

Manual for Chlorination Unit Installation at Existing Distribution Reservoir



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Introduction

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Annex 1: Example of Instruction for Tender

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List of Acronyms

BOQ	Bill of Quantities
PVC	Polyvinyl chloride

1 Concept

The chlorination unit in this manual is proposed to be installed on the concrete slab of the existing distribution reservoir and, to mix and inject into the pumped water manually in order to reduce the cost of installation, operation and maintenance.

This chlorination unit consists of base concrete, roof structure, storage tank and plumbing works.

2 Survey

2.1 Check the existing distribution reservoir

The following points shall be surveyed based on the above concept to install chlorination on the existing distribution reservoir.

- To verify if there is enough space on the concrete slab.to layout the facility of chlorination unit. To verify id the structure of concrete slab is strong enough for the installation of chlorination unit.

2.2 Measurement of the dimensions of existing reservoir

Dimensions of the existing facility such as concrete slab, manholes, ventilation pipes, inlet pipes, which are necessary for the design shall be measured (Figure 1).



Figure 1: Measurement of the dimension of the existing reservoir

3 Design

3.1 Determine the position of installation

The drawing of existing distribution reservoir layout shall be drawn up based on the results of measurement (Figure 2). The position of chlorination unit shall be determined on the drawing of existing layout and prepare the drawing of installation layout plan (Figure 3).

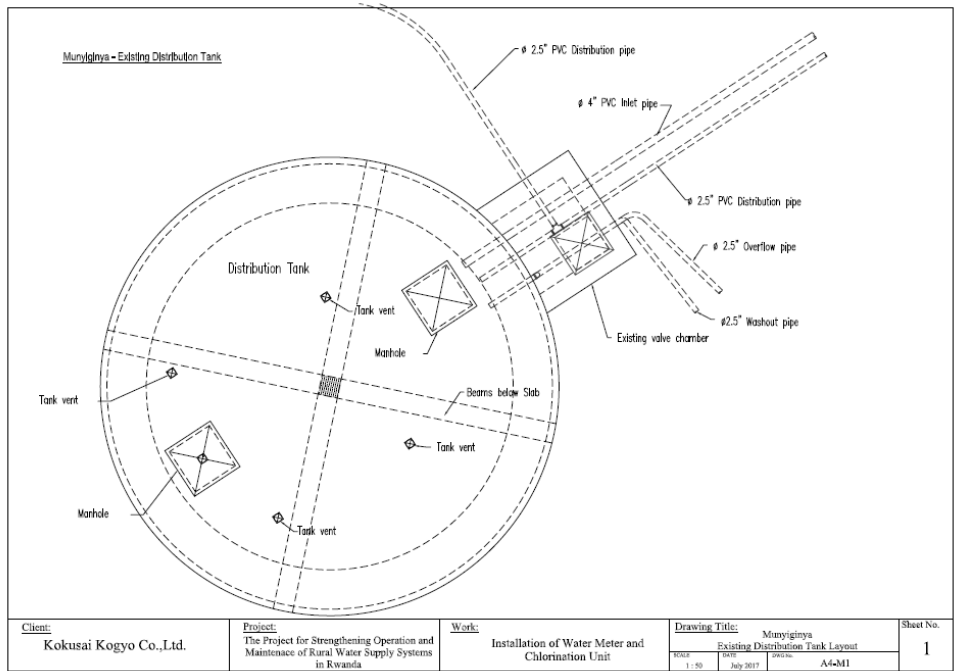


Figure 2: Plan of the existing distribution reservoir

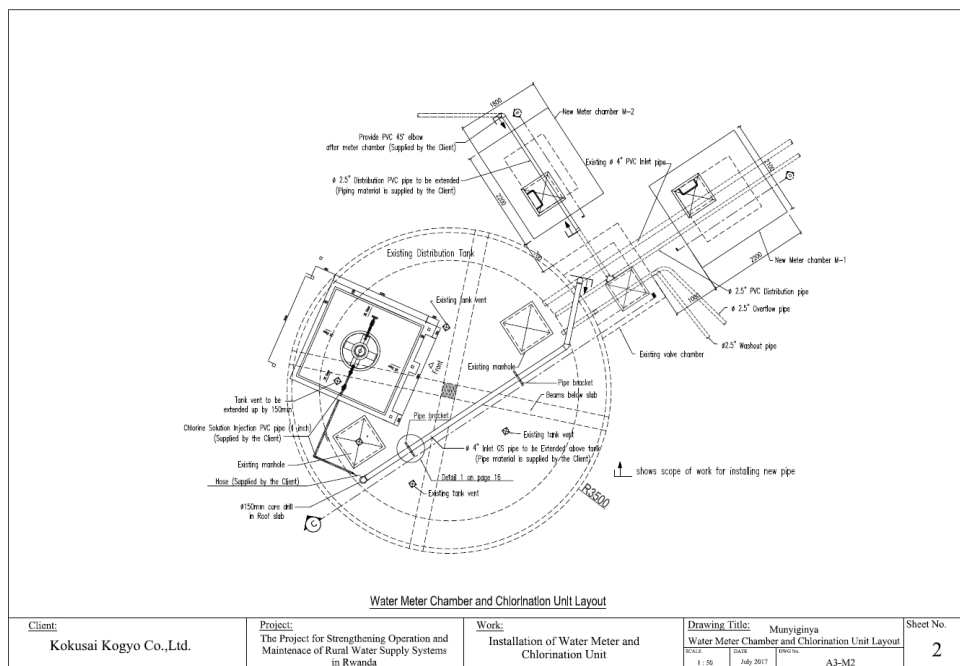


Figure 3: Layout plan of the chlorination unit on the existing reservoir

3.2 Base concrete

Base concrete shall be constructed as the foundation of storage tank unit and shall be reinforced to bear the load of storage tank. Thickness of the base concrete shall be minimized in order to reduce the load to the existing concrete slab. The surface of base concrete shall be coated by the anti-chemical paint to protect from the corrosion caused by the chlorine.

Parapet shall be installed on the perimeter of base concrete to avoid the overflow of chlorine solution and to drain it out to soak way pit through PVC drain pipe. The base concrete shall be placed on the beams of existing slab if possible.

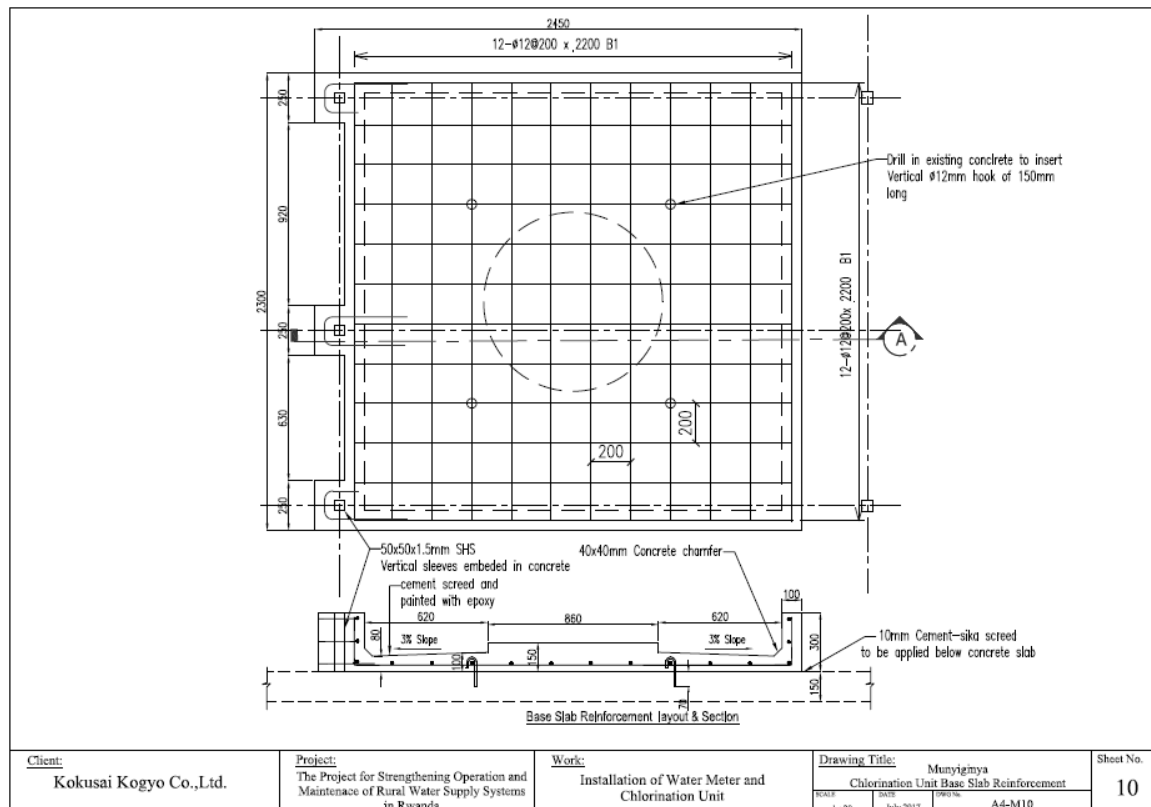


Figure 4: Section of the base concrete

3.3 Roof structure

The roof structure shall be installed for the following purpose;

- To secure the working space in which calcium hypochlorite powder mixed with water in storage tank is injected to the distribution reservoir.
- To prevent from unauthorized persons entering into the working space and to protect from the toxic material.

The following points shall be considered for the design.

- Roof cover shall be installed on top to protect from rain water.

- Wall and door with padlock shall be installed to avoid the children from entering into the working space.
- The columns and rafters shall be made in steel structures.
- The roof cover material shall be pre-painted iron sheet.
- Walling shall be made in galvanized steel wire mesh for ventilation.
- The front side columns shall be fixed in the base concrete.
- The back side columns shall be fixed in the concrete foundation in the ground.
- Access Ladder shall be installed at the back side columns.

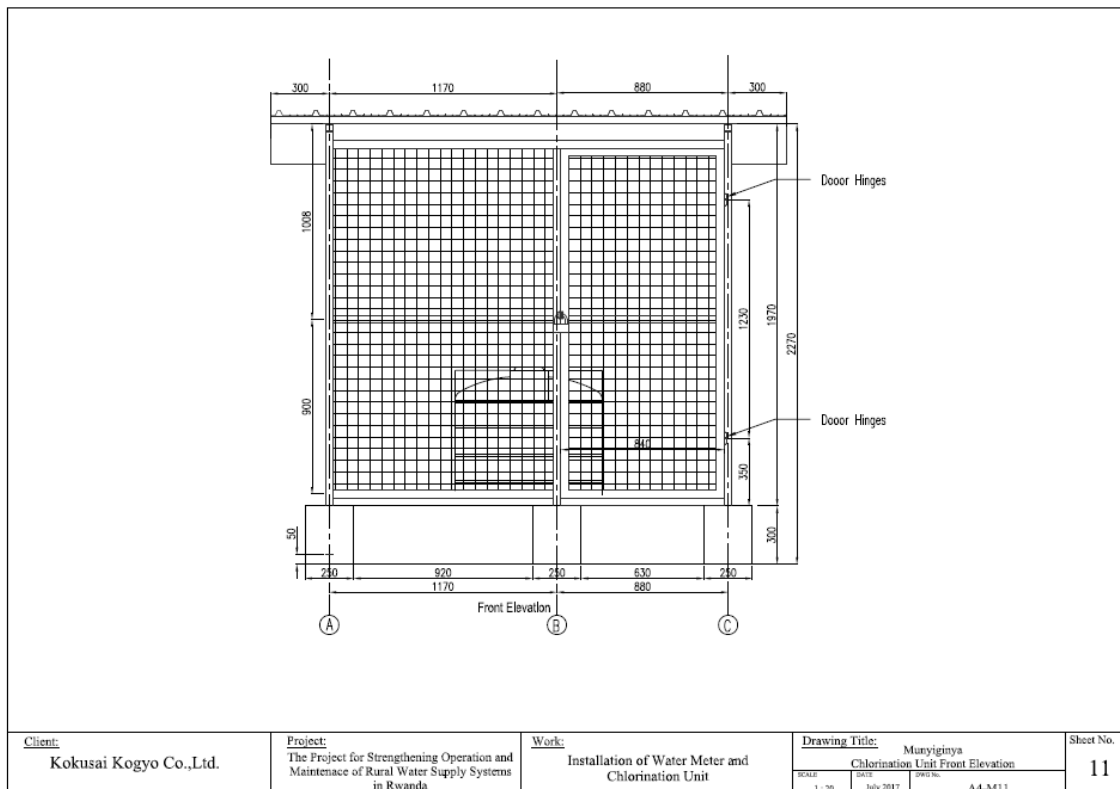


Figure 5: Front elevation of roof structure

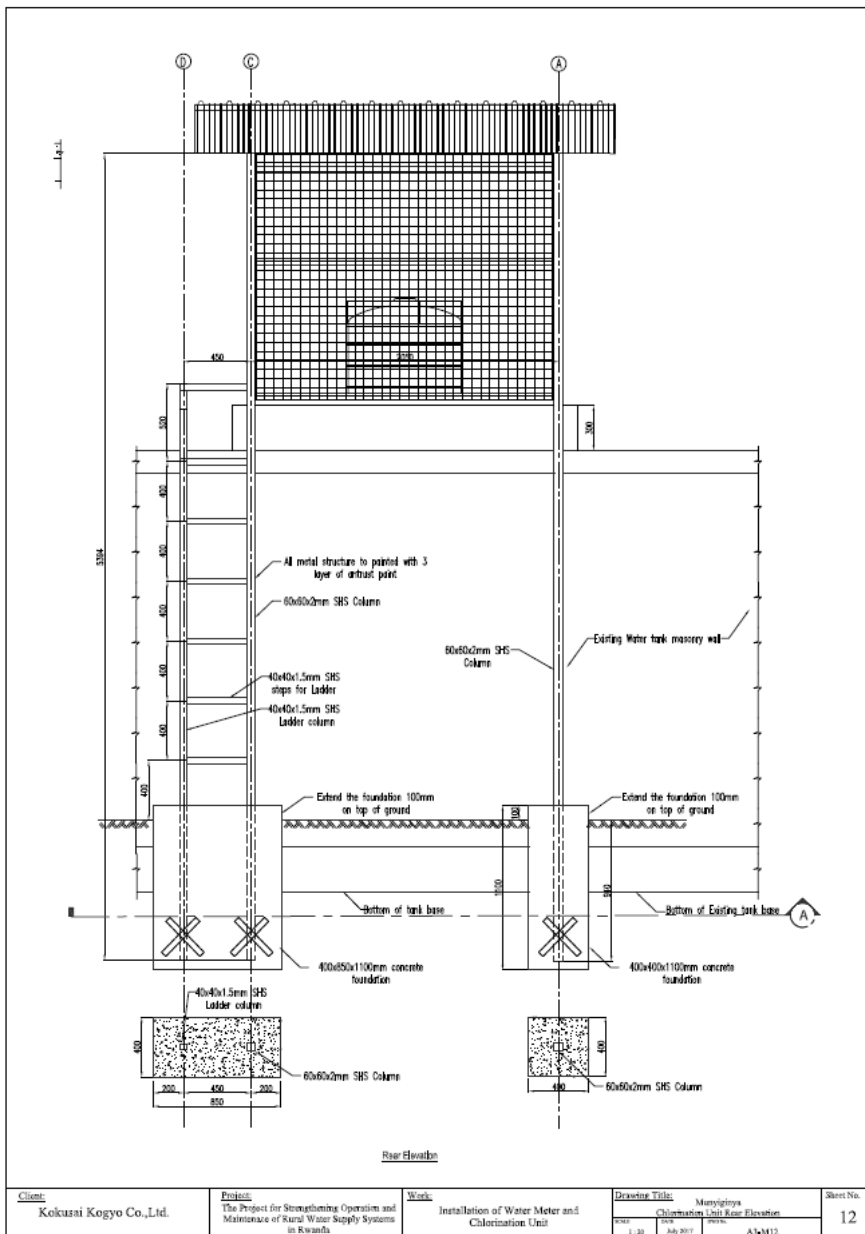


Figure 6: Back elevation of roof structure

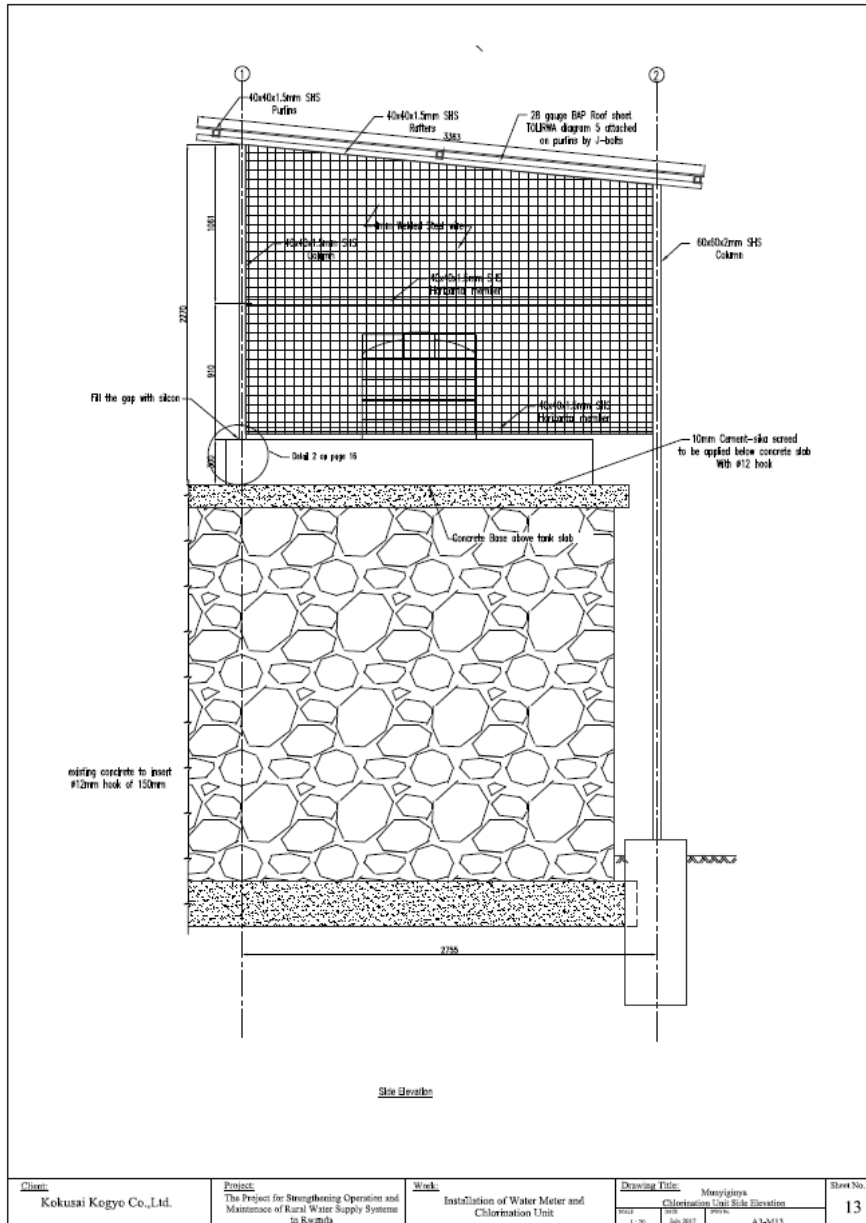


Figure 7: Side elevation of roof structure

3.4 Storage tank

Polyethylene (PE) tank which is available in the local market shall be used for the storage tank and modified for plumbing works. Detail of the storage tank is shown in the Figure 8.

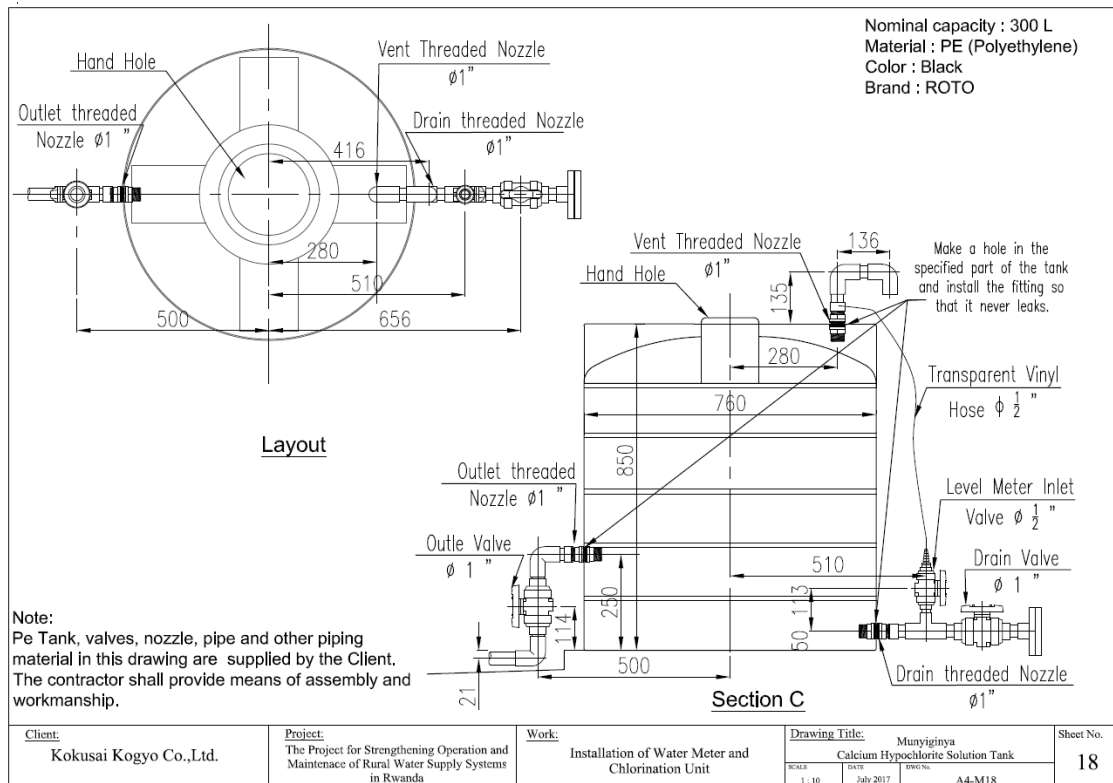


Figure 8: Detail of the storage tank

3.5 Plumbing works

In order to increase the effectiveness of chlorination, the position of the injection of calcium hypochlorite solution shall be set at the upstream (opposite side of the outlet) of the distribution reservoir as much as possible. In case the position of the inlet of distribution reservoir is near the outlet, inlet pipe shall be extended to the upstream and make the hole for injection of solution at the concrete slab (Figure 9).

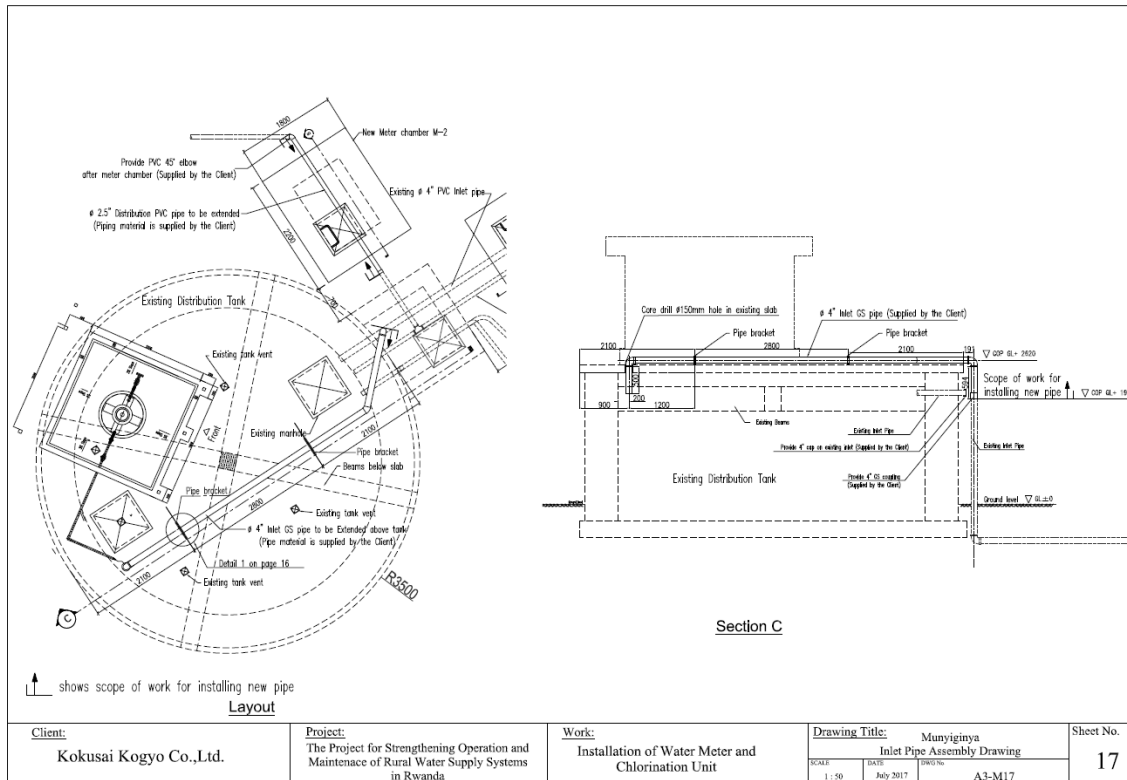


Figure 9: Detail of the plumbing works

4 Installation

4.1 Base concrete

4.1.1 Concrete base on the existing tank

The mortar and concrete aggregates will be extracted locally from the gravel or sand deposit or obtained by crushing and grinding rock extracted from local quarries without impurities.

Their storage should be carried out on raft concrete bases, bricks or planks to avoid any impurities. The crushing, screening, and washing facilities shall allow a variation, depending on needs, the proportions of the elements, so as to achieve the desired size. Usage of non-washed lake sand is prohibited.

The only cement to be used is that one from CIMERWA, HIMA (Portland cement), or any other equivalent type with equivalent characteristics.

The concrete base shall have the dimension as shown on plan, it shall be put in place by means of formworks and on top of exiting roof slab for the tank. The contractor shall provide a cement sika latex screed right on top of slab before casting a new concrete to make a perfect bonding. When casting the concrete, the contractor shall provide 50x50x1.5mm square hollow section sleeve of 300mm long for front columns. The concrete base shall have a smooth finish on top,

the contractor shall check whether the concrete is well dried and paint in 3 layer of epoxy paint brand AMEKI or equivalent.

4.1.2 Concrete foundation in the ground

Two columns of 60 x 60 x 2mm on rear side shall have a concrete foundation of class B in soils, the Contractor shall verify dimension on plan prior to the casting concrete. The foundation shall have the dimension of width 400mm, length 400mm and depth 1,100mm, with 100mm extended above finished grade level



Figure 10: Construction base concrete

4.2 Roof structure

This structure shall be done by metal tube making structure well stable and which shall protect and provide a shed of the chlorination storage tank. The shed shall be made by pre-painted iron sheet roof cover, metal tubes, galvanized welded wire mesh and concrete base.

4.2.1 Steel structure

The structure of chlorination unit shall be in hollow sections made of steel (rectangular or squared) horizontal members welded to vertical members columns embedded in concrete base as per drawings details, The elements of the steel work shall be protected by 2 coats of red oxide

paint. All elements of the metallic frame work and cover shall be provided and fixed by the Contractor.

The metal elements shall be 40 x 40 x 1.5mm, except two columns of 60 x 60 x 2mm on rear elevation extended to the base of the tank and embedded in the concrete foundation.

4.2.2 Roofing

The roof sheets shall be constituted of S profile galvanized sheets of 28 gauges TOLIRWA diagram 5 or equivalent. They shall be put with a slope of 10% at least. They shall rest to the purlins. They shall be fixed by means of galvanized J bolts of 60/100 mm of thickness provided with small plastic on upper part.

The Contractor shall provide a choice between several colors to get the approval by the Client. An overlap of 20 cm shall be necessary according to the slope after verification of the metallic framework that requires a fixing of the hooks.

This item of work shall consist of the supply of the new metal sheet and their installation including all pieces of fixing and joint in order to assure a perfect tightness of the roofing.

4.2.3 Wire mesh

The walling in metal structure shall be covered by galvanized welded steel wire mesh which has 4mm diameter. The size of mesh shall be 50x50mm rectangle. The wire mesh shall be attached on metal structure by welding. The contractor shall make a neat and clean point of weld.

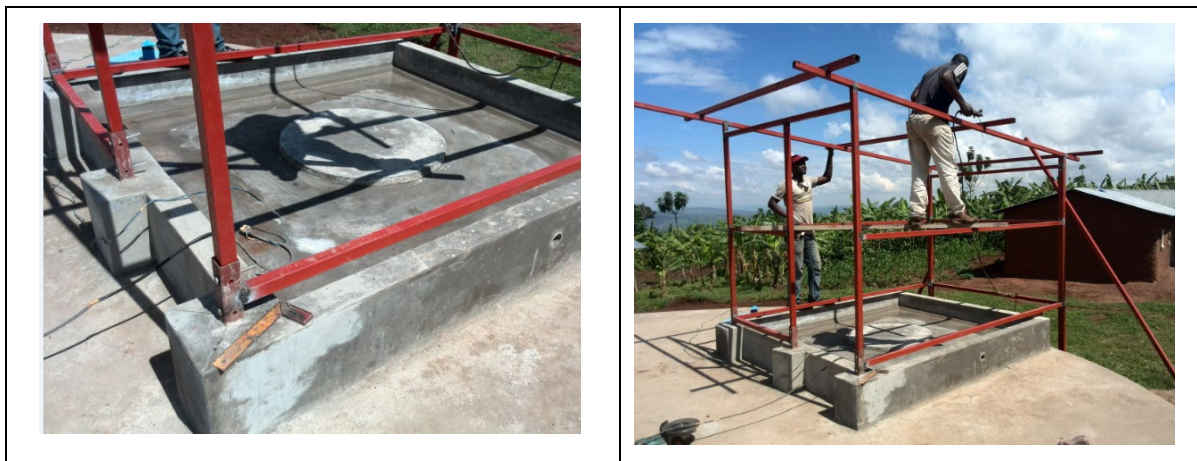




Figure 11: Construction of roof structure

4.3 Storage tank

This tank is cylindrical, is for dissolving, preparing and storing calcium hypochlorite solution. Material is made of PE, color is black. Install a ball valve and a hose in the drain line of the solution tank. When designing, manufacturing tanks, we shall have a structure that will not cause falls, sideslips, falling offs, breakages, etc., against seismic forces and heavy loads. The plate thickness of tank should be 4 mm or more. Structure without leakage. Especially about the connecting part of the nozzle. Take measures to prevent sediment in the tank from blocking the outlet nozzle. Install an outlet nozzle 200 mm above the bottom of the tank. Enclose the solution tank with a roof and a fence. The fence should be lockable. The valve for adjusting the addition amount of the solution is a diaphragm type.

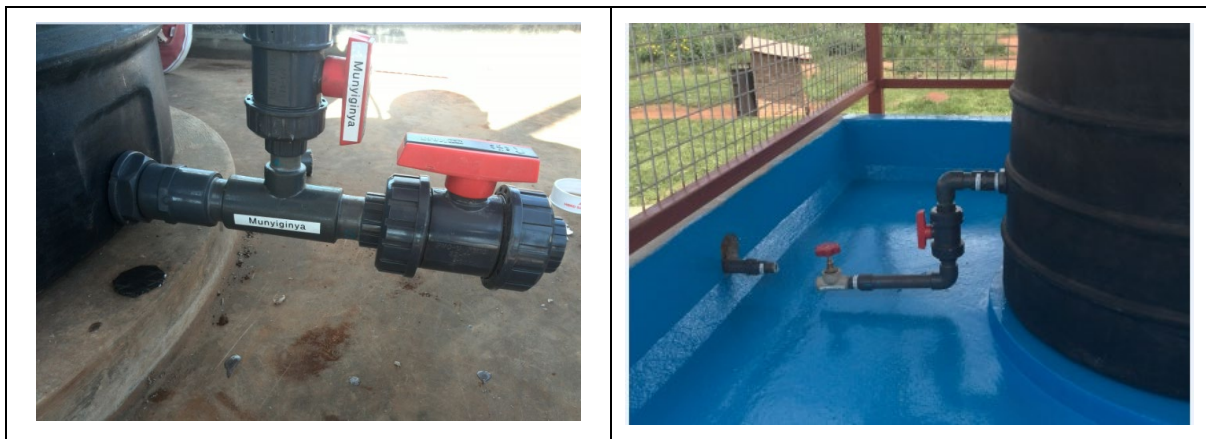




Figure 12: Installation of storage tank

4.4 Plumbing works

As indicated on drawings, the GI inlet pipe shall be extended above tanks slab. Before the installation, all pipes, the special parts and fittings shall be prepared and be ready for use, carefully cleaned and purged of any foreign element. During the installation, all the precautions shall be taken to avoid the entering of refuse or foreign body and not to damage the lower surface of the pipe. The ends of laid pipes shall have to be enter to the tank through a core drilled hole in top slab, the embedded part of pipe shall be closed carefully with plugs at existing entrance. External and interior protections, which would have been damaged during transport or by the cuts, shall be repaired before the installation. The pipes, special parts and fittings shall be raised carefully on top of slab where they shall be laid without shocks, falling, etc.

The GI pipe shall be attached on existing concrete slab by 300x300 mm wide and 500mm high concrete block of class B. the assembly of GI pipe shall be made by a flanged connection.

The installation and the assembly of the conduits and the valves and fittings shall have to be carried out by skilled workers.





Figure 13: Plumbing works

5 Cost

5.1 Method of cost estimate

Before start estimation, the person in charge shall verify if all plans are complete and whether they have all necessary information, cost estimate shall be prepared according to standard, widely recognized methodology. Preparing a cost estimate requires that the design is complete and a specification has been prepared.

This helps to avoid any ambiguities or misunderstandings and helps avoid disputes arising through different interpretations of what has been priced.

The quantities may be measured in number, length, area, volume, weight or time. Preparing a bill of quantities requires that the design is complete and a specification has been prepared.

5.2 Example of Bill of Quantity (BOQ)

Bills of Quantities and Price for Installation of Water Meter and Chlorination Unit - Munyiginya					
Item	DESCRIPTION	Unit	Qty	U.price	Total (RWF)
1	PRELIMINARY WORKS				
1.1	Site Installation, signage and site closing at the end of works, including the transport of materials and equipment necessary to perform works	LS	1	500,000	500,000
1.2	Excavation around existing pipe, temporarily disconnect from existing tank as stated in technical specification section 2.2	LS	1	300,000	300,000
1.3	Site cleaning and final submission of site documents	LS	1	100,000	100,000
1.4	temporarily water connection bypass out of excavation zone to keep up distribution scheme	LS	1	100,000	100,000
	S/Total 1				1,000,000
2.1	METER CHAMBER M1 (L=2; W=1.9 ;H=1.475m)				
2.1.1	Earthworks cut, fill and disposal or overlay of the surplus soils, including all accruals	m ³	16.38	5,000	81,900
2.1.2	Hardcore (stones pitching) of 30 cm with a filling of 1:10 cement sand mortar mix, saturated with water	m ³	1.95	40,000	78,000
2.1.3	Blind concrete class C, thickness 5 cm	m ³	0.276	120,000	33,120
2.1.4	150 mm Reinforced concrete for base slab ,class A	m ³	0.828	350,000	289,800
2.1.5	100mm Reinforced concrete for roof slab ,class A	m ³	0.462	350,000	161,700
2.1.6	400mm thick walls in stones masonry jointed outside face with a mortar of class D	m ³	3.6	70,000	252,000
2.1.7	Plastered masonry support base for meter	item	1	40,000	40,000
2.1.8	Plastering of the internal face of wall with 3 layers of plaster of 300 kg/m ³	m ²	9	7,000	63,000
2.1.9	Plaster on the upper side of roof slab with a rough mortar class B	m ²	4.62	10,000	46,200
2.1.10	Supply and fix of the steel cover of 600 x 600mm as per detail on drawing	item	1	100,000	100,000
2.1.11	Supply and fix an iron ladder steps as specified on dwg for interior access embedded in the wall, painted with 3 layers of paint "rust preventive",	item	4	15,000	60,000
	S/Total 2.1				1,205,720
2.2	Plumbing fitting for Meter chamber M1 (supplied by client),contractor will only provide labor and joining accessories				
2.2.1	Supply and fix PVC PN 16 Adapter 75*90 (embout)	item	2	9,000	18,000
2.2.2	Supply and fix Brass gate valve PN 16 2 ^{1/2} " (Vanne à glissière)	item	2	10,200	20,400
2.2.3	Supply and fix G.S Threaded adapter male-male 2 1/2" (Nipple)	item	3	2,400	7,200
2.2.4	Threaded flange 2 1/2"	item	2	7,500	15,000
2.2.5	Flanged Water meeter 2 1/2" (DN 65)	item	1	199,800	199,800
2.2.6	GS Union 2 1/2"	item	1	7,800	7,800
	S/Total 2.2				268,200
3.1	METER CHAMBER M2 (L=2; W=1.6 ;H=1.325m)				
3.1.1	Earthworks cut, fill and evacuation or overlay of the surplus soils, including all accruals	m ³	13.248	5,000	66,240
3.1.2	Hardcore (stones pitching) of 30 cm with a filling of 1:10 cement sand mortar mix, saturated with water	m ³	1.716	40,000	68,640
3.1.3	Blind concrete class C, thickness 5 cm	m ³	0.24	120,000	28,800
3.1.4	150 mm Reinforced concrete for base slab ,class A	m ³	0.72	350,000	252,000
3.1.5	100mm Reinforced concrete for roof slab ,class A	m ³	0.396	350,000	138,600
3.1.6	400mm thick walls in stones masonry jointed outside face with a mortar of class D	m ³	3.3	70,000	231,000
3.1.7	Plastered masonry support base for meter	item	1	40,000	40,000
3.1.8	Plastering of the internal face of wall with 3 layers of plaster of 300 kg/m ³	m ²	8.25	7,000	57,750
3.1.9	Plaster on the upper side of roof slab with a rough mortar class B	m ²	3.96	10,000	39,600
3.1.10	Supply and fix of the steel cover of 600 x 600mm as per detail on drawing	item	1	100,000	100,000
3.1.11	Supply and fix an iron ladder steps as specified on dwg for interior access embedded in the wall, painted with 3 layers of paint "rust preventive",	item	4	15,000	60,000
	S/total 3.1				1,082,630

3.2	Plumbing fitting for Meter chamber M2 (supplied by client),contractor will only provide labor and joining accessories				
3.2.1	Supply and fix PVC PN 16 Adapter 75*90 (embout)	item	2	9,000	18,000
3.2.2	Supply and fix 2 1/2"Brass gate valve PN 16 (Vanne à glissiere)	item	2	10,200	20,400
3.2.3	Supply and fix G.S Threaded adapter male-male 2 1/2" (Nipple)	item	3	2,400	7,200
3.2.4	Threaded flange 2 1/2"	item	2	7,500	15,000
3.2.5	Flanged Water meeter 2 1/2" (DN65)	item	1	199,800	199,800
3.2.6	GS Union 2 1/2"	item	1	7,800	7,800
3.3	Distribution Pipe out of water meter chamber M-2				
3.3.1	2 1/2" PVC PN16 Pipe	Lm	3	2,100	6,300
3.3.2	2 1/2" PVC PN16 45 Elbow	item	1	4,000	4,000
3.3.3	2 1/2" PVC PN16 Soket	item	1	5,000	5,000
	S/total 3.2,3.3				283,500
4	CHLORINATION STRUCTURE				
4.1	Base concrete				
4.1.1	Earthworks cut, fill and evacuation or overlay of the surplus soils, including all accruals	m ³	1.47	5,000	7,350
4.1.2	Concrete base for steel column class B	m ³	0.576	350,000	201,600
4.1.3	Concrete base for tank class A	m ³	0.6512	350,000	227,925
4.1.4	50x50x1.5mm steel tube	lm	0.9	22,000	19,800
4.1.5	cement- sika latex screed on top of slab	m ²	3.4619	35,000	121,165
4.1.6	painting epoxy paint on slab	m ²	3.4619	10,000	34,619
4.1.7	Core drill a hole Ø150mm in top slab for entrance pf Galv pipe	item	1	80,000	80,000
4.1.8	Concrete base for galvanised 110mm pipe	m ³	0.225	350,000	78,750
	S/total 4.1				771,208
4.2	Metalic structure				
4.2.1	Supply and fix 60x60x2mm steel tube	lm	11	8,000	88,000
4.2.2	Supply and fix 40x40x1.5mm steel tube whole structure	lm	55.1	5,000	275,500
4.2.3	Supply and fix 28 gauges BAP blue color 1m width, 2.85m long fixed with hooks	item	3	16,500	49,500
4.2.4	Supply and fix Door locks and hinges and bolting	LS	1	20,000	20,000
4.2.5	Supply and fix 4mm Galvanised Steel weded wire (treillis soudé) 3*2m	item	4	60,000	240,000
4.2.6	Supply antirust paint for all metal structure	item	1	25,000	25,000
	S/total 4.2				698,000
4.3	Plumbing material for chlorination tank (supplied by client),contractor will only provide labor and joining accessories				
4.3.1	300 liter Polyethylene Tank (ROTO Tank)	item	1	16,500	16,500
4.3.2	Making hole and install 1inch (DN25) fittings to PE tank	item	3	45,000	135,000
4.3.3	Fitting (Traverse de parois) 1 inch (DN25)	item	3	4,800	14,400
4.3.4	Diaphragm I valve 3/4 inch (DN20)	item	1	2,400	2,400
4.3.5	Outlet Ball valve 1 inch(DN25)	item	1	3,000	3,000
4.3.6	Drain Ball valve 1 inch(DN25)	item	1	3,000	3,000
4.3.7	Level meter inlet Ball valve 1/2 inch(DN15)	item	1	2,100	2,100
4.3.8	PVC Sokect 1 inch(DN25)	item	3	1,260	3,780
4.3.9	PVC Blind Flange 1 inch(DN25)	item	1	3,000	3,000
4.3.10	PVC T joint 1 inch(DN25) × 1/2 inch(DN15)	item	1	1,260	1,260
4.3.11	Transparent Hose 1/2 inch(DN15)	Lm	2	1,000	2,000
4.3.12	Hose joint to PVC pipe 1/2 inch(DN15)	item	1	1,500	1,500
4.3.13	PVC Reducer (1 inch(DN25)×3/4 inch(DN20))	item	2	1,260	2,520
4.3.14	PVC pipe 3/4 inch(DN20)	Lm	1	1,500	1,500
4.3.15	PVC 90°Elbow pipe joint 1 inch(DN25)	item	7	1,260	8,820
4.3.16	PVC pipe 1 inch(DN25)	Lm	6	2,000	12,000
4.3.17	Hose joint to PVC pipe 1 inch(DN25)	item	1	1,000	1,000
4.3.18	Hose 1 inch(DN25)	Lm	2	500	1,000
4.3.19	Extension of 4 inch(DN100) GS PN16 pipe above tank	Lm	10	33,000	330,000
4.3.20	4 inch(DN100) GS pipe support on slab	item	2	22,500	45,000
4.3.21	GS PN 16 elbow 90 4inch(DN100)	item	2	20,100	40,200
4.3.22	GS PN 16 elbow 45 4 inch(DN100)	item	1	35,400	35,400
4.3.23	GS PN 16 coupling 4 inch(DN100)	item	1	6,000	6,000
4.3.24	GS PN 16 Female cap 4 inch(DN100)	item	1	9,900	9,900
	S/total 4.3				681,280
	GRAND TOTAL in RWF				5,990,538

Annexes

TECHNICAL SPECIFICATIONS

**FOR PILOT INSTALLATION OF WATER METERS AND
CHLORINATION UNITS**

**FOR PROJECT FOR STRENGTHENING OPERATION AND
MAINTENANCE OF RURAL WATER SUPPLY SYSTEMS IN
RWANDA**

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1. General

1.1. Material supplied by the Client

The material for the Work indicated in the Table 1.1, Table 1.2, Table 1.3 and Table 1.4 will be provided to the Contractor by the Client.

Table 1.1: Material supplied by the Client for Munyiginya water supply system

No.	DESCRIPTION	Unit	Qty
1	Plumbing fitting for Meter chamber M1		
1.1	Supply and fix PVC PN 16 Adapter 75*90 (embout)	item	2
1.2	Supply and fix Brass gate valve PN 16 2 1/2" (Vanne à glissiere)	item	2
1.3	Supply and fix G.S Threaded adapter male-male 2 1/2" (Nipple)	item	3
1.4	Threaded flange 2 1/2"	item	2
1.5	Flanged Water meeter 2 1/2"	item	1
1.6	GS Union 2 1/2"	item	1
2	Plumbing fitting for Meter chamber M2		
2.1	Supply and fix PVC PN 16 Adapter 75*90 (embout)	item	2
2.2	Supply and fix 2 1/2"Brass gate valve PN 16 (Vanne à glissiere)	item	2
2.3	Supply and fix G.S Threaded adapter male-male 2 1/2" (Nipple)	item	3
2.4	Threaded flange 2 1/2"	item	2
2.5	Flanged Water meeter 2 1/2"	item	1
2.6	GS Union 2 1/2"	item	1
3	Distribution Pipe out of water meter chamber M-2		
3.1	2 1/2" PVC PN16 Pipe	Lm	3
3.2	2 1/2" PVC PN16 45 Elbow	item	1
3.3	2 1/2" PVC PN16 Soket	item	1
4	Plumbing material for chlorination tank		
4.1	300 liter Polyethylene Tank (ROTO Tank)	item	1
4.2	Fitting (Traverse de parois) 1 inch (DN25)	item	3
4.3	Diaphragm I valve 3/4 inch (DN20)	item	1
4.4	Outlet Ball valve 1 inch(DN25)	item	1
4.5	Drain Ball valve 1 inch(DN25)	item	1
4.6	Level meter inlet Ball valve 1/2 inch(DN15)	item	1
4.7	PVC Sokect 1 inch(DN25)	item	3
4.8	PVC Blind Flange 1 inch(DN25)	item	1
4.9	PVC T joint 1 inch(DN25) × 1/2 inch(DN15)	item	1
4.10	Transparent Hose 1/2 inch(DN15)	Lm	2
4.11	Hose joint to PVC pipe 1/2 inch(DN15)	item	1
4.12	PVC Reducer (1 inch(DN25)×3/4 inch(DN20))	item	2
4.13	PVC pipe 3/4 inch(DN20)	Lm	1
4.14	PVC 90°Elbow pipe joint 1 inch(DN25)	item	7
4.15	PVC pipe 1 inch(DN25)	Lm	6
4.16	Hose joint to PVC pipe 1 inch(DN25)	item	1
4.17	Hose 1 inch(DN25)	Lm	2
5	Plumbing material for chlorination tank		
5.1	Extension of 4 inch(DN100) GS PN16 pipe above tank	Lm	10

5.2	GS PN 16 elbow 90 4inch(DN100)	item	2
5.3	GS PN 16 elbow 45 4 inch(DN100)	item	1
5.4	GS PN 16 coupling 4 inch(DN100)	item	1
5.5	GS PN 16 Female cap 4 inch(DN100)	item	1

Table 1.2: Material supplied by the Client for Nyabombe water supply system

No.	DESCRIPTION	Unit	Qty
1	Plumbing fitting for Meter chamber N1		
1.1	Supply and fix PVC PN 16 Adapter 63*75 (embout)	item	4
1.2	Supply and fix Brass gate valve 2 " (Vanne à glissiere) PN 16	item	4
1.3	Supply and fix G.I Threaded adapter male-male 2" (Nipple) PN 16	item	6
1.4	Threaded flange 2"	item	4
1.5	Flanged Water meeter 2"	item	2
1.6	GI Union 2"	item	2
2	Plumbing fitting for Meter chamber N2		
2.1	Supply and fix PVC PN 16 Adapter 90*100 (embout)	item	2
2.2	Supply and fix 3" Brass gate valve PN 16 (Vanne à glissiere)	item	2
2.3	Supply and fix G.S Threaded adapter male-male 3" (Nipple)	item	3
2.4	Threaded flange 3"	item	2
2.5	Flanged Water meeter 3"	item	1
2.6	GS Union 3"	item	1
3	Distribution Pipe out of water meter chamber N-1		
3.1	2 " PVC PN16 Pipe	Lm	8
3.2	2" PVC PN16 45 Elbow	item	1
3.3	2" PVC PN16 Soket	item	1
3.4	Supply and fix PVC PN 16 Adapter 63*75 (embout)	item	2
3.5	2" GS Pipe Socket	item	2
4	Plumbing material for chlorination tank		
4.1	300 liter Polyethylene Tank (ROTO Tank)	item	1
4.2	Fitting (Traverse de parois) 1 inch (DN25)	item	3
4.3	Diaphragm I valve 3/4 inch (DN20)	item	1
4.4	Outlet Ball valve 1 inch(DN25)	item	1
4.5	Drain Ball valve 1 inch(DN25)	item	1
4.6	Level meter inlet Ball valve 1/2 inch(DN15)	item	1
4.7	PVC Sokect 1 inch(DN25)	item	3
4.8	PVC Blind Flange 1 inch(DN25)	item	1
4.9	PVC T joint 1 inch(DN25) × 1/2 inch(DN15)	item	1
4.10	Transparent Hose 1/2 inch(DN15)	Lm	2
4.11	Hose joint to PVC pipe 1/2 inch(DN15)	item	1
4.12	PVC Reducer (1 inch(DN25)×3/4 inch(DN20))	item	2
4.13	PVC pipe 3/4 inch(DN20)	Lm	1
4.14	PVC 90°Elbow pipe joint 1 inch(DN25)	item	6
4.15	PVC pipe 1 inch(DN25)	Lm	5

4.16	Hose joint to PVC pipe 1 inch(DN25)	item	1
4.17	Hose 1 inch(DN25)	Lm	2
4.18	PVC 45°Elbow pipe joint 1 inch(DN25)	item	1
5	Plumbing material for chlorination tank		
5.1	Extension of 4 inch(DN100) GS PN16 pipe above tank	Lm	8
5.2	GS PN 16 elbow 90 4inch(DN100)	item	2
5.3	GS PN 16 elbow 45 4 inch(DN100)	item	0
5.4	GS PN 16 coupling 4 inch(DN100)	item	1
5.5	GS PN 16 Female cap 4 inch(DN100)	item	1

Table 1.3: Material supplied by the Client for Kagoma water supply system

No.	DESCRIPTION	Unit	Qty
1	Plumbing fitting for Meter chamber K1		
1.1	Supply and fix PVC PN 16 Adapter 63*75 (embout)	item	2
1.2	Supply and fix Brass gate valve 2 " (Vanne à glissiere) PN 16	item	2
1.3	Supply and fix G.I Threaded adapter male-male 2" (Nipple) PN 16	item	3
1.4	Threaded flange 2"	item	2
1.5	Flanged Water meeter 2"	item	1
1.6	GI Union 2"	item	1
2	Plumbing fitting for Meter chamber K 2		
2.1	Supply and fix PVC PN 16 Adapter 50*63 (embout)	item	2
2.2	Supply and fix 1 1/2" Brass gate valve PN 16 (Vanne à glissiere)	item	2
2.3	Supply and fix G.S Threaded adapter male-male 1 1/2" (Nipple)	item	3
2.4	Flanged Water meeter 1 1/2"	item	1
2.5	GS Union 1 1/2"	item	1
2.6	Threaded flange 1 1/2"	item	2
3	Plumbing material for chlorination tank		
3.1	300 liter Polyethylene Tank (ROTO Tank)	item	1
3.2	Fitting (Traverse de parois) 1 inch (DN25)	item	3
3.3	Diaphragm I valve 3/4 inch (DN20)	item	1
3.4	Outlet Ball valve 1 inch(DN25)	item	1
3.5	Drain Ball valve 1 inch(DN25)	item	1
3.6	Level meter inlet Ball valve 1/2 inch(DN15)	item	1
3.7	PVC Sokect 1 inch(DN25)	item	3
3.8	PVC Blind Flange 1 inch(DN25)	item	1
3.9	PVC T joint 1 inch(DN25) × 1/2 inch(DN15)	item	1
3.10	Transparent Hose 1/2 inch(DN15)	Lm	2
3.11	Hose joint to PVC pipe 1/2 inch(DN15)	item	1
3.12	PVC Reducer (1 inch(DN25)×3/4 inch(DN20))	item	2
3.13	PVC pipe 3/4 inch(DN20)	Lm	1
3.14	PVC 90°Elbow pipe joint 1 inch(DN25)	item	6
3.15	PVC pipe 1 inch(DN25)	Lm	5
3.16	Hose joint to PVC pipe 1 inch(DN25)	item	1

3.17	Hose 1 inch(DN25)	Lm	2
4	Plumbing material for chlorination tank		
4.1	Extension of 4 inch(DN100) GS PN16 pipe above tank	Lm	10
4.2	GS PN 16 elbow 90 4inch(DN100)	item	2
4.3	GS PN 16 elbow 45 4 inch(DN100)	item	1
4.4	GS PN 16 coupling 4 inch(DN100)	item	1
4.5	GS PN 16 Female cap 4 inch(DN100)	item	1

Table 1.4: Material supplied by the Client for Gahezi water supply system

No.	DESCRIPTION	Unit	Qty
1	Plumbing fitting for Meter chamber G1		
1.1	Supply and fix PVC PN 16 Adapter 110*4" (embout)	item	2
1.2	Supply and fix Brass gate valve 4" (Vanne à glissiere) PN 16	item	2
1.3	Supply and fix G.I Threaded adapter male-male 4" (Nipple) PN 16	item	3
1.4	Threaded flange 4"	item	2
1.5	Flanged Water meeter 4"	item	1
1.6	GI Union 4"	item	1
2	Plumbing fitting for Meter chamber G 2		
2.1	Supply and fix PVC PN 16 Adapter 50*1 1/2" (embout)	item	2
2.2	Supply and fix 1 1/2" Brass gate valve PN 16 (Vanne à glissiere)	item	2
2.3	Supply and fix G.S Threaded adapter male-male 1 1/2" (Nipple)	item	3
2.4	Flanged Water meeter 1 1/2"	item	1
2.5	GS Union 1 1/2"	item	1
2.6	Threaded flange 1 1/2"	item	2
4	Plumbing material for chlorination tank		
4.1	300 liter Polyethylene Tank (ROTO Tank)	item	1
4.2	Fitting (Traverse de parois) 1 inch (DN25)	item	3
4.3	Diaphragm I valve 3/4 inch (DN20)	item	1
4.4	Outlet Ball valve 1 inch(DN25)	item	1
4.5	Drain Ball valve 1 inch(DN25)	item	1
4.6	Level meter inlet Ball valve 1/2 inch(DN15)	item	1
4.7	PVC Sokect 1 inch(DN25)	item	3
4.8	PVC Blind Flange 1 inch(DN25)	item	1
4.9	PVC T joint 1 inch(DN25) × 1/2 inch(DN15)	item	1
4.10	Transparent Hose 1/2 inch(DN15)	Lm	2
4.11	Hose joint to PVC pipe 1/2 inch(DN15)	item	1
4.12	PVC Reducer (1 inch(DN25)×3/4 inch(DN20))	item	2
4.13	PVC pipe 3/4 inch(DN20)	Lm	1
4.14	PVC 90°Elbow pipe joint 1 inch(DN25)	item	6
4.15	PVC pipe 1 inch(DN25)	Lm	6
4.16	Hose joint to PVC pipe 1 inch(DN25)	item	1
4.17	Hose 1 inch(DN25)	Lm	2
4.18	PVC 45°Elbow pipe joint 1 inch(DN25)	item	1

5	Plumbing material for chlorination tank		
5.1	Extension of 4 inch(DN100) GS PN16 pipe above tank	Lm	10
5.2	GS PN 16 elbow 90 4inch(DN100)	item	2
5.3	GS PN 16 elbow 45 4 inch(DN100)	item	0
5.4	GS PN 16 coupling 4 inch(DN100)	item	1
5.5	GS PN 16 Female cap 4 inch(DN100)	item	1

1.2. Compensation for heavy rains

The Contractor shall not claim compensation of damages caused to his installations, works and materials by torrential rain occurring during execution. He is required, from the beginning of works, to take security measures in this respect. It is the Contractor's responsibility to do all necessary requirements to carry out satisfactory drainage of all surface water. The Contractor is required to provide for that drainage system in the form of open ducts wherever it is necessary.

1.3. Compliance with standards and regulations

The standards and technical regulations referred to in these documents are intended to specify the quality and standard rules for the desired strengths. In principle, if nothing is mentioned, the standards that shall apply are: RWANDA STANDARDS (RS), ISO, DIN, BS or equivalent. More precise information is shown in the breakdown of contract amount specifying the number of comprehensive services and supplies.

The sources, qualities, characteristics, types, sizes and weight, mode of testing, marking, special fittings and manufactured goods in any case shall be consistent with the standards applied in this project or equivalent quality.

1.4. Maintenance of operation of existing facilities

If it is necessary to intervene on existing facilities, the Contractor shall take all necessary technical and organizational measures necessary in order not to unduly obstruct the operation of water supply, treatment and existing distributions. An interruption will be allowed only for connection of new facilities to the existing system. Each underground survey scheduled on existing facilities must be subject to a prior request to the Client, at least 10 days in advance and give rise to a written agreement on the latter.

In principle, the underground surveys and other interventions to the existing installations will be carried out by the staff of the Contractor in the presence of an officer supervising of the Client. All the expenses emanating from the activities defined above are to be included in the unit and contractual prices, and shall not give place to an additional payment.

1.5. Approval of supplies

The Contractor shall submit to the Client detailed documentation of supplies necessary for carrying out the work. After approval and taking into account the remarks of the Client, the supplies may be ordered.

1.6. Work schedule

The Contractor shall commence the Work within five (5) days from the date of receipt of the notice of the commencement issued by the Client.

The Contractor shall make the master schedule of the work and submit to the Client, and get his approval.

The Contractor shall submit a daily report, a weekly report and a monthly report to the Client. The Contractor shall carry out the management of the work progress in comparison with the master schedule.

Because all work shall be conducted safely, and the work shall be completed within the schedule of works, the Contractor shall organize the appropriate number of working parties, and shall get the Client's approval.

1.7. Technical instruction and inspection

All of the Contractor's work shall be carried out under the technical instruction and inspection by the Client.

1.8. Documents and samples to be submitted

All the following documents and samples shall be submitted to the Client by the deadline stated in the contract document and technical specifications.

1) Contractor's Construction Plan

The Contractor shall submit a Contractor's construction plan within three (3) days from the date of signing of the Contract.

The Contractor shall make the construction plan of work and get the Client's approval.

2) Sample of materials and shop drawings for construction

The Contractor shall submit the necessary drawings and documents to the Client within fourteen (14) days from the date of signing of the contract.

The Contractor shall show or submit samples, shop drawings, quality certification and/or catalogue and these items shall be approved by the Client for use in the construction within fourteen (14) days from the date of signing of the contract.

3) Daily report

The Contractor shall record the proceeding of the construction work daily in English and submit the daily report for each site every Monday morning. The daily report shall be submitted upon request by the Client anytime.

4) Weekly report

The Contractor shall prepare a weekly report every week in English and submit it every Monday morning.

5) Completion report and drawings

The Contractor shall submit a completion report and as-built drawings within one (1) week after the completion.

1.9. Site clearance

The Contractor shall clean the site after completion of all the works and restore the ground to original condition as much as possible. Any artificial materials shall not be left and the temporary mud pits, if any, shall be backfilled.

1.10. Meeting

The Client and the Contractor shall hold a meeting every week. At this meeting, the Client and the Contractor shall discuss every problem regarding the work. The meeting shall be held at the site. The Client will reserve the right to request a meeting with the Contractor at any time if necessary. The minutes of the meetings shall be recorded at every meeting. The Client and the Contractor each shall keep these minutes.

1.11. Communication equipment

The Contractor shall arrange effective communication equipment such as mobile phones, radio communication equipment or satellite phones in order to maintain on-time communication between the Contractor's main office and construction sites. The Contractor shall provide these to the Client as the need arises.

1.12. Safety control

The Contractor shall be responsible for safety measures at the sites. For safety precaution, the Contractor shall pay special attention to the following.

- 1) The site shall always be cleaned and tidied up.
- 2) Outsiders shall be kept out of the working site.
- 3) All labourers who are in the site shall wear safety hats and safety boots or shoes.
- 4) Steeplejacks who work in high places shall use safety harnesses.
- 5) Traffic laws shall be adhered to.

The Client and the Contractor shall have a safety meeting every month. All the members of the Contractor shall attend this meeting and the awareness to safety shall be improved.

The Contractor shall make his arrangements for treatment of casualties on the site in such first aid kits as may be regarded necessary.

1.13. Sign board

The Contractor is responsible for signposting, lighting and restricting barriers on the site as well as roads used. That signaling shall conform to the specifications of Highway and Administration code. The Contractor is entirely responsible for any accident or damage that may be caused during the traffic on public road or on the site resulting from works, either to his personnel, equipment, third parties, or District installations. It is the duty of the Contractor to keep clean all public roads used by trucks or other moving machinery. The Contractor shall

be forbidden to throw, take down or drop on roads materials, objects or any material that may disturb or make it dangerous for the traffic of vehicles or pedestrians.

The Contractor shall install a board describing the work at the site entrance within 10 days following the date of contract signature. Its exact location shall be determined by the Client. The board shall be constituted by a metallic frame with two posts and wind bracings on which there are parallel and horizontal planed planks of 1.20m x 12cm x 2cm minimum with 2cm spacing. Those planks painted in white shall carry the text (as shown in below) in black letters of 10cm in height. The lower part of the board shall be at a minimum height of 2m. This shall comprise the fabrication and fixation of the panel on the adequate foundation. The text shall be painted in black or dark blue on white background. The panel shall be presented as follows:

The Work: Pilot Installation of Water Meters and Chlorination Units
Contractor:
Client: Kokusai Kogyo Co., Ltd.
Project: Project for Strengthening Operation and Maintenance of Rural Water Supply Systems in Rwanda
Funding Agency : Japan International Cooperation Agency (JICA)
Counterpart: Water and Sanitation Corporation (WASAC)
Duration :

2. Source, Quality and Conditions of Usage of Materials

2.1. Quality and source of materials

The materials needed for construction works shall be provided entirely to the care and expense of the contractor, to ensure the execution of work within the time limits. They shall be of the highest quality available on the market, flawless, and implemented. The materials and their source (rivers, quarries, and factories) shall be subject to the approval of the Client prior to their usage.

Their qualifications shall be justified by presentation of certificates of laboratories and / or certificates of conformity from factories at the expense of the Contractor.

All materials to be used shall be approved by the Client. Materials rejected shall be removed at once from the site by the Contractor and at his expenses.

2.2. Aggregates for mortar and concrete (sand, stones and stone aggregates)

The mortar and concrete aggregates shall be extracted from the gravel or sand deposit or obtained by crushing and grinding rock extracted from quarries. All expenses for the operation of quarries are to be met by the Contractor.

Their storage shall be carried out on raft concrete bases, bricks or planks to avoid any impurities. The crushing, screening, and washing facilities shall allow a variation, depending on needs, the proportions of the elements, so as to achieve the desired size. Usage of non-washed lake sand is prohibited.

2.3. Cement

The only cement to be used shall be that one from CIMERWA, HIMA (Portland cement), or any other equivalent type with equivalent characteristics, approved by the Client.

The cement will be transported in a well-sealed impermeable bag of 50 kg. During the transport of cement while in transit, it shall be necessary to keep on protecting the cement from getting into contact with water and humidity. Cement bags shall not directly come into contact with wet soil or be exposed in an open space unless for a short period of loading and offloading and with that under favorable atmospheric conditions.

A) Mode of delivery:

The cement shall be delivered in bags. The re-bagging is strictly prohibited, as well as recoveries of cement dust.

B) Storage:

The buildings intended for storage shall be built and held safe from moisture and shall be ventilated. The cement supplies shall be kept on elevated boards. The storage of the bags shall be systematically organized, so that the storage period of cement in store shall not exceed three (3) months.

C) Control:

The cement shall be stored and used only after being assessed sound. The Client will decide on the need to test strength of cement on normal specimen and will visit at any time the premises used for storage.

2.4. Mixing with water

Any water drawn from nature shall be acceptable as water for mixing as long as it shall not contain elements that have an adverse effect on the hardening or other properties of concrete or protection against corrosion of the iron formwork, such as industrial wastewater. In case of doubt, it shall be necessary to carry out an analysis to prove that it is well adapted to be used for the concrete.

2.5. Mortars

Table 2.1: Application of the mortars

Class	Composition	Application
A	600 kg of cement/ m ³ , sand delivered in two type of aggregates	Coated with waterproof additives
B	400 kg of cement/ m ³ , sand delivered in two type of aggregates	Ground coats, manufacture the ventilator blocks
C	300 kg of cement/ m ³	External coats
D	250 kg of cement/ m ³	External coats, mortar for masonry

The sand for mortar shall be measured at each mixing by volume, while cement shall be measured by weight. The mixing of the mortar aggregates shall be carried out on timber or masonry prepared grounds, and with respect to consumption.

After its first setting, the plastered mortar shall be smoothed using the flat part of the trowel. The use of the special hydraulic mortar and additives shall be subjected to approval of the Client, and are to be prepared according to regulations of the supplier.

2.6. Concrete

The anticipated types of concrete shall be as follows.

- class **A**: Reinforced concrete
- class **B**: Mass concrete
- class **C**: Blinding concrete

The Table 2.2 shows the minimal characteristics of execution to be respected.

Table 2.2: Characteristics of execution of the concrete

Description	Unit	Class		
		A	B	C
Characteristic compressive strength ¹⁾	N/mm ²	27	19	
	bars	270	190	
Proportion of cement (min.)	kg/m ³	350	250	150
Proportion of cement (max.)	kg/m ³	450	350	150
Quantity of aggregate fraction		3	2	2
Allowed sieve granulometry (sieve analysis) ²⁾		A	A, B	A, B
Proportion of water: W/C (max.) ³⁾		0.60	0.75	0.75

1) Compressive strength after 28 days for test-cubes 15/30 cm.

2) According to Table 2.3 hereafter

3) For the works which are in contact with the water whose value of the Ph is equal or lower than 6,0, value W/C must be equal or lower than 0,50. (W/C = water Ratio/cement in weight)

Table 2.3: Percentage of aggregates passing through a sieve

Diameter (mm)	Type A		Type B	
	min.	max.	min.	max.
0.250	3	8	8	18
1.000	12	32	32	49
2.000	21	42	42	62
4.000	36	56	56	74
8.000	60	76	76	88
10.000	78	88	88	94
16.000	100	100	100	100

The use of calcium chloride and the additives on this basis is prohibited. The production of the concrete shall be obligatory made in concrete-mixers. The quantities of mixing water to be added shall be determined by the care of the Contractor after measurement of the water content initial of the aggregates. This measurement of the water content before manufacture of the concrete shall be obligatory.

The aggregates and the binder shall be proportioned:

- for the concrete of type A and the hydraulic concrete, by the proportions in weight in three fractions
- for the concrete of types B and C, by volume measuring in two fractions

The concrete shall be prepared progressively with the needs, and to be set up immediately. The surplus quantities shall be thrown out of the construction site.

2.7. Wood for formwork and propping

Timber necessary for the formwork and propping shall be chosen by the Contractor, who will justify qualities necessary for a good organize of the formwork and who shall submit for approval by the Client.

2.8. Formwork

a) Type C1: Raw formwork:

The ordinary formwork shall consist of boards with a minimal thickness of 25 mm. They shall be supported at least every 0.70 m. The tolerance of the joint between two boards shall be 2 mm.

b) Type C2: Neat formwork:

The neat formwork (clean concrete for dismantling) shall be carried out:

- in boards planed on three sides of a width from 7 to 10 cm, in line with the length prescribed by the Client
- out of steel plates on sawn boards
- in fiberboards of wood or plywood on sawn boards.

In any case, the surface of the concrete shall be regular and without nests of fine gravel. The application of oil for dismantling shall be obligatory.

2.9. Reinforcing steel

The quality of the steel used in this work and its shaping shall meet the requirements of the Rwandan standards or the equivalent standards.

The mild steels shall be allowed as well as high-strength steels (Tor, welded steel mesh) if they correspond to the norms and requirements of the design of reinforced concrete.

The Contractor shall be obliged to justify the source of the steel which he plans to use for the construction of the structural work. The steel bars shall be absolutely clean, without spot nor any oils.

2.10. Stones

The stones shall be compact hard stones, not very fragile, of the type:

- metamorphic quartzite with tightened beds
- metamorphic sandstones with tightened beds
- Granites and granitoid and, in general, any rock containing of quartz and the granite.

The kaolin metamorphic sandstones (colour clear grey) shall be eliminated.

2.11. Pipes, connections and joints

The pipes, connections and joints shall comply with the standards RWANDA STANDARDS (RS), ISO, DIN, BS or equivalent.

2.11.1. Common regulations

The pipes and connections shall comply with the standards RWANDA STANDARDS (RS), ISO, DIN, BS or equivalent, with regard to the terminology, classification, symbolization, the conditions of manufacture, the characteristics and the tolerances, the conditions of preparation of the test-tubes, the technique of the tests, the marks of identification and the applicable clauses of reception. They shall satisfy all the conditions or normal subjections of usages, in particular with regard to the interior pressure, the external loads, the live loads and the reaction of the ground or the supports.

The right pipes shall be cylindrical. The axis of the right pipes shall be rectilinear, and the faces of the ends of the right pipes and fittings shall be exactly of square with the axis of the parts; these ends shall be established so as to allow the perfect connection of the joints. The interior surface of the pipes and the fittings shall be smooth; the defects of this surface shall not be allowed in as far as they accidental and local irregularities, not being able to harm the quality of the part and entering the prescribed tolerances; no repair of such defects shall be made without the authorization of the Client. The supplies shall resist without damage with all the efforts which they shall support in service and during tests. They shall be tight under all the test or operating conditions. They shall resist in a durable way with all the external factors, either by themselves, or on the one hand by their lining with regard to the action of water, or, on the other hand, by their coating external with regard to the action of the ground or, in a more general way, surrounding environment.

The supplies shall in no way modify the physical qualities, chemical, bacteriological or organoleptic of water circulating normally in the network considered. All the supplies such as pipes, valves, accessories and other important parts shall carry the following indications:

- * mark factory;
- * plugs or plates allowing the identification of the material and the authorized pressure rating;
- * the nominal diameter;
- * characteristics of materials, so as to determine if the material corresponds to the necessary regulations;

2.11.2. Galvanized steel pipes

Galvanized steel pipes shall comply with the DIN 2440 or equivalent. Minimal thicknesses of the tubes for galvanized steel pipes shall comply with the Table 2.4 hereafter:

Table 2.4: Minimal thicknesses of the tubes for galvanized steel pipes

Inches	DN (mm)	External diameter (mm)	Minimal Thickness (mm)
¾	20	26,9	2,65
1	25	33,7	3,25
1 ½	40	48,3	3,25
2	50	60,3	3,65
2 ½	65	76,1	3,65
3	80	88,9	4,05
4	100	114,3	4,05

2.11.3. PVC pipes

Their diameters and thicknesses of minimal walls shall comply with the Table 2.5 hereafter:

Table 2.5: Thicknesses minimum of the tubes for PVC pipes

Inches	DN (mm)	External Diameters (ED) (mm)	Thickness of the tubes (mm)	Pressure ratings (bars)
3/8	10	18	2.5	10
1/2	15	22	3	10
3/4	20	26	3	10
1	25	32	3.5	10
1 1/4	32	38	3.5	10
1 1/2	40	48	4	10
2	50	60	4.5	10
2 1/2	65	76	4.5	10
3	80	89	6	10
4	100	114	7	10

2.11.4. Assemblage of the pipes

(1) Galvanized steel pipes:

Fitting shall be carried out by threaded connections.

(2) PVC pipes:

Interlock without joining (hot formed fittings) with rings of joint of rubber or elastomer and flanged joints for the pipes having a diameter DN 50 or bigger. For the pipes having a diameter smaller than DN 50 by joining (cold welding). The adhesives, the seals and the lubricant necessary to the assemblies shall be part of the supply.

2.11.5. Flanges

All the technical provisions concerning the flanges, machining, diameter, characteristic of the joint, surfaces contact, shall meet the requirements of the EN, RWANDA STANDARDS, ISO or equivalent.

Flanges shall be delivered complete, i.e. with nuts and bolts and sealing packing. The accessories like all the pipe fittings and valves and fittings shall be able to stand the pressures which they have to undergo, in particular at the time of the tests on the construction site. All the accessories of flanges shall be also designed to withstand the pressures. The bolts shall be galvanized with threading and diameters in conformity with the standards. The suppliers shall be to ensure, before forwarding, of the complete coherence of the deliveries: qualities of the provided equipment and cutting through templates in particular, to ensure the coherence of the supplies of the drains batches and valves and fittings and for the coherence of the parts of the same batch.

2.11.6. Bolts and nuts

All the bolts and nuts necessary to the assembly shall be provided with the delivered equipment, and according to the standards specific to the particular equipment. Bolts and nuts shall be protected from corrosion.

2.12. Valves, meters and fittings

2.12.1. Common regulations

The parts of valves, meters and fittings shall be in conformity with the applicable standards with regard to the terminology, classification, symbolization, conditions of manufacture, characteristics and tolerances, conditions of preparation of the specimen, technique of the testing, marks of identification and applicable clauses of reception. The parts of moulding shall have perfectly external surfaces, without trimmings that require again to be treated with the scraper or the file.

The assembly drawing of all the flanges shall be obtained from the factory. The flanges shall comprise of one or more circular and concentric washers, made in order to facilitate organize of gripping. All surfaces prone to friction shall be machined; the drilling of the lids, blank flanges, flanged joints with piping shall be made with a drilling machine.

The seats of valves and surfaces of the shut-offs shall be made and to be rectified by hand or to be ground in order to ensure a stable and perfect of closing. Threads shall be done by machine; they shall have to be complete, to have the right edges, and without defect. A factory mark indicating the diameter of passage and the arrow of the direction of flow of water shall have to be visible on the external surface of the equipment. For the stamped or forged special parts, these indications shall be obtained by punching.

The Contractor shall have a file in the offices of the Client, for acceptance and before any usage, a representative sample of valves, meters, fittings, etc. which he proposes to install.

2.12.2 Gate valves

The lower part of the passage of water shall be perfectly straight and smooth. The valve shutter shall be made of cast iron with vulcanized synthetic rubber mould. The seat of the shutter shall be out of synthetic rubber. The body of gate valves shall be made of cast iron. The elevated gate valves or those under manholes shall all be operated by turning a wheel. The valves buried under the ground shall be equipped with a mouth key, secured by a pit covered at the top at the roadside and to operate by turning long pieces of tubes.

2.12.3. Water meters

The meters shall be the model WPH or WPD of brand ZENNER or equivalent, installed horizontally with turbine, multiple jets laid out regularly, direct reading on numbered rollers contained in a transparent, sealed capsule, filled with a special and supplemented liquid of an effective device for the compensation of the pressure between the interior of the capsule and exterior.

The reading shall be done in cubic meters. The minimum graduation shall be 1 litre. The figures of the drums for the cubic meters shall be black. Those of the fractions of the cubic

meter shall be red. The totalized values recorded by the drum shall be read directly without any coefficient. The meters shall be protected from fraudulent handling by an external magnetism action.

The meter shall have to stand an operating pressure of 16 bars at maximum. The precision obtained from counter shall not be influenced by variations of operating pressure up to 10 bars. The manufacturer shall give a copy of an official statement of calibration of the meter of the type proposed.

2.12.4. Gate valves before and after water meter

The valves shall be of spherical plug type with integral passage, and with order $\frac{1}{4}$ of turn. The construction characteristics shall be as follows:

- * body: brass
- * bushel: mater “non-incorrosionable” or out of metal with coating ‘non-inscrutable ‘
- * seals : Teflon or perbunan
- * stem: brass
- * handle of turning: gate valve type

They shall be planned for an operating pressure of 10 bars, and a test pressure of 16 bars.

2.13. Chlorination unit

2.13.1. Calcium hypochlorite dissolve preparation storage tank

Calcium hypochlorite dissolve preparation storage tank shall meet the requirement of the Table-2.6 hereafter:

Table 2.6: Requirement for calcium hypochlorite dissolve preparation storage tank

No.	Items	Specification	Remarks
1	Type	Vertical stationary type made of polyethylene	
2	Volume	300 litter (nominal)	
3	Dimension	$\Phi 760 \times H850$	
4	Nozzle	Outlet: 25A \times 1 Drain: 25A \times 1 Vent: 25A \times 1	
5	Flange rating	ISO, JIS, DIN, ANSI or equivalent	
① Material			
No.	Items	Material	Remarks
1	Body	Polyethylene (PE)	
2	Level indicator	Transparent vinyl hose	
3	Bolt, Nut	Stainless steel	
4	Gasket	Fluor rubber or PTFE coating rubber or Natural Rubber	
② Standard accessories per unit			

	Foundation bolt nut	1 unit	
	Manhole	1 unit	
③ Outline of structure			
	This tank is cylindrical, is for dissolving, preparing and storing calcium hypochlorite solution.		
	Material is made of PE, color is black		
	Install a ball valve and a hose in the drain line of the solution tank. They are used as a level indicator.		
④ Essential condition of manufacture			
	When designing, manufacturing tanks, we shall have a structure that will not cause falls, sideslips, falling offs, breakages, etc., against seismic forces and heavy loads.		
⑤ Special notes (structure of each part)			
	The plate thickness of tank should be 4 mm or more		
	Structure without leakage. Especially about the connecting part of the nozzle.		
	Take measures to prevent sediment in the tank from blocking the outlet nozzle. Install an outlet nozzle 200 mm above the bottom of the tank.		
	Enclose the solution tank with a roof and a fence. The fence should be lockable.		
	The valve for adjusting the addition amount of the solution is a diaphragm type.		

2.13.2. Diaphragm valve

Diaphragm valve shall meet the requirement of the Table 2.7 hereafter:

Table 2.7: Requirement for diaphragm valve

① Specification			
No.	Items	Specification	Remarks
1	Type	Socket type and diaphragm type manual valve	
2	Diameter	20mm (3/4 inches)	
3	Working pressure	0.05MPa	
4	Flange rating	JIS10K or equivalent	
5	Handle	Polypropylene PP, equivalent	
② Material			
No.	Items	Material	Remarks
1	Casing	PVC	
2	Body	PTFE	
3	O ring	Fluor rubber or Natural Rubber	

2.13.3. Ball valve

Ball valve shall meet the requirement of the Table 2.8 hereafter:

Table 2.8: Requirement for Ball valve

① Specification			
No.	Items	Specification	Remarks
1	Type	Socket type and ball type manual valve	
2	Diameter	25mm (1 inch) × 2 sets 15mm (1/2 inch) × 1 set	
3	Working pressure	0.05MPa	
4	Flange rating	JIS10K or equivalent	
5	Handle	ABS (Acrylonitrile-Butadiene-Styrene resin) or equivalent	
② Material			
1	Casing	PVC	
2	Valve body	PVC	
3	Stem	PVC	
4	O ring	Fluor rubber or Natural Rubber	

3. Mode of execution

3.1. Preliminary activities

The preliminary works include:

- a) Thorough and detailed investigation of the places
- b) The checking and possible correction of the drawings and plans. The exact definition of the layout of the pipelines and their execution, in collaboration with all the authorities concerned
- c) Verification of a list of pipes, fittings, and accessories
- d) Setting up of the works
- e) All plans of implementation shall take into account the approved shop drawings.

3.2. Concrete work

Before setting for execution, the Contractor shall define and justify the following:

- * Conditions of setting up and stability of the formwork, and its rigidity to the pressure due to the fresh concrete and its possible effect on the process of the concreting;
- * The handling of the concrete faces like it's possible effect on the design and the treatment of the walls of the formwork;
- * The positioning of the iron formwork in the shutters in relation to the edges of the formwork;
- * The process of the executions section by section successively as well as the justification of the strength and the stability of the structure in each successive phase of construction;
- * Resumptions of concrete casting and it's possible effect on the strength and the stability of the structure;
- * Conditions of settlement; Provisional construction joints.

3.2.1. Formwork

The Contractor shall choose the categories of plane formwork and simple curve formwork as clarified by the offer.

In all the cases, the formwork shall be suitably jointed. The sealing of the joints shall be met by suitable approved means before casting concrete. Surfaces of contact with the concrete shall neither be projected nor warped.

In addition, the waterproofing system of the joints shall not make projections on the interior surface of the formwork.

The formwork shall be of sufficient rigidity to stand the earthworks and the adverse deformations due to various loads, surcharges and forces which can come into play during the execution of the works, and in particular the clamping forces and the vibration of the

concrete. Arches and their props in the formwork etc. shall be given with respect to the plan of the finished work.

The preparation of the formwork shall be obligatory before any concreting; it shall consist of:

- cleaning, possibly with the compressed air;
- humidification to tighten the joints and to avoid the fast drying of the concrete on the walls;
- an oiling to facilitate the removing of the shutters.

3.2.2. Dismantling of formwork

The removal of formwork shall be carried out with precaution, without shocks and by purely static efforts.

The times of dismantling shall depend on the growth of hardness of concrete.

The expansion and construction joints shall be cleared of all the elements likely to oppose their operation.

When, however, some reinforcing steels are accidentally exposed at the time of the dismantling, it shall be advisable, before finishing, revisiting the defective zone by adding additional plaster.

3.2.3. Reinforcing steel work

Except in the event of particular requirement of the Client, steels shall not be subjected to reception in factory. On the other hand, of the tests of control shall be carried out after delivery on the construction site. These tests shall have to be carried out on samples taken randomly. The expenses shall be met by the Contractor as contained in the pricing.

The bars shall be cut and made in accordance with the shop drawings. The minimal diameters of the bending blocks as well as speeds of bending shall correspond to the standards quoted above.

Any unbending of steels other than the mild steels is prohibited.

Welding is not allowed for steels of yield stress lower than 350 N/mm² and provided the welding does not decrease the strength and does not create a risk of brittleness.

At the time of their installation, the formwork shall have to be clean and shall not bear any traces of soil, paint, grease, or any other harmful matter.

They shall be placed in accordance with the shop drawing and shall be fastened with precision by means of clamps made of mortar or plastic, so as not to undergo any appreciable displacement before and during casting and the vibration of the concrete.

3.2.4. Mixing and placing of concrete

Before any mixing, the Contractor shall submit to the Client the curves of particle size distribution of the aggregates which he intends to use and shall give the fresh samples from the source as well as the test results from the laboratory.

The type of the mechanical concrete mixers and mode of vibration shall be submitted by the Contractor for the approval of the Client. The vibration of the formwork is prohibited.

Prior to the casting the chlorination unit base, the Contractor shall lay a 15mm thick cement-sika screed on top of existing slab to facilitate the bonding of new base concrete to existing slab.

During the casting of the concrete, the Contractor shall keep on site the vibrators and capacity able to replace the active machines in the event of any failure.

It shall be maintained humidified by continuous and permanent watering during at least seventy two (72) hours after casting. After these seventy two (72) hours, during the twelve (12) days which follow, the formwork in contact with the concrete and the free concrete surfaces shall be regularly sprinkled in order to constantly maintain them cured.

The detailing of formwork shall be subjected to the approval of the Client before the casting of the concrete.

The formwork shall be simple and robust. It shall stand without deformation the forces resulting from casting and ramming of the concrete. The sealing shall be sufficient so that the excess water from the concrete take cement.

The dismantling of the shutters shall take place fifteen (15) days after the completion of the concreting and the authorization written by the Client. This shall cover only side surfaces of the works and the parts of the concrete that work little under their actual weights and to which the surcharge shall not be applied immediately.

3.2.5. Sika Latex

It shall be mixed with Cement to form bonding slurry. It shall be used bonding agent between old concrete and new concrete. It shall be used by mixing one part of sika latex by one part of cement as mortar additive.

The preferred mix shall be 1bag of cement, 7 liters of sika latex, 125 kg of fine sand.

3.2.6. Concrete repair

Any concrete repair requires the consent of the Client. The defects which may result from an accident at the time of casting and which may appear after dismantling shall be repaired.

This remark shall apply in particular to the bubbles, honey combs, traces of resumption of formwork, gravel nests and badly made edges, at the time of the dismantling of formwork.

3.3. Water meter chamber

The excavation for meter chamber will be consisted of a clearing of underground and a scouring of topsoil on a variable depth. the excavation shall be according to the desired height and size on the drawing, For the construction of meter chamber it will be necessary to start with base slab compose of:

- Crushed stone,
- Blinding concrete layer: Class C,
- Reinforced concrete slab: Class A.

After laying crushed stone, vacuums between the stones will be filled with a mortar, which will be composed of one measurement of cement out of six measures of fine sand (1:6). The

blinding concrete layer class C will have a thickness of 0.05m. The reinforced concrete slab class A will have a thickness of 150mm.

On the slab, the walls of the meter chamber will be built in 400mm width of rubble stone of good quality plastered inside and pointed outside the plaster will be composed of one measurement of cement out of three measures of fine sand (1:3). All parts of walls exposed to ground shall be coated by 2 layers of bitumen.

The height of the wall will be according to the drawing extended on top 100mm above grade, The mortar for rubble stone construction will be composed of one measurement of cement for three measurements of sand,

For supporting the assembly of meter inside chamber, a rubble stone base will be built below meter and will have the dimension on the drawing.

On top of the meter chamber a top slab shall be provided with 100mm thick reinforced according to the details on drawing, on it, the contractor shall provide accessibility into the meter chamber by a manhole covered by metallic cover of 600mmx600mm attached on 40x40x4mm steel angle embedded in concrete, the metallic paint shall be painted by 3 layers of anti-corrosion paint.

After the completion of the chamber, the extra grounds will be spread out in the surrounding of work and a backfill will be carried out up to the level of the natural ground.

3.4. Works of pipe laying

3.4.1. Transportation and handling of pipes and fittings

The pipes, fittings or accessories shall be deposited without brutality on the ground or in the bottom of the trenches and shall not be rolled on stones or in rock ground without prior preparation the tracks with timbers.

Offloading by fall, even on sand or tires, shall be prohibited. If the Contractor does not have a rather powerful lifting gear, it shall be necessary to carry out offloading while rolling the pipes on a tilted level of beams and by slowing down their descent.

The handling operation of the lifting gear using hooks shall not be applicable to steel and cast iron pipes which are covered inside, but only be by using slings furnished with leather or thick rubber or by straps made of fabric and maintained apart aside by a bar.

3.4.2. Opening of the trenches

The trenches shall be made in accordance with the drawings and specifications of the Client. The minimum depth shall be given according to the diameter and of the material. In the event of rock, the Client will order a lower pipe cover. The bottom perfectly shall be drawn up and purged stones met.

When the opening of a trench reveals even light water leakages on existing pipes, the Contractor shall warn the Client.

The Contractor shall use an apparatus to detect the pipes before the opening of the trenches. In the event of meeting of the electric cables or telephone or other networks underground, the Contractor shall take all precautions so that it shall not be interfered with.

The Contractor shall remain entirely responsible in respect to the existing services concerned in case of any possible damage.

In general, when a control is to be posed an electric cable parallel to, the spacing shall be at least 80 cm. For a transverse cable, the minimal distance will be 40 cm. Exceptions shall be possible only on permission of the owner or his representative. Generally, the Contractor shall announce to the Client any meeting of objects in the excavations. When masonries appear in the ground, they shall be organized to 20 cm below the trench bottom. When they are rock grounds, this deepening could be reduced to 10 cm.

In these two cases, the excavation shall be filled with loose soils and compacted up to the level of the trench bottom.

The Contractor shall deposit or demolish carefully the floor surfaces, like their foundation, neither without shaking nor to degrade the areas that are neigh cutting through. The materials coming from these demolitions shall be carefully moved outside. If the base is made of wet soils, showing presence of ground water, the Contractor is obliged, before the opening of the trench, to provide drains for the ground water, or evacuation by pumping, or by gravity flow according to necessity. The drainage system shall be explained in advance using sketches with dimensions.

3.4.3. Timbering

Necessary propping shall be established according to the code of practice, and shall be made of timber or metal elements of size suitable for the intended use. They shall be carried out jointed if the nature of the ground or the duration of opening of the excavation requires it, and all precautions shall be taken, if it is necessary, to prevent any landslide. It shall be strictly prohibited to leave the propping timber in the excavations. The Contractor shall have to carry out his work in order to eliminate any timber before proceeding to back filling of the excavations.

3.4.4. Drainage of the excavations

The Contractor shall be held to avoid the entry of surface waters coming from the roads into the trench. The removal of surface water from the trenches shall be the responsibility of the Contractor and shall not be paid any extra remuneration for it. No possible prolongation of the completion period shall be authorized as a result of heavy rains except under circumstances beyond control.

The water collected in the trenches from the ground due to the water table, infiltrations, or any other source shall be organized to temporary sumps, from which the contractor shall remove it on his own expense.

The Contractor shall be held to dig, clean and maintain these sumps, as well as the drains and all special installations leading water to the sumps. These drains and installations shall have to ensure the complete draining of the excavations.

3.4.5. Laying of pipes

As indicated on drawings, the GI inlet pipe mostly 110 mm shall be extended above tanks slab. Before the execution, all the pipes, the special parts and fittings shall have to be ready for use, carefully cleaned and purged of any foreign element. During the installation, all the

precautions shall be taken to avoid the entering of refuse or foreign body and not to damage the lower surface of the pipe.

The ends of laid pipes shall have to be enter to the tank through a core drilled hole in top slab, the pipe shall be closed carefully with plugs at existing entrance.

External and interior protections, which would have been damaged during transport or by the cuts, shall be repaired before the installation.

The pipes, special parts and fittings shall be raised carefully on top of slab where they shall be laid without shocks, falling, etc.

The GI pipe shall be laid on concrete base of 80mm thick and 300mm wide concrete class B. The installation and the assembly of the conduits and the valves and fittings shall have to be carried out by skilled workers.

The Client shall have full powers to request from the contractor the presentation of the profile of the layers. If the latter do not appear to him to provide sufficient guarantee, the contractor shall have to replace these workmen immediately.

3.4.6. Works of rehabilitation and repair of leakages

If leakage is found on the existing pipe, the contractor shall notify to the client immediately.

Work of rehabilitation shall be carried out with the greatest possible care. For work of replacement of the pipes, the following instructions shall be observed, except in case of alternative indicated by the Client.

- * New pipe is to be laid beside existing pipe
- * The particular fittings to be rehabilitated by the Contractor are those on existing pipe.

During all the time of due water shortages, the Contractor shall be obliged to provide drinking water to the inhabitants concerned, by means of tankers on his expenses if this cut exceeds 24 hours. The contractor shall be held to repair the leaks which were identified at the time of surveying for the possible leakages.

3.4.7. Disinfection of the pipes and tanks

Before the startup, the totality of the pipes shall have to be disinfected using calcium hypochlorite according to following regulations.

Before disinfection, the pipes shall be rinsed with a volume equal to three times that of the pipes at 0.75 to 1.50 m/s at least. The by-pass of the water meters shall be open.

Disinfecting water shall contain 3 grams of free chlorine for each 0.1m³ of water and shall remain one hour at least in the pipes.

At the end of the time of disinfection, residual chlorine shall appear with the colorimeter in the pipes. Otherwise, disinfection shall be continued until obtaining valid results.

During the time of disinfection, the taps, tap valves, valves, public water points, etc. shall be handled several times.

After disinfection, the pipes shall be rinsed with their double volume of water. The water of disinfection shall be evacuated without risk for third party.

3.4.8. Backfill of the foundations trenches

Backfilling of the excavations shall take place only after approval of the level of the works. Backfilling shall be done in layers not exceeding 0.20 m thick, carefully rammed and if necessary sprinkled water to achieve optimal moisture content for the compaction. The layers shall not be made of muddy, elements, top soils or organic matter.

3.4.9. Particular precautions

All the metal parts (bolts, nuts, supports, consoles, saddles) and in particular those which will be in contact with water, shall be protected from corrosion by a paint from hot affixed bituminous coating or any other matter suitable for protecting metal effectively.

3.5. Roof structure for chlorination unit

This structure shall be done by metal tube making structure well stable and which shall protect and provide a shed of the chlorination shed made by iron sheet roof cover, metal tubes, galvanized welded wire mesh and concrete base.

3.5.1. Steel structure

The structure of chlorination unit shall be in hollow sections made of steel (rectangular or squared) horizontal members welded to vertical members columns embedded in concrete base as per drawings details,

The elements of the steel work shall be protected by 2 coats of red oxide paint.

All elements of the metallic frame work and cover shall be provided and fixed by the Contractor.

The metal elements shall be 40 x 40 x 1.5mm, except two columns of 60 x 60 x 2mm on rear elevation extended to the base of the tank and embedded in the concrete foundation.

3.5.2. Roofing

The roof sheets shall be constituted of S profile galvanized sheets of 28 gauges TOLIRWA diagram 5 or equivalent. They shall be put with a slope of 10% at least. They shall rest to the purlins. They shall be fixed by means of galvanized J bolts of 60/100 mm of thickness provided with small plastic on upper part.

The Contractor shall provide a choice between several colors to get the approval by the Client. A recovery of 20 cm shall be necessary according to the slope after verification of the metallic framework that requires a fixing of the hooks.

This item of work shall consist of the supply of the new metal sheet and their installation including all pieces of fixing and joint in order to assure a perfect tightness of the roofing.

3.5.3. Wire mesh

The walling in metal structure shall be covered by galvanized welded steel wire mesh which has 4mm diameter. The size of mesh shall be 50x50mm rectangle. The wire mesh shall be attached on metal structure by welding. The contractor shall make a neat and clean point of weld.

3.5.4. Concrete base on the existing tank

The concrete base shall have the dimension as shown on plan, it shall be put in place by means of formworks and on top of exiting roof slab for the tank.

The contractor shall provide a cement sika latex screed right on top of slab before casting a new concrete to make a perfect bonding.

When casting the concrete, the contractor shall provide e 50x50x1.5mm square hollow section sleeve of 300mm long for front columns.

The concrete base shall have a smooth finish on top, the contractor shall check whether the concrete is well dried and paint in 3 layer of epoxy paint brand AMEKI or equivalent.

3.5.5. Concrete foundation in the ground

Two columns of 60 x 60 x 2mm on rear side shall have a concrete foundation of class B in soils, the Contractor shall verify dimension on plan prior to the casting concrete. The foundation shall have the dimension of width 400mm, length 400mm and depth 1,100mm, with 100mm extended above finished grade level.

3.5.6. Painting and corrosion protection

The paint works shall be completed through the products designated by their mark, according to the manufacturer's instructions which might be specified in the instructions and labels.

The tints, paints qualities and whitewash on samples shall always be submitted by the approval of the Client before all completion works. The Contractor shall provide a well done work. He shall not take advantage of the descriptions detailed about the necessary number of coats, being known that walls and painting accessories shall be fully covered by thin layer rounded to the paint brush.

The paintings completion shall always include materials dusting and the resumption of surface defectiveness. The corrosion removal, grease removal shall be completed in accordance with the technical prescriptions.

The successive painting shall perfectly cover the surfaces to be painted, and be perfectly smooth and not showing any trace of paint brush. Each layer shall be removed from all dust and any kind residue and sanded if necessary.

3.5.6.1. Painting on metallic parts

All metallic parts and ironwork shall be coated by paintings in the following:

- a) After white sanding, a primary mono component of high content of zinc dust based on epoxy - polyamide resin, of two components: zinc phosphate and iron oxide. Thickness: two layers of 40 to 50 micron.
- b) An anti-corrosion intermediary-compatible-oleoglycerophtalic based on basic silicochromate of lead. Thickness: a layer of 40 to 50 microns or two layers each 25 microns.
- c) Oil based finishing of high viscosity based on basic silicochromate of lead. Two layers thickness with recoverable interval of 48 hours each from 70 to 80 microns. In the aggressive medium, the quoted intermediary in b) shall be validly accepted for primary and intermediate layer or two layers of 40 to 50 microns or four layers of 25 microns each.

The total thickness shall be 240-250 minimum microns for the painting layers assembly.
The inside steel conduits, iron work and metallic parts in contact with drinking water shall be coated by paint as follows:

- a) After white sanding, a modified primary epoxy coating of high viscosity of two resistant components to aggressive medium. Thickness: two layers of 75 to 80 microns each or 1 layer of 150 microns
 - b) Epoxy polyamide finishing of two components of supply quality. Thickness: two layers of 45-50 microns or 1 layer of 100-105 micron.
- Total: a) and b)= 240-250 minimum microns.

3.5.6.2. Galvanizing of metallic parts

The steel parts to be galvanized shall be hot galvanized by immersion in molten zinc. The tubes coating shall be homogenous and regular crystallization in general.

The minimum masses of zinc per square meter are:

- * thickness Steel up to 3 mm: 350 g/m² (49 microns)
- * thickness Steel up to 5 mm: 400 g/m² (59 microns)
- * High thickness steel: 450 g/m² (63 microns)
- * Bolts and nuts : 300 g/m² (42 microns)
- * Molded castings: 450 g/m² (63 microns).

4. Completion conditions

4.1. General test

Before the final inspection, there shall be a general test. This test shall be completed before the completion of particular connections, sectioning valves to the existing system being closed. This test shall be done at the same time as the conduits disinfection.

The water supply shall be the responsibility of the Contractor, as well as all the necessary equipment. Meanwhile, eventual breakdown causing an interruption of water supply shall not exceed two days. Otherwise the test shall restart without the contract period being extended.

All tests shall be exclusively to the responsibility of the Contractor who shall provide with his own fees the personnel, material and necessary chemicals.

4.2. Site cleaning

The Contractor shall verify work done according to drawings and specifications, and shall proceed by cleaning after he finish all works, and invite the Client for final inspection.

4.3. Final inspection

The Contractor shall inform the Client that they are ready to accept final inspection of the completion facility.

The Contractor shall take photographs of the important aspects of the work at every sites of work in order to prove that the work has been done properly according to the requirements at the site.

The Contractor shall submit three (3) hard copies and one (1) set of computer files of the final documents and as-built drawings to the Client one (1) week before final inspection.

The Client together with the Contractor shall inspect the work and make a statement agreeing to or refusing the acceptance of the work, indicating mistakes to be corrected if any. In case of mistakes, the Client may reschedule the inspection until full acceptance.

The Client shall issue the inspection certificate to the Contractor within one (1) week from the date of the final inspection if the Client accepts the Work by the Contractor after the inspection.

4.4. Handover

The facilities shall be handed over to the Client after the Client issues the inspection certificate. The Client shall issue the certificate of completion of the Work to the Contractor within one (1) week from the date of taking over of the facility from the Contractor.

4.5. Guaranty period

The Contractor shall guarantee all the Work to be executed in accordance with the Contract Documents for a period of one (1) year from the date of issue of certificate of completion of the Work. The Contractor shall issue the certificate of guarantee in writing for the completed facility.

Annex 4: Example of Drawings

DRAWINGS

FOR PILOT INSTALLATION OF WATER METERS AND CHLORINATION UNITS

**FOR PROJECT FOR STRENGTHENING OPERATION AND MAINTENANCE OF RURAL WATER
SUPPLY SYSTEMS IN RWANDA**

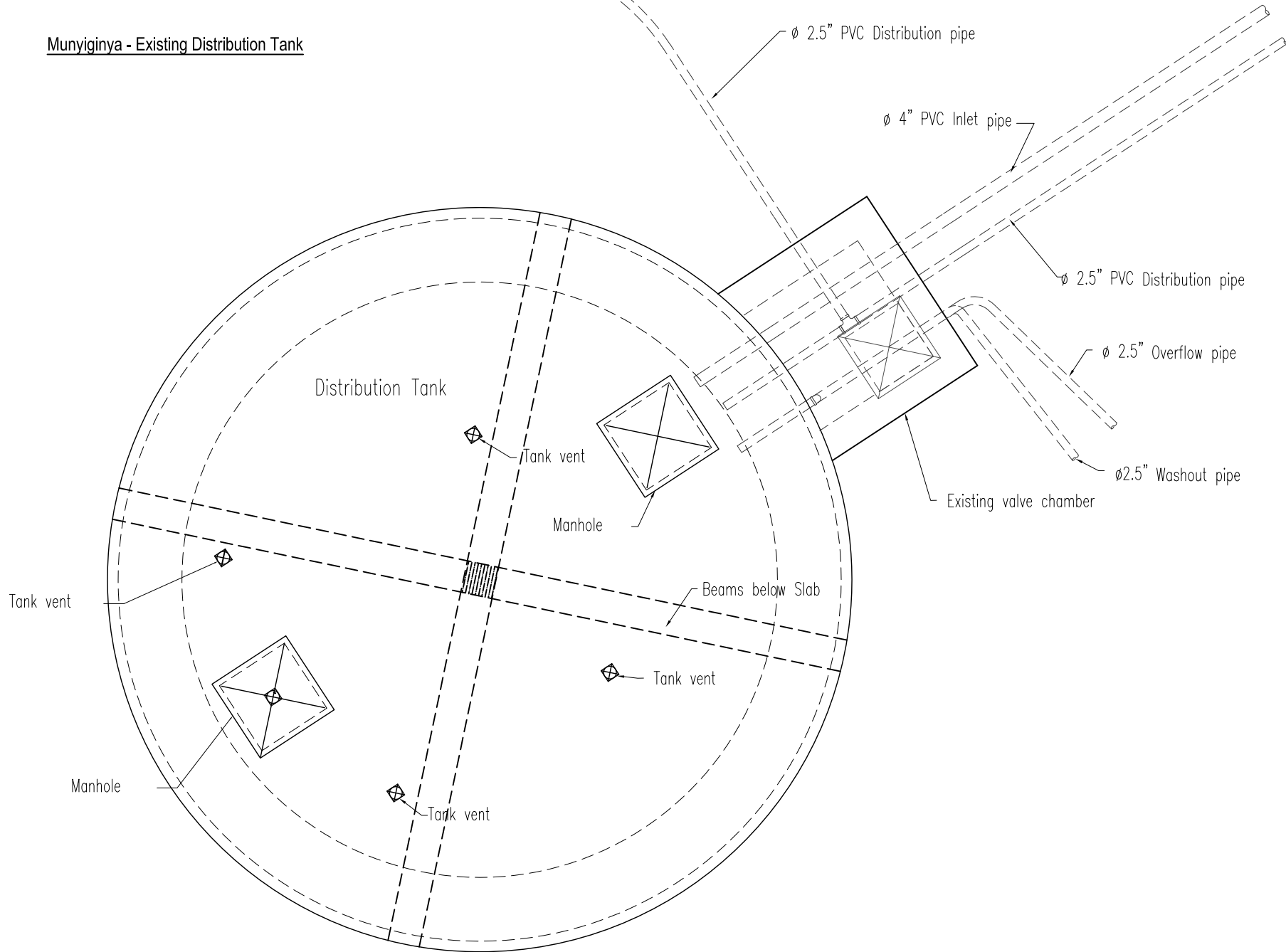
Drawing List 4-1

Drawing Title	Drawing No.	Sheet No.	Drawing Title	Drawing No.	Sheet No.
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Munyiginya Chlorination Unit Front Elevation	A4-M11	11	Nyabombe Chlorination Unit Front Elevation	A4-N11	29
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Munyiginya Inlet Pipe Assembly Drawing	A3-M17	17	Nyabombe Inlet Pipe Assembly Drawing	A3-N17	35
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Kagoma Meter Chamber K-1 Plan	A4-K3	39	Gahezi Meter Chamber G-1 Plan	A4-G3	57
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Kagoma Meter Chamber K-2 Section	A4-K6	42	Gahezi Meter Chamber G-2 Section	A4-G6	60
Kagoma Meter Chamber K-1 Top and Bottom Slab Reinforcement	A4-K7	43	Gahezi Meter Chamber G-1 Top and Bottom Slab Reinforcement	A4-G7	61
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Kagoma Chlorination Unit Base Slab Layout	A4-K9	45	Gahezi Chlorination Unit Base Slab Layout	A4-G9	63
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Kagoma Chlorination Unit Front Elevation	A4-K11	47	Gahezi Chlorination Unit Front Elevation	A4-G11	65
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Kagoma Chlorination Unit Section	A4-K15	51	Gahezi Chlorination Unit Section	A4-G15	69
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Kagoma Inlet Pipe Assembly Drawing	A3-K17	53	Gahezi Inlet Pipe Assembly Drawing	A3-G17	71
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Munyiginya - Existing Distribution Tank



Client:
Kokusai Kogyo Co.,Ltd.

Project:
The Project for Strengthening Operation and Maintenance of Rural Water Supply Systems in Rwanda

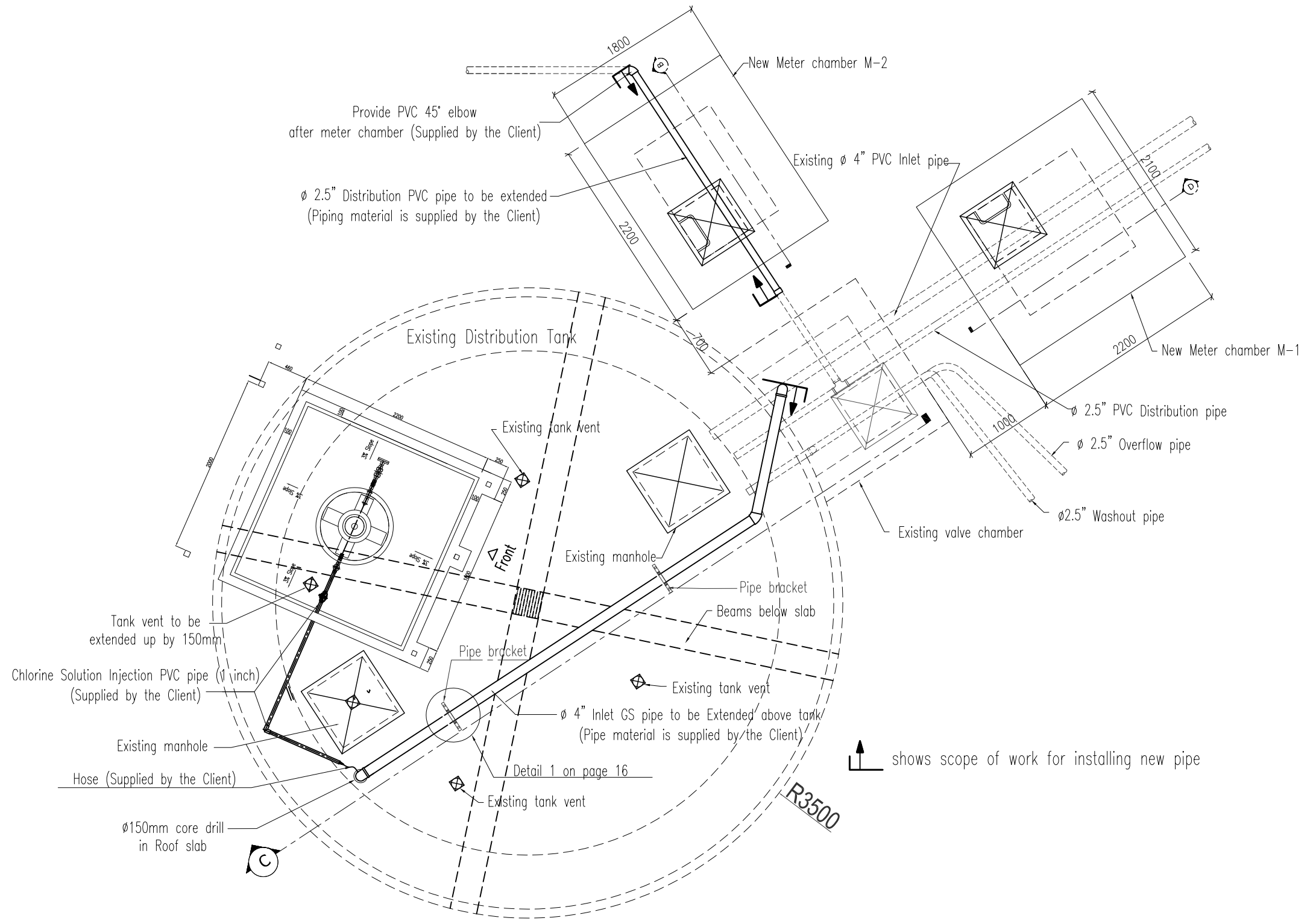
Work:
Installation of Water Meter and Chlorination Unit

Drawing Title:
Munyiginya
Existing Distribution Tank Layout

SCALE	DATE	DWG No.
1 : 50	July 2017	A4-M1

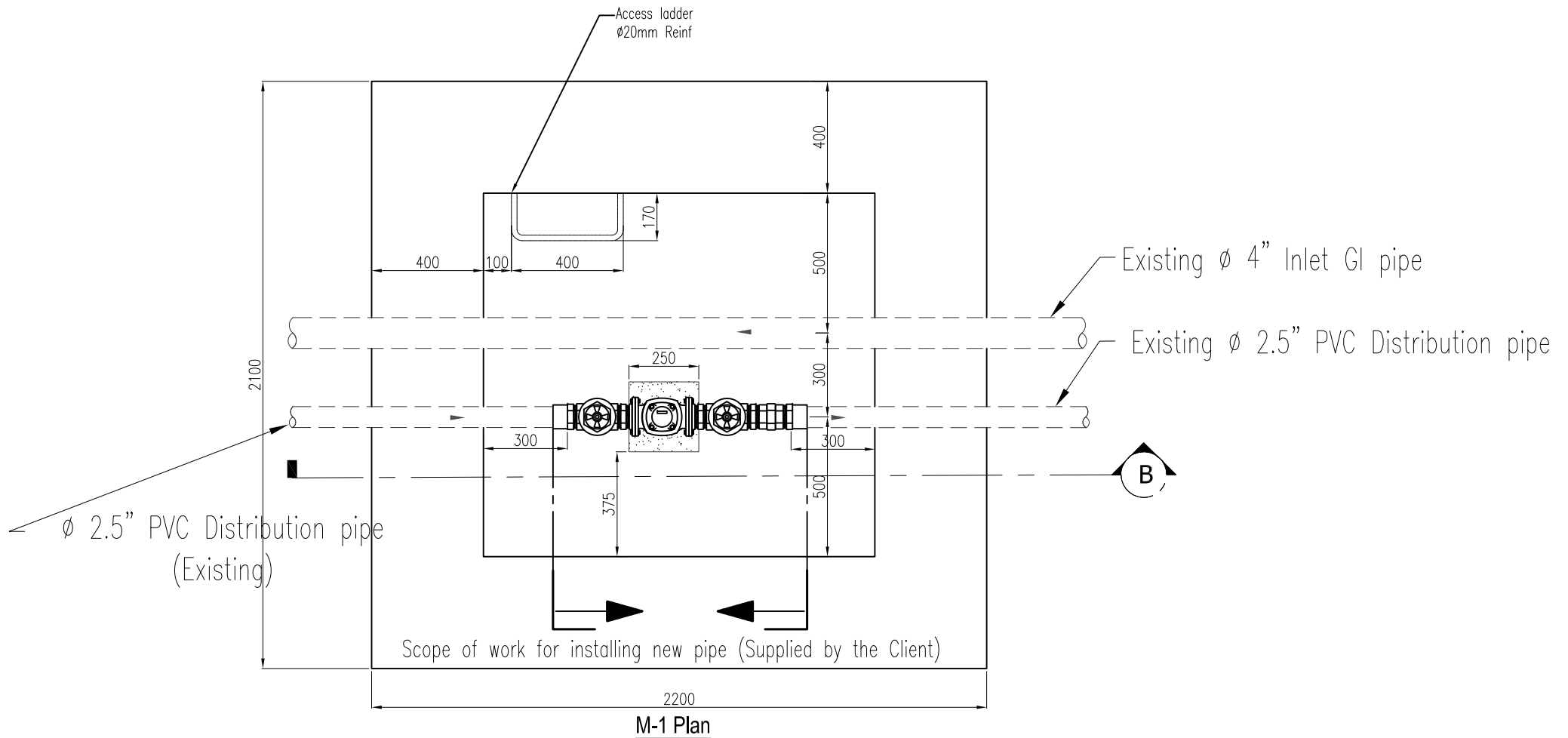
Sheet No.


1



Water Meter Chamber and Chlorination Unit Layout

Client: Kokusai Kogyo Co.,Ltd.	Project: The Project for Strengthening Operation and Maintenance of Rural Water Supply Systems in Rwanda	Work: Installation of Water Meter and Chlorination Unit	Drawing Title: Munyiginya Water Meter Chamber and Chlorination Unit Layout		Sheet No. 2
			SCALE 1 : 50	DATE July 2017	




 shows scope of work for installing new pipe
 (Piping material is supplied by the Client)

Client:
 Kokusai Kogyo Co.,Ltd.

Project:
 The Project for Strengthening Operation and
 Maintenance of Rural Water Supply Systems
 in Rwanda

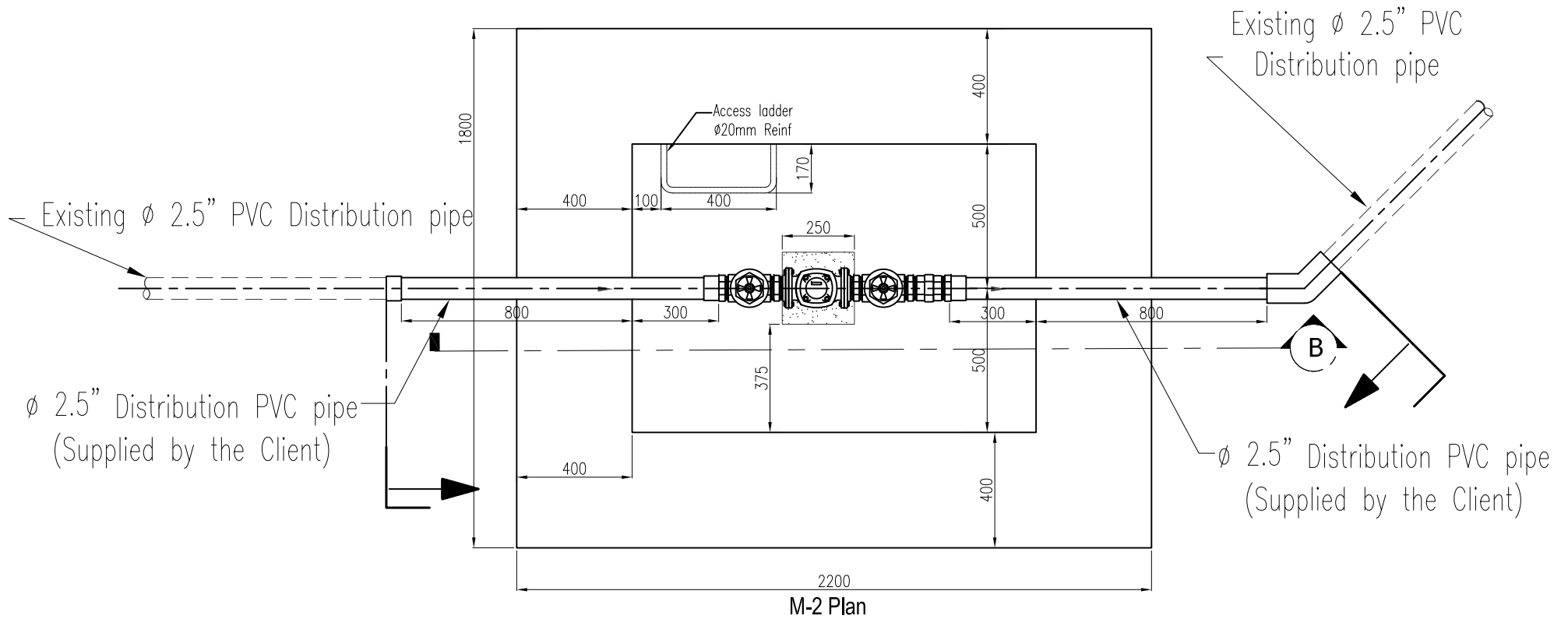
Work:
 Installation of Water Meter and
 Chlorination Unit


Drawing Title:
 Munyiginya
 Meter Chamber M-1 Plan

SCALE 1 : 20	DATE July 2017	DWG No. A4-M3
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Sheet No.

3




 shows scope of work for installing new pipe
 (Piping material is supplied by the Client)

Client:
 Kokusai Kogyo Co.,Ltd.

Project:
 The Project for Strengthening Operation and
 Maintenance of Rural Water Supply Systems
 in Rwanda

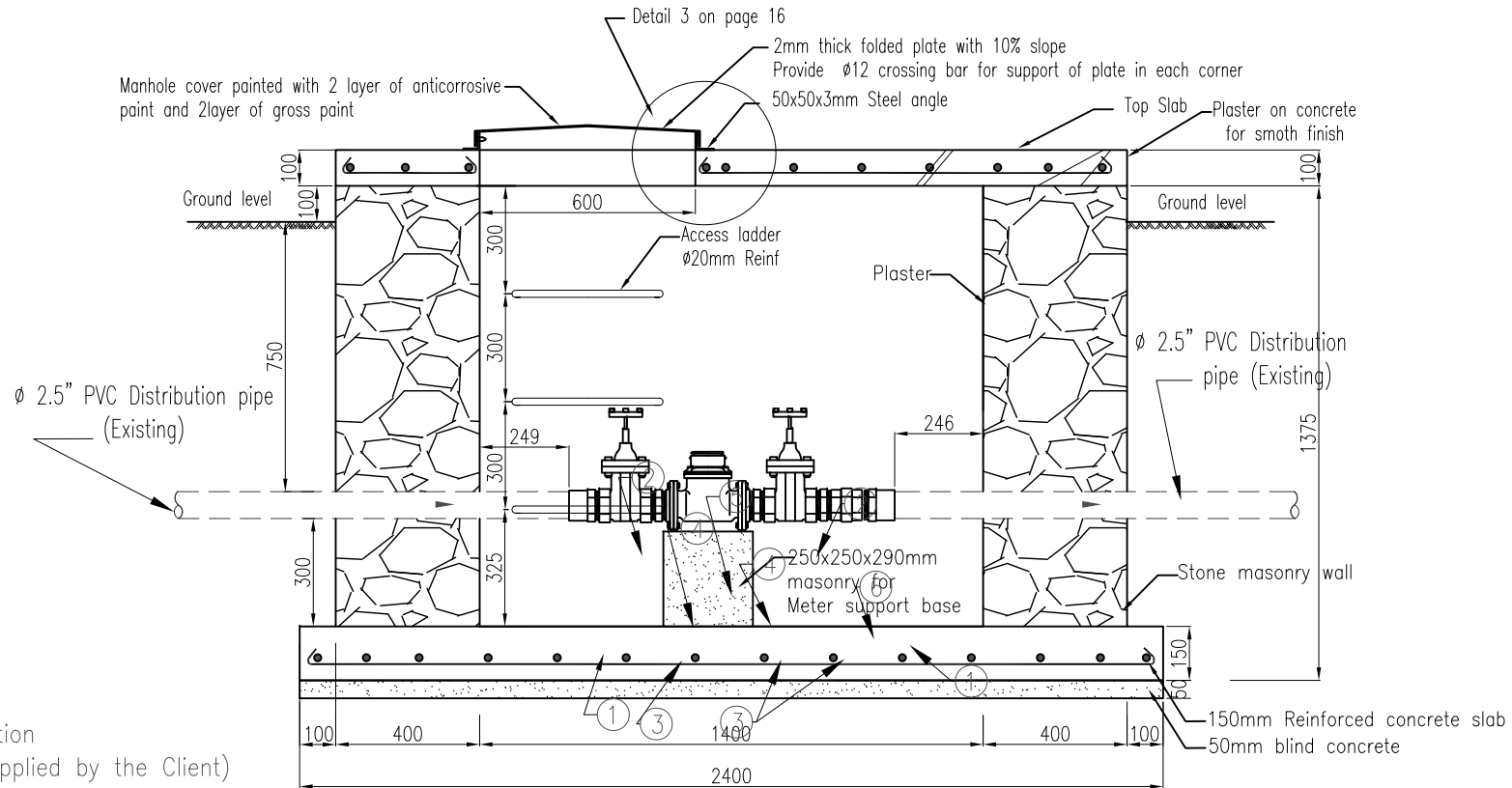
Work:
 Installation of Water Meter and
 Chlorination Unit

Drawing Title:
 Munyiginya
 Meter Chamber M-2 Plan

SCALE 1 : 20	DATE July 2017	DWG No. A4-M4
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Sheet No.

4



Meter connection
Parts list (Supplied by the Client)

- ① Adapter
- ② Valve
- ③ Nipple
- ④ Flange
- ⑤ Water Meter
- ⑥ GS Union

Section B

Note:

All Plumbing materials to be supplied by the client, the contractor Will provide means of assembly and workmanship

Client:
Kokusai Kogyo Co.,Ltd.

Project:
The Project for Strengthening Operation and Maintenance of Rural Water Supply Systems in Rwanda

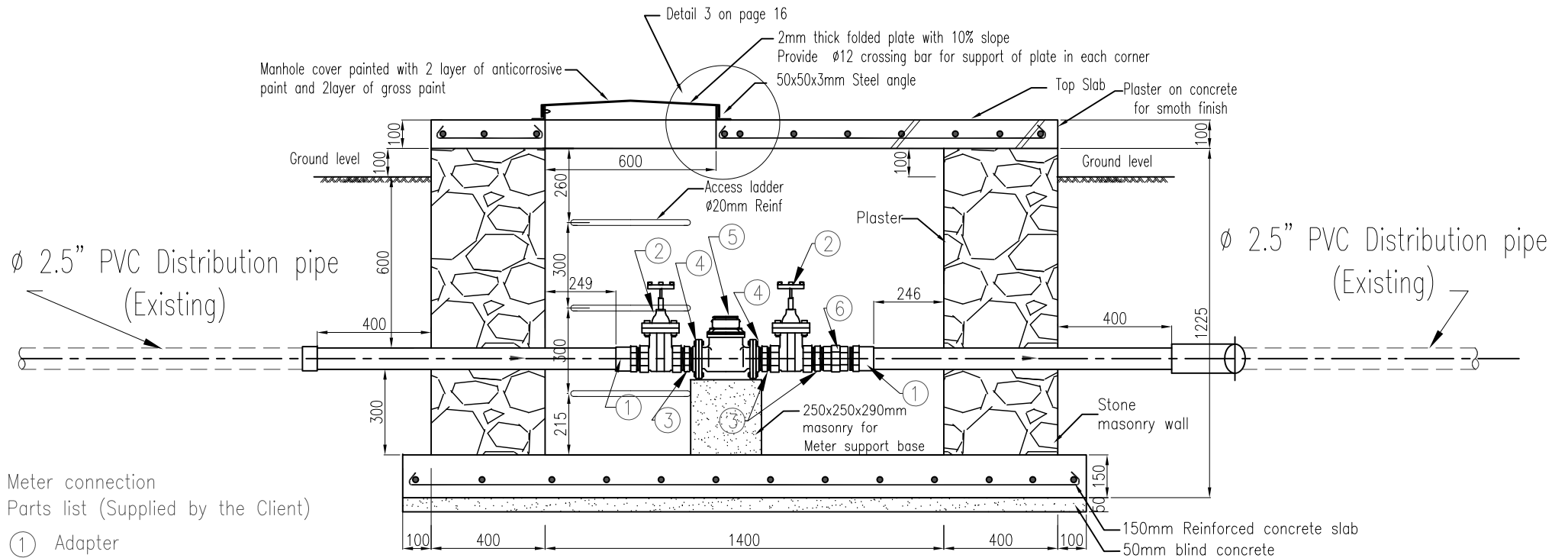
Work:
Installation of Water Meter and Chlorination Unit

Drawing Title:
Munyiginya
Meter Chamber M-1 Section

Sheet No.

5

SCALE 1 : 20	DATE July 2017	DWG No. A4-M5
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Meter connection
Parts list (Supplied by the Client)

- ① Adapter
- ② Valve
- ③ Nipple
- ④ Flange
- ⑤ Water Meter
- ⑥ GS Union

Section B

Note:

All Plumbing materials to be supplied by the client, the contractor Will provide means of assembly and workmanship

Client:
Kokusai Kogyo Co.,Ltd.

Project:
The Project for Strengthening Operation and Maintenance of Rural Water Supply Systems in Rwanda

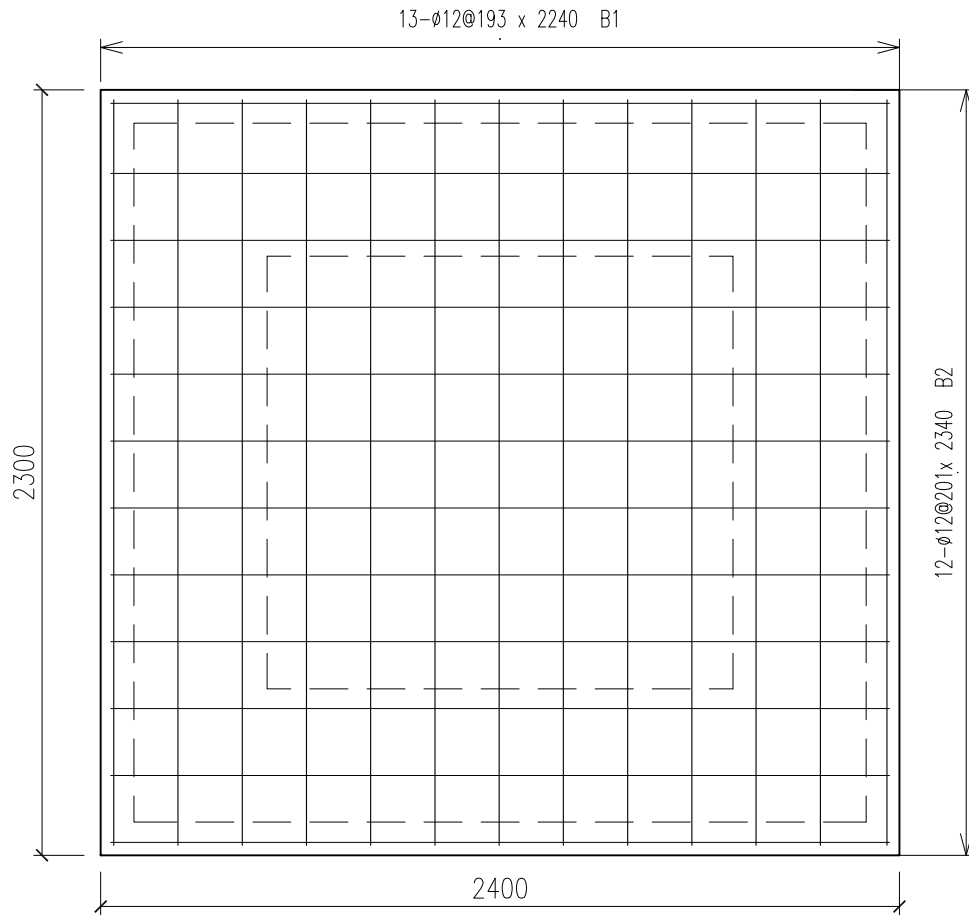
Work:
Installation of Water Meter and Chlorination Unit

Drawing Title:
Munyiginya
Meter Chamber M-2 Section

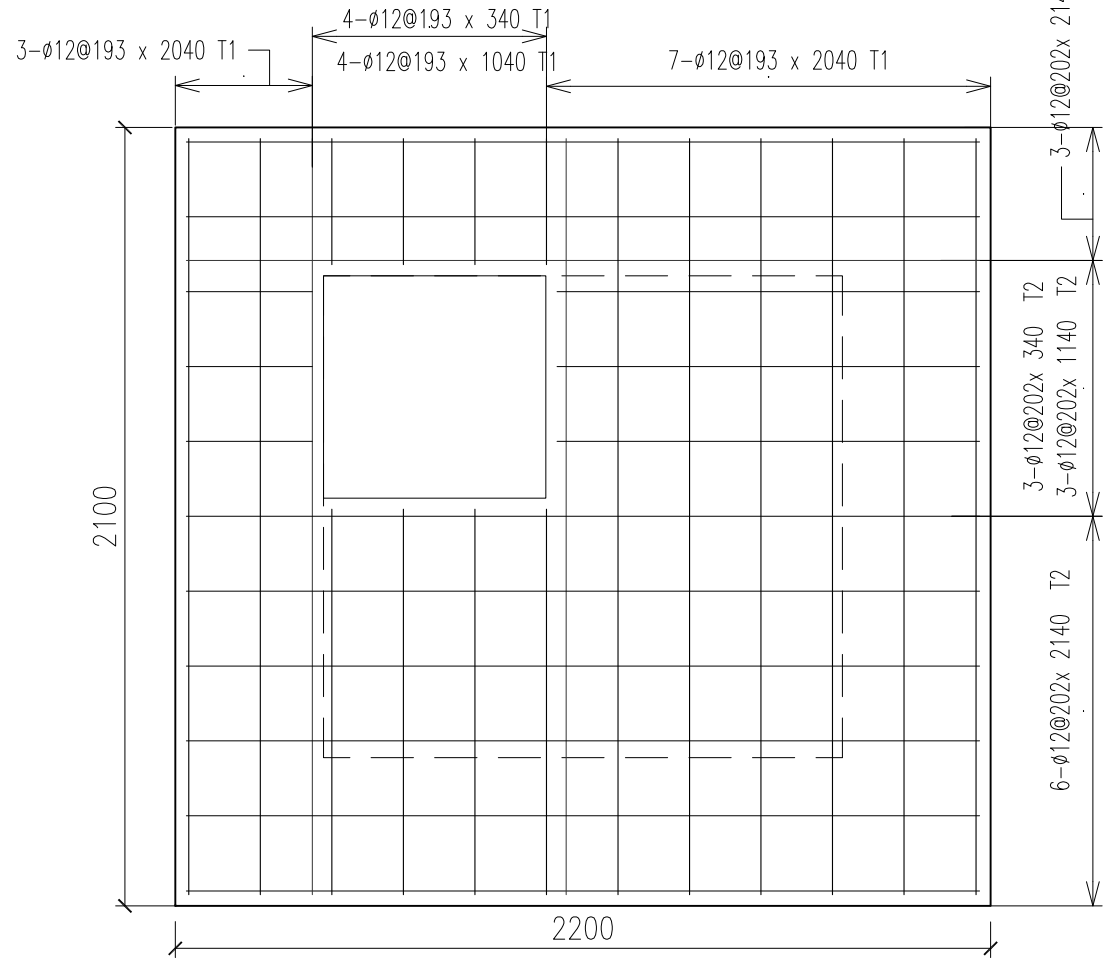
Sheet No.

6

SCALE 1 : 20	DATE July 2017	DWG No. A4-M6
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Bottom Slab Reinforcement Layout



Top Slab Reinforcement Layout

Client:
Kokusai Kogyo Co.,Ltd.

Project:
The Project for Strengthening Operation and Maintenance of Rural Water Supply Systems in Rwanda

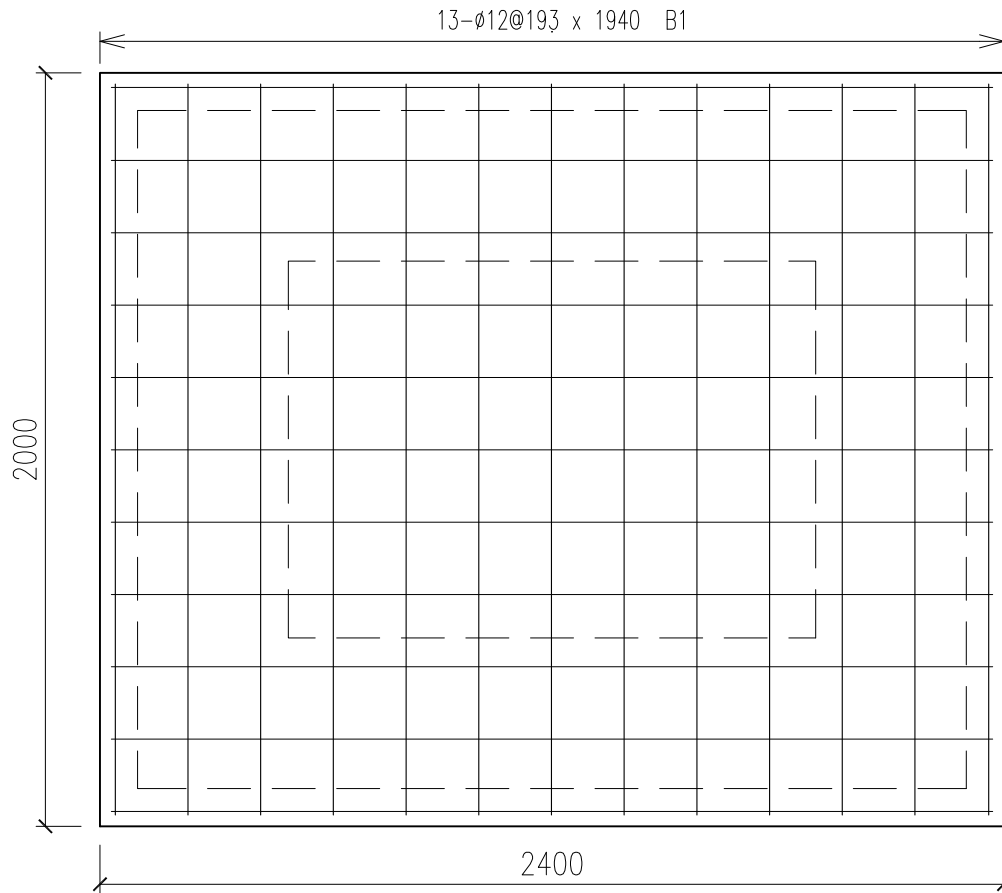
Work:
Installation of Water Meter and Chlorination Unit

Drawing Title:
Munyiginya
Meter Chamber M-1 Top and Bottom Slab Reinforcement

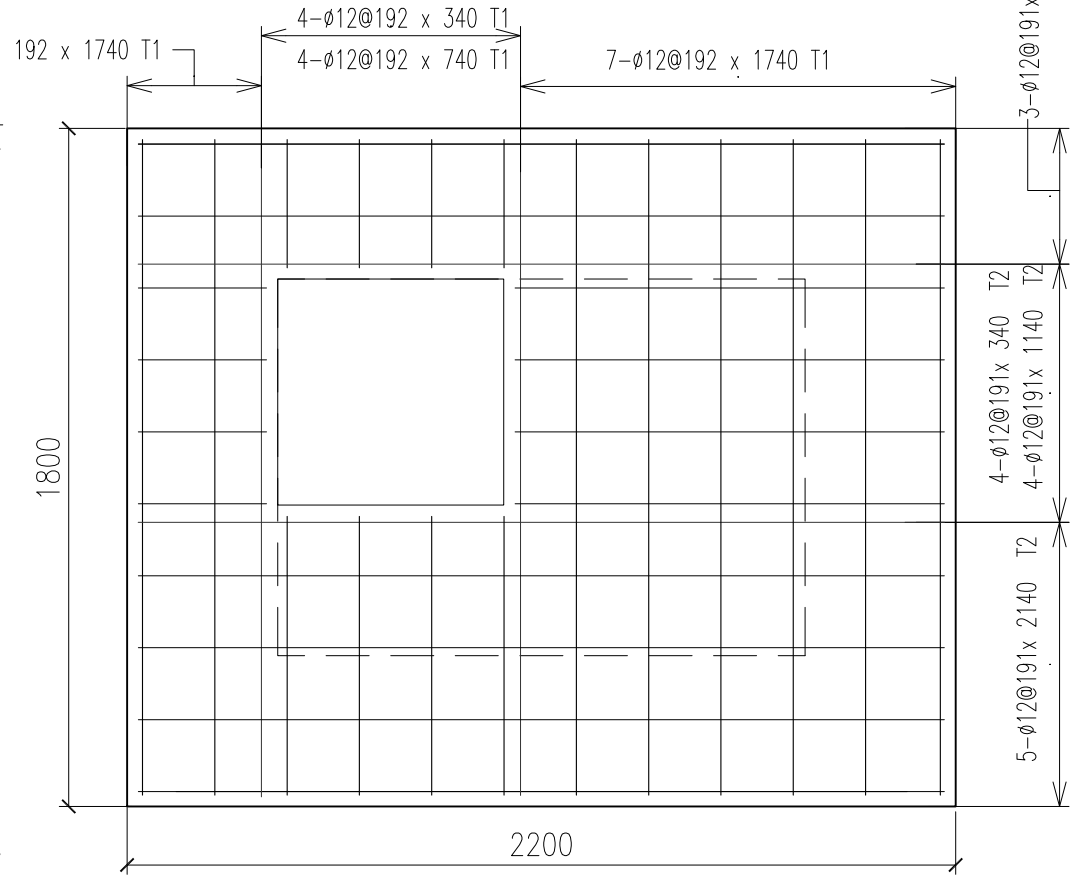
Sheet No.

SCALE 1 : 20	DATE July 2017	DWG No. A4-M7
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7



Bottom Slab Reinforcement Layout



Top Slab Reinforcement Layout

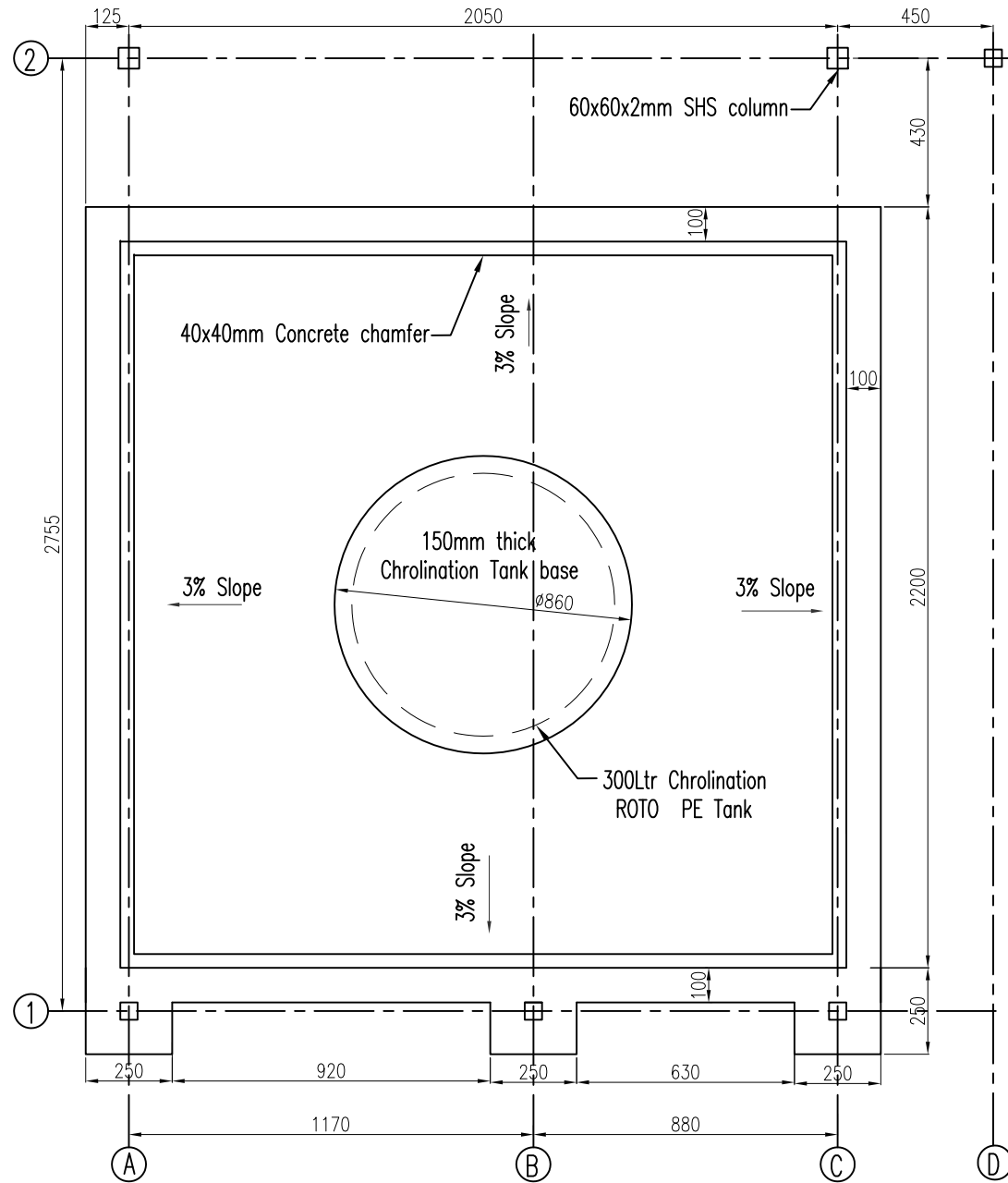
Client:
Kokusai Kogyo Co.,Ltd.

Project:
The Project for Strengthening Operation and
Maintenace of Rural Water Supply Systems
in Rwanda

Work:
Installation of Water Meter and
Chlorination Unit

Drawing Title:
Meter Chamber M-2 Top and Bottom Slab Reinforcement
Munyiginya
SCALE DATE DWG No.
1 : 20 July 2017 A4-M8

Sheet No.
8



Base Slab layout

Client:
Kokusai Kogyo Co.,Ltd.

Project:
The Project for Strengthening Operation and Maintenance of Rural Water Supply Systems in Rwanda

Work:
Installation of Water Meter and Chlorination Unit

Drawing Title:
Munyiginya
Chlorination Unit Base Slab Layout

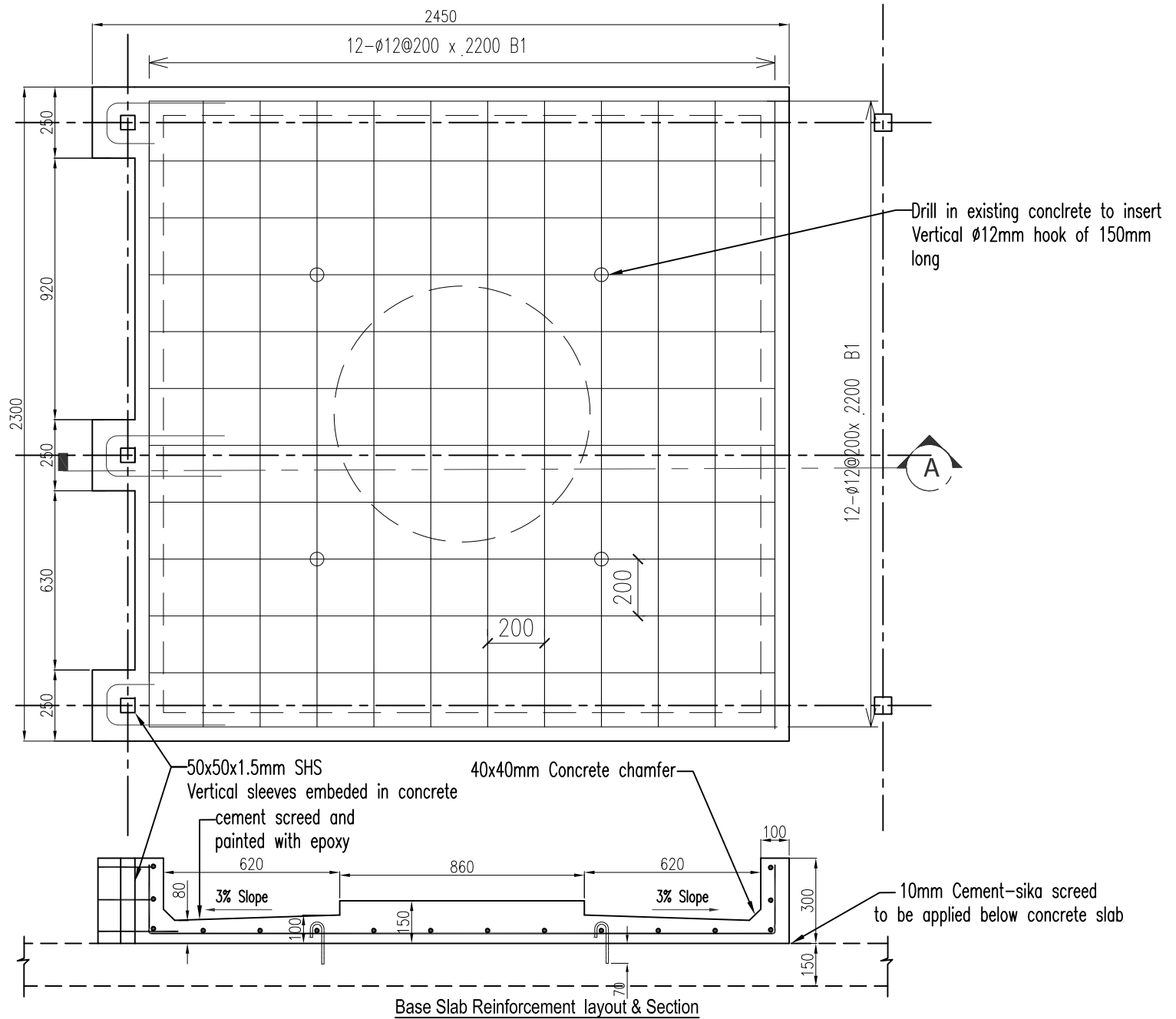
Sheet No.

9

SCALE
1 : 20

DATE
July 2017

DWG No.
A4-M9



Client:
Kokusai Kogyo Co.,Ltd.

Project:
The Project for Strengthening Operation and Maintenance of Rural Water Supply Systems in Rwanda

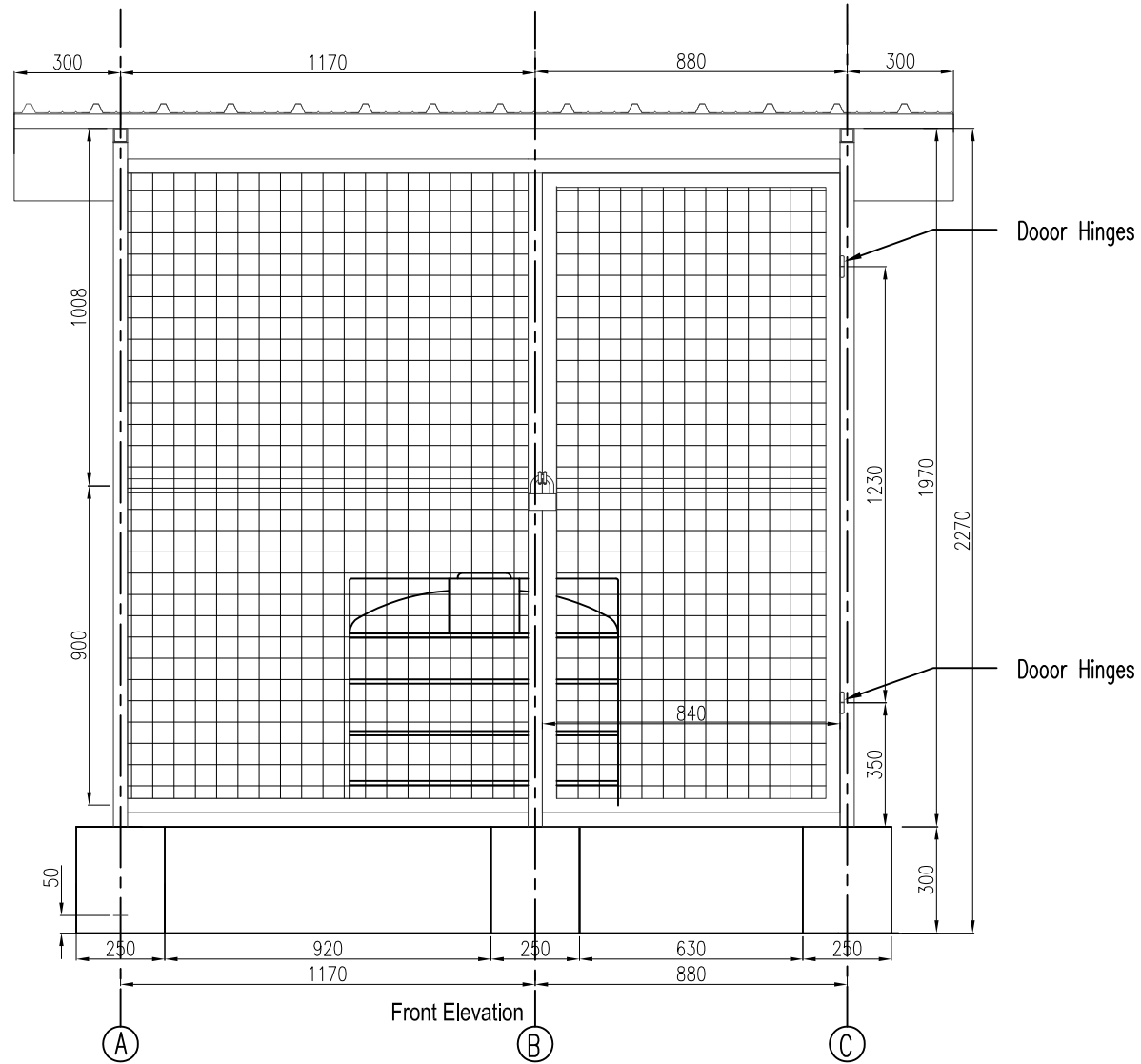
Work:
Installation of Water Meter and Chlorination Unit

Drawing Title:
Munyiginya
Chlorination Unit Base Slab Reinforcement

Sheet No.

10

SCALE 1 : 20	DATE July 2017	DWG No. A4-M10
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Client:
Kokusai Kogyo Co.,Ltd.

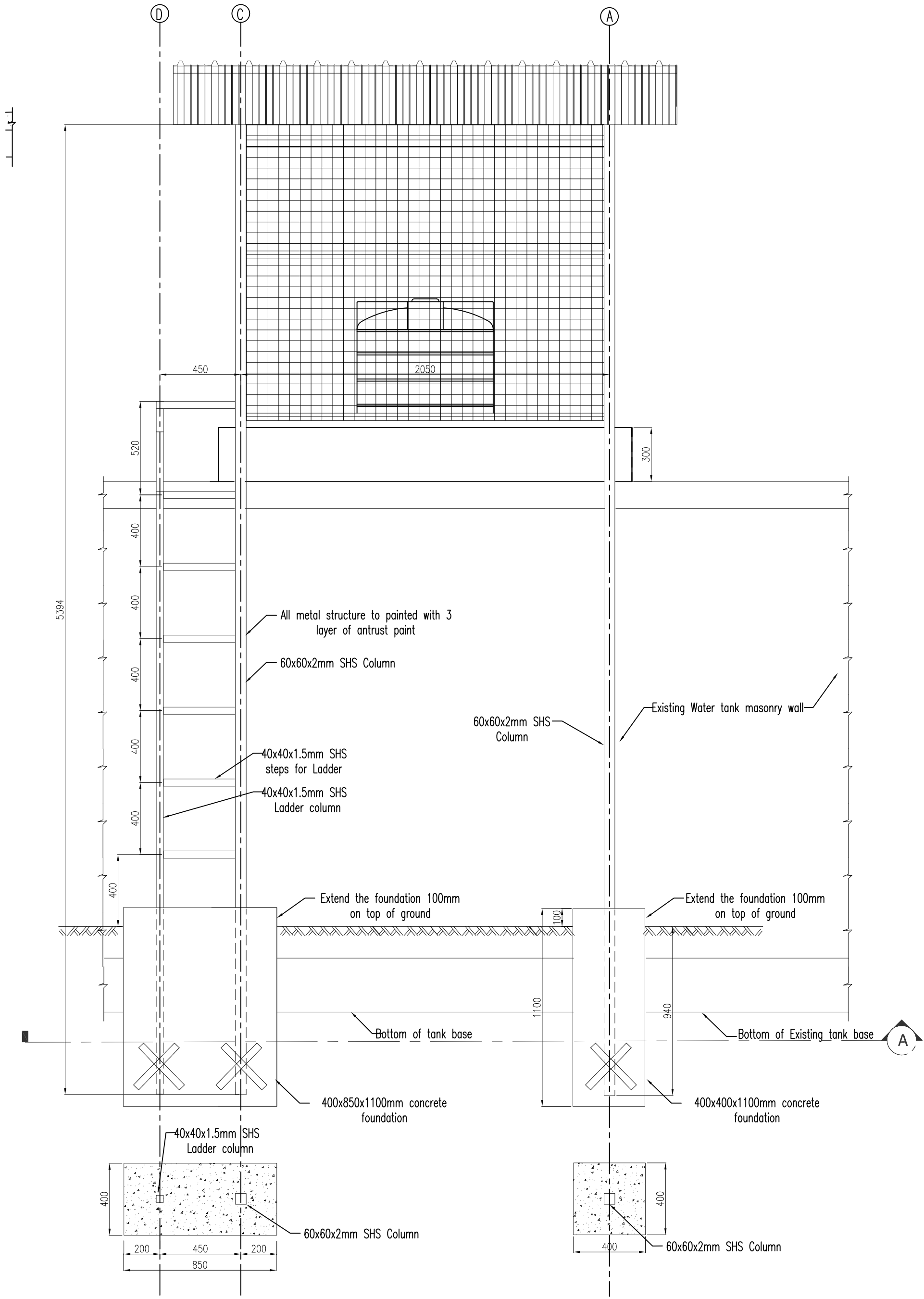
Project:
The Project for Strengthening Operation and
Maintenance of Rural Water Supply Systems
in Rwanda

Work:
Installation of Water Meter and
Chlorination Unit

Drawing Title:
Munyiginya
Chlorination Unit Front Elevation

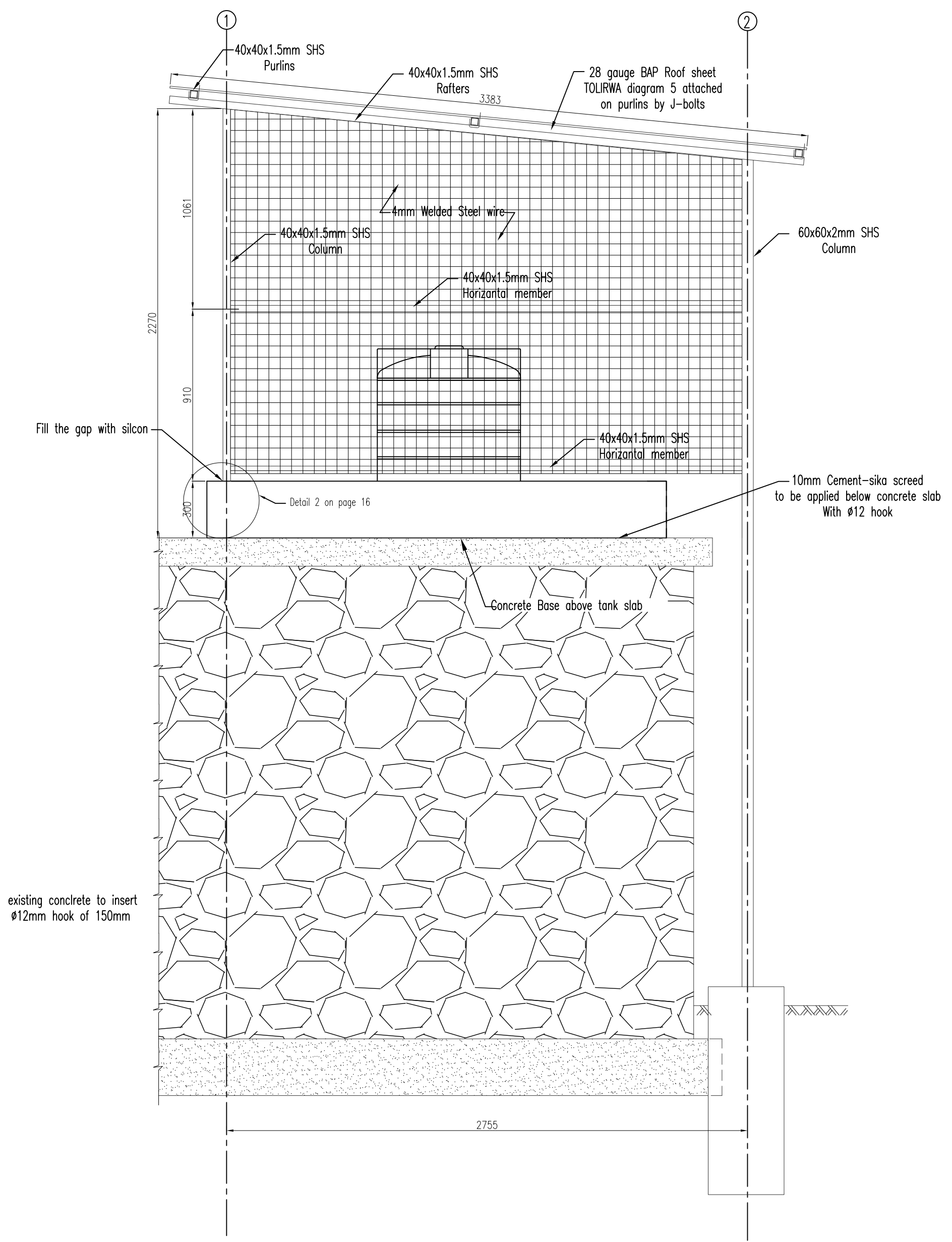
SCALE 1 : 20	DATE July 2017	DWG No. A4-M11
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Sheet No.
11



Rear Elevation

<p>Client: Kokusai Kogyo Co.,Ltd.</p>	<p>Project: The Project for Strengthening Operation and Maintenance of Rural Water Supply Systems in Rwanda</p>	<p>Work: Installation of Water Meter and Chlorination Unit</p>	<p>Drawing Title: Munyiginya Chlorination Unit Rear Elevation</p> <p>SCALE: 1 : 20 DATE: July 2017 DWG No.: A3-M12</p>	<p>Sheet No. 12</p>
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Side Elevation

Client:
Kokusai Kogyo Co.,Ltd.

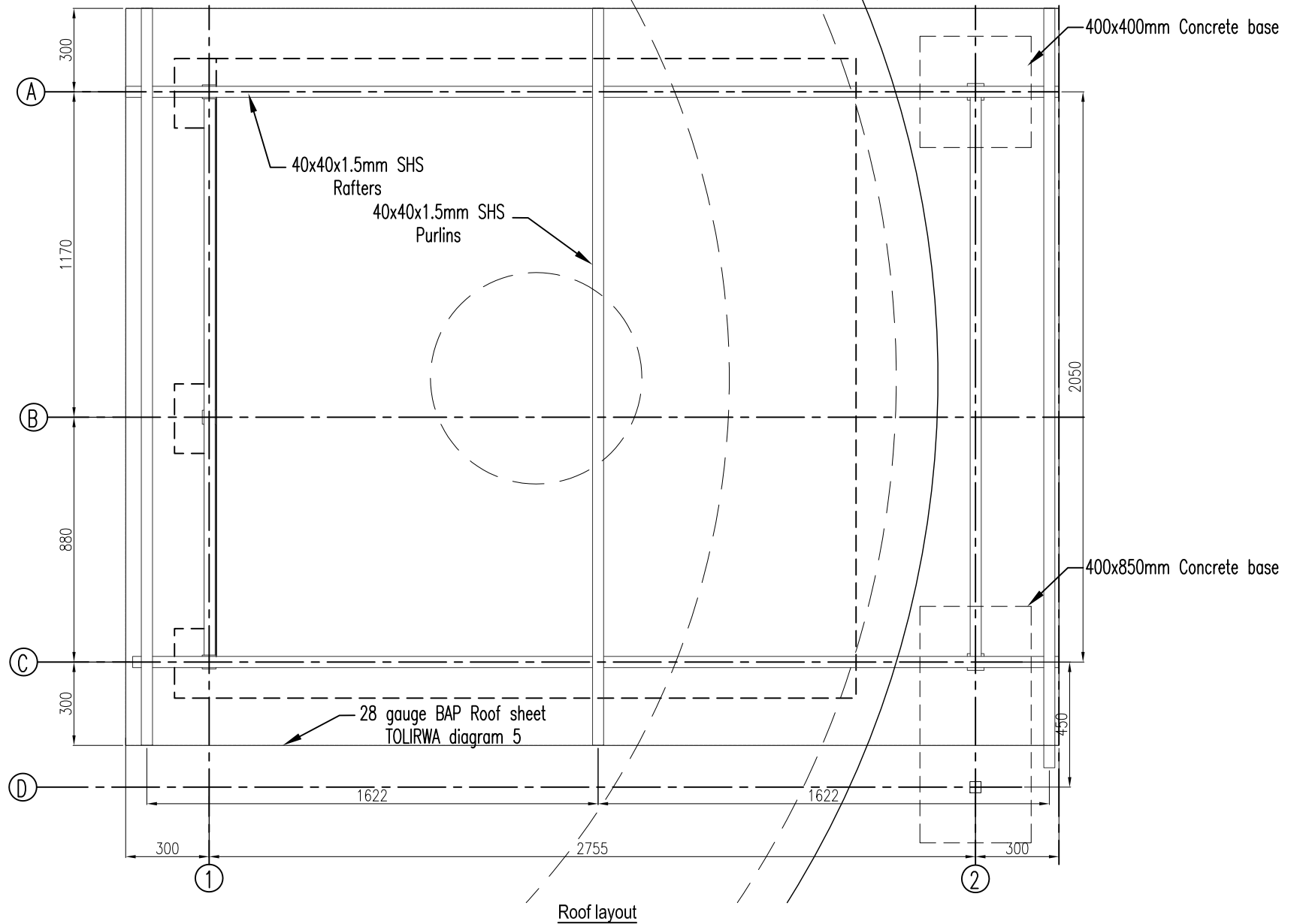
Project:
The Project for Strengthening Operation and Maintenance of Rural Water Supply Systems in Rwanda

Work:
Installation of Water Meter and Chlorination Unit

Drawing Title:
Munyiginya Chlorination Unit Side Elevation

Sheet No.
13

SCALE: 1:20
DATE: July 2017
DWG No.: A3-M13



Client:
Kokusai Kogyo Co.,Ltd.

Project:
The Project for Strengthening Operation and Maintenance of Rural Water Supply Systems in Rwanda

Work:
Installation of Water Meter and Chlorination Unit

Drawing Title:
Munyiginya
Chlorination Unit Roof Layout

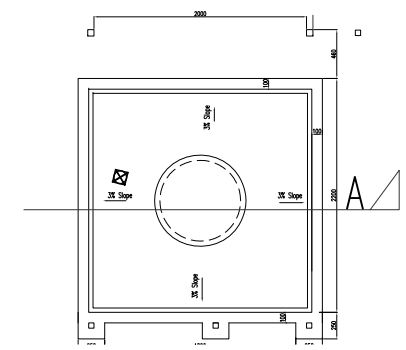
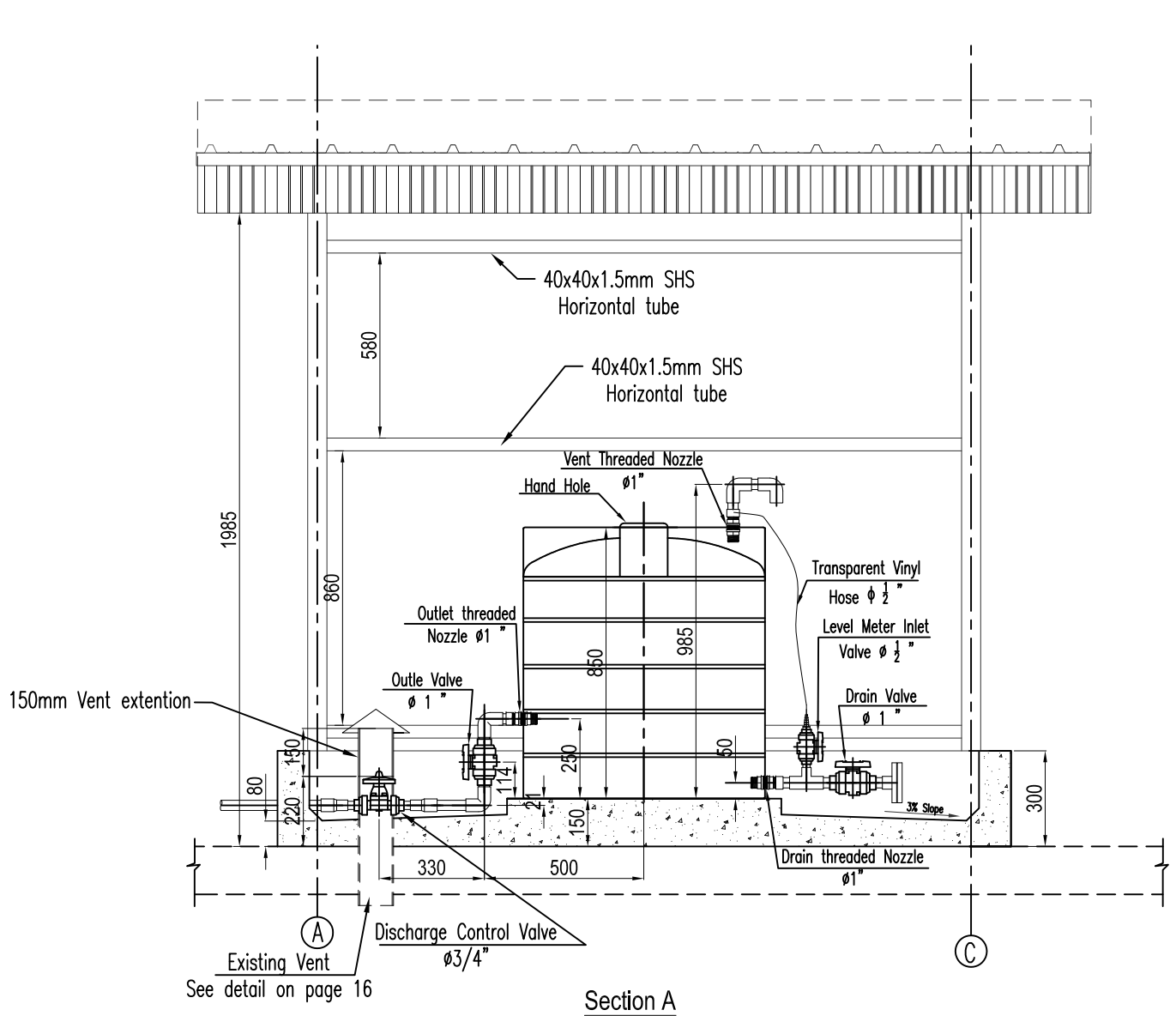
Sheet No.

14

SCALE
1 : 20

DATE
July 2017

DWG No.
A4-M14



Client:
Kokusai Kogyo Co.,Ltd.

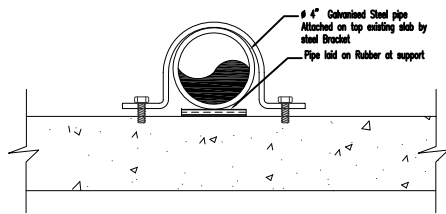
Project:
The Project for Strengthening Operation and Maintenance of Rural Water Supply Systems in Rwanda

Work:
Installation of Water Meter and Chlorination Unit

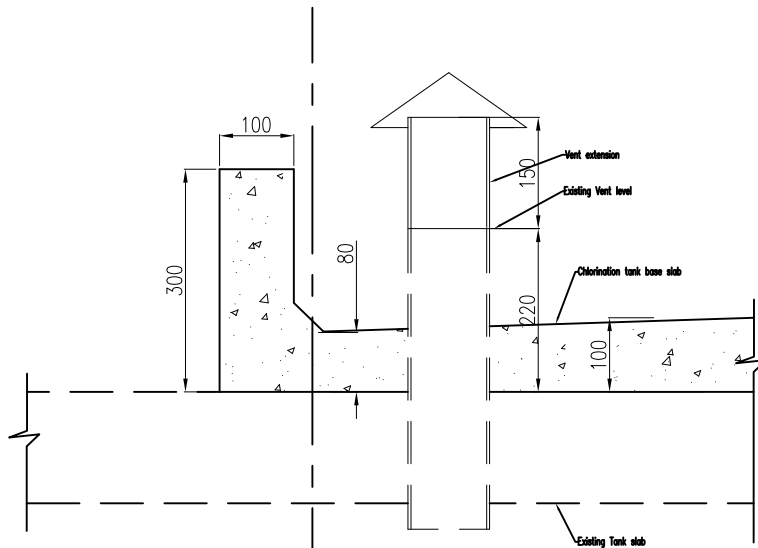
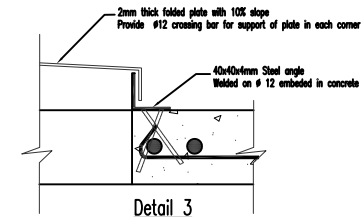
Drawing Title:
Munyiginya
Chlorination Unit Section

SCALE 1 : 20	DATE July 2017	DWG No. A4-M15
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Sheet No.
15

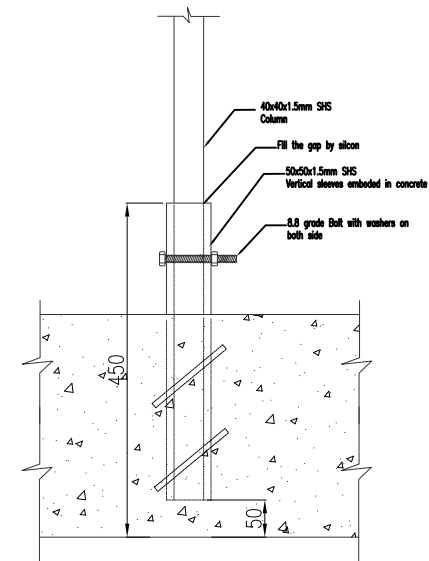


Fixing Detail 1- GS pipe on Tank Roof Sab



A

Vent Extension -Detail



Fixing Detail 2 - SHS tube to concrete base

Client:
Kokusai Kogyo Co.,Ltd.

Project:
The Project for Strengthening Operation and Maintenance of Rural Water Supply Systems in Rwanda

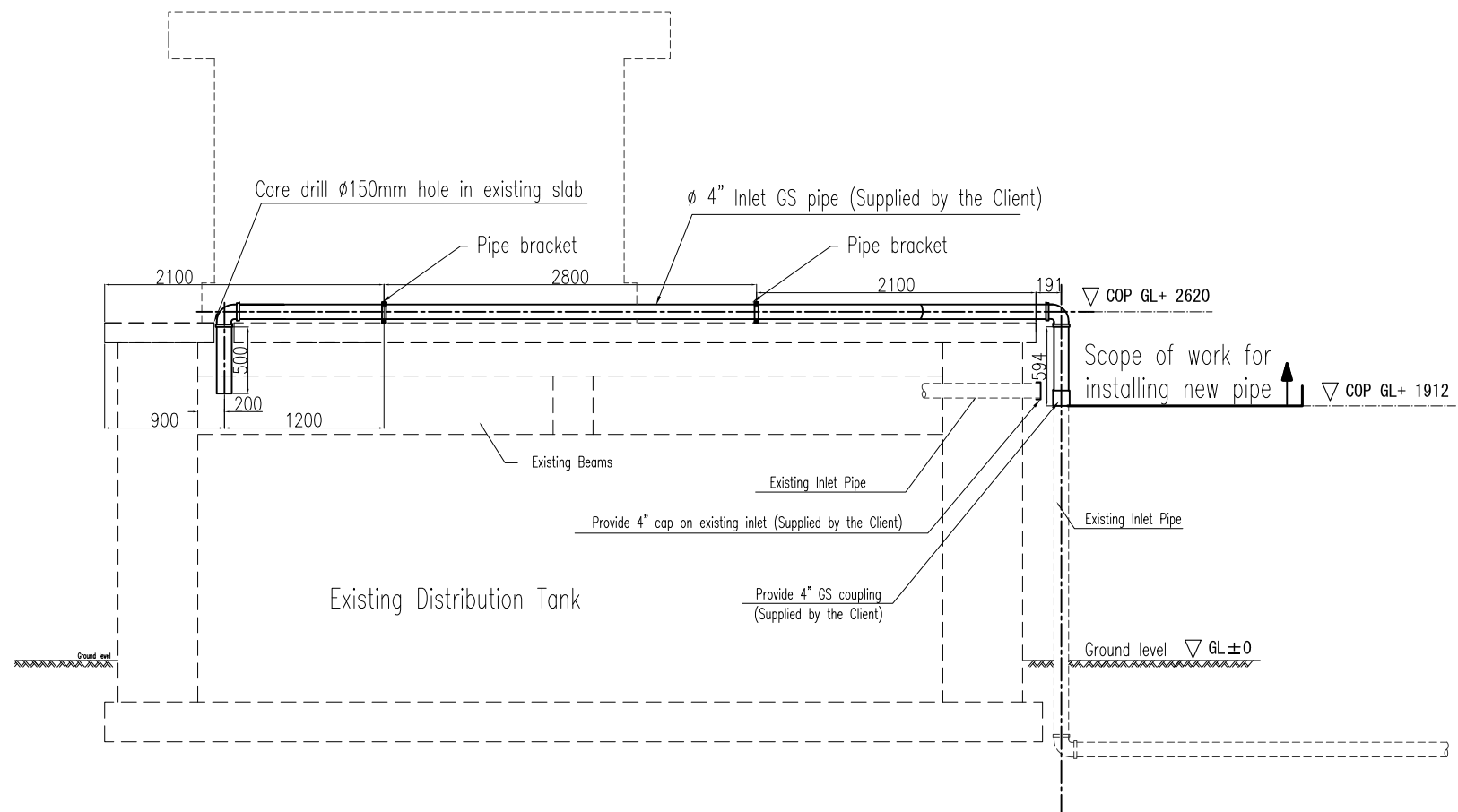
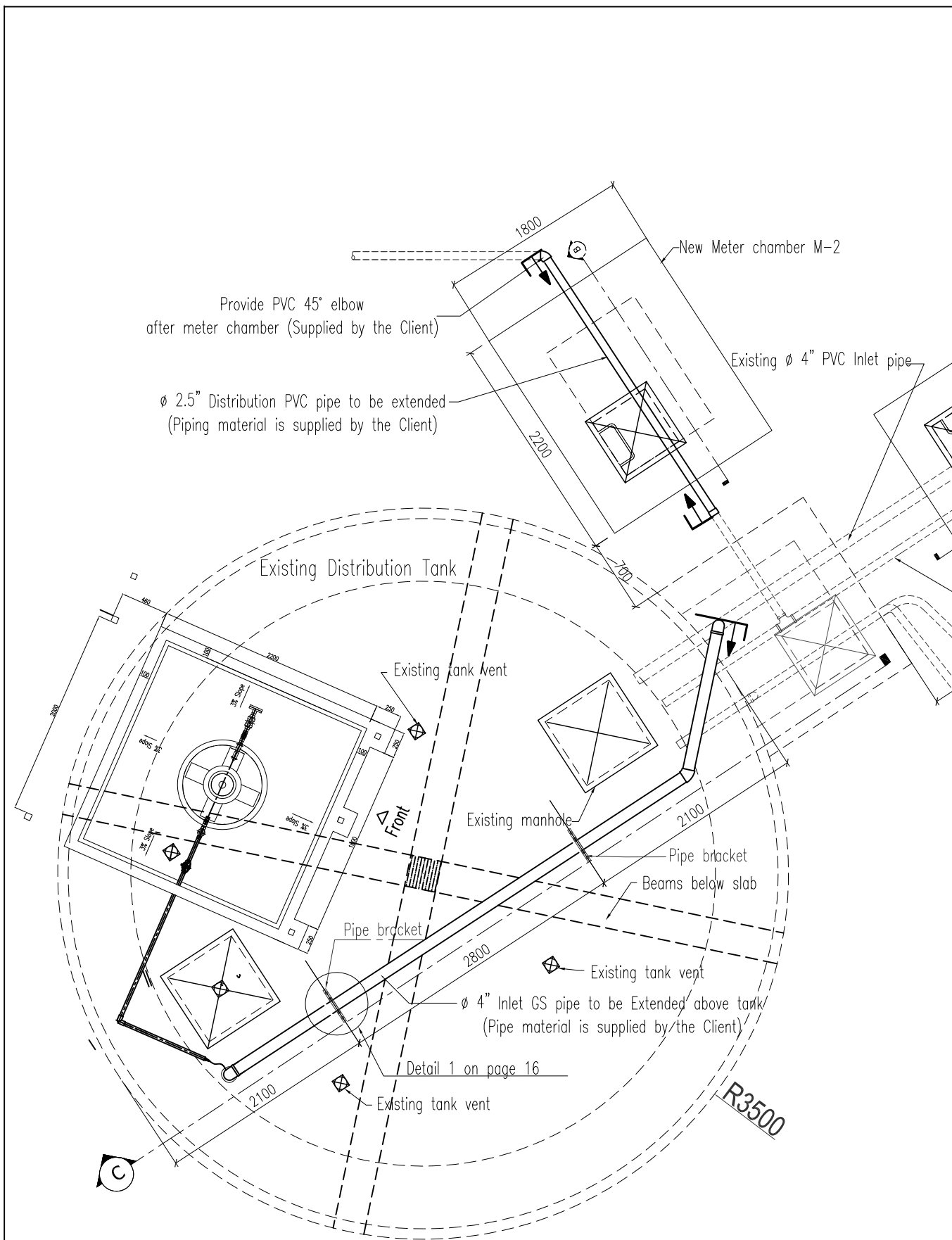
Work:
Installation of Water Meter and Chlorination Unit

Drawing Title: Munyiginya
Meter Chamber and Chlorination Unit Fixing Details

SCALE 1 : 10	DATE July 2017	DWG No. A4-M16
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Sheet No.

16



Section C

↑ shows scope of work for installing new pipe
Layout

Client:
 Kokusai Kogyo Co.,Ltd.

Project:
 The Project for Strengthening Operation and Maintenance of Rural Water Supply Systems in Rwanda

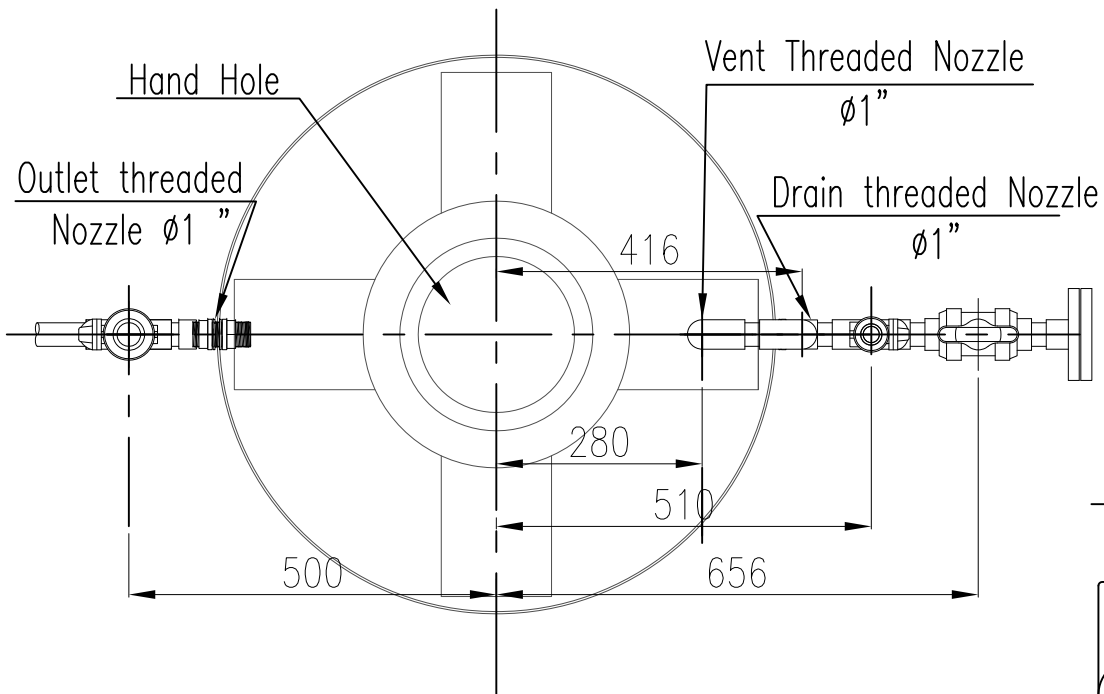
Work:
 Installation of Water Meter and Chlorination Unit

Drawing Title:
 Munyiginya
 Inlet Pipe Assembly Drawing

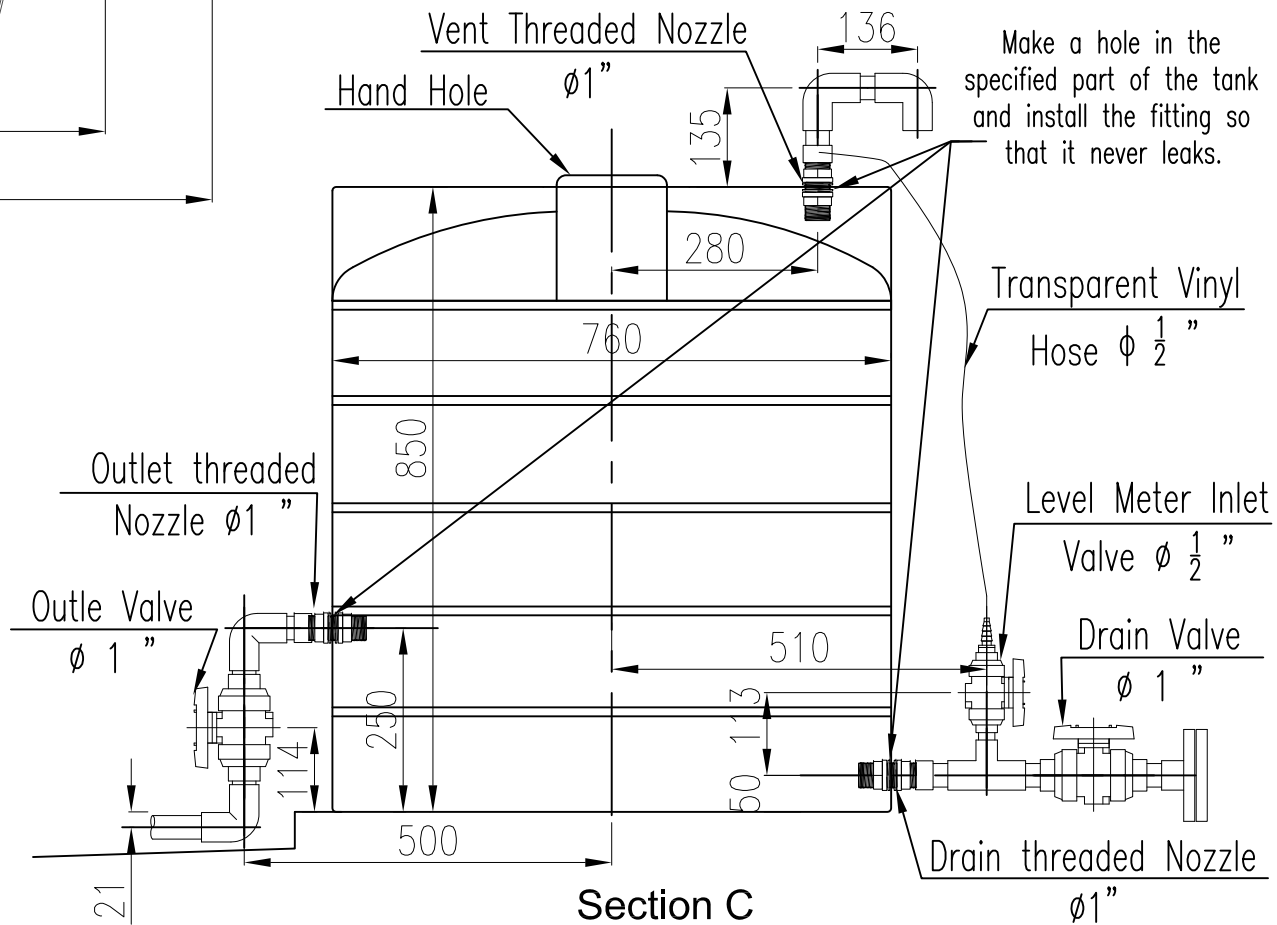
SCALE 1 : 50	DATE July 2017	DWG No. A3-M17
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Sheet No.
 17

Nominal capacity : 300 L
 Material : PE (Polyethylene)
 Color : Black
 Brand : ROTO



Layout



Section C

Note:
 Pe Tank, valves, nozzle, pipe and other piping material in this drawing are supplied by the Client. The contractor shall provide means of assembly and workmanship.

Client:
 Kokusai Kogyo Co.,Ltd.

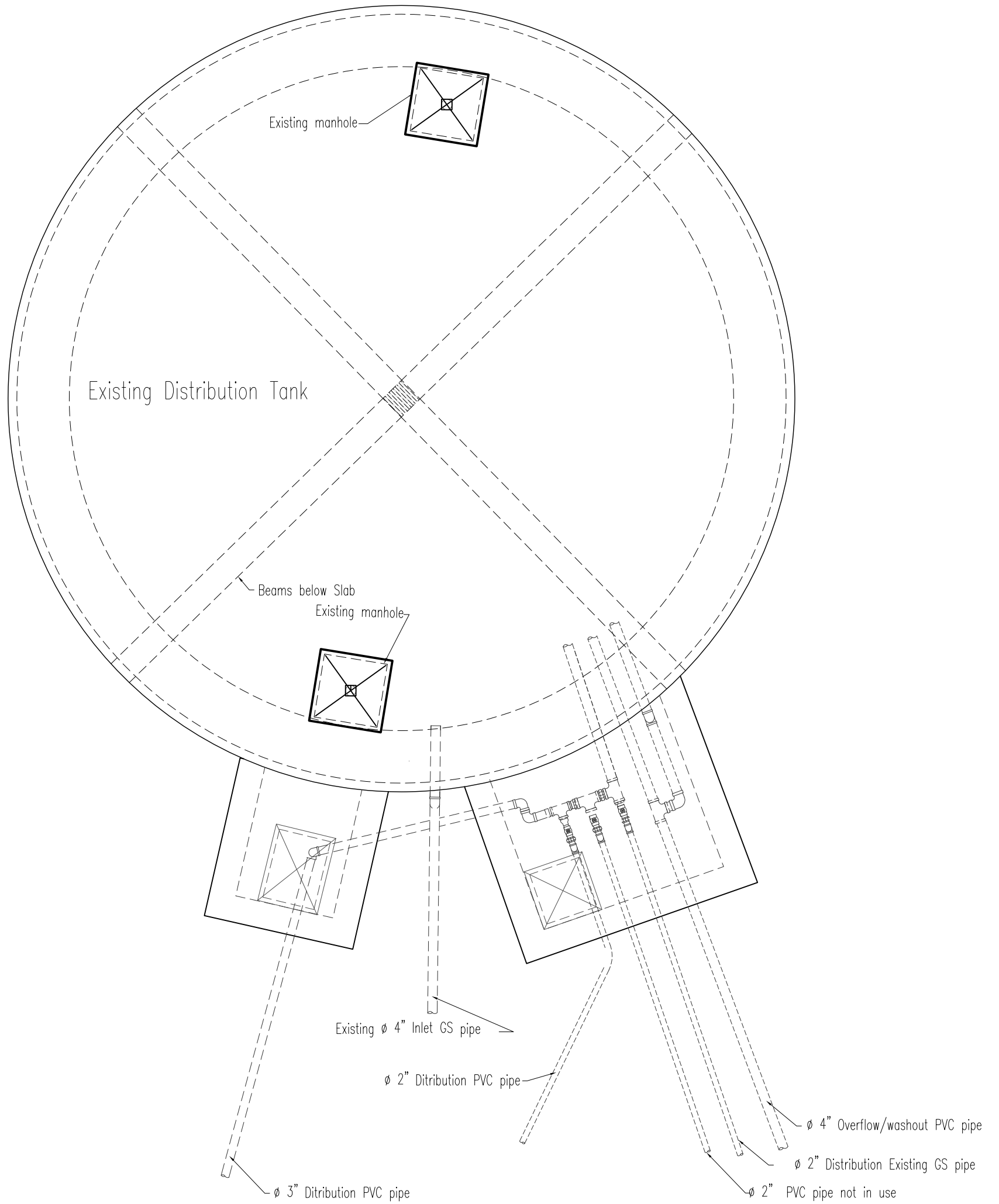
Project:
 The Project for Strengthening Operation and Maintenance of Rural Water Supply Systems in Rwanda

Work:
 Installation of Water Meter and Chlorination Unit

Drawing Title: Munyiginya Calcium Hypochlorite Solution Tank
 SCALE: 1 : 10 DATE: July 2017 DWG No.: A4-M18

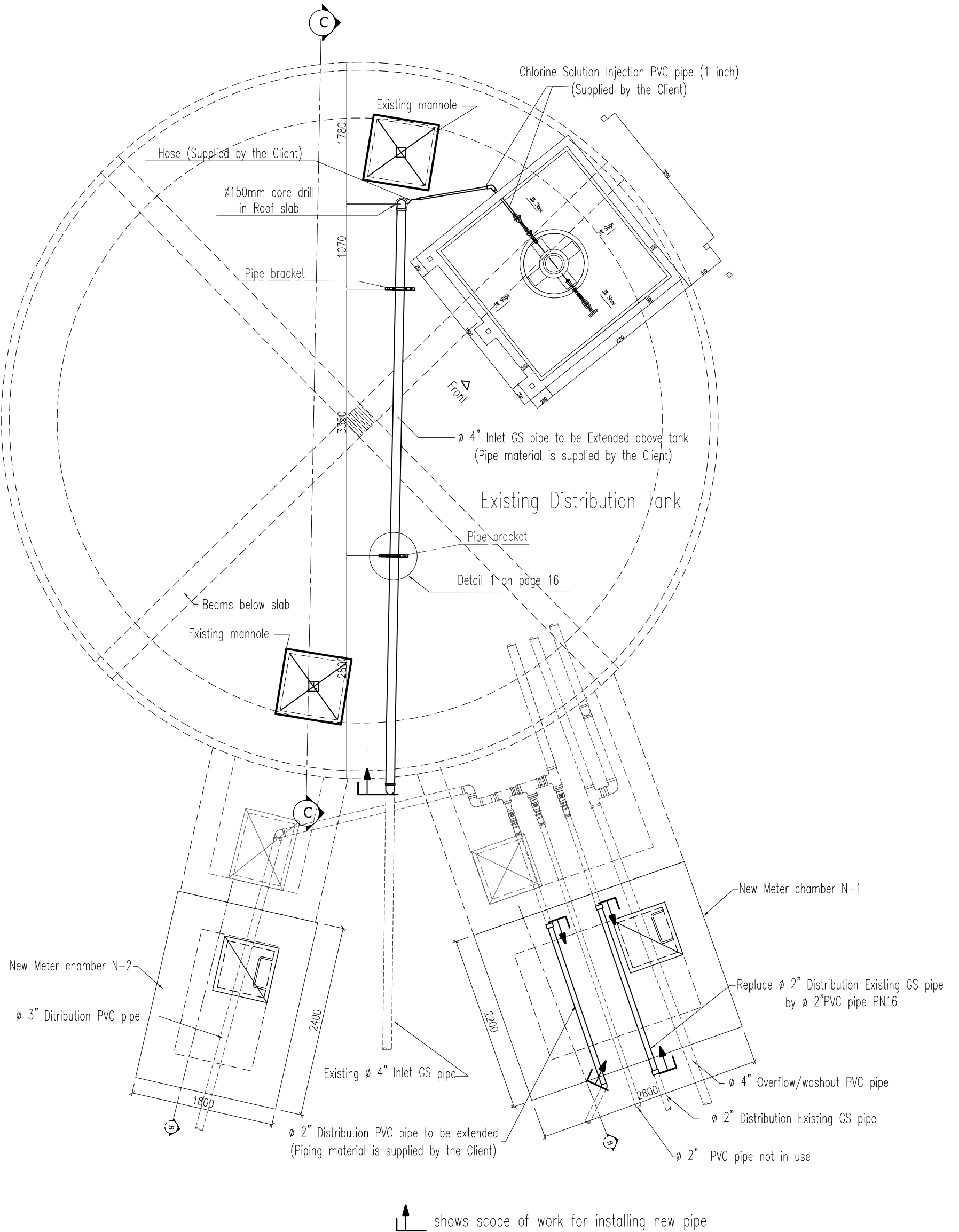
Sheet No.
 18

Nyabombe - Existing Tank Layout

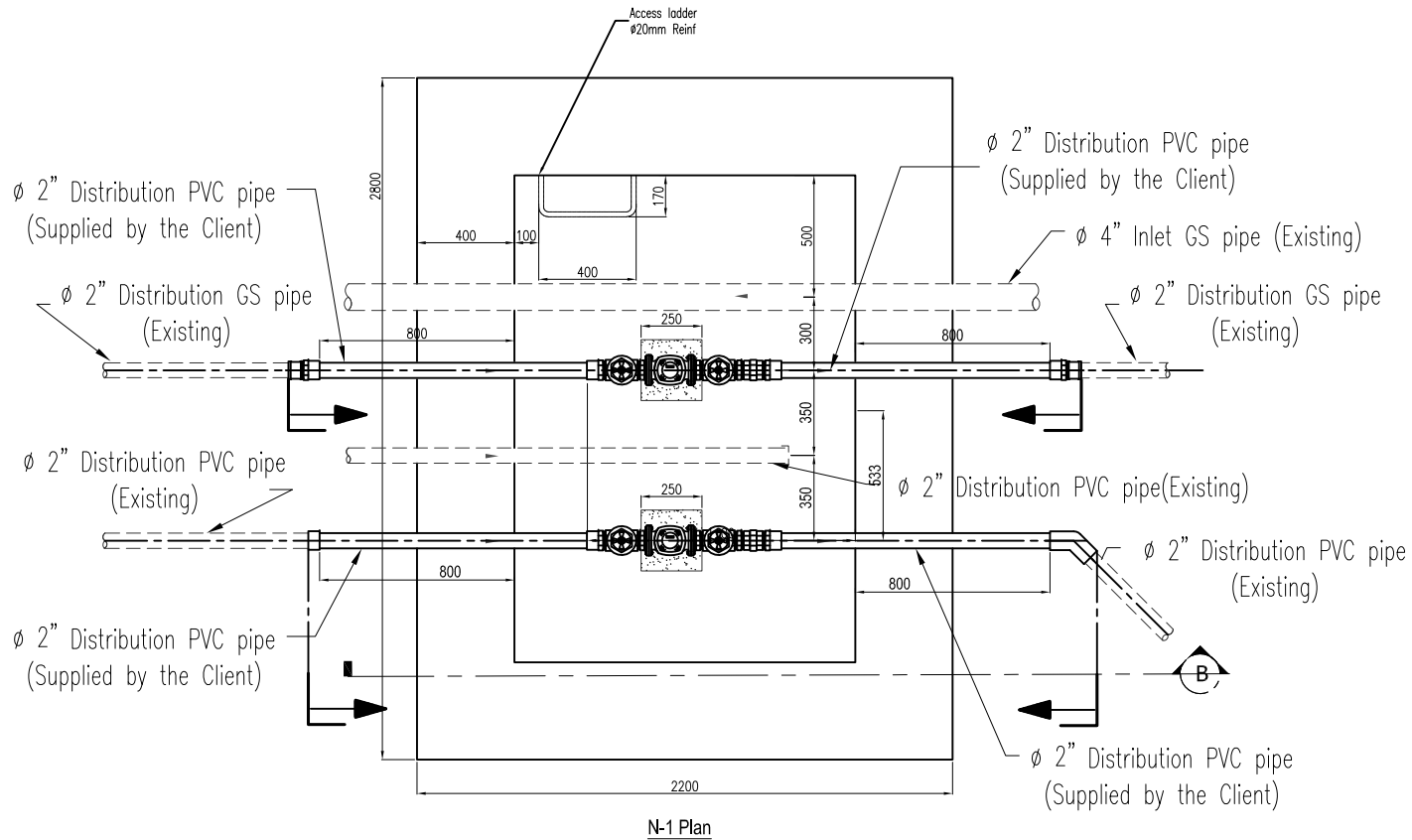



<p>Client: Kokusai Kogyo Co.,Ltd.</p>	<p>Project: The Project for Strengthening Operation and Maintenance of Rural Water Supply Systems in Rwanda</p>	<p>Work: Installation of Water Meter and Chlorination Unit</p>	<p>Drawing Title: Nyabombe Existing Distribution Tank Layout</p>	<p>Sheet No. 19</p>
		<p>SCALE 1 : 50</p>	<p>DATE July 2017</p>	<p>DWG No. A3-N1</p>

Nyabombe - Water Meter Chamber and Chlorination Unit Layout

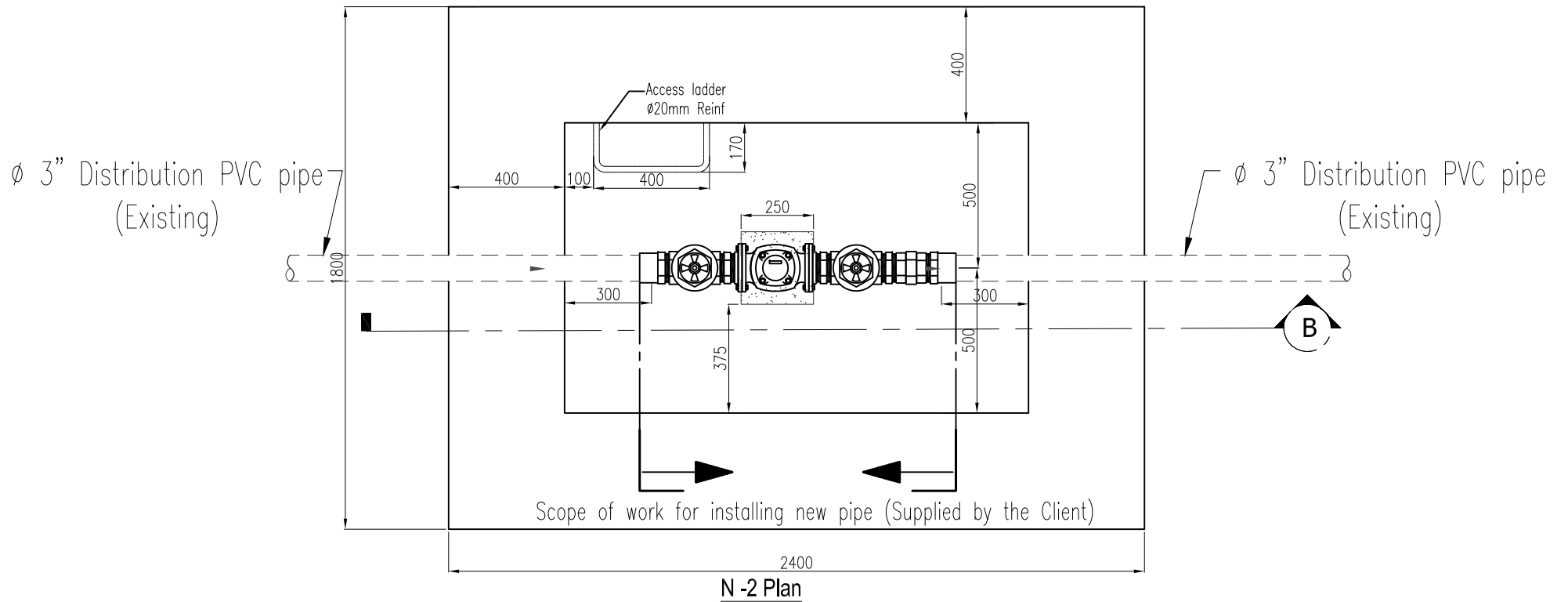



<p>Client: Kokusai Kogyo Co.,Ltd.</p>	<p>Project: The Project for Strengthening Operation and Maintenance of Rural Water Supply Systems in Rwanda</p>	<p>Work: Installation of Water Meter and Chlorination Unit</p>	<p>Drawing Title: Nyabombe Water Meter Chamber and Chlorination Unit Layout</p> <p>SCALE: 1:50 DATE: July 2017 DWG No.: A3-N2</p>	<p>Sheet No. 20</p>
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 shows scope of work for installing new pipe
 (Piping material is supplied by the Client)

Client: Kokusai Kogyo Co.,Ltd.	Project: The Project for Strengthening Operation and Maintenance of Rural Water Supply Systems in Rwanda	Work: Installation of Water Meter and Chlorination Unit	Drawing Title: Nyabombe Meter Chamber N-1 Plan		Sheet No. 21
			SCALE 1 : 30	DATE July 2017	



 shows scope of work for installing new pipe
 (Piping material is supplied by the Client)

Client:
 Kokusai Kogyo Co.,Ltd.

Project:
 The Project for Strengthening Operation and
 Maintenance of Rural Water Supply Systems
 in Rwanda

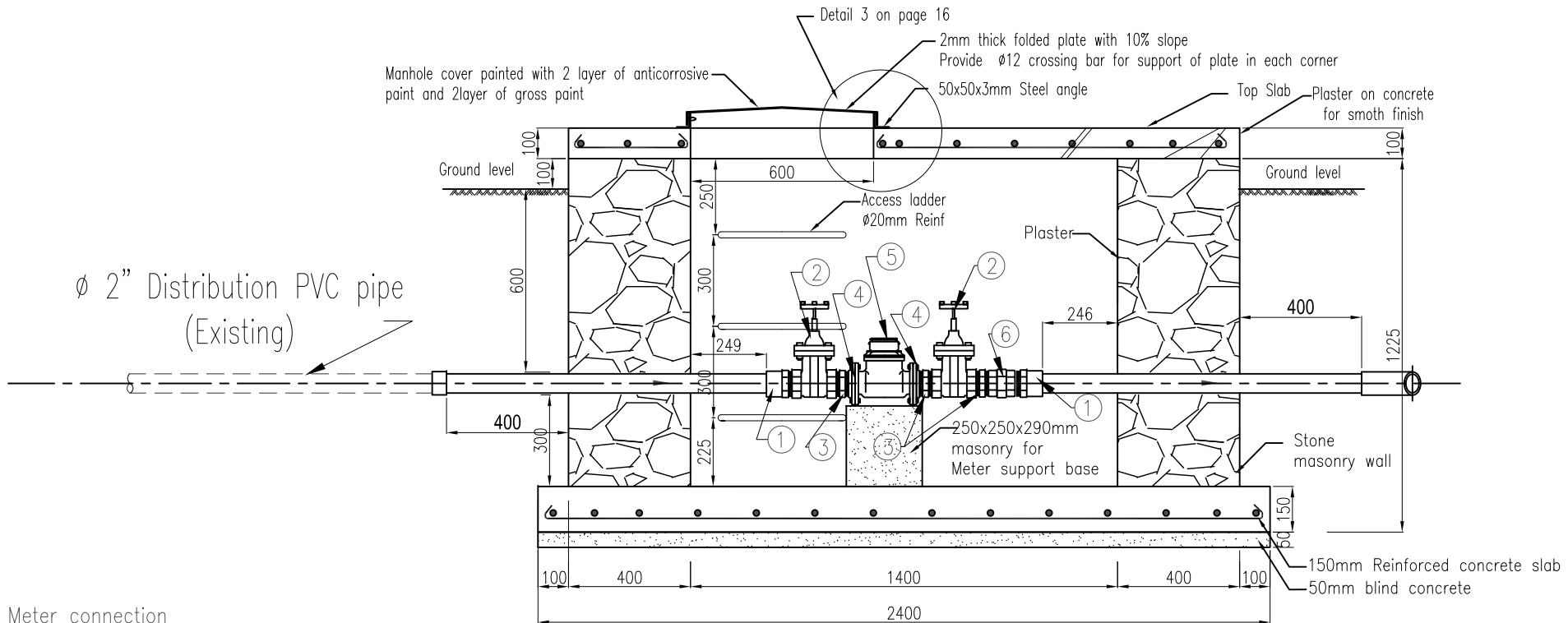
Work:
 Installation of Water Meter and
 Chlorination Unit

Drawing Title:
 Nyabombe
 Meter Chamber N-2 Plan

Sheet No.

22

SCALE 1 : 20	DATE July 2017	DWG No. A4-N4
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Meter connection
Parts list (Supplied by the Client)

- ① Adapter
- ② Valve
- ③ Nipple
- ④ Flange
- ⑤ Water Meter
- ⑥ GS Union

Section B

Note:

All Plumbing materials to be supplied by the client, the contractor Will provide means of assembly and workmanship

Client:
Kokusai Kogyo Co.,Ltd.

Project:
The Project for Strengthening Operation and Maintenance of Rural Water Supply Systems in Rwanda

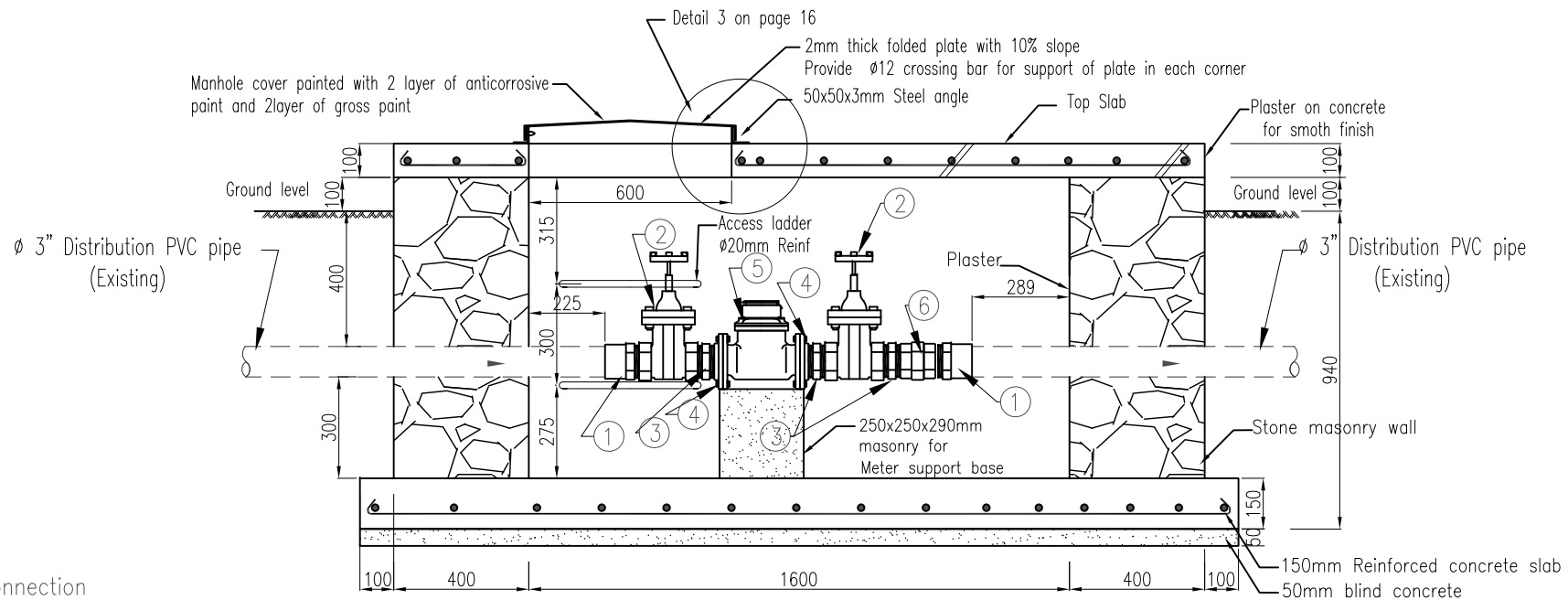
Work:
Installation of Water Meter and Chlorination Unit

Drawing Title:
Nyabombe
Meter Chamber N-1 Section

Sheet No.

23

SCALE 1 : 20	DATE July 2017	DWG No. A4-N5
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Meter connection
Parts list (Supplied by the Client)

- ① Adapter
- ② Valve
- ③ Nipple
- ④ Flange
- ⑤ Water Meter
- ⑥ GS Union

Section B

Note:

All Plumbing materials to be supplied by the client, the contractor Will provide means of assembly and workmanship

Client:
Kokusai Kogyo Co.,Ltd.

Project:
The Project for Strengthening Operation and Maintenance of Rural Water Supply Systems in Rwanda

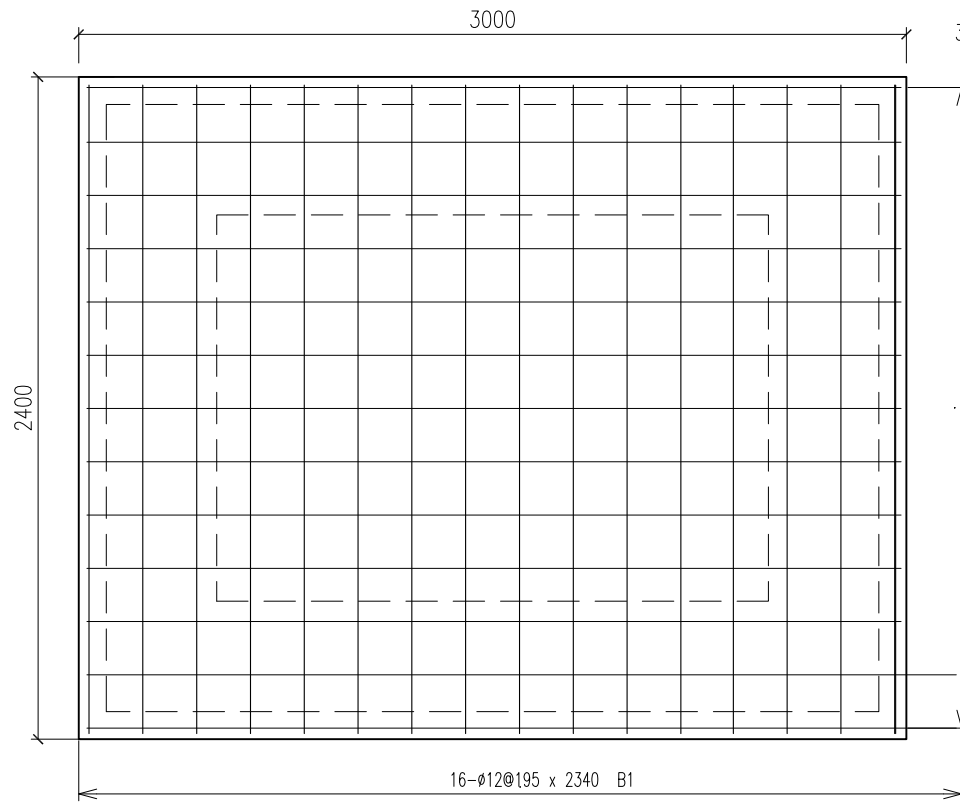
Work:
Installation of Water Meter and Chlorination Unit

Drawing Title:
Nyabombe
Meter Chamber N-2 Section

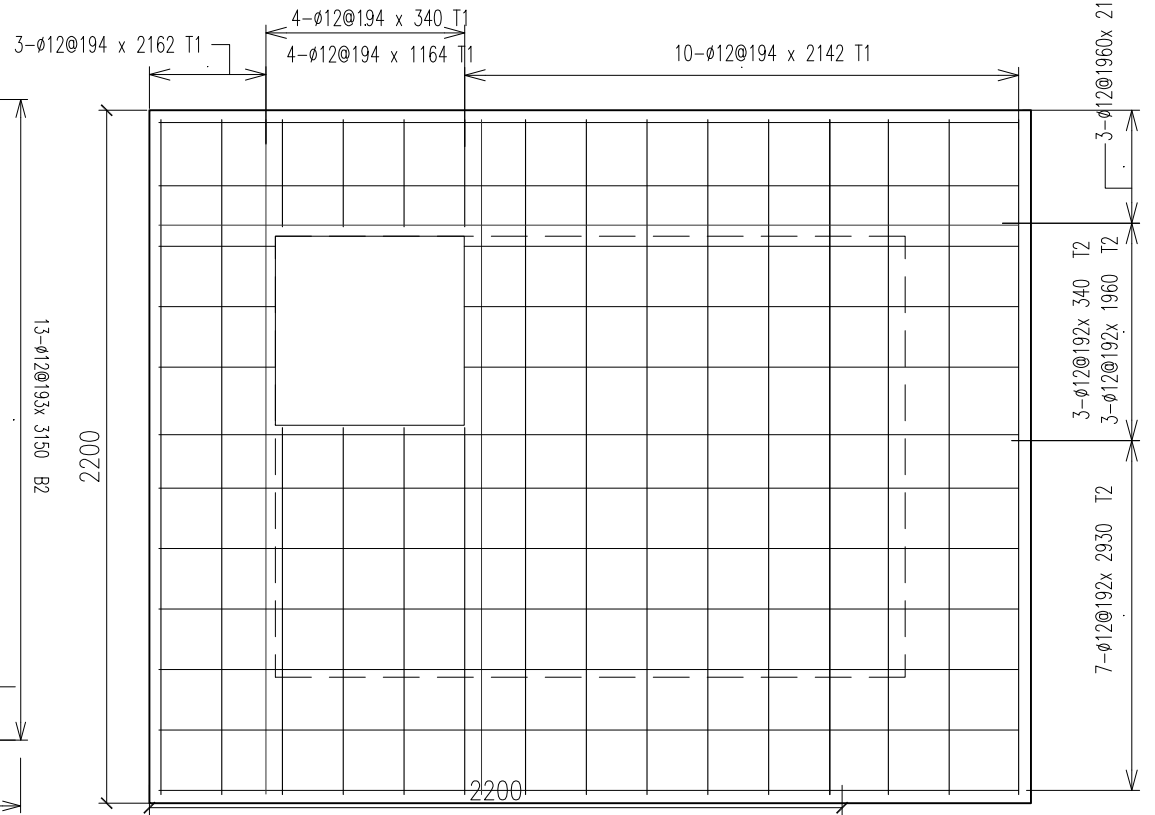
SCALE 1 : 20	DATE July 2017	DWG No. A4-N6
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Sheet No.

24



Bottom Slab Reinforcement Layout



Top Slab Reinforcement Layout

Client:
Kokusai Kogyo Co.,Ltd.

Project:
The Project for Strengthening Operation and Maintenance of Rural Water Supply Systems in Rwanda

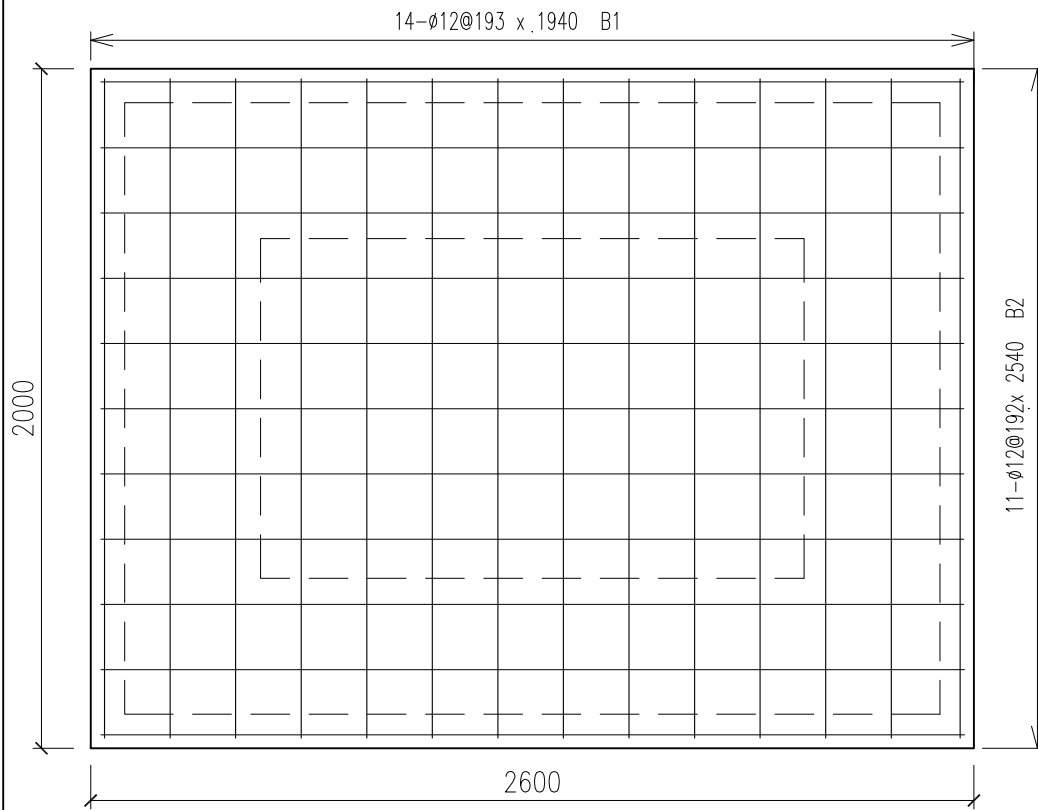
Work:
Installation of Water Meter and Chlorination Unit

Drawing Title:
Nyabombe
Meter Chamber N-1 Top and Bottom Slab Reinforcement

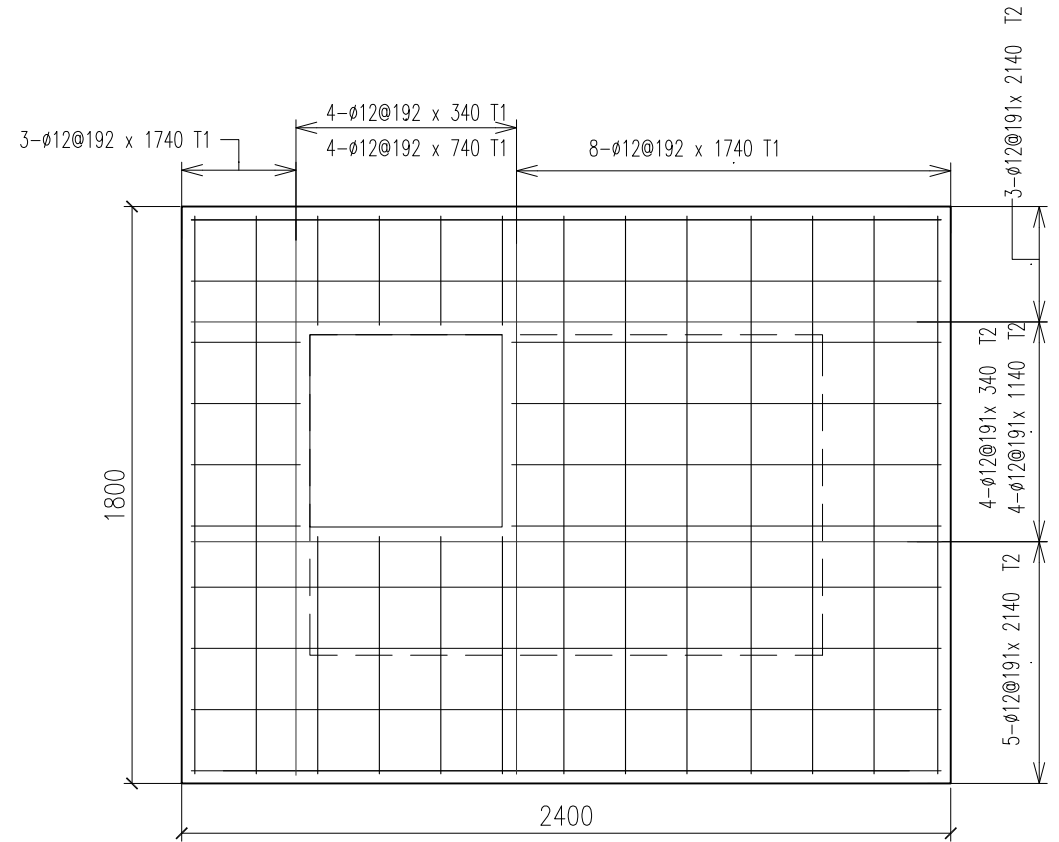
Sheet No.

25

SCALE 1 : 20	DATE July 2017	DWG No. A4-N7
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Bottom Slab Reinforcement Layout



Top Slab Reinforcement Layout

Client:
Kokusai Kogyo Co.,Ltd.

Project:
The Project for Strengthening Operation and
Maintenance of Rural Water Supply Systems
in Rwanda

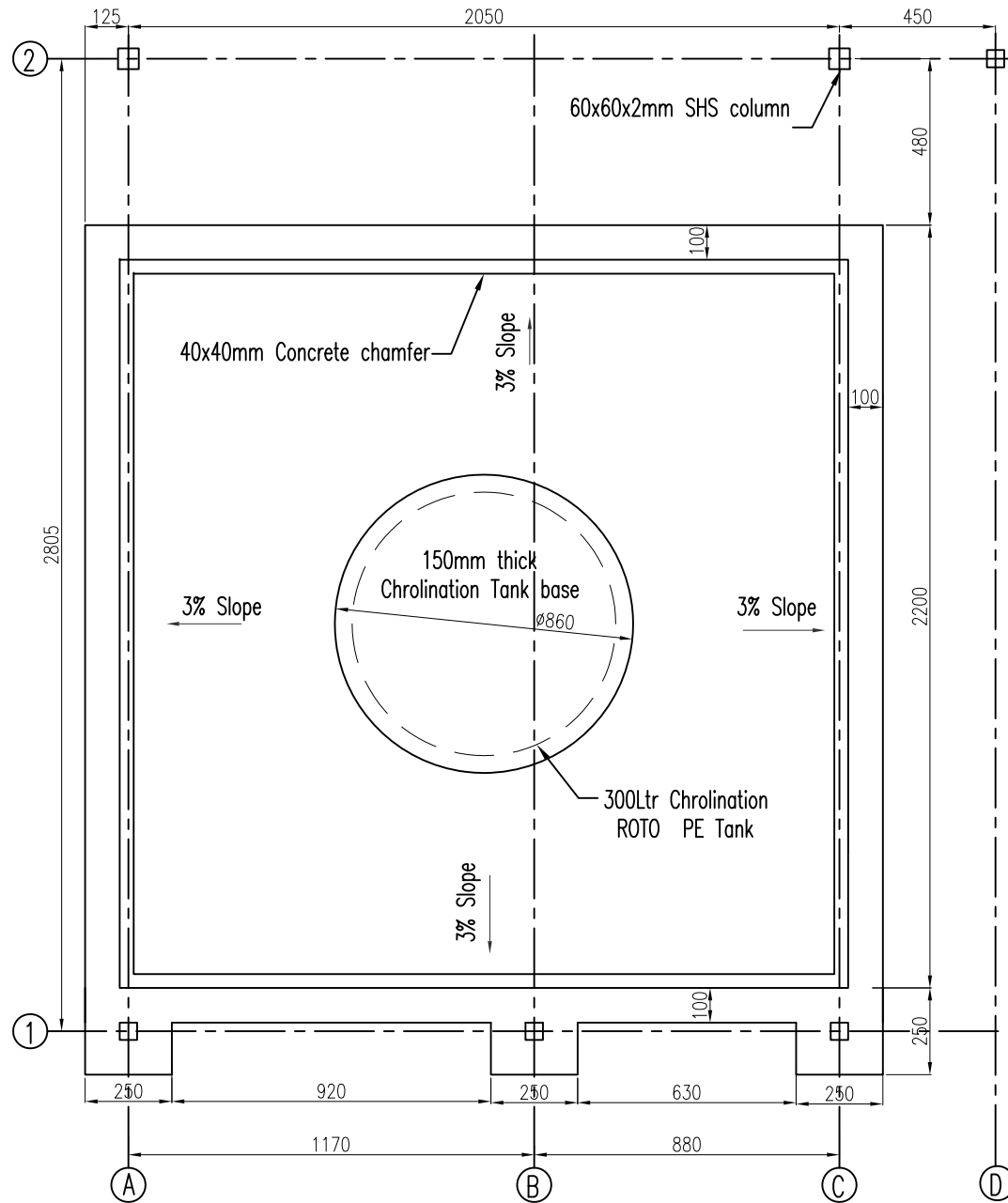
Work:
Installation of Water Meter and
Chlorination Unit

Drawing Title:
Nyabombe
Meter Chamber N-2 Top and Bottom Slab Reinforcement

Sheet No.

SCALE Not to scale	DATE July 2017	DWG No. A4-N8
-----------------------	-------------------	------------------

26



Base Slab layout

Client:
Kokusai Kogyo Co.,Ltd.

Project:
The Project for Strengthening Operation and Maintenance of Rural Water Supply Systems in Rwanda

Work:
Installation of Water Meter and Chlorination Unit

Drawing Title:
Nyabombe
Chlorination Unit Base Slab Layout

Sheet No.

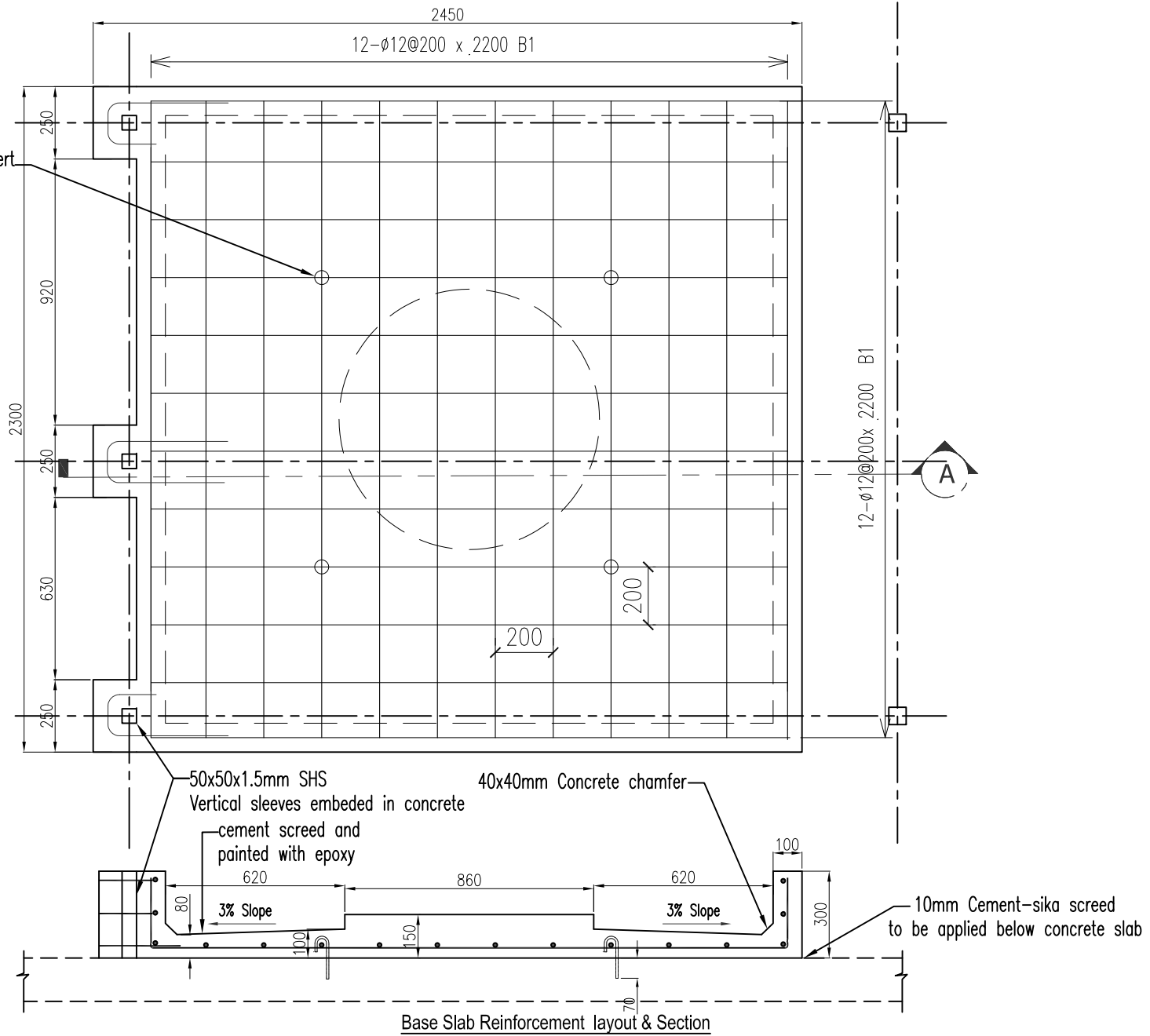
SCALE
1 : 20

DATE
July 2017

DWG No.
A4-N9

27

Drill in existing concrete to insert
Vertical $\phi 12$ hook



Client:
Kokusai Kogyo Co.,Ltd.

Project:
The Project for Strengthening Operation and
Maintenance of Rural Water Supply Systems
in Rwanda

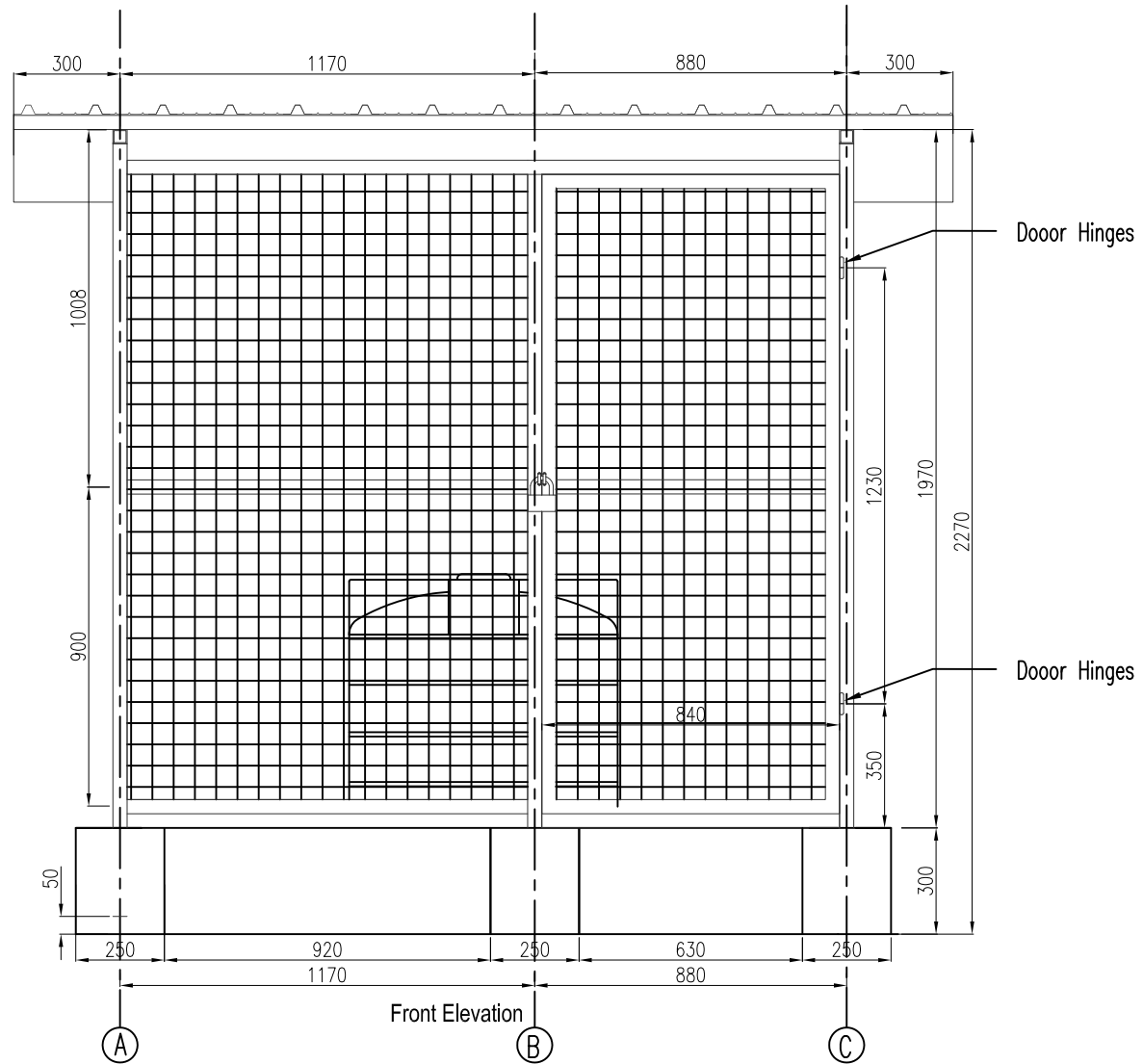
Work:
Installation of Water Meter and
Chlorination Unit

Drawing Title:
Nyabombe
Chlorination Unit Base Slab Reinforcement

Sheet No.

28

SCALE 1 : 20	DATE July 2017	DWG No. A4-N10
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Client:
Kokusai Kogyo Co.,Ltd.

Project:
The Project for Strengthening Operation and
Maintenance of Rural Water Supply Systems
in Rwanda

Work:
Installation of Water Meter and
Chlorination Unit

Drawing Title:
Nyabombe
Chlorination Unit Front Elevation

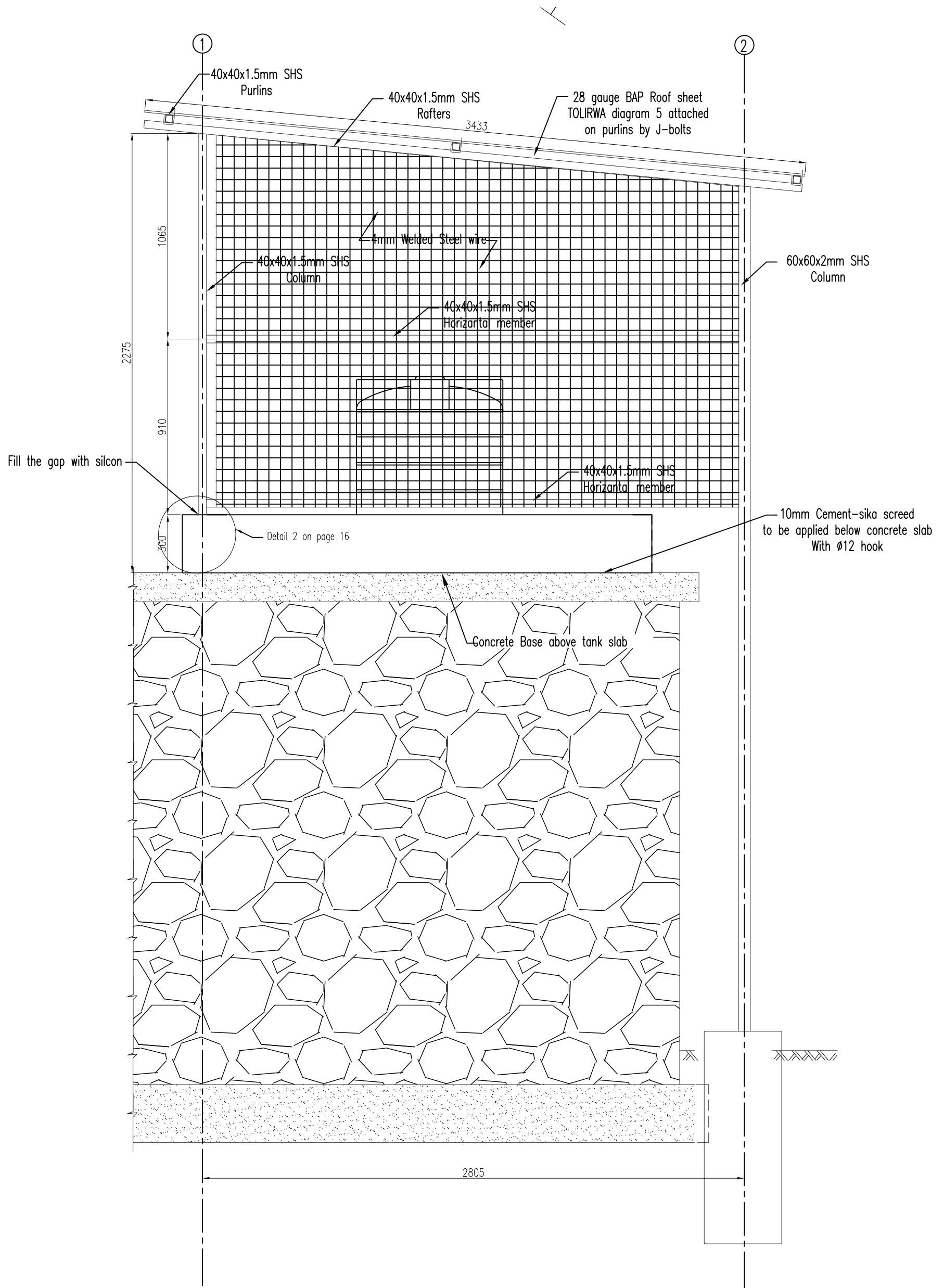
Sheet No.

29

SCALE
1 : 20

DATE
July 2017

DWG No.
A4-N11



Side Elevation

Client:
Kokusai Kogyo Co.,Ltd.

Project:
The Project for Strengthening Operation and Maintenance of Rural Water Supply Systems in Rwanda

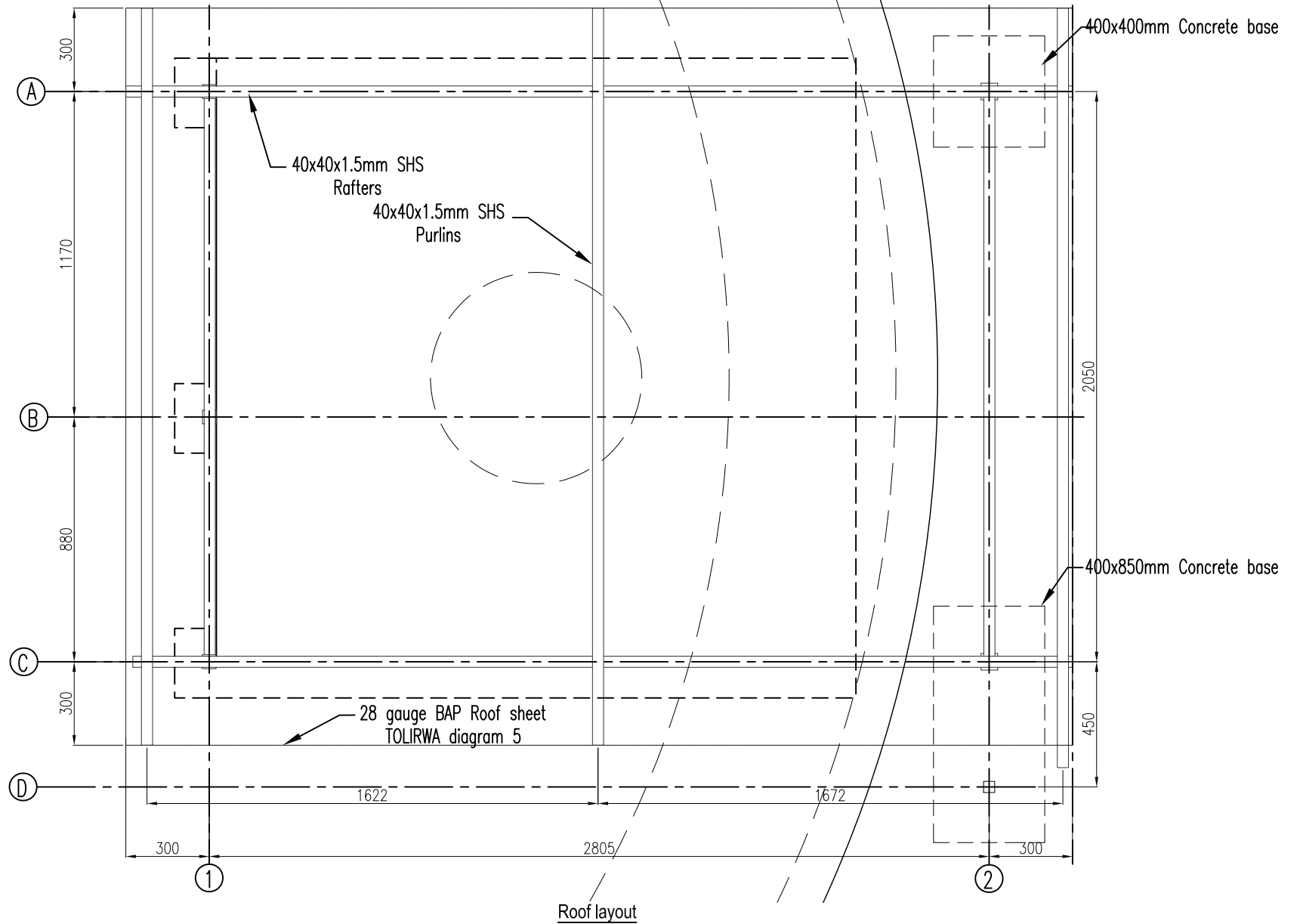
Work:
Installation of Water Meter and Chlorination Unit

Drawing Title:
Nyabombe Chlorination Unit Side Elevation

Sheet No.

31

SCALE	DATE	DWG No.
1 : 20	July 2017	A3-N13



Client:
Kokusai Kogyo Co.,Ltd.

Project:
The Project for Strengthening Operation and Maintenance of Rural Water Supply Systems in Rwanda

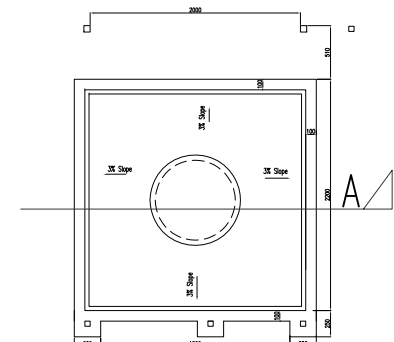
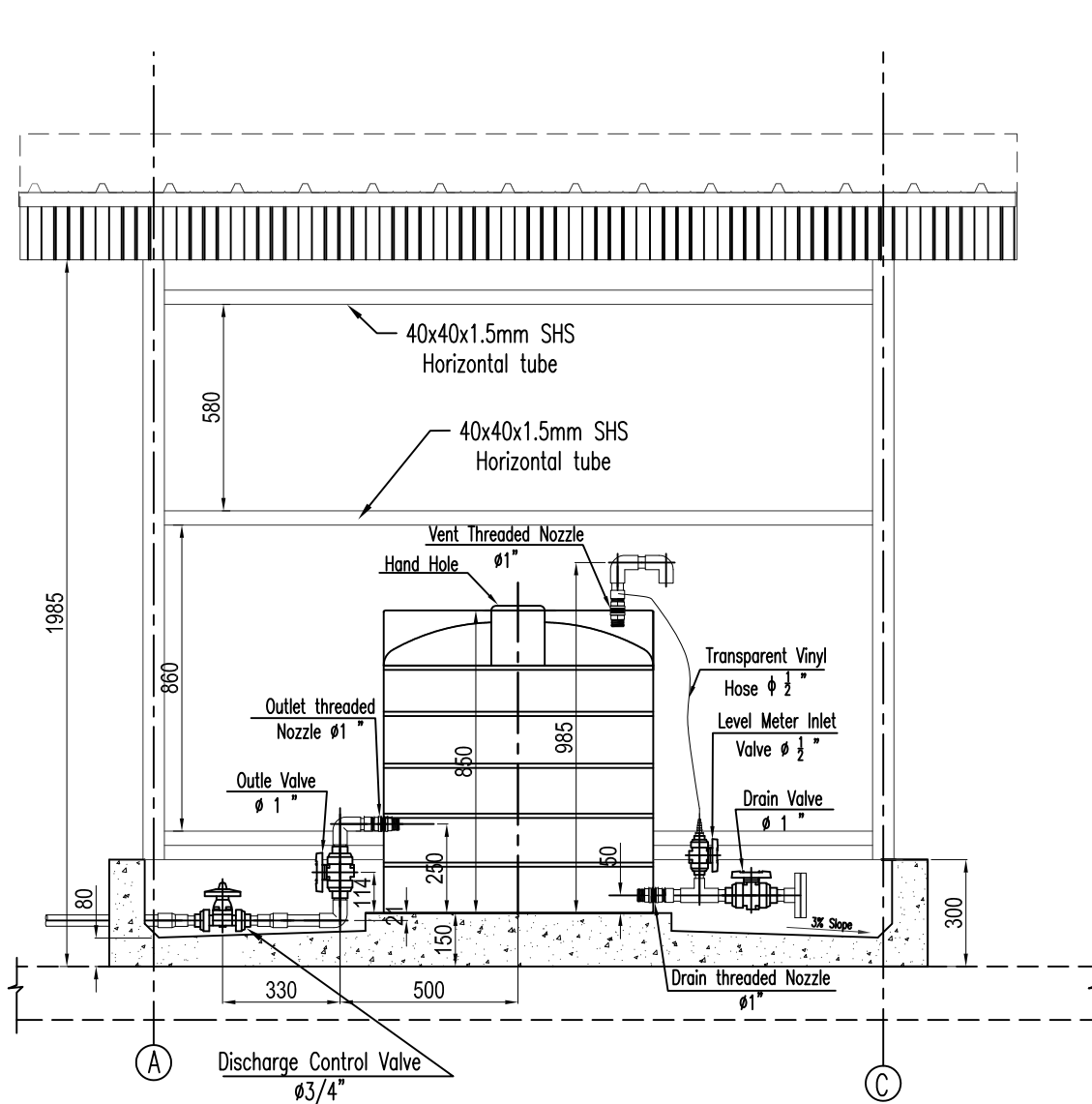
Work:
Installation of Water Meter and Chlorination Unit

Drawing Title:
Nyabombe
Chlorination Unit Roof Layout

Sheet No.

SCALE 1 : 20	DATE July 2017	DWG No. A4-N14
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32



Client:
Kokusai Kogyo Co.,Ltd.

Project:
The Project for Strengthening Operation and
Maintenance of Rural Water Supply Systems
in Rwanda

Work:
Installation of Water Meter and
Chlorination Unit

Drawing Title:
Nyabombe
Chlorination Unit Section

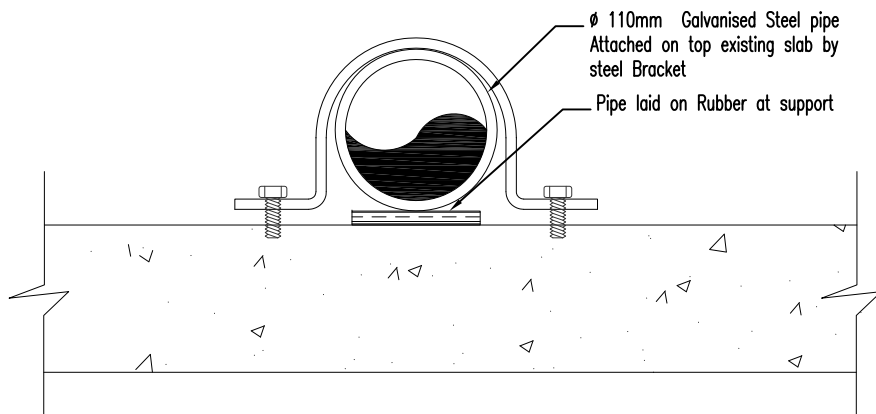
Sheet No.

33

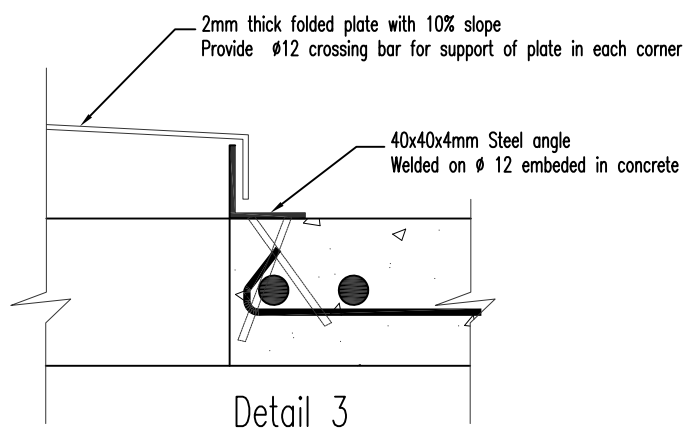
SCALE
1 : 20

DATE
July 2017

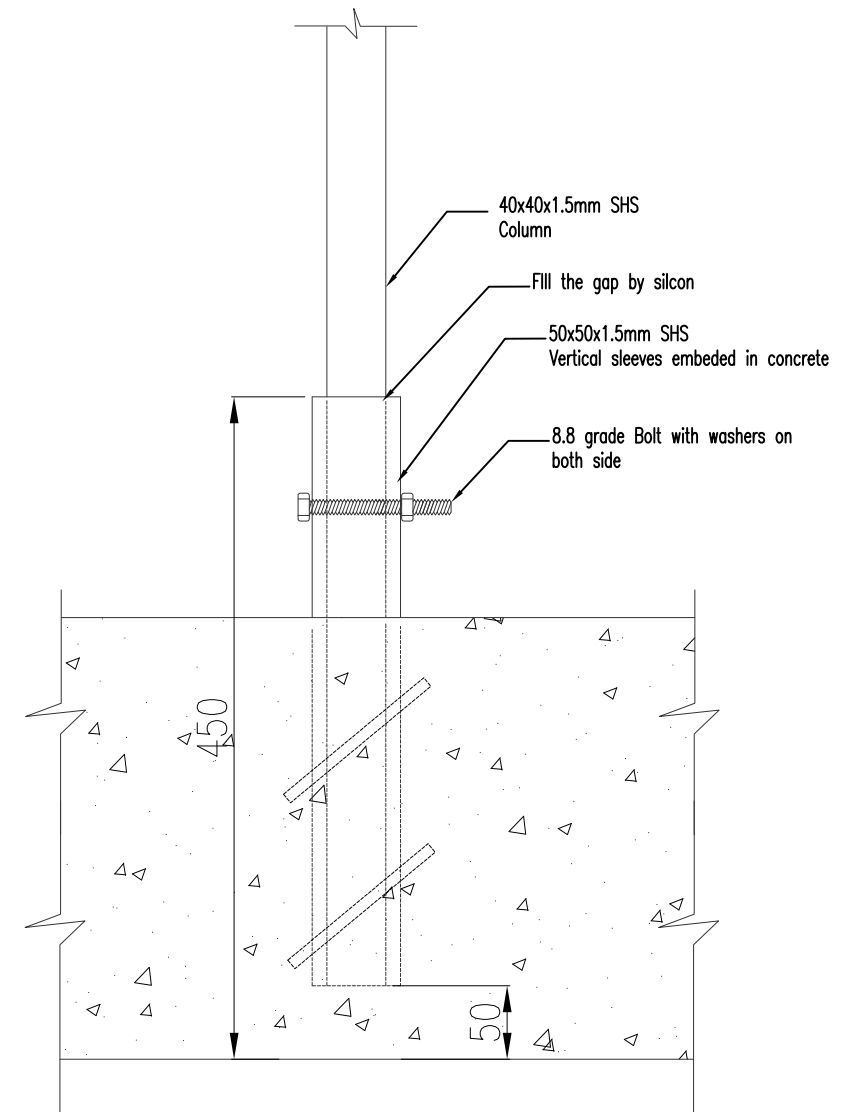
DWG No.
A4-N15



Fixing Detail 1- GS pipe on Tank Roof Sab

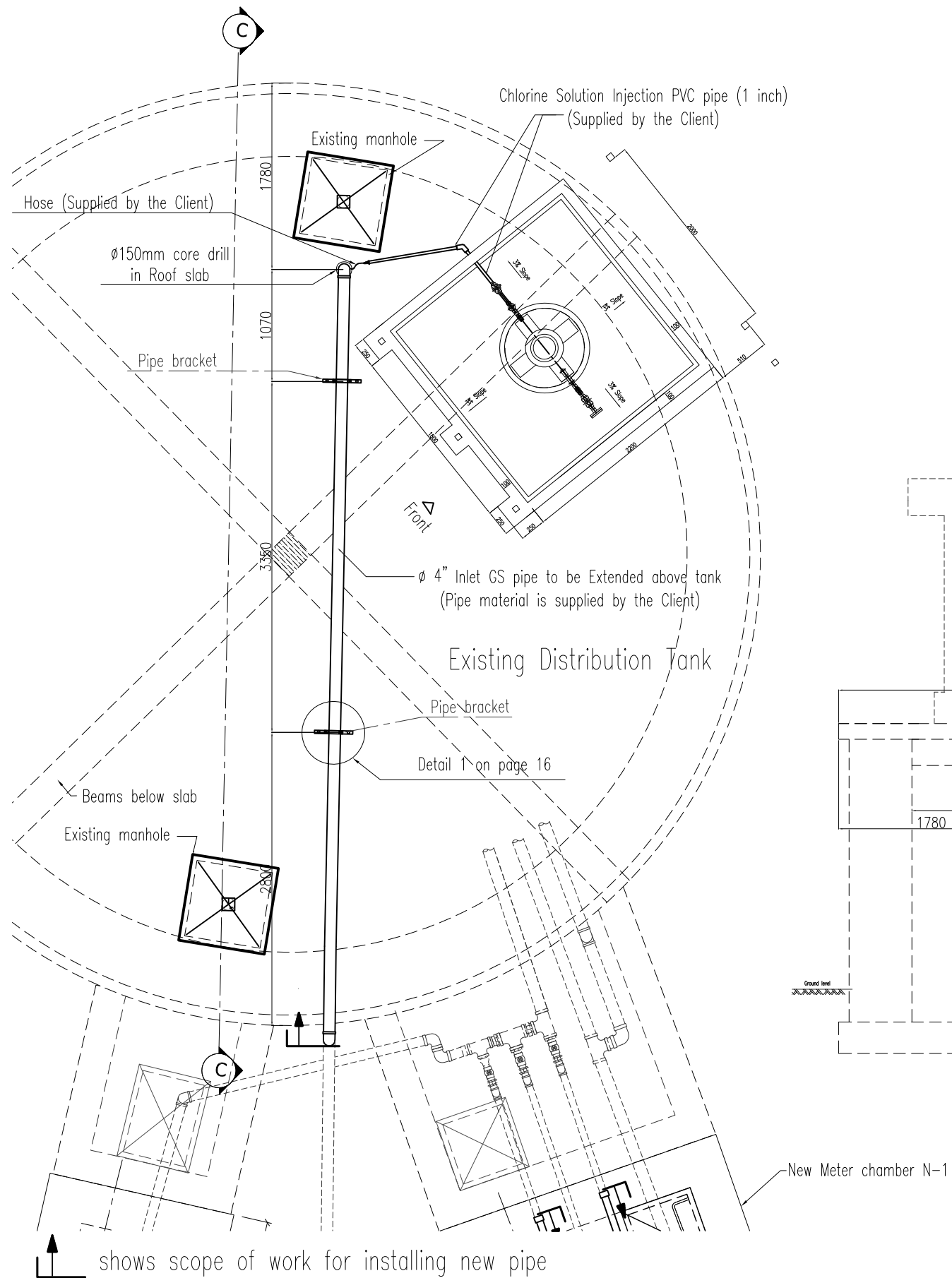


Detail 3

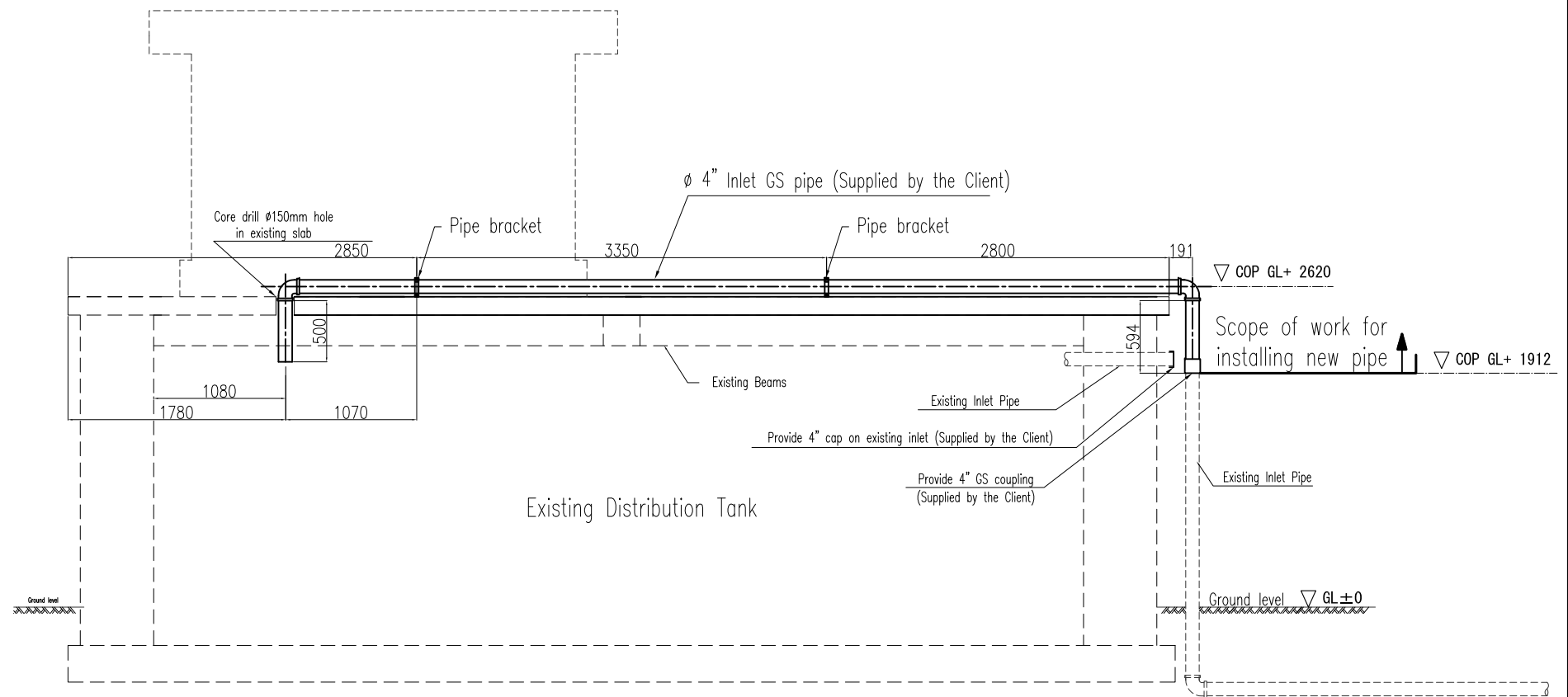


Fixing Detail 2 - SHS tube to concrete base

Client: Kokusai Kogyo Co.,Ltd.	Project: The Project for Strengthening Operation and Maintenance of Rural Water Supply Systems in Rwanda	Work: Installation of Water Meter and Chlorination Unit	Drawing Title: Nyabombe Meter Chamber and Chlorination Unit Fixing Details			Sheet No. 34
			SCALE 1 : 5	DATE July 2017	DWG No. A4-N16	



Layout



Section C

Client:
Kokusai Kogyo Co.,Ltd.

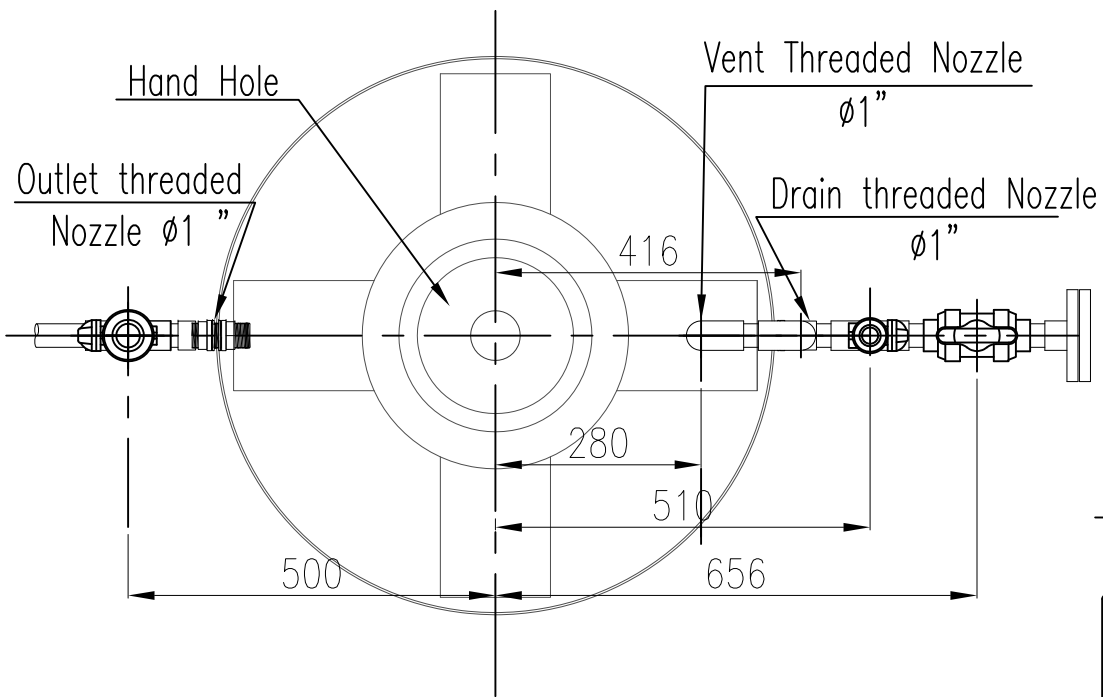
Project:
The Project for Strengthening Operation and
Maintenance of Rural Water Supply Systems
in Rwanda

Work:
Installation of Water Meter and
Chlorination Unit

Drawing Title:
Nyabombe
Inlet Pipe Assembly Drawing

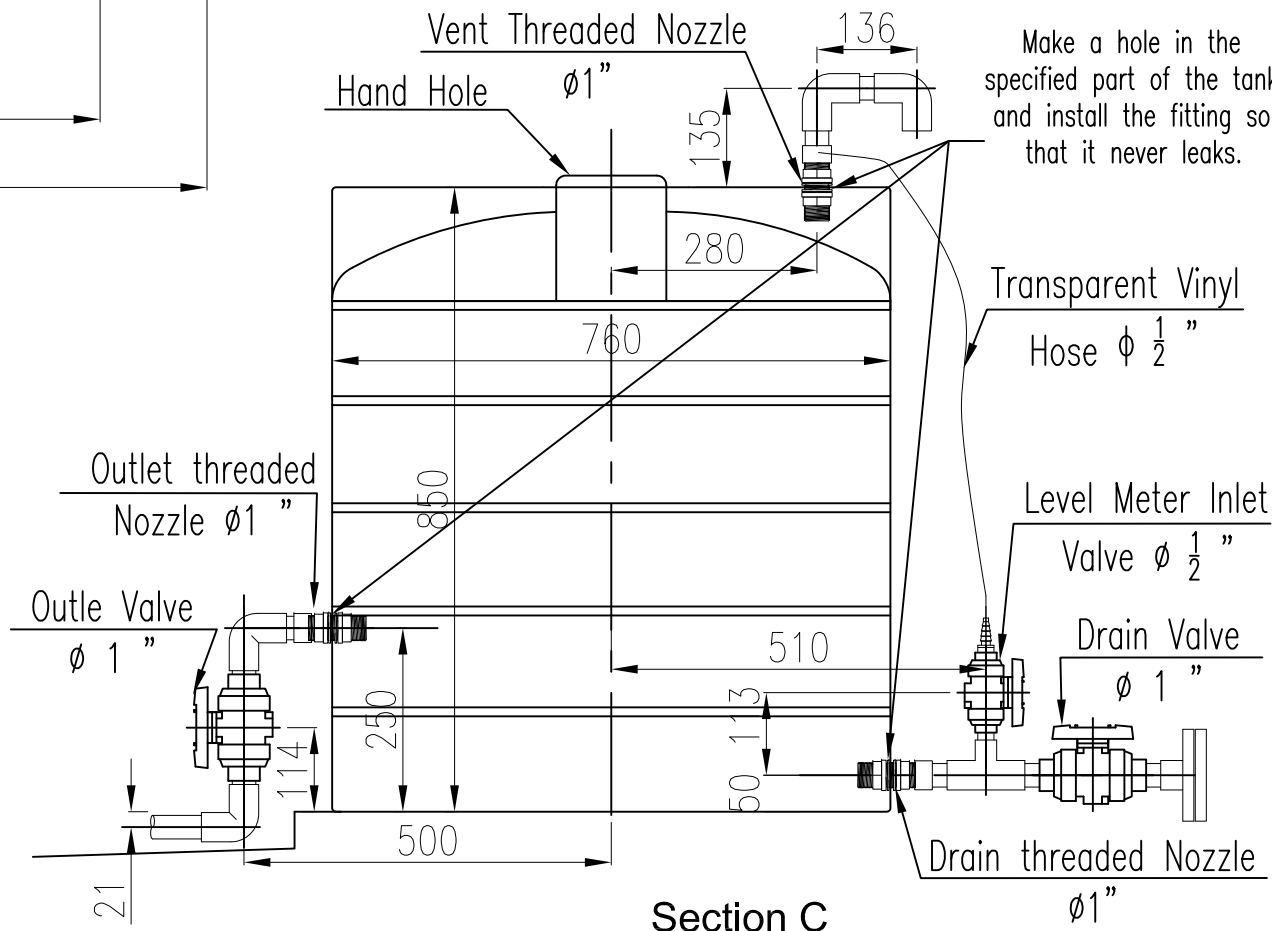
SCALE 1 : 50	DATE July 2017	DWG No. A3-N17
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Sheet No.
35



Layout

Nominal capacity : 300 L
 Material : PE (Polyethylene)
 Color : Black
 Brand : ROTO



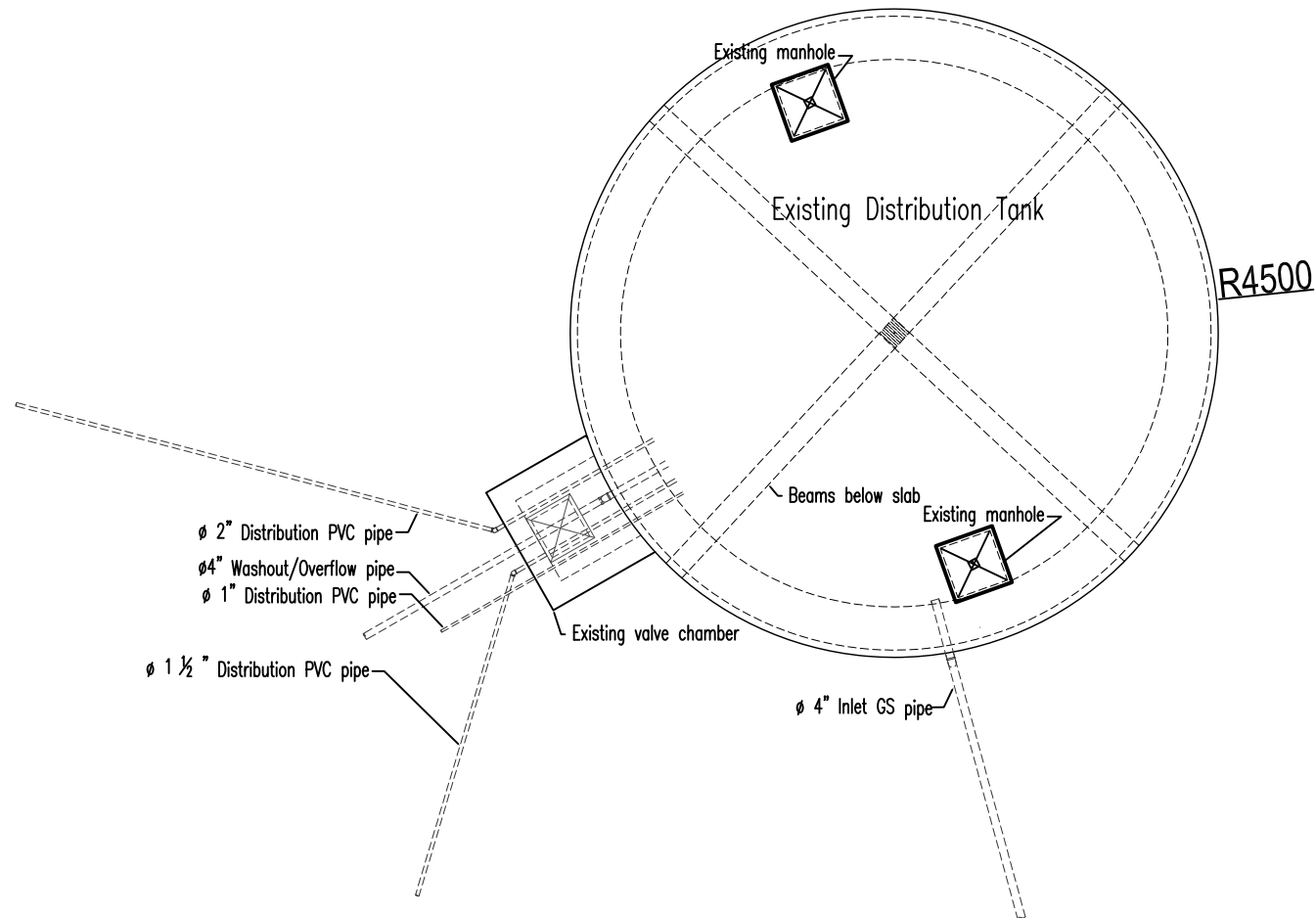
Make a hole in the specified part of the tank and install the fitting so that it never leaks.

Section C

Note:
 Pe Tank, valves, nozzle, pipe and other piping material in this drawing are supplied by the Client. The contractor shall provide means of assembly and workmanship.

Client: Kokusai Kogyo Co.,Ltd.	Project: The Project for Strengthening Operation and Maintenance of Rural Water Supply Systems in Rwanda	Work: Installation of Water Meter and Chlorination Unit	Drawing Title: Nyabombe Calcium Hypochlorite Solution Tank		Sheet No. 36
			SCALE 1 : 10	DATE July 2017	

Kagoma - Existing Distribution Tank



Client:
Kokusai Kogyo Co.,Ltd.

Project:
The Project for Strengthening Operation and Maintenance of Rural Water Supply Systems in Rwanda

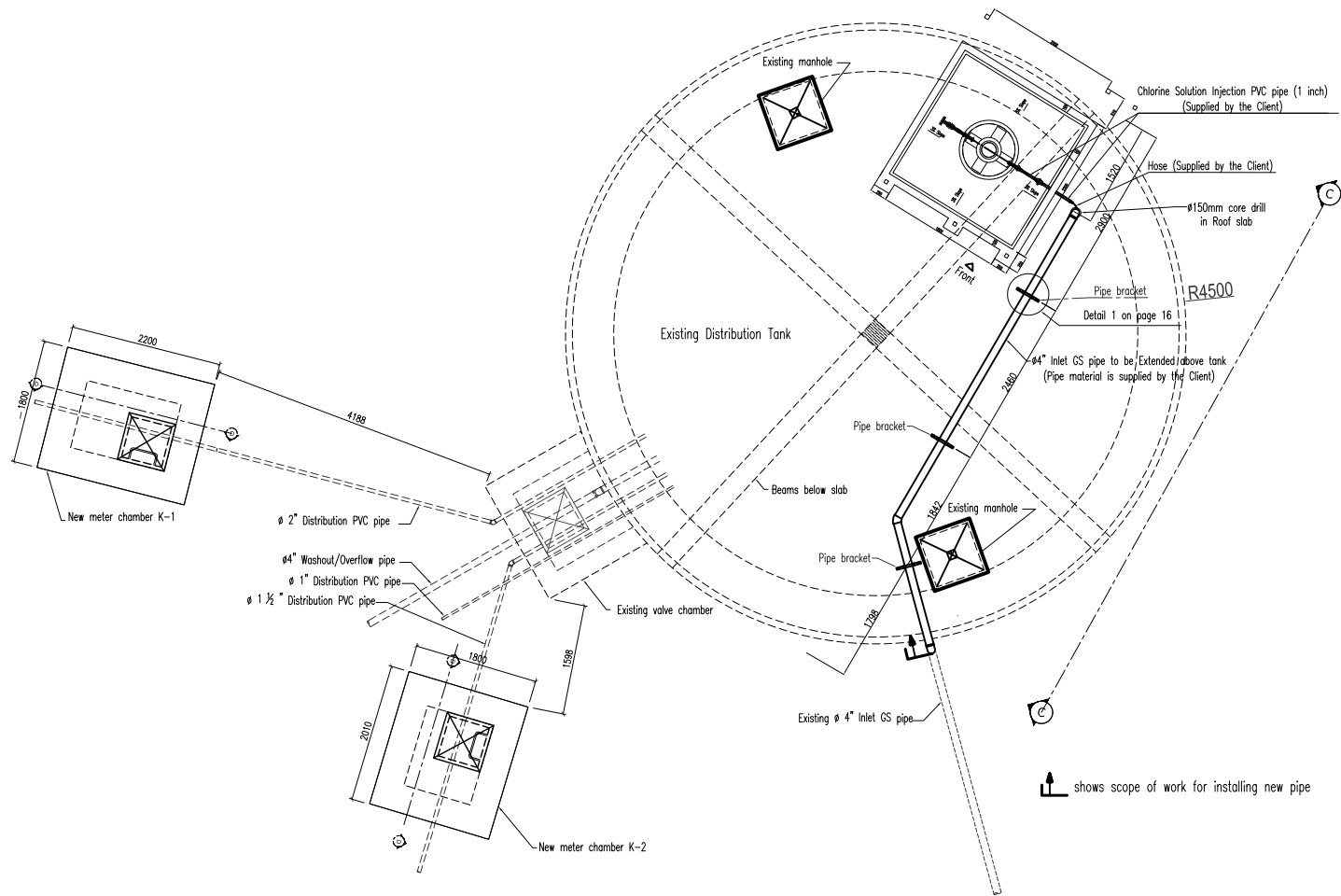
Work:
Installation of Water Meter and Chlorination Unit

Drawing Title:
Kagoma
Existing Distribution Tank Layout

Sheet No.

37

SCALE 1 : 100	DATE August 2017	DWG No. A4-K1
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Water Meter Chamber and Chlorination Unit Layout

Client:
Kokusai Kogyo Co.,Ltd.

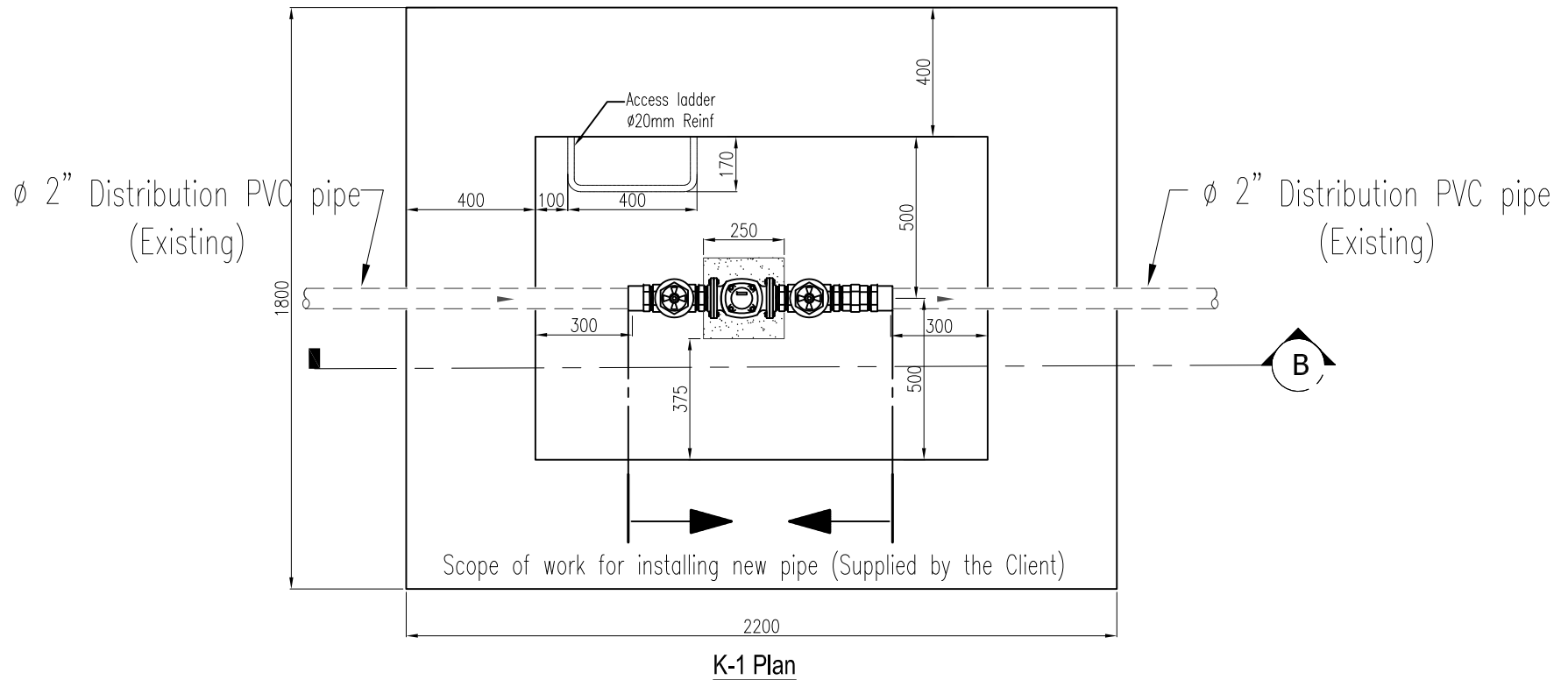
Project:
The Project for Strengthening Operation and Maintenance of Rural Water Supply Systems in Rwanda


Work:
Installation of Water Meter and Chlorination Unit

Drawing Title:
Kagoma
Water Meter Chamber and Chlorination Unit Layout

SCALE 1 : 100	DATE July 2017	DWG No. A4-K2
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Sheet No.
38




 shows scope of work for installing new pipe
 (Piping material is supplied by the Client)

Client:
Kokusai Kogyo Co.,Ltd.

Project:
The Project for Strengthening Operation and Maintenance of Rural Water Supply Systems in Rwanda

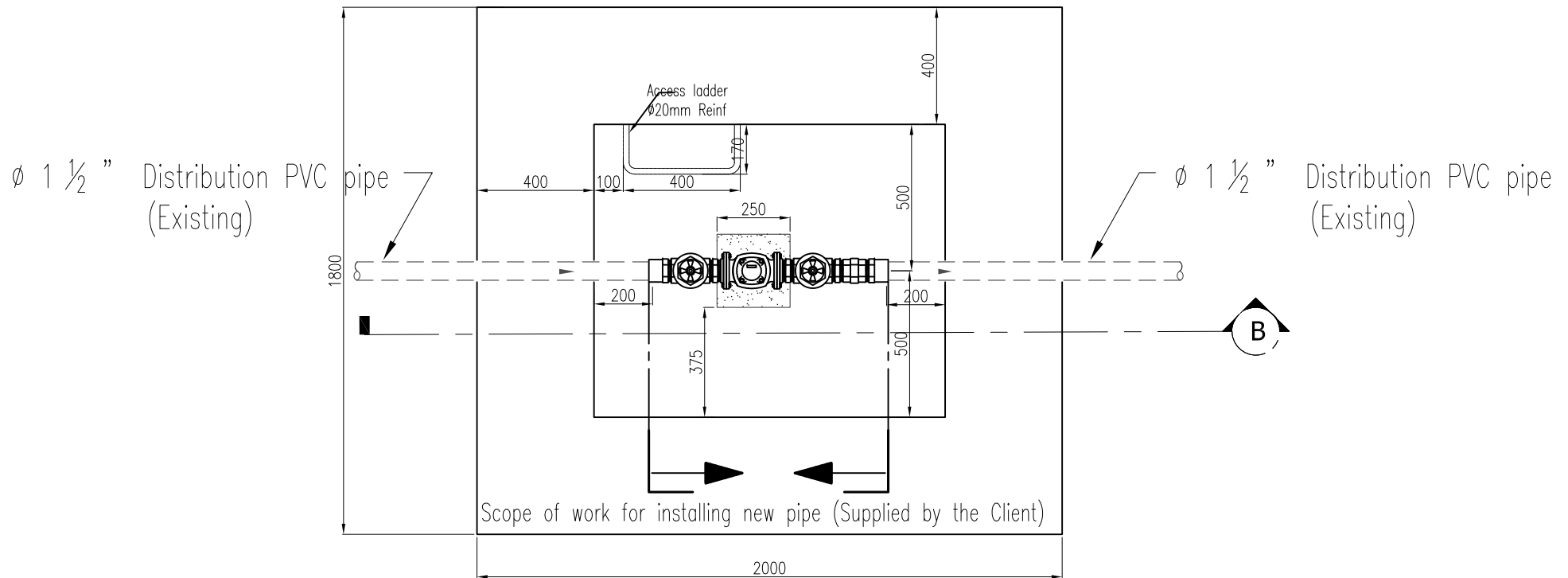
Work:
Installation of Water Meter and Chlorination Unit

Drawing Title:
Kagoma
Meter Chamber K-1 Plan


Sheet No.

39

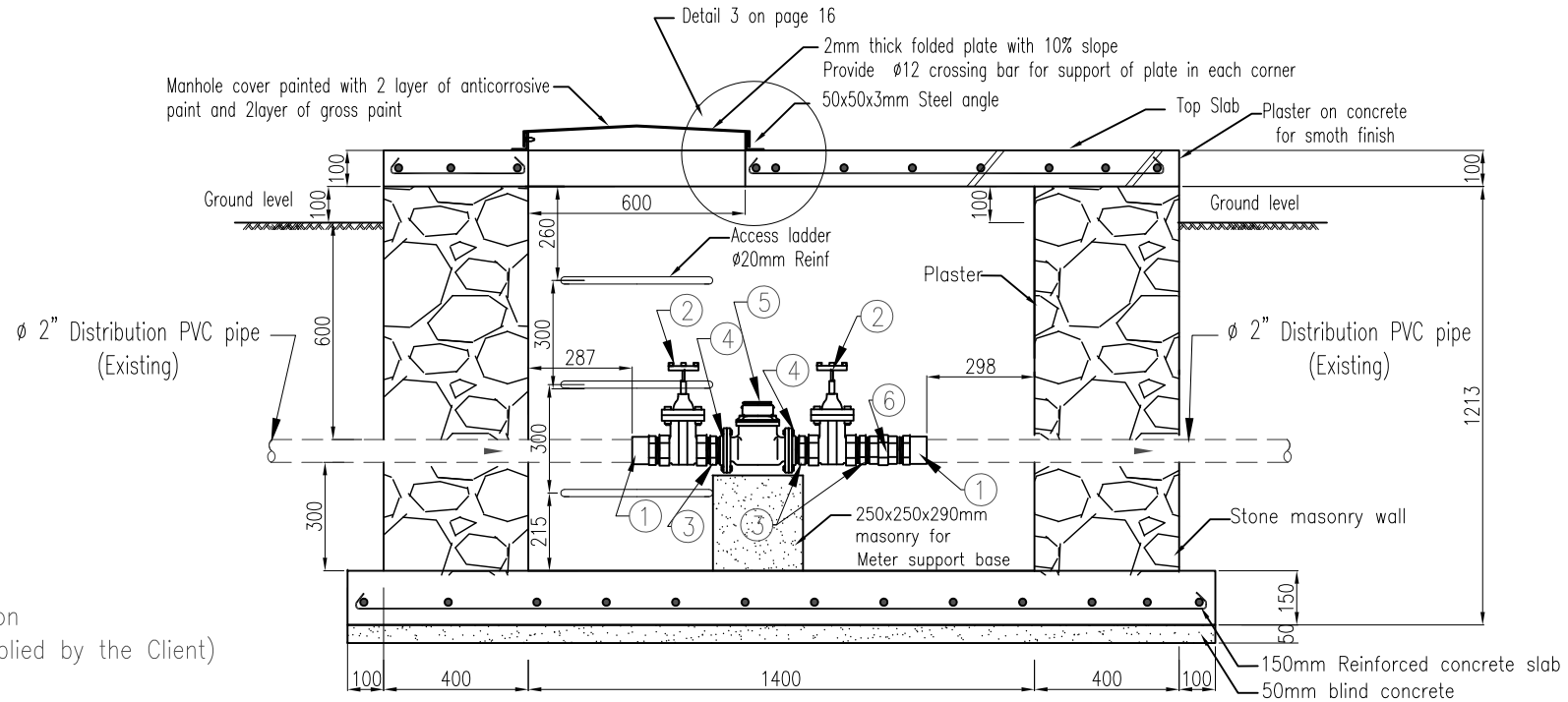
SCALE 1 : 20	DATE July 2017	DWG No. A4-K3
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K-2 Plan


 shows scope of work for installing new pipe
 (Piping material is supplied by the Client)

Client: Kokusai Kogyo Co.,Ltd.	Project: The Project for Strengthening Operation and Maintenance of Rural Water Supply Systems in Rwanda	Work: Installation of Water Meter and Chlorination Unit	Drawing Title: Kagoma Meter Chamber K-2 Plan			Sheet No. 40
			SCALE 1 : 20	DATE July 2017	DWG No. A4-K4	



Meter connection
Parts list (Supplied by the Client)

- ① Adapter
- ② Valve
- ③ Nipple
- ④ Flange
- ⑤ Water Meter
- ⑥ GS Union

Section B

Note:

All Plumbing materials to be supplied by the client, the contractor Will provide means of assembly and workmanship

Client:
Kokusai Kogyo Co.,Ltd.

Project:
The Project for Strengthening Operation and Maintenance of Rural Water Supply Systems in Rwanda

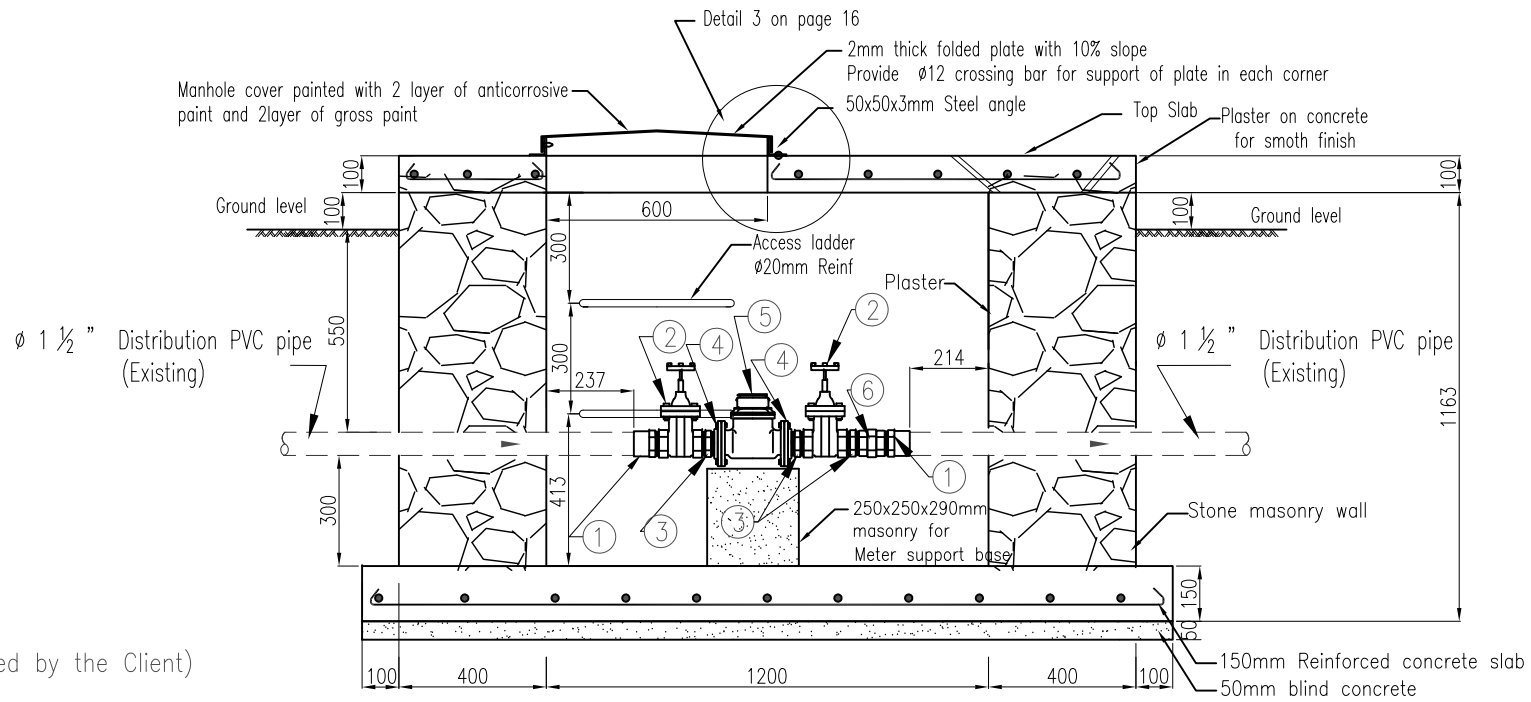
Work:
Installation of Water Meter and Chlorination Unit

Drawing Title:
Kagoma
Meter Chamber K-1 Section

Sheet No.

41

SCALE 1 : 20	DATE July 2017	DWG No. A4-K5
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Meter connection
Parts list (Supplied by the Client)

- ① Adapter
- ② Valve
- ③ Nipple
- ④ Flange
- ⑤ Water Meter
- ⑥ GS Union

Section B

Note:

All Plumbing materials to be supplied by the client, the contractor Will provide means of assembly and workmanship

Client:
Kokusan Kogyo Co.,Ltd.

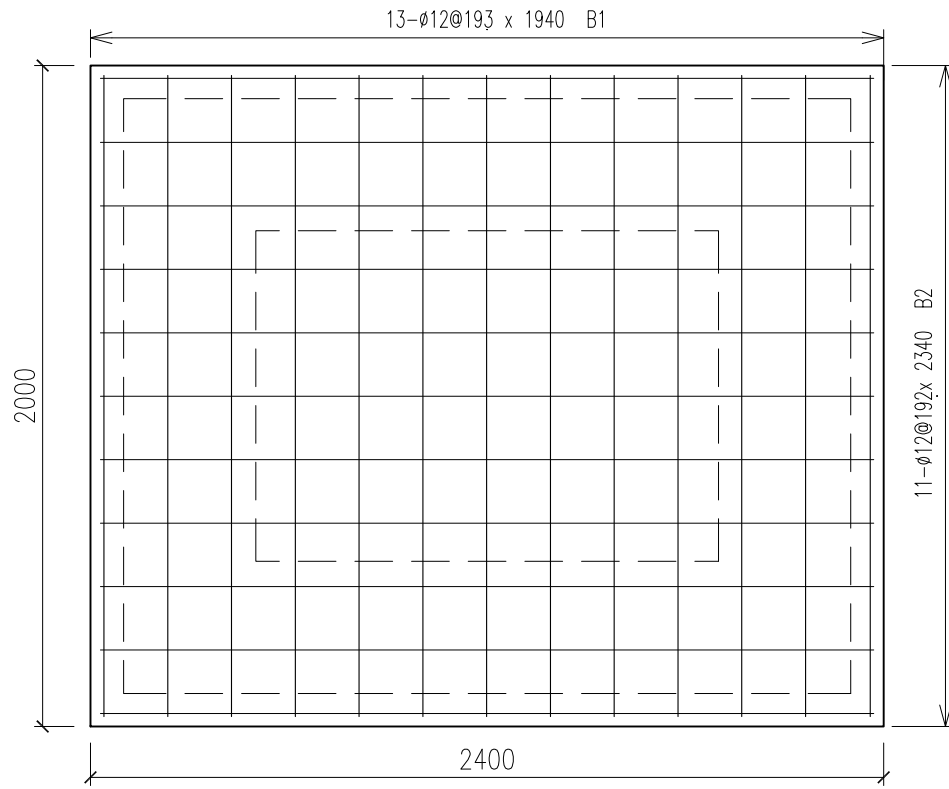
Project:
The Project for Strengthening Operation and Maintenance of Rural Water Supply Systems in Rwanda

Work:
Installation of Water Meter and Chlorination Unit

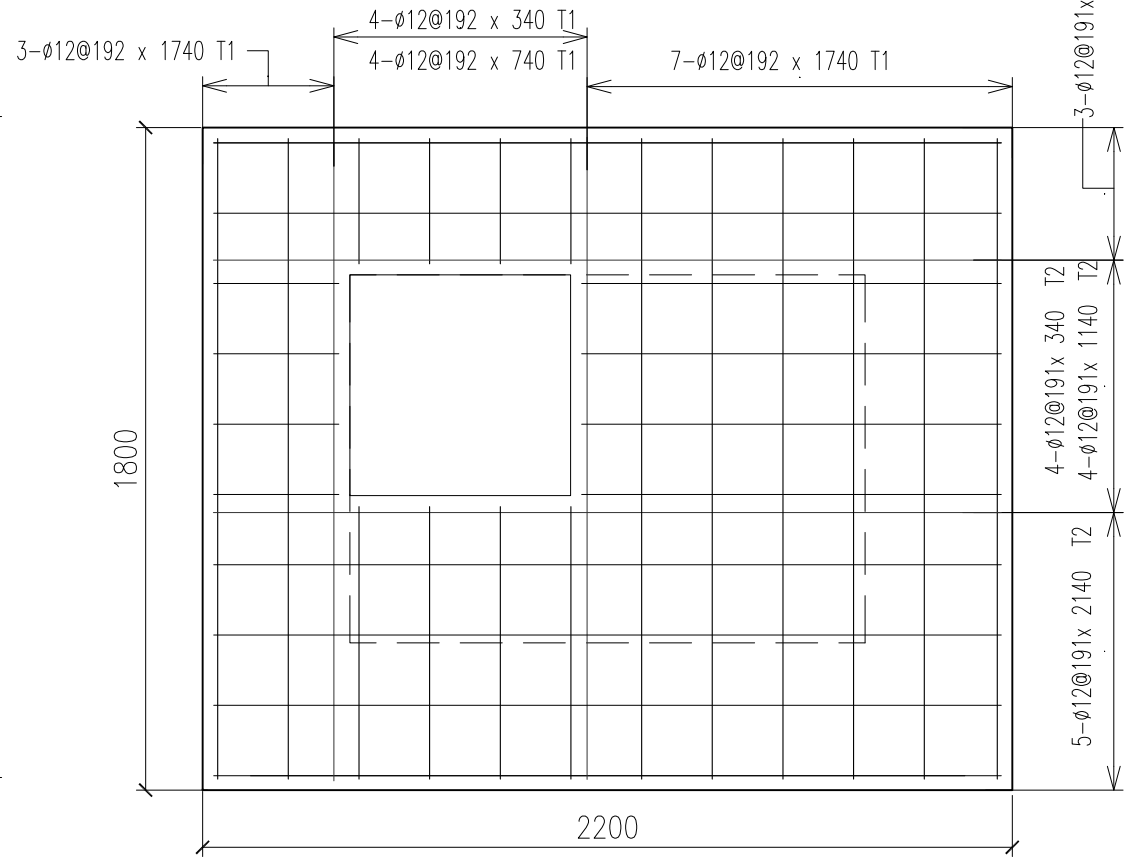
Drawing Title:
Kagoma
Meter Chamber K-2 Section

SCALE 1 : 20	DATE July 2017	DWG No. A4-K6
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Sheet No.
42



Bottom Slab Reinforcement Layout



Top Slab Reinforcement Layout

Client:
Kokusai Kogyo Co.,Ltd.

Project:
The Project for Strengthening Operation and Maintenance of Rural Water Supply Systems in Rwanda

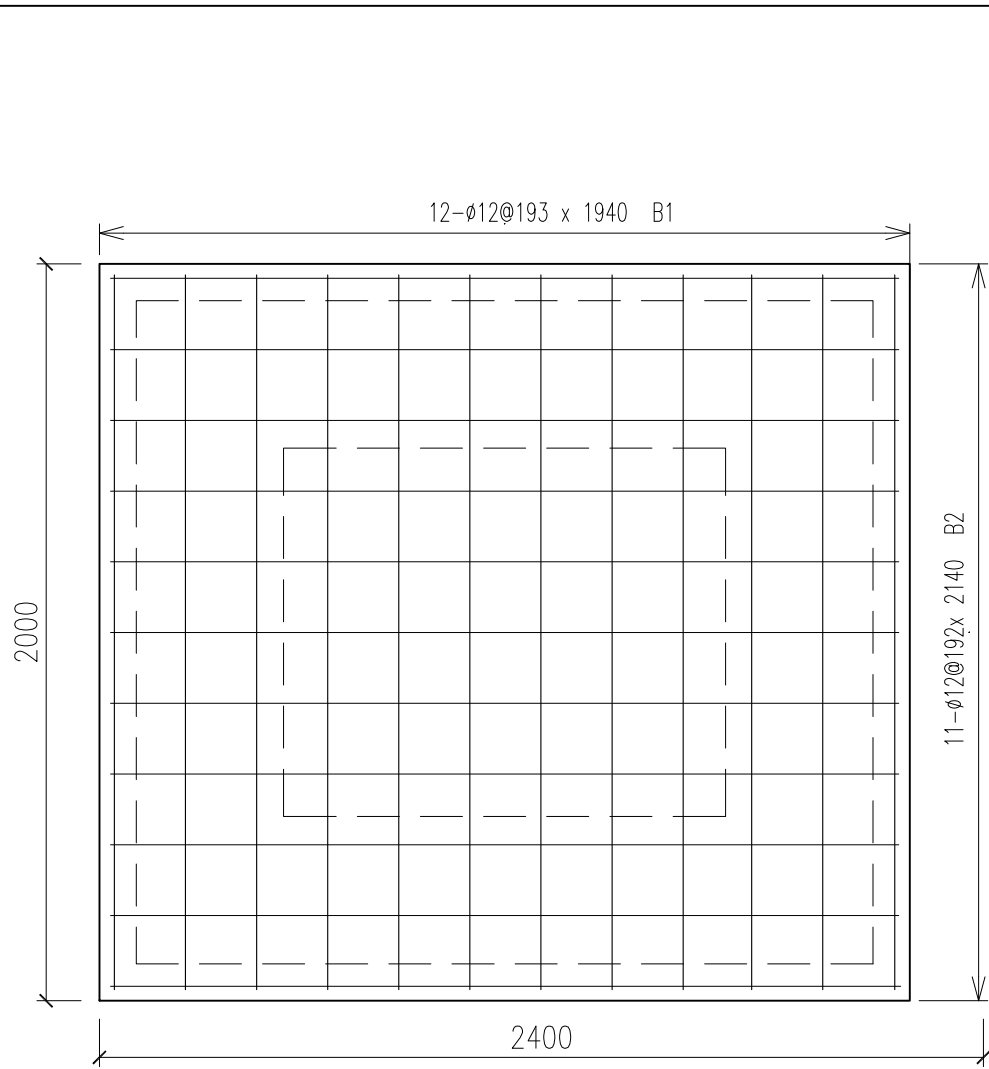
Work:
Installation of Water Meter and Chlorination Unit

Drawing Title:
Kagoma
Meter Chamber K-1 Top and Bottom Slab Reinforcement

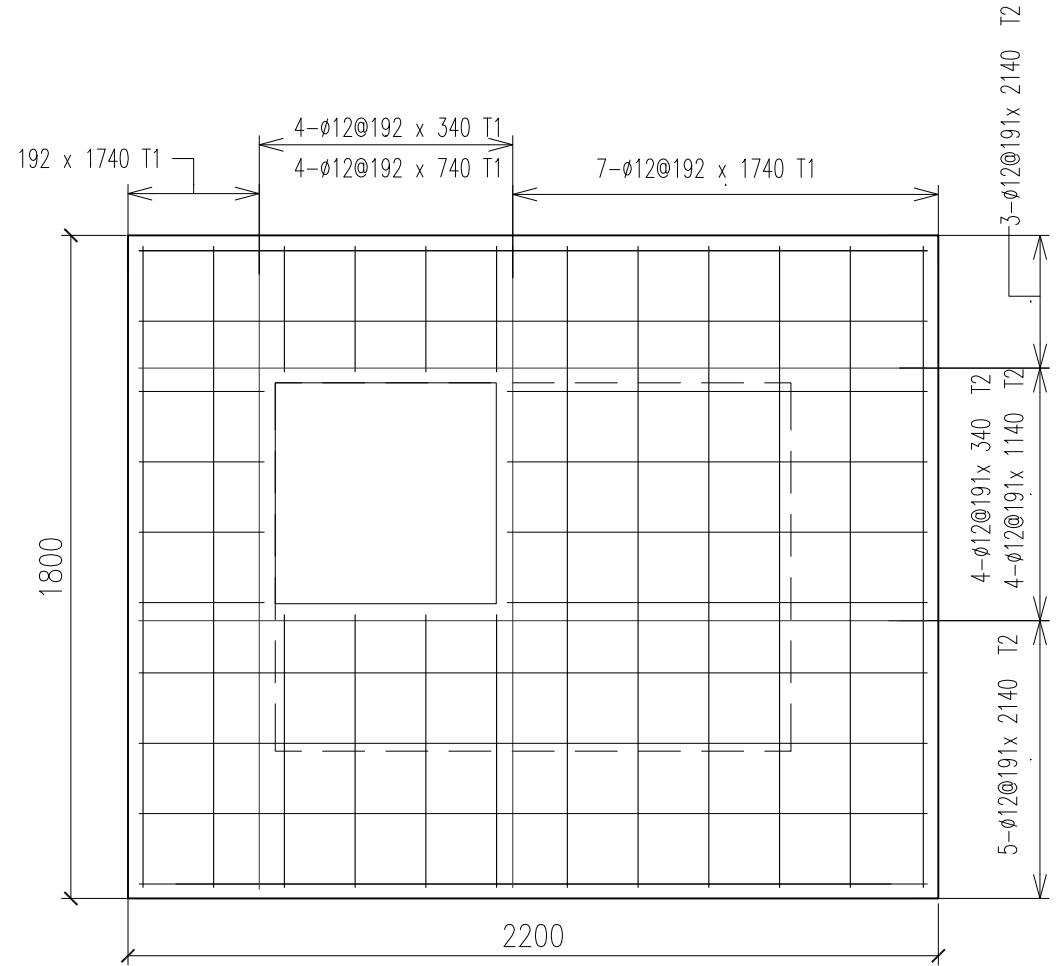
Sheet No.

SCALE 1 : 20	DATE July 2017	DWG No. A4-K7
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43



Bottom Slab Reinforcement Layout



Top Slab Reinforcement Layout

Client:
Kokusai Kogyo Co.,Ltd.

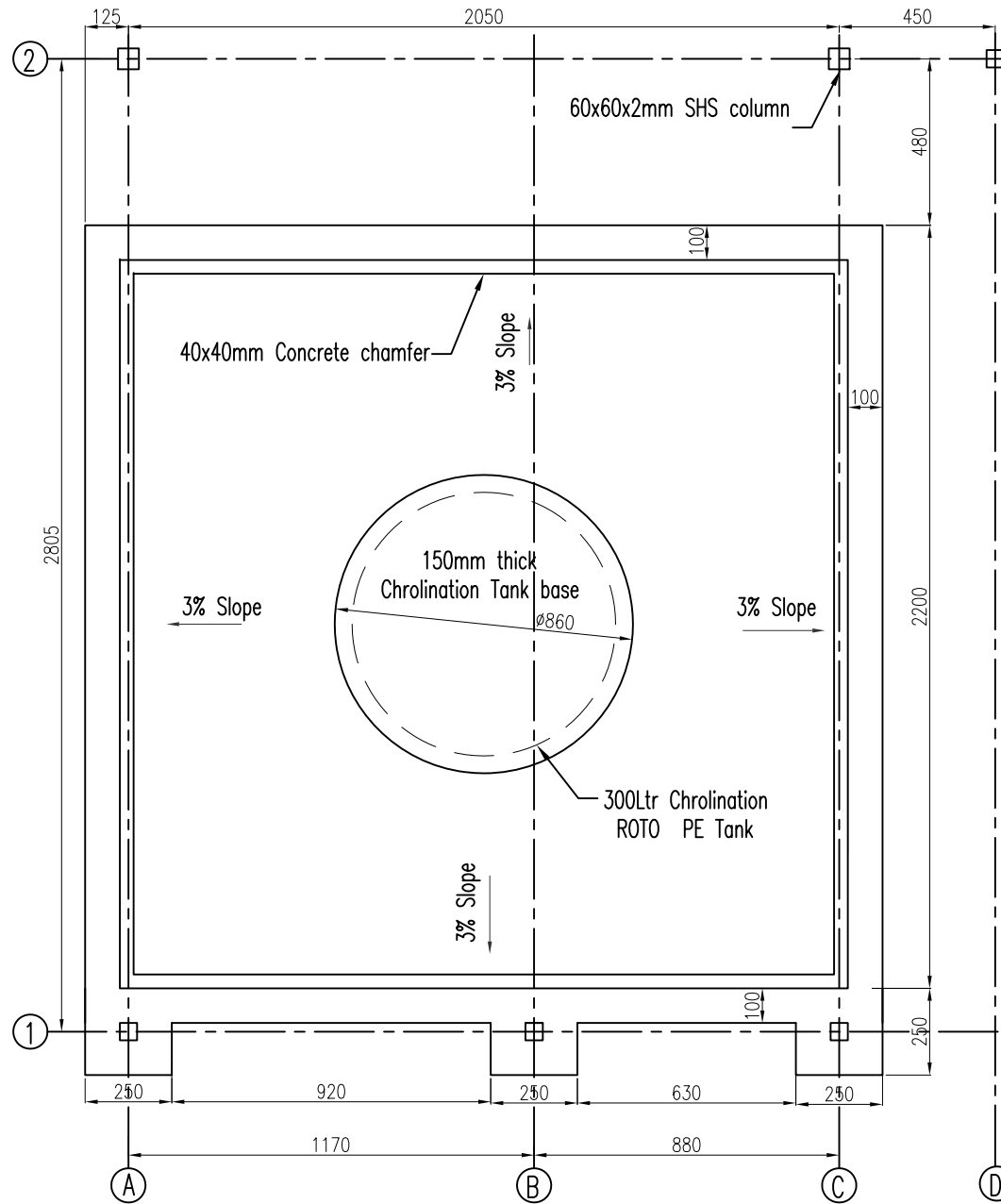
Project:
The Project for Strengthening Operation and Maintenance of Rural Water Supply Systems in Rwanda

Work:
Installation of Water Meter and Chlorination Unit

Drawing Title:
Kagoma
Meter Chamber K-2 Top and Bottom Slab Reinforcement

SCALE	DATE	DWG No.
1 : 20	July 2017	A4-K8

Sheet No.
44



Base Slab layout

Client:
Kokusai Kogyo Co.,Ltd.

Project:
The Project for Strengthening Operation and Maintenance of Rural Water Supply Systems in Rwanda

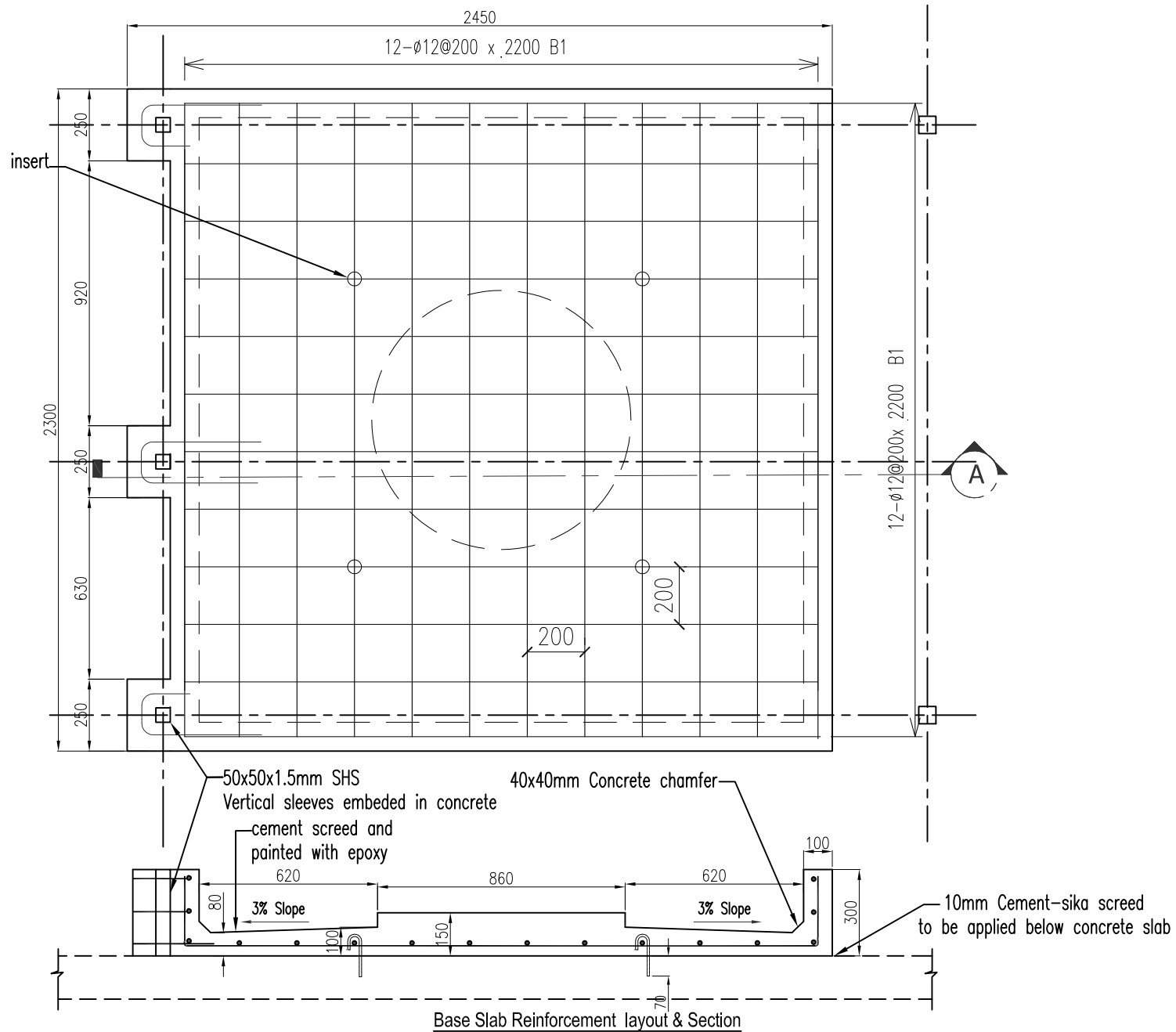
Work:
Installation of Water Meter and Chlorination Unit

Drawing Title:
Kagoma
Chlorination Unit Base Slab Layout

Sheet No.

45

SCALE 1 : 20	DATE July 2017	DWG No. A4-K9
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Client:
Kokusai Kogyo Co.,Ltd.

Project:
The Project for Strengthening Operation and
Maintenance of Rural Water Supply Systems
in Rwanda

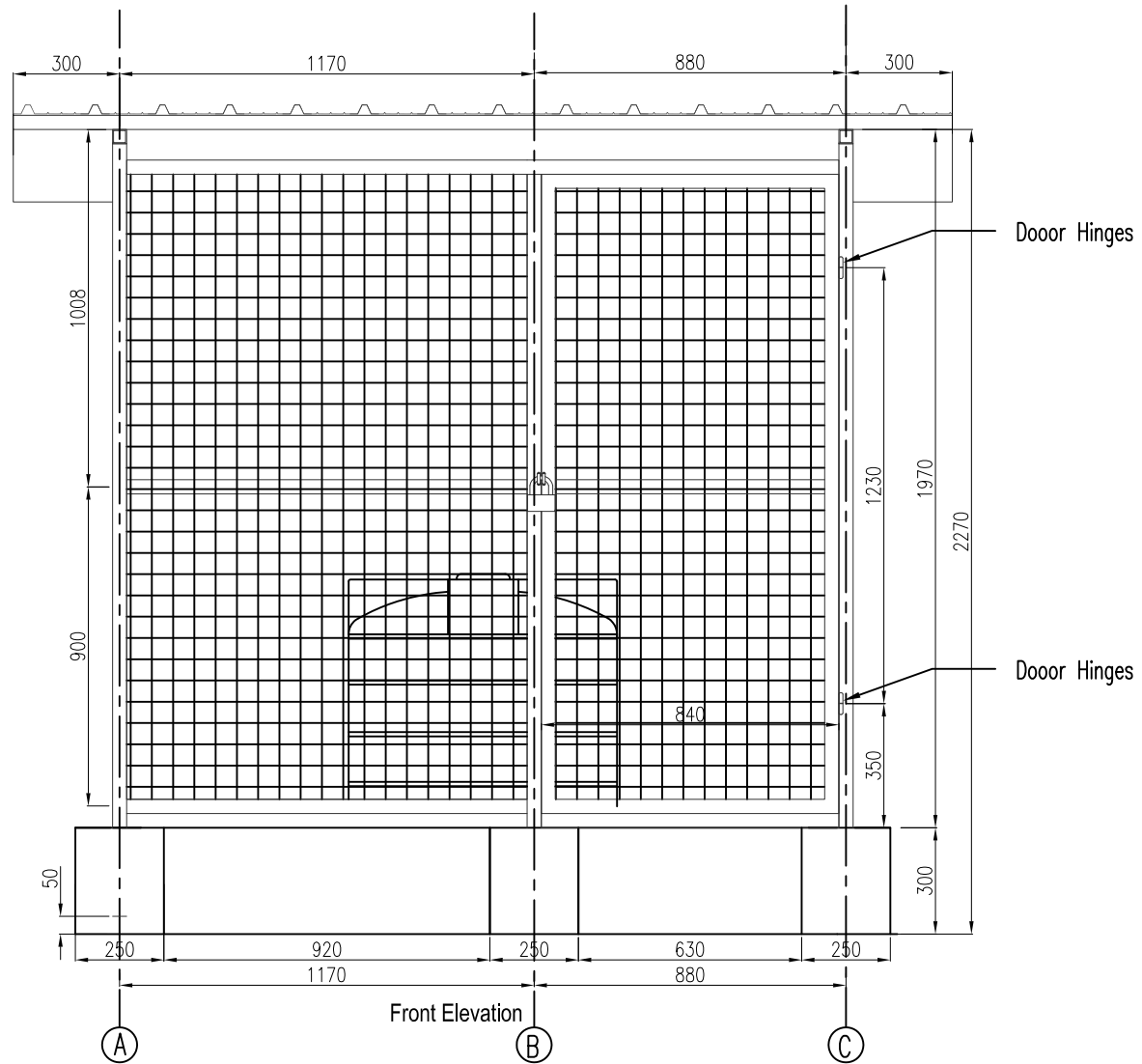
Work:
Installation of Water Meter and
Chlorination Unit

Drawing Title:
Kagoma
Chlorination Unit Base Slab Reinforcement

SCALE 1 : 20	DATE July 2017	DWG No. A4-K10
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Sheet No.

46



Client:
Kokusai Kogyo Co.,Ltd.

Project:
The Project for Strengthening Operation and
Maintenance of Rural Water Supply Systems
in Rwanda

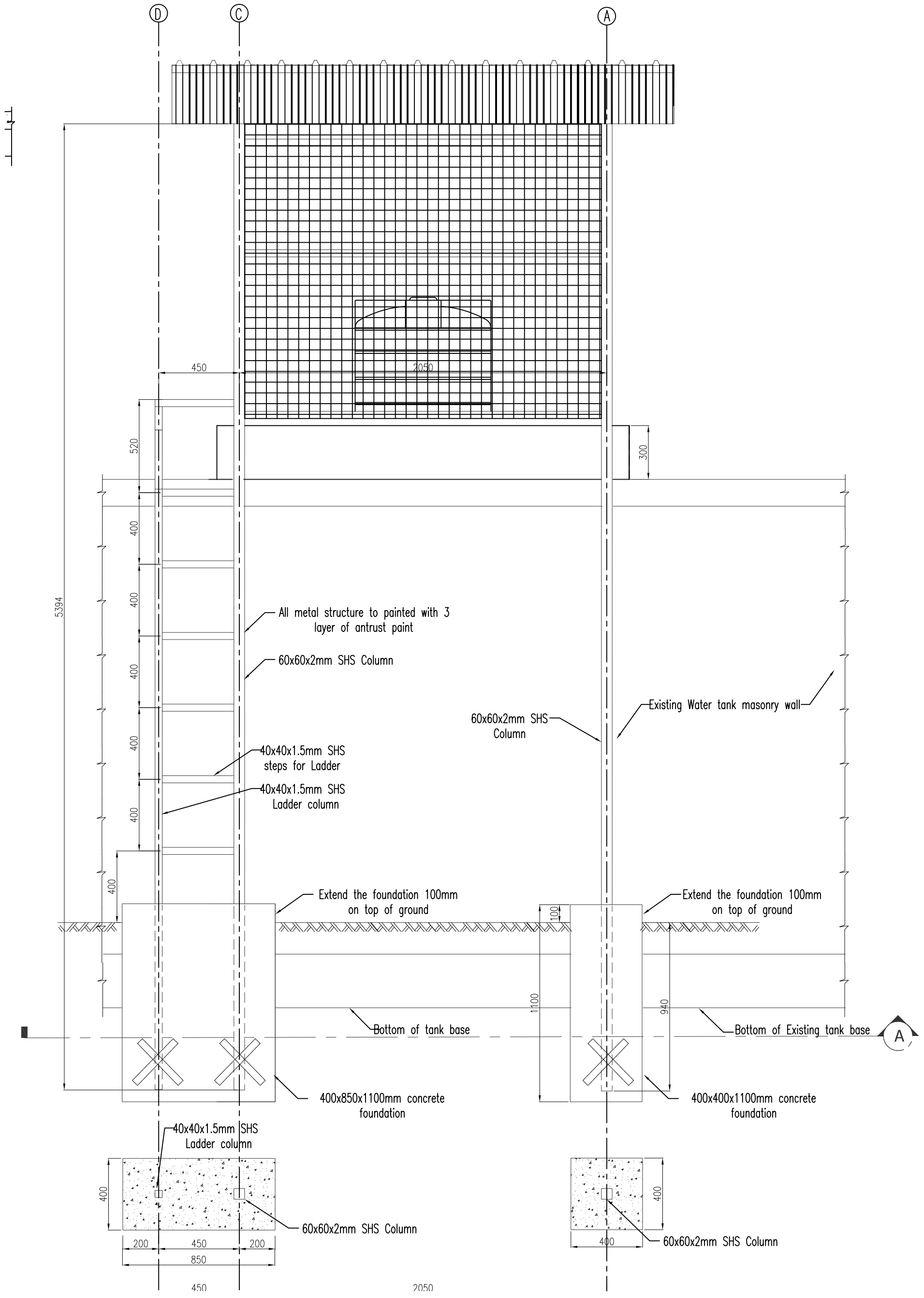
Work:
Installation of Water Meter and
Chlorination Unit

Drawing Title:
Kagoma
Chlorination Unit Front Elevation

SCALE 1 : 20	DATE July 2017	DWG No. A4-K11
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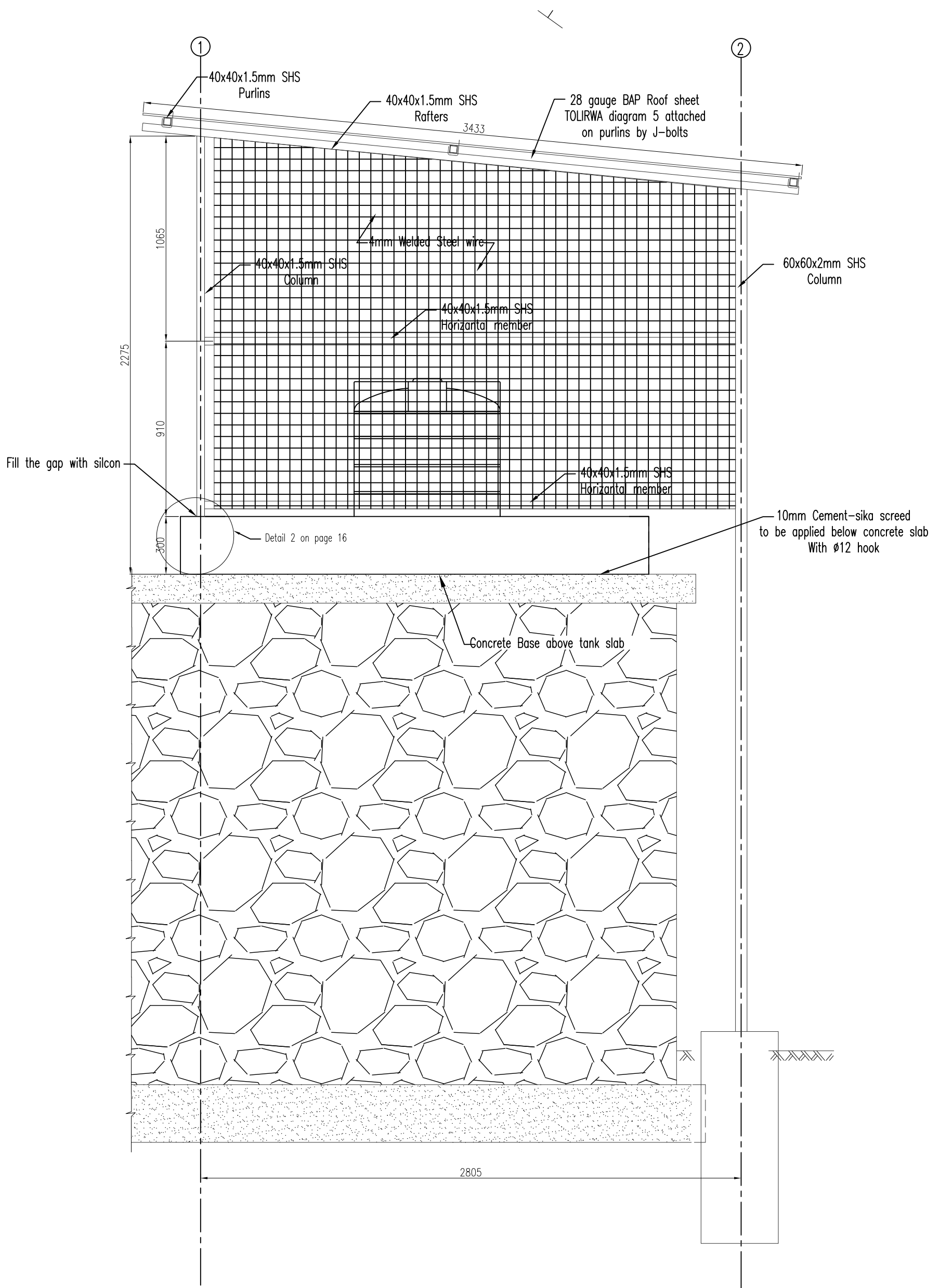
Sheet No.

47



Rear Elevation

Client: Kokusai Kogyo Co.,Ltd.	Project: The Project for Strengthening Operation and Maintenance of Rural Water Supply Systems in Rwanda	Work: Installation of Water Meter and Chlorination Unit	Drawing Title: Kagoma Chlorination Unit Rear Elevation			Sheet No. 48
			SCALE 1 : 20	DATE July 2017	DWG No. A3-K12	



Side Elevation

Client:
Kokusai Kogyo Co.,Ltd.

Project:
The Project for Strengthening Operation and
Maintenance of Rural Water Supply Systems
in Rwanda

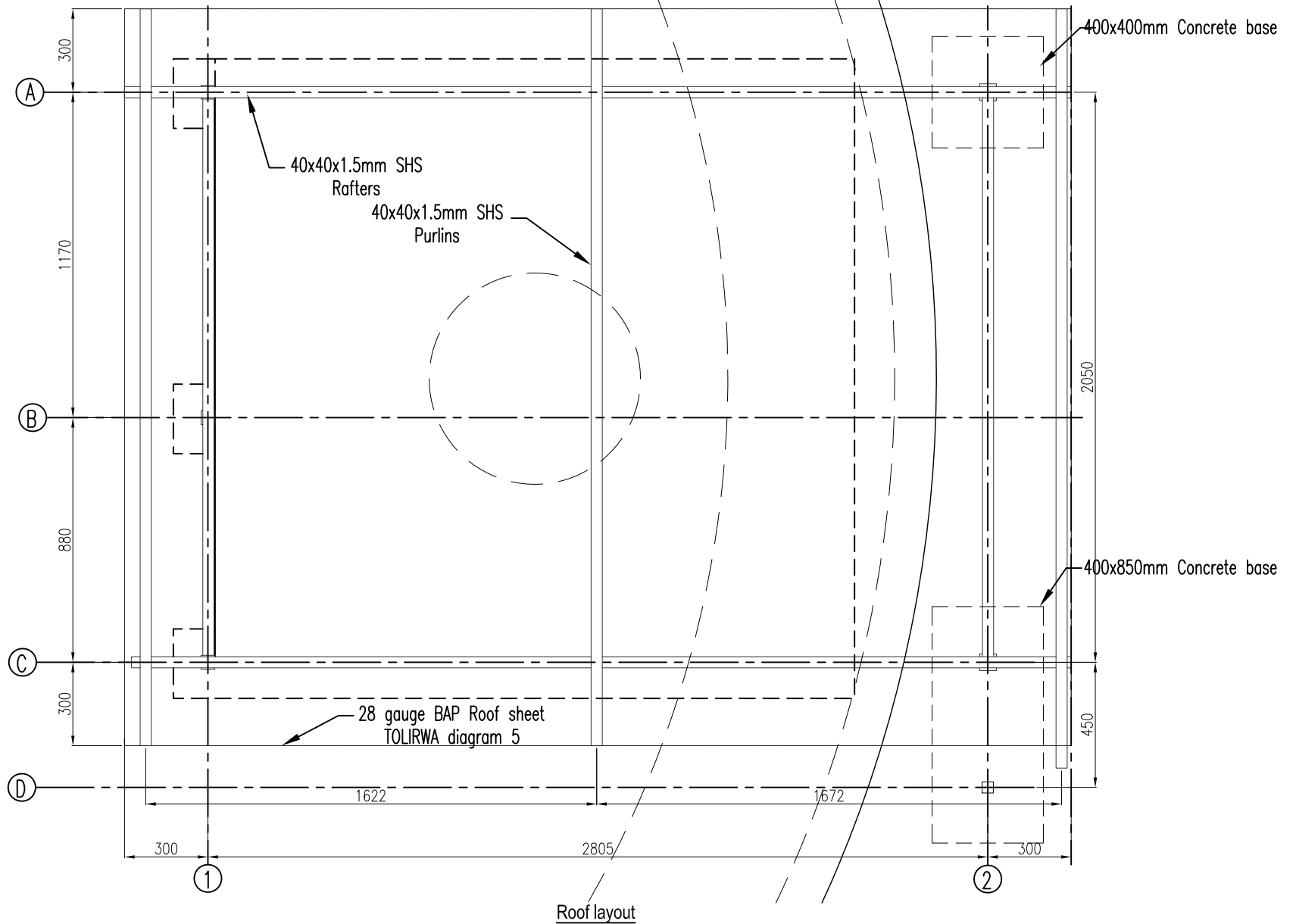
Work:
Installation of Water Meter and
Chlorination Unit

Drawing Title:
Kagoma
Chlorination Unit Side Elevation

Sheet No.

49

SCALE 1 : 20	DATE July 2017	DWG No. A3-K13
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Client:
Kokusai Kogyo Co.,Ltd.

Project:
The Project for Strengthening Operation and Maintenance of Rural Water Supply Systems in Rwanda

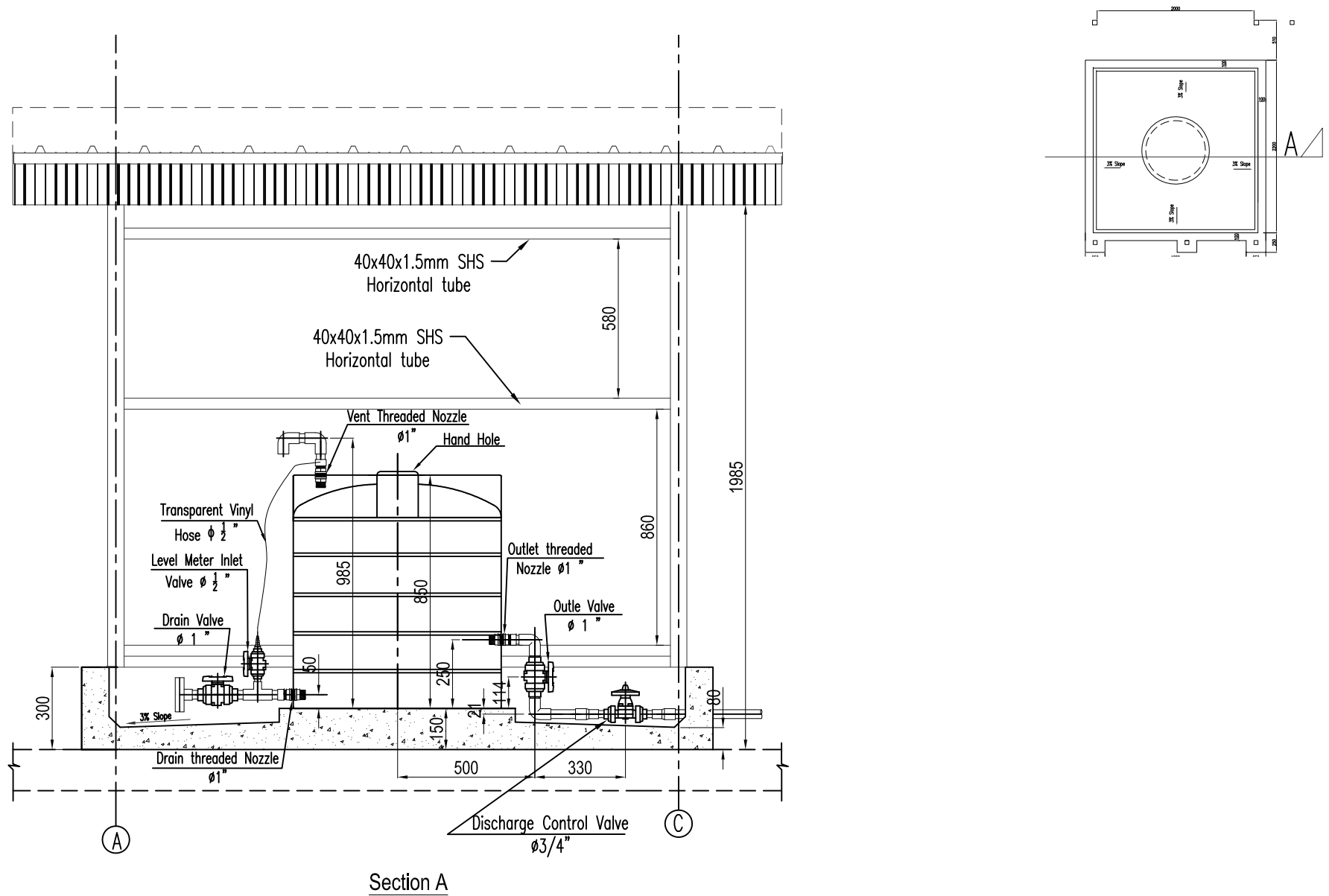
Work:
Installation of Water Meter and Chlorination Unit

Drawing Title:
Kagoma
Chlorination Unit Roof Layout

Sheet No.

SCALE 1 : 20	DATE July 2017	DWG No. A4-K14
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50



Client:
Kokusai Kogyo Co.,Ltd.

Project:
The Project for Strengthening Operation and Maintenance of Rural Water Supply Systems in Rwanda

Work:
Installation of Water Meter and Chlorination Unit

Drawing Title:
Kagoma
Chlorination Unit Section

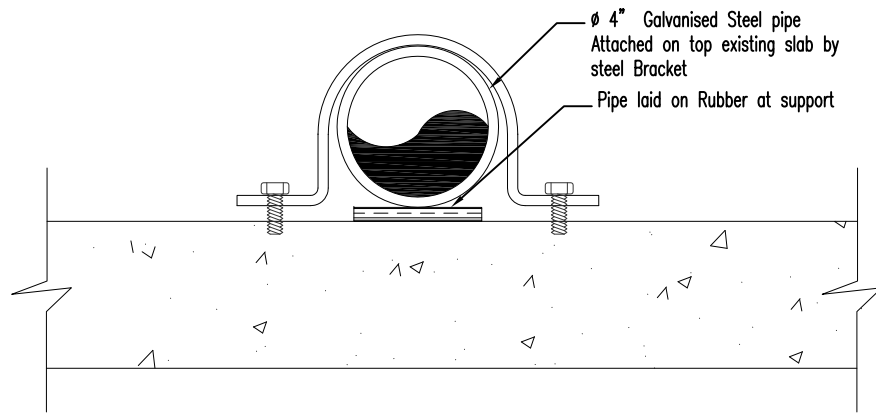
Sheet No.

51

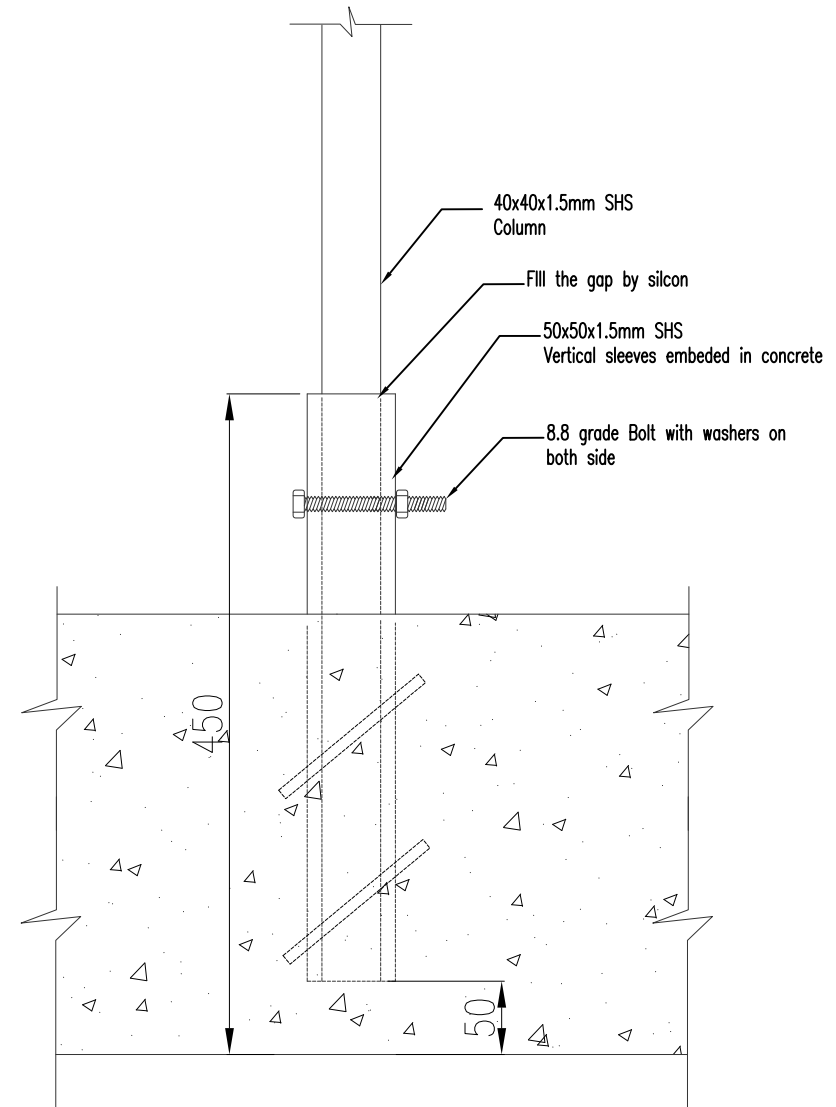
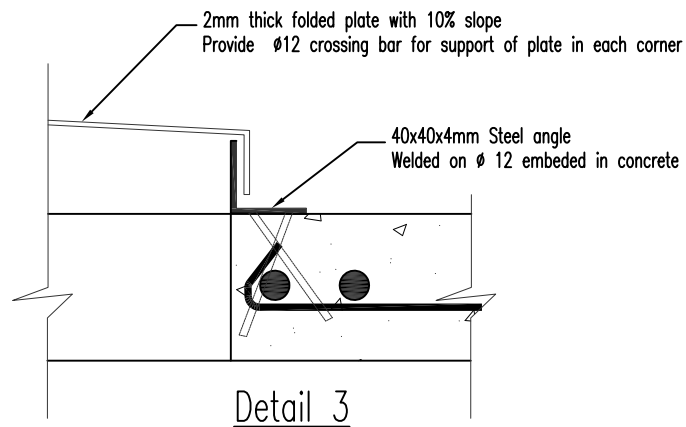
SCALE
1 : 20

DATE
July 2017

DWG No.
A4-K15



Fixing Detail 1- GS pipe on Tank Roof Sab



Fixing Detail 2 - SHS tube to concrete base

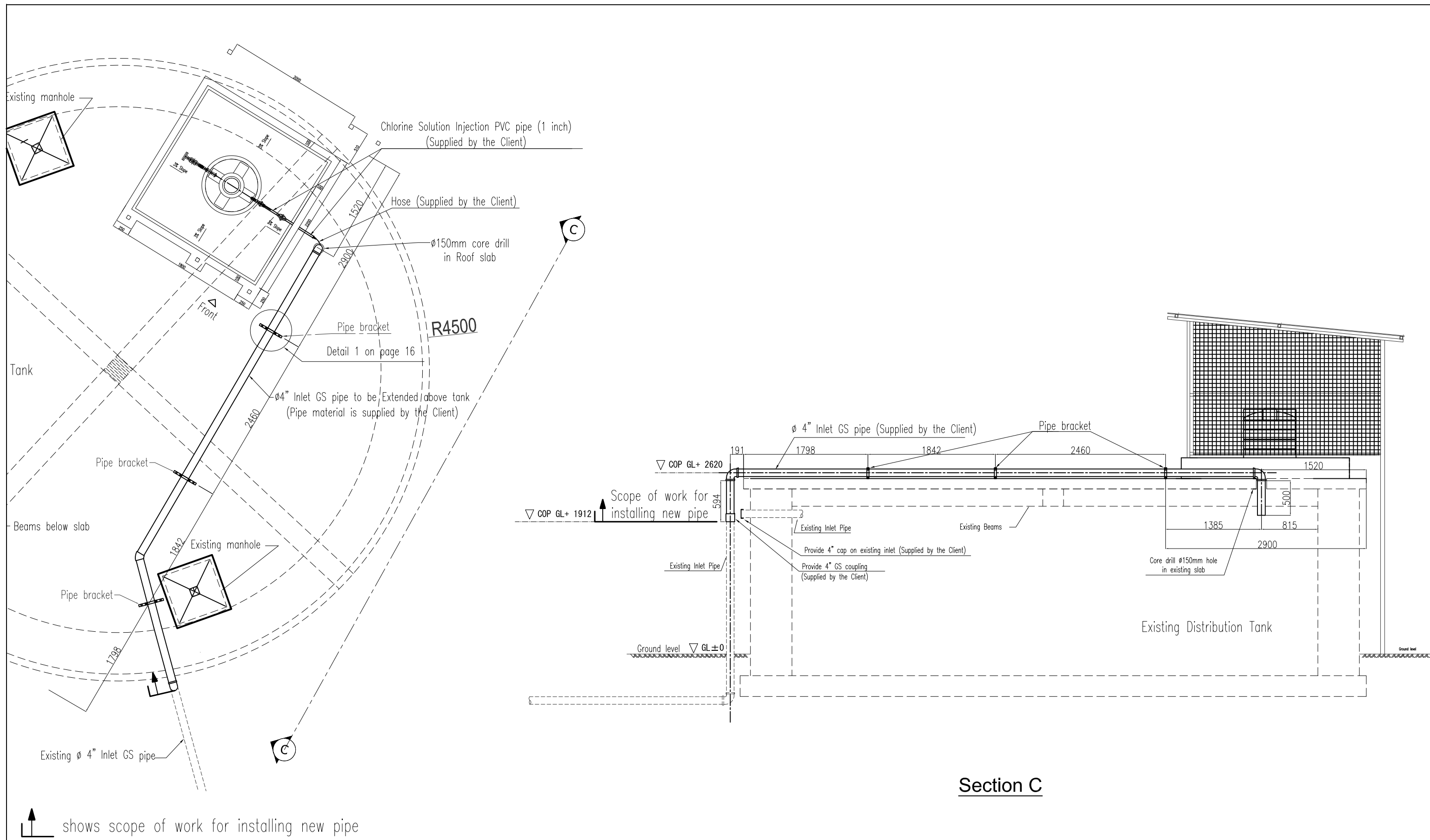
Client:
Kokusai Kogyo Co.,Ltd.

Project:
The Project for Strengthening Operation and Maintenance of Rural Water Supply Systems in Rwanda

Work:
Installation of Water Meter and Chlorination Unit

Drawing Title: Kagoma
Meter Chamber and Chlorination Unit Fixing Details
SCALE: 1:5 DATE: July 2017 DWG No.: A4-K16

Sheet No.
52

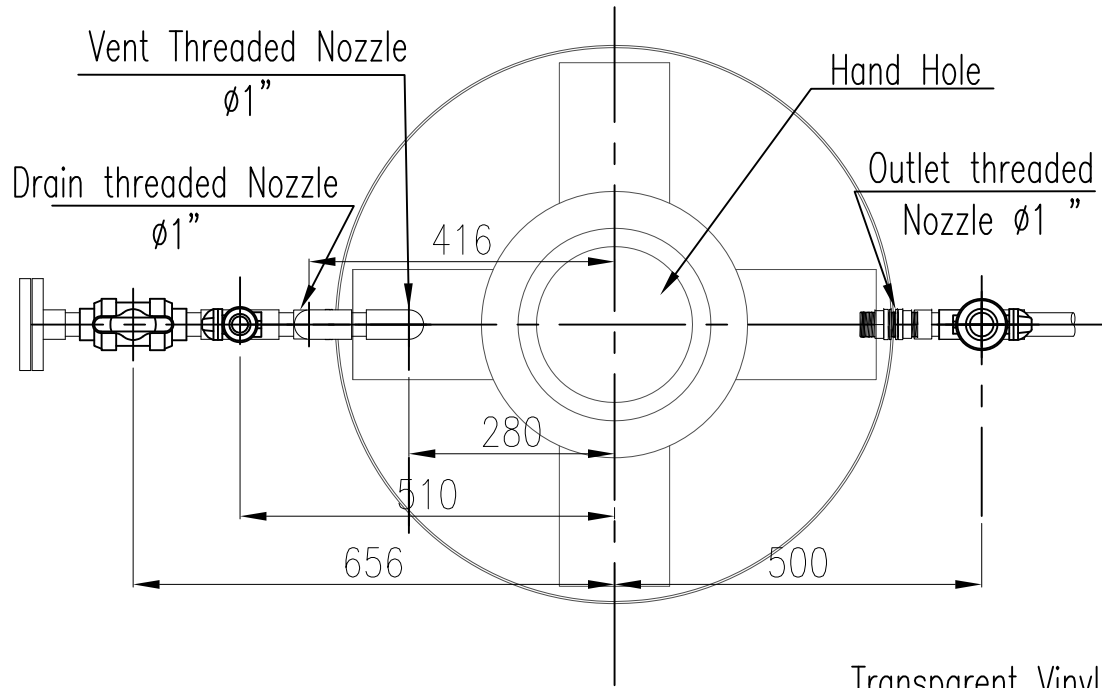


Layout

Section C

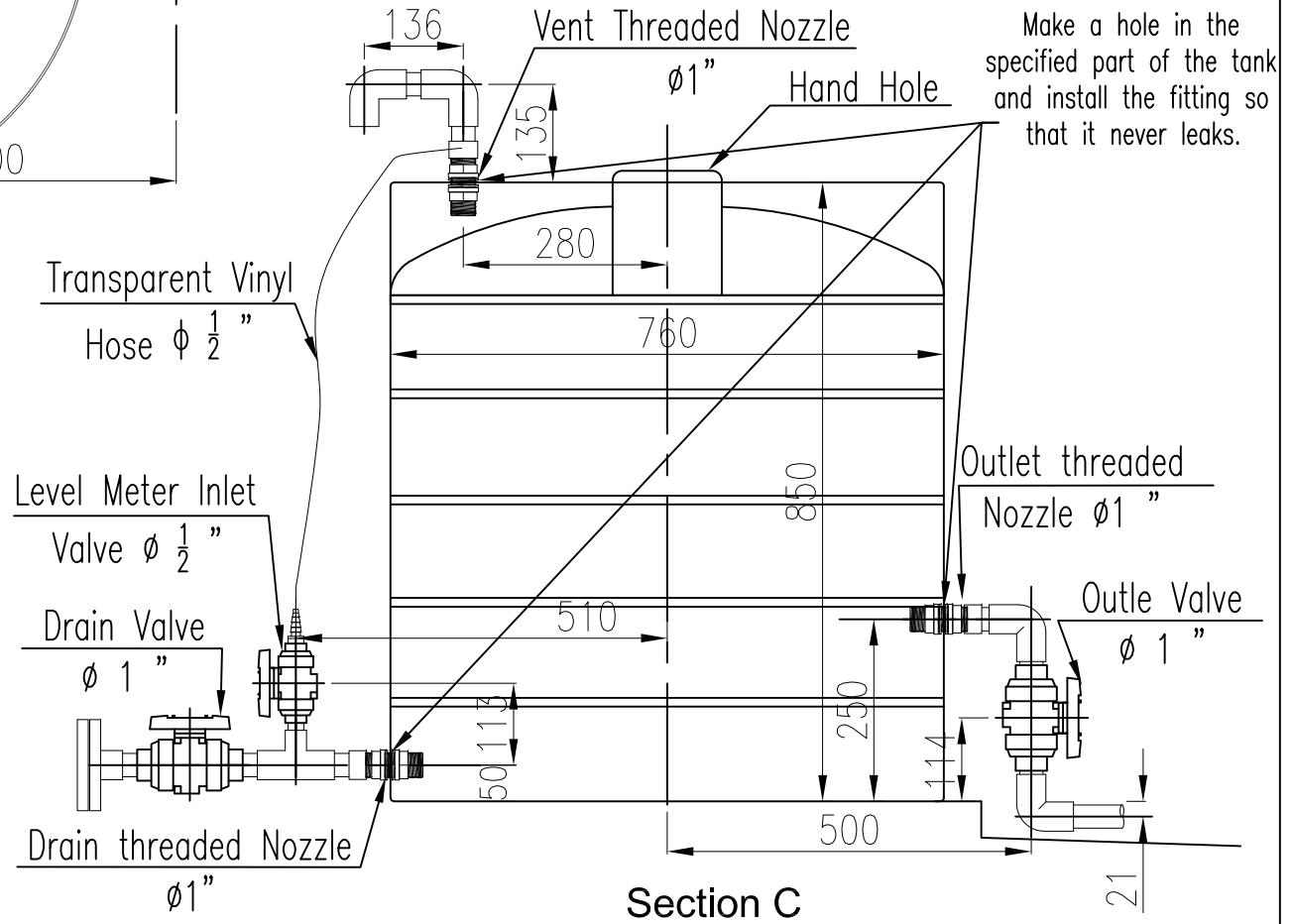
↑ shows scope of work for installing new pipe

Client: Kokusai Kogyo Co.,Ltd.	Project: The Project for Strengthening Operation and Maintenance of Rural Water Supply Systems in Rwanda	Work: Installation of Water Meter and Chlorination Unit	Drawing Title: Kagoma Chlorination Unit Injection Piping		Sheet No. 53
			SCALE 1 : 50	DATE July 2017	



Nominal capacity : 300 L
 Material : PE (Polyethylene)
 Color : Black
 Brand : ROTO

Layout



Make a hole in the specified part of the tank and install the fitting so that it never leaks.

Section C

Note:
 Pe Tank, valves, nozzle, pipe and other piping material in this drawing are supplied by the Client. The contractor shall provide means of assembly and workmanship.

Client:
 Kokusai Kogyo Co.,Ltd.

Project:
 The Project for Strengthening Operation and Maintenance of Rural Water Supply Systems in Rwanda

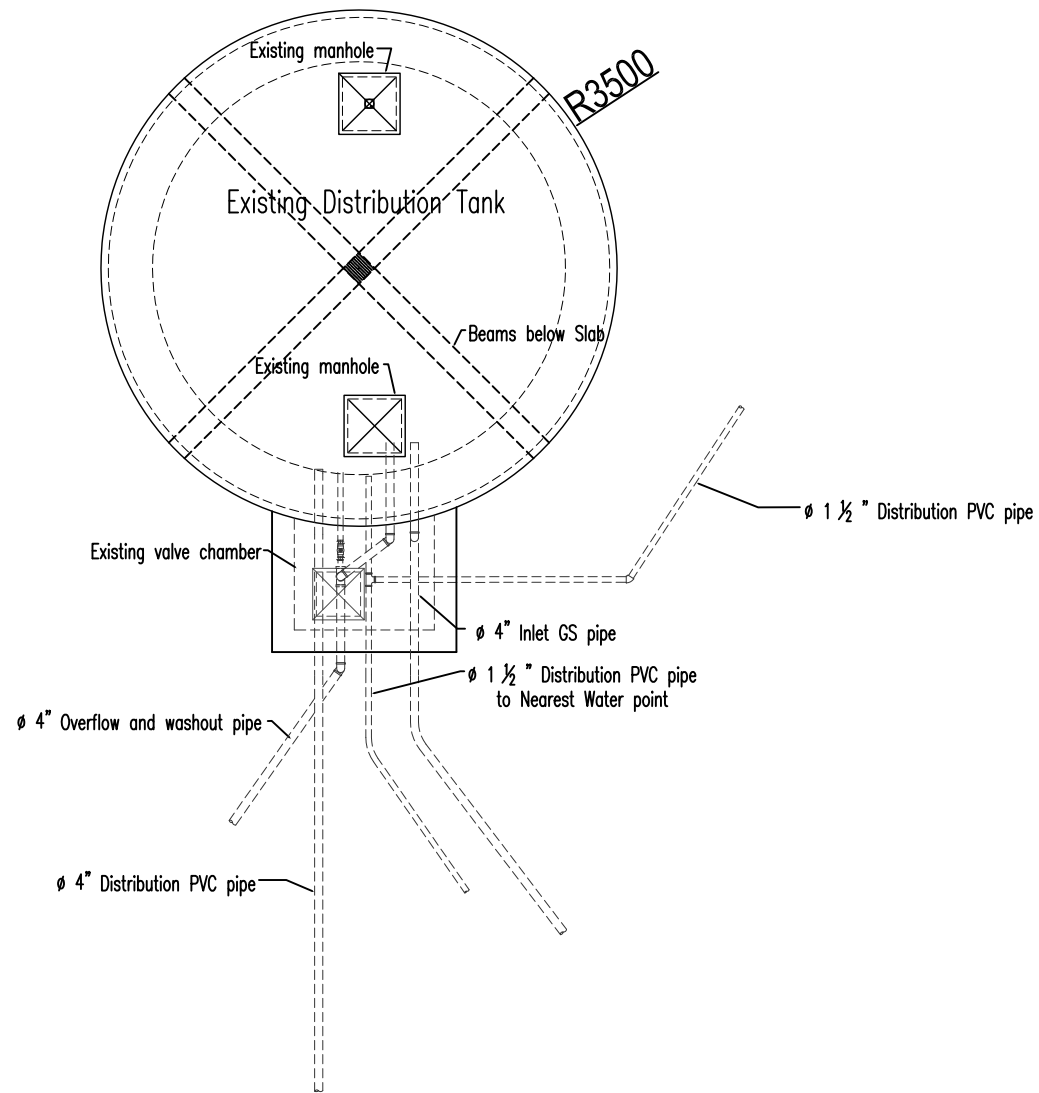
Work:
 Installation of Water Meter and Chlorination Unit

Drawing Title:
 Kagoma
 Calcium Hypochlorite Solution Tank

SCALE 1 : 10	DATE July 2017	DWG No. A4-K18
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Sheet No.
 54

Gahezi - Existing Distribution Tank



Client:
Kokusai Kogyo Co.,Ltd.

Project:
The Project for Strengthening Operation and Maintenance of Rural Water Supply Systems in Rwanda

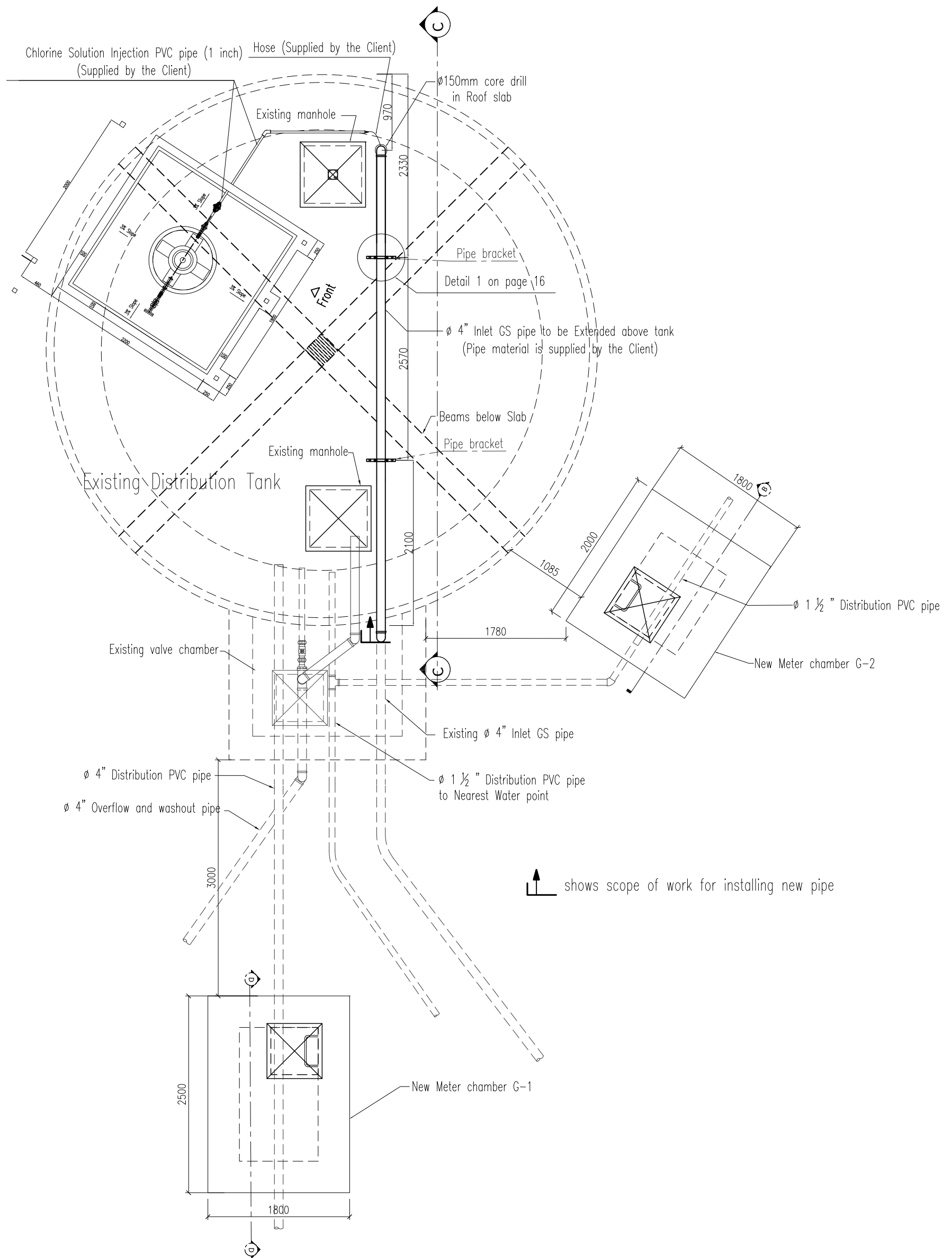
Work:
Installation of Water Meter and Chlorination Unit

Drawing Title:
Gahezi
Existing Distribution Tank Layout

Sheet No.

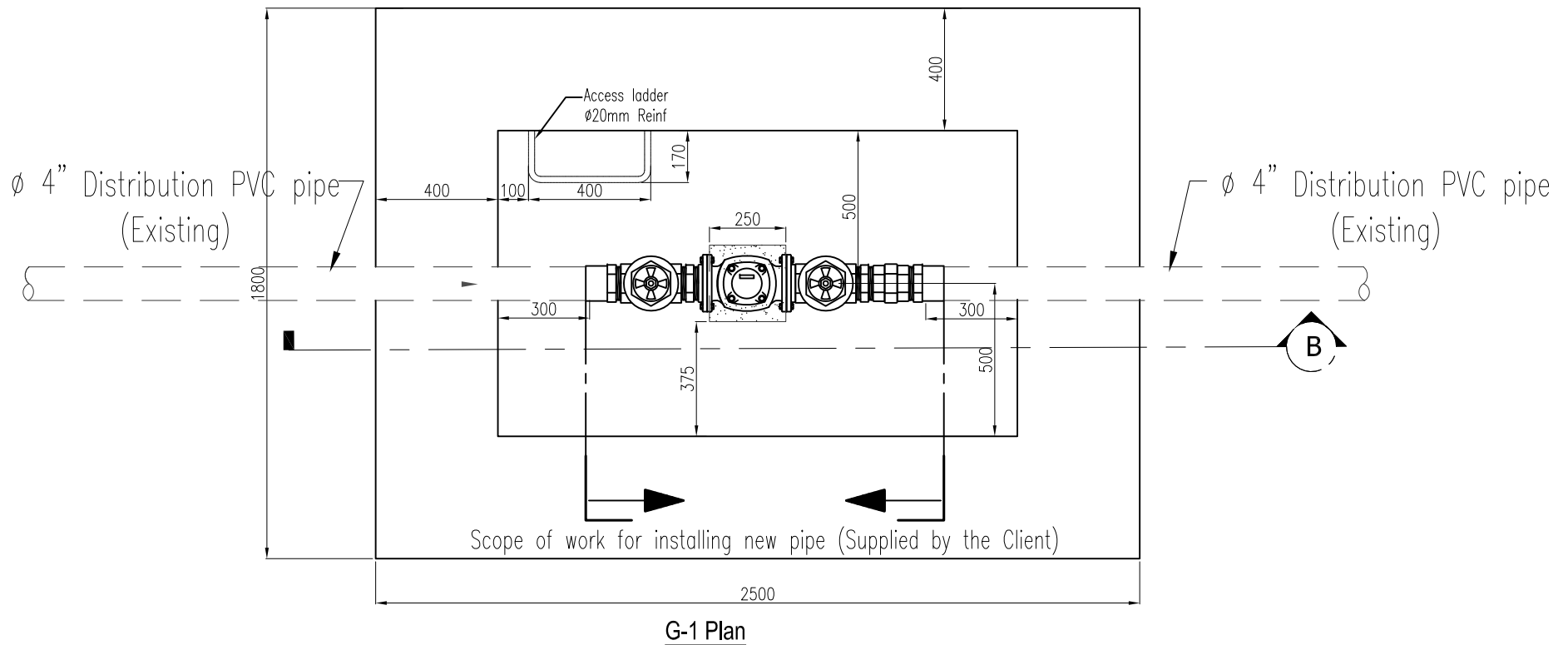
55


SCALE 1 : 100	DATE July 2017	DWG No. A4-G1
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Water Meter Chamber and Chlorination Unit Layout

Client: Kokusai Kogyo Co.,Ltd.	Project: The Project for Strengthening Operation and Maintenance of Rural Water Supply Systems in Rwanda	Work: Installation of Water Meter and Chlorination Unit	Drawing Title: Gaenzi Water Meter Chamber and Chlorination Unit Layout	Sheet No. 56						
			<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%;">SCALE</td> <td style="width: 33%;">DATE</td> <td style="width: 33%;">DWG No.</td> </tr> <tr> <td>1 : 50</td> <td>July 2017</td> <td>A3-G2</td> </tr> </table>	SCALE	DATE	DWG No.	1 : 50	July 2017	A3-G2	
SCALE	DATE	DWG No.								
1 : 50	July 2017	A3-G2								




 shows scope of work for installing new pipe
 (Piping material is supplied by the Client)

Client:
 Kokusai Kogyo Co.,Ltd.

Project:
 The Project for Strengthening Operation and
 Maintenance of Rural Water Supply Systems
 in Rwanda

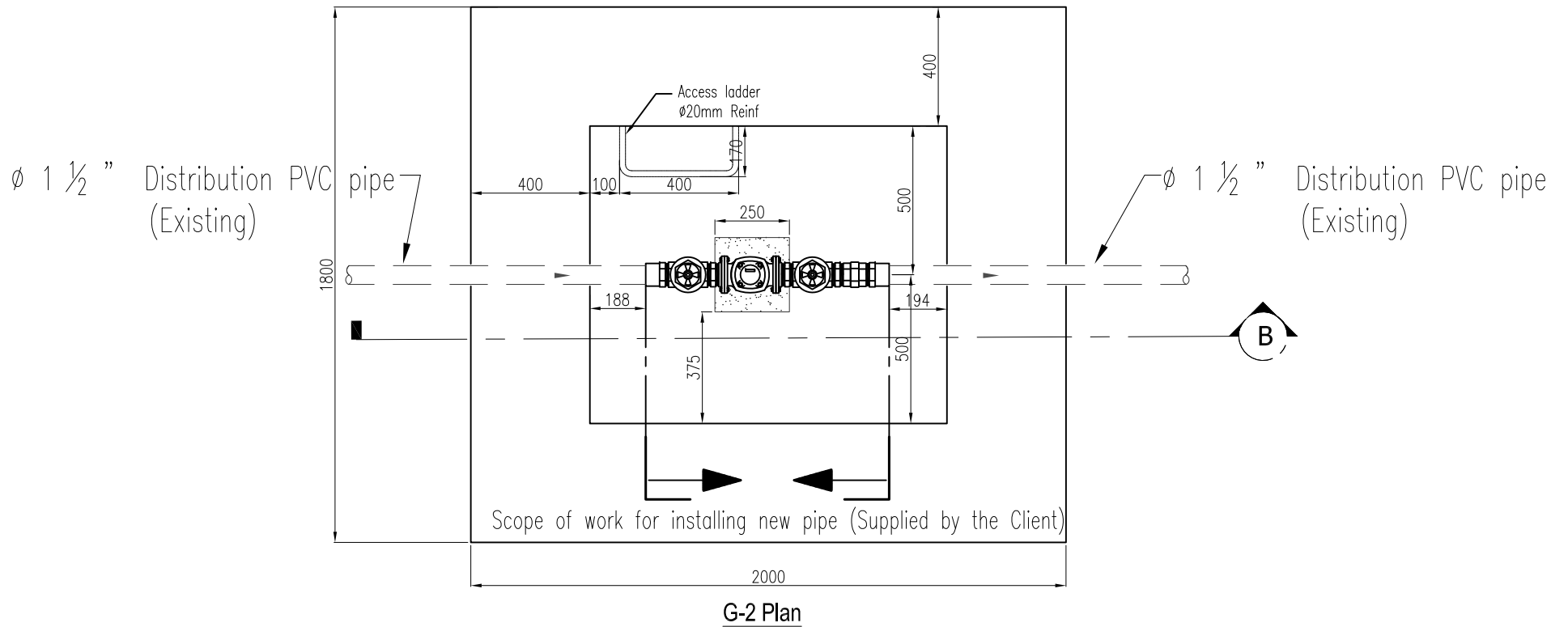
Work:
 Installation of Water Meter and
 Chlorination Unit

Drawing Title:
 Gaezi
 Meter Chamber G-1 Plan

SCALE	DATE	DWG No.
1 : 20	July 2017	A4-G3

Sheet No.

57



shows scope of work for installing new pipe
 (Piping material is supplied by the Client)

Client:
 Kokusai Kogyo Co.,Ltd.

Project:
 The Project for Strengthening Operation and
 Maintenance of Rural Water Supply Systems
 in Rwanda

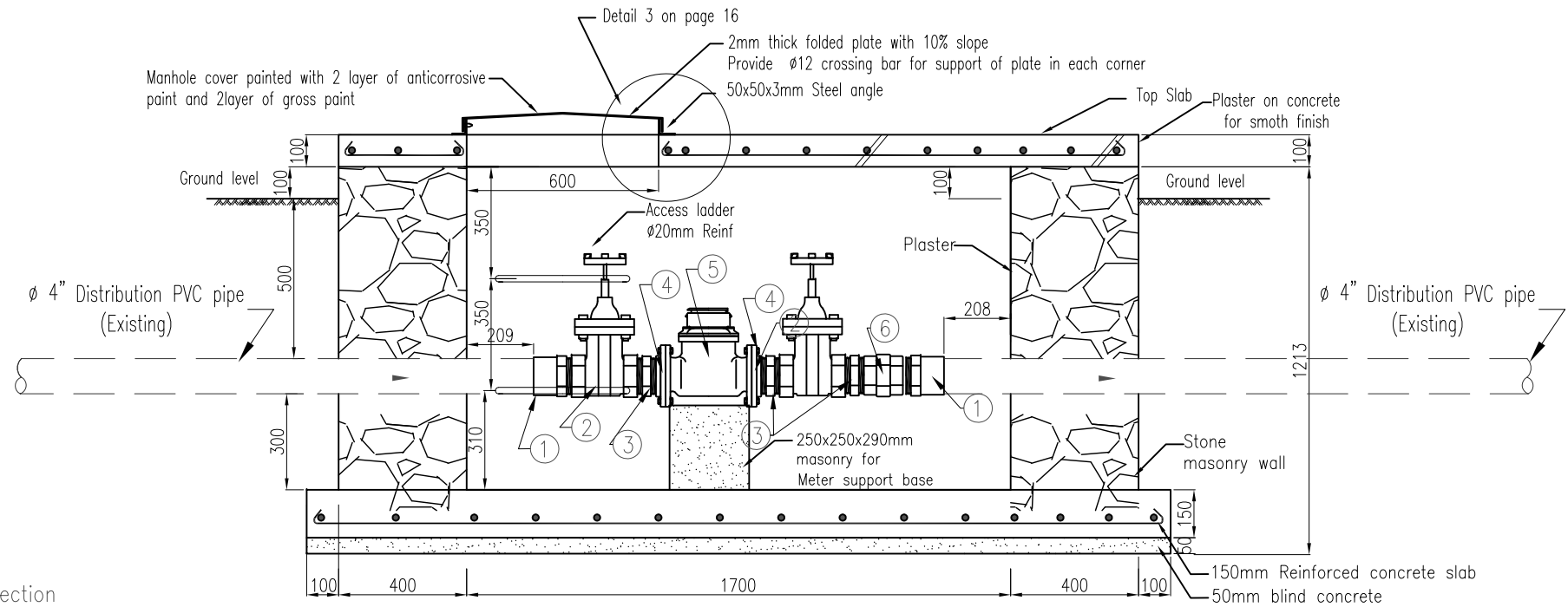
Work:
 Installation of Water Meter and
 Chlorination Unit

Drawing Title:
 Gahezi
 Meter Chamber G-2 Plan

SCALE 1 : 20	DATE July 2017	DWG No. A4-G4
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Sheet No.

58



Section B

Meter connection
Parts list (Supplied by the Client)

- ① Adapter
- ② Valve
- ③ Nipple
- ④ Flange
- ⑤ Water Meter
- ⑥ GS Union

Note:

All Plumbing materials to be supplied by the client, the contractor Will provide means of assembly and workmanship

Client:
Kokusai Kogyo Co.,Ltd.

Project:
The Project for Strengthening Operation and Maintenance of Rural Water Supply Systems in Rwanda

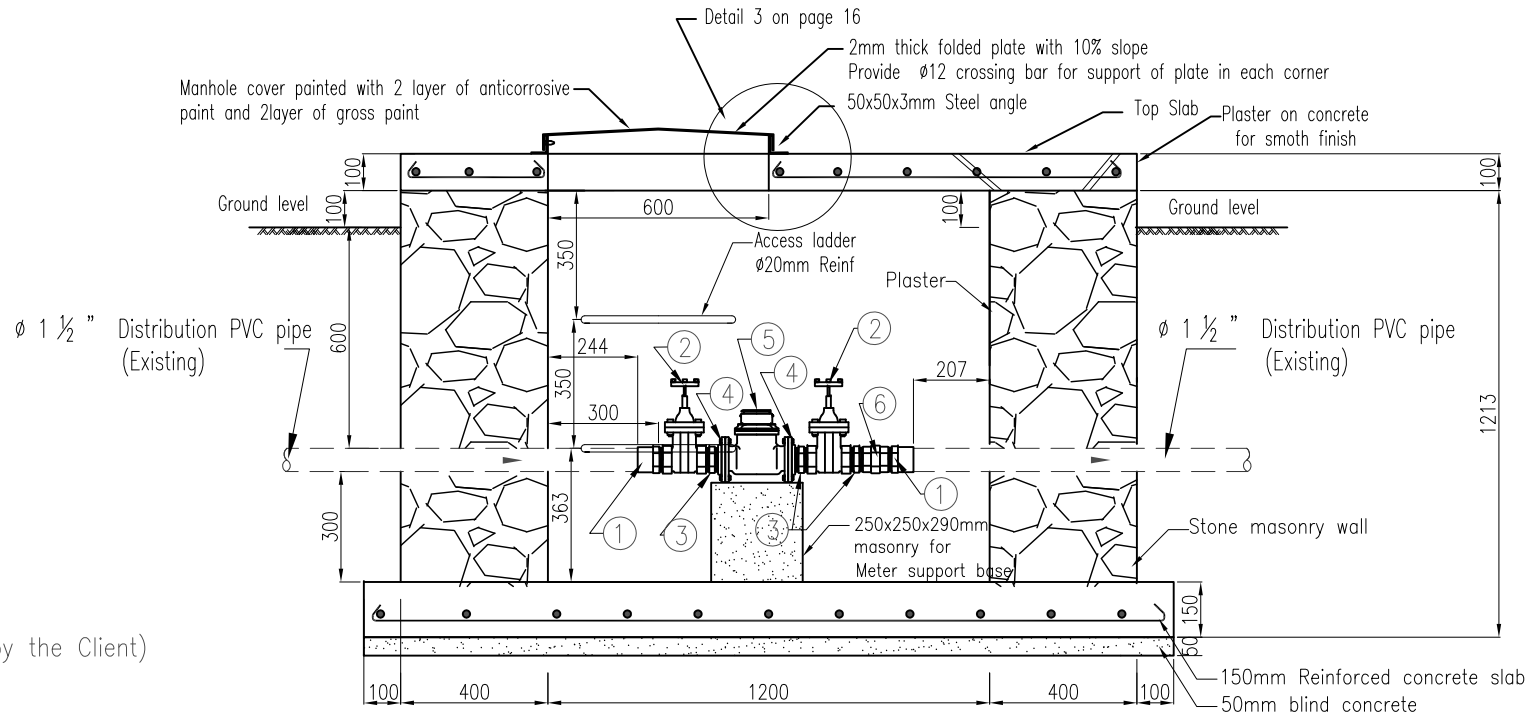
Work:
Installation of Water Meter and Chlorination Unit

Drawing Title:
Gahezi
Meter Chamber G-1 Section

Sheet No.

SCALE 1 : 20	DATE July 2017	DWG No. A4-G5
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59



Meter connection
Parts list (Supplied by the Client)

- ① Adapter
- ② Valve
- ③ Nipple
- ④ Flange
- ⑤ Water Meter
- ⑥ GS Union

Section B

Note:

All Plumbing materials to be supplied by the client, the contractor Will provide means of assembly and workmanship

Client:
Kokusai Kogyo Co.,Ltd.

Project:
The Project for Strengthening Operation and Maintenance of Rural Water Supply Systems in Rwanda

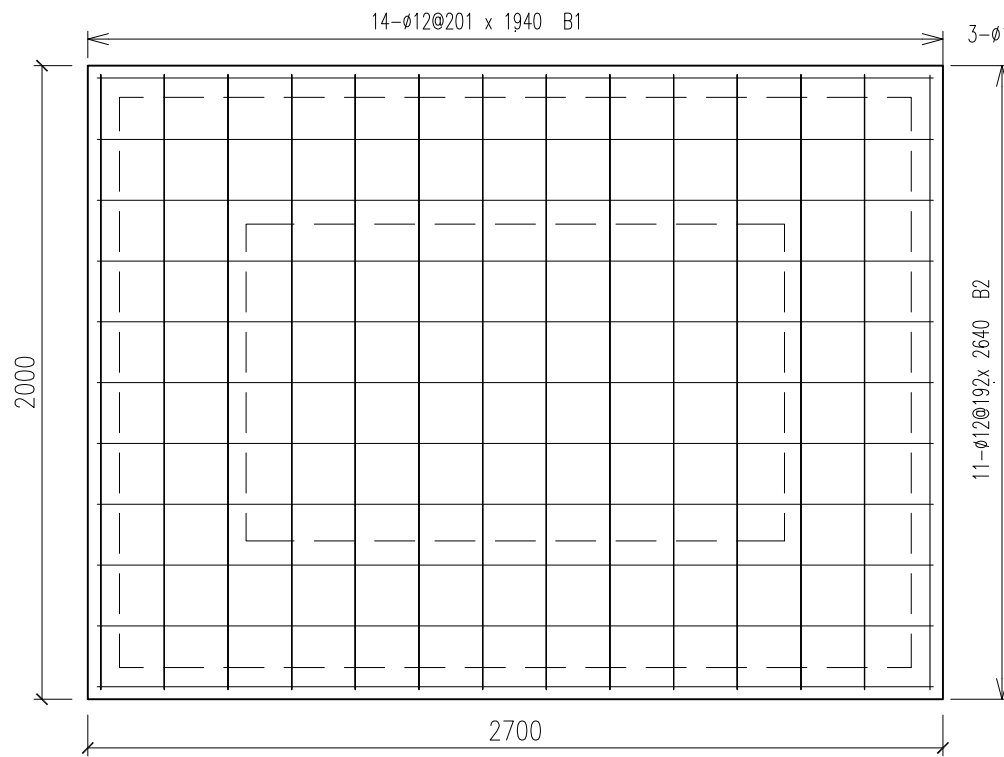
Work:
Installation of Water Meter and Chlorination Unit

Drawing Title:
Gahezi
Meter Chamber G-2 Section

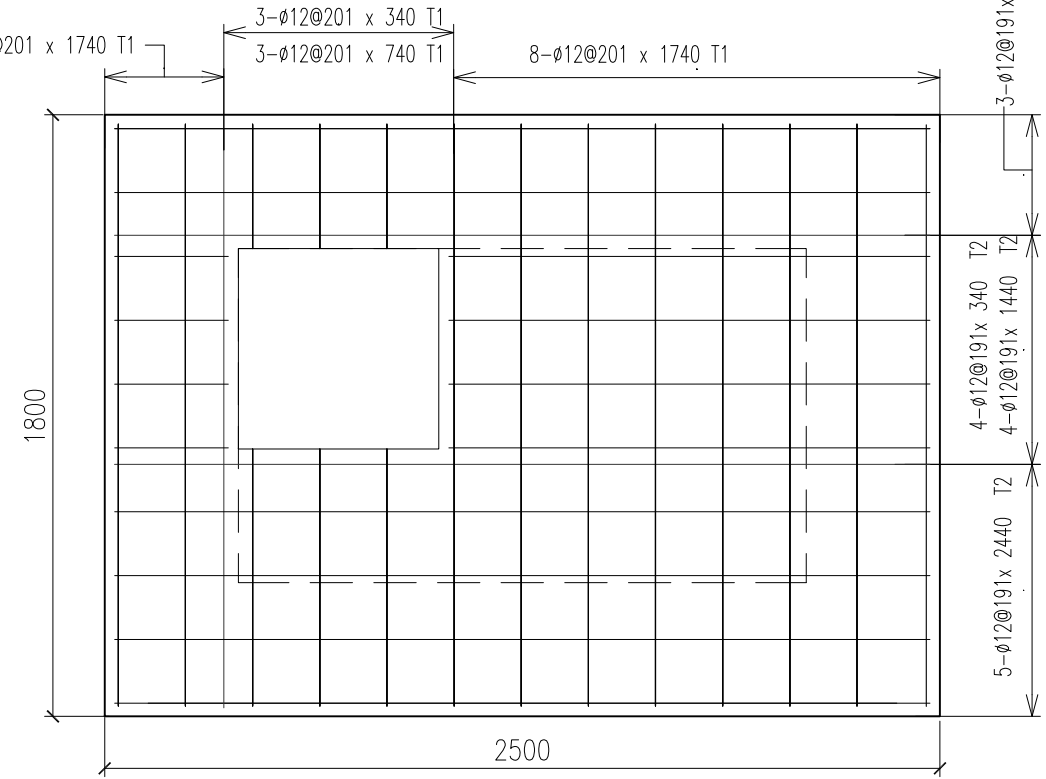
Sheet No.

60

SCALE 1 : 20	DATE July 2017	DWG No. A4-G6
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Bottom Slab Reinforcement Layout



Top Slab Reinforcement Layout

Client:
Kokusai Kogyo Co.,Ltd.

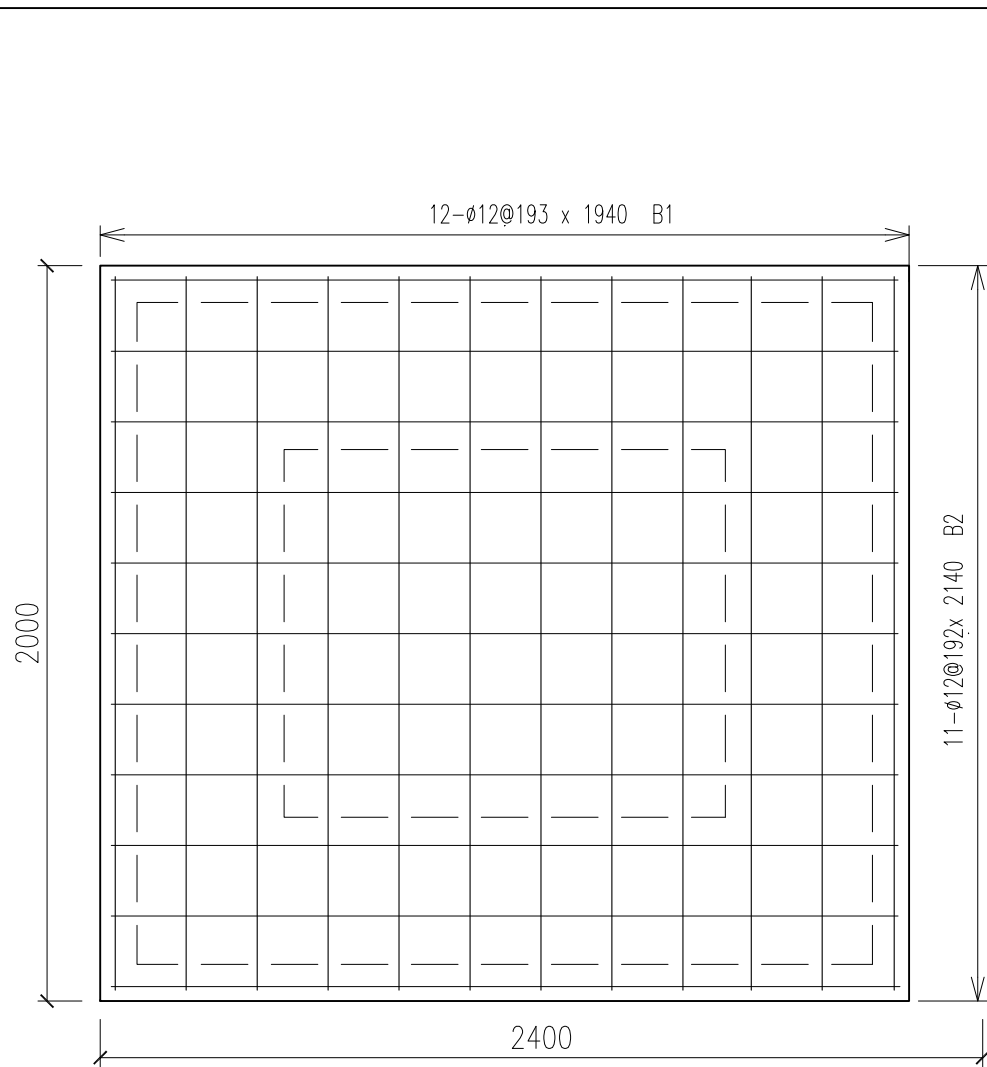
Project:
The Project for Strengthening Operation and Maintenance of Rural Water Supply Systems in Rwanda

Work:
Installation of Water Meter and Chlorination Unit

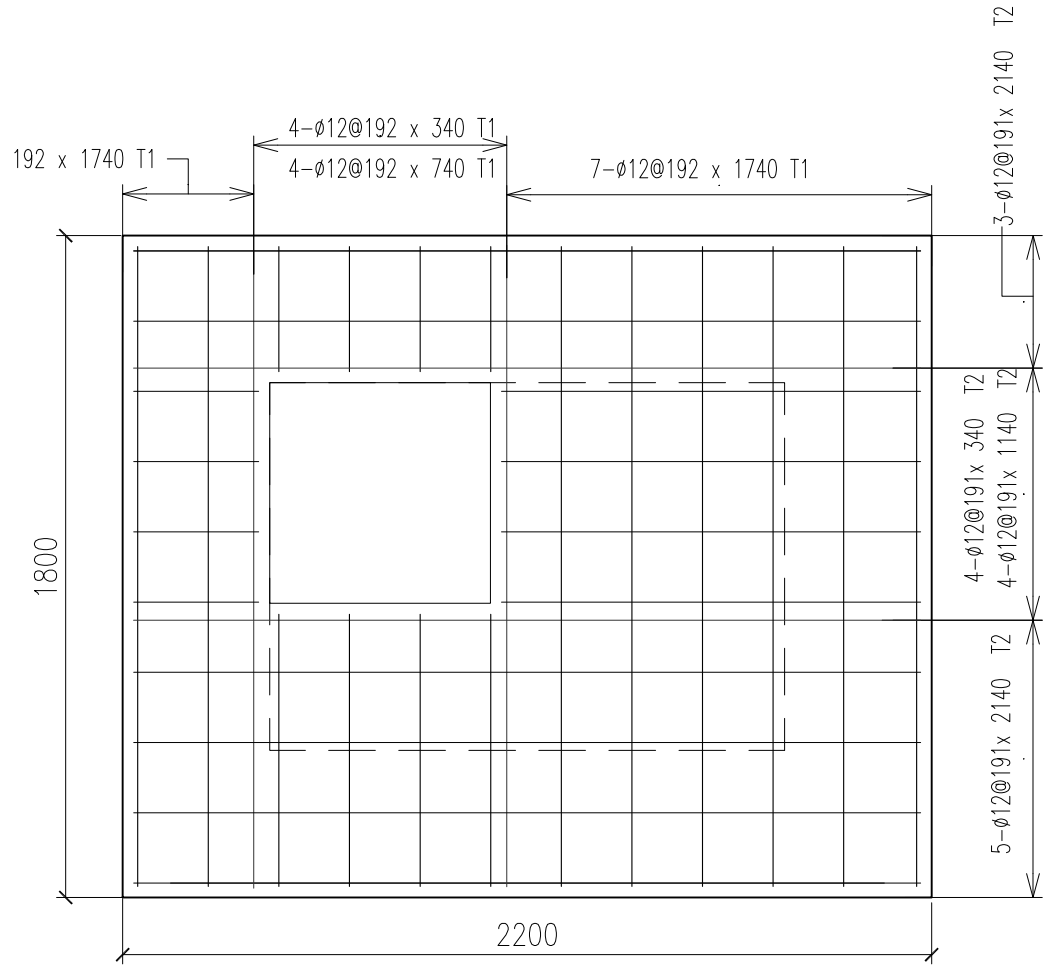
Drawing Title:
Gazezi
Meter Chamber M-1 Top and Bottom Slab Reinforcement

SCALE 1 : 20	DATE July 2017	DWG No. A4-G7
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Sheet No.
61



Bottom Slab Reinforcement Layout



Top Slab Reinforcement Layout

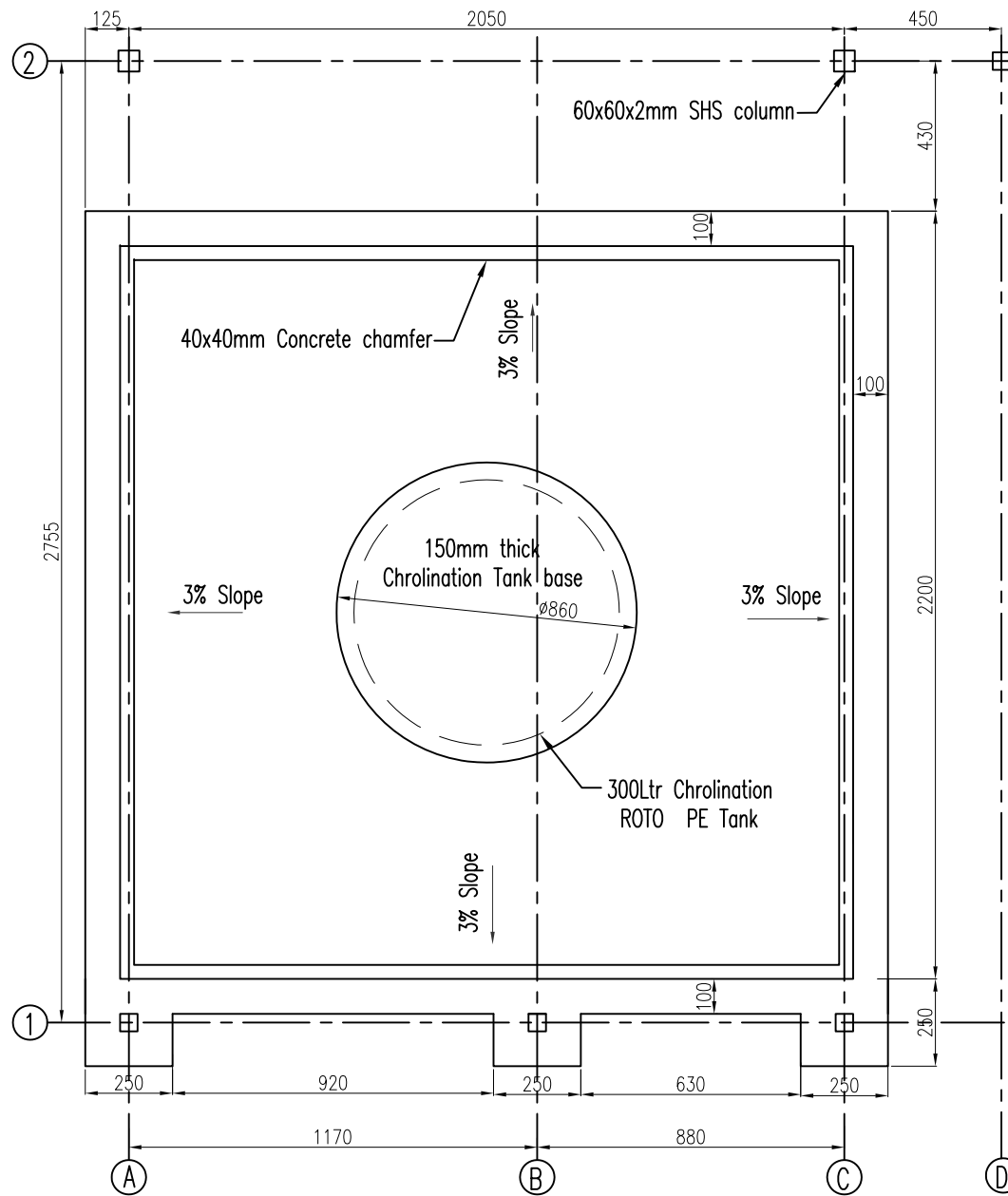
Client:
Kokusai Kogyo Co.,Ltd.

Project:
The Project for Strengthening Operation and
Maintenance of Rural Water Supply Systems
in Rwanda

Work:
Installation of Water Meter and
Chlorination Unit

Drawing Title:
Gahezi
Meter Chamber G-2 Top and Bottom Slab Reinforcement
SCALE DATE DWG No.
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Sheet No.
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Base Slab layout

Client:
Kokusai Kogyo Co.,Ltd.

Project:
The Project for Strengthening Operation and Maintenance of Rural Water Supply Systems in Rwanda

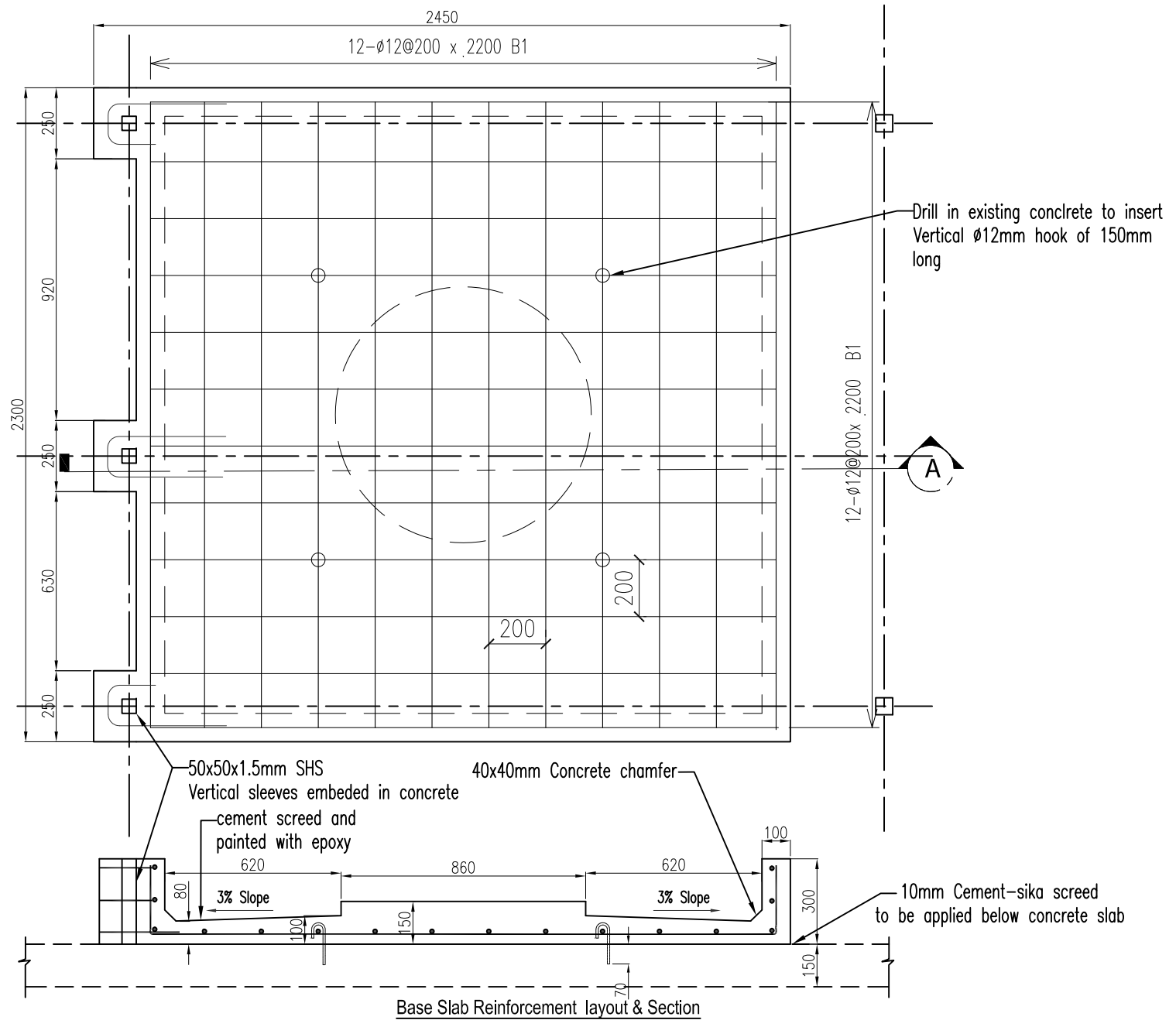
Work:
Installation of Water Meter and Chlorination Unit

Drawing Title:
Gazezi
Chlorination Unit Base Slab Layout

Sheet No.

SCALE 1 : 20	DATE July 2017	DWG No. A4-G9
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63



Client:
Kokusai Kogyo Co.,Ltd.

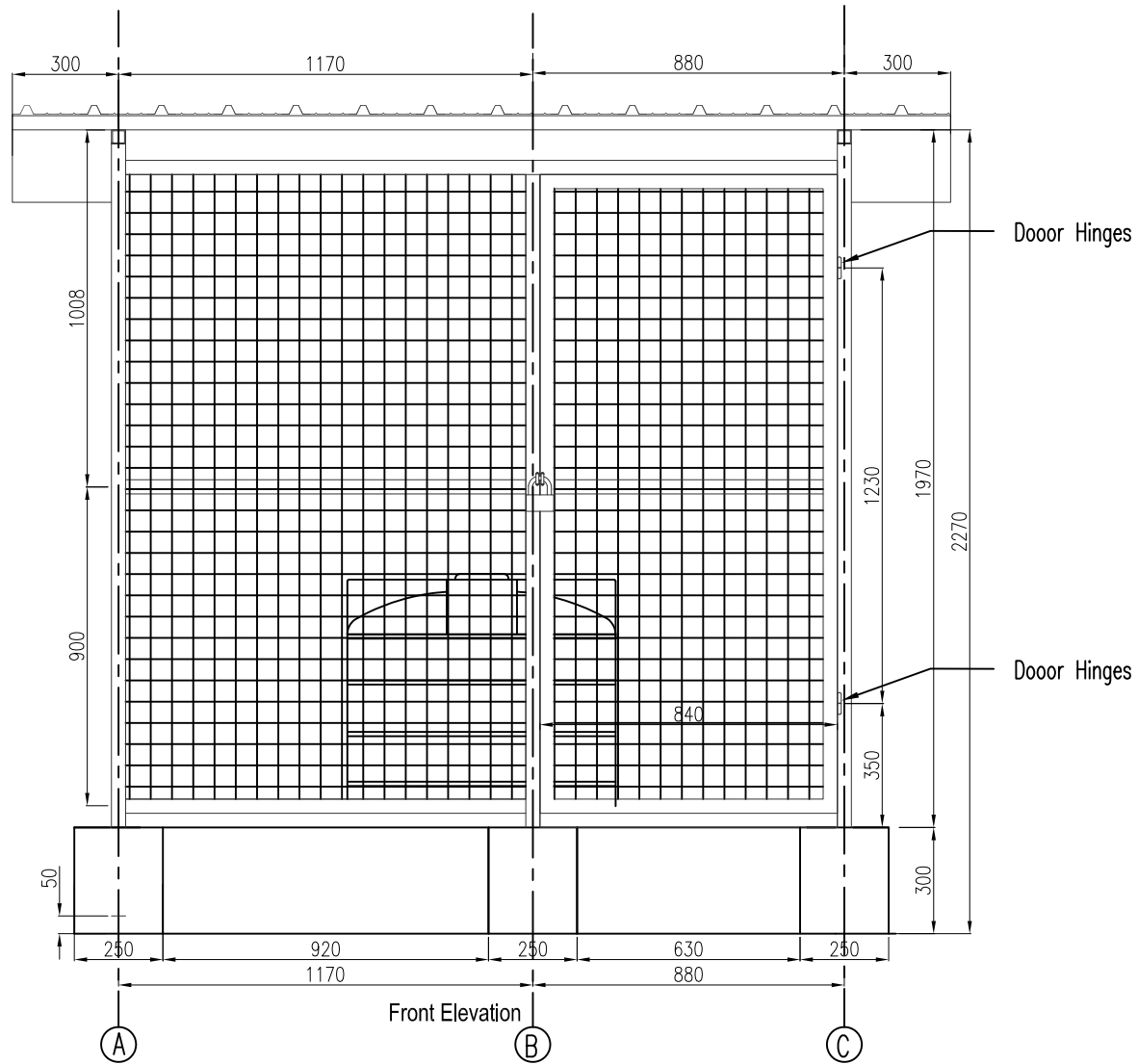
Project:
The Project for Strengthening Operation and
Maintenance of Rural Water Supply Systems
in Rwanda

Work:
Installation of Water Meter and
Chlorination Unit

Drawing Title :
Gagezi
Chlorination Unit Base Slab Reinforcement

SCALE 1 : 20	DATE July 2017	DWG No. A4-G10
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Client:
Kokusai Kogyo Co.,Ltd.

Project:
The Project for Strengthening Operation and
Maintenance of Rural Water Supply Systems
in Rwanda

Work:
Installation of Water Meter and
Chlorination Unit

Drawing Title:
Gaezi
Chlorination Unit Front Elevation

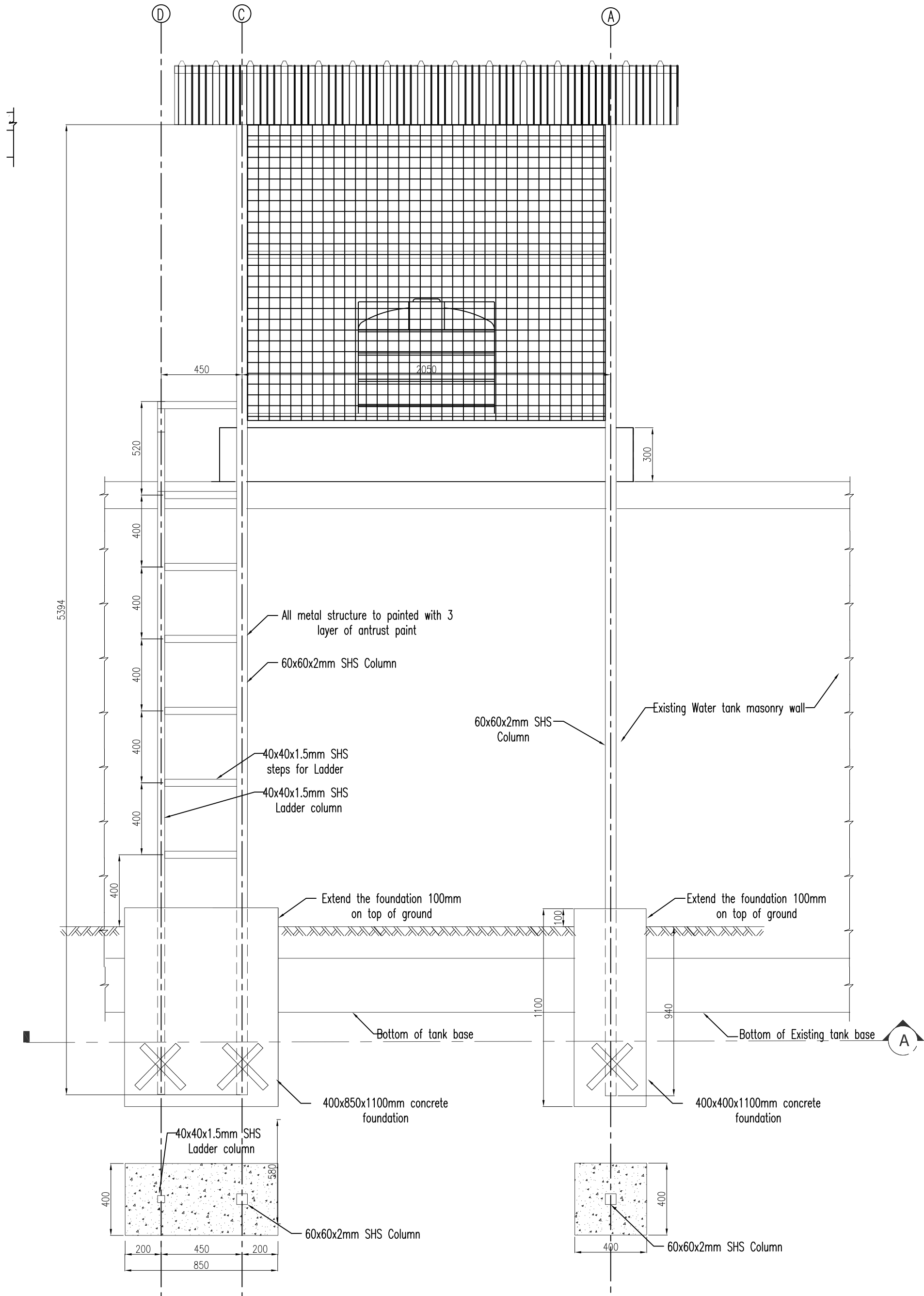
Sheet No.

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1 : 20

DATE
July 2017

DWG No.
A4-G11



Rear Elevation

Client:
Kokusai Kogyo Co.,Ltd.

Project:
The Project for Strengthening Operation and Maintenance of Rural Water Supply Systems in Rwanda

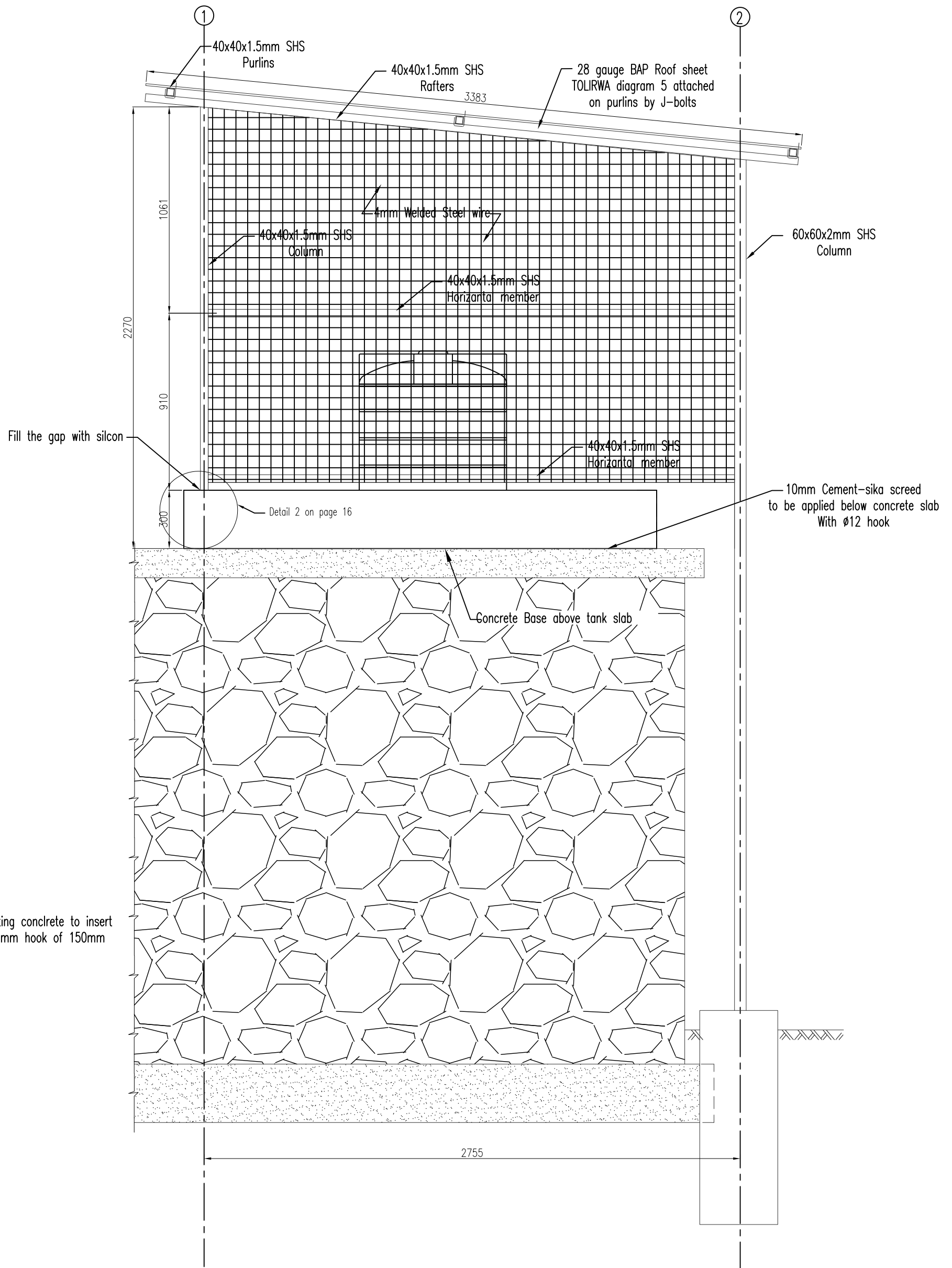
Work:
Installation of Water Meter and Chlorination Unit

Drawing Title:
Gahezi
Chlorination Unit Rear Elevation

Sheet No.

66

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Side Elevation

Client:
Kokusai Kogyo Co.,Ltd.

Project:
The Project for Strengthening Operation and
Maintenance of Rural Water Supply Systems
in Rwanda

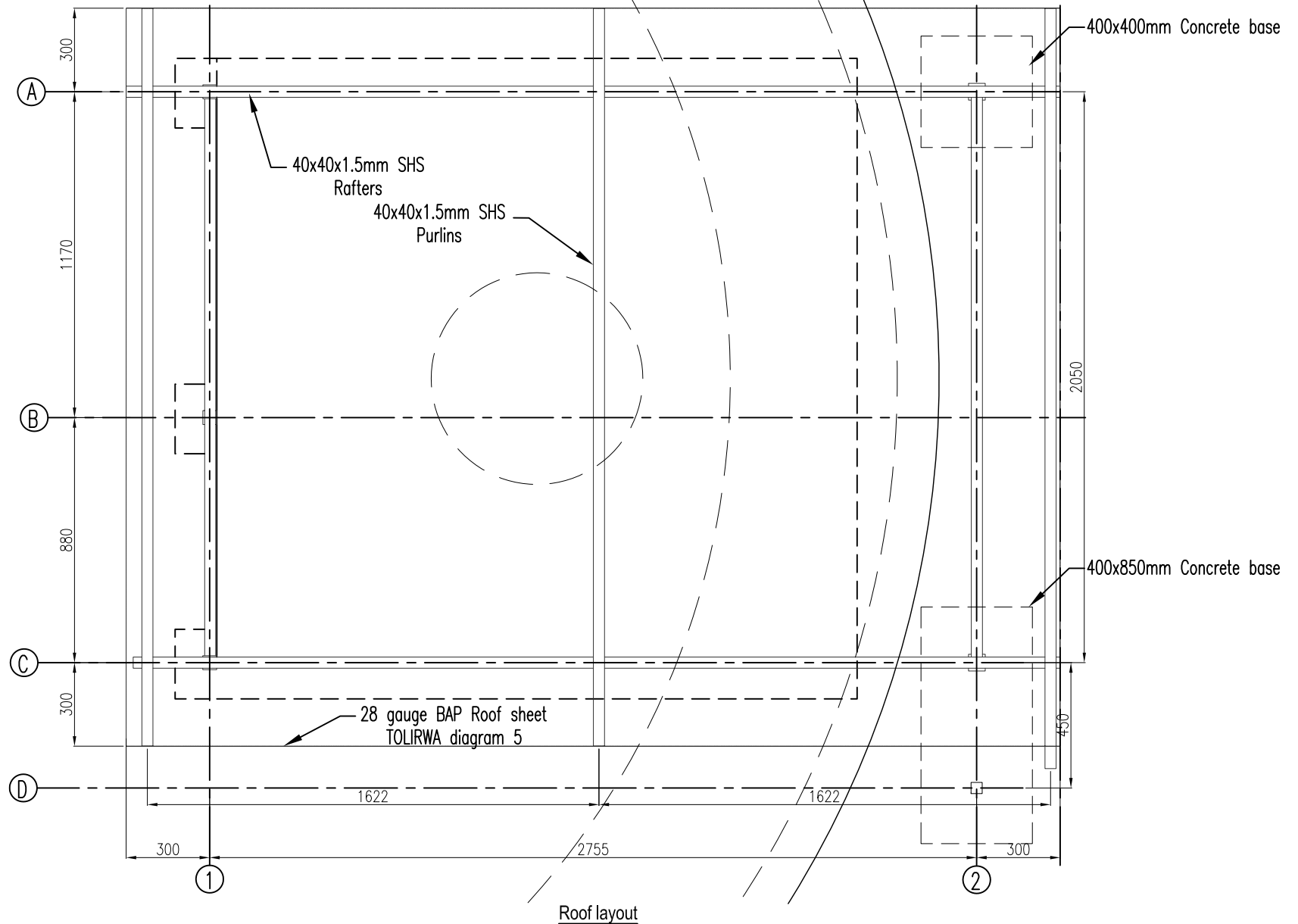
Work:
Installation of Water Meter and
Chlorination Unit

Drawing Title:
Gaezi
Chlorination Unit Side Elevation

SCALE 1 : 20	DATE July 2017	DWG No. A3-G13
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Sheet No.

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Client:
Kokusai Kogyo Co.,Ltd.

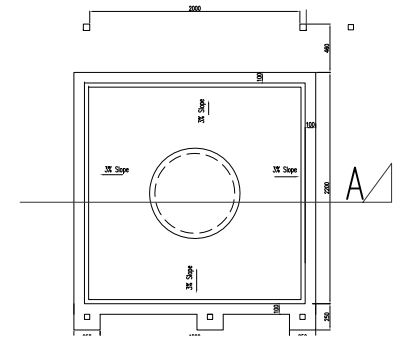
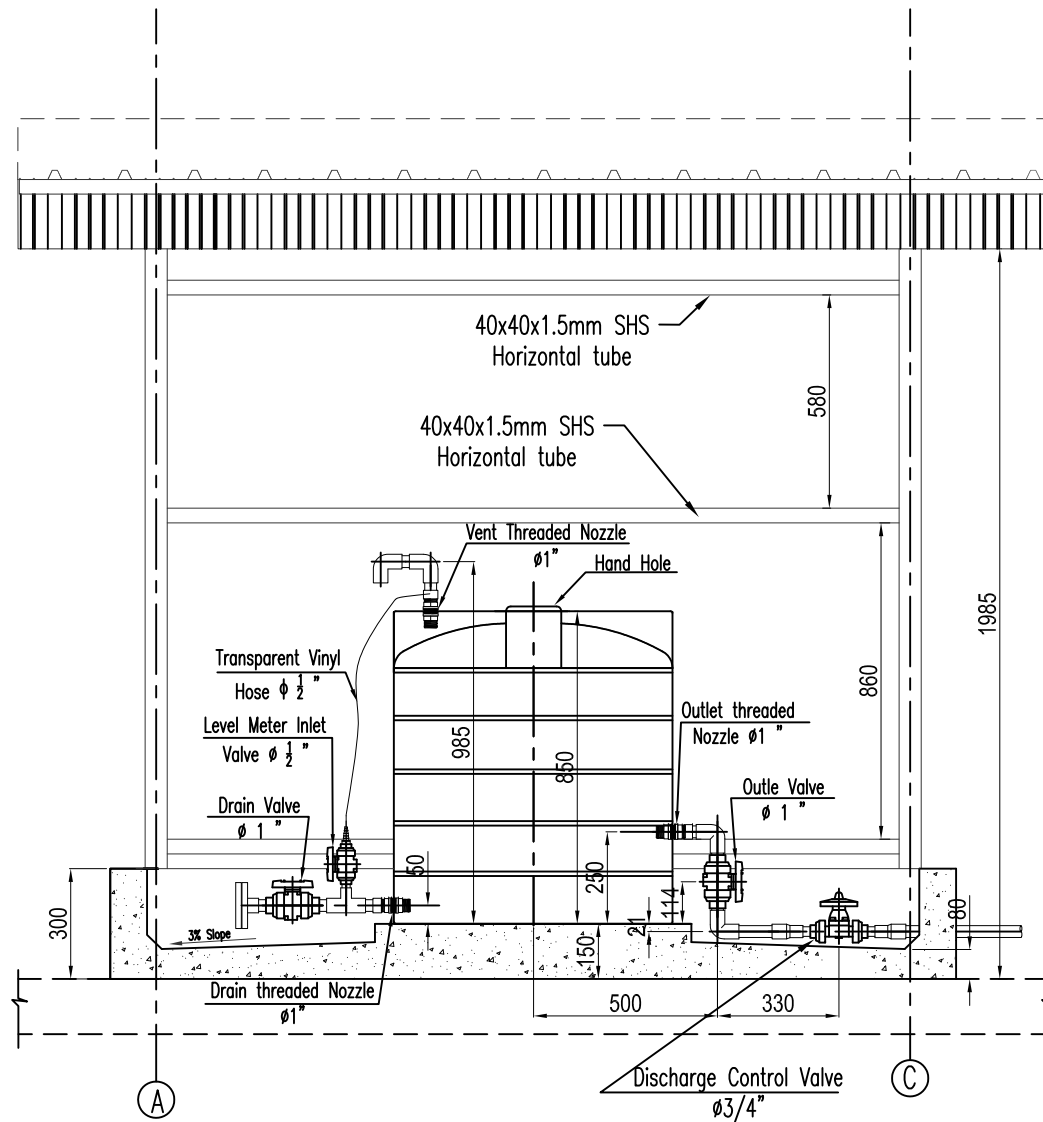
Project:
The Project for Strengthening Operation and Maintenance of Rural Water Supply Systems in Rwanda

Work:
Installation of Water Meter and Chlorination Unit

Drawing Title:
Gahezi
Chlorination Unit Roof Layout

SCALE: 1 : 20 DATE: July 2017 DWG No. A4-G14

Sheet No.
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Section A

Client:
Kokusai Kogyo Co.,Ltd.

Project:
The Project for Strengthening Operation and
Maintenance of Rural Water Supply Systems
in Rwanda

Work:
Installation of Water Meter and
Chlorination Unit

Drawing Title:
Gahezi
Chlorination Unit Section

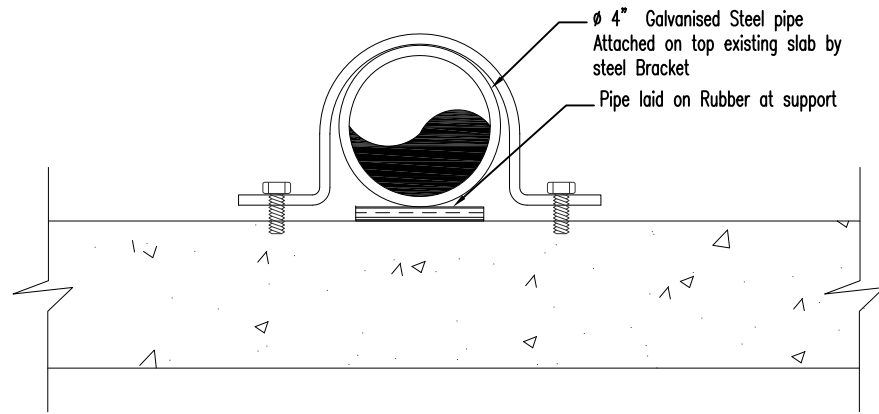
Sheet No.

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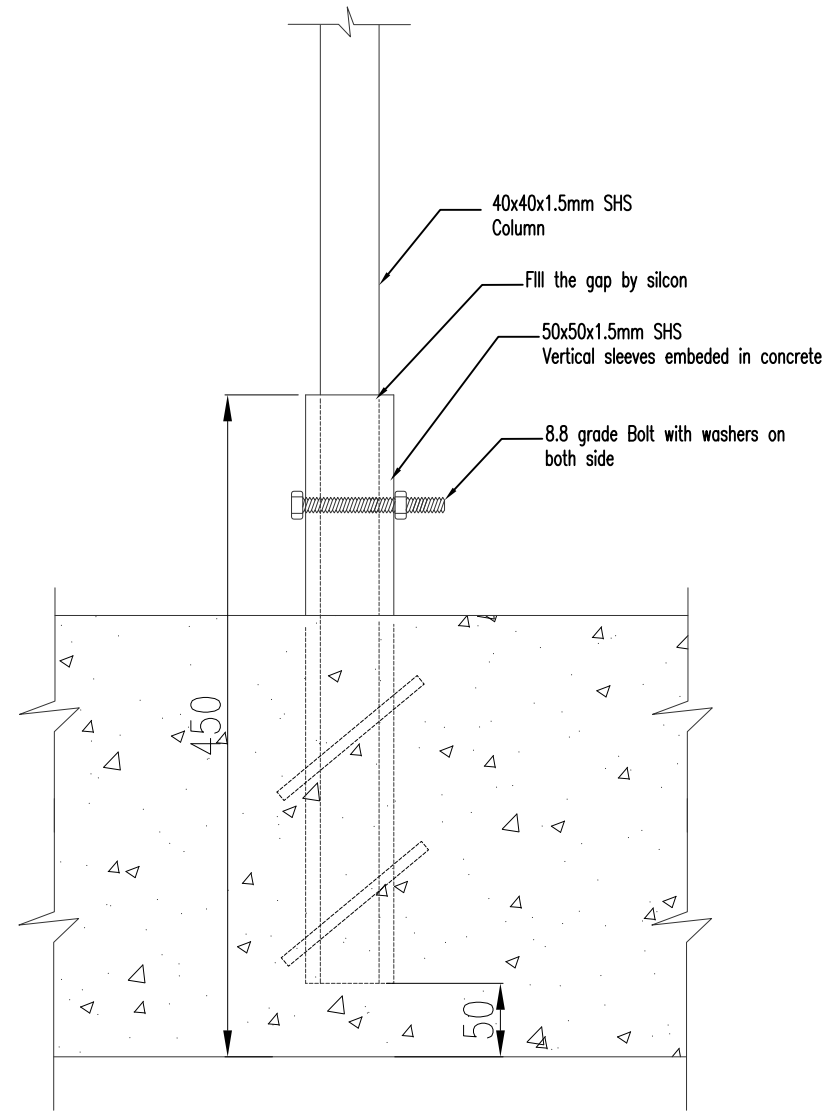
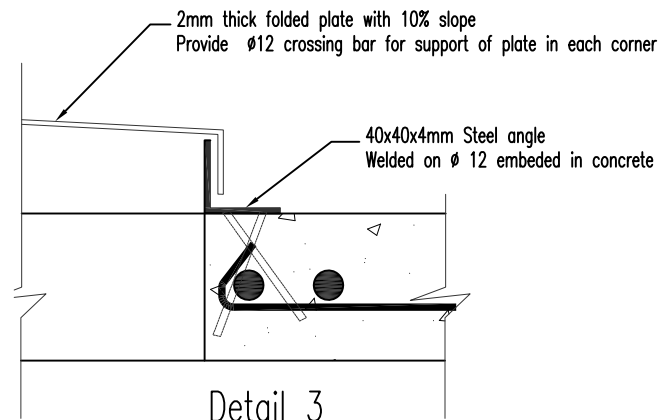
SCALE
1 : 20

DATE
July 2017

DWG No.
A4-G15



Fixing Detail 1- GS pipe on Tank Roof Sab



Fixing Detail 2 - SHS tube to concrete base

Client:
Kokusai Kogyo Co.,Ltd.

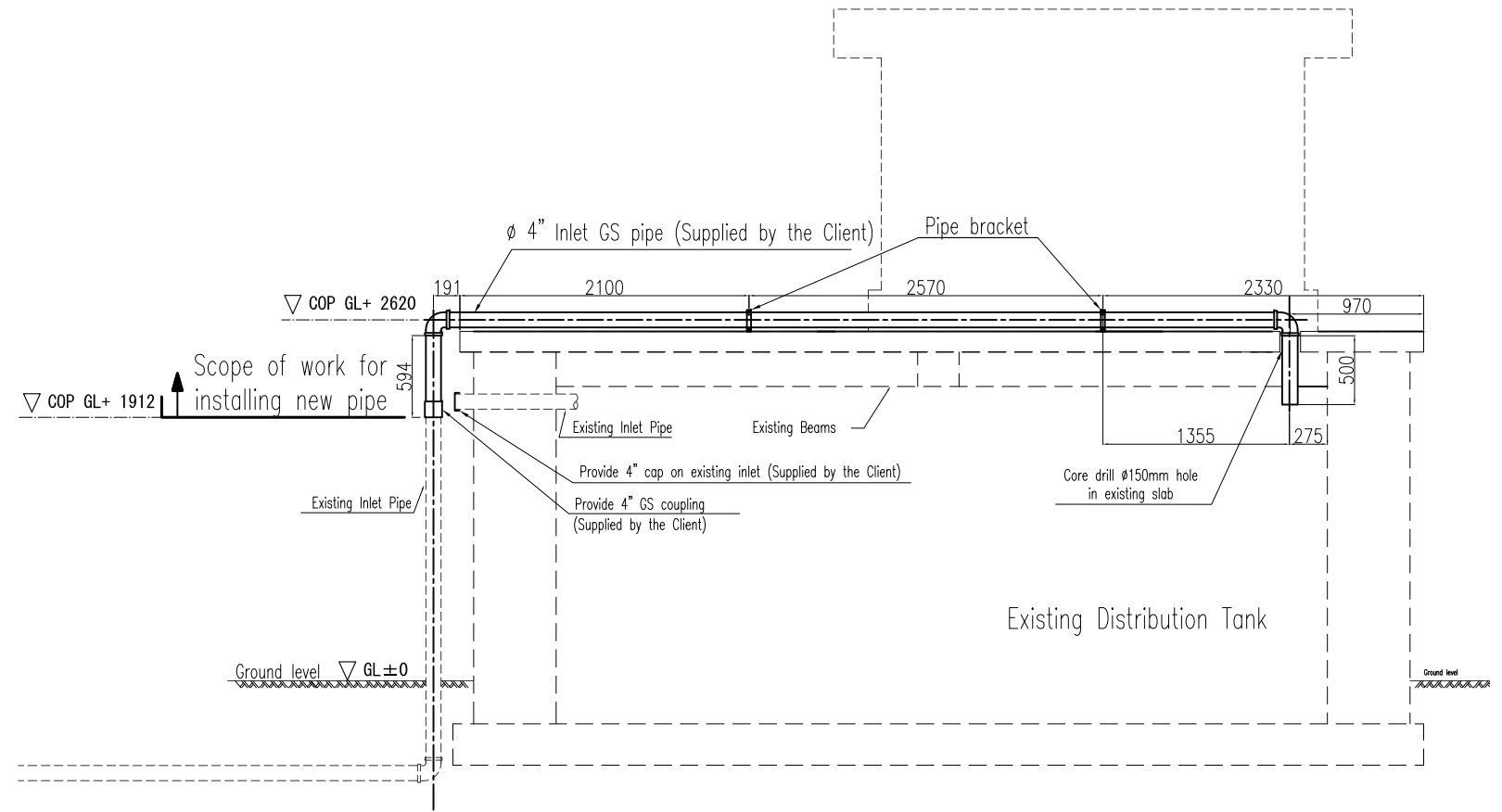
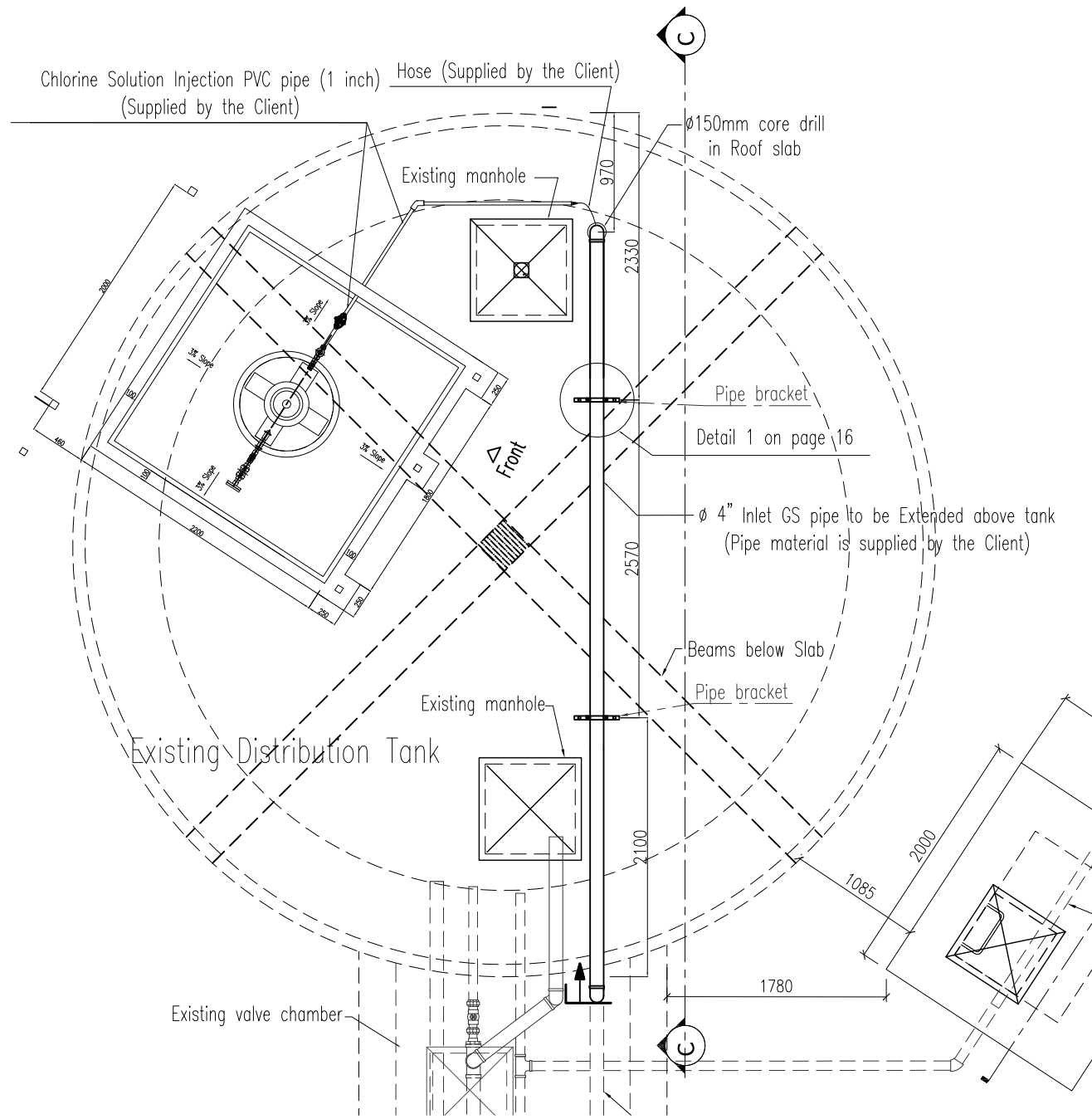
Project:
The Project for Strengthening Operation and Maintenance of Rural Water Supply Systems in Rwanda

Work:
Installation of Water Meter and Chlorination Unit

Drawing Title:
Gagezi
Meter Chamber and Chlorination Unit Fixing Details

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Section C

↑ shows scope of work for installing new pipe

Layout

Client:
Kokusai Kogyo Co.,Ltd.

Project:
The Project for Strengthening Operation and Maintenance of Rural Water Supply Systems in Rwanda

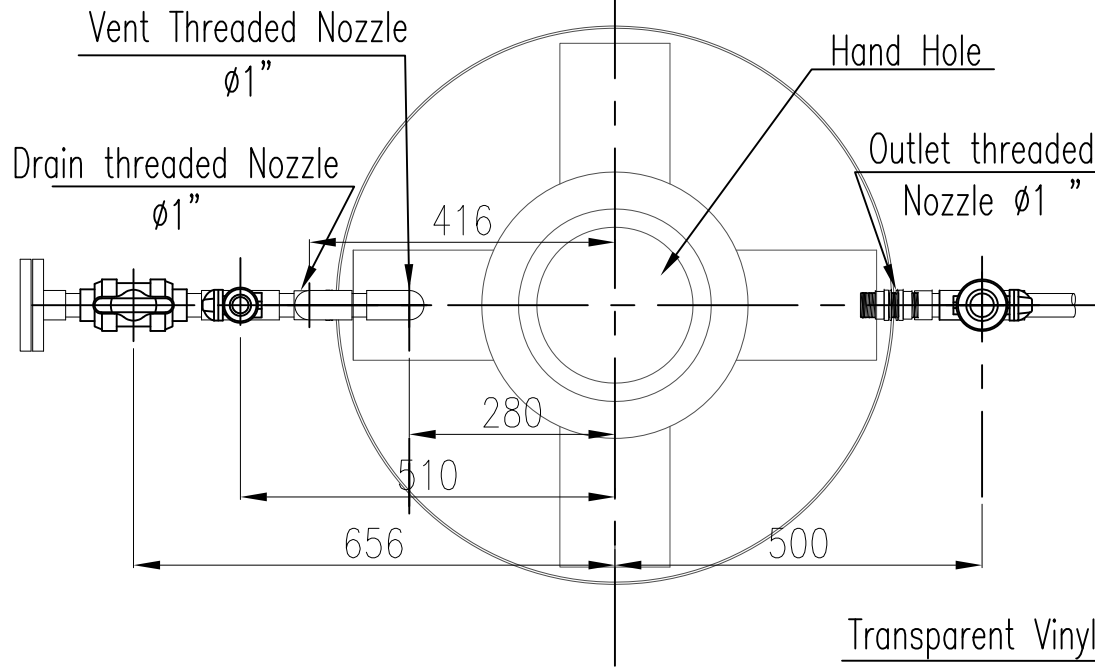
Work:
Installation of Water Meter and Chlorination Unit

Drawing Title:
Gahezi
Inlet Pipe Assembly Drawing

Sheet No.

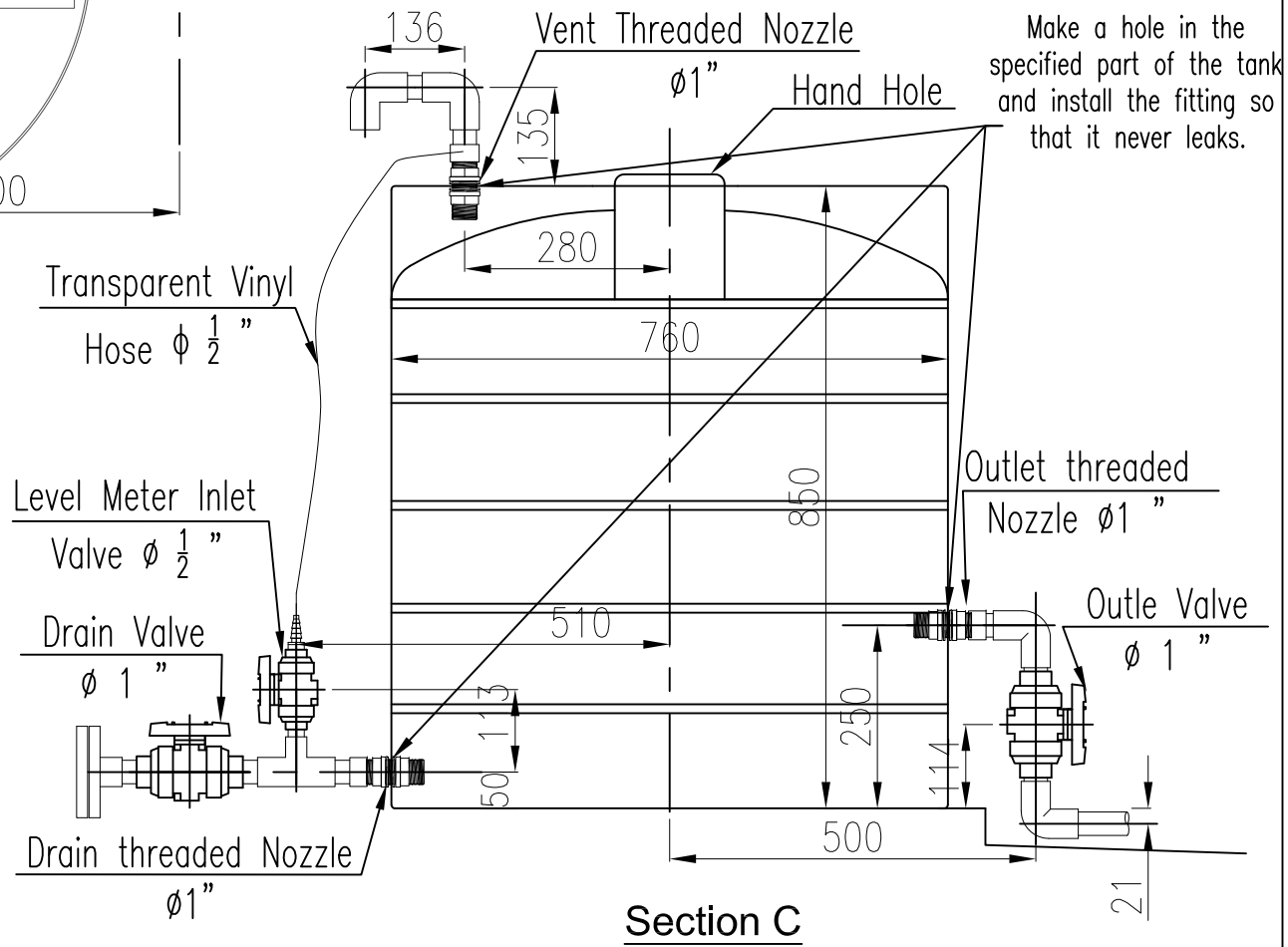
SCALE 1 : 50	DATE July 2017	DWG No. A3-G17
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Nominal capacity : 300 L
 Material : PE (Polyethylene)
 Color : Black
 Brand : ROTO

Layout



Make a hole in the specified part of the tank and install the fitting so that it never leaks.

Section C

Note:
 Pe Tank, valves, nozzle, pipe and other piping material in this drawing are supplied by the Client.
 The contractor shall provide means of assembly and workmanship.

Client: Kokusai Kogyo Co.,Ltd.	Project: The Project for Strengthening Operation and Maintenance of Rural Water Supply Systems in Rwanda	Work: Installation of Water Meter and Chlorination Unit	Drawing Titel: Gaezi Calcium Hypochlorite Solution Tank		Sheet No. 72
			SCALE: 1 : 10	DATE: July 2017	