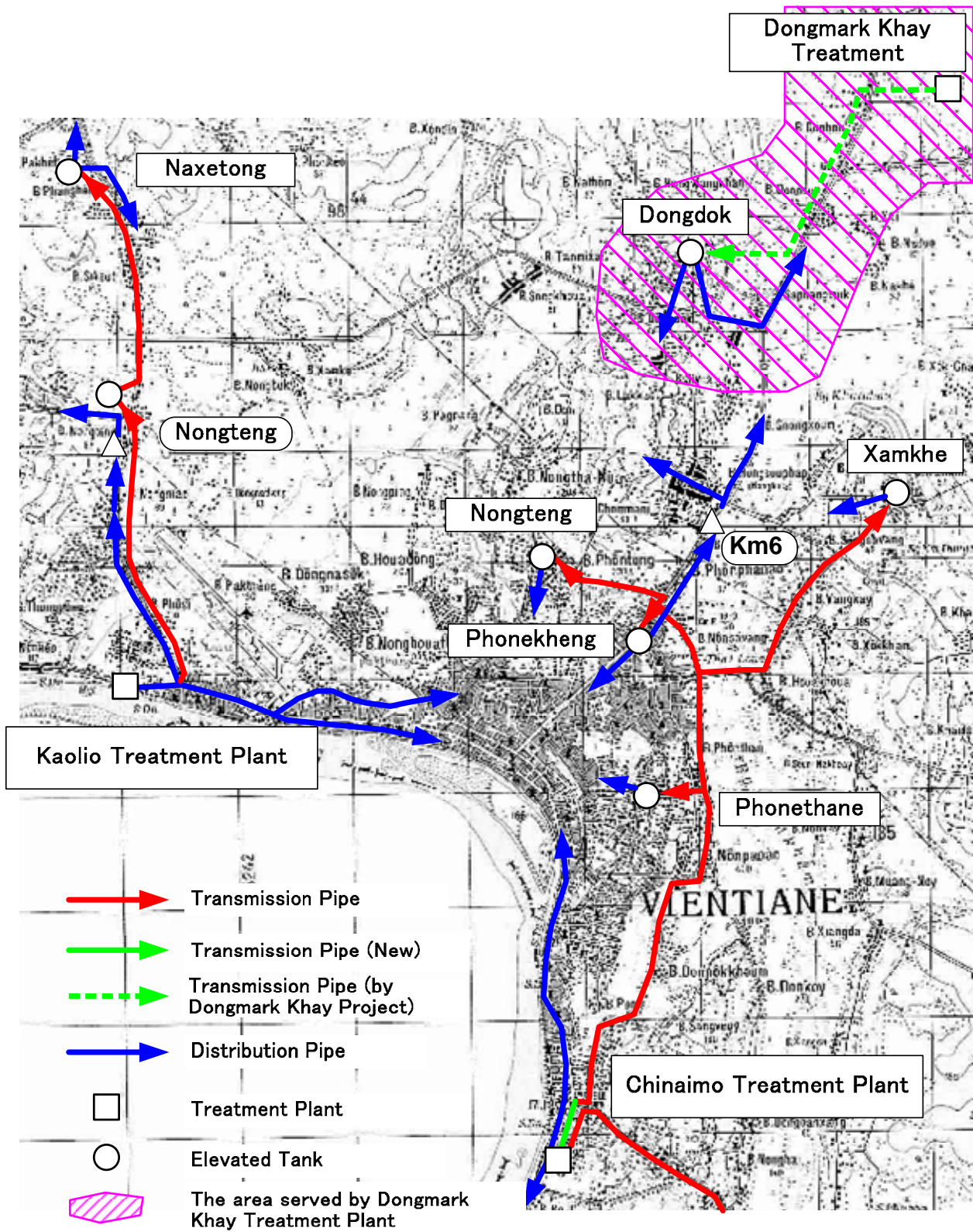


Figure 2-15 Water Transmission and Distribution System incorporating the Dongmark Khay Project



The required transmission and distribution pipeline specifications are summarized in Table 2-7.

Table 2-7 Required Pipe Specifications

Pipe Material and Diameter (mm)	*Pipe Length(m)	Duplication of No.1 road project (m)
DCIP 700	1,220	340
DCIP 600	1,580	1,560
DCIP 400	4,685	40
PVC 150	5,150	750
Total	12,635	2,690

* Pipe length includes duplicated alignment with “The project for the improvement of the Vientiane No.1 Road (hereinafter referred to as No.1 road project)”

(1) Coordination with Other Relevant Projects

1) Coordination with Distribution System Improvement Project by AFD

a. Overview of the Distribution System Improvement Project by AFD

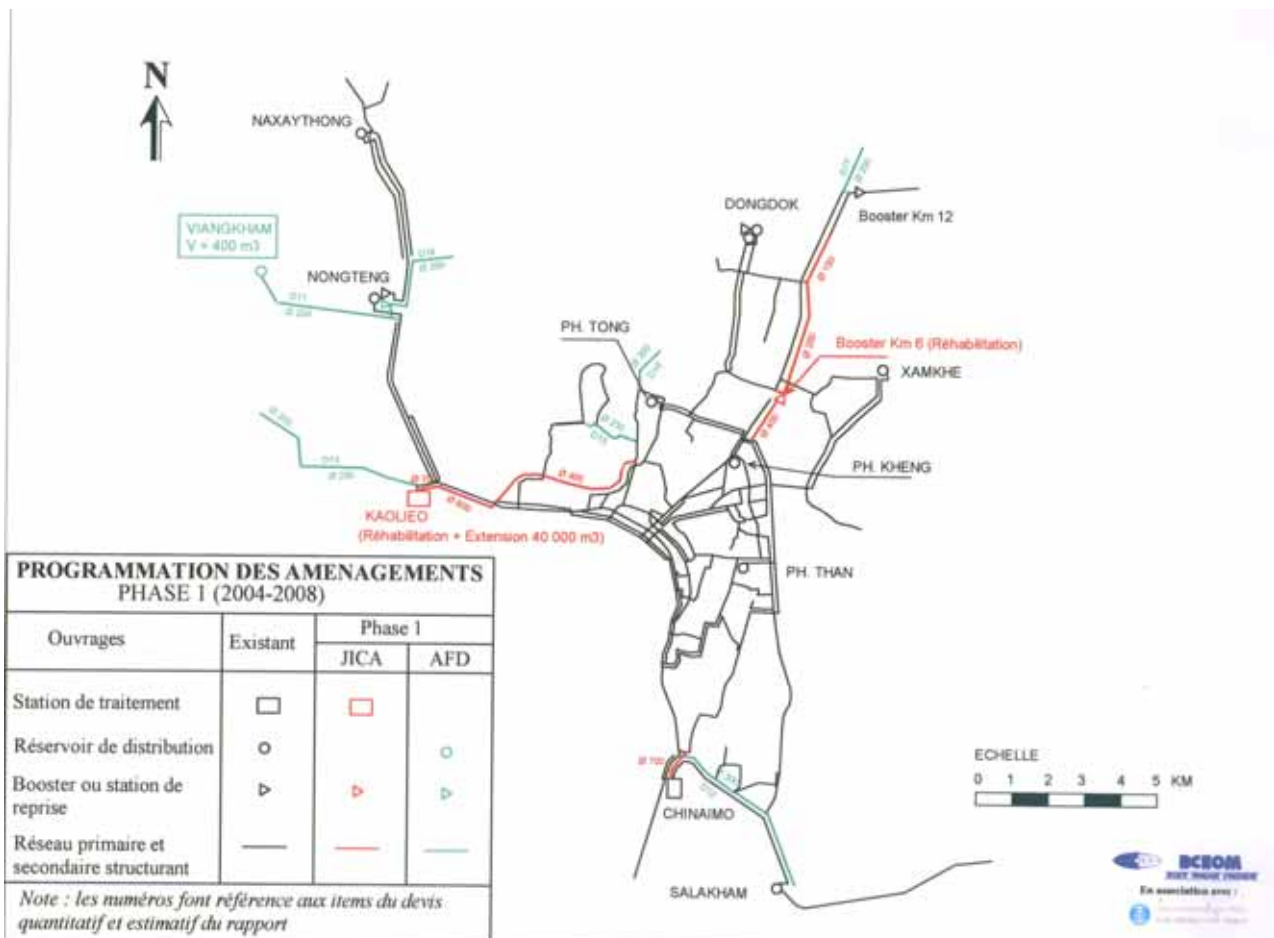
The AFD has completed a M/P study for improvements to the distribution system. The planned pipeline routes (which are included in Phase 1 of the AFD project) are marked as the blue lines on Figure 2-16. The scope of the proposed AFD project is as follows:

- Installation of distribution mains: diameter ranging from 200 to 300mm, with a total length of 30 km.
- Construction of new a distribution reservoir with a capacity of 400m³ at Viengkham.
- Expansion of the Nongteng booster pumping station.
- Installation of smaller distribution pipes: diameter ranging from 50 to 200mm, with a total length of 110km.
- Installation of 5,600 house connections.
- Rehabilitation of valve chambers and additional equipment associated with the existing elevated tanks.

The AFD advised that:

- the feasibility study for Phase 1 of their project will be conducted from September to November 2004;
- the AFD Board will approve the project implementation during September 2005; and
- construction work will commence during October 2005.

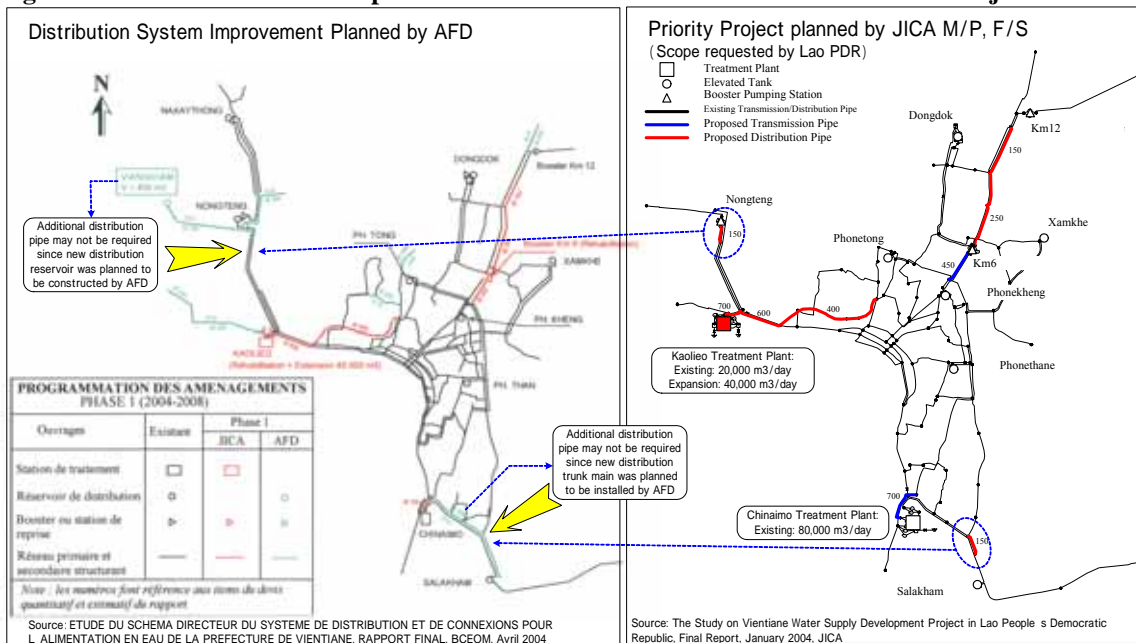
Figure 2-16 AFD Proposed Distribution Pipe Route (blue lines)



Source : Etude du Schema Directeur du Systeme de Distribution et de Connexions Pour L'alimentation en eau de la Prefecture de Vientiane, Repport Final – Resume, April 2004

In general, the AFD M/P for the distribution system improvement project was prepared consistently with the previous JICA M/P & F/S. However, two distributon pipe routes (with a diameter of 150 mm) that were proposed by the JICA Study were not included in the AFD distribution system (as shown on Figure 2-17). This is because the AFD believes that these two pipeline routes will not be required if they implement their project. The AFD project includes construction of a distribution reservoir and installation of distribution trunk mains. The relatively smaller size of the distribution pipelines that were proposed in the JICA Study to be installed downstream of the proposed AFD facilities will not be required.

Figure 2-17 Location of Two Pipeline Routes which were not Included in the AFD Project



To determine if the two pipelines marked in Figure 2-13 are required, an hydraulic network analysis was conducted which incorporates the AFD Phase 1 project implementation. The analysis was conducted for several cases.

b. Results of the Hydraulic Network Analysis

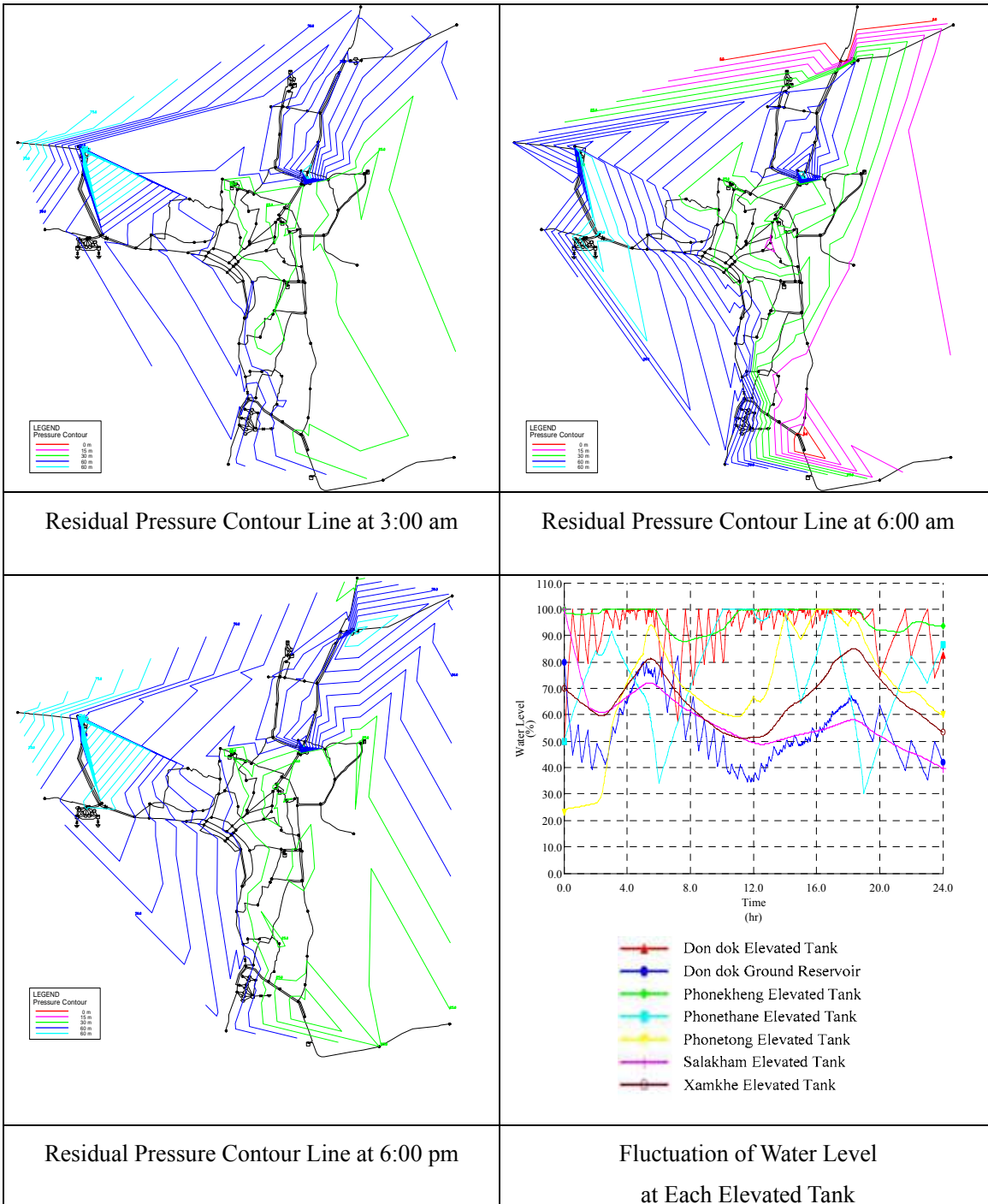
The hydraulic network model which was prepared during the previous JICA M/P & F/S was reviewed and adjusted in accordance with the AFD model. The network analyses were then conducted for the following three cases:

- Case 1 : Analysis without the proposed AFD Phase 1 planned distribution pipes (this represents the scenario that the AFD Phase 1 project is not implemented).
- Case 2 : Analysis incorporating the AFD Phase 1 planned distribution pipes into the Case 1 model (this represents the scenario that both the AFD and JICA projects are implemented).
- Case 3 : Analysis removing the two distribution pipes mentioned above from the Case 2 model (this represents the scenario that both the AFD and JICA projects are implemented but the two distribution pipes are excluded).

The results of the hydraulic network analysis are shown below.

Case 1 : Analysis on model without AFD Phase 1 planned distribution pipes

(The case that the AFD Phase 1 project is not implemented)



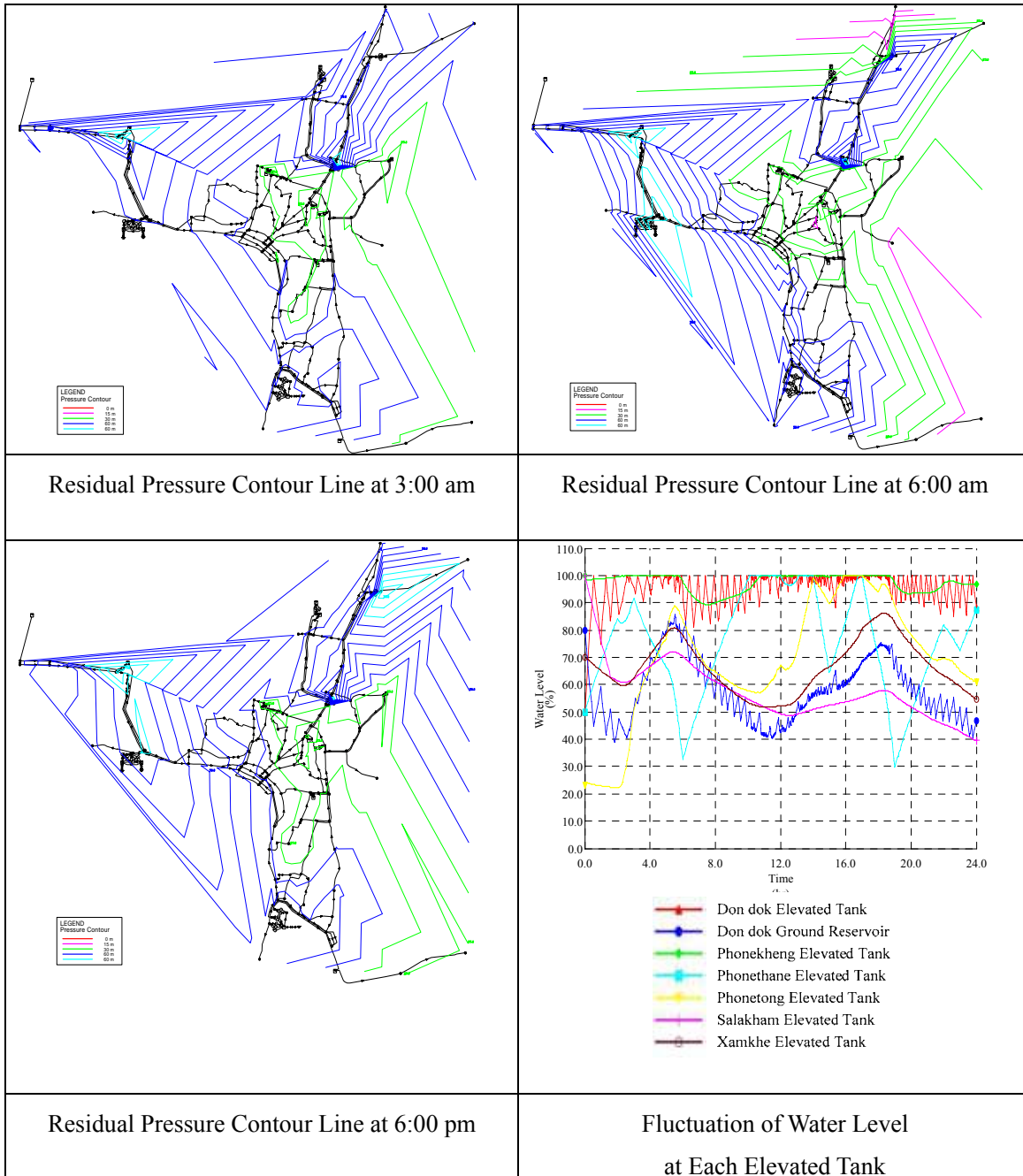
Residual Pressure Contour Line at 3:00 am

Residual Pressure Contour Line at 6:00 am

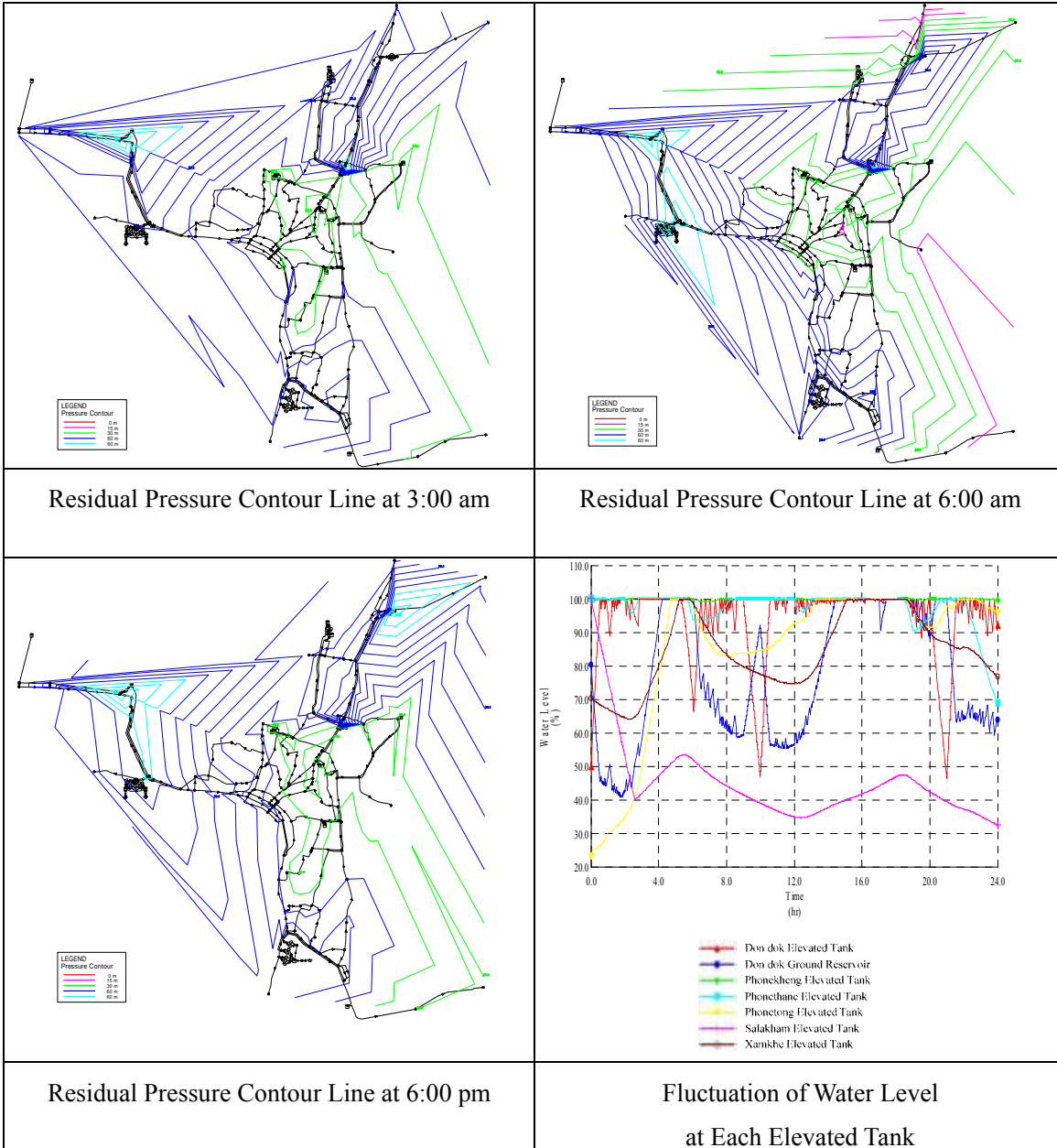
Residual Pressure Contour Line at 6:00 pm

Fluctuation of Water Level
at Each Elevated Tank

Case 2 : Analysis on model adding the AFD Phase 1 planned distribution pipes to the Case 1 model
 (The case that the both AFD and JICA projects are implemented)



Case 3 : Analysis on model deducting two distribution pipes mentioned above from the Case 2 model
 (The case that the both AFD and JICA projects are implemented and two distribution pipes are excluded.)



The Case 3 analysis indicates that even without the two proposed distribution pipes the residual pressure in the service area is adequate. The Case 1 analysis indicated that water treated at the expanded Kaolieo Treatment Plant can be distributed to the service area, however some parts of the city will experience low pressure for limited periods.

Despite the findings of the hydraulic analysis, the two pipelines were not excluded from the scope of the GOJ Basic Design Study because implementation of the AFD Phase 1 project has not been committed to by the AFD.

2) Coordination with Road Improvement Projects

a. Road Improvement Projects which Require Consideration

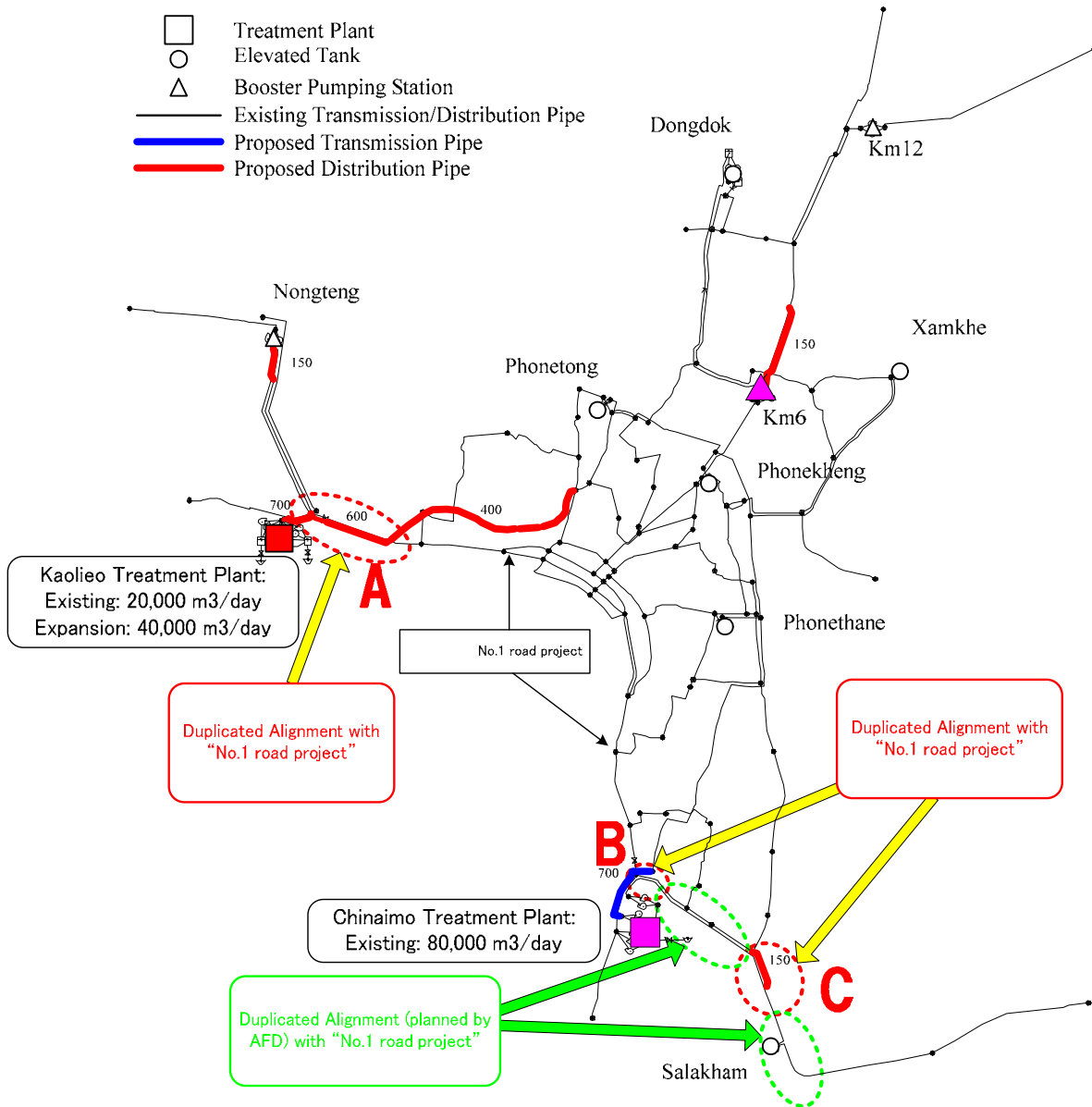
The Basic Design Study (May 2005, JICA) for No.1 road project (The Project for the Improvement of the Vientiane No. 1 Road) was conducted at the same time as this Basic Design Study. The pipeline routes associated with this current project and the route of No.1 road project are duplicated as shown on Figure 2-18. To avoid re-excavation (to install the pipelines) after No.1 road project is complete, coordination between this project and No.1 road project is necessary.

In addition, the ADB and the Thai Government are planning finance the following two projects:

- Hong Wattay Drainage Improvement Project; and
- T2 Road Improvement Project.

The scope of these related projects was also considered during the basic design for this current project.

Figure 2-18 Duplication of the Pipeline Route and the route of No.1 road project



b. No.1 road project

i. Design concepts

- When the construction of duplication part will be implemented after No.1 road project, installation of pipelines along the duplicated routes will be incorporated in the No.1 road project to avoid re-excavating the road.
- When the construction of duplication part will be implemented before No.1 road project, installation of pipelines along the duplicated routes will be incorporated in this project (the pavement: by simple restoration).
- The pipeline will be designed based on the road structural drawing as of the beginning of June 2005.

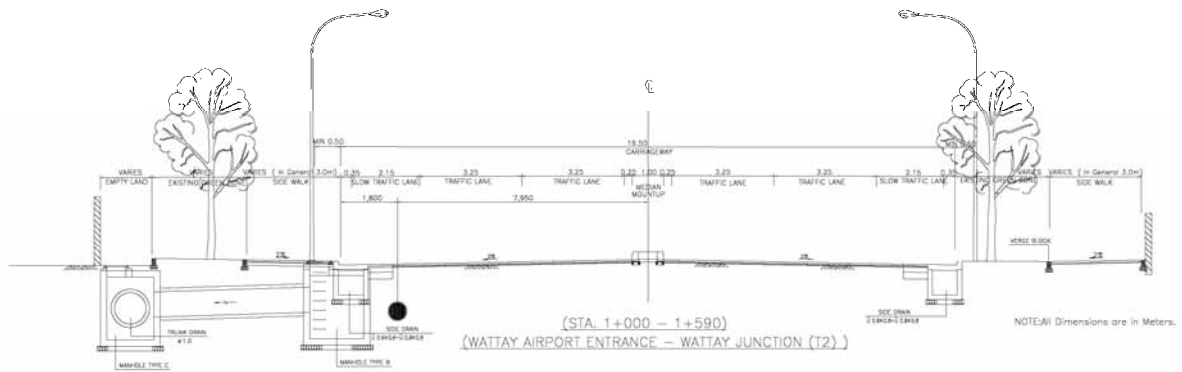
Therefore, the pipeline design should be reviewed during the detail design stage because the road structure is being examined by No.1 road project side at this moment.

ii. Basic Design

【Duplicated Route No. 1】 : From Sikai Junction to branch point of T2 Road at Road No. 1
 (Distribution Pipe No. 1)

The road structure at this stage is shown on below. The pipeline will be designed and estimated based on the road structure as shown on Figure 2-19. The pipeline was designed to avoid these underground drainage systems as shown on Figure 2-19.

Figure 2-19 Location of Distribution Pipe No. 1 in Road No. 1



【Duplicated Route No. 3 & 4】 : From Chinaimo Junction to east along Road No. 1 (Transmission Pipe No.2,
 Distribution Pipe No. 4)

The road structure at this stage is shown on below. The pipeline will be designed and estimated based on the road structure as shown on Figure 2-20 and Figure 2-21. The pipeline was designed to avoid these underground drainage systems as shown on Figure 2-20 and Figure 2-21.

Figure 2-20 Location of Transmission Pipe No. 2 along the Road No. 1 from Chinaimo Junction

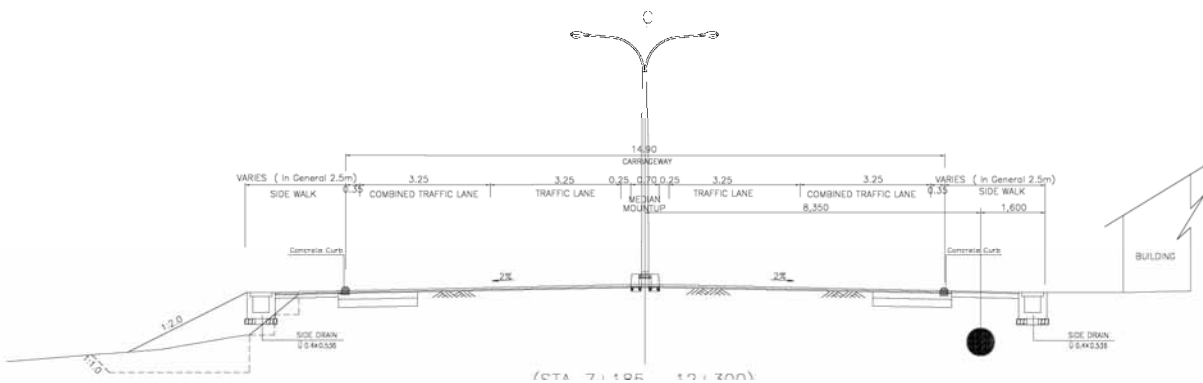
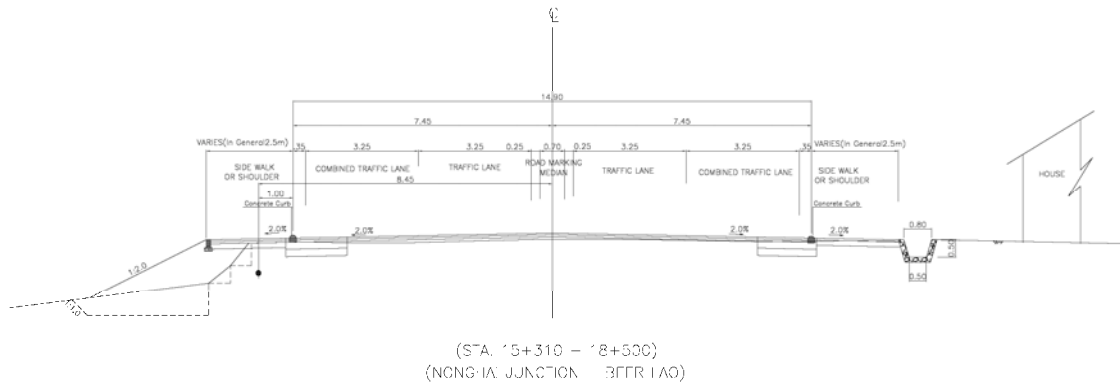


Figure 2-21 Location of Distribution Pipe No. 4 along the Road No. 1 from Chinaimo Junction



c. Hong Wattay Drainage Improvement Project and T2 Road Improvement Project

i. Design concepts

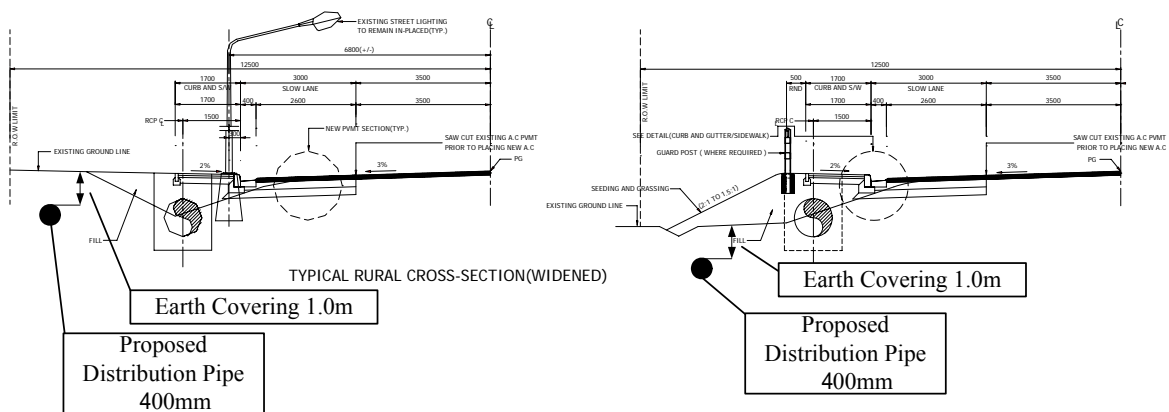
- The pipeline will be designed so that it can be installed before the road improvement project commences, in case the implementation of the road improvement project is delayed.
- The pipeline will be designed so as not to hinder construction of underground facilities that are part of the road improvement project (such as drain culverts).
- Use of restrain joints rather than concrete made thrust blocks will be considered because restrain joints can withstand the force associated with removing the pipe. If a concrete thrust block was used the area surrounding the block may need to be excavated during the road improvement project.
- The valve cover head and manhole levels will be designed to be consistent with the finished levels of the proposed road surface.

ii. Basic Design

【Duplicated Route No. 2】: T2 Road from branching point of Road No. 1 to the point where 2.86 km distance (Distribution Pipe No. 1)

The ADB and Thai Government propose to fund road and drainage improvement works for the T2 Road. The location of the pipeline has been designed to lie outside of the proposed sidewalk as shown on Figure 2-22.

Figure 2-22 Location of Distribution Pipe No. 1 along the T2 Road (from Road No. 1 to 2.86 km point)



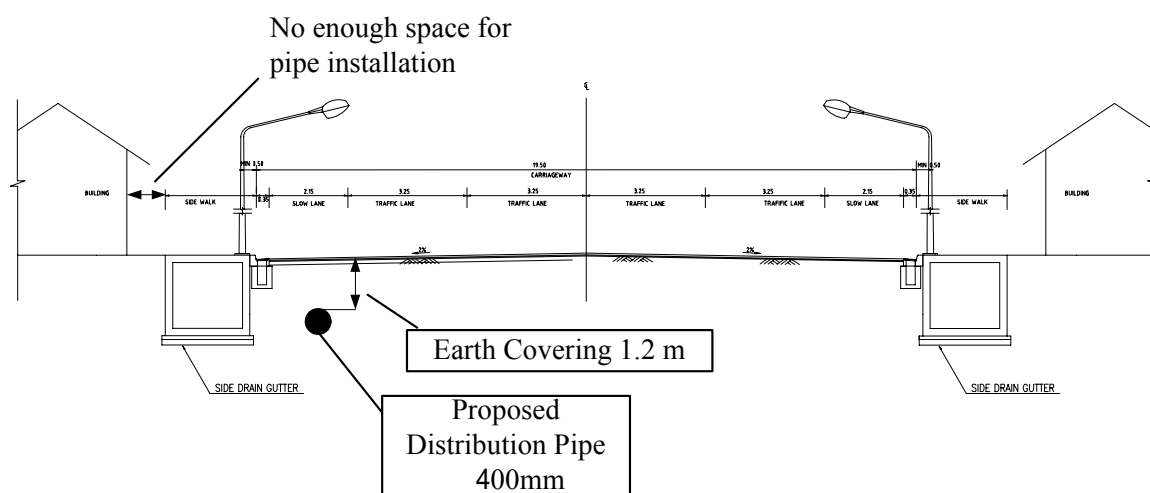
【Duplicated Route No. 2】: Beyond the 2.86 km point along the T2 Road (Distribution Pipe No. 1)

Improvements to the sidewalk and drainage along the T2 road beyond the 2.86 km point have been finished. As shown on Photo 2-1, there is no space for pipe installation between the shops/houses and the road. Therefore the pipe will be installed under the road pavement as shown on Figure 2-23.

Photo 2-1



Figure 2-23 Location of Distribution Pipe No. 1 along the T2 Road (beyond the 2.86 km point)



(2) Pipe Material

Most of the transmission and distribution pipelines were going to be installed along the major roads. However, the Lao PDR have advised that unless there are specific reasons for doing so, the pipes should be installed outside of the pavement. For example, the pipeline along the Road No. 13 needs to be installed in the narrow space between the side walk and the houses as shown on Figure 2-24 and Photo 2-2.

Figure 2-24 Location of pipeline along the Road No. 13

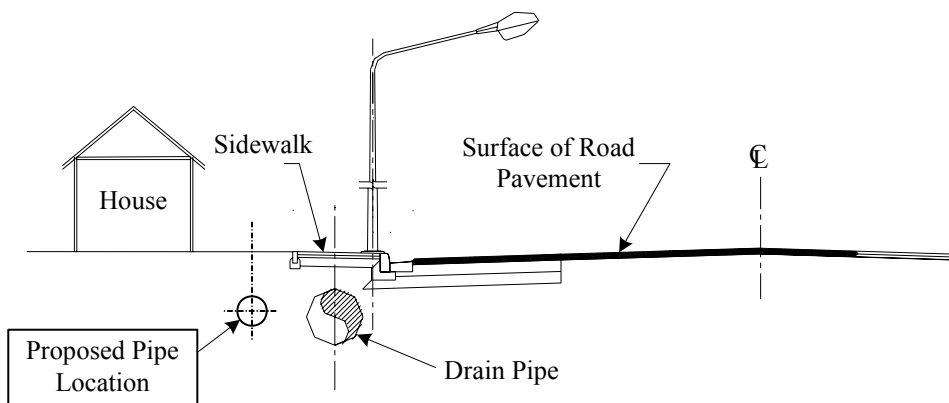


Photo 2-2 Proposed pipeline Route along the Road No. 13



When installing the pipeline along Road No. 1, the width of the pipe trench should be minimized to avoid interference with traffic. To minimize the trench width, a ductile cast iron pipe with push on joints will be used rather than a steel pipe that would require a wider and deeper trench for welding work.

The proposed pipe materials are :

- Ductile Cast Iron Pipes (DIP) for pipelines with a diameter larger than 300 mm.
- PVC for pipelines with a diameter smaller than 250 mm.
- Steel pipes for the pipe bridge.

Both the NPVC and AFD applied the ISO standards and therefore this project will also apply the ISO standards.

(3) Transmission and Distribution Pipeline

The basic designs for the transmission and distribution pipeline are shown in the following figures.

a. Transmission Pipe No. 2 : Chinaimo WTP to Chompheth Road, 700-0.72km

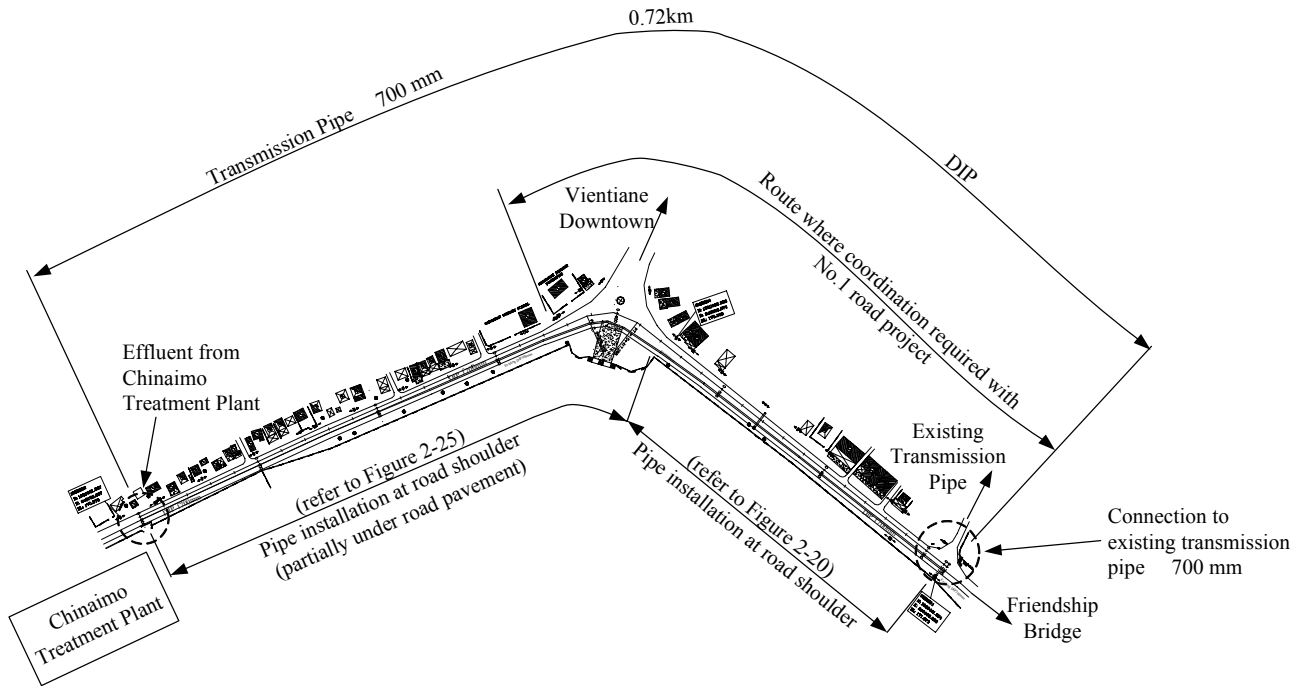
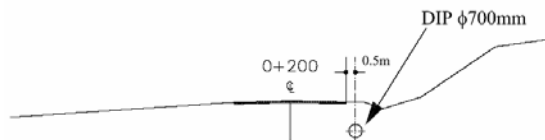


Figure 2-25 Pipe alignment located 0.4km from the Chinaimo Treatment Plant



b. Distribution Pipe No. 1 : Kaolioe WTP to Savang Theater, 700-0.50km, 600-1.58km, 400-4.69km

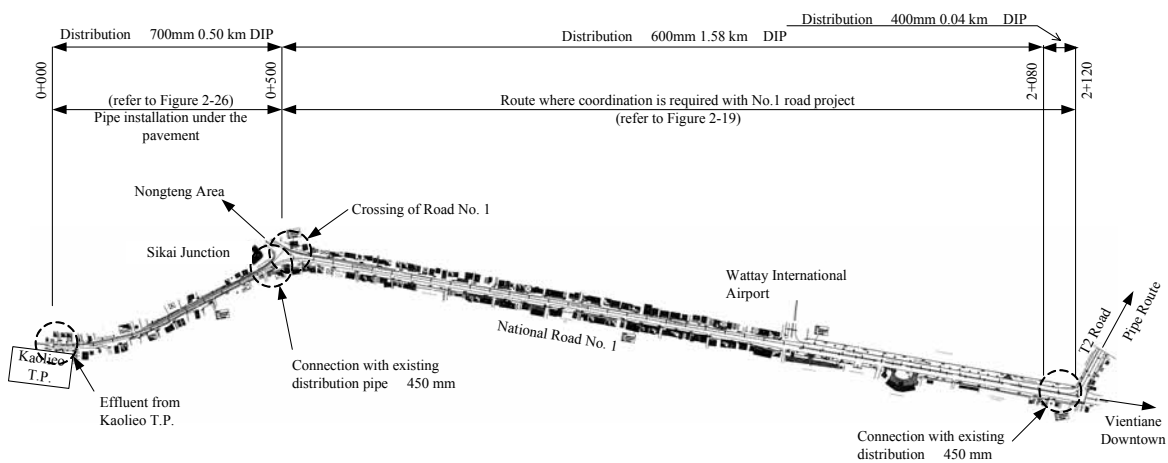


Figure 2-26 Pipe alignment located 0.5km from the Kaolieo Treatment Plant

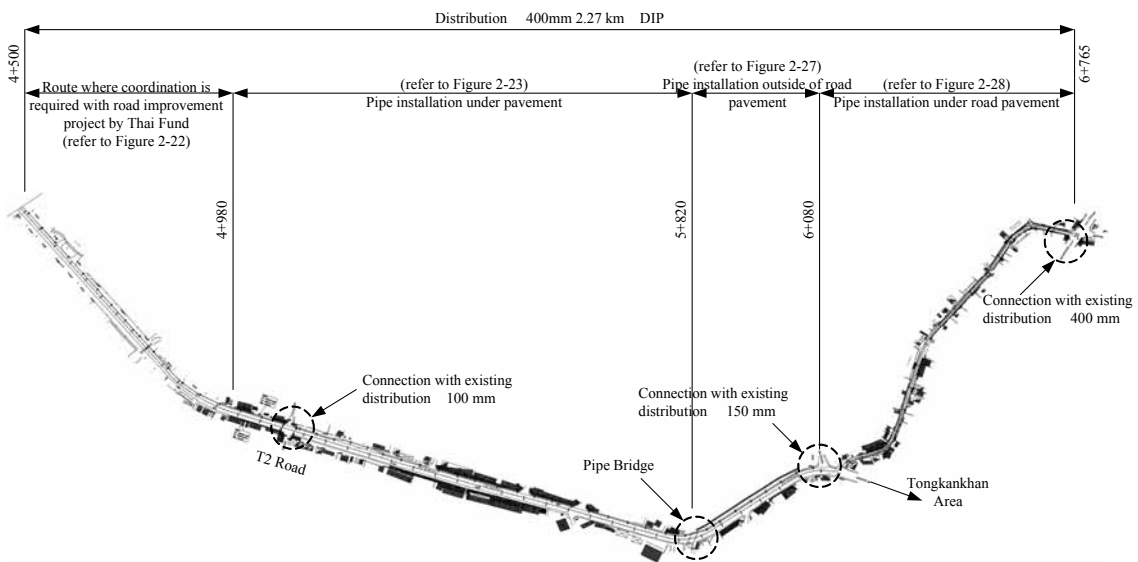
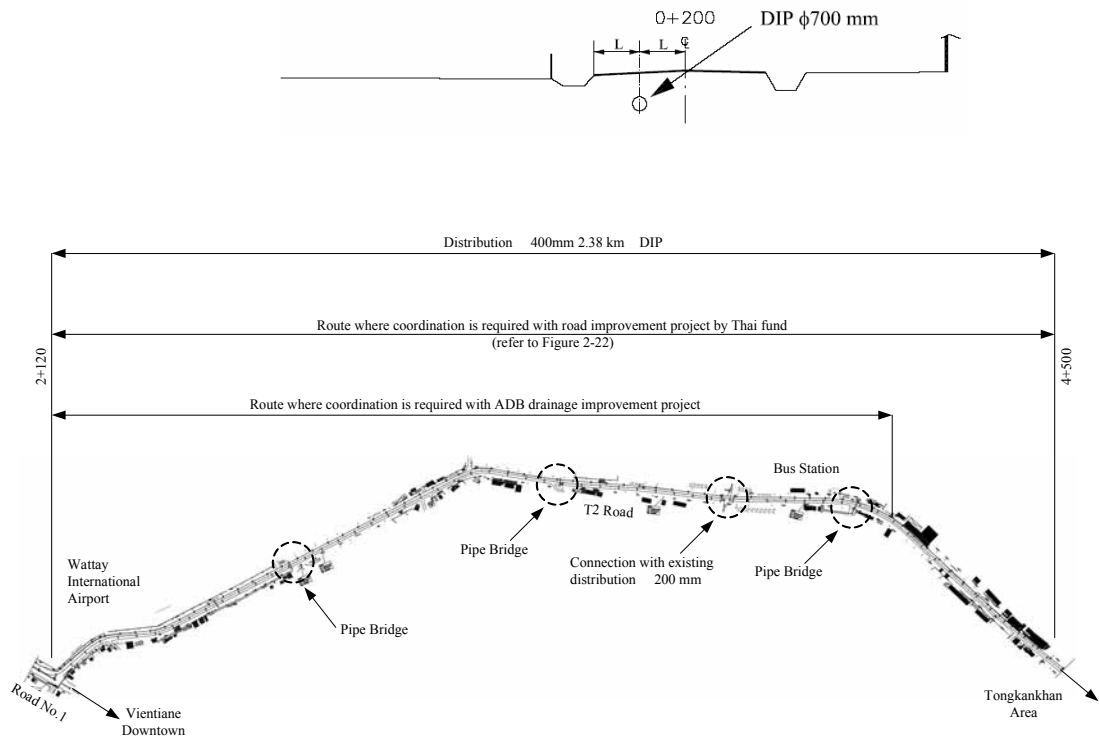


Figure 2-27 Pipe alignment located 5.08 to 6.06km from the Kaolieo Treatment Plant

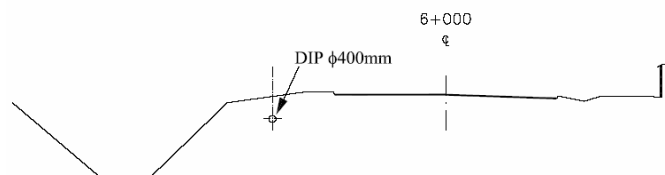
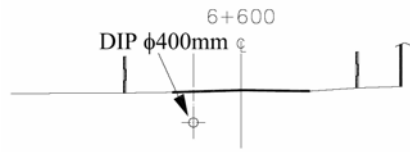
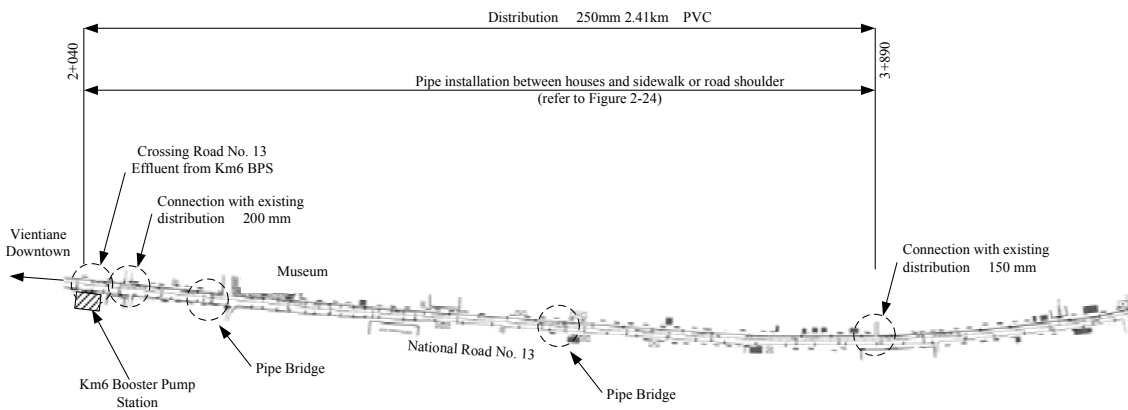


Figure 2-28 Pipe alignment located 6.06 to 6.77 km from the Kaolieo Treatment Plant



c. Distribution Pipe No. 2 : Km6 BPS to Donnoune, 150-1.85km



d. Distribution Pipe No. 3 : Thongpong to Nongteng BPS, 150-2.60km

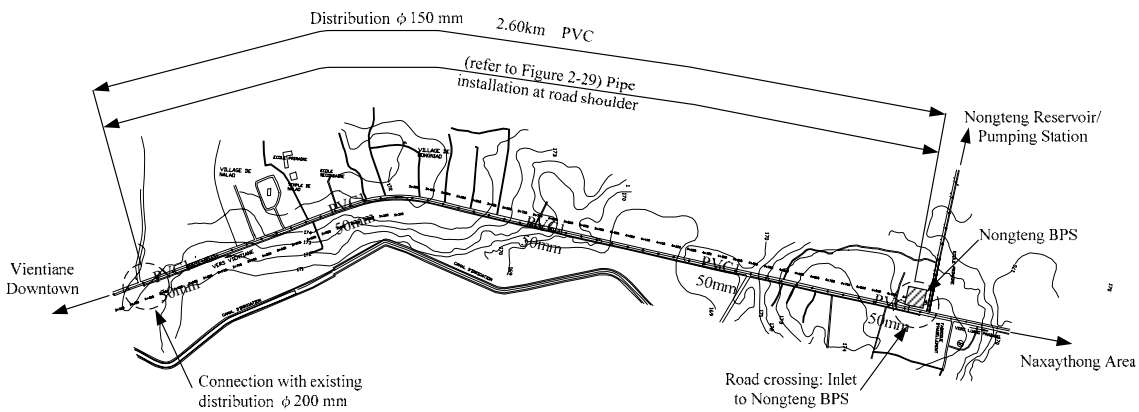
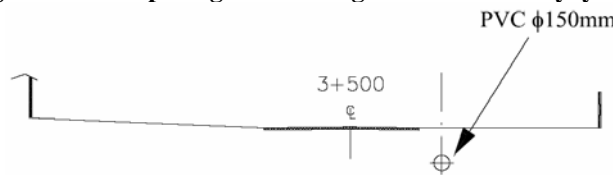
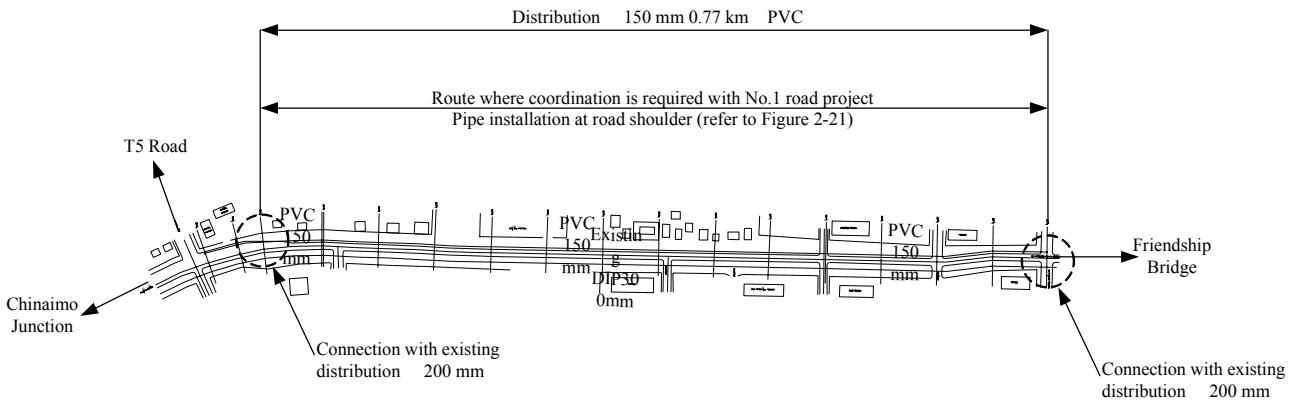


Figure 2-29 Pipe alignment along the Road to Naxyaythong



e. Distribution Pipe No. 4 : T5 Road to Plywood Factory, 150-0.77km



(4) Pipe Bridge and Culvert Crossing

Along the transmission and distribution pipe routes, there are several streams, ditches, and culverts which pipeline should cross. For these crossing, pipe bridges or culvert crossings are designed. For the pipe bridge, steel pipe of which unit weight is lighter than DIP is applied. Typical structure of the pipe bridge and culvert crossing are shown on Figures 2-30 and 2-31.

Figure 2-30 Typical Structure of Pipe Bridge

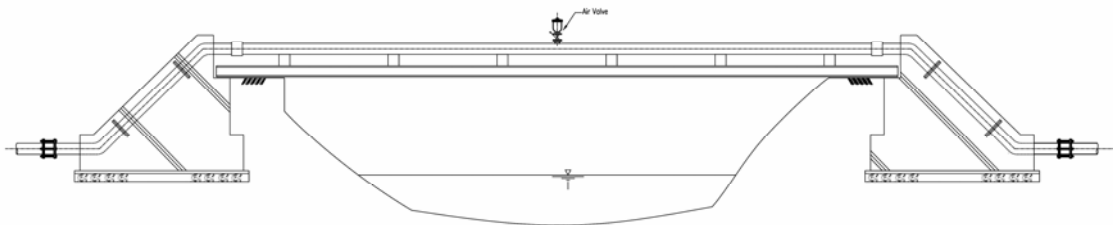
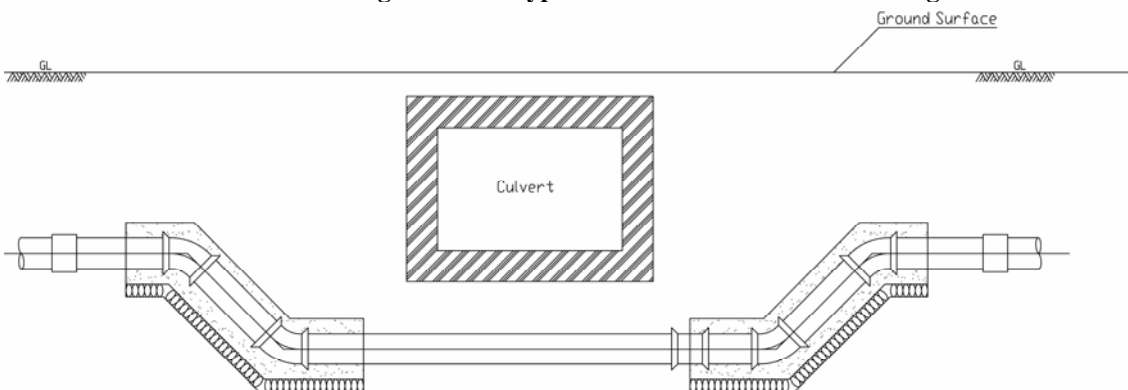


Figure 2-31 Typical Structure of Culvert Crossing

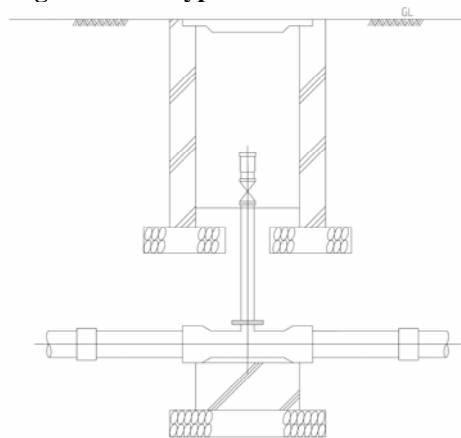


(5) **Accessories**

1) **Air Valve**

Air will be caught in the raised parts of the pipeline and will disrupt the smooth flow of water. Therefore air valves will be installed at the raised parts of the pipes to release the captured air and to allow air intake when water is draining from the pipeline. Figure 2-32 shows a typical air valve assembly.

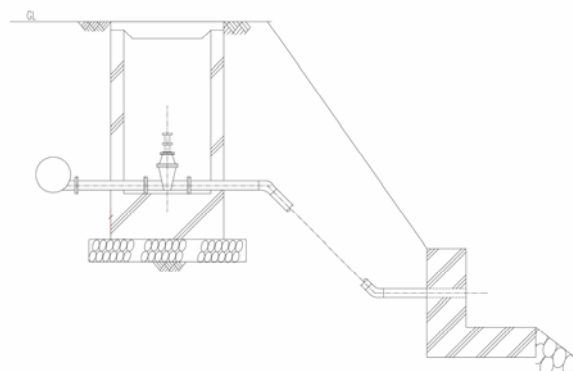
Figure 2-32 Typical Air Valve Assembly



2) **Blow-off**

A blow-off will be installed at the lower parts of the pipeline to drain water during flushing or after construction/repair work. A typical blow-off assembly is shown in Figure 2-33.

Figure 2-33 Typical Blow-off Assembly



3) **Thrust Block**

Water pressure will result in unbalanced forces affecting the fittings and valves that are inside the pipeline.

Concrete thrust blocks or restrain joints will be installed to prevent pipe or valve movement. Diagrams of a typical thrust block and a restrain joint are shown on Figures 2-34 and 2-35.

Figure 2-34 Concrete Thrust Block

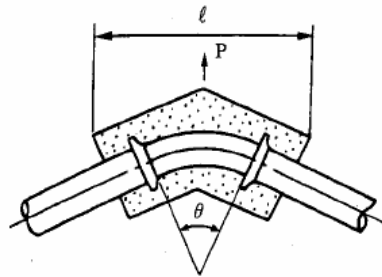
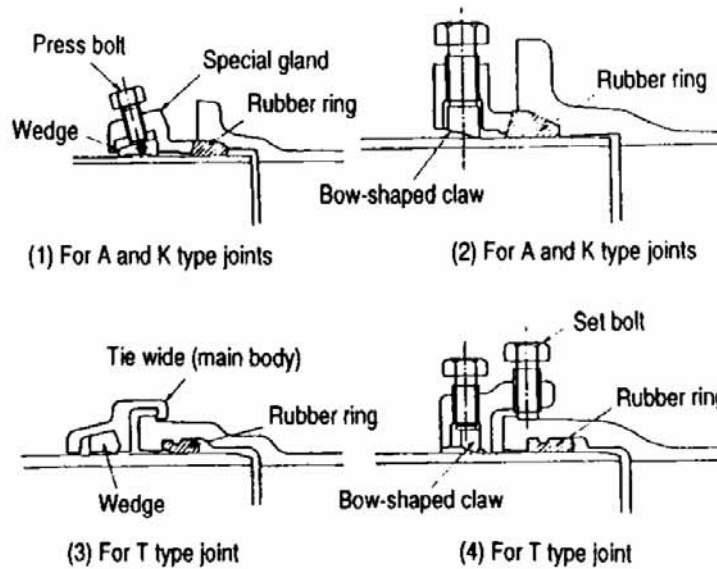


Figure 2-35 Restrain Joint



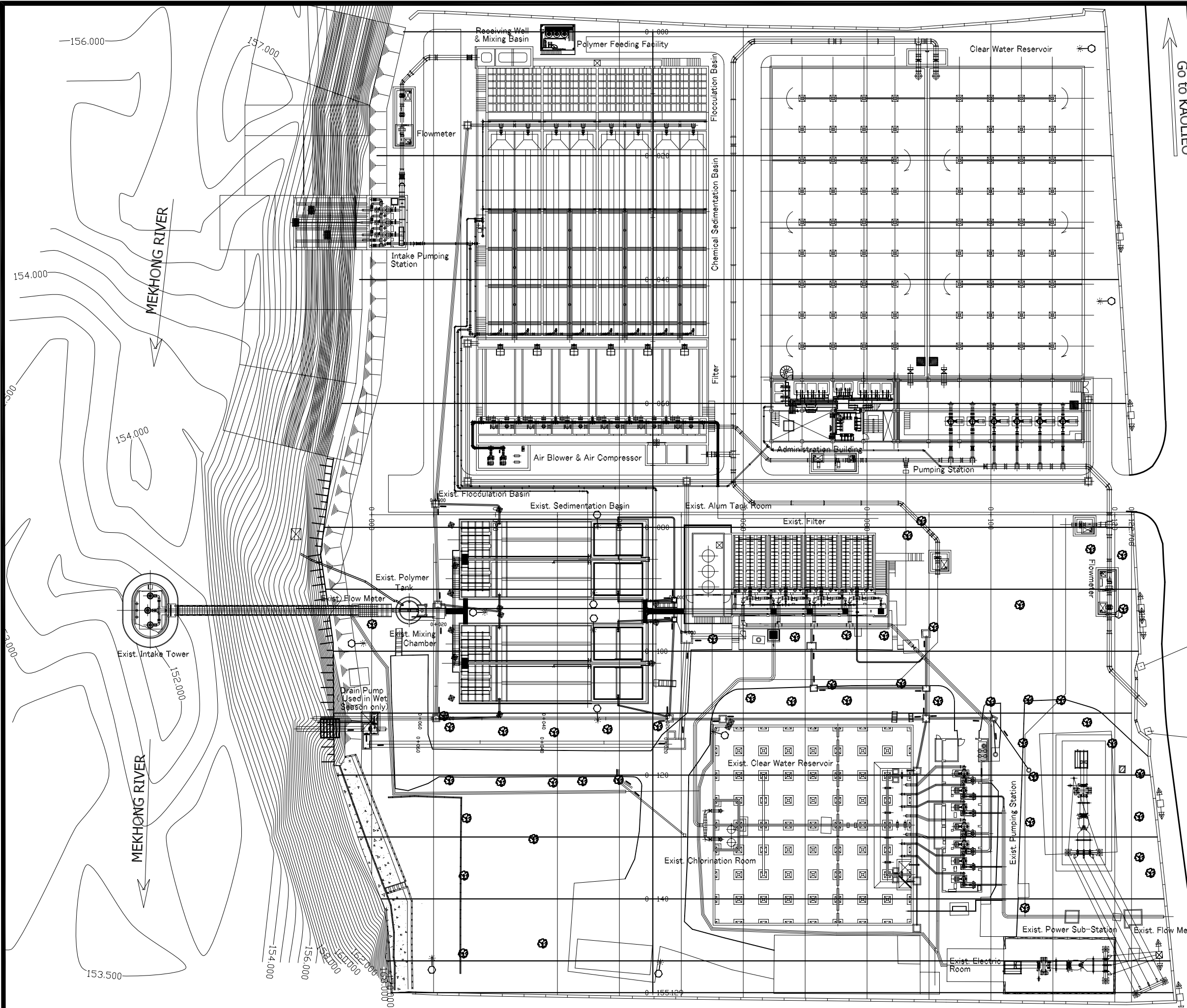
The excavation of the pipeline trenches will disrupt traffic flow and will affect access to the houses and shops located along the trench alignment. It is important that backfilling of the trench after pipe installation is quick, to minimize this disruption. Therefore, it is recommended that restrain joints rather than concrete thrust blocks are used, because restrain joints can withstand the force of pulling the pipe out. Also, concrete blocks would require several days to set before backfilling of the trench was possible.

2-2-3 Basic Design Drawings

Basic design drawings were prepared, based on the basic plan. The basic design drawings are listed below and provided in the following pages.

List of Drawings

- Figure 2-36 Expansion of Kaolieo Treatment Plant, General Plan
- Figure 2-37 Expansion of Kaolieo Treatment Plant, Water Flow Diagram
- Figure 2-38 Expansion of Kaolieo Treatment Plant, Details of Intake Gate
- Figure 2-39 Expansion of Kaolieo Treatment Plant, Flocculation Basin, Sedimentation, Filter
- Figure 2-40 Expansion of Kaolieo Treatment Plant, Details of Sedimentation Basin-1
- Figure 2-41 Expansion of Kaolieo Treatment Plant, Details of Sedimentation Basin-2
- Figure 2-42 Expansion of Kaolieo Treatment Plant, Details of Filter
- Figure 2-43 Expansion of Kaolieo Treatment Plant, Reservoir, Chemical/Office Bldg and Pumping Station-1
- Figure 2-44 Expansion of Kaolieo Treatment Plant, Reservoir, Chemical/Office Bldg and Pumping Station-2
- Figure 2-45 Expansion of Kaolieo Treatment Plant, Reservoir, Chemical/Office Bldg
- Figure 2-46 Rehabilitation of Kaolieo Treatment Plant, General Plan
- Figure 2-47 Rehabilitation of Kaolieo Treatment Plant, Water Flow Diagram
- Figure 2-48 Rehabilitation of Kaolieo Treatment Plant, Details of Intake Tower
- Figure 2-49 Rehabilitation of Kaolieo Treatment Plant, Details of Receiving Well
- Figure 2-50 Rehabilitation of Kaolieo Treatment Plant, Plan of Sedimentation Basin (Before Rehabilitation)
- Figure 2-51 Rehabilitation of Kaolieo Treatment Plant, Plan of Sedimentation Basin (After Rehabilitation)
- Figure 2-52 Rehabilitation of Kaolieo Treatment Plant, Filter (Before Rehabilitation)
- Figure 2-53 Rehabilitation of Kaolieo Treatment Plant, Filter (After Rehabilitation)
- Figure 2-54 Rehabilitation of Kaolieo Treatment Plant, Details of Pumping Station
- Figure 2-55 Improvement of Chinaimo Treatment Plant, General Plan
- Figure 2-56 Improvement of Chinaimo Treatment Plant, Water Flow Diagram
- Figure 2-57 Improvement of Chinaimo Treatment Plant, Plan of Reservoir and Pumping Station
- Figure 2-58 Improvement of Chinaimo Treatment Plant, Section of Reservoir and Pumping Station
- Figure 2-59 Rehabilitation of Km6 Booster Pumping Station, General Plan
- Figure 2-60 Rehabilitation of Km6 Booster Pumping Station, Detail of Existing Pumping Station
- Figure 2-61 Typical Drawings of Valve
- Figure 2-62 Typical Drawing of Valve Chamber
- Figure 2-63 Typical Drawing of Pipe Bridge



Go to KAOLIEO

Go to WATTAI

LEGEND

⊕	Bench Mark	—	Flow
+	Coordinate	—	Existing Road
—	Base Line	—	Pipe
□	Wooden House	⊙	Tree
□	Necessary House	+	Water valve
⊕	Electricity Pole	⊠	Main hole
—	Fence	□	Dirty Water Box
—	Wall	⊠	Fire Valve
⊠	Concrete Plate	—	Guardrail
—	Channel	—	Bank Protection
—	Side Drain	—	Mekong Border
—	Electricity Channel	⊠	Stair



BM01
N: 1988668.172
E: 241263.532
ELV: 171.581

DP01-SDVA(BM02)
N: 1988666.079
E: 241273.874
ELV: 171.926

Lao People's Democratic Republic Ministry of Communication, Transport, Post and Construction	
The Basic Design Study on The Project for the Vientiane Water Supply Development in Lao People's Democratic Republic	
TITLE Expansion of Kaoliao Treatment Plant, General Plan	
SCALE 1 / 600	DRAWING NO Figure 2-36
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JAPAN INTERNATIONAL COOPERATION AGENCY	