(5) Another supporting data

1) On-going Project of MCWD

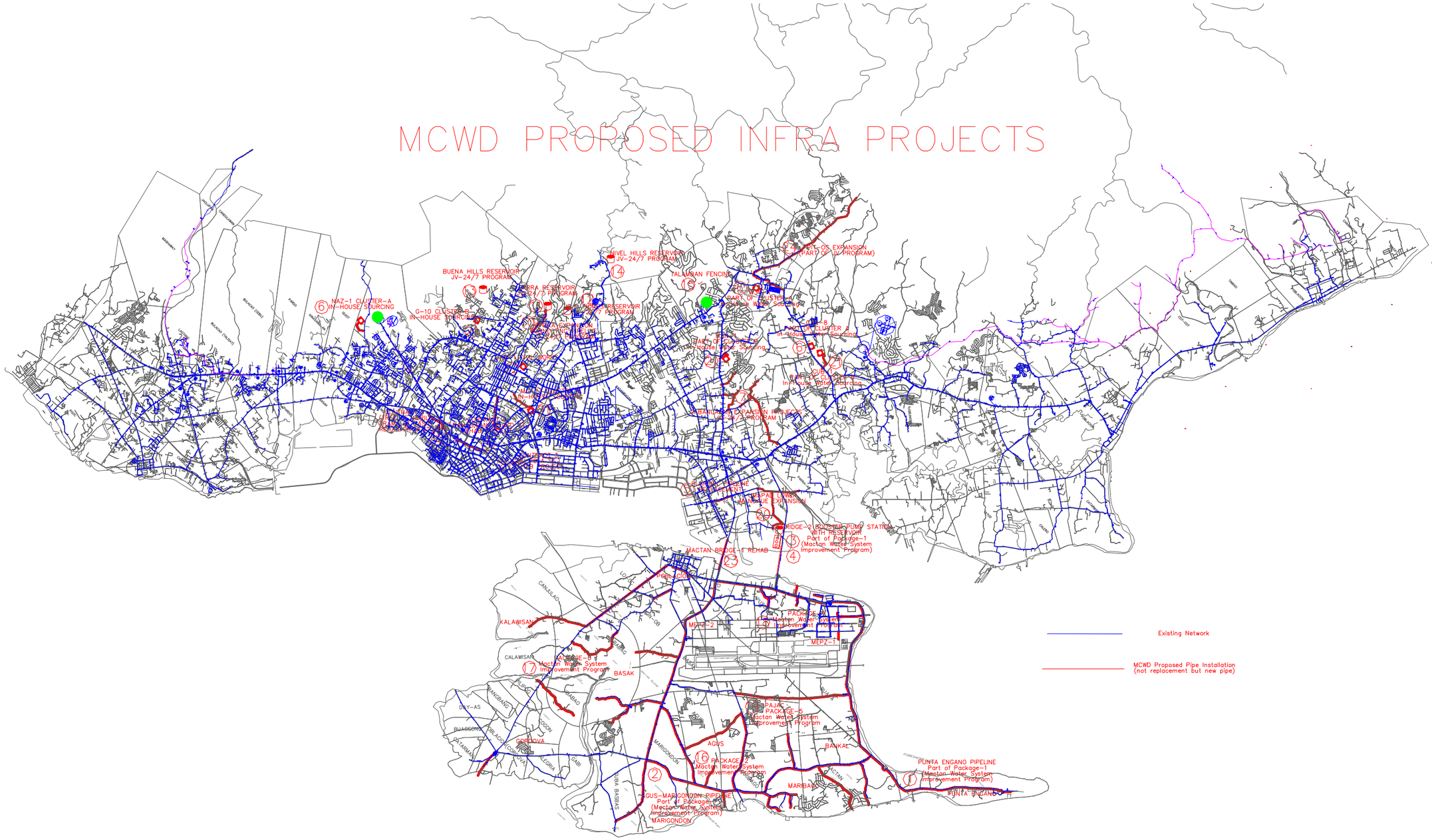

Figure C-II-43 On-going Project of MCWD

MCWD PROPOSED INFRA SCHEDULE

	Name of Project	LENGTH (in Meter)	PIPE SIZE (MM)	IMPLEMENTOR	PROJ. COST (PhP)	2009 J F M A M J J A S O N D	2010 J F M A M J J A S O N D	2011 J F M A M J J A S O N D	REMARKS
					-				
1	> PUNTA ENGANO PIPELINE *Part of Package-1 (Mactan Water Sytem Improvement Program)*								
2	> AGUS-MARIGONDON PIPELINE *Part of Package-1 (Mactan Water Sytem Improvement Program)*								
3	> BRIDGE 2 BOOSTER PUMP STATION *Part of Package-1 (Mactan Water Sytem Improvement Program)*								
4	> BRIDGE 2 BOOSTER PUMP STATION RESERVOIR *Part of Package-1 (Mactan Water Sytem Improvement Program)*								
5	> PLARIDEL PIPELINE REPLACEMENT				-				
6	> CLUSTER -A IN-HOUSE SOURCING *PIPELINE /CIVIL/ ELECTRO - MECHANICAL WORK*								
7	> CABANCALAN EXPANSION PROJECTS *JV-24/7 Program*								
8	> CONTRACT - 3 (Alviola, Tres de Abril, V. Rama & JM Basa) *Batch -1 Rehabilitation Project*								
9	> CONTRACT - 5 (F. Ramos & Sanciangko St.) *Batch -1 Rehabilitation Project*								
10	> OPRRA EXPANSION PIPELINE *JV-24/7 Program*								
11	> OPRRA RESERVOIR & CONNECTING PIPELINE *JV-24/7 Program*								
12	> BC HOMES RESERVOIR *JV-24/7 Program*								
13	> BUENA HILLS RESERVOIR & PIPELINES *JV-24/7 Program*								
14	> NIVEL HILLS RESERVOIR *JV-24/7 Program*								
15	> TALAMBAN FENCING								
16	> PACKAGE - 2 *Mactan Water System Improvement Program*								
17	> PACKAGE - 3 *Mactan Water System Improvement Program*								
18	> PACKAGE - 4 *Mactan Water System Improvement Program*								
19	> PACKAGE - 5 *Mactan Water System Improvement Program*								

LEGEND:
- ELECTION BAN PERIOD
- TOR PREPARATION
- DESIGN, ESTIMATES AND POW
- BIDDING PROCESS FOR CIVIL and ELECTRO-MECH'L WORKS
- PIPELAYING WORKS / PUMPHOUSE/IMPLEMENTATION

Figure C.II-44 On-going Project Schedule of MCWD (1/2)

	Name of Project	LENGTH (in Meter)	PIPE SIZE (MM)	IMPLEMENTOR	PROJ. COST (PhP)	2009 J F M A M J J A S O N D	2010 J F M A M J J A S O N D	2011 J F M A M J J A S O N D	REMARKS
20	UMAPAD LOWER MANDAUE EXPANSION								
21	CLUSTER B - IN-HOUSE SOURCING *(Man-1, Cub-1, MC-23, G-10)*								
22	CAM -1 CIVIL WORKS *Part of In-house Sourcing)*								
23	MACTAN BRIDGE 1 REHAB *(Part of Batch - 1 Rehab proposed by PMG)*								Bidding shall commence after Bridge 2 Booster Pummping Station commissioning
24	PIT-OS EXPANSION *(Part of JV Program)*								

LEGEND:
- ELECTION BAN PERIOD
- TOR PREPARATION
- DESIGN, ESTIMATES AND POW
- BIDDING PROCESS FOR CIVIL and ELECTRO-MECH'L WORKS
- PIPELAYING WORKS / PUMPHOUSE/IMPLEMENTATION

Figure C.II-44 On-going Project Schedule of MCWD (2/2)

2) Evaluation of Existing Tisa Water Treatment Plant

Dimension of main facility and actual parameter against daily average flow and daily maximum flow are shown in Table C.II-35. As far as it keeps working as slow sand filtration method, dimensional problem is difficult to find, although structural deterioration shall be reinforced by some remedy method.

Table C.II-35 Evaluation of Existing WTP

Daily Maximum Flow	Daily Average Flow	Existing Condition	Main parameter	Design Standard
10,000 m^3/d =6.94 m^3/min	4700 m^3/d =3.26 m^3/min			
Facility	Dimension			
Inlet Pipe	400mm	Reduced to 350mm		
Flow meter	Venturi Meter	Not Used		
Inlet Structure (Chemical Receiving Well)	W=2.5m x L=4.0m x H=2.6 m V= 26 m^3		Contact time =3.7 min (DMF) =8.0 min (DAF)	Contact time=1.5min (as receiving well)+ 1to 5min (as mixing tank)=2.5 to 6.5 min
Settling Basin	W=1.82m x L=36.8m x eH=2.7m x 4 module x 2 basin Surface Area 535.8 m^2 Volume 1,447 m^3		Surface loading rate = 13.0 mm/min(DMF) = 6.1 mm/min(DAF) Retention Time =209 min(DMF) =444 min(DAF)	Standard Surface loading rate 15 to 30 mm/min
Rapid Sand Filter	W= 3.5m x L= 4.8m x 3 module Filtration Area 50.4m^2		(w.o.stand-by) Filtration Velocity =198 m/d (DMF) =93 m/d (DAF) (w.1stand-by) Filtration Velocity =298 m/d (DMF) =140 m/d (DAF)	Standard Filtration Velocity 150 to 120 m/d
Slow sand filter (Clear well)	W=67.15m x L=54.25m x H=4.12m A=3,643 m^2 V=15,000 m^3		Filtration Velocity =2.7 m/d (DMF) =1.3 m/d (DAF)	Standard Filtration Velocity 4 to 5 m/d
Backwash Water Tank	D_{top}=15.33m, D_{bottom} =9.89m x H= 2.72m x 1 pond V=345m^3 *1			

*1=1/3x(15.33^2x0.785)x(15.33/2)-1/3x(9.89^2x0.785)x(9.89/2)

3) Construction Cost Estimation Data for Sewerage Facility (WTP)

(Cost Estimation of WTP)

As to the cost of WTP, it is, of course, desirable to sum up the each component cost, sedimentation tank, Rapid Sand filter, etc. The cost, however, is based on the comprehensive unit cost per m^3/d of capacity based on the past construction cost data since it is difficult to determine detailed specification of the plant.

From the data in Table C.II-36 and Table C.II-37, unit construction cost of 20,000 PHP/m^3/day seems appropriate, while unit O&M cost is estimated as 136 PHP/m^3/day/year

Construction cost and O&M cost is shown below.

- Construction cost 10,000 m^3/day x 20,0000 PHP/m^3/day = 200 million PHP
- O&M cost 4,700 m^3/day x 136 PHP/m^3/day/year = 0.64 million PHP

Table C.II-36 Construction Cost of WTP

WTP	Capacity (m^3/d)	Construction Cost (Million Japanese Yen)	Unit Price (Yen/m^3/d)	Unit Price (PhP/m^3/d)	
Cal, Sri Lanka	60,000	1,127	19,000	9,500	NJS estimation
Candy, Sri Lanka	36,670	2,064	57,000	28,500	ditto
Trabali, Nepal	4200	112	27,000	13,500	ditto
Carmen WTP, Cebu	42,000	1,259	30,000	15,000	NJS estimation in 2005
Kapsabet, Kenya	3,800	262	70,000	35,000	NJS estimation in 2008
Embu, Kenya	11,000	518	48,000	24,000	NJS estimation in 2009
Southern Bali, Indonesia	25,920	655	26,000	13,000	NK estimation in 2009
Average				19,786	→ 20,000

Table C.II-37 O&M cost from temporary designed plant

WTP capacity (m^3/day)	46,000
O&M cost (Chemical cost , PHP per year)	Alm 706.2 kg/d*30d*12month*10P/kg=2,542,320Peso Chlorine 141.3 kg/d*30d*12month*73P/kg=3,713,364Peso 6,255,684Peso
Unit cost (PHP per m^3/day/year)	136

Hardness removal cost is estimated from following data.

Construction cost is estimated nearly 33 million PHP based on the NJS data. The cost, however, is not included in the Project cost.

Table C.II-38 Hardness Removal Facilities Cost

Hardness Removal Facilities (Design Flow is 46,000m^3/d)							
Mechanical Facility			set	90,000,000	1	90,000,000	Include Chemical Dosing Facilities
Electrical Facility			set	60,000,000	1	60,000,000	
Total						150,000,000	

(Construction cost of 10,000 m^3/day hardness removal facility is 10,000 x 150 Million PHP / 46,000=32.6 Million PHP)

(Desalination Plant)

Detailed cost background is as follows

Table C.II-39 RO Plant Construction Cost

RO plant construction cost

	Search Agency/Time	Target Flow (m^3/d)	Construction Cost (Mill. PhP)	Unit Cost (PhP/m3/d)	Remarks
Construction Cost	JBIC/TEPSCO 2005	20,000 (Facility Capacity)	1,118	55,900	Nominal Capacity is 15,000 m^3/d
	JICA 2009	3,000	421	140,333	RO membrane is Japan-based cost
	1,000 m^3/d Hotel Facility	1,000	35	35,000	Cost estimate by Local Consultant (Asian Industry Inc.)
	Mactan SWRO Project	5,000	128	25600 ≒26,000	Cost estimate by Local Consultant(Taihon Engineering (Asia) Ltd.)

Table C.II-40 RO Plant Construction Cost

RO plant O&M cost

	Search Agency/Time	Target Flow (m^3/d)	O&M Cost (Mill. PhP/year)	Unit Cost (PhP/m3/d/Year)	Remarks
O&M Cost	JBIC/TEPSCO 2005	15,000	204	13,600	Nominal Capacity is 15,000 m^3/d
	JICA 2009	3,000	52	17,300	
	1,000 m^3/d Hotel Facility	1,000	–	–	No data
	Mactan SWRO Project	5,000	20.56 PhP/m3/d	7,500	Cost estimate by Local Consultant(Taihon Engineering (Asia) Ltd.)

4) MCWD Flow and Water Level Survey Result

MCWD Flow Surveillance Result

Date ; 2009/11/12 AM0:00 – 2009/11/14 PM12:00(=11/15 AM 0:00) , total 72 hours

Survey Item

- Water level fluctuation of six reservoir, Lagtang, Tisa, Talamban, Casili Old, Casili New (Inner and Outer, separately) and MEPZ reservoir at every hour
- Supply performance of two (2) bulk suppliers, Foremost and Mactan Rock, at every hour.
- Brownout time during survey span of each well

Main findings from the survey

- From 1:00 PM to 3:00 AM, Casili New Reservoir becomes empty in both inner and outer chamber. Water supply in accordance with hourly demand within Mandaue/Mactan area is not insufficient. Increase of supply volume from the Li-loan well field is necessary
- Tisa, Talamban and Casili Old reservoir show similar water level fluctuation. Their data shows no empty conditions emerge during measurement period, while Lagtang reservoir becomes empty from noon to 9:00 PM in two days among researched three days.
- Bulk supply from two private companies is observed in accordance with contract conditions.
- Direct supply wells in central area as well as local well field pumps, are operational almost 24 hours working even during midnight time. Brownout time of two Canduman well field pumps, CAN-3 and CAN-4, is outstandingly long, 17.5 hrs for CAN-3 and 6 hrs for CAN-4.

Countermeasures desirable

- To reduce the empty hour of the Casili New reservoir, water supply from the unapproved wells in Compostela is urgently desirable.

Water level fluctuation of each reservoir is shown as follows

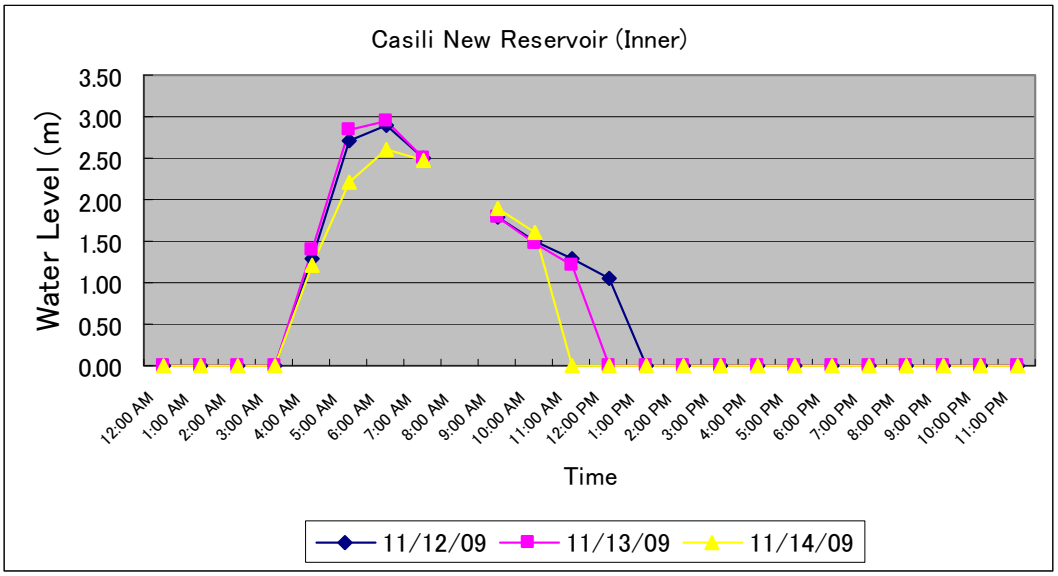

Figure C.II-45 Casili New Reservoir (Inner) Water Level Fluctuation Data

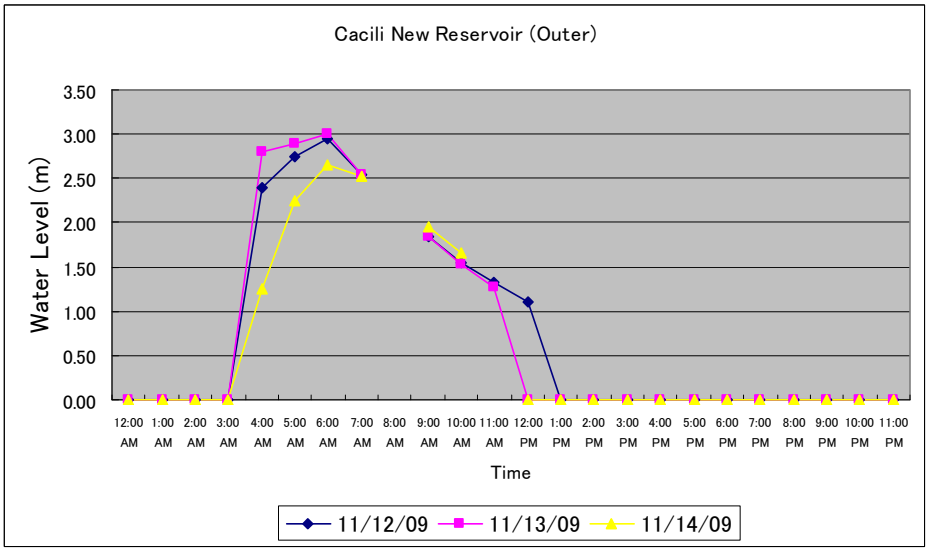

Figure C.II-46 Casili New Reservoir (Outer) Water Level Fluctuation Data

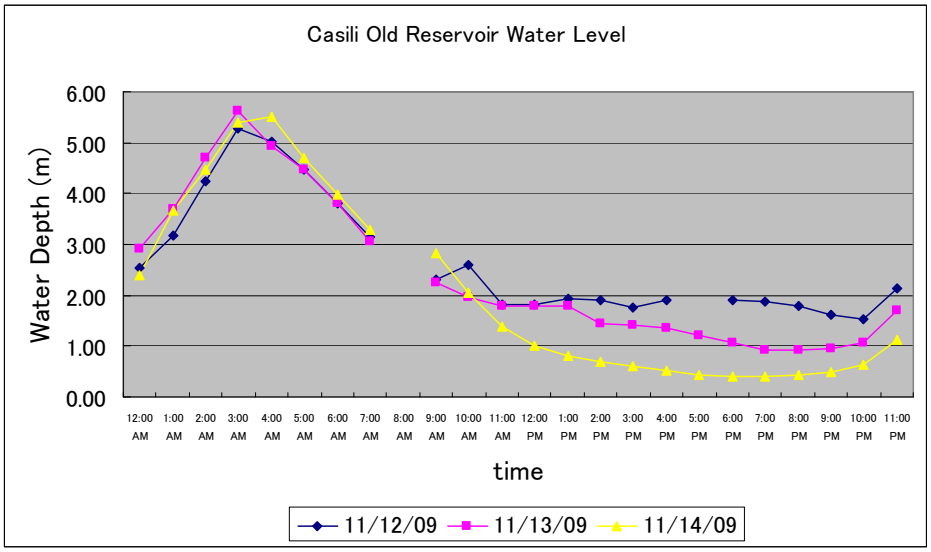

Figure C.II-47 Casili Old Reservoir Water Level Fluctuation Data

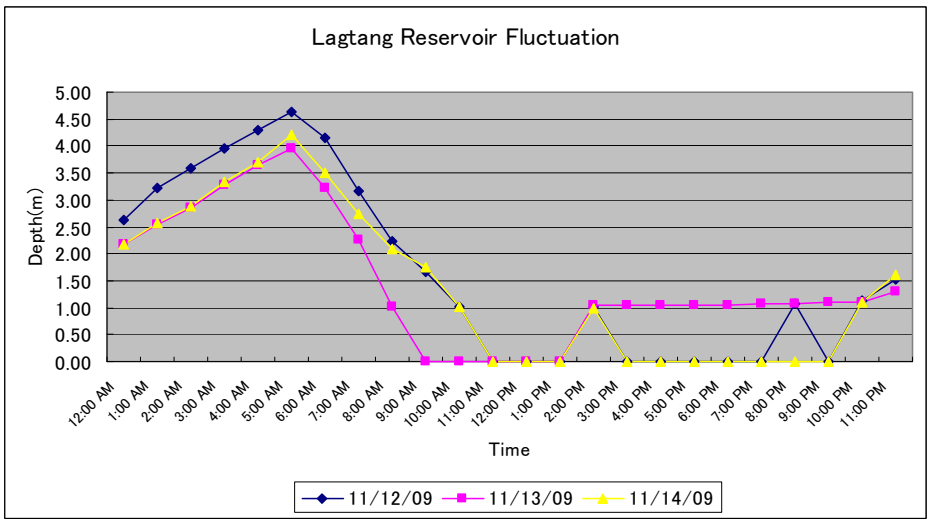

Figure C.II-48 Lagtang Reservoir Water Level Fluctuation Data

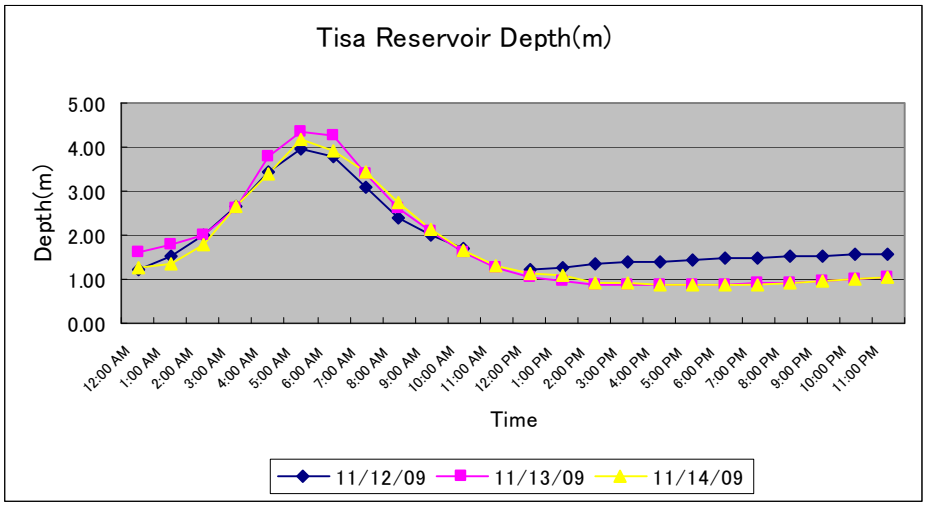

Figure C.II-49 Tisa Reservoir Water Level Fluctuation Data

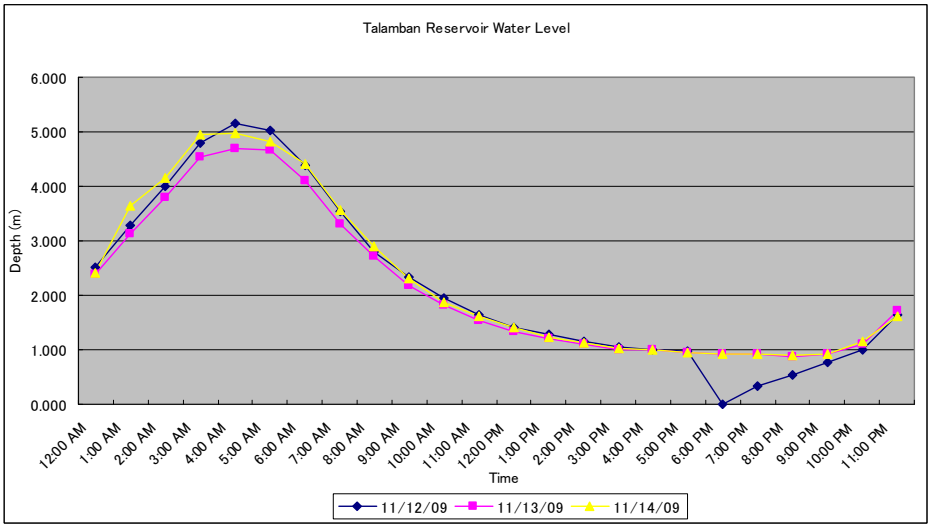

Figure C.II-50 Talamban Reservoir Water Level Fluctuation Data

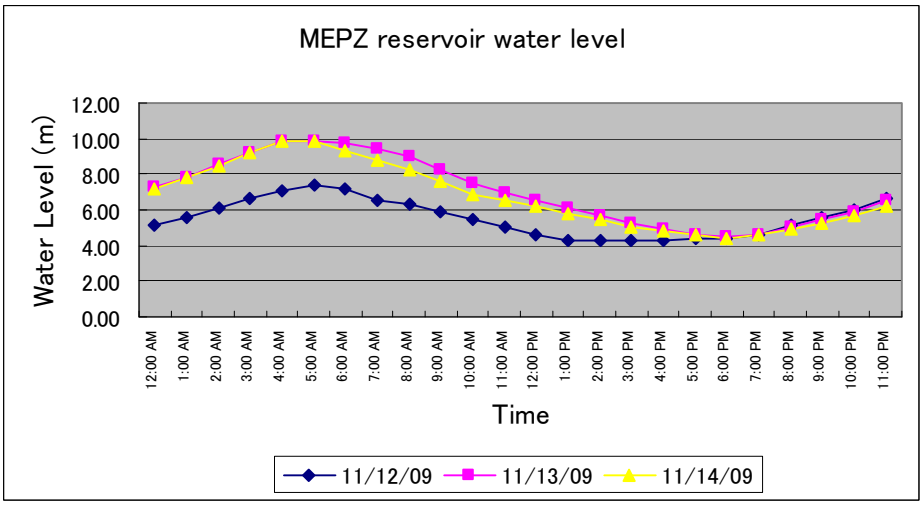

Figure C.II-51 MEPZ Reservoir Water Level Fluctuation Data

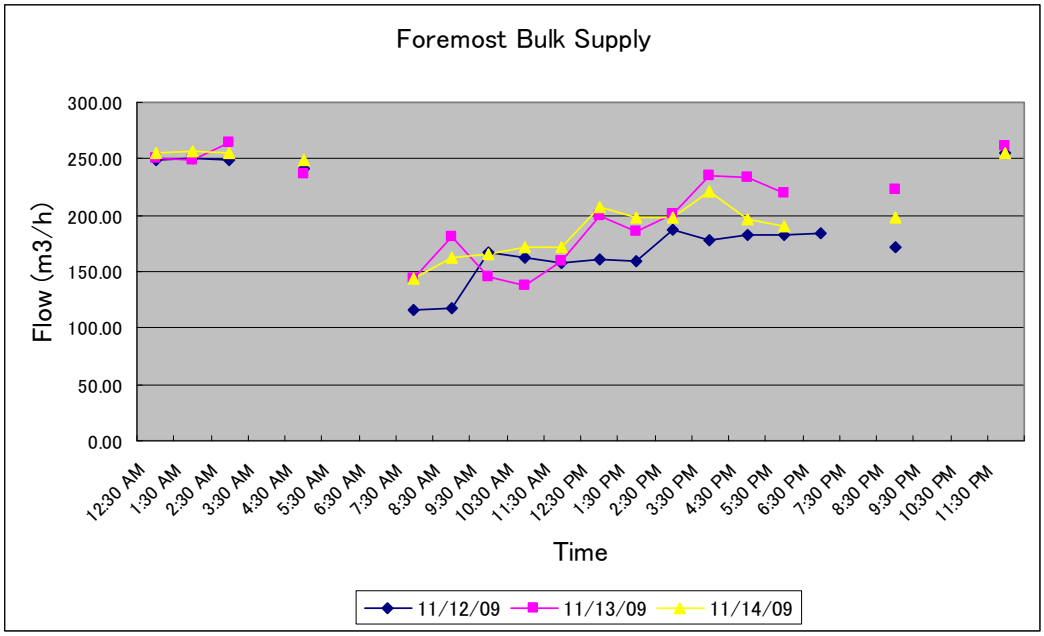

Figure C.II-52 Foremost Bulk Supply Data

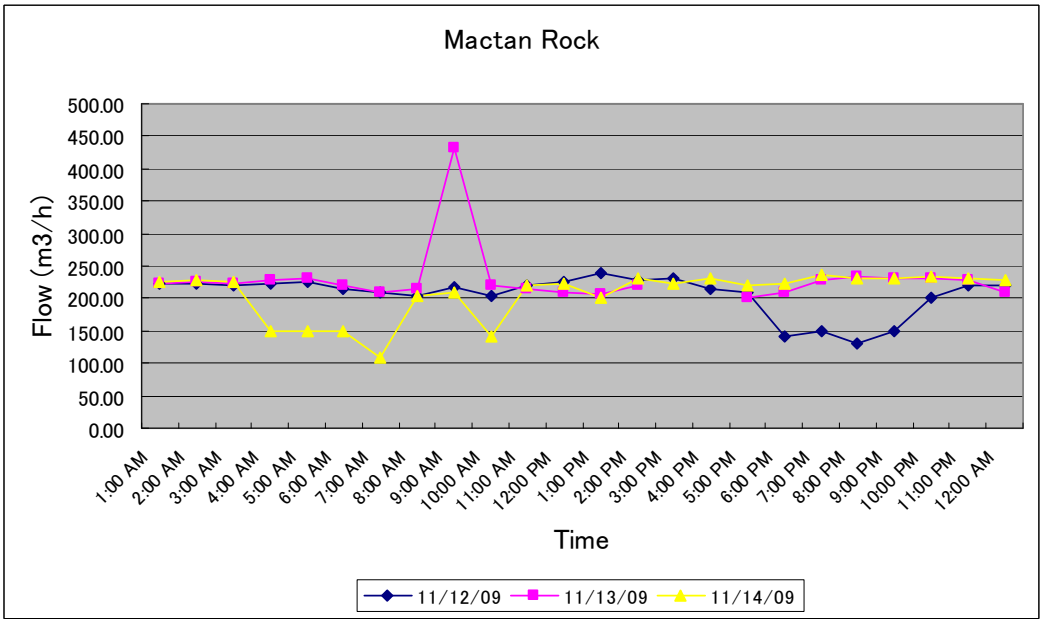

Figure C.II-53 Mactan Rock Bulk Supply Data

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