1. Background of Installation of GIS

- Major Issues on Water Utilities in Japan -

- Necessity to replace/renew the facilities

- Aging facilities
  - In the 1960s-70s, many water facilities were built to meet the increasing water demand
  - Now, those facilities are 40 years or over 40

- GIS will be an effective tool for preparation of system renewal plan
Necessity to manage the facilities efficiently and document properly

- Increase of Facilities and drawings
  - many water facilities = many documents (as-built drawings)

  GIS will provide efficiency on asset management

Necessity to transfer experienced engineer’s knowledge to younger generations

- Retirement of experienced engineers/field staff
  - After World War II, Baby boom (1947-1949)
  - They worked hard to build new facilities for increasing water demand.
  - They have a lot of knowledge and experience of management of water facilities
  - Now, the baby boom generation are nearly 60

  GIS will assist inheritance of the technical knowledge

Necessity to improve the facilities

- Changes of consumer’s needs for water supply service.
  - To supply palatable (good quality) water
  - To serve with adequate pressure/to serve to 3rd floor-5th floor directly (without receiving tank and pumping up).
  - To reduce troubles
    - red water
    - no/little suspension even in case of emergencies such as earthquake

  GIS will help you to improve customer services

Major Issues on Water Utilities in Japan

- Necessity to replace/renew the facilities
- Necessity to manage the facilities efficiently /properly
- Necessity to transfer their knowledge to younger generations
- Necessity to improve the facilities

- Facility data is necessary to conduct above items
- Facility data is various and is huge

  GIS must be effective to process these data
2. What is GIS?
- Outline of GIS -

Definition
- Geographic Information System is a computerized database management system for spatial data that enable storage, retrieval, analysis and support of decision making.
- Spatial data means a figure that have coordinate (position) data and attribute.

Components
- Application Software (for Water, Sewage, Gas, etc)
- GIS Engine (Arc GIS, Smallworld, GeoMedia, etc)
- Spatial Data: base map, water pipe, sewage pipe
- Operating system (OS): Microsoft Windows 2000 or XP
- Hardware: Personal Computer (PC)

Data Feature of GIS/Image data
- Dot data / pixel data.
- Resolution: dot per inch (dpi). ex: digital photos, scanned documents, etc
- File format: BMP, JPEG, Tiff
- Not usable for retrieval and analysis
Data Feature of GIS
Ex. of Image data: As-built drawings

Data Feature of GIS/Vector data
- Position/location
  X and Y coordinates/latitude and longitude
- Geometry/Shape
  point, line, polygon (rectangle, circle, etc)
- Attribute
  contents of objects
- Geographic display = Easy to grasp
- Usable for retrieval and analysis

Data Feature of GIS
Ex. of Vector data: Pipeline

Management of Vector Data
- GIS data is managed in layers separately.
  ➢ Base map: road layer, house layer, river layer, • • •
  ➢ Water data: water main, service pipe, valve, • • •
- Data display is controlled by layers.
- You can display only necessary data.
Ex. of layer control

Function Features of GIS

- Display
  - Arbitrary range: scale up / down, movement
  - Display of necessary data, non-display of unnecessary data
- Retrieval
  - Attribute condition
  - Spatial condition
  - Complex condition (Spatial + Attribute)

Business Activity Based on GIS

Facility data is used or updated at Each step

3. Using GIS in Water Utility
Planning support; Pipe Replacement

- Coloring by pipe types (materials) or installation year
- Easy to find which pipe should be replaced

Design support
Export of Existing base map and pipe data to CAD system

Maintenance/Pipe failure

- Indication of valves that should be closed
- Indication of suspension area

Checking performance/analysis

- Distribution of leak points
  - Frequent leak area

AWWA Research Foundation
“Water Main Evaluation for Rehabilitation/Replacement”
4. GIS Data for NRW Reduction

Representation of distribution pipelines

<table>
<thead>
<tr>
<th>Construction year</th>
<th>Length</th>
<th>Diameter</th>
<th>Material</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>1984</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2005</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

GIS data: Pipeline

<table>
<thead>
<tr>
<th>Contents</th>
<th>Attribute</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

GIS data: Valve

<table>
<thead>
<tr>
<th>Contents</th>
<th>Attribute</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
GIS data: Hydrant and Air valve

<table>
<thead>
<tr>
<th>Construction Year</th>
<th>Diameter</th>
<th>Purpose</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>25, 75, 100</td>
<td>fire fighting, drain</td>
<td>single, dual, type</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2004</td>
<td>75, 100</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Service installation
- Property and maintenance

Water service system
- Three types of water service system
  - Direct connection system
  - Receiving tank system
  - Booster pump system

Direct connection system

JWWA2000 "Guidelines for Design of Water Facilities"
Booster pump system

Representation of booster pump system

GIS data: Service pipe and stop valve

<table>
<thead>
<tr>
<th>Customer number</th>
<th>Stop valve</th>
<th>Diameter</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>13, 20, 25, ...</td>
<td>PE, AV, PB</td>
<td>etc</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Owner name</th>
<th>Owner address</th>
</tr>
</thead>
<tbody>
<tr>
<td>Watanabe</td>
<td>Yokohama city</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Owner tel. number</th>
<th>Customer tel. number</th>
</tr>
</thead>
<tbody>
<tr>
<td>03-5323-6220</td>
<td>Sayama city</td>
</tr>
</tbody>
</table>

GIS data: Meter

<table>
<thead>
<tr>
<th>Meter number</th>
<th>Diameter</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>3825</td>
<td>13, 20, 25</td>
<td>AV, PB, etc</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Customer name</th>
<th>Customer address</th>
</tr>
</thead>
<tbody>
<tr>
<td>Takayama</td>
<td>Sayama city</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Installation data</th>
<th>Customer number</th>
<th>Meter</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-Oct-06</td>
<td>3825</td>
<td></td>
</tr>
</tbody>
</table>
GIS data: receiving tank and booster pump

<table>
<thead>
<tr>
<th>Contents</th>
<th>Attributes</th>
<th>Name of Object</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1m³/min capacity</td>
<td>Pump head</td>
<td>30 m</td>
</tr>
</tbody>
</table>

GIS data: leak repair and customer complaint

<table>
<thead>
<tr>
<th>Contents</th>
<th>Attributes</th>
<th>Name of Object</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remarks</td>
<td>Instruction to contractors</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Delay in repaving the road</td>
<td></td>
</tr>
<tr>
<td></td>
<td>After pipe installation</td>
<td></td>
</tr>
<tr>
<td>Customer name</td>
<td>Customer name</td>
<td></td>
</tr>
<tr>
<td>Address</td>
<td>Address</td>
<td></td>
</tr>
<tr>
<td>Customer number</td>
<td>Customer number</td>
<td></td>
</tr>
<tr>
<td>Received date/time</td>
<td>Received date/time</td>
<td></td>
</tr>
<tr>
<td>Remarks</td>
<td>Remarks</td>
<td></td>
</tr>
<tr>
<td>Replacement</td>
<td>Repair data</td>
<td></td>
</tr>
<tr>
<td>2m pipe</td>
<td>Damaged data</td>
<td></td>
</tr>
<tr>
<td>DIP 300 installed in 1975</td>
<td>Pipe data</td>
<td></td>
</tr>
</tbody>
</table>

5. Conclusions
- Effect of GIS -

Effect of GIS-1
Adequate management of materials
- Less papers/Less space
- No deterioration or loss of data
Effect of GIS-2

Data Sharing

Planning section

Design section

Effect of GIS-3

Efficient operation
- Reduction of Retrieval Time of the Facilities data.
- Efficient Maintenance of the Facilities (pipe failure, leak inspection, etc).

Effect of GIS-4

Efficient operation
- Decision making support for Investment priority (pipe replacement, etc)
- Quick response to customer's inquiries/complaints

Improvement of Water Supply Service

Thank you (Questions)