Bulacan Aerotropolis (2,500 hectares), PRA Baseco (40 hectares), Waterfront Manila (318 hectares), City of Pearl (407 hectares), Horizon Manila (83 hectares), and other city-level reclamation proposals (e.g., Bacoor City Reclamation Project at 230 hectares). The scale and diversity of these projects indicate a metropolitan-level transformation rather than isolated site interventions, implying cumulative impacts and governance complexity.

Table 1
Major Manila Bay Reclamation Projects Included in the Study

Reclamation Project	Location	Approx. Area (ha)	Primary Development Purpose	Key Sustainability Concerns
Bulacan Aerotropolis	Bulacan	~2,500	Airport-led urban expansion	Flood risk, habitat loss, cumulative impacts
Horizon Manila	Manila	~83	Mixed-use urban district	Coastal process alteration, social equity
City of Pearl	Manila	~407	Commercial–residential	Water quality, governance transparency
Waterfront Manila	Manila	~318	Tourism and real estate	Ecosystem degradation
Bacoor City Reclamation	Cavite	~230	Urban expansion	Livelihood displacement

2. Environmental Sustainability: Coastal Processes, Ecosystems, and Climate Risk

2.1 Coastal-process alteration and hazard exposure

2.2 Ecosystem services and habitat pressures

2.3 Water quality and environmental obligations

Reclamation can alter sediment transport and wave dynamics, increasing susceptibility to erosion, sea-level rise, and storm surges. Such process changes can amplify flood risk for coastal communities and assets. Evidence from reclamation risk studies indicates that low-lying reclaimed zones are prone to storm tide-induced flooding, with climate change compounding impacts (Xu et al., 2021). Given IPCC AR6 conclusions that sea level will continue to rise through this century (IPCC, 2021), reclamation planning must incorporate forward-looking design and risk thresholds.

Coastal habitats, including mangroves, seagrass beds, and wetlands, provide shoreline protection and reduce disaster risk. Peer-reviewed synthesis shows mangroves can reduce storm impacts and stabilize coasts when properly configured (Sunkur, 2023), and combined habitats can attenuate storm surge and waves (Guannel et al., 2016). Reclamation that removes or fragments these habitats reduces protective services, increasing dependence on engineered defenses and raising long-term maintenance burdens.

Table 2
Summary of Environmental Sustainability Impacts of Manila Bay Reclamation

Impact Domain	Observed / Documented Effects	Supporting Literature / Policy Basis	Sustainability Implications
Coastal processes	Altered sediment transport and wave dynamics	Xu et al. (2021); IPCC (2021)	Increased erosion and flood susceptibility
Climate risk	Low elevation increases storm-tide flooding risk	IPCC AR6	Need for SLR design thresholds
Coastal ecosystems	Loss or fragmentation of mangroves and wetlands	Guannel et al. (2016); Sunkur (2023)	Reduced natural coastal protection
Water quality	Risk of undermining Manila Bay rehabilitation	PD 1586; MMDA v. Manila Bay	Stricter EIA and monitoring required

Manila Bay's rehabilitation is a national governance priority, reinforced by jurisprudence requiring agencies to protect and rehabilitate the bay (MMDA v. Concerned Residents of Manila Bay, 2008). Reclamation proposals must therefore demonstrate that they do not undermine rehabilitation goals, and must comply with the Philippine EIS System (PD 1586) and DENR implementing rules. This implies stricter baselines, transparent reporting, and cumulative impact evaluation.

3. Community Resilience: Livelihoods, Displacement, and Social Equity

3.1 Displacement and livelihood disruption

3.2 Opportunities for resilience enhancement

The capstone manuscript highlights that communities along Manila Bay depend on coastal resources and often have deep cultural and historical ties to the place. Forced relocation can disrupt social structures and traditional livelihoods, creating social tension and conflicts. These outcomes reduce resilience by weakening social capital and increasing economic precarity.

The manuscript also identifies opportunities: well-planned reclamation can integrate resilient infrastructure (flood protection systems), green spaces, and sustainable urban design that may improve quality of life while creating jobs and revenues that can be reinvested in community development. This potential is contingent on inclusive planning, equitable benefit distribution, and enforceable safeguards.

Table 3
Community Resilience Impacts Associated with Manila Bay Reclamation

Resilience Dimension	Key Issues Identified	Effects on Communities	Implications for Adaptive Capacity
Livelihood security	Disruption of fisheries and coastal work	Income loss, economic precarity	Reduced resilience
Displacement	Relocation from traditional settlements	Social disarticulation, stress	Weakening of social capital
Cultural ties	Loss of place-based identity	Reduced cohesion	Long-term vulnerability
Potential opportunities	Jobs, infrastructure, services	Conditional benefits	Requires inclusive planning

4. Governance and Adaptive Capacity

4.1 Environmental permitting and accountability

4.2 Policy coherence with Manila Bay rehabilitation

The Philippine EIS System, established under PD 1586, sets the legal basis for requiring environmental impact assessment for environmentally critical projects and areas. DENR procedural rules (e.g., DAO 2003-30) operationalize the system. For reclamation-specific governance, PRA provides procedural guidance and an approval workflow for reclamation proposals. In practice, the sustainability performance of reclamation projects depends on institutional coordination, consistency in standards, and the integrity of public participation mechanisms.

Given Manila Bay's court-mandated rehabilitation obligations, reclamation governance must demonstrate policy coherence: projects should not compromise water-quality and ecosystem restoration targets. Transparent public reporting and third-party monitoring can strengthen legitimacy and adaptive capacity.

Table 4
Governance and Adaptive-Capacity Assessment of Manila Bay Reclamation Projects

Governance Aspect	Existing Framework	Identified Gaps	Adaptive-Capacity Implications
Environmental permitting	PD 1586; DAO 2003-30	Cumulative impact limits unclear	Weak risk anticipation
Institutional coordination	DENR, PRA, LGUs	Fragmentation	Reduced accountability
Public participation	EIA consultation processes	Transparency concerns	Lower legitimacy
Monitoring and reporting	ECC conditions	Limited public access	Constrained adaptive learning

5. Case Illustration: Horizon Manila Reclamation Project

The capstone describes Horizon Manila as a proposed development platform with multiple islands bisected by a canal park and “distinct communities” integrating social and cultural heritage through

sustainable lifestyle commitments. The proposal includes green and water systems (open green spaces and urban waters), desalination and water-treatment components, and mobility/circulation strategies such as arcaded sidewalks, cycling infrastructure, pedestrian bridges, and low-emission transit options (e.g., electric trams and water taxis). As an illustration, these features align with resilience-oriented planning principles, but their sustainability outcomes depend on verified environmental baselines, cumulative impact controls, and the degree to which benefits and risk reductions extend to vulnerable coastal communities beyond the project boundaries.

CONCLUSION

Manila Bay reclamation embodies a high-stakes development decision where land scarcity, investment objectives, and metropolitan infrastructure needs intersect with ecological integrity and climate risk. This journal-format synthesis finds that reclamation sustainability hinges on managing coastal-process alteration, protecting ecosystem services, addressing social equity impacts, and strengthening governance and adaptive capacity. The legal and institutional context—particularly the Philippine EIS System (PD 1586) and Manila Bay rehabilitation obligations affirmed by the Supreme Court—sets a high bar for defensible reclamation. Where projects proceed, they should do so only under integrated coastal management, transparent public reporting, and explicit climate-risk design thresholds consistent with AR6 sea-level-rise trajectories.

Recommendations

1. Strengthen EIA rigor and cumulative impact assessment for Manila Bay reclamation proposals, including transparent publication of baseline studies and monitoring results.
2. Require explicit climate and sea-level-rise design thresholds, including storm-surge allowances and adaptive pathways, consistent with IPCC AR6 projections.
3. Protect and restore nature-based coastal defenses (mangroves, wetlands, seagrass systems) and integrate them with engineered measures to reduce lifecycle risk and costs.
4. Institutionalize equity safeguards, including participatory planning, livelihood transition support, fair compensation, and benefit-sharing mechanisms, for affected fishing and coastal communities.
5. Align reclamation approvals with Manila Bay rehabilitation targets and establish independent auditing/third-party monitoring to reinforce accountability.
6. Apply green architecture principles at the district scale, like energy-efficient building standards, low-carbon mobility systems, blue-green networks, and water-sensitive urban design

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