Delineating Coastal Development Setback Lines from the Perspective of Nature-based Solutions (NbS): A Case Study of Dalian City

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Abstract

As a coastal-zone development control instrument widely used by coastal countries, coastal development setback lines provide an important basis for guiding planning and construction in coastal areas and occupy a key position in specialized coastal-zone planning. Because coastal zones involve multidimensional development needs, existing methods for delineating coastal development setback lines still have limitations in addressing multiple shoreline types and ecosystem protection. Responding to the spatial governance needs of coastal zones, this study strengthens the principles of land-sea coordination and ecological priority. Building on existing technical approaches, it introduces the concept of nature-based solutions (NbS), integrates multi-factor spatial overlay analysis, and constructs a technical method for delineating coastal development setback lines from an NbS perspective. The method is applied in Dalian, an important coastal city in northern China. The results show that, compared with previous approaches, the proposed method provides more comprehensive setback thresholds for complex shorelines in practical planning. It can offer technical support for coastal planning and management in Dalian and for the protection and sustainable development of coastal-zone ecosystems.

Keywords

specialized coastal-zone planning; nature-based solutions (NbS); coastal development setback line; disaster risk and resilience; ecosystem services

1 Background and Analysis of Coastal Development Setback Lines

As transitional compound ecosystems linking land and sea, coastal zones feature diverse ecosystem types, rich natural-resource endowments, and highly varied socioeconomic activities. They are therefore the most important spatial carriers for implementing a land-sea coordinated development strategy [1]. Territorial spatial planning in China is shifting from single-plan preparation toward a systematic framework in which multiple levels and types of plans are coordinated. Bottom-line boundaries and control lines are being used to strengthen plan implementation [2-3]. Specialized plans for coastal-zone protection and utilization, prepared from the perspective of land-sea coordination, innovate beyond the traditional thinking of "defining the sea from the land" and use a systemic framework to optimize the spatial layout and integrated governance of coastal areas as a whole [4].

According to shoreline attributes and natural-environment characteristics, a coastal development setback line is a control line that, taking the coastline as a baseline, retreats landward by a certain distance and prohibits or restricts construction activities. It comprehensively considers marine-disaster impacts, protection of ecosystem integrity, and the expansion of public waterfront space [5]. Scientific delineation of coastal development setback lines is a critical part of coastal-zone management, an important instrument for realizing land-sea coordination, and a meaningful measure for reducing marine-disaster risk and protecting coastal ecosystems.

1.1 Progress in International Practice

Research and practice related to coastal development setback lines first emerged in major European and North American coastal countries in the 1970s and 1980s. By designating prohibited- or restricted-construction zones in coastal beach and tidal-flat areas, these countries imposed strict controls on coastal development activities (Table 1) [6]. Relevant cases generally consider multiple factors, including extreme climate events, geomorphological evolution, and climate change. Setback distances vary significantly across regions, mainly because natural conditions and functional requirements differ. In Hawaii, where demand for water-oriented activities is high, the coastal building setback distance is only 12 m [7]. In Indonesian mangrove areas with stricter ecological-protection requirements, the distance extends to 400 m [8-18]. Such differences have encouraged deeper exploration of the theoretical system for setback-line delineation.

Table 1. Comparison of coastal development setback systems in selected countries and regions [9-18]

Country	Legal or policy basis	Core management mechanism	Setback distance examples	Implementation period	Delineation basis
United States	Coastal Zone Management Act and federal/state laws, such as California and Florida laws, 1972	Dynamic setback lines based on historical erosion plus buffer zones; rolling setbacks	California: 30-60 m on average; Florida: dynamically delineated according to erosion rates, with some areas set back 50-100 m; Hawaii: 40 times the annual erosion-rate distance, about 20-100 m	Since the 1970s	Erosion rate and storm-surge models
Australia	Coastal Protection Act, state level, 1979	Hundred-year erosion lines, adaptive renewal, and prohibition of new construction in setback zones	New South Wales: hundred-year erosion line plus a 20 m buffer, total setback about 50-150 m; Queensland: dynamic delineation based on sea-level-rise projections, average setback 30-80 m	Since the 1980s	Sea-level-rise projections and GIS analysis
New Zealand	Resource Management Act, 1991	Natural-hazard zoning, dynamic modelling, and community consultation	Auckland: 30 m base setback plus additional hazard buffer, with total setback up to 100 m; Wellington coast: based on 1% annual-probability storm events, setback 50-200 m	Since 1991	Probabilistic risk models
Netherlands	National Water Plan,	Room for retreat,	Low-lying delta areas: compulsory setback of 500-	Since the	Hydrological models and

	2009	integrating flood control and ecology; resilient design	1000 m; Rhine-Meuse delta: partial setback of 300-500 m combined with dikes	1990s	thousand-year flood-control standards
Japan	Coast Act, 1956	Coastal conservation areas and double setback lines in tsunami areas	General coastal areas: 30-50 m, with building-type restrictions; high tsunami-risk areas such as Fukushima: setback of more than 1 km; Okinawa: 50-100 m in typhoon-prone areas	Since 1956, with revisions	Historical-disaster data and topographic analysis
United Kingdom	Marine and Coastal Access Act, 2009	Flexible planning based on managed retreat	Norfolk coast: 100-200 m in severely eroded areas; eastern England: dynamic adjustment, with areas where annual erosion exceeds 2 m set back by at least 50 m	Since the 2000s	Coastal-erosion monitoring and climate-change projections

1.2 Domestic Research and Practice

Although research on coastal development setback lines in China began relatively late, recent work has started to link ecosystem services with setback delineation. Some studies proceed from functional needs and delineate setbacks according to sea-area use functions, coastal functions, or marine ecosystem-service functions [7,18-19]. Others build scientific analytical frameworks and integrated evaluation methods to define setback lines more rationally [7,20]. There are also approaches based on real-scene 3D models, although their application remains limited [21].

In 2021 and 2024, the Ministry of Natural Resources issued the Guidelines for Preparing Provincial-level Comprehensive Coastal-zone Protection and Utilization Plans (Trial) [5] (hereafter the Guidelines) and the Technical Guidelines for Delineating Coastal Development Setback Lines (Draft for Approval) [22] (hereafter the Technical Guidelines), promoting setback-line delineation in coastal regions. Yet because coastal zones involve multidimensional development needs, the methods in these documents and related studies still have many limitations. They are mainly based on single shoreline-type analysis and therefore cannot fully reflect disaster response, ecosystem services, carbon-sequestration potential, or control over production and living-space uses under a land-sea coordinated development framework. This has intensified conflicts between socioeconomic demand for land and sea use and marine ecological protection [23-24].

1.3 Problem Analysis and Reflections

The delineation of coastal setback lines has become a focus in both academic research and planning practice. Because coastal zones involve multidimensional development needs, the constraint conditions and classification systems for setback-line delineation still require deeper study. First, research on the constraint mechanisms of setback-line delineation is limited and has not yet formed a systematic theoretical framework. Existing methods rely primarily on single shoreline-type analysis and therefore have difficulty reflecting multiple requirements under land-sea coordination, including disaster risk and resilience, ecosystem services, and carbon-sequestration potential. This, to some extent, aggravates tensions between socioeconomic development and marine ecological protection. Second, systemic thinking has not been fully established. The relationship between setback-line delineation and spatial governance as a whole is often overlooked. Because the landward side of coastal zones contains multiple landform types, natural-resource elements, and artificial structures, a single fixed distance cannot ensure contiguity and integrity of the setback space and may lead to overlapping control lines and spatial fragmentation [25]. At the same time, existing control measures for setback zones impose strict requirements mainly on new construction projects, while policy and technical support for managing existing built space remains insufficient, weakening the practicality and effectiveness of setback-line delineation [26].

1.4 Research Needs and Direction

In response to these problems, this study starts from the requirements of land-sea coordination in territorial spatial planning and uses natural processes as the basis for optimizing the technical method of coastal development setback-line delineation. The proposed method approaches control from the perspective of spatial systems, emphasizes coordination with natural processes, and seeks to strengthen territorial ecological resilience and ecosystem-service functions while addressing social challenges such as climate change and disaster prevention and mitigation. It also considers replicability under different natural and economic contexts, links effectively with local endowments and needs, and aims to ensure that the delineation method is operational and the resulting control line is implementable [27-29].

2 Methodological Framework for Delineating Coastal Development Setback Lines

2.1 Introducing the NbS Technical Framework

Nature-based solutions (NbS) are an important technical pathway for ecological-civilization construction and are highly consistent with the goals of coastal ecological protection and safety-oriented development. Their core is to protect, restore, and optimize ecosystems so as to coordinate disaster prevention and mitigation, biodiversity conservation, carbon sequestration, and other goals [30-32]. This can effectively address the limitations of traditional coastal development setback lines that rely on a single disaster threshold or isolated ecological factors. Compared with fixed-distance control, NbS emphasizes integrated regulation based on ecosystem functions. It provides a theoretical basis for shifting setback lines from "distance control" toward "functional control" and is consistent with the coastal-ecology goals proposed in the National Master Plan for Major Projects for the Protection and Restoration of Important Ecosystems (2021-2035).

2.2 Framework for Setback-line Delineation

Drawing on NbS, this study proposes a multi-factor analysis and evaluation model for coastal development setbacks, as well as a systematic method for correcting setback lines according to shoreline use (Fig. 1). Starting from NbS, the framework integrates four technical approaches as the basis for constructing setback space: ecosystem-based adaptation (EbA), ecosystem-based disaster risk reduction (Eco-DRR), nature-based infrastructure (NbI), and natural climate solutions (NCS). EbA emphasizes improving climate-adaptation capacity through the protection, restoration, and sustainable management of ecosystem-service functions. Eco-DRR focuses on strengthening ecosystem resilience to reduce disaster impacts. NbI uses natural processes to address climate adaptation, disaster-risk management, resource supply, and other challenges. NCS uses the carbon-sequestration potential and climate-regulation functions of natural ecosystems.

Because existing approaches to coastal setback delineation are not sufficiently coupled with these four NbS technical objectives, this study constructs three spatial dimensions: disaster risk and resilience (DRR-NbI), ecosystem services (EbA), and carbon-sequestration potential (NCS). Multi-factor spatial overlay analysis is then used, and the farthest distance is taken to establish a base setback line. The study further considers shoreline type and introduces land-sea coordinated management factors such as current and planned land development, existing buildings, urban development boundaries, and village construction boundaries. These factors are used to revise the base line and form the final coastal development setback line.

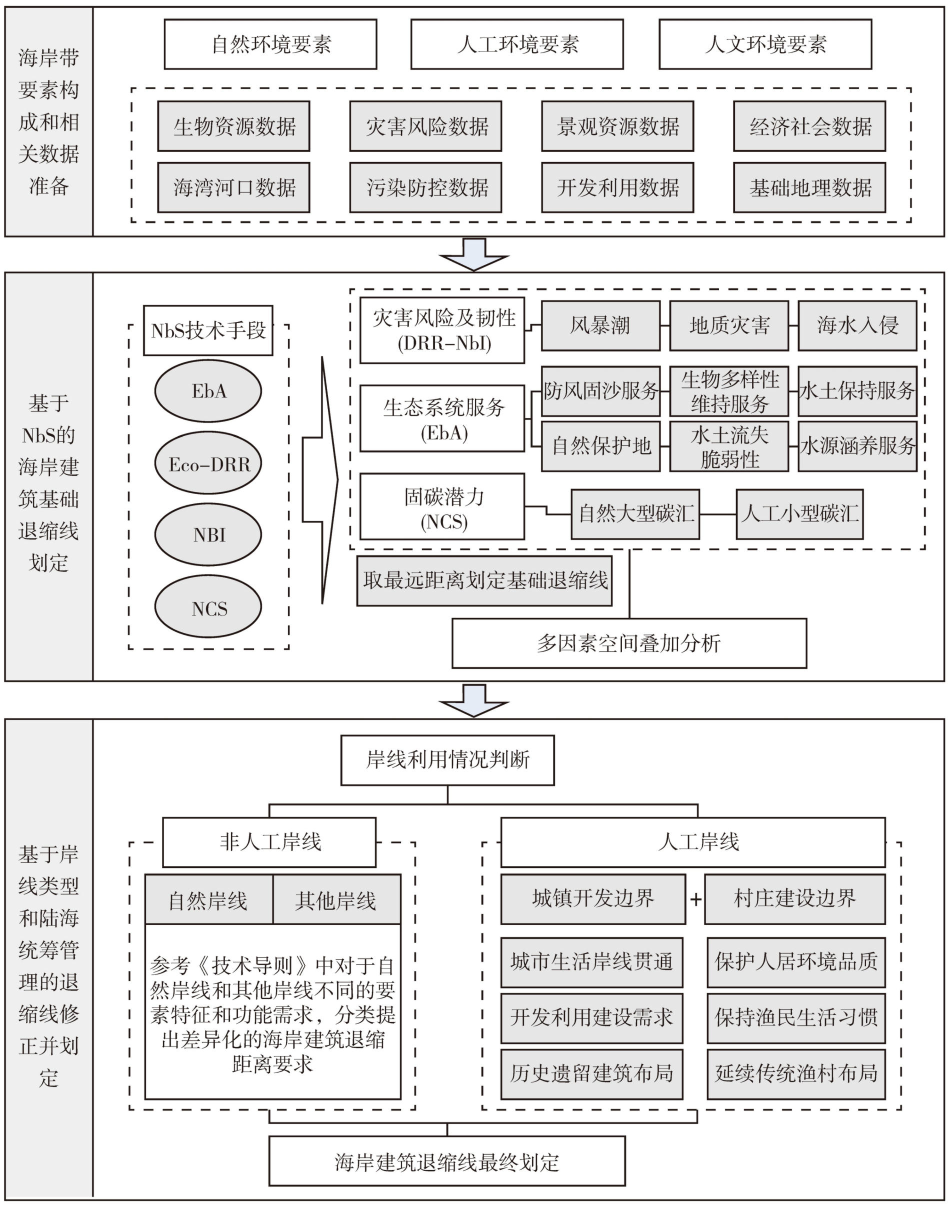


Figure 1. Technical roadmap for delineating coastal development setback lines.

2.3 Multi-factor Analysis and Evaluation Model Based on NbS

2.3.1 Disaster Risk and Resilience (DRR-NbI)

Based on historical spatial data for various disasters, this study considers the impacts of three major natural-resource hazards: storm surge, geological hazards, and seawater intrusion. It establishes a disaster-risk assessment model and uses the outermost boundary of the highest-level risk zone as the coastal setback distance. The DRR-NbI factor assessment model is:

$$R = (H / H_{max}) \times (E / E_{max}) \times (V / V_{max}) \quad (1)$$

where R is the disaster-risk index, H is hazard, meaning the probability and physical intensity of a disaster; E is exposure, including the population, property, and infrastructure in affected areas; and V is vulnerability, meaning the susceptibility and disaster-resistance capacity of exposed objects.

2.3.2 Ecosystem Services (EbA)

For ecosystem services, and with attention to aquatic habitat and drinking-water safety, this study uses the random forest method in machine learning to analyze the quantitative relationship between coastal setback thresholds and water quality. Five datasets were compiled around Dalian's marine water-quality monitoring sites: fishery sea-use types, distance between buildings and the shoreline, current shoreline-function use, water-quality class, and meteorological data. They were divided into test and training sets at a ratio of 1:4. After repeated iterative fitting, with the goodness of fit exceeding 0.7, the study simulated setback threshold distances required for water-quality protection.

The study also considers important areas for windbreak and sand fixation, water-source conservation, soil and water conservation, soil-erosion vulnerability, and biodiversity-maintenance services. The goal is to avoid and reduce as comprehensively as possible the negative ecological impacts of development activities and to provide focused protection for biodiversity hotspots, habitats of endangered species, migration corridors, and distinctive ecosystems.

2.3.3 Carbon-sequestration Potential (NCS)

For carbon-sequestration potential, the study first considers the protection of natural carbon sinks. Mangroves, for example, are key coastal ecological barriers, and setback lines need to reserve sufficient space to maintain their disaster-mitigation function. For protected natural areas, rigid control constraints are applied: setback lines must completely avoid the core zones of protected areas, and strict development restrictions are set for buffer zones. For smaller carbon sinks such as street trees, shrubs, urban green spaces, and parks, the study applies spatial-planning judgment to protect carbon-sink functions as much as possible and establishes carbon-sink coordination areas and protective buffers around coastal areas.

2.3.4 Multi-factor Spatial Overlay

The above factors are integrated through a multi-factor weighted spatial overlay method that combines disaster risk and resilience (DRR-NbI), ecosystem services (EbA), and carbon-sequestration potential (NCS). The formula is:

M = f max sum(i=m)(Di x Ri) (2)

where M is the setback distance under the influence of multiple factors, Di is the setback distance under the influence of factor i, Ri is the correction coefficient of factor i, and m denotes the set of factors, including DRR-NbI, EbA, and NCS. The correction coefficient Ri is scored by seven experts in ecology, disasters, and planning using the Delphi method and can be moderately calibrated according to the natural conditions and risk characteristics of different study areas.

On the basis of spatial overlay, the coastal development setback boundary is corrected according to shoreline type. For artificial shorelines, the method incorporates urban and village construction-management needs and focuses on factors such as continuity of urban living shorelines, development and utilization needs, and rural development-space protection. It revises setback lines inside urban development boundaries and village construction boundaries. For non-artificial shorelines, it proposes differentiated setback-distance requirements according to the element characteristics and functional needs of natural and other shorelines.

3 Empirical Study: Delineating Coastal Development Setback Lines in Dalian

3.1 Current Conditions of Dalian's Coastal Zone

Dalian is located at the southern tip of the Liaodong Peninsula, surrounded by sea on three sides and controlling the passage between the Yellow Sea and the Bohai Sea. It is an important coastal city connecting Northeast Asia and the Eurasian continent and has the longest and most diverse coastline in northern China. Although the Urban Master Plan (2001-2020) and the Regulations of Dalian Municipality on Marine Environmental Protection set out principled requirements for coastal building setbacks, these requirements long lacked clear technical methods and institutional support and were not effectively implemented. As a result, natural shorelines and coastal ecological space in Dalian have continued to shrink (Fig. 2), risks such as storm surge and seawater intrusion have intensified, and the connectivity of coastal public space as well as the quality of residential and landscape environments have been constrained. This highlights the practical urgency of establishing a scientific and operational system for delineating and controlling coastal development setback lines.

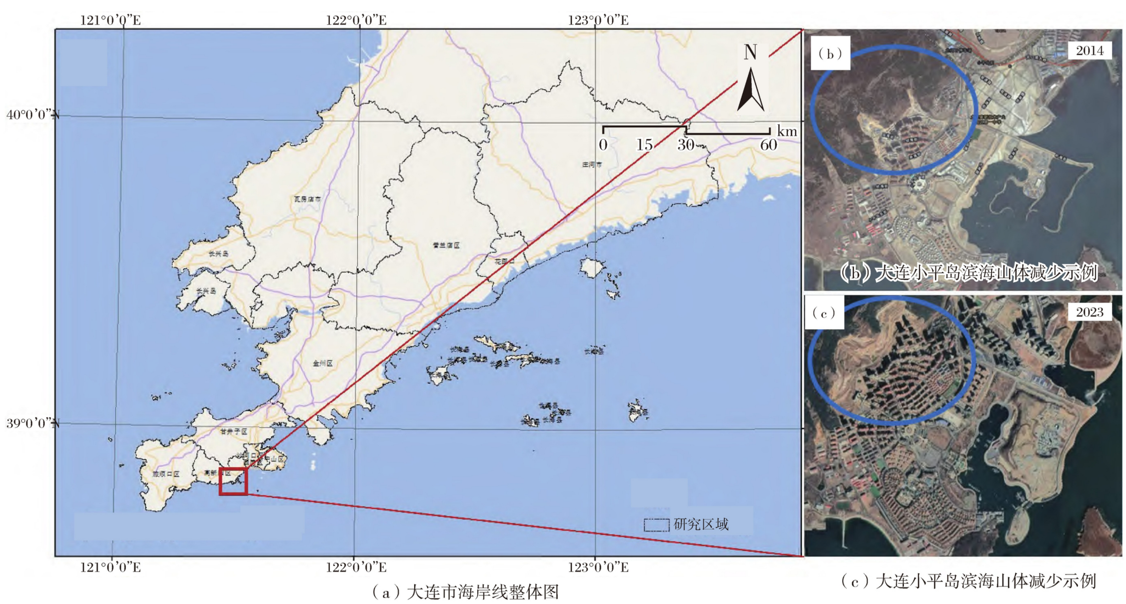


Figure 2. Overall coastline of Dalian and an example of compression of coastal ecological space.

3.2 Disaster Risk and Resilience (DRR-NbI)

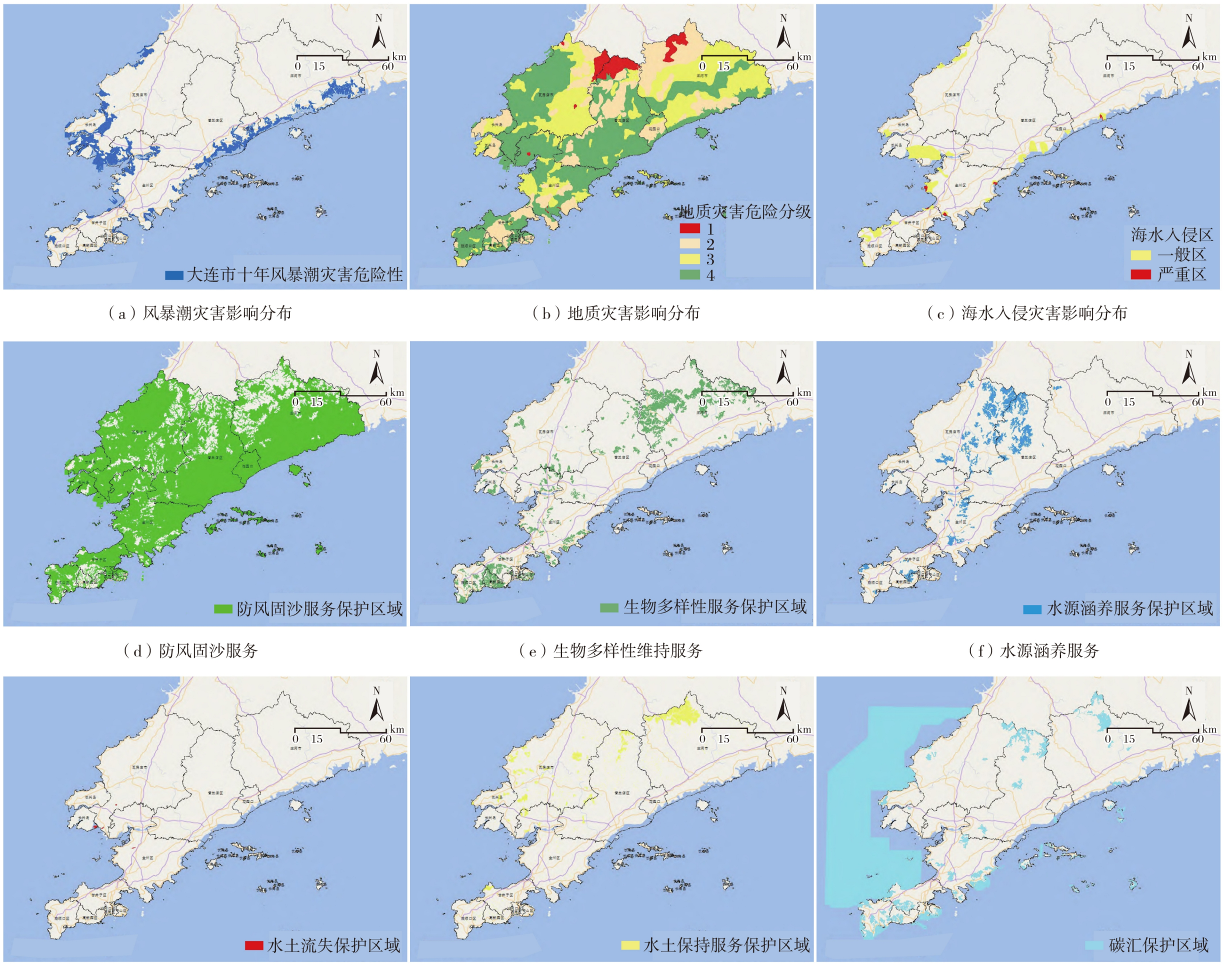
For disaster risk and resilience, the study classifies the three main natural hazards faced by Dalian's coastal zone. Storm-surge and geological-hazard risks are divided into four levels, while seawater-intrusion risk is divided into two levels. Areas affected by each hazard over the past ten years, as well as their maximum impact areas, are spatially located, as shown in Fig. 3(a)-(c). In the past decade, high-risk storm-surge areas in Dalian have been mainly concentrated on the Bohai Sea side, in Pulandian Bay and Hulushan Bay. Some high-risk areas extend about 1 km from the surveyed coastline. Three high-risk geological-hazard areas lie close to the surveyed coastline, in Taiping Bay, Pulandian Bay, and Xiaoyao Bay, with a maximum distance of about 2 km from the surveyed coastline. Four severe seawater-intrusion areas are found in Jinzhou Bay, Dalian Bay, Xingshu Wetland, and Zhangxia Bay, also extending up to about 2 km from the surveyed coastline.

3.3 Ecosystem Services (EbA)

For ecosystem services, Fig. 3(d)-(h) shows that enclosed aquaculture on the Bohai Sea side leads to a relatively high share of water quality worse than Class IV, about 17.39%, threatening aquatic habitats and biodiversity. Aquaculture scale therefore needs to be controlled, and the corresponding setback for enclosed-aquaculture shorelines should be at least 86 m to reduce the impact of aquaculture pollution on nearshore water quality. On the Yellow Sea side, water quality is generally good, with 94.05% reaching Class III or above. The setback is therefore set at no less than 19 m to protect existing ecosystems and prevent development from damaging aquatic habitats. Fishery-infrastructure shorelines require at least 21 m to ensure that nearshore ecosystems are not damaged. For unused shorelines, and considering ecosystem-service protection needs, land reclamation, enclosed aquaculture, and open aquaculture should be strictly controlled on both the Bohai Sea and Yellow Sea sides. The development setback for unused shorelines should be no less than 56 m.

3.4 Carbon-sequestration Potential (NCS)

Carbon-sequestration potential is considered in two aspects: large natural carbon sinks and small carbon sinks. Large natural carbon sinks include mangroves and protected natural areas. On the basis of biological and geographical boundaries in coastal zones, and with reference to avoidance distances, the study determines landward setback distances from the coast. Based on expert experience, this distance is set at 50 m. Small carbon sinks include linear elements such as street trees and shrubs and block-like elements such as urban green spaces and parks. The study uses the farthest landward edge of these features as the boundary to form a new building setback line, as shown in Fig. 3(i).



（a）风暴潮灾害影响分布　（b）地质灾害影响分布　（c）海水入侵灾害影响分布

（d）防风固沙服务　（e）生物多样性维持服务　（f）水源涵养服务

（g）水土流失脆弱性　（h）水土保持服务　（i）固碳潜力

Figure 3. Spatial analysis of disaster risk and resilience, ecosystem services, and carbon-sequestration potential in Dalian.

3.5 Delineating Dalian's Coastal Development Setback Lines

Based on the three dimensions in the NbS-based setback model - DRR-NbI, EbA, and NCS - the study uses multi-factor spatial overlay to preliminarily delineate Dalian's coastal development setback lines (Fig. 4). The key thresholds of the three dimensions are used as bottom-line constraints for overlay verification. In the DRR-NbI dimension, high-risk geological-hazard zones and severe seawater-intrusion zones, extending up to 2 km from the coast, are treated as safety red lines to ensure that setback lines avoid highly disaster-sensitive areas. In the EbA dimension, ecological constraints are integrated: enclosed-aquaculture shorelines on the Bohai Sea side are set back by at least 86 m to control aquaculture pollution, while unused shorelines on the Yellow Sea side are set back by at least 19 m to protect good water quality; biodiversity hotspots are avoided entirely. In the NCS dimension, the carbon-sink protection line is overlaid: natural carbon sinks are set back landward by at least 50 m, and local setback ranges for small carbon sinks are adjusted according to their outer edges. This produces a preliminary coastal development setback line that integrates all three dimensions.

On this basis, the setback lines are revised according to shoreline type. Within urban development boundaries, the setback distance is set at no less than 70 m (Fig. 4). Within the construction boundaries of coastal fishing villages, the setback distance is no less than 30 m. For different shoreline types, including natural, artificial, and other shorelines, the study proposes differentiated base setback distances in accordance with the Guidelines (Table 2), which serve as the basic principles and basis for controlling coastal development setback lines.

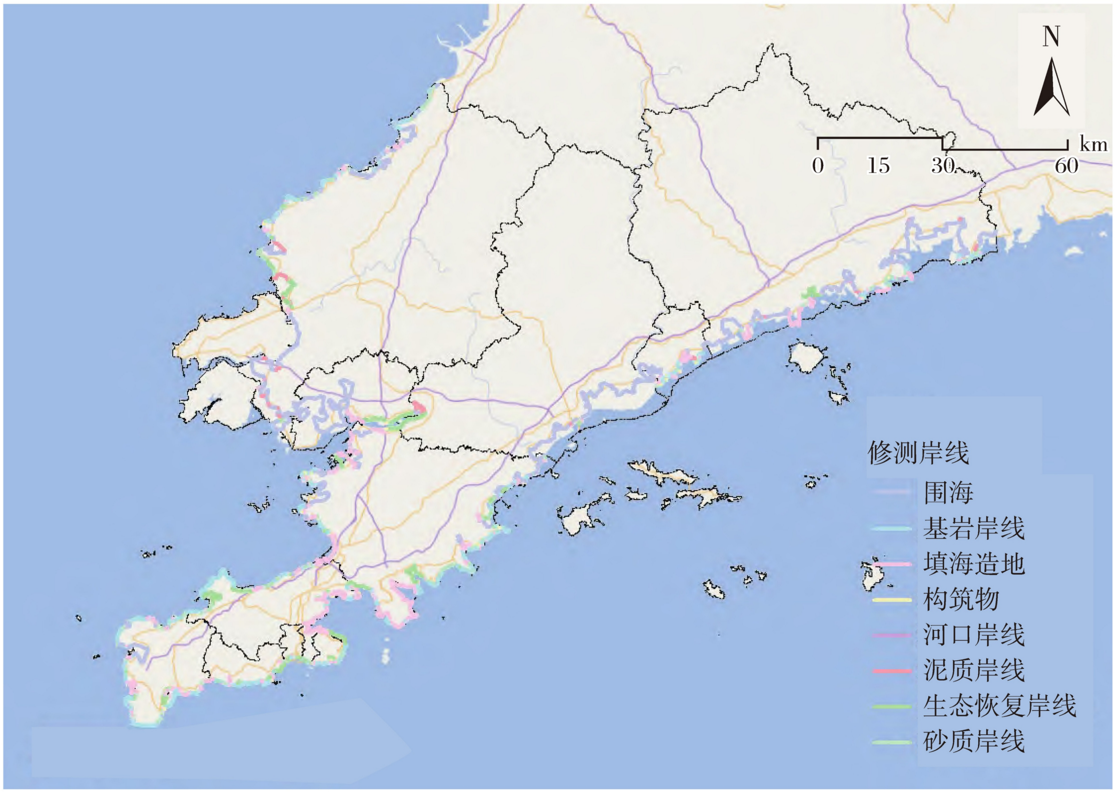


Figure 4. Initial delineation range of coastal development setback lines after multi-factor spatial overlay.

Table 2. Base setback distances for different shoreline types

Shoreline category	Shoreline type	Inside urban development boundary	Inside village construction boundary	Outside these boundaries	Main considerations
Natural shoreline	Bedrock shoreline	-	-	>=100 m	Public waterfront access and landscape construction
Natural shoreline	Sandy shoreline	-	-	>=200 m	Beach-resource protection and shoreline erosion
Natural shoreline	Muddy shoreline	-	-	>=100 m	Protection of tidal-flat wetlands and carbon-sequestration potential

Other shoreline	River-mouth shoreline and ecological-restoration shoreline	>=70 m	>=30 m	>=100 m	Flood safety, ecological restoration and protection, and carbon-sequestration potential
Artificial shoreline	General artificial shoreline	>=70 m	>=30 m	-	Creation of coastal public space, landscape construction, and urban design
Artificial shoreline	Reclamation shoreline	>=30 m	-	-	Land space and reclamation costs
Artificial shoreline	Port and port-industry shoreline	>=0 m	-	-	Production needs requiring coastal location
Artificial shoreline	Salt-field and enclosed-aquaculture shoreline	Bohai Sea side >=100 m; Yellow Sea side >=30 m	-	-	Impacts on sea-area water quality and the ecological environment

Specific-factor corrections: (1) If part or all of Binhai Road (G228) lies within the control zone, the landward side of the road within the control zone is used as the boundary to form a new development setback line. (2) If existing waterfront spaces such as beaches, bathing beaches, coastal parks, and public open green spaces, or marine-disaster impact areas, extend beyond the control zone, the farthest outer edge of these spaces is used as the boundary for the new coastal development setback line.

4 Results and Discussion

4.1 Delineation Results from the NbS Perspective

The delineation of coastal development setback lines is a core component supporting specialized coastal-zone planning from the perspective of land-sea coordination. By introducing an NbS-based delineation method, this study builds a multi-factor coordination framework that combines disaster risk and resilience, ecosystem services, and carbon-sequestration potential. It systematically considers multiple objectives, including protecting coastal ecological environments and important carbon sinks, reducing the impacts of natural disasters, and controlling the orderly seaward expansion of urban development and construction activities. Through differentiated threshold setting and adaptation to shoreline types, such as the >=86 m threshold for enclosed-aquaculture shorelines on the Bohai Sea side and the >=70 m threshold within urban development boundaries, the method transforms setback lines from technical calculation into planning control. It provides practical support for maintaining coastal ecological security, preventing and controlling disaster risks, and guiding orderly urban development in Dalian.

4.2 Linking and Optimizing Specialized Coastal-zone Planning through NbS

Introducing NbS helps address the shortcomings of specialized coastal-zone planning in coordinating multiple factors. Under the NbS framework, this study constructs a multi-factor analysis model. On one hand, it quantifies the relationship between water quality and setback distance in the ecosystem-service dimension and converts ecological functions into measurable thresholds. On the other hand, it integrates storm surge, geological hazards, and carbon-sequestration potential. The setback boundaries defined by this model can serve as a basis for ecological-security zoning and disaster-prevention zoning in specialized planning, promoting a shift from qualitative guidance to quantitative control. NbS-oriented differentiated thresholds and functional correction mechanisms also strengthen the linkage between specialized plans and hierarchical planning.

The Guidelines and Technical Guidelines provide a framework for delineating coastal development setback lines in China. While inheriting their principles, this study further addresses the implementation-level shortfall in multidimensional coordination. Although these documents emphasize land-sea coordination and ecological priority, they do not yet propose a concrete multi-factor coupling method. In local implementation, this can lead to an emphasis on shoreline types while neglecting system-level coordination. Based on the technical concept of NbS, this study translates the land-sea coordination principle in the Guidelines into a three-dimensional spatial coupling model of DRR-NbI, EbA, and NCS. Through multi-factor overlay, it integrates objectives such as landward urban development, disaster response, and marine ecological protection into setback thresholds. This provides a practical reference for localizing the Guidelines and Technical Guidelines in northern coastal cities.

4.3 Classification-based Shoreline Control under Multiple Factors

As multidimensional coordination becomes necessary, the limitations of single-objective approaches become increasingly apparent. Fixed setback distances based only on a single disaster risk or ecological factor may satisfy basic disaster-prevention requirements, but they do not incorporate the overlay of risk factors or the coordination of compound ecosystem services. As a result, setback space cannot easily form a region-wide risk-prevention network. In response, this study distinguishes water-quality protection setback distances on the Bohai Sea and Yellow Sea sides in the EbA dimension and requires avoidance of the core zones of protected natural areas. In the NCS dimension, it incorporates protection requirements for large carbon-sink areas and corrections based on urban green-space edge lines. In addition, to address rigid setback distances and spatial fragmentation in existing practice, the study implements classification-based control according to shoreline type and urban-rural construction needs. Differentiated setback distances improve the adaptability of the setback line.

4.4 Supporting Control System for Coastal Development Setback Lines

After delineating the development setback lines, this study, in response to actual coastal management needs, explores a control mechanism that combines rigidity and flexibility and implements zoned management based on positive and negative lists. For ecologically sensitive and strictly controlled areas, such as the core zones of protected natural areas, high-disaster-risk areas, and core sections of natural shorelines, a positive-list approach is adopted. Only ports, transport infrastructure, public services and industrial research facilities that genuinely require a coastal location, coastal-protection works, and major projects at or above the provincial level are permitted. For relatively flexible areas, such as compliant zones within urban development boundaries and supporting zones along artificial shorelines, a negative-list approach is adopted. Residential real-estate development, unnecessary coastal industrial facilities, and construction activities that affect coastal landscapes and public space or the water quality and ecological environment of sea areas are explicitly prohibited.

4.5 Planning Prospects for Coastal Development Setback Lines

From the perspective of planning implementation, the coordinated governance of existing built space formed by historical reclamation remains a key bottleneck. Some seaward reclamation construction activities have damaged both the contiguity of setback space and its ecological-buffer function. They have also generated compliance conflicts between existing buildings and new regulations. Without flexible disposal mechanisms, the governance effectiveness of setback lines will be directly weakened. Future planning linkage therefore needs to be strengthened in three ways. First, at the technical level, a dynamic adjustment mechanism should be established so that multi-factor weights ensure the setback line adapts to both natural processes and development needs. Second, at the planning-implementation level, control requirements should be converted into quantitative indicators and effectively linked with the Guidelines and Technical Guidelines. Third, at the institutional level, ecological-restoration-first and functional-classification optimization schemes should be formulated for reclamation construction land, drawing on positive and negative list-based zoned management to resolve difficulties in existing-space governance. At the same time, planning transmission and implementation should be strengthened to ensure that coastal development setback lines are scientifically delineated, strictly controlled, and adjusted in a standardized manner.

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