Technical Assistance Consultant's Report

Project Number: 46362
August 2014

Republic of the Philippines: Angat Water Transmission Improvement Project

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Prepared by Asia Halcrow, Inc.

Makati City, Philippines

For the Metropolitan Waterworks and Sewerage System and Asian Development Bank

Asian Development Bank

Final Feasibility Report

TA 8169-PHI: Angat Water Transmission Improvement Project

Asian Development Bank / Metropolitan Waterworks and Sewerage System

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Asia Halcrow, Inc.
8/F Salustiana Ty Tower
104 Paseo de Roxas Legaspi Village
1229 Makati City, Philippines
tel + 63 2 819 5231 fax + 63 2 750 0468
www.ch2mhill.com

Asia Halcrow, Inc is a CH2M HILL company

Document history

Feasibility Study / Final Report

Angat Water Transmission Improvement

ADB / MWSS

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04	28 August 2014	Final Feasibility Report based on the Accepted Documents by the ADB	Marissa De Guzman		

Contents

Figures

Tables

Abbreviations

ADB	Asian Development Bank
AHS	Affected Households
AFP	Armed Forces of the Philippines
AMRIS	Angat-Massim River Irrigation System
AWSTIP	Angat Water Supply Transmission Improvement Project
AWTIP	Angat Water Tunnel Improvement Project
AWUAIP	Angat Water Utilization and Asset Improvement Project
AP	Affected People
BAC	Bids and Awards Committee
BF	Bayabas Formation
CARD	Credit Assistance Rural Development
CEST	Center for Environmental Science and Technology
CHR	Commission on Human Rights
CO	Contracting officer
COBP	Country Operations Business Plan
CPF	Common Purpose Facilities Joint Undertaking
CPS	Country Partnership Strategy
CWA	Contractor's Work Area
D&B	Drill and blast
DCP	Double corrosion protection
DENR	Department of Environment and Natural Resources
DFR	Draft Final Report
DMCI	DMCI Holdings Inc.
DMF	Design Monitoring Framework
DPWH	Department of Public Works and Highways
DTI	Department of Trade and Industry
EA	Executing Agency
ESR	Excavation support ratio
FBI	Field-based investigation
FGD	Focal Group Discussion
FHH	Female Headed Households
FPIC	Free and Prior Informed Consent
FIDIC	International Federation of Consulting Engineers
GAD	Gender and Development
GAP	Gender Action Plan
GI	General Intervention
GOP	Government of the Philippines
GPPB-TSO	Government Procurement Policy Board Technical Services Office
GSI	Geological strength index
HH	Household
IA	Implementing Agency
IEC	Information, Education and Communication
IP	Indigenous Peoples
IPP	Indigenous Peoples Plan
IR	Involuntary Resettlement
JICA	Japan International Cooperation Agency
JV	Joint venture
LAWL	Lyonnaise Asia Water Limited

LIAC	Local Interagency Committee
LGU	Local Government Unit
LWD	Local Water District
LWUA	Local Water Utilities Administration
M&E	Monitoring and evaluation
MENRO	Municipal and Environmental Resource Officer
MGB	Mines and Geosciences Bureau
MHH	Male Headed Household
MHO	Municipal Health Office
MOA	Memorandum of Agreement
MPDC	Municipal Planning and Development Coordinator
MPIC	Metro Pacific Investments Corporation
MSWD	Municipal Social Welfare and Development
MWCI	Manila Water Company Inc.
MWSI	Maynilad Water Services Inc.
MWSS	Metropolitan Waterworks and Sewerage System
NAMRIA	National Mapping and Resource Information Authority
NEDA	National Economic Development Authority
NGI	Norwegian Geotechnical Institute
NGO	Non-Government Organization
NHA	National Housing Authority
NHC	National Historical Commission
NIA	National Irrigation Administration
NPC	National Power Corporation
NSCB	National Statistics Coordination Bureau
NSCP	National Structural Code of the Philippines
NWRB	National Water Resources Board
OFW	Overseas Foreign Workers
O&M	Operation and maintenance
OSP	Office of Special Projects
PAGASA	Philippine Atmospheric, Geophysical and Astronomical Services Administration
PAH	Potential affected household
PAM	Project administration manual
PCUP	Presidential Commission on Urban Poor
PCR	Project Completion Report
PNP	Philippine National Police
PPP	Public-private partnership
PPTA	Project preparatory technical assistance
PRC	People's Republic of China
PSA	Poverty and Social Analysis
RA	Republic Act
ROI	Return of Investment
ROM	Rehabilitation, operation and maintenance
ROW	Right-of-way
RP	Resettlement plan
RRP	Recommendation of the President
SCADA	Supervisory Control and Data Acquisition
SMC	San Miguel Corporation
SOP	Standard operating and maintenance procedure

SPRSS	Summary Poverty Reduction and Social Strategy
STM	Samahang Tubig Maynilad
TA	Technical assistance
TPSB	Tubig Para Sa Barangay
TOR	Terms of reference
TWG	Technical Working Group
UCS	Uniaxial compressive strength
ULS	Ultimate limit state
UPAO	Urban Poor Assistance Office
WB	World Bank
WSRAMP	Water Safety, Risk and Asset Management Plan
XW	Extremely weathered

Definition of Terms

Affected persons (or household)	Affected persons are those who are physically displace (relocation, loss of residential land, or loss of shelter) and or economically displaced (loss of land, assets, access to assets, income sources or means of livelihoods) as a result of (i) involuntary acquisition of land, or (ii) involuntary restrictions on land use or on access to legally designated parks and protected areas.
Ancestral Domain	(sec.3. IPRA Act) refers to all areas generally belonging to Indigenous Cultural Communities / Indigenous Peoples (ICCs / IPs) comprising lands, inland waters, coastal areas, and natural resources, therein, held under a claim of ownership, occupied or possessed by ICCs / IPs, by themselves or through their ancestors, communally or individually since time immemorial, continuously to the present except when interrupted by war, force majeure or displacement by force, deceit ,stealth or as a consequence of government projects or any other voluntary dealings entered into by government and by private individuals / corporations, and which are necessary to ensure their economic, social and cultural welfare.
Contractors work area	Is the area where facilities and utilities will be built used to as storage area for contractors' equipments, machines, staff housing, etc.
Involuntary Resettlement	It is the displacement of people from their homes, assets, sources of income and employment on account of the project undertaken by the Government of the Philippines. Involuntary resettlement may result in any or a combination of the following: loss of land, abode and other fixed assets, loss of income and/or employment, relocation, separation of family members, disintegration of communities, etc. Unless appropriate and adequate mitigation measures are carried out, involuntary resettlement will result to further hardship and impoverishment among the AHs, especially the marginal sectors of society (see definition of "vulnerable groups"). These adverse social impacts of development projects are often borne by AHs not of their own desire but involuntarily.
Spoils Disposal Area	Is the site where spoils including soil, stones, rocks, etc., from drillings during construction are dumped.
Vulnerable Groups	These are distinct groups of people who might suffer disproportionately or face the risk of being further marginalized by the effects of resettlement and specifically include: (i) households headed by women with dependents, (ii) disabled household heads, (iii) households falling under

	the generally accepted indicator for poverty, (iv) children and the elderly households who are landless and with no other means of support; (v) landless households; (vi) indigenous peoples or ethnic minorities

1 Executive Summary

1.1 Background

The bulk of the water supply for Metro Manila's 14 million inhabitants comes from the Umiray-Angat-Ipo system of tunnels, reservoirs and aqueducts.

The Angat Water Transmission Improvement Project (AWTIP) aims to improve the reliability and security of the raw water transmission system through partial rehabilitation from Ipo to La Mesa and the introduction of water safety, risk and asset management plans. Initially, the project only included the system downstream of Bigte but it has been found necessary to include the tunnels between Ipo and Bigte in the assessment as they form an integral system with the aqueducts downstream of Bigte.

Other projects are being developed to examine the raw water system capacity and security upstream of Ipo intake. This includes the Angat dam and Umiray facilities and new projects to increase flow to Angat and/or reduce irrigation demand from Angat.

1.2 Summary

The Project Preparatory Technical Assistance (PPTA) required the production of the following documents:

1. Inception Report (submitted 11 February 2013)
2. Supplementary Inception Report[1] (submitted February 2013)
3. Assessment Report (OUTPUT 1) (submitted 09 July 2013)
4. Feasibility Report (OUTPUT 2) (submitted 23 July 2013)
5. Bidding Documents (OUTPUT 3) (submitted 27 August 2013)
6. Water Safety, Risk and Asset Management Plan (OUTPUT 4) (submitted 10 July 2013)
7. FINAL REPORT (incorporating an updated feasibility report) (submitted 02 October 2013)

The feasibility study in its initial version issued in July 2013, represented Output 2 of our PPTA. It developed the details of the proposed new Tunnel 4 from Ipo to Bigte, and associated intake and outlet works, identified in the assessment and supplementary assessment reports (Output 1) as the priority scheme for the transmission system. Once constructed, it will facilitate the subsequent rehabilitation of the whole transmission system without compromising the continuing supply of water to meet the demands of Metro Manila.

This PPTA provides an illustrative design for the new tunnel project, together with the bidding documents for its design and construction under a FIDIC "Yellow Book", two-stage procurement process. The study includes assessments of the environmental, social, financial and institutional impacts of the new tunnel and identifies necessary actions to mitigate any perceived negative impacts to ensure the project's success.

The implementation of this project is expected to be financed by ADB and draft versions of the project administration manual (PAM) and report and recommendation of the president (RRP) have prepared in accordance with ADB requirements. To ensure that the procurement process can proceed in line with best international practice, terms of reference (TOR) for procurement consultancy services have

[1] The supplementary inception report was necessary after initial hydraulic analysis showed that Aqueducts 5 and 6 could not be supplied at their full capacities from Tunnel 3, and that it would not be possible to provide additional flow from Tunnel 2 / Basin 2 by virtue of incompatible operating levels.

also been prepared so that the executing agency obtains full benefit from the institutional strengthening which will inevitably result from their provision.

To promote sustainability of both the proposed new tunnel and existing transmission infrastructure, both a water safety plan (WSP) and asset management plan (AMP) were developed and provided to the executing agency for forward transmission to the concessionaires' common purpose facility's (CPF) management team. The paucity of data and records available for the transmission system limited the extent to which the WSP and AMP could be developed. For this reason, frameworks were presented on which CPF could build and extend to fully fledged systems. A basic geographical information system (GIS) was prepared and submitted to encourage the development of these essential management tools.

Finally, the Consultant would like to extend their gratitude and appreciation to the management and staff of MWSS, Maynilad, Manila Water and CPF for the support and assistance provided in completing these endeavours, and hope that this proposed project will provide a significant contribution to the security and safety of water supply to Metro Manila's inhabitants.

2 Supply and Demand

The assessment report (Output 1) has analysed Metro Manila's water supply and demand. The findings are summarised below.

2.1 Supply

The 14 million population of Metro Manila currently depends on the Umiray-Angat-Ipo multipurpose scheme for over 95% of its water supply. There are plans to develop another significant water source through the New Centennial Project currently being studied by MWSS. However, this will only be operational after 2020. The supply of sufficient and wholesome water from the Umiray-Angat-Ipo system is critical to the well being of the Manila population.

The reliable flow available to MWSS from the Angat reservoir is shown in Table 2-1, which is based on monthly mean flows from January 2001 to December 2010.

Table 2-1 Water available to MWSS from Angat reservoir

Probability	Flow to MWSS is below - m^3/s	Flow to MWSS is above - m^3/s	Granted water right - m^3/s
10%	27.5	48.6	46
20%	32.3	45.8	46
50%	39.2	39.2	46
Average	38.6	38.6	46

In addition to Angat releases, the available flows to MWSS at Ipo are augmented by runoff from the Ipo catchment between Angat and Ipo dams. This contributes an additional average flow of about $2m^3/s$ at Ipo.

Clearly, the water made available to MWSS is often below $46m^3/s$ granted water allocation. There are several potential projects that will improve the volume of reliable flow available to MWSS by transferring part of the irrigation demand from Angat to a new water source and/or transferring water to the Angat system for MWSS. MWSS plans to develop projects in the coming years so that a flow of $46m^3/s$ can be relied on from the Angat system. At the end of June, as this study was being finalised, MWSS informed that water allocation would be increased by $4m^3/s$ in consideration of the actual flows from Umiray, which are higher than the allocated $9m^3/s$. However, this additional allocation will be supplied to Bulacan Province from the transmission system. With the unreliability of the current water allocation, it is not clear how this additional allocation will be a secure resource.

The 2010 Memorandum of Agreement (MOA) on the Angat Water Protocol provides the allocation of water for irrigation and municipal use to be determined by National Water Resources Board (NWRB) in accordance with the Philippine Water Code. This arrangement is discussed in Section 0 of this document.

The Angat-Umiray-Ipo supply is augmented by flow from the La Mesa-Alat catchment estimated at an average of $1.4m^3/s$.

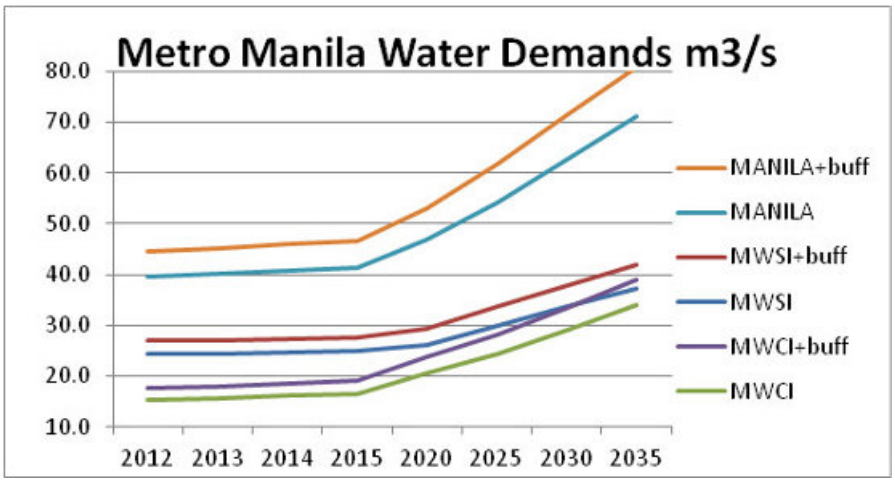
Water is also abstracted from Laguna Lake at the Putatan Reverse Osmosis (RO) plant. This has a capacity of $1.15m^3/s$, which is expected to double in the coming years.

Existing water resources could therefore provide up to $51.7m^3/s$, if the flow of $46m^3/s$ from Angat was secure and the relevant treatment plant and distribution infrastructure were constructed.

2.2 Demands

Several demand scenarios are available for the future water requirements in Metro Manila. The most recent are in the water security studies referenced in the assessment report (Output 1). MWSS and its concessionaires have used these studies, with some adjustments, to agree the demand forecast shown in Figure 1. The indicated growth and the 15% buffer are higher than what the World Bank and JICA studies suggest, but have been adopted by MWSS and its concessionaires in the on-going rate rebasing.

Figure 1 Manila water demand with and without 15% buffer



In addition to the demands of Metro Manila, the transmission system supplies approximately 0.5m³/s of raw water to San Jose del Monte treatment plant and other private customers. There are also many illegal users estimated to consume 0.1m³/s raw water for domestic use with similar quantity for agricultural purposes. At the end of June, we were informed that the Bulacan bulk water supply project currently under study within MWSS is likely to require up to 5.5m³/s from a take-off on the aqueducts at Pleasant Hills, approximately 10.2km from Bigte.

These forecasts are relevant to water resource planning, but do not directly affect the transmission system under study, which is limited by the granted water allocation of 46m³/s. There are suggestions that this may be increased by 4m³/s, as the Umiray scheme produces this in addition to the 9m³/s already granted to MWSS. However, given the unreliability of flow releases from Angat, the high risk of continuing to rely on the Angat single source, and the plan to develop the New Centennial Project, this increased flow is not a significant factor in this current design.

The current available supplies to meet the demand are approximately 49.4m³/s from Angat, Ipo, La Mesa and Alat catchments, and up to 2.3m³/s from the Putatan RO plant once its capacity is doubled. The New Centennial Water Source Project is set to meet the demands above these and planned to come on stream at about the same time as the 'demand with buffer' exceeds the available supply in 2020.

2.3 Treatment Plant Demand

For the Umiray-Angat-Ipo-La Mesa-Alat water sources,

Table 2-2 shows the treatment plant design capacities, average raw water demand and treated water production over three months from November 2012 to January 2013. Currently, raw water demand is approximately 40m³/s while the capacity is approximately 48m³/s. These volumes, along with direct

usage from the transmission system, can be made available from the current sources provided the reliability of the Angat system is improved.

Table 2-2 Treatment plant capacities and average volumes (Nov 2012-Jan 2013)

	Capacity m^3/s	Demand		Capacity MLD	Demand	
		Raw Water m^3/s	**Treated m^3/s**		**Raw Water MLD**	**Treated MLD**
MWSI						
La Mesa 1	17.4	15.3	14.1	1,500	1,326	1,214
La Mesa 2	10.4	8.6	8.1	900	742	700
Sub Total	27.8	23.9	22.2	2,400	2,068	1,914
MWCI						
Balara 1	5.4	3.6	3.6	470	312	307
Balara 2	13.1	11.6	11.3	1,130	1,001	979
Rodriguez (East La Mesa)	1.4	0.5	0.5	120	42	40
Sub total	19.9	15.7	15.3	1,720	1,355	1,326
Total	47.7	39.6	37.5	4,120	3,423	3,240

3 Transmission System Needs and Rehabilitation

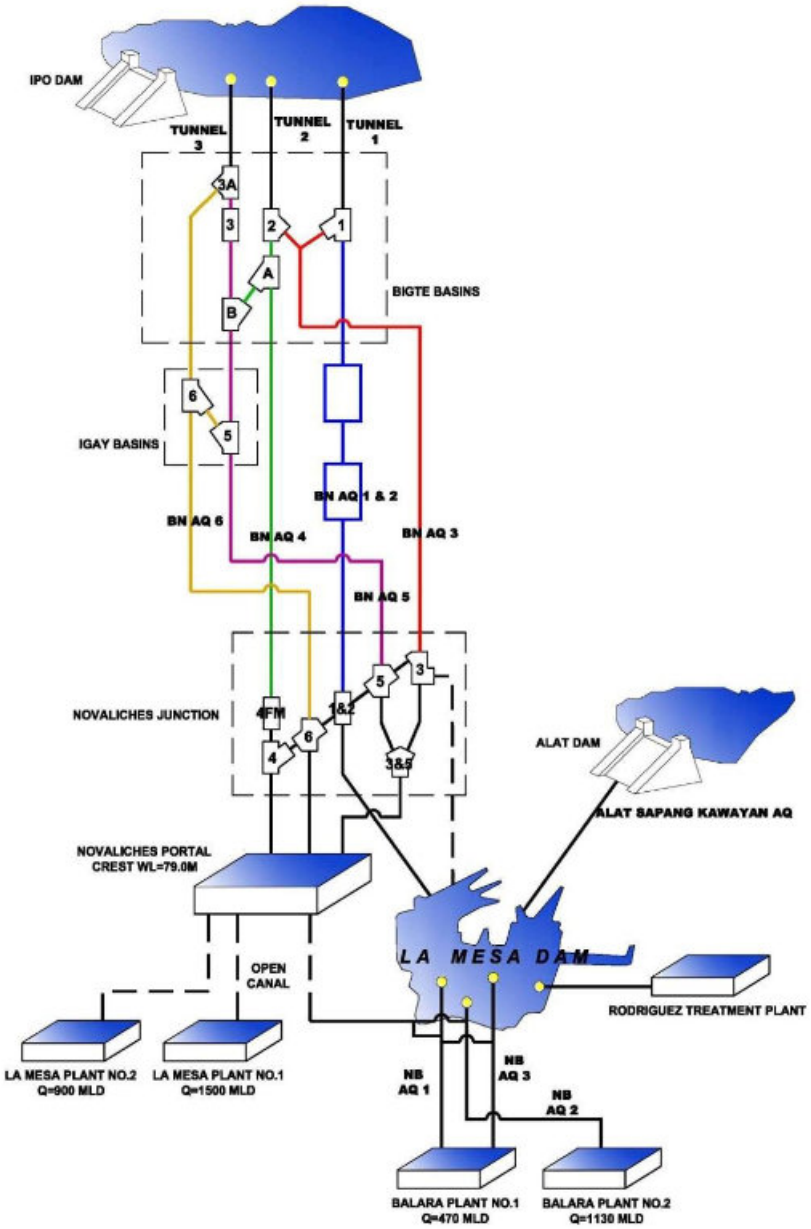
Assessment report (Output 1) has examined the transmission system needs and the overall rehabilitation plan. The findings are summarised below.

3.1 Transmission System Assessment

The existing transmission system, which is indicated schematically in Figure 2, has been assessed in three main areas:

- Condition
- Hydraulic performance
- Seismic resilience

Figure 2 Ipo-La Mesa transmission system schematic



3.1.1 Condition Assessment

The available data on the transmission system assets are limited. However, a reasonable idea of the general condition has been obtained based on the available drawings, site visits, the CPF asset register, limited repair and maintenance information, discussion with operators and other parties, and assessment of losses.

The main pipelines appear to be in reasonable condition, although the older aqueducts 1-2, 3, and 4 show leakage totalling nearly 10%. This will become unacceptable as demand increases given that water availability is limited. Remediation is likely to involve local repair and/or replacement of longer lengths of pipe. The tunnels continue to convey significant volumes of raw water, which indicate that they are intact with no major collapse. Once internal access is possible after tunnelling completion, the internal condition and extent of remediation required can be determined. It is anticipated that the unlined Tunnel 3 will need remediation.

The main basins at Bigte, Igay and Novaliches are in reasonable condition. The other structures and appurtenances along the aqueducts are generally in poor condition. Rehabilitation will require replacement of most of these structures and appurtenances over time to ensure the integrity of the transmission system.

3.1.2 Hydraulic Assessment

The capacity of the various tunnels and aqueducts of the transmission system have been assessed and used to develop an estimate of the hydraulic characteristics of the system. The capacities of the various conveyances using these characteristics are indicated in

Table 3-1.

Table 3-1 Calculated capacities of conveyances

	Water levels			Capacity (m^3/s)	Effective flow (m^3/s)
	Ipo	Bigte	Portal		
TUN1	100.3	88.0		6.6	6.6
TUN2	100.3	89.5		17.4	17.4
TUN3	100.3	95.5		19.0	19.0
TUN Total				**43.0**	**43.0**
AQ1+2		88.0	80.0	3.1	3.1
AQ3		88.0	80.0	6.8	6.8
AQ4		89.5	80.0	13.3	13.3
AQ5		95.5	80.0	19.0	19.0
AQ6		95.5	80.0	17.2	-
AQ Total				**59.4**	**42.2**

Estimated capacities highlight two important issues for the transmission system:

The capacity of the tunnels is below the anticipated maximum flow of $48m^3/s$ (MWSS water allocation of $46m^3/s + 2m^3/s$ from Ipo catchment below Angat) and needs to be increased in the next few years to meet future demands.

The aqueduct capacity is apparently more than the water allocation, but unfortunately only one of Aqueducts 5 and 6 can be supplied to its full capacity by Tunnel 3, reducing the effective capacity to

approximately 42.2m³/s. As a result, there is no flexibility in the system to allow closure of a conveyance for maintenance/ rehabilitation.

Hydraulically, the first requirement is to construct a new Tunnel 4 to augment the supply to Aqueducts 5 and 6 to their full capacities. After this, it will then be possible to sequentially close and fully inspect the older Tunnels 1, 2, 3 and Aqueducts 1-2, 3, and 4. This will also allow some of the assumptions made in the hydraulic and structural/seismic analyses to be reassessed.

3.1.3 Structural/Seismic Assessment

The assessment of structural resilience of aqueducts indicates that there are no major issues which need to be urgently addressed. The main concern is damage that will occur at hard/stiff points along the pipeline. It is considered that this risk is best dealt with post-earthquake repair, rather than installation of flexible joints. Such joints would be expensive given the large number of hard/stiff points and large diameter of the pipelines. Maintaining a stock of materials to enable rapid repair is considered to be of better value. Some structural reinforcement of several basins is also suggested.

3.2 Transmission System Rehabilitation

Assessment of the system identifies the need for:

- New tunnel to increase capacity and provide flexibility
- Internal inspection of conveyances and subsequent rehabilitation as necessary
- Rehabilitation/renewal of older structures and appurtenances

Suggested priority for these works is indicated in Table 3-2.

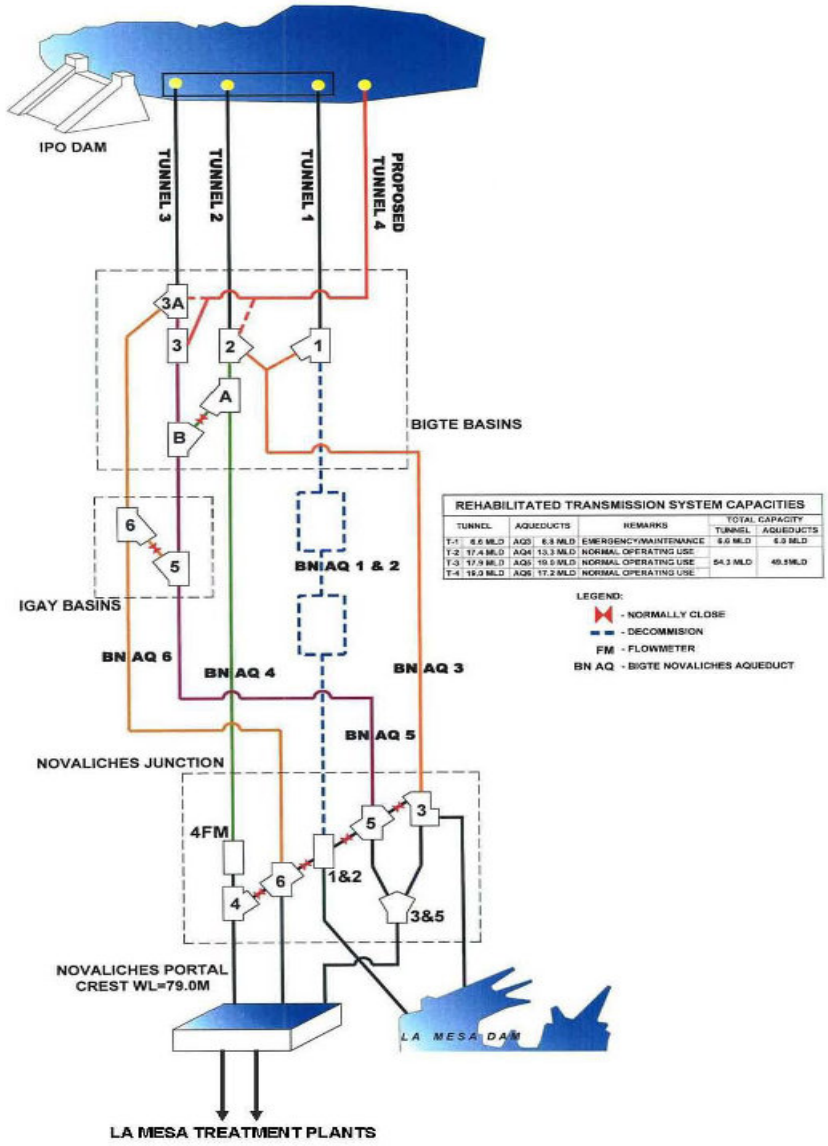
Table 3-2 Priority for potential rehabilitation to conveyance structures

Priority	Conveyance	Issues	Potential rehabilitation methods Detail study needed after inspection
1	New Tunnel 4	Critical to increase flow and facilitate subsequent inspection and rehabilitation	Described in this feasibility study
2	Tunnel 3	Critical tunnel, no permanent concrete lining, rock bolts 21-year-old	Permanent concrete lining - locally or total length, use corrosion resistant rock bolts + additional shotcrete
3=	Tunnel 2	Important tunnel, 30-year-old	Optioneered repairs to concrete lining
3=	Aqueduct 4	Important aqueduct, leakage at 9%, precast pipes potential seismic risk	Optioneered solution from local joint repair to full replacement of pipes, replace all fittings
4	Tunnel 1	74-year-old tunnel	Additional lining, lining repair to maintain integrity
5	Aqueduct 3	44-year-old, leakage at 10%	Repairs to concrete, replace essential fittings for emergency operation
6	Aqueduct 1-2	74-year-old, leakage at 6%, fittings generally not serviceable	Decommission

A schematic diagram of this rehabilitated transmission system is indicated in

Figure 3.

Figure 3 Proposed transmission system



The capacities of the existing conveyances after rehabilitation will be the calculated values shown in Table 3-1 with the probable exception of Tunnel 3 (where a concrete lining could reduce capacity to about 17.6m³/s); Aqueduct 4 (where a smooth lining or steel pipe could increase capacity to about

15.4m³/s); and Aqueducts 1-2 once decommissioned. Tunnel 4 will feed AQ5 and need a matching capacity of 19.0 m³/s. Proposed flows after rehabilitation are indicated in Table 3-3.

The potential 5.5m³/s supply to Bulacan Province from the transmission system, of which we were advised at the end of June, could in theory be accommodated in this rehabilitated system, although overall flexibility would be reduced. It will also be necessary for MWSS to agree with the concessionaires how this supply will be managed.

Table 3-3 Projected flows after rehabilitation

Tunnel	Capacity	Aqueduct	Capacity	Normal operation
	m³/s		m³/s	
Tun 1	6.6	AQ 3	6.8	
Tun 2	17.4	AQ 4	15.4	15.4
Tun 4	19.0	AQ 5	19.0	19.0
Tun 3	17.6	AQ 6	17.2	17.2
Tunnel Total		AQ Total		51.6

The assessment report identifies that in addition to potential rehabilitation of the conveyances, consideration needs to be given to:

- Improving measurement of flows and levels
- Ensuring operational flexibility at Bigte
- Improving flow distribution between concessionaires at La Mesa portal

In late June, a copy of the CPF rate rebasing submission was provided. The projects for study and development over the next five years which relate to the transmission system are:

- Rehabilitation/replacement of Aqueducts 1, 2, 3 and study for Tunnel 4
  – Our studies have shown that a new Tunnel 4 feeding Aqueducts 5/6 is required before this can be carried out.
- Settling basin/basins between Bigte and La Mesa to improve operational flexibility and reduce turbidity.
  – We are not convinced that such basins would be viable or effective and in any case, given the state of the system, they should be low down on any priority list.
- Supervisory Control and Data Acquisition (SCADA) system and associated instrumentation for all facilities to provide real-time information on quantity and quality of raw water in the system.
  – Our suggested improvement in flow and level measurement in the transmission system confirms this as being essential. This project should be accorded a high priority.
- Fencing along right-of-way (ROW) to improve security.
  – This could reduce theft and damage with sufficient security patrols, but should be accompanied by community engagement to ensure long-term sustainability.

The CPF document also notes that there was a bidding process for a portal flow metering and control project in 2012 which failed due to non-compliance of the bidders. The CPF plans are therefore reasonably in agreement with our own.

This feasibility study considers the operational flexibility at Bigte along with the new Tunnel 4 and its associated intake and outlet.

4 Geology of the Ipo-Bigte Tunnel Alignments

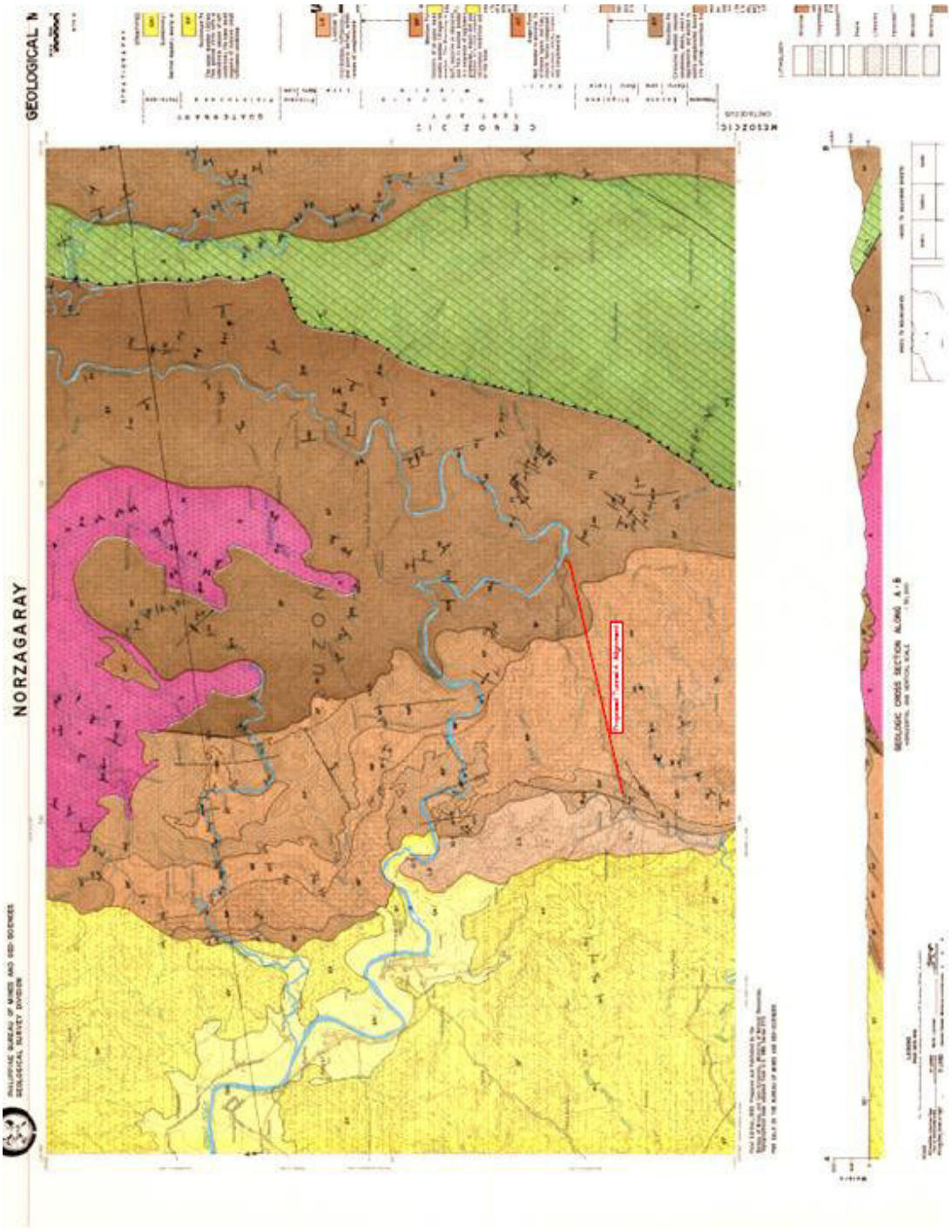
4.1 Regional Geology

Based on Mines and Geosciences Bureau's (MGB) geological plan and section map and publication, Ipo-Bigte area is underlain by the Eocene-Oligocene Bayabas Formation described as an extensive bedded sequence of highly indurated sandstone, shale, chert and pyroclastics mainly agglomerate and welded tuff, and volcanic flows predominantly amygdaloidal basalt with associated minor andesite pillows sometimes framed by chert materials. This is followed by the younger middle Miocene Madlum Formation on an angular unconformity, consisting of three rock groups. The older early Miocene Angat formation mostly of limestone mapped further north of the area is absent within the tunnel alignment. The geological contact of these formations dips towards Ipo inlet. Thus the lower member of the Madlum Formation, consisting of calcareous sandstone and silty shale, comes after the basalt Bayabas Formation and before transecting the middle Alagao volcanic, which consists of agglomerate, tuff, argillite, indurated greywacke basalt, and andesite flows at about mid-section. Finally, it traverses the upper member of Madlum Formation Buenacop limestone for a short distance into the outlet at Bigte.

The project area is slightly folded and 5km to 15km west of the inferred splay of the West Valley Fault. This is the geologic contact between Bayabas Formation and the cretaceous basement rocks consisting of massive to layered norite and partly normal gabro and pegmatitic anorthosite.

The regional map with the superimposed proposed Tunnel 4 alignment from Ipo to Bigte is shown in Figure 4.

Figure 4 Regional geology map



4.2 Local Geology

There are eight boreholes programmed for sub-surface investigation, two at the inlet (BH-01 and BH-03), two within the alignment (BH-04 and BH-04A) and five at the outlet (BHs-05, 06, 07 and 08). To date, all boreholes at the outlet and BH-03 have been completed while BH-01 and BH-04 are on-going.

Borehole logs exist from investigation boreholes from earlier projects at Ipo and Bigte. The relevant boreholes at Ipo are DH 22, DH 24, DH 27 and DH 28 (Figures 1 and 6 – Figures 1 to 8 can be found at the end of the chapter) and Bigte: BHs 1, 2, 3, 4, 5, and 6 (Figure 6), numbers 1, 2, 3, 4, 6, 7, 8, 9, 10 and 22 (Figures 3, 4, 5 and 7). These supplement the on-going sub-surface investigation that confirmed the basalt rock at the inlet, and the limestone rock at the outlet. Further, previous investigations show the basalt to have a Rock Quality Designation (RQD) within the 75% to 95% range with a thin highly weathered cover. A hard and fairly massive to massive, fresh to slightly weathered bedrock exists at depths more than 10m from the natural ground. The limestone rock has been recorded to have an RQD from 60% to 100% with variable overburden/slope wash materials of limestone fragments, mostly boulders. These descriptions suggest a massive to very massive and hard limestone formation at the outlet with substantial soil overburden, consisting mostly of limestone boulders.

The geology of Tunnel 1 "as-built drawing" and the construction support "as-built drawing" from Tunnel 3 provide a useful basis for estimating rock conditions for the proposed Tunnel 4. It is unfortunate that the Tunnel 1 geology incorrectly describes all rocks along the tunnel as basalt.

4.2.1 Tunnel Inlet

The tunnel inlet would be in the Bayabas Formation. Rock exposures around Ipo dam consist of fairly hard, massive and locally broken basalt and/or agglomerate with estimated rock mass rating (RMR) of a low of RMR = 30 and a high of RMR = 80 or an equivalent Tunnel Quality Index Q of 0.21 – 54.6 (from the equation RMR = 9 x ln Q + 44). The estimated RQD for these RMRs will be in the range from 30% to 80%. The locations of previous and current boreholes are shown in Figure 1.

BH-03, which is located just above the shotcrete slopes along the foot trail towards inlet of Tunnel 1 and Tunnel 2, showed a quick log of residual soil to highly weathered basalt to 5m depth followed by saprolite (moderately to highly weathered) until 10m, thence fairly massive/massive slightly-weathered to fresh basalt till bottom of 25m (Figure 2). The proposed Tunnel 4 will be driven at lower elevations where rock mass is likely to improve on the same formation of estimated RDQ from 60% to 80%. Fracture frequency (FF) is in the order of 30cm to 100cm. Thus the basalt within BF could be classified as sound to fractured/jointed basalt based on the extrapolation of Tunnel 3 supports (Figure 8). Estimated unconfined compressive strength or intact rock strength (IRS) of the fresh basalt could be over 50MPa.

The tunnel portal is excavated into the shotcrete protected slope and will have its own support. Existing boreholes DH 22 and DH 24 (Figure 06) showed RDQ at basalt bedrock of 60% to 90%, the lower value described as "slightly to badly fractured basalt with lots of calcite stringers" while the upper value describes the rock as "solid to slightly fractured basalt with calcite stringers". The existing shotcrete protection suggests that the ground here will be highly weathered and fractured. The portal excavation and support will need to proceed on the basis of poor rock quality.

The inlet structure will be built on fill within a cofferdam and in situ weathered basalt. It is anticipated that this in situ material will be able to provide a safe bearing capacity of 200kPa.

4.2.2 Tunnel Alignment

BH-4 and BH-04A are located at mid-section of the tunnel alignment but not yet drilled. Based on the regional geologic map, the Bayabas Formation extends only a short distance by about a kilometer from the tunnel inlet at Ipo. A Q-value of 0.21 to 5.91 (RMR from 30 to 60) can be expected here, after which

the tunnel alignment will transect the clastic member of the Madlum Formation thence the Alagao volcanics before exiting at the Buenacop limestone of the same formation at the tunnel outlet. The greater length of the proposed Tunnel 4 after the Bayabas Formation at the tunnel inlet will pass through the Madlum Formation through thin to thick bedded clastic member of calcareous sandstone with silty shale. Because of the "silty shale", this region is expected to include poor to very poor ground (RMR < 30 or Q < 0.20). This material may account for about 20% to 30 % of the entire tunnel length with RMRs ranging from 20 to 60 or Q of 0.06 to 14.4 (Extremely Poor to Good rock mass). It is expected that the ground conditions may improve as the tunnel extends closer to Bigte where the material becomes volcanics and limestone. The Alagao volcanics (basalt and pyroclastics) may have the same with the same Q-value as in the basalt at the Bayabas Formation. However, exposed pyroclastics along the road leading to Bigte showed a fractured/jointed rock mass to have lower Q-values resembling the sediments. The tunnel traverses only a portion of the Buenacop limestone following the Alagao volcanics. This area is estimated to be less than a kilometer, however, a better rock mass rating is expected with RQDs to be over 60% to 90%.

For the entire tunnel stretch, some low to medium amount of groundwater can be expected, the calcareous sandstone with silty shale being most likely an aquifer and significantly more water–bearing than other rock types.

4.2.3 Tunnel Outlet

The tunnel outlet will be on Buenacop limestone and may extend to less than a kilometer after the volcanics. The Buenacop limestone is very hard and massive to slightly-weathered but maybe locally broken. Solution cavities characteristic of karst topography are likely to be present with some seepages. BH-05, BH-06, BH-07 and BH-08 are drilled on talus materials that contain limestone boulders. Only BH-05 and BH-06 have encountered limestone bedrock which is hard to very hard and massive. RQDs for the bedrock ranges from 20% to 80% with estimated Q-values of 0.64 to 54.6 which are the expected Q values for the tunnel drive at the Buenacop limestone. Nevertheless, the natural cover may be less thick than elsewhere which may contribute to induced stress-related ground conditions, and being very massive, would require greater support. Likewise, the presence of a major geological contact between the Madlum Formation with the younger Guadalupe Formation/Lambak shale further to the east of Bigte might have induced local shears within the Limestone Formation which were observed in the logs of completed four boreholes at the outlet (Figures 3, 4 and 5).

4.3 Engineering Implications

4.3.1 Cut Slopes

The natural slopes within the area range from 40° to 70°. Thus, for the purposes of this preliminary design, the cut slope in fresh to slightly weathered basalt bedrock at the inlet area with the higher rock mass rating is assumed to be 0.7H:1V; for the cut slope in saprolite, 1 to 1.5H:1.0H is assumed. Figure 02 shows the extent of weathering at the inlet while Figures 04 and 05 are the geological sections for the outlet.

It is anticipated that cut slopes will need some additional strengthening with steel fiber reinforced shotcrete (SFRS) and rock bolts.

Table 4-1 summarizes the expected engineering parameters based on rock exposures and combined regional geologic descriptions for the proposed Tunnel 4.

Table 4-1 Summary of potential geological and geotechnical parameters

Location		Ipo	Ipo - Bigte		Bigte		
Boreholes	Programmed	BH-01, BH-03	BH-04, BH-04A		BH-05, BH-06, BH-07 AND BH-08		
	Existing	DH 22, DH 24, DH 27, DH 28			BHs 1, 2, 3, 4, 5, 6 and Nos. 1, 2, 3, 4 6, 7, 8, 9, 10, and 22		
Estimated rock mass properties		Tunnel inlet	Tunnel conveyance		Tunnel outlet	Interconnecting basins	
Rock type		Volcanics	Sediments	Volcanics	Limestone	Limestone Talus	
RQD, %		20 -80	0 - 30	20 - 80	40 - 80	Soils, N/A	
IRS, MPa		30 - 70	5 - 10	30 - 50	30 - 70	Soils, N/A	
FF, cm		30 - 100	10 -50	30 - 100	50 – 200	Soils, N/A	
Groundwater		Low to Mod	Mod to High	Low to Mod	Mod to High	Low to Mod	
Q –Value after Barton		0.21 – 54.6	0.06 – 14.4	0.21 – 54.6	0.21 – 54.6	N/A	
Barton's RMR		Very Poor to Very Good	Extremely Poor to Good	Very Poor to Very Good	Very Poor to Very Good	N/A	
Rock mass rating (Bieniawski, 1989)		Poor to Fair	Very Poor to Poor	Poor to Fair	Fair to Very Good	Soils, N/A	
Unit weight, kN/m³		25 - 30	20 - 25	25 - 30	25 - 30	20 - 25	
Cohesion, kPa		200 - 300	100 - 200	200 - 300	200 - 300	50 - 100	
PHI, degrees		30 - 35	25 - 30	30 - 35	30 - 35	15 – 25	
Others							
Road cuts		Cut slopes	Cohesion, kPa	PHI, degrees	Slope support enhancement	Toe support	Concrete canal
Rock		0.7 H : 1.0 V	100	35	SFRS, Rockbolt	None	Provide
Saprolite		1.0 – 1.5 H : 1.0 V	50	30	SFRS, Rockbolt	Provide	Provide
Soils		2.0 – 2.5 H : 1.0 V	25	25	Remove/Replace	Provide	Provide

The stability of underground openings will not only be dependent on the geology of the area but will also be affected by the size of the opening. A larger opening will expose more geological discontinuities that may contribute to higher probability of wedges and/or increasing the weight of potential blocks that could fall from the roof or slide from the walls. The proposed Tunnel 4 has a similar diameter to Tunnel 3, and similar conditions can be expected. All the existing conveyance tunnels from Ipo to Bigte (Tunnel 1, Tunnel 2 and Tunnel 3) and that of the proposed Tunnel 4 will be on the same geotechnical setting and little or insignificant variations are expected to give rationale to Figure 8.

A more detailed geological-geotechnical mapping during the actual driving of the tunnel will be needed as a basis of construction support categorization and forecasting of ground conditions.

4.4 Geological Figures

The following figures are attached:

Inlet area geological plan	Figure 1
Inlet geological section	Figure 2
Outlet and open channel area geological plan	Figure 3
Outlet geological sections	Figure 4
Open channel geological plan and sections	Figure 5
Borehole logs	Figure 6
Outlet - geology logs	Figure 7
Geology and tunnel support	Figure 8

5 Scheme Fundamentals/Design

5.1 Impact, Outcome, Output

The impact will be long-term security and efficiency of raw water flow in the transmission system from Ipo to La Mesa. This project is a step towards this.

The project outcome will be improved flow and flexibility in the transmission system which will enable the full rehabilitation of the transmission system.

The output of this project will be a new Tunnel 4 from Ipo to Bigte supplying 19.0m³/s to stilling Basin 3/AQ5.

5.2 Scheme Parameters/Constraints

There are a number of fixed parameters/constraints which define the Tunnel 4 project:

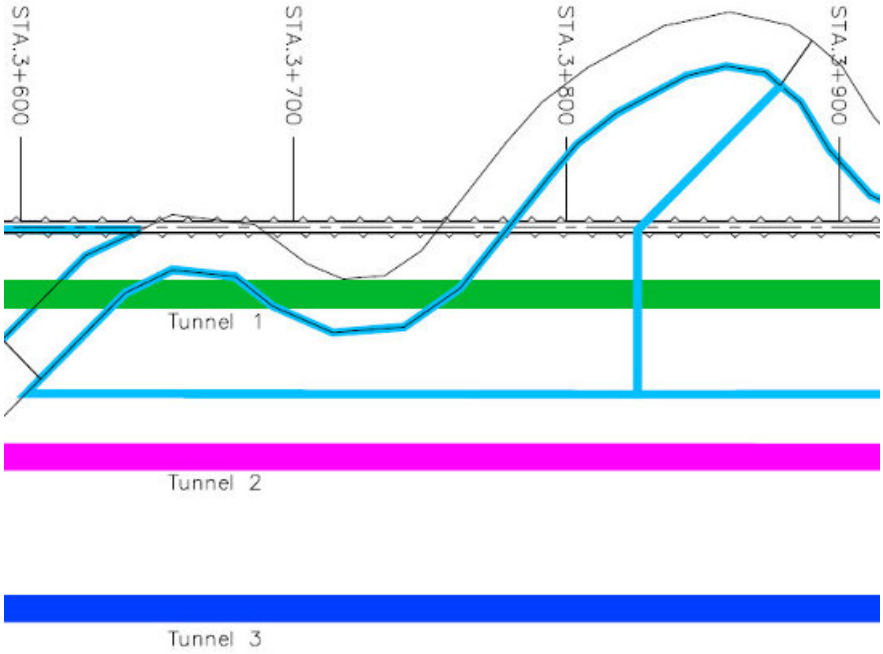
1. Operational disruption of transmission system during construction to be minimal.

2. Tunnel 4 must be within the existing MWSS ROW. This is a 60m wide corridor approximately centred on Tunnel 1. However, recent survey data have revealed that there are sections in the proposed alignment which are not within the MWSS ROW. The proposed new Tunnel 4 alignment will now require to be moved approximately 6m north (towards Tunnel 1) from the alignment shown in F
3.
4.

5. Figure 5 and additional land will have to be acquired by MWSS from approximately Stations 3+680 to 3+750. Given that both existing Tunnels 2 and 3 are currently outside the MWSS ROW, it is imperative that MWSS seeks to rectify this situation as a matter of urgency.

6. Moving the alignment of Tunnel 4 by 6m will bring the wall-to-wall separation between it and Tunnel 1 to less than 10m. Whilst this may not present any problem to the structural integrity of either tunnel, it may well have significant influence on the Contractor's assessment of risk, and therefore on cost. It would be prudent, therefore, to extend MWSS ROW to the south by at least 6m in addition to acquisition of ROW for Tunnels 2 and 3.

Figure 5 MWSS right of way (cyan)



7. Tunnel 4 is not to pass within the existing working tunnels as the risk of collapse and disruption is unacceptable. This means Tunnel 4 is restricted to the corridor between Tunnel 1 and the southern boundary of MWSS ROW.

8. The scheme must convey 19m³/s. Design criteria for this assessment are:
a. Elevation of Ipo reservoir water level 100.3m
b. Elevation of Basin 3 (AQ5 start) water level 95.5m
c. Hydraulic roughness of concrete taken as 4mm. This is considered to be the likely long-term, ultimate roughness after degradation of the concrete surface.

9. Intake will be located between the old and new Ipo dams to reduce risk of silt build-up in front of the intake. Silt levels upstream of the old dam are at an approximate elevation of 91m and are

increasing by approximately 0.3m a year. In comparison, levels downstream of the old dam are approximately 83m.

These constraints fix the basic layout of the scheme.

5.3 Hydraulics

In developing the illustrative design for the proposed Tunnel 4 and associated works, the following assumptions have been made:

1. All levels are stated and taken with reference to the MWSS datum (which is 10.46m above the NAMRIA datum).

2. The required minimum flow at the entry to Bigte Basin 3 is 19m³/s.

3. Friction losses were calculated using the implicit Colebrook-White formula to derive the friction factor 'f', using an absolute roughness of 4mm for the concrete tunnel lining. This roughness value was assumed to be the ultimate value, and at the required rate of flow corresponds approximately to a friction factor 'f' of 0.0197 and a Manning's 'n' of 0.0207 . Head loss was then calculated using the Darcy-Weisbach formula.

Colebrook-White formula

$$\frac{1}{\sqrt{f}} = -2\log_{10}\left(\frac{K_s}{14.8R_h} + \frac{2.51}{R_e\sqrt{f}}\right)$$

where: f the friction factor
K_s the absolute roughness in m
R_h the hydraulic radius in m
R_e the Reynolds number

Darcy-Weisbach formula

$$h_f = f * \frac{L}{4R_h} * \frac{V^2}{2g}$$

where: h_f the friction loss in m
f the friction factor
L the conduit length in m
R_h the hydraulic radius in m
V the fluid velocity in m/s
g gravitational acceleration in m/s²

4. A similar approach was taken to estimate losses in the channel proposed to connect Tunnel 4 outlet portal to Basin 3.

5. Minor losses were calculated for proposed trash screens and inlet isolating gates (penstocks) at the proposed Ipo reservoir intake structure using a simplified expression of Bernouilli's principle and considering the reduction in area as an orifice, with an assumed discharge coefficient of 0.61. Entry and exit losses were estimated in a similar manner using minor loss coefficients of 1.0 and 0.5, respectively.

Minor loss formula:

$$h_f = (C_d \text{ or } f) * \frac{V^2}{2g}$$

where:

C_d	the discharge coefficient
f	the friction factor
V	the fluid velocity in m/s
g	gravitational acceleration in m/s²

6. With the estimated head losses, along with the constraints described above, the indicative structural dimensions detailed in the illustrative drawings were derived.

5.4 Operating Philosophy

The fundamental concept of this project is to enhance the security of water supply to Metro Manila and improve its operational flexibility. Initially, it was thought that flexibility could only be improved by ensuring that any new tunnel should have the ability to feed any combination of stilling basins at Bigte. However, when closer examination of the system hydraulics confirmed that relative tunnel and basin invert levels would preclude this possibility, it was necessary to re-examine these initial thoughts. With the system proposed in this feasibility study, operational flexibility will still be achieved as a result of having effectively one tunnel for each operational aqueduct.

Consideration could be given to the provision of hydraulic connection between the proposed Tunnel 4 and Basins 1 and 2, possibly by combining this with the connecting channel overflow structure, but we consider system flexibility to be sufficient in current circumstances without this.

Our recommendation to abandon AQ1 and AQ2 will result in the following configuration (effective estimated capacities are shown in m³/s):

Tunnel 1	→	AQ3	6.6
Tunnel 2	→	AQ4	13.3
Tunnel 3	→	AQ6	19.0
Tunnel 4	→	AQ5	17.2

Total capacity: 56.1 m³/s

This will allow either Tunnel 1/AQ3 or Tunnel 2/AQ4 to be taken out of service for inspection, maintenance, repair or refurbishment with no loss of service at current levels of demand.

Either Tunnel 3/AQ6 or Tunnel 4/AQ5 could be taken out of service for similar works with only a slight to moderate adverse impact to levels of service during periods of high demand or when resources are limited during periods of drought.

The only apparent threat to this flexibility, and one which was only revealed to this study in late June 2013, is an intention to supply 5.5m³/s to the Bulacan Province from AQ6 at a point approximately 10.2km downstream of Bigte. Clearly, this will compromise the intended flexibility of the proposed system and any future project to implement this should take this into account.

In terms of operating procedures, the proposed system will be far less complex than at present. Although the system will still be driven by the sum of demands from the La Mesa 1 and 2, the Balara 1 and 2, and the Rodriguez (La Mesa East) Treatment Plants, the absence of any need to distribute flow from Tunnels 1 and 2 between AQ1 and 2, AQ3, and AQ4 will make flow regulation quite straightforward. The current complexity of operation has been exacerbated by the absence of

sufficiently robust, or well-maintained, flow and basin level instrumentation and of a comprehensive telemetry system. The provision of these should be considered a priority, and procurement of the SCADA project proposed by CPF in their rate rebasing submission should be initiated.

The control of raw water flow from Ipo Reservoir to La Mesa will be implemented by essentially the same means as at present by adjustment of the tunnel inlet gates (penstocks) at the intake structures. Because of the large mass of water, and of the length of the tunnels and aqueducts, the system response time is very long. This renders automatic control of little advantage and so it is recommended that operation remain under manual control – albeit with improved instrumentation and telemetry as mentioned above.

5.5 Common Design Parameters

Several parameters are common to the design of the tunnel, intake, outlet, and channel structures. The following sections provide a summary of design parameters common to all four structures. Design parameters specific to a particular structure are provided in their respective chapter of this feasibility study.

5.5.1 Geotechnical Parameters

Detailed site investigation and testing have not been carried out at this stage; the successful design build contractor will be responsible for verifying the parameters used to produce the preliminary design.

- **Unit Weight**

The unit weight of basalt is assumed to be 26kN/m^3.

Varying sizes of boulders are commonly found in fill and in extremely weathered (XW) basalt such as found within the proposed site. Therefore, the unit weight of 26kN/m^3 has conservatively been assumed for the fill, fault zones and the XW basalt.

- **Ratio of horizontal to vertical stress**

In the design of structures below grade, provisions are made to accommodate the static lateral pressure of adjacent soil. Where structures are free to move, the pressure is taken as active (K_a) and for structures restrained from moving and in the case of the in situ stress for design of the tunnel, the pressure is taken as at rest (K_o).

K_a is calculated in accordance with the following relationship:

$$K_a = \frac{1-\sin\Phi}{1+\sin\Phi}$$

K_o is calculated in accordance with the following relationship:

$K_o = 1-\sin\Phi$

Where Φ =soil friction angle

For XW basalt and fault zone material, the friction angle is assumed to be 24 degrees; thus K_a is taken to equal 0.410 and K_o is taken to equal 0.593.

5.5.2 Design Loads

The following loads are considered in establishing the feasibility of the project elements. Loads specific to a particular element are provided within their respective chapter.

- **Dead Loads**

Dead loads consist of the weight of all materials of construction incorporated into the structure, including but not limited to walls, floors, roofs, stairways, and fixed service equipment such as the weight of cranes. Assumed densities of materials used in the preliminary design are shown in Table 5-1.

Table 5-1 Material densities

Description	Unit weight (kN/m^3)
Rock	26
Fill / weak rock	26
Reinforced and unreinforced concrete and shotcrete	24
Steel	78.5
Water	9.81

- **Static Soil Loads**

As described in the previous section.

- **Hydrostatic Loads**

The four elements of the tunnel system are generally filled with water as a condition of operation. Thus, account must be taken of both hydrostatic and hydrodynamic loads imparted on the structure walls. Hydrodynamic loads are discussed in conjunction with seismic loads; hydrostatic loads are merely the triangular shaped load, maximum at the bottom, determined by multiplying the water depth by its density.

- **Live Loads**

A "Live Load" is defined as a load produced by the use and occupancy of the structure that does not include construction or environmental loads such as wind, snow, rain, earthquake, flood, or dead load.

- **Seismic Loads**

Seismic loads are determined based on appropriate consideration of proximity to fault(s), estimation of fault capacity, attenuation of seismic ground motions through the soil between the epicentre and the structure, and the structure's foundation. For design of permanent structures within this preliminary design, the following baseline values are used for the assessment of earthquake loads:

Moment Magnitude (M_w) = 7.4

Distance to the causative fault = 10km to 20km

Peak ground velocity (MCE) = 0.45g

5.5.3 Material Properties

The following material properties are used in the illustrative design.

- **Concrete**

Permanent Tunnel Lining: Compressive strength f'c = 40MPa at 28 days, maximum aggregate size 20mm.

All other structures: Compressive strength f'c = 24.0MPa at 28 days

- **Reinforcing Steel**

Concrete reinforcement used in the design and construction of Tunnel 4 shall be deformed bars conforming to the requirements of ASTM A706 Grade 460.

All other concrete reinforcements shall be deformed bars conforming to the requirements of ASTM A615 with the following grade designations:

fy = 414 MPa for 16mm Ø and larger deformed bars

fy= 275 MPa for 10mm and 12mm Ø deformed bars

- **Shotcrete**

Cube Strength: 12 MPa at 12 hours and 30 MPa at 30 days

- **Rock Dowels**

Rock Dowels shall conform to the requirements of ASTM 706 Grade 460

- **Structural Steel**

All structural steel shall conform to the requirements of ASTM A36 Structural Steel

5.5.4 Design for Durability

The durability of a component or structure may be defined as its capability to maintain serviceability over a specified time in a specified environment. The functional long-term performance of a structure (its design working life) is the assumed period for which a structure will be used for its intended purpose with anticipated maintenance but without major repair being necessary. Current design codes used in the Philippines do not specifically address "design working life"; however, EN 1900 *Basis of Structural Design* provides guidance in this regard (Table 5-2).

Table 5-2 Design working life

Design working life category	Indicative working life (years)	Examples
1	10	Temporary structures
2	10 to 25	Replaceable structural parts; e.g. gantry girders, bearings
3	15 to 30	Agricultural and similar structures
4	50	Building structures and other common structures
5	100	Monumental building structures, bridges, and other civil engineering structures

The structures associated with the proposed Ipo-Bigte Tunnel 4 project do not specifically fall into any of the Eurocode Design Working Life categories list above. In the case of the tunnel lining design, the difficulty of performing major remedial works without disruptions to the water supply is acknowledged and a 100-year design life has been specified accordingly. The remaining structures, i.e. inlet structure, outlet structure and open channel, are categorised between Categories 4 and 5 above and thus are assigned an indicative working life of approximately 75 years. To achieve the desired

design lives, as well as to provide adequately durable structures, the design takes account of the following:

- Intended or foreseeable use of the structure
- Required design criteria
- Expected environmental conditions including the micro-environments to which each material is exposed.
- Composition, properties and performance of the materials and products taking into consideration potential deterioration mechanisms within the different microclimates for the proposed materials and the potential deterioration mechanisms that may arise as a consequence of the actual materials employed and the methods of construction used in the project.
- Soil and ground water properties including testing both soil and ground water for chloride content, sulphate content, pH, and resistivity.
- Choice of structural system
- Shape of members and the structural detailing
- Quality of workmanship, and the control level
- Particular protective measures
- Intended maintenance during the design working life

Where structural or non-structural elements cannot be practically accessed for maintenance or repair during the life of the structure, e.g. critical elements, their design must ensure that all of their components remain durable throughout the service life of the structure. The performance criteria and protective measures for all structural and non-structural elements are determined based on an assessment of their risk of deterioration, the cost of preventative measures, and the cost of remedial works and on-going preventative maintenance.

6 Tunnel Design

6.1 Introduction

The tunnel is in rock, likely to be drill and blast, with a size of 4m clear internal diameter. The tunnel will be located between approximately 50 m and 200m below the surface.

6.2 References

The following codes, standards and references form the basis of design of Tunnel 4:

BS 8110 – 1997: Structural use of concrete. Code and practice for design and construction

BS EN 10080 – 2006: Steel for the reinforcement of concrete

BS 5950 – 1990: Structural use of steelwork in building

BS EN 10025-6 – 2004: Hot rolled products of structural steels

BS 6164 – 2011: Code of practice for safety in tunnelling in the Construction Industry

BS 8081 – 1989: Code of Practice for Ground Anchorages

US Department of Transportation – 1983: Design Recommendations for Concrete Linings (for non-linear material)

Hashash Y.M.A., Hook J.J., Schmidt B., Yao J. J-C. (2001) "Seismic Design and Analysis of Underground Structures," Tunnelling and Underground Space technology, vol. 16, pp. 247-293.

The permanent lining design is developed to the best international practices with regard to aspects not specifically covered by the standards listed above.

6.3 Site Description

The project lies outside Manila in the Eastern Cordillera. The tunnel passes through the Bayabas and Madlum formations which both contain basalt members as well as a variety of other rock types. The identified rock throughout the existing length of tunnel is basalt, described as a faulted section of basalt with slight displacement filled with quartz veinlet, slightly gougy and brecciated along the fault zone. The length of these zones is not clearly stated as the descriptions may be related to spot exposures. Many of the faults are described as quartz-filled.

The region lies in the tectonically active zone between the Philippine and the Eurasian Plate. The tunnel lies approximately 5km to 10km from the identified main fault trace zone for the West Valley fault.

The ground level rises rapidly from Ipo dam portal and up to RL+290mPD at the highest point. The region above the tunnel route is rural, with no significant urban development. An aerial photograph does show some vegetation clearance. However, the depth of the tunnel away from the portal areas will mean that there will be no physical effects (such as ground movements) experienced on the ground surface, or on any existing development in the right of way during the construction or operation of the new tunnel. It is also extremely unlikely that any future development on the surface will affect the tunnel. However, it would be consistent with normal practice for any significant new infrastructure or development (including excavations for quarries or mines) to be assessed for any influence they may have on the integrity of the tunnel, prior to construction permission being granted. The new tunnel is to augment three existing, parallel, drill and blast, partially lined, tunnels, constructed in the 1930s, 1970s and 1990s. It will run parallel to the existing tunnels, with the potential to cross above the abandoned section of Tunnel 1 near the Ipo dam.

The intake structure is placed between the new and old Ipo dams. A temporary structure shall be constructed to provide dry and stable excavation conditions at the intake and portal. The outlet portal is located adjacent to a new transition basin to be constructed at Bigte.

6.4 Proposed Tunnel

The proposed tunnel is designed to provide the minimum cross-sectional area required to transport the proposed water supply. The tunnel structure shall be of robust and durable design with a degree of structural safety and integrity consistent with international practice for water tunnels.

The design of the tunnel structure is to be cost-effective, not only in terms of capital costs, but also in terms of operation and maintenance.

Potential tunnel construction methods have been assessed in Table 6-1.

Table 6-1 Assessment of tunnel construction methods

	Method	Advantages	Disadvantages
1	Drill and Blast (D&B)	Low capital cost of equipment is likely to make it most cost effective Shorter mobilization than tunnel boring machine (TBM) Known technology Could work from both faces, giving flexibility and better programme certainty	
1.1	D&B one pass (i.e. no secondary lining)	Shorter construction programme than 1.2	Durability of rock bolts will be a problem, hence long-term reliability. Note that double corrosion protection (DCP) rock bolts could be used, but handling is an issue during the excavation support phase. High hydraulic roughness
1.2	D&B two pass with cast in-situ concrete lining	Better durability than 1.1 or 1.3 Low hydraulic roughness	Longer construction programme than 1.1 or 1.3 Higher capital cost than 1.1 or 1.3.
1.3	D&B two pass, with DCP rock bolts	Better construction programme than 1.2 Better reliability of durability than 1.1	High hydraulic roughness Poorer durability than 1.2
2	Tunnel boring machine (TBM)		High capital cost for machinery Long mobilization (potentially will need to build a new one, or refurbish and existing machine) High power requirements (potentially MWs) If TBM stops, all advance stops Note: that a Contractor might have appropriate TBM available, in which case programme and cost disadvantages could be negated.
2.1	TBM one pass with full segment ring	Low hydraulic roughness	Will require segment casting yard – increasing land take and capital cost
2.2	TBM one pass, with bolts and sprayed concrete	No segment casting yard required	Weak ground requiring ribs will reduce tunnel diameter, and rock bolt heads will be exposed, resulting in reduced hydraulic efficiency Durability of rock bolts will be a problem, hence long-term reliability
2.3	TBM two pass, with full segment lining followed by cast in-situ concrete lining		Not worth the increased time and cost to be viable – the segmental lining is likely to have a much better flow performance (even with the bolt pockets) than sprayed concrete anyway

	Method	Advantages	Disadvantages
2.4	TBM two pass, with bolts and sprayed concrete followed by cast in-situ concrete lining	Overcomes problem of varying diameter with ground conditions Overcomes need for segment casting yard	Extends construction programme
2.5	TBM two pass, with bolts and sprayed concrete temporary support, followed by DCP permanent bolts	As for 2.2, except durability issue addressed	Slightly longer construction programme
3	Roadheader construction	Advantages as for 1	Rock too hard to be viable

It is considered that the option 1.2 D&B two pass with cast in situ concrete lining offers the best value solution.

The tunnel is approximately 6300m long between a portal breakout at the Ipo dam reservoir and a portal breakout at the Bigte water retaining basic. The tunnel depth is generally between 100m and 150m, with a maximum of approximately 200m. The depth at the inlet and outlet is approximately 10m and 8m, respectively. The tunnel finished internal span is approximately 4m. The permanent lining for the tunnel consists of a cast in situ formed plain concrete lining and steel reinforced concrete lining. The design concept and construction sequence for the un-drained tunnel is summarized as follows:

Probing ahead will be undertaken from the tunnel face. The purpose of the probing will be to investigate the ground conditions ahead of the tunnel face, as the majority of fault zone and portal tunnel sections will be excavated in low quality ground.

Grouting of the ground in advance of excavation can be undertaken at the portal end to improve the ground conditions and control groundwater inflow.

Full face excavation of the tunnel heading will be undertaken using drill and blast (or mechanical depending on the Contractor's preference) methods. The length of each advance will be varied in accordance with the actual ground conditions. The excavation profile will be carefully controlled to minimise overbreak and damage to the surrounding rock mass.

Rock support will generally consist of steel sets and sprayed concrete in the poor ground conditions, with combinations of temporary rockbolts and steel fiber reinforced sprayed concrete if ground conditions are suitable.

The reinforced concrete invert is placed first. The edges of the invert arch pour are to form the footing for the tunnel arch formwork.

The concrete arch lining can be cast in situ in 10m to 12m long sections. Consideration of the effects of the tight radius bend at the Ipo end of the works will be needed, and the use of a shorter shutter length might be required.

Contact grouting will be carried out at the completion of concrete lining to fill any remaining void in the tunnel crown so that the concrete lining is in intimate contact with the rock around the tunnel. Contact grouting is carried out at low pressure between the excavated surface and the extrados of the concrete lining.

6.5 Design Criteria

This section sets out specific design criteria for the Tunnel 4 permanent lining; design criteria common to all structures are presented in Section 5.5 Common Design Parameters.

6.5.1 Loads

Rock and ground loads

Rock and ground loads for the tunnel between Ipo dam and Bigte basin vary along the alignment due to changes in the predicted rock level and increasing ground cover. For the design of the permanent lining, three rock load cases were developed. These rock load cases are considered to be representative of the worst case conditions in the tunnel section. These load cases, developed for submerged groundwater conditions, are as follows:

- Load Case 1: Where the tunnel is entirely within portal area with fill and extremely weathered basalt with the maximum ground cover expected for the undrained tunnel section, the ground load is determined in accordance with the Terzaghi rock load classification. As the tunnel is at a shallow depth, squeezing conditions are not anticipated and the ground load is determined based upon Terzaghi rock condition 6. This gives a dry rock load of 263kN/m^2, which is applied to the tunnel lining. For this load case a ground cover of 11m is adopted for Class 5, Class 6 (or fault zone) and portal.
- Load Case 2: Where the tunnel is in a good condition of fresh rock, the ground load is determined based upon the wedge loads.
- Load Case 3: Where the tunnel is in a mixed face condition of moderately weathered basalt with high ground cover (cover more than twice of diameter), the ground load is determined based upon the full overburden pressure. For this load case, a ground cover of 4m is adopted. Vertical and lateral loads are calculated for wet conditions.

Loadings on underground rock structures have generally been developed in accordance an empirical rock mass classification system. As with the design of temporary support, the NGI tunnelling quality index otherwise known as the Q System (Barton et al 1974), has been used.

The rock pressures applied to the tunnel roof have been calculated as:

$P_{roof} = 2Jn^{0.5} Q^{-1/3} / 3J_r$ (kg/cm^2) (After Barton et al

where:

J_n = Joint set number

Q = Tunneling quality index

J_r = Joint roughness number

Rock pressures applied to the tunnel walls have been calculated as:

$P_{wall} = 2Jn^{0.5} Qwall^{-1/3}$ (kg/cm^2) (After Barton et al)

where:

Q_{wall} = 5Q for Q>10 (not used), 2.5Q for 0.1<Q<10, 1Q for Q<0.1

For the portal and fault zone area which are located in possible soft ground, the roof pressure P_{roof} and wall pressure P_{wall} were assessed using Terzaghi classification.

$P_{roof} = 1.1 * (b + m)$,

where:

b = width of the tunnel

m = height of the tunnel

$P_{wall} = K_o P_{roof}$

As the test date and geological data is limited, rock wedge is assumed as follows:

- A symmetric rock wedge load acting over a 90° arc centred above the crown.
- An asymmetric rock wedge load acting over a 30° and 60° arc from the centreline of the tunnel towards the shoulder
- Rock wedge load is unit weight of rock multiplied by the length of the lining sector subtended by the angle (i.e. 30° / 360° x 2 π r).

Groundwater Pressure

Groundwater pressures acting on tunnel linings with low ground cover at the portal are designed to be at grade. For the high groundwater level load condition or other than portal section, a design groundwater pressure with nominal 0m, 10m and 30m are checked. A sensitivity check of 100m water head is checked and the result indicated such water pressure is beneficial to the lining section capacity. Therefore, low water pressure is critical to the design. It is likely that the tunnel will be designed to allow leakage in, although fully drained criteria may be impractical. A fully drained tunnel would require drainage layers below the invert and on the arch extrados, which would require extra construction processes.

Earthquake Loads

For the tunnel lining, the earthquake load is derived in accordance with the design approach and design methods described the reference by Hashash et al. The methods outlined in this publication, which are endorsed by the International Tunnelling Association, represent the state-of-the-art for this type of design. Baseline parameters utilized in the assessment of earthquake loads are provided in the previous chapter.

6.5.2 Load Combinations

Table 6-2 below summarizes the main load combinations for the ultimate limit state design. These load combinations are applied at a number of locations along the tunnel alignment. The load factors for each load combination are based upon the requirements of the design standards listed in Section 6.2 references. Load Combination 1 represents rock/soil pressure and water pressure. Load Combination 2 represents the dry (no groundwater pressure) condition. Load Combinations 3/4 represent rock/soil pressure and water pressure with or without surcharges.

Serviceability limit state load combinations are load combinations from table below with all factors reduced to 1.0

Table 6-2 Load combinations

Cases	LC1	LC2	LC3	LC4
Self Weight	1.4	1.4	1.4	1.4
Rock/soil Pressure	1.2	1.6	1.2	1.4
Water	1.2	0	1.2	0
Ground Surcharge (if any)	0	0	1.6	1.6

6.5.3 Materials

Material properties are provided in Section 5.5 Common Design Parameters.

6.6 Design Approach and Methodology

6.6.1 Temporary support

Design concept

The tunnel will be excavated by drill and blast methods. Temporary rock support will be installed throughout the tunnel, followed by a permanent concrete lining. The temporary support will take the

form of combinations of rock dowels and/or sprayed concrete in blocky rock, and steel sets, sprayed concrete and other special measures as necessary in mixed face ground conditions, faults, fracture zones, shear zones and portal.

For the purposes of design, the rock mass along the drill and blast section of the tunnel alignment has been divided into a range of rock support types (Support Class 1, Support Class 2, Support Class 3, Support Class 4, Support Class 5 and Support Class 6). For each rock support type a design value of the NGI Tunnelling Quality Index (Q) has been determined. The NGI Tunnelling Quality Index will be the rock mass classification system adopted during tunnel construction.

The inlet and outlet sections at each end of the tunnel are designated as portal for the purposes of design.

Preliminary design of rock temporary support may be based upon empirical methods using the Q rock mass classification system. Temporary support design may also be designed based on the predicted extent of the failure zone surrounding the excavation as determined from analytical methods. Where the stability of rock underground excavation is likely to be controlled by the geological structure in the rock mass discrete element methods of analysis shall be moved.

The tunnel rock support design at this stage is based upon two different design methods:

- empirical methods using the Q rock mass classification system
- analytical methods

The above methods are appropriate for the design of rock support in tunnels which are excavated in rock. For tunnels which are excavated in weak ground (e.g. fault zone) or portal conditions, a design method is adopted as follows:

- finite element analysis and beam-spring structural modelling.

This design approach is summarized in Table 6-3.

Table 6-3 Temporary support design approach

Support class	Limiting Q value	Construction method	Rock support design method
1	>10	D&B with 4m advance; supported by spot bolt	NGI Tunnelling Quality Index
2	10 ≥ Q > 4	D&B with 2.1m advance; supported by pattern bolt and shotcrete	NGI Tunnelling Quality Index
3	4 ≥ Q > 1	D&B with 2.1m advance; supported by pattern bolt and shotcrete	NGI Tunnelling Quality Index Analytical Methods: Bischoff and Barrett McCreath
4	1 ≥ Q >0.1	D&B with 1m advance; supported by pattern bolt and shotcrete	NGI Tunnelling Quality Index Analytical Methods: Bischoff and Barrett McCreath
5	0.1 ≥ Q >0.01	D&B with 1m advance; supported by pattern bolt and shotcrete	NGI Tunnelling Quality Index Analytical Methods: Bischoff and Barrett McCreath
6	0.01 ≥ Q	D&B with 1m advance; supported by pattern bolt, steel set, spilling bars and shotcrete	Finite element analysis and beam-spring structural modelling

Support class	Limiting Q value	Construction method	Rock support design method
Portal	-	Mechanical excavation with 1m advance; supported by canopy tubes, steel set and shotcrete	Finite element analysis and beam-spring structural modelling

NGI Tunnelling Quality Index (Q) Assessment

The purpose of the assessment of the NGI Tunnelling Quality Index is to:

- Determine the design Q values for each support class
- Determine the design rock load for each support class
- Provide a preliminary estimate of lateral rock dowel spacing and sprayed concrete thickness for each support class.

The design value of Q comprises six parameters – RQD, Jn, Jr, Ja, Jw and SRF.

For the temporary support design, the permanent rock load is taken as equivalent to the temporary rock load.

For portal and Support Class 6, the rock load is determined in accordance with Terzaghi (as modified by Rose (1982).

As the support is temporary until the permanent lining is constructed, the Q system allows the support requirements to be based on an excavation support ratio (ESR) of 1.0.

While the Q system provides a preliminary estimate of rock support required, the limitations of this design method are well known. In particular, tunnel rock support design using the Q system does not take into account the design capacity of the rock dowels, does not take into account the design strength of the sprayed concrete, and does not quantify the factor of safety of the rock support design. To address these issues, other rock support design methods need to be considered.

Analytical method - Barrett McCreath assessment

The Barrett McCreath method (1995) is an analytical method for determining the effectiveness of sprayed concrete for supporting defined blocks of loose material between the rock dowels. The method considers the failure mechanisms of sprayed concrete in adhesion, direct shear, flexure and punching shear. This design method has its limitations, and is not adopted in full for this support design. For the determination of the design strength of sprayed concrete under consideration for this design, only the shear failure mechanisms of the method are considered.

Methodology for Support Class 6 and portal

Support Class 6 and portal will be supported with conventional methods consisting of steel sets and sprayed concrete. This includes the temporary support of the sections of the tunnel which are to be excavated by drill and blast or mechanical methods. Finite element software is used for conventional beam spring modelling of the arch structure to account for structure-ground interaction. Each tunnel cross-section structural model is created with a series of short beam elements representing the support and radial spring elements attached at beam intersection points to simulate the ground stiffness. The radial springs are modelled as compression-only elements which are only active when the lining deforms outwards radially towards the ground. The ground loads adopted for the design have been determined by empirical methods.

6.6.2 Permanent Lining

Design concept

This section sets out the design approach and methodology adopted for the design of the main structural elements of the permanent lining.

The purpose of the structural analysis is to determine the concrete thickness and reinforcement required for the lining structures to resist the ground and groundwater pressures in the permanent condition.

Design methodology

All structural analyses and modelling of ground behavior are carried out to current industry practice, including empirical methods, closed form solutions, beam spring analyses and finite element analysis.

The following analysis methodology has been adopted for the design of the permanent lining.

Geological ground characteristics

The purpose of this stage is to determine the ground conditions intersected by the structure based upon the available sources of information such as feasibility studies report and site photos. This information shall be summarized and collated to achieve an understanding of the strata, the main geotechnical features that might affect the design, and the ground water regime. Where no information is available, the analyses have been carried out on the basis of conservative estimated ground parameters.

Records of installed support for the existing Tunnel 3 and rock mass description along Tunnel 1 have been used for estimating the extent of different classes of support required.

Derivation of ground loads

Rock and ground loads are derived as described in this report.

Permanent lining analysis

The permanent lining is designed as concrete arch structure. The good ground condition section of the tunnel will be an unreinforced concrete arch and designed as a plain concrete structure. In the poor ground section, reinforcement is included in the crown arch and invert arch and these structures are designed as reinforced concrete structures. Finite element software is used for conventional beam-spring modelling of the lining to account for structure-ground interaction. The tunnel cross-section structural model is created with a series of short beam elements representing the lining and radial spring elements attached at beam intersection points to simulate the ground stiffness. The radial springs are modelled as compression-only elements which are only active when the lining deforms outwards radially towards the ground. Conservatively, tangential springs are not considered.

All externally imposed loads are assumed to act on the lining elements directly ignoring any load-carrying or stiffness contribution from the temporary support. Model ground spring stiffness is dependent on the geometry of the lining and ground conditions. Spring stiffness calculations are based upon the methods described in element stiffness section of this report and spring stiffnesses are incorporated into the model using force-displacement tables.

The analysis performed uses a 'non-linear elastic' solver to account for the non-linear behaviour of the springs (i.e. compression only, no tension). Note that lining material behaviour is assumed to be elastic, i.e. non-linear material effects inherent in concrete are not included in the modelling. Non-linear material behaviour is checked using the analysis results, if appropriate.

Lining design is carried out by comparing the analysis outputs (axial forces and bending moments) with the appropriate structural section capacity envelope for beam-columns. If the analysis results points are within the capacity envelope limits, then the proposed section design is deemed to be acceptable. Further capacity checks are undertaken for limiting axial compressive forces and shear forces, and serviceability limit state criteria such as lining deformations and crack widths for reinforced lining zones are checked.

6.7 Analysis Results

6.7.1 Temporary Support

The temporary support results are summarized in Table 6-4.

Table 6-4 Temporary support results

Support class	Q value	Rock dowel spacing	Steel set size	Shotcrete thickness	Pre-support
1	10 > Q	Spot dowels	-	-	-
2	10 ≥ Q > 4	2.1m x 2.1m	-	-	-
3	4 ≥ Q > 1	1.7m x 2.1m	-	75mm	-
4	1 ≥ Q > 0.1	1.3m x 1.0m	-	120mm	-
5	0.1 ≥ Q > 0.01	1.0m x 1.0m	-	175mm	-
6	0.01 ≥ Q	-	Double 200UC59	400mm	piles
Portal	-	-	Double 200UC59	400mm	Canopy tubes

6.8 Tunnel Excavation Monitoring

Tunnel excavation monitoring has not been investigated as no sensitive structures or utilities are around the site have been identified. Therefore, no design or check has been carried out at this stage for excavation monitoring.

6.8.1 Permanent Lining

Permanent lining results are summarised in Table 6-5.

Table 6-5 Permanent lining results

Structural element	Tunnel lining
Support Class 1 and 2	250mm plain concrete lining
Support Class 3 and 4	250mm concrete lining with T10 at 125mm spacing at each face
Support Class 5, 6 and portal	250mm concrete lining with T32 at 150mm spacing at each face

6.9 Cofferdam

6.9.1 Design Concept

This section sets out the design approach and methodology adopted for the design of the main structural elements of the cofferdam.

The purpose of the structural analysis is to determine the tubular sheet pile requirement required for the cofferdam to resist the ground and water pressures during construction. Various cofferdam or construction options for tunnel portal have been reviewed (Table 6-6).

Table 6-6 Assessment of cofferdam options

Cofferdam type	Advantages	Disadvantages

Cofferdam type	Advantages	Disadvantages
Traditional sheet pile (Z type or U type sheet pile)	1. Simple in handling and sourcing 2. Low risk in installation 3. Relatively water tight structure	4. Lack of structural stability subject to earth pressure in cantilever section 5. Waling and strut may be required and the working space will be comprised 6. Won't take impact loads from waterborne craft – additional protection would be needed
Gabion wall	7. Utilises local material 8. Relatively cost-effective when compared to sheet pile in small scale of project	9. Stable foundation is required for cofferdam to provide overall stability 10. Significant dredging would be required prior to placing the wall, with resultant turbidity issues 11. Height and width of the Gabion wall in this case will be significantly cost ineffective 12. Water leakage could cause adverse effects
Tubular sheet pile	13. Simple in handling and sourcing 14. Low risk in installation 15. Can be installed in rock layer by coring method or pre-drill method 16. Relatively watertight structure 17. Good in structure capacity for earth pressure without waler or strut for cantilever section 18. Quiet installation if "press in" machines are used 19. Can take vertical load, and so could be used to support construction plant or a platform	20. The pile need to be sourced from overseas 21. Special machines are required for the coring or pre drill "press in" installation method 22. Relatively expensive when compared to traditional sheet pile or Gabion wall 23. Won't take impact loads from waterborne craft – additional protection would be needed.
Tunnel piercing	24. No cofferdam is required	25. The tunnel is under flood condition 26. Lack of space for intake structures

The proposed tubular sheet pile is to be installed by pre-drill press in method. This method is the most suitable method for intake structure and tunnel portal construction.

6.9.2 Design Methodology

The cofferdam structural analyses and modelling of ground behavior is carried out by using Wallap software. An assumed construction sequence is made to simulate the possible earth and water pressure acting to the cofferdam. The cofferdam is not designed for any impact load or accident loads. Cofferdam protection system shall be in place to avoid barge or any impact loads to the cofferdam.

6.9.3 Ground Profile

Where no test data is available, the analyses are carried out on the basis of conservative estimated ground parameters and stated in this report. The thickness of soft material layer (fill or silt sediment or XW basalt) is assumed to be 5m at the reservoir bed. Fresh basalt is assumed underneath the soft material layer.

6.9.4 Construction Sequence

Assumed construction sequence for the cofferdam is:

- Install tubular piles (under constant water head around the cofferdam area)
- Undertake wet excavation inside the cofferdam to remove soft material and expose rock

- Backfill the cofferdam (inside) to intake structure construction working level
- De-water inside the cofferdam to provide a dry working platform
- Prepare surface for construction activities

6.9.5 Tubular Sheet Pile Analysis

For the design of the cofferdam, a model was created to estimate the earth pressure acting to the cofferdam.

The walls are analyzed using the Wallap software, to establish the bending moments and shear forces induced in the tubular sheet piles, and the pile deformations/displacements for various construction stages.

The toe of the tubular sheet pile is assumed to be embedded in rock layer. A minimum 5m embedment length is assumed in the model. The embedment length is required to resist overturning and sliding forces.

7 Inlet-Outlet and Channel Design

7.1 Introduction

This section provides a summary of the preliminary design for structures associated with the proposed Ipo-Bigte Tunnel 4 of the Angat Water Transmission System. For purposes of this section, Ipo-Bigte Tunnel 4 is separated into parts as follows:

- Intake structure - located at the New Ipo dam reservoir
- Outlet structure - located at Bigte where the tunnel daylights
- Channel - connects Tunnel 4 outlet portal to existing Basin 3 and Aqueduct 5 (AQ5).

7.2 References

The following codes and standards form the basis of structural design of the intake and outlet structures:

NSCP 2010 Volumes 1 and 2 – National Structural Code of the Philippines

ACI 318– American Concrete Institute (as adapted in the NSCP 2010)

ACI 350.3 – American Concrete Institute: Seismic Design of Liquid Containing Structures

AISC – Manual of Steel Construction (as adapted in the NSCP 2010)

ASTM – American Society for Testing of Materials

AWS D1.1 – American Welding Society Structural Welding Code

PNS – Philippine National Standard

DPWH Standard Specifications Vol. II, 2004

DPWH Standard Typical Plan and Details

USACE - Engineering and Design Retaining and Floodwalls - EM 1110-2-2502

USACE – Stability Analysis of Concrete Structures – EM 1110-2-2100

USACE – Earthquake Design and Evaluation of Concrete Hydraulic Structures - EM 1110-2-6053

USACE – Structural Design and Evaluation of Outlet Works – EM-1110-2-2400

7.3 Site Description

The intake structure provides a conduit between the reservoir and the tunnel inlet portal, and is placed between the new and old Ipo dams. This location is chosen to minimize the potential for siltation. The intake structure is founded on fill and extremely weathered basalt layer, expected to be approximately 5m thick. The extremely weathered basalt could be blocky with clay infill. A temporary structure, described in Section 6 of this report, is to be constructed to provide dry and stable excavation conditions at the intake and portal. The outlet portal is located adjacent to a new transition basin to be constructed at Bigte. The new Basin is founded on Buenacop limestone which is very hard and massive to slightly weathered but may be locally broken. The connecting channel alignment follows the existing hillside requiring cuts to provide a level construction surface. It is anticipated that slope support will be required to provide a stable foundation and hill above the structures; however, a more detailed geological-geotechnical mapping is required during the detailed design phase.

7.4 Design Criteria

The section sets out specific design criteria for the inlet, outlet, and channel structures; design criteria common to all structures are presented in Section 5.5 Common Design Parameters.

7.4.1 Loads

Wind loads

Wind pressure and pressure coefficients shall be in accordance with NSCP 2010. The following data will serve as a guide in calculating the wind force on a closed structure.

Seismic soil loads

The effect of earthquake on backfill behind structures is considered by adding a dynamic increment to the static backfill pressure on the structure using the Mononobe- Okabe methodology.

Hydrodynamic loads

Seismic loads, associated with liquid containing structures, consist of several components as follows:

- Lateral inertia force of the accelerating wall
- Hydrodynamic impulsive force: impulsive component of the stored liquid
- Hydrodynamic convective force: convective component of the stored liquid
- Vertical accelerations: effective fluid pressure will be increased or decreased due to the effects of vertical acceleration.

Within the seismic analysis of water holding structures, there are two types of walls, leading wall and trailing wall, each perpendicular to the direction of the ground motion being investigated.

Loads to leading wall:

- Wall's inertia force (P'w)
- One-half of the impulsive force (Pi)
- One-half the convective force (Pc)

Loads to trailing wall:

- Wall's inertia force (P'w)
- One-half of the impulsive force (Pi)
- One-half the convective force (Pc)
- Dynamic earth and groundwater pressure against the buried portion of the wall

Uplift pressure

Uplift pressure due to headwater exists along the structure-foundation interface, within the foundation below the base, and through every cross section within the structure. Uplift at the base is assumed to be 100% of the reservoir pressure over 100% of the base area. Uplift pressures are assumed to remain unchanged during an earthquake.

7.4.2 Stability

Where appropriate, the preliminary design investigates the stability of structures for resistance to overturning, sliding and floatation. The basic requirements for stability of gravity structures for all loading conditions are:

- That it will be safe against overturning about an axis in any plane within the structure or the base or in a plane below the base.
- That it will be safe against sliding on any plane within the structure or at the base or at a plane below the base.
- That it will be safe against floatation for normal operating condition as well as for the construction or maintenance condition.
- That allowable stresses in the concrete or in the foundation material shall not be exceeded.

The following loading will be considered to be unusual and extreme conditions for evaluation of stability and are not investigated at preliminary design.

- Unusual condition
- Construction or erection
- OBE (Operating basis earthquake)
- Wind
- Extreme condition
- MDE (Maximum Design Earthquake)
- MDF (Pool at Maximum Design Flood)
- Overturning stability

Resultant location: The overturning stability is calculated by applying all the vertical forces (ΣV) and lateral forces for each loading condition to the structure and then summing moments (ΣM) caused by the consequent forces about the downstream toe. When the resultant of all forces acting above any horizontal plane through a structure intersects that plane outside the middle third, a non-compression zone will result. For usual loading conditions, it is required that the resultant along the plane of study remains within the middle third to maintain compressive stresses in the concrete. For unusual loading conditions, the resultant must remain within the middle half of the base. For extreme loading conditions, the resultant must remain sufficiently within the middle half of the base to ensure that base pressures are within prescribed limits.

Sliding stability

The criterion for safety against sliding is that the ratio of shearing resistance to the sum of horizontal forces is investigated.

Floating stability

The criteria for safety against floating is that the factor of safety, defined as the ratio of the dead weight to the uplift force, is at least equal to or greater than values shown in the table in the next section.

Stability criteria

The stability criteria for each loading condition is as listed in Table 7-1.

Table 7-1 Stability criteria

Load condition	Resultant location at base	FS sliding	FS floatation	Foundation bearing pressure
Usual	Middle 1/3	2	1.3	≤ Allowable
Unusual	Middle 1/2	1.7	1.2	≤Allowable
Extreme	Within base	1.3	1.1	≤1.33XAllowable

7.4.3 Materials

Material properties are provided in Section 5.5 Common Design Parameters.

7.5 Design Approach and Methodology

7.5.1 Concrete

The design of structural concrete and members shall be proportioned for adequate strength in accordance with the provisions of NSCP 2010 using the load and strength reduction factors specified therein.

7.5.2 Steel

Designs shall be in accordance with the provisions of Allowable Strength Design (ASD) in accordance with the provisions of NSCP 2010.

7.5.3 Intake Structure

Design concept

The intake structure serves several different functions in the water transportation system. In addition to forming the entrance to Tunnel 4, the intake structure includes:

- Trash rack to control debris entering the tunnel
- Stoplogs for closure
- Control or sluice gates to regulate flow to the tunnel

Considerations in determining intake structure size and configuration include hydraulic configuration, space and clearance requirements for mechanical and electrical equipment, and range of reservoir levels. In addition, consideration is given to operation and maintenance when determining whether the structure will extend above the maximum reservoir water surface. Another consideration, although not a decision driver in this case, is access for both construction and operation.

Siting considerations

It is noted that the original intake structures for Tunnels 1 and 2 were closed as part of the construction of the new Ipo dam as they could not be operated once the new dam was completed. Thus, a new single intake serving both Tunnel 1 and 2 through connecting tunnels was located near the new dam crest. Tunnel 3 was able to utilize this intake structure when it was subsequently constructed.

A significant consideration in siting the new tunnel included the location of MWSS right of way (ROW). MWSS ROW is 60 meters wide and centred approximately on Tunnel 1; in addition, MWSS requires that the new tunnel be within this ROW. Furthermore, the optimum tunnel site must minimize disruption to operations. Finally, it is considered important to place the new tunnel intake in the same general area as the existing intakes. Taking all the constraints into account, as well as the technical challenges of maintaining construction within the ROW, the most favourable location for the Tunnel 4 intake is upstream of the existing intakes and in an area where reservoir silting is at a minimum.

Bathymetry studies indicate that upstream of the Old Ipo Dam silt levels are at elevation 91.0m and rising at a rate of 1.3m a year; downstream of the Old Ipo Dam, the level is around 83.0m and apparently regularly flushed during large storm flows. Combined with the location of the tunnel right of way, this logically places the intake downstream of the Old Ipo Dam and approximately midway between the original and now abandoned Tunnel 1 and Tunnel 2 intake structures.

Intake structure

Considerations for sizing the intake structure include flow, hydrology, topography, foundations, geology, and seismicity. The size and shape of the intake structure can take any number of shapes, the most common being rectangular, which is generally used for low head reservoirs, and circular, which is generally used for high head reservoirs. Additionally, rectangular shapes are more easily constructable and adaptable to varying site conditions.

For the purposes of this preliminary design, the Tunnel 4 intake structure is rectangular with nominal dimensions of 10m wide by 18m long. Similarly, the transition structure, which allows for transition from rectangular section at the intake structure to circular profile at the tunnel, is approximately 10 meters long and 4m wide.

The intake structure invert is set at relative elevation 95.7m, nearly five meters below the normal reservoir operating level. The top deck is set at relative elevation 103.5. It is envisioned that the platform will be used to provide hoist access for placement and removal of sluice gates and stop logs.

A trash rack fabricated of closely spaced bars is placed at the intake entrance. The purpose of the trash rack is to prevent clogging the water pathway and to prevent debris damage to the sluice gates. Once through the trash rack, the water is diverted through three channels, each equipped with a sluice/sliding gate that can be used to regulate flow. Stop log slots are located both upstream and downstream of each gate so they can be fully isolated for maintenance and repair. The gates and openings are sized for the design flow and regulate the flow through the tunnel to the downstream aqueducts. Design load cases for the inlet structure are as shown in Table 7-2.

Table 7-2 Intake structure loading condition classification

Load case	Loading description	Loading condition classification
U1	Normal Pool, All Gates Open	Usual
U2	Normal Pool, One Gate Closed	Usual
U3	Normal Pool, All Gates Closed	Usual
U4	Normal Pool with Silt	Usual
U5	Minimum Pool	Usual
UN1	Infrequent Flood, All Gates Open	U/UN/E
UN2	Infrequent Flood, One Gate Closed	U/UN/E
UN3	Infrequent Flood, All Gates Closed	U/UN/E
UN4	Construction	Unusual
UN5	Diversion	Unusual
UN7	Maintenance Stop Logs in Place	Unusual
UN8	Operating Basis Earthquake	Unusual
E1	Maximum Design Earthquake	Extreme
E2	Maximum Design Flood	Extreme
U=Usual UN=Unusual E=Extreme		

Preliminary design takes account of load cases as much as necessary to size members and establishes a basic footprint.

Construction access

The reservoir working level is at relative elevation 100; the intake invert elevation is at relative elevation 95.7; thus, it is clear that some sort of dewatering scheme will be needed to afford access for construction of both the tunnel and the intake structure. In order to have a dry construction area a cofferdam is required around the intake site which can be dewatered to provide a construction platform.

The photograph below shows the area where the intake is to be sited.

As can be seen, the reservoir bank is quite steep and is covered with shotcrete indicating the slope is likely quite unstable. Access can be gained to the top of the ridge via an existing dirt road as seen in the figure below.

To gain access to the construction site from the landside, a road will need to be constructed from the existing dirt road, down the hill and finally to the intake. The access road needs to be founded on competent soils which necessitates the use of a pile supported concrete road on the final section to the intake. This road would form the permanent access to allow operation and maintenance of the intake. Additionally, the site can be accessed via the waterside by utilizing a barge to transport workers and materials. Furthermore, consideration could be given to utilizing a rail and cart system to extract spoils from the tunnel excavation directly up the hillside to the existing dirt road. It is likely that a combination of all three access methods will be utilized to construct the intake and tunnel structures.

7.5.4 Outlet Structure

Design concept

The outlet structure is located at the Bigte end of Tunnel 4 and provides a transition between the tunnel cross section and the channel that carries water to Basin 3. In addition to forming the outlet for Tunnel 4, the outlet structure includes:

- Observation deck for maintenance and operations

Considerations in determining the outlet structure size and configuration include hydraulic configuration and access for both construction and operation.

Siting considerations

The outlet structure invert elevation is controlled by the Tunnel 4 invert elevation as it daylights at the Bigte basin site. The Tunnel invert elevation at daylight is approximately 92.3. This places the outlet structure on the lower part of the slope from the Ipo road. A bench will be formed to create a platform for construction. The outlet structure is envisioned to be founded on the bench; foundation backfill is envisioned to create a suitable foundation base.

Outlet structure

Considerations for sizing the outlet structure include flow, hydrology, topography, foundations, geology, and seismicity. The outlet structure is considered to be an open structure with a rectangular shape. The structure dimensions as shown in this preliminary design are 4 meters wide and approximately 7 meters long. The top of the perimeter walls are set at elevation 97.30; providing approximately 1.0 meters freeboard above the maximum flow level. The outlet structure is founded on a 50mm thick layer of lean concrete placed over approximately 100mm of well-compacted gravel fill. The structure is to be backfilled with well-compacted clean fill.

The outlet structure as shown in the preliminary design provides an observation platform for operations as well as provisions for installation of stop logs on the downstream wall. Load cases used for the preliminary design are similar to those used for the preliminary design of the intake structure with the exception of loads cases varying gate closures. Similarly, the calculations were carried out to obtain basic member sizes and to establish a footprint.

Construction access

Construction access to the outlet structure and tunnel will be from the contractor's work site. This is accessed from the road at the west end of the work site. The contractor will need to provide protection to aqueducts 1, 2, 3, 4, and 5 from construction traffic and loads.

7.5.5 Channel

Design concept

The channel structure connects Tunnel 4 outlet portal to Existing Basin 3 and Aqueduct 5. An open channel section has been developed which is capable of transporting the design flow to Basin 3 and ultimately to Aqueduct 5.

Siting considerations

The channel alignment generally follows the contour of the hill behind the existing Bigte basins. Siting considerations include minimizing excavation and curves. The channel must cross over existing Tunnel 1 and Tunnel 2, which necessitates construction of a support system to minimize loads imparted on these structures.

Channel

The water channel is sized to transport the design flow from Tunnel 4 to Bigti Basin 3. It is rectangular in section with dimensions of 4m by 4.5m deep. The normal water depth is 3.5 meters. An overflow is provided close to the creek to prevent uncontrolled spillage. When the overflow is in operation the freeboard in the channel is expected to be approximately 0.3m. The channel foundation will be on competent native limestone with 50mm of lean concrete placed on a 100mm layer of compacted gravel fill. The upslope side will be backfilled with compacted backfill, resulting in a 2.5 to 3.0m bench. The channel is restrained from lateral sliding through a combination of friction between the base and lean concrete fill and a shear key where necessary. The down-slope side may require construction of a small bench (2.00m in width) to allow for access to the entire channel length.

Construction access

No permanent access road to the channel is required as the existing access to Basin 1 will be sufficient. During construction the contractor will need to ensure the tunnels are not subjected to any construction loads.

8 Social Due Diligence

8.1 Resettlement and Indigenous Peoples

The Angat Water Transmission Improvement Project (AWTIP) intends to improve the reliability and security of the raw water transmission system through partial rehabilitation of the transmission system from Ipo to La Mesa as well as introduction of water safety, risk and asset management plans. It will develop Tunnel 4, a 6.5 km tunnel from Ipo dam to Bigte and associated intake and outlet works, as the priority scheme for the transmission system. Its completion will pave way for the rehabilitation of the other tunnels 1-3 and AQ -6 Phase II (aqueduct) and the whole transmission system.

8.1.1 Project Design and Minimization of Impacts

To minimize impact, the project design uses tunneling from Ipo Dam intake point to Bigte portal. Tunnel 4, which is within the 60 m ROW of MWSS is to be constructed at a depth of 50-200 m underground depending on area elevation. According to project engineers, tunnel construction will not cause any physical impact and neither will it pose threat and risks to structures and people living on the surface. MWSS will secure the ROW above tunnel 4 to protect both integrity of the project investment and to avoid any potential issues linked with surface land uses.

8.1.2 Project Impact on Land Acquisition and Resettlement

The project is not expected to cause any physical displacement and/or economic impacts such as to cause economic losses or limit access to resources, income sources, or loss to protected areas.

The project will not require any land acquisition as 6.5 km-tunnel 4 is within the MWSS 60 m ROW, which is titled and owned by MWSS, except in segment 3 where National Housing Authority (NHA) is claiming ownership. Tunnel 4 8m ROW is not expected to extend outside of the MWSS 60 m ROW. Other associated facility/construction activities, particularly, the spoil disposal area located downstream of Ipo Dam will not require land acquisition but will need lease or rental agreement with land owner which will be returned to its former form after construction. This area is a brush land and is not productive. It has previously been used by MWSS temporarily for its past project with permission from the owner. For this project, MWSS has confirmed to talk with the owner for its use for this project during project implementation.

On top of tunnel 4, there are 9 structures, 7 of which are occupied by families, and 22 unoccupied housing structures of NHA, particularly located in Segment 3. Tunnel construction will not affect the integrity of these structures. MWSS and NHA have already agreed on how to secure safety of the tunnel for the welfare of future residents in the NHA-AFP housing sites at segment 3. NHA will inform the future occupants of the existence of tunnel 4 below their units and that it will issue proper guidelines on proper use and limits of activities that can be undertaken on the surface area to ensure security of the tunnel.

At the intake area and outlet area, no land acquisition is needed as both are within the compound of MWSS. The intake area is part of the Ipo Watershed and near the Angat Watershed area that is also claimed by the Dumagats, an indigenous peoples (IP) group as part of their ancestral domain. The Ipo dam watershed is being managed by MWSS and the Department of Environment and Natural Resources (DENR). Temporary impact of diggings and inconvenience caused to IP communities leading to proposed transfer of passage way of students and residents at the CWA area to nearby alternate route and transfer of boat landing located at the opposite site of Ipo Dam to upstream site at the mouth of Sapang Munti river has been addressed in the draft Indigenous Peoples Plan (IPP).

Tunnel 4 is far from the road system where most of the structures and residential houses are built. However, it may cause inconvenience and time delays for residents, workers and housewives doing marketing and other social obligations caused by potential traffic jams and passage of construction vehicles going in and out of the construction area using the road system. This has been discussed during the meetings with barangay councils and mitigation measures have been identified including establishment of alternate road routes, installation of traffic signs, and public awareness of traffic safety and designation of traffic officers in potentially congested areas to facilitate traffic flow. These mitigation measures of these minimal and temporary impacts have been included in the Environmental Management Plan (EMP) and Project Design Measures in Social Development as well as identified in this document.

8.1.3 Impact Categorization

Based on the results of the Due Diligence and impact assessment, the ADB involuntary resettlement (IR) Safeguard policy is not trigged by the Project, except when significant changes in the technical design is shown to create IR issues. The project is considered Category C as no IR physical and economic impacts will be experienced by APs. No Resettlement Plan is required.

8.1.4 Future Activity

Further due diligence activities will be undertaken during the final design phase when technical design will be finalized to determine any adverse impacts that may then trigger the ADB social safeguards policy. Impact assessment will also be undertaken to update the final number of structures and families are living on top of tunnel 4.

Safeguards compliance monitoring will be undertaken to check for any unintended impacts the project may create during project implementation. In case such impacts are found, the borrower / executing agency (EA) will conduct a social impact assessment and formulate a Corrective Action Plan covering all applicable IR safeguards requirements specified in the ADB Safeguard Policy Statement (SPS 2009).

8.2 Project Description

8.2.1 Introduction

The Angat Water Transmission Improvement Project (AWTIP) goal is to improve the reliability and security of the raw water transmission system through partial rehabilitation of the transmission system from Ipo to La Mesa as well as introduction of water safety, risk and asset management plans. Originally, the project only included the system downstream of Bigte but it has been found necessary to include the tunnels between Ipo and Bigte in the assessment as they form an integral system with the aqueducts downstream of Bigte.

8.2.2 Subproject Description

The AWTIP will develop Tunnel 4, a 6.5 km tunnel from Ipo dam to Bigte and associated intake and outlet works, as the priority scheme for the transmission system. Once constructed, it will facilitate the subsequent rehabilitation of tunnels 1-3 and AQ-6 Phase II (aqueduct) and whole transmission system.

The proposed tunnel 4 will have the following components: (i) intake at Ipo dam (site), (ii) a contractors' work area (CWA) of one- hectare at an elevated portion which is part of the Ipo Watershed (protected area) and which is incidentally a part of the claimed ancestral domain area claimed by the Dumagat IP community (Said IP community has filed an application for Certificate of Ancestral Domain Title or CADT with the National Commission for Indigenous Peoples or NCIP); (iii) 2 spoils disposal area, one located at the downstream of Ipo dam area and the other, at Bigte area

within the MWSS property,(iv) 6.5 km tunnel (4m in diameter) with 8 m ROW traversing two barangays of Norzagaray Bulacan (San Mateo and Bigte) and (v) and outlet at the Bigte portal, located within the MWSS property.

8.3 Scope of Land Acquisition

8.3.1 Impact of Land Acquisition

The location of the proposed tunnel 4 stretching 6.5 km with 8m ROW is within the 60 m ROW of the Metropolitan Water Works and Sewerage System (MWSS), the executing agency. It is not expected that it will extend outside of the 60 M ROW. Hence, new land acquisition is not expected unless substantial changes in the ROW alignment is made during the detailed engineering and implementation phase.

Based on project design the project will not cause any physical impacts on the ground surface as the tunnel construction will be 50 -200 meters below the surface.. It will not pose a threat or any risk to structures and people living on the surface based on the assessment of technical engineers.

Other associated facility/construction activities will not require land acquisition but lease or rental agreement with land owner particularly, the spoil disposal area downstream of CWA in Ipo dam which is a brush land and unproductive. The other spoils disposal area is in Bigte currently owned by MWSS.

Based on impact assessment, from segment 1- 7 except Segment 3, there are 9 structures on ground surface along the 8m ROW of tunnel 4. These 9 structures are as follows: (i) 7 permanent residential structures with family occupant owners, (ii) 1 temporary residential structure occupied by owner/family; and (iii) 1 temporary shelter with no occupant except a security guard. These structures were built on land owned by MWSS and have encroached into the existing ROW.

In segment 3, there are 22 unoccupied permanent housing structures of the housing project of National Housing Authority (NHA) and Armed Forces of the Philippines (AFP). MWSS and NHA had met regarding the project, particularly, the existence of 22 housing units located on the surface of Tunnel 4 8m ROW. Both MWSS and NHA agreed on safety measures to ensure the security of the tunnel and future residents. The safety measures include informing the future residents of the existence of tunnel 4 below the ground and providing guidelines on the use and limited activities that can be undertaken on the ground surface to ensure the security of the tunnel.

8.3.2 Socioeconomic Characteristics of Affected Households

- **Socio-demographic Profile**

Six (6) households, comprising of one male household head, 3 female spouses and 2 children of legal age were interviewed out of the 8 households identified occupying structures located along the Tunnel 4 8m ROW in 6.5 km distance from Ipo to Bigte. All six household heads were born in Norzagaray, Bulacan and native in Bulacan. All of the household heads are males (6). All household heads belong to potential labor force (15-64 years old). Three household heads are in the age range 45-49 years, 1 is under the 30-34 years category and another one, a senior citizen who is 74 years old. All spouses are younger than their husband, with three within 30-39 years old; two, between 45-49 years of age; while one, is within the age bracket of 60-64 years. Educational attainment of household heads is low, with 5 household heads having completed elementary education and one household head, a high school graduate. The interviewed household heads have the following occupations: employed in1); engaged in farming (2); driving (1); labor/construction (1) and a kargador/ laborer (1). Their spouses are involved in: business (1); farming (1); house help (1); manicurist (1) and 2 others are not working. The two longest staying household heads in the area extends above 31 to 50 years and have

been there since birth Four (4) others have stayed in the area for up to 20 years. Although they have established residence in the area, the land they are occupying is MWSS property.

The average household size is 7; with the interviewed households having a total population of 42 members. There is almost an equal number of female (20) and male members (22). A total of 13 household members are engaged in some occupation or work.

- **Economic Profile**

As to land tenure status, 2 HHs claimed they are residential land owners in another place while another 1 is a rent free occupant/ caretaker. Three (3) others expressed they hold a tax declaration document but have stopped paying taxes since 5 years ago after finding out that MWSS owned the property they are occupying and declared they have no rights to it. All of the households own their residential structures where they are currently residing in. Four (4) houses are made of concrete/permanent housing materials while one is semi-concrete. One residential structure is made of temporary and light materials.

8.3.2.1.1 Monthly Gross Household income from all Sources and Expenses / Net Savings

Two households have incomes below Php 8,000 a month, particularly Php 5,853 and Php 6,266,67, respectively. These two households are living below the poverty threshold, which is pegged at Php 8,295 per month for a household of 5 members in Bulacan province National Statistical Coordination Board (NSCB, 2012). Another 3 households belong to the bracket (Php 12,001- Php 19, 000) and one household income is Php 50,000 per month that has an overseas foreign worker (OFW) household member sending monthly remittances.

Average household expenses amount to Php 16,000 per month. Households spend most on food (Php 6,416) and education-food and allowance of children (Php 1,400), medical bills (Php 1,400) and cell phone load (Php 600.00). Average amount spent on water is Php 641.00 while electricity is Php 1,600. All of the households claimed they do not have savings.

- **Basic Household Facilities**

8.3.2.1.2 Toilet

Four households use sanitary toilet facilities with water sealed toilets connected to septic tank and another one, water sealed toilet connected to pit while another one shared toilet with its neighbor.

8.3.2.1.3 Source of water supply

Two households have piped connections, and another two have shallow/deep wells and 3 households buy from water vendors for bottled water and in container drums.

8.3.2.1.4 Electricity

Four households have electricity from a power company while 2 households are sub connected to a neighbor.

8.3.2.1.5 Cooking Facilities

Five households use wood/fuel for cooking. One household uses a combination of two fuel sources, LPG and charcoal.

- **Garbage Disposal and Management**

Five out of six households resort to burning their garbage. Three of these five households also practice composting. Only one household said its garbage is collected by the LGU but waste is not segregated.

- **Common Illness Affecting Household Members by Gender / Causes of Death in the Community**

Common illnesses afflicting household male and female members are flu, common fever, and colds / cough. One male household member is afflicted with skin allergy while a female member has heart disease. On the other hand, old age has been identified as common cause of death in the community (5), aside from rabies and malaria.

- **Access to Basic Social Services**

As to health facilities, the most accessible to households is the barangay health center which is usually used for medical consultations and pre-natal check-up for pregnant mothers. For more complicated cases, they are brought to the provincial hospital. As for access to educational facilities, both pre-school and elementary education facilities are located near the residences and a high school is located near some barangays.

- **Membership to Community Organization**

Three households confirmed membership in a community organization while the other 3 households expressed otherwise. Two households are members of the 4 Ps (Pantawid Pamilyang Pilipino Program) known as the Cash Transfer Program of the national government while another one, a member of Senior Citizens Association. The three (3) households said they are active in their organization. The active members said they attend meetings, vote in elections, consulted in decision-making and are involved in projects. Activities of their organization include livelihood and beautification/greening projects. Those who did not join the organizations noted they are not interested and do not have the time for it.

- **Credit Sources and Purpose of Credit**

Two households borrowed money from private money lenders while another one, from a cooperative and two others, from a store and from friends. Four (4) household respondents said they borrowed money for business capital while one household borrowed money for food.

- **Project Perception / Concerns**

When asked what were their concerns and issues on the project, four (4) household heads said they have no concerns because the tunnel to be constructed is deep below the ground and it would not have any effects on them. Two (2) households hope houses will not be affected if there will be ground shaking or affected once construction will start.

They expressed hope that the safety of households would be ensured during construction and that they would not be adversely affected by construction activities. The project team informed the households that there is no rick or threat to the structures above the surface as confirmed by engineers and MWSS and assured all possible measures will be designed to respond to all project related impacts.

8.4 Due Diligence

8.4.1 Coverage and Objectives

Due diligence was carried out to examine land acquisition and resettlement issues in more detail, particularly in consonance with ADB Safeguards policy, which requires that (i) impacts are identified and assessed early in the project cycle;(ii) plans to avoid, minimize, mitigate, or compensate for the potential adverse impacts are developed and implemented; and affected people are informed and consulted during project preparation and implementation.

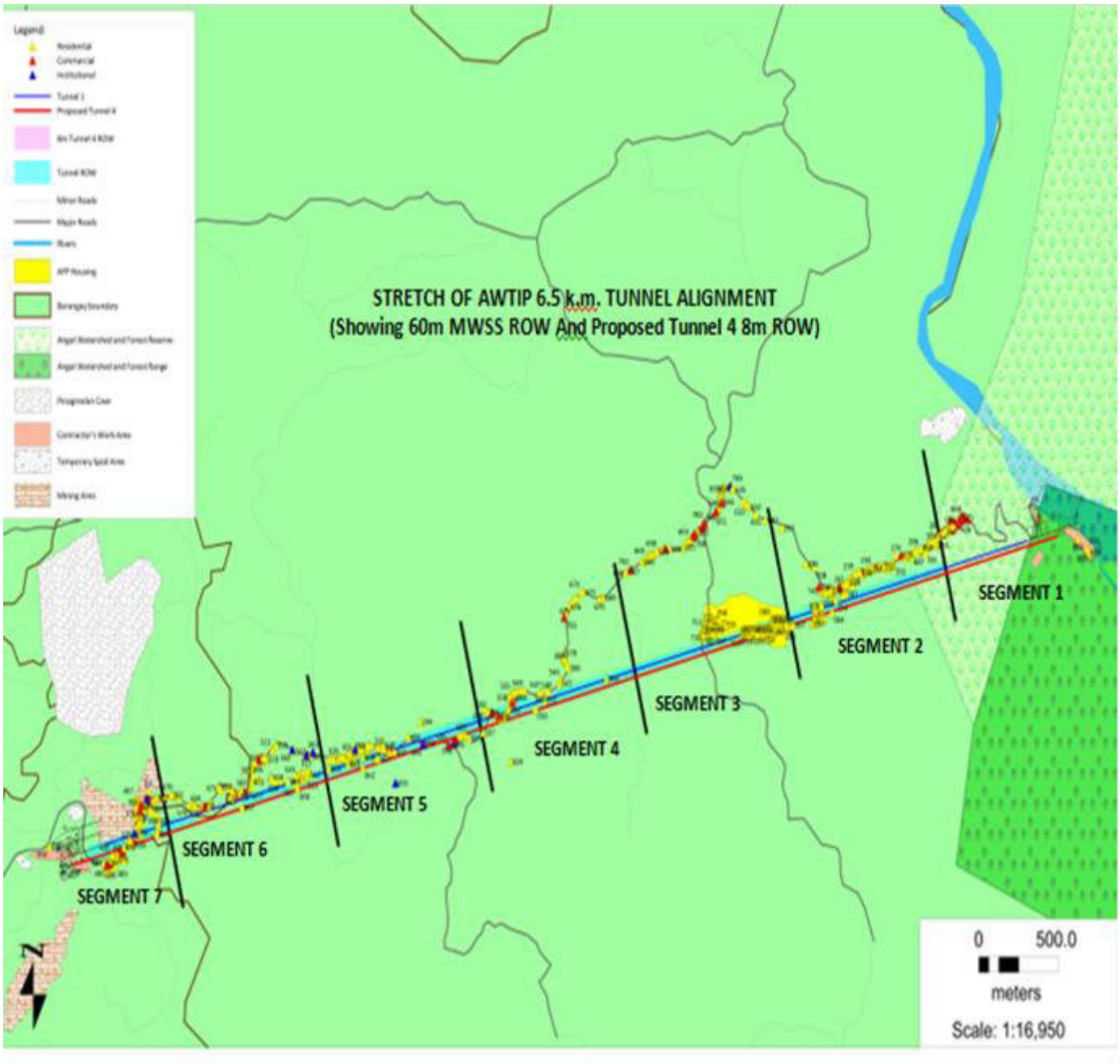
8.4.2 Background

The due diligence activity started with the appreciation of the technical design of the project, what activities are to be undertaken during design and construction activities, type of structure to be built and their location within the 60 m MWSS ROW (vis-à-vis the other three (3) existing tunnels which were constructed in the 1930's) and their potential impact on structures and other assets, people and their surroundings and immediate environment.

Following the preliminary appreciation was an ocular survey of the area driving through the national road from Bigte to the Ipo Dam reservoir. Type of structures, economic activities and the adjacent vicinity were also noted.

In order to determine geographical impact and more focused assessment, the 6.5 km alignment was divided into 7 segments at more or less one km distance per segment. Structure inventory using GPS was undertaken to indicate location of the structures identified within the 6.5 km and 8m ROW of the proposed tunnel 4. As part of understanding the socio-economic profile of the people occupying the surface of the tunnel, socio-economic survey was also conducted.

Figure 6 Segmented Map of Proposed Tunnel 4



8.4.3 Findings of Due Diligence

The table below shows the due diligence matrix including Infrastructure Activities and IR impacts on a per segment basis:

Table 8-1 Due Diligence Matrix – Infrastructure Activities and IR Impacts

Segment / Location	Infrastructure Activities		IR Impacts			Remarks
	Proposed Facility	Construction Activity	Existing Structure / Asset on Surface of 8M ROW	Impact on Structures and Others	Land Acquisition / Other Measures	
Contractors work area(CWA)	Contractors work area (1 hectare area)	Construction of contractor's work camp and facilities /diggings	3 Project Bunk Houses(MWSS)	None. Dust and noise	No land acquisition and resettlement expected	Proclaimed as a protected area / watershed now under the management of MWSS and DENR. Also claimed as part of the ancestral domain applied for by IPs. The area is one of the access route/passage of some school children in going to school within the MWSS compound, however, alternate route has been identified by IPs themselves. No habitation and productive assets in the area/ -nearest habitation (Sitio Ipo) is more or less half kilometre away.
Downstream of CWA /inlet area near Ipo dam	Spoils Disposal area(1)	Temporary storage facility for spoils from tunnel excavation.	No structure found on site.	None.	No land acquisition expected /but rental or lease agreement with land owner	The area is brush land, barren and not productive. It used to be a spoils disposal area of previous construction of MWSS. The current boat landing area is located at the other side of the Ipo dam and near the intake area which may be affected during construction due to installation of facilities and equipment at the intake area. Hence, an alternative boat landing area has been identified for use during construction.

Segment / Location	Infrastructure Activities		IR Impacts			Remarks
	Proposed Facility	Construction Activity	Existing Structure / Asset on Surface of 8M ROW	Impact on Structures and Others	Land Acquisition / Other Measures	
Segment 1	Tunnel	Underground tunnel construction at a depth of 50 -200 m	-No structure	No surface impact	No land acquisition expected	ROW owned by MWSS(with original title)
Segment 2	Tunnel	Underground tunnel construction at a depth of 50 -200 m	3 concrete and 1 temporary residential structures occupied by families on surface	None. No surface impact	No land acquisition expected /MWSS ROW	ROW owned by MWSS(with original title)
Segment 3	Tunnel	Underground tunnel construction at a depth of 50 -200 m	22 NHA-AFP housing structures with no occupants*	None. No surface impact	No land acquisition expected	MWSS and NHA have already discussed how to secure the tunnel. NHA claims it owns and has the title of the housing site while MWSS has been there since 1930's with the construction of old tunnels 1-3.MWSS has no certificate title in this segment.
Segment 4	Tunnel	Underground tunnel construction at a depth of 50 -200 m	No structure	No surface impact	No land acquisition expected /MWSS ROW	ROW owned by MWSS (with original title)
Segment 5	Tunnel	Underground tunnel construction at a depth 50 -200 m	3 residential structures (concrete materials)	None. No surface impact	No land acquisition expected /MWSS ROW	ROW owned by MWSS (with original title)
Segment 6	Tunnel	Underground tunnel construction at a depth 50 -200 m	No structure	No surface impact	No land acquisition expected /MWSS ROW	ROW owned by MWSS (with original title)
Segment 7	Tunnel	Underground tunnel construction, at a depth of 50 -200 m	1 concrete residential structure with no occupant ; 1 temporary structure	No surface impact	No land acquisition expected /MWSS ROW	ROW owned by MWSS (with original title)

Segment / Location	Infrastructure Activities		IR Impacts			Remarks
	Proposed Facility	Construction Activity	Existing Structure / Asset on Surface of 8M ROW	Impact on Structures and Others	Land Acquisition / Other Measures	
MWSS compound (Bigte Portal)	Outlet area	Diggings	1 temporary bunkhouse structure	Temporary diggings/ noise and pollution in short period during construction.	No land acquisition expected /MWSS ROW	ROW owned by MWSS (with original title) Mitigations measures are identified to respond to noise and pollution in EMP.
	Temporary Spoils Disposal Area	Diggings/minimal	No structures	None	No land acquisition expected	Land is within the compound of MWSS/ owned and titled to MWSS

8.4.4 Summary Findings and Conclusions

- **Land Acquisition**

The results of the due diligence study concludes that, there should be no issues of land acquisition and resettlement related to this project, if the project design does not change substantially.

8.4.4.1.1 Tunnel Construction

All tunnels will be constructed underground.

The proposed tunnel 4 location is not expected to extend outside of the boundaries of the 60 m ROW of the MWSS. Hence, no new land acquisition is required for the project. MWSS has original titles of the 6.5 km 60 m ROW, except in one segment (segment 3) within which NHA-AFP housing is located. Both MWSS and NHA have met and agreed to commit safety measures for the proposed tunnel once constructed. (See Annex-6 attached MWSS original land title certificates).

In view of the tunnel design, where no surface construction will be made, no involuntary resettlement, whether physical or economic, will be experienced by households living on the surface of tunnel 4, 8 m ROW along the 6.5 km alignment. There has been an earlier plan between MWSS and the two concessionaires to secure or fence the 60 m ROW, where tunnel 4 is located. Both agreed to inform the future occupants about tunnel below including the guidelines on protecting and securing the tunnel.

8.4.4.1.2 Construction of Temporary Spoils Disposal Area

No land acquisition is also required for the two (2) temporary spoil disposal area, where waste materials from tunnel excavations will be temporarily stored. Particularly, one area which is privately owned is located downstream of the inlet area at the Ipo dam which is about 1.2 hectares.

The land is used as temporary spoil disposal area during the construction of some MWSS structures in Ipo dam, now currently unproductive, idle and brush land. No habitation is found within the area.

Temporary lease or rental for the area to be used during construction period will be arranged with the land owner to be used during construction period. Land area will be returned to its original state by the contractor as it was in before rented out by the owner.

The second temporary spoil disposal area is within the MWSS-Bigte compound covering less than a hectare. There is no need to rent or lease as the area is owned by MWSS.

There will be temporary use of the areas earmarked for the spoil disposal, hence, there will be no permanent impact.

8.4.4.1.3 Construction of Intake and Outlet Points

Limited diggings will be undertaken at the intake point located at the Ipo dam site and outlet sections at the Bigte portal. For these activities, no land acquisition is expected as such sites are within the bounds of Ipo dam watershed currently managed by MWSS and DENR and the latter (outlet) is located within the MWSS ROW property at Bigte. No habitation or structures are found in the area.

- **Temporary Inconvenience / Disturbance**

No disruption of activities will be experienced by IPs living upstream of Ipo due to construction activities at the intake point as an alternative boat landing site has been identified in consultation with the IPs at the mouth of Sapang Munti river a half kilometer away from the intake point site. Preparation of the landing site will be undertaken before tunnel construction starts.

Most of the segments of the 60 m ROW are located away from the national road where almost all of residential houses are located. Although, there are no requirements for land acquisition from private

individuals some temporary disturbance will be experienced by the source communities where the proposed tunnel 4 will traverse, however, will be limited only during construction.

The residents to be affected will be those living along or near the highway due to passage of trucks carrying gravel and sand and other materials to and from project site during construction including transport of excavated materials from the construction site to designated spoils disposal area. One temporary impact would be the increase in noise or dust pollution which may trigger health problems including asthma attacks or dust allergies and potential safety risks and accidents potentially happening to residents and pedestrians.

During construction activities, the residents may also experience inconvenience due to potential traffic or congestion which would result to potential time delays of residents' social and economic activities such as going to work, children going to school, marketing and other social activities.

The following measures are foreseen to address and eliminate such temporary impacts and inconveniences:

- Informing all the residents and businesses/institutions about the nature and duration of work three months before actual construction so that they can make the necessary preparations.
- Limit dust by covering soil and other construction materials by canvass when carried on by trucks to ensure such materials will not spill or safely covered to avoid health risks to residents.
- Proper timing of delivery of construction materials to the construction site and transfer of spoils from construction site to the designated spoils area.
- Dust suppression by spraying water certain time of the day.
- Installing proper signage and safety measures/ speed limit and traffic re-routing to ease traffic flow and avoid accidents, prevent disruption of business and other social activities.
- Measures to ensure the physical safety of women and children will also be planned during final design and will be incorporated in the IEE document.

- **Impact Categorization**

ADB IR policy safeguards define scope and triggers for IR impacts as follows:

- Physical displacement (relocation, loss of residential land, or loss of shelter) and economic displacement (loss of land, assets, access to assets, income sources, or means of livelihoods) as a result of (i) involuntary acquisition of land, or (ii) involuntary restrictions on land use or on access to legally designated parks and protected areas. It covers them whether such losses and involuntary restrictions are full, or partial, permanent or temporary.
- Based on Due Diligence findings, the sub-project is unlikely to have any involuntary resettlement impacts and thus can be classified as Category C. ADB OM Section F1/OP issued 20 January 2010 states, "a proposed project is considered as Category C if it has no involuntary resettlement impacts." No further action is required.
- The ADB IR Safeguard policy is not triggered, unless significant changes in the project design are made during detailed engineering phase.
- As the final design is yet to be undertaken, an updated due diligence and inventory of structures and families is necessary during detailed design stage. Safeguard compliance monitoring will also be conducted during the project implementation and civil works activities to check for any unintended impacts during project implementation. In case such impacts are found, the borrower / executing agency (EA) will conduct a social impact assessment and formulate a Corrective Action Plan covering all applicable IR safeguard requirements specified in the ADB Safeguard Policy Statement (SPS 2009).

8.5 Information Disclosure, Participatory Consultation and Grievance Redress

8.5.1 Activities Accomplished

Six (6) consultation meetings were jointly undertaken with Project Preparatory Technical Assistance (PPTA) Environment Specialist with key officers with National agencies and LGUs' key officers and department heads; (two) 2 consultation meetings with Barangay Council of Bigte and San Mateo, and four (4) community consultation meetings at different stages during the project preparation activities:

- Consultation meetings were conducted on April 13, 2013 and April 15, 2013 with the MWSS – Asset Management Development Department (MWSS-AMDD) and the two concessionaires and Common Purpose Facility (CPF) and other units of MWSS to discuss the project and consultants' information needs for completing the study and to assess their capacity to implement relocation/resettlement activities. MWSS-AMDD is responsible for securing the ROW and other MWSS assets and the resettlement of the affected families in case of involuntary resettlement in MWSS projects in coordination with NHA, LGU and to other departments/government agencies such as Social Welfare, Health, Education, among others. On the other hand, the discussion with the two concessionaires and the Common Purpose Facility (CPF) focused on their tasks and on-going corporate social responsibility (CSR) for ensuring the access of low income households for water services and other social development activities including livelihood and health programs as well as partnership with IP communities in tree planting and maintenance of the Ipo watershed.
- A project information meeting was also conducted on March 21, 2013 with Bulacan Province particularly its Planning and Development Office and Provincial Environment and Natural Resources Office. Discussion focused on their concerns and issues about the project and on-going reforestation and social development activities at the municipal level.
- Consultation meetings were conducted on May 2, 2013 with the Norzagaray Municipality particularly, the Municipal Planning and Development Office (MPDC), the Municipal Environment and Natural Resources office (MENRO) and the Municipal Assessor's Office. Discussion focused on their concerns and issues about the project and as well as of their on-going programs with the residents for the two affected barangays.
- Consultation meetings with the Regional and Municipal Service Offices of the National Commission on Indigenous Peoples (NCIP) on April 25, 2013, and May 2, 2013, respectively. Specific concerns and issues about the project was also discussed including the Certificate of Ancestral Domain Title (CADT) application of the IP communities involving Cabayunan, municipality of Dona Remedios Trinidad, some portion of San Mateo and IP sitios and the Ipo watershed of covering an estimated 60,000 hectares.
- Consultation meetings were conducted on July 18, 2013 and July 19, 2013 with the Barangay Councils in Bigte and San Mateo, where the tunnel will directly traverse. Project concerns and issues during construction included safety and traffic, disturbance and noise/pollution including recommendations that local residents should be prioritized for labor work during construction and request for waste materials for filling-up poorly maintained barangay roads.
- Community consultation meetings on May 15, 2013 (San Mateo) and May 19, 2013 (Bigte) with the households and residents were also conducted before the mapping, SES/household survey and due diligence activities and final results were also presented on September 13, 2013 (San Mateo) and September 27,2013 (Bigte) after the SES/households surveyof the households living on the ground surface of the proposed tunnel 4 8m ROW along the 6.5 km alignment (See Appendixes 1-4 Minutes of Community Meetings).
  The output of the community consultations were peoples' concern that they will be relocated, the extent of the ROW, eligibility for priority local labour during construction, tunnel impact and safety, potential traffic during construction, potable water supply needs, among others.

On January 29, 2013, the results of the final inventory of the structures and assets and households living on top of tunnel 4 were also discussed individually with the APs in their homes before letting them sign the summary findings document which is presented as Annex 5 in this report.

- Consultation meetings with the IPs residing in barangay San Mateo were also undertaken last July 19, 2013 and September 13, 2013, to discuss their concerns and issues, their recommendations to such issues and discuss IP impact assessment findings and mitigation plan for identified impacts.

8.5.2 Future Activities

During final design and project implementation, the safeguard plans will be updated based on detailed engineering design and changes in scope, if any.

Future safeguard activities, including information disclosure and consultations, are as follows:

- Final community consultations with persons living on top of proposed tunnel 4 and communities living near the tunnel alignment based on detailed design. They will be updated on project implementation activities, schedules and proper safety and traffic measures installed including access to grievance redress mechanisms in case of complaints and issues.
- Updating of the IPP and final IR due diligence to ensure mitigation measures in case of changes in the final engineering design, or changes in scope.
- As result of the final engineering design, final inventory of the structures and households on the surface of 8m ROW of proposed tunnel 4 will be undertaken.
- Necessary safeguards monitoring will be undertaken by Social Safeguard (IR/IP) Officer with the technical support from the IR/IP Specialist in coordination with the Office of Special Projects (OSP-AWTIP) during implementation and construction.

8.5.3 Grievance Redress Mechanism

A Resettlement Plan is not required for this project, however, in anticipation of unintended impacts including possible issues and complaints that may arise during project implementation and in order to receive and facilitate resolution of identified AP issues and concerns with regards to project implementation and construction, the grievance redress mechanisms developed for Safeguards (IR/IP/Environment) and Social Development components will be used, in case it is found necessary for unintended IR Impacts.

In consonance to ADB safeguard policy, the GRM will include a proactive component whereby at the commencement of construction of the project ,prior to mobilization, community will be formally advised of project implementation details, so that all necessary project information is communicated effectively to the community and their immediate concerns can be addressed. This proactive approach will be pursued throughout the implementation of the project addressing complaints promptly, using an understandable and transparent process that is gender responsive, culturally appropriate, and readily accessible to all segments of the affected people at no costs. All costs involved in resolving complaints (meetings, consultations, communication and reporting/information dissemination) will be borne by the EA. The project's Grievance redress mechanism should not impede access to the country's jurisdiction and administrative remedies.

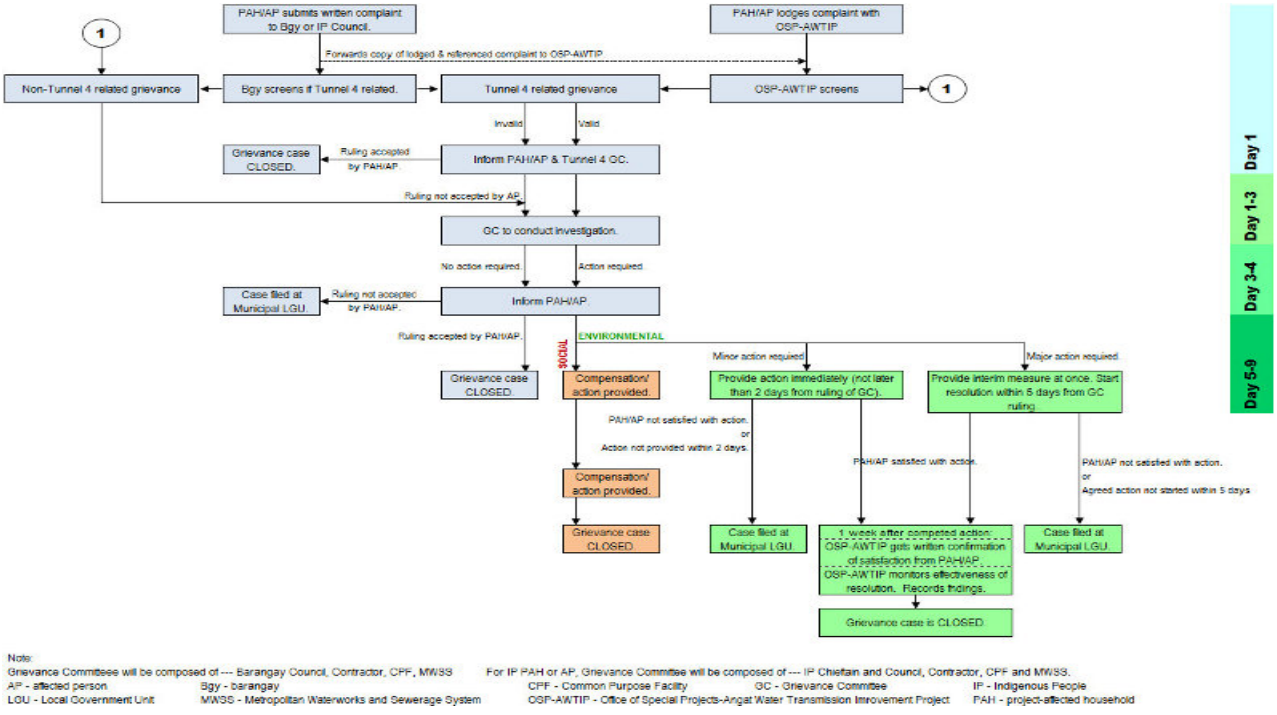
GRM for the Environmental, IR/IP safeguards and social development are integrated and aligned. Potential grievance to be raised on environmental and social impacts are critical to the health, wellness and safety of affected persons, hence proposed mechanism intends to respond to such environmental and social complaints. Under the integrated mechanism, two approaches will be used: namely, the informal and formal approach.

- **Informal Approach**

The informal approach is simpler and faster. Informally, the APs can lodge complaints directly to the D& B contractor during construction or CPF (Common Purpose Facility) during operations. The D& B contractor/CPF shall document and assess the complaint immediately. If assessment validates the complaint as within the scope of the GRM/ eligible, the D& B contractor/CPF shall act on the complaint within three (3) days from receipt of complaint. If assessment does not fall under the social and environmental performance, then the D&B contractor/CPF shall direct the AP to the Grievance Committee for confirmation, triggering the formal approach.

The Contractor/CPF shall report the following to the OSP-AWTIP within 2 days from receipt of complaint: (i) complaint received, eligible or ineligible, duly referenced; and (ii0 actions to be taken/taken including timeline. The OSP-AWITP shall obtain in a written confirmation of satisfaction from the AP, 7 days from completion of resolution by Contractor/CPF.

Figure 7 Grievance Redress Mechanism Flow



- **Formal Approach**

The formal approach will take necessary steps from lodging of the complaints up to the time the complaints are acted upon by the designated Project Grievance Committee.

If complaint lodged informally is eligible but is not acted on within three days from receipt of complaint, or if AP is not satisfied with the resolution undertaken by the Contractor/CPF, he or she can access the formal approach. A Project Grievance Committee (GC) will be set up to consist of the Barangay Council (or IP Chieftain and Council for IP complaints), contractor, CPF and MWSS as follows:

- Step 1: Lodging a Complaint (Day 1)
  - AP files complaint with the OSP-AWTIP or the barangay.
- Step 2: Documentation and Registration of Complaint
  - OSP-AWTIP or Barangay registers lodged complaint and makes sure these are duly referenced and provides AP with a copy of reference complaint.

  - The Barangay forwards a copy of the referenced complaint to the OSP-AWTIP.
- Step 3: Screening (Day 1)
  - OSP-AWTIP or barangay screens if complaints related to Tunnel 4.
  - AP is informed if the grievance relates or does not relate to Tunnel 4.
  - The Tunnel 4 Grievance Committee (GC) is also informed of the screening result.
  - If screening ruling is not acceptable to the AP, he / she may re-lodge his / her complaint with the Grievance Committee, which will properly document the complaint.
- Step 4 Complaint (Day 1 to Day 3)
  - The GC conducts investigation of the complaint to determine if actions are required or not.
  - The AP is informed of the findings / ruling.
  - If actions are required, AP is informed of the expected action timeliness as set out in the established mechanism. Agreement is properly documented and filed. OSP-AWTIP, Barangay Council (or IP Chieftain and Council), contractor / CPF and AP are furnished copies.
  - If actions are not required and GC ruling is not acceptable to the AP, AP may file the case with the Municipal Government Unit.
- Step 5 Implementing the Agreed Action
  - For minor action required (Day 4 – 5), the Contractor / CPF implements agreed on action within 2 days. If AP is not satisfied with the completed action or if action is not started within 2 days from GC ruling, AP may file a case with the Municipal LGU.
  - For major action required (Day 4/5—Day 8/9), the Contractor / CPF provided agreed interim measure and starts work on the final action within 5 days from GC ruling. If AP is not satisfied with the completed action or if clarification is not started within 5 days from GC ruling, AP may file case with the Municipal LGU.
- Step 6 Acceptance of Resolution (1 week after completion of action)
  - If, according to the AP, the impact has been resolved satisfactorily, OSP-AWTIP will obtain a written confirmation of satisfaction from the AP. This confirmation will signify closure of grievance and will form part of the grievance documentation. The GC, Barangay Council (or IP Chieftain and Council), Contractor / CPF and AP are furnished copies.
- Step 7 Monitoring and Evaluation (for 1 week after the completion of action)
  - The OSP-AWTIP shall monitor the effectiveness of the resolution for at least a week after completion of action.
  - Monitoring and evaluation shall be properly documented and included in the Environmental Monitoring Report / or in the IR/IP mid evaluation report prepared by MWSS, submitted to ADB.

The mechanism prescribes that the OSP-AWTIP shall inform the ADB of the complaints evaluated as major issues, and any appeal raised by dissatisfied AP.

The AP wishing to make claim must first make an appeal to his respective barangay or to the IP leaders for the case of the Dumagats. The claim must be made in writing and should include brief details including factual background; issues; and APs position on the issue/s raised. The barangay must review the case within the context of existing policy, regulations, procedures and valid entitlement of the AP as provided in relevant implementing plans. The barangay council should respond within five days of receipt of the complaint. Should the grievance case cannot be resolved, the AP can file complain to the municipal level.

8.6 Legal Framework, Compensation and Entitlement Policy

Results of the Due Diligence study reveal ADB IR safeguards policy is not triggered, hence no resettlement plan, will be prepared. Similarly, Philippine resettlement and land acquisition and compensation laws are not also triggered.

For reference, the following are Philippine laws on resettlement, land acquisition and compensation. These are likewise not triggered by the Project:

- Philippine Constitution 1987 –private property is the right for every Filipino citizen. No taking of property is allowed by law without just compensation. Requires "full disclosure by the State of all its transactions involving the public interest" and "citizens have the right of access to information on matters of public concern."
- RA 7160 (Local Government Code) Section 2 (c) and 27- provide prior consultation with affected communities on any project and require the approval of the concerned Sangguniang Panglunsod (Provincial Council) / Sangguniang Bayan (Municipal Council).
- RA 7279 (UDHA Law), Article I, Sec.2; Article VII, Sec. 28 (2) and IRR of UDHA, Sec.3 (e.1) – requires consultations with affected persons. The results of consultations will form part of the RP by the LGUs Sangguniang Panglunsod (SP); Sangguniang Bayan (SB) -Provision for the development, award and disposal of land under usufruct arrangement for socialized housing and urban services (Article V sections 21 and 22 implementing Rules and regulations of UDHA, Section 3, III (b.3.0) - for urban poor, provision of basic services and livelihood component under socialized housing and urban services. They are not to be evicted nor are their dwellings demolished except in accordance with the law in a just and humane manner (Constitution). Assistance is limited to payment at replacement cost for structures and improvements. Additional assistance may be provided on a case-by-case basis. Also requires that all households affected are informed of any proposed development plan.
- RA 8974, Sections 8,9,10 and 13. An act to facilitate the Acquisition of the ROW, site or location of National Government Infrastructure Projects. Provides for the compensation of affected properties based on prevailing market prices. The IRR stipulates that the implementing agency shall negotiate with the owner for the purchase of the property by offering first zonal value issued by the Bureau of Internal Revenue (BIR) for the area where the private property is located. Further, that valuation of improvements and /or structures on land to be acquired shall be based on the replacement cost, defined as the amount necessary to replace the structure or improvement based on the current process of materials equipment, labor contractor's profit and overhead, and all other attendant costs associated with the acquisition and installation in place of the affected improvements / installation.
- EO 1035 sec 17 and 18. Relocation / resettlements of tenants / occupants affected by Property / ROW Acquisitions. Financial assistance to be given to tenants / farmers equivalent to the value of the gross harvest for one year on the principal and secondary crops of the area acquired, based on the average annual gross harvest of the last three preceding crop years and in no case, financial assistance be less than Php 15,000 per hectare.
- RA 6389 –states "in the event of change in land use from agriculture to other uses, agricultural lessees are entitled to disturbance compensation equivalent to five times the average of the gross harvests on his landholding during the last five preceding calendar years".
- RA 6657 (Comprehensive Agrarian Reform Law) - section 28 states that the land owner shall retain his share of any standing crop in harvested at the time the DAR shall take possession of the land under section 16 of this Act and shall be given reasonable time to harvest.
- RA 7192 (Gender Equality and Women in Development) – promotes the integration of women as full and equal partners of men in development and nation building. All government departments. All government departments will ensure women benefit equally and participate directly in the development programs and projects specifically those funded under foreign

development assistance, to ensure their full participation and involvement in the development process; to provide income and employment opportunities to women and assess the extent to which such programs helped in enhancing their self-reliance. Women of legal age has the capacity to enter into contract; has the capacity to borrow and obtain loans and execute security and credit arrangements under the same conditions as men /act as incorporators and enter into insurance contracts and secure travel visas without the consent of their spouses, among others.

- Executive Order 152 (Series of 2002) – prescribes for the broad monitoring of all types of eviction and demolitions involving the underprivileged and homeless citizens by the Presidential Commission for the Urban Poor (PCUP) All the national government agencies and local government units (LGUs) should apply for a Certificate of Compliance prior to the implementation of eviction and demolition.

ADB SPS 2009 provides the social safeguard framework of involuntary resettlement.

The objectives of the SPS are to avoid involuntary resettlement whenever possible; to minimize involuntary resettlement by exploring project and design alternatives; to enhance or at least restore, the livelihoods of all displaced persons in real terms relative to pre-project levels; and to improve the standards of living of the displaced poor and other vulnerable groups.

8.6.1 Scope and Triggers

The involuntary resettlement safeguards covers physical displacement (relocation, loss of residential land, or loss of shelter) and economic displacement (loss of land, assets, access to assets, income sources, or means of livelihoods) as a result of (i) involuntary acquisition of land, or (ii) involuntary restrictions on land use or on access to legally designated parks and protected areas. It covers them whether such losses and involuntary restrictions are full, or partial, permanent or temporary.

8.6.2 Policy Principle

Screen the project early on to identify past, present, and future involuntary resettlement impacts and risks. Determine the scope of resettlement planning through a survey and /or census of displaced persons, including a gender analysis, specifically related to resettlement impacts and risks.

Carry out meaningful consultations with affected persons, host communities, and concerned non-government organizations. Inform all displaced persons of their entitlements and resettlement options. Ensure their participation in planning, implementation, and monitoring and evaluation of resettlement programs. Pay particular attention to the needs of vulnerable groups, especially those below the poverty line the landless, the elderly, women and children, and Indigenous peoples, and those without legal title to land, and ensure their participation in consultations. Establish a grievance mechanism to receive to receive and facilitate resolution of the affected persons concerns. Support the social and cultural institutions of displaced persons and their host population. Where involuntary resettlement impacts and risks are highly complex and sensitive, compensation and resettlement decisions should be preceded by a social preparation phase.

Improve or at least restore , the livelihoods of all displaced persons through (i) land-based resettlement strategies when affected livelihoods are land based, where possible, or cash compensation at replacement value for land when the loss of land does not undermine livelihoods, (ii) prompt replacement of assets with access to assets of equal or higher value, (iii) prompt compensation at full replacement cost for assets that cannot be restored, and (iv) additional revenues and services through benefit sharing schemes where possible.

Provide physically and economically displaced persons with needed assistance, including the following: (i) if there is relocation, secured tenure to relocation land, better housing at resettlement sites with comparable access to employment and production opportunities, integration of resettled

persons economically and socially into their host communities, and extension of project benefits to host communities; transitional support and development assistance, such as land development, credit facilities, training, or employment opportunities; and (iii) civic infrastructures and community services, as required.

Improve the standards of living of the displaced poor and other vulnerable groups, including women, to at least national minimum standards. In rural areas provide them with legal and affordable access to land and resources, and in urban areas provide them with appropriate income sources and legal and affordable access to adequate housing.

Develop procedures in a transparent, consistent, and equitable manner if the land acquisition is through negotiated settlement to ensure that those people who enter into negotiated settlements will maintain the same or better income and livelihood status.

Ensure that displaced persons without titles to land are eligible for resettlement assistance and compensation for loss of non-land assets.

Prepare a resettlement plan elaborating on displaced persons' entitlements, the income and livelihood restoration strategy, institutional arrangements, monitoring and reporting framework, budget, and time-bound implementation schedule.

Disclose a draft resettlement plan, including documentation of the consultation process in a timely manner, before project appraisal, in an accessible place and a form and language(s) understandable to affected persons and other stakeholders. Disclose the final resettlement plan and its updates to affected persons and other stakeholders.

Conceive and execute involuntary resettlement as part of a development project or program. Include the full costs of resettlement in the presentation of project's costs and benefits. For a project with significant involuntary resettlement impacts, consider implementing the involuntary resettlement component of the project.

Pay compensation and provide other resettlement entitlements before physical and or economic displacement. Implement the resettlement plan under close supervision throughout project implementation.

Monitor and assess resettlement outcomes, their impacts on the standard of living of displaced persons, and whether the objectives of the resettlement plan have been achieved by taking into account the baseline conditions and the results of resettlement monitoring.

In case of differences between local law and ADB policy, an effort shall be made to reconcile gaps in favour of the latter to the satisfaction of both the Government of the Philippines and ADB.

8.6.3 Project Policy Commitments

In case of unanticipated IR impacts are found during project implementation, the borrower / Executing Agency will conduct a social impact assessment and formulate a Corrective Action Plan covering all applicable requirements specified in the ADB SPS (2009).

8.7 Resettlement Budget

8.7.1 Budget Assumptions

Since a Resettlement Plan is not prepared, the budget for future IR activities including (i) due diligence validation and inventory update and (i) safeguard compliance monitoring during final design and construction will be integrated into survey costs and administrative costs of the project. Capacity building cost is integrated in the IP Plan. Only one person for Safeguard (IR/IP) and Social Development Officer will be designated from MWSS-Social Services Group/Resettlement to proposed

OSP-AWTIP. One (1) will be hired as Safeguard (IR/IP)/ Social Development Specialist to undertake the related tasks of IR/IP and Social development concerns for a period of 10 man months on an intermittent basis.

8.8 Institutional Arrangements

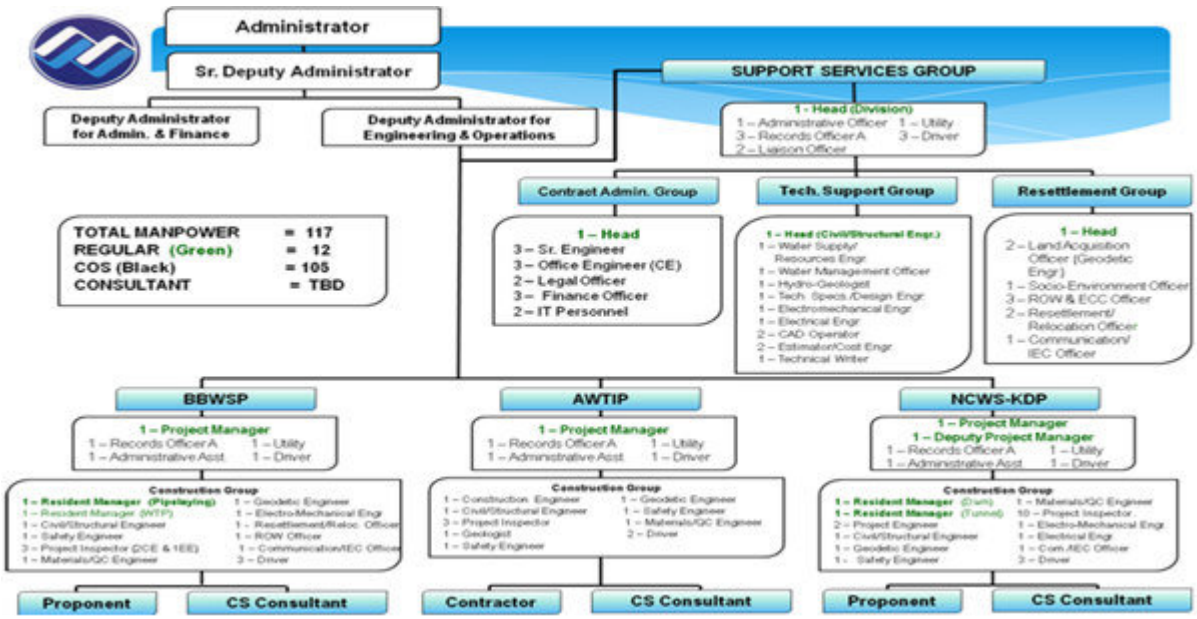
Although a Resettlement Plan is not prepared, some IR activities during final design such as updating of IR due diligence and impact inventory (based on final technical design) and safeguard compliance of monitoring are IR unintended impacts during planning design and construction are needed to be undertaken. As in the implementation arrangement of the IP plan, the tasks of undertaking related IR activities during final design phase is lodged in two persons, the Safeguard (IP/IR) Specialist and assisted by the designated IR/IP Officer from MWSS Resettlement group to OSP-AWTIP Group. The Terms of Reference (TOR) for both positions is included as Annex 7-8 of this report. Similarly, the proposed arrangement for the remaining IR tasks will follow similar structure proposed for IP Plan implementation.

8.8.1 MWSS Existing Structure

The existing MWSS organization includes an Office of Special Project (OSP) that looks after the implementation of its special projects. The OSP falls under the Office of the Deputy Administrator for Engineering and Operations. This project will be managed by the Office for Special Project - Angat Water Transmission Improvement Project – (OSP -AWTIP) (see Figure 25). The OSP-AWTIP includes the project manager and his administrative support staff, a construction group as technical staff, the contractor, and the construction supervision consultant.

A Resettlement Group within a Support Services Group under the Deputy Administrator for Engineering and Operations composed of Land Acquisition officer / Geodetic Engineer (2), Socio-Environment Officer (1), ROW& ECC Officer (3), Resettlement / Relocation Officer (2) and Communication / IEC Officer. This group is responsible for the projects that requires crucial component such as land acquisition and ROW and relocation/resettlement concerns.

Figure 8 Existing Structure of MWSS

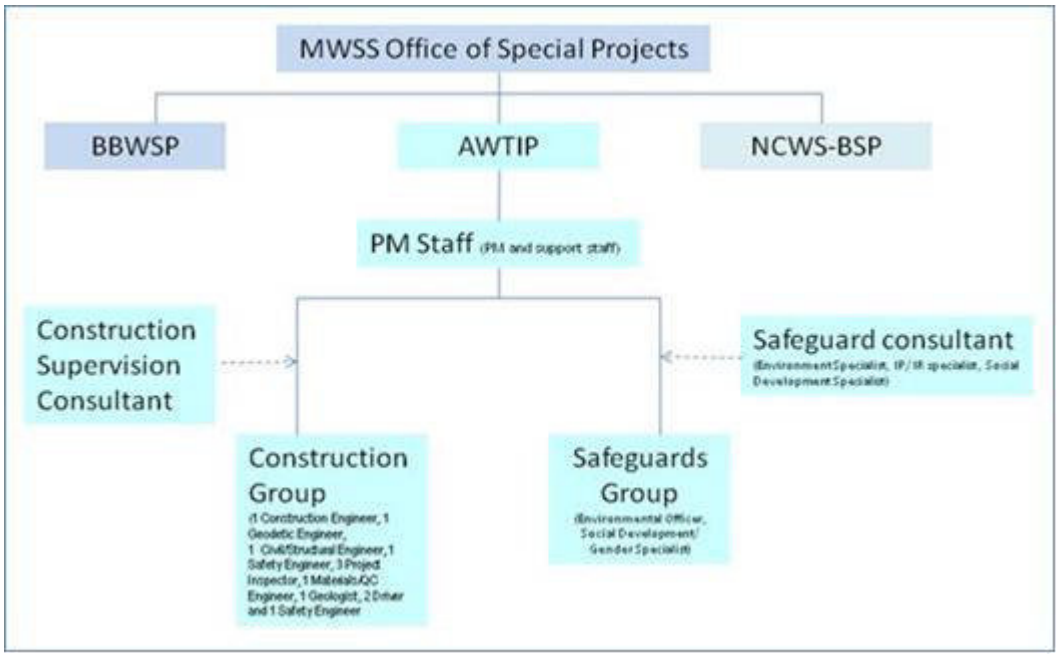


8.8.2 Proposed Arrangement for Future IR Tasks

Based on Due Diligence Assessment, there will be no IR policy that will be triggered, however, in anticipation of the any IR impacts due to design changes during project implementation, and for

purposes of compliance safeguard monitoring, it is proposed that a Safeguards Group (SG) be set up within the AWTIP- OSP. The SG will have its own Safeguard Officer (IR / IP) / Social Development Officer) and Environmental Officer (EO) which the MWSS envisioned to provide for this project. The IR / IP Safeguard Officer will handle IR / IP safeguard and social development concerns. The IR / IP Safeguard Officer will come from the Resettlement Group of current MWSS structure. Specific tasks of the IR / IP Safeguard Officer is described as Annex -8 (TOR of the IR / IP Safeguard Officer) He / she will be required to board at least 3 months prior to operation.

Figure 9 Proposed OSP – AWTIP Structure including Safeguards Group



8.8.3 Delineation of Responsibilities

In consonance with the set up proposed Safeguards Group, the following institutions will be involved in the implementation of IR/IP concerns:

- The, MWSS, as the Executing Agency (EA) and the Implementing Agency , for the project will be responsible for setting the PMO, engaging the IR / IP officer and ensuring defined tasks and responsibilities based on the requirements of the IR / IP component of the project.
- The Office of the Special project for AWTIP (OSP-AWTIP), as the project management office, specifically the IR / IP Safeguard Officer of its SG, will be responsible for overseeing the updated final design, and corresponding changes, if any, as well as the corresponding social impact assessment if required. It shall also prepare IR / IP reports.
- IR / IP Officer for project implementation will provide necessary inputs as to the requirements, updated social impact assessment during detailed engineering and in case of changes in the design, appropriate changes and design measures ,as appropriate, as well conduct safeguard monitoring of IR / IP impacts and prepare required monitoring reports for the EA and IA to be submitted to ADB
- IR / IP Specialist to be engaged as part of the project implementation support Consultants will provide technical assistance and guidance to the AWTIP-OSP, particularly its IR / IP Safeguard Officer in the final impact assessment and safeguard monitoring and capability building activities.
- ADB will approve any IR / IP social impact revisions and design measures, if any, and review safeguard monitoring reports and undertake missions to review the IR / IP performance of the project.

- NCIP will facilitate the conduct of FPIC activity, review and approve updated IPP and conducts monitoring visits for the implementation of the IPP and monitoring reports from AWTIP OSP.
- Local Government Units, namely, the Municipality of Norzagaray (through its Municipal Planning and Development Office and Barangays Bigte and San Mateo will provide representation for necessary support and facilitate the lodging and resolution of complaints of APs as part of the Grievance Committee.

The Institutional Responsibilities related to Social Safeguards are summarized in the Table below.

Table 8-2 Institutional Responsibilities

Responsible Institution/Individual	Prior to Construction	During Construction	During Operation
MWSS	Prepare integration of the SG to OSP-AWTIP as Project Management Staff	Decide on matters related to IR / IP safeguard requirements and other concerns, that may arise that need intervention	Decide on matters related to IR / IP safeguard requirements and other concerns, that may arise that need intervention
	Engage IR / IP Safeguard Officer for the OSP AWITP		
OSP-AWTIP	Update social impact assessment based on final engineering design, and make necessary changes and plan, if any.	Conduct inspections and spot checks to monitor the performance of the D&B contractor in implementing the Social safeguard requirements and implementation of IPP	Conduct inspections and spot checks to monitor the performance of the D&B contractor in implementing the Social safeguard requirements and implementation of IPP
	Coordinate with D& B contractor to ensure the incorporation of updated findings and mitigation, if any	Review monthly and semi-annual report of D&B contractor related to safeguards	Review monthly and semi-annual report of D&B contractor related to safeguards
	Conduct IEC, together with the Social Safeguard Officer (IP/IR) in the OSP-AWTIP, for social preparation.	Prepare the project's semi-Annual IR/IP reports for submission to ADB	Prepare the project's semi-Annual IR/IP reports for submission to ADB
IR/IP Specialist	Provide technical assistance, capacity building and guidance to OSP-AWTP in the: Validate / update of the IR / IP Due Diligence / Impact Assessment, as necessary	Provide technical advice / assistance e.g, preparation of semi-annual safeguard report for ADB / review quarterly monitoring reports Continue capacity strengthening for SG-Resettlement Group / IR / IP Safeguard Officer	
	Review bidding documents as necessary, to incorporate social		

Responsible Institution/Individual	Prior to Construction	During Construction	During Operation
	safeguards in the project		
ADB	Review and clear IR safeguards plan (in case corrective actions are needed)/updated IPP, as applicable	Review semi-Annual IR / IP report; carry out periodic review missions	Review Annual social safeguards / IP monitoring
Design and Build contractor (D& B contractor)	Incorporate mitigation measures in design and bidding documents	Implement mitigation measures as necessary Prepare monthly and semi Annual report	Implement mitigation measures/other activities Prepare monthly and semi Annual report
Municipality and Barangay	Facilitate social preparation	Participate in the monitoring of the performance operation in IPP implementation Facilitate (and participate in) public consultation/s and information disclosure Assist in ensuring the observance of the GRM.	Participate in monitoring of the performance operation in IPP implementation Facilitate (and participate in) public consultation/s and information disclosure Assist in ensuring the observance of the GRM

8.8.4 Subcomponent Capacity Building

To ensure effective project implementation and strengthen the capacity of the MWSS- Resettlement Group and designated IR / IP / Social Development Officer under the proposed OSP-AWTIP project structure, they will be capacitated to plan, implement and monitor project's resettlement and IP component.

Training focus of the IR / IP and Social development concerns are integrated into one training design with appropriate modules on IR, IP and Social Development.

Training needs assessment will be undertaken immediately, as soon as, IR / IP / Social Development Specialist is mobilized three (3) months before final design and construction. Based on the training needs assessment, a capacity building program will be developed and implemented. Aside from identified needs, the focus of the training will include Resettlement / IP planning, implementation and monitoring. It will also include an orientation on ADB related Social Safeguards Policy from the SPS (2009) and Social Policy Guidelines.

8.8.5 Implementation Schedule

Final due diligence and updating of inventory and impact assessment will be undertaken as soon as final engineering design has been completed during the detailed design phase of the project by the Safeguard (IR / IP) Specialist. If final due diligence states no involuntary resettlement, subsequent activity will just be limited to compliance monitoring of any unintended impacts during project implementation. The table below presents the indicative time frame of key IR / IP activities in relation to project implementation schedule.

Table 8-3 Indicative Project and Safeguards Implementation Schedule

Activity	Indicative Time frame
A. Project Implementation: Major Activities	
D& B contractor's mobilization	Q1 Y1
Detailed design	Q1 Y1 – Q2 Y1
Design review and Approval	Q1 Y1 – Q3Y1
Surveys and related Due diligence/impact inventory	Q3 Y1 – Q4 Y1
Construction	Q2 Y1 – Q2 Y5
Maintenance Period	Q2 Y5 – Q2 Y6
B. Specific Activities	
1. Preparatory	
1.1 Engagement of Safeguard Specialist (IR / IP) for project implementation support	Y0 (in place at least 2 months prior to bidding process for D&B starts)
1.2 Mobilization of IR/IP Safeguard Officer	Y0 (in place at least two months prior to bidding process for D&B starts)
1.3 Training needs assessment	Q4 Y0
1.4 Capacity Building Activities / Follow-up support	Q4 Y0 – Q4 Year 3
1.5 Inclusion of the remaining IR and IP activity update in the bid documents	Q4 Y0 (Prior to Notice of Award)
2. Project Detailed Design /Approval	Q1 Y1 – Q4 Y1
2.1 Community Preparation Activities	Q1 Y1
2.2 Updating of IR/IP Due Diligence /impact inventory and	Q3 Y1 – Q4 Y1
2.3 Finalize IPP	Q4 Y1
2.4 ADB review and approval of IPP	Q4 Y1
3. Construction Period (Mobilization to Demobilization)	Q2 Y1 – Q2 Y5
3.1 IR Safeguard Compliance Monitoring	Q2 Y2 – Q2 Y5
3.2 Submission IR / IP Report	Q3 Y2 – Q2 Y5
- Monthly, by Safeguard (IR/IP) Officer	5th day of the month following the effective month
- Semi-annually, by Safeguard (IR/IP) Officer /OSP-AWTIP for submission to ADB	5th day of the month following the effective 6-month period
-Annual, by Safeguard (IR/IP) Officer for submission to ADB	5th day after effective year
4. Operation Period (potentially could start even before Maintenance Period is over)	Q3 Y5 and thereafter
4.1 Continue IR /IP safeguard compliance monitoring activities	Starting Q2 Y6

8.9 Internal Monitoring and Reporting

8.9.1 Internal Monitoring

Safeguard internal monitoring will be conducted by the Office of Special Projects (OSP- AWTIP) particularly, the IR/IP Safeguard Officer to ensure that project safeguards during implementation and construction is undertaken. It is also to determine if there are occurring issues and concerns of the affected communities, particularly, if there are unintended impacts that have to be addressed.

Project Internal monitoring will be on a quarterly basis and bi-annual safeguards monitoring will be undertaken to look at project effects on people and communities and whether such effects are negative or positive to determine appropriate measures where needed. Bi annual monitoring report will be submitted to ADB during the 4-year project implementation

8.9.2 External Monitoring

MWSS will engage an independent third party agency or academic institution to carry out external monitoring for safeguards compliance/implementation. External monitoring will serve to validate results of internal monitoring activities and to assess if unintended impacts are found and if there are, recommend the preparation of a Corrective Action Plan. External monitoring will be undertaken for 3 years throughout the construction period, covering annual external evaluation and a final evaluation at the end of year 3.

8.10 Poverty and Social Analysis

The section of the report presents the Poverty and Social Analysis (PSA) of the local and beneficiary communities in the Bulacan and Metro Manila regions that will be impacted by the Angat Water Transmission Improvement Project (AWTIP). It seeks to review and complete the initial social and poverty due diligence assessment that was prepared by the national social development/safeguards consultant.

The PSA is intended to mitigate the project's social risks and ensure the intended beneficiaries' inclusion and enjoyment of project benefits and development, especially the poor and vulnerable groups. It will focus particularly on the assessment of their socio-economic conditions, access to water supply services including existing network and linkages, and risks that might increase vulnerability. It will also assess social processes and opportunities for stakeholder participation to contribute towards the project's success and sustainability.

The report will cover the following topics: an examination of the ADB's PSA policy and project documentation requirements; project background and links with national poverty reduction and inclusive growth strategies; project outputs and social, poverty and gender impacts; social development analysis; gender analysis; poverty and social risks analysis; institutional gender analysis; the project's social inclusion, poverty and gender design measures and targets; and proposed implementation, monitoring and evaluation arrangements.

The report draws on: (i) the findings of the initial PPTA socio-economic survey of the source communities in Bigte and San Mateo Barangays in Bulacan; (ii) field inspection of the Ipo Dam, new tunnel route, Bigte Settling Basin and La Mesa Reservoir / treatment plants; (iii) available secondary data; and (iv), and the findings from second round of interviews held with the project's executing agency (EA) / implementing agency (IA), source community residents and local governments (refer to Appendix 1 for summary notes).

8.11 ADB PSA Policy and Documentation Requirements

The PSA is a policy requirement of ADB (A Handbook on Poverty and Social Analysis, 2012) and is usually carried out in the conceptual and design stages of ADB funded projects.

The purpose of assessing the poverty impact and social dimensions of project preparation is to provide information on the: (i) links of the project to the national poverty reduction strategy and the Country Partnership Strategy (CPS); (ii) the poverty targeting classification and its justification; (iii) key poverty and social issues (including gender) of the potential beneficiaries including the impact channels and expected systematic changes; (iv) opportunities and constraints for client/beneficiaries, particularly the poor and marginalised groups to benefit from the project activities and outputs; and (v) prepare design measures to achieve inclusive development outcomes during implementation. The

preparation of the PSA should also address issues on gender, stakeholder participation, social safeguards and other social risks.

It is a policy requirement of ADB that all investment projects should seek to be socially inclusive, equitable and sustainable (ADB Handbook on Poverty and Social Analysis, 2012). These three objectives can or should be achieved in an urban water supply project by being: (i) equitable in the form of geographic location in poor and/or vulnerable hot spot areas (e.g. development of new water sources); (ii) inclusive in terms of access to water supply infrastructure (e.g. tariff structures and connection subsidies); and (iii) sustainable (e.g. local operation and management of facilities and inclusion of stakeholders in urban water sector development strategy and planning processes).

The scale and extent to which these three objectives could be achieved depends on the nature, technical design and purpose of the investment project, its scope and level of funding and the socio-economic situation and needs of the affected peoples (APs), indigenous peoples (IPs), source communities and beneficiaries (end users).

The findings of this PSA are reflected in the design and monitoring framework (DMF), summary poverty reduction strategy (SPRSS), and stakeholder communication strategy. Due to the nature and scope of the investment project, an assessment of opportunities for stakeholder participation and gender mainstreaming were deemed limited. Hence, preparation of a participation plan and gender action plan were not warranted.

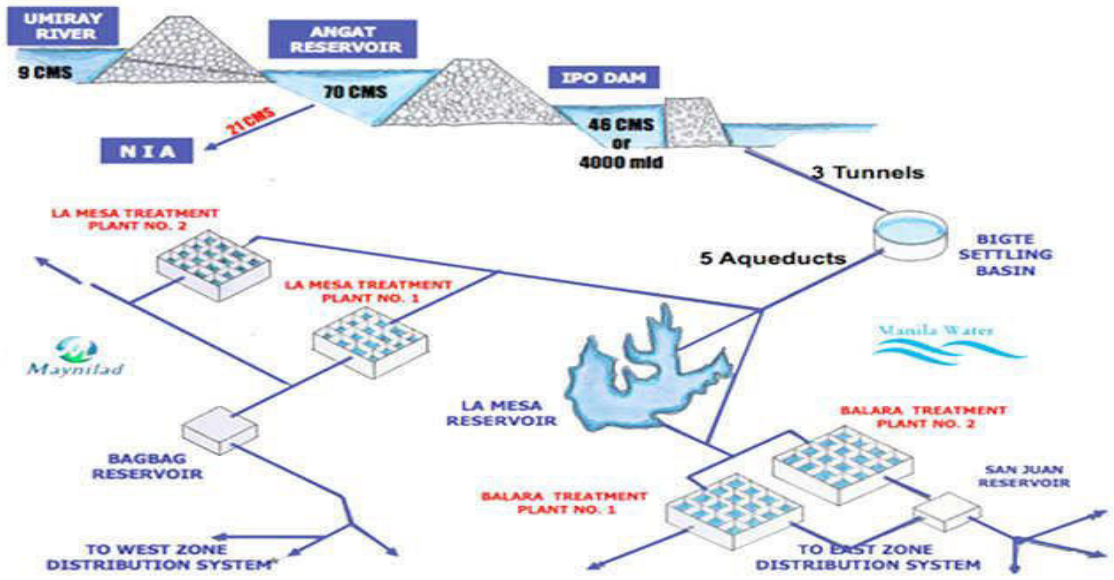
8.12 Project Background and Links to National Poverty Reduction, Inclusive Growth Strategy and Country Partnership Strategy

ADB's Strategy 2020 lends support to the implementation of the Philippines National Development Plan 2011-2016 which gives high priority to the accelerated development of national infrastructure including the water sector to promote economic growth, equitable development and poverty reduction. This commitment is reflected in the Philippine Country Partnership Strategy (CPS) 2011-2016 and the Philippine Country Operations Business Plan (COBP) 2014-2016 which extend assistance to this key sector and project and is consistent with the key elements of ADB's Water Operations Plan 2011-2020 which supports the expansion and improvement of water delivery services, conservation of water and increased system efficiencies. It also closely aligns with Metropolitan Waterworks and Sewerage System's (MWSS) 2011 Water Security Legacy Plan. The project also reinforces the Philippine Government's commitment to the MDG 7 goal of increasing the number of people with access to potable water supply to 86.6% of the total population by 2015 and halving the number of people without access to portable water.

The Metro Manila Water Supply system supplies potable water to the Metro Manila concession area's 14 million residents and is owned and managed by MWSS, a government corporate entity. MWSS runs a transmission system from the Ipo Dam to the treatment plants downstream at La Mesa and Balara in Quezon City which supplies its two concessionaires that distribute water to Metro Manila (see Figure 8-1: Metro Manila water supply system below).

AWTIP supports the implementation of the Angat Water Utilisation and Asset Improvement Project (AWUAIP) Phase 2, which aims to improve the reliability, integrity and security of the raw water transmission system through partial rehabilitation of the transmission line from Ipo Dam to La Mesa as well as the introduction of water safety, risk and asset management plans (WSRAMP).

Figure 10 Metro Manila Water Supply System, MWSS



AWTIP will involve the construction of a new 6.3 km long concrete tunnel with internal diameter of 4 meters (Tunnel No. 4) between Ipo Dam and Bigte Settling Basin No. 3 at a cost of US$100 million. The tunnel will be constructed along the right of way (ROW) between Ipo Dam and Bigte Settling Basin, 50-180 meters below the surface. Tunnel 4 will enable the continuous raw water supply for the service of the two concessionaires in Metro Manila while old water transmission system (Tunnels 1, 2 or 3) is closed for quality checks and rehabilitation. The latter will be part of a separate project under AWUAIP, Phase 2.

Technically, AWTIP is an infrastructure rehabilitation and replacement project. It does not expand the Angat system's infrastructure but will enable the rehabilitation project to take place which will improve its security, integrity, quality, flexibility and restore its designed capacity. The project will not provide additional water to the Angat system or increased access and connections for the end users. The project will also not increase the sales revenues of MWSS and the two concessionaires, Manila Water Company Inc. (Manila Water) and Maynilad Water Services Inc. (Maynilad).

The project directly supports the future security of water supply to the people of Metro Manila and lowers or eliminates the risk of a future system collapse. This will ensure that the current water and social, economic, poverty and gender benefits they receive from the Metro Manila water supply system is maintained and not eroded.

MWSS is EA / IA for the project. It will set up the Office of Special Projects (OSP) to manage the project's implementation. MWSS owns the entire Metro Manila raw water supply infrastructure ranging from the Angat / Ipo Dams and catchment, transmission system to the Bigte Settling Basins, La Mesa Reservoir, and treatment plants and pumping stations called the Common Purpose Facility (CPF). The common facilities including the dams, transmission system, reservoir and treatment plants are managed by the CPF which is jointly operated by the two concessionaires.

8.13 Project Outputs and Social, Poverty and Gender Impacts

AWTIP's potential social, poverty and gender impacts (positive or negative) are determined by the project's outputs and how they might erode or enhance the current socio-economic condition and status of the people in the source area and Metro Manila.

The project's main outputs are:

- Construction of the 6.3km underground transmission tunnel from Ipo Dam to the Bigte Settling Basin.
- Contract Supervision.

The project's main impact groups are:

- Source communities – locals living in the Bigte and San Mateo Barangays which includes IPs living in the Ipo / Angat catchment area.
- Beneficiaries - Metro Manila concession area residents who are the end users serviced by the Metro Manila water supply system.

The project's potential social, poverty and gender impacts are:

- Temporary employment and income generation opportunities generated by the tunnel construction civil works.
- Experience and skills development for the local workforce from construction related employment.
- Increased traffic movement and disruptions in the source communities posing risks for road safety and possibly business losses.
- Exposure of local residents including women to health risks such as STDs and HIV / AIDs from increased presence of male construction staff and opportunities for adult entertainment.
- Capacity building for gender awareness and equality in the executing and implementing institutions (MWSS and CPF).

8.14 Social Development Analysis

The objective of the social development analysis is to assess the socio-economic conditions of the people that will be directly and indirectly impacted by the project and their prevailing access to water supply services including existing network, linkages and conditions that will make them more vulnerable and at risk. The analysis will focus, firstly, on the source communities in Bigte and San Mateo where the tunnel will be constructed, and second, on the end user beneficiaries who are the residents of Metro Manila and the new expansion areas like Cavite and Rizal.

8.14.1 Source Communities

The project's source communities refer generally to the population of Bigte and San Mateo Barangays in the Municipality of Norzagaray in the Bulacan Province, Central Region, and Luzon, where the new Tunnel 4 will be built (see Figure 8-2 below). They include and refer in particular to the residents and communities living along the 6.5km tunnel route and ROW between Ipo Dam in San Mateo Barangay and Bigte Settling Basin in the Bigte Barangay and the IPs living in the Ipo Dam water catchment. These people are the secondary project beneficiaries who may benefit from project related employment during construction and other small business and income generating activities such as operating Karienderia or mobile food stalls. They are not connected or served by the two Metro Manila water supply concessionaires.

Figure 11 Map of Province of Bulacan and Municipality of Norzagaray

- **Socio-demographic profile**

Norzagaray is located 47 km north of Metro Manila and is one of the 21 municipalities in the province of Bulacan. It has three cities, the largest of which is San Jose del Monte. Bulacan has a total land area of 279,610 hectares with a population of 2,924,433 in 2010, the second most populated province in the Philippines after Cavite. Half the population of Bulacan are men and half are women. In 2010, the number of households was 659,158 with an average family size of 4.4. The urban population was 77.8% in 2013. The median age was 24.8 years which means that half the population is younger than 24.8 years. Moreover, 31.5% of the population were under 15 years old and there are more females in the age group 25-29 and older groups (50 years and over). The population growth in Bulacan was 3.3% in 2007 (NSCB, 2012). This population growth rate has continued in the past 15 years and is attributed to natural increase as well as the influx of migrants from other parts of the Philippines, especially the Northern Luzon provinces. The two main contributing factors to the growth in Bulacan's population are its proximity to Metro Manila and it being a major urban centre.

Bulacan is one of the richest provinces in the Philippines. Its economy is dominated by the services sector which accounts for 60% of total employment. Its other main industries include marble and marbleized limestone, jewelry, pyrotechnics, leather, aquaculture, meat and meat products, garments, furniture, farming, and sweets and native delicacies, tourism and a wide variety of high-quality native products.

The Bulacan average annual family income in 2009 was Php 253, 279 while the average annual family expenditure was Php 212, 492. The average annual family savings was Php 40, 7879. With an average household size of 4.4, the average annual per capita income of Bulacanyo's was Php 57,536 or Php 4,796 a month. In 2009, Bulacan enjoyed the highest human development index (HDI) in the country at 0.760. The Province's poverty incidence was 4.8% in 2009 (ranked third lowest at the national level) compared to national poverty incidence of 22.3% (NSCB, 2012). This means that less than half a person out of every 10 people is poor or living below the national poverty line of P 7,021 at the time.

Norzagaray has 13 barangays which includes San Mateo and Bigte. The municipality has a total land area of 28,852 hectares with a population of 103,295 in 2010 - around half are women. Norzagaray is

the richest municipality in Bulacan. The backbone of its economy includes farming, marble production and cement manufacturing.

The new Tunnel 4 ROW will traverse two barangays; namely Bigte and San Mateo. In 2010, Bigte and San Mateo Barangays, each had a population of 11,032 and 9,089 and number of households of 2,206 and 1,818 respectively (see Table 8-1). Together, they account for 20% of Norzagaray's population. The population of these two Barangays have grown significantly since 2003 when they had populations of 8,221 and 5,636, and number of households of 1,683 and 1,100 respectively. Around half their population are men and half are women if the Provincial gender ratio is applied. The average size per household is 5 members. Their main sources of income and livelihood are farming, small business, employment with local business and local government, tricycle drivers and remittance income from OFWs (NSCB, 2012).

Table 8-4 2010 Population of Bigte and San Mateo Barangays, NSCB 2013

	Bigte	San Mateo	Total
Population	11,032	9,089	20,121
Households	2,206	1,818	4,024

In relation to the project, the APs total around 5245 people that live along the ROW and the public road between Bigte and Ipo which runs parallel to the tunnel's route. These people have been accounted for in the due diligence report on safeguards and Involuntary Resettlement (IR) Impact but are still included with the source communities for the purpose of this analysis. The APs include the 5,000 population of Air Force, Police and Army officers and their families that will live in the new NHA-AFP housing project which is located within the MWSS 60 meter ROW in Segment 3 (to be occupied in 6 months' time) and the 49 other households living on the ROW in Segments 2 and 5. With the local area average family size of 5, the 49 households will comprise around 245 people. The other significant group is the IPs who live in the Ipo water catchment zone within the San Mateo Barangay with a population of 1152 people consisting of 361 households. Their needs and concerns are also being addressed separately in the safeguards due diligence report in accordance with ADB's social safeguards policy but they are also included in this analysis as part of the source communities.

The population of Bigte and San Mateo consist of rural and urban dwellers. The rural people rely mostly on farming, employment in local government and businesses, small business operations (sari-sari stores) and other income generating activities, tricycle drivers and OFWs remittance for their livelihood. On the other hand, the urban population rely on wage employment in local governments, industries and service sector, small and micro business, tricycle drivers and OFWs remittance for their livelihoods.

- **Water Demand and Supply**

The lack of piped clean water is a major development set-back for the people in the source communities as well as much of the Bulacan Province. Typically, they need water for their daily needs including drinking, washing, cleaning, sanitation, food preparation, bathing and farming, etc. While the Angat water transmission pipes traverse the Bigte and San Mateo Barangays, the locals expressed their frustration during consultation that they are not connected despite the raw water coming from their area. The source communities that live along the Ipo Road and tunnel ROW up to 6km from Ipo Dam commonly source their water supply from household and community wells and springs as well as potable water supplied through water tankers by a single contractor approved by the Local Water Districts (LWDs). The water from wells and springs are untreated and used mainly for domestic purpose but are also boiled for drinking while potable water sold be vendors is used mainly for drinking and food preparation.

The local residents are dependent on the local portable water vendors which operate as a private monopoly. Residents are limited to one supplier and there is no competition in terms of service quality, water quality and price. Potable water is delivered by water trucks 4-5 times a week and is sold for Php 35 for a 200 litres drum or Php 175 cu.m. The average family uses 3-4 drums a week or 3-4 cubic meters a month. They pay between Php 100 – Php 500 a month for their water. Bigger consumers with bigger households and businesses who belong above the poverty line (households with monthly income of Php 8,000) pay between Php 800 – Php 1,000 a month. Clearly, potable water is expensive for the poor source communities compared to what the Metro Manila residents pay for their water which is charged by the two concessionaires at an average lifeline rate of Php 79.40 for 10 cu.m. Comparatively, Metro Manila low income and low user residents pay Php 7.90 for 1 cu.m of water compared to the source communities who pay Php 175 for 1 cu.m which is 22 times more.

In San Mateo, small private piped water systems exist which draw untreated water from deep wells and connect up to five households. In the San Mateo Township, the local piped water system is operated by the barangay council. A new private piped water supply system owned by a local businessman is being developed in the informal settlement next to Ipo Dam. It draws water from a nearby spring, treats the water, and provides free metered connections to 28 households consisting of 140 members charging P110 per cubic meter which is 13.8 times more expensive than lifeline tariff in Metro Manila.

In Bigte, there are three existing piped water system (2 operated by the Bigte Barangay and 1 by an NGO) which traps untreated water from the Angat transmission blow outs and connects around 600 households. According to these figures, 27% (600 out of 2,206 households) of the people in Bigte have access to untreated piped water and 73% do not. For these services, consumers are required to pay a flat connection fee of Php 500 and a flat tariff rate of Php 100 a month for 10 cu.m (12.6 times more expensive then the lifeline tariff in Metro Manila). The Bigte Barangay also provides subsidised water hand pumps to the community and free maintenance and repairs; each pump can serve up to 80 households. There are 10 pumps currently in operation serving about 800 households or 4000 people, calculated based on the Bigte / San Mateo average household size of 5. Households with piped water or connection to the barangay supplied community hand pumps represent 1,000 households (45.3% of Bigte's total households) or 5,000 people (45.3% of Bigte's population).

The residents of Bigte and San Mateo suffer from water shortage during the dry season (December to May), especially those that are dependent on wells, springs, rivers and trucked potable water. During this period, the demand for trucked potable water increases as wells, springs and rivers dry up or run low on water. Locals complain that the trucked potable water concessionaire does not adequately meet the demand which is inconvenient and forces people to face problems of shortage of water supply.

The two Metro Manila water concessionaires, Manila Water and Maynilad, are not responsible for supplying water to Bigte and San Mateo and the rest of the Province of Bulacan under their Charter. The immediate responsibility for water supply to the barangays in the Province of Bulacan, including Bigte and San Mateo, is with the Local Water Districts (LWDs) under the umbrella of Local Water Utilities Administration (LWUA). The LWDs water supply system include piped and truck delivery of potable and untreated raw water sourced from deep wells, springs and the Angat system blow outs. Since the 1920s, after the establishment of the Angat Water Supply System, Bulacan has supplied 97% of Metro Manila's raw water supply from the Angat/Ipo Dam. Bulacan, however, has not benefitted from the water system and continues to extract water from depleting aquifers to the detriment of the environment.

The LWDs in the province face a number of obstacles that impinge on the ability to fully serve their service area. The major deficiencies include:

- Inadequate water supply.

- Low water pressure due to undersized distribution system and inadequate supply.
- Saline water intrusion.
- Ageing and depilated pipelines.
- Inadequate storage volume.
- High Non-Revenue.

MWSS has assumed the responsibility to supply bulk water to Bulacan from its Angat source after signing a Memorandum of Agreement (MOA) with the Provincial Government of Bulacan on 12 December 2007. MWSS has initiated the Bulacan Bulk Water Supply Project (BBWSP), estimated to cost Php 29.83 million (US$694 million), to address the need for bulk water supply though the construction of infrastructure and utilities for abstraction, treatment and conveyance of the treated water supply to the intended connectors of the LWDs. The project will cover 24 LWDs, spanning the whole of the Bulacan Province and will be implemented in 3 phases. The areas covered in Phase 1 include Malolos, Meycauyan, Sta. Maria, Obando, Baliuag, Bulacan, Pani, Guiguinto, and Bocaue. Norzagaray Municipality which includes Bigte and San Mateo Barangays will be covered in Phase 3 which will materialise in 2020.

BBWSP will be implemented under a public private partnership (PPP) scheme by outsourcing the services and infrastructure responsibilities to a private concessionaire as a Built Operate Transfer (BOT) Agreement for a 30 year concession period. The project will be underpinned by contractual agreement through concession/BOT agreement between MWSS and the Proponent; multiple Water Purchase Agreements (WPAs) between the Proponent and the LWDs; and a guarantee mechanism potentially between LGUGC and LWDs in need of credit enhancement. The bid parameter for the tender will be the lowest bulk water charge that can meet the output specifications. The issue of pre-invitation to tender will made in the first quarter of 2014 (IMC Worldwide, 2013). The financially weak LWDS in Bulacan will be able to benefit from the soon to be implemented PHI Water District Development Sector Project (WDDSP) where they can access sector loans for their capex through the Local Water Utilities Administration (LWUA).

According to MWSS and CPF engineers, the truck delivery of portable water seems the only feasible option for areas like Bigte and San Mateo at this stage. The areas hilly terrains and rugged landscape and sparse population will make piped water supply a very expensive proposition because it will need multiple water pumps and reservoirs to be installed and continuously operated.

- **Socio-economic Study (Bigte and San Mateo)**

8.14.1.1.1 Approach and Methodology

Data collection was undertaken through the PPTA socio-economic survey targeting the source communities of Bigte and San Mateo Barangays using random sampling in the selection of the respondents. The source communities are confined to the combined land areas of the Bigte and San Mateo Barangays which cover the Angat/Ipo Dam and the 6.5km tunnel ROW between Ipo Dam and Bigte Settling Basin. They include the IPs in the Angat/Ipo Dam Catchment area, the affected peoples living as informal settlers along the ROW and the two barangays overall population. The labelling of this geographical area as the source community is self-defined by its resident's direct emotional, economic and physical association with the Angat/Ipo Dams and water transmission system and will be impacted by the project. A total of 68 households were interviewed covering the project area in Barangay San Mateo and Upper Bigte in Norzagaray, Bulacan (see Figures 8-3 and 8-4 with maps of Tunnel 4 ROW and settlements below). There are about 248 family members or an average of 5 members per household.

Figure 12 Maps of Tunnel 4 Route and Settlements: Ipo Dam / San Mateo – Bigte

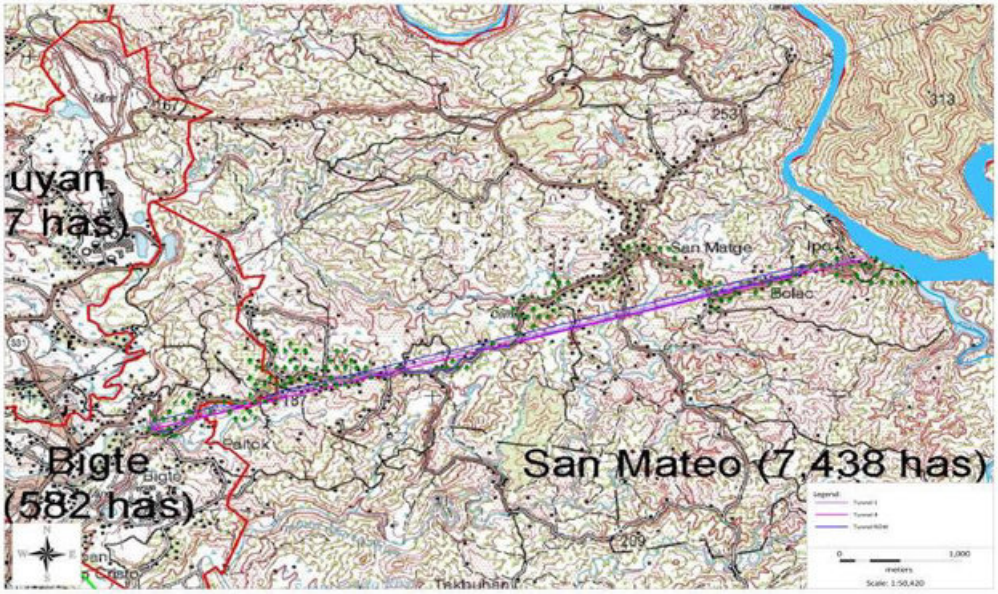
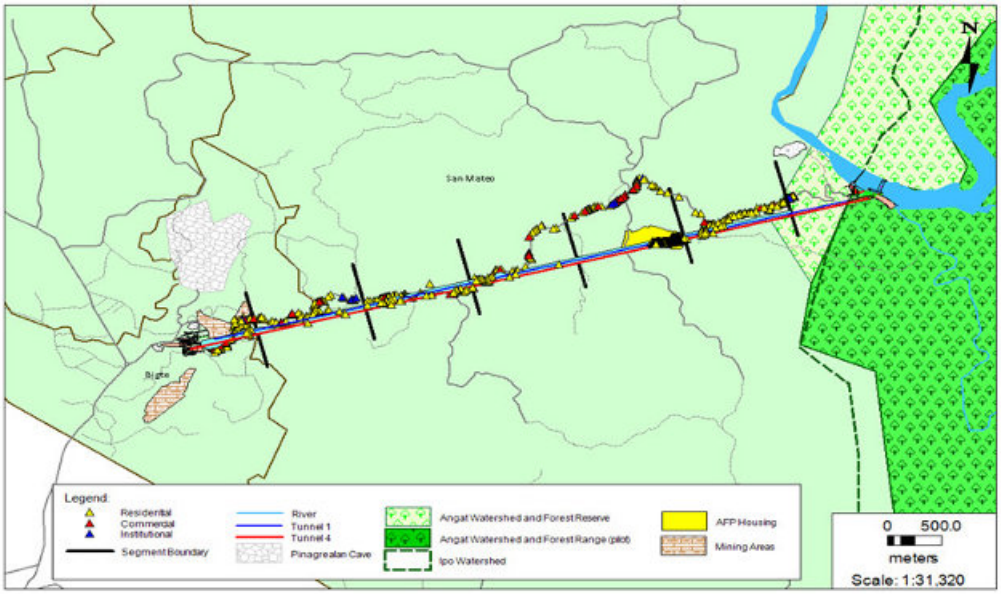


Figure 13 Map of Informal Settlers and Settlements along Tunnel 4 ROW, MWSS 2014



- **Socio-demographic Profile**

8.14.1.1.2 Gender, Age and Educational Attainment

The respondents comprised about 18 males and 50 females, representing 73 % of the total respondents. Respondents composed of mostly household heads equivalent to 73% of the respondents. The respondents' age varied from a youngest of 18 years old to oldest of 65 years old.

The household heads are mostly males (83.3% or 57) while the female household heads composed only about 16% or 11. Most household heads are married (67%) while about 10.2% are separated and the rest are widowed (14.7%). Most of the female household heads are separated (36.6%), widow (36.6%) and living-in (14.75%).

In terms of the household member's age profile, ages 14 and below comprised 12% while ages 15-64 represent 63.71%. The rest, 65 and above, represent 2.81%. Among the productive age group (15-64 years), more males are working (42 or 70%) than females (18 or 30%).

Highest educational attainment of household heads is represented by 34% achieving elementary education; 41 % reaching high school education and 8.82 % having college education. The spouses, who are 85.2% females, have 29.4% reaching elementary education; 39.24 %, high school education and 17.64%, college education. Comparing the educational attainment of the household heads and their spouses, there are more female spouses reaching college compared to the male household heads.

8.14.1.1.3 Occupation of Household Heads

In terms of occupation, the household heads are engaged in various occupations, comprising of government and private employees (14.7%), owning business (8.8%), vending and trading (10.41%) and farming and fishing (10.2%), driving (16.8%), labour and construction (10.29%) and OFWs (17.65%). Most of the household heads do not have regular employment but do self-employment, entrepreneurial activities and seasonal economic activities.

In particular, the male household heads (57) are into driving and construction (31.5%), farming and fishing (12.2%), OFWs (21.05%), employment (14%) and own business (5.26%). Most of the female household heads are engaged mostly in business, sales and vending (54.5%) and employment (18%).

8.14.1.1.4 Household Monthly Income, Expenses and Savings

The respondent's monthly household income distribution is in Table 8-2 below. Household monthly income, Php 8,000 and below represent about 30% while those between Php 8,001 to Php 25,000, represent 57.4%. The rest, Php 25,000 and above composed only 13.2%. Income from OFWs (Php 20,000-Php 50,000) are larger compared to the regular employment from government and private (Php 12,000-20,000). The lowest amounts of income are those coming from pension, farming, labour, and small business (Php 2,000-4,000).

In regards to the monthly income of male-headed households, a smaller proportion (24.6%) account for the income group (Php 8,000 and below) while majority (61.4%) belongs to the income group Php 8001- 25,000. Only 15.8% represent the income bracket above Php 25,000.

For the female-headed household, there is almost an equal proportion between those belonging to the Php 8,000 below bracket and Php 8,001-25,000 bracket, 54.5% and 45.5 %, respectively. No female headed household reached the income bracket, Php 25,000 and above.

Table 8-5 Monthly Income by Gender

Monthly Income Group by Gender	Male HH		Female HH		Total	
	N	%	N	%	N	%
Php 8,000 and below	14	24.6	6	54.5	20	29.4
Php 8,000 – 25,000	35	61.4	5	45.5	39	57.4
Php 25,000 and above	9	15.8	0	0.0	9	13.2
Total	57	100	11	100	68	100

Monthly household expenses Php 8,000 and below is represented by 36.7% of the households while Php 8,001-Php 19,000 is composed of 50.27%. Above Php 20,000 monthly expense is attributed to only a few (7.35%).

A look at the average expense on each line item for the survey respondents show food has the biggest chunk of the household expenses amounting to Php 6,377.08 per month. This is followed by (i) educational allowance of students (Php 991.04), (ii) tuition fee (Php 805.79), (iii) transportation (Php

763), (iv) electricity (Php 803.00); (v) water (Php 480.94), (vi) housing repair / amortization (Php 326.), (vii) cell phone load (Php 265.00) and fuel for cooking Php 192.00 (LPG) and Php 157.05 (fuel wood). Medical bills only cost an average of Php 176.05. Expenses on entertainment; betting and cigarette/alcohol reached an average of Php 288 monthly. However, the expenses for food and other items would be proportionately higher for poor households with monthly income of Php 8,000 or less which represent 30% of the respondents. Generally these are families with inadequate income to meet their basic food and non-food needs.

About 41.8 % expressed after deducting their monthly expense, they do not any savings left. Only 16% declared less than a thousand net incomes while about 10.29 % between Php 1,000-8,000. Among the households, 75% expressed they do not have savings. The amount saved by 20% is not much falling between less than Php 1,000 – Php 3,000 per month.

- **Water Services**

8.14.1.1.5 Water Needs and Supply

The respondents use water for domestic purpose, drinking, bathing, food preparation, cleaning, washing sanitation and economic activities including gardening and farming. There is no potable piped water supply in the area. Water sources come from deep well/shallow well (39.7%), public faucet (1.47%) and spring/river (35.2%). Purchases from potable water vendors (bottled water, 200 litre containers, and peddlers) also represent a significant proportion at 35.29%. Some families and communities have developed piped water systems sourcing from wells and springs benefitting between 5-30 families. A business venture has started near Ipo Dam where a local businessman is now supplying the informal settlers around him with filtered piped spring water. He now has 28 connections serving 80 households who are billed monthly for P 110 per cubic meter. Similarly, a barangay owned and operated deep well piped water system exists in the San Mateo township. All families have access to well and spring water but not all families buy potable trucked water.

In regard to gender, both male and female headed households of lower income bracket use a combination of three sources: (i) shallow and deep wells, (ii) spring/pond/river and (iii) water vendors. A large number of households use water vendor as one source in combination with the deep well and spring/river/pond/stream sources.

8.14.1.1.6 Affordability

Most of the respondents and participants of the FGDs expressed the need for a clean water supply. Table 8-6 below shows the expenditure on water by income group. An assessment of the water expense of the male and female-headed households and across all income categories reveal that 24 out 68 (35.29%) of households do not spend on water because either they have constructed their own system (shallow well or deep well) or that others share with the shallow/deep wells of their neighbours. For these people, the common practice is to boil their drinking water. On the other hand, 44 or 64.71% of households purchase potable trucked water and water from other sources such as local piped water systems. About 45.54% of all households spend from less than Php 100 - 500 per month on water. Around 8.82% of households spend Php 501 – 1000 per month while 10.29% households spend between Php 1,001 – 3,000 a month, 2 of which are poor households belonging to the income bracket of Php 8,000 or less per month. Among the poor households with monthly incomes of Php 8,000 or less, 7 out of the 9 households that spend on water spend between below Php 100 – 500. Water fees constitute 4.1% of average monthly expense of the households that purchase water.

Table 8-6 Expenditure on water by income group

Monthly Water Expense	Php 8,000 below (bracket (*n*=20)		Php 8,000-25,000 (*n*=39)		Php 25,000 and above (*n*=9)		Total	%
	Male	Female	Male	Female	Male	Female		
None	8	3	10		3		24	35.29
Below 100			2				2	2.94
100-200	2	1	6	2	4		15	22.06
201-300	1	1	5				7	10.29
301-400		1	1		1		3	4.41
401-500	1		1	1	1		4	5.88
501-1,000			4	2			6	8.82
1,001-2,000			2				2	2.94
2,001-3,000	2		3				5	7.35
Total	14	6	34	5	5	0	68	100

Assuming an average monthly water bill of Php 500 with the establishment of a water system, the lower income groups with income bracket of Php 8,000 and below may have difficulty in paying or accessing the service.

- **Asset ownership and access to resources**

8.14.1.1.7 Asset Ownership

Most of the equipment owned by the households including those with low incomes are TV sets, refrigerator, telephone/ and cellular phone, motor cycle and tricycle, washing machine, among others. Only a few households have a car and similarly, a few own a computer.

8.14.1.1.8 Basic Utilities

In terms of household basic utilities, most have water sealed toilets (95.58%).

Most households are lighted or use electricity (82%) while majority used fuel/wood for cooking (63.2%).Wood is abundant in nearby forest but may cause deforestation if not controlled or sustainable.

200 litres portable water drums

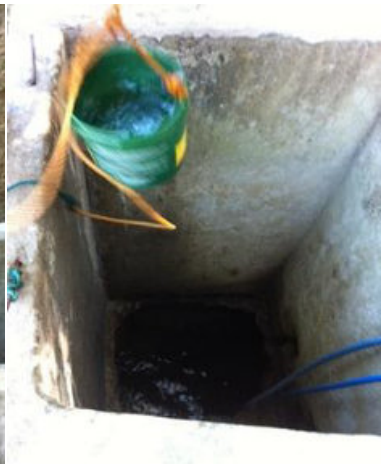
Woman fetching water from a deep well

A deep well in San Mateo

200 litres portable water drums

Woman fetching water from a deep well

A deep well in San Mateo



8.14.1.1.9 Incidence of Illness / Death

The incidence of water and sanitation related diseases such as diarrhoea, malaria, dengue and skin infections were reported as low and insignificant despite the lack of piped potable water supply. The common causes of household illness are cough, colds and fever (75.93%). Other respiratory disease includes bronchitis, pneumonia, and asthma (9.2%).Incidence of diarrhoea is not many (3%). Chronic diseases include hypertension, heart disease and cancer (4%). The causes of death among community members are hypertension, pneumonia/bronchitis and asthma, heart and kidney disease. Old age appeared to be one of the causes of death among the community residents (35.19%).

8.14.1.1.10 Access to Basic Social Services

In terms of access to basic social services, the barangay health centre is mostly visited by the household for their check-up and medical consultation. Government hospitals and private hospitals are used during emergency cases. Both male and female households use the barangay health centre for consultation and check-up because it is free.

The elementary and high school students go to the elementary and high school located in the two barangays.

8.14.1.1.11 Access to Credit Facilities

Available credit facilities identified in the area include cooperatives (51.4%), private money lenders (35%), banks (10.3%) and relatives and friends (29.4%).

In terms of access to credit among the households, some borrow money from cooperatives (16.6%) while others from friends / relatives (17.6%). Most of the credit purpose is for business capital while others used it to buy food (5%) and pay debts (9.4%).

Among the female household heads who borrowed money, it was sourced from private money lenders (33.3%) and 16.7% from cooperatives. All use it for business purposes.

The male headed households who borrowed capital for business got it from a private money lender. Private money lenders charged exorbitant rates of 10%-20% per month and for a small business owner, this may render his/her business unprofitable. Majority did not access credit.

8.14.1.1.12 Network and Linkages / Community Organizations

Interview with barangay officers revealed a number of active community organizations in the two barangays that undertake socio-economic and development activities (Table 8-4). Of particular interest

are the women associations and cooperatives (KABALINGAY, Bigte Women's Power Association, Home Builders Alkansya Multi-purpose Coop and Credit Assistance Rural Development (CARD) which have been operating for at least 3- 15 years. These groups offer credit and training/livelihood assistance to women who are unemployed.

Among the respondents, less than half (40%) noted membership in these community organizations. The female household heads reported being a member of a cooperative (33.3%) and religious/savings group organization (66.57%). The longest existing organization (KABALINGAY) has been operating for 17 years and the newest (Bigte Women's Power Association), for 2 years. A brief profile of the community organizations are described below:

Table 8-7 Community Organizations

Community Organizations	Objectives/Programs and Services	Sources of Funds	Status of Membership
Senior Citizens Association (San Mateo)	Provide assistance to its members Death benefits to members (Php 5,000 to beneficiaries) Socialization during x mas parties	Membership fees / donations	200 members of which 120 active members organized in 2001
Senior Citizens (Bigte)	Provide assistance to poor senior citizens	Membership fees Donation of PHP 30,000 from Barangay Captain	500 members of which 300 active members organized in 2009
Bigte Women's Power Association)	Assist mothers / wives who are unemployed / don't work Livelihood / skills training Rag making / sewing uniform project for kinder students Training on food processing / perfume and candle making / recycled paper making	Membership Fees Donation from Congressman Mendoza Php 30,000	200 of which 100+ active members, organized in 2011
KABALINGAY (Women)	Assist mothers/housewives Skills training and livelihood Food processing (products sold by members every Friday of the month) Medical mission	Membership fee of Php 20.00 collected from every member during meetings. Interest from membership fees given in the form of groceries every December.	200 members, organized in 1995
Home builders *Alkansya* Multi- purpose Coop	Strengthen families socially and financially Provides loan to its members Medical missions (for members and non- members) Training on Candle making / Noodles making	Membership fees / Grants	200 members with 100+ active, organized in 2005
Credit Assistance for Rural Development (CARD)	Assist members through loan assistance	Capital build-up from members	50 members, organized 1990
Sangguniang Kabataan (SK) youth (San Mateo)	Assist youth members in various projects Cleanliness programs Home / vegetable gardening Sport Facilities improvement / movable court	Regular SK budget Php 400,000	500 members of which 250 active members, organized in 2010

Community Organizations	Objectives/Programs and Services	Sources of Funds	Status of Membership
	Books / materials for library		
Sangguniang Kabataan (SK) youth (Bigte)	Assist youth away from drugs through sports Medical mission Sports fest every summer Provides school supplies to students Provide electric fan to schools	Regular SK budget Php 900,000	700 members
Virgen de las Flores Church	-Assist church members grow in Christian faith	Donations from parishioners	Organized in 2007

Overall, these organizations including youth (SKs), Senior Citizen's Group and the spiritual association have been contributing to the socio-economic development of the two barangays.

8.14.2 Beneficiaries

The project's ultimate beneficiaries would be the end water users who are the residents of Metro-Manila's and the new expansion areas. While the project will not contribute directly to increasing water supply to Metro Manila or deal with any consumer connections, it will, however, enable the rehabilitation work on Angat's old tunnels and aqueducts transmission system to take place while ensuring the continuity of water supply. The end users will directly benefit from the continuation of the socio-economic benefits they receive from the Metro manila water supply system.

Potable water supply (piped and trucked) for Metro Manila is supplied by the two concessionaires of MWSS, with Maynilad covering the west zone and Manila Water covering the east zone. As of December 2012, the east zone covers an area of 1,400 sq. km, with 858,672 water connections benefitting 6.8 million people (99% coverage). The west zone covers an area of 540 sq.km, with 988,503 water connections benefitting of 8.2 million people (94.6% coverage).

Since the beneficiaries will not directly benefit from the project through additional gains in access and consumption, they will not be subjected to the same detailed socio-economic study that was done for Bigte and San Mateo. Instead, this analysis will describe their socio-demographic profile and basic socio-economic conditions, and assess the extent of the two concessionaires social and livelihood programs which targets the poor and low income people of Metro Manila.

- **Socio-demographic Profile**

Based on the 2010 national census, Metro Manila has a total population of 11.7 million people (14 million is the total population for the concession areas), comprising 2,743,459 households/families at 4.3 members per household (Table 8-5 below). The female population which comprise about 6,015,066 or 50.9% is slightly higher than the male population which comprised about 5,781,807 or 49.1%. About 67.5% of the total population are in the labor force (15-64 years old). The total dependency ratio is 48% (48 persons out of every 100 who are productive) (NSCB, 2013).

According to July 2013 Labour Force survey, the total labour force representing ages 15-64 (both employed and unemployed) is about 8,124,000 persons while labour force participation rate is 64.3%. Unemployment rate is 10.9%. In regards to gender employment, based on LFS October 2011, of the total 4,567,000 employed persons, 55.1% are males and 44.9% are females. The females, however, dominated the serves sector (89.1%). Majority of these women were employed in the wholesale and

retail trade industry (33.2%), private households with employed persons (16.4%) and real estate, renting and business activities (10.3%) (NSCB, 2013).

NSCB 2009 data also revealed 64% of household incomes are obtained from wages and salaries, 13% from entrepreneurial activities and 22.9% from other sources. About two-thirds of families with average over Php 100,000 obtain their incomes from wages and salaries while 28.5% of those whose income was below Php 60,000 obtained their income from entrepreneurial activities.

Table 8-8 Metro Manila Population Demography, National Census Survey (NSO 2012)

Indicators	Quantity
Number of cities/municipalities	16 cities/I municipality
Total population (2010 Census)	11,796,873
Male population	5,781,807 (49.1%)
Female population	6,015,066 (51.9%)
Number of households/families	2,743,548 (@4.3 per household)
0-14 years	3,432,903 (29.1%)
15-64 years	7,964,646 (67.5%)
65 years and over	399,324 (3.4%)
Density (persons per sq.km)	19,137
Population growth rate (2010)	2.02
Project population	2013: 11,953,140; 2025: 20.8 million

Among all regions in the Philippines, Metro Manila has the highest average annual household income of Php 380,000, which is higher than the national income average of Php 234,000 (2012 FIES Survey). It also has the highest average savings of Php 40,000 (at current prices).

A household of 5 members has to have a monthly income of Php 8,403.33 to stay out of poverty or for it to meet basic food and non-food needs. In terms of expenditure, households spend mostly on food, equivalent to 36.2% of total household expenses. House rental comprised about 18.5% while fuel, light and water accounted for about 8%. Transport and communication accounted for 9% while education fees at 4% and medical care, 1.9% (NSCB 2012).

In terms of water expenses, a study conducted by the Centre for Environmental Science and Technology (CEST) and NJS for Manila Water entitled "Pasig River Catchment Project" in 2010 with 600 sample households in Mandaluyong, Pasig and Makati showed that on average, households spend Php 478 to as high as Php 903 per month. Water expense is about 4.2% of household income for the low income group (Php 9,000 below) and 1% for those with an average income of more or less Php 50,000 per month.

Those with annual income of Php 69,000 (or Php 5,750 monthly) had negative net incomes while those with annual Php 108,000 (Php 9,000 monthly) had savings of about Php 6,000 annually or Php 500 monthly.

The registered annual poverty incidence among families is 3.8%, considered lowest among all the regions and compared with the national poverty incidence of 22.3%. In 2009, Metro Manila has about 64,404 poor families comprising 1.67% of the 3,855,730 poor families registered nationwide (NSCB, 2012).

8.14.2.1.1 Gender Roles and Relations

The traditional separation of gender roles in the Filipino culture between men and women also prevails in Metro Manila. Men have historically been the breadwinner in the family and women

undertake household management including child and elderly care, food preparation, water fetching and management, washing, cleaning, children's schooling, care for the sick and sanitation. However, women are increasingly joining the workforce either because of their progressive education and careers or to help supplement their household incomes to meet the pressures of increased cost of living in the urban areas. In modern and middle to upper income households, men are increasingly sharing in the domestic labour because of their education and changing values in favour of gender equality.

The above CEST Pasig River Catchment Project socio-economic survey in 2010 supported this observation. It showed that more low income male headed households (MHHs) are formally employed (43.2%) compared to FHHs (16.5%) and more FHHs are OFWs than MHHs. More FHHs (16%) have college education than MHHs (14%) and more FHHs own microenterprises (24.1%) than MHHs (11.7%) but more MHHs own formal businesses compared to FHHs. Across all income groups, the income of MHHs is higher than FHHs.

The connection to treated piped water makes a big difference to the convenience and status of women in the family and community. Not only is piped water cheaper, safe and convenient compared to other sources like wells and water supplied by vendors, its availability helps women effectively and efficiently carry out their domestic tasks, and spend less time fetching water and attending to the sick. This time saving helps reduce their time poverty and enables them to engage in other productive activities such as income generation and small businesses which is not only empowering but more importantly improves their living standards and that of their families.

- **Water Demand and Supply**

8.14.2.1.2 Metro Manila Water Concessionaires

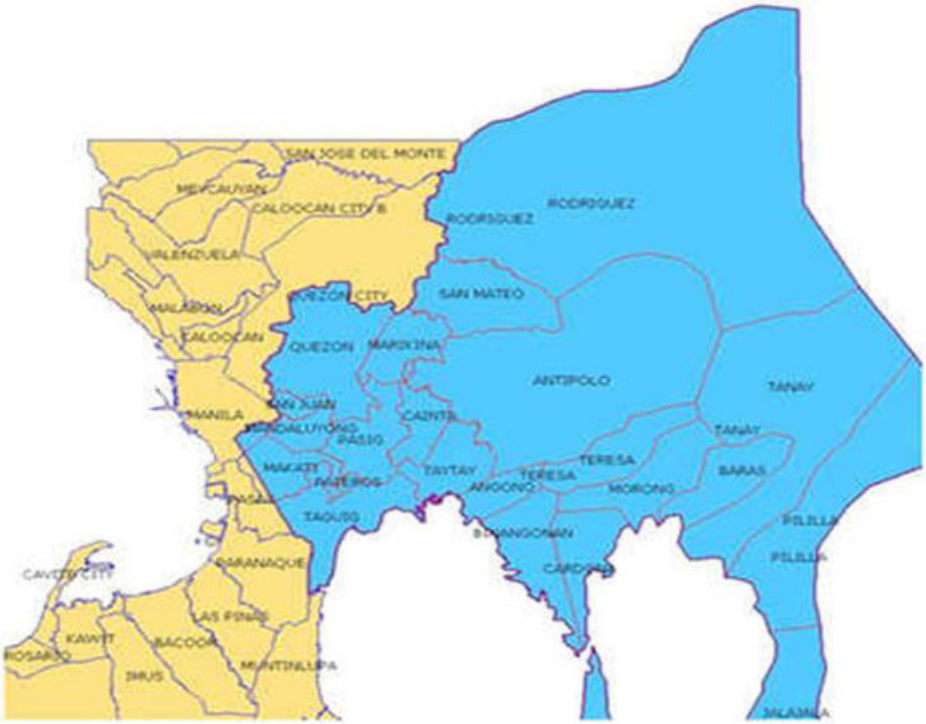
The 14 million population of Metro Manila currently depend on the Metro Manila water supply system for all of its potable water supply (piped and trucked). The supply of sufficient raw water from the Umiray-Angat-Ipo system (95%) is critical to the well-being of the Metro Manila population. Naturally, it is the desire of every person and household to have the convenience of 24/7 piped potable water connection. However, the two concessionaires in 2011 have only managed to reach an average of 96.8% of the population in terms of coverage while 3.2% remain unconnected (MWSS, 2014). The unconnected population are mainly people that reside in sparsely populated areas possibly with difficult terrains where it's uneconomic to provide and operate piped water infrastructure but they still get serviced with trucked portable water. The latter are people that live mainly in the poor areas and most of whom are informal settlers or squatters but they are still served with potable water supply delivered by water tankers and vendors.

Potable water is supplied in Metro Manila by the two concessionaires under 25 year contracts since 1997. Their contracts were recently extended by another 15 years up to 2037. Metro Manila has been carved up in two areas between Manila Water and Maynilad which supply the east zone and west zone respectively (Figure 8-5 below). As of December 2012, the east zone has covered 181,369 households (6.8 million people) while the west zone covered 315,770 households (8.2 million people).

Since water is a basic need, it is sold at an affordable rate by the concessionaires to benefit the low income and poor households – also an obligation under the concessions. Both concessionaires apply a lifeline or socialised tariff. For a minimum consumption of 10 cu.m, Manila Water and Maynilad charge a rate of Php 80.61 and Php 78.19 respectively in 2012. The average lifeline tariff for the two concessionaires is Php 79.40 which is equivalent to Php 7.94 for 1 cu.m. Customers that consume higher than 10cu.m are charged a higher rate for every next 10 cu.m. Businesses and other high users are charged a separate and higher rate than households. Despite having 24/7 treated piped water supply, Metro Manila residents generally buy their drinking water from private potable water vendors that do door to door delivery at the price of P75 a 10 litre gallon, equivalent to P 7,500 a

cubic meter which is very expensive. For the areas that remain unconnected, the concessionaires are required to provide them with trucked potable water.

Figure 14 Map of Metro Manila Water Concession Areas, MWSS



As of August, 2011	West Zone – Maynilad	East Zone – Manila Water
Land Areas (sq.km.)	540	1,400
Service Area	17 cities / municipalities	23 cities / municipalities
Total population	8.2 M	6.8 M
Raw Water Allocation	2,400 mld	1,600 mld
Water 1,073,508 94.6% 8.2 M		 858,672 99% 6.8 M

Sewerage		
# Sewer Connections	45,166	90,292
% Water Supply Coverage	9%	12%
Total Population	334,228	731,365

The introduction of the private sector under the PPP into Metro Manila's water distribution concessions has achieved fairly good results since 1997. It has resulted in significant improvements in operational efficiency, improved the quality of infrastructure investments, increased new connections and coverage, improved the level of customer service and quality of water, lowered non-revenue water (NRW) by up to 50% and lowered water rates by 60% (ADB, 2008). Initially, Manila Water outperformed Maynilad, the latter eventually encountered financial problems and a change of ownership in 2007. To date, both companies are operating profitably and have increased their coverage to over 94% of their respective areas.

8.14.2.1.3 Manila Water

Manila Water is a joint venture between three companies with the Ayala Corporation holding majority control of the partnership. The other two are foreign companies namely International Water and Mitsubishi Corporation. Manila water won the bid in 1997 to operate the concession in the eastern half of Manila and nearby Rizal Province which consists of 23 cities and municipalities. It is tasked to supply water, manage the distribution system and improve and expand the east zone concession area up to 2037. The east concession area includes Mandaluyong, Marikina, Pasig, Pateros, San Juan, Taguig, Makati and parts of Quezon City and Manila. It also serves Antipolo City and the Rizal towns of Angono, Baras, Binangonan, Cainta, Cardona, Jala-Jala, Marong, Pilipia, Rodriquez Tanay, Taytay and San Mateo.

Manila Water is now providing 24 hour availability of water (99%) and compliance with water quality standards (100%) (MWSS, 2014). Part of Manila Water's mission is to improve the health and sanitation conditions of the low income communities. In addition to charging inexpensive rates and accepting flexible payment methods, it runs livelihood programs which are specifically designed to improve the lives of low income households and communities. Manila Water's Tubig Para Sa Barangay (TPSB) or "Water for the Poor" program, provides 24 hour supply of safe, affordable drinking water to low income consumers in greater Manila. To date, over 700 TPSB projects have been implemented serving 1.7 million people. It has also lowered the incidence of water borne diseases and improved the overall health and sanitation conditions. Part of the program is giving livelihood for community based cooperatives and engaging them as suppliers and service providers for some company requirements which so far as generated more than 17,000 jobs. Manila Water has also helped marginalised communities by installing washing facilities and drinking fountains in schools, hospitals, jails, markets and orphanages.

8.14.2.1.4 Maynilad

Maynilad is the water and wastewater services provider for the 17 cities and municipalities that comprise the West Zone of the greater Metro Manila area. In 1997, the company was granted a 25-year exclusive concession by the Philippine Government, through MWSS, to operate, maintain and invest in the water and sewerage system in Caloocan, Las Piñas, Malabon, Manila, Muntinlupa, Navotas, Pasay, Parañaque, Valenzuela, parts of Quezon City, a part of Makati; the cities of Bacoor, Cavite and Imus, and the municipalities of Kawit, Noveleta and Rosario all in the Cavite Province.

Maynilad went through a change of ownership on January 24, 2007, with the consortium of DMCI Holdings, Inc. (DMCI) and Metro Pacific Investments Corporation (MPIC) winning 84% of the water company's shares in a public bidding. Lyonnaise Asia Water Limited (LAWL) held a 16% share. The MPIC-DMCI consortium immediately worked on the financial and operational rehabilitation of Maynilad. In August of the same year, the consortium signed a prepayment and settlement agreement with Maynilad's creditors and MWSS. By January 2008, the new owners of Maynilad had already paid off the company's outstanding debts, which had then reached $240 million. An aggressive catch-up plan was also implemented to increase company revenue, improve water service operations, and drastically cut commercial losses.

Similar to Manila Water, Maynilad has its own social and livelihood program. It launched the Samahang Tubig Maynilad (STM) in May 2009 to address the problems of water inaccessibility and irresponsible water use in Maynilad's concession area. Under the project, residents of urban poor communities are organized and given training to manage the water supply delivery system in their areas. Initially implemented in year 2009 at Tondo, Manila, STM has since been extended to other areas of the West concession. As of 2012, there are now 12 STMs servicing 2,683 low-income families. Maynilad is also experimenting livelihood projects with the STM's such as the manufacture of Kapwa product line which includes hand soaps and sanitisers Maynilad also runs the Lingkod Eskuwela project intended for West Zone public schools that have no access to clean and portable water and involves the construction of drinking fountains, clean-up of water reservoirs or tanks and regular sampling of drinking water to check its quality. The project also conducts regular desludging of the school's septic tanks to ensure proper sanitation. In 2012 alone, drink-wash stations in 40 public schools were built, each with an upgraded design featuring child-friendly facts on water and the environment. Maynilad is also building rotary homes for the poor in Paranaque with a target of 1,500 units (Maynilad, 2013).

In terms of future supply and demand, there are plans to develop another significant water source for Metro Manila through the New Centennial Development Project currently being studied by MWSS. The new source will supply Metro Manila's future needs as well as expand into new areas including Cavite and Bulacan. However, this will only be operational from 2020. Until then, the Angat system will be critical to Metro Manila's water needs.

8.15 Gender Analysis

The gender analysis presented here is focused only on the source communities in Bigte and San Mateo. The intention is to analyze and understand the gender disparities between men and women, the causes and needs in order to help formulate relevant project interventions to address the disparities and promote equitable gender benefits. It uses the same sex disaggregated data from the Bigte / San Mateo socio-economic survey to extrapolate and analyze the differences in the situation of men and women in the community and existing gender inequalities and risks.

In terms of gender roles, the Filipino society traditionally assigned men to be the breadwinner and to women the role of the housekeeper and house maker although these gender roles and relations are changing especially where women are becoming an increasing contributor to family income. Women are increasingly joining the workforce because they are educated or are forced to work to make family ends meet because of the high cost of living.

Traditional gender roles mostly prevail in the rural areas where men cultivate the land and the rest of the family including women are involved in planting and harvesting crops. Women work in gardens and perform most of the domestic work including cleaning the house, preparing food, caring for the children, elderly and the sick, supervising school work, fetching water, washing clothes, family hygiene and sanitation. The burden of women's domestic role increases their time poverty denying them the opportunity to engage in other productive activities such as employment and microbusiness.

In urban areas, men work in construction and other heavy duty jobs and as drivers of passenger vehicles. Apart from being housekeepers, women also work as teachers, clerks, sales staff, owners of sari-sari stores, and marketer of produce and health care givers. However, they are not engaged in construction or any heavy duty jobs. In the urban areas, women are also marginalized by their time poverty. In professional work, gender lines are less important. Women attorneys, doctors and lawyers are found in the provinces as well as in urban areas.

The general lack of piped potable water for the residents of Bigte and San Mateo has only reinforced the burden of women's traditional role in the community. Women continue to spend a lot of their time and energy on water fetching which is inconvenient for the efficient and effective discharge of their domestic chores adding considerably to their time poverty and lack of economic empowerment.

In the surveyed areas, more males are working than females and income was higher for males than females. In terms of savings, no female households reported any savings compared to some male households that reported between Php 1,000 – 3,000 monthly savings. In this regard, it appears that there is a slight disparity between income of male and female headed households.

In terms of educational attainment, there were more female spouse who reached high school and college compared to men. Even as the male household head is the bread winner, the wife is consulted in major family decisions, particularly in the following: (i) who is to buy equipment (47%); (ii) when to renovate the house (50%); (iii) whether to give assistance to a relative or friend (52%); and (iv) who to join and involve in community projects (50%).

However, when it came to the management of the households, the wife was involved in: (i) monitoring of the activities of the children (75%); (ii) cleaning the house (65%); (iii) water collection and management (60%); garbage disposal (60.29%); and (iv) preparing food and meals (76.5%). In the conduct of household activities, both female and male children assist in the cooking, collecting water, washing clothes and other domestic chores.

Women are involved in entrepreneurial activities such as food vending, trading as well as managing sari-sari stores. These activities are often done concurrently with the household activities and women's free time in the afternoons before children return from school.

Some women are members of the women organization in their barangay. The women are organized at the site level then federated at the barangay level. The association is involved in credit program usually accessed by women members (51.74%). Another cooperative called CARD is also available for the capital needs of the women in San Mateo. Access to credit is not difficult as the women organization (KABALINGAY) and CARD are available as credit facilities for their members.

In community activities, the women attend the meetings as their husbands are at work. In San Mateo, majority of the more than 50 attendees during the public consultation were women. Some women are members of the barangay council as well as barangay officials. During consultation the women are happy to see potential livelihood activities during construction activities such as food vending, merienda as well as other economic activities. Construction labour employment is also seen to provide work for their husbands.

Issues that may affect women with regard to the project include the following: (a) The potential exclusion of the low income group/unskilled/women headed household from economic opportunities during construction and post project O&M; (b) The lack of access to clean piped water supply in San Mateo and Bigte especially among the low income communities/female headed households; and (c) Women and men may also be exposed to the threat of STD/HIV infection through the influx of external male construction workers and proliferation of adult entertainment venues.

8.16 Poverty and Social Risk Analysis

ADB's Strategy 2020 lends support to the implementation of the Philippines National Development Plan 2011-2016 which gives high priority to the accelerated development of national infrastructure including the water sector to promote economic growth, equitable development and poverty reduction. This commitment is reflected in the Philippines Country Partnership Strategy 2011-2016 which extends assistance to this key sector and is consistent with the key elements of ADB's Water Operations Plan 2011-2020 which supports the expansion and improvement of water delivery services, conservation of water and increased system efficiencies.

The project's targeting classification is general intervention (GI). AWTIP will ensure the continuity of water supply to Metro Manila's water concession areas benefiting its 14 million population including poor people and women. T It will support social inclusion and poverty reduction measures indirectly for the source communities through employment and income generating opportunities during construction. Poverty was observed as prevalent in the surveyed source community areas in terms poor quality houses and peoples poor living standards (includes hygiene and sanitation) especially along the public road corridor between Ipo Dam and Bigte Settling Basin which is parallel to the route of the new Tunnel 4. The sample socio-economic survey reported a poverty incidence of 30% which is reflective of the underdeveloped state of Bigte and San Mateo where economic opportunities and farming are limited constrained by the lack of water and the rugged hilly terrain and poor quality soil. The project also carries some social risks which could potentially marginalize and threaten the safety of source communities including the poor, women and children. The main poverty and social issues and risks that will need to be addressed during the project design are the traffic hazard during construction, health risks and the lack of employment and lack of economic opportunities in the area.

8.16.1 Low Household Incomes and Poverty Threshold

Bigte and San Mateo Barangays are part of the Bulacan Province which has a low poverty incidence of 4.8% in 2009 – the third lowest in the country. Annual per capita threshold for the Bulacan Province is Php 19,756 (NCB, 2012). For an average family of 5 household members, it should have an income of Php 7,705 per month to meet food and non-food requirements. The average annual per capita income of Bulacanyo's is Php 57,536 or Php 4,796 a month. This is well above the annual per capita threshold. However, based on the survey findings, Bigte and San Mateo have a much higher level of poverty due to the lack of economic opportunities in the area and peoples low income levels. The survey households with incomes of Php 8,000 or below a month represent about 30% of the total respondents. Out of the households living below the poverty line, 9% receiving the lowest monthly income of about Php 2000 – 4000 are represented by pensioners and self-employed such as micro-entrepreneurs, labourers, garbage scrap collectors. Given that per capita threshold for an average household is Php 7,705 a month, up to 40% of the people in Bigte and San Mateo have difficulty making ends meet. This group is the most vulnerable to negative socio-economic changes and shocks. There are a relatively higher proportion of households having an income of between Php 8,000 – 20,000 represented by 38.2% than those having P 20,000 and above comprising only 8.8%. Income of OFWs (Php 20,000 – 50,000) is larger compared to the regular employment from government and private sector (Php 12,000-20,000)

8.16.2 Poor Households

According to the survey, the proportion of poor families in the source communities is around 30% based on household incomes of Php 8,000 or less per month. The poor mostly live as informal settlers on public land along the tunnel ROW and public roads without any piped water supply, wastewater and solid waste collection and treatment services and proper sanitation. They either rent homes in squatter areas or have their own but without titles to the land they live. They typically dwell in makeshift and poorly constructed homes and some have been there since the 1930s while others have

been around for 10-30 years. Their houses are typically small and overcrowded but most have electricity connections. The project does not require the informal settlers on the ROW to be relocated. In Bigte and San Mateo, the number of poor households is growing as a result of natural growth and the increase in new migrants from other parts of the country. The project is likely to attract more people to move into the area in search of work and economic opportunities. The poor often experience poor quality water supply and water shortages. They face poor hygiene problems and high exposure to water borne diseases and infections.

8.16.3 Employment and Income Generation

Although the project will not address the clean piped water supply needs of the source communities in Bigte and San Mateo, it will however, bring significant economic spin-offs through employment in construction jobs for men and entrepreneurial activities for women. Since employment is scarce in the area, the competition for jobs both skilled and unskilled will be stiff among the locals and migrants from other parts of Bulacan and Philippines. The exclusion of low income households from employment and entrepreneurial activities for women and female heads is, however, possible. The project will include socially inclusive measures in the DMF for their equal participation such as targeted preferential employment for unskilled jobs during construction for locals and IPs as well as IEC campaigns on business opportunities for men and women. The IEC campaign will be coordinated by MWSS-OSP/PICs in collaboration with other partners including the civil works contractor, LGUs, DPWH, barangay councils, NGOs and local health authorities to inform locals and construction workers of the project's grievance redress mechanism, health and traffic risks and mitigation, employment and business/livelihood opportunities.

Ipo Dam Women owned Sari-sari Store, Ipo Dam

A squatter home on the tunnel 4 ROW, Segment 2 near Ipo Dam

8.16.4 Water Access and Affordability

The lack of access to clean piped water and the high water expense of the source communities is an important development constraint that contributes to the local poverty. The lack of clean water directly exposes people to water-borne diseases, lack of hygiene and sanitation problems. This reduces people's living standards and will add to their medical costs which they already cannot afford. In regards to supply, there was a strong demand from surveyed households for an improvement in the trucked potable water supply especially during the dry season. Although the potable water trucks visit 4-5 times a week, they wanted an increase in frequency and availability and a reduction in price. The increase in traffic could disrupt the regular delivery and reliability of potable water supply and the presence of hundreds of construction workers—which according to MWSS, it is expected that up to 300 construction workers will be employed, during the peak of construction—at the base camp at Ipo Dam will place additional burden on the water contractor's resources and obligations.

In terms of affordability, the source communities' water expense is much higher compared to Metro Manila residents who pay Php 175 (@ Php 35 per 200 litre drum) and Php 7.94 respectively for one 1 cu.m – a significant difference of P 167.06 (in other words, the people of Bigte and San Mateo are paying 22 times more for portable water). The high cost of water crowds out other essential family expenses such as basic food and non-food items and limits households' ability to save.

8.16.5 Traffic Disruptions and Safety Risk

The project will not physically displace people in the ROW but there will be major disturbance because of a significant increase in traffic in the area during the three years of construction, especially the movement of big trucks, machines and plants. The increased traffic during construction, although temporary, has been expressed as a concern by most of the stakeholders. Since the local public road is very narrow, winding and barely has two normal sized lanes, construction traffic is likely to cause traffic jams, delays and inconvenience to the general public undertaking their daily activities such as accessing basic social and health services, going to work, children going to school, marketing and pedestrian safety. The traffic nuisance can also drive customers away and cause losses to local businesses. Road safety risk will be heightened putting the safety of the travelling public and motorists in danger. Proper road signage, public awareness and safety driving training among the contracting companies and local residents will be required.

8.16.6 Other Social Risks

While there are no incidence of HIV/AIDs and human trafficking confirmed by the local health authorities and barangay tanods, there may be potential social risks involved during construction activities. Project construction will lead to significant labour migration into the Ipo-Bigte area by mostly men who will be involved in building the tunnel. The base camp will be at the Ipo Dam and at the peak of construction; up to 300 men will be employed. This situation presents the opportunity for the operation of beer houses and videoke bars in the area which can increase the consumption of alcohol and cause social problems for the workers and local people. Local people can be exposed to the contraction of STDs including HIV/AIDs through sexual contacts with workers. Other possible social risks for locals include gambling and drugs which may undermine the enjoyment of project benefits by the households. This may reduce take-home pay for workers compromising the financial needs of families.

8.16.7 Beneficiaries (Metro Manila / End Users)

The project beneficiaries or water end users in Metro Manila water concession areas stand to directly benefit from the continuity of the raw water supply to Metro Manila and the improvement in the integrity and security of the Angat transmission system once the rehabilitation to the old tunnels and aqueducts are completed. The protection of the integrity of the system is an insurance against the risk of a future collapse which will be catastrophic for Metro Manila residents. It will also restore the old transmission system to its full capacity hence augmenting additional water supply for the new expansion areas and for Metro Manila's future needs. For the people of Metro Manila, this means that the current benefits/utilities they receive from the Metro Manila water supply system will be maintained and not eroded. The continuation of portable water supply is beneficial to women and poor households. For the poor, the benefits include lower costs (lifeline water tariffs), cost savings and improved services and connections. Manila still has 3.4% of its population that live in areas that are difficult and expensive to connect. It also has poor people (64,404 households) with special needs in terms of piped water access and affordability but they are being taken care of by the two concessionaires social and livelihood programs.

8.17 Institutional Gender Analysis

The institutional assessment is covered in Section 10.0 of the DFR. It identifies the main institutions involved in the project's planning and implementation, and assesses their capacity to carry out their mandates and responsibilities under the project. The intention here, however, is to specifically assess the gender awareness and gender equality policies and practices of the concerned institutions and how they could contribute to addressing any perceived and reported gender disparities and risks. This analysis supplements section 10.0 of the DFR.

MWSS and CPF are the main institutions involved in the execution and implementation of AWTIP and will be assessed here. MWSS is the project EA / IA and owner of the new tunnel while CPF will manage, operate, maintain and renew it as part of the Angat transmission system under its CPF mandate. Under the Concession Agreements, MWSS and the two concessionaires have entered into a joint venture agreement for the latter to jointly share in the responsibilities and liabilities with regard to the operation, maintenance and renewal of the common purpose facilities which includes the Angat/Ipo Dams, transmission tunnels, aqueducts, Bigte settling basins, La Mesa reservoir and the La Mesa and Balara treatment plants and related facilities. Maynilad and Manila Water are excluded from the analysis because they are not involved the AWTIP implementation and management, albeit they are indirectly linked to the project as joint venture partners under CPF.

8.17.1 MWSS

MWSS is a government owned and controlled corporation, established in 1971 through the Republic Act 6234, responsible for water and sewerage in Metro Manila. In 1997, operational services were awarded to the two concessionaires under a 25 year concession which have been extended for another 15 years to 2037. The two concessionaires are responsible for the operation, maintenance and investments in water and sewerage systems while MWSS remains the owner of all assets.

Following the privatisation, MWSS was reorganised into a regulatory arm led by the Chief Regulator and a corporate arm led by the Administrator. The MWSS Regulatory Office monitors the concessionaires and sets tariffs. The MWSS Corporate Office is the legal owner of the water and sewerage assets and plans and implements water projects and loans. A gender review of MWSS confirmed the following information about the entity:

- It has a total of 123 staff.
- Gender ration is closed to equal with 66 men (53%) and 57 women (47%).
- In a board of 6 people, 5 are men (83%) and 1 woman (17%).
- In a management team of 18 people, 9 are men (50%) and 9 are women (50%).
- In the finance, professional, technical / engineering and O&M divisions, there is gender balance of 50/50.
- MWSS does not have any internal formalized gender policies but it is compliant with the Civil Service Commission Laws and Regulations gender equity and equal opportunities.
- Gender activities and practices are coordinated by a Gender and Development (GAD) Committee. It partially applies the Philippine Government's policy to dedicate 5% of its annual organizational budget for GAD activities.
- Gender awareness is not formally promoted within the organization.

Based on the above statistics, MWSS has an exceptional gender profile that has been accomplished without a formal gender policy framework. MWSS is strong on giving women and men equal opportunities. Perhaps the only areas that need improvement are for MWSS to: (i) formally adopt a company gender policy; (ii) promote gender awareness across the company; and (iii) build capacity and train staff on gender analysis and gender mainstreaming.

MWSS will set up internally the OSP to manage AWTIP similar to what it did for AWUAIP, Phase 2 completed in 2012. However, it will need to assign a staff member with social development/gender

expertise to strategize, plan, implement, monitor, evaluate and report on the project's social development, poverty and gender measures and targets, results and impacts. The person will have to work in partnership with NGOs, LGUs, Project Consultants and other stakeholders and will be monitored by an external expert to be hired on an intermittent basis.

8.17.2 Common Purpose Facility

The CPF is responsible for the operation and maintenance of the common purpose facilities which includes the Angat / Ipo Dams, Angat transmission system, Bigte Settling Basin, pumping stations, La Mesa Reservoir and water treatment plants in La Mesa and Balara. It is a non-incorporated joint venture between the two concessionaires, Manila Water and Maynilad and draws its personnel equally from these two companies.

A gender review of CPF confirmed the following information about the entity:

- Total Staff: 29
- Gender ratio: male, 26 (90%) and females 3 (10%)
- Executive Committee of 4 members: 3 men (75%) and 1 women (25%)
- Management is entirely male (100%)
- The occupations cadres are predominantly O&M (22) with 10% women.
- It has no official gender policy and zero gender awareness.

The above information clearly shows that gender inequality exists in CPF and is not helped by the absence of an official gender organizational policy and management commitment. Only 10% of the staff are women. The organization has the potential to increase the number of women employed in management and the professional cadres but since it is a private entity, the opportunity for such intervention is limited.

8.17.3 Other Concerns

In connection with the institutional gender concerns and the implementation of WSRAMP, some related but pertinent questions need to be raised about MWSS and CPF's technical capability to ensure the effective asset inventory management and systematic maintenance. This issue was not fully addressed in Section 10.0. The institutional analysis had stated, (para 10.3.3) based on MWSS's experience with the construction of Aqueduct 6, that MWSS has limited capacity for handling the procurement process in compliance with ADB requirements, international bidding and evaluation of tenders and implementing design and construct contracts. It had to rely on a hired consultant for this expertise. MWSS has again relied on a similar consultant for AWTIP's project preparation, procurement and implementation.

The interview with the MWSS management confirmed that the organisation has weak capacity in asset inventory management and monitoring the asset maintenance obligations of CPF in relation to the Angat water transmission system and treatment plants and the two concessionaires in relation to the Metro Manila water supply distribution system. MWSS management revealed that its multimillion dollar water supply infrastructure assets have not been well maintained before and after privatisation in 1997 which is attributed to its inability to effectively monitor CPF and the two concessionaires.

Upon reflection, this point raises the important question whether MWSS has the capacity to implement the WSRAMP in collaboration with CPF and the two concessionaires. MWSS indicated that CPF was responsible for the implementation of WSRAMP and its common facilities O&M obligations but MWSS has limited capability to play this role effectively.

Given the criticality of the Angat water transmission system to the vitality of more than 14 million people in Metro Manila, it is clear that O&M for the transmission system must be improved and

prioritised. This is a well justified and an important focal area to target for improving and strengthening MWSS's future operation in asset maintenance and management. It is consistent with MWSS's 2011 Water Security Legacy Plan which aims to promote infrastructure management, protection and efficiency and lists Angat-Umiray raw water transmission improvement as a key project.

Similarly, CPF has been neglectful in carrying out O&M of the Angat transmission system in the past 16 years which now needs significant rehabilitation to ensure the future security and integrity of the Metro Manila water supply. For example, questions have been raised as to why CPF has not addressed the problems of illegal usage, damaged appurtenances and general lack of maintenance and there are no standard operating and maintenance procedures (SOP). The lag is attributed to several factors including CPF's lack of capacity for O&M and the lack of clear demarcation of roles and responsibilities for O&M between MWSS and CPF. There is no reason why improved O&M cannot be carried out by the CPF joint undertaking. The two concessionaires that make up CPF have the capability, as evidenced by the improvement of their respective water treatment and distribution system and the reduction in NRW from 60% to below 40%.

The high risk associated with the lack of O&M does make a very strong business case to broaden AWTIP's scope and design to include capacity building for the effective implementation of WSRAMP as a separate project output. From an investment and asset management perspective, it would be imperative for MWSS to go down this path at this stage to ensure a turnaround in the maintenance and protection of its current stock of expensive water infrastructure assets and the hundreds of millions of dollars in planned future water sector investments.

8.18 Project Design Measures & Risk Mitigation

A project design measures matrix is presented below (Table 8-6). It lists the beneficiary enhancement design measures and targets to address the social, poverty reduction and gender issues that were identified in the source and beneficiary communities.

Table 8-9 Project Design Measures

Project Impact, Issues and Risks	Proposed Design Measures	Responsibility
Poverty Reduction and Social Inclusion		
Potential exclusion and marginalisation of people in the source communities from fully benefitting in the project's construction employment.	Prioritise locals including IPs in temporary construction employment, targeting 50% of unskilled jobs.	MWSS-OSP/Contractors
Institutional Capacity Building and Gender		
MWSS demonstrates gender sensitive practices. However, it needs institutional gender strengthening and capacity building through the promotion of gender awareness and the formalisation and implementation of a company gender policy.	Promote gender awareness and training across the company targeting the OSP and other project planning and implementation functional departments and adopt and implement a company gender policy	MWSS-OSP

Based on Table 8-9 above, Table 8-10 below presents the risks and risk mitigation measures proposed to be included in the Risk and Mitigation Management Plan.

Table 8-10 Risk Mitigation and Management Plan

Risks	Mitigation Measures	Responsibility
Traffic increase in the source communities during construction will cause traffic jams, delays and inconvenience to the general public undertaking their daily activities and posing serious road safety risks for the travelling public and local motorists.	Ensure proper traffic route planning and management, and proper road signage, public awareness and safety driving training among the contracting companies and local residents will be required.	MWSS-OSP / DPWH / Contractor
The increase in traffic could disrupt the regular delivery and reliability of trucked potable water supply and the presence of hundreds of construction workers at the base camp at Ipo Dam will place additional burden on the water contractor's resources, operations and supply capacity.	Implement plans with future demand projections and procurement/supply strategies to ensure that the trucked potable water contractor can capably manage the consistent supply of adequate and reliable water for the source community during project construction and the annual dry season.	MWSS-OSP / DPWH / Contractor
Need to raise awareness for local men and women on the potential business/livelihood opportunities that will be generated during project construction and how they can be meaningfully involved.	Include in the communication strategy (in partnership with local women's NGOs and financial credit agencies) an awareness program targeting men and women in Bigte and San Mateo to inform them of the business/livelihood opportunities that will be generated during project construction and how they could participate and benefit from it.	MWSS-OSP / Women's NGOs, local micro-credit schemes / Credit Cooperatives, KABALINGAY and CARD
Women and children are at high risk from the increased traffic hazard during project construction.	Ensure that road traffic plans and management initiatives take into account the needs and concerns of women and children to ensure their safety and protection.	MWSS-OSP / DPWH / LGUs / Contractor / Barangay Councils
Risk exposure of source community residents, particularly women, to STDs/ HIV/AIDs, drugs, gambling and alcohol abuse through the influx of external construction workers and the proliferation of adult entertainment venues.	Include in the communication strategy and the Project Implementation Consultant's (PICs) contract the implementation of public awareness and training for the source communities and contract workers on the risks of STDs and HIV/AIDS and responsible sexual behaviour.	MWSS-OSP / LGUs / Barangay Councils / Contractors / Rural health Unit and Barangay Health Stations

8.19 Implementation, Monitoring and Evaluation

The OSP within MWSS (EA / IA) will coordinate and manage the implementation of AWTIP. It will be responsible for the implementation of the social inclusion, poverty reduction and gender equality measures and targets that are listed in Section F of the RRP on Risks and Mitigation Measures. OSP will have experts nominated from within MWSS to manage different components of the project. The OSP will assign a social/gender expert to coordinate the social development and gender strategizing, planning, implementation, monitoring and reporting under the supervision of an international social/gender specialist (intermittent). Internal monitoring will be undertaken by the EAs/IAs and the OSP social development and gender specialist. They will develop sex disaggregated data to feed into the project's monitoring and regular progress reports, mid-term review and PCR.

9 Environmental Due Diligence

The project components will be located in Barangay San Mateo and Barangay Bigte of the Municipality of Norzagaray.

The environmental due diligence was undertaken on all associated project facilities such as the inlet and outlet of the tunnel and the proposed disposal sites as well as the contractors work areas and access roads. The proposed alignment of Tunnel 4 was divided into 1km segments from the Ipo dam site to the MWSS compound at Bigte. A Rapid Environmental Assessment (REA) was undertaken on each segment.

9.1 Compliance with National Regulatory Framework

The environmental laws provide the background for determining the main issues that should be considered during the environmental appraisal process. Environmental regulations, standards and guidelines provide practical information concerning emission limits, permitting requirements, pollution abatement and control techniques and equipment. Best management and operational practices are required to be followed.

The Philippines has established environmental laws, and regularly updates its environmental policies, implementing rules and regulations.

The inlet is at the edge of the indicative boundaries of the Angat Watershed and Forest Range (pilot) which is considered as an initial component of a Protected Area (PA). This means that the watersheds were proclaimed as such prior to the gazetting of the NIPAS Act. The Angat Watershed and Forest Range is currently managed jointly by MWSS and the DENR. The Protected Area Management Board (PAMB) has not yet been established for the Angat Watershed and Forest Range (pilot).

The project will be required to secure an Environmental Compliance Certificate (ECC) issued by the central office of the Environmental Management Bureau (EMB-DENR) in compliance to Philippine EIS System. The ECC is also required by MWSS for any construction project within the watershed of its jurisdiction. A certificate of PA coverage should also be secured from DENR Region 3 Office to confirm that the inlet site is within, or outside of, the PA.

9.1.1 Environmental Impact Assessment

The 1987 Philippine Constitution, Section 16, Article II and Section 15 is the basic framework for the Philippine's Policy on Environment which states that "The State shall protect and advance the right of the people to a balanced and healthful ecology in accord with the rhythm and harmony of nature. The state is mandated to protect and promote the people's right to health."

The Philippine EIS System is set out in the Presidential Decree 1586. The Department Administrative Order (DAO) 2003-30 was issued to further rationalize the EIS System and to support the processes for its implementation. The Revised Procedural Manual for DAO 03-30 does not cover tunnels for water supply projects.

A Project Description Report was submitted to DENR for their review and classification, which will confirm the type of EIA document required for the acquisition of an Environmental Compliance Certificate.

9.1.2 Other Applicable Regulations

Other legal environmental issuances most relevant to the project are presented in the following table.

Table 9-1 Relevant Legal Environmental Issuances

Law / Regulation / Guideline	Year	Relevant provisions	Remarks
Protected area management			
Republic Act No. 7586 The National Integrated Protected Areas System (NIPAS) Act	1992	Proposals for activities that are outside the scope of the management plan for protected areas (PAs) shall be subject to an EIA before they are adopted, and the results thereof shall be taken into consideration in the decision-making process. An EEC is required prior to the actual implementation of such activities. When allowed to undertake activities, the proponent shall plan and institute measures to minimize any adverse effects and take preventive and remedial action when appropriate.	Although the Project is within a PA classified as initial component, the NIPAS may not be applicable because the Ipo watershed does not have an organized Protected Area Management Board (PAMB) for the watershed PA. The MWSS ROW is included in the management plan of the Angat Watershed Reserve and Forest Range (Pilot), a protected area. Nevertheless, the Project will secure an ECC in compliance to the Philippine EIS System.
DENR Administrative Order No. 17 Rules and Regulations Governing Special Uses within Protected Areas	2007	A Special Use Agreement in the Protected Areas (SAPA) may be issued within PAs except in strict nature reserves and shall be confined only to the management zones of the PA appropriate for the purpose.	Issuance of SAPA is currently suspended. DENR Region 3 has advised that a Memorandum of Agreement (MOA) is applicable for the Project. An initial draft MOA between the National Power Corporation (NPC), MWSS and DENR has been drafted by DENR and the Consultant on 7 November 2013. Copy has been forwarded to MWSS for its review. It is aimed to secure this MOA promptly.
DENR Administrative Order No. 26 Revised Implementing Rules and Regulations of the NIPAS Act	2008	Prohibited acts within protected areas includes: (1) destroying and disturbing plants or animals; (2) dumping of wastes; (3) destroying objects of natural beauty or of interest to cultural communities; (4) damaging roads and trails; (5) squatting or occupying any land within; (6) constructing structure without permit; (7) leaving the PA in unsanitary conditions with refuse, debris or depositions in water bodies; and (8) removing or destroying boundary marks or signs.	Project will be implemented within the MWSS ROW. Appropriate measures are recommended I the EMP to ensure such prohibited acts are prevented during construction and operation.
Technical Bulletin No. 2013-01: List of Protected Areas Under NIPAS System	2013	Lists the Angat Watershed and Forest Range (Pilot) among the PAs under the NIPAS.	This has been considered in the feasibility study.
Tree-cutting			
Executive Order No. 277, Amending Secion 68 of the PD No. 705 (Revised Forestry Code)	1987	Watershed reserves are included under forest lands in the Revised Forestry Code. Cutting of trees in forest lands without license is a criminal offense.	Tree-cutting permit is not necessary when cutting trees of common species.

Law / Regulation / Guideline	Year	Relevant provisions	Remarks
DENR Administrative Order No. 21 Revised Guidelines on the Issuance of Private Land Timber Permit/Special Private Land Timber Permit	2000	Tree-cutting permit is required for cutting premium hardwood. Same permit is not required for trees of common species.	Some trees need to be cleared to give way to the construction activities. Some of the affected trees at the outlet area would qualify for a permit. As such, a tree-cutting permit is necessary.
Executive Order (EO) 23 dated 1 Feb 2011 Moratorium on cutting of timber in natural and residual forests	2011	The DENR is prohibited from issuing tree-cutting permits in all natural and residual forests nationwide, except for clearing of ROW by DPWH, site preparation for tree plantations, silvicultural treatment and similar activities, provided that logs derived from the cutting permits shall be turned over to DENR for proper disposal.	Exemptions may be considered if project is a priority by Government of the Philippines (GOP).
Health and Safety			
DOLE Department Order No. 13 Guidelines governing occupational safety and health in the construction industry	1998	Provisions on safety rules, including rules in working at hazardous workplace.	This is considered in the EMP.
DOLE: Occupational Safety and Health Standards (as amended, 1989	2013 May	Provision on duties of employers, workers and other persons, safety rules, including rules in working at hazardous workplace.	This is considered in the EMP.
IRR of RA 8294 dated 06 June 1997		Permit for the use of explosives.	This is considered in the EMP.

Four environment-related clearances/agreements/permits/licenses have emerged as requisite documents to be secured prior to Project implementation, i.e., prior to the issuance of Notice of Award or Notice to Proceed as shown in Figure 3. These are:

- ECC, which will require the submission of an EIS that is prepared and submitted for approval to the DENR Environmental Management Bureau (EMB) Central Office following the EIA process described in Table 2. An ECC will be required prior to Notice of Award. An ECC or proof of submission of the Project EIS to the EMB Central Office for processing is a requisite document for ICC clearance/NEDA Board approval for the Project loan. Proof of submission of EIS to the EMB Central Office for processing is a requisite document for the application of a tree-cutting permit.
- MoA among MWSS, NPC, and DENR in place of SAPA as advised by DENR Regional Office 3 (Appendix 8). This will be required prior to the submission of the EIA to EMB Central Office for processing. A draft MoA prepared jointly by DENR and Consultant has been forwarded to the MWSS for review on 7 November 2013 and consequently forwarded to NPC by MWSS. The MOA will be attached as supporting document to the application of the tree-cutting permit by MWSS.
- Tree-cutting permit, which will be secured from DENR RO3 by MWSS as the authorized land user of MWSS ROW. This will be applied for only when the EIS has been submitted to the EMB Central Office for processing; but should have been secured prior to Notice of Award.

According to DAO 2000-21, the following documents will be required: (i) letter application; (ii) sketch map of area applied for; (iii) development plan, if application covers 10ha or larger with at least 50% of the area covered with forest trees; (iv) endorsement from any of the following LGU officials, namely: concerned Barangay Chairman, Municipal/City Mayor, or Provincial Governor; and (v) inventory fee based on existing regulations. DENR RO3 advised that the MOA among MWSS, NPC and DENR will be attached to the application as supporting document. In addition to the application requirements, a 100% timber inventory needs to be undertaken by registered forester/s of Region 3 in accordance with the guidelines set in Section 6 of DAO 2000-21. A proof of submission of the Project EIS to the EMB Central Office for processing will be used as basis for permit issuance.

- License to use explosives in construction, which shall be secured from the Philippine National Police (PNP) by the Contractor (Purchaser License) and his chief blaster (Foreman Blaster License). This can only be applied for after Contractor has received the Notice of Award but should have been secured prior to Notice to Proceed. Application shall be addressed to the Chief, PNP through the Chief of the Fire and Explosives Division (FED). Processing period for both licenses is 15 working days.

9.2 ADB Guidelines on Water Supply Projects

ADB classifies the project as category B. The Rapid Environmental Assessment provided in the Environmental Assessment Guidelines (2003) was the basis for determining the category of the project. The details of the REA is presented in the Annex.

9.3 PCRs and Protected Area

The physical cultural resource[2] (PCR) near the MWSS tunnel ROW is the Pinagrealan Cave. This is near the Bigte segment and is about 450 m north of the tunnel ROW. It is a declared historical landmark by the National Historical Commission of the Philippines. The local government of Norzagaray also recognizes its historical and tourism importance[3]. The application to have the cave gazetted as a protected area under NIPAS (National Integrated Protected Area System) is ongoing.

The tunnel inlet at the Ipo Dam segment is within the indicative boundaries[4] of Angat Watershed Forest Reserve, Angat Watershed and Forest Range (Pilot) and the Ipo Watershed. The Angat Watershed Forest Reserve which covers about 55,707 ha is managed by NPC[5] while the lower portion of the reserve, the Angat Watershed and Forest Range (Pilot) and the Ipo Watershed, is managed by MWSS[6]. The Angat Watershed Forest Reserve and the Angat Watershed and Forest Range are considered protected areas under RA 7586 or the NIPAS Act[7].

It was noted at the time of visual inspection that much of the accessible areas of the forest are now degraded and there are many areas where bamboo is dominant. A reforestation program initiated by MWSS is ongoing. The areas to the south towards Bigte, are covered with sparse scrub and grassland.

The Ipo dam facilities and infrastructures are located at the boundary of the watersheds and are fully operational.

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[2] Physical and cultural resources are defined as movable or immovable objects, sites, structures, groups of structures, and natural features and landscapes that have archaeological, paleontological, historical, architectural, religious, aesthetic or other cultural significance. PCRs are important as sources of valuable scientific and historical information, as assets for economic and social development and as integral parts of a people's cultural identity and practices.

[3] This was included in Norzagaray CLUP 2011-2020

[4] The boundaries of the watersheds are in the process of validation according to DENR-Protected Areas and Wildlife Bureau.

[5] The Angat Watershed Forest Reserve was proclaimed watershed forest Under Proclamation 71 dated 27 March 2010.

[6] The Angat Watershed and Forest Range (Pilot) was proclaimed a watershed forest reserve under Proclamation 391 dated 30 April 1968. It covers about 6,600 ha.

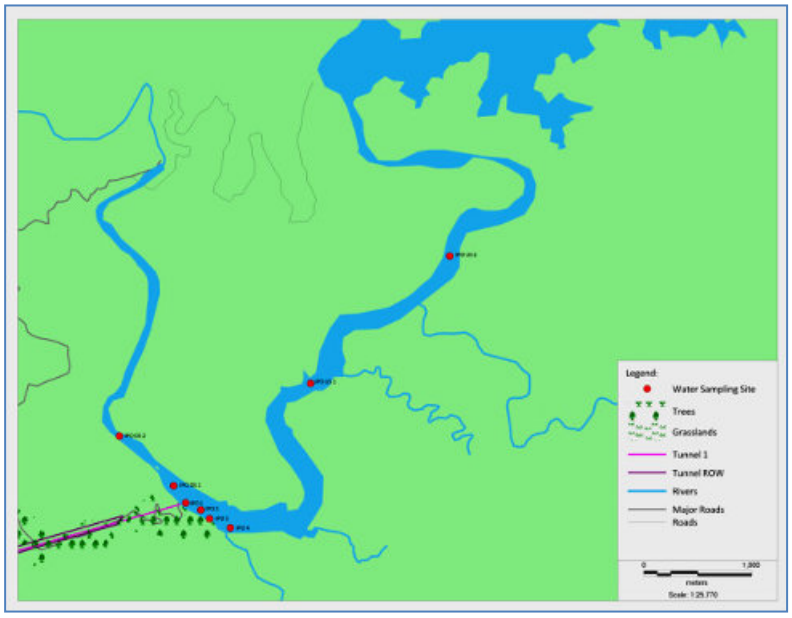
[7] Protected Areas and Wildlife Bureau, Technical Bulletin No2013-01 dated January 10,2013

9.4 Water Quality of Angat Upper Reach

The Angat Upper Reach, which encompasses Angat dam to Ipo dam, is classified as class B fresh surface water. This means the river is suitable for primary contact recreation such as bathing, swimming, skin diving etc (particularly those sections designated for tourism purposes).

Water quality sampling and rapid site assessment was undertaken on 22 May 2013. Water samples were collected from 8 sampling points (see Figure 15).

Figure 15 Water quality sampling stations



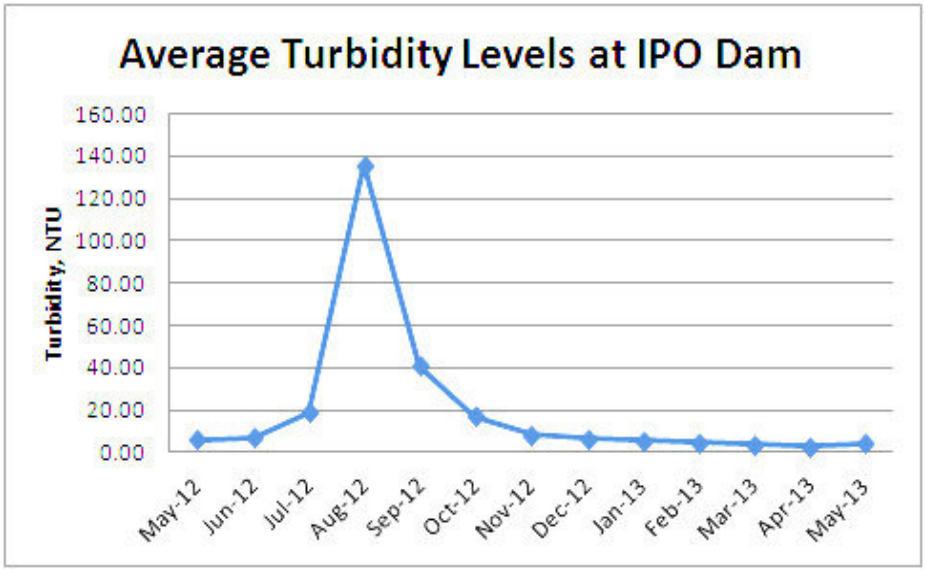
In situ tests and laboratory results show that the water quality is within the class B standards for fresh surface water. Elevated faecal and total coliform counts were observed at the Ipo dam site and downstream of Ipo dam. This can be attributed to the settlements found near the dam site and downstream of the dam.

Table 9-2 Water quality of Angat Upper Reach

Parameter, mg/L (unless stated)	Adopted Criteria	Reference	IPO US 2	IPO US 1	IPO 4	IPO 3	IPO 2	IPO 1	IPO DS 1	IPO DS 2
Physical Characteristics										
Temp (°C)	3 (monthly max rise)	DAO 90-34	27.55	28.75	32.17	28.33	30.80	30.95	31.30	31.30
Salinity (%)			0.09	0.09	0.10	0.09	0.09	0.10	0.10	0.10
Electric Cond. (mS/cm)	-		135.15	135.65	154.83	138.40	147.47	149.90	151.70	151.65
Turbidity (NTU)	-		1.89	2.33	113.60	16.00	32.73	44.05	5.14	6.41
TDS			85.72	84.98	96.41	86.69	92.06	93.31	94.58	94.58
Inorganic and nonmetallic constituents										
pH	6.50-8.50	DAO 90-34	7.83	7.84	8.06	7.90	8.12	7.86	8.32	8.47
Nitrogen (as NO_3^-)	10	DAO 90-34								
ORP (mV)			216.50	235.50	265.33	242.00	234.50	229.50	212.00	190.50
Organic and biological constituents										
Faecal Coliform (MPN/100mL)	200	DAO 90-34	27.00	70.00	350.00	110.00	350.00	170.00	130.00	350.00
Total Coliform (MPN/100mL)	1000	DAO 90-34	540.00	350.00	3,500.00	16,000.00	3,500.00	3,500.00	1,600.00	9,200.00
Heavy metals										
Antimony (Sb)	-		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Arsenic (As)	0.05	DAO 90-34	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium (Cd)	0.01	DAO 90-34	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
Copper (Cu)	0.05	DAO 90-34	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Lead (Pb)	0.05	DAO 90-34	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Mercury (Hg)	0.002		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Nickel (Ni)	-		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Vanadium (V)	-		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Zinc (Zn)	-		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Bromide			4.10	2.00	2.50	1.60	2.50	6.70	2.50	1.60

The turbidity levels at Ipo dam are presented in Figure 16.

Figure 16 Turbidity levels at Ipo dam



The turbidity levels at Ipo dam increase during the wet season. This is mainly attributed to erosion due to degraded forests in the area, which has resulted in significant siltation in both the Angat and Ipo reservoirs.

9.4.1 Ground Water

Information on the level of ground water in the project area is very limited. Communities obtain their drinking water supply from the local water district, distributed by water trucks.

Ground water wells registered at the National Water Resources Board (NWRB) include 2 Norzagaray Water District wells in Partida and Matictic, with 31.95m and 8.11m water levels respectively.

Table 9-3 Depth of water table in borehole

Borehole No.	Location	Drilled depth	Depth to water table	Remarks
BH-1	River hole. Bedrock not reached	16	-	River hole; No measurement of water
BH-1A	River hole. Bedrock reached	25	-	River hole; No measurement of water
BH-3	Tunnel	25	15.10	-
BH-4	Tunnel	45	4.5	-
BH-4A	Tunnel	40	15.5	-
BH-5	Upstream, Tunnel Outlet Portal	30	-	Hole dry
BH-6	Tunnel Outlet Portal	20	8.45	-
BH-7	Connecting Channel	16.5	-	Hole dry
BH-8	Connecting Channel	12	9.5	-

It is anticipated that additional study will be done at some time in the future to verify the current data.

9.5 The Tunnel ROW and Project Components

The alignment of the proposed Tunnel 4 is required to be within the existing tunnel ROW. It will be constructed to the south of, and adjacent to Tunnel 1, and located at the edge of existing tunnel ROW of MWSS.

9.5.1 The Segments of the ROW and Project Components

There is a Dumagat population at IPO watershed and a portion of the Angat Watershed, which is a proclaimed protected area. There are no Indigenous People who will be affected by the proposed project.

The study of the ROW of the proposed tunnel was undertaken in segments. Each segment was about one kilometre in length, and extended from the IPO dam site to Bigte. The following describes the characteristics of each segment of the ROW.

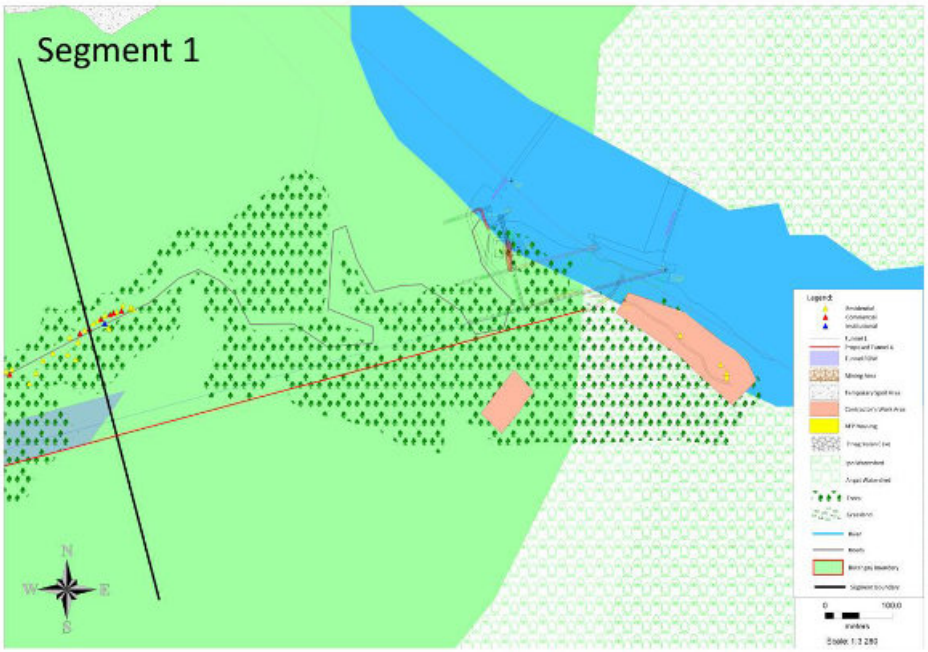
Segment 1: IPO dam site

The Ipo dam site is enclosed with a concrete fence. The existing ROW starts at the gate of MWSS Ipo dam site and continues in the direction of Bigte.

The vegetation in segment 1 includes various dipterocarps such as acacia, mahogany, gemilina and narra, but is dominated by domesticated trees, shrubland and agroecosystem crops and associated weeds. The underlying rock is agglomerate/basalt. The proposed tunnel will be at 100-200 metres below ground (mbg). Existing buildings and facilities of the Ipo Dam are within the indicative boundaries of Angat Watershed Forest Reserve, Angat Watershed and Forest Range and Ipo Watershed.

Project components during the construction phase, such as contractor's work area and temporary spoil area, may be located at this segment. A potential temporary spoil disposal site of about 3ha barren land is owned by a private individual.

Figure 17 Segment 1 ROW



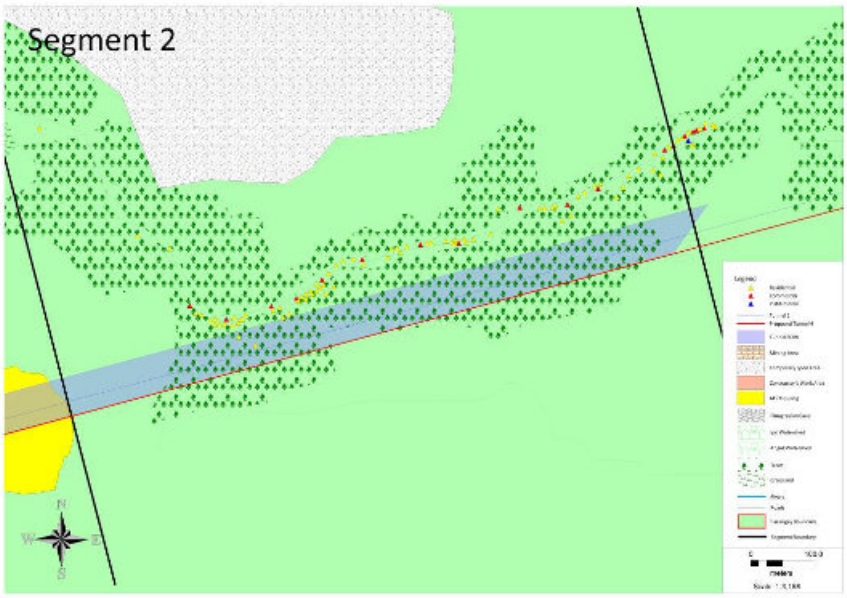
Segment 2: San Mateo rolling terrain

The MWSS tunnel ROW runs through the rolling terrain of San Mateo. The vegetation cover is predominantly grassland. Coconut, acacia, ipil ipil are some identified trees in the area. Fruit-bearing trees such as banana, coconut, jackfruit, kamias, star apple and pomelo can be found in the area. Low-lying plants, shrubs and bamboo are observed in the area.

The proposed Tunnel 4 will be at 125-200mbg. The underlying rock consists mostly of agglomerate/ basalt.

Temporary spoil disposal at this segment has been considered. However, the area is currently used as rice paddy and for agro-forestry and is therefore not favoured for spoil disposal.

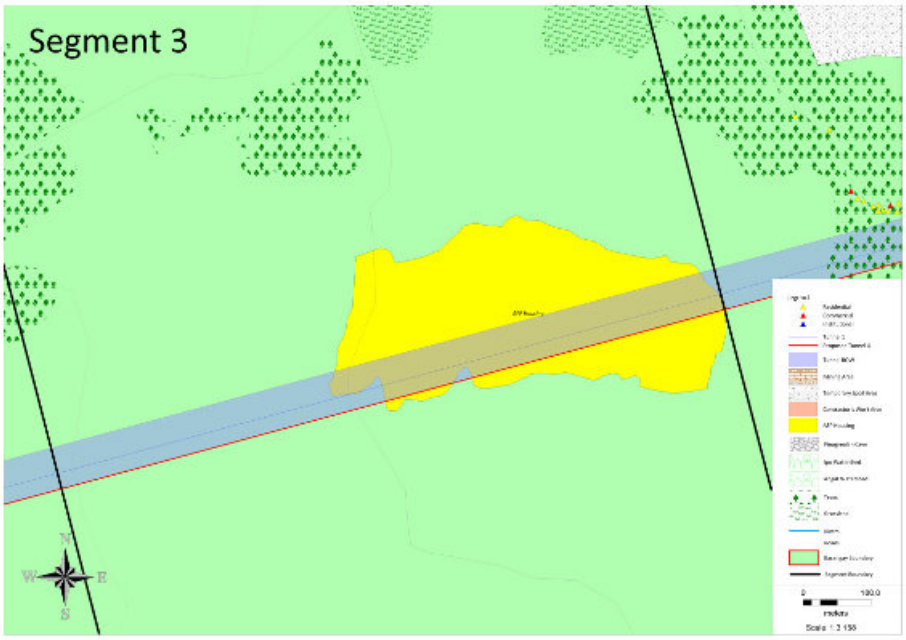
Figure 18 Segment 2 ROW: San Mateo rolling terrain



Segment 3: AFP housing

The majority of this segment of the tunnel ROW is grassland. The tunnel ROW at this segment is about 500m south of the road above. It traverses underneath the housing project for the Armed Forces of the Philippines (AFP). The vegetation cover is mostly grassland. The tunnel at this segment is about 100-125 mbg. The underlying rock is principally alagao volcanics and a fraction of agglomerate.

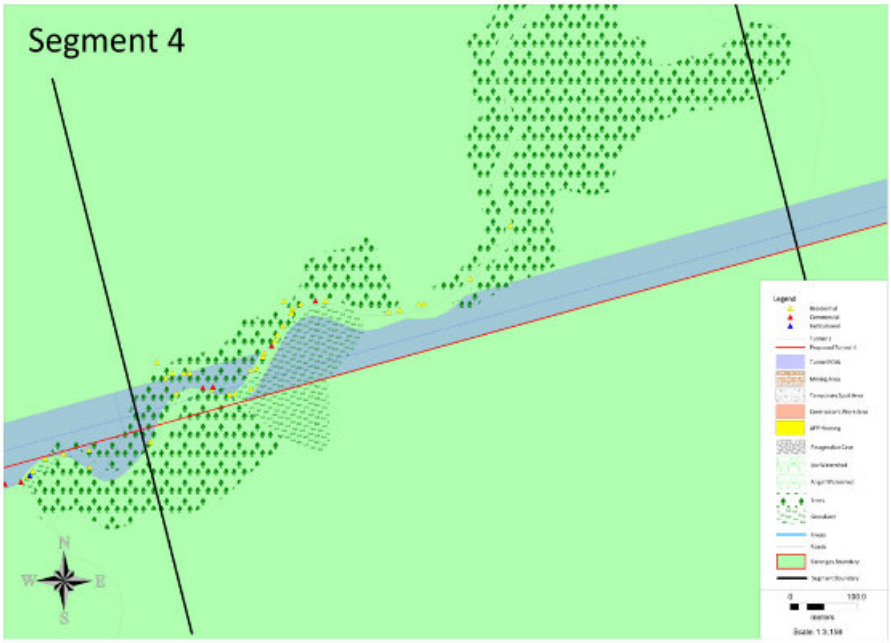
Figure 19 Segment 3 ROW: AFP housing



Segment 4: San Mateo grassland

The tunnel ROW in this segment is initially to the south of the road above, but ends directly below it. The majority of the area is grassland. Some is vegetated with trees, mostly banana, coconut, ipil, papaya. The tunnel at this segment is about 100-125 mbg. The underlying rock is alagao volcanics.

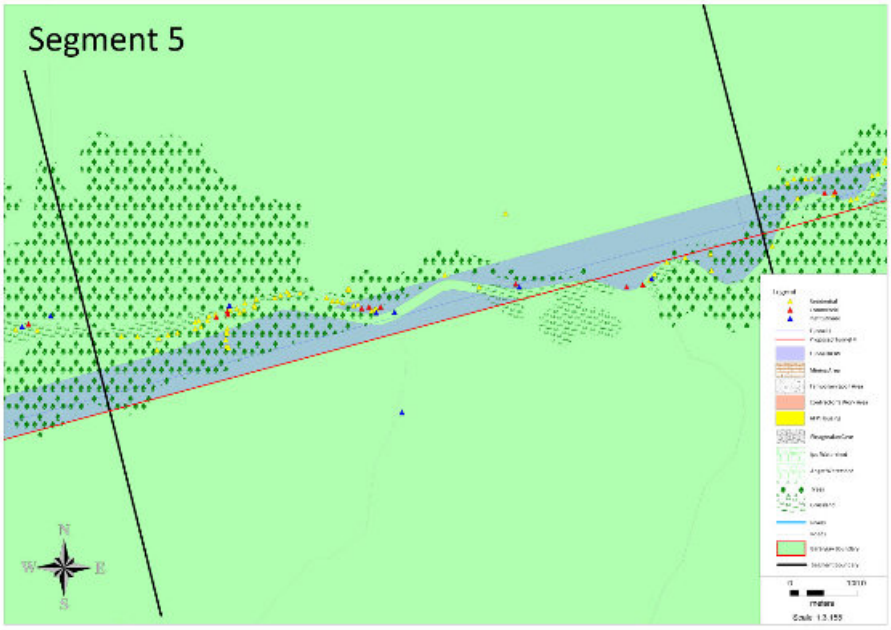
Figure 20 Segment 4 ROW: San Mateo grassland



Segment 5: road ROW

The majority of the tunnel ROW at this segment follows the road above, with the rest traversing the rolling terrain of San Mateo. Grassland area is predominant. The vegetation in areas near the road includes banana, mango, coconut, corn and santol. The underlying rock is alagao volcanic, and the proposed tunnel is estimated at 100-125 mbg.

Figure 21 Segment 5 ROW: Road ROW

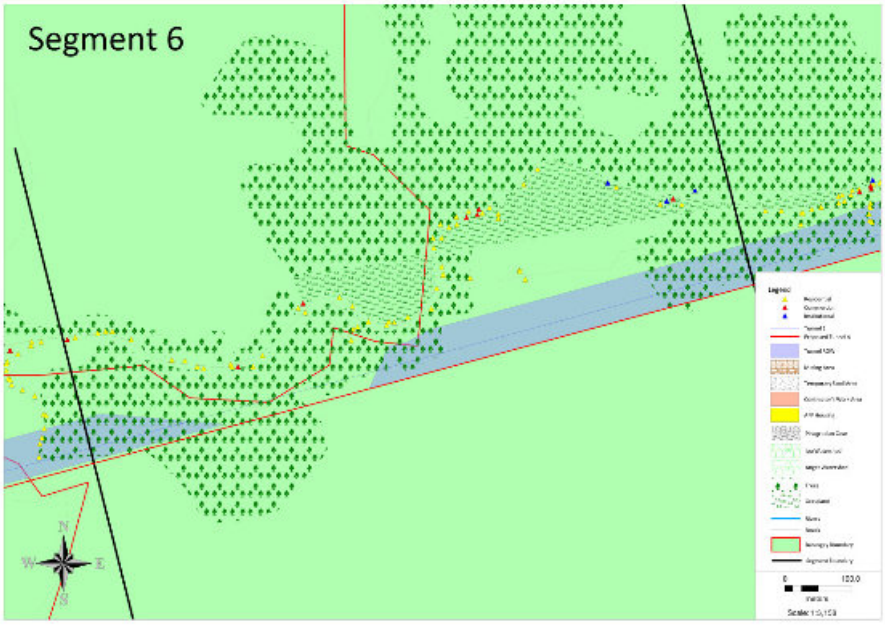


Segment 6: grassland

The tunnel alignment does not fall completely within the MWSS ROW in this segment. There is a small section that is not delineated as MWSS or Road ROW. This 70m section lies outside the tunnel ROW. The distance from the boundary of the ROW to the edge of Tunnel 4 ranges from 3.2m to 2.64m at the downstream end near Bigte. It should be noted that Tunnel 1 does not lie at the centre of the tunnel ROW.

Like the other segments, grassland area is predominant. Vegetation cover includes coconut, cacao, banana and corn. The underlying rock at this segment is composed of limestone with a majority of alagao volcanics. The tunnel is about 50-100 mbg.

Figure 22 Segment 6 ROW: Grassland



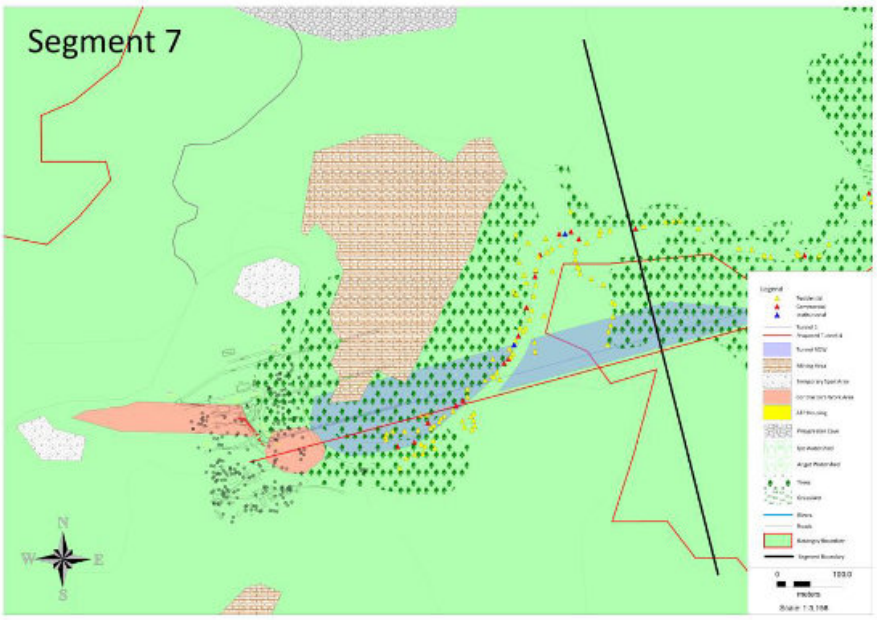
Segment 7

There are several houses in the area near the Bigte Portal. Exposed limestone is observed along the road. There is a limestone quarry to the north and adjacent to the outlet. The quarry area appears to encroach the MWSS tunnel ROW. The outlet of the proposed tunnel is about 500m away from Pinagrealan Cave. The underlying rock is limestone. The tunnel is about 50mbg and about 10mbg where it emerges at the Bigte Portal. The tunnel alignment is below the road alignment in this area.

There are dipterocarps at the outlet which will be potentially disturbed or cut to give way to the construction of the tunnel. Hardwood trees including narra and acacia will also be cut in this area.

Other project components during construction, such as temporary spoil disposal area and contractor's work area will be located at the Bigte Portal.

Figure 23 Segment 7 ROW: Bigte



9.6 Impact Assessment

The most optimum location of the alignment of the tunnel from inlet, through the entire alignment to the outlet has been selected to mitigate the impacts of tunnelling construction and operation works on air, water, flora, fauna and communities.

A Rapid Impact Assessment was undertaken for the project. It is perceived that most of the impacts will be observed during the construction period, which is the main focus of the impact assessment presented below. Table 9-4 summarizes major potential positive and adverse impacts of the proposed Tunnel 4 alignment during construction. The Interaction Matrix (Leopold Matrix) is used to assess the potential adverse environmental impacts in every segment during the construction phase of the tunnel alignment.

Table 9-4 Potential Impacts during construction phase

Category	Description	1 Ipo dam site	2 San Mateo rolling terrain	3 AFP housing	4 San Mateo grassland	5 Road ROW	6 Grassland	7 Bigte
A. Physical and chemical characteristics								
Earth/Land	Mineral resources							
	soils	Low impact						
	landform							
	unique physical features							
Water	surface	high impact						low impact
	quality	high impact						low impact
	underground	Low impact						
	temperature							
	recharge							
Air	quality	moderate impact						moderate impact
	noise	moderate impact						moderate impact
	climate							
	temperature							
Processes	floods							
	stability (slides, slumps)	low impact						
	stress-strain (earthquake)	low impact						
	fire	low impact						
	air movements							
B. Biological conditions								
Flora	trees, grass	moderate impact						moderate impact
	microflora	moderate impact						moderate impact
	Endangered species	low impact						
	endemic species	low impact						
	crops							
fauna	birds							
	endangered species	low impact						
	endemic species	low impact						
	insects	low impact						
	bentthic organism	low impact						
	microfauna	low impact						
Biological Interactions	ecological relationships, ecosystem based processes, food chains							
C. Cultural factors								
Landuse	wilderness							

	wetlands							
	forestry	moderate impact						
	peatlands							
	agricultural							
	residential							
	commercial							
	industry							
Recreation	hunting							
	fishing	low impact						
	boating	low impact						
	swimming	low impact						
	camping and hiking							
	resorts							
Aesthetics	scenic views and vistas							
	open space							
	parks and reserves	moderate impact						
	unique physical features							low impact
	rare and uniqe ecosystems							
	historical or archeological sites and objects							low impact
Cultural Status	Cultural patterns (lifestyle)							
	health and safety	moderate impact						
	employment	moderate impact	moderate impact	moderate impact	moderate impact	moderate impact	moderate impact	moderate impact
	population density							
Manufactured facilities and activities	transportation network (movement, access)	high impact	moderate impact	moderate impact	moderate impact	moderate impact	moderate impact	moderate impact
	utility networks							
	waste disposal	high impact						high impact
	structures							
	government activities							

Table 9-5 Potential Impacts during operation phase

Environmental Items		Alignment segment						
Category	Description	1 Ipo dam site	2 San Mateo rolling terrain	3 AFP housing	4 San Mateo grassland	5 Road ROW	6 Grassland	7 Bigte
A. Physical and Chemical Characteristics								
Earth/Land	Mineral resources							
	soils							
	landform							
	unique physical features							
Water	surface	low impact						
	quality							
	underground							
	temperature							
	recharge							
Air	quality							
	noise							
	climate							
	temperature							
Processes	floods							
	stability (slides, slumps)							
	stress-strain (earthquake)							
	fire							
	air movements							
B. Biological Conditions								
Flora	trees, grass							
	microflora							
	Endangered species							
	endemic species							
	crops							
fauna	birds							
	endangered species							
	endemic species							
	insects							
	benthic organism	low impact						
	microfauna							
Biological Interactions	ecological relationships, ecosystem based processes, food chains							
C. Cultural Factors								

Environmental Items		Alignment segment						
Category	Description	1 Ipo dam site	2 San Mateo rolling terrain	3 AFP housing	4 San Mateo grassland	5 Road ROW	6 Grassland	7 Bigte
Landuse	wilderness							
	wetlands							
	forestry							
	peatlands							
	agricultural							
	residential							
	commercial							
	industry							
Recreation	hunting							
	fishing							
	boating							
	swimming							
	camping and hiking							
	resorts							
Aesthetics	scenic views and vistas							
	open space							
	parks and reserves							
	unique physical features							
	rare and unique ecosystems							
	historical or archeological sites and objects							
Cultural Status	Cultural patterns (lifestyle)							
	health and safety	low impact						low impact
	employment							
	population density							
Manufactured facilities and activities	transportation network (movement, access)							
	utility networks	low impact						low impact
	waste disposal							
	structures	low impact	low impact	low impact	low impact	low impact	low impact	low impact
	government activities			low impact				

9.7 Environmental Management Plan

The project only involves construction of new tunnel. The Environmental Management Plan (EMP) presented below is preliminary, and based on the initial data collected. The conduct of the Initial Environmental Examination will present the EMP in greater detail. Potential moderate to high impact environmental aspects were considered as a result of the impact identification exercise.

Table 9-6 Preliminary Environmental Management Plan

Potential Impact	Possible approach/mitigating measures	Cost of mitigation/ enhancement Responsible	Performance Standard and Guarantee
Physical (Land) Environment			
Spoil disposal (estimated 150,000m^3 is expected to be generated due to tunnelling works, about 190,000 m^3 loose volume)	Staging area and temporary spoil disposal shall be integrated in the design plans / construction plans. Potential temporary disposal areas were identified: 3Ha private land at the intake previously used as disposal site. The area is accessible by concrete road of MWSS at Ipo Dam Site. The area is barren, surrounded by mostly bamboos and a few dipterocarps. Pile of riverbed materials still remains within the site. The land area is owned by Palomo Family and may be leased. Portion of the spoil may be disposed at unpaved secondary roads of Brgy San Mateo and Bigte. Characterization of the extracted rocks prior to planning of the disposal site. Geological map shows that the rocks are good construction materials and could be used in the works. The contractor should identify cement, aggregate and construction projects that can utilize the spoil.	Part of project development cost MWSS; DED Consultants; and Construction contractor	Detailed Engineering Design (DED) Scope of Work Detailed Engineering and Design Plans
Solid waste generation by the workers	The contractor shall be required to implement appropriate solid waste management program	Part of project (construction) cost MWSS; and Construction contractor	Construction contractor Scope of Work Construction contractor's Environmental Monitoring and Management Plan
Hazardous waste generation due to construction works	The contractor shall be required to implement appropriate hazardous waste management program. Fuel, oil and grease will be stored in contained areas.	Part of project (construction) cost MWSS; and Construction contractor	Construction contractor Scope of Work Construction contractor's Environmental Monitoring and Management Plan
Air quality			
Air pollution	The contractor shall be required to implement air quality control plan for land-based activities based on: (a) control of point emissions at source, (b) use site layout to locate emission sources away from sensitive receptors, (c) control of dust from specific dusty activities such as excavations, stockpiling and rock	Part of project (construction) cost MWSS; and Construction contractor	Maintain air quality within national air quality standards, or if these are not available, internationally

Potential Impact	Possible approach/mitigating measures	Cost of mitigation/ enhancement Responsible	Performance Standard and Guarantee
	crushing, (d) avoid unpaved roads around site and near communities on access roads, (e) use dust suppression techniques eg watering, sheeting particularly at Bigte area at the possible location of contractor's work area, (f) issue personal protective equipment (PPE) to workers, (g) prohibit open burning of vegetation and other waste (h) community awareness program including liaison and grievance mechanisms.		accepted air quality standards, such as WHO Air Quality Guidelines Global Update, 2005 Construction Contractor Scope of Work; and Construction Contractor's Environmental Monitoring and Management Plan
Vibrations and noise generation	High level noise is often generated during construction phase. Prior to construction, monitor existing noise level for baseline Require the Constructor to implement a Noise Control Plan as part of their CEMP. Typical approaches (a) compliance with noise standards, (b) control of noise at source, e.g. low noise plant, muffling, acoustic screening, switch off campaigns, (c) use of facility layout to minimize noise propagation e.g. using topography / existing buildings as barriers, where possible locate noisy activities away from local communities, (d) constraints on working hours and timing of noisy activities, (e) control haulage traffic e.g. routes, speeds, no horns, no night-time traffic, (f) personal protective equipment for workers, (f) community awareness program including liaison and grievance mechanisms. In section 6.3 of this FS notes that the depth of the tunnel away from the portal areas will mean that there will be no physical affect (such as ground movements) on the ground surface, or on any existing development in the right of way, during the construction or operation of the new tunnel. It is also extremely unlikely that future developments will affect the tunnel. However, it would be consistent with normal practice for significant new infrastructure or developments (including excavations for quarries or mines) to be assessed for influence on the tunnel, prior to construction permission being granted.	Part of project (construction) cost MWSS; and Construction contractor	Adopt national standards for construction sites and residential areas if available. Alternatively use internationally accepted standards such as WHO Guidelines for Community Noise, 1999. Construction contractor Scope of Work; and Construction contractor's Environmental Monitoring and Management Plan
Water Quality			
Most of the impact of on water happens during construction phase	Use of cofferdam to contain construction area and minimize water disturbance during construction. If trigger threshold in water quality is reached during construction, the contractor shall take corrective action to reduce concentration to below the standard. Wastewater should be properly treated before	Part of project (construction) cost MWSS; and Construction contractor	Water Column. Parameters to characterize the physico-chemical and biological status of the water column to include but not limited to:

Potential Impact	Possible approach/mitigating measures	Cost of mitigation/ enhancement Responsible	Performance Standard and Guarantee
Impact of construction on water quality (elevated water turbidity and associated pollutants in the water column; potential elevated oil and grease which may be attributed to the heavy equipment used during construction)	discharge. Installation of settling pond for wastewater generated during tunnel boring. Additional grease trap or oil/collector should be installed before discharge. Regular water quality monitoring should be implemented. The contractor should submit water quality monitoring reports to MWSS copied to CPF.		temperature, salinity, total suspended solids, turbidity, dissolved oxygen, nutrients, heavy metals, organic compounds, and bacteriological parameters. Refer to DAO 34 and 35 for water quality standards Construction contractor Scope of Work; and Construction contractor's Environmental Monitoring and Management Plan
Extraction and discharge of water	The impact of tunnelling project during construction includes turbidity of the construction site effluent Extraction of water from the dam site (inlet) and creek (near the outlet) to be used as coolant to the tunnel boring machine (TBM). The contractor should use efficient tunnelling technology that recycles tunnel drainage water to minimize use of water. Possible elevated oil and grease measure may be observed due to heavy equipment and machines used in the construction. Collection and treatment of the tunnel drainage water during the construction of the tunnel, so that it does not pollute any waterways.	Part of project (construction) cost MWSS; and construction contractor	If significant amount of water is to be used, permit from the National Water Resources Board may be necessary. DAO 34 and 35 for water quality standards Detailed Engineering Design (DED) Scope of Work; Detailed Engineering and Design Plans; and Construction contractor's Environmental Monitoring and Management Plan
Biological environment			
Loss of vegetation and temporary disturbance to wildlife at the intake and outlet due to clearing activities	The contractor should include measures to avoid impacting on habitats and wildlife in their EMPs e.g. minimize vegetation clearance at Bigte and especially at the intake, adequate wastewater and solid waste management, environmental training for workforce, and site rules and sanctions to discourage workforce from hunting, fishing and poaching.	Part of project (construction) cost MWSS; and Construction contractor	Tree cutting permit from DENR required. Number of trees felled to be minimized Construction contractor Scope of Work; and Construction contractor's

Potential Impact	Possible approach/mitigating measures	Cost of mitigation/ enhancement Responsible	Performance Standard and Guarantee
			Environmental Monitoring and Management Plan.
Construction safety			
Traffic impacts due to movement of vehicles, heavy equipment, workers	Traffic Management Plan to include procedures to protect the safety of local communities and other road users. Maximum speed limits should be observed at all times. The plan should be strictly implemented by contractor and monitoring activity should be carried out regularly by MWSS including road signage established at strategic points. Contractors shall provide health facilities for their own staff and keep records.	Part of project (construction) cost MWSS; and Construction contractor	Zero road accident and related incidents Construction contractor Scope of Work; and Construction contractor's Environmental Monitoring and Management Plan

10 Institutional Assessments

There are four areas where institutional arrangements could potentially impact the effective implementation of the Tunnel 4 project and the efficient operation and maintenance (O&M) of the raw water transmission system and where institutional strengthening may be required:

- Water allocation from Angat-Umiray system
- Procurement and management of the tunnel works
- Financial capacity of MWSS
- O&M of the water transmission system

These are examined in the following sections.

10.1 Water Allocation from Angat-Umiray System

The World Bank July 2012 Metro Manila Water Security study and the JICA March 2013 Water Security Master Plan for Metro Manila and its Adjoining Areas both indicate that water shortages occur in the Angat-Umiray system that can cause conflict among its water users.

Main water users are:

- MWSS for municipal water in Metro Manila
- NIA for Angat-Massim River Irrigation System (AMRIS)
- NPC/K Water for hydropower generation

There is a 2010 Memorandum of Agreement on the Angat Water Protocol prepared prior to the privatisation of hydropower generation. This sets out with clarity the basis for determining the water releases and allocation from Angat. A technical working group with representatives of the three users plus NWRB and PAGASA (Philippine climatological service) regularly assess the allocation based on the users' granted water rights/permits and requirements, hydrological conditions, reservoir operation rules and the Water Code. Such assessment is forwarded to NWRB for final determination and approval.

Water releases for both municipal and irrigation purposes are made through turbine discharges which, except for flood operations, are the only turbine discharges permitted. Generally, if there is sufficient water, releases will meet the requirements of all users. However, when there is a deficit, the allocation is reduced in accordance with the Water Code after consultation with the users.

The Water Code adopts the principal of "oldest right, highest priority" except that Article 22 provides that in times of emergency, municipal water supply is prioritised provided that where shortage is recurrent and the appropriator for municipal use does not have the oldest right, then the municipal user must find an alternative source of supply.

15m^3/s of the MWSS water allocation of 46 m^3/s is conditional upon AMRIS not requiring this flow as part of its allocated 40 m^3/s. During dry years, there is a potential conflict between NIA and MWSS depending on how the emergency provisions of Article 22 are interpreted. In the drought of 2004, the supply to AMRIS was suspended for four months to maintain a municipal water supply. NIA made a claim for compensation which is not resolved to date while MWSS maintains that the drought was a 'force majeure' event.

The protocol for allocating water from Angat is reasonably clear, and provided the private hydropower operator abides by it, this should ensure reasonable allocation of available water to MWSS. However, as the demand for water in Manila increases, MWSS will require the full 46 m^3/s most of the time, which could make the allocation of available water more contentious. It is expected

that some of the additional water resource schemes being considered to augment the availability of municipal water from Angat will be implemented to prevent this.

At the end of June, MWSS advised that it is expected that its allocation would be increased by 4m^3/s in recognition of the actual flows from Umiray being higher than the allocated 9m^3/s. MWSS plans to use this allocation to supply Bulacan Province through the transmission system. This additional allocation will be made with no increase in water resource. Given the shortages of water occurring in dry years, it appears that this will reduce water security. This is likely to reduce the water available to AMRIS and the power generated. Clearly, there is a need to discuss this proposal with all users and to amend the MOA on the Angat Water Protocol to take this proposal into account.

10.2 Project Procurement and Management

10.2.1 MWSS

Metropolitan Waterworks and Sewerage System (MWSS) will be the executing and implementing agency for the project. MWSS is a government owned and controlled corporation, established in 1971 through Republic Act 6234, responsible for water and sewerage services in Metro Manila.

In 1997, operational services were awarded to Manila Water Company Inc (MWCI) and Maynilad Water Services Inc (MWSI) under a 25-year concession. The concessionaires are responsible for operation, maintenance and investment in the water and sewerage systems while MWSS remains the owner of all assets.

As a result of the privatisation, MWSS is organised into two independent entities under the Board of Trustees:

- MWSS Regulatory Office is led by the chief regulator. It monitors the performance of the concessionaires and sets tariffs.
- MWSS Corporate Office is led by the administrator. It is the legal owner of the water and sewerage assets and reviews the concessionaires' projects technically. The corporate office is also responsible for planning and implementing water resource projects and managing MWSS loans.

In 2011, MWSS introduced its seven-point Water Security Legacy Plan, a comprehensive set of programs aimed at establishing a comprehensive and sustainable approach for water and sewerage services within its corporate, franchise area. The program focuses on:

- Water resources and infrastructure development management and protection
- Water distribution efficiency
- Sewerage and sanitation compliance
- Water rates review and rationalisation
- Organisation excellence
- Partnership development
- Communications and knowledge management

Key projects in the legacy plan include:

- Ensuring sustainability and reliability of the Angat-Umiray raw water source of which this project is a part
- Angat Dam and Dike Strengthening Project
- Rehabilitation, operation and maintenance (ROM) of the Angat Hydroelectric

Power Plant Auxiliary Unit Nos. 4 and 5

- New Centennial Water Source Project (a new water source for MWSS)
- Bulacan Bulk Water Supply Project
- Watershed Management Project

To deliver these key projects, a vital component is its Water Legacy Plan Organization Excellence Program. This programme was launched in 2011 with the objective of instituting major reforms in the organisation, people and processes.

The four major thrusts are:

- Institutionalization of the MWSS Strategic Management System
- Building a new MWSS culture
- MWSS reorganization
- Institutional strengthening

While it is understood a reorganization plan is in hand, there have been few concrete changes made to date.

It is anticipated that the Tunnel 4 project will be procured in accordance with ADB/MWSS procurement procedures and that this will be managed by MWSS with a similar organisation to that employed on the Angat water utilisation and improvement project Phase 2 project (AWUITP2) completed in 2012. In the following sections the areas of the organisation relevant to the delivery of this project are examined and areas where capacity strengthening would be useful identified.

10.2.2 Procurement

MWSS will be responsible for the procurement of this new Tunnel 4 project in accordance with ADB requirements. Their procurement capability is discussed below:

Experience in ADB procurement / international competitive bidding

The last project where MWSS adopted ADB procurement guidelines was the Angat-Umiray Transbasin Project, which was funded by ADB and completed in 2003. Most of those who were involved in the procurement activities have already left the agency.

From March 2010 to September 2012, MWSS implemented the construction of Aqueduct 6, which was funded by the China Eximbank. For this project, MWSS conducted international bidding for the civil works, adopting the FIDIC format with some variations using the harmonised procurement guidelines. The procurement, however, was limited to three contractors pre-selected by China. Consulting services packages were tendered by MWSS but using government procurement procedures. In both projects, MWSS was assisted by consultants in preparing the bid documents.

Experience in design-build procurement

MWSS attempted to package a project – the Angat Dam and Dike Strengthening Project – for design and build implementation. Bid documents were drafted by a local consulting firm and discussed with MWSS officials and key staff using standard bid documents and procurement guidelines of the Government of the Philippines (GOP) under Republic Act (RA) 9184. Two of the contentious issues raised by key MWSS staff were (a) lump sum pricing, and (b) basis for evaluation of bids since contractors will submit based on their preliminary designs and not on common designs. The project, however, did not proceed due to moves to privatize the operation of the Angat Dam power plant.

In 2009, MWSS was involved in the preparation and finalisation of tender documents for the "Swiss challenge" for the Laiban Dam (Manila Water Supply III) Project. This was in response to the

unsolicited proposal of San Miguel Corporation (SMC) following the National Economic Development Authority (NEDA) guidelines for the joint venture agreement. The project, however, did not materialise. MWSS was assisted by consultants in the bid preparation.

Current organisation

MWSS has one Bids and Awards Committee (BAC) that is responsible for all procurement: goods, consulting services and civil works. The BAC is supported by a Secretariat and Technical Working Group (TWG). The BAC is currently chaired by a senior deputy administrator, a second ranked officer of the agency, while the Secretariat is led by a deputy administrator, a third ranked officer of the agency. In practice, a TWG is organised for a specific procurement to suit the project.

Training

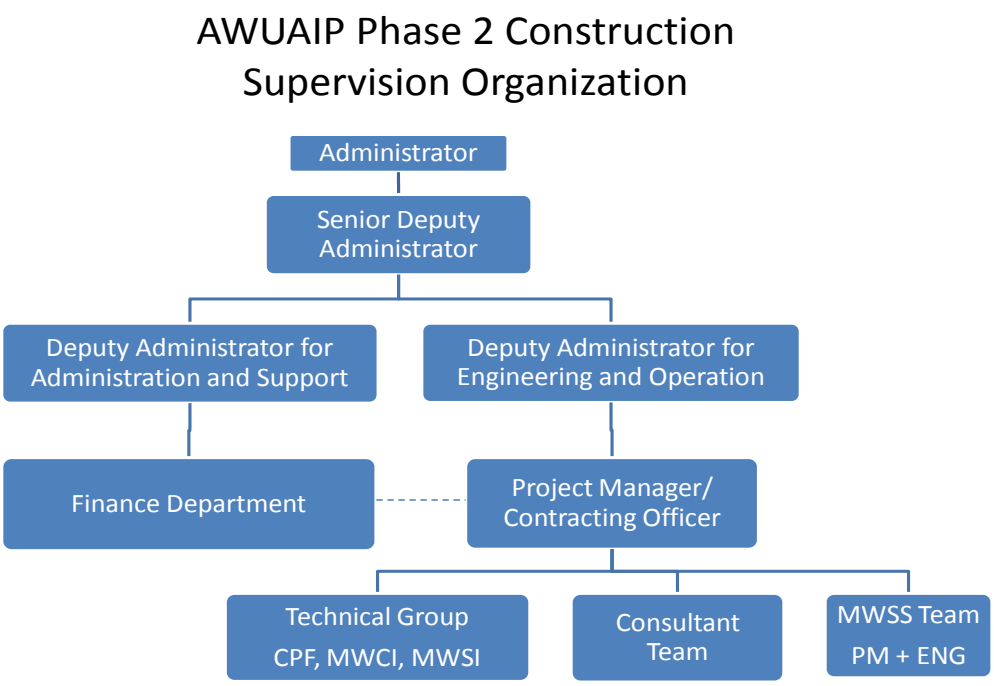
In May 2013, upon request by MWSS, the Government Procurement Policy Board Technical Services Office (GPPB-TSO) conducted a series of seminars for the MWSS procurement staff. The seminars focused on the updated implementing rules and regulations of the government procurement guidelines, including design-build arrangements.

To prepare the agency to conduct bidding of contracts financed by ADB, the procurement officers and staff have to undergo training on the Bank's procurement guidelines and procedures. It is suggested that this training is provided by the consultant employed to provide technical assistance during tendering and construction.

10.2.3 Project Management

The AWUAIP2 project for the construction of 10km Aqueduct 6 and rehabilitation of 5km Aqueduct 5 was procured through an engineer designed contract. The project was implemented with financial assistance from the People's Republic of China (PRC) through the China Eximbank. Selection of the contractor was through limited competitive bidding among pre-qualified Chinese international contracting companies, following International Federation of Consulting Engineers' (FIDIC's) procurement procedures. The project management arrangement for AWUAIP2 is illustrated in Figure 24

Figure 24 AWUAIP Phase 2 Supervision Organisation



A project management team led by a MWSS project manager/contracting officer (CO) was organised from MWSS engineering and project management staff supported by a consultant's team. A technical group representing the two concessionaires and the Common Purpose Facilities (CPF) provided assistance and advice concerning the requirements of CPF, MWCI, MWSI. The consultant provided construction supervision for the entire project and was generally delegated to act on behalf of the engineer, the CO. Scope of work also included review and monitoring of the contractor's plans for: traffic management and re-routing, environmental management, and safety, protection, security and accident prevention.

This arrangement is considered to have worked satisfactorily and a similar organisation is proposed for this Angat water transmission improvement project. MWSS will be the Executing Agency (EA) and will serve as the Implementing Agency (IA) for Procurement and Contracting. A design-build contract shall be formalised between MWSS and a qualified design-build contractor following ADB's two-stage two envelope standard bidding documents for the plant with the conditions of contract being FIDIC Conditions of Contract for plant and design-build.

The implementation will be managed by a project management office, staffed mainly by MWSS employees. It will be organised for the day-to-day management of the project from pre-construction (including procurement) up to post-construction (commissioning and project close-out). The project management office will be led by a MWSS project manager/CO. Support will be provided by a suitably experienced consultant to provide advice and TA during tender assessment and project construction.

MWSS has little experience in handling the procurement process in compliance with ADB requirements and the consultant will need to provide suitable expertise and guidance in this area, in addition to the technical expertise required for evaluation and clarification of the tender designs.

The experience of MWSS in implementing design and construct contracts is also limited, although the concessionaires have some experience in procuring projects through design and build. The consultant will need to provide guidance to ensure that the contract requirements are followed. A main concern is that with their limited experience in design and build contracts, MWSS may want to impose their preferences on the contractor's design and construction, with potentially severe consequences to responsibilities and costs.

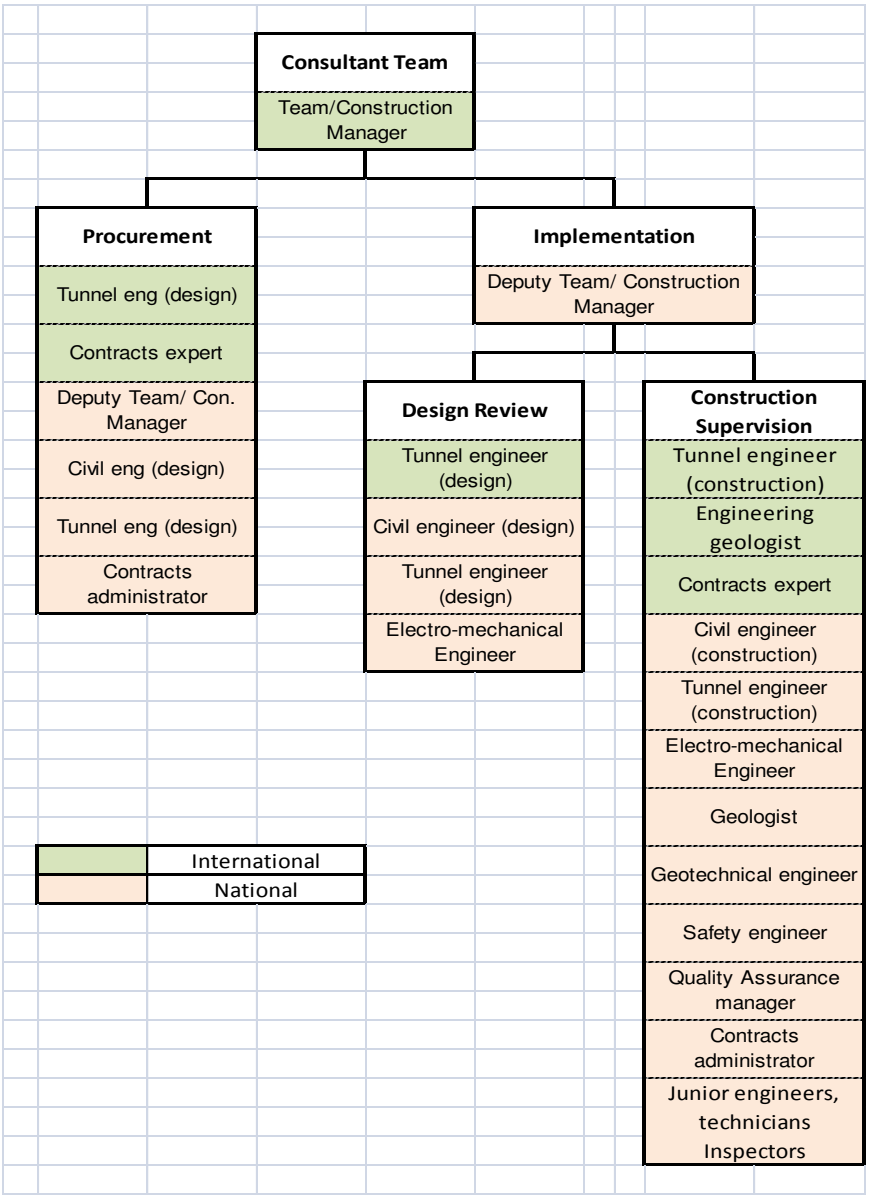
The consultant will be appointed to provide TA during project preparation, procurement and implementation phases. Tasks will include:

- Assistance to MWSS during project preparation (once appointed) with documentation for project approvals and permits from government and funding agencies
- Assistance in the procurement process
- Review of contractors' detailed designs to ensure they comply with the employer's requirements
- Monitoring of construction activities
- Monitoring environmental management compliance in line with the environmental management plan and environmental compliance certificate conditions
- Review of contractor's testing of plant, materials and workmanship
- Advise/assist the engineer, who shall be the CO, in the performance of all duties under the contract
- Review of all contractor's documents, including as-built drawings and O&M manuals
- Preparation of interim and final payment certificates
- Progress reporting, including completion report.

A possible organization structure for the consultant is illustrated in

Figure 25

Figure 25 Proposed Consultant's Organization Chart



10.2.4 Property Management

During the conduct of this study it has become apparent that MWSS do not own the land and/or right of way for all the transmission system. In particular neither Tunnel 2 nor 3 is within any right of way, and part of the area at Bigte is not owned by MWSS, although staff on site were under the understanding that it was. This is a concern for the long term operation of the system as well as being a possible risk during construction. The property department of MWSS needs to be more proactive in ensuring their ownership of the necessary land rights.

10.2.5 Social Issue Management

Consultation meeting with the Property Management Department of MWSS was undertaken to (a) determine its capacity to implement social safeguards and (b) assess its mechanisms and processes in

undertaking social safeguards with projects that had been implemented. The Property Management Department is responsible for managing the properties and assets of the proponent. Through its ROW division, it is also responsible for coordinating and managing activities related to relocation and provision of compensation benefits as approved by the MWSS Board.

MWSS has established partnership with national agencies and LGUs with projects that need relocation intervention.

During preparatory and detailed design stage, it conducts consultation with LGUs to inform of potential displacement of persons and consequent need for relocation of affected persons. It also mobilizes Local Interagency Committee (LIAC) comprising of local government unit (LGU), Presidential Commission on Urban Poor (PCUP), Department of Environment and Natural Resources (DENR), Municipal Social Welfare and Development (MSWD), National Housing Authority (NHA), Commission on Human Rights (CHR), Philippine National Police (PNP), Urban Poor Assistance Office (UPAO) and Municipal Health Office (MHO) during planning and implementation process.

It consults with affected persons in discussing project issues and concerns and affected persons are presented compensation options to choose from: (i) cash compensation or (ii) a relocation package. It observes disclosure of the Resettlement Plan /compensation package with the APs.

MWSS coordinates with NHA where affected persons opt for a relocation package. NHA provides assistance including social preparation, APs site visit to potential relocation sites and, at the resettlement site, provides housing and basic social services including livelihood assistance as part of its income restoration and livelihood rehabilitation strategy.

The proponent maintains coordination efforts with the LGUs to help in securing its ROWs after completion of the clearing of informal settlers and encroachers. Sustaining cleared ROWs, however, remains a challenge for the proponent due to its limited resources and available staff for securing the ROWs.

"MWSS has been compliant with the requirements of the UDHA Act of 1992 that protects the rights of the urban poor in case of displacement as a result of project implementation. In its foreign assisted projects, it follows prescribed social safeguards processes of donor agencies (ADB, China Eximbank, etc). It has been following the procedures for resettlement and compensation assistance in coordination with the LGUs, national agencies and local organizations.

To further strengthen its social safeguard processes and to avoid APs from going back to cleared ROWs, MWSS should review, in coordination with partner agencies, adequacy of support for APs opting for compensation assistance. It should continue to forge its partnership with LGUs and communities along their ROWs and make them partners in preventing encroachments and securing its assets and facilities. To enhance capacity of the ROW division, there is a need to hire staff for unfilled positions."

10.2.6 Environmental Management

The reliability and security of the water transmitted to Manila is dependent on the management of the watershed and the infrastructure transmitting water from the water source to users. The Ipo Watershed is under joint management of DENR and MWSS[8]. Under the Common Facilities Agreement in 1997, the concessionaires are responsible *to alter, modify, repair and make additions, as may be necessary, to the Common Purpose Facilities.* DENR further granted the concessionaires of MWSS (MWCI and MWSI) in 2009 to assist in the management of IPO watershed.

[8] Pursuant to Proclamation 391 dated April 30 1968. DENR DAO 2005-23 provided for the adoption and implementation of a co-management approach to watershed management that involves the participation of stakeholders in management actions and sharing of resources based on mutually acceptable decisions.

In 2009, MWSS and Bantay Kalikasan ABSCBN Foundation Inc signed a Memorandum of Agreement for the implementation of Ipo Watershed Management Project. The contract with Bantay Kalikasan was terminated in 2012 Feb. The 7 forestry staff of Bantay Kalikasan currently act as technical consultants for the MWSS Watershed Management Unit which is under the office of the Deputy Administrator for Administration and Support Services. The sum of P83,000.00/ Ha as funding for the implementation of the watershed management plan is shared by the two concessionaires.

MWSS does not have an environment unit to handle environmental management of the existing infrastructures. It appears that the environmental management of the common purpose facilities was handed over to the concessionaires as implied in the Common Facilities Agreement. The AQ6 is the only common purpose facility that has an environmental management plan since it was required of an IEE by ADB and DENR.

Although the environmental management of the facilities was shared by the concessionaires, MWSS should monitor proper implementation of environmental management and monitoring activities for the watershed and operation of the infrastructure as well as related CSR activities in these areas. DENR should closely monitor watershed activities with MWSS and strengthen forest patrol measures, and should make this a priority. The reforestation program of MWSS Watershed Management Unit carried out today will not be successful since *kaingin* is apparently still rampant in the watershed areas.

10.3 Financial Capacity

The financial capacity of MWSS is primarily based on its ability to collect concession fees from the two service concessionaires. The concession fees can be grouped into two general categories:

- Debt service obligations and payments to finance the on-going investment projects which are treated as pass-on payments
- Current operating budget for the administrative expenditures of MWSS Corporate Office and Regulatory Office subject to consumer price index adjustment

Concession fees roughly represent 90% of MWSS revenues. Other revenue sources of MWSS include rentals of leased properties and interest income.

Every start of the year, MWSS provides the two concessionaires with the schedule of all anticipated amounts due related to the concession fee payable during the year. This includes the total amount due for any scheduled payment of principal, interest, fees or other amount under existing MWSS loans. MWSS can draw from the performance bond as set in the concession agreement in the event that the concessionaire fails to pay the concession fee.

The above arrangement is based on the concession agreements between MWSS and the two concessionaires. MWSS retains ownership of the water facilities and exercises its regulatory functions on water rates and monitoring of performance. The concessionaires operate and manage the water supply, sewerage and sanitation services in the MWSS service area for a 25-year period, which has recently been extended for a further 15 years to 2037.

The concession agreement also provides mechanisms to enable the concessions to adjust the water rates in the form of rate rebasing every five years. The rate rebasing allows the concessionaires to recover operating, capital maintenance and investment expenditures over the concession period and at the same time earn a reasonable rate of return on what they have spent. The adjustment in water rates also considers economic parameters like inflation and foreign exchange fluctuations. However, the rate rebasing exercise has recently become politically sensitive among consumers. In the early years, the relatively lower water rates gained consumer acceptance to Public-private partnership (PPP) but over time, consumer acceptance has slowly eroded, as water rates have increased significantly to

cover both high investment and extraordinary expenditures such as foreign exchange losses. The 2013 rate rebasing exercise needs to be managed well by MWSS.

The overall financial performance of the concessionaire is based on how well each concessionaire manages its capital expenditures, its operating cost structure and its collection efficiency.

With the concession fees, MWSS can service its debt obligations, cover its annual operating expense and finance the local counterpart requirements of its on-going projects.

The nature of water-related projects (i.e. water supply development and sewerage and sanitation facilities) is considered lumpy investments which require access to long-term financing. However, long-term financing normally requires sovereign guarantees. With respect to existing MWSS loans, MWSS has not passed on the sovereign guarantee of loan payments to the concessionaires. MWSS still carries the risks of the non-payment of the concession fee in spite of the performance bond set in the concession agreement. MWSS still has the obligation to pay its loans even with the non-payment of the concession fees from the concessionaires. It happened in early 2001 when MWSI stopped paying the concession fees to MWSS. As a result, MWSS had to resort to short-term borrowings to fulfill its financial obligations to its lenders.

The financial performance of MWSS depends heavily on the performances of the two concessionaires which are both dependent on the way water rates are set.

It is therefore important to strengthen the functions of MWSS Regulatory Office when it comes to the financial, technical and customer service aspects to ensure the sustainability of operations of the two concessionaires, which in turn, secures the financial capacity of MWSS Corporate Office.

10.4 Operation and Maintenance of Water Transmission System

The water transmission system, along with the Umiray transfer and Ipo reservoir and catchment, is defined as the Common Purpose Facilities in the concession agreements. The concession agreements require these Common Purpose Facilities to be operated and maintained by joint venture (JV) of the two concessionaires (MWCI and MWSI). The Common Purpose Facilities agreement between MWSI and MWCI establishes the JV and its organisation and responsibilities. The JV is non-incorporated and is in essence a joint undertaking to operate and maintain the Common Purpose Facilities and share all obligations and costs equally. This joint undertaking organisation is generally referred to as the CPF and this nomenclature is followed here.

The CPF's responsibility is to:

- Operate, maintain, renew and, as appropriate, decommission the Common Purpose Facilities in a manner consistent with the National Building Standards and best industrial practices.
- Alter, modify, repair and make additions, as may be necessary, to the Common Purpose Facilities.
- Allocate raw water between the two service areas in accordance with the provisions of the concession agreements.

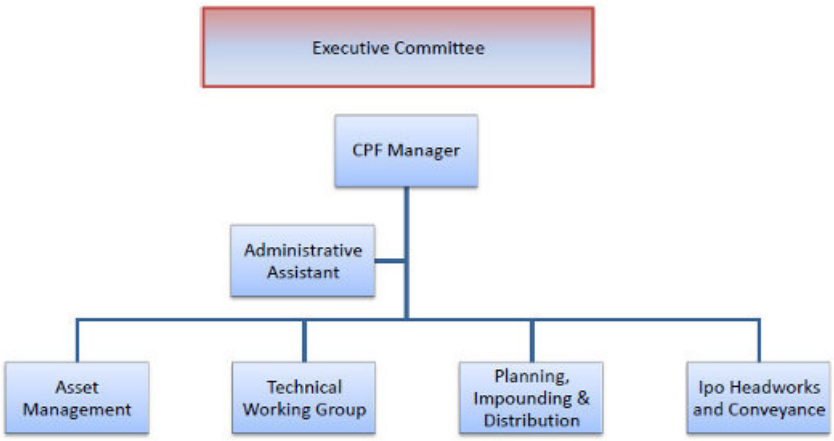
The agreement states that the CPF:

- Shall be staffed by personnel drawn from and seconded by MWCI and MWSI
- Shall ensure that it is independent and serves the needs of MWCI and MWSI on a fair and equitable basis

The day-to-day activities of the CPF are managed by a full-time manager (currently from MWCI) who reports to the executive committee which has an overall responsibility to the activities of the CPF and has four members, two from each concessionaire.

The organisation of the CPF is indicated in Figure 26.

Figure 26 CPF (JV) organisation



Asset Management is overseen by a single full-time representative (currently from MWCI) whose role is to manage the documentation of assets, to work with the operation and maintenance group in assessing the condition of all infrastructure, fixtures and fittings and ensure that maintenance is sufficient to preserve efficient operation throughout the expected lifetime of the assets. Where an asset approaches the end of its useful life, then the asset manager should alert the TWG to impending refurbishment or replacement so this can be planned and budgeted.

The TWG comprises a full-time team leader (currently from MWCI) and two part-time representatives from each of the concessionaires who provide technical inputs to the CPF. The TWG can call on specialist expertise within the two concessionaires when necessary. The TWG is responsible for identification and initial development of capital projects associated with asset refurbishment and renewal. These projects are then taken forward by a project management team from one of the concessionaires. This appears to lead to some devolution of responsibility as discussed later.

The Planning, Impounding and Distribution section is formed from a team leader and five staff (currently all from MWSI), and all based at the La Mesa dam office. They are responsible for the day-to-day operation of the raw water transmission system and Novaliches portals, and the equitable distribution of raw water between the concessionaires.

The Ipo Headworks and Conveyance section comprise a team leader and 14 staff from the two concessionaires. They are based at the Ipo dam office and are responsible for the O&M of the Umiray transbasin facilities and the headworks downstream of the Angat dam, including the Ipo intake works. They also have some shared responsibility for the raw water transmission system.

Although MWSS owns auxiliary Turbines 4 and 5 at Angat Dam, operation and regular maintenance is undertaken by the National Power Corporation (NPC). No formal agreement or protocol exists between MWSS and NPC relating to water quality aspects of the system therefore any works, O&M necessary to conserve quality and quantity, such as that required by de-silting, can only be accommodated after negotiation. This informal arrangement has worked reasonably well to date, although it remains to be seen whether cooperation continues once O&M is outsourced to a private operator. Negotiations with K Water, the preferred bidder, are reported to be well advanced.

As described in our assessment report, the water transmission system appears not to have been cared for over many years and needs significant rehabilitation to ensure the future security of water supply

to Metro Manila. We cannot comment on CPF performance in looking after common purpose facilities other than the raw water transmission system from Ipo to La Mesa. It is not totally clear why CPF has not addressed the problems of illegal usage, damaged appurtenances and general lack of maintenance of the water transmission system for the 16 years they have been responsible for its operation, maintenance and renewal.

We understand that there are some financial and/or administrative issues between MWSS and the concessionaires concerning security along the ROW of the transmission system and of the financial allocation to the transmission system during rate rebasing. These issues appear to be used as an excuse for the poor performance of CPF in operating and maintaining the system. The transmission system is critical to the supply of water to 14 million people, and the operation and maintenance of the system must be improved. Any issues between MWSS and CPF need to be clearly stated and urgently resolved by the parties, if necessary through a conciliator.

We believe that essential to both a successful O&M programme, and a secure supply of raw water, is a manager who is empowered to take responsibility for the CPF performance and can devote his full attention to this important role. Although this is clearly the intention of the CPF agreement it has been apparent during this study that the CPF manager has not always been able to act independently as required under the CPF agreement. On occasion, the CPF manager has had to seek approval from a higher authority before being able to make a decision, although it is not clear whether the 'higher authority' was the CPF Executive Committee or the concessionaire under which he is primarily employed.

Currently the CPF manager, asset management head and TWG head are based in their employers' offices at Balara. There are plans to construct a CPF office at La Mesa, which is being procured through MWSI under the 2008-2012 re-profiled budget. It is understood that the design is currently being finalised. Once this office is up and running, it should be easier for the CPF manager and his team to function as an independent organisation.

The CPF agreement requires the manager to be responsible for proposing, recommending and/or preparing for the approval of the Executive Committee, the following:

- Organisational structure
- Financial, operating and administrative procedures
- Financial budgets and operating plans
- Operating and efficiency targets
- Analysis of performance against budgets and plans
- Financial statements/returns
- Plans for capital works, maintenance works, renewals, expansions, additions and, as appropriate, decommissioning of facilities
- Monthly reports

Our request for these items has resulted in partial submission of only a few items, with others being described as dependent on rate rebasing, or commercially sensitive.

We were provided with an asset register, after many requests, which contains only very high level information on individual assets, including an ordinal estimate of condition and performance. No details of manufacturer, model, spare parts held or required, are included.

During the asset management workshop in May, it was apparent that only very primitive routine inspection, operation and lubrication activities have been carried out for which no formal records appear to exist. A copy of the CPF Manual has since been received which provides general

information on the system (some incorrect), some basic rules for operation, and general guidelines for inspection/maintenance. The records that are required by this manual have not been provided and are clearly not readily accessible for analysis in an asset management system.

In June, we were provided with a copy of the CPF submission to MWSS for rate rebasing 2013. One of the projects proposed from 2013 to 2017 is 'Comprehensive Maintenance and Upgrading of CPF Facilities'. The description of this project states that since formation of CPF (and clearly, prior to the award of the concessions) there are no comprehensive standard operating and maintenance procedures (SOP). The proposed project aims to hire consultants to assess the O&M of the CPF raw water capture and transmission system, and develop an organisation and SOPs that will enable CPF to become an ISO accredited unit. In parallel, there will be projects intended to improve data gathering, accessibility and other aspects identified by the consultant. This proposed project, along with the associated installations (such as instrumentation and SCADA), would dramatically improve the performance of CPF in its key area of O&M and should, in our view, be a priority.

Capital projects initially developed by the CPF TWG are handed over to the project management arm of one of the concessionaires for further development and execution. One of the reasons for this is understood to relate to the non-incorporation of CPF and the consequent inability to award contracts in its own right. The other is that there is not sufficient expertise seconded to CPF. The concessionaire project management team follows all the technical and financial procedures internal to the company, including obtaining internal approvals of proposals, budgets, contract awards and payments from the concession company. This both compromises the independence of CPF and takes away responsibility from the CPF for its projects. In our view, all approvals of costs, timing and quality required should be given by the CPF staff and executive committee within any constraints laid down by the concessionaires.

Given the criticality of the Ipo to La Mesa raw water transmission system to the vitality of more than 14 million people in Metropolitan Manila, it is clear that the O&M function must be improved. There is no reason this cannot be carried out by the CPF joint undertaking. The two concessionaires have the capability, as evidenced by the improvement in O&M of their respective water treatment and distribution systems. We do consider that the concessionaires need to ensure that the CPF feels empowered to act independently in delivering raw water to, and maintaining assets on behalf of, the concessionaires within agreed financial, performance and quality parameters.

However, this will require full agreement between MWSS and the concessionaires on the capex and opex requirements/responsibilities, and acceptable allowance for this in the current rate rebasing. This can then be passed to CPF to manage on behalf of the concessionaires. The MWSS regulatory office must then ensure that the CPF carries out its responsibilities satisfactorily, as this will be the single most important incentive for the concessionaires to support CPF in meeting its full responsibilities.

10.5 Conclusions

Water allocation

It is worrying that a further water allocation will be made to MWSS and used for Bulacan bulk water supply without having any corresponding increase in the volume of water entering Angat reservoir. An agreement should be made between MWSS, the concessionaires, and the Bulacan bulk water authority, following which, the Memorandum of Agreement on the Angat Water Protocol should be amended to take this proposal into account.

Project procurement and management

MWSS has little experience in design and build projects and ADB procurement requirements. It is proposed that an international consultant be contracted to provide Technical Assistance in assessing contractor tender proposals, reviewing contractor detailed design and supervising construction. Part

of the consultant's scope will include providing expertise and training in the procurement and management of design-build contracts so that MWSS is better prepared for future projects.

Financial capacity of MWSS

MWSS is dependent on the concessionaires paying the concession fees to cover its debt obligations and annual running costs. It is important that the concessionaires operate both efficiently and profitably. The current rate rebasing assessment is important in ensuring this. It is probable that the regulatory office capability in establishing rates and monitoring performance of concessionaires could be strengthened although an investigation of the regulatory office has not been carried out.

Operation and maintenance

The operation, maintenance and renewal of the transmission system before and after privatisation have been poor. It is apparent that this is recognised by the concessionaires in the CPF rate rebasing submission wherein priority projects, including an O&M capability improvement programme are planned. Given the success of the concessionaires in improving the performance of the water treatment and distribution systems we feel these important projects should be supported by MWSS and implemented urgently by the concessionaires.

There is concern that the CPF does not function as independently as required. We believe that the CPF team will function better as an independent unit when it can move to its own office at La Mesa.

The Regulatory Office needs to be proactive in monitoring the performance of CPF in meeting the commitments within the approved rate rebasing submission.

11 Construction planning

11.1 Construction Constraints

The main project specific constraints on construction activities that have been identified are:

- Maintaining water flows in existing transmission system
- Minimising turbidity in Ipo reservoir
- Minimising impact on operations at existing Ipo dam and intake
- Minimising impact on indigenous people in Ipo catchment
- Minimising impact on Ipo catchment
- Disposal of tunnel excavated material
- Minimising impact on operations at Bigte basin compound
- Preventing damage from construction traffic to aqueducts and existing roads

These are summarised below.

11.1.1 Maintaining Water Flows

The raw water transmission system from Ipo to La Mesa carries almost all the water for Metro Manila's 14 million population. It is therefore imperative that the construction works do not significantly reduce the flows that are transported through the system. Apart from the connection to aqueduct 5 at Bigte the works are located away from the existing system and therefore should not affect flows in the system. Tunnel 4 is located 23m centre to centre south of Tunnel 1, giving at least 19m of rock between the tunnels, therefore the construction of Tunnel 4 should not affect the integrity of Tunnel 1.

11.1.2 Turbidity

The bed of Ipo reservoir has a layer of silt which has built up since impoundment. This layer is around 10m thick upstream of the old Ipo dam and 3m between the old and new Ipo dams. The intake is located in the latter section between the dams where silt thickness is at a minimum. The intake will be constructed within a cofferdam so the only silt disturbance affecting turbidity will be during cofferdam construction. The resulting turbidity will be small compared to that during storm conditions.

11.1.3 Impact on Operations at Ipo

The contractor's works should not affect the operations at Ipo as they are separated from the operational site. The access road will be shared for most of its length and generally contractor traffic is not expected to be more than a few vehicles an hour. For special loads or high densities of traffic the contractor will need to liaise with the operator.

11.1.4 Impact on Indigenous People

The works at Ipo are within the area claimed as ancestral domain by the Dumagats. Agreements will need to be made with them in accordance with IPRA Act 1997, which may have some affect on contractor activities, although this is not expected to be major.

11.1.5 Impact on Ipo Catchment

The construction will require establishment of a construction compound near the old Ipo dam. This is open ground and the provision of a temporary well designed compound which is removed at the end of construction will have no significant effect on the Ipo catchment.

11.1.6 Tunnel Excavated Material

Over 150,000 m^3 of material, mostly basalt, will be excavated for the tunnel. This has to be disposed of by the contractor in an environmentally acceptable manner. It is envisaged that much of the excavated material will be useful as a construction material on this and other projects.

11.1.7 Impact on Operations at Bigte

Unlike at Ipo, the construction works at Bigte are within the operational compound and will therefore need to be planned in conjunction with the operations team. The tunnel portal is relatively clear of the operational site and a construction compound area is available within the compound with separate access to the operational site from the south. The contractor will therefore be able to carry out tunnelling works without impacting the operations. The construction of the conveyance from the tunnel to aqueduct 5 and the connection to aqueduct 5 at basin 3 will need to be carefully planned with the operations team. The connection will require the closure of the aqueduct for a time: provided this is done when the La Mesa reservoir is full, it is anticipated that the connection can be carried out without affecting the supply of treated water to Manila.

11.1.8 Damage from Construction Traffic

Construction traffic can be heavy and lead to damage of existing roads and below ground infrastructure. The contractor will need to consider what size construction traffic is suitable for the existing roads, especially the access road to Ipo. To enter the proposed construction compound at Bigte it will be necessary to cross existing aqueducts. The contractor will need to provide protection to these in order to prevent damage from construction traffic.

11.2 Construction Schedule

The Tunnel 4 project will be constructed under a design and build FIDIC contract enabling contractors to match design details to their available resources. This generally has cost and time benefits.

The critical item on the construction programme will be the tunnel excavation and lining and therefore design, and approval related to the tunnel but not the whole project will be critical. Sectional design submissions will be permitted to facilitate this.

The preliminary design is for a tunnel excavated by drill and blast method with a permanent concrete lining. In order to keep the overall project schedule to an acceptable timescale, it is considered necessary to tunnel from both ends. Access to the portal at the Bigte outlet end is relatively straightforward and tunnelling should be able to commence as soon as applicable design is approved and construction permit issued.

Access to the upstream portal at Ipo is more challenging and the contractor will need to decide on his methodology to enable tunnelling to proceed from this end. In the indicative programme it has been assumed that construction will take place from the cofferdam that has to be constructed to enable construction of the intake. Land access to this is difficult due to the potential instability of the hillside. There are other options, such as constructing the tunnel from a temporary shaft or adit, which would enable the main tunnelling from Ipo to be carried out independently of the inlet works. The contractor will consider the pros and cons of various options. All options will require significant works before tunnelling can begin from Ipo.

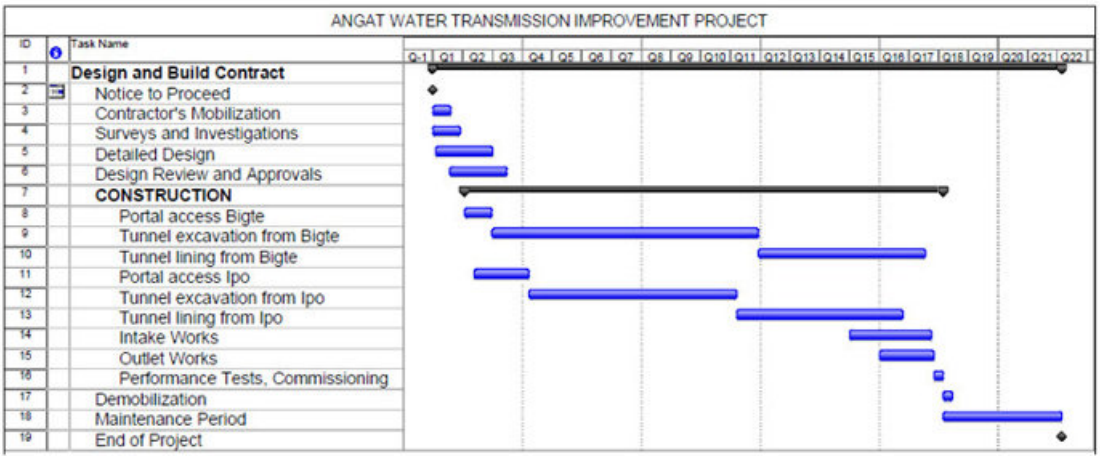
Construction of the intake will be dependent on tunnel progress particularly if the cofferdam is used for tunnel construction. Construction of the outlet structures and interconnection to aqueduct 5 (basin 3) at Bigte can be carried out independently of tunnel construction except for the final section connecting to the tunnel portal.

Although 3-shift working was used during excavation of Tunnel 3, the indicative programme is based on 2 shifts as there are concerns about the time needed to clear the blasting gases down the length of the tunnel before re-entry. A contractor will need to demonstrate a safe method of working for 24-hour working. Excavation rates will vary between 1 and 4m per shift depending on the rock quality. Tunnel 3 rock support drawings have been examined to estimate the lengths of different rock quality and an average advance of 2.7m per shift has been estimated.

The permanent concrete lining required for durability will almost certainly have to wait for completion of tunnel excavation as the logistics of managing lining and excavation in a 4m diameter tunnel are too complex. The lining logistics will need to be carefully thought out by the contractor to achieve the required progress.

The indicative programme in Figure 27 shows a 52-month design and construction period and a 12-month defects notification period.

Figure 27 Indicative Construction Programme



12 Cost estimate

12.1 Project

The direct project costs are indicated in the table below.

	In PhP	In US$
DESIGN and BUILD CONTRACT		
General Items	112.780	2.623
Contractor Design	104.630	2.433
Civil Works	3,444.605	80.107
Electrical Mechanical	43.071	1.002
Taxes	444.611	10.340
Environment Mitigation	82.994	1.930
Sub-total	**4,232.691**	**98.435**
Physical Contingency	578.694	13.458
Price Contingency	380.986	8.490
Sub-total	**959.680**	**21.948**
DESIGN and BUILD CONTRACT	**5,192.371**	**120.383**
OTHERS		
Construction Supervision	259.619	6.038
OTHERS	**259.619**	**6.038**
		-
TOTAL PROJECT COST without financing charges	**5,451.989**	**126.421**

The costs for construction have been built up from quantities established from the preliminary design and cost rates derived from various contracts and studies. These include Sibulan hydro scheme near Davao in Mindanao completed in 2011, studies for Novaliches – Balara aqueduct 4, Sumag river diversion works, and the recently completed aqueduct 6 from Bigte to La Mesa.

The cost rates include allowances of 10% for overheads and miscellaneous costs (such as contractor staff, insurance, bonds, and contractor office costs) and 10% for profit as well as 12% VAT.

The general items include mobilization and demobilization, site establishment, labour costs, facilities for Employer/Engineer, traffic management and others.

A physical contingency of 15% on civil works is included to allow for unforeseen issues, particularly related to tunnelling and intake construction. A price contingency of 5% is also included.

There are likely to be costs associated with resolving some of the land ownership issues and possibly for mitigating environmental issues. These are estimated at 5% at this stage.

A consultant will be required to provide technical assistance during procurement and construction. It is proposed that this consultant will provide advice and training to MWSS staff on design and build contracts. No other capacity strengthening is currently proposed. It is anticipated that the consultant fee will be around 5% of the construction cost.

The total direct cost of the project is therefore expected to be US dollars 126.4 million.

13 Financial and Economic Analysis

The proposed project partly addresses the overall objective to improve the reliability and security of the raw water transmission system for MWSS. This new tunnel system forms an integral component of overall improvement of the transmission system and the other future projects (such as rehabilitation of the aqueduct systems) need to be well integrated. The project is estimated to be $133.615 million of which $120.383 million is for the design and build contract, $6.038 million for construction supervision, and $7.194 million is allocated for the financial charges during implementation. Table 13-1 shows the breakdown of the project cost.

Table 13-1 Total Project Cost

Description	PROJECT COST ESTIMATE					
	LOAN PROCEEDS		GOP COUNTERPART		TOTAL COST	
	US$ M	PhP M Equiv	US$ M	PhP M Equiv	US$ M	PhP M Equiv
I. DESIGN AND BUILD CONTRACT						
Base Cost						
a. Facilities	2.623	112.780			2.623	112.780
b. Contractor's Design	2.433	104.630			2.433	104.630
c. Civil Works	80.107	3,444.605			80.107	3,444.605
d. Electrical/Mechanical	1.002	43.071			1.002	43.071
e. Taxes			10.340	444.611	10.340	444.611
f. Environmental Mitigation	1.930	82.994			1.930	82.994
sub-total	**88.095**	**3,788.080**	**10.340**	**444.611**	**98.435**	**4,232.691**
Contingencies:						
a. Physical Contingency 15%	13.458	578.694			13.458	578.694
b. Price Contingency 8%	8.490	380.986			8.490	380.986
sub-total	**21.948**	**959.680**	**-**	**-**	**21.948**	**959.680**
TOTAL DESIGN AND BUILD CONTRACT	**110.043**	**4,747.760**	**10.340**	**444.611**	**120.383**	**5,192.371**
II. OTHERS						
a. Construction Supervision	**6.038**	**259.619**	**-**	**-**	**6.038**	**259.619**
sub-total						
TOTAL (I and II)	**116.081**	**5,007.379**	**10.340**	**444.611**	**126.421**	**5,451.989**
a. Interest During Implementation			7.742	332.927	7.742	332.927
b. Commitment Charges			0.334	14.344	0.334	14.344
sub-total	**-**	**-**	**8.076**	**347.271**	**8.076**	**347.271**
TOTAL PROJECT COST ESTIMATE	**116.081**	**5,007.379**	**18.416**	**791.881**	**134.497**	**5,799.260**

Foreign Exchange Rate:

US$1.0 = PhP 43.00

The general assumptions used are shown in Table 13-2.

Table 13-2 Assumptions Used

Assumptions					
Exchange Rate	US$1 =Php 43.00				
Physical Contingency	15%		Civil Works only		
Price Contingency	**2013**	**2014**	**2015**	**2016**	**2017**
International Cost Escalation	1.90%	2.20%	1.90%	1.80%	1.80%
Domestic Cost Escalation	3.60%	4.00%	4.00%	4.00%	4.00%

Assumptions					
Peso depreciation rate		1.76%	2.06%	2.16%	2.16%
Peso exchange rate (derived)	43.00	43.757	44.659	45.624	46.610

The annual breakdown of project cost is shown in Table 13-3.

Table 13-3 Annual Breakdown of Project Cost

Amount in US$ million	Total Cost	Year 1	Year 2	Year 3	Year 4	Year 5
Design and Build Contract						
General Items	2.623	1.311	0.393	0.393	0.393	0.131
Contractor Design	2.433	1.825	0.243	0.122	0.122	0.122
Civil Works	80.107	16.580	18.444	18.444	16.692	9.947
Electrical Mechanical	1.002	0.150	0.000	0.000	0.300	0.551
Taxes	10.340	2.140	2.381	2.381	2.154	1.284
Environment Mitigation	1.930	0.965	0.965	0.000	0.000	0.000
Sub-total	**98.435**	**22.971**	**22.427**	**21.340**	**19.662**	**12.035**
Contingency	21.948	5.460	4.902	4.674	4.321	2.592
Design and Build Contract	120.383	28.432	27.329	26.014	23.983	14.627
OTHERS						
Construction Supervision	6.038	3.019	0.906	0.906	0.906	0.302
OTHERS	6.038	3.019	0.906	0.906	0.906	0.302
TOTAL PROJECT COST (less financing charges)	126.421	31.450	28.234	26.919	24.888	14.928
Financing Charges during Implementation	8.076	0.330	1.026	1.650	2.240	2.830
TOTAL PROJECT COST	134.497	31.780	29.260	28.570	21.128	17.758
% Total Project Cost	100%	23.6%	21.8%	21.2%	20.2%	13.2%

At MWSS' request, the project is to be financed through a long-term loan from ADB's Ordinary Capital Resources. The taxes and financing costs will be borne by the Government, which are being / charged to the Concessionaire.

Table 13-4 shows the proposed financing plan:

Table 13-4 Proposed Financing Plan

Source	Amount ($ million)	Share of Total (%)
Asian Development Bank - OCR	75.500	56.1%
Asian Development Bank - AFI	40.000	29.7%
Sub-total	***115.500***	***85.9%***
Government	18.997	14.1%
Total	**134.497**	**100.0%**

Under the concession agreement between MWSS and the two Metro Manila service concessionaires, the repayment of this loan will be passed on to the concessionaires which, in turn, will pass this on to consumers in the form of water rates.

13.1 Financial Analysis

The proposed project partly addresses the overall objective to improve the reliability and security of the raw water transmission system for MWSS. This new tunnel system forms an integral component of overall improvement of the transmission system and the other future projects (such as

rehabilitation of the aqueduct systems) need to be well integrated. The project will not provide additional raw water supply to the system, but will allow rehabilitation of the transmission system by creating redundancy and flexibility in diverting flows without disrupting water supply to Metro Manila. Given no additional raw water supply, the project output is considered as non-incremental water.

Therefore the common financial analysis is not appropriate, but instead the "failure rate" approach is used to compute the financial viability of the project. In the failure rate approach, a comparison is made on the "with" and "without" project scenarios. Under the "without" project scenario, the probability of failure in the water supply increases over time under present conditions. This failure of the water transmission system means "loss of billed water" or "lost revenue". The project will help minimize the failure rate and thus limit lost water revenue.

Ideally, the probability of failure in the water supply is based on the historical performance of the system. Unfortunately, the maintenance records in the existing tunnel system were not available. This is also compounded by the absence of written maintenance procedures. Technical expert advice was sought on the "failure rate" of the tunnel system. The combined knowledge and experience of the personnel directly involved with the operation and maintenance of the assets was then used, with guidance from the technical consultant, to develop a less subjective assessment of asset condition, and a 'consequence / likelihood' risk matrix developed.

The project analysis is done on a 25-year timetable (even if the project is designed for a 100-year timetable). Based on technical assessment, it is assumed that once every five years the system will fail and it will take around 60 days to restore capacity meaning 60 days of lost revenue. Furthermore, it is assumed that a failure will only reduce raw water supply by 13m³/s or one-third of the total water supply. It is calculated that each day of water disruption translates to 842,400 m³ of lost water or roughly $777,564 of lost revenues, based on an average water tariff of $0.92 per m3. For each instance of failure, this translates to $46.65 million of lost revenues. It is further assumed that under the "without" project, the demand exceeds supply of water. The annual O&M, 0.2% of investment costs, and the residual value of the project, 75% of investment costs, are likewise considered in the net project financial cash flow.

The Weighted Average Cost of Capital (WACC) is calculated at 2.25% as illustrated in a Table 13-5.

Table 13-5 Computation of Weighted Average Cost of Capital

	ADB OCR	ADB AFI	Government Counterpart	TOTAL
Amount	75.50	40.00	19.00	134.50
Weighting	56.14%	29.74%	14.12%	100.00%
Nominal Cost[9]	3.49%	4.39%	10.00%	
Weighted Component of WACC (nominal)	1.96%	1.31%	1.41%	**4.68%**
Inflation Rate	1.80%	1.80%	4.00%	
Real Cost	1.69%	2.59%	6.00%	
Weighted Component of WACC (real)	0.95%	0.77%	0.85%	**2.56%**

The financial internal rate of return (FIRR) is computed to be 5.72% and the financial Net Present Value is calculated to be $68.33 million. This means that the project is financially viable; the avoidance of losses of water revenue for the concessionaires more than offsets the project cost.

[9] The nominal cost for ADB OCR is based on a 10-year Libor and spread of 2.888% per annum and a ROP guarantee of 1.0% annum. The nominal cost for government funds is 10% which the prescribed rate set by the Philippine economic planning agency.

13.2 Economic Analysis

The economic analysis follows the same methodology used in the "with and without" project financial analysis. As discussed in the financial analysis, the "failure rate" approach is used to compute for the viability of the project. The economic analysis uses instead the economic costs and benefits of the project. The economic analysis follows the ADB guidelines on the economic analysis of water projects. While the project is expected to last for 100 years, the economic analysis is done on a 25 year period. Residual value of the project investment at the end of the 25 year period is considered in the economic analysis.

In the "with" project scenario, the financial project cost is translated to its economic value using the domestic price numeraire by converting the foreign exchange and labour costs to their economic shadow prices. The assumptions on the shadow prices used by ADB are shown in Table _. Furthermore, taxes are excluded in the economic analysis as these are considered transfer costs.

In the event of a failure in the transmission system, the water supply is expected to reduce by 13m³/s or one-third of the total water supply in the Angat system. Under this "without" project scenario, the financial lost-billed revenue is converted to its economic value. Given that the project output is non-incremental water, the economic benefit of the project is the resource cost savings on the non-incremental water. The economic value of non-incremental water is the economic supply price instead of the willingness-to-pay. The price of alternative water supply is used as the economic supply price. The alternative sources of water supply are from small private companies willing to deliver water in drums to residential areas during the failure of the main water system. The residential demand for alternative water supply is assumed to be 40% of the total water demand during water disruption as consumers limit the use of water to bare essentials and the cost of alternative water is significantly higher than what the consumers are currently paying.

The economic supply price of water is based on the weighted average of the economic supply price for domestic (for household use) and non-domestic (commercial and industrial) use. The economic supply price for domestic use is further broken down into for drinking water and for other uses. The economic supply price for drinking water is much higher than for the other uses as household residential consumers tend to buy bottled water in case of water interruption. The economic price of water for residential has more impact on the weighted average economic price of water.

The table below shows the weighted average economic supply price of water.

Table 13-6 Weighted Average Economic Supply Price of Water[10]

Category	% to Total	Pesos per cu. meter	USD per cu. meter
Residential	66%	132.69	3.09
Drinking	1.82%		
Other uses	98.18%		
Commercial	27%	71.12	1.65
Industrial	7%	71.12	1.65
Weighted Average		111.75	2.60

[10] The cost of drinking water from alternative sources is based on price of bottled water ($0.81 per 5 gallon of water) which translates to an equivalent of $43/cm. The cost of non-drinking alternative water is assumed to be $5.81/cm based on $1.16 per 200 liter drum supplied by small private companies. It is further assumed that alternative supply for commercial and industrial uses is from the existing "reservoir" of these commercial and industrial establishments and can be replenished using bulk supply of water which conservatively priced the same as the economic supply price.

At 2013 prices, the economic supply price of water is calculated to be 11.75 per m3 (or $2.60 per m3) equivalent to 2.82 times the financial cost of water of $0.92 per m3. In economic terms, it is calculated that each day of water disruption of 842,400 m3, translates to lost economic revenue of $2.19 million.

Given the "with- and with-out" annual project economic cash flows, the net project economic cash flow is computed. The economic viability of the project is then determined using the indicators like the economic net present value (ENPV) and economic internal rate of return (EIRR) of the project using an economic hurdle rate of 12%.

The economic NPV is computed to be $13.27 million using an economic hurdle rate of 12% or an EIRR of 15.42%. Given the positive economic NPV and an EIRR greater than the hurdle rate, the project is therefore considered as economically viable.

In the distribution analysis, the major stakeholder that will benefit from the project is the Metro Manila consumers comprising the residential, commercial and industrial users.

Table 13-7 Assumptions Used in Economic Analysis

Shadow Factors for Economic Analysis	
1.20	Forex
0.6	Unskilled Labour
1.0	Skilled Labour
50%	Relative cost of labour in O&M activities (based on technical assessment)

13.3 Sensitivity Analysis

The sensitivity analysis examines the effects of changes in the assumptions used on the determining the financial and economic viability of the project.

Table 13-8 Financial and Economic Analysis, Base Case

	Net Present Value (in million pesos)	Net Present Value (in US$ million)	Internal Rate of Return	Hurdle Rate
Financial Indicators	2,938.34	68.33	5.72%	2.56%
Economic Indicators	1,238.06	28.79	15.42%	12.00%

Table 13-9 summarizes the range of the variables used in determining the sensitivity of the base case financial and economic analysis to changes in these variables.

Table 13-9 Variables in Determining the Sensitivity of the Base Case

Item	Change	Remarks
Investment	10%	Affects the project cost with the increase in both forex and local components
Benefits	-10%	Decrease in benefits can be a result of decrease in failure rate or the flow rate
Investment and Benefits	10% and -10&	Affects the project cost with the increase in both forex and local components and decrease in benefits can be a result of decrease in failure rate or the flow rate

Results of the sensitivity analyses are shown in Table 13-10 for the financial analysis and Table 13-11 for the economic analysis.

Table 13-10 Sensitivity of Financial Analysis[11]

Item	Change	FNPV (in million pesos)	FNPV (in US$ million)	FIRR %	SI (FNPV)	SV (FNPV)
Base Case		2,938.34	68.33	5.72%		
Investment	10%	2,659.42	61.85	5.14%	0.95	105.3%
Benefits	-10%	2,365.59	55.01	5.08%	-1.95	-51.3%
Investment and Benefits	10% and -10%	2,086.68	48.53	4.54%	-2.90	-34.5%

Table 13-11 Sensitivity of Economic Analysis[12]

Item	Change	ENPV (in million pesos)	ENPV (in US$ million)	EIRR %	SI (ENPV)	SV (ENPV)
Base Case		1,238.06	28.79	15.42%		
Investment	10%	883.06	20.54	14.27%	2.87	34.9%
Benefits	-10%	759.25	17.66	14.15%	-3.87	-25.9%
Investment and Benefits	10% and -10%	404.25	9.40	13.06%	-6.73	-14.8%

The project still remains economically viable even with a 10% increase in project investment or with a 10% decrease in benefits and on a scenario with a 10% increase in project investment and simultaneously with a 10% decrease in benefits.

Failure rate and flow rate are the two major input variables used in computing for the project benefits. It is calculated that a rate of one failure incident for every 6.74 years is the minimum failure rate for the project to still be financially and economically viable.

The economic viability of the project is not affected if the decrease in the values of the variables is less than 14.8% (as shown in the switching value column in the above table).

As stated in the financial analysis, other non-quantitative cost of the "without" project scenario include water-borne diseases during water disruption as consumers will rely on the informal supply for much needed water supply. The prolonged water disruption in Metro Manila can cause social and political unrest which can contribute to a significant loss in the economy.

13.4 Financial Capacity Assessment of MWSS

MWSS retains ownership of the water facilities and exercises its regulatory functions on water rates. Under the concession agreements between MWSS and the two concessionaires (Manila Water Company Inc. [MWCI] and Maynilad Water Services, Inc. [MWSI]), the concessionaires operate and manage the water supply, sewerage and sanitation services in the MWSS service area for a specified number of years.

[11] Financial Analysis using WACC = 2.25% (Base Case NPV = US$68.33m and IRR = 5.72%); SI = Sensitivity Indicator; SV= Switching Value

[12] Financial Analysis using WACC = 2.25% (Base Case NPV = US$68.33m and IRR = 5.72%); SI = Sensitivity Indicator; SV= Switching Value

The concessionaires have also directly funded certain water and sanitation infrastructure investments. The concession agreement allows the concessionaires to collect water rates from consumers, to recover operating, capital maintenance and investment expenditures, and concession fees over the concession period and at the same time earn a reasonable rate of return on what they have spent. The concession agreement also provides mechanisms to enable the concessionaires to adjust the water rates in the form of rate rebasing every five years. The adjustment in water rates also considers economic parameters like inflation and foreign exchange fluctuations. The overall performance of each concessionaire is based on how well the concessionaire manages its capital expenditures, its operating cost structure and its collection efficiency.

Concession fees roughly represent 90% of MWSS revenues, and can be grouped into two general categories: (i) debt service obligations and payments to finance MWSS's direct investments in water supply and transmission, which are treated as pass-on payments, and (ii) current operating budget for the administrative expenditures of MWSS Corporate Office and Regulatory Office subject to consumer price index adjustment. Other revenue sources of MWSS include rentals of leased properties and interest income. The financial capacity of MWSS is, therefore, primarily based on the ability of MWSS to collect concession fees from the two concessionaires. MWSS can draw down from the performance bond as set in the concession agreement in the event that the concessionaire fails to pay the concession fee.

MWSS also undertakes major development projects, the costs associated to such projects are passed on to the concessionaires as part of concession fees. At the start of the fiscal year, MWSS provides the two concessionaires the schedule of all anticipated amount due related to the concession fee payable during the year. This includes the total amount due for any scheduled payment of principal, interest, fees or other amount under existing MWSS loans. The concession fees received are used by MWSS to service its debt obligations, cover its annual operating expense and finance the local counterpart requirements of its ongoing projects. MWSS still carries the risk of the non-payment of the concession fee (although this risk is mitigated to some extent by the performance bond set in the concession agreement). MWSS still has the obligation to pay its loans even with the non-payment of the concession fees from the concessionaires. Under the concessionaire agreement, the concessionaire shall post a Performance Bond in favour of MWSS to secure the concessionaire's performance on its obligations. With respect to existing MWSS loans, MWSS has not passed on the sovereign guarantee of loan payments to the concessionaires although the 1% sovereign guarantee fee for ROP guarantee of the ADB loan will be passed on and paid by the two concessionaires as part of the debt servicing under the concession fees.

MWSS administration undertook major reforms in 2012 including cost rationalization on the employee benefits system and tight controls on maintenance and operating expenses including prudent capital investment programming. These reforms have improved the financial condition of MWSS. MWSS has able to pay off their tax balance as well as declare cash dividends.

The funds to service interest and principal on this loan will come from concession fees paid by the two Metro Manila concessionaires.

Table 13-12 Selected Financial Statement and Financial Indicators for MWSS

	2008	2009	2010	2011	2012
In Million pesos					
Gross Revenue	2,148	2,520	2,298	2,643	2,719
Net Income	(3,553)	399	(33)	333	1,945
Cash and cash equivalents	5,591	4,948	4,384	1,412	1,970

	2008	2009	2010	2011	2012
Long-term Liabilities	18,107	16,535	15,452	11,974	11,614
Interest coverage ratio	0.08	0.83	0.63	2.71	3.30
Debt service ratio	-1.25	1.17	1.08	1.19	2.19
Current ratio	2.77	3.08	3.15	2.47	2.74
Quick ratio	1.65	1.67	1.51	0.84	1.05
Accounts receivable turnover	-2.73	0.29	-0.02	0.18	0.98
Accounts payable turnover	5.17	2.03	2.14	2.49	0.77

Table 13-13 Financial Projections for MWSS

(In million pesos)	2020	2025	2030	2035	2040
Operating Receipts	2,649.80	2,282.91	2,171.31	2,185.76	2,314.18
Concession Fees	2,567.66	2,200.77	2,089.17	2,103.62	2,232.04
Debt Service	1,438.81	885.75	557.29	1,534.64	853.92
Operating Expenses	329.31	383.61	446.88	395.51	433.44
Debt Service/ Concession Fees	56%	40%	27%	73%	38%

MWSS financial performance remains dependent on the collection of concession fees from the concessionaires for its debt servicing obligations. Under the concession agreement, the concessionaires will collect the debt service on MWSS' loan from ADB for this project, as part of the tariffs collected from consumers. As the ADB loan matures after the end of the current concession period, MWSS will assume the remaining debt which is covered by the sovereign guarantee by the Philippine Government. With its thrust towards water security, MWSS is expected to undertake other major water supply projects under PPP arrangements which will minimize the overall financial risk for MWSS.

13.5 Financial Capacity Assessment of MWCI and MWSI

With the robust growth in billed volume and improved operating efficiencies, MWCI has continued its financial growth exceeding the goals set for the East Zone business. This allowed MWCI to explore new business development outside the primary concession area. With this strategy coupled with good cost management and efficiency initiatives, MWSS has achieved record financial results across all domestic operating groups. MWSS expects higher growth in the future with the expanded base of operations.

For MWSI, the strong growth in the financial position is a result of an aggressive water service rehabilitation program which started in 2007.The continuous efforts towards network improvement and the reduction of non-revenue water will enable MWSI to maintain its momentum towards financial growth. MWSI has likewise expanded their business coverage beyond the West Zone of Metro Manila.

Table 13-14 Selected Financial Statement and Financial Indicators for MWCI and MWSI

	MWCI			MWSI		
	2010	2011	2012	2010	2011	2012
In Million Pesos						
Gross revenues	11,013	12,003	14,553	12,050	13,770	15,880
Net Income	3,987	4,278	5,451	4,780	5,860	6,390
Cash and Cash equivalents	2,412	5,235	5,540	1,306	4,175	3,906
Current Liabilities	5,421	6,288	9,899	10,216	12,119	13,244
Total debt, incl. current portion	28,642	38,085	40,228	34,646	42,884	44,575
Billed volume (in million cm)	410	412	427	374	405	428
Non-revenue water (% of water production volume)	11.0%	11.2%	12.2%	53.0%	48.0%	43.0%
Interest coverage ratio	5.06	4.00	5.15	3.29	3.87	3.64
Current ratio	1.09	1.24	0.83	0.43	0.69	0.61
Accounts receivable turnover	12.47	6.70	5.46	4.57	3.90	3.57
Accounts payable turnover	1.20	1.19	1.22	0.67	0.62	0.61

While there has been an improvement in the financial capacity of the two concessionaires over the last few years, the rate rebasing exercise in 2013 creates uncertainty in meeting the projected financial targets of the two concessionaires as well as the implementation of capital investment plans.

The increase in billed volume for the compounded by the approved 2012 tariff adjustments contributed to healthy financial performance of the two concessionaires. The growth can likewise be attributed to the increase in coverage areas and the higher consumptions of key accounts. The challenge, however, remains for both concessionaires in minimizing any adverse effects of the delay in the implementation of the 2013 rate rebasing on the operations.

13.6 Impact on Affordability

It may be difficult to assess the effect on tariff due to the project given the complexity of the rate rebasing exercise. An attempt is made in calculating the increase in tariff due to the project using the projected financial obligations of the two concessionaires due to project and the total billed water volume. The increase in water tariff is computed to be P0.098 per cubic meter for the first four years (during the grace period of the loan) and P0.552 per cubic meter (after the grace period) based on the total billed water for both concessionaires.

Based on the 2005 study, the average monthly volume of water for the lowest 20% income group is 23.73 cubic meters per household. Given the monthly volume of water, the increase in water tariff due to the project is computed to be only P13/month for the lowest 20% income group representing an insignificant % of the income. In addition, the lowest income group also enjoys socialized tariffs for the first 10 cubic meters of monthly water consumption.

13.7 Other Impact

While the project output is non-incremental water but with alternative water supply source in case of water disruption, the impact of the "without" project scenario on areas like water-borne diseases, etc. may be significant. The prolonged disruption in water supply in Metro Manila may lead to social and even political unrest. Given that Metro Manila constitutes more that 10% of the entire population and business activities remains concentrated in Metro Manila, the impact on the Philippine gross domestic product can be significant under this scenario.

13.8 Financial Management Assessment

MWSS follows the basic policies and procedures outlined by the New Government Accounting System (NGAS) as required by the Commission on Audit (COA).

MWSS has prepared a comprehensive well-documented MWSS Accounting and Internal Audit Manual to comply with the basic objectives of financial reporting and the objectives of the prescribed NGAS. The manual covers the basic transaction cycles involved in MWSS and the related internal audit guidelines related to these transaction cycles (refer to the Attachment for the Table of Contents of the Manual).

Even before the introduction of NGAS, MWSS has been implementing a commercial accounting-based system in contrast to the Fund Accounting-based system used by most government agencies and made MWSS complied with some of the basic principles of the NGAS policies.

13.8.1 Project Funds Flow Arrangements

The following are the funds flow arrangements:

For Loan Disbursement

- Contractor submits billing to MWSS. MWSS gets concurrence from concessionaires for fund release to supplier.
- ADB releases funds directly to the contractor upon payment advice from MWSS.

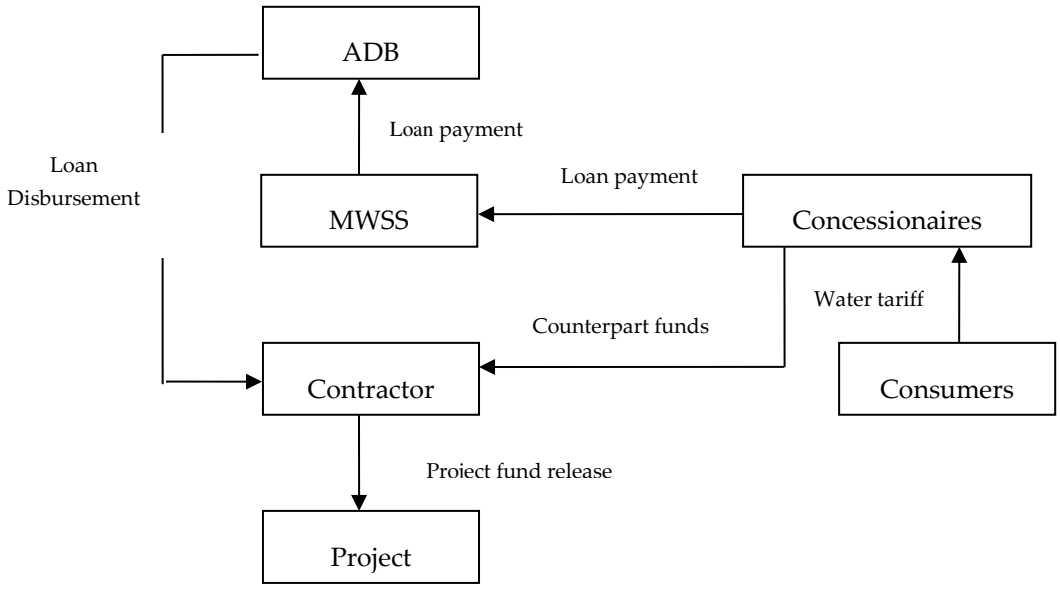
For Government Counterpart funds:

- Contractor submits billing MWSS. MWSS advises concessionaires for payment to contractor.
- Concessionaires release funds to contractor.

For Loan / Interest Repayment

- ADB submits billing to MWSS for loan / interest payment.
- MWSS advises concessionaires for loan / interest payment.
- Concessionaires release funds to MWSS representing loan / interest payment.
- MWSS releases funds to ADB representing loan / interest payment.

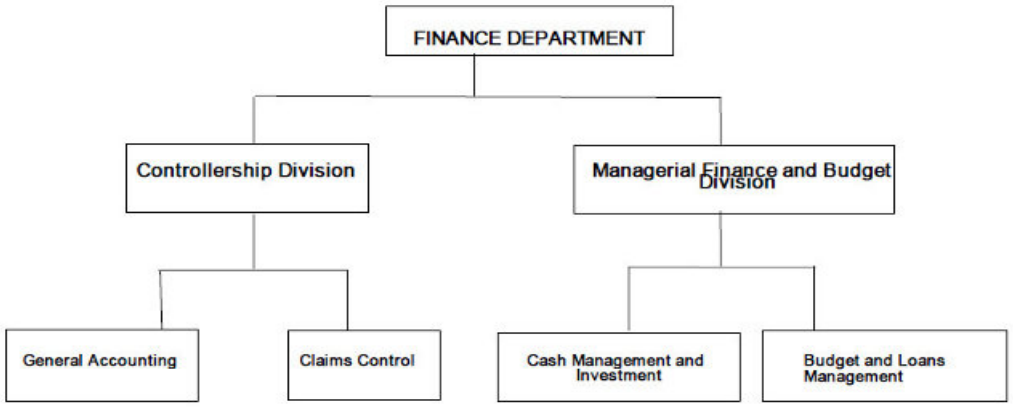
Figure 28 Funds Flow



13.8.2 Staffing

The organizational structure of the finance department is shown below:

Figure 29 Organizational Structure



Under the new MWSS organization, MWSS aims to further strengthen its funds sourcing and management staff.

13.8.3 Accounting Policies and Procedures

In line with the NGAS policies, MWSS follows the modified accrual accounting method. Under this method, all expenses shall be recognized when incurred and reported in the financial statements in the period to which they relate. Income shall be on accrual basis except for transactions where accrual basis is impractical or when other methods are required by law.

MWSS follows the Electronic New Government Accounting System (ENGAS) and the Government Auditing and Accounting Manual (GAAM) which allows for the proper recording of project financial transactions, including the allocation of expenditures in accordance with the respective components, disbursement categories and sources of funds.

13.8.4 Safeguard Over Assets

While there is a system for safeguarding MWSS assets, MWSS is currently reconciling the subsidiary records of fixed assets and stocks with control accounts.

13.8.5 Audit

The COA undertakes an audit on MWSS financial statements in accordance with the Philippine Standards of Auditing including audit on project accounts. Audit reports are issued annually. For the last three (3) years, no major accountability issues were brought out in the audit reports. However, there are COA recommendations on the treatment of personal services by MWSS.

On project accounts, aside from COA, MWSS needs to seek NEDA approval for any cost variation of more than 10%. MWSS is also expected to submit monthly report on drawdown and utilization of external funding to the Department of Finance and Central Bank of the Philippines.

13.8.6 Reporting and Monitoring

MWSS is required to prepare and submit reports in accordance with NGAS of COA and GAAM on a monthly, quarterly, semi-annually, annual or as may be required.

MWSS is also required to submit every year consolidated financial reports to the Government Accounting and Financial Management Information System (GAFMIS), COA.

MWSS currently maintains both computerized system and spreadsheets in preparing financial reports. There is a need to install a more upgraded computerized system and for the staff to undergo training on this system.

13.8.7 Information System

In coordination with the National Computer Center (NCC), MWSS plans to install a three-year long Information system strategic program to improve the knowledge management, operational efficiency and cost reduction efforts.

The financial management system is currently undergoing its full implementation. MWSS is requesting to have the general ledger financial management system. While the existing system can produce the necessary project financial reports, much needs to be done to make the process more efficient.

13.8.8 Others

As indicated in the MWSS 2012 Annual report, part of the thrusts of MWSS is to establish a relationship of mutual trust and respect with the business community, especially the financial institutions, to be able to plan and build water projects, naturally characterized by long gestation period and big financial requirements.

Furthermore, MWSS is currently undergoing a reorganization designed to strengthen their support functions like funds sourcing and management, information technology, and knowledge management. MWSS puts priority in improving their financial systems particularly “in strengthening controls, ensuring accuracy of input and output of systems and reports, facilitating ease of use of management analyses, ensuring requirement-timely reports and analyses for managerial decision making and regulatory compliances, and the completeness and integrity of historical databases.”

14 Project Preparation

The proposed project is the construction of a new Tunnel 4 from Ipo to Bigte to supply Basin 3/Aqueduct 5; Tunnel 3 will supply Aqueduct 6.

It is proposed that this is procured through a design and build contract using the ADB Standard Bidding Document for Procurement of Plant (Design, Supply and Install) - two stage, two envelope procedure with post-qualification. The FIDIC General Conditions of Contract for Plant and Design-Build 1999 will be used. The bidding documents are being prepared.

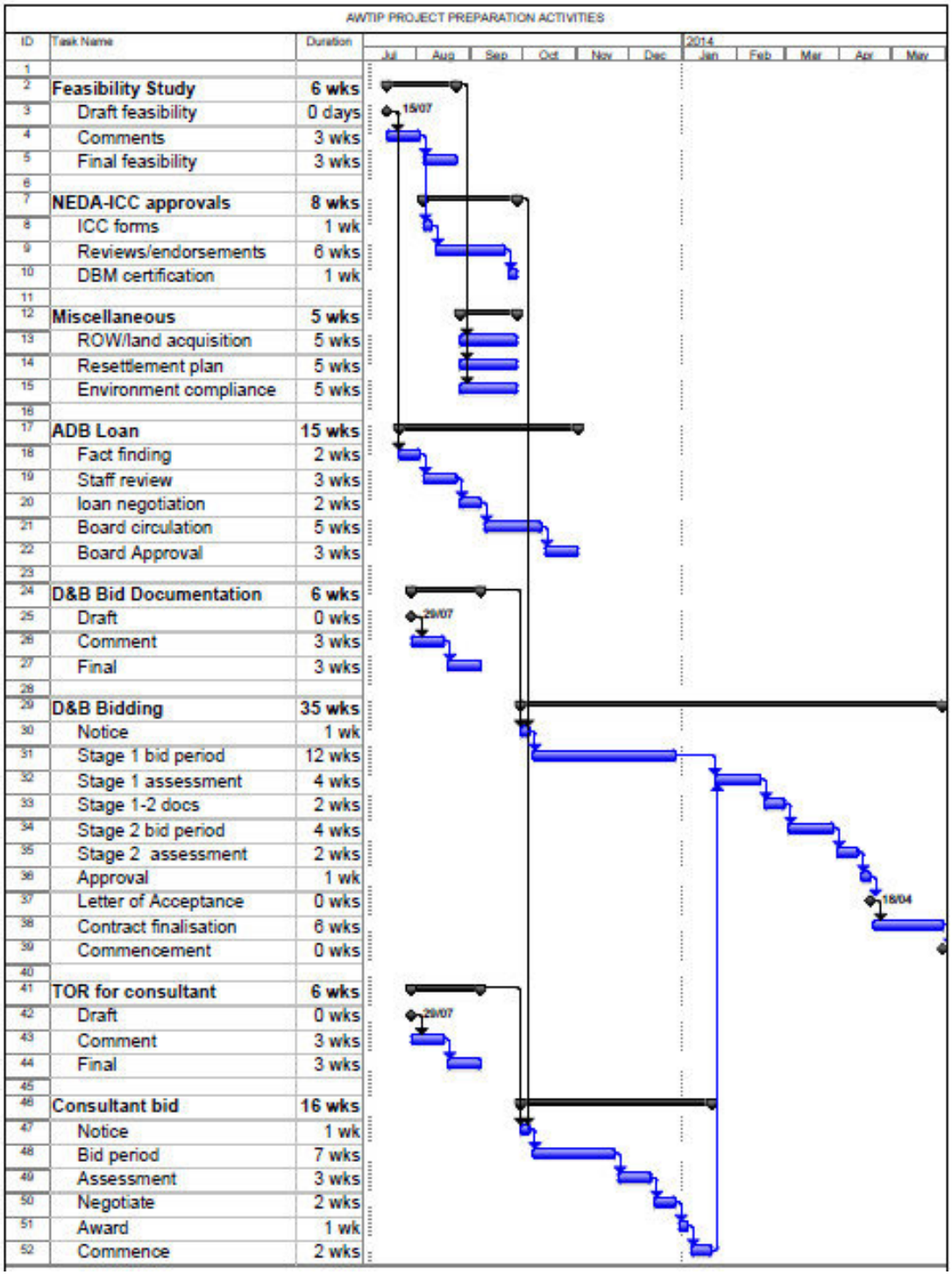
Technical assistance with the procurement and management of this contract will be provided by an International Consultant procured through the ADB quality and cost- based selection procedure. TOR is in preparation.

There is a need for MWSS to resolve the land ownership at Bigte where part of the compound is apparently not owned by MWSS and will be required by the contractor to construct the tunnel. While they will not be affected by the tunnel construction, there are 380 households within the existing Tunnel 1 ROW. MWSS needs to decide if they are to be resettled.

The process of loan and project approval involves a number of agencies and will take time as indicated in the tentative schedule in Figure 30. This schedule also indicates the bidding periods for the technical assistance consultant and D&B contractor. The consultant needs to be appointed before Stage 1 bid assessment can proceed as much of this assessment relates to assessing the design proposals of the bidders.

The earliest that a contractor will commence is June 1, 2014 and, depending on time taken to obtain approvals from NEDA-ICC and negotiate the loan from ADB, this could be later. It is apparent that bidding for TA and the D&B contract is likely to commence a number of weeks before the ADB loan is finalised.

Figure 30: Tentative project preparation schedule



ID	Task Name	Duration
1		
2	**Feasibility Study**	**6 wks**
3	Draft feasibility	0 days
4	Comments	3 wks
5	Final feasibility	3 wks
6		
7	**NEDA-ICC approvals**	**8 wks**
8	ICC forms	1 wk
9	Reviews/endorsements	6 wks
10	DBM certification	1 wk
11		
12	**Miscellaneous**	**5 wks**
13	ROW/land acquisition	5 wks
14	Resettlement plan	5 wks
15	Environment compliance	5 wks
16		
17	**ADB Loan**	**15 wks**
18	Fact finding	2 wks
19	Staff review	3 wks
20	loan negotiation	2 wks
21	Board circulation	5 wks
22	Board Approval	3 wks
23		
24	**D&B Bid Documentation**	**6 wks**
25	Draft	0 wks
26	Comment	3 wks
27	Final	3 wks
28		
29	**D&B Bidding**	**35 wks**
30	Notice	1 wk
31	Stage 1 bid period	12 wks
32	Stage 1 assessment	4 wks
33	Stage 1-2 docs	2 wks
34	Stage 2 bid period	4 wks
35	Stage 2 assessment	2 wks
36	Approval	1 wk
37	Letter of Acceptance	0 wks
38	Contract finalisation	6 wks
39	Commencement	0 wks
40		
41	**TOR for consultant**	**6 wks**
42	Draft	0 wks
43	Comment	3 wks
44	Final	3 wks
45		
46	**Consultant bid**	**16 wks**
47	Notice	1 wk
48	Bid period	7 wks
49	Assessment	3 wks
50	Negotiate	2 wks
51	Award	1 wk
52	Commence	2 wks

15 List of Drawings

The following drawings are attached:

Table 15-1: Drawing list

General	
Location Plan	AWTIP-GEN-01
Tunnel 4 Plan and Profile	AWTIP-GEN-02
Ipo Dam Area-Permanent Arrangement	AWTIP-GEN-03
Bigte Area-Permanent Arrangement	AWTIP-GEN-04
Contractor's Site	AWTIP-GEN-05
Civil	
Inlet Works	
General Arrangement Plan	AWTIP-INT-01
Intake Plan	AWTIP-INT-02
Intake Section 1	AWTIP-INT-03
Intake Sections 2 and 3	AWTIP-INT-04
Tunnel Works	
General Notes - Sheet 1 of 2	AWTIP-TUN-01
General Notes - Sheet 2 of 2	AWTIP-TUN-02
Tunnel Temporary Support - Sheet 1 of 2	AWTIP-TUN-03
Tunnel Temporary Support - Sheet 2 of 2	AWTIP-TUN-04
Tunnel Portal Construction Sequence	AWTIP-TUN-05
Tunnel Permanent Support Drawings	AWTIP-TUN-06
Outlet Works	
Tunnel 4 Bigte Outlet - General Arrangement Plan	AWTIP-OUT-01
Outlet Portal Sections	AWTIP-OUT-02
Transition Basin Plan and Section	AWTIP-OUT-03
Open Channel Plan and Profile	AWTIP-OUT-04
Open Channel Sections	AWTIP-OUT-05
Interconnection to Basin 3 Plan and Section	AWTIP-OUT-06

Appendix A Bigte Public Consultation

Angat Water Transmission Improvement Project

Record of Public Consultation: Barangay Bigte, Norzagaray, Bulacan

Date: 18 July 2013
Time: 0919 to 1000hrs
Venue: Barangay Session Hall, Bigte
Attendees:

Kon. Normil Bigote	Kag. Arvel V. Barcena	Kag. Jovina Lamatid
Kag. Ambet Cruz	Kag. Gilbert Ignacio	Kap. Resty Sumbillo
SK Therryne Samson	Kag. Ric Romel L. San Diego	Kag. Diony Delos Santos

Meeting notes:

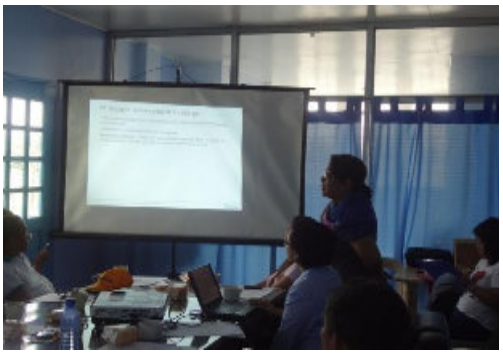
- Prayer and National Anthem led by Bigte Public officials
- Introduction of project by Rusty Romero
- Scope of project
- Discussion of maps (tunnels, tunnel ROW and per segment focusing on Segment 7)
- Discussion of potential environmental impacts by Rusty Romero
- Environmental degradation (loss of trees), air pollution and heavy vehicular traffic
- Discussion of IR/IP impacts/ social issues by Mildred Rollolazo (IR/IP/Social Development Specialist)
- National Housing Authority (NHA's) AFP housing at the surface of the proposed tunnel 4
- Validation of households within direct impact been conducted
- No IPs are found to reside within the alignment, but a small area (approx. 1ha) which is to be used temporarily during construction as a Contractor's work area, is claimed as ancestral domain by IPs.
- Discussion of social issues
- Scarcity of potable water supply
- Residents expressed the need for adequate water supply and for other sources of income and means of sustaining life.
- No negative comments from residents with regard to the project/ perceived project to be beneficial for the Barangay residents as they will bring employment/business opportunities
- Discussion about issues and concerns of the Barangay Council

Questions / Concerns / Issues	Response
Asked if spoils can be donated to the Barangay for sitio roads construction	Yes, just indicate the roads that will be improved to assess volume needed
Asked when the project will start	Projected is expected to start on 2014 but needs approval from NEDA and ADB. Project duration: 3 years
Asked if water supply is not enough in Metro Manila that's why another tunnel is needed	Rusty Romero answered about water loss and inefficiency in water flow from Ipo to Bigte (probably) due to the current status of old tunnels (e.g. with leakages)as well as inefficient water flows in aqueducts, etc and explained the proposed schemes : either close and rehabilitate two aqueducts or close and rehabilitate one tunnel

Questions / Concerns / Issues	Response
Concerned about the current status of Angat Dam and its possible impact on the community	Explained that building tunnel 4 is one mitigation measure on future seismic activities in the area
Requested to hire labourers for the project from the local residents	Mildred Rollolazo explained that labourers coming from the area will be given priority during construction

- Wrap-up by the Barangay Captain
- Thankful for the information presented
- Requested another consultation / discussion during project implementation before the project starts (e.g. scope, handling of work, safety, etc)
- Agreements: Rusty Romero (Environment Specialist) to coordinate with Barangay with regard to spoils to be donated to build roads
- Schedule for week commencing 20 July 2013 for mapping of roads to be improved

Photographic Record



Appendix B San Mateo Public Consultation

ANGAT WATER TRANSMISSION IMPROVEMENT PROJECT

Record of Public Consultation: San Mateo, Norzagaray, Bulacan

Date: 19 July 2013

Time: 0950 to 1115hrs

Venue: San Mateo Covered Court

Attendees:

Estrelita Santiago	Helen Santiago	Thelma Nicolas
Zenaida Viray	Emma Santos	Danilo Callvena
Narding Celestino	Carlota Reyes	Rosalyn Avendano
Marilyn Tikcon	Ellen Alano	Victoria S. Pulido
Marlyn B. Garcia	Ofelis Rilloma	Areta Balane
Valentina Co	Pio Dela Merced	Remedios Cabaling
Dennis Feliciano	Alma Balagta	Nelda Cabung
Rogelio Dela Merced Sr.	Wilfredo Palad	Arnol

MWSS Representative:
Mr Vicente Elefante
Manager, Property Management Department

Meeting notes:

- Opening remarks by First Kagawad Kon. Mario, and introduction of Barangay Secretary to Halcrow staff
- Mildred Rollolazo (Involuntary Resettlement / Indigenous People / Social Development Specialist) explained the project background and introduced Halcrow staff
- Rusty Romero (Environmental Specialist) presented Right Of Way impacts and environmental issues:
- Presented maps (overall and per segment)
- Presented the environmental impacts such as expected deterioration of air and water quality, loss of trees and increase in traffic. Also pointed out the lack of traffic signs
- Explained that as the site is within the indicative boundaries of a watershed, an Environmental Impact Assessment would be required prior to any construction activities.
- Identified possible sites for spoil disposal
- Mildred Rollolazo then discussed the social impacts and issues:
- Explained that should MWSS, as owner of the title to the land above the proposed tunnel, choose to impose its right to clear this land of any unauthorised settlement, then relocation of encroaching persons would be necessary. She also explained that although this was not a technical requirement of the proposed project, possible relocation of informal settlers may result - even if the project were not to go ahead.
- Confirmed that no IPs reside within the alignment
- Acknowledged the needs of the community with respect to both potable water supply and employment opportunities which may arise as a result of the proposed project.

Discussion:

Questions / Concerns / Issues	Response
Fomer Kagawad Danilo asked why MWSS and Maynilad don't pay taxes to the LGU	Mr Elefante answered that there's an on-going case and legal issues are being discussed
No water supply for the residents, despite the fact that Ipo dam and tunnel are within their area.	Mr Elefante said it could be addressed within this project
Asked if Sitio Ipo is included in the ROW	Sitio Ipo is not within the alignment/ROW
Residents are concerned about the process of relocation (if there will be and what will happen to them after) 27. properties with titles will be considered 28. properties without title within the ROW	MWSS assures to have proper measurement(within ROW) and mitigation measures before project begins Residents will be provided with relocation assistance and compensated
Asked what will be the project risks involved Asked about the extent of road that will be affected	MWSS affirmed: SAFETY FIRST Rusty Romero pointed out that some houses outside MWSS gate have no easement and in some cases, overlap the road reserve. This will not however, result in any requirement for their clearance under this proposed project.
Resident requested watering of road during the project to avoid air pollution (dust particles, etc)	Rusty Romero said that it is included in the Environmental Management Plan
If there employment opportunities during the project	Rusty Romero assured that the community will be prioritized for work during construction
Requested if spoils can be given to residents to build their houses	Rusty Romero said they can address their request to the Barangay captain
Asked when the project will start	Project will start in 2014
What are the benefits the project will give for the residents of San Mateo Residents wanted to have water first before tunnel	MWSS wants to provide water supply, but this is completely outwith the scope of this proposed project. Mr Elefante discussed possibility of having a treatment plant in the community, or for either MWSS or one of the concessionaires provide potable water.
Major concerns: provide water for the residents; and livelihood / work during construction	Mildred Rollolazo and Rusty Romero confirmed that a Social Development Plan would be prepared by the Contractor, prior to project implementation, which would address these concerns by incorporating the provision of skills training for livelihood support, credit assistance and giving priority to local communities for employment opportunities during construction

Rusty Romero gave summary of:

- Traffic and movement of vehicles
- Spoil disposal
- Health and safety at the construction site
- Potential re-location if MWSS impose ROW policy / compensation for losses
- Water supply, employment opportunities and other benefits for the remaining residents

Photographic Record

Appendix C Dumagat (IP) Consultation

Angat Water Transmission Improvement Project

Record of Public Consultation: Dumagat (Indigenous People) representatives from 7 sitios

Date: 18 July 2013

Time: 1430 to 1600hrs

Venue: CPF Multipurpose Building, Ipo Dam Site

Attendees:

Archie Barria	Marvin Villanueva	Hermie Medrano
Brenda A. Molina	Imelda C. Banong	Vergina
Mailo Cruz	Roserano	Reynaldo Aquino
Sandy Corañes	Many Cruz	Daniel Bartolome
Mary Grace Corañes	Rogelio Cruz	
MWSS representative:		
Mr Vicente Elefante		
CPF representatives:		
NCIP Representative:		

Meeting Notes:

- Opening Remarks/Introduction by Mildred Rollolazo
- Rusty Romero discussed project location and scope of work to IPs as well as environmental impacts and mitigation measures to be employed
- Mildred Rollolazo discussed social issues and impacts of projects on these

Issues and Concerns:

Question	Response
IPs are applying for Ancestral Domain for the whole Angat Watershed (IP Population: 3,000)	The project will only cover a small portion (approx. 1 ha) of the watershed area as a temporary Contractors work area during construction and that further assessment prior to construction would be undertaken to eliminate or minimise any impact on the environment.
IPs recognised that project could not be stopped or delayed. IP (Sapang Munti) asked if they would be temporarily relocated or otherwise affected during dam construction.	It will not be necessary to relocate anyone as the tunnel will be constructed entirely underground.
CPF is concerned if any areas within the construction site will be bulldozed	Rusty Romero explained that environmental management strategies will be used during construction within the protected area. She clarified that only a part of the area will be used and not the whole area shown on the maps displayed to participants
Sapang Munti and Sapang Bato use the river's water for bathing and washing (laundry) but they also buy water or get it from the uplands using a hose for drinking/cooking	Minimal impact will be seen only at the dam area during the commencement of construction works, when localised turbidity increases will be observed as a result of drainage from initial excavations. The environmental management plan would, however require suitable interception and settlement facilities to minimise any adverse impact.
IPs are helping with the reforestation (Bantay Gubat). They have contracts with DENR for planting of bamboo and coffee, and with MWSS for planting a variety of	Workers from the area will be given priority for job opportunities during construction. Women may also benefit from it by engaging in entrepreneurial activities such as food vending, serving merienda

	trees Asked what opportunities they can expect from the project	to workers, selling goods and groceries, etc.
	IP organizations are still active but there are no more community-based forest projects	The project team will relay this information on the status of these CBFM projects to DENR
	Mildred Rollolazo asked IPs what is the current use mas being made of the area proposed as the contractor's work area (CWA) Asked further if there were other alternative routes that students could take in going to school	Response of IPs: It is currently used as a route for children / students going to school. Response of IPs: Yes, there is another route. However, it is slightly longer Mildred Rollolazo responded that the use of this area is temporary and will only be for the duration of construction activities.

Wrap up: Mildred Rollolazo concluded by asking if there were any other questions the IPs wanted to ask, but since there were no further questions from the IPs the, consultation was adjourned.

Photographic Record:

Appendix D IR Categorisation

INVOLUNTARY RESETTLEMENT IMPACT CATEGORISATION

Date: 09 September 2013

Instructions

(i) The project team completes and submits the form to the Environment and Safeguards Division(RSES) for endorsement by RSES Director, and for approval by the Chief Compliance Officer (COO).

(ii) The classification of a project is a continuing process. If there is a change in the project components or/and site that may result in category change, the sector Division submits a new form and requests for re-categorisation, and endorsement by RSES Director and by the COO. The old form is attached as reference.

(iii) In addition, the project team may propose in the comments section that the project is highly complex and sensitive (HCSI),for approval by the COO.HCS projects are a subset of Category A projects that ADB deems to be highly risky or contentious or involve serious and multidimensional and generally interrelated potential social and /or environmental impacts.

B. Project Data

Country/Project No./Project Title: PHI-TA 8169 ANGAT WATER TRANSMISSION IMPROVEMENT PROJECT

Department /Division : RSDD/RSES

Processing Stage : _____

Modality : _____

[x] Project Loan **[ ]** Program Loan **[ ]** Financial Intermediary **[ ]** General Corporate Finance

[ ] Sector Loan **[ ]** MFF **[ ]** Emergency Assistance **[ ]** Grant

Involuntary Resettlement Category

[x] New **[ ]** Re-categorisation- Previous Category **[ ]**

_____

[ ] Category A **[ ]** Category B **[x]** Category C **[ ]** Category FI

Comments

Project Team Comments:	**RSES Comments:**
No one will be displaced or resettled .Two non-IP households, with members who are former project security guards occupying MWSS project staff housing, will experience temporary disturbance due to construction of facilities for temporary works. These persons may be hired by the Contractor as workers during the construction phase.	

Approval		
Proposed by: _____ _____ **Project Team Leader(Department/Division)** **Date:**	**Reviewed by:** **Social Safeguard Specialist, RSDD/RSES** **Date:** **Endorsed by:** _____ **Director, RSES** **Date:**	
Social Development Specialist(Department/ Division) **Date:** **Endorsed by:** **Director,(Division)** **Date:**	**Approved by:** **Chief Compliance Officer**	☐ Highly Complex and Sensitive Project

Involuntary Resettlement Impact Categorization Checklist

Probable Involuntary Resettlement Effects	**Yes**	**No**	**Not Known**	**Remarks**
Involuntary Acquisition of Land				
1. Will there be land acquisition?		X		
2. Is the site for land acquisition known?				Not Applicable
3. Is the ownership status and current usage of land to be acquired known?				Not Applicable
4. Will easement be utilized within an existing Right of Way (ROW)?		X		
5. Will there be loss of shelter and residential land due to land acquisition?				Not Applicable
6. Will there be loss of agricultural and other productive assets due to land acquisition?				Not Applicable
7. Will there be losses of crops, trees, and fixed assets due to land acquisition?				Not Applicable
8. Will there be loss of businesses or enterprises due to land acquisition?				Not Applicable
9. Will there be loss of income sources and means of livelihoods due to land acquisition?				Not Applicable
Involuntary restrictions on land use or on access to legally designated parks and protected areas				
10. Will people lose access to natural resources, communal facilities and services?		X		

11. If land use is changed, will it have an adverse impact on social and economic activities?		X		
12. Will access to land and resources owned communally or by the state be restricted?		X		Not applicable.
Information on Displaced Persons:				
Any estimate of the likely number of persons that will be displaced by the Project? *[x] No [ ] Yes* If yes how many? **Not applicable.**				
Are any of them poor, female-heads of households, or vulnerable to poverty risks? *[ ] No [ ] Yes Not applicable*				
Are any displaced persons from indigenous or ethnic minority groups? *[ ] No [ ] Yes Not applicable*				

Note: The project team may attach additional information on the project, as necessary **attached…**

Additional Information:

The proposed project involves the construction of a new tunnel between Ipo Reservoir and the existing transition basin structures at Bigte, both in the province of Norzagary. The new tunnel will be 6.4km in length and will run at a depth of between approximately 50m and 200m below existing ground level. The new tunnel will be the fourth tunnel to be constructed at the same locality, and will be within MWSS' existing Right of Way (ROW) for all but a very small segment (stations: 3,680 to 3,750) lying deep below the road above. No work will be required within the ROW on the surface, therefore no disturbance to existing communities or facilities can be expected.

The areas allocated for use by the Contractor at either end of the proposed tunnel are both on land already owned by MWSS and therefore no easement is envisaged during the construction period.

Part of the proposed intake at Ipo Reservoir lies within an area which is currently being claimed by the Dumagat community as part of their Ancestral Domain. The status of this application shall be reviewed and re-assessed during the construction period.

One Indigenous Peoples family currently occupy an existing MWSS staff house which was part of an earlier tunnel project. It is likely that members of this household will find employment in the proposed new tunnel project.

Appendix E IP Categorisation

INDIGENOUS PEOPLES IMPACT CATEGORISATION Date: 09 September 2013

Instructions

(i) The project team completes and submits the form to the Environment and Safeguards Division(RSES) for endorsement by RSES Director, and for approval by the Chief Compliance Officer (COO).

(ii) The classification of a project is a continuing process. If there is a change in the project components or/and site that may result in category change, the sector Division submits a new form and requests for re-categorisation, and endorsement by RSES Director and by the COO. The old form is attached as reference.

(iii) In addition, the project team may propose in the comments section that the project is highly complex and sensitive (HCSI),for approval by the COO.HCS projects are a subset of Category A projects that ADB deems to be highly risky or contentious or involve serious and multidimensional and generally interrelated potential social and /or environmental impacts.

B. Project Data

Country/Project No./Project Title: PHI-TA 8169 ANGAT WATER TRANSMISSION IMPROVEMENT PROJECT

Department /Division : RSDD/RSES

Processing Stage : _____

Modality : _____

[x] Project Loan **[ ]** Program Loan **[ ]** Financial Intermediary **[ ]** General Corporate Finance
[ ] Sector Loan **[ ]** MFF **[ ]** Emergency Assistance **[ ]** Grant
[ ] Other Financing Modalities

Indigenous Peoples Category

[x] New **[ ]** Re-categorisation- Previous Category **[ ]**

_____

[ ] Category A **[ ]** Category B **[x]** Category C **[ ]** Category FI

Project requires the broad community support of affected Indigenous peoples communities [x] Yes [ ] No

Comments

Project Team Comments:	**RSES Comments:**
The project will not displace any IP. One IP household which occupies staff house within CWA may experience disturbance but may be hired as worker during construction. Possible overlap of proposed contractors work area (CWA) with Ancestral Domain being applied for by IP Dumagats; but use of such area is temporary which will be further assessed during construction.	
Approval	

<table>
<tr><td colspan="3">Proposed by:

_____
Project Team Leader(Department/Division)
Date:

_____
Social Development Specialist(Department/ Division)
Date:

Endorsed by</td><td colspan="2">Reviewed by:

_____
Social Safeguard Specialist, RSDD/RSES
Date:
Endorsed by:

_____
Director, RSES
Date:</td></tr>
<tr><td colspan="2">Director,(Division)

Date:</td><td>Approved by:

Chief Compliance Officer</td><td>☐ Highly Complex and Sensitive Project</td></tr>
</table>

KEY CONCERNS (Please provide elabouration in the Remarks column)	YES	NO	NOT KNOWN	Remarks
Indigenous Peoples Identification				
1. Are there socio-cultural groups present in or use the project area who may be considered as "tribes" (hill tribes, schedules tribes, tribal peoples), "minorities" (ethnic or national minorities), or "indigenous communities" in the project area?	X			The Ipo Watershed is currently inhabited by the Dumagats and is clained by them as part of their ancestral domain. An application for Ancestral Domain status (CADT) is currently the NCIP office. The application process is lengthy and will require survey and other investigative works to delineate the claimed area before status approval. Initial assessment results show that the project may affect a small area (approx. 1 hectare) which will be used temporarily by the Contractor during construction. Within this Contractors area are three families (1 IP and 2 non-IP) who are occupying MWSS houses which were used during an earlier tunnel project . These were former security guards employed by the earlier project. These houses will not be demolished during the proposed project and some household members may be employed by the Contractor.
2. Are there national or local laws or policies as well as anthropological researches/studies that consider these groups present in or using the project area as belonging to "ethnic minorities", scheduled tribes, tribal peoples, national minorities, or cultural communities?	X			IPRA Act 1997 recognises the rights of IPs including Dumagats to their traditional sites and ancestral domains as areas for practising their rituals, traditions and culture.
3. Do such groups self-identify as being part of a distinct social and cultural group?	X			Dumagats, who live within the Sierra Madre Mountain range, are a recognised minority group and consider themselves to be a distinct social and cultural group.

4. Do such groups maintain collective attachments to distinct habitats or ancestral territories and/or to the natural resources in these habitats and territories?	X			The Dumagats claim Ipo Watershed area (a declared protected area by NIPAs Act) as their ancestral domain. A CADT has been awarded earlier to other Dumagat tribes covering Angat watershed.
5. Do such groups maintain cultural, economic, social, and political institutions distinct from the dominant society and culture?				Although most of the Dumagats have already been mainstreamed and integrated with the lowland culture as a result of intermarriage and access to education, they still practice an indigenous political system and recognise their chieftains as traditional heads of different IP 'Sitios', observing the consultation process (FPIC), particularly those aspects affecting the welfare and condition of the Dumagats.
6. Do such groups speak a distinct language or dialect?		X		In the past yes, but now they speak Tagalog.
7. Have such groups been historically, socially and economically marginalised, disempowered, excluded, and/or discriminated against?	X			Historical accounts show that IPs, including Dumagats, were economically marginalised and discriminated against in many social aspects such as access to education, health, and livelihood/ economic resources, among others. The migration of lowlanders has forced many of the Dumagats further into the uplands in search for food and resources to sustain their households and way of life. However, due to intermarriage and education, they have now been mainstreamed into local civil society. NCIP, the agency in charge of looking after the welfare and development of IP communities has so far provided educational scholarships and employment opportunities to Local Dumagats. The Dumagats at Ipo dam are partners of DENR and MWSS in watershed management and tree planting activities.

8. Are such groups represented as "Indigenous Peoples" or as "ethnic minorities" or "scheduled tribes" or "tribal populations" in any formal decision-making bodies at the national or local levels?	X			The Dumagats are recognised and represented as part of the IP minorities at the Barangay/LGU level with parallel tribal councils. They are consulted in key aspects affecting their welfare, particularly development projects within their ancestral domain which affect the socio-economic and cultural environment. Before any project can proceed, a project proponent must obtain the approval of the whole IP community through the Free Prior Informed Consent (FPIC) process during consultation.
B. Identification of Potential Impacts				
9. Will the project directly or indirectly benefit or target Indigenous Peoples?	X			During construction, they will be given priority for recruitment as construction workers or for other tasks for which where they are suited. IP women may be engaged in business activities such food vending, provision of goods and services, etc. MWSS and DENR jointly manage the Ipo Dam Watershed area. The IPs are directly hired for tree planting, watershed protection and management, reforestation and alternative livelihood opportunities.
10. Will the project directly or indirectly affect Indigenous Peoples' traditional socio-cultural and belief practices? (e.g. child-rearing, health, education, arts, and governance)		X		Based on consultation with IPs, a track near the proposed Construction Work Area is used by IP children as a route to school. An alternative route has, however, been identified by IPs that could be used for the same purpose during construction.

11. Will the project affect the livelihood systems of Indigenous Peoples? (e.g., food production system, natural resource management, crafts and trade, employment status)		X		The project will not affect the livelihood system of the Dumagats but will in fact provide employment opportunities for IPs not only during project activities, but also after completion of the project as MWSS and DENR continue to undertake watershed management / reforestation activities. The IPs act as labourers and as maintenance workers during such activities.
12. Will the project be in an area (land or territory) occupied, owned, or used by Indigenous Peoples, and/or claimed as ancestral domain?			x	While a part of the project covers a small area within the claimed ancestral domain being applied for CADT status, this is not utilised for either food production or for any other purposes by the IPs.
C. Identification of Special Requirements Will the project activities include:				
13. Commercial development of the cultural resources and knowledge of Indigenous Peoples?		X		
14. Physical displacement from traditional or customary lands?		X		
15. Commercial development of natural resources (such as minerals, hydrocarbons, forests, water, hunting or fishing grounds) within customary lands under use that would impact the livelihoods or the cultural, ceremonial, spiritual uses that define the identity and community of Indigenous Peoples?		X		
16. Establishing legal recognition of rights to lands and territories that are traditionally owned or customarily used, occupied or claimed by indigenous peoples?		X		
17. Acquisition of lands that are traditionally owned or customarily used, occupied or claimed by indigenous peoples?		X		

INDIGENOUS PEOPLE (IP) IMPACT SCREENING CHECKLIST

D. Anticipated project Impacts on Indigenous Peoples

Project component /Activity /Output	Anticipated Positive Effect	Anticipated Negative Effect
Project Construction	IPs will be hired as labourers and for other work during construction. IP women may engage in entrepreneurial activities during construction such food vending, goods and other services provision for Contract ors workers.	none

Note: The project team may attach additional information on the project as necessary:

(no further information provided)

Appendix F Summary Notes: AWTIP Field Inspection and Stakeholder Interviews (San Mateo & Bigte)

FRIDAY 24 JANUARY 2014

SAKIUSA TUISOLIA

Location

- Ipo Dam is in San Mateo Barangay
- Bigte in Bigte Barangay
- San Mateo and Bigte are part of Norzagaray Municipality
- Norzagaray is a municipality in Bulacan Region
- Bulacan has 22 Barangays and one of the richest province in Philippines
- Bulacan population = 2.7 million
- Local communities scattered along Ipo road between Bigte and Ipo in ribbon development fashion

Project Outputs

- $143 million for the construction of 6.3km underground tunnel from Ipo Dam to Bigte settling B9asin 50-180km below the surface
- Tunnel needed to transfer raw water supply from Ipo Dam to Aqueducts 5 and 6.
- To enable checks and repairs to Aqueducts 1, 2, 3 and 4 to be carried out and repairs to Tunnels 1, 2, 3.
- Transmission old and first aqueducts built in 1936
- Project will not increase raw water supply or connections to end users.
- An infrastructure rehab and replacement project
- Outputs are tunnel construction and water safety, risk and asset management plan
- Tunnel route has 60 meters ROW on public land with most of title with MWSS
- Proposed tunnel has 4 meters ROW and distance of 6km

Affect Persons

- Households/families settling on ROW – informal settlers and squatters with no legal land title
- Average family size is 5
- Mainly migrants from Visayas and other regions
- Some have lived there since 1930s and others between 10-30 years
- Own residential and business structures
- Segment 1: clear
- Segment 2: 4 structures
- Segment 3: has big residential subdivision build by NHA
- Segment 4: clear
- Segment 5: 3 structures
- Segment 6: Clear
- Segment 7: Clear
- Consulted twice on Angat project.

- IPs live in Angat/IPO catchment area 3 km from the Ipo Dam and tunnel intake construction site

San Mateo/Bigte Socio-economic profile

- 40% of people are poor
- Average income is P4000 – P6000 a month – people don't have enough to meet their basic needs
- Livelihood earned through employment in local government, farming, tricycle drivers, owners of sarisari stores, FOWs.
- Locals mainly rely on cash for a living, they practice little subsistence farming and home gardening
- Farming and economic opportunities are limited by the lack of reliable and quality water supply
- People are mostly informal settlers with no land titles.
- APs living on ROW know there are illegal settlers –some have been around since the 1930's, other 10-30 years, rest are new settlers from other parts of Luzon and Philippines.
- More men work than women and men earn more than women.
- Traditional gender roles exist – men are breadwinner s and women are housekeepers.
- Women responsible for fetching water
- Women also operate small businesses on the side like sari-sari stores and other economic activities to supplement family incomes.
- Some families also supported directly by OFWs

Source Community (San Mateo Barangay) Water Needs and Supply

- Local community in Ipo and San Mateo source water from wells, springs and portable water vendor (54%)
- Some families don't but water and use only water from wells and springs – their drinking water is usually boiled.
- Potable water sold at P35 a 200 litre drum supplied by water tankers
- Families use 3-4 drums a week.
- Paid P110 per cubic meter
- Family pays P100-500 for portable water among low income families and high users pay P500-P1000.
- Tankers visit around 3-4 times a week.
- Lack of water limits economic opportunities like crop, cattle, poultry and piggery
- A private treated water supply system is run by a local businessman near Ipo Dam sourcing water from a local spring exists. Has 28 connections and serves 80 households. Investment cost is 0.5 million. Additional new connections will be made. Payment made through monthly billings.
- A Barangay/LUUA sponsored water supply exists for San Mateo. Water drawn from deep well and pumped into a reservoir concrete tank on a hill.
- San Mateo heights residential subdivision sits on ROW. Will house 1000 servicemen and 5000 families. Has a local water supply system sourced from a deep well and pumped into a mounted reservoir. Water is treated.

- Locals complained about not being served by the Metro Manila water supply although the raw water comes from their area.
- Potable water supply made by a single contractor approved by LWD – water supplied by water trucks
- 20 litre gallons cost P3

Bigte Water Supply Need and Supply

- 13,000 population
- Sources of water include wells, springs; potable water sold by vendors and contractor and piped untreated water.
- Has three raw water supply system, 2 owned by Bigte Barangay and 1 by NGO – all sourced from Angat transmission "blowouts"
- CRUSH water system, 144 connections; Bigte water supplies 389 connections
- 600 have untreated raw water supply with piped water connections
- Connection fee flat rate P500
- Tariffs = P10 a cubic meter, minimum charge of P100 for 10 cubic meters per household (use 4-5 cubic meters)
- Barangay subsidises and provides hand pumps for wells FOC as well as free maintenance and repairs – 10 pumps in operations, budget provided every year.
- 1 pump serves up to 50 households from a central facility
- Bulk of water supplied by portable water vendors

Bulacan Water Supply

- MWSS responsible for regional water supply.
- Aim is to address water supply requirements of Bulacan through most efficient and practical means which is portable water and reduce ground water usage because of its environmental impact.
- Provided under PPP framework
- A Northern Concessionaire for Bulacan Bulk Water supply to be awarded soon and issuance of prequalification to bid in Q 1 2014
- Concessionaire will: 1. Construct water transmission mains including line appurtenances from WTPs to municipalities; 2. Construct WTPs, 3. Construct pumping stations and 4 install metering devices
- Estimated cost: $693.72m
- Provincial population = 2.7 million; need 174.5 million litres of water a day and population growth project to grow to 10 million by 2040 and will require 1,120 million litres per day
- BBWP will supply 24 area of region including coastal and central towns.
- San Jose is covered in first phase with 5 other districts
- Separate entity to be formed to regulate concession
- BBW needs to address water quality, access, reliability and affordability

ROW and Resettlement Issues

- Area is 6.5km x 60 meters from Ipo Dam to Bigte
- Area not marked or demarcated and covered with grassland and bush.
- Most of ROW is owned by MWSS with legal title except 2 spots.

- Squatters on ROW have lived there since 1930s and some 10-30 years, rest are new migrants
- New state subdivision for servicemen and their families (1,000 households) built over ROW in Segment 3 – will have a population of around 5,000
- Water for subdivision will be supplied from deep well and pumped into elevated tank and treated - portable water also supplied.
- CPFs will fence the ROW and have started work at Ipo Dam and Bigte settling basin.
- Encroachers/APs will not be displaced.

Stakeholder Consultations

- Squatter households on ROW were consulted individually x 2 and issued with leaflet in project info – signed confirmation of participation
- 8 Barangay consultations were held
- Locals have different perceptions – ROW senior citizens were accepting and understood ROW and aware of construction of old pipes
- Locals voiced need for piped water and improved portably water supply (frequency and quantity especially during dry season)
- Women interested in economic opportunities from project like food vendors

Beneficiaries – Metro Manila End Users and Concessionaires Obligations

- 14 million people in Metro Manila concession areas
- 2 concessionaires, Maynilad and Manila Water, contracted for 25 years since 1997 as distributors – also responsible for O&M and investment in new infrastructure
- Concessions extended another 15 years to 2037 – because if Asian financial crises
- Maynilad – west zone (60% customer base) = 95% coverage
- Manila Water – east zone (40% of customer base) = 99% coverage
- Both run pro poor water and livelihood programs
- Both profitable after initial problems with Maynilad and change of ownership in 2007
- Both jointly run CPF to manage and operate Angat source and transmission, treatment plants and La Mesa reservoir
- Regulator set up to regulate concessionaires
- Concession terms for pro poor – amortization of connection fees, low rates for first 10 cubic meters
- Been recent cuts in water rates by regulator
- Concessionaires investing in fixing leaks and non-revenue water conversion to augment water supply from existing system, reduced NRWC from 65% down to 10%

MWSS

- Office in Quezon City
- Metropolitan Waterworks Sewerage System (MWSS), owner of metro manila water supply system and assets, a government owned corporate entity set up in 1971
- MWSS runs and owns Metro Manila water supply system and assets
- Revenue comes from the concession fees
- 1997 – awarded water concessions to Maynilad and Manila Water
- Split into Regulatory Office and Corporate Office
- Introduced 2011 Water Legacy Plan

- Has 123 staff, nearly half men & half women
- Will set up Office of Special Projects (OSP) to be EA/IP and coordinate and implement AWTIP
- Also responsible for Bulacan Province water supply
- Weak capacity for monitoring asset maintenance

CPF

- Office in Balara
- JV between Manila Water and Maynilad to operate, maintain, renew and decommission when necessary the common purpose facilities
- CPF includes Angat water transmission system, Bigte settling basin, La Mesa reservoir, La Mesa and Balara water treatment plans and pumping stations.
- Allocates raw water between two concessionaires as per the concession agreement
- Equally staffed by the two concessionaires and run by Manager
- 29 staff; 10% are women
- 14 of the staff at Ipo Dam (all men)
- Been slack in ensuring proper maintenance of transmission system in last 16 years
- Demarcation of roles between CPF and MWSS on maintenance and control of assets including ROW still unclear
- Weak in assets inventorying and maintenance.

Appendix G Common Purpose Facility (CPF) Institutional Gender Analysis Questionnaire Response

1. Name of organization/company; CPF (comprises of MWCI/MWSI personnel)

2. Address / Contact; La Mesa Compound, Quezon City/ 929-7477

3. Total workforce (includes temporary); 29

4. No of male employees / % of total; 25 / 86.3% of total

5. No of woman employees / % of total; 4 / 13.7%

6. No of men and woman in the Board; Executive Committee: 4 (3 men; 1 woman (25%))

7. No of men and woman in management; 10 (9 men / 1 woman (10%))

8. Male/ female distribution in skilled position: accounting/finance, project Management

Accounting/finance administration ed position: Engineering - 2

Project Management - 1

Technical anagement - 1 O&M nica

9. There is no organizational and management gender awareness.

10. None. No gender policies

11. No gender mainstreaming.

12. No, does not apply and use the government instituted 5% budgeted activities for gender and development.

Appendix H Institutional Due Diligence and Analysis

1. Name of Organization/Company

Metropolitan Waterworks and Sewerage System (MWSS)

2. Address/Contact :

 # 489 Katipunan Road, Balara, Quezon City

Tel. nos.: 928-5691 / 922-2568

3. Total workforce (includes temporary staff) :

117 – Regular Personnel 6 – Personnel Total workforce – 123

4. No. of Male Employees / % of total :

66 / (53%)

5. No. of Women / % of total :

57 / (47%)

6. No. of Men and Women in the Board / % of total :

Men = 5 (90%) Women = 1 (10%)

7. No. of Men and Women in Management / % of total :

Men = 9 Women = 9 (50%)

8. Male/Female distribution in skilled positions: accounting / finance, project management, technical, engineering, O & M, etc.

There is a balance distribution of Male and Female.

9. What is the status of organizational and management gender awareness?

10. Does the company have any gender policies, and if yes what has been the success of its implementation?

Yes, pursuant to Civil Service Commission (CSC) Laws and Rules.

11. What is the status of gender mainstreaming of training of staff?

On-going training, there is a Gender and Development (GAD) Committee and study are on-going.

12. Does the Organization apply and use the government instituted 5% budgeted activities for Gender and Development (GAD)?

Yes we have, but the program was not fully implemented

Appendix I Financial Management Assessment

Topic		Response	Remarks
1.	**Implementing Agency**		
1.1	What is the entity's legal status / registration?	MWSS is created under RA 6234 as a government-owned corporation	
1.2	Has the entity implemented an externally- financed project in the past (if so, please provide details)?	Yes, MWSS has implemented several projects using foreign-assisted loans.	
1.3	What are the statutory reporting requirements for the entity?	MWSS follows the basic policies and procedures outlined by the by the New Government Accounting System (NGAS) as required by the Commission on Audit (COA). MWSS has prepared a comprehensive well-documented MWSS Accounting and Internal Audit Manual to comply with the basic objectives of financial reporting and the objectives of the prescribed NGAS New Government Accounting System (NGAS)	
1.4	Is the governing body for the project independent?	Yes	
1.5	Is the organizational structure appropriate for the needs of the project?	Yes	
2.	**Funds Flow Arrangements**		
2.1	Describe (proposed) project funds flow arrangements, including a chart and explanation of the flow of funds from ADB, government and other financiers.	The project funds flow is shown in Diagram 1	
2.2	Are the (proposed) arrangements to transfer the proceeds of the loan (from the government / Finance Ministry) to the entity satisfactory?	Yes	
2.3	What have been the major problems in the past in receipt of funds by the entity?	None	
2.4	In which bank will the Imprest Account be opened?	Land Bank of the Philippines	
2.5	Does the (proposed) project implementing unit (PIU) have experience in the management of disbursements from ADB?	Yes	
2.7	Does the entity have/need a capacity to manage foreign exchange risks?	Yes	

2.8	How are the counterpart funds accessed?	Counterpart funds are billed to the concessionaires	
2.9	How are payments made from the counterpart funds?	Payments are governed using the government auditing rules	
2.10	If part of the project is implemented by communities or NGOs, does the PIU have the necessary reporting and monitoring features built into its systems to track the use of project proceeds by such agencies?	Not applicable	
2.11	Are the beneficiaries required to contribute to project costs? If beneficiaries have an option to contribute in kind (in the form of labor), are proper guidelines formulated to record and value the labor contribution?	No	
3.	**Staffing**		
3.1	What is the (proposed) organizational structure of the accounting department? Attach an organization chart.	Refer to Diagram 2	
3.2	Identify the (proposed) accounts staff, including job title, responsibilities, educational background and professional experience. Attach job descriptions and CVs of key accounting staff.		

[END OF DOCUMENT]