Study on the Improvement Path of Water Environment Quality -- A Case Study of Tianjin

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Abstract. In recent years, although the water environment quality of Tianjin has improved, there are still some problems such as poor water environment quality, shortage of water resources and weak water ecological function. Based on the analysis of the current situation of water environment in Tianjin, this study analyzes the existing problems and puts forward the implementation path matrix of water environment protection, which can reduce water environment pollution.

1. Introduction
Tianjin locates in the lower reaches of Haihe River Basin, with a dense network of rivers and numerous depressions, including seven major water systems in Haihe River Basin and Luanhe River Basin. There are 19 first-class rivers mainly for flood discharge, with a total length of 1095.1km, and 109 second-class rivers mainly for flood drainage, with a total length of 1363.4km.

2. Analysis on the current situation of water environment quality and water pollutant discharge
The environmental quality of surface water has been improved year by year. From 2014 to 2018, the permanganate index and ammonia nitrogen concentration of main rivers entering and within Tianjin decreased year by year. Compared with 2014, the permanganate index decreased by 33.6 percentage points and ammonia nitrogen decreased by 50.6 percentage points; compared with 2014, the permanganate index decreased by 15.4 and 30.4 percentage points respectively, and the environmental quality of surface water improved year by year.

The pollution sources are divided into three categories: industrial sources, agricultural sources and domestic sources, and the discharge amount of water pollutants is fine calculated. The total discharge of COD, ammonia nitrogen and total phosphorus in Tianjin is 141381.7 tons, 7280.1 tons and 1489.9 tons respectively. Among them, the highest COD emission is from agricultural sources, accounting for 66.9% of the total; ammonia nitrogen is mainly from agricultural sources, accounting for 78.2%; total phosphorus is mainly from agricultural sources, accounting for 68%.
Table 1. Current situation of pollutant discharge in Tianjin

| pollution sources | COD(ton) | ammonia nitrogen(ton) | total phosphorus(ton) |
|-------------------|---------|-----------------------|----------------------|
| Direct industrial source | 1623.7 | 71.9 | 7.2 |
| Industrial Park sewage treatment plant | 1980.9 | 99.0 | 23.2 |
| Planting | 20878.8 | 4175.8 | 292.3 |
| Aquaculture | 26996.1 | 1066.0 | 216.0 |
| Animal husbandry | 46734.5 | — | 509.7 |
| Rural life | 18227.9 | 926.2 | 91.9 |
| Urban sewage treatment plant | 24345.5 | 897.2 | 341.7 |
| Rural sewage treatment station | 594.3 | 44.1 | 7.9 |
| Total | 141381.7 | 7280.1 | 1489.9 |

The COD emission of pollutants is mainly concentrated in the northern part of Tianjin, accounting for 45.3% of the total emission of Tianjin; secondly, the total emission of COD in the eastern and southeast regions is relatively high, accounting for 28.6% of the total emission. The COD emission in the northern and western regions mainly comes from agricultural sources, followed by domestic and industrial sources. Ammonia nitrogen emissions are mainly concentrated in the northern part of Tianjin, accounting for 46.7% of the total emissions of Tianjin, followed by the southern part of Tianjin, accounting for 17.2% of the total emissions. The main source of ammonia nitrogen in all regions of Tianjin is still agricultural. The total phosphorus emissions of the northern and eastern regions are higher, accounting for 43.0% and 21.6% of the total emissions of Tianjin respectively. The total phosphorus emission in the northern and eastern regions is mainly from agricultural sources, followed by living and industrial sources.

3. Analysis of Issue
The quality of water environment in Tianjin still needs to be improved. The reasons are summarized as follows: 1. Serious shortage of water resources; 2. Weak ecological function of river water; 3. Insufficient ecological flow; serious shrinkage of Lake wetland area; 4. Hidden danger of drinking water safety.

4. The improvement path of water ecological environment protection in Tianjin
Follow the water control policy of "water saving priority, space balance, system management and two hand efforts", adhere to the four water (water environment, water security, water resources and water ecology) as a whole, adhere to the quality guidance, system governance, water bank co governance, unit control, river sea linkage, land and sea as a whole, firmly promote the river system and lake system, adhere to the two hand efforts of pollution reduction and ecological capacity expansion, and continue to improve. The level of drinking water safety guarantee shall be accelerated, the treatment of industrial, agricultural and domestic pollution source systems shall be accelerated, the water resources shall be saved and optimized, and the efforts of water ecological protection and restoration shall be continuously increased, so as to achieve the overall improvement of water environment quality of the whole city as soon as possible, the ecological flow shall be fully guaranteed, and the function of water ecological system shall be realized in a virtuous circle. Reappear the "North China Water Town" with shallow bottom and dense water network.
Table 2. Implementation path matrix of water ecological environment protection in Tianjin

| Water Environment | Year 2021-2025 | Year 2026-2030 | Year 2031-2035 |
|-------------------|---------------|---------------|---------------|
| Water environment control-unit control | A new round of renovation of sewage treatment plant | Full resource utilization of sewage treatment plant drainage | |
| Full collection of municipal sewage | Stable operation of rural sewage treatment facilities | Strive to achieve zero growth of pollution load of water intake and drainage | |
| Operation of rural sewage treatment facilities | Total amount control of water pollution by total nitrogen and total phosphorus | | |
| Water security | Long term and stable compensation for upstream and downstream of Luan River Diversion | All the cities and drinking water sources meet the standard stably, realizing the guarantee of double water sources | Establish an effective prevention system for drinking water, groundwater and water pollution |
| Rural quality improvement and efficiency improvement | Establish an effective emergency plan system for water supply safety | Determine people by water and control population size | |
| Coordinated treatment of surface water and groundwater | Optimize industrial layout, planting and breeding structure, and control population size | Total amount control of aquaculture | |
| Joint prevention and control of upstream and downstream water pollution | | | |
| Water resources | Agricultural water price reform and industrial water saving | The water use efficiency and the red line of total water use have met the national assessment requirements and reached the national advanced level | Guarantee stable ecological flow |
| Increase the proportion of reclaimed water and desalinated water | Building sponge City | Further optimization of water resources allocation | |
| Maintain stable ecological water volume | Construction of artificial wetland, river and lake vegetation buffer zone | Carry out water ecological health assessment regularly | |
| Water ecology | Preliminary establishment of water ecological index system | Water ecological indicators included in assessment | Increase the proportion of water ecological assessment | |

5. Conclusion
In summary, The following measures should be taken to protect the water ecological environment in Tianjin:

1. We will strictly manage water resources and strengthen conservation. We will implement the strictest water resource management system and continue to improve water use efficiency.

2. We will ensure the safety of water use, prevent environmental risks, strengthen the protection of drinking water sources, strictly control the development of high water consumption and high drainage industries, strengthen the prevention and control of groundwater pollution, and strictly prevent water environmental risks.

3. We will carry out river basin system management, strengthen control unit management, deepen industrial pollution control, make up for the shortage of urban infrastructure, further promote the
prevention and control of agricultural and rural pollution, and strengthen the treatment of port ship water pollution.

4. Strengthen the protection and restoration of water ecology, implement the ecological water quantity, strengthen the connection and circulation of water system, and increase the construction and protection of rivers and lakes.

5. Improve the environmental management system, improve the level of refinement, strengthen the construction of environmental supervision capacity, and improve the environmental management system.

6. Establish the linkage mechanism of water ecological protection in Beijing, Tianjin and Hebei, establish the long-term mechanism of ecological compensation in the upstream and downstream of Luan River Diversion, strengthen the linkage of pollution control in the upstream and downstream, and establish the coordination and linkage mechanism of long-term management of cross-border rivers and lakes in Beijing, Tianjin and Hebei.

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