Gulpocheon Flood Control Project

**Purpose**
- Flood prevention in the Gulpocheon basin (134 km², 1.5 million people)
- Drainage of the 1,030 m³/s of flow to the West Sea

**Construction**
- Construction of connection channel (1993)
- Stage I (2001 - 2003): Temporary channel (Length: 14.2 km; Width: 20 m)
- Stage II (2004 - 2008): Expansion of channel width to 80 m
- Cost: 0.55 billion US$
Completion of Temporary Channel (Stage I)
Plan of Kyungin Canal Project

Background: utilization of the drainage channel for transport
Purpose: flood control and transport
Layout:
- Channel expansion (L: 18 km; D: 6 m, W: 80 m)
- Facilities: navigation locks, wharfs, bridges, roads, etc.
- Cost: 1.31 billion US$ (including 0.4 billion US$ subsidy)
- Construction period: Stage 1: 2001 – 2005
  Stage 2: 2009 - 2012
Kyungin Canal

Incheon Terminal

Seoul Terminal
History of the Projects

Kyungin Canal Project

1987
Feasibility study

1989
Designated as a project of private investment

1991
Completion and promulgation of a basic design

1993
Contract with the Kyungin Canal Company (KCC)
KCC: consortium of 8 companies
Operated by the KCC for 40 years
for investment recovery

Draft of Environmental Impact Assessment
Opposition by resident and NGO parties
Re-evaluation of the economic feasibility (by KDI)
Contract with the KCC abandoned
Starting feasibility study (by DHV and Saman)

Gulpocheon Flood Control Project

1987
Investigation of Gulpocheon basin
Start as one of presidential pledges
Preliminary study

1989
Construction of connection channel (width: 40 m)

1991

1993

1995

1996

1998

2000

2001

2003

2004

2005

2006

Start of the 1st stage construction (width: 20 m)
Completion of the 1st stage (temporary channel)
Start of the 2nd stage of construction (width: 80 m)
Disputing Points of NGOs

- **Lack of Economic Feasibility**
  - Overestimated cargo volume
  - Underestimated construction cost and overestimated benefit
    - Benefits: flood (8%), land (5%), transportation (87%)

- **Regional Separation**
  - Social, cultural and administrative disconnection
    - Need 300m of width for canal, railway, and highway
  - Traffic problems in crossing the separated areas

- **Environmental Problems**
  - Gulpocheon drainage alone is enough for flood control
  - Environmental destruction
    - Ecological destruction and disconnection
    - Water quality deterioration in the West Sea and canal
Effort of Problem Settlement

- **Re-evaluation of Economic Feasibility**
  - By Korea Development Institute (KDI, 2002 - 2003)
  - Result: economically feasible, but stepwise construction needed

- **NGOs’ Petition for Special Investigation**
  - Executed by the Board of Audit and Investigation (March 2003)
  - Result: Gulpocheon Flood Control Project feasible, but re-study required for the Kyungin Canal Project (Sept. 2003)

- **Participation of Stakeholders**
  - “Committee of Sustainable Development of the Gulpocheon Basin” (2005)
  - Members: government, national assembly, experts, residents, NGOs
  - Mission: reviewing the feasibility of the Kyungin Canal Project
Selection of Canal Type

<table>
<thead>
<tr>
<th>Factor</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxygen depletion/Eutrophication</td>
<td>High</td>
<td>Mid.</td>
<td>Low</td>
</tr>
<tr>
<td>Bacteriological condition</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Influence fresh water on West Sea</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salt water intrusion</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ice formation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Locking time</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Costs for navigation locks</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Salt water (option 3) Selected.
Incheon Terminal

Locks
Recreation Lock
Area
Bottom Level

210m×28.5m
250m×28.5m
35m×14.5m
20
510,000 m²
EL(-) 6.0m
Seoul Terminal

Number of Berths in 2030
14

Area
360,000m²

Bottom Level
EL(-) 3.6m
## Economic Feasibility

### Cargo

<table>
<thead>
<tr>
<th>Cargo</th>
<th>Year</th>
<th>Year</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2011</td>
<td>2020</td>
<td>2030</td>
</tr>
<tr>
<td>Container (1,000 TEU)</td>
<td>366</td>
<td>613</td>
<td>973</td>
</tr>
<tr>
<td>Sea Sand (1,000 m³)</td>
<td>7,230</td>
<td>9,447</td>
<td>12,655</td>
</tr>
<tr>
<td>Waste (1,000 ton)</td>
<td>1,362</td>
<td>1,584</td>
<td>1,644</td>
</tr>
<tr>
<td>Steel (1,000 ton)</td>
<td>657</td>
<td>713</td>
<td>748</td>
</tr>
<tr>
<td>Car (1,000 unit)</td>
<td>45</td>
<td>59</td>
<td>76</td>
</tr>
<tr>
<td>Passenger (1,000 person)</td>
<td>920</td>
<td>970</td>
<td>1,045</td>
</tr>
</tbody>
</table>

### Cost (billion US$)

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>General facilities</td>
<td>0.20</td>
</tr>
<tr>
<td>Incheon terminal</td>
<td>0.15</td>
</tr>
<tr>
<td>Seoul terminal</td>
<td>0.05</td>
</tr>
<tr>
<td>Navigation canal facilities</td>
<td>0.27</td>
</tr>
<tr>
<td>Han River navigation</td>
<td>0.03</td>
</tr>
<tr>
<td>Recreation facilities</td>
<td>0.08</td>
</tr>
<tr>
<td>Bridges &amp; underpasses</td>
<td>0.20</td>
</tr>
<tr>
<td>Compensation</td>
<td>0.33</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1.31</strong></td>
</tr>
</tbody>
</table>

1. **B/C Ratio**: 1.76
2. **Net Present Value (NPV)**: 0.83 billion US$
3. **Internal Return Rate (IRR)**: 13.8 %
## Economic Issues

<table>
<thead>
<tr>
<th>Classification</th>
<th>Issues</th>
<th>Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cargo Volume Forecast</td>
<td>- New transport mode not reflected</td>
<td>✓ Calculated by a forecast method (LOGIT) considering cost of transport mode</td>
</tr>
<tr>
<td></td>
<td>- Estimation method and results unreliable</td>
<td>✓ KMI estimates cargo volume and ECORYS (foreign expert) reviews</td>
</tr>
<tr>
<td>Cost Estimation</td>
<td>- Compensation cost for alternative landfill sites</td>
<td>✓ Include compensation cost in the analysis (KW 112 billion)</td>
</tr>
<tr>
<td></td>
<td>- Construction cost for additional roads and bridges</td>
<td>✓ Include access roads to terminals and bridges</td>
</tr>
<tr>
<td></td>
<td>- Environmental cost for noise barrier, water treatment, groundwater</td>
<td>✓ Include environmental cost (0.02 billion US$)</td>
</tr>
<tr>
<td>Benefit Estimation</td>
<td>- Benefit overestimated due to incorrect cargo volume</td>
<td>✓ Re-evaluate cargo volume based on actual transport costs</td>
</tr>
<tr>
<td></td>
<td>- Benefit overestimated in soil deposition</td>
<td>✓ Benefit computed as costs for dumping soil in Cheongna area</td>
</tr>
</tbody>
</table>
## Environmental Issues

<table>
<thead>
<tr>
<th>Classification</th>
<th>Issues</th>
<th>Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Water Quality in the Canal</strong></td>
<td>▪ Deterioration of water quality in the canal</td>
<td>✓ Allow salt water in the canal (increase mixing)</td>
</tr>
<tr>
<td></td>
<td>▪ Cost for improving water quality</td>
<td>✓ Include costs for water treatment</td>
</tr>
<tr>
<td><strong>Water Quality in the Han River and West Sea</strong></td>
<td>▪ Pollution caused by sea-sand wharf</td>
<td>✓ Small impact by Han River sand wharf</td>
</tr>
<tr>
<td></td>
<td></td>
<td>✓ Incheon sand wharf discharges into the canal</td>
</tr>
<tr>
<td><strong>Ecosystem</strong></td>
<td>▪ Impact caused by vessels</td>
<td>✓ Include waste and wastewater collection system</td>
</tr>
<tr>
<td></td>
<td>▪ Impact on surrounding area</td>
<td>✓ Adopt mitigation measures (trees, parks, camouflage)</td>
</tr>
<tr>
<td><strong>Wastewater Leakage from Landfill Site</strong></td>
<td>▪ Water pollution</td>
<td>✓ Adopt sheet pile embankment and clay layer at the canal bottom</td>
</tr>
</tbody>
</table>
Evaluation of the Project

- National economy will benefit from traffic alleviation and transport savings.
- Canal operation will be possible without government funding (government fund of 208 billion KW for crossing bridges).
- The project will open up the Han River for navigation, and reduce traffic on the road and at the Incheon Port.
- Air quality in the Seoul metropolitan area will improve, but SO$_2$ will increase along the West coast.
- The project will attract new factories due to access for shipping, and increase local economy.
- The project will increase recreation possibilities in the vicinity of the canal (yachting/marina, ship cruise, park/recreation areas).
- The project will not significantly affect the environment.