The Practice of Guangzhou Port Planning Environmental Impact Assessment

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Abstract. In this paper, the effects of the implementation of Guangzhou port plan were analyzed from hydrological condition, water environment and ecological environment. Regional water environmental carrying capacity was analyzed. Guangzhou port is a main port in the coast of China, it is an important port of foreign trade in south China, it is an important port for energy supplies and raw materials in Guangdong province [1]. With the shipping channel condition improvement and the construction of large specialized container port area, Guangzhou port will gradually become trunk line port of container transport in south China.

Keywords: Guangzhou port; Plan; Environmental Impact Assessment

1. General Planning of Guangzhou Port

Guangzhou Port includes Harbor port area, Huangpu port area, Xinsha port area, Nansha Port Area and the Pearl River Estuary. The harbour includes 15 terminals; mainly provide energy, raw materials, food, bulk cargo and container handling and passenger transport services for guangzhou and the pearl river delta region. With the needs of urban development and comprehensive development, some terminals will gradually adjust existing functions; Huangpu port is mainly responsible for the transportation of bulk goods such as coastal, near-ocean container transportation and grain, coal, fertilizer and oil products; Xinsha port is mainly transported by container, coal, ore, grain and fertilizer; Nansha Port area is a comprehensive port area, include four operating areas such as Shazai island, Xiaohu, Luwan and Nansha area. The main functions of Shazai island operating area are car roll-roll shipment and general cargo transportation, the main functions of Xiaohu operating area are energy and liquid chemical transportation, Luwan operating area’s function is general cargo transport, Nansha operating area’s function is foreign trade container transportation, corresponding develop the functions of bonded, logistics and commerce.[2-3].

2. Analysis of Impact of Planning on the Environment

2.1. Analysis of Impact of Planning on Hydrodynamic Environment

According to the plan, Nansha operating area have reclamation projects, these projects will have a certain impact on the hydrodynamic conditions.

Nansha operating area covers the whole Long Xue island reclamation projects; the reclamation area is 17km2. In addition, two excavation ports are formed in the central and northern part of Nansha operating area. Reclamation projects and excavation ports will have some influence on the hydrodynamic conditions of the area. The influence on hydrodynamic environment is analyzed by using two - dimensional flow mathematical model.
Set the velocity contrast points around the planning scheme (Figure 1), the changes of points’ velocity before and after the plan implementation are shown in table 1. From the table, it can be seen that the velocity of point A.B.C.D is almost unchanged, and only the point E causes the increase in velocity due to the narrowing of the channel. It is indicated that the planning scheme conforms to the trend characteristics of the area, and the overall planning scheme will not cause significant changes in the hydrodynamic conditions of the area.

![Figure 1. Velocity contrast feature point](image)

Table 1. Velocity of contrast points before and after the plan implementation

| time of tide | point | tide | before | after | neap | before | after |
|-------------|-------|------|--------|-------|------|--------|-------|
|             |       |      | velocity | flow | velocity | flow | velocity | flow |
| rising tide | A     | 0.49 | 291.8   | 0.49  | 290.4   | 0.41  | 291.5   | 0.41  | 289.0 |
|             | B     | 0.80 | 327.4   | 0.80  | 325.2   | 0.61  | 327.2   | 0.61  | 325.1 |
|             | C     | 0.62 | 333.6   | 0.61  | 327.4   | 0.58  | 334.4   | 0.56  | 327.9 |
|             | D     | 0.51 | 351.5   | 0.49  | 351.4   | 0.72  | 347.5   | 0.67  | 347.0 |
|             | E     | 0.53 | 336.2   | 0.68  | 344.7   | 0.53  | 336.1   | 0.55  | 344.5 |
| falling tide| A     | 0.92 | 110.5   | 0.92  | 109.0   | 0.89  | 109.5   | 0.89  | 107.9 |
|             | B     | 0.87 | 143.2   | 0.87  | 142.3   | 0.65  | 143.8   | 0.65  | 142.4 |
|             | C     | 0.90 | 154.9   | 0.90  | 150.8   | 0.67  | 154.7   | 0.67  | 149.1 |
|             | D     | 0.78 | 168.9   | 0.77  | 166.9   | 0.78  | 164.5   | 0.77  | 161.8 |

2.2. Analysis of Impact of Planning on the Water Environment

2.2.1. Nansha Port. Sewage treatment plants are planned for the four operating areas of Nansha port; the processing capacity of the planned sewage treatment plants can meet the recent and long-term sewage treatment requirements.

2.2.2. Xinsha Port. The Xinsha port company has equipped with a certain amount of sewage treatment facilities, the existing processing capacity can meet the sewage treatment requirements. In the future, Xinsha port will focus on developing container berth, which will make the port sewage quantity increased. However, due to the relatively single pollution factor contained in sewage, the wastewater from the forward port can be treated with urban sewage treatment plants as the continuous improvement of urban sewage pipe network.
2.2.3. Harbor Port and Huangpu Port. The plan will adjust the existing functions and reduce the size of the Harbor port, some of the coastline is changed to the city life, this will be beneficial to control and gradually reduce the amount of sewage produced in the Harbor port.

Technological transformation will be carried out in Huangpu port, therefore, in the process of technological transformation in the wharf itself, the environmental protection facilities that accompany it need to be upgraded simultaneously to meet the requirements of pollutants discharge under certain standard or recycling.

2.3. Analysis of Impact of Planning on Ecological Environment

2.3.1. The Impact of Reclamation Projects on the Ecological Environment and Suggestions for Protection. Reclamation projects occupy the water area and can cause irreversible effects on ecological environment. The reclamation projects in the Nansha operation area will directly result in the biological loss in the area of the sea, the loss of benthic organisms is about 651.84t, and the loss of fish eggs and larvae is about \(3.62 \times 10^6\).

In order to mitigate the impact of planning implementation on aquatic biological resources, it is suggested to take the method of enhancement and releasing to make ecological compensation.

2.3.2. The Impact on Yellow-lip Fish Municipal Nature Reserve and Suggestions for Protection. Yellow-lip fish is a national secondary protection aquatic animal. On January 12, 2005, Dongguan city approved the establishment of yellow-lip fish nature reserve in Humen waters area. The nature reserve area is 686hm, the core area of the reserve is located in waters around Weiyuan island.

This plan does not have any development activities on the coastline of Weiyuan island, so the plan implementation will not have a direct impact on the yellow-lip fish municipal nature reserve. But the Luwan operating area is closer to the protected area; the suspended objects produced during construction will have a certain effect on the growth of yellow-lip fish eggs and larvae, and further affect the health of yellow-lip fish populations. The spawning period of yellow-lip fish is from March to June, so construction should be restricted during this period.

2.3.3. The Impact on Dahu Island Brackish Fishing Spawning Area and Suggestions for Protection. Shazai island, Xiaohu and Luwan operating area are located on the north side and west side of Dahu island, these operating areas are closer to Dahu island. The construction work of the wharf will cause the suspended solids to form a high concentration diffusion field in a certain range. Excessive suspension in water will reduce the dissolved oxygen and light transmittance, this will change photosynthetic intensity of marine organism and reduce primary productivity in local waters. Furthermore, the brackish fishing spawning activities of the Dahu island were affected.

The main economic fish spawning periods in the Pearl River estuary are concentrated in March and August. Therefore, in order to effectively protect the Dahu island brackish fishing spawning area, it is recommended to strengthen the management of the area, which will be protected from March to August every year. During this period, the construction work of port should be restricted. During the operation of the port, it is recommended to control the quantity of large vessels which water depth greater than 10m in March and August, and to control the speed of all passing vessels. Honking should be strictly prohibited.

2.3.4. The Impact on Tan Tou Mangrove Forests and Suggestions for Protection. The Tantou mangrove forest is mainly distributed in the waters around the Humen ferry terminal, the east side of Ma An Chong sea and the two sides of the He Cheng Chong sea. The mangrove forest along the coast is generally 30-50m, and the widest part is about 80m. The mangroves on both sides of the river are elongated and generally 5-10m wide, the whole natural mangrove area is 5ha.

The Tantou mangrove forest is located in the planned Xiaohu operation area, both sides of the mangrove have been developed, only 400m natural mangrove forest coastline is reserved. In order to
protect the remaining natural mangrove forest, it is suggested to adjust the coastline to the ecological protection of mangrove forest.

3. Water Environment Carrying Capacity Analysis

3.1. The Constraints of Environment

The carrying capacity of water environment is under certain constraints. The concentration of pollutants in seawater can't completely homogenization when sewage into the sea, it will form a range of mixed zone (A region where water concentrations exceed the standard concentration of water quality). According to the pollution control standard of sewage Marine disposal engineering, environmental constraint is the mixed area which less than 1km², and the environmental capacity is predicted by COD.

3.2. Outlet Location

The Nansha operation area is located in the northwest waters of Lingdingyang, and it is reasonable to set the sewage outlet in the central part of the east side of the Nansha operation area. The sewage outlet is located in the III class functional area. This area is conducive to the spread of pollution; its COD average concentration of background is 2.5 mg/L.

3.3. Source Intensity of Pollution

According to the water pollutant emission limit of Guangdong province, the COD primary emission concentration is 40mg/L, assuming that the amount of sewage is 500,000 m³/d and 200,000 m³/d respectively, and its predicted source intensity is 231.5g/s and 92.6g/s.

3.4. Forecast Results

The pollutant concentration distribution can be obtained by using the diffusion equation and the two-dimensional flow prediction model.

Under the condition of the above calculation, the COD in sewage diffusion is calculating until the biggest COD concentration envelope basically area is stable. The predicted results of the added water quality (2.5mg/L) were as follows, the area of mixed characterized by COD is 0.75km² and 1.52km² when the daily emission is 200,000m³ and 500,000 m³ respectively. Although it is difficult to calculate the amount of 1 km² from the prediction calculation, however, it can be stated that under the forecast conditions, the water environment carrying capacity of a single sewage outlet in the Nansha operation area is more than 200,000m³/d, less than 500,000m³/d. In the case of linear relationship, the water environment carrying capacity is about 300,000m³/d.

4. Conclusion

The practice of Guangzhou Port planning environmental impact assessment shows that environmental impact assessment can effectively promote the planning’s ecological environmental evaluation and meets the demands of environmental protection.

5. Acknowledgement

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6. References

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