



Reference Example for Japanese Underground Development Project

Project Outline

Schedule

Organization and manning

Planning Designing Construction

Geological investigation

Preconstruction phase

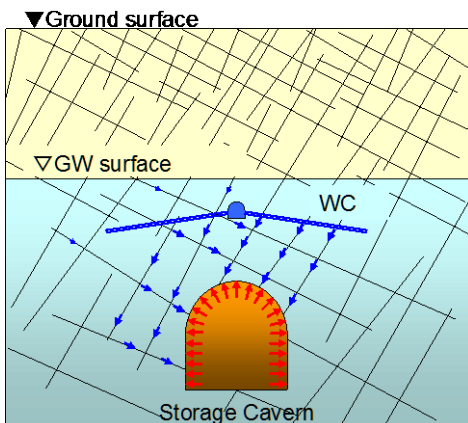
7th Oct 2014

Underground LPG stockpiling Project

- 5 National LPG Stockpiling Bases in Japan
- Underground water-sealed rock cavern tank system is used for 2 of LPG Stockpiling base



Underground water-sealed rock cavern tank system



Gas and oil are stored in cavern tank by the effect of groundwater pressure safely

Owner : JOGMEC

Independent Administrative Cooperation

Milestone

- Project plan is established 1981
according to the petroleum reserve law
- Construction authorized at 2001
- Construction : 2002 – 2012
- Operation commencement : 2013



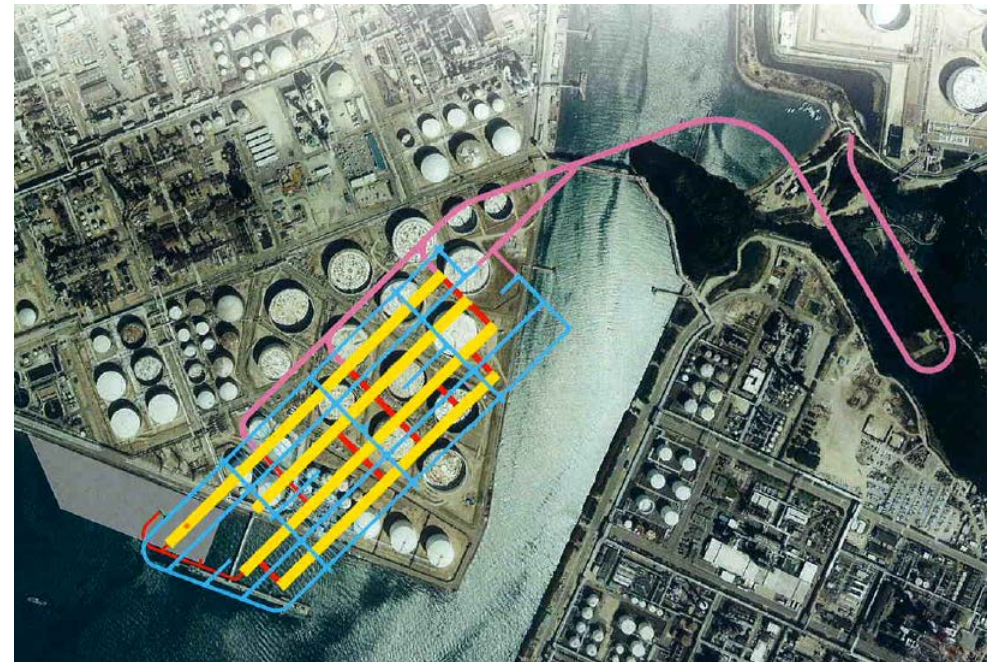
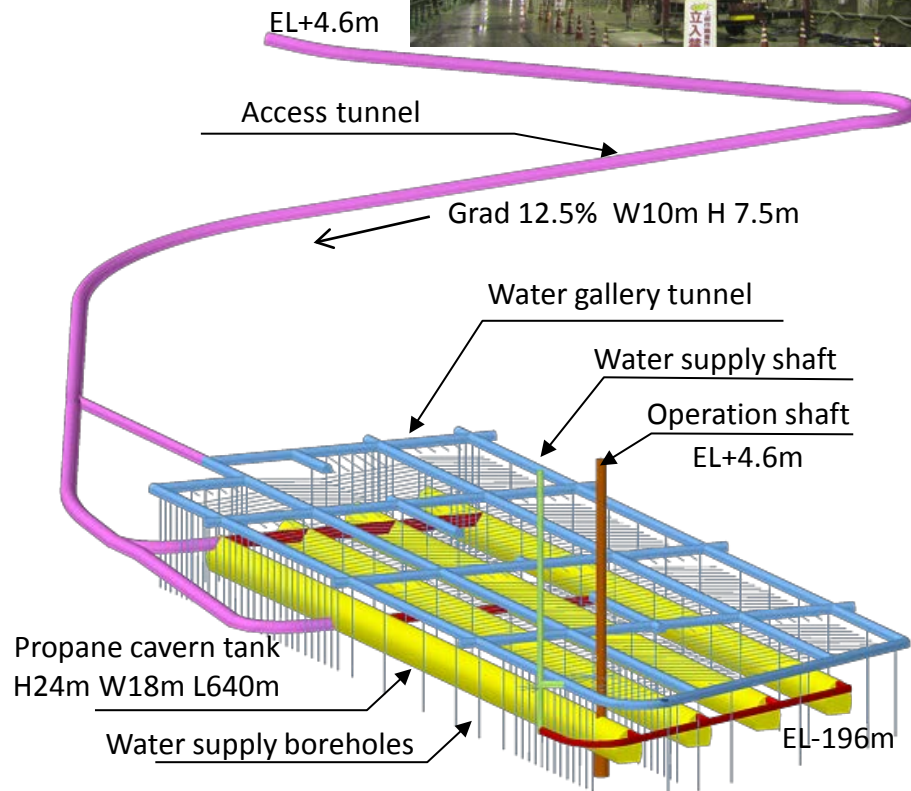
Project outline of Kurashiki Base

Kurashiki Base

One-Unit Tank
P : 400,000 t

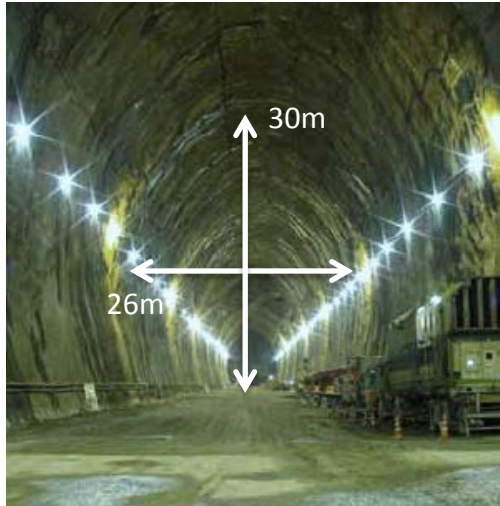


Caverns : H24m W18m L640m 4 rows
Installation depth : -160m from sea level
Access tunnel : Length 2025m Max12.5%
Operation shaft : Diameter 6.8m





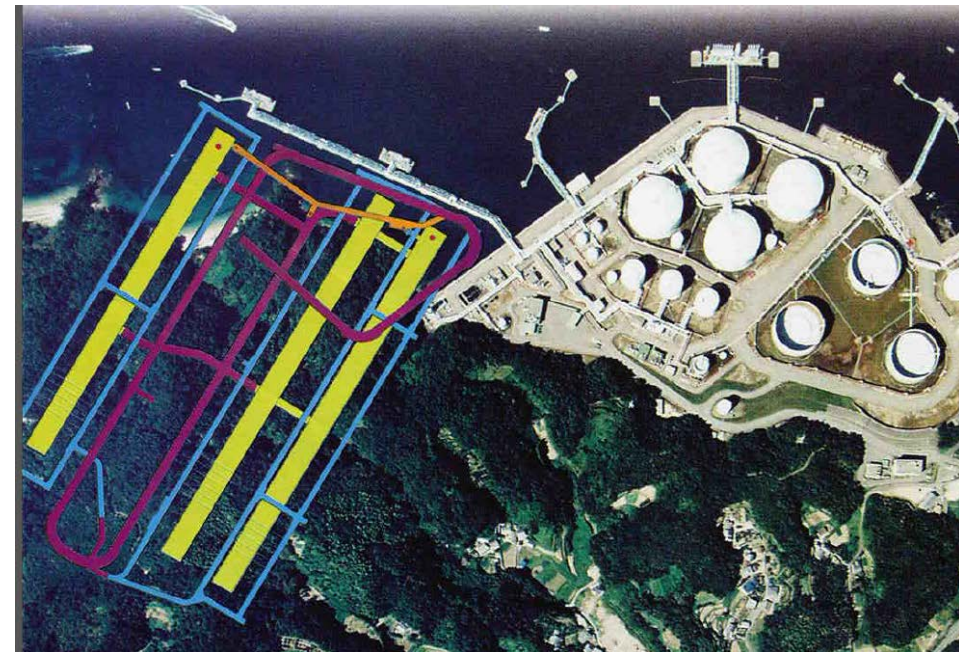
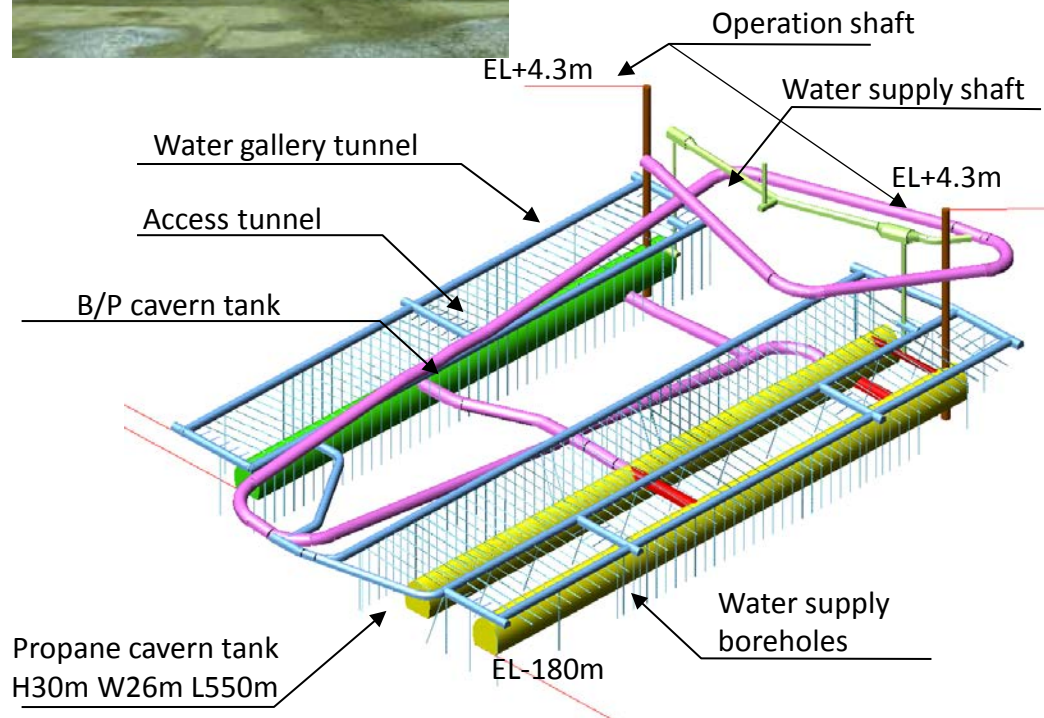
Project outline of Namikata Base



Namikata Base

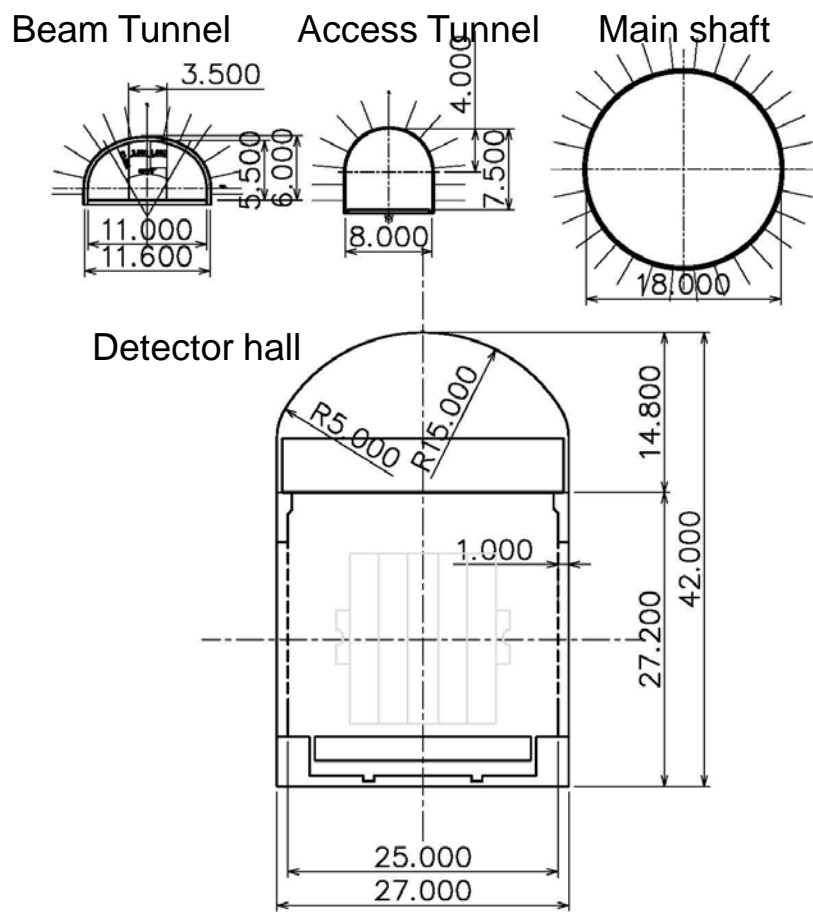
Total 450,000 t
Two-Unit Tank
P : 300,000 t
B/P : 150,000 t

Caverns : H30m W26m L485m 3 rows
Installation depth : -150m from sea level
Access tunnel : Length 1800m Max12.5%
Operation shaft : Diameter 6.8m

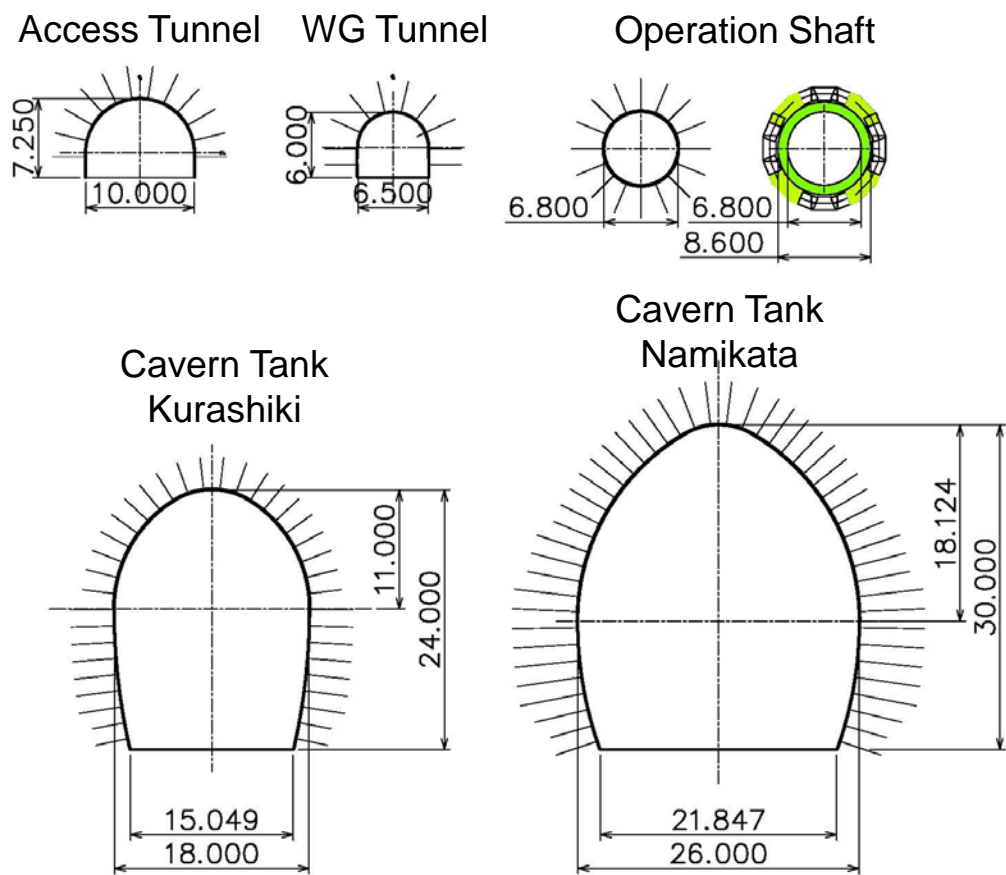


Underground structure

ILC Project

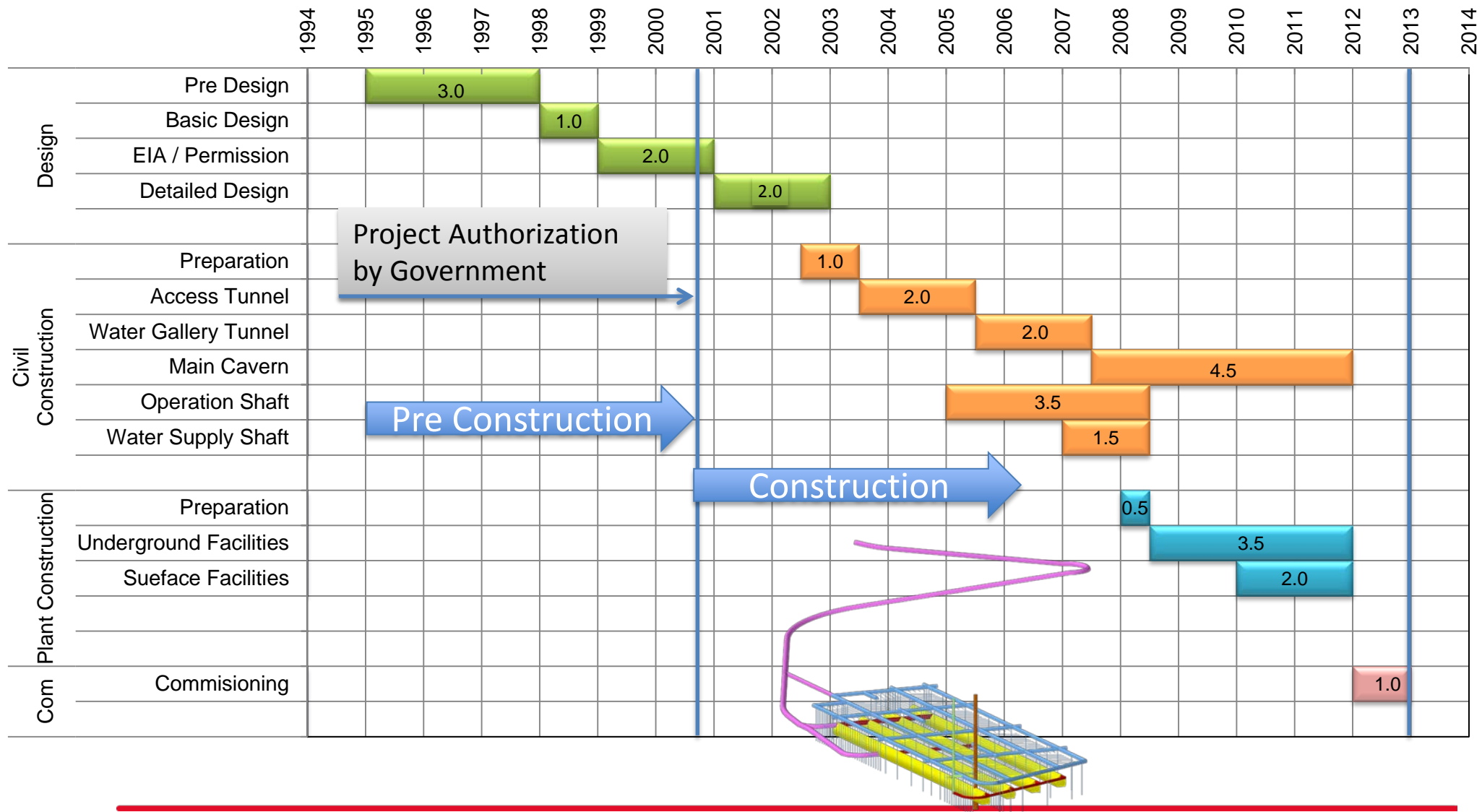


LPG Stockpiling Project



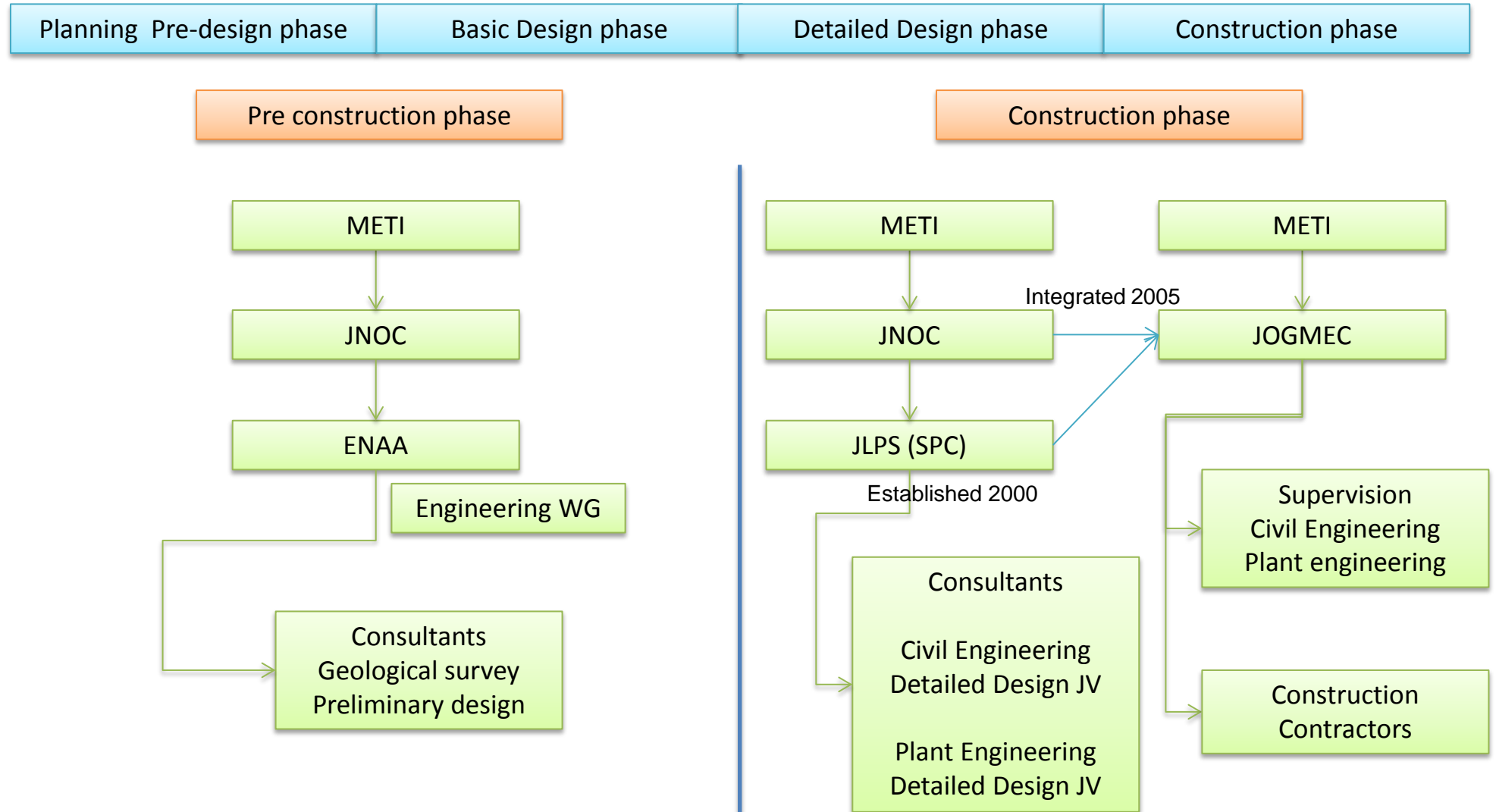


Construction Schedule (Kurashiki base)



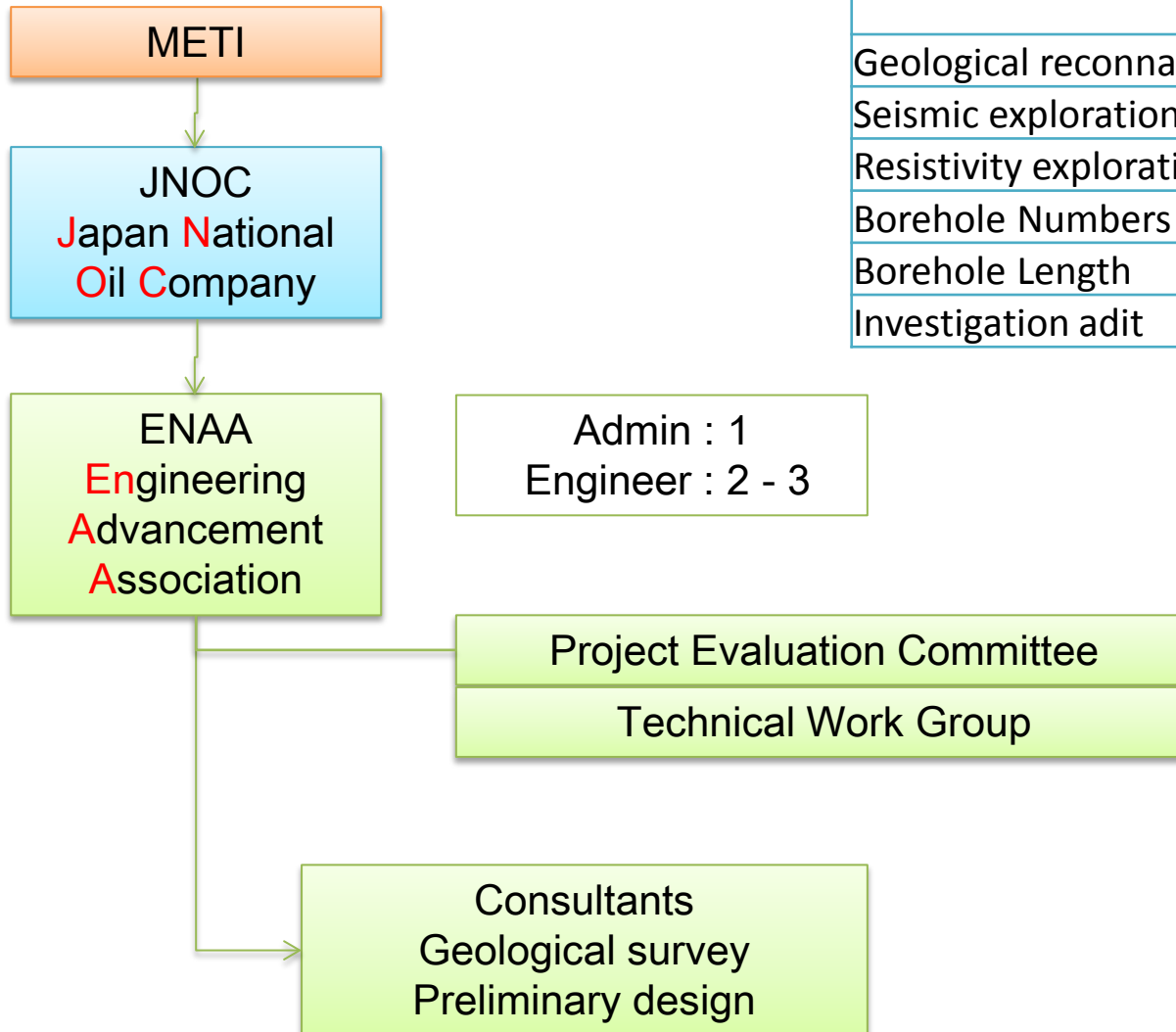


Organization



Planning - Basic Design Phase

Implemented geological investigation by the end of basic design



| | Kurashiki | Namikata |
|---------------------------|-----------|----------|
| Geological reconnaissance | 2 km2 | 1 km2 |
| Seismic exploration | 5,400 m | 4,750 m |
| Resistivity exploration | 2,900 m | 3,750 m |
| Borehole Numbers | 32 pcs | 16 pcs |
| Borehole Length | 8,569 m | 3,274 m |
| Investigation adit | | 960 m |

Design items

- Site selection
- Layout design
- Standard section design
- Environmental impact assessment

Organization in Detailed Design Phase

METI

JNOC

JLPS

Technical Evaluation
Committee

Civil Engineering
Detailed Design JV

Plant Engineering
Detailed Design JV

Items of Civil Engineering Detailed Design

- Design criteria
- Design condition
 - Material, Rock properties, Loadings
- Layout design (rev)
- Standard section design (rev)
- Detail part design
- Structural design :rock support
- C/M criteria
- Monitoring plan
- Construction plan
- Temporally facility plan
- Contract Cost estimation
- Contract Documents

PM : 1

Admin : 1 + 4 : common
Engineer : 5 + 4 : common

Staffs are from
Government / Petroleum company /
Engineering company

Manager : 1
Geologist : 3

Technical Engineer : 12
Construction plan : 5
Cost Estimation : 5

Out sourcing work

Additional Geological survey
Numerical simulation

personnel number is as one site



Organization in Construction Phase

