A Brand-new Future of the Sewer System in Taipei

Speaker: Chien-Hsien Lee, Director

2020.09.24
Outline

I. Sewer System of Taipei City – Current Situation

II. Sewer System of Taipei City – Planning

III. Sewer System of Taipei City – Vision
I. Sewer System of Taipei City - Current Situation

II. Sewer System of Taipei City - Planning

III. Sewer System of Taipei City – Vision
The major targets of sewer system in Taipei

- To ensure a clean and healthy living environment
- To improve and protect the river water quality
- To promote the reuse of water resources
Taipei City (July 2020)
Area: 271 km²
Population: 2,620,037
Household: 1,060,529

Sewer System
- Wastewater treatment plants: 2+1 / 2.06 x 10⁶ CMD
- Pumping stations: 4
- Lifting stations: 36
- Interception facilities: 14 / 676 x 10³ CMD
- Gravel treatment facilities: 5 / 64 x 10³ CMD
890,924 households having sewerage service and household connection rate is about 84% (July 2020)

About 300,000 CMD of excessive sewage is transported to Bali Plant for treatment.

Source: Construction and Planning Agency, Ministry of the Interior
Statistical Table of National Sanitary Sewer Piping Rate and Overall Sewage Treatment Rate (July 2020)
Current Status of Sewerage Pipeline System in Taipei

- **Total length of sewerage pipeline 2,717.7 km (2019)**

<table>
<thead>
<tr>
<th>Age (year)</th>
<th>Built year</th>
<th>Length (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0~10</td>
<td>2010~2019</td>
<td>656,263</td>
</tr>
<tr>
<td>10~20</td>
<td>2000~2009</td>
<td>1,120,651</td>
</tr>
<tr>
<td>20~30</td>
<td>1990~1999</td>
<td>472,956</td>
</tr>
<tr>
<td>30~40</td>
<td>1980~1989</td>
<td>458,585</td>
</tr>
<tr>
<td>&gt;40</td>
<td>Before 1979</td>
<td>24,677</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>2,717,688</td>
</tr>
</tbody>
</table>

- **42% built between 1999-2008**

- **Age profile of existing sewerage pipelines**
  - 0~10 years: 24%
  - 10~20 years: 41%
  - 20~30 years: 17%
  - 30~40 years: 17%
  - >40 years: 1%
Water Quality Trends of Taipei Rivers Over the Last 12 Years

River Pollution Index (RPI)

- **Tamsui River**: Improvement 37%
- **Keelung River**: Improvement 32%
- **Xindian River**: Improvement 47%
- **Jingmei River**: Improvement 45%

**Water Quality Trends of Taipei Rivers Over the Last 12 Years**

- Serious Pollution
- Moderate Pollution
- Mild Pollution
- No (Slight) Pollution
I. Sewer System of Taipei City – Current Situation

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III. Sewer System of Taipei City – Vision
Climate Change

2020, Japan. Source: Associated Press

2019, India. Source: Reuters

2020, Taiwan. Source: China TV


2015, California. Source: Tech News

2017, Taiwan. Source: China Times
International Trends and Indicators

Sustainable Development Goals (SDGs)

- Percentage of City Population Served by Wastewater Collection
- Percentage of the City’s Wastewater Receiving Tertiary Treatment
International Trends and Indicators

Percentage of the City’s Wastewater Receiving Tertiary Treatment

Taipei 0.9%

World Council on City Data (WCCD)

Percentage of City Population Served by Wastewater Collection

Percentage of the City’s Wastewater that has Received No Treatment

Percentage of the City’s Wastewater Receiving Primary Treatment

Percentage of the City’s Wastewater Receiving Secondary Treatment

Percentage of the City’s Wastewater Receiving Tertiary Treatment

Source: WCCD, 2018
New Issues Facing of Sewer System in Taipei

1. Wastewater Treatment
   - Build a new generation water resource center
   - Increase the production of reclaimed water

2. Emergency Response
   - Change the form of manhole covers
   - Electronic Early Warning and Emergency Response Platform
   - Sewerage System Hydraulic Monitoring Center

3. Lifespan Extension Plan
   - Sewage Treatment plant
   - Pipeline Inspection & Repairing
   - Water Quality Audit

4. Household Connection
   - Change in contracting method
   - Rule amendment
   - Adoption of new techniques
Wastewater Treatment
- Build a New Generation Water Resource Center

**Total sewage treatment capacity:** 975,000 CMD

**Shezidao WRRC**
- Tertiary treatment
  - Treatment capacity: 35,000CMD

**Mingsheng WRRC**
- Tertiary treatment
  - Treatment capacity: 40,000CMD

**Binjiang WRRC**
- Tertiary treatment
  - Treatment capacity: 160,000CMD

**(Existing) Dihua STP**
- Secondary treatment
  - Treatment capacity: 500,000CMD

**(Existing) Neihu STP**
- Secondary treatment
  - Treatment capacity: 240,000CMD

**Dihua STP**
- Secondary treatment
  - Treatment capacity: 240,000CMD (Existing)

**Neihu STP**
- Secondary treatment
  - Treatment capacity: 500,000CMD (Existing)

**Total sewage treatment capacity:** 975,000 CMD
Wastewater Treatment
- Build a New Generation Water Resource Center

✓ New **Generation** Water Resource Center

∞ **Circular Economy**

- Methane is recovered for fuel or power generation.
- Dried sludge is manufactured into water permeable paving and flower containers.
- Reclaimed water is reused.

✓ **Water quality requirements are far higher than discharge standards**

<table>
<thead>
<tr>
<th>AO+MBR System</th>
<th>Design Discharge Water Quality (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOD</td>
<td>SS</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>4</td>
</tr>
</tbody>
</table>
Wastewater Treatment
-MingSheng Water Resource Reclaimed Center

- Sewer Intelligent Operation Management Center
- Sewer Environmental Education Center
Wastewater Treatment
-Laying of Reclaimed Water Pipeline Network

Street spraying
Watering of pedestrian green belts
Mitigate heat island effect
再生水質即時監測系統
COD | 濁度 | NH₃-N | NO₃-N | TDS
1.2 | 0.3  | 0.4   | 7.2   | 132
溫度 | pH   | 餘氯  | EC    | 硬度
27.3 | 7.3  | 0.7   | 197   | 49

Online Quality Analysis
Monitoring Points
Smart Kiosk
RO System and Pumping Station

Wastewater Treatment
- Build Smart Online Water Intake System for Reclaimed Water
Extreme rainfall

Water volume increased drastically in the sewerage system

Air in the pipelines is compressed by the large volume of water and not vented in time

Manhole cover explosion

Source: TVBS

Source: CNA
Emergency Response - Replacing Manhole Cover

Total Replacement Numbers

Before

After

Pressure-resistant Manhole Cover

Locks

Chain
Emergency Response
- Existing Sewerage System Hydraulic Monitoring Center

Plant Operation Situation

Water Level and Flow Monitoring
Emergency Response

-Early Warning and Emergency Response Platform

- Weather forecast
- Hydro information
- Real-time rainfall
- Real-time monitoring
- Computer-assisted operations system
- GIS potential overflow zones
- Integrated app information
- Early warning and emergency response platform

Water level station
71 sites

Key facilities

Integration and interfacing of existing real-time surveillance systems and information

AI deep learning and system water volume forecast

2 sets of servers and system platform

Hydraulic model calibration and verification

SWMM hydraulic modeling

Parameter configuration for auxiliary management system

Early warning modeling and verification

Upgrade to the existing computer-assisted operations management system

Establishment of early warning and emergency response system
Emergency Response
-Early Warning and Emergency Response Platform

- SWMM model simulation for Dihau WWTP inflow during Storm water event
# Emergency Response

- Early Warning and Emergency Response Platform

## 1. Function List

<table>
<thead>
<tr>
<th>Facility</th>
<th>Management</th>
<th>Water Level (m)</th>
<th>Trend</th>
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<tr>
<td>AS0</td>
<td>2.4</td>
<td>43%</td>
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<tr>
<td>A01</td>
<td>1.1</td>
<td>32%</td>
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<tr>
<td>B33</td>
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<tr>
<td>B06</td>
<td>3.1</td>
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<td>↑</td>
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<tr>
<td>B04</td>
<td>3.6</td>
<td>40%</td>
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<td>B36</td>
<td>3.9</td>
<td>24%</td>
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<tr>
<td>B41</td>
<td>3.6</td>
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<td>↑</td>
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<tr>
<td>B095</td>
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<td>B106</td>
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<tr>
<td>B18</td>
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<tr>
<td>C68</td>
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<tr>
<td>CB00</td>
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<tr>
<td>DB17</td>
<td>1.2</td>
<td>20%</td>
<td>↑</td>
</tr>
<tr>
<td>DC20</td>
<td>1.2</td>
<td>40%</td>
<td>↑</td>
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<tr>
<td>DA24</td>
<td>1.2</td>
<td>40%</td>
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<tr>
<td>DA26</td>
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<tr>
<td>1471</td>
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<td>0%</td>
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</tr>
</tbody>
</table>

## 2. Facilities Catalog

- Flood model emergency simulation
- Click icons to display information

## 3. Map Area

- Map showing facilities
- Click icon to display information

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http://192.168.32.32/MainBoard
Emergency Response
-Early Warning and Emergency Response Platform
# Emergency Response

- Early Warning and Emergency Response Platform

## 污水抽水站

<table>
<thead>
<tr>
<th>設備</th>
<th>狀態</th>
</tr>
</thead>
<tbody>
<tr>
<td>污水抽水機</td>
<td>溝閉式</td>
</tr>
<tr>
<td>抽水機</td>
<td>維護中</td>
</tr>
<tr>
<td>抽水機 (CMS)</td>
<td>演習完成</td>
</tr>
<tr>
<td>污水抽水機</td>
<td>溝閉式</td>
</tr>
<tr>
<td>抽水機</td>
<td>維護中</td>
</tr>
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</table>

## 污水處理廠

<table>
<thead>
<tr>
<th>設備</th>
<th>狀態</th>
</tr>
</thead>
<tbody>
<tr>
<td>污水處理機</td>
<td>溝閉式</td>
</tr>
<tr>
<td>污水測量</td>
<td>演習完成</td>
</tr>
<tr>
<td>污水處理器</td>
<td>維護中</td>
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</tbody>
</table>

## 繞縫流設施

<table>
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<tr>
<td>污水處理機</td>
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</tr>
<tr>
<td>污水測量</td>
<td>演習完成</td>
</tr>
<tr>
<td>污水處理器</td>
<td>維護中</td>
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</table>

## 雨量觀測站

<table>
<thead>
<tr>
<th>設備</th>
<th>時間</th>
<th>級別</th>
<th>更新間隔</th>
</tr>
</thead>
<tbody>
<tr>
<td>雨量計</td>
<td>0.0 mm</td>
<td></td>
<td>2020/09/14 09:25</td>
</tr>
</tbody>
</table>

## 地表處理設施

<table>
<thead>
<tr>
<th>設備</th>
<th>時間</th>
<th>級別</th>
<th>更新間隔</th>
</tr>
</thead>
<tbody>
<tr>
<td>地表處理機</td>
<td>0.0 mm</td>
<td></td>
<td>2020/09/14 09:25</td>
</tr>
</tbody>
</table>

## 截流站

<table>
<thead>
<tr>
<th>設備</th>
<th>時間</th>
<th>級別</th>
<th>更新間隔</th>
</tr>
</thead>
<tbody>
<tr>
<td>截流閘門</td>
<td>0.0 mm</td>
<td></td>
<td>2020/09/14 09:25</td>
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</tbody>
</table>

## 河川水位站

<table>
<thead>
<tr>
<th>河川水位站</th>
<th>水位</th>
<th>更新時間</th>
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<tbody>
<tr>
<td>河川水位站</td>
<td>0.07</td>
<td>2020/09/14 09:25</td>
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<td>河川水位站</td>
<td>0.14</td>
<td>2020/09/14 09:25</td>
</tr>
<tr>
<td>河川水位站</td>
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## 揚水站

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<th>揚水站</th>
<th>揚水機設置</th>
<th>浮球設置</th>
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<tbody>
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<td>設置完成</td>
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<td>七號路</td>
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<td>設置完成</td>
</tr>
<tr>
<td>八號路</td>
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## 液位監測站

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<tr>
<th>設備</th>
<th>水深</th>
<th>濃度</th>
</tr>
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<tr>
<td>A07</td>
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<td>0%</td>
</tr>
<tr>
<td>AE05</td>
<td>1 m</td>
<td>65%</td>
</tr>
<tr>
<td>BJ1</td>
<td>2 m</td>
<td>50%</td>
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</table>

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Emergency Response
- Early Warning and Emergency Response Platform

- APP Functions:
  1. Real time rainfall
  2. River water level
  3. Pumping stations
  4. Intercetors
  5. Manhole water level
  6. Gate Operation of WWTP
### Lifespan Extension Plan - Wastewater Treatment plants

<table>
<thead>
<tr>
<th>WWTP</th>
<th>Equipment upgrade Duration</th>
<th>Budget (NTD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dihua</td>
<td>2018-2022</td>
<td>711,500</td>
</tr>
<tr>
<td>Neihu</td>
<td>2018-2021</td>
<td>209,000</td>
</tr>
<tr>
<td>Bali</td>
<td>2016-2021</td>
<td>701,000</td>
</tr>
</tbody>
</table>
Lifespan Extension Plan
-Purchase Wastewater Treatment Services and Equipment Upgrades

- Procurement Contract
  - Purchase long term wastewater treatment service
  - ROT concept

- Purpose
  - Efficiency improving
  - Reducing interface conflict

- Service Fee
  - Base on the amounts of wastewater

- Quality Assurance
  - Accountability and Strict audit

- Stable
- Reliable
- Responsible
Lifespan Extension Plan - Pipeline Inspection and Repairing
Household Connection Upgrade

- Change in contracting method
- Improve household connection rate
- Rule amendment
- Adoption of new techniques
Turkey Contract

Traditional procurement

Design

Construction

New Techniques

1. Efficiency improvement
2. Milestones

Vacuum sewerage

Vertical and horizontal boring for small-diameter piping

Small pumping manholes

Vacuum sewerage

Straight pipe connection well model

TurnKey

Design + Construction
Household Connection - Rule Amendment

**Incentives**

- Subsidizing policy adapt
  - Scope expansion
  - Scale increase

**Penalties**

- Inspection enforcement
  - Announcement of penalties for households not connected to existing sewerage systems with deadlines for improvement.

- Water pollution prevention fee
  - Announcement of water pollution levy for households not connected to existing sewerage systems.
I. Sewer System of Taipei City – Current Situation

II. Sewer System of Taipei City – Planning

III. Sewer System of Taipei City – Vision
Visions for Taipei City sewer system

- **2030** – Wastewater Treatment self-sufficiency
- **2032** – 90% household connection rate
Sustainable River Water Quality Improvement

(Existing) Bali Plant
Primary Treatment
Suburban sewage transport through Taipei City:
70,000 ~ 80,000 CMD

(Existing) Neihu Plant
Secondary treatment
Wet season: < 240,000 CMD
Dry season: 140,000 ~ 160,000 CMD

Shezidao Plant
Tertiary treatment
Wet season: 35,000 CMD
Dry season: 35,000 CMD

Minsheng Plant
Tertiary treatment
Wet season: 40,000 CMD
Dry season: 40,000 CMD

Binjiang Plant
Tertiary treatment
Wet season: 35,000 CMD
Dry season: 35,000 CMD

(Existing) Dihua Plant
Secondary treatment
Wet season: ≤ 450,000 CMD
Dry season: 500,000 ~ 550,000 CMD

(Diagram showing the locations and water quality standards for each plant)
Total reclaimed water up to 145,000 CMD

Reclaimed Water in 2030

- **Shezidao Plant**: 35,000 CMD
  - Estimated completion time is 2028

- **Binjiang Plant**: 60,000 CMD
  - Estimated completion time is 2025

- **Dihua Plant**: 10,000 CMD

- **Minsheng Plant**: 20,000 CMD
  - Estimated completion time is 2022

- **Neihu Plant**: 20,000 CMD
  - Estimated completion time is 2022

**Estimated completion time** is 2025

**Total reclaimed water up to 145,000 CMD**
Visions for Taipei City

- Habitable
- Recyclable
- Sustainable

Sustainability  Ecology  Water Resources  Water Loving
Thank for your attention