

Article

From Policy to Practice: The Role of Strategic Environmental Assessment in Coastal Zone Management in Qatar

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Abstract

Strategic Environmental Assessment (SEA) is increasingly recognized as a cornerstone of contemporary environmental governance because it operates at the strategic level — policies, plans and programs — where long-term development trajectories are established and where cumulative and indirect effects can still be avoided. In Qatar, the coastal zone concentrates a large share of the nation's population, transport corridors, industrial hubs, tourism assets and cultural heritage, while also supporting sensitive marine and coastal ecosystems such as mangroves, seagrass beds, tidal flats and sabkhas. These ecosystems are exposed to intensive development pressure, and to escalating climate risks including sea-level rise and compound flooding. This paper defines the role of SEA in delivering high-level environmental policy objectives within coastal zone management in Qatar, and proposes practical pathways for strengthening policy integration, alternatives appraisal, cumulative effects governance and monitoring-led adaptive management. The study adopts a qualitative methodology combining structured literature review (with emphasis on 2024–2025 sources), synthesis of Qatar's ICZM and SEA documentation, and comparative case study learning from Europe, Australia and Gulf-region practice. The analysis shows that Qatar has a strong foundation: SEA has been embedded in national spatial planning and within the ICZM planning cycle. However, SEA's strategic value is not fully realized without binding triggers for coastal policies and programs, cumulative effects registers, climate-scenario testing and performance monitoring. The paper recommends an SEA-enabled ICZM cycle for Qatar, anchored in enforceable screening, ecosystem-service thresholds, climate-risk mainstreaming and transparent reporting.

Keywords: Strategic Environmental Assessment; Integrated Coastal Zone Management; Qatar; Policy Integration.

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1. Introduction

Coastal zones represent the most contested interface between development imperatives and environmental integrity. They are shaped by dynamic processes — waves, sediment transport, tidal regimes, and episodic storms — yet are commonly governed by sectoral decisions made in isolation. This governance mismatch elevates the risk of

cumulative degradation, particularly in contexts where coastal land is scarce and development pressure is intense. Qatar exemplifies this challenge. The state is predominantly coastal, and its economic diversification and urban growth have historically concentrated along the shoreline. At the same time, the Qatar coast supports sensitive habitats that provide essential ecosystem services, including nursery habitat for fisheries, coastal stabilization, carbon sequestration, and cultural landscape value. (Partidário, 2012; Kusters et al., 2024).

Integrated Coastal Zone Management (ICZM) was introduced in Qatar to balance economic development with ecosystem protection and social needs, and to reduce conflict among uses and regulators. The national ICZM framework emphasizes that coastal planning is not only about guiding development locations; it is also about maintaining the integrity of coastal systems and ensuring that future generations retain access to healthy coastal environments. Within this governance architecture, SEA is explicitly positioned as a strategic mechanism that complements project-level Environmental Impact Assessment (EIA) by evaluating environmental consequences at the level of policies, plans, and programs, where cumulative effects and long-term trajectories are formed. (Wataniya Environmental Services, 2015).

International SEA practice has evolved substantially over the last two decades. SEA is no longer seen merely as a technical assessment report. It has become an iterative decision support process that can influence the framing of objectives, the selection of alternatives, the allocation of land uses, and the creation of monitoring frameworks that enforce accountability. This expanded understanding is particularly relevant to coastal systems, where the strategic location of ports, the extent of reclamation, the distribution of tourism zones, and the prioritization of nature-based adaptation versus engineered protection can determine environmental outcomes for decades.

This paper addresses a persistent gap: SEA in coastal contexts is often treated as a compliance deliverable rather than as a mechanism for delivering high-level environmental policy objectives. The paper asks: What is the role of SEA in delivering high-level environmental policy objectives in coastal zone management in Qatar, and how can this role be operationalized through governance, spatial planning and monitoring? The aim is not only to describe SEA processes, but to specify how SEA can translate policy intent into decision rules, support cumulative effects governance, mainstream climate adaptation, and institutionalize monitoring in Qatar's coastal planning cycle.

The paper is structured as follows. Section 2 presents a conceptual framework linking SEA functions to policy delivery in coastal systems. Section 3 explains the methodology. Section 4 provides an analysis of Qatar's coastal context, policy architecture, and SEA practice, and synthesizes international case studies and best practices. Section 5 summarizes findings. Section 6 discusses implications and implementation barriers. Section 7 proposes recommendations for institutionalizing SEA effectiveness in Qatar. Section 8 concludes with an SEA-enabled ICZM roadmap.

2. Conceptual Framework

2.1 SEA as a policy-delivery mechanism

SEA is commonly defined as a systematic process for evaluating the environmental effects of proposed policies, plans, and programs (PPPs). However, to understand SEA's relevance to high-level environmental objectives, it must be conceptualized as a policy-delivery mechanism. SEA delivers policy objectives through four interacting functions: (i)

policy integration and coherence testing; (ii) appraisal of reasonable alternatives and explicit tradeoffs; (iii) cumulative and strategic effects governance; and (iv) monitoring-led adaptive management.

Policy integration is the foundational SEA function. It maps high-level objectives into decision criteria and identifies inconsistencies between sector plans, spatial policies, and regulatory instruments. Alternatives appraisal operationalizes policy integration by requiring that multiple pathways to achieve development goals are tested against environmental objectives. Cumulative effects governance recognizes that coastal pressures interact and accumulate over time, and that system-wide trajectories cannot be managed through single-project EIAs alone. Monitoring-led adaptive management converts SEA from a one-off appraisal into a governance system by defining indicators, responsibilities, reporting cycles, and triggers for revision.

2.2 Coastal zone management as a complex socio-ecological system

Coastal zones are complex socio-ecological systems where environmental assets and development pressures are tightly coupled. In Qatar, coastal habitats are interdependent on physical processes such as tidal exchange, sediment transport, and shoreline dynamics. Development interventions—reclamation, dredging, desalination discharge, coastal road construction—can alter these processes. A system's view of the coast, therefore, requires strategic governance that recognizes feedback loops, thresholds, and uncertainty.

A practical systems framing for coastal Qatar includes: (i) ecosystem assets (mangroves, seagrass, coral, tidal flats); (ii) development drivers (urban expansion, industrial corridors, tourism); (iii) risk drivers (sea-level rise, storm surge, compound flooding, pollution incidents); and (iv) institutional complexity (overlapping mandates across land, sea, environment, infrastructure and investment entities). SEA's role in such systems is to connect these dimensions in strategic decision-making.

2.3 High-level environmental policy objectives in Qatar's coastal context

High-level environmental policy objectives are broad commitments embedded in national vision and strategy documents, national spatial planning frameworks, and environmental regulations. In a coastal context, they are best understood as desired end-states of ecosystem integrity and environmental quality, combined with societal expectations of resilience, public access, and sustainable use.

For Qatar's coastal zone, five clusters of objectives are particularly relevant: biodiversity conservation; coastal water quality and pollution prevention; climate adaptation and resilience; sustainable use of coastal resources and ecosystem services; and public access, cultural, and landscape protection. A key challenge is translation: these objectives must be translated into enforceable spatial criteria, such as setbacks, buffers, zoning constraints, and development-intensity rules. SEA can strengthen this translation by creating assessment objectives, thresholds, and monitoring indicators aligned to coastal policy goals.

2.4 SEA effectiveness and role pathways

SEA effectiveness literature distinguishes between procedural effectiveness (whether the SEA process follows required steps) and substantive effectiveness (whether SEA influences decisions and improves outcomes). In coastal governance, substantive effectiveness is critical. This paper, therefore, adopts an SEA role pathways approach: the specific mechanisms through which SEA can deliver policy objectives. The role pathways

correspond to the four SEA functions introduced above and serve as the analytical lens for Section 4.

2.5 Best-practice principles for coastal SEA

International best practice identifies principles that are particularly relevant to coastal SEA: early and iterative integration into planning; scenario-based alternatives assessment; cumulative effects accounting; ecosystem-based and nature-positive orientation; climate mainstreaming (including sea-level rise and compound flooding); transparent participation; and monitoring aligned to governance cycles. These principles are reflected in contemporary research on SEA within marine spatial planning (e.g., increasing SEA use in MSP to support sustainable sea-use plans) and in regional coastal SEA studies in the Gulf.

3. Methodology

This study adopts a qualitative design that combines a structured literature review, a synthesis of Qatar documents, and comparative case study analysis.

3.1 Literature review approach

A targeted literature review was undertaken focusing on: SEA theory and effectiveness; SEA practice in coastal and marine planning; SEA as a mechanism for cumulative effects governance; and SEA's role in climate adaptation mainstreaming. Emphasis was placed on recent research (2024–2025) to reflect emerging practice, such as SEA integration with marine spatial planning and restoration strategies.

3.2 Qatar document synthesis

The analysis synthesized Qatar's ICZM and SEA documents, including national spatial planning SEA materials, ICZM SEA guidelines and reports, coastal planning and management guidelines, institutional and stakeholder analyses, and climate change and sea-level rise studies. Document analysis focused on SEA entry points, institutional responsibilities, objective translation mechanisms (e.g., setbacks), and monitoring provisions.

3.3 Comparative case study selection

International case clusters were selected to derive transferable lessons: (i) European SEA practice integrated with marine spatial planning and coastal restoration; (ii) Australia's strategic assessment approaches to cumulative coastal development; and (iii) Gulf-region coastal SEA advances, including Saudi Arabia's SEA for sustainable coastal zone management aligned to national vision objectives. These cases were analyzed against the SEA role pathways framework.

3.4 Analytical method

Thematic coding was used to identify governance barriers and enabling conditions for SEA policy delivery. Findings were organized by role pathway and translated into operational recommendations for Qatar.

4. Analysis

4.1 Qatar's coastal zone: assets, pressures, and emerging risks

Qatar's coastline supports important ecological functions and ecosystem services in an arid marine environment. Mangroves provide nursery habitat for fish, stabilize sediments, and support biodiversity. Seagrass beds contribute to water quality and carbon storage. Tidal flats and sabkhas provide habitat for specialized species and migratory birds. These ecosystems are sensitive to physical disturbance, changes in water quality, and hydrodynamic alteration.

Coastal pressures are multi-dimensional. Land reclamation and dredging change currents and sediment transport, affecting habitat connectivity. Industrial corridors and desalination discharge increase pollution risk and thermal stress. Urban expansion adds stormwater and wastewater loads. Tourism development can fragment habitats and restrict public access if setbacks and buffers are not enforced.

Climate change amplifies these pressures. Sea-level rise threatens low-lying coastal areas, infrastructure corridors, and coastal settlements. Ba-Khamis (2025) provides a national assessment of coastal vulnerability to sea-level rise in Qatar using a Coastal Vulnerability Index approach and highlights the need for broader national coverage beyond Doha. Sea-level rise also threatens infrastructure connectivity: Serdar et al. (2025) assess Qatar's road network vulnerability under sea-level rise scenarios, demonstrating strategic exposure pathways relevant to coastal planning. These emerging risks underline the necessity for strategic instruments that embed climate-risk criteria into coastal planning. (Ba-Khamis et al., 2025; Serdar et al., 2025).

4.2 Policy and planning architecture for coastal management

Qatar's coastal management system operates across multiple levels: national vision and development strategies; national spatial development frameworks; sector strategies for infrastructure, tourism, environment, and industry; the ICZM Plan and technical guidelines; and project EIAs. SEA links these levels by embedding environmental objectives into strategic choices and providing monitoring structures that support accountability.

The QNDF SEA demonstrates the feasibility of applying SEA to national spatial planning. It establishes environmental outcomes, appraises strategic alternatives, and proposes mitigation and monitoring measures. The ICZM SEA embeds SEA within the coastal planning cycle and provides guidance for screening, scoping, assessment, and monitoring. However, policy delivery gaps remain where mandates overlap, where cross-sector coordination is weak, and where monitoring is not institutionally enforced. (GHD, 2013; Arup, 2010).

4.3 SEA practice in Qatar: strengths and limitations

Qatar's SEA practice exhibits notable strengths aligned with international best practice. SEA has been integrated in parallel to planning processes, enabling early influence. Structured SEA frameworks have been developed with outcomes, criteria, and monitoring indicators. ICZM-specific SEA technical guidelines provide clarity on roles and timing. (Wataniya Environmental Services, 2015).

Limitations concern mainstreaming and governance continuity. SEA remains concentrated in flagship plans rather than consistently applied to all coastal PPPs. Cumulative effects assessment requires shared datasets, long-term monitoring, and institutional ownership. Without binding triggers, cumulative registers, and reporting obligations, SEA risks becoming a procedural deliverable rather than a decision-shaping governance tool.

4.4 Defining SEA's role pathways for delivering coastal policy objectives in Qatar

4.4.1 Translation: from objectives to decision rules

SEA's first delivery role is translation: converting high-level objectives into operational decision rules such as coastal setbacks, ecological buffers, development intensity limits, and no-go zones. In Qatar, coastal setbacks defined within ICZM guidelines provide a strong basis. SEA can operationalize these rules by requiring strategic alternatives to model sea-level rise and storm surge scenarios, and by setting thresholds for acceptable habitat loss and water quality changes. (Wataniya Environmental Services, 2015).

4.4.2 Alternatives appraisal and transparent trade-offs

SEA's second role pathway is a structured appraisal of reasonable alternatives. Coastal plans often face decisions on reclamation extent, tourism zoning intensity, port expansion, and infrastructure corridors. SEA requires that multiple options be compared using explicit criteria, making trade-offs transparent and defensible. This strengthens legitimacy and helps avoid path dependency.

4.4.3 Cumulative effects governance

SEA's third role is cumulative effects governance. Coastal environmental degradation is typically driven by multiple interacting interventions rather than single projects. SEA provides a platform for assessing trajectories of combined habitat loss and pollutant load trends, and risk exposure over time. Recent work on SEA within marine spatial planning emphasizes that SEA is increasingly central to managing large-scale sea-use change and assessing cumulative impacts across multiple sectors (Kusters et al., 2024). This logic directly applies to Qatar's coastal zone.

4.4.4 Climate adaptation mainstreaming

SEA's fourth role pathway is climate adaptation mainstreaming. SEA can embed sea-level rise projections, compound flooding scenarios, and shoreline change dynamics into strategic planning. It may require that alternatives include nature-based solutions and ecosystem-based adaptation, rather than only engineered defenses. Qatar's emerging vulnerability evidence (Ba-Khamis, 2025; Serdar et al., 2025) supports prioritizing this role pathway.

4.4.5 Monitoring and accountability

SEA becomes a delivery instrument only when it establishes monitoring indicators, responsibilities, and reporting cycles aligned to planning review periods. Indicators should reflect both environmental conditions (e.g., mangrove extent, seagrass health, coastal water quality) and governance performance (e.g., compliance with setbacks, enforcement actions). Monitoring supports adaptive management and institutional learning.

4.5 International case studies and best practices

4.5.1 EU: SEA in marine spatial planning and coastal restoration

European SEA practice is supported by legal requirements and has increasingly integrated SEA into marine spatial planning. Kusters et al. (2024) describe SEA as becoming standard in MSP processes to support sustainable marine plans, especially in contexts of rapid offshore renewable energy expansion. EU practice also demonstrates strong public participation requirements and structured monitoring commitments. For Qatar, the principal lesson is that SEA effectiveness improves when screening triggers are binding and when monitoring is institutionally anchored.

4.5.2 Australia: strategic assessment for cumulative coastal development

Australia has applied strategic assessment approaches to manage cumulative impacts in regions with intensive coastal development. Best practices include regional ecosystem baseline mapping, cumulative accounting frameworks, and adaptive triggers for policy revision. The transferable implication for Qatar is the value of maintaining national cumulative datasets and linking them to SEA scoping and monitoring.

4.6 Qatar Coastal SEA Application: operationalizing SEA within ICZM and strategic planning

Qatar has already established an enabling institutional base for SEA-enabled coastal governance. The ICZM Plan sets out coastal objectives and an iterative planning cycle, while the ICZM SEA Report and SEA Technical Guidelines formalize SEA as a required process conducted in parallel with plan preparation (Wataniya Environmental Services, 2015). National-scale SEA practice—particularly the Strategic Environmental Assessment of the Qatar National Development Framework (QNDF)—provides a transferable approach for objectives frameworks, alternatives appraisal, and monitoring design (GHD, 2013; Arup, 2010).

To move from SEA documentation to SEA delivery, coastal SEA should be embedded within plan-making teams. The ICZM SEA Technical Guidelines specify that SEA begins after visioning and strategic objectives are set and before options are selected, enabling iterative feedback as the plan evolves (Wataniya Environmental Services, 2015). This early integration reduces late-stage mitigation-only SEA and strengthens SEA influence on spatial choices.

SEA should operationalize Qatar's coastal setback and ecological buffer requirements as enforceable decision rules. The ICZM Coastal Planning Guidelines provide risk-informed setback logic and ecological buffers such as mangrove setbacks to protect ecosystem functions and services (Wataniya Environmental Services, 2015). SEA can require strategic alternatives to demonstrate compliance, quantify ecosystem-service impacts, and apply avoidance and minimization before compensation measures.

Governance integration is central. Stakeholder feedback in the ICZM SEA Report noted the absence of a single entity responsible for coastal protection and systematic monitoring of coastal dynamics (Wataniya Environmental Services, 2015). SEA can function as a governance alignment mechanism by requiring cross-agency scoping, explicit allocation of monitoring responsibilities, and shared indicator reporting aligned with ICZM objectives.

A practical Qatar coastal SEA application should therefore include: (i) a cumulative effects baseline by coastal segment; (ii) scenario testing for sea-level rise and compound flooding; (iii) alternatives appraisal for reclamation, tourism zoning and infrastructure corridors; and (iv) indicator-led monitoring aligned to ICZM review cycles with clear reporting responsibilities (Wataniya Environmental Services, 2015; GHD, 2013).

Gulf-region coastal SEA research highlights the relevance of SEA for aligning coastal development with national visions. Hegazy (2024) analyses SEA for sustainable coastal zone management in Saudi Arabia, emphasizing SEA's capacity to guide coastal development towards long-term sustainability and to address cumulative pressures in megaproject contexts. For Qatar, regional evidence supports prioritizing SEA as a strategic governance mechanism while investing in capacity and legal clarity. (Hegazy, 2024).

5. Findings

5.1 SEA Effectiveness Evaluation Matrix (Qatar)

The matrix below provides a concise qualitative evaluation of SEA effectiveness in Qatar's coastal zone management context (Table 1), aligned with SEA role pathways and drawing on national and ICZM SEA practice (Wataniya Environmental Services, 2015; GHD, 2013; Arup, 2010). Five primary findings emerge from the analysis:

- **First**, SEA is structurally embedded in Qatar's coastal governance architecture through ICZM guidance and national SEA experience, but SEA must be mainstreamed across coastal PPPs beyond flagship plans.
- **Second**, translation of high-level objectives into enforceable spatial and regulatory criteria is SEA's most critical role. Qatar's setback rules and ecological buffers provide a strong starting point, yet SEA can improve consistency, transparency, and risk-informed application.
- **Third**, cumulative effects constitute the decisive policy delivery gap. Project EIAs cannot manage system-wide change; SEA must provide cumulative baselines, thresholds, and scenario-based assessments.
- **Fourth**, climate risk integration is now central to SEA effectiveness. Evidence of national vulnerability and infrastructure exposure under sea-level rise scenarios reinforces the need for SEA-led scenario testing and resilience criteria.
- **Fifth**, monitoring and accountability mechanisms require strengthening. Without indicators, reporting, and institutional mandates, SEA recommendations may not translate into measurable outcomes.

Table 1: SEA effectiveness evaluation matrix (table) for Qatar

SEA effectiveness criterion	What good looks like (benchmark)	Current Qatar status (evidence)	Rating (Low/Med/High)	Priority improvement action
Early integration in planning	SEA starts after objectives are set and before options are selected; continuous feedback loops with planners.	ICZM SEA guidelines specify an early start point and parallel SEA with planning; QNDF SEA demonstrates early strategic appraisal.	High	Institutionalise binding SEA triggers for all coastal PPPs beyond flagship plans.

Alternatives and trade-off appraisal	Reasonable alternatives assessed with explicit criteria and transparent trade-offs.	Strong in QNDF SEA and ICZM SEA design; uneven mainstreaming across non-ICZM coastal plans.	Medium	Require alternative matrices for reclamation/tourism/infrastructure PPPs and publish non-technical summaries.
Cumulative effects assessment	Cumulative baselines, thresholds, pressure–state indicators, and scenario accounting across sectors.	Recognised need; methods exist in QNDF SEA, but a limited institutional cumulative register for coastal pressures.	Medium–Low	Create a National Coastal Cumulative Effects Register and require it in SEA scoping and monitoring.
Climate risk mainstreaming	SLR/storm surge/compound flooding scenarios embedded in alternatives; nature-based solutions evaluated.	Climate/SLR studies available; integration is improving, but not fully systematic across PPPs.	Medium	Make scenario testing mandatory in coastal SEA and link outputs to setback/zoning rules.
Monitoring and adaptive governance	Indicators, baselines, responsibilities, and reporting cycles tied to plan review; adaptive triggers defined.	Monitoring frameworks are proposed in SEA practice, but responsibilities and reporting cycles require strengthening.	Medium–Low	Adopt a national indicator set for ICZM; formalise reporting and assign agency responsibilities.
Institutional coordination and accountability	Clear roles across agencies; joint scoping; compliance checks; enforcement mechanisms.	Stakeholder feedback notes fragmented responsibility for coastal protection/monitoring; SEA can bridge, but needs a mandate.	Medium–Low	Formal inter-agency SEA steering group for coastal PPPs and integrated monitoring dashboards.

6. Discussion

SEA's capacity to deliver high-level environmental objectives depends on governance conditions: mandate clarity, institutional capacity, enforcement systems, and data availability. Qatar has developed robust ICZM and SEA guidance, yet delivery can be weakened by fragmented responsibilities and inconsistent enforcement.

SEA can act as a governance reform instrument by requiring cross-agency scoping, joint approval of objectives, and shared monitoring responsibilities. It also enables transparent trade-offs in contested coastal decisions and can strengthen legitimacy. International practice is increasingly shifting from protection-only approaches towards restoration and nature-positive outcomes; SEA can institutionalize this shift by requiring nature-based solutions and restoration alternatives.

A key enabling opportunity for Qatar is integrating SEA monitoring with digital governance systems, including coastal observatories and spatial dashboards. Digital platforms can support real-time performance tracking and strengthen accountability in implementation.

7. Recommendations

This paper proposes an SEA-enabled ICZM cycle for Qatar anchored in five operational reforms.

7.1 Establish binding SEA screening triggers for coastal PPPs

SEA should be mandatory for coastal zoning updates, major tourism and resort master plans, ports and reclamation programs, coastal infrastructure corridors, and coastal climate adaptation programs. Screening should be linked to coastal zone definitions and sensitivity maps.

7.2 Create a National Coastal Cumulative Effects Register

A national register should track reclamation footprints, dredging activity, habitat loss and restoration, pollutant load trends, water quality indicators, hazard exposure, and development intensity. SEA scoping should require the use of the register to establish cumulative baselines.

7.3 Institutionalize climate scenario testing within SEA

All coastal SEAs should test multiple sea-level rise scenarios and uncertainty bands, incorporate storm surge and compound flooding, assess cascading infrastructure impacts, and compare engineered versus nature-based adaptation pathways.

7.4 Strengthen monitoring, reporting, and accountability

SEA should define a national indicator set aligned to ICZM objectives, including mangrove extent and condition, seagrass and coral indices, shoreline change rate, coastal water quality, public access compliance, and resilience metrics for critical infrastructure. Reporting cycles should align with ICZM review periods (5–10 years) and include annual updates for key indicators.

7.5 Build SEA capacity, quality assurance, and transparency

Qatar should institutionalize coastal SEA training programs, adopt an SEA quality review checklist tailored to coastal PPPs, define participation protocols for key stakeholders, and publish SEA summaries and monitoring reports to strengthen transparency and accountability.

8. Conclusions

SEA can play a decisive role in delivering high-level environmental policy objectives in Qatar's coastal zone management. Qatar's institutional architecture provides strong foundations: national spatial planning SEA experience demonstrates structured outcomes appraisal and monitoring design, and the ICZM framework embeds SEA through technical guidelines that define timing, roles, and content requirements.

The main opportunity is to mainstream SEA across all coastal PPPs and to reposition SEA as a continuous governance mechanism rather than a plan-level report. As climate risks accelerate and coastal development intensifies, policy objectives — biodiversity conservation, water quality protection, resilience, and public access — cannot be achieved

without strategic tools to assess alternatives, manage cumulative effects, and enforce monitoring.

An SEA-enabled ICZM cycle, supported by binding screening triggers, a cumulative effects register, climate scenario testing, and indicator-led accountability, provides a practical roadmap for strengthening environmental policy delivery in Qatar's coastal governance.

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