

“The Last Waterfront in Pearl River Delta”: Space Generation and Cultural Ecological Characteristics of Traditional Village in Gulao Waterfront

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ABSTRACT: Lingnan waterfront is a relatively complete cultural ecosystem formed under the influence of unique natural environment, social economy and regional culture. However, the existing researches on Lingnan waterfront pay more attention to the physical space of traditional settlements than the overall natural environment surrounding the settlements. Taking Gulao Waterfront as an example, this paper analyzes it from the perspective of interactions between human and natural environment, social economy and regional culture by using the theory of cultural ecology. This paper also analyzes the spatial generation process of Gulao Waterfront, systematically sorts out the overall village pattern, water network and water conservancy space, settlement space, agriculture and fairs space, folk beliefs and ritual space, and conclude that the cultural ecological characteristics of Gulao Waterfront is under the law of water. The important value in Gulao Waterfront of the cultural ecological characteristics and integrated historical heritage protection for the Pearl River Delta has been excavated, which enriches and deepens the cultural heritage research of traditional village in Lingnan waterfront.

KEY WORDS: Lingnan waterfront; traditional village; cultural ecology; Gulao

Introduction: Traditional villages in Lingnan waterfront from a cultural ecology perspective

Traditional villages in Lingnan waterfront are primarily distributed across the present-day Pearl River Delta region. This delta is formed by sediment deposition from the Xijiang River, Beijiang River, Dongjiang River, and several smaller streams [1], known for its complex natural geography and frequent flood hazards. Due to environmental constraints and the level of productivity, the Lingnan waterfront developed relatively slowly before the Ming and Qing dynasties, with a limited number of villages. During the Ming Dynasty, in response to local defense

needs, many coastal fishermen and boat people were incorporated as “households” [2]. At the same time, the migration of people from the North brought advanced agricultural techniques and water management skills [3], accelerating population concentration and village development in Lingnan waterfront. Thus, traditional villages in Lingnan waterfront were shaped by a combination of complex natural environments and diverse socio-economic conditions.

Current research on traditional Lingnan waterfront is extensive, focusing mainly on three areas. First, there is classification of the settlement spatial patterns of tradition-

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al villages in Lingnan waterfront [4-6]. Second, research dissects the traditional villages into various independent systems such as architecture, streets, water networks, and agriculture to study their characteristics [4,7-9]. Third, studies explore the formation mechanisms of the spatial patterns of these villages [6,10,11], suggesting that the development of the traditional villages is closely related to the dense water network environment. Overall, existing research on Lingnan waterfront tends to focus more on the physical space of the villages. While some scholars have examined the relationship between the villages and the water network, there has been insufficient comprehensive attention to the broader natural, social, and economic contexts. This has led to a lack of in-depth analysis of the interactive relationship between the villages and their environment, resulting in an incomplete understanding of the overall development, evolution, and spatial characteristics of traditional villages in Lingnan waterfront.

The cultural ecology theory proposed by J.H. Steward emphasizes the relationship between human culture and its natural environment. It posits that the driving force behind cultural development and evolution is culture's adaptation to the environment and asserts that culture forms a complete cultural ecological system through continuous interaction with its natural, social, and economic surroundings [12-14]. In recent years, many domestic scholars have applied cultural ecology theory to the study of traditional villages. This includes analyses of the spatial and landscape characteristics and evolutionary processes of traditional villages [15-17], research on the protection of cultural heritage in traditional villages [13,18-20], and investigations into the characteristics of traditional regional cultural landscapes and their inherent genes and formation mechanisms [21-22]. However, there has been limited application of this theory to the Lingnan region. For traditional villages in Lingnan waterfront, humans are both the producers and consumers of culture, while the surrounding dense water network serves both as the object the culture is adapted for and the subject it works to transform. The settlement space, dike-pond agriculture space, market spaces, and spaces for rituals and folk beliefs represent the spatial manifestation of the interaction between culture and the natural environment. Thus, humans, the natural environment, settlement space, dike-pond agriculture, market

spaces, and ritual and folk belief spaces collectively constitute a cultural ecological whole. This paper adopts a cultural ecology perspective, treating traditional villages in Lingnan waterfront as a complete cultural ecological system, to analyze the interactive relationship between the villages and their environment and to explore the spatial generation process and cultural ecological characteristics of these villages.

1 Case overview and research methodology

1.1 Case overview

Gulao Waterfront, situated on the banks of the Xijiang River in the northern part of Heshan City, Guangdong Province, has developed and prospered since the early Ming Dynasty when the Gulao Enclosure was established, giving it a history of over 600 years. Generally, Gulao Waterfront has been relatively undisturbed by urbanization and industrialization processes, allowing it to retain its traditional cultural ecological features. In contrast, other regions in the Pearl River Delta, although home to numerous distinctive Lingnan water towns, sharing the similar natural, economic, and social environments historically, have experienced significant damage to their traditional cultural ecological characteristics due to rapid urbanization and industrialization. Consequently, Gulao Waterfront has been referred to as "the last pristine waterfront of the Pearl River Delta" by the CCTV program "Remembering Our Homeland," and its Shangsheng Village has been listed as one of the fifth batch of ancient villages in Guangdong Province. Research on Gulao Waterfront is valuable for tracing the formation process of cultural ecological characteristics in traditional villages of Lingnan waterfront in the Pearl River Delta and is significant for the protection of historical heritage in these villages. This study focuses on Gulao Waterfront in Heshan City, which is both typical and relevant.

To ensure the integrity of the research subject and to thoroughly reconstruct the spatial generation process of Gulao Waterfront and analyze its cultural ecological characteristics, this study encompasses the Dongning Community, Gulao Village, Shuangqiao Village, Shangsheng Village, Xinxing Village, and Poshan Village in Shaping Street (Poshan Village was administratively separated from Gulao Town in the 1990s), covering a total area of approxi-

mately 17 km² (Figure 1). By the end of 2018, the registered population was about 15000, and the area of fish ponds was approximately 6700 acres.



Figure 1 Study area and location map of Gulao water town

1.2 Research methodology

The data for this study were primarily obtained through historical archive reviews, field surveys, and in-depth interviews. The main sources of information include: (1) Historical Archives: In addition to local chronicles, this category encompasses specialized records and genealogies. Given the limited references to Gulao Waterfront in ancient official documents like county chronicles, it is necessary to explore various specialized records and local genealogies to uncover clues about the spatial generation of Gulao Waterfront. (2) Field Survey Reports resulting from extensive fieldwork and in-depth interviews: Between April 2019 and July 2020, the author conducted nine field surveys and several supplementary investigations in Gulao Waterfront, focusing on aspects such as settlement space, water systems and hydraulic engineering, dike-pond agriculture, and traditional customs. During the research process, in-depth interviews were conducted with Gulao Town government staff, village committee members, some village group leaders, general villagers, and local scholars responsible for compiling genealogies. These interviews were instrumental in refining and revising the research conclusions.

2 Analysis of spatial generation in Gulao Waterfront

Gulao Waterfront is situated in the northwestern part of the Xijiang River Delta, formed by sediment deposition from the Xijiang River [23] (Figure 2). The terrain is char-

acterized by slightly elevated areas to the east and west with a low-lying center. Despite the relatively early formation of the delta [24] (Figure 3), frequent flooding due to its proximity to the Xijiang River severely constrained the development of Gulao Waterfront in the absence of effective flood control measures. Prior to the Song and Yuan dynasties, the region experienced minimal human activity due to harsh natural conditions¹⁾. However, from the Song and Yuan periods onwards, with the increase of northern migrants, improved flood management capabilities, and advancements in agricultural techniques, development activities gradually expanded.



Figure 2 Simplified distribution map of ancient alluvial riverbeds in the pearl river delta

2.1 Song and Yuan dynasties sporadic development phase

From Song to Yuan dynasties, Gulao Waterfront lacked continuous levees, making it vulnerable to flooding from the Xijiang River. The entire waterfront faced the risk of inundation, with the central low-lying areas particularly prone to frequent flooding. Development was confined to the higher terrain on the eastern and western sides of the waterfront, resulting in a dispersed pattern of settlement avoiding flood-prone areas.

In the eighth year of the Xianchun era of the Southern Song Dynasty (1272 AD), the court-admonishing offi-

cial Lao Wei, fleeing the turmoil caused by the imperial concubine Hu, relocated with his family from Zhujixiang to the elevated area at the foot of Chashan in the western part of Gulao Waterfront²⁾. During the same period, his relatives, the Gu family, also moved to this area, gradually establishing Gulao Village [25] 18. Shortly after the fall

of the Song Dynasty, the Yi family migrated from Yuqiao in Heshan to the elevated terrain in the eastern part of Gulao Waterfront, eventually forming today's Pingshan Village³⁻⁴⁾ (Figures 4-5). At this time, Gulao Waterfront saw the emergence of two independently developing, dispersed settlement clusters.

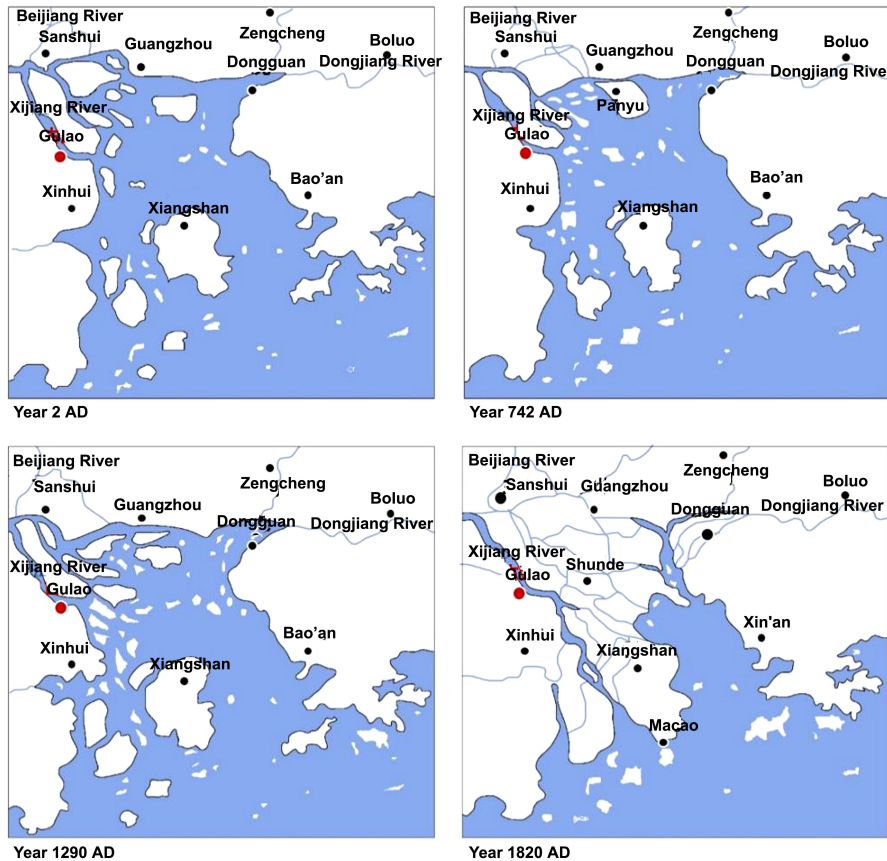


Figure 3 Evolution of the Pearl River Delta



Figure 4 The relationship between villages of Song and Yuan Dynasties and their environment

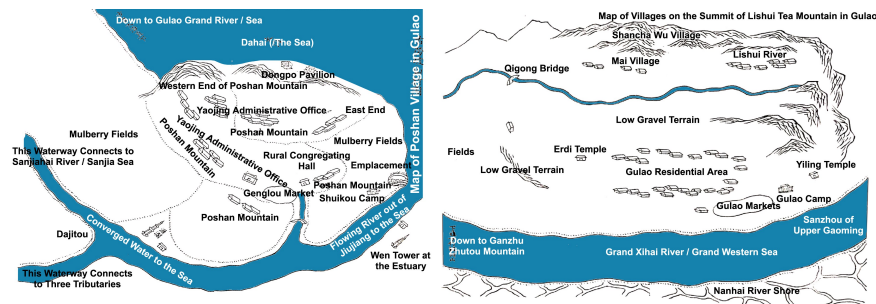


Figure 5 Poshan mountain, Gulao settlements and the environment

2.2 Ming Dynasty comprehensive development phase

From the Ming Dynasty onwards, with the gradual increase in population, the conflict between the growing people and limited land began to emerge, making the reclamation of the low-lying tidal flats in the central part of the waterfront a significant topic. To protect the newly re-

claimed land, extensive levee construction was undertaken. This marked a profound shift in the relationship between humans and water, evolving from merely avoiding flooding to actively interacting with it. Consequently, the spatial development of Gulao Waterfront transitioned from a dispersed to a comprehensive development pattern (Figure 6).

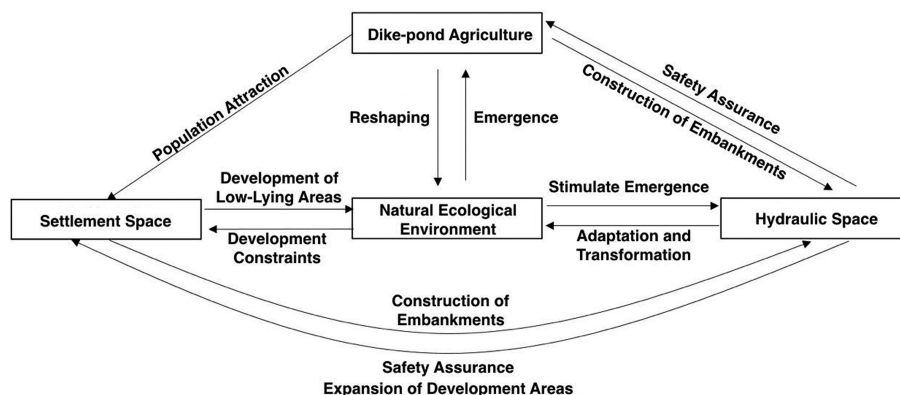


Figure 6 Relationship between Ming Dynasty villages and their environment

During the mid-Ming Dynasty, in order to control flooding from the Xijiang River, villagers constructed several levees along the Xijiang River and Shaping River, including the Gulao Enclosure, Tie Enclosure, and Dugang Enclosure. These levees represented a substantial improvement in scale and quality compared to previous ones, effectively protecting the newly reclaimed land and laying the groundwork for the development of the central low-lying areas. For instance, the Gulao Enclosure irrigated 223 hectares, and the Tie Enclosure irrigated 7 hectares⁵⁾.

Although the levees prevented floods from the Xijiang River, severe internal flooding occurred within the enclosures due to difficulties in water drainage. To effectively manage flooding and fully utilize space, a unique land-use method known as “digging ponds and building mud foundations” emerged. The natural environment, characterized by dense ponds, led to the development of a dike-pond agricultural model in Gulao Waterfront. By the late Ming and early Qing Dynasties, a mature mulberry-dike-fish-pond agricultural model had appeared[7,26].

The control of flooding and the improvement of agricultural conditions stimulated the migration and development of populations into the central low-lying areas of Gulao Waterfront. Prominent clans such as the Ye, Huang, and Wen families migrated to areas known today as Shan-

gsheng Village and Shuangqiao Village during the Ming Dynasty⁶⁻⁸⁾. Thus, the development of Gulao Waterfront expanded from the eastern and western regions to the central area, marking the beginning of a period of comprehensive development.

2.3 Qing Dynasty to republic of China: multi-center development phase

During the Qing Dynasty, the further construction and reinforcement of water management infrastructure in Gulao Waterfront provided a stable environment for the development of “mulberry-dike-fish-pond” commercial agriculture. This stability fostered the growth of market trade, leading to the emergence of markets of various sizes and marking the onset of a multi-center development phase in Gulao Waterfront (Figures 7-8).

As the construction and management of levees improved, control over flooding from the Xijiang River became more effective. The levee construction and management system evolved from being government-constructed to a model where the government supervised but villagers undertook construction⁹⁾. The management authority shifted from government agencies to village-led “public offices”¹⁰⁾, and funding sources transitioned from voluntary contributions by villagers to rents and taxes from fish-ponds¹¹⁾, which enhanced management efficiency. In the

128 years following 1837, there were no recorded breaches of the Gulao levees.

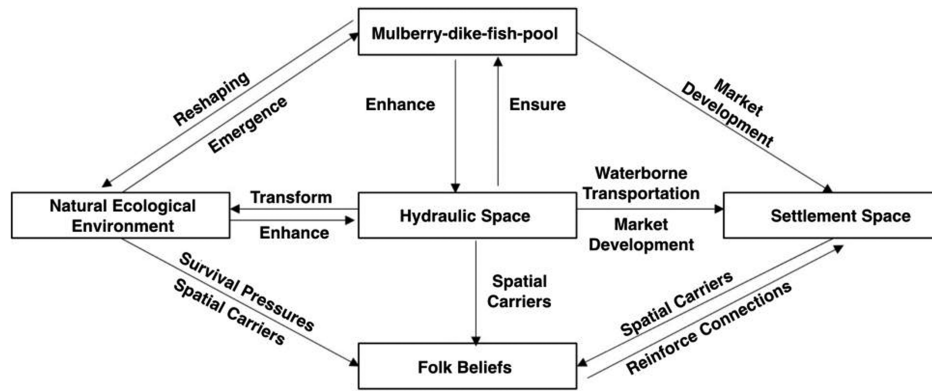


Figure 7 Relationship between villages and their environment during Qing Dynasty and Republic of China

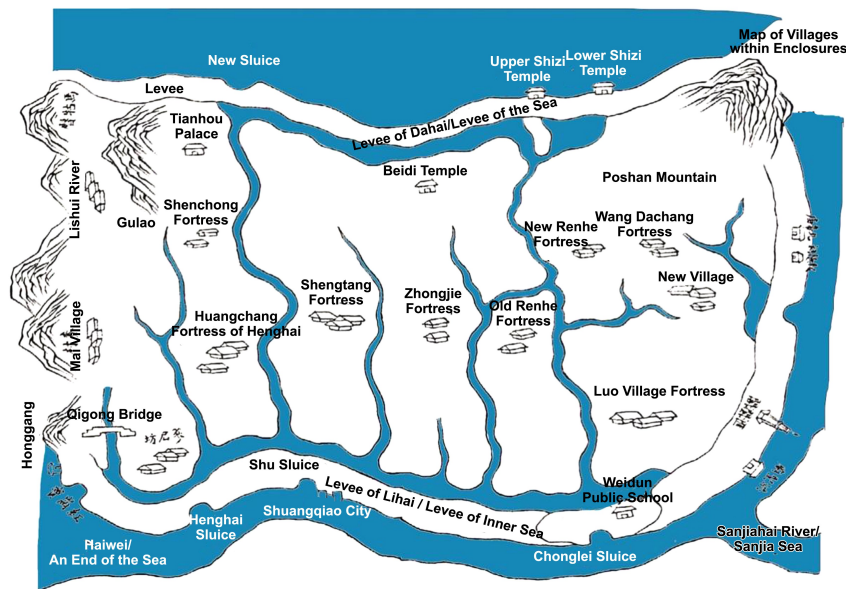


Figure 8 Map of villages in Gulao Waterfront during Qing Dynasty

Simultaneously, the mid-to-late 18th century saw a dramatic increase in the price of raw silk due to foreign merchant demand, which triggered a peak in the “abandonment of rice fields for mulberry cultivation” in the Pearl River Delta[27]. The solid levees provided a foundation for the rapid development of the “mulberry-dike-fish-pond” model in Gulao. By the early Qing Dynasty, the mulberry-dike-fish-pond agricultural model in Gulao Waterfront had become highly developed, known for reports such as “women from the Poshan Enclosure and above are engaged in sericulture” and “fish from the Villages within Enclosures are highly profitable, frequently transported and sold in provincial capitals”^[12]. By the mid-to-late Qing Dynasty, the Gulao Waterfront area had reached a state where “Poshan Enclosure... had no land without mulberry trees and no person

without silkworms”^[13].

The development of commercial agriculture in the mulberry-dike-fish-pond system and the enhancement of water conservancy infrastructure significantly accelerated the growth of market trade in Gulao Waterfront. Along transportation hubs such as sluices and docks, various market towns emerged with differing scales and service scopes. Larger markets, such as Gulao Market, with “more than two hundred shops”^[14], had extensive trade networks reaching Guangzhou, Nanhai, and even Wuzhou. Shengping Market, due to its convenient water transport, experienced “daily markets”^[15]. The number of markets increased from one in the Ming Dynasty’s Wanli period to five in the early Republic of China[28], indicating a shift to a multi-center development phase.

The growing prosperity of Gulao Waterfront also led to the expansion of water-based folk activities. For instance, dragon boat racing evolved from simple “gatherings to watch races”^[16] to an event where “no fewer than ten thousand spectators line the riverside two days before the Dragon Boat Festival”^[17], becoming one of the most significant annual festivals.

2.4 Post-1949 transformation and development period

Following the establishment of New China and before the reform and opening-up period, the development of water infrastructure and changes in the social environment had a profound impact on Gulao Waterfront. After years of warfare, by the time New China was founded, the Gulao embankments were in disrepair, and dike-pond agriculture had declined. In the 1950s, the original Gulao enclosure was integrated with Tie enclosure to enhance flood control along the Xijiang River^[29]. Modern water management techniques effectively addressed issues of waterlogging within the embankments^[30]. This improvement in water infrastructure facilitated the restoration of dike-pond agriculture, and with policy support, the mulberry-dike-fish-pond farming model gradually recovered through the 1950s^[31]. However, the embankment breach in 1962 resulted in extensive flooding that devastated mulberry

fields, causing sericulture to enter a downturn that persisted until the eve of the reform and opening-up period. Furthermore, the 1962 floods and the “Four Olds” campaign led to the destruction of numerous traditional residences and ceremonial spaces, such as ancestral halls and temples. After the reform and opening-up, traditional cultural and ecological features of Gulao Waterfront faced intense challenges from urbanization and industrialization (Figure 9).

2.5 Summary

The spatial development process of Gulao Waterfront reveals that its growth represents a cultural-ecological adaptation to the environment. Central to this process is how the early inhabitants of Gulao Waterfront adapted and transformed the densely interlaced water network through the construction of embankments and the development of dike-pond agriculture. This adaptation led to the emergence of distinctive settlement spaces, market trade, and cultural beliefs characteristic of waterfront. Throughout this process, a complex cultural-ecological system formed, integrating the early settlers, natural environment, settlement spaces, and both economic and cultural dimensions. Consequently, waterfront villages evolved into spatial carriers of human-environment interactions.

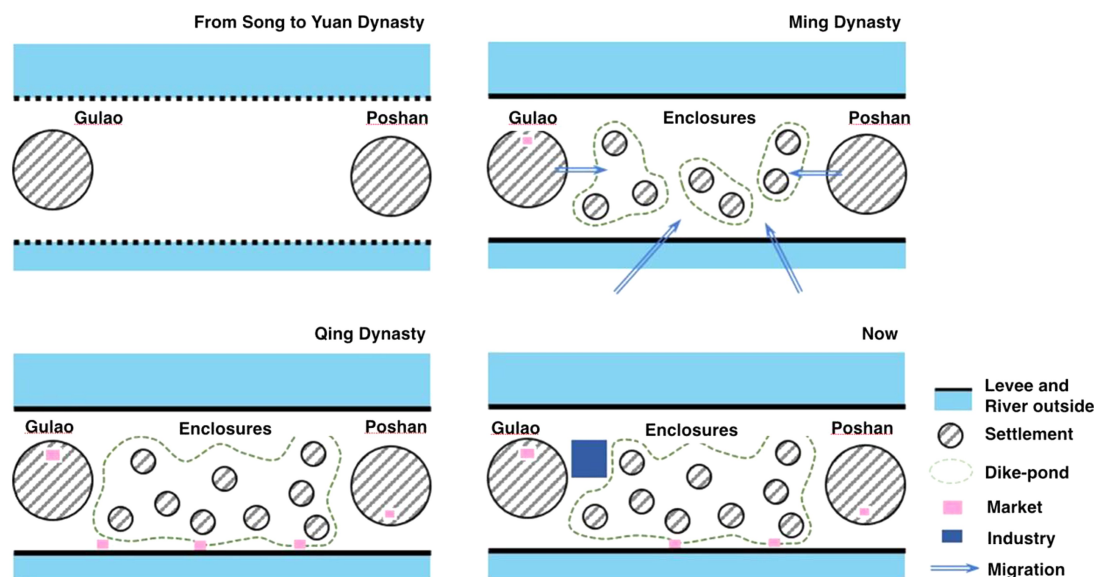


Figure 9 Schematic Diagram of the Evolution of Gulao Waterfront

3 Cultural-Ecological characteristics of the traditional villages in Gulao Waterfront: “water as the life-blood”

The spatial development of Gulao Waterfront demonstrates that it emerged and developed through intense interaction between humans and the environment. It represents a comprehensive cultural-ecological system encompassing humanity, settlements, natural elements, and socioeconomic conditions. Within this system, the water network of the natural environment plays a particularly significant role, and the cultural-ecological characteristics of Gulao Waterfront distinctly embody the theme of “water as the Lifeblood.”

3.1 Overall waterfront pattern—Ancient Embankments Bordering Three Rivers; meandering channels within enclosures with Oceanic dike-pond and Island-like villages

The spatial configuration of Gulao Waterfront, char-

acterized by “Ancient Embankments Bordering Three Rivers; meandering channels within Enclosures with Oceanic dike-pond and Island-like villages,” epitomizes the traditional Lingnan waterfront characteristics (Figure 10). Located to the north of the Xijiang River and bordered to the south and east by Shengping River and Shaping River, Gulao Waterfront is defined by a natural geographical pattern encircled by these three rivers. The embankments, constructed since the Ming Dynasty, outline the town with rivers and encircling embankments creating a distinctive layout. Inside the embankments, a dense network of rivers and channels forms a complex water system extending throughout Gulao Waterfront. Additionally, dike-pond agriculture holds a crucial role in local agriculture, with extensive areas of dike-ponds still present. Settlements are situated on larger dikes or on contiguous land with fewer ponds, creating varied forms of settlement spaces that are embedded within the natural ecological base of dike-ponds and water networks, akin to numerous small islands.



Figure 10 Overall spatial pattern of Gulao Waterfront

3.2 Waternetwork and hydraulic space—encircling rivers and networked water system

The fundamental characteristics of Gulao Waterfront's hydraulic spatial layout are its encircling rivers and networked water system. Surrounded by Shaping River, Shengping River, and Xijiang River, the town has established external embankments such as Gulao Enclosure, Tie Enclosure, and Goose Enclosure to mitigate flood risks, resulting in an external geo-

graphical pattern of the triadic encirclement formed by the outer river and these embankments. While the embankments provide protection, they also impede water flow and the town's connection with the outside. To facilitate communication between the inside and outside of the embankments, nine traditional sluices were originally installed under the embankments, serving both drainage and irrigation purposes and functioning as crucial nodes for water transport (Table 1).

Table 1 Schematic cross-section of traditional sluices

Representative sluices	Gumao sluice, Shengping sluice, Shuangqiao sluice, Meng sluice, Tianmen sluice, Honggang sluice, Bianyu sluice, New sluice	Hengchong sluice
Cross-sectional schematic		
Sluice gate type	Shengping outlet and Shuangqiao outlet retain existing wooden double-leaf square sluice gates, while other sluices are currently without gates.	

Within Gulao Waterfront, the river channels and ponds create a complex networked water system. On the northern and southern sides, there are major river channels flowing northwest-southeast through numerous villages, known as Suyueba Channel and Changlian Channel. Other primary river channels generally flow southwest-northeast, connecting Suyueba and Changlian Channels. Additionally, secondary river channels, flowing roughly northwest-southeast, connect the primary channels laterally, forming a comprehensive networked water system.

3.3 Settlement spaces in the waterfront—"clustered villages at eastern and western sides and weidun in the center"

3.3.1 Settlement spatial patterns

The spatial patterns of settlements in Gulao Waterfront are categorized into two primary types: clustered and dispersed, reflecting an adaptation to the natural hydrological environment and an integration with the water network.

Clustered settlements are predominantly found on the higher terrain on the eastern and western sides of Gulao Waterfront, such as Gulao and Poshang villages. These settlements are situated on contiguous land areas, with a

concentrated layout of buildings and minimal division by the water network. Surrounded by a network of ponds and river channels, these settlements exhibit a characteristic of being "embraced by ponds and channels." Due to their larger development space, clustered settlements tend to be more extensive.

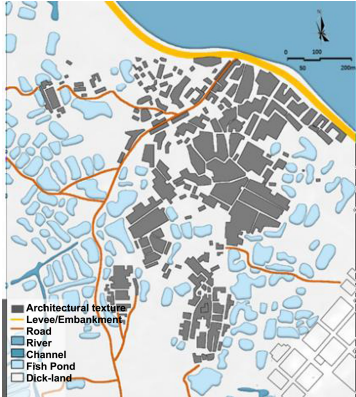
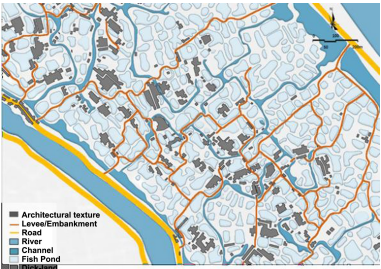


Dispersed settlements are primarily located in the central regions of Gulao Waterfront, such as Shuangqiao, Shangsheng, and Xinxing villages, where the area is densely covered with ponds and channels. These settlements, collectively referred to as "Weidun," consist of individual building clusters known as "Dun." These dispersed settlements generally develop on the dike, with limited space leading to smaller settlement sizes, typically ranging from a few households to several dozen. The "Dun" are separated by the water network and are embedded in the pond and water network base in a patchwork pattern (Table 2).

3.3.2 Alley layouts—"following the flow" and "alleyways facing water"

In Gulao Waterfront, adapting to the densely inter-

laced water network and making optimal use of limited land resources are crucial factors influencing settlement alley layouts. In clustered settlements, main roads connecting to other villages typically serve as primary thoroughfares, with secondary alleys arranged perpendicular to them, creating a comb-like pattern typical of traditional “comb-style” layouts in the Guangfu region. However, the layout of these main roads varies with the natural hydro-

Table 2 Spatial pattern of settlements

Settlement patterns	Clustered pattern	Dispersed pattern
Layout		
Photograph		

Dispersed settlements, embedded within the water network, face limited construction space. To maximize land use, larger “Dun” settlements often adopt a grid-like alley layout. This grid layout provides excellent connectivity, with alleys typically offering direct access to surrounding channels and ponds, establishing a strong interactive relationship with the water system and reflecting the “alleyways facing water” characteristic of the waterfront. In this layout, buildings within the settlement are arranged in orderly rows, with deviations from this pattern occurring only at the settlement’s edge. For smaller “Dun,” while a complete alley system may not be feasible, a regular and compact layout is still employed to conserve land resources.

3.3.3 Waterway transportation spaces—“hundreds of bridges and thousands of wharfs connecting thousands of houses”

In the intricate water network environment, traditional

logical environment, resulting in two types of comb-style alley layouts: those positioned away from and those adjacent to the water, embodying the “following the flow” characteristic. In the former, main roads are situated within the settlement, with alleys extending sideways and often leading to the dike-ponds; in the latter, main roads are located near the ponds, at the settlement’s periphery, with alleys extending away from the ponds.

waterfront residents in Lingnan have developed a transportation system heavily reliant on waterways, resulting in a diverse array of waterway transportation spaces, with wharfs and bridges being the most characteristic. According to incomplete statistics, there are over 50 wharfs and more than 30 bridges in Shangsheng Village alone. The Duns within the waterfront are closely connected through various waterway transportation spaces such as wharfs and bridges (Figure 11). Wharfs, which facilitate access from land to water, are typically constructed along the riverbanks and feature steps descending into the water, allowing residents to dock boats, transport goods, and conduct washing activities.

Bridges, serving as essential systems crossings over water, reflect the adaptation and transformation of the natural water network by the local inhabitants. Gulao Waterfront’s bridges include stone slab bridges, arch bridge-

es, and flat bridges. Stone slab bridges, designed to span one or more large ponds, can extend several hundred to over a thousand meters and are particularly emblematic of waterfront. Arch and flat bridges, usually built from granite blocks, are em-

ployed to cross smaller channels, with lengths of about 5-6 meters. These bridges are often positioned at the entrances to dispersed settlements, such as the Toudu Bridge and Erdu Bridge of Shangsheng Village.



Figure 11 Wharfs, bridges and settlements

3.4 Dike-pond agriculture and market spaces—born from water, thriving for water

3.4.1 Dike-pond agriculture—“ponds and fields interwoven, fish pools arranged like a chessboard”

Many regions within Gulao Waterfront still retain a well-preserved traditional dike-pond agriculture pattern. Traditional fish ponds vary in size and shape, with a naturally flowing and seemingly organic layout. The main connecting roads between settlements are constructed on broader dikes, winding through the fish ponds and villages. The picturesque landscape of interwoven dikes and ponds with shimmering water remains a true reflection of the waterfront scenery. However, contemporary dike-pond agriculture in Gulao Waterfront differs significantly from historical practices. Historically, the mulberry-dike-fish-pond agriculture model followed a cycle: pond mud fertilized mulberry trees, mulberry leaves fed silkworms, and silkworm excrement and cocoon debris nourished fish, creating a beneficial agricultural cycle. Today, however, there is minimal connection between crop cultivation on dike surfaces and fish farming. On one hand, mulberry trees have been replaced by economic crops such as bananas, corn, and vegetables, while fish ponds are primarily fed with modern feed, irrelevant from cultivation. On the

other hand, lands of dike-pond are allocated by village groups, while fishing rights are auctioned separately, often leading to different operators managing the ponds and the cultivation, further disrupting the traditional linkage. Additionally, since the 1990s, Poshang Village has implemented standardized modifications to the dike-pond system to facilitate the bidding process for fish farming, exacerbating the degradation of the traditional pond landscape (Figure 12).



Figure 12 Comparative analysis of modern and traditional dike-pond textures in Gulao Waterfront

3.4.2 Market spaces—“thriving by the ferries”

The development of markets in Gulao Waterfront is built upon the commercial dike-pond agriculture and facil-

itated by convenient water transportation. Markets are typically located in conjunction with transportation facilities such as ferry terminals and docks, reflecting the characteristic of “thriving by the ferries.” For example, the Shengping Market in Shangsheng Village is situated atop an embankment, with the embankment serving as the main street and the Shengping Sluice located beneath it. Nearby, three docks were present during the Republic era¹⁴⁾, which contributed to its status as a bustling market that operated daily due to the efficient water transport.

Another manifestation of the market's dependence on

ferry services is the relationship between ferry terminal hierarchy and market scale. The largest market, Gulao Market, once had three docks and offered ferry services to Nanhai, Jiujiang, Guangzhou, and even Wuzhou. Its service area extended beyond Gulao to neighboring regions such as Gaoming, Nanhai, and Jiujiang, making it the largest and most expansive market in Gulao Waterfront. In contrast, Shuangqiao Market, with only one ferry crossing to Shaping, served only Shuangqiao Village, demonstrating a more localized scale and service area (Table 3).

Table 3 Relationships between markets and related ferries

Market name	Number of docks	Dock name	Ferry destinations	Service area	Notes
Gulao Market	3	Sanbao Tongjin Dock Yanbu Dock Passenger Dock	Guangzhou, Wuzhou, Jiangmen, Nanhai, Jiujiang	Gaoming, Nanhai, Jiujiang, Gulao Village	
Genglou Market	2	Poshang Dock	Haishou Sha, Jiujiang	Jiujiang, Shaping, Poshan Village, Haishou Sha	
		Guibu Dock	Guangzhou, Zhaoqing, Nanhai, Jiujiang, Shaping		
Shengping Market	3	Shengping Hengshui Ferry	Shaping	Shenping Village, Shuangqiao Village, Dabu Village, Xinxing Village, Shaping	
Shuangqiao Market	1	Shuangqiao Hengshui Ferry	Shaping	Shuangqiao Village	
Gongqiao Market	—	—	—	—	Originally had few shops; no longer exists after the 1950s.

3.5 Ritual and folk belief spaces—water as a link connecting villages and clans

3.5.1 Ritual spaces—worship of water deities

In traditional agrarian societies reliant on natural economies, frequent natural disasters often left villagers with limited means to address their challenges. To seek benefits and avoid harm, numerous local deities were created and worshipped in the Lingnan waterfront. Gulao Waterfront also features a diverse and complex system of deities, with water deity worship being particularly widespread across various villages. This form of worship occupies a significant place within the local pantheon and represents a common belief among the villages of Gulao Waterfront. The prevalence of water deity worship can be

attributed to the town's location along the Xijiang River, an area prone to frequent flooding. Given the high dependency of early inhabitants on water management and transportation, seeking the aid of water-related deities became a necessity. Ritual spaces dedicated to water deities, such as the Beidi Temple, Tianhou Palace, and Hongsheng Temple, are among the most numerous and are widely distributed throughout the villages within the waterfront. These temples are often situated near the Xijiang River and Shaping River, reflecting their alignment with the rivers (Table 4), and indicating a common belief in the divine power to control flooding [32]. Many of these ritual spaces continue to thrive, demonstrating the enduring nature of water deity worship among the local populace.

Table 4 Traditional beliefs and ritual spaces dominated by water deity worship in Gulao Waterfront

Temple	Location	Deity worshiped	Primary festival dates	Ritual practices	Service area	Preservation status	Photograph
Beidi Temple	West of Xinrenhe Village, Shangsheng Village	Beidi	—	—	—	No longer extant	—
	Poshang Shuizhai Village, relocated from the embankment in 1997	Beidi	Major festivals such as Lunar New Year and the Lantern Festival	Prayers for favorable weather and safety	Poshang Shuizhai Village	Relocated in the 1990s	
Hongsheng Temple	Poshang South Gate Village	Hongsheng Gong	Lunar February 13th, HongSheng's Birthday	Prayers for safety and marital bliss	Poshang South Gate Village	Relocated in 2011	
Tianhou Palace	Shuangqiao Village	Shengmu, Guangong	Lunar New Year, Qingming Festival, Buddha's Birthday on the 8th day of the 4th lunar month, and Guanyin's Birthday on the 19th day of the 2nd lunar month	Prayers for safety	Shuangqiao Village	Well-preserved	
	North of the embankment, Poshang Village	Shengmu, Madam Huifu	Major festivals such as the Lantern Festival and Qingming Festival	Prayers for favorable weather, safety, and marital bliss	Poshang West End Village	Well-preserved	
Weilong Temple	North of the embankment, Poshang Village	Weilong Gong, Zhangwang	Lunar March 23rd, Wei Long's Birthday	Prayers for favorable weather, academic success, and marital bliss	Poshang West End Village	Well-preserved	
Baode Shrine	Next to Gumao Sluice, Xinxing Village	Fengbaxiu	—	—	—	No longer extant	—
Upper Shizi Temple	West of the Gulao Enclosure, Poshang Village	—	—	—	—	No longer extant	—
Lower Shizi Temple	West of the Gulao Enclosure, Poshang Village	—	—	—	—	No longer extant	—

3.5.2 “Sanjia flying dragon” folk activity spaces—cross-village and clan unity

One of the most distinctive folk activities in Gulao Waterfront is the dragon boat racing held annually during the Dragon Boat Festival. This event, known as “Sanjia Flying Dragon,” takes place at the confluence of Shaping River and Shengping River. Dragon boat racing in Gulao transcends individual villages and clans, fostering a communal belief system across settlements. First, the dragon boat races involve not only the villages within Gulao Waterfront, such as Shuangqiao, Shangsheng, Xinxing, and Poshang, but also several villages on the southern banks of Shengping River and Shaping River. “Sanjia Flying Dragon” has become a collective memory and cultural symbol for the communities along these rivers. Second, the composition of dragon boat teams spans across clans. For example, the Qixing Dragon Boat team from Shangsheng Village includes natural villages with surnames Li, Feng, Wang, Zhang, Wen, Yi, and Zhong, while the Xinlai Dragon Boat team from Shuangqiao Village represents all the surnames in the village. Thus, dragon boat racing has become a means of clan cohesion. Moreover, villagers believe that dragon boats are symbols of good fortune. They hold that “performing dragon dances, paddling the dragon boat, and taking a shower in the water with the dragon boat will ensure favorable weather, peace, and prosperity” [25]231. This belief reflects the villagers’ simple wish for safety amidst the unpredictable natural environment and underscores the shared concerns for collective well-being in an area frequently affected by floods [33].

4 Conclusions and discussion

Cultural ecology theory emphasizes the interaction between regional culture and the environment, studying them as an integrated whole. It posits that cultural heritage encompasses not only the material accumulation of the culture itself but also its natural, social, and cultural environments. This perspective offers a more comprehensive approach to understanding and protecting the heritage value of traditional Lingnan waterfront.

From this viewpoint, Gulao Waterfront has evolved

through the adaptation and transformation of its environment by its inhabitants. The town’s proximity to the Xi-jiang River and frequent flooding led early settlers to construct embankments to protect their fields, altering the internal water network and creating a distinctive settlement pattern characterized by intertwined water villages. Dike-pond agriculture emerged as a commercial agricultural practice designed to address the hydrological challenges of waterlogged areas within the embankments, which, in turn, spurred the growth and prosperity of market spaces. Additionally, in response to the frequent floods, Gulao Waterfront developed water deity worship and reinforced inter-village connections through folk activities such as the “Sanjia Flying Dragon” dragon boat races.

The spatial development and cultural ecological characteristics of Gulao Waterfront are thus marked by a central theme of “water as the lifeblood.” In the context of rapid urbanization in the Pearl River Delta, the holistic historical heritage and conservation value of Gulao Waterfront are increasingly significant and precious.

Despite Gulao Waterfront being one of the “last remaining areas with an original waterfront appearance” in the Pearl River Delta, its cultural ecological heritage has not been sufficiently recognized, leading to increasingly concerning protection conditions. On one hand, there is a lack of adequate awareness regarding the importance of preserving Gulao Waterfront’s heritage. Both the overall planning of Heshan City and Gulao Town lack specific provisions for heritage conservation, and local efforts to apply for traditional village status have been limited. The focus of Gulao Town remains predominantly on industrial development, which has resulted in the encroachment of urbanization and industrialization on the town’s periphery, with numerous pond spaces being repurposed for industrial use. Furthermore, the economic changes have led to the decline of traditional mulberry cultivation and sericulture, with pond-based agriculture rapidly diminishing. On the other hand, increasing regional tourism demand has led to recent involvement by the OCT Group in the tourism development of Gulao Waterfront. This intervention poses

significant challenges to the holistic protection of the town's heritage.

Figure and table sources

Figures 1, 4, 6, 7, 9, 10,11: Created by the author.

Figure 2: Adapted from “Historical changes of river channels in the pearl river delta”.

Figure 3: Adapted from “Historical atlas of china”.

Figures 5, 8: Adapted from qing dynasty dao guang's “Heshan county annals”.

Figure 12: Source:google maps.

Table 1: Compiled from “Heshan county water conservancy engineering annals” and field investigations.

Tables 2, 3,4: Created by the author.

Notes

1.The Tang Dynasty mid-late period ceramic kiln site was discovered in Poshang Village.

2. “Lao Clan Genealogy”: “The founding ancestor, named Wei and courtesy name Zhenyuan, was granted the title of ‘Counselor,’ originally residing in Zhuji Li, Nan-hong. After the upheaval of Empress Hu of the Song Dynasty, he relocated to Gugangzhou, Xinhui, Guangdong (later renamed Heshan Gulao during the Qing Dynasty's Kangxi period, which is now Gulao Village in Longxi Township).”

3. “Gugang Yi Clan Genealogy,” Volume 7: “The fourth generation, named Boyan, son of Kangsun... Admiring the scenic beauty of Poting Mountain, with remnants of Su Wen Zhong, settled separately from Yubridge and was born in the Yuan Dynasty's Zhiyuan year and died in the Yuan Dynasty's Zhizheng year.”

4. “West End Village History”: “The fourth-generation ancestor Boyan (1285-1357) of the Yishan family in Heshan was attracted to the scenic beauty of Poting Mountain and the remnants of Su Dongpo. He moved from Yubridge to Poshang and became the progenitor of the Poting clan, dividing into eastern and western villages.”

5. Liu Ji et al., “Heshan County Annals,” Volume 4, “Water Conservancy”

6. “Genealogy of the Wen Clan of Gulao Jiangtou,” preface: “The fourth-generation ancestor, named Shineng

and courtesy name Mengzuo... In the sixteenth year of Hongwu... appointed to the Nanjing Shence Guard... married Huang Shi... and had five sons: the eldest, Youren (courtesy name Dongyin); the second, Youyi (courtesy name Dongqi); the third, Youli (courtesy name Dongya); the fourth, Youzhi (courtesy name Dongzhuang); and the youngest, Youxin (courtesy name Dongqiao). He married Lv Shi and had two sons: the eldest, Qiong (courtesy name Rubi), settled in Weidun Township.”

7. “The Eighth Generation Ye Clan Genealogy” states: “YeHao... a scholar in the first year of Shaoxing, Song Dynasty (1131)... passed down to the eighth generation, with Jingxiu Gong's two sons migrating to Weidun.” Based on the temporal gap between the first and eighth generations and corroborated by village interviews, it can be inferred that the Ye clan migrated to Gulao Waterfront during the Ming Dynasty.

8. “Brief Biography of Mo'an of the Huang Clan”: “Mo'an initially moved to Poshang... After the completion of Gulao Weir, he relocated to the present site of Renhe Village.”

9. Guangdong Provincial Local History and Chronicles Editorial Committee, “Historical Materials of Guangdong during the Qing Dynasty (Volume I)”[M]. Guangzhou: Guangdong Map Publishing House, 1995: “In the Guangzhou and Zhaoqing regions, the embankments along the river have long experienced breaches... In the first year of Qianlong, Supervisor E Mida and Zou Qing utilized salt revenue for repairs... The local officials were still required to supervise the people in repairing the embankments during agricultural off-seasons... In the event of erosion or damage, the embankment residents were required to make repairs themselves, as a permanent practice.”

10. Song Sen et al., “Heshan County Annals,” Volume 4, “Chronological Records”: “In the twentieth year of Jiaqing... the Gulao Weir embankment collapsed... In the autumn of that year, County Magistrate Zhang Chexun established a repair office for the embankment.”

11.Xu Xiangzu et al., “Heshan County Annals” dur-

ing the Daoguang Era, Volume 1, “Administrative Structures”: “In the fourteenth year of Qianlong, Zhang Zhentao’s detailed account of the repair costs for the Gulao Great Embankment, with annual calls for tenancy, the rental amount was undetermined. In the eighteenth year of Jiaqing, it was still assigned to gentry for tenancy approval.”

12. Liu Ji et al., “Heshan County Annals” during the Qianlong Era, Volume 7, “Resources.”

13. Xu Xiangzu et al., “Heshan County Annals” during the Daoguang Era, Volume 2, Part 2, “Geography.”

14. Song Sen et al., “Heshan County Annals” during the Republic of China, Volume 1, “Territorial Records.”

15. Same as above.

16. Liu Ji et al., “Heshan County Annals” during the Qianlong Era, Volume 1, “Customs.”

17. Xu Xiangzu et al., “Heshan County Annals” during the Daoguang Era, Volume 2, Part 2, “Geography.”

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