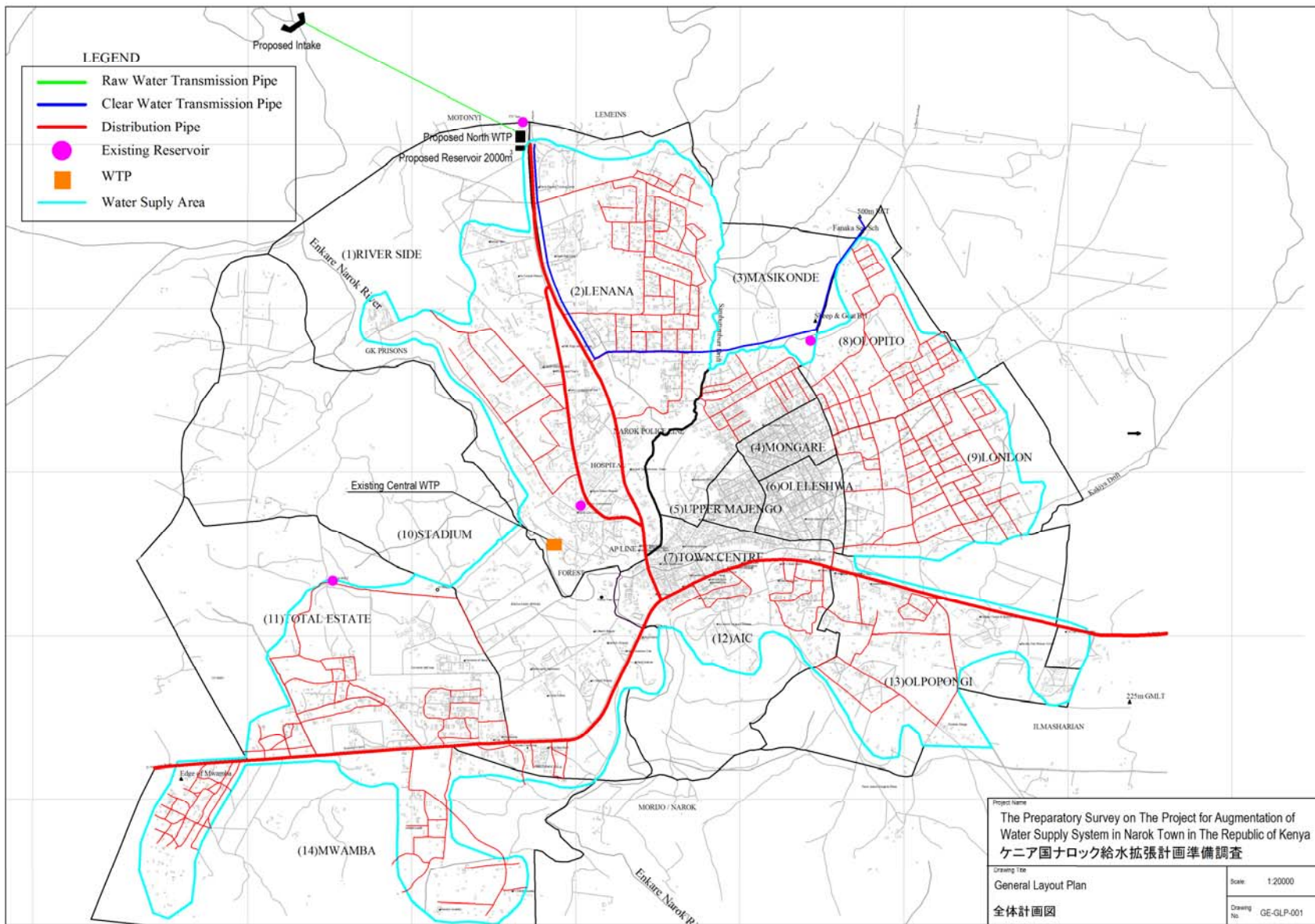


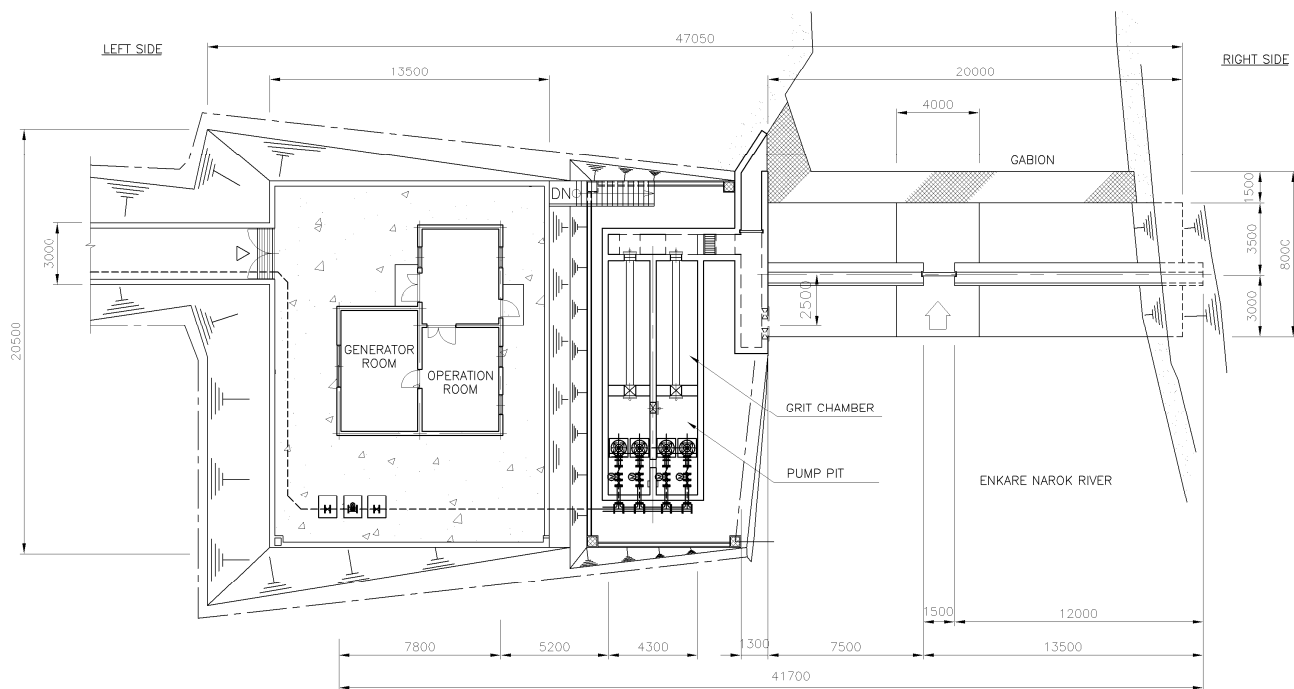
2-2-3 Outline Design Drawing

Table 2-2-23 shows the list of outline design drawings:

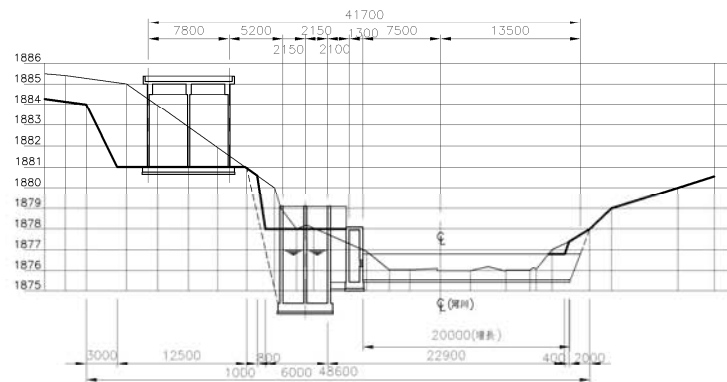
Table 2-2-23 List of Outline Design Drawings

No.	Drawing No.	Drawing Title
1	GE-GLP-001	General Layout Plan
2	WIF-LP-001	Water Intake Facility General Layout Plan
3	WIF-PFD-001	Water Intake Facility Process Flow Diagram
4	WIF-IW-001	Water Intake Facility Weir Plan and Section
5	WIF-PR-001	Water Intake Facility Grit Chamber and Pump Room Layout Plan and Section
6	WIF-GER-001	Water Intake Facility Generator/ Electrical Room Plan, Section and Elevation
7	WIF-E-001	Water Intake Facility Single Line Diagram
8	WIF-E-002	Water Intake Facility LV Distribution Panel and Local Control Panel Outline Diagram
9	WTP-LP-001	Proposed North WTP Layout Plan
10	WTP-HP-001	Proposed North WTP Hydraulic Profile
11	WTP-PFD-001	Proposed North WTP Process Flow Diagram
12	WTP-IFD-001	Proposed North WTP Instrumentation Flow Diagram
13	WTP-RW-001	Proposed North WTP Receiving Well Plan and Section
14	WTP-ST-001	Proposed North WTP Sedimentation Tank Plan
15	WTP-ST-002	Proposed North WTP Sedimentation Tank Section
16	WTP-RSF-001	Proposed North WTP Rapid Filter Plan
17	WTP-RSF-002	Proposed North WTP Rapid Filter Section
18	WTP-CWR-001	Proposed North WTP Clear Water Reservoir Plan
19	WTP-CWR-002	Proposed North WTP Clear Water Reservoir Section
20	WTP-EWT-001	Proposed North WTP Elevated Backwash Water Tank Plan and Section
21	WTP-SDB-001	Proposed North WTP Drying Bed Plan and Section
22	WTP-DP-001	Proposed North WTP Drainage Pond Plan and Section
23	WTP-ADB-001	Proposed North WTP Operation Building Plan and Section
24	WTP-CR-001	Proposed North WTP Chemical House Plan and Section
25	WTP-CR-002	Proposed North WTP Chemical House Elevation
26	WTP-GER-001	Proposed North WTP Generator and Electrical House Plan, Section and Elevation
27	WTP-E-001	Proposed North WTP Single Line Diagram
28	WTP-E-002	Proposed North WTP LV Distribution Panel and Local Control Panel Outline Diagram
29	WTP-GH-001	Proposed North WTP Guard House Plan, Section and Elevation
30	WTP-Reh-001	Existing Central WTP General Layout Plan
31	WTP-Reh-002	Existing Central WTP Chemical House Plan, Section and Elevation
32	EDT-Reh-001	Existing Reservoir Outline Plan and Painting Area
33	PI-RM-001	Raw Water Transmission Pipe Plan and Profile
34	PI-RM-002	Raw Water Transmission Pipe Plan and Profile
35	PI-TM-001	Clear Water Transmission Pipe Layout Plan
36~43	PI-DP-001~008	Distribution Pipe, Distribution Main Plan and Profile
44	PI-WPB-001	Water Pipe Bridge Plan and Profile
45~50	PI-SP-001~006	Distribution Branch Pipe Plan





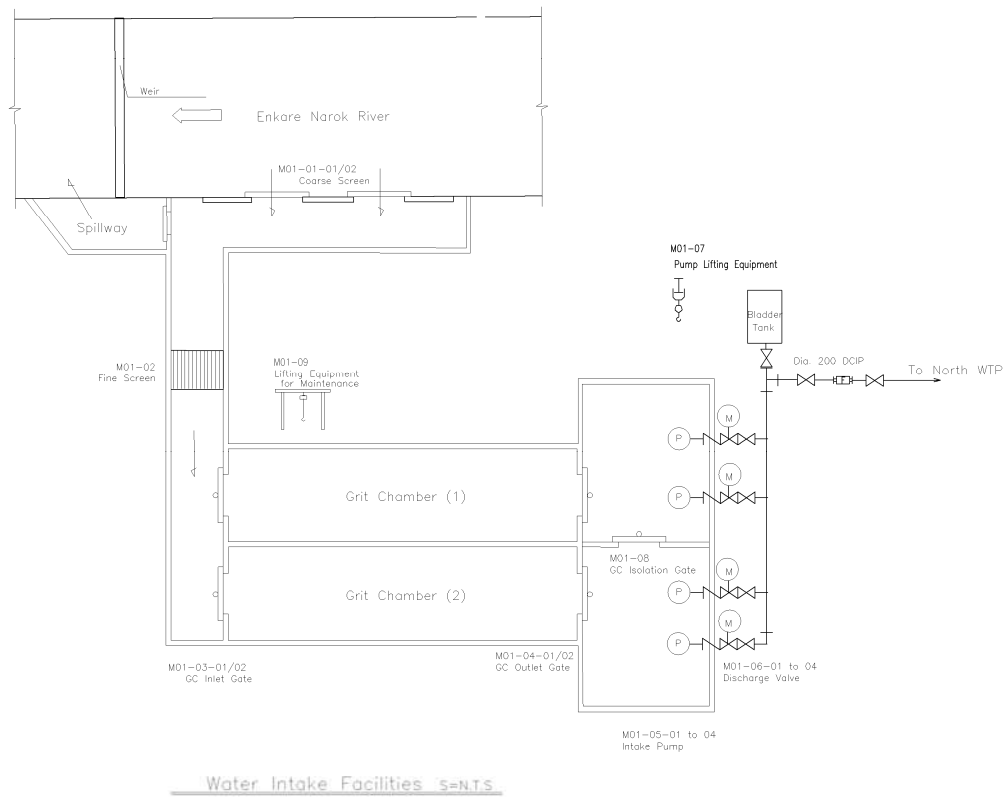
INTAKE FACILITY LAYOUT PLAN S=1:200



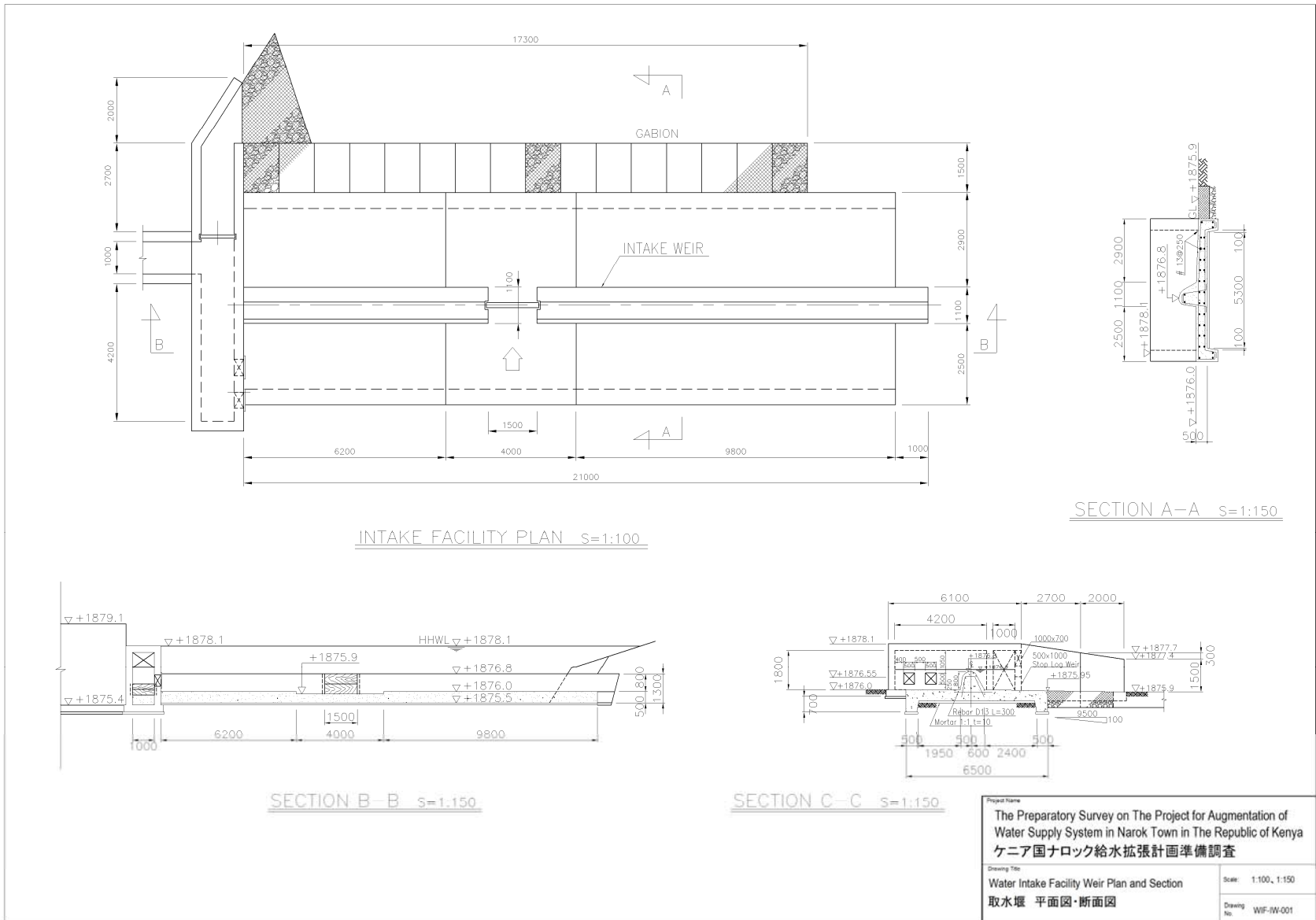
INTAKE FACILITY SECTION

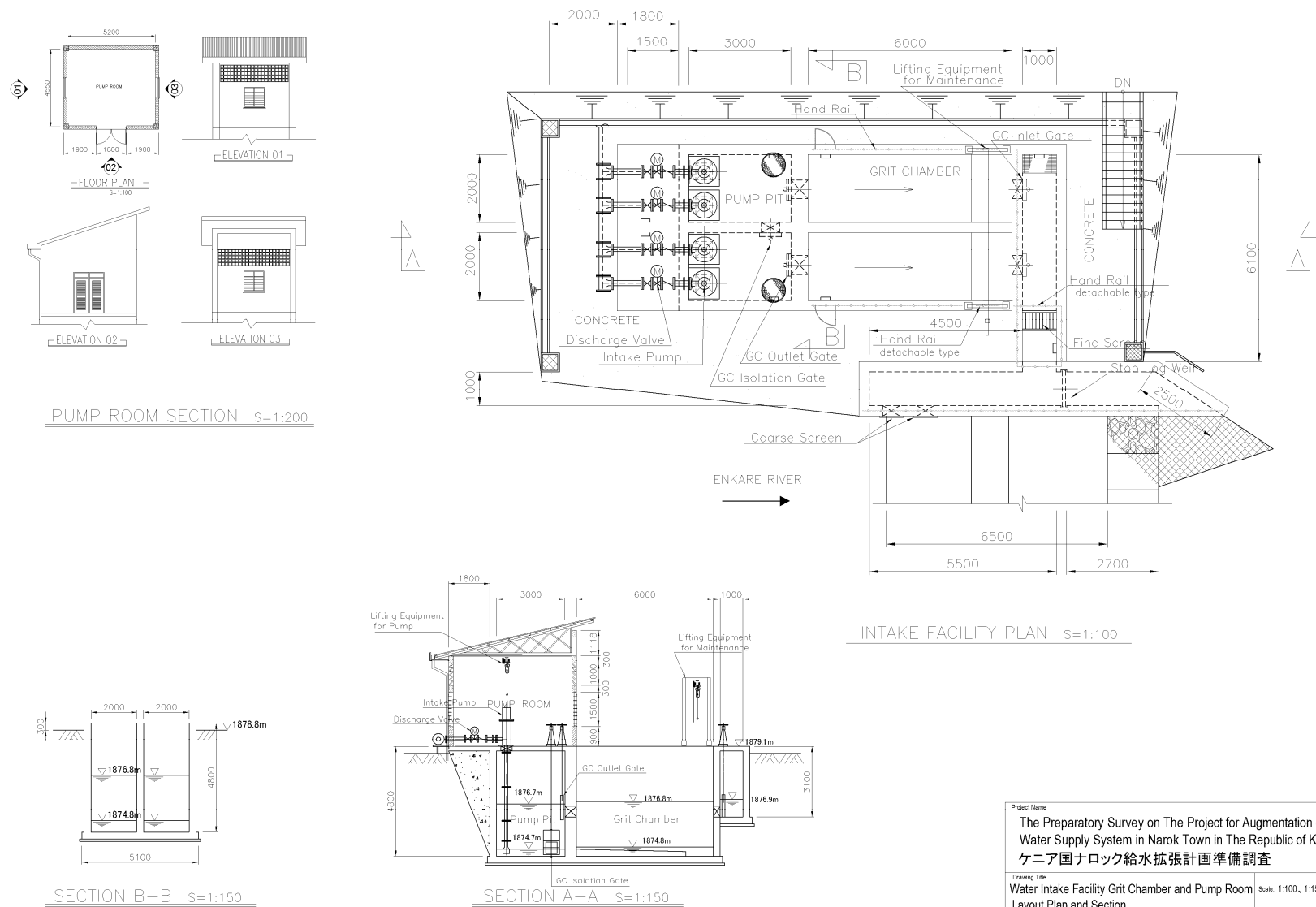
V=1:200, H=1:400

Project Name	
The Preparatory Survey on The Project for Augmentation of Water Supply System in Narok Town in The Republic of Kenya ケニア国ナロック給水拡張計画準備調査	
Drawing Title	Scale
Water Intake Facility General Layout Plan	1:200, 1:400
取水施設 一般平面図	Drawing No
	WIF-LP-001

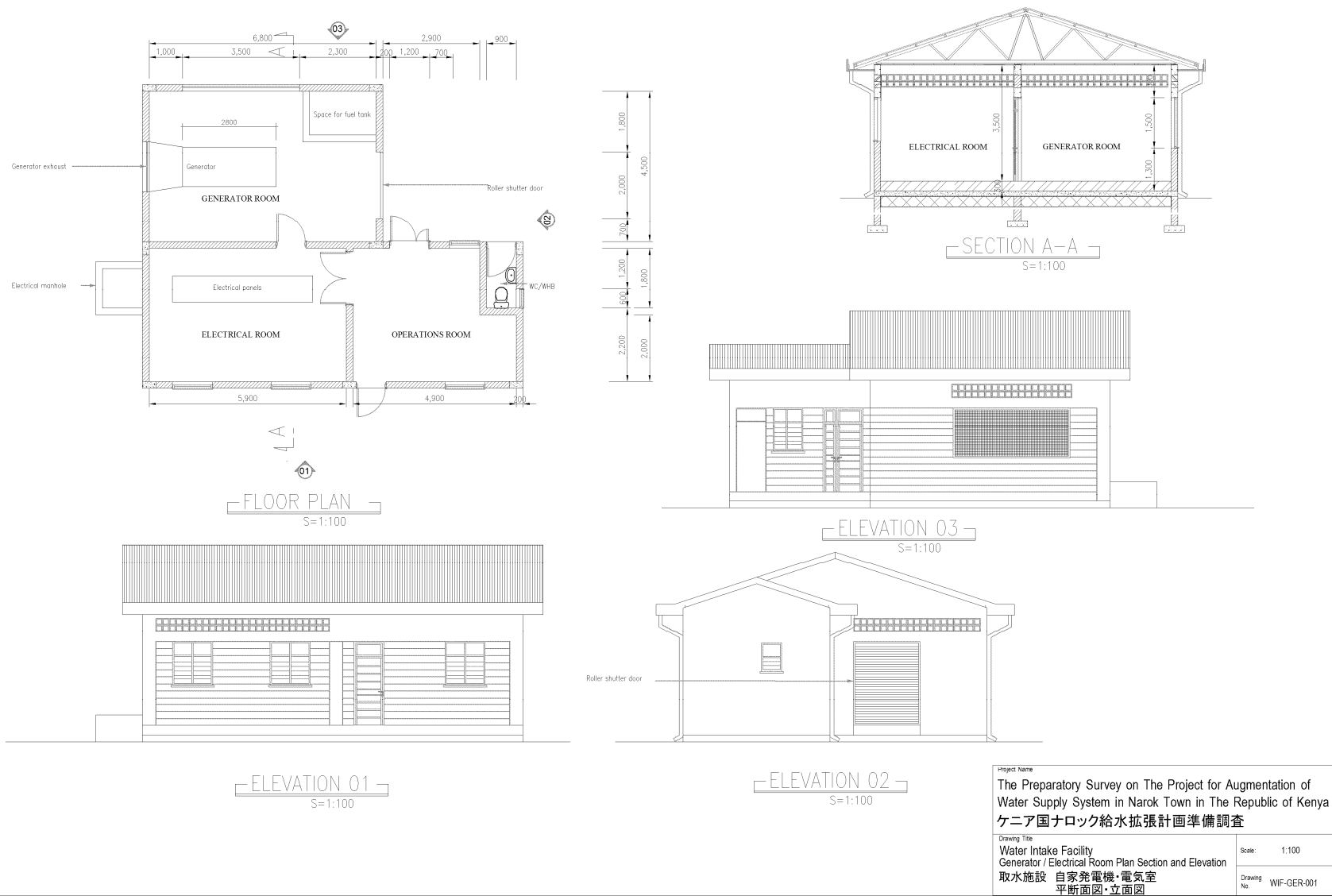


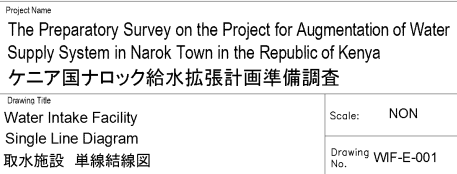
Project Name The Preparatory Survey on The Project for Augmentation of Water Supply System in Narok Town in The Republic of Kenya ケニア国ナロック給水拡張計画準備調査	
Drawing Title Water Intake Facility Process Flow Diagram 取水施設 処理フロー図	Scale: NON
	Drawing No. WIF-PFD-001

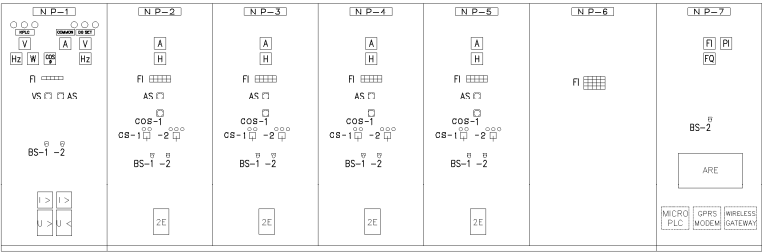




Project Name	
The Preparatory Survey on The Project for Augmentation of Water Supply System in Narok Town in The Republic of Kenya ケニア国ナロク給水拡張計画準備調査	
Drawing Title	Scale: 1:100, 1:150, 1:200
Water Intake Facility Grit Chamber and Pump Room Layout Plan and Section	
沈砂池・ポンプ室 平面図・断面図	
Drawing No.	WIF-PR-001







Front View



Side View

LEGEND	
No.	NAME
NP-1	INCOMING PANEL
NP-2	No.1 INTAKE PUMP PANEL
NP-3	No.2 INTAKE PUMP PANEL
NP-4	No.3 INTAKE PUMP PANEL
NP-5	No.4 INTAKE PUMP PANEL
NP-6	LV FEEDER PANEL
NP-7	INSTRUMENTATION PANEL
NP-8	WH METER PANEL
NP-9	No.1,2 INTAKE PUMP LOCAL PANEL
NP-10	No.3,4 INTAKE PUMP LOCAL PANEL
COS-1	CHANGE OVER SWITCH (AUTO - MANUAL)
COS-2	CHANGE OVER SWITCH (LOCAL - ELECTRICAL ROOM)
CS-1	OPERATION SWITCH (RUN-STOP)
CS-2	OPERATION SWITCH (OPEN-OFF - CLOSE)
BS-1	PUSH BUTTON SWITCH (ALARM RESET)
BS-2	OPERATION SWITCH (LAMP TEST)
ARE	AUTOMATIC REPORT EQUIPMENT



Front View



Side View

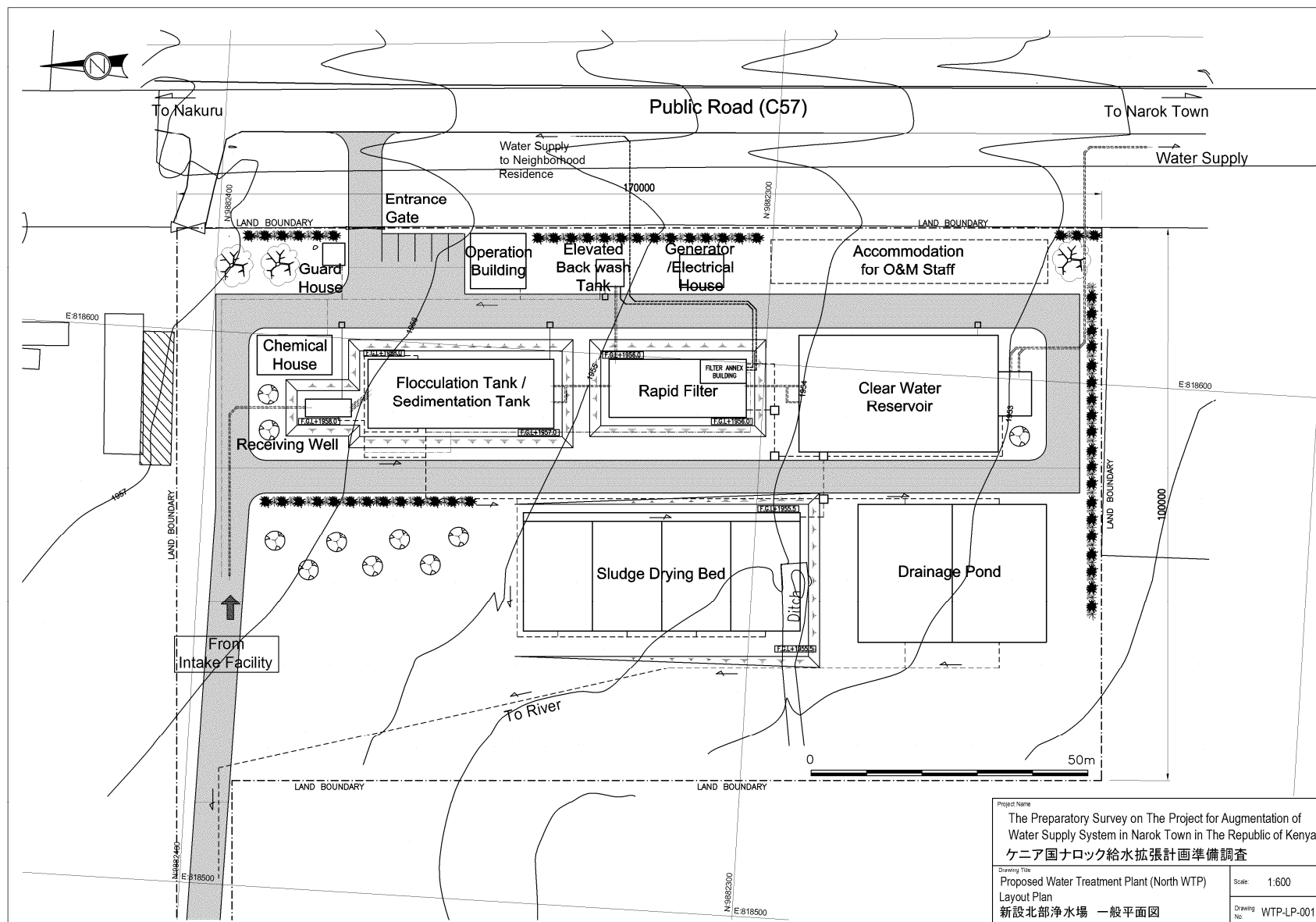


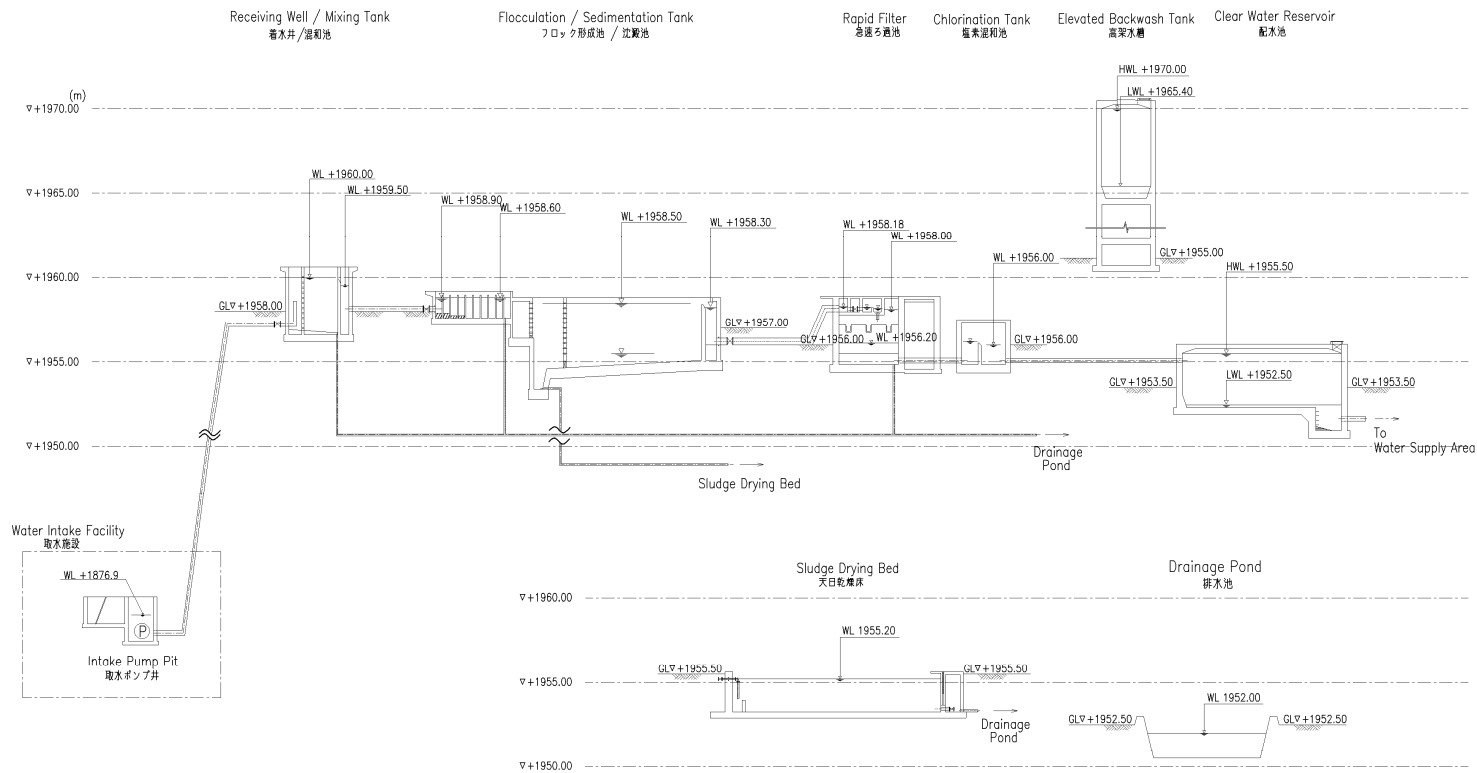
Front View



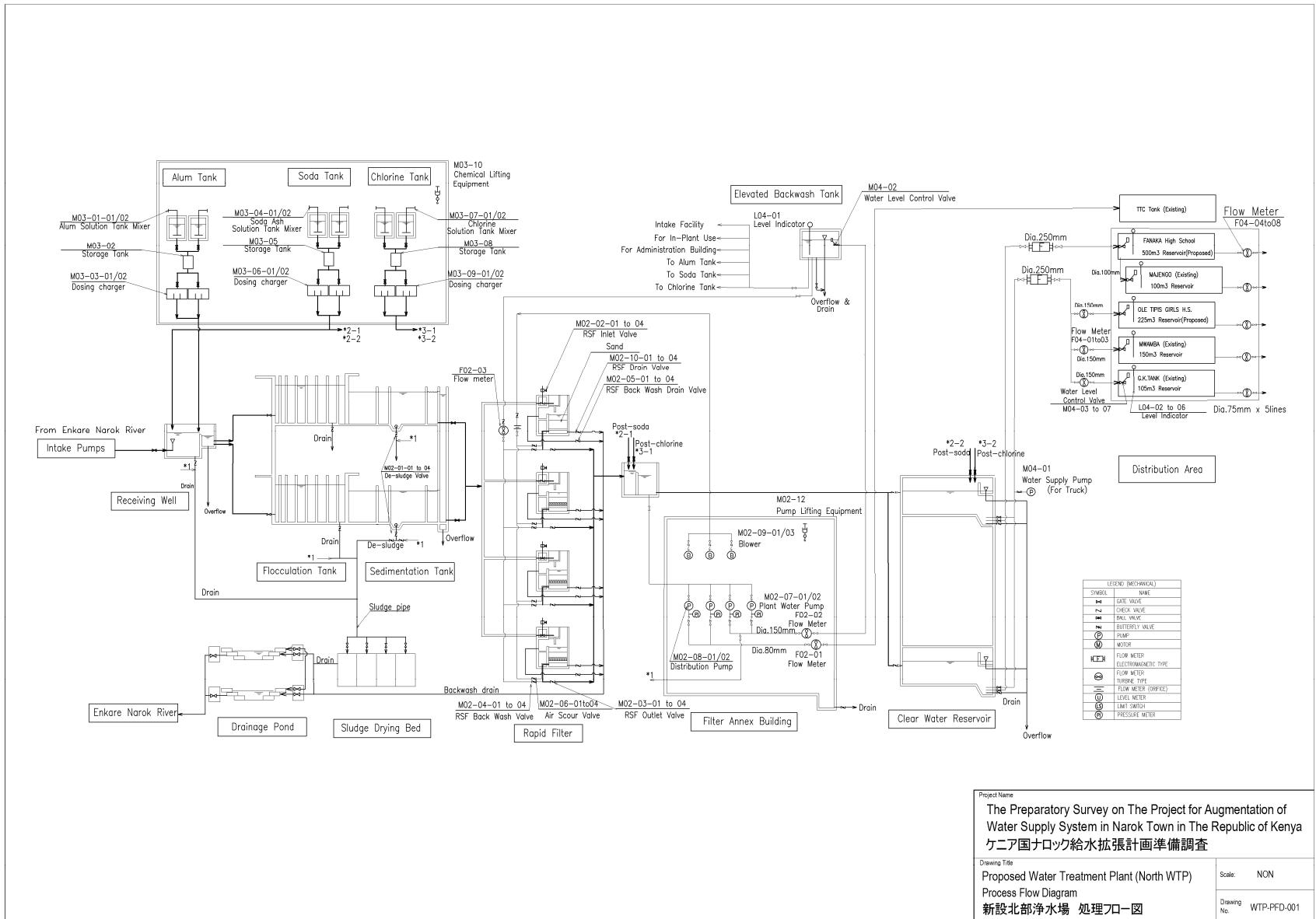
Side View

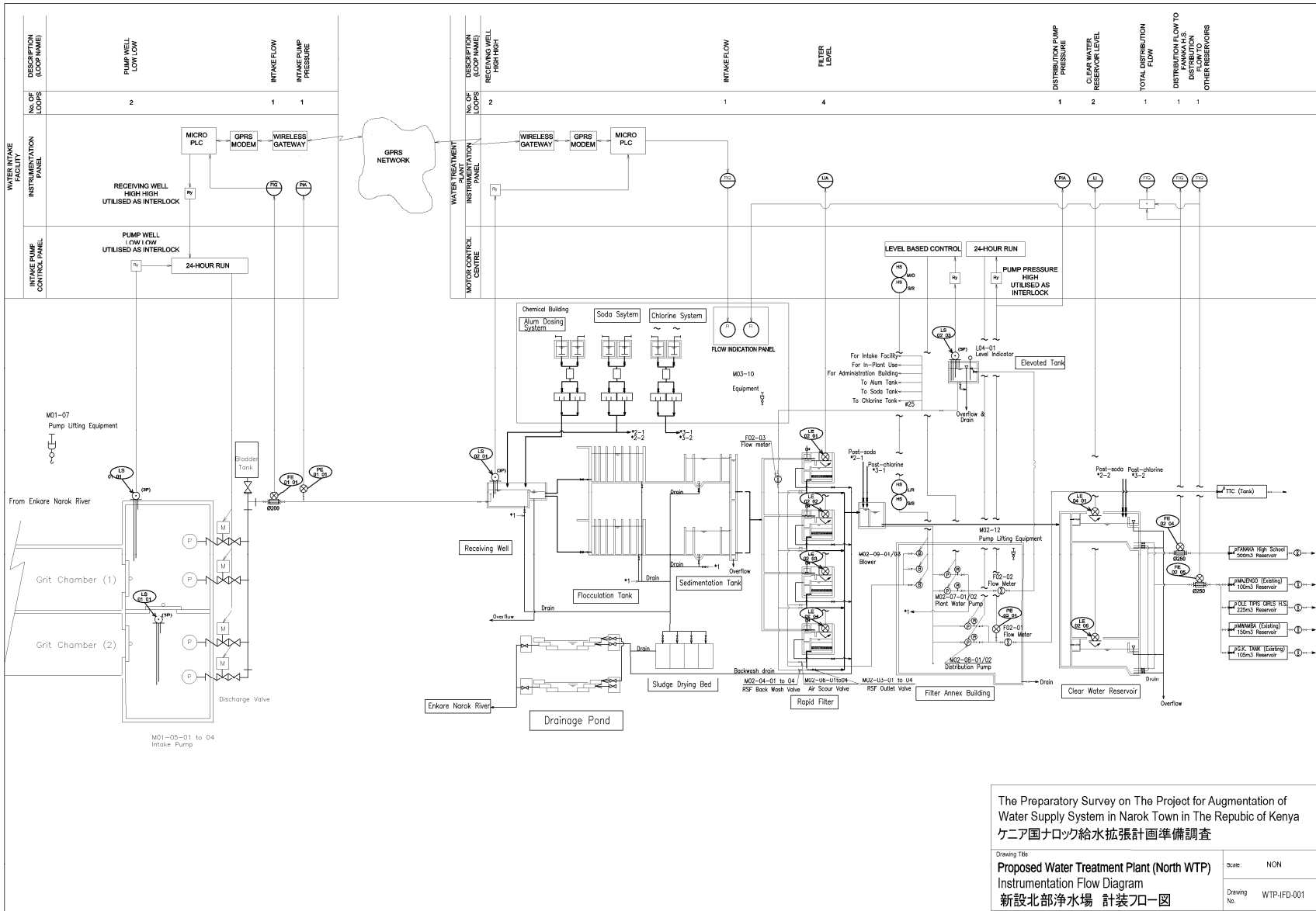
Project Name The Preparatory Survey on the Project for Augmentation of Water Supply System in Narok Town in the Republic of Kenya ケニア国ナロック給水拡張計画準備調査	
Drawing Title Water Intake Facility LV Distribution Panel and Local Control Panel Outline Diagram 取水施設 低圧盤姿図 現場盤姿図	Scale: NON
	Drawing No. WIF-E-002

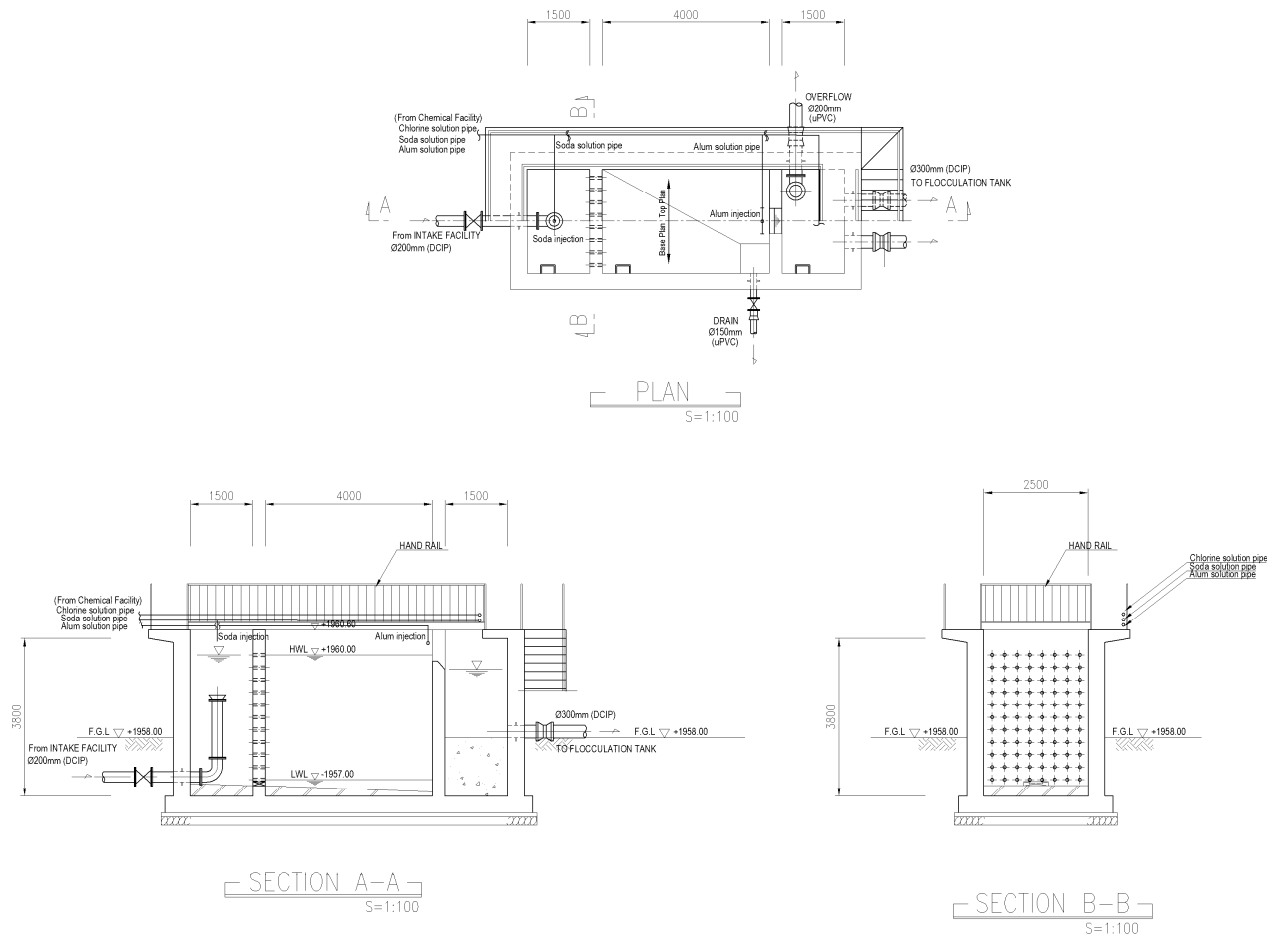




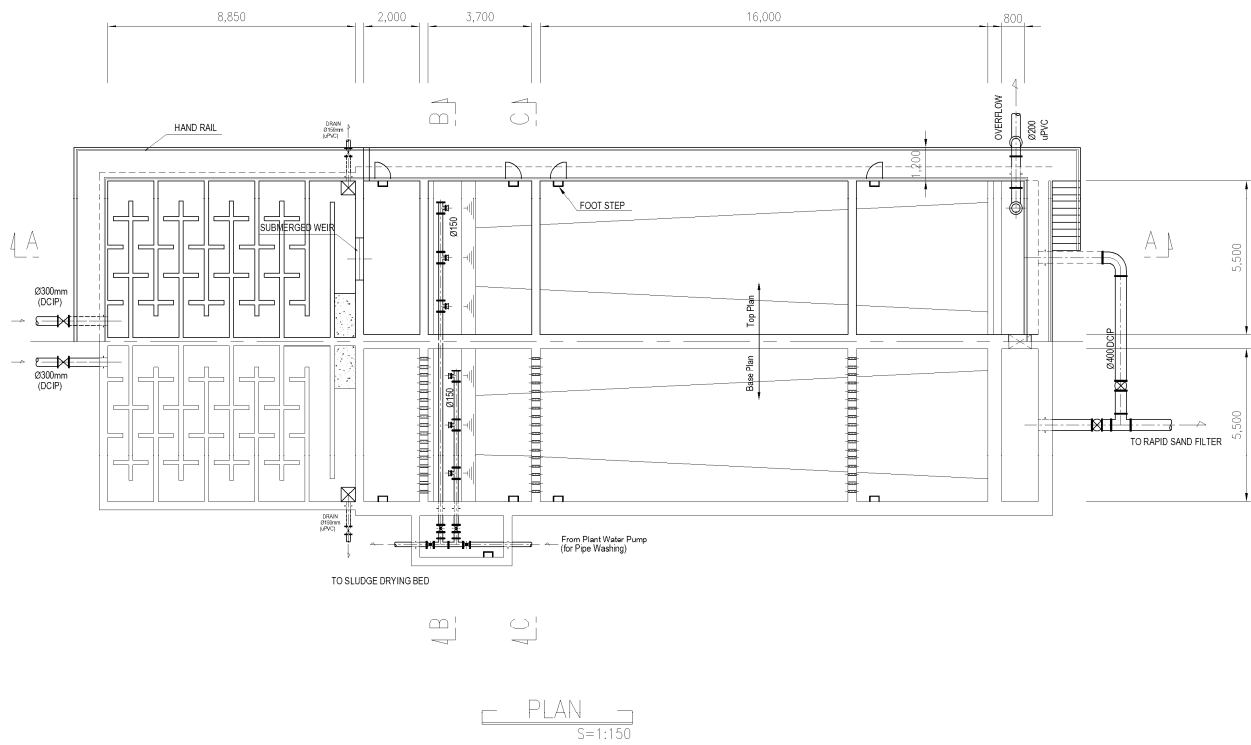
Project Name The Preparatory Survey on The Project for Augmentation of Water Supply System in Narok Town in The Republic of Kenya ケニア国ナロック給水拡張計画準備調査		
Drawing Title Proposed Water Treatment Plant (North WTP) Hydraulic Profile 新設北部浄水場 水位関係図	Scale:	1:250
	Drawing No.	WTP-HP-001



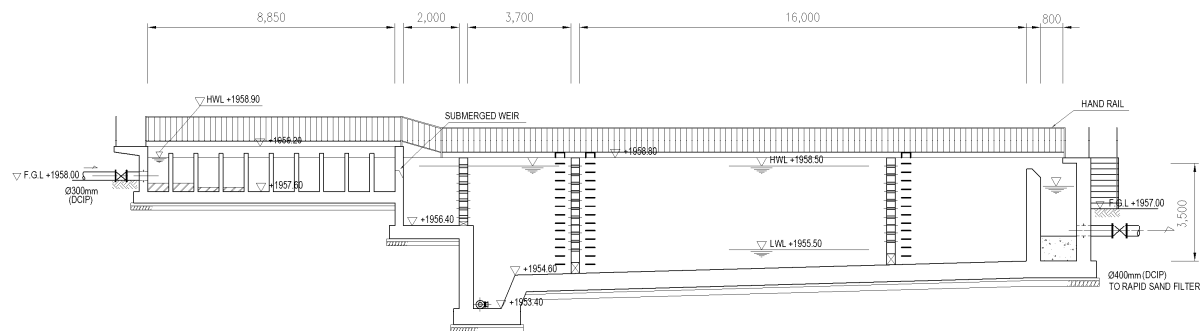




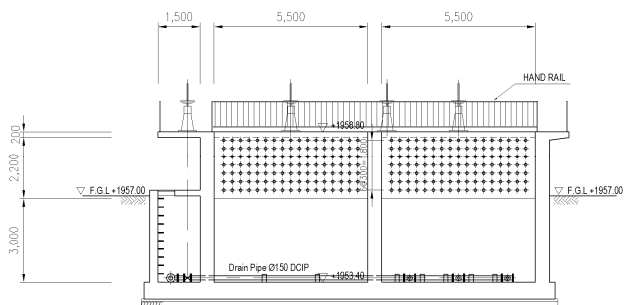
Project name	
The Preparatory Survey on The Project for Augmentation of Water Supply System in Narok Town in The Republic of Kenya ケニア国ナロック給水拡張計画準備調査	
Drawing Title	Scale: 1:100
Proposed Water Treatment Plant (North WTP) Receiving Well Plan and Section 新設北部浄水場 着水井 平面図, 断面図	
Drawing No.	WTP-RW-001



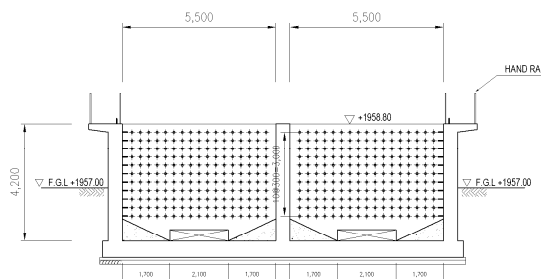
Project Name The Preparatory Survey on The Project for Augmentation of Water Supply System in Narok Town in The Republic of Kenya ケニア国ナロック給水拡張計画準備調査		
Drawing Title Proposed Water Treatment Plant (North WTP) Sedimentation Tank Plan 新設北部浄水場 沈澱池 平面図	Scale:	1:150
	Drawing No.:	WTP-ST-001



SECTION A-A
S=1:150

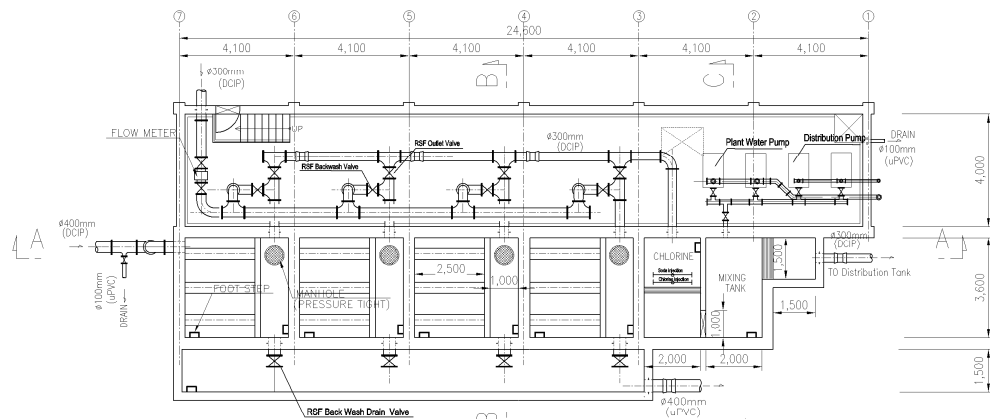


SECTION B-B
S=1:150



SECTION C-C
S=1:150

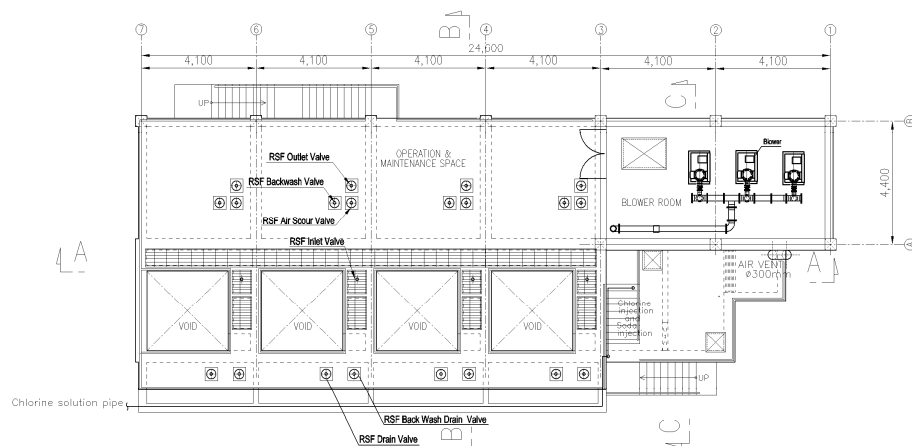
Project Name The Preparatory Survey on The Project for Augmentation of Water Supply System in Narok Town in The Republic of Kenya ケニア国ナロック給水拡張計画準備調査		
Drawing Title Proposed Water Treatment Plant (North WTP) Sedimentation Tank Section 新設北部浄水場 沈澱池 断面図	Scale:	1:150
	Drawing No.	WTP-ST-002



BASE PLAN
S=1:150

Specification for Filter Sand

Effective Size	φ 0.8~0.9mm
Uniformity Coefficient	1.7 and over

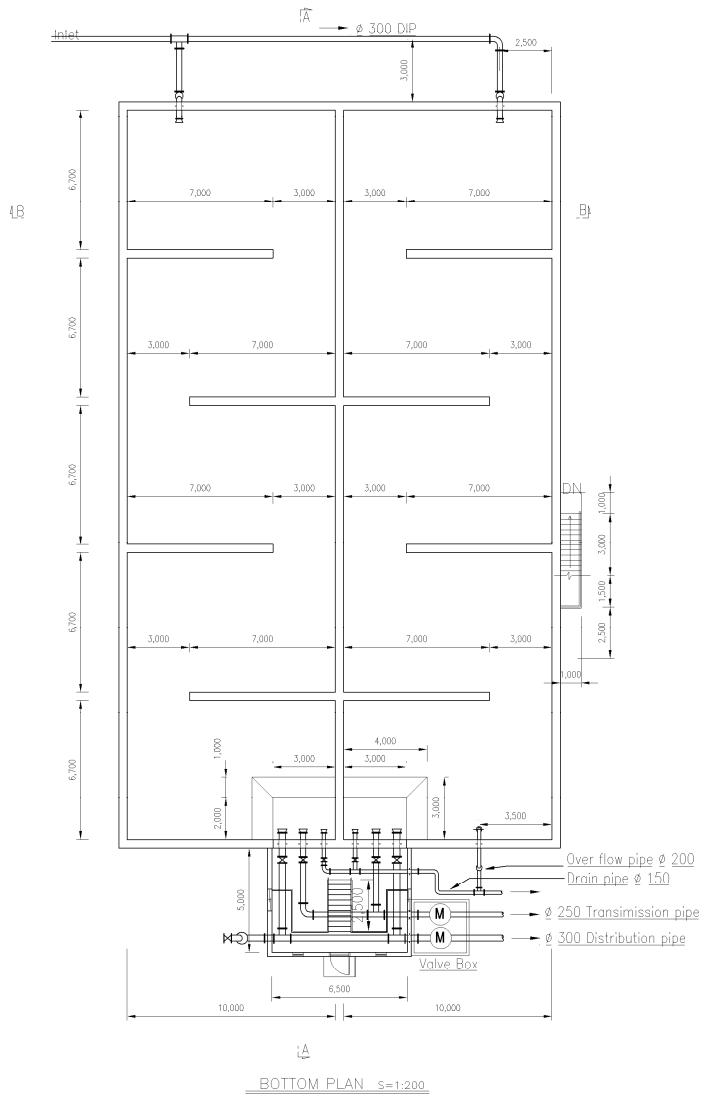
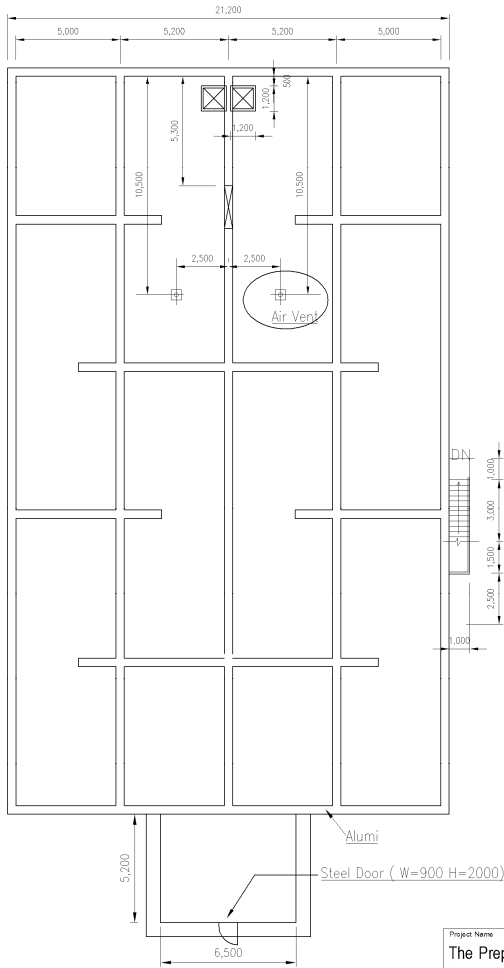


TOP PLAN
S=1:150

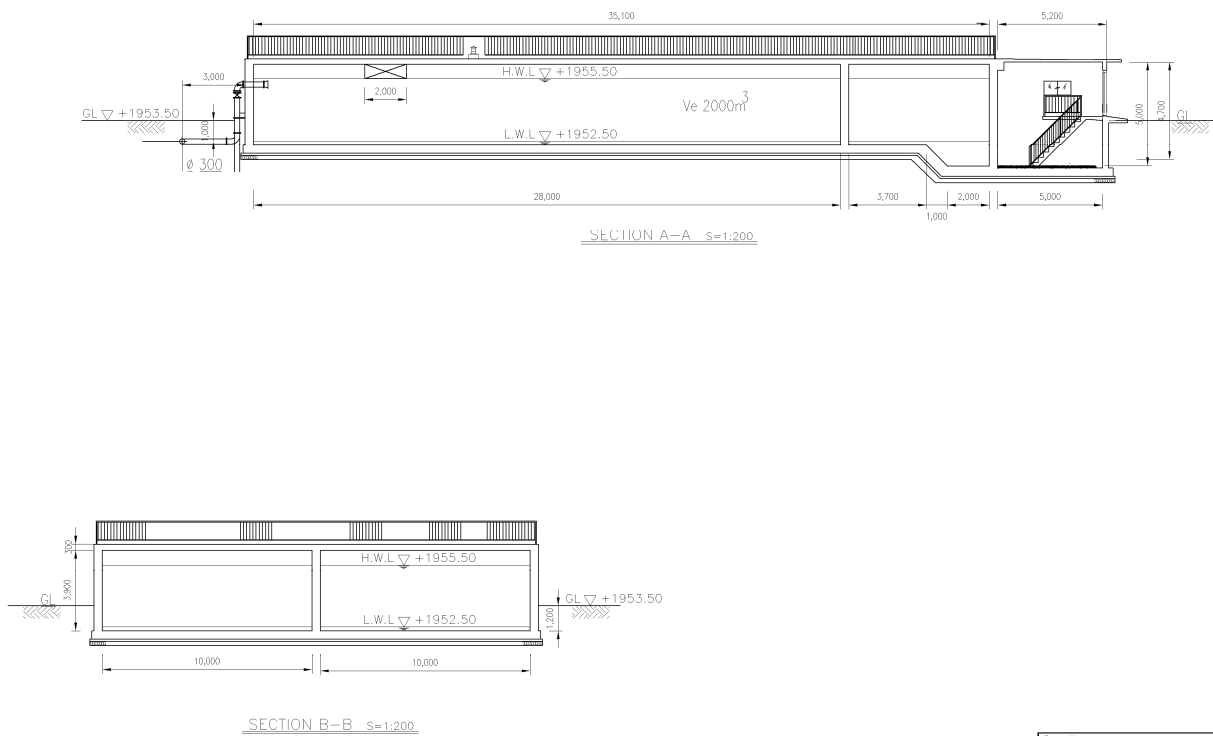
Project Name		The Preparatory Survey on The Project for Augmentation of Water Supply System in Narok Town in The Republic of Kenya ケニア国ナロック給水拡張計画準備調査	
Drawing Title		Proposed Water Treatment Plant (North WTP) Rapid Filter Plan 新設北部浄水場 急速ろ過池 平面図	Scale: 1:150 Drawing No. WTP-RSF-001



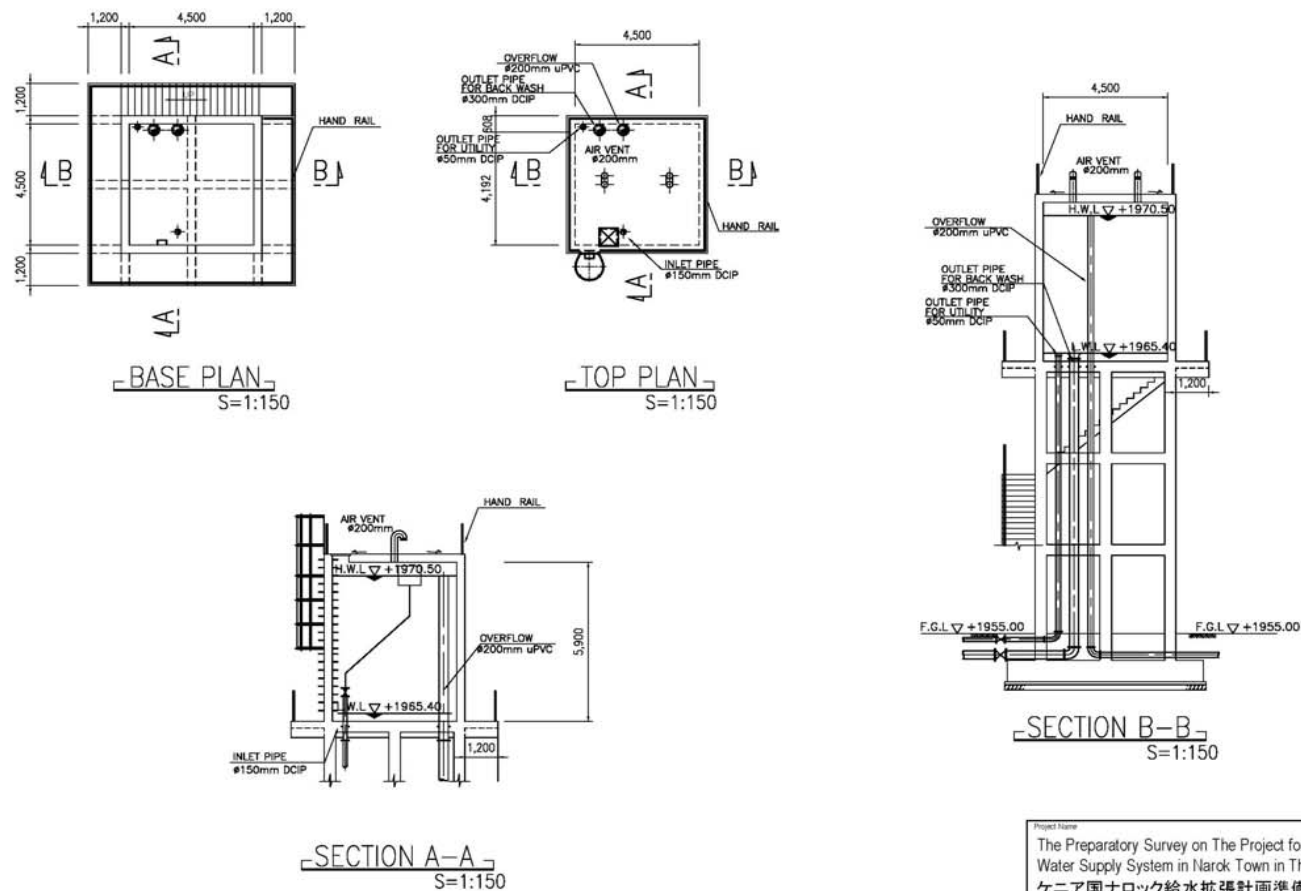
Project Name	
The Preparatory Survey on The Project for Augmentation of Water Supply System in Narok Town in The Republic of Kenya ケニア国ナロック給水拡張計画準備調査	
Drawing Title	Scale: 1:150
Proposed Water Treatment Plant (North WTP) Rapid Filter Section 新設北部浄水場 急速ろ過池 断面図	Drawing No. WTP-RSF-002



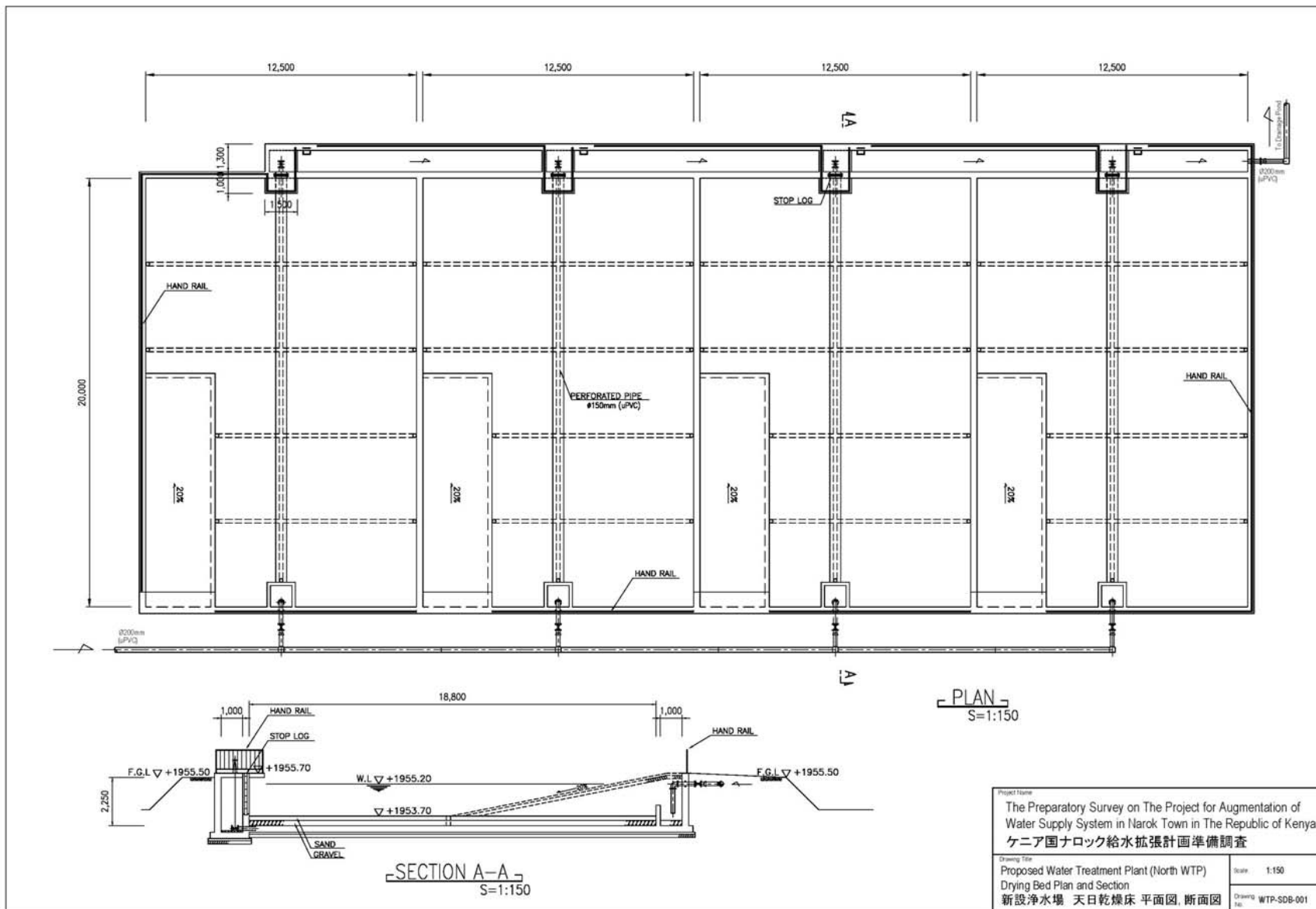
Project Name		
The Preparatory Survey on The Project for Augmentation of Water Supply System in Narok Town in The Republic of Kenya ケニア国ナロック給水拡張計画準備調査		
Drawing Title		
Proposed Water Treatment Plant (North WTP) Clear Water Reservoir Plan 新設北部浄水場 浄水池 平面図		Scale: 1:200
Drawing No.		WTP-CWR-001

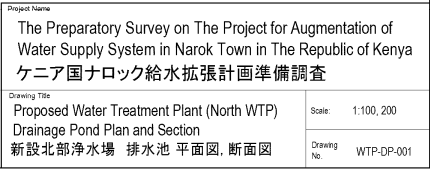


Project Name	
The Preparatory Survey on The Project for Augmentation of Water Supply System in Narok Town in The Republic of Kenya ケニア国ナロク給水拡張計画準備調査	
Drawing Title	
Proposed Water Treatment Plant (North WTP) Clear Water Reservoir Section 新設北部浄水場 浄水池 断面図	
Scale	1:200
Drawing No	WTP-CWR-002



Project Name		
The Preparatory Survey on The Project for Augmentation of Water Supply System in Narok Town in The Republic of Kenya ケニア国ナロック給水拡張計画準備調査		
Drawing Title		Scale: 1:150
Proposed Water Treatment Plant (North WTP) Elevated Backwash Tank Plan and Section 新設北部浄水場 高架水槽 平面図、断面図		Drawing No. WTP-EWT-001







S=1:100



S=1:100



S=1:100



S=1:100



S=1:100

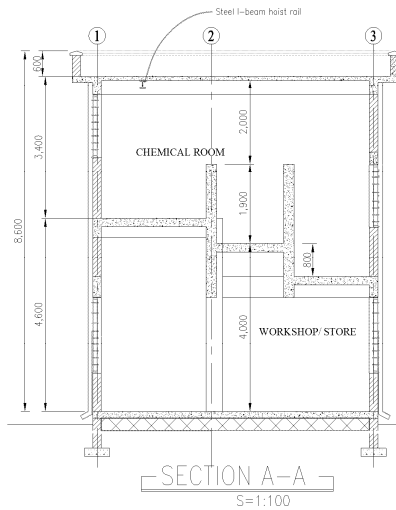
Project Name

The Preparatory Survey on The Project for Augmentation of
Water Supply System in Narok Town in The Republic of Kenya
ケニア国ナロク給水拡張計画準備調査

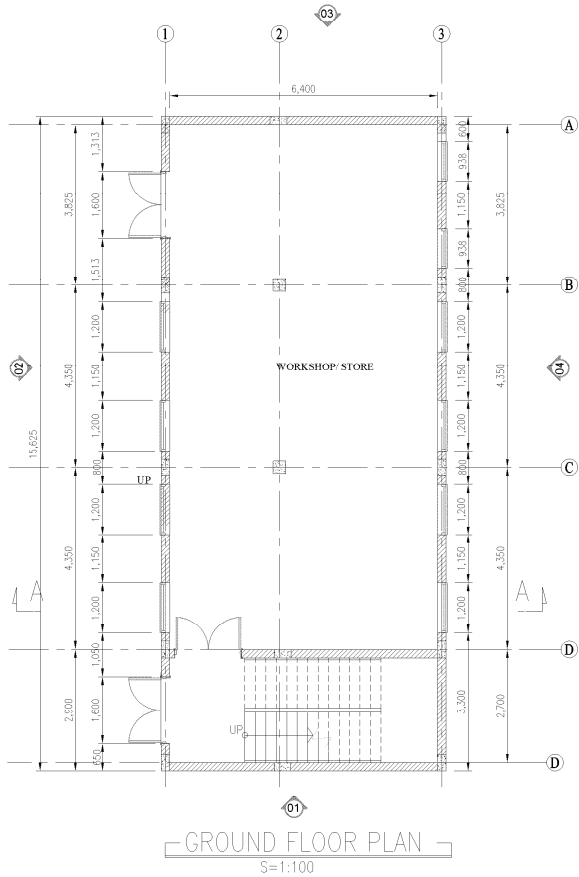
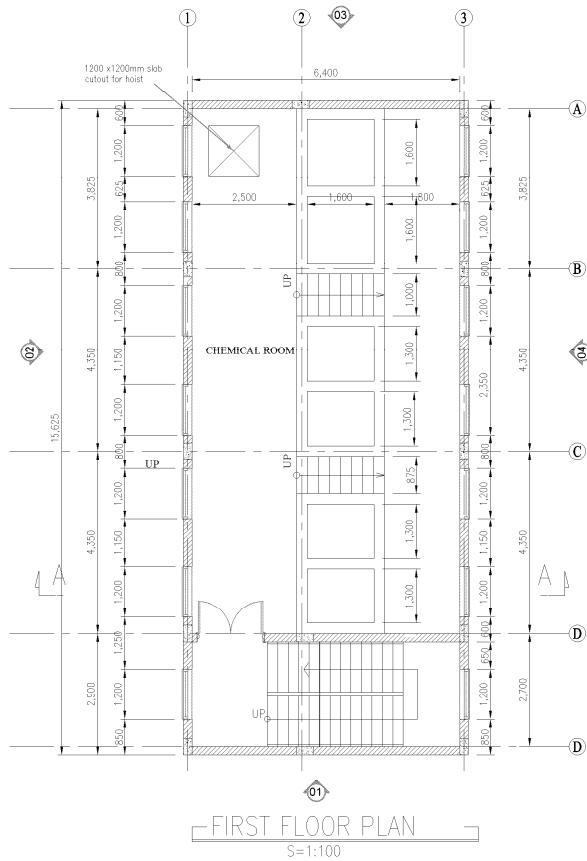
Drawing Title
Proposed Water Treatment Plant (North WTP)
Operation Building Plan , Section and Elevation

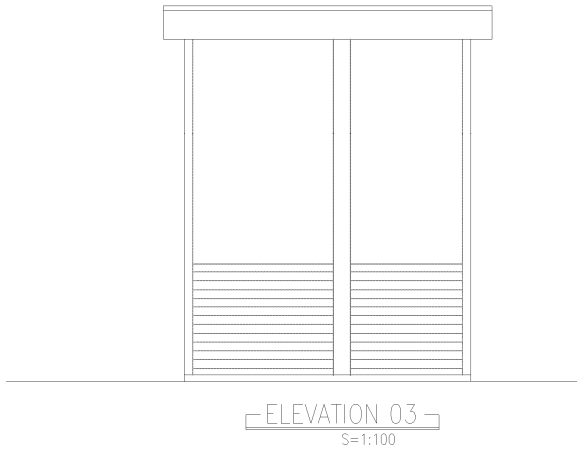
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Drawing No. WTP-ADB-001

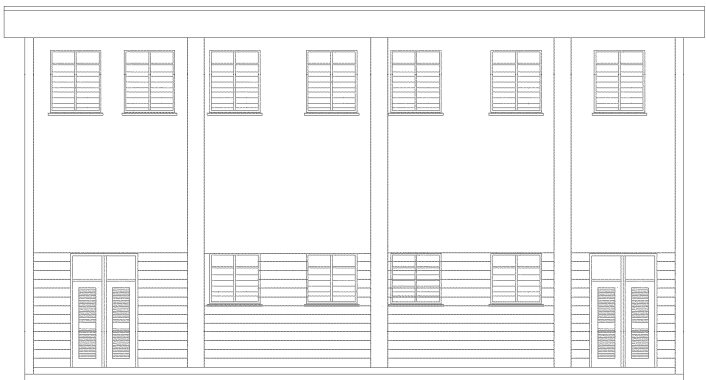


Project Name The Preparatory Survey on The Project for Augmentation of Water Supply System in Narok Town in The Republic of Kenya ケニア国ナロック給水拡張計画準備調査		
Drawing Title Proposed Water Treatment Plant (North WTP) Chemical House - Plan and Section 新設北部浄水場 薬品管理室 平面図・断面図		Scale: 1:100
Drawing No. WTP-CR-001		





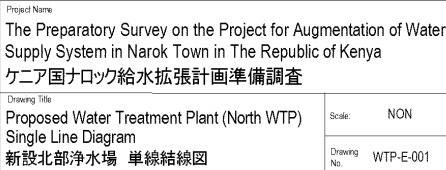
ELEVATION 04
S=1:100

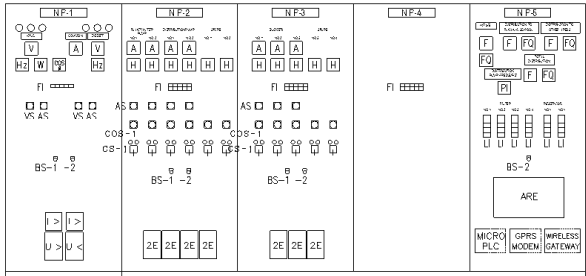


Project Name		
The Preparatory Survey on The Project for Augmentation of Water Supply System in Narok Town in The Republic of Kenya ケニア国ナロック給水拡張計画準備調査		
Drawing Title		Scale: 1:100
Proposed Water Treatment Plant (North WTP) Chemical House - Elevations 新設北部浄水場 薬品管理室 立面図		Drawing No. WTP-CR-002

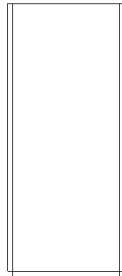


新設北部浄水場 自家発電機/電気室
平面図・断面図・立面図





Front View



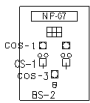
Side View



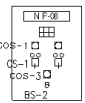
Front View



Side View



Front View



Side View



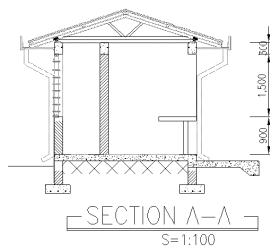
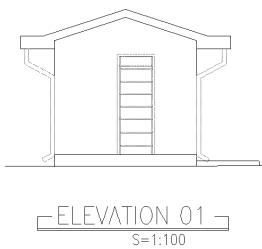
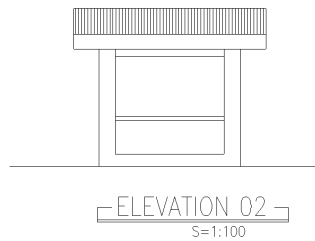
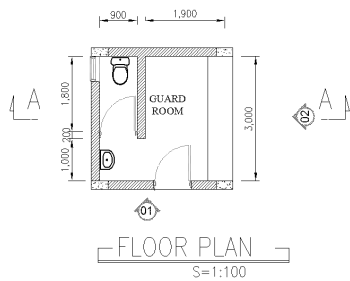
Front View



Side View

LEGEND	
No.	NAME
NR-1	INCOMING PANEL
NR-2	PLANT WATER/DISTRIBUTION PUMP PANEL
NR-3	BLOWER PANEL
NR-4	LV FEEDER PANEL
NR-5	INSTRUMENTATION PANEL
NR-6	WH METER PANEL
NR-7	PLANT WATER PUMP LOCAL PANEL(PUMP ROOM)
NR-8	DISTRIBUTION PUMP LOCAL PANEL
NR-9	BLOWER LOCAL PANEL
NR-10	FLOW INDICATION PANEL (CHEMICAL BUILDING)
COS-1	CHANGE OVER SWITCH (AUTO – MANUAL)
COS-2	CHANGE OVER SWITCH (LOCAL – ELECTRICAL ROOM)
COS-3	CHANGE OVER SWITCH (No.1 – ALTERNATE – No.2)
COS-4	CHANGE OVER SWITCH (No.1/2 – 2/3 – 3/1 – CYCLIC)
COS-5	CHANGE OVER SWITCH (RESERVOIR LEVEL No.1 – No.2)
COS-6	CHANGE OVER SWITCH (ELECTRODE No.1 – No.2)
CS-1	OPERATION SWITCH (RUN–STOP)
CS-2	OPERATION SWITCH (OPEN–WORKING–CLOSE)
BS-1	PUSH BUTTON SWITCH (TROUBLE RETURN)
BS-2	OPERATION SWITCH (CLAMP TEST)
ARE	AUTOMATIC REPORT EQUIPMENT

Project Name	
The Preparatory Survey on the Project for Augmentation of Water Supply System in Narok Town in The Republic of Kenya	
ケニア国ナロク給水拡張計画準備調査	
Drawing Title	Scale
Proposed Water Treatment Plant (North WTP) LV Distribution Panel and Local Control Panel Outline Diagram	NON
新設北側浄水場 低圧盤図、現場盤図	Drawing No. WTP-E-002



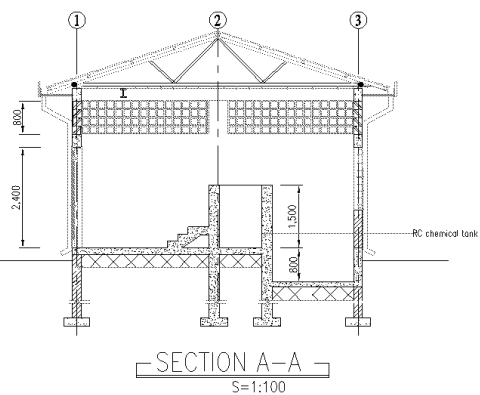
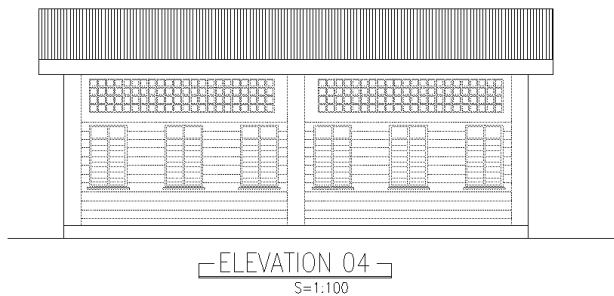
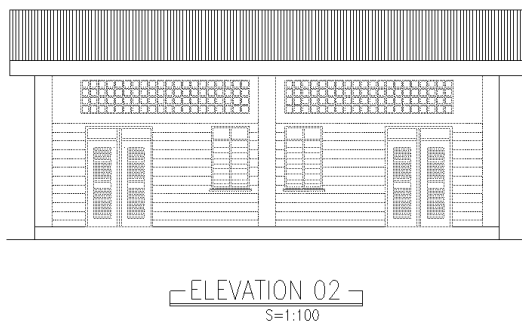
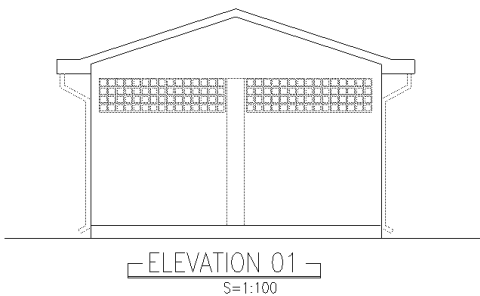
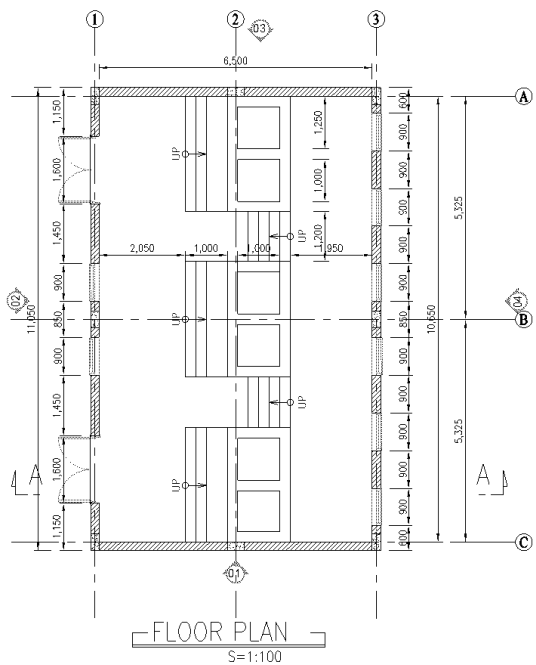
Project Name The Preparatory Survey on The Project for Augmentation of Water Supply System in Narok Town in The Republic of Kenya ケニア国ナロク給水拡張計画準備調査	
Drawing Title Proposed Water Treatment Plant (North WTP) Guard House Plan , Section and Elevation 新設北部浄水場 ガードハウス 平面図・立面図	Scale 1:100
	Drawing No. WTP-GH-001



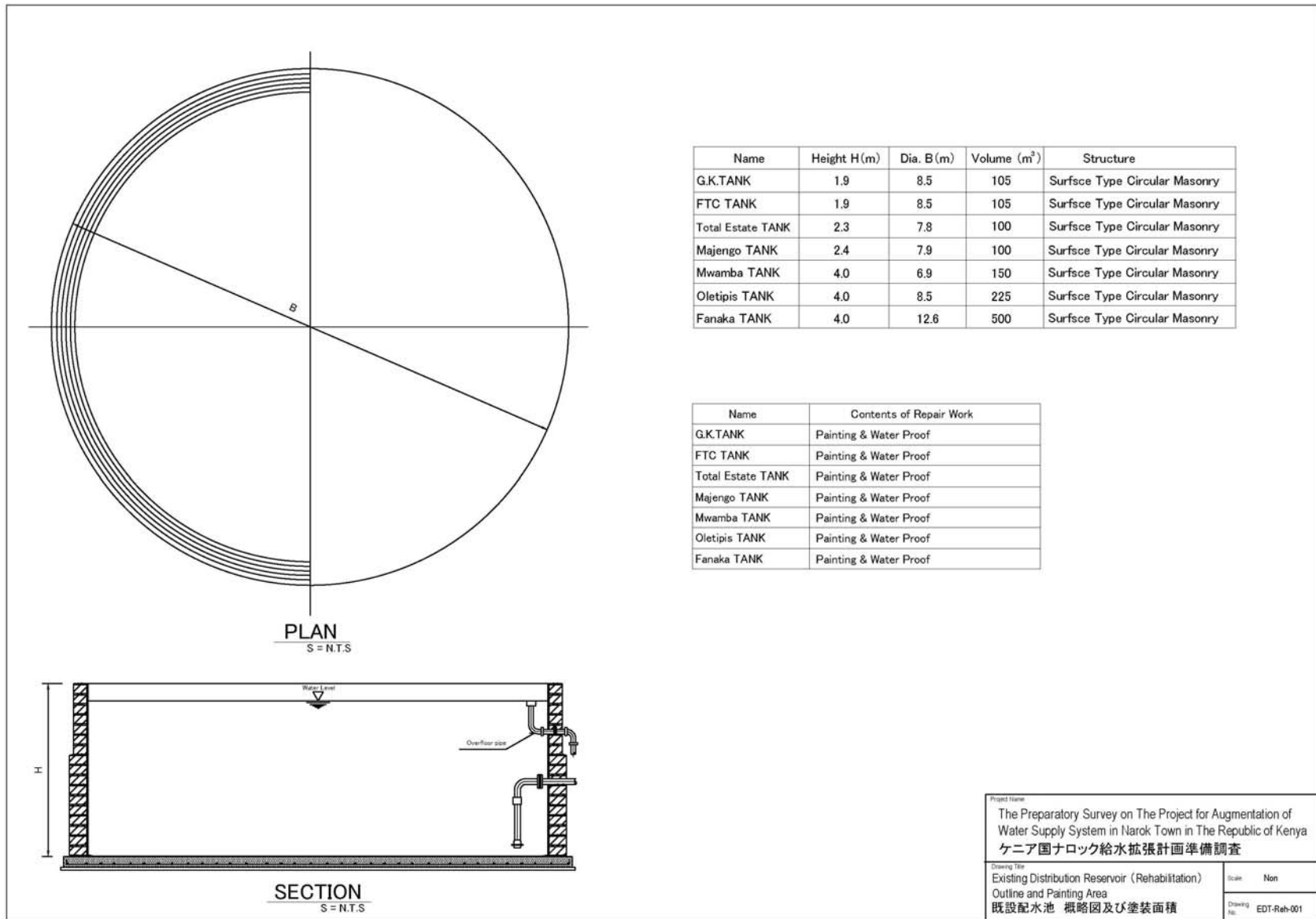
COMPONENT	
1. Replace of Filter Media in Rapid Filter	Sand W2.5m x L2.8m x H0.7m x 2 Tanks = 9.8m ³ Gravel W2.5m x L2.8m x H0.2m x 2 Tanks = 2.8m ³
2. Reconstruction of Chemical Room	(1) Demolition of Existing Building Existing Chemical House (Tinplate Shack) W3.1mxL3.9mxH3.0m=36.3m³ Existing Water Tank (Natural Stone Masonry, RC) D2.25² x3.14/4xH3.0m=11.9m³ (2) Construction of New Chemical Room See Dwg.No. "WTP-Reh-002" (3) Pipe Installation for Chemical Dosage ø20mm uPVC 46.5m for Alum ø32mm uPVC 82.1m for Soda-ash ø32mm uPVC 76.8m for Chlorine ø50mm uPVC 41.3m for Pipe Washing
3. Material/Equipment Procurement	Water Quality Analysis Equipment Jar Tester x1 Turbidimeter x1 Chlorine Meter x1 pH Meter x1 Electronic Balance x1

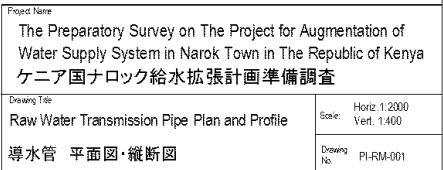
Drawing Title
Existing Central Water Treatment Plant (Rehabilitation)
Layout Plan
既設中部浄水場 改築工事 一般平面図

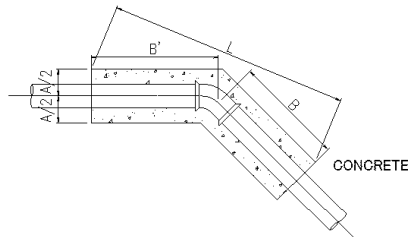
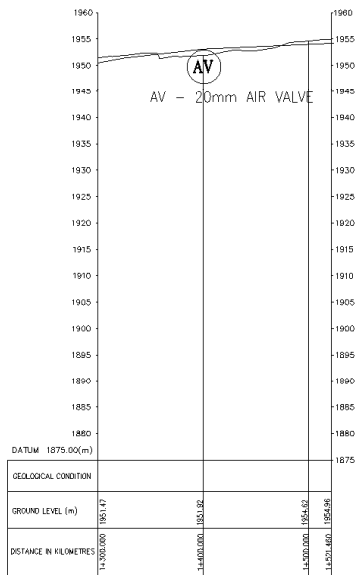
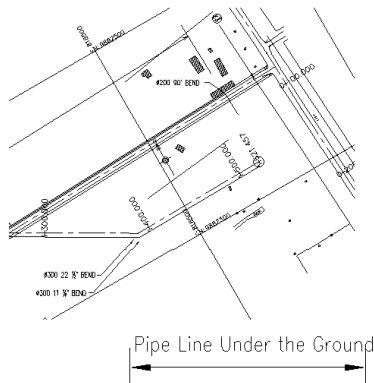
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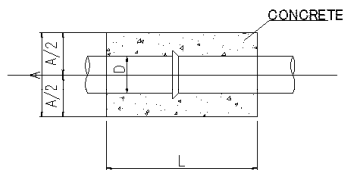
Project Name The Preparatory Survey on The Project for Augmentation of Water Supply System in Narok Town in The Republic of Kenya ケニア国ナロック給水拡張計画準備調査		
Drawing Title Existing Central Water Treatment Plant (Rehabilitation) Chemical Room Plan, Section and Elevation 既設中部浄水場 改築工事 薬品管理室 平面図・断面図・立面図		Scale: 1:100
Drawing No. W/TP-Reh-002		



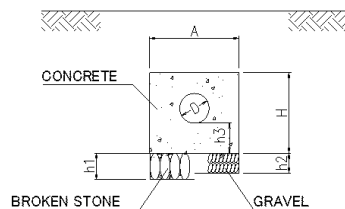




PLAN (45° 22 1/2° 11 1/4° BENDS)



PLAN (STRAIGHT)



SECTION

BENDS(Raw Water Pipes)

DIMENSIONS

BEND TYPE	NOMINAL DIA D	A	B	B'	L	H	h1	h2	h3
45° BEND	50	300	150	150	390	300	-	150	100
	75	300	200	200	480	300	-	150	100
	100	400	200	200	520	400	-	150	150
	150	500	300	300	750	500	-	150	150
	200	600	300	300	780	600	-	150	200
	250	700	550	550	1280	700	-	150	200
	300	800	700	700	1600	800	-	150	200
22 1/2° BEND	50	300	150	150	380	300	-	150	100
	75	300	300	300	700	300	-	150	100
	100	400	350	350	830	400	-	150	150
	150	500	450	450	1070	500	-	150	150
	200	600	500	500	1200	600	-	150	200
	250	700	850	850	1970	700	-	150	200
	300	800	1100	1100	2520	800	-	150	200
11 1/4° BEND	50	300	150	150	360	300	-	150	100
	75	300	250	250	590	300	-	150	100
	100	400	250	250	600	400	-	150	150
	150	500	350	350	830	500	-	150	150
	200	600	350	350	840	600	-	150	200
	250	700	650	650	1520	700	-	150	200
	300	800	800	800	1860	800	-	150	200

STRAIGHT(Raw Water Pipelines)

DIMENSIONS

NOMINAL DIA	D	d	A	H	L	h1	h2	h3
150	100	500	400	400	-	150	100	
200	150	600	600	600	-	150	200	

Project Name

The Preparatory Survey on The Project for Augmentation of Water Supply System in Narok Town in The Republic of Kenya
ケニア国ナロック給水拡張計画準備調査

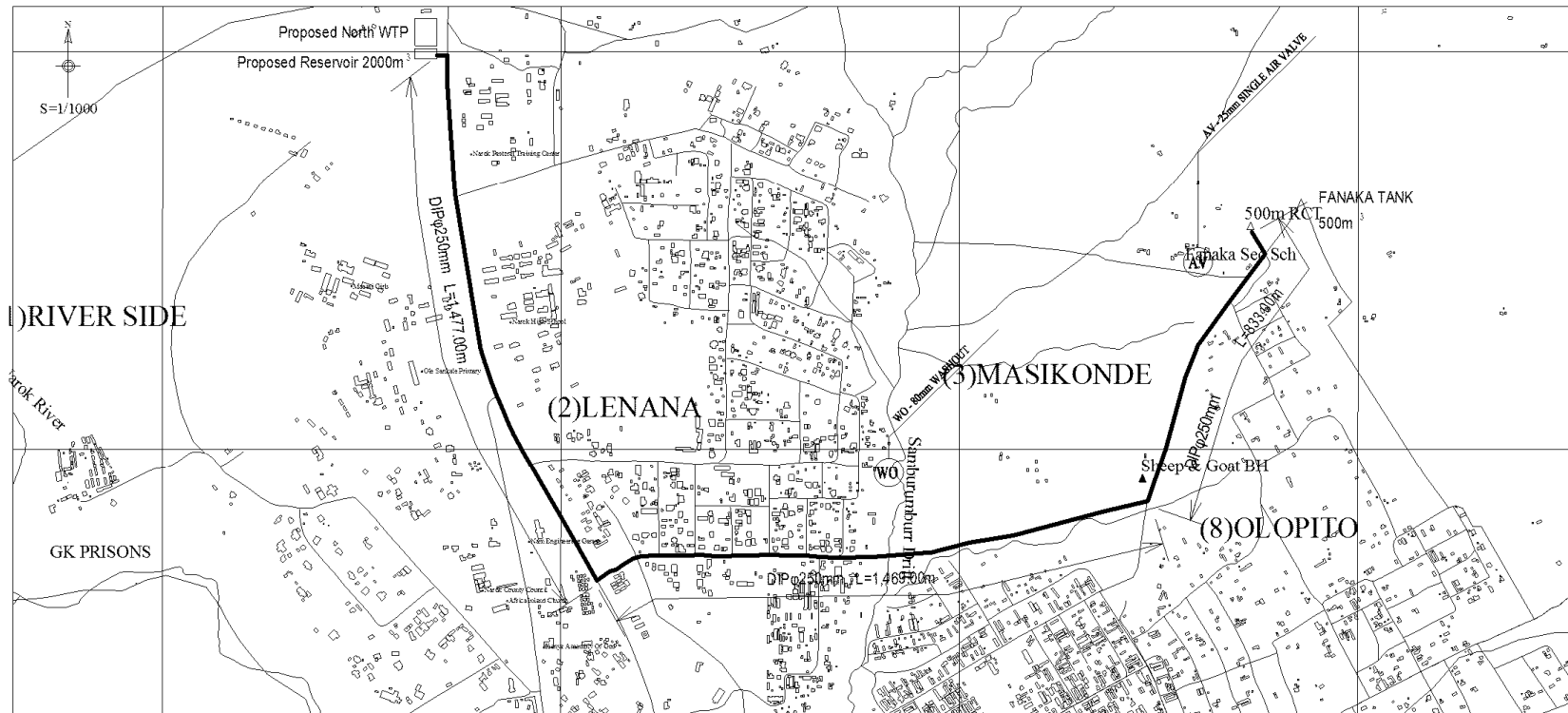
Drawing Title

Raw Water Transmission Pipe Plan and Profile

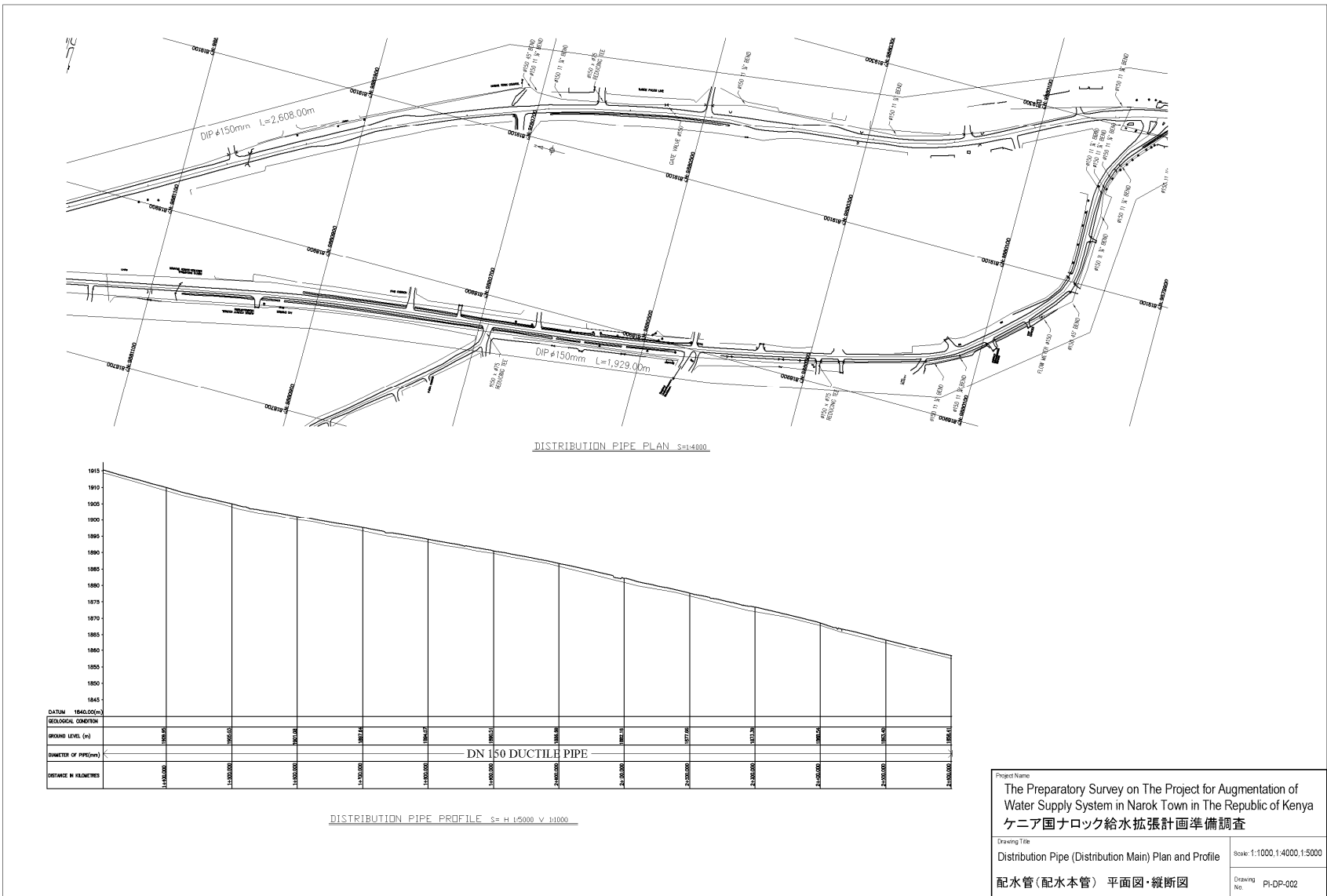
導水管 平面図・縦断面図

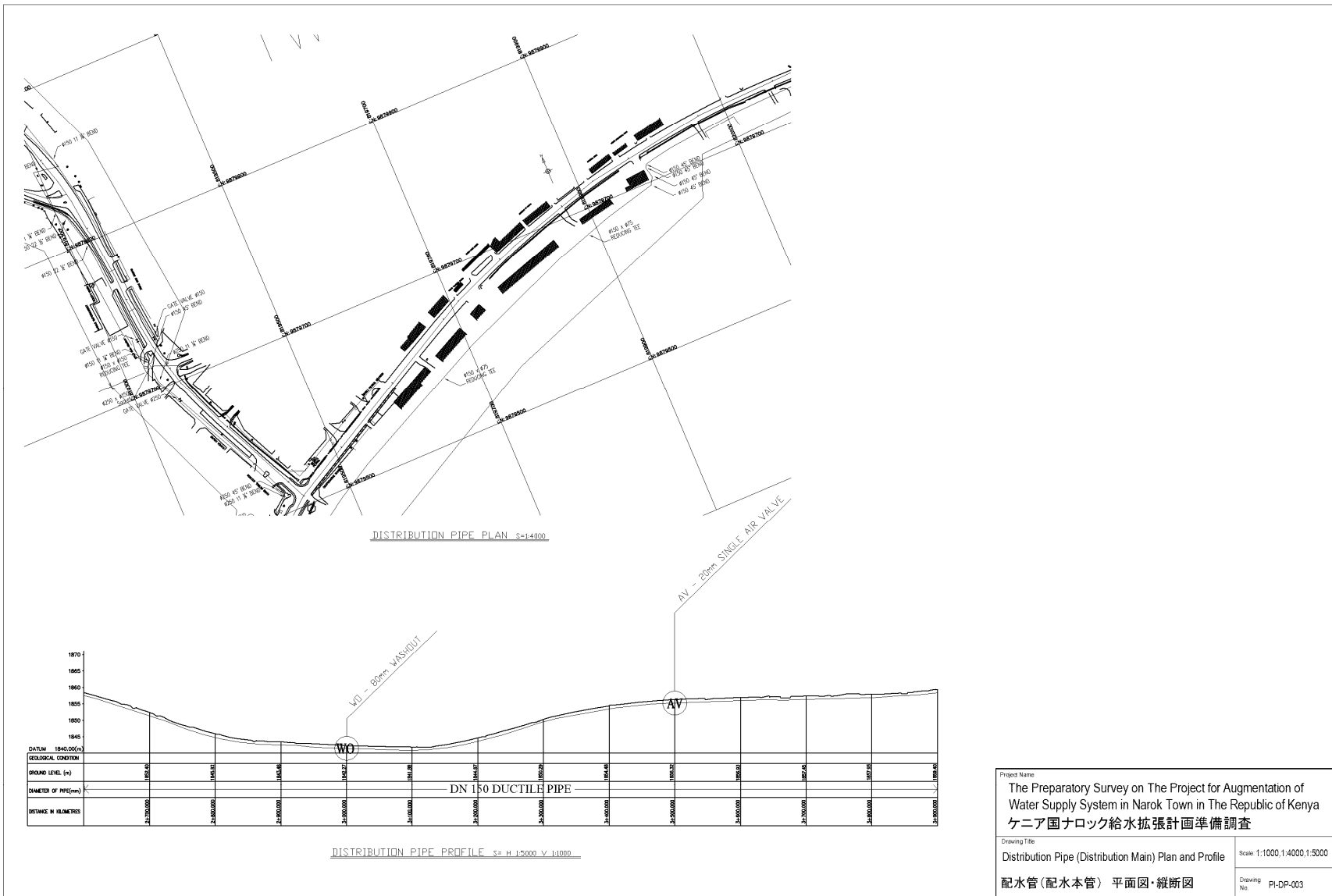
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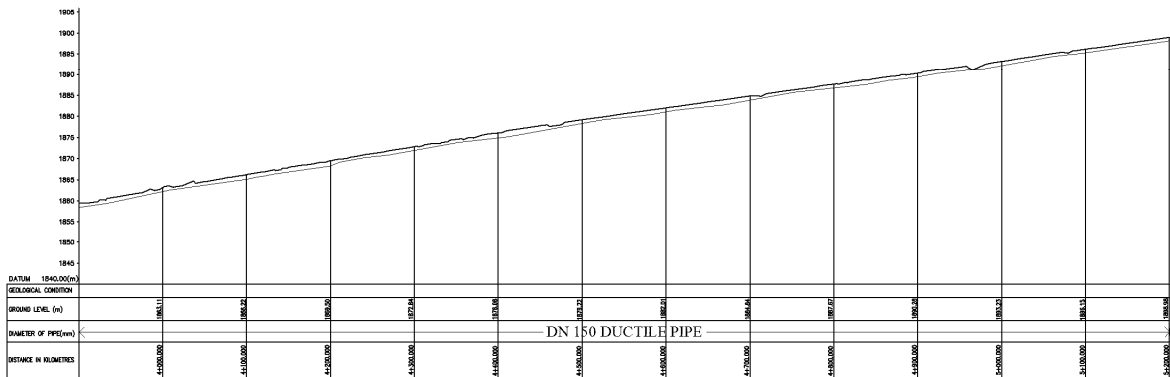
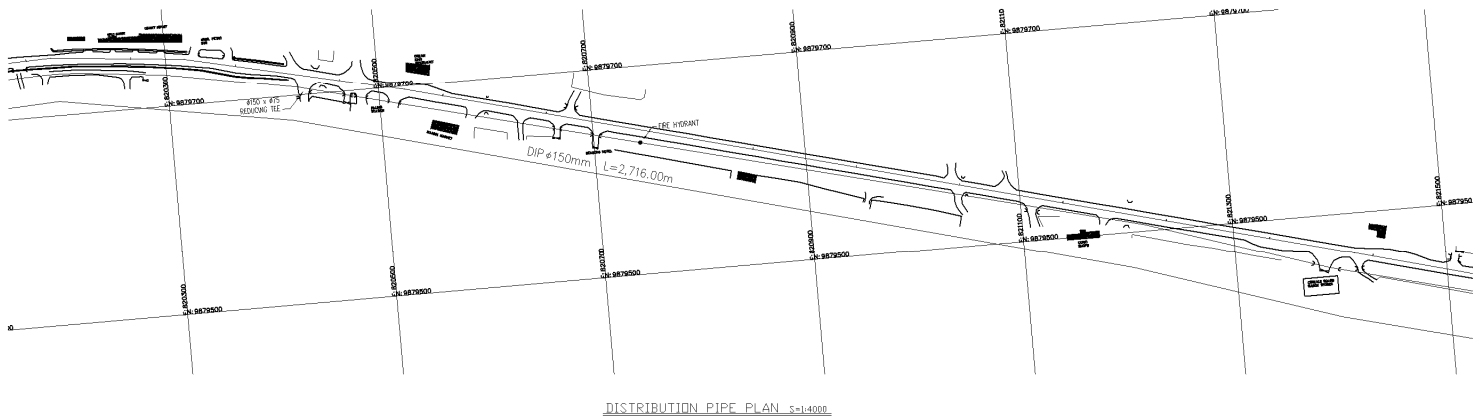
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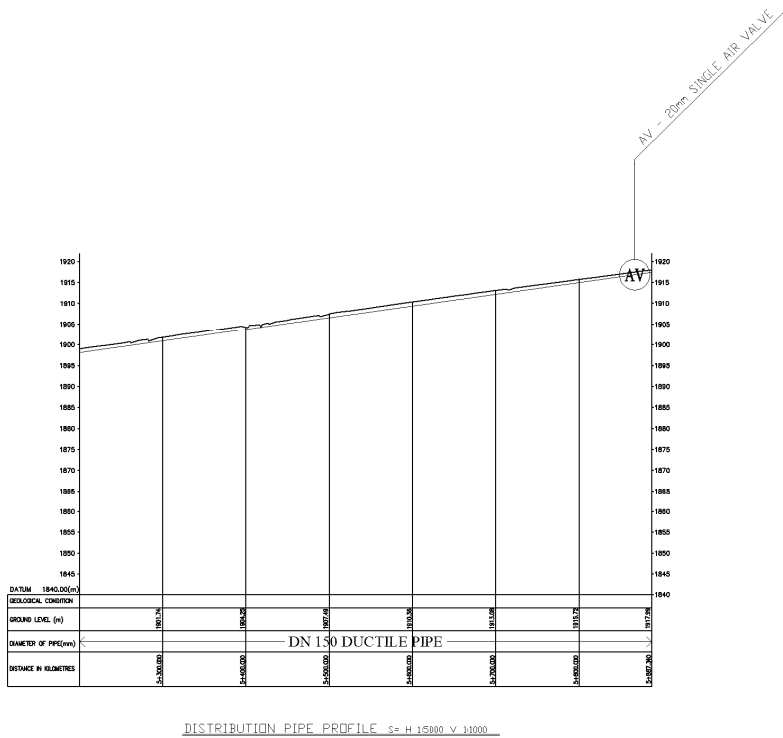
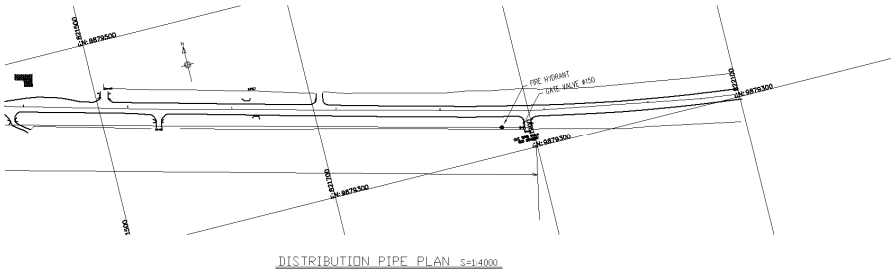
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Drawing Title	Scale: 1:1000
Clear Water Transmission Pipe Layout Plan 送水管 平面図	Drawing No. PI-TM-001



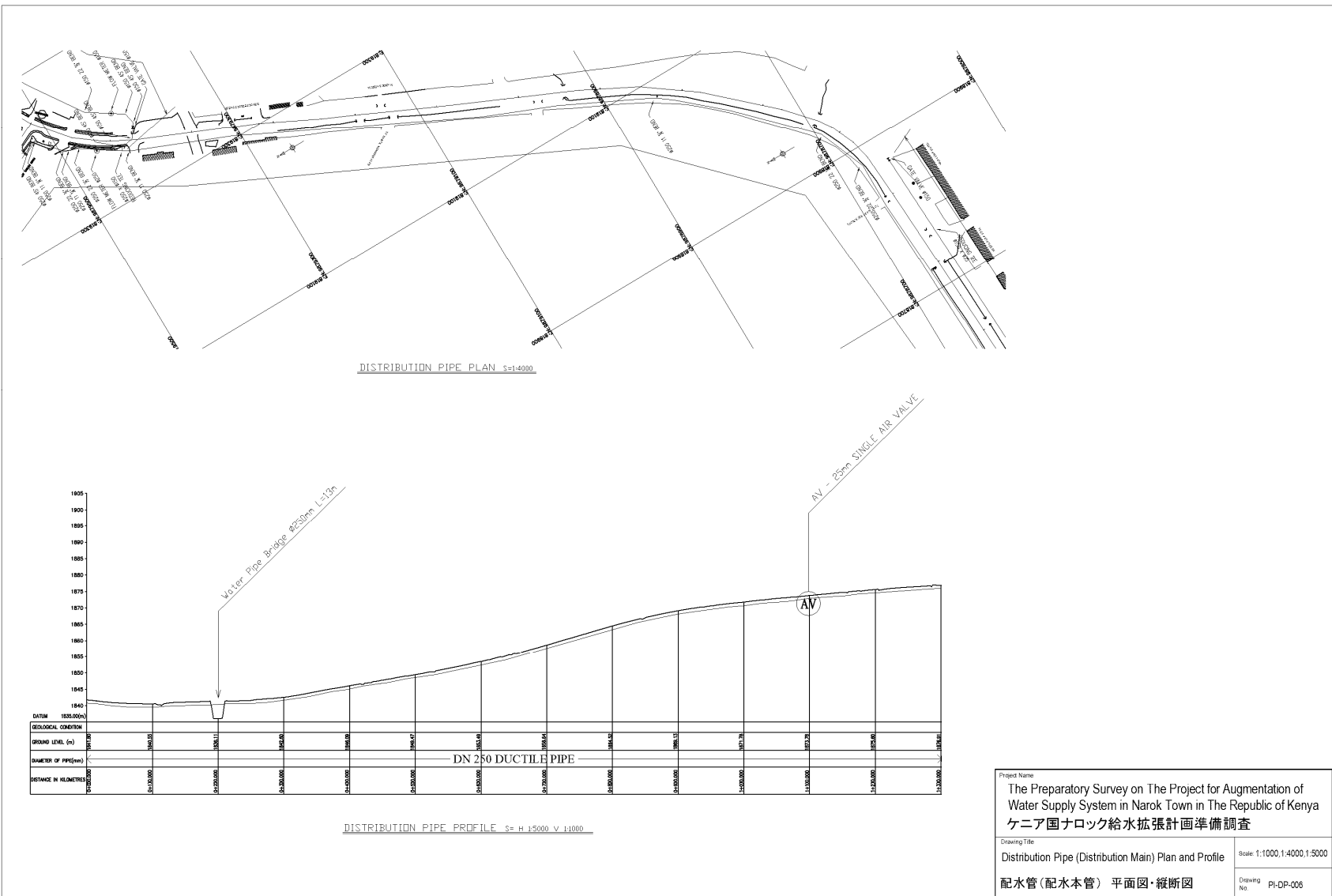


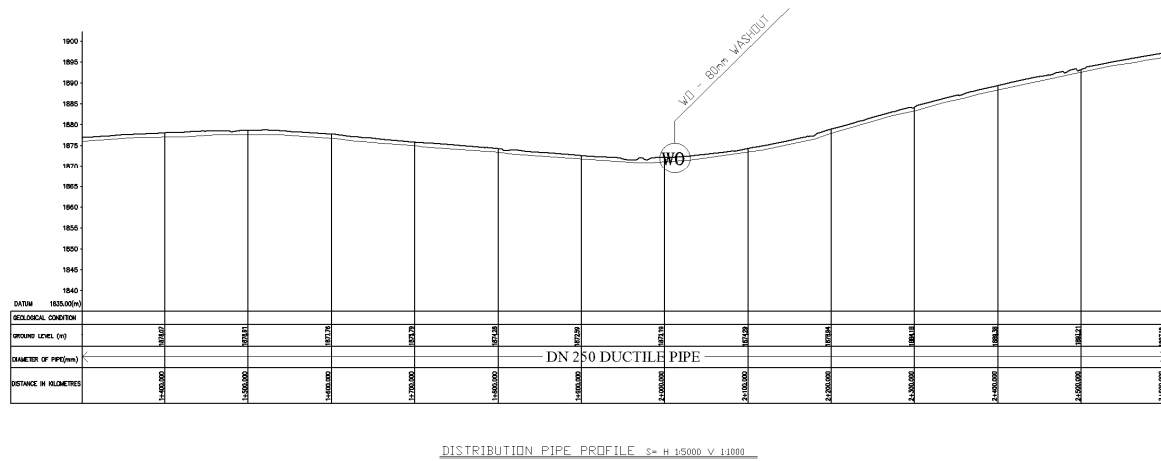
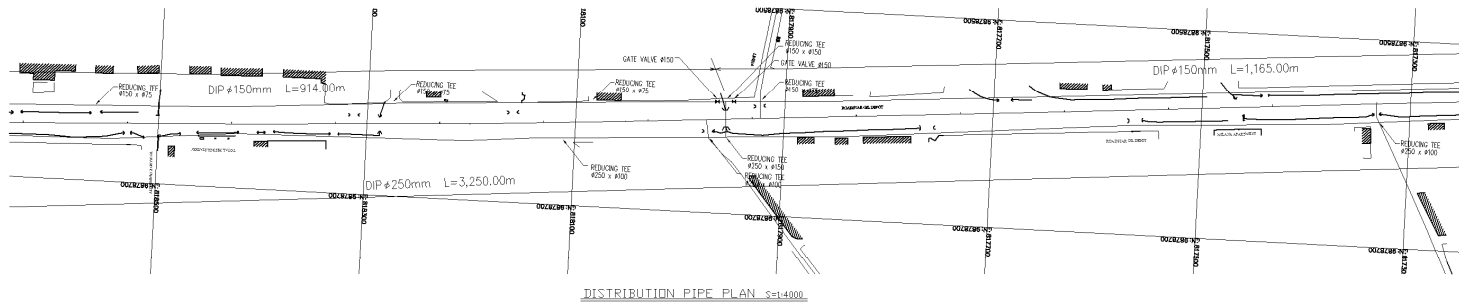


Project Name The Preparatory Survey on The Project for Augmentation of Water Supply System in Narok Town in The Republic of Kenya ケニア国ナロック給水拡張計画準備調査	
Drawing Title Distribution Pipe (Distribution Main) Plan and Profile	Scale: 1:1000, 1:4000, 1:5000
配水管 (配水本管) 平面図・縦断面図	Drawing No. PI-DP-004

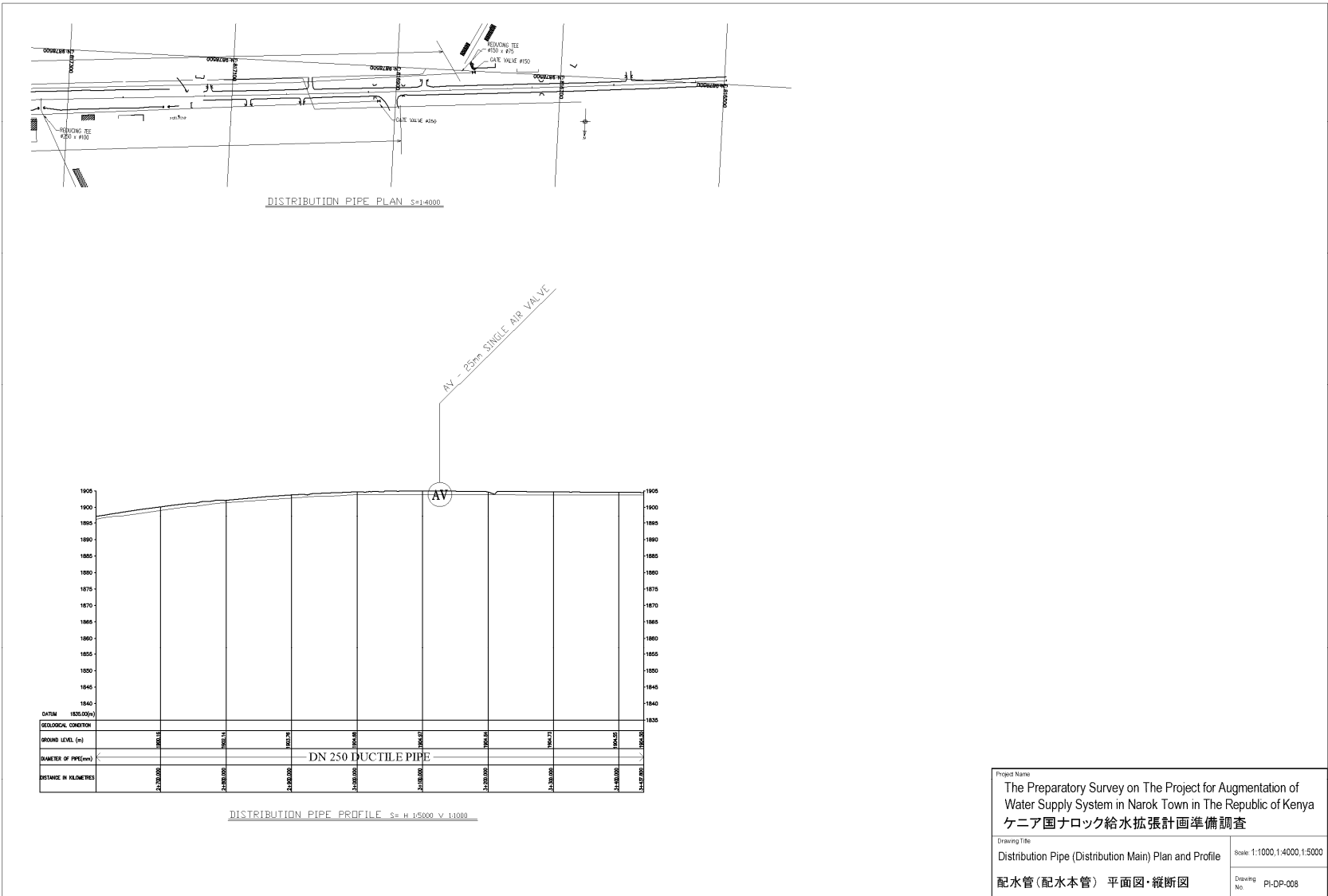


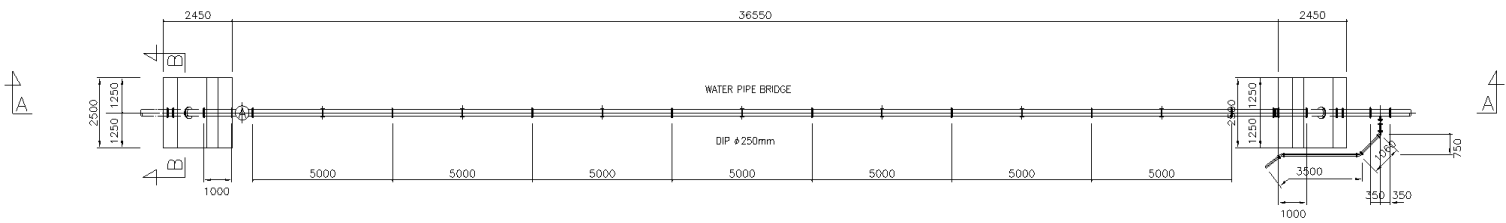
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The Preparatory Survey on The Project for Augmentation of Water Supply System in Narok Town in The Republic of Kenya ケニア国ナロック給水拡張計画準備調査	
Drawing Title	Scale: 1:1000,1:4000,1:5000
Distribution Pipe (Distribution Main) Plan and Profile	
配水管(配水本管) 平面図・縦断面図	Drawing No. PI-DP-005



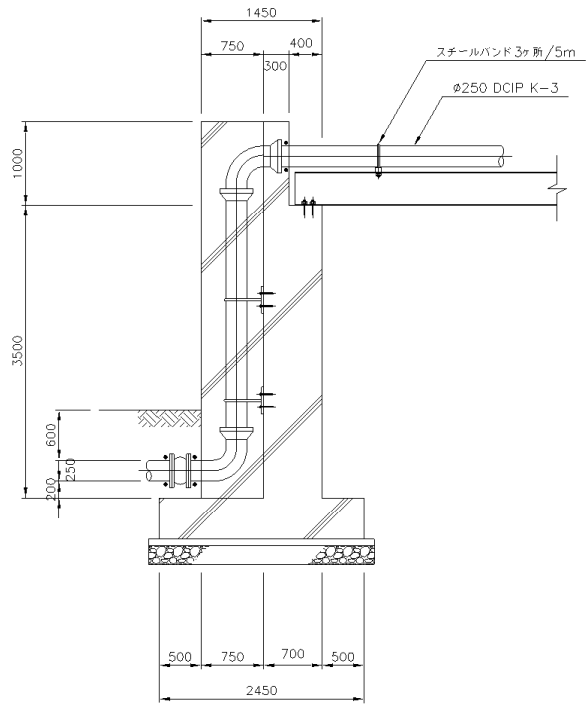


Project Name	
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Drawing Title	Scale: 1:1000, 1:4000, 1:5000
Distribution Pipe (Distribution Main) Plan and Profile	
配水管(配水本管) 平面図・縦断面図	Drawing No. PI-DP-007

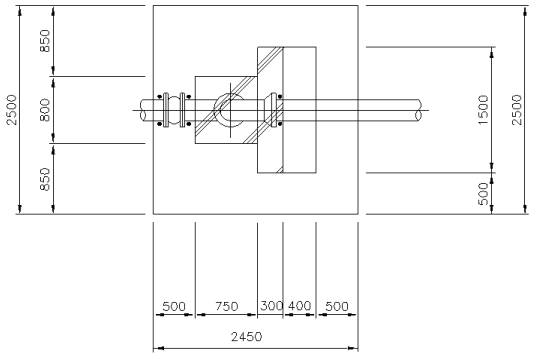




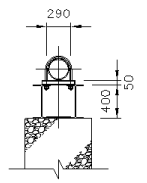
WATER PIPE BRIDGE PLAN S=1:150



WATER PIPE BRIDGE SECTION A-A S=1:50

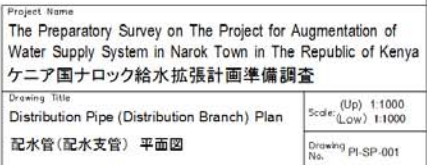


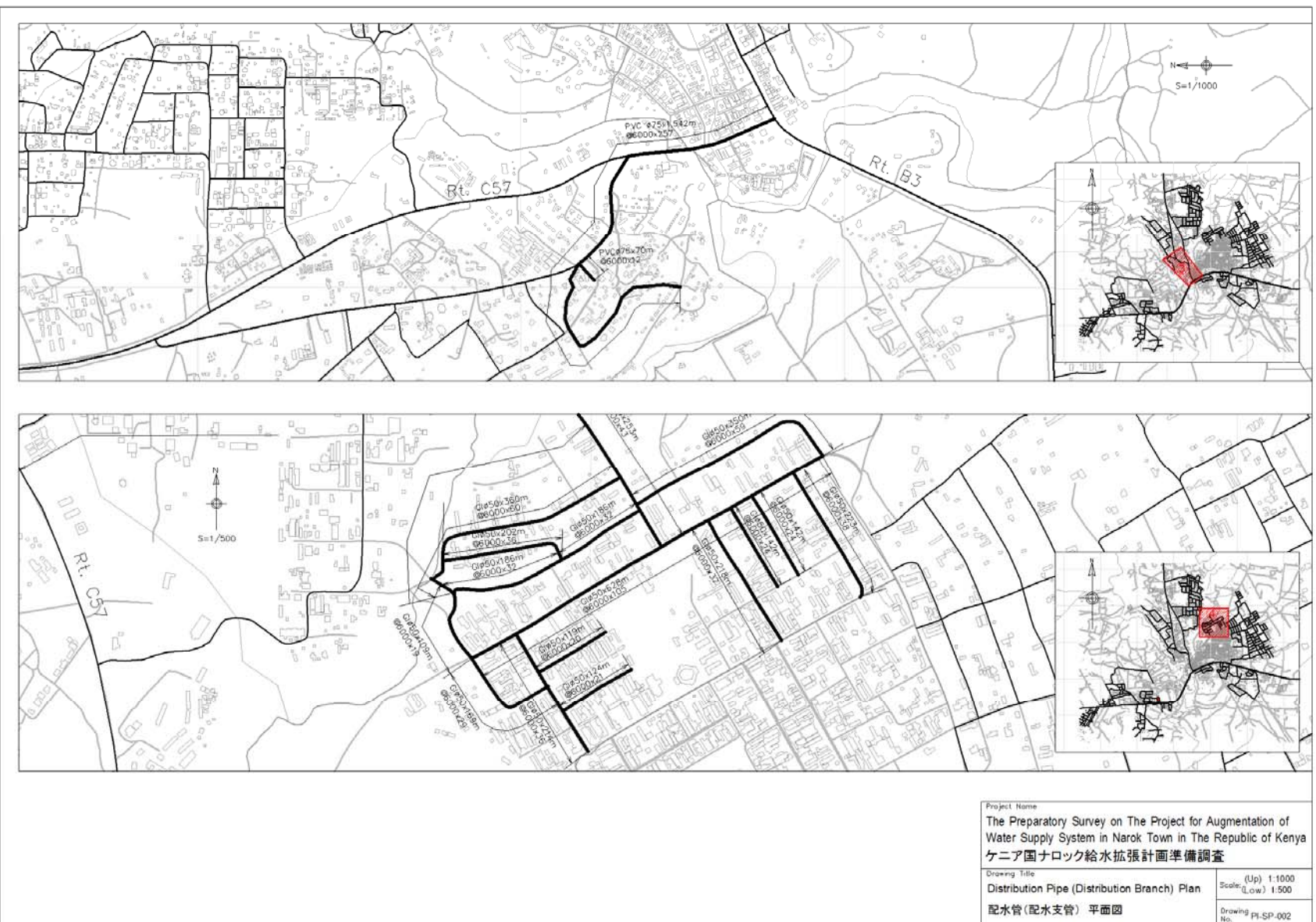
WATER PIPE BRIDGE PLAN B-B S=1:50

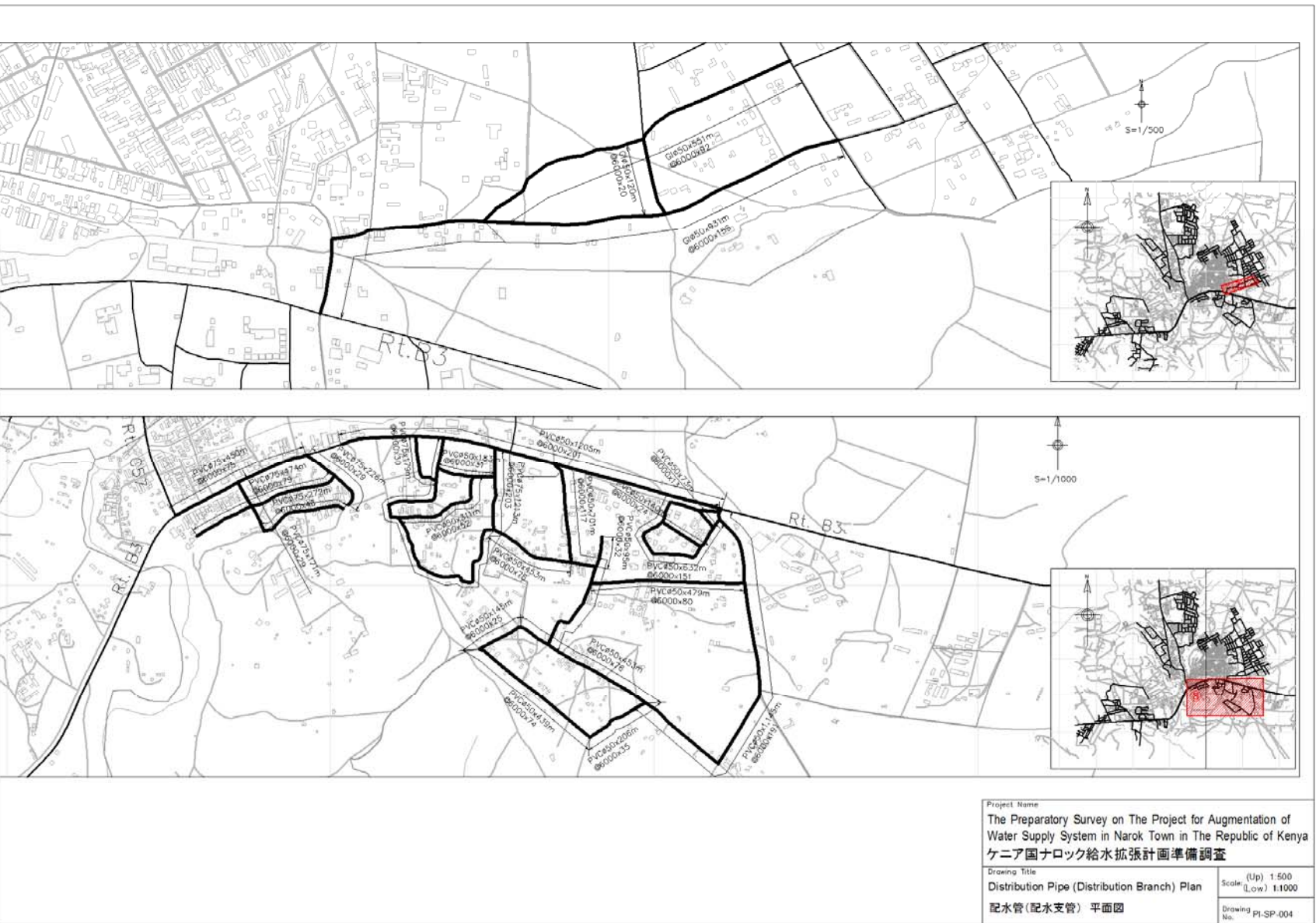


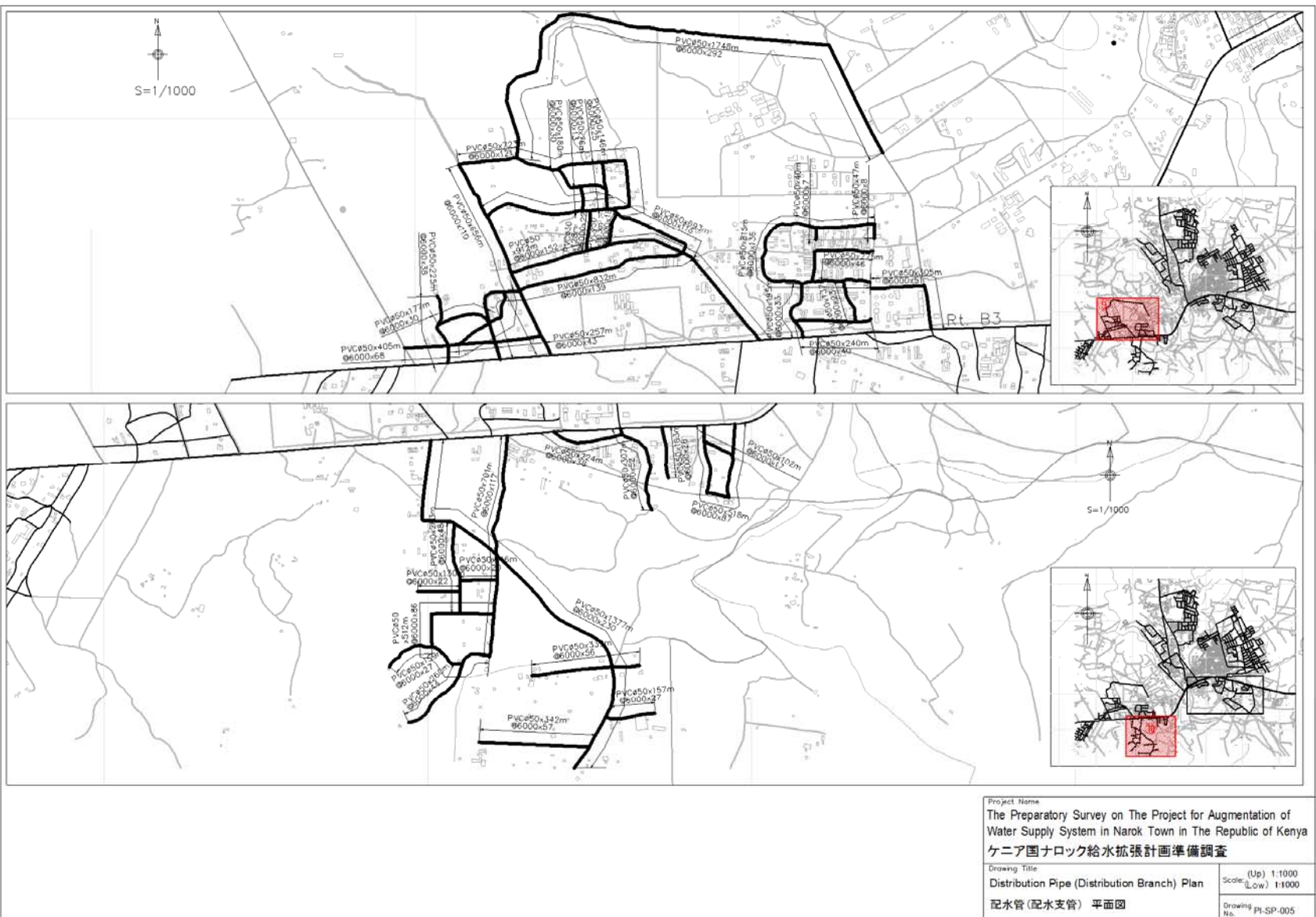
WATER PIPE BRIDGE SECTION B-B S=1:50

Project Name	
The Preparatory Survey on The Project for Augmentation of Water Supply System in Narok Town in The Republic of Kenya ケニア国ナロク給水拡張計画準備調査	
Drawing Title	Scale: 1:150, 1:50
Water Pipe Bridge Plan and Section	
水管橋 平面図・断面図	Drawing No. PI-WPB-001











2-2-4 Implementation Plan

2-2-4-1 Implementation Policy

Actual water supply projects are implemented by NARWASSCO through trust contract with RV-WSB. Project execution structure is shown in **Figure 2-2-13**. From detailed design stage, this project will be consistently led by the project team specially established in RV-WSB and NARWASSCO.

The roles of the project team are as follows:

- a. Represent the RV-WSB and NARWASSCO for this project
- b. Communicate with related Kenyan agencies
- c. Communicate with related external agencies
- d. Coordinate system design and tender procedure as counterpart of the consultant
- e. Coordinate additional survey and investigation

For smooth project implementation, the consultant carries out the detailed design, tender procedures and construction supervision within the planned work period. To achieve this, the consultant shall dispatch a resident construction supervision engineer to manage whole construction works on behalf of RV-WSB and shall also assign experts in specific fields of civil, pipeline, mechanical and electrical depending on the progress of works.

As major portion of this project is civil works, pipe laying and installation of mechanical/electrical equipment, and the assignment of Japanese contractor who has broad experience in similar works abroad is necessary. The selection of the contractor shall be done by general open tendering. Required contractors' qualifications and contractor selection criteria shall be examined and confirmed during the tender preparation stage, in with consultation with RV-WSB.

Upon the implementation of construction work, the resident engineer assigned by the contractor will manage the works. As Kenyan construction firms have been developed, local contractors can be employed as sub-contractors but will be supervised for strict work quality and safety management. There are security restrictions on storage yard for pipes and fittings and these should be properly secured by guards. Furthermore, uPVC pipes are vulnerable to sunlight. Thus, their site delivery schedule shall be carefully planned according to work progress.

Unification of pipe specifications, careful arrangement on flange specifications of valves, fittings and joint parts and on locally available diameter of these are required. For timely site delivery, work plan and actual work progress shall always be monitored properly.

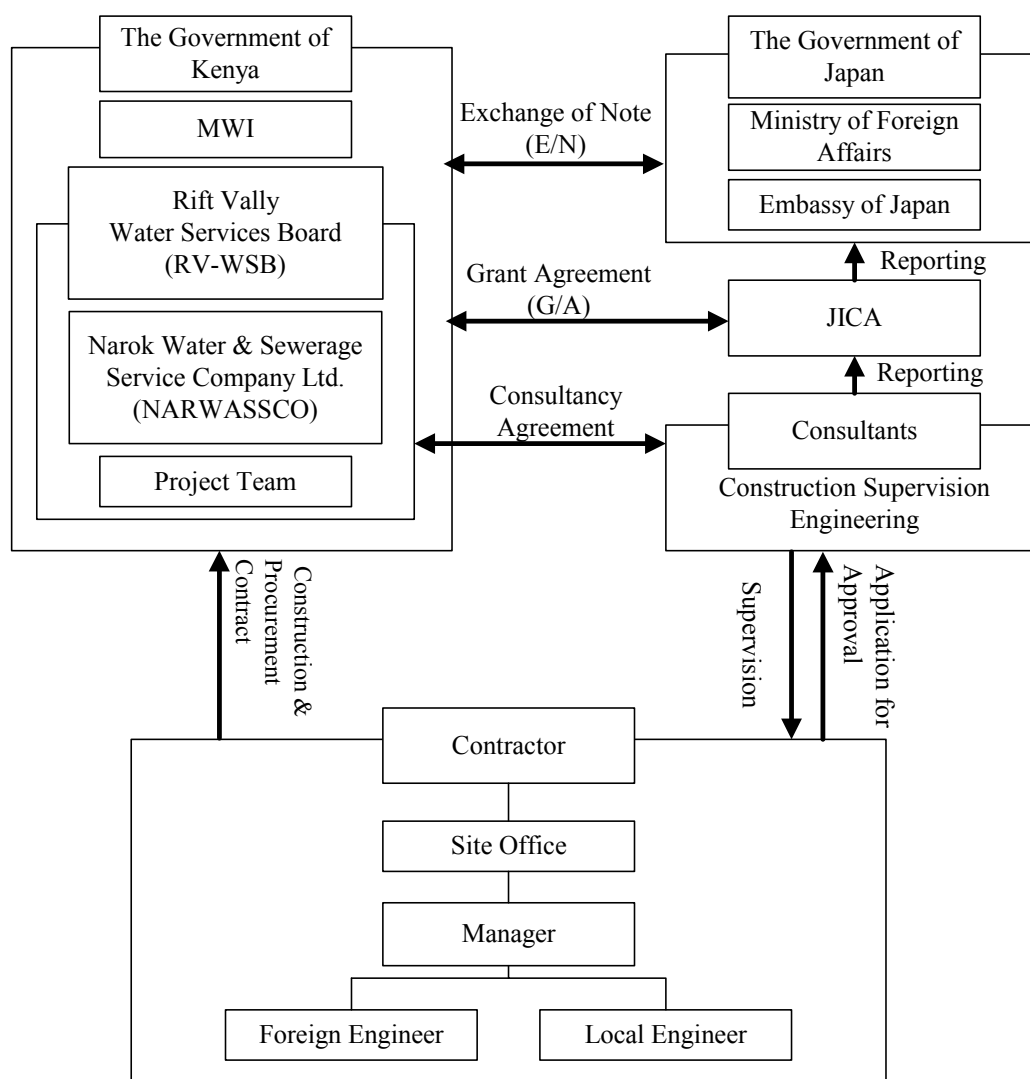


Figure 2-2-13 Project Execution Structure

2-2-4-2 Implementation Conditions

The planned construction works are comprised of the construction of water intake facility and water treatment plant, the rehabilitation of the existing Central WTP and reservoirs and the installation of raw water transmission pipes, clear water transmission pipes and distribution pipes. Site office and material storage yard have already been acquired by NATWASSCO and are located near the construction site of the proposed North WTP, secured with adequate space.

As eligible local contractors are available, part of the works can be executed by them with strict management on construction materials and heavy machinery. Important points on construction work are summarized as follows.

(1) General

- a. It shall be noted that Muslims take several days off after Ramadan, aside from public holiday and national holiday in Kenya. Religious composition in Kenya is Protestant 47.7%, Roman Catholic 23.5%, Islam 11.2%, Transitional 1.7% and others 16.0%.
- b. Narok Town is located in African Rift Valley and is 140km away from national capital Nairobi in West. Since Narok Town is also located at the entrance of world famous Masaimara National Park and serves as a key entry point to major cities of Nairobi, Nakuru, Kissii and Kisumu, industrial and tourism development is expected. Such circumstances shall be considered in labor procurement and material/equipment transportation.
- c. Land transportation is mostly by vehicles since the railway has not yet reached to Narok Town.
- d. Annual rainfall in Narok Town has a wide range. Average rainfall during years of 2001 to 2010 was 736mm, 390mm in 2005 and 1,065mm in 2002. Temperature in 2011 ranged from

9°C to 27°C and average is 20°C. Average monthly rainfall is spread from 11.0mm to

113.8mm with total annual rainfall at 762.4mm. Rainy seasons can be divided into long-term rainy season from March to May, short-term rainy season from November to December and dry season from January to February, from June to October. Rainfall during rainy seasons fluctuates year on year. Intense rain comes with thunder mainly in nighttime during long-term rainy season, while temperate rain comes in the evening during short-term rainy season. In general, expected impact on construction work caused by rainfall is minimal although heavy rain should be expected. So, work efficiency can decrease during work days with rainfall greater than 10mm/day

- e. Water intake facility construction work and raw water transmission pipe installation work shall be executed during the dry season excluding months of November to May.
- f. During earthwork, rock excavation is anticipated especially in the construction of the water intake facility and raw water transmission pipe laying. Compared with in Embu and Kapsabet, there is a bigger possibility of rock excavation thus, heavy breakers are needed.
- g. Since pipe laying along the paved road of main road B3, Mai Mahiu-Narok section is prohibited, pipe shall be installed in the open space secured outside of drainage gutter. If pipe is planned in private land, RV-WSB and NARWASSCO shall obtain land use allowance and deal with necessary compensation.
- h. Complying with regulations of Road Authority, pipes shall be protected at the crossing points of the National Road or major town roads, if required.
- i. As the National Road B3 is trunk road for Kenyan inland transportation, pipe installation work plan shall be prepared that avoids road blockades.
- j. No stable commercial suppliers of ready mixed concrete are available in nearby cities including Nairobi. Thus, selection of a concrete batcher plant site is definitely needed.

Strict quality management shall be in place.

- k. Current water supply amount is insufficient, so water for construction work shall be secured by water tanker or storage pond.
- l. Japanese experts shall be dispatched and works shall be carried out under their strict supervision for specific works such as pump placing work/test operation, welding works and so on.
- m. Heavy vehicles pass frequently during work period and thus, traffic congestion and impact by earth/gravel hauling is anticipated. To manage the dust problem, watering and spreading of gravel to un-paved roads shall be done.
- n. Comprehensive work plan is needed for rehabilitation works of the existing Central WTP, including filter material replacement and chemical dosage equipment installation to avoid adverse operational impacts on water treatment process.
- o. VAT on imported products and imported tax can be exempted by routine procedures. As to domestic procurements, refund process is generally done.
- p. The contractor will pay the custom bond to the insurance company or the bank when imported products which arrived at the port will be received. And, at that time, the contractor must pay the issue commission to the insurance company or the bank. The Kenyan side must pay the contractor in case the contractor submits the receipt for issue commission.
- q. Construction work implementation plan with full consideration of the surrounding environmental condition shall be prepared. As stipulated in NEMA regulation, countermeasures for environment related issues such as restoration of material storage yard, dust, noise and turbid water and surplus soil disposal shall be examined.
- r. Since local infrastructure is fragile and power failure occurs frequently, generators shall be utilized when needed.
- s. Price increases occur in the Kenyan market. According IMF estimates, price escalation of 11.3% is considered from cost estimation month to scheduled tendering month.

(2) Safety Control

Local safety related information shall be collected from JICA Kenya Office and the Embassy of Japan to prepare the safest measures with attention on the following items:

- a. Presidential election is scheduled on March 2013. According to the past experiences, security in Nairobi and other major local cities worsen in times of election, and thus safety measures shall be strengthened during the election period.
- b. Get timely advice from Kenyan counterpart agencies for safe and smooth work implementation.
- c. Keep close contact with donor agencies working in Narok to share security-related information.
- d. Generally, security in Narok Town and its surroundings is satisfactory and there are no problems in daily life. However, living in single detached housing is not favorable. Accommodation shall be in secured hotels or in several large housings units that provide communal living.
- e. Security incidents such as kidnapping have occurred in the past. Maximum care shall be taken when in major cities and facilities with many foreigners.

- f. Recently, Kenyan security has been deteriorating, including Nairobi City. Murders and robberies have become frequent. In the past, the site office of a Japanese contractor was attacked by robbers in Tanzania and Zambia. In this project, the project team shall consider contracting security with a security service provider in water supply facilities, site office and lodging areas. Guards with firearms shall be allocated, if needed.
- g. Logo marks shall be pasted on the work vehicles and the machineries to show that they are engaged in Japan-assisted project.
- h. Basic Operating Guideline (BOG) shall be publicized to related staff and workers to enable them to cope with unexpected security contingencies.

(3) Procurement Plan

a. Cement

Cement for ready-mixed concrete used for general concrete structure is manufactured in several factories of Banburi Cement Company in Mombasa, Blue Triangle Company and Rhino Cement Company in Nairobi. Raw material of cement is imported and landed at Mombasa port and transported to each factory by land. Total of cement price in Mombasa and transportation cost to site and cement price in Nairobi are almost the same. In case of the Embu project, cement is procured from Banburi Cement Company in Mombasa. In this project, procurement source shall be compared on the perspective of price and quality based on factory survey results.

b. Reinforcement bars

Though the price of reinforcement bars rapidly escalated in the years of 2010 and 2011 affected by World-cup Football Game, the price is stabilizing and fluctuates around peak level during run up years. Local products are available and only those manufactured based on British Standard (hereafter BS) quality control shall be procured.

c. Formwork

Domestic products are available but qualified formwork shall be supplied.

d. Gravel (coarse aggregate) and Sand (fine aggregate)

In Kenya, dust generated during gravel shaping is circulated in market as fine aggregate. Since dust contains fine powder, grain size distribution shall be confirmed upon application. Said aggregates are available at a quarry located an hour's drive from the site. There are two stores selling gravel and sand, one is on the way to Kisumu and another is on the way to Nairobi. However, when the construction work starts, this shall be re-confirmed.

e. Distribution Pipe Materials

As DI pipe is not currently manufactured in Kenya, this shall be imported from Japan or third countries. GI pipe, steel pipe with internal and external coating, uPVC pipe and HDPE pipe are manufactured in Nairobi factories and are domestically available. Spiral steel pipe is manufactured by only one company, called ASP Company situated in Nairobi. The minimum order length is 100m. As water leakage usually occurs in the butt welding joint, a simple steel plate socket is inserted at joint portion and is welded to pipe body by fillet welding.

Kenyan standard on uPVC pipe was revised in 2009 to comply with ISO1452-2 and pipe quality rapidly improved in recent years. Some companies have also been aggressively introducing foreign technologies, importing high quality raw materials and conducting water pressure test three times a day, taking samples every eight hours. Strict quality control should be practiced.



Low quality uPVC pipe

As some impurity might be contained, surface finishing and color are not homogeneous and pipe thickness is uneven. (Brown : for sewer and drainage, Grey : for water supply)



High quality uPVC pipe (Eslon Company)

Raw pipe materials are imported by mediation of Japanese company. Surface finishing and color are homogeneous and shiny. Pipe thickness is constant. (Brown : for sewer and drainage, Grey : for water supply)

Photo 2-2-2 uPVC Products

To secure a certain quality and durability, local pipe products that comply with BS and ISO specifications should be employed. Furthermore, pipes shall be procured from manufacturers which conduct voluntary quality test to produce high quality products.

f. Transportation Cost

Fuel costs have increased along with general price escalation. As fuel cost escalation directly affects in-land transportation cost, transportation cost shall be carefully estimated.

g. Exchange rate Fluctuation

Recently, there have been movements on the exchange rate between Japanese yen (hereafter JPY) and Kenya shilling (Kshs). Exchange rate fluctuations shall be carefully monitored.

2-2-4-3 Scope of Works

Table 2-2-24 and **Table 2-2-25** summarize work obligation and major undertakings of Japanese and Kenyan side.

Table 2-2-24 Work Demarcation

Work Items	Work Contents	Kenyan Side	Japanese Side
Water intake facilities construction and raw water transmission pipe laying	Procurement		○
	Construction works		○
North WTP construction and clear water transmission pipe laying	Procurement		○
	Construction works		○
	Equipment installation		○

**Preparatory Survey on The Project for Augmentation of Water Supply System
in NAROK Town in The Republic of KENYA
Chapter2 Contents of the Project**

Work Items	Work Contents	Kenyan Side	Japanese Side
	Land acquisition	○	
	Gate and Fence	○	
	Distribution line	○	
Rehabilitation of existing Central WTP and reservoirs	Procurement		○
	Construction works		○
	Equipment installation		○
Distribution Pipe	Procurement	○	○
	Construction works	○	○
Common	Temporary work road		○
	Permit approval acquisition	○	

Table 2-2-25 Major Undertakings to be taken by each Government (General)

No.	Undertakings	Japan (Grant)	Kenya
1	Secure land		●
2	Clear, level and reclaim the site when needed		●
3	Construct gates and fences in and around the site		●
4	Access road		●
	In-site work road	●	
5	Construct water intake facility, raw water transmission pipe, North WTP and clear water transmission pipe	●	
	Rehabilitation of the existing Central WTP and reservoirs	●	
	Distribution pipe, L = 80km, φ50~300mm	●	
	Distribution pipe, L = 20km, φ50mm		●
7	Provide facilities for power supply, water supply, storm drainage and other incidental facilities		
	1) Power Supply		
	a. Distribution line to the site		●
	b. Main circuit breaker and transformer		●
	c. Wiring within the site	●	
	2) Water Supply (in site)	●	
	3) Storm Drainage (in site)	●	
	4) Telephone		
	a. Telephone trunk line from site office to main distribution panel		●
	b. Office cable	●	
	5) Furniture and Equipment		
	a. General furniture		●
	b. Project equipment	●	
8	Bear the following commissions to Japanese Bank for banking service based on the B/A		
	1) Advising Commission of A/P		●
	2) Payment commission		●
9	Ensure unloading and customs clearance at port of disembarkation in recipient country		
	1) Marine (Air) transportation of the products from Japan to the recipient country	●	
	2) Tax exemption and custom clearance of the products at the port of disembarkation		●
	3) International transportation from the port of disembarkation to the project site	●	
10	Accord Japanese nationals, whose service may be required in connection with the supply of the products and the service under the verified contract, such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work		●
11	Exempt Japanese nationals from custom duties, internal taxes and other fiscal levies which may be imposed on the recipient country with respect to the supply of the products and services under the verified contracts		●
12	Bear all expenses needed to maintain, use properly and effectively the materials and		●

No.	Undertakings	Japan (Grant)	Kenya
	equipment provided under the Grant		
13	Bear all installation cost for equipment not provided under the Grant		●

(B/A: Bank Arrangement, A/P: Authorization to Pay)

2-2-4-4 Consultant Supervision

After completion of the preparatory survey, cabinet approval of GoJ is executed. The proposed project will commence with the “Signing on Exchange of Note (E/N) related to grant aid assistance on this project”.

(1) Detailed Design

If GoJ decides the grant aid assisted implementation based on the preparatory survey results, signing of E/N shall be carried out between GoJ and GoK. The consultant will then prepare the contract with RV-WSB and start the detailed design after certification by GoJ. The consultant shall conduct detailed field survey including topographic survey and carry out facilities design, cost estimation and preparation of tender documents.

(2) Tendering Procedures

All tender documents shall be approved by RV-WSB and after approval, move into tendering procedure immediately.

- a. Receive tender participation application from tenderers within one week after tender announcement.
- b. Evaluate tenderers' qualification with the least delay after receiving the applications
- c. Distribute tender documents to the eligible tenderers. After 1.5 months of preparation period, hold tender meeting with participation of persons involved.
- d. Tenderer that offers the lowest tender price is recommended to RV-WSB as successful tenderer and arrange for construction work contract.

(3) Construction Supervision

Site work consists of a wide-range of works such as, civil work, architectural work, pipe work, mechanical/electrical work. Engineers dispatched from Japan shall be one civil engineer to conduct resident supervision, structural and pipeline civil engineers, mechanical and electrical engineers. These engineers will be dispatched several times to carry out spot supervision according to the progress of major facility construction works. An assistant resident civil (local) engineer shall also be employed. Supervisory work shall be conducted with comprehensive meetings between the RV-WSB and the Japanese contractor.

Progress reports shall be submitted to MWI, RV-WSB, NARWASSCO, JICA Kenya office and JICA headquarters on schedule. Reports, contacts and meetings with relevant persons shall be carried out with undue delay.

2-2-4-5 Quality Control Plan

The Consultant shall require the Contractor to conduct the following tests shown in **Table 2-2-26** and reflect them to quality control plan.

Table 2-2-26 Test Methods for Quality Control

Test Items	Control Items	Test Methods	Standard/Remarks
Pipe Materials	Strength/Dimensions Appearance/Dimensions	Confirm factory inspection report Visual inspection/dimension measurement Gauge	Japanese Standard
Pipe Installation	Torque Leakage Coating	Torque wrench Water pressure test Coating thickness meter/visual inspection	Japanese Standard
Ground Foundation	Ground bearing capacity	Plate loading test	Japanese Standard
Concrete	Aggregate/Cement Water Fresh Concrete Concrete Strength	Physical test/chemical test Grain size test Slump/air content/chloride content Compressive strength test	Japanese Standard BS ISO
Reinforcement Bar	Strength	Tensile strength test Reinforcement bar arrangement inspection	Japanese Standard 440~600N/mm ² Kenyan Standard 545~595N/mm ²
Structure Appearance	Structure dimension	Dimension measurement	Japanese Standard
Water-proof Work	Material quality Paint thickness/ adhesion Finishing status Leakage	Confirmation of warranty Thickness test/tensile test Visual inspection Water filling test	Japanese Standard
Mechanical /Electrical Equipment	Installation precision Functions	Installation location measurement Loading operation test	Japanese Standard

2-2-4-6 Procurement Plan

(1) Source of Materials and Equipment

Eligible sources of materials and equipment to be procured by grant assistance project are basically Japan and recipient country. As much as possible, materials and equipment shall be procured in Kenya. However, for goods are not available in the local market, or stable supply cannot be ensured, or if cost is prohibitive, then these can be imported from Japan, considering cost benefit performance and O&M efficiency. Middle-south African countries, south Asian countries and EU countries are regarded as eligible third countries.

a. Civil materials

Among major civil and architectural materials, general ones such as cement, gravel, sand, brick, timber, petrol and oil shall be procured in the domestic market. However, measures to procure quality goods that comply with specifications shall also be examined.

b. Piping materials

Steel pipe with internal and external coating and uPVC pipe are manufactured in Nairobi factories and are available.

In the past years, domestic DI pipes were also manufactured but these are not currently circulated in the domestic market. Since no products have complied with the specifications, DI pipe shall be

imported from Japan or overseas factory of a Japanese manufacturer.

c. Mechanical/electrical equipment

The quality of equipment in water treatment plants is important and cannot be compromised. The advantage of third country procurement may be resorted to, but reliable Japanese products may also be procured.

d. Filter materials

High specifications such as grain size, specific gravity and grain size distribution are required for filter sand. Based on field survey results, domestic filter sand can be procured but strict quality control is needed.

e. Construction machineries

Though local construction machinery lease market is insufficient in terms of the number of available/operational machine units, so procurement of such general machineries employed in this project is permissible. **Table 2-2-27** shows material/equipment procurement demarcation.

Table 2-2-27 Material/Equipment Procurement Demarcation

Construction Materials/Equipment		Procurement Source		
Classifications	Items	Kenya	Japan	Third Country
Civil Materials	Cement	○		
	Reinforcement bar	○		
	Formwork	○		
	Sand, Gravel, Brick	○		
	Light oil, Petrol	○		
Pipe Materials	DI Pipe		○	(○)
	GI Pipe, Steel Pipe	○		
	uPVC Pipe	○		
Mechanical/Electrical Equipment	Pumps		○	
	Chemical dosing device		○	
	Filter sand	○		
Construction Equipment (Lease)	Construction Equipment	○		
Common Temporary Works	Concrete Plant	○		

(○): Provided the supply of products from overseas factory of Japanese Manufacturer

(2) Site Delivery and Storage Yard

Basically, the delivery site of procured material/equipment shall be the storage yard in Narok Town which shall be designated by NARWASSCO within or near the proposed North WTP site. Security shall be maintained at all times to prevent theft. Therefore, huge volume delivery is unfavorable especially in case of bulky pipe materials, and deliveries will have to be made in several batches according to the progress of work.

2-2-4-7 Operational Guidance Plan

Upon facility completion, test operation shall be scheduled before the final turn-over of the facilities to confirm the function and operation of the installed equipment such as, generator, intake pump, transmission pump, chemical dosing equipment and so on. During the test operation, the initial operational training shall be conducted by the technical staff by the contractor before NARWASSCO O&M personnel to demonstrate the proper operation of each equipment. The contents of initial operational guideline are shown in **Table 2-2-28**.

Table 2-2-28 Initial Operational Guidance

Facilities	Major Guidance	Remarks
North WTP/ Clear Water Reservoir	Surface washing function : Confirm functioning status, ON-OFF operation, water amount setting, inspection method Pumping function : Confirm functioning status, ON-OFF operation, water amount setting, inspection method, emergency stop procedure Sludging devices : Sludge operation Chemical dosing devices : Dosage amount setting, agitator operation, inspection method Electrical equipment : Confirm functioning status, inspection method Generating equipment : Confirm functioning status, operation method, inspection method	Including operation guidance to the existing Central WTP, especially chemical dosage equipment
Rehabilitation of the existing Central WTP	Water level setting : Confirm functioning status, inspection method	Rehabilitation of the existing seven (7) reservoirs
Raw Water Transmission Pipe, Clear Water Transmission Pipe and Distribution Pipe	Valves : Confirm functioning status, open-close operation, inspection method	
Raw Water Transmission Equipment	Transmission function : Confirm functioning status, ON-OFF operation, North WTP receiving well water level setting, inspection method, emergency stop procedure Generator : Confirm functioning status, open-close operation, inspection method	
Water Intake Equipment	Valves and Gates : Confirm functioning status, open-close operation, desludging method, inspection method Screen : Inspection and cleaning method	

2-2-4-8 Soft Component Plan (Technical Assistance) Plan

The objective of “Project for Augmentation of Water Supply System in Narok Town” is to improve current unreliable water supply condition caused by deterioration of existing facilities and resulting to inadequate of water supply capacity which is to be implemented through Japanese Grant Aid assistance. These are: (1) Facility construction composed of (i) Rehabilitation of the existing Central WTP and reservoirs, (ii) Construction of new North WTP, water intake facility and a clear water reservoir, (iii) Installation of raw water transmission pipe, clear water transmission pipe and distribution pipe, and (2) Material/equipment procurement, composed of (i) Chemical dosage equipment and water quality analysis equipment, and (ii) Distribution pipe/house connection pipe/water meter.

NARWASSCO has to develop its capacity in managing the implementation of an improvement project

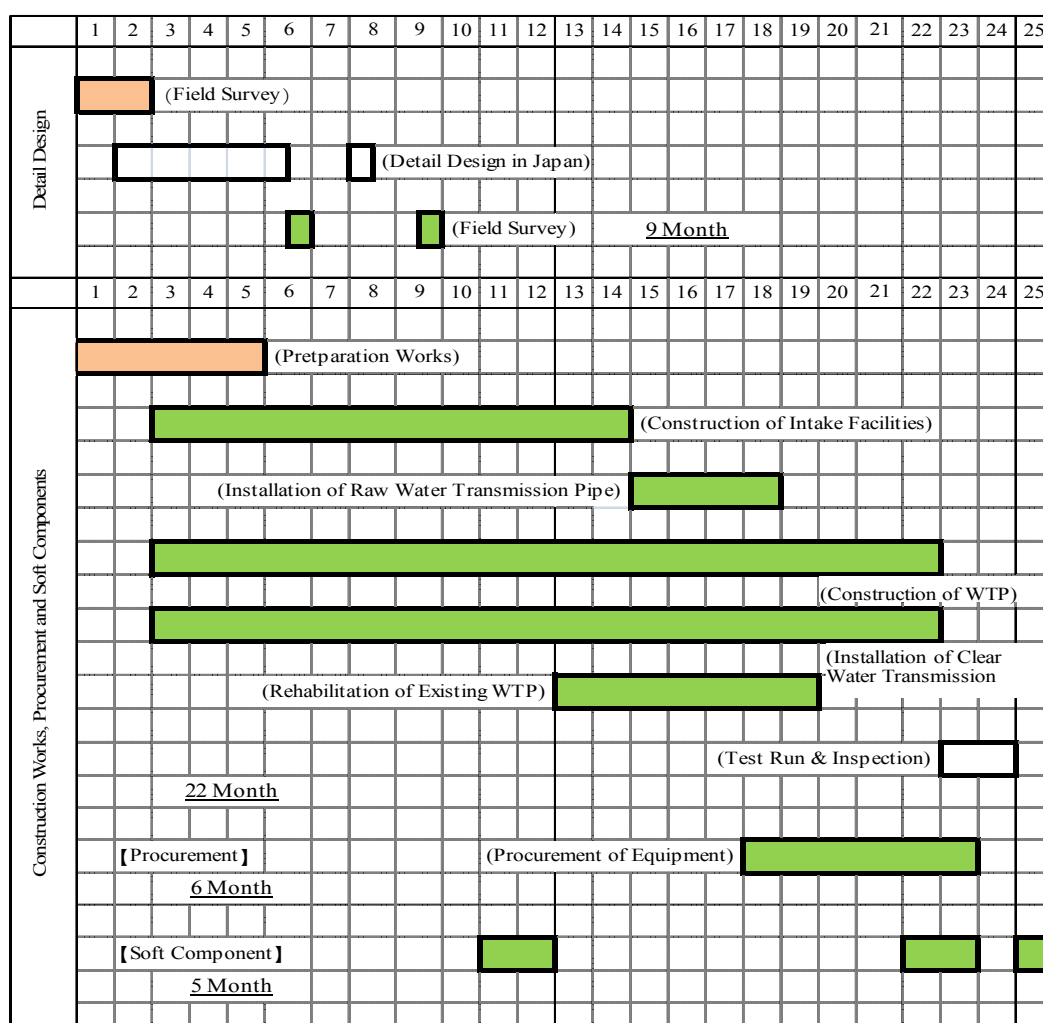
of this size, as well as operating and maintaining the system after construction. Thus, a soft component is planned to enhance the organizational capacity of NARWASSCO and of those who will be tasked with operation and maintenance. This will ensure that the project benefits are sustained. In preparing the soft component plan, these three separate activities shall be undertaken: 1) Capacity building on facility operation and maintenance of the entire water supply system, from the intake facility up to house connection. 2) Capacity upgrading on customer service management, particularly pipeline installation, water tariff billing and collection, finance and accounting work. 3) Capacity improvement and strengthening in over-all water utility management.

These three separate capacity development activities will become the core for the scope of work for soft component, as detailed in **Appendix 5**.

- ① O&M of Water Supply Facility
- ② Upgrading Supervising Capacity of Pipe Installation
- ③ Strengthening Managerial Capacity of Water Supply Undertaking

2-2-4-9 Implementation Schedule

Table 2-2-29 Implementation Schedule



2-3 Obligations of Recipient Country

The activities undertaken by GoK and NARWASSCO are described in “2-2-4-3 Scope of Works” and are tabulated in **Table 2-3-1**.

Table 2-3-1 Undertaking by GoK and NARWASSCO

No.	Work Items	Description	Quantity	Unit
1	New North WTP	Gate	1	set
		Fence	880	m
2	Intake Facility	Gate	1	set
		Fence	85	m
3	Access road to intake facility (work road is undertaken by Grant Aid)	Pavement cost is also borne by Kenyan side	1,500	m
4	Power receiving (distribution line+main breaker + transformer)	WTP	30	m
		Intake facility	1,500	m
5	Distribution Pipe	Lay ϕ 50mm pipe with pipe materials and labor borne by Kenyan side	20,000	m
6	House Connection Pipe - 1	ϕ 13mm, Installation of Procured Pipe	16,000	m
7	House Connection Pipe - 2	ϕ 13mm, Procured and Installation of Pipe	16,000	m
8	Water Meter - 1	Placing of provided meter	1,600	pcs
9	Water Meter - 2	Procured and placing water meter	2,000	pcs
10	Land Acquisition	Land acquisition for North WTP, raw water transmission pipe and access road. As they are governmental land, land acquisition cost is free	5.5	ha
11	Land Rental	Contractors Camp, stock yard and so on, 2 years	1.5	ha
12	Furniture for Administration Building	If needed	1	set
13	Bank Commission	0.05% of total construction cost + 20,000Kshs	1	set
14	Disposal Site for Sludge (RV-WSB)	Secure of disposal site for dry sludge contains Fluorine	1	set
15	Commission Fee for Custom Bond		1	set

The abovementioned works are all important, especially for No.5, the laying of distribution pipe which is critical to achieve the project objectives. Out of the total distribution pipelines, with length of 80km priority pipes will be installed by the Japanese side. Distribution branch pipes of 20km shall be covered by NARWASSCO, including pipe material and installation costs.

Work schedule conducted by Kenyan side is shown in **Figure 2-3-1**. Most of the works except pipe work will be completed by the end of this project, and the rest of pipe works shall be completed within 5 years after this project.

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Work Items	Description	Details	Work Schedule (Year)							
			1	2	3	4	5	6	7	8
			Construction Work conducted by Japan's Side Start				Construction Work conducted by Japan's Side Completed			
1	Installation of Distribution Pipe	φ50mm, Total Length 20km								
		L = 5km								
		L = 5km								
		L = 5km								
2	Installation of House Connections (Pipe Material to be provided under the	φ13mm (1/2"), Total Length 16km								
		L = 8km								
3	Installation of House Connection (Pipe Material provided by Kenyan side)	φ13mm (1/2"), Total Length 16km								
		L = 4km								
		L = 4km								
		L = 4km								
4	Installation of Water Meters (Water Meters to be provided under the	Total 1,600 pcs								
		800 pcs								
5	Installation of Water Meters (Water Meters provided by Kenyan side)	Total 2,000 pcs								
		500 pcs								
		500 pcs								
		500 pcs								
6	Tree Felling & Leveling	for Temporary Work Road at Raw Water Transmission Pipe								
7	Construction of Access Road	from Intake to North WTP								
8	Installation of Gate & Fence at Intake	Gate: 1 set, Fence 85m								
9	Installation of Gate & Fence at North WTP	Gate: 1 set, Fence 880m								
10	Preparation of Power Receiving	Distribution Line, Main Breaker, Transformer at Intake & North WTP								
11	Furniture for Administration Building at WTP									

Figure 2-3-1 Work Schedule conducted by Kenyan Side

A 5km/year distribution branch pipe laying shall be conducted by NARWASSCO. The on-going pipe laying work in Embu is performed by EWASCO with progress rate of 10km/month. NARWASSCO does not have working department at present, but it must develop a supervision capacity equivalent to 10% of EWASCO's.

Work capacity of contractors who have pipe laying work experiences in Narok Town is shown in **Tabele 2-3-2**. Work progress rate can be increased by manpower input, but the current NARWASSCO's work quality inspection is quite inadequate necessitating training by the soft component.

Table 2-3-2 Local Contractors in Narok Town

Items	STROIKA	ENTAWUO	ERETO
Number of workers (persons)	10 (Regular)	8 (Regular)	50 (Regular/Part-time)
Pipe laying capacity (Interview survey)	5 km/month (Employing additional workers)	3 to 5 km/month (Employing additional workers)	1km/month
Experiences in Plumbing works	15 years	5 years	15 years
Experiences in Construction works	15 years	Not Available	15 years
Experiences in Pipe laying works	8 years	6 years	—
No. of projects undertaken (Interview survey)	8 to 10 projects/year	15 pipe laying works More than 100 material procurement	More than 50 large-scaled projects

If Kenyan side works are executed smoothly, the planned distribution branch and house connection pipes are going to be completed within target year of 2020. This will enable achievement of the water service rate.

2-4 Project Operation Plan

(1) O&M Structure

The current NARWASSCO O&M structure is headed by a manager director, assisted by a commercial and sales department, a technical department and an administration and human resource department. The number of total staff is 23. At present no manager and staff are allocated to the administration and human resource department. With this project, the current water supply amount of 2,000m³/day will double to 5,000m³/day and so with the number of WTP from one to two. The current number of house connections of 2,000 HH is projected to exceed 5,000 HH. Therefore, personnel increase in the commercial and sales department, as well as the technical department is necessary. Furthermore, computer system will be needed to ensure efficient water tariff billing and accounting work. **Table 2-4-1** shows the work assignment, work contents, current staff number and proposed staff number for target year 2020.

Table 2-4-1 Composition of NARWASSCO Staff

Line of Work	Description	Staff Number as End of February 2012	Proposed Staff Number in 2020
Managing Director	Generalization of Project Operation	1	1
Commercial & Sales Manager	Generalization of Commercial & Sales	1	1
Technical Manager	Chief in charge of Design Techniques	1	1
Administration & Human Resource Manager	Chief in charge of Administration & Human Resource Matters	—	1
Sub Total		3	4
Commercial & Sales			
Assistant Account & IT officer	Accounting and computer operation	—	1
Meter readers	Water meter reading	2	5
Billing clerk & revenue collection clerk	Bill issue and charge collection	2	3
Customer care officer & receptionist	Q&A for customers	1	2
Disconnection assistant	Valve disconnection for customers in arrears	1	2
Driver		2	4
Sub Total		8	17
Technical operations			
Water supply operator	Chief of WTP	1	2
Artisan I (Water supply)		3	8
Artisan II (Masson Artisan)		1	1
Lab. Technologist	Water quality analysis	1	1
Pump operators	O&M of intake facility, WTP and raw water transmission pump	1	2
UFW & Reconnection officers	UFW handling and private faucet reconnection	5*1)	8
Sub Total		12	22
Audit Officer		—	
Human Resources		—	
Grand Total		23	43

*1) : Though they are assigned as UFW & reconnection officer, they also engaged in other works due to man power shortage. They shall be exclusive officers for assigned work and other works shall be covered by personnel increase

Aside from the increase in personnel, proper maintenance of transport such as vehicles, motor bikes

and working trucks will be required. There will also be a need to have ties with local contractors to whom O&M work can be outsourced. New water meters must be installed to allow for easy meter reading, unlike the existing manner where meters are difficult to verify access and read.

(2) Required Number of Staff from Work Commencement Year to Target Year

Yearly personnel increase and allocation by work assignment is shown in **Table 2-4-2**. Since the organization structure has already been established, the increases in personnel by each department will be systematic.

As scheduled work commences on November 2013 up to work completion year, two water supply engineers will be required to personnel increase of two water supply engineers is needed to acquire O&M technology through soft component and OJT at the proposed North WTP.

On work completion year scheduled on October 2015, personnel increase is planned in WTP operation staff and in commercial and sales department to deal with house connection and customer increase. This arrangement is quite important for smooth progress of routine works and to upgrade customer service. Meter reader personnel shall be increased arbitrarily according to water meter placing plan and actual progress.

Table 2-4-2 Required Number of Staff from Work Commencement Year to Target Year

Line of Work	2012	2014	2015	2016	2017	2018	2019	2020
	At present			Work Completion/ Commisioning				Target Year
Managing Director	1	1	1	1	1	1	1	1
Commercial & Sales Manager	1	1	1	1	1	1	1	1
Technical Manager	1	1	1	1	1	1	1	1
Administration & Human Resource Manager	—	—	—	1	1	1	1	1
Sub Total	3	3	3	4	4	4	4	4
Commercial & Sales								
Assistant Account & IT officer	—	—	1	1	1	1	1	1
Meter readers	2	2	2	3	4	4	5	5
Billing clerk & revenue collection clerk	2	2	2	3	3	3	3	3
Customer care officer & receptionist	1	1	1	2	2	2	2	2
Disconnection assistant	1	1	1	2	2	2	2	2
Driver	2	2	2	3	3	4	4	4
Sub Total	8	8	9	14	15	16	17	17
Technical operations								
Water supply operator	1	1	1	2	2	2	2	2
Artisan I (Water supply)	3	3	5	8	8	8	8	8
Artisan III	1	1	1	1	1	1	1	1
Lab. Technologist	1	1	1	1	1	1	1	1
Pump operators	1	1	1	2	2	2	2	2
UFW & Reconnection officers	5	5	5	8	8	8	8	8
Sub Total	12	12	14	22	22	22	22	22
Grand Total	23	23	26	40	41	42	43	43

2-5 Project Cost Estimation

2-5-1 Initial Cost Estimation

(1) Cost to be Borne by the Kenyan Side

Table 2-5-1 Cost to be borne by the Kenyan side

No	Work Items	Description	Quantity	Unit	Unit Cost	Cost (Kshs)
1	New North WTP (NARWASSCO)	Gate	1	set	150,000	150,000
		Fence	880	m	1,900	1,672,000
2	Intake Facility (NARWASSCO)	Gate	1	set	150,000	150,000
		Fence	85	m	1,900	161,500
3	Access road to intake facility (road work is undertaken by Japan Grant Aid) (NARWASSCO)	Pavement cost is also borne by Kenyan side	1,500	m	34,000	5,100,000
4	Power receiving (distribution line+main breaker+transformer) (NARWASSCO)	WTP	30	m	-	11,000,000
		Intake facility	1,500	m		
5	Distribution Pipe (NARWASSCO)	Lay ϕ 50mm pipe with pipe materials and labor borne by Kenyan side	20,000	m	1,000	20,000,000
6	House Connection Pipe (NARWASSCO)	ϕ 13mm, Installation of procured pipe	16,000	m	600	9,600,000
7	House Connection Pipe (NARWASSCO)	ϕ 13mm, Procured and installation of pipe	16,000	m	700	11,200,000
8	Water meter (NARWASSCO)	Placing of provided water meters	1,600	pcs	300	1,110,000
9	Water meter (NARWASSCO)	Procured and placing water meters	2,000	pcs	4,300	8,600,000
10	Land Acquisition (NARWASSCO)	Land acquisition for WTP, raw water transmission pipe and access road. As they are governmental land, land acquisition cost is free.	5.5	ha	-	0
11	Land Rental (NARWASSCO)	Contractors Camp, stock yard and so on, 2 years	1.5	ha	1,250,000	0
12	Furniture for Administration Building (NARWASSCO)	If needed	1	set	200,000	200,000
13	Bank Commission (RV-WSB)	0.05% of total construction cost + 20,000Kshs	1	set	580,000	580,000
14	Disposal Site for Sludge (RV-WSB)	Secure of disposal site for dry sludge contains Fluorine	1	set	-	-
15	Commission Fee for Custom Bond		1	set	3,000,000	3,000,000
Grand Total						72,523,500

Distribution pipe (pipe materials + installation) conducted by NARWASSCO with length of 20km will be installed 4 years from 2015. GoK budget for Implementation of Water Project is about 600 to 700 million Kshs, 2011/2012 budget is 670 million Kshs. Therefore, construction cost borne by Kenyan side (72.5 million Kshs) considering implemented in 5 years is estimated (72.5 million Kshs / 5 years) / 670 million Kshs $\times 100\% \div 2.2\%$. It is conceivable that Kenyan side can bear this cost sufficiently.

2-5-2 Operation and Maintenance Cost

(1) O&M Cost

The estimated O&M cost in the target year of 2020 is shown in **Table 2-5-2**. Price escalation of 4% is utilized for cost estimation purposes. Refer to Kenyan major indices view, April 2012, JICA. As a result, the projected O&M cost in 2020 is 84.3 million Kshs/year. Compared with actual performance in 2011 of 30.9 million Kshs/year, O&M cost is projected to be 2.7 times in 2020.

Table 2-5-2 Expected O&M Cost in Target Year

Cost Items	Calculation (at year of 2020)	O&M Cost (Kshs/Year)	
		2020	2011 Actual Performance
Private Cost	- Total 43 persons 40,000Kshs Ave./person • month×12 months×43preson = 20,640,000Kshs/year	20,640,000	7,700,000
Chemical Cost	<u>Existing Central WTP</u> - Aluminum Sulfate (Average dosing rate 80ppm) 50Kshs/kg×84kg/day×365 day = 1,533,000Kshs/year - Lime (Average dosing rate 10ppm) 70Kshs/kg×10.5kg/day×365 day = 268,000Kshs/year - Calcium hypochlorite (Average dosing rate as effective chlorine 2ppm) 240Kshs/kg×3.2kg/day×365 day = 280,000Kshs/year <u>New North WTP</u> - Aluminum Sulfate (Average dosing rate 80ppm) 50Kshs/kg×344kg/day×365 day = 6,278,000Kshs/year - Lime (Average dosing rate 10ppm) 70Kshs/kg×43kg/day×365 day = 1,099,000Kshs/year - Calcium hypochlorite (Average dosing rate as effective chlorine 2ppm) 240Kshs/kg×13.2kg/day×365 day = 1,156,000Kshs/year	10,614,000	2,891,000
Electricity	<u>Water Intake Facility</u> 2,203kWh/day×365 day×24Kshs /kWh* = 19,298,000Kshs/year <u>Existing Central WTP</u> 1,173kWh/day×365 day×24Kshs /kWh* = 10,275,000Kshs/year <u>New North WTP</u> 257kWh/day×365 day×24Kshs /kWh* = 2,251,000Kshs/year *Average unit cost per KWh calculated based on KPLC regulations	31,824,000	8,645,000
Sludge Hauling/Disposal Cost	- Generated amount of dried sludge : 53 ton/30 days - Dump truck (4 ton loading) : 53t / 4t = 13 units, 5,000Kshs/time 5,000 Kshs/time×13 units×12 time/year= 780,000Kshs/year	780,000	-
Equipment Repair Cost	Providing 4% of mechanical/electrical equipment cost 235,000,000Kshs×0.04/year = 9,400,000Kshs/year	9,400,000	5,332,000
Office Expense, Communication Expenses and Consumable Cost	Calculate on15% of total of abovementioned costs 73,258,000Kshs/year×0.15=11,000,000Kshs/year	11,000,000	6,332,000
Total		84,258,000	30,900,000

(2) Estimation of Water Tariff Income

The projected water tariff income in 2020 is shown below. Water tariff income is calculated as 49.6 million Kshs/year if applying the current water tariff.

- ① Water supply amount : 3,730m³/day (Effective amount out of design water supply amount 5,000m³/day)

- ② Served population : 49,980 persons
- ③ Served household number : 10,000HH (5 persons per HH) Estimated [High–middle income class 7,500HH, Low income class 2,500HH]
- ④ Breakdown of water consumption :
 - a. High - middle income group 2,450m³/day (included shops and offices)
 ⇒ per HH average consumption 9.8m³/month
 (2,450m³/day×30 days ÷ 7,500HH = 9.8m³/month • HH)
 - b. Low income group 500 m³/day
 ⇒ per HH average consumption 6 m³/month
 (500m³/day×30 days ÷ 2,500 HH = 6.0m³/month • HH)
 - c. Boarding school, collage 780 m³/day
 ⇒ 23,400m³/month (780m³/day× 30 days = 23,400m³/month)
- ⑤ Water tariff (applied current water tariff)
 - a. High - middle income group : 390Kshs/month×7,500HH×12 months = 35,100,000 Kshs/year
 - b. Low income group : 200Kshs/month×2,500HH×12 months = 6,000,000 Kshs/year
 - c. Boarding school, collage : 50Kshs/ m³×23,400m³/month×12 months = 14,040,000 Kshs/year
- ⑥ Water tariff income (providing tariff collection rate of 90%)
 (35,100,000+6,000,000+14,040,000) Kshs/year×90% = 49,626,000 Kshs/year

(3) Income and Expenditure Projection based on Water Tariff Income

Table 2-5-3 shows a comparison of O&M cost and water tariff income in the future. If current water tariff is continuously applied, a deficit of 34.7 million Kshs/year is expected.

Table 2-5-3 Comparison between O&M Cost and Water Tariff Income

Cost Item	O&M Cost (Million Kshs/year)	Water Tariff Income (Million Kshs/year)	Balance (Million Kshs/year)
Estimated Amount at 2020	84.3	49.6	▲ 34.7

Since GoK will subsidize the project, there are no serious restrictions on the project's implementation. However, since expenditures shall be covered by income from water tariff in the future, tariff may need to be adjusted by around 70% (84.3/49.6=1.70).

If the 70% water tariff increase is then executed, the new water tariff becomes 660 Kshs/month for the high to middle income group and 340 Kshs/month for low-income group. According to the results of social survey, the average household income is 22,000 Kshs/month, thus new water tariff is well within 3 to 5% of the average income, which is affordable. Furthermore, the new water tariff is lower than the average willingness to pay amount of 1,050 Kshs/month. Coupled with increases in household incomes in the future, the proposed water tariff increase is judged to be feasible from viewpoint of affordability-to-pay and willingness-to-pay by the average household, and will be considered to cover the O&M cost for water supply facilities.

The implementation of the new water tariff increase in the future shall also necessitate the revision of water tariff discounts to the low income group which already utilizes government subsidy. The water tariff income shall have to be augmented by vigorously promoting new house connection and a strong metering program to improve the financial standing of the water authority. Soft component performed by this project will support O&M and water tariff.

(4) Facility Renewal and Equipment Replacement Period

According to durable period prescription using Kenyan design standards, the captioned period is set as follows:

- Structure : 50 years
- Pipeline : 50 years (Main) , 30 years (Branch)
- Mechanical and Electrical Equipment : 15 year

Chapter 3

Project Evaluation

Chapter 3 Project Evaluation

3-1 Preconditions

The preconditions for project implementation are follows:

- (a) Secure the budget on the activities to be undertaken by the Kenyan side. Disbursements shall depend on the work schedule. The contents of the activities are construction of the fence, gate and access road for the water intake facility and the proposed North WTP, power transmission, installation of a part of distribution pipelines, water meters and house connections.
- (b) Progress on the land transaction authentication procedure application addressed to the Narok Town council to get official land transaction approval from Ministry of Land and National Land Authority.
- (c) Progress on the water right authentication procedure application addressed to WRMA to get official water right.
- (d) Get the necessary approval and license needed regarding the facility construction works in advance to avoid delays in project implementation schedule.
- (e) Get the approval of EIA from NEMA.

3-2 Necessary Inputs by Recipient Country

The followings are items to be undertaken by Kenyan side:

- (a) Organize the project team, allocate necessary personnel, and secure the required budget. This activity shall be performed during project implementation and after facility completion.
- (b) Establish project team during detailed design study to comprehend project contents and to master techniques.
- (c) Actively participate in the soft component and apply acquired techniques for proper project operation and O&M.
- (d) Until target year of 2020, install distribution pipe with length of 20km using the budget allocated from the Kenyan side.
- (e) Connect house connection pipe to distribution pipe (installed by Japanese side) and install water meter by using the materials produced by Japanese side.
- (f) Collect proper water tariff in a timely manner to sustain project operation.

3-3 Important Assumptions

- 1) Important assumptions on project implementation is construction and reinforcement works for the water supply facility utilizing subsidy issued carrying out by NARWASSCO under supports from Water Service Trust Fund and RV-WSB . While the work scale of the subsidized project will not seriously affect the contents of this augmentation project, careful consideration shall be given to former.

3-4 Project Evaluation

3-4-1 Relevance

The existing Central WTP capacity is inadequate to supply water to the growing population of the central area of Narok Town. It is also overloaded, thus treated water cannot be assured to match of the service area such as schools, hospitals, households and so on. This is aggravated by numerous leaks in the old pipelines. Furthermore, the town has pockets of unserved areas.

Since significant project benefits on water supply service in Narok Town is expected and this project broadly contributes to residents' BHN upgrading, project implementation through Japanese Grant Aid scheme is judged as appropriate for the following reasons:

- i) Narok Town is located very close to the world famous Masaimara National Park, therefore industry and tourism is expected to grow. It has also been nominated as one of 15 cities prioritized for water supply system development in Vision 2030.
- ii) In 2008, national road B3 was connected to Masaimara National Park. The construction of housing units has been rapidly on-going, with the attendant increase in population in the area.
- iii) Currently, there is not 24 hours water supply service, and water supply hours are uncertain.
- iv) Fetching of water is mainly performed by women and children, and has become a huge burden, since water service area is limited, even if there is water supplied by KIOSKs.
- v) The existing Central WTP produces water beyond its capacity, so the water quality of treated water is compromised.
- vi) Advancing Narok universities and some schools in Narok Town remarkably.
- vii) Since the existing Central WTP and reservoirs are still available, a full package water supply system is not required, thereby reducing and construction cost.
- viii) Since schools, hospitals and houses are concentrated in the centre of Narok Town, the

length of distribution pipelines for the project is reduced, leading to substantial savings.

- ix) There is no foreseen technical problem because target water supply facilities are of the same type and same method with that applied in the local water supply system. Furthermore, procured materials and equipment are indispensable to achieve the target water service ratio.
- x) Only the cost needed for O&M is covered by water tariff income and thus, this project will not be a big burden to water consumers.
- xi) Minimum environmental impact is foreseen during construction works and system operation.
- xii) Smooth project implementation through Japanese Grant Aid scheme is feasible.

3-4-2 Effectiveness

The following quantitative and qualitative project effectiveness is anticipated:

(1) Quantitative Effectiveness

Quantitative project effectiveness indices are shown in **Table 3-4-1**.

Table 3-4-1 Quantitative Project Effectiveness

Indices	At Present (2012)	Target Year (2020)
Served Population	18,000 person ^{*1)}	49,980 person
Supply Amount	2,000m ³ /day ^{*2)}	5,000m ³ /day

*1): Current served population. But water supply is unstable and water service time is not regularly.

*2): Current water supply amount. But water is treated beyond its design capacity, resulting to water quality that does not conform to standards

(2) Qualitative Effectiveness

The following qualitative project effectiveness as shown in **Table 3-4-2** is expected to Narok Town water supply service and residents.

Table 3-4-2 Qualitative Project Effectiveness

Current Status and Issues	Countermeasures to be implemented by this Project	Project Effects
A: Direct Effects		
(1) Water supply capacity		

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Current Status and Issues	Countermeasures to be implemented by this Project	Project Effects
Water supply capacity is extremely deficient compared with water demand	- Construction of the proposed North WTP - Construction of the new clear water reservoir (2,000m³) within North WTP premises as clear water reservoir - Installation of distribution pipe (80km)	Water amount equivalent to water demand can be supplied by distribution pipe installation
(2) Stable water supply Currently, 24 hours water supply is not performed and water supply hours are uncertain	- Construction of new WTP with sufficient capacity - Construction of reservoir and distribution pipe to system augmentation	24 hours water supply is available.
(3) Water quality - Operation of the existing Central WTP in overloaded, treated water quality is below potable water standard - Proper water quality control has not been practiced	- Construction of new WTP where adequate water treatment is possible - Construct the chemical house and procure chemical dosage equipment for the existing Central WTP - O&M upgrading through Soft Component	Supplied water quality is to be improved by construction of new WTP and repair/ and O&M capacity upgrading of the existing Central WTP
(4) NRW measure / water charge collection - According to current water service, registered house connections number 2,131 but water charge is collected from only 1,175 which have negatively affected financial health of the water system. - NRW rate is high. Improvement shall be required	- Procurement of water meters and house connection pipes - NRW rate is to be reduced by laying of new distribution pipes	- Increasing water income and amount - NRW reduction, proper water charge billing/collection by water meter installation stabilize managerial status of NARWASSCO
B: Indirect Effects		
(1) Water-borne diseases Safe and sanitary potable water supply has not been secured or is insufficient and this causes high morbidity due to water-borne diseases	—	Stable supply of safe and sanitary potable water supply will contribute to the reduction of water-borne diseases morbidity, such as Diarrhea, Typhoid and Cholera
(2) Water fetching labor Water fetching labor is mainly performed by women and children and this becomes a huge burden	—	Water fetching labor will be mitigated by house connection

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Current Status and Issues	Countermeasures to be implemented by this Project	Project Effects
(3) Effect of global warming ▪ Intensity of rainfall fluctuation, drought might increase by climate change caused by global warming	—	▪ By completion of this project, safe and stable water supply is realized and social adaptability against climate change is improved