



Management and conservation strategy for Taipei Water Resources District

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Abstract

Taipei Water Resources District is located in the south-eastern part of Taipei basin. The administrative district belongs to New Taipei City and the total area is about 717 km², which covers approximately one-third of New Taipei City. There are Beishi River, Nanshi River, Xindian River and some important water supply facilities including Feitsui dam, Zhitan dam, and Qingtan dam in this area, which are the sources of five million people's water supply in the Taipei area; therefore, water resource conservation is very crucial in this area.

Taipei Water Resources District is the first nationally managed water resources, water quality & quantity conservation area by the "City Planning Act" and the "Water Supply Act". Other than business objective act, Taipei Water Management office was also established for water resources conservation purposes. In recent year, due to climate change and locals fighting for their benefits in the conservation area, the approach of managing Taipei Water Management Office has gradually become both managing and finding solutions. Under the implement of managing and resolving from various aspects, Taipei Water Management Office is able to supply excellent drinking water for many years. The Carlson Trophic State Index (CTSI) in the Feitsui reservoir has been maintained at a mesotrophic level; also, rivers' RPI in the area have also been controlled at the best level. Moreover, the sediment accumulation rate is also lower than the expected level, meaning great management has been implemented.

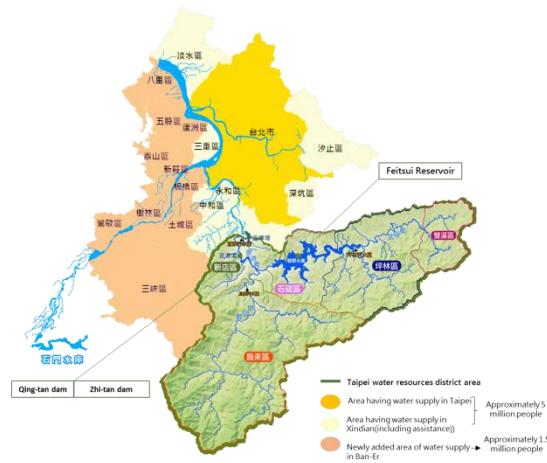
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1 Taipei Water Resources conservation area's history and mission

In order to render clean and safe drinking water, and sustainable water usage, in 1979, Xindian River Qing-tan water resources and water quantity conservation area was set up according to "Water Act" in 1979. In 1984, Taipei Water Resources Urban Planning area and Taipei Water Resources conservation area committee were established to manage the area. In 2002, the committee was renamed "Water Resources Agency, MOEA, Taipei Water Management Office". Currently in the jurisdiction, other than setting up "Xindian River Qing-tan Water quality and quantity conservation area" according to the water act, "Taipei Water Resources District" was also established.

The main catchment areas include Beishi and Nanshi River. The catchment area of Beishi River is located at Pinglin District of New Taipei City, and a part of it in the District of ShuangXi and Shiding. The catchment area of Nanshi River is located in the district of Wulai and a part of Xindian, and Xindian River is where both Rivers meet. Important water facilities in the area are Feitsui reservoir, Qing-tan dam, Zhi-tan dam, Cu-keng dam, Gui-shan dam, Luo-hao dam, and A-yu dam. The facilities provide water for Taipei City and San-chong, Xindian, Zhong-he, Dan-shui, San-zhi in New Taipei City, and after the project of Banxin Water Supply Plann II is done, they will be providing water to more than six million people.

Taipei Water Management Office of Water Resources Agency, MOEA, is responsible for managing the Qing-tan dam's water quality and quantity conservation area, and it also governs building management, land usage, water resources conservation, sewage treatment, and water environment monitoring..



Picture 1: Taipei Water Resources District range and related water engineering facilities

2 Strategies for management

2.1 Building regulations

According to “Urban Planning Act”, Taipei Water Resources Conservation area breaks down the area into residential area, commercial area, conservation area, and agriculture area. Projects in the jurisdiction include Xindian Water Resources district plan, Wulai Water Resources district plan, Pinglin Water Resources district plan, and Taipei Water Resources district plan. Our office is the competent authority of building managing of Taipei Water Resources district plan, and this is the main difference from other authorities in other districts.

95% of the area is conservation area, and residential area only accounts for 0.4%. Low building density is employed to achieve a low pollution to water resources. Some related building regulation standards includes Building density 30%~60% (normally

50%) ;Building bulk ratio 60%~120% (normally 120%) ;Residential area and legal house construction need to have a minimum distance of 8 meters.

2.2 Land Regulations

In order to ensure the safe water resources and environment conservation, the jobs are:

- Violation patrol and dealing : All related land use should follow “Taipei Water Resources District land use regulations” to prevent land overuse, deforestation, unregistered burial, unregistered collecting, stacking soil or rocks, unregistered mining, unregistered road construction, overuse, stacking wastes, etc. Staffs patrol with police officers, collect samples to monitor pollution, and patrol campsites, viewing points, deer farm, and cemetery. When violations occur, New Taipei City Government will take part in these cases Moreover, the results are analyzed for avoiding pollution from source.
- Entertainment Management : We deal with ecological preservation management at Tong-hou River and Nei-dong River to cut down pollutions from camping, swimming, grilling, and vehicles.
- Crucial pollution management : Pig farms relocating took place from 1988-1989, and 6000 pigs were bought off. 621 boats were bought off which efficiently cut down water resources pollution.
- Gradually collecting lands above 171 m. From 1987 to 1994, 1785 ha of land were managed, and reforestation is executed for an area of 588 ha. On the other hand, village relocating plan is reinforced within 50 m of the buffer zone of the Feitsui reservoir, which the total area is 1054ha and 345 ha of area underwent reforestation.

2.3 Soil and Water Conservation

Conservation projects have been focusing on blocking soil. Recently, due to the issue of environmental conservation and the area of conservation in the district is more than 95%. , the core value of the conservation area has become preserving the harmony among water, soil, and forest, and the main concern is natural restoration. We emphasize “conservation and managing altogether”, and enhance environment survey, monitoring projects, and non-engineering managing approaches. The goal is to minimize the engineering area in order to preserve the natural environment.

- Engineering and non-engineering approaches: Engineering projects not only need to consider concepts, systematics, benefits, and risks, but also have to stress on ecology culture, cut down carbon, quantity, pollution, resources utilization, intelligent managing; non-engineering approaches include basic data construction, Nan-shi and Bei-shi River’s disaster investigation and planning,

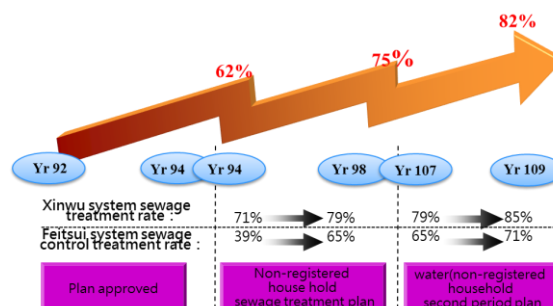
enhance risk managing, combine engineering facility's security checks with intelligent database system.

- Enhance ecological analysis and participation of public: Focus on each stage of life cycles to confirm ecology's situation. Through ecology evaluation and communication, conservation strategies appear and ecology conversation and public participation can be achieved. For the ecology sensitive area's project, actions such as avoidance, minimize, decrease, compensation have been called out to alleviate the construction impact on the ecology.

2.4 Point(sewage)pollution treatment

In 1985 and 1989, two major sewerage systems in Nan-shi River and Bei-shi River were built. In 2009, "Taipei Water Resources District sewerage system unregistered household managing plan" is finished, jurisdiction.

- Xin-wu region sewerage system : Construct Wu-lai and Zhi-tan level 2 sewage treatment plants, six small sewage treatment plants, 13 large sewage pumping stations, 43 small pumping stations and related pipes network system.
- Feitsui reservoir upstream region sewerage system : Construct level 3 Ping-lin sewage treatment plant, 3 small sewage treatment plants, 15 large pumping stations, 17 small pumping stations, and four public washrooms.
- Small sewage treatment plants are constructed for rural or scattered households. Private developed land use is regulated according to "Taipei Water Resources district plan", and the fees for constructing sewage treatment plants and the pipes network system are paid by the land developing company itself.
- The current sewage treatment efficiency is 75.46%, and in order to improve the efficiency, the water resources management office is working on "Taipei Water Resources District sewerage system unregistered household plan 2nd phase". It is expected that when the project is finished, the sewage treatment efficiency will reach 81.56% in 2020. In the future, the sewerage system will be electronically managed, and the efficiency will gradually reach 100%.



Picture 2: Taipei Water Resources District Unregistered Household Resolving Executive Plan

2.5 Non-point pollution reduction

Non-point pollution reduction project are focusing on Tea plantations of Feitsui reservoir catchment area.

- Pinglin district Ren-li Ban demonstration area(BMPs): For the non-point pollution caused by heavy rain wash at the tea plantations of Jingua Liao Watershed and the around forests, water purification plant was constructed. It collects surface run-off at tea plantations and use artificial wetlands' infrastructure to purify the water which is discharged into Jin-gua Liao River after it was treated. Through BMP structural measures and non-structural measures, the total amount of phosphorus in the stream, BOD, and SS can be cut down 50~70%. With the aids of the micro-organic decomposition and the absorption of plants, a reduction of N and P can be achieved.



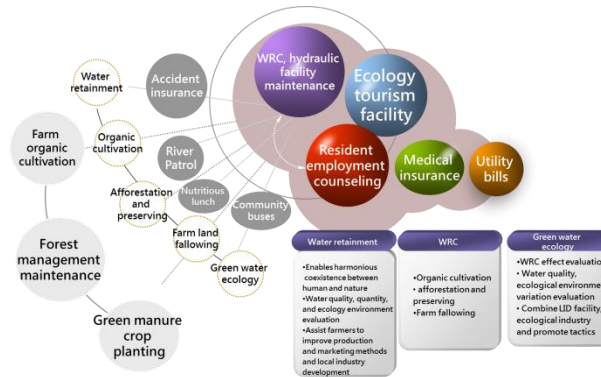
Picture 3: Promote LID innovation

- Ping-lin district low impact development(LID) measures : Artificial wetlands require a larger area, so it's harder to promote. In 2013, our office imported the concept of LID. By permitting through bio-retention slot, staying, and evaporating, heavy rain run-off is reduced and can treat water quality at the same time. This is utilized for tea plantation non-point pollution reduction, and because only small area is required, using leftover land is sufficient for cultivation. The area of farm land is greatly reduced, and this can stimulate farmers to cooperate and enhance environmental-friendly product development.
- Continue to promote LID innovation : Since 2018, the office promote tea plantation LID optimized configuration and LID facility system modularization operation. This not only can be used to come up with short, medium, and long term strategies for non-point pollution reduction, but also can be used to provide user-friendly controlling mode.

2.6 Conservation compensation

People whose rights are limited due to living in the conservation area will be compensated. The conservation area's water conservation and compensation fee started

to be charged since 2006, and the fees are used to maintain basic facilities of ecological conservation and to compensate locals' public benefits and the land use restrictions they faced. The yearly funding is around a quarter billion NTD and is distributed to the five district offices. "Xindian River Qing-tan water quality and quantity conservation area utility team" is formed to supervise how fee is used.



Picture 4: Water Resources Conservation and Compensation utilization Diagram

Moreover, in order to take care local industry's development and the environment at the same time, our office continues to promote water preservation, green-water ecology, construct environmental-friendly cultivation, counselling organic cultivation, and forest management, etc. The jobs promoted includes water resources preservation ,water resources conservation, and green water ecology.

2.7 Intelligent management

For intelligent management, model development combining with business is promoted.

- Construct the system of internet of things to sense internet deployment in order to reach instant compensation, efficient management, and human resources saving. The information source includes LID/BMP monitoring results, hydrology water quality monitoringa, sewerage system management results, land covering and monitoring, intelligent electronic eye CCTV and vehicle monitoring system, etc. By massive data analysis and integration techniques, intelligent assisting managing mechanism can be provided.
- Combine WRA perspective intelligent water management and water resources internet platform, share and use the data.
- IOT demonstration zone : (1)Setting up inclinometers at the upstream flood wall of Lan-sheng bridge, and setting up alert and mobile management staffs. (2) Setting up slope monitoring system and forecast mode at Tai 9th Jia Wu-lai Zhong-zhi Duan side slopes, sending back data to platform for slope safety monitoring. (3) Inspecting facilities and prevention maintenance device, setting up inclinometer to detect engineering facility displacement and safety situation (4) Setting up management platform of sewerage system and monitoring

facilities' voltage and water level for analysis. (5) Adding water quantity monitoring to LID In-Situ management facility to assist on maintaining water flow.

2.8 Water Resources Conservation Environmental education promotion

We raise water conservation minions and construct a series of water conservation teaching materials. and cooperate with local NGO teams, community residents, and governmental institutions in jurisdiction.

- We go deep into schools and crowds to actively involve related organizations of water conservation propagating campaigns.
- Enhance local cooperation, and combine local community, schools, NGO team, and governmental institutions to promote interactions.
- Construct 5-star environmental education center: Taipei water resources district environmental education learning center is certified by the EPA. This includes the sewage treatment plant in Ping-lin and water quality purification demonstration zone in Ren-li Ban.
- Later, we will continue planning environmental-education's locations, and will be doing cross-region cooperation and resources sharing with Feitsui reservoir management office and Taipei Water Supply Division.

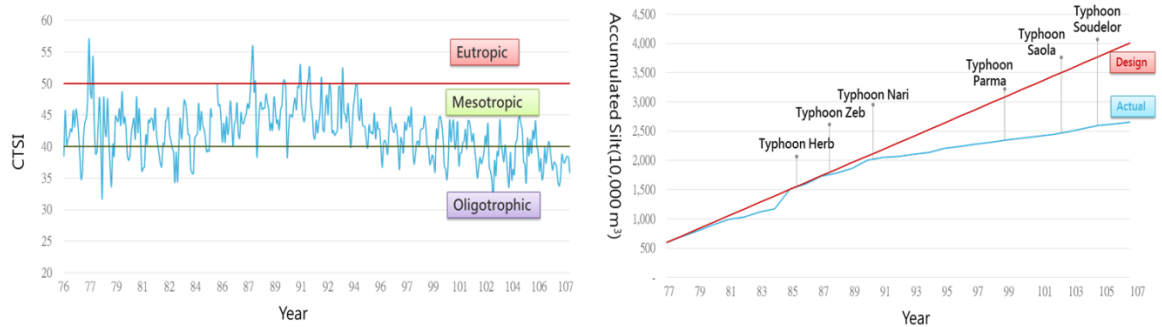
2.9 Future Outlook

For reaching a balance between developing and conserving the environment can be achieved ,we drafts four main goals and five executive strategies

4 Main Goals	5 Executive Strategies
	Soil conservation to reduce disasters, enhance resilience to natural disasters
Slow down the process of soil loss	Point&non-point pollution reduction
Maintain excellent water quality	Improve water environment and land management monitoring
Maintain steady water quantity	
Risk management that covers ecology and industry	Local industry development and conservation of the environment at the same time
	Enhance risk management and environmental education

3 Conclusion and recommendations

- The Feitsui reservoir's accumulation rate is far lower than that designed; moreover, the Carlson trophic state index (CTSI) in Feitsui reservoir stays at a mesotrophic level, and the RPI of the rivers in jurisdiction are all maintained at minor to non-polluted level, which indicates great management results.



Picture 5: Feitsui Reservoir CTSI and Accumulation Rate throughout the years

- Some restricted area and matters can be discussed further, and goals and strategies can be planned to reach a balance.
- Some intelligent management has been conducted and shows good results. We will use big data analysis and go further to develop water resources network for jurisdiction's industry management assistance.
- The district covers a large area, and it's necessary to work with the local groups and form a team using funds and counseling.
- In the future, by enhancing the cooperation between schools and communities, and listening to local residents' voice, a more efficient management mode can be drafted. Simplification of customer service and operation standardization are trends of service, and this can effectively improve service efficacy.

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