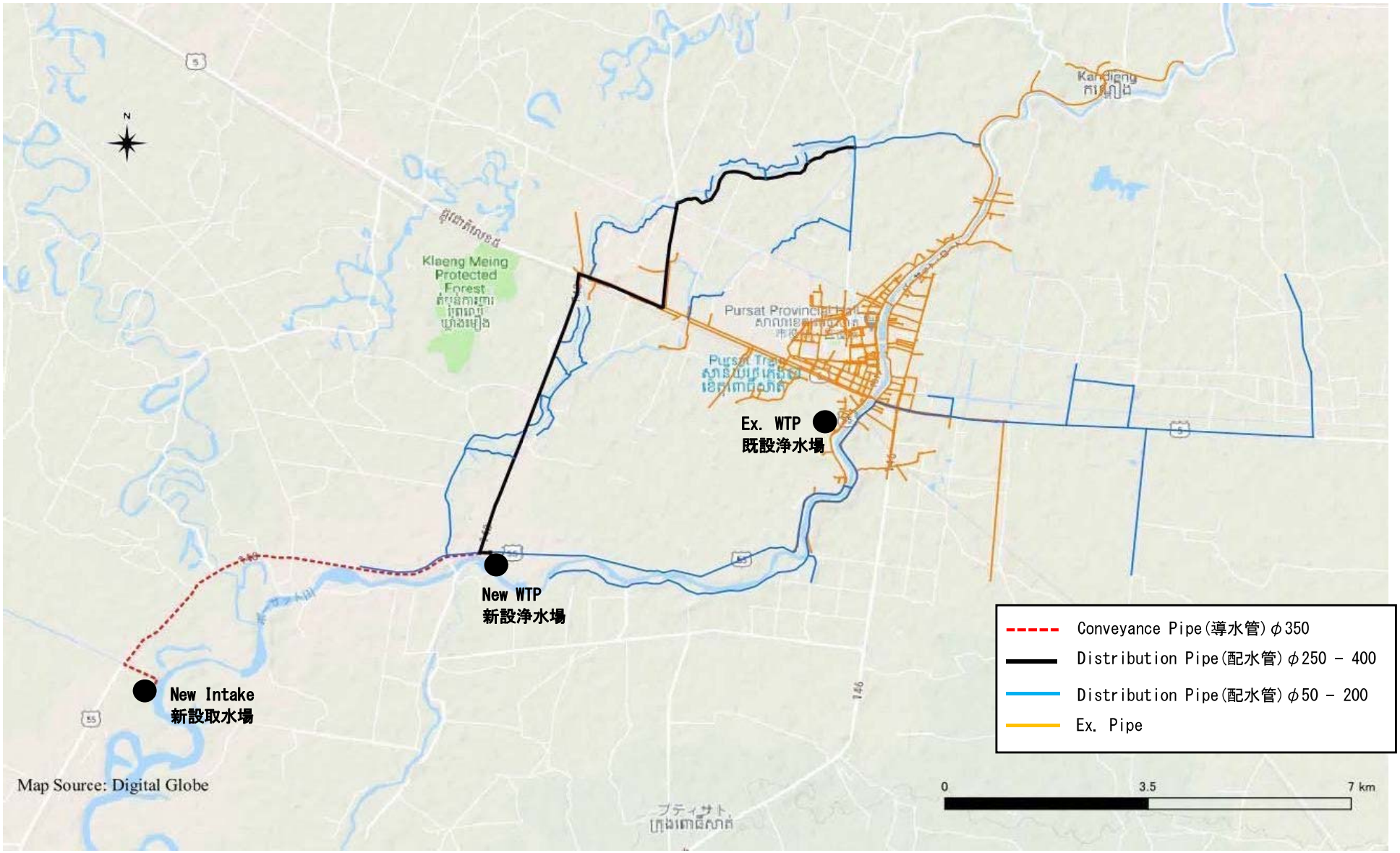
Annex 7.2

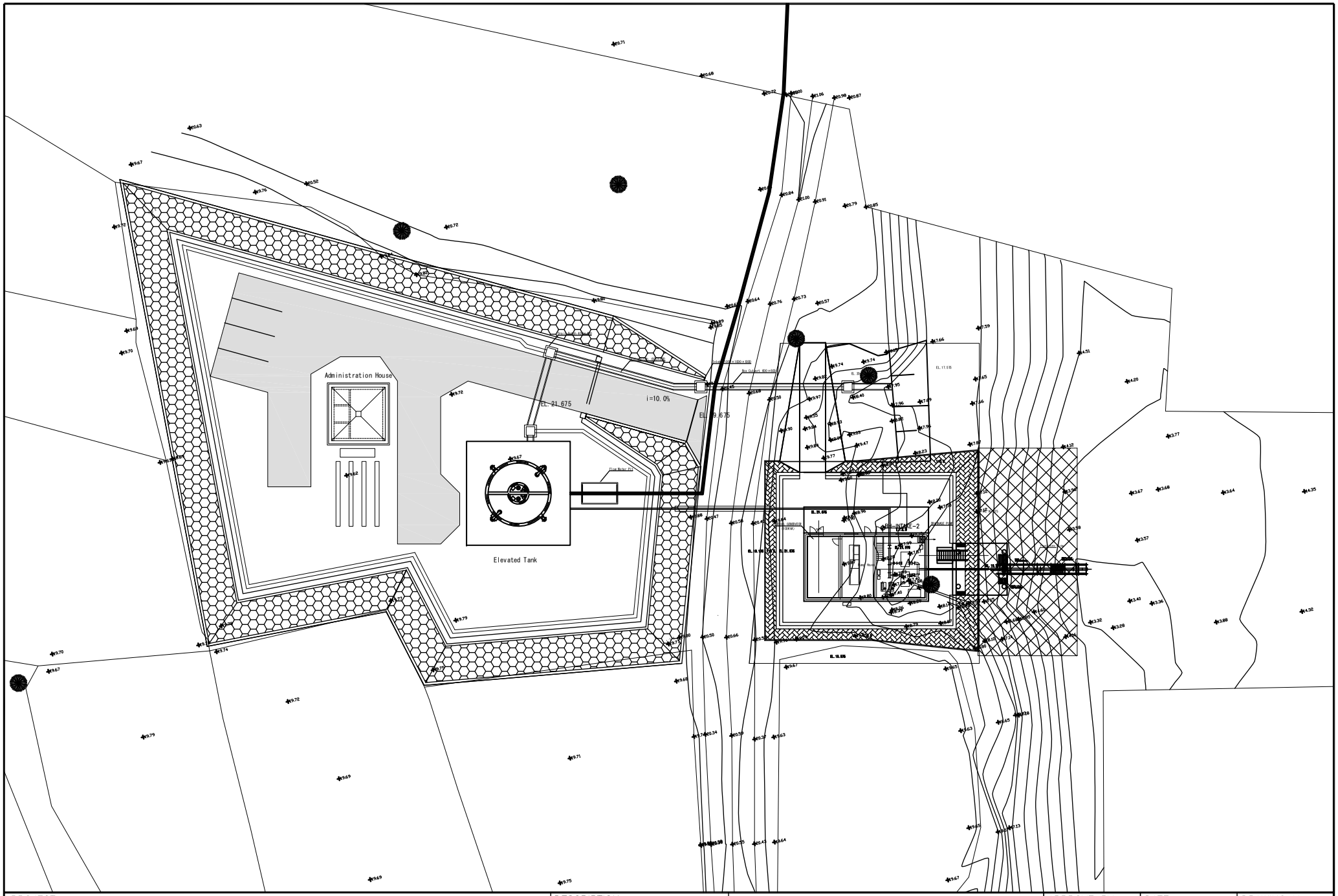
Outline Design Drawings

No.	FACILITYCLASIFICATION	Description	DRAWING No
1.	General (G)	General Layout of Pursat	G1
2.	Intake Facility (I)	Intake Facilities (1)	PI-1
		Intake Facilities (2)	PI-2
		Elevated Tank	PI-3
		Pump House Plan	PI-4
		Pump House Section	PI-5
		Office Plan, Section, Elevation	PI-6
3.	Conveyance Pipe (R)	General Map for Conveyance Pipeline	PR-1
		Conveyance Pipeline Plan (1)	PR-2
		Conveyance Pipeline Plan (2)	PR-3
		Conveyance Pipeline Plan (3)	PR-4
4.	Treatment Facility (T)	Water Treatment Plant General Plan	PT-1
		Hydraulic Profile of Pursat Water Treatment Plant	PT-2
		Water Treatment Facilities Structure (1)	PT-3
		Water Treatment Facilities Structure (2)	PT-4
		Water Treatment Facilities Structure (3)	PT-5
		Water Treatment Facilities Structure (4)	PT-6
		Water Treatment Facilities Structure (5)	PT-7
		Water Treatment Facilities Structure (6)	PT-8
		Water Treatment Facilities Structure (7)	PT-9
		Water Treatment Facilities Structure (8)	PT-10
		Water Treatment Facilities Structure (9)	PT-11
		Service Reservoir and Pumping Station Structure (1)	PT-12
		Service Reservoir and Pumping Station Structure (2)	PT-13
		Service Reservoir and Pumping Station Structure (3)	PT-14
		Drainage Basin Structure	PT-15
		Drying Bed Structure	PT-16
5.	Distribution Facility (D)	Location Map for Distribution Pipe Line	PD-1
		Distribution Pipe Plan (1)	PD-2
		Distribution Pipe Plan (2)	PD-3
		Distribution Pipe Plan (3)	PD-4
		Distribution Pipe Plan (4)	PD-5
		Distribution Pipe Plan (5)	PD-6
		Distribution Pipe Plan (6)	PD-7
		Distribution Pipe Plan (7)	PD-8
		Distribution Pipe Plan (8)	PD-9
		Distribution Pipe Plan (9)	PD-10
		Distribution Pipe Plan (10)	PD-11
		Distribution Pipe Plan (11)	PD-12
		Distribution Pipe Plan (12)	PD-13
		Distribution Pipe Plan (13)	PD-14
		Distribution Pipe Plan (14)	PD-15
		Distribution Pipe Plan (15)	PD-16
		Distribution Pipe Plan (16)	PD-17
		Distribution Pipe Plan (17)	PD-18

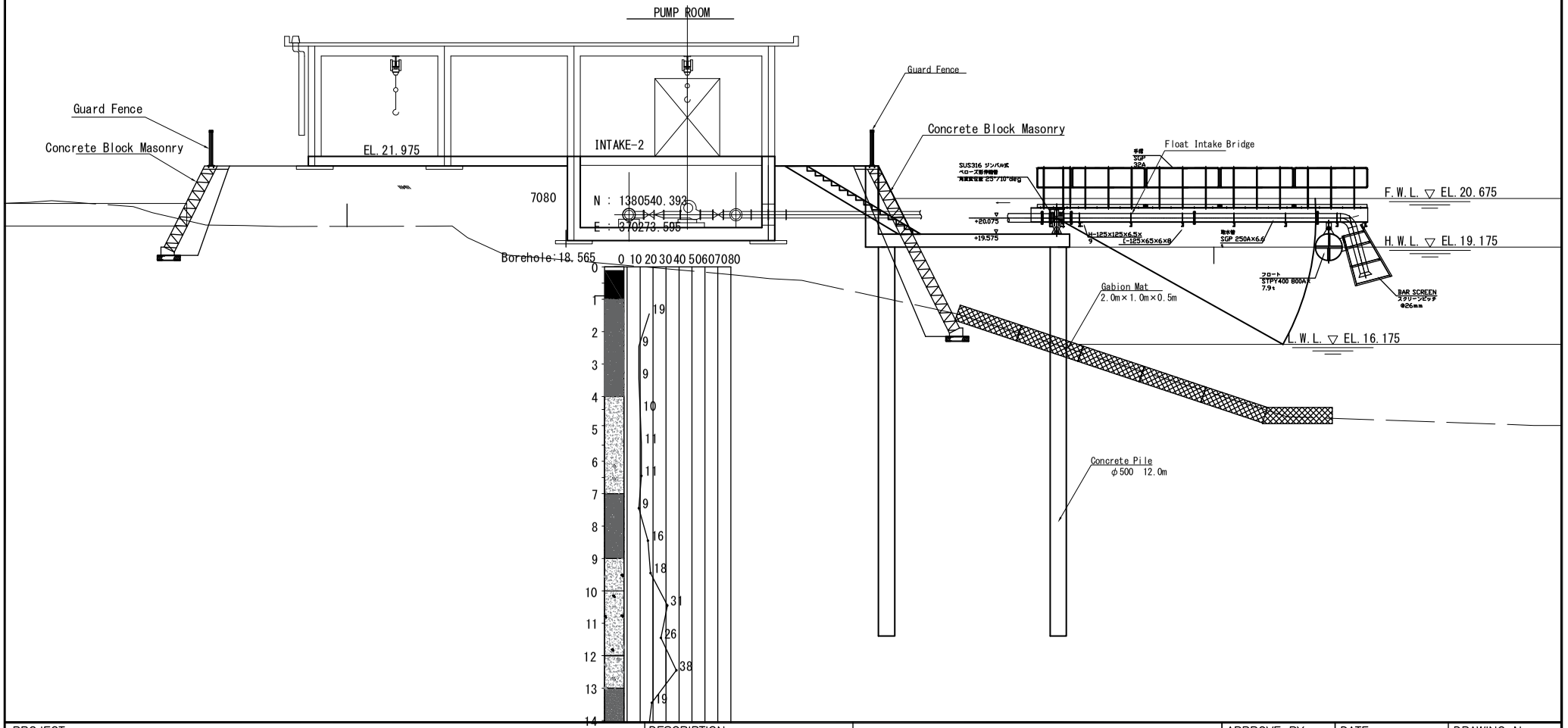
No.	FACILITYCLASIFICATION	Description	DRAWING No
		Distribution Pipe Plan (18)	PD-19
		Distribution Pipe Plan (19)	PD-20
		Distribution Pipe Plan (20)	PD-21
		Distribution Pipe Plan (21)	PD-22
		Distribution Pipe Plan (22)	PD-23
		Distribution Pipe Plan (23)	PD-24
		Distribution Pipe Plan (24)	PD-25
		Distribution Pipe Plan (25)	PD-26
		Typical Drawing for Pipe Laying (1)	TYP-1
		Typical Drawing for Pipe Laying (2)	TYP-2
		Typical Drawing for Pipe Laying (3)	TYP-3
		Typical Drawing for Pipe Laying (4)	TYP-4
		Typical Drawing for Pipe Laying (5)	TYP-5
		General Earth Work for Pipe Laying	TYP-6
		Typical Drawing for Sluice Valve	TYP-7
		Typical Drawing for Installation of Air Valve and Washout	TYP-8
		Typical Drawing for Pipe Beam ND200	TYP-9
		Typical Drawing for Pipe Beam ND80	TYP-10
		Typical Drawing for Bridge Attached Pipe	TYP-11



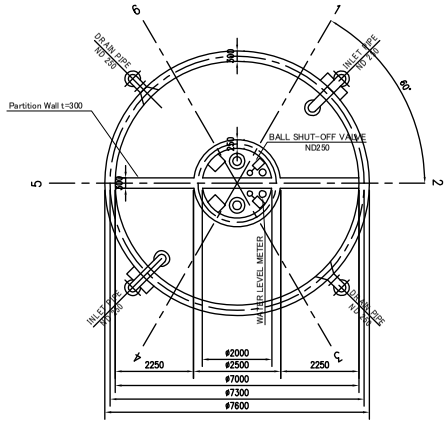
PROJECT	DESCRIPTION		APPROVE BY	DATE	DRAWING No
PREPARATORY SURVEY ON THE PROJECT FOR EXPANSION OF WATER SUPPLY SYSTEMS IN PURSAT	General Map	MINISTRY OF INDUSTRY AND HANDICRAFT			G1
		CTI ENGINEERING INTERNATIONAL CO., LTD. WATER AND SEWER BUREAU, CITY OF KITAKYUSHU TEC INTERNATIONAL CO., LTD.	PREPARED BY	DATE	SCALE



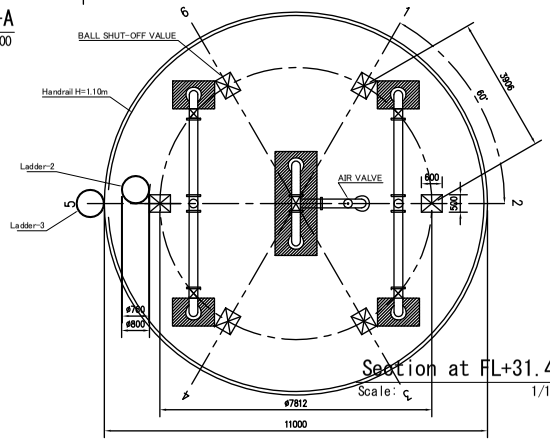
PROJECT	DESCRIPTION		APPROVE BY	DATE	DRAWING No
PREPARATORY SURVEY ON THE PROJECT FOR EXPANSION OF WATER SUPPLY SYSTEM S IN PURSAT	Intake Facilities (1)	MINISTRY OF INDUSTRY AND HANDICRAFT			
		CTI ENGINEERING INTERNATIONAL CO., LTD. WATER AND SEWER BUREAU, CITY OF KITAKYUSHU TEC INTERNATIONAL CO., LTD.	PREPARED BY	DATE	SCALE



PROJECT	DESCRIPTION		APPROVE BY	DATE	DRAWING No
PREPARATORY SURVEY ON THE PROJECT FOR EXPANSION OF WATER SUPPLY SYSTEM S IN PURSAT	Intake Facilities (2)	MINISTRY OF INDUSTRY AND HANDICRAFT			
		CTI ENGINEERING INTERNATIONAL CO., LTD. WATER AND SEWER BUREAU, CITY OF KITAKYUSHU TEC INTERNATIONAL CO., LTD.	PREPARED BY	DATE	SCALE

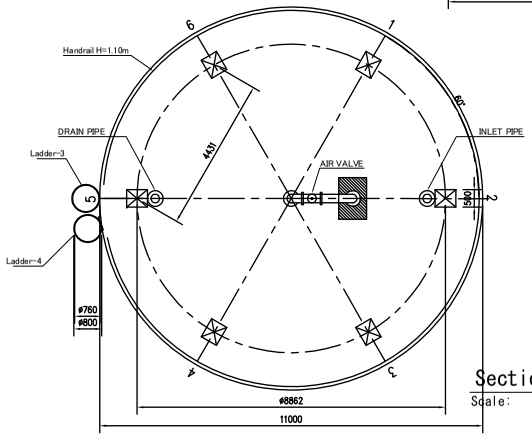


Section A-A
Scale: 1/100



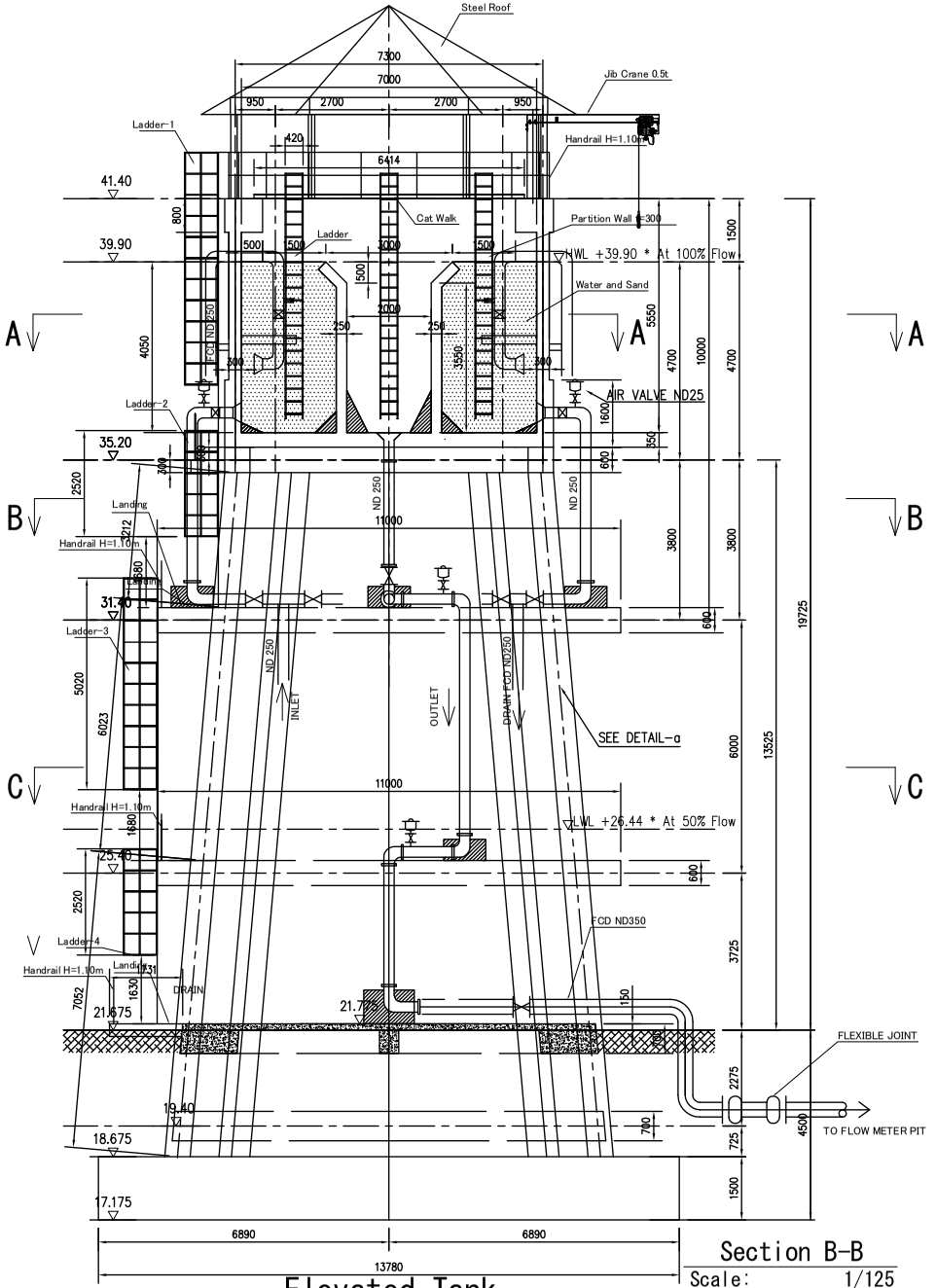
Section at FL+31.40
Scale: 1/100

Section B-B
Scale: 1/100



Section at FL+25.40
Scale: 1/100

Section C-C
Scale: 1/100



Elevated Tank

Section B-B
Scale: 1/125

PROJECT	DESCRIPTION		APPROVE BY	DATE	DRAWING No
PREPARATORY SURVEY ON THE PROJECT FOR EXPANSION OF WATER SUPPLY SYSTEM IN PURSAT AND SVAY RIENG IN THE KINGDOM OF CAMBODIA	Intake Facilities (3)	MINISTRY OF INDUSTRY AND HANDICRAFT			
		CTI ENGINEERING INTERNATIONAL CO., LTD. WATER AND SEWER BUREAU, CITY OF KITAKYUSHU TEC INTERNATIONAL CO., LTD.	PREPARED BY	DATE	SCALE

構造部材断面

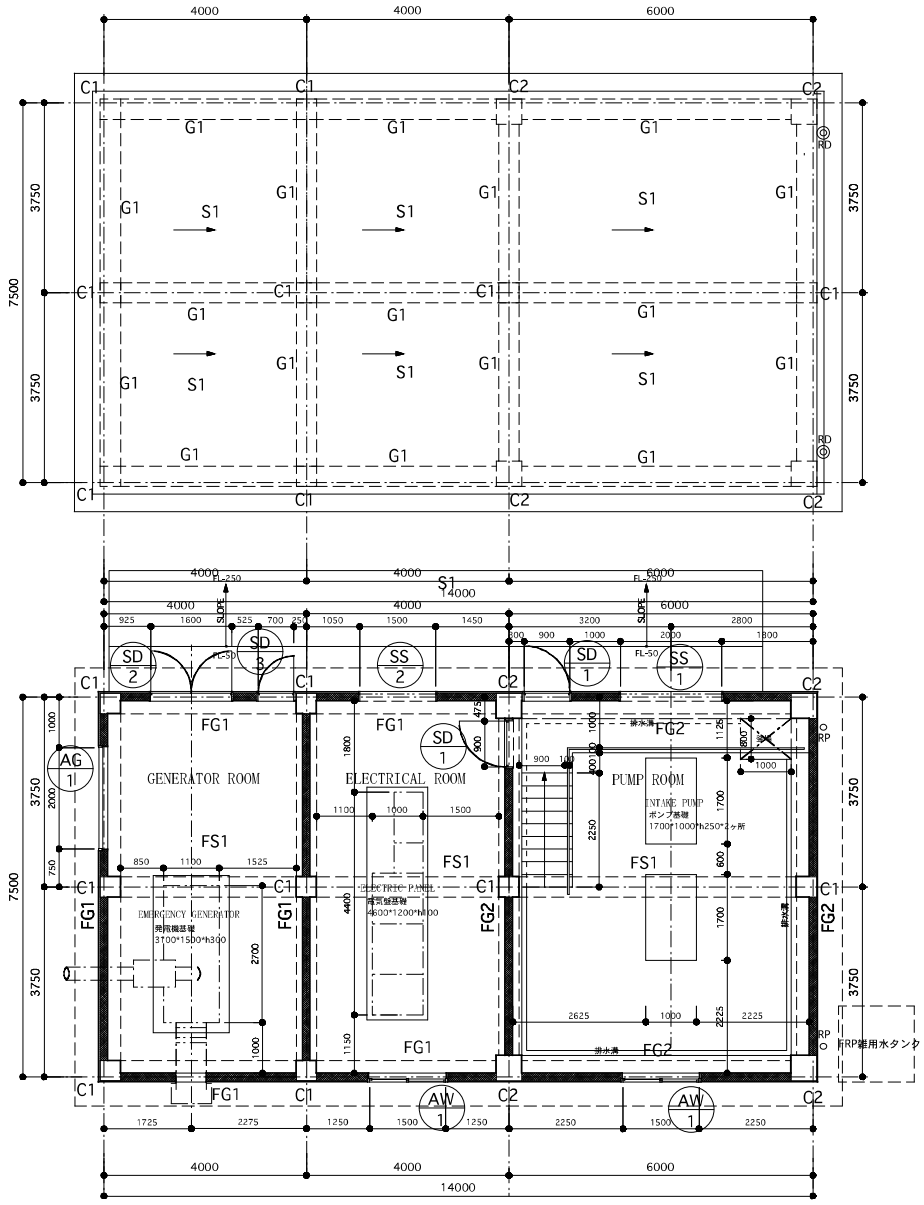
柱C1:400角
柱C2:500角
梁G1:W400*H700
基礎梁FG1:W400*H1000
基礎梁FG2:W500*H2600
スラブS1:t150
土間スラブFS1:t300
耐圧盤FS2:t400

外部仕上表（ポンプ室）

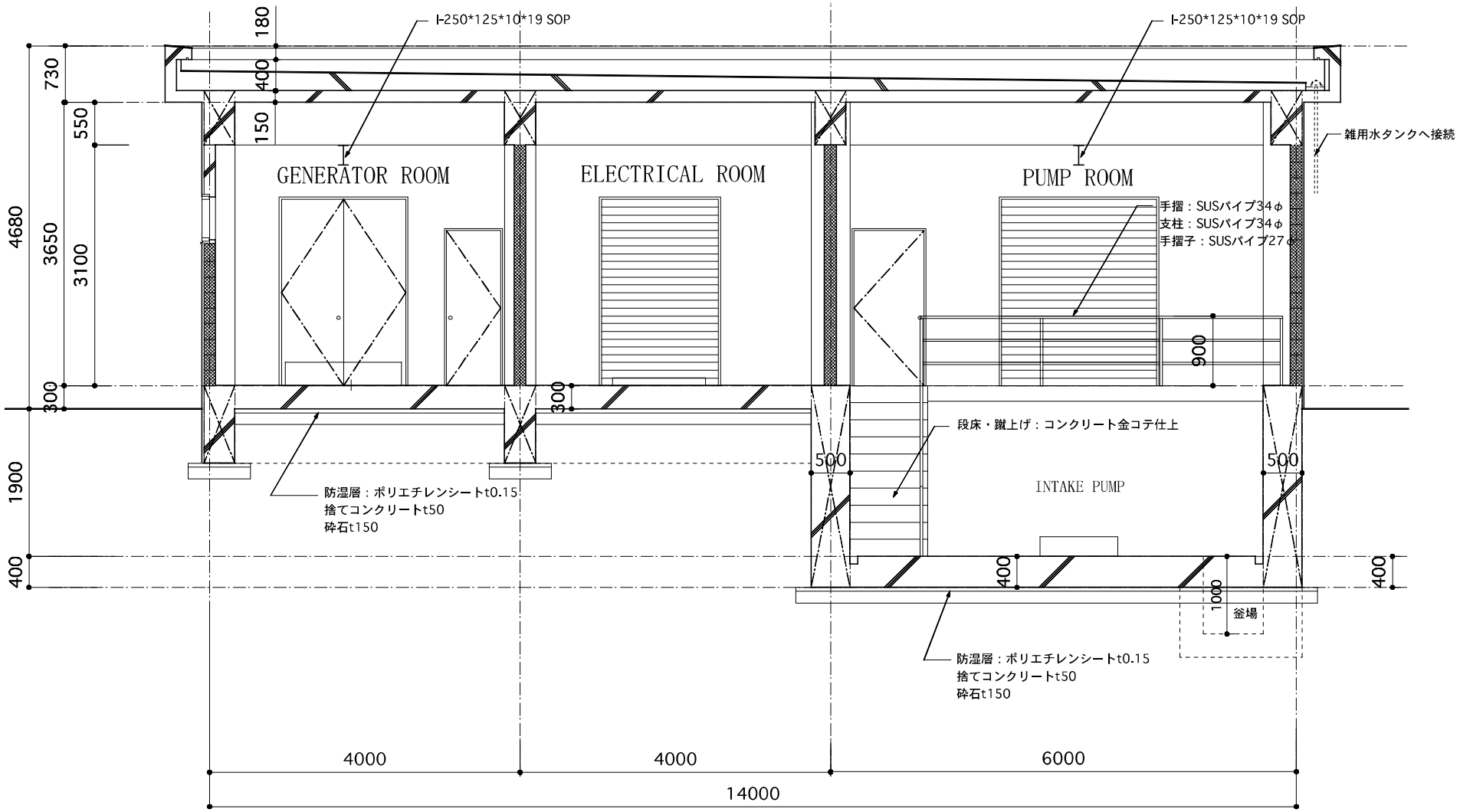
部位	仕上
屋根	アスファルト防水、保護コンクリートt250~50
軒先	打放しコンクリートAEP
縦樋	塩ビカラーパイプ100φ
外壁	モルタル金コテ仕上t25AEP、コンクリートブロックt150下地
柱	モルタル金コテ仕上t25AEP、コンクリート下地
外部扉	スチール製ドア
外巾木	モルタル金コテ仕上
地下外壁	改質アスファルト防水（後やり工法）、コンクリート下地

内部仕上表（ポンプ室）

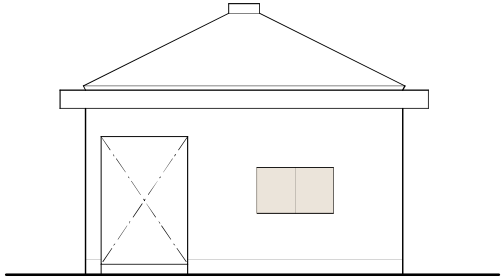
室名	床	巾木	壁	天井
ポンプ室	コンクリート金コテ仕上	コンクリートブロックt150 コンクリート打放し補修（地下部）	コンクリートブロックt150 コンクリート打放し補修（地下部）	コンクリート打放しのまま
電気室	コンクリート金コテ仕上	コンクリートブロックt150	コンクリートブロックt150	コンクリート打放しのまま
発電機室	コンクリート金コテ仕上	コンクリートブロックt150	コンクリートブロックt150	コンクリート打放しのまま



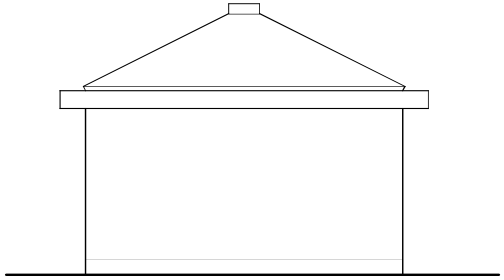
PROJECT	DESCRIPTION		APPROVE BY	DATE	DRAWING No
PREPARATORY SURVEY ON THE PROJECT FOR EXPANSION OF WATER SUPPLY SYSTEM IN PURSAT	PUMP HOUSE PLAN ROOF PLAN FINISH SCHEDULE	MINISTRY OF INDUSTRY AND HANDICRAFT			
		CTI ENGINEERING INTERNATIONAL CO., LTD. WATER AND SEWER BUREAU, CITY OF KITAKYUSHU TEC INTERNATIONAL CO., LTD.	PREPARED BY	DATE	SCALE 1 : 100



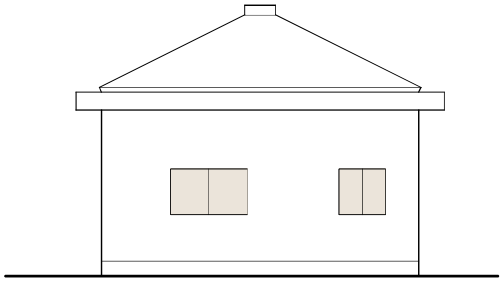
PROJECT	DESCRIPTION				
PREPARATORY SURVEY ON THE PROJECT FOR EXPANSION OF WATER SUPPLY SYSTEM IN PURSAT	PUMP HOUSE DETAIL SECTION	MINISTRY OF INDUSTRY AND HANDICRAFT	APPROVE BY	DATE	DRAWING No
		CTI ENGINEERING INTERNATIONAL CO., LTD. WATER AND SEWER BUREAU, CITY OF KITAKYUSHU TEC INTERNATIONAL CO., LTD.	PREPARED BY	DATE	SCALE 1 : 50



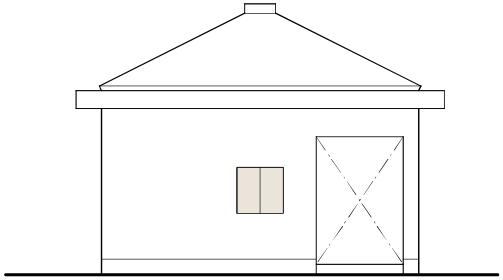
北立面図



西立面図

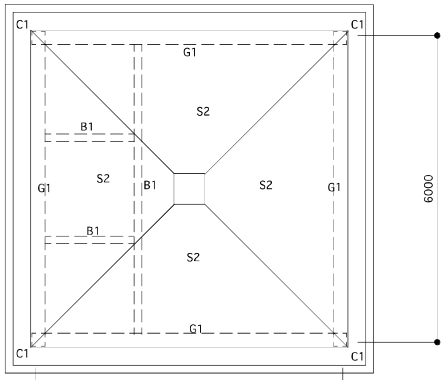


南立面図

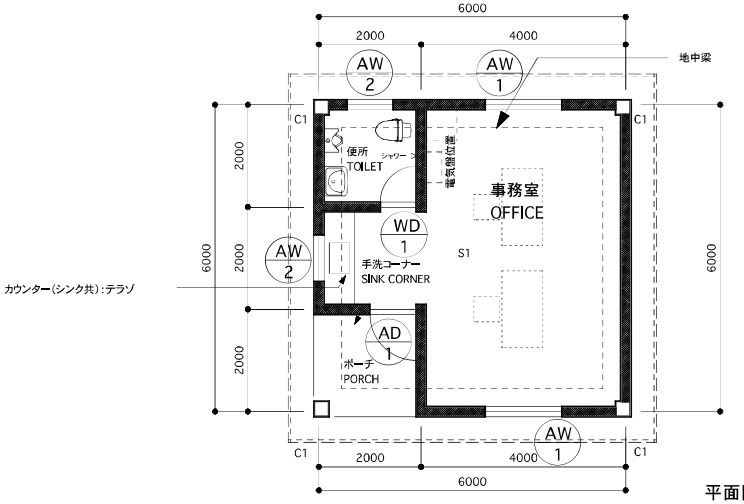


東立面図

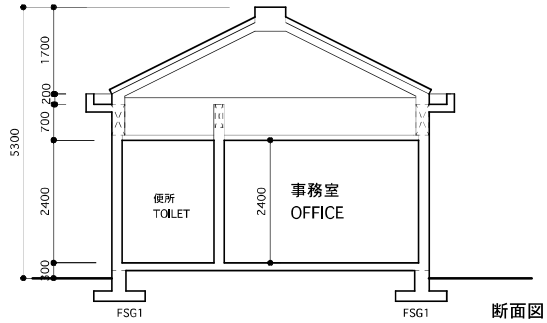
柱C1:250角
梁G1:W250*H600
臥梁B1:W150*H450
床スラブS1:t150
屋根スラブS2:t150
地中梁SFG1:W1000*H600(図示)



屋根伏図

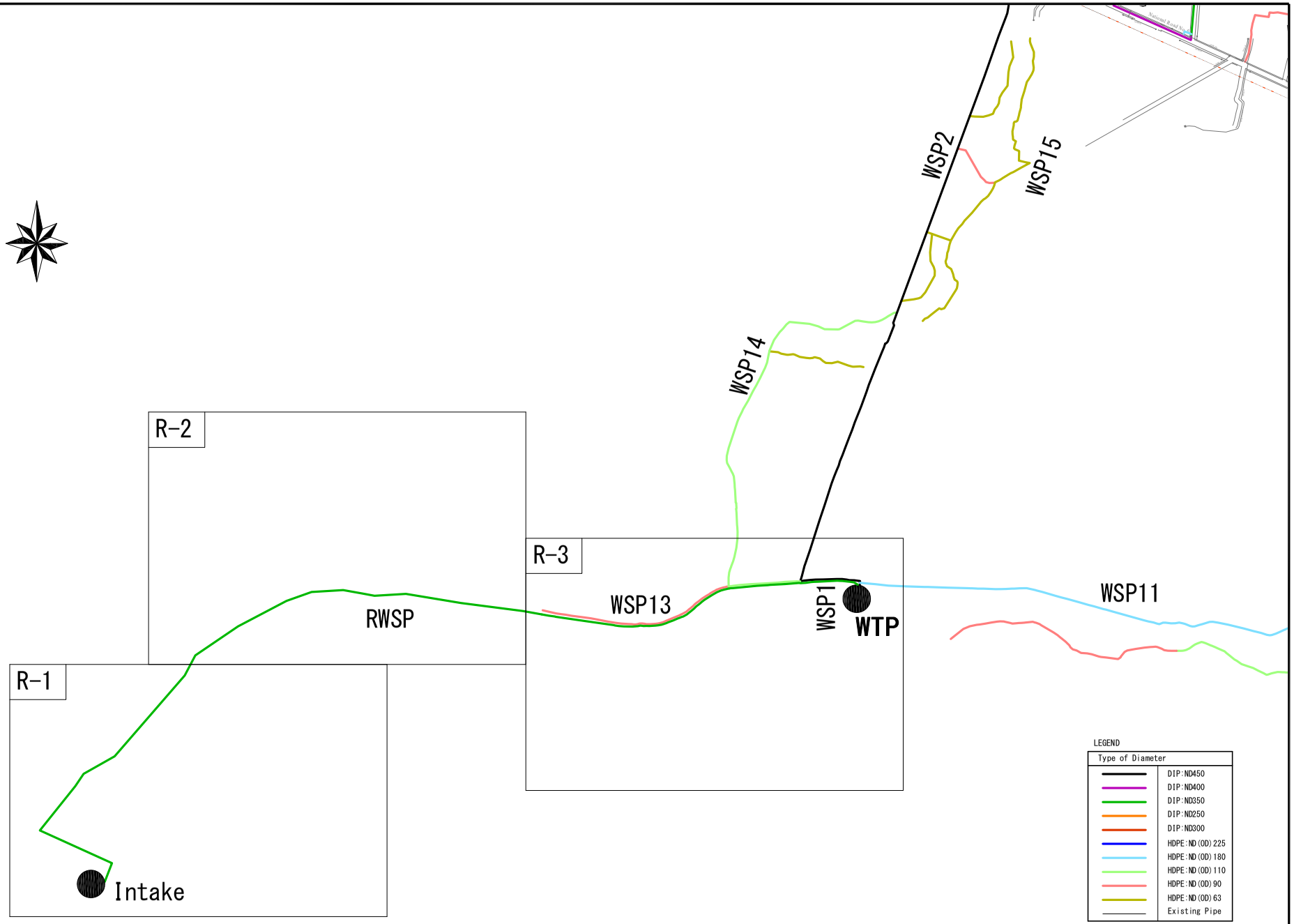


平面図

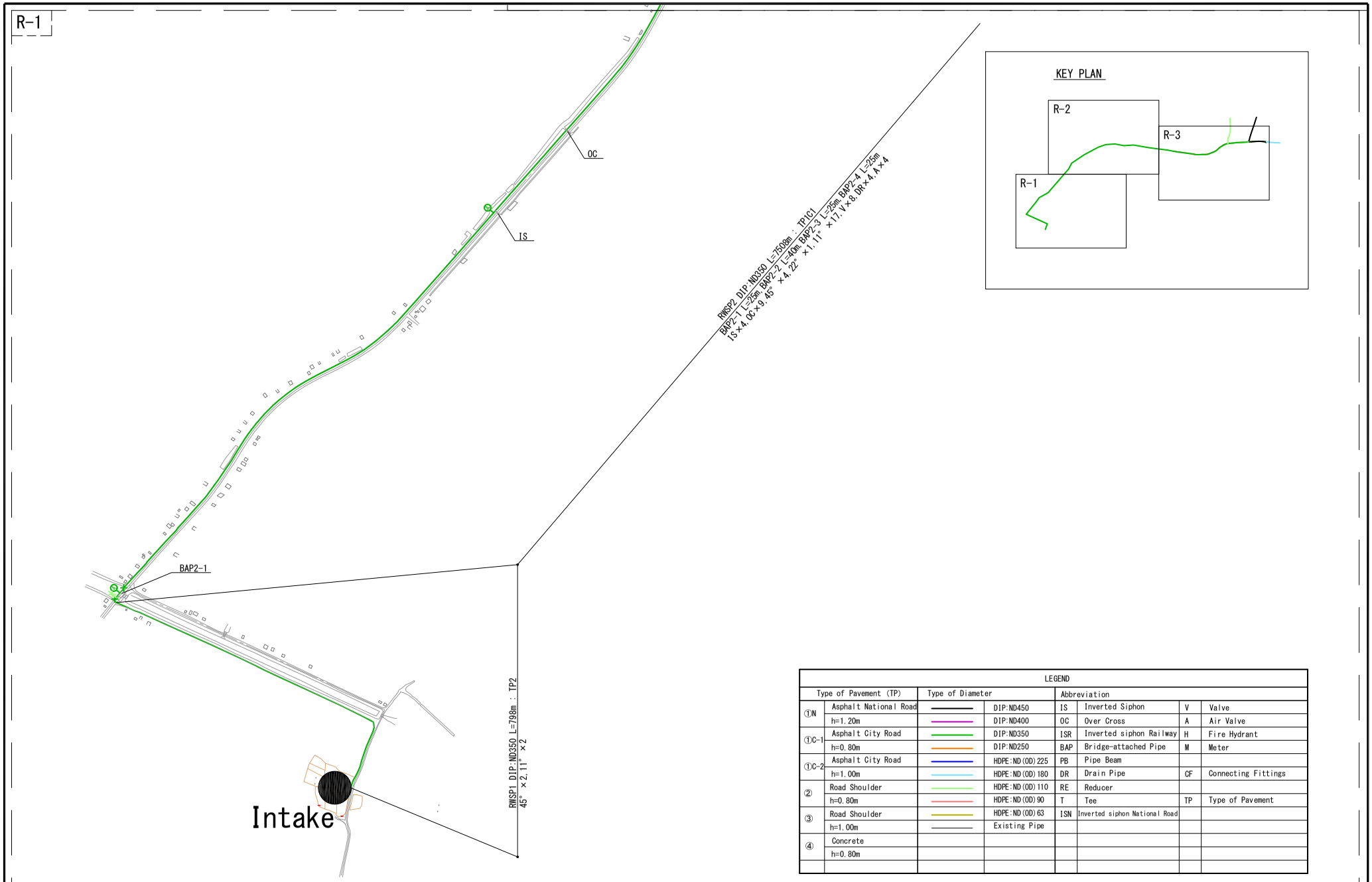


断面図

PROJECT	DESCRIPTION		APPROVE BY	DATE	DRAWING No
PREPARATORY SURVEY ON THE PROJECT FOR EXPANSION OF WATER SUPPLY SYSTEM IN PURSAT AND SVAY RIENG IN THE KINGDOM OF CAMBODIA	Office Plan, Section, Elevation	MINISTRY OF INDUSTRY AND HANDICRAFT			
		CTI ENGINEERING INTERNATIONAL CO., LTD. WATER AND SEWER BUREAU, CITY OF KITAKYUSHU TEC INTERNATIONAL CO., LTD.	PREPARED BY	DATE	SCALE 1:100



PROJECT PREPARATORY SURVEY ON THE PROJECT FOR EXPANSION OF WATER SUPPLY SYSTEM IN PURSAT AND SVAY RIENG IN THE KINGDOM OF CAMBODIA	DESCRIPTION General Map for Conveyance Pipeline	MINISTRY OF INDUSTRY AND HANDICRAFT	APPROVE BY	DATE	DRAWING No PR-1
		CTI ENGINEERING INTERNATIONAL CO., LTD. WATER AND SEWER BUREAU, CITY OF KITAKYUSHU TEC INTERNATIONAL CO., LTD.	PREPARED BY	DATE	SCALE 1:30,000

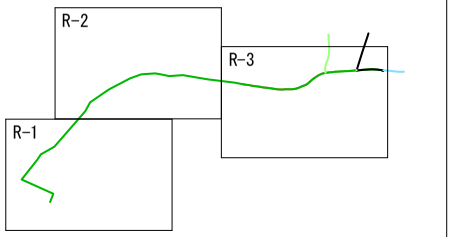


LEGEND							
Type of Pavement (TP)		Type of Diameter		Abbreviation			
①N	Asphalt National Road		DIP:ND450	IS	Inverted Siphon	V	Valve
	h=1.20m		DIP:ND400	OC	Over Cross	A	Air Valve
①C-1	Asphalt City Road		DIP:ND350	ISR	Inverted siphon Railway	H	Fire Hydrant
	h=0.80m		DIP:ND250	BAP	Bridge-attached Pipe	M	Meter
①C-2	Asphalt City Road		HDPE:ND(OD)225	PB	Pipe Beam		
	h=1.00m		HDPE:ND(OD)180	DR	Drain Pipe	CF	Connecting Fittings
②	Road Shoulder		HDPE:ND(OD)110	RE	Reducer		
	h=0.80m		HDPE:ND(OD)90	T	Tee	TP	Type of Pavement
③	Road Shoulder		HDPE:ND(OD)63	ISN	Inverted siphon National Road		
	h=1.00m		Existing Pipe				
④	Concrete						
	h=0.80m						

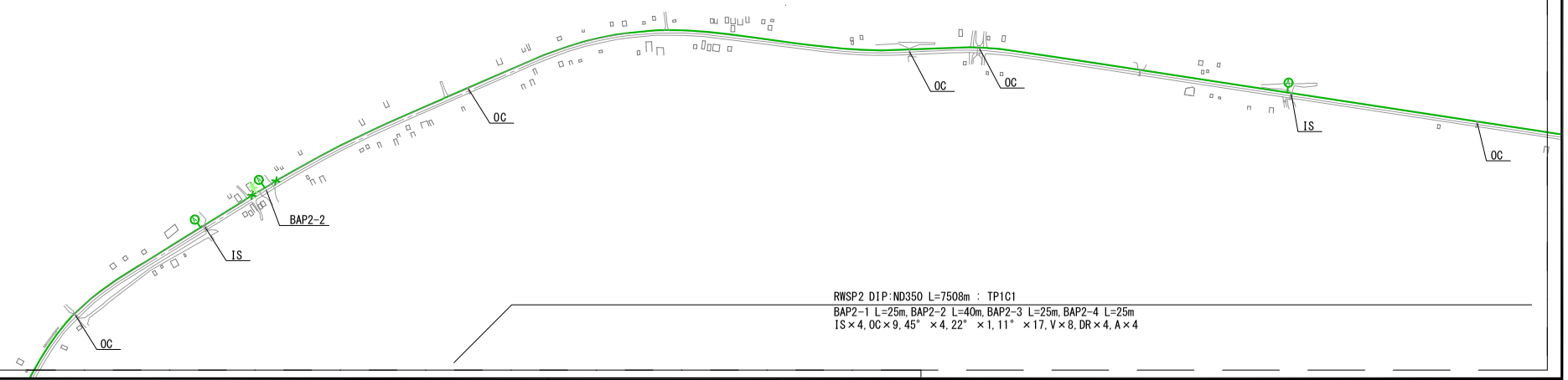
PROJECT	DESCRIPTION		APPROVE BY	DATE	DRAWING No
PREPARATORY SURVEY ON THE PROJECT FOR EXPANSION OF WATER SUPPLY SYSTEM IN PURSAT AND SVAY RIENG IN THE KINGDOM OF CAMBODIA	**Conveyance Pipeline Plan(1)**	MINISTRY OF INDUSTRY AND HANDICRAFT			**PR-2**
		CTI ENGINEERING INTERNATIONAL CO., LTD. WATER AND SEWER BUREAU, CITY OF KITAKYUSHU TEC INTERNATIONAL CO., LTD.	PREPARED BY	DATE	SCALE **1:8,000**

R-2

KEY PLAN



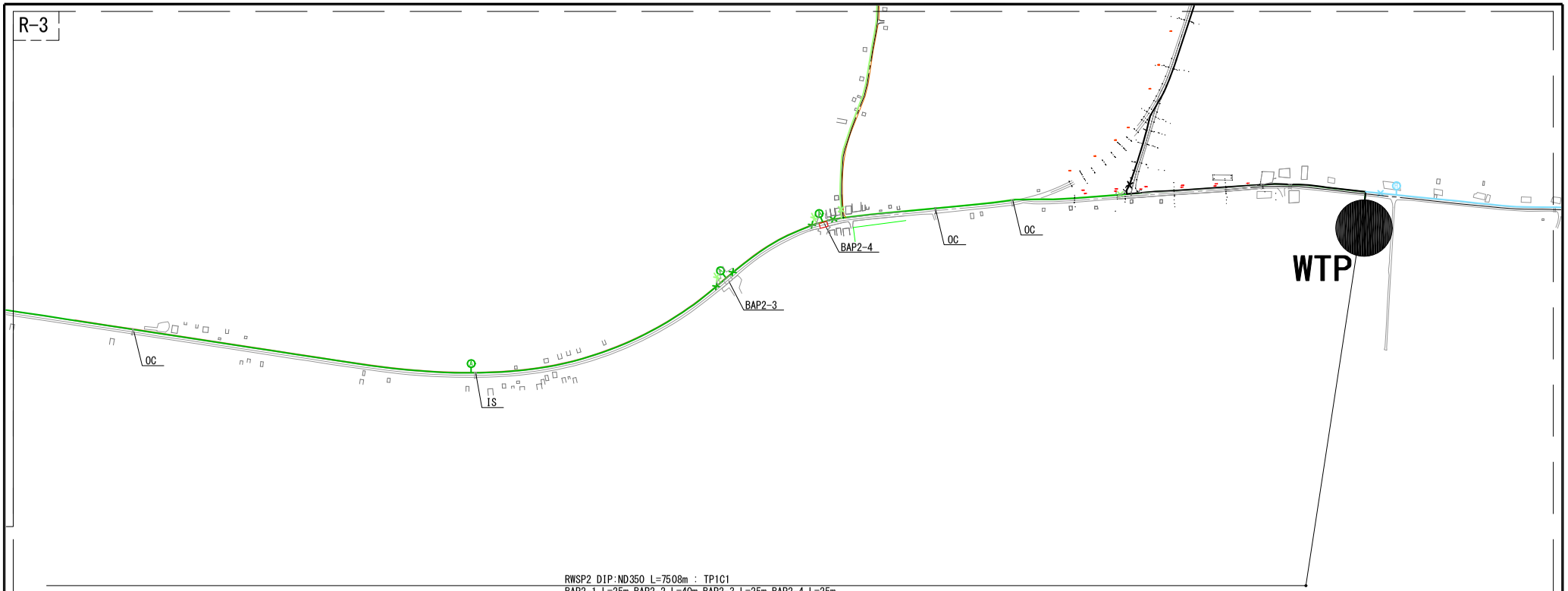
LEGEND							
Type of Pavement (TP)		Type of Diameter		Abbreviation			
①N	Asphalt National Road		DIP:ND450	IS	Inverted Siphon	V	Valve
	h=1.20m		DIP:ND400	OC	Over Cross	A	Air Valve
①C-1	Asphalt City Road		DIP:ND350	ISR	Inverted siphon Railway	H	Fire Hydrant
	h=0.80m		DIP:ND250	BAP	Bridge-attached Pipe	M	Meter
①C-2	Asphalt City Road		HDPE:ND(OD)225	PB	Pipe Beam		
	h=1.00m		HDPE:ND(OD)180	DR	Drain Pipe	CF	Connecting Fittings
②	Road Shoulder		HDPE:ND(OD)110	RE	Reducer		
	h=0.80m		HDPE:ND(OD)90	T	Tee	TP	Type of Pavement
③	Road Shoulder		HDPE:ND(OD)63	ISN	Inverted siphon National Road		
	h=1.00m		Existing Pipe				
④	Concrete						
	h=0.80m						



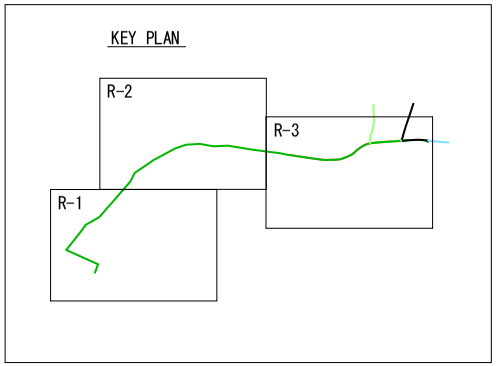
RWSP2 DIP:ND350 L=7508m : TP1C1

BAP2-1 L=25m, BAP2-2 L=40m, BAP2-3 L=25m, BAP2-4 L=25m
IS×4, OC×9, 45° ×4, 22° ×1, 11° ×17, V×8, DR×4, A×4

PROJECT	DESCRIPTION		APPROVE BY	DATE	DRAWING No
PREPARATORY SURVEY ON THE PROJECT FOR EXPANSION OF WATER SUPPLY SYSTEM IN PURSAT AND SVAY RIENG IN THE KINGDOM OF CAMBODIA	Conveyance Pipeline Plan(2)	MINISTRY OF INDUSTRY AND HANDICRAFT			PR-3
		CTI ENGINEERING INTERNATIONAL CO., LTD. WATER AND SEWER BUREAU, CITY OF KITAKYUSHU TEC INTERNATIONAL CO., LTD.	PREPARED BY	DATE	SCALE 1:8,000



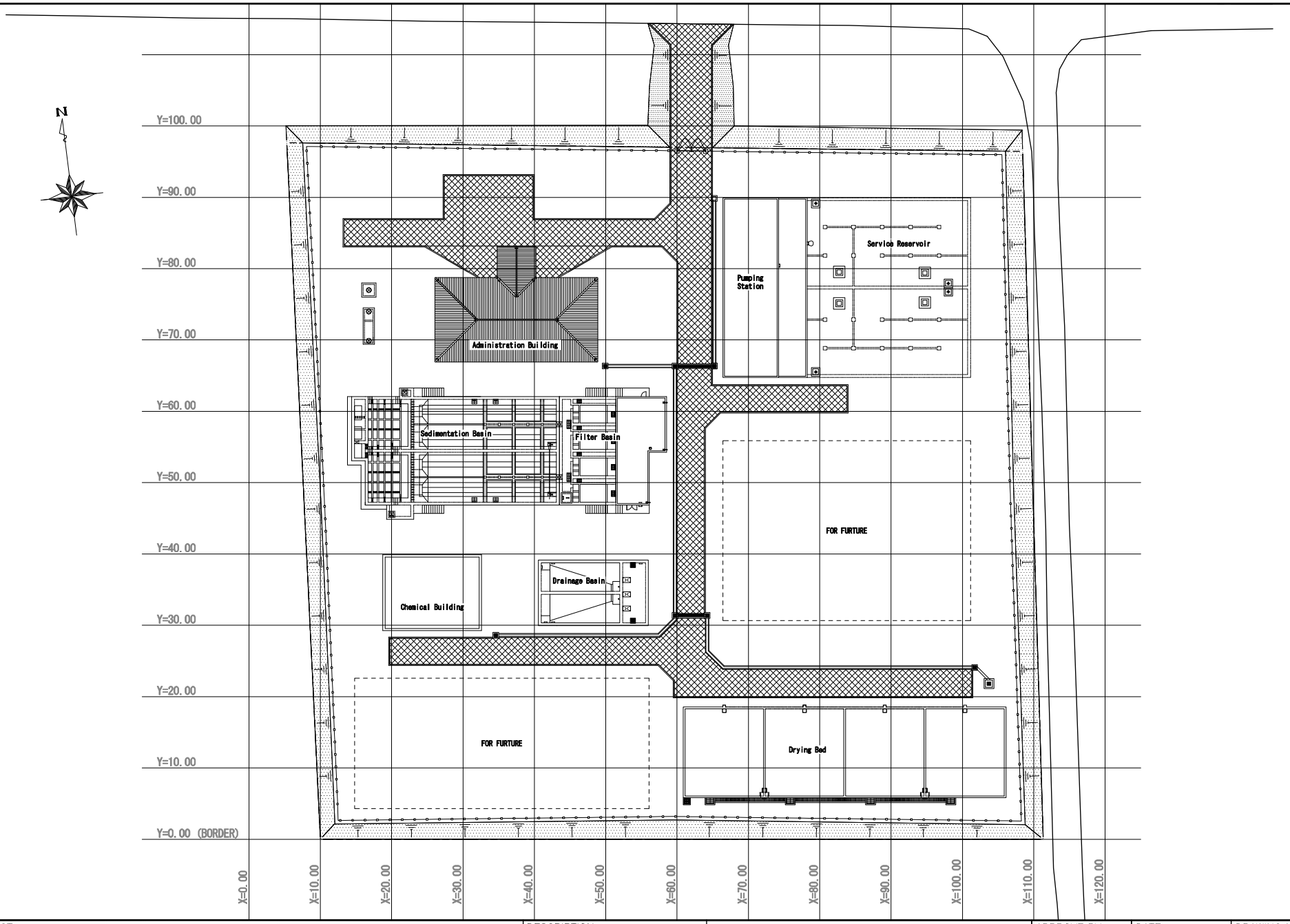
RWSP2 DIP:ND350 L=7508m : TP1C1
BAP2-1 L=25m, BAP2-2 L=40m, BAP2-3 L=25m, BAP2-4 L=25m
IS×4, OC×9, 45° ×4, 22° ×1, 11° ×17, V×8, DR×4, A×4



LEGEND

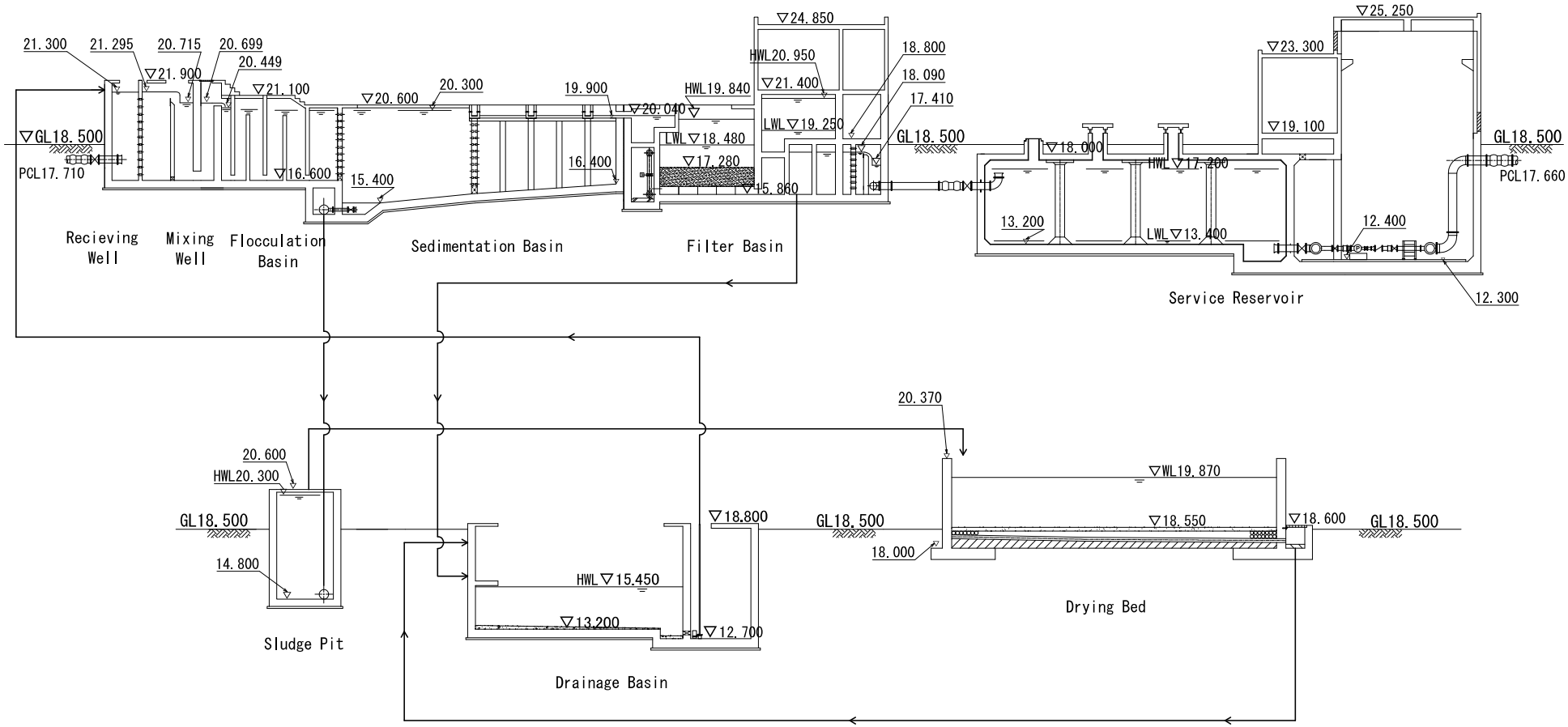
Type of Pavement (TP)		Type of Diameter		Abbreviation			
①N	Asphalt National Road		DIP:ND450	IS	Inverted Siphon	V	Valve
	h=1.20m		DIP:ND400	OC	Over Cross	A	Air Valve
①C-1	Asphalt City Road		DIP:ND350	ISR	Inverted siphon Railway	H	Fire Hydrant
	h=0.80m		DIP:ND250	BAP	Bridge-attached Pipe	M	Meter
①C-2	Asphalt City Road		HDPE:ND(OD)225	PB	Pipe Beam		
	h=1.00m		HDPE:ND(OD)180	DR	Drain Pipe	CF	Connecting Fittings
②	Road Shoulder		HDPE:ND(OD)110	RE	Reducer		
	h=0.80m		HDPE:ND(OD)90	T	Tee	TP	Type of Pavement
③	Road Shoulder		HDPE:ND(OD)63	ISN	Inverted siphon National Road		
	h=1.00m		Existing Pipe				
④	Concrete						
	h=0.80m						

PROJECT	DESCRIPTION	MINISTRY OF INDUSTRY AND HANDICRAFT	APPROVE BY	DATE	DRAWING No
PREPARATORY SURVEY ON THE PROJECT FOR EXPANSION OF WATER SUPPLY SYSTEM IN PURSAT AND SVAY RIENG IN THE KINGDOM OF CAMBODIA	**Conveyance Pipeline Plan(3)**				**PR-4**
		CTI ENGINEERING INTERNATIONAL CO., LTD. WATER AND SEWER BUREAU, CITY OF KITAKYUSHU TEC INTERNATIONAL CO., LTD.	PREPARED BY	DATE	SCALE **1:8,000**

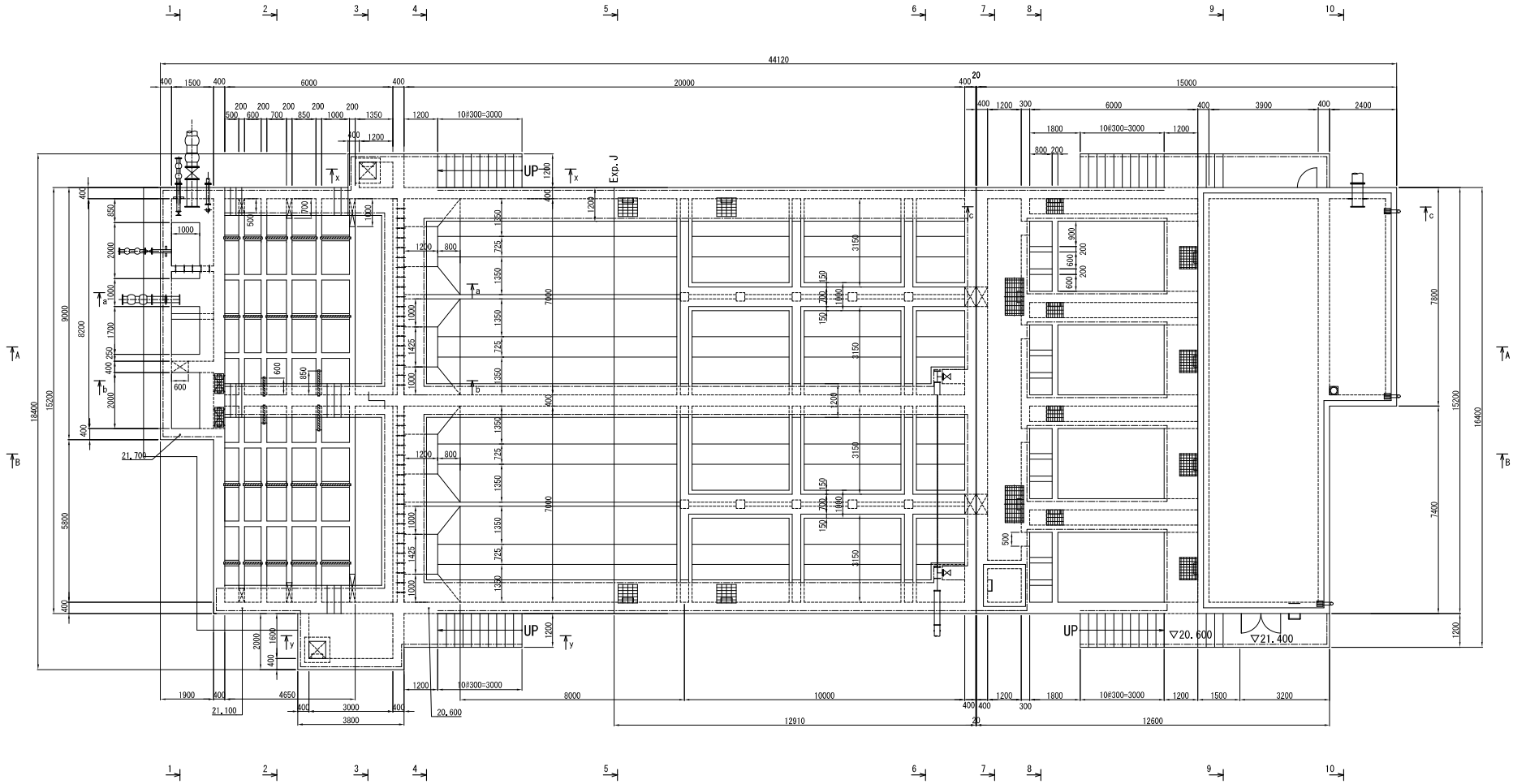


PROJECT PREPARATORY SURVEY ON THE PROJECT FOR EXPANSION OF WATER SUPPLY SYSTEM IN PURSAT AND SVAY RIENG IN THE KINGDOM OF CAMBODIA	DESCRIPTION Water Treatment Plant General Plan	MINISTRY OF INDUSTRY AND HANDICRAFT	APPROVE BY	DATE	DRAWING No PT-1
		CTI ENGINEERING INTERNATIONAL CO., LTD. WATER AND SEWER BUREAU, CITY OF KITAKYUSHU TEC INTERNATIONAL CO., LTD.	PREPARED BY	DATE	SCALE S=1:500 (A3)

FLOW DIAGRAM PURSAT WATER TREATMENT PLAN



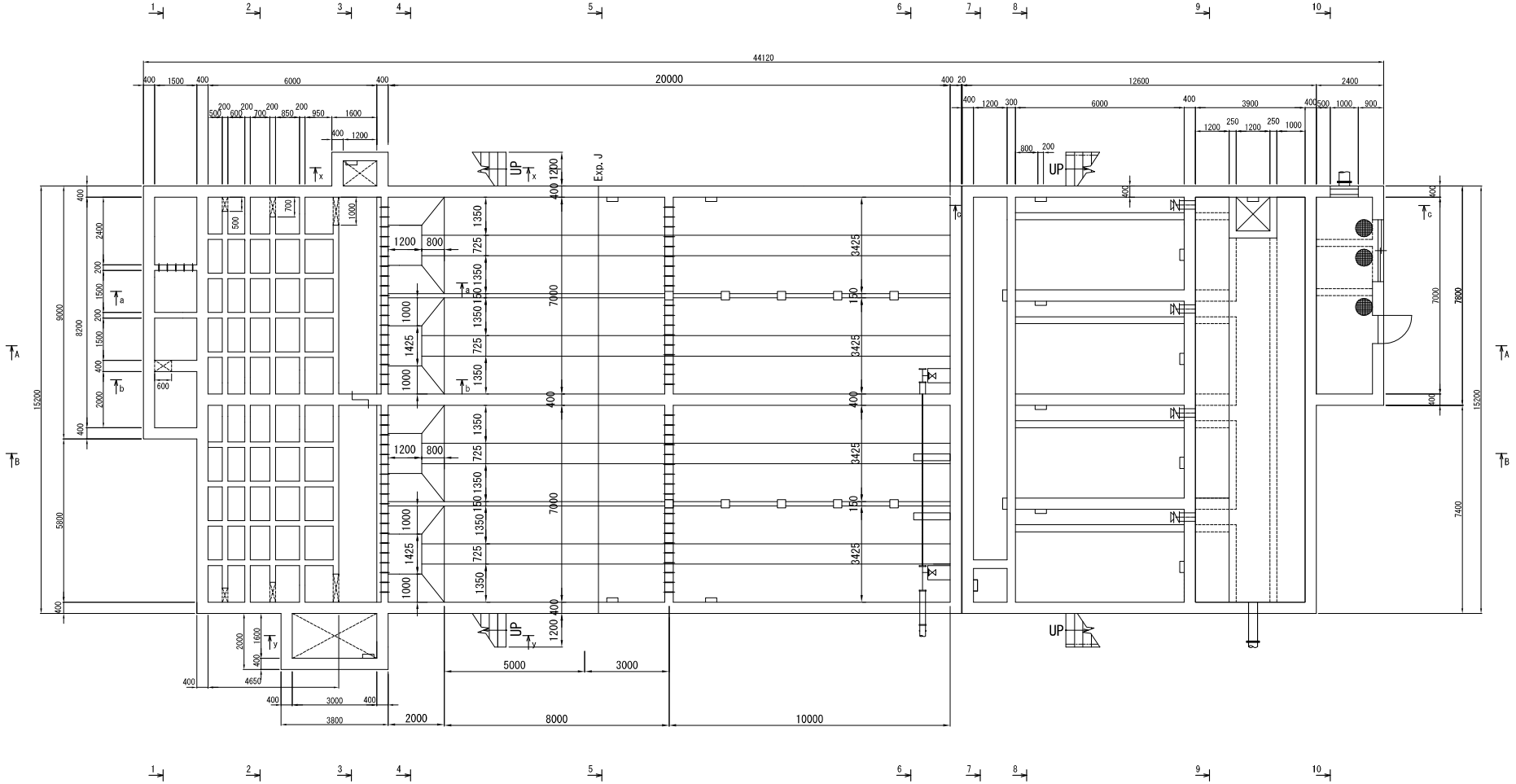
PROJECT	DESCRIPTION		APPROVE BY	DATE	DRAWING No
PREPARATORY SURVEY ON THE PROJECT FOR EXPANSION OF WATER SUPPLY SYSTEM IN PURSAT AND SVAY RIENG IN THE KINGDOM OF CAMBODIA	Hydraulic Profile of Pursat Water Treatment Plant	MINISTRY OF INDUSTRY AND HANDICRAFT			PT-2
		CTI ENGINEERING INTERNATIONAL CO., LTD. WATER AND SEWER BUREAU, CITY OF KITAKYUSHU TEC INTERNATIONAL CO., LTD.	PREPARED BY	DATE	SCALE NONE



Recieving Well & Flocculation Basin　　Sedimentation Basin　　Filter Basin

Treatment Facilities PLAN1 (EL 25.500)

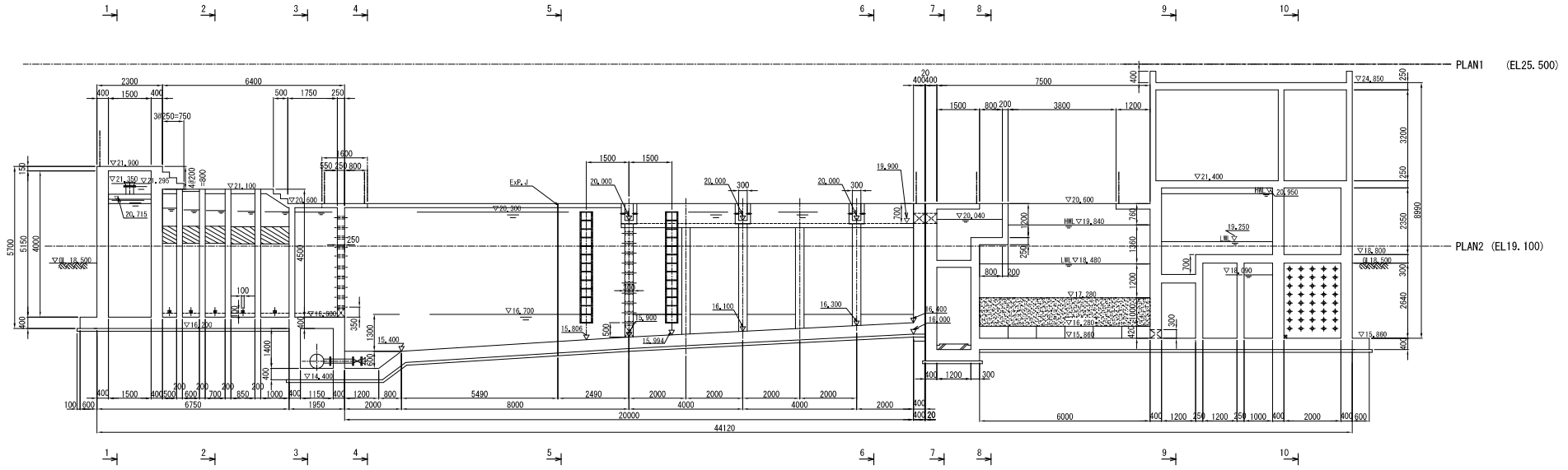
PROJECT: PREPARATORY SURVEY ON THE PROJECT FOR EXPANSION OF WATER SUPPLY SYSTEM IN PURSAT AND SVAY RIENG IN THE KINGDOM OF CAMBODIA	DESCRIPTION: Water Treatment Facilities Structure (1)	MINISTRY OF INDUSTRY AND HANDICRAFT	APPROVE BY	DATE	DRAWING No: PT-3
		CTI ENGINEERING INTERNATIONAL CO., LTD. WATER AND SEWER BUREAU, CITY OF KITAKYUSHU TEC INTERNATIONAL CO., LTD.	PREPARED BY	DATE	SCALE: S=1:150 (A3)



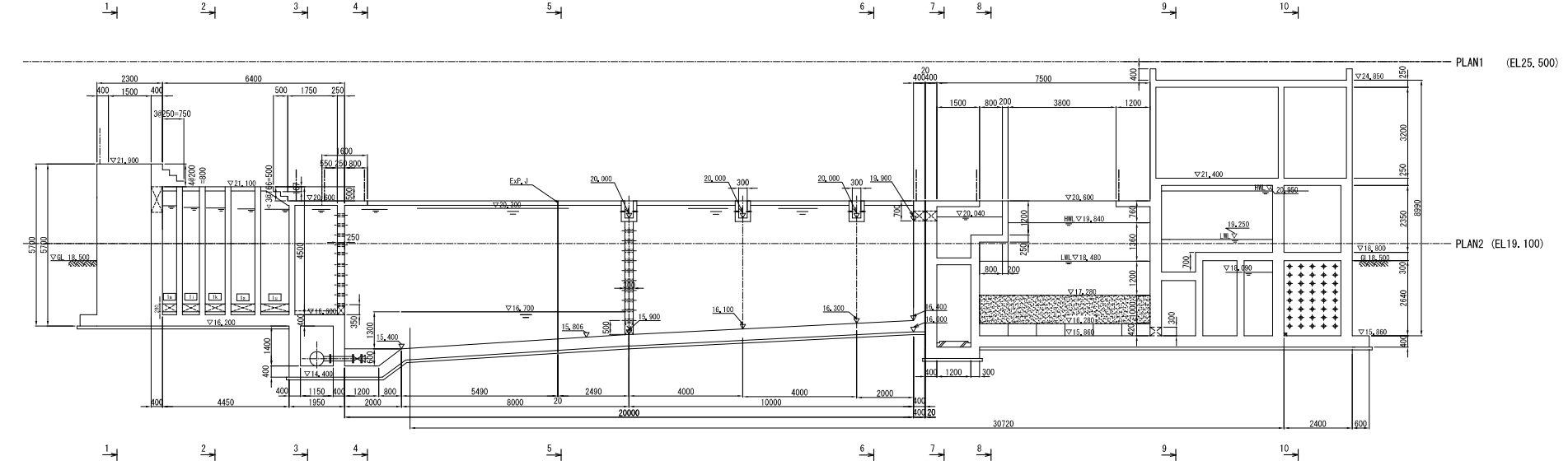
Recieving Well & Flocculation Basin　　Sedimentation Basin　　Filter Basin

Treatment Facilities PLAN2 (EL 19.100)

PROJECT: PREPARATORY SURVEY ON THE PROJECT FOR EXPANSION OF WATER SUPPLY SYSTEM IN PURSAT AND SVAY RIENG IN THE KINGDOM OF CAMBODIA	DESCRIPTION: Water Treatment Facilities Structure (2)	MINISTRY OF INDUSTRY AND HANDICRAFT	APPROVE BY	DATE	DRAWING No: PT-4
		CTI ENGINEERING INTERNATIONAL CO., LTD. WATER AND SEWER BUREAU, CITY OF KITAKYUSHU TEC INTERNATIONAL CO., LTD.	PREPARED BY	DATE	SCALE: S=1:150 (A3)

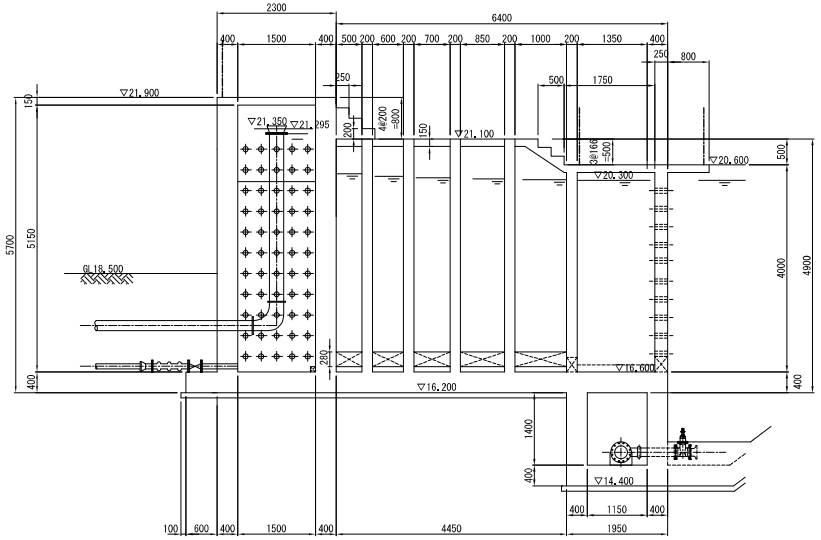


A-A Section

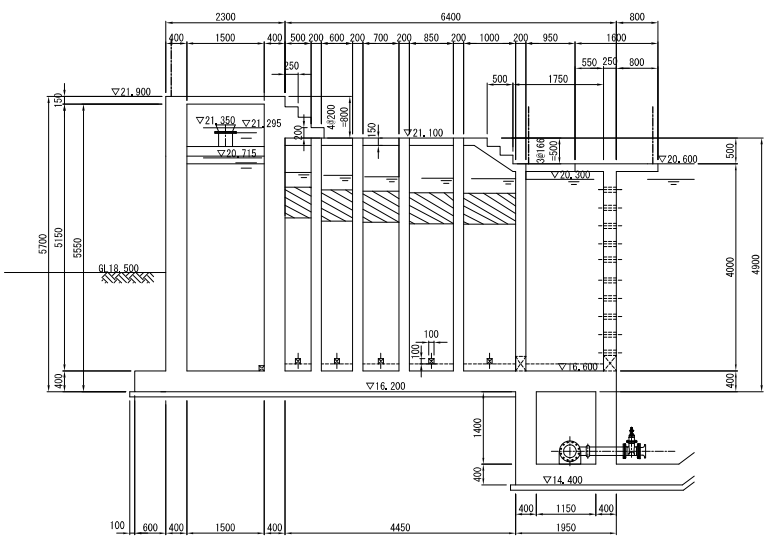


B-B Section

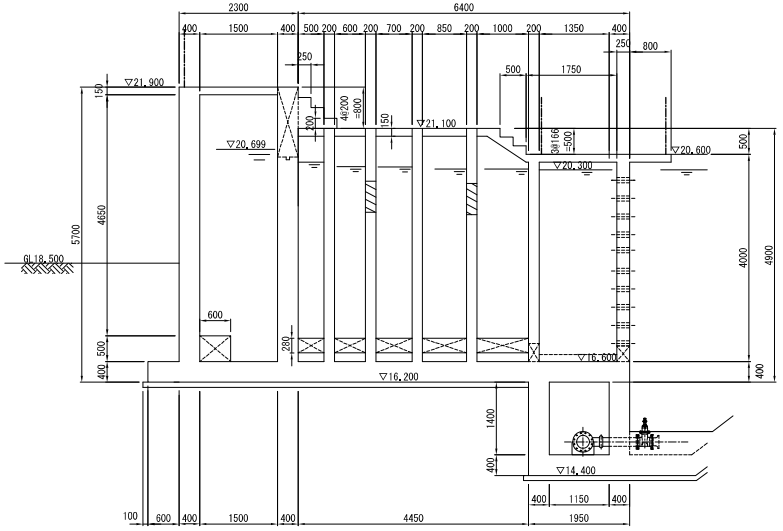
PROJECT	DESCRIPTION		APPROVE BY	DATE	DRAWING No
PREPARATORY SURVEY ON THE PROJECT FOR EXPANSION OF WATER SUPPLY SYSTEM IN PURSAT AND SVAY RIENG IN THE KINGDOM OF CAMBODIA	Water Treatment Facilities Structure(3)	MINISTRY OF INDUSTRY AND HANDICRAFT			PT-5
		CTI ENGINEERING INTERNATIONAL CO., LTD. WATER AND SEWER BUREAU, CITY OF KITAKYUSHU TEC INTERNATIONAL CO., LTD.	PREPARED BY	DATE	SCALE S=1:150 (A3)



a-a Section

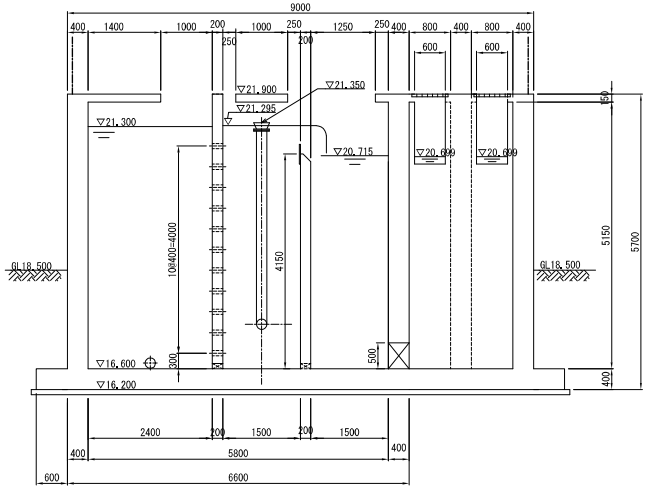


A-A Section

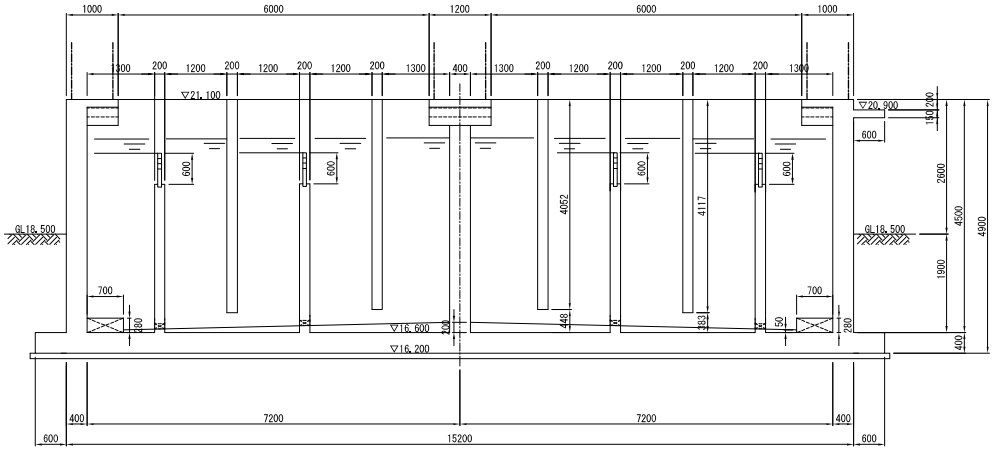


b-b Section

PROJECT: PREPARATORY SURVEY ON THE PROJECT FOR EXPANSION OF WATER SUPPLY SYSTEM IN PURSAT AND SVAY RIENG IN THE KINGDOM OF CAMBODIA	DESCRIPTION: Water Treatment Facilities Structure (4)	MINISTRY OF INDUSTRY AND HANDICRAFT	APPROVE BY	DATE	DRAWING No: PT-6
		CTI ENGINEERING INTERNATIONAL CO., LTD. WATER AND SEWER BUREAU, CITY OF KITAKYUSHU TEC INTERNATIONAL CO., LTD.	PREPARED BY	DATE	SCALE: S=1:100 (A3)

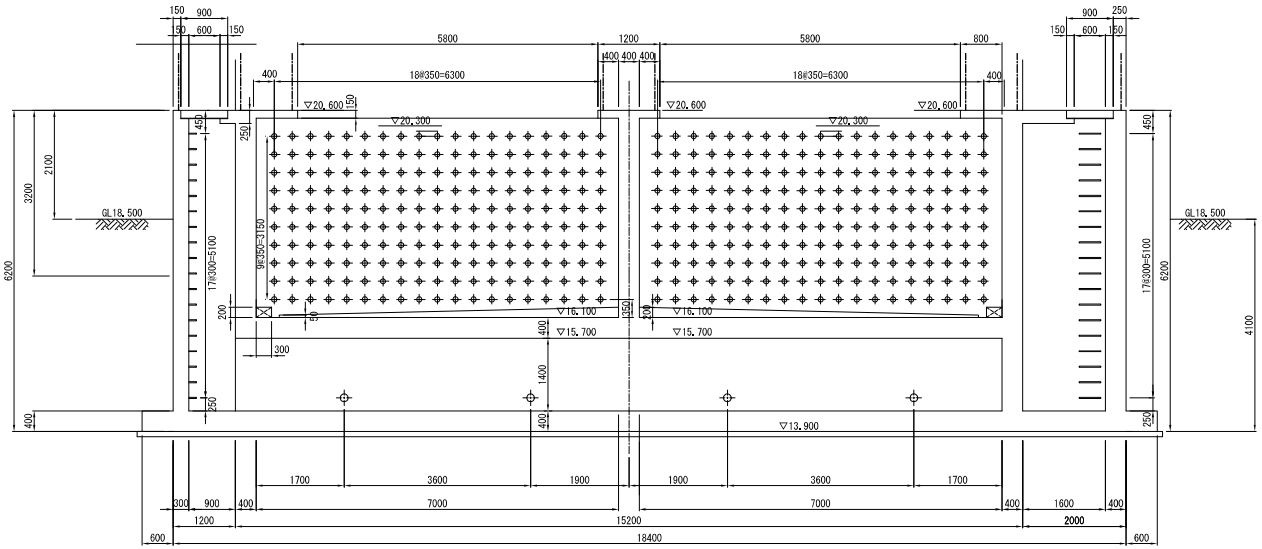


1-1 Section

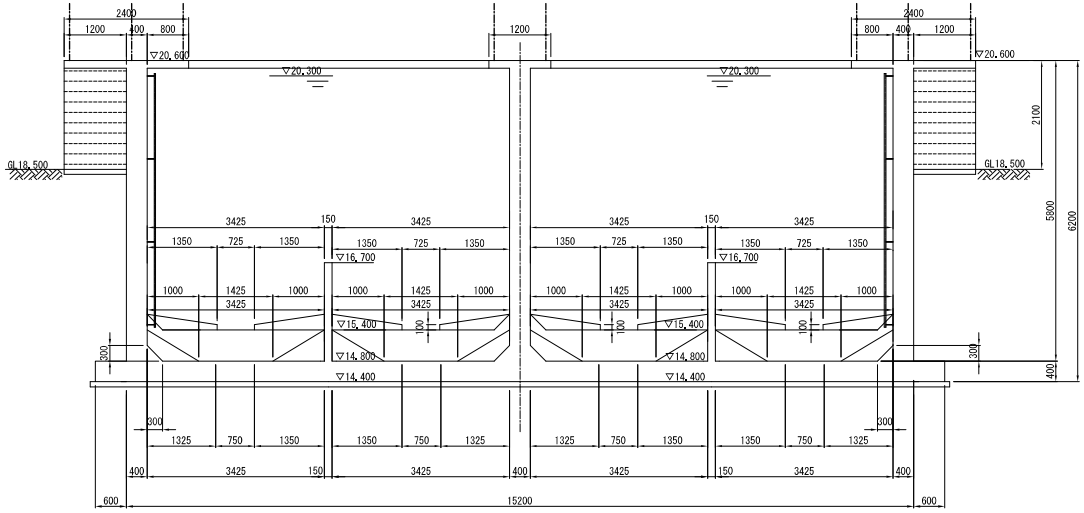


2-2 Section

PROJECT	DESCRIPTION		APPROVE BY	DATE	DRAWING No
PREPARATORY SURVEY ON THE PROJECT FOR EXPANSION OF WATER SUPPLY SYSTEM IN PURSAT AND SVAY RIENG IN THE KINGDOM OF CAMBODIA	Water Treatment Facilities Structure (5)	MINISTRY OF INDUSTRY AND HANDICRAFT			PT-7
		CTI ENGINEERING INTERNATIONAL CO., LTD. WATER AND SEWER BUREAU, CITY OF KITAKYUSHU TEC INTERNATIONAL CO., LTD.	PREPARED BY	DATE	SCALE S=1:100 (A3)

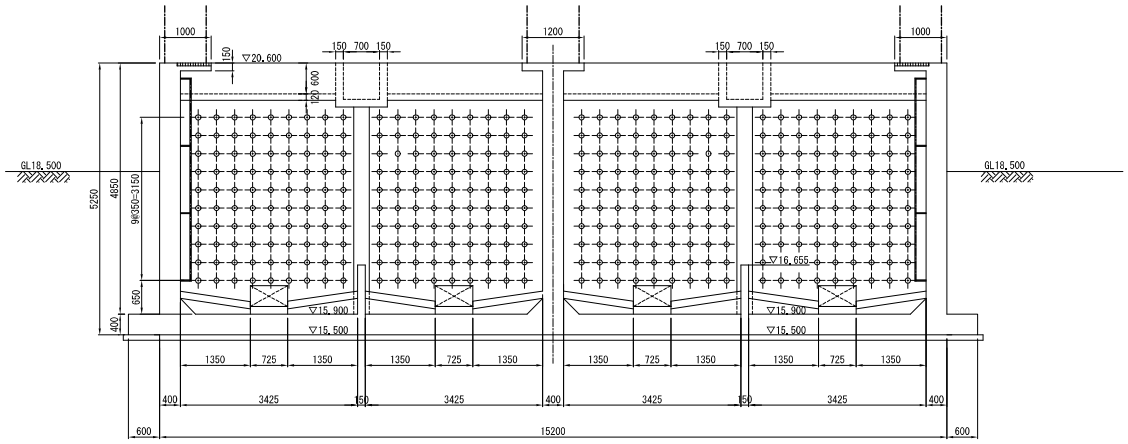


3-3 Section

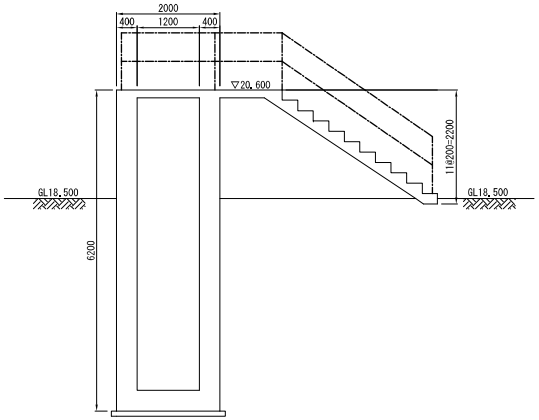


4-4 Section

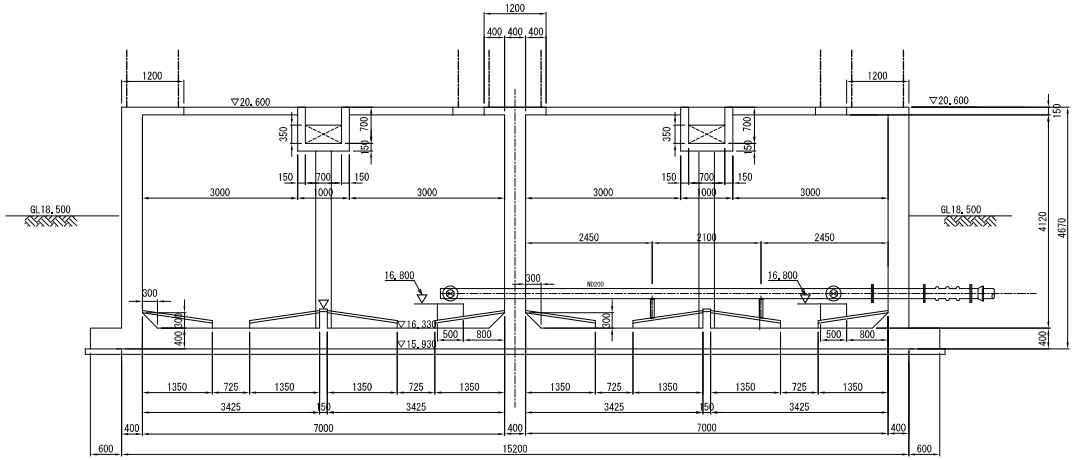
PROJECT	DESCRIPTION		APPROVE BY	DATE	DRAWING No
PREPARATORY SURVEY ON THE PROJECT FOR EXPANSION OF WATER SUPPLY SYSTEM IN PURSAT AND SVAY RIENG IN THE KINGDOM OF CAMBODIA	Water Treatment Facilities Structure (6)	MINISTRY OF INDUSTRY AND HANDICRAFT			PT-8
		CTI ENGINEERING INTERNATIONAL CO., LTD. WATER AND SEWER BUREAU, CITY OF KITAKYUSHU TEC INTERNATIONAL CO., LTD.	PREPARED BY	DATE	SCALE S=1:100 (A3)



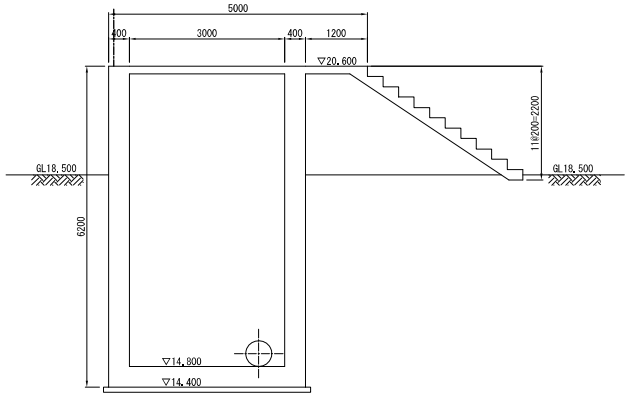
5-5 Section



x-x Section

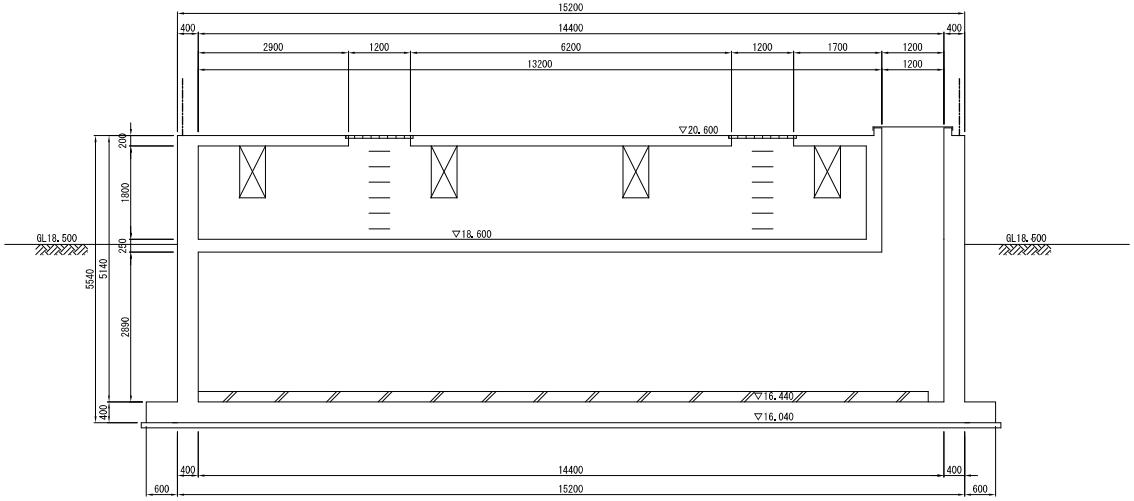


6-6 Section

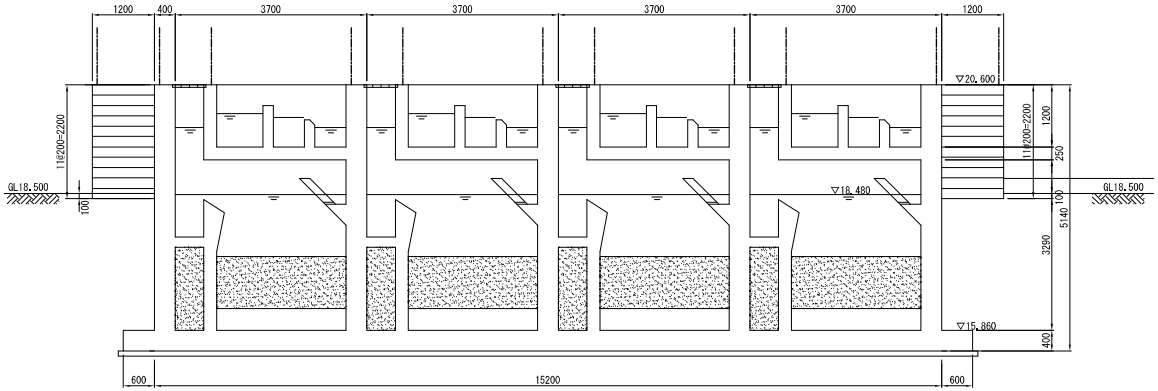


y-y Section

PROJECT	DESCRIPTION		APPROVE BY	DATE	DRAWING No
PREPARATORY SURVEY ON THE PROJECT FOR EXPANSION OF WATER SUPPLY SYSTEM IN PURSAT AND SVAY RIENG IN THE KINGDOM OF CAMBODIA	Water Treatment Facilities Structure (7)	MINISTRY OF INDUSTRY AND HANDICRAFT			PT-9
		CTI ENGINEERING INTERNATIONAL CO., LTD. WATER AND SEWER BUREAU, CITY OF KITAKYUSHU TEC INTERNATIONAL CO., LTD.	PREPARED BY	DATE	SCALE S=1:100 (A3)

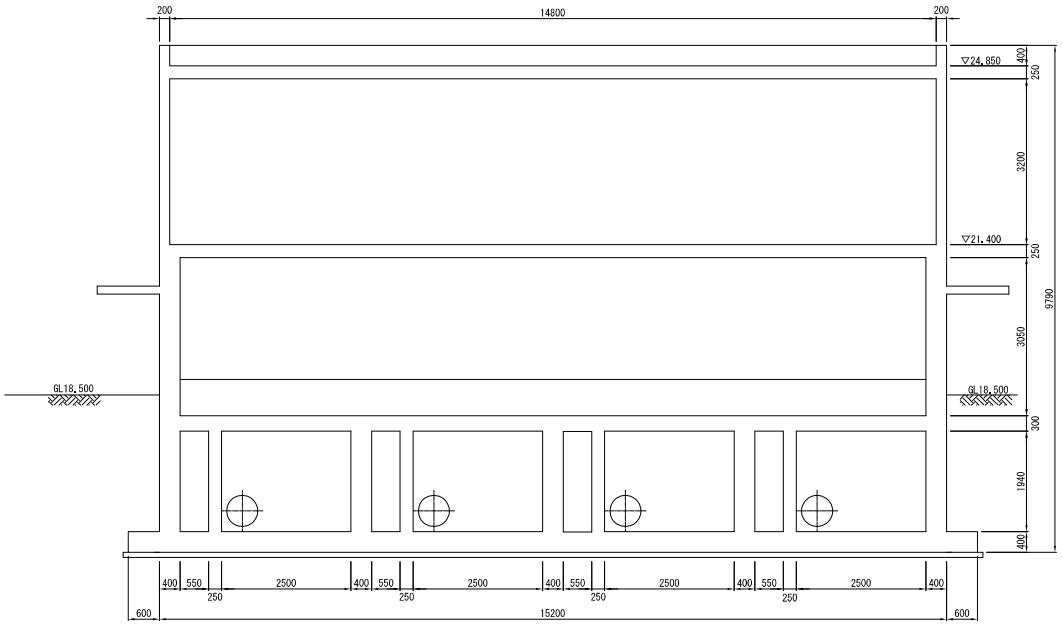


7-7 Section

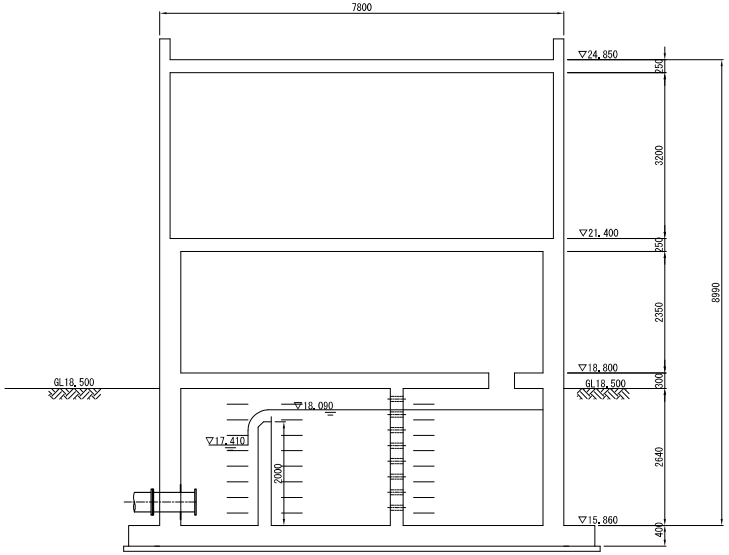


8-8 Section

PROJECT PREPARATORY SURVEY ON THE PROJECT FOR EXPANSION OF WATER SUPPLY SYSTEM IN PURSAT AND SVAY RIENG IN THE KINGDOM OF CAMBODIA	DESCRIPTION Water Treatment Facilities Structure(8)	MINISTRY OF INDUSTRY AND HANDICRAFT	APPROVE BY	DATE	DRAWING No PT-10
		CTI ENGINEERING INTERNATIONAL CO., LTD. WATER AND SEWER BUREAU, CITY OF KITAKYUSHU TEC INTERNATIONAL CO., LTD.	PREPARED BY	DATE	SCALE S=1:100 (A3)

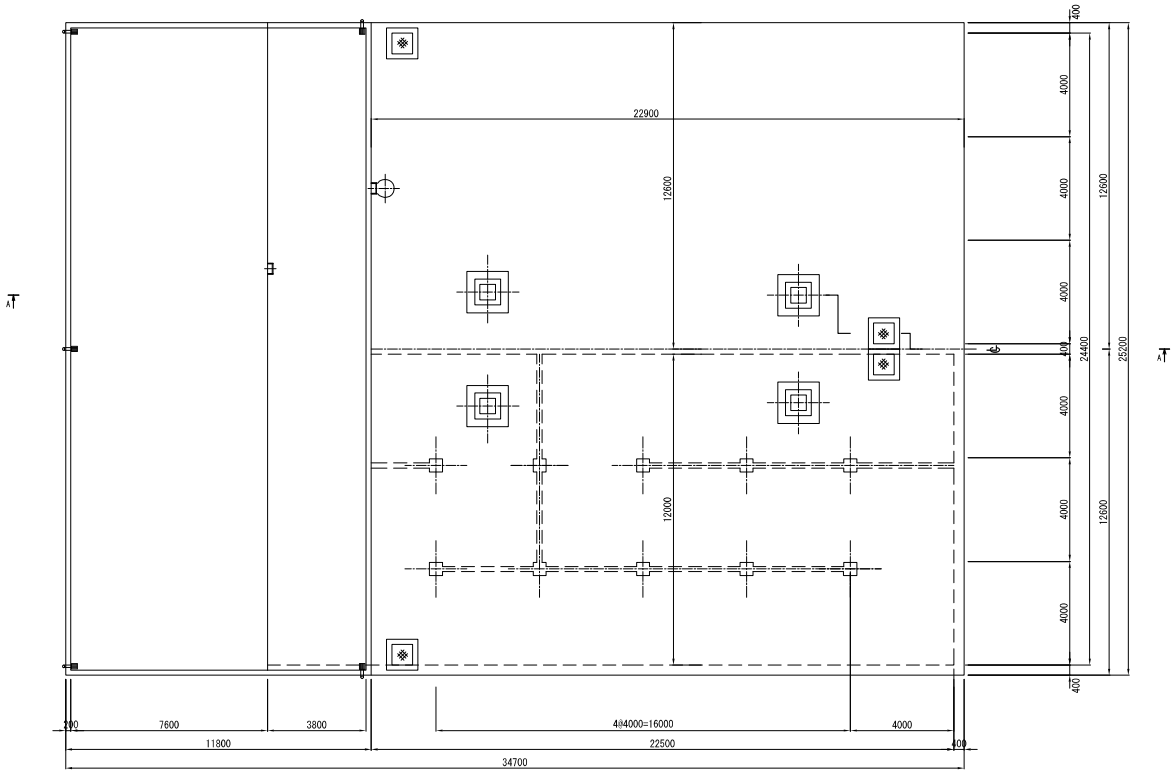


9-9 Section

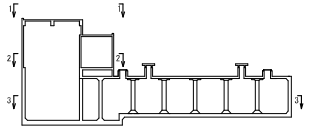


10-10 Section

PROJECT PREPARATORY SURVEY ON THE PROJECT FOR EXPANSION OF WATER SUPPLY SYSTEM IN PURSAT AND SVAY RIENG IN THE KINGDOM OF CAMBODIA	DESCRIPTION Water Treatment Facilities Structure (9)	MINISTRY OF INDUSTRY AND HANDICRAFT	APPROVE BY	DATE	DRAWING No PT-11
		CTI ENGINEERING INTERNATIONAL CO., LTD. WATER AND SEWER BUREAU, CITY OF KITAKYUSHU TEC INTERNATIONAL CO., LTD.	PREPARED BY	DATE	SCALE S=1:100 (A3)

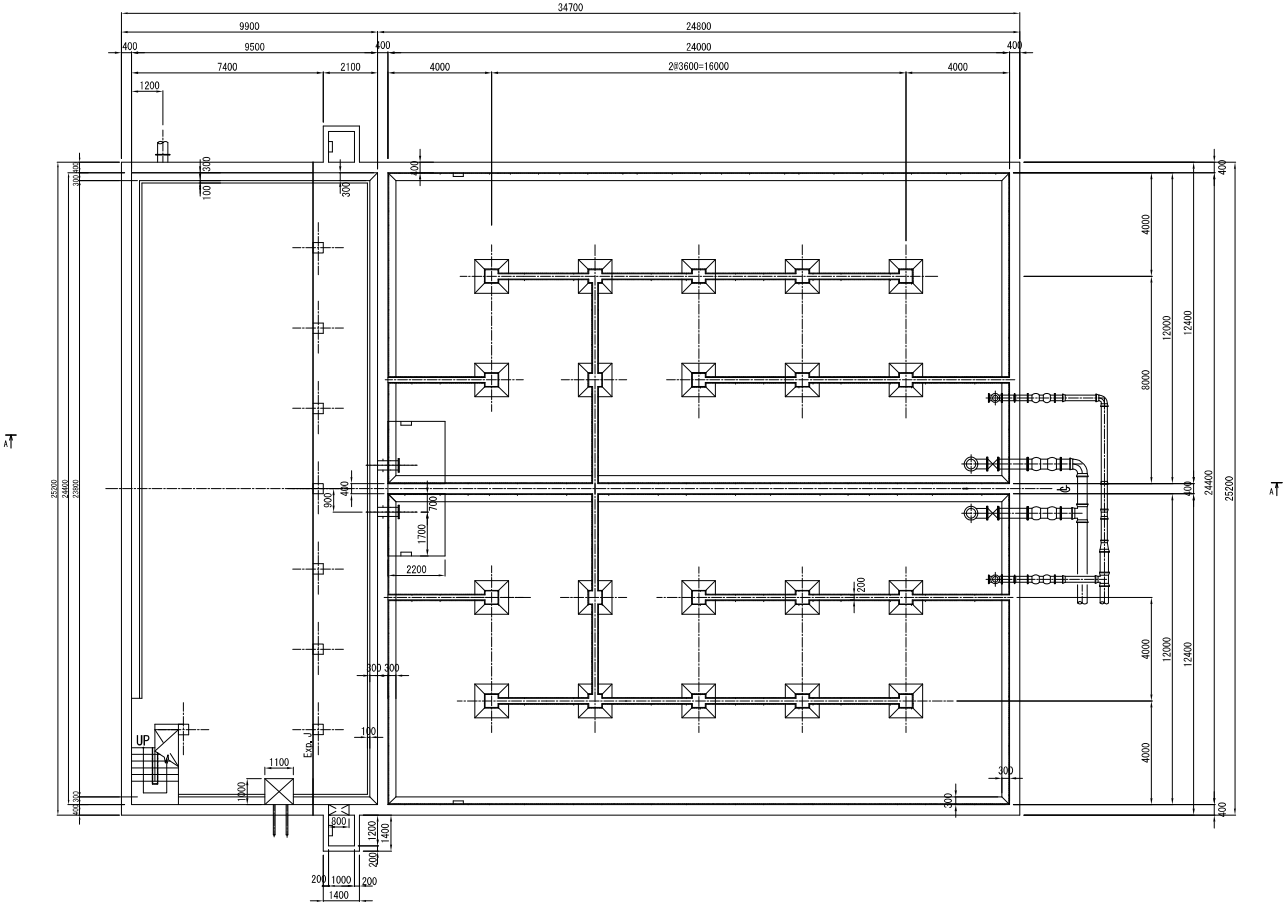


PLAN 1 (EL25.500)

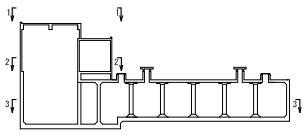


Key Plan

PROJECT	DESCRIPTION		APPROVE BY	DATE	DRAWING No
PREPARATORY SURVEY ON THE PROJECT FOR EXPANSION OF WATER SUPPLY SYSTEM IN PURSAT AND SVAY RIENG IN THE KINGDOM OF CAMBODIA	Service Reservoir and Pumping Station Structure (1)	MINISTRY OF INDUSTRY AND HANDICRAFT			PT-12
		CTI ENGINEERING INTERNATIONAL CO., LTD. WATER AND SEWER BUREAU, CITY OF KITAKYUSHU TEC INTERNATIONAL CO., LTD.	PREPARED BY	DATE	SCALE S=1:200 (A3)

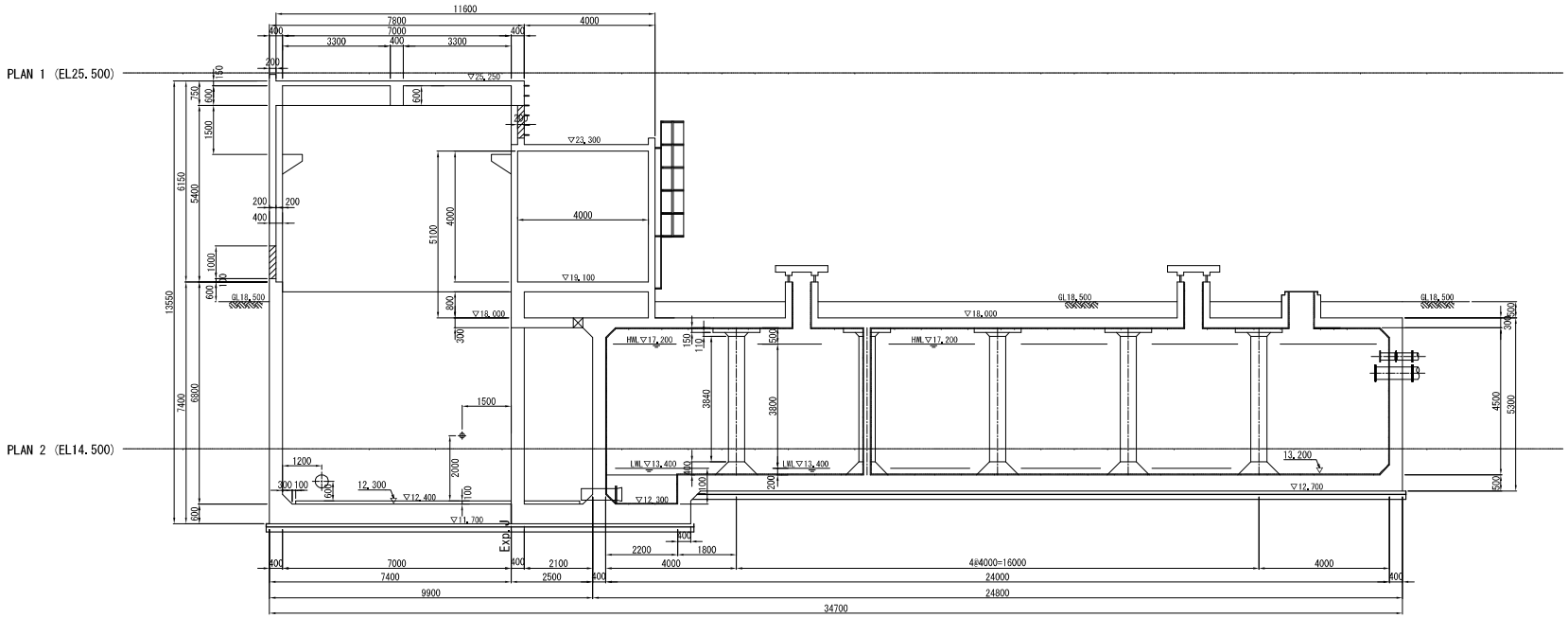


PLAN 2 (EL14.000)



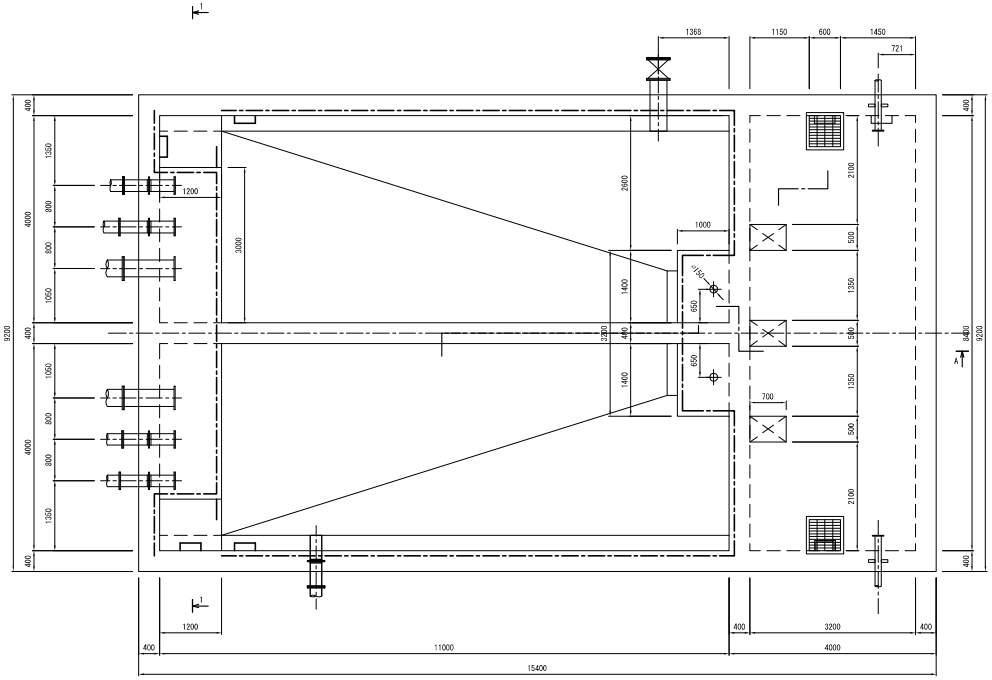
Key Plan

PROJECT	DESCRIPTION		APPROVE BY	DATE	DRAWING No
PREPARATORY SURVEY ON THE PROJECT FOR EXPANSION OF WATER SUPPLY SYSTEM IN PURSAT AND SVAY RIENG IN THE KINGDOM OF CAMBODIA	Service Reservoir and Pumping Station Structure (2)	MINISTRY OF INDUSTRY AND HANDICRAFT			PT-13
		CTI ENGINEERING INTERNATIONAL CO., LTD. WATER AND SEWER BUREAU, CITY OF KITAKYUSHU TEC INTERNATIONAL CO., LTD.	PREPARED BY	DATE	SCALE S=1:200 (A3)

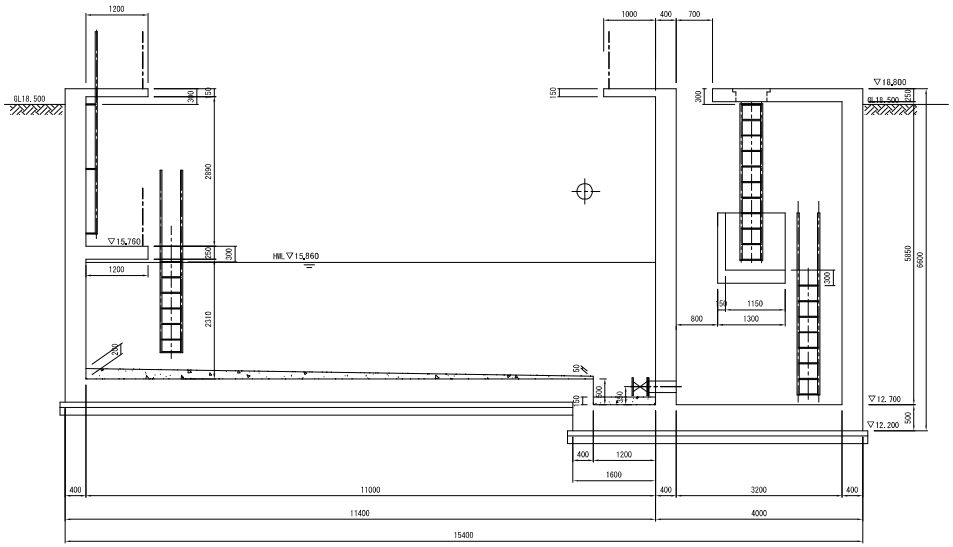


A-A Section

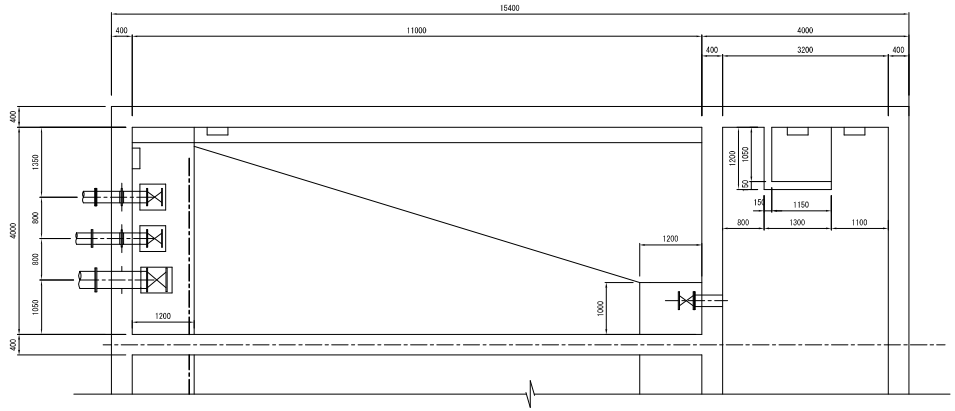
PROJECT	DESCRIPTION		APPROVE BY	DATE	DRAWING No
PREPARATORY SURVEY ON THE PROJECT FOR EXPANSION OF WATER SUPPLY SYSTEM IN PURSAT AND SVAY RIENG IN THE KINGDOM OF CAMBODIA	Service Reservoir and Pumping Station Structure (3)	MINISTRY OF INDUSTRY AND HANDICRAFT			PT-14
		CTI ENGINEERING INTERNATIONAL CO., LTD. WATER AND SEWER BUREAU, CITY OF KITAKYUSHU TEC INTERNATIONAL CO., LTD.	PREPARED BY	DATE	SCALE S=1:150 (A3)



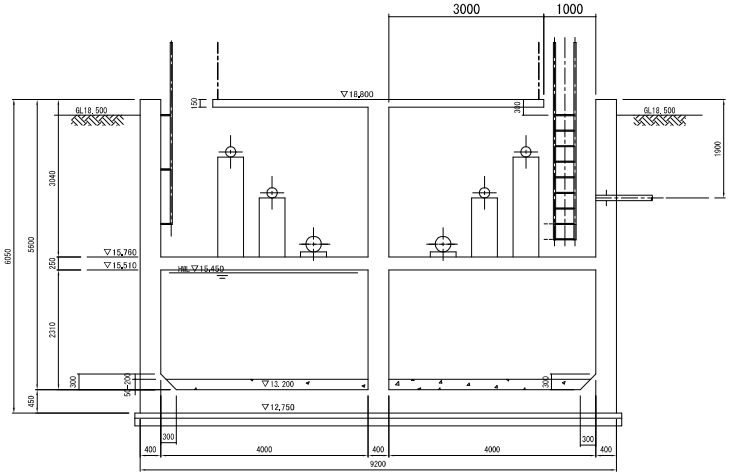
PLAN1 (19.000)



A-A Section

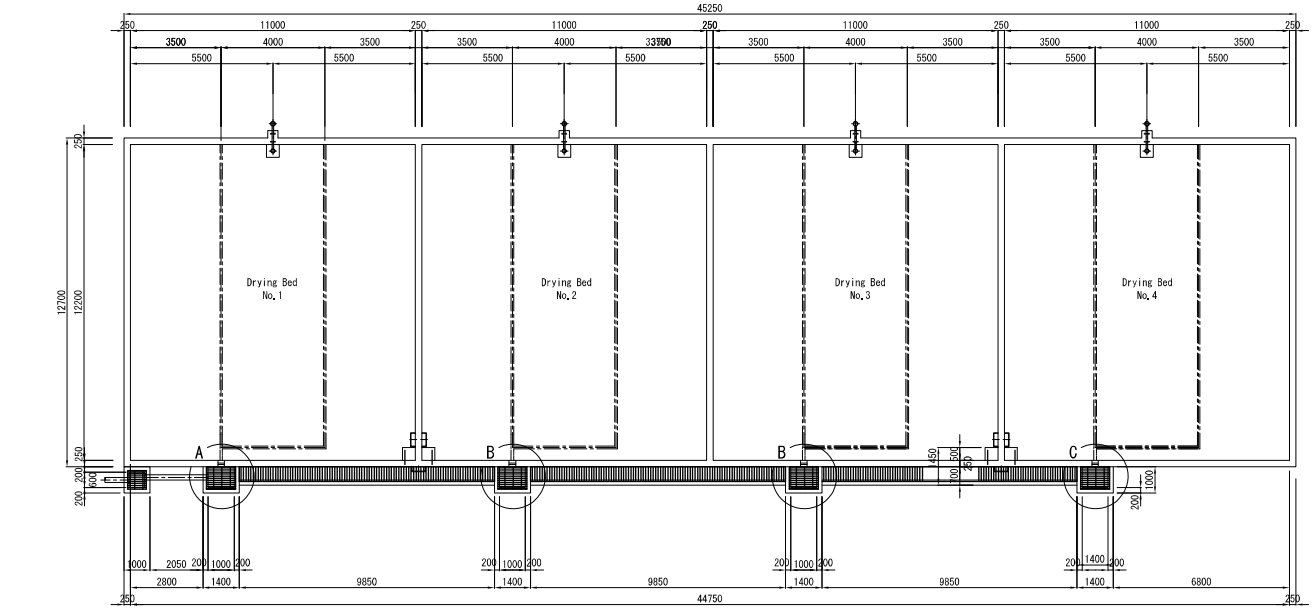


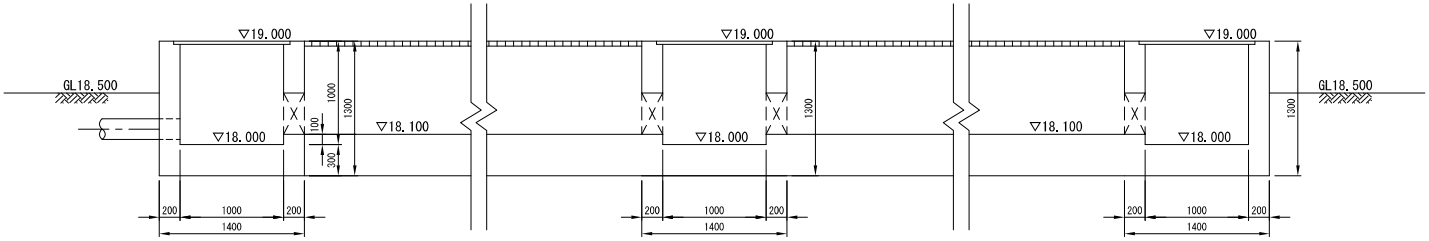
PLAN2 (17.000)



1-1 Section

PROJECT	PREPARATORY SURVEY ON THE PROJECT FOR EXPANSION OF WATER SUPPLY SYSTEM IN PURSAT AND SVAY RIENG IN THE KINGDOM OF CAMBODIA	DESCRIPTION	MINISTRY OF INDUSTRY AND HANDICRAFT	APPROVE BY	DRAWING No PT-15
		Drainage Basin Structure	CTI ENGINEERING INTERNATIONAL CO., LTD. WATER AND SEWER BUREAU, CITY OF KITAKYUSHU TEC INTERNATIONAL CO., LTD.	PREPARED BY	SCALE S=1:100 (A3)



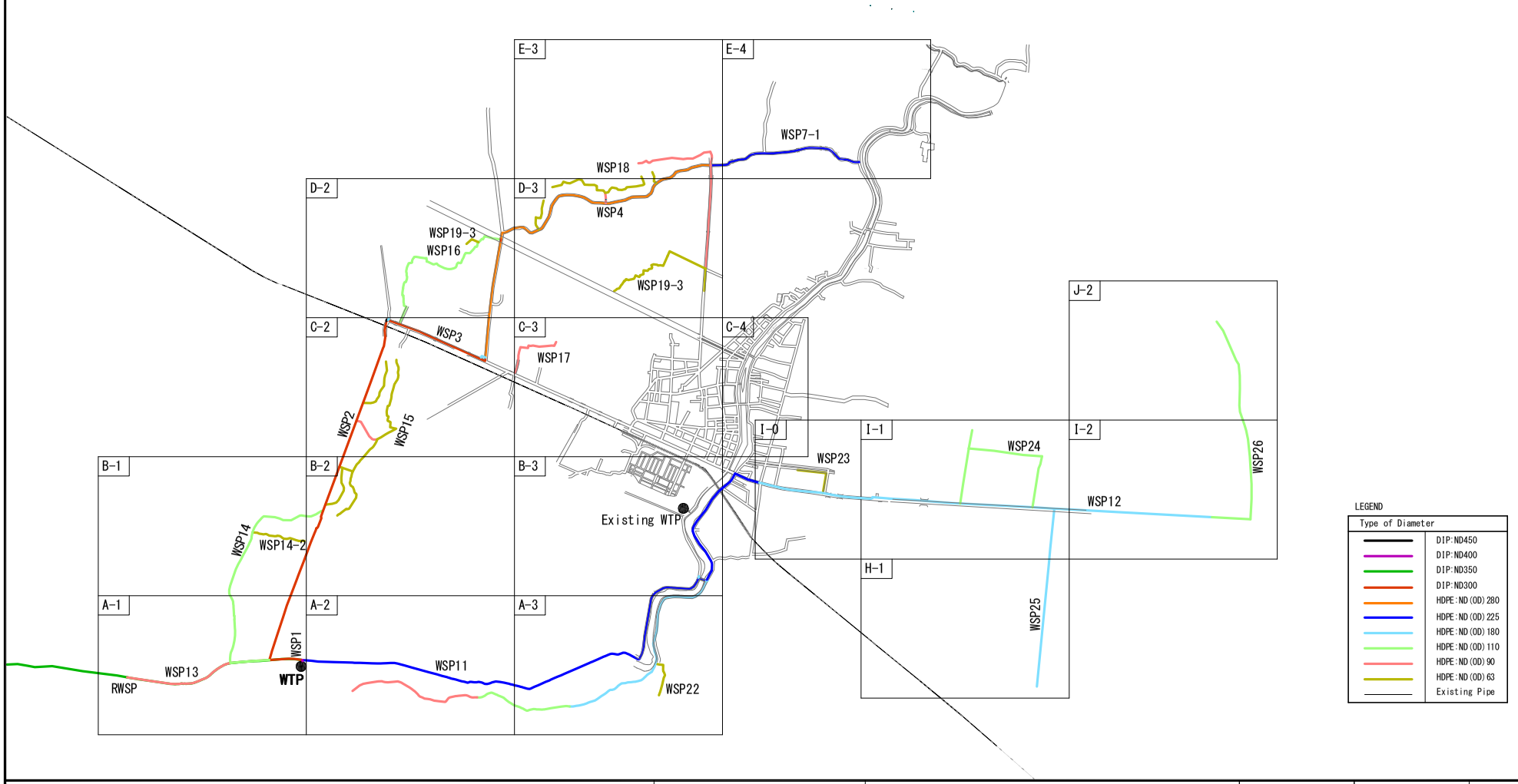


Detail A
Scale=1/50

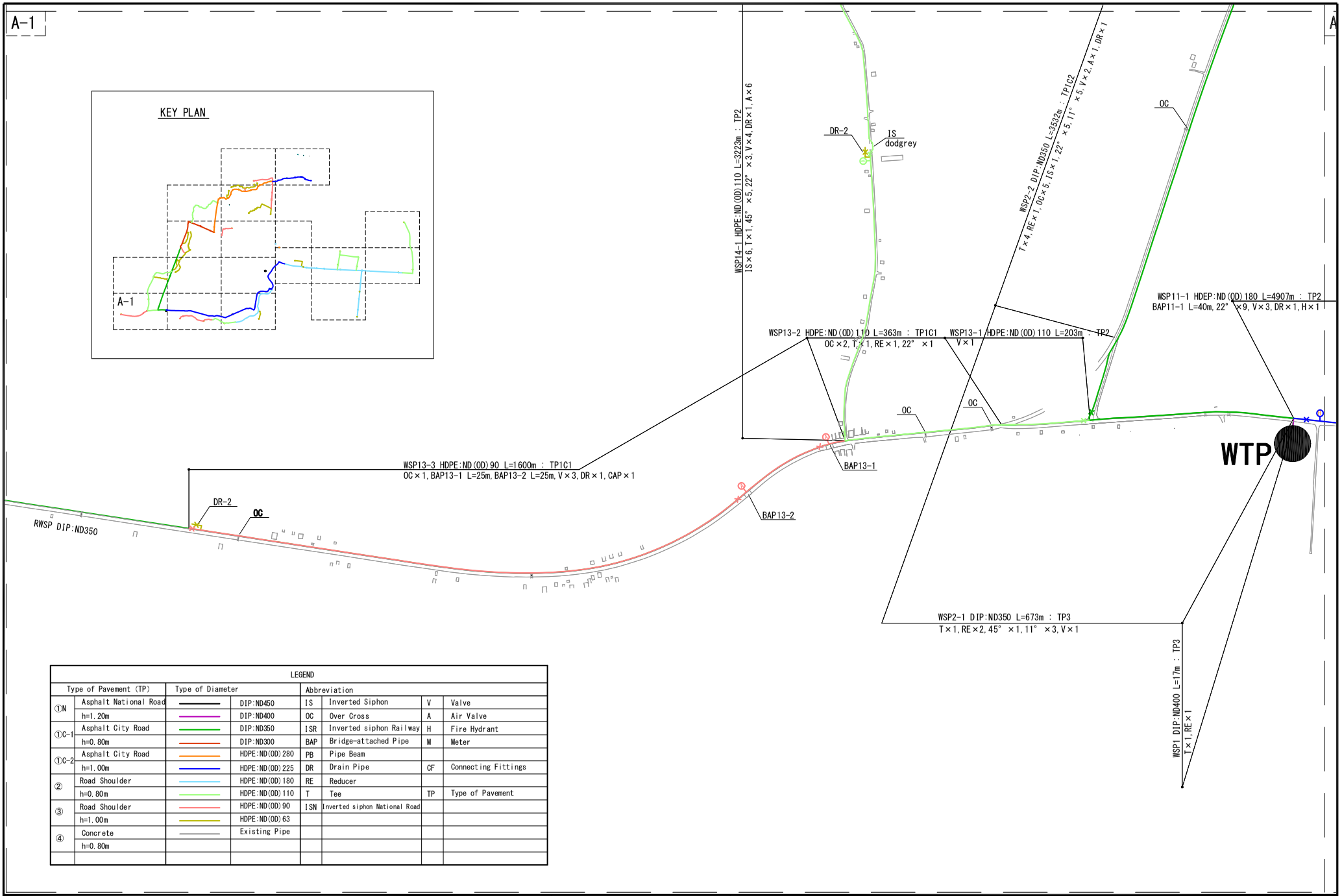
Detail B
Scale=1/50

Detail C
Scale=1/50

PROJECT PREPARATORY SURVEY ON THE PROJECT FOR EXPANSION OF WATER SUPPLY SYSTEM IN PURSAT AND SVAY RIENG IN THE KINGDOM OF CAMBODIA	DESCRIPTION Drying Bed Structure	MINISTRY OF INDUSTRY AND HANDICRAFT	APPROVE BY	DATE	DRAWING No PT-16
		CTI ENGINEERING INTERNATIONAL CO., LTD. WATER AND SEWER BUREAU, CITY OF KITAKYUSHU TEC INTERNATIONAL CO., LTD.	PREPARED BY	DATE	SCALE S=1:200,1:50 (A3)



PROJECT	DESCRIPTION		APPROVE BY	DATE	DRAWING No
PREPARATORY SURVEY ON THE PROJECT FOR EXPANSION OF WATER SUPPLY SYSTEMS IN PURSAT	General Map for Distribution Pipeline Network	MINISTRY OF INDUSTRY AND HANDICRAFT			PD-1
		CTI ENGINEERING INTERNATIONAL CO., LTD. WATER AND SEWER BUREAU, CITY OF KITAKYUSHU TEC INTERNATIONAL CO., LTD.	PREPARED BY	DATE	SCALE 1:60,000

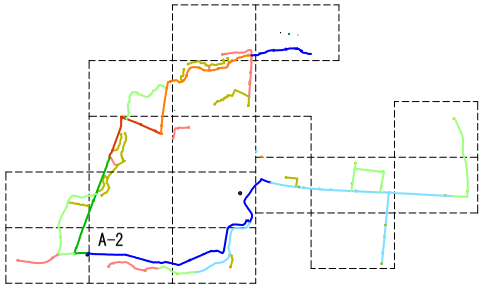


LEGEND							
Type of Pavement (TP)		Type of Diameter		Abbreviation			
①N	Asphalt National Road	DIP:ND450	IS	Inverted Siphon	V	Valve
	h=1.20m	DIP:ND400	OC	Over Cross	A	Air Valve
①C-1	Asphalt City Road	DIP:ND350	ISR	Inverted siphon Railway	H	Fire Hydrant
	h=0.80m	DIP:ND300	BAP	Bridge-attached Pipe	M	Meter
①C-2	Asphalt City Road	HDPE:ND(OD)280	PB	Pipe Beam		
	h=1.00m	HDPE:ND(OD)225	DR	Drain Pipe	CF	Connecting Fittings
②	Road Shoulder	HDPE:ND(OD)180	RE	Reducer		
	h=0.80m	HDPE:ND(OD)110	T	Tee	TP	Type of Pavement
③	Road Shoulder	HDPE:ND(OD)90	ISN	Inverted siphon National Road		
	h=1.00m	HDPE:ND(OD)63				
④	Concrete	Existing Pipe				
	h=0.80m					

PROJECT	DESCRIPTION		APPROVE BY	DATE	DRAWING No
PREPARATORY SURVEY ON THE PROJECT FOR EXPANSION OF WATER SUPPLY SYSTEMS IN PURSAT	**Distribution Pipeline Plan(A-1)**	MINISTRY OF INDUSTRY AND HANDICRAFT			**PD-2**
		CTI ENGINEERING INTERNATIONAL CO., LTD. WATER AND SEWER BUREAU, CITY OF KITAKYUSHU TEC INTERNATIONAL CO., LTD.	PREPARED BY	DATE	SCALE **1:8,000**

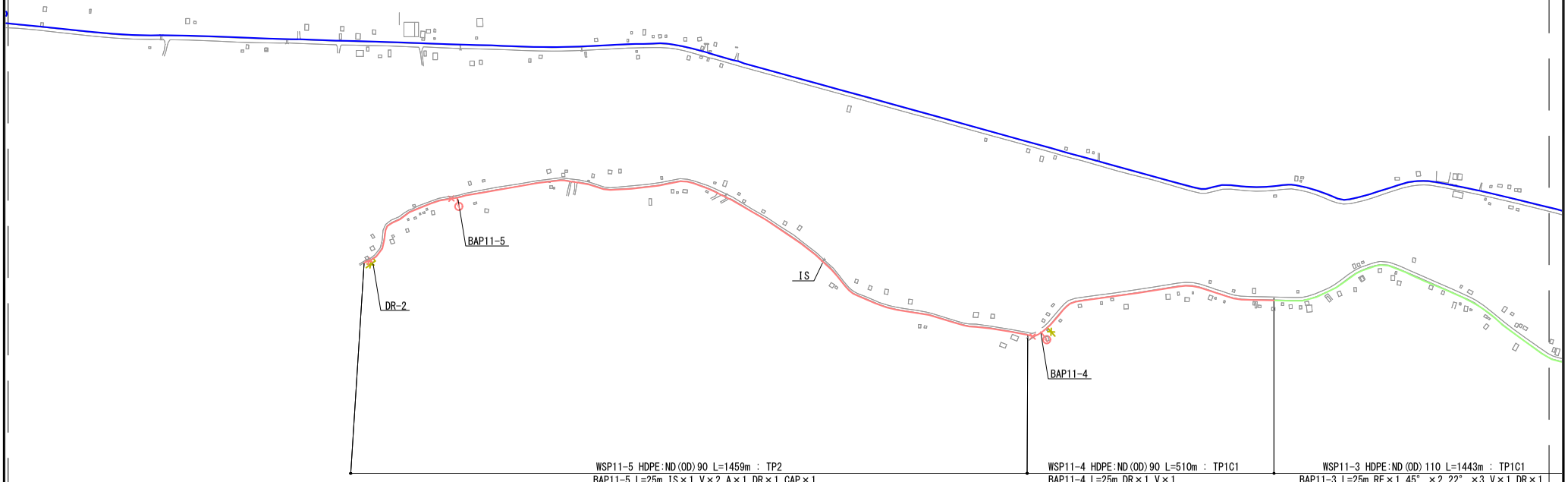
A-2

KEY PLAN



LEGEND							
Type of Pavement (TP)		Type of Diameter		Abbreviation			
①N	Asphalt National Road		DIP:ND450	IS	Inverted Siphon	V	Valve
	h=1.20m		DIP:ND400	OC	Over Cross	A	Air Valve
①C-1	Asphalt City Road		DIP:ND350	ISR	Inverted siphon Railway	H	Fire Hydrant
	h=0.80m		DIP:ND300	BAP	Bridge-attached Pipe	M	Meter
①C-2	Asphalt City Road		HDPE:ND(OD)280	PB	Pipe Beam		
	h=1.00m		HDPE:ND(OD)225	DR	Drain Pipe	CF	Connecting Fittings
②	Road Shoulder		HDPE:ND(OD)180	RE	Reducer		
	h=0.80m		HDPE:ND(OD)110	T	Tee	TP	Type of Pavement
③	Road Shoulder		HDPE:ND(OD)90	ISN	Inverted siphon National Road		
	h=1.00m		HDPE:ND(OD)63				
④	Concrete		Existing Pipe				
	h=0.80m						

WSP11-1 HDPE:ND(OD)225 L=4907m : TP2
BAP11-1 L=40m, 22° ×9, V×2, DR×1, H×1



WSP11-5 HDPE:ND(OD)90 L=1459m : TP2
BAP11-5 L=25m, IS×1, V×2, A×1, DR×1, CAP×1

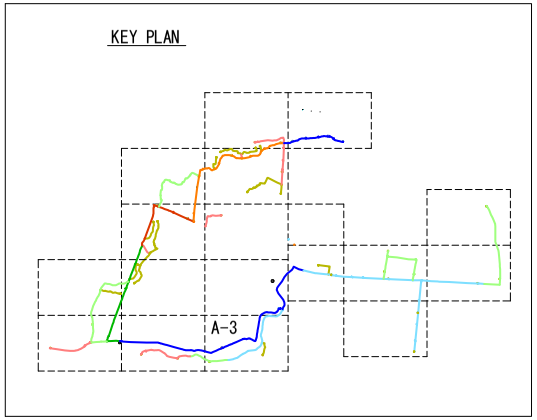
WSP11-4 HDPE:ND(OD)90 L=510m : TP1C1
BAP11-4 L=25m, DR×1, V×1

WSP11-3 HDPE:ND(OD)110 L=1443m : TP1C1
BAP11-3 L=25m, RE×1, 45° ×2, 22° ×3, V×1, DR×1

PROJECT	DESCRIPTION		APPROVE BY	DATE	DRAWING No
PREPARATORY SURVEY ON THE PROJECT FOR EXPANSION OF WATER SUPPLY SYSTEMS IN PURSAT	**Distribution Pipeline Plan(A-2)**	MINISTRY OF INDUSTRY AND HANDICRAFT			**PD-3**
		CTI ENGINEERING INTERNATIONAL CO., LTD. WATER AND SEWER BUREAU, CITY OF KITAKYUSHU TEC INTERNATIONAL CO., LTD.	PREPARED BY	DATE	SCALE **1:8,000**

A-3

KEY PLAN



WSP11-1 HDPE:ND(OD)180 L=4907m : TP2
BAP11-1 L=40m, 22° ×9, V×3, DR×1, H×1

WSP11-2 HDPE:ND(OD)225 L=2115m : TP1C1
BAP11-2 L=95m, T×1, RE×1, 90° ×1, 45° ×2, 22° ×3, V×2, DR×1, CF×2

WSP11-2 HDPE:ND(OD)180 L=3228m : TP1C1
T×1, RE×2, 22° ×11, V×1, DR×1, H×1

WSP22 HDPE:ND(OD)63 L=579m : TP2
DR×1, 90° ×1, 45° ×1, V×2, CAP×1

BAP11-1

BAP11-3

DR-2

WSP11-3 HDPE:ND(OD)110 L=1443m : TP1C1
BAP11-3 L=25m, RE×1, 45° ×2, 22° ×3, V×1, DR×1

LEGEND

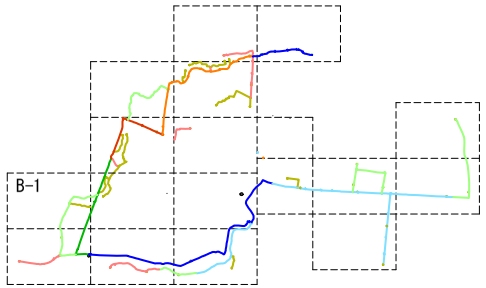
Type of Pavement (TP)		Type of Diameter		Abbreviation			
①N	Asphalt National Road		DIP:ND450	IS	Inverted Siphon	V	Valve
	h=1.20m		DIP:ND400	OC	Over Cross	A	Air Valve
①C-1	Asphalt City Road		DIP:ND350	ISR	Inverted siphon Railway	H	Fire Hydrant
	h=0.80m		DIP:ND300	BAP	Bridge-attached Pipe	M	Meter
①C-2	Asphalt City Road		HDPE:ND(OD)280	PB	Pipe Beam		
	h=1.00m		HDPE:ND(OD)225	DR	Drain Pipe	CF	Connecting Fittings
②	Road Shoulder		HDPE:ND(OD)180	RE	Reducer		
	h=0.80m		HDPE:ND(OD)110	T	Tee	TP	Type of Pavement
③	Road Shoulder		HDPE:ND(OD)90	ISN	Inverted siphon National Road		
	h=1.00m		HDPE:ND(OD)63				
④	Concrete		Existing Pipe				
	h=0.80m						

PROJECT	DESCRIPTION	MINISTRY OF INDUSTRY AND HANDICRAFT	APPROVE BY	DATE
PREPARATORY SURVEY ON THE PROJECT FOR EXPANSION OF WATER SUPPLY SYSTEMS IN PURSAT	**Distribution Pipeline Plan(A-3)**	CTI ENGINEERING INTERNATIONAL CO., LTD. WATER AND SEWER BUREAU, CITY OF KITAKYUSHU TEC INTERNATIONAL CO., LTD.	PREPARED BY	DATE

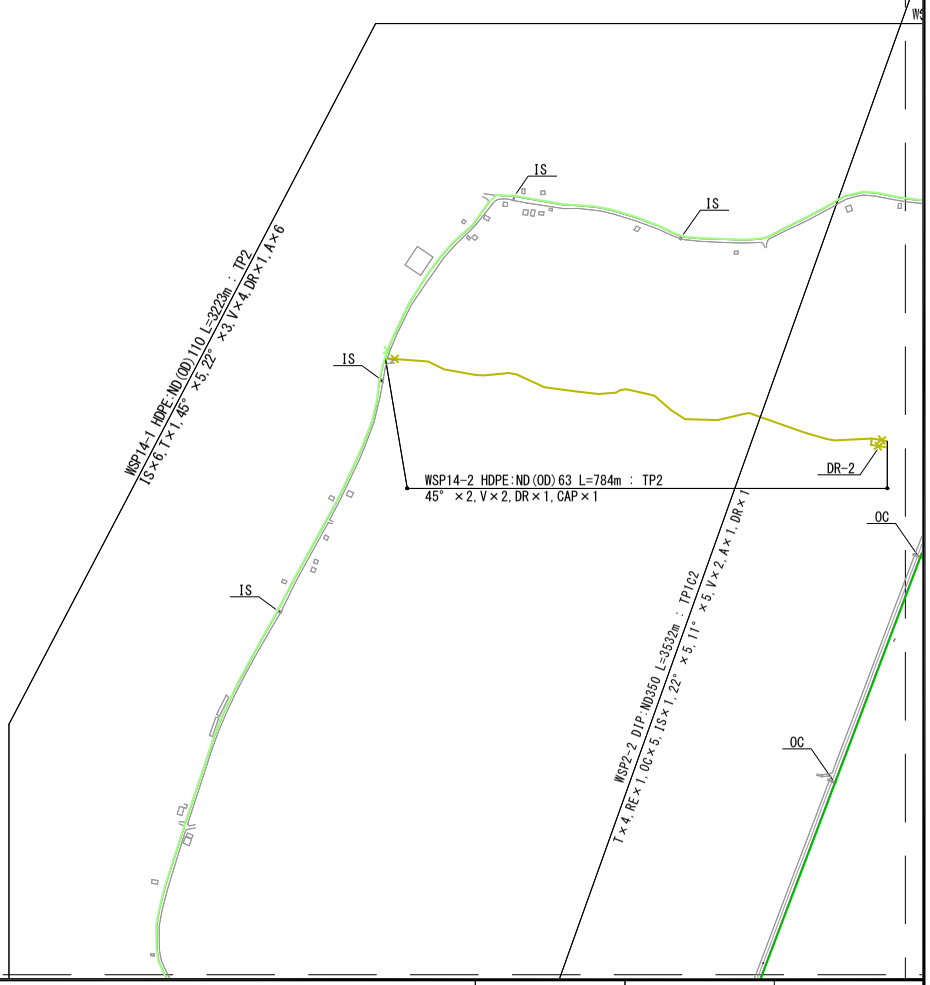
DRAWING No **PD-4**
SCALE **1:8,000**

B-1

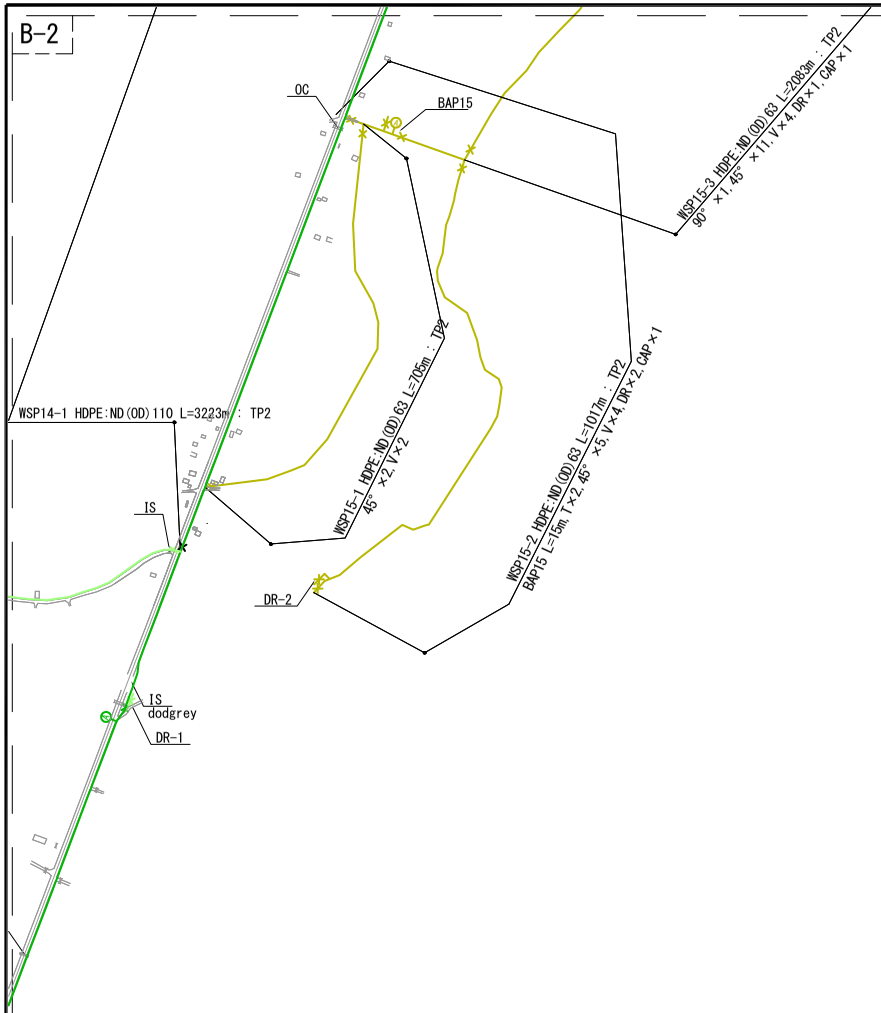
KEY PLAN



LEGEND							
Type of Pavement (TP)		Type of Diameter		Abbreviation			
①N	Asphalt National Road		DIP:ND450	IS	Inverted Siphon	V	Valve
	h=1.20m		DIP:ND400	OC	Over Cross	A	Air Valve
①C-1	Asphalt City Road		DIP:ND350	ISR	Inverted siphon Railway	H	Fire Hydrant
	h=0.80m		DIP:ND300	BAP	Bridge-attached Pipe	M	Meter
①C-2	Asphalt City Road		HDPE:ND(OD)280	PB	Pipe Beam		
	h=1.00m		HDPE:ND(OD)225	DR	Drain Pipe	CF	Connecting Fittings
②	Road Shoulder		HDPE:ND(OD)180	RE	Reducer		
	h=0.80m		HDPE:ND(OD)110	T	Tee	TP	Type of Pavement
③	Road Shoulder		HDPE:ND(OD)90	ISN	Inverted siphon National Road		
	h=1.00m		HDPE:ND(OD)63				
④	Concrete		Existing Pipe				
	h=0.80m						

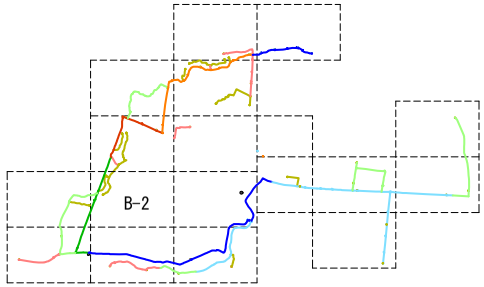


PROJECT	DESCRIPTION		APPROVE BY	DATE	DRAWING No
PREPARATORY SURVEY ON THE PROJECT FOR EXPANSION OF WATER SUPPLY SYSTEMS IN PURSAT	**Distribution Pipeline Plan(B-1)**	MINISTRY OF INDUSTRY AND HANDICRAFT			**PD-5**
		CTI ENGINEERING INTERNATIONAL CO., LTD. WATER AND SEWER BUREAU, CITY OF KITAKYUSHU TEC INTERNATIONAL CO., LTD.	PREPARED BY	DATE	SCALE **1:8,000**



LEGEND							
Type of Pavement (TP)		Type of Diameter		Abbreviation			
①N	Asphalt National Road		DIP:ND450	IS	Inverted Siphon	V	Valve
	h=1.20m		DIP:ND400	OC	Over Cross	A	Air Valve
①C-1	Asphalt City Road		DIP:ND350	ISR	Inverted siphon Railway	H	Fire Hydrant
	h=0.80m		DIP:ND300	BAP	Bridge-attached Pipe	M	Meter
①C-2	Asphalt City Road		HDPE:ND(OD)280	PB	Pipe Beam		
	h=1.00m		HDPE:ND(OD)225	DR	Drain Pipe	CF	Connecting Fittings
②	Road Shoulder		HDPE:ND(OD)180	RE	Reducer		
	h=0.80m		HDPE:ND(OD)110	T	Tee	TP	Type of Pavement
③	Road Shoulder		HDPE:ND(OD)90	ISN	Inverted siphon National Road		
	h=1.00m		HDPE:ND(OD)63				
④	Concrete		Existing Pipe				
	h=0.80m						

KEY PLAN

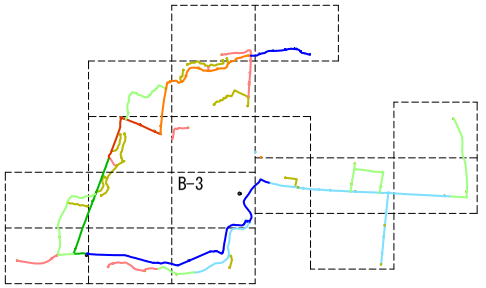


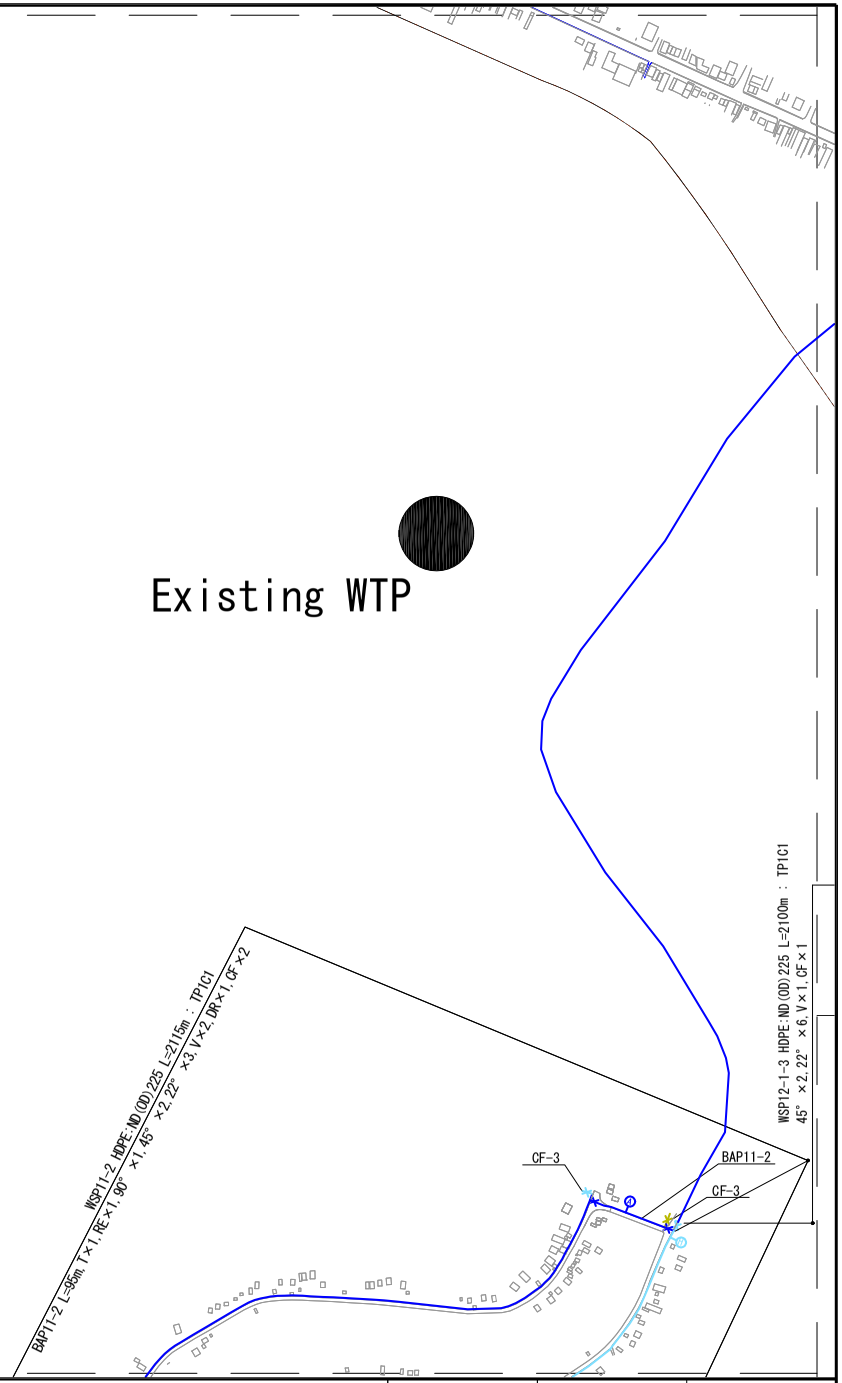
PROJECT	DESCRIPTION		APPROVE BY	DATE	DRAWING No
PREPARATORY SURVEY ON THE PROJECT FOR EXPANSION OF WATER SUPPLY SYSTEMS IN PURSAT	**Distribution Pipeline Plan(B-2)**	MINISTRY OF INDUSTRY AND HANDICRAFT			**PD-6**
		CTI ENGINEERING INTERNATIONAL CO., LTD. WATER AND SEWER BUREAU, CITY OF KITAKYUSHU TEC INTERNATIONAL CO., LTD.	PREPARED BY	DATE	SCALE **1:8,000**

B-3

LEGEND							
Type of Pavement (TP)		Type of Diameter		Abbreviation			
①N	Asphalt National Road		DIP:ND450	IS	Inverted Siphon	V	Valve
	h=1.20m		DIP:ND400	OC	Over Cross	A	Air Valve
①C-1	Asphalt City Road		DIP:ND350	ISR	Inverted siphon Railway	H	Fire Hydrant
	h=0.80m		DIP:ND300	BAP	Bridge-attached Pipe	M	Meter
①C-2	Asphalt City Road		HDPE:ND(OD)280	PB	Pipe Beam		
	h=1.00m		HDPE:ND(OD)225	DR	Drain Pipe	CF	Connecting Fittings
②	Road Shoulder		HDPE:ND(OD)180	RE	Reducer		
	h=0.80m		HDPE:ND(OD)110	T	Tee	TP	Type of Pavement
③	Road Shoulder		HDPE:ND(OD)90	ISN	Inverted siphon National Road		
	h=1.00m		HDPE:ND(OD)63				
④	Concrete		Existing Pipe				
	h=0.80m						

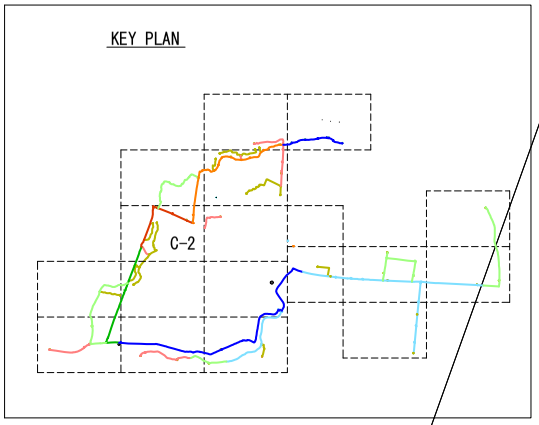
KEY PLAN





PROJECT	DESCRIPTION		APPROVE BY	DATE	DRAWING No
PREPARATORY SURVEY ON THE PROJECT FOR EXPANSION OF WATER SUPPLY SYSTEMS IN PURSAT	**Distribution Pipeline Plan(B-3)**	MINISTRY OF INDUSTRY AND HANDICRAFT			**PD-7**
		CTI ENGINEERING INTERNATIONAL CO., LTD. WATER AND SEWER BUREAU, CITY OF KITAKYUSHU TEC INTERNATIONAL CO., LTD.	PREPARED BY	DATE	SCALE **1:8,000**

C-2



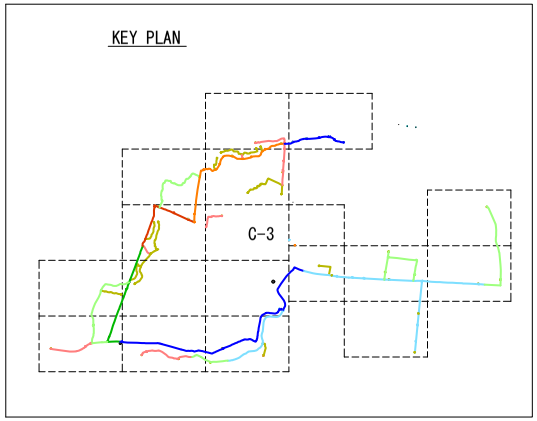
ISN
ISR
OC
BAP3-1
CF-2
BAP3-2
BAP3-3
IS
DR-2
DR-2
OC
OC
IS
WSP3 DIP:ND300 L=1570m : TP1N
BAP3-1 L=50m, BAP3-2 L=35m, BAP3-3 L=40m, T×1, RE×1, 45° ×2, 22° ×1, V×4, DR×2, CF×1, CAP×1
WSP4-1 HDPE:ND(OD)280 L=5522m : TP2
BAP4-1 L=20m, BAP4-2 L=15m, BAP4-3 L=15m, BAP4-4 L=15m, IS×10
T×6, RE×1, 45° ×4, 22° ×3, 11° ×33, V×5, A×5, DR×4, H×1, CF×1
WSP2-2-2 DIP:ND300 L=1558m : TP1C2
T×2, OC×2, ISR×1, ISN×1, 11° ×7, V×1, A×1
WSP15-4 HDPE:ND(OD)63 L=799m : TP2
IS×1, 45° ×1, V×2, DR×1, CAP×1
WSP15-5 HDPE:ND(OD)90 L=429m : TP2
T×1, RE×2, 45° ×2, V×1
WSP15-3 HDPE:ND(OD)63 L=2083m : TP2
90° ×1, 45° ×11, V×4, DR×1, CAP×1
WSP2-2 DIP:ND350 L=3532m : TP1C2

LEGEND

Type of Pavement (TP)		Type of Diameter		Abbreviation			
①N	Asphalt National Road		DIP:ND450	IS	Inverted Siphon	V	Valve
	h=1.20m		DIP:ND400	OC	Over Cross	A	Air Valve
①C-1	Asphalt City Road		DIP:ND350	ISR	Inverted siphon Railway	H	Fire Hydrant
	h=0.80m		DIP:ND300	BAP	Bridge-attached Pipe	M	Meter
①C-2	Asphalt City Road		HDPE:ND(OD)280	PB	Pipe Beam		
	h=1.00m		HDPE:ND(OD)225	DR	Drain Pipe	CF	Connecting Fittings
②	Road Shoulder		HDPE:ND(OD)180	RE	Reducer		
	h=0.80m		HDPE:ND(OD)110	T	Tee	TP	Type of Pavement
③	Road Shoulder		HDPE:ND(OD)90	ISN	Inverted siphon National Road		
	h=1.00m		HDPE:ND(OD)63				
④	Concrete		Existing Pipe				
	h=0.80m						

PROJECT	DESCRIPTION		APPROVE BY	DATE	DRAWING No
PREPARATORY SURVEY ON THE PROJECT FOR EXPANSION OF WATER SUPPLY SYSTEMS IN PURSAT	**Distribution Pipeline Plan(C-2)**	MINISTRY OF INDUSTRY AND HANDICRAFT			**PD-8**
		CTI ENGINEERING INTERNATIONAL CO., LTD. WATER AND SEWER BUREAU, CITY OF KITAKYUSHU TEC INTERNATIONAL CO., LTD.	PREPARED BY	DATE	SCALE **1:8,000**

C-3



IS

OC

WSP17 HDPE:ND(OD)90 L=928m : TP2
IS×1, OC×1, 45° ×6, V×2, DR×1, CF×1, CAP×1

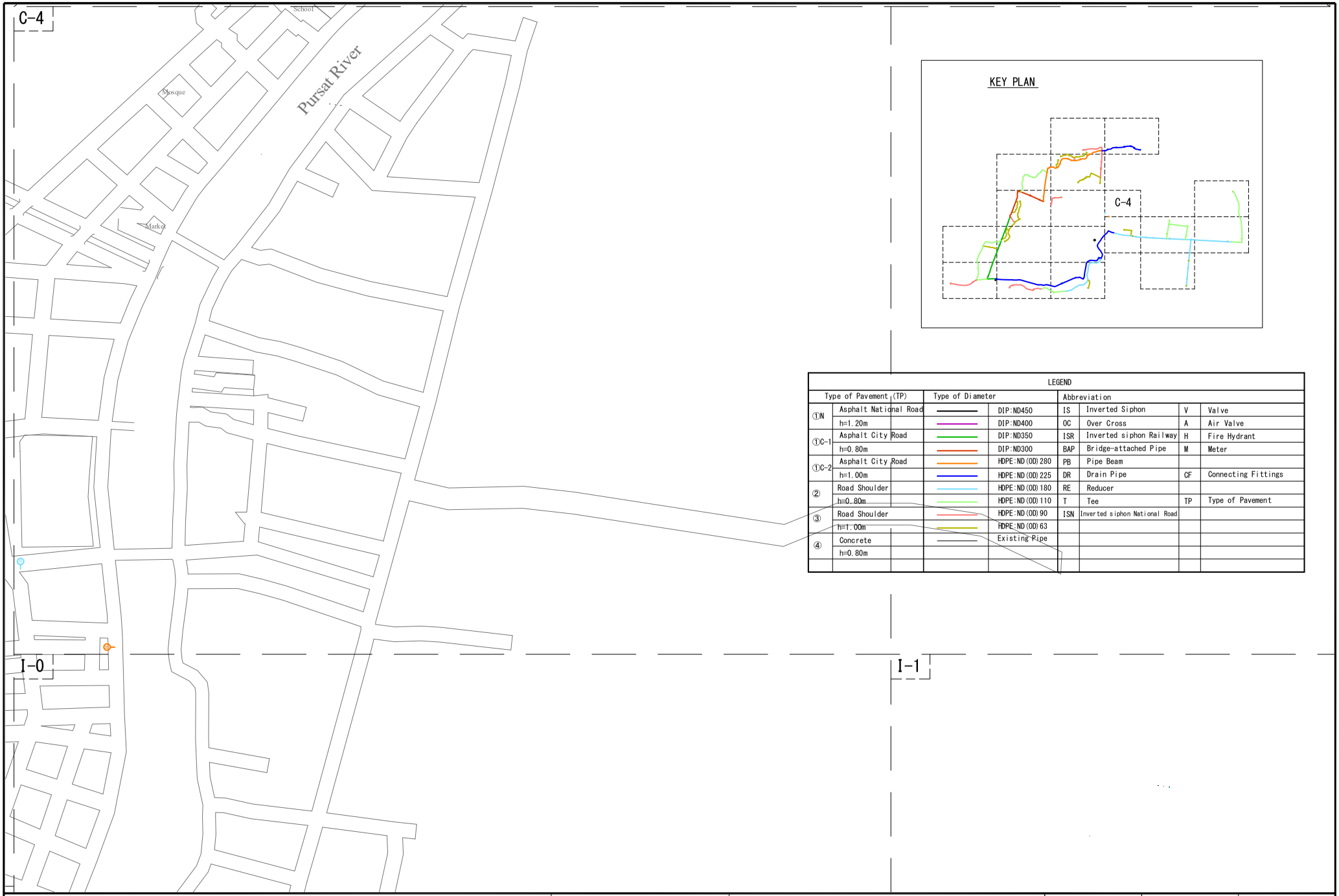
CF-3

LEGEND								
Type of Pavement (TP)		Type of Diameter		Abbreviation				
①N	Asphalt National Road		DIP:ND450	IS	Inverted Siphon	V	Valve	
	h=1.20m		DIP:ND400	OC	Over Cross	A	Air Valve	
①C-1	Asphalt City Road		DIP:ND350	ISR	Inverted siphon Railway	H	Fire Hydrant	
	h=0.80m		DIP:ND300	BAP	Bridge-attached Pipe	M	Meter	
①C-2	Asphalt City Road		HDPE:ND(OD)280	PB	Pipe Beam			
	h=1.00m		HDPE:ND(OD)225	DR	Drain Pipe	CF	Connecting Fittings	
②	Road Shoulder		HDPE:ND(OD)180	RE	Reducer			
	h=0.80m		HDPE:ND(OD)110	T	Tee	TP	Type of Pavement	
③	Road Shoulder		HDPE:ND(OD)90	ISN	Inverted siphon National Road			
	h=1.00m		HDPE:ND(OD)63					
④	Concrete		Existing Pipe					
	h=0.80m							

PROJECT PREPARATORY SURVEY ON THE PROJECT FOR EXPANSION OF WATER SUPPLY SYSTEMS IN PURSAT	DESCRIPTION **Distribution Pipeline Plan(C-3)**	MINISTRY OF INDUSTRY AND HANDICRAFT	APPROVE BY	DATE
		CTI ENGINEERING INTERNATIONAL CO., LTD. WATER AND SEWER BUREAU, CITY OF KITAKYUSHU TEC INTERNATIONAL CO., LTD.	PREPARED BY	DATE

DRAWING No **PD-9**

SCALE **1:8,000**



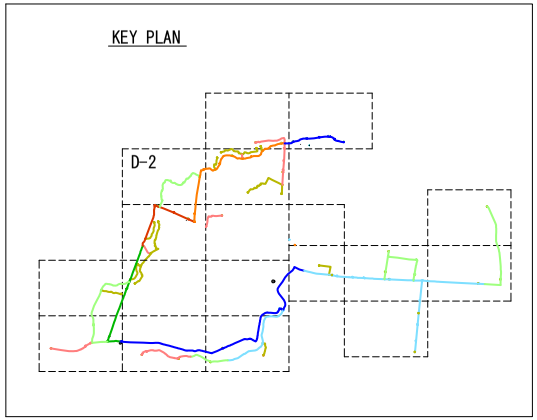
KEY PLAN

LEGEND								
Type of Pavement (TP)		Type of Diameter		Abbreviation				
①N	Asphalt National Road		DIP:ND450	IS	Inverted Siphon	V	Valve	
	h=1.20m		DIP:ND400	OC	Over Cross	A	Air Valve	
①C-1	Asphalt City Road		DIP:ND350	ISR	Inverted siphon Railway	H	Fire Hydrant	
	h=0.80m		DIP:ND300	BAP	Bridge-attached Pipe	M	Meter	
①C-2	Asphalt City Road		HDPE:ND(OD)280	PB	Pipe Beam			
	h=1.00m		HDPE:ND(OD)225	DR	Drain Pipe	CF	Connecting Fittings	
②	Road Shoulder		HDPE:ND(OD)180	RE	Reducer			
	h=0.80m		HDPE:ND(OD)110	T	Tee	TP	Type of Pavement	
③	Road Shoulder		HDPE:ND(OD)90	ISN	Inverted siphon National Road			
	h=1.00m		HDPE:ND(OD)63					
④	Concrete		Existing Pipe					
	h=0.80m							

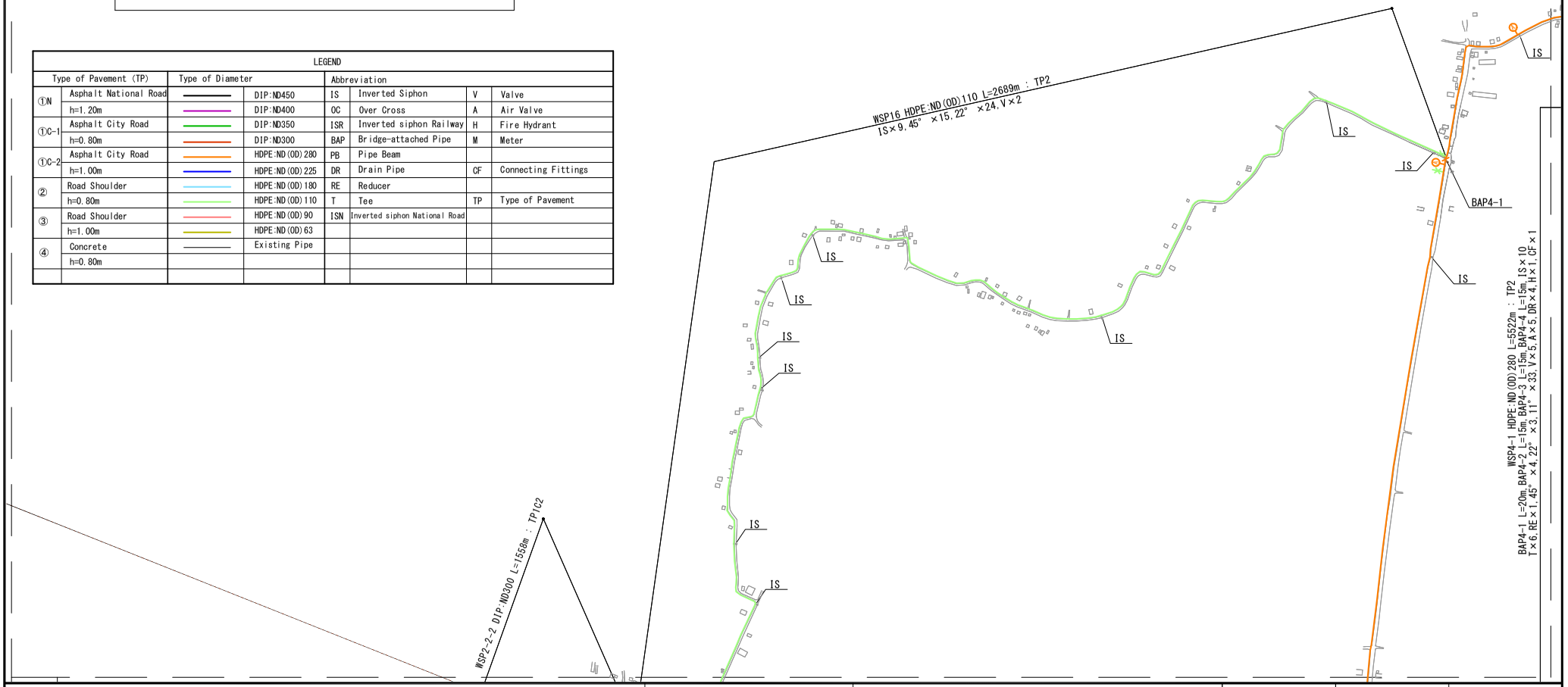
PROJECT	DESCRIPTION		APPROVE BY	DATE	DRAWING No
PREPARATORY SURVEY ON THE PROJECT FOR EXPANSION OF WATER SUPPLY SYSTEMS IN PURSAT	**Distribution Pipeline Plan(C-4)**	MINISTRY OF INDUSTRY AND HANDICRAFT			**PD-10**
		CTI ENGINEERING INTERNATIONAL CO., LTD. WATER AND SEWER BUREAU, CITY OF KITAKYUSHU TEC INTERNATIONAL CO., LTD.	PREPARED BY	DATE	SCALE **1:8,000**

D-2

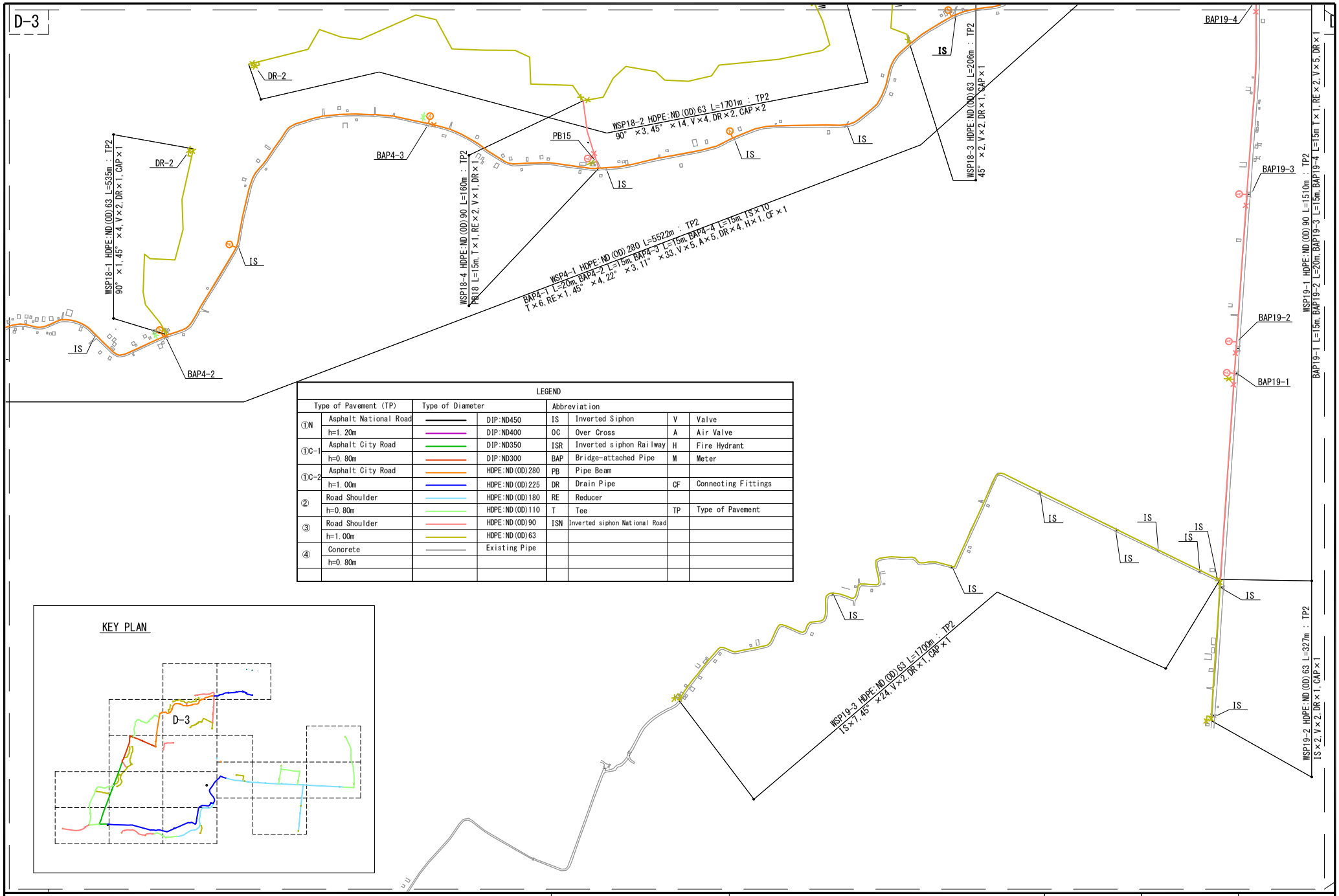
KEY PLAN



LEGEND							
Type of Pavement (TP)		Type of Diameter		Abbreviation			
①N	Asphalt National Road		DIP:ND450	IS	Inverted Siphon	V	Valve
	h=1.20m		DIP:ND400	OC	Over Cross	A	Air Valve
①C-1	Asphalt City Road		DIP:ND350	ISR	Inverted siphon Railway	H	Fire Hydrant
	h=0.80m		DIP:ND300	BAP	Bridge-attached Pipe	M	Meter
①C-2	Asphalt City Road		HDPE:ND(OD)280	PB	Pipe Beam		
	h=1.00m		HDPE:ND(OD)225	DR	Drain Pipe	CF	Connecting Fittings
②	Road Shoulder		HDPE:ND(OD)180	RE	Reducer		
	h=0.80m		HDPE:ND(OD)110	T	Tee	TP	Type of Pavement
③	Road Shoulder		HDPE:ND(OD)90	ISN	Inverted siphon National Road		
	h=1.00m		HDPE:ND(OD)63				
④	Concrete		Existing Pipe				
	h=0.80m						



PROJECT	DESCRIPTION		APPROVE BY	DATE	DRAWING No
PREPARATORY SURVEY ON THE PROJECT FOR EXPANSION OF WATER SUPPLY SYSTEMS IN PURSAT	**Distribution Pipeline Plan(D-2)**	MINISTRY OF INDUSTRY AND HANDICRAFT			**PD-11**
		CTI ENGINEERING INTERNATIONAL CO., LTD. WATER AND SEWER BUREAU, CITY OF KITAKYUSHU TEC INTERNATIONAL CO., LTD.	PREPARED BY	DATE	SCALE **1:8,000**



LEGEND

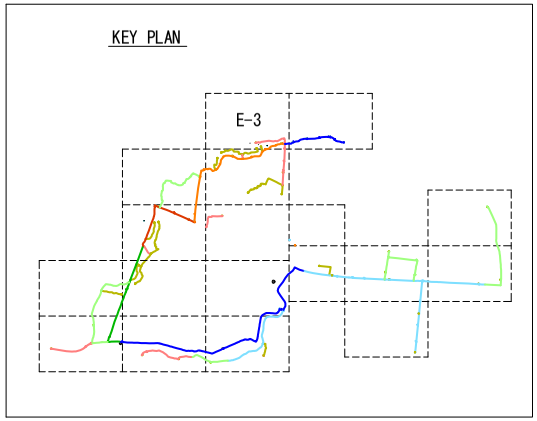
Type of Pavement (TP)		Type of Diameter		Abbreviation			
①N	Asphalt National Road		DIP:ND450	IS	Inverted Siphon	V	Valve
	h=1.20m		DIP:ND400	OC	Over Cross	A	Air Valve
①C-1	Asphalt City Road		DIP:ND350	ISR	Inverted siphon Railway	H	Fire Hydrant
	h=0.80m		DIP:ND300	BAP	Bridge-attached Pipe	M	Meter
①C-2	Asphalt City Road		HDPE:ND(OD)280	PB	Pipe Beam		
	h=1.00m		HDPE:ND(OD)225	DR	Drain Pipe	CF	Connecting Fittings
②	Road Shoulder		HDPE:ND(OD)180	RE	Reducer		
	h=0.80m		HDPE:ND(OD)110	T	Tee	TP	Type of Pavement
③	Road Shoulder		HDPE:ND(OD)90	ISN	Inverted siphon National Road		
	h=1.00m		HDPE:ND(OD)63				
④	Concrete		Existing Pipe				
	h=0.80m						

KEY PLAN

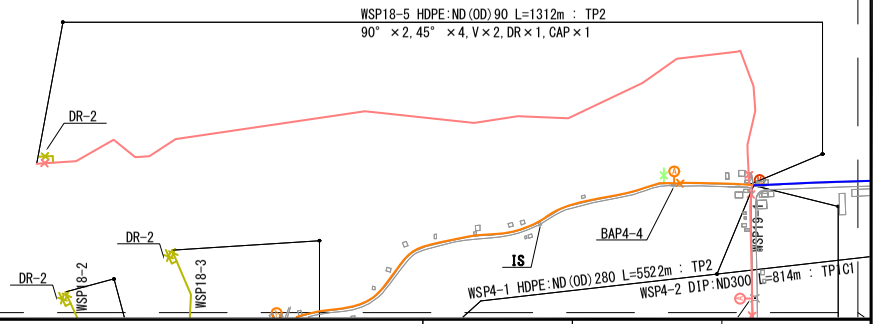
PROJECT	DESCRIPTION		APPROVE BY	DATE	DRAWING No
PREPARATORY SURVEY ON THE PROJECT FOR EXPANSION OF WATER SUPPLY SYSTEMS IN PURSAT	**Distribution Pipeline Plan(D-3)**	MINISTRY OF INDUSTRY AND HANDICRAFT			**PD-12**
		CTI ENGINEERING INTERNATIONAL CO., LTD. WATER AND SEWER BUREAU, CITY OF KITAKYUSHU TEC INTERNATIONAL CO., LTD.	PREPARED BY	DATE	SCALE **1:8,000**

E-3

KEY PLAN



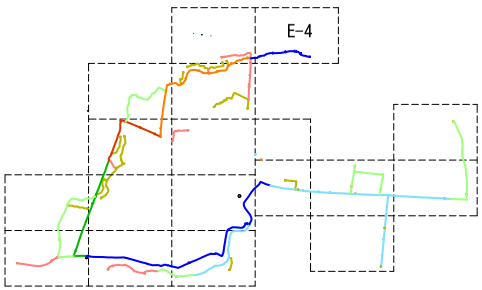
LEGEND								
Type of Pavement (TP)		Type of Diameter		Abbreviation			
①N	Asphalt National Road		DIP:ND450	IS	Inverted Siphon	V	Valve
	h=1.20m		DIP:ND400	OC	Over Cross	A	Air Valve
①C-1	Asphalt City Road		DIP:ND350	ISR	Inverted siphon Railway	H	Fire Hydrant
	h=0.80m		DIP:ND300	BAP	Bridge-attached Pipe	M	Meter
①C-2	Asphalt City Road		HDPE:ND(OD)280	PB	Pipe Beam		
	h=1.00m		HDPE:ND(OD)225	DR	Drain Pipe	CF	Connecting Fittings
②	Road Shoulder		HDPE:ND(OD)180	RE	Reducer		
	h=0.80m		HDPE:ND(OD)110	T	Tee	TP	Type of Pavement
③	Road Shoulder		HDPE:ND(OD)90	ISN	Inverted siphon National Road		
	h=1.00m		HDPE:ND(OD)63				
④	Concrete		Existing Pipe				
	h=0.80m						



PROJECT	DESCRIPTION		APPROVE BY	DATE	DRAWING No
PREPARATORY SURVEY ON THE PROJECT FOR EXPANSION OF WATER SUPPLY SYSTEMS IN PURSAT	**Distribution Pipeline Plan(E-3)**	MINISTRY OF INDUSTRY AND HANDICRAFT			**PD-13**
		CTI ENGINEERING INTERNATIONAL CO., LTD. WATER AND SEWER BUREAU, CITY OF KITAKYUSHU TEC INTERNATIONAL CO., LTD.	PREPARED BY	DATE	SCALE **1:8,000**

E-4

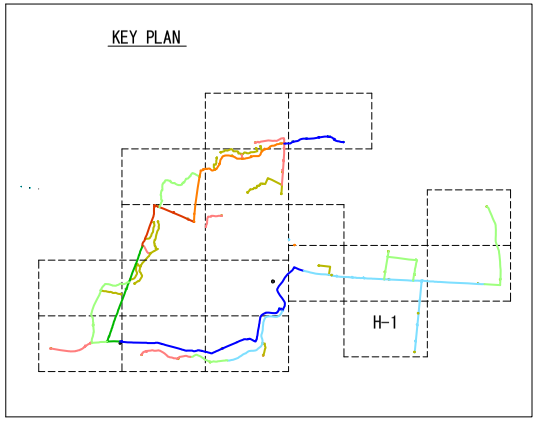
KEY PLAN



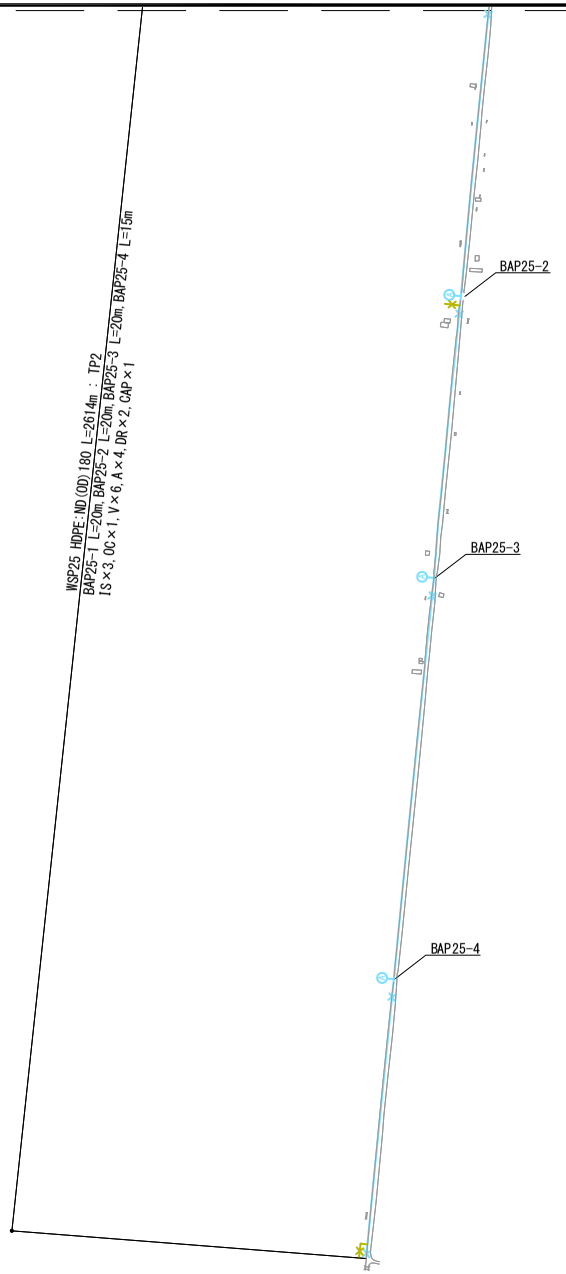
LEGEND							
Type of Pavement (TP)		Type of Diameter		Abbreviation			
①N	Asphalt National Road		DIP:ND450	IS	Inverted Siphon	V	Valve
	h=1.20m		DIP:ND400	OC	Over Cross	A	Air Valve
①C-1	Asphalt City Road		DIP:ND350	ISR	Inverted siphon Railway	H	Fire Hydrant
	h=0.80m		DIP:ND300	BAP	Bridge-attached Pipe	M	Meter
①C-2	Asphalt City Road		HDPE:ND(OD)280	PB	Pipe Beam		
	h=1.00m		HDPE:ND(OD)225	DR	Drain Pipe	CF	Connecting Fittings
②	Road Shoulder		HDPE:ND(OD)180	RE	Reducer		
	h=0.80m		HDPE:ND(OD)110	T	Tee	TP	Type of Pavement
③	Road Shoulder		HDPE:ND(OD)90	ISN	Inverted siphon National Road		
	h=1.00m		HDPE:ND(OD)63				
④	Concrete		Existing Pipe				
	h=0.80m						

PROJECT	DESCRIPTION		APPROVE BY	DATE	DRAWING No
PREPARATORY SURVEY ON THE PROJECT FOR EXPANSION OF WATER SUPPLY SYSTEMS IN PURSAT	**Distribution Pipeline Plan(E-4)**	MINISTRY OF INDUSTRY AND HANDICRAFT			**PD-14**
		CTI ENGINEERING INTERNATIONAL CO., LTD. WATER AND SEWER BUREAU, CITY OF KITAKYUSHU TEC INTERNATIONAL CO., LTD.	PREPARED BY	DATE	SCALE **1:8,000**

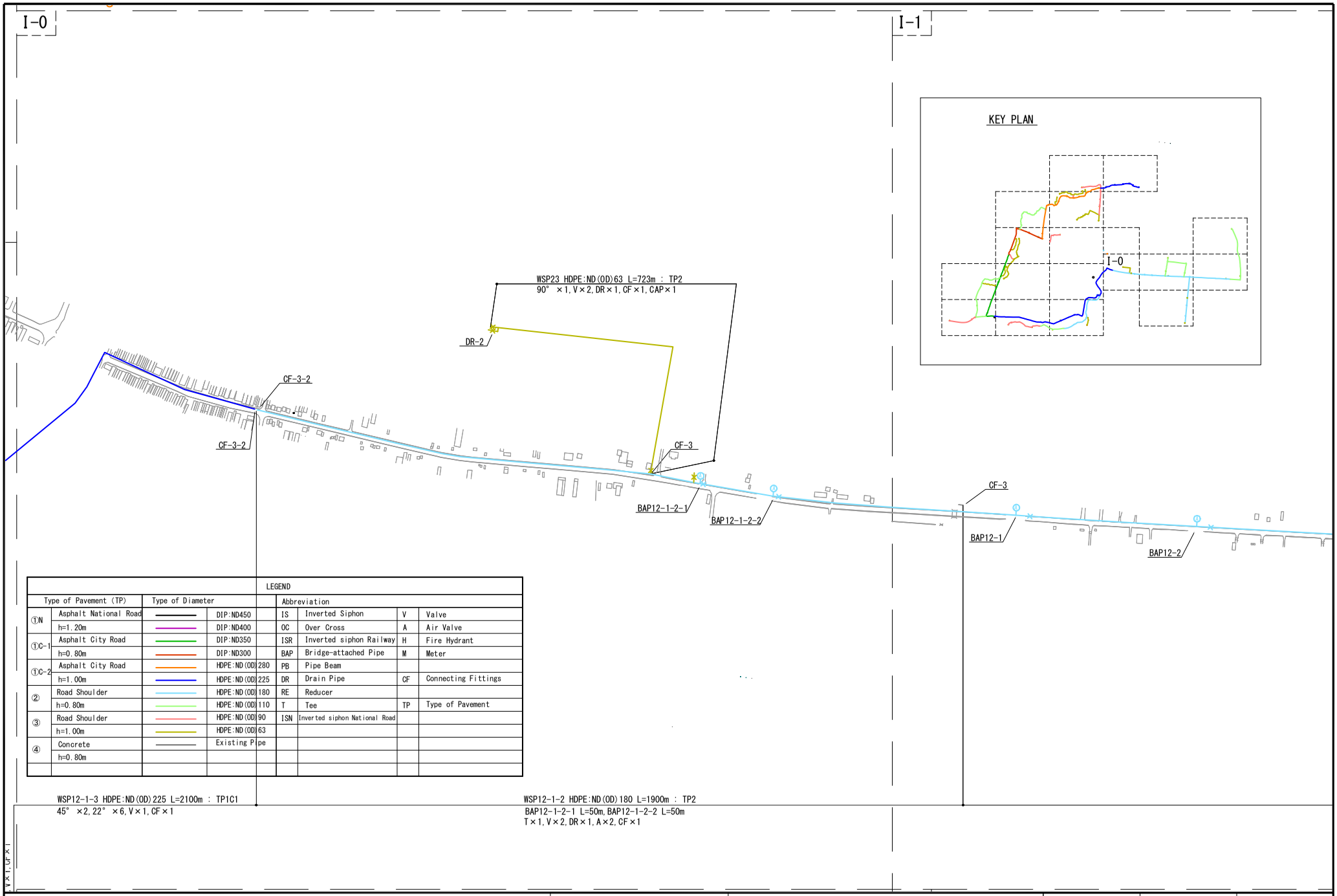
H-1



LEGEND								
Type of Pavement (TP)		Type of Diameter		Abbreviation				
①N	Asphalt National Road		DIP:ND450	IS	Inverted Siphon	V	Valve	
	h=1.20m		DIP:ND400	OC	Over Cross	A	Air Valve	
①C-1	Asphalt City Road		DIP:ND350	ISR	Inverted siphon Railway	H	Fire Hydrant	
	h=0.80m		DIP:ND300	BAP	Bridge-attached Pipe	M	Meter	
①C-2	Asphalt City Road		HDPE:ND(OD)280	PB	Pipe Beam			
	h=1.00m		HDPE:ND(OD)225	DR	Drain Pipe	CF	Connecting Fittings	
②	Road Shoulder		HDPE:ND(OD)180	RE	Reducer			
	h=0.80m		HDPE:ND(OD)110	T	Tee	TP	Type of Pavement	
③	Road Shoulder		HDPE:ND(OD)90	ISN	Inverted siphon National Road			
	h=1.00m		HDPE:ND(OD)63					
④	Concrete		Existing Pipe					
	h=0.80m							



PROJECT	DESCRIPTION		APPROVE BY	DATE	DRAWING No
PREPARATORY SURVEY ON THE PROJECT FOR EXPANSION OF WATER SUPPLY SYSTEMS IN PURSAT	**Distribution Pipeline Plan(H-1)**	MINISTRY OF INDUSTRY AND HANDICRAFT			**PD-15**
		CTI ENGINEERING INTERNATIONAL CO., LTD. WATER AND SEWER BUREAU, CITY OF KITAKYUSHU TEC INTERNATIONAL CO., LTD.	PREPARED BY	DATE	SCALE **1:8,000**

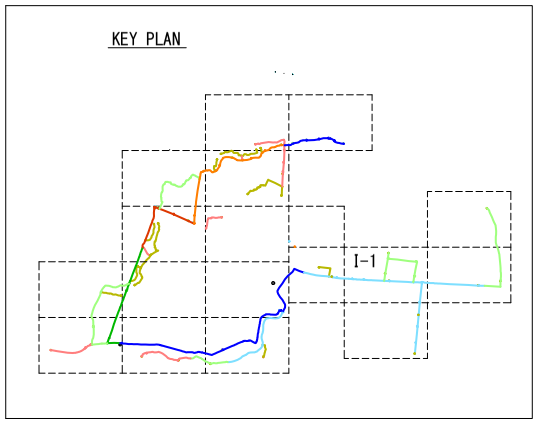


LEGEND

Type of Pavement (TP)		Type of Diameter		Abbreviation			
①N	Asphalt National Road	DIP:ND450		IS	Inverted Siphon	V	Valve
	h=1.20m	DIP:ND400		OC	Over Cross	A	Air Valve
①C-1	Asphalt City Road	DIP:ND350		ISR	Inverted siphon Railway	H	Fire Hydrant
	h=0.80m	DIP:ND300		BAP	Bridge-attached Pipe	M	Meter
①C-2	Asphalt City Road	HDPE:ND(OD)280		PB	Pipe Beam		
	h=1.00m	HDPE:ND(OD)225		DR	Drain Pipe	CF	Connecting Fittings
②	Road Shoulder	HDPE:ND(OD)180		RE	Reducer		
	h=0.80m	HDPE:ND(OD)110		T	Tee	TP	Type of Pavement
③	Road Shoulder	HDPE:ND(OD)90		ISN	Inverted siphon National Road		
	h=1.00m	HDPE:ND(OD)63					
④	Concrete	Existing Pipe					
	h=0.80m						

PROJECT	DESCRIPTION	MINISTRY OF INDUSTRY AND HANDICRAFT	APPROVE BY	DATE	DRAWING No
PREPARATORY SURVEY ON THE PROJECT FOR EXPANSION OF WATER SUPPLY SYSTEMS IN PURSAT	**Distribution Pipeline Plan(I-0)**				**PD-16**
		CTI ENGINEERING INTERNATIONAL CO., LTD. WATER AND SEWER BUREAU, CITY OF KITAKYUSHU TEC INTERNATIONAL CO., LTD.	PREPARED BY	DATE	SCALE **1:8,000**

I-1



WSP24-2 HDPE:ND(OD)110 L=1837m : TP2
BAP24-2 L=15m, BAP24-3 L=15m, BAP24-4 L=15m
45° ×2, V×4, DR×1, A×3

WSP24-1 HDPE:ND(OD)110 L=1039m : TP2
BAP24-1 L=15m, IS×4, T×1, V×4, A×1, DR×1, CAP×1

WSP25 HDPE:ND(OD)180 L=2614m : TP2
BAP25-1 L=20m, BAP25-2 L=20m, BAP25-3 L=20m, BAP25-4 L=15m
IS×3, OC×1, V×6, A×4, DR×2, CAP×1

WSP12-1 HDPE:ND(OD)180 L=4983m : TP1N
BAP12-1 L=50m, BAP12-2 L=50m, BAP12-3 L=30m, BAP12-4 L=30m
IS×4, T×3, RE×4, 90° ×1, 22° ×4, V×7, DR×2, A×4, CF×1

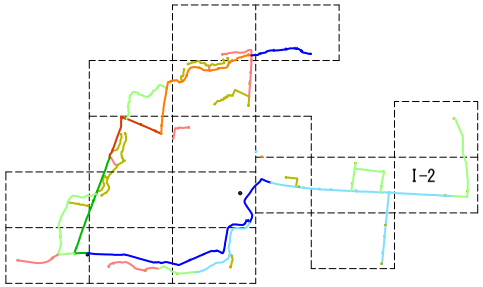
LEGEND							
Type of Pavement (TP)		Type of Diameter		Abbreviation			
①N	Asphalt National Road		DIP:ND450	IS	Inverted Siphon	V	Valve
	h=1.20m		DIP:ND400	OC	Over Cross	A	Air Valve
①C-1	Asphalt City Road		DIP:ND350	ISR	Inverted siphon Railway	H	Fire Hydrant
	h=0.80m		DIP:ND300	BAP	Bridge-attached Pipe	M	Meter
①C-2	Asphalt City Road		HDPE:ND(OD)280	PB	Pipe Beam		
	h=1.00m		HDPE:ND(OD)225	DR	Drain Pipe	CF	Connecting Fittings
②	Road Shoulder		HDPE:ND(OD)180	RE	Reducer		
	h=0.80m		HDPE:ND(OD)110	T	Tee	TP	Type of Pavement
③	Road Shoulder		HDPE:ND(OD)90	ISN	Inverted siphon National Road		
	h=1.00m		HDPE:ND(OD)63				
④	Concrete		Existing Pipe				
	h=0.80m						

PROJECT	DESCRIPTION	MINISTRY OF INDUSTRY AND HANDICRAFT	APPROVE BY	DATE
PREPARATORY SURVEY ON THE PROJECT FOR EXPANSION OF WATER SUPPLY SYSTEMS IN PURSAT	**Distribution Pipeline Plan(I-1)**	CTI ENGINEERING INTERNATIONAL CO., LTD. WATER AND SEWER BUREAU, CITY OF KITAKYUSHU TEC INTERNATIONAL CO., LTD.	PREPARED BY	DATE

DRAWING No **PD-17**
SCALE **1:8,000**

I-2

KEY PLAN



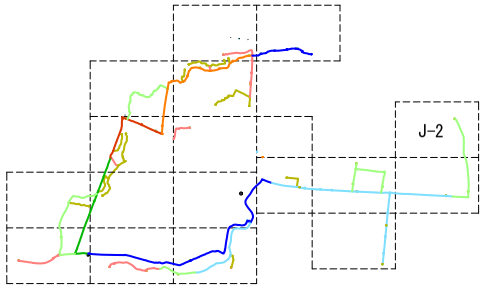
LEGEND

Type of Pavement (TP)		Type of Diameter		Abbreviation			
①N	Asphalt National Road		DIP:ND450	IS	Inverted Siphon	V	Valve
	h=1.20m		DIP:ND400	OC	Over Cross	A	Air Valve
①C-1	Asphalt City Road		DIP:ND350	ISR	Inverted siphon Railway	H	Fire Hydrant
	h=0.80m		DIP:ND300	BAP	Bridge-attached Pipe	M	Meter
①C-2	Asphalt City Road		HDPE:ND(OD)280	PB	Pipe Beam		
	h=1.00m		HDPE:ND(OD)225	DR	Drain Pipe	CF	Connecting Fittings
②	Road Shoulder		HDPE:ND(OD)180	RE	Reducer		
	h=0.80m		HDPE:ND(OD)110	T	Tee	TP	Type of Pavement
③	Road Shoulder		HDPE:ND(OD)90	ISN	Inverted siphon National Road		
	h=1.00m		HDPE:ND(OD)63				
④	Concrete		Existing Pipe				
	h=0.80m						

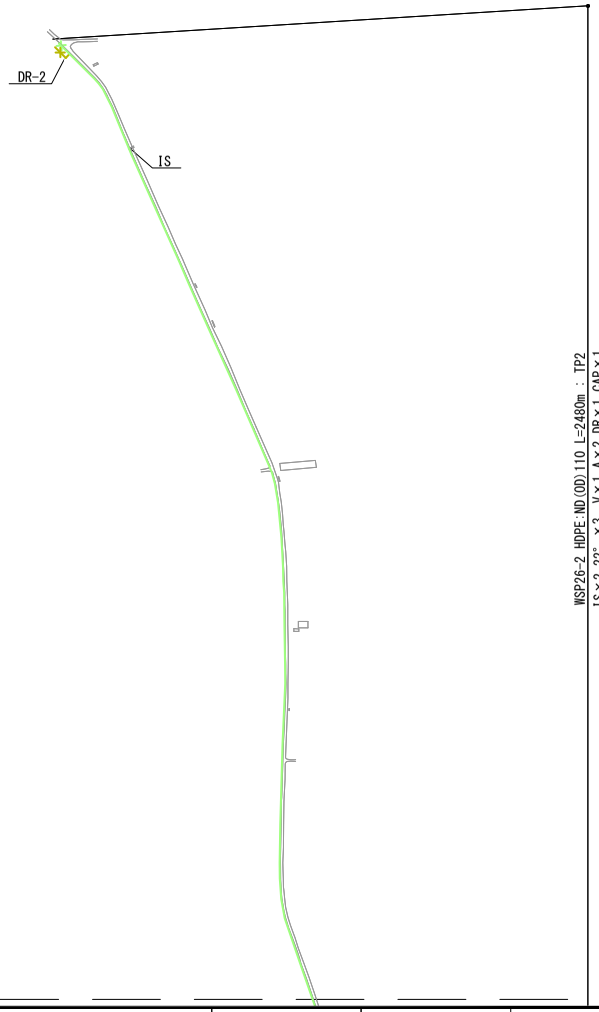
PROJECT	DESCRIPTION		APPROVE BY	DATE	DRAWING No
PREPARATORY SURVEY ON THE PROJECT FOR EXPANSION OF WATER SUPPLY SYSTEMS IN PURSAT	**Distribution Pipeline Plan(I-2)**	MINISTRY OF INDUSTRY AND HANDICRAFT			**PD-18**
		CTI ENGINEERING INTERNATIONAL CO., LTD. WATER AND SEWER BUREAU, CITY OF KITAKYUSHU TEC INTERNATIONAL CO., LTD.	PREPARED BY	DATE	SCALE **1:8,000**

J-2

KEY PLAN



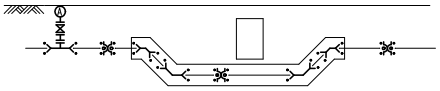
LEGEND							
Type of Pavement (TP)		Type of Diameter		Abbreviation			
①N	Asphalt National Road		DIP:ND450	IS	Inverted Siphon	V	Valve
	h=1.20m		DIP:ND400	OC	Over Cross	A	Air Valve
①C-1	Asphalt City Road		DIP:ND350	ISR	Inverted siphon Railway	H	Fire Hydrant
	h=0.80m		DIP:ND300	BAP	Bridge-attached Pipe	M	Meter
①C-2	Asphalt City Road		HDPE:ND(OD)280	PB	Pipe Beam		
	h=1.00m		HDPE:ND(OD)225	DR	Drain Pipe	CF	Connecting Fittings
②	Road Shoulder		HDPE:ND(OD)180	RE	Reducer		
	h=0.80m		HDPE:ND(OD)110	T	Tee	TP	Type of Pavement
③	Road Shoulder		HDPE:ND(OD)90	ISN	Inverted siphon National Road		
	h=1.00m		HDPE:ND(OD)63				
④	Concrete		Existing Pipe				
	h=0.80m						



PROJECT	DESCRIPTION		APPROVE BY	DATE	DRAWING No
PREPARATORY SURVEY ON THE PROJECT FOR EXPANSION OF WATER SUPPLY SYSTEMS IN PURSAT	**Distribution Pipeline Plan(J-2)**	MINISTRY OF INDUSTRY AND HANDICRAFT			**PD-19**
		CTI ENGINEERING INTERNATIONAL CO., LTD. WATER AND SEWER BUREAU, CITY OF KITAKYUSHU TEC INTERNATIONAL CO., LTD.	PREPARED BY	DATE	SCALE **1:8,000**

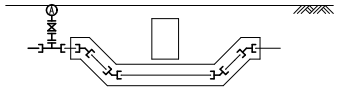
Typical Drawing for Connecting

IS(Inverted siphon)



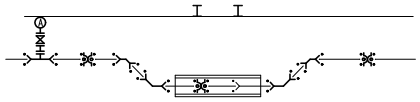
Material	Joint Type	Diameter	Number
Double Socket Bend	DIP(T)	250～450×45°	4
Double Socket Tee	DIP(T)	250～450	1
Collar	DIP(K)	250～450	3
Restrained Coupling	DIP(T)	250～450	10
Restrained Coupling	DIP(K)	250～450	6
Air Valve	—	80	1
Ball Valve	—	80×100H	1
Flange Extension Pipe	—	80×500H (h=1.20m)	1
Flange Extension Pipe	—	80×150H (h=0.80m)	1
Flange Joint	—	80	3

IS(Inverted siphon)



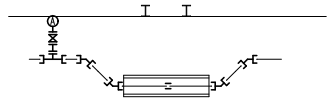
Material	Joint Type	Diameter	Number
Double Socket Bend	HDPE	63～225×45°	4
Double Socket Tee	HDPE	63～225×80	1
Air Valve	—	80	1
Ball Valve	—	80×100H	1
Flange Extension Pipe	—	80×500H (h=1.20m)	1
Flange Extension Pipe	—	80×150H (h=0.80m)	1
Flange Joint	—	80	3

ISR(Inverted Siphon Railway)



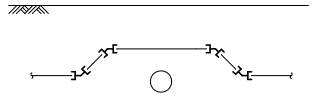
Material	Joint Type	Diameter	Number
Double Socket Bend	DIP(T)	250～450×45°	4
Double Socket Tee	DIP(T)	250～450	1
Collar	DIP(K)	250～450	3
Restrained Coupling	DIP(T)	250～450	10
Restrained Coupling	DIP(K)	250～450	6
Air Valve	—	80	1
Ball Valve	—	80×100H	1
Flange Extension Pipe	—	80×500H (h=1.20m)	1
Flange Extension Pipe	—	80×150H (h=0.80m)	1
Flange Joint	—	80	3

ISR(Inverted Siphon Railway)



Material	Joint Type	Diameter	Number
Double Socket Bend	HDPE	63～225×45°	4
Double Socket Tee	HDPE	63～225×80	1
Socket	HDPE	63～225	1
Air Valve	—	80	1
Ball Valve	—	80×100H	1
Flange Extension Pipe	—	80×500H (h=1.20m)	1
Flange Extension Pipe	—	80×150H (h=0.80m)	1
Flange Joint	—	80	3

OC-2(Over Cross)



Material	Joint Type	Diameter	Number
Double Socket Bend	HDPE	63～225×45°	4

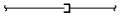
PC-1(Pipe cutting fittings-1)

Material	Joint Type	Diameter	Number
Collar	DIP(K)	250～450	1
Flanged Socket	DIP(T)	250～450	1
Flanged Spigot	DIP(T)	250～450	1
Valve	—	250～450	1
Restrained Coupling	DIP(T)	250～450	1
Restrained Coupling	DIP(K)	250～450	2
Flange Joint	—	250～450	2

PC-2(Pipe cutting fittings-2)

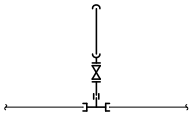
Material	Joint Type	Diameter	Number
Mechanical Adapter	HDPE	63～225	1
Stub Flange	HDPE	63～225	1
Socket	HDPE	63～225	1
Valve	—	63～225	1
Flange Joint	—	63～225	2

PC-3(Pipe cutting fittings-1)



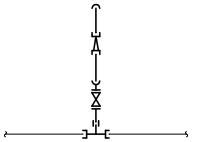
Material	Joint Type	Diameter	Number
Socket	HDPE	63～225	1
			1

PE-1(Pipe end fittings-1)



Material	Joint Type	Diameter	Number
Straight Pipe	HDPE	63	m
		80～225	m
Double Socket Tee	HDPE	63～225	1
Mechanical Adapter	HDPE	63～225	1
Stub Flange	HDPE	63～225	1
Socket	HDPE	63～225	1
Cap	HDPE	63～225	1
Valve	—	63～225	1
Flange Joint	—	63～225	2

PE-2(Pipe end fittings-2)



Material	Joint Type	Diameter	Number
Straight Pipe	HDPE	63	m
		80～225	m
Double Socket Tee	HDPE	63～225	1
Double Socket Reducer	HDPE	63～225	1
Mechanical Adapter	HDPE	63～225	1
Stub Flange	HDPE	63～225	1
Socket	HDPE	63～225	1
Cap	HDPE	63～225	1
Valve	—	63～225	1
Flange Joint	—	63～225	2

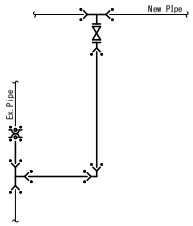
PROJECT PREPARATORY SURVEY ON THE PROJECT FOR EXPANSION OF WATER SUPPLY SYSTEM IN PURSAT AND SVAY RIENG IN THE KINGDOM OF CAMBODIA	DESCRIPTION Typical Drawing for Pipe Laying (1) Connecting	MINISTRY OF INDUSTRY AND HANDICRAFT	APPROVE BY	DATE	DRAWING No TYP-1
		CTI ENGINEERING INTERNATIONAL CO., LTD. WATER AND SEWER BUREAU, CITY OF KITAKYUSHU TEC INTERNATIONAL CO., LTD.	PREPARED BY	DATE	SCALE NONE

Typical Drawing for Connecting

PE-3

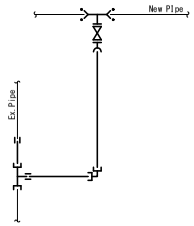
Material	Joint Type	Diameter	Number
Straight Pipe	HDPE	63	m
		80～225	m
Double Socket Reducer	HDPE	63～225	1
Mechanical Adapter	HDPE	63～225	1
Stub Flange	HDPE	63～225	1
Cap	HDPE	63～225	1
Valve	—	63～225	1
Flange Joint	—	63～225	2

CF-1 (Connecting fittings-1)



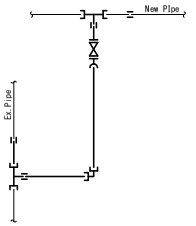
Material	Joint Type	Diameter	Number	Remarks
Straight Pipe	DIP(T)	250～450	2	Ex.Diameter
Triple Socket Tee	DIP(T)	250～450	1	Ex.Diameter
Double Socket Tee	DIP(T)	250～450	1	New×Ex
Double Socket Bend	DIP(T)	250～450×90°	1	Ex.Diameter
Collar	DIP(K)	250～450	1	Ex.Diameter
Flanged Socket	DIP(T)	250～450	1	Ex.Diameter
Restrained Coupling	DIP(T)	250～450	2	New Pipe Diameter
Restrained Coupling	DIP(T)	250～450	6	Ex.Diameter
Restrained Coupling	DIP(K)	250～450	2	Ex.Diameter
Valve	—	250～450	1	Ex.Diameter
Flange Joint	—	250～450	2	Ex.Diameter

CF-2 (Connecting fittings-2)



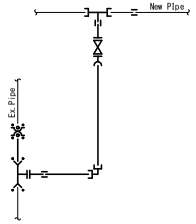
Material	Joint Type	Diameter	Number	Remarks
Straight Pipe	HDPE	63	m	
		80～225	m	
Double Socket Tee	DIP(T)	250～450	1	New×Ex
Double Socket Tee	HDPE	63～225	1	Ex×Ex
Double Socket Bend	HDPE	63～225×90°	1	Ex.Diameter
Socket	HDPE	63～225	2	Ex.Diameter
Mechanical Adapter	HDPE	63～225	1	Ex.Diameter
Restrained Coupling	DIP(T)	250～450	2	New Pipe Diameter
Valve	—	63～225	1	Ex.Diameter
Flange Joint	—	63～225	2	Ex.Diameter

CF-3 (Connecting fittings-3)



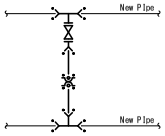
Material	Joint Type	Diameter	Number	Remarks
Straight Pipe	HDPE	63	m	
		80～225	m	
Double Socket Tee	HDPE	63～225	1	New×Ex
Double Socket Tee	HDPE	63～225	1	Ex.Diameter
Double Socket Bend	HDPE	63～225×90°	1	Ex.Diameter
Socket	HDPE	63～225	1	New Pipe Diameter
Socket	HDPE	63～225	3	Ex.Diameter
Mechanical Adapter	HDPE	63～225	1	Ex.Diameter
Stub Flange	HDPE	63～225	1	Ex.Diameter
Valve	—	63～225	1	Ex.Diameter
Flange Joint	—	63～225	2	Ex.Diameter

CF-3-2 (Connecting fittings-3-2)



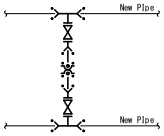
Material	Joint Type	Diameter	Number	Remarks
Straight Pipe	HDPE	63	m	
		80～225	m	
Straight Pipe	DIP(T)	250～450	1	
Double Socket Tee	DIP(T)	250～450	1	New×Ex
Double Socket Tee	HDPE	63～225	1	Ex.Diameter
Double Socket Bend	HDPE	63～225×90°	1	Ex.Diameter
Socket	HDPE	63～225	1	New Pipe Diameter
Socket	HDPE	63～225	2	Ex.Diameter
Mechanical Adapter	HDPE	63～225	1	Ex.Diameter
Stub Flange	HDPE	63～225	2	Ex.Diameter
Valve	—	63～225	1	Ex.Diameter
Flange Joint	—	63～225	3	Ex.Diameter
Collar	DIP(K)	250～450	1	Ex.Diameter
Restrained Coupling	DIP(T)	250～450	2	Ex.Diameter
Restrained Coupling	DIP(K)	250～450	2	Ex.Diameter

CF-4 (Connecting fittings-4)



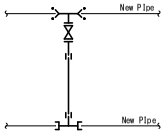
Material	Joint Type	Diameter	Number
Straight Pipe	DIP(T)	250～450	1
Triple Socket Tee	DIP(T)	250～450	1
Double Socket Tee	DIP(T)	250～450	1
Collar	DIP(K)	250～450	1
Flanged Socket	DIP(T)	250～450	1
Restrained Coupling	DIP(T)	250～450	6
Restrained Coupling	DIP(K)	250～450	2
Valve	—	250～450	1
Flange Joint	—	250～450	2

CF-4-2 (Connecting fittings-4-2)



Material	Joint Type	Diameter	Number
Straight Pipe	DIP(T)	250～450	1
Double Socket Tee	DIP(T)	250～450	2
Collar	DIP(K)	250～450	1
Flanged Socket	DIP(T)	250～450	2
Restrained Coupling	DIP(T)	250～450	6
Restrained Coupling	DIP(K)	250～450	2
Valve	—	250～450	2
Flange Joint	—	250～450	4

CF-5 (Connecting fittings-5)

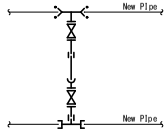


Material	Joint Type	Diameter	Number
Straight Pipe	HDPE	63	m
		80～225	m
Double Socket Tee	DIP(T)	250～450	1
Double Socket Tee	HDPE	63～225	1
Socket	HDPE	63～225	2
Stub Flange	HDPE	63～225	1
Restrained Coupling	DIP(T)	250～450	2
Valve	—	63～225	1
Flange Joint	—	63～225	2

PROJECT PREPARATORY SURVEY ON THE PROJECT FOR EXPANSION OF WATER SUPPLY SYSTEM IN PURSAT AND SVAY RIENG IN THE KINGDOM OF CAMBODIA	DESCRIPTION Typical Drawing for Pipe Laying (2) Connecting	MINISTRY OF INDUSTRY AND HANDICRAFT	APPROVE BY	DATE	DRAWING No TYP-2
		CTI ENGINEERING INTERNATIONAL CO., LTD. WATER AND SEWER BUREAU, CITY OF KITAKYUSHU TEC INTERNATIONAL CO., LTD.	PREPARED BY	DATE	SCALE NONE

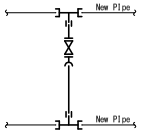
Typical Drawing for Connecting

CF-5-2(Connecting fittings-5-2)



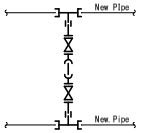
Material	Joint Type	Diameter	Number
Straight Pipe	HDPE	63	m
		80～225	m
Double Socket Tee	DIP(T)	250～450	1
Double Socket Tee	HDPE	63～225	1
Socket	HDPE	63～225	2
Mechanical Adapter	HDPE	63～225	1
Stub Flange	HDPE	63～225	2
Restrained Coupling	DIP(T)	250～450	2
Valve	—	250～450	2
Flange Joint	—	250～450	4

CF-6(Connecting fittings-6)



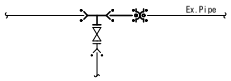
Material	Joint Type	Diameter	Number
Straight Pipe	HDPE	63～225	m
Double Socket Tee	HDPE	63～225	2
Socket	HDPE	63～225	2
Mechanical Adapter	HDPE	63～225	1
Stub Flange	HDPE	63～225	1
Valve	—	63～225	1
Flange Joint	—	63～225	2

CF-6-2(Connecting fittings-6-2)



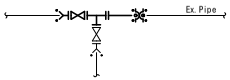
Material	Joint Type	Diameter	Number
Straight Pipe	HDPE	63	m
		80～225	m
Double Socket Tee	HDPE	63～225	2
Socket	HDPE	63～225	2
Mechanical Adapter	HDPE	63～225	2
Stub Flange	HDPE	63～225	2
Valve	—	63～225	2
Flange Joint	—	63～225	4

CF-7(Connecting fittings-7)



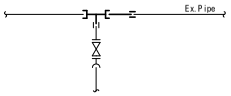
Material	Joint Type	Diameter	Number
Straight Pipe	DIP(T)	250～450	1
Double Socket Tee	DIP(T)	250～450	1
Collar	DIP(K)	250～450	1
Restrained Coupling	DIP(T)	250～450	2
Restrained Coupling	DIP(K)	250～450	2

CF-8(Connecting fittings-8)



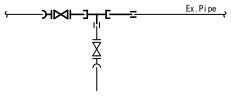
Material	Joint Type	Diameter	Number
Triple Flanged Tee	DIP(T)	250～450	1
Collar	DIP(K)	250～450	1
Flanged Socket	DIP(T)	250～450	1
Flanged Spigot	DIP(T)	250～450	1
Valve	—	250～450	1
Restrained Coupling	DIP(T)	250～450	1
Restrained Coupling	DIP(K)	250～450	2
Flange Joint	—	250～450	3

CF-9(Connecting fittings-9)



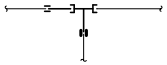
Material	Joint Type	Diameter	Number
Straight Pipe	HDPE	63	m
		80～225	m
Double Socket Tee	HDPE	63～225	1
Socket	HDPE	63～225	1

CF-10(Connecting fittings-10)



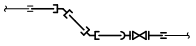
Material	Joint Type	Diameter	Number
Straight Pipe	HDPE	63	m
		80～225	m
Double Socket Tee	HDPE	63～225	1
Mechanical Adapter	HDPE	63～225	1
Stub Flange	HDPE	63～225	1
Socket	HDPE	63～225	1
Valve	—	63～225	1
Flange Joint	—	63～225	2

CF-11



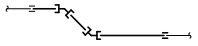
Material	Joint Type	Diameter	Number
Straight Pipe	HDPE	63	m
		80～225	m
Double Socket Tee	HDPE	63～225	1
Socket	HDPE	63～225	2

CF-12



Material	Joint Type	Diameter	Number
Straight Pipe	HDPE	63	m
		80～225	m
Double Socket Bend	HDPE	63～225×45°	2
Socket	HDPE	63～225	1
Mechanical Adapter	HDPE	63～225	1
Valve	—	63～225	1
Flange Joint	—	63～225	2
Stub Flange	HDPE	63～225	1

CF-13

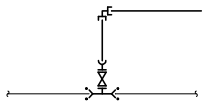


Material	Joint Type	Diameter	Number
Straight Pipe	HDPE	63	m
		80～225	m
Double Socket Bend	HDPE	63～225×45°	2
Socket	HDPE	63～225	1

PROJECT PREPARATORY SURVEY ON THE PROJECT FOR EXPANSION OF WATER SUPPLY SYSTEM IN PURSAT AND SVAY RIENG IN THE KINGDOM OF CAMBODIA	DESCRIPTION Typical Drawing for Pipe Laying (3) Connecting	MINISTRY OF INDUSTRY AND HANDICRAFT	APPROVE BY	DATE	DRAWING No TYP-3
		CTI ENGINEERING INTERNATIONAL CO., LTD. WATER AND SEWER BUREAU, CITY OF KITAKYUSHU TEC INTERNATIONAL CO., LTD.	PREPARED BY	DATE	SCALE NONE

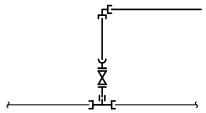
Typical Drawing for Connecting

DR-1(Drain pipe fittings-1)



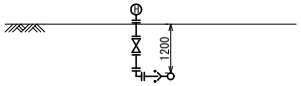
Material	Joint Type	Diameter	Number
Double Socket Tee	DIP(T)	250～450×110,180	1
Restrained Coupling	DIP(T)	250～450	2
Straight Pipe	HDPE	110,180	m
Double Socket Bend	HDPE	110,180×90°	1
Mechanical Adapter	HDPE	110,180	1
Valve	—	110,180	1
Flange Joint	—	110,180	2

DR-2(Drain pipe fittings-2)



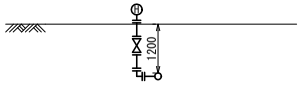
Material	Joint Type	Diameter	Number
Straight Pipe	HDPE	63	m
		80～225	m
Double Socket Tee	HDPE	63～225×63	1
Double Socket Bend	HDPE	63×90°	1
Mechanical Adapter	HDPE	63～225	1
Stub Flange	HDPE	63～225	1
Socket	HDPE	63～225	1
Valve	—	63～225	1
Flange Joint	—	63～225	2

H-1(Fire Hydrant-1)



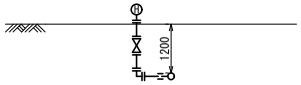
Material	Joint Type	Diameter	Number
Triple Socket Tee	DIP(T)	350～450×100	1
Flanged Spigot	DIP(T)	100	1
Double Flanged Bend	—	100×90°	1
Flange Extension Pipe	—	100×350H	1
Flange Extension Pipe	—	100×650H	1
Ball Valve	—	100×100H	1
Fire Hydrant (Double Mouths)	—	100	1
Restrained Coupling	DIP(T)	100	1
Flange Joint	—	100	5

H-2(Fire Hydrant-2)



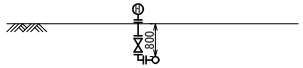
Material	Joint Type	Diameter	Number
Double Socket Tee	DIP(T)	250×80	1
Double Flanged Bend	—	80×90°	1
Flange Extension Pipe	—	80×350H	1
Flange Extension Pipe	—	80×650H	1
Ball Valve	—	80×100H	1
Fire Hydrant (Sigle Mouth)	—	80	1
Flange Joint	—	80	5

H-3(Fire Hydrant-3)



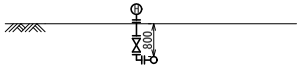
Material	Joint Type	Diameter	Number
Double Socket Tee	HDPE	110～225×80	1
Socket	HDPE	80	1
Stub Flange	HDPE	80	1
Double Flanged Bend	—	80	1
Flange Extension Pipe	—	80×400H	1
Flange Extension Pipe	—	80×650H	1
Ball Valve	—	80×100H	1
Fire Hydrant (Sigle Mouth)	—	80	1
Flange Joint	—	80	5

H-4(Fire Hydrant-4)



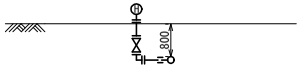
Material	Joint Type	Diameter	Number
Double Socket Tee	DIP(T)	250×80	1
Flanged Spigot	DIP(T)	80	1
Double Flanged Bend	—	80	1
Flange Extension Pipe	—	80×650H	1
Ball Valve	—	80×100H	1
Fire Hydrant (Sigle Mouth)	—	80	1
Flange Joint	—	80	4

H-5(Fire Hydrant-5)



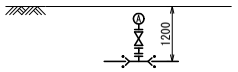
Material	Joint Type	Diameter	Number
Double Socket Tee	DIP(T)	350～450×100	1
Flanged Spigot	DIP(T)	100	1
Double Flanged Bend	—	100	1
Flange Extension Pipe	—	100×650H	1
Ball Valve	—	100×100H	1
Fire Hydrant (Double Mouths)	—	100	1
Flange Joint	—	100	4

H-6(Fire Hydrant-6)



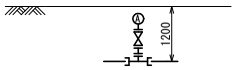
Material	Joint Type	Diameter	Number
Double Socket Tee	HDPE	110～225×80	1
Socket	HDPE	80	1
Stub Flange	HDPE	80	1
Double Flanged Bend	—	80	1
Flange Extension Pipe	—	80×650H	1
Ball Valve	—	80×100H	1
Fire Hydrant (Sigle Mouth)	—	80	1
Flange Joint	—	80	4

A-1(Air Valve-1)



Material	Joint Type	Diameter	Number
Double Socket Tee	DIP(T)	250～450×80	1
Flange Extension Pipe	—	80×500H	1
Ball Valve	—	80×100H	1
Air Valve	—	80	1
Restrained Coupling	DIP(T)	200～500	2
Flange Joint	—	80	3

A-2(Air Valve-2)

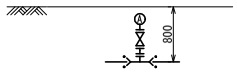


Material	Joint Type	Diameter	Number
Double Socket Tee	HDPE	90～220×80	1
Flange Extension Pipe	—	80×500H	1
Ball Valve	—	80×100H	1
Air Valve	—	80	1
Flange Joint	—	80	3

PROJECT PREPARATORY SURVEY ON THE PROJECT FOR EXPANSION OF WATER SUPPLY SYSTEM IN PURSAT AND SVAY RIENG IN THE KINGDOM OF CAMBODIA	DESCRIPTION Typical Drawing for Pipe Laying (4) Connecting	MINISTRY OF INDUSTRY AND HANDICRAFT	APPROVE BY	DATE	DRAWING No TYP-4
		CTI ENGINEERING INTERNATIONAL CO., LTD. WATER AND SEWER BUREAU, CITY OF KITAKYUSHU TEC INTERNATIONAL CO., LTD.	PREPARED BY	DATE	SCALE NONE

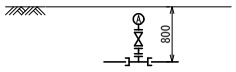
Typical Drawing for Connecting

A-3(Air Valve-3)



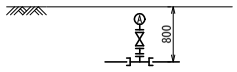
Material	Joint Type	Diameter	Number
Double Socket Tee	DIP(T)	250～450×80	1
Flange Extension Pipe	—	80×150H	1
Ball Valve	—	80×100H	1
Air Valve	—	80	1
Restrained Coupling	DIP(T)	250～450	2
Flange Joint	—	250～450	3

A-4(Air Valve-4)



Material	Joint Type	Diameter	Number
Double Socket Tee	HDPE	63×50	1
Flange Extension Pipe	—	50×150H	1
Ball Valve	—	50×100H	1
Air Valve	—	50	1
Flange Joint	—	50	3

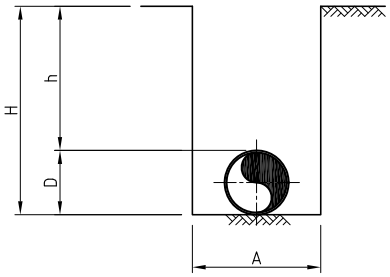
A-5(Air Valve-5)



Material	Joint Type	Diameter	Number
Double Socket Tee	HDPE	90～225×80	1
Flange Extension Pipe	—	80×150H	1
Ball Valve	—	80×100H	1
Air Valve	—	80	1
Flange Joint	—	80	3

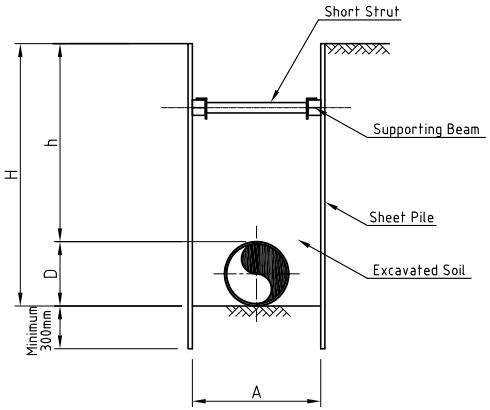
PROJECT PREPARATORY SURVEY ON THE PROJECT FOR EXPANSION OF WATER SUPPLY SYSTEM IN PURSAT AND SVAY RIENG IN THE KINGDOM OF CAMBODIA	DESCRIPTION Typical Drawing for Pipe Laying (5) Connecting	MINISTRY OF INDUSTRY AND HANDICRAFT	APPROVE BY	DATE	DRAWING No TYP-5
		CTI ENGINEERING INTERNATIONAL CO., LTD. WATER AND SEWER BUREAU, CITY OF KITAKYUSHU TEC INTERNATIONAL CO., LTD.	PREPARED BY	DATE	SCALE NONE

Typical Drawing for Pipe Laying



MACHINE EXCAVATION

NORMAL PART



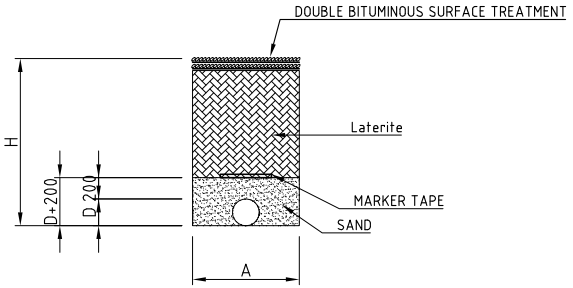
MACHINE EXCAVATION

SHEET PILE PART

TYPICAL SIZE OF TRENCH EXCAVATION (MACHINE EXCAVATION)

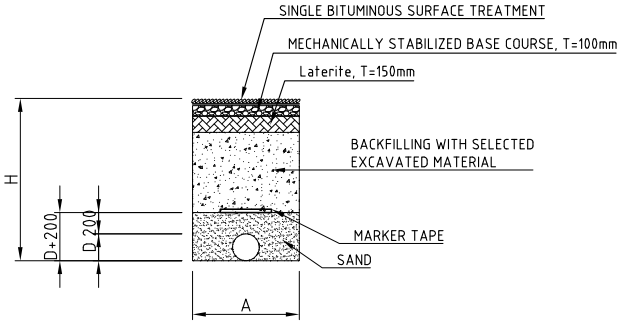
PIPE		NORMAL PART			SHEET PILE PART		
PIPE MATERIAL	NOMINAL PIPE DIAMETER D(mm)	TRENCH WIDTH A(m)	DEPTH OF COVER *1 h(m)	EXCAVATION DEPTH H(m)	TRENCH WIDTH A(m)	DEPTH OF COVER *1 h(m)	EXCAVATION DEPTH H(m)
HDPE	50(63)	0.50	0.8/1.2	0.87/1.27	0.70	-	H ≧ 1.50
	75(90)	0.50	0.8/1.2	0.89/1.29	0.70	-	H ≧ 1.50
	100(110)	0.50	0.8/1.2	0.91/1.31	0.75	-	H ≧ 1.50
	150(180)	0.50	0.8/1.2	0.96/1.36	0.80	-	H ≧ 1.50
	200(225)	0.50	0.8/1.2	1.22/1.42	0.85	-	H ≧ 1.50
DIP	250	0.50	0.8/1.2	1.05/1.45	0.85	-	H ≧ 1.50
	300	0.55	0.8/1.2	1.10/1.50	0.90	-	H ≧ 1.50
	350	0.60	0.8/1.2	1.15/1.55	1.00	-	H ≧ 1.50
	400	0.70	0.8/1.2	1.20/1.60	1.05	-	H ≧ 1.50
	450	0.75	1.0/1.2	1.45/1.65	1.10	-	H ≧ 1.50

*1 Depth of cover : Depend on the site condition.



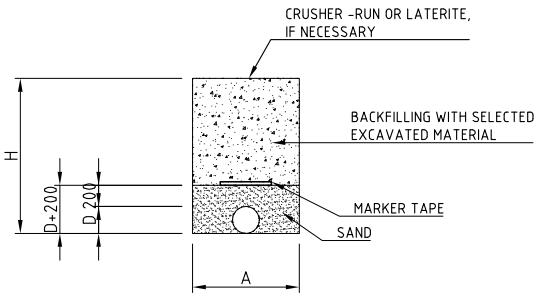
BACKFILL

TP:1N, ROADWAY OF THE NATIONAL ROAD



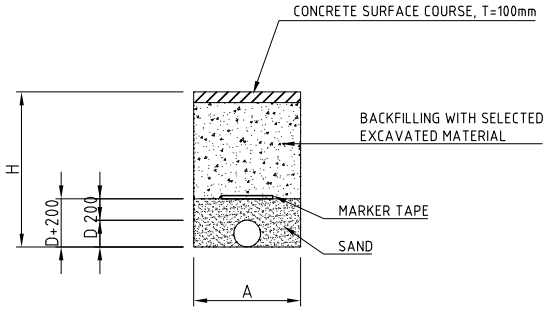
BACKFILL

TP:1C, CITY ROAD (PAVING)
SHOULDER OF THE NATIONAL ROAD



BACKFILL (TP: 3)

TP:2,3 . ROAD SHOULDER

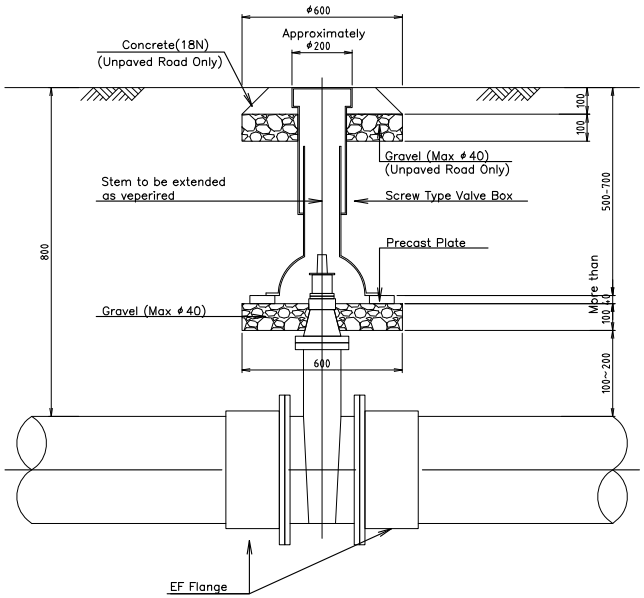


BACKFILL

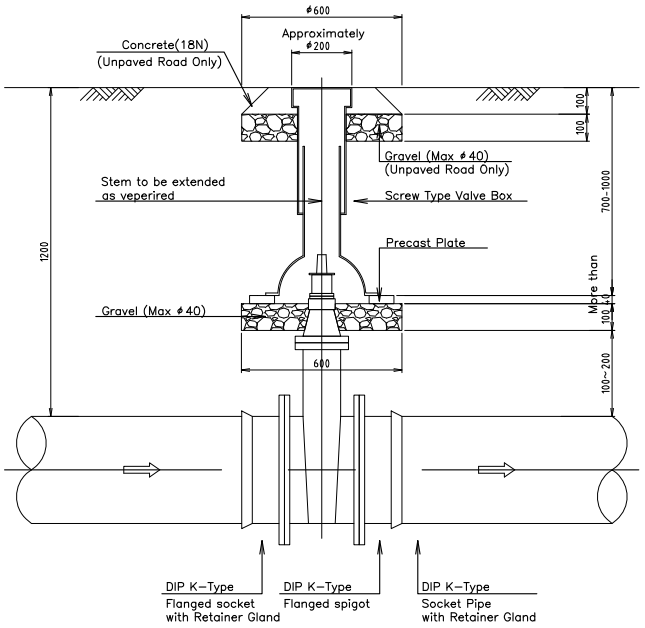
TP: 4, CONCRETE SURFACE COURSE

PROJECT	PREPARATORY SURVEY ON THE PROJECT FOR EXPANSION OF WATER SUPPLY SYSTEM IN PURSAT AND SVAY RIENG IN THE KINGDOM OF CAMBODIA	DESCRIPTION	MINISTRY OF INDUSTRY AND HANDICRAFT	APPROVE BY	DATE / DRAWING No TYP-6
		Typical Drawing for Pipe Laying General Earth Work for Pipe Laying	CTI ENGINEERING INTERNATIONAL CO., LTD. WATER AND SEWER BUREAU, CITY OF KITAKYUSHU TEC INTERNATIONAL CO., LTD.	PREPARED BY	DATE / SCALE NONE

Typical Drawing for Sluice Valve



SLUICE VALVE INSTALLATION
(HDPE:ND(OD)63–225)



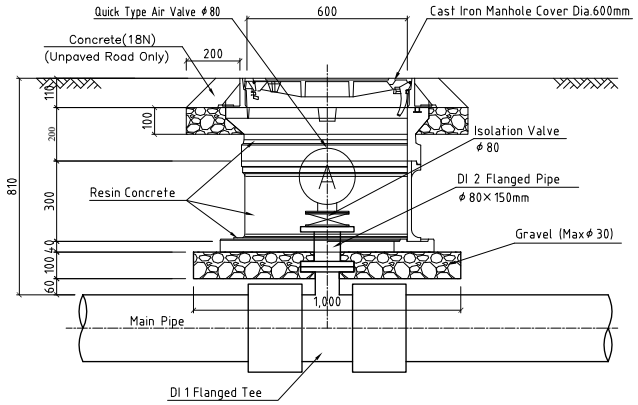
SLUICE VALVE INSTALLATION
(DIP:ND250–450)

NOTE

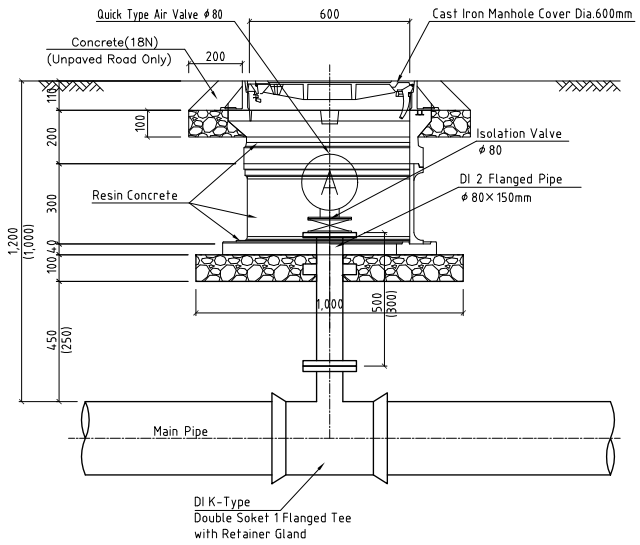
1. ALL SLUICE VALVES LESS THAN 400mm DIA WILL HAVE NO CHAMBERS AND WILL BE INSTALLED SEEMLIER TO WASH OUT VALVES HEAVY-DUTY SURFACE BOXES AT THE ROAD LEVEL TO OPERATE THEM.
2. ALL DIMENSIONS ARE IN mm.

PROJECT	DESCRIPTION		APPROVE BY	DATE	DRAWING No
PREPARATORY SURVEY ON THE PROJECT FOR EXPANSION OF WATER SUPPLY SYSTEM IN PURSAT AND SVAY RIENG IN THE KINGDOM OF CAMBODIA	Typical Drawing for Pipe Laying Sluice Valve	MINISTRY OF INDUSTRY AND HANDICRAFT			TYP-7
		CTI ENGINEERING INTERNATIONAL CO., LTD. WATER AND SEWER BUREAU, CITY OF KITAKYUSHU TEC INTERNATIONAL CO., LTD.	PREPARED BY	DATE	SCALE NONE

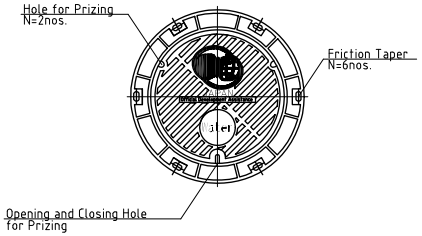
Typical Drawing for Installation of Air Valve and Washout



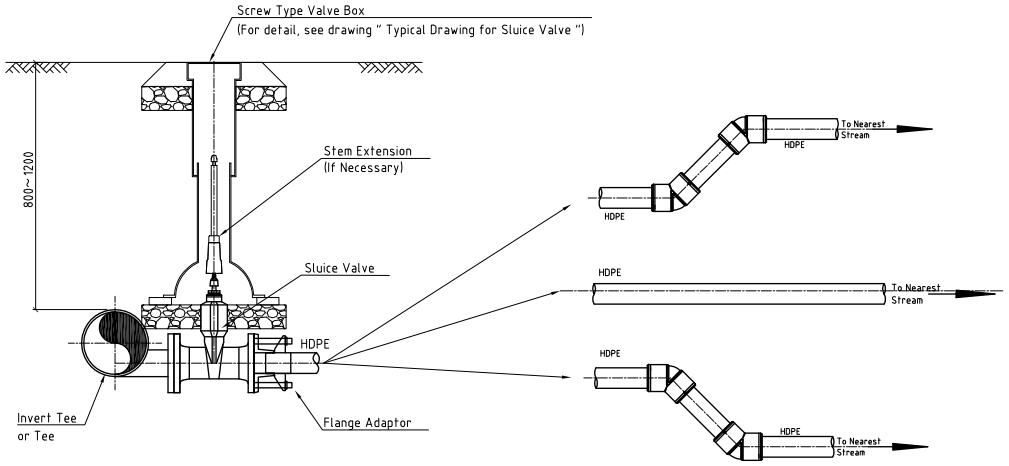
AIR VALVE CHAMBER
MAIN PIPE ≦ND(OD)220 (HDPE)



AIR VALVE CHAMBER
MAIN PIPE ND250~350 (DIP)



CAST IRON MANHOLE COVER
ϕ500 (No.3 Type)



WASHOUT

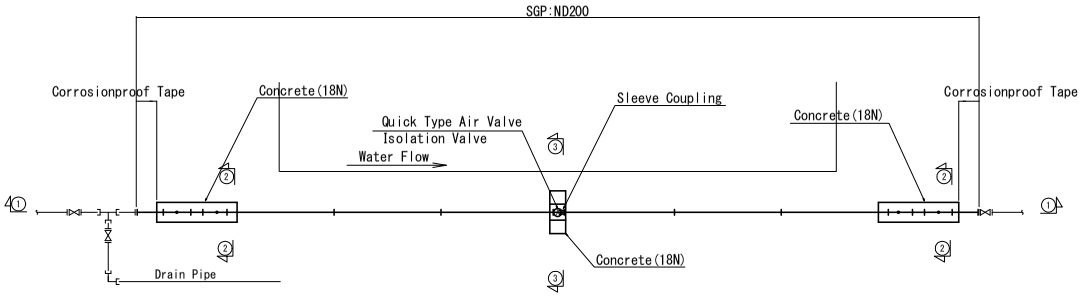
CRITERIA FOR AIR VALVE AND WASH OUT

MAIN PIPE	MAIN PIPE MATERIAL	BRANCH PIPE for AIR VALVE	BRANCH PIPE for WASH OUT
ϕ50(63)	HDPE	ϕ50	ϕ50
ϕ75(90)		ϕ80	ϕ50
ϕ100(110)		ϕ80	ϕ50
ϕ150(180)		ϕ80	ϕ50
ϕ200(225)		ϕ80	ϕ50
ϕ250	DIP	ϕ80	ϕ100
ϕ300		ϕ80	ϕ100
ϕ350		ϕ80	ϕ150
ϕ400		ϕ80	ϕ150
ϕ450		ϕ80	ϕ150

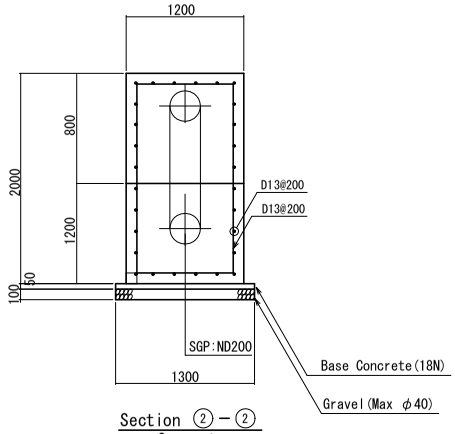
NOTE

1. THE THICKNESS OF THE BLINDING LAYER SPECIFIED IN THE DRAWING IS FOR NORMAL SOIL TYPES. HOWEVER, IF THE STRUCTURE IS FOUNDED ON VERY WEAK SOIL SUCH AS PEAT, A GROUND STABILIZATION METHOD, AS DIRECTED BY THE ENGINEER, SHALL BE FOLLOWED.
2. THE TOP OF THE AIR VALVE CHAMBER SHOULD BE AT THE SAME LEVEL AS THE ROAD TOP LEVEL.
3. THE VALVE BOXES FOR WASHOUT MAY BE ON THE BANK OF THE ROAD.
4. ALL DIMENSIONS ARE IN mm.

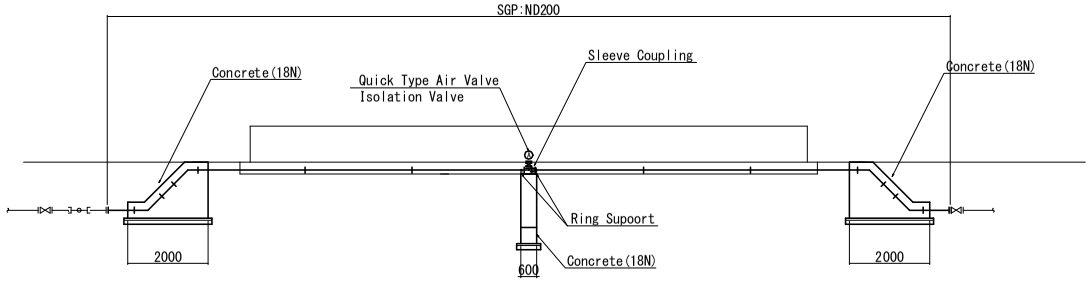
PROJECT	DESCRIPTION		APPROVE BY	DATE	DRAWING No
PREPARATORY SURVEY ON THE PROJECT FOR EXPANSION OF WATER SUPPLY SYSTEM IN PURSAT AND SVAY RIENG IN THE KINGDOM OF CAMBODIA	Typical Drawing for Pipe Laying Installation of Air Valve and Washout	MINISTRY OF INDUSTRY AND HANDICRAFT			TYP-8
		CTI ENGINEERING INTERNATIONAL CO., LTD. WATER AND SEWER BUREAU, CITY OF KITAKYUSHU TEC INTERNATIONAL CO., LTD.	PREPARED BY	DATE	SCALE NONE



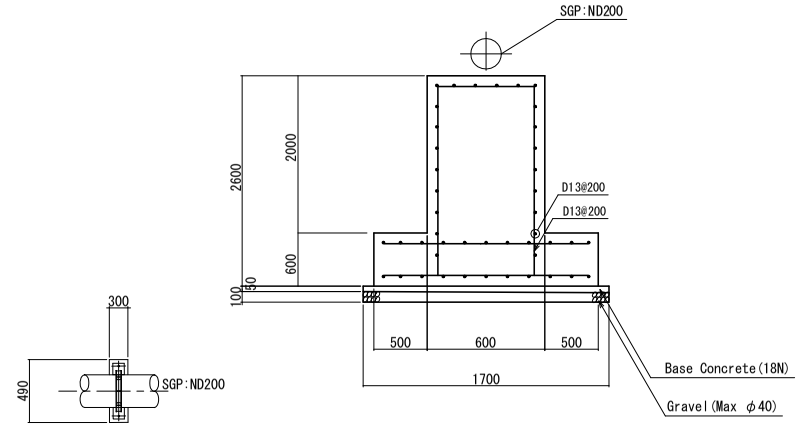
PLAN



Section ②－②
Concrete



Section ①－①



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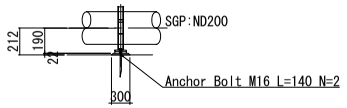
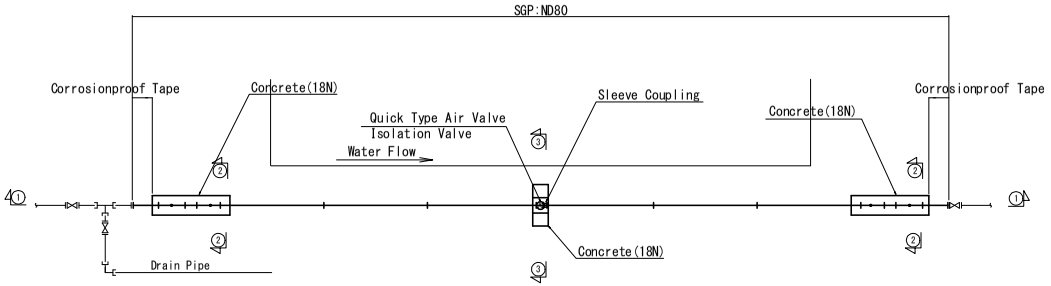
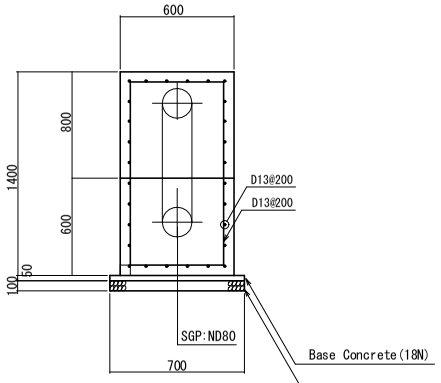


PROJECT	DESCRIPTION		APPROVE BY	DATE	DRAWING No
PREPARATORY SURVEY ON THE PROJECT FOR EXPANSION OF WATER SUPPLY SYSTEM IN PURSAT AND SVAY RIENG IN THE KINGDOM OF CAMBODIA	Typical Drawing for Pipe Beam ND200	MINISTRY OF INDUSTRY AND HANDICRAFT			TYP-9
		CTI ENGINEERING INTERNATIONAL CO., LTD. WATER AND SEWER BUREAU, CITY OF KITAKYUSHU TEC INTERNATIONAL CO., LTD.	PREPARED BY	DATE	SCALE NONE



PLAN



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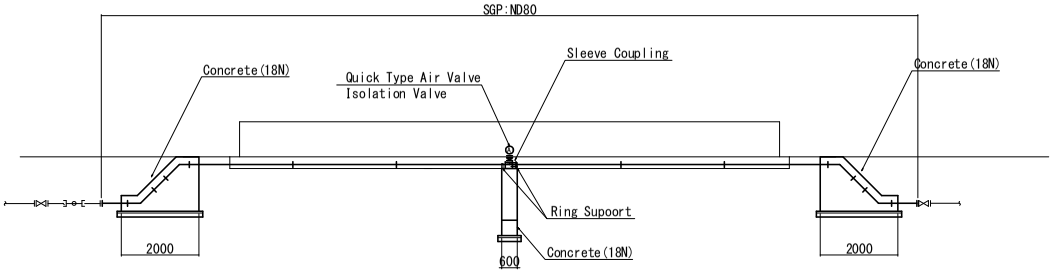

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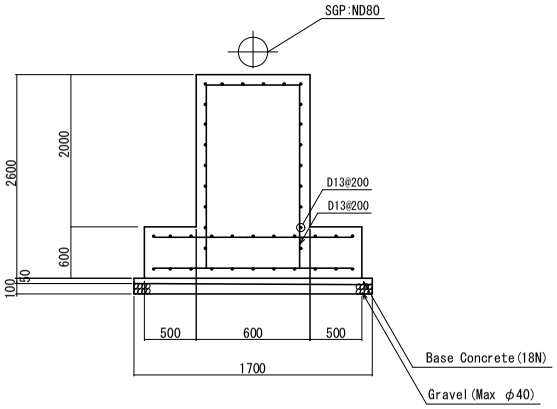

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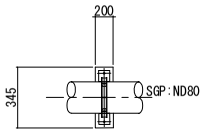
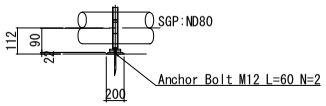
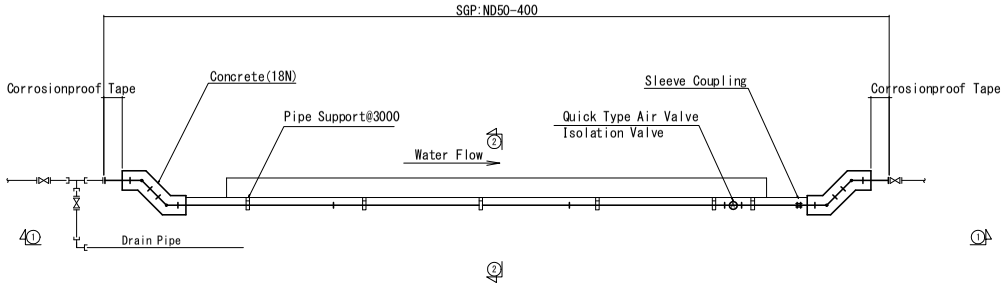


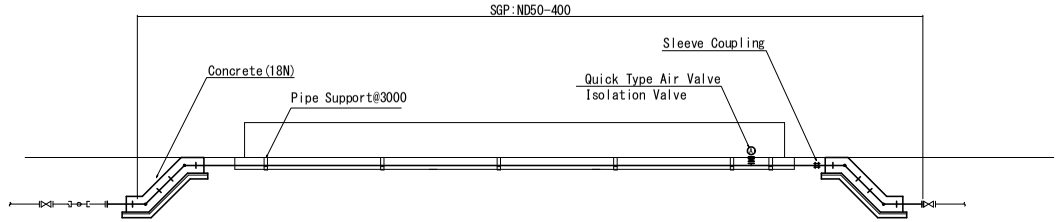


Ring Supoort

PROJECT: PREPARATORY SURVEY ON THE PROJECT FOR EXPANSION OF WATER SUPPLY SYSTEM IN PURSAT AND SVAY RIENG IN THE KINGDOM OF CAMBODIA	DESCRIPTION: Typical Drawing for Pipe Beam ND80	MINISTRY OF INDUSTRY AND HANDICRAFT	APPROVE BY	DATE	DRAWING No: TYP-10
		CTI ENGINEERING INTERNATIONAL CO., LTD. WATER AND SEWER BUREAU, CITY OF KITAKYUSHU TEC INTERNATIONAL CO., LTD.	PREPARED BY	DATE	SCALE: NONE



PLAN



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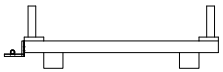

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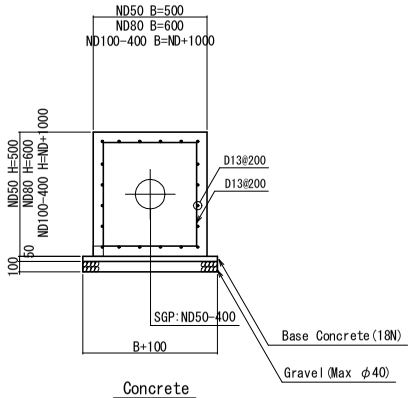

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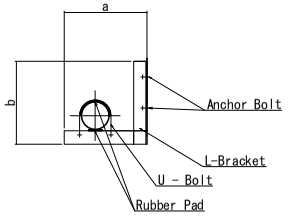


Pipe Support

ND	a	b	L-Bracket	Anchor Bolt	U - Bolt	Rubber Pad
50	250	300	65×65×6 SUS304	M12 L=60	50A M12	t=10mm L=5cm
80	300	350	65×65×6 SUS304	M12 L=60	80A M12	t=10mm L=5cm
100	400	400	65×65×6 SUS304	M12 L=60	100A M12	t=10mm L=5cm
150	400	400	65×65×6 SUS304	M16 L=140	150A M16	t=10mm L=10cm
200	450	400	75×75×6 SUS304	M16 L=140	200A M20	t=10mm L=10cm
250	500	450	100×100×10 SUS304	M16 L=140	250A M20	t=10mm L=10cm
350	550	500	100×100×10 SUS304	M16 L=140	350A M20	t=10mm L=10cm
400	550	500	100×100×10 SUS304	M16 L=140	400A M20	t=10mm L=10cm

PROJECT	PREPARATORY SURVEY ON THE PROJECT FOR EXPANSION OF WATER SUPPLY SYSTEM IN PURSAT AND SVAY RIENG IN THE KINGDOM OF CAMBODIA	DESCRIPTION	Typical Drawing for Bridge Attached Pipe	MINISTRY OF INDUSTRY AND HANDICRAFT	APPROVE BY	DATE
				CTI ENGINEERING INTERNATIONAL CO., LTD. WATER AND SEWER BUREAU, CITY OF KITAKYUSHU TEC INTERNATIONAL CO., LTD.	PREPARED BY	DATE

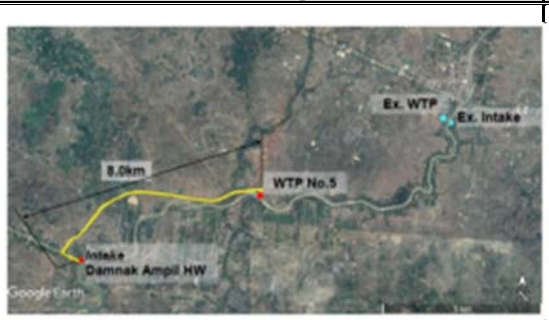
DRAWING No TYP-11

SCALE NONE

Annex 7.3

Intake and WTP Site in Pursat

Intake and WTP Site in Pursat

		Case1 （Intake：Dhamnak Ampil, WTP：No.5）	Case2 （Intake：near the existing intake point, WTP：No.2）
Plan Drawing			
Outline of Intake Site and Facilities		**Site Condition** - WL Condition: LWL+16.300m, HWL+18.200m Water Level Fluctuation:1.9m - Land: 100mx100m (Intake and Yard for Construction) - 1.0m of inundation depth from the ground in 1996 and 2006 **Civil Work** - Conveyance Pipe: DIP350 x 8,000m - Pump Room and ancillary works : LxWxH=37.3mx8.4mx10.5m - Generator Room: LxWxH=6mx5mx4m - Land Creation: 0.5m up (EL18.070m→EL18.570m) **Temporary Work** - Coffer Dam of River Side, Steel Sheet Pile SP-III - Excavation by Open Cut **Mechanical Works** - Pump Type: Horizontal End Suction Pump - Pump Head:37m - Pump :150mm/ 2duty +1 stand-by/ 30kW - Q=5.04m3/min	**Site Condition** - WL Condition: LWL+11.635m, HWL+17.635m Water Level Fluctuation:6.0m - Land: 50mx50m, Residential houses are adjacent. (Intake and Yard for Construction) - Flood Prone Area, 2.0m of inundation depth from the ground in 1996 and 2006 **Civil Work** - Conveyance Pipe: DIP350 x 1,500m - Size of Pump Room and ancillary works : LxWxH=44.0mx8.1mx14.5m - Generator Room: LxWxH=6mx5mx4m - Land Creation: 2.0m up (EL16.135m→EL18.135m) **Temporary Work** - Coffer Dam of River Side, Steel Sheet Pile SP-IV - Retaining Wall for Civil Work Construction SP-IV **Mechanical Works** - Pump Type: Horizontal End Suction Pump - Pump Head:21m - Pump :150mm/ 2duty +1 stand-by/ 15kW - Q=5.04m3/min
Outline of WTP Site and Facilities		**Site Condition** - Candidate Site No.5 - Area:100mx100m - 1.0m of inundation depth from the ground in 1996 and 2006 - Distance from the River: Approx.400m **Civil Work** - Land Creation: 1.0m up (EL17.650m→EL18.650m) - Land Creation of Access Road: not Required (EL18.650m) **Temporary Work** - Access from the Main Road	**Site Condition** - Candidate Site No.2 - Area:100mx100m, Elementary school is adjacent. - Flood Prone Area, 2.0m of inundation depth from the ground in 1996 and 2006 - Distance from the River: Approx.400m - 4 Residential Houses along Access Road **Civil Work** - Land Creation: 2.0m up (EL15.260m→EL17.260m) - Land Creation of Access Road: 1.0m (EL16.260m→EL17.260m) **Temporary Work** - Construction Road: L=500m, W=10m
Status of the water source	Stability of water intake	○Stable river channel ○Proven track records of the water intake for the irrigation ○Sufficient amount of water and water depth in the dry season	○Stable river channel ○Located near the existing water intake facilities (upstream side) ○Sufficient amount of water and water depth in the dry season

		Case1 （Intake：Dhamnak Ampil, WTP：No.5）	Case2 （Intake：near the existing intake point, WTP：No.2）
	Situation of sediment	○Coarse sand and a certain amount of floating sand accumulate in the flooded pond of the weir. ○The flow is relatively slow because of the wide flooded pond, and the migration and floating of the silt part are less. ○Sedimentation volume is less than Case2 and the damage to the intake pump will be less.	▲Move of sandy soil (bedload, floating sand wash load) is relatively large. ▲The flow is relatively fast and the silt is easy to move and float. ▲Sedimentation volume is more than Case1 and the damage to the pump will be more.
Construction	Workability	○ Large-scale temporary facilities are unnecessary because changes in the water level during the dry season and rainy season are small. ○The traffic of heavy construction machinery is easy because of flat ground shape and the stability of heavy construction machinery can be secured. ○Easy access from the main road. ○Construction period for pump station is relatively short because the scale of the facilities (sedimentation basin and pumping station) are smaller than Case 2. ▲It takes time to install conveyance pipes because of long distance.	▲Large-scale temporary earth retaining work is required, because changes in the water level during the dry season and rainy season are large and houses are adjacent to facilities. ▲The traffic of heavy construction machinery is difficult due to the narrow space of intake site and the stability of rough terrain crane with vibro hammer cannot be secured due to the unevenness of ground surface shape. ▲It is difficult to carry in/out construction vehicles, because the access road to the WTP is narrow and passes through a residential area. Embankment and widening of the existing access road, or the provision of new construction road is required. ▲Construction period for pump station is relatively long because the scales of the facilities (pump station and ancillary works) are larger than Case 1. ○The conveyance pipe is short, so the construction period is short.
	Impact on surrounding environment	○Neighboring construction is not required because there are few adjacent houses at the intake pump station and the WTP site. ○There is no houses near the WTP site ○There is no important facilities near WTP site.	▲Neighboring construction is required because there are houses around the intake facility. ▲Impact on houses by widening the access road to the WTP site. ▲Using the school route of elementary school as the access road to the treatment plant is not preferred for safety reasons. It must be set such as the detour path or the temporary school road. In addition, there is the possibility that adverse effects on the school activities by noise and vibration during the construction will occur. Therefore, measures must be taken against them.
Facilities	Civil engineering facility	○Both pumping station and ancillary works of the water intake point are smaller than those of Case 2. ○The risk of flooding is small, and the height of land forming is low. ▲The water conveyance pipe extension is long (8.0 km).	▲Both pumping station and ancillary works of the water intake point are larger than those of Case 1. ▲Since WTP site is in flood prone, it is necessary to raise the ground (about 2 m, in 1996 and 2006). ○The water conveyance pipe extension is relatively short (1.5 km).
	Electromechanical equipment	▲Large motor output. Electricity cost is higher than Case2.	○Small motor output. Electricity cost is lower than Case1.
Operation and Maintenance		○The cleaning and parts exchange frequency of the sand sedimentation is low. ▲The distance is far between the WTP and the intake	▲The cleaning and parts exchange frequency of the sedimentation basin is high. ○Easy access between the WTP and the intake pump

		Case1 （Intake：Dhamnak Ampil, WTP：No.5）	Case2 （Intake：near the existing intake point, WTP：No.2）
		pump station.	station
Cost	JPY	○Initial cost：344,633 (thousand yen) ：36,531(thousand yen/year) ▲Running cost ：24,616 (thousand yen/year)	▲Initial cost：423,067 (thousand yen) ：44,845 (thousand yen/year) ○Running cost ：22,054 (thousand yen/year)
	KHR	○Initial cost：12,135 (million riel) ：1,286(million riel/year) ▲Running cost：867 (million riel /year)	▲Initial cost：14,897 (million riel) ：1,579 (million riel/year) ○Running cost：777 (million riel/year)

Annex 7.4

Hydraulic calculation for Conveyance Pipe

1. Hydraulic calculation for Conveyance Pipe

The diameter of the conveyance pipe shall be 350mm, as per the result of hydraulic calculations carried out as below, and examining economic relationship between appropriate flow velocity, reasonable pipe loss or pump head, and pipe diameter.

The water flow formulae of the Hazen-Williams is used:

$H = 10.666 \times C^{-1.85} \times D^{-4.87} \times Q^{1.85} \times L$

Where,

H: Friction Head Loss (m)

C: Velocity coefficient: 110

D: Internal diameter of pipe (m)

Q: Flow rate (m3/s): design flow of conveyance pipe main: 7,260 m^3/day = 5.042m^3/min = 0.0840m^3/s

L: Length (m): 8,320m

Table 1 shows computation results for each pipe diameter. The flow velocity in the water transmission main should be at least 0.3 m/s or more in order to prevent stagnation of turbidity inside the pipe. Economic velocity of pipe flow, generally, is about 1 m/s. The head loss of 300 mm diameter is as high as 53.5 m and, and it is difficult to cope up with future water volume. Difference between head losses of 350 mm and 400 mm diameter do not significantly affect pump specification. Consequently, the pipe diameter shall be φ 350 mm, which is most economical.

Table 1 Hydraulic Calculation Results of Each Pipe Diameter

Flow rate (m^3／s) Q	Diamter (mm) D	Length (m) L	Velocity coefficient C	Velocity (m/s) V	Hydraulic gradient I	Loss head (m) H=LLh	Remarks
0.0840	φ.08	8,320	110	0.22	0.00010	0.83	
	φ.83			0.30	0.00022	1.83	
	φ.83			0.43	0.00053	4.41	
	φ.41			0.53	0.00089	7.40	
	φ.40			0.67	0.00158	13.15	
	φ3.1			**0.88**	**0.00303**	**25.21**	**Recommendable**
	φeco			1.20	0.00643	53.50	
	φ3.5			1.72	0.01562	129.96	
	φ29.			2.69	0.04630	385.22	

Source: JICA Survey Team

Annex 7.5

Selection of Pipe Material

1. Selection of Pipe Material

Based upon Table 2, applicable type of each pipe shall be as follows:

Conveyance Pipe Main

- General buried sections: φ350mm, Ductile cast iron pipe (DIP) (ISO standard, push-on joint)
- River crossing sections: φ350mm, Steel pipe (with corrosion prevention)

Distribution Mains

- General buried sections: φ250mm or more, Ductile cast iron pipe (DIP) (ISO standard, push-on joint) / φ200mm or less, High density polyethylene (HDPE) (PN10)
- River crossing sections: all pipe diameter, Steel pipe (with corrosion prevention)

Table 2 Comparison of Pipe Material

Pipe material	High density polyethylene (HDPE)	Ductile cast iron pipe (DIP)	Steel pipe (SP)
Precedent	· In Cambodia, there are many precedents of 200mm or less, and few precedents for 250mm or more.	· In Cambodia, there are many precedents of 250mm or more	· There is little experience as a buried pipe. It is widely used in the bridge-piggybacked water main or the water main bridge.
Durability	· Body strength is smaller than metal materials. · Excellent corrosion resistance. · Vulnerable to heat and UV ray. · Caution shall be paid for its permeability to organic solvents. · Electrofusion welding can be integrated and highly earthquake resistant.	· Pipe body is strong, high in ductility and can withstand strong impact. · High durability. · Push-on joints have lower earthquake resistance than welding and electrofusion welding.	· Pipe body is strong, high in ductility and can withstand strong impact. · High durability. · Protection against electrolytic corrosion shall be taken into account. · Easily corroded if the protection coating of the inside or outside wall is damaged. · Welding can be integrated and highly earthquake resistant.
Ease of construction work	· Handling is easy owing to its light weight. · Pipe laying under rainy condition or where water springs out is difficult. · Such special tool as the controller is needed in the case of the electrofusion welding method.	· Push-on joints have high workability. · Relatively heavy. · Protection of special fittings is needed.	· Processability is good, complicated piping is also possible. · Welding is difficult to connect, and there are some concerns of poor construction. · Pipe coated with corrosion-proof material is needed.
Maintainability	· For repairing less than 200 mm, it is possible to repair etc. from past precedent. · It is difficult to procure repair pipes and connecting equipment of 250 mm or more and there is a possibility that it cannot be constructed quickly.	· For repairing more than 250 mm, it is possible to repair etc. from past precedent.	· It is considered that it takes a relatively long time because construction technique is necessary.
Construction cost	· Inexpensive.	· Relatively expensive.	· Relatively expensive.

Source: JICA Survey Team

Annex 7.6

Location and Depth of Laying for Conveyance Pipe and Distribution Mains

1. Location and Depth of Laying for Conveyance Pipe and Distribution Mains

Road occupation conditions and other information was collected from Department of Public Works and Transports (DPWT).

In general, the roads in Cambodia consist of roads managed by the Ministry of Public Works and Transport (MPWT) and rural roads managed by the Ministry of Rural Development (MRD).

1-1 Location of pipe laying / Earth covering

MPWT shall stipulate the occupation conditions of public facilities and services construction (optical cable, burial of water supply network, etc.) for each type of road as follows.

- One-digit national road (within 5 m from the end point of 30 m from the center of the road) Managed by Ministry of Public Works and Transport (MPWT)
- Two-digit national road (within 5 m from the end point of 25 m from the center of the road) Managed by Ministry of Public Works and Transport (MPWT)
- Three-digit national road (within 5 m from the end point of 20 m from the center of the road) Managed by Ministry of Public Works and Transport (MPWT)
- Rural road (within 5 m from the end point of 15 m from the center of the road) Managed by Ministry of Rural Development (MRD)
- Village road (depending on actual situations)

Difficult to do this, pipes can be laid under the road shoulder. The earth covering shall be 0.5 to 1 m from the road surface. In case of crossing a single-digit national road, it is necessary to use the construction method of non-excavation method and it is necessary to officially apply for permission to MPWT.

1-2 Road structure / Pavement composition, Pavement restoration

An example of the standard road structure and pavement structure is shown in Figure 1 and Figure 2. Pavement restoration shall be 0.5 m from both sides of the laying piping center.

1-3 Possibility to install the bridge-piggybacked water main to the road bridge

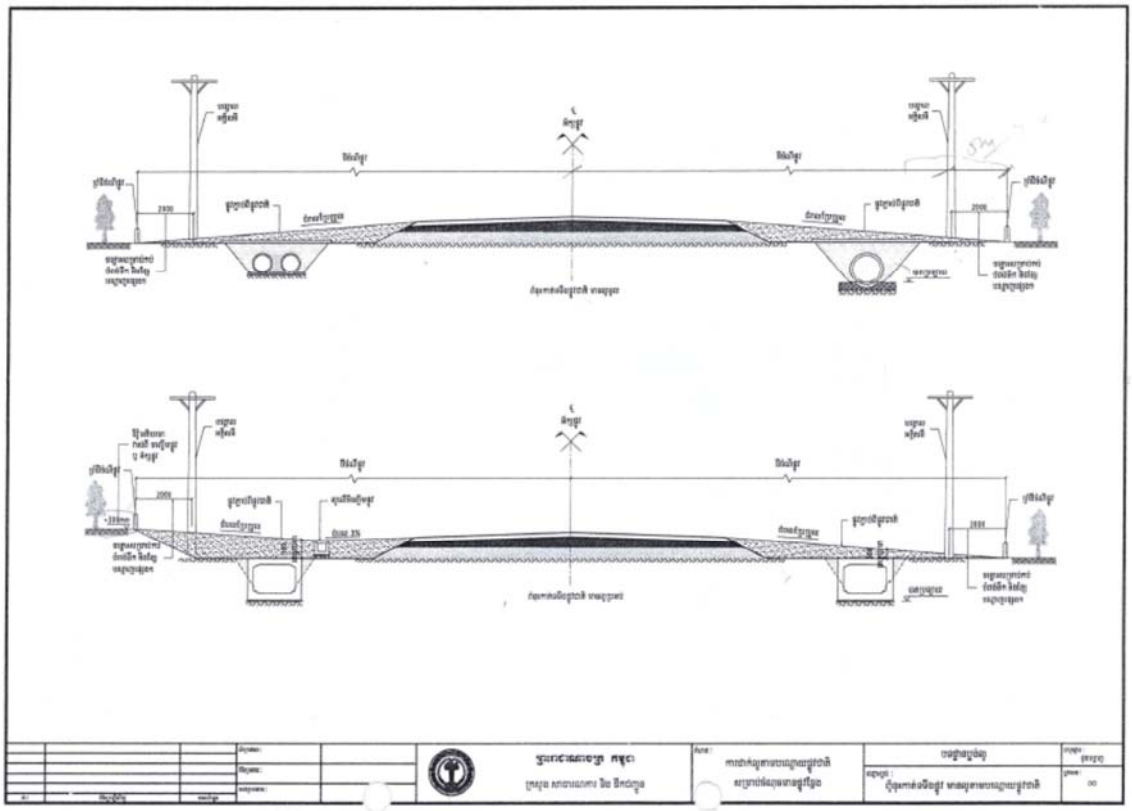
Although there is no problem loading the road bridge up to 500 mm, it is necessary to officially apply for MPWT to one-digit national road. It is necessary to notify DPWT on three-digit national road and MRD on rural road and village road. Normally, it takes about one month for MPWT permission.

1-4 Crossing railway

When the pipeline crosses the railway, it is necessary to construct with the non-excavation method (earth covering; 1.5 to 2 m, sheath tube type etc) and it is necessary to officially apply for permission to MPWT.

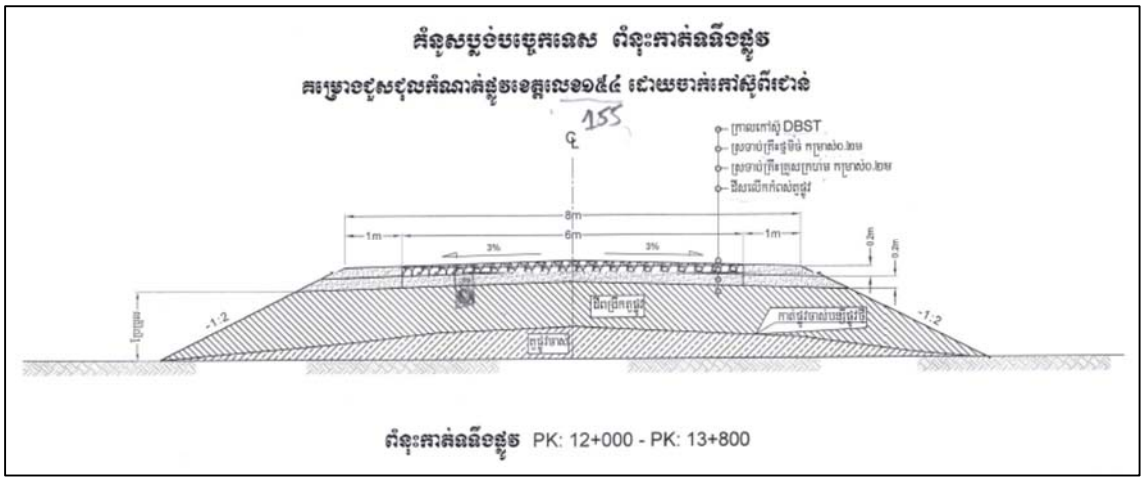
1-5 Relevant Plans in future

There is no tangible plan on the route to be designed. Although it is said that there is a rehabilitation plan of the inactive railway, details are unknown.



Source: DPWT

Figure 1 Example of typical road occupation condition



Source: DPWT

Figure 2 Example of standard of road structure and pavement structure

Annex 7.7

Setting Time Coefficient for Calculating Design Maximum Hourly Distribution Flow

1. Setting Time Coefficient for Calculating Design Maximum Hourly Distribution Flow

According to distribution flow data at the maximum daily supply during the past 3 days, measured by the existing water distribution monitoring system in Pursat City as shown in Table 3, the time coefficient is approximately 1.30. As shown in Table 4, the time coefficients in the similar size city plans (Japanese grant-aid project) were adopted as approximately 1.70.

With reference to figure above, in consideration of future expansion of water demand, and as a result of discussion with MIH, time coefficient of 1.30 for the Project shall be adopted.

Table 3 Flow per hour at maximum daily supply in existing service area of Pursat

Time	7th July 2015		7th March 2015		28th February 2015	
	(A) Flow per hour (m^3)	(A)/(C)	(A) Flow per hour (m^3)	(A)/(C)	(A) Flow per hour (m^3)	(A)/(C)
1:00	216	0.79	153	0.58	166	0.65
2:00	210	0.77	147	0.56	159	0.62
3:00	209	0.76	146	0.56	155	0.60
4:00	211	0.77	146	0.56	157	0.61
5:00	221	0.81	166	0.63	169	0.66
6:00	272	0.99	236	0.90	219	0.85
7:00	322	1.18	313	1.19	314	1.22
8:00	318	1.16	329	1.26	328	1.28
9:00	309	1.13	321	1.23	312	1.21
10:00	301	1.10	311	1.19	302	1.18
11:00	302	1.10	311	1.19	300	1.17
12:00	301	1.10	312	1.19	305	1.19
13:00	297	1.08	302	1.15	296	1.15
14:00	291	1.06	299	1.14	294	1.14
15:00	289	1.05	294	1.12	292	1.14
16:00	292	1.07	299	1.14	288	1.12
17:00	290	1.06	298	1.14	304	1.18
18:00	303	1.11	321	1.23	314	1.22
19:00	308	1.12	319	1.22	306	1.19
20:00	307	1.12	292	1.11	292	1.14
21:00	290	1.06	268	1.02	275	1.07
22:00	268	0.98	249	0.95	251	0.98
23:00	240	0.88	233	0.89	195	0.76
24:00	219	0.80	219	0.84	168	0.65
(B)Daily distribution flow	6,586	-	6,284	-	6,161	-
(C) Average hourly distribution flow	274	-	262	-	257	-

Note: The top three days that recorded the maximum daily supply in 2015. No record due to breakdown of the water distribution monitoring system after 2016.

Source: JICA Survey Team

Table 4 Design time coefficient of other cities in Cambodia

Item	Kampong Cham	Battambang	Kampot
Design maximum daily distribution flow	16,200 m^3/day	32,473 m^3/day	13,260 m^3/day
Time coefficient	1.72	1.65	1.75

Annex 7.8

Capacity of the service reservoir

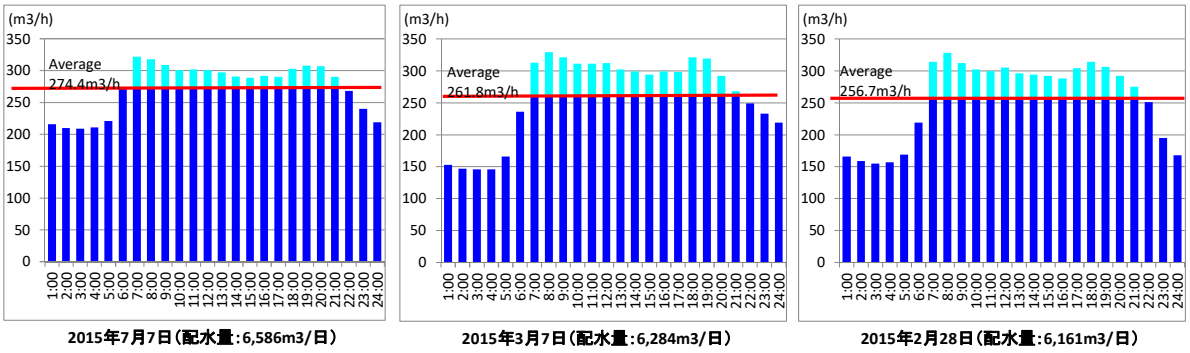
1. Capacity of the service reservoir

A service reservoir is required to regulate the fluctuation of water supply with respect to the transmitted quantity; and, furthermore, it shall possess the capacity to supply water for a certain period of time even in an emergency.

The capacity of existing reservoir (nominal 2,000 m^3) has 7.3 hours of the past maximum daily supply (6,586 m^3 /day). As shown in the figure below, the volume required for regulating the fluctuation of water demand is 410 to 670 m^3 (light blue parts of the figure below, the total volume that the distribution flow per hour at the time of maximum daily supply exceeds average hourly distribution flow) and is equivalent to 2.6 hours volume of the maximum daily supply.

In addition, it is necessary to consider the water volume necessary for coping with an emergency as what is needed upstream of the reservoir (drought, water pollution, damage in facilities etc.), and what is needed downstream thereof (firefighting water, damage in facilities etc.). On the other hand, in the plans of similar size cities (Japanese grant-aid project), as shown in Table 5, the capacities of the service reservoir are 3.5 to 6.5 hours.

Based on the above, as a result of coordination with MIH, the capacity of the service reservoir shall be 8 hours volume equivalent of the maximum daily supply of the service area; 2,200 m^3 (6,600 m^3 × 8/24) in order to secure stable water supply at all times including during an emergency.



Note: The top three days that recorded the maximum daily supply in 2015. No record due to breakdown of the water distribution monitoring system after 2016.
Source: JICA Survey Team

Figure 3 Flow per hour in existing service area of Pursat (maximum daily supply)

Table 5 Design Service reservoir capacity of other cities in Cambodia

Item	Kampong Cham	Battambang	Kampot
Design maximum daily distribution flow	16,200 m^3/day	32,473 m^3/day	13,260 m^3/day
Service reservoir capacity	5.2 hour	6.5 hour	3.5 hour

Annex 7.9

Hydraulic network analysis

1. Hydraulic network analysis

The hydraulic network analysis was carried out by EPANET Ver 2.0 under the following conditions.

The water flow formulae: Hazen - Williams formula
Velocity coefficient: 110
Minimum water pressure:

- 50 kPa or more at design maximum hourly distribution flow
- 0 kPa or more (not to be negative pressure) at the time of fire, design average hourly distribution flow plus firefighting water

Time coefficient: 1.30
Condition at the time of fire:

- Assumed firefighting water of 0.5m3/min for a single mouth fire hydrant, set at a location which is assumed to have hydraulically worst condition at the time of a fire.

The hydraulic network analysis is conducted for area where water is distributed from the existing WTP and for area where water is distributed from the new WTP. The hydraulic network models and computation results are shown below.

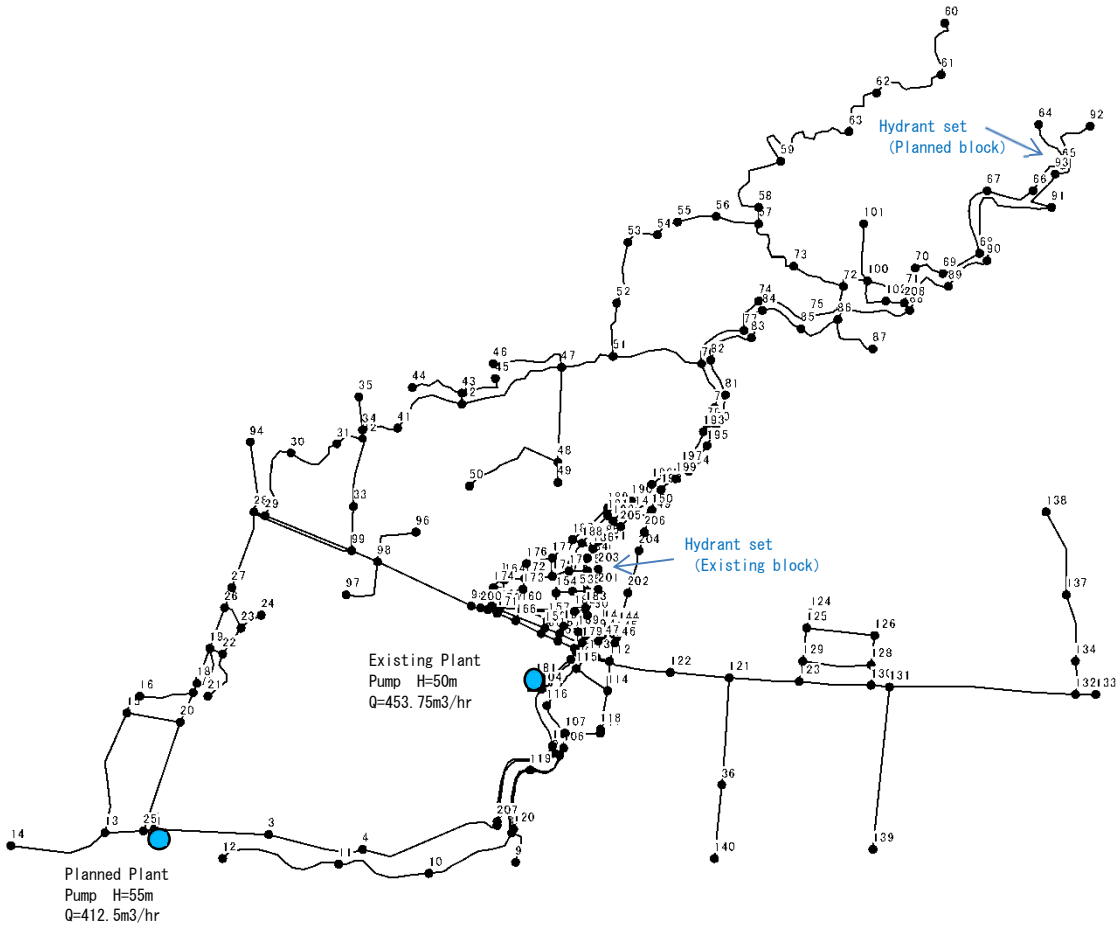


Figure 4 Distribution network model

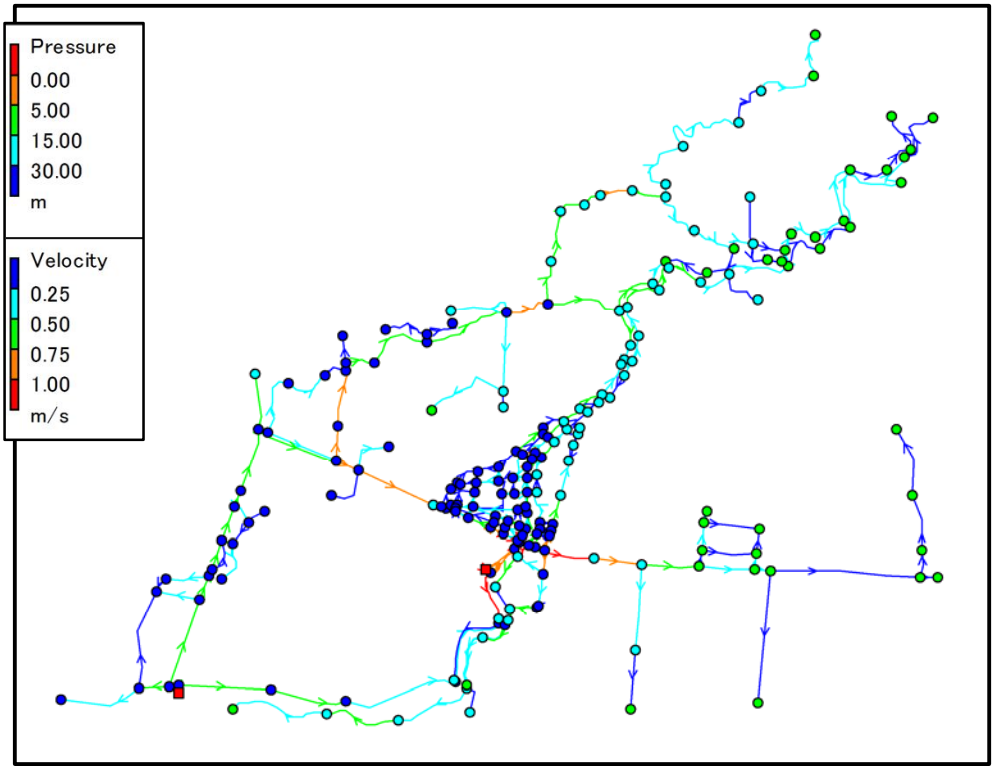


Figure 5 Hydraulic Network Analysis Result at maximum hourly distribution flow

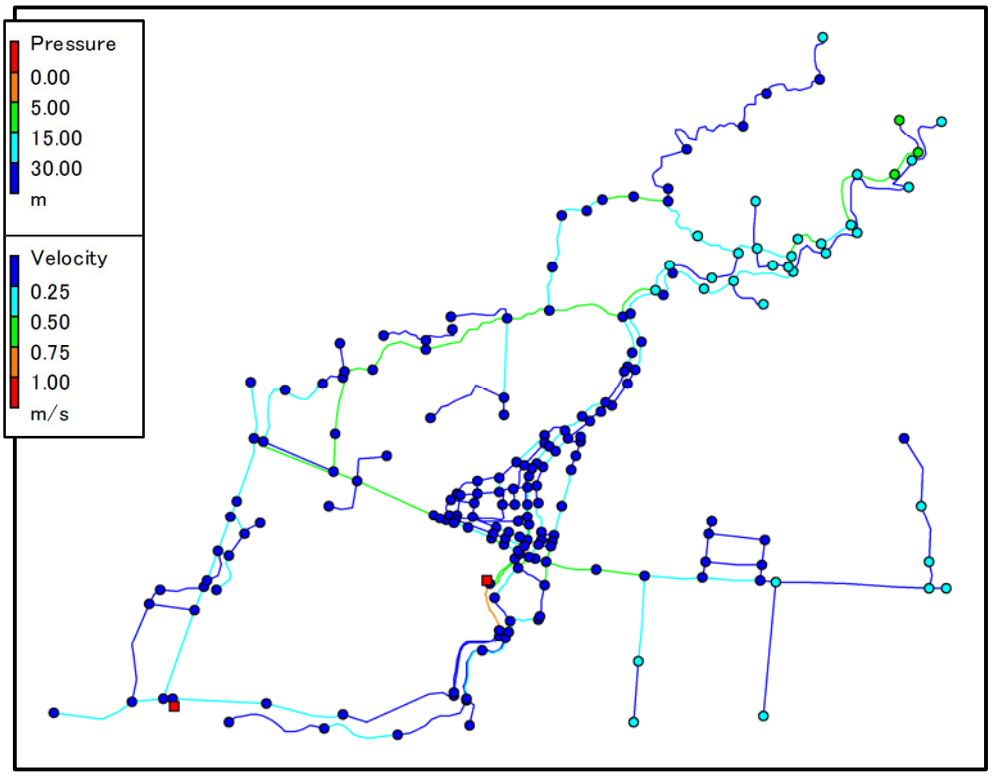


Figure 6 Hydraulic Network Analysis Result at time of fire extinguishing

Calculation data and result（Junctions） -1

NodeID	Elevation m	Peak Demand		Extinction Demand	
		Demand LPS	Pressure m	Demand LPS	Pressure m
Junc2	18.2	0.00	49.59	0.00	49.68
Junc3	17.8	1.22	42.77	0.81	46.67
Junc4	17.6	2.91	38.05	1.94	44.55
Junc5	17.1	0.00	34.86	0.00	43.31
Junc6	17.9	0.00	31.28	0.00	41.20
Junc7	17.9	0.00	31.07	0.00	41.10
Junc8	17.2	0.00	28.89	0.00	40.44
Junc9	17.0	0.00	29.09	0.00	40.64
Junc10	17.5	2.30	26.07	1.53	38.95
Junc11	17.3	2.63	18.39	1.75	35.43
Junc12	17.5	1.61	11.11	1.07	31.89
Junc13	19.8	1.50	44.62	1.00	46.41
Junc14	20.0	1.88	36.81	1.25	42.62
Junc15	16.6	2.01	45.58	1.34	48.39
Junc16	16.6	0.81	45.75	0.54	48.46
Junc17	16.7	0.00	48.00	0.00	49.38
Junc18	16.9	0.00	47.64	0.00	49.08
Junc19	16.6	0.00	47.25	0.00	48.97
Junc20	17.4	0.00	47.91	0.00	49.03
Junc21	16.0	0.75	38.33	0.50	45.04
Junc22	15.9	0.72	43.54	0.48	47.55
Junc23	15.9	0.75	43.62	0.50	47.58
Junc24	15.5	0.00	44.02	0.00	47.98
Junc25	18.6	0.00	48.92	0.00	49.12
Junc26	16.5	0.00	46.54	0.00	48.60
Junc27	15.5	0.00	47.16	0.00	49.37
Junc28	17.1	0.00	44.15	0.00	46.94
Junc29	17.7	2.04	42.75	1.36	45.88
Junc30	15.5	0.51	41.10	0.34	45.76
Junc31	15.0	2.25	39.61	1.50	45.01
Junc32	14.5	0.00	40.08	0.00	45.45
Junc33	14.7	0.75	42.32	0.50	46.78
Junc34	14.7	0.00	39.56	0.00	45.05
Junc35	14.2	2.37	39.93	1.58	45.49
Junc36	18.5	1.50	8.36	1.00	28.37
Junc41	14.7	0.00	38.33	0.00	44.26
Junc42	13.6	0.00	36.62	0.00	43.56
Junc43	13.5	1.50	35.48	1.00	43.08
Junc44	13.5	0.48	32.99	0.32	41.91
Junc45	13.5	0.48	33.50	0.32	42.15
Junc46	14.0	1.51	28.62	1.01	38.97
Junc47	14.0	3.00	32.70	2.00	40.89
Junc48	13.9	1.50	23.37	1.00	36.55
Junc49	14.0	0.00	23.27	0.00	36.45
Junc50	14.0	0.69	14.25	0.46	32.19
Junc51	13.5	0.00	30.17	0.00	39.38
Junc52	13.2	1.25	28.50	0.83	38.39
Junc53	13.3	0.00	26.32	0.00	36.92
Junc54	13.5	3.45	25.00	2.30	35.98
Junc55	13.3	1.14	24.53	0.76	35.71
Junc56	13.5	1.61	21.54	1.07	33.56

Calculation data and result（Junctions） -2

NodeID	Elevation	Peak Demand		Extinction Demand	
		Demand	Pressure	Demand	Pressure
	m	LPS	m	LPS	m
Junc57	13.4	2.44	18.95	1.63	31.72
Junc58	13.1	0.00	18.89	0.00	31.85
Junc59	12.9	0.91	17.20	0.61	31.16
Junc60	12.1	1.19	11.81	0.79	29.04
Junc61	11.8	0.90	14.02	0.60	30.24
Junc62	11.9	0.72	15.72	0.48	30.99
Junc63	12.4	2.25	15.54	1.50	30.65
Junc64	12.9	1.50	10.13	1.00	12.10
Junc65	13.6	1.66	10.03	9.44	11.68
Junc66	13.9	0.00	10.02	0.00	13.96
Junc67	14.2	3.21	10.05	2.14	16.68
Junc68	12.9	4.50	13.17	3.00	24.39
Junc69	13.3	3.16	13.44	2.11	25.31
Junc70	13.3	0.00	14.29	0.00	26.61
Junc71	13.6	1.59	14.57	1.06	27.19
Junc72	14.5	4.57	14.60	3.05	27.72
Junc73	13.8	0.61	16.68	0.41	29.66
Junc74	14.4	4.49	14.22	2.99	27.87
Junc75	14.1	0.00	14.77	0.00	28.14
Junc76	14.8	0.00	25.21	0.00	35.60
Junc77	14.2	2.14	16.64	1.43	29.91
Junc78	15.0	2.33	23.78	1.55	34.57
Junc79	15.2	1.08	23.18	0.72	34.09
Junc80	16.6	0.87	21.57	0.58	32.54
Junc81	15.9	0.00	21.75	0.00	32.85
Junc82	15.8	1.93	21.28	1.29	32.52
Junc83	15.7	0.00	19.29	0.00	30.97
Junc84	15.6	0.00	18.09	0.00	30.05
Junc85	15.6	1.56	16.41	1.04	28.71
Junc86	15.1	1.73	15.60	1.15	28.14
Junc87	14.5	0.00	16.20	0.00	28.74
Junc88	14.6	1.29	14.05	0.86	26.84
Junc89	14.6	1.26	13.43	0.84	26.54
Junc90	15.2	0.00	12.59	0.00	25.83
Junc91	13.3	1.29	9.76	0.86	25.50
Junc92	13.0	0.74	6.75	0.49	24.24
Junc93	13.1	0.60	7.74	0.40	24.65
Junc94	16.1	1.20	28.96	0.80	40.30
Junc95	16.5	13.50	27.56	9.00	39.10
Junc96	14.5	1.20	38.24	0.80	45.20
Junc97	15.0	0.00	39.70	0.00	45.63
Junc98	16.8	1.10	37.90	0.73	43.83
Junc99	15.6	2.01	42.99	1.34	46.87
Junc100	13.7	1.08	15.10	0.72	28.07
Junc101	13.7	0.00	15.10	0.00	28.07
Junc102	14.0	0.00	14.63	0.00	27.47
Junc104	16.5	0.00	49.51	0.00	49.94
Junc105	17.9	0.00	25.45	0.00	37.53
Junc106	17.9	1.69	20.70	1.13	35.21
Junc107	16.9	2.80	18.85	1.87	34.49
Junc108	17.7	0.00	44.86	0.00	46.78

Calculation data and result（Junctions） -3

NodeID	Elevation	Peak Demand		Extinction Demand	
		Demand	Pressure	Demand	Pressure
	m	LPS	m	LPS	m
Junc109	17.8	0.00	40.68	0.00	44.36
Junc110	16.7	2.92	38.17	1.95	43.41
Junc111	18.2	0.00	35.41	0.00	41.30
Junc112	18.2	0.00	34.75	0.00	40.99
Junc113	18.2	0.00	32.39	0.00	39.83
Junc114	15.5	2.56	33.07	1.71	41.64
Junc115	17.7	5.34	27.97	3.56	38.07
Junc116	16.2	3.00	19.63	2.00	35.20
Junc117	15.4	0.00	31.68	0.00	41.06
Junc118	15.4	1.29	31.72	0.86	41.08
Junc119	16.9	1.20	15.70	0.80	33.38
Junc120	17.2	3.92	10.55	2.61	30.79
Junc121	16.4	3.15	16.67	2.10	33.40
Junc122	15.7	2.63	25.80	1.75	38.08
Junc123	16.2	0.00	13.03	0.00	31.79
Junc124	14.0	0.51	12.99	0.34	32.94
Junc125	14.5	1.50	13.23	1.00	32.79
Junc126	15.3	0.93	10.85	0.62	31.24
Junc128	15.8	1.14	10.60	0.76	30.86
Junc129	15.1	0.00	13.56	0.00	32.62
Junc130	16.9	0.00	10.26	0.00	30.11
Junc131	17.0	2.38	9.77	1.59	29.83
Junc132	19.6	0.30	6.72	0.20	27.02
Junc133	19.5	0.41	6.14	0.27	26.80
Junc134	17.8	0.00	8.29	0.00	28.71
Junc137	16.8	0.36	8.82	0.24	29.49
Junc138	15.6	0.75	9.73	0.50	30.55
Junc139	18.4	1.50	8.10	1.00	28.30
Junc140	18.5	1.89	7.17	1.26	27.81
Junc141	15.6	0.00	31.10	0.00	39.96
Junc142	15.6	0.00	32.06	0.00	40.83
Junc143	15.6	0.99	32.47	0.66	41.07
Junc144	14.8	0.00	32.55	0.00	41.51
Junc145	14.6	2.01	33.47	1.34	42.08
Junc146	14.9	0.00	34.31	0.00	42.37
Junc147	15.6	1.13	33.11	0.75	41.42
Junc148	16.2	0.75	26.33	0.50	37.55
Junc149	14.2	0.00	28.15	0.00	39.48
Junc150	14.2	0.00	28.15	0.00	39.48
Junc151	15.5	0.00	35.23	0.00	41.71
Junc152	16.0	0.00	35.09	0.00	41.50
Junc153	16.0	0.00	34.61	0.00	41.25
Junc154	15.0	5.94	35.26	3.96	42.09
Junc155	16.5	0.00	38.06	0.00	43.43
Junc156	16.4	0.00	35.50	0.00	42.00
Junc157	15.5	4.50	34.64	3.00	41.92
Junc158	16.0	3.49	34.24	2.33	41.50
Junc159	16.2	0.00	36.67	0.00	42.59
Junc160	16.3	3.35	33.48	2.23	40.80
Junc161	16.5	5.41	32.92	3.61	40.44
Junc162	15.5	0.00	33.86	0.00	41.32

Calculation data and result（Junctions） -4

NodeID	Elevation m	Peak Demand		Extinction Demand	
		Demand LPS	Pressure m	Demand LPS	Pressure m
Junc163	15.3	0.00	34.12	0.00	41.64
Junc164	15.5	3.00	33.45	2.00	41.15
Junc165	16.0	4.55	33.43	3.03	40.95
Junc166	16.5	0.00	33.75	0.00	40.92
Junc167	16.4	4.50	33.75	3.00	41.07
Junc168	15.6	4.50	35.10	3.00	42.11
Junc169	16.0	0.00	36.04	0.00	42.38
Junc170	16.0	0.00	33.62	0.00	41.06
Junc171	16.5	0.00	33.17	0.00	40.59
Junc172	16.0	4.50	33.08	3.00	40.68
Junc173	16.0	0.00	33.37	0.00	40.86
Junc174	15.3	0.00	34.08	0.00	41.56
Junc175	14.6	0.00	35.70	0.00	42.46
Junc176	16.2	3.13	33.10	2.09	40.52
Junc177	14.6	0.00	34.77	0.00	42.12
Junc178	14.6	3.82	35.80	2.55	42.50
Junc179	16.2	0.00	37.42	0.00	43.09
Junc180	16.2	0.00	35.78	0.00	41.96
Junc182	16.0	0.00	35.87	0.00	42.10
Junc183	16.2	0.00	35.66	0.00	41.88
Junc184	15.5	0.00	35.16	8.33	41.61
Junc185	16.0	0.00	32.92	0.00	40.44
Junc186	15.6	0.00	33.88	0.00	41.08
Junc187	14.1	0.00	35.22	0.00	42.55
Junc188	14.5	1.85	34.88	1.23	42.16
Junc189	14.1	3.22	31.06	2.15	40.58
Junc190	15.3	0.00	29.63	0.00	39.26
Junc191	15.0	0.00	34.09	0.00	41.52
Junc192	15.3	0.00	32.19	0.00	40.47
Junc193	15.0	2.40	22.04	1.60	35.84
Junc194	16.0	1.08	21.46	0.72	32.81
Junc195	15.9	1.15	21.78	0.77	33.01
Junc196	15.1	1.75	25.81	1.17	37.57
Junc197	14.9	1.68	23.39	1.12	36.53
Junc198	15.8	0.67	26.27	0.45	37.73
Junc199	15.8	0.91	26.19	0.61	37.69
Junc200	16.5	0.00	32.92	0.00	40.44
Junc201	16.4	1.88	29.61	1.25	39.00
Junc202	14.2	1.88	29.62	1.25	40.31
Junc203	16.5	3.75	29.38	2.50	38.78
Junc204	14.0	3.11	28.17	2.07	39.62
Junc205	16.0	1.14	27.90	0.76	38.33
Junc206	14.0	1.08	28.18	0.72	39.62
Junc207	17.1	1.65	24.62	1.10	37.56
Junc208	14.0	0.00	14.55	0.00	27.32

Calculation data and result（Pipes） -1

LinkID	Node1 (Junction)	Node2 (Junction)	Diameter mm	Length m	Roughness	Peak Demand		Extinction Demand	
						Flow LPS	Velocity m/s	Flow LPS	Velocity m/s
Pipe1	1	2	450	131	110	116.44	0.73	85.96	0.54
Pipe2	2	3	150	1,783	110	10.65	0.60	7.10	0.40
Pipe3	3	4	150	1,520	110	9.44	0.53	6.29	0.36
Pipe4	4	5	150	2,263	110	6.53	0.37	4.35	0.25
Pipe5	25	2	450	200	110	-105.79	0.67	-78.86	0.50
Pipe6	25	13	100	582	110	4.25	0.54	2.88	0.37
Pipe7	13	14	75	1,602	110	1.88	0.42	1.25	0.28
Pipe8	13	15	75	1,928	110	0.88	0.20	0.63	0.14
Pipe9	15	16	75	328	110	-0.57	0.13	-0.34	0.08
Pipe10	16	17	75	870	110	-1.38	0.31	-0.88	0.20
Pipe11	17	20	450	489	110	-100.98	0.63	-75.61	0.48
Pipe12	20	25	450	1,769	110	-101.54	0.64	-75.98	0.48
Pipe13	15	20	50	859	110	-0.56	0.28	-0.37	0.19
Pipe14	17	18	450	139	110	99.60	0.63	74.73	0.47
Pipe15	18	19	450	575	110	99.32	0.62	74.53	0.47
Pipe16	19	26	450	688	110	98.23	0.62	73.81	0.46
Pipe17	26	27	450	327	110	97.38	0.61	73.25	0.46
Pipe18	26	23	50	442	110	0.85	0.43	0.56	0.29
Pipe19	23	24	50	386	110	0.00	0.00	0.00	0.00
Pipe20	23	22	50	484	110	0.10	0.05	0.06	0.03
Pipe21	19	22	50	231	110	1.37	0.70	0.92	0.47
Pipe22	22	21	50	815	110	0.75	0.38	0.50	0.25
Pipe23	18	19	50	702	110	0.28	0.14	0.21	0.11
Pipe24	27	28	450	1,217	110	97.38	0.61	73.25	0.46
Pipe25	28	29	150	189	110	10.92	0.62	8.11	0.46
Pipe26	28	94	50	1,081	110	1.20	0.61	0.80	0.41
Pipe27	29	30	100	1,257	110	3.15	0.40	2.40	0.31
Pipe28	30	31	100	899	110	2.64	0.34	2.06	0.26
Pipe29	32	33	350	1,073	110	-72.43	0.75	-56.32	0.59
Pipe30	29	99	150	1,445	110	5.72	0.32	4.35	0.25
Pipe31	99	98	150	464	110	15.80	0.89	10.53	0.60
Pipe32	98	95	150	1,695	110	13.50	0.76	9.00	0.51
Pipe33	98	96	75	942	110	1.20	0.27	0.80	0.18
Pipe34	98	97	63	946	110	0.00	0.00	0.00	0.00
Pipe35	121	36	100	1,773	110	3.39	0.43	2.26	0.29
Pipe36	36	140	100	1,000	110	1.89	0.24	1.26	0.16
Pipe40	35	34	150	516	110	-2.37	0.13	-1.58	0.09
Pipe41	34	32	350	140	110	-72.82	0.76	-56.88	0.59
Pipe42	31	32	100	471	110	0.39	0.05	0.56	0.07
Pipe43	34	41	350	571	110	70.46	0.73	55.30	0.57
Pipe44	41	42	350	1,302	110	70.46	0.73	55.30	0.57
Pipe45	42	43	75	158	110	2.46	0.56	1.64	0.37
Pipe46	44	43	50	905	110	-0.48	0.24	-0.32	0.16
Pipe47	43	45	50	719	110	0.48	0.24	0.32	0.16
Pipe48	42	47	350	1,739	110	67.99	0.71	53.66	0.56
Pipe49	46	47	75	1,276	110	-1.51	0.34	-1.01	0.23
Pipe50	47	48	75	1,489	110	2.19	0.50	1.46	0.33
Pipe51	48	49	50	307	110	0.00	0.00	0.00	0.00
Pipe52	50	48	50	1,679	110	-0.69	0.35	-0.46	0.23
Pipe53	47	51	300	856	110	61.29	0.87	49.19	0.70
Pipe54	51	76	250	1,488	110	31.20	0.64	25.29	0.52

Calculation data and result（Pipes） -2

LinkID	Node1 (Junction)	Node2 (Junction)	Diameter mm	Length m	Roughness	Peak Demand		Extinction Demand	
						Flow LPS	Velocity m/s	Flow LPS	Velocity m/s
Pipe55	76	78	250	728	110	25.45	0.52	20.59	0.42
Pipe56	78	79	250	284	110	23.12	0.47	19.04	0.39
Pipe57	79	80	250	159	110	22.04	0.45	18.32	0.37
Pipe58	80	81	250	535	110	18.94	0.39	16.25	0.33
Pipe59	81	82	250	585	110	18.94	0.39	16.25	0.33
Pipe60	82	83	200	880	110	17.00	0.54	14.96	0.48
Pipe61	83	84	200	548	110	17.00	0.54	14.96	0.48
Pipe62	84	85	200	712	110	17.00	0.54	14.96	0.48
Pipe63	85	86	200	657	110	15.44	0.49	13.92	0.44
Pipe64	86	87	75	890	110	0.00	0.00	0.00	0.00
Pipe65	86	88	200	1,290	110	13.72	0.44	12.77	0.41
Pipe66	88	89	150	991	110	3.88	0.22	2.59	0.15
Pipe67	89	90	150	791	110	2.63	0.15	1.75	0.10
Pipe68	90	91	100	2,169	110	2.63	0.33	1.75	0.22
Pipe69	91	93	75	875	110	1.34	0.30	0.89	0.20
Pipe70	93	92	75	1,301	110	0.74	0.17	0.49	0.11
Pipe71	64	65	100	776	110	-1.50	0.19	-1.00	0.13
Pipe72	65	66	150	662	110	-3.16	0.18	-10.44	0.59
Pipe73	66	67	150	773	110	-3.16	0.18	-10.44	0.59
Pipe74	67	68	150	1,163	110	-6.38	0.36	-12.58	0.71
Pipe75	68	69	200	651	110	-10.88	0.35	-15.58	0.50
Pipe76	69	70	200	510	110	-14.04	0.45	-17.69	0.56
Pipe77	70	71	200	346	110	-14.04	0.45	-17.69	0.56
Pipe78	100	71	100	650	110	1.71	0.22	2.15	0.27
Pipe79	100	102	200	615	110	5.38	0.17	7.28	0.23
Pipe81	100	101	50	884	110	0.00	0.00	0.00	0.00
Pipe82	100	72	200	489	110	-8.17	0.26	-10.15	0.32
Pipe83	72	75	100	815	110	0.88	0.11	-0.27	0.03
Pipe84	72	73	200	873	110	-13.62	0.43	-12.93	0.41
Pipe85	73	57	200	1,099	110	-14.23	0.45	-13.34	0.42
Pipe86	74	75	100	872	110	-0.88	0.11	0.27	0.03
Pipe87	77	74	100	564	110	3.61	0.46	3.26	0.42
Pipe88	76	77	100	983	110	5.75	0.73	4.69	0.60
Pipe89	57	58	150	260	110	5.97	0.34	3.98	0.23
Pipe90	58	59	150	1,361	110	5.97	0.34	3.98	0.23
Pipe91	59	63	150	2,121	110	5.05	0.29	3.37	0.19
Pipe92	63	62	150	955	110	2.80	0.16	1.87	0.11
Pipe93	62	61	100	1,266	110	2.09	0.27	1.39	0.18
Pipe94	61	60	75	937	110	1.19	0.27	0.79	0.18
Pipe95	51	52	250	857	110	30.09	0.61	23.91	0.49
Pipe96	52	53	250	978	110	28.84	0.59	23.08	0.47
Pipe97	53	54	250	524	110	28.84	0.59	23.08	0.47
Pipe98	54	55	250	400	110	25.39	0.52	20.78	0.42
Pipe99	55	56	200	609	110	24.25	0.77	20.02	0.64
Pipe100	56	57	200	668	110	22.65	0.72	18.95	0.60
Pipe101	5	6	150	1,701	110	6.53	0.37	4.35	0.25
Pipe102	6	7	150	127	110	6.53	0.37	4.35	0.25
Pipe103	7	8	150	1,764	110	6.53	0.37	4.35	0.25
Pipe104	8	9	50	552	110	0.00	0.00	0.00	0.00
Pipe105	8	10	150	1,538	110	6.53	0.37	4.35	0.25
Pipe106	10	11	100	1,495	110	4.23	0.54	2.82	0.36

Calculation data and result（Pipes） -3

LinkID	Node1 (Junction)	Node2 (Junction)	Diameter mm	Length m	Roughness	Peak Demand		Extinction Demand	
						Flow LPS	Velocity m/s	Flow LPS	Velocity m/s
Pipe107	11	12	75	1,987	110	1.61	0.36	1.07	0.24
Pipe108	28	99	400	1,655	110	85.26	0.68	64.34	0.51
Pipe109	104	108	250	681	110	46.06	0.94	33.95	0.69
Pipe110	108	109	250	144	110	116.71	2.38	86.04	1.75
Pipe111	108	104	300	749	110	-70.65	1.00	-52.08	0.74
Pipe112	110	109	250	128	110	-116.71	2.38	-86.04	1.75
Pipe113	110	111	250	380	110	36.57	0.74	24.63	0.50
Pipe114	110	113	100	247	110	8.03	1.02	5.44	0.69
Pipe115	113	115	100	288	110	7.98	1.02	5.24	0.67
Pipe116	115	114	50	593	110	-0.66	0.33	-0.44	0.22
Pipe117	114	112	100	439	110	-5.96	0.76	-3.95	0.50
Pipe118	111	112	250	201	110	36.57	0.74	24.63	0.50
Pipe119	115	116	75	731	110	3.29	0.75	2.12	0.48
Pipe120	116	107	75	530	110	0.29	0.07	0.12	0.03
Pipe121	107	117	50	530	110	-1.45	0.74	-0.94	0.48
Pipe122	117	118	100	58	110	-1.45	0.19	-0.94	0.12
Pipe123	118	114	100	610	110	-2.74	0.35	-1.80	0.23
Pipe124	104	105	100	956	110	9.52	1.21	6.45	0.82
Pipe125	105	106	100	285	110	7.87	1.00	5.35	0.68
Pipe126	106	107	50	240	110	1.06	0.54	0.81	0.41
Pipe127	119	106	100	799	110	-5.12	0.65	-3.41	0.43
Pipe128	120	119	100	1,062	110	-3.92	0.50	-2.61	0.33
Pipe129	112	122	150	973	110	18.94	1.07	12.63	0.71
Pipe130	122	121	150	944	110	16.32	0.92	10.88	0.62
Pipe132	121	123	150	1,111	110	9.78	0.55	6.52	0.37
Pipe133	123	129	100	313	110	2.38	0.30	1.59	0.20
Pipe134	123	130	150	1,111	110	7.01	0.40	4.67	0.26
Pipe135	130	131	150	302	110	5.70	0.32	3.80	0.22
Pipe136	131	132	150	2,922	110	1.82	0.10	1.21	0.07
Pipe137	132	133	50	340	110	0.41	0.21	0.27	0.14
Pipe138	131	139	150	2,517	110	1.50	0.08	1.00	0.06
Pipe139	130	128	75	308	110	1.31	0.30	0.87	0.20
Pipe140	128	126	75	457	110	0.59	0.13	0.39	0.09
Pipe142	124	125	50	242	110	-0.51	0.26	-0.34	0.17
Pipe143	125	129	100	518	110	-2.35	0.30	-1.57	0.20
Pipe144	129	123	50	313	110	-0.39	0.20	-0.26	0.13
Pipe145	129	128	50	1,073	110	0.42	0.21	0.28	0.14
Pipe146	125	126	50	1,076	110	0.34	0.17	0.23	0.12
Pipe148	134	132	100	522	110	-1.11	0.14	-0.74	0.09
Pipe149	134	137	100	1,064	110	1.11	0.14	0.74	0.09
Pipe151	138	137	100	1,368	110	-0.75	0.10	-0.50	0.06
Pipe152	112	146	100	295	110	6.79	0.86	4.73	0.60
Pipe153	146	145	100	101	110	6.39	0.81	4.46	0.57
Pipe154	145	144	100	130	110	4.34	0.55	3.05	0.39
Pipe155	99	33	350	678	110	73.18	0.76	56.82	0.59
Pipe156	149	150	100	101	110	0.00	0.00	0.00	0.00
Pipe157	148	149	100	253	110	1.41	0.18	0.81	0.10
Pipe160	142	143	100	125	110	-3.24	0.41	-2.45	0.31
Pipe161	143	147	100	124	110	-4.20	0.53	-3.04	0.39
Pipe162	147	113	100	269	110	-4.93	0.63	-3.52	0.45
Pipe163	142	144	50	264	110	0.30	0.16	0.18	0.09

Calculation data and result（Pipes） -4

LinkID	Node1 (Junction)	Node2 (Junction)	Diameter mm	Length m	Roughness	Peak Demand		Extinction Demand	
						Flow LPS	Velocity m/s	Flow LPS	Velocity m/s
Pipe164	143	145	50	263	110	-0.04	0.02	-0.07	0.03
Pipe165	147	146	50	264	110	-0.40	0.20	-0.27	0.14
Pipe166	113	112	100	343	110	-4.87	0.62	-3.32	0.42
Pipe167	154	153	150	245	110	-6.05	0.34	-4.00	0.23
Pipe168	153	152	150	235	110	-7.41	0.42	-5.17	0.29
Pipe169	164	165	100	388	110	-1.93	0.25	-1.51	0.19
Pipe170	161	163	150	118	110	0.58	0.03	0.90	0.05
Pipe171	163	165	150	142	110	-1.08	0.06	-1.36	0.08
Pipe172	165	157	150	805	110	-4.66	0.26	-3.72	0.21
Pipe173	160	166	100	230	110	-2.54	0.32	-2.06	0.26
Pipe175	166	156	150	465	110	-9.90	0.56	-7.49	0.42
Pipe176	156	155	150	263	110	-17.46	0.99	-12.95	0.73
Pipe177	155	110	250	299	110	-19.44	0.40	-14.39	0.29
Pipe178	156	158	100	108	110	7.56	0.96	5.45	0.69
Pipe179	158	157	100	129	110	1.53	0.19	1.34	0.17
Pipe180	157	168	150	256	110	-7.64	0.43	-5.38	0.30
Pipe181	168	169	150	239	110	-12.73	0.72	-8.76	0.50
Pipe182	169	159	150	146	110	-12.73	0.72	-8.76	0.50
Pipe184	155	167	50	116	110	1.99	1.01	1.45	0.74
Pipe185	167	168	50	136	110	-0.59	0.30	-0.38	0.19
Pipe186	158	167	100	248	110	1.01	0.13	0.52	0.07
Pipe187	161	171	150	174	110	-5.99	0.34	-4.51	0.26
Pipe188	171	166	150	288	110	-7.36	0.42	-5.43	0.31
Pipe189	162	174	150	177	110	-1.51	0.09	-2.13	0.12
Pipe190	174	163	150	340	110	-1.66	0.09	-2.26	0.13
Pipe191	174	173	100	470	110	0.15	0.02	0.13	0.02
Pipe192	164	172	100	323	110	-1.07	0.14	-0.49	0.06
Pipe193	172	175	100	444	110	-2.97	0.38	-1.59	0.20
Pipe194	172	173	100	167	110	-2.33	0.30	-1.78	0.23
Pipe195	173	160	100	265	110	-2.17	0.28	-1.65	0.21
Pipe196	176	162	150	498	110	-1.51	0.09	-2.13	0.12
Pipe197	176	172	50	241	110	0.27	0.14	0.11	0.06
Pipe198	177	175	100	265	110	-3.39	0.43	-1.97	0.25
Pipe199	176	177	150	411	110	-1.90	0.11	-0.08	0.00
Pipe201	160	154	50	853	110	-0.20	0.10	0.03	0.02
Pipe202	175	178	200	265	110	-6.45	0.21	-3.49	0.11
Pipe203	178	151	200	292	110	-11.25	0.36	-6.35	0.20
Pipe204	178	153	100	312	110	-1.36	0.17	-1.17	0.15
Pipe205	175	154	50	338	110	0.09	0.05	-0.07	0.04
Pipe206	151	152	250	296	110	-21.46	0.44	-18.98	0.39
Pipe207	167	179	50	381	110	-0.92	0.47	-0.65	0.33
Pipe208	110	179	250	214	110	49.74	1.01	39.62	0.81
Pipe209	179	159	250	134	110	48.82	0.99	38.97	0.79
Pipe210	160	182	100	866	110	-2.77	0.35	-1.86	0.24
Pipe211	182	180	150	270	110	-3.13	0.18	-2.25	0.13
Pipe212	159	180	250	316	110	33.41	0.68	27.99	0.57
Pipe213	180	152	250	383	110	30.28	0.62	25.74	0.52
Pipe214	182	183	100	244	110	0.36	0.05	0.40	0.05
Pipe215	152	183	100	268	110	-3.04	0.39	-2.62	0.33
Pipe216	183	159	100	446	110	-2.68	0.34	-2.23	0.28
Pipe217	177	187	150	458	110	1.49	0.08	1.90	0.11

Calculation data and result（Pipes） -5

LinkID	Node1 (Junction)	Node2 (Junction)	Diameter mm	Length m	Roughness	Peak Demand		Extinction Demand	
						Flow LPS	Velocity m/s	Flow LPS	Velocity m/s
Pipe219	184	151	250	216	110	-10.21	0.21	-12.63	0.26
Pipe220	184	152	150	537	110	4.45	0.25	4.21	0.24
Pipe221	185	186	150	133	110	-10.98	0.62	-6.88	0.39
Pipe222	186	184	150	161	110	-14.65	0.83	-8.51	0.48
Pipe223	187	188	150	149	110	-2.96	0.17	-1.08	0.06
Pipe224	188	186	150	185	110	-3.67	0.21	-1.63	0.09
Pipe225	188	178	100	584	110	-2.33	0.30	-1.48	0.19
Pipe226	185	141	100	143	110	7.58	0.96	4.61	0.59
Pipe227	185	192	100	405	110	3.41	0.43	2.27	0.29
Pipe228	192	190	100	414	110	4.61	0.59	3.07	0.39
Pipe229	190	189	100	440	110	-1.23	0.16	-0.82	0.10
Pipe230	189	187	100	718	110	-4.45	0.57	-2.97	0.38
Pipe231	188	191	100	570	110	1.20	0.15	0.80	0.10
Pipe232	191	192	50	107	110	1.20	0.61	0.80	0.41
Pipe233	190	196	100	420	110	5.84	0.74	3.89	0.50
Pipe234	196	197	100	530	110	4.08	0.52	2.72	0.35
Pipe235	197	193	100	678	110	2.40	0.31	1.60	0.20
Pipe236	80	195	100	307	110	2.23	0.28	1.49	0.19
Pipe237	195	194	100	511	110	1.08	0.14	0.72	0.09
Pipe238	199	198	100	274	110	-0.91	0.12	-0.61	0.08
Pipe239	148	198	100	533	110	1.59	0.20	1.06	0.13
Pipe240	200	161	100	113	110	0.00	0.00	0.00	0.00
Pipe242	144	202	100	562	110	4.65	0.59	3.23	0.41
Pipe243	201	142	100	615	110	-2.94	0.37	-2.27	0.29
Pipe245	202	204	100	684	110	2.77	0.35	1.98	0.25
Pipe247	141	203	100	362	110	2.69	0.34	1.48	0.19
Pipe248	203	201	100	326	110	-1.06	0.14	-1.02	0.13
Pipe249	204	206	100	303	110	-0.33	0.04	-0.09	0.01
Pipe250	141	205	100	405	110	4.89	0.62	3.13	0.40
Pipe251	205	148	100	324	110	3.75	0.48	2.37	0.30
Pipe252	149	206	100	251	110	1.41	0.18	0.81	0.10
Pipe253	207	105	100	1,762	110	-1.65	0.21	-1.10	0.14
Pipe254	71	208	200	235	110	-13.92	0.44	-16.60	0.53
Pipe255	102	208	200	289	110	5.38	0.17	7.28	0.23
Pipe256	208	88	200	143	110	-8.54	0.27	-9.32	0.30
Pipe257	165	170	100	72	110	-2.90	0.37	-2.19	0.28
Pipe258	170	171	100	72	110	-1.37	0.17	-0.93	0.12
Pipe259	170	158	100	775	110	-1.53	0.19	-1.26	0.16
Pipe264	181	104	300	73	110	126.22	1.79	92.48	1.31

Annex 7.10

Assumption of the number of poor households

1. Assumption of the number of poor households

Number of poor households in design service area

The number of poor level 1 households in the service area in 2025 is estimated to be 1,248 households as per the following equation, based on the data of "Identification of Poor Household Program" conducted by the Ministry of Planning of Cambodia in 2010 and 2011.

Number of poor households (F) = Σ {Rate of poor households by village (C) x Number of households by village in 2025 (E)}

Where,

Number of households by village (E): Design population served in 2025

÷ Number of household members: 4.91 *

* Number of household members: Design population served 75,033

÷ Number of services 15,282 (in 2025)

Number of poor households to be targeted under the Project

Number of poor level 1 households to which materials for house connection will be provided under this project is expected to be 257 households (1,248 – calculated by deducting 991 poor households already being served.)

Table 6 Number of poor households in design service area

Commune	VillageName	(B") Poor 1 Households	(C)=(B")/(A) Rate of Total Poor	(D) 2025 year population	(E)=(D)/4.91 2025 year population	Poor Households	Poor Households (Urban)	Poor Households (Rural)
07_Snam Preah	Svay Att	18	16.2%	549	112	19		19
07_Snam Preah	Kam Peanh Svay	14	10.3%	742	152	16		16
07_Snam Preah	Dang Keab Kdam	23	17.3%	523	107	19		19
8_Snam Preah	Ang Doung Sambour	16	10.2%	40	9	1		1
9_Snam Preah	Snam Preah	8	4.2%	58	12	1		1
01_Anlong Vil	Toul Cha	230	19.1%	492	101	20		20
01_Anlong Vil	Ou Bakon	12	18.2%	417	85	16		16
01_Anlong Vil	Wat Por 1	13	15.7%	643	131	21		21
01_Anlong Vil	Wat Por 2	4	7.8%	327	67	6		6
01_Anlong Vil	Kancheut Baydak	10	16.1%	451	92	15		15
01_Anlong Vil	Ang long Vil	4	7.0%	262	54	4		4
01_Anlong Vil	Preak Ta Voung	21	23.3%	560	114	27		27
01_Anlong Vil	Kampong Kra bey	7	12.5%	263	54	7		7
01_Anlong Vil	Phlouv Kra bey	5	8.8%	298	61	6		6
01_Anlong Vil	Preak Ta Kong	11	18.3%	0	0			
01_Anlong Vil	Koah Kra sang	14	20.6%	0	0			
01_Anlong Vil	Preak Chheur Trav	25	26.9%	0	0			
01_Anlong Vil	Chey Chom mas	28	29.2%	0	0			
01_Anlong Vil	Boeung Chhouk	22	20.8%	0	0			
01_Anlong Vil	Kbal Ro meas	11	12.1%	0	0			
03_Kandieng	Kandieng Knoung	8	12.1%	321	66			
03_Kandieng	Kandieng	12	16.7%	352	72			
03_Kandieng	Station	17	15.0%	270	55			
03_Kandieng	Yous	7	10.3%	63	13			
03_Kandieng	Keo Vi chey	13	15.1%	6	2			
03_Kandieng	Prey Kdey leu	9	20.9%	45	10			
03_Kandieng	Prey Kdey Kandal	9	16.7%	38	8			
03_Kandieng	Kampong Roka	8	15.1%	0	0			
03_Kandieng	Svay Yeang	15	19.5%	0	0			
03_Kandieng	Bong Kol	16	12.7%	0	0			
03_Kandieng	Steoung Leu	14	15.4%	0	0			
03_Kandieng	Steoung Krom	14	16.9%	0	0			
03_Kandieng	Kampong Krasang leu	3	3.9%	0	0			
03_Kandieng	Kampong Krasang Kron	11	11.2%	0	0			
03_Kandieng	Boeung Chhouk	18	11.1%	0	0			
03_Kandieng	Prey Kdey Krom	12	12.5%	0	0	0		0
07_Svay Luong	Boeung Kranh	13	10.7%	328	67			
07_Svay Luong	Rong Machine	2	2.6%	157	32			

Commune	VillageName	(B") Poor 1 Households	(C)=(B")/(A) Rate of Total Poor	(D) 2025 year population	(E)=(D)/4.91 2025 year population	Poor Households	Poor Households (Urban)	Poor Households (Rural)
07_Svay Luong	Svay Luong	3	5.0%	232	48			
07_Svay Luong	Svay Chan	4	3.8%	130	27			
07_Svay Luong	Plouv portivong	22	30.1%	160	33			
07_Svay Luong	Svay Cham bok	23	28.8%	391	80	23		23
07_Svay Luong	Por Leurng	4	4.6%	0	0			
07_Svay Luong	Ko Kor	3	5.5%	0	0			
07_Svay Luong	San lot	5	7.8%	0	0			
07_Svay Luong	Svay Yeang	16	15.1%	0	0			
09_Veal	Kbal Hong	14	9.8%	869	178	18	18	
09_Veal	Bralay Thom	68	35.2%	998	204	72	72	
09_Veal	Veal	8	6.7%	513	105	8	8	
09_Veal	Por Kambor	23	15.4%	669	137	22	22	
09_Veal	Kancheut Baydak	4	4.4%	385	79	4	4	
09_Veal	Por Damnak	9	5.6%	692	141	8	8	
09_Veal	Boeung Ya	13	11.4%	508	104	12	12	
09_Veal	Ta Sdey	26	28.3%	440	90	26	26	
09_Veal	Toul Pon Ro	9	11.1%	462	95	11	11	
10_Kaoh Chum	Bridge	17	8.9%	1073	219	20		20
10_Kaoh Chum	Dong Ron	24	14.6%	1062	217	32		32
10_Kaoh Chum	Ang long hab	11	6.4%	862	176	12		12
01_Chamraeun Phal	Leav	56	32.0%	672	137	44	44	
01_Chamraeun Phal	Au Toung	32	17.3%	1423	290	51	51	
01_Chamraeun Phal	Svay Meas	10	8.3%	658	135	12	12	
03_Lolok Sa	Por ta koy	8	3.1%	1422	290	9	9	
03_Lolok Sa	Preak Sdey	9	3.4%	1478	302	11	11	
03_Lolok Sa	Lolork sa	3	2.8%	536	110	4	4	
03_Lolok Sa	Phsar Leu	2	2.0%	631	129	3	3	
03_Lolok Sa	Phum Kok	33	15.3%	1223	250	39	39	
03_Lolok Sa	Wat Loung	13	6.2%	1364	278	18	18	
03_Lolok Sa	Chhom rom siem	13	10.4%	1020	208	22	22	
04_Phteah Prey	Peal nheak 1	44	2.5%	3298	672	18	18	
04_Phteah Prey	Peal nheak 2	44	2.5%	3404	694	18	18	
04_Phteah Prey	Khal Hong	44	2.5%	1355	276	8	8	
04_Phteah Prey	North banana plantation	4	0.9%	3266	666	6	6	
04_Phteah Prey	South banana plantation	4	1.5%	1025	209	4	4	
04_Phteah Prey	Ou Sdav	1	0.7%	785	160	2	2	
04_Phteah Prey	Ra	4	1.3%	1608	328	5	5	
04_Phteah Prey	Thnort Threat	8	4.4%	1100	225	10	10	
04_Phteah Prey	Kork	19	10.9%	887	181	20	20	
04_Phteah Prey	Dong ka	4	2.0%	1158	236	5	5	
05_Prey Nhi	Bak roteas	25	10.4%	1652	337	36	36	
05_Prey Nhi	Doung Chhroum	3	2.4%	639	131	4	4	
05_Prey Nhi	Bralay Thom	4	3.9%	449	92	4	4	
05_Prey Nhi	Kbal saen thmor	1	1.1%	437	89	1	1	
05_Prey Nhi	Man chear	27	13.9%	1450	296	42	42	
05_Prey Nhi	Krang Ta Sen	24	15.1%	423	87	13	13	
05_Prey Nhi	Sala Kom rou	14	13.5%	790	161	22	22	
05_Prey Nhi	Sras Srong	8	10.3%	300	62	7	7	
06_Roleab	Por Andat	4	3.3%	730	149	5	5	
06_Roleab	Thnorl Bombeak	7	6.5%	725	148	10	10	
06_Roleab	Concrete bridge	182	6.3%	1267	259	17	17	
06_Roleab	Chhloun kat	7	4.7%	712	146	7	7	
06_Roleab	Steung Toch	7	5.0%	763	156	8	8	
06_Roleab	Japan road	9	4.4%	1093	223	10	10	
06_Roleab	Preak Orl mal	26	5.3%	2711	553	30	30	
06_Roleab	Soriya leu	1	1.4%	486	99	2	2	
06_Roleab	Soriya krom	6	7.2%	365	75	6	6	
06_Roleab	Preak Tnout	2	1.1%	996	203	3	3	
06_Roleab	Toul Makak	15	4.7%	1474	301	15	15	
06_Roleab	Roleab	56	9.3%	4	1	1	1	

Commune	VillageName	(B") Poor 1 Households	(C)=(B")/(A) Rate of Total Poor	(D) 2025 year population	(E)=(D)/4.91 2025 year population	Poor Households	Poor Households (Urban)	Poor Households (Rural)
07_Svay At	Kran Pornlak	5	2.6%	1143	233	6	6	
07_Svay At	Trang	6	6.3%	514	105	7	7	
07_Svay At	Station	28	8.8%	1742	355	32	32	
07_Svay At	Ou Sdav	20	11.0%	1151	235	26	26	
07_Svay At	Svat At	43	20.7%	1477	301	63	63	
08_Bateay Dei	Ou Bakon leu	7	11.1%	398	82	10	10	
08_Bateay Dei	Ou Bakon Krom	12	10.1%	479	98	10	10	
08_Bateay Dei	Ou Bakon Kandal	8	13.8%	256	53	8	8	
08_Bateay Dei	Keo Sovann leu	4	3.7%	680	139	6	6	
08_Bateay Dei	Keo Sovann krom	4	5.6%	339	70	4	4	
08_Bateay Dei	Kbal Hong	10	11.4%	695	142	17	17	
08_Bateay Dei	Bondous Sandaek	15	11.9%	548	112	14	14	
08_Bateay Dei	Ouek Slam	9	5.4%	764	156	9	9	
08_Bateay Dei	Banteay dey leu	5	3.2%	724	148	5	5	
08_Bateay Dei	Banteay dey krom	6	5.0%	592	121	7	7	
08_Bateay Dei	Keo Mony	13	10.7%	652	133	15	15	
08_Bateay Dei	Ta Koy	9	11.1%	453	93	11	11	
Total		1990	10.6% (Average)	75035	15329	1248	983	265

Annex 7.11

Basic information of the water sector in each country/organization

Basic information of the water sector in each country/organization

Country: Cambodia **Organization: Pursat Water Works**

	指標・情報/ Indicators & Information	Figure/Information	Unit	Resource/ Calculation basis
セクター概要 (Sector Information)				
1	国家人口 / Total Population of the country	1,630	people	2018, IMF
	一人当たりGDP/ GDP per capita	1,485	USD／capita	2018, IMF
2	年間降水量/ Annual rainfall	1,410	mm／year	MOWRAM, 1996-2016
	気候帯/ Climatic zone	Tropical Monsoon		Statistic Yearbook 2008 Ministry of Planning
3	改善された水源へのアクセス率/ % of access to improved water sources	75	%	JMP2017
4	水道セクターのガバナンス/ Governance of the water sector	The water supply department in General Affairs of the Industry in Ministry of Industry and Handycraft has jurisdiction over the water supply to urban areas. Waterworks, which is a subordinate organization of the DIH in each state, operates and maintains actual water supply. There are 24 provences in Cambodia. Water Supply Corporation in Phnom Penh and Siem Reap city, Public water surveces (Water Works) in the capital city of 12 provinces), and other private enterprises in other provinces have responsibility to supply water. Water supply to rural areas is under the jurisdiction of Rural water supply department in the Ministry of Rural Development.		Survey on the Water Supply Sector in the Kingdom of Cambodia, June, 2010, JICA
5	主要な開発方針、開発課題/ Main development strategies and challenges (National strategies, master plan, relevant regulations, structural reform plans, etc.)	Cambodian government set up "Citizens receive safe water supply, have sanitation facilities, enjoy safe, hygienic and environmentally adapted living environment " as national policy in water supply sector. Goal in 2025: 100% of citizens can access safety water in urban area. There is not any relevant laws on water supply. Cambodian Goverment proceeds to formulate the laws currently. MIH publishes water quality standards on drinking water.		National Policy on Water Supply and Sanitation, 2003 National Strategic Development Plan（NSDP, 2014-2018）
Outline of the Organization				
1	水道事業体の形態、監督・規制体制/ (1) Type of the organization (State enterprise / Independent water utility, etc.) (2) Ministry or other government agency which is overseeing the organization	Pursat Water Works under Pursat DIH supplies water to the urban area in Pursat province.		Project on Capacity Building for Urban Water Supply System in Cambodia（Phase 3), Monitoring Report, May 2014, JICA
2	当該水道事業体の計画給水区域/ Geographical area for which the organization is responsible for to provide water supply services	3Districts(Bakan, Kandieng, Krong Pursat)、13Communes, 97Villages		
3	水源/ Type of water sources	Surface Water : Pursat River		
4	水源開発余力/ Potential for future development of water sources	Minimum Discharge from Dhamnak Ampil to the downstream: 6.67m^3/sec Intake Amount: 0.09m^3/sec Necessary Environmental Discharge to the Downstream: 4.48m^3/sec		
5	水道普及率/ Service coverage ratio	37.8 (2018, Water Supplied Population(urban area 35,682+rural area 4,003) /Population in Administrative Area 99,691)	%	
6	給水人口/ Service population	37,661 (2018)	people	

7	一日平均給水量/ Average daily water supply volume	5,607 (2018)	m^3／day	
8	一人一日平均給水量/ Average daily per-capita water supply volume	100 (Average in 2013 - 2018)	litre/person/day	
9	給水時間/ Average service hours	24 (2016)	hour/day (or hour/week)	
10	無収水率/ Non-revenue water ratio	11.3	%	
11	財務規模、収支/ Fiscal scale, Operating cost coverage	<2018> Gross Income: 3,189 million Riel (88.69million Yen) Total Cost: 2,783million Riel (77.39million Yen) (Depriciation Cost Inclusive) Net Income: 406million Riel (11.30million Yen)		
12	水道料金水準/ (1) Water tariff structure (2) Average tariff (USD／m^3)	1,600 Riel/m^3 (0.40USD/m3)	USD／m^3	
13	料金徴収率/ Tariff collection ratio	100 (2017)	%	
14	メーター設置率/ Customer meter installation ratio	100 (2017)	%	
15	1,000接続当たりの職員数/ Number of employees per 1,000 connections	5.2 (2017)	staff／1,000 connections	
16	施設の状況、施設の運転・維持管理状況/ Current issues of water supply facilities and their O&M (e.g., leakage, water quality degradation due to old equipment or over-capacity operation etc., low/high water pressure, etc.)	Regarding water supply facilities, ADB conducted a renovation project in 2007. In addition, as a result of extending the capacity by the Pursat Waterworks, the water supply capacity as of 2017 was 7,260 m 3 / day. Failed valves are reported at intake pump stations in existing water supply facilities , but other major facilities are in operation. In the expenditure plan, a certain amount of repair and maintenance expenses are recorded monthly. Regarding the above-mentioned failed valves, the waterworks repaired it during the dry season from 2017 to 2018. Regarding the operation and maintenance of the facility, the Pursat Waterworks has basic technical capabilities through the technical cooperation project "Project on Capacity Building for Urban Water Supply System in Cambodia (Phase 3)".		
17	水道事業体の業務目標と課題/ (1) Business plan and strategy (Mid-term strategy, target performance indicators, etc.) (2) Challenges of the organization	There is no mid- to long-term plan concerning the Pursat water service business. The Waterworks formulates the annual business plan and is approved by Department of Industry and Handicraft of Pursat province (DIH) and is submitted to the Minister of Industry and Handicraft (MIH) from DIH, every year. In recent years, connection of 100 houses per year has been progressing. However, as the water supply facilities expand, additional maintenance staff will be required. The non-revenue water ratio is around 10%, which is low as a developing country.		

Annex 7.12

Scope of JICA Grant Aid Project in Pursat

(Study of Water Supply Area)

1. Purpose and the Methodology of Steps of Study

In order to decide the water supply area, which is one of the basic matters of the scope of JICA grant aid project in Pursat, the following study was conducted.

Firstly, the areas were categorized into seven cases of the water supply area considering the priority water supply area set by the Cambodian side and the area emphasizing investment efficiency.

Next, increased population to be served and increased maximum daily supply in the extended water supply areas was estimated based on the water demand projection of year 2025.

Following this, preliminary design of facilities including intake, water conveyance, water treatment, and water distribution facilities was carried out considering their capacities as the above maximum daily water supply.

Finally, the initial and renewal cost and operation and maintenance cost required for this was estimated, and cost-benefit analysis was examined. The optimal water supply area was proposed based on the results of these studies.

2. Study Cases and Assumptions

(1) **Water supply area**：The area is proposed considering the priority water supply area set by the Cambodian side and investment efficiency.

(2) **Population to be served and maximum daily water supply**：The increased population to be served was calculated for the existing area plus the extended area for projected population of year 2025. Maximum daily water supply was calculated for this increased population to be served.

(3) **Outline of the water supply facility plan**：water intake facilities, water conveyance facilities, water treatment facilities, and water distribution system with facilities capacity equivalent to the maximum daily water supply.

(Refer to Table 2 for the above)

(4) **Initial and renewal cost**: Approximate initial cost was calculated based on the preliminary facility design by referring to the similar, same-sized projects and renewal cost for the mechanical and electrical equipment was calculated considering their design life.

(5) **Operation and maintenance (O&M) cost**: It is based on preliminary facility plan and consists of personnel expenses calculated with reference to actual results, electric power costs, chemical expenses, and repair costs for mechanical and electric equipment after the completion of initial water facilities construction.

(6) **Cost-benefit analysis**: The total cost (C) is the cost of initial water facilities to be constructed and the renewal cost for mechanical and electric equipment based on the design life and O & M cost. The effect (total benefit (B)) generated by the project is the revenue from water charges. Net present values of both cost and benefit are calculated for a period of 50 years after the completion of construction of the initial water facilities. The benefit-cost ratio (B/C) is calculated with the NPVs.

(Refer to Table 1 for the above)

3. Results and Recommendation

The results of the preliminary study are shown in Table 2. It is desirable to further adjust the water supply area, which is one of the fundamental matters of the scope of JICA grant aid project in Pursat, based on Case 6 which has high investment effects. The reasons are as follows.

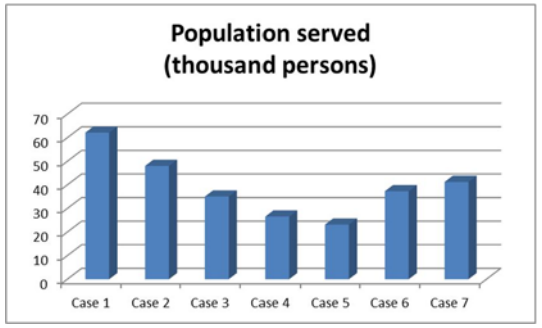
- Current piped water supply coverage ratio in Pursat is 37.3%. In the year 2025, the coverage ratio is estimated to be about 70% in case 1, case 2, case 6 and case 7.
- It is very difficult to include the entire area requested by the Cambodian side (Case 1). It is also not possible to include the area as per case 2 from the viewpoint of the project cost and JICA grant aid budget constraint.
- Assuming that initial construction of water supply facilities is undertaken with JICA grant aid project, Cases 1, 2, 6, and 7 results in B/C >1.
- Generally, the construction cost of the water distribution pipe occupies a large proportion of the project cost. Under Case 6, the length of water distribution pipe is 3.4 m/person (1.5 m/person for 75 mm or bigger diameter pipe). This length is the smallest length of the water supply pipe per population served. Therefore, this case is the most efficient plan with respect to pipe length and the investment effect is also reasonable compared to other cases.

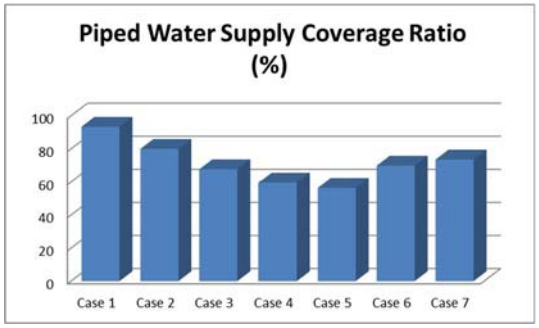
Table 1 Result of examination of planned water supply area setting

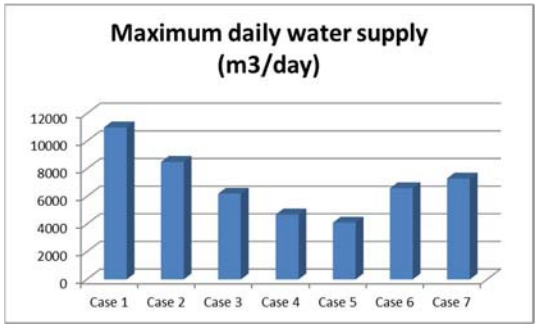
	Case1	Case2	Case 3	Case 4	Case 5	Case 6	Case 7
	Proposed extended area considering the priority water supply area set by the Cambodian side					Proposed extension area focusing on investment efficiency	
Comparison of each item							
Population served (thousand persons)*1	62.1	48.0	35.0	26.6	23.2	37.3	41.2
Piped water supply coverage ratio (%)*2	93.4	80.0	67.6	59.6	56.4	69.8	73.5
Piped water supply coverage ratio (%) for Urban Area	*100*	*91.1*	*81.8*	*75.8*	*75.8*	*84.9*	*88.4*
Maximum daily water supply (m^3/day)*1	11,000	8,500	6,200	4,700	4,100	6,600	7,300
Number of service connections (places)*1	13,020	10,060	7,340	5,560	4,850	7,810	8,640
Length of distributing pipes (km)(φ75 or more)*3	224.0 (121.0)	167.3 (83.3)	124.0 (66.0)	96.7 (48.7)	81.3 (37.3)	128.1 (57.1)	144.1 (68.1)
Length of distributing pipes per population served (m/person)(φ75or more)*4	3.6 (1.9)	3.5 (1.7)	3.5 (1.9)	3.6 (1.8)	3.5 (1.6)	3.4 (1.5)	3.5 (1.7)
Calculation and comparison of B/C (a): Assuming that the initial facility construction cost is a burden on Cambodian side. (b): Assumed that the initial facility construction cost is covered by grant aid (a)-(b): Assumed amount to be borne by Japanese grant aid							

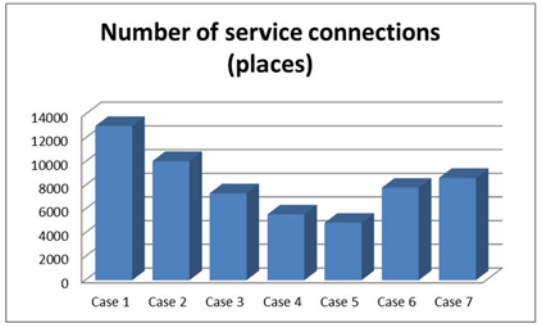
		Case1		Case2		Case 3		Case 4		Case 5		Case 6		Case 7	
Total cost	Initial and renewal cost (hundred million yen)*5	(a) 56.3	(b) 7.5	(a) 47.4	(b) 7.0	(a) 40.7	(b) 6.6	(a) 36.1	(b) 6.3	(a) 33.7	(b) 6.2	(a) 41.6	(b) 6.7	(a) 44.0	(b) 6.8
		(a)-(b) 48.8		**(a)-(b) 40.4**		**(a)-(b) 34.1**		**(a)-(b) 29.8**		**(a)-(b) 27.5**		**(a)-(b) 34.9**		**(a)-(b) 37.2**	
	O&M costs (hundred million yen)*6	10.9	10.9	8.5	8.5	7.9	7.9	6.2	6.2	6.0	6.0	7.7	7.7	7.9	7.9
	Total (hundred million yen) (C)	67.2	18.4	56.0	15.6	48.6	14.5	42.3	12.5	39.7	12.2	49.3	14.4	51.9	14.7
Total benefit	Water charges revenue (hundred	25.5	25.5	19.7	19.7	14.4	14.4	10.9	10.9	9.5	9.5	15.3	15.3	16.9	16.9

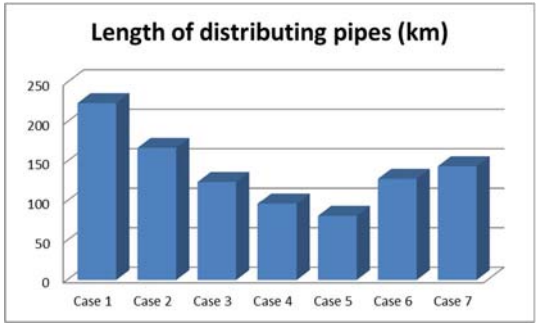
【Reference diagram】

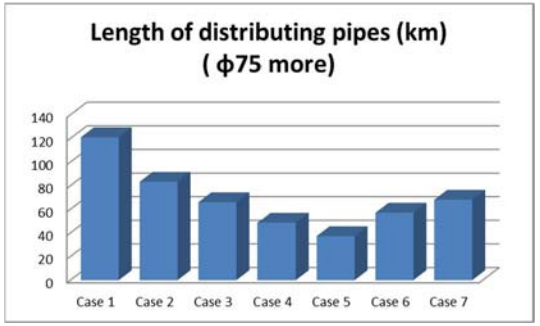


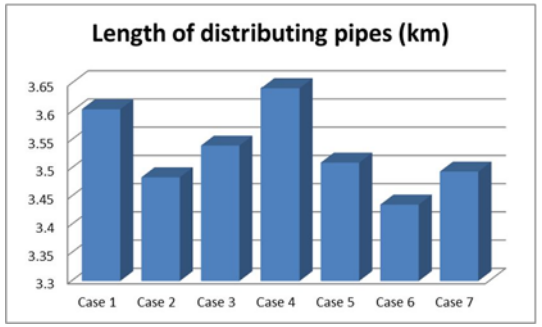


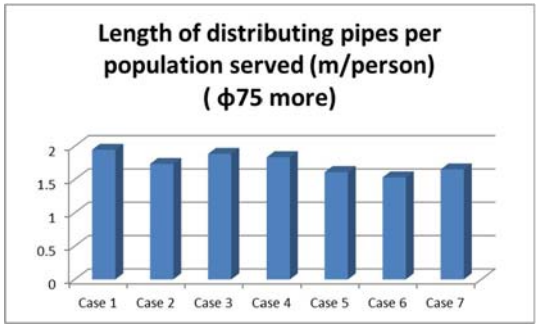












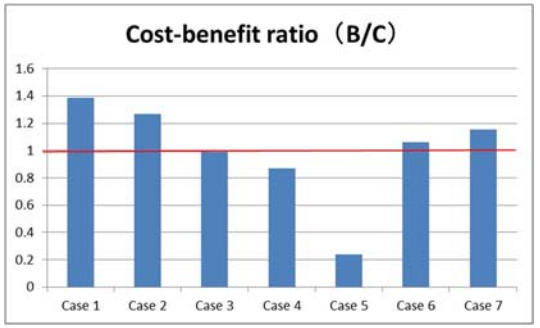
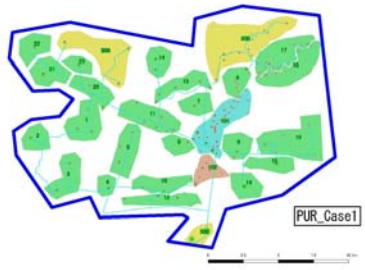
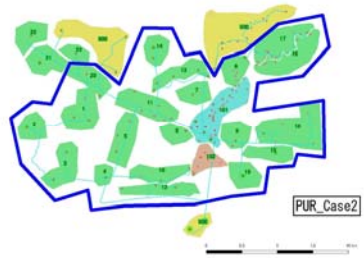
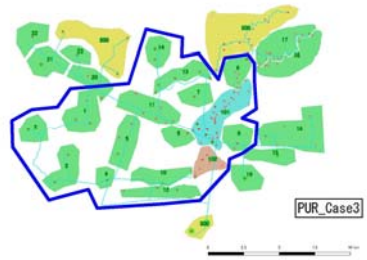


Table 2 Cases of the water supply area and increased water supply population, increased daily maximum water supply and outline of the water supply facility plan

<table>
<tr><th>Case №</th><th>Water supply area</th><th>Increased water supply population, increased daily maximum water supply and outline of the water supply facility plan</th></tr>
<tr><td>1</td><td> 

Water supply area (Existing and extended)
A case where the water supply area is set for the entire area requested from the Cambodian side</td><td>Increased population served 62,100 persons
Increased maximum daily water supply 11,000m³/day
<table>
<tr><td rowspan="2">Water intake facility</td><td>Intake
Grit removal chamber</td><td>12,100 m³/day</td></tr>
<tr><td>Intake pump</td><td>4.2m³/min x 30m x 45kw x 3(1 stand-by) sets</td></tr>
<tr><td>Water conveyance facility</td><td>Water conveyance pipe</td><td>φ450 x 7.8km</td></tr>
<tr><td>Water treatment facility</td><td>Water treatment facility</td><td>Coagulation-sedimentation・rapid sand filtration method 11,000m³/day</td></tr>
<tr><td rowspan="3">Water distribution system</td><td>Distribution reservoir</td><td>1,800m³ x 1basin</td></tr>
<tr><td>Distribution pump</td><td>2.5m³/min x 50m x 30kw x 5(1 stand-by) sets</td></tr>
<tr><td>Distribution pipe</td><td>φ75~φ500x121km,φ50x103km Total224km</td></tr>
<tr><td>Service connections</td><td></td><td>13,020 places</td></tr>
</table></td></tr>
<tr><td>2</td><td> 

Water supply area (Existing and extended)
In this case, the area is set based on the priority of the Cambodian side, water supply area is narrower than case 1</td><td>Increased population served 48,000 persons
Increased maximum daily water supply 8,500m³/ day
<table>
<tr><td rowspan="2">Water intake facility</td><td>Intake
Grit removal chamber</td><td>9,350 m³/day</td></tr>
<tr><td>Intake pump</td><td>3.2m³/min x 32m x 30kw x 3(1 stand-by) sets</td></tr>
<tr><td>Water conveyance facility</td><td>Water conveyance pipe</td><td>φ400 x7.8km</td></tr>
<tr><td>Water treatment facility</td><td>Water treatment facility</td><td>Coagulation-sedimentation・rapid sand filtration method 8,500m³/day</td></tr>
<tr><td rowspan="3">Water distribution system</td><td>Distribution reservoir</td><td>1,500m³ x1 basin</td></tr>
<tr><td>Distribution pump</td><td>2.6m³/min x 50m x 30kw x 4(1 stand-by) sets</td></tr>
<tr><td>Distribution pipe</td><td>φ75~φ450 x 83.3km, φ50 x 84km Total 167.3km</td></tr>
<tr><td>Service connections</td><td></td><td>10,060 places</td></tr>
</table></td></tr>
<tr><td>3</td><td> 

Water supply area (Existing and extended)
In this case, the area is set based on the priority of the Cambodian side, water supply area is narrower than case 2</td><td>Increased population served 35,000 persons
Increased maximum daily water supply 6,200m3/ day
<table>
<tr><td rowspan="2">Water intake facility</td><td>Intake
Grit removal chamber</td><td>6,820 m³/day</td></tr>
<tr><td>Intake pump</td><td>2.4m³/min x 33m x 30kw x 3(1 stand-by) sets</td></tr>
<tr><td>Water conveyance facility</td><td>Water conveyance pipe</td><td>φ350 x 7.8km</td></tr>
<tr><td>Water treatment facility</td><td>Water treatment facility</td><td>Coagulation-sedimentation・rapid sand filtration method 6,200m³/day</td></tr>
<tr><td rowspan="3">Water distribution system</td><td>Distribution reservoir</td><td>1,200m³ x 1basin</td></tr>
<tr><td>Distribution pump</td><td>1.9m³/min x 50m x 30kw x 4(1 stand-by) sets</td></tr>
<tr><td>Distribution pipe</td><td>φ75~φ400 x 66km, φ50 x 58km Total 124km</td></tr>
<tr><td>Service connections</td><td></td><td>7,340 places</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>Case №</th><th>Water supply area</th><th>Increased water supply population, increased daily maximum water supply and outline of the water supply facility plan</th></tr>
<tr><td>4</td><td> 

Water supply area (Existing and extended)
In this case, the area is set based on the priority of the Cambodian side, water supply area is narrower than case 3</td><td>Increased population served 26,600 persons
Increased maximum daily water supply 4,700m^3/ day
<table>
<tr><td rowspan="2">Water intake facility</td><td>Intake</td><td rowspan="2">5,170 m^3/day</td></tr>
<tr><td>Grit removal chamber</td></tr>
<tr><td></td><td>Intake pump</td><td>1.8m^3/min x 39m x 18.5kw x 3(1 stand-by) sets</td></tr>
<tr><td>Water conveyance facility</td><td>Water conveyance pipe</td><td>φ300 x 7.8km</td></tr>
<tr><td>Water treatment facility</td><td>Water treatment facility</td><td>Coagulation-sedimentation・rapid sand filtration method 4,700m^3/day</td></tr>
<tr><td rowspan="3">Water distribution system</td><td>Distribution reservoir</td><td>1,000m^3 x 1basin</td></tr>
<tr><td>Distribution pump</td><td>1.5m^3/min x 50m x 22kw x 4(1 stand-by) sets</td></tr>
<tr><td>Distribution pipe</td><td>φ75~φ400 x 48.7km, φ50 x 48km Total 96.7 km</td></tr>
<tr><td>Service connections</td><td></td><td>5,560 places</td></tr>
</table></td></tr>
<tr><td>5</td><td> 

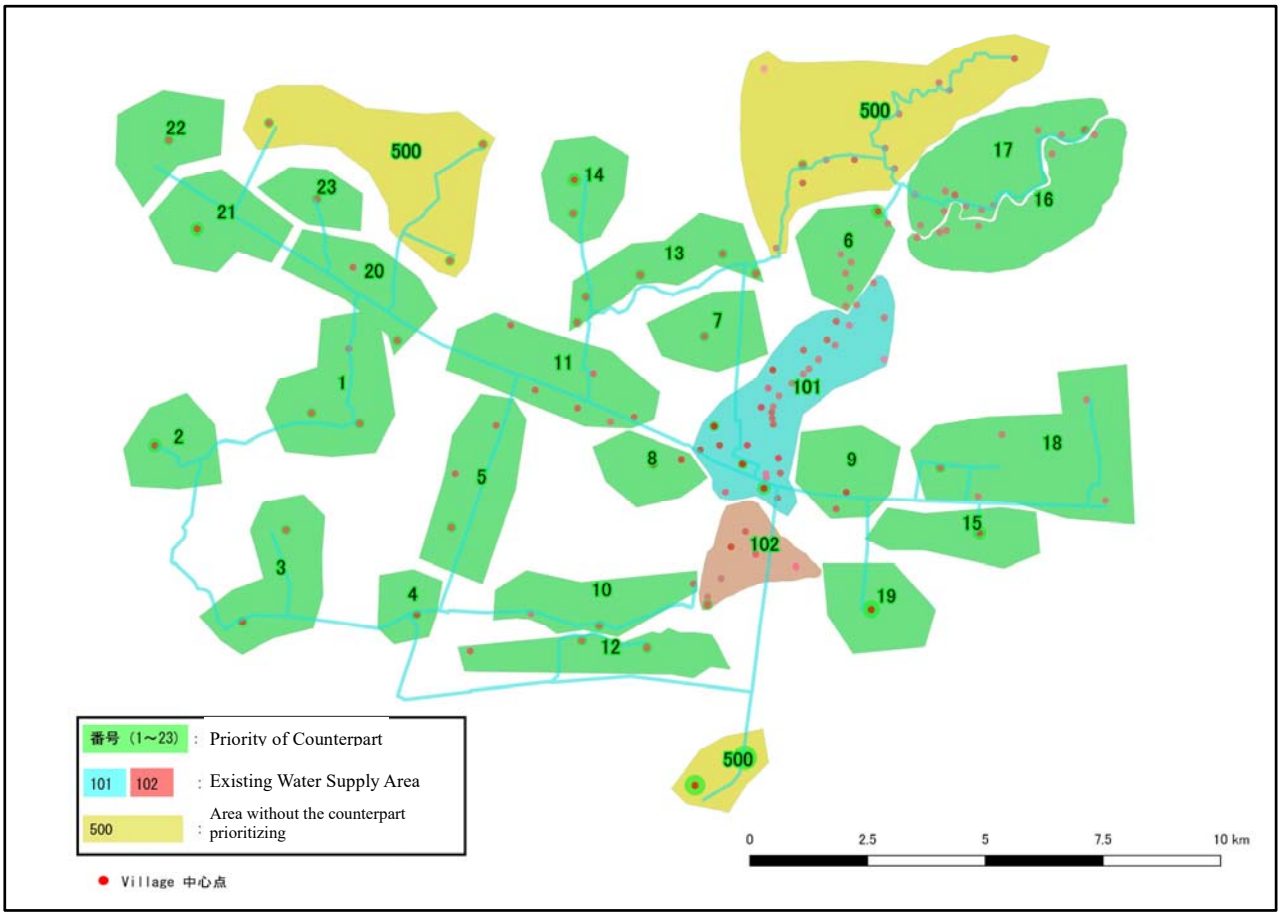
Water supply area (Existing and extended)
In this case, the area is set based on the priority of the Cambodian side, water supply area is narrower than case 4</td><td>Increased population served 23,200 persons
Increased maximum daily water supply 4,100m^3/ day
<table>
<tr><td rowspan="2">Water intake facility</td><td>Intake</td><td rowspan="2">4,510 m^3/day</td></tr>
<tr><td>Grit removal chamber</td></tr>
<tr><td></td><td>Intake pump</td><td>1.6m^3/min x 33m x 18.5kw x 3(1 stand-by) sets</td></tr>
<tr><td>Water conveyance facility</td><td>Water conveyance pipe</td><td>φ300x7.8km</td></tr>
<tr><td>Water treatment facility</td><td>Water treatment facility</td><td>Coagulation-sedimentation・rapid sand filtration method 4,100m^3/day</td></tr>
<tr><td rowspan="3">Water distribution system</td><td>Distribution reservoir</td><td>1,000m^3 x 1basin</td></tr>
<tr><td>Distribution pump</td><td>1.3m^3/min x 50m x 22kw x 4(1 stand-by) sets</td></tr>
<tr><td>Distribution pipe</td><td>φ75~φ300x37.3km, φ50 x 44km Total 81.3km</td></tr>
<tr><td>Service connections</td><td></td><td>4,850 places</td></tr>
</table></td></tr>
<tr><td>6</td><td> 

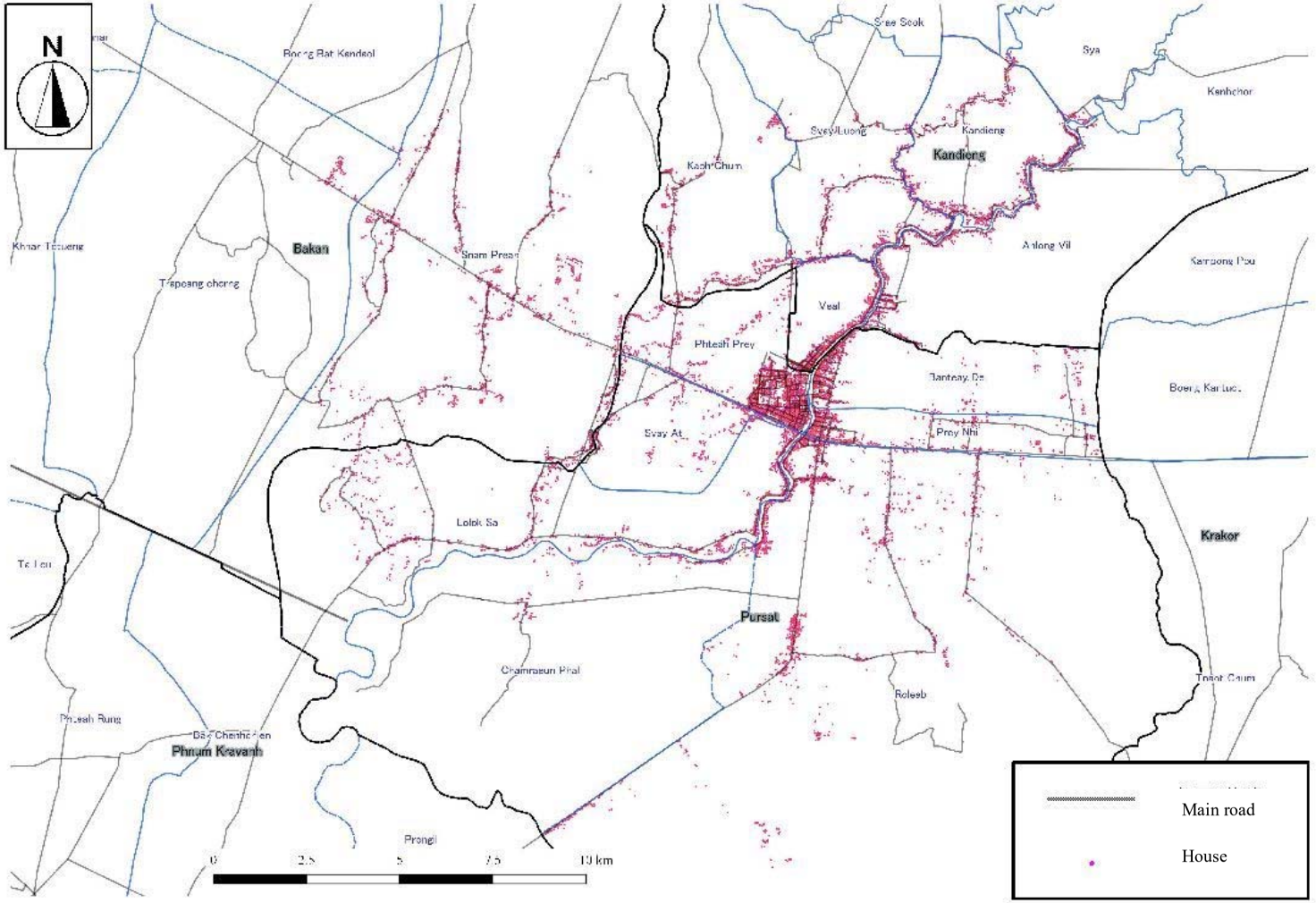
Water supply area (Existing and extended)
Proposed extension area focusing on investment efficiency</td><td>Increased population served 37,300 persons
Increased maximum daily water supply 6,600m^3/ day
<table>
<tr><td rowspan="2">Water intake facility</td><td>Intake</td><td rowspan="2">7,260 m^3/day</td></tr>
<tr><td>Grit removal chamber</td></tr>
<tr><td></td><td>Intake pump</td><td>2.5 m^3/min x 36m x 30 kw x 3(1 stand-by) sets</td></tr>
<tr><td>Water conveyance facility</td><td>Water conveyance pipe</td><td>Φ350x7.8km</td></tr>
<tr><td>Water treatment facility</td><td>Water treatment facility</td><td>Coagulation-sedimentation・rapid sand filtration method 6,600m^3/day</td></tr>
<tr><td rowspan="3">Water distribution system</td><td>Distribution reservoir</td><td>1,000m^3 x 1basin</td></tr>
<tr><td>Distribution pump</td><td>2.0m^3/min x 50m x 30kw x 4(1 stand-by) sets</td></tr>
<tr><td>Distribution pipe</td><td>φ75~φ300 x 57.1km, φ50 x 71km Total 128.1km</td></tr>
<tr><td>Service connections</td><td></td><td>7,810 places</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>Case №</th><th>Water supply area</th><th>Increased water supply population, increased daily maximum water supply and outline of the water supply facility plan</th></tr>
<tr><td>7</td><td> 

Water supply area (Existing and extended)
Proposed extension area focusing on investment efficiency, water supply area further extended than Case 6</td><td>Increased population served 41,200 persons
Increased maximum daily water supply 7,300 m^3/ day
<table>
<tr><td rowspan="2">Water intake facility</td><td>Intake</td><td rowspan="2">8,030 m^3/day</td></tr>
<tr><td>Grit removal chamber</td></tr>
<tr><td></td><td>Intake pump</td><td>2.8m^3/min x 33m x 30kw x 3(1 stand-by) sets</td></tr>
<tr><td>Water conveyance facility</td><td>Water conveyance pipe</td><td>φ450 x 7.8km</td></tr>
<tr><td>Water treatment facility</td><td>Water treatment facility</td><td>Coagulation-sedimentation・rapid sand filtration method 7,300m^3/day</td></tr>
<tr><td rowspan="3">Water distribution system</td><td>Distribution reservoir</td><td>1,000m^3 x 1 basin</td></tr>
<tr><td>Distribution pump</td><td>2.2m^3/min x 50m x 30kw x 4(1 stand-by) sets</td></tr>
<tr><td>Distribution pipe</td><td>φ75~φ300 x 68.1km, φ50 x 76km Total 144.1km</td></tr>
<tr><td>Service connections</td><td></td><td>8,640 places</td></tr>
</table></td></tr>
</table>

＜Explanation of each case target area map (reference)＞





Reference map) The situation of house distribution in Pursat

Source) JICA Survey Team

Reference table) Village included in water supply area for each case

Legend 1: Within the water supply area 0: Outside the water supply area

№	District	Commune	VillageNumber	VillageName	Village Level Priority 1	Village Level Priority 2	Area classification	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7
35	1502Kandieng	03_Kandieng	15020302	Keo Vi chey	99	24	Existing	1	0	0	0	0	0	0
36	1502Kandieng	03_Kandieng	15020308	Prey Kdey leu	29	17	Existing	1	1	0	0	0	1	1
37	1502Kandieng	03_Kandieng	15020309	Prey Kdey Kandal	29	17	Existing	1	1	0	0	0	1	1
38	1502Kandieng	03_Kandieng	15020301	Kampong Roka	99	500	Extended	1	0	0	0	0	0	0
39	1502Kandieng	03_Kandieng	15020303	Svay Yeang	99	500	Extended	1	0	0	0	0	0	0
40	1502Kandieng	03_Kandieng	15020312	Bong Kol	99	500	Extended	1	0	0	0	0	0	0
41	1502Kandieng	03_Kandieng	15020313	Steoung Leu	99	500	Extended	1	0	0	0	0	0	0
42	1502Kandieng	03_Kandieng	15020314	Steoung Krom	99	500	Extended	1	0	0	0	0	0	0
43	1502Kandieng	03_Kandieng	15020315	Kampong Krasang leu	29	17	Extended	1	1	0	0	0	1	1
44	1502Kandieng	03_Kandieng	15020316	Kampong Krasang Krom	29	17	Extended	1	1	0	0	0	1	1
45	1502Kandieng	03_Kandieng	15020317	Boeung Chhouk	29	17	Extended	1	1	0	0	0	1	1
46	1502Kandieng	07_Svay Luong	15020701	Boeung Kranh	99	17	Existing	1	1	0	0	0	1	1
47	1502Kandieng	07_Svay Luong	15020702	Rong Machine	99	17	Existing	1	1	0	0	0	1	1
48	1502Kandieng	07_Svay Luong	15020703	Svay Luong	99	6	Existing	1	1	1	1	1	1	1
49	1502Kandieng	07_Svay Luong	15020704	Svay Chan	99	6	Existing	1	1	1	1	1	1	1
50	1502Kandieng	07_Svay Luong	15020705	Plouv portivong	9	6	Existing	1	1	1	1	1	1	1
51	1502Kandieng	07_Svay Luong	15020706	Svay Cham bok	99	500	Extended	1	0	0	0	0	0	0
52	1502Kandieng	07_Svay Luong	15020707	Por Leurng	99	500	Extended	1	0	0	0	0	0	0
53	1502Kandieng	07_Svay Luong	15020708	Ko Kor	99	500	Extended	1	0	0	0	0	0	0
54	1502Kandieng	07_Svay Luong	15020709	San lot	99	500	Extended	1	0	0	0	0	0	0
55	1502Kandieng	07_Svay Luong	15020710	Svay Yeang	99	500	Extended	1	0	0	0	0	0	0
56	1502Kandieng	09_Veal	15020901	Kbal Hong	99	101-102	Existing	1	1	1	1	1	1	1
57	1502Kandieng	09_Veal	15020902	Bralay Thom	99	101-102	Existing	1	1	1	1	1	1	1
58	1502Kandieng	09_Veal	15020903	Veal	99	101-102	Existing	1	1	1	1	1	1	1
59	1502Kandieng	09_Veal	15020904	Por Kambor	99	101-102	Existing	1	1	1	1	1	1	1
60	1502Kandieng	09_Veal	15020905	Kancheut Baydak	99	6	Existing	1	1	1	1	1	1	1
61	1502Kandieng	09_Veal	15020906	Por Damnak	99	101-102	Existing	1	1	1	1	1	1	1
62	1502Kandieng	09_Veal	15020907	Boeung Ya	99	6	Existing	1	1	1	1	1	1	1
63	1502Kandieng	09_Veal	15020908	Ta Sdey	99	6	Existing	1	1	1	1	1	1	1
64	1502Kandieng	09_Veal	15020909	Toul Pon Ro	99	13	Extended	1	1	1	0	0	1	1
65	1502Kandieng	10_Kaoh Chum	15021002	Bridge	25	13	Extended	1	1	1	0	0	1	1
66	1502Kandieng	10_Kaoh Chum	15021003	Dong Ron	99	13	Extended	1	1	1	0	0	1	1
67	1502Kandieng	10_Kaoh Chum	15021004	Dong Lon	26	14	Extended	1	1	1	0	0	0	1
68	1502Kandieng	10_Kaoh Chum	15021001	Ang long hab	25	13	Extended	1	1	1	0	0	1	1
69	1502Kandieng	10_Kaoh Chum	15021005	Stock Chhom	26	14	Extended	1	1	1	0	0	0	1

Reference table) Village included in water supply area for each case

Legend 1: Within the water supply area 0: Outside the water supply area

№	District	Commune	VillageNumber	VillageName	Village Level Priority 1	Village Level Priority 2	Area classification	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7
1	1501Bakan	07_Snam Preah	15010715	Svay Att	99	11	Existing	1	1	1	1	1	1	1
2	1501Bakan	07_Snam Preah	15010712	Kam Peanh Svay	8	5	Existing	1	1	1	1	1	1	1
3	1501Bakan	07_Snam Preah	15010707	Stock Svay	40	23	Extended	1	0	0	0	0	0	0
4	1501Bakan	07_Snam Preah	15010703	Ang Doung Sambour	99	500	Existing	1	0	0	0	0	0	0
5	1501Bakan	07_Snam Preah	15010711	Ang long Mean	99	500	Extended	1	0	0	0	0	0	0
6	1501Bakan	07_Snam Preah	15010717	Ang Doung Krasang	36	21	Extended	1	0	0	0	0	0	0
7	1501Bakan	07_Snam Preah	15010701	Snam Preah	35	20	Existing	1	1	0	0	0	0	0
8	1501Bakan	07_Snam Preah	15010716	A Rean	1	1	Extended	1	1	1	1	0	0	0
9	1501Bakan	07_Snam Preah	15010719	Chheung Phleurng	2	1	Extended	1	1	1	1	0	0	0
10	1501Bakan	07_Snam Preah	15010702	Kra Peur Rol	99	20	Extended	1	1	0	0	0	0	0
11	1501Bakan	07_Snam Preah	15010708	Koah Krasang	3	1	Extended	1	1	1	1	0	0	0
12	1501Bakan	07_Snam Preah	15010710	Dang Keab Kdam	17	5	Extended	1	1	1	1	1	1	1
13	1501Bakan	07_Snam Preah	15010714	Chhout Ta Cab	4	2	Extended	1	1	1	1	0	0	0
14	1501Bakan	07_Snam Preah	15010718	Bak Prenh	99	500	Extended	1	0	0	0	0	0	0
15	1501Bakan	10_Trapeang Chorng	15011018	Kdey Chhnoul	38	22	Extended	1	0	0	0	0	0	0
16	1502Kandieng	01_Anlong Vil	15020101	Toul Cha	99	101-102	Existing	1	1	1	1	1	1	1
17	1502Kandieng	01_Anlong Vil	15020102	Ou Bakon	99	101-102	Existing	1	1	1	1	1	1	1
18	1502Kandieng	01_Anlong Vil	15020103	Wat Por 1	99	101-102	Existing	1	1	1	1	1	1	1
19	1502Kandieng	01_Anlong Vil	15020104	Wat Por 2	99	101-102	Existing	1	1	1	1	1	1	1
20	1502Kandieng	01_Anlong Vil	15020107	Kancheut Baydak	99	101-102	Existing	1	1	1	1	1	1	1
21	1502Kandieng	01_Anlong Vil	15020108	Ang long Vil	99	16	Existing	1	1	0	0	0	1	1
22	1502Kandieng	01_Anlong Vil	15020109	Preak Ta Voung	99	101-102	Existing	1	1	1	1	1	1	1
23	1502Kandieng	01_Anlong Vil	15020105	Kampong Kra bey	99	6	Extended	1	1	1	1	1	1	1
24	1502Kandieng	01_Anlong Vil	15020106	Phlouv Kra bey	99	6	Extended	1	1	1	1	1	1	1
25	1502Kandieng	01_Anlong Vil	15020110	Preak Ta Kong	28	16	Extended	1	1	0	0	0	1	1
26	1502Kandieng	01_Anlong Vil	15020111	Koah Kra sang	28	16	Extended	1	1	0	0	0	1	1
27	1502Kandieng	01_Anlong Vil	15020112	Preak Chheur Trav	28	16	Extended	1	1	0	0	0	1	1
28	1502Kandieng	01_Anlong Vil	15020113	Chey Chom mas	28	16	Extended	1	1	0	0	0	1	1
29	1502Kandieng	01_Anlong Vil	15020114	Boeung Chhouk	28	16	Extended	1	1	0	0	0	1	1
30	1502Kandieng	01_Anlong Vil	15020116	Kbal Ro meas	28	16	Extended	1	1	0	0	0	1	1
31	1502Kandieng	03_Kandieng	15020304	Kandieng Knoung	99	17	Existing	1	1	0	0	0	1	1
32	1502Kandieng	03_Kandieng	15020305	Kandieng	99	17	Existing	1	1	0	0	0	1	1
33	1502Kandieng	03_Kandieng	15020306	Station	99	17	Existing	1	1	0	0	0	1	1
34	1502Kandieng	03_Kandieng	15020307	Yous	99	17	Existing	1	1	0	0	0	1	1

Reference table) Village included in water supply area for each case

Legend 1: Within the water supply area 0: Outside the water supply area

№	District	Commune	VillageNumber	VillageName	Village Level Priority 1	Village Level Priority 2	Area classification	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7
70	1505Sampov Meas	01_Chamraeun Phal	15050101	Leav	24	12	Extended	1	1	1	0	0	0	1
71	1505Sampov Meas	01_Chamraeun Phal	15050103	Au Toung	24	12	Extended	1	1	1	0	0	0	1
72	1505Sampov Meas	01_Chamraeun Phal	15050107	Svay Meas	99	12	Extended	1	1	1	0	0	0	1
73	1505Sampov Meas	03_Lolok Sa	15050301	Por ta koy	99	101-102	Existing	1	1	1	1	1	1	1
74	1505Sampov Meas	03_Lolok Sa	15050302	Preak Sdey	99	101-102	Existing	1	1	1	1	1	1	1
75	1505Sampov Meas	03_Lolok Sa	15050303	Lolork sa	99	10	Existing	1	1	1	1	1	1	1
76	1505Sampov Meas	03_Lolok Sa	15050305	Phsar Leu	15	10	Extended	1	1	1	1	1	1	1
77	1505Sampov Meas	03_Lolok Sa	15050304	Phum Kok	14	10	Extended	1	1	1	1	1	1	1
78	1505Sampov Meas	03_Lolok Sa	15050306	Wat Loung	7	4	Extended	1	1	1	1	1	1	1
79	1505Sampov Meas	03_Lolok Sa	15050307	Chhom rom siem	99	5	Extended	1	1	1	1	1	1	1
80	1505Sampov Meas	03_Lolok Sa	15050308	Dob Bat	6	3	Extended	1	1	1	1	1	0	0
81	1505Sampov Meas	03_Lolok Sa	15050310	Khmoar	5	3	Extended	1	1	1	1	1	0	0
82	1505Sampov Meas	04_Phteah Prey	15050401	Peal nheak 1	99	101-102	Existing	1	1	1	1	1	1	1
83	1505Sampov Meas	04_Phteah Prey	15050402	Peal nheak 2	99	101-102	Existing	1	1	1	1	1	1	1
84	1505Sampov Meas	04_Phteah Prey	15050403	Khal Hong	99	101-102	Existing	1	1	1	1	1	1	1
85	1505Sampov Meas	04_Phteah Prey	15050405	North banana plantation	99	101-102	Existing	1	1	1	1	1	1	1
86	1505Sampov Meas	04_Phteah Prey	15050406	South banana plantation	99	101-102	Existing	1	1	1	1	1	1	1
87	1505Sampov Meas	04_Phteah Prey	15050407	Ou Sdav	23	11	Existing	1	1	1	1	1	1	1
88	1505Sampov Meas	04_Phteah Prey	15050410	Ra	99	101-102	Existing	1	1	1	1	1	1	1
89	1505Sampov Meas	04_Phteah Prey	15050408	Thnort Threat	24	11	Existing	1	1	1	1	1	1	1
90	1505Sampov Meas	04_Phteah Prey	15050409	Kork	99	13	Existing	1	1	1	0	0	1	1
91	1505Sampov Meas	04_Phteah Prey	15050404	Dong ka	10	7	Existing	1	1	1	1	1	1	1
92	1505Sampov Meas	05_Prey Nhi	15050501	Bak roteas	99	101-102	Existing	1	1	1	1	1	1	1
93	1505Sampov Meas	05_Prey Nhi	15050502	Doung Chhroum	99	101-102	Existing	1	1	1	1	1	1	1
94	1505Sampov Meas	05_Prey Nhi	15050503	Bralay Thom	99	101-102	Existing	1	1	1	1	1	1	1
95	1505Sampov Meas	05_Prey Nhi	15050504	Kbal saen thmor	99	101-102	Existing	1	1	1	1	1	1	1
96	1505Sampov Meas	05_Prey Nhi	15050505	Man chear	13	9	Existing	1	1	1	1	1	1	1
97	1505Sampov Meas	05_Prey Nhi	15050507	Krang Ta Sen	30	18	Extended	1	1	0	0	0	1	1
98	1505Sampov Meas	05_Prey Nhi	15050506	Sala Kom rou	99	18	Extended	1	1	0	0	0	1	1
99	1505Sampov Meas	05_Prey Nhi	15050508	Sras Srong	31	18	Extended	1	1	0	0	0	1	1
100	1505Sampov Meas	06_Roleab	15050601	Por Andat	99	101-102	Existing	1	1	1	1	1	1	1
101	1505Sampov Meas	06_Roleab	15050604	Thnorl Bombeak	27	9	Existing	1	1	1	1	1	1	1
102	1505Sampov Meas	06_Roleab	15050605	Concrete bridge	99	101-102	Existing	1	1	1	1	1	1	1
103	1505Sampov Meas	06_Roleab	15050606	Chhloun kat	99	101-102	Existing	1	1	1	1	1	1	1
104	1505Sampov Meas	06_Roleab	15050607	Steung Toch	99	101-102	Existing	1	1	1	1	1	1	1

Annex 7.13

Project Monitoring Reports

Annex 7.13
G/A NO. XXXXXXX
PMR prepared on 14/August/2018

Project Monitoring Report

on
Project Name
Chapter 1. *Grant Agreement No. XXXXXXX*

20XX, Month

Organizational Information

Signer of the G/A (Recipient)	_____ Person in Charge (Designation)_____ _____ Contacts Address:_____ Phone/FAX:_____ Email:_____
Executing Agency	**Ministry of Industry and Handicraft (MIH)** Person in Charge H.E. EK SONNCHAN, Secretary of State Ministry of Public Works and Transport_____ Contacts Address: 45, Preah Norodom Boulevard Phone/FAX: +855-97-77-11111 Email: eksonnchan@hotmail.com
Line Ministry	_____ Person in Charge (Designation)_____ _____ Contacts Address:_____ Phone/FAX:_____ Email:_____

General Information:

Project Title	The Project for Expansion of Water Supply Systems in Pursat
E/N	Signed date: Duration:
G/A	Signed date: Duration:
Source of Finance	Government of Japan: Not exceeding JPY _____mil. Government of (_____): _____

1: Project Description

1-1 Project Objective

The overall goal of the project is to contribute to the social development through the expansion of water supply system in Pursat, Cambodia. The purpose of the project is as follows;
1) Improving living environment of the residents
2) Increasing house connections for the poor household

1-2 Project Rationale

- Higher-level objectives to which the project contributes (national/regional/sectoral policies and strategies)
- Situation of the target groups to which the project addresses

Ability of water supply to the residents in Pursat City is expanded by this project. The water supply coverage ratio of approximately 40% in 2016 in the controlled area of the Water Works will be risen to 73.9% in the target year:2025. The ratio in the urban area advocated by MIH becomes 86.5%. Increased benefit population is approximately 39,400 people. The additional daily average water supply volume and daily maximum water supply volume are approximately 5,500m^3/day and 7,200m^3/day respectively.

Although the Pursat City has an existing water supply system, the expansion of the system becomes the urgent matter for the further improvement of the water supply coverage ratio because the ratio remains in approximately 40% in 2016

MIH aims to work out 100% of the water supply coverage ratio in the urban area by 2025 by covering 90% with pipe water supply system and remaining 10% with other water supply system. This aim can be almost accomplished in the urban area within the administrative area of the Waterworks. This project also includes supplying equipment and materials to the poor households for house connection works conducted by the Cambodian side. Therefore, the consistency with the poverty reduction which is the greatest purpose in NPDS is ensured.

According to "Rolling Plan for the Royal Government of Cambodia, July 2017", one of the important priority areas is "Promotion of Social Development" including "Program for Water Supply and Sewage System". The implementation of this project has consistency with this Japan's ODA policy.

1-3 Indicators for measurement of "Effectiveness"

Quantitative indicators to measure the attainment of project objectives		
Indicators	Original (Yr: 2016)	Target (Yr: 2025)
Dairy average water supply volume (m^3/day)	5,464	10,900
Population served (Person)	38,436	77,800
Qualitative indicators to measure the attainment of project objectives		
➢ Improving living environment of the residents ➢ Increasing house connections for the poor household		

2: Details of the Project

2-1 Location

Components	Original *(proposed in the outline design)*	Actual
1. Intake Pump Station 2. Water Treatment Plant	(1) 220m upstream of Damnak Ampil HW (2) 8.3km downstream of intake point	

2-2 Scope of the work

Components	Original* *(proposed in the outline design)*	Actual*
1. Intake Facility, 7260m^3/day	(1) Sedimentation pond: 3,630m^3/day x 2 pond (2) Intake Pump Facility Pump Room with intake pump: (2.52m3/min x 3 sets) Personnel Office	
2. Conveyance Facility	(1) DCIPφ350 x 8.3km (2) Bridge piggy-backed pipe: SPφ350 x 4 sites	
3. Water Treatment Plant	(1) Receiving well (1Basin) Volume: 27.5m^3, Retention Time: 5.5min (2) Mixing Well (1Basin) Volume: 9.27m^3, Retention Time: 1.83min (3) Flocculation Basin (2Basin) Up-and-Down Roundabout Type (zigzag flow) (4) Sedimentation Basin (2Basin) Surface Loading: Q/A=18.0mm/min Mean Velocity (V): 0.08m/min (5) Rapid Sand Filter (4Basin) (Reference) Filtration Rate (V): 121m/day Backwash Method: Air Wash + Water Wash (6) Service Reservoir (2Basin) Effective Volume: 1,152m^3 (576m^3×2Basins) Retention Time: 8.4hours (7) Drainage Basin (2Basin) Volume: 228.8m^3 (114.4m^3×2Basins) (8) Drying Bed (4Bed) Effective Area: 536.8m^2 (9) Chemical Feeding Facilities (1Unit) (10) Power Generator Equipment (in Chemical Building) (1Unit) Capacity: 350KVA (11) Chemical Building (1Unit)	

	3Storey Building, Total Floor Area (A):425.8m² (12) Administration Building (1Unit) 1 Story Building, Total Floor Area (A): 266.7m²	
4. Distribution Facility	(1) Service Reservoir (inside new WTP) Capacity: V=1,100 m³×2 (2) Distribution Pump Facilities (inside new WTP) Horizontal Volute Pump 3.5m³/min (3 Pumps) (3) Distribution Mains (DCIP: T type) φ450mm L= 5.8km / φ400mm L= 1.6km / φ350mm L= 5.5km / φ300mm L= 0.8km / φ250mm L= 6.6km (HDPE) φ200mm L= 8.9km / φ150mm L= 27.5km / φ100mm L= 18.6km / φ 80mm L= 11.7km / φ 50mm L= 28.5km (4) Water Main Bridge (Steel Pipe) φ200mm 3 Places / φ 80mm 1 Place (5) Bridge-piggybacked Water Main (Steel Pipe) φ400mm 3 Places / φ350mm 8 Places / φ300mm 1 Place / φ250mm 8 Places / φ200mm 2 Places / φ150mm 11 Places / φ100mm 6 Places / φ 80mm 9 Places / φ 50mm 1 Place (6) Monitoring equipment of water distribution (1LS)	
5. Procurement of equipment	(1) Sediment evacuation equipment for existing intake pit Sand pump, Generator (2) Equipment for Water quality management Jar tester, distilled water maker, pH meter, residual chlorine meter, conductance meter, water bath, microscope, continuous water quality analyzer for conductivity and residual chlorine, absorptiometer, UPS, microorganism analyzer, reagents, glassware, laboratory table etc. (3) Tools for Mechanical Equipment	

	Clamp Power Meter, Vibration Checker, Mechanical Torque Wrench, Portable Ultrasonic Flow meter, Sieve Shaking Machine (4) Equipment for management of distribution pipes Butt Fusion Machine for PE Pipes (5) Equipment and materials for house connection to poor households Water supply pipes, water meters and accessories (6) Accounting system SUMS system (PC and extra software license)	
6. Soft Component	(1) Formulating and learning work procedures for new facilities (2) Distribution flow monitoring (3) Ensuring quality of service connection installations (4) Promotion of applications for service connections (5) Improvement of production management Creation and revision of SOP	
7. Consulting Services	Detailed design, bidding assistance and construction supervision	

Reasons for modification of scope (if any).

(PMR)

2-3 Implementation Schedule

Items	Original		Actual
	(proposed in the outline design)	*(at the time of signing the Grant Agreement)*	
Cabinet approval	09/2018		
E/N	10/2018		
G/A	10/2018		
Detail Design	11/2018-04/2019		
Tender Notice	05/2019		
Tender	08/2019		
Award to Contract	09/2019		
Completion of Contract	10/2021		
Defect Liability Period	09/2022		
Project Completion	09/2022		

Reasons for any changes of the schedule, and their effects on the project (if any)

2-4 Obligations by the Recipient

2-4-1 Progress of Specific Obligations

See Attachment 2.

2-4-2 Activities

See Attachment 3.

2-4-3 Report on RD

See Attachment 11.

2-5 Project Cost

2-5-1 Cost borne by the Grant (Confidential until the Bidding)

Components			Cost(Million Yen)	
	Original *(proposed in the outline design)*	Actual *(in case of any modification)*	Original[1),2)] *(proposed in the outline design)*	Actual
Construction Facilities	1. Intake Facilities 2. Water Treatment Plant 3. Water Conveyance and Distribution Pipes			
Equipment	1. Water Quality Analysis Equipment 2. Tools for Mechanical Equipment 3. Accounting System Equipment 4. Service Connection Installations			
Consulting Services	1. Detailed Design 2. Construction Supervision 3. Soft Component			
Total				

Note: 1) Date of estimation: June, 2018
2) Exchange rate: 1 US Dollar = 112.05 Yen

2-5-2 Cost borne by the Recipient

Components			Cost (USD)	
	Original *(proposed in the outline design)*	Actual *(in case of any modification)*	Original[1)] *(proposed in the outline design)*	Actual
1	Land leveling for the Intake and WTP		437,305	
2	Rental Cost for Temporary Yard		49,978	
3	UXO Survey for Temporary Yard		20,527	
4	Environmental Monitoring for Noise, Vibration and Treatment of Dry Sludge		8,925	
5	Contracting process of broadband LAN connection for the distribution information system		4,463	
6	Transmission of electricity to the Intake facilities and WTP		51,763	
7	Bank arrangement Charge and Commission of Authorization to Pay		22,313	
8	Installation of connection equipment for poor households (2,469 houses)		74,551	
			669,825	

Note: 1) Date of estimation: June, 2018

Reasons for the remarkable gaps between the original and actual cost, and the countermeasures (if any)

(PMR)

2-6 Executing Agency

- Organization's role, financial position, capacity, cost recovery etc,
- Organization Chart including the unit in charge of the implementation and number of employees.

Original *(at the time of outline design)*

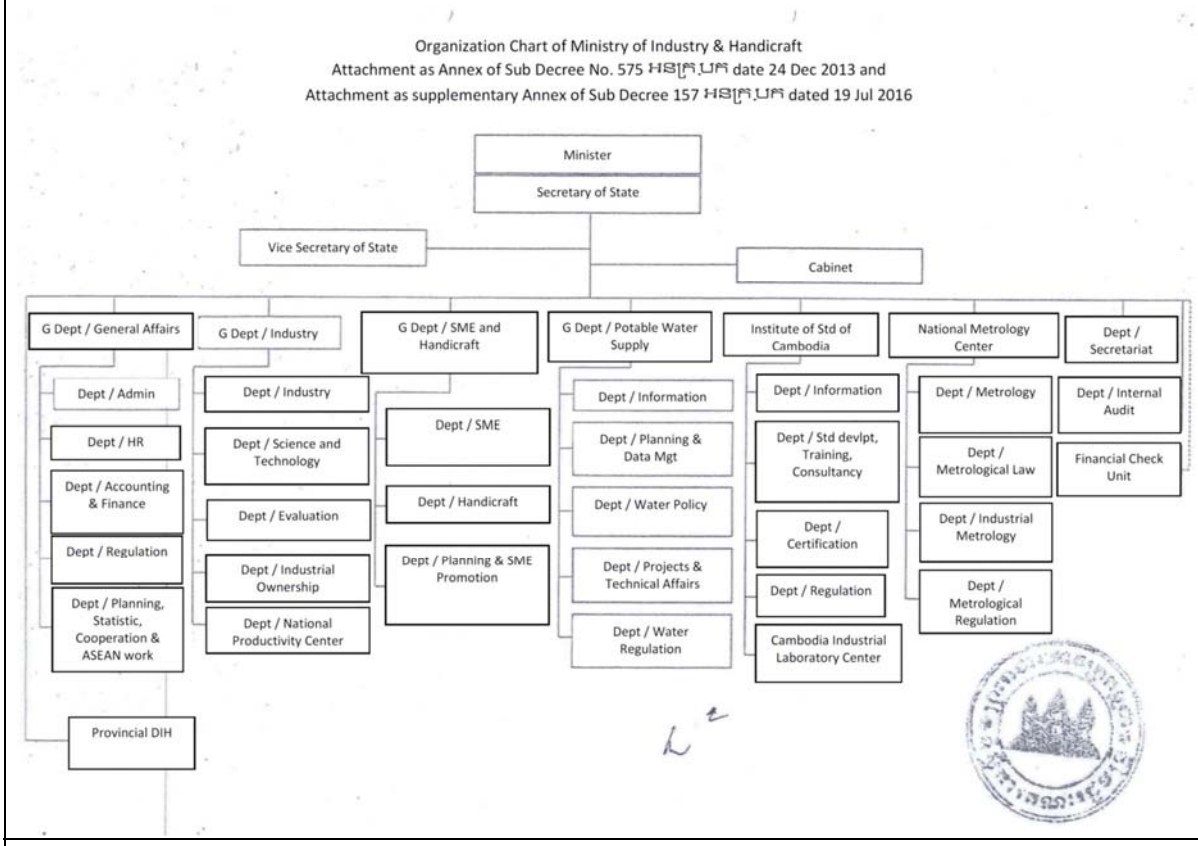
name: Ministry of Industry and Handicraft (MIH)

role:

financial situation:

institutional and organizational arrangement (organogram):

human resources (number and ability of staff):



Actual *(PMR)*

2-7 Environmental and Social Impacts

- The results of environmental monitoring based on Attachment 5 (in accordance with Schedule 4 of the Grant Agreement).
- The results of social monitoring based on in Attachment 5 (in accordance with Schedule 4 of the Grant Agreement).
- Disclosed information related to results of environmental and social monitoring to local stakeholders (whenever applicable).

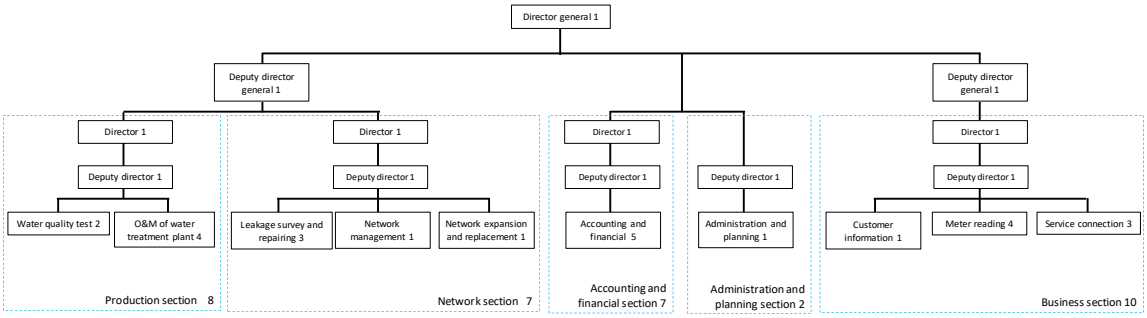
3: Operation and Maintenance (O&M)

3-1 Physical Arrangement

- Plan for O&M (number and skills of the staff in the responsible division or section, availability of manuals and guidelines, availability of spareparts, etc.)

Original *(at the time of outline design)*

Current organization of Pursat Waterworks is shown below;



Actual *(PMR)*

3-2 Budgetary Arrangement

- Required O&M cost and actual budget allocation for O&M

Original *(at the time of outline design)*

Outline of Profit and Loss (PL) Statement in Pursat Waterworks in 2016 is shown below

(Unit: Riel)

Revenue		Expense	
Water Sales	2,948,433,600	Personnel	422,021,596
Other Revenue	233,577,886	Material/Chemical	262,716,400
Revenue Total	3,182,011,486	Electricity/Fuel	617,794,518
		Depreciation	598,402,787
		Interest Payment	22,202,043
		Taxes	46,539,351
		Other	503,525,534
		Expense Total	2,473,202,229
Net Profit			708,809,257

Actual *(PMR)*

4: Potential Risks and Mitigation Measures

- Potential risks which may affect the project implementation, attainment of objectives, sustainability
- Mitigation measures corresponding to the potential risks

Assessment of Potential Risks (*at the time of outline design)*

Potential Risks	Assessment

1. To complete the investigation and removal of UXO and Mines in all construction and temporary areas	Probability: High/Moderate/Low
	Impact: High/Moderate/Low
	Analysis of Probability and Impact:
	The clearance of UXO/Mines for the construction area is essential for the project commencement. Without the clearance of UXO/Mines, the construction work will not be started.
	Mitigation Measures:
	Discussing the clearance of UXO/Mines in well advance, and to ask the clearance completed prior to the bidding announcement as "Major Undertakings to be taken by the Government of Cambodia".
	Action required during the implementation stage:
	The clearance of UXO/Mines required prior to the bidding announcement.
	Contingency Plan (if applicable):
	The delay of UXO clearance causes the contractor's claims. Therefore, in case UXO clearance may be delayed, the timing of bidding shall be postponed.
2. To secure and clear the temporary construction yard near the Project area	Probability: High/Moderate/Low
	Impact: High/Moderate/Low
	Analysis of Probability and Impact:
	The temporary yard will be required prior to the bidding announcement to commence the construction work smoothly.
	Mitigation Measures:
	Discussion of the temporary construction yard in well advance so that the securing of the yard could complete prior to the bidding announcement.
	Action required during the implementation stage:
	The securing of the temporary construction yard is required prior to the bidding announcement.
	Contingency Plan (if applicable):
	The delay of UXO clearance causes the contractor's claims. Therefore, in case UXO clearance may be delayed, the timing of bidding shall be postponed.
3. (Description of Risk)	Probability: High/Moderate/Low
	Impact: High/Moderate/Low
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action required during the implementation stage:
	Contingency Plan (if applicable):
Actual Situation and Countermeasures	
(PMR)	

5: Evaluation and Monitoring Plan (after the work completion)

5-1 Overall evaluation

Please describe your overall evaluation on the project.

5-2 Lessons Learnt and Recommendations

Please raise any lessons learned from the project experience, which might be valuable for the future assistance or similar type of projects, as well as any recommendations, which might be beneficial for better realization of the project effect, impact and assurance of sustainability.

5-3 Monitoring Plan of the Indicators for Post-Evaluation

Please describe monitoring methods, section(s)/department(s) in charge of monitoring, frequency, the term to monitor the indicators stipulated in 1-3.

Attachment

1. Project Location Map
2. Specific obligations of the Recipient which will not be funded with the Grant
3. Monthly Report submitted by the Consultant

Appendix - Photocopy of Contractor's Progress Report (if any)
- Consultant Member List
- Contractor's Main Staff List

4. Check list for the Contract (including Record of Amendment of the Contract/Agreement and Schedule of Payment)
5. Environmental Monitoring Form / Social Monitoring Form
6. Monitoring sheet on price of specified materials (Quarterly)
7. Report on Proportion of Procurement (Recipient Country, Japan and Third Countries) (PMR (final)only)
8. Pictures (by JPEG style by CD-R) (PMR (final)only)
9. Equipment List (PMR (final)only)
10. Drawing (PMR (final)only)
11. Report on RD (After project)

Attachment 1 Project Location Map

Attachment 2 Specific obligations of the Government of Cambodia which will not be funded with the Grant

(1) Before the Tender

NO	Items	Deadline	In charge	Estimated Cost	Ref.
1	To open bank account (B/A)	within 1 month after the signing of the G/A	MEF	$4,463	
2	To issue A/P to a bank in Japan (the Agent Bank) for the payment to the consultant	within 1 month after the signing of the contract(s)	MIH		
3	To approve IEIA (Conditions of approval should be fulfilled, if any) and secure the necessary budget for implementation	within 1 month after the signing of the G/A	MIH		
4	To contract land lease in order to secure the temporary yard	before notice of the bidding document(s)	MIH	$49,978	
5	To obtain the planning, zoning, building permit	before notice of the bidding document(s)	MIH		
6	To clear, level and reclaim the following sites 1) Embankment at proposed water treatment plant site and intake pump station site) 2) To explore landmines and UXO at construction site and temporary yard	before notice of the bidding document(s)	MIH MIH	$437,305 $20,527	
7	To submit Project Monitoring Report (with the result of Detail Design)	before preparation of bidding document(s)	MIH		

(2) During the Project Implementation

NO	Items	Deadline	In charge	Estimated Cost	Ref.
1	To issue A/P to a bank in Japan (the Agent Bank) for the payment to the Supplier(s)	within 1 month after the signing of the contract(s)	MIH	$4,463	
2	To bear the following commissions to a bank in Japan for the banking services based upon the B/A				

NO	Items	Deadline	In charge	Estimated Cost	Ref.
	1) Advising commission of A/P	within 1 month after the signing of the contract(s)	MIH		
	2) Payment commission for A/P	every payment	MEF	$13,387	
3	To ensure prompt unloading and customs clearance at ports of disembarkation in Cambodia and to assist the Supplier(s) with internal transportation therein	during the Project	MIH		
4	To accord Japanese physical persons and/or physical persons of third countries whose services may be required in connection with the supply of the products and the services such facilities as may be necessary for their entry into the Cambodia and stay therein for the performance of their work	during the Project	MEF		
5	To ensure that customs duties, VAT, internal taxes and other fiscal levies which may be imposed in Cambodia with respect to the purchase of the products and/or the services be exempted by its designated authority without using the Grant;	during the Project	MEF		
6	To bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project	during the Project			
7	1) To submit Project Monitoring Report	every month	MIH		
	2) To submit Project Monitoring Report (final)	within one month after signing of Certificate of Completion for the works under the contract(s)	MIH		
8	To submit a report concerning completion of the Project	within six months after completion of the Project	MIH		
9	To get permit for construction of temporary access bridges for laying water pipes and lease necessary land for approach road to the temporary access bridges (if necessary)	1 month before the start of the construction	Local Communities, MIH		

NO	Items	Deadline	In charge	Estimated Cost	Ref.
10	To provide facilities for distribution of electricity, water supply and drainage and other incidental facilities necessary for the implementation of the Project outside the site(s)				
	1) Electricity The distributing line to the site	before start of the construction	MIH	$51,763	
	2) Information System Contracting process of broadband LAN connection for the distribution information system	2 months before completion of the construction	MIH	$4,463	
11	To take necessary measure for safety construction - traffic control - rope off	during the construction	MIH		
12	To implement EMP and EMoP	during the construction	MIH		
13	To submit results of environmental monitoring to JICA, by using the monitoring form, on a quarterly basis as a part of Project Monitoring Report	during the construction	MIH		
14	To obtain permission for occupancy of roads for the pipe laying work	before start of the construction for conveyance, transmission and distribution pipes	MIH (PWW[1])		
15	To obtain all permissions required for the project implementation such as construction permission for intake facility and water treatment facility	before start of the construction	MIH (PWW)		
16	To recruit new staff members who are necessary for the operation of new system	up to the end of 2025	MIH (PWW)		
17	To establish the construction scheme for the new service pipe connections, including hiring temporary work force. To carry out the technical guidance, budgeting, planning and publicity for enhancing new connections.	up to the end of 2025	MIH (PWW)		

[1] PWW: Provincial Waterworks

NO	Items	Deadline	In charge	Estimated Cost	Ref.
18	To identify poor household (planning households is 2,469)[2]	up to the end of 2025	MIH (PWW)		

(3) After the Project

NO	Items	Deadline	In charge	Estimated Cost	Ref.
1	To implement EMP and EMoP	for a period based on EMP and EMoP	MIH	$8,925	
2	To submit results of environmental monitoring to JICA, by using the monitoring form, semiannually - The period of environmental monitoring may be extended if any significant negative impacts on the environment are found. The extension of environmental monitoring will be decided based on the agreement between MIH and JICA.	for 3 years after the Project	MIH		
3	To maintain and use properly and effectively the facilities constructed and equipment provided under the Grant Aid 1) Allocation of maintenance cost 2) Operation and maintenance structure 3) Routine check/Periodic inspection	after completion of the construction	MIH		
4	To work for service pipe connection (planned number of households (HHs) is 7,544) The implementation plan is about 1,510 connections per year after completion. (Maximum is 1,670 connections per year). (in 2021: 1,433HHs, in 2022: 1,528HHs, in 2023: 1,595HHs, in 2024: 1,672HHs, in 2025: 1,316HHs) 1) Establishment of construction scheme including hiring temporary staff for service connection work, providing guidance, budgeting, planning and publicity for enhancing new connections.	up to the end of 2025	MIH (PWW)		
	2) Connection for the poor household (2,496 HHs) - Material is procured by Japanese side, connection work is conducted by Cambodian side. 3) Connection for household without poverty group (5,075 households)			$74,521	

[2] Planning household number of 2,469 is an estimation referable in the section of 2-2-2-7 (5). At the construction, PWW shall identify the target household.

	- Material and connection work is under responsibility of Cambodian side.				

Attachment 5 Environmental Monitoring Form / Social Monitoring Form

1) Environmental Check List

Cate-gory	Environ-mental Item	Main Check Items	Yes: Y No : N	Specific Environmental and Social Considerations (Reason for Yes or No, rationale, mitigation measures, etc.)
1 Approvals, explanations	(1) EIA and Environmental Permits	(a) Have EIA reports been already prepared in official process? (b) Have EIA reports been approved by authorities of the host country's government? (c) Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied? (d) In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government?	(a) Y (b) Y (c) Y (d) Y	(a) IEIA is required. Preparation is in the process. It will be submitted in May 2018. (b) It will be approved after submission. (c) MOE will give all consents at approval of IEIA. (d) MIH obtained the permission of water extraction from Pursat River by MOWRAM.
	(2) Explanation to the Local Stakeholders	(a) Have contents of the project and the potential impacts been adequately explained to the Local stakeholders based on appropriate procedures, including information disclosure? Is understanding obtained from the Local stakeholders? (b) Have the comment from the stakeholders (such as local residents) been reflected to the project design?	(a) Y (b) N	(a) All related departments of city hall understood the project purpose and contents, and they agreed on the implementation. At the public hearing, the villagers welcomed the project. They wished for the affordable price setting of connection and assistance to poor. There is no particular objection. (b) Disturbance on traffic was suspected, it will be solved by the setting of detour and information sharing of construction program.
	(3) Examination of Alternatives	(a) Have multiple alternative plans for the Project been analyzed? (Including analysis of items related to the environment/society.)	(a) Y	(a) Alternatives have been examined for the site selection of intake and WTP, and extent of the supply area.
2 Pollution Measures	(1) Air Quality	(a) Is there a possibility that chlorine from chlorine storage facilities and chlorine injection facilities will cause air pollution? Are any mitigating measures taken? (b) Do chlorine concentrations within the working environments comply with the country's occupational health and safety standards?	(a) N (b) Y	(a) The Project plans to use breaching power for disinfection. This reagent is stable, and occurrence of air pollution is considered less. The exhaust fan will be situated at the facilities of disinfection. (b) The above measures serve to keep appropriate working condition.

Cate-gory	Environ-mental Item	Main Check Items	Yes: Y No : N	Specific Environmental and Social Considerations (Reason for Yes or No, rationale, mitigation measures, etc.)
	(2) Water Quality	(a) Do pollutants, such as SS, BOD, COD contained in effluents discharged by the facility operations comply with the country's effluent standards?	(a) N/A	Discharge generated at the treatment process will be recycled, and sludge will be dried. Therefore, any effluent from treatment process will not be generated. Sewage will be treated by septic tanks and clear upper portion will be infiltrated into ground. Therefore, the discharge water is not generated.
	(3) Wastes	(a) Are wastes, such as sludge generated by the facility operations properly treated and disposed in accordance with the country's regulations?	(a) Y	(a) Sludge will be treated and dried at dry-bed, then dumped to the dumping yard prepared by the PWW.
	(4) Noise and vibration	(a) Do noise and vibrations generated from the facilities, such as pumping stations comply with the country's standards?	(a)Y	(a) The pump will be installed at basement made by the RC with the noise reducing walls. The noise will be controlled within the limit of RGC requirement. There is no standards of vibration, but it is controlled in permissible limit by the above measures.
	(5) Subsidence	(a) In the case of extraction of a large volume of groundwater, is there a possibility that the extraction of groundwater will cause subsidence?	(a)N	(a) The Project does not use groundwater.
3 Natural Environment	(1) Protected areas	(a) Is the project site or discharge area located in protected areas designated by the country's laws or international treaties and conventions? Is there a possibility that the project will affect the protected areas?	(a) N	(a) There are no protected areas within the vicinity of the Project Site.
	(2) Ecosystems	(a) Does the project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)? (b) Does the project site or discharge area encompass the protected habitats of endangered species designated by the country's laws or international treaties and conventions? (c) If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impacts on the ecosystem? (d) Is there a possibility that the amount of water used (e.g., surface water,	(a) N (b) N (c) N (d) N	(a) The site does not contain any virgin forests, tropical old-growth forests, or important ecological habitats. (b) No habitats for any rare species are present in the site. (c) No major concerns. (d) No major concerns

Cate-gory	Environ-mental Item	Main Check Items	Yes: Y No : N	Specific Environmental and Social Considerations (Reason for Yes or No, rationale, mitigation measures, etc.)
		groundwater) by project will adversely affect aquatic environments, such as rivers? Are adequate measures taken to reduce the impacts on aquatic environments, such as aquatic organisms?		
	(3) Hydrology	(a) Is there a possibility that the amount of water used (e.g., surface water, groundwater) by the project will adversely affect surface water and groundwater flows?	(a) N	(a) At the time of serious draught, the Pursat River had enough discharge to cover the intake amount for the project. Therefore, the hydrological impact is not significant.
4.Social Environment	(1) Resettlement	(a) Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement? (b) Is adequate explanation on compensation and resettlement assistance given to affected people prior to resettlement? (c) Is the resettlement plan, including compensation with full replacement costs, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement? (d) Is the compensation going to be paid prior to the resettlement? (e) Are the compensation policies prepared in document? (f) Does the resettlement plan pay particular attention to vulnerable groups or people, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous peoples? (g) Are agreements with the affected people obtained prior to resettlement? (h) Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan? (i) Are any plans developed to monitor the impacts of resettlement? (j) Is the grievance redress mechanism established?	(a)N (b) N/A (c) N/A (d) N/A (e) N/A (f) N/A (g) N/A (h) N/A (i) N/A (j) N/A	(a) There will be no involuntary settlement, meaning that questions (b)-(j) are not applicable.
	(2) Living and Livelihood	(a) Is there a possibility that the project will adversely affect the living conditions of inhabitants? Are adequate measures considered to reduce the impacts, if necessary? (b) Is there a possibility that the amount of	(a) N (b) N	(a) The project has positive impact to improve basic human needs. There is no particular negative impact. (b) The Pursat River has enough discharge capacity and the

Cate-gory	Environ-mental Item	Main Check Items	Yes: Y No : N	Specific Environmental and Social Considerations (Reason for Yes or No, rationale, mitigation measures, etc.)
		water used (e.g., surface water, groundwater) by the project will adversely affect the existing water uses and water area uses?		intake of water supply does not affect significantly.
	(3) Heritage	(a) Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage? Are adequate measures considered to protect these sites in accordance with the country's laws?	(a) N	(a) No anthropological, historical, cultural, religiously important heritages or historical remains have been identified in the project site.
	(4) Landscape	(a) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?	(a) N	(a) The building location is in paddy field and residents are rare in the vicinity, therefore the impact on landscape is not significant.
	(5) Ethnic Minorities and Indigenous Peoples	(a) Are considerations given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous peoples? (b) Are all of the rights of ethnic minorities and indigenous peoples in relation to land and resources respected?	(a) N/A (b) N/A	(a)(b) There are no ethnic minorities or indigenous peoples living near the project site.
	(6) Working Conditions	(a) Is the project proponent not violating any laws and ordinances associated with the working conditions of the country which the project proponent should observe in the project? (b) Are tangible safety considerations in place for individuals involved in the project, such as the installation of safety equipment which prevents industrial accidents, and management of hazardous materials? (c) Are intangible measures being planned and implemented for individuals involved in the project, such as the establishment of a safety and health program, and safety training (including traffic safety and public health) for workers etc.? (d) Are appropriate measures taken to ensure that security guards involved in the project not to violate safety of other individuals involved, or local residents?	(a) Y (b) Y (c) Y (d) Y	(a) Adherence to laws concerning working conditions will be made explicit in contracts with contractors and managed. (b) Countermeasures such as installation of safety handrail are taken. (c) It will be achieved to set as an obligation of contractor in contract document. (d) Security guards will be included in target members of worker training.
5 Others	(1) Impacts during Construction	(a) Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)? (b) If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce	(a) Y (b)N (c) Y (d)N	(a) Mitigation measures will be taken under EPM for managing all noise, vibration, turbid water, dust, gas emissions, and waste discharged from the work site.

Cate-gory	Environ-mental Item	Main Check Items	Yes: Y No : N	Specific Environmental and Social Considerations (Reason for Yes or No, rationale, mitigation measures, etc.)
		impacts? (c) If construction activities adversely affect the social environment, are adequate measures considered to reduce impacts? (d) If the construction activities might cause traffic congestion, are adequate measures considered to reduce such impacts?		(b) Particular negative impact is not expected. (c) Temporary traffic disturbance will occur. The negative effect will be minimized by the measures such as setting of detour, assignment of traffic guide, installation of signboard, appropriate information sharing. (d) This is an expansion of the water supply and construction site is out of the city center. Therefore, serious traffic congestion is not expected.
	(2) Monitoring	(a) Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts? (b) What are the items, methods and frequencies of the monitoring program? (c) Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)? (d) Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities?	(a) Y (b) Y (c) Y (d) Y	(a) MIH is responsible for the monitoring as in previous similar project which they are experienced. (b) It will be determined in EMoP. (c) Monitoring by proponent is a part of usual operation activities. The training will be given as a part of soft component. (d) It is stipulated in the EMP.
6 Focal points	Reference to Checklist of Other Sectors	(a) Where necessary, pertinent items described in the Dam and River Projects checklist should also be checked.	(a) N	(a) The intake amount is not much, and the intake structure is small scale at the upper flow of existing headwork. Therefore, it is not necessary to refer the checklist of Dam and River Projects
	Precautions when using the environmental checklist	(a) If necessary, the impacts to transboundary or global issues should be confirmed (e.g., the project includes factors that may cause problems, such as transboundary waste treatment, acid rain, destruction of the ozone layer, or global warming).	(a) N	(a) None

2) Environmental Management Plan / Environmental Monitoring Plan

Impact	Parameter	Monitoring Method	Monitoring Point	Frequency	Responsibility
Construction					
Air Pollution	Dust	Visual observation	Vicinity of construction site	Daily	Contractor
	Exhaust gas	Inspection of registered vehicle	Construction Office	Monthly	Contractor
Noise and vibration	Working time	Working record	Construction site	Daily during construction	Contractor
	Management of vehicles	Inspection of registered vehicles	Construction Office	Monthly	Contractor
	Guidance to operator	Training record	Construction Office	Once during construction	Contractor
Water Pollution and sediment	Turbidity, oil	Visual inspection	Inlet of discharge	Weekly but daily during construction of foundation	Contractor
	Water quality	pH, EC, BOD, turbidity, oil	Inlet of discharge	When abnormal incident is observed	Contractor
Solid Waste (domestic)	Proper management	Visual inspection	Domestic waste	Weekly	Contractor
Solid Waste (Construction)	Proper dumping	Visual inspection	Temporary damping yard	At the time of damping	Contractor
	Preparation of dumping site	Contract document	Dumping site for soil waste	At the time of contract	PWW, MIH
Ecosystem	Ban of hunting and fishing	Training record	Construction Office	Monthly	Contractor
Hydrology	Construction schedule in rainy season	Monthly construction report	Construction Office	Monthly during rainy season	Contractor
Land and local resource usage	Lease of land	Contract document	Construction Office	At the time of contract of lease	PWW、MIH
Existing social infrastructure and services	Mitigation measures to prevent traffic disturbance	Monthly construction report	Construction Office	Monthly	Contractor
HIV/AIDS and other infectious disease	Management of occupational safety and hygiene	Monthly construction report	Construction Office	Monthly	Contractor
Working condition	Management of occupational safety and hygiene	Monthly construction report	Construction Office	Monthly	Contractor
Accident	Traffic plan of construction vehicle	Plan	Construction Office	At planning	Contractor
	Safety training	Monthly construction report	Construction Office	Monthly	Contractor
Miscellaneous	Complaint management	Analysis of complaint	Construction Office	Monthly	Contractor

Impact	Parameter	Monitoring Method	Monitoring Point	Frequency	Responsibility
Operation					
Waste	Appropriate treatment of sludge	Monitoring record	WTP	Every three months	PWW
	Preparation of dumping site for sludge	Contract document	PWW	At the time of contract	PWW
Noise and vibration	Monitoring with standard operating procedure (SOP)	SOP and monitoring record	Pumping station	Every three months	PWW
	Guidance for operators	Training record	Pumping station	Every three months	PWW

3) Environmental and Social Monitoring Form

Monitoring Form (Construction)

Construction site (Daily monitoring)

Monitoring Item		Procedure	Result	Measures to be taken	Reference standard		Frequency
Dust		Visual inspection			Acceptable or not		Daily
Noise		Sensory inspection			Acceptable or not		Daily
		Operation time check			Stated operation time in EMP		Daily
Water Quality (turbidity, oil)		Visual inspection			Acceptable or not		Daily (during foundation work)
Water Quality	pH	Laboratory test			5 - 7	Determined by the monitoring result	In case of abnormal observation of turbidity or oil
	EC				80		
	BOD				10		
	Turbidity				250		

Construction site (Weekly monitoring)

Monitoring Item	Procedure	Result	Measures to be taken	Reference standard	Frequency
Waste (Domestic)	Patrol			Acceptable or not	Weekly

Construction site (Monthly monitoring)

Monitoring Item	Procedure	Result	Measures to be taken	Reference standard	Frequency
Condition of construction machinery and vehicles	Maintenance record check			Acceptable or not (Exhaust gas, noise, vibration, and usual safety check)	
Traffic management	Patrol			Stated procedure in EMP	Monthly
Accident	Patrol			Acceptable or not	Monthly
Training and educational meeting to worker	Report check			Stated procedure in EMP (frequency, contents, target, etc.)	
Claim and comment	Report check			Acceptable or not	Monthly

Others

Monitoring Item	Procedure	Result	Measures to be taken	Reference standard	Frequency
Land for waste dumping Land for temporary use	Lease condition			Appropriate or not	Contract of lease
Plan of safety transportation	Plan check			Acceptable or not	At planning

Source: JICA Survey Team

Monitoring Form (Operation)

Monitoring Item	Procedure	Result	Measures to be taken	Reference standard	Frequency
Waste (treatment sludge)	Patrol			Appropriate or not	Monthly
Land for waste dumping	Procedure check			Appropriate or not	At contract agreement
Noise and vibration*	Patrol and maintenance			Normal condition or not	Daily

*Noise and vibration of pump shall be checked in an operation record every day.

Attachment 6 Monitoring sheet on price of specified materials

1. Initial Conditions (Confirmed)

	Items of Specified Materials	Initial Volume A	Initial Unit Price (¥) B	Initial total Price C=A×B	1% of Contract Price D	Condition of payment	
						Price (Decreased) E=C－D	Price (Increased) F=C＋D
1	Item 1	●●t	●	●	●	●	●
2	Item 2	●●t	●	●	●		
3	Item 3						
4	Item 4						
5	Item 5						

2. Monitoring of the Unit Price of Specified Materials

(1) Method of Monitoring : ●●

(2) Result of the Monitoring Survey on Unit Price for each specified materials

	Items of Specified Materials	1st ●month, 2015	2nd ●month, 2015	3rd ●month, 2015	4th	5th	6th
1	Item 1						
2	Item 2						
3	Item 3						
4	Item 4						
5	Item 5						

(3) Summary of Discussion with Contractor (if necessary)

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Attachment 7 Report on Proportion of Procurement (Recipient Country, Japan and Third Countries)

（Actual Expenditure by Construction and Equipment each）

		Domestic Procurement （Recipient Country） A	Foreign Procurement （Japan） B	Foreign Procurement （Third Countries） C	Total D
Construction Cost		（A/D%）	（B/D%）	（C/D%）	
	Direct Construction Cost	（A/D%）	（B/D%）	（C/D%）	
	others	（A/D%）	（B/D%）	（C/D%）	
Equipment Cost		（A/D%）	（B/D%）	（C/D%）	
Design and Supervision Cost		（A/D%）	（B/D%）	（C/D%）	
Total		（A/D%）	（B/D%）	（C/D%）	


JICA