YongChunPi Wetland Park Environmental Construction Project

Presenter: Chief Engineer, Chien-chun Wu(吳健羣)

Organizer : Geotechnical Engineering Office, Public Works Department, Taipei City Government(台北市大地處)

Designer  : Classic Design and Planning Co., Ltd. (經典工程顧問有限公司)

Supervisor: Chan’s Engineering Consultants Co., Ltd. (安笙工程顧問有限公司)

Contractor : Yu Dong Construction Co., Ltd. (郁東營造有限公司)

• A wetland from a military site • A stepping stone • A century-old park

Altogether, this project and the urban projects of Xinyi District, the East Extension Segment of MRT Xinyi Line, Guangci Care Home and Fude Low-Income Housing combine the urban and forest space, thus accomplishing a complete urban ecological corridor.
- Distribution map of protected species and species of concern at and around the project area
• Conducting an ecological survey in advance
• A wetland from a military site
• **A wetland from a military site**

• There are seven buildings, and three of them will be used for information and tour service station, multifunctional service center, and volunteer offices.

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**BEFORE**

- Information and tour service station
- Multifunctional Pavilion
- Volunteer office

**AFTER**

- Information and tour service station
- Multifunctional Pavilion
- Volunteer office

**Features:***

- Bat cave
- Stone cages made of wastes
- Coexistence among the artificial space, natural habitat, and natural species

**Activating the current buildings with natural materials.**
A wetland ecological stepping stone from a military site

- During park construction, the white-bellied crakes, kingfishers, whistling thrushes, and black bulbul were observed.
- People joined in constructing the artificial floating island, thus creating more habitats for wading birds and amphibians.
A wetland ecological stepping stone from a military site

Before construction (military site)

Completion of project
Difficulty in land acquisition

- **City-owned land**
  Through urban planning, the NT$ 38.9 billion residential area was changed to a park area.

- **State-owned land**
  Establishing a cooperative relationship with the Ministry of Defense by signing a MOU of bulk transfer.

- **Private land**
  Acquisition of the private land of Liugong Irrigation Association by paying NT$ 447,955,401.
Difficulty in land acquisition

• Visiting the Ministry of Defense
Vision Workshop

Local residents and schools

NGOs

Experts

Vision Workshop
Features

**Using materials on site**
- Fallen woods for flood protection
- Backfilling with on-site soil
- Pebble walls

**A wetland from a military site**
- Ecological wetland
- Artificial floating islands
- Bird stands and microhabitat

**Activating original buildings**
- Service and tour station
- Multifunctional Pavilion
- Volunteer office

**Lively scenery**
- Cypress trails
- Crape myrtles
- Kapoks

Integration of wetland, life, and scenery
Yongchunpi Wetland Park layout

Location: No.657, Songshan Road, Xinyi District

Total area: 3.98 ha

- Green space area: 26,077 m²
- Water area: 6,873 m²
- 86.3% of total area
- Total green coverage ration 117%

Entrance square
Windows on the walls
Vine tunnel
Observation room
Phase 1
Phase 2
## Shared area between life and ecology

<table>
<thead>
<tr>
<th>Phase</th>
<th>Total construction cost</th>
<th>Start date</th>
<th>Completion date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 1</td>
<td>NT$ 3,820,649</td>
<td>2017/05/08</td>
<td>2017/09/28</td>
</tr>
<tr>
<td>Phase 2</td>
<td>NT$ 82,396,232</td>
<td>2018/06/23</td>
<td>2019/12/27</td>
</tr>
</tbody>
</table>

**Diagram:**
- **Human activity zone**
- **Buffer zone**
- **Ecological restoration zone**

**Legend:**
- 0: Human activity zone
- 25: Buffer zone
- 50: Ecological restoration zone
Shared area between life and ecology
Combining ecology and water conservation

- **High capacity of water detention**
  According to “Taipei City base development standard for runoff discharged into stormwater sewer,” the minimum water detention capacity:
  \[39.832 \text{m}^2 \times 0.078 \text{m}^3/\text{m}^2 = 3.107 \text{m}^3\]

  Designed water detention capacity = 4895.32 m³

- **Stationary of instant heavy rain could last 8.77 hours.**

  According to “Regulation of soil and water conservation,” hydraulic calculation of detention facilities is based on the rainfall intensity of 92.7 mm/1hr (Nangang station).
Flood detention water stage +13
Normal water stage +12.5

Flood detention water stage +14
Normal water stage +13.7

Flood detention water stage +14.5
Normal water stage +14

Flood detention water stage +15
Normal water stage +14.5

Flood detention water stage +15.8
Normal water stage +15.3

Flood detention water stage +18.5
Normal water stage +17

Flood detention water stage +18.5
Normal water stage +17
Flowing scenery (functional and landscaping)

Attracting birds and butterflies
- 紫薇樹 (Crape myrtle)
- 木棉 (Kapok)
- 蜘蛛百合 (Spider lily)

Purifying with grit
- 濕地沙洲 (Sandbar wetland)
- 落瀑 (Falling water)
- 濕地植物 (Wetland plants)

Purifying with landscape
- 落雨松 (Cypress)
- 穗花棋盤腳 (Small-leaved Barringtonia)
- 香蒲 (Cat-tail)

Great landscapes
- 水丁香 (Lantern Seedbox)
- 台灣百合 (Taiwan lily)
- 平戶杜鵑 (Hirado Azalea)

Integration of wetland, life, and landscape
Greening ecology (functional and landscaping)

Conserving the existing plants

About 215 trees including mulberry, common garcinia, paper mulberry, banyan, sweet gum, etc.
✓ Conserving the existing arbors for 67.4%.

Growing extra plants

439 strands and 34 species of arbors; 15,650 strands and 25 species of shrubs; 25 species and 32,128 strands of aquatic plants; green space area: 26,077 m²

Integration of wetland, life, and landscape
Plants representing changes of seasons

Changes of weathers, plants, and forests in four seasons.

Changes of Nature
Feel the changes of seasons from the changes of 24 solar terms.

Spring
From Feb. to April
Taiwan Cherry, Sweet gum, and Salix kusanoi.

Summer
From May to September
Crape myrtle, tassel, Formosan Ash, Small-leaved Barringtonia, Buttonbush, and Cat-tail.

Autumn and Winter
From October to November
Taiwan Sapium, Tallow tree, Sweet gum, soap berry, and cypress.
Main arbors in Yongchunpi Wetland Park

**Fusang**
Sweet gum
Taiwan native species
Flowering stage: from February to April
Fruiting stage: from April to June

**Zhanbianyou**
Spider tree
Taiwan native species
Flowering stage: from April to June
Fruiting stage: from September to November

**Liu Shu**
Tassel
Taiwan native species
Flowering stage: from December to February
Fruiting stage: from June to November

**Shui She柳**
Kusano Willow
Taiwan native species
Flowering stage: from March to July
Fruiting stage: from June to November

Flowering stage: from February to April
Fruiting stage: from April to June

Flowering stage: from December to February

Flowering stage: from March to July
Fruiting stage: from June to November

Flowering stage: from April to June
Fruiting stage: from September to November

Source: Internet
Main arbors in Yongchunpi Wetland Park

穗花棋盤腳
/水茄苳
Small-leaved
Barringtonia
Taiwan native species
Flowering stage: from July to September
Fruiting stage: from January to February

落葉松
Cypress
Alien species
Flowering stage: late April
Fruiting stage: October

黃連木
Chinese Pistache
Taiwan native species
Flowering stage: from March to April
Fruiting stage: from September to October

烏桕
Chinese Tallow
Alien species
Flowering stage: from June to July
Fruiting stage: from August to October

Source: Internet
## Purifying with plants-arbor species(functional and landscaping)

(Source: The Society of Wilderness, Environmental Protection Administration of Executive Yuan, Environment Protection Bureau, Pingtung County, Weng Jinwu (2015), Zhu Minhua, etc. (2018))

<table>
<thead>
<tr>
<th>Waterfront arbor</th>
<th>Cypress 落羽松</th>
<th>Small-leaved Barringtonia 穗花棋盤腳</th>
<th>Kusano Willow 水社柳</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taiwan native species 臺灣原生種</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Nitrogen 氮</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Phosphorus 磷</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Nutrients 營養鹽</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Conserving trees with slope protection 護坡水土保持樹種</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Flood-tolerant trees 耐水淹樹種</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
</tbody>
</table>
Purifying water and enhancing water detention capacity

1. Grit
2. Aeration
3. Filtration
4. Landscaping ecological pond

Outlet
EL.12m

Intake
EL.19m

Bottom of the pond EL.11m
Depth of the pond 3m

Bottom of the pond EL.15m
Depth of the pond 3m
Purifying with plants

水面上的植物組織

光線衰減→抑制植物性浮游生物的生長
影響微部氣候→對溫度的隔絕作用
降低水面風速→避免顆粒再懸浮
排出光合作用產生的氧→增進好氧分解

水中的莖及葉組織
過濾效應→過濾大的顆粒殘骸
降低水流速度→增進沉降效果，避免顆粒再懸浮

底泥中的根及地下莖
底泥表層穩定化→減少受侵蝕
防止溝地中礫石間隙的堵塞
營養物的攝取
釋出有機物→促進脫氮作用
Wetland plants

Open water (landscape ecology)

Shallowed water area (aeration and filtration)

Dense planting area (grit)

Vegetable fern
Cat-tail
Yellow Water Lily
Buttonbush
Small-leaved Barringtonia
Floating-leaved plant
Emerged plant
Cypress
Oldworld Arrow-head
Wild ginger flower
Perennial herb
Perennial herb
Perennial herb

Aquatic fern
Reed
Wetland plants

蘆葦
過溝菜蕨
香蒲
台灣萍蓬草
野慈菇
野薑花
落雨松
穂花棋盤腳
Open water (landscape ecology)

Shallowed water area (aeration and filtration)

Dense planting area (grit)

Ground grading level:
- 1.72% grade over 58m
- 2.27% grade over 44m
### Purification by plants – Aquatic plants (functional and landscaping)


<table>
<thead>
<tr>
<th></th>
<th>Aquatic plants</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Reed（蓬蘽） (blooming from September to October)</td>
</tr>
<tr>
<td><strong>Suspended solids (SS)</strong> 懸浮固體</td>
<td>● (99%)</td>
</tr>
<tr>
<td><strong>Biochemical oxygen demand (BOD)</strong> 生化需氧量</td>
<td>● (95%)</td>
</tr>
<tr>
<td><strong>Ammonia</strong> 氨氮</td>
<td>● (97%)</td>
</tr>
<tr>
<td><strong>Total phosphorus</strong> 總磷</td>
<td>● (57%)</td>
</tr>
<tr>
<td><strong>Promoting sedimentation of the particles</strong> 促進入流顆粒沉降</td>
<td>● (99%)</td>
</tr>
</tbody>
</table>
Eutrophication

On Feb. 25, 2019, Professor Wu Junzong, Hou Wenxiang, etc. held meetings for eutrophication.

Status of eutrophication

Site survey of eutrophication
Total phosphorus tests

Associate inspection unit: Taipei Feit sui Reservoir Administration

8 inspection points
## Total phosphorus tests

According to “Surface Water Classification and Water Quality Standards” ruled by Environmental Protection Administration – discharge to non-ocean surface water bodies: Below 2.0(mg/L) of total phosphorus

- Start of construction: 2018/6/23
- Completion of construction: 2019/12/27

<table>
<thead>
<tr>
<th>Date</th>
<th>Sampling point 3</th>
<th>Outflow point 8</th>
<th>Removal efficiency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2019.3.21</td>
<td>0.034</td>
<td>0.025</td>
<td>26%</td>
</tr>
<tr>
<td>2019.4.22</td>
<td>0.044</td>
<td>0.061</td>
<td>-</td>
</tr>
<tr>
<td>2019.5.28</td>
<td>0.159</td>
<td>0.216</td>
<td>-</td>
</tr>
<tr>
<td>2019.6.21</td>
<td>0.153</td>
<td>0.101</td>
<td>34%</td>
</tr>
<tr>
<td>2019.7.24</td>
<td>0.098</td>
<td>0.124</td>
<td>-</td>
</tr>
<tr>
<td>2019.8.28</td>
<td>0.137</td>
<td>0.166</td>
<td>-</td>
</tr>
<tr>
<td>2019.9.25</td>
<td>0.278</td>
<td>0.076</td>
<td>73%</td>
</tr>
<tr>
<td>2019.10.21</td>
<td>0.187</td>
<td>0.352</td>
<td>-</td>
</tr>
<tr>
<td>2019.11.21</td>
<td>0.456</td>
<td>0.056</td>
<td>88%</td>
</tr>
<tr>
<td>2019.12.20</td>
<td>0.259</td>
<td>0.028</td>
<td>89%</td>
</tr>
<tr>
<td>2020.6.19</td>
<td>0.082</td>
<td>0.067</td>
<td>18%</td>
</tr>
<tr>
<td>2020.7.14</td>
<td>0.052</td>
<td>0.039</td>
<td>25%</td>
</tr>
</tbody>
</table>

- BOD: < 10 (Surface Water Classification and Water Quality Standards)
Soils on the site cannot be used for planting

On Nov.20, 2018, invited Professor Zhang Yusen to perform site survey of soil

On April 17, 2019, the site survey of soil along the Shuangxi section of the Keelung River with Hydraulic Engineering Office.
The soils on the site cannot be used for planting

On October 3, 2019, the soils from Shuangxi section of the Keelung River were sent to National Taiwan University Department of Horticulture and Landscape Architecture for soil analysis.

- The analysis result: great for plants.

<table>
<thead>
<tr>
<th>土壤物理性狀調查</th>
<th>砂粒（％）</th>
<th>坊粒（％）</th>
<th>粘粒（％）</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. 土壤質地分析</td>
<td>76</td>
<td>11</td>
<td>13</td>
</tr>
<tr>
<td>2.粒徑：土壤顆粒與</td>
<td>土壤顆粒（％）</td>
<td>石礦（％）</td>
<td></td>
</tr>
<tr>
<td>石粒的比例（％）</td>
<td>70</td>
<td>30</td>
<td></td>
</tr>
</tbody>
</table>

土壌質地為 砂質壤土 (Sandy Loam)，為良好的綠美化土壌，>2 mm 之土壤顆粒（石礦）佔土壤體積之 30％。
Utilize the existing resources for sustainable use of materials

**Wetland excavation**

- **18,656 M³(100%)**
  - **Reusing current site** 現地利用
    - **11,268 M³(60.4%)**
  - **Transporting wastes** 垃圾外運
    - **252 M³(1.4%)**
  - **Excavation** 出土
    - **18,656 M³(100%)**

**(Bricks or concrete blocks)**
- **7,136 M³(38.2%)**

**Wetland backfilling**

- **18,420 M³(100%)**
  - **Reusing current site** 現地利用
    - **11,268 M³(61.2%)**
  - **Backfilling** 進土
    - **18,420 M³(100%)**

**(Backfilling plants soil with embankments soil)**
- **7,152 M³(38.8%)**

**Classifying the reusable soil** 回填土方分類
- **2,729 M³(14.6%)**

**Reusing and crushing stones** 可利用粒料分類及破碎
- **8,539 M³(45.8%)**

**Transporting wastes** 垃圾外運
- **252 M³(1.4%)**

**Stone cage walls, seats, facades made of wastes, etc.** 石籠牆、石籠座椅及廢料鋪面等
- **233 M³(1.3%)**

**Backfilling earth hummocks** 回填土丘
- **11,035 M³(59.9%)**

**Landscaping** 造景
- **Shaping terrains** 地形塑造
- **Backfilling plants soil with embankments soil**
  - **7,152 M³(38.8%)**

**(Backfilling plants soil with embankments soil)**
- **11,035 M³(59.9%)**
Utilize the existing resources for sustainable use of materials

Classifying the backfilling soil

Classifying and crushing backfilling materials

Recycling wastes

Backfilling wetland

Remodeling old buildings

Landscape construction

Crushing and classifying

Wetland construction

Activating buildings

Backfilling
Utilize the existing resources for sustainable use of materials

- **Filling construction site with building wastes**
  Classifying reusable materials and crushing them to the size less than 10 cm. Backfilling site with building wastes, thus reducing amount of wastes transportation.

- **Making wastes reusable and using them for construction**
  The excavated pebbles, concrete blocks, thinned woods, etc. reused for construction.
Difficult to construct landscape

Topographic measurement and application of aerial photography

◆ Drones used for aerial photography

3D construction models of Yongchunpi Wetland Park
The eco-friendly habitat---kingfisher earth embankment

Kingfisher
(female)

Kingfisher
(make)

Kingfishers reappear
The eco-friendly habitat---microhabitat and bird stands

Birds on wood stands

Microhabitat for aquatic animals
Environmental education---tree planting

◆ On November 14, 2019, Mr. Chen Hung-Kai taught tree planting.
Environmental education---making artificial floating islands

On August 11 and 18, Mr. Chen Te-Hung from the Society of Wilderness and people made artificial floating islands.
Environmental education---Removing invasive species

- On May 30 and 31, 2020, Mr. Chen Te-Hung and some enthusiastic people removed invasive species such as mile-a-minute weeds and apple snails.
The beautiful Yongchunpi Wetland Park
Night Views at Yongchunpi Wetland Park
Night Views at Yongchunpi Wetland Park
The Sawdust Trails
The Spiral Landscape
Landscape of Stones and River
The Beautiful Sawdust Trails and Cypresses
Service and Tour Station
Multifunctional Pavilion
Changes Come True

Before Construction

During Construction

After Completion
台北的生態棲地保護區