embrace the waterfront and create a new living room for the city
Ecology

Caohai North Shore

Upper Caohai

Dianchi Lake

Kunming City Center

Green Lake

**improve the water quality** of Dianchi Lake
improve the water quality of Dianchi Lake

TP: 1.35 mg/L (Level V = 0.4)
TN: 13.5 mg/L (Level V = 2.0)
Chlorophyll: 184.1 mg/m3
improve the water quality of Dianchi Lake
improve the water quality of Dianchi Lake
Short-Term Strategy: The Lake Cell

- 2 to 5 year timeframe
- US$ 25 – 33 million
- +/- 80 hectares (198 acres)

Mid-Term Strategy: Upper Caohai

- 10 to 15 year timeframe
- US$ 400 – 600 million
- +/- 1,020 hectares (2,500 acres)

Long-Term Strategy: Dianchi

- 25 to 35 year timeframe
- US$ 1 billion
- +/- 309 sq km (120 sq miles)

**improve the water quality** of Dianchi Lake
improve the water quality of Dianchi Lake
urbanity

Caohai North Shore
drive a vibrant mix of uses
integrate public transit to provide better access and connections
urbanity

Caohai North Shore

protect sensitive **natural and cultural assets**
Caohai North Shore

provide **contiguous public access** along the lakefront.
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Caohai North Shore
create **compact and walkable neighborhoods** with a mix of uses
learn **from the local architectural vernacular** and use locally sourced materials
learn *from the local architectural vernacular* and use locally sourced materials
Lashihai Basin

protect *sensitive wetland habitats* within the basin.
**Primary Productivity**
- Lashihai contains 63 species of zooplankton
- Zooplankton filters water and supports fish

**Plant Communities**
- 4 zones of varying plant community types
- Differentiated by varying water levels
- 17 different aquatic plant communities in Lashihai

**Meadow Communities**
- Emergent Communities
- Submerged Communities
- Inundated Communities

protect **sensitive wetland habitats** within the basin.
Lashihai supports 76 species of geese and ducks.

Oct-April monitoring documented 217,995 water birds.

8 endangered bird species.

RAMSAR Designated Wetland (1 of 30 in China).

Water birds are closely associated with plant communities.

Plant communities are dependent on water depth.

Protected sensitive wetland habitats within the basin.
Primary Productivity
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Plant Communities
• 4 zones of varying plant community types
• Differentiated by varying water levels
• 17 different aquatic plant communities in Lashihai

Agricultural Commodities
• Villages maintain 3,088 hectares of agricultural land
• Average annual yield is 19,125 tons
• Grains (wheat, corn, rice) comprise +/-6,051 tons/year
• Vegetables comprise +/-13,459 tons/year

Meadow Communities
Emergent Communities
Submerged Communities
Inundated Communities

protect **sensitive wetland habitats** within the basin.
Lakeside Grazing
- Wetland plant community destruction
- Excess nutrient runoff from waste
- Water contamination source from animal waste

Consumption of Lake Resources
- Excessive aquatic plant harvesting for livestock feed
- Harvesting of endangered Ottelia sp. for human use
- Fishing net-killed birds estimated at 6,164 per year

Wetland Loss
- Lakeside development
- Large lakeside horse pastures
- Lakeside agriculture

Lashihai Basin protects sensitive wetland habitats within the basin.
Existing Agricultural Practices

- Existing wetlands converted to crop production
- Herbicide and pesticide runoff
- Sedimentation and soil erosion
- Irrigation demands

Lashihai Tributary Conditions

- Widespread channelization
- Canals convey discarded village waste to lake
- Increased runoff velocity and sedimentation
- Septic field leaching

The Lashihai Basin protects sensitive wetland habitats within the basin.
Wetland Restoration
- Restore wetlands in seasonally inundated zones
- Focus on bird/plant/fish community interactions
- Develop connections to tributary corridors
- Provide large area of reduced disturbance

Tributary Restoration
- Reduce erosion
- Eliminate debris inputs
- Widen channels outside of villages
- Decrease flow velocity to reduce sedimentation

protect sensitive wetland habitats within the basin
Existing Lake and Wetland Conditions

- Average water surface area is 933 hectares
- Maximum volume is 38 million m$^3$
- Average depth is 4.5 meters
- Excellent water quality

- The delicate balance of soil hydrology and underwater light penetration support diverse plant communities
- Plant communities act as a biofilter that contributes to the high water quality of Lashihai
- Plant communities serve as nesting and foraging habitat for many species of birds and fish
- The zone between the seasonal high and seasonal low water line is crucial for multiple endangered bird species

protect sensitive wetland habitats within the basin
Concerns of Dam Enlargement
- Proposed area enlarged to 1,500 hectares
- Maximum proposed volume 71 million m$^3$
- Average depth will become 10.3 meters
- Water quality will deteriorate, plant communities will be displaced

- Underwater light penetration will decrease and result in the loss of submerged plant communities
- Fish habitat and Water Quality will be degraded by the loss of submerged vegetation
- Emergent meadows will be displaced due to longer periods of inundated soils
- Wading/Grazing bird populations will be adversely impacted by the loss of emergent meadows
- Diving birds will be adversely impacted by the decline in fish populations
Lake Pollution
Conventional agriculture and channelized streams increase sedimentation, nutrient and chemical runoff to the lake and threaten the rich ecosystem of the Lashihai Basin.

Dam Construction
The constant lake level resulting from the dam construction impacts seasonal fluctuations that support the wetland plant communities and reduces the area of wetland habitat used by migratory birds.

Resource Consumption
Agricultural use of wetlands and harvesting of aquatic plants threatens the lake water quality and basin biodiversity.

Overfishing and invasive fish introduction have led to a decline in native fish populations.

Human/bird conflicts occur as a result of crop losses to foraging birds and bird kills due to fishing net entanglement.

Wetland Grazing
Unrestricted use of wetlands for horse grazing degrades plant communities, reduces bird habitat, and increases nutrient and fecal coliform loading to the lake.

Lakeside Development
Poorly planned lakeside development increases human impact on the basin ecosystem by destroying hundreds of hectares of wetland habitats and increasing runoff to the lake.

Lijiang Encroachment
Ramplike and unplanned development encroachment from Lijiang threaten the unique culture of the Lashihai Villages and the sensitive ecological balance of the basin.

protect sensitive wetland habitats within the basin.
integrate new development in an *ecologically and culturally sensitive* manner
Village population: +/-17,500 permanent residents

integrate new development in an ecologically and culturally sensitive manner
integrate new development in an **ecologically and culturally sensitive** manner.
balance

Lashihai Basin

integrate new development in an **ecologically and culturally sensitive** manner

Total Study Area: 9,391 ha

Non-Developable Lands:

- Average Lake Level: 895 ha
- Maximum High Water / Wetlands: 1,651 ha
integrate new development in an **ecologically and culturally sensitive** manner.

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- **Existing Settlements:** 572 ha
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Total Study Area: 9,391 ha

Non-Developable Lands:

- Average Lake Level: 895 ha
- Maximum High Water / Wetlands: 1,651 ha
- Existing Settlements: 572 ha
- Agricultural Land: 2,660 ha
- Steep Slopes (>20%): 3,165 ha

Total: 8,943 ha

Net Usable Land Area: 448 ha

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Qinhuangdao Waterfront  Qinhuangdao, China
capitalize on the unique environmental assets of the site
Qinhuangdao Waterfront

• Felled maritime forest
  • Poor water quality
  • Upland clearing of vegetation has led to sedimentation
  • Stream discharges directly to swimming beach

threatened dunes and lagoon

• Dune system has been destroyed by human use
• Beach erosion is excessive
• Lagoon offers potential value for wildlife habitat

capitalize on the unique **environmental assets** of the site
Maritime forest patches are reconnected via planting

Native plant species used to improve wildlife habitat value

Forest acts as buffer against highway and supports recreation

Land clearing has destroyed the forest

Only small patches of trees remain

Habitat value is low due to fragmentation

restore degraded landscapes and improve native habitats
EXISTING STREAM
• Stream is severely degraded
• Steam is biologically devoid
• Water quality is low due to sediment and pollution

RESTORED STREAM
• Stream channel is contoured to reduce velocity
• Native wetland vegetation is planted to remove pollutants
• Habitat value is improved for aquatic organisms
PHOTOREMEDIATION

• Utilize plant materials and soil microbes to improve water quality

• Create plant palette to target specific pollutants
  Pennisetum spp: Nitrogen + Cadmium
  Pteris spp: Arsenic + Zinc

• Restore endangered, native intertidal wetland plant species

restore degraded landscapes and improve native habitats
Dune restoration provides storm and flood mitigation
Controlled access points protect sensitive ecological resources
Multiple habitats (forest, dune, lagoon) are connected to support a variety of wildlife

EXISTING DUNES
- Beach erosion is accelerated
- Lagoon is filling in from excess erosion
- Larger dune system degraded by human activity

RESTORED DUNES
- Dune restoration provides storm and flood mitigation
- Controlled access points protect sensitive ecological resources
- Multiple habitats (forest, dune, lagoon) are connected to support a variety of wildlife
Silt Fence Stabilization

Native Vegetation Re-establishment

Restored Dune Community

Passive Dune Restoration: +/-5 Year Timeframe

*restore degraded landscapes* and improve native habitats
provide access to the beach and view corridors to the sea
PROVIDE PEDESTRIAN WATERFRONT ACCESS TO PROVIDE ACCESS TO THE BEACH AND VIEW CORRIDORS TO THE SEA.

- TERRACED BUILDINGS MAXIMIZE VIEWS
- WATERFRONT PROMENADE
- PUBLIC OPEN SPACE

Qinhuangdao Waterfront Ecology

RESIDENTIAL
UNIVERSITY
SPORTS
develop a **sustainable approach** to architecture and the landscape.
develop a **sustainable approach** to architecture and the landscape
Qinhuangdao Waterfront development aims to develop a **sustainable approach** to architecture and the landscape by integrating MARITIME FOREST CORRIDOR, DUNE PROTECTION ZONE, and GREEN ROOFS into the LANDSCAPE SYSTEMS.
Green roof for heat island reduction and stormwater collection

Operable windows allow for natural ventilation

Shading devices on south facades designed to block heat gain during summer and allow during winter

Radiant floors and chilled ceiling for efficient thermal comfort

Geothermal heat exchange

Roof pond system as thermal mass for passive heating / cooling

Grey water reuse and storm water drainage system

Summer Sun

Winter Sun

Bio-filter

Wind Farms

Storm water surface run-off infiltrated through riparian zone

Qinhuangdao Waterfront
develop a **sustainable approach** to architecture and the landscape
integrate the development into the existing context of the city
integrate the development into the existing context of the city
emphasize and maximize ocean views as the primary amenity

Solar Orientation:
- 30 to 45 degrees: 14.70%
- 15 to 30 degrees: 53.00%
- 0 to 15 degrees: 32.30%
emphasize and **maximize ocean views** as the primary amenity
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Create **active public spaces** that are used in all seasons.
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