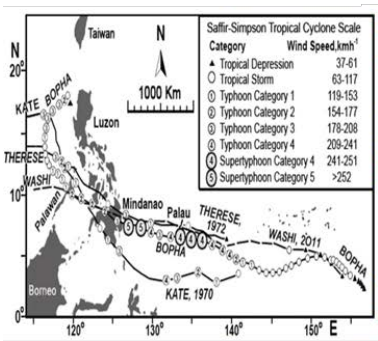
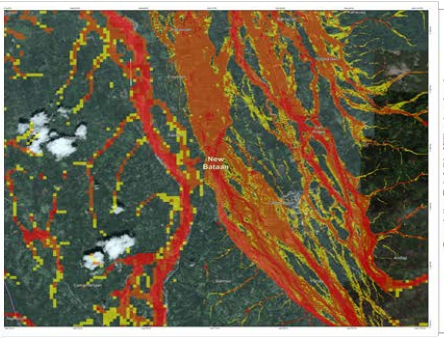
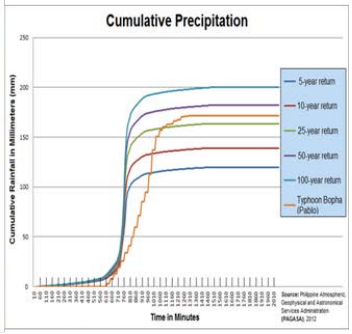
USAID'S Growth with Equity in Mindanao Program

CLIMATE CHANGE VULNERABILITY RAPID ASSESSMENT REPORT







Prepared by:

LBG:
Charles E. Feibel
Michael Ross
Eva Mendoza
Francesca Nikki Meru

with:
UP-NIGS:
Mahar Lagmay
Rodrigo Narod Eco
Jerico Mendoza
Eric Paringit
Kelvin Rodolfo
Anton Sison
Chino Uichanco

Submitted by:
THE Louis Berger Group, INC.
Engineers ● Scientists ● Economists ● Planners
Unit 1, 12/F, Export Bank Plaza, Sen. Gil Puyat cor. Don Chino Roces Ave., Makati City 1200 Philippines
Tel; (63-02) 812-5783 to 85 Fax: (63-02) 818-8990

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Growth with Equity in Mindanao (GEM) Program

Makati Office: Unit 1, 12th Flr., Export Bank Plaza Sen. Gil Puyat cor. Don Chino Roxas Aves., Makati City 1200 Philippines Tel: (63-02) 812-5783 to 85 Fax: (63-02) 818-8990
Project Management Office: 2nd Flr., Damosa Business Center, Damosa Complex, Angliongto Ave., Lanang, Davao City 8000 Philippines Tel: (63-82) 234-7720 Fax: (63-82) 234-3060 E-mail: gem@mindanao.org

June 24, 2013

Ms. Maria Teresa Robielos
Development Assistance Specialist and GEM COTR
U.S. Agency for International Development
3rd Floor, Annex 2 Building
U.S. Embassy
1201 Roxas Boulevard
1000 Ermita, Manila, Philippines

Dear Ms. Robielos:

Please find attached the Climate Change Vulnerability Rapid Assessment Report.

This rapid assessment focuses on the eight municipalities in the provinces of Davao Oriental and Compostela Valley. These municipalities were most affected by Typhoon Pablo and selected based upon where USAID may rebuild infrastructure within the next three months under the Growth with Equity in Mindanao (GEM) Program.

Preparation of the attached Assessment was based on the issued Scope of Work, which called for:

Inventory and Characterize Available Data and Information: see Sections 1.1 and 2.1; Annexes A and B

Fill Gaps of Key Data: see Sections 1.2 and 2.2; Annexes C, D and E

Conduct Risk Assessment: see Sections 2.3 – 2.6; Annex C

Provide Recommendations: see Section 3; Annex G

Very truly yours,
THE LOUIS BERGER GROUP, INC.

MICHAEL ROSS
Team Leader

Attachments: 5 copies and 1 CD

cc: Charles Feibel, GEM3 COP

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Annex G Concept Proposals for Immediate Follow-up Activities

LIST OF ACRONYMS AND ABBREVIATIONS

AusAID	Australian Agency for International Development
CCA	Climate Change Adaptation
CCC	Climate Change Commission
CEDA	Community Economic Development Authority
CSOs	Civil Society Organizations
DA	Department of Agriculture
DEM	Digital Elevation Model
DENR	Department of Environmental and Natural Resources
DILG	Department of Interior and Local Government
DOST	Department of Science and Technology
DPWH	Department of Public Works and Highways
DREAM	Disaster Risk and Exposure for Mitigation Program
DRRM	Disaster Risk Reduction and Management
DSWD	Department of Social Welfare and Development
EIC	Education Information Communication
ESRs	Environmental Screening Reviews
GEM	Growth with Equity in Mindanao Program
GPS	Global Positioning System
HLURB	Housing and Land Use Regulatory Board
IEC	Information, Education and Communication
IP	Indigenous people
JMA	Japan Meteorological Agency
KIIs	Key Informant Interviews
LGUs	Local Government Units
LiDAR	Light Detection and Ranging
LGSP	Local Government Support Program
MGB	Mines and Geosciences Bureau
MOU	Mutual of Understanding
MRDP	Mindanao Rural Development Program
MVGs	Most Vulnerable Groups

NAMRIA	National Mapping and Resource Information Authority
NDRRC	Natural Disaster Risk Reduction Council
NEDA	National Economic Development Authority
NGOs	Non-Government Offices
NIA	National Irrigation Administration
NOAH	Nationwide Operational Assessment of Hazards Program
OCD	Office of Civil Defense
PAGASA	Philippine Atmospheric Geophysical and Astronomical Services Administration
PAGRO	Provincial Agriculturist Office
PEC	Provincial Environmental Code
PENRO	Provincial Environment and Natural Resources Office
PHIVOLCS	Philippine Institution of Volcanology and Seismology
PHO	Provincial Health Office
PPDO	Provincial Planning and Development Office
PWDs	Persons & People with Disorders
RIDF	Rainfall Intensity Duration Frequency
SAF	Special Activities Fund
SRTM	Shuttle Radar Topography Mission
TroPICS	Tropical Institute for Climate Studies
UNDP	United Nations Development Programme
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
UP-NIGS	University of the Philippines – National Institute of Geological Sciences
VA	Vulnerability Assessment
WMO	World Meteorogical Organization

RAPID ASSESSMENT OF VULNERABILITY TO CLIMATE CHANGE IN SELECTED MUNICIPALITIES AFFECTED BY TYPHOON PABLO IN THE PROVINCES OF COMPOSTELA VALLEY AND DAVAO ORIENTAL

CLIMATE CHANGE VULNERABILITY RAPID ASSESSMENT REPORT

1.0 BACKGROUND

The provinces of Compostela Valley and Davao Oriental (Region 11) sustained heavy damage to population centers, infrastructure, forest, upland, and coastal ecosystems due to the onslaught of Typhoon Pablo (international name "Bopha"; **Figure 1**). This Category 5 super typhoon, which struck Region 11 starting December 4, represented the most southerly Category 5 typhoon to have occurred to date throughout the world. A January 2013 summary assessment of the impacts of Typhoon Pablo is provided in **Annex A**.

The advent of climate change, which may cause extreme weather events, has made recurring typhoons with a similar or stronger intensity a distinct possibility in Mindanao, particularly in the southeastern Mindanao area of Region 11, which had been previously referred to as comparatively "typhoon-free". The Philippine Atmospheric Geophysical and Astronomical Services Administration (PAGASA) has warned of a change in climate and weather trends as strong typhoons directly hit Mindanao two years in a row, followed by Tropical Depression Crising which occurred last February 2013. Prior to Typhoon Pablo, significant rainfall caused by the inter-tropical convergence zone caused major flooding and fatalities in the study area. Historical records indicate that Mindanao has experienced the direct impact of one typhoon every two years, while the southerly provinces around Davao Oriental experienced one typhoon every two decades.

1.1 Scope of Work

To help address such extreme weather events, USAID funded a Rapid Climate Change Vulnerability Assessment (VA) in the eight hardest hit municipalities in the two provinces most seriously affected by Typhoon Pablo. This VA study was conducted as part of a larger USAID-funded Typhoon Pablo Recovery Assistance program which includes infrastructure, livelihood and education components. These recovery assistance activities implemented under the Growth with Equity in Mindanao 3 (GEM3) Program, will be completed by September 2013.

The two provinces and eight municipalities included in the VA study are:

- Province of Compostela Valley: Laak, Monkayo, Compostela, New Bataan, Montevista
- Province of Davao Oriental: Baganga, Boston, Cateel

These eight municipalities were also selected for the VA since rehabilitation and construction of 15 critical infrastructure projects, with a typical budget in the range of Php 1.5 to 3 million, are proposed for funding by USAID in these areas. The proposed infrastructure projects, requested and prioritized in consultation with the respective local government units (LGUs), include construction of 3 slab bridges, slope protection and road / approach improvements to 4 overflow bridges, 1 footbridge, and reconstruction of 4 trading centers (**Figure 2**).

Figure 1: Geographical and Administrative Map with Typhoon Pablo Storm Path: Compostela Valley and Davao Oriental

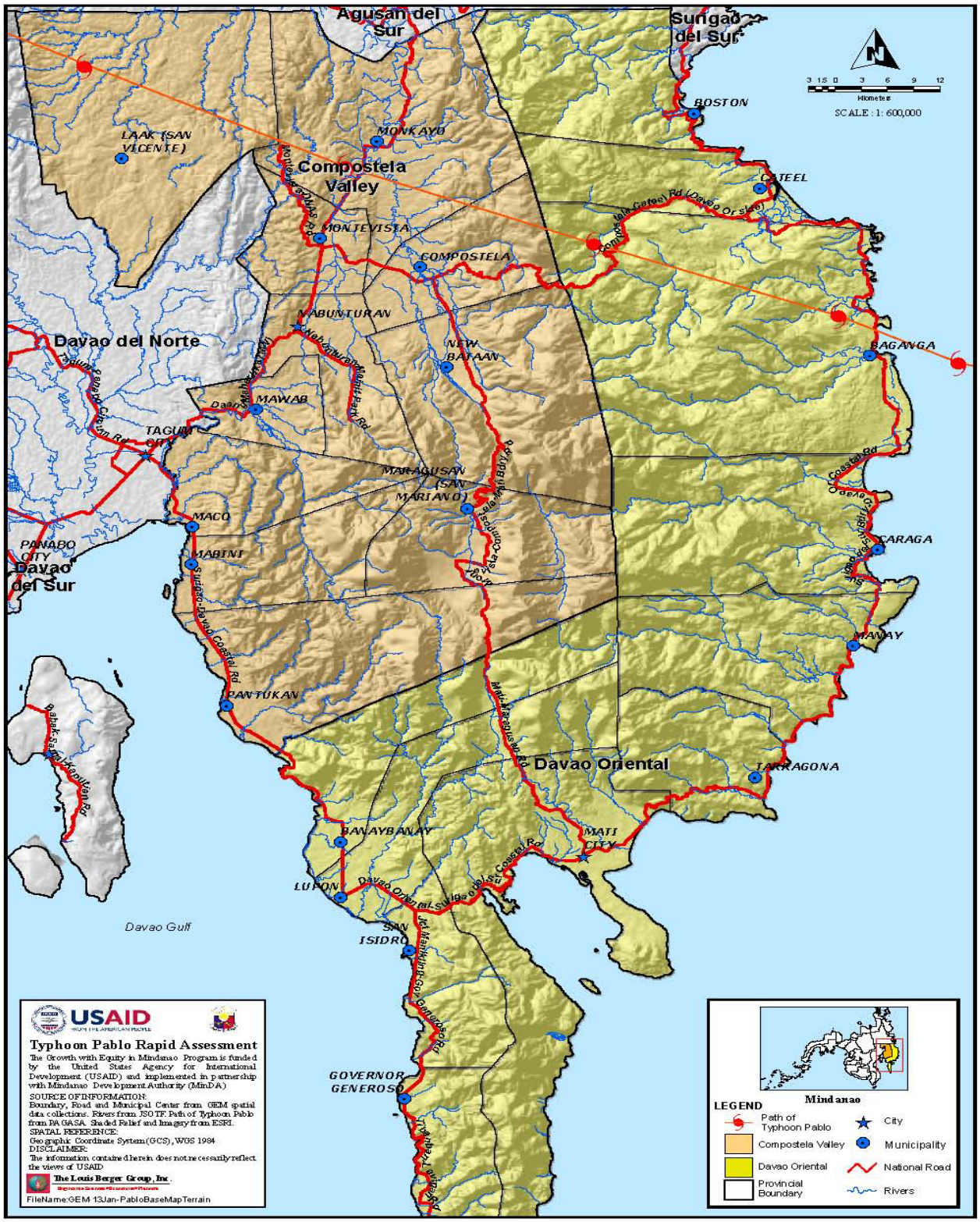
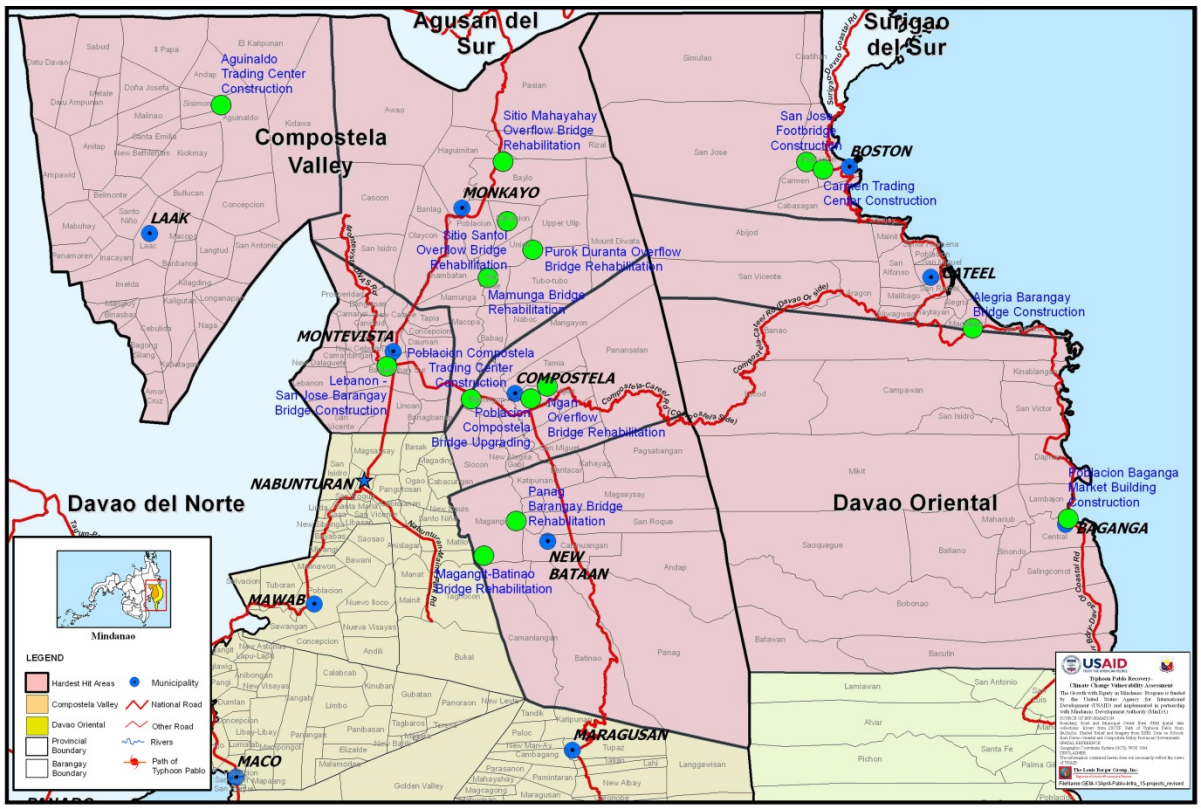


Figure 2: Location Map of 15 Proposed Infrastructure Projects



This VA study provides an initial analysis of the potential impacts of climate change, focusing on increased rainfall, flooding, landslide, debris flow events, as experienced during Typhoon Pablo. Focus is further placed on the 15 vital infrastructure projects proposed for USAID funding that are considered critical to local transport and economic activity, and serve as evacuation routes during extreme storm events. Mitigation, adaptation and institutional measures are recommended to reduce future vulnerability and increase local resilience to extreme rainfall and typhoon related events by identifying hazard zones and responsive measures.

The tasks are in line with Strategic Objective 2 of USAID's *Climate Change and Development Strategy*, to increase the resilience of people, places, and livelihoods to changing climate. Further, it will support USAID/Philippines' Development Objective 3 (DO3), under its *Country Development Cooperation Strategy,* to improve environmental resilience, specifically increasing climate change resilience (Sub IR 3.2.3) and reducing disaster risks (IR 3.1).

This VA study builds directly on the January 2013 *USAID Rapid Assessment for Typhoon Pablo Recovery Assistance* prepared under the GEM3 Program. The VA study should be taken in the context of this earlier Assessment which covered all key sectors and provided comprehensive background information on the two provinces included in this Report (**Table 1**). A copy of the full report is provided in the attached DVD (**Annex C**).

The design of the VA study reflects the United Nations framework for climate change vulnerability and the key components of hazards, exposure and capacity.

Table 1: Contents of Typhoon Pablo Rapid Assessment Report Submitted by the GEM Program to USAID in January 2013
CHAPTER 1: Introduction; Typhoon Pablo**;** Purpose and Scope; Methodology **CHAPTER 2: Infrastructure Rapid Assessment;** Situation Overview**;** Statistics**;** LGU and Government Agency Priorities**;** Existing and Committed Assistance**;** Possible USAID Assistance **CHAPTER 3: Livelihood Rapid Assessment;** Agriculture**;** Fisheries and Aquaculture**;** Agriculture and Fisheries Assistance **CHAPTER 4: Education Rapid Assessment;** Situation Overview**;** LGU and Community Priorities**;** Existing and Committed LGU, National Government and Donor Assistance**;** Possible USAID Assistance **CHAPTER 5: Health Rapid Assessment;** Situation Overview**;** Statistics on Damage**;** LGU Priorities in Health Service**;** Existing and Committed LGU, National Government and Donor Assistance**;** Possible USAID Assistance **CHAPTER 6: Displaced Persons and Issues in Evacuation Centers;** Situation Overview**;** LGU Priorities**;** Existing and Committed LGU, National Government and Donor Assistance**;** Possible USAID Assistance **CHAPTER 7: Environment Rapid Assessment;** Situation Overview**;** LGU and Other's Priorities**;** Existing/Committed LGU, National Government and Donor Assistance**;** Possible USAID Assistance **CHAPTER 8: Summary of Possible GEM Assistance;** Infrastructure / Barangay Infrastructure Projects (BIPs)**;** Livelihood**;** Education**;** Environment **CHAPTER 9: Security Advisory and Coordination Guidelines for Pablo Response Effort;** Security**;** Pablo Response Coordination

1.2 Existing Assessments and Resources

This VA study builds on and incorporates relevant work which have been completed to date for assessing climate change vulnerability in the study areas, including:

- **Department of Science and Technology (DOST)** which operates the *Nationwide Operational Assessment of Hazards (NOAH) Program* and its *Disaster Risk and Exposure for Mitigation (DREAM) Program.* Project NOAH recently completed a pilot project involving Light Detection and Ranging (LIDAR) as part of their vulnerability assessment and detailed topographic mapping of the New Bataan municipality (Compostela Valley). Their nationwide hazard risk assessments for major river basins are presented in their website - www.noah.dost.gov.ph. DOST is currently launching their SMARTER Philippines Program which fully integrates climate change, vulnerability and best practices.
- **Philippine Atmospheric, Geophysical and Astronomic Services Administration (PAGASA)** which is a part of the DOST and completed the comprehensive study "Climate Change in the Philippines" in 2011. This climate change projections to 2050.
- **Manila Observatory** has generated hazard / climate change vulnerability assessments for the entire country. The Observatory has extensive historical data and projections for the project area. They have recently completed a Typhoon Pablo report which covers both the science of climate change and preliminary institutional capacity assessments.
- **The Mines and Geosciences Bureau (MGB) of the Department of Environmental and Natural Resources (DENR)** has completed landslide susceptibility and flood risk (1:10,000 scale) assessments and hazard maps for Compostela Valley and Davao Oriental.

- **Tropical Institute for Climate Studies (TropICS / Ateneo de Davao)** has conducted an "Aftermath Assessment" of the affected communities. Their recent fora have explored the road map in building a better and more resilient post-Typhoon Pablo economy and communities in the provinces of Compostela Valley and Davao Oriental.
- **Department of Public Works and Highways** (DPWH), which chairs the Infrastructure Cluster of the Typhoon Pablo Task Force (and DPWH XI is the Infrastructure Cluster's point office). Following Typhoon Pablo, DPWH issued an Aide Memoire from the DPWH-Bureau of Design (dated February 5, 2013) which increased the wind load design standard in the Pablo-affected area to 200 kph.

A summary list of references and related assessments reviewed in this VA study is provided in **Annex B**.

1.2.1 Parallel Activities by Other Donor Organizations

The Philippines' Climate Change Commission (CCC), supported by the United Nations Development Programme (UNDP) and the Australian Agency for International Development (AusAID), has signed a Memorandum of Understanding to conduct climate change vulnerability assessments in the two provinces. These assessments, which are general in nature and broad utilizing existing, pre-Typhoon Pablo maps, will build on the recent work completed for Davao Oriental (**Table 2**) and initial work completed in Compostela Valley.

Table 2: Summary Contents of the Disaster Risk and Vulnerability Assessment Report of Davao Oriental (2013)

GEOGRAPHICAL, ADMINISTRATIVE/POLITICAL PROFILE
VULNERABILITY ASSESSMENT

1. HAZARD CHARACTERIZATION: Hydro-meteorological Hazards; Geologic Hazard; Climate Change; Sea Level Rise
2. VULNERABILITY AND CONSEQUENCE ANALYSIS: Vulnerability and Consequence Analysis of Population and Settlements; Vulnerability and Consequence Analysis of Built-Up Areas
3. INFRASTRUCTURE, LIFELINE (WATER, ROADS, LINKAGES): Seaports; Airports; Roads; Risk Evaluation
4. ENVIRONMENT INVENTORY: Protected Areas; Vulnerability of Forestry Sector to Climate Change; Risk Evaluation

These upcoming CCC-supported activities will include:

- Training of local leaders and community members to read and apply geo-hazard maps prepared by the MGB, and
- Improve application and integration of disaster risk reduction and climate change adaptation towards inclusive, sustainable and resilient development.

2.0 RESULTS OF VULNERABILITY ASSESSMENT

2.1 Summary of Climate Change Projections and Special Hazards in the Study Area

The Philippines ranks third in the list of countries most vulnerable to climate change, a study by a United Nations University's Institute for Environmental and Human Security has warned. The risk index used in the report analyzed each country's exposure to natural disasters such as storms, floods, earthquakes, droughts and sea level rise. Rainfall in the Philippines is expected to increase in the coming years due to

climate change. Man-made factors such as land conversion, deforestation, and small-scale mining activities, are expected to worsen the effects of climate change, with a multiplier effect on disasters.

The following summary of projected climate change impacts in the VA study area are based on a 2011 report issued by PAGASA. The Agency's climate change projections in Region XI for 2020 and 2050 include:

- ***Increased seasonal temperature***, from 1°C increase (2020) and +2 °C increase (2050)
- ***Seasonal rainfall change***, with
  Increased rainfall (1st quarter) from 10 – 12% (2020) and 7 – 16% (2050)
  Decreased rainfall (2nd quarter) from 6 – 11% (2020) and 16 – 22% (2050)
  Decreased rainfall (3rd quarter) from 3 – 5% (2020) and 7 – 10% (2050)
  Increased rainfall (4st quarter) from 0.3 – 1.2% (2020) and 0 – 5% (2050)
- ***Increased frequency of extreme rainfall events***
- Number of days with rainfall > 150 mm: 2 days (1971 – 2000); 3 days (2020); 4 days (2050)

Based on climate change reports by the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) / World Meteorological Organization (WMO), 2012; PAGASA, 2011; World Bank, 2008, typhoon and storm surge projections include:

- ***Global increases in typhoon intensity*** with heavier precipitation but decreases in typhoon frequency;
- ***Increased vulnerability of coastal areas / communities to storm surge*** flooding linked to typhoons with future sea level rise and increased coastal development.

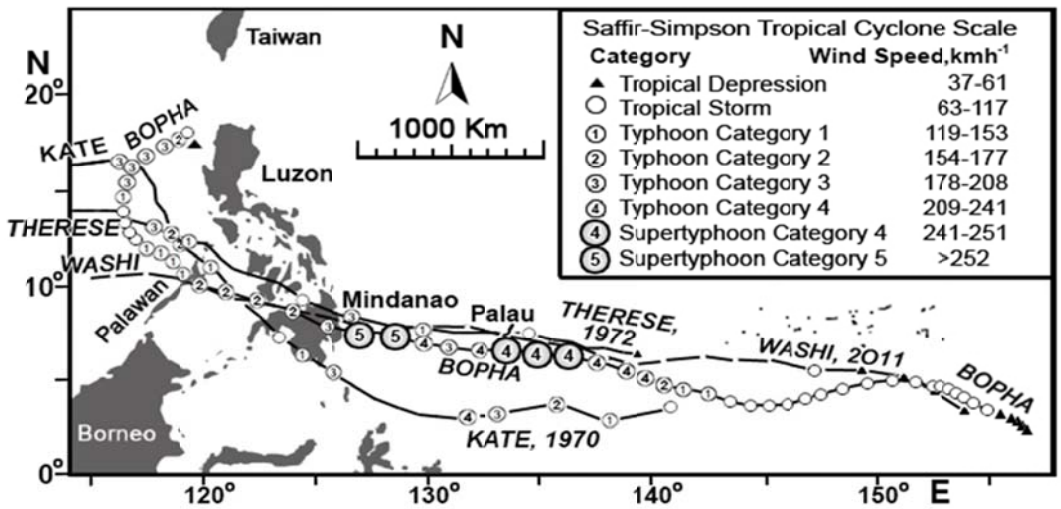
2.1.1 Equitorward Shift of Typhoons

Typhoon Pablo represented the lowest latitude Category 5 typhoon ever recorded in the world. In Barangay Andap, New Bataan, catastrophic debris flow caused by Pablo, which resulted in over 550 deaths, emphasizes the dire importance of such climate change related events.

Since the US Joint Typhoon Warning System began to archive western Pacific tropical cyclones in 1945, Mindanao was largely spared until it was hit by Category 3 typhoons Kate in 1970 and Therese in 1972 **(Figure 3**). Typhoon Kate passed some 45 km south of New Bataan, where it is remembered for its heavy rain and flooding. Typhoon Therese crossed the northern extremity of Mindanao, far from New Bataan. Mindanao then remained essentially typhoon-free until December 2011, a year before Pablo, when Tropical Storm Sendong floods killed 1,227 people. These rare events document that typhoons one or two years apart can hit Mindanao.

Most climatologists equate climate change with fewer but increasingly intense tropical cyclones, and agree that tracks in mid-latitudes are shifting poleward (Ramos, 2013; Webster et al, 2005; Bengtsson et al, 2007; Elsner et al, 2008). A recent strengthening and equatorward shift of the eastern Pacific typhoon track has been reported (Knutson et al, 2010); whether this also holds for the western Pacific is unclear, although one analysis suggests an equatorward shift during the period 2000-2029 (Bengtsson et al, 2006). Modeling indicates that storm tracks shift equatorward in response to increased sea-surface temperature gradients in the tropics (Wu and Wang, 2004), in agreement with experiments employing an increase in sea surface temperatures (Brayshaw et al, 2012). Furthermore, El Niño warming of the equatorial Pacific causes storm tracks to shift equatorward (Graff et al, 2012; Chang et al, 2002).

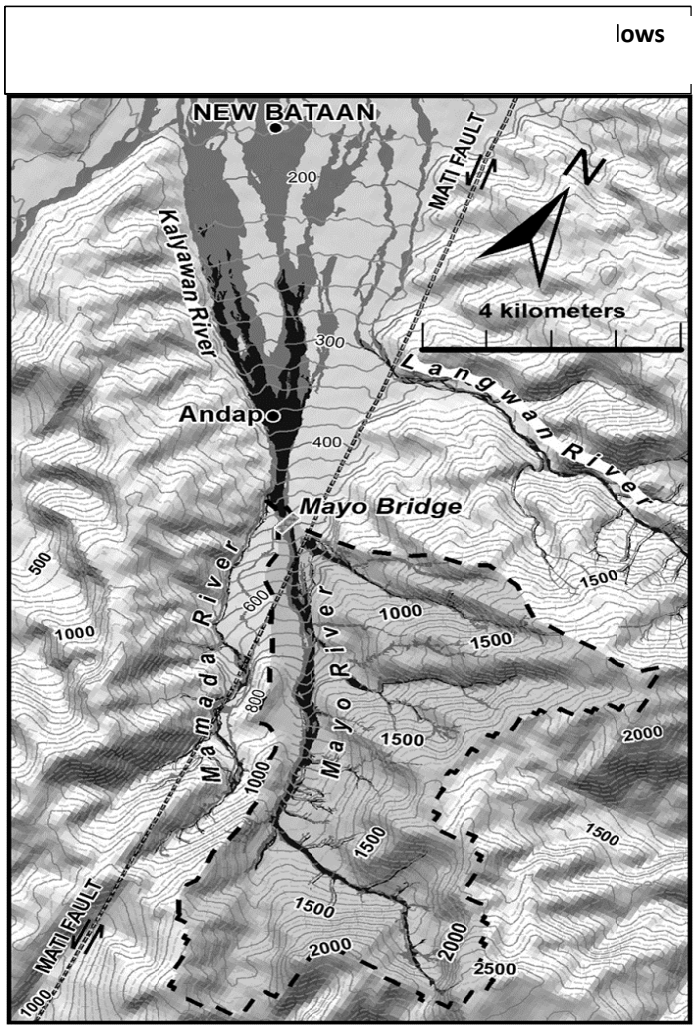
Figure 3: Track of Super Typhoon Pablo (Bopha; 2012), along with those of Tropical Storm Sendong (Washi; 2011), Typhoon Therese (1972) and Typhoon Kate (1970), which May Represent Southward Typhoon-Track Shifts in Response to Climate Change



2.1.2 Mayo River / New Bataan Debris Flow

Storm-generated debris flows, among the world's most destructive natural phenomena, are fast-moving slurries of water and rock fragments, soil, and mud (Takahashi, 1981). When rainfall on slopes exceeds critical thresholds of intensity, duration and cumulative precipitation, soil, sediment and rock masses are dislodged into landslides.

In **Figure 4**, the grey area enclosed by dashes is the New Bataan watershed that accumulated the rain which triggered the debris flow. All steep slopes are contoured at 50 m intervals. To better define the surface of the valley below 700 m, it is contoured at 20 m intervals. Deposits of true debris flows south of the Mayo Bridge are shown in solid black; hyperconcentrated-flow deposits are shaded in grey.

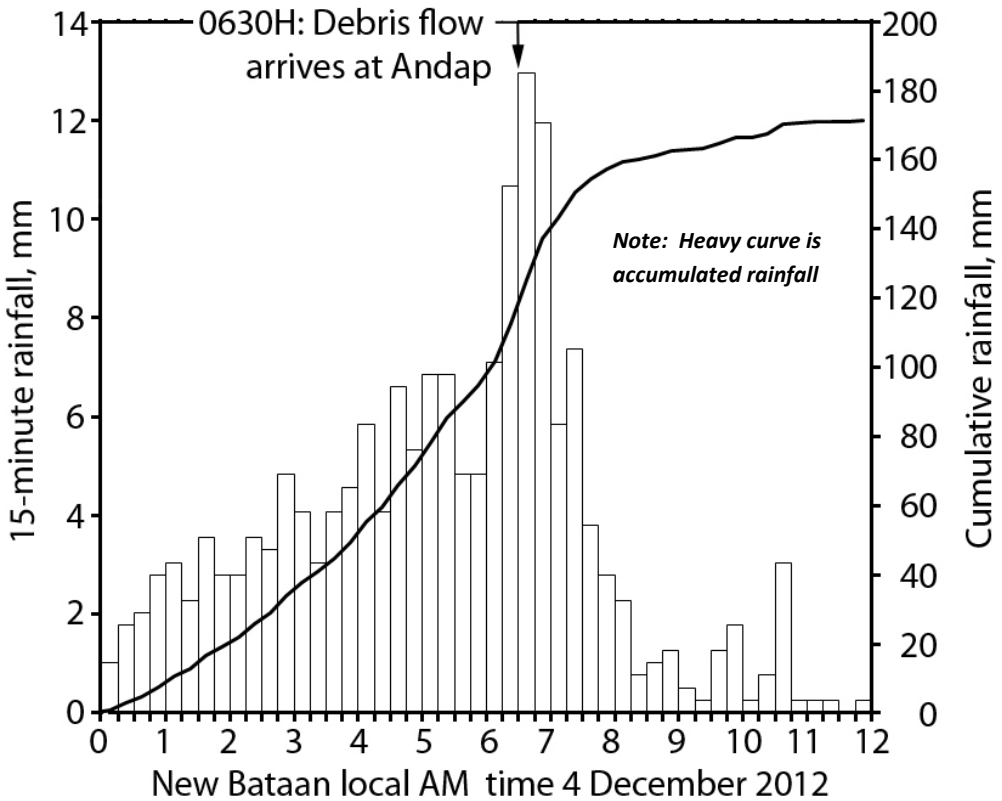


Geomorphologic Setting: In 1968, the founders of the Municipality of New Bataan did not realize that its 6 km-wide valley (Figure 4) is an avenue for debris flows. This lack of geomorphologic understanding would prove fatal during Typhoon Pablo. Barangay

Andap was established at the head of the valley, 3 km upstream of the town proper, on what was not recognized as an alluvial fan but is clearly expressed as such on topographic maps by contour lines that convex downstream where they cross the valley. Characteristically reverse-graded debris-flow deposits have built up the fan over time.

The Mayo River debris flows: Rain-gauge data from Maragusan municipality 17 km south of Barangay Andap are our proxies for the rainfall that triggered the debris flows (**Figure 5**). From midnight on December 4 until the flows occurred at 6:30 AM, the 36.5 km^2 Mayo River watershed above the alluvial fan received 120 mm of rain that fell at intensities up to 43 mmh^{-1} and accumulated 4.4 x 106 m3, greatly exceeding the global initiation thresholds for debris flows (Guzzetti et al, 2008). After the debris flows were triggered at 6:30 AM, they were sustained until 7:00 AM by another 24 mm of torrential rains that peaked at 52 mmh-1 at 6:45 AM and delivered an additional 9 x 105 m^3 of runoff.

Figure 5: Rainfall that Triggered and Sustained the Mayo River / New Bataan Debris Flows



From satellite and post-Pablo LiDAR imagery and field measurements, the Barangay Andap debris-flow volume was 2.5 - 3 x 107 m^3, ranking it among the largest ever experienced worldwide.

2.2 Methodology Applied for Vulnerability Assessment

Light Detection and Ranging (LiDAR) is one of the major tools used in the VA study as post-Typhoon Pablo data was available for Compostella Valley. It is a remote sensing technology that can measure the three-dimensional configuration of the Earth's surface by using a laser in measuring the variable distance of the source to the ground and other features therein such as buildings, canopy, and

pavements etc. In the VA study, the technology was used for contour mapping to develop a more precise base of data for flood simulations. With the absence of LiDAR data in Davao Oriental, Shuttle Radar Topography Mission (SRTM) 2000 data was used.

Using a high resolution Digital Elevation Model (DEM), flood simulations were made using a two-dimensional flood modelling software (FLO-2D). 15 m by 15 m grids were used for areas with LiDAR data and 90 m by 90 m grids were used for areas using SRTM LiDAR data. It is important to note that since LiDAR data have a higher resolution, simulations using LiDAR are more precise than simulations using SRTM data.

Five sub-basins were generated for the Compostela Valley flood plain to be able to handle the processing power needed by the high resolution flood simulation and maximize the high resolution LiDAR data set. Four sub-basins were generated to simulate the lower resolution data for its upper watershed which acts as the catchment and passes on discharge to the lower areas. Only three basins were generated for Davao Oriental since only low resolution elevation data were used in the area (**Figure 6**).

Figure 6: Delineation of Watersheds and Sub-Watersheds within the VA Study Area

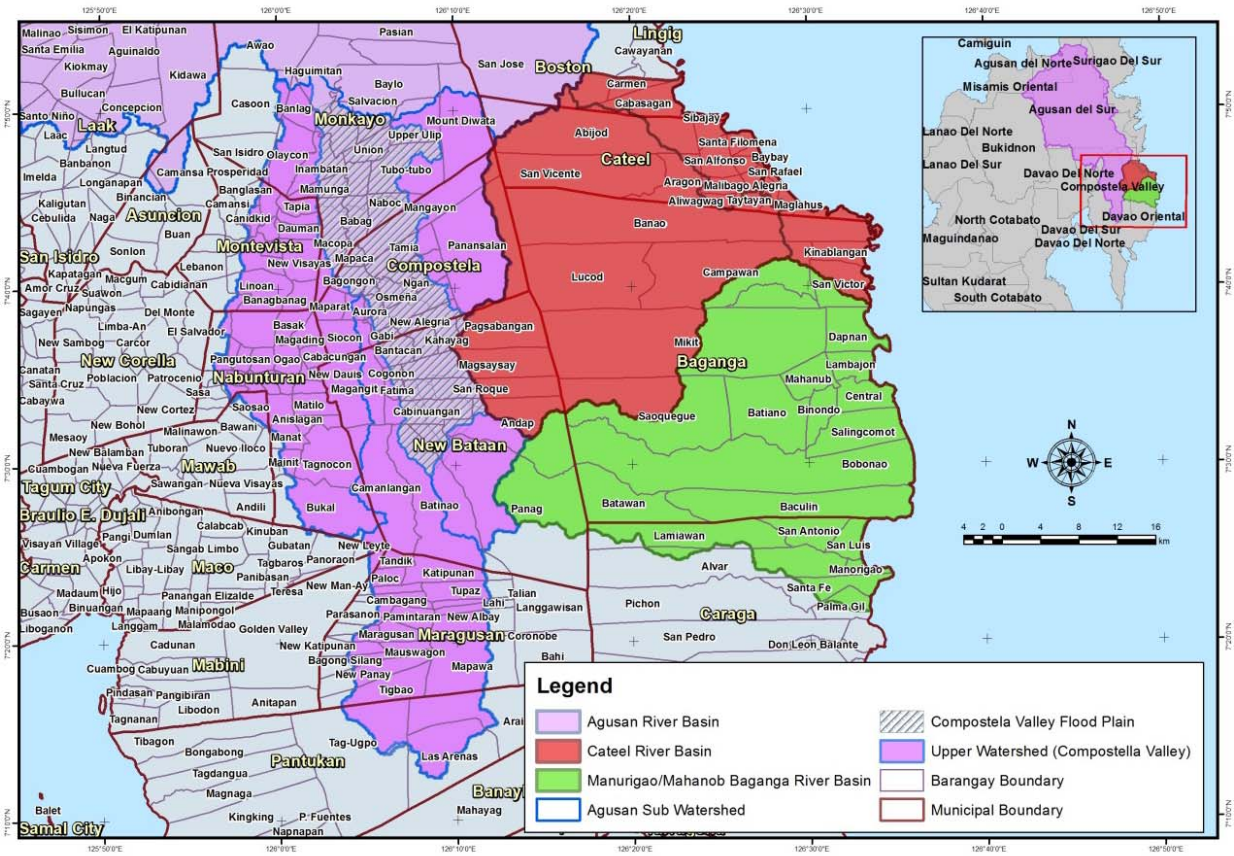


Figure 6.1: Cateel Watershed

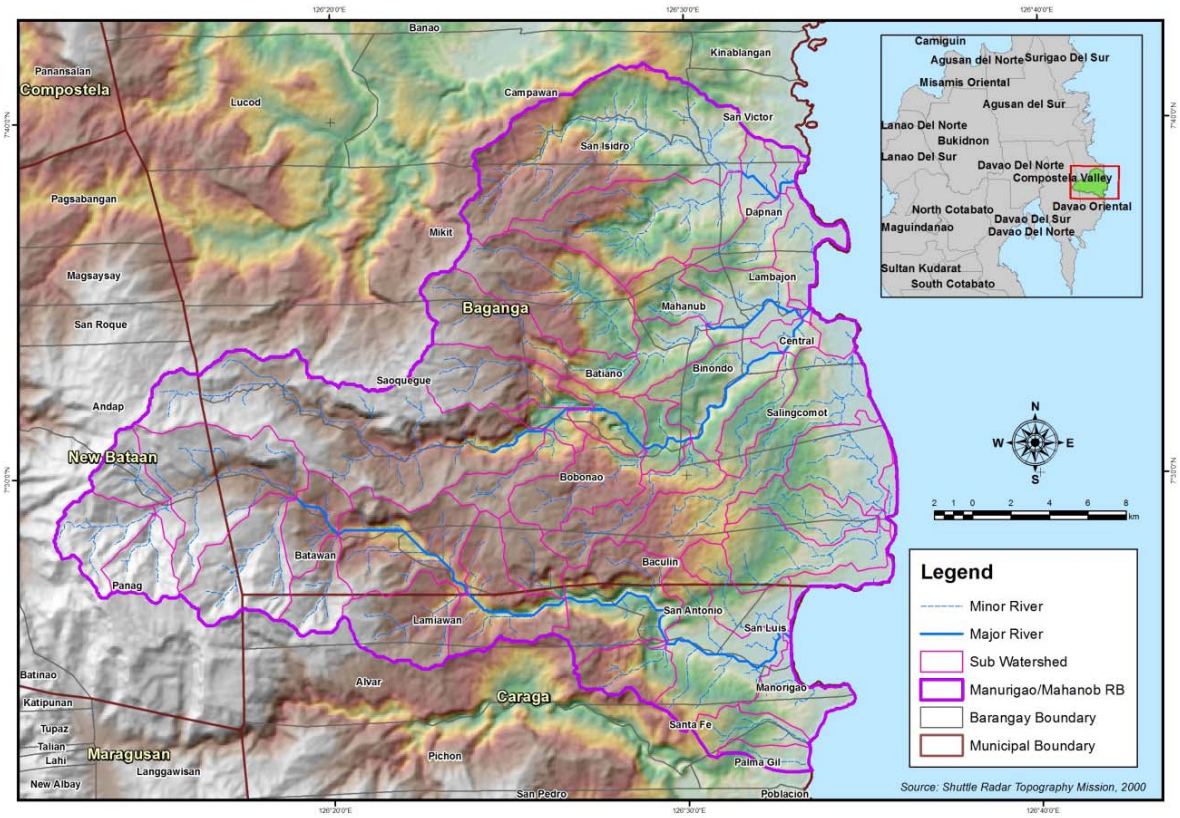


Figure 6.2: Baganga Watershed

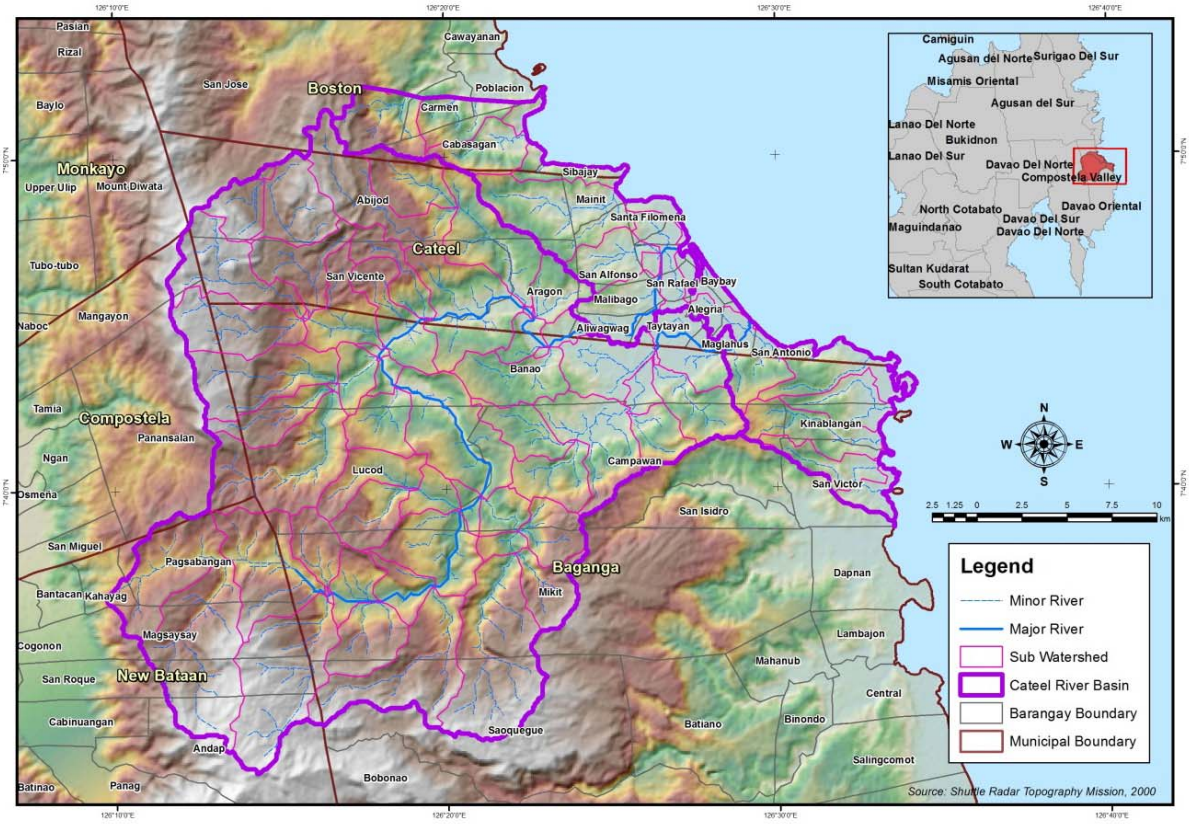
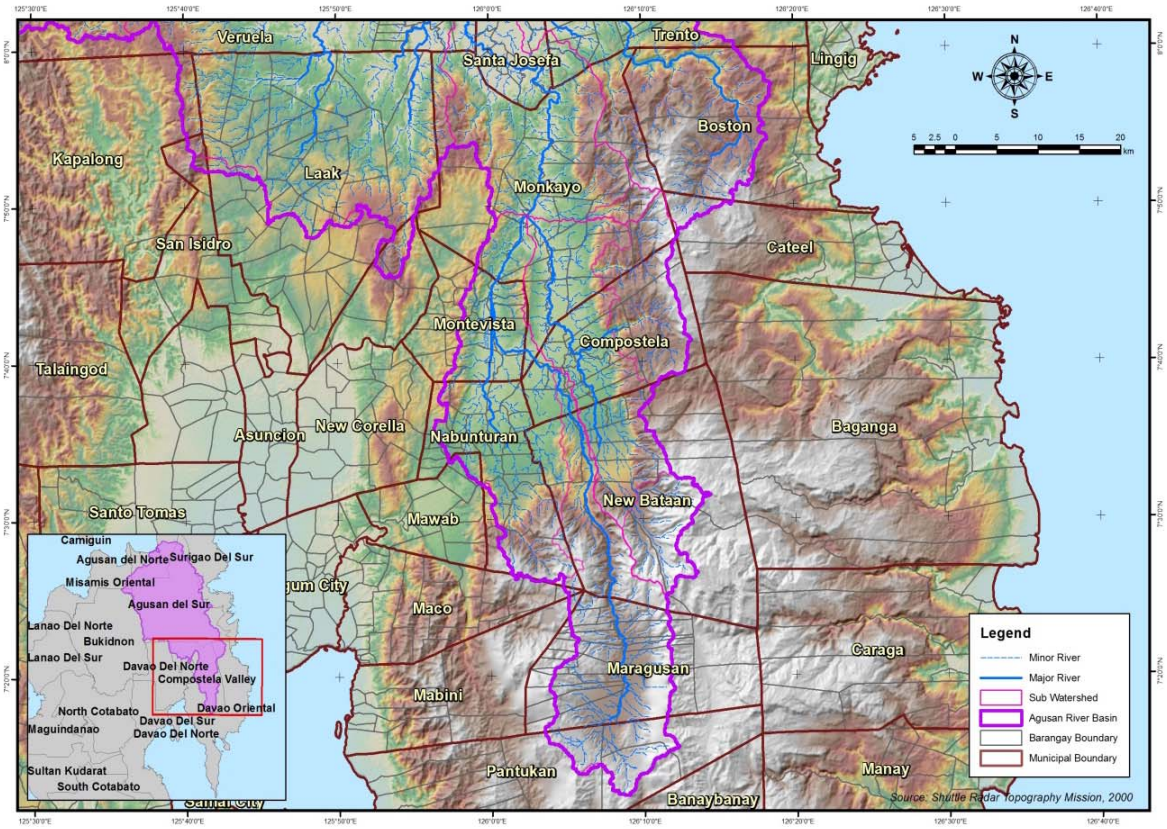


Figure 6.3: Agusan Watershed



Flood simulation was based on the 100-year Rainfall Intensity Duration Frequency (RIDF) data provided by PAGASA. The RIDF used was specific for their Davao City station which is the nearest station to both provinces. The maximum rain value used was 199.90 mm of rain over a span of 34 hours (**Figure 7**).

The ratings applied in generating the VA flood hazard map flood simulation are:

<u>High</u> (red): Flood height is greater than 1.5 m OR V x H is greater than 1.5 m^2 per second

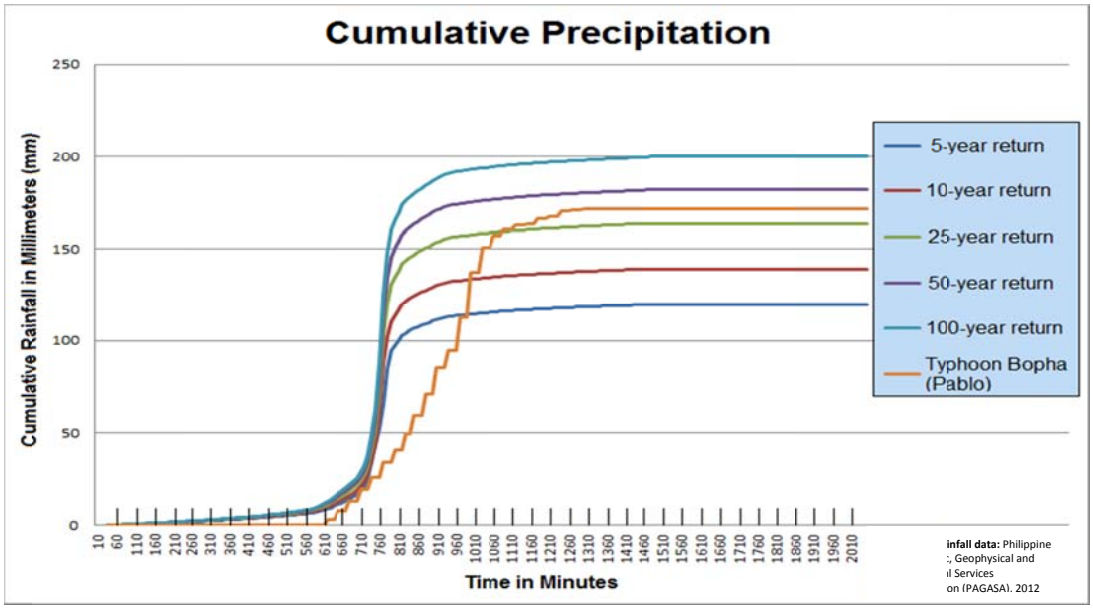
<u>Moderate</u> (orange): Flood height ranges from 0.5 m to 1.5 m *OR* V x H ranges from 0.5 m^2 per second to 1.5 m^2 per second

<u>Low</u> (yellow): Flood height ranges from 0.1 m to 0.5 m *AND* V x H ranges from 0.1 m^2 per second to 0.5 m^2 per second, where V= velocity; H = flood height

The comparative flooding and landslide susceptibility rating applied by MGB and recommended adaptation measures are provided in **Table 3**.

Contour lines were generated as part of the parameters for analysis. One meter contour intervals were generated with five meters as the base contour. Contour lines are useful to show relatively flat and relatively steep areas as suitability for safe locations. These contours could also indicate alluvial fan formations which are dynamic zones with high geomorphic activity (e.g., debris flows) and could be a dangerous location for communities.

Figure 7: Projected Rainfall Values per Return Period Compared to Typhoon Pablo



<u>Cumulative rainfalls for each scenario (per 34 hour period)</u>:

Typhoon Pablo:	171.45mm
100 year event:	199.9mm
50 year event:	181.9mm
25 year event:	163.7mm
10 year event:	139.17mm
5 year event:	119.78mm

<u>Comparisons of cumulative rainfall amounts</u>:

100 year event compared to the Pablo event:	16.59% greater
100 year event compared to a 50 year event:	9.89% greater
100 year event compared to a 25 year event:	22.11% greater
100 year event compared to a 10 year event:	43.63% greater
100 year event compared to a 5 year event:	66.89% greater

A 5-meter pixel resolution post-Pablo disaster spot satellite image (dated December 12, 2012 / 8 days after Typhoon Pablo) was also used in the VA study. The flood footprint taken by the satellite image was digitized and compared to the result of the VA flood simulation. An aerial image was also stitched together to act as a reference map. The 15 project sites were plotted as points along with the barangay boundary shapefile.

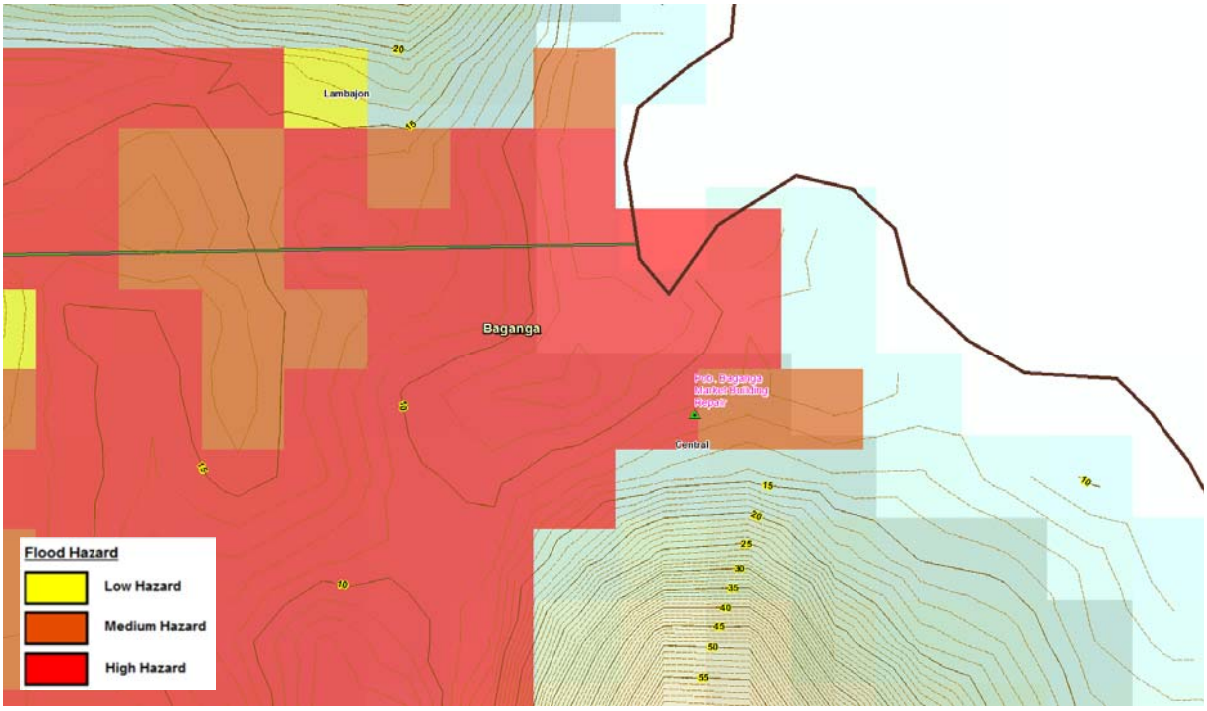
Table 3: Comparative Flooding and Landslide Susceptibility Rating

Definition of General Susceptibility Ratings	Recommended Adaptation Measures (source: Mines and Geosciences Bureau (MGB) Region XI, 2013; see footnotes)
The **flooding susceptibility ratings** applied by the Mines and Geosciences Bureau (MGB) Region XI based on their May / June 2012 surveys are as follows:	
High: Areas likely to experience flood heights of greater than 1 meter and/or flood duration of more than 3 days. These areas are immediately flooded during heavy rains of several hours; include landforms of topographic lows such as active river channels, abandoned river channels and areas along river banks; also prone to flash floods.	• Monitor rapid increase / decrease in creek / river water levels, possibly accompanied by increase turbidity (soil content) • Develop an early warning device / system (e.g. signages) and communication network with upland barangays • Maintain constant communication and updates with the barangay officials on geohazard situation • Report situation to MGB office and the municipal / city authorities
Moderate: Areas likely to experience flood heights of 0.5 to 1 meter and/or flood duration of 1 to 3 days. These areas are subject to widespread inundation during prolonged and extensive heavy rainfall or extreme weather condition. Fluvial terraces, alluvial fans, and infilled valleys are areas moderately subjected to flooding.	• Monitor rapid increase / decrease in creek / river water levels, possibly accompanied by increase turbidity (soil content) • Maintain constant communication and updates with the barangay officials on geohazard situation
Low: Areas likely to experience flood heights of less than 0.5 meter and/or flood duration of less than 1 day. These areas include low hills and gentle slopes. They also have sparse to moderate drainage density.	• Monitor rapid increase/decrease in creek/river water levels • Maintain constant communication and updates with the barangay officials on geohazard situation
The **landslide susceptibility ratings** applied by the MGB Region XI based on their May / June 2012 surveys of the are as follows:	
Very high: Areas with steep to very steep slopes and underlain by weak materials. Recent landslides, escarpments and tension cracks are present. Human initiated effects, such as small scale mining and deforestation, could be an aggravating factor.	• Observe for and / or monitor for presence of mass movement (e.g. landslide, tension cracks) • Report situation to MGB office and the municipal / city authorities • Observe for saturated ground / seeps and sunken or displaced road surfaces
High: Areas usually with steep to very steep slopes and underlain by weak materials. Areas with numerous old / inactive landslides.	• Observe for and / or monitor for presence of mass movement (e.g. landslide, tension cracks) • Report situation to MGB office and the municipal / city authorities • Observe for saturated ground / seeps and sunken or displaced road surfaces
Moderate: Areas with moderately steep slopes. Soil creep and other indications for possible landslide occurrence are present.	• Observe for and/or monitor for presence of mass movement (e.g. landslide, tension cracks) • Report situation to MGB office and the municipal/city authorities
Low: Gently sloping areas with no identified landslides.	• No recommendations provided by MGB for Low Level risks
The **coastal inundation / storm surge susceptibility ratings** applied by LBG are based on available historical storm surge records for the eastern Mindanao provided by the UP National Institute of Geological Sciences (UP-NIGS) based on historical data from PAGASA from 1898-2012. Nearest historical storm surge was recorded in Bislig (Surigao del Sur) with a reported height of 2.98 - 3.67 m.	**Not part of MGB study**
High: Coastal areas / sites that are 1 m or less in elevation.	
Moderate: Coastal areas / sites that are 1.1 - 3.5 m in elevation.	
Low: Coastal areas / sites that are 3.6 - 5.0 m in elevation.	

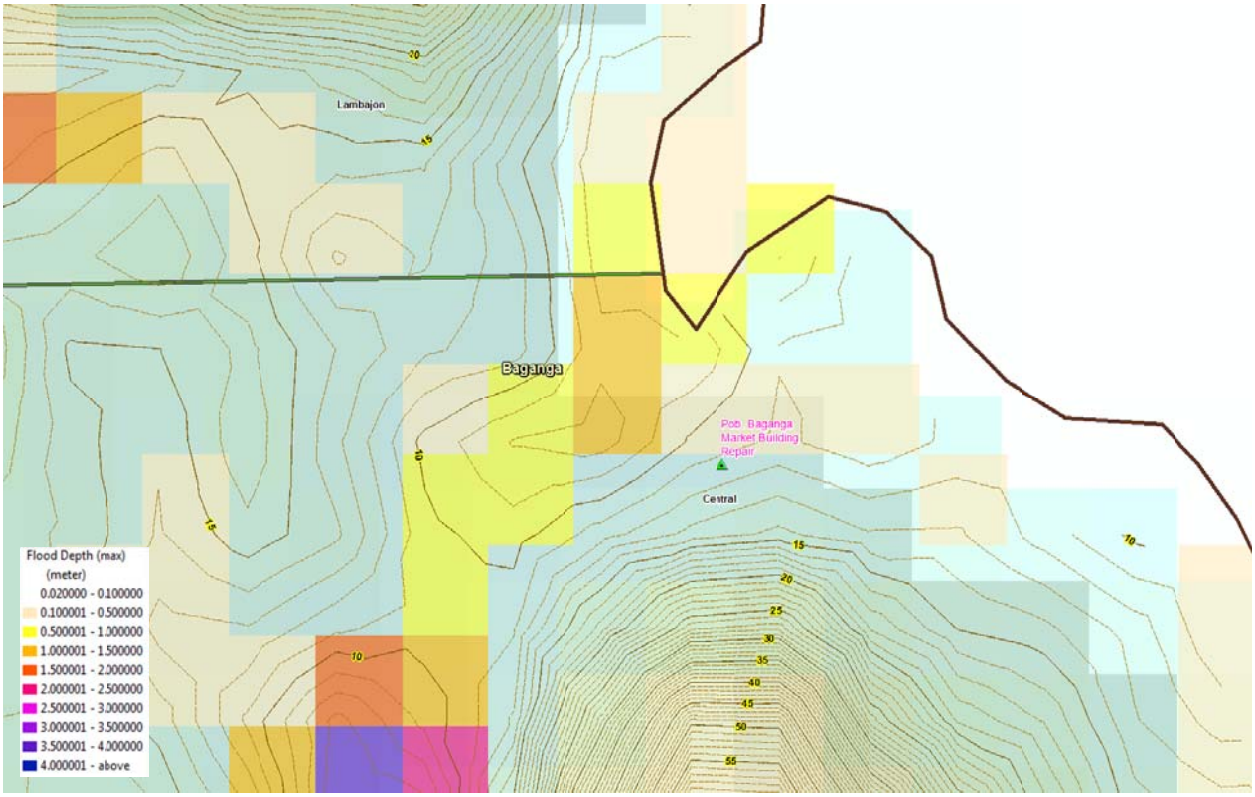
Flood and landslide hazard maps and earthquake induced hazard maps were source from MGB and the Philippine Institution of Volcanology and Seismology (PHIVOLCS) respectively. The GIS layers applied during the VA study were:

- Base map (15 project sites & barangay boundaries)
- Aerial image
- LiDAR coverage (if applicable; SRTM elevation data used in the absence of LiDAR data)
- Contour lines
- Digitized spot satellite image
- Hazard map generated by the flood simulation
- Flood depth generated by the flood simulation
- Flood flow velocity generated by the flood simulation
- MGB's flood and landslide hazard map
- PHIVOLCS' earthquake induced landslide hazard map

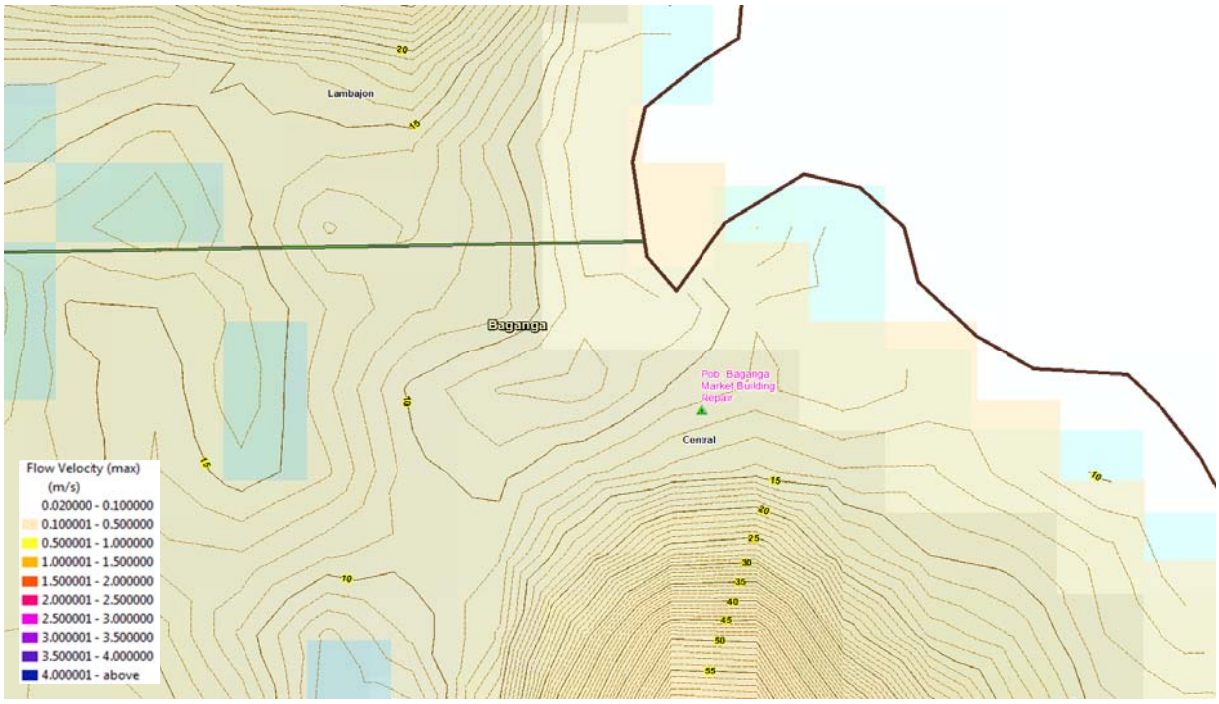
Representative examples of the generated and applied layers for the VA study maps are presented on the following pages while the complete set of maps is provided in the attached DVD (Annex C). All data layers were compiled in a GIS database where each of the project sites were analysed using the available data types listed above.



Simulated Hazard Map - Poblacion Baganga Market Building Construction - Future flood hazard based on a 100-year rain return flood scenario is medium to high



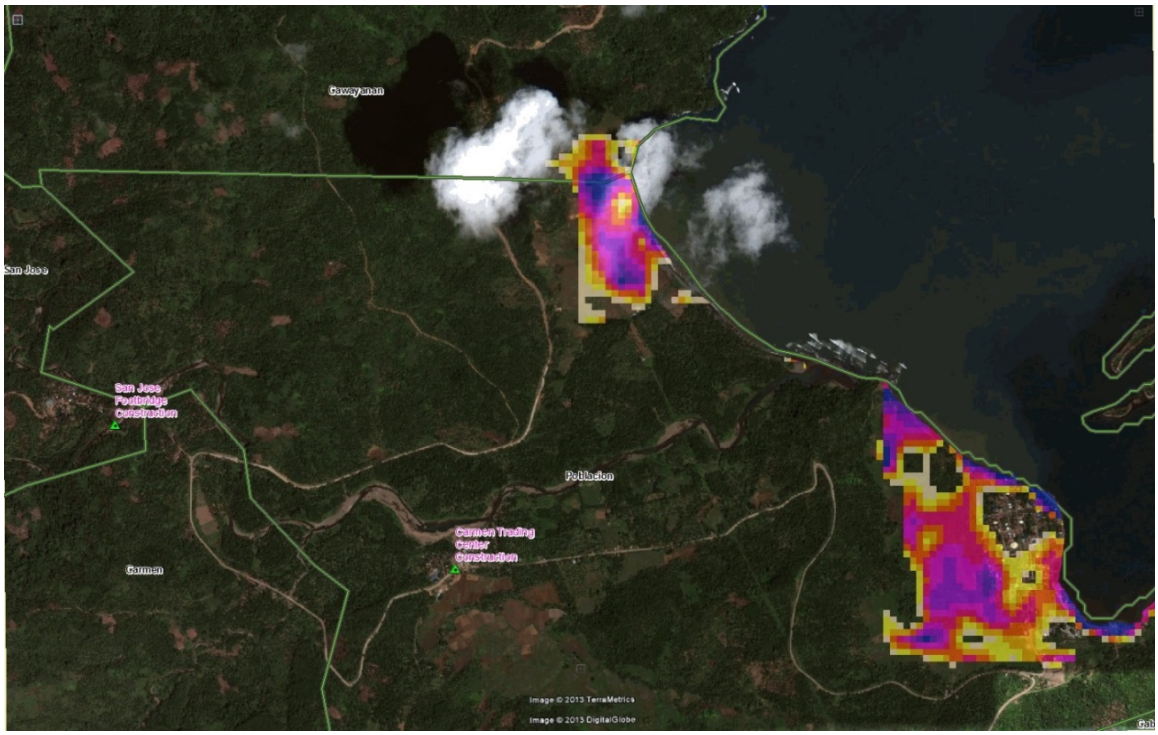
Simulated Flood Depth Map - Projected flood level of up to 0.1 meter



Simulated Flow Velocity Map - Poblacion Baganga Market Building Construction – Velocity of the flood is up to 0.5 m/s

A storm surge simulation was also accomplished through FLO-2D to check if project sites near coastal areas could be affected by storm surge and storm tides, taking into consideration modelled tides given the pressure and wind speed and direction of Typhoon Pablo's best track path according to the Japan Meteorological Agency (JMA) and the astronomical tide as parameters (**Figure 8**).

Figure 8: Storm Hazard Projection – San Jose Footbridge and Carmen Trading Center Project Areas



Analysed data were counter checked and compared with field observations by the VA study team and GEM engineers. Field data that provide information regarding the actual flood depth in the project sites during Typhoon Pablo were also lifted and compared with the field validation conducted by the University of the Philippines – National Institute of Geological Sciences (UP-NIGS).

2.2.1 Rapid Assessment of Adaptive Capacities and Sensitivities

The rapid assessment of adaptive capacities and sensitivities employed Key Informant Interviews (KIIs), a qualitative method of data collection. 39 key informants (**Annex D**) were selected in the eight municipalities based on their direct involvement in institutional adaptive capacity on climate change, including the fields of:

- Environment and natural resources;
- Planning and development;
- Engineering and agriculture;
- Social welfare, gender and development; and
- Indigenous people

Building on the Rapid Assessment completed by the GEM Program in January 2013, a review of available secondary data was conducted to assess the socio-economic conditions and vulnerabilities in the study areas.

The data generated through KIIs were subjected to descriptive analysis. Athematic analysis was employed where patterns and themes of the responses were determined and analyzed to form part of the discussion. Copies of the survey forms and questions asked are provided in **Annex E**.

2.3 Summary Results of Vulnerability Assessment - 15 Proposed Infrastructure Projects

The results of the VA study, observations of the Pablo impacts, and status for the 15 infrastructure projects proposed for USAID funding are provided in **Table 4**. This summary focuses on the susceptibility of the projects to flooding risks which is the key potential hazard identified in the project sites. Based on the results of the VA, potential climate change hazards involving landslide, debris flow and storm surge were not identified for the projects.

Three of the 15 projects are currently no longer proposed for construction due to time constraints to complete these activities by September 2013, namely:

- Magangit – Batinao Bridge Rehabilitation
- Mamunga Bridge Rehabilitation
- Poblacion Compostela Bridge Rehabilitation

The bridges survived Typhoon Pablo and the physical works in most cases consist of improvements to the road approaches and embankments (**Annex F**). Four of the proposed bridge projects are designed to overflow during extreme flood levels and will be temporarily (hours or days) closed for use during these periods. The remaining three slab bridges and one footbridge are designed to accommodate 100-year flood levels. The four trading centers are all designed to resist extreme typhoon winds of 250 kph, which is higher than Typhoon Pablo.

The Environmental Screening Reviews (ESRs) for all projects have been approved and incorporate adaptation measures as described in Section 3.

2.4 Projected Susceptibility to 100-year Flood Hazard

Table 5 presents the susceptibility, by area, to projected 100-year flood hazard in the eight municipalities in the VA study area. The maps of these projected flood hazard areas are included in the attached DVD (Annex C). A representative sample, for the municipality of New Bataan, is provided in **Figure 9**.

These projected 100-year impact areas include <u>all but two</u> barangays in these eight municipalities and directly affects 12 – 28.5% of each municipality. These study projections compare closely with those experienced during Typhoon Pablo.

Table 4: Summary of Vulnerability Assessment and Status:
15 Infrastructure Projects proposed for USAID funding

Project Name and Description	**Results of Vulnerability Assessment: Extreme Flooding / Typhoon Winds** (all project sites are outside of identified landslide and storm surge hazard areas)	**Project Status** (as of June 13) **and Mitigation / Adaptation Measures**
1. ***Poblacion Baganga Market Building Construction*** (re-construction of wind-damaged public market structure)	**No flood hazards projected:** UP-NIGS projected that there is no future flood hazard based on a 100 year return flood scenario. The structure was not flooded during Typhoon Pablo.	Environmental Screening Review (ESR), design and cost approved by USAID, construction ongoing. Mitigation measures: Design is typhoon wind resistant. Floor elevation raised to prevent flooding of the structure during heavy rains. Drainage canal to be provided around the perimeter of the structure. Adaptation measures: Proper maintenance of the structure, roof and drainage canal.
2. ***Sitio Mahayahay Overflow Bridge Rehabilitation*** (re-construction of a retaining wall and rip-rap slope protection; concrete and gravel paving of bridge approach road; river clearing / desilting)	UP-NIGS projected 100-year flood level is 2 meters above the area near the bridge. The Pablo flood level was 0.5 meters above the top of overflow structure.	ESR approved, design and cost approved by USAID, construction ongoing. Mitigation measures: Bridge is designed to allow high flood levels to overflow the structure. Rip-rap slope and concrete pavement protection will improve resilience of the structure during such flood events. Existing horizontal railing will be removed to avoid obstruction of debris during overflow. River clearing / desilting will restore flow capacity of the channel and bridge. Adaptation measures: Temporarily close the bridge during high floods. Provide warning signs near bridge approaches. Adopt communication / evacuation plans which identify appropriate measures when the bridge is closed.
3. ***Purok Duranta Overflow Bridge Rehabilitation*** (concrete and gravel paving of bridge approach road; rip-rap slope protection; reconstruction of concrete wheel guards; channel clearing)	UP-NIGS projected 100-year flood level is 0.5 to 1 meter above the structure's surface. The Pablo flood was 1.2 meters above the top of the overflow structure.	ESR approved, design and cost approved by USAID, procurement in progress, scheduled for survey/lay-out. Mitigation measures: Bridge is designed to allow high flood levels to overflow the structure. Rip-rap slope and concrete pavement protection will improve resilience of the structure during such flood events. River clearing / desilting will restore flow capacity of the channel and bridge. Adaptation measures: see Project 2 - Sitio Mahayahay Overflow Bridge Rehabilitation.
4. ***Sitio Santol Overflow Bridge Rehabilitation*** (concrete paving of bridge approach roads; concrete slope protection; concrete wheel guards to be constructed)	UP-NIGS projected 100-year flood level is up to 4 meters above the riverbank and 1 to 1.5 meters in nearby areas. The Pablo flood level was 0.4 meters above the top of the overflow bridge.	ESR approved, design and cost approved by USAID, procurement in progress, scheduled for survey / lay-out. Mitigation measures: Bridge is designed to allow high flood levels to overflow the structure. Slope and pavement protection will improve resilience of the structure during such flood events.

Project Name and Description	Results of Vulnerability Assessment: Extreme Flooding / Typhoon Winds (all project sites are outside of identified landslide and storm surge hazard areas)	Project Status (as of June 13) and Mitigation / Adaptation Measures
		Adaptation measures: see Project 2 - Sitio Mahayahay Overflow Bridge Rehabilitation.
5. ***Mamunga Bridge Rehabilitation*** (additional stone masonry wall; concrete paving of bridge approach road; installation of metal flex beam)	UP-NIGS projected 100-year flood level is up to 2.5 meters in nearby areas but the Pablo peak flood level did not overflow the bridge based on local reports.	**Project currently planned to not be constructed** due to time constraints in completing the project by September, the current schedule for GEM contract completion. ESR approved, design and cost have approved been approved by USAID.
6. ***Ngan Overflow Bridge Rehabilitation*** (slope protection; retaining wall; concrete paving of the bridge approaches and road; cleaning and desilting of existing culverts; channel cleaning)	UP-NIGS projected 100-year flood level is 2 meters above the surface of the bridge structure. The Pablo flood level was 1.3 meters above the top of the overflow bridge.	Environmental Screening Review (ESR) approved, design and cost approved, procurement in progress, scheduled for survey/lay-out. Mitigation measures: Bridge is designed to allow high flood levels to overflow the structure. Slope and pavement protection will improve resilience of the structure during such flood events. Adaptation measures: see Project 2 - Sitio Mahayahay Overflow Bridge Rehabilitation.
7. ***Poblacion Compostela Trading Center Construction*** (construction of new trading center structure with raised floor elevation to prevent flooding of the structure during heavy rains; drainage canal)	UP-NIGS projected 100-year flood level of 0.5 meters and up to 1.5 meters in surrounding areas. The Pablo flood level was 0.15 meters above the trading center floor.	ESR approved, design and cost approved by USAID, construction ongoing. Mitigation measures: Design is typhoon wind resistant. Elevated floor will minimize / avoid future flooding; drainage canal to be constructed around structure. Adaptation measures: Provide proper maintenance of the structure, roof and drainage canal.
8. ***Magangit-Batinao Bridge Rehabilitation*** (repair of abutment protection; concrete paving of bridge approach roads; channel excavation and desilting)	UP-NIGS projects flood level of up to 1 meter in the area of the structure. Pablo flood was 2.663 meters above the river bed. The structure was not flooded during Pablo.	**Project currently planned to not be constructed** due to time constraints in completing the project by September, the current schedule for GEM contract completion. ESR approved, design and cost have approved been approved by USAID.
9. ***Lebanon-San Jose Barangay Bridge Construction*** (construction of concrete slab bridge to replace former culverts; concrete paving of bridge approach roads; riprap slope protection)	UP-NIGS projected 100-year flood level of up to 1 meter in the area of the structure. The Pablo flood level was 0.6 meters above the existing bridge's gravel road.	Environmental Screening Review (ESR) approved, design and cost approved, procurement in progress, scheduled for survey/lay-out. Mitigation measures: Replacement of former culverts with slab bridge will increase channel opening and reduce clogging of debris during heavy rains; design elevation is well above maximum flood levels. Adaptation measures: Provide proper maintenance of bridge structure, including regular cleaning of debris and silt from channel; install appropriate warning signage.

Project Name and Description	Results of Vulnerability Assessment: Extreme Flooding / Typhoon Winds (all project sites are outside of identified landslide and storm surge hazard areas)	Project Status (as of June 13) and Mitigation / Adaptation Measures
10. ***San Jose Footbridge Construction*** (raise elevation of footbridge; riprap abutment protection; walling along approaches)	UP-NIGS projected that there is no flood hazard based on a 100-year return flood scenario. However, flood hazard is high in nearby areas, with projected flood level of up to 3 meters. The Pablo flood level was 0.8 meters above the existing footbridge floor planks.	ESR approved, design and cost approved by USAID, construction ongoing. Mitigation measures: Raised elevation is well above maximum flood levels; abutment protection and approach walling will protect against debris and scouring. Adaptation measures: Provide proper maintenance of bridge structure; install appropriate warning signage.
11. ***Alegria Barangay Bridge Construction*** (construction of concrete slab bridge to replace former culverts; riprap slope protection; desilting)	UP-NIGS projected 100-year flood level is up to 1 meter. The Pablo flood level was 0.2 meters above the existing bridge gravel surface.	Environmental Screening Review (ESR) approved, design and cost approved, procurement in progress, scheduled for survey/lay-out. Mitigation and adaptation measures: see Project 9 - Lebanon-San Jose Barangay Bridge Construction.
12. ***Carmen Trading Center Construction*** (construction of new trading center structure with raised floor elevation to prevent flooding of the structure during heavy rains; drainage canal)	UP-NIGS projected 100-year flood level is 0.5 meters. The structure was not flooded during Pablo.	ESR approved, design and cost approved by USAID, construction ongoing. Mitigation and measures: see Project 7 - Poblacion Compostela Trading Center Construction.
13. ***Poblacion Compostela Bridge Rehabilitation*** (slope protection; concrete paving of bridge approach roads)	UP-NIGS projected 100-year flood level is more than 3.5 meters above the river bottom and up to 2.4 meters above the riverbanks. The Pablo fllod level did not overflow the existing bridge structure.	**Project currently planned to not be constructed** due to time constraints in completing the project by September, the current schedule for GEM contract completion. ESR approved, design and cost have approved been approved by USAID.
14. ***Aguinaldo Trading Center Construction*** (construction of new trading center structure with raised floor elevation to prevent flooding of the structure during heavy rains; drainage canal)	UP-NIGS projected that there is no future flood hazard based on a 100 year return flood scenario. The structure was not flooded during Pablo.	ESR approved, design and cost approved by USAID, construction ongoing. Mitigation measures: see Project 7 - Poblacion Compostela Trading Center Construction
15. ***Panag Barangay Bridge Construction*** (construction of concrete slab bridge to replace former culverts; riprap slope protection; desilting)	UP-NIGS projected 100-year flood level is up to 2.5 meters in the area of the structure. The Pablo flood level was about 0.4 meters above existing bridge pavement	ESR approved, design and cost approved, procurement in progress, scheduled for survey/lay-out. Mitigation and adaptation measures: see Project 9 - Lebanon-San Jose Barangay Bridge Construction.

Figure 9: Representative Hazard Map: 100-year Flood
Municipality of New Bataan

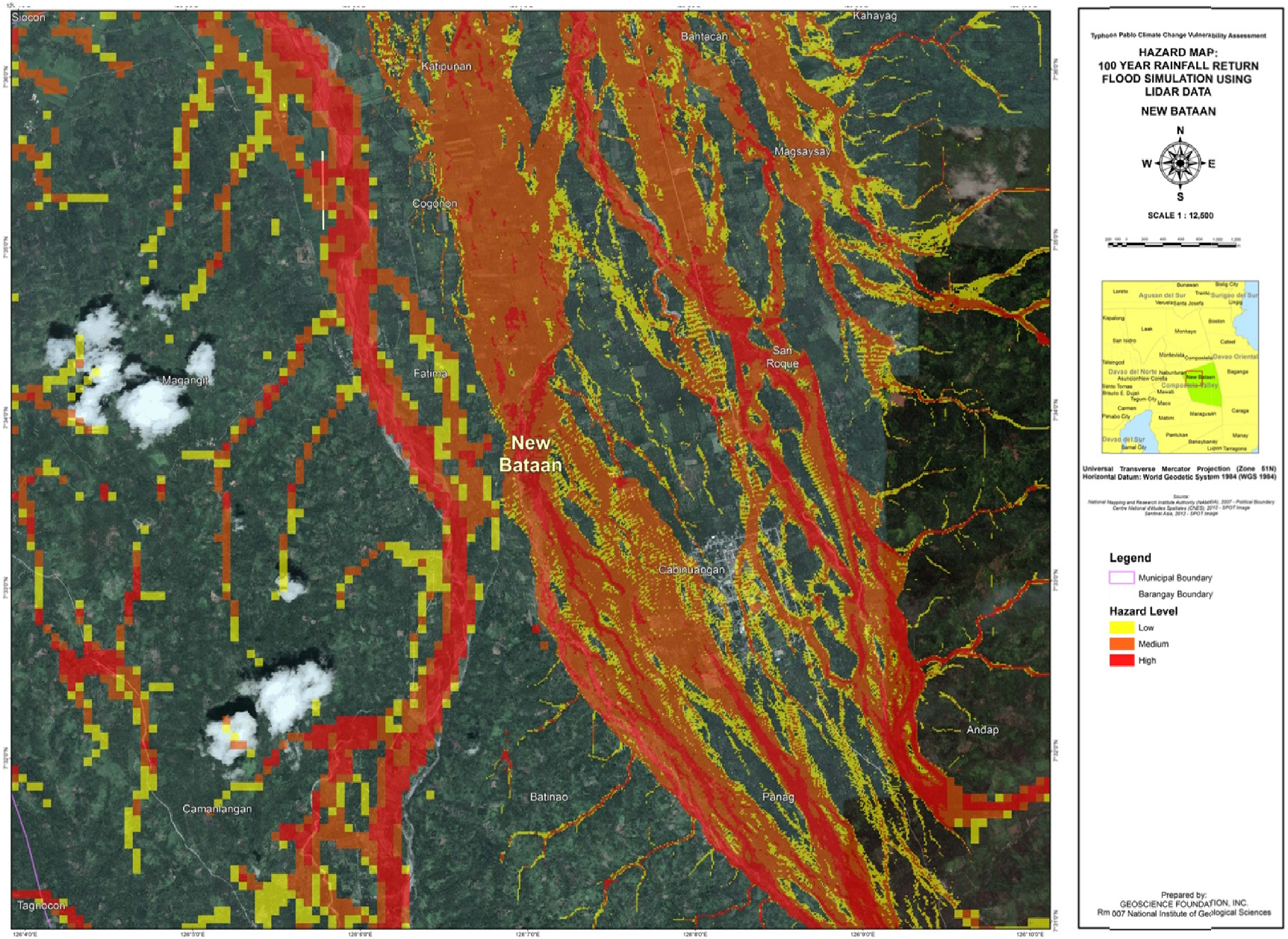


Table 5: Projected Areas Subject to Flood Susceptibility Hazard from 100-year Flood Return

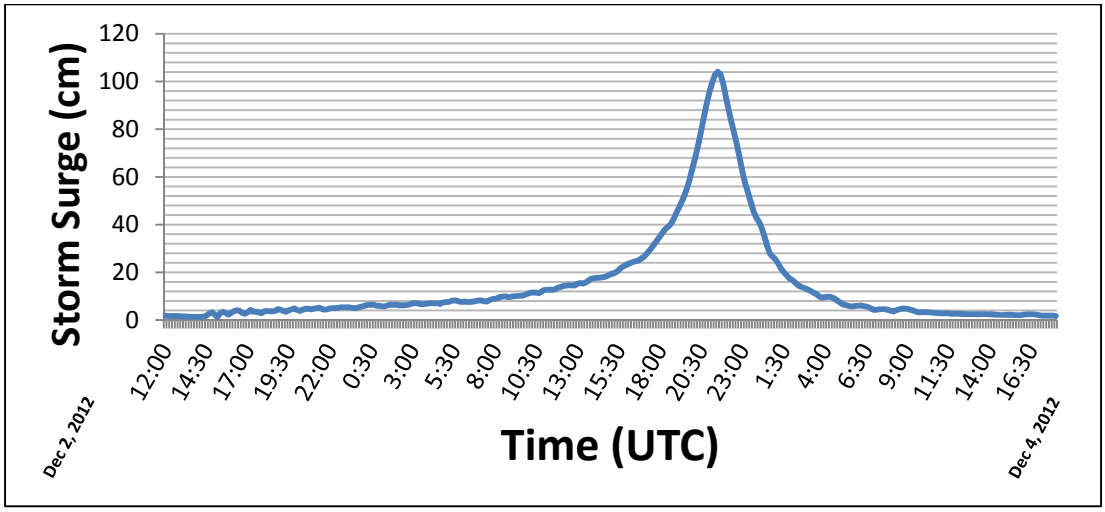
Municipality	Area (Ha)	Affected Area (Ha)	Affected Area over Total Area (%)
Davao Oriental			
Baganga	115,312.4	21,209.9	18.4
Boston	39,261.6	6,153.9	15.7
Cateel	26,364.6	5,862.6	22.2
Total (3 LGUs)	**246,564.8**	**45,242.9**	
Compostela Valley			
Compostela	26,213.4	7,470.3	28.5
Laak	75,856.7	9,342.6	12.3
Monkayo	65,884.7	12,847.7	19.5
Montevista	17,150.4	2,758.9	16.1
New Bataan	57,969.8	11,035.9	19.0
Total (5 LGUs)	**459,936.6**	**79,440.4**	

2.5 Projected Susceptibility to Storm Surge

Storm surges may be associated with major typhoons and the vulnerability to storm surges is expected to increase with increasing coastal populations and raising sea levels. Based on local reports, a storm surge of approximately one meter was experienced during Typhoon Pablo. This storm surge reportedly covered an area up to 500 meters inland from the shore. See sample storm surge hazard map in **Figure 10**.

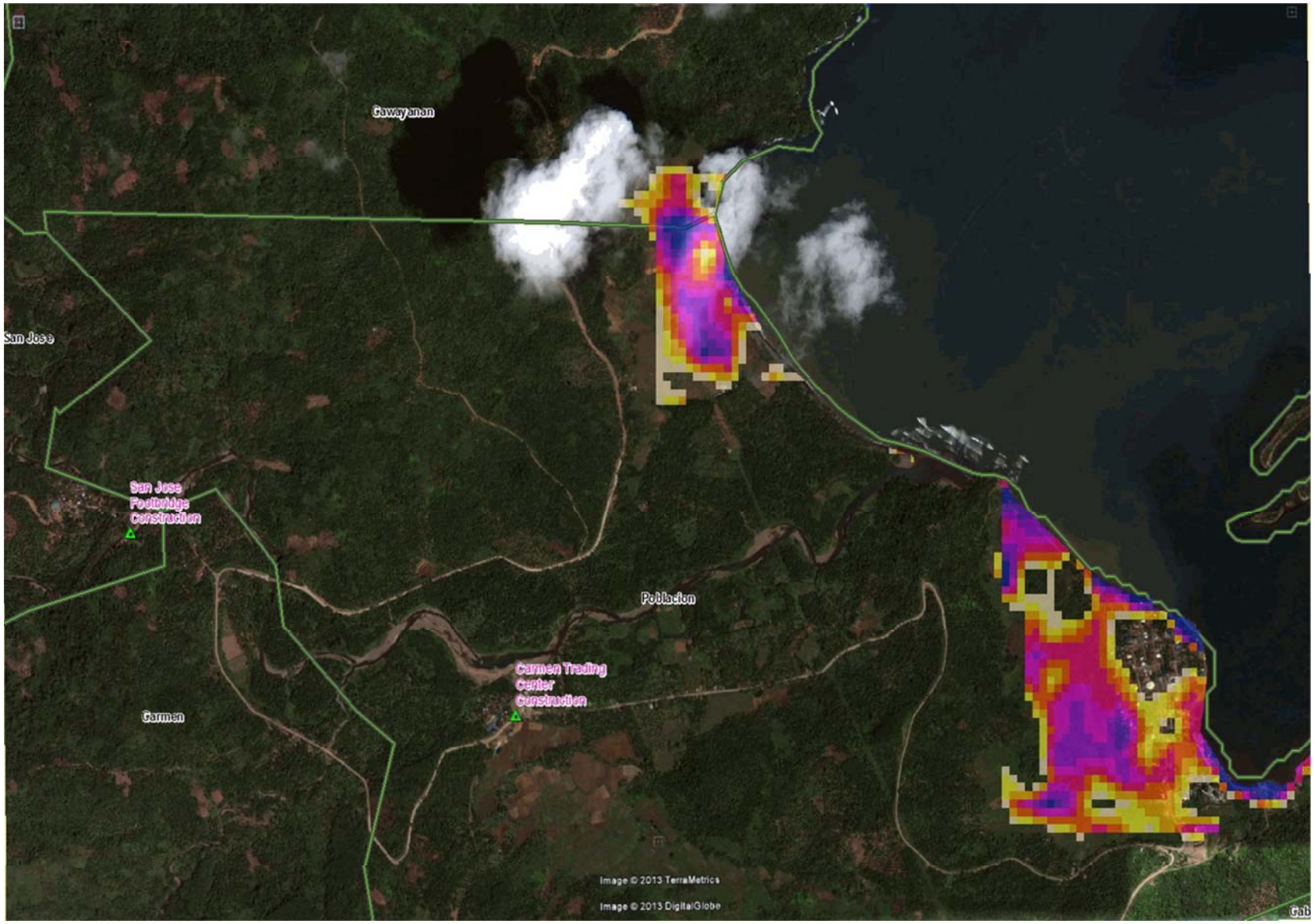
During the VA study, the Japan Meteorological Agency (JMA) Storm Surge Model was applied to simulate conditions experienced during Pablo, the results of which are illustrated in **Figure 11**. Various parameters (e.g., wind speed, atmospheric pressure, tide) were applied using this numerical model which was developed to simulate and predict storm surges caused by tropical cyclones. The numerical scheme of the model is based on the shallow water equations and thus this model is two-dimensional.

Figure 11: Projected Storm Surge generated by Typhoon Pablo Conditions



Legend: UTC – Coordinated Universal Time

Figure 10: Representative Storm Surge Hazard Map: San Jose Footbridge Construction and Carmen Trading Center Construction



Based on the VA simulation and conditions equivalent to Pablo, the projected areas susceptible to storm surge / coastal flooding are summarized in **Table 6**. None of the proposed 15 infrastructure projects are located within these hazard areas.

Table 6: Projected Areas Susceptible to Storm Surge / Coastal Flooding Based by Typhoon Pablo Conditions

Municipality	Barangay	Affected Area by Storm Surge (Ha)	Population Density (People/Ha)
BAGANGA	Central	241.8	2.6
	Dapnan	35	1.0
	Lambajon	11	5.0
		287.8	
CATEEL	Alegria	26.7	4.7
	Baybay	103.5	4.0
	Maglahus	0.6	2.4
	Mainit	0.0	2.5
	Poblacion	16.9	35.1
	San Antonio	5.9	5.4
	San Miguel	44.8	2.1
	San Rafael	44.5	7.2
	Santa Filomena	6.4	2.6
		249.6	
BOSTON	Cabasagan	5.4	0.8
	Cawayanan	9.8	0.8
	Poblacion	85.0	3.2
	Sibajay	4.8	
		105.1	
TOTAL		**642.4**	

Historical records dating back 100 years provided by PAGASA reported a strom surge in Bislig (north of VA study area) of up to 3.66 meter height.

2.6 Sensitivities

An important area in assessing the climate change vulnerability of a community is **sensitivity** or "the degree to which a community is negatively affected by changes in climate". It is "largely determined by the relationship of individuals, households, or a community to resources impacted by climate events, and by the degree of dependency on those resources". (Marshall et. al. 2010, USAID 2009, Turner 2003 cited in Wongbusarakum & Loper, 2011). The socio-economic condition of a particular community would indicate its sensitivity, and consequently, vulnerability to climate change. Thus, a community with relatively poor socio-economic condition will be more likely sensitive and

vulnerable to negative impacts of climate changes. The assessment of Typhoon Pablo impacts and sensitivities provided in Annex A indicates the range of sensitivities in the study area due to a major climate-related event.

As of 2009, the province of Davao Oriental where three of the eight study areas are located, has the second lowest estimated average annual family income (Php97,289) among all the provinces in the Philippines. The province of Compostela Valley where the remaining five study areas are located also has relatively low average annual family income (Php137,747) (2009 Family Income and Expenditure Survey, NSO). In In these two provinces, many of the constituents are dependent on marginal farming and fishing (especially for Davao Oriental) as their main source of income.

Indigenous people (IP) are among the most vulnerable groups and will most likely be affected by the negative impacts of climate change, particularly if they are dependent on natural resources. **Tables 7** and **8** show that a significant number of people in the study areas are IPs. In Compostela Valley, the *Mansakas* could be considered as IPs, while the *Mandayas* and *Manobos* are IPs in Davao Oriental.

Table 7: Distribution by Ethnicity and by Municipality in Compostela Valley, 2000

Municipality	Ethnicity								
	Cebuano	Boholano	Bisaya/ Binisaya	Mansaka	Hiligaynon /Ilongo	Other Foreign Language	Others	Not reported	TOTAL
COMPOSTELA VALLEY	**302,979**	**71,341**	**50,819**	**32,050**	**27,549**	**106**	**92,378**	**2,454**	**579,676**
Compostela	32,226	7,588	5,405	3,409	2,930	11	9,826	261	61,656
Laak	31,073	7,316	5,212	3,287	2,825	11	9,474	252	59,450
Monkayo	44,721	10,530	7,501	4,731	4,066	16	13,635	362	85,562
Montevista	17,365	4,089	2,913	1,837	1,579	6	5,295	141	333,225
New Bataan	22,214	5,231	3,726	2,350	2,020	8	6,773	180	42,502

Source: NSO 2000 Census of Population

Table 8: Top 10 Ethnic Groups / Dialects in Davao Oriental, 2000

Ethnicity / Dialects	Total Population
Dabaweño	135,555
Bisaya/Binisaya	82,491
Cebuano	80,978
Mandaya	66,634
Boholano	21,288
Kalagan	14,284
Waray	7,900
Hiligaynon/Ilongo	7,148
Manobo/Ata-Manobo	5,195
Ilocano	3,642

Source: NSO 2000 Census of Population

2.7 Safe Relocation Sites

Under the directive of the Presidential Management Office, Project NOAH and MGB collaborated and identified safe relocation sites using the highest technology possible. Following Typhoon Pablo, public school facilities were commonly used as evacuation centers and these school facilities can be identified within these safe relocation sites using GPS coordinates. For Compostela Valley and Davao Oriental, Project NOAH and MGB recommended a total of 35 relocation sites: 16 in Monkayo, 3 in Compostela, 5 in new Bataan, 3 in Montevista, 3 in Laak (all in Comspostela Valley) and 5 in Baganga, Davao Oriental.

However, the exact locations of the relocation sites are still concealed due to the sensitivity of the matter. Exact locations were referred to local government authorities and should be a topic for recommended follow-on activities and consultations.

Table 9: Summary of Recommended Safe Relocation Sites per Municipality

COMPOSTELA VALLEY PROVINCE				**DAVAO ORIENTAL PROVINCE**	
Monkayo		**New Bataan**		**Baganga**	
Site	Area (ha)	Site	Area (ha)	Site	Area (ha)
1	2	20	7.19	31	8
2	1	21	10	32	2
3	14.6	22	7.3	33	6.3
4	3	23	123	34	**3**
5	3	24	53	35	**5**
6	2	**Total**	**193.19**	**Total**	**24.3**
7	1.5	**Montevista**			
8	97	Site	Area (ha)		
9	12.47	25	2		
10	2.5	26	2.5		
11	8.27	27	1.5		
12	16.69	**Total**	**6**		
13	2.5	**Laak**			
14	4.43	Site	Area (ha)		
15	3.46	28	2.6		
16	12.35	29	5		
Total	**186.77**	30	1		
Compostela		**Total**	**8.6**		
Site	Area (ha)				
17	16				
18	170.25				
19	60.8				
Total	**247.05**				

3.0 RECOMMENDATIONS

Extreme climate-related hazards, equivalent to or higher than those experienced during Typhoon Pablo, were assessed as a basis for this rapid evaluation of vulnerabilities, which includes exposure and adaptive capacities.

The following sections provide recommendations to mitigate and adapt to climate change hazards, focusing on the potential increase in extreme rainfall and potential flooding caused by typhoons, and on the 15 infrastructure projects proposed for USAID funding. Potential climate change impacts on the 15 infrastructure projects are mitigated via design and adaptation measures are proposed to address risks identified.

This section further provides recommendations for potential follow-on activities, including a prioritized listing of recommended immediate activities which could be supported by USAID through the Special Activities Fund (SAF) budget provided in the Typhoon Pablo Recovery Assistance component of the GEM Program.

3.1 Mitigation Measures – Design Features of the 15 Infrastructure Projects

Design modifications applied for the infrastructure projects proposed for funding by USAID included increased hydraulic designs and elevations, strengthened structures and embankments, overflow capacities and recommended siting / location of facilities. These design modifications are included in the Environmental Screening Reviews (ESRs) which were prepared and approved by USAID for each project.

Empirical formulas (Rational / Manning) were applied in the design process (**Table 10**) based on available field data (PAGASA Davao City rainfall records, 100-year flood return projections), field survey reports (channel / river profile), tables and maps and from the designer's judgement. A comparative analysis for the maximum flood discharge from the Rational formula (theoretical) versus the Manning's formula (for historical) was applied to compute the sizes of box, suspension footbridges and slab bridges free board. GEM design engineers were involved during the VA study and were provided with copies of independently projected flood levels and velocities by UP-NIGS.

Table 10: Summary VA Mitigation Design Parameters:
15 Infrastructure Projects proposed for USAID Funding

Project		Design Parameters
1	Poblacion Baganga Market Building Construction	
2	Sitio Mahayahay Overflow Bridge Rehabilitation	Catchment Area, A = 568 ha Design Rainfall Frequency = 100 yrs Discharge, Q = 145.90 cu.m./s (Rational Method)
3	Purok Duranta Overflow Bridge Rehabilitation	Catchment Area, A = 1,080 ha Design Rainfall Frequency = 100 yrs Discharge, Q = 200.96 cu.m./s (Manning's Formula and observed peak flood)

Project		Design Parameters
4	Sitio Santol Overflow Bridge Rehabilitation	Catchment Area, A = 1,048 ha Design Rainfall Frequency = 100 yrs Discharge, Q = 200.96 cu.m./s (Manning's Formula and observed peak flood)
5	Mamunga Bridge Rehabilitation	Catchment Area, A = 2,800 ha Design Rainfall Frequency = 100 yrs Discharge, Q = 246.17 cu.m./s (Rational Method)
6	Ngan Overflow Bridge Rehabilitation	Catchment Area, A = 6,074 ha Design Rainfall Frequency = 100 yrs Discharge, Quantity (Q) =1062.76 cu.m./s (Rational Method)
7	Poblacion Compostela Trading Center Construction	
8	Magangit-Batinao Bridge Rehabilitation	Catchment Area, A = 900 ha Design Rainfall Frequency = 100 yrs Discharge, Q = 146.42 cu.m./s (Rational Method)
9	Lebanon-San Jose Barangay Bridge Construction	Catchment Area, A = 176 ha Design Rainfall Frequency = 100 yrs Discharge, Q = 41.44 cu.m./s (Rational Method)
10	San Jose Footbridge Construction	Catchment Area, A = 1,649.6 ha Design Rainfall Frequency = 100 yrs Discharge, Q = 314.78 cu.m./s (Rational Method)
11	Alegria Barangay Bridge Construction	Catchment Area, A = 350.93 ha Design Rainfall Frequency = 100 yrs Discharge, Q = 50.74 cu.m./s (Rational Method)
12	Carmen Trading Center Construction	
13	Poblacion Compostela Bridge Construction	Catchment Area, A = 11,690 ha Design Rainfall Frequency = 100 yrs Discharge, Q = 1385.59 cu.m./s (Rational Method)
14	Aguinaldo Trading Center Construction	
15	Panag Barangay Bridge Rehabilitation	Catchment Area, A = 375.47 ha Design Rainfall Frequency = 100 yrs Discharge, Q = 200.96 cu.m./s (Manning's Formula and observed peak flow)

The projection models applied using the Flo-2D use the Rational Formula and consider specific infiltration method (Green Ampt). In the algorithm, law of conservation is observed. The total water in the model is equal to the discharge, stored water (water that are still in the channel and other low area), and infiltration (water that is absorb by the ground).

The velocity and discharge measurements carried out using Flo-2D can be used as a validation to the Rational formula and Manning equation for open channel flow results used in the engineering design of culverts and bridges. In the Flo-2D simulation that were conducted, the rainfall intensity duration frequency curves of PAGASA coming from Davao City station were used and applied to the respective watersheds in Compostela Valley and Davao Oriental. There are intrinsic differences in the assumptions used in both methods to calculate discharge and flow velocities between the Rational/Manning formulas and Flo-2D but the output of the 2 dimensional flow simulation results is expected not to deviate significantly.

The DPWH-Region 11 design criteria adjustment for the proposed trading centers is based on the design of a one-story school building. The DPWH wind load standard used for areas in Compostela Valley and Davao Oriental is wind velocity of 200 kph since these areas are located in Wind Zone 2, based on the National Structural Code of the Philippines, 6th Edition (2010), Volume 1.

As a mitigation measure, the GEM design for the roofing of proposed trading centers is based on a wind load of 250 kph which is higher than the wind velocity of 210 kph brought about by Typhoon Pablo. In addition, all structures are designed in accordance with the PHIVOLCS Zone 4 earthquake conditions.

DPWH's design for box culverts is based on "25-year flood with sufficient freeboard to contain the 50-year flood" and for river protection works on principal and major rivers (40 sq km drainage area and above) is "50-year flood with sufficient freeboard to contain the 100-year flood" and on small rivers (below 40 sq km drainage area) is "25-year flood with sufficient freeboard to contain the 50-year flood".

As a mitigation measure, GEM's design for bridge rehabilitation and slab bridge, box culvert and overflow structure (box or pipe culverts and approaches) construction and rehabilitation, will integrate 100-year flood level projections to make the structure more robust, despite being more costly. In addition, necessary freeboard is provided in the designs (**Annex F**).

3.2 Adaptation Measures / Strategies

Adaptation measures and strategies are recognized as a key response in addressing vulnerabilities created by potential climate changes. MGB's recommended adaptation measures for flooding and landslide susceptibility risk levels are included in **Table 11**. A summary of representative adaptation options identified from recent VA international pilot studies and selected DENR best practices are provided in **Table 12**.

Interviews with 39 key informants during the VA study highlighted local adaptation measures, focusing on most vulnerable groups.

3.2.1 Special Adaptation Measures for Most Vulnerable Groups (MVGs)

The VA survey of 39 key informants (Annex E) revealed that the most vulnerable groups (elderly, differently abled persons and people with disorders (PWDs), women, children, and IP) have special or specific needs that have to be addressed especially in times of calamities. For instance, in the establishment of evacuation centers, there are certain things to be considered in response to the special needs of the MVGs.

Table 11: Representative Adaptation Options Identified from recent VA Pilot Studies

	HONDURAS	MALI	SOUTH AFRICA	THAILAND
Infrastructure	• Construction of groins, sea walls, breakwaters, dams, drainage systems • Sand pumping, river dredging, lining of river channel • Improved design and higher levees • Installation of collectors, storm gates and pumps	• Construction of water gate • Development of food storage facilities • Install rock lines to capture runoff	• Recycling urban • Reuse mining • Build dam • Expand well fields	• Water resource development • Construction of weirs
Capacity Building	• Improve environmental education • Build staff capacity and infrastructure to implement flood warning system	• Build knowledge and capacity to understand agricultural production stressors • Build capacity in weather forecasting	• Drought/risk management • Hydro-climatic network/ monitoring	• Build knowledge and capacity in adaptation • Encourage conservation • Strengthen commodity value chains and find new markets
Policy	• Design and implement zoning regulations and building codes • Limit deforestation • Adoption of local policy and ordinance initiatives	• Facilitate access to credit	• Intersectoral reallocation • Reallocation of reservoir yield • Water conservation and demand management (including metering and price structure) • Conjunction use	• Compensation for flood damages • Regulations to control unsustainable fishery practice • Develop resource management plans at the community level
New Practices	• Construction of houses on stilts • Incorporation of risk assessment and mitigation information into micro-watershed management plans	• Incorporation of crop residues into soil and ridge tillage • Use of short-rotation and heat tolerant rice and maize • Intercropping and crop rotation (to address pests) • Seed priming (e.g. soaking) prior to planting • Planting of agroforestry species	• Rainwater harvesting	• Shift to flood-tolerant crops and crop varieties • Plant eucalyptus and para rubber trees • Develop aquaculture industry • Increase livestock rearing in upper lands

Table 12: Selected Climate Change Adaptation *Best Practices* in the Philippines (DENR, 2012)

Adaptation measures / strategies

Agriculture: *Adjust planting dates and crop variety; crop relocation; improved land management, e.g. erosion control and soil protection through tree planting.*

Water: *Expand rainwater harvesting; water storage and conservation techniques; water re-use; desalination; improve water use and irrigation efficiency.*

Human health: *Prepare health action plans; emergency medical services; improve climate-sensitive disease surveillance and control; provide for safe water and improved sanitation.*

Infrastructure / Settlement; *Relocate settlements from high hazard areas; construct seawalls and storm surge barriers; acquire land and create marshlands / wetlands as a buffer against sea level rise and flooding; protection of existing natural barriers (eg. mangroves, reefs, sand dunes).*

For the elderly and PWDs in particular, there are some structural considerations that have to be addressed to make evacuation centers accessible and adaptable to them. e.g., height, design. It is suggested that ramps and clear signage will be put in place. There is also a need to provide cane, wheel chairs and other facilities to support the mobility of the elderly and PWDs.

Gender concerns were likewise emphasized. Specifically, evacuation centers need to have enough space to avoid congestion otherwise privacy will be compromised. It was suggested that mechanisms to protect the privacy of every evacuee particularly women, are to be developed (e.g., establishment of comfort rooms labelled *Male* and *Female*). Evacuation centers should address health and sanitation as a necessity especially for the elderly and children because of their propensity to get sick.

3.3 Institutional / LGU Adaptation Initiatives and Identified Gaps

The role of local officials in climate change adaptation was highlighted in the 2010 Disaster Risk Reduction and Management Act (DRRM). This Act specifies how preparing for the possible effects of climate change should be primarily a local-level effort. The DENR provides further guidance on institutional best practices, a selected summary of which are presented in **Table 13**.

Table 13: Selected Climate Change Institutional *Best Practices* in the Philippines (DENR, 2012)

Institutional actions

Strengthen environmental awareness and action by initiating innovative and creative information and education campaigns.

Encourage cooperation and partnerships among other institutions in programs and activities that would help fight global warming and reduce climate change.

Review current policies and programs of institutions that may work as either mitigation or adaptation strategies and measures in addressing climate change.

Based on key informant interviews conducted during the VA study, a summary of local initiatives to address climate change adaptation is provided in **Table 14**. These include policies, plans, projects and activities.

Both provinces have formulated their Provincial Environmental Code (PEC), where climate change adaptation is integrated. The PEC of Compostela Valley was approved for implementation in 2012 while the PEC of Davao Oriental was approved by the Provincial Council but has not yet published (which is a requirement before its implementation). However, except for municipality of Monkayo, the rest of the municipalities reportedly have poor implementation of the initiatives listed in Table 14.

Table 14: Summary of Existing LGU Initiatives for Climate Change Adaptation

Existing Initiatives	Description
Policies	• Provincial Environmental Code • Ordinance on solid waste management • Ordinance on "no open burning" • Ordinance on organic agriculture • Implementation of Fisheries Act (national)
Plans	• Mainstreaming disaster risk reduction and climate change adaptation (CCA) in the Provincial Development and Physical Framework Plan • CCA is integrated in ancestral domain plan • Disaster risk reduction plan • CCA is integrated in the Comprehensive Land Use Plan • Shelter Plan with consideration of climate change implications and vulnerabilities • Ecological Waste Management Plan • Water Management Plan
Projects/Programs	• Integrated Coastal Resource Management Project • Provincial/Municipal/Barangay Greening Program • Environmental Management Protection • Upland Development Program • Watershed management projects • Organic agriculture

Activities	• Infrastructure
	  o Improvement of drainage system
	  o Elevation of roads and bridges
	  o Construction/rehabilitation of dumping sites
	  o Construction/rehabilitation of sea wall and river protection
	  o Construction of flood controls
	  o Upgrading of irrigation and farm to market roads
	  o Provision of material recovery facility
	• Education
	  o Fora/seminars on climate change
	  o Basic education on forest management
	• Environment
	  o Tree planting/reforestation
	  o Garbage segregation
	  o Mangrove reforestation/plantation
	  o Creek rehabilitation
	  o Reproduction of seedlings (including fruit trees)
	  o De-siltation of rivers
	• Agriculture
	  o Campaigns/training on organic agriculture
	  o Campaigns for production of high value crops e.g., rubber, abaca, and cash crops
	  o Seed subsidy

The projects or programs related to climate change adaptation are mostly initiated by national government agencies e.g., Department of Environment and Natural Resources (DENR), Department of Agriculture (DA), supported by the representative provincial and municipal LGU.

While there are a number of activities being under taken by LGUs in response to climate change, most of the informants revealed that these still have to be strengthened. There is a need for generating more resources in order to widen the scope of, and sustain these activities.

Capacity building assistance received by LGUs: LGUs received capacity building assistance related to climate change adaptation, through participation in seminars or training activities, and fora. They are also recipients of specific projects e.g., reforestation, flood control, that may contribute to climate change mitigation and adaptation.

Seminars / Trainings and Fora: Some LGU officials / personnel have participated in training activities /seminars that sparingly discussed climate change issues. The following seminars related to climate change also involved some LGU personnel:

- Preparation for the mainstreaming of climate change on Provincial Development and Physical Framework Plan among Provincial Environment and Natural Resources Office (PENRO), Provincial Health Office (PHO), Provincial Agriculturist Office (PAGRO), Provincial Planning and Development Office (PPDO), etc. by the National Economic Development Authority (NEDA);
- Crop rotation and introduction of new species by the Department of Agriculture (DA);
- Disaster preparedness and climate change adaptation by the Natural Disaster Risk Reduction Council (NDRRC), Office of Civil Defense (OCD), Department of Social Welfare and Development (DSWD), NEDA/CEDA (Community Economic Development Authority), Local Government Support Program (LGSP);
- Land use planning by the Housing and Land Use Regulatory Board (HLURB);
- Forest management by DENR;
- Geotapping by the Mines and Geosciences Bureau (MGB); and
- Coastal resource / water management by DENR

In most of the municipalities, these fora on climate change were conducted by PAGASA and NDRRC, and involved different sectors e.g., barangay officials, women, students, and the private sector.

Projects: Presently, there are few projects related to climate change adaptation that have been received by LGUs from government agencies and other institutions, including:

- Generating a geo-hazard map where “no build zones” are identified by MGB;
- Reforestation and rubber plantation by DENR and rubber processing plant through Davao Integrated Development Program by the European Commission;
- Irrigation projects by National Irrigation Administration (NIA);
- Roads (including farm to market roads) and bridges by DPWH, Department of Interior and Local Government (DILG), Mindanao Rural Development Program (MRDP); and
- Flood controls by DPWH, MRDP.

Gaps to be Addressed to Improve Adaptive Capacity: Identified gaps that need to be addressed in order to improve adaptive capacity are categorized in the areas of governance, education, infrastructure, and agriculture and environment.

Governance: A major issue of governance identified through key informant interviews was poor implementation of policies and plans e.g., solid waste management, which is often attributed to lack of political will. Reported gaps in governance related to climate change included:

- Partisan politics resulting to conflict between legislative and executive branches of LGUs which affect poor implementation of policies, plans, and/or projects;
- Lack of political will in the implementation of policies;
- Lack of concrete legislation on climate change adaptation particularly at the municipal level;
- No budget allocation specific for climate change-related activities/projects;
- Lack of sufficient coordination between national and local agencies e.g., DENR and LGUs;
- Lack of sufficient capacity building activities among LGU officials e.g., mainstreaming their awareness on climate change issues;
- Low participation/cooperation of municipal LGUs e.g., providing data for consolidation at the provincial level;
- Need for data base to document pattern/frequency of events;
- Lack of mechanisms for resource mobilization e.g., in order to establish linkage with international communities; and
- Difficulty in securing areas for relocation because of land ownership issues.

Education: The need for additional education campaigns on climate change issues was identified during the key informant interviews as a gap in all the study areas. Specific gaps that should be addressed if climate change adaptation and mitigation measures are to be learned and adopted by the people, especially those at the grassroots are:

- Low level of awareness on climate change adaptation;
- Lack of intensified information dissemination;
- Lack of training on new structural or engineering designs that are adaptive to climate change; need to acquire and apply geo-referenced survey instruments such as GPS; and
- Lack of agricultural technologies that mitigate the impact of climate change.

Agriculture and Environment: While there are reforestation efforts in the study areas, the key informants noted the need to intensify such activities. They also mentioned the following gaps in the area of agriculture and environment:

- Need for diversification of crops, particularly in Davao Oriental;
- Lack of inputs for rubber and coconut production e.g., planting materials;
- Lack of alternative livelihood sources e.g., livestock raising;

- Limited source of water for irrigation especially for vegetable growing areas;
- Lack of facilities suited for organic farming e.g., combined harvester; and
- Siltation of rivers.

Infrastructure: Development of infrastructure facilities is considered one of the ways to mitigate climate change impacts. The key informants mentioned the following as the infrastructure constraints to be addressed to help them cope with climate change:

- Lack of agricultural infrastructure;
- Lack of dikes, landslide protection, and sea walls;
- Lack of basic infrastructure facilities e.g., water, power, communication;
- Need to review building standards; and
- Lack of budget for basic infrastructure facilities e.g., bridges, roads.

3.4 Recommended Follow-On Activities

3.4.1 Immediate Follow-On Activities which Could Be Implemented Under the GEM Program

The following potential follow-on activities were identified over the course of the VA study. These are listed in a prioritized order and all proposed Special Activity Fund (SAF) applications / deliverables would be contracted to be completed by September 2013 when the GEM Program contract is currently scheduled to end. Recommended service providers for each potential SAF are listed in italics.

- Conduct two provincial-level (ComVal; Davao Oriental) conferences to present and validate the results and recommendations of the rapid VA study and support technology sharing with government agencies, regional / provincial disaster management councils, LGUs and NGOs. Based on the conferences and results of written surveys, local capacities and capacity building needs related to climate change vulnerability will be assessed. Identified key local issues and concerns will be addressed through open fora and break-out, technical working sessions with the output goal of developing or strengthening local capacity building appreciation, plans and approaches.

  The needs to be assessed will be guided by the UN Framework of Risk, which links vulnerabilities, exposure and capacities, building on similar assessments conducted in Region XI by TropICS. An integrated approach will be applied in assessing needs, ranging from disaster risk reduction, watershed management, resilient planning and response measures and engineering (*with Nikki Meru / GEM staff; Eva Mendoza, Central Mindanao University / GEM VA consultant; Tropical Institute of Climate Studies (TropICS) / Ateneo de Davao; Manila Observatory*).

  These conferences will serve to coordinate and facilitate the proposed follow-on activities in the two target provinces and involve a two-day, live-in consultation per province. This will involve an average of four municipal LGUs per province, 10 participants per LGU plus provincial LGU, to include key LGU planning / operational staff, national government representatives (MGB; Provincial disaster management council), NGOs / CSOs, indigenous people / vulnerable people representatives and media.

The design and conduct of these two conferences will be closely coordinated with the Climate Change Commission, which with funding support from the UNDP and AusAID has just entered into a MOU with both study provinces to conduct climate change vulnerability assessments. These on-going assessments are general in nature, broad in scope and limited to use of existing / pre-Typhoon Pablo NAMRIA 1:50,000 maps. The assessment of Davao Oriental was recently completed and will be reflected on during the conferences.

- Support the review / updating of eight LGU disaster management plans, to be initiated during the two provincial-level consultations. These reviews / updating activities and inputs will focus on long-term adaptation needs, building on the results and projections developed during the VA study. Technical assistance and "learn by doing" capacity building will be provided as required by these LGUs to complete the updating of plans to national standards, such as set by the DILG *(with UP-NIGS / Project Noah and TropICS)*.

  During the provincial consultations, each province and municipal LGU will be asked to present the status of their disaster management plans, focusing on climate change related issues. Our panel of experts (UP-NIGS, TropICS) will provide feedback and advice on any needed improvements. Breakout working meetings will then be held with each LGU to address specific issues. Follow-up reviews and written advice will subsequently be provided by our panel of experts on improving these LGU plans to enhance their operational applications.

- Assess watershed planning and management capacities and needs for *Mobilizing for Watershed Management* in two selected, populated watersheds (one watershed in each province) and develop action plans during the two provincial consultations followed by working meetings in two LGUs with the selected pilot watersheds *(Philippine Watershed Management Coalition / Jessica Salas).*

  The assessment will focus on how well watershed management is currently integrated into the broader LGU development plan and on opportunities where alliances can be created to strengthen watershed management integration into local development plans, local ordinances and annual investment plans.

  Action plans for improved watershed management will be prepared for the two selected LGU watersheds and will address:

  1. Implementing public education for watershed;
  2. Integrating watershed in the LGU development plan;
  3. Initiating community action; and
  4. Linking the watershed to a river basin or a cluster of watersheds.

- Develop a pilot communications program, such as bi-lingual "tarpaulins" of new hazard and watershed boundary maps and "operational manuals" on adaptation best practices. *(Nikki Meru / Eva Mendoza / Mines and Geosciences Bureau).*

  1. *Layout and production of existing 1:10,000 scale hazard susceptibility maps.* Existing area-specific maps generated by MBG and/or UP-NIGS will be printed on tarpaulin sheets and distributed to LGUs in municipalities that were most severely affected by Typhoon Pablo. This Education Information Communication (EIC) activity is a two-pronged approach to capacity

building. Primarily, the maps will provide LGUs with access to vital hazard susceptibility information that they can utilize in planning. These materials will also serve as benchmarks for the LGUs' future grassroots communication initiatives for their constituents.

2. *Installation of bi-lingual warning signage.* Rendered in both English and Visayan, these signage materials will be installed in identified critical areas which are heavily populated or frequented by local residents. This will help educate locals of the potential hazards in the area, and thereby encourage increased resilience to the impacts of climate change, cooperation with local authorities, and vigilance in monitoring weather conditions.
3. *Development and implementation of training activities in each of the 8 LGUs on reading and appreciating hazard maps and on disaster preparedness.* These training activities will apply current best practices developed and endorsed by key institutions, such as PAGASA, DENR, MGB, DOST's Project NOAH, and Manila Observatory.

Concept proposals for immediate follow on activities are attached as **Annex G**.

3.4.2 Medium- to- Long-Term Activities

The following medium-to-long-term activities were identified during the VA study through key 39 informant interviews:

Governance:

- Provide concrete legislation / implementation of climate change adaptation (CCA) policies;
- Improve / implement plans integrating CCA, e.g., disaster management plans;
- Establish a focal person in every agency to be responsible for formulating, implementing, and monitoring CCA policies, plans, and activities; and
- Encourage CCA budget allocations by including Local Finance Committees in CCA seminars.

Information and Communication:

- Raise consciousness through seminars, for a and IEC materials on CCA for all levels, with special focus on grassroots communication; and
- Intensify the inclusion of climate change issues in school curriculum.

Livelihood and Infrastructure:

- Develop water sources for vegetable production areas, and provide farm machinery to better utilize coconut land e.g., conversion to corn land;
- Develop climate adaptive, diversified livelihoods e.g., livestock raising;
- Provide training on climate adaptive infrastructure development and maintenance, especially for LGU and DPWH engineers;
- Provide training on agricultural technologies that are adapted to climate change impacts, particularly for DA personnel and farmers;
- Develop infrastructure for adaptive agriculture e.g., establish and improve farm-to-market roads, dams/water impounding and other irrigation sources; and
- Construct needed / resilient bridges and rechannel rivers that changed their courses as a result of Typhoon Pablo.

Criteria for Evacuation Centers Recommended by the Key Informants:

- Secure MGB approval and ensure that evacuation centers are built in "safe zones" while addressing geophysical and other considerations;
- Ensure accessibility, e.g., establishment of road systems;
- Provide essential facilities, e.g., establishment of water systems, lighting;
- Ensure climate resilience of evacuation centers;
- Establish permanent evacuation centers to avoid compromising functions of other government / school buildings; and
- Provide safe, structural considerations to accommodate most vulnerable groups; address gender sensitivities, health and sanitation, essential psychosocial activities for evacuees.

ANNEXES

Annex A

January 2013 Summary Assessment
Key Findings

Emergency Food Security, Nutrition and Livelihoods Assessment for Typhoon Bopha (Pablo), Philippines

January 2013

Key Findings

Typhoon Bopha (local name Pablo) made landfall early morning on 4 December 2012, in Davao Oriental (Mindanao) and traversed Mindanao, Visayas and Palawan leaving severe damages and destruction behind. This Typhoon contained twice the rainfall and three times the wind strength of the Tropical Storm Washi which hit northern Mindanao in December 2011. Typhoon Bopha severely affected several regions along its course and in seven regions 6.2 million persons (over 1.2 million families) were reported to have been affected.

The Philippines Department of Agriculture (DA) estimated cost of damage caused by Typhoon Bopha at more than Php30 billion (USD 750 million). According to the DA, the banana industry incurred the highest loss, amounting to around Php20 billion (USD 500 million). Damage to coconut farms amounted to Php7.22 billion (USD 193 million), while rice and maize farms incurred damage costs reaching Php197 million (USD 5 million) and Php362 million (USD 9 million), respectively. Farms growing high value crops like coffee, cacao, vegetables, rubber and fruit trees had a total damage valued at Php2 million (USD 50 thousand). Abaca plantations incurred Php233,000 (USD 6,000) worth of damage, while livestock and poultry raisers incurred Php327, 000 (USD 8,000.) Damage to fisheries infrastructure was estimated at Php53 million (USD 1.3 million), and irrigation facilities at Php829 million (USD 21 million).

Worst affected was the eastern part of the island where the typhoon made its landfall, particularly the provinces of Davao Oriental, Compostela Valley, Surigao del Sur and Agusan del Sur. The government reported that a total of 14,176 hectares (ha) of banana plantations, mostly located in Compostela Valley Province, were destroyed in the typhoon. The majority of losses were incurred by small growers (9,020 hectares). The Philippine Coconut Authority-Region XI (PCA-XI) estimates that Bopha affected at least 101,000 ha of coconut farms in the region. Coconut farmers in Compostela Valley and Davao Oriental suffered the most severe damage, losing 33 percent and 52 percent, respectively, of their total coconut areas.

Pre-typhoon livelihoods in Eastern Mindanao were characterized by subsistence agriculture and small livestock and poultry-raising, augmented with income from various labour opportunities, both salaried and unsalaried, and skilled and unskilled. The area enjoyed a mixed food economy, with most households growing some of their food and purchasing the rest with income earned from both farm and off-farm activities. Staple food supplies in the market were generally sufficient, and markets prices stable.

Typhoon Bopha turned this picture upside down overnight, destroying houses and infrastructure, devastating agricultural and horticultural assets, seriously eroding the commercial agriculture industry for which the area is known, and thereby seriously reducing other income streams for some time to come.

One month after the typhoon, a survey was conducted jointly by the Department of Social Welfare and Development, National Nutrition Council, Department of Labor and Employment, World Food Programme (WFP), UNICEF, FAO, UNDP, ILO, World Vision International and Action Against Hunger (ACF International) to better understand the impact of the typhoon on household food security, nutrition and livelihoods. The survey covered a total of 865 households in the 4 worst affected provinces. The affected communities were divided into 6 strata – worst hit municipalities in Davao Oriental (Boston-Cateel-Baganga) and Compostela Valley (New Bataan-Compostela-Montevista), rest of these two provinces, Surigao del Sur and Agusan del Sur. Additionally, 172 traders and 125 community questionnaires were also canvassed to elicit market and community level information through key informant interviews.

Key Findings

Demography

More than half of the respondents in this survey are females (54%). One-fifth surveyed households are headed by females. Educational attainment of the head of the household was lowest in Agusan Del Sur (47%) compared to rest of the survey areas (77%). Around 28 percent households belong to Indigenous People (67% in Boston-Cateel-Baganga). The average household size is 5. Around 30 percent households have children aged 0-59 months – 53 percent boys and 47 percent girls.

Housing and Amenities

Around three-fourth respondents own their houses, with those in Rest Of Compostela Valley (86%), Agusan Del Sur (88%) and Surigao Del Sur (86%) were higher, while in Boston-Cateel-Baganga only 42 reportedly owning their own houses. At the time of the survey, 45 percent households in Boston-Cateel-Baganga lived in Temporary Shelters. Nearly two-third of the respondents in Boston-Cateel-Baganga cited living conditions from poor to very poor, compared to 45 percent in New Bataan-Montevista-Compostela. Overall, 77 percent reported some damages to their housing. The greatest depth of damage was reported in Boston-Cateel-Baganga (65% reporting complete destruction), followed by New Bataan-Montevista-Compostela (37%). New Bataan-Compostela-Montevista reported maximum usage of unsafe water sources (38%), followed by Boston-Cateel-Baganga (35%). Across all strata, 76 percent respondents reported access to a toilet, either owned or shared. Only 4 percent, on average, reported no access to a toilet. Conditions were worst in Boston-Cateel-Baganga, where 13 percent reported no access to toilet.

Access to Education and Healthcare

A large majority of respondents (80%) reported sufficient access to education (i.e. average, good or very good access). Of those citing bad or very bad access, Boston-Cateel-Baganga stood out (53%) from the rest. Nearly 40 percent respondents reported changes in children's behavior since the typhoon (62% in Boston-Cateel-Baganga). These parents reported more frequent crying and screaming, sadness and depression, nightmares and inability to sleep, fear of going out or being separated from parents etc.

Overall, 80 percent respondents rated their access to health care as sufficient, although respondents in Boston-Cateel-Baganga and Agusan Del Sur rated their access to health care much lower compared to other areas.

Livelihood

Before typhoon, agriculture, including livestock and poultry-raising, was the most important livelihood, along with skilled and unskilled labour. More respondents reported skilled and unskilled salaried employment in Surigao Del Sur, Agusan Del Sur and Compostela Valley. Fishing was predominant livelihood activity only in Surigao Del Sur and Davao Oriental, and transportation work was a principal activity only in Davao Oriental.

Due to the impact of Typhoon Bopha, agriculture as the primary source of livelihood declined by 23 percent followed by poultry and livestock declined (18%) and fishing (26%). Boston-Cateel-Baganga saw a 45 percent drop in the number of households reporting agriculture as a principle livelihood activity after the typhoon. Nearly 12 percent respondents are rendered completely jobless as a result of typhoon – majority from the agriculture (farming and livestock based) and fishing sectors. Increase in the reliance of households across the strata on a host of 'other' formerly minor livelihoods activities is reported everywhere. Shift in livelihood as a result of the disaster is more pronounced in Boston-Cateel-Baganga and New Bataan-Montevista-Compostela. More people are currently engaged in daily paid labour, offered by the government and other agencies as a part of humanitarian response. Between 40-66 percent rated their access to work and income generating activities as 'bad' or 'very bad', signifying a drop in local economic opportunities.

Nearly two-third of the households own their farm land, while 15 percent are tenant farmers, 11 percent are leased/borrowed/rented free of charge and 6 percent households got their land through award of certificate of land ownership (more Agrarian Reform Beneficiaries in Boston-Cateel-Baganga – 13%). In terms of land holding, around 47percent hold less than 2 ha and 37 percent 2-5 ha, signifying that majority are small farmers. As high as 80 percent reported that their maize/corn production was affected. This is followed by impact on coconut (73%), Banana plantation (72%), rice (72%) and cassava (61%) growing. Apart from losses on farmland, crops and plants, households also reported damages on livestock (57%), poultry (59%), farm machineries (47%), irrigation facilities (45%), post-harvest facilities (42%) and fishing boats (70%), which clearly demonstrate the extent of damages to agricultural sector as a whole.

Food Consumption

A composite Food Consumption Score (FCS) was computed by combining food frequency and dietary diversity of the households. Based on FCS analysis and grouping of households in 'poor', 'borderline' and 'acceptable' food consumption groups, nearly 38 percent households have low food consumption levels. Broken out by strata, the greatest proportions of low food consumption reported in New Bataan-Montevista-Compostela (48%), Agusan Del Sur (43%) and Surigao Del Sur (43%). Furthermore, New-Bataan-Montevista-Compostela had a significantly greater depth (severity) of lower level of food consumption, with two-third of its households scoring in the lowest possible category ('poor').

Those households who perceived their access to income to be 'very good' had the highest food consumptions scores (only 7% low food consumption). Those who perceived their access to income as 'good' have 14 percent in low food consumption. 'Bad' and 'very bad' access to income reported 33 percent and 52 percent low food consumption respectively. Households with more children (3-5) have much lower levels of food consumption than those with fewer children. Based on gender of the head of the household, 57 percent female-headed households have acceptable levels of food consumption compared to 65 percent male-headed households. In Surigao Del Sur, only 25 percent female-headed households reported acceptable levels of consumption as compared to 60 percent male-headed households.

On average, there is perfect relationship between educational level attained by the head of the household and food consumption levels, meaning the higher the level of education the better the level of food consumption. However, this relationship is less pronounced in Boston-Cateel-Baganga and New Bataan-Compostela-Montevista. In terms of livelihoods, those relying on charcoal making / forestry (61%) and daily / common labour (48%) have lower food consumption levels, followed closely by livestock and poultry raising (43%) and unskilled salaried employment (40%). Somewhat better, but still nearly one-third or more households with low food consumption are reported in 'other' (37%), agriculture (37%), and construction / skilled labour livelihood groups.

Households in New Bataan-Montevista-Compostela and Boston-Cateel-Baganga are heavily reliant on relief food assistance for two thirds of their consumption. Market purchase is their second most important source for food. This is in stark contrast to all other affected areas, where two thirds or more of food consumption comes from non-relief sources.

Coping Strategies

Typhoon-affected households are applying a variety of coping mechanisms to address the sudden loss of agricultural production, jobs and income. The most frequently applied coping responses are reliance upon less preferred, less expensive food, reducing expenditures on other living costs, accepting emergency food assistance and food from friends and relatives, borrowing money and spending down savings. In the worst-hit areas, one in five families reported having to reduce the number or portion of meals in order to get by. Unfortunately, many of these strategies are negative and some of them are irreversible, potentially causing indelible damage on a household and individuals.

Household Expenditure

Main expenditures reported by the surveyed households are on house construction material, food, medical care, education, celebrations and social events and clothing. Expenditures on house construction materials are valuated the highest (Php3,027), followed by food. The highest average estimate was observed in Boston-Cateel-Baganga while the lowest was in the rest of Davao Oriental.

Access to Markets

About half of the total respondents (52%) said there is a market in close proximity to their dwellings. Cost of travelling to the market (one-way) in the sample areas is Php26, cheapest (Php16) in New Bataan-Montevista-Compostela, while most expensive (Php55) in Boston-Cateel-Baganga.

Access to Credit

One-third respondents considered their access to credit as average, 23 percent as good. About one-fifth viewed their access to credit as bad, followed by very bad (17%). Boston-Cateel-Baganga households report most proportion of very bad (39%) and bad (28%) access to credit. Almost all respondents said that they borrow money mostly from their relatives and friends. Local lenders and pawnshops, and other local institutions (i.e., sari-sari stores, local traders, and landlords) are also significant sources for borrowing money. Around 45 percent households borrowed money to buy food in the last month preceding the survey.

Health and Nutrition

The impact of an emergency situation on infant, young child and maternal nutrition and health cannot be overstated. Of the 494 children aged 0-59 months in the surveyed households, 66 percent are reported to have developed an illness since the onset of the disaster. The observed incidence of illnesses (i.e. fever, cough, and diarrhea) was highest among children 6-23 months. When viewed across all age groups, more children are reported ill in Boston-Cateel-Baganga.

Results of the assessment showed that almost 66 percent of the children are ever breastfed. At the time of the interview, 33 percent of the children 0-59 months are still receiving breastmilk. A 24-hour recall of the child's food intake shows that about 57 percent are given complementary food at least 3 times per day.

Priorities of the Households

Households in all areas surveyed cited access to food, shelter and income as their most pressing concerns, and also as their highest priorities for immediate intervention. Households prioritized food and shelter at a rate of two to one over the next closest priorities - lack of money and finding work/job. For households in the worst-affected areas, these concerns were higher still. Shelter concerns were highest in Boston-Cateel-Baganga and New Bataan-Compostela-Montevista. Income and livelihood issues occupied the next level of concern, followed by health, water and sanitation and health, and education.

The Way Forward

The restoration of food and nutrition security in this region will depend greatly upon households' abilities to find alternative income generation activities to replace, at least temporarily, the traditional income opportunities lost until traditional banana and coconut production can be restored, or until alternative long-term household livelihood strategies can be consolidated. Some immediate income opportunities will come in the way of the unskilled casual labour required to rehabilitate the damaged commercial agricultural sector. It is important that the Government of the Philippines, commercial investors and contract farmers work together to secure a tri-partite strategy to restore these critical commercial agricultural sectors as quickly as possible.

The significance of banana and coconut production to the food security and livelihoods of the people in the affected areas cannot be understated. While cereal crops (rice, maize) can be replanted almost immediately, and will begin to restore normality to at least one part of the household livelihood picture within as little as 3-4 months, restoring the critical contribution of bananas and coconuts will be measured in years, not months.

The shock to household food security and livelihoods resulting from Typhoon Bopha was widespread and comprehensive, impacting all sectors. Subsistence and commercial activities alike have been brought to a standstill. In the immediate term, the food and nutrition security and livelihood strategy must focus on ensuring adequate food consumption and income support to allow people to get on with the most pressing needs of recovery. Providing agricultural inputs and technical support for the next rice and maize crop are also key objectives, followed by assistance with the restoration of assets associated with household banana and coconut production, fishing and other traditional (or substitute) livelihoods. At every step, a complementary health and nutrition strategy is also required, primarily to address critical nutritional needs of children 6-59 months and pregnant and lactating women. Short term hunger mitigation strategies like targeted general food distribution, vulnerable group feeding, emergency school feeding etc. could be useful measures at least till these households get some semblance of their pre-typhoon socio-economic status by accessing recovery and rehabilitation interventions that are more medium to longer term in nature.

For further queries, please contact **Dipayan.Bhattacharyya@wfp.org**

Annex B

List of References

Annex B
List of References

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Annex C

DVD: VA Study Area Hazard Maps_100 year / Watershed Maps / Draft Rapid Assessment For Typhoon Pablo Recovery Assistance

Annex D

VA Survey List of 39 Key Informants

Annex D
39 Key Informants

Name of Key Informant	Position	Date of Interview	Place of Interview
Dolores Valdesco	Sr. Environment Officer	April 22, 2013 April 24, 2013	Davao City & Mati, Davao Oriental
Padodong Salvaña	Municipal Environment and Natural Resources Officer	April 23, 2013	Cateel, Davao Oriental
Concepcion del Rosario	Senior Citizen representative	April 23, 2013	Cateel, Davao Oriental
Joel Beroy	Chieftain/IP representative	April 23, 2013	Cateel, Davao Oriental
Rose Cantivo	Gender And Development(GAD) Focal Person	April 23, 2013	Cateel, Davao Oriental
Anthony Fernandez	Admin Assistant, MENRO	April 23, 2013	Cateel, Davao Oriental
Consolacion Cabrera	Gender And Development Focal Person	April 23, 2013	Boston, Davao Oriental
Judit Castres	Acting Municipal Environment and Natural Resources Officer	April 23, 2013	Boston, Davao Oriental
Victoria Pagaduan	Municipal Agriculture Officer	April 23, 2013	Boston, Davao Oriental
Nelson Añuevo	Municipal Engineering Officer	April 23, 2013	Boston, Davao Oriental
Norma Castillones	Senior Citizen Officer	April 23, 2013	Boston, Davao Oriental
Dewey Clark	Municipal Planning & Development Officer/Coordinator	April 24, 2013	Baganga, Davao Oriental
Norman Sia	Engineer, Municipal Engineering Office	April 24, 2013	Baganga, Davao Oriental
Evangeline Nazareno	Municipal Administrator GAD Focal Person	April 24, 2013	Baganga, Davao Oriental
Gisica Sayman	OIC-Provincial Engineers Office	April 24, 2013	Mati, Davao Oriental
Kent Dan Albirto	Economic Researcher, Provincial Planning and Development Office	April 24, 2013	Mati, Davao Oriental
Sarah Gudez	Provincial Social Welfare and Development Officer	April 24, 2013	Mati, Davao Oriental
Ester Quiling	Senior Citizen Coordinator	April 24, 2013	Mati, Davao Oriental
Alfredo Aguilar	Municipal Engineer	April 25, 2013	New Bataan, Compostela Valley
Nile Cabunoc	Municipal Administrator	April 25, 2013	New Bataan, Compostela Valley
Edgar Villafuente	Municipal Environment and Natural Resources Officer	April 25, 2013	New Bataan, Compostela Valley
Maricel Lindaan	IP representative	April 25, 2013	New Bataan, Compostela Valley
Agripino Gunida	Municipal Environment and Natural Resources Officer Municipal Planning & Development Officer	April 25, 2013	Compostela, Compostela Valley

Elisa L. Pajar	GAD Focal Person	April 25, 2013	Compostela, Compostela Valley
Teodolfo Celora	Municipal Agriculture Officer	April 25, 2013	Compostela, Compostela Valley
Santiago Cruda Jr.	Municipal Engineering Officer	April 25, 2013	Compostela, Compostela Valley
Emilio Corias	Municipal Planning & Development Officer/Coordinator	April 25, 2013	Montevista, Compostela Valley
Condrado Medillo	Engineer, Municipal Engineering Office	April 25, 2013	Montevista, Compostela Valley
Edgar Sangco	Municipal Environment and Natural Resources Officer & Municipal Agriculture Officer	April 25, 2013	Montevista, Compostela Valley
Denia Nepomuceno	GAD Focal Person	April 25, 2013	Montevista, Compostela Valley
Gerry Balana	Municipal Planning & Development Officer/Coordinator	April 26, 2013	Monkayo, Compostela Valley
Ma. Doloris Dalogdog	Municipal Environment and Natural Resources Officer	April 26, 2013	Monkayo, Compostela Valley
	Municipal Agriculture Officer	April 26, 2013	Monkayo, Compostela Valley
Jay Magpusao	Engineer, Municipal Engineering Office	April 26, 2013	Monkayo, Compostela Valley
Raymundo Pajarito	Assistant Provincial Planning & Development Officer/Coordinator	April 26, 2013	Province of Compostela Valley
Trinidad Briones-Jumol	Provincial Environment and Natural Resources Officer-DENR GAD Focal Person	April 26, 2013	Province of Compostela Valley
ManoloSerafin Cayme	Assistant Provincial Agriculture Officer	April 26, 2013	Province of Compostela Valley
Christopher Marcon	Assistant Provincial Engineer	April 26, 2013	Province of Compostela Valley

Annex E

VA Survey Forms

Annex E
January 2013 Summary Assessment

CLIMATE HAZARDS AND IMPACT	Which of the ff. events has your community experienced in the past 20-30 years?	A. How would you rate the frequency of its occurrence? 3- high 2- medium 1 -low	B. How would you rate the severity of this hazard? 3- high 2- medium 1 -low	C. How would you rate the degree of negative impact in your community? 3- high 2- medium 1 -low	D. How would you rate the difficulty of coping with this hazard for your community? 3- high 2- medium 1 -low	TOTAL vulnerability rating Sum of columns A-D
Changes in rainy seasons leading to changes in cropping season						
Changes in dry seasons leading to changes in cropping season						
Sea level rise						
Coastal/beach erosion						
Salt water intrusion into gardens, wells						
Drought						
Flood						
Storm surge						
Climate-related land or mud slide						
Tropical storm (typhoon)						
Brush fire caused by heat and dryness						
Increased water surface temperature						
Hotter climate						
Cooler climate						
Coral bleaching						
Others (specify)						

Annex E
VA Survey of 39 Key Informants

- **Provincial & Municipal chair, environment/"climate change" committee or other committees with related/corresponding function;**
- **DENR (provincial and municipal);**
- **Financial Management Officer (provincial & municipal);**
- **Planning officer (provincial and municipal);**
- **SB chair/vice mayor (provincial and municipal)**
- **DSWD/DepEd (provincial and municipal)**
- **NCIP (provincial and municipal)**
- **Leaders of POs (e.g. women's organizations, senior citizens' association, IP/tribal group)**
- **DPWH regional office;**

1. What have you observed in or known about changing climate in your municipality/province?Fill up "climate hazard and impact" form (except column D: ask after #4)

2. What are the responses or actions made so far by your LGU (municipality/province)? What can you say about these activities? Ask column D of "climate hazard and impact" form.

3. What specific policies that are enacted about these changing climate? How about on infrastructure? What is the extent of implementation?

4. What specific plans or programs that are implemented to address this changing climate? Who formulated the plans? Who implemented the said programs? How about on infrastructure?What is your assessment of the implementation?

5. Does your LGU (municipality/province) allocate budget for these activities? If so, How much or (as the % relative to the total budget)?

6. What activities (e.g. trainings), projects or any efforts that you received that you think could improve your knowledge about and adaptation to climate change?How about on infrastructure? Who have provided you this assistance? Are these from NGOs/academe? What can you say about these activities/projects?

7. What are the current gaps that need to be addressed to improve adaptive capacity? What are other factors (non-Climate Stressors) that you think could increase risk and hamper effective adaptation to climate change e.g. low level of investments in critical infrastructure, extraction activities contributing to soil erosion, landslide, tenure issues, etc.?

8. What groups are most likely affected to changing climate? What activities, projects or any efforts that ___ (specify vulnerable group) received that you think made them/you more adaptive? How about on infrastructure?Who provided this assistance?

9. What are your recommendations (policies, plans, programs, activities) for your community to be more adaptive to climate change? How about specific for (specify vulnerable group)?How about on infrastructure?

10. What can you say about the proposed infrastructure project (show/describe the infra project) of GEM? What are your suggestions/ recommendations for this project to be more responsive to ___ (specify vulnerable group) that could help them more adaptive to changing climate (design, location, etc.)?

11. What are your suggestions/ recommendations about evacuation centers in terms of design, location, etc.)? How about in relation to __ (specify vulnerable group)?

Annex F

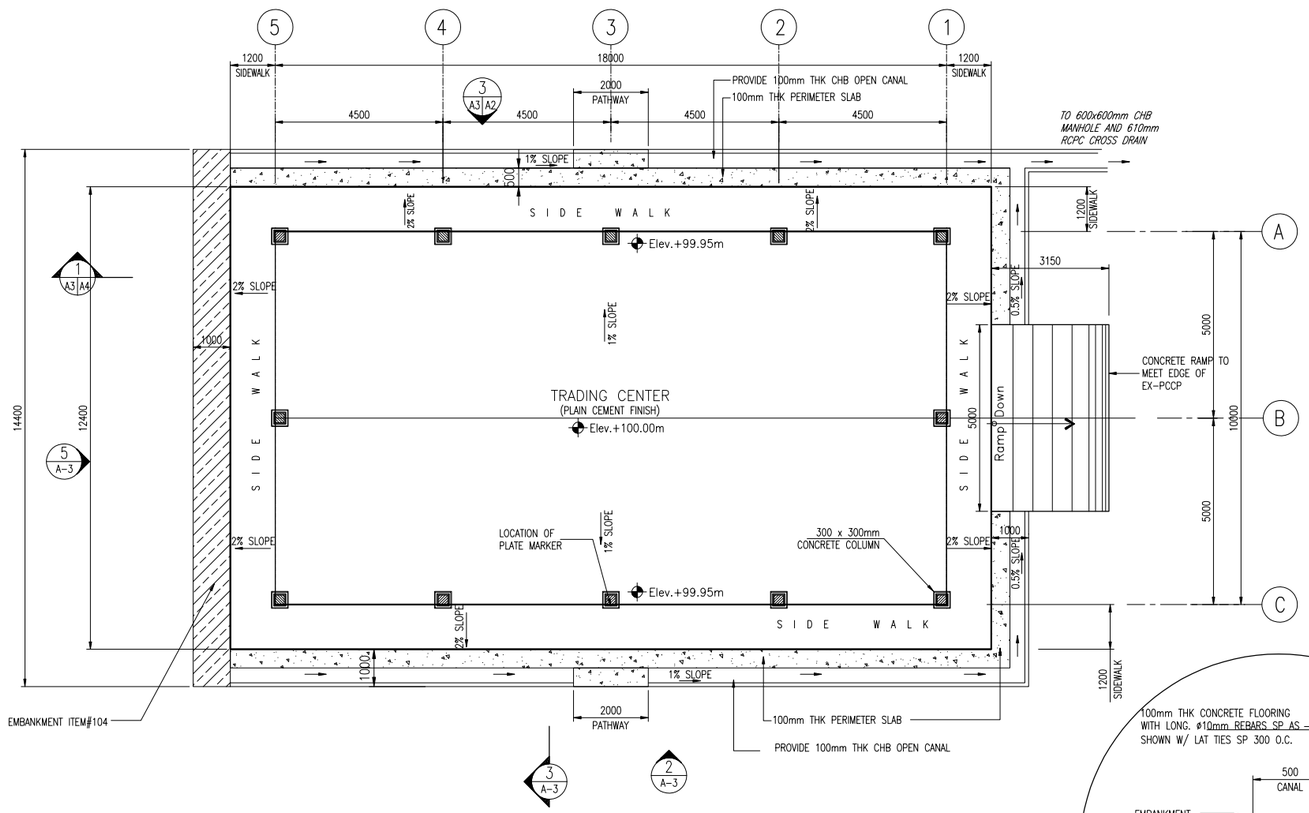
Project Pictures and Design Profiles

Growth with Equity in Mindanao 3 Program

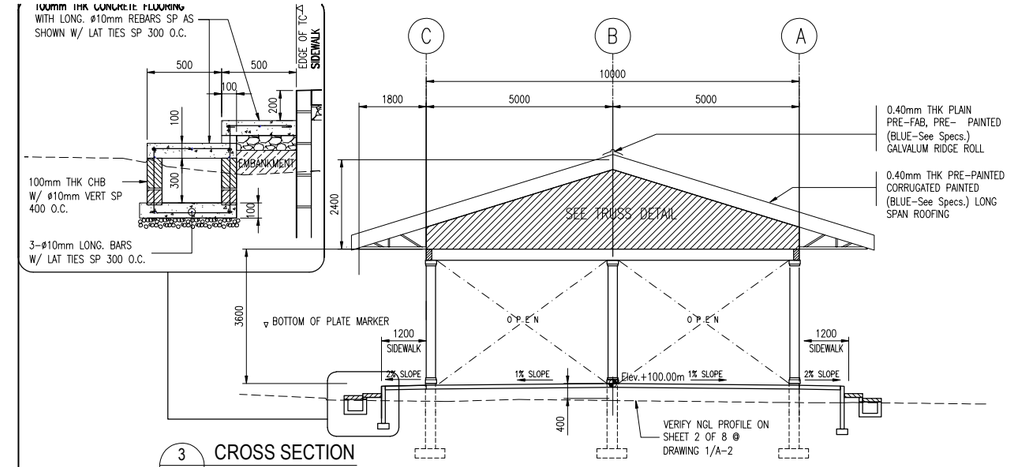
Typhoon Pablo Disaster Response Infrastructure Projects

USAID Concurrence No.	Project and GEM Project Component
1	Poblacion Baganga Market Building Construction
2	Sitio Mahayahay Overflow Bridge Rehabilitation
3	Purok Duranta Overflow Bridge Rehabilitation
4	Sitio Santol Overflow Bridge Rehabilitation
5	Mamunga Bridge Rehabilitation
6	Ngan Overflow Bridge Rehabilitation
7	Poblacion Compostela Trading Center Construction
8	Magangit-Batinao Bridge Rehabilitation
9	Lebanon-San Jose Barangay Bridge Construction
10	San Jose Footbridge Construction
11	Alegria Barangay Bridge Construction
12	Carmen Trading Center Construction
13	Poblacion Compostela Bridge Rehabilitation
14	Aguinaldo Trading Center Construction
15	Panag Barangay Bridge Rehabilitation

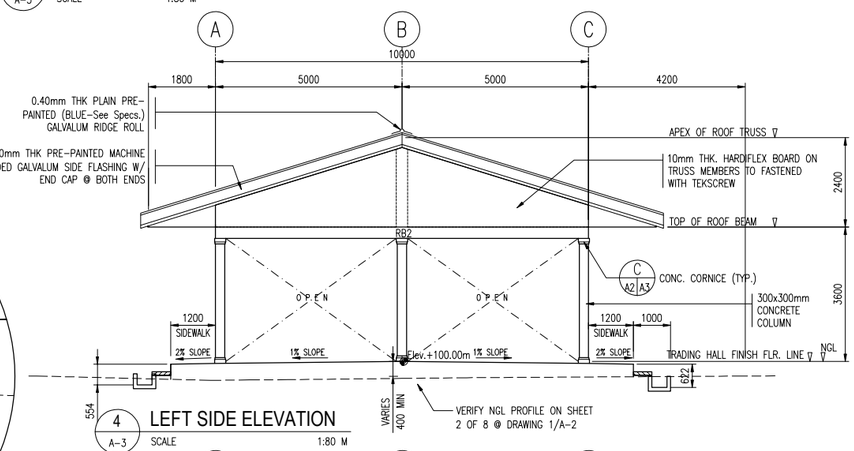
Poblacion Baganga Market Building Construction



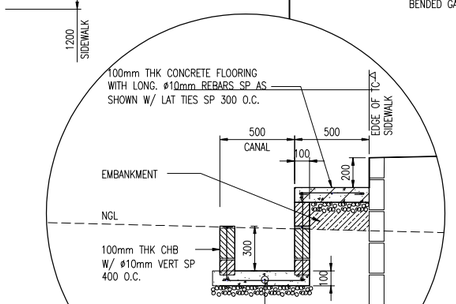
1 A-3 FLOOR PLAN
SCALE 1:80 M



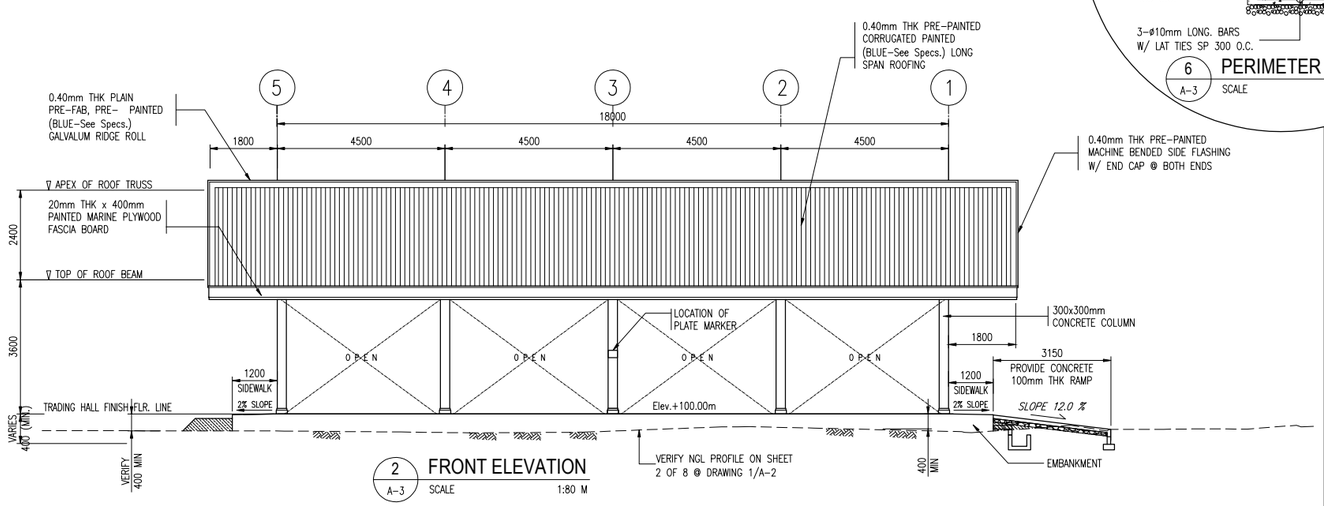
3 A-3 CROSS SECTION
SCALE 1:80 M



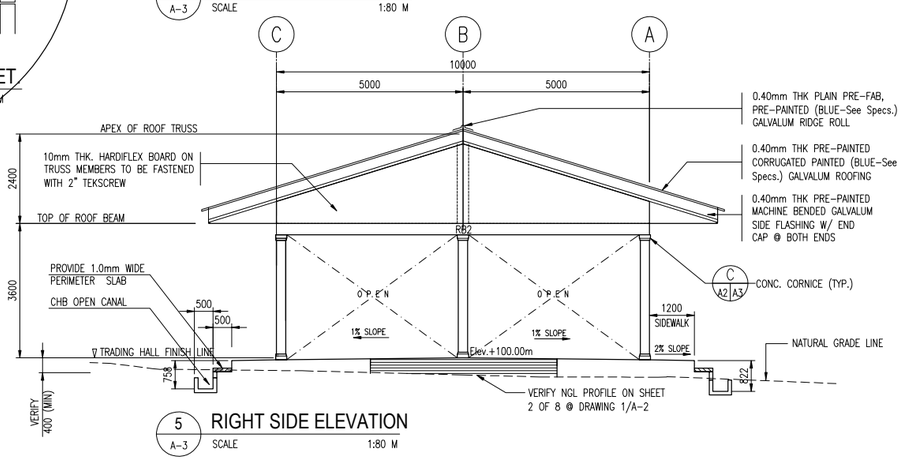
4 A-3 LEFT SIDE ELEVATION
SCALE 1:80 M



6 A-3 PERIMETER CANAL DET.
SCALE 1:20 M



2 A-3 FRONT ELEVATION
SCALE 1:80 M

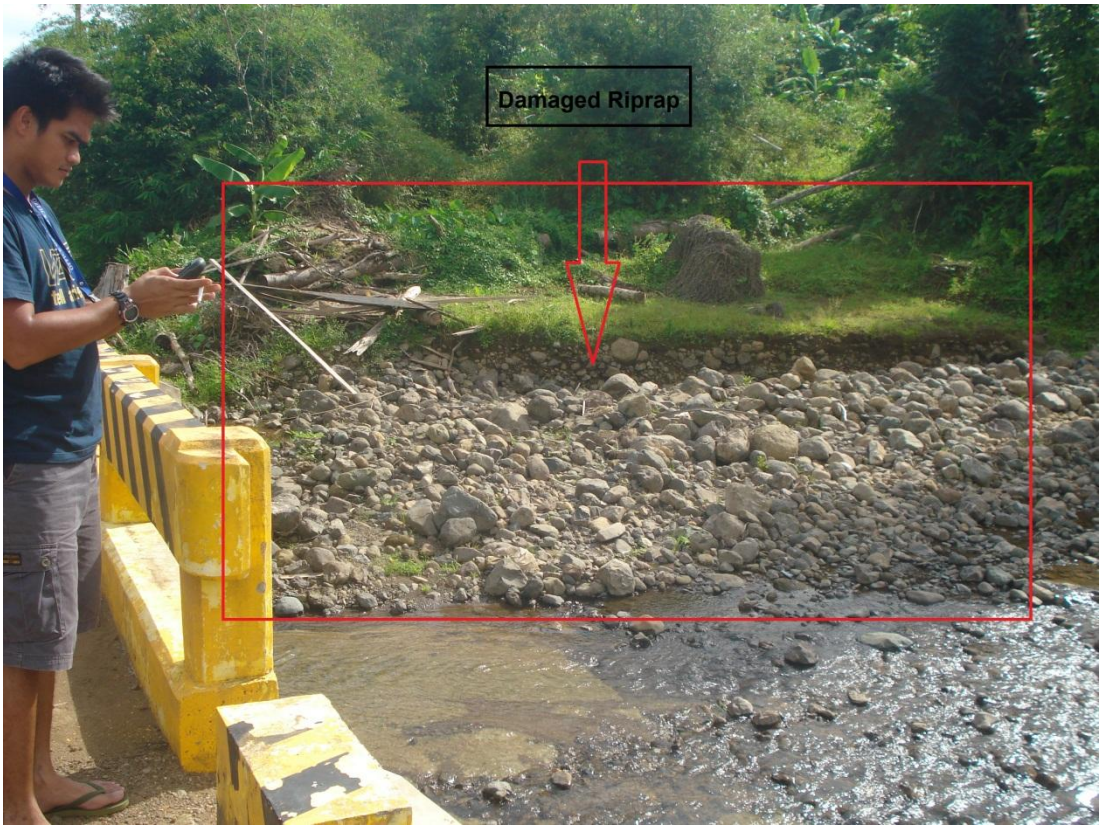


5 A-3 RIGHT SIDE ELEVATION
SCALE 1:80 M

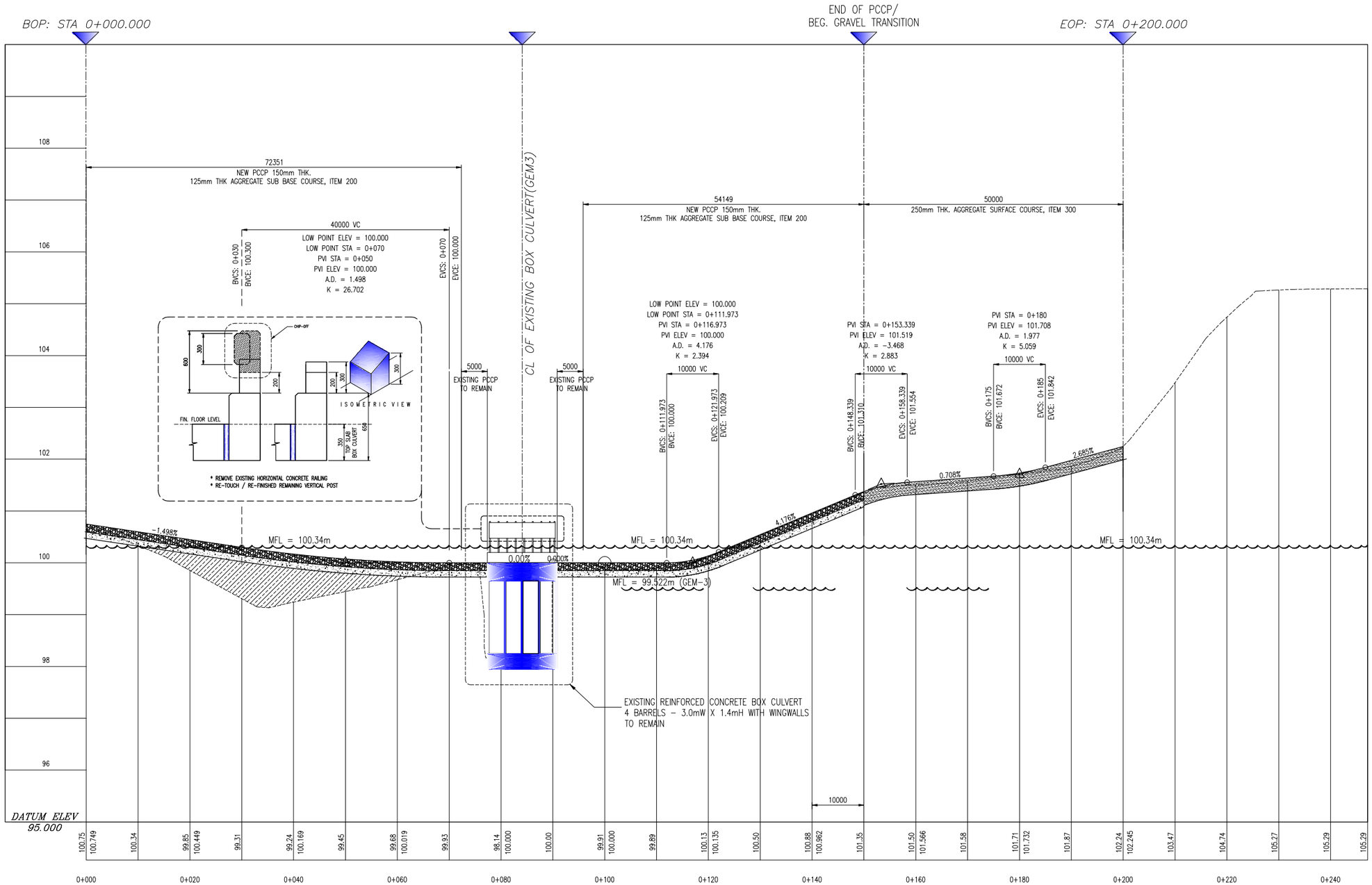
USAID's Growth with Equity in Mindanao Program

2/F Damosa Business Center, Damosa Complex, Anglionglo Ave., Lanang, DC 8000
Tel: (63 82) 234-7720 Fax: (63 82) 234-3060
UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT
USAID Contract No. 492-C-00-08-00001-00

IMPLEMENTING FIRM:	SUBPROJECT NAME:	PRIMARY PROPONENT:	ENGINEER OF RECORD:	RECOMMENDING APPROVAL:	APPROVED BY:	CHECKED BY: DATE: –	REVIEWED BY: DATE: –	NO.	DATE	ISSUE / REVISION	SHEET CONTENTS:	DWG NUM:
THE LOUIS BERGER GROUP, INC. Engineers • Planners • Scientists • Economists Unit 3, 12th Floor, Exportbank Plaza, Gil Puyat cor. Chino Roces Ave., Makati City	POB. BAGANGA MARKET BUILDING CONSTRUCTION	MUNICIPAL GOVERNMENT OF BAGANGA	DINDO S. LEGROLAGA CIVIL ENGINEER DATE: – REG. No. 0082358 Date :07-09-98 PTR No. 8928339A Date :04-13-10	MA. VILMAN. BELCHES ASST. GM MANAGER	CEBENERIO CHARLO A. DISPO JR. INFRA. CONST. TEAM LEADER	DRAWN BY: DATE: – LORINO S. BALDEZAMO	EDITED BY: DATE: – MANNY W.B. AMOR	1 2 3	13-05-18 13-05-22 13-06-01	FOR REVIEW & COMMENTS – 1 FOR BIDDING / PROJECT PACKAGING FINAL ISSUE AND PERMIT	FLOOR PLAN, FRONT ELEVATION, CROSS SECTION, LEFT AND RIGHT SIDE ELEVATIONS	TC A-3
	LOCATION: POBLACION, BAGANGA, DAVAO ORIENTAL	CONFORMED BY: HON. ARTURO MONDAY–Municipal Mayor		DATE: –	DATE: –						SCALE: AS SHOWN	SHEET 3 OF 9



Sitio Mahayahay Overflow Bridge Rehabilitation



A
S-05
ROAD DESIGN PROFILE
SCALE 1: 400 M

PIP-06 SITIO MAHAYAHAY OVERFLOW BRIDGE REHAB

USAID's Growth with Equity in Mindanao Program
2/F Damosa Business Center, Damosa Complex, Anglíongto Ave., Lanang, DC 8000
Tel: (63 82) 234-7720 Fax: (63 82) 234-3060
UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT
USAID Contract No. 492-C-00-08-00001-00

IMPLEMENTING FIRM:
THE LOUIS BERGER GROUP, INC.
Engineers • Planners • Scientists • Economists
Unit 3, 12th Floor, Exportbank Plaza,
Gil Puyat cor. Chino Roces Ave., Makati City

SUBPROJECT NAME:
SITIO MAHAYAHAY BARANGAY BRIDGE REHABILITATION
LOCATION: BRGY.BAYLO, MONKAYO, COMPOSTELA VALLEY

PRIMARY PROPONENT:
PROVINCIAL GOVERNMENT OF COMPOSTELA VALLEY
CONFORMED BY:
HON. ARTURO T. UY - Provincial Governor

ENGINEER OF RECORD:
DINDO C. SUCERO-LAGA
CIVIL ENGINEER
DATE: -
REG. No. 0082358
Date :07-09-98
PTR No. 8928339A
Date :04-13-10

RECOMMENDING APPROVAL:
MA. VILMAN N. BELCHES
ASST. BP MANAGER
DATE: -

APPROVED BY:
CEBENERIO CHARLO A. DISPO JR.
INFRA. CONST. TEAM LEADER
DATE: -

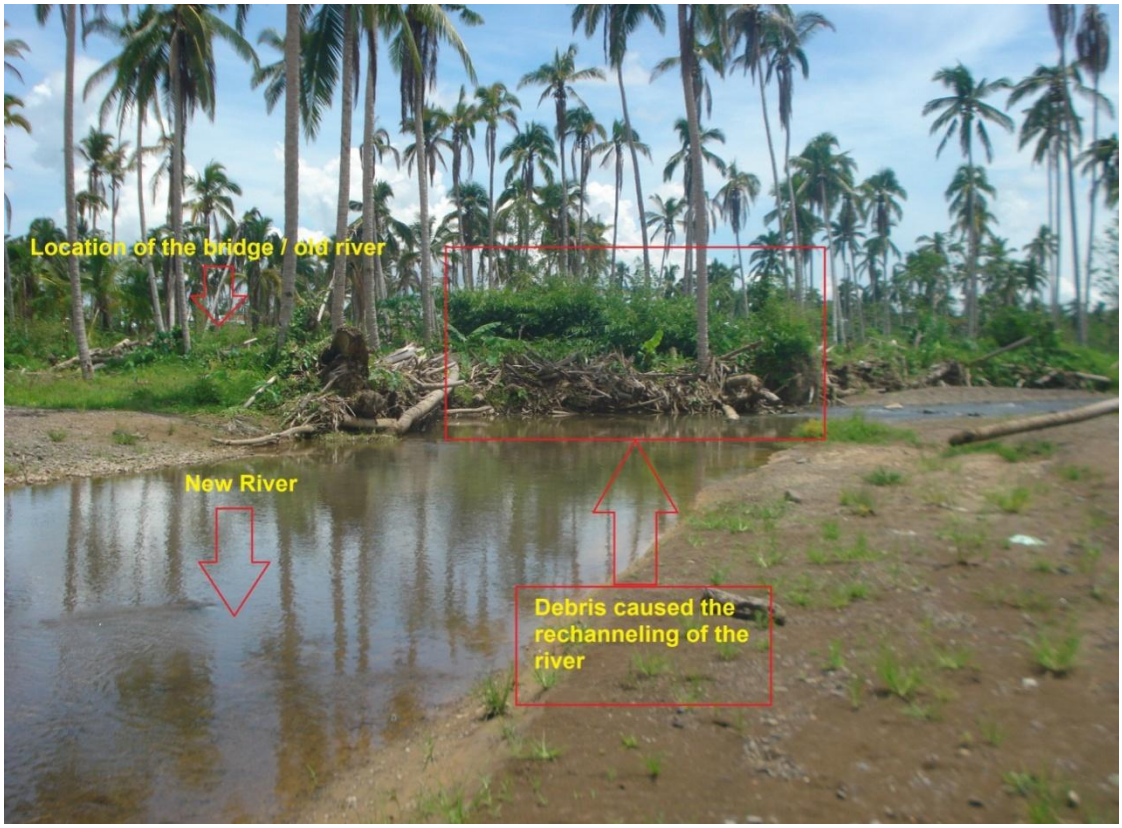
CHECKED BY: DATE: -
DRAWN BY: DATE: 13-05-12
LORINO S. BALDEZAMO

REVIEWED BY: DATE: -
MA. VILMAN N. BELCHES
EDITED BY: DATE: -
MANNY W.B. AMOR

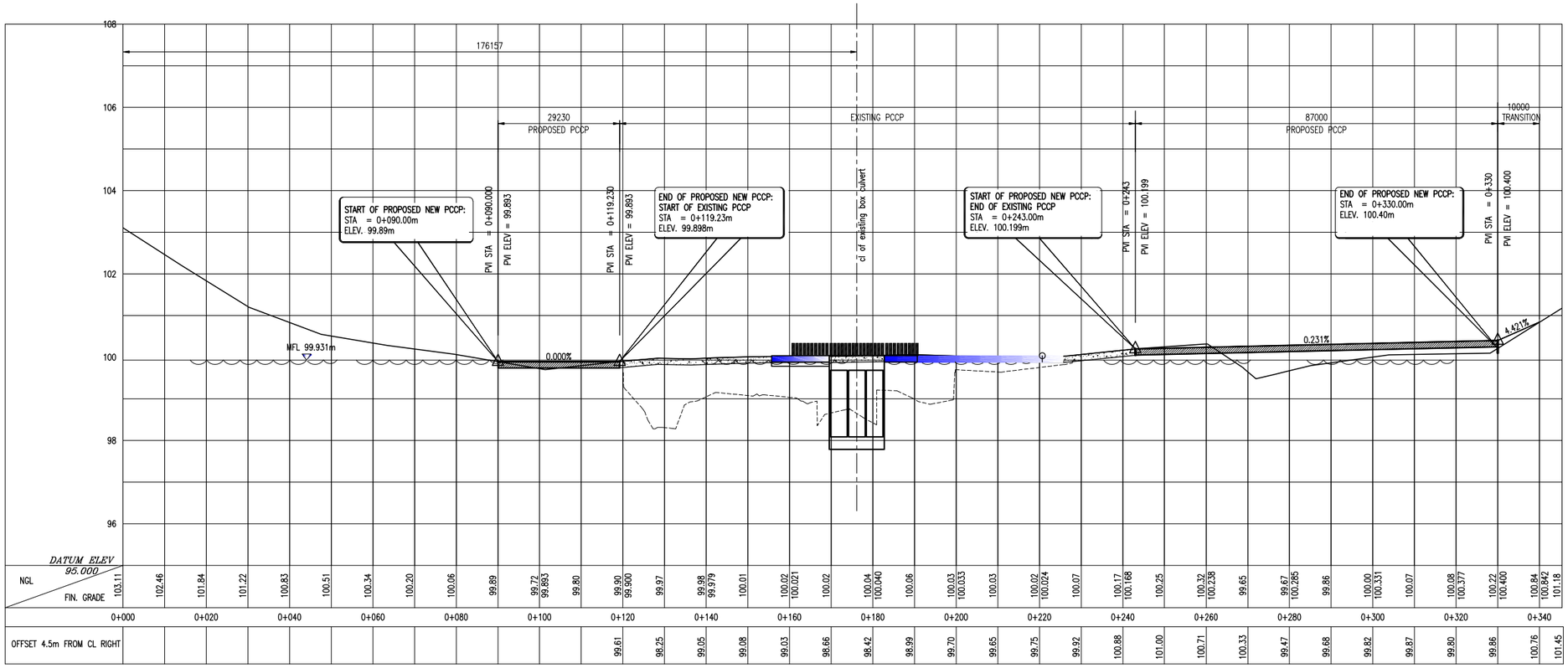
NO.	DATE	ISSUE / REVISION
1	13-05-18	FOR REVIEW & COMMENTS - 1
2	13-05-22	FOR BIDDING / PROJECT PACKAGING
3	13-06-01	FINAL ISSUE AND PERMIT

SHEET CONTENTS:
ROAD DESIGN PROFILE
SCALE: AS SHOWN

DWG NUM:
BB
S-05
SHEET 06 OF 27



Purok Duranta Overflow Bridge Rehabilitaion



NGL / FIN. GRADE	0+000	0+020	0+040	0+060	0+080	0+100	0+120	0+140	0+160	0+180	0+200	0+220	0+240	0+260	0+280	0+300	0+320	0+340
NGL	103.11	102.46	101.84	101.22	100.83	100.51	100.34	100.20	100.06	99.89	99.72	99.90	99.97	99.98	100.01	100.02	100.04	100.06
FIN. GRADE											99.893	99.900		99.979		100.021	100.040	
	100.03	100.03	100.02	100.07	100.17	100.25	100.32	99.65	99.67	99.86	100.00	100.07	100.08	100.22	100.84			
	100.033		100.024		100.168		100.238		100.285		100.331		100.377	100.400	100.842	101.18		
OFFSET 4.5m FROM CL RIGHT							99.61	98.25	99.05	99.08	99.03	98.66	98.42	98.99	99.70	99.65	99.75	99.92
	100.88	101.00	100.71	100.33	99.47	99.68	99.82	99.87	99.80	99.86	100.76	101.45						

A / C-04 CENTERLINE PROFILE

SCALE 1:600M

USAID's Growth with Equity in Mindanao Program

2/F Damosa Business Center, Damosa Complex, Anglongto Ave., Lanang, DC 8000
Tel: (63 82) 234-7720 Fax: (63 82) 234-3060
UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT
USAID Contract No. 492-C-00-08-00001-00

IMPLEMENTING FIRM: THE LOUIS BERGER GROUP, INC.
Engineers • Planners • Scientists • Economists
Unit 3, 12th Floor, Exportbank Plaza, Gil Puyat cor. Chino Roces Ave., Makati City

SUBPROJECT NAME: PUROK DURANTA BARANGAY BRIDGE REPAIR
LOCATION: BRGY. UNION, MONKAYO COMPOSTELA VALLEY

PRIMARY PROPONENT: PROVINCIAL GOVERNMENT OF COMPOSTELA VALLEY
CONFORMED BY: HON. Arturo T. Uy – Provincial Governor

ENGINEER OF RECORD: DINDO S. CEROLAGA, CIVIL ENGINEER
DATE: –
REG. No. 0082358 Date :07-09-98
PTR No. 8928339A Date :04-13-10

RECOMMENDING APPROVAL: MA. VILMA N. BELCHES, ASST. BRP MANAGER
DATE: –

APPROVED BY: CEBENERIO CHARLO A. DISPO JR., INFRA. CONST. TEAM LEADER
DATE: –

CHECKED BY: DATE: –
DRAWN BY: DATE: –
JACQUILINE E. ANG

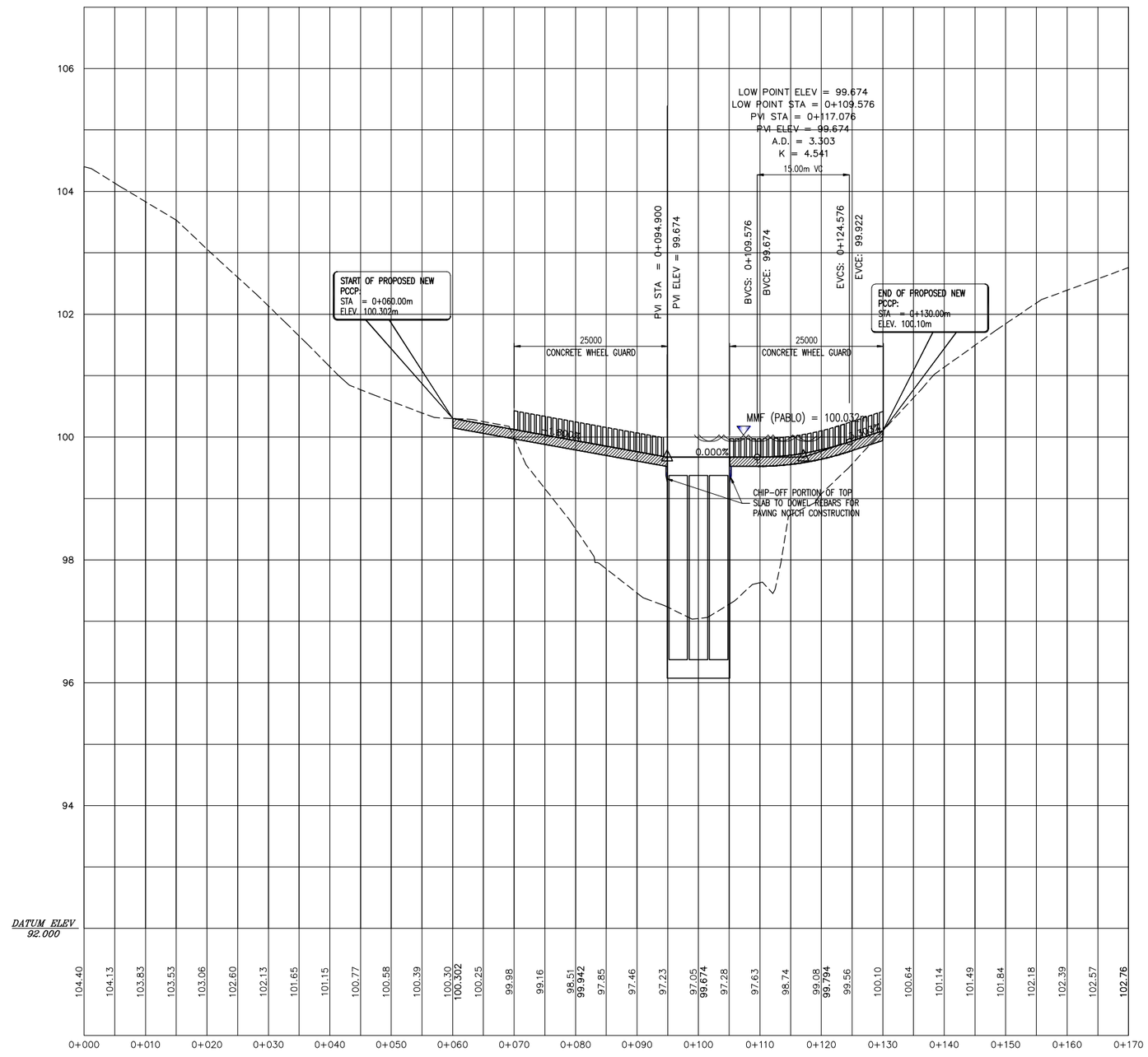
REVIEWED BY: DATE: –
MA. VILMA N. BELCHES
EDITED BY: DATE: –
MARY W.B. AMOR

NO.	DATE	ISSUE / REVISION
1	–	FOR REVIEW & COMMENTS – 1
2	–	FOR BIDDING / PROJECT PACKAGING
3	–	FINAL ISSUE AND PERMIT

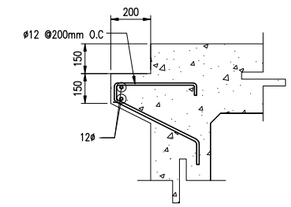
SHEET CONTENTS: CENTERLINE PROFILE
SCALE: VERT: 1:1000, HOR: 1:100m

DWG NUM: BC C-04
SHEET 03 OF 09

Sitio Santol Overflow Bridge Rehabilitation



A C-03 CENTERLINE PROFILE
SCALE 1:400M



B C-03 PAVING NOTCH DETAIL
SCALE 1:15M

\\wilmar\PROJECT PACKAGE\PACKAGE 2\Drawing\PIP-08_Sitio Santol_BC_Pablo_cmvl_jacq\dwg\0.3\PIP-08_13 May 31-Drawing\C_C2-Sitio Santol_BB_jacq.dwg, 6/1/2013 5:25:53 AM, DWF6 ePlot.pc3

USAID's Growth with Equity in Mindanao Program
Damosa Business Center, Damosa Complex, Anglongto Ave., Lanang, DC 8000
Tel: (63 82) 234-7720 Fax: (63 82) 234-3060
UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT
USAID Contract No. 492-C-00-08-00001-00

IMPLEMENTING FIRM: THE LOUIS BERGER GROUP, INC.
Engineers • Planners • Scientists • Economists
Unit 3, 12th Floor, Exportbank Plaza, Gil Puyat cor. Chino Roces Ave., Makati City

SUBPROJECT NAME: SITIO SANTOL BARANGAY BRIDGE REPAIR
LOCATION: BRGY. SALVACION, MONKAYO COMPOSTELA VALLEY

PRIMARY PROPONENT: PROVINCIAL GOVERNMENT OF COMPOSTELA VALLEY
CONFORMED BY: HON. Arturo T. Uy – Provincial Governor

ENGINEER OF RECORD: DINDO S. CEROLAGA, CIVIL ENGINEER
DATE: –
REG. No. 0082358 Date :07-09-98
PTR No. 8928339A Date :04-13-10

RECOMMENDING APPROVAL: MA. VILMA N. BELCHES, ASST. DEP. MANAGER
DATE: –

APPROVED BY: CEBENERIO C. CARLO A. DISPO JR., INFRA. CONST. TEAM LEADER
DATE: –

CHECKED BY: DATE: –
DRAWN BY: JACQUILINE E. ANG DATE: –

REVIEWED BY: MA. VILMA N. BELCHES DATE: –
EDITED BY: MARY W.B. AMOR DATE: –

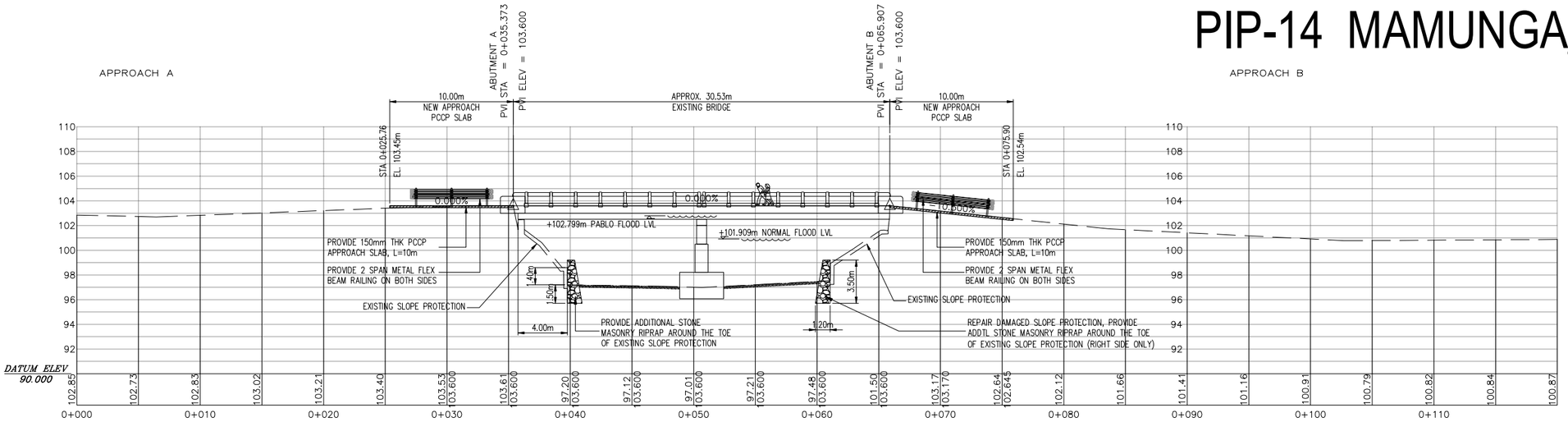
NO.	DATE	ISSUE / REVISION
1	–	FOR REVIEW & COMMENTS
2	–	FOR BIDDING / PROJECT PACKAGING
3	–	FINAL ISSUE AND PERMIT

SHEET CONTENTS: CENTERLINE PROFILE
SCALE: VERT: 1:1000, HOR: 1:100m

DWG NUM: BC C-03
SHEET 03 OF 06

Mamunga Bridge Rehabilitation

PIP-14 MAMUNGA_REHAB



B C-2 EXISTING BRIDGE PROFILE
SCALE 1:200m

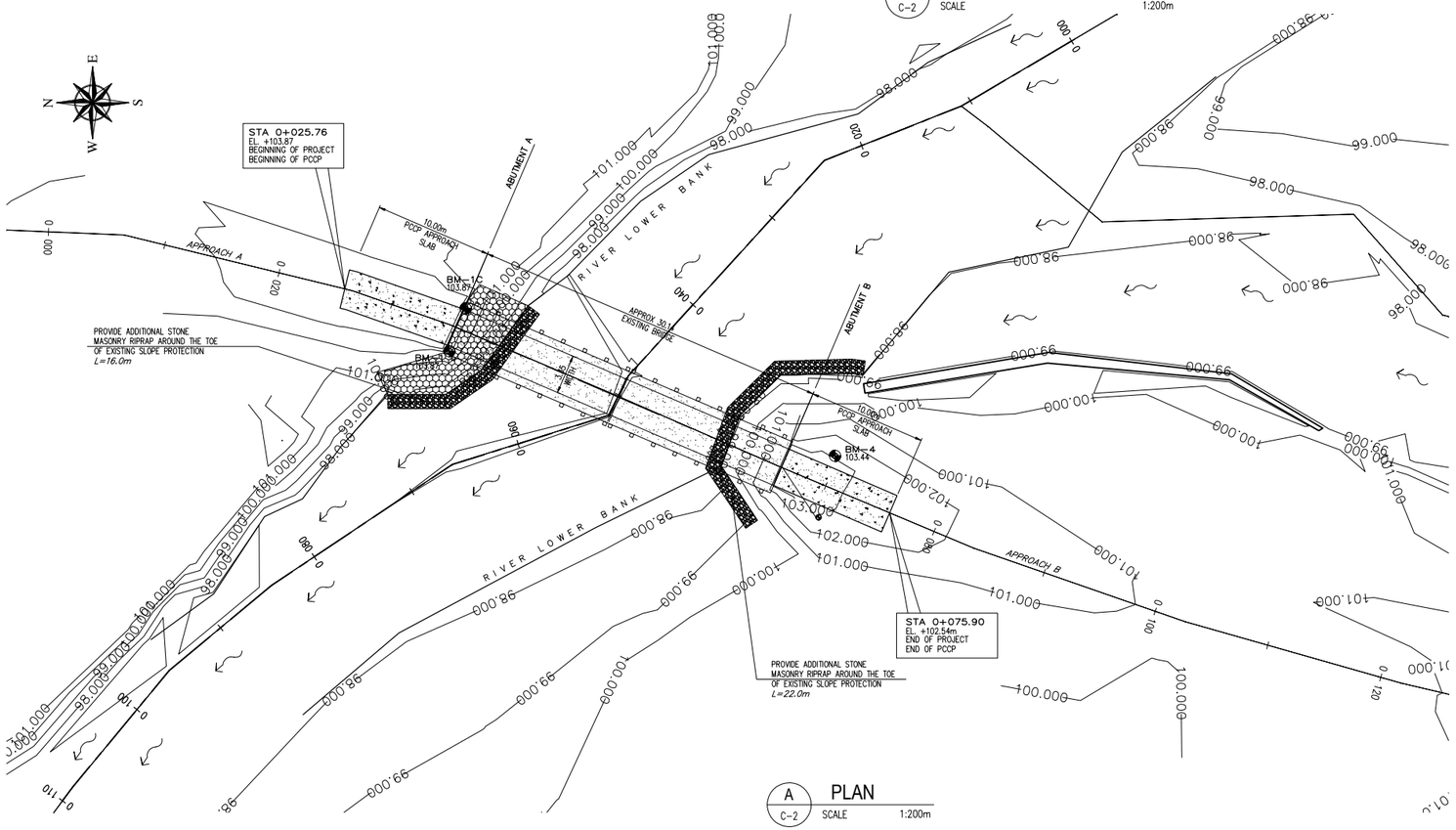
SCOPE OF WORK:

1. PROVIDE ADDITIONAL STONE MASONRY WALL AROUND THE TOE OF EXISTING SLOPE PROTECTION
   ABUTMENT A, L=16.0m
   ABUTMENT B, L=22.0m

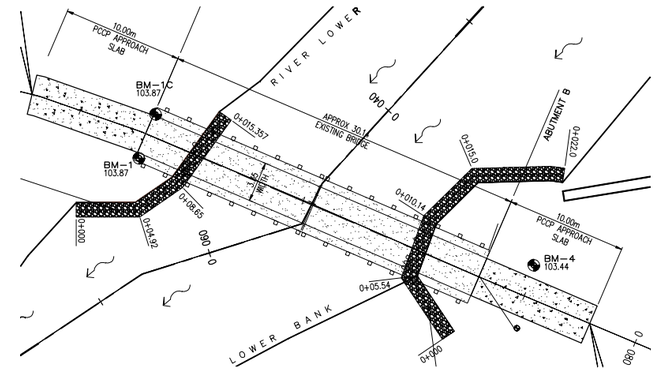
2. CHANNEL CLEARING 30m UPSTREAM AND DOWNSTREAM FROM CENTER OF BRIDGE, TOTAL L= 60m

3. PROVIDE 10m LENGTH 150mm THK PCCP ON APPROACH A & B.

4. PROVIDE METAL FLEX BEAM GUARD RAIL ON EACH APPROACHES ON BOTH SIDES



A C-2 PLAN
SCALE 1:200m

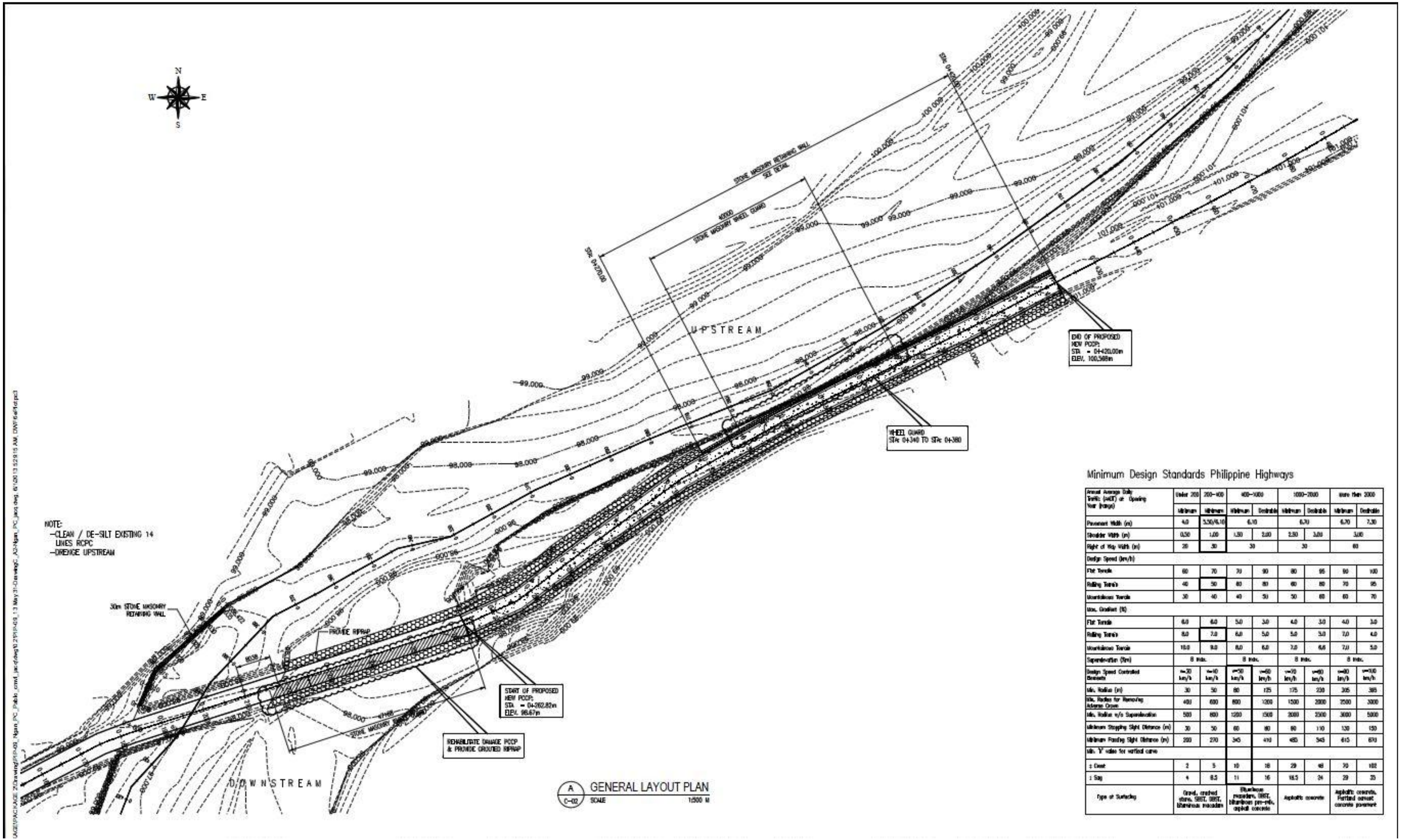


C C-2 RIPRAP PLAN AND STATIONING
SCALE 1:200m

USAID's Growth with Equity in Mindanao Program
2/F Damosa Business Center, Damosa Complex, Anglionqto Ave., Lanang, DC 8000
Tel: (63 82) 234-7720 Fax: (63 82) 234-3060
UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT

IMPLEMENTING FIRM:	SUBPROJECT NAME:	PRIMARY PROPONENT:	ENGINEER OF RECORD:	RECOMMENDING APPROVAL:	APPROVED BY:	CHECKED BY: DATE: –	REVIEWED BY: DATE: –	NO.	DATE	ISSUE / REVISION	SHEET CONTENTS:	DWG NUM:
THE LOUIS BERGER GROUP, INC. Engineers • Planners • Scientists • Economists Unit 3, 12th Floor, Exportbank Plaza, Gil Puyat cor. Chino Roces Ave., Makati City	MAMUNGA BRIDGE REHABILITATION	PROVINCIAL GOVERNMENT OF COMPOSTELA VALLEY	DINDO D. GEROLAGA, CIVIL ENGINEER	MA. VILMA N. BELCHES, ASST. BIP MANAGER	**CEBENERIO CHARLO A. DISPO JR.**, INFRA. CONST. TEAM LEADER	DRAWN BY: DATE: –	MA. VILMA N. BELCHES	1	–	FOR REVIEW & COMMENTS – 1	PLAN, EXISTING BRIDGE PROFILE, **RIPRAP PLAN AND STATIONING**	BB C-2
			DATE: –				EDITED BY: DATE: –	2	–	FOR BIDDING / PROJECT PACKAGING		
	LOCATION: BRGY. MAMUNGA, MONKAYO	CONFORMED BY:	REG. No. 0082358 Date :07-09-98					3	–	FINAL ISSUE AND PERMIT		SHEET
			PTR No. 8928339A	DATE	DATE							

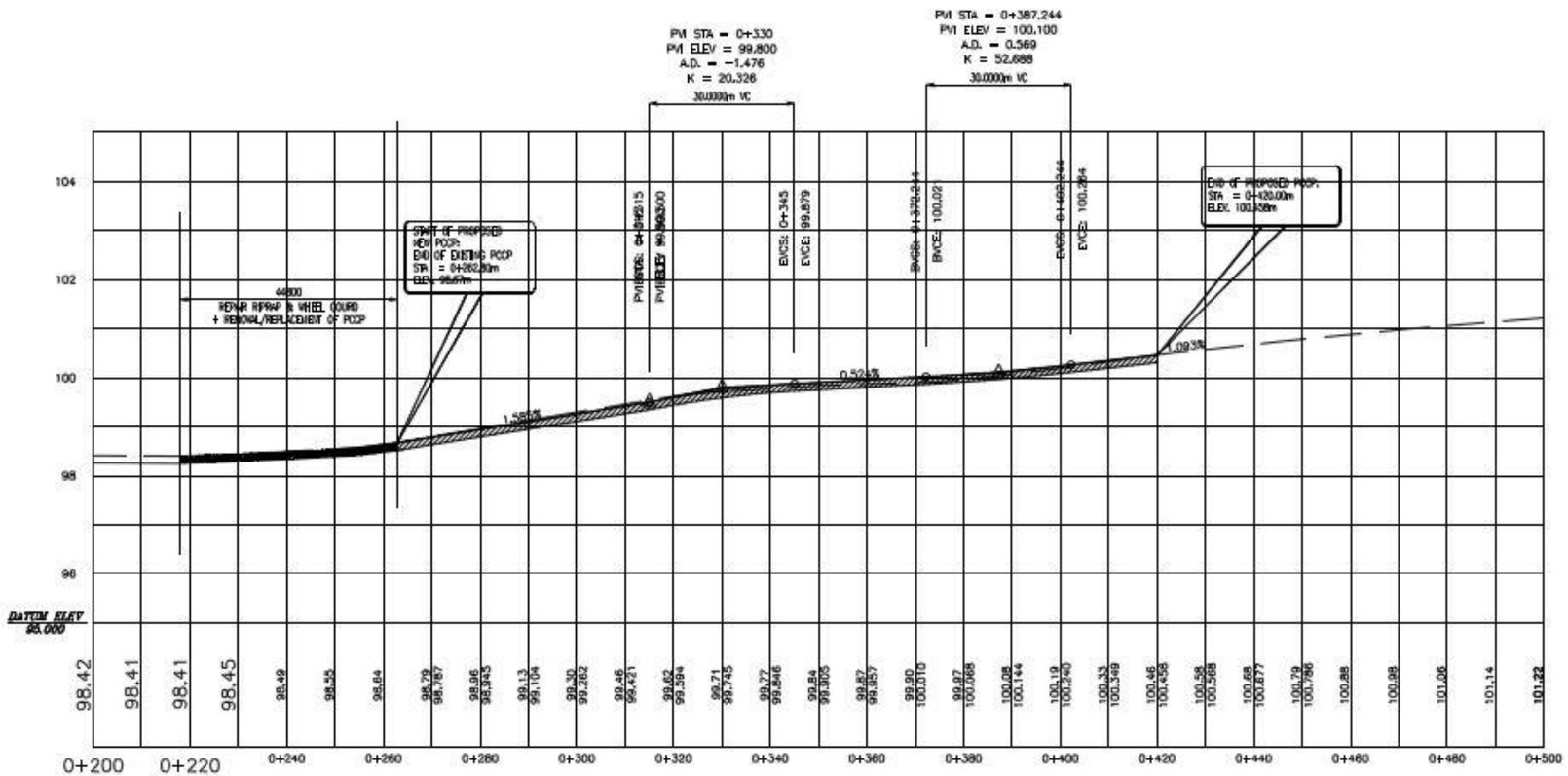
Ngan Overflow Bridge Rehabilitation



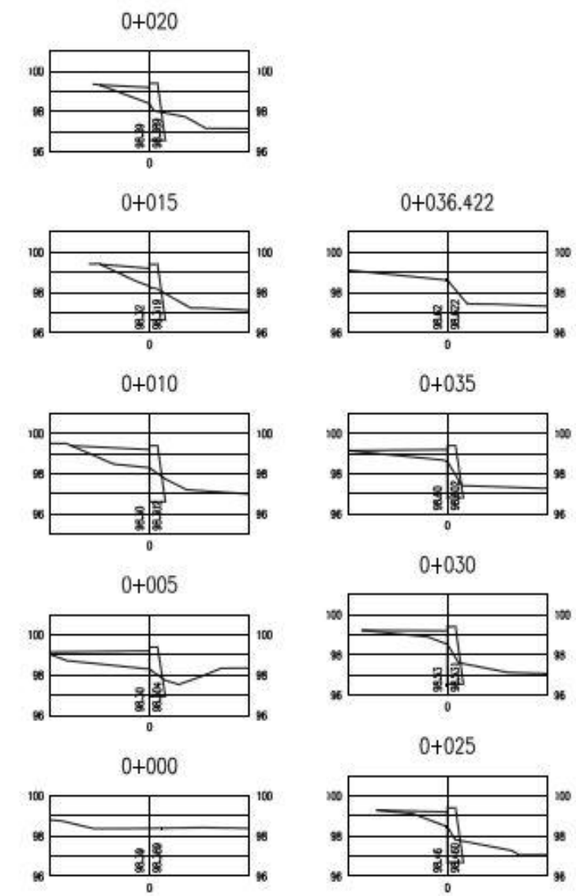
A
C-02
GENERAL LAYOUT PLAN
SCALE 1:500 M

Minimum Design Standards Philippine Highways

Annual Average Daily Traffic (AADT) or Opening Year (range)	Under 200	200–400	400–1000		1000–2000		more than 2000	
	Minimum	Minimum	Minimum	Desirable	Minimum	Desirable	Minimum	Desirable
Pavement Width (m)	4.0	5.50/6.10	6.10		6.70		6.70	7.30
Shoulder Width (m)	0.50	1.00	1.50	2.00	2.50	3.00	3.00	
Right of Way Width (m)	20	30	30		30		60	
Design Speed (km/h)								
Flat Terrain	60	70	70	90	80	95	90	100
Rolling Terrain	40	50	60	80	60	80	70	95
Mountainous Terrain	30	40	40	50	50	60	60	70
Max. Gradient (%)								
Flat Terrain	6.0	6.0	5.0	3.0	4.0	3.0	4.0	3.0
Rolling Terrain	8.0	7.0	6.0	5.0	5.0	5.0	7.0	4.0
Mountainous Terrain	10.0	9.0	8.0	6.0	7.0	6.0	7.0	5.0
Superelevation (%m)	8 max.		8 max.		8 max.		8 max.	
Design Speed Controlled Elements	v=30 km/h	v=40 km/h	v=50 km/h	v=60 km/h	v=70 km/h	v=80 km/h	v=80 km/h	v=100 km/h
Min. Radius (m)	30	50	80	125	175	230	305	385
Min. Radius for Removing Adverse Cross	400	600	800	1200	1500	2000	2500	3000
Min. Radius w/o Superelevation	500	800	1250	1500	2000	2500	3000	5000
Minimum Stopping Sight Distance (m)	30	50	60	80	90	110	130	150
Minimum Passing Sight Distance (m)	200	270	345	410	485	543	615	670
Min. 'K' value for vertical curve								
± Crest	2	5	10	16	29	48	70	102
± Sag	4	8.5	11	16	18.5	24	29	35
Type of Surfacing	Gravel, crushed stone, SBST, BBST, bituminous macadam		Bituminous macadam, BBST, bituminous pen-mix, asphalt concrete		Asphaltic concrete		Asphaltic concrete, Portland cement concrete pavement	

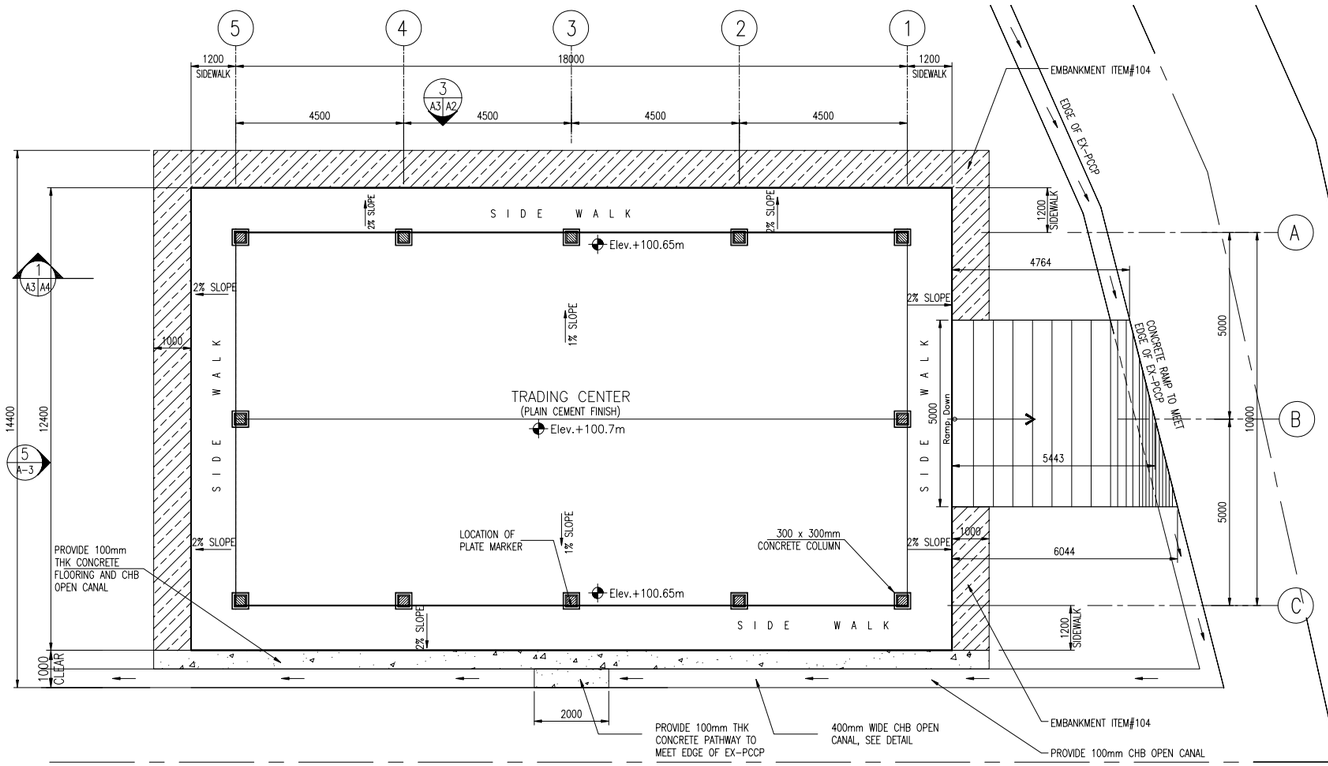


A C-04 CENTERLINE PROFILE
SCALE 1:600M

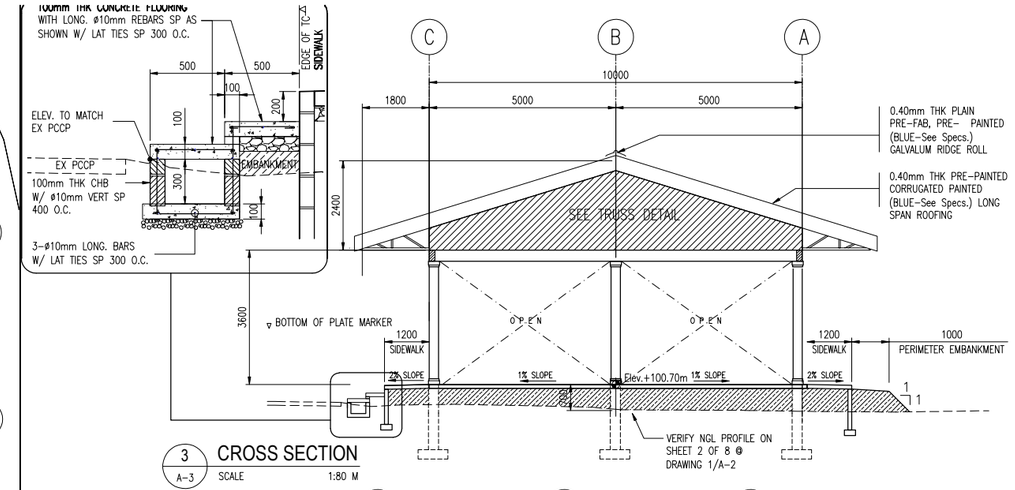


B C-05 STONE MASONRY RETAINING WALL ALONG STA. 0+180.00
SCALE 1:150M

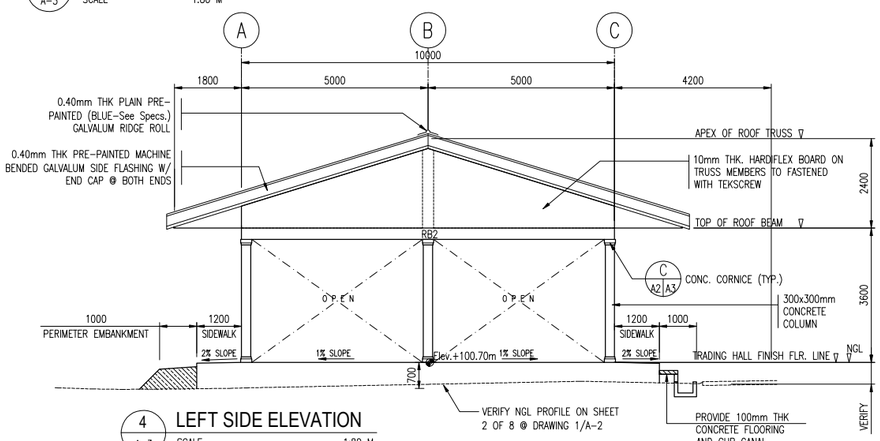
Poblacion Compostela Trading Center Construction



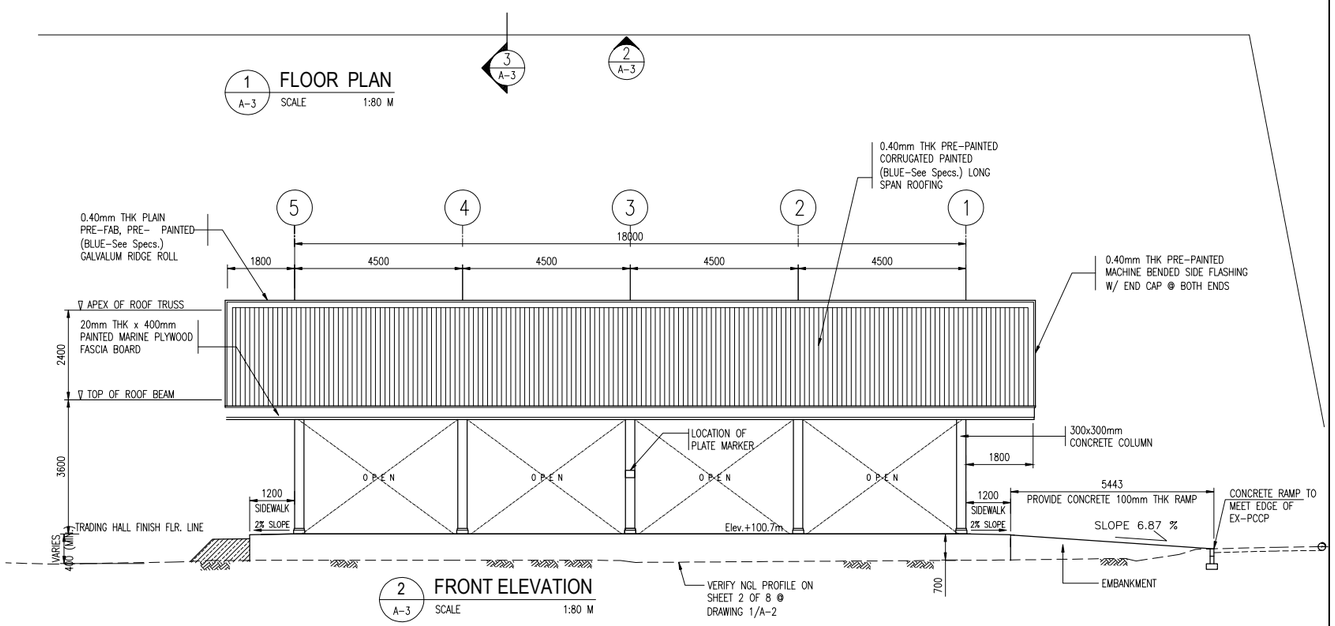
1 A-3 FLOOR PLAN
SCALE 1:80 M



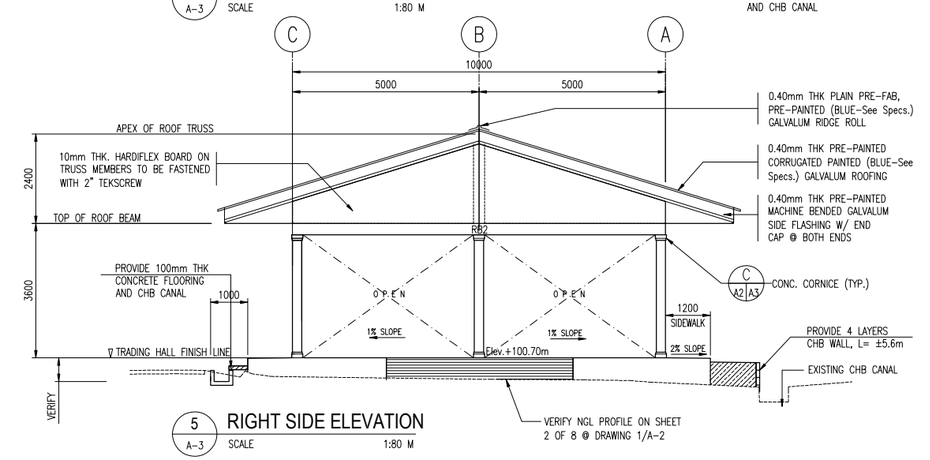
3 A-3 CROSS SECTION
SCALE 1:80 M



4 A-3 LEFT SIDE ELEVATION
SCALE 1:80 M



2 A-3 FRONT ELEVATION
SCALE 1:80 M



5 A-3 RIGHT SIDE ELEVATION
SCALE 1:80 M

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2/F Damosa Business Center, Damosa Complex, Anglionglo Ave., Lanang, DC 8000
Tel: (63 82) 234-7720 Fax: (63 82) 234-3060
UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT
USAID Contract No. 492-C-00-08-00001-00

IMPLEMENTING FIRM: THE LOUIS BERGER GROUP, INC.
Engineers • Planners • Scientists • Economists
Unit 3, 12th Floor, Exportbank Plaza, Gil Puyat cor. Chino Roces Ave., Makati City

SUBPROJECT NAME: POBLACION COMPOSTELA TRADING CENTER CONSTRUCTION
LOCATION: POBLACION COMPOSTELA, COMPOSTELA VALLEY

PRIMARY PROPONENT: PROVINCIAL GOVERNMENT OF COMPOSTELA VALLEY
CONFORMED BY: HON. ARTURO T. UY-PROVINCIAL GOVERNOR

ENGINEER OF RECORD: DINDO B. CEROLAGA, CIVIL ENGINEER
DATE: –
REG. No. 0082358
Date :07-09-98
PTR No. 8928339A
Date :04-13-10

RECOMMENDING APPROVAL: MA. VILMAN N. BELCHES, ASST. GP MANAGER
DATE: –

APPROVED BY: CEBENERIO CHARLO A. DISPO JR., INFRA. CONST. TEAM LEADER
DATE: –

CHECKED BY: DATE: –
DRAWN BY: LORINO S. BALDEZAMO DATE: –

REVIEWED BY: MA. VILMAN N. BELCHES DATE: –
EDITED BY: MANNY W.B. AMOR DATE: –

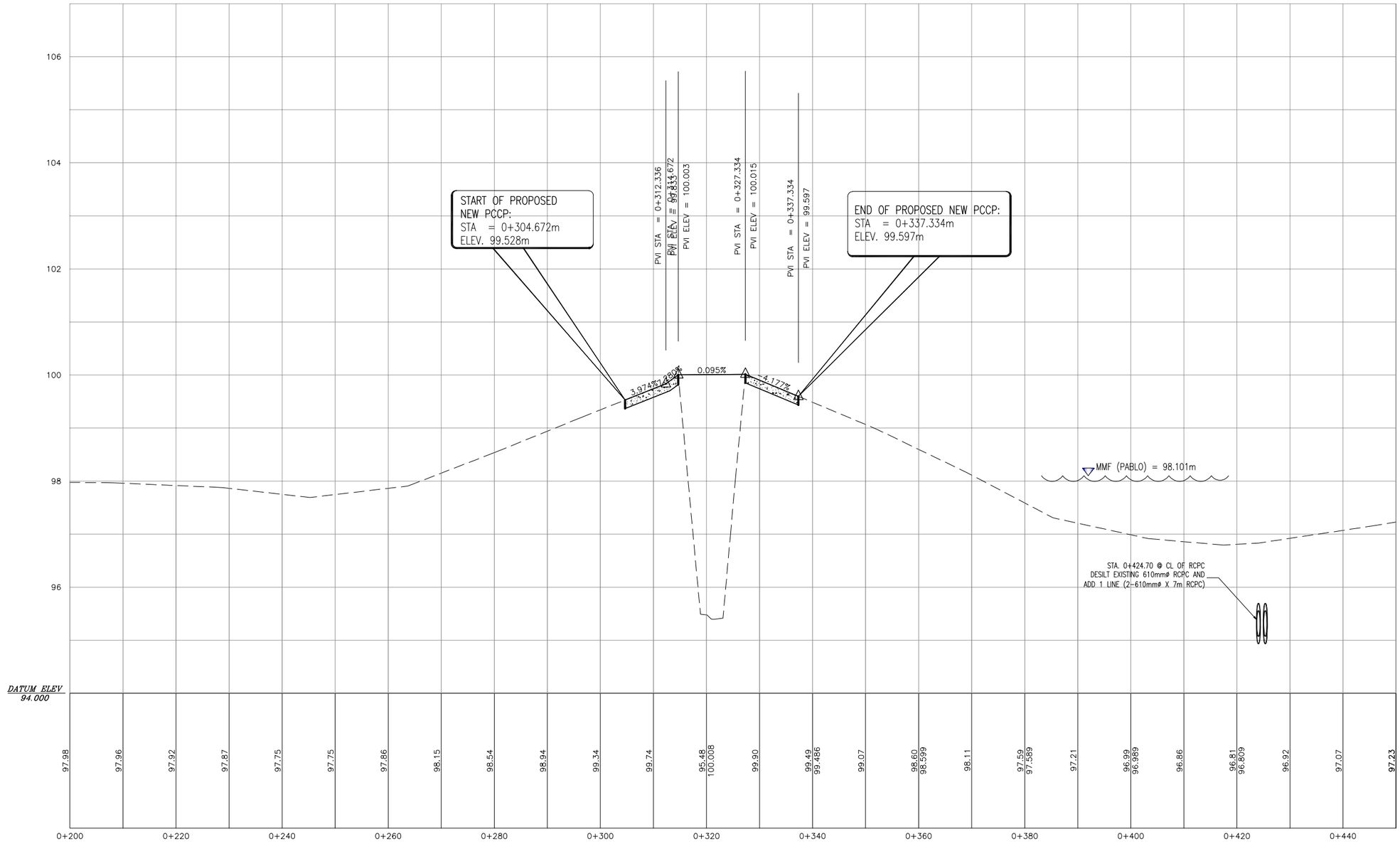
NO.	DATE	ISSUE / REVISION
1	13-05-18	FOR REVIEW & COMMENTS – 1
2	13-05-22	FOR BIDDING / PROJECT PACKAGING
3	13-06-01	FINAL ISSUE AND PERMIT

SHEET CONTENTS: FLOOR PLAN, FRONT ELEVATION, CROSS SECTION, LEFT AND RIGHT SIDE ELEVATIONS
SCALE: AS SHOWN

DWG NUM: TC A-3
SHEET 3 OF 9

Magangit-Batinao Bridge Rehabilitation

PIP-13 MAGANGIT-BATINAO_REHAB



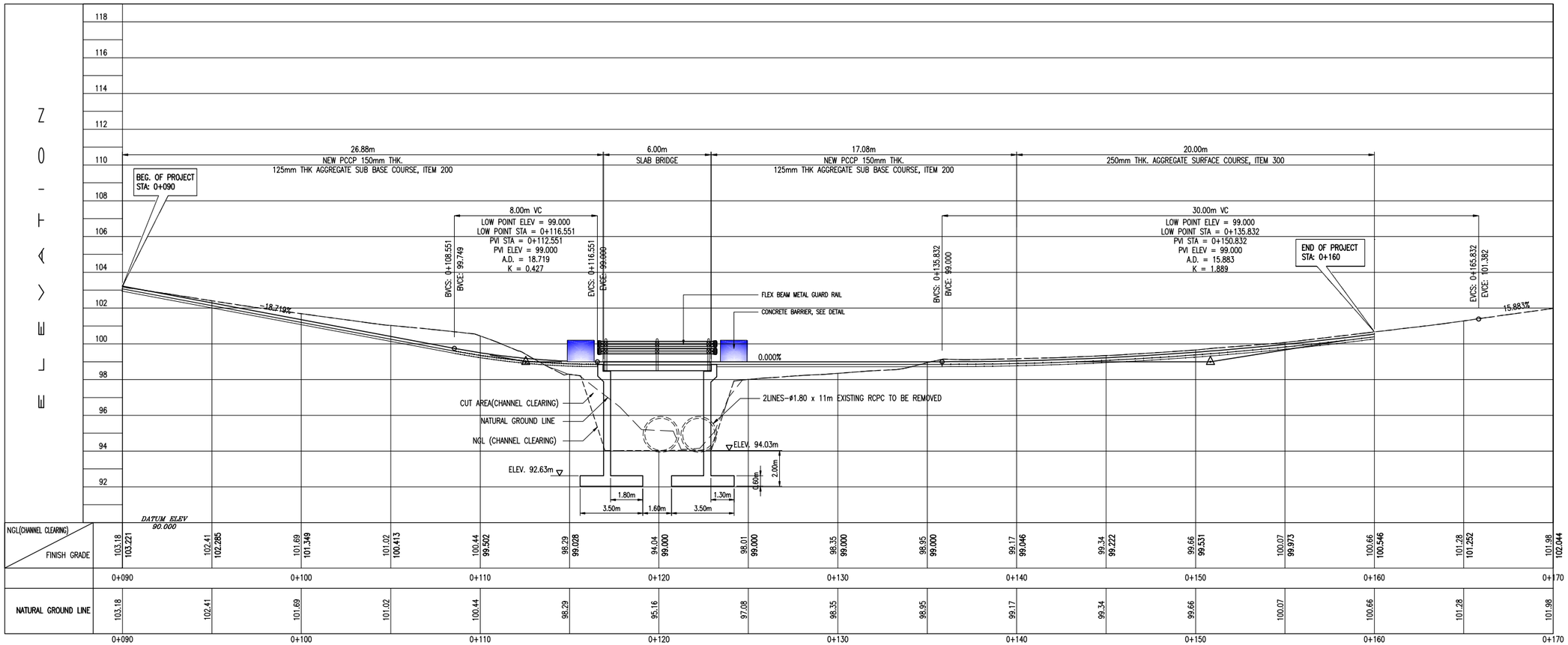
A
C-04

CENTERLINE PROFILE

SCALE 1:600M

USAID's Growth with Equity in Mindanao Program 2/F Damosa Business Center, Damosa Complex, Anglíongto Ave., Lanang, DC 8000 Tel: (63 82) 234-7720 Fax: (63 82) 234-3060 UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT USAID Contract No. 492-C-00-08-00001-00	IMPLEMENTING FIRM: THE LOUIS BERGER GROUP, INC. Engineers • Planners • Scientists • Economists Unit 3, 12th Floor, Exportbank Plaza, Gil Puyat cor. Chino Roces Ave., Makati City	SUBPROJECT NAME: MAGANGIT-BATINAO BRIDGE REHABILITATION LOCATION: BRGY. MAGANGIT – BRGY. BATINAO, NEW BATAAN COMVAL	PRIMARY PROPONENT: PROVINCIAL GOVERNMENT OF COMPOSTELA VALLEY CONFORMED BY: HON. Arturo T. Uy – Provincial Governor	ENGINEER OF RECORD: DINDO S. GERONAGA CIVIL ENGINEER DATE: – REG. No. 0082358 Date :07-09-98 PTR No. 8928339A Date :04-13-10	RECOMMENDING APPROVAL: MA. VILMA N. BELCHES ASST. DEP. MANAGER DATE: –	APPROVED BY: CEBENERIO CHARLO A. DISPO JR. INFRA/ CONST. TEAM LEADER DATE: –	CHECKED BY: DATE: – DRAWN BY: DATE: – JACQUILINE E. ANG	REVIEWED BY: DATE: – EDITED BY: DATE: – MA. VILMA N. BELCHES MARNY W.B. AMOR	NO. 1 2 3	DATE – – –	ISSUE / REVISION FOR REVIEW & COMMENTS FOR BIDDING / PROJECT PACKAGING FINAL ISSUE AND PERMIT	SHEET CONTENTS: CENTERLINE PROFILE SCALE: VERT: 1:1000, HOR: 1:100m	DWG NUM: BC C-04 SHEET 03 OF 11

Lebanon-San Jose Barangay Bridge Construction



A
C-4
ROAD DESIGN PROFILE
SCALE 1:110m

\\wlmai\PROJECT PACKAGE\PACKAGE 2\Drawing\PIP-10_Lebanon-San Jose Barangay Bridge Construction_rey\dwg\0\PIP-10_13 May 31-DrawingC_C1-C9_Lebanon-San Jose Barangay Bridge Construction_rey.dwg, 6/1/2013 5:32:18 AM, DWF6 ePlot.pc3

USAID's Growth with Equity in Mindanao Program
25/F Damosa Business Center, Damosa Complex, Anglongto Ave., Lanang, DC 8000
Tel: (63 82) 234-7720 Fax: (63 82) 234-3060
UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT
USAID Contract No. 492-C-00-08-00001-00

IMPLEMENTING FIRM:
THE LOUIS BERGER GROUP, INC.
Engineers • Planners • Scientists • Economists
Unit 3, 12th Floor, Exportbank Plaza,
Gil Puyat cor. Chino Roces Ave., Makati City

SUBPROJECT NAME:
LEBANON - SAN JOSE BARANGAY BRIDGE CONSTRUCTION
LOCATION: PUROK 2, BRGY. SAN JOSE, MONTEVISTA, COMPOSTELA VALLEY

PRIMARY PROPONENT:
MUNICIPAL GOVERNMENT OF MONTEVISTA
CONFORMED BY:
HON. TOPOY JAYECTIN -Municipal Mayor

ENGINEER OF RECORD:
DINDO S. CEROLAGA
CIVIL ENGINEER
DATE: –
REG. No. 0082358
Date :07-09-98
PTR No. 8928339A
Date :04-13-10

RECOMMENDING APPROVAL:
MA. VILMAN. BELCHES
ASS. DP MANAGER
DATE: –

APPROVED BY:
CEBENERIO CHARLO A. DISPO JR.
INFRA. CONST. TEAM LEADER
DATE: –

CHECKED BY: DATE: –
DRAWN BY: DATE: 13-05-12
LORINO S. BALDEZAMO

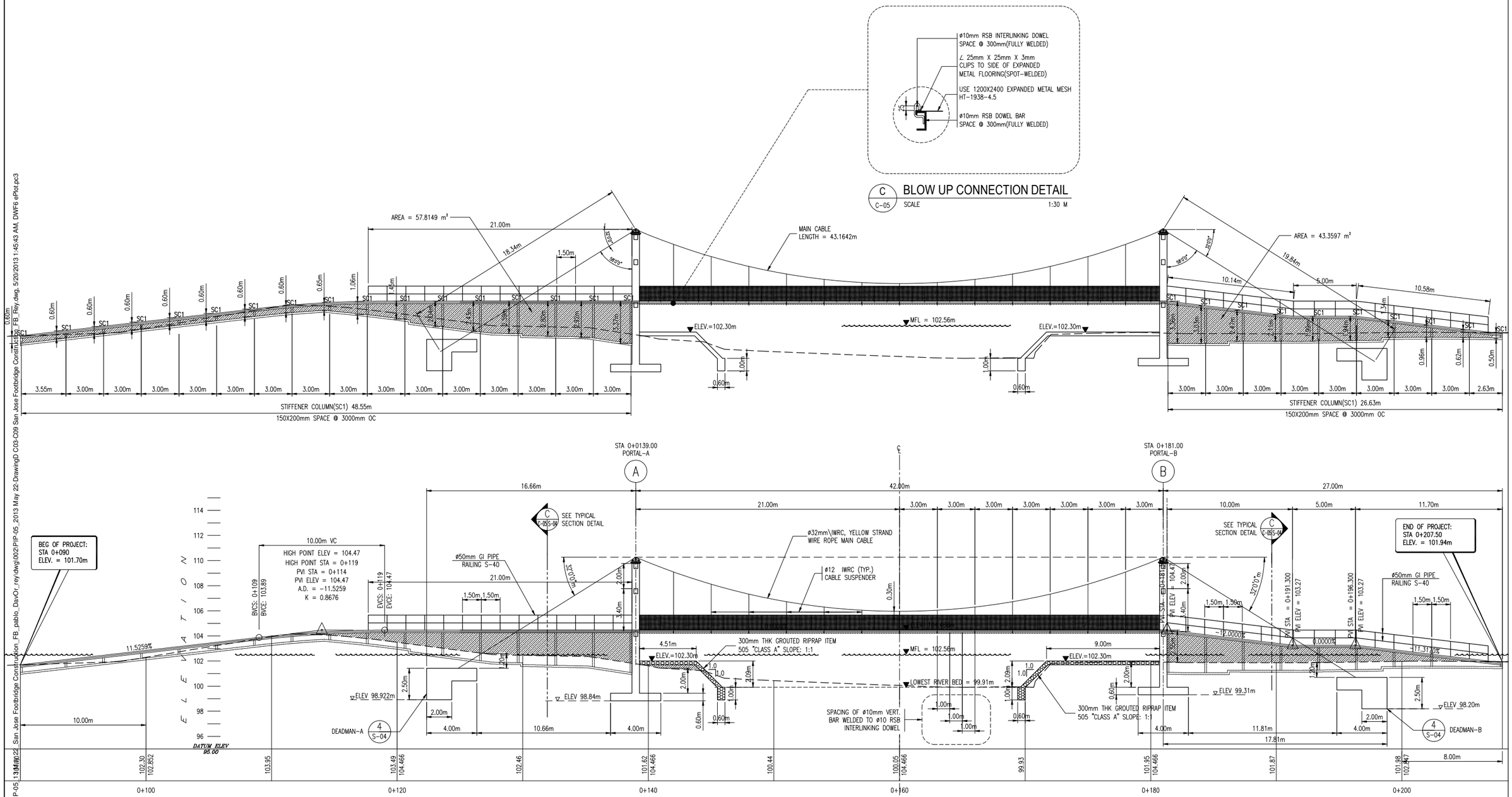
REVIEWED BY: DATE: –
MA. VILMAN. BELCHES
EDITED BY: DATE: –
MANNY W.B. AMOR

NO.	DATE	ISSUE / REVISION
1	13-05-20	FOR REVIEW & COMMENTS – 1
2	13-05-31	FOR BIDDING / PROJECT PACKAGING
3	–	FINAL ISSUE AND PERMIT

SHEET CONTENTS:
ROAD DESIGN PROFILE
SCALE: AS SHOWN

DWG NUM:
BB
C-4
SHEET 04 OF 14

San Jose Footbridge Construction



USAID's Growth with Equity in Mindanao Program

2nd St. Damosa Business Center, Damosa Complex, Anglongto Ave., Lanang, DC 8000
Tel: (63 82) 234-7720 Fax: (63 82) 234-3060
UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT
USAID Contract No. 492-C-00-08-00001-00

IMPLEMENTING FIRM: THE LOUIS BERGER GROUP, INC.
Engineers • Planners • Scientists • Economists
Unit 3, 12th Floor, Exportbank Plaza, Gil Puyat cor. Chino Roces Ave., Makati City

SUBPROJECT NAME: SAN JOSE FOOTBRIDGE CONSTRUCTION
LOCATION: BRGY. SAN JOSE, BOSTON DAVAO ORIENTAL

PRIMARY PROPONENT: MUNICIPAL GOVERNMENT OF BOSTON
CONFORMED BY: HON. REBECCO ROSITO SR.-Municipal Mayor

ENGINEER OF RECORD: DINDO D. GEROLAGA, CIVIL ENGINEER
DATE: –
REG. No. 0082358 Date :07-09-98
PTR No. 8928339A Date :04-13-10

RECOMMENDING APPROVAL: CEBENERIO CHARLO A. DISPO JR., INFRA. CONST. TEAM LEADER
DATE: –

APPROVED BY: MARILOU M. SIAN, DEPUTY CHIEF OF PARTY
DATE: –

CHECKED BY: LORINO S. BALDEZAMO DATE: –
DRAWN BY: DATE: –
REVIEWED BY: MA. VILMA N. BELCHES DATE: –
EDITED BY: MANNY W.B. AMOR DATE: –

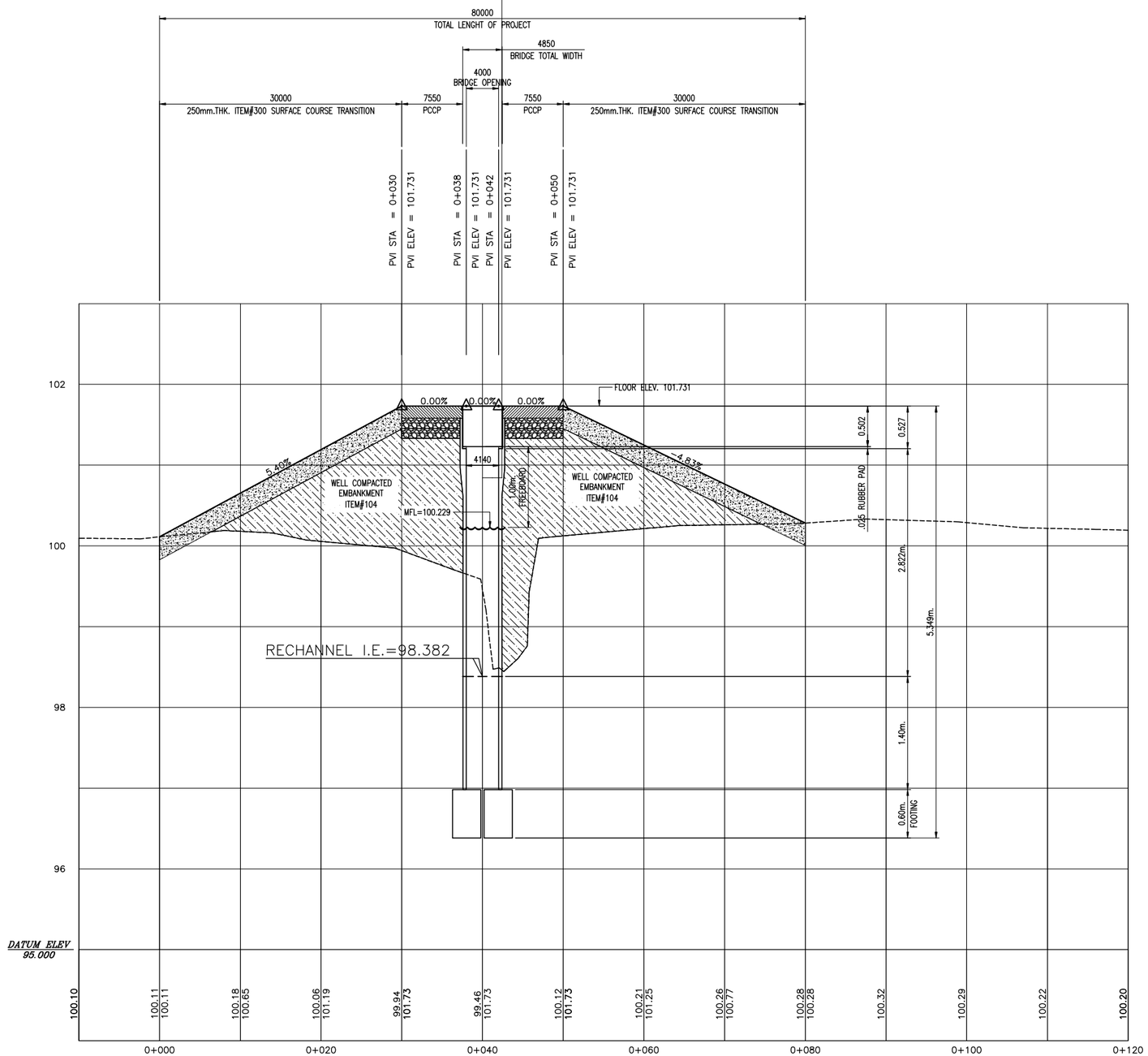
NO.	DATE	ISSUE / REVISION
1	–	FOR REVIEW & COMMENTS – 1
2	–	FOR BIDDING / PROJECT PACKAGING
3	–	FINAL ISSUE AND PERMIT

SHEET CONTENTS: PROFILE
FOOTBRIDGE GENERAL SECTION DETAIL
SCALE: AS SHOWN

DWG NUM: FB C-05
SHEET 05 OF 20

C:\Users\pjpDocuments\003_typhon pablo projects\PIP-05_13\May 22_San Jose Footbridge Construction_FB_pablo_DavOr_rev\dwg\002\PIP-05_2013 May 22-DrawingD C03-C09 San Jose Footbridge Construction_FB_Rev.dwg, 5/20/2013 1:45:43 AM, DWF6 ePlot.pc3

Alegria Barangay Bridge Construction



1 / C-3 VERTICAL ALIGMENT PROFILE

SCALE V=1:30 H=1:300M.

GENERAL NOTES :

SPECIFICATION :

DPWH STANDARD SPECIFICATION FOR HIGHWAY BRIDGES

DESIGN LOAD :

LIVE LOAD MS-18 (HS 15-44)

STEEL REINFORCEMENT :

ALL REINFORCING STEEL TO BE INTERMEDIATE (GRADE 33) ASTM A-615 WITH DEFORMATIONS CONFORMING TO ASTM A-305.

CONCRETE :

ALL CONCRETE SHALL HAVE A MINIMUM COMPRESSION STRENGTH IN 28 DAYS OF f'c = 20.7 MPa (3000psi). ALL EXPOSED CORNERS TO BE CHAMFERED 20mm MINIMUM. NO CONSTRUCTION JOINT ARE TO BE MADE EXCEPT WHERE SHOWN. WHEN BOTTOM SLAB IS SUBJECT TO ABRASION ADD 25mm TO BOTTOM SLAB TO INCREASE COVERAGE ON STEEL.

\\wilma\PROJECT PACKAGE\PACKAGE 2\Drawing\PIP-11_Alegria_Barangay Bridge_Construction_DavOrl\dwg\2\PIP-11_13 May 31_Drawing\C_C2-C6-Alegria Barangay Bridge Construction.dwg, 6/1/2013 5:39:25 AM, DWF6 ePlot.pc3

USAID's Growth with Equity in Mindanao Program
2F Damosa Business Center, Damosa Complex, Anglongto Ave., Lanang, DC 8000
Tel: (63 82) 234-7720 Fax: (63 82) 234-3060
UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT
USAID Contract No. 492-C-00-08-00001-00

IMPLEMENTING FIRM: THE LOUIS BERGER GROUP, INC.
Engineers • Planners • Scientists • Economists
Unit 3, 12th Floor, Exportbank Plaza, Gil Puyat cor. Chino Roces Ave., Makati City

SUBPROJECT NAME: ALEGRIA BARANGAY BRIDGE CONSTRUCTION
LOCATION: BRGY. ALEGRIA, CATEEL, DAVAO ORIENTAL

PRIMARY PROPONENT: MUNICIPAL GOVERNMENT OF CATEEL
CONFORMED BY: HON. Camilo Nuñez - Municipal Mayor

ENGINEER OF RECORD: DINDO B. CEROLAGA, CIVIL ENGINEER
DATE: -
REG. No. 0082358 Date :07-09-98
PTR No. 8928339A Date :04-13-10

RECOMMENDING APPROVAL: MA. VILMANY BELCHES, ASST. DPP MANAGER
DATE: -

APPROVED BY: CEBENERIO CHARLO A. DISPO JR., INFRA. CONST. TEAM LEADER
DATE: -

CHECKED BY: DATE: -
DRAWN BY: LORINO S. BALDEZAMO DATE: -
REVIEWED BY: MA. VILMA N. BELCHES DATE: -
EDITED BY: MANNY W.B. AMOR DATE: -

NO.	DATE	ISSUE / REVISION
1	13-06-28	FOR REVIEW & COMMENTS - 2
2	13-06-31	FOR BIDDING / PROJECT PACKAGING
3	-	FINAL ISSUE AND PERMIT

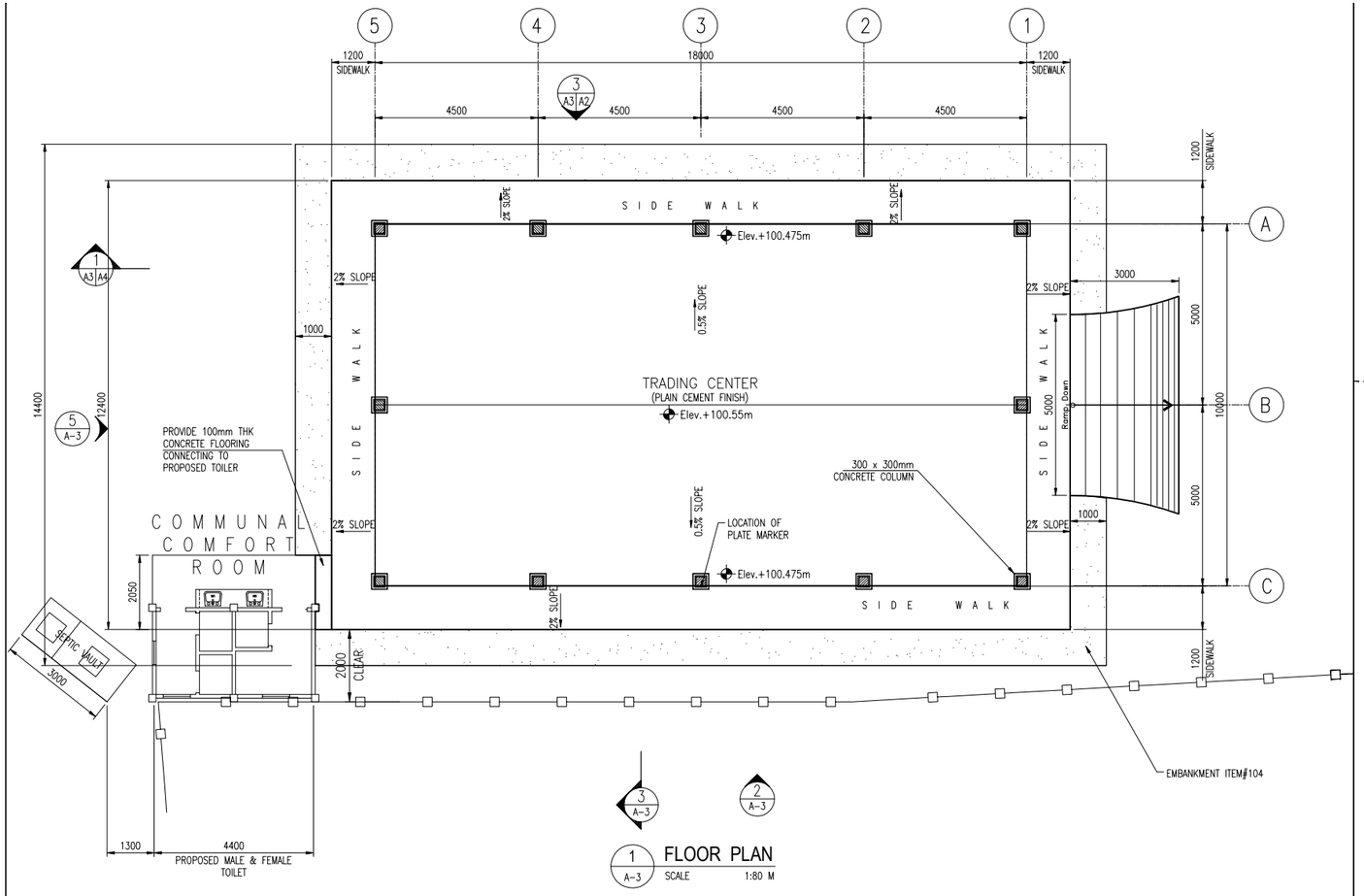
SHEET CONTENTS: VERTICAL ALIGMENT PROFILE

SCALE: AS SHOWN

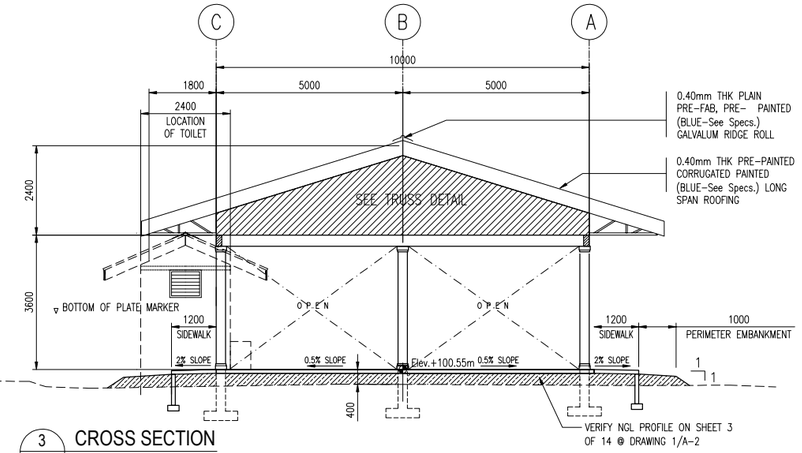
DWG NUM: BB / C-3

SHEET 03 OF 13

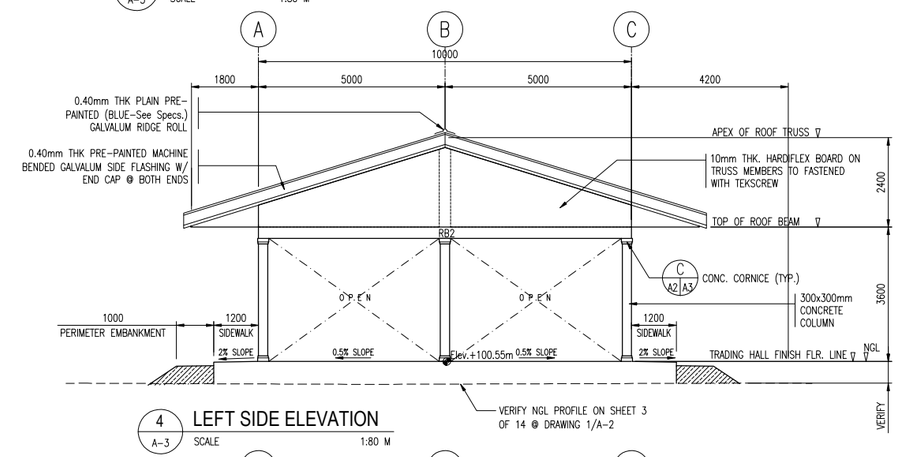
Carmen Trading Center Construction



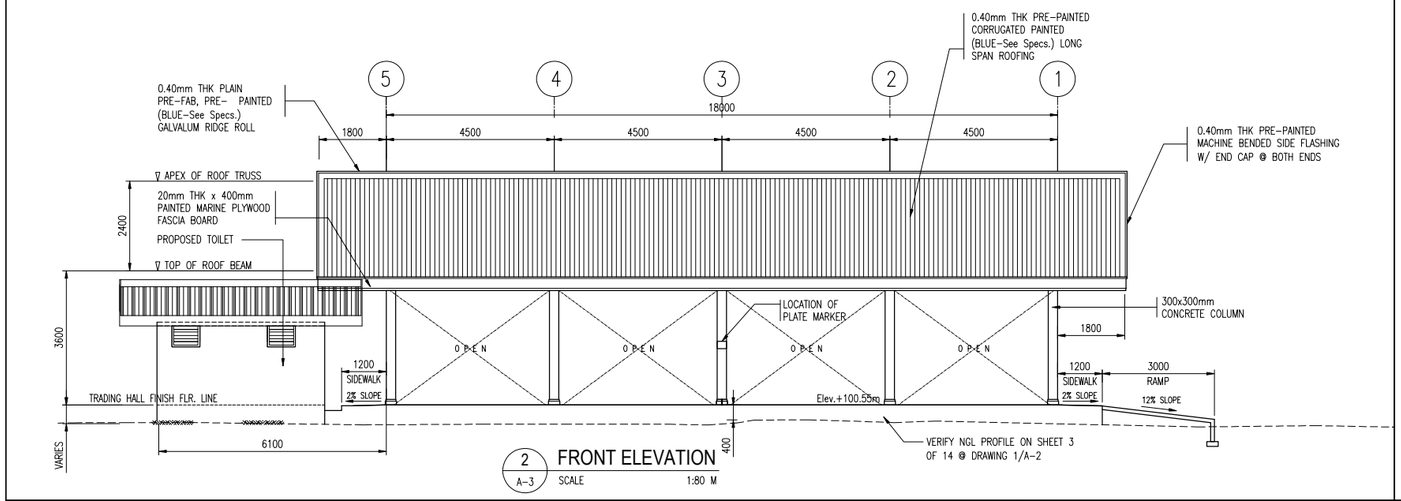
1 A-3 FLOOR PLAN
SCALE 1:80 M



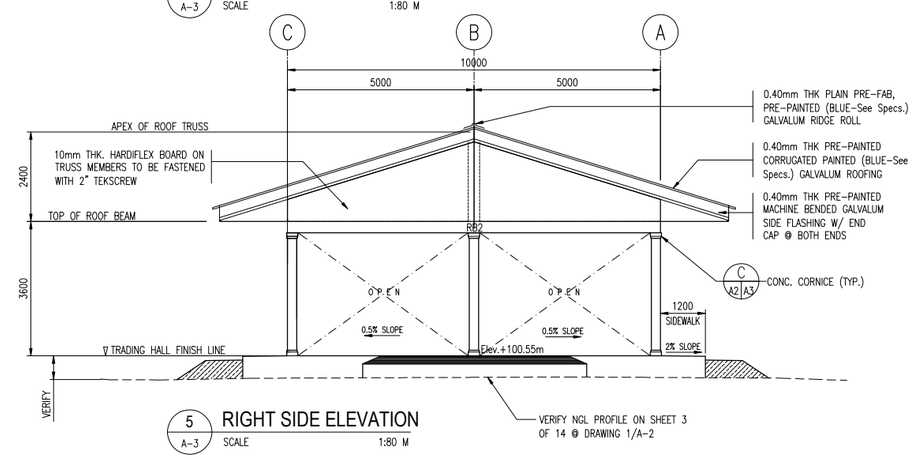
3 A-3 CROSS SECTION
SCALE 1:80 M



4 A-3 LEFT SIDE ELEVATION
SCALE 1:80 M



2 A-3 FRONT ELEVATION
SCALE 1:80 M



5 A-3 RIGHT SIDE ELEVATION
SCALE 1:80 M

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2/F Damosa Business Center, Damosa Complex, Anglíongto Ave., Lanang, DC 8000
Tel: (63 82) 234-7720 Fax: (63 82) 234-3060
UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT
USAID Contract No. 492-C-00-08-00001-00

IMPLEMENTING FIRM: THE LOUIS BERGER GROUP, INC.
Engineers • Planners • Scientists • Economists
Unit 3, 12th Floor, Exportbank Plaza, Gil Puyat cor. Chino Roces Ave., Makati City

SUBPROJECT NAME: CARMEN TRADING CENTER CONSTRUCTION
LOCATION: BRGY. CARMEN, BOSTON, DAVAO ORIENTAL

PRIMARY PROPONENT: MUNICIPAL GOVERNMENT OF BOSTON
CONFORMED BY: HON. REBECCO B. ROSIT SR.-Municipal Mayor

ENGINEER OF RECORD: DINDO U. SUGEROLAGA, CIVIL ENGINEER
DATE: –
REG. No. 0082358 Date :07-09-98
PTR No. 8928339A Date :04-13-10

RECOMMENDING APPROVAL: MA. VILMA N. BELCHES, ASSIST. DIP MANAGER
DATE: –

APPROVED BY: CEBENERIO CHARLO A. DISPO JR., INFRA. CONST. TEAM LEADER
DATE: –

CHECKED BY: DATE: –
DRAWN BY: LORINO S. BALDEZAMO DATE: –

REVIEWED BY: MA. VILMA N. BELCHES DATE: –
EDITED BY: MANNY W.B. AMOR DATE: –

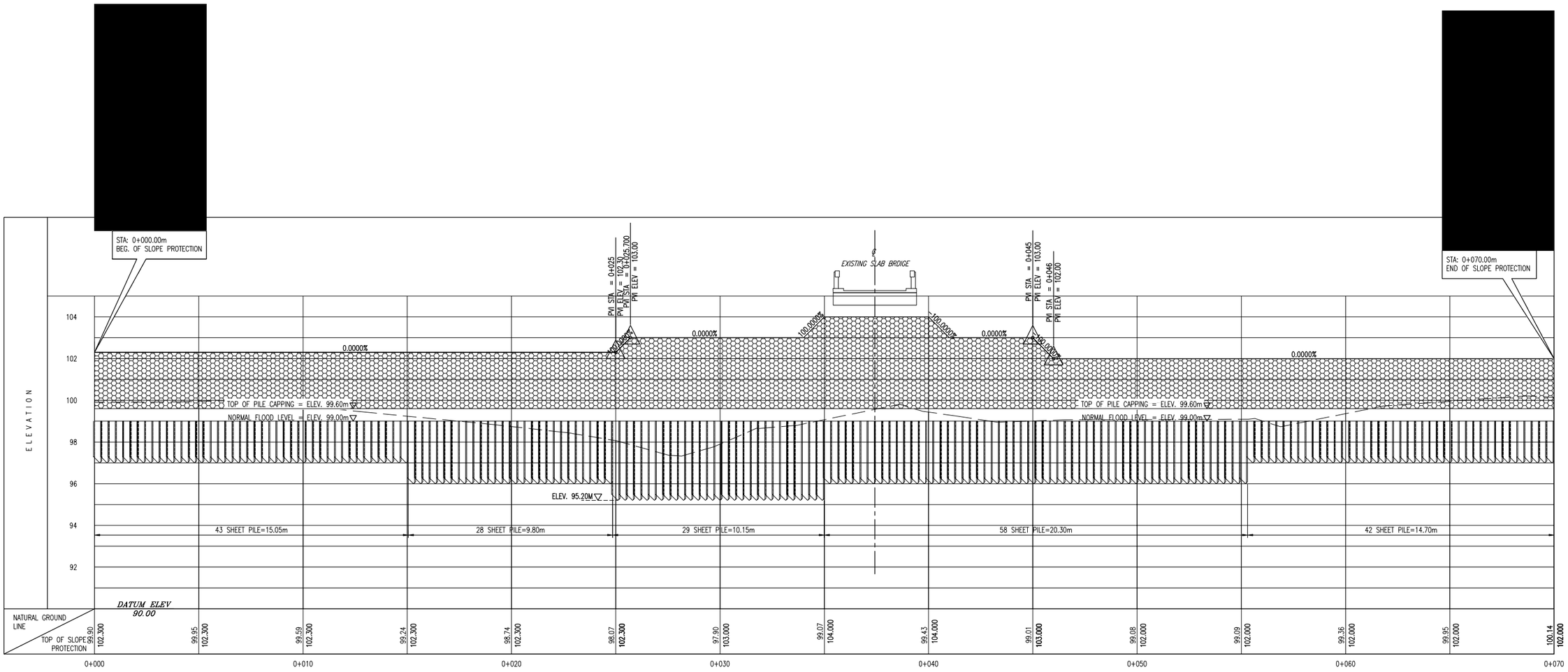
NO.	DATE	ISSUE / REVISION
1	13-05-18	FOR REVIEW & COMMENTS – 1
2	13-05-22	FOR BIDDING / PROJECT PACKAGING
3	13-06-01	FINAL ISSUE AND PERMIT

SHEET CONTENTS: FLOOR PLAN, FRONT ELEVATION, CROSS SECTION, LEFT AND RIGHT SIDE ELEVATIONS
SCALE: AS SHOWN

DWG NUM: TC A-3
SHEET 3 OF 14

Poblacion Compostela Bridge Rehabilitation

PIP-15 POB. COMPOSTELA BRIDGE_REHAB



A / C-03 SLOPE PROTECTION PROFILE (SHEET PILE)

SCALE 1:100M

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2/F Damosa Business Center, Damosa Complex, Anglionglo Ave., Lanang, DC 8000
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UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT
USAID Contract No. 492-C-00-08-00001-00

IMPLEMENTING FIRM: THE LOUIS BERGER GROUP, INC.
Engineers • Planners • Scientists • Economists
Unit 3, 12th Floor, Exportbank Plaza, Gil Puyat cor. Chino Roces Ave., Makati City

SUBPROJECT NAME: POBLACION COMPOSTELA BRIDGE REHABILITATION
LOCATION: POBLACION, COMPOSTELA, COMPOSTELA VALLEY

PRIMARY PROPONENT: PROVINCIAL GOVERNMENT OF COMPOSTELA VALLEY
CONFORMED BY: HON. ARTURO T. UY – Provincial Governor

ENGINEER OF RECORD: DINDO D. GEROLAGA, CIVIL ENGINEER
DATE: –
REG. No. 0082358
Date :07-09-98
PTR No. 8928339A
Date :04-13-10

RECOMMENDING APPROVAL: MA. VILMAN N. BELCHES, ASST. DIV. MANAGER
DATE: –

APPROVED BY: CEBENERIO CHARLO A. DISPO JR., INFRA. CONST. TEAM LEADER
DATE: –

CHECKED BY: DATE: –
DRAWN BY: JACQUILINE E. ANG DATE: –

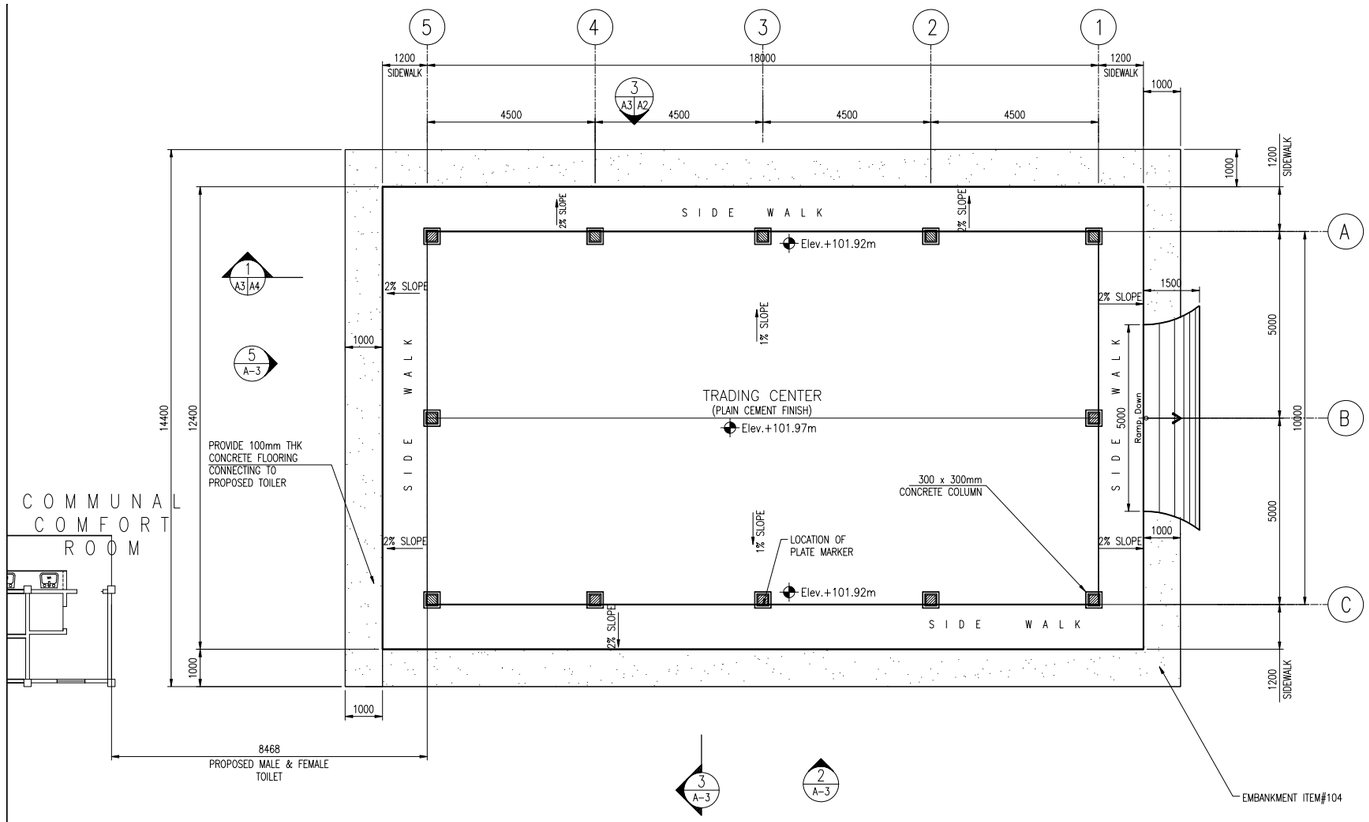
REVIEWED BY: MA. VILMAN N. BELCHES DATE: –
EDITED BY: MANNY W.B. AMOR DATE: –

NO.	DATE	ISSUE / REVISION
1	–	FOR REVIEW & COMMENTS – 1
2	–	FOR BIDDING / PROJECT PACKAGING
3	–	FINAL ISSUE AND PERMIT

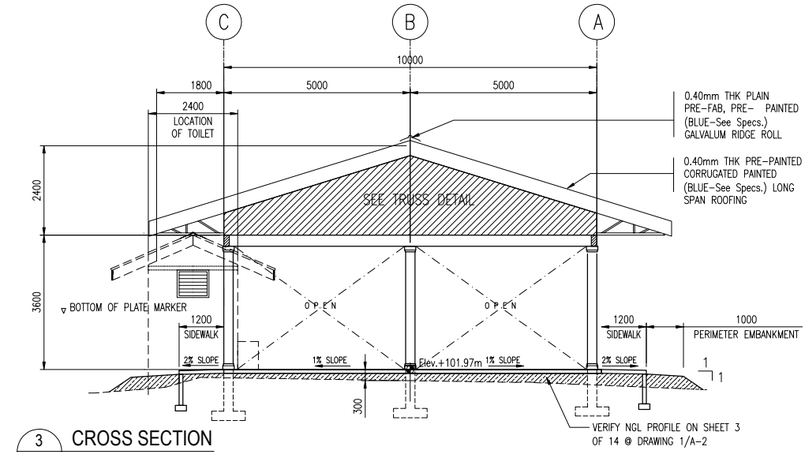
SHEET CONTENTS: SLOPE PROTECTION PROFILE
SCALE: AS SHOWN

DWG NUM: BB / C-03
SHEET 03 OF 10

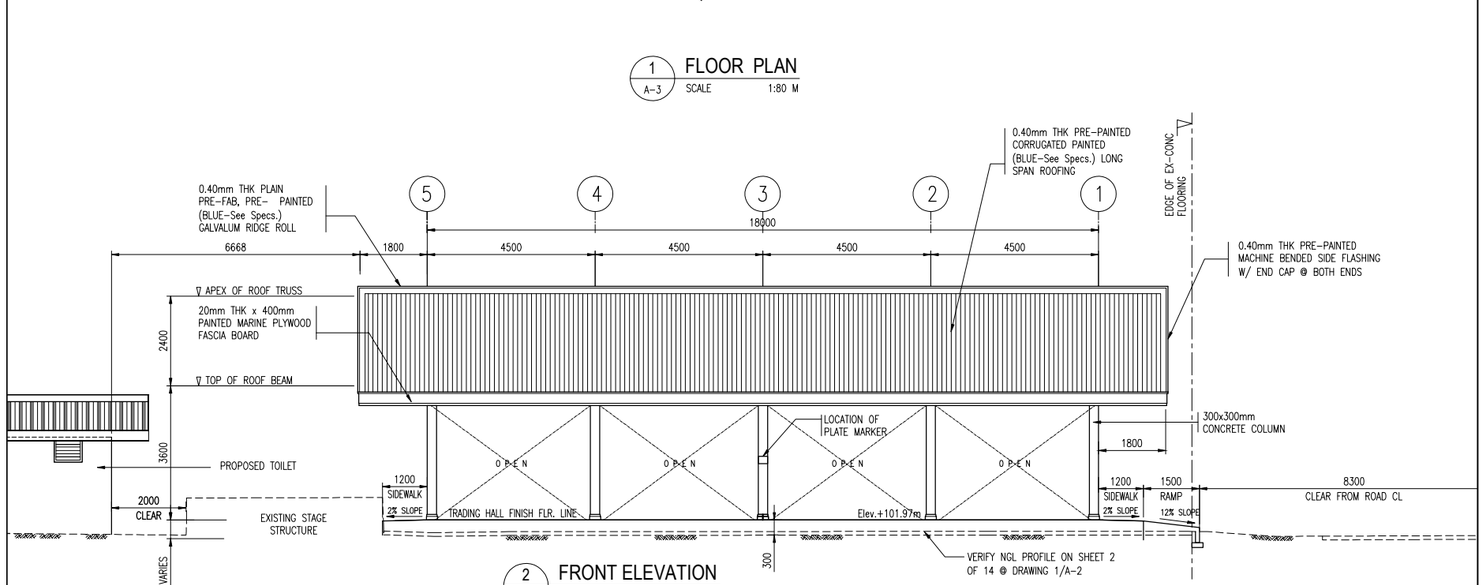
Aguinaldo Trading Center Construction



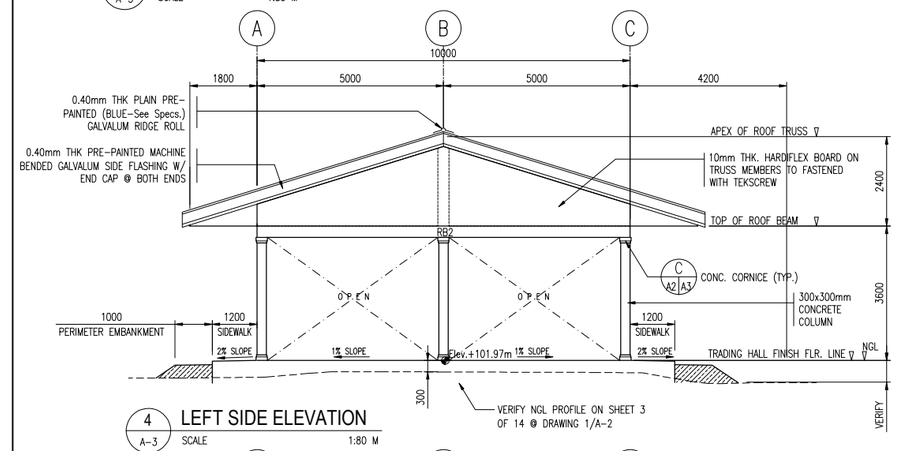
1 A-3 FLOOR PLAN
SCALE 1:80 M



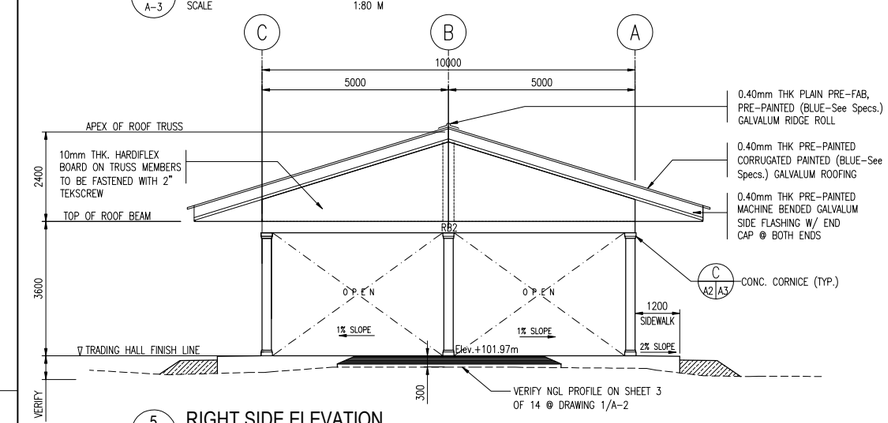
3 A-3 CROSS SECTION
SCALE 1:80 M



2 A-3 FRONT ELEVATION
SCALE 1:80 M



4 A-3 LEFT SIDE ELEVATION
SCALE 1:80 M



5 A-3 RIGHT SIDE ELEVATION
SCALE 1:80 M

USAID's Growth with Equity in Mindanao Program

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IMPLEMENTING FIRM: THE LOUIS BERGER GROUP, INC.
Engineers • Planners • Scientists • Economists
Unit 3, 12th Floor, Exportbank Plaza, Gil Puyat cor. Chino Roces Ave., Makati City

SUBPROJECT NAME: AGUINALDO TRADING CENTER CONSTRUCTION
LOCATION: BRGY. AGUINALDO, LAAK, COMVAL

PRIMARY PROPONENT: MUNICIPAL GOVERNMENT OF COMVAL
CONFORMED BY: HON. Arturo T. Uy - Provincial Governor

ENGINEER OF RECORD: DINDO SUGEROLAGA, CIVIL ENGINEER
DATE: –
REG. No. 0082358
Date :07-09-98
PTR No. 8928339A
Date :04-13-10

RECOMMENDING APPROVAL: MA. VILMAN. BELCHES, ASST. PROJ. MANAGER
DATE: –

APPROVED BY: CEBENERIO CHARLO A. DISPO JR., INFRA. CONST. TEAM LEADER
DATE: –

CHECKED BY: DATE: –
DRAWN BY: LORINO S. BALDEZAMO DATE: 13-05-12

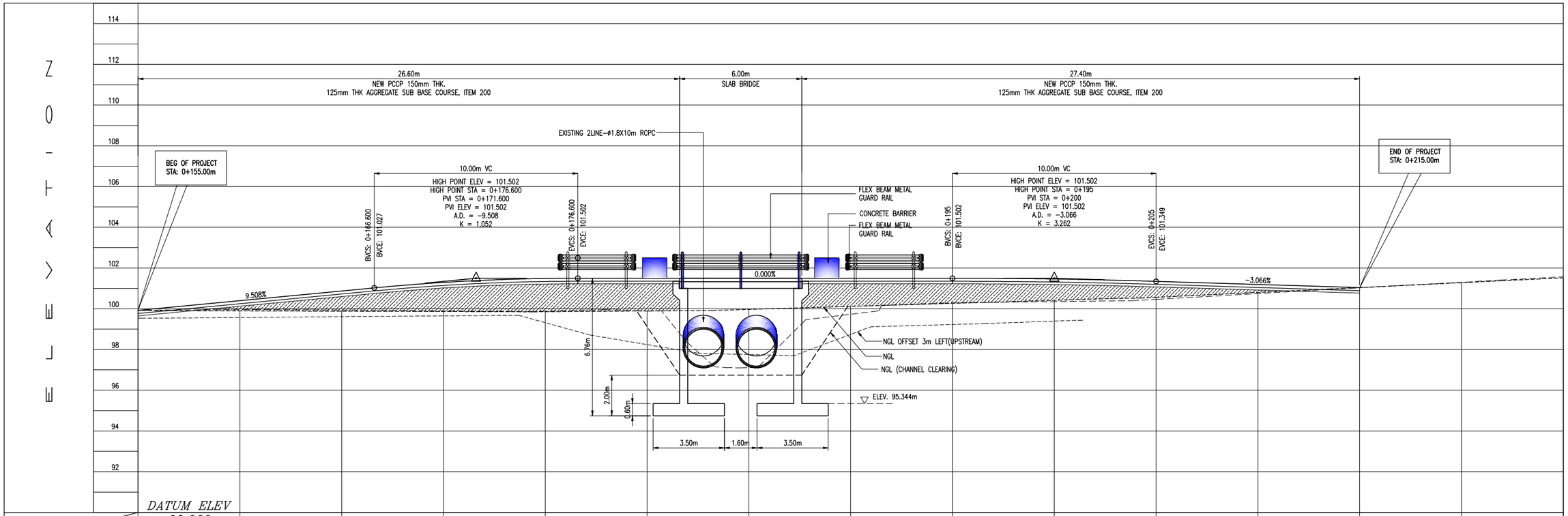
REVIEWED BY: MA. VILMAN. BELCHES DATE: –
EDITED BY: MANNY W.B. AMOR DATE: –

NO.	DATE	ISSUE / REVISION
1	13-05-18	FOR REVIEW & COMMENTS – 1
2	13-05-22	FOR BIDDING / PROJECT PACKAGING
3	13-06-01	FINAL ISSUE AND PERMIT

SHEET CONTENTS: FLOOR PLAN, FRONT ELEVATION, CROSS SECTION, LEFT AND RIGHT SIDE ELEVATIONS
SCALE: AS SHOWN

DWG NUM: TC A-3
SHEET 3 OF 14

Panag Barangay Bridge Rehabilitation



DATUM ELEV
90.000

NGL / FINISH GRADE	0+160		0+170		0+180		0+190		0+200		0+210		0+220	
NGL	99.92	99.90	99.88	99.86	99.85	99.89	99.97	100.12	100.26	100.42	100.56	100.80	101.04	101.28
FINISH GRADE	99.924	100.399	100.875	101.295	101.490	101.502	101.502	101.502	101.502	101.464	101.349	101.195	101.042	101.52
OFFSET 3m LEFT (UPSTREAM)	99.93	99.96	99.94	99.90	99.89	99.88	97.11	99.73	100.29	100.35	100.46	100.75	101.03	101.30	101.57
OFFSET 5.3m LEFT (DOWNSTREAM)	99.54	99.57	99.61	99.65	99.32	98.24	97.75	98.74	99.23	99.39				

A / C-4 ROAD DESIGN PROFILE
SCALE 1:110m

\\wlma\PROJECT PACKAGE\PACKAGE 2\Drawing\PIP-12_Panag Barangay Bridge Construction_BB_cmvl_mnv\dwg\0\PIP-12_13 May 31-DrawingC_C2-C10-Panag Barangay Bridge Construction.dwg, 6/1/2013 5:46:43 AM, DWF6 ePlot.pc3

USAID's Growth with Equity in Mindanao Program
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USAID Contract No. 492-C-00-08-00001-00

IMPLEMENTING FIRM: THE LOUIS BERGER GROUP, INC.
Engineers • Planners • Scientists • Economists
Unit 3, 12th Floor, Exportbank Plaza, Gil Puyat cor. Chino Roces Ave., Makati City

SUBPROJECT NAME: PANAG BARANGAY BRIDGE REHABILITATION
LOCATION: BRGY. PANAG, NEW BATAAN COMPOSTELA VALLEY

PRIMARY PROPONENT: PROVINCIAL GOVERNMENT OF COMPOSTELA VALLEY
CONFORMED BY: HON. Arturo T. Uy – Provincial Governor

ENGINEER OF RECORD: DINDO SUCEROLAGA, CIVIL ENGINEER
DATE: –
REG. No. 0082358 Date :07-09-98
PTR No. 8928339A Date :04-13-10

RECOMMENDING APPROVAL: MA. VILMANY BELCHES, ASST. DEP MANAGER
DATE: –

APPROVED BY: CEBENERIO CHARLO A. DISPO JR., INFRA. CONST. TEAM LEADER
DATE: –

CHECKED BY: DATE: –
DRAWN BY: LORINO S. BALDEZAMO DATE: –
EDITED BY: MANNY W.B. AMOR DATE: –
REVIEWED BY: MA. VILMA N. BELCHES DATE: –

NO.	DATE	ISSUE / REVISION
1	13-05-20	FOR REVIEW & COMMENTS – 1
2	13-05-31	FOR BIDDING / PROJECT PACKAGING
3	–	FINAL ISSUE AND PERMIT

SHEET CONTENTS: ROAD DESIGN PROFILE
SCALE: AS SHOWN

DWG NUM: BB / C-4
SHEET 04 OF 15

Annex G

Concept Proposals for Immediate Follow-up Activities

- Ateneo TropICS
- Mines and GeoSciences Bureau - DENR
- Kahublagan sang Panimalay Foundation, Inc.

Concept Proposal provided by:

Tropical Institute for Climate Studies (TropICS) / Ateneo de Davao

Concept Proposal provided by:

Tropical Institute for Climate Studies (TropICS) / Ateneo de Davao

Climate Change Capacity Assessment of the Provinces of Davao Oriental and Compostela Valley

Background: The provinces of Compostela Valley and Davao Oriental (in Region XI) sustained heavy damage to forest, upland, and coastal ecosystems due to the onslaught of Typhoon Pablo (international name "Bopha"). While already in an imperiled state brought about by logging and mining activity, the provinces' watersheds have been severely affected by the further denudation of forest cover from the typhoon. This will cause additional risks during future typhoons as watersheds are a natural environmental defense from floods, debris flow, and other physical manifestations of typhoons. Similarly, coastal ecosystems have been affected, such as mangrove areas, provide natural barriers from waves and saltwater intrusion. With the resultant destruction of large portions of mangrove forests, especially in Davao Oriental, coastal villages are made more vulnerable to possible wave surges and coastal inundation from future storms.

The advent of climate change, which may cause enhanced extreme weather events, has made recurring typhoons with a similar or stronger intensity a distinct possibility. In this regard, USAID-Philippines conducted a Rapid Climate Change Vulnerability Assessment in selected affected municipalities of both provinces. This rapid assessment provided an initial, summarized analysis of the potentialimpacts of climate change on various sectors. The rapid assessment concentrated on the hazards on the particular municipalities.

An immediate need is to increase the resilience of people, places and livelihoods to a changing climate. This is an important aspect of in the reduction of risk using the UN Framework of Analysis in which ***vulnerability*** is a function of (***exposure x sensitivity***)/***capacity***. Once the capacity of the community has increased, then the risk decreases.Since a thorough hazard analysis has been done and an initial vulnerability assessment has been conducted these can be integrated to the next stage of the project which is to assess capacities.

Scope of Work

Conduct a Capacity Assessment to Climate Change in 8 municipalities affected by Typhoon Pablo in the Provinces of Compostela Valley and Davao Oriental, which will:

- Consolidate existing resources, risk assessment results and recommendations on climate change vulnerabilities from key agencies, institutions and local government units (LGUs).

- Assess the vulnerability of the selected municipalities to climate change within the planning timeframes to identify areas and sectors most likely to be affected. This qualitative assessment will be based on available projections, scenarios, methods and parameters currently applied in the Philippines to ensure consistency and utility of the results.

Phases	Objective	Activity	Resources Needed	Timeframe	Deliverables
1	Finalize Proposed	Inception Meeting			Proposals and Deliverables Finalized
2	Evaluate the two provinces vis a vis the UN framework of Risk	Secondary Data Gathering	All consolidated risk and vulnerability assessment done in the past (GEM, UP-NIGS, Eva Mendoza's Work	1 week	
		Risk Assessment	Risk AssessmentTeam and GIS Team	1 week	Multiple Risk Map Vulnerability Map
	Assess the most vulnerable barangay from multiple risk and vulnerability analysis	Participatory Capacity and Vulnerability Analysis process Probable FGD and KII's	Team goes to field. Meet with previous contacts build during the vulnerability assessment projects	2 weeks	Thorough Analysis of Combined Hazard and Vulnerability Assessment
	Generateprograms, projects and activities (PPA's)			1 week	PPA's generated vis-a-vis risk analysis
	Propose to LGU's themainstreaming of PPA's		FGD's and KII	1 week	Propose incorporation to LGU planning process
Phase 3	Finalize Report			1 week	Final Report

Department of Environment and Natural Resources
MINES AND GEOSCIENCES BUREAU
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Republic of the Philippines
Department of Environment and Natural Resources
MINES AND GEOSCIENCES BUREAU
Regional Office No. XI
669 Konsuela Bldg., Aurora Quezon Street, Davao City
Tel. No. (082) 222-5601 Telefax No. (082) 221-6535 Email: mines@mgbxi.com

A PROPOSAL ON THE REPRODUCTION AND PROVISION OF THE 1:10,000 SCALE GEOHAZARD MAPS AND OTHER IEC MATERIALS TO THE LOCAL GOVERNMENT UNITS IN REGION XI

1. Introduction

The Mines and Geosciences Bureau-XI is currently undertaking the detailed 1:10,000 Geohazard Mapping and Assessment covering the whole region. This activity commenced last 2011 and is targeted to be completed by 2014. In view of the importance of geohazard maps in providing information and guidance for the enhancement of the provincial/city/municipal agendas, programs and policies related to disaster risk reduction, MGB-XI would like to initiate an IEC program particularly focused in providing copies of available detailed geohazard maps of each municipal/city to local government units (LGU) affected by Typhoon Pablo.

The proposal presents the coverage and outline of the IEC program design and required budgetary and material requirements for the said undertaking.

2. Implementation and Time-Frame

2.1 Key Activities

The key activities that will be undertaken for the IEC program is primarily the finalization and lay-outing of the available 1:10,000 scale geohazard maps to be printed in a tarpaulin and will be distributed to the concerned local government unit for their utilization, information and guidance. This activity is also aimed to provide access to the geohazard information contained in the said maps to local and non-local clientele of the said government office. The target municipalities include those devastated by Typhoon Pablo namely (Davao Oriental Province) Boston, Cateel, Baganga, (Compostela Valley Province) New Bataan, Nabunturan, Laak, Monkayo and Montevista.

The secondary activity would be the putting up of warning signage in identified critical areas which are heavily populated or regions frequented by local residents. These signages will serve as a notification to the locals within the area of the geohazards present and its impending danger.

2.2 Time-Frame

The project implementation for the reproduction of the geohazard maps will cover the eight municipalities that was hard hit by the Typhoon Pablo event which have been mapped and assessed by the Mines and Geosciences Bureau Central and Regional Office and will entail a total of six weeks for the finalization and lay-outing as well as reproduction and printing of the maps and finally distribution to the concerned LGUs.

For the warning signage, a week will be spent identifying at least three critical areas per municipality wherein a warning sign will be most useful in alerting locals to the dangers present. Three weeks will be utilized for the physical production of these signages with the actual distribution and installation conducted in the 5th and 6th week of the project. Refer to Gantt Chart for specific schedule of activities.

GANTT CHART

ACTIVITY	WEEKS					
	1	2	3	4	5	6
Finalization and Lay-outing of geohazard maps						
Printing and reproduction of maps						
Distribution to the LGU's						
Identification of critical areas for signage installation						
Production of signages						
Distribution and installation of signages						

3. Project Output

The expected outputs of this proposed project are the following:

a] Eight (8) 2400mm x 1700mm printed municipal geohazard map tarpaulins containing the results of the 1:10,000 scale geohazard

mapping and assessment of MGB which will be distributed to the target municipal LGUs.

b] Twenty four (24) geohazard warning signs installed in different critical areas of the target municipalities (3 signs/municipality).

c] Accomplishment report detailing the different activities undertaken within the project including hard copies of maps and photo documentation of turn-over and installation of tarpaulin geohazard maps and warning signages.

4. Financial Consideration

The budgetary requirement is presented hereunder in breakdown, to wit:

*Budgetary Requirement (**net of tax**)*		*Amount in Php*
Tarpaulin (piece) *x 8 municipalities*	*1,000.00*	8,000.00
GIS Geologist (day) *x 10 days*	*2,000.00*	20,000.00
Signage (piece) *x 3 signs x 8 municipalities*	*5,000.00*	120,000.00
Distribution of Maps and Installation of Signage		
Geologist (day) *x 2 personnel x 10 days*	*2,000.00*	40,000.00
Support Staff (day) *x 2 personnel x 10 days*	*1,000.00*	20,000.00
Driver (day) *x 1 personnel x 10 days*	*1,000.00*	10,000.00
Local Hire (day) *x 2 personnel x 10 days*	*500.00*	10,000.00
Fuel		20,000.00
Food (person/meal) *x 5 person x 3 meals x 10 days*	*150.00*	22,500.00
Accommodation (night) *x 8 nights*	*3,000.00*	24,000.00
Supplies		10,000.00
	TOTAL	**304,500.00**

Kahublagan sang Panimalay Foundation Inc.

Kahublagan sang Panimalay Foundation Inc.
25B Magsaysay Village, La Paz, Iloilo City 5000 Philippines. Tel/Fax 63 33 3297362.
kahublagan@pldtdsl.net www.philwatershed.net

May 28, 2013

Dr.Mike Ross
Executive Director
The Louis Berger Group Inc.

Dear Mike:

I thank you for inviting us to submit a concept paper on how to start watershed activities in Davao Oriental-Compostela Valley watersheds – the area which was affected by the recent typhoon so that assistance can be extended to the beneficiaries in a sustainable way.

Attached is a one-page concept paper, as requested, which I based on how our Foundation work in the watersheds for the last 20 years. The methodology was improved year after year giving cognizance to new perspectives and available technologies. I hope this will fit the requirements of the locality.

I expect your feedback and reactions to this concept. Hoping to hear from you soon.

Sincerely,

Jessica C. Salas

Mobilizing for Watershed Management: the *Kahublagan* approach

The way of looking at watersheds today has changed, as climate and its impact have brought changes to the watersheds. The watershed human ecology dominates the new perspective. Watershed is not only limited to natural resources but more so how humans and their institutions have transformed watersheds. After all, there is no such thing as a pure natural environment as organisms continue to make changes; and not just humans who have transformed landscapes into rice terraces and have used infrastructures to create new water divides.

The human ecology of watersheds, according to FAO, consists of a set of human factors surrounding and modifying watershed resources. These are: (a) population dynamics, (b) policies, norms and laws, (c) local livelihoods and (d) external interests. The new way of managing the watershed, is to look at how a population of humans modify their environment, how these modifications affect their lives and livelihood, and how their institutions and externalities sustain or modify these changes.

Based on this anthropologic view of the watershed, a mobilization plan is designed. The objective is for an institution, a local government unit to facilitate the decision of its constituents in protecting themselves, their assets or their livelihood base for the welfare of and safety of all and to balance its participation in the broader economic, social and political systems without sacrificing equity and quality of life. There are four (4) basic activities to attain this goal:

1. implementing public education for watershed
2. integrating watershed in the development plan
3. initiating community action
4. linking the watershed to a river basin or a cluster of watersheds.

If the stakeholders in the watershed have to participate in making decisions to optimize the use of their resources in the most equitable and efficient way, these stakeholders have to understand the workings, the functions and the relationships within the watershed. In Iloilo, *Kahublagan* used a radio program with barangay information centers as the vehicles for public education.

Watershed management should be a part and parcel of the broader development plan of the local government unit. While alliances can be created due to nature of watersheds, commitment to the plans of the watershed and the alliance can be integrated into the local development plan and annual investment plan. Local ordinances can be instituted to support the integration particularly in creating structures, functions and management processes in the watershed.

Community action is initiated through barangay information centers, focusing on the interest in the natural resources and how livelihood can be sustained as people respond to the issues in their own micro watershed. The community action plan could be an extension of the watershed management plan to include livelihood, disaster risk reduction, and adaptation to climate changes.

Sustainability should be addressed by looking at the broader catchment if the management unit is a sub-watershed of a river basin. Use of modeling systems especially the Decision Support System or DSS, help in understanding river basins and large watersheds. The organization has to link with the river basin organization to know the impact of activities in various sub watersheds on each other and on the basin as a whole. Salas J. jessica_c_salas@yahoo.com

KAHUBLAGAN SANG PANIMALAY FOUNDATION, INC.

Activity List

Based on the concept submitted, the following are the detailed actions for Mobilizing for Watershed Management

1.0 PUBLIC EDUCATION

1. **Objective:** To enable a broad-based participation of stakeholders in a demo-watershed organization and management.

2. **Outputs:**
   2.1 xxx number of Information Officers at the provincial and municipal level who have the knowledge of watershed functions and the purpose of watershed management and the skill to communicate them.
   2.2 A re-entry plan for each province with contents and methodology and action plan for communication.

3. **Expected Outcome:** A communication support for provincial administrative and legislative actions; creating a watershed consciousness among the stakeholders in the demo-watershed.

4. **Content/topics**
   4.1 Knowing your watershed
      a. rivers
      b. ridges, end points
      c. watershed divide
      d. by doing transect walk, talking to people about water flow in the village, check on available maps, trace connections of rivers and watershed divide beyond the village
   4.2 Understanding the issues, the catalyst of organizing
      a. Make a people's list of issues and talk about them.
      b. Make a people's list of practices/way of life and make a tentative guess as to how these affect the list of issues. Emphasize that responses are tentative and are guesses.
      c. Check local understanding on relationships between following topics; ask people.
         a) Between land and water use
         b) Between surface water and ground water
         c) Between water quantity and quality
         d) Between upstream and downstream
         e) Between the freshwater system and the coastal waters
      d. Allow the issues list to educate the people about the ecosystems in the watershed and the externalities. Discover some myths.

5. **Method:**
   - Workshop with Information Officers of the two provinces and representatives from IO's of concerned upland towns or interested NGOs/ local media
   - Coaching
   - Monitoring

- Feedback
- Determine impact

6. **Time table**: for the whole plan is 6 months.

7. **Limitations for LBII plan:**
   - Because of the limited period of implementation (6 weeks), what we can do is just to share in a workshop what we did in our program and what was the result. This could only be done in one hour presentation including questions and answers and integrated in planned workshops of the project. Attending communication professionals may integrate our radio public education program in their own program intended for the ComVal/Oriental Davao area. (Meru and Mendoza component)

8. **Estimated cost:**
   Preparatory time - 3 hours
   Delivery time - 1 hour
   Professional rate - P10,000/day

B. INTEGRATING WATERSHED IN LOCAL DEVELOPMENT PLANS

1. **Objective:** To create a structure and identify functions for integrated watershed management

2. **Outputs:**
   2.1 List of reasons why collaboration of LGUs is needed
   2.2 Action plan for alliance building or the Watershed Organization
   2.3 Municipal action plan for participation in the Watershed Organization

3. **Expected Outcomes:**
   3.1 Collaboration among stakeholders within the watershed
   3.2 Creating a need for the rationalization/integration of upland-lowland-coastal programs and projects.

4. **Content**
   4.1 Organizing for LGU-led watershed management
      a. Use topographic map to define a particular chosen watershed
      b. Identify ecological zones within the watershed
      c. Determine LGU boundaries
      d. Explore with neighboring LGUs possibility of working together in the same watershed
      e. Prepare action program towards an alliance
   4.2 Integrate watershed management in the LGU development process (long term)
      a. Legislate watershed organizations & preparation of the watershed mgt plan
      b. Inclusion of watershed management program in the provincial development plan framework
      c. Integration of the watershed plan in the Municipal Development Plan & Annual Investment Plan processes
      d. Monitoring and evaluation at the municipal/ provincial/ watershed levels

5. **Method:**

- Pre-workshop activities: (2 days)
  - Identification of sub watershed
  - Identify river system
  - Identify political boundaries (provincial, municipal, barangay)
  - Identify populated areas and various land uses (by GIS?)
  - Identify other bio-physical characteristics by GIS maps
  - Get consensus from key informants on a demo watershed which includes upland, low land, coastal, areas.
  - Get a profile of invitees to the workshop (the stakeholders)
  - Familiarize with administrative structure, political leaders and possible champions
  - Prepare workshop design
- Workshop Proper 2 days
- Post Workshop – 2 days, preparation of report, clarification/ confirmation

Assumptions:

1. This workshop is part of the project workshop.
2. The expected outputs will help in charting the next steps for the alliance or Watershed Organization and the member municipalities of the Watershed Organization.
3. Next steps may be determined by the participants.
4. It is assumed that understanding and protection of small and micro watersheds will strengthen resiliency of people living in such watersheds as they know what the hazards are, where the vulnerable areas are, where are the safe places, and what is the strength of their communities. These were identified by a different component of the study. The community DRRM plan will not also be conducted as it is assumed that such plan is already in place.
5. Because of the limited time (6 weeks) it is not possible to conduct actual watershed planningexercise. These can be undertaken by the LGU with the help of national government agencies in the region; including monitoring of the plans prepared.
6. Estimated cost:

   Pre-workshop – 2days
   Workshop proper – 2 days
   Post workshop - 2 day
   Documentation 3 days at P 2,500/day or P7,500
   Workshop assistant facilitator, 2 days at P2,500 or P5,000
   Professional fee, 6 days @ P10,000 or P60,000
   Total is P72,500