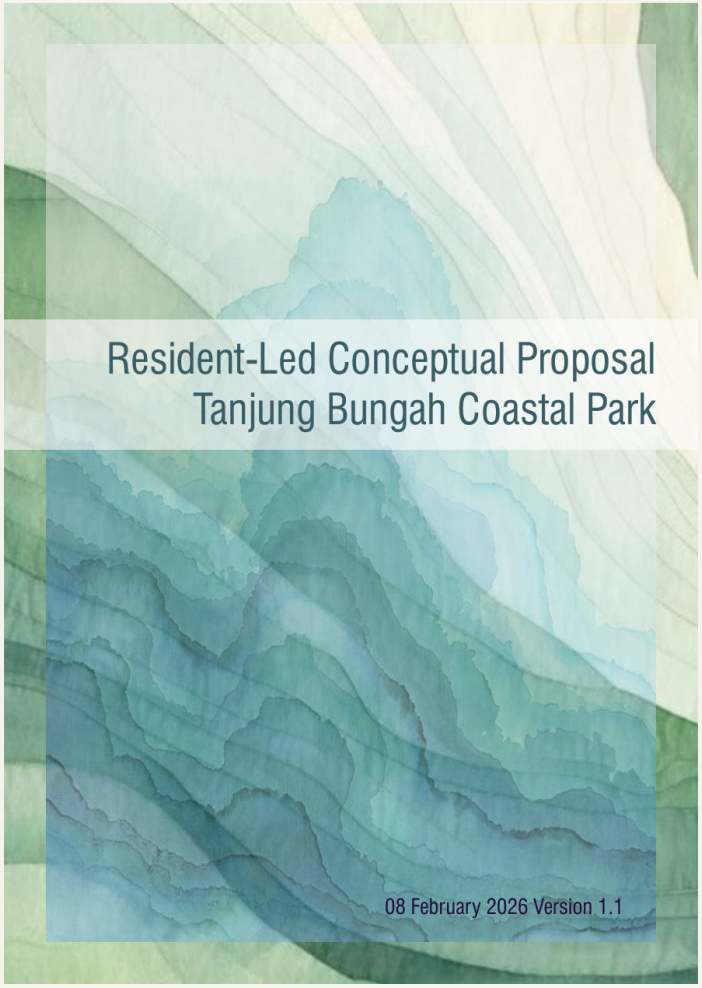


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Edisi bacaan lengkap. Semua teks cadangan diterjemahkan mengikut halaman sumber, termasuk kapsyen dan jadual tanaman. Lukisan asal dipaparkan di sebelah. Teks bahasa Inggeris ialah rujukan asal; ini bukan terjemahan diperakui.

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Cadangan Konseptual Diterajui Penduduk

Taman Pesisir Tanjung Bungah

08 Februari 2026 Versi 1.1

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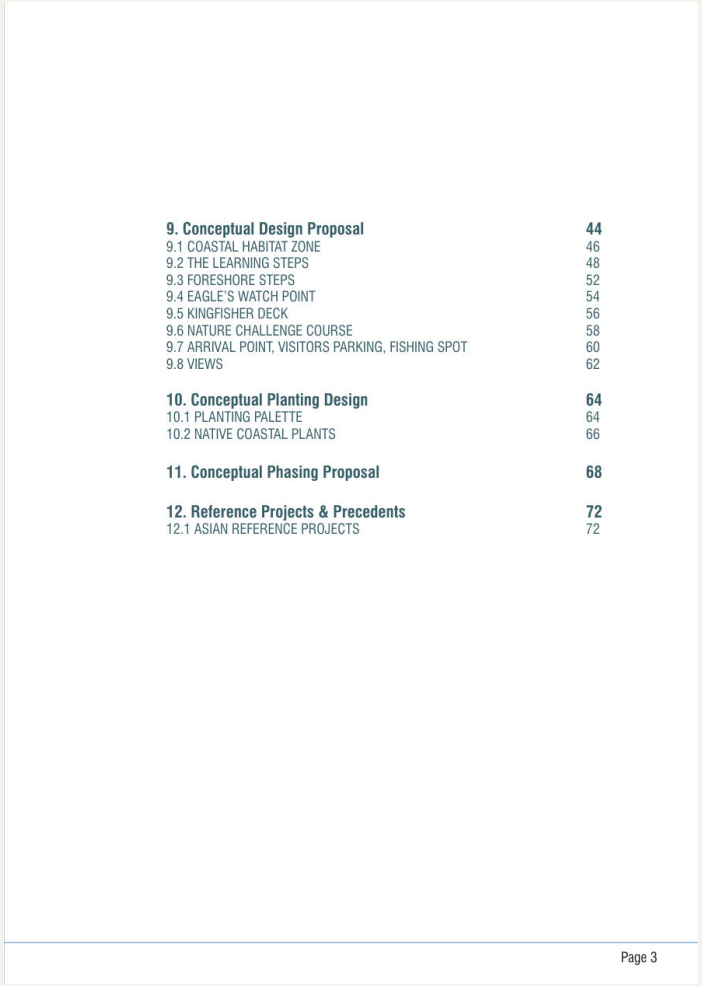
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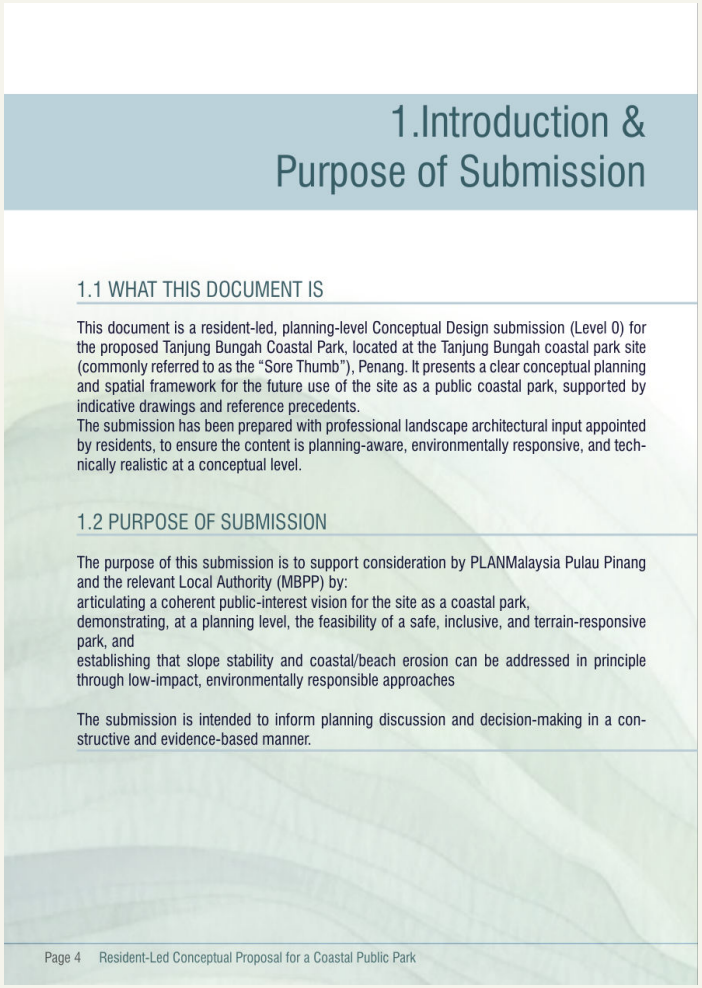
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1.Introduction &
Purpose of Submission

1.1 WHAT THIS DOCUMENT IS

This document is a resident-led, planning-level Conceptual Design submission (Level 0) for the proposed Tanjung Bungah Coastal Park, located at the Tanjung Bungah coastal park site (commonly referred to as the “Sore Thumb”), Penang. It presents a clear conceptual planning and spatial framework for the future use of the site as a public coastal park, supported by indicative drawings and reference precedents.
The submission has been prepared with professional landscape architectural input appointed by residents, to ensure the content is planning-aware, environmentally responsive, and technically realistic at a conceptual level.

1.2 PURPOSE OF SUBMISSION

The purpose of this submission is to support consideration by PLANMalaysia Pulau Pinang and the relevant Local Authority (MBPP) by:
articulating a coherent public-interest vision for the site as a coastal park,
demonstrating, at a planning level, the feasibility of a safe, inclusive, and terrain-responsive park, and
establishing that slope stability and coastal/beach erosion can be addressed in principle through low-impact, environmentally responsible approaches

The submission is intended to inform planning discussion and decision-making in a constructive and evidence-based manner.

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TERJEMAHAN BAHASA MELAYU

Halaman 4

Cadangan Konseptual Diterajui Penduduk untuk Sebuah Taman Awam Pesisir

1. Pengenalan & Tujuan Penyerahan

1.1 SIFAT DOKUMEN INI

Dokumen ini ialah penyerahan Reka Bentuk Konseptual pada peringkat perancangan (Tahap 0), diterajui penduduk, bagi cadangan Taman Pesisir Tanjung Bungah yang terletak di tapak taman pesisir Tanjung Bungah (lazimnya dikenali sebagai “Sore Thumb”), Pulau Pinang. Dokumen ini mengemukakan rangka perancangan konsep dan ruang yang jelas bagi kegunaan tapak pada masa hadapan sebagai taman awam pesisir, disokong oleh lukisan indikatif dan contoh rujukan terdahulu.

Penyerahan ini disediakan dengan input profesional seni bina landskap yang dilantik oleh penduduk, bagi memastikan kandungannya mengambil kira perancangan, responsif terhadap alam sekitar dan realistik dari segi teknikal pada peringkat konsep.

1.2 TUJUAN PENYERAHAN

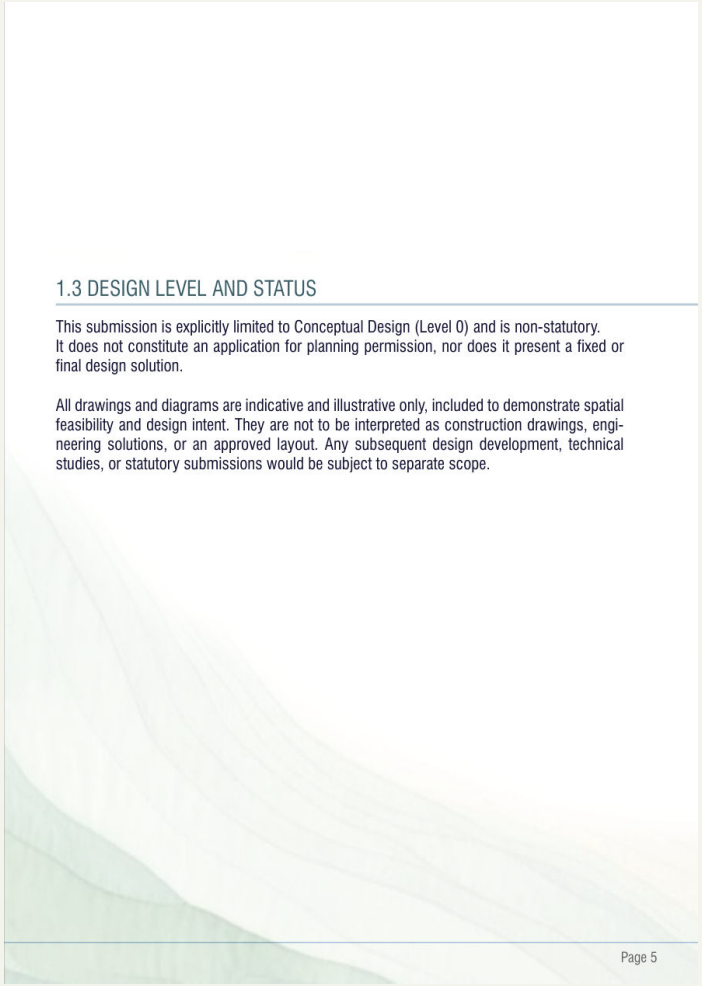
Tujuan penyerahan ini adalah untuk menyokong pertimbangan oleh PLANMalaysia Pulau Pinang dan Pihak Berkuasa Tempatan yang berkaitan (MBPP) dengan:

• menghuraikan visi yang menyeluruh dan mengutamakan kepentingan awam bagi tapak ini sebagai taman pesisir;

• menunjukkan, pada peringkat perancangan, kebolehlaksanaan sebuah taman yang selamat, inklusif dan responsif terhadap bentuk muka bumi; dan

• menetapkan bahawa kestabilan cerun serta hakisan pesisir/pantai boleh ditangani secara prinsip melalui pendekatan berimpak rendah dan bertanggungjawab terhadap alam sekitar.

Penyerahan ini bertujuan memberikan maklumat untuk perbincangan perancangan dan pembuatan keputusan secara membina dan berasaskan bukti.



1.3 DESIGN LEVEL AND STATUS

This submission is explicitly limited to Conceptual Design (Level 0) and is non-statutory. It does not constitute an application for planning permission, nor does it present a fixed or final design solution.

All drawings and diagrams are indicative and illustrative only, included to demonstrate spatial feasibility and design intent. They are not to be interpreted as construction drawings, engineering solutions, or an approved layout. Any subsequent design development, technical studies, or statutory submissions would be subject to separate scope.

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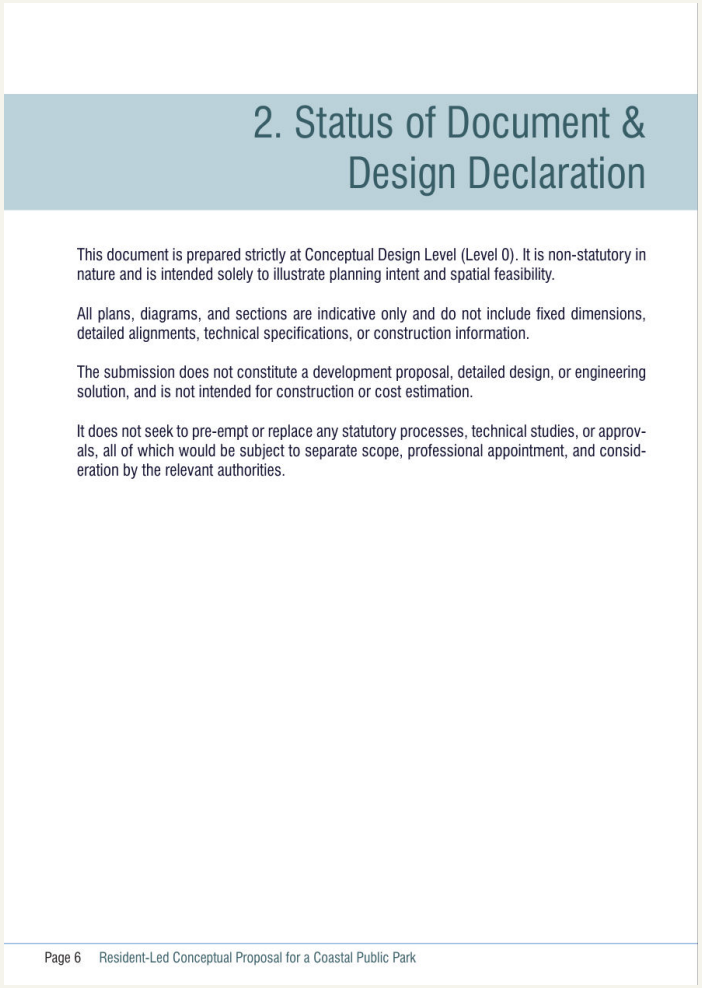
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1.3 PERINGKAT DAN STATUS REKA BENTUK

Penyerahan ini secara jelas terhad kepada Reka Bentuk Konseptual (Tahap 0) dan bersifat bukan statutori. Ia bukan permohonan kebenaran merancang, dan tidak mengemukakan penyelesaian reka bentuk yang tetap atau muktamad.

Semua lukisan dan rajah hanyalah indikatif dan bersifat ilustrasi, disertakan untuk menunjukkan kebolehlaksanaan ruang serta hasrat reka bentuk. Ia tidak boleh ditafsirkan sebagai lukisan pembinaan, penyelesaian kejuruteraan atau susun atur yang telah diluluskan. Sebarang pembangunan reka bentuk, kajian teknikal atau penyerahan statutori seterusnya akan tertakluk pada skop yang berasingan.



2. Status of Document & Design Declaration

This document is prepared strictly at Conceptual Design Level (Level 0). It is non-statutory in nature and is intended solely to illustrate planning intent and spatial feasibility.

All plans, diagrams, and sections are indicative only and do not include fixed dimensions, detailed alignments, technical specifications, or construction information.

The submission does not constitute a development proposal, detailed design, or engineering solution, and is not intended for construction or cost estimation.

It does not seek to pre-empt or replace any statutory processes, technical studies, or approvals, all of which would be subject to separate scope, professional appointment, and consideration by the relevant authorities.

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TERJEMAHAN BAHASA MELAYU

Halaman 6

Cadangan Konseptual Diterajui Penduduk untuk Sebuah Taman Awam Pesisir

2. Status Dokumen & Perisytiharan Reka Bentuk

Dokumen ini disediakan khusus pada Peringkat Reka Bentuk Konseptual (Tahap 0). Ia bersifat bukan statutori dan bertujuan semata-mata untuk menggambarkan hasrat perancangan serta kebolehlaksanaan ruang.

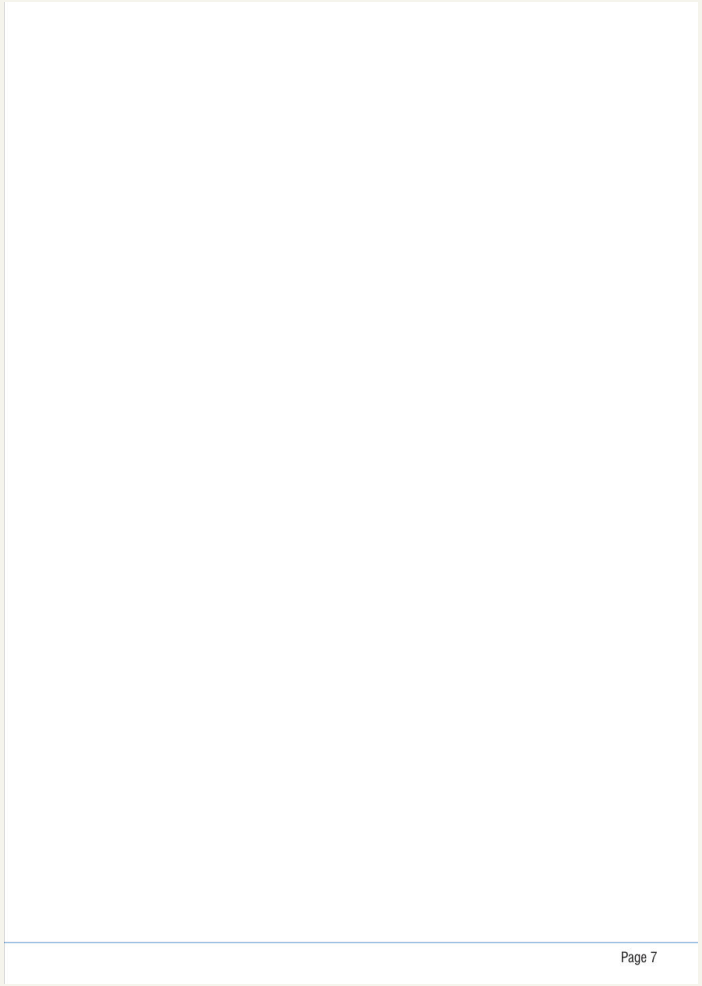
Semua pelan, rajah dan keratan hanyalah indikatif dan tidak merangkumi dimensi tetap, jajaran terperinci, spesifikasi teknikal atau maklumat pembinaan.

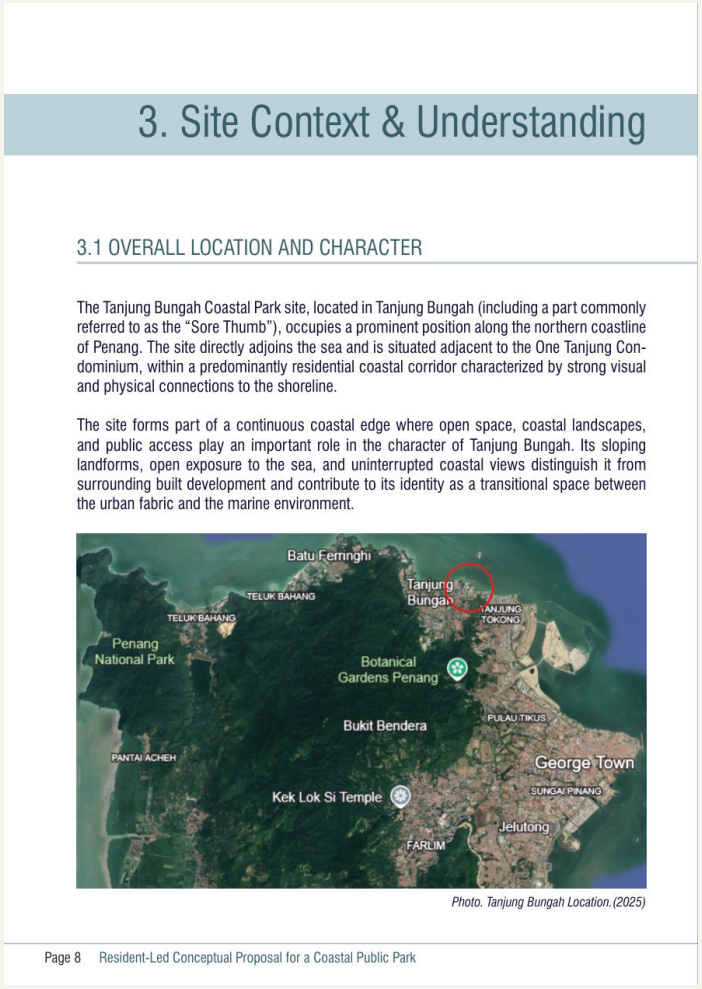
Penyerahan ini bukan cadangan pembangunan, reka bentuk terperinci atau penyelesaian kejuruteraan, dan tidak dimaksudkan untuk pembinaan atau anggaran kos.

Ia tidak bertujuan mendahului atau menggantikan mana-mana proses statutori, kajian teknikal atau kelulusan; semuanya akan tertakluk pada skop berasingan, pelantikan profesional dan pertimbangan pihak berkuasa yang berkaitan.

TERJEMAHAN BAHASA MELAYU

Halaman 7





3. Site Context & Understanding

3.1 OVERALL LOCATION AND CHARACTER

The Tanjung Bungah Coastal Park site, located in Tanjung Bungah (including a part commonly referred to as the "Sore Thumb"), occupies a prominent position along the northern coastline of Penang. The site directly adjoins the sea and is situated adjacent to the One Tanjung Condominium, within a predominantly residential coastal corridor characterized by strong visual and physical connections to the shoreline.

The site forms part of a continuous coastal edge where open space, coastal landscapes, and public access play an important role in the character of Tanjung Bungah. Its sloping landforms, open exposure to the sea, and uninterrupted coastal views distinguish it from surrounding built development and contribute to its identity as a transitional space between the urban fabric and the marine environment.

Photo. Tanjung Bungah Location.(2025)

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TERJEMAHAN BAHASA MELAYU

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Cadangan Konseptual Diterajui Penduduk untuk Sebuah Taman Awam Pesisir

3. Konteks & Pemahaman Tapak

3.1 LOKASI DAN CIRI KESELURUHAN

Tapak Taman Pesisir Tanjung Bungah, yang terletak di Tanjung Bungah (termasuk bahagian yang lazimnya dikenali sebagai "Sore Thumb"), menduduki lokasi yang menonjol di sepanjang garis pantai utara Pulau Pinang. Tapak ini bersempadan terus dengan laut dan terletak bersebelahan Kondominium One Tanjung, dalam koridor pesisir yang sebahagian besarnya merupakan kawasan kediaman serta mempunyai hubungan visual dan fizikal yang kukuh dengan persisiran pantai.

Tapak ini merupakan sebahagian daripada pinggir pesisir yang berterusan, di mana kawasan lapang, landskap pesisir dan akses awam memainkan peranan penting dalam membentuk ciri Tanjung Bungah. Bentuk muka buminya yang bercerun, keterbukaannya kepada laut dan pemandangan pesisir tanpa halangan membezakannya daripada pembangunan binaan di sekeliling, serta menyumbang kepada identitinya sebagai ruang peralihan antara persekitaran bandar dan persekitaran marin.

Foto: Lokasi Tanjung Bungah (2025).

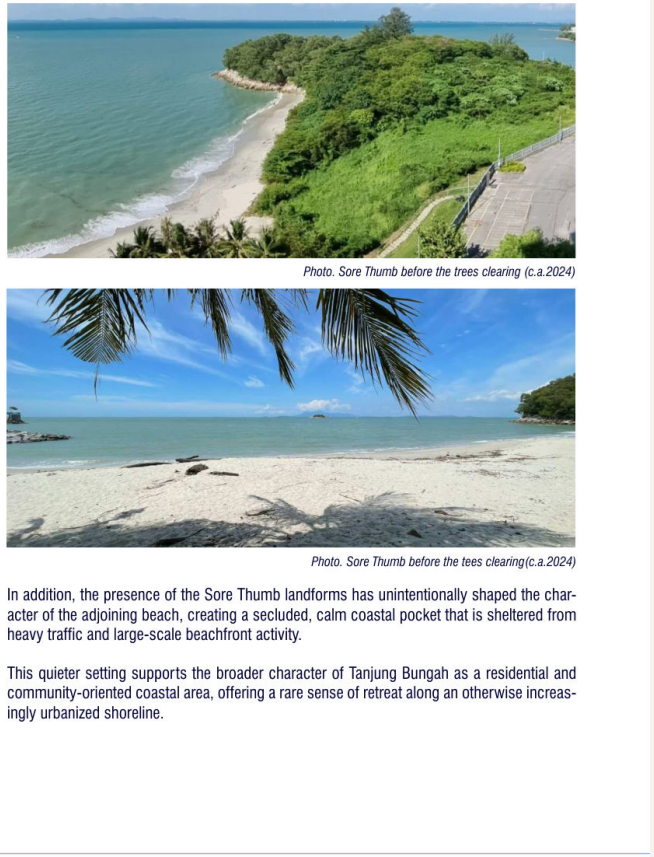


Photo. Sore Thumb before the trees clearing (c.a.2024)

Photo. Sore Thumb before the tees clearing(c.a.2024)

In addition, the presence of the Sore Thumb landforms has unintentionally shaped the character of the adjoining beach, creating a secluded, calm coastal pocket that is sheltered from heavy traffic and large-scale beachfront activity.

This quieter setting supports the broader character of Tanjung Bungah as a residential and community-oriented coastal area, offering a rare sense of retreat along an otherwise increasingly urbanized shoreline.

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TERJEMAHAN BAHASA MELAYU

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Di samping itu, kehadiran bentuk muka bumi Sore Thumb secara tidak sengaja telah membentuk ciri pantai bersebelahan, mewujudkan ruang pesisir yang tersorok dan tenang, terlindung daripada trafik sibuk serta aktiviti tepi pantai berskala besar.

Suasana yang lebih tenang ini menyokong ciri Tanjung Bungah secara lebih luas sebagai kawasan pesisir berorientasikan kediaman dan komuniti, menawarkan ketenangan yang jarang ditemui di sepanjang garis pantai yang semakin dibandarkan.

Foto: Sore Thumb sebelum pembersihan pokok (sekitar 2024).

Foto: Sore Thumb sebelum pembersihan pokok (sekitar 2024).



Plan: Public access is currently limited and poorly signed, unintentionally gate-keeping the beach for private users — a growing concern in Penang.



Photo. Public Access seen from the street (2025)



Photo. Public Access seen from the beach (2025)



Photo. Public Access seen from the beach (2025)

Although the beach **remains publicly accessible**, its entrance is poorly defined, with no signage, unclear way-finding, and a lack of safe, formalized access such as steps or graded paths, which limits its usability and visibility.

Local residents strongly value the ability to reach and use the shoreline, particularly in a context where many beaches in Penang are becoming de facto private due to gated developments and restricted access through private land.

TERJEMAHAN BAHASA MELAYU

Halaman 10

Cadangan Konseptual Diterajui Penduduk untuk Sebuah Taman Awam Pesisir

AKSES AWAM

AKSES SEPARA PERSENDIRIAN

AKSES SEPARA PERSENDIRIAN

TIADA AKSES

Foto: Akses awam dilihat dari jalan (2025).

Walaupun pantai ini masih boleh diakses oleh orang awam, pintu masuknya tidak jelas, tanpa papan tanda, pandu arah yang tidak jelas, serta kekurangan akses rasmi yang selamat seperti tangga atau laluan berkecerunan terancang. Keadaan ini mengehadkan kebolehgunaan pantai dan menyukarkan orang ramai mengenal pasti aksesnya.

Penduduk setempat amat menghargai keupayaan untuk sampai ke dan menggunakan pesisir pantai, khususnya ketika banyak pantai di Pulau Pinang menjadi persendirian secara de facto akibat pembangunan berpagar serta akses yang dihadkan melalui tanah persendirian.

Foto: Akses awam dilihat dari pantai (2025).

Foto: Akses awam dilihat dari pantai (2025).

Pelan: Akses awam pada masa ini terhad dan kurang papan tanda, secara tidak sengaja menjadikan pantai seolah-olah dikhaskan untuk pengguna persendirian — suatu kebimbangan yang semakin meningkat di Pulau Pinang.



Plan. The introduction of a second public access will improve accessibility to the beach for a wider range of users.

The proposed **Coastal Park seeks to directly address these shortcomings** by clarifying and safeguarding public access to the beach.

By integrating the beach with a clearly legible public park, the project will make the shoreline easier to find, safer to access, and more enjoyable to use, while retaining its calm and intimate character.

Despite its secluded nature, the beach already serves as a shared space during national holidays, when it is actively used by both Malaysians and visitors alike—highlighting its importance as a genuinely public coastal asset worthy of protection and enhancement.

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Halaman 11

AKSES AWAM SEDIA ADA

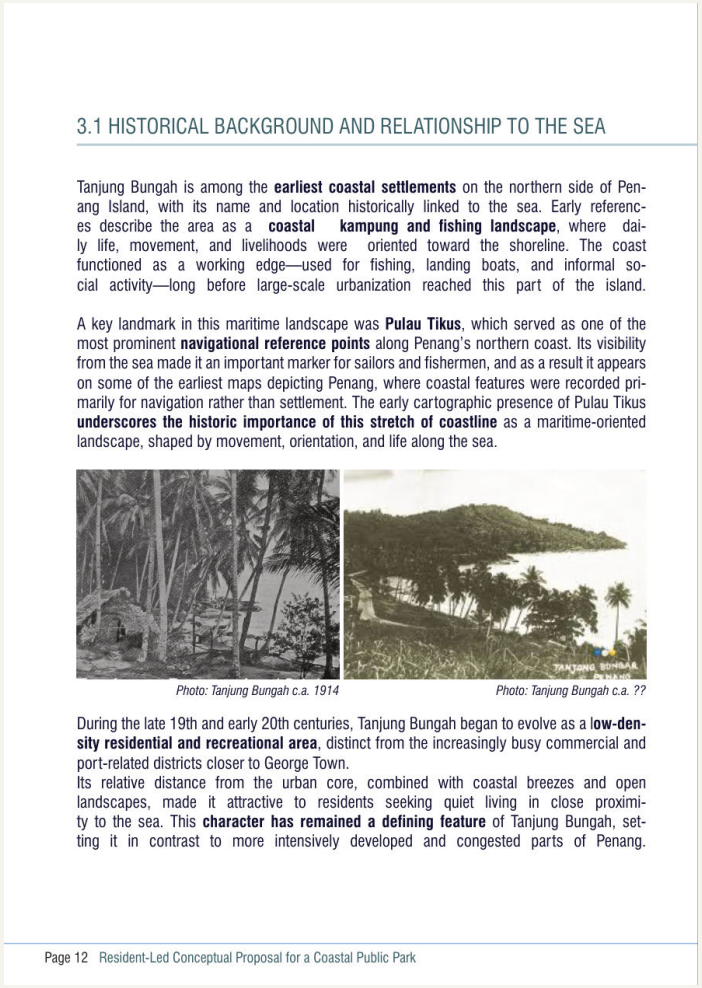
AKSES AWAM BAHARU

Cadangan Taman Pesisir ini bertujuan menangani kelemahan tersebut secara langsung dengan memperjelas dan melindungi akses awam ke pantai.

Dengan menyepadukan pantai dengan taman awam yang mudah dikenal pasti dan difahami, projek ini akan menjadikan pesisir pantai lebih mudah ditemui, lebih selamat diakses dan lebih menyeronokkan untuk digunakan, sambil mengekalkan suasananya yang tenang dan mesra.

Walaupun agak tersorok, pantai ini sudah menjadi ruang bersama semasa cuti umum negara, apabila ia digunakan secara aktif oleh rakyat Malaysia dan pengunjung — menonjolkan kepentingannya sebagai aset pesisir yang benar-benar awam serta wajar dilindungi dan dipertingkatkan.

Pelan: Pengenalan akses awam kedua akan meningkatkan kebolehcapaian ke pantai untuk kumpulan pengguna yang lebih luas.



3.1 HISTORICAL BACKGROUND AND RELATIONSHIP TO THE SEA

Tanjung Bungah is among the **earliest coastal settlements** on the northern side of Penang Island, with its name and location historically linked to the sea. Early references describe the area as a **coastal kampung and fishing landscape**, where daily life, movement, and livelihoods were oriented toward the shoreline. The coast functioned as a working edge—used for fishing, landing boats, and informal social activity—long before large-scale urbanization reached this part of the island.

A key landmark in this maritime landscape was **Pulau Tikus**, which served as one of the most prominent **navigational reference points** along Penang's northern coast. Its visibility from the sea made it an important marker for sailors and fishermen, and as a result it appears on some of the earliest maps depicting Penang, where coastal features were recorded primarily for navigation rather than settlement. The early cartographic presence of Pulau Tikus **underscores the historic importance of this stretch of coastline** as a maritime-oriented landscape, shaped by movement, orientation, and life along the sea.

Photo: Tanjung Bungah c.a. 1914 *Photo: Tanjung Bungah c.a. ??*

During the late 19th and early 20th centuries, Tanjung Bungah began to evolve as a **low-density residential and recreational area**, distinct from the increasingly busy commercial and port-related districts closer to George Town.
Its relative distance from the urban core, combined with coastal breezes and open landscapes, made it attractive to residents seeking quiet living in close proximity to the sea. This **character has remained a defining feature** of Tanjung Bungah, setting it in contrast to more intensively developed and congested parts of Penang.

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TERJEMAHAN BAHASA MELAYU

Halaman 12

Cadangan Konseptual Diterajui Penduduk untuk Sebuah Taman Awam Pesisir

3.1 LATAR BELAKANG SEJARAH DAN HUBUNGAN DENGAN LAUT

Tanjung Bungah merupakan antara penempatan pesisir terawal di bahagian utara Pulau Pinang, dengan nama dan lokasinya mempunyai hubungan sejarah dengan laut. Rujukan awal menggambarkan kawasan ini sebagai kampung pesisir dan landskap nelayan, di mana kehidupan harian, pergerakan dan mata pencarian berorientasikan persisiran pantai. Pesisir ini berfungsi sebagai ruang kegiatan — digunakan untuk menangkap ikan, mendaratkan bot dan aktiviti sosial tidak formal — lama sebelum pembandaran berskala besar sampai ke bahagian pulau ini.

Satu mercu tanda penting dalam landskap maritim ini ialah Pulau Tikus, yang berfungsi sebagai salah satu titik rujukan pelayaran paling menonjol di sepanjang pantai utara Pulau Pinang. Kebolehlihatannya dari laut menjadikannya penanda penting bagi pelayar dan nelayan. Oleh itu, ia muncul dalam beberapa peta terawal yang menggambarkan Pulau Pinang, ketika ciri pesisir direkodkan terutamanya untuk pelayaran, bukannya penempatan. Kehadiran Pulau Tikus dalam kartografi awal menekankan kepentingan sejarah bahagian pantai ini sebagai landskap berorientasikan maritim, dibentuk oleh pergerakan, orientasi dan kehidupan di tepi laut.

Pada penghujung abad ke-19 dan awal abad ke-20, Tanjung Bungah mula berkembang sebagai kawasan kediaman dan rekreasi berkepadatan rendah, berbeza daripada daerah perdagangan dan pelabuhan yang semakin sibuk berhampiran George Town.

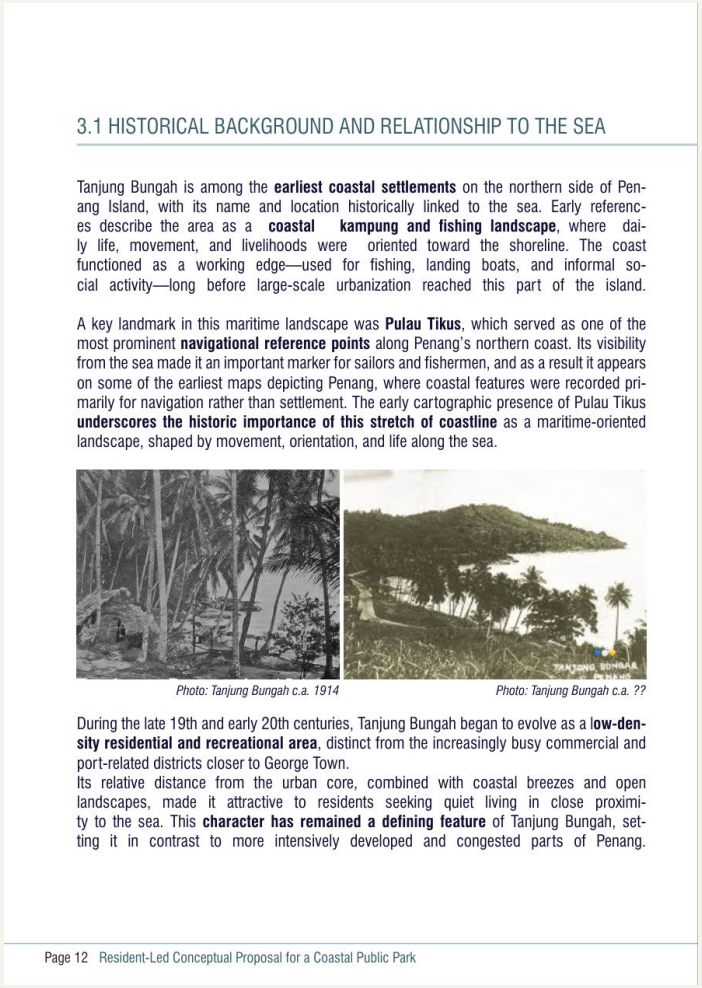
Jaraknya yang agak jauh dari pusat bandar, bersama angin pesisir dan landskap terbuka, menjadikannya menarik kepada penduduk yang mencari kehidupan tenang berdekatan laut. Ciri ini kekal sebagai sifat utama Tanjung Bungah, membezakannya daripada bahagian lain Pulau Pinang yang lebih pesat dibangunkan dan sesak.

Foto: Tanjung Bungah, sekitar 1914.

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TERJEMAHAN BAHASA MELAYU · sambungan

Foto: Tanjung Bungah, sekitar ??.



3.1 HISTORICAL BACKGROUND AND RELATIONSHIP TO THE SEA

Tanjung Bungah is among the **earliest coastal settlements** on the northern side of Penang Island, with its name and location historically linked to the sea. Early references describe the area as a **coastal kampung and fishing landscape**, where daily life, movement, and livelihoods were oriented toward the shoreline. The coast functioned as a working edge—used for fishing, landing boats, and informal social activity—long before large-scale urbanization reached this part of the island.

A key landmark in this maritime landscape was **Pulau Tikus**, which served as one of the most prominent **navigational reference points** along Penang's northern coast. Its visibility from the sea made it an important marker for sailors and fishermen, and as a result it appears on some of the earliest maps depicting Penang, where coastal features were recorded primarily for navigation rather than settlement. The early cartographic presence of Pulau Tikus **underscores the historic importance of this stretch of coastline** as a maritime-oriented landscape, shaped by movement, orientation, and life along the sea.

Photo: Tanjung Bungah c.a. 1914 *Photo: Tanjung Bungah c.a. ??*

During the late 19th and early 20th centuries, Tanjung Bungah began to evolve as a l**ow-density residential and recreational area**, distinct from the increasingly busy commercial and port-related districts closer to George Town.
Its relative distance from the urban core, combined with coastal breezes and open landscapes, made it attractive to residents seeking quiet living in close proximity to the sea. This **character has remained a defining feature** of Tanjung Bungah, setting it in contrast to more intensively developed and congested parts of Penang.

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Photo: Tanjung Bungah c.a 1960

One of the earliest major formal developments in the area was the Penang Swimming Club, established in the early 20th century along the Tanjung Bungah shoreline. The club's siting directly at the water's edge reflects the long-standing recreational relationship between the community and the sea, reinforcing the area's identity as a coastal leisure environment rather than an industrial or commercial one.



Photo: Penang Swimming Club: founded in 1903

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TERJEMAHAN BAHASA MELAYU

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Salah satu pembangunan formal utama yang terawal di kawasan ini ialah Penang Swimming Club, yang ditubuhkan pada awal abad ke-20 di sepanjang persisiran Tanjung Bungah. Kedudukan kelab ini betul-betul di tepi air mencerminkan hubungan rekreasi yang telah lama terjalin antara komuniti dengan laut, memperkukuh identiti kawasan ini sebagai persekitaran riadah pesisir, bukannya kawasan perindustrian atau perdagangan.

Foto: Tanjung Bungah, sekitar 1960.

Foto: Penang Swimming Club: ditubuhkan pada 1903.

Pulau Tikus

More recently, this relationship is also symbolically expressed through the Tanjung Bungah **Floating Mosque (Masjid Terapung Tanjung Bungah)**, which is deliberately positioned in close dialogue with the water. The mosque's setting reinforces the cultural and spiritual significance of the sea within the local landscape, and reflects a continued tradition of integrating built form with the coastal environment rather than separating it through hard barriers.



Photo: Masjid Terapung Tanjung Bungah by Hafiz Ismail c.a 2024



Photo: Before Masjid Terapung Tanjung Bungah

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TERJEMAHAN BAHASA MELAYU

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Cadangan Konseptual Diterajui Penduduk untuk Sebuah Taman Awam Pesisir

Pada masa yang lebih terkini, hubungan ini turut diungkapkan secara simbolik melalui Masjid Terapung Tanjung Bungah, yang sengaja diletakkan dalam hubungan yang rapat dengan air. Kedudukan masjid ini memperkukuh kepentingan budaya dan kerohanian laut dalam landskap setempat, serta mencerminkan kesinambungan tradisi menyepadukan bentuk binaan dengan persekitaran pesisir dan bukannya memisahkannya melalui penghadang keras.

Foto: Masjid Terapung Tanjung Bungah oleh Hafiz Ismail, sekitar 2024.

Foto: Sebelum Masjid Terapung Tanjung Bungah.

The subject site itself originated from a past unauthorized **land reclamation,** which altered the original shoreline configuration. While this intervention was not formally planned, the resulting landform has since become embedded within the broader coastal fabric of Tanjung Bungah. Over time, natural coastal processes and vegetation establishment have reshaped the site, allowing it to reconnect functionally and visually with the sea. In this sense, the site reflects the layered history of Tanjung Bungah—where natural systems, informal coastal use, and later residential development have coexisted and evolved along the shoreline.



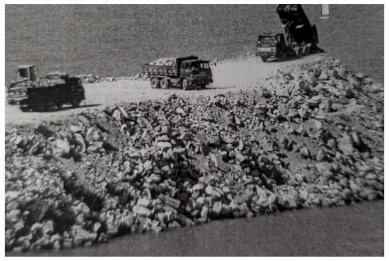


Photo: Land reclamation (alleged illegal): the extensive footprint of the "Sore Thumb" is clearly visible

TERJEMAHAN BAHASA MELAYU

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Tapak berkenaan sendiri berasal daripada kerja penambakan tanah tanpa kebenaran pada masa lalu, yang mengubah konfigurasi asal garis pantai. Walaupun campur tangan ini tidak dirancang secara rasmi, bentuk muka bumi yang terhasil sejak itu telah menjadi sebahagian daripada persekitaran pesisir Tanjung Bungah yang lebih luas. Seiring masa, proses pesisir semula jadi dan pertumbuhan tumbuh-tumbuhan telah membentuk semula tapak ini, membolehkannya berhubung semula dengan laut dari segi fungsi dan visual. Dalam pengertian ini, tapak tersebut mencerminkan sejarah Tanjung Bungah yang berlapis-lapis — di mana sistem semula jadi, penggunaan pesisir secara tidak formal dan pembangunan kediaman kemudian telah wujud bersama serta berkembang di sepanjang garis pantai.

Foto: Penambakan tanah (didakwa menyalahi undang-undang): keluasan jejak “Sore Thumb” jelas kelihatan.



3.2 ENVIRONMENTAL IMPORTANCE AND ECOLOGICAL ROLE

Despite its artificial origin, the site has evolved into a **functioning coastal ecosystem** through natural succession. Vegetation has established across the sloping landform, creating ground cover that supports surface stability and moderates erosion.

This naturalized landscape now provides **habitat and foraging opportunities** for a range of coastal and terrestrial fauna, including birds and other small animals commonly associated with shoreline environments.

Although the site is relatively new and its ecological value is modest at the island-wide scale, it plays a pivotal role in shaping local ecology, landscape identity, and environmental continuity for the Tanjung Bungah area.

The site functions as a **local ecological haven** within an increasingly urbanized coastal stretch, providing refuge, feeding grounds, and movement space for a range of coastal and terrestrial wildlife. Its position along the shoreline allows it to operate as **a local ecological corridor,** supporting continuity between land-based habitats and nearshore marine environments. This connective role is particularly important in Penang, where much of the natural coastline has already been fragmented or replaced by hard engineering.

Photo: A continuous green link supporting wildlife movement between Penang's hill forests and the shoreline.

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TERJEMAHAN BAHASA MELAYU

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Cadangan Konseptual Diterajui Penduduk untuk Sebuah Taman Awam Pesisir

3.2 KEPENTINGAN ALAM SEKITAR DAN PERANAN EKOLOGI

Walaupun berasal daripada pembentukan buatan, tapak ini telah berkembang menjadi ekosistem pesisir yang berfungsi melalui sesaran ekologi semula jadi. Tumbuh-tumbuhan telah bertapak di seluruh bentuk muka bumi yang bercerun, mewujudkan litupan tanah yang menyokong kestabilan permukaan dan mengurangkan hakisan.

Landskap yang telah menjadi semula jadi ini kini menyediakan habitat dan peluang mencari makanan bagi pelbagai fauna pesisir dan daratan, termasuk burung serta haiwan kecil lain yang lazim dikaitkan dengan persekitaran persisiran pantai.

Walaupun tapak ini agak baharu dan nilai ekologinya sederhana pada skala seluruh pulau, ia memainkan peranan penting dalam membentuk ekologi setempat, identiti landskap dan kesinambungan alam sekitar bagi kawasan Tanjung Bungah.

Tapak ini berfungsi sebagai kawasan perlindungan ekologi setempat di bahagian pesisir yang semakin dibandarkan, menyediakan tempat berlindung, kawasan mencari makanan dan ruang pergerakan bagi pelbagai hidupan liar pesisir dan daratan. Kedudukannya di sepanjang persisiran membolehkannya berfungsi sebagai koridor ekologi setempat, menyokong kesinambungan antara habitat daratan dengan persekitaran marin berhampiran pantai. Peranan penghubung ini amat penting di Pulau Pinang, di mana sebahagian besar garis pantai semula jadi sudah terpecah-pecah atau digantikan oleh struktur kejuruteraan keras.

Foto: Rangkaian hijau berterusan yang menyokong pergerakan hidupan liar antara hutan bukit Pulau Pinang dengan persisiran pantai.

Taman Pesisir Tanjung Bungah

Pulau Tikus

Pearl Hill

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TERJEMAHAN BAHASA MELAYU · sambungan

Bukit Olivia

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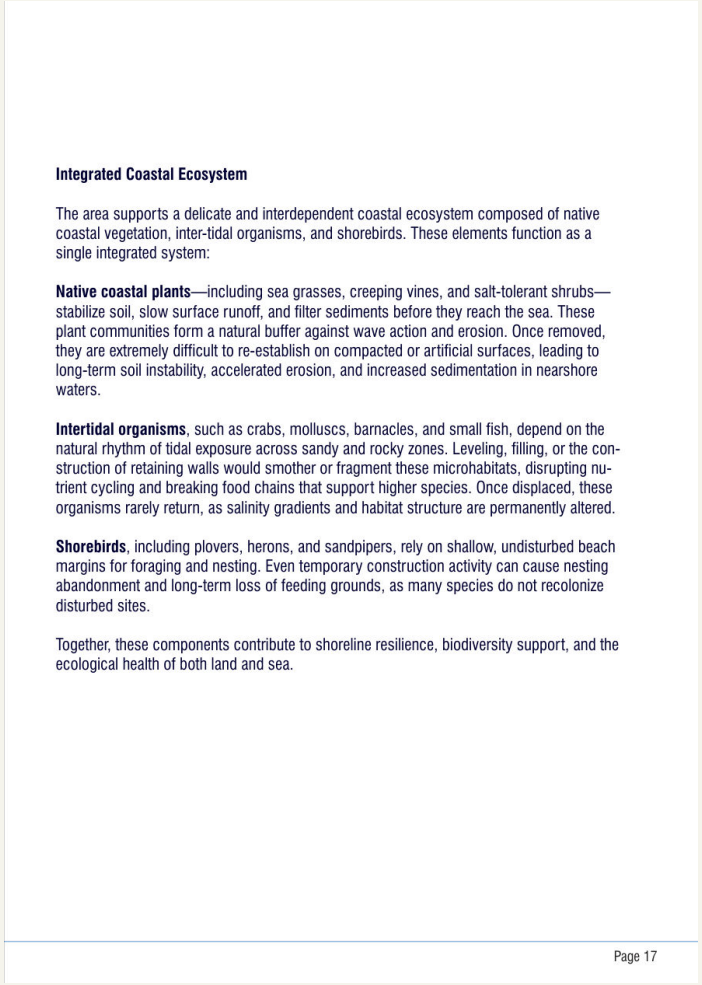
The site functions as a **local ecological haven** within an increasingly urbanized coastal stretch, providing refuge, feeding grounds, and movement space for a range of coastal and terrestrial wildlife. Its position along the shoreline allows it to operate as **a local ecological corridor,** supporting continuity between land-based habitats and nearshore marine environments. This connective role is particularly important in Penang, where much of the natural coastline has already been fragmented or replaced by hard engineering.



Photo: A continuous green link supporting wildlife movement between Penang's hill forests and the shoreline.

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Integrated Coastal Ecosystem

The area supports a delicate and interdependent coastal ecosystem composed of native coastal vegetation, inter-tidal organisms, and shorebirds. These elements function as a single integrated system:

Native coastal plants—including sea grasses, creeping vines, and salt-tolerant shrubs—stabilize soil, slow surface runoff, and filter sediments before they reach the sea. These plant communities form a natural buffer against wave action and erosion. Once removed, they are extremely difficult to re-establish on compacted or artificial surfaces, leading to long-term soil instability, accelerated erosion, and increased sedimentation in nearshore waters.

Intertidal organisms, such as crabs, molluscs, barnacles, and small fish, depend on the natural rhythm of tidal exposure across sandy and rocky zones. Leveling, filling, or the construction of retaining walls would smother or fragment these microhabitats, disrupting nutrient cycling and breaking food chains that support higher species. Once displaced, these organisms rarely return, as salinity gradients and habitat structure are permanently altered.

Shorebirds, including plovers, herons, and sandpipers, rely on shallow, undisturbed beach margins for foraging and nesting. Even temporary construction activity can cause nesting abandonment and long-term loss of feeding grounds, as many species do not recolonize disturbed sites.

Together, these components contribute to shoreline resilience, biodiversity support, and the ecological health of both land and sea.

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Ekosistem Pesisir Bersepadu

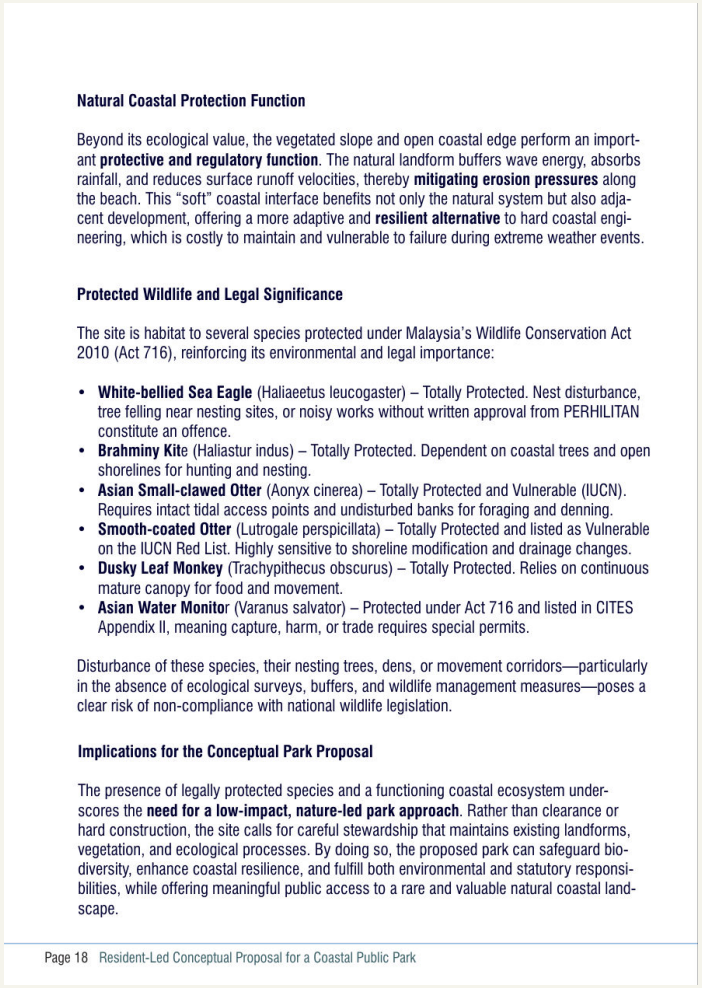
Kawasan ini menyokong ekosistem pesisir yang rapuh dan saling bergantung, terdiri daripada tumbuh-tumbuhan pesisir asli, organisma antara pasang surut dan burung pantai. Unsur-unsur ini berfungsi sebagai satu sistem bersepadu:

Tumbuhan pesisir asli — termasuk rumput laut, tumbuhan menjalar dan pokok renek tahan garam — menstabilkan tanah, memperlahankan larian air permukaan dan menapis sedimen sebelum sampai ke laut. Komuniti tumbuhan ini membentuk penampan semula jadi terhadap tindakan ombak dan hakisan. Setelah dibuang, ia amat sukar diwujudkan semula pada permukaan yang dipadatkan atau buatan, lalu menyebabkan ketidakstabilan tanah jangka panjang, hakisan yang dipercepat dan peningkatan pemendapan sedimen di perairan berhampiran pantai.

Organisma antara pasang surut, seperti ketam, moluska, teritip dan ikan kecil, bergantung pada rentak semula jadi pendedahan pasang surut merentasi zon berpasir dan berbatu. Kerja meratakan, menambak atau membina tembok penahan akan menimbus atau memecah-belahkan mikrohabitat ini, mengganggu kitaran nutrien dan memutuskan rantaian makanan yang menyokong spesies pada peringkat lebih tinggi. Setelah tersingkir, organisma ini jarang kembali kerana kecerunan kemasinan dan struktur habitat berubah secara kekal.

Burung pantai, termasuk burung kedidi jenis plover, burung bangau dan burung kedidi jenis sandpiper, bergantung pada pinggir pantai cetek yang tidak terganggu untuk mencari makanan dan bersarang. Malah aktiviti pembinaan sementara boleh menyebabkan sarang ditinggalkan serta kehilangan kawasan mencari makanan dalam jangka panjang, kerana banyak spesies tidak kembali menghuni tapak yang terganggu.

Secara bersama, komponen ini menyumbang kepada daya tahan persisiran pantai, sokongan biodiversiti serta kesihatan ekologi darat dan laut.



Natural Coastal Protection Function

Beyond its ecological value, the vegetated slope and open coastal edge perform an important **protective and regulatory function**. The natural landform buffers wave energy, absorbs rainfall, and reduces surface runoff velocities, thereby **mitigating erosion pressures** along the beach. This "soft" coastal interface benefits not only the natural system but also adjacent development, offering a more adaptive and **resilient alternative** to hard coastal engineering, which is costly to maintain and vulnerable to failure during extreme weather events.

Protected Wildlife and Legal Significance

The site is habitat to several species protected under Malaysia's Wildlife Conservation Act 2010 (Act 716), reinforcing its environmental and legal importance:

- **White-bellied Sea Eagle** (Haliaeetus leucogaster) – Totally Protected. Nest disturbance, tree felling near nesting sites, or noisy works without written approval from PERHILITAN constitute an offence.
- **Brahminy Kite** (Haliastur indus) – Totally Protected. Dependent on coastal trees and open shorelines for hunting and nesting.
- **Asian Small-clawed Otter** (Aonyx cinerea) – Totally Protected and Vulnerable (IUCN). Requires intact tidal access points and undisturbed banks for foraging and denning.
- **Smooth-coated Otter** (Lutrogale perspicillata) – Totally Protected and listed as Vulnerable on the IUCN Red List. Highly sensitive to shoreline modification and drainage changes.
- **Dusky Leaf Monkey** (Trachypithecus obscurus) – Totally Protected. Relies on continuous mature canopy for food and movement.
- **Asian Water Monitor** (Varanus salvator) – Protected under Act 716 and listed in CITES Appendix II, meaning capture, harm, or trade requires special permits.

Disturbance of these species, their nesting trees, dens, or movement corridors—particularly in the absence of ecological surveys, buffers, and wildlife management measures—poses a clear risk of non-compliance with national wildlife legislation.

Implications for the Conceptual Park Proposal

The presence of legally protected species and a functioning coastal ecosystem underscores the **need for a low-impact, nature-led park approach**. Rather than clearance or hard construction, the site calls for careful stewardship that maintains existing landforms, vegetation, and ecological processes. By doing so, the proposed park can safeguard biodiversity, enhance coastal resilience, and fulfill both environmental and statutory responsibilities, while offering meaningful public access to a rare and valuable natural coastal landscape.

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Cadangan Konseptual Diterajui Penduduk untuk Sebuah Taman Awam Pesisir

Fungsi Perlindungan Pesisir Semula Jadi

Selain nilai ekologinya, cerun yang dilitupi tumbuhan dan pinggir pesisir yang terbuka melaksanakan fungsi perlindungan dan pengawalseliaan yang penting. Bentuk muka bumi semula jadi menampan tenaga ombak, menyerap air hujan dan mengurangkan halaju larian air permukaan, sekali gus mengurangkan tekanan hakisan di sepanjang pantai. Antara muka pesisir yang "lembut" ini memberi manfaat bukan sahaja kepada sistem semula jadi, malah kepada pembangunan bersebelahan, dengan menawarkan alternatif yang lebih boleh disesuaikan dan berdaya tahan berbanding kejuruteraan pantai berstruktur keras, yang mahal untuk disenggara serta terdedah kepada kegagalan ketika kejadian cuaca ekstrem.

Hidupan Liar Dilindungi dan Kepentingan dari Segi Undang-undang

Tapak ini menjadi habitat kepada beberapa spesies yang dilindungi di bawah Akta Pemuliharaan Hidupan Liar 2010 (Akta 716) Malaysia, sekali gus memperkukuh kepentingannya dari segi alam sekitar dan undang-undang:

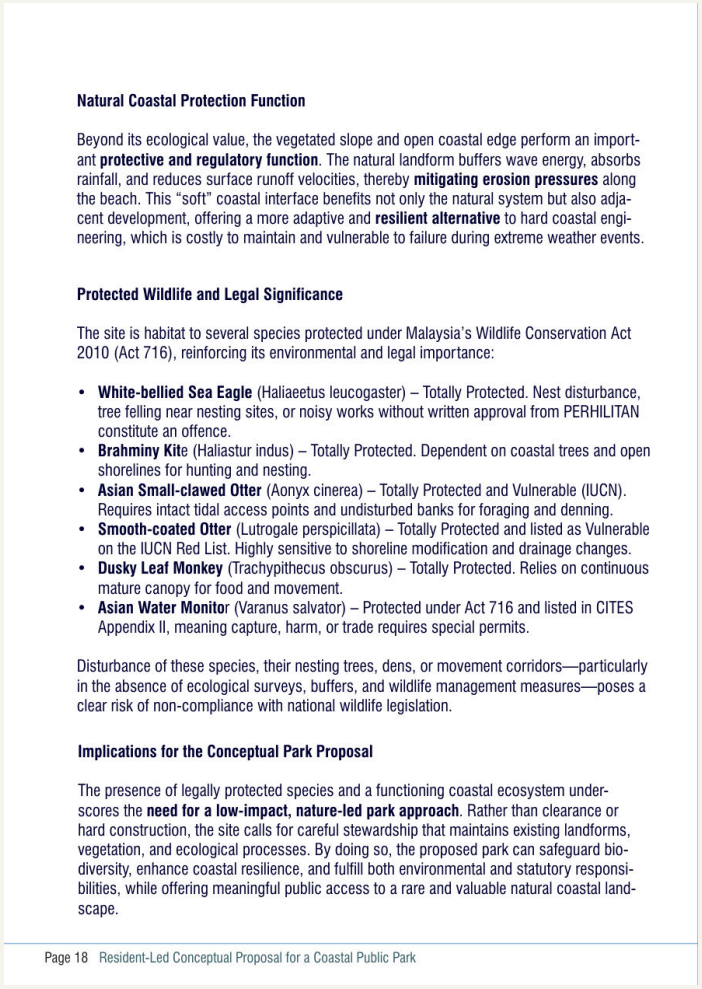
• Helang Laut Perut Putih (White-bellied Sea Eagle; Haliaeetus leucogaster) — Dilindungi Sepenuhnya. Gangguan sarang, penebangan pokok berhampiran tapak bersarang atau kerja bising tanpa kelulusan bertulis PERHILITAN merupakan suatu kesalahan.

• Helang Merah (Brahminy Kite; Haliastur indus) — Dilindungi Sepenuhnya. Bergantung pada pokok pesisir dan persisiran pantai terbuka untuk memburu dan bersarang.

• Memerang Cakar Kecil Asia (Asian Small-clawed Otter; Aonyx cinerea) — Dilindungi Sepenuhnya dan Rentan (IUCN). Memerlukan titik akses pasang surut yang utuh dan tebing yang tidak terganggu untuk mencari makanan serta membuat sarang.

• Memerang Licin (Smooth-coated Otter; Lutrogale perspicillata) — Dilindungi Sepenuhnya dan disenaraikan sebagai Rentan dalam Senarai Merah IUCN. Amat sensitif terhadap pengubahsuaian persisiran pantai dan perubahan saliran.

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Natural Coastal Protection Function

Beyond its ecological value, the vegetated slope and open coastal edge perform an important **protective and regulatory function**. The natural landform buffers wave energy, absorbs rainfall, and reduces surface runoff velocities, thereby **mitigating erosion pressures** along the beach. This "soft" coastal interface benefits not only the natural system but also adjacent development, offering a more adaptive and **resilient alternative** to hard coastal engineering, which is costly to maintain and vulnerable to failure during extreme weather events.

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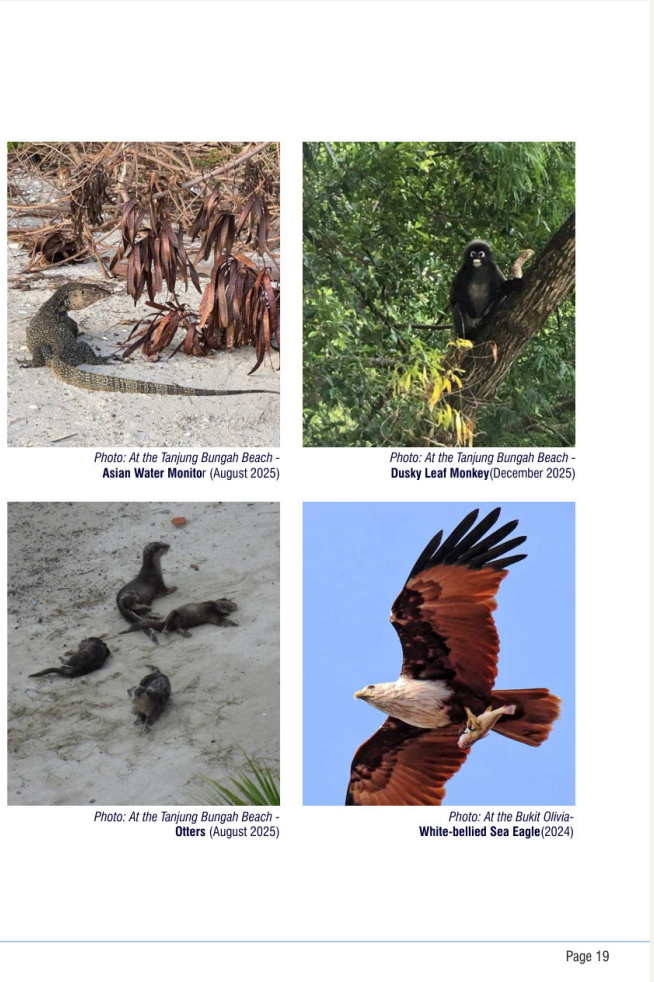
• Lotong Cengkong (Dusky Leaf Monkey; Trachypithecus obscurus) — Dilindungi Sepenuhnya. Bergantung pada kanopi matang yang bersambung untuk makanan dan pergerakan.

• Biawak Air Asia (Asian Water Monitor; Varanus salvator) — Dilindungi di bawah Akta 716 dan disenaraikan dalam Lampiran II CITES, bermakna penangkapan, pencederan atau perdagangan memerlukan permit khas.

Gangguan terhadap spesies ini, pokok sarangnya, sarang atau koridor pergerakannya — khususnya tanpa tinjauan ekologi, zon penampan dan langkah pengurusan hidupan liar — menimbulkan risiko jelas ketidakpatuhan terhadap perundangan hidupan liar negara.

Implikasi terhadap Cadangan Konseptual Taman

Kehadiran spesies yang dilindungi undang-undang dan ekosistem pesisir yang berfungsi menekankan keperluan pendekatan taman berimpak rendah yang berpandukan alam semula jadi. Tapak ini memerlukan penjagaan yang teliti untuk mengekalkan bentuk muka bumi, tumbuh-tumbuhan dan proses ekologi sedia ada, bukannya pembersihan kawasan atau pembinaan struktur keras. Dengan berbuat demikian, taman yang dicadangkan dapat melindungi biodiversiti, meningkatkan daya tahan pesisir dan memenuhi tanggungjawab alam sekitar serta statutori, sambil menawarkan akses awam yang bermakna kepada landskap pesisir semula jadi yang jarang ditemui dan bernilai.



TERJEMAHAN BAHASA MELAYU

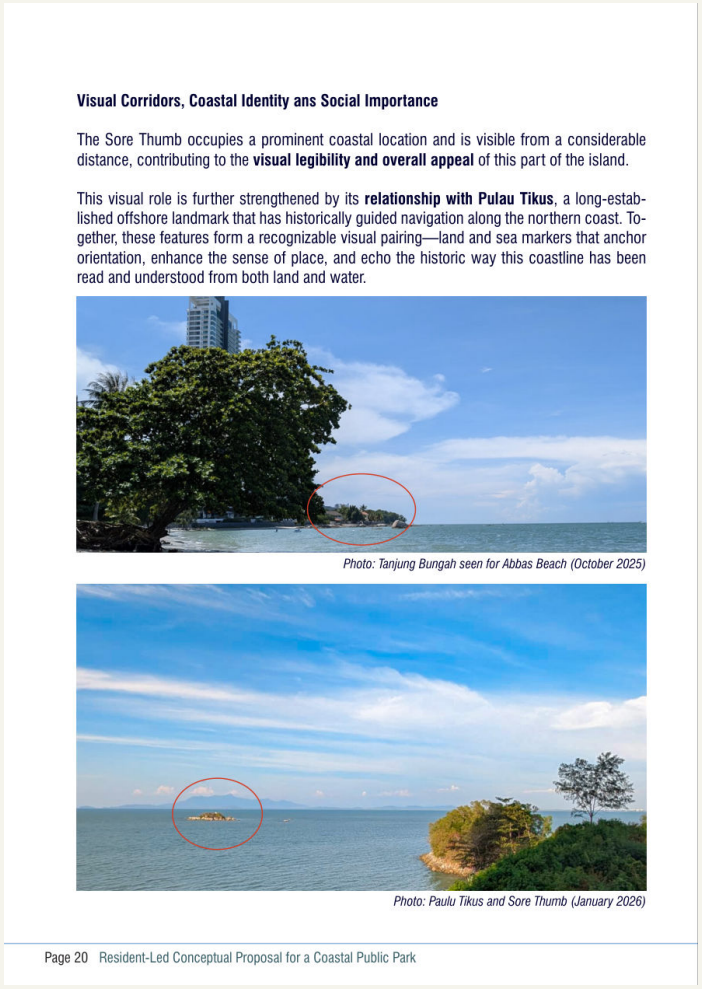
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Foto: Di Pantai Tanjung Bungah — Biawak Air Asia (Ogos 2025).

Foto: Di Pantai Tanjung Bungah — Lotong Cengkong (Disember 2025).

Foto: Di Pantai Tanjung Bungah — Memerang (Ogos 2025).

Foto: Di Bukit Olivia — Helang Laut Perut Putih (2024).



Visual Corridors, Coastal Identity ans Social Importance

The Sore Thumb occupies a prominent coastal location and is visible from a considerable distance, contributing to the **visual legibility and overall appeal** of this part of the island.

This visual role is further strengthened by its **relationship with Pulau Tikus**, a long-established offshore landmark that has historically guided navigation along the northern coast. Together, these features form a recognizable visual pairing—land and sea markers that anchor orientation, enhance the sense of place, and echo the historic way this coastline has been read and understood from both land and water.

Photo: Tanjung Bungah seen for Abbas Beach (October 2025)

Photo: Paulu Tikus and Sore Thumb (January 2026)

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TERJEMAHAN BAHASA MELAYU

Halaman 20

Cadangan Konseptual Diterajui Penduduk untuk Sebuah Taman Awam Pesisir

Koridor Pandangan, Identiti Pesisir dan Kepentingan Sosial

Sore Thumb menduduki lokasi pesisir yang menonjol dan boleh dilihat dari jarak yang agak jauh, menyumbang kepada kejelasan orientasi visual serta tarikan keseluruhan bahagian pulau ini.

Peranan visual ini diperkukuh lagi oleh hubungannya dengan Pulau Tikus, mercu tanda luar pesisir yang telah lama membimbing pelayaran di sepanjang pantai utara. Bersama-sama, kedua-dua ciri ini membentuk pasangan visual yang mudah dikenali — penanda darat dan laut yang menjadi asas orientasi, mengukuhkan rasa keterikatan kepada tempat serta mencerminkan cara garis pantai ini dibaca dan difahami sepanjang sejarah, dari darat mahupun air.

Foto: Tanjung Bungah dilihat dari Pantai Abbas (Oktober 2025).

Foto: Pulau Tikus dan Sore Thumb (Januari 2026).

Protecting this site directly supports the **Penang Green Agenda and Penang 2030** aspirations, which emphasize not only environmental resilience but also **social wellbeing, inclusivity, and people-centred urban development.** Public access to the coast is a vital social asset in Penang, supporting everyday recreation, informal community life, and a shared sense of place that has long defined the island's coastal settlements.

The **public protest held on the beach** after access was fenced off is a clear demonstration of this social importance. It revealed strong local concern and collective resistance to the gradual loss of public shoreline, and underscored that this space is not perceived as vacant land, but as a shared community resource. The protest was not an isolated incident, but part of a broader public response to a growing pattern of restricted coastal access across the island.



Photo: Tanjung Bungah Public Protest (1st November 2025)

Coastal protection does not always begin with large-scale projects—often **it starts with small, deliberate decisions to retain existing landscapes,** respect natural systems, and respond to public needs. This Conceptual Design is a direct, constructive response from the community to proposals that conflict with public wishes, offering an alternative that aligns environmental responsibility with social values.

Safeguarding this stretch of coast as a public, accessible natural edge therefore preserves not only ecological value and coastal resilience, but also Penang's social fabric—ensuring the shoreline remains a place where people can gather, express collective voice, and maintain an enduring relationship with the sea for generations to come.

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TERJEMAHAN BAHASA MELAYU

Halaman 21

Melindungi tapak ini menyokong secara langsung aspirasi Penang Green Agenda dan Penang 2030, yang menekankan bukan sahaja daya tahan alam sekitar tetapi juga kesejahteraan sosial, keterangkuman dan pembangunan bandar berpusatkan manusia. Akses awam ke pesisir merupakan aset sosial yang amat penting di Pulau Pinang, menyokong rekreasi harian, kehidupan komuniti tidak formal serta rasa keterikatan bersama kepada tempat yang telah lama mencirikan penempatan pesisir pulau ini.

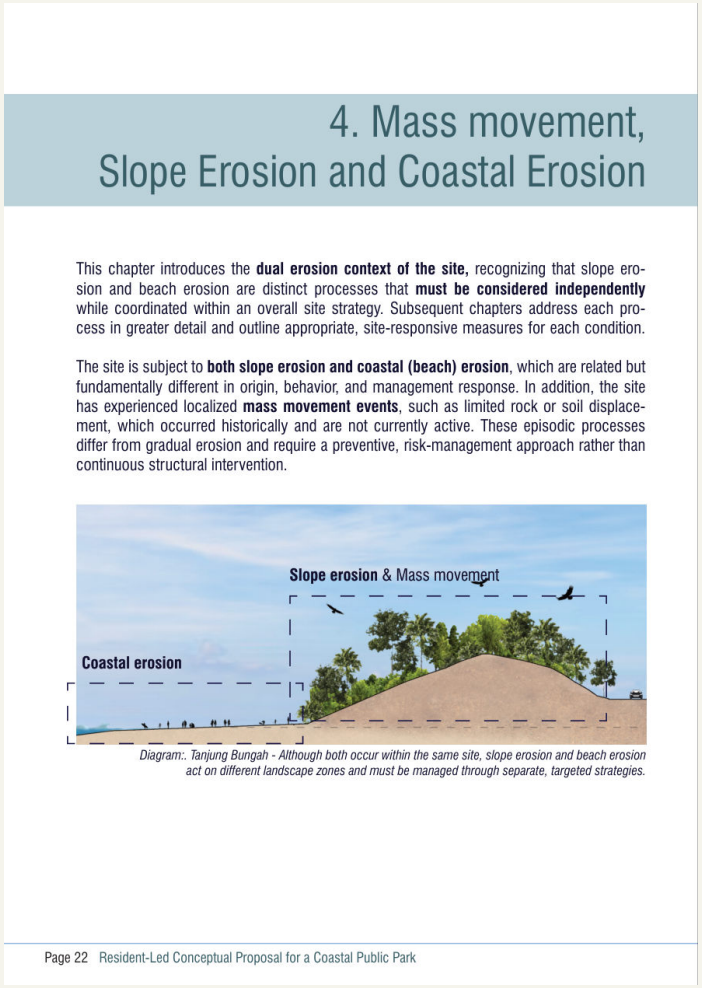
Bantahan awam yang diadakan di pantai selepas akses dipagar merupakan bukti jelas kepentingan sosial ini. Ia memperlihatkan kebimbangan setempat yang kuat dan penentangan bersama terhadap kehilangan persisiran awam secara beransur-ansur, serta menekankan bahawa ruang ini bukan dianggap tanah kosong, tetapi sumber komuniti yang dikongsi bersama. Bantahan tersebut bukan kejadian terpencil, sebaliknya sebahagian daripada tindak balas awam yang lebih luas terhadap pola sekatan akses pesisir yang semakin meningkat di seluruh pulau.

Foto: Bantahan Awam Tanjung Bungah (1 November 2025).

Perlindungan pesisir tidak semestinya bermula dengan projek berskala besar — sering kali ia bermula dengan keputusan kecil yang dibuat dengan sengaja untuk mengekalkan landskap sedia ada, menghormati sistem semula jadi dan memenuhi keperluan awam. Reka Bentuk Konseptual ini merupakan tindak balas langsung dan membina daripada komuniti terhadap cadangan yang bercanggah dengan kehendak awam, menawarkan alternatif yang menyelaraskan tanggungjawab alam sekitar dengan nilai sosial.

Oleh itu, melindungi bahagian pesisir ini sebagai pinggir semula jadi yang awam dan boleh diakses bukan sahaja memelihara nilai ekologi dan daya tahan pesisir, malah juga jalinan sosial Pulau Pinang — memastikan persisiran pantai terus menjadi tempat orang ramai berkumpul, menyuarakan pendirian bersama dan mengekalkan hubungan yang berkekalan dengan laut untuk generasi akan datang.

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4. Mass movement, Slope Erosion and Coastal Erosion

This chapter introduces the **dual erosion context of the site,** recognizing that slope erosion and beach erosion are distinct processes that **must be considered independently** while coordinated within an overall site strategy. Subsequent chapters address each process in greater detail and outline appropriate, site-responsive measures for each condition.

The site is subject to **both slope erosion and coastal (beach) erosion**, which are related but fundamentally different in origin, behavior, and management response. In addition, the site has experienced localized **mass movement events**, such as limited rock or soil displacement, which occurred historically and are not currently active. These episodic processes differ from gradual erosion and require a preventive, risk-management approach rather than continuous structural intervention.

Diagram:. Tanjung Bungah - Although both occur within the same site, slope erosion and beach erosion act on different landscape zones and must be managed through separate, targeted strategies.

TERJEMAHAN BAHASA MELAYU

Halaman 22

Cadangan Konseptual Diterajui Penduduk untuk Sebuah Taman Awam Pesisir

4. Pergerakan Jisim, Hakisan Cerun dan Hakisan Pantai

Bab ini memperkenalkan dua konteks hakisan di tapak, dengan mengiktiraf bahawa hakisan cerun dan hakisan pantai ialah proses berbeza yang perlu dipertimbangkan secara berasingan, sambil diselaraskan dalam strategi keseluruhan tapak. Bab seterusnya membincangkan setiap proses dengan lebih terperinci dan menggariskan langkah yang sesuai serta responsif terhadap tapak bagi setiap keadaan.

Tapak ini terdedah kepada hakisan cerun dan hakisan pesisir (pantai), yang saling berkaitan tetapi pada asasnya berbeza dari segi asal usul, tingkah laku dan tindak balas pengurusan. Di samping itu, tapak ini pernah mengalami kejadian pergerakan jisim setempat, seperti peralihan batu atau tanah yang terhad, yang berlaku pada masa lalu dan tidak aktif pada masa ini. Proses yang berlaku sekali-sekala ini berbeza daripada hakisan beransur-ansur dan memerlukan pendekatan pencegahan serta pengurusan risiko, bukannya campur tangan struktur secara berterusan.

Hakisan cerun & pergerakan jisim

Hakisan pantai

Rajah: Tanjung Bungah — Walaupun kedua-duanya berlaku dalam tapak yang sama, hakisan cerun dan hakisan pantai bertindak pada zon landskap yang berbeza dan mesti diurus melalui strategi berasingan yang bersasar.

Process	Main Causes	Typical Characteristics	Most Appropriate Treatments
Slope erosion	• Surface runoff from rainfall • Loss or disturbance of vegetation • Concentrated drainage paths • Foot traffic and informal access	• Gradual loss of surface soil • Rills and shallow gullies • Exposure of underlying rock or soil	• Retention and reinforcement of vegetation • Surface stabilization (mulch, erosion mats) • Dispersed drainage and permeable surfaces • Defined paths to prevent trampling
Coastal (beach) erosion	• Wave action and tides • Seasonal monsoon conditions • Sea level rise • Altered sediment supply (reclamation, structures)	• Seasonal beach width changes • Sand loss during storms • Shoreline retreat	• Setbacks and managed retreat • Dune and upper-beach vegetation • Elevated or relocatable access • Preservation of nearshore features • Monitoring and adaptive management
Mass movement	• Historic disturbance or reclamation • Weathering of rock and soil • Intense rainfall events • Loss of root reinforcement	• Sudden, localized movement • Discrete rock or soil displacement • Episodic rather than continuous	• Vegetation retention and surface stabilization • Drainage control to prevent saturation • Targeted rockfall netting or mesh (localized) • Setbacks, access management, monitoring

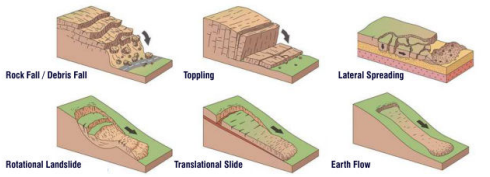


Diagram:. Typical types of **Slope Erosion**

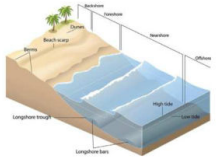


Diagram:. **Coastal Erosion** *and Deposition*

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TERJEMAHAN BAHASA MELAYU

Halaman 23

Proses | Punca Utama | Ciri Lazim | Rawatan Paling Sesuai

HAKISAN CERUN

Punca utama:

• Larian air permukaan akibat hujan

• Kehilangan atau gangguan tumbuh-tumbuhan

• Laluan saliran yang tertumpu

• Pergerakan pejalan kaki dan akses tidak formal

Ciri lazim:

• Kehilangan tanah permukaan secara beransur-ansur

• Alur kecil dan lurah cetek

• Pendedahan batu atau tanah di bawahnya

Rawatan paling sesuai:

• Pengekalan dan pengukuhan tumbuh-tumbuhan

• Penstabilan permukaan (sungkupan, tikar kawalan hakisan)

• Saliran tersebar dan permukaan telap air

• Laluan yang ditetapkan untuk mengelakkan pemijakan

HAKISAN PESISIR (PANTAI)

Punca utama:

• Tindakan ombak dan pasang surut

• Keadaan monsun bermusim

Process	Main Causes	Typical Characteristics	Most Appropriate Treatments
Slope erosion	• Surface runoff from rainfall • Loss or disturbance of vegetation • Concentrated drainage paths • Foot traffic and informal access	• Gradual loss of surface soil • Rills and shallow gullies • Exposure of underlying rock or soil	• Retention and reinforcement of vegetation • Surface stabilization (mulch, erosion mats) • Dispersed drainage and permeable surfaces • Defined paths to prevent trampling
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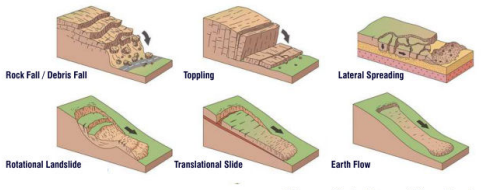


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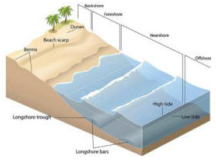


Diagram:. **Coastal Erosion** *and Deposition*

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TERJEMAHAN BAHASA MELAYU · sambungan

• Kenaikan aras laut

• Bekalan sedimen yang berubah (penambakan, struktur)

Ciri lazim:

• Perubahan lebar pantai mengikut musim

• Kehilangan pasir semasa ribut

• Pengunduran garis pantai

Rawatan paling sesuai:

• Anjakan undur dan pengunduran terurus

• Tumbuh-tumbuhan gumuk pasir dan bahagian atas pantai

• Akses bertingkat atau yang boleh dipindahkan

• Pemeliharaan ciri berhampiran pantai

• Pemantauan dan pengurusan adaptif

PERGERAKAN JISIM

Punca utama:

• Gangguan atau penambakan pada masa lalu

• Luluhawa batu dan tanah

• Kejadian hujan lebat

• Kehilangan pengukuhan akar

Ciri lazim:

• Pergerakan setempat secara tiba-tiba

• Peralihan batu atau tanah yang berasingan

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Process	Main Causes	Typical Characteristics	Most Appropriate Treatments
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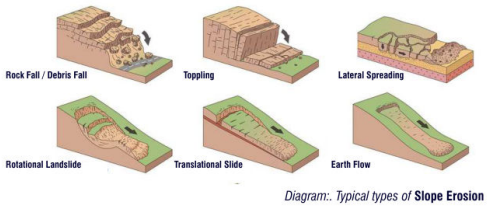


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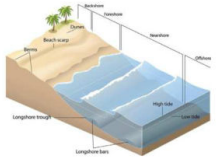


Diagram:. **Coastal Erosion** *and Deposition*

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TERJEMAHAN BAHASA MELAYU · sambungan

• Berlaku sekali-sekala, bukannya berterusan

Rawatan paling sesuai:

• Pengekalan tumbuh-tumbuhan dan penstabilan permukaan

• Kawalan saliran untuk mengelakkan ketepuan

• Jaring atau jejaring penahan runtuhan batu yang bersasar (setempat)

• Anjakan undur, pengurusan akses dan pemantauan

Rajah: Jenis-jenis lazim hakisan cerun.

Rajah: Hakisan pantai dan pemendapan.

Runtuhan batu / runtuhan puing

Tumbangan

Sebaran sisi

Gelinciran tanah putaran

Gelinciran translasi

Aliran tanah

Label rajah hakisan pantai dan pemendapan:

• Zon belakang pantai (Backshore)

• Zon pasang surut (Foreshore)

• Perairan dekat pantai (Nearshore)

• Perairan lepas pantai (Offshore)

• Gumuk pasir (Dunes)

• Tebing hakisan pantai (Beach scarp)

Process	Main Causes	Typical Characteristics	Most Appropriate Treatments
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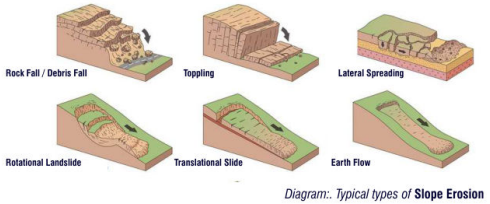


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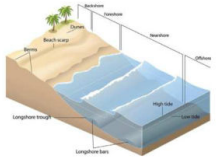
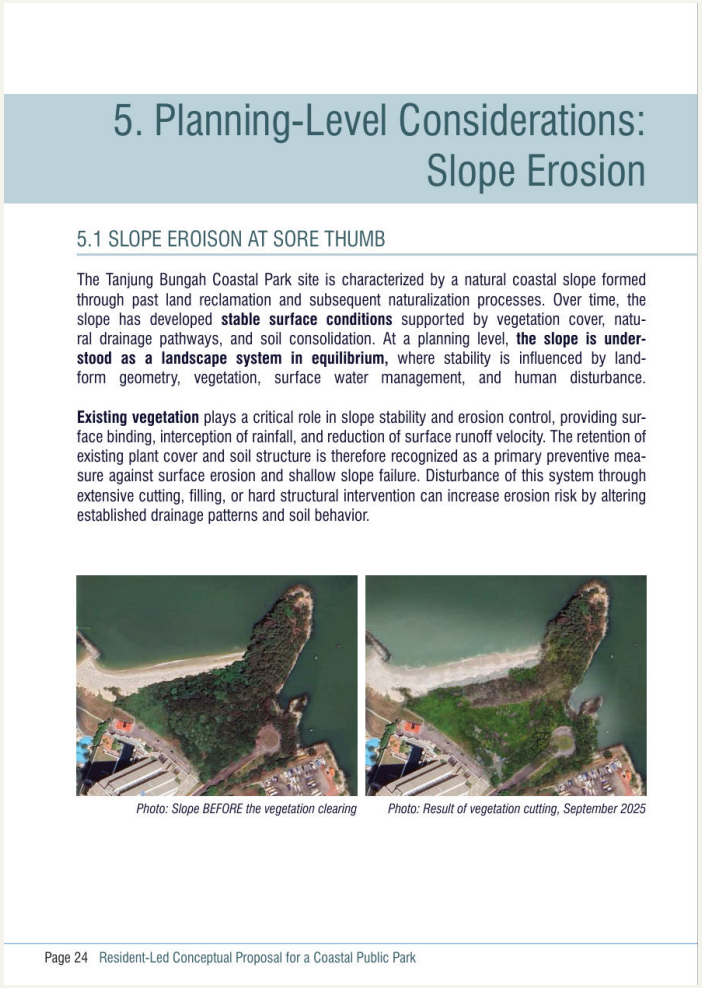


Diagram:. **Coastal Erosion** *and Deposition*

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TERJEMAHAN BAHASA MELAYU · sambungan

- Berm pantai (Berms)
- Palung sejajar pantai (Longshore trough)
- Beting sejajar pantai (Longshore bars)
- Air pasang (High tide)
- Air surut (Low tide)



5. Planning-Level Considerations: Slope Erosion

5.1 SLOPE EROISON AT SORE THUMB

The Tanjung Bungah Coastal Park site is characterized by a natural coastal slope formed through past land reclamation and subsequent naturalization processes. Over time, the slope has developed **stable surface conditions** supported by vegetation cover, natural drainage pathways, and soil consolidation. At a planning level, **the slope is understood as a landscape system in equilibrium,** where stability is influenced by landform geometry, vegetation, surface water management, and human disturbance.

Existing vegetation plays a critical role in slope stability and erosion control, providing surface binding, interception of rainfall, and reduction of surface runoff velocity. The retention of existing plant cover and soil structure is therefore recognized as a primary preventive measure against surface erosion and shallow slope failure. Disturbance of this system through extensive cutting, filling, or hard structural intervention can increase erosion risk by altering established drainage patterns and soil behavior.

Photo: Slope BEFORE the vegetation clearing

Photo: Result of vegetation cutting, September 2025

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TERJEMAHAN BAHASA MELAYU

Halaman 24

Cadangan Konseptual Diterajui Penduduk untuk Sebuah Taman Awam Pesisir

5. Pertimbangan pada Peringkat Perancangan: Hakisan Cerun

Foto: Cerun SEBELUM pembersihan tumbuh-tumbuhan.

Foto: Kesan pemotongan tumbuh-tumbuhan, September 2025.

5.1 HAKISAN CERUN DI SORE THUMB

Tapak Taman Pesisir Tanjung Bungah dicirikan oleh cerun pesisir semula jadi yang terbentuk melalui penambakan tanah pada masa lalu dan proses pembentukan semula jadi selepasnya. Seiring masa, cerun ini telah membentuk keadaan permukaan yang stabil, disokong oleh litupan tumbuh-tumbuhan, laluan saliran semula jadi dan pengukuhan tanah. Pada peringkat perancangan, cerun ini difahami sebagai sistem landskap dalam keseimbangan, di mana kestabilannya dipengaruhi oleh geometri bentuk muka bumi, tumbuh-tumbuhan, pengurusan air permukaan dan gangguan manusia.

Tumbuh-tumbuhan sedia ada memainkan peranan kritikal dalam kestabilan cerun dan kawalan hakisan dengan mengikat permukaan, memintas air hujan serta mengurangkan halaju larian air permukaan. Oleh itu, pengekalan litupan tumbuhan dan struktur tanah sedia ada diiktiraf sebagai langkah pencegahan utama terhadap hakisan permukaan dan kegagalan cerun cetek. Gangguan terhadap sistem ini melalui pemotongan, penambakan atau campur tangan struktur keras secara meluas boleh meningkatkan risiko hakisan dengan mengubah pola saliran yang telah terbentuk dan tingkah laku tanah.

Recent site clearing has resulted in the loss of approximately one third of the vegetated area, including the removal of **several large mature trees** with trunk circumferences **exceeding 1 meter**. This represents a substantial reduction in vegetation cover and has temporarily reduced slope stability, leading to increased surface erosion.



Photo: Tree stump ca=1,6m, October 2025



Photo: Tree stem ca=1,9m, October 2025

However, as the root systems of the removed trees were left in situ, they continue to play a **critical role in subsoil reinforcement and ground stabilization** and should therefore not be disturbed or removed. Since the clearance took place, natural regeneration has already begun, and **newly established vegetation has significantly reduced visible erosion on the slope.**

By formally integrating the slope into a park design and introducing targeted **planting selected for root structure, soil binding capacity and erosion control performance,** there is a strong basis to maintain and further improve long-term slope stability. A landscape-led approach that priorities vegetation-based stabilization provides an effective and low-impact alternative to heavy structural interventions.

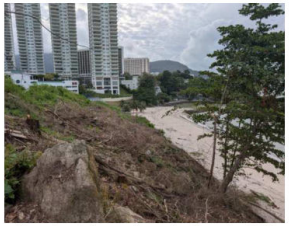


Photo: Result of vegetation cutting, September 2025

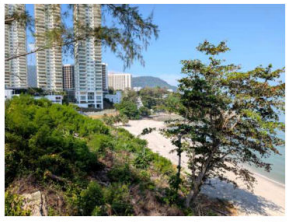


Photo: Vegetation regeneration, January 2026

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TERJEMAHAN BAHASA MELAYU

Halaman 25

Pembersihan tapak baru-baru ini telah mengakibatkan kehilangan kira-kira satu pertiga kawasan bertumbuhan, termasuk penebangan beberapa pokok besar yang matang dengan lilitan batang melebihi 1 meter. Ini merupakan pengurangan besar litupan tumbuh-tumbuhan dan telah mengurangkan kestabilan cerun buat sementara waktu, lalu meningkatkan hakisan permukaan.

Foto: Tunggul pokok, kira-kira 1.6 m, Oktober 2025.

Foto: Batang pokok, kira-kira 1.9 m, Oktober 2025.

Walau bagaimanapun, memandangkan sistem akar pokok yang ditebang dibiarkan di tempat asal, akar tersebut terus memainkan peranan kritikal dalam pengukuhan tanah bawah permukaan dan penstabilan tanah, dan oleh itu tidak seharusnya diganggu atau dibuang. Sejak pembersihan dijalankan, pertumbuhan semula secara semula jadi sudah bermula, dan tumbuh-tumbuhan yang baru bertapak telah mengurangkan dengan ketara hakisan yang kelihatan pada cerun.

Dengan menyepadukan cerun secara rasmi ke dalam reka bentuk taman serta memperkenalkan penanaman bersasar yang dipilih berdasarkan struktur akar, keupayaan mengikat tanah dan prestasi kawalan hakisan, terdapat asas yang kukuh untuk mengekalkan serta terus memperbaik kestabilan cerun jangka panjang. Pendekatan berpandukan landskap yang mengutamakan penstabilan berasaskan tumbuh-tumbuhan menawarkan alternatif berkesan dan berimpak rendah kepada campur tangan struktur berat.

Foto: Kesan pemotongan tumbuh-tumbuhan, September 2025.

Foto: Pertumbuhan semula tumbuh-tumbuhan, Januari 2026.



5.2 SLOPE EROSION CONTROL: PRINCIPLES AND MEASURES

Slope erosion is a natural process that can be significantly accelerated by vegetation removal, surface disturbance and unmanaged runoff. Effective erosion control relies on selecting measures that are proportionate to the severity of site conditions, rather than defaulting to heavy engineering solutions.

Any proposal that depends on extensive structural slope stabilization or major alteration of the existing landform should be supported by ***site-specific geotechnical evidence*** *demonstrating that landscape-led measures are insufficient.*

Best practice in slope management follows a graduated response, where the level of intervention matches the degree of risk:

- **Low-risk slopes** with shallow erosion and existing vegetation require minimal intervention focused on surface stabilization and vegetation recovery(Sore Thumb),
- **Moderate-risk** slopes with partial vegetation loss and surface runoff benefit from combined bioengineering and light structural measures.
- **High-risk slopes** with deep-seated instability, active slips or geotechnical failure may require engineered solutions, supported by detailed geotechnical assessment.

In the absence of evidence of deep slope failure, landscape-led and bioengineering approaches are generally preferred.

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Cadangan Konseptual Diterajui Penduduk untuk Sebuah Taman Awam Pesisir

Sebarang cadangan yang bergantung pada penstabilan struktur cerun secara meluas atau perubahan besar terhadap bentuk muka bumi sedia ada perlu disokong oleh bukti geoteknik khusus tapak yang menunjukkan bahawa langkah berpandukan landskap tidak mencukupi.

5.2 KAWALAN HAKISAN CERUN: PRINSIP DAN LANGKAH

Hakisan cerun ialah proses semula jadi yang boleh dipercepat dengan ketara oleh penyingkiran tumbuh-tumbuhan, gangguan permukaan dan larian air yang tidak diurus. Kawalan hakisan yang berkesan bergantung pada pemilihan langkah yang setimpal dengan tahap keterukan keadaan tapak, bukannya secara automatik memilih penyelesaian kejuruteraan berat.

• Cerun berisiko rendah dengan hakisan cetek dan tumbuh-tumbuhan sedia ada memerlukan campur tangan minimum yang tertumpu pada penstabilan permukaan serta pemulihan tumbuh-tumbuhan (Sore Thumb).

• Cerun berisiko sederhana dengan kehilangan sebahagian tumbuh-tumbuhan dan larian air permukaan mendapat manfaat daripada gabungan biokejuruteraan dengan langkah struktur ringan.

• Cerun berisiko tinggi dengan ketidakstabilan dalam, gelinciran aktif atau kegagalan geoteknik mungkin memerlukan penyelesaian kejuruteraan, disokong oleh penilaian geoteknik terperinci.

Tanpa bukti kegagalan cerun dalam, pendekatan berpandukan landskap dan biokejuruteraan lazimnya diutamakan.

Amalan terbaik pengurusan cerun mengikuti tindak balas berperingkat, di mana tahap campur tangan sepadan dengan tahap risiko:

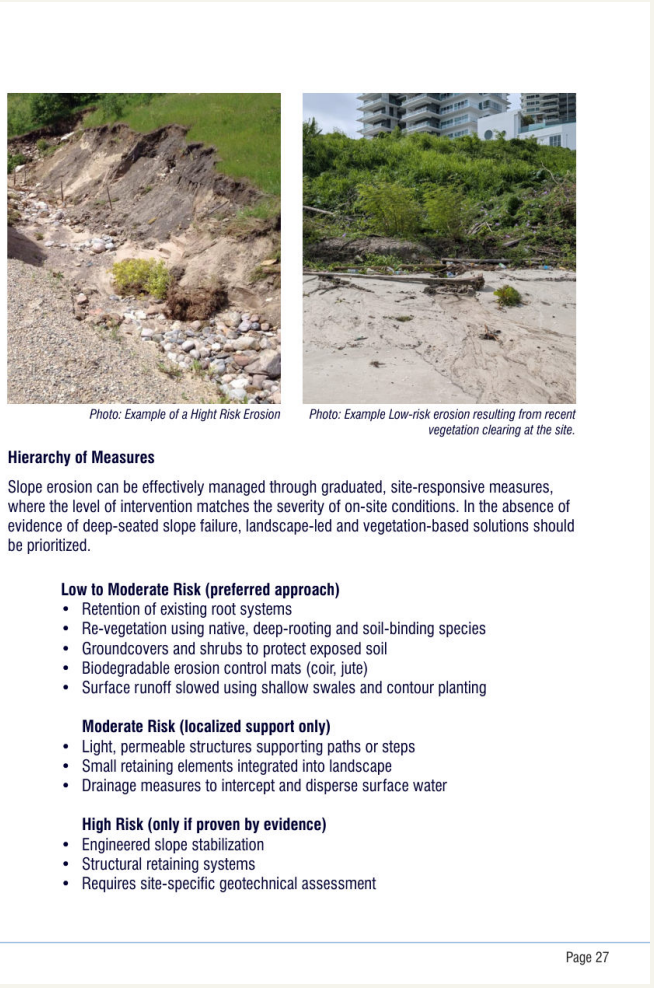


Photo: Example of a Hight Risk Erosion

Photo: Example Low-risk erosion resulting from recent vegetation clearing at the site.

Hierarchy of Measures

Slope erosion can be effectively managed through graduated, site-responsive measures, where the level of intervention matches the severity of on-site conditions. In the absence of evidence of deep-seated slope failure, landscape-led and vegetation-based solutions should be prioritized.

Low to Moderate Risk (preferred approach)

- Retention of existing root systems
- Re-vegetation using native, deep-rooting and soil-binding species
- Groundcovers and shrubs to protect exposed soil
- Biodegradable erosion control mats (coir, jute)
- Surface runoff slowed using shallow swales and contour planting

Moderate Risk (localized support only)

- Light, permeable structures supporting paths or steps
- Small retaining elements integrated into landscape
- Drainage measures to intercept and disperse surface water

High Risk (only if proven by evidence)

- Engineered slope stabilization
- Structural retaining systems
- Requires site-specific geotechnical assessment

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Foto: Contoh hakisan berisiko tinggi.

Foto: Contoh hakisan berisiko rendah akibat pembersihan tumbuh-tumbuhan baru-baru ini di tapak.

Hakisan cerun boleh diurus dengan berkesan melalui langkah berperingkat yang responsif terhadap tapak, dengan tahap campur tangan sepadan dengan tahap keterukan keadaan di tapak. Tanpa bukti kegagalan cerun dalam, penyelesaian berpandukan landskap dan berasaskan tumbuh-tumbuhan perlu diutamakan.

Risiko Rendah hingga Sederhana (pendekatan pilihan)

• Mengekalkan sistem akar sedia ada

• Menanam semula menggunakan spesies asli yang berakar dalam dan mengikat tanah

• Tumbuhan penutup bumi dan pokok renek untuk melindungi tanah terdedah

• Tikar kawalan hakisan boleh biodegradasi (sabut kelapa, jut)

• Memperlahankan larian air permukaan menggunakan alur saliran cetek dan penanaman mengikut kontur

Risiko Sederhana (sokongan setempat sahaja)

• Struktur ringan dan telap air yang menyokong laluan atau tangga

• Elemen penahan kecil yang disepadukan dalam landskap

• Langkah saliran untuk memintas dan menyebarkan air permukaan

Risiko Tinggi (hanya jika dibuktikan melalui bukti)

• Penstabilan cerun secara kejuruteraan

• Sistem struktur penahan

• Memerlukan penilaian geoteknik khusus tapak

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Hierarki Langkah



Photo: Example of a Hight Risk Erosion

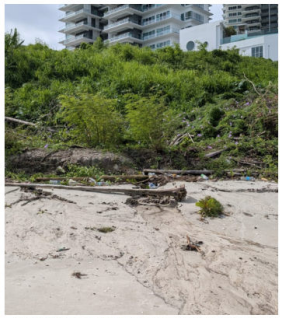


Photo: Example Low-risk erosion resulting from recent vegetation clearing at the site.

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- Groundcovers and shrubs to protect exposed soil
- Biodegradable erosion control mats (coir, jute)
- Surface runoff slowed using shallow swales and contour planting

Moderate Risk (localized support only)

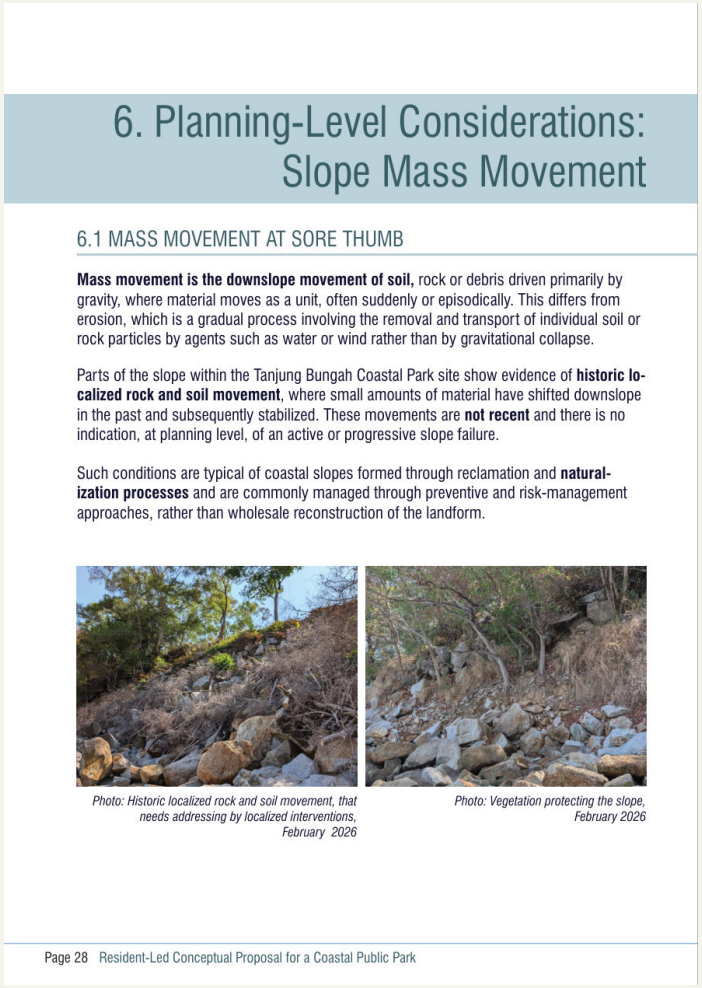
- Light, permeable structures supporting paths or steps
- Small retaining elements integrated into landscape
- Drainage measures to intercept and disperse surface water

High Risk (only if proven by evidence)

- Engineered slope stabilization
- Structural retaining systems
- Requires site-specific geotechnical assessment

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6. Planning-Level Considerations: Slope Mass Movement

6.1 MASS MOVEMENT AT SORE THUMB

Mass movement is the downslope movement of soil, rock or debris driven primarily by gravity, where material moves as a unit, often suddenly or episodically. This differs from erosion, which is a gradual process involving the removal and transport of individual soil or rock particles by agents such as water or wind rather than by gravitational collapse.

Parts of the slope within the Tanjung Bungah Coastal Park site show evidence of **historic localized rock and soil movement**, where small amounts of material have shifted downslope in the past and subsequently stabilized. These movements are **not recent** and there is no indication, at planning level, of an active or progressive slope failure.

Such conditions are typical of coastal slopes formed through reclamation and **naturalization processes** and are commonly managed through preventive and risk-management approaches, rather than wholesale reconstruction of the landform.

Photo: Historic localized rock and soil movement, that needs addressing by localized interventions, February 2026

Photo: Vegetation protecting the slope, February 2026

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Cadangan Konseptual Diterajui Penduduk untuk Sebuah Taman Awam Pesisir

6. Pertimbangan pada Peringkat Perancangan: Pergerakan Jisim Cerun

6.1 PERGERAKAN JISIM DI SORE THUMB

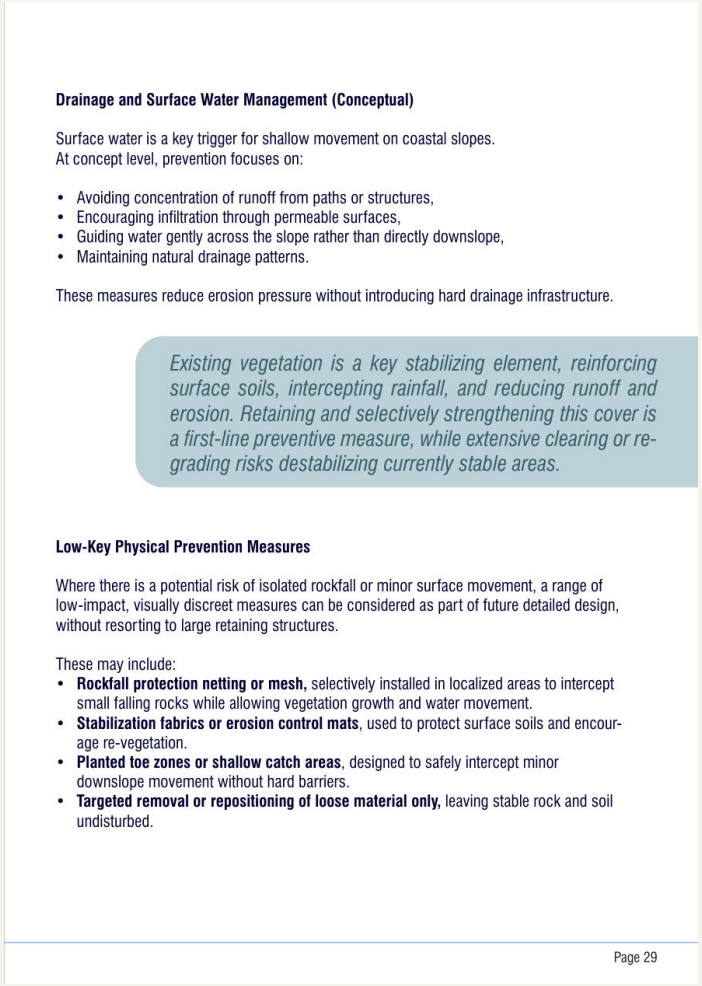
Pergerakan jisim ialah pergerakan tanah, batu atau puing menuruni cerun yang didorong terutamanya oleh graviti, di mana bahan bergerak sebagai satu unit, selalunya secara tiba-tiba atau sekali-sekala. Ini berbeza daripada hakisan, iaitu proses beransur-ansur yang melibatkan penyingkiran dan pengangkutan zarah tanah atau batu secara individu oleh agen seperti air atau angin, bukannya keruntuhan akibat graviti.

Foto: Tumbuh-tumbuhan yang melindungi cerun, Februari 2026.

Foto: Pergerakan batu dan tanah setempat pada masa lalu yang perlu ditangani melalui campur tangan setempat, Februari 2026.

Sebahagian cerun dalam tapak Taman Pesisir Tanjung Bungah menunjukkan bukti pergerakan batu dan tanah setempat pada masa lalu, apabila sedikit bahan telah beralih menuruni cerun dan kemudiannya menjadi stabil. Pergerakan ini bukan kejadian terkini dan, pada peringkat perancangan, tiada petunjuk kegagalan cerun yang aktif atau progresif.

Keadaan sedemikian lazim bagi cerun pesisir yang terbentuk melalui penambakan dan proses pembentukan semula jadi, serta biasanya diurus melalui pendekatan pencegahan dan pengurusan risiko, bukannya pembinaan semula keseluruhan bentuk muka bumi.



Drainage and Surface Water Management (Conceptual)

Surface water is a key trigger for shallow movement on coastal slopes.
At concept level, prevention focuses on:

- Avoiding concentration of runoff from paths or structures,
- Encouraging infiltration through permeable surfaces,
- Guiding water gently across the slope rather than directly downslope,
- Maintaining natural drainage patterns.

These measures reduce erosion pressure without introducing hard drainage infrastructure.

Existing vegetation is a key stabilizing element, reinforcing surface soils, intercepting rainfall, and reducing runoff and erosion. Retaining and selectively strengthening this cover is a first-line preventive measure, while extensive clearing or re-grading risks destabilizing currently stable areas.

Low-Key Physical Prevention Measures

Where there is a potential risk of isolated rockfall or minor surface movement, a range of low-impact, visually discreet measures can be considered as part of future detailed design, without resorting to large retaining structures.

These may include:

- **Rockfall protection netting or mesh,** selectively installed in localized areas to intercept small falling rocks while allowing vegetation growth and water movement.
- **Stabilization fabrics or erosion control mats**, used to protect surface soils and encourage re-vegetation.
- **Planted toe zones or shallow catch areas**, designed to safely intercept minor downslope movement without hard barriers.
- **Targeted removal or repositioning of loose material only,** leaving stable rock and soil undisturbed.

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Tumbuh-tumbuhan sedia ada ialah unsur penstabil utama, yang mengukuhkan tanah permukaan, memintas hujan serta mengurangkan larian air dan hakisan. Mengekalkan dan mengukuhkan litupan ini secara terpilih ialah langkah pencegahan barisan pertama, manakala pembersihan meluas atau penggredan semula berisiko menjejaskan kestabilan kawasan yang kini stabil.

Saliran dan Pengurusan Air Permukaan (Konseptual)

Air permukaan ialah pencetus utama pergerakan cetek pada cerun pesisir.

Pada peringkat konsep, pencegahan tertumpu pada:

• Mengelakkan penumpuan larian air dari laluan atau struktur;

• Menggalakkan resapan melalui permukaan telap air;

• Mengarahkan air secara perlahan merentasi cerun, bukannya terus menuruni cerun;

• Mengekalkan pola saliran semula jadi.

Langkah ini mengurangkan tekanan hakisan tanpa memperkenalkan infrastruktur saliran keras.

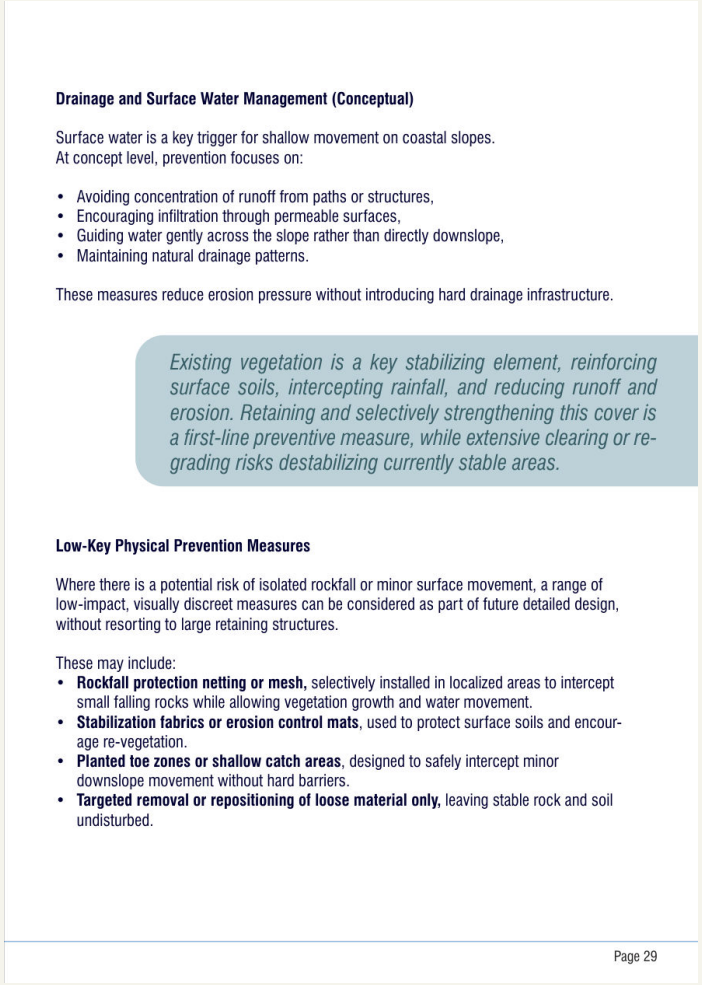
Langkah Pencegahan Fizikal yang Sederhana

Di kawasan yang mempunyai potensi risiko runtuhan batu terpencil atau pergerakan permukaan kecil, pelbagai langkah berimpak rendah yang tidak menonjol secara visual boleh dipertimbangkan sebagai sebahagian daripada reka bentuk terperinci pada masa hadapan, tanpa menggunakan struktur penahan besar.

Langkah ini boleh merangkumi:

• Jaring atau jejaring perlindungan runtuhan batu, dipasang secara terpilih di kawasan setempat untuk menahan batu kecil yang jatuh sambil membenarkan pertumbuhan tumbuh-tumbuhan dan pergerakan air.

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Drainage and Surface Water Management (Conceptual)

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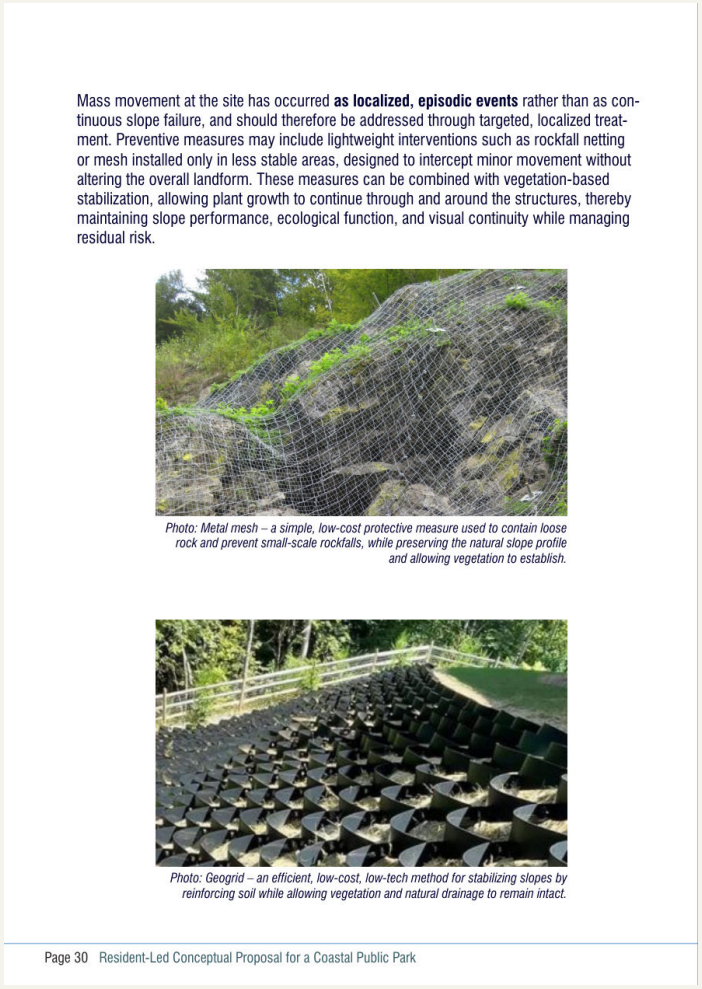
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• Fabrik penstabilan atau tikar kawalan hakisan, digunakan untuk melindungi tanah permukaan dan menggalakkan penanaman semula.

• Zon kaki cerun yang ditanam atau kawasan tadahan cetek, direka untuk menahan pergerakan kecil menuruni cerun dengan selamat tanpa penghadang keras.

• Penyingkiran atau pengalihan kedudukan bahan longgar sahaja secara bersasar, sambil membiarkan batu dan tanah yang stabil tidak terganggu.



Mass movement at the site has occurred **as localized, episodic events** rather than as continuous slope failure, and should therefore be addressed through targeted, localized treatment. Preventive measures may include lightweight interventions such as rockfall netting or mesh installed only in less stable areas, designed to intercept minor movement without altering the overall landform. These measures can be combined with vegetation-based stabilization, allowing plant growth to continue through and around the structures, thereby maintaining slope performance, ecological function, and visual continuity while managing residual risk.

Photo: Metal mesh – a simple, low-cost protective measure used to contain loose rock and prevent small-scale rockfalls, while preserving the natural slope profile and allowing vegetation to establish.

Photo: Geogrid – an efficient, low-cost, low-tech method for stabilizing slopes by reinforcing soil while allowing vegetation and natural drainage to remain intact.

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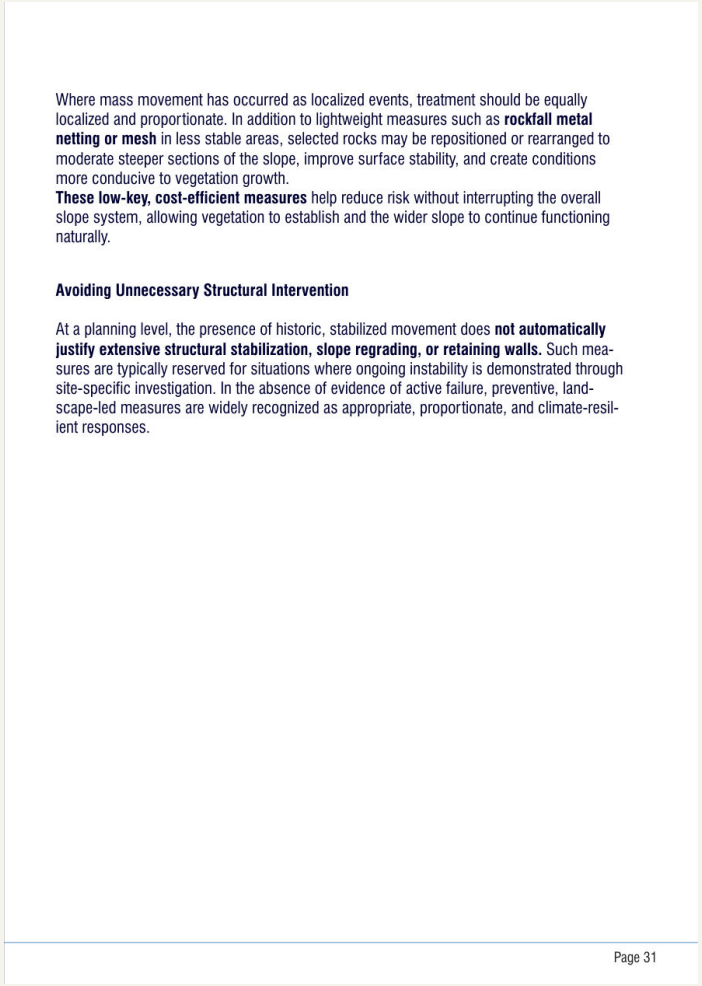
Halaman 30

Cadangan Konseptual Diterajui Penduduk untuk Sebuah Taman Awam Pesisir

Pergerakan jisim di tapak telah berlaku sebagai kejadian setempat yang sekali-sekala, bukannya kegagalan cerun berterusan, dan oleh itu perlu ditangani melalui rawatan bersasar dan setempat. Langkah pencegahan boleh merangkumi campur tangan ringan seperti jaring atau jejaring penahan runtuhan batu yang dipasang hanya di kawasan kurang stabil, direka untuk menahan pergerakan kecil tanpa mengubah bentuk muka bumi keseluruhan. Langkah ini boleh digabungkan dengan penstabilan berasaskan tumbuh-tumbuhan, membolehkan tumbuhan terus tumbuh melalui dan di sekeliling struktur, sekali gus mengekalkan prestasi cerun, fungsi ekologi dan kesinambungan visual sambil mengurus risiko baki.

Foto: Jejaring logam — langkah perlindungan yang mudah dan berkos rendah untuk menahan batu longgar serta mencegah runtuhan batu berskala kecil, sambil memelihara profil cerun semula jadi dan membolehkan tumbuh-tumbuhan bertapak.

Foto: Geogrid — kaedah cekap, berkos rendah dan berteknologi ringkas untuk menstabilkan cerun dengan mengukuhkan tanah, sambil membolehkan tumbuh-tumbuhan serta saliran semula jadi kekal utuh.



Where mass movement has occurred as localized events, treatment should be equally localized and proportionate. In addition to lightweight measures such as **rockfall metal netting or mesh** in less stable areas, selected rocks may be repositioned or rearranged to moderate steeper sections of the slope, improve surface stability, and create conditions more conducive to vegetation growth.
These low-key, cost-efficient measures help reduce risk without interrupting the overall slope system, allowing vegetation to establish and the wider slope to continue functioning naturally.

Avoiding Unnecessary Structural Intervention

At a planning level, the presence of historic, stabilized movement does **not automatically justify extensive structural stabilization, slope regrading, or retaining walls.** Such measures are typically reserved for situations where ongoing instability is demonstrated through site-specific investigation. In the absence of evidence of active failure, preventive, landscape-led measures are widely recognized as appropriate, proportionate, and climate-resilient responses.

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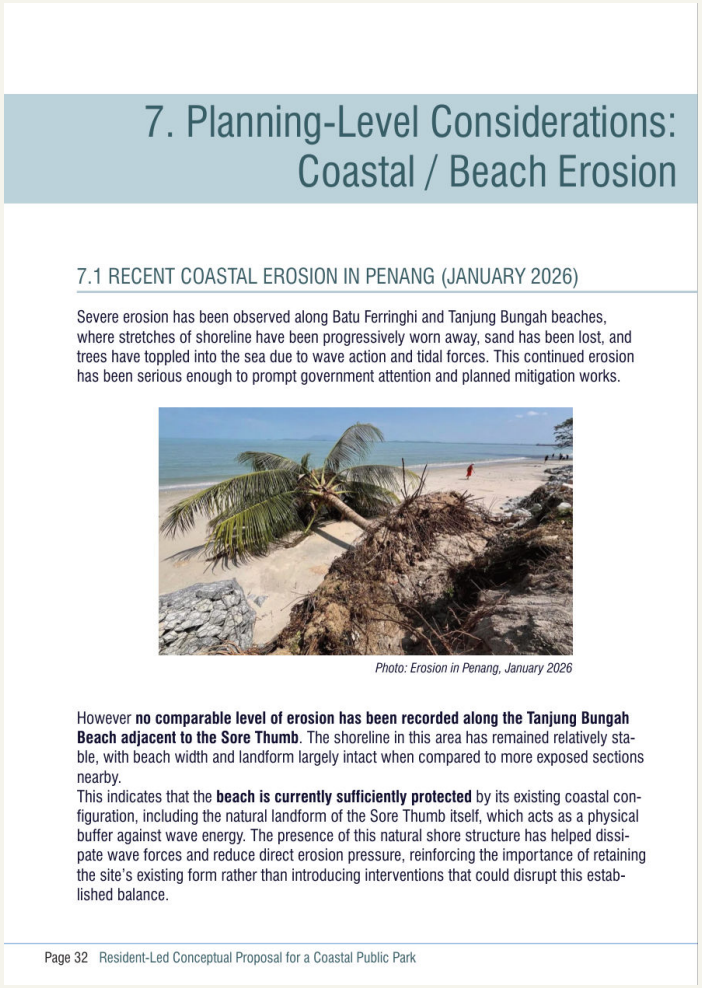
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Apabila pergerakan jisim berlaku sebagai kejadian setempat, rawatannya juga perlu bersifat setempat dan setimpal. Selain langkah ringan seperti jaring atau jejaring logam penahan runtuhan batu di kawasan kurang stabil, batu terpilih boleh dialihkan kedudukan atau disusun semula untuk mengurangkan kecuraman bahagian tertentu cerun, memperbaik kestabilan permukaan dan mewujudkan keadaan yang lebih sesuai untuk pertumbuhan tumbuh-tumbuhan.

Langkah sederhana yang menjimatkan kos ini membantu mengurangkan risiko tanpa mengganggu sistem cerun secara keseluruhan, membolehkan tumbuh-tumbuhan bertapak dan cerun yang lebih luas terus berfungsi secara semula jadi.

Mengelakkan Campur Tangan Struktur yang Tidak Perlu

Pada peringkat perancangan, kehadiran pergerakan lama yang telah stabil tidak secara automatik mewajarkan penstabilan struktur secara meluas, penggredan semula cerun atau tembok penahan. Langkah sedemikian lazimnya dikhaskan untuk keadaan di mana ketidakstabilan berterusan dibuktikan melalui penyiasatan khusus tapak. Tanpa bukti kegagalan aktif, langkah pencegahan yang berpandukan landskap diiktiraf secara meluas sebagai tindak balas yang sesuai, setimpal dan berdaya tahan terhadap iklim.



7. Planning-Level Considerations: Coastal / Beach Erosion

7.1 RECENT COASTAL EROSION IN PENANG (JANUARY 2026)

Severe erosion has been observed along Batu Ferringhi and Tanjung Bungah beaches, where stretches of shoreline have been progressively worn away, sand has been lost, and trees have toppled into the sea due to wave action and tidal forces. This continued erosion has been serious enough to prompt government attention and planned mitigation works.

Photo: Erosion in Penang, January 2026

However **no comparable level of erosion has been recorded along the Tanjung Bungah Beach adjacent to the Sore Thumb**. The shoreline in this area has remained relatively stable, with beach width and landform largely intact when compared to more exposed sections nearby.
This indicates that the **beach is currently sufficiently protected** by its existing coastal configuration, including the natural landform of the Sore Thumb itself, which acts as a physical buffer against wave energy. The presence of this natural shore structure has helped dissipate wave forces and reduce direct erosion pressure, reinforcing the importance of retaining the site's existing form rather than introducing interventions that could disrupt this established balance.

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Cadangan Konseptual Diterajui Penduduk untuk Sebuah Taman Awam Pesisir

7. Pertimbangan pada Peringkat Perancangan: Hakisan Pesisir / Pantai

7.1 HAKISAN PANTAI TERKINI DI PULAU PINANG (JANUARI 2026)

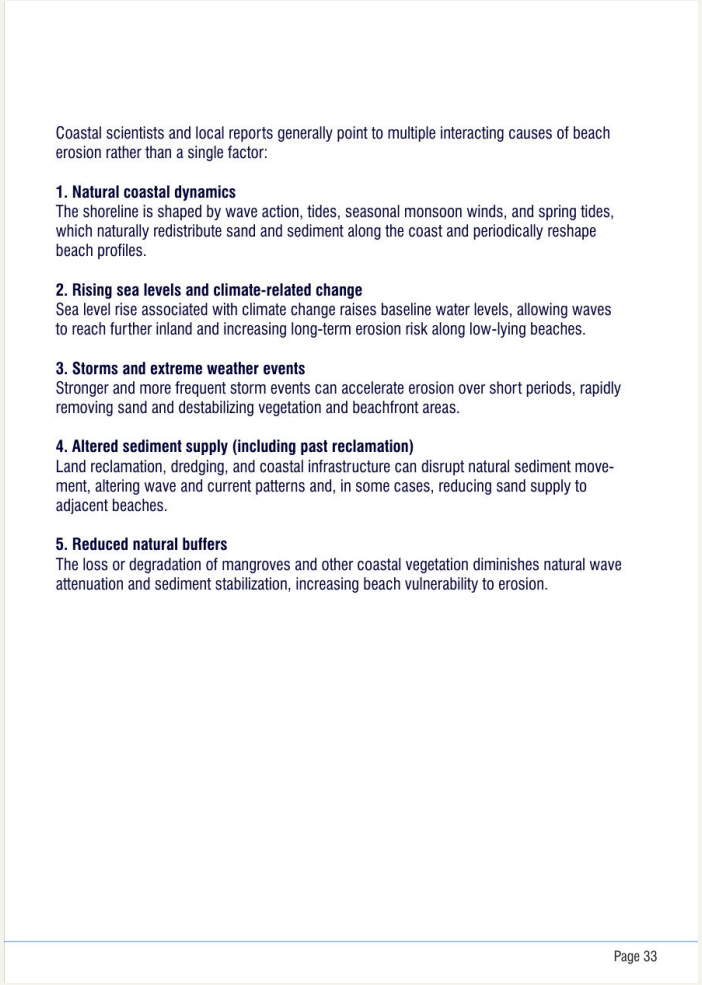
Hakisan teruk telah diperhatikan di sepanjang pantai Batu Ferringhi dan Tanjung Bungah, apabila beberapa bahagian persisiran semakin terhakis, pasir hilang dan pokok tumbang ke laut akibat tindakan ombak serta daya pasang surut. Hakisan berterusan ini cukup serius sehingga mendapat perhatian kerajaan dan mendorong perancangan kerja mitigasi.

Foto: Hakisan di Pulau Pinang, Januari 2026.

Walau bagaimanapun, tiada tahap hakisan setanding direkodkan di sepanjang Pantai Tanjung Bungah yang bersebelahan Sore Thumb. Persisiran di kawasan ini kekal agak stabil, dengan lebar pantai dan bentuk muka bumi sebahagian besarnya masih utuh berbanding bahagian berhampiran yang lebih terdedah.

Ini menunjukkan bahawa pantai tersebut pada masa ini dilindungi secukupnya oleh konfigurasi pesisir sedia ada, termasuk bentuk muka bumi semula jadi Sore Thumb sendiri, yang bertindak sebagai penampan fizikal terhadap tenaga ombak. Kehadiran struktur pantai semula jadi ini telah membantu melesapkan daya ombak dan mengurangkan tekanan hakisan secara langsung, memperkukuh kepentingan mengekalkan bentuk sedia ada tapak dan bukannya memperkenalkan campur tangan yang boleh mengganggu keseimbangan yang telah terbentuk.

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Coastal scientists and local reports generally point to multiple interacting causes of beach erosion rather than a single factor:

1. Natural coastal dynamics
The shoreline is shaped by wave action, tides, seasonal monsoon winds, and spring tides, which naturally redistribute sand and sediment along the coast and periodically reshape beach profiles.

2. Rising sea levels and climate-related change
Sea level rise associated with climate change raises baseline water levels, allowing waves to reach further inland and increasing long-term erosion risk along low-lying beaches.

3. Storms and extreme weather events
Stronger and more frequent storm events can accelerate erosion over short periods, rapidly removing sand and destabilizing vegetation and beachfront areas.

4. Altered sediment supply (including past reclamation)
Land reclamation, dredging, and coastal infrastructure can disrupt natural sediment movement, altering wave and current patterns and, in some cases, reducing sand supply to adjacent beaches.

5. Reduced natural buffers
The loss or degradation of mangroves and other coastal vegetation diminishes natural wave attenuation and sediment stabilization, increasing beach vulnerability to erosion.

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Ahli sains pesisir dan laporan tempatan secara umumnya menunjukkan bahawa hakisan pantai berpunca daripada pelbagai sebab yang saling berinteraksi, bukannya satu faktor tunggal:

1. Dinamik pesisir semula jadi

Garis pantai dibentuk oleh tindakan ombak, pasang surut, angin monsun bermusim dan pasang besar, yang secara semula jadi mengagihkan semula pasir serta sedimen di sepanjang pesisir dan membentuk semula profil pantai secara berkala.

2. Kenaikan aras laut dan perubahan berkaitan iklim

Kenaikan aras laut yang dikaitkan dengan perubahan iklim meningkatkan aras asas air, membolehkan ombak mencapai lebih jauh ke darat dan meningkatkan risiko hakisan jangka panjang di sepanjang pantai yang rendah.

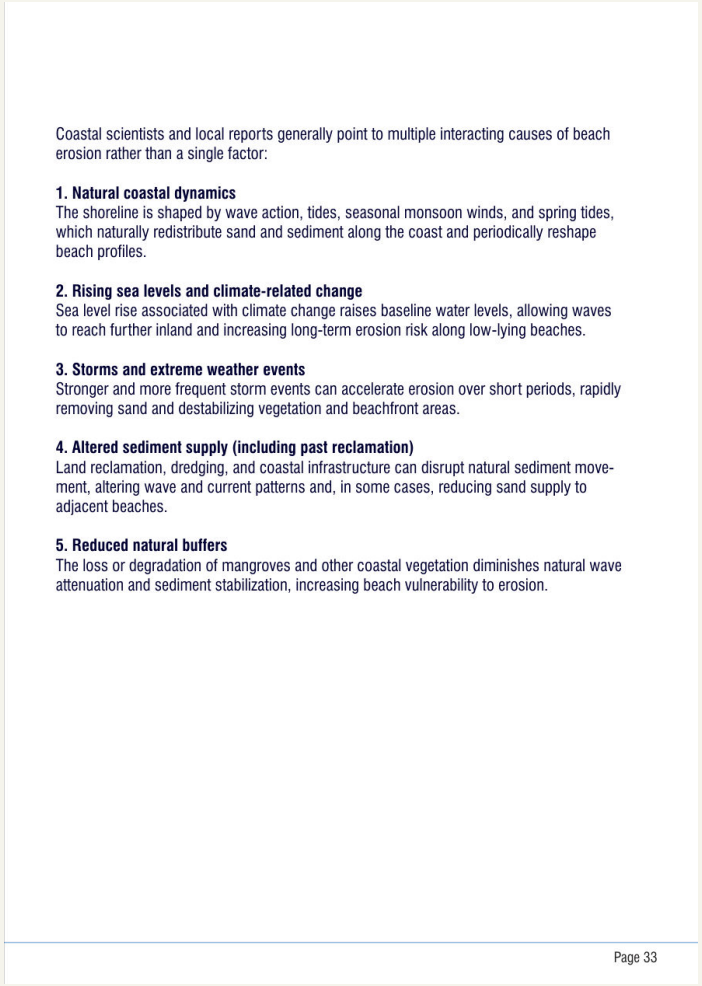
3. Ribut dan kejadian cuaca ekstrem

Kejadian ribut yang lebih kuat dan lebih kerap boleh mempercepat hakisan dalam tempoh singkat, menyingkirkan pasir dengan pantas serta menjejaskan kestabilan tumbuh-tumbuhan dan kawasan tepi pantai.

4. Bekalan sedimen yang berubah (termasuk penambakan terdahulu)

Penambakan tanah, pengorekan dan infrastruktur pesisir boleh mengganggu pergerakan sedimen semula jadi, mengubah pola ombak serta arus dan, dalam sesetengah keadaan, mengurangkan bekalan pasir ke pantai bersebelahan.

5. Pengurangan penampan semula jadi



Coastal scientists and local reports generally point to multiple interacting causes of beach erosion rather than a single factor:

1. Natural coastal dynamics
The shoreline is shaped by wave action, tides, seasonal monsoon winds, and spring tides, which naturally redistribute sand and sediment along the coast and periodically reshape beach profiles.

2. Rising sea levels and climate-related change
Sea level rise associated with climate change raises baseline water levels, allowing waves to reach further inland and increasing long-term erosion risk along low-lying beaches.

3. Storms and extreme weather events
Stronger and more frequent storm events can accelerate erosion over short periods, rapidly removing sand and destabilizing vegetation and beachfront areas.

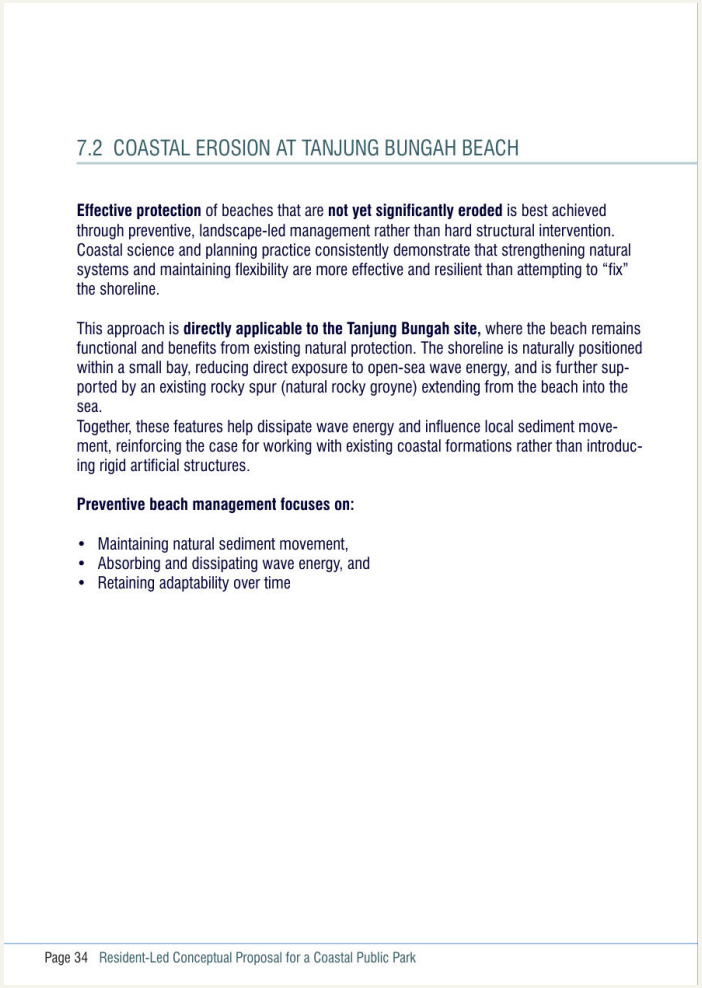
4. Altered sediment supply (including past reclamation)
Land reclamation, dredging, and coastal infrastructure can disrupt natural sediment movement, altering wave and current patterns and, in some cases, reducing sand supply to adjacent beaches.

5. Reduced natural buffers
The loss or degradation of mangroves and other coastal vegetation diminishes natural wave attenuation and sediment stabilization, increasing beach vulnerability to erosion.

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Kehilangan atau kemerosotan hutan bakau dan tumbuh-tumbuhan pesisir lain mengurangkan pelemahan ombak serta penstabilan sedimen secara semula jadi, menjadikan pantai lebih mudah terhakis.



7.2 COASTAL EROSION AT TANJUNG BUNGAH BEACH

Effective protection of beaches that are **not yet significantly eroded** is best achieved through preventive, landscape-led management rather than hard structural intervention. Coastal science and planning practice consistently demonstrate that strengthening natural systems and maintaining flexibility are more effective and resilient than attempting to "fix" the shoreline.

This approach is **directly applicable to the Tanjung Bungah site,** where the beach remains functional and benefits from existing natural protection. The shoreline is naturally positioned within a small bay, reducing direct exposure to open-sea wave energy, and is further supported by an existing rocky spur (natural rocky groyne) extending from the beach into the sea.
Together, these features help dissipate wave energy and influence local sediment movement, reinforcing the case for working with existing coastal formations rather than introducing rigid artificial structures.

Preventive beach management focuses on:

- Maintaining natural sediment movement,
- Absorbing and dissipating wave energy, and
- Retaining adaptability over time

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Cadangan Konseptual Diterajui Penduduk untuk Sebuah Taman Awam Pesisir

7.2 HAKISAN PANTAI DI PANTAI TANJUNG BUNGAH

Perlindungan berkesan bagi pantai yang belum terhakis dengan ketara paling baik dicapai melalui pengurusan pencegahan yang berpandukan landskap, bukannya campur tangan struktur keras. Sains pesisir dan amalan perancangan secara konsisten menunjukkan bahawa pengukuhan sistem semula jadi dan pengekalan fleksibiliti lebih berkesan serta berdaya tahan berbanding cubaan "menetapkan" garis pantai.

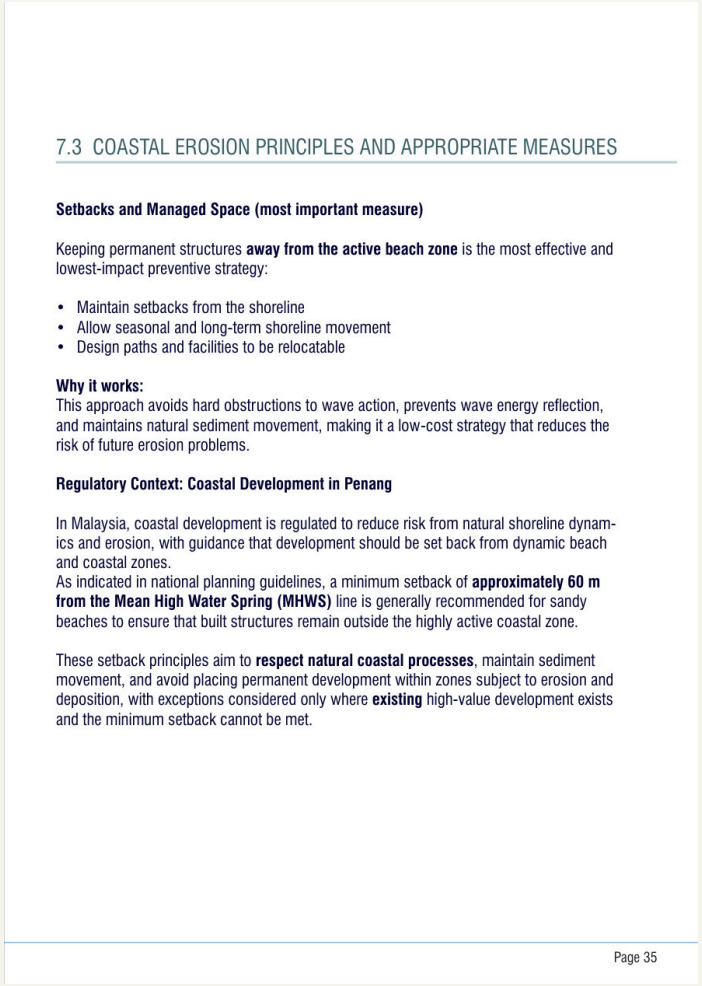
Pendekatan ini boleh digunakan secara langsung di tapak Tanjung Bungah, di mana pantai masih berfungsi dan mendapat manfaat daripada perlindungan semula jadi sedia ada. Persisiran ini secara semula jadi terletak dalam sebuah teluk kecil, mengurangkan pendedahan langsung kepada tenaga ombak laut terbuka, dan turut disokong oleh unjuran batu sedia ada (groin berbatu semula jadi) yang memanjang dari pantai ke laut.

Bersama-sama, ciri ini membantu melesapkan tenaga ombak dan mempengaruhi pergerakan sedimen setempat, memperkukuh alasan untuk memanfaatkan bentukan pesisir sedia ada dan bukannya memperkenalkan struktur buatan yang tegar.

Pengurusan pencegahan pantai tertumpu pada:

- Mengekalkan pergerakan sedimen semula jadi;
- Menyerap dan melesapkan tenaga ombak; dan
- Mengekalkan keupayaan menyesuaikan diri dari semasa ke semasa.

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7.3 COASTAL EROSION PRINCIPLES AND APPROPRIATE MEASURES

Setbacks and Managed Space (most important measure)

Keeping permanent structures **away from the active beach zone** is the most effective and lowest-impact preventive strategy:

- Maintain setbacks from the shoreline
- Allow seasonal and long-term shoreline movement
- Design paths and facilities to be relocatable

Why it works:
This approach avoids hard obstructions to wave action, prevents wave energy reflection, and maintains natural sediment movement, making it a low-cost strategy that reduces the risk of future erosion problems.

Regulatory Context: Coastal Development in Penang

In Malaysia, coastal development is regulated to reduce risk from natural shoreline dynamics and erosion, with guidance that development should be set back from dynamic beach and coastal zones.
As indicated in national planning guidelines, a minimum setback of **approximately 60 m from the Mean High Water Spring (MHWS)** line is generally recommended for sandy beaches to ensure that built structures remain outside the highly active coastal zone.

These setback principles aim to **respect natural coastal processes**, maintain sediment movement, and avoid placing permanent development within zones subject to erosion and deposition, with exceptions considered only where **existing** high-value development exists and the minimum setback cannot be met.

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7.3 PRINSIP HAKISAN PANTAI DAN LANGKAH YANG SESUAI

Anjakan Undur dan Ruang Terurus (langkah paling penting)

Menempatkan struktur kekal jauh daripada zon pantai aktif ialah strategi pencegahan yang paling berkesan dan paling rendah impaknya:

• Mengekalkan anjakan undur dari garis pantai

• Membenarkan pergerakan garis pantai bermusim dan jangka panjang

• Mereka bentuk laluan dan kemudahan supaya boleh dipindahkan

Mengapa pendekatan ini berkesan:

Pendekatan ini mengelakkan halangan keras terhadap tindakan ombak, mencegah pantulan tenaga ombak dan mengekalkan pergerakan sedimen semula jadi, menjadikannya strategi berkos rendah yang mengurangkan risiko masalah hakisan pada masa hadapan.

Konteks Kawal Selia: Pembangunan Pesisir di Pulau Pinang

Di Malaysia, pembangunan pesisir dikawal selia untuk mengurangkan risiko daripada dinamik garis pantai semula jadi dan hakisan, dengan panduan supaya pembangunan dianjakkan ke belakang dari zon pantai serta pesisir yang dinamik.

Seperti yang dinyatakan dalam garis panduan perancangan negara, anjakan undur minimum kira-kira 60 m dari garisan Purata Air Pasang Besar (Mean High Water Spring, MHWS) secara umum disyorkan bagi pantai berpasir untuk memastikan struktur binaan kekal di luar zon pesisir yang sangat aktif. Prinsip anjakan undur ini bertujuan menghormati proses pesisir semula jadi, mengekalkan pergerakan sedimen dan mengelakkan penempatan pembangunan kekal dalam zon yang terdedah kepada hakisan serta pemendapan, dengan pengecualian dipertimbangkan hanya apabila terdapat pembangunan bernilai tinggi sedia ada dan anjakan undur minimum tidak dapat dipenuhi.



Dune and Upper-Beach Vegetation

Dune and upper-beach vegetation function as coastal infrastructure rather than decoration. Creeping vines such as *Ipomoea pes-caprae*, coastal grasses including *Spinifex* and low shrubs such as *Scaevola* and *Vitex* play a critical role in trapping and retaining sand, stabilizing surface sediments, reducing wind erosion, and absorbing wave run-up energy. Healthy, continuous vegetation cover in these zones is therefore a key indicator of beach resilience and an essential component of preventive coastal management.

Photo: Coastal Vegetation: Spinifex littoreus

Photo: Coastal Vegetation: Scaevola taccada

Photo: Coastal Vegetation: Vitex trifolia

Photo: Coastal Vegetation: Ipomoea pes-caprae

The proposed concept **reinforces and enhances this natural protection** by introducing and supporting vegetation that is well suited to coastal conditions and effective for beach stabilization.
The planting approach priorities **native and coastal-adapted species** that tolerate salt spray, wind, and sandy soils, and that contribute directly to sediment retention, surface stabilization, and erosion prevention. Importantly, the entire Sore Thumb hill functions as a large-scale natural buffer, reducing wind exposure, intercepting runoff, and dissipating wave and storm energy before it reaches the beach. In the context of climate change and rising sea levels, retaining and strengthening this vegetated landform provides a **resilient, landscape-led defense against land and sand loss**, demonstrating that the site already performs a significant protective role without the need for hard coastal structures.

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Cadangan Konseptual Diterajui Penduduk untuk Sebuah Taman Awam Pesisir

Tumbuh-tumbuhan Gumuk Pasir dan Bahagian Atas Pantai

Tumbuh-tumbuhan gumuk pasir dan bahagian atas pantai berfungsi sebagai infrastruktur pesisir, bukan sekadar hiasan. Tumbuhan menjalar seperti Ipomoea pes-caprae, rumput pesisir termasuk Spinifex dan pokok renek rendah seperti Scaevola serta Vitex memainkan peranan kritikal dalam memerangkap dan mengekalkan pasir, menstabilkan sedimen permukaan, mengurangkan hakisan angin dan menyerap tenaga larian ombak ke pantai. Oleh itu, litupan tumbuh-tumbuhan yang sihat dan berterusan di zon ini ialah petunjuk utama daya tahan pantai serta komponen penting pengurusan pencegahan pesisir.

Foto: Tumbuhan pesisir: Scaevola taccada.

Foto: Tumbuhan pesisir: Spinifex littoreus.

Foto: Tumbuhan pesisir: Vitex trifolia.

Foto: Tumbuhan pesisir: Ipomoea pes-caprae.

Konsep yang dicadangkan memperkukuh dan meningkatkan perlindungan semula jadi ini dengan memperkenalkan serta menyokong tumbuh-tumbuhan yang sesuai dengan keadaan pesisir dan berkesan untuk menstabilkan pantai.

Pendekatan penanaman mengutamakan spesies asli dan spesies yang menyesuaikan diri dengan pesisir, yang tahan terhadap semburan garam, angin dan tanah berpasir, serta menyumbang secara langsung kepada pengekalan sedimen, penstabilan permukaan dan pencegahan hakisan. Yang penting, keseluruhan bukit Sore Thumb berfungsi sebagai penampan semula jadi berskala besar, mengurangkan pendedahan kepada angin, memintas larian air serta melesapkan tenaga ombak dan ribut sebelum sampai ke pantai. Dalam konteks perubahan iklim dan kenaikan aras laut, mengekalkan serta memperkukuh bentuk muka bumi yang dilitupi tumbuhan ini memberikan pertahanan berdaya tahan yang berpandukan landskap terhadap kehilangan tanah dan pasir, menunjukkan bahawa tapak ini

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Dune and Upper-Beach Vegetation

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sudah melaksanakan peranan perlindungan yang ketara tanpa memerlukan struktur pantai keras.

Preservation of Natural Nearshore Features and Breakwater Function

Natural nearshore features such as **shallow reefs, rocky outcrops, and natural seabed formations** play an important protective role by functioning as a natural breakwater system. These features dissipate wave energy offshore, reduce wave height before it reaches the shoreline, and help stabilize nearshore sediments, supporting the natural balance of sand movement along the coast.

At the Tanjung Bungah "Sore Thumb" site, this function is already present through an existing of-shore **rocky breakwater** extending from the beach into the sea. This formation contributes to partial sheltering of the beach and influences local sediment dynamics, reducing direct erosive pressure on the shoreline.

The removal or alteration of such nearshore features often worsens erosion by eliminating this first line of wave energy dissipation and disrupting sediment pathways. For this reason, **preservation of existing formations is a key preventive measure**.

Should future monitoring indicate the need for additional protection, the existing natural breakwater function could be carefully reinforced or elaborated, building on what already works rather than introducing rigid artificial structures. This approach maintains flexibility, limits environmental impact, and supports long-term coastal resilience.

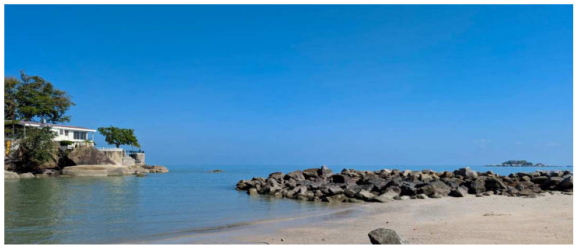


Photo: Existing breakwater efficiently protecting the beach

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Foto: Pemecah ombak sedia ada yang melindungi pantai dengan cekap.

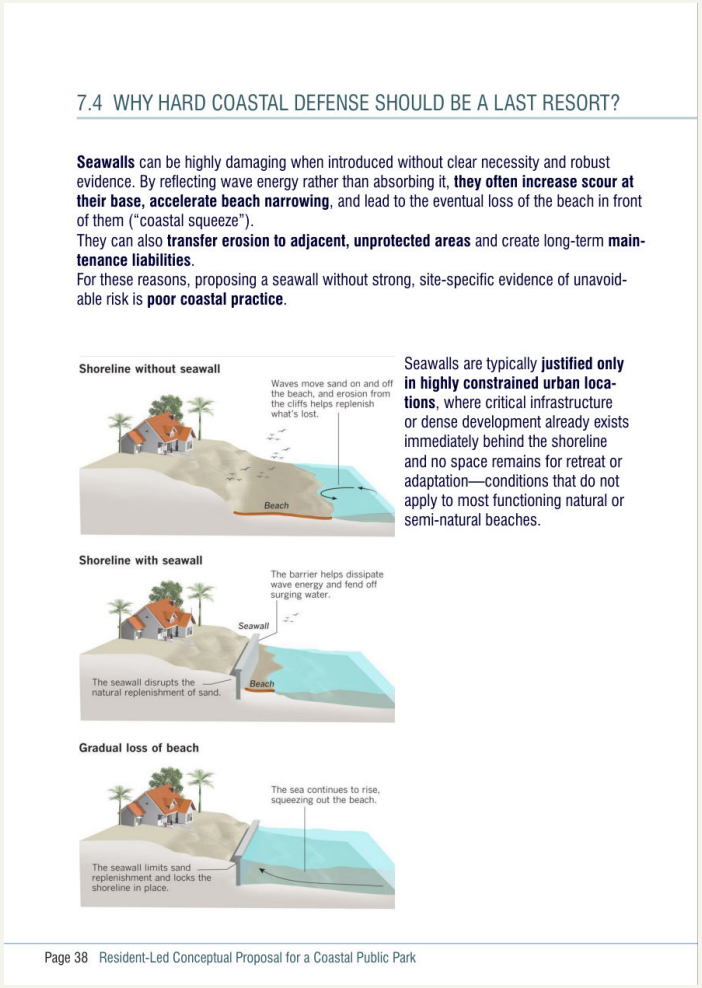
Pemeliharaan Ciri Semula Jadi Berhampiran Pantai dan Fungsi Pemecah Ombak

Ciri semula jadi berhampiran pantai seperti terumbu cetek, singkapan batu dan bentukan dasar laut semula jadi memainkan peranan perlindungan penting dengan berfungsi sebagai sistem pemecah ombak semula jadi. Ciri ini melesapkan tenaga ombak di luar pesisir, mengurangkan ketinggian ombak sebelum sampai ke persisiran dan membantu menstabilkan sedimen berhampiran pantai, sekali gus menyokong keseimbangan semula jadi pergerakan pasir di sepanjang pesisir.

Di tapak "Sore Thumb" Tanjung Bungah, fungsi ini sudah wujud melalui pemecah ombak berbatu sedia ada di luar pesisir yang memanjang dari pantai ke laut. Bentukan ini menyumbang kepada perlindungan separa pantai dan mempengaruhi dinamik sedimen setempat, mengurangkan tekanan hakisan secara langsung pada persisiran.

Penyingkiran atau pengubahan ciri berhampiran pantai sedemikian sering memburukkan hakisan dengan menghapuskan barisan pertama pelesapan tenaga ombak ini dan mengganggu laluan sedimen. Atas sebab ini, pemeliharaan bentukan sedia ada ialah langkah pencegahan utama.

Sekiranya pemantauan pada masa hadapan menunjukkan keperluan perlindungan tambahan, fungsi pemecah ombak semula jadi sedia ada boleh diperkukuh atau dikembangkan dengan teliti, memanfaatkan apa yang sudah berfungsi dan bukannya memperkenalkan struktur buatan tegar. Pendekatan ini mengekalkan fleksibiliti, mengehadkan impak alam sekitar dan menyokong daya tahan pesisir jangka panjang.



7.4 WHY HARD COASTAL DEFENSE SHOULD BE A LAST RESORT?

Seawalls can be highly damaging when introduced without clear necessity and robust evidence. By reflecting wave energy rather than absorbing it, **they often increase scour at their base, accelerate beach narrowing**, and lead to the eventual loss of the beach in front of them ("coastal squeeze").
They can also **transfer erosion to adjacent, unprotected areas** and create long-term **maintenance liabilities**.
For these reasons, proposing a seawall without strong, site-specific evidence of unavoidable risk is **poor coastal practice**.

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Cadangan Konseptual Diterajui Penduduk untuk Sebuah Taman Awam Pesisir

7.4 MENGAPAKAH PERTAHANAN PANTAI BERSTRUKTUR KERAS PATUT MENJADI PILIHAN TERAKHIR?

Tembok laut boleh membawa kerosakan yang besar apabila diperkenalkan tanpa keperluan yang jelas dan bukti yang kukuh. Dengan memantulkan tenaga ombak dan bukannya menyerapnya, tembok ini sering meningkatkan hakisan kikisan di pangkalnya, mempercepat penyempitan pantai dan akhirnya menyebabkan kehilangan pantai di hadapannya ("himpitan pesisir" atau "coastal squeeze").

Ia juga boleh memindahkan hakisan ke kawasan bersebelahan yang tidak dilindungi serta mewujudkan tanggungan penyelenggaraan jangka panjang.

Atas sebab ini, mencadangkan tembok laut tanpa bukti khusus tapak yang kukuh tentang risiko yang tidak dapat dielakkan merupakan amalan pesisir yang lemah.

Tembok laut lazimnya hanya wajar di lokasi bandar yang mempunyai kekangan ruang yang besar, di mana infrastruktur kritikal atau pembangunan padat sudah wujud betul-betul di belakang persisiran dan tiada ruang lagi untuk pengunduran atau penyesuaian — keadaan yang tidak terpakai kepada kebanyakan pantai semula jadi atau separa semula jadi yang masih berfungsi.

Rajah: Garis pantai tanpa tembok laut

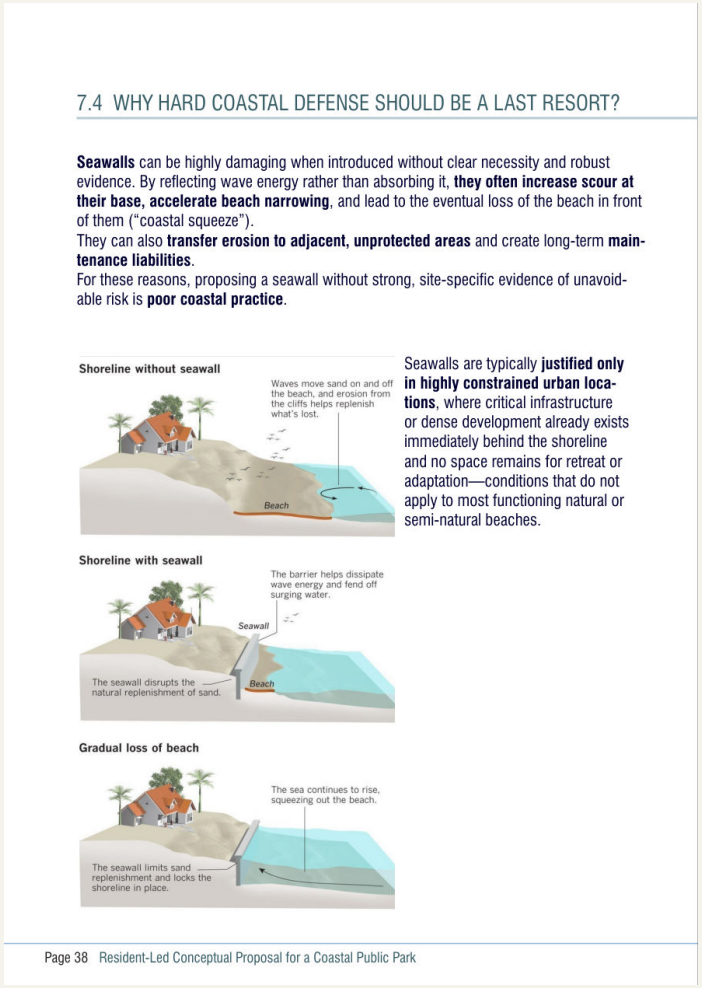
Ombak membawa pasir ke pantai dan keluar dari pantai, manakala hakisan tebing membantu menggantikan pasir yang hilang.

Label: Pantai.

Rajah: Garis pantai dengan tembok laut

Penghalang ini membantu melesapkan tenaga ombak dan menahan air yang meluru.

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7.4 WHY HARD COASTAL DEFENSE SHOULD BE A LAST RESORT?

Seawalls can be highly damaging when introduced without clear necessity and robust evidence. By reflecting wave energy rather than absorbing it, **they often increase scour at their base, accelerate beach narrowing**, and lead to the eventual loss of the beach in front of them ("coastal squeeze").
They can also **transfer erosion to adjacent, unprotected areas** and create long-term **maintenance liabilities**.
For these reasons, proposing a seawall without strong, site-specific evidence of unavoidable risk is **poor coastal practice**.

Seawalls are typically **justified only in highly constrained urban locations**, where critical infrastructure or dense development already exists immediately behind the shoreline and no space remains for retreat or adaptation—conditions that do not apply to most functioning natural or semi-natural beaches.

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Label: Tembok laut; Pantai.

Tembok laut mengganggu penambahan semula pasir secara semula jadi.

Rajah: Kehilangan pantai secara beransur-ansur

Aras laut terus meningkat, lalu menghimpit pantai sehingga hilang.

Tembok laut mengehadkan penambahan semula pasir dan menetapkan garis pantai pada kedudukannya.



Infrastructure built directly at the shoreline is **inherently costly to maintain** and **highly vulnerable to damage or failure** during extreme weather events. Continuous exposure to saltwater, wave impact, and tidal action accelerates material deterioration, increasing the risk of structural damage, repeated repair, and eventual demolition.

Photo: Infrastructure built close to the shoreline is never a one-time investment, as ongoing maintenance and damage repair from wave action and extreme weather result in high long-term costs.

Experience in Penang has shown that seawalls, where previously introduced, often make beach spaces **difficult or unusable**. By fixing the shoreline, they commonly lead to beach narrowing or complete loss of the beach during high tides, reducing public access and recreational value.
Seawalls are not only **expensive to maintain, prone to deterioration in harsh marine conditions,** and **vulnerable to vandalism**.

Ecologically, they create a "dead coast"—a hard edge with little or no habitat value for coastal flora and fauna. Over time, these impacts undermine both environmental quality and public benefit, while locking authorities into long-term maintenance costs.

Photo: Narrowing beach reduced escape space during high tide increases public health and safety risks, potentially trapping beach users between rising water and hard structures with limited ability to avoid wave impact. Penang 2025

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Pengalaman di Pulau Pinang menunjukkan bahawa tembok laut yang pernah diperkenalkan sering menjadikan ruang pantai sukar digunakan atau langsung tidak boleh digunakan. Dengan menetapkan garis pantai, tembok ini lazimnya menyebabkan penyempitan pantai atau kehilangan keseluruhan pantai semasa air pasang, mengurangkan akses awam dan nilai rekreasi.

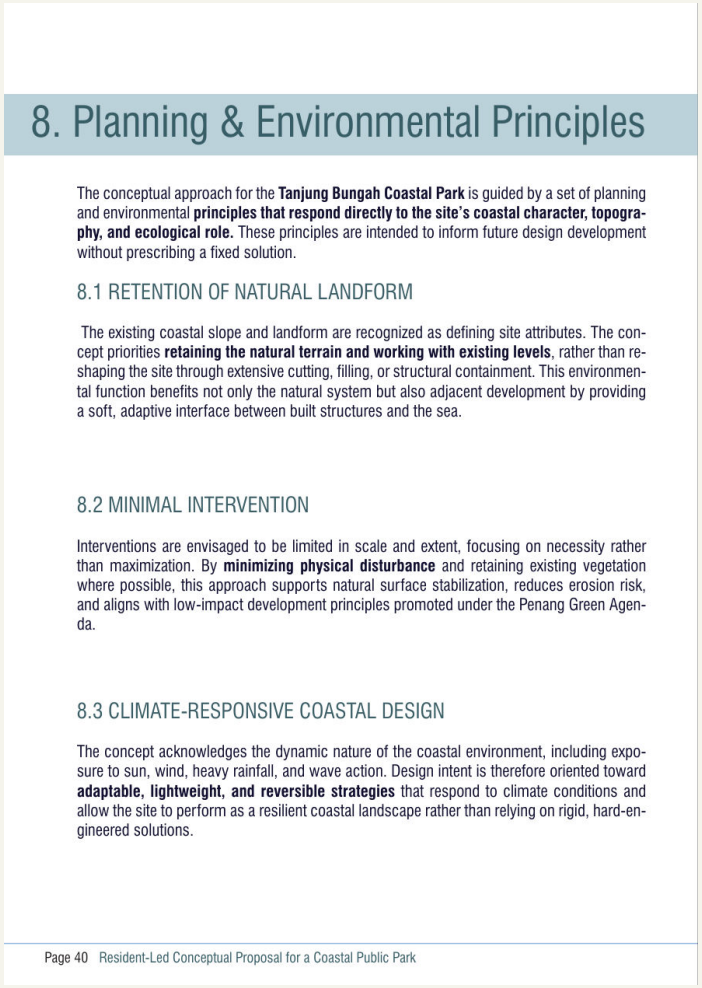
Tembok laut bukan sahaja mahal untuk disenggara, malah mudah merosot dalam keadaan marin yang keras dan terdedah kepada vandalisme.

Dari segi ekologi, ia mewujudkan "pesisir mati" — pinggir keras yang mempunyai sedikit atau tiada nilai habitat bagi flora dan fauna pesisir. Seiring masa, kesan ini menjejaskan kualiti alam sekitar serta manfaat awam, sambil mengikat pihak berkuasa kepada kos penyelenggaraan jangka panjang.

Infrastruktur yang dibina terus di persisiran pantai sememangnya mahal untuk disenggara dan sangat terdedah kepada kerosakan atau kegagalan semasa kejadian cuaca ekstrem. Pendedahan berterusan kepada air masin, hentaman ombak dan tindakan pasang surut mempercepat kemerosotan bahan, meningkatkan risiko kerosakan struktur, pembaikan berulang dan akhirnya perobohan.

Foto: Pantai yang semakin sempit mengurangkan ruang menyelamatkan diri semasa air pasang, meningkatkan risiko kesihatan dan keselamatan awam, serta berpotensi memerangkap pengguna pantai antara air yang semakin naik dengan struktur keras, dengan keupayaan yang terhad untuk mengelakkan hentaman ombak. Pulau Pinang, 2025.

Foto: Infrastruktur yang dibina berhampiran persisiran pantai tidak pernah menjadi pelaburan sekali sahaja, kerana penyelenggaraan berterusan dan pembaikan kerosakan akibat tindakan ombak serta cuaca ekstrem mengakibatkan kos jangka panjang yang tinggi.



8. Planning & Environmental Principles

The conceptual approach for the **Tanjung Bungah Coastal Park** is guided by a set of planning and environmental **principles that respond directly to the site's coastal character, topography, and ecological role.** These principles are intended to inform future design development without prescribing a fixed solution.

8.1 RETENTION OF NATURAL LANDFORM

The existing coastal slope and landform are recognized as defining site attributes. The concept priorities **retaining the natural terrain and working with existing levels**, rather than reshaping the site through extensive cutting, filling, or structural containment. This environmental function benefits not only the natural system but also adjacent development by providing a soft, adaptive interface between built structures and the sea.

8.2 MINIMAL INTERVENTION

Interventions are envisaged to be limited in scale and extent, focusing on necessity rather than maximization. By **minimizing physical disturbance** and retaining existing vegetation where possible, this approach supports natural surface stabilization, reduces erosion risk, and aligns with low-impact development principles promoted under the Penang Green Agenda.

8.3 CLIMATE-RESPONSIVE COASTAL DESIGN

The concept acknowledges the dynamic nature of the coastal environment, including exposure to sun, wind, heavy rainfall, and wave action. Design intent is therefore oriented toward **adaptable, lightweight, and reversible strategies** that respond to climate conditions and allow the site to perform as a resilient coastal landscape rather than relying on rigid, hard-engineered solutions.

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Cadangan Konseptual Diterajui Penduduk untuk Sebuah Taman Awam Pesisir

8. Prinsip Perancangan & Alam Sekitar

Pendekatan konsep bagi Taman Pesisir Tanjung Bungah dipandu oleh satu set prinsip perancangan dan alam sekitar yang memberi respons secara langsung kepada ciri pesisir, topografi serta peranan ekologi tapak. Prinsip ini bertujuan memaklumkan pembangunan reka bentuk pada masa hadapan tanpa menetapkan penyelesaian yang tetap.

8.2 CAMPUR TANGAN MINIMUM

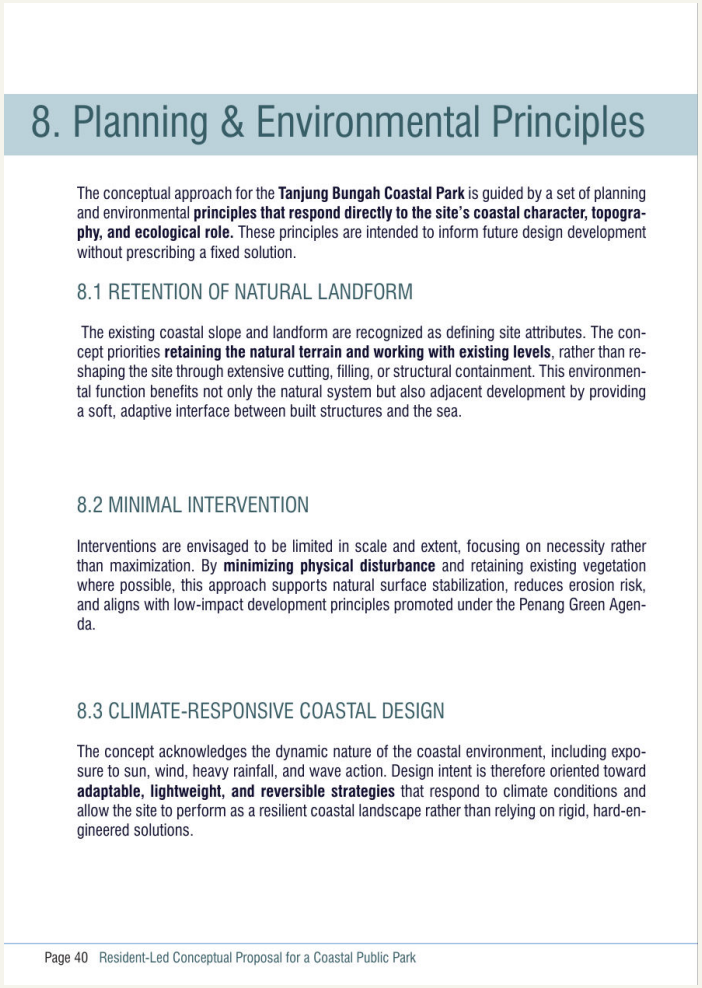
Campur tangan dibayangkan terhad dari segi skala dan keluasan, dengan tumpuan pada keperluan dan bukannya memaksimumkan pembangunan. Dengan meminimumkan gangguan fizikal dan mengekalkan tumbuh-tumbuhan sedia ada jika boleh, pendekatan ini menyokong penstabilan permukaan secara semula jadi, mengurangkan risiko hakisan dan selaras dengan prinsip pembangunan berimpak rendah yang dipromosikan di bawah Penang Green Agenda.

8.3 REKA BENTUK PESISIR YANG RESPONSIF TERHADAP IKLIM

Konsep ini mengiktiraf sifat dinamik persekitaran pesisir, termasuk pendedahan kepada matahari, angin, hujan lebat dan tindakan ombak. Oleh itu, hasrat reka bentuk berorientasikan strategi yang boleh disesuaikan, ringan dan boleh dipulihkan kepada keadaan asal, yang memberi respons kepada keadaan iklim serta membolehkan tapak berfungsi sebagai landskap pesisir yang berdaya tahan, bukannya bergantung pada penyelesaian kejuruteraan keras yang tegar.

8.1 PENGEKALAN BENTUK MUKA BUMI SEMULA JADI

Cerun pesisir dan bentuk muka bumi sedia ada diiktiraf sebagai ciri utama yang menentukan identiti tapak. Konsep ini mengutamakan pengekalan rupa bumi semula jadi dan penggunaan aras sedia ada, bukannya membentuk semula tapak melalui pemotongan, penambakan atau



8. Planning & Environmental Principles

The conceptual approach for the **Tanjung Bungah Coastal Park** is guided by a set of planning and environmental **principles that respond directly to the site's coastal character, topography, and ecological role.** These principles are intended to inform future design development without prescribing a fixed solution.

8.1 RETENTION OF NATURAL LANDFORM

The existing coastal slope and landform are recognized as defining site attributes. The concept priorities **retaining the natural terrain and working with existing levels**, rather than reshaping the site through extensive cutting, filling, or structural containment. This environmental function benefits not only the natural system but also adjacent development by providing a soft, adaptive interface between built structures and the sea.

8.2 MINIMAL INTERVENTION

Interventions are envisaged to be limited in scale and extent, focusing on necessity rather than maximization. By **minimizing physical disturbance** and retaining existing vegetation where possible, this approach supports natural surface stabilization, reduces erosion risk, and aligns with low-impact development principles promoted under the Penang Green Agenda.

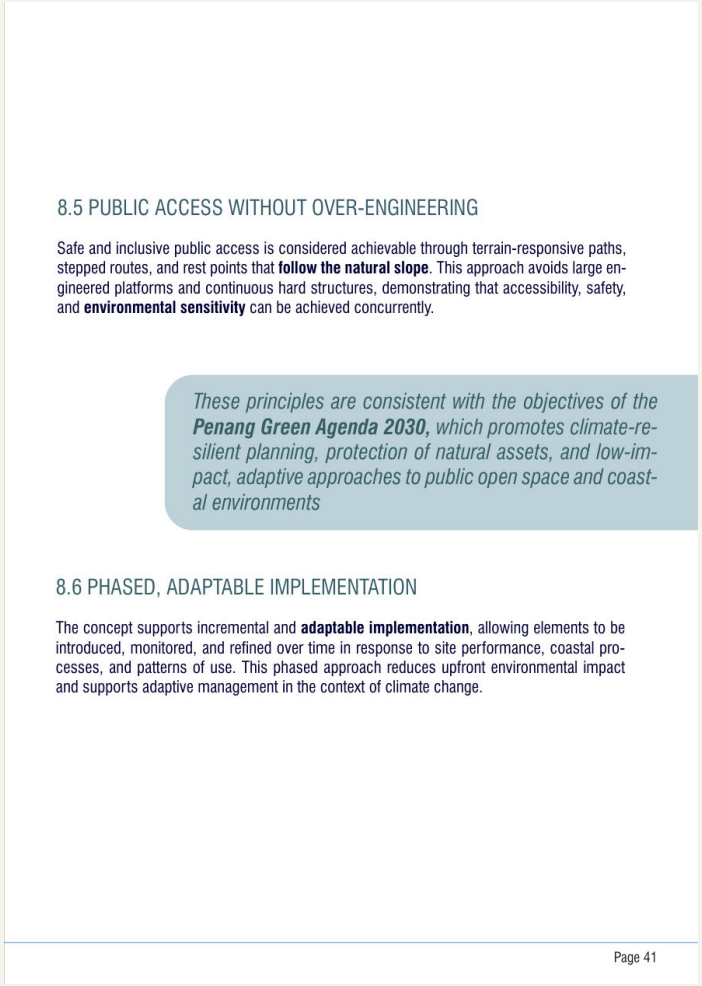
8.3 CLIMATE-RESPONSIVE COASTAL DESIGN

The concept acknowledges the dynamic nature of the coastal environment, including exposure to sun, wind, heavy rainfall, and wave action. Design intent is therefore oriented toward **adaptable, lightweight, and reversible strategies** that respond to climate conditions and allow the site to perform as a resilient coastal landscape rather than relying on rigid, hard-engineered solutions.

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TERJEMAHAN BAHASA MELAYU · sambungan

pengekangan struktur secara meluas. Fungsi alam sekitar ini memberi manfaat bukan sahaja kepada sistem semula jadi, malah kepada pembangunan bersebelahan dengan menyediakan antara muka yang lembut dan adaptif antara struktur binaan dengan laut.



8.5 PUBLIC ACCESS WITHOUT OVER-ENGINEERING

Safe and inclusive public access is considered achievable through terrain-responsive paths, stepped routes, and rest points that **follow the natural slope**. This approach avoids large engineered platforms and continuous hard structures, demonstrating that accessibility, safety, and **environmental sensitivity** can be achieved concurrently.

*These principles are consistent with the objectives of the **Penang Green Agenda 2030,** which promotes climate-resilient planning, protection of natural assets, and low-impact, adaptive approaches to public open space and coastal environments*

8.6 PHASED, ADAPTABLE IMPLEMENTATION

The concept supports incremental and **adaptable implementation**, allowing elements to be introduced, monitored, and refined over time in response to site performance, coastal processes, and patterns of use. This phased approach reduces upfront environmental impact and supports adaptive management in the context of climate change.

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8.5 AKSES AWAM TANPA KEJURUTERAAN BERLEBIHAN

Akses awam yang selamat dan inklusif dianggap boleh dicapai melalui laluan yang responsif terhadap rupa bumi, laluan bertangga dan tempat berehat yang mengikuti cerun semula jadi. Pendekatan ini mengelakkan pelantar kejuruteraan besar dan struktur keras berterusan, menunjukkan bahawa kebolehcapaian, keselamatan dan kepekaan terhadap alam sekitar boleh dicapai serentak.

8.6 PELAKSANAAN BERFASA DAN BOLEH DISESUAIKAN

Konsep ini menyokong pelaksanaan secara beransur-ansur dan boleh disesuaikan, membolehkan elemen diperkenalkan, dipantau serta diperhalus dari semasa ke semasa mengikut prestasi tapak, proses pesisir dan pola penggunaan. Pendekatan berfasa ini mengurangkan impak awal terhadap alam sekitar dan menyokong pengurusan adaptif dalam konteks perubahan iklim.

Prinsip ini selaras dengan objektif Penang Green Agenda 2030, yang menggalakkan perancangan berdaya tahan terhadap iklim, perlindungan aset semula jadi serta pendekatan berimpak rendah dan adaptif terhadap ruang terbuka awam serta persekitaran pesisir.



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Cadangan Konseptual Diterajui Penduduk untuk Sebuah Taman Awam Pesisir

Taman awam yang direka dengan baik bermula dengan penghormatan terhadap tempat.

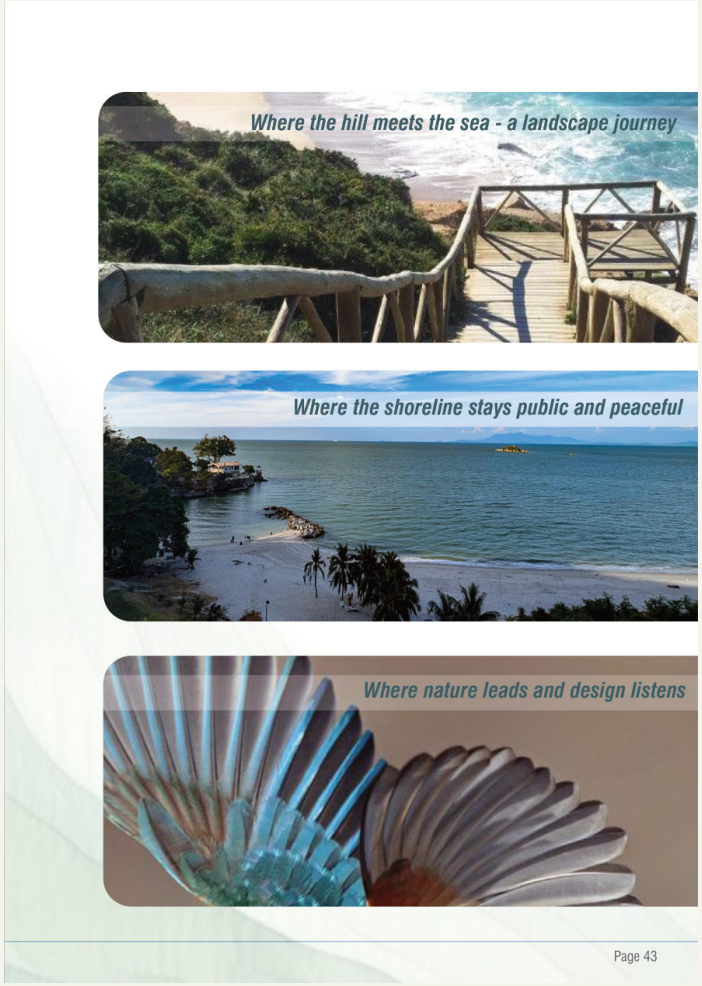
Reka bentuk taman yang baik bekerjasama dengan alam semula jadi, bukannya menentangnya, dengan menganggap bentuk muka bumi, tumbuh-tumbuhan dan proses semula jadi sedia ada sebagai aset, bukan kekangan.

Ia memanfaatkan apa yang sudah ada — menambah nilai tanpa mengurangkannya — dan memberi respons dengan teliti kepada ciri khusus tapak serta persekitarannya yang lebih luas.

Pada masa yang sama, ia kekal berorientasikan manusia, memastikan keperluan asas seperti keselamatan, keselesaan, kebolehcapaian dan keseronokan dipenuhi tanpa keterlaluan atau reka bentuk berlebihan.

Taman yang berjaya tidak perlu mahal atau megah; ia sering ringkas tetapi tidak pernah cetek, di mana sikap berpada-pada, kejelasan dan pemikiran berpandukan landskap menghasilkan hasil yang paling kukuh.

Yang paling utama, taman yang bermakna perlu mencerminkan identitinya sendiri — bukan bercita-cita menjadi sebuah lagi Dubai atau Singapura, tetapi menjadi Tanjung Bungah yang sebenar.



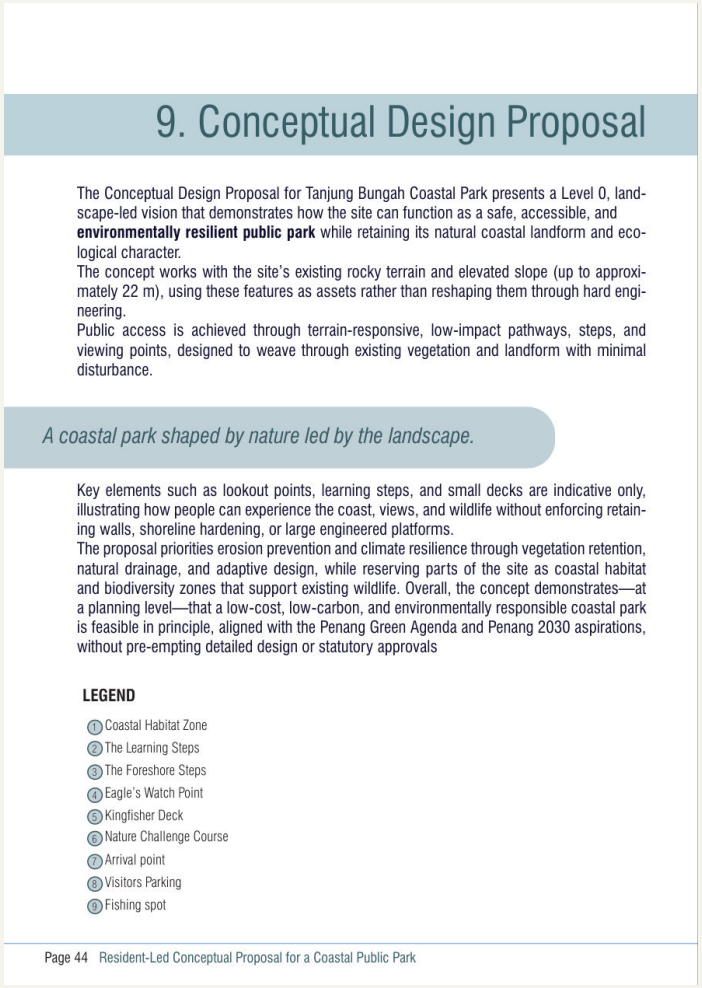
TERJEMAHAN BAHASA MELAYU

Halaman 43

Di mana bukit bertemu laut — sebuah perjalanan landskap

Di mana persisiran kekal terbuka kepada awam dan damai

Di mana alam memimpin dan reka bentuk mendengar



9. Conceptual Design Proposal

The Conceptual Design Proposal for Tanjung Bungah Coastal Park presents a Level 0, landscape-led vision that demonstrates how the site can function as a safe, accessible, and **environmentally resilient public park** while retaining its natural coastal landform and ecological character.
The concept works with the site's existing rocky terrain and elevated slope (up to approximately 22 m), using these features as assets rather than reshaping them through hard engineering.
Public access is achieved through terrain-responsive, low-impact pathways, steps, and viewing points, designed to weave through existing vegetation and landform with minimal disturbance.

A coastal park shaped by nature led by the landscape.

Key elements such as lookout points, learning steps, and small decks are indicative only, illustrating how people can experience the coast, views, and wildlife without enforcing retaining walls, shoreline hardening, or large engineered platforms.
The proposal priorities erosion prevention and climate resilience through vegetation retention, natural drainage, and adaptive design, while reserving parts of the site as coastal habitat and biodiversity zones that support existing wildlife. Overall, the concept demonstrates—at a planning level—that a low-cost, low-carbon, and environmentally responsible coastal park is feasible in principle, aligned with the Penang Green Agenda and Penang 2030 aspirations, without pre-empting detailed design or statutory approvals

LEGEND

1. Coastal Habitat Zone
2. The Learning Steps
3. The Foreshore Steps
4. Eagle's Watch Point
5. Kingfisher Deck
6. Nature Challenge Course
7. Arrival point
8. Visitors Parking
9. Fishing spot

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TERJEMAHAN BAHASA MELAYU

Halaman 44

Cadangan Konseptual Diterajui Penduduk untuk Sebuah Taman Awam Pesisir

9. Cadangan Reka Bentuk Konseptual

Cadangan Reka Bentuk Konseptual bagi Taman Pesisir Tanjung Bungah mengemukakan visi Tahap 0 yang berpandukan landskap, menunjukkan bagaimana tapak ini boleh berfungsi sebagai taman awam yang selamat, boleh diakses dan berdaya tahan terhadap alam sekitar, sambil mengekalkan bentuk muka bumi pesisir semula jadi serta ciri ekologinya.

Konsep ini memanfaatkan rupa bumi berbatu dan cerun tinggi sedia ada di tapak (sehingga kira-kira 22 m), menggunakan ciri ini sebagai aset dan bukannya membentuknya semula melalui kejuruteraan keras.

Akses awam dicapai melalui laluan pejalan kaki, tangga dan titik tinjau berimpak rendah yang responsif terhadap rupa bumi, direka untuk menyusuri tumbuh-tumbuhan serta bentuk muka bumi sedia ada dengan gangguan minimum.

PETUNJUK

1. Zon Habitat Pesisir

2. Tangga Pembelajaran (The Learning Steps)

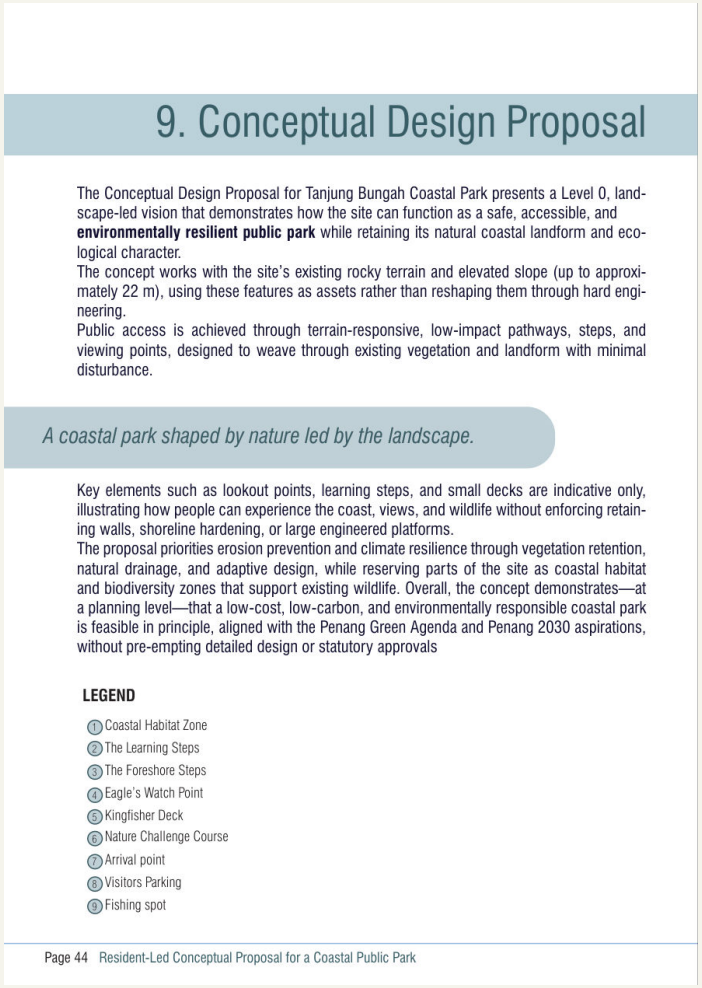
3. Tangga ke Pantai (The Foreshore Steps)

4. Titik Tinjau Helang (Eagle’s Watch Point)

5. Dek Raja Udang (Kingfisher Deck)

6. Laluan Cabaran Alam (Nature Challenge Course)

7. Ruang ketibaan



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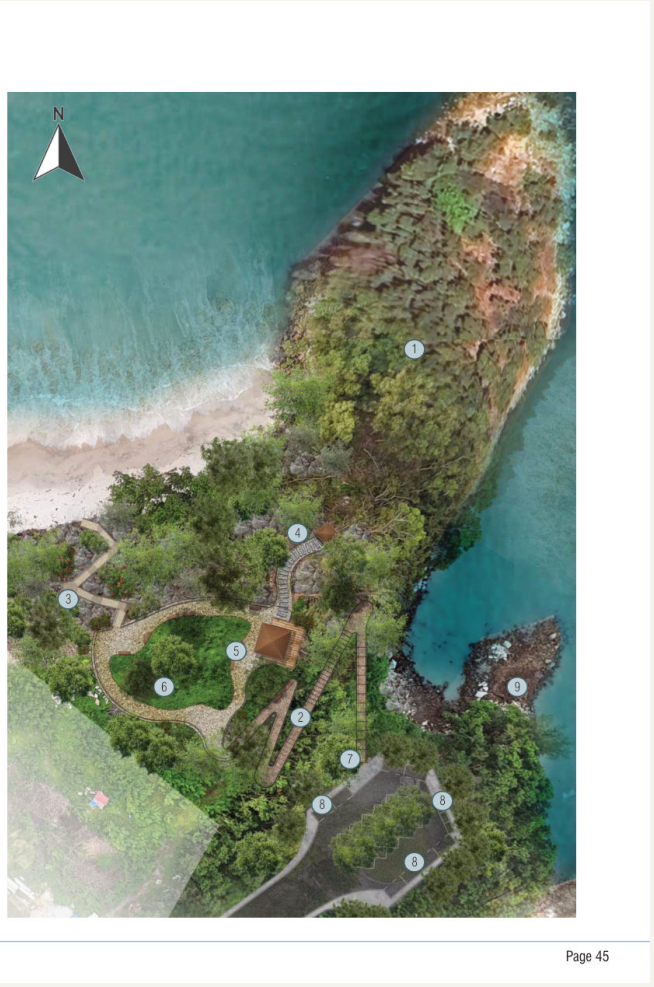
8. Tempat letak kenderaan pengunjung

9. Tempat memancing

Taman pesisir yang dibentuk oleh alam, dipandu oleh landskap.

Elemen utama seperti titik tinjau, tangga pembelajaran dan dek kecil hanyalah indikatif, menggambarkan bagaimana orang ramai boleh menikmati pesisir, pemandangan dan hidupan liar tanpa mengenakan tembok penahan, pengerasan persisiran atau pelantar kejuruteraan besar.

Cadangan ini mengutamakan pencegahan hakisan dan daya tahan iklim melalui pengekalan tumbuh-tumbuhan, saliran semula jadi serta reka bentuk adaptif, sambil memperuntukkan sebahagian tapak sebagai zon habitat pesisir dan biodiversiti yang menyokong hidupan liar sedia ada. Secara keseluruhan, konsep ini menunjukkan — pada peringkat perancangan — bahawa sebuah taman pesisir berkos rendah, rendah karbon dan bertanggungjawab terhadap alam sekitar boleh dilaksanakan secara prinsip, selaras dengan aspirasi Penang Green Agenda dan Penang 2030, tanpa mendahului reka bentuk terperinci atau kelulusan statutori.



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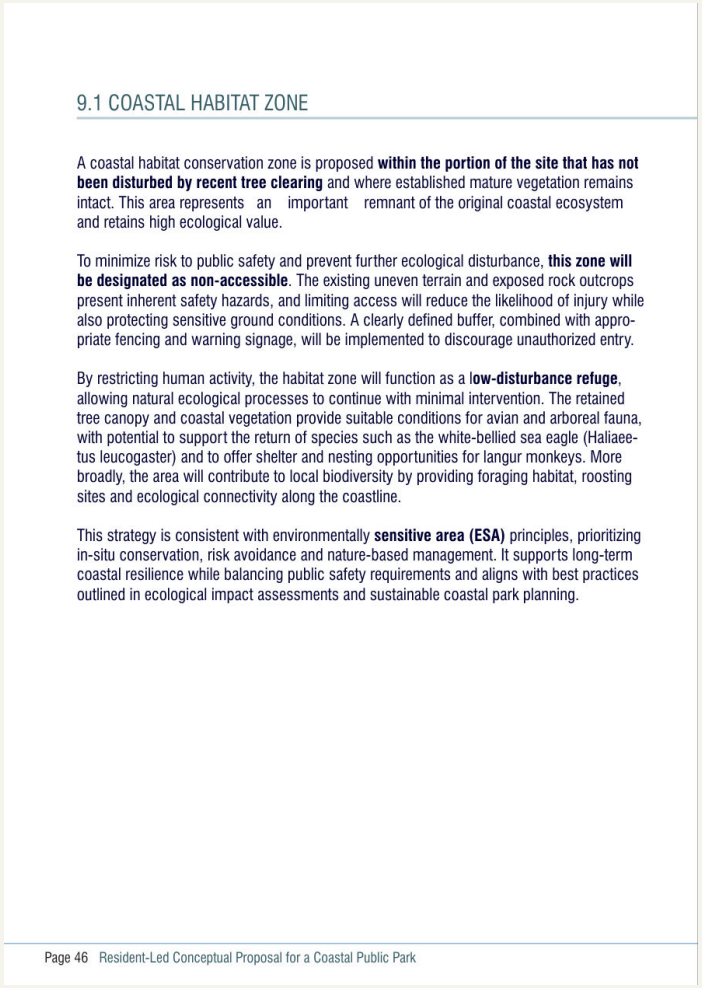
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9.1 COASTAL HABITAT ZONE

A coastal habitat conservation zone is proposed **within the portion of the site that has not been disturbed by recent tree clearing** and where established mature vegetation remains intact. This area represents an important remnant of the original coastal ecosystem and retains high ecological value.

To minimize risk to public safety and prevent further ecological disturbance, **this zone will be designated as non-accessible**. The existing uneven terrain and exposed rock outcrops present inherent safety hazards, and limiting access will reduce the likelihood of injury while also protecting sensitive ground conditions. A clearly defined buffer, combined with appropriate fencing and warning signage, will be implemented to discourage unauthorized entry.

By restricting human activity, the habitat zone will function as a l**ow-disturbance refuge**, allowing natural ecological processes to continue with minimal intervention. The retained tree canopy and coastal vegetation provide suitable conditions for avian and arboreal fauna, with potential to support the return of species such as the white-bellied sea eagle (Haliaeetus leucogaster) and to offer shelter and nesting opportunities for langur monkeys. More broadly, the area will contribute to local biodiversity by providing foraging habitat, roosting sites and ecological connectivity along the coastline.

This strategy is consistent with environmentally **sensitive area (ESA)** principles, prioritizing in-situ conservation, risk avoidance and nature-based management. It supports long-term coastal resilience while balancing public safety requirements and aligns with best practices outlined in ecological impact assessments and sustainable coastal park planning.

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TERJEMAHAN BAHASA MELAYU

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Cadangan Konseptual Diterajui Penduduk untuk Sebuah Taman Awam Pesisir

9.1 ZON HABITAT PESISIR

Zon pemuliharaan habitat pesisir dicadangkan dalam bahagian tapak yang tidak terganggu oleh pembersihan pokok baru-baru ini dan di mana tumbuh-tumbuhan matang yang telah bertapak masih kekal utuh. Kawasan ini merupakan sisa penting ekosistem pesisir asal dan mengekalkan nilai ekologi yang tinggi.

Untuk meminimumkan risiko terhadap keselamatan awam dan mencegah gangguan ekologi lanjut, zon ini akan ditetapkan sebagai kawasan yang tidak boleh diakses. Rupa bumi tidak rata dan singkapan batu terdedah sedia ada membawa bahaya keselamatan tersendiri, dan mengehadkan akses akan mengurangkan kemungkinan kecederaan sambil melindungi keadaan tanah yang sensitif. Zon penampan yang ditakrifkan dengan jelas, bersama pagar dan papan tanda amaran yang sesuai, akan diwujudkan untuk menghalang kemasukan tanpa kebenaran.

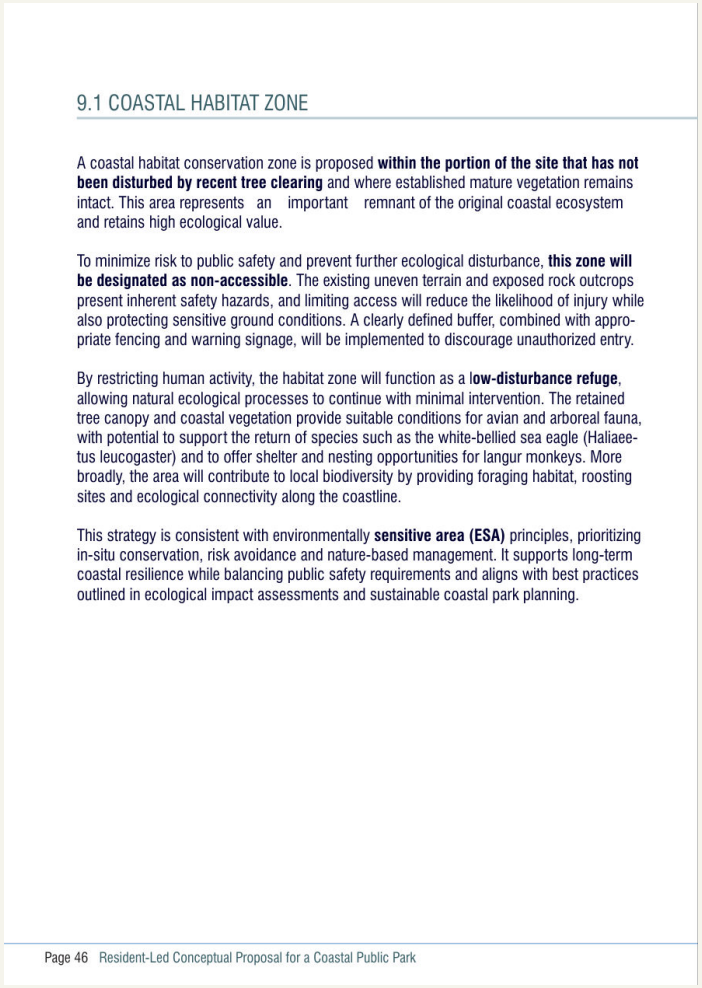
Dengan mengehadkan aktiviti manusia, zon habitat akan berfungsi sebagai kawasan perlindungan bergangguan rendah, membolehkan proses ekologi semula jadi diteruskan dengan campur tangan minimum. Kanopi pokok dan tumbuh-tumbuhan pesisir yang dikekalkan menyediakan keadaan sesuai bagi fauna burung serta fauna yang hidup di pokok, dengan potensi menyokong kepulangan spesies seperti helang laut perut putih (Haliaeetus leucogaster) serta menawarkan tempat berlindung dan peluang bersarang bagi lotong. Secara lebih luas, kawasan ini akan menyumbang kepada biodiversiti setempat dengan menyediakan habitat mencari makanan, tempat bertenggek dan hubungan ekologi di sepanjang garis pantai.

Strategi ini selaras dengan prinsip kawasan sensitif alam sekitar (ESA), mengutamakan pemuliharaan di tempat asal, pengelakan risiko dan pengurusan berasaskan alam semula jadi. Ia menyokong daya tahan pesisir jangka panjang sambil mengimbangi keperluan keselamatan awam, serta selaras dengan amalan terbaik yang digariskan dalam penilaian

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impak ekologi dan perancangan taman pesisir mampan.



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9.2 THE LEARNING STEPS

Learning Steps provide a simple and intuitive means of access to the upper part of the hill. They are conceived as lightweight, low-impact elements, constructed from timber or a timber-and-earth combination, and aligned as closely as possible with the natural contour lines to minimize ground disturbance and avoid the need for heavy construction.

The design intent includes safe handrails and, where feasible, ramp-like alternatives or gentler gradients to support inclusive use by people with mobility impairments, parents with prams, children, and elderly visitors. An intermediate landing at approximately +6 m is envisaged as an accessible terrace, offering a resting and viewing space that can be reached more easily by users with limited mobility. In this way, the Learning Steps demonstrate how the park can remain natural in character while being inclusive and socially accessible.

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Cadangan Konseptual Diterajui Penduduk untuk Sebuah Taman Awam Pesisir

9.2 TANGGA PEMBELAJARAN (THE LEARNING STEPS)

Tangga Pembelajaran menyediakan cara yang mudah dan intuitif untuk mengakses bahagian atas bukit. Ia dibayangkan sebagai elemen ringan dan berimpak rendah, dibina daripada kayu atau gabungan kayu dengan tanah, serta dijajarkan sedekat mungkin dengan garisan kontur semula jadi untuk meminimumkan gangguan tanah dan mengelakkan keperluan pembinaan berat.

Hasrat reka bentuk merangkumi susur tangan yang selamat dan, jika boleh dilaksanakan, alternatif seperti tanjakan atau kecerunan yang lebih landai untuk menyokong penggunaan inklusif oleh individu yang mengalami keterbatasan pergerakan, ibu bapa dengan kereta sorong bayi, kanak-kanak dan pengunjung warga emas. Pelantar perantaraan pada aras kira-kira +6 m dibayangkan sebagai teres boleh akses, menawarkan ruang berehat dan menikmati pemandangan yang lebih mudah dicapai oleh pengguna dengan pergerakan terhad. Dengan cara ini, Tangga Pembelajaran menunjukkan bagaimana taman dapat mengekalkan ciri semula jadinya sambil bersifat inklusif dan boleh diakses oleh masyarakat.

Tanjakan boleh akses

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PETUNJUK



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TERJEMAHAN BAHASA MELAYU · sambungan

Titik Tinjau Boleh Akses

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Elemen Pendidikan

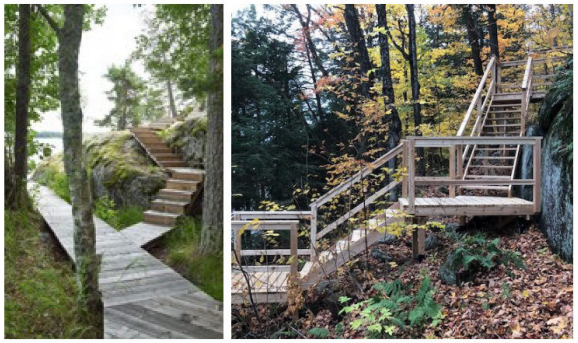


Photo: Nature-based paths provide safe, low-impact access along natural slopes without intrusive construction.



Photo: Example of different types of natural steps are possible. Final detailing can be adapted to respond to site conditions and address specific needs in the most appropriate way.

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Foto: Laluan berasaskan alam semula jadi menyediakan akses yang selamat dan berimpak rendah di sepanjang cerun semula jadi tanpa pembinaan yang mengganggu.

Foto: Contoh pelbagai jenis tangga semula jadi yang boleh digunakan. Perincian akhir boleh disesuaikan dengan keadaan tapak dan memenuhi keperluan khusus dengan cara yang paling sesuai.



In addition, the **Learning Steps** may be complemented by a simple **educational program** for children, introducing **coastal ecology, local wildlife, and environmental processes** in an engaging and informal way. This approach supports learning through play and observation, encouraging awareness of the coastal environment while reinforcing the park's educational value.

Any learning elements are envisaged as l**ow-cost, durable installations made from natural materials, consistent with the park's landscape character and low-impact design principles.** The content and format of the educational program would be developed in collaboration with **local environmental groups**, with input from relevant government agencies to ensure accuracy, appropriateness, and alignment with broader environmental education objectives.

Photo: Example of low-cost, simple play–learn elements that are a well-established way to enrich park experiences for both adults and children, supporting informal learning about the local environment.

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TERJEMAHAN BAHASA MELAYU

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Cadangan Konseptual Diterajui Penduduk untuk Sebuah Taman Awam Pesisir

Di samping itu, Tangga Pembelajaran boleh dilengkapi dengan program pendidikan ringkas untuk kanak-kanak, memperkenalkan ekologi pesisir, hidupan liar tempatan dan proses alam sekitar dengan cara yang menarik serta tidak formal. Pendekatan ini menyokong pembelajaran melalui permainan dan pemerhatian, menggalakkan kesedaran tentang persekitaran pesisir sambil memperkukuh nilai pendidikan taman.

Sebarang elemen pembelajaran dibayangkan sebagai pemasangan berkos rendah dan tahan lama yang diperbuat daripada bahan semula jadi, selaras dengan ciri landskap taman serta prinsip reka bentuk berimpak rendah. Kandungan dan format program pendidikan akan dibangunkan dengan kerjasama kumpulan alam sekitar tempatan, dengan input daripada agensi kerajaan berkaitan untuk memastikan ketepatan, kesesuaian dan keselarasan dengan objektif pendidikan alam sekitar yang lebih luas.

Foto: Contoh elemen bermain sambil belajar yang ringkas dan berkos rendah, yang merupakan cara yang telah terbukti untuk memperkaya pengalaman taman bagi orang dewasa dan kanak-kanak, menyokong pembelajaran tidak formal tentang persekitaran setempat.



Local Environmental Groups (Penang, Malaysia)

Friends of Penang Botanic Gardens (FoPBG)
Strong in environmental education, nature walks, and school engagement. While forest-focused, they have experience translating ecology into child-friendly learning and could advise on program structure and interpretation.

Penang Green Council
A key state-linked organization supporting sustainability education, community programs, and public awareness. Well positioned to help align content with Penang 2030 goals and broader environmental messaging.

Centre for Marine and Coastal Studies (CEMACS)
Based at Universiti Sains Malaysia (USM), CEMACS specialists in marine and coastal ecology, including shoreline processes, intertidal life, and coastal conservation. Ideal for ensuring scientific accuracy in coastal and marine topics.

Water Watch Penang
Experienced in public education related to rivers, water quality, and coastal pollution. They frequently work with communities and schools and are well suited to hands-on, observation-based learning.

Langur Project Penang (LPP)
The educational program focuses on wildlife conservation, education, and community engagement in Penang. Although best known for its work with dusky leaf monkeys (Trachypithecus obscurus), its programs also promote broader wildlife awareness, habitat protection, and responsible human-nature coexistence — all of which align well with a coastal ecology education initiative.

Entopia by Penang Butterfly Farm
A locally based environmental education center with strong experience in hands-on learning for children, specializing in insects, life cycles, and ecosystem awareness through simple, engaging interpretation.

The Habitat Penang Hill
A conservation-led nature park recognized for its low-impact access design and educational programs that promote biodiversity awareness and respect for sensitive landscapes.

Tropical Spice Garden
A community-oriented environmental attraction focused on plants, ecology, and cultural landscapes, with extensive experience in informal, sensory-based learning using natural materials.

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Kumpulan Alam Sekitar Tempatan (Pulau Pinang, Malaysia)

Friends of Penang Botanic Gardens (FoPBG)

Mempunyai kekuatan dalam pendidikan alam sekitar, aktiviti berjalan di alam semula jadi dan penglibatan sekolah. Walaupun berfokus pada hutan, mereka berpengalaman menterjemahkan ekologi kepada pembelajaran mesra kanak-kanak dan boleh menasihati tentang struktur program serta interpretasi.

Penang Green Council

Organisasi utama berkaitan kerajaan negeri yang menyokong pendidikan kelestarian, program komuniti dan kesedaran awam. Berada pada kedudukan yang baik untuk membantu menyelaraskan kandungan dengan matlamat Penang 2030 serta mesej alam sekitar yang lebih luas.

Centre for Marine and Coastal Studies (CEMACS)

Berpusat di Universiti Sains Malaysia (USM), CEMACS mempunyai kepakaran dalam ekologi marin dan pesisir, termasuk proses persisiran, hidupan antara pasang surut dan pemuliharaan pesisir. Sesuai untuk memastikan ketepatan saintifik dalam topik pesisir dan marin.

Water Watch Penang

Berpengalaman dalam pendidikan awam berkaitan sungai, kualiti air dan pencemaran pesisir. Mereka kerap bekerjasama dengan komuniti serta sekolah dan sangat sesuai untuk pembelajaran praktikal berasaskan pemerhatian.

Langur Project Penang (LPP)

Program pendidikannya memberi tumpuan pada pemuliharaan hidupan liar, pendidikan dan penglibatan komuniti di Pulau Pinang. Walaupun paling dikenali melalui usahanya bersama lotong cengkong (Trachypithecus obscurus), programnya turut menggalakkan kesedaran hidupan liar yang lebih luas, perlindungan habitat dan kehidupan bersama manusia dengan



Local Environmental Groups (Penang, Malaysia)

Friends of Penang Botanic Gardens (FoPBG)
Strong in environmental education, nature walks, and school engagement. While forest-focused, they have experience translating ecology into child-friendly learning and could advise on program structure and interpretation.

Penang Green Council
A key state-linked organization supporting sustainability education, community programs, and public awareness. Well positioned to help align content with Penang 2030 goals and broader environmental messaging.

Centre for Marine and Coastal Studies (CEMACS)
Based at Universiti Sains Malaysia (USM), CEMACS specialists in marine and coastal ecology, including shoreline processes, intertidal life, and coastal conservation. Ideal for ensuring scientific accuracy in coastal and marine topics.

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alam secara bertanggungjawab — semuanya selaras dengan inisiatif pendidikan ekologi pesisir.

Entopia by Penang Butterfly Farm

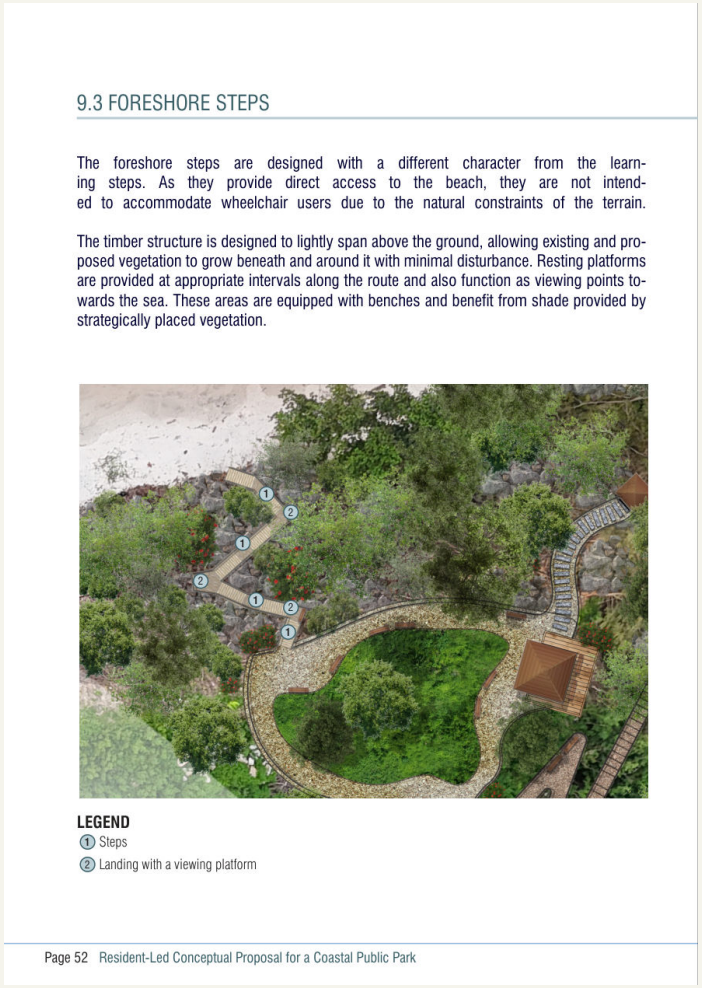
Pusat pendidikan alam sekitar tempatan yang mempunyai pengalaman kukuh dalam pembelajaran praktikal untuk kanak-kanak, dengan pengkhususan pada serangga, kitaran hidup dan kesedaran ekosistem melalui interpretasi yang mudah serta menarik.

The Habitat Penang Hill

Taman alam yang diterajui pemuliharaan, diiktiraf kerana reka bentuk akses berimpak rendah serta program pendidikan yang menggalakkan kesedaran biodiversiti dan penghormatan terhadap landskap sensitif.

Tropical Spice Garden

Tarikan alam sekitar berorientasikan komuniti yang memberi tumpuan pada tumbuh-tumbuhan, ekologi dan landskap budaya, dengan pengalaman luas dalam pembelajaran tidak formal berasaskan deria menggunakan bahan semula jadi.



9.3 FORESHORE STEPS

The foreshore steps are designed with a different character from the learning steps. As they provide direct access to the beach, they are not intended to accommodate wheelchair users due to the natural constraints of the terrain.

The timber structure is designed to lightly span above the ground, allowing existing and proposed vegetation to grow beneath and around it with minimal disturbance. Resting platforms are provided at appropriate intervals along the route and also function as viewing points towards the sea. These areas are equipped with benches and benefit from shade provided by strategically placed vegetation.

LEGEND
① Steps
② Landing with a viewing platform

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TERJEMAHAN BAHASA MELAYU

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Cadangan Konseptual Diterajui Penduduk untuk Sebuah Taman Awam Pesisir

9.3 TANGGA KE PANTAI (FORESHORE STEPS)

Tangga ke Pantai direka dengan ciri yang berbeza daripada Tangga Pembelajaran. Oleh sebab ia menyediakan akses terus ke pantai, tangga ini tidak dimaksudkan untuk menampung pengguna kerusi roda kerana kekangan semula jadi rupa bumi.

Struktur kayu ini direka untuk merentang secara ringan di atas tanah, membolehkan tumbuh-tumbuhan sedia ada dan yang dicadangkan tumbuh di bawah serta di sekelilingnya dengan gangguan minimum. Pelantar berehat disediakan pada sela yang sesuai di sepanjang laluan dan turut berfungsi sebagai titik tinjau ke arah laut. Kawasan ini dilengkapi bangku dan mendapat manfaat daripada teduhan tumbuh-tumbuhan yang ditempatkan secara strategik.

Tangga

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PETUNJUK

TERJEMAHAN BAHASA MELAYU · sambungan

Pelantar perantaraan dengan platform tinjau

9.3 FORESHORE STEPS

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LEGEND

① Steps

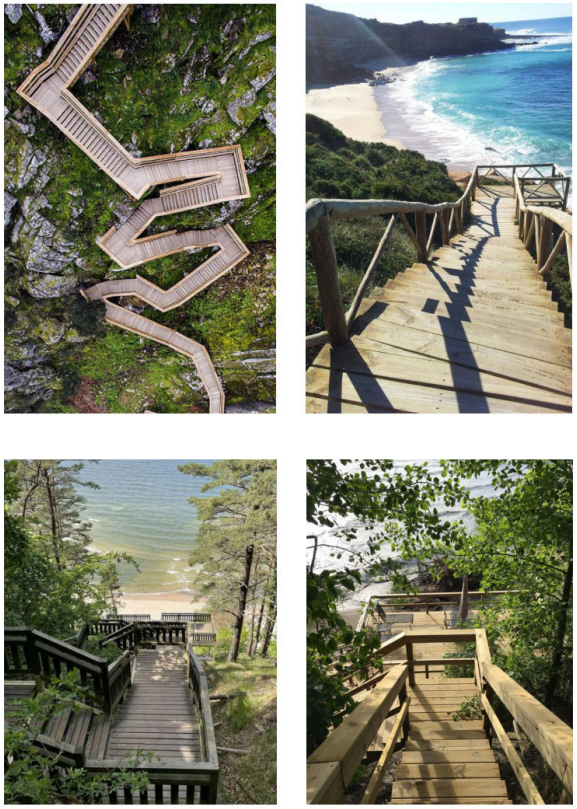
② Landing with a viewing platform

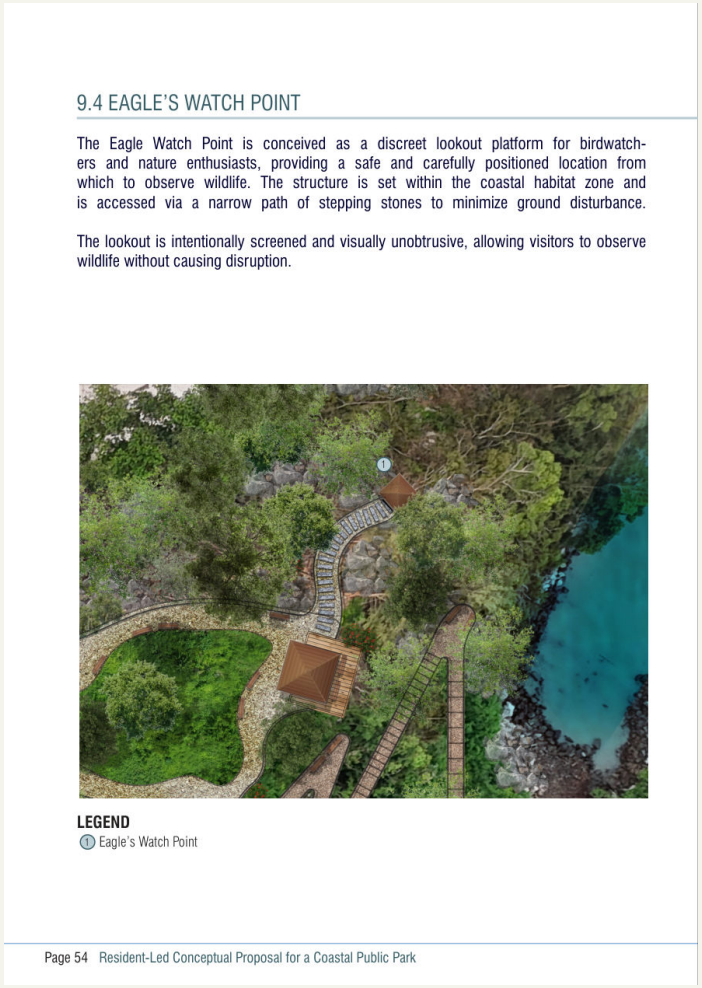
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TERJEMAHAN BAHASA MELAYU

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Cadangan Konseptual Diterajui Penduduk untuk Sebuah Taman Awam Pesisir

9.4 TITIK TINJAU HELANG (EAGLE'S WATCH POINT)

Titik Tinjau Helang dibayangkan sebagai pelantar tinjau yang tidak menonjol bagi pemerhati burung dan pencinta alam, menyediakan lokasi yang selamat serta ditempatkan dengan teliti untuk memerhati hidupan liar. Struktur ini terletak dalam zon habitat pesisir dan diakses melalui laluan batu pijak yang sempit untuk meminimumkan gangguan tanah.

Tempat tinjau ini sengaja dilindungi dengan pengadang dan tidak menonjol secara visual, membolehkan pengunjung memerhati hidupan liar tanpa menyebabkan gangguan.

Titik Tinjau Helang

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PETUNJUK

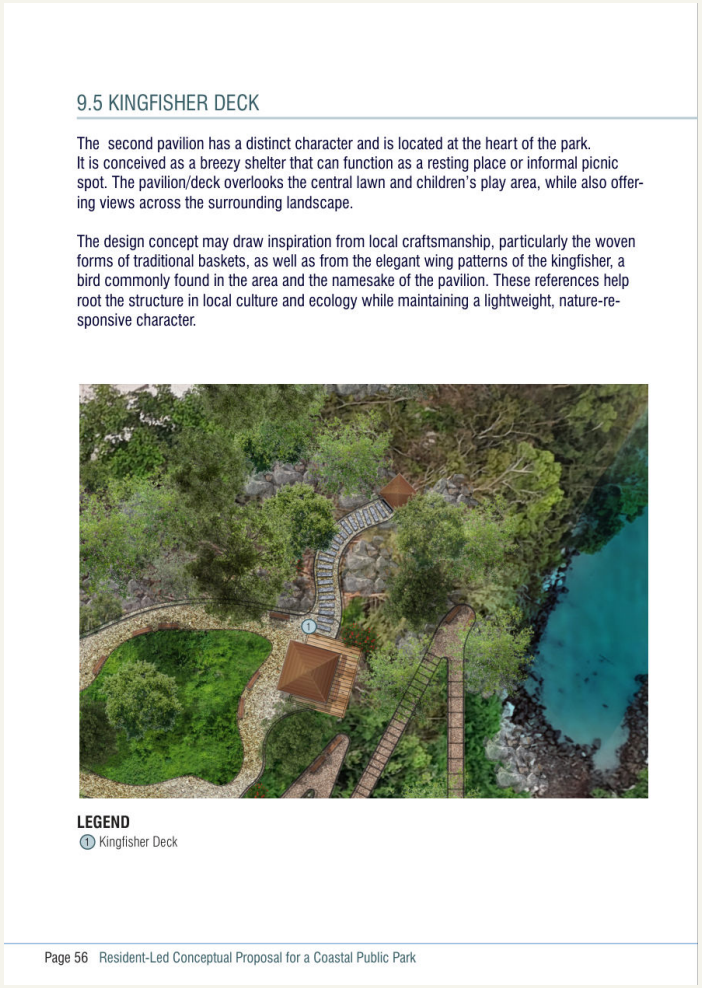


TERJEMAHAN BAHASA MELAYU

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Reka bentuk ini mengambil inspirasi daripada warisan budaya tapak, merujuk kepada bentuk dan kemahiran pertukangan bakul anyaman tradisional nelayan. Pendekatan ini mewujudkan bahasa seni bina yang halus dan sebati dengan landskap, sambil menghormati sejarah setempat serta meraikan kemahiran pertukangan tradisional.

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9.5 KINGFISHER DECK

The second pavilion has a distinct character and is located at the heart of the park. It is conceived as a breezy shelter that can function as a resting place or informal picnic spot. The pavilion/deck overlooks the central lawn and children's play area, while also offering views across the surrounding landscape.

The design concept may draw inspiration from local craftsmanship, particularly the woven forms of traditional baskets, as well as from the elegant wing patterns of the kingfisher, a bird commonly found in the area and the namesake of the pavilion. These references help root the structure in local culture and ecology while maintaining a lightweight, nature-responsive character.

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Cadangan Konseptual Diterajui Penduduk untuk Sebuah Taman Awam Pesisir

9.5 DEK RAJA UDANG (KINGFISHER DECK)

Pavilion kedua mempunyai ciri tersendiri dan terletak di tengah-tengah taman.

Ia dibayangkan sebagai tempat berteduh yang nyaman ditiup angin, yang boleh berfungsi sebagai tempat berehat atau berkelah secara santai. Pavilion/dek ini menghadap kawasan rumput tengah dan kawasan permainan kanak-kanak, sambil turut menawarkan pemandangan landskap sekeliling.

Konsep reka bentuk boleh mengambil inspirasi daripada pertukangan tempatan, khususnya bentuk anyaman bakul tradisional, serta corak sayap anggun burung raja udang, iaitu burung yang lazim ditemui di kawasan ini dan menjadi asal nama pavilion tersebut. Rujukan ini membantu mengakar struktur dalam budaya serta ekologi setempat sambil mengekalkan ciri yang ringan dan responsif terhadap alam semula jadi.

Dek Raja Udang

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PETUNJUK



Photo: Biophilic design uses natural materials and forms inspired by nature, blending gently into the park.



Photo: Liang Hin Rattan Shop (102 years old), run by third-generation craftsman Mr. Chow. Traditional rattan craftsmanship offers opportunities to integrate local heritage and skills into the park.

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Foto: Kedai Rotan Liang Hin (berusia 102 tahun), dikendalikan oleh tukang generasi ketiga, Encik Chow. Pertukangan rotan tradisional menawarkan peluang untuk menyepadukan warisan dan kemahiran tempatan ke dalam taman.

Foto: Reka bentuk biofilik menggunakan bahan semula jadi dan bentuk yang diilhamkan oleh alam, lalu sebati dengan lembut ke dalam taman.



9.6 NATURE CHALLENGE COURSE

The children's playground and obstacle course are conceived as a **nature-based play** environment, integrated into the existing topography and shaped by it.
Using natural materials such as timber, driftwood, stones, and earth, the design avoids over-elaboration and instead leaves space for **imagination, exploration, and self-directed play**.
This approach reflects a well-established **international trend in playground design**, where natural play landscapes are valued for supporting physical development, creativity, risk awareness, and connection to nature.
By working with slopes, level changes, and existing landforms, the playground becomes an organic part of the park rather than an imposed structure.

LEGEND
① Nature Challenge Course

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Cadangan Konseptual Diterajui Penduduk untuk Sebuah Taman Awam Pesisir

9.6 LALUAN CABARAN ALAM (NATURE CHALLENGE COURSE)

Taman permainan kanak-kanak dan laluan berhalangan dibayangkan sebagai persekitaran permainan berasaskan alam semula jadi, disepadukan dalam topografi sedia ada dan dibentuk olehnya.

Dengan menggunakan bahan semula jadi seperti kayu, kayu hanyut, batu dan tanah, reka bentuk ini mengelakkan perincian berlebihan dan sebaliknya memberi ruang kepada imaginasi, penerokaan serta permainan yang diarahkan sendiri oleh kanak-kanak.

Pendekatan ini mencerminkan aliran antarabangsa yang sudah mantap dalam reka bentuk taman permainan, di mana landskap permainan semula jadi dihargai kerana menyokong perkembangan fizikal, kreativiti, kesedaran risiko dan hubungan dengan alam.

Dengan memanfaatkan cerun, perubahan aras dan bentuk muka bumi sedia ada, taman permainan menjadi sebahagian taman secara organik, bukannya struktur yang dipaksakan ke atasnya.

Laluan Cabaran Alam

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PETUNJUK



Photo: Nature-based playgrounds are increasingly popular in Asia, using natural materials and forms that blend with the landscape and encourage imaginative, exploratory play.



Photo: Forest Ramble — Jurong Lake Gardens, Singapore
A large, nature-inspired play garden with log trails, climbing stations, water play and naturalistic features that let children explore like animals in the landscape.



Photo: Coastal PlayGrove Nature Playgarden — East Coast Park, Singapore. A nature play area within a coastal park that includes natural elements like sand, logs, and bamboo for imaginative, landscape-based play.

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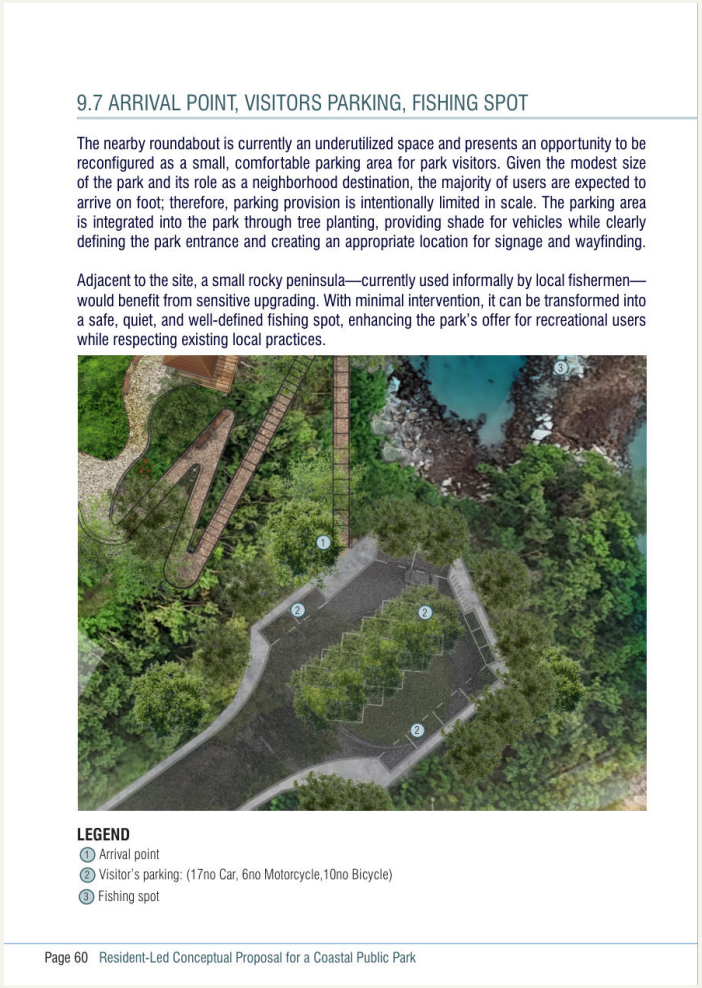
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Foto: Taman permainan berasaskan alam semula jadi semakin popular di Asia, menggunakan bahan dan bentuk semula jadi yang sebati dengan landskap serta menggalakkan permainan berimaginasi dan penerokaan.

Foto: Forest Ramble — Jurong Lake Gardens, Singapura.

Taman permainan besar berilhamkan alam dengan laluan kayu balak, stesen memanjat, permainan air dan ciri bercorak semula jadi yang membolehkan kanak-kanak meneroka landskap seperti haiwan.

Foto: Coastal PlayGrove Nature Playgarden — East Coast Park, Singapura. Kawasan permainan alam dalam taman pesisir yang merangkumi unsur semula jadi seperti pasir, kayu balak dan buluh untuk permainan berimaginasi yang berasaskan landskap.



TERJEMAHAN BAHASA MELAYU

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Cadangan Konseptual Diterajui Penduduk untuk Sebuah Taman Awam Pesisir

9.7 RUANG KETIBAAN, TEMPAT LETAK KENDERAAN PENGUNJUNG, TEMPAT MEMANCING

Bulatan berhampiran pada masa ini merupakan ruang yang kurang dimanfaatkan dan menawarkan peluang untuk disusun semula sebagai kawasan letak kenderaan yang kecil dan selesa bagi pengunjung taman. Memandangkan saiz taman yang sederhana dan peranannya sebagai destinasi kejiranan, majoriti pengguna dijangka datang dengan berjalan kaki; oleh itu, penyediaan tempat letak kenderaan sengaja dihadkan skalanya. Kawasan letak kenderaan disepadukan dengan taman melalui penanaman pokok, memberikan teduhan untuk kenderaan sambil memperjelas pintu masuk taman dan mewujudkan lokasi yang sesuai bagi papan tanda serta pandu arah.

Bersebelahan tapak, sebuah semenanjung berbatu kecil — yang kini digunakan secara tidak formal oleh nelayan tempatan — akan mendapat manfaat daripada naik taraf yang peka terhadap persekitaran. Dengan campur tangan minimum, ia boleh diubah menjadi tempat memancing yang selamat, tenang dan jelas batasnya, memperkaya kemudahan taman bagi pengguna rekreasi sambil menghormati amalan setempat sedia ada.

Ruang ketibaan

Tempat letak kenderaan pengunjung: (17 kereta, 6 motosikal, 10 basikal)

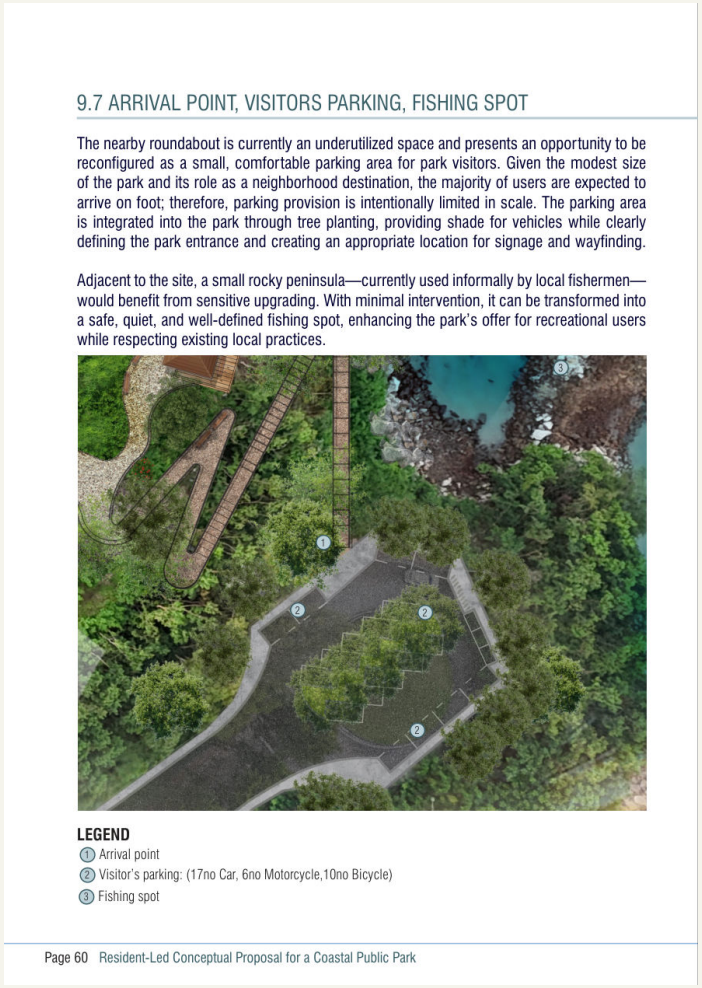
Tempat memancing

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9.7 ARRIVAL POINT, VISITORS PARKING, FISHING SPOT

The nearby roundabout is currently an underutilized space and presents an opportunity to be reconfigured as a small, comfortable parking area for park visitors. Given the modest size of the park and its role as a neighborhood destination, the majority of users are expected to arrive on foot; therefore, parking provision is intentionally limited in scale. The parking area is integrated into the park through tree planting, providing shade for vehicles while clearly defining the park entrance and creating an appropriate location for signage and wayfinding.

Adjacent to the site, a small rocky peninsula—currently used informally by local fishermen—would benefit from sensitive upgrading. With minimal intervention, it can be transformed into a safe, quiet, and well-defined fishing spot, enhancing the park's offer for recreational users while respecting existing local practices.

LEGEND

1. Arrival point
2. Visitor's parking: (17no Car, 6no Motorcycle,10no Bicycle)
3. Fishing spot

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PETUNJUK



Photo: Example of contemporary way-finding signage that informs visitors while fostering a sense of belonging. Site-specific design draws on local heritage and landscape character to reflect the identity of the location.

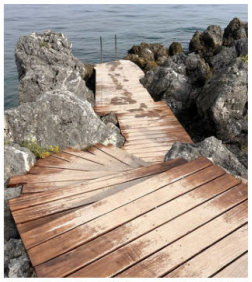


Photo: Beauty in simplicity: a modest and elegant fishing spot, carefully designed to respect its set-ting and spatial footprint.

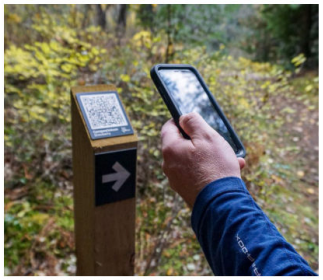


Photo: Digital technologies allow minimal signage to carry layered information. QR codes support wayfinding and offer deeper insights into the park's nature, ecology, and features.



Photo: Currently underutilized space around the existing roundabout that could be easily converted into visitor parking.

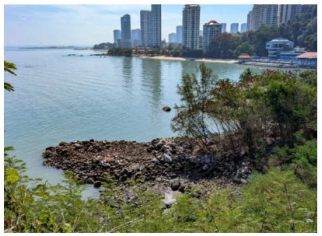


Photo: Existing rocky peninsula used by locals as an informal fishing spot

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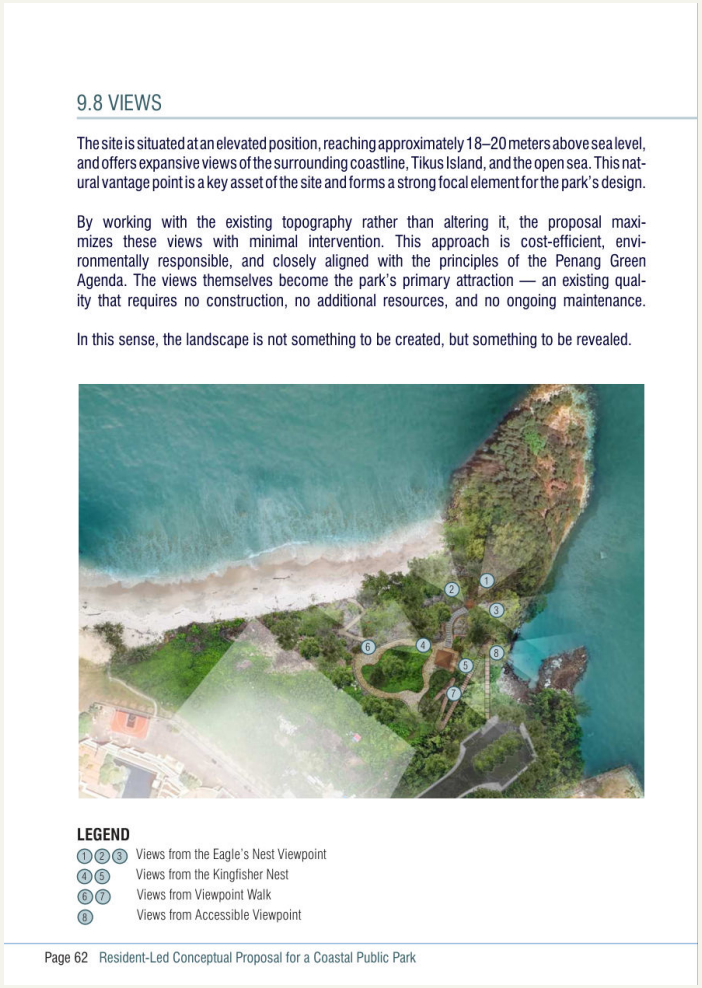
Foto: Contoh papan tanda pandu arah kontemporari yang memberikan maklumat kepada pengunjung sambil memupuk rasa keterikatan. Reka bentuk khusus tapak mengambil inspirasi daripada warisan tempatan dan ciri landskap untuk mencerminkan identiti lokasi.

Foto: Teknologi digital membolehkan papan tanda yang minimum memuatkan maklumat berlapis. Kod QR menyokong pandu arah dan menawarkan pemahaman lebih mendalam tentang alam semula jadi, ekologi serta ciri taman.

Foto: Keindahan dalam kesederhanaan: tempat memancing yang sederhana dan anggun, direka dengan teliti untuk menghormati persekitaran serta jejak ruangnya.

Foto: Ruang di sekitar bulatan sedia ada yang kini kurang dimanfaatkan dan boleh ditukar dengan mudah kepada tempat letak kenderaan pengunjung.

Foto: Semenanjung berbatu sedia ada yang digunakan penduduk setempat sebagai tempat memancing tidak formal.



9.8 VIEWS

The site is situated at an elevated position, reaching approximately 18–20 meters above sea level, and offers expansive views of the surrounding coastline, Tikus Island, and the open sea. This natural vantage point is a key asset of the site and forms a strong focal element for the park's design.

By working with the existing topography rather than altering it, the proposal maximizes these views with minimal intervention. This approach is cost-efficient, environmentally responsible, and closely aligned with the principles of the Penang Green Agenda. The views themselves become the park's primary attraction — an existing quality that requires no construction, no additional resources, and no ongoing maintenance.

In this sense, the landscape is not something to be created, but something to be revealed.

LEGEND

① ② ③ Views from the Eagle's Nest Viewpoint
④ ⑤ Views from the Kingfisher Nest
⑥ ⑦ Views from Viewpoint Walk
⑧ Views from Accessible Viewpoint

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Halaman 62

Cadangan Konseptual Diterajui Penduduk untuk Sebuah Taman Awam Pesisir

9.8 PEMANDANGAN

Tapak ini terletak pada kedudukan tinggi, mencapai kira-kira 18–20 meter di atas aras laut, dan menawarkan pemandangan luas ke arah garis pantai sekeliling, Pulau Tikus serta laut terbuka. Titik pandang semula jadi ini ialah aset utama tapak dan menjadi elemen tumpuan yang kukuh bagi reka bentuk taman.

Dengan memanfaatkan topografi sedia ada dan bukannya mengubahnya, cadangan ini memaksimumkan pemandangan tersebut melalui campur tangan minimum. Pendekatan ini menjimatkan kos, bertanggungjawab terhadap alam sekitar dan sangat selaras dengan prinsip Penang Green Agenda. Pemandangan itu sendiri menjadi tarikan utama taman — suatu kualiti sedia ada yang tidak memerlukan pembinaan, sumber tambahan atau penyelenggaraan berterusan.

Dalam pengertian ini, landskap bukan sesuatu yang perlu dicipta, tetapi sesuatu yang perlu diserlahkan.

Pemandangan dari Titik Tinjau Sarang Helang (Eagle's Nest Viewpoint)

Pemandangan dari Sarang Raja Udang (Kingfisher Nest)

Pemandangan dari Laluan Titik Tinjau (Viewpoint Walk)

Pemandangan dari Titik Tinjau Boleh Akses (Accessible Viewpoint)

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LEGEND

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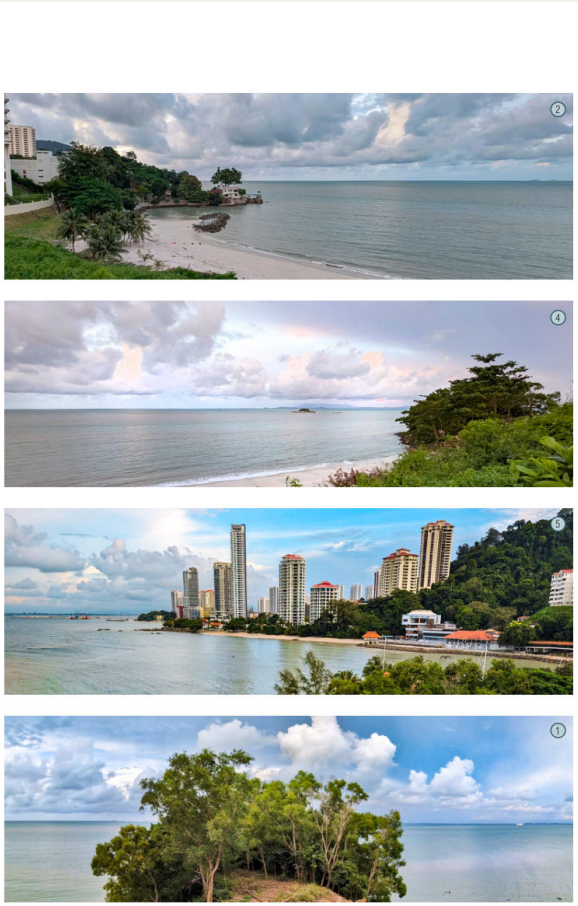
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10. Conceptual Planting Design

10.1 PLANTING PALETTE

The planting design adopts a zoned, **slope-responsive approach** using **native coastal and climate-resilient species** selected for their proven performance in saline, wind-exposed, and free-draining conditions.

Planting is structured across the top, middle, and bottom of the embankment to support slope stabilization and coastal protection functions. **Deep-rooted tree and shrub species contribute to soil reinforcement and surface stabilization** by binding loose substrates and reducing erosion risk, while mid-storey and groundcover species limit surface runoff and improve soil cohesion. At the foreshore, **salt-tolerant dune and pioneer species** provide natural buffering against wind, wave action, and sand movement, supporting beach stability.

Existing vegetation that has naturally regenerated following previous clearing is retained and incorporated into the planting framework wherever feasible. Supplementary planting is introduced selectively to strengthen ecological continuity, address gaps in slope coverage, and enhance long-term resilience. This incremental, site-responsive approach minimizes disturbance, reduces establishment costs, and results in a robust, low-maintenance landscape system appropriate for long-term management and future climatic conditions.

Photo: Five months after clearance, vegetation is regenerating strongly, with fresh greenery and pioneer species naturally re-stabilising the slope cover

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Cadangan Konseptual Diterajui Penduduk untuk Sebuah Taman Awam Pesisir

10. Reka Bentuk Penanaman Konseptual

Reka bentuk penanaman menggunakan pendekatan berzon yang responsif terhadap cerun, dengan spesies pesisir asli dan berdaya tahan terhadap iklim yang dipilih berdasarkan prestasi terbukti dalam keadaan masin, terdedah kepada angin dan bersaliran baik.

Penanaman disusun merentasi bahagian atas, tengah dan bawah tambakan untuk menyokong fungsi penstabilan cerun serta perlindungan pesisir. Spesies pokok dan renek berakar dalam menyumbang kepada pengukuhan tanah dan penstabilan permukaan dengan mengikat substrat longgar serta mengurangkan risiko hakisan, manakala spesies lapisan tengah dan penutup bumi mengehadkan larian air permukaan serta meningkatkan kohesi tanah. Di gigir pantai, spesies gumuk pasir dan perintis yang tahan garam memberikan penampan semula jadi terhadap angin, tindakan ombak serta pergerakan pasir, menyokong kestabilan pantai.

Tumbuh-tumbuhan sedia ada yang tumbuh semula secara semula jadi selepas pembersihan terdahulu dikekalkan dan dimasukkan ke dalam rangka penanaman di mana boleh dilaksanakan. Penanaman tambahan diperkenalkan secara terpilih untuk mengukuhkan kesinambungan ekologi, menangani jurang litupan cerun dan meningkatkan daya tahan jangka panjang. Pendekatan beransur-ansur yang responsif terhadap tapak ini meminimumkan gangguan, mengurangkan kos pembentukan awal tanaman dan menghasilkan sistem landskap yang kukuh serta rendah penyelenggaraan, sesuai untuk pengurusan jangka panjang dan keadaan iklim pada masa hadapan.

Foto: Lima bulan selepas pembersihan, tumbuh-tumbuhan tumbuh semula dengan pesat, dengan kehijauan baharu dan spesies perintis menstabilkan semula litupan cerun secara semula jadi.

10.1 PALET TANAMAN



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TUMBUH-TUMBUHAN PESISIR ASLI

Bahagian Atas Tambakan

- Terminalia catappa (Ketapang / Sea Almond)
- Calophyllum inophyllum (Penaga Laut)
- Diospyros maritima (Eboni Laut / Sea Ebony)
- Casuarina equisetifolia (Rhu Laut)
- Saribus rotundifolius

Bahagian Tengah Tambakan

- Vatica harmandiana (Resak Laut)
- Hibiscus tiliaceus (Bebaru / Sea Hibiscus / Waru Laut)
- Thespesia populnea (Pokok Portia / Portia Tree)
- Millettia pinnata (Mempari / Pongam)
- Morinda citrifolia

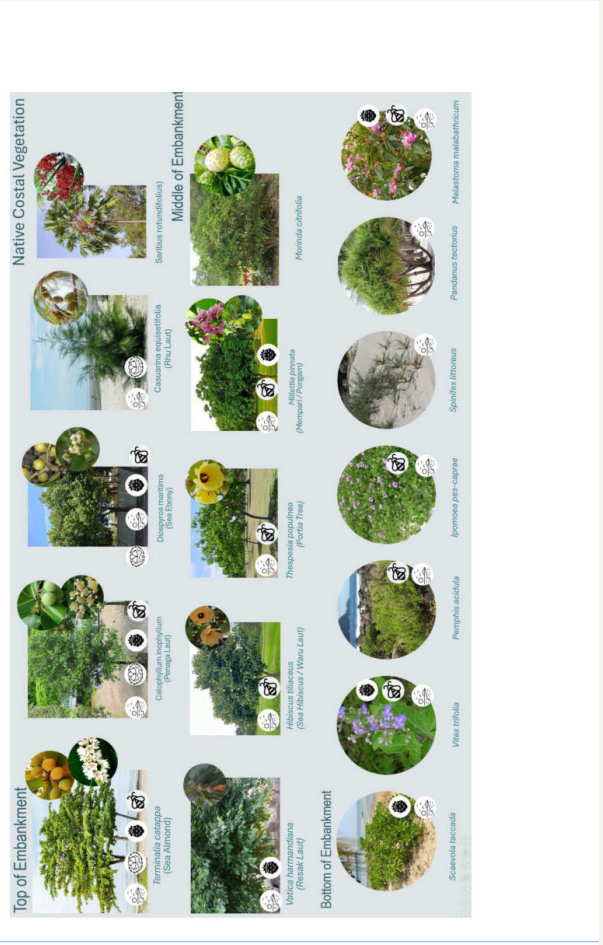
Bahagian Bawah Tambakan

- Scaevola taccada
- Vitex trifolia
- Pemphis acidula
- Ipomoea pes-caprae
- Spinifex littoreus
- Pandanus tectorius

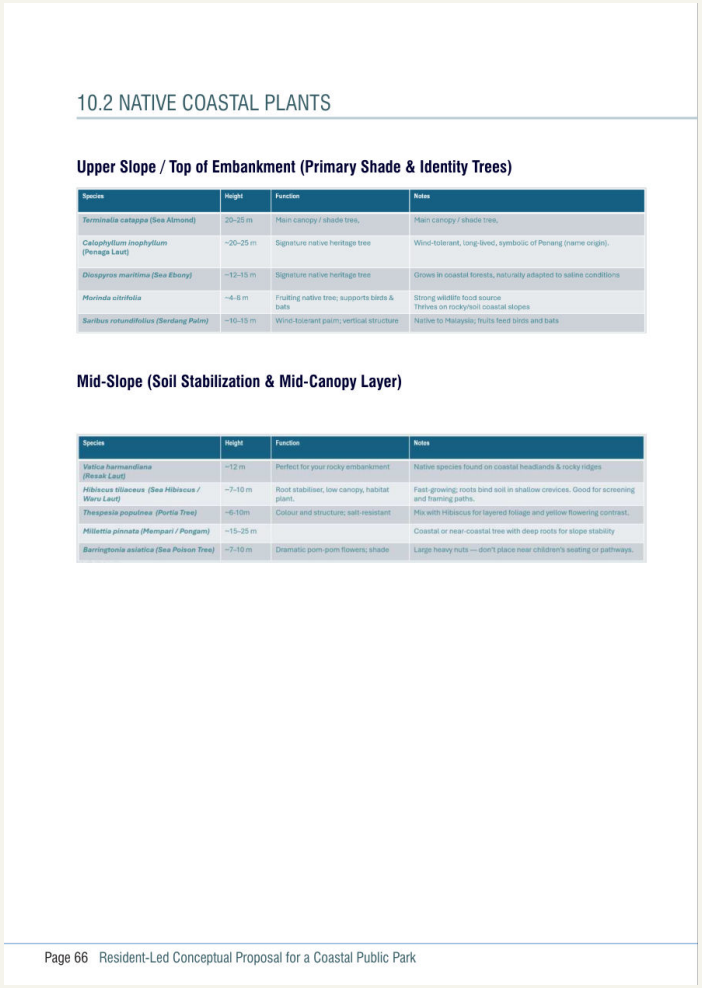
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• Melastoma malabathricum



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10.2 NATIVE COASTAL PLANTS

Upper Slope / Top of Embankment (Primary Shade & Identity Trees)

Species	Height	Function	Notes
Terminalia catappa (Sea Almond)	20–25 m	Main canopy / shade tree,	Main canopy / shade tree,
Calophyllum inophyllum (Penaga Laut)	~20–25 m	Signature native heritage tree	Wind-tolerant, long-lived, symbolic of Penang (name origin).
Diospyros maritima (Sea Ebony)	~12–15 m	Signature native heritage tree	Grows in coastal forests, naturally adapted to saline conditions
Morinda citrifolia	~4–8 m	Fruiting native tree; supports birds & bats	Strong wildlife food source Thrives on rocky/soil coastal slopes
Saribus rotundifolius (Serdang Palm)	~10–15 m	Wind-tolerant palm; vertical structure	Native to Malaysia; fruits feed birds and bats

Mid-Slope (Soil Stabilization & Mid-Canopy Layer)

Species	Height	Function	Notes
Vatica harmandiana (Resak Laut)	~12 m	Perfect for your rocky embankment	Native species found on coastal headlands & rocky ridges
Hibiscus tiliaceus (Sea Hibiscus / Waru Laut)	~7–10 m	Root stabiliser, low canopy, habitat plant.	Fast-growing; roots bind soil in shallow crevices. Good for screening and framing paths.
Thespesia populnea (Portia Tree)	~6-10m	Colour and structure; salt-resistant	Mix with Hibiscus for layered foliage and yellow flowering contrast.
Millettia pinnata (Mempari / Pongam)	~15–25 m		Coastal or near-coastal tree with deep roots for slope stability
Barringtonia asiatica (Sea Poison Tree)	~7–10 m	Dramatic pom-pom flowers; shade	Large heavy nuts — don't place near children's seating or pathways.

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Cadangan Konseptual Diterajui Penduduk untuk Sebuah Taman Awam Pesisir

10.2 TUMBUHAN PESISIR ASLI

Cerun Atas / Bahagian Atas Tambakan (Pokok Teduhan Utama & Pembentuk Identiti)

Spesies | Ketinggian | Fungsi | Catatan

Terminalia catappa (Ketapang / Sea Almond) | 20–25 m | Pokok kanopi / teduhan utama | Pokok kanopi / teduhan utama.

Calophyllum inophyllum (Penaga Laut) | ~20–25 m | Pokok warisan asli yang menjadi identiti | Tahan angin, berumur panjang, simbolik kepada Pulau Pinang (asal nama).

Diospyros maritima (Eboni Laut / Sea Ebony) | ~12–15 m | Pokok warisan asli yang menjadi identiti | Tumbuh di hutan pesisir, secara semula jadi disesuaikan dengan keadaan masin.

Morinda citrifolia | ~4–8 m | Pokok asli berbuah; menyokong burung dan kelawar | Sumber makanan yang penting untuk hidupan liar. Tumbuh subur pada cerun pesisir berbatu/bertanah.

Saribus rotundifolius (Palma Serdang / Serdang Palm) | ~10–15 m | Palma tahan angin; struktur menegak | Asli Malaysia; buah menjadi makanan burung dan kelawar.

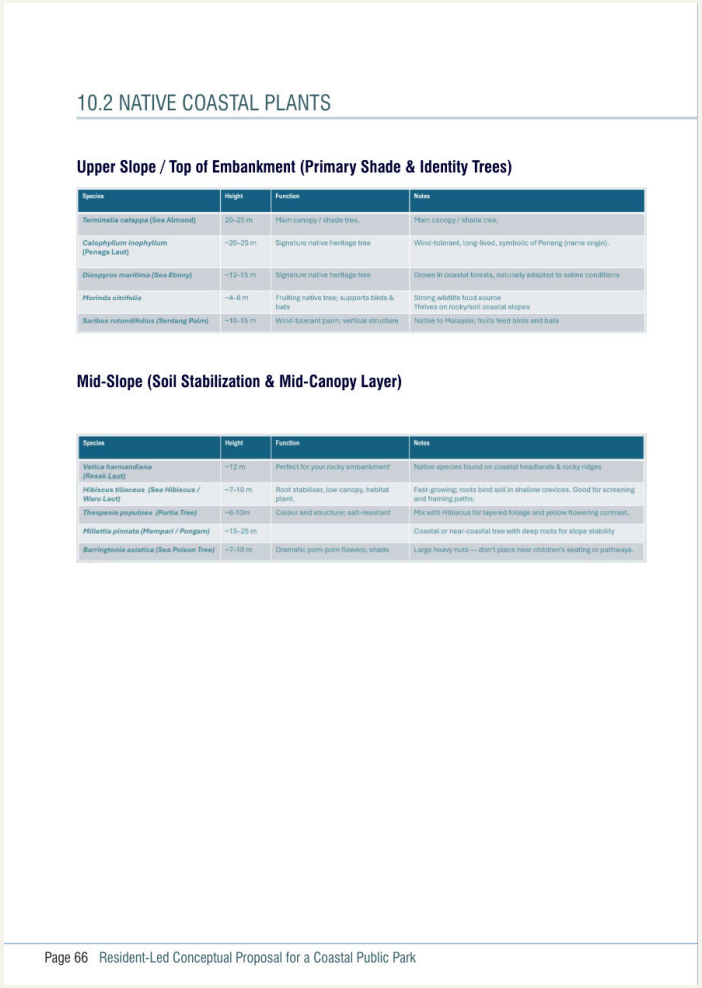
Cerun Tengah (Penstabilan Tanah & Lapisan Kanopi Tengah)

Spesies | Ketinggian | Fungsi | Catatan

Vatica harmandiana (Resak Laut) | ~12 m | Sangat sesuai untuk tambakan berbatu anda | Spesies asli yang ditemui di tanjung pesisir dan rabung berbatu.

Hibiscus tiliaceus (Bebaru / Sea Hibiscus / Waru Laut) | ~7–10 m | Penstabil melalui akar, kanopi rendah, tumbuhan habitat | Cepat tumbuh; akar mengikat tanah dalam rekahan cetek. Baik sebagai pengadang dan pembingkai laluan.

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Thespesia populnea (Pokok Portia / Portia Tree) | ~6–10 m | Warna dan struktur; tahan garam | Campurkan dengan Hibiscus untuk lapisan dedaunan dan kontras bunga kuning.

Millettia pinnata (Mempari / Pongam) | ~15–25 m | | Pokok pesisir atau berhampiran pesisir dengan akar dalam untuk kestabilan cerun.

Barringtonia asiatica (Pokok Racun Laut / Sea Poison Tree) | ~7–10 m | Bunga pom-pom yang menonjol; teduhan | Buah kekeras yang besar dan berat — jangan tempatkan berhampiran tempat duduk kanak-kanak atau laluan.

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Toe of Embankment / Windbreak Line (Salt-Spray Tolerant & Structural)

Species	Height	Function	Notes
Casuarina equisetifolia (Rhu Laut)	~6-12m	Windbreak, erosion control	Plant at 2–3 m offset from beach edge to avoid root exposure. Provides roosting habitat for birds
Ipomoea pes-caprae	Creeper	Anti-erosion, soil binding	
Spinifex littoreus	2–4 m	Excellent slope stabiliser White flowers → pollinators Fleshy fruits → birds	Hedges
Vitex trifolia (Simple-leafed Vitex)	1–3 m	Purple flowers loved by bees Fruits eaten by birds	Survives sandy/rocky soils and wind exposure
Pemphis acidula (Pemphis / Cangkok Laut)	1–2 m	Extremely wind- and salt-tolerant Forms beautiful sculptural shapes	Iconic littoral shrub of Penang's natural coast
Melastoma malabathricum	1–2 m	Purple flowers feed bees and butterflies Fruits eaten by birds	Widespread Malaysian native Thrives in disturbed soils — good for early succession
Guettarda speciosa	3–8 m	Shade, fruiting, supports moths & birds	One of the most characteristic native coastal shrubs in Penang Fragrant white flowers (night) • fruit eaten by birds Perfect for viewpoints and mid-slope



Photo: Existing vegetation at the Sore Thumb, forming a foundation that can be strengthened by carefully chosen supplementary planting to support local wildlife and site conditions.

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Kaki Tambakan / Barisan Pengadang Angin (Tahan Semburan Garam & Pembentuk Struktur)

Spesies | Ketinggian | Fungsi | Catatan

Casuarina equisetifolia (Rhu Laut) | ~6–12 m | Pengadang angin, kawalan hakisan | Tanam pada jarak 2–3 m dari pinggir pantai untuk mengelakkan akar terdedah. Menyediakan habitat bertenggek bagi burung.

Ipomoea pes-caprae | Tumbuhan menjalar | Mencegah hakisan, mengikat tanah |

Spinifex littoreus | 2–4 m | Penstabil cerun yang sangat baik. Bunga putih → pendebunga. Buah berdaging → burung. | Pagar hidup.

Vitex trifolia (Vitex Berdaun Ringkas / Simple-leafed Vitex) | 1–3 m | Bunga ungu digemari lebah. Buah dimakan burung. | Boleh hidup di tanah berpasir/berbatu dan terdedah kepada angin.

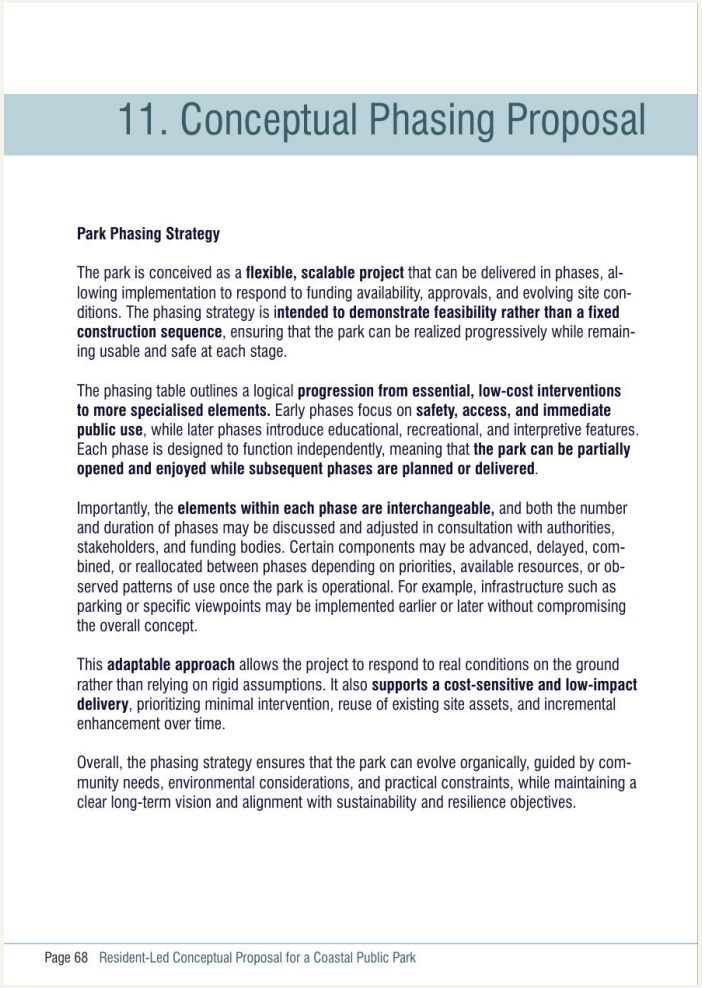
Pemphis acidula (Pemphis / Cangkok Laut) | 1–2 m | Sangat tahan angin dan garam. Membentuk rupa seperti arca yang indah. | Pokok renek litoral ikonik bagi pesisir semula jadi Pulau Pinang.

Melastoma malabathricum | 1–2 m | Bunga ungu menjadi makanan lebah dan rama-rama. Buah dimakan burung. | Tumbuhan asli Malaysia yang tersebar luas. Tumbuh subur di tanah terganggu — baik untuk peringkat awal sesaran ekologi.

Guettarda speciosa | 3–8 m | Teduhan, berbuah, menyokong rama-rama malam dan burung | Antara pokok renek pesisir asli yang paling mencirikan Pulau Pinang. Bunga putih harum (malam) serta buah dimakan burung. Sangat sesuai untuk titik tinjau dan cerun tengah.

Foto: Tumbuh-tumbuhan sedia ada di Sore Thumb, membentuk asas yang boleh diperkukuh melalui penanaman tambahan yang dipilih dengan teliti bagi menyokong hidupan liar tempatan dan keadaan tapak.

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11. Conceptual Phasing Proposal

Park Phasing Strategy

The park is conceived as a **flexible, scalable project** that can be delivered in phases, allowing implementation to respond to funding availability, approvals, and evolving site conditions. The phasing strategy is **intended to demonstrate feasibility rather than a fixed construction sequence**, ensuring that the park can be realized progressively while remaining usable and safe at each stage.

The phasing table outlines a logical **progression from essential, low-cost interventions to more specialised elements.** Early phases focus on **safety, access, and immediate public use**, while later phases introduce educational, recreational, and interpretive features. Each phase is designed to function independently, meaning that **the park can be partially opened and enjoyed while subsequent phases are planned or delivered**.

Importantly, the **elements within each phase are interchangeable,** and both the number and duration of phases may be discussed and adjusted in consultation with authorities, stakeholders, and funding bodies. Certain components may be advanced, delayed, combined, or reallocated between phases depending on priorities, available resources, or observed patterns of use once the park is operational. For example, infrastructure such as parking or specific viewpoints may be implemented earlier or later without compromising the overall concept.

This **adaptable approach** allows the project to respond to real conditions on the ground rather than relying on rigid assumptions. It also **supports a cost-sensitive and low-impact delivery**, prioritizing minimal intervention, reuse of existing site assets, and incremental enhancement over time.

Overall, the phasing strategy ensures that the park can evolve organically, guided by community needs, environmental considerations, and practical constraints, while maintaining a clear long-term vision and alignment with sustainability and resilience objectives.

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Cadangan Konseptual Diterajui Penduduk untuk Sebuah Taman Awam Pesisir

11. Cadangan Pelaksanaan Berfasa Secara Konseptual

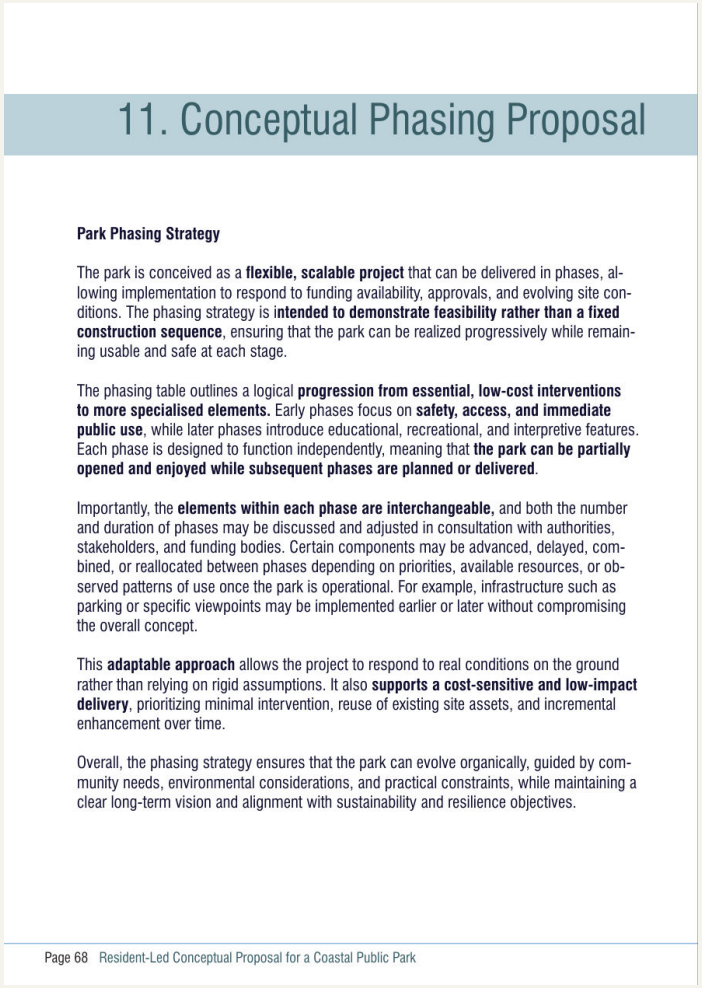
Strategi Pelaksanaan Taman Berfasa

Taman ini dibayangkan sebagai projek yang fleksibel dan boleh dikembangkan skalanya, yang dapat dilaksanakan secara berfasa, membolehkan pelaksanaan disesuaikan dengan ketersediaan dana, kelulusan dan keadaan tapak yang berubah. Strategi berfasa ini bertujuan menunjukkan kebolehlaksanaan, bukannya urutan pembinaan yang tetap, bagi memastikan taman dapat diwujudkan secara progresif sambil kekal boleh digunakan dan selamat pada setiap peringkat.

Jadual pelaksanaan berfasa menggariskan perkembangan yang logik daripada campur tangan penting yang berkos rendah kepada elemen yang lebih khusus. Fasa awal memberi tumpuan pada keselamatan, akses dan penggunaan segera oleh orang awam, manakala fasa kemudian memperkenalkan ciri pendidikan, rekreasi serta interpretasi. Setiap fasa direka untuk berfungsi secara berasingan, bermakna taman boleh dibuka sebahagiannya dan dinikmati sementara fasa seterusnya dirancang atau dilaksanakan.

Yang penting, elemen dalam setiap fasa boleh ditukar ganti, dan bilangan serta tempoh fasa boleh dibincangkan dan diselaraskan melalui rundingan dengan pihak berkuasa, pihak berkepentingan serta badan pembiayaan. Komponen tertentu boleh dipercepat, ditangguhkan, digabungkan atau diperuntukkan semula antara fasa bergantung pada keutamaan, sumber yang tersedia atau pola penggunaan yang diperhatikan setelah taman beroperasi. Sebagai contoh, infrastruktur seperti tempat letak kenderaan atau titik tinjau tertentu boleh dilaksanakan lebih awal atau lebih lewat tanpa menjejaskan konsep keseluruhan.

Pendekatan yang boleh disesuaikan ini membolehkan projek memberi respons kepada keadaan sebenar di lapangan dan bukannya bergantung pada andaian yang tegar. Ia juga menyokong pelaksanaan yang peka terhadap kos dan berimpak rendah, mengutamakan



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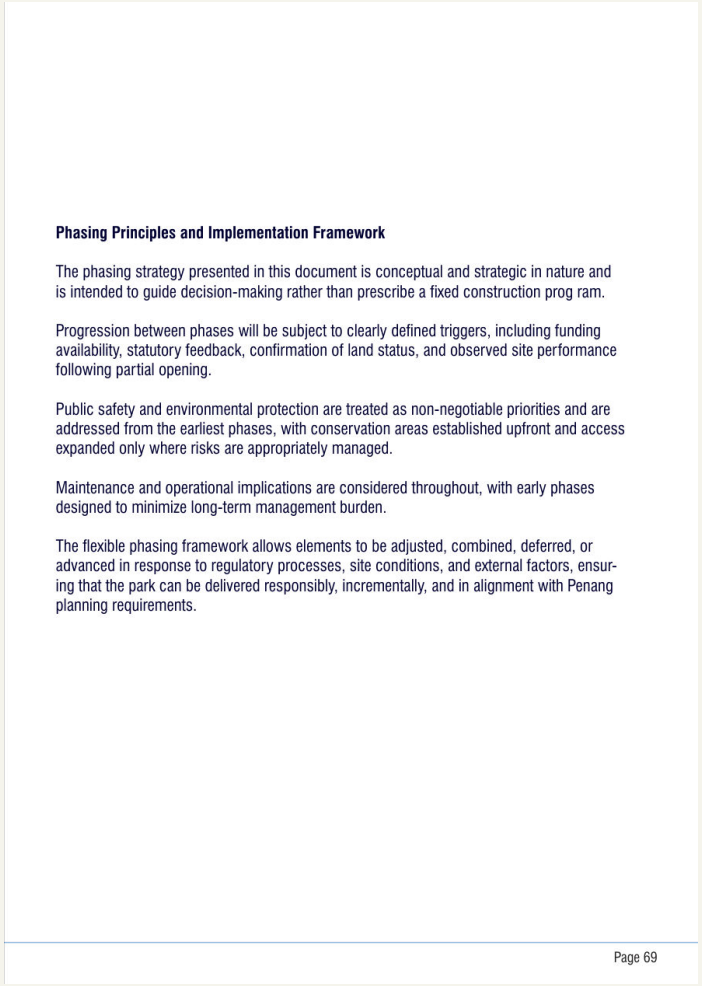
Overall, the phasing strategy ensures that the park can evolve organically, guided by community needs, environmental considerations, and practical constraints, while maintaining a clear long-term vision and alignment with sustainability and resilience objectives.

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campur tangan minimum, penggunaan semula aset tapak sedia ada serta penambahbaikan beransur-ansur dari semasa ke semasa.

Secara keseluruhan, strategi berfasa memastikan taman dapat berkembang secara organik, dipandu oleh keperluan komuniti, pertimbangan alam sekitar dan kekangan praktikal, sambil mengekalkan visi jangka panjang yang jelas serta keselarasan dengan objektif kelestarian dan daya tahan.



Phasing Principles and Implementation Framework

The phasing strategy presented in this document is conceptual and strategic in nature and is intended to guide decision-making rather than prescribe a fixed construction prog ram.

Progression between phases will be subject to clearly defined triggers, including funding availability, statutory feedback, confirmation of land status, and observed site performance following partial opening.

Public safety and environmental protection are treated as non-negotiable priorities and are addressed from the earliest phases, with conservation areas established upfront and access expanded only where risks are appropriately managed.

Maintenance and operational implications are considered throughout, with early phases designed to minimize long-term management burden.

The flexible phasing framework allows elements to be adjusted, combined, deferred, or advanced in response to regulatory processes, site conditions, and external factors, ensuring that the park can be delivered responsibly, incrementally, and in alignment with Penang planning requirements.

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Prinsip Pelaksanaan Berfasa dan Rangka Pelaksanaan

Strategi berfasa yang dikemukakan dalam dokumen ini bersifat konseptual dan strategik, serta bertujuan membimbing pembuatan keputusan dan bukannya menetapkan program pembinaan yang tetap.

Peralihan antara fasa akan tertakluk pada pencetus yang ditakrifkan dengan jelas, termasuk ketersediaan dana, maklum balas statutori, pengesahan status tanah dan prestasi tapak yang diperhatikan selepas pembukaan sebahagian taman.

Keselamatan awam dan perlindungan alam sekitar dianggap keutamaan yang tidak boleh dikompromi dan ditangani sejak fasa terawal, dengan kawasan pemuliharaan diwujudkan dari awal serta akses diperluas hanya apabila risiko diurus dengan sewajarnya.

Implikasi penyelenggaraan dan operasi dipertimbangkan sepanjang proses, dengan fasa awal direka untuk meminimumkan beban pengurusan jangka panjang.

Rangka berfasa yang fleksibel membolehkan elemen diselaraskan, digabungkan, ditangguhkan atau dipercepat sebagai respons kepada proses kawal selia, keadaan tapak dan faktor luar, memastikan taman dapat dilaksanakan secara bertanggungjawab, beransur-ansur dan selaras dengan keperluan perancangan Pulau Pinang.

Indicative Phasing Plan for Park Implementation

Phase	Focus	Key Elements
Phase 1 **Minimum Viable Park**	Safety, access & views	• Learning Steps; • Primary circulation / viewpoint path; terrain safety measures (surface stabilization, localized protection); • Modest visitor parking; • Basic park furniture; • Initial wayfinding; • Protective fencing defining wildlife conservation areas with "no-entry" signage
Phase 2 **Foreshore Access**	Coastal connection	• Foreshore steps; • Improved access to fishing spot with basic safety and seating
Phase 3 **Learning & Play**	Education & community use	• Learning Steps enriched with educational and interpretive elements; • Kingfisher Deck viewing platform with roof (form and size to be determined); • Nature-based play and learning features; biodiversity interpretation
Phase 4 **Eagle's Viewpoint**	Wildlife observation & interpretation	• Eagle's Viewpoint – a small, secluded structure designed for bird and wildlife observation; • Advanced interpretation; digital / QR-based content

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Cadangan Konseptual Diterajui Penduduk untuk Sebuah Taman Awam Pesisir

Pelan Berfasa Indikatif untuk Pelaksanaan Taman

Fasa | Tumpuan | Elemen Utama

FASA 1 — TAMAN MINIMUM YANG BOLEH DIGUNAKAN

Tumpuan: Keselamatan, akses & pemandangan

Elemen utama:

• Tangga Pembelajaran;

• Laluan pergerakan utama / laluan titik tinjau; langkah keselamatan rupa bumi (penstabilan permukaan, perlindungan setempat);

• Tempat letak kenderaan pengunjung berskala sederhana;

• Perabot taman asas;

• Pandu arah awal;

• Pagar perlindungan yang menetapkan kawasan pemuliharaan hidupan liar, dengan papan tanda “dilarang masuk”.

FASA 2 — AKSES KE GIGIR PANTAI

Tumpuan: Hubungan dengan pesisir

Elemen utama:

• Tangga ke Pantai;

• Akses yang dipertingkat ke tempat memancing dengan keselamatan asas dan tempat duduk.

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Indicative Phasing Plan for Park Implementation

Phase	Focus	Key Elements
Phase 1 **Minimum Viable Park**	Safety, access & views	• Learning Steps; • Primary circulation / viewpoint path; terrain safety measures (surface stabilization, localized protection); • Modest visitor parking; • Basic park furniture; • Initial wayfinding; • Protective fencing defining wildlife conservation areas with "no-entry" signage
Phase 2 **Foreshore Access**	Coastal connection	• Foreshore steps; • Improved access to fishing spot with basic safety and seating
Phase 3 **Learning & Play**	Education & community use	• Learning Steps enriched with educational and interpretive elements; • Kingfisher Deck viewing platform with roof (form and size to be determined); • Nature-based play and learning features; biodiversity interpretation
Phase 4 **Eagle's Viewpoint**	Wildlife observation & interpretation	• Eagle's Viewpoint – a small, secluded structure designed for bird and wildlife observation; • Advanced interpretation; digital / QR-based content

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FASA 3 — PEMBELAJARAN & PERMAINAN

Tumpuan: Pendidikan & kegunaan komuniti

Elemen utama:

• Tangga Pembelajaran diperkaya dengan elemen pendidikan dan interpretasi;

• Pelantar tinjau Dek Raja Udang dengan bumbung (bentuk dan saiz akan ditentukan);

• Ciri permainan dan pembelajaran berasaskan alam; interpretasi biodiversiti.

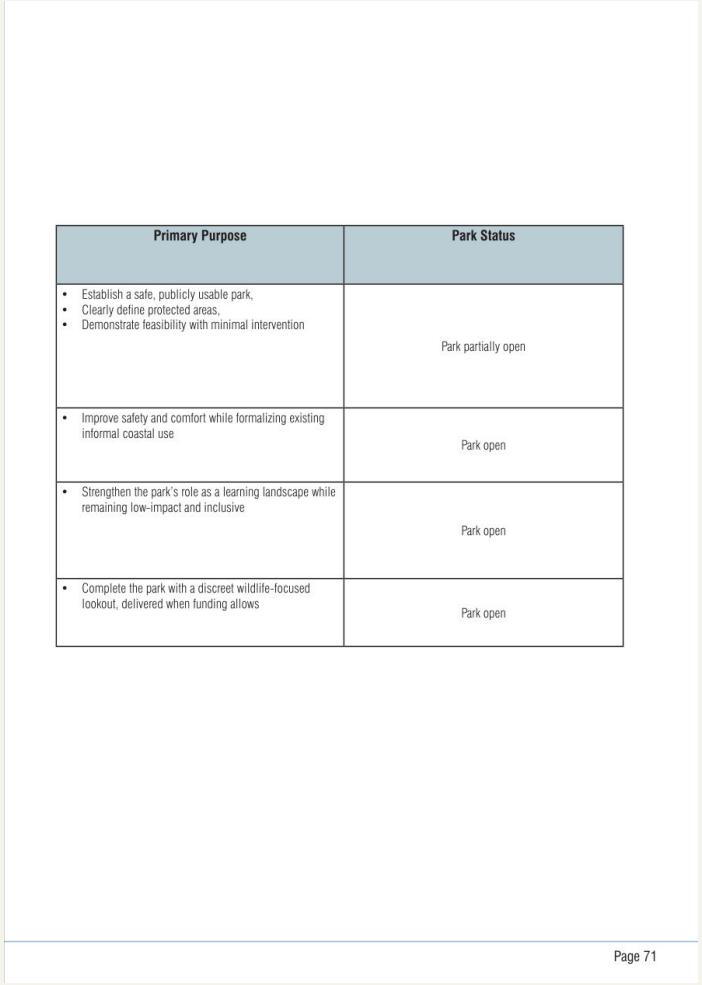
FASA 4 — TITIK TINJAU HELANG

Tumpuan: Pemerhatian hidupan liar & interpretasi

Elemen utama:

• Titik Tinjau Helang — struktur kecil dan tersorok yang direka untuk pemerhatian burung serta hidupan liar;

• Interpretasi lanjutan; kandungan digital / berasaskan QR.



Primary Purpose	Park Status
• Establish a safe, publicly usable park, • Clearly define protected areas, • Demonstrate feasibility with minimal intervention	Park partially open
• Improve safety and comfort while formalizing existing informal coastal use	Park open
• Strengthen the park's role as a learning landscape while remaining low-impact and inclusive	Park open
• Complete the park with a discreet wildlife-focused lookout, delivered when funding allows	Park open

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Tujuan Utama | Status Taman

• Mewujudkan taman yang selamat dan boleh digunakan orang awam;

• Menetapkan kawasan perlindungan dengan jelas;

• Menunjukkan kebolehlaksanaan dengan campur tangan minimum.

Status taman: Taman dibuka sebahagiannya.

• Memperbaik keselamatan dan keselesaan sambil merasmikan penggunaan pesisir tidak formal sedia ada.

Status taman: Taman dibuka.

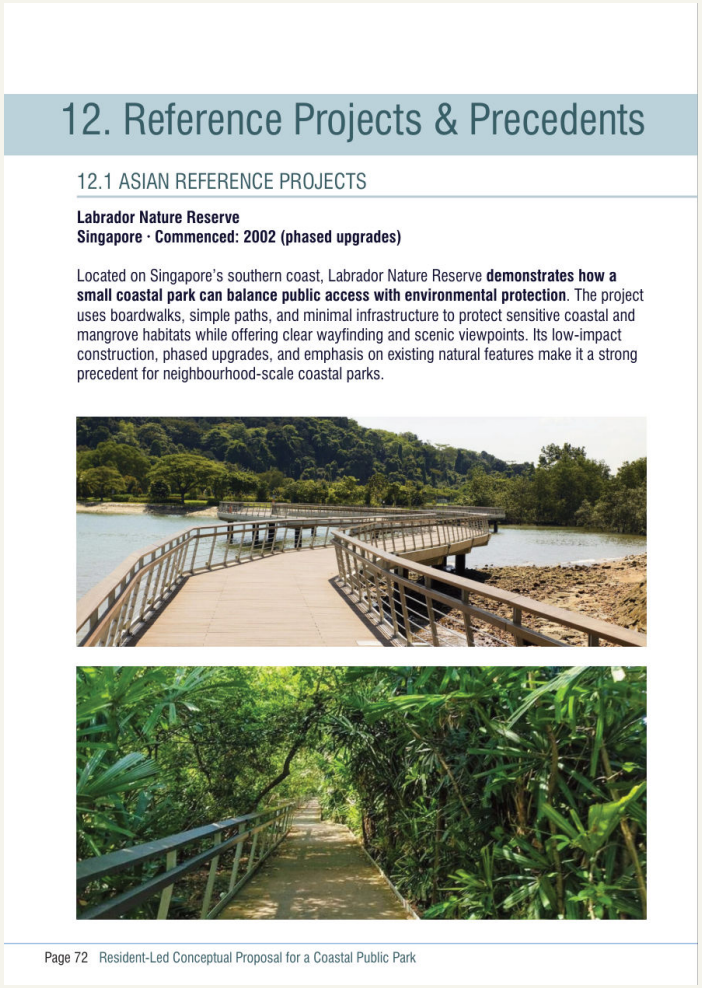
• Memperkukuh peranan taman sebagai landskap pembelajaran sambil kekal berimpak rendah dan inklusif.

Status taman: Taman dibuka.

• Melengkapkan taman dengan tempat tinjau yang tidak menonjol dan berfokus pada hidupan liar, dilaksanakan apabila dana mengizinkan.

Status taman: Taman dibuka.

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12. Reference Projects & Precedents

12.1 ASIAN REFERENCE PROJECTS

Labrador Nature Reserve
Singapore · Commenced: 2002 (phased upgrades)

Located on Singapore's southern coast, Labrador Nature Reserve **demonstrates how a small coastal park can balance public access with environmental protection**. The project uses boardwalks, simple paths, and minimal infrastructure to protect sensitive coastal and mangrove habitats while offering clear wayfinding and scenic viewpoints. Its low-impact construction, phased upgrades, and emphasis on existing natural features make it a strong precedent for neighbourhood-scale coastal parks.

Page 72 Resident-Led Conceptual Proposal for a Coastal Public Park

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Cadangan Konseptual Diterajui Penduduk untuk Sebuah Taman Awam Pesisir

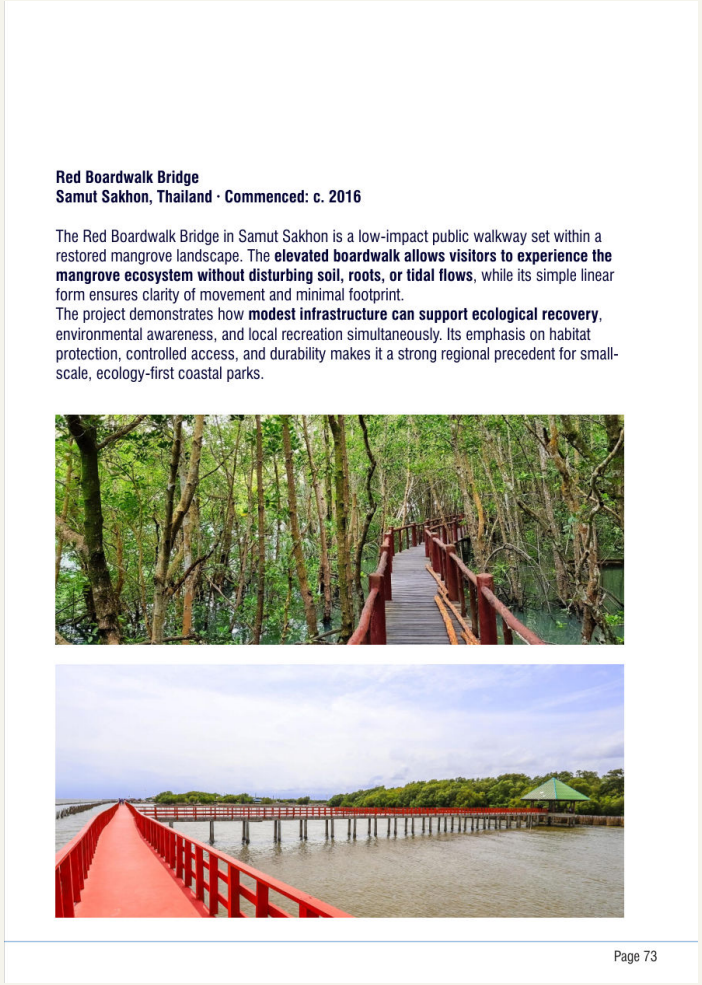
12. Projek Rujukan & Contoh Terdahulu

12.1 PROJEK RUJUKAN ASIA

Labrador Nature Reserve

Singapura · Bermula: 2002 (naik taraf berfasa)

Terletak di pantai selatan Singapura, Labrador Nature Reserve menunjukkan bagaimana sebuah taman pesisir kecil dapat mengimbangi akses awam dengan perlindungan alam sekitar. Projek ini menggunakan laluan papan, laluan ringkas dan infrastruktur minimum untuk melindungi habitat pesisir serta bakau yang sensitif sambil menawarkan pandu arah yang jelas dan titik tinjau dengan pemandangan indah. Pembinaan berimpak rendah, naik taraf berfasa dan penekanannya terhadap ciri semula jadi sedia ada menjadikannya contoh terdahulu yang kukuh bagi taman pesisir berskala kejiranan.



Red Boardwalk Bridge
Samut Sakhon, Thailand · Commenced: c. 2016

The Red Boardwalk Bridge in Samut Sakhon is a low-impact public walkway set within a restored mangrove landscape. The **elevated boardwalk allows visitors to experience the mangrove ecosystem without disturbing soil, roots, or tidal flows**, while its simple linear form ensures clarity of movement and minimal footprint.
The project demonstrates how **modest infrastructure can support ecological recovery**, environmental awareness, and local recreation simultaneously. Its emphasis on habitat protection, controlled access, and durability makes it a strong regional precedent for small-scale, ecology-first coastal parks.

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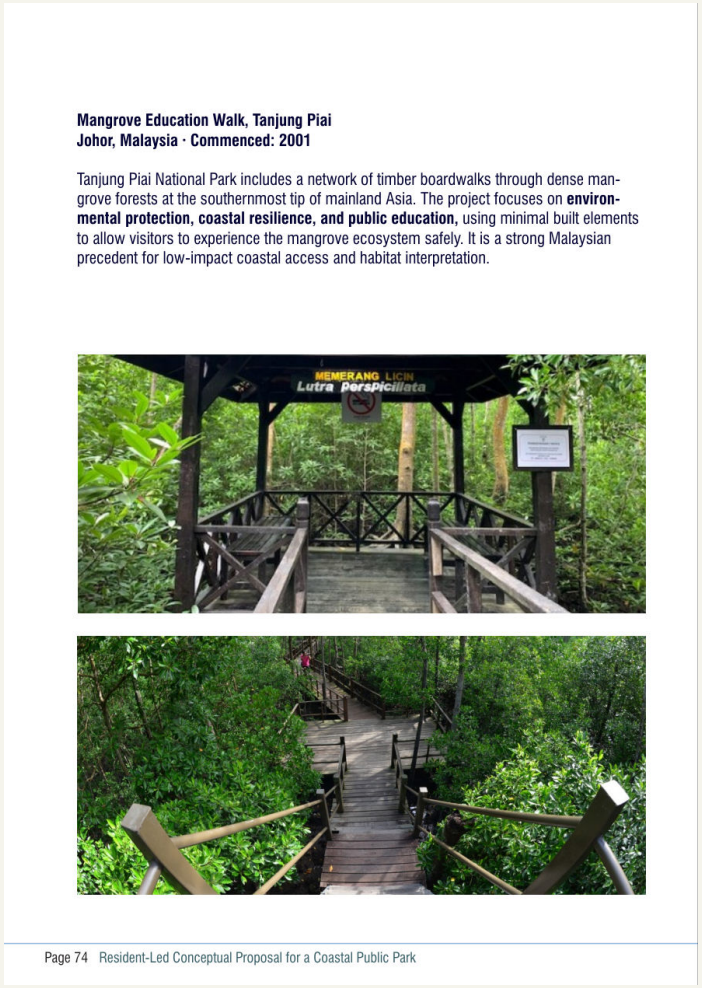
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Red Boardwalk Bridge

Samut Sakhon, Thailand · Bermula: sekitar 2016

Red Boardwalk Bridge di Samut Sakhon ialah laluan pejalan kaki awam berimpak rendah dalam landskap bakau yang dipulihkan. Laluan papan bertingkat membolehkan pengunjung merasai ekosistem bakau tanpa mengganggu tanah, akar atau aliran pasang surut, manakala bentuk linearnya yang ringkas memastikan arah pergerakan jelas dan jejak ruang minimum.

Projek ini menunjukkan bagaimana infrastruktur sederhana dapat menyokong pemulihan ekologi, kesedaran alam sekitar dan rekreasi setempat secara serentak. Penekanannya terhadap perlindungan habitat, akses terkawal dan ketahanan menjadikannya contoh serantau yang kukuh bagi taman pesisir berskala kecil yang mengutamakan ekologi.



Mangrove Education Walk, Tanjung Piai
Johor, Malaysia · Commenced: 2001

Tanjung Piai National Park includes a network of timber boardwalks through dense mangrove forests at the southernmost tip of mainland Asia. The project focuses on **environmental protection, coastal resilience, and public education,** using minimal built elements to allow visitors to experience the mangrove ecosystem safely. It is a strong Malaysian precedent for low-impact coastal access and habitat interpretation.

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Cadangan Konseptual Diterajui Penduduk untuk Sebuah Taman Awam Pesisir

Laluan Pendidikan Bakau (Mangrove Education Walk), Tanjung Piai

Johor, Malaysia · Bermula: 2001

Taman Negara Tanjung Piai merangkumi rangkaian laluan papan kayu melalui hutan bakau tebal di hujung paling selatan tanah besar Asia. Projek ini memberi tumpuan pada perlindungan alam sekitar, daya tahan pesisir dan pendidikan awam, menggunakan elemen binaan minimum untuk membolehkan pengunjung merasai ekosistem bakau dengan selamat. Ia merupakan contoh Malaysia yang kukuh bagi akses pesisir berimpak rendah dan interpretasi habitat.



Pasir Ris Park
Singapore · Commenced: 1986 (phased development)

Pasir Ris Park is a neighbourhood-scale coastal park that successfully integrates a public sandy beach with protected mangrove habitats. Elevated boardwalks provide controlled access through sensitive ecological zones, while open beach areas allow for informal recreation without compromising habitat integrity. The park is delivered in clearly zoned and phased layers, separating active public use from conservation areas. Its combination of beach access, mangrove protection, low-impact infrastructure, and long-term manageability makes it a particularly strong precedent for small coastal parks that balance ecology, public access, and cost-efficient maintenance.

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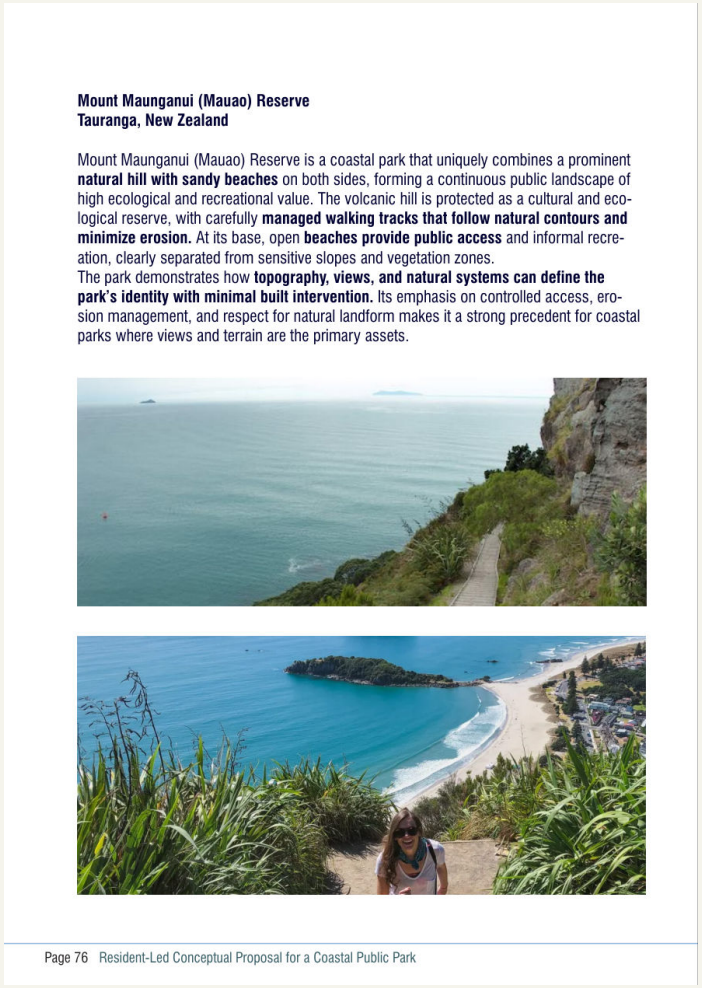
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Pasir Ris Park

Singapura · Bermula: 1986 (pembangunan berfasa)

Pasir Ris Park ialah taman pesisir berskala kejiranan yang berjaya menyepadukan pantai berpasir awam dengan habitat bakau yang dilindungi. Laluan papan bertingkat menyediakan akses terkawal melalui zon ekologi sensitif, manakala kawasan pantai terbuka membolehkan rekreasi tidak formal tanpa menjejaskan keutuhan habitat. Taman ini dilaksanakan dalam lapisan yang dizonkan dan difasakan dengan jelas, memisahkan penggunaan awam aktif daripada kawasan pemuliharaan. Gabungan akses pantai, perlindungan bakau, infrastruktur berimpak rendah dan kemudahan pengurusan jangka panjang menjadikannya contoh yang amat kukuh bagi taman pesisir kecil yang mengimbangi ekologi, akses awam serta penyelenggaraan yang menjimatkan kos.



Mount Maunganui (Mauao) Reserve
Tauranga, New Zealand

Mount Maunganui (Mauao) Reserve is a coastal park that uniquely combines a prominent **natural hill with sandy beaches** on both sides, forming a continuous public landscape of high ecological and recreational value. The volcanic hill is protected as a cultural and ecological reserve, with carefully **managed walking tracks that follow natural contours and minimize erosion.** At its base, open **beaches provide public access** and informal recreation, clearly separated from sensitive slopes and vegetation zones.
The park demonstrates how **topography, views, and natural systems can define the park's identity with minimal built intervention.** Its emphasis on controlled access, erosion management, and respect for natural landform makes it a strong precedent for coastal parks where views and terrain are the primary assets.

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Cadangan Konseptual Diterajui Penduduk untuk Sebuah Taman Awam Pesisir

Mount Maunganui (Mauao) Reserve

Tauranga, New Zealand

Mount Maunganui (Mauao) Reserve ialah taman pesisir yang menggabungkan secara unik sebuah bukit semula jadi yang menonjol dengan pantai berpasir di kedua-dua sisinya, membentuk landskap awam berterusan yang mempunyai nilai ekologi serta rekreasi tinggi. Bukit gunung berapi ini dilindungi sebagai rizab budaya dan ekologi, dengan laluan berjalan kaki yang diurus dengan teliti, mengikuti kontur semula jadi serta meminimumkan hakisan. Di kaki bukitnya, pantai terbuka menyediakan akses awam dan rekreasi tidak formal, dipisahkan dengan jelas daripada cerun serta zon tumbuh-tumbuhan yang sensitif.

Taman ini menunjukkan bagaimana topografi, pemandangan dan sistem semula jadi dapat menentukan identiti taman dengan campur tangan binaan minimum. Penekanannya terhadap akses terkawal, pengurusan hakisan dan penghormatan terhadap bentuk muka bumi semula jadi menjadikannya contoh yang kukuh bagi taman pesisir di mana pemandangan serta rupa bumi merupakan aset utama.

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Bishan–Ang Mo Kio Park
Singapore · Commenced: 2007 (redevelopment completed 2012)

Bishan–Ang Mo Kio Park, developed with Singapore's National Parks Board and Public Utilities Board, is a seminal example of **bringing landscape and ecology to the center of an urban park's identity**. As part of the Active, Beautiful, Clean Waters Program, a formerly straight, concrete drainage channel of the Kallang River was transformed into a naturalized, meandering river system. Stormwater management, soil bio-engineering, and native planting are integrated to create a dynamic ecological landscape that is both functional and accessible to the public. The project successfully combines hydrological performance with everyday recreation, allowing direct interaction with water while enhancing biodiversity and urban resilience. Reuse of existing materials and ecologically driven bank stabilization demonstrate how natural processes can guide sustainable and resilient public space design.

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Bishan–Ang Mo Kio Park

Singapura · Bermula: 2007 (pembangunan semula siap pada 2012)

Bishan–Ang Mo Kio Park, yang dibangunkan bersama National Parks Board dan Public Utilities Board Singapura, ialah contoh penting yang meletakkan landskap serta ekologi di tengah-tengah identiti taman bandar. Sebagai sebahagian daripada Program Active, Beautiful, Clean Waters, saluran saliran konkrit Sungai Kallang yang dahulunya lurus telah diubah menjadi sistem sungai berliku yang menyerupai keadaan semula jadi. Pengurusan air ribut, biokejuruteraan tanah dan penanaman spesies asli disepadukan untuk mewujudkan landskap ekologi dinamik yang berfungsi serta boleh diakses orang awam. Projek ini berjaya menggabungkan prestasi hidrologi dengan rekreasi harian, membolehkan interaksi langsung dengan air sambil meningkatkan biodiversiti dan daya tahan bandar. Penggunaan semula bahan sedia ada dan penstabilan tebing yang berpandukan ekologi menunjukkan bagaimana proses semula jadi dapat membimbing reka bentuk ruang awam yang mampan serta berdaya tahan.