Appendix 13

Design Conditions of Architecture

1. Design Policy

1.1 Outline of Structure

(1) Structural Classification — RC

(2) Type of Framework — Rigid Frame Construction

(3) Type of Foundation
- Pile Foundation ... RC Pre-fabricated Piles
- Direct Foundation

1.2 Structural Analysis and Design of Members

(1) The calculation of the stress and deformation of each portion of buildings shall be, in general, made based on the elastic rigidness of the structural members. However, for the portion where the stress is large, the rigidness shall be lowered in consideration of the effects of cracks of the concrete and plastic deformation of the members.

(2) For the design of the structural members (calculation of the cross-sectional area), the allowable unit stress design method, in which the obtained unit stress of a cross-sectional area of a member is held to be within the specified allowable unit stress, shall be applied.

2 Design in General

2.1 Materials to be Used and Physical Constants

Physical Constants

Kind	Young's Modulus
Concrete (Fc = 210 kg/cm^2)	2.15 x 10^5 kg/cm^2
Steel bars (SD295A), Steel material (SS400), Equivalent	2.15 x 10^6 kg/cm^2

2.2 Allowable Unit Stress

(1) Concrete

- Design standard strength — Fc = 210 kg/cm^2
- Compressive unit stress — 70 kg/cm^2
- Shearing unit stress — 7.0 kg/cm^2

- Bonding unit stress

Round bars	Top bar	8.4 kg/cm^2
	Others	12.6 kg/cm^2
Deformed bars	Top bar	14.0 kg/cm^2
	Others	21.0 kg/cm^2

(2) Reinforcement Bars

- Standards — JIS/SD295A or Equivalent
- Tensile unit stress — 2,000 kg/cm^2
- Compressive unit stress — 2,000 kg/cm^2

(3) Steel Materials

- Standards — JIS/SS400 or Equivalent
- Tensile unit stress — 1,600 kg/cm^2
- Compressive unit stress — 1,600 kg/cm^2 or below*
- Shearing unit stress — 923.7 kg/cm^2

(4) Extra Allowable Unit Stress

- Long period (vertical load) — Factor for increase 1.0
- Short period (typhoon) — Factor for increase 1.5

The figures marked with * shall be calculated at the time of cross-sectional design.

2.3 Soil Condition

The soil condition shall be set from the results of borings and laboratory tests.

3. Loads and External Forces

(1) Combination of Loads

Load	Assumed Condition	Combination of Loads
Long period load	Normally	G + P
Short period load	Under typhoon	G + P + W

G : Dead load
P : Live Load
W : Wind load

- Seismic load shall not be considered.
- Wind loads shall be set in accordance with the relevant standards being applied in Japan.

(2) Live loads

Unit (kg/cm^2)

Classification	A	B
Roof	90	65
Pump room, Control room, Others	300	180

A : For calculation of floor

B : For calculation of main frames and foundations

- Other loads shall be set, if necessary, in consideration of the actual condition.
- The weight of the pump and the pump-foundation shall be considered in a separate manner.

Appendix 14

Hydraulic Calculation and Specification of Treatment Plant

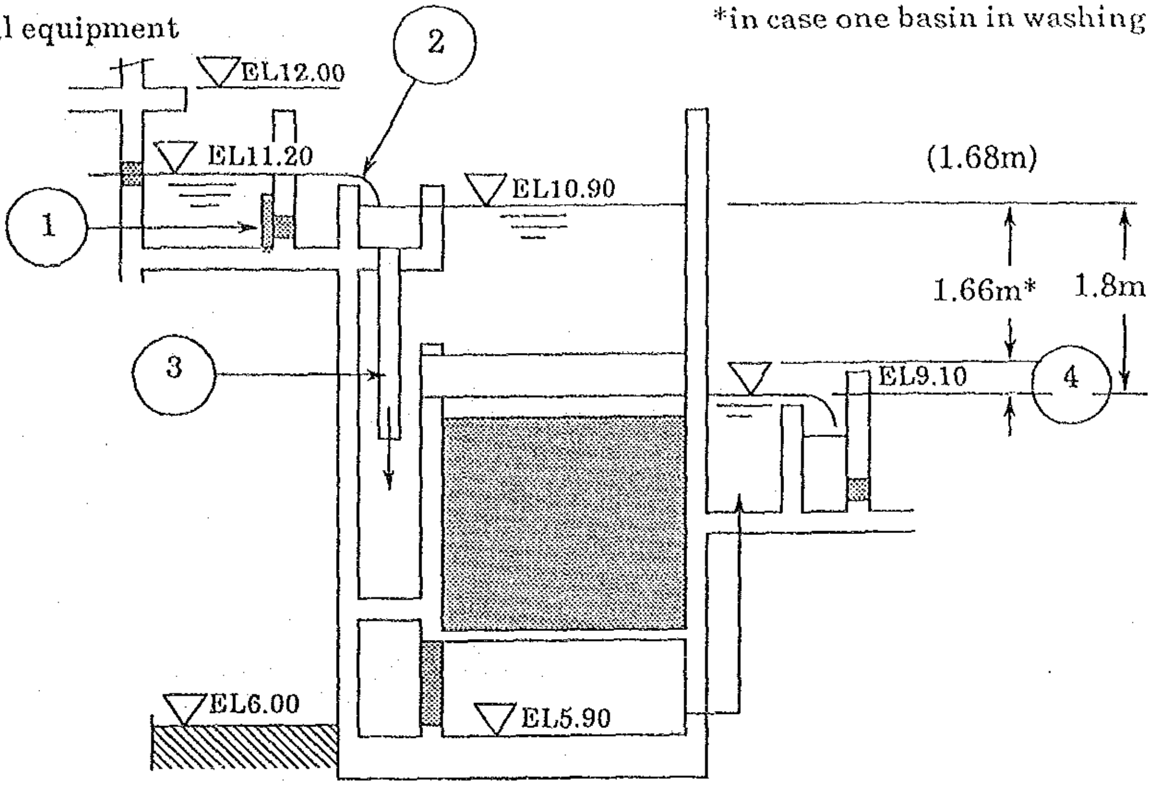
1. Aeration Equipment

	Items	Details of Calculation
1	Raw water Pipe :H1	Connecting point of Raw water pipe~Header pipe of Aeration Flow rate: $32100m^3/d \div 2 = 16050m^3/d = 0.186m^3/s$ Pipe size: 350mm(Sectional area $= 0.09m^2$) Flow velocity in the pipe: $0.186m^3/s \div 0.09m^2 = 2.1m/s$
	Friction loss of the pipe	Total length of the pipe: 40m $h1 = \lambda \times \frac{L}{D} \times \frac{V^2}{2g} = 0.015 \times \frac{40}{0.34} \times \frac{2.1^2}{2g} = \underline{0.397m}$ λ : Coefficient of friction of Darcy-Weisbach' formula
	Friction loss of the bent	Quantity: 4 pcs $h2 = f_{b1} \times f_{b2} \times \frac{V^2}{2g} \times n = 1.0 \times 1.0 \times \frac{2.1^2}{2g} \times 4 = \underline{0.9m}$ f_{b1}: Coefficient of loss caused by radius of curvature f_{b2}: Coefficient of loss coused by center angle of curvature
	Loss of valve	Valve size: 350mm(butterfly valve) Quantity: 3 pcs $h3 = f_u \times \frac{V^2}{2g} \times n = 0.15 \times \frac{2.1^2}{2g} \times 3 = \underline{0.101m}$ $f_u = \frac{t}{D} = 0.15$ (t = Thickness of disk) (D = Bore size of Valve)
	Loss of flow meter	Nominal Size of Flow meter : 350mm(Orifice) Quantity: 1 pcs $h4 = 2.0m$
	Total loss of Raw water pipe	$H1 = h1 + h2 + h3 + h4 = 0.397m + 0.9m + 0.101m + 2.0m = \underline{3.398m}$

	Items	Details of Calculation
2	Spray pipe main :H2	Header pipe~Spray pipe main of Aeration
		Flow rate: $16050m^3/d \div 6 = 2675m^3/d = 0.031m^3/s$
		Pipe size: 150mm(Sectional area $= 0.018m^2$)
		Flow velocity in the pipe: $0.031m^3/s \div 0.018m^2 = 1.72m/s$
	Friction loss of the pipe	Total length of the pipe: 14m
		$h1 = \lambda \times \frac{L}{D} \times \frac{V^2}{2g} = 0.018 \times \frac{14}{0.155} \times \frac{1.72^2}{2g} = \underline{0.245m}$
		λ : Coefficient of friction of Darcy-Weisbach' formula
	Friction loss of the bent	Quantity: 1pcs
		$h2 = f_{b1} \times f_{b2} \times \frac{V^2}{2g} \times n = 1.0 \times 1.0 \times \frac{1.72^2}{2g} \times 1 = \underline{0.15m}$
		f_{b1}: Coefficient of loss caused by radius of curvature
		f_{b2}: Coefficient of loss coused by center angle of curvature
	Loss of valve	Valve size: 150mm(butterfly valve) Quantity: 1 pc
		$h3 = f_u \times \frac{V^2}{2g} \times n = 0.15 \times \frac{1.72^2}{2g} \times 1 = \underline{0.023m}$
		$f_u = \frac{t}{D} = 0.15$ (t=Thickness of disk (D=Bore size of Valve)
	Total loss of Spray pipe main	$H2 = h1 + h2 + h3 = 0.245m + 0.15m + 0.023m = \underline{0.418m}$
3	Spray lateral pipe :H3	Spray pipe main ~Spray lateral pipe
		Flow rate: $2675m^3/d \div 30 = 89.2m^3/d = 0.001m^3/s$
		Pipe size: 40mm(Sectional area $= 0.0013m^2$)
		Flow velocity in the pipe: $0.001m^3/s \div 0.0013m^2 = 0.77m/s$
		Total length of the pipe: 2m
		$h1 = \lambda \times \frac{L}{D} \times \frac{V^2}{2g} = 0.025 \times \frac{2}{0.041} \times \frac{0.77^2}{2g} = \underline{0.037m}$
		λ : Coefficient of friction of Darcy-Weisbach' formula
		$H3 = h1 = \underline{0.037m}$
	Total head loss of Aeration Equipment=(H1+H2+H3=3.853 m) +(Actual head=10 m) +(Dynamic head of water at the jet=3m)=16.853 m Raw water pressure at the grand level(EL 6.00)should be at least 17 mAq.	

2. Iron removal equipment

*in case one basin in washing



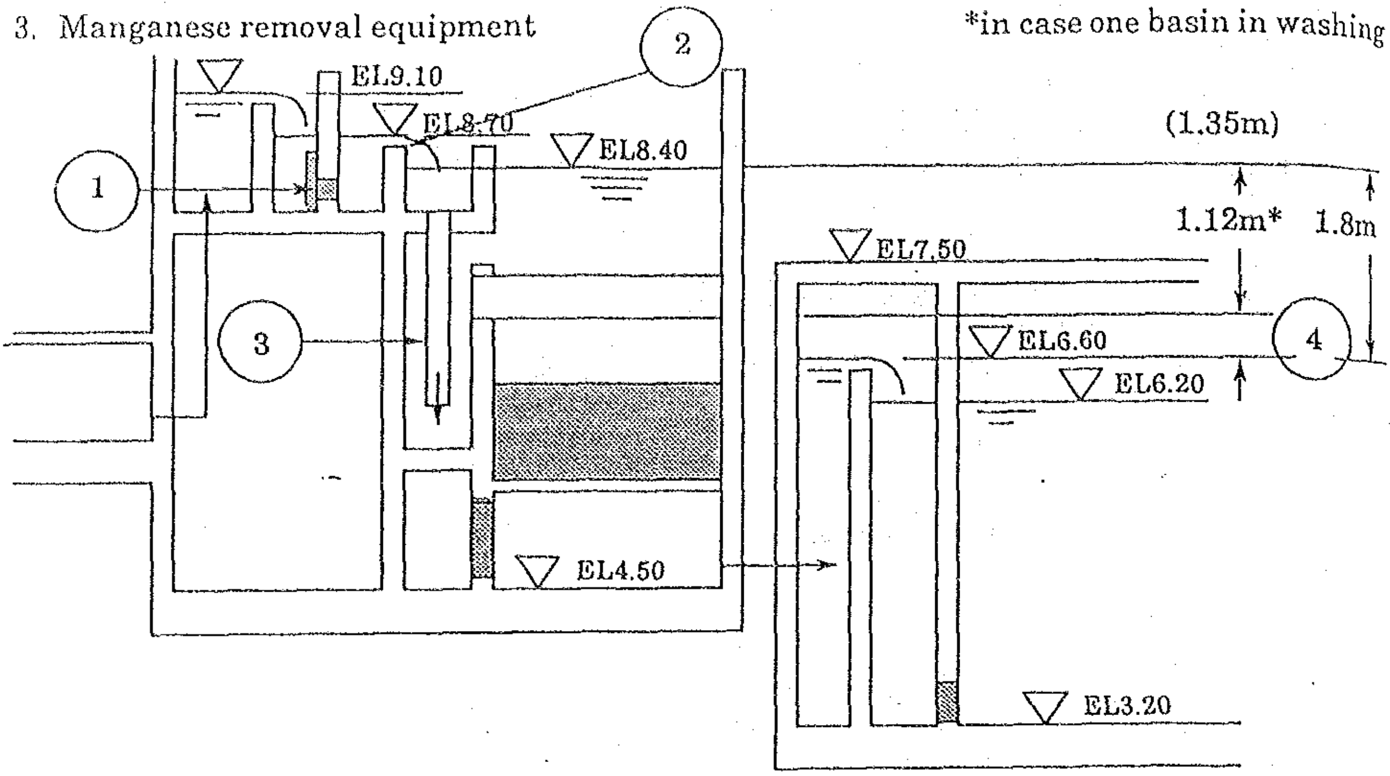
	Items	Details of Calculation
1	Raw water distribution valve :H1	Flow rate: 16050m³/d ÷ 5 = 3210m³/d = 0.0371m³/s Valve size: 300mm(butterfly valve) Quantity: 1 pc $H1 = f_u \times \frac{V^2}{2g} \times n = 0.1 \times \frac{0.53^2}{2g} \times 1 = \underline{0.0014m}$ $f_u = \frac{t}{D} = 0.1$ (t = Thickness of disk (D = Bore size of Valve)
2	Overflow depth of distribution weir :H2	Flow rete: 16050m³/d ÷ 5 = 3210m³/d = 0.0371m³/s Width of weir: 800mm(B) $H2 = \left(\frac{0.0371}{1.84 \times 0.8}\right)^{2/3} = \underline{0.086m}$
3	Raw water inlet pipe :H3	Pipe size: 300mm(Sectionl area = 0.072m²) Flow velocity in the pipe: 0.0371m³/s ÷ 0.072m² = 0.51m/s
	Friction loss of the pipe	Total length of the pipe: 3m $h1 = \lambda \times \frac{L}{D} \times \frac{V^2}{2g} = 0.015 \times \frac{3}{0.3} \times \frac{0.51^2}{2g} = \underline{0.002m}$ λ : Coefficient of friction of Darcy-Weisbach' formula
	Friction loss of the bent	Quantity: 2pcs $h2 = f_{b1} \times f_{b2} \times \frac{V^2}{2g} \times n = 1.0 \times 1.0 \times \frac{0.51^2}{2g} \times 2 = \underline{0.027m}$ f_{b1}: Coefficient of loss caused by radius of curvature f_{b2}: Coefficient of loss coused by center angle of curvature $H3 = h1 + h2 = 0.002m + 0.027m = \underline{0.029m}$

	Items	Details of Calculation
4	Initial fitration loss : H4	Flow rate: $16050m^3/d \div 5 = 3210m^3/d = 0.0371m^3/s$ Filtration area: $3m \times 6.2m = 18.6m^2$ Filtration velocity: $0.0371m^3/s \div 18.6m^2 = 0.002m/s$
	Head loss of filter layer	v = Filtration velocity: $0.0371m^3/s \div 18.6m^2 = 0.002m/s$ L = Depth of filter layer: 2m D = Size of filter sand: 1.6mm = 0.0016m ϕ = Shape coefficient of sand: 0.8(0.7~0.85) ε = Initial void ratio of sand: 0.45(0.4~0.5) γ = Liquid density: $1000kg/m^3$ μ = Viscocity coefficient: $0.001kg/m{\cdot}s$ g = Gravity acceleration: $9.8m/s^2$ α/β = 5.5(5.5~5.7) α: Shape coefficient of sand (for surface area) β: Shape coefficient of sand (for volume) Re = Reynold's number: $(\gamma \times D \times v)/\mu = (1000 \times 0.0016 \times 0.002)/0.001 = 3.2$ $h0 = f \times \dfrac{\mu \times v \times L}{g \times \gamma \times \phi^2 \times D^2} \times \dfrac{(1-\varepsilon)^2}{\varepsilon^3}$ (in case $2 \leq Re \leq 6$, f=144)
	*in case one basin in washing	$h0 = 144 \times \dfrac{0.001 \times 0.002 \times 2}{9.8 \times 1000 \times 0.8^2 \times 0.0016^2} \times \dfrac{(1-0.45)^2}{0.45^3} = \underline{0.119m}$* = (0.101m)
	Outlet pipe branch	Flow rate: $3210m^3/d = 0.0371m^3/s$ Pipe size: 300mm(Sectional area = $0.0725m^2$) Flow velocity in the pipe: $0.0371m^3/s \div 0.0725m^2 = 0.512m/s$
	Friction loss of the pipe	Total length of the pipe: 2m $h1 = \lambda \times \dfrac{L}{D} \times \dfrac{V^2}{2g} = 0.01 \times \dfrac{2}{0.3} \times \dfrac{0.512^2}{2g} = \underline{0.0009m}$ λ : Coefficient of friction of Darcy-Weisbach' formula
	Friction loss of the bent	Quantity: 1pc $h2 = f_{b1} \times f_{b2} \times \dfrac{V^2}{2g} \times n = 1.0 \times 1.0 \times \dfrac{0.512^2}{2g} \times 1 = \underline{0.013m}$ f_{b1}: Coefficient of loss caused by radius of curvature f_{b2}: Coefficient of loss coused by center angle of curvature
	Loss of valve	Valve size: 300mm(butterfly valve) Quantity: 1pc $h3 = f_u \times \dfrac{V^2}{2g} \times n = 0.15 \times \dfrac{0.512^2}{2g} \times 1 = \underline{0.002m}$ $f_u = \dfrac{t}{D} = 0.15$ (t = Thickness of disk (D = Bore size of Valve)

Items	Details of Calculation
Outlet pipe main	Flow rate: $16050m^3/d \times 3/5 = 9630m^3/d = 0.111m^3/s$ Pipe size: 500mm(Sectional area $= 0.19m^2$) Flow velocity in the pipe: $0.111m^3/s \div 0.19m^2 = 0.59m/s$ Total length of the pipe: 15m $h4 = \lambda \times \frac{L}{D} \times \frac{V^2}{2g} = 0.01 \times \frac{16}{0.49} \times \frac{0.59^2}{2g} = \underline{0.0058m}$ λ : Coefficient of friction of Darcy-Weisbach' formula
Initial filtration loss	$H4 = h0 + h1 + h2 + h3 + h4$ $= 0.119m + 0.0009m + 0.013m + 0.002m + 0.0058m$ $= \underline{0.1407m}$

3. Manganese removal equipment

*in case one basin in washing

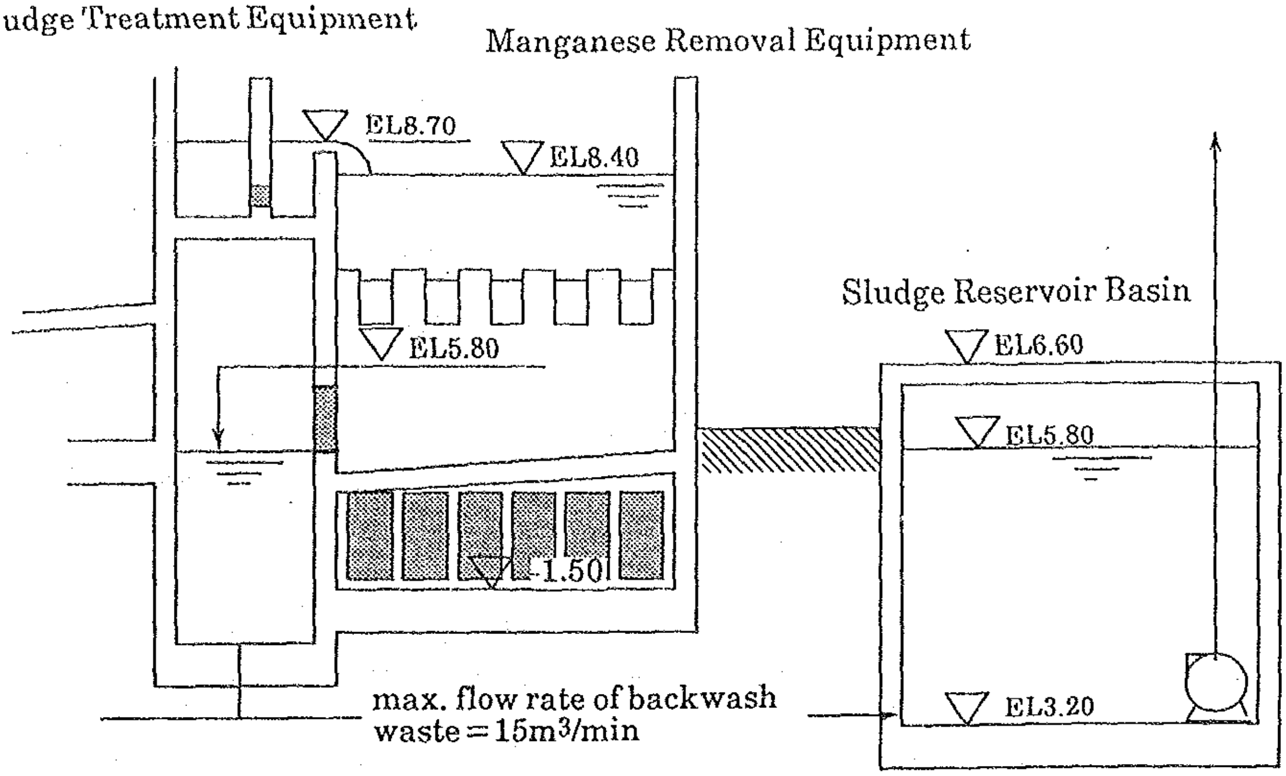


	Items	Details of Calculation
1	Raw water distribution valve :H1	Flow rate: 16050m³/d ÷ 3 = 5350m³/d = 0.0619m³/s Valve size: 400mm(butterfly valve) Quantity: 1pc $H1 = f_u \times \frac{V2}{2g} \times n = 0.1 \times \frac{0.492}{2g} \times 1 = \underline{0.0012m}$ $f_u = \frac{t}{D} = 0.1$ (t = Thickness of disk (D = Bore size of Valve)
2	Overflow depth of distribution weir :H2	Flow rate: 16050m³/d ÷ 3 = 5350m³/d = 0.0619m³/s Width ofn weir: 800mm(B) $H2 = \left(\frac{0.0619}{1.84 \times 0.8}\right)^{2/3} = \underline{0.12m}$
3	Raw water inlet pipe :H3	Pipe size: 400mm(Sectionl area = 0.119m²) Flow velocity in the pipe: 0.0619m³/s ÷ 0.119m² = 0.52m/s
	Friction loss of the pipe	Total length of the pipe: 3m $h1 = \lambda \times \frac{L}{D} \times \frac{V2}{2g} = 0.01 \times \frac{3}{0.39} \times \frac{0.52^2}{2g} = \underline{0.001m}$ λ : Coefficient of friction of Darcy-Weisbach' formula
	Friction loss of the bent	Quantity: 2pc $h2 = f_{b1} \times f_{b2} \times \frac{V2}{2g} \times n = 1.0 \times 1.0 \times \frac{0.52^2}{2g} \times 2 = \underline{0.028m}$ f_{b1}: Coefficient of loss caused by radius of curvature f_{b2}: Coefficient of loss coused by center angle of curvature $H3 = h1 + h2 = 0.001m + 0.028m = \underline{0.029m}$

	Items	Details of Calculation
4	Initial fitration loss: H4	Flow rate: $16050m^3/d \div 3 = 5350m^3/d = 0.0619m^3/s$ Filtration area: $3.6m \times 6.2m = 22.32m^2$ Filtration velocity: $0.0619m^3/s \div 22.32m^2 = 0.0028m/s$
	Head loss of filter layer	v = Filtration velocity: $0.0619m^3/s \div 22.32m^2 = 0.0028m/s$ L = Depth of filter layer: 0.9m D = Size of filter sand: 0.6mm = 0.0006m ϕ = Shape coefficient of sand: 0.8(0.7~0.85) ε = Initial void ratio of sand: 0.45(0.4~0.5) γ = Liquid density: $1000kg/m^3$ μ = Viscocity coefficient: 0.001kg/m·s g = Gravity acceleration: $9.8m/s^2$ α/β = 5.5(5.5~5.7) α: Shape coefficient of sand (for surface area) β: Shape coefficient of sand (for volume) Re = Reynold's number: $(\gamma \times D \times v)/\mu = (1000 \times 0.0006 \times 0.0028)/0.001 = 1.68$ $h0 = f \times \frac{\mu \times v \times L}{g \times \gamma \times \phi^2 \times D^2} \times \frac{(1-\varepsilon)^2}{\varepsilon^3}$ (in case $1 \leqq Re \leqq 2$, f=180)
	*in case one basin in washing	$h0 = 180 \times \frac{0.001 \times 0.0028 \times 0.9}{9.8 \times 1000 \times 0.8^2 \times 0.0006^2} \times \frac{(1-0.45)^2}{0.45^3} = \underline{0.664m}$* $= (\underline{0.474m})$
	Outlet pipe branch	Flow rate: $5350m^3/d = 0.0619m^3/s$ Pipe size: 400mm(Sectionl area = $0.119m^2$) Flow velocity in the pipe: $0.0619m^3/s \div 0.119m^2 = 0.52m/s$
	Friction loss of the pipe	Total length of the pipe: 2m $h1 = \lambda \times \frac{L}{D} \times \frac{V^2}{2g} = 0.01 \times \frac{2}{0.39} \times \frac{0.52^2}{2g} = \underline{0.0007m}$ λ : Coefficient of friction of Darcy-Weisbach' formula
	Friction loss of the bent	Quantity: 1pc $h2 = f_{b1} \times f_{b2} \times \frac{V^2}{2g} \times n = 1.0 \times 1.0 \times \frac{0.52^2}{2g} \times 1 = \underline{0.014m}$ f_{b1}: Coefficient of loss caused by radius of curvature f_{b2}: Coefficient of loss coused by center angle of curvature
	Loss of valve	Valve size: 400mm(butterfly valve) Quantity: 1pc $h3 = f_u \times \frac{V^2}{2g} \times n = 0.15 \times \frac{0.52^2}{2g} \times 1 = \underline{0.002m}$ $f_u = \frac{t}{D} = 0.15$ (t = Thickness of disk (D = Bore size of Valve)

	Items	Details of Calculation
	Outlet pipe main	Flow rate: 16050m^3/d× 2/3 = 10700m^3/d = 0.123m^3/s Pipe seze:500mm(Sectional area = 0.19m^2) Flow velocity in the pipe: 0.123m^3/s ÷ 0.19m^2 = 0.65m/s Total length of the pipe: 15m $h4 = \lambda \times \frac{L}{D} \times \frac{V^2}{2g} = 0.01 \times \frac{15}{0.49} \times \frac{0.65^2}{2g} = \underline{0.0066m}$ λ : Coefficient of friction of Darcy-Weisbach' formula
	Initial filtration loss	H4 = h0 + h1 + h2 + h3 + h4 = 0.664m + 0.0007m + 0.014m + 0.002m + 0.0066m = <u>0.6873m</u>

4. Sludge Treatment Equipment



	Items	Details of Calculation
1	Waste water pipe :H1	Flow rate: $15m^3/min = 0.25m^3/s$
	Friction loss of the pipe	Pipe size: 700mm(Sectional area = $0.38m^2$) Flow velocity in the pipe: $0.25m^3/s \div 0.38m^2 = 0.66m/s$ Total length of the pipe: 110m $h1 = \lambda \times \frac{L}{D} \times \frac{V^2}{2g} = 0.01 \times \frac{110}{0.7} \times \frac{0.66^2}{2g} = \underline{0.035m}$ λ : Coefficient of friction of Darcy-Weisbach' formula
	Friction loss of the bent	Quantity: 2pc $h2 = f_{b1} \times f_{b2} \times \frac{V^2}{2g} \times n = 1.0 \times 1.0 \times \frac{0.66^2}{2g} \times 2 = \underline{0.044m}$ f_{b1}: Coefficient of loss caused by radius of curvature f_{b2}: Coefficient of loss coused by center angle of curvature
	Loss of outlet and inlet of the pipe	$h3 = f \times \frac{V^2}{2g} = 1.5 \times \frac{0.66^2}{2g} = \underline{0.033m}$
	Total loss of Waste water pipe	$H1 = h1 + h2 + h3 = 0.035m + 0.044m + 0.033 = \underline{0.112m}$

2. Calculation Sheet for the Design of the Water Treatment Plant

2-5 Calculation of the Capacity and Outline of the Specification of each Equipment

2-5-1 Mechanical Equipment

(1) Aeration Equipment

Raw water quantity in total	:	32100m³/d(1338m³/h)
Number of the series	:	2 series
Raw water quantity of one series	:	16050m³/d(669m³/h)
(as for one series)		
Aeration area	:	$669m^3/h \times 0.4m^2/m^3/h = 268m^2$
Dimension of Aeration room	:	12m(width)×24m (length)
Capacity of Hold tank	:	740m³
Retention time of Hold tank	:	66min

Outer Structure: Concrete made and Etc.(double floor system)
Spray pipe : Perforated lateral pipe type
Materials of the Spray pipe : Stainless steel Pipe
Accessories : Inlet valves
Drain valves

(2) Iron Removal Equipment

Raw water quantity in total	:	32100m³/d(1338m³/h)
Number of the series	:	2 series
Raw water quantity of one series	:	16050m³/d(669m³/h)
(as for one series)		
Total Filtration area	:	111.6m²
Number of the Basins	:	6 basins
Filtration area per Basin	:	18.6m²
Dimensoin of one Basin	:	3m(width)×6.2m(length)
Filtration Rate	:	$16050m^3/d \div 111.6m^2 = 144m/d$
Depth of Filter Layer	:	2000mm
Size of Sand	:	1.6~2.0mm
Water Backwash velocity	:	Backwash with Air = 0.4m/min Backwash without Air = 0.8m/min
Air Scouring velocity	:	1m/min

Outer Structure : Concrete made
Water collecting device : Concrete floor with Nozzle
Piping materials : Steel pipe inside Tar Epoxy coating

Accessories : Pneumatic valves
Aeration device for Ammonia removal

(3) Manganese Removal Equipment

Raw water quantity in total	:	32100m3/d(1338m3/h)
Number of the series	:	2 series
Raw water quantity of one series (as for one series)	:	16050m3/d(669m3/h)
Total Filtration area	:	89.3m2
Number of the Basins	:	4池
Filtration area per Basin	:	22.32m2
Dimensoin of one Basin	:	3.6m(width)×6.2m(length)
Filtration Rate	:	16050m3/d÷89.3m2=180m/d
Depth of Filter Layer	:	900mm
Size of Sand	:	0.6mm
Water Backwash velocity	:	Backwash=0.6m/min
Air Scouring velocity	:	1m/min

Outer Structure	:	Concrete made
Water collecting device	:	Concrete floor with Nozzles
Piping materials	:	Steel pipe inside Tar Epoxy coating
Accessories	:	Pneumatic valves

(4) Common use Equipments for Iron and Manganese Removal Equipment

1) Backwash Pumps
Type : Double Suction Sentrifugal Pump
Capacity : 7.5m3/min × 10mAq
Motor : 380V、50Hz、4P、18.5kw
With Standarad Accessories
Mumber of pumps : 2sets

2) Air Scouring Blower
Type : Roots Blower
Capacity : 18.5m3/min × 5mAq
Motor : 380V、50Hz、4P、26kw
With Standarad Accessories
Number of Blowers : 2 sets

3) Aeration Blower for Ammonia removal
Type : Roots Blower
Capacity : 5.5m3/min × 5mAq
Motor : 380V、50Hz、4P、11kw

With Standarad Accessories
Number of Blowers : 2 sets

(5) Treated water Reservoir

Outer Structure : Concrete made
Dimension : 30m(width)×35(length)×4.3m(height)
(water depth: 3m)
Total Capacity : 3000m^3
Number of Basin : 2 basins
Accessories : Outlet weir for Manganese Remobable Equipment
Valves

(6) Chlorination Equipment

Water quantity to be dosed : 32100m^3/d(1338m^3/h)
Dosing rate :
for Manganese removal 2mg/l ×1.3 =2.6 mg/l(max.)
for Steralization =2 mg/l
Total =4.6 mg/l
Capacity of Dosing : 1338m^3/h×4.6mg/l=6.15kg/h

1) Chlorinator
Type : Wall mounting Type
Capacity : 2000g/h
Number of Chlorinator : 4 sets

2) Chlorine Container
Type : 1 ton Container
Number of Container : 4 sets

3) Container Weighing Mashine
Type : Load cell type for two Containers
Number of Weighing Mashine : 1 set

4) Container Carrying Equipment
Type : Manual operating Chain Hoist
Capacity : 2 ton
Number of Equipment : 1 set

5) Pressurized water supply Pump
Type : Multi Stage Centrifugal Pump
Capacity : 70 l/min × 50mAq
Motor : 380V、50Hz、2P、2.2kw
With standard accessories

Number of Pump : 3 sets

(7) Sludge Treatment Equipment

Dry solid : 1381kg/d

Quantity of Sludge : $2570m^3/d = 1.78m^3/min$

1) Sludge Reservoir Basin

Outer Structure : Concrete made

Dimension : 10m(width)×18(length)×3.4m(height)
(water depth : 2.6m)

Total Capacity : $450m^3$

Number of Basin : 2 basin

2) Suludge Transfer Pump

Type : Submerged Pump

Capacity : $1\,m^3/min \times 12mAq$

Motor : 380V、50Hz、4P、3.7kw

With standard accessories

Number of Pump : 4 sets

3) Sludge thcikening Basin

Separation Area : $100m^2/basin$

Dimension : 10m×10m

Number of Basin : 2 basin

Up flow velocity : $1.78m^3/min \div (100m^2 \times 2) = 9mm/min$

Outer Structure : Concrete made

Driving Unit : Cyclo Reducer

Motor : 380V、50Hz、4P、0.4kw

Inner Structure :
Center well
Scraper
Water collecting weir

Materials of Inner Structure : Steel with Tar Epoxy Coating

4) Concentrated Sludge Discharge Pump

Type : Snake Pump

Capacity : $50\,m^3/h \times 10mAq$

Motor : 380V、50Hz、4P、11kw

With standard accessories

Number of Pump : 4sets

5) Clear water Return Pump

Type : Singale Suction Centrufugal Pmup

Capacity : $1.8\,m^3/min \times 10mAq$

Motor : 380V、50Hz、4P、5.5kw

With standard accessories
Number of Pump : 2sets

6) Aluminum Sulfate Dosing Equipment

Water quantity to be dosed	:	2570m3/d
Dosing Rate	:	50mg/l (to be assumed)
Dosing Capacity	:	2570m3/d×50mg/l=129kg/d
Concentration of Solution	:	10%
Dosing Flow	:	1290 l/d =0.9 l/min (approx.)

a) Dilution Tank

Outer Construction	:	Concrete made(Inside Epoxy Linning)
Dimension	:	1.6m×1.6m×2.6m(height)
Effective Volume	:	5m3
Number of Tank	:	2 tanks
Accessories	:	Mixer 1.5kw

b) Dosing Pump

Type	:	Metering Pump
Capacity	:	600 lit/min × 5kg/cm2
Motor	:	380V、50Hz、4P、0.2kw

With standard sccessories
Number of Pump : 3 sets

(8) Sludge Drying Bed

Dry Sludge	:	1381kg/d
Sludge Volume	:	138m3/d
Sludge Receiving Rate	:	2762kg/5~6hs(276m3/5~6hs)
Outer Construction	:	Concrete made
Dimension per Bed	:	16m(width)×32m(length)×2m(height)
Number of Beds	:	5 beds

Accessories : Sludge Distribution Pipes
Valves
Overfow Weir

(9) Pipings in the Field

a) Raw water Pipe	350mm、250mm	Steel Pipe
b) Filtered water Pipe	500mm	Steel Pipe
c) Treated water Pipe	700mm	Steel Pipe
d) Wash water Waste	700mm	Steel Pipe
e) Scouring Air Pipe	300mm	Steel Pipe
f) Backwash water Pipe	400mm	Steel Pipe

g)	Clear water Pipe	150mm		PVC
h)	Slude Transfer Pipe	150mm		PVC
i)	Aeration Pipe	150mm		PVC
j)	Chroline Solution and Pressurized water Pipe	80mm、	25mm	PVC
k)	Utility Pipe	50mm		PVC

2-5-2 Electrical Equipment

(1) Center Control Panel with Graphic board

1) Center Control Panel for Intake Pumps
Type : Enclosed Self Standing Indoor Type
Number of Panel : 1 set

2) Center Control Panel for Water Treatment Facility
Type : Enclosed Self Standing Indoor Type
Number of Panel : 1 set

3) Center Control Panel for Distribution Pump
Type : Enclosed Self Standing Indoor Type
Number of Panel : 1 set

(2) Control Panel

1) Control Panel for Backwash Pump and Air Scouring Blower
Type : Enclosed Self Standing Indoor Type
Number of Panel : 2sets

2) Control Panel for Chlorination Equipment
Type : Enclosed Self Standing Indoor Type
Number of Panel : 1 set

3) Control Panel for Sludge Treatment Equipment
Type : Enclosed Self Standing Indoor Type
Number of Panel : 1 set

4) Control Panel for Iron and Manganese Removal Equipment
Type : Enclosed Self Standing Indoor Type
Number of Panel : 2 sets

5) Receptacle for Sludge Drying Bed
Type : Enclosed Wall Mounted Outdoor Type
Number of Panel : 8 pcs

(3) Wiring Materials (for power)

1) Indoor
Cross-Linked Polyethlene Insulated Cable (CV)

2) Outdoor
Steel Armored CV Cable

(4) Instrument

1) Raw water Flow Indicator and Recorder (for 8-wells)
Type of Transmitter : 350 mm Orifice Type
Number : 2 sets

2) Raw water Flow Indicator and Recorder (for 4-wells)
Type of Transmitter : 250 mm Orifice Type
Number : 2 sets

3) Distribution Flow Indicator and Recorder
Type of Transmitter : 600 mm Ultrasonic Type
Number : 2 sets

4) Clear water Flow Indicator
Type of Transmitter : 100 mm Orifice Type
Number : 2 sets

5) Treated Water Reservoir Water Level Indicator and Alarmer
Type of Transmitter : Float Type
Number : 2 sets

6) Chlorine Gas Leak Detector
Type of Transmitter : Non Reagent
Number : 1 set

7) Water Level Alarmer
Number :

for Iron Removal Equipment	12sets
for Manganese Removal Equipment	8sets
for Aluminum Sulfate Dissolving Tank	2sets
for Sludge Reservoir Basin	2sets
for Sump Pit	2sets

(5) Wiring Materials (for instruments)

1) Indoor
Cross-Linked Polyethlene Insulated Cable (CV Cable)

2) Outdoor
Steel Armored CV Cable

Appendix 15

Hydraulic Calculation of Pipelines

Hydraulic Calculation of Raw Water Transmission Pipeline (1)

(From the Red River side to the Treatment Plant)

Pipeline No.- No.	Flow (l/sec)	Dia. (mm)	L (m)	I (1/1000)	V (m/s)	H (m)	T.H. (m)
A - B	50	450	280	0.34	0.31	0.10	0.10
B - C	100	450	320	1.23	0.63	0.39	0.49
C - D	150	450	330	2.61	0.94	0.86	1.35
D - E	200	450	250	4.44	1.26	1.11	2.46
E - F	300	600	120	2.31	1.06	0.28	2.74
F - G	350	600	650	3.08	1.24	2.00	4.74
G - H	372	600	5,300	3.45	1.31	18.29	23.03
NO.4 - E	50	250	280	5.98	1.02	1.67	
NO.2 - F	50	250	140	5.98	1.02	0.84	

(Note):

Flow required = Treatment plant capacity = 30,000 m3/day x 107%
= 32,100 m3/day
= 372 l/sec

L = Length of the pipeline
I (Hydraulic gradient) = 10.666 x C**(-1.85) x D**(-4.87) x Q**(1.85)
(C = 110)
H (Loss of head in the pipeline) = I x (Length)
T.H. = Total loss of head from No.A

Capacity of Intake Pump (Submersible pump)

(Well Nos. 1 - 8 in the Well Field)

- Pumping capacity per unit = 50 l/sec = 3.00 m3/min
- Water level of Aearation Tank in the Plant = + 16.00 m
- Dynamic groundwater level in the well = - 4.00 m
- Actual pumping head = (+16.00) - (-4.00) = 20.00 m
- Loss of head in the raw water transmission pipeline = 23.03 m (See above Table)
- Loss of head around the pump = 1.50 m
- Total pumping head = 20.00 + 23.03 + 1.50 = 44.53 m --> 45 m
- Motor power required:
  P = { 0.163 x 3.00 x 45.0 / (0.7) } x (1+0.15)
  = 36.2 kw --> 37 kw
- Total power required = 37 kw x 8 pumps = 296 kw

Hydraulic Calculation of Raw Water Transmission Pipeline (2)
(In the Treatment Plant)

Pipeline No.- No.	Flow (l/sec)	Dia. (mm)	L (m)	I (1/1000)	V (m/s)	H (m)	T.H. (m)
K - L	50	250	250	5.98	1.02	1.50	1.50
L - M	100	350	160	4.19	1.04	0.67	2.17
M - N	186	450	30	3.88	1.17	0.12	2.29

(Note):

Flow required = 1/2 x (Treatment plant capacity)
= 1/2 x 30,000 m3/day x 107% = 16,050 m3/day = 186 l/sec

L = Length of the pipeline
I (Hydraulic gradient) = 10.666 x C**(-1.85) x D**(-4.87) x Q**(1.85)
(C = 110)
H (Loss of head in the pipeline) = I x (Length)
T.H. = Total loss of head from No.K

Capacity of Intake Pump (Submersible pump)
(Well Nos. 9 - 12 in the Plant)

- Pumping capacity per unit = 50 l/sec = 3.00 m3/min
- Water level of Aearation Tank in the Plant = + 16.00 m
- Dynamic groundwater level in the well = - 5.00 m
- Actual pumping head = (+16.00) - (-5.00) = 21.00 m
- Loss of head in the raw water transmission pipeline = 2.29 m (See above Table)
- Loss of head around the pump = 1.50 m
- Total pumping head = 21.00 + 2.29 + 1.50 = 24.79 m --> 27 m
- Motor power required:
  P = { 0.163 x 3.00 x 27.0 / (0.7) } x (1+0.15)
  = 21.7 kw --> 22 kw
- Total power required = 22 kw x 4 pumps = 88 kw

Water Demand in the Year 2000 (1)

Khu Ngoc Thuy Area

Block No.	Daily Max. Demand (m3/d)	Hourly Max. Demand (l/sec)
A1	347	5.41
A2	282	4.40
A3	256	4.00
Sub Total	884 m3/day	13.81 l/sec

Gia Lam Area

Block No.	Daily Max. Demand (m3/d)	Hourly Max. Demand (l/sec)
B1	373	5.83
B2	460	7.19
B3	773	12.08
B4	633	9.89
B5	530	8.28
B6	478	7.48
B7	628	9.81
B8	511	7.98
B9	395	6.17
B10	457	7.14
B11	307	4.80
B12	257	4.02
B13	62	0.97
B14	73	1.14
B15	169	2.64
B16	137	2.14
B17	116	1.81
B18	100	1.56
B19	82	1.28
B20	446	6.97
B21	485	7.58
B22	76	1.19
B23	244	3.81
B24	42	0.65
Sub Total	7,834 m3/day	122.41 l/sec

Duc Giang Area

Block No.	Daily Max. Demand (m3/d)	Hourly Max. Demand (l/sec)
C1	178	2.78
C2	450	7.03
C3	692	10.81
C4	105	1.64
C5	-	-
C6	746	11.66
C7	423	6.61
C8	-	-
C9	278	4.34
C10	145	2.27
C11	221	3.45
C12	86	1.34
C13	301	4.70
C14	298	4.66
C15	20	0.31
C16	147	2.30
C17	627	9.80
C18	198	3.09
C19	-	-
C20	88	1.38
C21	233	3.64
C22	40	0.63
C23	573	8.95
C24	896	14.00
C25	659	10.30
Sub Total	7,404 m3/day	115.69 l/sec

Sai Dong Area

Block No.	Daily Max. Demand (m3/d)	Hourly Max. Demand (l/sec)
D1	179	2.80
D2	138	2.16
D3	180	2.81
D4	117	1.83
D5	76	1.19
D6	491	7.67
D7	200	3.13
D8	557	8.70
D9	221	3.45
D10	284	4.44
D11	565	8.83
D12	474	7.41
D13	106	1.66
D14	630	9.84
D15	507	7.92
D16	252	3.93
D17	433	6.77
D18	323	5.05
D19	363	5.67
D20	566	8.84
D21	249	3.89
D22	523	8.17
D23	534	8.34
Sub Total	7,968 m3/day	124.50 l/sec

(Note):
Hourly Maximum Demand = (Daily Maximum Demand) x (135 %)

Water Demand in the Year 2000 (2)

Block No.	Daily Max. Demand (m3/d)	Hourly Max. Demand (l/sec)
Sub Urban Area		
Gia Thuong	95	1.48
Gia Quat	217	3.39
Gia Thuy	285	4.45
Ngoc Lam	452	7.06
Lam Du	520	8.13
Viet Hung	1,109	17.33
Thuong Cat	424	6.63
Duc Giang	207	3.23
Thanh Am	242	3.78
Lon Caie	399	6.23
Gia Thuy	433	6.77
Xon Dang	130	2.03
Thon Ngo	607	9.48
Long Bien	790	12.35
Sub Total	5,910 m3/day	92.34 l/sec

Block No.	Daily Max. Demand (m3/d)	Hourly Max. Demand (l/sec)
Summary		
Block A (Ngo Thuy)	884	13.81
Block B (Gia Lam)	7,834	122.41
Block C (Duc Giang)	7,404	115.69
Block D (Sai Dong)	7,968	124.50
Sub Urban Area	5,910	92.34
Grand Total	30,000 m3/day	468.75 l/sec

(Note):
Hourly Maximum Demand
= (Daily Maximum Demand) x (135 %)

Hydraulic Calculation of Distribution Pipelines (1)
(Gia Lam Area)

Pipeline No. - No.	Flow (l/sec)	Dia. (mm)	L (m)	I (1/1000)	V (m/s)	H (m)	T.H. (m)	G.H. (m)	R.Head (m)
(Dynamic Water Level at Treatment Plant = +50.00 m)									
(LWL of Reservoir = + 1.00 m, Pump Head = 49.0 m, 1.0 + 49.0 = 50.0 m)									
100 - 200	468.75	700	600	2.45	1.22	1.47	1.47	+5.3	43.23
200 - 500	310.19	600	1400	2.45	1.10	3.43	4.90	+7.3	37.80
500 - 11	145.44	450	400	2.43	0.91	0.97	5.87	+7.0	37.13
11 - 12	140.34	450	300	2.40	0.88	0.73	6.60	+7.2	36.20
12 - 13	70.16	300	300	4.60	0.99	1.38	7.98	+7.0	35.02
13 - 14	68.40	300	200	4.30	0.97	0.86	8.84	+6.7	34.46
14 - 15	60.34	300	300	3.45	0.85	1.04	9.88	+6.7	33.42
15 - 16	50.08	300	300	2.50	0.71	0.76	10.64	+6.6	32.76
16 - 17	46.12	300	200	2.12	0.65	0.42	11.06	+6.6	32.34
17 - 18	42.55	250	300	4.30	0.87	1.29	12.35	+6.6	31.05
18 - 19	37.66	250	400	3.50	0.78	1.40	13.75	+6.6	29.65
19 - 20	10.52	150	200	3.90	0.59	0.78	14.53	+6.5	28.97
20 - 21	6.78	150	200	1.75	0.38	0.35	14.88	+13.0	22.12
12 - 22	66.37	300	400	4.15	0.94	1.66	8.26	+6.8	34.94
22 - 23	65.90	300	400	4.00	0.93	1.60	9.86	+6.6	33.54
23 - 24	52.05	300	300	2.80	0.74	0.84	10.70	+6.5	32.80
24 - 25	50.02	300	100	2.45	0.71	0.25	10.95	+6.4	32.65
25 - 26	47.62	300	200	2.25	0.67	0.45	11.40	+6.2	32.40
26 - 27	44.05	250	300	4.60	0.90	1.38	12.78	+6.1	31.12
27 - 28	28.88	200	300	6.30	0.92	1.89	14.67	+6.0	29.33
28 - 29	20.90	200	200	3.40	0.67	0.68	15.35	+5.8	28.85
29 - 30	9.97	150	200	3.55	0.56	0.71	16.06	+10.0	23.94
19 - Lam Du	8.13	150	1200	2.41	0.46	2.89	16.64	+6.0	27.36

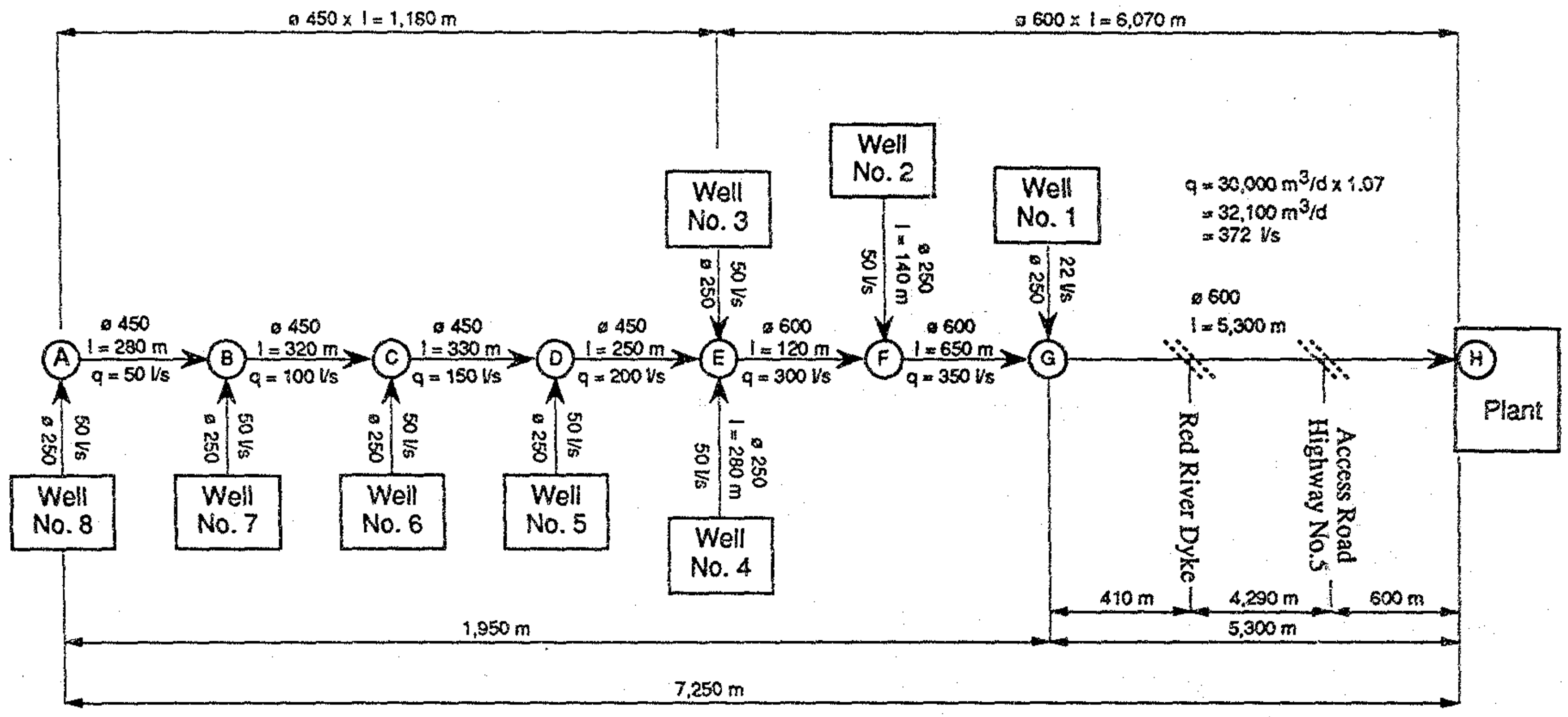
(Note)
L = Length of the pipeline
I (Hydraulic gradient) = 10.666 x C**(-1.85) x D**(-4.87) x Q**(1.85)
(C = 110)
H (Loss of head in the pipeline) = I x (Length)
T.H. = Total loss of head from Treatment Plant
G.H. = Ground height above sea level
R. Head = Residual head

Hydraulic Calculation of Distribution Pipelines (2)
(Duc Giang Area)

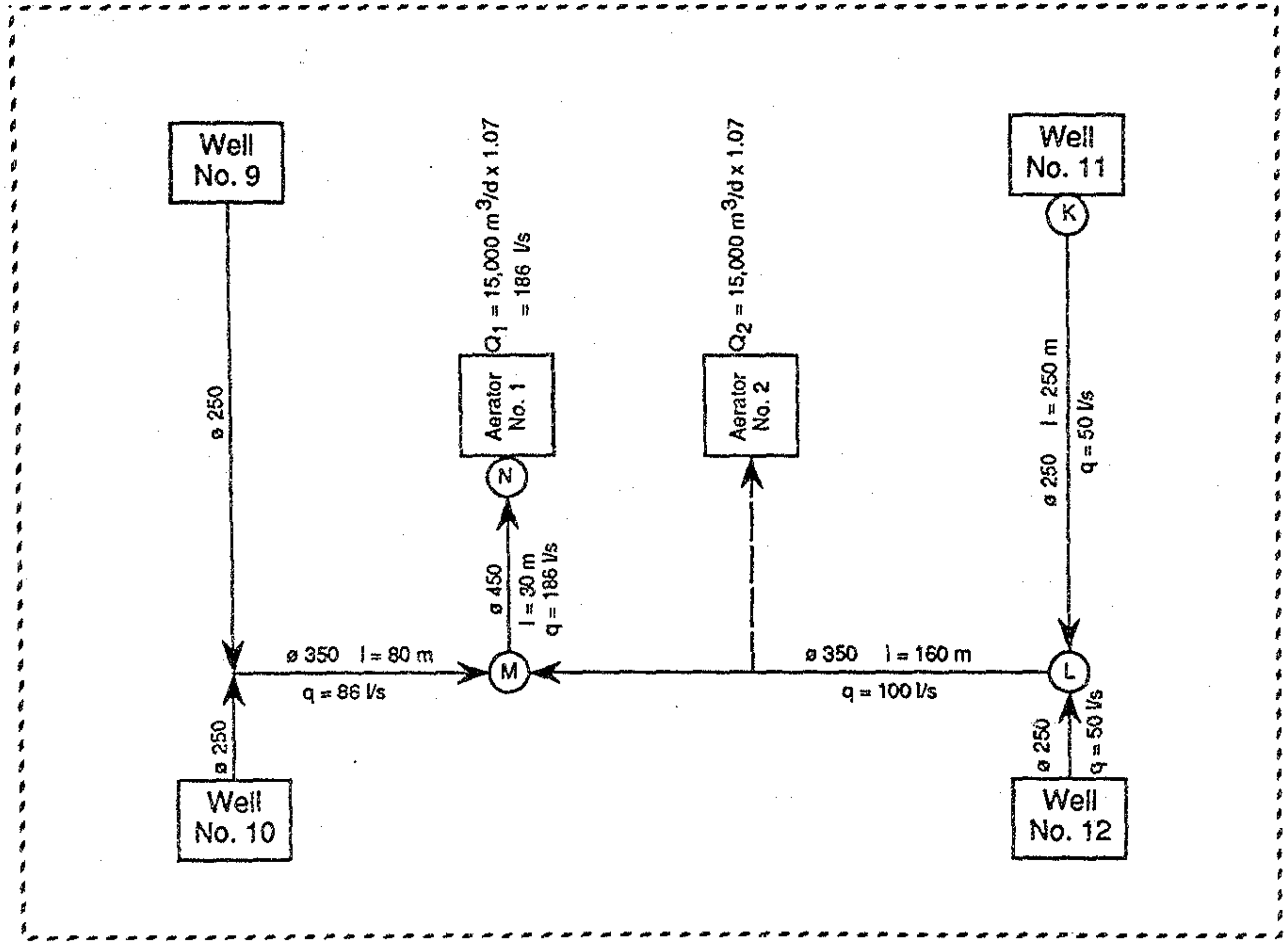
Pipeline No. - No.	Flow (l/sec)	Dia. (mm)	L (m)	I (1/1000)	V (m/s)	H (m)	T.H. (m)	G.H. (m)	R.Head (m)
(Dynamic Water Level at Treatment Plant = +50.00 m)									
100 - 200	468.75	700	600	2.45	1.22	1.47	1.47	+5.3	43.23
200 - 500	310.19	600	1400	2.45	1.10	3.43	4.90	+7.3	37.80
500 - 41	155.32	450	400	2.79	0.98	1.12	6.02	+7.6	36.38
41 - 42	152.74	450	400	2.67	0.96	1.07	7.09	+7.6	35.31
42 - 43	130.02	400	400	3.50	1.03	1.40	8.49	+7.5	34.02
43 - 44	56.61	250	300	7.50	1.15	2.25	10.74	+7.5	31.76
44 - 45	50.66	250	700	6.20	1.03	4.34	15.08	+7.5	27.50
45 - 46	32.74	250	700	2.68	0.67	1.82	16.90	+7.5	25.60
46 - 47	10.30	150	300	3.80	0.58	1.14	18.04	+8.5	23.46
43 - 48	60.16	250	300	8.30	1.23	2.49	10.98	+8.0	31.02
48 - 49	55.82	250	600	7.20	1.14	4.32	15.30	+8.0	26.70
49 - 50	49.21	250	200	5.75	1.00	1.15	16.45	+8.0	25.55
50 - 51	40.54	250	500	3.95	0.83	1.98	18.43	+8.1	23.47
51 - 52	15.29	200	800	1.90	0.49	1.52	19.95	+8.1	21.95
52 - 53	5.88	150	400	1.35	0.33	0.54	20.49	+8.3	21.27
42 - Viet Hung	17.33	200	800	2.45	0.55	1.96	9.05	+7.0	33.95

Hydraulic Calculation of Distribution Pipelines (3)
(Sai Dong Area)

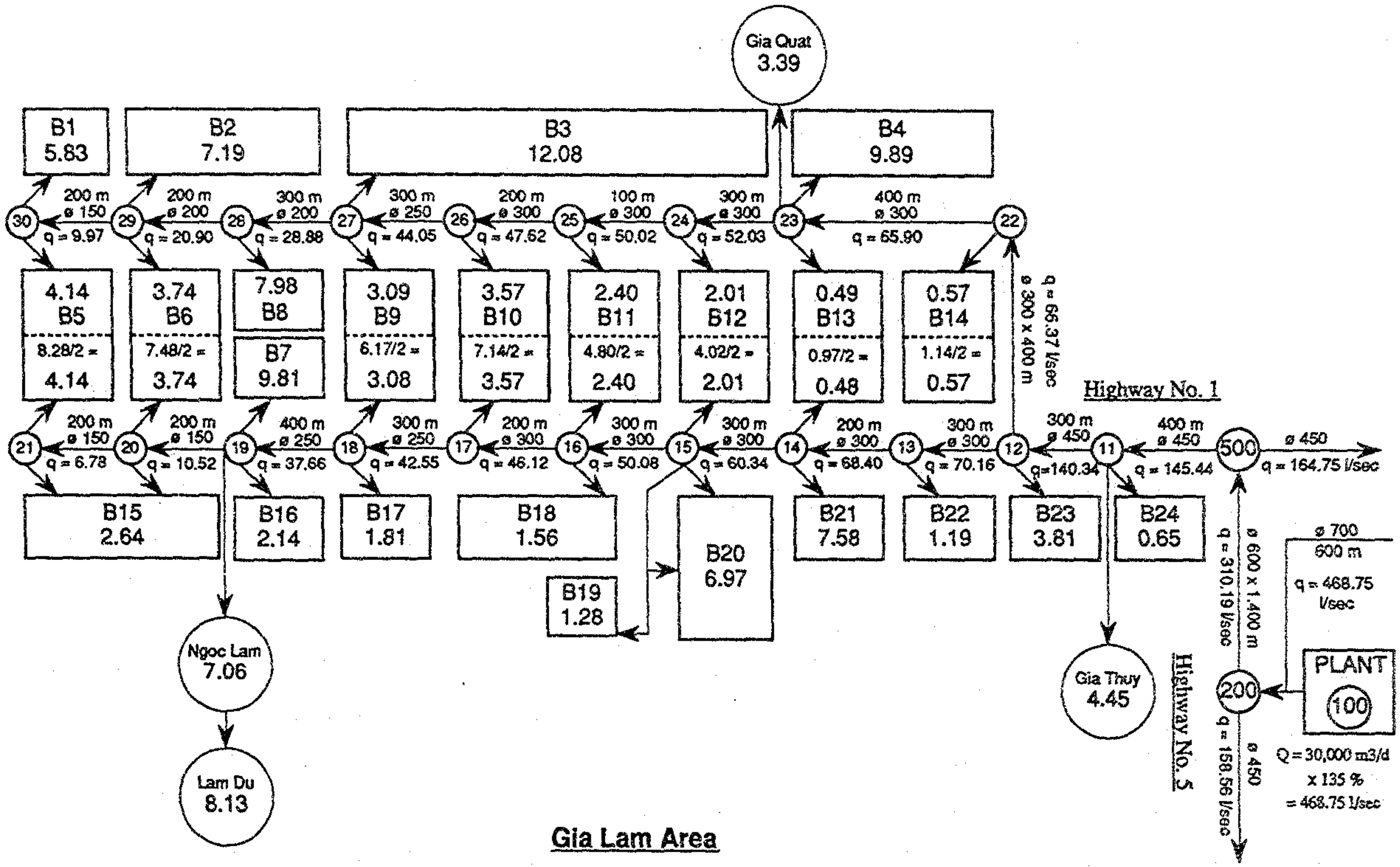
Pipeline No. - No.	Flow (1/sec)	Dia. (mm)	L (m)	I (1/1000)	V (m/s)	H (m)	T.H. (m)	G.H. (m)	R.Head (m)
(Dynamic Water Level at Treatment Plant = +50.00 m)									
100 - 200	468.75	700	600	2.45	1.22	1.47	1.47	+5.3	43.23
200 - 71	158.56	450	900	2.85	1.00	2.57	4.04	+5.2	40.76
71 - 72	156.40	450	600	2.78	0.98	1.67	5.71	+5.1	39.19
72 - 73	146.82	400	300	4.40	1.17	1.32	7.03	+5.0	37.97
73 - 74	118.67	400	400	2.95	0.94	1.18	8.21	+4.9	36.89
74 - 75	81.74	350	550	2.80	0.85	1.54	9.75	+4.8	35.45
75 - 76	18.08	200	800	2.65	0.58	2.12	11.96	+4.6	33.44
76 - 77	10.16	150	250	3.70	0.57	0.93	12.87	+4.5	32.63
75 - 84	35.92	250	900	3.20	0.73	2.88	12.63	+5.5	31.87
84 - 85	25.72	250	400	1.72	0.52	0.69	13.32	+6.0	30.68
85 - 86	12.35	150	1000	5.41	0.70	5.41	18.73	+6.2	25.07
74 - 78	28.59	250	450	2.10	0.58	0.95	9.16	+5.2	35.64
78 - 79	22.97	200	200	4.15	0.73	0.83	9.99	+5.2	34.81
79 - 80	11.83	150	350	4.80	0.67	1.68	11.67	+5.2	33.13
75 - 81	27.74	250	200	1.98	0.56	0.40	10.15	+5.3	34.55
81 - 82	18.91	200	400	2.84	0.60	1.14	11.29	+5.3	33.41
82 - 83	1.66	150	350	0.13	0.09	0.05	11.34	+5.3	33.36
85 - Thon Ngo	9.48	150	700	3.22	0.54	2.25	15.57	+6.5	27.93



Hydraulic Calculation Chart of Raw Water Transmission Pipelines (1)

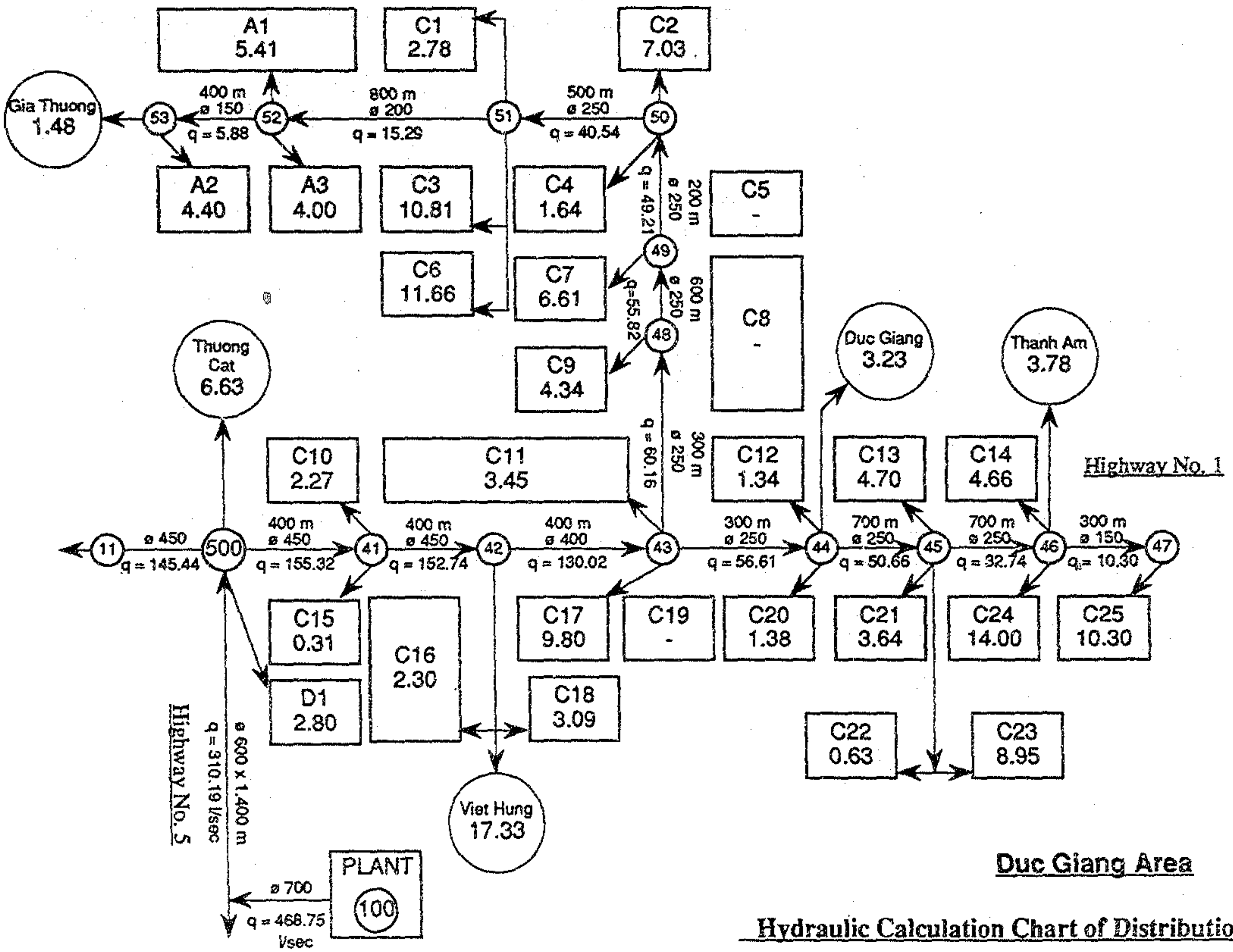


Hydraulic Calculation Chart of Raw Water Transmission Pipelines (2)



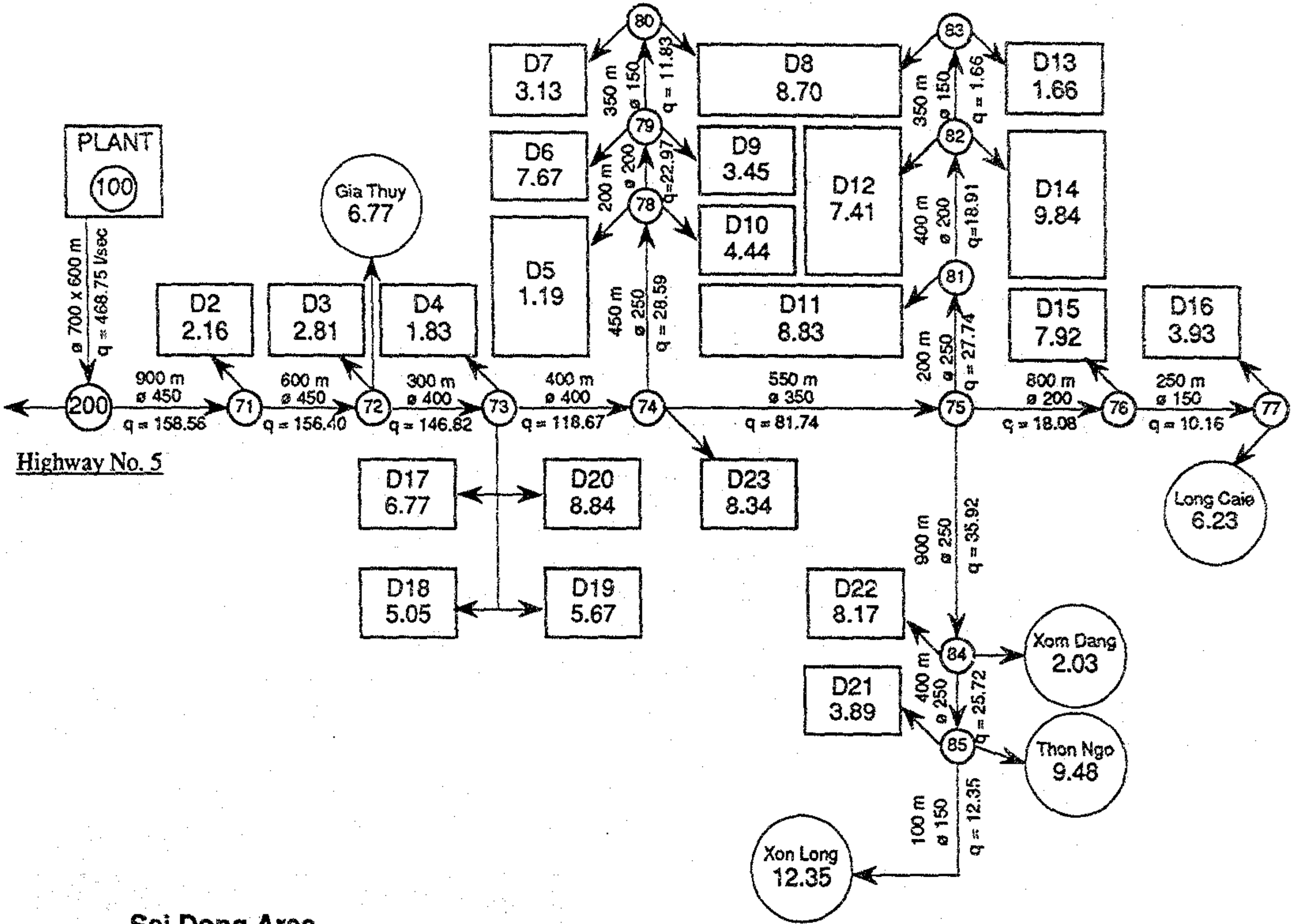
Gia Lam Area

Hydraulic Calculation Chart of Distribution Pipelines (1)



Duc Giang Area

Hydraulic Calculation Chart of Distribution Pipelines (2)



Sai Dong Area

Hydraulic Calculation Chart of Distribution Pipelines (3)

Appendix 16

List of Equipment and Materials

1. Well Construction Materials

No.	ITEM	Q'TY	SPECIFICATION
1	Well construction equipment and materials		
1-1	Well construction equipment		
1-1-01	Well drilling rig	2 Units	Cable percussion type well drilling rig with deck engine power unit. Drilling capacity : φ20"×100m
1-1-02	Transportation truck for drilling rig	2 Units	With 3 ton crane, 6×4
1-2	Standard operation accessories		
1-2-01	Drilling line wire rope	2 Rolls	φ24mm, L=200m
1-2-02	Sand line wire rope	2 Rolls	φ12mm, L=200m
1-2-03	Casing line wire rope	2 Rolls	φ18mm, L=110m
1-2-04	Travelling block for casing line	2 Pcs.	Capacity : 30 ton, 3-wheel
1-2-05	Mast reinforcing legs with screw type levelling jacks	2 Sets	
1-2-06	Working platform for drilling operation	2 Sets	4,000×4,000mm
1-2-07	Guy line system as follows	2 Sets	
1-2-08	Miscellaneous and maintenance tools for drilling rig	2 Sets	
1-3	Open hole drilling tools		
1-3-01	Drilling bit	2 Pcs.	Tubular type φ600mm (24") bit, for conductor pipe
1-3-02	Drilling bit	3 Pcs.	Tubular type φ500mm (20") bit, for casing pipe
1-3-03	Wire crip for drilling line	50 Pcs.	For φ24mm
1-3-04	Flat valve bailer	2 Pcs.	14"×3,500L
1-3-05	Bailing ditch for above	2 Boxes	Steel
1-3-06	Mud mixer	2 Units	Engine drive type, capacity : 250 l
1-3-07	Outlet mud hose for above	2 Pcs.	φ 4"×L5,000, with clamp
1-3-08	Wire grip for drilling line	2 Pcs.	For φ24mm
1-3-09	Casing clamp for 24" conductor pipe	2 Sets	For φ24" conductor pipe
1-3-10	Wrench for above	8 Pcs.	
1-3-11	Sling wire rope for above	8 Pcs.	
1-3-12	Engineering tool kit	2 Sets	
1-3-13	Wire grip for drilling line	2 Pcs.	
1-3-14	Saver for wire line of drilling bit	2 Set	

No.	ITEM	Q'TY	SPECIFICATION
1-4	Well logging equipment		
1-4-01	Well logging equipment	1 Set	Normal resistivity, point mesuring system
1-4-02	Logging cable	1 Pce.	Electrode span:50cm and 100cm, L=100m
1-4-03	Battery	1 Pce.	
1-4-04	Battery cable	1 Pce.	With terminals
1-5	Casing equipment		
1-5-01	Casing clamp for 14" casing pipe	4 Pcs.	For SGP 350A
1-5-02	Wrench for above	8 Pcs.	
1-5-03	Sling wire rope for above	2 Sets	φ22mm×L 1,500mm
1-6	Well development equipment		
1-6-01	Flat valve bailer	2 Pcs.	For SGP 350A, L=3,500mm
1-6-02	Surge block with stem	2 Pcs.	For SGP 350A
1-7	Well testing equipment		
1-7-01	Submersible motor pump	1 Set	Capacity:Q=3,000 l/min, H=27m With 50m power cable and standard accessorty, voltage:380V
1-7-02	Riser pipe	8 Pce.	JIS G-3452 SGP 150A×5.5m, galvanized pipe
1-7-03	Nipple	2 Pce.	150A
1-7-04	Elbow	1 Pce.	150A
1-7-05	Sluice valve	1 Pce.	150A, JIS 10K
1-7-06	Check valve	1 Pce.	150A, JIS 10K
1-7-07	Flange	2 Pce.	150A
1-7-08	Bolt and nut	24 Sets	SUS, M20×70
1-7-09	Packing	3 Pce.	150A
1-7-10	Control panel	1 Unit	
1-7-11	Diesel engine generator	1 Unit	3-phase, 380V×50KVA
1-7-12	Intermediate cable	1 Pce.	38mm²×3c×20m, With terminals
1-7-13	Notch box	1 Box	Steel triangular notch weir
1-7-14	Band for riser pipe	1 Sets	for 150A
1-7-15	Water level indicator	1 Unit	Measuring deepth:100m
1-7-16	Discharge pipe	1 Pce.	φ150mm, L=5m, with JIS 10K flange
1-8	Consumable goods for well construction works		
1-8-01	Electrode by electric welding	50 kg	
1-8-02	Special electrode by gas welding	50 kg	

No.	ITEM	Q'TY	SPECIFICATION
1-9	Fishing tools		
1-9-01	Hidraulic jack	2 Sets	Capacity:30 t. lift:200mm
1-9-02	Jack up rod	14 Pcs.	φ89.1mm(2-3/8"IF), L=6,000mm, with wrench recess
1-9-03	Jack up rod	2 Pcs.	φ89.1mm(2-3/8"IF), L=3,000mm, with wrench recess
1-9-04	Jack up rod	2 Pcs.	φ89.1mm(2-3/8"IF), L=1,500mm, with wrench recess
1-9-05	Overshot for tubular bit	1 Set	With 2-3/8" IF. thread
1-9-06	Hoisting plug for jack up rod	1 Pce.	For φ89.1mm(2-3/8"IF)
1-9-07	Wedge band	1 Pce.	For φ89.1mm(2-3/8"IF)
1-9-08	Wedge band	2 Pcs.	For φ89.1mm(2-3/8"IF)
1-9-09	Hook	1 Pce.	With 2-3/8" IF. thread
1-9-10	Rope spear	1 Pce.	With 2-3/8" IF. thread
1-9-11	Rod wrench	2 Pcs.	For φ89.1mm(2-3/8"IF)
1-10	Spare parts		
1-10-01	Spare parts for well drilling rig	1 Set	
1-10-02	Spare parts for transportation truck	1 Set	
1-10-03	Spare parts for submersible motor pump	1 Set	
1-10-04	Spare parts for control panel	1 Set	
1-10-05	Spare parts for diesel engine generator	1 Set	

No.	ITEM	Q'TY	SPECIFICATION
2	Well construction material		
2-1	Conductor pipe	18 Pcs.	JIS G-3457, STPY, 600A, L=6,000mm
2-2	Casing pipe	100 Pcs.	JIS G-3452, SGP, 350A, L=5,500mm
2-3	Strainer pipe	88 Pcs.	Pipe base type round wire strainer, Slot of round wire:1.0mm Base pipe:JIS G-3452, SGP, 350A, L=5,500mm Effective length of strainer : 5,000mm
2-4	Bottom plug	12 Pcs.	same quality as casing pipe
3	Erectric welder		
3-1	Engine drive welder	1 Unit	Welding ampacity:50~240A, Applicability of electrode:2.6~5.0mm With generator, capacity:380V×7.5KVA
3-2	Accessory for welder		
3-2-01	Welding holder	1 Pce.	38mm²
3-2-02	Earth grip	1 Pce.	38mm²
3-2-03	Welding cable	1 Pce.	38mm²×15m
3-2-04	Earth cable	1 Pce.	38mm²×10m
3-2-05	Werding mask	2 Pcs.	
3-2-06	Werding glove	6 Pcs.	
3-2-07	Chipping hammer	2 Pcs.	
3-3	Spare parts for welder	1 Set	

II. DISTRIBUTION PIPE MATERIALS

No.	ITEM	SIZE	Q'TY
1	DUCTILE IRON STRAIGHT PIPES	φ 75×4,000	4,826
2	〃	φ100×4,000	800
3	〃	φ150×5,000	2,472
4	〃	φ200×5,000	592
5	〃	φ250×5,000	1,104
6	〃	φ300×6,000	385
7	〃	φ350×6,000	92
8	〃	φ400×6,000	189
9	〃	φ450×6,000	482
10	〃	φ600×6,000	214
11	〃	φ700×6,000	110
12	SOCKET AND SPIGOT 90° BEND	φ 75	5
13	〃	φ100	2
14	〃	φ100	1
15	SOCKET AND SPIGOT 45° BEND	φ 75	9
16	〃	φ100	2
17	〃	φ150	3
18	SOCKET AND SPIGOT 22.5° BEND	φ 75	1
19	〃	φ100	2
20	〃	φ150	13
21	〃	φ300	2
22	〃	φ700	2
23	COLLAR	φ 75	194
24	〃	φ100	33
25	〃	φ150	124
26	〃	φ200	32
27	〃	φ250	57
28	〃	φ300	24
29	〃	φ350	6
30	〃	φ400	13
31	〃	φ450	30
32	〃	φ600	13
33	〃	φ700	7
34	FLANGED SOCKET	φ 75	47
35	〃	φ100	14
36	〃	φ150	25
37	〃	φ200	8
38	〃	φ250	5
39	〃	φ300	2
40	〃	φ450	2

No.	ITEM	SIZE	Q'TY
41	FLANGED SPIGOT	φ 75	185
42	〃	φ100	16
43	〃	φ150	27
44	〃	φ200	5
45	〃	φ250	5
46	〃	φ300	2
47	〃	φ450	4
48	PLUG	φ 75	4
49	〃	φ100	1
50	〃	φ150	6
51	〃	φ250	1
52	BLANK FLANGE	φ150	5
53	〃	φ200	3
54	〃	φ250	1
55	SOCKET AND SPIGOT TEE W/ SOCKET BRANCH	φ 75×φ 75	36
56	〃	φ100×φ 75	18
57	〃	φ150×φ 75	62
58	〃	φ150×φ100	6
59	〃	φ150×φ150	10
60	〃	φ200×φ100	11
61	〃	φ200×φ150	2
62	〃	φ200×φ200	3
63	〃	φ250×φ100	20
64	〃	φ250×φ150	5
65	〃	φ250×φ250	2
66	〃	φ300×φ100	4
67	〃	φ300×φ150	3
68	〃	φ350×φ250	2
69	〃	φ400×φ300	5
70	〃	φ450×φ300	6
71	〃	φ500×φ300	1
72	〃	φ600×φ600	1
73	〃	φ700×φ400	2
74	〃	φ700×φ700	1
75	SOCKET AND SPIGOT TEE W/ FLANGED BRANCH	φ100×φ 75	7
76	〃	φ150×φ 75	33
77	〃	φ200×φ 75	9
78	〃	φ250×φ 75	14
79	〃	φ300×φ 75	7
80	〃	φ350×φ 75	2
81	〃	φ400×φ 75	4
82	〃	φ450×φ 75	8
83	〃	φ600×φ 75	4

No.	ITEM	SIZE	Q'TY
84	LARGE SOCKET TAPER	φ100×φ 75	12
85	〃	φ150×φ100	15
86	〃	φ200×φ100	1
87	〃	φ200×φ150	3
88	〃	φ250×φ150	3
89	〃	φ250×φ200	3
90	〃	φ300×φ150	2
91	〃	φ300×φ250	1
92	〃	φ350×φ200	1
93	〃	φ400×φ250	1
94	〃	φ400×φ300	1
95	〃	φ450×φ300	1
96	〃	φ450×φ400	2
97	〃	φ600×φ450	1
98	〃	φ700×φ400	1
99	SMALL SOCKET TAPER	φ100×φ 75	34
100	〃	φ150×φ100	2
101	〃	φ200×φ100	3
102	〃	φ250×φ200	1
103	〃	φ300×φ100	2
104	〃	φ350×φ150	3
105	〃	φ300×φ200	1
106	〃	φ300×φ250	2
107	〃	φ350×φ200	1

No.	ITEM	SIZE	Q'TY
108	SMALL SOCKET TAPER	φ400×φ150	1
109	〃	φ450×φ200	1
110	〃	φ600×φ450	1
111	〃	φ700×φ600	1

VALVES & OTHERS

No.	ITEM	SIZE	Q'TY
112	SLUICE VALVE	φ450	3
113	〃	φ300	2
114	〃	φ250	6
115	〃	φ200	8
116	〃	φ150	31
117	〃	φ100	26
118	〃	φ 75	157
119	FIRE HYDRANT W/ ISOLATING VALVE	φ 75	91
120	PVC (SOCKET & SPIGOT W/ RUBBER GASKET)	φ100×5,000	538
121	〃	φ 75×5,000	2,110
122	〃	φ 50×5,000	5,614
123	TS CAP	φ 75	7
124	〃	φ 50	75
125	FCD MECHANICAL TEE W/ RESTRAINED JOINT	φ100×φ100	5
126	〃	φ100×φ 50	10
127	〃	φ 75×φ 75	17
128	〃	φ 75×φ 50	33
129	〃	φ 50×φ 50	58
130	FCD VS JOINT W/ RESTRAINED JOINT	φ100×φ 75	10
131	〃	φ 75×φ 50	28
132	FCD MECHA. BEND W/ RESTRAINED JOINT	φ100× 90°	2
133	〃	φ100× 45°	4
134	〃	φ100× 22°	1
135	〃	φ 75× 90°	20
136	FCD MECHANICAL BEND W/ RESTRAINED JOINT	φ 75× 45°	8
137	〃	φ 75× 22°	13
138	〃	φ 50× 90°	83
139	〃	φ 50× 45°	39
140	〃	φ 50× 22°	25
141	FCD VC FLANGED SOKET	φ100	9
142	〃	φ 75	24
143	FCD VC FILANGED SOCKET TAPER	φ150×φ100	2
144	〃	φ100×φ 75	11
145	〃	φ 75×φ 50	71
146	FCD MECHANICAL TEE W/ FLANGED BRANCH	φ100×φ 75	3

IN TREATMENT PLANT

No.	ITEM	SIZE	Q'TY
1	DUCTILE IRON STRAIGHT PIPES	φ700×6,000	20
2	COLLAR	φ700	6
3	PLUG	φ700	1
4	SOCKET AND SPIGOT TEE W/ FLANGED BRANCH	φ700×φ400	6
5	SMALL SOCKET TAPER	φ700×φ200	6

TOOLS

No.	ITEM	SIZE
1	JOINTING TOOLS	1 LOT
2	WATER PRESSURE TEST MACHINARY	1 LOT

SPARE ITEMS

No.	ITEM	SIZE	Q'TY
1	DUCTILE IRON STRAIGHT PIPES (JIS CLASS 3)	φ 75×4,000	145
2	〃	φ100×4,000	24
3	〃	φ150×5,000	74
4	〃	φ200×5,000	18
5	〃	φ250×5,000	33
6	〃	φ300×6,000	12
7	〃	φ350×6,000	3
8	〃	φ400×6,000	6
9	〃	φ450×6,000	14
10	〃	φ600×6,000	6
11	〃	φ700×6,000	3
12	SOCKET AND SPIGOT 90° BEND	φ 75	1
13	〃	φ100	1
14	SOCKET AND SPIGOT 45° BEND	φ 75	12
15	〃	φ100	4
16	〃	φ150	8
17	〃	φ200	4
18	〃	φ250	4
19	〃	φ600	4
20	SOCKET AND SPIGOT 22.5° BEND	φ 75	12
21	〃	φ100	4
22	〃	φ150	8
23	〃	φ200	4
24	〃	φ250	4
25	〃	φ300	2
26	SOCKET AND SPIGOT 11.25° BEND	φ 75	12
27	〃	φ100	4
28	〃	φ150	8
29	〃	φ200	4
30	〃	φ250	4
31	〃	φ300	4
32	〃	φ350	2
33	〃	φ400	4
34	〃	φ450	4
35	PVC (SOCKET & SPIGOT W/ RUBBER GASKET)	φ100×5,000	27
36	〃	φ 75×5,000	106
37	〃	φ 50×5,000	281
38	TS CAP	φ 75	2
39	〃	φ 50	7
40	FCD VS JOINT W/ RESTRAINED JOINT	φ100×φ 75	2
41	〃	φ 75×φ 50	5

SPARE ITEMS

No.	ITEM	SIZE	Q'TY
42	FCD MECHANICAL BEND W/ RESTRAINED JOINT	φ100× 90°	1
43	〃	φ100× 45°	1
44	〃	φ100× 22°	1
45	〃	φ 75× 90°	4
46	〃	φ 75× 45°	2
47	〃	φ 75× 22°	3
48	〃	φ 50× 90°	16
49	〃	φ 50× 45°	8
50	〃	φ 50× 22°	5
51	FCD VC FLANGED SOCKET	φ100	2
52	〃	φ 75	5
53	FCD VC FLANGED FLANGED TAPER	φ150×φ100	1
54	〃	φ100×φ 75	2
55	〃	φ 75×φ 50	14
56	TAPPING MACHINE	φ 20	5
57	〃	φ 40	5

FOR HOUSE CONNECTION , PUBLIC TAP (TYPE A)

No.	ITEM	SIZE	Q'TY
1	TAPPING SADDLE	(φ200×φ20)	(5,940) *1
2	POLYETHYLENE SERVICE PIPE	φ20×20m	5,940
3	WATER METER	φ13	5,940
4	SCREW FITTINGS FOR SERVICE PIPE	φ20, φ13	5,940

*1 TAPPING SADDLE

MAININE DIP	φ200×φ20	240
	φ150×φ20	950
	φ100×φ20	245
	φ 75×φ20	1,490
MAINLINE PVC	φ100×φ20	185
	φ 75×φ20	780
	φ 50×φ20	2,050

FOR PLANT, LARGE USER (TYPE A)

No.	ITEM	SIZE	Q'TY
1	TAPPING SADDLE	(φ200×φ40)	(180) *1
2	FOLYETHYLENE SERVICE PIPE	φ40×50m	180
3	WATER METER	φ40	180
4	SCREW FITTINGS FOR SERVICE PIPE	φ40	180
	*1 TAPPING SADDLE		
	MAINLINE DIP	φ200×φ40	30
		φ150×φ40	120
		φ100×φ40	10
		φ75×φ40	20

FOR BUILDING (TYPE B)

No.	ITEM	SIZE	Q'TY
1	TAPPING SADDLE	(φ200×φ40)	(70) *1
2	FOLYETHYLENE SERVICE PIPE	φ40×20m	70
3	SCREW FITTINGS FOR SERVICE PIPE	φ40、φ20	70
	*1 TAPPING SADDLE		
	MAINLINE DIP	φ200×φ40	10
		φ150×φ40	50
		φ100×φ40	10

No.	ITEM	SIZE	Q'TY
1	FOLYETHYLENE SERVICE PIPE	φ20×60m	950
2	SATER METER	φ13	950
3	SCREW FITTINGS FOR SERVICE PIPE	φ20、φ13	950

JICA

JICA BASIC DESIGN STUDY REPORT ON THE PROJECT FOR THE WATER SUPPLY SYSTEM IN GIA LAM AREA, HA NOI CITY IN THE SOCIALIST REPUBLIC OF VIET NAM OCTOBER 1993