The System of Sewage and Domestic Wastewater Treatment Plants in Tan-Sui River Basin*

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ABSTRACT

Tan-Sui River Basin covers Taipei metropolitan area of 2,726 square kilometers with more than six million residents. Since 1988, Taiwan government started to plan and construct an integrated sewerage system, consisted by both separated and concentrated trunk sewers, wastewater treatment plants and ocean outfalls. This presentation will introduce the master plan and major facilities of Tan-Sui River Basin sewerage system. Other measures to protect general water quality and the environment of adjacent river basin area of Tan-Sui River and her tributaries by Taiwan EPA will be presented as well.

TAN-SUI RIVER RESTORATION PROJECTS

In addition to system of wastewater treatment plant system in this article, Taiwan EPA has administered an integrated Tan-Sui restoration project. The following are the four major goals:

- Sufficient dissolved oxygen of river water even under dry season.
- Free of debris upon surface of Tan-Sui river and its tributaries.
- Ensure of drinking water with safe quality and sufficient quantity.
- Creation of new recreations areas among riverside.

Hence, the integrated Tan-Sui restoration project also consists other administrative measures, like: extensive enforcement of industrial and agricultural point source of pollution; non-point source control of upstream tea plantation; decision making system combined with water quality models for basin-wide point source control; wide-ranged landscape engineering for riverside recreation facilities, etc. Fully treatment of domestic sewerage is still the core of the integrated Tan-Sui restoration project, therefore, this article will focus on sewerage system of Tan-Sui river basin.

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THE SEWERAGE SYSTEM IN TAIPEI CITY

The revised "Plan of Sewerage System in Taipei City" had been accomplished in 1986, trunk sewers, secondary sewers and household connections have been established actively. In order to lend impetus to the successive development, operation and management of sewerage system, the "Second Stage Development Plan of Sewerage System in Taipei City" had been accomplished in 1998.

Objective

1. Service area in Taipei City: 27,180 ha.
2. Sewerage system service area: 12,506 ha.
3. Target Year: 2020.
4. Population Served: 3,500,000.
5. Project Wastewater Flow-rate: 1,530,000 m^3/day.

Main Contents of the Project

After the "Common Outfall Facilities of Taiwan Province and Taipei City" being accomplished, the sewerage system in Taipei City will include four collection and treatment systems that are 1.Min-Shen Sewerage Treatment Plant, 2.Noi-Hu Sewerage Treatment Plant, 3.Di-Hua Sewerage Treatment Plant, and 4.Pa-Li Sewerage Treatment Plant.

The main engineering contents include trunk sewers, secondary sewers, lateral sewers, tributaries and household connections, pumping stations, night soil dumping stations, treatment plants and outfall facilities. The implement is scheduled on base of various phases and various regions. The important projects that are under executing include:

1. Di-Hua Sewerage Treatment Plant Upgrading Project.
2. Nei-Hu Sewerage Treatment Plant Newly Established Project, and Nei-Hu Sewerage Collection System Project.
3. User Connections Project: The household connection rate is more than 41.06% in the end of 1998. The project develops lateral sewers, tributaries and household connections continually in the area where trunk sewers and secondary sewers had completed, and to forge ahead the policy goal of 60% household connection rate in the end of 2002.

DEVELOPMENT OF THE SEWERAGE SYSTEM

The construction of sewerage system in Taipei City have taken in order to trunk sewers, secondary sewers, lateral sewers, tributaries and household connections respectively. The construction technologies of each system have taken appropriate measures in accordance with local traffic impact at construction site and the properties of collection pipelined.

For trunk sewers and secondary sewers, tunneling jacking construction method is used usually, the characteristic of this method are construction an underground vertical shaft, then the sewers can be pushed for reasonable distance through the ground. The alignment can be curvilinear base on a special curvature radius, to reduce the number of vertical shaft. The traffic impact on the ground surface can be minimized. Expect Nei-Hu area, trunk sewers have been completed 100%; secondary sewers have been completed 97.8% presently.

As most lateral sewers were set up in narrow alley in the Taipei municipal area, the KCMM and the PMP II tunneling jacking method with main cavern mode round well from Japan has been conducted to Taipei. These methods have small vertical shaft size, use integrated mechanized operation, complete the vertical shaft in the minimized period, and covered by temporary decking, so as to have traffic impact minimized.

There a lot of houses built illegally in Taipei municipal area, a passage at least 1.5 meter wide between houses has to be cleared before tributaries and household connections can be constructed. In order to have citizen's supporting of construing the household connections in narrow alley, the public explanation showing the reference space layout of sewer construction and maintenance has held before construction work start. To repress odor impact and shorten workdays, deodorizing boxes, junction boxes and plastic manholes had been developed and improved successfully.

SEWAGE TREATMENT PLANTS IN TAIPEI CITY

Presently there are 3 sewage treatment plants in Taipei City, together with Pa-Li Sewage Treatment Plant, which is managed by Taipei City Government on consignment basis; the treatment capacity suffices to treat the sewage produced in Taipei Area. While Min-Shen Sewage Treatment Plant and Pa-Li Sewage Treatment Plant and Nei-Hu Sewage Treatment Plant are in construction. The Plants have been described in the following:

Min-Shen Sewage Treatment Plant

1. Opening Data: December 1971, expansion work completed in March 1984.
2. Type of Treatment: Secondary Activated Sludge Treatment, and Rotating Biological Contact Treatment with Pressured Sand Filtration.
3. Design capacity and Flow Quality:
   (1).Design capacity Average treatment capacity: 15500m^3/day.
   Maximum treatment capacity: 24750 m^3/day.
   (2).Design Flow Quality:
   Influent: BOD_5=180mg/L, SS=250mg/L.
   Effluent: Activated Sludge: BOD_5=25mg/L, SS=25mg/L.
   Rotating Biological Contact and Pressured Sand Filtration: BOD_5=15mg/L, SS=15mg/L.
   (3).Reuse Water: 2000 m^3/day.

4. Process Description:
   - After entering the treatment plant, the sewage passes through coarse bar screens, grit chambers and comminutors to remove grit and coarse material to protect the following pumps. It is then pumped into primary clarifiers to remove 30% of the organic matter and 50% of the suspended solids in the sewage.
   - The effluent of primary clarifier will be divided into two parts, one flows into aeration basins for activated sludge treatment the other flows into RBC basins for biological treatment.
   - The effluent of activated sludge treatment will be disinfected with sodium hypochlorite, to remove pathogens before discharging into the Keelung River.
   - The effluent of RBC basins will pass through final clarifiers, pressurized sand filters, and disinfected with sodium hypochlorite. Part of it becomes reuse water for the plant.
   - The scum and sludge from sewage treatment process is passed through revolving drum screens, then sent into aerobic digesters where decayed organisms in the sludge will be stabilized. After being concentrated and being dewatered, it becomes sludge cake. The cake can be used as fertilizer for inedible vegetation, or be disposed in sanitary landfill site.
   - To prevent the dispersion of hydrogen sulfide and ammonia, the small amount gases produced in the treatment process naturally by the decomposition of organic matter in sludge, from affecting the air quality of nearby communities, lids have been placed over treatment facilities.

The gases will be collected through gas ducts and blown to 4 wet scrubbers with chemical deodorizing system. The gases will then be released into air to meet the environmental air quality standards.

5. Engineering Charateristics:

- In the treatment plant there are two biological treatment processes coexistently, it is very helpfully for academic research.
- The treatment plant is a typical community sewerage treatment plant; the noise control system and deodorizing system can be a pattern for the other community sewerage treatment plants extended in the future.
- The treatment plant has equipped tertiary treatment reuse facilities; the effluent can be used as utility water, vegetation water for treatment plant, and garden water for citizen. That is a pattern for the effluent recycle and reuse.

6. Major Benefit:

- The treatment of community sewage can successfully maintain a sanitary environment, and promote the quality of living environment.
- The sewage treated to meet the Effluent Standard then discharged, will alleviate the pollution loading and promote the capacity of self-purification of the Keelung River.

Di-Hua Sewage Treatment Plant

Originally the Di-Hua Sewage Treatment Plant was a primary treatment plant opening in July 1980, which had an average treatment capacity of 274000m^3/day and treating sewage from Taipei City household connections and interception stations. In order to comply with EPA new Effluent Standards taking effect at January 1 1998, the Treatment Plant was closed, and marches forward Upgrading Project.

1. Project Schedule:

The main contents of Di-Hua Sewage Treatment Plant Upgrading Project include civil and architecture engineering work, treatment system engineering work and landscaping engineering work. The major task (civil and architecture engineering work) had started its implementation at January 20 1999. The whole project is scheduled to complete in March 2003 for test run.

2. Type of Treatment:

Deep Tank, Step Feed Aeration, Secondary Treatment, and disinfection before discharging into the Tan-Sui River. Sludge concentrated, digested and dewaterered before disposed in sanitary landfill site.

3. Design Capacity and Flow Quality:

(1).Design Treatment capacity: average 500000m^3/day

(2).Design Flow Quality:

Influent: BOD_5=180mg/L, SS=180mg/L.

Effluent: BOD_5□20mg/L, SS□20mg/L.

(3).Reuse Water: 10000 m^3/day

4. Process Description:

- After dividing a portion effluent of Di-Hua Sewage Pumping Station and entering Di-Hua Sewage Treatment Plant, the sewage passes through fine bar screens to remove coarse materials. It is then flowed into primary clarifiers to remove a greater part of the suspended solids and a small portion of the organic matter in the sewage.
- The effluent of primary clarifiers flows into aeration basin and secondary clarifiers to remove organic matter in the sewage.
- The effluent of secondary clarifiers has been disinfected with sodium hypochlorite, to remove pathogens before discharging into the Tan-Sui River. After sand filtration, 10000m^3/day of effluent becomes utility water for the plant.
- The night soil combined with primary sludge and secondary sludge has been concentrated, anaerobic digested and dewatered to become sludge cake, then disposed in landfill site, or used as fertilizer for inedible vegetation for any organization which ask for.
- Part of the biogas produced by anaerobic digestion has been used for digesters mixing; the excess parts will be incinerated in a waste gas burner in the first stage, there are space reserved for the biogas energy recovery facilities to be set up in the future any timely.

5. Engineering Characteristics:

- The Plant with capacity of 500000m^3/day will be the largest secondary sewage treatment plant in Taiwan.
- The major civil work is a 210m length, 250m width, 17m depth underground structure, it needs deep excavation in large area, and the construction work is rather difficult.
- The plant uses double-layer design for both primary and secondary clarifiers, the first ever used in Taiwan area. It allows higher treatment capacity in the existing land area. The biological treatment system using deep tank step feed aeration also is first ever used in Taiwan area, which have partial denitrification added common biological treatmen‘ unction.
- The preliminary treatment facilities, primary clarifiers, aeration tanks, secondary clarifiers, disinfection chambers and effluent

pumping station all are designed to be isolated and subterraneous, the deodorizing system and noise control facilities have been set up. There will be no environmental impact when the plant starts to running.

- Feedback facilities occupied 4 hectares setting on the roof of major treatment units have been designed to be a recreation park with diverse facilities, include kiddie land, roller-skating rink, lawn amusement fields, basketball fields, tennis court, softball fields and parking lot. The whole area will open to the citizen.
- The plant has equipped tertiary treatment reuse facilities; the effluent can be used as utility water, vegetation water for treatment plant, and garden water for citizen.

6. Major Benefit:

- Comply with EPA regulation.
- Alleviate the risk of the Large Sewerage System.
- Land used with most efficiently; in the same land area the treatment capacity of 500000m^3/day of the Upgrading Plant is almost twice of the original Primary Treatment Plant.
- Have feedback facilities for citizen, include recreation and exercise fields.

Nei-Hu Sewage Treatment Plant

1. Project Schedule:

The main contents of Nei-Hu Sewage Treatment Plant Newly Established Project include civil and architecture engineering work, treatment system engineering work and landscaping engineering work. The civil and architecture engineering work had started its implementation at February 13 1998. The whole project is scheduled to complete in the end of 2001 for test run.

2. Type of Treatment:

Secondary activated sludge treatment process. Portions of the treated effluent will pass through filters and used as utility water. Space is being reserved for tertiary treatment.

3. Design Capacity and Flow Quality:

(1) Design capacity:

Average treatment capacity in the first stage: 150000m^3/day.

Average treatment capacity in the final stage: 240000m^3/day.

Maximum treatment capacity: 480000 m^3/day.

(2) Design Flow Quality :

Influent: BOD_5=185mg/L, SS=190mg/L.

Activated Sludge Effluent: BOD_5=20mg/L, SS=10mg/L

Filter Effluent: BOD_5=10mg/L, SS=10mg/L

(3) Reuse Water:

a. Vegetation water, street cleaning water:20000 m^3/day.

b. Artificial streams in watery recreation park (the treated effluent of secondary treatment process, which had past through filters and disinfected with ultraviolet light): 100 m^3/day.

4. Process Description:

- After entering the treatment plant, the sewage passes through bar screen, grit chamber and comminutor to remove grit and floating debris to protect the pumps. The sewage will flow by gravity from the grit chamber to the primary clarifiers which will remove 30% of the organic mater and 50% of the suspend solids.
- The effluent from the primary clarifiers will flow into a plug flow aeration basin and a secondary clarifier for activated sludge treatment.
- Effluent from the activated sludge process is disinfected with sodium hypochlorite, to remove pathogen before discharging into the Keelung River.
- Part of the effluent from the secondary biological treatment is passed through an automatic filter and disinfected with sodium hypochlorite before being used as utility water.
- The sludge and scum from the primary clarifiers and the secondary clarifiers are concentrated and dewatered. The dewatered sludge is stabilized with lime and then disposed at a sanitary landfill.
- To prevent the dispersion of hydrogen sulfide and ammonia from affecting operators and nearby residents, the dispersed gases are collected through gas ducts and send to a wet chemical scrubber and activated carbon deodorizing system for treatment. The gases will then be released into the air to meet environmental air quality standards.

5. Engineering Characteristics:

- The plant is the first ever built sewage treatment plant in Taiwan area constructed underground, to prevent the dispersion of odor.
- Feedback facilities occupied 3.8 hectares setting on the roof of major treatment units will be designed to be a watery recreation park with treatment process exhibition facilities. It is helpful for recreation and environmental education of citizen.
- Partial effluent of the plant can be reused as vegetation water, street cleaning water, and artificial streams in watery recreation park. That is a pattern of the effluent reuse.

6. Major Benefit:

- After commissioning, the fully implemented treatment plant will alleviate the sewage loading of the Sewerage System in Taipei City. The effluent discharge into the Keelung River will promote the capacity of self-purification and the capacity of assimilation of the River.

Pa-Li Sewage Treatment Plant

1. Project Schedule:

The development of the plant had been divided into three phases; the first and the secondary phases have completed. The plant will be commissioning in the July 1999.

2. Type of treatment:

After primary treatment process, the effluent is discharged into ocean. The sludge is concentrated, digested and dewatered to become sludge cake.

3. Design Capacity and Flow Quality

(1) Design Capacity:

Treatment capacity:	Average	Maximum
First phase:	1,320,000m^3/day	1,530,000m^3/day
Secondary phase:	1,980,000m^3/day	2,163,000m^3/day
Third phase:	3,300,000m^3/day	3,542,000m^3/day

(2) Desighn Flow Quality:

Influent:BOD_5=185~191mg/L, SS=182~204mg/L.

Effluent:BOD_5=130~134mg/L, SS=73~84mg/L

(3) Reuse Water: 25,000m^3/day.

(4) Biogas Energy Recovery:biogas produced: 24,000m^3/day.

(5) Electrolysis and Chlorination System: sodium hypochlorite produced: 17 ton/day.

4. Process Description:

- The effluent of Shitzu-Tow sewage pumping station flow in the Treatment Plant, the sewage pass through mechanical bar screen to remove debris, than after passing through aerated grit chamber to remove grit, the sewage will flow to the primary clarifier to remove most of the suspend solids and organic matter.

- Part of the effluent from the primary clarifier has further treated to become utility water for the plant. The other effluent after disinfected with sodium hypochlorite produced by the sea water electrolysis system, has pumped and discharged into Taiwan Strait via 6,660m length Off-Shore Outfall Pipes.
- The sludge from clarifiers after being concentrated and pumped into egg-shaped digesters for anaerobic digestion, the sludge has been dewatered to become sludge cake and disposed in landfill site.

5. Main Contents of Ocean Outfall Pipes:

- The design peak capacity of the ocean outfall pipes is 21.96m/sec, the diameters are 2.4m to 3.6m, total length is 6,660m, and the maximum water depth is 43m. Main content includes discharge pipes with diameter of 3.6m and length of 5,160m, diffusion pipes with diameter of 3.6m and length of 5,160m, diffusion pipes with diameters of 2.4m to 3.6m and length of 1,500m. Spaced at an interval of each 30m of diffusion pipes, there is a vertical shaft, totally 50 shafts. The shaft has a diameter of 0.5m and length of 4m. At the top of the shaft there are 6 jet-orifices each with 0.15m diameter opening set around the circumference of the shaft. At the end of the diffusion pipes there is a terminal cleanout set at a 15-degree angle of elevation and expending upon seabed. The cleanout is closed normally; it is opened while flushing the debris out of diffusion pipe. Upon the top of the diffusion pipe, the alarm buoys have been set up on the sea level, which is controlled by a photo-electric automatic control system, and shining with orange color light, the visibility is more than 4 km in clear days.

6. Engineering Characteristics:

- Effluent reuse: The treatment plant has equipped a tertiary treatment reuse process; the effluent can be used as vegetation water, utility water, deforming water, and fire fighting water for treatment plant.
- Offshore Outfall Pipes System: Outfall Pipes with inner diameter of 3.6m and 6,660m length discharge the effluent into ocean. The mammoth dilution capacity of ocean can make the effluent of the primary treatment plant to comply with the national Effluent Standards, reduce the treatment plant land area required and treatment cost.
- Biogas Energy Recovery System: Six egg-shaped digesters built in the first phase each with a volume of 9,000m^3, produce biogas th ugh anaerobic digestion. The biogas is collected and used to power generator to produce electricity 4,250kw. The electricity produced will be used for partial

facilities in the treatment plant. This is an unprecedented undertaking in our country.

- Electrolysis and Chlorination System: The treatment plant is close to seashore, sea water electrolysis is used to produce sodium hypochlorite solution, then the solution is used for disinfection of effluent and sludge. This will reduce the risk of using chlorine gas, and reduce the purchase cost and transportation cost of sodium hypochlorite.

7. Major Benefit:

- The Plant treating sewage from Municipal Taipei promotes environmental sanitation and alleviates water pollution.
- The Plant treats biogas and sludge with carefully, to prevent secondary pollution and minimize environmental impact.

SYSTEM OPERATION AND MANAGEMENT OUTSIDE TAIPEI CITY MAGISTRACY

The management of sewerage system of Tan-Sui River Lineage

In according to the instruction of Prime Minister in 5th, November of 1991, Taipei City Government shall have an exclusive unit to take charge of sewerage system management of Tan-Sui River Lineage; the portion of Taiwan Province shall commission Taipei City Governmnet to manage. The organization of sewerage Engineering Department, Public Works Bureau, Municipal Government of Taipei has been magnified, the Facilities Management Section and the Secondary Sewage Treatment Plant are in charge of the committed business activities. Taipei City Government, Taipei County Government and Keelung City Government shall provide the operation and management finance according to the ratio of sewage flow rate pumped and treated respectively. Each government shall have their budget prepared annually, then executed by Taipei City Government. The management of technical portion was entrusted to professional consultant organization; the operation and maintenance portion was labored by professional business firm on consignment basis.

The sewerage system

This project's tributary system is divided into two areas. Sewage from Taipei County Keelung River lineage interception stations, Taipei City household connections and interception stations will be collected to Di-Hua sewage pumping station. After aerated grit removal in the pumping station, portion

sewage flow was treated in the pumping station, portion sewage flow was treated in Di-Hua Sewage Treatment Plant. The other portion sewage flow exceeding the capacity of Di-Hua Sewage Treatment Plant will flow to Shitzu-Tow sewage pumping station via the Taipei City Discharge Pipes and the Tatung Trunk Sewer Crossing the Tan-Sui River.

Sewage intercepted by the interception station on the left bank of the Tan-Sui River will also collected to Shitzu-Tow sewage pumping station via the No.1 Special Trunk Sewer. The sewage will be raisd up 30 meter high in Shitzu-Tow sewage pumping station, then flow along Lung-Shing Tunnel, On Land Discharge Pipe, to Pa-Li Sewage Treatment Plan. After primary treatment (including full sludge treatment) and disinfection with sodium hypochlorite in Pa-Li Sewage Treatment Plant, the effluent is then discharged into the Taiwan Strait through Off-Shore Outfall Pipe. Three main facilities contents

1. Pumping stations:
   (1). Di-Hua sewage pumping station: 4 sewage pumps starting with variable frequency, variable speed pumps.
   (2). Shitzu-Tow sewage pumping station: 6 sewage pumps.
   (3). Hsi-Chih sewages pumping station: 5 sewage pumps.

2. Interception stations: 9 interception station and 3 interception wells.

3. Trunk sewers:
   Trunk Sewer Crossing the Tan-Sui River: inner diameter: 2.6m, south trunk sewer length: 575m, and north trunk sewer length: 568m.
   His-Chih Trunk Sewer: inner diameter: 1.5m~1.8m, length: 10,092m.
   No.1 Special Trunk Sewer: inner diameter: 3.6~3.8m, length: 5,471m.
   Secondary Sewers: inner diameter: 1.1~1.8m, length: 4,975m.
   Taipei City Discharge Pipe: inner diameter: 3.6m, length: 7,027m.
   Connection pipes: inner diameter: 1.2~1.65m, length: 3,336m.
   Lung-Shing Tunnel: inner diameter: 4.6m, length: 1,277m.
   On Land Discharge Pipe: inner diameter: 3.4m, length: 8,677m.
   Off-Shore Outfall Pipe: inner diameter: 3.6m, length: 6,660m.

4. Other Municipal Wastewater Plants Outside Taipei City Magistracy (Operating or under planning)

Several discentralized WWTP's within Tan-Sui River Basin, especially among upstream area, are operating or under planning.

Decentralization of WWTP's allows treatment of sewerage from remote township too far to be economically reached by the major trunk sewerage line. In addition, the sewerage generated by townships upstream from drinking water reservoirs is ensured to receive tertiary treatment to protect water quality for downstream residents. In stead of being administered by Sewerage Engineering Department of Taipei Municipal Government, the following facilities will be administered by respective county governments.

Keelung County: Liu-Du secondary WWTP: 20,000 m^3/day.

Taipei County: Rui-Fang secondary WWTP: 23,000 m^3/day; Chi-Tan secondary WWTP: 3,300 m^3/day; Pin-Lin tertiary WWTP: 4,000 m^3/day; Oo-Lai tertiary WWTP: 1,300 m^3/day; Pan-Shin tertiary WWTP: 52,000 m^3/day.

Tao-Yuan County: She-Men tertiary WWTP: 8,000 m^3/day; Da-She tertiary WWTP: 24,000 m^3/day, Pu-Ding tertiary WWTP: 16,000 m^3/day.

PROSPECTS

Since 1987, Taipei City Government coordinated with Central Government and Taiwan Province Government to develop the common Outfall Facilities of Taiwan Province and Taipei City. Gone through over those 20years, the substantial experiences have achieved in fields of engineering design, construction, regulation instituting, operation and management, building connection.

For the sustainable sewerage management, the proposals for future development include:

- To have finished Di-Hua Sewage Treatment Plant Upgrading Project and Nei-Hu Sewage Treatment Plant newly established project as planned and have good quality as required, then they will be the national pattern of park-like, semi-underground sewage treatment plant.
- Continue to finish the construction work of trunk sewers and secondary sewer in all sewer system, to set up a complete sewerage collection system in the whole city.
- Continue to develop lateral sewer system in the whole city, to accerlerate the household connection rate.
- To plan a monitoring and control system, so as to manage the sewage collection system efficiently.
- To research and construct sludge final disposal facilities, the target of those facilities will be the resource reuse.
- Continue to lend impetus to the standardization of operation and maintenance

model of sewage treatment plant and labored by professional business firm on consignment basis, so as to reduce manpower and promote efficiency.

- To develop the criterion for effluent reuse system, so as to coordinate with the demand of water resource frugality and utilization in the large-scale municipal development project.
- To set up the information management system of sewerage business activities and the file system of investigated sewers with affairs concerning accounts, and to connect with the information service network. So as to provide sewerage information efficiently and reliably, to heighten administrative efficiency and citizen can get the information in network conveniently.
- To set up the sewerage manual of planning, design, engineering affairs, operation, management and maintenance, and to develop the standard operation process, so as to heighten sewage development quality.
- To set up the feed back mechanism of sewers maintenance and clearance, to review and discuss the flowing function of sewers, so as to provide sewer renew project timely.
- To attain new construction methods, new technologies and new material, to set up both the engineering of pipe jacking and the mode of house connection efficiently.
- To research the encouragement and subsidiary modus for the area where beyond sewage collection system and using the combined clarifiers package treatment system, so as to promote the effect of water pollution control.