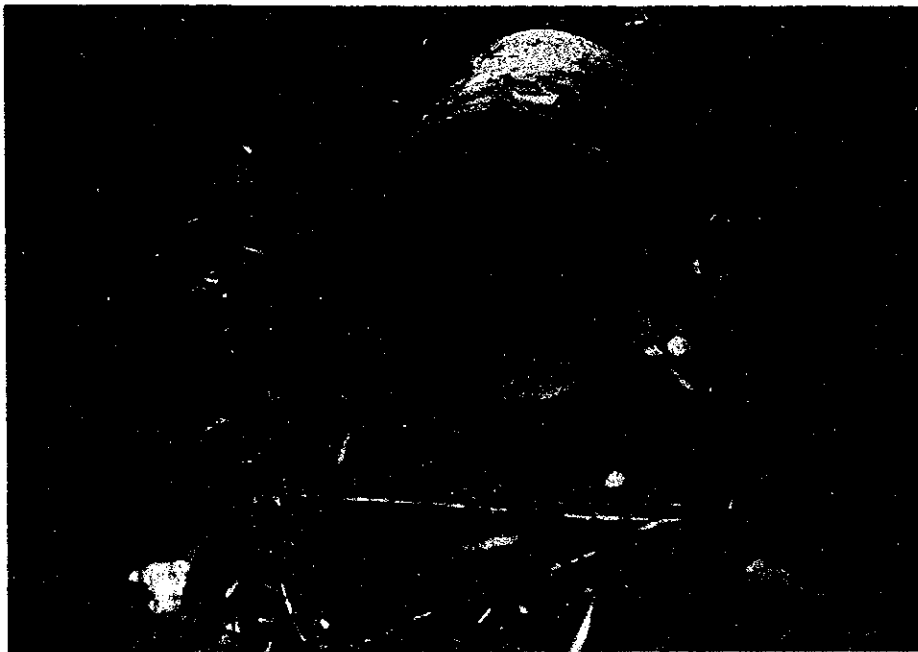
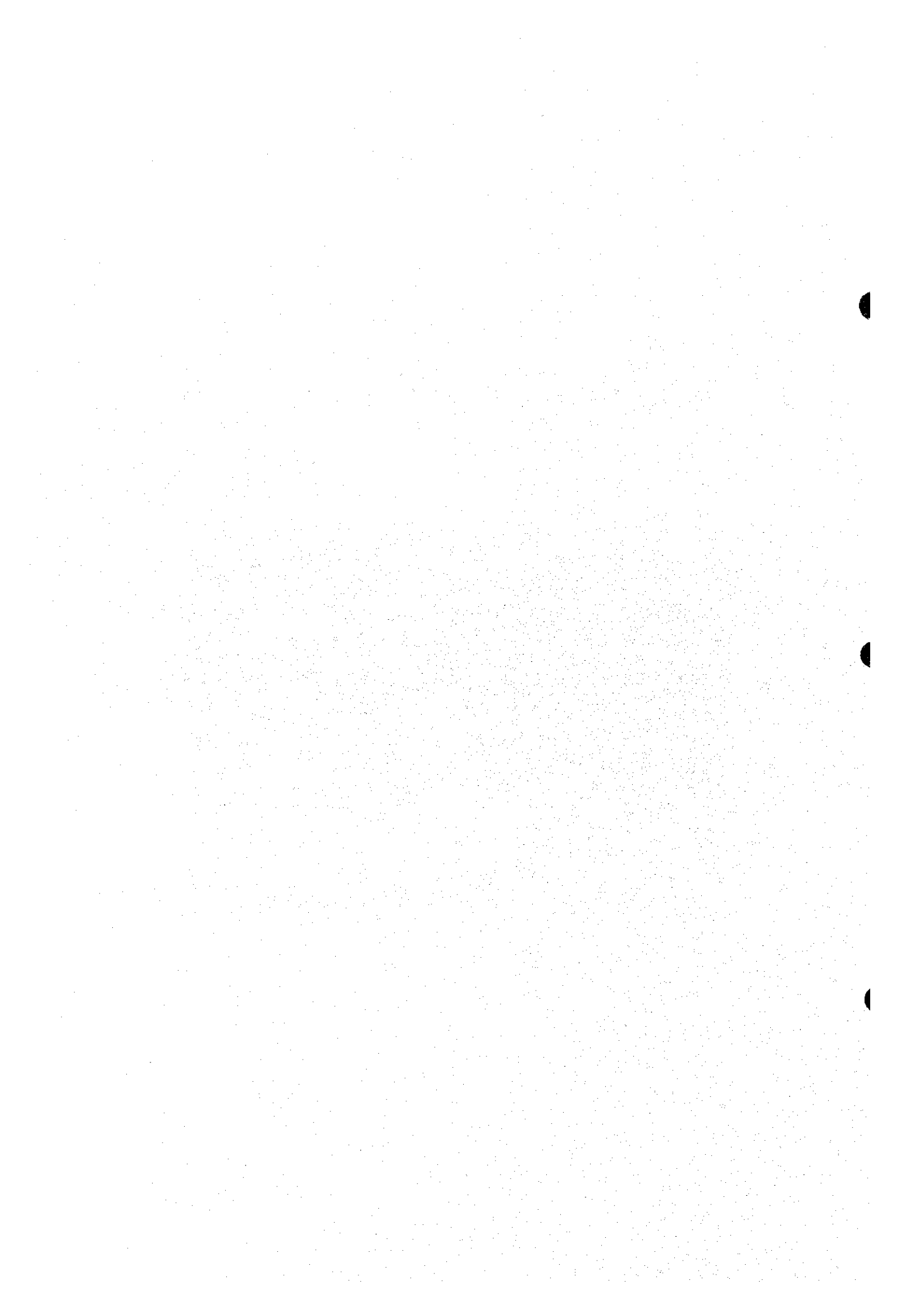


**P. BILL OF QUANTITIES & COST ESTIMATES**





**APPENDIX P. BILL OF QUANTITIES & COST ESTIMATES**

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Table P.1 Bill of Quantities & Cost Estimate

Facility	Description of Work	Unit	Qty	Unit Cost	Total Cost
1. Raw water pumpong station	<b>Demolition works</b>				
	remove inlet gate	hr	24	30	720
	remove wire mesh in wet well	hr	8	100	800
	remove concrete pillars	hr	70	100	7,000
	remove access ladders	ea.	2	120	240
	remove concrete stairs	hr	70	30	2,100
	sub-total				8,760
	<b>Repair concrete surfaces</b>				
	*on top of walls				
	remove top 50mm concrete	hr	25	30	750
	refinish with 50 mm air entrained concrete	m2	30	27	795
	sub-total		55		1,545
	<b>New stop boards for foot bearing penstock</b>				
		ea.	6	300	1,800
	sub-total				1,800
	<b>Install new aluminium stairs, and railings</b>				
	stairs (east side)	ea.	1	2,000	2,000
	new railings perimeter of wet well	m	50	100	5,000
	sub-total				7,000
					<b>Total</b>

Bill of Quantities & Cost Estimate

Facility	Description of Work	Unit	Qty	Unit Cost	Total Cost
2. Screening Station	<b>Modify cross sectional area</b>				
	formwork	m2			
	concrete walls	m3	45	190	8,550
	reinforcement	kg	10,000	2	20,000
	new sluice gate	ea.	1	5,000	5,000
	<b>Rehabilitate sluice gates</b>				
	replace packing and grease spindle	ea.	4	750	3,000
				<b>Total</b>	<b>36,550</b>

Bill of Quantities & Cost Estimate

Facility	Description of Work	Unit	Qty	Unit Cost	Total Cost
3. Aerated Grit Chamber	<b>Seal cracks in walls &amp; construction joints</b>				
	Epoxy injection vertical cracks	m	34	100	3,360
	Epoxy injection horizontal cracks	m	-	100	-
	Epoxy injection vertical construction joints	m	10	100	960
	Epoxy injection horizontal construction joints	m	66	100	6,640
	sub-total		110		10,960
	<b>Repair expansion joints</b>	ea.			
	New sealant on inside and outside of joints	m	-	20	-
	<b>Repair running surface for travelling bridge</b>				
	remove top 100mm concrete	hr	35	30	1,050
	disposal	m3	6	50	300
	100mm air entrained concrete, with carborundum finish	m2	60	64	3,816
	provide heat tracing cable	m	60	50	3,000
	sub-total		161		8,166
	<b>Remove all handrails, ladders and concrete walkway slabs</b>				
	ladders	ea.	2	40	80
	railings	m	100	10	1,000
	access walkways (concrete)	m2	40	45	1,800
	sub-total		142		2,880
	<b>Install new aluminium stairs, walkways, and railings</b>				
	stairs (east and west side)	ea.	2	1,000	2,000
	walkways (each side of travelling bridge) 1.2 m wide with railings	m	58	500	29,000
	open grating over inlet well	m2	-	250	-
	open grating over outlet well	m2	-	250	-
	new railings	m	-	100	-
	sub-total				31,000
	<b>Rehabilitate Sluice Gates</b>				
change packing & grease spindle	ea.	6	750	4,500	
				<b>Total</b>	<b>57,506</b>

Bill of Quantities & Cost Estimate

Facility	Description of Work	Unit	Qty	Unit Cost	Total Cost
4.1 Primary Sedimentation Tank (Typical of 2)	<b>Seal cracks in walls &amp; construction joints</b>				
	Epoxy injection vertical cracks	m	203	100	20,290
	Epoxy injection horizontal cracks	m	3	100	300
	Epoxy injection vertical construction joints	m	32	100	3,200
	Epoxy injection horizontal construction joints	m	187	100	18,672
	sub-total		425		42,462
	<b>Repair Expansion Joints</b>	ea.			
	remove old sealant	m	234	15	3,511
	install new seal both sides (except floor)	m	282	20	5,636
	channel gasket for wall joints	m	17	50	848
	channel gasket for effluent launder joints	m	18	60	1,056
	" " effluent chamber joints	m	13	60	792
	bottom gasket for floor joints	m	186	45	8,384
	sub-total		234		20,227
	<b>Repair concrete surfaces</b>				
	*on top of walls				
	top of tank walls	m2	99		
	top of effluent launder walls	m2	34		
	top of walls - effluent outlet structure	m2	4		
	sub-total	m2	137		
	remove top 50mm concrete	hr	34	30	1,029
	disposal	m3	6.86	50	343
	refinish with 50 mm air entrained concrete	m2	137	27	3,637
	sub-total				5,009
	*on floors				
	new screed on floor of effluent launder	m2	185		-
	new screed on floor of tank	m2	2,095		-
	sub-total	m2	2,280		-
	remove 50 mm of existing screed	hr	456	30	13,681
	disposal	m3	22.80	50	1,140
	new 100mm concrete floor slab	m2	2,095	19	39,805
	reinforcement, No.10-11.3mm dia.	kg	20,000	2	40,000
	remove scrappers	hr	30	30	900
re-install and adjust scrapper height	hr	45	30	1,350	
sub-total				96,876	

Facility	Description of Work	Unit	Qty	Unit Cost	Total Cost
4.1 Primary Sedimentation Tank (East)	<b>Repair reinforcing steel inside walls</b>				
	remove effluent weirs	hr	4	30	120
	remove concrete over steel	m2	234	20	4,697
	disposal	m3	116.83	50	5,842
	sand blast steel	m2	234	12	2,804
	treat steel with rust inhibitor	m2	234	10	2,337
	<b>new inside walls of clarifer, 150mm concrete</b>	m3	71	190	13,463
	reinforcement, No.10-11.3mm	kg	3,880	2	7,760
	modified formwork	m2	234	44	10,281
	epoxy resin coating at water line	m2	234	50	11,683
	reinstall & level effluent weirs	hr	8	30	240
	sub-total				59,225
	<b>Reconstruct columns supporting running surface of rotating scrapper (4 locations only)</b>				
	labour to remove existing concrete, expose and treat reinforcement	hr	16	30	480
	new steel No. 16 dia	kg	80	2	160
	new concrete	m3	4	190	760
	sub-total				1,400
	<b>Remove all handrails, ladders and concrete walkway slabs</b>				
	ladders	ea.	-	40	-
	railings	m	-	10	-
	access walkways (concrete)	m2	-	45	-
	sub-total				-
	<b>Install new aluminium stairs, walkways, and railings</b>				
	stairs (Northwest side)	ea.	1	1,000	1,000
	walkways (perimeter of tank) 1.2 m wide with railings	m	82	500	40,850
	open grating over inlet well	m2	-	250	-
	open grating over outlet well	m2	-	250	250
	new railings	m	-	100	-
	sub-total				42,100
	<b>Miscellaneous</b>				
	Crane	month	1	25,000	25,000
	Backfill	m3	1,325	60	79,519
sub-total				104,519	
<b>Total cost typical for one (1) sedimentation tank</b>					<b>371,819</b>
<b>Total for two (2) sedimentation tank</b>					<b>743,638</b>



Cost Report - Civil Structures

Facility	Description of Work	Unit	Qty	Unit Cost	Total Cost	
4.0 Inlet Structure for Primary Clarifiers	<b>Remove all handrails, ladders and concrete walkway slabs</b>					
	ladders	ea.	1	40	40	
	railings	m	13.6	10	136	
	sub-total				176	
	<b>Replace slab supporting sluice gates at intake structure</b>					
	remove gate actuator and stem	hr	2	4	8	
	remove slab	hr	16	30	480	
	replace packing and grease spindle	ea.	2	750	1,500	
	provide new reinforcement, 16mm	kg	29	2.5	72	
	provide new concrete slab 200mm	m3	1.4	190	272	
	sub-total				2,331	
	<b>Install new galvanized walkways, and railings</b>					
	open grating over well	m2	4.4	250	1100	
	stairs and walkway from pumping station roof	ea.	1	1000	1000	
	new railings	m	15.2	100	1520	
	sub-total				3620	
					<b>Total</b>	<b>6,127</b>

Facility Bill of Quantities & Cost Estimate

Facility	Description of Work	Unit	Qty	Unit Cost	Total Cost
5 Aeration Tank	<b>Seal cracks in walls &amp; construction joints</b>				
	Epoxy injection vertical cracks	m	323	100	32,300
	Epoxy injection construction joints	m	-	100	-
	sub-total		323		32,300
	<b>Repair Expansion Joints</b>				
	remove old sealant	m	1,065	15	15,978
	install new seal both sides (except floor)	ea.	1,233	20	24,662
	channel gasket for wall joints	m	102	50	5,098
	channel gasket for influent launder joints	m	19	60	1,130
	" " influent chamber joints	m	9	60	564
	bottom gasket for floor joints	m	935	45	42,075
	new 100mm concrete floor slab reinforcement, No.10-11.3mm	m2	6,360	19	120,840
	sub-total		60,000	2.5	150,000
					360,347
	<b>Repair concrete surfaces</b>				
	*on top of walls				
	top of tank walls	m2	1,638		
	top of walls - effluent outlet structure	m2	442		
	sub-total	m2	2,079		
	remove top 50mm concrete	hr	520	30	15,596
	refinish with 50 mm air entrained concrete	m2	2,079	27	55,106
	sub-total				70,702
	<b>Repair reinforcing steel inside walls</b>				
	remove concrete over steel	m2	1,645	20	33,055
	sand blast steel	m2	1,645	12	19,734
	treat steel with rust inhibitor	m2	1,645	10	16,445
	new wall inside of east & west walls, 150mm concrete	m3	247	190	46,869
	reinforcement, No.15 @ 100 cc	kg	11,657	2	23,315
	modified formwork	m2	1,645	44	72,359
	reinstall & level effluent weirs	hr	8	30	240
	sub-total				212,018
	<b>Reconstruct columns &amp; slabs supporting surface aerators</b>				
	remove aerators	ea.	36	60	2,160
	remove existing slabs & walls (150mm)	ea.	36		
	provide supporting scaffolding	m2	2,862	75	214,650
	remove and dispose	m3	72	50	3,600
	new slab 300 mm on new 400mm beams				
	formwork	m2	2,862	125	357,750
	concrete for slab	m3	41	190	7,716
	concrete for beams	m3	115	190	21,888
	steel for beams and slab	kg	50,000	2.5	125,000
	remove loose concrete on columns	ea.	144	20	2,894
	expose and treat corroded steel	m2	541	22	11,912

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Facility	Description of Work	Unit	Qty	Unit Cost	Total Cost	
5. Aeration Tank	form new column, 600 mm square concrete	m2	1,728	44	76,032	
		m3	160.74	190	30,541	
	steel	kg	24,000	2.5	60,000	
	epoxy resin coating underside of slabs & beams	m2	541	50	27,072	
	epoxy resin coating columns	m2	864	50	43,200	
	sub-total				984,414	
	<b>New exterior walls (East &amp; West)</b>					
	new concrete, 150mm	m3	171	190	32,416	
	reinforcement, No.15 @ 100 cc	kg	11,375	2	22,749	
	modified formwork	m2	1,137	44	50,046	
	Polyester resin "Estercrete" protective wall coating	m2	1,137	50	56,870	
	sub-total				162,081	
	<b>Remove all ladders and concrete walkway slabs</b>					
	ladders	ea.	20	40	800	
	access walkways (concrete)	m2	594	45	26,730	
	sub-total		614		27,530	
	<b>Install new aluminium stairs, walkways, and railings</b>					
	stairs	ea.	4	1,000	4,000	
	walkway 2 wide - along each row of aerators c/w railings	m	297	750	222,750	
	walkway 1.5 wide - across row of aerators c/w railings	m	120	500	60,000	
	railings at inlet well	m	25	100		
	open grating over inlet well	m2	20	250	5,000	
	sub-total				291,750	
	<b>Miscellaneous</b>					
	Provide new stop boards	ea.	5	300	1500	
	Rehabilitate sluice gates					
	replace packing and grease spindle	ea.	20	750	15000	
	re-install surface aerators	ea.	36	90	3240	
	crane to remove aerators & hoist construction equipments	month	3	25,000	75000	
	sub-total				94740	
				<b>Total</b>	<b>2,235,882</b>	

Bill of Quantities & Cost Estimate

Facility	Description of Work	Unit	Qty	Unit Cost	Total Cost
6.4 Secondary Sedimentation Tank (Typical of 4)	Seal cracks in walls & construction joints				
	Epoxy injection vertical cracks	m	36	100	3,600
	Epoxy injection horizontal cracks	m	83	100	8,262
	Epoxy injection vertical construction joints	m	-	100	-
	Epoxy injection horizontal construction joints	m	-	100	-
	sub-total		119		11,862
	Repair Expansion Joints	ea.			
	remove old sealant	m	221	15	3,320
	install new seal both sides (except floor)	m	289	20	5,790
	channel gasket for wall joints	m	20	50	1,000
	channel gasket for effluent launder joints	m	12	60	722
	" " effluent chamber joints	m	12	60	720
	bottom gasket for floor joints	m	177	45	7,979
	sub-total		221		19,532
	Repair concrete surfaces				
	*on top of walls				
	top of tank walls	m2	-		
	top of effluent launder walls	m2	17		
	top of walls - effluent outlet structure	m2	-		
	sub-total	m2	17		
	remove top 50mm concrete	hr	4	30	127
	refinish with 50 mm air entrained concrete	m2	17	27	447
	sub-total				574
	*on floors				
	new screed on floor of effluent launder	m2	67		-
	new screed on floor of tank	m2	2,119		-
	sub-total	m2	2,186		-
	remove 50 mm of existing screed	hr	437	30	13,115
	new 100mm concrete floor slab	m2	2,119	19	40,261
	reinforcement, No.10-11.3mm	kg	20,000	2	40,000
	remove scrappers	hr	30	30	900
	re-install and adjust scrapper height	hr	45	30	1,350
	sub-total				95,626
	Repair reinforcing steel inside walls				
	remove effluent weirs	hr	4	30	120
	remove concrete over steel	m2	245	20	4,927
	sand blast steel	m2	245	12	2,941
	treat steel with rust inhibitor	m2	245	10	2,451
	new inside walls of clarifer, 150mm concrete	m3	73	190	13,927
	reinforcement, No.10-11.3mm	kg	2,500	2	5,000
	modified formwork	m2	245	44	10,784
	epoxy resin coating at water line	m2	245	50	12,255
	reinstall & level effluent weirs	hr	8	30	240
	sub-total				52,645

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Facility	Description of Work	Unit	Qty	Unit Cost	Total Cost	
Typical Secondary Sedimentation Tank (Cont'd)	<b>Remove all handrails, ladders and steel walkways</b>					
	ladders	ea.	1	40	40	
	railings	m	-	10	-	
	access walkways (concrete)	m2	-	45	-	
	sub-total		1		40	
	<b>Install new aluminium stairs, walkways, and railings</b>					
	stairs	ea.	1	500	500	
	walkways (effluent launder) with railings two sides	m	82	500	40,850	
	clean and paint existing railings	m	60	25	1,500	
	sub-total				42,850	
	<b>Total cost typical for one (1) sedimentation tank</b>					<b>223,129</b>
	<b>Total for four (4) sedimentation tanks</b>					<b>892,514</b>

6.0 Inlet Structure for Secondary Clarifiers	<b>Remove all handrails, ladders and concrete walkway slabs</b>				
	ladders	ea.	4	40	160
	railings	m	0	10	-
	sub-total				160
	<b>Seal cracks in walls &amp; construction joints</b>				
	Epoxy injection construction joints	m	257.05	100	25,705
	Epoxy injection cracks	m	23.5	100	2,350
	sub-total				28,055
	<b>Repair concrete surfaces</b>				
	*on top of walls				-
	top of tank walls	m2	-	30	-
	top of effluent launder walls	m2	17	2.5	42
	sub-total	m2	17		
	remove top 50mm concrete	hr	3.37		
	refinish with 50 mm air entrained epoxy mortar	m2	0.8	190	160
	sub-total				202
	<b>Install new galvanized walkways, and railings</b>				
	open grating over well	m2	200	250	50000
	new railings	m	130	100	13000
	sub-total				63000
	<b>Rehabilitate Sluice gates</b>				
	replace packing and grease spindle	ea.	4	750	3000
	sub-total				3000
<b>Total</b>					<b>94,417</b>

Bill of Quantities & Cost Estimate

Facility	Description of Work	Unit	Qty	Unit Cost	Total Cost	
8. Recycled sludge pumping station	<b>Seal construction joints</b>					
	horizontal joints in effluent launder	m	40	100	4000	
	<b>Remove all handrails, ladders and concrete walkway slabs</b>					
	ladders	ea.	1	40	40	
	railings	m	100	10	1,000	
	access walkway to effluent penstocks(concrete)	m2	40	45	1,800	
	sub-total	ea.			2,840	
	<b>Install new aluminium stairs, walkways, and railings</b>					
	stairs (north side)	ea.	1	1,000	1,000	
	open grating over wet well	m2	30	250	7,500	
	open grating walkway to effluent penstocks	m	20	500		
	new railings	m	50	100	5,000	
	sub-total				13,500	
	<b>New penstock stop planks</b>					
	in wet well to isolate foot bearings	ea.	4	300	1,200	
	in effluent launder	ea.	4	300	1,200	
	sub-total				2,400	
					<b>Total</b>	<b>22,740</b>

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Facility	Description of Work	Unit	Qty	Unit Cost	Total Cost	
9 Primary sludge pumping station	<b>Seal leaks in wet well</b>					
	provide waterproof membrane inside wet well	m2	60	100	6000	
	<b>Remove all handrails, ladders and concrete walkway slabs</b>					
	ladders	ea.	1	40	40	
	railings	m	100	10	1,000	
	access walkway to esedimentation tanks (concrete)	m2	10	45	450	
	sub-total	ea.			1,490	
	<b>Install new aluminium stairs, walkways, and railings</b>					
	stairs to sedimentation tanks from wet well platform	ea.	2	500	1,000	
	open grating over wet well	m2	10	250	2,500	
	open grating walkway to sedimentation tanks	m	3	500	1,500	
	new access stair to wet well platform	ea.	1	500	500	
	new railings	m	35	100	3,500	
	sub-total				9,000	
	<b>Miscellaneous works</b>					
	support valve stems and actuators at wet well platform	ea.	1	1,000	1,000	
	retaining wall for stairs down to motor room	ea.	1	5,000	5,000	
	sub-total				6,000	
					<b>Total</b>	<b>22,490</b>

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Facility	Description of Work	Unit	Qty	Unit Cost	Total Cost	
10 Sludge Thickener (Typical of 2))	<b>Seal cracks in walls &amp; construction joints</b>					
	Epoxy injection vertical cracks	m	210	100	21,000	
	Epoxy injection horizontal cracks	m	77	100	7,680	
	Epoxy injection vertical construction joints	m	-	100	-	
	Epoxy injection horizontal construction joints	m	95	100	9,487	
	sub-total		382		38,167	
	<b>Repair Expansion Joints</b>	ea.				
	channel gasket for wall joints	m	-	50	-	
	channel gasket for effluent launder joints	m	-	60	-	
	" " effluent chamber joints	m	-	60	-	
	bottom gasket for floor joints	m	580	45	26,082	
	sub-total		580		26,082	
	<b>Repair concrete surfaces</b>					
	<b>*on top of walls</b>					
	top of tank walls	m2	14			
	top of effluent launder walls	m2	24			
	sub-total	m2	38			
	remove top 50mm concrete	hr	9	30	284	
	refinish with 50 mm air entrained concrete	m2	38	27	1,002	
	sub-total				1,286	
	<b>*on floors</b>					
	new screed on floor of effluent launder	m2	67		-	
	new screed on floor of tank	m2	59		-	
	sub-total	m2	125		-	
	remove 50 mm of existing screed	hr	25	30	753	
	new 100mm concrete floor slab	m2	59	19	1,114	
	reinforcement, No.10-11.3mm	kg	600	2	1,200	
	remove scrappers	hr	30	30	900	
	re-install and adjust scrapper height	hr	45	30	1,350	
	sub-total				5,317	
	<b>Repair reinforcing steel inside walls</b>					
	remove effluent weirs	hr	8	30	240	
	remove concrete over steel	m2	165	20	3,315	
	sand blast steel	m2	165	12	1,979	
	treat steel with rust inhibitor	m2	165	10	1,649	
	new inside walls of clarifer, 150mm concrete	m3	14	190	2,673	
	reinforcement, No.10-11.3mm	kg	1,700	2	3,400	
	modified formwork	m2	165	44	7,257	
epoxy resin coating at water line	m2	165	50	8,246		
reinstall & level effluent weirs	hr	12	30	360		
sub-total				29,119		



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Facility	Description of Work	Unit	Qty	Unit Cost	Total Cost	
10 Sludge Thickener (Typical of 2)	<b>Remove all handrails, ladders and steel walkways</b>					
	ladders	ea.	1	40	40	
	railings	m	-	10	-	
	access walkways (concrete)	m2	-	45	-	
	sub-total		1		40	
	<b>Install new aluminum ladder, walkways, and railings</b>					
	ladder	ea.	1	500	500	
	walkways (effluent launder) with railings two sides	m	-	500	-	
	clean and paint existing railings	m	50	25	1,250	
	sub-total				1,750	
	<b>Total cost typical for one (1) thickener tank</b>					<b>101,762</b>
	<b>Total for two (2) thickeners</b>					<b>203,523</b>

Bill of Quantities & Cost Estimate

Facility	Description of Work	Unit	Qty	Unit Cost	Total Cost	
11 Thickened sludge pumping station	<b>Seal leaks in wet well</b>					
	provide waterproof membrane inside wet well	m2	60	100	6000	
	<b>Remove all handrails, ladders and concrete walkway slabs</b>					
	ladders	ea.	1	40	40	
	sub-total				40	
	<b>Install new aluminium ladder and platforms</b>					
	open grating over wet well	ea.	10	250	2,500	
	new ladder to roof	ea.	1	500	500	
	new ladder into wet well	ea.	1	500	500	
	new railings	m	15	100	1,500	
	sub-total				5,000	
					<b>Total</b>	<b>11,040</b>

Bill of Quantities & Cost Estimate

Facility	Description of Work	Unit	Qty	Unit Cost	Total Cost	
12 Sludge Digester	<b>Remove sludge</b>					
	sludge volume	m3	6,000			
	vacumm pump truck 5m3	no. of trips	1,200	200	240,000	
	disposal to land area	m3	12,000	-		
	cleaning	hr	640	30	19,200	
	sub-total				259,200	
	<b>Thermal insulation</b>	ea.				
	remove existing wall insulation	m2	1,223	30	36,690	
	remove existing roofing insulation	m2	640	30	19,200	
	expanded polystyrene insulation, 100mm on walls	m2	1,223	50	61,150	
	expanded polystyrene insulation, 75mm on roof	m2	640	40	25,600	
	pre-finished aluminum sheet metal cladding on walls	m2	1,223	150	183,450	
	scaffolding for working on walls	m2	1,223	175	214,025	
	hot welded synthetic roofing membrane	m2	640	100	64,000	
					604,115	
	<b>Install new aluminium ladder and platforms</b>					
	remove existing	hr	24	30	720	
	new platform	m	15	750	11,250	
	new railings	m	35	100	3,500	
	sub-total				15,470	
	<b>Total for one (1) digester</b>					<b>878,785</b>
	<b>Total for two (2) digesters</b>					<b>1,757,570</b>

Bill of Quantities & Cost Estimate

Facility	Description of Work	Unit	Qty	Unit Cost	Total Cost	
15 Gas Storage Tank	Seal cracks in walls, floors & construction joints					
	Epoxy injection vertical cracks	m	657	100	65,700	
	Epoxy injection horizontal cracks	m	-	100	-	
	Epoxy injection cracks in floor	m	150	100	15,000	
	Epoxy injection horizontal construction joints	m	134	100	13,364	
	sub-total		941		94,064	
	Repair concrete surfaces *on top of walls	ea.				
	top of tank walls	m2	104			
	remove top 50mm concrete	hr	21	30		622
	refinish with 50 mm air entrained concrete	m2	104	27		2,749
	epoxy resin coating to inside wall surfaces	m2	405	50		20,263
	sub-total					23,634
	Repair reinforcing steel at base of exterior wall					
	remove concrete over steel	m2	47	20		947
	sand blast steel	m2	47	12		565
	treat steel with rust inhibitor	m2	47	10		471
	new epoxy mortar cover, 50mm thick	m3	1.0	1,000		1,000
	sub-total					2,984
	Corrosion Protect Steel Roof	m2	1,065			
	5 cranes (100ton) to lift & lower roof support with falsework	days	30	7,000		210,000
	remove rust (sandblast)	m3	10,216	50		510,788
	tar epoxy chemical resistant coating to inside of dome	m2	2,129	12		25,553
	epoxy paint outside of dome	m2	1,065	100		106,473
		m2	1,065	100		106,473
						959,287
	Remove all handrails, ladders and steel walkways					
	ladders	ea.	1	40		40
	railings	m	48	10		481
	sub-total		49			521
	Install new aluminium ladder and railings					
	ladder	ea.	1	1,000		1,000
	new railings	m	47	100		4,712
Miscellaneous						
dewatering	days	7	700		4,900	
new gas pressure relief valve	ea.	1	15,000		15,000	
hot water piping	ea.	1	30,000		30,000	
concrete mortar on slab over piping 100mm	m3	60	530		31,708	
sub-total					81,608	
<b>Total cost</b>					<b>1,162,098</b>	

Bill of Quantities & Cost Estimate

Facility	Description of Work	Unit	Qty	Unit Cost	Total Cost	
16 Sludge Holding Tank	<b>Seal cracks in walls &amp; construction joints</b>					
	Epoxy injection vertical cracks	m	194	100	19,350	
	Epoxy injection horizontal cracks	m		100	4,712	
	Epoxy injection vertical construction joints	m	-	100	-	
	Epoxy injection horizontal construction joints	m	47	100	4,712	
	sub-total		241		28,775	
	<b>Repair Expansion Joints</b>	ea.				
	channel gasket for wall joints	m	17	50	870	
	channel gasket for effluent launder joints	m	-	60	-	
	" " effluent chamber joints	m	-	60	-	
	bottom gasket for floor joints	m	83	45	3,731	
	sub-total		100		4,601	
	<b>Repair concrete surfaces</b>					
	<b>*on top of walls</b>					
	top of tank walls	m2	24			
	top of effluent launder walls	m2	-			
	sub-total	m2	24			
	remove top 50mm concrete	hr	6	30	178	
	refinish with 50 mm air entrained concrete	m2	24	27	630	
	sub-total				808	
	<b>*on floors</b>					
	new screed on floor of effluent launder	m2	-			-
	new screed on floor of tank	m2	714			-
	sub-total	m2	714			-
	remove 50 mm of existing screed	hr	143	30	4,282	
	new 100mm concrete floor slab	m2	714	19	13,559	
	reinforcement, No.10-11.3mm	kg	7,000	2	14,000	
	remove scrappers	hr	30	30	900	
	re-install and adjust scrapper height	hr	45	30	1,350	
	sub-total				34,091	
	<b>Repair reinforcing steel inside walls</b>					
	remove effluent weirs	hr	-	30	-	
	remove concrete over steel	m2	203	20	4,073	
	sand blast steel	m2	203	12	2,432	
	treat steel with rust inhibitor	m2	203	10	2,026	
	new inside walls of clarifer, 150mm concrete	m3	14	190	2,673	
	reinforcement, No.10-11.3mm	kg	2,000	2	4,000	
	modified formwork	m2	203	44	8,916	
	epoxy resin coating at water line	m2	203	50	10,131	
	reinstall & level effluent weirs	hr	-	30	-	
	sub-total				34,250	

Cost Report - Civil Structures

Facility	Description of Work	Unit	Qty	Unit Cost	Total Cost
16 Sludge Holding Tank	<b>Remove all handrails, ladders and steel walkways</b>				
	ladders	ea.	1	40	40
	railings	m	-	10	-
	access walkways (concrete)	m2	-	45	-
	sub-total		1		40
	<b>Install new aluminum ladder, walkways, and railings</b>				
	ladder	ea.	1	500	500
	walkways (effluent launder) with railings two sides	m	-	500	-
	clean and paint existing railings	m	35	25	875
	sub-total				1,375
				<b>Total cost</b>	<b>103,939</b>

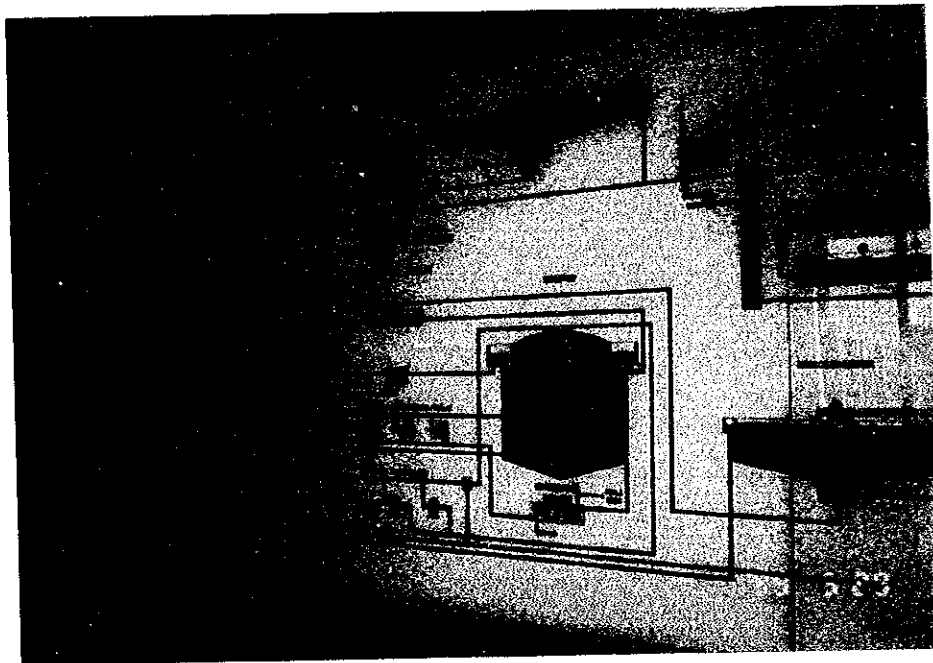
Bill of Quantities & Cost Estimate

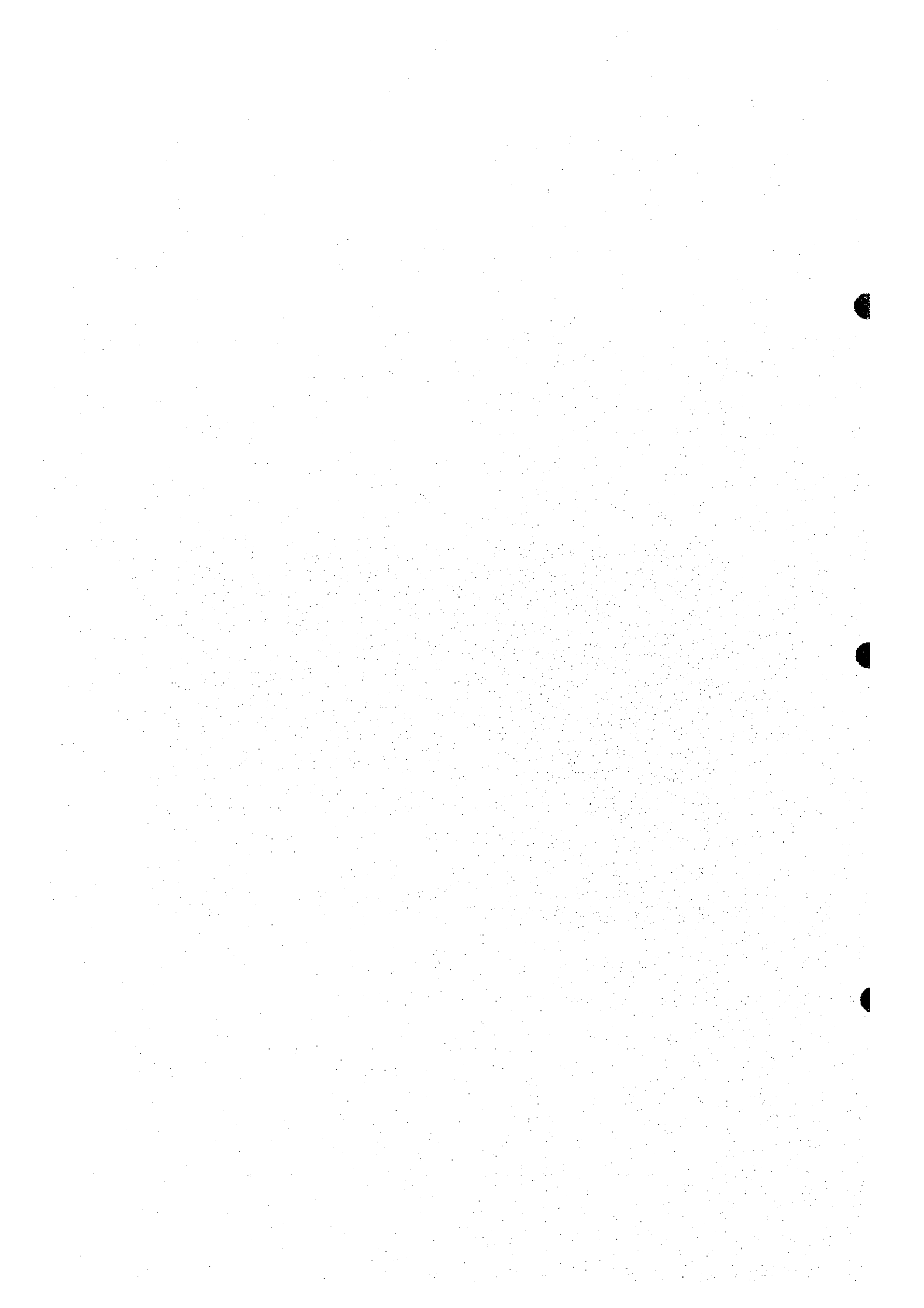
Facility	Description of Work	Unit	Qty	Unit Cost	Total Cost	
17 Sludge pumping station	Seal leaks in wet well					
	epoxy inject cracks	m	30	100	3000	
	Install new aluminium ladder and platforms					
	open grating over wet well	m2	30	250	7,500	
	ladder into wet well	ea.	1	500	500	
	new railings	m	27	100	2,700	
	sub-total	ea.				10,700
					<b>Total</b>	<b>13,700</b>





## Q. ELECTRICAL LOAD & EQUIPMENT LISTS





**APPENDIX Q. ELECTRICAL LOAD & EQUIPMENT LISTS**

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Table Q.2 ELECTRICAL EQUIPMENT LIST .....	Q-7

Appendix

Table Q.1 ELECTRICAL LOAD LIST

Equipment	Installed Load (kW)	Emergency Load(A) *1 (kW)	Emergency Load(B) *2 (kW)	Operation Hour *3 (hr/day)	Consumed Power (kWh/day)	Note
<b>0a-Pre-treatment</b>						
-Rail crane	4.7	4.7		1	4.7	
<b>0b-Pre-screening Station</b>						
-Rough screen	2.5×3 =7.5	7.5		1	7.5	
-Fine screen	2.5×3 =7.5	7.5		1	7.5	
-Lighting	3	3		Ns	Ns	
<b>1-Raw Water Pumping Station</b>						
-Pump	160×4 =640	160×2 =320		24×2/4	7,680	
-Rail crane	4.7			Ns	Ns	
-Lighting	4	4		Ns	Ns	
<b>2-Screening Station</b>						
-Rough screen	2.5×4 =10	10		1	10	
-Fine screen	2.5×4 =10	10		1	10	
-Stop plank	1.1×2 =2.2	2.2		Ns	Ns	
-Belt conveyer	2.5	2.5		1	2.5	
-Rail crane	4.7			Ns	Ns	
-Lighting	4	4		Ns	Ns	
<b>3-Aerated Grit Chamber</b>						
-Bridge	1.5	1.5		24	36	
-Compressor-A	3.5	3.5		24	84	
-Compressor-B	1.5	1.5		24	36	

Equipment	Installed Load (kW)	Emergency Load(A) *1 (kW)	Emergency Load(B) *2 (kW)	Operation Hour *3 (hr/day)	Consumed Power (kWh/day)	Note
<b>19-Air Blower Room</b>						
-Blower	10×3 =30	30		24	720	
-Lighting	1	1		Ns	Ns	
<b>4-Primary Sedimentation Tank</b>						
-Bridge	0.75×2 =1.5	1.5		24	36	
<b>9-Primary Sludge Pumping Station</b>						
-Pump	15×2 =30	30		24	720	
-Lighting	0.5	0.5		Ns	Ns	
<b>10-Sludge Thickener</b>						
-Mud beater	1.5×2 =3	3		24	72	
-Compressor	0.75×4 =3	3		24	72	
<b>11-Thickened Sludge Pumping Station</b>						
-Pump	15×2 =30	30		24	720	
-Lighting	0.5	0.5		Ns	Ns	
<b>Outdoor Lighting</b>	3.5	3.5	3.5	10	35	
<b>Sub-total</b>	<b>814.3</b>	<b>484.9</b>	<b>3.5</b>		<b>10,253.2</b>	
<b>5-Aeration Tank</b>						
-Turbine	37×36 =1,332	37×18 =666		24	31,968	

Equipment	Installed Load (kW)	Emergency Load(A)*1 (kW)	Emergency Load(B) *2 (kW)	Operation Hour *3 (hr/day)	Consumed Power (kWh/day)	Note
<b>6-Final Sedimentation Tank</b>						
-Bridge	0.75×4 =3	3		24	72	
-Bridge	0.75×2 =1.5	1.5		24	36	Year 2015
<b>8-Recycled Sludge Pumping Station</b>						
-Pump	100×2 =200	100×1 =100		24×1/2	2,400	
-Rail crane	4.7			Ns	Ns	
-Excess sludge pump	6×2 =12	12		12	144	
-Lighting	0.5	0.5		Ns	Ns	
<b>24-Service Water Pumping Station</b>						
-Pump-A	37×2 =74	74		24	1,776	
-Pump B	22×2 =44	44		24	1,056	
-Lighting	7	7		Ns	Ns	
<b>A1-Chlorination Building</b>						
-Doser	0.3	0.3		24	7	Year 2015
-Rail crane	4.7	4.7		0.5	2	Year 2015
-Lighting	4	4		0.5	2	Year 2015
<b>22-Reception</b>						
-Lighting	0.5	0.5	0.5	10	5	

Equipment	Installed Load (kW)	Emergency Load(A) *1 (kW)	Emergency Load(B) *2 (kW)	Operation Hour *3 (hr/day)	Consumed Power (kWh/day)	Note
<b>23-Administration Building</b>						
-Central control equipment	5	5	5	24	120	
-Lighting	38	38	38	10	380	
<b>Outdoor Lighting</b>	7.5	7.5	7.5	10	75	
<b>Sub-total</b>	<b>1,738.7</b>	<b>968</b>	<b>51</b>		<b>38,043</b>	
<b>12-Sludge Digester</b>						
-Lighting	1	1	1	Ns	Ns	
<b>13-Boiler &amp; Engine Generator Room</b>						
-Old boiler	1.1×2 =2.2	2.2	2.2	24	53	
-New boiler	1.5	1.5	1.5	24	36	
-Mud recycle pump	18.5×3 =55.5	55.5	55.5	24	1,332	
-Service water pump	1.5×2 =3	3	3	8×1/2	12	
-Central heating pump	16.4	16.4	16.4	0	0	
-Lighting	5	5	5	10	50	
<b>14-Gas Compressor Station</b>						
-Recycle compressor	37×3 =111	111	111	24	2,664	
-Transfer compressor	30×3 =90	90	90	24	2,160	
-Lighting	1	1	1	Ns	Ns	

Equipment	Installed Load (kW)	Emergency Load(A) *1 (kW)	Emergency Load(B) *2 (kW)	Operation Hour * 3 (hr/day)	Consumed Power (kWh/day)	Note
<b>16-Homogenised Sludge Holding Tank</b>						
-Bridge	1.5			24	36	
<b>17-Sludge Pumping Station</b>						
-Mud pump	1.5×5 =7.5			24	180	
-Lighting	1			Ns	Ns	
<b>18-Sludge Dehydration</b>						
-Filter press	1.5×5 =7.5			8	60	
-Belt conveyer	5.5			8	44	
-Rail crane	8			Ns	Ns	
-Polyelectro mixer	2.2×2 =4.4			8	35.2	
-Doser	0.3			8	2.4	
-Dosing pump	0.75×5 =3.75			8	30	
-Lighting	15			10	150	
<b>Outdoor Lighting</b>	2	2	2	10	20	
<b>Sub-total</b>	<b>343.05</b>	<b>288.6</b>	<b>288.6</b>		<b>6,864.6</b>	
<b>Total</b>	<b>2,896.05</b>	<b>1,741.5</b>	<b>343.1</b>		<b>55,160.8</b>	
<b>Power demand</b>	×0.7 * =2,028	×0.7 * =1,220	×0.7 * =240			* Demand factor

(Note) \* 1 ; In case of that the Generator (2pcs) are operated under cutting off of commercial electric power supply

\* 2 ; In case of that the Generator (1pcs) is operated under cutting off of commercial electric power supply, during maintenance stop of another Generator(1pcs)

\* 3 ; In summer season

Ns ; Negligible small



Appendix

Table Q.2 ELECTRICAL EQUIPMENT LIST(1/2)

Equipment	Qty.	Specification
<b>0. Pre-treatment and Pre-screening Station</b>		
-Local control panel	1 lot	Metal enclosed indoor type
-CCTV camera and monitor	1 lot	Monitor is installed in Administration
-Measuring instrument	1 pc.	PH
<b>1. Raw Water Pumping Station</b>		
-Local control panel	1 lot	Metal enclosed indoor type
-Measuring instrument	1 pc	Level
<b>2. Screening Station</b>		
-Measuring instrument	1 pc.	Level
<b>5. Aeration Tank</b>		
-Local control panel	1 lot	Metal enclosed indoor type
-Switch box for machine side	1 lot	Metal enclosed outdoor type
-Measuring instrument	4 pcs.	DO
<b>7. Flow Metering</b>		
-Measuring instrument	1 pc.	Flow
-Measuring instrument	1 pc.	pH
<b>8. Recycled Sludge Pumping Station</b>		
-Local control panel	1 lot	Metal enclosed indoor type
-Measuring instrument	1 pc.	Level
-Measuring instrument	1 pc.	Flow
<b>9. Primary Sludge Pumping Station</b>		
-Local control panel	1 lot	Metal enclosed indoor type
-Measuring instrument	1 pc.	Flow
<b>11. Thickened Sludge Pumping Station</b>		
-Local control panel	1 lot	Metal enclosed indoor type
-Measuring instrument	1 pc.	Flow
<b>12. Sludge Digester</b>		
-Measuring instrument	2 pcs.	Temperature
<b>13. Boiler &amp; Engine Generator Room</b>		
-Transformer	2 pcs.	1000 kVA, 10/0.4kV, 3 $\phi$ , 50Hz Class H, Dry type
-HT switchgear	1 lot	Metal enclosed indoor type 10kV
-Local control panel	1 lot	Metal enclosed indoor type

**ELECTRICAL EQUIPMENT LIST(2/2)**

<b>Equipment</b>	<b>Qty.</b>	<b>Specification</b>
<b>15. Gas Storage Tank</b> -Measuring instrument	2 pcs.	Flow
<b>16. Homogenized Sludge Holding Tank</b> -Measuring instrument	1 pc.	Flow
<b>18. Sludge Dehydration</b> -Local control panel	1 lot	Metal enclosed indoor type
<b>19. Air Blower Room</b> -Local control panel	1 lot	Metal enclosed indoor type
<b>20. Power Station</b> -Transformer	2 pcs.	1600 kVA, 10/0.4kV, 3 $\phi$ , 50Hz Class H, Dry type
-HT switchgear	1 lot	Metal enclosed indoor type 10kV
-LT power distribution / motor control panel	1 lot	Metal enclosed indoor type
<b>21. Substation</b> -Transformer	1 pc.	1600 kVA, 10/0.4kV, 3 $\phi$ , 50Hz Class H, Dry type
-HT switchgear	1 lot	Metal enclosed indoor type 10kV
-LT power distribution / motor control panel	1 lot	Metal enclosed indoor type
<b>23. Administration Building</b> -Main control panel with mimic graphic	1 lot	Metal enclosed indoor type
-Operator console	1 lot	Metal enclosed indoor type
-Data logging system	1 lot	
-UPS	1 lot	Metal enclosed indoor type
<b>24. Service Water Pumping Station</b> -Local control panel	1 lot	Metal enclosed indoor type
-Measuring instrument	1 pc	Flow
<b>Outdoor lighting fixture with pole</b>	1 lot	200W natrium lamp

## MECHANICAL EQUIPMENT

### 0A Pre-Treatment Grit Chamber

0A.1	Automatic Gate;	1,500 mm width x 1,500 mm length	3 sets
0A.2	Grab Bucket;	Grab bucket capacity of 0.3 m <sup>3</sup>	1 set
0A.3	Grit Hopper;	Grit hopper capacity of 10 m <sup>3</sup>	3 sets

### 0B Pre-Screening Station

0B.1	Inlet Automatic Gate;	2,500 mm width x 2,500 mm length	3 sets
0B.2	Automatic Coarse Screen;	50 mm opening x 2,000 mm width	3 sets
0B.3	Automatic Medium Screen;	25 mm opening x 2,000 mm width	3 sets
0B.4	Outlet Automatic Gate;	2,500 mm width x 2,500 mm length	3 sets
0B.5	Screenings Hopper;	Hopper capacity of 20 m <sup>3</sup>	3 sets

### 1. Pumping Station: Screw Pump; Archimedean Spiral

1.1	Screw Pump;	78 m <sup>3</sup> / min x 8.91 m	4 sets
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### 2. Screening Station

2.1	Inlet Automatic Gate;	1,500 mm width x 1,500 mm length	4 sets
2.2	Automatic Fine Screen;	6 mm opening x 1,500 mm width	4 sets
2.3	Outlet Automatic Gate;	1,500 mm width x 1,500 mm length	4 sets

### 3. Aerated Grit Chamber: Sand Bridge Trap

3.1	Inlet Gate;	1,500 mm width x 1,500 mm length	3 sets
3.2	Sand Bridge Trap;	2,000 mm width x 1.5 kw	1 set
	with 3 sets of air lift pipes		
3.3	Scum Outlet Gate;	1,000 mm width x 1,000 mm length	3 sets
3.4	Outlet Gate;	2,000 mm width x 2,000 mm length	3 sets

### 4. Primary Sedimentation Tank

4.1	Peripheral Drive with Scum Skimmer;	52 m diameter x 2.8 m depth x 0.75 kw	2 sets
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### 5. Aeration Tank

5.1	Surface Aeration Turbine;	2,000 mm diameter x 37 kw	36 sets
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### 6. Final Sedimentation Tank

6.1	Center Drive	52 m diameter x 2.8 m depth x 0.75 kw	4 sets
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	with Scum Skimmer;		
<b>7.</b>	<b>Flow Meter</b>		
7.1	Flow Meter with Level Meter and Transducer		1 set
<b>8.</b>	<b>Recycled Sludge Pumping Station: Screw Pump; Archimedean Spiral</b>		
8.1	Screw Pump;	200 m <sup>3</sup> / min x 8 m x 100 kw	2 sets
<b>9.</b>	<b>Primary Sludge Pumping Station</b>		
9.1	Sludge Pump with Induce Screw;	5.0 m <sup>3</sup> / min x 11 m x 15 kw	2 sets
<b>10.</b>	<b>Sludge Thickener</b>		
10.1	Center Drive with Picket;	30 m diameter x 3.5 m depth x 1.5 kw	2 sets
<b>11.</b>	<b>Thickened Sludge Pumping Station</b>		
11.1	Sludge Pump with Induce Screw;	1.0 m <sup>3</sup> / min x 49 m x 22 kw	2 sets
<b>12.</b>	<b>Sludge Digester</b>		
12.1	Sludge Pump with Induce Screw;	3.75 m <sup>3</sup> / min x 9 m x 11 kw	3 sets
12.2	Heat Exchanger	Heat exchange capacity of 3,350J	2 sets
	with Double Tube;		
<b>13.</b>	<b>Boiler, Engine, Generator Room</b>		
13.1	Digested Gas Boiler;	650,000 kcal / h x 110 ° C x 6 bars	2 sets
13.2	Digested Gas/Diesel Oil, Dual Fuel Diesel Engine;	1,000 rpm x 900 kw	2 sets
<b>14.</b>	<b>Gas Compressor Station</b>		
14.1	Digested Gas Mixing Blower;	582 Nm <sup>3</sup> / h x 2 bars x 37 kw	3 sets
14.2	Digested Gas Transporting Blower;	400 Nm <sup>3</sup> / h x 2.2 bars x 30 kw	3 sets
<b>15.</b>	<b>Gas Storage Tank</b>		
15.1	Gas Storage Tank with Water Seal;	Storage Capacity of 5,000 Nm <sup>3</sup> / h	1 set
<b>16.</b>	<b>Homogenized Sludge Holding Tank</b>		
16.1	Center Drive with Picket;	30 m diameter x 3.5 m depth x 1.5 kw	1 set

**17. Sludge Pumping Station**

17.1 Moineau Pump; 6 ~ 28 m<sup>3</sup> / h x 15 m x 1.5 kw 5 sets

**18. Sludge Dehydration**

18.1 Belt Filter Press; 3 m width x 140 kg / h filter capacity 5 sets  
x 1.5 kw

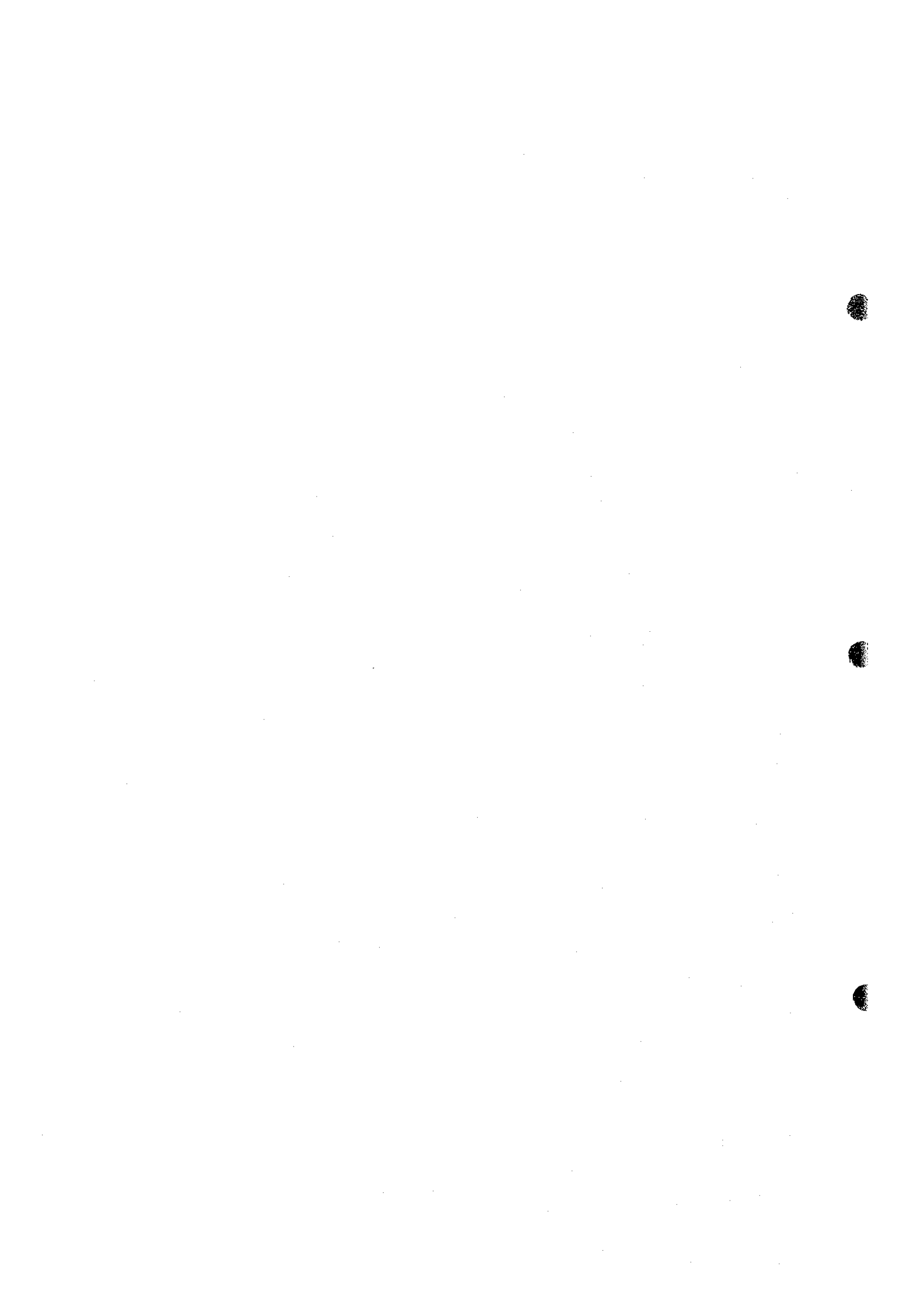
**19. Air Blower Room**

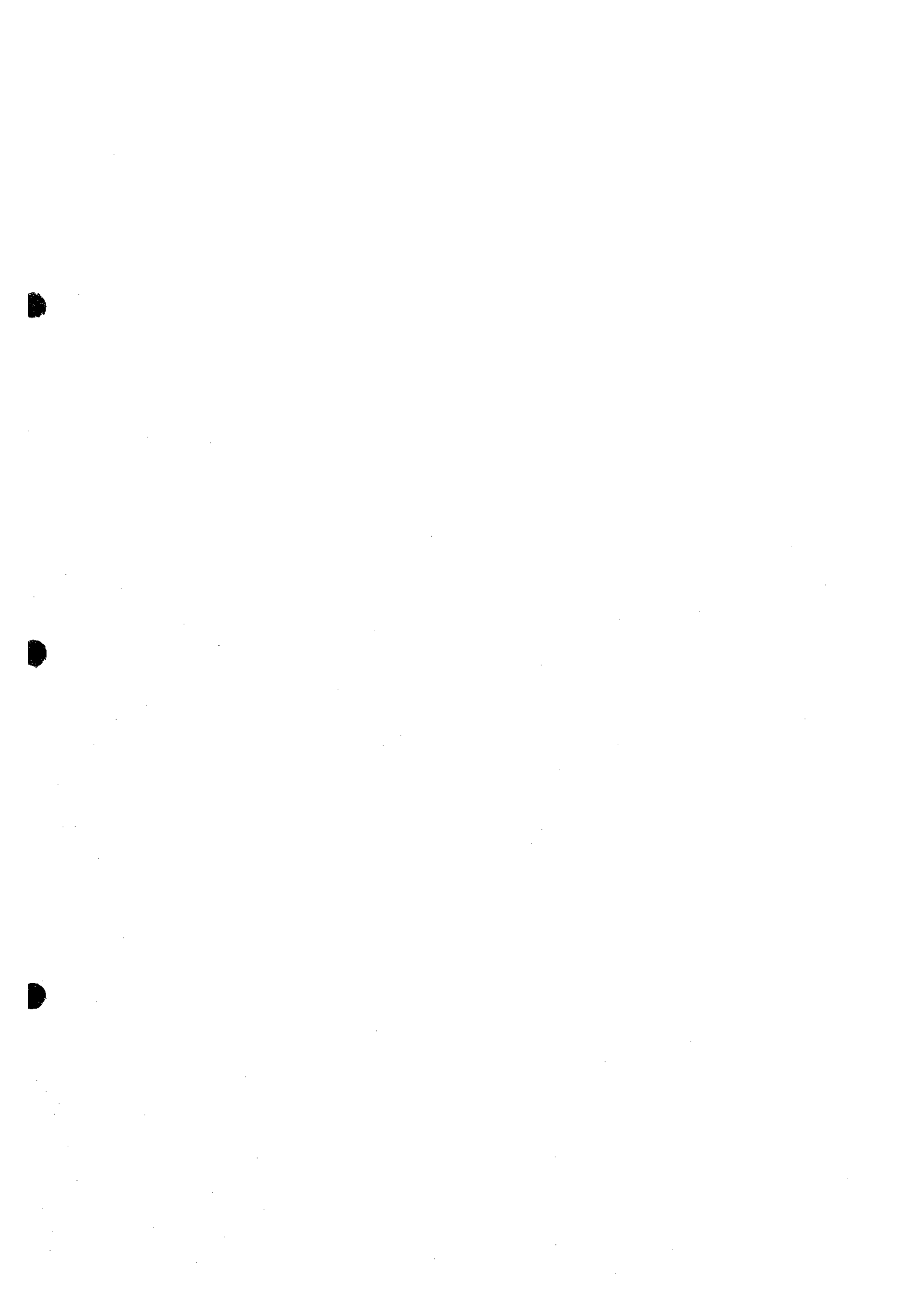
19.1 Air Blower for 13 Nm<sup>3</sup> / min x 1 bar x 10 kw 3 sets  
Aerated Grit Chamber;

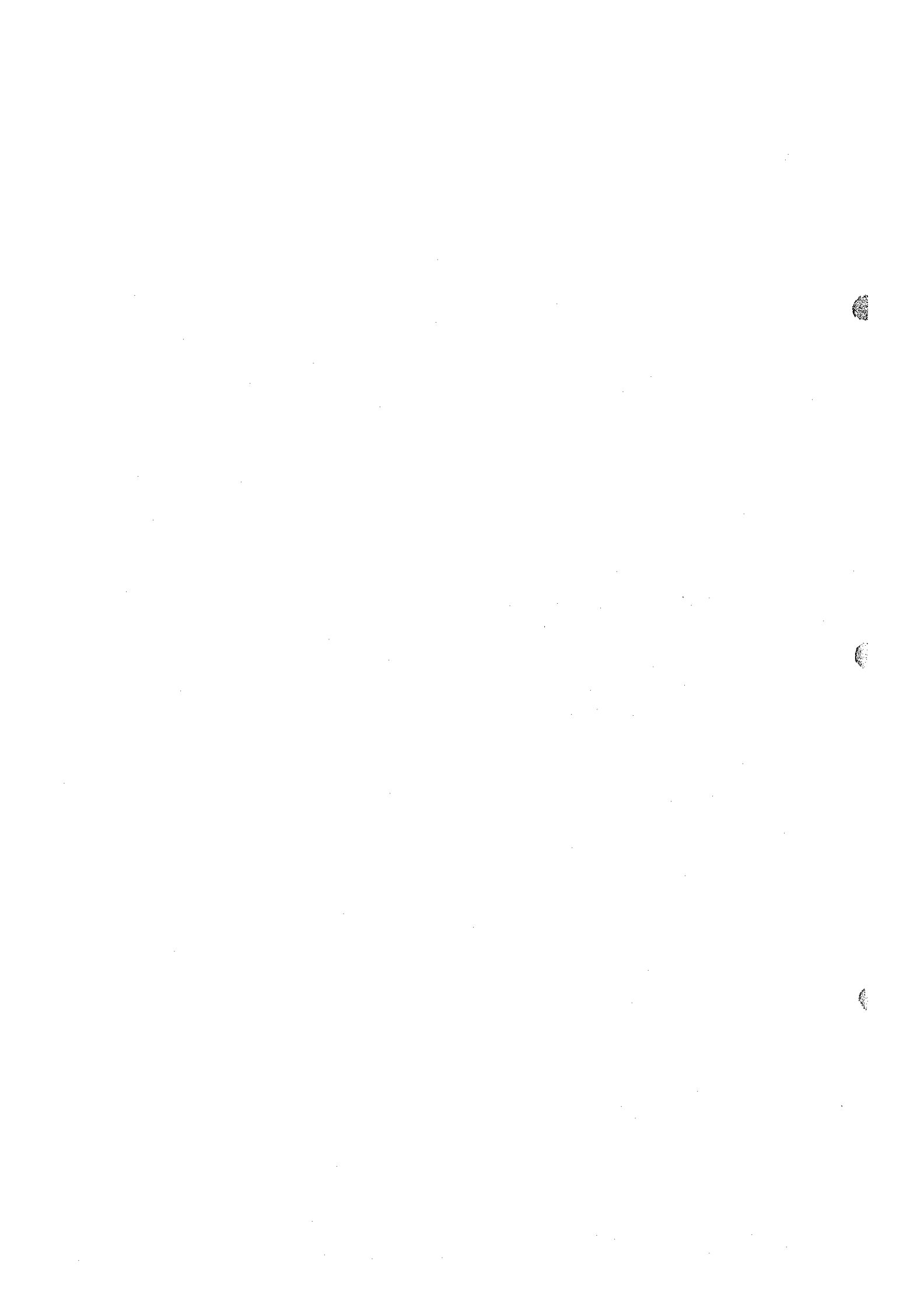
**20. Service Water Pumping Station**

20.1 Plant Water Transporting Pump; 1.2 ~ 2.1 m<sup>3</sup> / h x 7.1 m x 37 kw 2 sets

20.2 Hydrant Water 0.36 ~ 0.84 m<sup>3</sup> / h x 6.85 m x 22 kw 2 sets  
Transporting Pump;











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