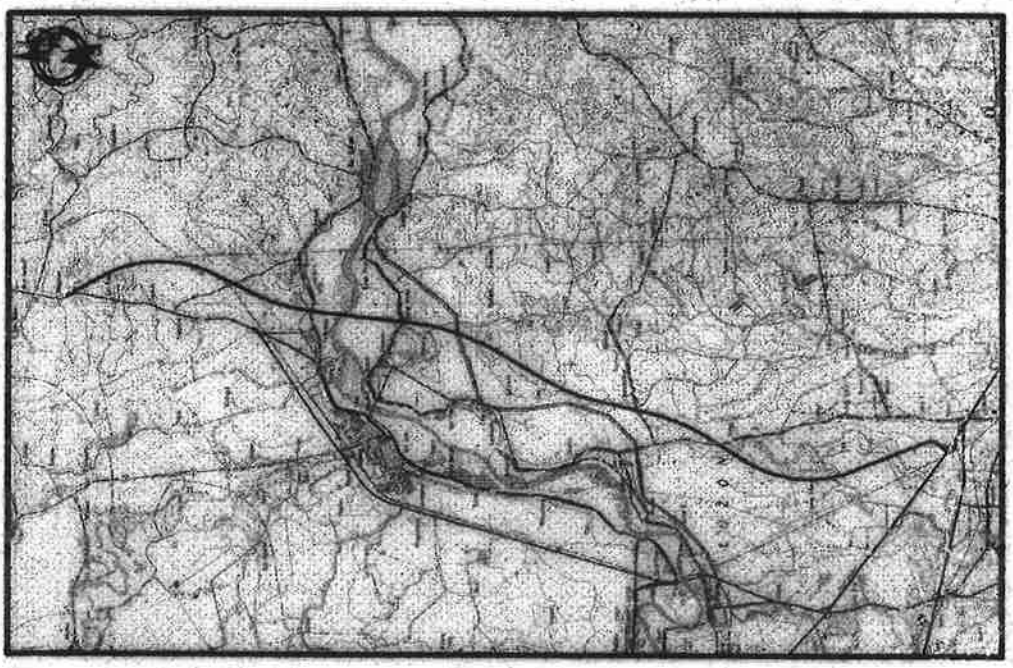
Department of Environment and Natural Resources
Environmental Management Bureau

Environmental Impact Statement
for the

Plaridel Bypass Project

(Under the JICA-Assisted Detailed Design Study on Upgrading of Inter-Urban Highway System Along the Pan-Philippine Highway)



Submitted by:

Department of Public Works and Highways

KATAHIRA & ENGINEERS INTERNATIONAL
YACHICO ENGINEERING CO., LTD
ECOSYS Corporation

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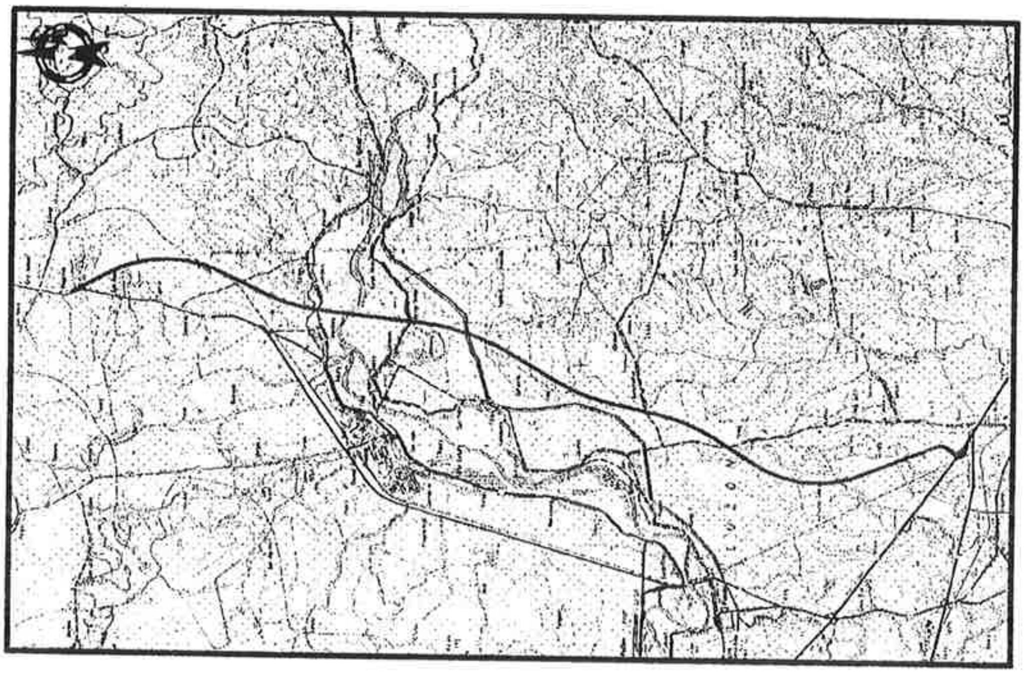

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ABBREVIATIONS AND ACRONYMS

AASHTO	American Association of State Highway and Transport Officials
AFMA	Agricultural and Fisheries Modernization Acts
ALMED	Agricultural Land Management and Evaluation Division
ARI	Acute Respiratory Tract Infection
BCWSP	Bulacan Central Bulk Water Supply Project
BIR	Bureau of Internal Revenue
BL	Bill Length
BOD	Biological Oxygen Demand
BRC	Barangay Registration Committee
BSD	Bird Species Diversity
BSU-ANEC	Benguet State University-Affiliated Non-Conventional Energy Center
BSWM	Bureau of Soils and Water Management
CADC	Certificate of Ancestral Domain Claim
CARO	City Agrarian Reform Office
CARP	Comprehensive Agrarian Reform Program
CBD	Central Business District
CENRO	Community Environment and Natural Resources Office
CHD	Congestive Heart Disease
CHF	Congenital Heart Failure
CLSU-ANEC	Central Luzon State University-Affiliated Non-Conventional Energy Center
CLUDP	Comprehensive Land Use and Development Plan
CLUP	Comprehensive Land Use Plan
CPDC	City Planning and Development Coordinator
CRA	Cardio Respiratory Arrest
CRF	Chronic Renal Failure
CVA	Cardio Vascular Accidents
DAR	Department of Agrarian Reform

DENR	Department of Environmental and Natural Resources
DIA	Direct Impact Area
DPWH	Department of Public Works and Highways
DPWH PMO-FS	Department of Public Works and Highways Project Management Office-Feasibility Study
DSWD	Department of Social Welfare and Development
DECS	Department of Environment Culture and Sports
DOH	Department of Health
ECC	Environmental Compliance Certificate
EGGC	Engineering Geological and Geohazard Characterization
EGGC	Engineering Geological and Geohazard Characterization
EGGAR	Engineering Geological and Geohazard Assessment Report
EIA	Environmental Impact Assessment
EIARC	EIA Review Committee
EIS	Environmental Impact Statement
EL	Ear Length
EMB	Environmental Management Bureau
FL	Forearm Length
FMNH	Field Museum Natural History
GOJ	Government of Japan
GOP	Government of the Philippines
HB	Head Breadth
HBL	Head and Body Length
HF	Hind Foot
HLL	Hind Limb Length
HLRB	Housing and Land Use Regulatory Board
HUDCC	Housing and Urban Development Coordinating Council
HVD	Hypertension Vascular Disease
IIA	Indirect Impact Area
IRA	Internal Revenue Allotment

JICA	Japan International Cooperation Agency
LARR	Land Acquisition Resettlement and Rehabilitation
LGU	Local Government Unit
LMB	Land Management Bureau
MARO	Municipal Agrarian Reform Office
masl	meters above sea level
MGB	Mines and Geosciences Bureau
MMT	Multi-Partite Monitoring Team
MPN	Most Probable Number
mps	meter per second
NAMRIA	National Mapping and Resource Information
NEA	National Electrification Administration
NEPC	National Environmental Protection Council
NEDA	National Economic Development Authority
NGO	Non Government Organization
NHA	National Housing Authority
NIPAS	National Integrated Protected Areas System
NPAAAD	Network of Protected Agricultural Areas and Agro-Industrial Development
NPCC	National Pollution Control Commission
NSO	National Statistics Office
PAFs	Project Affected Families
PAGASA	Philippine Atmospheric Geophysical and Astronomical Services Administration
PAPs	Project Affected Persons
PARO	Provincial Agrarian Reform Office
PCM	Public Consultation Meeting
PENRO	Provincial Environment and Natural Resources
PGA	Peak Ground Acceleration
PFZ	Philippine Fault Zone
PHIVOLCS	Philippine Institute of Volcanology and Seismology
PO	Peoples Organization

PPFP	Provincial Physical Framework Plan
PTB	Pulmonary Tuberculosis
RAP	Resettlement Action Plan
RHU	Rural Health Unit
ROW	Right-Of-Way
SDP	Social Development Program
SAFDZ	Strategic Agricultural and Fishery Development Zone
SEC	Species Effort Curve
SEP	Socio-Economic Profile
SVL	Snout-Vent Length
SWIP	Small Water Impounding Project
TaL	Tail Length
TB	Tuberculosis
TD	Tax Declaration
TESDA	Technical and Educational Skills Development Administration
TL	Total Length
TRIIS	Talavera River Integrated Irrigation System
TSP	Total Suspended Particulate
TSS	Total Suspended Solids
TV	Tail Vent
UPRIIS	Upper Pampanga River Integrated Irrigation System
URI	Upper Respiratory Infection
UTI	Upper Respiratory Infection

BASIC INFORMATION

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Executive Summary

EXECUTIVE SUMMARY

BRIEF DESCRIPTION OF THE PROJECT

The Government of Japan (GOJ) conducted the "Feasibility Study on Upgrading Inter-Urban Highway System Along the Pan-Philippine Highway (Sta. Rita, Guiguinto–San Jose Section)" in July 1998 in response to the request of the Government of the Philippines (GOP). The Japan International Cooperation Agency (JICA), which is the official agency responsible for the implementation of the technical cooperation programs of GOJ, organized and dispatched a Study Team to undertake the said study.,

The Study Area included the road section of the Pan-Philippine Highway from Sta. Rita, Guiguinto, Bulacan, to San Jose, Nueva Ecija. It starts at around 40 km north of Metro Manila and extends for another 123.5 km. Along this section of the Pan-Philippine Highway, small to medium size urban centers are situated at about 10 km intervals, where a ***ribbon type*** of development flourishes. Examples of these include those at Plaridel, Baliuag, San Rafael, San Ildefonso, and San Miguel in the Province of Bulacan, and Gapan, Sta. Rosa, Cabanatuan City, Talavera, and San Jose in the Province of Nueva Ecija. Along these urban sections, the arterial road function of the Pan-Philippine Highway is hampered due to the high composition of slow and undisciplined traffic such as tricycles and jeepneys.

Results of the Feasibility Study conducted showed that the populations of provinces that will be traversed by the proposed bypasses would grow by factors of 1.1, 1.23, and 1.4 of that of 1998 by the years 2005, 2010, and 2020, respectively. Future land use plans, from the regional down to the city and municipal levels indicate urbanization trends that would require **serious consideration of the existing functional serviceability of the road networks**.

To **help restore the arterial road function** of the existing Pan-Philippine Highway, the DPWH proposed the construction of the **Plaridel Bypass**. In effect, this would improve the Level of Service of the Highway from the present **E** (unstable flow with short stoppages) and **F** (forced on breakdown flow), to **B** (reasonably free flow, but speeds beginning to be restricted by traffic conditions).

The primary objectives of constructing the bypass are to:

i) Provide a free-flowing alternative route to through traffic motorists;

ii) Allow separation of slow and fast moving vehicles; and

iii) Provide a highway that follows international standards in terms of vertical and horizontal curvature, sufficient and regular shoulder widths, with limited number of intersections

The proposed **Plaridel Bypass** has total length of about **23.3 kilometers**, and the only bypass with an interchange (with respect to the Cabanatuan and San Jose Bypasses). The alignment shall start along the North Luzon Expressway in Brgy. Guiguinto, Bulacan, approximately **500 meters** north of the existing Burol Interchange in Burol 2nd, Balagtas, Bulacan. It will cross several municipalities in the Province of Bulacan, which include Guiguinto, Balagtas, Plaridel, Bustos, and San Rafael.

Since the alignment traverses areas designated as agricultural in the future land use plan and existing and future residential areas, which are mostly located at intersections with existing roads, the bypass alignment was divided into **two (2)** major areas – *1) Populated Areas,* and *2) Non-Populated Areas*. Frontage or service roads will be provided along commercial and populated areas. The proposed road Right-Of-Way (ROW) width for the bypass sections with frontage roads is **50.0 m**. For sections without frontage roads (non-populated or areas considered as productive agricultural lands), the ROW width will be **32.0 m**.

The planned bypass shall consist of **nine (9) Type A**, **four** (4) **Type C**, and **ten (10) Type B** intersections. There are **Seven (7)** access roads that will be made available to the communities traversed by the proposed alignment. It will also incorporate **ten (10)** short and medium bridges, including **one (1)** major bridge crossing the Angat River, which has a total length of **1,090.7 m**.

Due to financial constraints, construction of the bypass alignment will be done in **two (2)** stages, the **initial** and **ultimate** stages. In the initial stage, entire ROW requirement of 50 m along sections with frontage roads and 32 m in areas without frontage roads will be acquired.

The construction cost will be through a soft loan from the Japan Bank for International Cooperation. The project cost in the initial phase of the project amounts to **Million 452.4** and **Million 386.3 Pesos** during the ultimate stage. The total project cost for both stages is **Million 838.7 Pesos** or tantamount to **Million 1,996.1 Yen**.

BRIEF DESCRIPTION OF DATA GATHERING

The Environmental Impact Assessment (EIA) for the proposed Plaridel Bypass Project was conducted from May to October 2001. The approach and methodology adopted are based on the Procedural Flow of the Environmental Impact Statement (EIS) System prescribed under Article III of the DENR Administrative Order No. 96-37, series of 1996.

Gathering and Collection

Baseline information on the project area were established through primary and secondary data gathering procedures.

A series field investigations and alignment walk-throughs were conducted along the alignment in the duration of the EIA study (i.e. May-October 2001) to verify and validate the secondary information obtained from different concerned government agencies and to collect additional baseline data needed in the preparation of this report. Several government entities visited include the Provincial Government of Bulacan, Municipal Governments of Balagtas, Guiguinto, Plaridel, Bustos, and San Rafael, Philippine Atmospheric Geophysical and Astronomical Services Administration (PAGASA), Mines and Geosciences Bureau (MGB), Bureau of Soils and Water Management (BSWM), and Philippine Institute of Volcanology and Seismology (PHIVOLCS).

With respect to the **ambient air** and **water quality, noise level, terrestrial flora and fauna,** and **socio-economic** aspects, actual samplings and field surveys within the study area were carried out.

Air quality and noise level monitoring at selected sites were simultaneously undertaken from 09-10 June 2001. Water sampling at the downstream and upstream portions of the rivers, creeks and irrigation canals crossed by the alignment was carried out from 29-31 July 2001. Studies on the existing terrestrial and aquatic fauna were conducted from 04-06 June and 16-17 October 2001, respectively. Identification of the flora species along the alignment was done on-site in the duration of the study.

Socio-economic interviews in the direct impact area started in July and were concluded in September 2001.

PROJECT SCOPING

The Proponent formally presented the proposed Plaridel Bypass Project to the selected Environmental Impact Assessment Review Committee Members (EIARC) on 28 May 2001 at the Environmental Management Bureau (EMB) Conference Room. The meeting was conducted to determine the appropriate scope and level of environmental assessment to be used for the proposed undertaking, and also to ensure the project's compliance with the procedural requirements of the Department of Environment and natural Resources (DENR) for the issuance of the Environmental Compliance Certificate (ECC).

The Formal Scoping Session was held on the afternoon of June 23, 2001 at the Bustos Multi-Purpose gymnasium, Bustos, Bulacan. The meeting was well represented and attended by the stakeholders in the project area. After the Open Forum, the Agreed Upon Studies To be Undertaken and Agreed Upon Issues to be Addressed by the EIA were signed by the stakeholders.

A joint site inspection along the bypass alignment attended by the members of the EIARC, a representative of EMB-DENR EIA Division, and EIA Team was conducted in the morning of June 23, 2001, prior to the formal scoping session.

A Scoping Report was prepared and submitted by the EIA Preparer to the EMB on. **July 2001.** A letter acknowledging the said report and the matrices of the Agreed Upon Scope of Work to be Included in the EIS Study are attached as **Appendices A** and **B**, respectively.

BRIEF DESCRIPTION OF PROJECT ENVIRONMENT

The proposed Plaridel Bypass alignment will traverse five (5) municipalities in the province of Bulancan, namely, Balagtas, Guiguinto, Plaridel, Bustos, and San Rafael.

The connecting point of the Bypass along the North Luzon Expressway will be at around **500** meters north of the existing Burol Interchange, located at Brgy. Borol 2nd, **Balagtas**, where it proceeds on an northeasterly direction towards Brgy. Tiaong of **Guiguinto**. The alignment then continues towards Brgys. Pulong Gubat and Cutcut, still in the Municipality of **Guiguinto**. It then enters paddy fields at the Municipality of **Plaridel** through Brgys. Bulihan and San Jose, then enters vast agricultural lands in Brgys. Camachilihan, Talampas, Liciada, and Malamig, all in the Municipality of **Bustos**. It then continues towards the last barangay in Bustos, Bonga Menor, before it crosses the Angat River on the way to Brgy. Tambubong of **San Rafael**. It will maintain a northeasterly direction, traversing through Brgys. Caingin and Capihan, until it veers to the northwest towards Brgy. San Roque. The Bypass rejoins the Pan-Philippine Highway at Brgy. Maguinao, San Rafael, a few hundred meters away from the Maguinao High School.

In the assessment of the project's possible impact to the host communities, **Direct Impact Area (DIA)** and **Indirect Impact Area (IIA)** were delineated. As defined in the approved Scoping Report for this project, the primary or direct impact zones of the bypass project are those within the required ROW of 32 meters along areas without frontage roads and 50 meters in areas with frontage or service roads, and will entail physical displacement of houses, loss of means of livelihood, loss of properties and improvements. On the other hand, IIAs are areas to be indirectly affected by the possible increase in noise levels, possible increase in TSP levels and other air pollutants such as SO_X and NO_X.

Physico-Chemical Aspects

Geology

The geology of the area traversed by the bypass project is divided into alluvial sediments blanketing the low lands and bedrock occupying the eastern highlands of Bulacan Province. This formation and the quaternary pyroclastic underlie the alluvium at the eastern margin of Bulacan

Guadalupe Formation includes two (2) members, the older marine littoral conglomerate named Alat Conglomerate and the Diliman Tuff (*Gonzales, Ocampo & Espiritu, 1971*).

The **Alat Conglomerate** consist of poorly sorted, well-rounded pebbles, cobbles and boulders of the under laying igneous, metamorphic and sedimentary rock types cemented by a course grained calcareous sandy matrix.

The entire sequence of **Diliman Tuff** is almost flat lying or with a very gentle westerly dip, thin to medium bedded and regularly stratified and consist of tan or light gray fine-grained vitric tuff, welded volcanic breccia with subordinate amount of tuffaceous fine to medium grained sandstone. Dark minerals, pumiceous and scoriaceous materials are scattered in the glassy tuff matrix.

Quaternary deposits in the alluvial plains of Bulacan are mainly alluvial and fluvial sediments derived from the highlands of the Sierra Madre Mountains. The hilly areas are covered by residual soil and slope colluvium derived from the weathering of the underlying bedrock.

Weathering and decomposition has formed a layer of residual and colluvial soil over older bedrock present in the study area. These cover the hillslopes on the northeastern and eastern foothills of Bulacan. Residual soils developed from the parent rocks are deeply weathered resulting to dark red to brownish red stiff clayey soil, with some relict features of the parent material.

Coalescing alluvial fan and slopewash materials deposited by the Angat River occur at the base of the bedrock hillslopes at the northeastern portion of the project area. These consist of moderately to loosely consolidated well-graded gravel arid sand, interspersed with silt and clay. The alluvial fans interfinger with fluvial deposits farther downslope.

Deposits in active channels, meander belts and the flood basin are similar in character to but younger than the fluvial and alluvial fan deposits (Qal_1). They consist of loosely consolidated, well-graded sand, gravel and boulders, with some silt. These deposits formed along the flood plains of the Angat River, and on the channels of their tributary streams and creeks.

Engineering Geohazard and Geological Characterization

An Engineering Geological and Geohazard Characterization (EGGC) report along the bypass route is submitted as a separate document.

Pedology

The soils in Bulacan are classified into five (5) major types namely: the Soils of the Coastal Landscape, which are generally coarse loamy and clayey fluvio-marine deposits found in former tidal flats. Soil units categorized under this type include the Dolongan Variant, Matimbo Series, Obando Series, and the Masantol Series. Immediately adjacent to the coastal landscape are the Soils of the Alluvial Landscape, composed of six (6) soil series in the low alluvial terraces and four (4) series in the river terraces and levees. Soils of this category represent about 18% of the Province's total land area.

The third geomorphic soil classification is found in the Piedmont Landscape with a total of seven (7) soil series. These are: 1) Mysan; 2) Pulong Buhangin; 3) Batia; 4) Awayan; 5) Prensa; 6) Mahipon; and 7) Kalayakan. Soils of this type constitute about 20% of the provincial land area. The Hilly Landscape has four (4) soil series. The Miscellaneous Soil Type on the other hand includes the loamy tidal swamp, mucky tidal swamp, mountainous lands, and streams and rivers.

Slope

The Plaridel Bypass alignment generally traverses level to very gently sloping areas. The lowland landscape is concentrated along the western, northwestern, and southwestern municipalities of the province including Balagtas, Guiguinto, Plaridel, Bustos, and San Rafael. The rolling to hilly slopes of more than 18% but less than 30% are commonly found scattered on the eastern part of Bulacan. The slope range between 0-30% is considered the maximum limit for sustained agricultural production.

Areas with steep to very steep slopes and are concentrated in the eastern Municipality of Doña Remedios Trinidad. These areas are by nature of no agricultural potential and are either for rehabilitation to permanent cover or preservation of its present state.

Erosion

Bulacan Province is influenced by varying degrees of erosion. On the eastern and central parts, slight to severe erosion (cultivated) affects the Municipalities of Norzagaray, Doña Remedios Trinidad, and San Jose Del Monte.

Since the landscape of the western side of Bulacan is level to very gently sloping, it is not even affected by erosion. However, there areas of the Angat River ion Bustos and San Rafael that are affected by severe erosion due to cultivation along the vast floodplains.

Hydrology

River Morphology

The Angat River is a meandering river system where the active channel is confined within a meander belt like the Pampanga River. The meander belt is defined by steep scarps formed in the initial development of the river through lateral erosion.

The meander belt is blanketed with a sequence of 1.5 meter thick loose silty medium to fine sand overlying a thick poorly consolidated gravel bed with lenses of coarse to medium sand.

Geomorphic features of the river section upstream and down stream from the proposed corridor shows a broader lateral extent of the terraces at the southern bank compared to those on the northern bank. This may indicate that the channel may have also been migrating on the northerly direction.

The presence of the irrigation channel about 2 km upstream from the proposed by pass alignment had altered flow behavior of the Angat River. Erosional features are not so evident from the aerial photographs and at the site.

However, natural erosion process is replaced by active quarrying operation within the river segment from the upstream section of the irrigation dam to the proposed by pass alignment. Huge volume of loose aggregate materials present within the meander belt is extracted from pre-existing quarry site using heavy equipment such as pay loaders.

Based what could be observed at the site, the rate of extraction appears to outpace the rate in which the river could replenish the aggregate materials during flood period.

Flooding

Based on the survey conducted by the JICA Study Team, severe flooding along the alignment occurs in Bgry. Camachilihan in Bustos (Sta. 14) once every 20-30 years. Flood level ranges between 1.5~2 meters (depth from rice field). Other areas that experience inundation in Sta. 14 include Brgy. Talampas, Liciada and Malamig.

Water Quality

A total of eight sampling sites were established at the upstream and downstream sections of the Angat River, Maguinao Creek and Irrigation canals at in Brgy. Bulihan Plaridel and Brgy. Malamig Bustos.

Based on the sampling results, the bacteriological content of the water samples collected from selected rivers, creeks, and irrigation canals crossed by alignment, specifically coliform exceeded the standard limit. This is an indication that the nutrient supporting these bacteria present along these waterways are adequate. This can be very well explained by the presence of agricultural lands with patches of human habitation that drain into these water bodies; i.e., from fertilizers and other organic wastes (human and animal excreta). Aside from fertilizers, other possible sources of nutrients are feeds from overflows of man-made aquaculture ponds, and domestic and animal wastes that are directly disposed into these water bodies. As observed during the conduct of sampling, these creeks and rivers have varying uses, such as for bathing (for carabaos, ducks, and humans as well), duck raising, fish pond propagation, and other activities that may have contribute to the high nutrient contents of these river systems.

Maguinao Creek is basically used as a source of irrigation water of adjacent non-irrigated rice paddies, especially during continuous precipitation periods. Based on local accounts, cattle, hog and poultry farms located farther upstream of the creek directly drain their wastes into the creek. The waste, which is composed of a mixture of feeds and animal manure, come in the form of a white substance, which makes the water sticky during summer. Furthermore, the color of the water resembles very much like that of cattle manure, which is dark brown

Generally, the waters in the sampling sites are turbid and are brownish in color.

Meteorology

The nearest synoptic meteorological station in the Province of Bulacan is located at the Science Garden in Quezon City. Based on the Modified Corona's Classification the climate in the project area is categorized under Type I characterized by two (2) pronounced seasons, the wet and the dry. The rainy season coincides with the Southwest Monsoon during the months of June to September. The month of August has the longest number of rainy days and it receives the maximum amount precipitation of **526.8 mm**. The dry season is experienced from December to April, with the minimum rainfall amount of **8.9 mm** in February.

The mean monthly temperature in the Bulacan changes from a minimum of **25.4°C** in January to maximum of **29.3°C,** which is usually experienced in May. The annual average mean temperature is **28.0°C**. The highest mean monthly relative humidity of

84% is felt in during the months of August and September, while the lowest is experienced in April, which is about **65%.** The warmest months are from April to June with mean values ranging from **29.3°C** to **28.2°C.**

The principal air streams that are significantly affecting the study area are the Northeast Monsoon, Southwest Monsoon, and the North Pacific Trades. The Northeast Monsoon predominates from October to May. The Southwest Monsoon on the other hand prevails from June to September. The North Pacific Trades is the southern portion of the North Pacific anti-clyclone. Having passed over a vast expanse of the North Pacific Ocean, this air stream is classified as a maritime tropical air mass. This air stream, which is extremely warm, is generally dominant over the entire Philippines in April and early May. It commonly arrives in the country from an easterly direction but may come from any direction from northeast to southeast.

Ambient Air Quality

Three sampling stations were set up at the selected sites along the proposed Plaridel Bypass alignment. Ambient air quality at the sampling sites was monitored on a 1-hour basis as well as within a 24-hour average.

The highest amount of suspended particulate matter based on a 1-hour observation was at recorded Sta. 2, at **1599.83 µg/Ncm,** which is more than five times the standard TSP limit (300 µg/Ncm) set the DENR. The relatively high concentration of suspended particulate matter may be due by the high volume of traffic along the highway and possibly the dispersion level in the area is at the minimum because it is densely populated. The result of the 24-hour air quality observation also exceeded the **Hazardous Level (600 µg/Ncm)** based on the Air Quality Indices. Monitoring results in other stations are way below the standard.

The observed levels of other air pollutants such as SOx and NOx both on a 1-hour and a 24-hour averaging time are well within permissible limits.

Noise Levels

The observed noise levels along the sampling stations slightly went beyond the permissible limits. Accordingly, the noise levels recorded were due to the instantaneous peaks generated by the vehicles passing by during the conduct of the sampling.

Land Use

General Land Uses

Agricultural is the predominant land use type in the host municipalities. These are mostly planted to rice, which is the primary crop grown in the entire province. Commercial zones are concentrated along existing highways and transport lines like the Tabang, Guiguinto area fronting the Rocka Village along the Cagayan Valley Road, Brgy. Cruz na Daan, San Rafael along the Maharlika Highway, and the intersection going to Poblacion, Plaridel where Chowking and Merced Drugstore are situated.

Silica, a very important raw material for cement production is commonly extracted along Masim River. Gravel and sand also abound along riverbeds of Angat from Brgy. Pulo to Brgy. Tambubong, San Rafael. Marble, white and red clay deposits used for construction and decorative purposes are found in Brgy. Pasong Bangkal.

Numerous subdivisions augment to the areas devoted to residential uses. These are also mostly located along transport lines and roadways. Institutional areas accommodate the school buildings, government offices, churches, hospitals and health facilities, and sports centers.

The forest area in San Rafael is located in Brgy. Tukod near the Municipality of Doña Remedios Trinidad. It occupies close to 7,517.76 ha or 28.19% of San Rafael's total land area.

Strategic Agricultural and Fishery Development Zone (SAFDZ)

The present SAFDZs of Bulacan Province is approximately 124,922 ha. During the conduct of the study however, there is no available map to determine the location of the said zones. Accordingly, the SAFDZ Map of Region III was submitted to the Regional Office for updating.

The classified SAFDZs of Bulacan area as follows:

- Strategic crop sub-development zone (85,304 ha);
- Strategic livestock sub-development zone (14,034 ha);
- Strategic fishery sub-development zone (23,319 ha);
- Strategic crop/livestock sub-development zone (624 ha); and
- Strategic crop/fishery sub-development zone (1,641 ha)

The remaining Network of Protected Agricultural Areas and Agro-Industrial Development (NPAAAD) are about 85 ha.

Biological Aspects

Terrestrial Flora

The flora composition in the project area is classified under the primary vegetation, which can be divided into **two (2)** major types namely the (i) natural vegetation and the (ii) cultivated vegetation. The natural type consists mainly of the lowland grassland associated with shrubland. The cultivated type on the other hand is comprised of agricultural and built-up types.

A diverse species of common riceland and wasteland weeds, grass shrubs, and herbs characterize the lowland grassland vegetation type. Species belonging to different families such *Cyanotis axillaris* (alikbangon), *Chromolaena odorata* (hagonoy), *Echinochloa crus-galli* (dawa-dawa), *Saccharum spontaneum* (talahib) and *Imperata cylindrical* (cogon) were observed.

Sparse stands of trees were noted and are usually converged along the banks of rivers, creeks, and irrigation canals.

Palay (*Oryza sativa*) is the primary crop grown in the project area. The secondary crops cultivated during rainy season are corn (*Zea mays*), okra (*abelmoschus esculentus*), sitaw (*Vigna sesquipedalis*), and water melon (*Citrullus vulgaris*). Tomato (*Lycopersicon lycopersicum*), ampalaya (*Momordica charantia*), talong (*Solanum melongena*), calabasa (*Cucurbita maxima*), and onions (*Allium sepa*) on the other hand are the most popular crops planted during the dry season.

Built-up vegetation refers to ornamental plants found around settlement areas, as well as those along roadsides. The widely propagated among the ornamental plants observed is golden bush *(Duranta repens, c.v.)*, which is uniformly shaped in the front yards. Adding aesthetics to the area are the vibrant colors of the roses *(Rosa cvs. and hybrids)*, gumamelas *(Hibiscus rosa-sinensis cvs. and hybrids)*, Bougainvilleas

(Bougainvillea spectabilis cvs and hybrids). Complementing the abundantly cultured varieties of *Vanda* and *Dendrobium (Orchidaceae)* species and hybrids are the *Heliconias* (false bird's of paradise, hanging lobster claw, golden lobster claw, and parrots' flower).

There are no endangered, rare, or endemic flora species encountered along the bypass alignment.

Terrestrial Fauna

A total of **eleven (11)** species of amphibians and reptiles belonging to **five (5)** families was recorded from the study site. The most commonly observed among the **four (4)** amphibians noted are *Bufo marinus, Rana erythraea* and *Polypedates leucomysta.* While the **seven (7)** recorded reptiles are well represented by *Cosymbotus platyurus, Gehyra mutilata, Hemidactylus frenatus* and *Mabouya multifasciata*. All these species are known to tolerate and thus, characteristic of highly disturbed and non-forested habitats.

The bird survey recorded a total of **thirty-five (32)** species within **eighteen (18)** families, excluding **three (3)** individuals that were identified up to the genus level only. A low number of endemic species characterizes the birds documented. *Centropus viridis*, *Orthotomus derbianus* and *Diceum australe* **(9.4%)** are the only endemic species noted out of the total number of individuals encountered. These species, although endemic, are expected to be present in the study site because they are adapted to grassland and agricultural types of habitat. There are also **four (4)** uncommon species included in the list namely, *Gallinago gallinago*, *Streptopelia bitorquata*, *Copsychus saularis*, *Acrocephalus stentoreus* and *Orthotomus cucullatus*. In general, the most commonly observed group in the site was family Sylviidae. It was represented by tailorbirds, warblers, grass birds and cisticola with a total of seven (7) species and an individual, which was identified up to the genus level

The calculated Bird Species Diversity (BSD) for the study site is **3.013447856**, which is relatively high indicating complex composition as dictated by high species richness. But close examination of species will reveal that they are mostly common with wide range of distribution. Further, they are mostly resident breeding that are non-endemic, which can inhabit highly disturbed habitats such as grasslands, agricultural, residential, commercial, and industrial areas.

Seven (7) species of mammals was recorded in the study site based mainly on interviews, actual observations and trappings. This is comprised of **three (3)** bats and **four (4)** small non-volant forms within **three (3)** families. Captured bats are both fruit eating. Of the seven species recorded, *Ptenochirus jagori* is the only the endemic species noted. The rest are non-endemic (i.e. *Cynopterus brachyotis*) and accidental introduced (i.e. *Suncus murinus, Rattus tanezumi, R. norvegicus, R. argentiventer,* and *Mus musculus*). .

There are no recorded amphibian and reptilian species that are either threatened or near threatened, (RDB, 1997; Alcala and Custodio, 1997; Alcala and Brown, 1998; Alcala et al., 199) in the study site. Except for *N. philippinensis*, which is uncommon, based on Alcala, 1986, all recorded species are common. Actual observations and field interviews will support this population condition. The low record for snake species and uncommon status of *N. philippinensis* in the study site can be attributed to the attitude of people towards snakes. They are usually eliminated on sight for fear of deadly bites. As well, there are no mammalian species encountered categorized under rare and uncommon status.

A certification stating that the project does not traverse nor within a proclaimed protected or approved CADC areas is attached as **Appendix C**.

Aquatic Fauna

Observation of the samples collected from the Angat River showed a very diverse phytoplankton composition. The average pH and temperature gathered from the said River also showed its physicochemical characteristics. Temperature and alkalinity dictate the composition of these organisms in aquatic ecosystems. Some species of diatoms dominate in lakes and rivers with high pH, while some in neutral pH such as the species under Division Chrysophyta. Angat River with relatively neutral pH value and low temperature is more conducive for the phytoplankton to thrive. Phytoplankters are producers and depend so much on light for reproduction. There are no indications of possible eutrophication in the river.

Nutrient level and composition of the aquatic ecosystem also dictate its biotic composition where in this case, the sources of these chemical characteristics are farmlands, and anthropogenic activities in the project area.

The zooplankton community on the other hand is not that diverse as the observed phytoplankton. The number of individuals was also fewer as observed under the microscope. Some of the zooplankton species identified include *Brachionus sp. 1*, *Brachionus sp. 2*, *Trichocerca sp. 1*, *Trichocerca sp. 2*, *Lecane sp.*, *Lophocharis sp.*, *Rotifer*, and an *Unidentified* species.

Socio- Economic Aspects

The information discussed here are results of the actual perception survey conducted in the direct impact areas.

Demography and Basic Information

Household Size

The perception survey revealed that greater part of the PAPs (Project Affected Persons) per barangay have an average household size of "5-7" **(35.4%)** and "1 to 4" **(47.8%)**. Only **5.6%** have household size greater than 10.

Educational Attainment

About **31.3%** of the female spouse respondents in the direct impact areas are elementary undergraduates. Only **21.7%** graduates (). For the male spouses, majority are high school graduates **(27.0%)** and high school undergraduates and graduates **(18.8%)**. Only a few attained college education. Between both sexes, low numbers in terms of higher levels of education make them less eligible and competitive in terms of landing jobs, particularly at more urbanized areas.

Socioeconomic Characteristics

Primary Occupation

The PAPs' primary occupation is farming. Of the total respondents consulted, **38.5%** are farmers. This is expected since Bulacan economy is still considered primarily agriculture-based.

Household Income

Approximately **57.0%** of the surveyed households fall above **P71,304**, Region 3's annual poverty threshold for a family of six. Respondents who fall between P39, 240 and P71,304 comprise **18.6%.** The percentage falling below the annual food threshold of **P39, 239 (24.4%)** represent the farmers in the DIA who would become highly vulnerable to impoverishment if their farm income are taken away from them.

If the income of the respondents would be derived from farming only, **33.7%** would still be above Region 3's poverty threshold, and **59.3%** would already fall below the threshold. If the respondents' incomes are solely obtained from non-farm sources such as those mentioned above, **54.1%** would fall below the annual food threshold, and only **31.4%** earn more than **P71,304** per annum. These figures show the PAPs' dependence on both farming and non-farming as their major means of livelihood.

Household and Farm Expenditures

Food expenses accounts for the bulk **(64.4%)** of the respondents' total annual expenditures in all barangays. They also spend a big portion of their incomes for education **(12.2%)**, electricity **(9.3%)**, and medical expenses **(7.5%)**. This indicates that crops obtained from the farmlands are not depended on as sustenance, but more of a source of income.

The respondents pay up to **P677,515.65** for farm labor. Buying farm supplies and other implements such as seedlings **(P289,365.20)**, fertilizers **(P611,520.20)**, and pesticides **(P436,731.20)** also contribute to the bulk of farmer's expenditures. On the other hand, approximately **19.4%** or **P596,128.13** is spend for agro-industrial and aquaculture feeds.

Net Income

The respondents' total household income amounts to **P28,193,032.00**. More than **70%** of this is spent on household expenditures, whereas around **20-25%** goes to farm expenditures.

Tenure

In terms of land occupation, the survey showed that majority, or **33.6%** are occupying lands with prior consent from the respective landowners, **29.6%** are tenants, and **28.3%** of the total project affected persons are landowners.

Availability of Basic Social Services

About **85.1%** of the households consulted have access to electricity as a source of lighting. Only **6.4%** still use kerosene for illuminating their homes.

Water Supply

In terms of source of water supply, majority or **55.3%** of the respondents obtain their domestic water supply from artesian wells, whereas **23.4%** are with piped connections

Sanitation Facilities

Other indicators of the standard of living are deficiencies in terms of sanitation facilities. As gathered from the survey, a high percentage of **63.8%** of the residents at the host barangays use the semi flush type of toilet. Close to **13.8%** on the other hand, use Antipolo type.

Cooking Fuel

Majority of the respondents **(54.3%)** are still using kerosene to cook their food. Those who are using LPGs in their kitchens consist of **23.4%** of the total respondents. However, about **17.0%** are still using wood as cooking fuel.

Available Skills in the Community

Nearly **37.6%** of the female respondents asked during the survey have skill in cooking. Those with sewing expertise represent **32.5%** of the total respondents. There are about **14.5%** office personnel **10.5%** factory workers in the project area.

Skilled drivers in the project area are approximately **41.3%.** Laborers are next in rank with **27.5%.** Other skills of male household members include carpentry **(17.4%)**, masonry **(8.2%)**, mechanic **(4.6%)**, and heavy equipment operator **(0.9%)**.

SUMMARY OF PROOF OF SOCIAL ACCEPTABILITY

Project Awareness

When asked if they were informed about the project, **92.6%** of the respondents said that they are very much aware of the proposed Plaridel Bypass Project.

Majority **(38.0%)** of the PAPs disclosed that their key informant is the DPWH. Other sources of information about the project include the LGUs **(30.1%)**, neighbors/friends **(13.5%)**, and the EIA Team with **(12.9%)**.

Social Acceptability

Based on a **100%** interview of the directly affected communities, a very high **70.8%** of the respondents expressed full support to the proposed Plaridel Bypass. Only **29.2%** disapproved of the proposed undertaking.

When asked why they are in-favor of the Project, the top **three** (3) answers are because (i) it is a government project and they cannot do anything but accept it (*Others*, **43.7%**), and (ii) the Bypass, will improve the quality of life of people, particularly those near the bypass **(27.7%)**; and (ii) will improve accessibility **(14.3%)**.

For those who do not favor the construction of the Bypass, the main reason is understandable; i.e., because it ***"will displace people"***.

Other Forms of Social Acceptability

The project presentation rendered to the respective Sangguniang Bayan (SB) of the concerned municipalities enable them to fully appreciate and understand the proposed Plaridel Bypass Project, as well as the need for an endorsement letter in the form of a resolution. Aside from the social acceptability culled from the respondents in the impact areas, SB resolutions shall serve as another form of the project's acceptability.

Sangguniang Bayan resolutions (**Appendix D**) stating support to the project were obtained from the following municipalities:

- Municipality of Guiguinto;
- Municipality of Plaridel; and
- Municipality of San Rafael

SUMMARY MATRICES

The Impact Assessment, Mitigation, and Enhancement Matrices are presented in the following tables.

The proposed Environmental Monitoring Plan in matrix form is also presented in the end of the section.

IMPACTS AND MITIGATION MATRIX

Parameters to be Monitored	Impacts	Duration and Degree of Impacts	Mitigating/Enhancement Measures
PRE-CONSTRUCTION AND CONSTRUCTION PHASES PHYSICAL ENVIRONMENT			
Land	Construction of the bypass will inevitably reduce the area of productive farmlands along the alignment	*Long-term, negative*	• The construction of the bypass alignment along agricultural areas will be limited to the required ROW of **32 meters**; • Bypass sections with frontage or service roads are concentrated in areas designated or are planned by the respective city or municipality for commercialization; and • Fertile top soil which contain moisture-retaining organic humus will be transferred to other farmlands;
Hydrology	Improper and indiscriminate disposal of cut vegetation may impede the flow of the rivers, creeks, and irrigation canals crossed by the bypass alignments	*Short-term, negative*	• Since the alignment will generally traverse agricultural areas with sparse trees, vegetation cover to be cut is expected to be minimal; • Secondary cut logs will be properly surrendered to the nearest DENR Office; and • Small pieces of logs, twigs, shrubs, etc. will be disposed accordingly at DENR-approved disposal site/s
	Increase in the rate of siltation along the waterways crossed by the bypass alignments It is important to note here that the present the sources of siltation are: • Continuous extraction of aggregate materials during summer;	*Short-term, negative*	• Temporary sediment traps will be constructed at critical construction areas such as rivers, creeks and irrigation canals to prevent siltation of these waterways; • Excavated unsuitable materials, construction spoils, and fill materials for temporary stockpiling will be located in properly designated areas far from the waterways. These will be covered with tarpaulin, canvass or sack materials to prevent these materials from being carried away by run-off, particularly during high precipitation periods; and • Excavated unsuitable materials and construction spoils will be regularly hauled and disposed to the DENR-approved disposal site/s

IMPACTS AND MITIGATION MATRIX (continued)

Parameters to be Monitored	Impacts	Duration and Degree of Impacts	Mitigating/Enhancement Measures
PHYSICAL ENVIRONMENT			
Water Quality	Bored piling at river bed for bridge substructure and alteration of stream/river flow to accommodate construction of works would increase the turbidity along major waterways crossed by the bypass alignments	*Short-term, negative*	This impact is unavoidable but temporary in nature. Condition of the waterways will be back to normal about a year or two after the construction works are completed
	Possible Increase in the bacteriological content, particularly coliform, of local surface water bodies due to domestic wastes generated by construction personnel	*Short-term-negative*	Temporary sanitation facilities such as portable toilets and garbage bins will be provided by the Contractors to ensure that domestic wastes generated by the construction personnel are properly handled and are not thrown directly into the waterways to prevent pollution of the surface water bodies
	Possible contamination of local surface waters due to washing of construction machinery and other mobile equipment such as transit mixers and dump trucks may contaminate local surface waters. As well, improper handling of chemicals such as lubricants, fuel, paint, and other solutions for routine vehicular operation may have similar effects	*Short-term-negative*	• Contractors will be prohibited from washing of construction vehicles and other mobile equipment along the waterways to prevent spillage of oil and grease and other contaminants to the receiving surface waters; and • Lubricants, fuel, paint, and other chemicals solutions utilized for routine vehicular operation will be carefully handled and properly stored in a temporary storage area far from the waterways to prevent possible contamination of rivers, creeks, and irrigation canals
Air Quality	Dozing, stripping, earth moving, and other related activities involved during the pre-construction and construction phases of the project may possibly add to the present level of suspended particulate matters within the construction and adjacent areas. Temporary stockpiles of excavated and surplus materials as well as fill and embankment materials may also add to the present TSP levels.	*Short-term-negative*	• Exposed and cleared construction areas will be regularly sprayed with water; • Excavated unsuitable materials and construction spoils will be regularly hauled and disposed to the DENR-approved disposal site/s; and • Temporary stockpiles of fill and embankment materials will be covered with tarpaulin, canvass or sack materials to prevent re-suspension of particulate matters

IMPACTS AND MITIGATION MATRIX (continued)

Parameters to be Monitored	Impacts	Duration and Degree of Impacts	Mitigating/Enhancement Measures
PHYSICAL ENVIRONMENT			
Air Quality	Possible increase in exhaust gas emission levels such as SO_X, NO_X, CO, and other hydrocarbons generated by the various pre-construction and construction equipment	*Short-term-negative*	• Contractors will be required to conduct daily routine equipment and machinery check-ups; and • Regular tune-up and maintenance of construction equipment and machinery will be strictly complied with
Noise Level	Possible increase in noise level generated by the various construction heavy equipment and machinery during the pre-construction and construction phases of the project	*Short-term-negative*	• Noise suppressors, such as mufflers will be installed whenever deemed necessary to maintain noise generated by the various heavy equipment and construction machinery at permissible limits; • Being direct receivers of the noise generated by the construction equipment and machinery, operators will be provided with earmuffs to avoid drastic effects; and • High-noise generating pre-construction and construction activities will be scheduled during daytime to minimize disturbance to surrounding residential areas;
BIOLOGICAL ENVIRONMENT			
Flora	Minimal loss of vegetation covers along the bypass alignments due to site clearing and grubbing	*Long-term, negative*	• This impact is considered minimal and insignificant, since the areas to be traversed by the alignments are mostly agricultural with sparse stands of trees usually concentrated along the banks of rivers, creeks, and irrigation canals; • Construction of the bypass alignment will be limited to the required ROW of **32 m** along prime agricultural areas and **50 m** along urbanized areas with frontage or service roads; and • Just compensations will be accorded to owners of damaged agricultural crops and fruit bearing trees in accordance with the existing DPWH ROW Acquisition Guidelines

IMPACTS AND MITIGATION MATRIX (continued)

Parameters to be Monitored	Impacts	Duration and Degree of Impacts	Mitigating/Enhancement Measures
BIOLOGICAL ENVIRONMENT			
Terrestrial Fauna	Actual displacement of wildlife species caused by the complete habitat transformation along the areas traversed by the bypass alignments It should be noted here that actual field survey along the project site revealed that the area is already highly disturbed. Critical habitats such as forests and natural marshes along the actual alignment and within a 2-3 kilometer perpendicular distance on both sides of the proposed bypasses are also absent. These significantly lower the projected negative effects. Moreover, most of the identified species particularly the amphibians, reptiles and mammals are common and non-threatened and sometimes considered commensals of people. In addition, all small non-volant mammals species recorded are considered pests, while the noted species endemic species for the four groups was low.	*Long-term, negative*	• The Multi-Partite Monitoring Team (MMT) that will be formed will conduct a periodic but continuous survey of wildlife vertebrates within and around the project site to obtain clearer picture of the wildlife composition. The main priority of this activity should be the endemic and threatened species; • The concerned government agency will initiate an information and education campaign in the project area. This is to disseminate the importance of conserving and protecting the remaining wildlife species as well as their habitats. The local community must be involved in this effort; and • The remaining critical wildlife habitats that will be intercepted by the alignment will be protected and conserved no matter how small in size
Aquatic Fauna	Bored piling and related bridge works along Angat River may contribute to the disturbance in the biotic community in the said waterway	*Short-term, negative*	• This impact is unavoidable but temporary in nature. Condition of the waterways will be back to normal about a year or two after the construction works are completed; and • The identified organisms are resilient and can adapt to physical changes in their environment. However, changes in the chemical characteristics of the river may be deleterious to the plankton community, the macro invertebrates and larger organisms, that is the increase in the amount of nutrient input to the river systems. It also important to emphasize here that construction works along the river will have no significant effect on the species' food web

IMPACTS AND MITIGATION MATRIX (continued)

Parameters to be Monitored	Impacts	Duration and Degree of Impacts	Mitigating/Enhancement Measures
SOCIO-ECONOMIC ENVIRONMENT			
	Farmers may experience temporary difficulty in terms of accessibility to the farmland they are cultivating	*Short-term, negative*	Farmers will be provided with temporary and safe access roads and crossings for carabaos and other farm implements such as hand tractors and threshers
	Disruption of irrigation water services of farmlands adjacent to the construction areas due to construction of culverts and/or bridges. Improper disposal of surplus materials may also impede the flow of water.	*Short-term, negative*	• Temporary culverts and irrigation channels will be provided to the farmers to ensure continuous supply of irrigation water; • Temporary sediment traps will be constructed at critical construction areas such as irrigation canals to prevent siltation of said waterways; • Temporary stockpiles of excavated unsuitable materials and construction spoils will be located in designated areas to ensure that clogging of irrigation canals will not occur. These will be covered with tarpaulin, canvass or sack materials to prevent these materials from being carried away by run-off, particularly during high precipitation periods; and • Excavated unsuitable materials and construction spoils will be regularly hauled and disposed to the DENR-approved disposal site/s
	Temporary stockpiles of stripped excavated materials, construction spoils, and fill and embankment materials may: • fill adjacent farmlands; and • cause local flooding	*Short-term, negative*	• Activities during pre-construction and construction phases will be restricted within the construction limit; • Temporary stockpiles of excavated unsuitable materials and construction spoils will be located in designated areas to ensure that clogging of irrigation canals will not occur. These will be covered with tarpaulin, canvass or sack materials to prevent local flooding, run-off and accidental filling-up of adjacent farmlands especially during high precipitation periods; and • Excavated unsuitable materials and construction spoils will be regularly hauled and disposed to the DENR-approved disposal site/s

IMPACTS AND MITIGATION MATRIX (continued)

Parameters to be Monitored	Impacts	Duration and Degree of Impacts	Mitigating/Enhancement Measures
SOCIO-ECONOMIC ENVIRONMENT			
	Construction of the bypass roads will entail: • minimal loss of properties; • permanent displacement of residential houses; and • loss/damage to means of livelihood, especially farmers	*Long-term, negative*	• Construction of the bypass alignment will be limited to the required ROW of **32 m** along prime agricultural areas and **50 m** along urbanized areas with frontage or service roads, thus permanent displacement of residential houses and damage to properties are expected to be minimal; • Just compensation will be accorded to landowners in harmony with the existing DPWH ROW Acquisition Guidelines. Agricultural tenants and lessees will be given financial assistance and disturbance compensation, respectively. These will also be in accordance with the existing DPWH ROW Acquisition Guidelines; • Depending on the discretion of owners, the DPWH may also offer the option to reconstruct a house exactly the same as the house to be affected in lot/s provided by the homeowners. The DPWH may also replace the affected land with public land of the same size available within the project area if the owner opted to have his property replaced; • Sound SDP packages will be designed according to the types and specific situations of population groups that may be displaced by the project. The DPWH must realize that the affected groups did not voluntarily put up their homes and properties for sale. As such, the guiding attitude should not only be towards offering acceptable packages but to open up opportunities for them to improve the affected communities' current situation; • The DPWH will provide alternative means of livelihood to severely project affected families, particularly those who will lose the entire parcel/s of land they are cultivating so that they can be assured of a continuous source of income; • The SDP will also include a plan that will encourage the active participation of women and other vulnerable groups (e.g. physically challenged, indigenous cultural communities, etc.); and • Informal settlers will be transferred to the designated relocation area/s provided by the host city. The DPWH through the help of the LGUs will provide basic social services such as water supply, electricity, health facilities, and means of transportation and communication

IMPACTS AND MITIGATION MATRIX (continued)

Parameters to be Monitored	impacts	Duration and Degree of Impacts	Mitigating/Enhancement Measures
SOCIO-ECONOMIC ENVIRONMENT			
	Generation of temporary employment for qualified laborers within the host communities during the construction phase of the project	*Short-term, positive*	Qualified workers and laborers from the host communities will be given priority in hiring during the construction stage of the project
OPERATIONAL PHASE PHYSICAL ENVIRONMENT			
Air Quality	Using the vehicular emission factors and the projected traffic of the project, a ***Gaussian Dispersion Model*** was used to predict the contribution of the project to the 1-hour average ambient ground level concentrations in the area. The model results are presented in graphical outputs showing isolines of SO2, NO2, and TSP concentrations for four (4) most prevailing wind directions in the area. From these results, the maximum predicted GLCs are **156.8 µg/N**cm for TSP, **71.29 µg/Ncm** for SO2, and **79.64 µg/Ncm** for NO2. The maximum observed ambient concentrations are **60.66 µg/Ncm** for SO2 and **41.9 µg/Ncm** for NO2. Superimposing these values to the predicted contribution of the project, the total predicted values are **131.95** µg/Ncm for SO2 and **121.54 µg/Ncm** for NO2. These are within the DENR ambient standards of 340 µg/Ncm for SO2 µg/Ncm and 260 µg/Ncm for NO2.	*Long-term, positive*	To further improve the quality of air along the existing Pan-Philippine Highway, LGUs with relatively high local traffic volume (i.e. Plaridel, San Rafael, Gapan, Gapan, Sta. Rosa, Cabanatuan City, and San Jose City) will implement a sound traffic management plan and strictly enforce existing traffic rules and regulations

IMPACTS AND MITIGATION MATRIX (continued)

Parameters to be Monitored	Impacts	Duration and Degree of Impacts	Mitigating/Enhancement Measures
PHYSICAL ENVIRONMENT			
Air Quality	The maximum observed background TSP concentration was **1599.8 µg/Ncm.** This already exceeds the DENR ambient standard of 300 µg/Ncm. However, when this project is completed the background concentrations are expected to improve and it is expected that the total predicted values will be within DENR ambient standard. As such, there would be a dramatic reduction in gaseous emissions in urban areas along the Pan-Philippine as a result of the diversion of thru traffic to the newly constructed bypass roads	*Long-term, positive*	To further improve the quality of air along the existing Pan-Philippine Highway, LGUs with relatively high local traffic volume (i.e. Plaridel, San Rafael, Gapan, Gapan, Sta. Rosa, Cabanatuan City, and San Jose City) will implement a sound traffic management plan and strictly enforce existing traffic rules and regulations
Noise Level	There would be a significant reduction in the levels of noise in urban areas along the Pan-Philippine as a result of the diversion of thru traffic to the newly constructed bypass roads	*Long-term, positive*	To further improve the level of noise along the existing Pan-Philippine Highway to permissible limits, LGUs with relatively high local traffic volume (i.e. Plaridel, San Rafael, Gapan, Gapan, Sta. Rosa, Cabanatuan City, and San Jose City) will implement a sound traffic management plan and strictly enforce existing traffic rules and regulations
SOCIO-ECONOMIC ENVIRONMENT			
	Possible illegal conversion remaining productive agricultural lands adjacent to the newly constructed bypass roads into other uses	*Long-term, negative*	• The construction of the bypass roads along prime agricultural areas will be limited to the required ROW of **32 meters**; • Bypass sections along prime agricultural areas will be on embankment, thus providing a natural barrier discouraging commercialization of the areas fronting the newly constructed bypass roads; • Bypass sections with frontage or service roads are concentrated in areas designated or is planned by the respective city and municipality for commercialization; and

IMPACTS AND MITIGATION MATRIX (continued)

Parameters to be Monitored	Impacts	Duration and Degree of Impacts	Mitigating/Enhancement Measures
SOCIO-ECONOMIC ENVIRONMENT			
	Possible illegal conversion remaining productive agricultural lands adjacent to the newly constructed bypass roads into other uses	*Long-term, negative*	The concerned Municipal Councils will pass a resolution or zoning ordinance prohibiting the conversion of prime agricultural areas along the newly constructed bypass roads into any other uses
	Property owners of adjacent lands to the newly constructed bypass roads will benefit from the significant increase in land values.	*Long-term, positive*	This is particularly true in sections immediately fronting service roads. Although the conversion of prime agricultural lands adjacent to the newly constructed bypass roads is illegal and ribbon-type of development is discouraged, property owners would still profit from the economic benefit that will accrue to each City/Municipality once it is traversed by a National Highway
	The newly constructed bypass roads will: • ensure continuous flow of commodity; • ease the traffic along the Pan-Philippine Highway, particularly in urban areas; and • reduce transport costs due to improved traffic flow	*Long-term, positive*	The DPWH will continuously keep its regular maintenance activities to ensure optimal service and benefits to the road users;
	Increase in employment opportunities as a result of urbanization and commercial development of non-agricultural and non-prime areas	*Long-term, negative*	• The respective LGUs will ensure that qualified members of the host community are given first priority in hiring of local labor force; and • The concerned LGs. will wok hard towards achieving the development plans of the City or Municipality

ENVIROMENTAL MONITORING MATRIX

Parameters to be Monitored	Stations to be Monitored	Frequency of Monitoring	Methods of Analysis/Execution	DENR Standard	Implementor
CONSTRUCTION PHASE					
PHYSICAL					
Water Quality BOD, TSS, and oil and grease of surface water	All major bridge sites, RCBC, and RCPC sites	Quarterly during construction	Standard EMPASS-EQD water quality analysis.	*Class "C"* **BOD - <10 mg/L** **TSS- <30 mg/L increase** **Oil & Grease - <3mg/L**	DENR
BIOLOGICAL					
Tree Cutting	Entire alignment where there are trees to be cut	Daily	Monitoring team must ensure that tree cutting is limited within the required ROW only	N. A.	MMT
Waste management and disposal	All portions with excavation and fill activities	Weekly during construction	Site inspection	Based on EMP	DENR
SOCIAL					
Compliance of Contractor to occupational health and safety rules and regulation	All construction areas	Weekly	Site inspection of work areas including sanitation facilities	Based on EMP	MMT
Road Safety	Signalized intersections, merging ianes	Quarterly	Site inspection	Based on DPWH Standard Operating Procedures	DPWH
OPERATIONAL PHASE					
BIOLOGICAL					
Tree planting and its maintenance on both sides of the highway, and possibly at areas designated for Stage 2 construction	Designated environmental belts/zones, and R-O-W for Stage 2 construction	Monthly	Site inspection	Based on EMP	DENR MMT
SOCIAL					
Informal settling/squatting	Acquired R-O-W for Stage 2 Construction	Weekly	Site inspection	Based on EMP	LGUs, MMT
Illegal conversion of prime agricultural land	Areas adjacent to the Bypass	Weekly	Site inspection	Based on EMP	LGUs, MMT
Road condition	Bypass road, bridge, including pavement, drainage system, embankments	Based on standard DPWH maintenance procedures	Standard DPWH road and bridges maintenance works	Based on DPWH Standard Operating Procedures	DPWH

Chapter 1
Introduction

1 INTRODUCTION

1.1 PROJECT BACKGROUND

Systematic road in the Philippines began in the late '60s. The Government's thrust was initially geared on the expansion of road networks to provide basic access to major regions. In the mid '80s, the country started suffering from various types of premature road deteriorations such as slope failures and landslides due to natural calamities. To cope with such situations, the Government's focus was shifted to road rehabilitation and betterment of existing types to more durable ones. Since then, various road improvement projects have been implemented.

Aside from the above-mentioned physical deterioration of the road networks in the country, the recent years' economic growth brought about the sharp increase of road traffic, in and around Metro Manila and regional growth pole cities. This is particularly true in urban sections along arterial roads, wherein a sharp increase in local and through traffic has seriously affected the main function of arterial roads, such as the Pan-Philippine Highway. Restoration of this traffic function and proper sharing with roads of lower categories has become vital issues to be addressed in the formulation of road development policies, particularly along the subject highway.

In response to the request of the Government of the Philippines (**GOP**), the Government of Japan (**GOJ**) decided to conduct the "**Feasibility Study on Upgrading Inter-Urban Highway System Along the Pan-Philippine Highway (Sta. Rita, Guiguinto–San Jose Section)**" in July 1998. The Japan International Cooperation Agency (**JICA**), which is the official agency responsible for the implementation of the technical cooperation programs of GOJ, organized and dispatched a Study Team to undertake the said study.

The Study Area included the road section of the Pan-Philippine Highway from Sta. Rita, Guiguinto, Bulacan, to San Jose, Nueva Ecija. It starts at around 40 km north of Metro Manila and extends for another 123.5 km. Along this section of the Pan-Philippine Highway, small to medium size urban centers are situated at about 10 km intervals, where a ***ribbon type*** of development flourishes. Examples of these include those at Plaridel, Baliuag, San Rafael, San Ildefonso, and San Miguel in the Province of Bulacan, and Gapan, Sta. Rosa, Cabanatuan City, Talavera, and San Jose in the Province of Nueva Ecija. Along these urban sections, the arterial road function of the Pan-Philippine Highway is hampered due to the high composition of slow and undisciplined traffic such as tricycles and jeepneys.

1.2 EIA APPROACH AND METHODOLOGY

1.2.1 Approach

The general approach adopted in the present study is based on the procedural flow of the Environmental Impact Statement (EIS) System prescribed under Article III of the DENR Administrative Order No. 96-37. The EIA Team followed the Participatory Impact Assessment Method (PIAM) wherein the stakeholders were involved in the conduct of the EIA through project briefings, public consultation meetings/barangay assemblies, and formal scoping meeting.

1.2.2 Methodology

The EIA study covered the following modules:

- Geology
- Meteorology
- Hydrology
- Water Quality
- Air Quality and Noise
- Terrestrial Biology
- Socio-Economics

Physical Environment

Geology

The geological study for the proposed project was done through aerial photo interpretation and field verification of pertinent secondary data. The information used in the preparation of this report were obtained from various government offices/entities among others, the MGB, PHIVOLCS, and BSWM. Published and unpublished literatures were also utilized.

Water Quality

On-site measurements of water temperature and pH were performed using a thermometer and a digital pH-meter, respectively. Water samples were collected from all the stations and then brought to the laboratory for assessment. Standard procedure of water handling was conscientiously followed to maintain the water's freshness. The samples taken from the waterways were properly labeled and stored in a 4°-ice bin. These were later brought to the SGS Philippines in Makati City for laboratory analyses.

The water samples were analyzed for parameters Biological Oxygen Demand (BOD), bacteriological (Coliform), and Total Suspended Solids (TSS) as agreed upon during the 1st Level Scoping for the project.

Air Quality

The conduct of air quality sampling followed the standard procedure according to the prescribed methodology in DAO 14. *Spectrophotometric Griess-Salztman* and *Spectrophotometric Pararosaniline* methods were used for NO_2 and SO_2, respectively.

All samples were stored in a refrigerator prior to analyses. Color developments for the SO_2 absorbed in TCM immediately done before analyses to prevent color loss during storage. The standards used are; sodium nitrite for NO_2 and sodium metabisulfite for SO_2.

Air quality monitoring in all stations was performed on a 1-hour basis. Furthermore, 24-hour average air quality testing was carried out at Sta. 3.

Noise Level

Noise level was measured using a standard noise meter. Noise sampling was conducted simultaneously with the air quality test at the same stations.

Biological Environment

Flora

Since the proposed project is a road network and is linear in nature, there was no line transect or quadrat method of sampling done. Moreover, the extent to be affected by the project is considered minimal, given that the road ROW along agricultural and residential areas are 32 and 50, respectively.

On-site identification of the flora species encountered through gross morphology was performed. This is a type of plant identification that relies heavily on the external features of both vegetative and reproductive parts, since these are easily observable. Flora guidebooks and other related reference materials were used during the conduct of the study.

Fauna

Terrestrial Fauna

Actual field survey, validation of secondary information and interviews with local residents were conducted to obtain baseline information on the wildlife present in the area. The main focus of the study was on the four (4) higher groups of terrestrial wildlife vertebrate species comprised of amphibians, reptiles, birds and mammals. The study was conducted from June 04-06, 2001

The sampling site for the wildlife identification in the project area was selected based on the existing vegetation condition, habitat type representation, and actual location of the proposed project and its projected extent of disturbance. Since the proposed project is a bypass road and is linear in nature, it is assumed that the disturbance will primarily be a habitat transformation on the actual site because of the structure to be placed. And since the area is already heavily disturbed, it is projected that it will exhibit very minimal effects on wildlife. Sites representing other nearby critical habitats were not sampled because of the site-concentrated effect of the project.

Line Transect Survey for Birds

A 1.5 to 2.0 kilometer transect line was randomly established in the area. It was divided into eight major points using a 250-meter distance between each point. The observer walked for 15 minutes between each point thus, covering a total of 120 minutes (two hours) for the entire transect length. Whenever possible, a straight line-transect route was maintained to minimize duplication of recorded species. Whenever birds were observed, the following information were noted species name, number of individuals, habitat, elevation and others (i.e., flying, perched, heard, seen, foraging behavior, etc.).

Whenever the observer encountered difficulties or problems in identifying species, distinguishing morphological and/or behavioral characteristics were noted (i.e., general size, prominent color of the feather, bill color and shape, tail length, leg length, flight patterns, etc.). Gathered information were then used as guides and as point of comparisons with field guides and other relevant documentation.

Mist Netting for Birds and Volant Mammals (Bats)

Nets used were 35-millimeter mono-filament mist nets, 12 meters in length and two meters in width. Strategic positioning of mist nets was observed at all times to increase capture rate. Nets were hoisted along possible flight paths (i.e., between trees near an opening or possible passageway, on the ground with approximately 30 centimeter clearance for ground dwelling species, etc.). The same mist nets used for birds were utilized to catch bats as well.

For each captured bird, standard bio-metric measurements that were taken are bill length (BL), tail length (TL), forearm length (FL), hind foot or tarsus (HF) and weight. As much as possible identification of captured individuals were up to the species level. All captured birds were released immediately after processing and identification.

Standard bio-metric measurements noted for bats were forearm length (FL), hind foot (HF), ear length (EL), head and body length (HBL), total length (TL) and weight. All captured bats were released immediately after processing and identification.

Live Trapping of Small Non-Volant Mammals

Generally, a minimum of 300 trap nights for a given site replicated thrice is considered as part of a standardized methodology for the results to be considered significant and acceptable. But during survey proper, it was inevitable that traps were misplaced or lost. Also, trap operation is also sometimes cut short because of unfavorable weather condition.

In this study, a maximum of 50 traps was operated because of time constraint and presence of passers-by. Traps were baited with roasted coconut meat mixed with peanut butter. These traps were placed in areas suspected to be most productive (i.e., along possible runways, near hole or among root tangles and fallen logs). Checking was performed immediately after dawn (0600 HR) while re-baiting was performed late in the afternoon (1600 HR).

Each captured individual was processed for its standard biometric measurements, which include, tail vent (TV), hind foot (HF), head and body length (HBL), total length (TL) and weight. Similar to birds, all captured small non-volant mammals were released immediately after processing and identification.

Opportunistic Catching for Amphibians and Reptiles

Existing trails, rivers and springs within the site served as survey routes for amphibians and reptiles. Whenever amphibians and reptiles were encountered along these routes, they were captured by hand. It should be noted that sampling was not limited to these routes. It was usually conducted late in the afternoon and in some occasions during the early evening.

It is primarily through the use of bare hands that amphibians and reptiles were captured. By checking a variety of habitats (i.e., tree trunk, tree holes, root tangles, water tributaries and small bodies of water) possible for these two groups within a site, opportunistic catching were performed.

Standard bio-metric measurements noted for amphibians are snout-vent length (SVL), head breadth (HB) and hind limb length (HLL). While for reptiles, snout-vent length (SVL), tail length (TaL), head breadth (HB) and total length (TL). All captured individuals for these two groups were immediately released after processing and identification.

Interviews

This survey did not take into account statistical information, as it simply focused on the inventory and identification of wildlife species. To augment data gathering, a group type of interview was conducted. An informal type of meeting is initiated, which led to a discussion type of information extraction. The respondents were the guides and some in occasion settlers or communities near the sampling sites. No questionnaires were presented to the respondents.

Pictures and other visual materials that can aid in the identification process were also made available. Whenever doubts are encountered regarding the occurrence of species in the area, they are automatically excluded from the list.

Sample Collections and Handling

Voucher specimens were taken only when the identity of a captured individual cannot be ascertained. It was measured first while distinguishing characteristics were noted. Specimens were then washed with soap and water to remove dirt and other body stains, which can possibly affect the preservation process and external appearance.

Each specimen was tagged and given a corresponding catalogue or field number. This tag contained immediate information about the specimen (i.e., catalogue or field number, species, date of collection, sex, collector and place of collection). Catalogue sheets that were adapted and utilized in this research were that of the Field Museum of Natural History's (FMNH) format. It contains a more comprehensive information regarding the specimen, namely: mode of preparation, approximate age, biometric measurements, collection method; for males- position and size of testes, epididymis and accessory glands; for females- position, number and condition of mammae, vaginal condition, reproductive stage, pubic symphysis, embryos and placental scars; habitat type, and other remarks.

The fluid specimen preparation was used as the preservation method. Collected individuals were placed first in a solution with 10 % formalin and 90% distilled water. After six months to one year, these will be transferred to a solution with 70% ethyl alcohol and 30% distilled water. But before placing them in the said solutions, they were injected first with 10% formalin in some strategic body parts to preserve the internal organs.

Aquatic Fauna

Phytoplankton samples were collected using a 10μ net samples by sieving water collected from Angat River. Samples were then fixed with 10% formalin on site. Zooplankton samples were collected using a 40 μ net since they are larger than the phytoplankton and to segregate them from the phytoplankton collected. Samples were then fixed with 10% formalin. Phytoplankton samples were still fixed with Lugol's solution for coloration and for further fixation and sedimentation. Collected samples were then brought to the laboratory for identification and photomicrograph. Illustrations from Enriquez, 2001; Zafaralla, 1998; Pantastico, 1977; Prescott, 1951; Prescott, 1951; Smith, 1950; and Wolle, 1884 were used for identification and classification of phytoplankton and that of Mamaril and Fernando, 1978 for zooplankton.

Socio-Economic

Pre-Scoping Social Preparation Activities

The pre-scoping social preparation activities were carried out after the May 11, 2001 Elections. Since, the elections have just been concluded, the EIA Team expected that scheduling of presentations and consultative meetings with the LGUs would be difficult since most of the local officials are on vacation.

The Consultant however, was able to set appointments with the some local officials of the concerned municipalities as well as the community leaders of affected barangays, through the office of the Municipal Planning and Development Coordinators (MPDC) of the concerned municipalities.

The planning coordinators of the affected localities have been involve since the Feasibility Study (FS) stage of the Bypass Alignment, so they are very familiar with the EIA process the project has to undergo, particularly, the social aspect. In addition, the Preparer has been closely working with them since, especially in terms of the environmental aspect.

The accomplished pre-scoping social preparation activities were included in the Scoping Report submitted to the EMB on July 2001.

Actual field investigations, series of alignment walk-throughs and other baseline and secondary data gathering were concurrently conducted with the social preparation activities.

Project Presentations

Project presentations were rendered to the LGUs of the affected municipalities in the Province of Bulacan. These were arranged through constant coordination with the MPDC of Balagtas, Guiguinto, Plaridel, San Rafael, and the Office of the Municipal Mayor in Bustos.

Public Consultation Meeting (PCM)

After completion of the project presentations with the LGUs, community-based consultation meetings with the affected people were organized. Barangay leaders of the affected areas assisted in facilitating the meetings.

The Consultant ensured that all stakeholders and concerned sectors are well informed of the scheduled meetings. The consultations were undertaken to:

- Inform and generate awareness and understanding of the stakeholders about the project;
- Provide the stakeholders an avenue to freely voice out their issues, perceptions, and concerns regarding the project;
- Address and identify salient issues and concerns of the stakeholders;
- Familiarize the stakeholders of the EIA Process the project has to undergo; and
- Enable the stakeholders to effectively participate and make informed and guided decisions

During the meeting, the stakeholders were informed that the Preparers would facilitate an overall meeting called the 2nd Level Scoping or the Formal Scoping Session after completing all barangay assemblies. Stakeholders and LGUs from the concerned areas are invited to the session. Members of the EIARC, and representatives of the EMB and the Proponent would also attend the scoping. The participants were also advised to prepare a position paper to be read during the session by the selected spokesperson so that the review committee members would hear out their issues, concerns, and comments about the project.

Complete and proper documentations of the meetings were strictly observed. All participants of each activity were noted and the proceedings were recorded on tape. Likewise, photographs were taken during the consultations.

Table 1.2-1 presents a list of the social preparation activities accomplished by the EIA Team prior to the conduct of the formal scoping session.

Scoping Process

1st Level Scoping (Technical)

The 1st Level Scoping was held on 28 May 2001 at the Conference Room of the Environmental Management Bureau (EMB). Representatives of the Proponent, Engr. Juanito R. Alamar from the DPWH PMO-FS and Dr. Shingo Gose of the Japan International Cooperation Agency (JICA), formally presented the proposed Plaridel Bypass Project to the designated

Environmental Impact Assessment Review Committee (EIARC) headed by the Chairman, Dr. Emmanuel I. Astillero and members, Engr. Antonio E. Kaimo, Engr. Jose Marie U. Lim and Ms. Soledad M. Dalisay. The Environmental Consultant, ECOSYS Corporation led by EIA Team Leader Ms. Annabelle N. Herrera was present in the meeting. Representatives from the EMB EIA Division Mr. Roman Parungao and Mr. Jonas Maronilla were also in attendance.

In the meeting, representatives of the Proponent, the Preparer, and the EIARC determined and agreed upon the technical and substantive scope to be covered by the EIA study, based on duly approved scoping guidelines.

The Formal Scoping Session was scheduled on 23 June 2001.

Site Inspection

Members of the EIARC, the representative of the Proponent, and the representative from the DENR-EMB EIA Division together with the EIA Team conducted a joint site inspection in the areas to be traversed by the bypass alignment on 23 June 2001. This was done prior to the conduct of the Formal Scoping Session.

Formal Scoping Session

The Formal Scoping Session for the planned Plaridel Bypass was held at the Bustos Multi-Purpose Gymnasium,in Bustos, Bulacan on 23 June 2001 at 1:30 P.M. It was well attended and represented by the LGUs, the stakeholders, and representatives of concerned sectors from the five municipalities.

Out-going San Rafael Mayor Hon. Lorna C. Silverio delivered the welcome remark after the invocation and the singing of the National Anthem. It was followed by the brief discussion of the project by Engr. Juanito R. Alamar. Then, Ms. Herrera presented the social preparation activities achieved by the EIA Team as well as the issues and concerns raised during the barangay assemblies.

As agreed upon during the PCMs, the designated spokespersons were given the opportunity to read the position papers prepared the stakeholders. The position papers were then collected for inclusion in the Scoping Report.

Signing of the "PAGPAPATUNAY" document was carried out after the open forum. The said document confirms that a formal scoping was held and that all significant issues and concerns identified will be included in the conduct of EIA study. Selected representatives of the stakeholders signed the PAGPAPATUNAY document together with the members of the EIARC, representatives of the Proponent, representatives of the concerned government agencies, the EMB, and the EIS Prepares.

Post-Scoping Activities

Post-scoping activities referred to here are other social preparation processes, which were not accomplished during the pre-scoping period.

Perception Survey

Perception surveys were administered after the conduct of the Formal Scoping Session. Three (3) main groups of project-affected persons (PAPs) were identified. These are the (i) landowners, (ii) improvement (house, fence, trees, etc.) owners, and (iii) tenant farmers.

Interview with improvement owners were undertaken at the actual site; i.e., enumerators went to the houses that will be displaced during the construction of the bypass. Prior to the tagging and interview, the PAPs were properly informed regarding the procedures to be undertaken. Structures that will be affected were tagged with stickers written with a "control number" that corresponds to number indicated on the survey instrument. Structures, along with the owners were photographed to discourage further improvements to the existing structures. The PAPs were also informed that any other structures that will be built after the census would NOT be eligible for compensation. The same is true for further improvements to the existing structures.

The EIA Consultant sought the assistance of the local leaders and key informants in undertaking the survey for tenant-farmers. This was because most of the tenants do not live in the areas where they work. After coordinating with the Barangay Captains and the Barangay Agrarian Reform Committee (BARC) Chairman/members, particularly with regards to the identification of these tenants, the tenant farmers were requested to proceed to the concerned barangay hall for the interview on a prior arranged schedule.

Similarly, some of the PAPs refused to be interviewed. In these cases, their names were just listed and a remark "refused to be interviewed" was placed opposite their names.

It is emphasized here that during the actual perception survey, it was found out that Brgy. Capihan in San Rafael and Bgry. Liciada in Bustos will not be affected by the alignment. Therefore, the said areas were not included in the study and survey.

Project Presentation to the LGUs

As previously discussed, the social preparation activities were conducted after the local and national elections. The EIA Team was not able to present the proposed bypass alignment to the Municipal Mayors as well as the Sangguniang Bayan (SB) of the concerned areas, primarily because most of them are on vacation.

Given this situation, the Team waited for the official turnover of administration to the newly elected officials on June 30, 2001.

Bustos

The planned Plaridel Bypass Project was presented to Hon. Mayor Carlito D. Reyes on 19 July 2001. The meeting was organized through close coordination with the Office of the Mayor. Also present during the presentation were Brgy. Captains Edgardo de le Cruz of Camachilihan, Antonio Punongbayan of Liciada, Felicisimo R. Ramos of Malamig, Martin Perez of Bonga Menor, Vicente Ramos of Tanawan, and Brgy. Secretary Reynaldo Alcantara of Taslampas.

The EIA Team also informed and explained to the LGUs the socioeconomic survey that will soon be conducted in the affected areas.

Attached here are some of the photographs taken during the project presentation.

Plate No. 1 *EIA Team Member* **Mr. Ronaldo T. Manipol** (left) showing newly elected mayor, **Hon. Toti Reyes** (center) and community leaders of affected barangays the areas to be traversed by the planned Plaridel Municipality of Bustos.

Plate No.3 **Ms. Annabelle N. Herrera** giving *Mayor* **Jaime J. Viceo** a brief background of the proposed Plaridel Bypass Project. Seated next **to him is** ***Brgy. Capt.*** **Ramon** Pantaleon of Tambubong.

Plate No. 2 *EIA Team Leader* **Ms. Annabelle N. Herrera** explaining the tagging procedure for the structures to be affected by the alignment

Plate No. 4 **Mayor Viceo** asking when the project will be started.

San Rafael

A project briefing with Mayor Jaime J. Viceo of San Rafael Bulacan was undertaken on 19 July 2001. Brgy. Capt. Ramon Pantaleon of Tambubong, Eduardo A. de la Cruz of Caingin, Feliciano C. Mendoza of Capihan, Ric del Rosario of San Roaque, and Mnadro J. Manabat of Maguinao also attended the meeting.

Shown here are some of the photographs taken during the project briefing.

Project Presentation to the Sangguniang Bayan (SB)

The Preparer requested for an audience with the SB of the municipalities crossed by the alignment to present the proposed bypass alignment. Organization of the meetings was again coursed through the MPDC offices of concerned municipalities. This activity was undertaken to enable the SB to appreciate the proposed undertaking and understand the need for a favorable municipal council resolution endorsing the project.

Guiguinto

The project presentation to the SB of Guiguinto was held on 03 December 2001. Prior to the presentation, the EIA Team together with the representatives of JICA Study Team updated Mayor Ambrosio C. Cruz, Jr. on the recent re-alignment sections along Guiguinto, particularly in Tiaong and Cutcut (see **Plate 5**).

The main issue raised during the presentation was regarding process of compensation to affected property owners. Other queries are engineering-related, which includes the following:

- Width and length of the bypass alignment;
- Width and length of service roads;
- If the alignment will be fenced;
- Implementation schedule;
- Height of embankment along agricultural areas; and
- Provision of underpass for farmers, carabaos, and other farm implements such as hand tractors and threshers

Attached here are some photographs taken during the SB presentation

Plate No. 5 **Dr. Shingo Gose** of the JICA Study Team showing *Mayor* **Ambrosio C. Cruz, Jr.** (left) the re-alignment sections of the bypass route in Guiguinto. Looking on are EIA Team Leader Ms. Annabelle N. Herrera, EIA Team Member Mr. Ronaldo T. Manipol (in yellow), and other department heads of Guiguinto.

Plate No. 6 Brief discussion of the proposed Plaridel Bypass by Ms. Annabelle N. Herrera.

Plate No. 7 Ms. Herrera explaining the importance of the resolution of the SB to the project's acceptability.

San Rafael

The SB presentation at San Rafael was undertaken on 29 November 2001. Majority of the councilors attended the session.

Some of the issues raised include the following:

- Procedure of payment to affected property owners;
- If the bypass will be fenced;
- If the bypass will be a tolled highway;
- Implementation schedule; and
- Relocation site for affected families

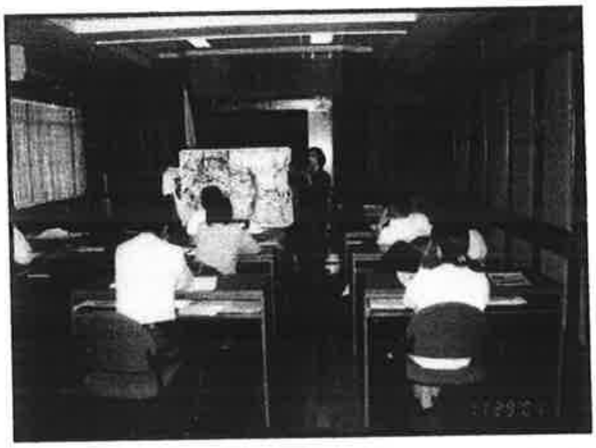


Plate No. 8 EIA Team Leader Ms. Annabelle N. Herrera briefly explaining the planned Plaridel Bypass Project.

Plate No. 9 **Ms. Herrera** familiarizing the councilors on the areas to be traversed by the bypass alignment.

Public Consultation Meetings (PCMs)

Consultation meetings were administered in Brgy. Tiaong and Cutcut in Guiguinto to hear out the issues and concerns of the stakeholders who were not involved during the pre-scoping social preparation activities.

It is important to note here that these stakeholders are those who will be affected by the recent changes in some sections of the alignment.

Brgy. Tiaong

The consultation meeting was held at the Chapel in Brgy Tiaong on 14 August 2001.

Although the atmosphere was still quite tensed just like the first few consultations the Consultant was able to control the situation and kept the meeting amicable. The primary issue raised was why the alignment was shifted. Majority of the stakeholders objected to the change, stressing that it could still be moved towards west to avoid displacement of residential houses.

It was agreed upon that the suggestions of the stakeholders regarding possible realignments would be forwarded to the Design Team to be discussed in one of the meetings with the DPWH.

Plate No. 10 Invocation led by Ms. Annabelle N. Herrera.

Plate No. 11 Ms. Herrera showing the participants the areas crossed by the re-alignment sections of the bypass route.

Plate No. 12 **Ms. Feiza S. Narciso** asking if the alignment could still be moved to more open area to prevent displacement houses.

Plate No. 13 **Mr. Francisco C. Sillano** is eager to know why the alignment was again re-aligned.

Brgy. Cutcut

The PCM at Cutcut was conducted on 09 August 2001. All affected residents were present during the meeting, as well as the Brgy. Captain Librado Osorio and some of the Brgy. Kagawads.

The following are the issues and concerns aired during the consultation:

- Process of compensation to affected property owners;
- Relocation site for affected families;
- Funding for the construction of the bypass project;
- Process of compensation for tenants;
- If who will shoulder the cost of transfer of land titles; and
- Priority in hiring to affected people in Cutcut

Plate No. 14 Invocation led by **Ms. Felicia G. Rubianes**.

Plate No. 15 *JICA Study Team's Environmental Specialist* **Ms. Annabelle N. Herrera** enlightening the participants on the bypass alignment.

Plate No. 16 **Mrs. Aurora Osorio** asking about the process of compensation to affected property owners.

Plate No. 17 **Mr.** and **Mrs. Salagala** would like to know if displaced families will be provided with relocation site.

Plate No. 18 *Brgy. Kgwd.* **Apolonio Cruz** suggesting that the affected persons in Cutcut be given priority in hiring of workers during implementation period.

1.3 THE EIA TEAM

Team Leader

Annabelle N. Herrera earned her Master of Science Degree in Geology from the University of the Philippines, Diliman, Quezon City and specializes in the conduct of Environmental Impact Studies and other environmental related researches. She is an EMB-Accredited EIS Preparer, Team Leader Category with Accreditation No. A2AHD0024. As an Environmental Specialist/Team Leader, Ms. Herrera has completed the Resettlement Action Plan (RAP) for the National Road Improvement and Management Program Phase I (NRIMP) and the Manila North Tollways Project. As well, she has completed the Environmental Studies on Protected Areas, Ethnic Groups, and Squatters under the Master Plan Study on Visayas and Mindanao Islands Strategic Road Network Development Project (Eastern and Western Mindanao). To date, Ms. Herrera has accomplished EIAs of at least **sixty-five (65)** infrastructure projects, resource extractive and golf course projects among others, the LRT Line 1 South Extension Project, LRT Line 2 Project, Fort Bonifacio-Kalayaan/EDSA Buendia Flyover Project, Dalton Pass Eastern Alternative Route Project, SMBA-Tipo Road Project, Expansion of the PMSC-DMC's Dolomite Mining Project in Alcoy Cebu, Agno Cement Plant and Quarry Project, Republic Cement Corporation Limestone and Silica Claims Project, Hi Cement Quarry and Plant Expansion Project, Subic Bay Golf Course Project, and Alta Vista Royale Golf Course Project

Geologist

Carlo D. Dayanghirang is a BSc. Geology graduate of Adamson University in Manila. He obtained a MSc. in Quaternary Geology (Magna cum Laude) degree from Vrije University of Brussels, Brussels Belgium in 1986. He has been involved in various exploration works and consultancy jobs as a geologist for the EIA of several geothermal plants, mining and major infrastructure projects. These include, Dalton Pass Eastern Alternative Route Project in the Province of Nueva Ecija and Nueva Vizcaya, Dalton Pass Eastern Alternative Route Bunga-Baluarte-Tayabo Section Project in Nueva Ecija, and the LRT Line Extension Project in Manila.

Terrestrial Biologist

Michael G. de Guia, is a BSc. Biology graduate from the University of the Philippines in Los Baños, Laguna. He is a candidate for a Master of Science Degree in Wildlife Studies at the University of the Philippines in Diliman, Quezon City. He has worked as a Wildlife Biologist for several preliminary wildlife inventories. He was employed as a Terrestrial Biologist in various EIA projects such as Dalton Pass Eastern Alternative Route Project in the Province of Nueva Ecija and Nueva Vizcaya, Dalton Pass Eastern Alternative Route Bunga-Baluarte-Tayabo Section Project in Nueva Ecija, and Expansion of the PMSC-DMC's Dolomite Mining Project in Alcoy Cebu.

Biologist

Evangeline B. Enriquez is a candidate for a Master of Science Degree in Biology at the University of the Philippines in Diliman, Quezon City. She has conducted field and laboratory research on marine and terrestrial habitat. Ms. Enriquez attended the "Workshop on Limnology within the EC-INCO Programme" held at the National Institute of Fisheries, Bangkok, Thailand on February 19-22 2000. As a Marine Biologist, she has worked on several EIA projects that include, Expansion of the PMSC-DMC's Dolomite Mining Project in Alcoy Cebu, Agno Cement Plant and Quarry Project in Agno, Pangasinan and Liboganon Flood Control Component, Tagum City, Davao Del Norte. In 1998, she completed the Study of the Chlorophyll Content of the Taal Lake, in Batangas Province. She is a Certified Open Water Diver.

The accountability statements of the EIS Preparer and Project Proponent are attached as **Appendices E** and **F,** respectively.

1.4 EIA STUDY SCHEDULE

1.4.1 Social Preparation and Scoping Activities

The preliminary site inspection conducted along the route corridor in May 2001marked the start of the EIA study. It was followed by a series of rigorous alignment walk-throughs to determine the specific barangays to be affected by the project.

After establishing the areas to be traversed by the planned bypass alignment, the Preparer then requested for a 1st Level Scoping (Technical). The scoping was scheduled on 28 May 2001. It is essential to note here that the there is only one 1st Level Scoping for the Plaridel Bypass, and the Cabanatuan and San Jose Bypasses. The Formal Scoping Session was held on 23 June 2001 at the Bustos Multi-Purpose Gymnasium in Bustos, Bulacan. Prior to the session proper, a site inspection was conducted in the morning of that same date.

Constant and close coordination with the MPDC of concerned the municipalities resulted to a series of project briefings and consultative meetings with the local officials and community leaders of affected barangays. Upon completion of the Municipal level consultations, barangay assemblies were then undertaken.

Table 1.4-1 gives an overview of the social preparations and scoping activities accomplished by the EIA Team.

Baseline data gathering was concurrently undertaken with the conduct of the social preparation activities.

Water sampling along the rivers and creeks crossed by the Bypass alignment was conducted from 29-31 July 2001. Air quality and noise level monitoring were done from 09-10 June 2001.

Flora survey along the alignment was done simultaneously with the alignment walk-throughs and site inspections, while the study on terrestrial and aquatic fauna was undertaken from 04-06 June and 17 October 2001, respectively.

Perception survey was initiated after the Formal Scoping Session. Interview with key informants was carried out from July to September 2001.

Other related baseline and secondary data gatherings were undertaken in the duration of the study.

Table 1.4-1 Completed Project Presentations and Public Consultation Meetings

Office/Barangay	Date; Time	Venue	No. of Participants
Project Presentation to the LGUs of Balagtas	11 June 2001	Office of the Mayor, Balagtas, Bulacan	10
Project Presentation to the LGUs of Guiguinto	11 June 2001	Office of the Mayor, Guiguinto, Bulacan	12
Project Presentation to the LGUs of Plaridel	13 June 2001	Office of the Mayor, Plaridel, Bulacan	14
Project Presentation to the LGUs of Bustos	13 June 2001	SB Session Hall, Bustos, Bulacan	8
Project Presentation to the LGUs of San Rafael	05 June 2001	SB Session Hall, San Rafael, Bulacan	17
Project Presentation to FILINVEST Land Incorporated	05 June 2001	Office of the Mayor, San Rafael, Bulacan	8
PCM at Brgy. Borol 2nd, Balagtas	21 June 2001	Brgy. Hall, Borol 2nd, Balagtas	20
PCM at Brgy. Tiaong, Guiguinto	21 June 2001	Community Chapel, Brgy. Tiaong, Guiguinto	34
PCM at Brgy. Cutcut and Pulong Gubat, Guiguinto	21 June 2001	Community Chapel, Pulong Gubat	11
PCM at Brgy. Bulihan, Plaridel	22 June 2001	Brgy. Hall, Bulihan	37
PCM at Brgy. San Jose, Plaridel	22 June 2001	Brgy. Hall, San Jose	21
PCM at Brgy. Camachilihan, Bustos	19 June 2001	Brgy. Hall, Camachilihan	15
PCM at Brgy. Talampas, Bustos	19 June 2001	Brgy. Hall, Talampas	18
PCM at Brgy. Liciada, Bustos	19 June 2001	Brgy. Hall, Liciada	13
PCM at Brgy. Bonga Menor, Bustos	20 June 2001	Brgy. Bonga Menor	18
PCM at Brgy. Tambubong, San Rafael	12 June 2001	Brgy. Hall, Tambubong	19
PCM at Brgy. Caingin, San Rafael	12 June 2001	Brgy. Hall, Caingin	22
PCM at Brgy. Capihan and San Roque, San Rafael	12 June 2001	Brgy. Hall, San Roque	33
PCM at Brgy. Maguinao, San Rafael	12 June 2001	Brgy. Hall, Maguinao	12

1.4.2 Post-Scoping Activities

Table 1.4-2 presents a summary of activities, which were not accomplished prior to the conduct of the formal scoping session and were not included to the submitted Scoping Report in July 2001.

Table 1.4-2 Completed Post-Scoping Project Presentations and PCMs

Office/Barangay	Date	Venue
Project Presentation to the LGUs of Bustos	19 July 2001	SB Session Hall, Bustos, Bulacan
Project Presentation to the LGUs of San Rafael	19 July 2001	Office of the Mayor, San Rafael, Bulacan
Project Presentation to the SB of Guiguinto	03 December 2001	SB Session Hall, Guiguinto, Bulacan
Project Presentation to the SB of San Rafael	29 November 2001	SB Session Hall, San Rafael, Bulacan
PCM at Brgy. Tiaong, Guiguinto	14 August 2001	Community Chapel, Brgy. Tiaong, Guiguinto, Bulacan
PCM at Brgy. Cutcut	21 June, 10:00	Community Chapel, Cutcut, Guiguinto, Bulacan

Chapter 2
Project Description

2 PROJECT DESCRIPTION

2.1 PROJECT RATIONALE

Goals and Objectives

In the same line with the other two (2) proposed bypass roads within the Sta. Rita-San Jose section of the Pan-Philippine Highway, the main goal of the construction of the **Plaridel Bypass** is to **help restore the arterial road function** of the said highway. In effect, this would improve the Level of Service of the Highway from the present **E** (unstable flow with short stoppages) and **F** (forced on breakdown flow), to **B** (reasonably free flow, but speeds beginning to be restricted by traffic conditions).

The main objectives of constructing the bypass are to:

i) Provide a free-flowing alternative route to through traffic motorists;

ii) Allow separation of slow and fast moving vehicles; and

ii) Provide a highway that follows international standards in terms of vertical and horizontal curvature, sufficient and regular shoulder widths, with limited number of intersections.

Rationale

Results of the Feasibility Study conducted showed that the populations of provinces that will be traversed by the proposed bypasses would grow by factors of 1.1, 1.23, and 1.4 of that of 1998 by the years 2005, 2010, and 2020, respectively. Future land use plans, from the regional down to the city and municipal levels indicate urbanization trends that would require **serious consideration of the existing functional serviceability of the road networks**.

Based on Bulacan's Physical Framework Plan, the Province is basically agricultural, but has been considerably urbanized due to its proximity to Metro Manila. The Province ranked number one (1t) in hog production, third (3rd) in poultry production, and ninth (9th) in palay production (in 1997). Agriculture and other agri-business activities are thriving, but the extent of rice paddy fields have decreased. The predicted urbanization trend of the Province is as follows:

- Settlements are expected in the Norzagaray-San Jose del Monte Growth corridor, the eastern parts of Bulacan Province in the immediate vicinity of Metro Manila. This is envisaged as a natural reaction to cope with the rapid urban expansion from Metro Manila. It is also envisioned that in the future, paddy fields will be replaced by buildings;

- In response to urbanization, the southern part of Bulacan which are in the neighborhood of NCR and crossing the North Luzon Expressway (NLE) will be developed further as a Malolos-Meycauayan urban core;

- The growth corridor along the northwest side of the growth triangle of the Province (i.e., the Municipalities of Plaridel and Baliuag) is a gateway of the Cagayan Valley Road, connecting to Cabanatuan City. These two municipalities are expanding to its neighboring Municipalities---San

Rafael, San Miguel, Bustos, and a portion of Angat;

- San Miguel will be urbanized further as an urban service center and as a distribution center for agricultural goods.

The urban expansion trends of the municipalities of Plaridel and Baliuag would significantly influence the urbanization of the nearby municipalities, such as the corridor where the proposed Plaridel Bypass will pass through; i.e., **Guiguinto**, **Bustos**, and **San Rafael**. Plaridel is envisioned as the nucleus of the major growth corridor in southern Bulacan. Based on the prevailing Provincial Physical Framework Plan of Bulacan, settlements are expected to expand towards proposed industrial estates and towards **Guiguinto** on the south, Malolos on the west, and Pulilan on the north. This expansion is seen as a result of the natural rural-urban migration triggered by economic growth rates in the urban centers and industrial estates.

Malolos and Guiguinto are sites of **two (2) future** major development projects namely the, (i) Bulacan Central Bulk Water Supply Project (BCBWSP) and the Manila-Clark Rapid Railway Systems. These two projects are expected to cause a rapid increase in population not only in the said municipalities, but also towards other growth areas such as Plaridel.

Baliuag, the other municipality on the northwest side of the growth triangle of the Province is also considered as a rapid economic growth center, given its strategic location and extensive commercial development. The expansion of settlement is expected to be towards Pulilan and three other growth areas, **Bustos**, **San Rafael**, and **San Ildefonso**. Pulilan is a candidate to become a major urban center, whereas the other three municipalities are expected to develop from a classification as Non-Central Places in 1995, to **secondary urban centers** in 2007.

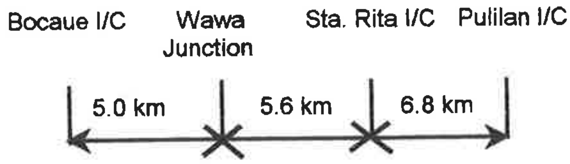
2.2 ALTERNATIVE ALIGNMENTS

2.2.1 Alternative Route Corridors Studied

During the Feasibility Study (FS) stage of the proposed project, **four (4)** possible alternative route corridors **(Figure 2.2-1)** were comparatively studied to minimize the potential adverse impacts to the environment, while enhancing the level of service to the traveling public and constructing a cost-effective bypass alignment.

The following major factors were considered in the preparation of the alternative routes:

- Location of an interchange (I/C) with the North Luzon Expressway (NLE);



- Linkage with Metro Manila (the shorter the better for long distance thru traffic along the Pan-Philippine Highway);

- Access to the proposed industrial areas in Plaridel and Guiguinto, and Baliuag Urban Center; and

- Bridge location to span over Angat River

Table 2.2-1 summarizes the descriptions of the four (4) alternative routes proposed for comparative study.

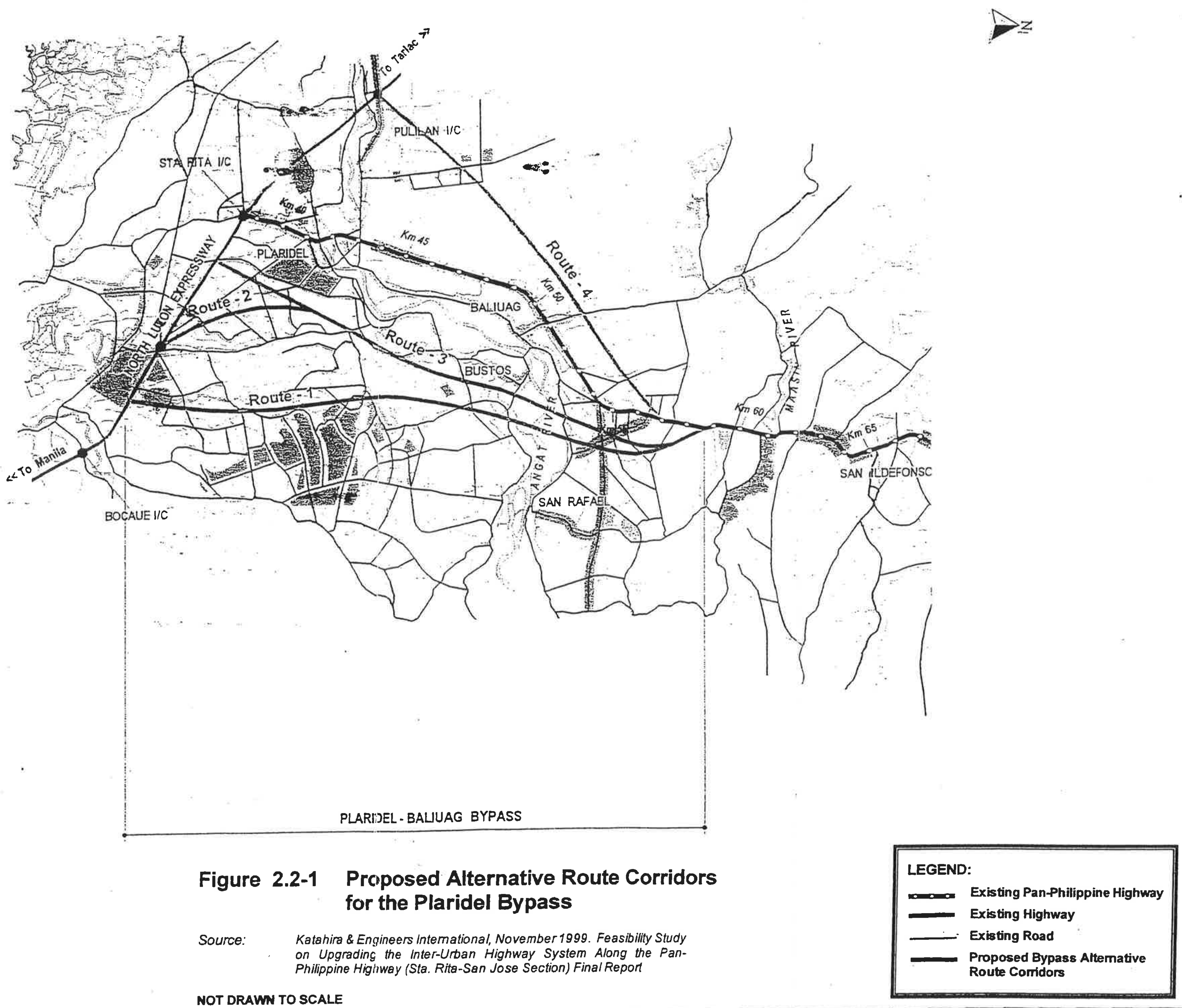


Figure 2.2-1 Proposed Alternative Route Corridors for the Plaridel Bypass

Source: *Katahira & Engineers International, November 1999. Feasibility Study on Upgrading the Inter-Urban Highway System Along the Pan-Philippine Highway (Sta. Rita-San Jose Section) Final Report*

NOT DRAWN TO SCALE

Table 2.2-1 Alternative Bypass Routes Proposed for Comparative Study

Route No	Planning Concepts	Route Length	Route Alignment
Route – 1	• New interchange between Bocaue1/C and Wawa Junction; • Shortest linkage with Metro Manila; • To provide direct access to proposed Guiguinto Industrial area.	22.5 km	This route starts at the halfway of existing Bocaue Interchange and Wawa Junction of the North Luzon Expressway: It runs northward through the eastside of the proposed Pulang Lupa urban area and existing Malawak Town, and crosses Angat River at Bonga Mayor. It joins with Pan-Philippine Highway at San Roque (Km 59).
Route –2	• Existing Wawa Junction is to be converted to an interchange; • Second shortest linkage with Metro Manila; • To provide better access to proposed Plaridel industrial area and Baliuag Urban Center.	22.0 km	This route starts at the existing Wawa Junction, and runs northward, then turns to northeastward parallel to Angat River, and crosses the River at Tambubong. It connects with Pan-Philippine Highway at San Roque (Km 59).
Route – 3	• Almost the same concept as Route –2, except that new interchange is provided between Wawa Junction and Sta. Rita 1/C.	20.0 km	This route starts at the middle of the existing Wawa Junction, and Sta. Rita Interchange. It runs northeastward through the eastside of the proposed Plaridel Industrial Area, then proceeds parallel to Angat River with the same alignment with Route – 2.
Route - 4	• The only route considered at west of the existing Pan-Philippine Highway; • To utilize existing Pulilan 1/C; • Through this route is the longest linkage with Metro Manila a bridge over Angat River can be avoided.	16.8 km	This route starts at the existing Pulilan Interchange, and runs north-eastward crossing Highway No. 359 at Santo Niño, then runs parallel to Pan-Philippine Highway until it links with it at Capihan (km 57).

SOURCE: *Katahira & Engineers International, November 1999. Feasibility Study on Upgrading the Inter-Urban Highway System Along the Pan-Philippine Highway (Sta. Rita-San Jose Section), Final Report*

2.2.2 Selection of the Route Corridor

Rating Criteria and Evaluation

To provide a rating system in the selection of the of the best bypass route for the Feasibility Study, a rating criteria has been formulated based on the evaluation of four (4) factors namely; *1) Technical; 2) Development; 3) Environment;* and *4) Economic and Financial* evaluations related to the upgrading the inter-urban road system as described in the succeeding sections.

Technical Evaluation

The comparative evaluation for the proposed bypass routes shall involve the comprehensive factors such as mobility, accessibility, harmony with existing network, etc., including the following:

Location of Interchange

The appropriateness of connection point with the existing NLE was evaluated in terms of space of the interchange and connection with the existing main arterial roads.

a) Good (reasonable spacing and connection);

b) Fair (connection with the west side);

c) Bad (no connection with main arterials)

Geometry

The mobility of the bypass was evaluated only by differences in vertical and horizontal geometries because a proposed cross section was the same for each route, thus could provide the same level of mobility:

a) Good (preferable standards);

b) Fair (minimum standards);

c) Bad (sub-standards)

Efficiency of Bypass

The efficiency of the bypass was measured by a ration of traffic volume diverted to the proposed bypass from the existing Pan-Philippine Highway in the proposed target year of completion in Year 2010.

a) Good;

b) Fair;

c) Bad

Accessibility to Urban Center

The accessibility was estimated by spaces between access roads and distances from access points to the urban center.

a) Good (narrow spaces, short distances);

b) Fair (fair spaces, fair distances);

c) Bad (wide space, longer distance

Harmony with Existing Road Network

The harmony of the proposed bypass in the existing road network was assessed in terms of highway hierarchy, density, space and continuity in the influenced area.

a) Good (highly harmonized);

b) Fair (fairly harmonized);

c) Bad (poorly harmonized)

Construction Difficulty

The construction difficulty was evaluated by special structures such as long-span bridges and high embankment of soft grounds.

a) Good (no/small bridges, no high embankment;

b) Fair (fair-length bridge, fair high embankment);

c) Bad (long-span bridge, high embankment)

Developmental Evaluation

Compatibility with City Development Plan

a) Good;

b) Fair;

c) Bad

Compatibility with Provincial Development Plan

a) Good;

b) Fair;

c) Bad

Service to Private Development Plan

a) Good;

b) Fair;

c) Bad

Environmental Evaluation

The environmental issue is given an importance in the comparative evaluation because major construction activities may cause some negative impacts on the natural and social environment.

Natural Environment

The natural environment was assessed by physical constraints (air pollution and noise level), and biological constraints (flora and fauna), etc.

a) Good;

b) Fair;

c) Bad

Socio-Economic Environment

The negative impacts on the socio-economic aspect were assessed with respect to historical sites and protected areas, density of communities, and agricultural productivity.

a) Low;

b) Medium;

c) High

Number of Houses Affected

The number of houses to be affected by the construction of the bypass and access roads was considered as a factor of environmental evaluation

a) Few;

b) Fair;

c) Many

Economic and Financial Evaluation

As the indicators of financial evaluation, the following three (3) factors were quantified and used for comparative evaluation of the proposed bypass alternatives.

Financial Aspect (Construction Cost)

a) Low;

b) Fair;

c) High

Social Aspect (ROW Acquisition and Compensation

a) Low;

b) Fair;

c) High

Economic Aspect (EIRR)

a) High;

b) Medium;

c) Low

Overall Evaluation on Bypass Alternatives

In the overall evaluation of the bypass alternatives, at first, from four factors including, technical, developmental, environment, and economic and financial aspects, these were then evaluated separately giving the following points:

a) 3 points;

b) 2 points;

c) 1 point

The total points of each factor was then classified into three (3) categories to evenly evaluate each factor as follows:

- Technical Evaluation

Points 15-18 Class A
Points 11-14 Class B
Points 6-10 Class C

- Development Evaluation

Points 8,9 Class A
Points 6,7 Class B
Points 3,4,5 Class C

- Environment Evaluation

Points 10-12 Class A
Points 7-9 Class B
Points 4-6 Class C

- Economic and Financial Evaluation

Points 8,9 Class A
Points 6,7 Class B
Points 3,4,5 Class C

In order to express the results of the overall evaluation with numeral, each class was again given the following points:

a) 3 points;

b) 2 points;

c) 1 point

The results of the rating and evaluation of the route alternatives for the Plaridel Bypass are presented in **Table 2.2-2.**

Table 2.2-2 Evaluation on the Plaridel Bypass Route Alternatives

FACTORS	Route-1		Route-2		Route-3		Route-4		REMARKS
Length of Routes	22.5 km		22.0 km		20.3 km		16.8 km		
1. Technical Evaluation	**Evaluation**	**Rating**	**Evaluation**	**Rating**	**Evaluation**	**Rating**	**Evaluation**	**Rating**	
1.1 Interchange Location	Bad	c	Good	a	Bad	c	Fair (Connection with west side. Utilization of existing VC.)	b	
1.2 Geometry	Good	a	Fair	b	Good	a	Good	A	
1.3 Efficiency of Bypass	0.16	c	0.46	a	0.46	a	0.41	b	AADT IN 2010(2)
1.4 Accessibility to Urban Center	S=1.0-4.8km	c	S=1.7-4.0km D=9.3/6.3km Fair	b	S=1.7-3.5km D=9.2/6.2km Fair	b	S=2.3-4.3km D=9.2/7.1km Fair	b	S=Spaces D=Distances
1.5 Harmony with Existing Network	Bad	c	Good	a	Bad	c	Bad	C	
1.6 Construction difficulty	Fair (L=1000m. New Interchange	b	Fair (L=425m, Improvement Junction)	b	Fair (Fair 425,New Interchange)	b	Good (L=0m, Improvement of Access)	A	
RATING	***a + b + 4c (9 points)***		***3a + 3b (15 points)***		***2a + 2b + 2c (12 points)***		***2a + 3b + c (13 points)***		***A=3 b=2 c=1***
2. Development Evaluation	**Evaluation**	**Rating**	**Evaluation**	**Rating**	**Evaluation**	**Rating**	**Evaluation**	**Rating**	
2.1 Compatibility with City Development Plan	Bad	c	Good	a	Good	a	Bad	C	
2.2 Compatibility with Provincial Development Plan	Good	a	Fair	b	Bad	c	Bad	C	
2.3 Service to Private Development Plan	Bad	c	Good	a	Good	a	Bad	C	
RATING	***A + 2c (7 points)***		***2a + b (8 points)***		***2a + c (7 points)***		***3c (3 points)***		***A=3, b=2, c=1***
3. Environmental Evaluation	**Evaluation**	**Rating**	**Evaluation**	**Rating**	**Evaluation**	**Rating**	**Evaluation**	**Rating**	
3.1 Existing Natural Environment	Medium	b	Low	a	Low	a	Medium	B	
3. Social-economic Environment	Medium	b	Low	a	Low	a	Medium	b	
3.3 No of Houses affected	20 ea	a	25 ea	b	30 ea	c	20 ea	A	
3.4 ROW Acquisition	1073 ha	c	1068 ha	c	980 ha	b	840 ha	b	
RATING	***A + 2b + c (8 points)***		***a + 2b + c (9 points)***		***2a + b + c (9 points)***		***2a + 2b (10 points)***		***A=3, b=2, c=1***
4. Economic and Financial Evaluation	**Evaluation**	**Rating**	**Evaluation**	**Rating**	**Evaluation**	**Rating**	**Evaluation**	**Rating**	
4.1 Financial Aspect	P 2.861 M	c	P 2,568 M	b	P 2,331 M	b	P 1,632 M	A	
4.2 Social Aspect	P 636M	b	P 720M	b	P 805M	c	P 311 M	A	
4.3 Economic Aspect	24.6	b	26.3	a	25.0	a	21.3	c	
RATING	***2b + c (5 points)***		***a + 2b (7 points)***		***a + b + c (6 points)***		***2a + c (7 points)***		***A=3,b=2, c=1***

OVERALL RATING

	Route-1	Route-2	Route-3	Route-4	
1. Technical Evaluation	9 (c)	15 (A)	12 (B)	13 (B)	A= 15 – 18 B = 11- 14 C= 6-10
2. Developmental Evaluation	7 (B)	8 (A)	7 (B)	3 (c)	A=8.9 B=6.7 C=3,4,5
3. Environmental Evaluation	8 (B)	9 (B)	9 (B)	10 (A)	A=10 – 12 B=7 – 9 C= 4 – 6
4. Economic and Financial Evaluation	5 (c)	7 (B)	6 (B)	7 (B)	A=8,9 B=6,7 C=3,4,5
OVERALL RATING	***2B + 2c (6 points)***	***2A + 2B (10 points)***	***4B (8 points)***	***A + 2B =C (8 points)***	***A=3; B=2; C=1***
RATING	***4***	***1***	***2***	***2***	

SOURCE: *Katahira & Engineers International, November 1999.*

2.2.3 Selection of Alignment

The approximate route corridors of the proposed Plaridel Bypass were selected as discussed in the preceding sections. Within the selected corridor, several alignments were studied to select the best based on aerial photo mosaics, 1:50,000 topographic maps, and field investigations

The major considerations in the selection of the best alignment were the following:

- Minimization of adverse social impacts;
- Conformity with the land use plan and the local road network plan;
- Access points to the urban center and other major facilities and the planned development sites; and
- Location of a long bridge

Control Points

The identified control points in establishing the alternative alignments for the Plaridel Bypass are reflected in **Figure 2.2-2**. The major control points are:

- Beginning point at Wawa Junction of NLE (converted to the Burol Interchange) as discussed in **Table 2.2-1**;
- High density residential areas scattered in the route corridor;
- Crossing location of a bridge over the Angat River (the shorter the better, but due to the development of built-up areas along the riverbanks, bridge crossing location is limited); and
- End Point – high density residential areas along the existing Pan-Philippine Highway

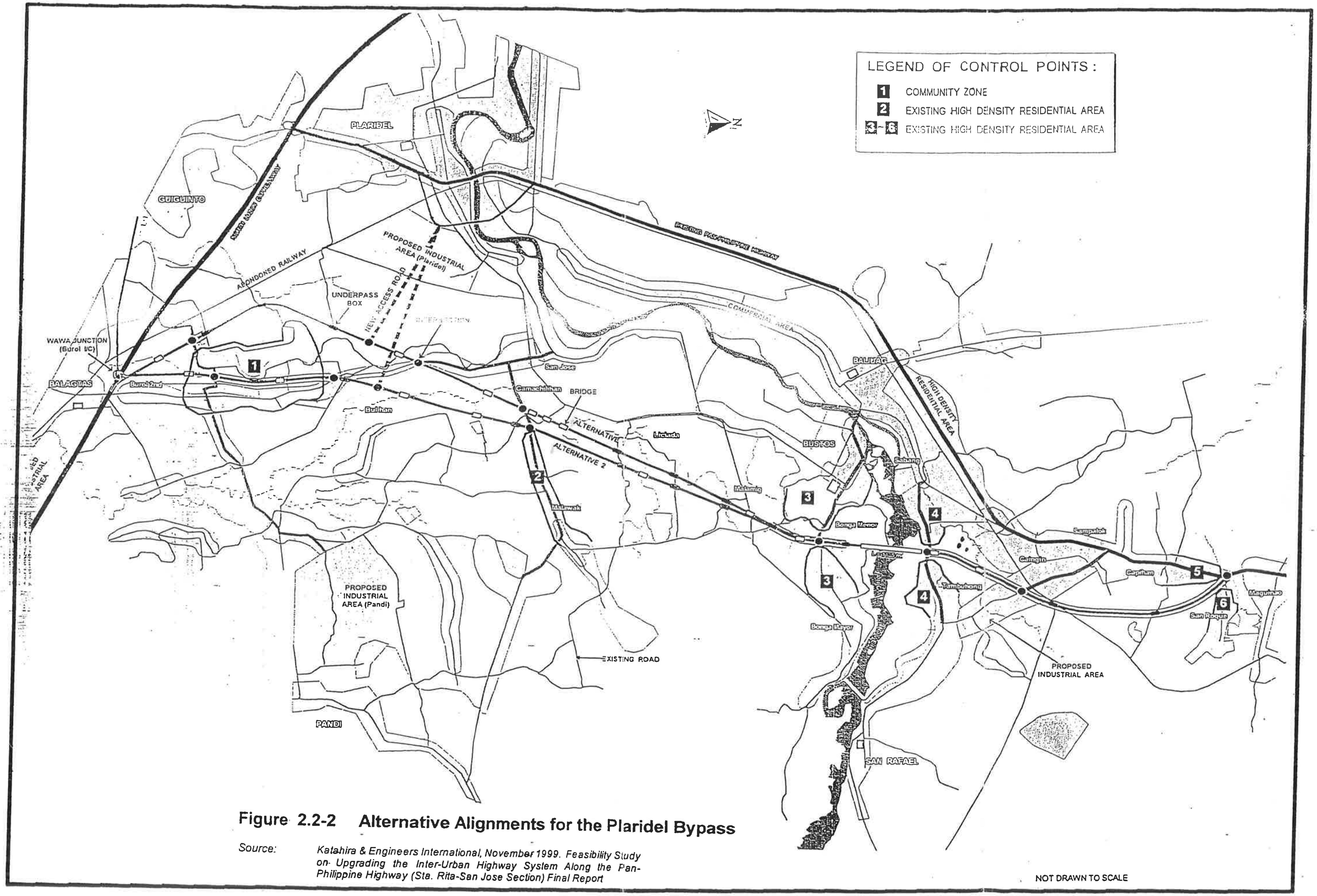


Figure 2.2-2 Alternative Alignments for the Plaridel Bypass

Source: *Katahira & Engineers International, November 1999. Feasibility Study on Upgrading the Inter-Urban Highway System Along the Pan-Philippine Highway (Sta. Rita-San Jose Section) Final Report*

The Selected Alignment

There were **two (2)** alternative alignments considered based on the selected route corridors **(Figure 2.2-2)**. These are:

Alternative 1 – This is the alignment studied during the route selection presented in **Table 2.2-1, Section 2.2.1** of this Chapter. The alignment mostly passes through agricultural lands. Access to the proposed agro-industrial areas in Plaridel and Pandi is focused.

Alternative 2 – This alignment intends to provide the shortest link with due consideration of access to the proposed agro-industrial areas.

The results of the comparison of the two alternative alignments are given in **Table 2.2-3**.

Based on the comparison result the selected route is Alternative 1, presented as **Figure 2.2-3**.

Table 2.2-3 Comparison of Alternative Alignments

		Alternative – 1	Alternative – 2
1)	Length (km)	22.0	20.9
2)	Construction Cost (Million P)	2,830 (1.00)	2,850 (1.007)
3)	No. of houses affected	76 (1.00)	102 (1.34)
4)	Mobility		
	- No. of intersection		
	- Shortest of interval of intersection		
5)	Access to the Existing Urban Centers		
	- Plaridel	Good	Fair
	- Baliuag	Good	Good
6)	Access to the proposed agro-industrial areas	Good	Good
7)	Conformity with local road network	Good	Bad
8)	Impacts on local development	High	Medium
9)	Linkage with Metro Manila	Fair	Good

2.2.4 Adjustments to the Selected Alignment

The selected alignment during the FS stage of the project was reviewed after detailed field reconnaissance was conducted. The information collected focused mainly on:

- New development, particularly new houses buildings, subdivisions, etc.;
- Latest land use plan of the concerned LGUs;
- Best location of a bridge to span over major rivers

The selected alignment was also presented to the concerned LGUs and project affected persons (PAPs) during the conduct of the social preparation activities. The developer of the Green Estates (under construction) was also consulted. Their inputs were gathered and reflected in the selection of the final alignment.

Based on the results of the preliminary Engineering Design and the series of public consultations conducted along in the project area, alternative alignments were considered, particularly at the beginning section of the planned Plaridel Bypass. The remaining sections of the selected alignment were judged appropriate with minor adjustments.

The primary issues at the beginning section of the proposed bypass are:

- The beginning point (where to connect the Bypass with the NLE (FS recommendation)
  - The Bypass be connected with the existing Burol Interchange of the NLE
  - The Bypass be connected with the NLE at the north of the existing Burol Interchange to avoid short nose-to-nose distance and to reduce number of overpass bridges as well as difficult construction.
- New subdivision under construction;
- Results of the preliminary Engineering Design conducted; and
- Results of the consultation meeting with the PAPs in Brgy. Tiaong, Guiguinto, Bulacan

In view of the above mentioned issues and concerns, **four (4)** alternative alignments at the beginning section of the Bypass were developed **(Figure 2.2-4)**. These consist of:

Alternative 1 – FS alignment which hits the new subdivision;

Alternative 2 – FS alignment avoiding the new subdivision;

Alternative 3 – Interchange at the north of the existing Burol Interchange and to hit the new subdivision; and

Alternative 4 – Interchange at the north of the existing Burol Interchange avoiding the new subdivision

The selected alignment is presented in **Figure 2.2-5.**

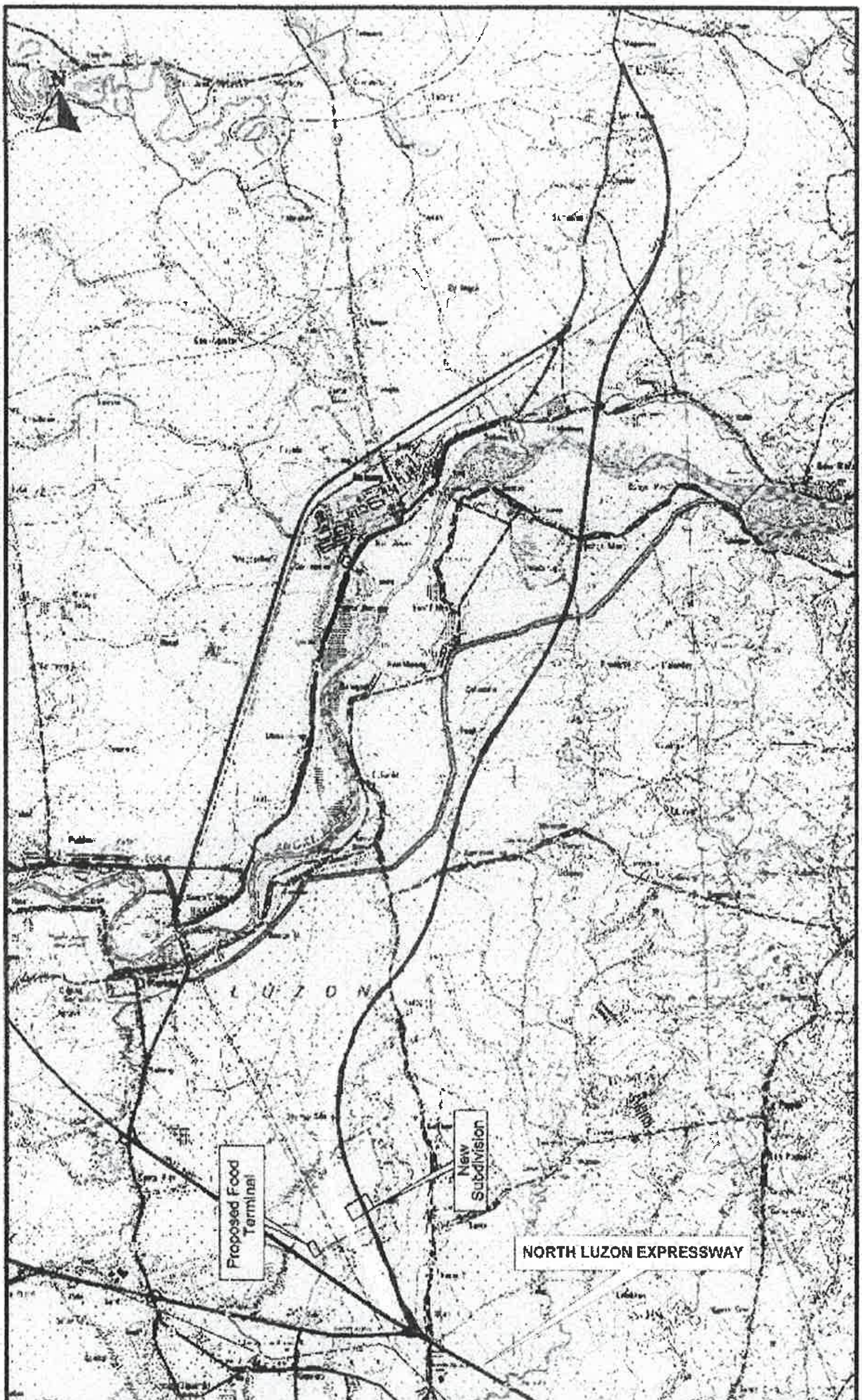


FIGURE 2.2-3 SELECTED BYPASS ALIGNMENT FOR PLARIDEL BYPASS DURING FEASIBILITY STUDY

SOURCE: Katahira & Engineers International, July 2001 Detailed Design on Upgrading Inter-Urban Highway System Along the Pan-Phil. Highway (Plaridel, Cabanatuan & San Jose Bypasses) Alternative Study

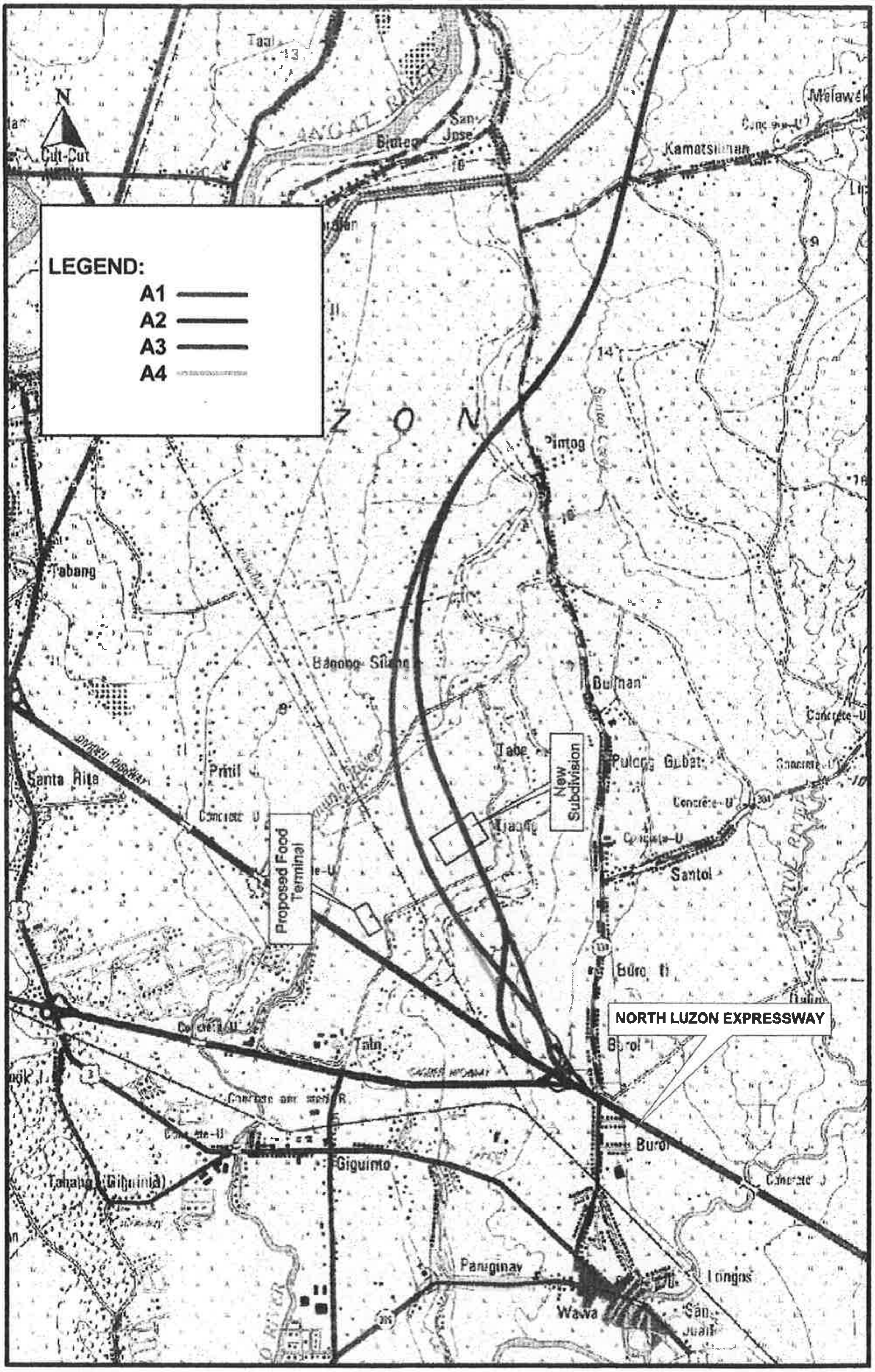


FIGURE 2.2- 4 ALTERNATIVE ALIGNMENTS AT BEGINNING SECTION FOR PLARIDEL BYPASS

SOURCE: Katahira & Engineers International, July 2001 Detailed Design on Upgrading Inter-Urban Highway System Along the Pan-Phil. Highway (Plaridel,Cabanatuan & San Jose Bypasses)Alternative Study

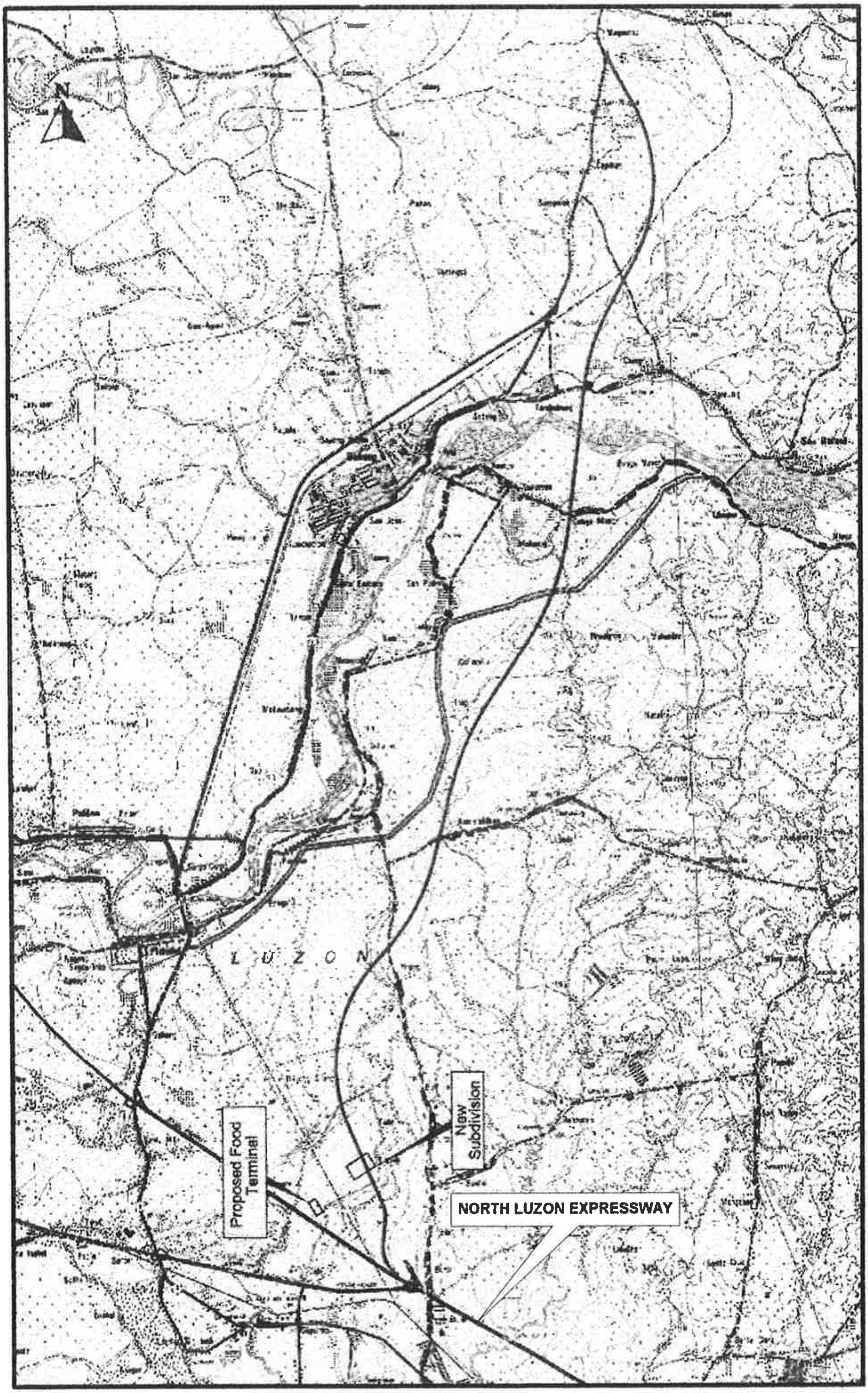


FIGURE 2.2- 5 SELECTED ALIGNMENT FOR PLARIDEL BYPASS

SOURCE: Katahira & Engineers International, July 2001 Detailed Design on Upgrading Inter-Urban Highway System Along the Pan-Phil. Highway (Plaridel,Cabanatuan & San Jose Bypasses)Alternative Study

2.3 PROJECT AREA AND LOCATION

The **Plaridel Bypass** will traverse **five (5)** municipalities in Bulacan namely the Municipalities of Balagtas, Guiguinto, Plaridel, Bustos, and San Rafael. Most of the areas to be traversed by the Plaridel Bypass are designated as agricultural land based on future land use plans. It passes through existing and planned residential areas that are mostly located at intersections with existing roads. Thus, the provision of frontage roads is limited to the said populated areas.

The Plaridel Bypass has an approximate length of **23.3** kilometers, and the only one with an interchange (Please refer to **Figure 2.3-1**). As previously mentioned, the provision of frontage roads will be limited to populated areas; i.e., from Brgy. Borol 2nd, in Balagtas, to Brgy Cutcut, Guiguinto, and from Brgy. Malamig, in Bustos up to the end of the Bypass at Brgy. Maguinao in San Rafael.

The connecting point of the Bypass along the North Luzon Expressway will be at around **500** meters north of the existing Burol Interchange, located at Brgy. Borol 2nd, **Balagtas**, where it proceeds on an northeasterly direction towards Brgy. Tiaong of **Guiguinto**. It is important to note at this point that the alignment that was presented during the Formal Scoping Session at the Bustos Multi-Purpose Gym has been slightly **shifted** towards the south. The realignment came about as a form of mitigating measure to avoid displacement of 45+ families against less than 10 in the new alignment. The shift in alignment inevitably hit a new subdivision, known as the "Green Estates", which at the time of the scoping was still in the pre-construction phase (i.e., earthworks, drainage, road preparation), meaning, there were no housing structures built yet. The Design and the EIA Team met with the owner of the subdivision prior to the shift, and reached an amicable agreement regarding the said shift in alignment.

The alignment then continues towards Brgys. Pulong Gubat and Cutcut, still in the Municipality of **Guiguinto**. It then enters paddy fields at the Municipality of **Plaridel** through Brgys. Bulihan and San Jose, then enters vast agricultural lands in Brgys. Camachilihan, Talampas, Liciada, and Malamig, all in the Municipality of **Bustos**. It then continues towards the last barangay in Bustos, Bonga Menor, before it crosses the Angat River on the way to Brgy. Tambubong of **San Rafael**. It will maintain a northeasterly direction, traversing through Brgys. Caingin and Capihan, until it veers to the northwest towards Brgy. San Roque. The Bypass joins the Pan-Philippine Highway at Brgy. Maguinao, San Rafael, a few hundred meters away from the Maguinao High School.

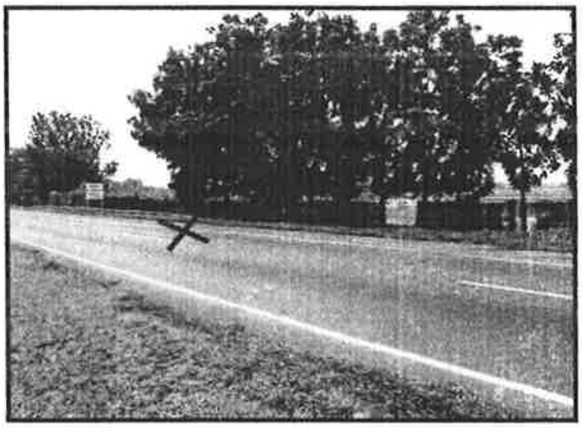


Plate No. 1 Taken at the start of the proposed Plaridel Bypass Alignment along the NLE at Brgy. Tiaong, Guiguinto, Bulacan.

Plate No. 2 The alignment coming from Brgy. Borol 2nd, Balagtas crossing the open areas at Brgy. Tiaong.

Plate No. 3 Taken at Sta. 1+032.05, the alignment crossing a Brgy. Road at Tiaong. The unfinished concrete house on the background would be directly hit the alignment.

Plate No. 4 Showing the alignment crossing the Green Estates at Brgy. Pulong Gubat, Guiguinto.

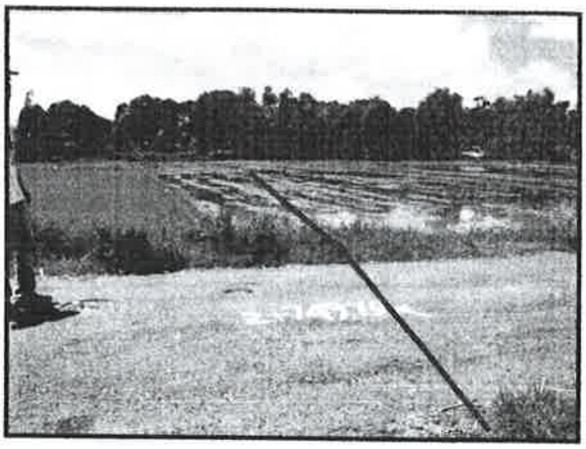


Plate No. 5 Taken at Sta. 2+749.75 in Brgy. Cutcut, Guiguinto (looking south). Several houses among the trees on the background would be affected.

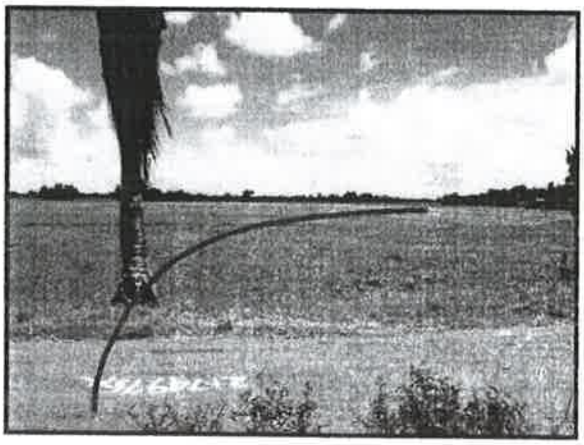


Plate No. 6 Taken at Sta. 2+749.75 in Brgy. Cutcut, Guiguinto alignment going towards Brgy. Bulihan, Plaridel, Bulacan (looking north).

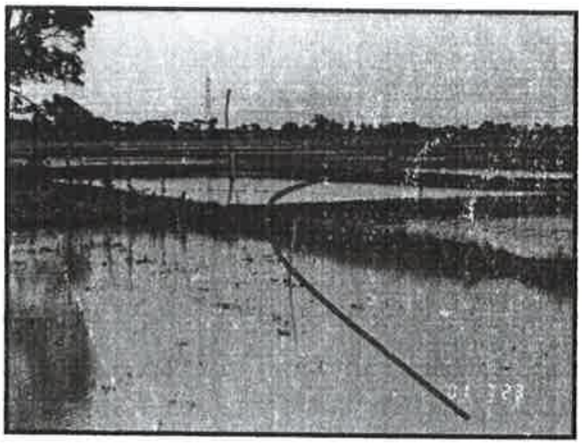


Plate No. 7 Taken at Km 3+720 in Brgy. Bulihan, Plaridel, alignment going towards Brgy. San Jose, Plaridel, Bulacan (looking north)

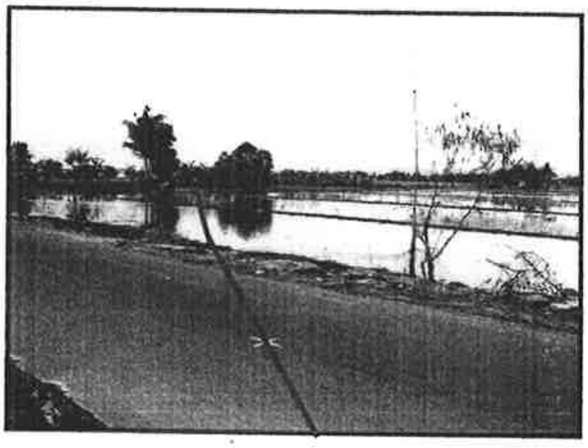


Plate No. 8 Taken at Sta. 5+564. Alignment crossing the Balagtas-San Jose Road in Brgy. Bulihan, Plaridel, (looking north).

Plate No. 9 Taken at Sta. 7+653.15, looking south. Alignment crossing the Camachilihan-Liciada Road in Brgy. Camachilihan, Bustos.

Plate No. 10 Alignment traversing the vast agricultural areas in Brgy. Malamig, Bustos, before crossing the Liciada-Malamig Road (looking south).

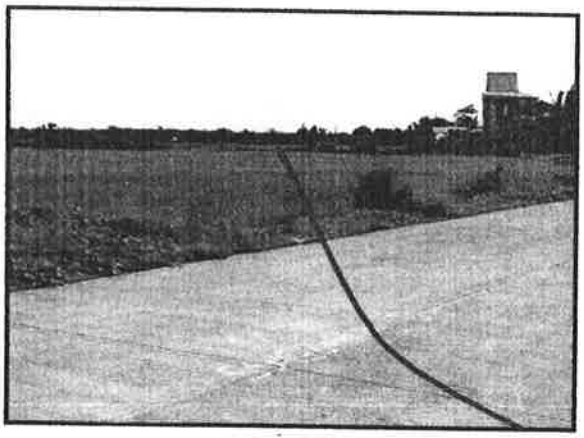


Plate No. 11 Alignment coming from Brgy. Tambubong crossing Francisco Viola St. in Brgy. Caingin, San Rafael.

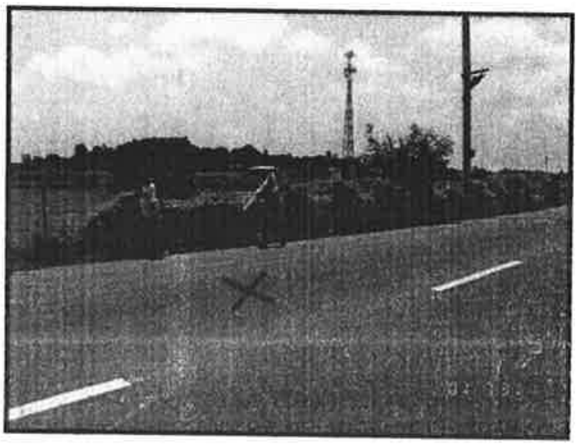


Plate No. 12 Taken at the end of the alignment in Brgy. Maguinao, San Rafael, Bulacan.

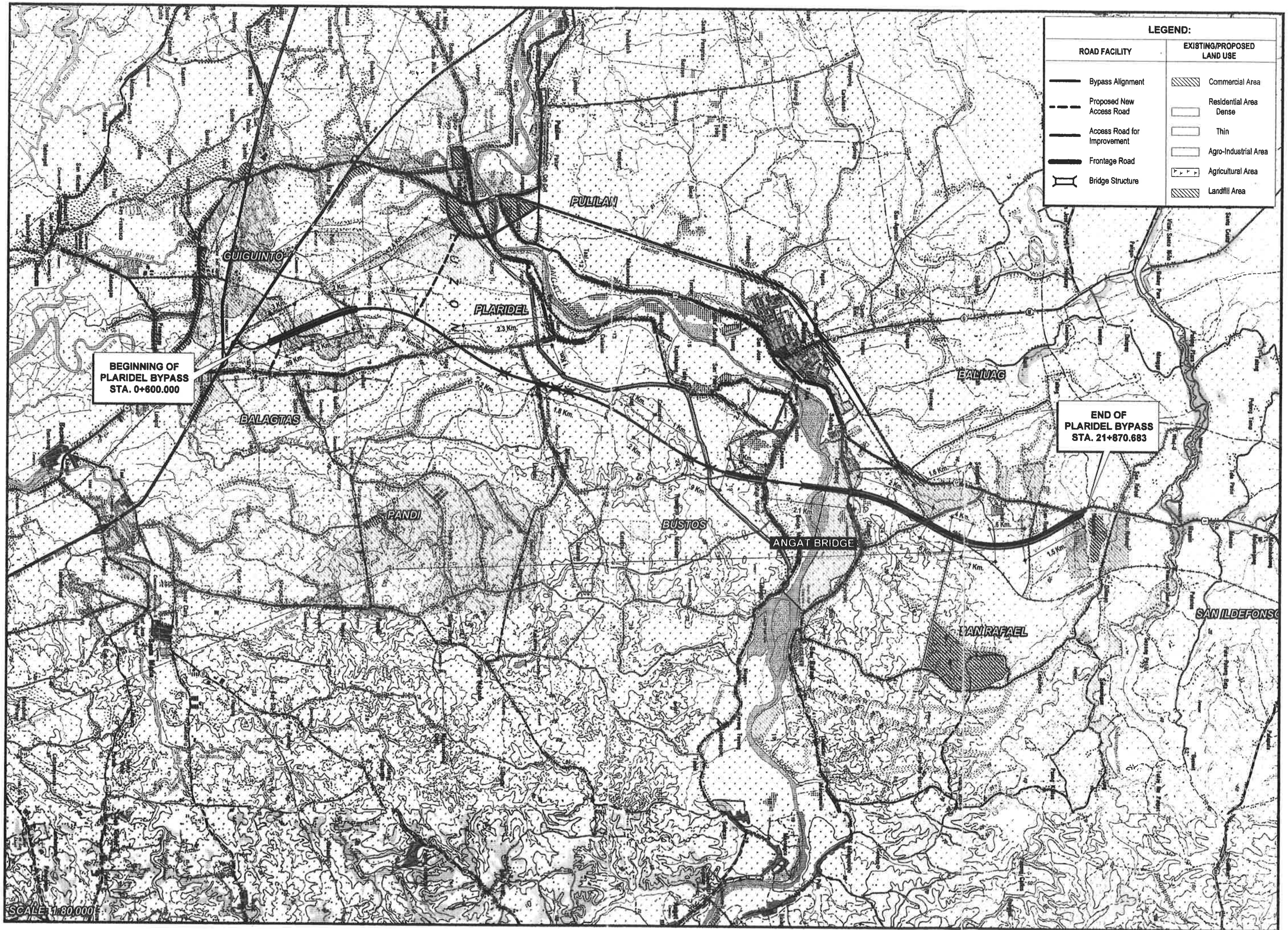


FIGURE 2.3-1 THE PROPOSED PLARIDEL BYPASS ALIGNMENT

2.4 PROJECT DESCRIPTION

This section discusses the basic description of the proposed Plaridel Bypass Project, as well as the activities involved in the Pre-Construction, Construction, Operational, and Abandonment (Demobilization and Maintenance) Phases.

2.4.1 Design Features

Based on future traffic demand forecasts in a form of Origin-Destination (O-D) distribution conducted during the FS, the Level of Service (LOS) at the Plaridel Bypass, assuming that is constructed as a 2-lane road during the initial stage; it would become **E**[1] by the year 2005 (i.e., just after the completion of the construction), and would even become F[2] by 1212 or so. On the other hand, in case a 4-lane road is instead constructed, the LOS in 2020 would be **D**[3]. The Study Team therefore recommended that the Bypass be constructed as a **4-lane divided road** from the initial stage.

However if financial requirements become too restrictive, it can initially be built as a 2-lane, then widened to a 4-lane divided road by 2010. In terms of forecasted maximum bypass traffic, it was computed to have a traffic volume of 19,600 PCU/day in year 2005, 22,600 PCU/day in 2010, and 42,900 PCU/day in 2020.

Therefore the project will be done in two (2) stages. The initial stage will involve the acquisition of the required right-of-way (ROW) for the bypass.

In determining the basic elements of design standards for the Plaridel Bypass, the following were considered:

- To maintain at least the design standards adopted fro the existing Pan-Philippine Highway; and
- Urbanization would be expanded beyond the bypass in the future. Standards under urban arterials of AASHTO would serve as good reference

<u>Interchange</u>

Plaridel Bypass is the only alignment with an interchange since its beginning section will be directly connected to the existing north Luzon Expressway (NLE).

The connecting point of the bypass alignment with the NLE will be approximately **500 m** north of the existing Burol Interchange as shown in **Figure 2.4-1**. This was recommended by the Study Team to avoid construction difficulties and constraints such as:

- The overpass bridge (Provincial Road No. 334, crossing over NLE) is located too close to the Burol Interchange, the distance for a nose-to-nose, merging and diverging are required to be planned within limited conditions;
- A ramp from the Bypass to Manila has to crossover NLE and the existing ramp from Malolos to Manila, thus two (2) overpass bridges are needed; and
- The construction must be done maintaining traffic on the existing ramps, which is deemed to be very difficult

---

1 The Level of Service, E, based on the HCM, 1994 corresponds to "heavy traffic" with an equivalent traffic volume/capacity ratio (v/c ratio) of 0.65 to 1.00.

2 The Level of Service, F, based on the HCM, 1994 corresponds to "saturation volume" with a stop and go situation.

3 The Level of Service, D, based on the HCM, 1994 corresponds to "moderate/heavy traffic" with an equivalent traffic volume/capacity ratio (v/c ratio) of 0.44 to 0.64.

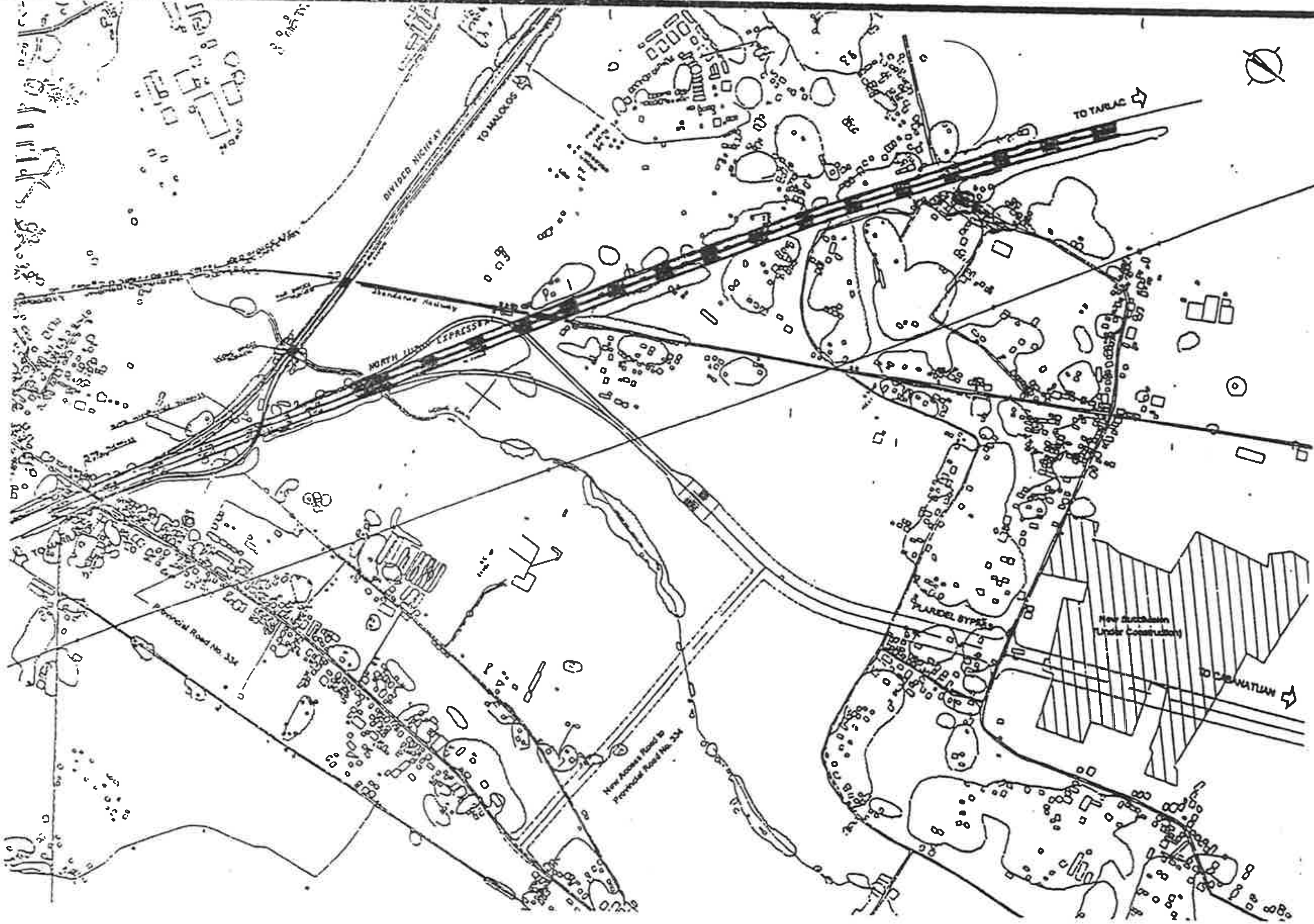


Figure 2.4-1 The Selected Connecting Point of the Bypass with the North Luzon Expressway (NLE)

NOT DRAWN TO SCALE

SOURCE: *Katahira & Engineers International, September 2001*

Standard Road Cross Section

The standard cross section for the Plaridel Bypass was developed taking into considerations the present and future land use plans of the municipalities traversed by the alignment.

Most of the areas along the bypass alignment are designated as agricultural in the future land use plan. The alignment also passes through existing and future residential areas, which are mostly located at intersections with existing roads. Given these conditions, the bypass alignment was divided into two (2) major areas – *1) Populated Areas,* and *2) Non-Populated Areas*.

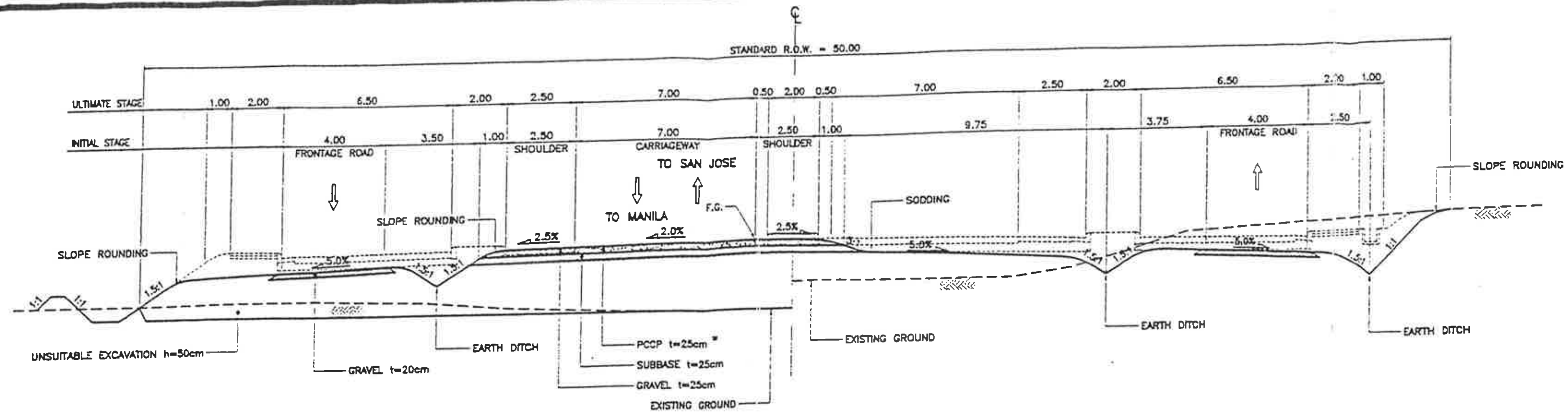
Frontage roads are proposed to be provided along commercial and populated areas. The proposed road ROW width for the bypass sections with frontage roads is **50.0 m**. For sections without frontage roads (non-populated or areas considered as productive agricultural lands), the ROW width will be **32.0 m**.

The typical sections with and without frontage roads for the initial and ultimate stages of the Bypass are shown in **Figures 2.4-2** and **2.4-3,** respectively. **Figures 2.4-4** and **2.4-5** on the other hand presents the typical cross sections along transition and underpass sections. **Figure 2.4-6** shows the typical road section along full superelevation. The summary of the design controls, criteria, and elements in determining the road cross section and horizontal and vertical alignments are given in **Table 2.4-1**. As well, the outline of the cross sections is provided in **Table 2.4-2**.

Table 2.4-1 Summary of Design Controls, Criteria, and Elements of the Standard Cross Section for the Plaridel Bypass

ADT at Opening and Target Years	Year 2005	Year 2020
Number of Lanes	2	4
Design Traffic Volume in Year 2020 (pcu/day)	42,999	
Carriage Width	3.5	
Shoulder Width (m)	2.5	
Sidewalk Width (m)	2.0	
Median Width (m)	3.0	
Design Speed (km/h)	80	
Frontage Road Width (m)	6.5	
Cross Slope (%)	2.0	
Horizontal Alignment		
Minimum Radius	280, 360 (desirable)	
Maximum Superelevation (m)	8	
Sharpest Curve Without Superelevation (m)	3,500	
Rate of Runoff	1/185	
Vertical Alignment		
Grade (%)	4	
Crown and Sag Lengths (m)	4,800 (crown), 3,200 (sag)	
Stopping and Passing Sight Distances (m)	100 (stopping), 560 (passing)	
Vertical Clearance (m)	5.0, 4.4, 2.5	

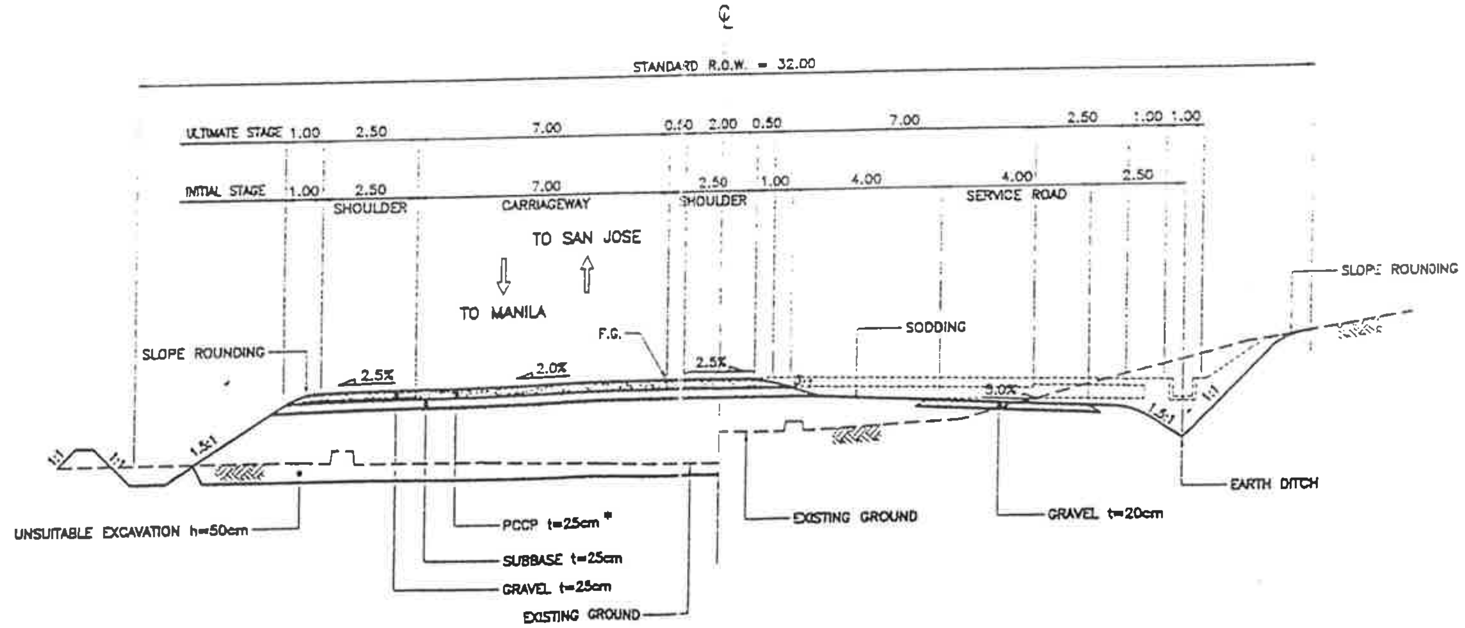
SOURCE: *Katahira & Engineers International, September 2001.*



EMBANKMENT SECTION

CUT SECTION

INITIAL STAGE
TYPICAL SECTION WITH FRONTAGE ROAD
SCALE 1:200



EMBANKMENT SECTION

CUT SECTION

INITIAL STAGE
TYPICAL SECTION WITHOUT FRONTAGE ROAD
SCALE 1:200

* NOTE:
PCC PAVEMENT THICKNESS SHALL BE 28cm FROM STA. 0+000.00 TO STA. 14+815.00.

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YACHIYO ENGINEERING CO., LTD.

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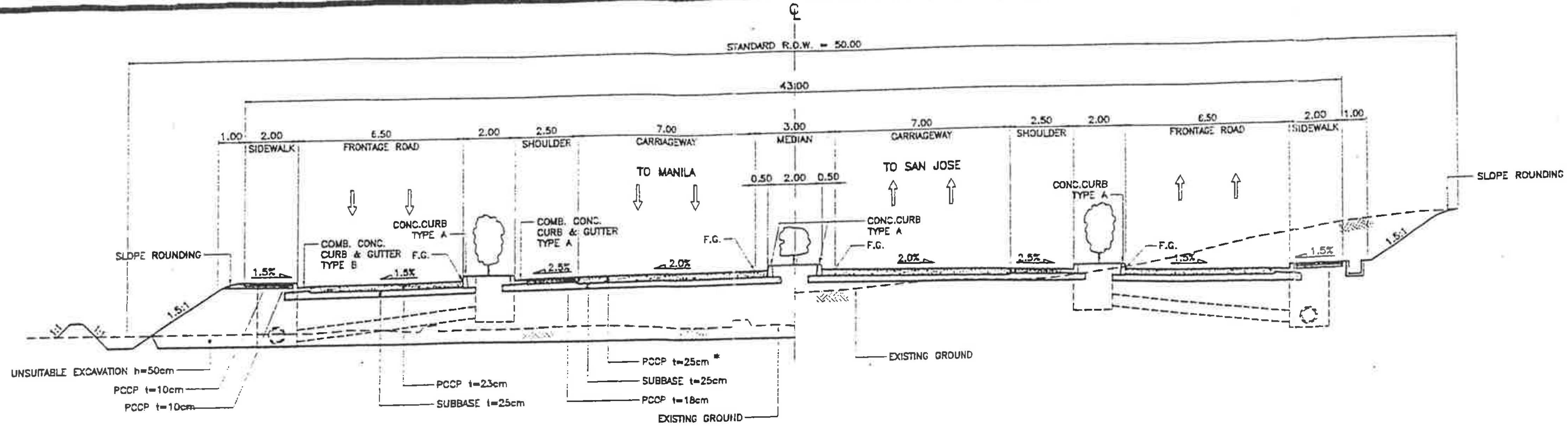
REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
PORT AREA, MANILA

PROJECT AND LOCATION :
DETAILED DESIGN STUDY ON UPGRADING INTER-URBAN HIGHWAY SYSTEM ALONG THE PAN-PHILIPPINE HIGHWAY (Plaridel, Cabanatuan and San Jose Bypasses)

SCALE : NOT DRAWN TO SCALE

SHEET CONTENTS : PLARIDEL BYPASS
TYPICAL ROADWAY SECTION (INITIAL STAGE)

FIGURE NO. : 2.4-2



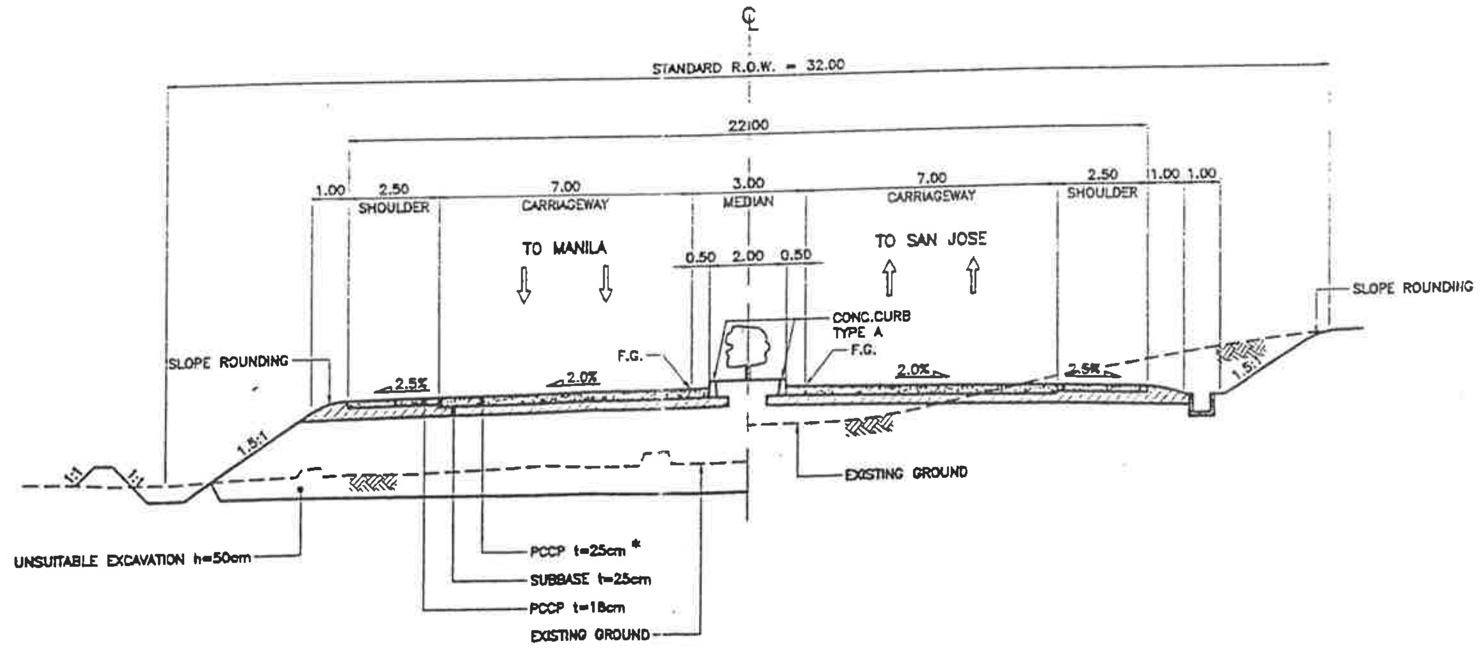
EMBANKMENT SECTION

CUT SECTION

NORMAL CROSS SLOPE

PLANNED URBAN AREA (WITH FRONTAGE ROAD)

SCALE 1:200



EMBANKMENT SECTION

CUT SECTION

* NOTE:
PCC PAVEMENT THICKNESS SHALL BE 28cm FROM STA. 0+000.00 TO STA. 14+815.00.

NORMAL CROSS SLOPE

OUTSKIRTS OF PLANNED URBAN AREA (WITHOUT FRONTAGE ROAD)

SCALE 1:200

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	DESIGNED							
	CHECKED							
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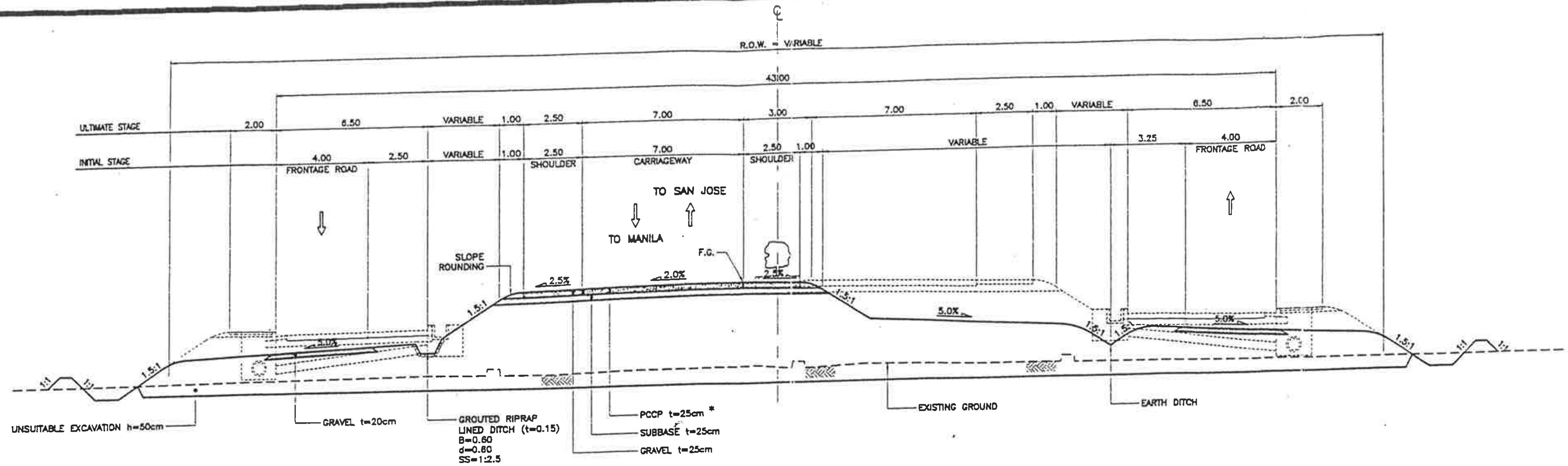
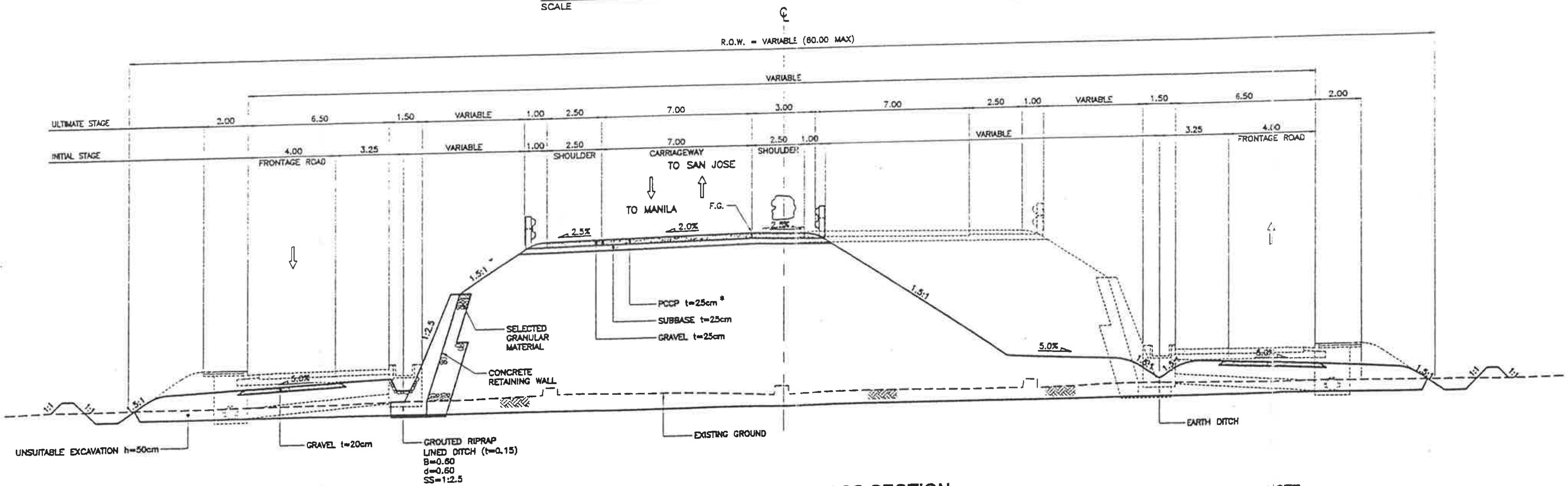


INITIAL STAGE
TRANSITION SECTION (FLAT SECTION TO UNDERPASS)
PLANNED URBAN AREA (WITH FRONTAGE ROAD)

SCALE 1:200



INITIAL STAGE-UNDERPASS SECTION
PLANNED URBAN AREA (WITH FRONTAGE ROAD)

SCALE 1:200

* NOTE:
PCC PAVEMENT THICKNESS SHALL BE 28cm FROM STA. 0+000.00 TO STA. 14+615.00.

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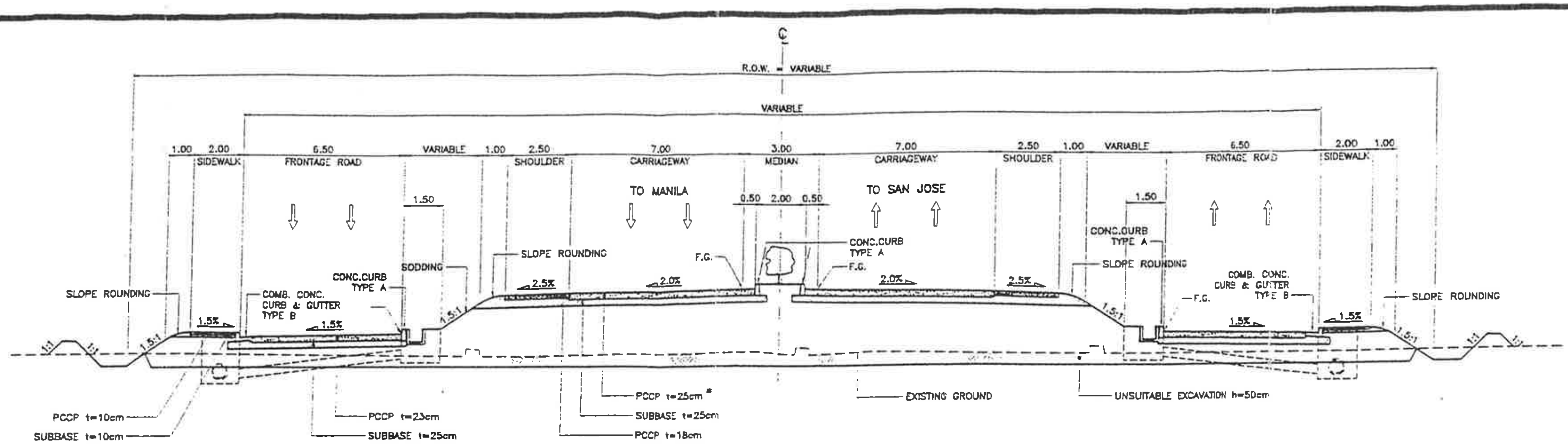
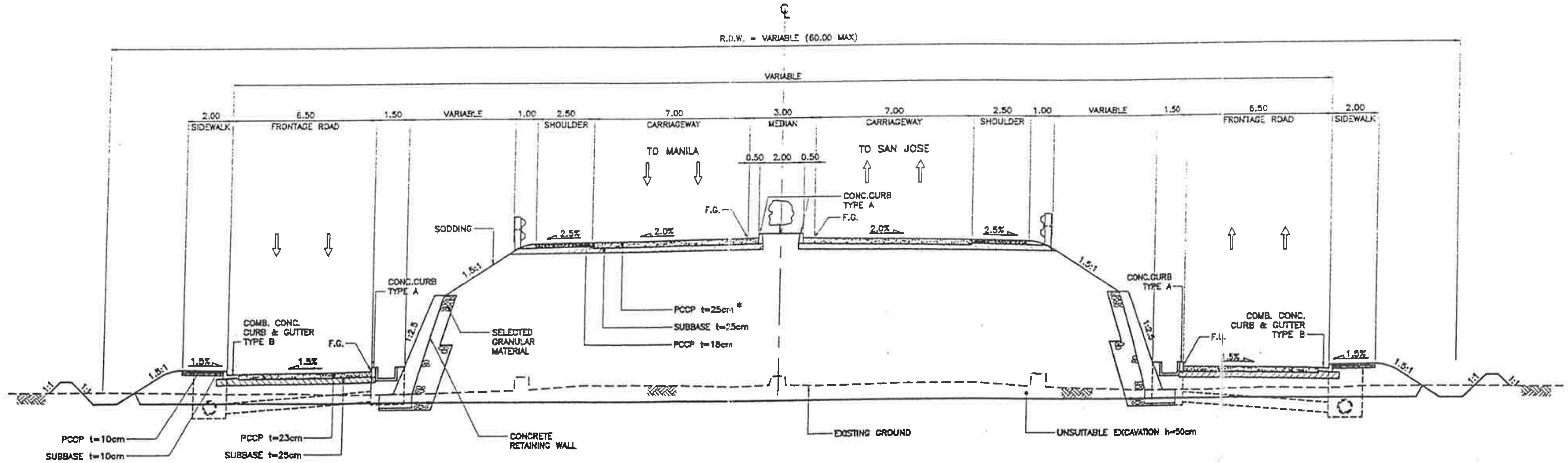
	DESIGNED				DETAILED DESIGN STUDY ON UPGRADING INTER-URBAN HIGHWAY SYSTEM ALONG THE PAN-PHILIPPINE HIGHWAY (Plaridel, Cabanatuan and San Jose Bypasses)	NOT DRAWN TO SCALE	PLARIDEL BYPASS TYPICAL ROADWAY SECTION (INITIAL STAGE - UNDERPASS SECTION)	2.4-4
	CHECKED							
	SUBMITTED		TEAM LEADER					



TRANSITION SECTION (FLAT SECTION TO UNDERPASS)
PLANNED URBAN AREA (WITH FRONTAGE ROAD)

SCALE 1:200



* NOTE:
PCC PAVEMENT THICKNESS SHALL BE 28cm FROM STA. 0+000.00 TO STA. 14+615.00.

(UNDERPASS SECTION)
PLANNED URBAN AREA (WITH FRONTAGE ROAD)

SCALE 1:200

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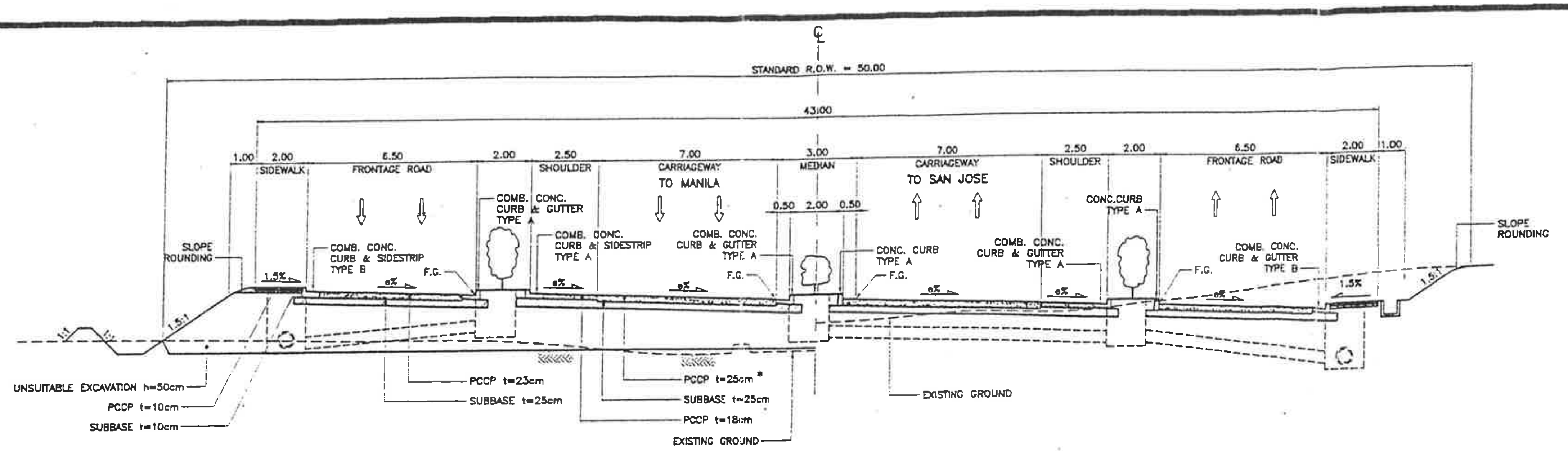
	DESIGNED							
	CHECKED							
	SUBMITTED		TEAM LEADER					

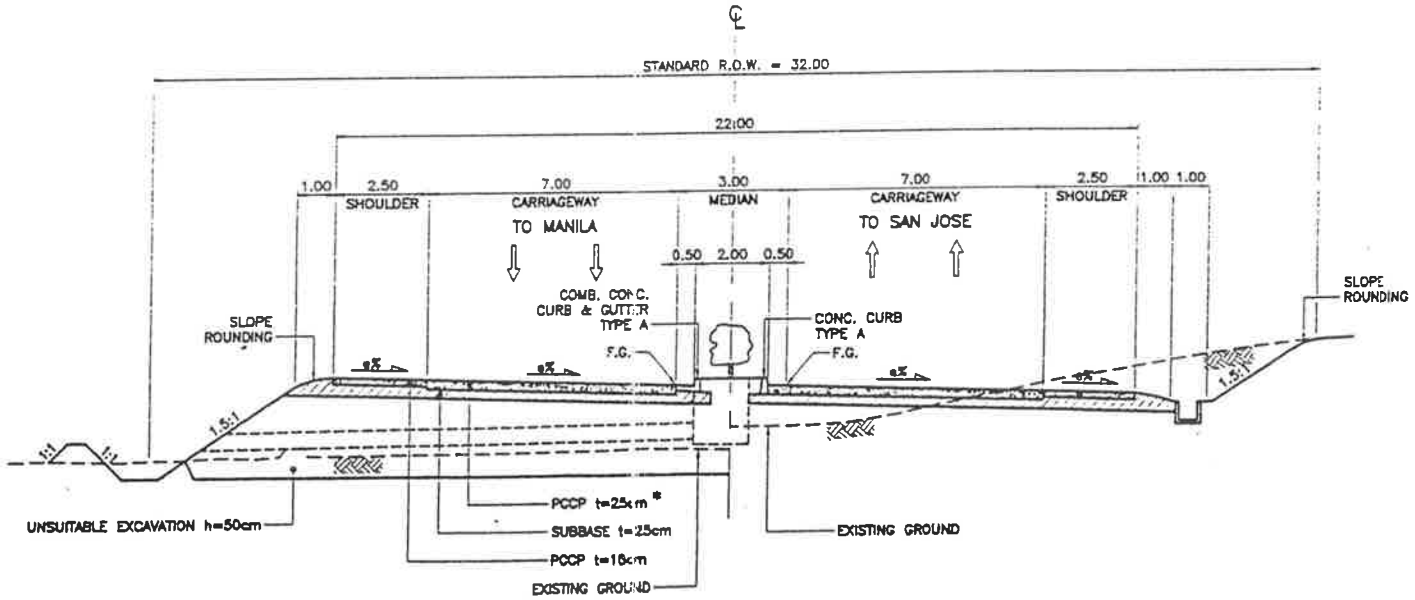


EMBANKMENT SECTION

CUT SECTION

FULL SUPERELEVATION
PLANNED URBAN AREA (WITH FRONTAGE ROAD)

SCALE 1:200



EMBANKMENT SECTION

CUT SECTION

* NOTE:
PCC PAVEMENT THICKNESS SHALL BE 25cm FROM STA. 0+000.00 TO STA. 14+615.00.

FULL SUPERELEVATION
OUTSKIRTS OF PLANNED URBAN AREA (WITHOUT FRONTAGE ROAD)

SCALE 1:200

		DATE	SIGNATURE		PROJECT AND LOCATION :	SCALE :	SHEET CONTENTS :	FIGURE NO. :
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Table 2.4-2 Outline of the Standard Cross Section for the Plaridel Bypass

ITEM	WIDTH
INITIAL STAGE	
Carriage Way	3.5, PCC* (t=25cm, 28cm)
Shoulder	2.5 m, Gravelled (t=25 cm)
Service Road*	4.0 m, Gravelled (t=20 cm)
ULTIMATE STAGE	
Carriage Way	7.0 m, PCC (t=25cm, 28cm)
Shoulder	2.5 m, PCC (t=18cm)
Frontage Road	7.0 m, PCC (t=23cm)
Sidewalk	7.0 m, PCC (t=10cm)
Median	3.0 m
Planting Zone 1	2.0 m (between frontage road and carriage way)
Planting Zone 2	0.0 m (between frontage road and sidewalk)

SOURCE: *Katahira & Engineers International, September 2001.*

**t* = 28cm, Before Angat River; t =25 cm, after Angat River*

**Without frontage section = Service Road*

With Frontage Section = Frontage Road

Intersections

There are **three (3)** types of intersections adopted in the detailed engineering design of the Plaridel Bypass Project depending on the importance of the intersecting roads.

As shown in **Figure 2.4-7**, Plaridel Bypass shall consist of **nine (9) Type A**, **four (4) Type C**, and **ten (10) Type B** intersections.

The concept of providing these types of intersection was adopted primarily to address the needs of the local communities, without sacrificing the integrity of the engineering design

A minimum interval of **800** meters and absolute minimum interval of **500** meters between intersections was set, since these intervals are critical elements in the design of a bypass road. The following factors were considered in setting the minimum distance for intersection interval:

- Mobility;
- Attraction of traffic onto a bypass;
- Traffic safety, and
- Population along the roadway.

In terms of traffic movement along these intersections, the following concepts would be adopted:

(i) Traffic will be controlled by traffic signals;

(ii) Traffic movements are to be channelized as much as possible;

(iii) Left turn lane will be provided with enough storage length;

(iv) Pedestrian crosswalks will be provided; and

(v) When roads intersect with the bypass at a skew angle less than 60°, the intersecting road would be re-aligned so as to intersect at right angle.

Intersection Type A (At-Grade)

This type of intersection was adopted for an intersection between the bypass and a major road such as national or provincial road, allowing for an intersecting road getting on/off the bypass. **Figure 2.4-8** shows the typical drawing of intersection detail Type A9 end of the intersection. On the other hand, **Figures 2.4-9** to **2.4-12** present the detail of other Type A intersections during the initial and ultimate stages of the project.

Intersection Type B (Underpass)

This intersection type was adopted for minor roads such as municipal and barangay in rural areas for the convenience of farmers and local communities. Road users will be allowed to get on the bypass only through the nearest at-grade intersection. Three (3) kinds of horizontal clearance were applied for traffic depending upon the existing road classification ---**2.5 m**, **4.4 m**, and **5.0 m**. The horizontal clearance was determined in consideration of the road classification, the number of lanes of the existing roads, and the kind of vehicles using the existing roads at present.

Intersection Type C (Access to Frontage Road)

This type of intersection was adopted for minor roads in urban areas for the convenience of the local communities. Direct access to the bypass is not allowed.

Figures 2.4-13 to **2.4-14** give the detail of intersection Types B and C in the initial and ultimate stages, respectively.

Access Roads

Seven (7) access roads will be made available to the communities traversed by the Bypass. A new access road will be constructed from an existing road near the Plaridel commercial center, passing through Brgy. Parulan, and intersecting the Bypass at Brgy. Bulihan. Other access roads will just be in terms of improvement of existing roads such as the Balagtas-San Jose Road, San Jose-Liciada Road, Gen. Alejo National Highway, portion of the Baliuag-San Rafael Road, and the Caingin-Sampaloc Road. **Figure 2.4-15** shows the location of these access roads.

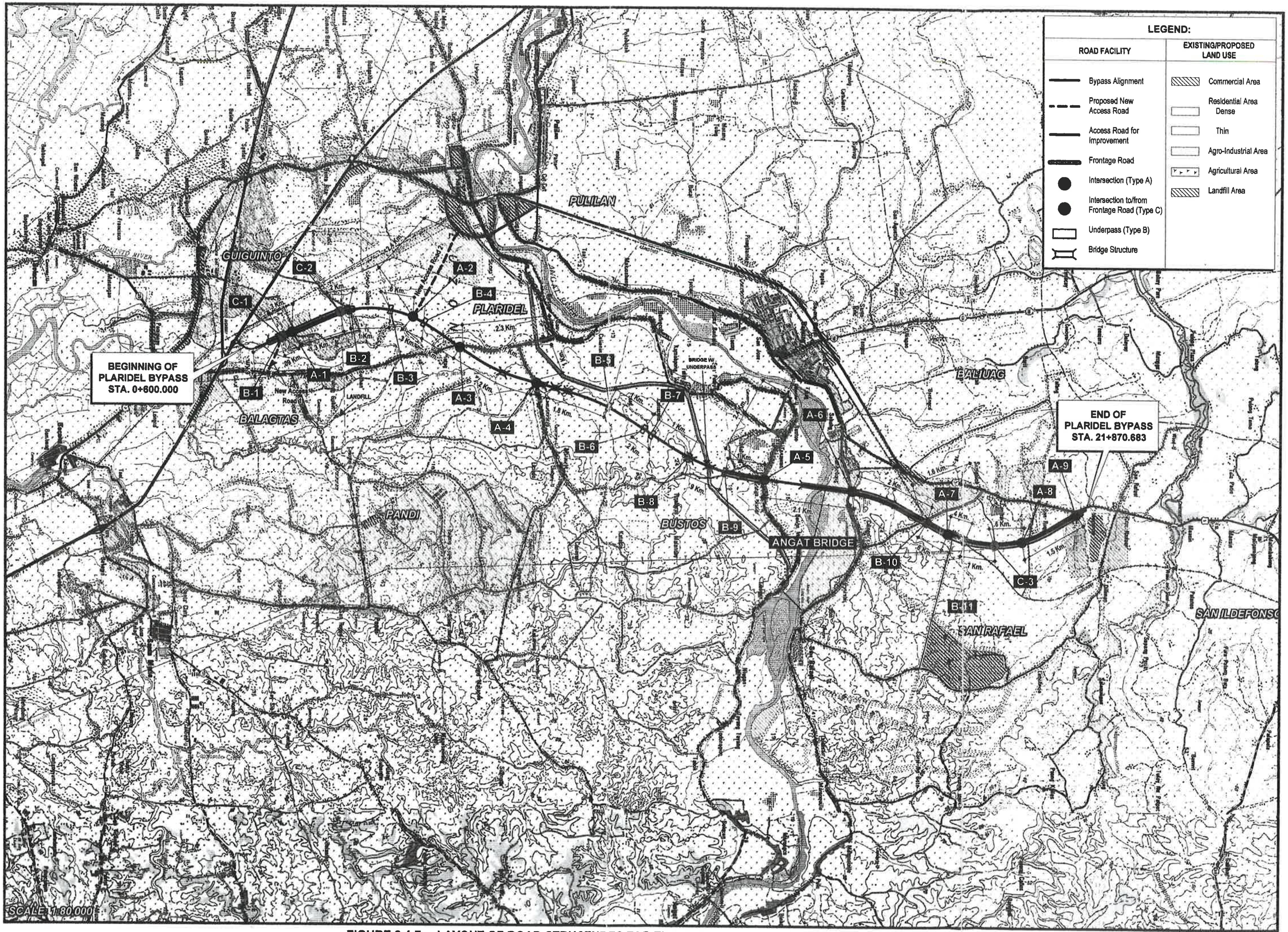
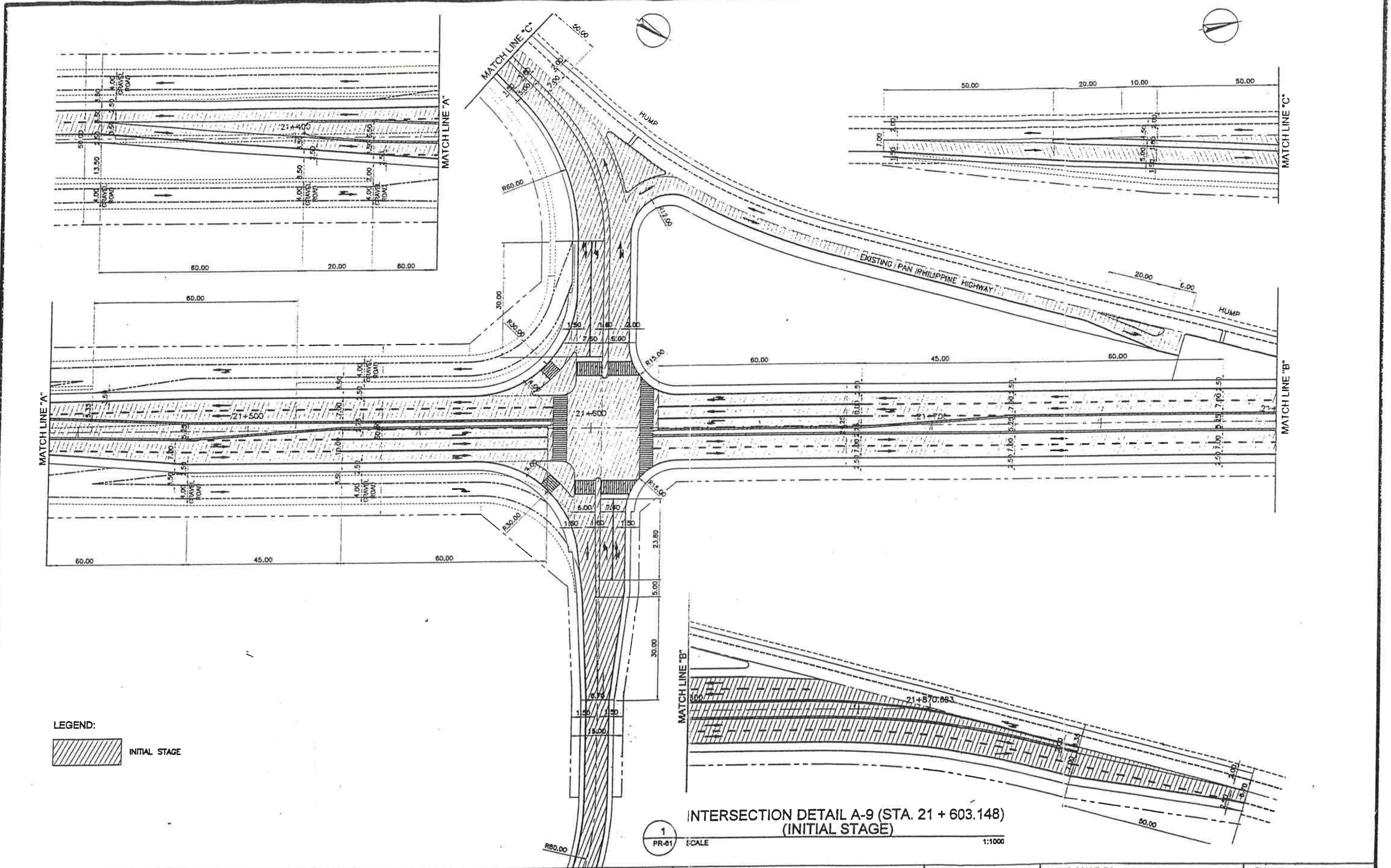


FIGURE 2.4-7 LAYOUT OF ROAD STRUCTURES FOR EXISTING ROADS ALONG THE PLARIDEL BYPASS



INTERSECTION DETAIL A-9 (STA. 21 + 603.148)
(INITIAL STAGE)

1 PR-61 SCALE 1:1000

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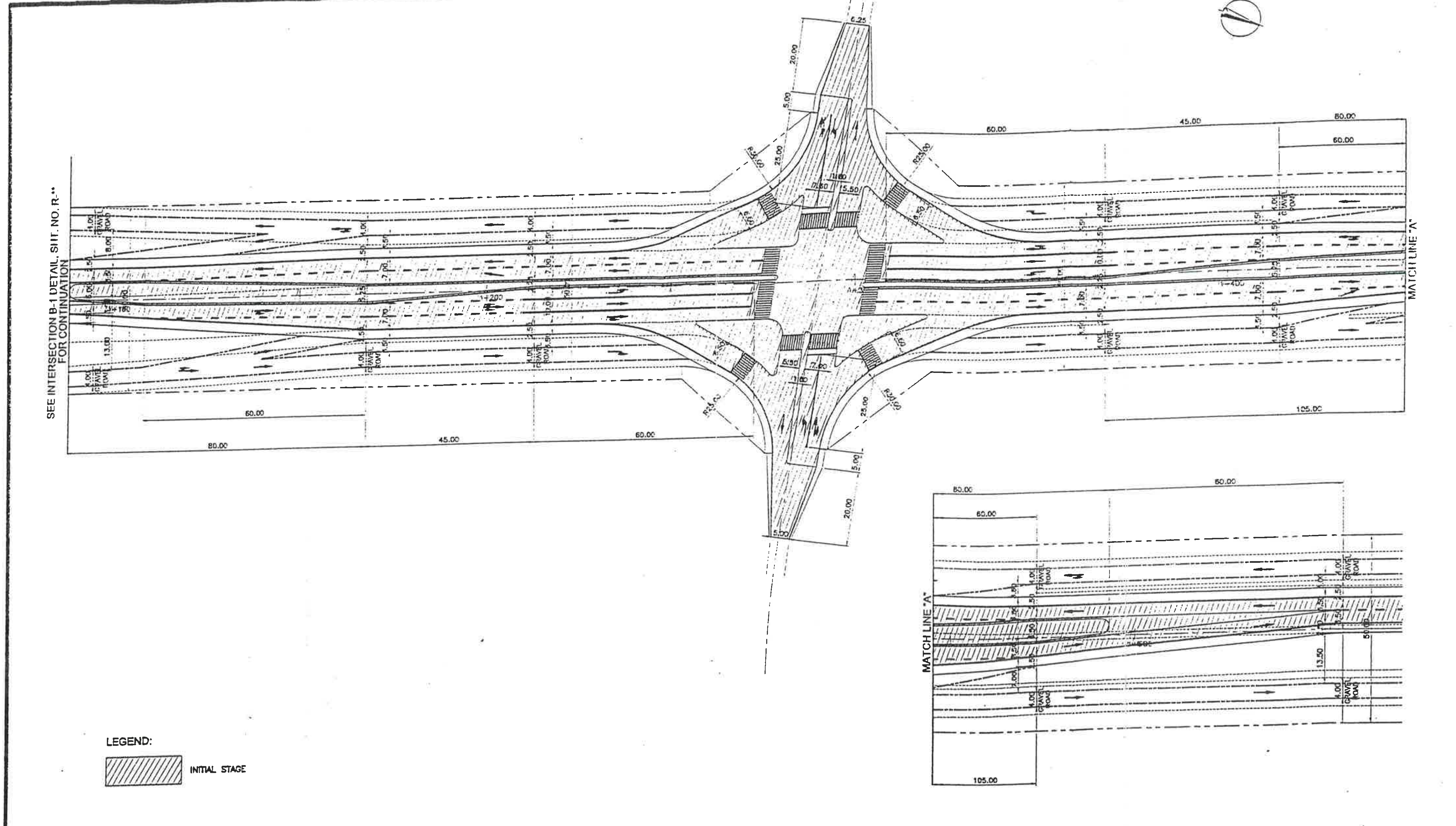

INTERSECTION DETAIL A-1 (STA. 1 + 290.645)
(INITIAL STAGE)

1
PR-48

SCALE 1:1000

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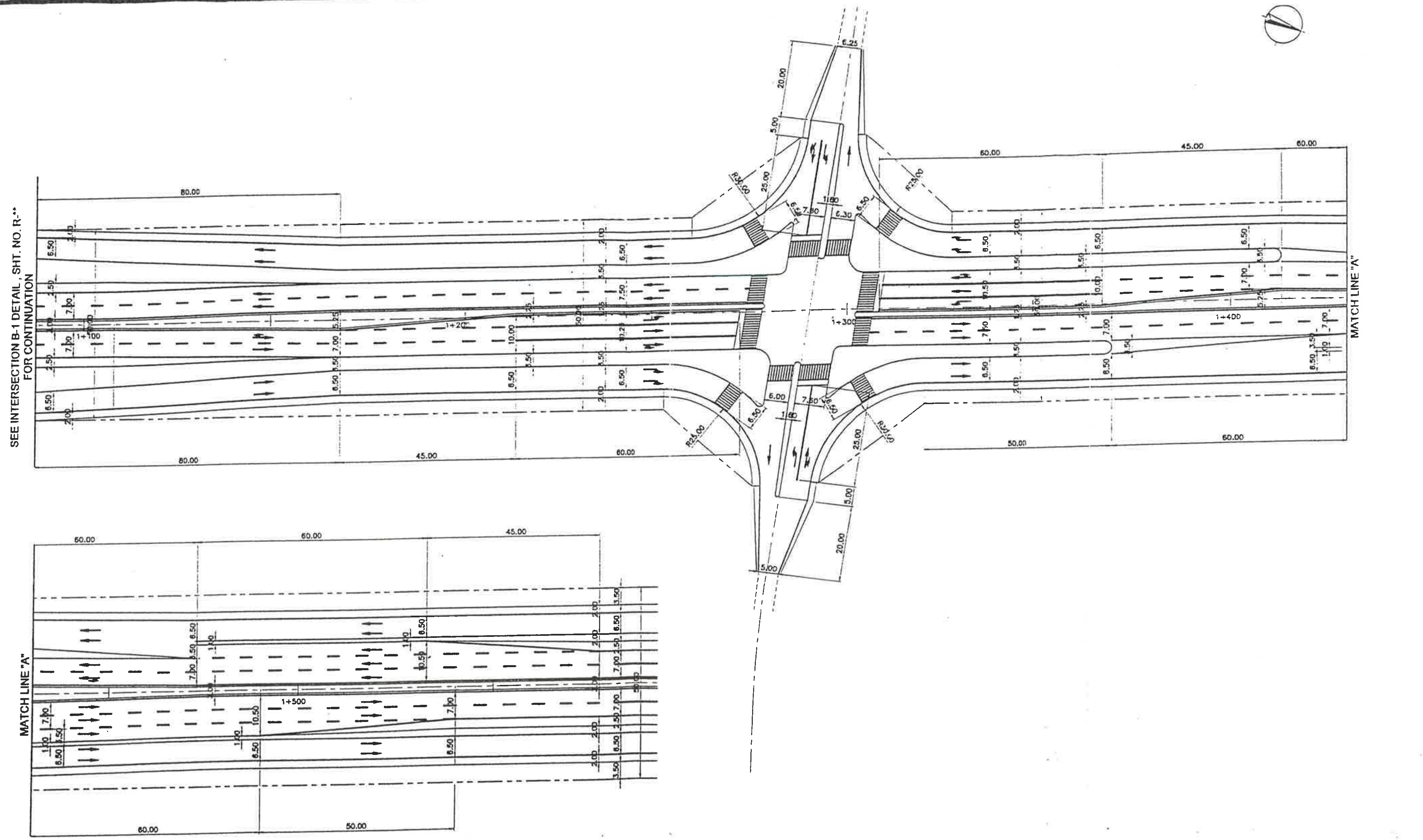
(Plaridel, Cabanatuan and San Jose Bypasses)

SCALE :
NOT DRAWN TO SCALE

SHEET CONTENTS :
PLARIDEL BYPASS
INTERSECTION DETAIL
A-1 (STA. 1 + 290.645)
INITIAL STAGE

FIGURE NO. :
2.4-9



INTERSECTION DETAIL A-1 (STA. 1 + 290.645)
(ULTIMATE STAGE)

1
PR-63
SCALE 1:1000

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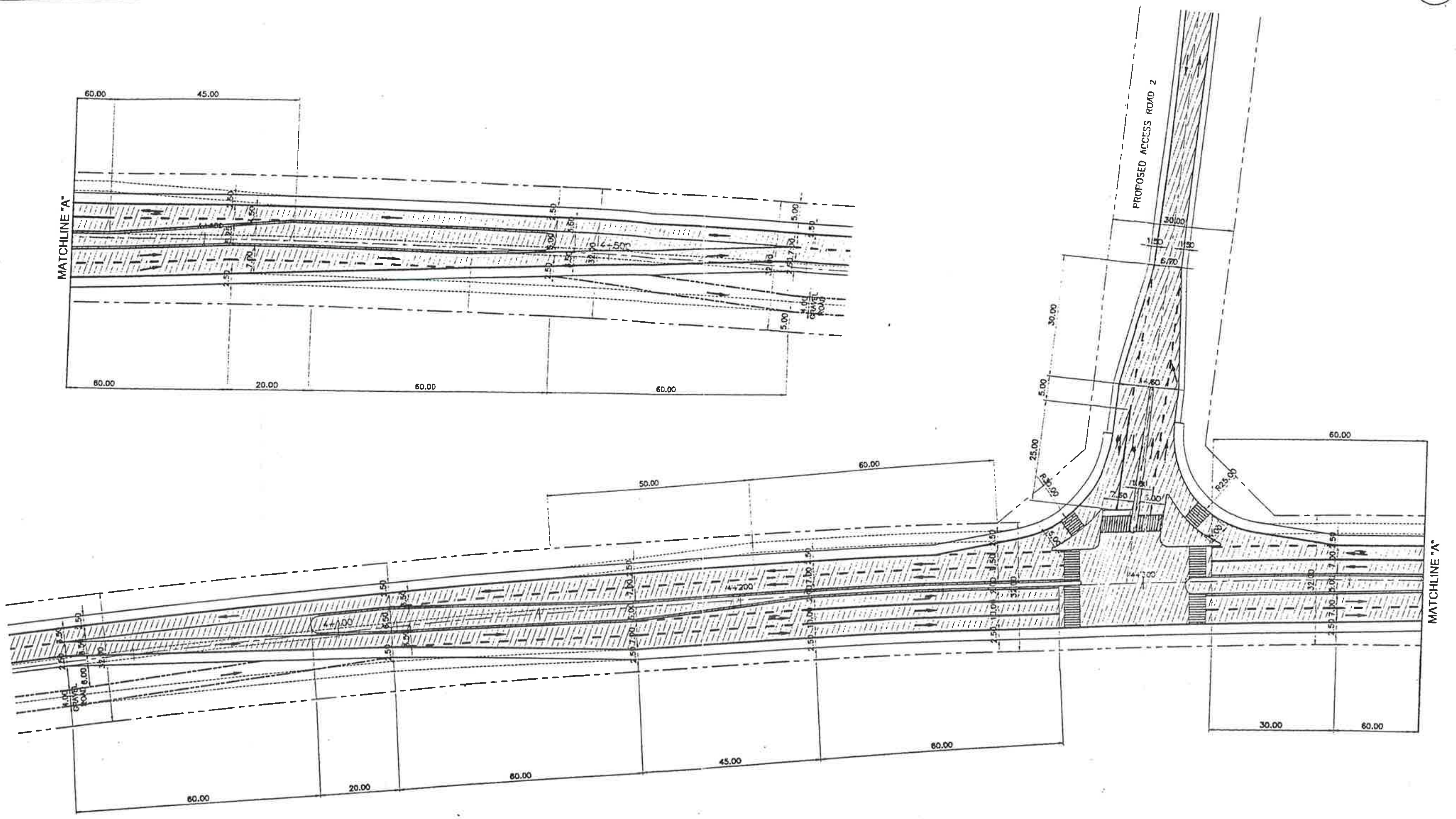
	DESIGNED							
	CHECKED							
	SUBMITTED		TEAM LEADER					



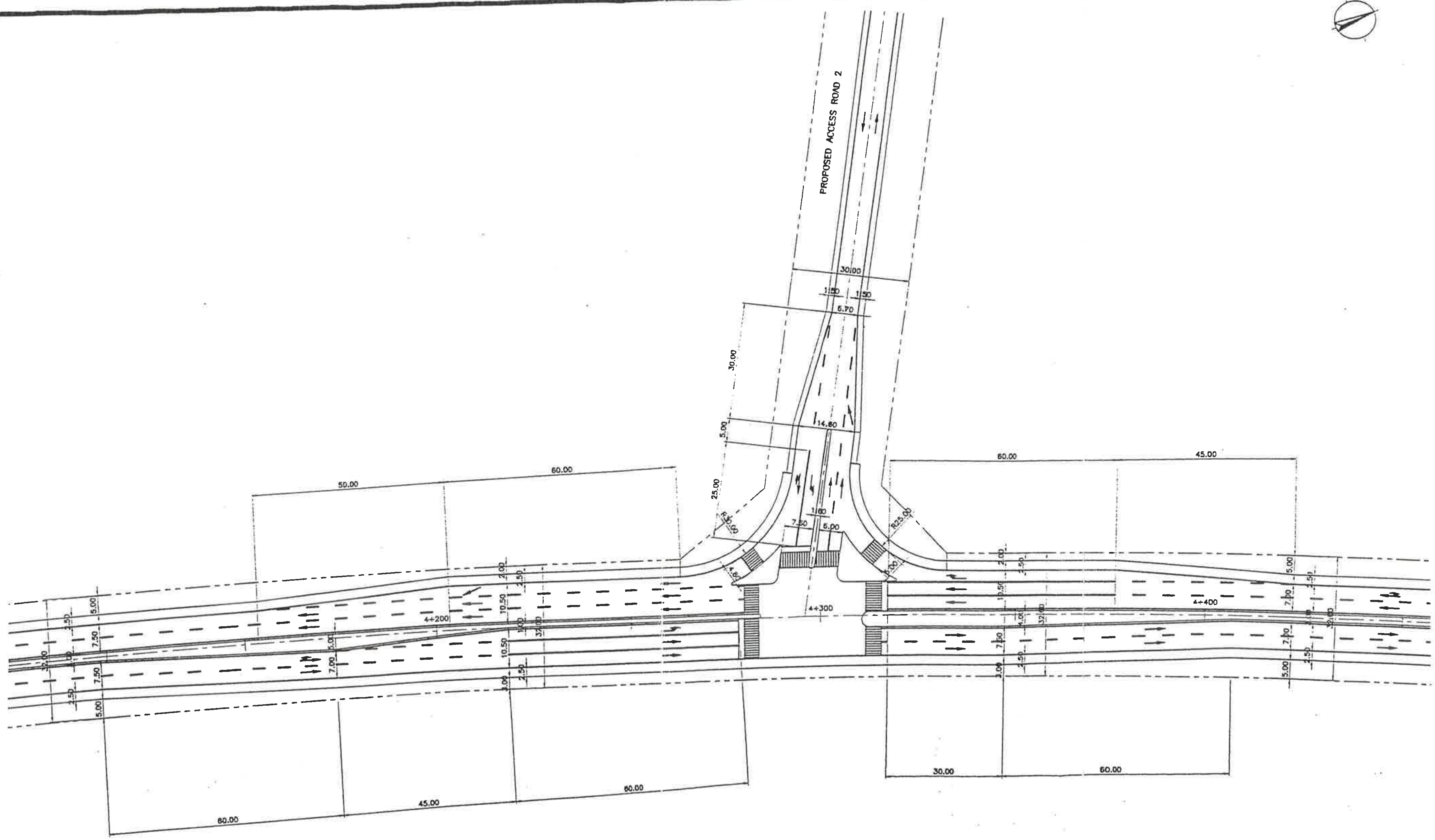
LEGEND:

INITIAL STAGE

INTERSECTION DETAIL A-2 (STA. 4 + 295.853)
(INITIAL STAGE)

1 PR-49 SCALE 1:1000

JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL YACHIYO ENGINEERING CO., LTD.		DATE	SIGNATURE	REPUBLIC OF THE PHILIPPINES DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS PORT AREA, MANILA	PROJECT AND LOCATION : DETAILED DESIGN STUDY ON UPGRADING INTER-URBAN HIGHWAY SYSTEM ALONG THE PAN-PHILIPPINE HIGHWAY (Plaridel, Cabanatuan and San Jose Bypasses)	SCALE : NOT DRAWN TO SCALE	SHEET CONTENTS : PLARIDEL BYPASS INTERSECTION DETAIL A-2 (STA. 4 + 295.853) INITIAL STAGE	FIGURE NO. : 2.4-11
	DESIGNED							
	CHECKED							
	SUBMITTED		TEAM LEADER					

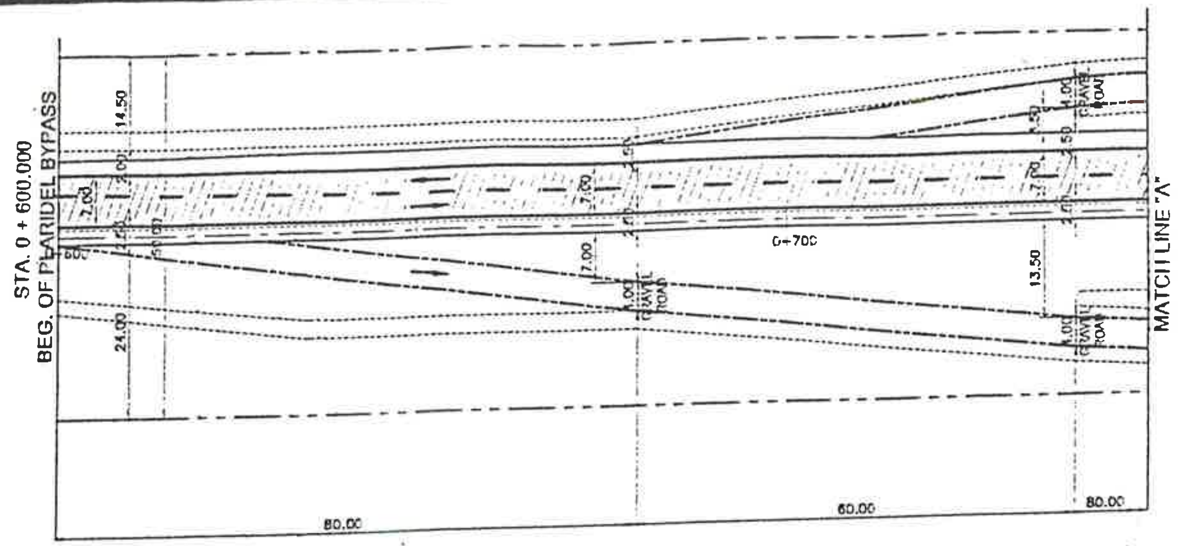


INTERSECTION DETAIL A-2 (STA. 4 + 295.853)
(ULTIMATE STAGE)

1
PR-66
SCALE 1:1000

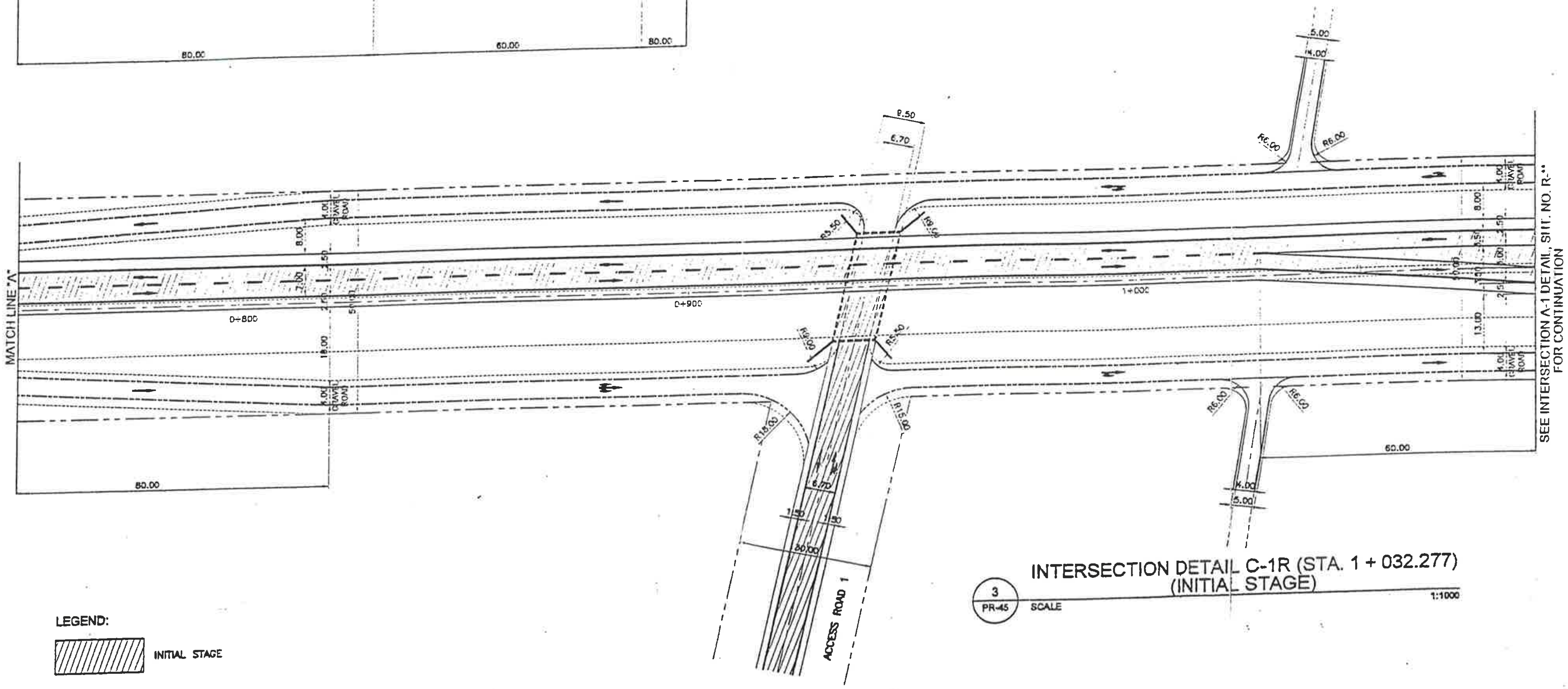
JICA JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL YACHIYO ENGINEERING CO., LTD.	DESIGNED / CHECKED / SUBMITTED	DATE	SIGNATURE TEAM LEADER	REPUBLIC OF THE PHILIPPINES DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS PORT AREA, MANILA	PROJECT AND LOCATION : DETAILED DESIGN STUDY ON UPGRADING INTER-URBAN HIGHWAY SYSTEM ALONG THE PAN-PHILIPPINE HIGHWAY (Plaridel, Cabanatuan and San Jose Bypasses)	SCALE : NOT DRAWN TO SCALE

SHEET CONTENTS :	FIGURE NO. :
PLARIDEL BYPASS INTERSECTION DETAIL A-2 (STA. 4 + 295.853) ULTIMATE STAGE	2.4-12



INTERSECTION DETAIL C-1L (STA. 1 + 032.037)
(INITIAL STAGE)

2
PR-45 SCALE 1:1000



INTERSECTION DETAIL C-1R (STA. 1 + 032.277)
(INITIAL STAGE)

3
PR-45 SCALE 1:1000

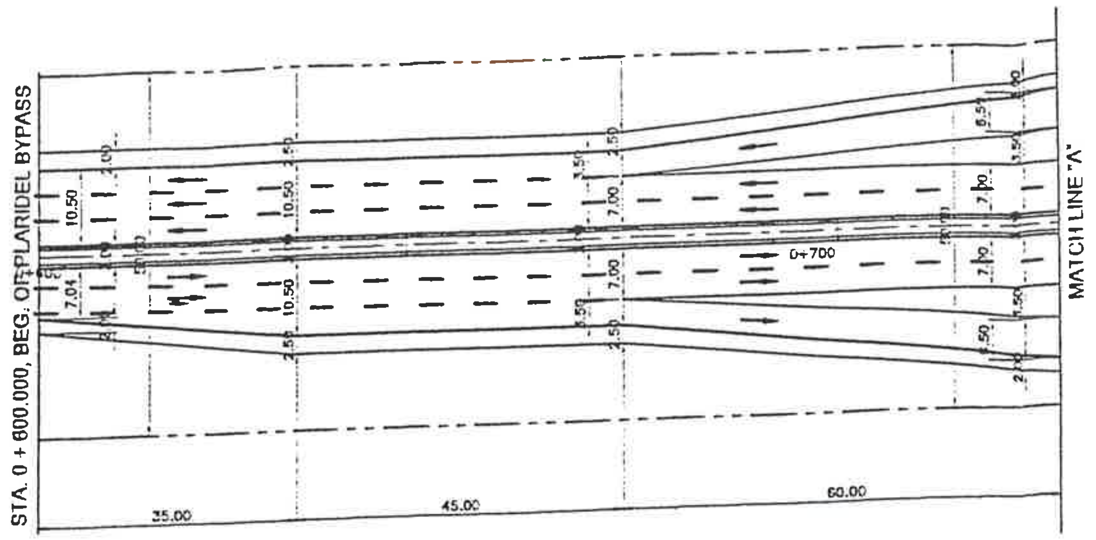
LEGEND:

INITIAL STAGE

INTERSECTION DETAIL B-1 (STA. 0 + 940.000)
(INITIAL STAGE)

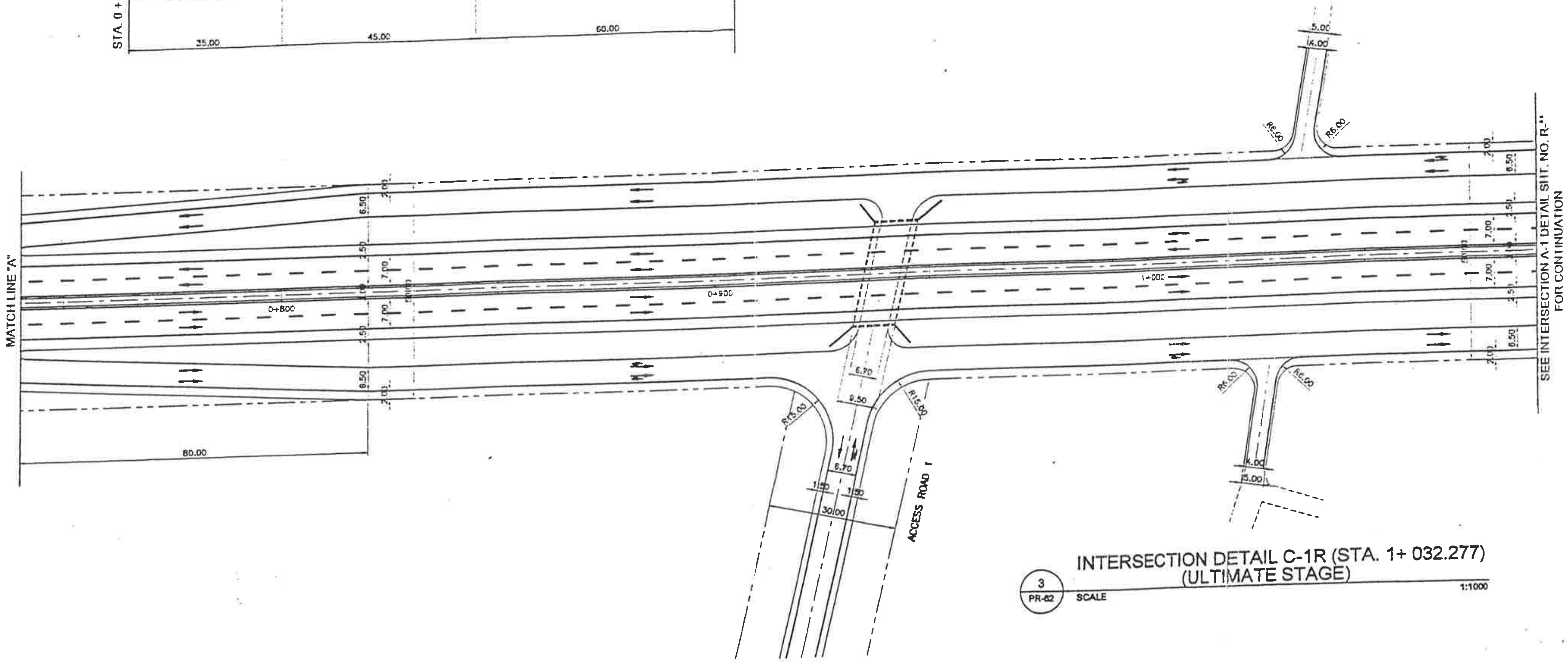
1
PR-45 SCALE 1:1000

JICA JAPAN INTERNATIONAL COOPERATION AGENCY / KATAHIRA & ENGINEERS INTERNATIONAL / YACHIYO ENGINEERING CO., LTD.		DATE	SIGNATURE	REPUBLIC OF THE PHILIPPINES DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS PORT AREA, MANILA	PROJECT AND LOCATION : DETAILED DESIGN STUDY ON UPGRADING INTER-URBAN HIGHWAY SYSTEM ALONG THE PAN-PHILIPPINE HIGHWAY (Plaridel, Cabanatuan and San Jose Bypasses)	SCALE : NOT DRAWN TO SCALE	SHEET CONTENTS : PLARIDEL BYPASS INTERSECTION DETAIL B-1 (STA. 0 + 940.000), C-1L (STA. 0 + 032.037) & C-1R (STA. 0 + 032.277) INITIAL STAGE	FIGURE NO. : 2.4-13
	DESIGNED							
	CHECKED							
	SUBMITTED		TEAM LEADER					



INTERSECTION DETAIL C-1L (STA. 1 + 032.037)
(ULTIMATE STAGE)

2 PR-62 SCALE 1:1000



INTERSECTION DETAIL C-1R (STA. 1+ 032.277)
(ULTIMATE STAGE)

3 PR-62 SCALE 1:1000

INTERSECTION DETAIL B-1 (STA. 0 + 940.000)
(ULTIMATE STAGE)

1 PR-62 SCALE 1:1000

JICA JAPAN INTERNATIONAL COOPERATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL YACHIYO ENGINEERING CO., LTD.	DESIGNED / CHECKED / SUBMITTED	DATE / SIGNATURE / TEAM LEADER	REPUBLIC OF THE PHILIPPINES DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS PORT AREA, MANILA	PROJECT AND LOCATION : DETAILED DESIGN STUDY ON UPGRADING INTER-URBAN HIGHWAY SYSTEM ALONG THE PAN-PHILIPPINE HIGHWAY (Plaridel, Cabanatuan and San Jose Bypasses)	SCALE : NOT DRAWN TO SCALE	SHEET CONTENTS : PLARIDEL BYPASS INTERSECTION DETAIL B-1 (STA. 0 + 940.000), C-1L (STA. 0 + 032.037) & C-1R (STA. 0 + 032.277) ULTIMATE STAGE	FIGURE NO. : 2.4-14

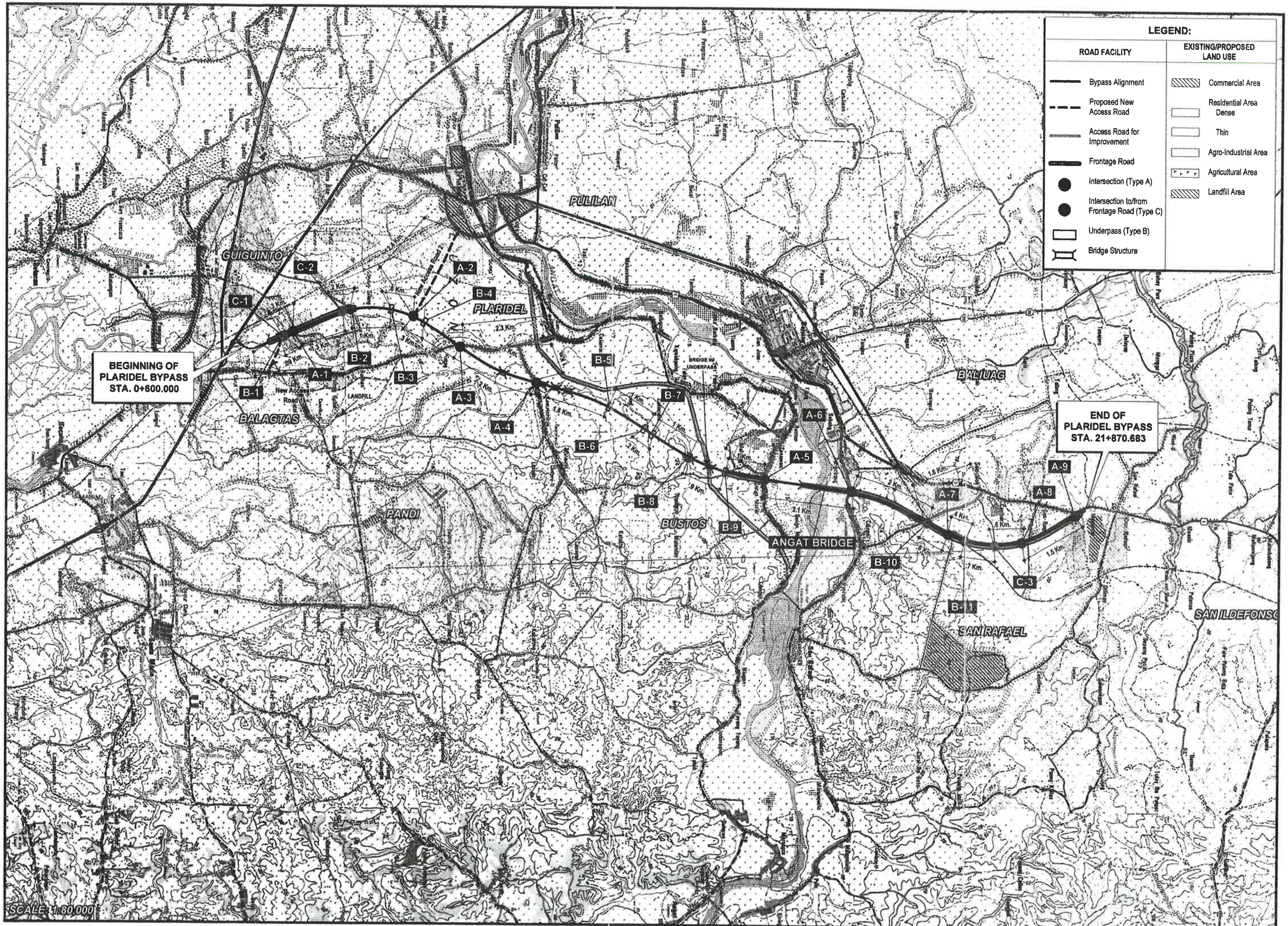


FIGURE 2.4-15 LOCATION OF ACCESS ROADS

Bridges

A total of **eleven (11)** bridges will be constructed along the proposed bypass alignment including the proposed ramp for the interchange crossing over the existing North Luzon Expressway **(Figure 2.4-16)**. There will be **one (1)** major bridge --- a **1,090.7 m** bridge crossing the Angat River and **ten (10)** medium/short bridges. **Table 2.4-3** gives a summary of the proposed bridges along the Plaridel Bypass alignment.

Table 2.4-3 Proposed Bridges Along the Plaridel Bypass Alignment

Site Crossing	No. of Bridges	Bridge Site No.
River and Streams	7	1, 2, 4, 5, 7, 9, & 10
Irrigation Canals	2	3 & 6
Angat River	1	8
Expressway	1	Ramp A

SOURCE: *Katahira & Engineers International, September 2001.*

Bridge Length and Span

The span and total length of the bridges are determined for each location following the design principle adopted and the considerations discussed below:

- The bridge length should maintain the original river width configuration;
- The minimum clearance of the bridge member (usually the girder soffit) from the maximum flood water level should be maintained;
- Encroachment on river waterway should be minimized; and
- The modified river section should be able to accommodate the design river discharge and minimize back water

The river hydraulic requirements were calculated for each location of the bridges **(Table 2.4-4)**. Bridges are proposed for river/stream sites where the calculated discharge for a 50-year return period is greater than 50 m^3/s.

For short and medium bridge, the calculated discharge varies from 56 m^3/s to 150 m^3/s, except for Bridge No. 7 (Sta. 13+156.7), where the discharge is about 14.8 m^3/s only. A bridge is proposed at this location since the river width is approximately 25 m.

For the Angat River, the calculated discharge is about 3,620 m3/s, where a 1,090.7 m long bridge is proposed.

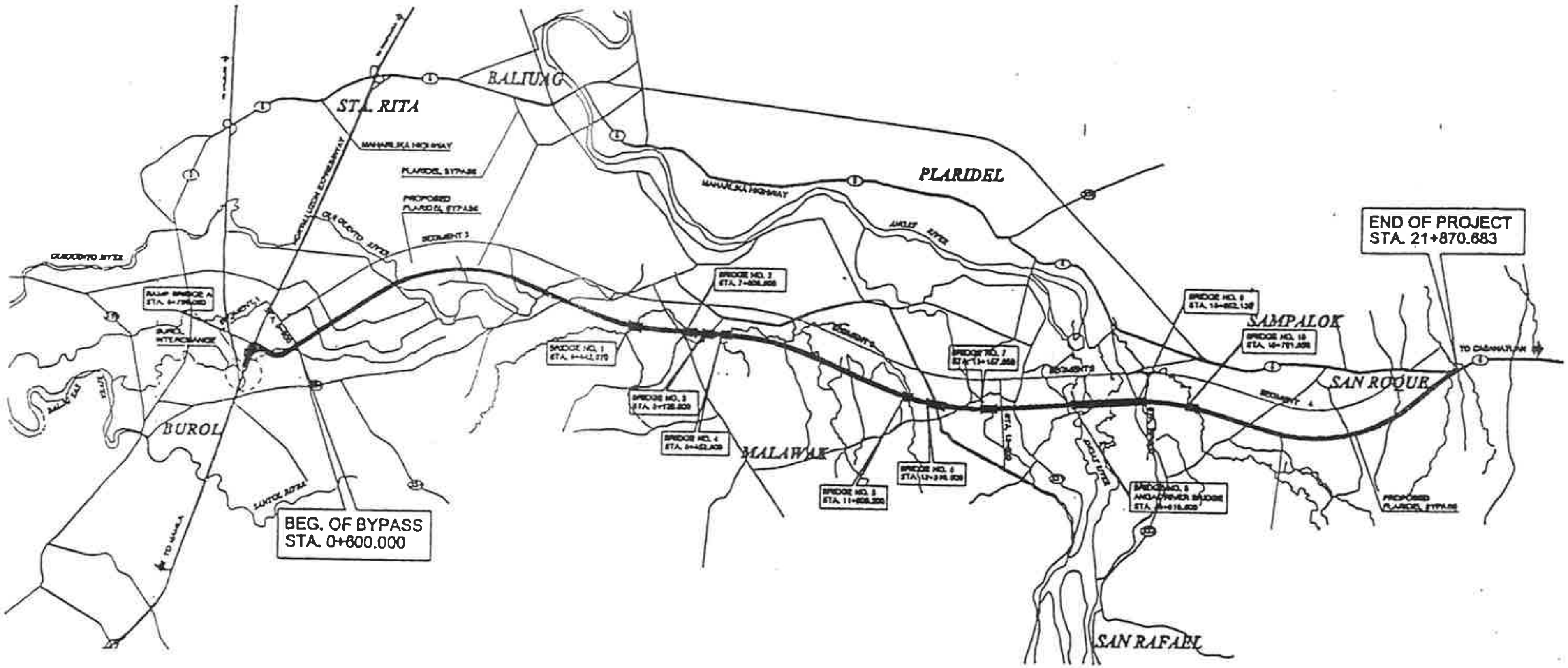


Figure 2.4-16 **Bridge Location Map for Plaridel Bypass**

SOURCE: *Katahira & Engineers International, September 2001.*

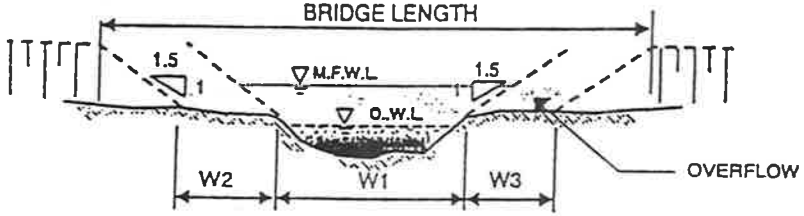
NOT DRAWN TO SCALE

Table 2.4-4 River Hydraulics for the Plaridel Bypass

Bridge No.	Beginning Station	Flood Depth* (Survey)	Bank Elevation	50-Year Design Hydraulics					River Width (m)				Proposed Bridge Length (m)
				Discharge Q(m^3/s)	Velocity (m/s)	Flood Depth* (m)	Depth* with Backwater (m)	Design Flood EL (+m)	W1	W2	W3	ΣW (Clear Span)	
1	6 +842.1	1.2	8.0	64.4	2.639	0.806	1.106	9.106	9.0	-	3.0	12.0	25.7
2	7+808.1	1.5	8.6	79.0	2.648	1.157	1.457	10.057	9.0	3.0	3.0	15.0	29.7
3	8+126.8	Irrigation Canal	9.4	-	-	-	-	10.000	7.2	-	-	7.2	20.7
4	8+452.0	1.2	8.9	56.3	2.527	0.843	1.143	10.043	9.0	-	4.0	13.0	25.7
5	11+800.8	0.3	12.5	63.4	3.720	0.244	0.544	13.044	8.0	-	-	8.0	22.7
6	12+310.2	Irrigation Canal	14.4	-	-	-	-	15.150	29.3	-	-	29.3	32.8
7	13+157.6	0.3	16.9	14.8	0.888	-1.206	-0.906	15.994	25.0	-	-	25.0	30.2
8	14+615.0	El 15.3	15.5	3,620.0	0.42			14.773	400.0	450.0	240.0	1090.0	1090.7
9	15+852.1	0.3	17.5	120.4	4.060	-3.214	-2.914	17.800	24.0	-	-	24.0	32.8
10	16+701.6	1.5	15.8	149.6	3.206	1.118	1.418	17.218	8.0	10.0	10.0	28.0	39.7

NOTES:

1. * - Flood depth reckoned from rice field/bank level.
2. River width is defined as:



Soil Condition

At all time of basis design for the proposed bridge locations, the geotechnical investigations are being carried out however, preliminary results:

- For short and medium bridges, on river/streams and irrigations canals, the soil type predominant from ground level to 3 m until 8 m deep clay with silt and gravel. Sand and predominantly gravel layer underlie this layer. Since the geotechnical investigation is still on-going, it is assumed that the bearing layer is less than 15.0m deep. Piles are assumed to be 15.0m long.

- However, at the interchange location (Ramp A), the soft clay layer extends deeper with the gravel-bearing layer at 28m below ground surface.

- For the Angat River Bridge location, the initial results of soil investigation indicates gravel with sand as the predominant soil type with N-values exceeding 50 at 8m below ground surface. The bearing layer is taken at 18m to 20m deep. Considerations for riverbed scouring leads to longer pile length (assumed 25.0m long).

Bridge Schemes

Substructure

Abutment

For all bridges, the closed type abutment is proposed with the superstructure seating on bearing. The embankment behind the abutment is more stable using this scheme than the open type or spill through abutment.

Piers

For medium bridges with multiple spans, a two-column pier is recommended since the bridge width is between 11.2 and 11.7 m.

On the other hand, for the Angat River Bridge, single oval column (oval type) pier is recommended since the bridge width is only 9.95 m. This will also increase the natural period of the structure and reduce the seismic forces absorbed by the foundation.

Foundation

Pile foundations are proposed for all the bridges along the bypass alignment. For short and Medium bridges, a 450mm x 450mm RC Driven Pile is recommended.

However, bored pile foundation is recommended for the Angat River Bridge since greater forces are expected due to its longer spans. Circular bored piles range from 1.0 m to 1.5 m in diameter.

Superstructure

Short and Medium Bridges

The type of superstructures recommended for short and medium bridges are flat slab, Reinforced Concrete Deck Girder (RCDG) and Prestressed Concrete Deck Girder (PCDG).

Table 2.4-5 gives a summary of the superstructure types of the proposed bridges along the Plaridel Bypass Alignment.

Table 2.4-5 Superstructure Types of the Proposed Bridges Along the Plaridel Bypass Alignment		
Superstructure Type	**Span Range (m)**	**Bridge No.**
Flat Slab	10.4m to 12.0m	No. 6 & 9
RCDG	12.0m to 20.0m	No. 3 & 10
PCDG	22.0m to 29.5m	No. 1,2,4,5,7, and Ramp A
SOURCE *Katahira & Engineers International, September 2001.*		

Angat River Bridge

Angat River Bridge is a **1,090-m** long bridge with **430 m + 270 m** approach spans at **30-meter** span length on PCDG (Type V AASHTO Girders) and 8-spans 400m long at **50-meter** span length on prestressed **2-cell** box girder.

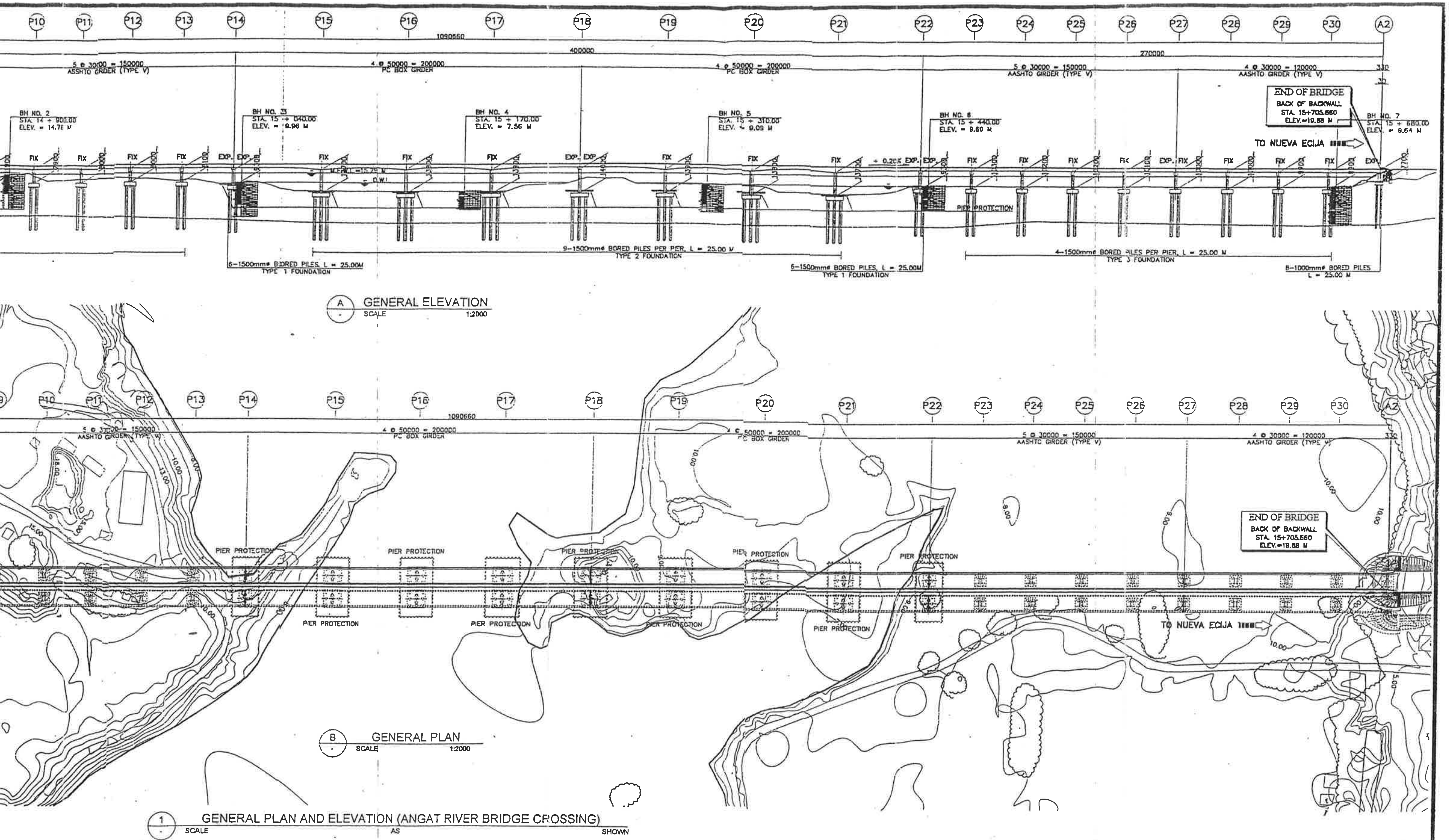
Table 2.4-6 gives the basic data of the Angat River Bridge. The general elevation scheme is presented in **Figure 2.4-17**.

A summary of the structural components of the proposed bridges for the different locations along the Plaridel Bypass alignment is presented in **Table 2.4-7**. The general elevation schemes of the proposed bridges are presented in **Figures 2.4-18** to **2.4-20**.

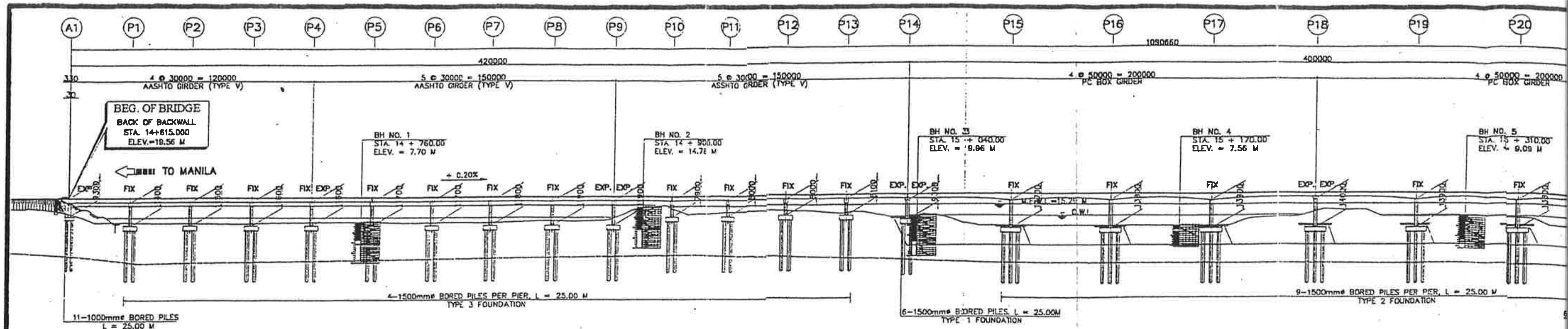
Cross Drainage Facilities

A total of **73** cross drainage facilities will be installed along the Plaridel Bypass. Of these, **nine** (9) will be in form of Reinforced Concrete Box Culverts (RCBC), and **64** Reinforced Concrete Pipe Culverts (RCPC). In some sections, the diameter/height of these culverts shall be adjusted to allow the passage of human beings, carabaos, and other farm implements to cross the bypass without using the highway.

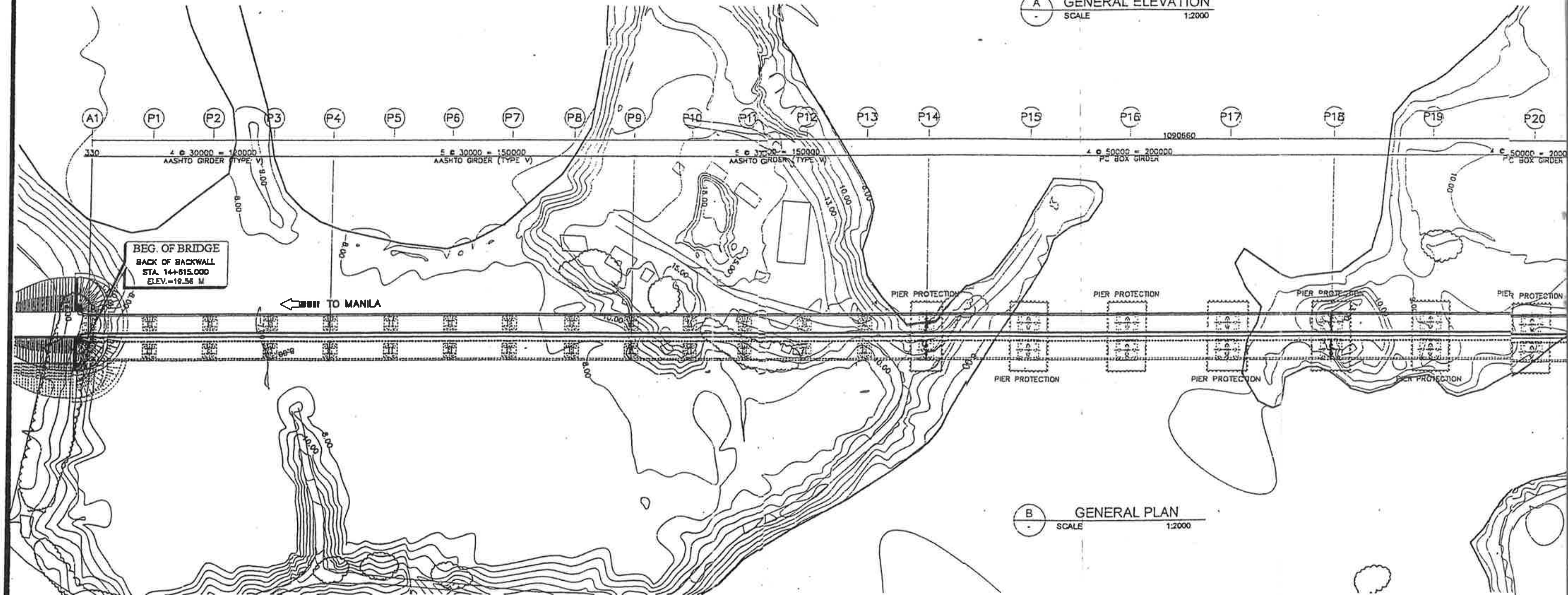
Table 2.4-6 Basic Description of the Angat River Bridge		
Total Bridge Length		1090m
Main Bridge	Length	400m
	Span	4 @ 50m + 4 @ 50m
	Superstructure	PC Box Girder by Balanced Cantilever
	Pier Column	1.8m x 4.5m Single Oval Type
	Foundation	Multiple Ø 1.5m Bored Pile
Approach Bridge	Length	420m + 270m
	Span	4 @ 30m + 5 @ 30m + 5@ 30m + 5 @ 30m + 4 @ 30m
	Superstructure	AASHTO Girder Type V
	Pier Column	1.5 x 3.5m Single Oval Type
	Foundation	Multiple Ø 1.5m Bored Pile



JICA JAPAN INTERNATIONAL COOPERATION AGENCY		DATE	SIGNATURE	REPUBLIC OF THE PHILIPPINES DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS PORT AREA, MANILA	PROJECT AND LOCATION :	SCALE :	SHEET CONTENTS :	FIGURE NO. :
KEI KATAHIRA & ENGINEERS INTERNATIONAL / YEC YACHIYO ENGINEERING CO., LTD.	DESIGNED				DETAILED DESIGN STUDY ON UPGRADING INTER-URBAN HIGHWAY SYSTEM ALONG THE PAN-PHILIPPINE HIGHWAY (Plaridel, Cabanatuan and San Jose Bypasses)	NOT DRAWN TO SCALE	PLARIDEL BYPASS ANGAT RIVER BRIDGE CROSSING (BRIDGE NO. 8) GENERAL PLAN & ELEVATION	2.4-17
	CHECKED							
	SUBMITTED		TEAM LEADER					



A GENERAL ELEVATION
SCALE 1:2000



B GENERAL PLAN
SCALE 1:2000

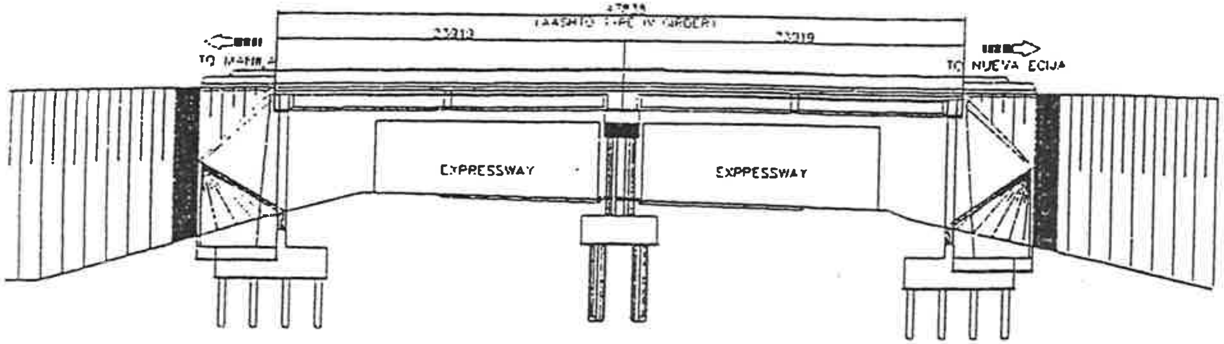
1 GENERAL PLAN AND ELEVATION (ANGAT RIVER BRIDGE CROSSING)
SCALE AS SHOWN

JICA		DATE	SIGNATURE	REPUBLIC OF THE PHILIPPINES
JAPAN INTERNATIONAL COOPERATION AGENCY	DESIGNED			DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
KATAHIRA & ENGINEERS INTERNATIONAL; YACHIYO ENGINEERING CO., LTD.	CHECKED			PORT AREA, MANILA
	SUBMITTED		TEAM LEADER	

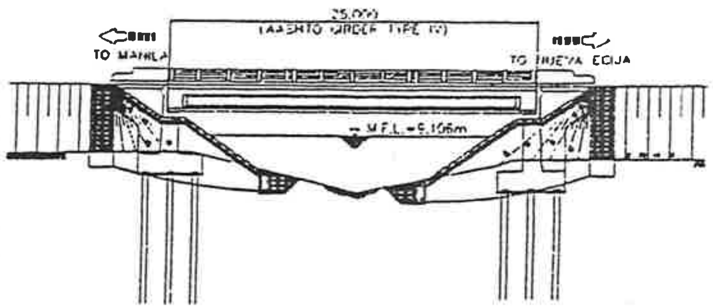
Table 2.4-7 Summary of Proposed Bridges for Plaridel Bypass

Bridge No.	Beginning		End		MFWL El (+m)	Bridge Length (m)	No. of Spans	Span Length (m)	Bridge Type	Substructure Type			Superstructure	
	Station	Elev. (m)	Station	Elev. (m)						Foundation	Abutment	Pier	Girder (mm)	Slab (mm)
RAMP A	0 + 796.1	16.3	0 + 844.6	16.3	-	48.5	2	2 @ 23.9	PCDG	450X450 R.C .PILES + ϕ1200 BORED PILE	Closed/Seat	Single Column	AASHTO TYPE-IV	RC (230)
1	6 + 842.1	12.6	6+867.7	12.7	9.1	25.7	1	1 @ 25.0	PCDG	450X450 R.C. PILES	Closed/Seat	-	AASHTO TYPE-IV	RC (230)
2	7 + 808.8	13.7	7 + 838.5	13.8	10.1	29.7	1	1 @ 29.0	PCDG	450X450 RC. PILES	Closed/Seat	-	AASHTO TYPE-IV	RC (230)
3	8 + 126.0	13.4	8+148.7	13.4	10.0	20.7	1	1 @ 20.0	PCDG	450X450 R.C. PILES	Closed/Seat	-	AASHTO TYPE-IVA	RC (230)
4	8 + 452.8	13.5	8+478.5	13.5	10.04	25.7	1	1 @ 25.0	PCDG	450X450 R.C. PILES	Closed/Seat	-	AASHTO TYPE-IVA	RC (230)
5	11 + 800.2	17.7	11+822.9	17.4	14.0	22.7	1	1 @ 22.0	PCDG	450X450 R.C. PILES	Closed/Seat	-	AASHTO TYPE-IVA	RC (230)
6	12+ 310.5	18.2	12+343.3	18.2	Irrigation Canal	32.8	3	10.4+12+10.4	FLATSLAB	450X450 R.C. PILES	Closed/Seat	2-Column	-	RC (600)
7	13 + 157.6	19.8	13+187.8	19.8	16.5	30.2	1	1 @ 29.5	PCDG	450X450 R.C. PILES	Closed/Seat	-	AASHTO TYPE-IVA	RC (230)
8	14 + 615.0	19.6	15+705.7	19.9	15.2	1090.7	14+8+9	23 @ 30 + 8 @ 50	PCDG + PCBOX GIRDER	ϕ1000+ ϕ1500 BORED PILES	Closed/Seat	Single Column	AASHTO TYPE-IV 2-CELL BOX	RC (230) +BOX
9	15 +852.1	20.2	15 + 884.9	20.2	17.8	32.8	3	10.4+12+10.4	FLATSLAB	450X450 R.C. PILES	Closed/Seat	2-Column	-	RC (600)
10	16 + 701.6	20.7	16 + 741.3	20.7	17.4	39.7	3	12+15++12	RCDG	450X450 R.C. PILES	Closed/Seat	2-Column	RC (950)	RC (230)

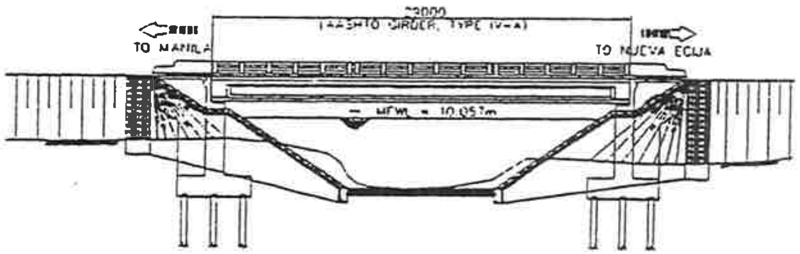
SOURCE: *Katahira & Engineers International, September 2001.*



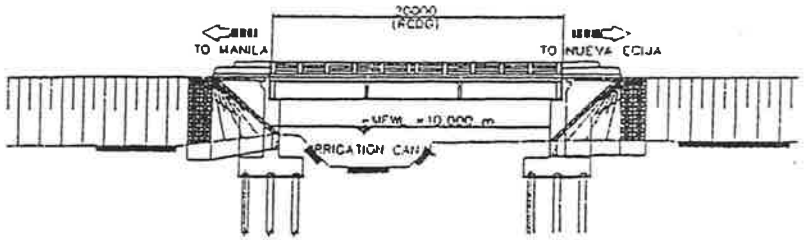
INTERCHANGE BRIDGE RAMP
(TWO SPAN AASHTO TYPE IV GIRDER)



BRIDGE NO.1
(ONE SPAN AASHTO TYPE IV)



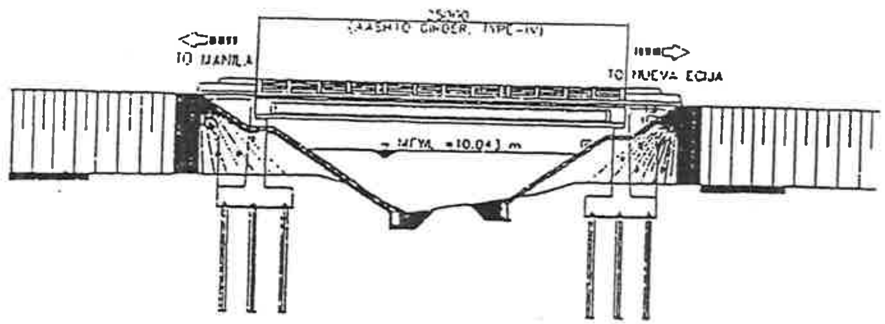
BRIDGE NO.2
(ONE SPAN AASHTO TYPE IV-A)



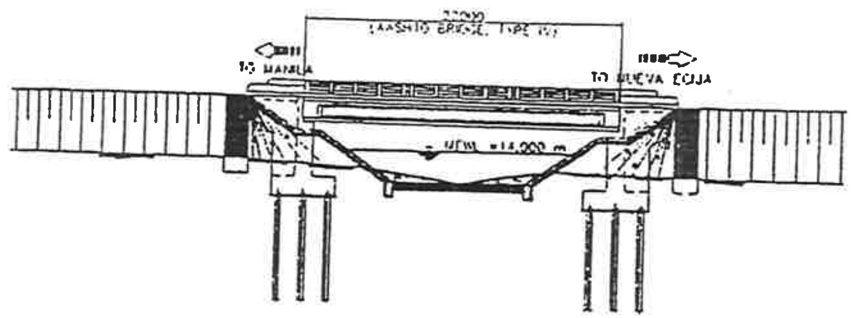
BRIDGE NO.3
(ONE SPAN RCDG)

Figure 2.4-18 General Elevation Schemes of the Proposed Bridges Along the Plaridel Bypass Alignment

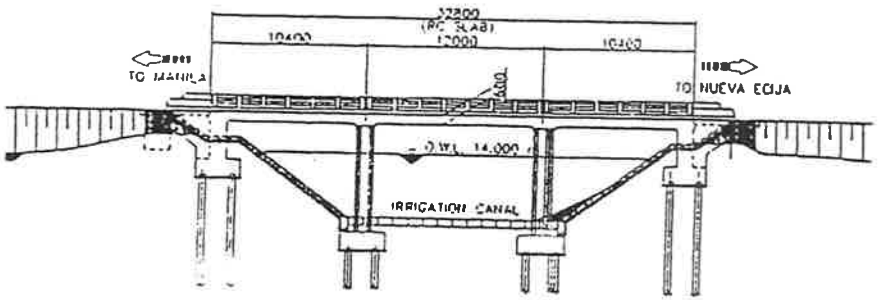
NOT DRAWN TO SCALE



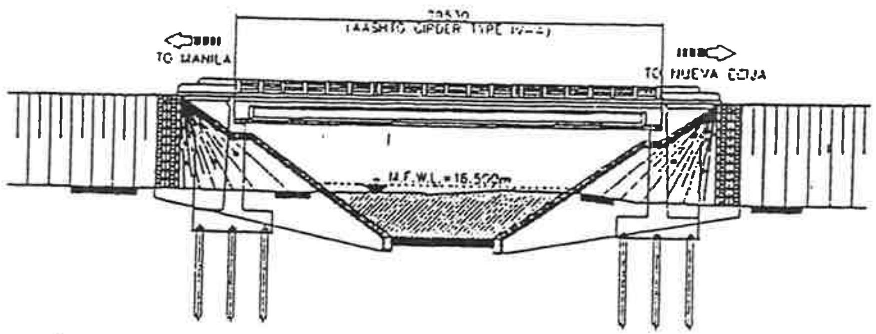
BRIDGE NO.4
(ONE SPAN AASHTO TYPE IV)



BRIDGE NO.5
(ONE SPAN AASHTO TYPE IV)



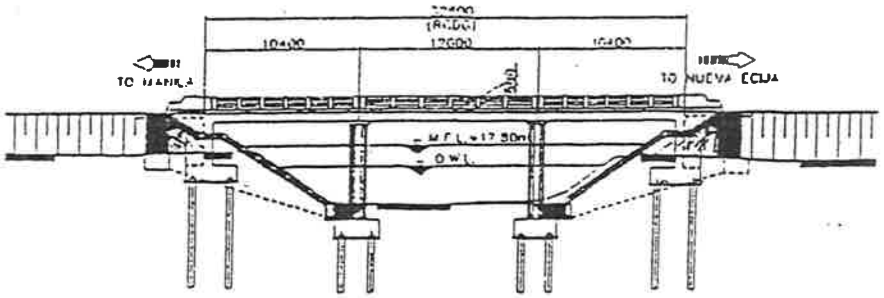
BRIDGE NO.6
(THREE SPAN RC SLAB)



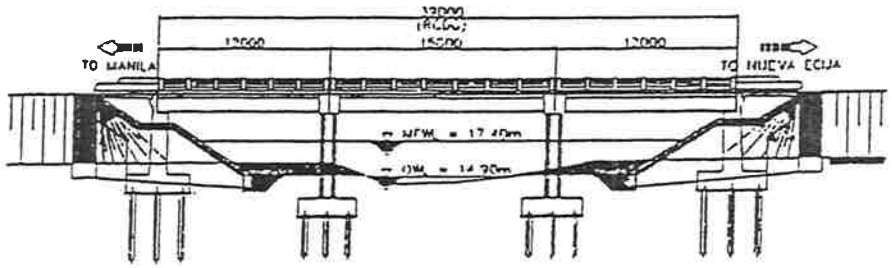
BRIDGE NO.7
(ONE SPAN AASHTO TYPE IV-A)

Figure 2.4-19 General Elevation Schemes of the Proposed Bridges Along the Pilaridel Bypass Alignment

SOURCE: *Katahira & Engineers International, September 2001*



BRIDGE NO.9
(THREE SPAN RCDG)



BRIDGE NO.10
(THREE SPAN RCDG)

Figure 2.4-20 General Elevation Schemes of the Proposed Bridges Along the Plaridel Bypass Alignment

NOT DRAWN TO SCALE

2.4.2 Project Activities

Pre-Construction Phase

Most segments of the alignment are located at the middle of rice lands. Only few and scattered residential houses are observed.

The following is a simplified chronological sequence of the site preparation activities involved during the Pre-Construction Phase of the proposed Plaridel Bypass Project:

- Survey and ROW Acquisition (entire);
- Clearing and Stripping (vegetation);
- Removal of Existing Structures;
- Construction of Access Roads within the acquired ROW; and
- Construction of Temporary Bridge Crossings or Embankments

Construction Stage

Once the temporary access roads are constructed and all pre-construction activities are completed, the construction works will commence.

Earthworks

Surface Soil Excavation

Since most of the segments of the alignment are located in farmlands, soft surface soil at depth of approximately 0.5 m ~ 0.75 m will be excavated before embankment works start.

The excavation works shall involve a total of **132,614 m^3** of soil during the initial stage of the project. These basically are from unsuitable excavation **(126,267 m^3)**, structural excavation **(967 m^3)**, and pipe culverts and drain excavation **(5,280 m^3)**. In the ultimate stage, another **3,532 m^3** of soil will be excavated from the construction of pipe culverts and drains.

Embankment

A large amount of embankment material is required for the construction of the bypass alignment. Initially, the required embankment fill is approximately **468,349 m^3**. Another **38, 394 m^3** embankment from borrow will be needed during the ultimate implementation stage. The total embankment required for the project is **506,743 m^3**.

As previously mentioned, most segments of the alignment will traverse farmlands, thus, it is considered that excavated materials in the project site will not be good enough to be used for embankment. Therefore, borrow material will be utilized for the construction of the embankment.

Embankment will be constructed in a good manner so that it will be firm enough to bear the traffic load and minimize settlement. Selected fill materials shall be laid in a layer of not greater than **30 cm** in thickness and compacted to **95%** of the optimum water ratio as specified in the AASHTO.

Surplus from the excavated soil and construction spoils will be properly disposed at DENR-approved disposal site/s. The possible site/s will be determined prior to implementation of the project.

Slope Protection

Seeding will be adopted for the slope protection of the embankment in most parts of the alignment, taking into consideration the environment, both in the aesthetic and economic points of view. However, in areas where gentle slope cannot be adopted or in structurally important sections, riprap and stone masonry protection will be implemented.

Pavement Works

Once preparation of the subgrade, placing and compaction of subbase course are completed, curbs will be installed and pavement concrete will be constructed.

Portland Cement Concrete (PCC) type of pavement is adopted for the road surfacing.

Bridge Construction

General

Most of the bridges along the alignment are single span varying from 12 m to 30 m span. For bridges with spans greater than 20 m, these will be constructed through simple prestressed concrete girders. However, for bridges with spans shorter than 20 m, reinforced concrete girder will be implemented to carry out the construction. Moreover, bridges with multi-spans other than Pampanga Bridge, simple prestressed concrete girders are also adopted to facilitate the construction.

Access Roads, Craneway, and Jetty

Temporary access roads and jetty/craneway will be constructed in order to proceed with the construction of the approach and main bridge. This will give access for equipment, materials and manpower to and from the construction areas.

On low-lying areas, temporary access roads will be constructed within the acquired ROW using earth fill materials. The height of embankment will be based on the anticipated floodwater depth during construction. In other areas where flooding is not expected, the existing ground will be utilized as access road.

On waterways, temporary jetty will be used as craneway to access construction areas. The jetty will be made of steel H-Piles, driven to sufficient depth to support the anticipated construction loads (equipment and materials). Where boats or other river vessels pass through, sufficient opening will be provided on the jetty/craneway. These will be constructed so as not to impose too much restriction on the river course. The maximum anticipated flood level during construction would determine the height of the jetty/craneway.

Foundation

To prevent the groundwater from entering the construction area, construction of foundation for the approach and main bridge will be protected by cofferdams. The cofferdams will be made of two layers of steel sheet piles with compacted sand and gravel between the sheet piles. Sufficient width of the cofferdam will be provided to allow construction equipment access the area.

The bored piles for the foundation will be excavated using earth/auger drill as shown in the drawings. In cases where the sides of excavation are not stable, steel casing will be used to protect the excavation. Prefabricated reinforcing bars will be inserted in the excavated hole and concrete pumped to fill the void.

Pier Column

The pier columns including coping beams and pier heads for the main bridge will be constructed and erected on site by staging using falseworks and shoring supports. The temporary support will be founded on top of the pile cap to minimize settlement

Superstructure (Angat River Bridge)

Approach (ASSHTO Girders)

The supersturcture for the approach bridge will be made of precast/presstressed AASHTO Girders which will be delivered on site and launched by cranes. Each precast girder will be lifted in place on top of the constructed coping. Once the girders are already set in place, construction of the cast-in-situ slab follows utilizing the girders to support the formworks.

Main Bridge (PC Box Girder by Balanced Cantilever)

The main bridge box girder superstructure will be constructed by balanced cantilevering method to eliminate the use of falseworks and shoring necessary for staging method. This is identified as the most appropriate method considering the height of the superstructure, the depth of the river water level, and minimizes obstruction to river flow.

Construction of the superstructure proceeds from the pier table by cantilevering-out the box girder segments as balanced as possible. Once the cantilevering is completed, the center closure on suspended formworks follows to connect the cantilever segments together. Side span closure will be done using staging method on falsework and shoring.

Source of Construction Materials

Construction materials such as borrow pits and aggregate materials (fine and coarse) for the project will be sourced from nearby existing quarry areas. The identified areas as possible sources of the said construction materials are shown in **Figure 2.4-21** and are listed in **Table 2.4-8**.

Other basic construction materials will be directly procured from local dealers within the vicinity of the project area. In cases wherein materials are not readily available from the nearby sources, suppliers from neighboring towns may be tapped.

Construction Schedule

The completion of the Plaridel Bypass Project is urgently needed. Hence, construction period shall be at the shortest time possible. **Figures 2.4-22a** and **2.4-22b** shows the intended implementation of the proposed bypass project during the initial and ultimate stages, respectively.

Table 2.4-8 Location and Quantity of Borrow Pit for the Plaridel Bypass Project

Location	Aggregate (m^3)	Coarse Material (m^3)	Fine Material (m^3)
Angat River (P1)	50,000	(50,000)	10,000
Angat River (P2)	(50,000)	(50,000)	10,000
Maronquillo River	500,000	(500,000)	0
Panaban Angat River	30,000	(30,000)	0
Baybay River	30,000	(30,000)	0
Doña Remedios Trinidad	0	(UNLIMITED)	UNLIMITED

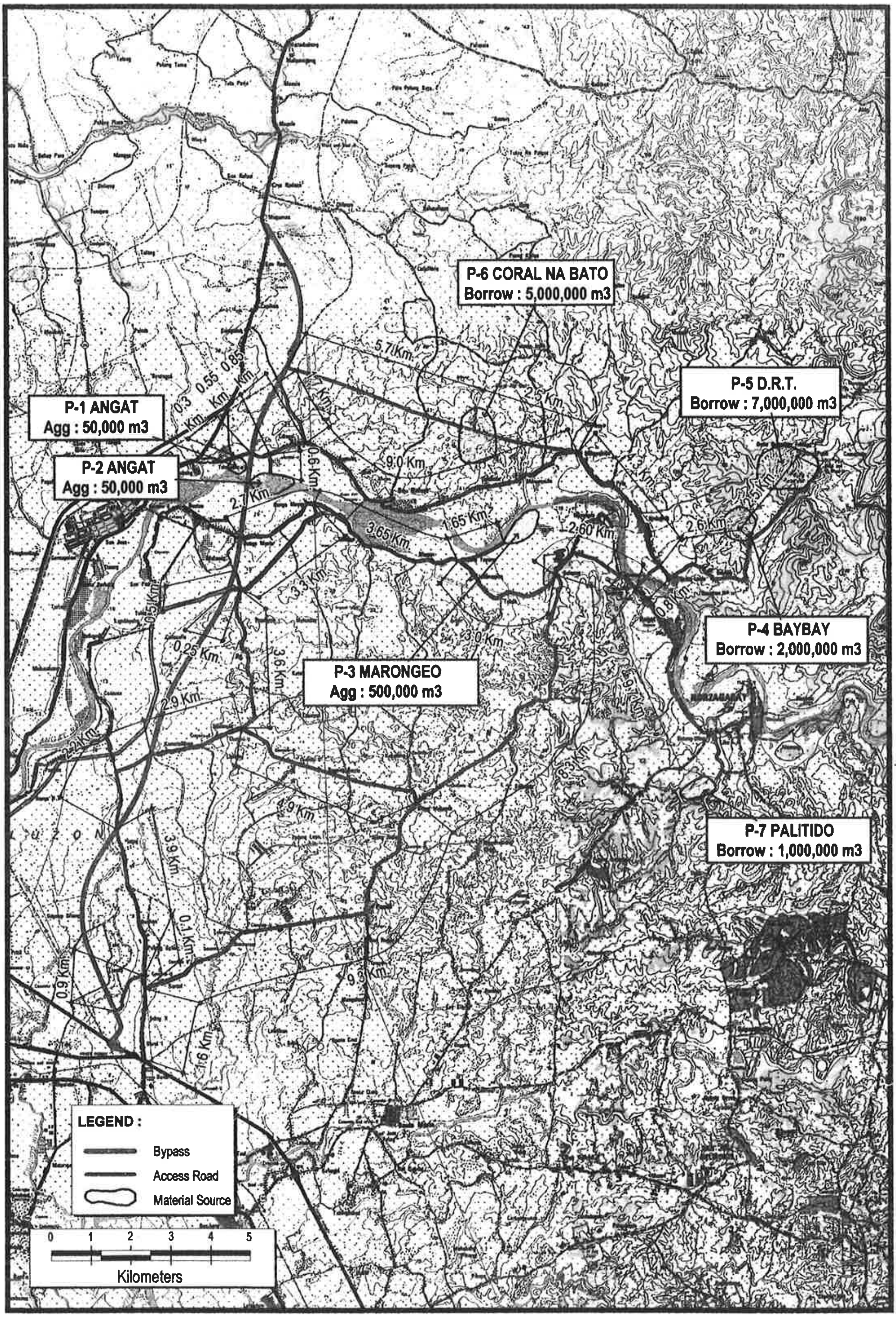


FIGURE 2.4-21 LOCATION OF MATERIAL SOURCES AND ACCESS ROADS (PLARIDEL BYPASS)

Construction Cost

The construction cost of the project should be within the appropriate range. Contractors will be selected through the international Competitive Bidding (ICB). One contract size of DPWH projects through ICB ranges from 300 to 1,2000 Million Pesos, which should be followed under this project as shown in **Table 2.4-9**. As shown in the Table, the total project cost for the initial and ultimate stages is **838.7 Million Pesos** or **1,996.1 Million Yen**.

Table 2.4-9 Total Project Cost

	Initial Stage	Ultimate Stage	Total (in Million Pesos/Yen)
Plaridel Bypass	452.4	386.3	**838.7/1,996.1**

SOURCE: *Katahira & Engineers International, September 2001.*

List of Minimum Essential Construction Equipment for the Bypass Project

Table 2.4-10 enumerates the minimum essential construction equipment for the implementation of the proposed Plaridel Bypass Project.

Table 2.4-10 Minimum Essential Construction Equipment

Description	Specifications
Concrete Mixing Plant	30m3
Concrete Mixing Plant	40m3
Concrete Mixing Plant	60m3
Tractor Crawler w/ Dozer	140hp
Tractor Crawler w/ Dozer	200 hp
Motor Grader	135 hp
Tandem Smooth Drum Vibratory	
Vibratory Plate Compactor	
Hydraulic Truck Crane	21~25t
Hydraulic Truck Crane	46~50t
Hydraulic Truck Crane	51~60t
Crawler Crane	21~25t
Crawler Crane	41~45t
Hydraulic Excavator	0.46m3
Hydraulic Excavator	0.61m3
Asphalt Finisher	3m
Asphalt Finisher	4.7m
Dump Truck	4.59~6.87m3
Water Tank Truck	3000gals
Water Tank Truck	1000gals
Air Compressor	251~315cfm
Air Compressor	126~160cfm
Grout Pump Air Driven	
Concrete Vibrator	
Generator	601~700kw
Generator	101~150kw
Pile Hammer	
Vibro Hammer	40 kw
Vibro Hammer	70t-m
Hydraulic Jack	100t
Hydraulic Jack	30t
Welding Machine	300 Amps
Welding Machine	250 Amps

SOURCE: *Katahira & Engineers International, September 2001.*

Availability of Support Services and Facilities

The required support services and facilities for the implementation of the project do not constitute a problem. Since the project area is urbanized, water resources, electricity, and other basic support services are readily available.

Water and Power Supply Demand

The project is not expected to cause significant increase in demand for water in the impact areas, as water use would be mainly for domestic purposes and sprinkling of disturbed surfaces to avoid dust resuspension. It would be too premature to provide an estimate of water consumption in terms of cubic meters at this stage. This is because the Plaridel Bypass would later be subdivided into Contract Packages for the construction phase, and thus the number of workforce is still indefinite at this point.

In terms of power supply, the project will be tapping available sources in the impact areas. If necessary, generators on stand by will also be used to augment power supply demand.

Operational Phase

The proposed Plaridel Bypass Project shall be opened to traffic after **2.5 years** of construction period.

Annual inspection of bridge structures and critical embankments shall be conscientiously done to avoid major repairs or reconstruction works. Maintenance work shall be scheduled on the pavement and drainage systems at least twice a year.

Abandonment Phase

Abandonment being referred to here are the activities that will be undertaken immediately before and during operation of the project. These consist of the following:

- Demobilization of construction works;
- Vegetation of embankments and exposed slopes;
- Tree planting along the environmental zone and center median;
- Reforestation/afforestation of DENR-designated areas; and
- Periodic road maintenance

Once the construction works are completed, the DPWH and the Constructors must ensure that:

- All excavated unsuitable materials and construction spoils have been properly hauled and disposed at DENR-approved disposal site/s;
- All disconnected/disrupted basic social service facilities such as power lines and water pipes as well as irrigation canals have been restored to its original function and efficiency;
- Damaged properties have been settled and properly compensated;
- Embankments and exposed slopes have been vegetated;
- Tree planting along the environmental zone as well as along the center median are already in place; and

- Afforestation of the designated DENR reforestation areas have been started

Once the road is opened to traffic, the DPWH must guarantee that standard and periodic maintenance of the newly constructed bypass is performed to ensure that the road reach its projected optimal structural life. One aspect that should be given focus and strict compliance is the monitoring of critical embankments and the continuous enhancement of slope protection measures.

Activity Description	Qty	Unit
S-1—Interchange		
Mobilization and Access Road	1	ls
Drainage Work	3	ls
Unsuitable Excavation	16,334	m3
Embankment	147,495	m3
Concrete Pavement	20,300	m2
Bridge Ramp A & Ramp B	2	Each
Miscellaneous Work	1	ls
Demobilization	1	ls
S-2—Embankment/Pavement		
Mobilization and Access Road	1	ls
Drainage Work	53	ls
Unsuitable Excavation	239,557	m3
Embankment	1,033,145	m3
Concrete Pavement	141,914	m2
Bridges	7	Each
Miscellaneous Work	1	ls
Demobilization	1	ls
S-3—Angat Bridge		
Mobilization and Access Road	1	ls
Drainage Work	5	ls
Unsuitable Excavation	25,551	m3
Embankment	105,953	m3
Concrete Pavement	16,980	m2
Bridges	2	Each
Miscellaneous Work	1	ls
Demobilization	1	ls
S-4—Embank...		
Mobilization and Access Road	1	ls
Drainage Work	22	ls
Unsuitable Excavation	146,846	m3
Embankment	436,239	m3
Concrete Pavement	58,650	m2
Bridge	1	Each
Miscellaneous Work	1	ls
Demobilization	1	ls

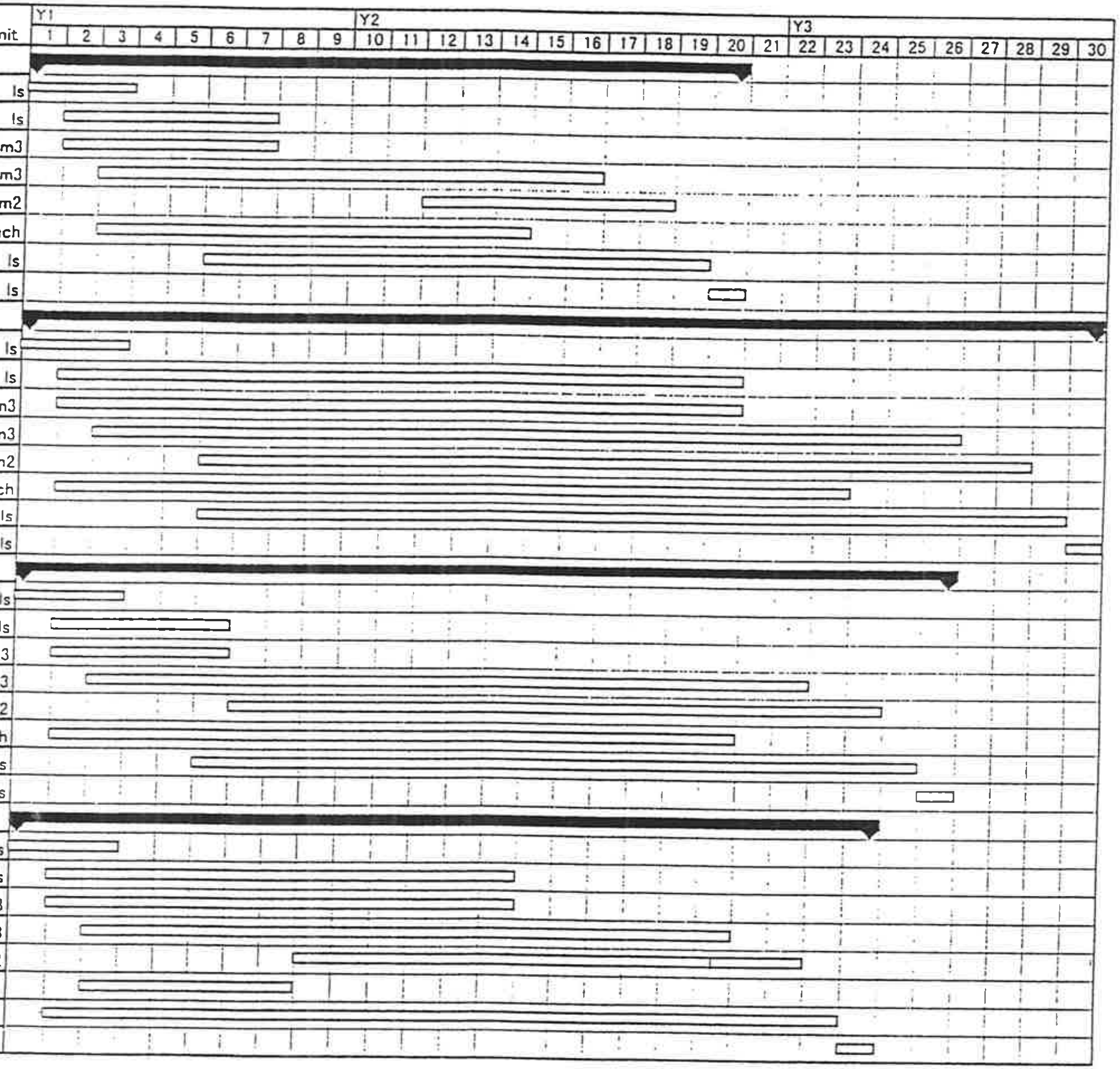


Figure 2.4-22a Construction Schedule for the Plaridel Bypass (Initial Stage)

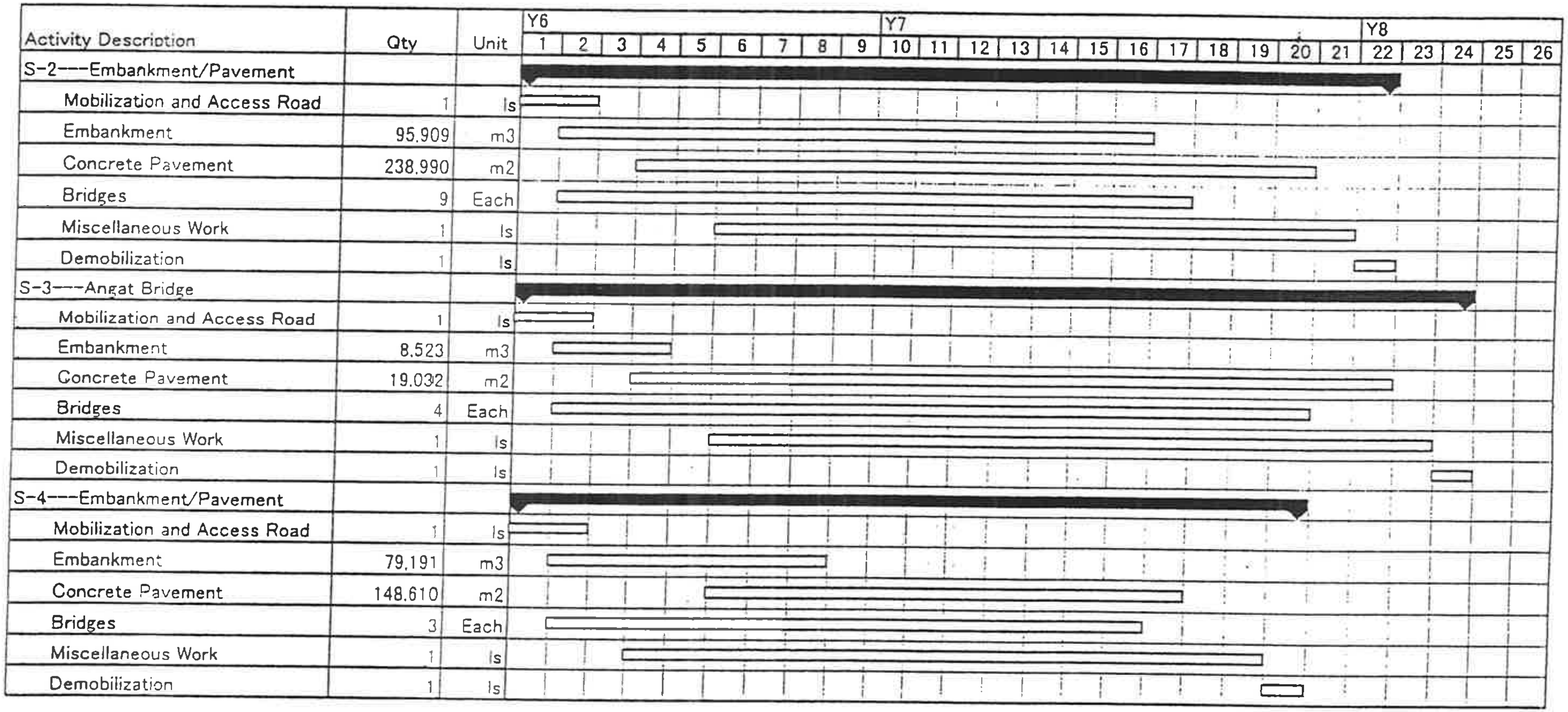


Figure 2.4-22b Construction Schedule for the Plaridel Bypass (Ultimate Stage)

Chapter 3

Baseline Environmental Condition

3 BASELINE ENVIRONMENTAL CONDITION

3.1 ENVIRONMENTAL STUDY AREA

The proposed Plaridel Bypass Project will traverse five (5) Municipalities in the Province of Bulacan namely Balagtas, Guiguinto, Plaridel, Bustos, and San Rafael.

In the Municipality of Balagtas, the bypass will only traverse Borol 2nd. In Guiguinto, Brgy. Tiaong, Pulong Gubat, and Cutcut will be crossed by the alignment. Barangays Bulihan and San Jose will be traversed by the project. Among the municipalities, Bustos has the most number of barangays that will be crossed by the bypass alignment namely, Camachilihan, Talampas, Malamig, and Bonga Menor. In San Rafael, Brgy. Tambubong, Caingin, San Roque, and Maguinao.

Direct Impact Area (DIA) and **Indirect Impact Area (IIA)** were delineated to assess the probable impacts of the project to the host communities. DIAs are areas that will be directly affected by the proposed undertaking, and will entail physical displacement of houses, loss of means of livelihood, agricultural lands and improvements. On the other hand, IIAs refer to those that will be indirectly affected by the possible increase in noise levels, TSP levels and other air pollutants such as SO_X and NO_X due to the operation of various equipment and machinery during the pre-construction and construction phases of the project

3.2 PHYSICAL ENVIRONMENT

3.2.1 Tectonic Setting

The Philippine archipelago is situated at the junction of two colliding tectonic plates and a large part of it belongs to the northwesterly Philippine Mobile Belt accreted during Tertiary. The accretion resulted from the oblique collision between the Eurasian margin and the Philippine Plate (**Figure 3.2-1**). Near Luzon, the rate of convergence of the Philippine Plate relative to Eurasia falls in the range of 8.0 cm/yr. The movement is accommodated on three main parallel zones namely:

i) The westward verging subduction zones such as the Manila Trench and collision zones running through the Taiwan-Mindoro-Panay trenches;

ii) The Philippine Plate at the eastern side, subducting westward along the Philippine Trench; and

iii) In between the two, the Philippine Fault, an active left-lateral strike-slip which runs from Southern Mindanao to Northern Luzon.

The subduction at the Philippine Trench and the Philippine Fault are young features, initiated in late Early Pliocene, probably in response to increasing blockage by collisions along Eurasia's boundary. Most of the oblique convergence would have since been partitioned between the two structures (*Ringenbach et. al., 1991*).

In Luzon, the South China Sea plate is subducted eastward along the Manila Trench while at the eastern side, the Philippine Trench is indented by the Benham Rise. A strike slip fault zone to the south and an incipient subduction, zone along the East Luzon Trough, borders the latter. The area of Northern Luzon is wedged and compressed by the two opposing subduction zones.

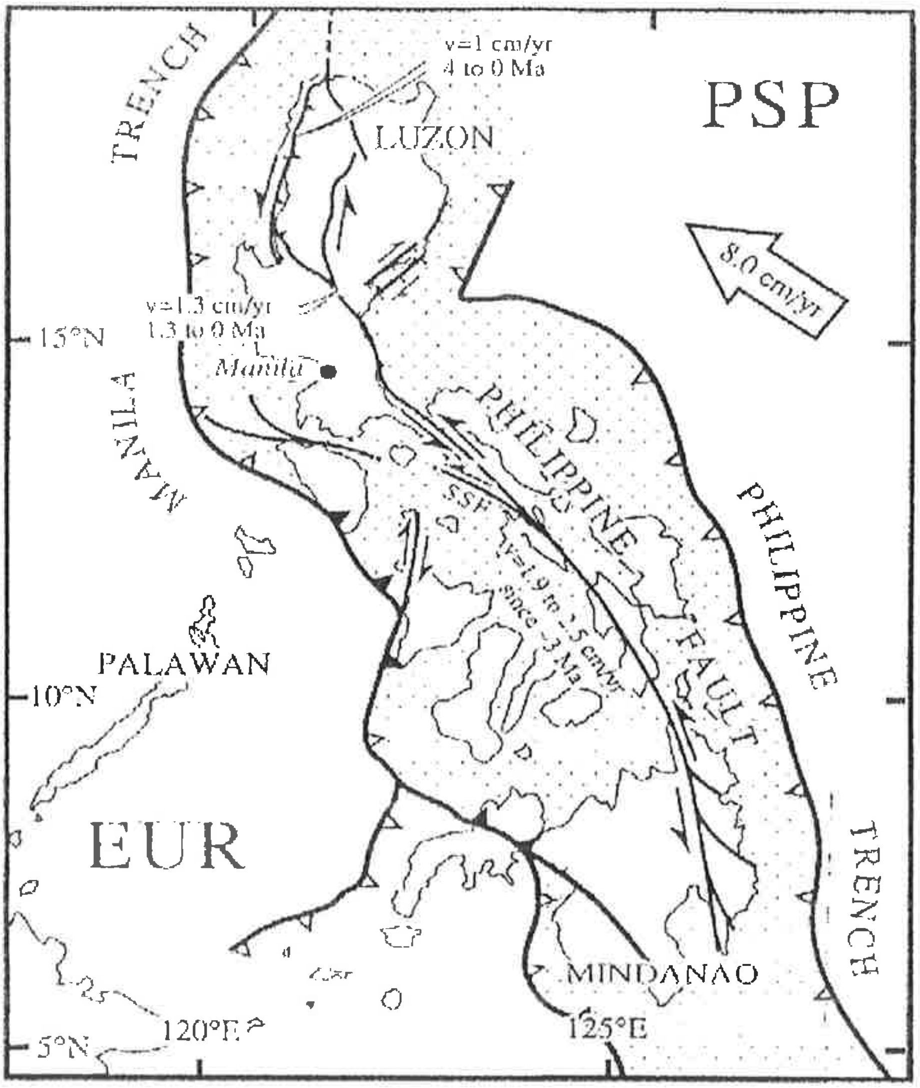
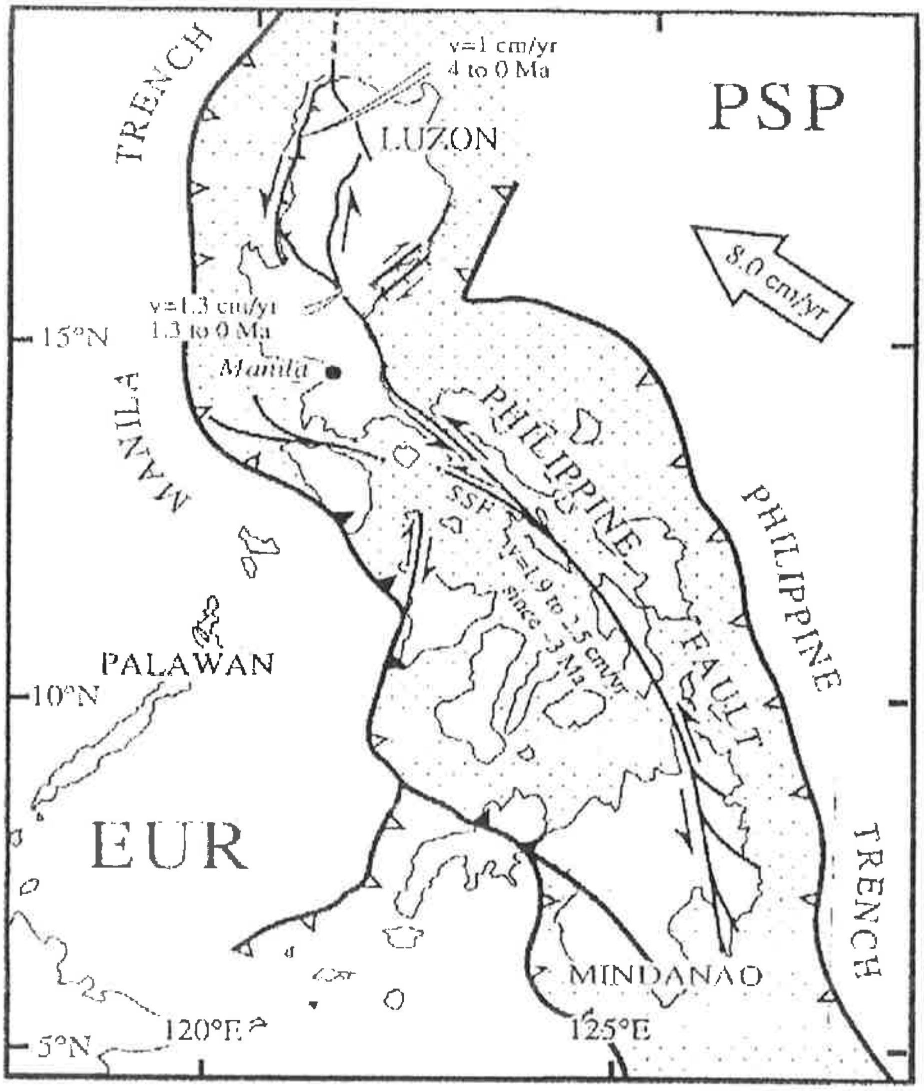


Figure 3.2-1 **TECTONIC MAP OF THE PHILIPPINES.** Only the active structures are represented. The Philippine Mobile Belt (dotted) lies between the Philippine Sea Plate (PSP) and Eurasia Plate (EUR). It is limited by collision zone (solid triangle) and subduction zone (open triangle) and is transected lengthwise by the left-lateral Philippine Fault along which movement is locally transtensive (ticks) or transpressive (solid triangle). North of Masbate Island, the Sibuyan Fault (SSF) branches out. ***(From Ringenbach 1992)***

Potential Earthquake Generators

Most of the earthquakes that affect Luzon are generated at the Philippine Trench and Manila Trench. The subductions and slippage in these tectonic lines generates shallow and deep-seated quakes of varying intensities. Seismological studies showed that aside from offshore trenches and subduction zones, active faults could generate earthquakes of significant intensities. Shown in **Figure 3.2-2** are the geotectonic features that can cause significant earthquakes that can affect the island of Luzon. (*E. Ramos, 1999*).



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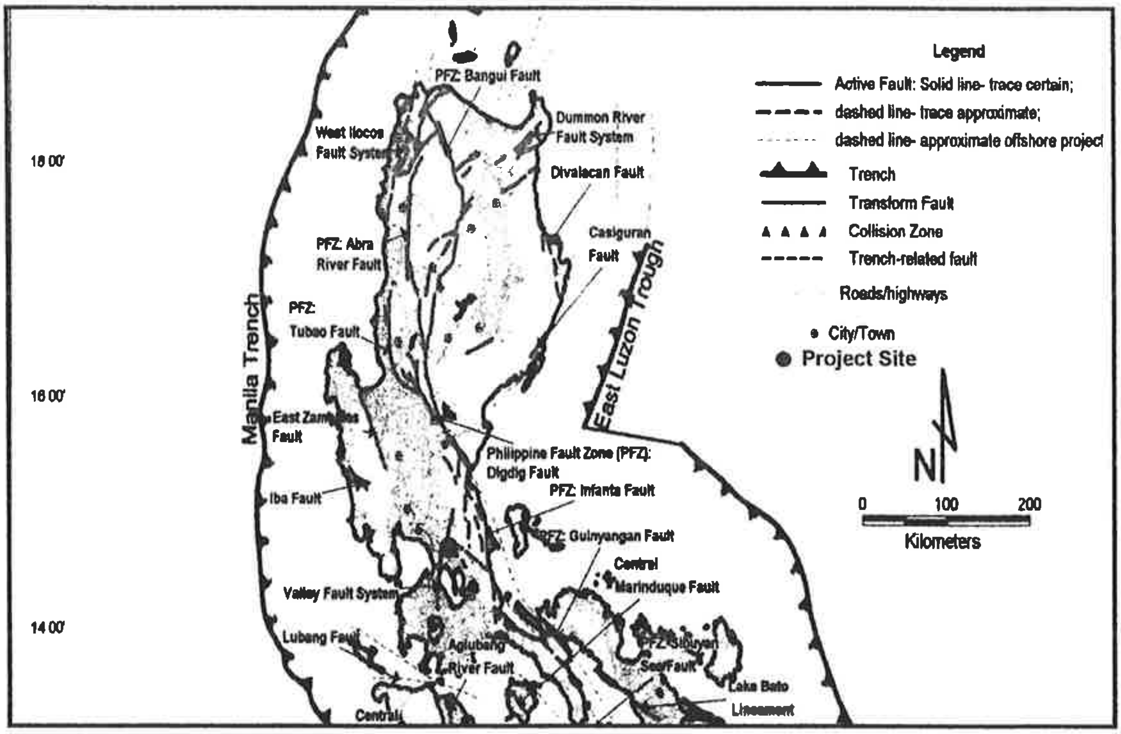


Figure 3.2-2 DISTRIBUTION OF ACTIVE FAUTLS AND TRENCHES IN LUZON

(Modified from PHIVOLCS 2000)

The following geologic structures stretches not only within Luzon Island but stretches on whole length of the country. This includes the Manila Trench, the East Luzon Trough, Carranglan Fault and the Philippine Fault.

The Manila Trench

The Manila Trench is a subduction related feature that parallels the western shore of Luzon. Convergence of the oceanic crust of South China Sea and the Luzon landmass causes the subduction of the oceanic crust under Luzon.

The East Luzon Trough

This is a deep oceanic trench that roughly traces the eastern shores of Luzon, serving as a tectonic boundary between the Luzon arc and the Philippine Sea Plate, which forms the western Pacific plate. At this trench, the Philippine Sea Plate subducts under the Luzon arc along the East Luzon Trough. This subduction process is marked by the depression of the ocean floor along the East Luzon Trough, and by the intense and westward-deepening region of earthquakes.

The Philippine Fault

The 1,200 km. long Philippine Fault is one of the world's major strike-slip faults. It extends from Luzon to Mindanao and is related to oblique convergence between the Philippine Trench and the Manila Trench. It follows a simple curved trace in the central and southern Philippines becoming a complex system of anatomizing branches in the northernmost part of Luzon. The northwest trending main active branch, which emerges from the Philippine Sea, splits into an array of N-S strike-slip faults responsible for the tectonic evolution of the Central Cordillera. The active splays, from northwest to southeast are, the San Manuel, San Jose, Digdig, and Gabaldon Faults. This pattern was acquired in Middle Miocene and reactivated since late Early Pliocene (*Ringenbach et. al., 1991*).

The Digdig Fault

A splay of the Philippine Fault is a pure strike slip along its N16E coarse and has a normal component along the northwesterly one, which coincides with the NW-SE strand of the Philippine Fault. Data indicate that the Digdig Fault have an average slip rate in the order of 1-1.5 cm./year (Daligdig *et al*, 1994). Analysis made by Ringenbach (1992) gave an average minimum horizontal slip rate of 1.3 cm/yr. Regional geologic and kinematics analysis done by Barrier *et al* (1991) predicted a 1.9 to 2.5 cm/yr. velocity for the southern part of the fault and this is supported by GPS data (Duquesnoy *et. al.* 1994).

The Carranglan Fault

The Carranglan Fault runs north-northwest parallel to the Digdig Fault, from the north to south of Carranglan town proper and is considered active by Ringenbach (1991). Unfortunately no supporting recent morphological features or rupture have been observed along its trace.

The fault stretches south from Pantabangan along the western border of Carranglan basin and makes a sharp bend toward a northwesterly trend and dies out 3 to 4 km. further on, between Seguim and Bunga Rivers. From the aerial photographs, the fault segment crossing the Seguim River shows a wide shear zone on the sandstone-siltstone bedrock. Fault scarplets, offset tributaries and ridges mark the fault's trace along the western banks of Carranglan River. Vertical displacement is estimated to be 130m based on the elevation difference between the Carranglan River at 230m and the 360m high conglomerate highland on the west bank. This estimate does not include the elevation lost through erosion as marked by the erosional surface on the conglomerate capping the highland.

Table 3.2-1 Classification of Selected Northern Luzon Faults		
Fault	**Classification of Activity**	**Criteria**
San Manuel	Active	Historical faulting & associated strong earthquakes displacement of recent deposits; Geomorphic features
Digdig	Active	Displacement of resent deposits; Geomorphic features; Earthquake epicenters
Casiguran	Active	Historical faulting; Geomorphic features; Earthquake epicenters
Vigan-Vintar River	Active	Geomorphic features; Earthquake epicenters; Displacement of recent deposits
Bangui	Active	Displacement of resent deposit; Geomorphic features; Earthquake epicenters
Bornay River	Potentially Active	Geomorphic features; Geologic setting; Earthquake epicenters
Abra River	Potentially Active	Geomorphic features; Geologic setting; Earthquake epicenters;
Kapampangan River	Potentially Active	Geomorphic features; Geologic setting; Earthquake epicenters
Chico River	Potentially Active	Geomorphic features; Geologic setting; Earthquake epicenters
Pidding - Adam	Active	Earthquake epicenters; Displacement of recent deposits; Geomorphic features
Adopted from N.M. Tuñgol & J.A. Daligdig 1990		

Seismicity

Listed in **Table 3.2-2** are earthquakes with epicenters traced to various earthquake generators that affected Northern Luzon. Historically, the Northern Luzon section of the Philippine Fault had been relatively quite and only subjected to earthquakes with long return periods. Prior to the 1990 earthquake, data shows that this section of the fault had moved in two occasions in 1645 and in 1839, an interval of 151, and 194 years.

Table 3.2-2 Historical Earthquakes with Surface Magnitudes of Over 5.0 that Affected Luzon Island

Date	Affected Areas	* Io	* Ms	Generator
21 June 1599	Manila	VIII	7.9	Undetermined
30 Nov. 1619	N. Luzon, Ilocos & Cagayan (Batac, Dingres, Sinait, Vigan)	IX	8,4	Undetermined
30 Nov. 1645	Manila,	IX	8.4	Philippine Fault Nueva Ecija
12 Jan. 1743	Tayabas, Sariaya, Lucban, Majayjay, Lilio, Nagcarlan, Mt. Banahaw	IX	8.4	Philippine Fault (Tayabas)
5 Nov. 1796	Pangasinan, Manila	IX	8.4	San Manuel Fault
16 Sept. 1852	SW Luzon, Manila, Orion, Orani, Abucay, Pilar, Mariveles, Balanga Balayan, Taal Batangas Mindoro	VIII	7.9	Lubang Fault
3 June 1863	Manila Rizal, Bulacan Pampanga	VIII	7.9	Lubang Fault
19 Oct. 1865	SE Luzon, N. Caceres	VIII	7.9	Samar-Bicol Fault
6 March 1892	Manila, Marikina, Montalban Rizal, Laguna, Bolinao, Pangasinan, San.Fernando, La Union Bayongbong, Nueva Ecija	VIII	7.9	Digdig Fault

***Io = Maximum Intensity Recorded**   ***Ms = Surface Magnitude**

As illustrated in **Figure 3.2-3**, the 16 July 1990 filled in the seismic gap along Northern Luzon section of the Philippine Fault. The earthquake was a result of strike-slip movements along the NW segment of the Philippine Fault Zone and its splays, the Digdig and Gabaldon Faults (R.S.Punongbayan et al 1992). The quake is the first documented occurrence for this century with a magnitude (Ms) of 7.8 and produced a 125 km-long ground rupture that stretches from Dingalan, Aurora to Kayapa, Nueva Vizcaya. The epicenter was placed near the town of Rizal, Nueva Ecija.

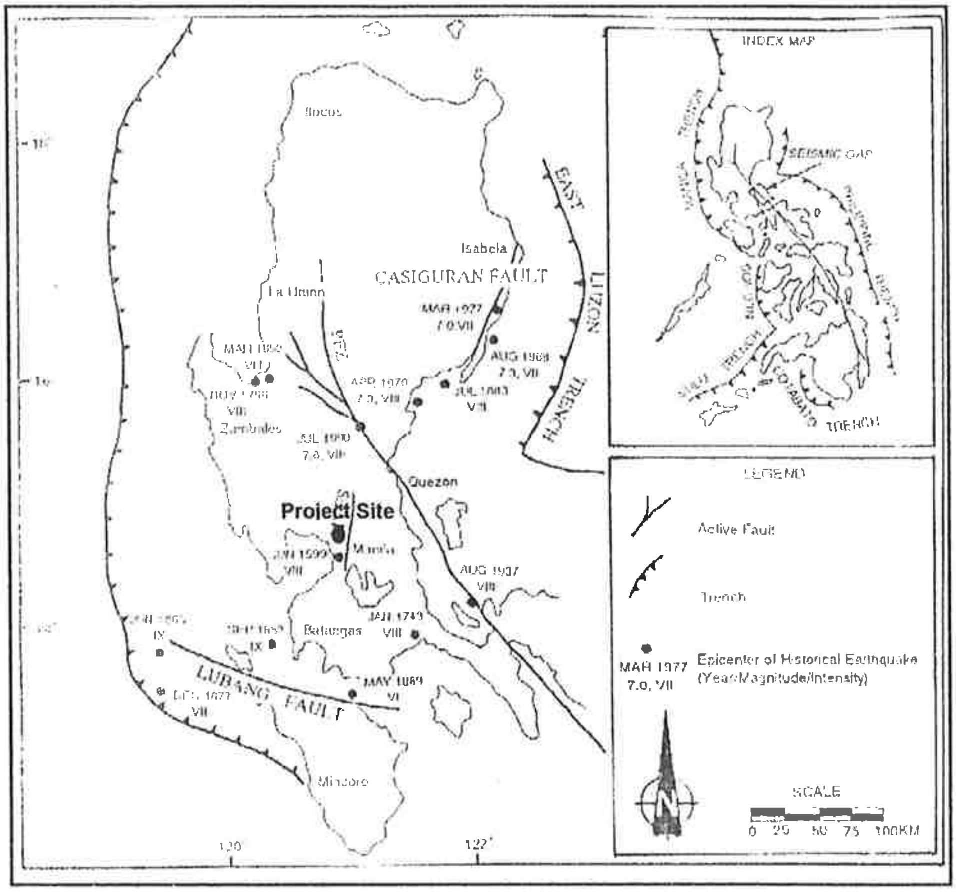


Figure 3.2-3 Locations of Epicenters of Historically Damaging Earthquakes In Luzon Island

(Adopted From R.S. Punongbayan et al 1991)

The surface rupture followed the pre-earthquake active fault trace with only slight deviations in certain places. Secondary shears are present as localized features along portions of the main rupture trace. Movement along the ground rupture was predominantly left-lateral with measured vertical and horizontal displacements varying from 0.1-2.5 and 0.2-6.2 meters respectively. **Table 3.2-3** summarizes the ground rapture along the Digdig-Tayabo stretch of the rapture zone. Movement is concentrated along the main rupture although right-stepping en echelon faults and trace discontinuities interrupt the narrow fault trace. Based on its distribution, the en-echelon faults are surface expressions of fault bends. Rupture length and measured maximum horizontal (6.2 m) and vertical (2.5 m) displacements are within the range of expected values observed world wide for earthquakes of this magnitude.

Table 3.2-3 Ground Rupture Data of the July 16, 1990 Earthquake (Anabat-Digdig-Tayabo Fault Segments)							
Locality	**Distance from NW Terminus (km)**	**Displacement (m)**		**Net Slip (m)**	**Hor./Ver. Displacement Ratio**	**Reference**	**Up Thrown Block**
		HOR.	VER.				
Anabat	37.92	4.90				Rice paddy	
	45.12	3.00	0.30	3.01	10.00	Foot trail	
	46.62	4.44	0.60	4.44	7.33	Road	NW
Digdig	47.22	6.20	0.30	6.21	22.00	Road	NE
	48.02	4.80	1.50	5.03	3.20	Road	NE
	49.92	5.80	0.40	5.81	14.50	Road	NE
	51.72	5.70	0.00	5.70		Road	
	53.22	4.60	0.70	4.65	6.57	Fence	NE
	56.07	5.80	0.40	5.12	12.75	Rice paddy	NE
	57.87	3.80	0.50	3.83	7.80	Foot trail	NE
Tayabo	60.92	2.40	0.00	2.40		Foot trail	
	67.07	4.00	0.60	4.04	6.67	Foot trail	NE
	68.52	1.40	0.30	1.43	4.67	Road	NE
	73.77	0.20	0.00	0.20		Foot trail	NE
Modified From Punongbayan et.al. 1992							

Effect of the 1990 Earthquake on Area Between of Tayabo and San Juan

The northern most end of the San Juan Bypass ends at about 10 km west of Tayabo where the trace of the Digdig fault is present. The pre-1990 earthquake location of Digdig fault is well defined by characteristic tectonic landform formed by repeated earthquake occurrences in the past (**Figures 3.2-4 and 3.2-5**). Mapping done by Nakata *et al* shows that at about 800 m northeast from the highway at Tayabo where the road makes a right angle bend, the surface rupture was mapped at the east bank of the Talavera River as right stepping en echelon fractures that trend N20°W and extend south-eastward for about 1 km before intersecting a small tributary at about 1km east of Rosaldo. The channel edge is was laterally offset by about 3-4 m From this point, the fault assumes a more north-north-westerly trend (N15°W) for another 1.5 km towards Kagomizan. From Kagomizan, the fault trace assumes a N30oW trend and extends along the northeast foot of a pre-existing pressure ridge about 1.5 km to the east of Kalinagawan. A 3.2 m lateral offset was measured from offset of foot trail. From this point, the trace steps to the right and follows the break in slope along the alluvial fan fronting the Mt. Mangeoban. At this area, offset was measured at 2.8 m and 0.4 vertically, northeast side up.

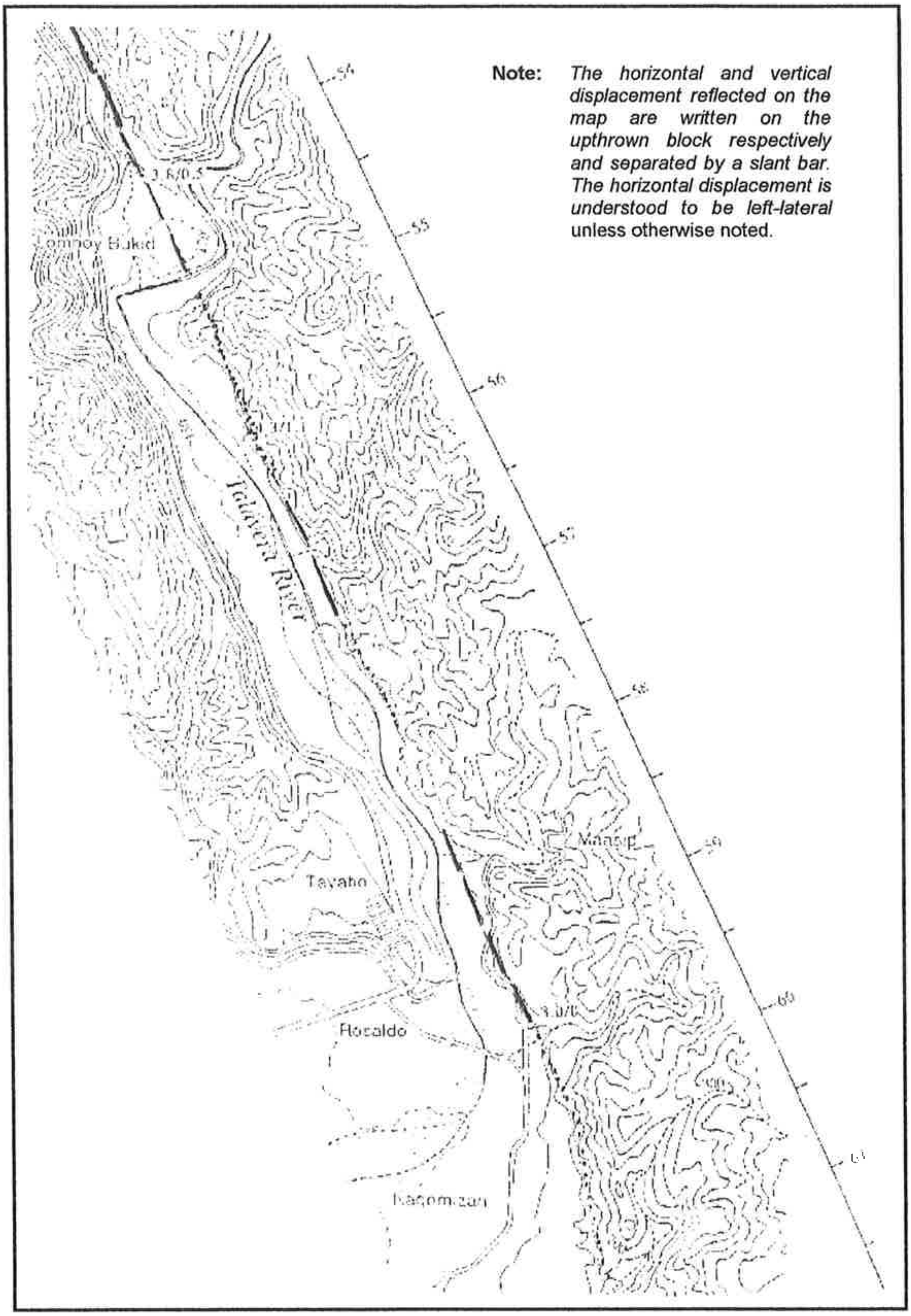


Figure 3.2-4 Trace Of Ground Rapture During the 1990 Earthquake Along the Digdig Fault With Vertical and Horizontal Displacement Traversing the Talavera River (4.4/1.5 = Horizontal/Vertical Displacement)

(From Nakata et al, 1996)

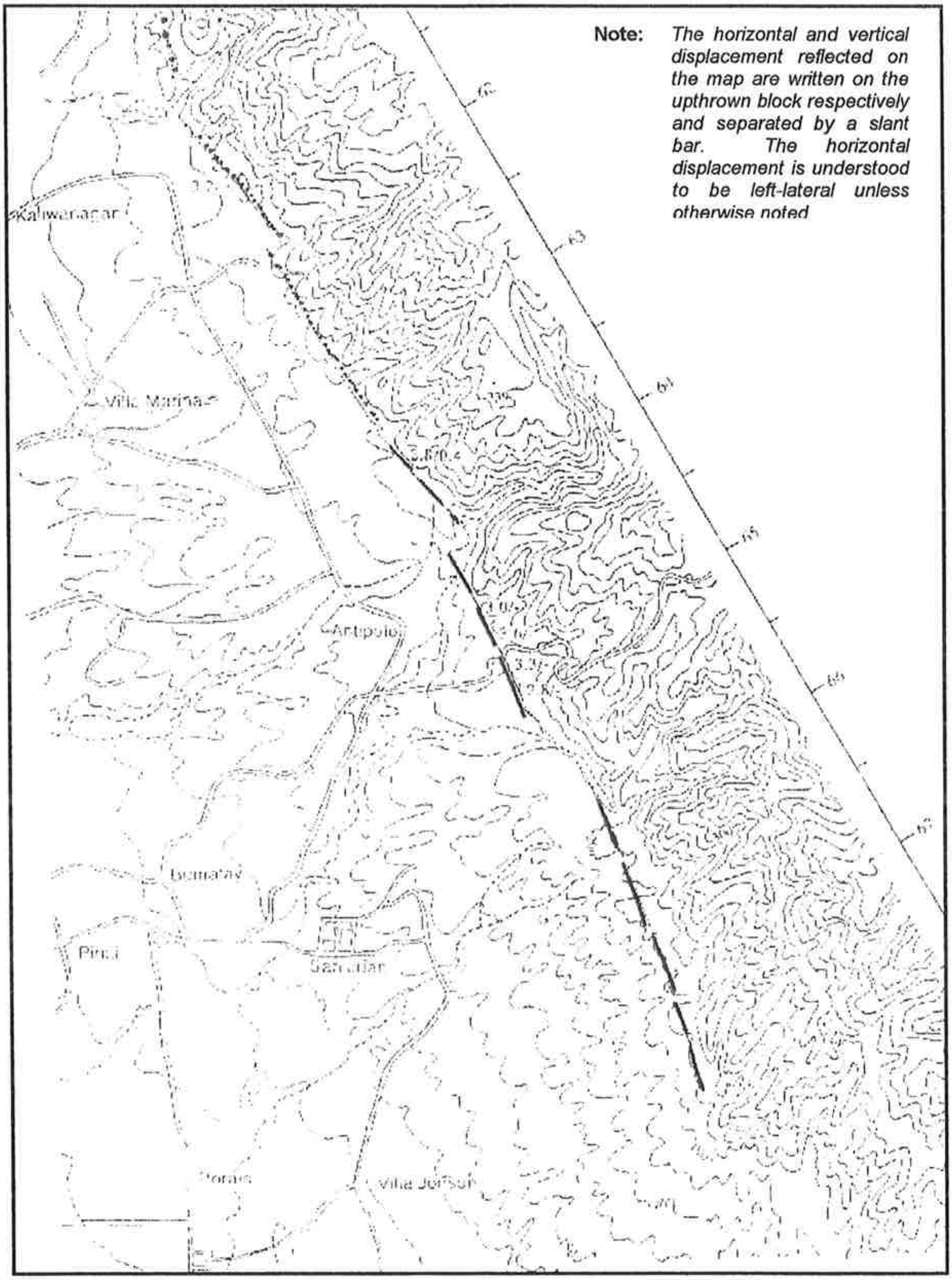


Figure 3.2-5 Trace of Ground Rapture During the 1990 Earthquake Along the Digdig Fault With Vertical and Horizontal Displacement Traversing the Southern Talavera River (4.4/1.5 = Horizontal/Vertical Displacement)

(From Nakata et al, 1996)

Ground Motion Modeling

Thenhaus et al (1994) presented statistical models to estimate the level of future ground motion that can affect the Philippines. The models are shown in **Figures 3.2-6 to 3.2-8** for an annual probability of approximately 1/500 (i.e. 10% exceedance probability in 50 years). A separate model was also presented for the East Zambales Fault and Marikina Fault shown in **Figure 3.2-9**. Primary fault lines were recognized as the earthquake sources for the models. Earthquake ground-motions that have a 90 percent probability of not being exceeded in 50 years were uniformly estimated for rock, medium soil, and soft soil site conditions. Estimates on rock range from a low of 11% g (11 %of the acceleration of gravity) to a high of 30% g. Estimates for soft soil conditions are considerably higher and range between 27% g and 80% g.

Areas with the highest area-normalized rate of earthquake activity pose the highest ground-motion hazard while those with the lowest area-normalized activity rates have the lowest ground-motion hazard. Ground motions increase as ground conditions deteriorate. Lowest ground motions are expected on rock sites whereas highest ground motions are expected on poorly consolidated soil sites.

The relationship used by Thenhaus has a standard deviation of the logarithm to the base 10 of 0.21. This imply that there is a 20% chance that the motion is at least 50% greater than the median value and an 8% chance that the motion is at least double the median. Equally, there is a 20% chance that the ground motion will be less than half the median. There is also uncertainty regarding the local site effects on ground motion.

GEOMETRIX (1995) also prepared a ground motion model for Northern Luzon based on data from the 1990 earthquake. Since no operating ground motion instruments on areas hit by the earthquake, the level of ground motion was estimated using the following methods:

i) Using published attenuation relationships based on the earthquake magnitude and distance; and

ii) By inferring it from the intensity or level of damage.

The first method showed peak acceleration have a median value of peak ground acceleration varying from a maximum of about 0.60 g in the vicinity of fault rupture reducing to about 0.10 g at 100 km from the rapture. **Table 3.2-4** gives the calculated median values at of ground acceleration on various locations in Northern Luzon during the 1990 earthquake.

Table 3.2-4	Estimated Peak Ground Accelerations During the 1990 Earthquake				
Location	Attenuation Relationship		Intensity of Damage		Best Estimate
	Distance (km)	p.g.a (g)	Intensity	p.g.a. (g)	p.g.a. (g)
Baguio	32	0.30	VIII	0.2-0.4	0.15-0.3
Agoo, Caba	55	0.19	VIII	0.2-0.4	0.2-0.3
Dagupan	63	0.17	VIII	0.2-0.4	0.15-0.25
Gerona, Pura	50	0.22	VIII	0.2-0.4	0.15-0.25
Gabaldon, Rizal	0	0.60	VII	0.1-0.2	0.1-0.2
San Jose City	6	0.55	VI	0.05-0.1	0.05-0.1
Cabanatuan City	25	0.35	VI	0.05-0.1	0.05-0.1
Adopted From GEOMETRIX 1995					

Notes:
1) *Distance is measured from the closest part of the fault rapture*
2) *Attenuation relationship gives the median value for average soil condition*
3) *Best estimate value has been largely assessed from intensity of damage to structures*

pga – Peak Ground Acceleration

The other method used in quantifying the ground motion during the 1990 earthquake at a particular location is to infer it from the amount and nature of the building damaged caused at that location using an Intensity Scale. This is an ordinal scale that characterizes the different levels of severity or intensity, by the observed effects on people, building and nature.

An earthquake will have different intensities based on factors like distance from the epicenter, path effect and local geology. The felt intensity and extent of damage increase or decrease relative to distance from the epicenter as shown in **Figure 3.2-10**. Path effect depends on the manner rupture was propagated and in the presence of any topographic barrier around the epicentral area. The local geology of an area can amplify or attenuate earthquake intensities. Areas underlain by soft sediments usually have intensities one step higher than those underlain by bedrock.

Table 3.2-5 shows a modified Rossi-Forel Intensity Scale of I-IX with intensity (Io) - magnitude (Ms) relationship (B.S. Punzalan, 1980) used in measuring magnitudes of earthquake in the Philippines.

Table 3.2-5 Rossi-Forrel Earthquake Intensity Scale and Corresponding Range in Ground Acceleration (Adopted for Application in the Philippines)

Earthquake Intensity Scale	Effects	Range in Ground Acceleration
I. HARDLY PERCEPTIBLE SHOCK	Felt only by an experienced observer under favorable conditions.	< 0.0002 g
II. EXTREMELY FEEBLE SHOCK	Felt by some people at rest or in the upper floors of tall buildings.	0.0003 g–0.0005 g
III. VERY FEEBLE SHOCK.	Felt by several persons at rest. Duration and Direction of ground vibrations may be perceptible. Dizziness or nausea may be experienced by a few	0.0006 g–0.0020 g
IV. FEEBLE SHOCK	Felt generally by people indoors; by few people outdoors. Hanging object swing slightly. Frames of houses creak.	0.0030 g–0.0040 g
V. SHOCK OF MODERATELY INTENSITY	Felt generally by everyone. Hanging objects swing freely. Tall vases and unstable objects were overturned. Light sleepers were awakened.	0.0050 g–0.0180 g
VII. STRONG SHOCK	Overturning of movable and unstable objects like bookshelves and drawers. Slight damage in well built houses. Considerable damage in old or poorly built houses and other man-made structures	0.0170 g–0.065 g
VIII. VERY STRONG SHOCK.	Many people are panic–stricken. Trees were shaken strongly. Partial to total destruction of some buildings. Changes in the flow of springs and conditions of wells (e.g. drying up of some wells). Sand and mud ejected from fissures in soft grounds. Formation of cracks in concrete dikes of fishponds. Occurrences of small landslides and rockfalls.	0.0270 g–1.104 g
IX. EXTREMELY STRONG SHOCK	Widespread panic among people in the affected area. Partial or total destruction of many buildings. Formation of ground fissures and sand boils. Subsidence of some sites, especially those on soft grounds. Occurrences of major landslides and rockfalls.	> 1.04g

Adopted from M.L.P. Bautista, PHILVOLCS, 1993

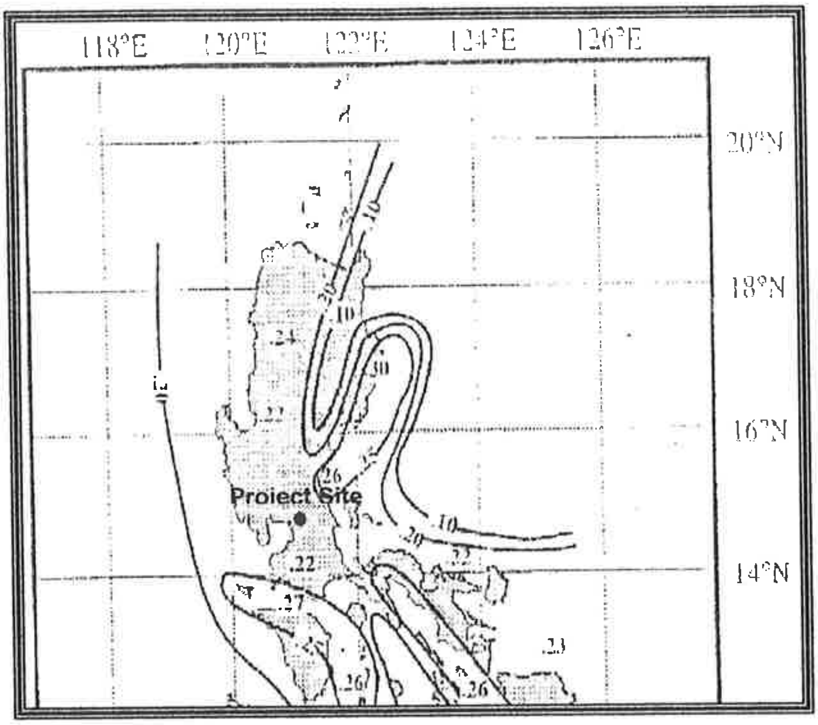


Figure 3.2-6 Map Showing Peak Horizontal Acceleration Amplitudes in Rocks for the Philippines. Acceleration values have a 10% probability of exceedance in 50 years; Contours are in terms of the acceleration of gravity (g)

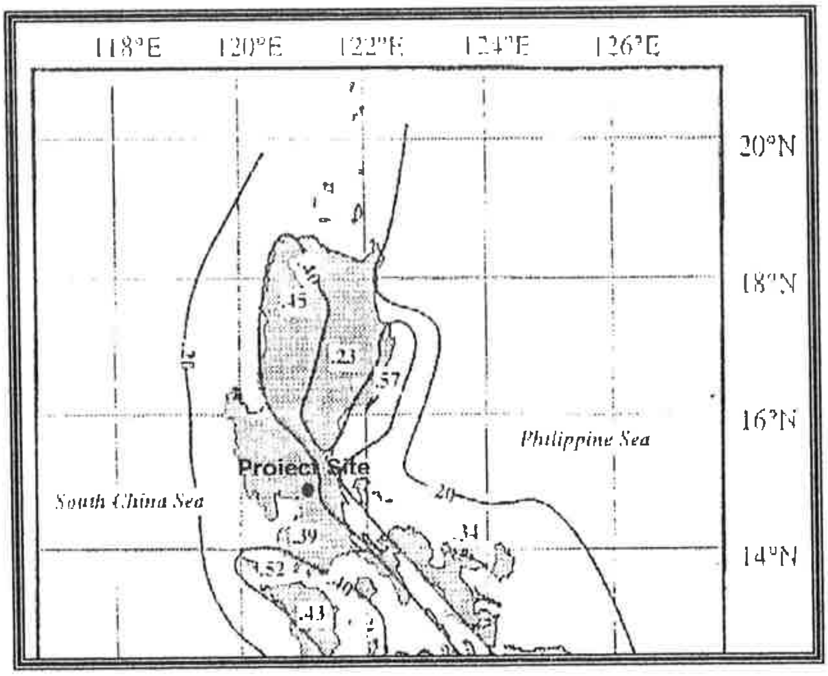


Figure 3.2-7 Map Showing Peak Horizontal Acceleration Amplitudes in Medium Soil for the Philippines. Acceleration values have a 10% probability of exceedance in 50 years; Contours are in terms of the acceleration of gravity (g)

(Both Figures were Adopted from Thenhaus, et. al. 1994)

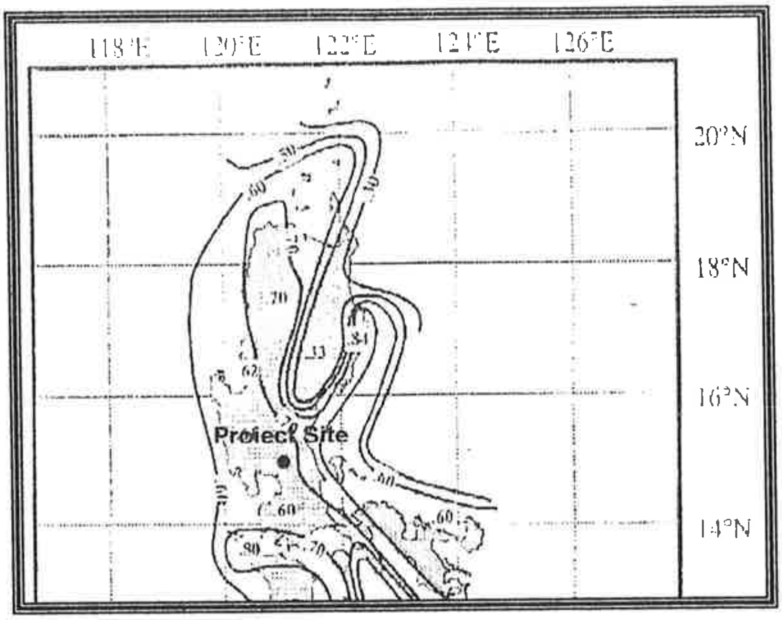


Figure 3.2-8 Map Showing Peak Horizontal Acceleration Amplitudes in Soft Soil for the Philippines. Acceleration values have a 10% probability of exceedance in 50 years; Contours are in terms of the acceleration of gravity (g)

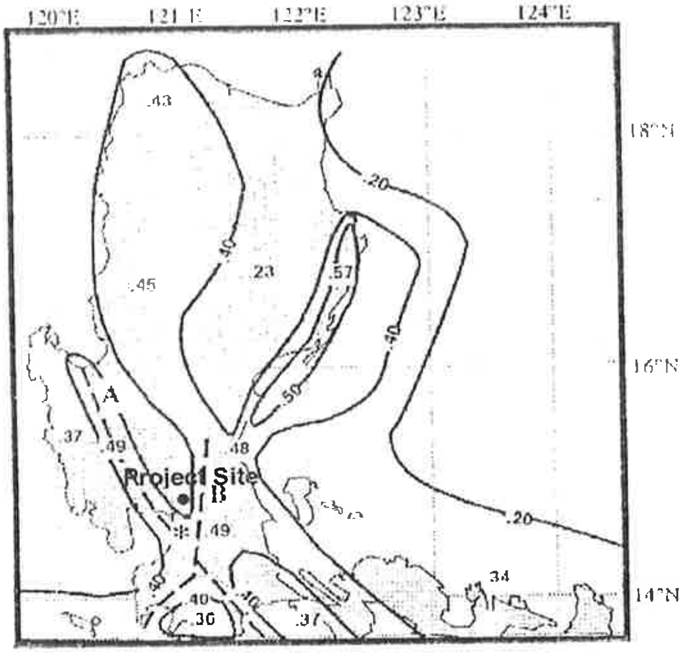


Figure 3.2-9 Map showing the effect on estimated horizontal acceleration of modeling the East Zambales Fault ("A") and the Marikina Fault ("B") with assumed slip rates of 1 cm/yr. Acceleration amplitudes are estimated for the medium site condition and have a 10% probability of exceedance in 50 years.

(Both Figures were Adopted from Thenhaus, et. al. 1994)

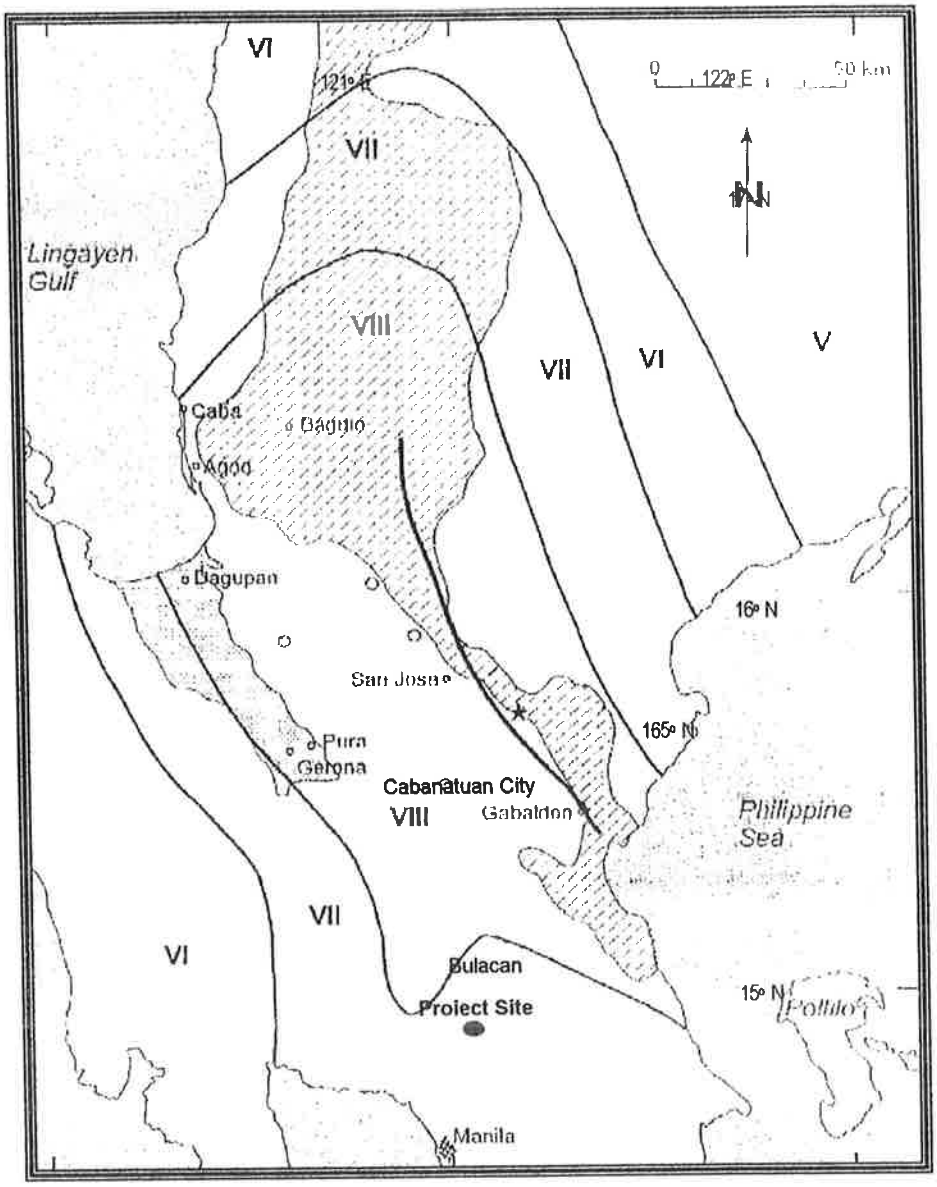


Figure 3.2-10 Map Showing the Effects of the July 16, 1990 Luzon Earthquake.

LEGEND:

STAR marks the epicenter.

ISOSEISMAL CONTOURS & ROMAN NUMERALS show the areas of equally felt earthquake intensity based on the Adopted Rossi-Forrel Intensity Scale. These are generalized intensities, locally, greater and lesser intensities were felt.

DOT STRIPPLE PATTERN shows the areas affected by liquefaction

DIAGONAL DAS PATTERN shows areas affected by landslides

SOLID LINE show location of surface rupture along Philippine and Digdig Faults.

(After Punongbayan et.al 1991)

3.2.2 Regional Geology

The geology of the area traversed by the bypass project is divided into alluvial sediments blanketing the low lands and bedrock occupying the eastern highlands of Bulacan Province. This formation and the quaternary pyroclastic underlying the alluvium at the eastern margin of Bulacan are reflected in the MGB Regional Geologic Map published in 1997 presented as **Figure 3.2-11**.

Guadalupe Formation (GuT)

The highland at the east of the Plaridel Bypass route is underlain by Guadalupe Formation. The formation is includes two (2) members, the older marine littoral conglomerate named Alat Conglomerate and the Diliman Tuff (*Gonzales, Ocampo & Espiritu, 1971*).

The Alat Conglomerate consist of poorly sorted, well-rounded pebbles, cobbles and boulders of the under laying igneous, metamorphic and sedimentary rock types cemented by a course grained calcareous sandy matrix. The interbedded sandstone is massive to poorly-bedded, fine to medium grained, loosely-cemented and friable, slightly tuffaceous and greenish grey when fresh and yellowish brown when weathered. Weathering results to earthy brown sandy soil, that is sticky when wet. The mudstone, is soft and sticky, thin to medium bedded tuffaceous and greenish-grey to olive green when fresh and light-grey, buff, or yellowish brown when weathered. Thin yellowish brown siltstone parting demarcates the bedding planes with individual thickness of layers from a few centimetre to about 40 cm.

The entire sequence of **Diliman Tuff** is almost flat lying or with a very gentle westerly dip, thin to medium bedded and regularly stratified and consist of tan or light gray fine-grained vitric tuff, welded volcanic breccia with subordinate amount of tuffaceous fine to medium grained sandstone. Dark minerals, pumiceous and scoriaceous materials are scattered in the glassy tuff matrix.

Typical exposures consist of flat-bedded glassy tuff, breccia, and tuffaceous sandstones in beds of more than one meter thick. Tightly welded medium grey volcanic breccia, fine to medium vetric tuff are also common.

Quaternary Deposits

Quaternary deposits in the alluvial plains of Bulacan are mainly alluvial and fluvial sediments derived from the highlands of the Sierra Madre Mountains. The hilly areas are covered by residual soil and slope colluvium derived from the weathering of the underlying bedrock. The study area was mapped using strips of aerial photographs taken along the proposed by-pass corridors in 1999 with a scale of 1:20,000. Aerial photo interpretations were supplemented by observations along the main channel walls and secondary data from previous studies on the sites.

The quaternary geologic units in the study area were delineated by the following:

i) Landform morphology,

ii) Relative topographic position using 1:50,000 topographic maps; and

iii) Tonal contrasts on aerial photographs,

The sequence of the deposits is based primarily on stratigraphic position, relative sequential development, and correlation with other landform features.

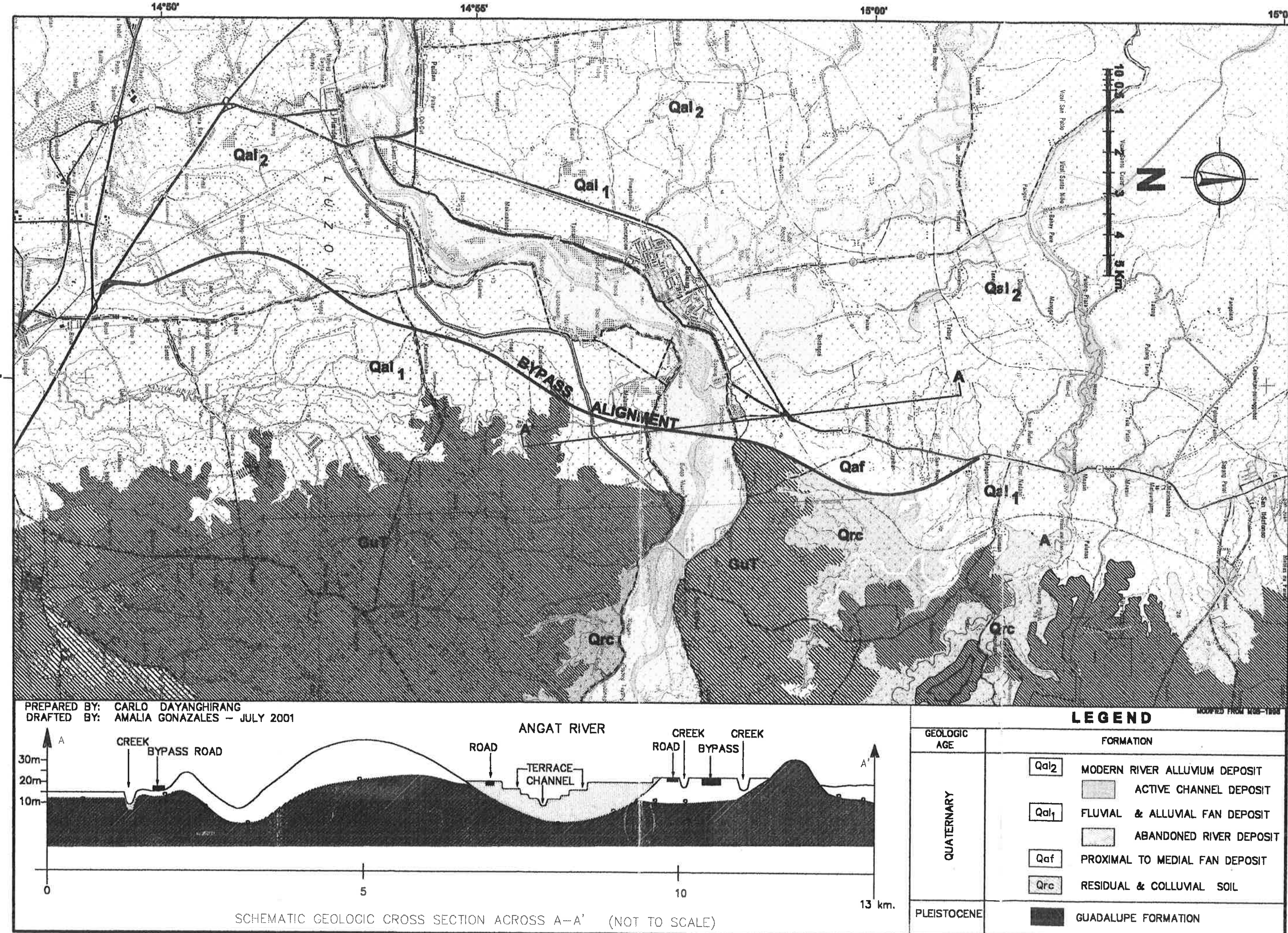


FIGURE 3.2-11 REGIONAL GEOLOGIC MAP OF PLARIDEL BYPASS

Residual and Colluvial Soils (Qrc)

Weathering and decomposition has formed a layer of residual and colluvial soil over older bedrock present in the study area. These cover the hillslopes on the northeastern and eastern foothills of Bulacan. Residual soils developed from the parent rocks are deeply weathered resulting to dark red to brownish red stiff clayey soil, with some relict features of the parent material. The texture of the residual soils varies depending on the texture of the underlying bedrock.

Proximal to Medial Alluvial Fan Deposits (Qaf)

Coalescing alluvial fan and slopewash materials deposited by the Angat River occur at the base of the bedrock hillslopes at the northeastern portion of the project area. These consist of moderately to loosely consolidated well-graded gravel arid sand, interspersed with silt and clay. The alluvial fans interfinger with fluvial deposits farther downslope.

Fluvial and Alluvial Fan Deposits (Qal_1)

These comprise of abandoned river alluvium and river terrace and distal alluvial fan deposits. The abandoned river alluvium are generally composed of loose, fining upward sequenced of gravel, coarse to medium sand with capping of brown silty, medium to fine sand and sandy silt. The distal alluvial fan sediments are composed of well graded, loose, fine to medium gravel layer with overlying coarse to fine sand with capping of clayey, silty fine sand and sandy silt.

Modern River Alluvium (Qal_2)

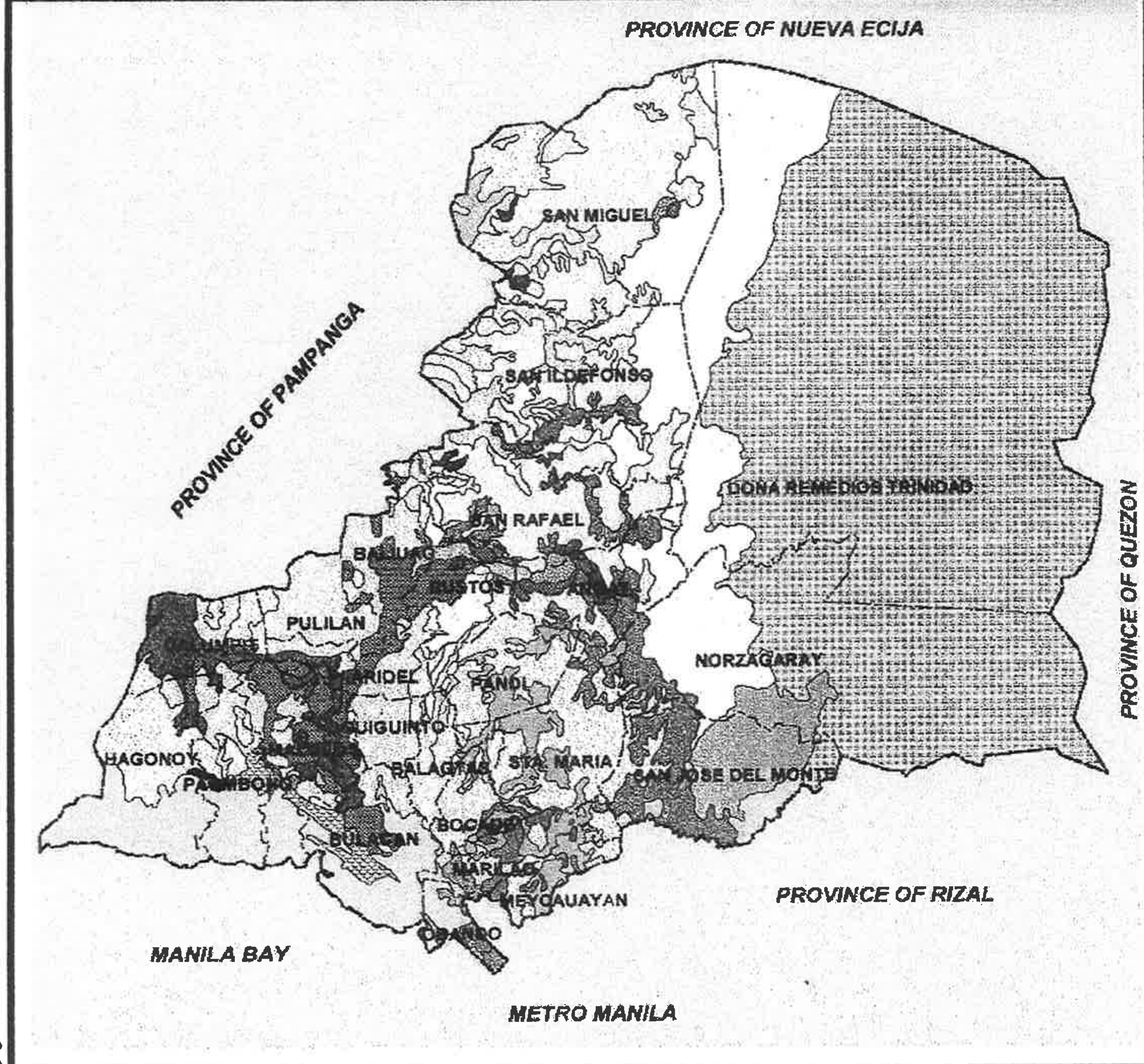
Deposits in active channels, meander belts and the flood basin are similar in character to but younger than the fluvial and alluvial fan deposits (Qal_1). They consist of loosely consolidated, well-graded sand, gravel and boulders, with some silt. These deposits formed along the flood plains of the Angat River, and on the channels of their tributary streams and creeks.

3.2.3 Pedology

Provincial

The various soil series and soil-mapping units that were initially identified by the BSWM have been classified to geomorphic types. The soils in the Province of Bulacan as illustrated in **Figure 3.2-12** are classified into five (5) major types namely: the Soils of the Coastal Landscape, which are generally coarse loamy and clayey fluvio-marine deposits found in former tidal flats. Soil units categorized under this type include the Dolongan Variant, Matimbo Series, Obando Series, and the Masantol Series. Immediately adjacent to the coastal landscape are the Soils of the Alluvial Landscape, composed of six (6) soil series in the low alluvial terraces and four (4) series in the river terraces and levees. Soils of this category represent about 18% of the Province's total land area.

The third geomorphic soil classification is found in the Piedmont Landscape with a total of seven (7) soil series. These are: 1) Mysan; 2) Pulong Buhangin; 3) Batia; 4) Awayan; 5) Prensa; 6) Mahipon; and 7) Kalayakan. Soils of this type constitute about 20% of the provincial land area. The Hilly Landscape has four (4) soil series. The Miscellaneous Soil Type on the other hand includes the loamy tidal swamp, mucky tidal swamp, mountainous lands, and streams and rivers.



PROVINCE OF BULACAN
PROVINCIAL PHYSICAL FRAMEWORK PLAN

FIGURE 3.2-12

SOIL MAP

LEGEND:
- Provincial Boundary
- Municipal Boundary
- Tidal Swamp
- Dolongan
- Matimbo
- Obando
- Masantol
- Quingua
- San Miguel
- Gapan
- Penaranda
- San Fernando
- Corgante
- Bigaa
- Bantog
- Taguiod
- Kapalangan
- Myaan
- Pulong Buhangin
- Batia
- Awayan
- Prensa
- Mahipon
- Kalayaan
- Paraiso
- Novaliches
- Kaybanban
- Sibol
- Mountains

N

10 0 10 Kilometers

SCALE 1:400,000

Prepared by
PROVINCIAL PLANNING AND DEVELOPMENT OFFICE
Malolos, Bulacan

December 1997

Source:
Department of Environment & Natural Resources - Reg. III
and
Bureau ofSoils and Water Management

3.2.4 Slope

More than 50% of Bulacan Province's terrain is classified as level to undulating, with slope less 8%. The lowland landscape is concentrated along the western, north-western, and southwestern municipalities of the province. The rolling to hilly slopes of more than 18% but less than 30% represent about 12.01% of the total. These are commonly found scattered on the eastern part of Bulacan. The slope range between 0-30% is considered the maximum limit for sustained agricultural production.

The remaining 25% of land are areas with steep to very steep slopes and are usually found in the northeastern portion of the Municipality of Doña Remedios Trinidad. These areas are by nature of no agricultural potential and are either for rehabilitation to permanent cover or preservation of its present state (Department of Agriculture, Bureau of Soils and Water Management, 1987, Soil/Land Resources Evaluation Project).

In the project area, the Municipalities of Balagtas, Guiguinto, Plaridel, Bustos, and the western portion of San Rafael, the topography is level to very gently sloping as shown in **Figure 3.2-13**.

3.4.5 Erosion

Loss of surface soil either by sheet, rills, or gullies is controlled primarily by slope, vegetative cover, and intensity and amount of rainfall. In cultivated sloping areas, the farm management practices employed by farmers also determine the extent of erosion that may take place.

The Erosion Map of Bulacan given in **Figure 3.2-14** shows that the province is influenced by varying degrees of erosion. On the eastern and central parts, slight to severe erosion (cultivated) affects the Municipalities of Norzagaray, Doña Remedios Trinidad, and San Jose Del Monte.

Since the landscape of the western side of Bulacan is level to very gently sloping, it is not even affected by erosion. However, there areas of the Angat River ion Bustos and San Rafael that are affected by severe erosion due to cultivation along the vast floodplains.

3.2.6 Hydrology

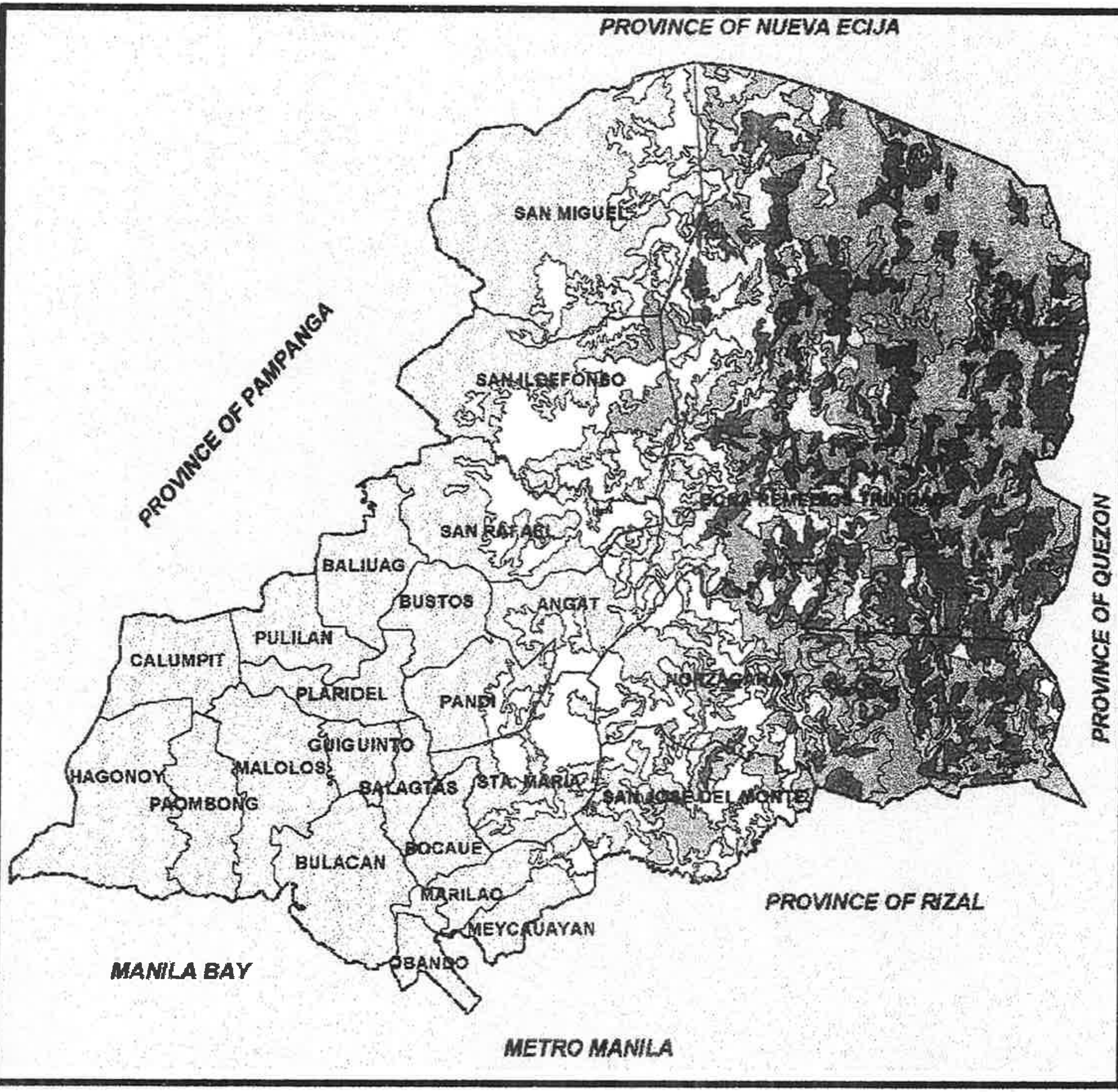
<u>River Morphology</u>

The Angat River is a meandering river system where the active channel is confined within a meander belt like the Pampanga River. The meander belt is defined by steep scarps formed in the initial development of the river through lateral erosion.

Within the pre-defined meander belt, the channel had also vertically incised through the channel floor. This formed a sequence of two terraces forming a step like features at both banks of the meander belt. A 2-meter high scarp marked the terrace edges. In addition, the terrace bordering the main channel rises about 1 meter above the main channel floor.

The meander belt is blanketed with a sequence of 1.5 meter thick loose silty medium to fine sand overlying a thick poorly consolidated gravel bed with lenses of coarse to medium sand.

Geomorphic features of the river section upstream and down stream from the proposed corridor shows a broader lateral extent of the terraces at the southern bank compared to those on the northern bank. This may indicate that the channel may have also been migrating on the northerly direction.



PROVINCE OF BULACAN

PROVINCIAL PHYSICAL FRAMEWORK PLAN

FIGURE 3.2-13

SLOPE MAP

LEGEND:

Symbol	Slope Range (%)	Description
	0 - 3	Level to Very Gently Sloping
	3 - 8	Gently Sloping to Undulating
	8 - 18	Undulating to Rolling
	18 - 30	Rolling to Hilly
	30 - 50	Steep Hills
	> 50	Very Steep Hills

Provincial Boundary
Municipal Boundary

N

10 0 10 Kilometers

SCALE 1:400,000

Prepared by
PROVINCIAL PLANNING AND DEVELOPMENT OFFICE
Malolos, Bulacan

December 1997

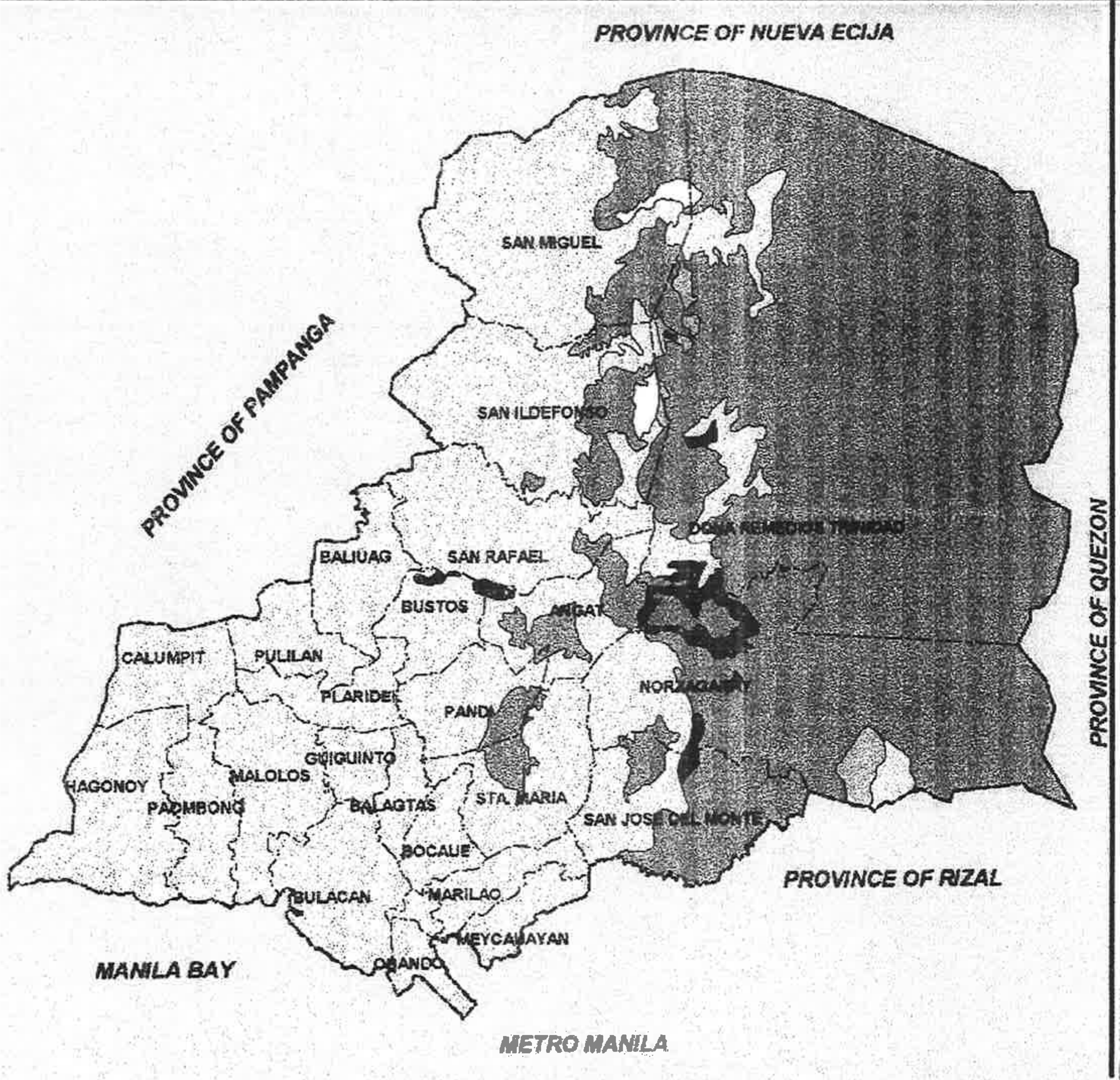
Sources:
Department of Environment & Natural Resources - Reg. III
and
Bureau of Soils & Water Management

PROVINCE OF BULACAN

PROVINCIAL PHYSICAL FRAMEWORK PLAN

FIGURE 3.2-14

EROSION MAP



LEGEND:

- Severe Erosion
- Severe Erosion (Cultivated)
- Moderate Erosion
- Slight Erosion
- No Apparent Erosion
- Unclassified Erosion
- Provincial Boundary
- Municipal Boundary

N

10 0 10 Kilometers

SCALE 1:400,000

Prepared by
PROVINCIAL PLANNING AND DEVELOPMENT OFFICE
Malolos, Bulacan

December 1997

Source:
Department of Environment & Natural Resources - Reg. III
and
Bureau of Soils & Water Management

Channel Erosion

The presence of the irrigation channel about 2 km upstream from the proposed by pass alignment had altered flow behavior of the Angat River. Erosional features are not so evident from the aerial photographs and at the site.

However, natural erosion process is replaced by active quarrying operation within the river segment from the upstream section of the irrigation dam to the proposed bypass alignment. Huge volume of loose aggregate materials present within the meander belt is extracted from pre-existing quarry site using heavy equipment such as pay loaders. At the immediate vicinity of the proposed alignment, the continuous quarry operations created huge diameter quarry ponds with depths of up to 7 meters from the riverbed. These ponds are now filled with water seeping from the main channel.

Considering that the quarrying is sanctioned by the local govern and covered by necessary permits, on land owned by the quarry operators, the quarrying operation could be expected to continue in the future. Based what could be observed at the site, the rate of extraction appears to outpace the rate in which the river could replenish the aggregate materials during flood period. At such a pace, the aggregate materials present in the immediate vicinity of the proposed bridge site will be exhausted in the near future and may even contribute to the shortening of the economic life of the structure if not taken into consideration.

Flooding

The proposed Plaridel Bypass generally passes through flat agricultural areas. Flooding survey was undertaken by the JICA Study Team along the alignment to identify areas prone to inundation. The survey was conducted through actual interview with local residents focusing on the following:

- Flood area;
- Flood depth and year occurred;
- Cause of flood; and
- Frequency of flooding

The bypass is planned to be constructed by embankment. In flooded areas, the following are considered:

- To avoid pavement to be under flood level; and
- To provide proper cross drainage facilities in order to minimize adverse impact of flood water, since the bypass acts like a dike. Change of flood area, extension of flood area, increase of flood depth, concentration of water at certain areas, etc. should be minimized

Results of the survey conducted are presented in **Figure 3.2-15**. As shown in the drawing, severe flooding recently occurred (Year 2000) at Sta. 14 (Brgy. Camachilihan and Talampas, Bustos). Flood level ranges between 0.8~2.0 m. The maximum level of flood is 1.2 m from the road surface at the existing bridge. Accordingly, this happens once every 20-30 years.

The issue on flooding also transpired during the public consultation meeting at Bgry. Camachilihan. The people expressed their apprehension that the project may worsen the current perennial flooding problem in the area since it will be constructed on embankment, which will act as a dike and contain floodwater in low-lying areas. However, the EIA Team assured them that appropriate drainage facilities would be incorporated in the design to prevent inundation.

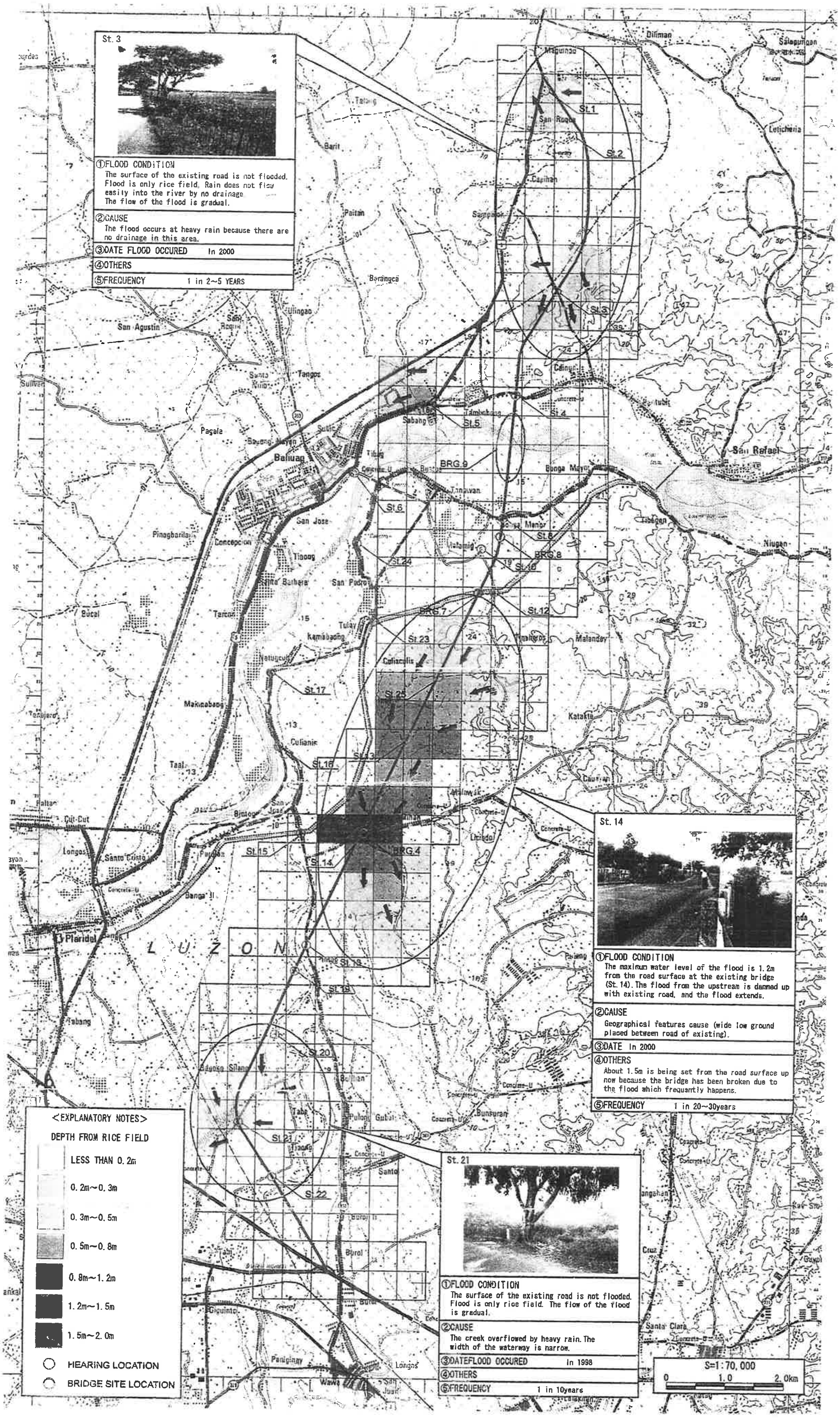


FIGURE 3.2-15
FLOOD AREA MAP (PLARIDEL BYPASS)

3.2.7 Water Quality and Limnology

The EIA Team conducted water quality sampling at the upstream and downstream portions of the rivers, creeks, and irrigation canals to be crossed by the proposed bypass to establish baseline information on the water bodies' physical properties. The sampling was carried out on 29 and 31 July 2001.

On-site measurements of the pH and temperature of the creek water were performed using a portable pH meter and a laboratory thermometer, respectively. The pH meter was calibrated before usage. The flow rate of streams was also measured.

Water samples were collected and prepared following the standard procedure of water sample handling and then stored in a **4°**-ice bin and immediately brought to SGS Philippines in Makati for laboratory analyses. The samples were assessed for the following parameters: Coliform, Total Suspended Solids (TSS), and Bacteriological Oxygen Demand (BOD).

The Sampling Sites

A total of **eight (8)** sampling sites were established along selected bodies of water crossed by the bypass alignment. (See **Figure 3.2-16**)

Sampling Sta. 1 was located at the downstream of the NIA sub-irrigation canal in Brgy. Bulihan, Plaridel, approximately 100 m south of the bypass alignment. A poultry farm is situated about 25 m east of the sampling site. Sta. 2 was established at the upstream portion of the same irrigation canal. Patches of residential houses line the eastern bank of the canal, while fishponds border the west bank.

Sampling Sta. 3 and 4 are established at the upstream and downstream portions, respectively of the NIA main irrigation canal in Brgy. Malamig, Bustos. The canal is about 30 m wide. Eutrophication is evidently shown by the abundant growth of water lilies.

Sampling Sta. 5 and 6 are established along the Angat River. Sta. 5 was located in Brgy. Bonga Menor approximately 750 m upstream of the alignment, while Sta. 6 was established 500 m downstream of the alignment in Brgy. Tanawan. Quarrying is common in area. It is evidently shown by the presence of shieves and various equipment for quarry activities. Garbage dumps are also noted.

Sampling Sta. 7 was established at the upstream portion of Maguinao Creek approximately 100 m from the bypass alignment. Sta. 8 was located at the downstream of the same creek, about 100 m west of the alignment.

Sampling Results

The DENR Standards for **Class C** and **D waters** were adopted to compare the results of the laboratory analyses and field measurements done.

Class C waters are fresh water surfaces such as rivers, creeks, lakes, reservoir, etc., which are fishery waters for the propagation and growth of other aquatic resources. Class D waters on the other hand are primarily used for agriculture, irrigation, livestock watering, etc. (DENR DAO 34, March 20, 1990).

The bacteriological content of the water samples, specifically coliform surpassed the standard limit of 5,000 MPN per 100 ml. Samples collected from Sta. 1-6 exceeded almost five times over the limit. As well water samples taken from Sta. 7 and 8 exceeded the maximum value. This is an indication that there is adequate nutrient supporting the proliferation of such bacteria. The relatively high nutrient content of the said waterways can be primarily attributed to the agricultural lands with patches of human habitation that drain into these water bodies; i.e., from fertilizers and other organic wastes (human and animal excreta). Aside from fertilizers, other possible sources of nutrients are feeds from overflows of man-made aquaculture ponds, and domestic and animal wastes that are directly disposed into these water bodies. As observed during the conduct of sampling, these creeks and rivers have varying uses, such as for bathing (for carabaos, ducks, and humans as well), duck raising, fish pond propagation, and other activities that may have contribute to the high nutrient contents of these river systems. And this was confirmed by the owner of the land adjacent to the Maguinao Creek that was informally interviewed during actual sampling.

The creek is basically used as source of water of adjacent non-irrigated rice paddies, especially during continuous precipitation periods. Accordingly, cattle, hog and poultry farms located farther upstream of the creek directly drain their wastes into the creek. The waste, which is composed of a mixture of feeds and animal manure, come in the form of a white sticky substance, as shown in **Plate 12**. The color of the water resembles very much like that of cattle manure, which is dark brown (see **Plate 11**). Moreover, the creek water becomes very sticky during summer. Overflow water of the creek with animal wastes serve as irrigation during rainy season (refer to **Plate 13**). This has been occurring for seven years since the mentioned agro-industrial farms started their operation.

Generally, the waters in the sampling sites are turbid and are brownish in color.

The sampling results presented in **Table 3.2-6** shall serve as baseline data for future comparison in the changes in the levels of the identified water pollutants and determine potential sources of such contaminants during the Pre-Construction, Construction, and Operational Phases of the project.

Plate No. 1 Water sample collection Sta. 1, downstream portion of the NIA sub-iirigation canal in Brgy. Bulihan, Plaridel, Bulacan.

Plate No. 2 EIA Team Member **Mr. Federico R. Talaña, Jr.** checking the surface temperature of the water at Sta. 2.

Plate No. 5 EIA Team members measuring the pH of the water sample taken from Sta. 3.

Plate No. 6 Sample collection at the downstream portion of the NIA main irrigation canal in Brgy. Malamig, Bustos, Bulacan.

Plate No. 9 Water sample collection at Sta. 7, upstream portion of Maguinao Crreek in Brgy. Maguinao, San Rafael, Bulacan.

Plate No. 7 Water sample collection at the upstream section of Angat River in Brgy. Bonga Menor, Bustos (Sta. 5).

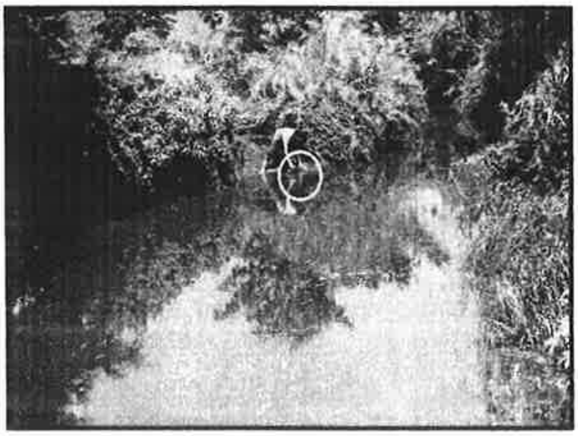


Plate No. 10 Water sample collection at Sta. 8, downstream portion of Maguinao Creek.

Plate No. 8 EIA Team Members measuring the pH of the water sample taken from Sta. 6, downstream portion of the Angat River in Brgy. Tanawan, Bustos. Sampling was performed at around 6:45 P.M.

Plate No. 11 pH measurement of the water sample from upstream portion of Sta. 8.

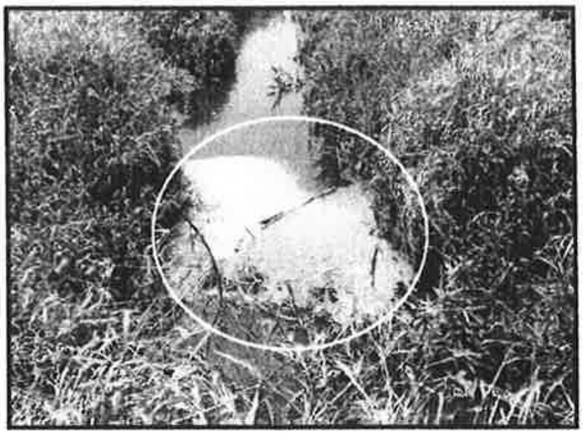


Plate No. 12 Photo taken about 3 meters upstream of Sta. 7. Note the white sticky substance on the surface. Based on interview this is a mixture of animal feeds and wastes directly drained into the creek by the agro-industrial farms located farther upstream of the said creek.

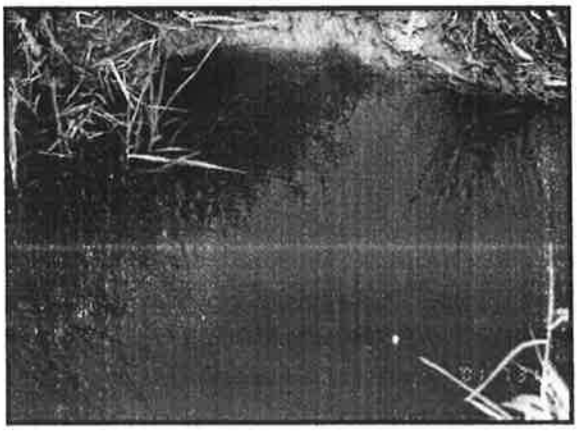


Plate No. 13 Showing the dark brown color of the water of Maguinao Creek, which resembles to the color of cattle excreta.

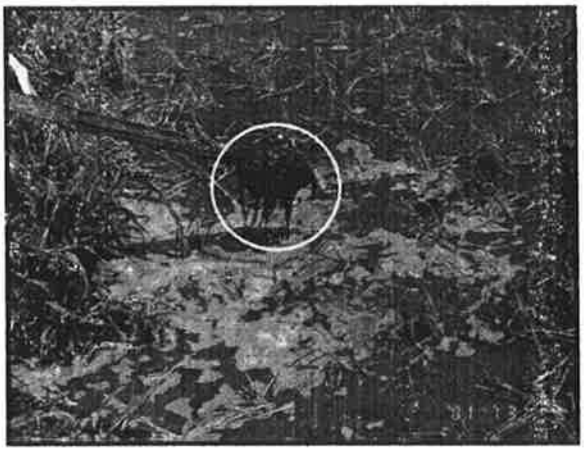


Plate No. 14 Mixture of mud and cattle manure, which, based to local account is very common during continuous precipitation periods, and the creek overflows on adjacent farmlands.

Table 3.2-6 Physical and Chemical Properties of the Waterways Crossed by the Proposed Plaridel Bypass Alignment

			PARAMETERS							
			Temp. (C°)	pH Range	Coliform		TSS	BOD	Turbidity and Color
					MPN	*Fecal Coliform*			
	DENR Standards for Class C Water		***Max. 3° increase***	***6.5-8.5***	***5,000 MPN/100 m***		***Not more than 30 mg/L Increase***	***7 mg/L (5-day 20° BOD, mg/L)***	
Sta. No.	**Location**	**Date and Time of Collection**							
1	NIA Sub-Irrigation Canal (DOWNSTREAM) Brgy. Bulihan, Plaridel, (approx. 100 m from the alignment)	29 July 2001 16:30 P.M.	24°	7.2	24,000	(+)	93.0 mg/L	2.9 mg/L	Turbid, brownish
2	NIA Sub-Irrigation Canal (UPSTREAM) Brgy. Bulihan, Plaridel, (approx. 100 m from the alignment)	29 July 2001 16:55 P.M.	23°	7.6	24,000	(+)	151 mg/L	3.0 mg/L	Turbid, brownish
3	NIA Main Irrigation Canal (UPSTREAM) Brgy. Malamig, Bustos, (approx. 150 m from the alignment)	29 July 2001 17:35 P.M.	22°	7.4	24,000	(+)	138 mg/L	2.8 mg/L	Turbid, brownish
4	NIA Main Irrigation Canal (UPSTREAM) Brgy. Malamig, Bustos, (approx. 150 m from the alignment)	29 July 2001 18: 02 P.M.	23°	7.5	24,000	(+)	126 mg/L	4.0 mg/L	Turbid, brownish
5	Angat River (UPSTREAM) Brgy. Bonga Menor, Bustos (approx. 750 m from the alignment)	29 July 2001 18:25 P.M.	28°	7.1	24,000	(+)	116 mg/L	1.7 mg/L	Turbid, brownish
6	Angat River (DOWNSTREAM) Brgy. Tanawan, Bustos (approx. 500 m from the alignment)	29 July 2001 18:45 P.M.	27°	7.3	24,000	(+)	122 mg/L	2.3 mg/L	Turbid, brownish
7	Maguinao Creek UPSTREAM) Brgy. Maguinao, San Rafael, (approx. 100 m from the alignment)	31 July 2001 10:25 A.M.	29°	7.6	230,000	(+)	59.0 mg/L	14.5 mg/L	Dark brown
8	Maguinao Creek (DOWNSTREAM) Brgy. Maguinao, San Rafael, (approx. 100 m from the alignment)	31 July 2001 11:10 A.M.	29°	7.4	230,000	(+)	60.5	30.4 mg/L	Dark brown

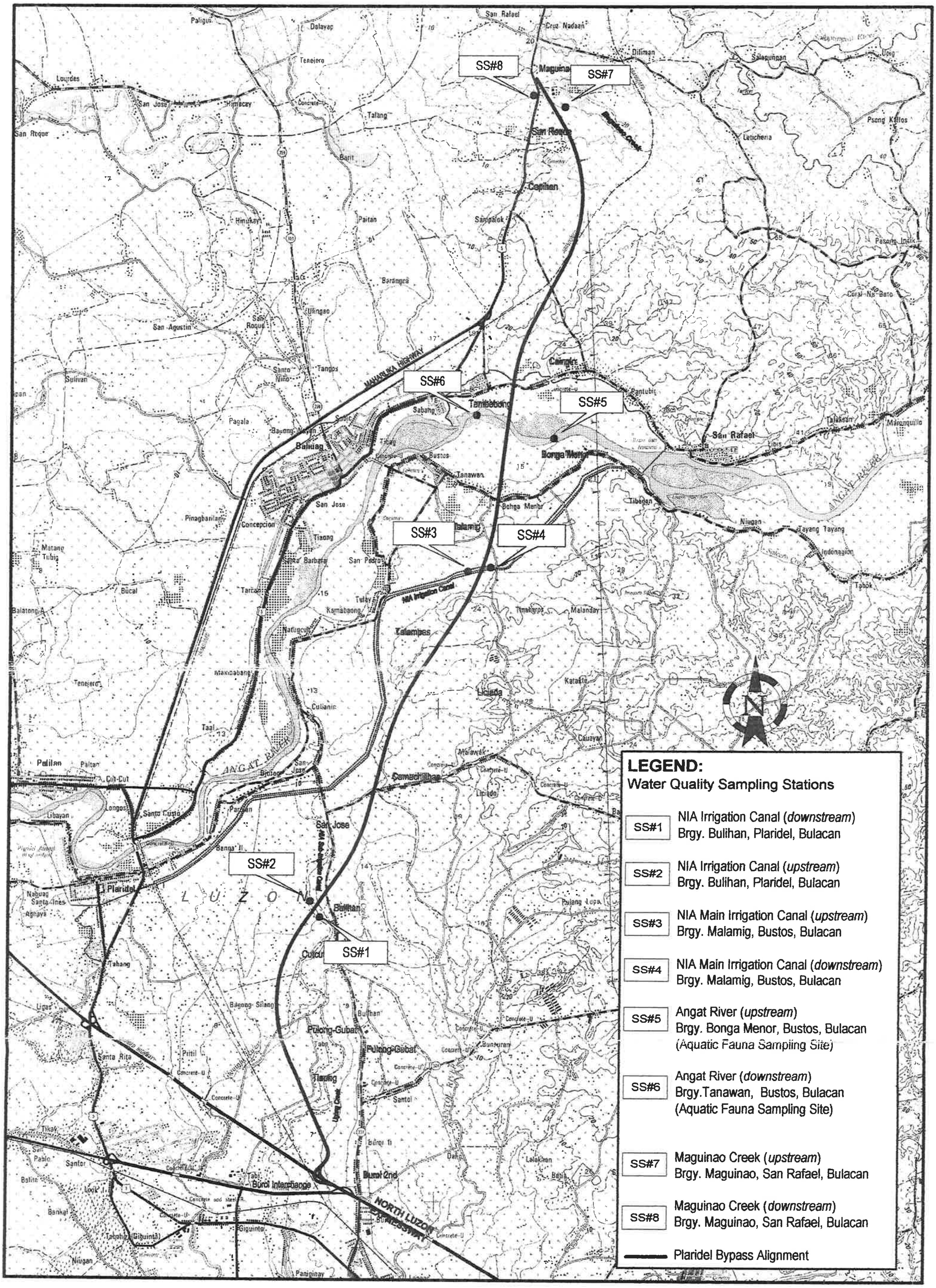


FIGURE 3.2-16
WATER QUALITY SAMPLING STATIONS
PLARIDEL BYPASS

3.2.8 Meteorology

Climate Type

The nearest synoptic meteorological station in the Province of Bulacan is located at the Science Garden in Quezon City. Based on the Modified Corona's Classification presented in **Figure 3.2-17,** the climate in the project area is categorized under Type I. Two (2) pronounced seasons characterizes this climate type, the wet and dry seasons. The area experiences a relatively dry period during the months of December to April (see **Table 3.2-7**). Wet months on the other hand are felt from May to November.

Rainfall

The project area has an annual rainfall of about **2531.8 mm**. The rainy season coincides with the Southwest Monsoon during the months of June to September. The month of August receives the maximum amount precipitation of **526.8 mm**. As well, this month has the longest number of rainy days with **24**. The dry season is experienced from December to April, with the minimum rainfall amount of **8.9 mm** in February.

Temperature

The mean monthly temperature in the Bulacan changes from a minimum of **25.4°C** in January to maximum of **29.3°C,** which is experienced in May. The annual average mean temperature is **28.0°C**. The highest mean monthly relative humidity of **84%** is felt in during the months of August and September, while the lowest is experienced in April, which is about **65%**. The warmest months are from April to June with mean values ranging from **29.3°C** to **28.2°C.**

Air Streams

The principal air streams that are significantly affecting the study area are the Northeast Monsoon, Southwest Monsoon, and the North Pacific Trades. The Northeast Monsoon predominates from October to May. The Southwest Monsoon on the other hand prevails from June to September. The North Pacific Trades is the southern portion of the North Pacific anti-clyclone. Having passed over a vast expanse of the North Pacific Ocean, this air stream is classified as a maritime tropical air mass. This air stream, which is extremely warm, is generally dominant over the entire Philippines in April and early May. It commonly arrives in the country from an easterly direction but may come from any direction from northeast to southeast.

A Wind Rose Diagram for the Province of Bulacan is presented in **Appendix G.**

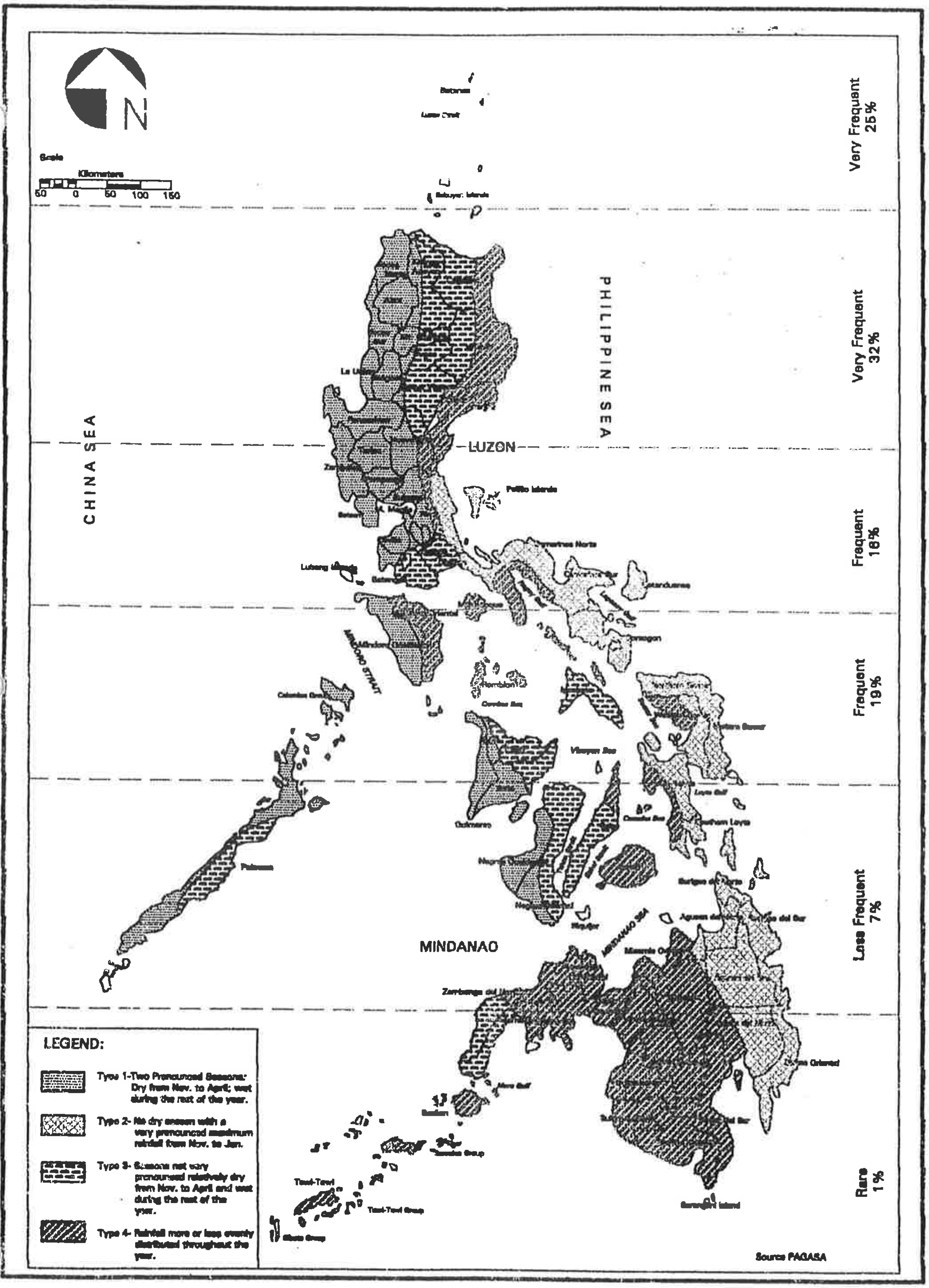


FIGURE 3.2-17
CLIMATE MAP OF THE PHILIPPINES

TABLE 3.2-7 CLIMATOLOGICAL NORMALS

STATION : 430 – SCIENCE GARDEN, QUEZON CITY
LATITUDE : 14° 39' N
LONGITUDE : 121° 03' E
ELEVATION : 43.0 m
PERIOD : 1971-2000

MONTH	RAINFALL		TEMPERATURE °C						VAPOR PRES. MBS.	REL. HUM. %	MSLP MBS.	WIND		CLOUD AMT. (okta)	NO. DAYS w/	
	AMT. (mm)	No. Of RD	MAX (°C)	MIN. (°C)	MEAN (°C)	DRY BULB (°C)	WET BULB (°C)	DEW PT. °C)				DIR (16-pts)	SPEED (mps)		THUNDR STORM	LHTNG
JAN.	19.5	4	30.4	20.4	25.4	25.2	22.0	20.7	24.2	76	1012.2	NE	1	5	0	0
FEB.	8.9	2	31.6	20.6	26.1	26.0	22.0	20.3	23.7	70	1012.1	NE	1	4	0	0
MAR.	22.9	3	33.2	21.6	27.4	27.4	22.7	20.8	24.3	67	1011.5	SE	2	4	1	1
APR.	35.1	4	34.9	23.3	29.1	29.1	23.9	21.9	26.1	65	1009.9	SE	2	4	4	4
MAY	160.4	12	34.6	24.4	29.5	29.3	25.1	23.6	29.0	71	1008.6	SE	2	5	14	13
JUNE	311.6	18	32.9	24.3	28.6	28.2	25.3	24.3	30.2	79	1008.0	SW	2	6	17	13
JULY	503.5	22	31.6	23.9	27.8	27.3	25.0	24.2	30.1	83	1007.4	SW	2	6	19	13
AUG.	526.8	24	31.1	23.9	27.5	27.1	25.0	24.3	30.2	84	1007.2	SW	2	7	17	9
SEPT	391.7	22	31.5	23.7	27.6	27.1	24.9	24.1	30.0	84	1008.2	SW	1	6	18	12
OCT.	312.0	19	31.3	23.2	27.3	26.9	24.6	23.8	29.3	83	1008.6	N	1	6	11	9
NOV.	155.5	14	31.1	22.4	26.7	26.4	23.8	22.8	27.7	80	1010.1	N	1	5	5	2
DEC.	83.9	9	30.3	21.3	25.8	25.5	22.7	21.6	25.7	79	1011.6	N	1	5	1	0
ANNUAL	**2531.8**	**153**	**32.1**	**22.8**	**27.4**	**27.1**	**23.9**	**22.7**	**27.5**	**77**	**1009.6**	**SW**	**2**	**5**	**107**	**76**

SOURCE: *CDS/CAB/PAGASA, 2001.*

3.2.9 Air Quality

In order to determine present level of the air pollutants such as Sulfur Dioxide (SO_x), Nitrogen Dioxide (NO_x) and Total Suspended Particulate (TSP), the EIA Team carried out air quality sampling along the proposed Plaridel Bypass route and its immediate vicinities.

Appendix H shows the Settlement Maps reflecting the Annual Wind Rose Diagram of Science Garden, Quezon City.

The Sampling Sites

The **three (3)** sampling sites selected are representatives of areas with the same condition such as high-density areas in terms of population and vehicular traffic, medium-density populated areas, and least busy and populated areas (**Figure 3.2-18**).

Sampling Sta. 1 along the Camachilihan-Liciada Road in Brgy. Camachilihan, Bustos. This was located about 50 m from the bypass alignment. Sparse residential houses are observed in the area. As well, the volume of traffic along this route is low.

Sampling Sta. 2 was set up along Gen. Alejo Santos Highway in Brgy. Bonga Menor also in Bustos (see **Plate 15**). The site was established about 50 m from the bypass alignment. Brgy. Bonga Menor is densely populated and the traffic volume along the highway is relatively high, since it is the major road connecting Angat and Bustos, as well as other eastern municipalities of Bulacan.

Sampling Sta. 3 was located along Francisco Viola St in Brgy. Caingin, San Rafael. It is approximately 25 m from the bypass alignment. Traffic volume is low and the area is sparsely populated. (See **Plate 16**).

Sampling Results

Ambient air quality at the sampling sites was monitored on a 1-hour basis as well as within a 24-hour average. The highest amount of suspended particulate matter based on a 1-hour observation was at recorded Sta. 2, at **1599.83 µg/Ncm**. This is more than five times the standard TSP limit (300 µg/Ncm) set the DENR. This not surprising though, because as previously discussed, the sampling site was located along a national highway with a significantly high volume of traffic. In addition, the area is densely populated, thus, the dispersion level of particulate matter is probably at the minimum. But what is more alarming is the result of the 24-hour averaging observation, which even went beyond the **Hazardous Level (600 µg/Ncm)** based on the Air Quality Indices. This must be looked into and appropriate steps must be made in order to control and lessen the present level of particulate matter in the area.

The observed levels of other air pollutants such as SOx and NOx on a 1-hour basis are well within the permissible limits. As well, the result of the 24-hour averaging time showed that the SOx level at Sta. is still in good quality.

The complete results of the sampling conducted are presented in **Table 3.2-8**. These shall serve as the foundation in assessing the probable impacts of these airborne pollutants to the receiving environment, especially to human health. Likewise the values obtained shall be the baseline in measuring the changes in the levels of these noxious gases and amount of suspended dust particulate during the Pre-Construction, Construction, and Operational Phases of the proposed bypass project.

Plate No. 15 Air quality sampling at Sta. 2.

Plate No. 16 Air quality sampling at Sta. 3.

Table 3.2-8 Observed Ambient Air Quality Along the Proposed Plaridel Bypass Alignment

Sta. No	Date & Time of Sampling	Ave. Time	Concentration in µg/Ncm					
			mpling Results			*DENR Standards*		
			SO_X	NO_X	TSP	SO_X	NO_X	TSP
1	09 June 2001 1930–2030	1 hr	7.89	13.60	208.67	***340***	***260***	***300***
2	09 June 2001 1620–1720	1 hr	34.88	40.79	1599.83	***340***	***260***	***300***
	09-10 June 2001 1745–1745	24-Hrs Ave.	25.93	15.45	620.51	***180***	***150***	***230***
3	09 June 2001 1445–1545	1 hr	7.41	12.69	187.40	***340***	***260***	***300***

Sampling Stations:

Sta. 1 Along the Camachilihan-Liciada Road in Brgy. Camachilihan, Bustos, approximately 50 from the bypass alignment

Sta. 2 Along Gen. Alejo Santos National Highway in Brgy. Bonga Menor, Bustos, approximately 50 m from the bypass alignment

Sta. 3 Along Francisco Viola St. in Brgy. Caingin, San Rafael, approximately 25 m from the bypass

3.2.10 Noise Level

Noise level monitoring was simultaneously performed with the air quality sampling at the same stations.

The results of the monitoring showed that at the time of sampling, the level of noise along the sites slightly exceeded the standard limit. The recorded noise can be attributed to the instantaneous peaks generated from the vehicles passing by area during sampling.

The values obtained presented in **Table 3.2-9** shall serve as the baseline in monitoring the changes in noise levels during the Pre-Construction, Construction, and Operational Phases of the proposed bypass project. These will also be the bases in assessing the likely effects of noise to the to the receiving environment, especially to human.

Plate No. 17 Noise level monitoring at Sta. 3

Table 3.2-9 Observed Noise Level Along the Proposed Plaridel Bypass Alignment

	Noise Levels in dB (A)		
		Evening (18-22 hrs)	**Daytime (09-18 hrs)**
DENR Standard [a]		***50***	***55***
Sampling Station	**Date & Time of Sampling**		
1	09 June 2001, 1930–2030	52-57	
2	09 June 2001, 1620–1720	–	58-69
3	09 June 2001, 1445–1545	–	48-53

NOTE: *a – DENR Standards for residential areas*

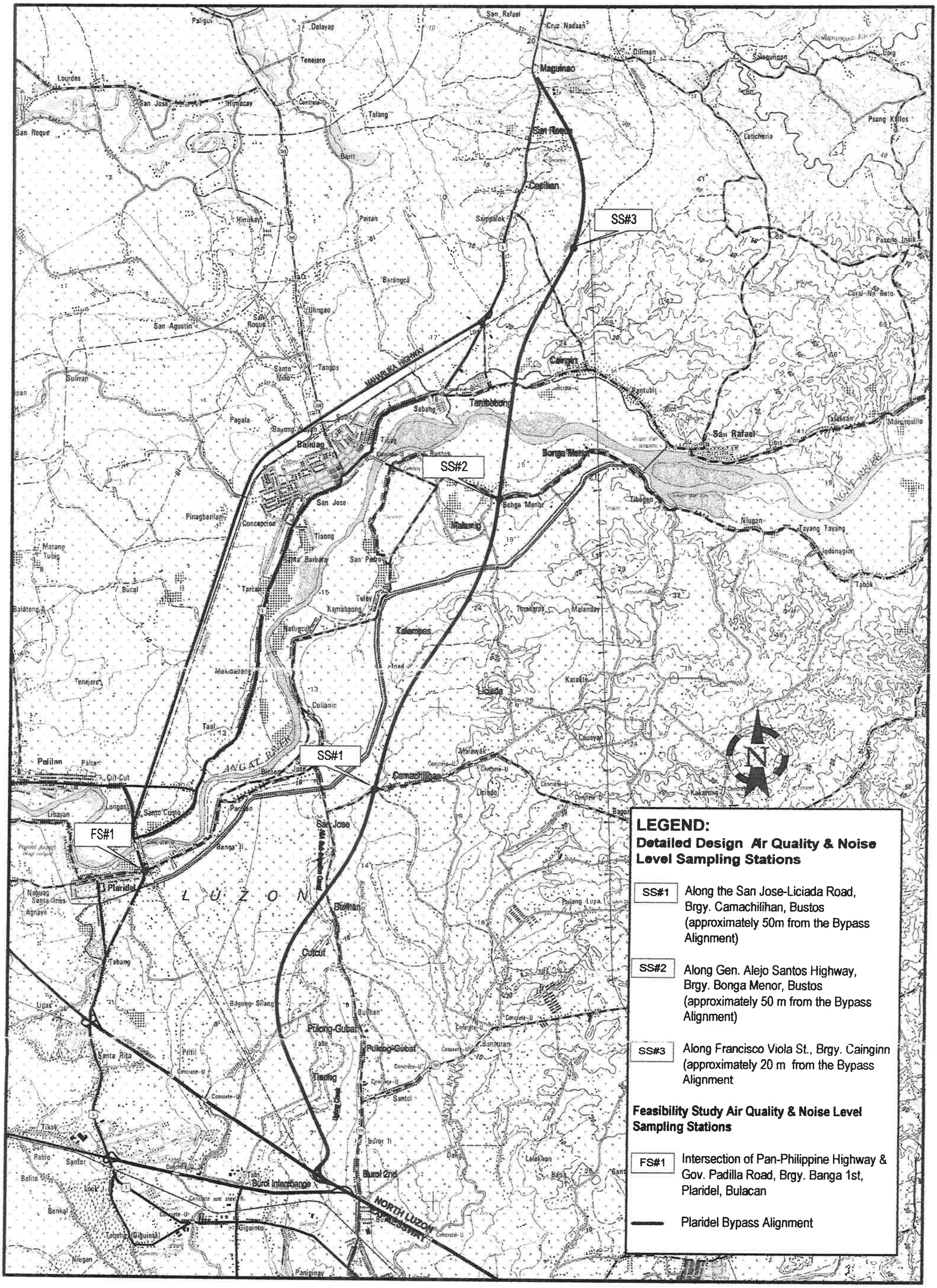


FIGURE 3.2-18
AIR QUALITY & NOISE LEVEL SAMPLING STATIONS
PLARIDEL BYPASS

3.2.11 Land Use

General Land Uses in Guiguinto

Residential Use

The residential type occupies about 402 ha or 16.28% of the Guiguinto's total land area. These are mostly converged along transport lines and national highways.

Commercial Use

Space for commercial activities represents about 49.46 ha of the total land area. Business establishments are found along the existing McArthur Highway as well as in urban areas where various commercial and service-oriented businesses such as restaurants, gifts shops, and various retail trades are located. .

Industrial Use

Industrial establishments in Guiguinto are limited to light and medium type. Presently, industrial areas constitutes 71.56 has of the total municipal land area, specifically located in Brgy. Tuktukan and Poblacion.

Institutional Use

Institutional land use covers the space allocated for government offices, schools, hospitals and health centers, sports facilities, religious structures, cemeteries and other public buildings. This type comprises approximately 1.63% of Guiguinto' total land area of 2,512 ha.

Agricultural Use

Agricultural is the predominant land use type in Guiguinto. Land devoted to agriculture is 1,948.05 ha, which are classified as irrigated, prime agricultural lands under the Comprehensive Agrarian Reform Program (CARP) and the National Integrated Protected Areas System (NIPAS) as well as based on the Agriculture and Fisheries Modernization Act (AFMA. These lands are commonly cultivated with rice and assorted vegetables.

A map showing the general land use types in Guiguinto is presented in **Figure 3.2-19**.

General Land Uses In San Rafael

The Municipality of San Rafael, Bulacan has a total land area of 26,670 hectare. This is delineated into residential uses, commercial uses, parks and open space, agricultural, industrial, open water space, road infrastructure and forest area as shown in **Figure 3.2-20**. A more detailed description on the general land use types in San Rafael is discussed in the succeeding section.

Residential

The residential area of the town is about 344.12 hectares or 1.29% of the municipality's total land area. The residential subdivisions and residential areas are scattered along transport lines. At present, there are about (12) subdivisions in the municipality. Average lot are per household is approximately 200 to 500 square meters.

Commercial

The commercial type comprised of various business activities ranging from restaurants, wholesale and retail, agro-industrial supplies, etc. are concentrated along the existing Cagayan Valley Road in Brgy. Cruz na Daan and Poblacion. San Rafael public market is also situated here. This land use type represents about 344.12 ha or 1.29% of the Municipality's totals land area.

Agricultural

This type constitutes more than 50% of San Rafael's total land area. The 15,110.62 hectares of agricultural lands are cultivated to rice, corn leafy vegetable, fruit, root crops, and other high value agricultural products. The open grasslands are also part of this land use type.

Forest

The forest area located in Brgy. Tukod near the Municipality of Doña Remedios Trinidad is close to 7,517.76 ha or 28.19% of San Rafael's total land area.

Institutional

The Municipal Hall, schools, rural health units, day care centers, public buildings, and places of worships cover an are of 30.48 ha or 0.11% of the town's land area. The public and private schools occupies the largest among these institutional buildings.

Industrial

The area devoted for industrial purposes covers about 34.25 ha or 0.13% of the total municipal land area. Silica, a very important raw material for cement production is extracted along Masim River. Gravel and sand also abound along riverbeds of Angat from Brgy. Pulo to Brgy. Tambubong. Marble, white and red clay deposits used for construction and decorative purposes are found in Brgy. Pasong Bangkal. Other industrial establishments operating within the town are rice mill, mini-cono, poultry and hog farms.

Parks and Open Space

The existing land area for parks and open space is approximately 150.00 ha. This accommodates playgrounds, parks, plaza, and cemeteries.

Open Water Space

The lakes, creeks, and rivers represent the open water space area, which is about 3,207.69 ha or 12.03% of the municipality's total land area.

Road Infrastructure

Approximately 260 ha is dedicated to this use which includes national, provincial, municipal, and barangay roads.

General Land Uses in Plaridel

Agro-Industrial Zone

The industrial complex in the Municipality of Plaridel is concentrated in the vicinity of the diversion road to Parulan-Plaridel-Pulilan.

Residential Zone

Residential zones are areas with the actual use for residential and those converted into residential subdivisions, the most popular of which is the Rocka Village. Residential areas are mostly found along existing transport lines and roadways, like in Poblacion where residential houses are owned by rich and prominent families in Plaridel.

Commercial Zone

Although the designated areas for commercial activities remain in Banga 1st and Poblacion area, other commercial zones sprout in areas fronting national highways and existing transport lines. These include the Tabang area in front of the Rocka Village along Cagayan Valley Road, the intersection going to Sta. Ines before Ramona Subdivision; and the intersection going to Poblacion where Chowking and Merced Drugstore are situated.

Agricultural Zone

Plaridel lies on a relatively flat terrain with fertile soil and fully irrigated agricultural areas. The agricultural areas, which capture the biggest share in the Municipality's land area are predominantly scattered in Brgy. Bulihan, San Jose, Culianin, Bintog, Parulan, Bagong Silang, Dampol, Sipat Lagundi, Lumang Bayan, Sto. Niño, Sta. Ines, and Rueda.

Institutional Zone

The present sites of all school, public and private are predominantly concentrated in areas owned and purchased by private owners. As a matter of policy, however, they should not be put in areas near pollutive industries, but will be established within or close to settlement areas. St. James Academy is now settled in Barangay Sta. Ines, a location suited for the school. Immaculada Conception School in Barangay Bulihan in the center of the Riceland area near the road going to Bustos junction is also another site.

Aeronautical Training School situated in Barangay Lumang Bayan and the Admiral Maritime Training Center in Barangay Sipat are some of the designated-present site of institutional operating in Plaridel. The Poblacion served now as the major institutional centers.

Figure 3.2-21 shows the general land use types in the Municipality of Plaridel.

Strategic Agricultural and Fishery Development Zone (SAFDZ)

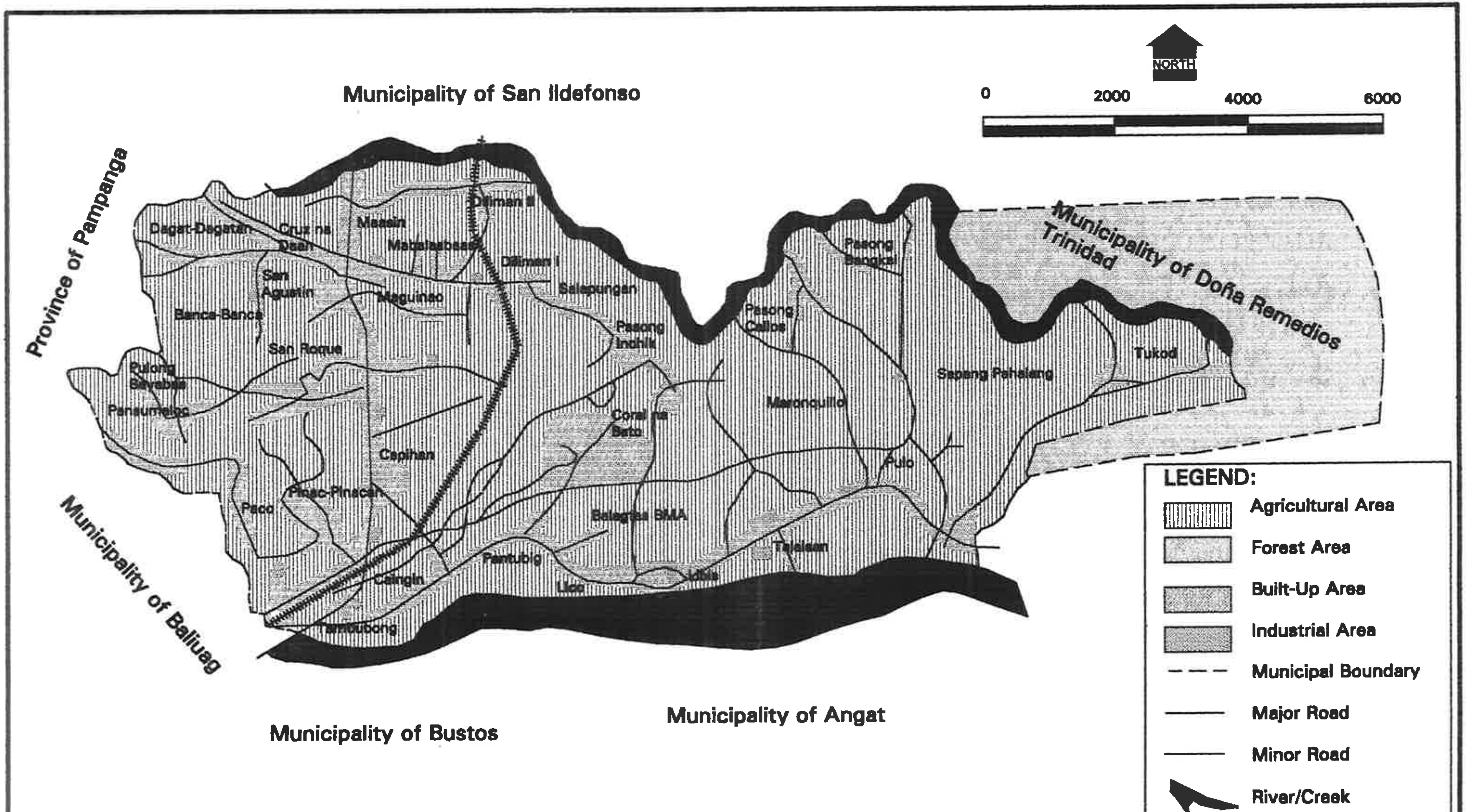
The existing SAFDZs of Bulacan Province are given in **Table 3.2-10.** Location of these areas could not be determined since there is no available map to show the said zones. Accordingly, the SAFDZ Map of Region III was submitted to the Regional Office for updating (Personal communication, Mrs. Feliciana Santiago, Cartography and Design Section, BSWM).

Table 3.2-10 SAFDZ Area Distribution in the Province of Bulacan

Category/Mapping Symbol	Area (hectare)
SAFDZ AREAS	
1 Strategic crop sub-development zone	85,304
2 Strategic livestock sub-development zone	14,034
3 Strategic fishery sub-development zone	23,319
4 Strategic crop/livestock sub-development zone	624
5 Strategic crop/fishery sub-development zone	1,641
6 Strategic crop/livestock/fishery sub-development zone	–
7 Strategic fishery and livestock sub-development zone	–
TOTAL	**124,922**
%	**42**
8 Remaining NPAAAD	**85**
%	**0**

SOURCE: *Agricultural Land Management and Evaluation Division (ALMED), BSWM, 2002*

FIGURE 3.2.19
EXISTING GENERAL LAND USE MAP
MUNICIPALITY OF GUIGUINTO



Source: Comprehensive Land Use Plan San Rafael Bulacan (MPDO)

FIGURE 3.2-20
EXISTING GENERAL LAND USE MAP
SAN RAFAEL, BULACAN

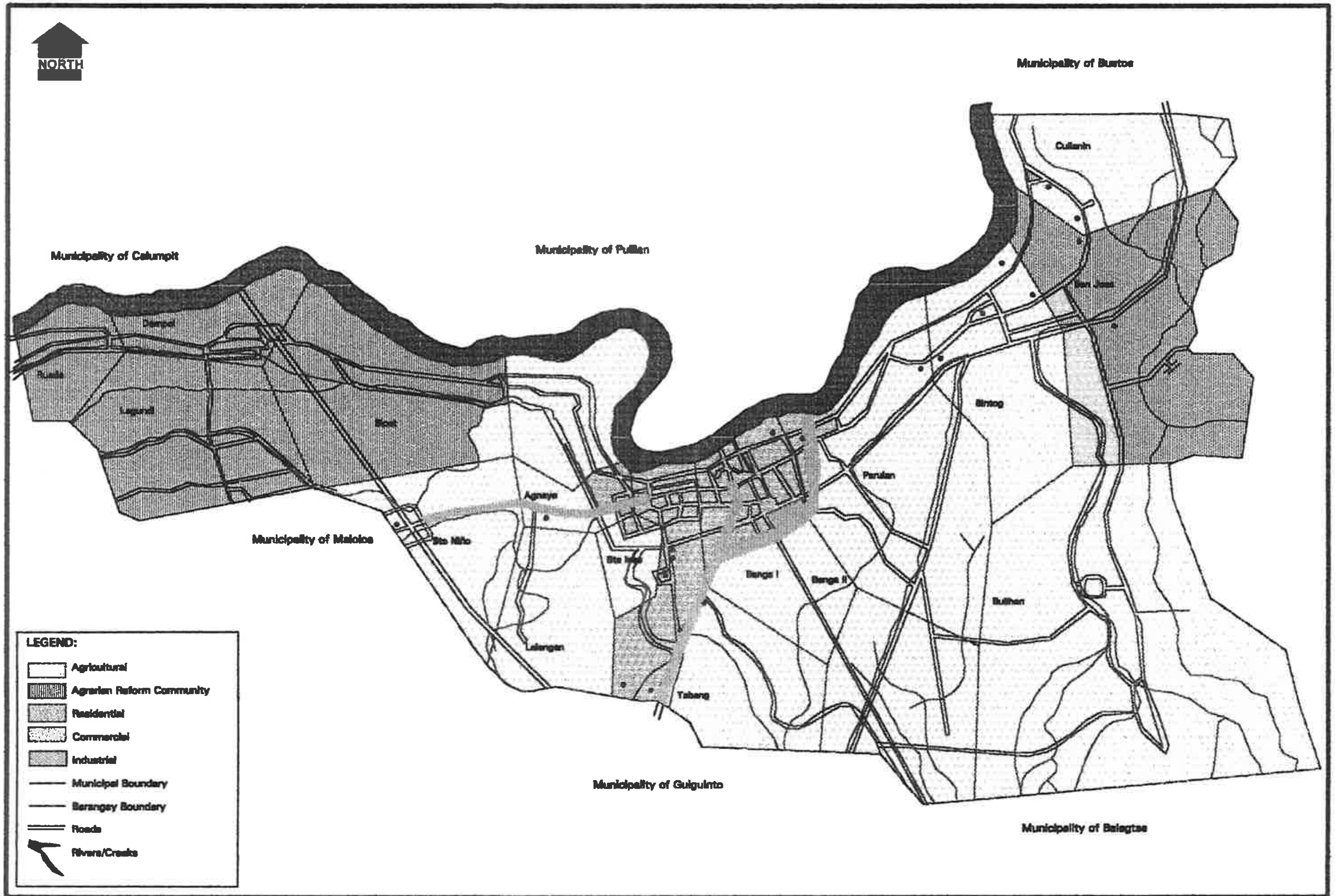


FIGURE 3.2-21
EXISTING GENERAL LAND USE MAP
MUNICIPALITY OF PLARIDEL

3.3 BIOLOGICAL ENVIRONMENT

3.3.1 Terrestrial Flora

Actual field observation and ocular survey were conducted along the bypass alignment to determine the existing vegetation cover along the route. Since the proposed project is a road network and is linear in nature, there was no line transect or quadrat method of sampling done. Besides, the extent to be affected by the project is considered minimal, given that the road ROW along agricultural and residential areas are 32 and 56, respectively.

Instead, on-site identification of the flora species encountered through gross morphology was performed. This is a type of plant identification that relies heavily on the external features of both vegetative and reproductive parts, since these are easily observable. In addition, these features have a wide range of variability and occur in great numbers. Flora guidebooks and other related materials were referred to during the conduct of the study.

The investigations conducted revealed that the flora composition along the alignment belongs to two major vegetation types namely, ***i) Natural Type*** and, ***(ii) Cultivated Type.*** The Lowland Grassland characterizes the natural type, whereas the cultivated consist primarily of Agricultural and Built-Up Types of vegetation.

The field investigation carried out revealed that the vegetation cover in the area can be categorized into **two (2)** major types; ***(i) Natural Type*** and, ***(ii) Cultivated Type.***

The natural vegetation primarily consists of the *lowland grassland associated with shrubland.* The cultivated type on the other hand is further subdivided into *Agricultural* and *Built-Up*.

The study on the flora ecosystem is focused mainly on lowland grassland and cultivated vegetation type, which includes its two major components. Detailed discussions of these vegetative patterns are presented in the succeeding sections.

Natural Vegetation Type

Lowland Grassland Associated with Shrubland

The common riceland and wasteland weeds, grass, shrubs, and herbs characterize this type of vegetation. Representative species belonging to different families such spiderwort, sedge, grass, composite, and soapberry were noted. These include *Cyanotis axillaris* (alikbangon), *Cyperus iria* (alinang), *Chromolaena odorata* (hagonoy), *Echinochloa crus-galli* (dawa-dawa), and *Cardiospermum halicacabum* (parul-parolan). Groves of *Saccharum spontaneum* (talahib) and *Imperata cylindrical* (cogon) were observed.

Sparse stands of trees were noted and are usually converged along the banks of rivers, creeks, and irrigation canals.

The recorded weed and tree species encountered in the project area are enumerated in **Tables 3.3-1 and 3.3-2,** respectively.

Table 3.3-1 List of Grass, Shrub, and Herb Species Identified Through Ocular Survey

Family	Scientific Name	Common Name	Habit
Acanthaceae	*Justicia gendarussa*	malabulak	shrub
	Ruella tuberosa	meadow weed	herb
Amaranthaceae	*Amaranthus spinosus*	kolitis	herb
Commelinaceae	*Aneilema malabaricum*	bangal	creeping herb
	Murdania nudiflora	alikbangon-lalaki	herb
Compositae	*Chromolaena odorata*	hagonoy	herb
	Bidens pilosa	nguad	berb
Cyperaceae	*Cyperus rotundus*	mutha	grass
Euphorbiaceae	*Ricinus communis*	tangan-tangan	shrub
Graminae	*Axonopus compresus*	carabao grass	grass
	Chloris barbata	korokorosan	grass
	Echinochloa crus-galli	dawa-dawa	grass
	Saccharum spontaneum	talahib	grass
	Eriochloa procera	bakwit	grass
	Imperata cylindrica	cogon	grass
	Rottbellia exaltata	aguingay	grass
	Paspalum conjugatum	"T" grass	grass
	Pennisetum polystachyon	buntot-pusa	grass
Leguminosae	*Clitorea ternatea*	pukinggan	vine
	Indigofera suffruticosa	tayum	herb
	Mimosa pudica	makahiya	herb
Malvaceae	*Urena lobata*	kulutkulutan	shrub
Poaceae	*Andropogon aciculatus*	amor seco	grass
Portulacaceae	*Portulaca oleracea*	golasiman	herb
Sapindaceae	*Cardiospermum halicacabum*	parul-parolan	vine
Verbenaceae	*Lantana camara*	coronitas	shrub
	Stachytarpheta jamaicensis	kandi-kandilaan	herb

Table 3.3-2 List of Tree Species Identified Through Ocular Survey

Family	Scientific Name	Common Name
Anacardiaceae	*Mangifera indica*	mango
	Sandoricum koetjape	santol
Annonaceae	*Annona muricata*	guyabano
	Annona squamosa	atis
	Polyalthia longifolia	Indian tree
Bignoniaceae	*Tectoma stans*	yellow bignonia
Bixaceae	*Bixa orellana*	achuete
Bombacaceae	*Ceiba pentadra*	kapok

Table 3.3-2 List of Tree Species Identified Through Ocular Survey (continued)

Family	Scientific Name	Common Name
Caricaceae	*Carica papaya*	papaya
Casuarinaceae	*Casuarinas equisetifolia*	agoho
Combretaceae	*Terminalia catappa*	talisay
Elaeocarpaceae	*Muntingia calabura*	aratiles
Euphorbiaceae	*Antidesma bunius*	bignay
	Macaranga tanarius	binunga
	Mallotus multiglandosus	alim
Graminae	*Bambusa sp.*	cauayan
	Dendrocalamus merrilianus	bayog
Lauraceae	*Persiana americana*	avocado
Leguminosae	*Acacia auriculiformis*	Japanese acacia
	Cassia fistula	Caña fistula
	Delonix regia	fire tree
	Leucaena leucocephala	ipil-ipil
	Pterocarpus indicus	smooth narra
	Pterocarpus indicus subsp. indicus	narra
	Samanea saman	acacia
	Tamarindus indica	sampalok
Lythraceae	*Lagerstroemia speciosa*	banaba
Meliacea	*Swietenia mahogany*	common mahogany
	Azidarachta indica	neem tree
	Swietenia macrophylla	mahogany
Moraceae	*Artocarpus altilis*	rimas
	Artocarpus hetrophylla	langka
	Ficus sceptica	hauili
Moringaceae	*Moringa oleifera*	malunggay
Myrtaceae	*Eucalyptus deglupta*	bagras
	Eucalyptus terecticornis	gum tree
	Psidium guajava	bayabas
	Syzygium cumini	duhat
	Syzygium samarangense	makopa

Table 3.3-2 List of Tree Species Identified Through Ocular Survey (continued)

Family	Scientific Name	Common Name
Oxalidaceae	*Averrhoa bilimbi*	kamias
Oxalidaceae	*Averrhoa carambola*	balimbing
Palmae	*Areca catechu*	bunga
	Cocos nucifera	niyog
	Corypha elata	buri
	Livistonia rotundifolia	anahaw
Rubiaceae	*Morinda bracteata*	apatot/nino
	Nauclea orientalis	bangkal
Sapotaceae	*Chrysophyllum cainito*	caimito
	Manilkara zapota	tsiko
Sterculiaceae	*Theobroma cacao*	cacao
Ulmaceae	*Trema orientalis*	anabiong
Verbenaceae	*Gmelina arborea*	gmelina/yemane

Cultivated Vegetation Type

Agricultural

Palay (*Oryza sativa*) is the primary crop grown in the project area. The secondary crops cultivated during rainy season are corn (*Zea mays*), okra (*abelmoschus esculentus*), sitaw (*Vigna sesquipedalis*), and water melon (*Citrullus vulgaris*). Tomato (*Lycopersicon lycopersicum*), ampalaya (*Momordica charantia*), talong (*Solanum melongena*), calabasa (*Cucurbita maxima*), and onions (*Allium sepa*) on the other hand are the most popular crops planted during the dry season.

High value crop such as mango (*Mangifera indica*) is also widely cultivated in the non-irrigated and tailend areas of the NIA.

Built-Up Vegetation Type

Built-up vegetation referred to here consist of ornamental plants found around settlement areas. The widely propagated among the ornamental plants observed is golden bush *(Duranta repens, c.v.)*, which is uniformly shaped in the front yards. Adding aesthetics to the area are the vibrant colors of the roses *(Rosa cvs. and hybrids)*, gumamelas *(Hibiscus rosa-sinensis cvs. and hybrids)*, Bougainvilleas *(Bougainvillea spectabilis cvs and hybrids)*. Complementing the abundantly cultured varieties of *Vanda* and *Dendrobium (Orchidaceae)* species and hybrids are the *Heliconias* (false bird's of paradise, hanging lobster claw, golden lobster claw, and parrots' flower). Other ornamental plants observed are listed in **Table 3.3-3.**

There are no endangered, rare, or endemic flora species encountered along the bypass alignment.

Table 3.3-3 List of Ornamental Plant Species Identified Through Ocular Survey

Family	Scientific Name	Common Name	Habit
Acanthaceae	*Fittonia sp., cvs.*	fittonia	herb
	Justicia brandegeana	shrimp plant	shrub
	Pseuderan-themum reticulatum	moradong dilaw	shrub
Araceae	*Cyrtosperma merkusii*	palawan	herbaceous aroid
	Dieffenbachia cvs.	dieffenbachia	herb
	Philodendron sp.	philiodendron	epiphytic climbing aroid
Balsaminaceae	*Impatiens balsamina*	kamantigue	herb
Cannaceae	*Canna indica*	Bandera Española	herb
Compositae	*Cosmos sulphureus*	cosmos	herb
Cupressaceae	*Juniperus communis*	common juniper	shrub
Euphobiaceae	*Cordiaeum varriegatum*	San Francisco	shrub
	Acalypha hispida	Chenille plant	shrub
Heliconiaceae	*Heliconia cvs and hybrids*		herb
Malvaceae	*Hibiscus rosa-sinensis*	gumamela	shrub
Nyctiginaceae	*Bougainvillea spectabilis*	bougainvillea	vine
Orchidaceae	*Dendrobium cvs. and hybrids*	dendrobium	epiphytic herb
	Vanda cvs. and hybrids	vanda	epiphytic herb
Polypodiaceae	*Neophrolepis sp.*	fern	fern
Rosaceae	*Rosa cvs. and hybrids*	rose	creeping shrub
Verbenaceae	*Duranta repens cvs.*	golden bush	shrub

3.3.2 Terrestrial Fauna

The primary environmental goal of this component is to determine the existing wildlife vertebrate species found along the route corridor of the proposed Plaridel Bypass and its immediate vicinities with special focus on endemic and threatened species. Species composition (i.e., richness and diversity), Species Effort Curve (SEC) as a measure of adequacy of sampling efforts and as a means of predicting possible trend of recorded species, species and habitat "quality" analysis and evaluation were provided and performed in this report. It should be noted that species richness and diversity should be coupled with the "quality" of recorded species to come up with a stronger analysis and evaluation of an area. Using past records and researches, it is hypothesized that the study sites including proximate areas will exhibit very close similarities in species composition. And since the study site is heavily disturbed, it is also hypothesized that most of the species that will be recorded are non-endemic and locally common; threatened species will be very limited in number if not totally absent.

Actual field survey, validation of secondary information and interviews with local residents were conducted to obtain baseline information on the wildlife present in the area. The main focus of the study was on the **four (4)** higher groups of terrestrial wildlife vertebrate species comprised of amphibians, reptiles, birds and mammals. Any known domesticated form of animal (i.e., carabao, cattle, horse, etc.) is not included except for individuals of a given species that were captured from a wild population stock (i.e., parrot, myna, pigeons, etc.) and caged as pets. It is important to consider and evaluate individuals captured from wild population stock since they can provide some information on the former species composition of an area and other nearby places together with the habitat quality that they possess. Furthermore, other members of the general context of wildlife (i.e., fishes, invertebrates, others) are also excluded.

Based on actual observations and the current Provincial Land Use Map of Bulacan as adapted from the Provincial Environment and Natural Resources Office (PENRO), 2001 and the identified "key sites" for birds from the Threatened Birds of the Philippines (Collar et al., 1999), there are no documented critical habitat areas for wildlife along the proposed bypass route. The study site in fact is already significantly disturbed, composed primarily of agricultural areas, grasslands, residential, commercial as well as industrial areas.

The most significant areas for wildlife would be the grasslands and the agricultural areas thus, sampling were performed along these zones. The map will show that the study site (light blue color) is within the alienable and disposable classification. The protected areas, military reservation (both in gray-green color) and forestland (dark green color) are all on the eastern most municipalities of Nueva Ecija (golden brown) covering the main stretch and edges of the Sierra Madre Range. They form a continuous corridor of protected areas from Rizal and Quezon all the way to Gabaldon and Laur in Nueva Ecija and Dingalan in Aurora. In the book "Threatened Birds of the Philippines" there are three (3) "key sites" identified that are relatively proximate to the study site, these are: Aurora Memorial National Park in Aurora, Candaba Marsh in Pampanga and Angat Watershed in Bulacan. However, it should be noted that these "key sites" are known to support threatened bird species and is composed of unique bird habitats (i.e., good quality forest and marsh area) that serve as the main attractant of the said group. Both important characteristics are absent in the study area.

The sampling site for the wildlife identification in the project area was selected based on the existing vegetation condition, habitat type representation, and actual location of the proposed project and its projected extent of disturbance. Since the proposed project is a bypass road and is linear in nature, it is assumed that the disturbance will primarily be a habitat transformation on the actual site because of the structure to be placed. And since the area is already heavily disturbed, it is projected that it will exhibit very minimal effects on wildlife. Sites representing other nearby critical habitats were not sampled because of the site-concentrated effect of the project.

The Study Site – *Brgy. Tambubong, San Rafael, Bulacan (16° 57' 54.50" N, 120° 55' 53.14" E)* **– Figure 3.3-1**

The study area is near the northern end of the by-pass about six (6) kilometers from the exit point at Brgy. Maguinao. Survey area is along a quarried river that is bisecting a rice field with an estimated area of 20 to 30 hectares. The site is an irrigated field but it should be noted that actual rice paddies are of some distance from the line transect route. The original direction of the river has also changed and has exhibited some form of overflowing due to the quarrying activities. Transect line established is about one-and-half to two-and-half kilometers in length following a south to northwest direction. Vegetation is primarily agricultural (i.e., rice) surrounded by other economically less important grass species. Traps, nets, and opportunistic catching and random sampling were performed mainly along the mentioned river.

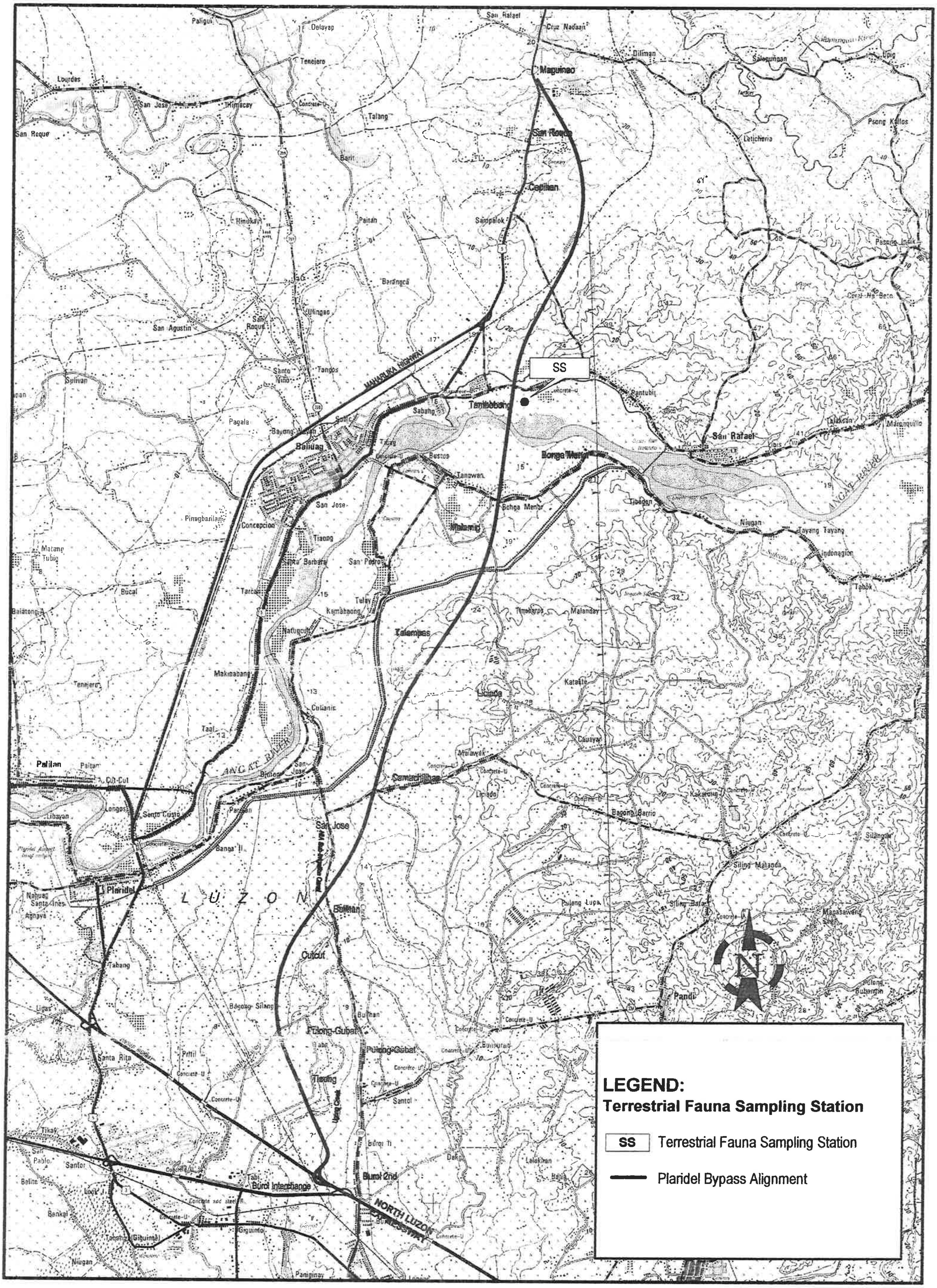


FIGURE 3.3-1
TERRESTRIAL FAUNA SAMPLING SITE
PLARIDEL BYPASS

Amphibians and Reptiles (Herpetofauna)

As can be seen in **Table 3.3-4** a total of **eleven (11)** species of amphibians and reptiles belonging to **five (5)** families was recorded from the study site. The most commonly observed among the **four (4)** amphibians noted are *Bufo marinus, Rana erythraea* and *Polypedates leucomysta.* While the **seven (7)** recorded reptiles are well represented by *Cosymbotus platyurus, Gehyra mutilata, Hemidactylus frenatus* and *Mabuya multifasciata.* All these species are known to tolerate and thus, characteristic of highly disturbed and non-forested habitats. To illustrate, 10 out of the 11-recorded species were also observed in UP Diliman and Ateneo de Manila both in Quezon City in a study conducted by Ong et al., 1998. Quezon City is a known urbanized and developed area with its original forest cover depleted even before the entry of the 1900's. The presence of species in areas like this increases the possibility of their distribution in other areas of the same geographic affinity with the same to lesser degree of disturbance.

Only **one (1)** among the recorded species was found to be endemic, the *Naja philippinensis* (Philippine cobra). The rest are native non-endemic (i.e., 6 species) and accidental introduction (i.e., 4 species). Native non-endemic species naturally occurred in a given locality but their distribution is not limited to it but instead can also be found in other countries or areas with similar habitat condition. Their distribution is sometimes referred to as cosmopolitan. Accidental introduction is the transfer of species from an area of its original distribution to another where it is not naturally occurring. Humans usually catalyze this process. In conservation and protection efforts, these two groups are usually least prioritized because of their wide distribution, strong habitat change adaptability and possible threat to original species composition through displacement. Endemic species of amphibians, on the other hand, require lightly disturbed to pristine **forest habitats with** clean and unpolluted water (Alcala and Custodio (1997). The main reason for this observation could be traced back to a Philippine setting wherein forest cover dominates the landscape (i.e., 1900's going back). Most amphibians and other groups of wildlife adapted and evolved under this scenario. Going back to the paper by Alcala and Custodio (1997), they grouped and categorized amphibian species based on distribution, residency and threat status. Using it as an index, it would come out that all the recorded amphibian species in this study except for *Rana limnocharis* are commensals of people and biogeographically insignificant. The same trend is observed and established for reptiles in terms of habitat requirements especially for endemic forms (Gonzalez, unpublished, Brown et al., 1999, Alcala et al., 1999, etc.).

There are no recorded amphibian and reptilian species that are either threatened or near threatened (RDB, 1997; Alcala and Custodio, 1997; Alcala and Brown, 1998; Alcala et al., 199) in the three study sites. Except for *N. philippinensis*, which is uncommon based on Alcala, 1986, all the recorded species are common. Actual observations and interviews from the field will support this population condition. The low record for snake species and the uncommon population status of *N. philippinensis* in the study sites could be attributed to the attitude of people towards snakes. They are usually eliminated on sight for fear of deadly bites.

The individual Species Effort Curve (SEC) for all the sites showed continuous increase in their respective graphs even after the allotted 3-day sampling period (**Figure 3.3-2**). This indicates that the number of recorded species is not yet the actual number of species distributed in that area. This observed trend supports the projected number of amphibian and reptilian species for such type of habitat within the same geographic region. For the amphibians, it is possible that another three 3 to 4 species (e.g. *Haplobatrachus rugulosus* and *Kaloula picta*) will be encountered if sampling will be continued. For reptiles, additional 6 to 10 species (e.g. *Lamprolepis smaragdina*, *Draco volans*, *Varanus salvator* and *Calotes cristatellus*) are still expected. But it should be noted that all these projected additional species are inhabitant of highly disturbed areas. It is possible that the non-observance of some species is due to spatial and/or temporal distribution to minimize competition or encounter with people.

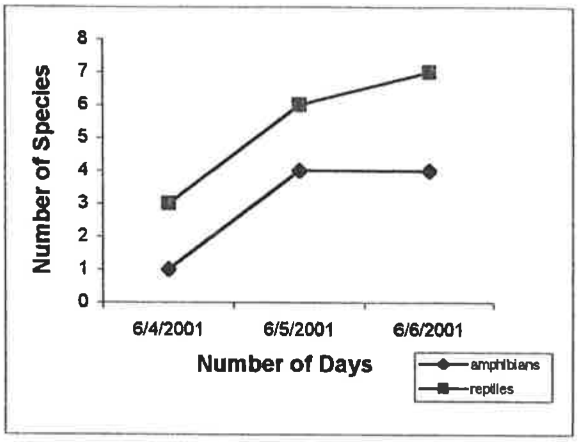


Figure 3.3-2 Number of Amphibian and Reptilian Species Recorded in the Study Site Site from June 04-06, 2001 (Based on Random Sampling and Interviews)

Table 3.3-4 Compiled Listing of Amphibian and Reptilian Species Recorded in the Study Site

Scientific Names	Common Name	Distribution Status	Population Status	Remarks
AMPHIBIANS				
Family Bufonidae				
Bufo marinus	Giant Marine Toad	Introduced	Common	visual
Family Ranidae				
Occidozyga laevis	Puddle Frog	Native non-endemic	Common	interview
Rana limnocharis	Common Pond Frog	Native non-endemic	Common	interview
Rana erythraea	Common Green Frog	Native non-endemic	Common	visual
REPTILES				
Family Gekkonidae				
Cosymbotus platyurus	Flat-bodied House Gecko	Introduced	Common	visual
Gehyra mutilata	Tender-skinned House Gecko	Introduced	Common	visual
Hemidactylus frenatus	Common House Gecko	Introduced	Common	visual
Gekko gecko	Toko Narrow-disked Gecko	Native non-endemic	Common	interview
Family Scincidae				
Mabuya multicarinata	Two-striped Mabouya	Native non-endemic	Common	visual
Mabuya multifasciata	Common Mabouya	Native non-endemic	Common	visual
Family Elapidae				
Naja philippinensis	Philippine Cobra	Luzon endemic	Uncommon	interview

Birds (Avifauna)

The bird survey recorded a total of **thirty-five (32)** species within **eighteen (18)** families, excluding **three (3)** individuals that were identified up to the genus level only (**Table 3.3-5**). Although netting was carried out, its success ratio was **zero**; all the recorded species was identified based on line transect survey. The high mobility of birds combined with their spatial distribution explains their absence or presence in a particular portion or location of a habitat in a given time. This is to minimize competition and possibly as dictated by other factors such as disturbance, threat from predators, food availability and limited population. Some species (i.e., quails and rails) are also very elusive such that although they are distributed within a portion of the habitat where sampling was conducted they are not observed and recorded.

A low number of endemic species characterizes the birds documented. *Centropus viridis*, *Orthotomus derbianus* and *Dicaeum australe* **(9.4%)** are the only endemic species noted out of the total number of individuals encountered. These species, although endemic, are expected to be present in the study site because they are adapted to grassland and agricultural types of habitat. There are also **four (4)** uncommon species included in the list namely, *Gallinago gallinago*, *Streptopelia bitorquata*, *Copsychus saularis*, *Acrocephalus stentoreus* and *Orthotomus cucullatus*.

In general, the most commonly observed group in the site was family Sylviidae. It was represented by tailorbirds, warblers, grass birds and cisticola with a total of seven (7) species and an individual, which was identified up to the genus level. Habitat preference of this family is associated with agricultural areas and extensive grasslands with sparse stands of small trees, a habitat type characteristic dominant in the area. Other families that dominate the study sites are family Estrildidae composed of **four (4)** species followed by family Columbidae with **three (3)** species. The latter family is a known inhabitant of agricultural areas, grasslands and forest edges while the former is mostly represented by forest dwelling and some open area species. It should also be noted that the diets of species from the three most represented families depend mainly on insects (insectivore), grains (graminivore) and various invertebrates (faunivore). Species that are fruit eating (i.e., frugivores) and nectar feeding (i.e., nectarivores) are very limited in number primarily because of the non-abundance of food sources in the area.

The calculated Bird Species Diversity (BSD) for the study site as shown in **Table 3.3-6** is **3.013447856**. This actual value is relatively high indicating complex composition as dictated by high species richness. But close examination of species will reveal that they are mostly common with wide range of distribution. Further, they are mostly resident breeding that are non-endemic, which can inhabit highly disturbed habitats such as grasslands, agricultural, residential, commercial, and industrial areas. In BSD interpretation, it is a prerequisite to consider that recorded species be individually checked and evaluated to determine their "quality." There are instances wherein a study site with good quality wildlife habitat (i.e., mixed forest in Peacock Area in Calauit Island) with computed BSD of 2.745 is comparable to highly disturbed areas (i.e., UP Diliman in Quezon City) with computed BSD of 3.256. This is using BSD in the two sites as an index of reference.

Looking at the SEC graph for the study area presented as **Figure 3.3-3**, it is still showing an increasing trend even after the end of the sampling. This indicates the presence of other species within the site, which are not yet recorded. This is clearly shown by the ratio of known and recorded species between the general Luzon area and the study site.

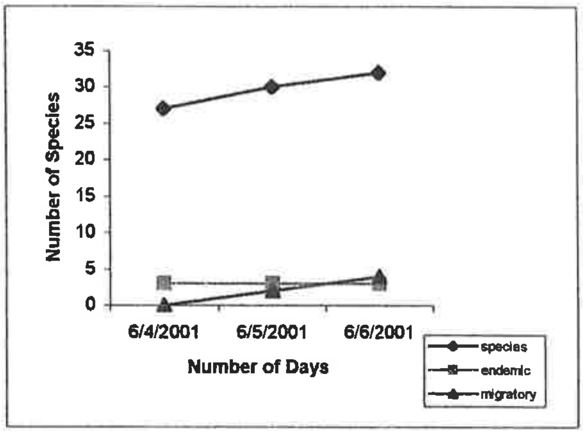


Figure 3.3-3 Number of Bird Species Recorded in the Study Site from June 04-06, 2001 (Based on Line Transect Survey)

Table 3.3-5 Compiled Bird Listing Recorded in the Study Site

Scientific name	Common Name	Distribution Status	Population Status	Remarks
Family Ardeidae				
Ixobrychus sinensis	Yellow Bittern	Resident Breeding	Common	visual/heard
I. cinnamomeus	Cinnamon Bittern	Resident Breeding	Common	visual
Family Turnicidae				
Turnix sp.	Button-quail	Resident Breeding	Uncommon	visual
Family Rallidae				
Gallirallus torquatus	Barred rail	Resident Breeding	Common	visual
Amauromis phoenicurus	White-breasted Waterhen	Resident Breeding	Fairly Common	visual
Family Scolopacidae				
Gallinago gallinago	Common Snipe	Winter Visitor	Uncommon	visual
Family Columbidae				
Streptopelia bitorquata	Island Collared-dove	Resident Breeding	Uncommon	visual/heard
S. tranquebarica	Red Turtle-dove	Resident Breeding	Fairly Common	visual/heard
Streptopelia sp.	Dove			visual
Geopelia striata	Zebra Dove	Resident Breeding	Common	visual
Family Cuculidae				
Centropus viridis	Philippine Coucal	Philippine Endemic	Common	visual/heard
C. bengalensis	Lesser Coucal	Resident Breeding	Fairly Common	visual/heard
Family Apodidae				
Collocalia esculenta	Glossy Swiftlet	Resident Breeding	Fairly Common	visual
Family Alcedinidae				
H. smyrnensis	White-throated Kingfisher	Resident Breeding	Common	visual/heard

Table 3.3-5 Compiled Bird Listing Recorded in the Study Site (continued)

Scientific name	Common Name	Distribution Status	Population Status	Remarks
Family Meropidae				
Merops viridis	Blue-throated Bee-eater	Resident Breeding	Fairly Common	visual/heard
Family Hirundinidae				
Riparia riparia	Sand Martin	Winter Visitor	Rare	visual
Family Pycnonotidae				
Pycnonotus goiavier	Yellow-vented Bulbul	Resident Breeding	Common	visual/heard
Family Sylviidae				
Megalurus palustris	Striated Grassbird	Resident Breeding	Common	visual/heard
M. timoriensis	Tawny Grassbird	Resident Breeding	Common	visual/heard
Cisticola exilis	Bright-capped Cisticola	Resident Breeding	Common	visual/heard
C. juncidis	Zitting Cisticola	Resident Breeding	Common	visual/heard
Acrocephalus stentoreus	Clamorous Reed-warbler	Resident Breeding	Uncommon	visual/heard
Orthotomus derbianus	Grey-backed Tailorbird	Philippine Endemic	Common	visual/heard
O. cucullatus	Mountain Tailor-bird	Resident Breeding	Uncommon	visual/heard
Orthotomus sp.	Tailor-bird			heard
Family Muscicapidae				
Rhipidura javanica	Pied Fantail	Resident Breeding	Common	visual/heard
Ficedula narcissina	Narcissus Flycatcher	Winter Visitor	Rare	visual
Family Motacillidae				
Anthus novaeseelandiae	Richard's Pipit	Resident Breeding	Fairly Common	visual/heard
Family Laniidae				
Lanius cristatus	Brown Shrike	Winter Visitor	Common	visual/heard
Family Nectariniidae				
Nectarinia jugularis	Olive-backed Sunbird	Resident Breeding	Common	visual/heard
Family Diceidae				
Diceum australe	Red-keeled Flowerpecker	Philippine Endemic	Common	visual/heard
Family Estrildidae				
Lonchura malacca	Chestnut Mannikin	Resident Breeding	Common	visual/heard
L. leucogastra	White-bellied Mannikin	Resident Breeding	Fairly Common	visual/heard
L. punctulata	Scaly-breasted Munia	Resident Breeding	Fairly Common	visual/heard
Passer montanus	Eurasian Tree Sparrow	Resident Breeding	Common	visual/heard

Table 3.3-6 Computed Bird Species Diversity (BSD) for the Study Site

Scientific Name	Common Name	No. of Individuals	Pi	lnPi	Pi(lnPi)
Ixobrychus sinensis	Yellow Bittern	5	0.031055901	-3.471966453	-0.107825045
I. cinnamomeus	Cinnamon Bittern	6	0.037267081	-3.289644896	-0.122595462
Turnix sp.	Button-quail	1	0.00621118	-5.081404365	-0.031561518
Gallirallus torquatus	Barred rail	2	0.01242236	-4.388257184	-0.054512512
Amaurornis phoenicurus	White-breasted Waterhen	1	0.00621118	-5.081404365	-0.031561518
Gallinago gallinago	Common Snipe	1	0.00621118	-5.081404365	-0.031561518
Streptopelia bitorquata	Island Collared-dove	4	0.02484472	-3.695110004	-0.091803975
S. tranquebarica	Red Turtle-dove	2	0.01242236	-4.388257184	-0.054512512
Streptopelia sp.	Dove	1	0.00621118	-5.081404365	-0.031561518
Geopelia striata	Zebra Dove	6	0.037267081	-3.289644896	-0.122595462
Centropus viridis	Philippine Coucal	2	0.01242236	-4.388257184	-0.054512512
C. bengalensis	Lesser Coucal	5	0.031055901	-3.471966453	-0.107825045
Collocalia esculenta	Glossy Swiftlet	5	0.031055901	-3.471966453	-0.107825045
H. smyrnensis	White-throated Kingfisher	1	0.00621118	-5.081404365	-0.031561518
Merops viridis	Blue-throated Bee-eater	4	0.02484472	-3.695110004	-0.091803975
Riparia riparia	Sand Martin	2	0.01242236	-4.388257184	-0.054512512
Pycnonotus goiavier	Yellow-vented Bulbul	12	0.074534161	-2.596497715	-0.19352778
Megalurus palustris	Striated Grassbird	6	0.037267081	-3.289644896	-0.122595462
M. timoriensis	Tawny Grassbird	4	0.02484472	-3.695110004	-0.091803975
Cisticola exilis	Bright-capped Cisticola	7	0.043478261	-3.135494216	-0.136325835
C. juncidis	Zitting Cisticola	3	0.01863354	-3.982792076	-0.074213517
Acrocephalus stentoreus	Clamorous Reed-warbler	1	0.00621118	-5.081404365	-0.031561518
Orthotomus derbianus	Grey-backed Tailorbird	1	0.00621118	-5.081404365	-0.031561518
O. cucullatus	Mountain Tailor-bird	1	0.00621118	-5.081404365	-0.031561518
Orthotomus sp.	Tailor-bird	1	0.00621118	-5.081404365	-0.031561518
Rhipidura javanica	Pied Fantail	4	0.02484472	-3.695110004	-0.091803975
Ficedula narcissina	Narcissus Flycatcher	1	0.00621118	-5.081404365	-0.031561518
Anthus novaeseelandiae	Richard's Pipit	6	0.037267081	-3.289644896	-0.122595462
Lanius cristatus	Brown Shrike	1	0.00621118	-5.081404365	-0.031561518
Nectarinia jugularis	Olive-backed Sunbird	2	0.01242236	-4.388257184	-0.054512512
Diceum australe	Red-keeled Flowerpecker	2	0.01242236	-4.388257184	-0.054512512
Lonchura malacca	Chestnut Mannikin	7	0.043478261	-3.135494216	-0.136325835
L. leucogastra	White-bellied Mannikin	8	0.049689441	-3.001962823	-0.149165855
L. punctulata	Scaly-breasted Munia	6	0.037267081	-3.289644896	-0.122595462
Passer montanus	Eurasian Tree Sparrow	40	0.248447205	-1.392524911	-0.345968922
	Total	**161**	**1**	**-141.1143209**	**-3.013447856**

Mammals

Seven (7) species of mammals was recorded in the study site based mainly on interviews, actual observations and trappings. As given in details in **Table 3.3-7**, this is composed of **three (3)** bats and **four (4)** small non-volant forms within **three (3)** families. All bats were identified through interviews and actual observations. None of the individuals were caught using mist nets. The small non-volant mammals were recorded based on capture using traps. It is difficult to assess the state of information for mammals and even for the other groups in the study site due to the lack of baseline information on the Province of Bulacan.

Captured bats are both fruit eating. Value for this group is still expected to slightly increase as common and other possible species (i.e., *Macroglossus minimus*, *Rousettus amplexicaudatus*, *Eonycteris spelaea*, etc.) in the area were not recorded. This is clearly shown by the non-leveling of the SEC graph presented as **Figure 3.3-4.** All the non-recorded species are non-endemic with wide distribution range. No insect bats were recorded during the survey. This does not mean that they do not exist in the area. There are about three to five species (*Taphozous melanopogon*, *Scotophilus kuhli*, etc.) of this group possible and most probably be present. It is assumed that insect and fruit eating bats will have a close total number after exhaustive samplings are performed. For the small non-volant mammals, all species possible in a disturbed habitat and in the study sites were recorded in this study. Even if further sampling will be performed in the area, it is projected that there will be no more increase in the recorded species.

Of the seven species recorded, *Ptenochirus jagori* is the only the endemic species noted. The rest are non-endemic (i.e. *Cynopterus brachyotis*) and accidental introduced (i.e. *Suncus murinus*, *Rattus tanezumi*, *R. norvegicus*, *R. argentiventer*, and *Mus musculus*). The high number of introduced species recorded is explained by the habitat present in the area, which is very much preferred by the said species. It is almost sure that no endemic and threatened species will be recorded in the sites. This is clearly shown by a field study conducted by Ong and de Guia (unpublished) in Limay and Mariveles, Bataan. At the low-lying areas (i.e., 0 to 500 meters above sea level) majority of the species recorded are introduced forms while at the higher elevations (i.e., 900 meters above sea level) most of the identified species are endemics. This is also supported by elevation distribution of small non-volant mammals identified by Heaney et al. 1998 in the "Synopsis of Philippine Mammals." No recorded mammals fall within any threatened or near threatened category. Furthermore, there are no species encountered categorized under rare and uncommon status.

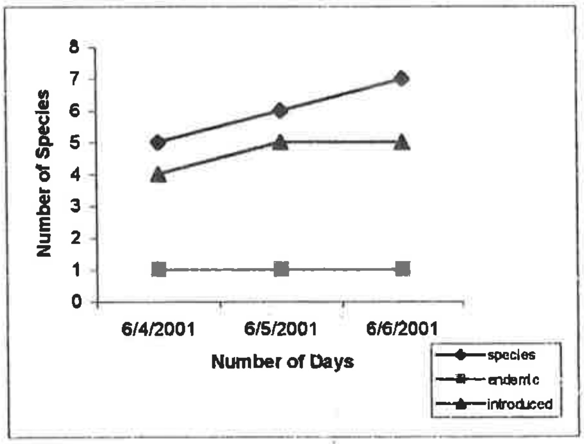


Figure 3.3-4 Number of Terrestrial Mammals (Volant and Non-Volant) Recorded in the Site from June 04-06, 2001 (Based on Interviews and Capture by Traps)

Table 3.3-7 List Of Terrestrial Mammals Recorded in the Study Site				
Scientific Name	**Common Name**	**Distribution Status**	**Population Status**	**Remarks**
VOLANT MAMMALS				
Family Pteropodidae				
Ptenochirus jagori	Musky Fruit Bat	Philippine Endemic	Population large and generally stable	interview
Cynopterus brachyotis	Common Short-nosed Fruit Bat	Native non-endemic	Abundant and geographically widespread	interview
NON-VOLANT MAMMALS				
Family Soricidae				
Suncus murinus	Asian House Shrew	Introduced	Abundant and stable	captured/interview
Family Muridae				
Rattus tanezumi	Oriental House Rat	Introduced	Abundant	captured/interview
R. norvegicus	Common Brown Rat	Introduced	Abundant in urban areas	interview
R. argentiventer	Rice-field Rat	Introduced	Abundant	interview
Mus musculus	House Mouse	Introduced	Abundant	interview

3.3.3 Aquatic Fauna

Angat River

Despite the increase awareness by governments and general public on the need for protecting all types of aquatic habitats, human impacts continue to impair the services that these ecosystems provide. Increases monitoring activities that focus on all major biological compartments are needed to quantify the present condition of the earth's aquatic resources and to evaluate the effectiveness of regulations designed to rehabilitate damaged ecosystems. Algae are an ecologically important group in most aquatic ecosystems but are often ignored as indicators of aquatic ecosystem change (McCormick, P. & J. Cairns, 1994). Zooplankton, on the other hand feed on these organisms and are also affected by the changes on the phytoplankton structure.

Because of their nutritional needs and their position at the base of aquatic food webs, algal indicators provide relatively unique information concerning ecosystem condition. Zooplankton composition, on the other hand feed on algal cells on which they depend on for survival that they rarely kill but rather consumes only a portion without having a lethal effect (Bronmark & Hanson, 1998)

Sample collection was conducted in Angat River on to identify the existing aquatic fauna in the said river system. The two (2) sites selected are those used for the water sampling (See **Figure 3.2-16**).

Plate No. 18 Zooplankton sample collection at the downstream portion of the Angat River.

Plate No. 19 Phytoplankton sample collection at the downstream portion of the Angat River.

Phytoplankton

From the samples observed, Angat River showed very diverse phytoplankton composition (**Table 3.3-8**). The average pH and temperature gathered from the said River system also showed its physicochemical characteristics. Temperature and alkalinity dictate the composition of these organisms in aquatic ecosystems. Some species of diatoms dominate in lakes and rivers with high pH (Bronmark & Hanson, 1998) while some in neutral pH (Reynolds, 1990), which is also shown in the Table (Division Chrysophyta). Angat River with relatively neutral pH value and low temperature is more conducive for the phytoplankton to thrive. Phytoplankters are producers and depend so much on light for reproduction. There are no indications of possible eutrophication in the river.

Nutrient level and composition of the aquatic ecosystem also dictate its biotic composition where in this case, the sources of these chemical characteristics are farmlands, and anthropogenic.

Table 3.3-8 Phytoplankton Observed From Angat River

Genus/Species	Angat River
Ave. pH/Temp.	7.2/27.5
Division CHLOROPHYTA	
Order Chlorococcales	
Family Characiaceae	
Schroederia sp.	+
Characium sp.	+
Family Chlorococcaceae	
Chlorococcum sp.	+
Family Coelastraceae	
Coelastrum sp.	+
Family Hydrodictyaceae	
Pediastrum simplex Meyen var.clathratum (A. Braun) Lagerheim	+
Family Micractiniaceae	
Golenkinia sp.	+
Errerela sp	+
Micractinium sp.	+
Family Oosystaceae	
Ankistrodesmus convolatus Corda	
Ankistrodesmus sp.	+
Oocystis pusilla Hansgirg	+
Oocystis sp. 1	+
Chlorella sp.	+
Trochiscia sp.	+
Closterium sp.	+
Lagerheimia sp.	+
Selenastrum sp.	+
Family Scenedesmaceae	
Scenedesmus acuminatus (Lagerheim) Chodat	+
S. quadricauda (Turpin) Brebisson	+
S. bijugatus	+
S. dimorphus	+
Scenedesmus sp.	+
Family Ulotrichaceae	
Hormidium sp.	+
Order Ulotrichales	
Family Cylindrocapsaceae	
Stigoclonium sp.	+

Table 3.3-8 Phytoplankton Observed From Angat River (continued)

Genus/Species	Angat River
Order Zygnematales	
Family Desmidiaceae	
Cosmarium sp. 1	+
Cosmarium sp. 2	+
Closterium sp.	+
Staurastrum grallatorium Nord.	+
Order Tetrasporales	
Family Palmelaceae	
Gloeocystis sp.	+
Division CHRYSOPHYTA	
Order Centrales	
Family Coscinodiscaceae	
Coscinodiscus sp.	+
Other centric diatoms	+
Order Pennales	
Family Fragilariaceae	
Fragilaria sp.	+
Synedra ulna (Nitz.) Ehr.	+
Family Naviculaceae	
Navicula sp. 1	+
Navicula sp. 2	+
Navicula sp. 3	+
Navicula sp. 4	+
Family Achnanthaceae	
Cocconeis sp.	+
Family Diatomophyceae	
Aulacoseira sp.	+
Family Cymbellaceae	
Cymbella sp.	+
Family Surirellaceae	
Surirella sp.	+
Division PYRROPHYTA	
Class Dinophyceae	
Order Peridiniales	
Family Peridiniaceae	
Peridiniopsis sp.	+

Table 3.3-8 Phytoplankton Observed From Angat River (continued)

Genus/Species	Angat River
Family Ceratiaceae	
Ceratium hirundinella (Mueller) Schrank	+
Family Gymnodiniaceae	
Gymnodinium sp.	
Division CYANOPHYTA	
Class Cyanophyceae	
Order Chroococcales	
Family Chroococcaceae	
Chroococcus dispersus (Keissler) Lemm.	+
Chroococcus sp.	+
Merismopedia sp.	
Microcystis sp.	+
Order Oscillatoriales	
Family Oscillatoriaceae	
Lynbya sp	+
Oscillatoria sp.	+
Phormidium sp.	+
Spirulina sp.	+
Family Nostocaceae	
Anabaena variabilis Kuetzing	+
Division EUGLENOPHYTA	
Order Euglenales	
Family Euglenaceae	
Phacus sp. 1	+
Phacus sp. 2	+
Phacusp. 3	+
Trachelomonas sp.	+

Plates 20 to 23 show some of the phytoplankton documented from the site.

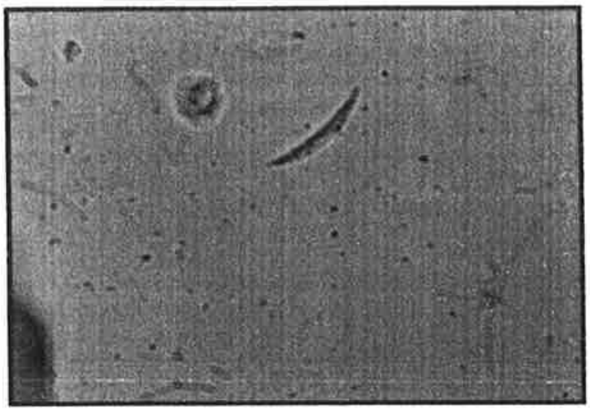


Plate No. 20 *Closterium sp.*

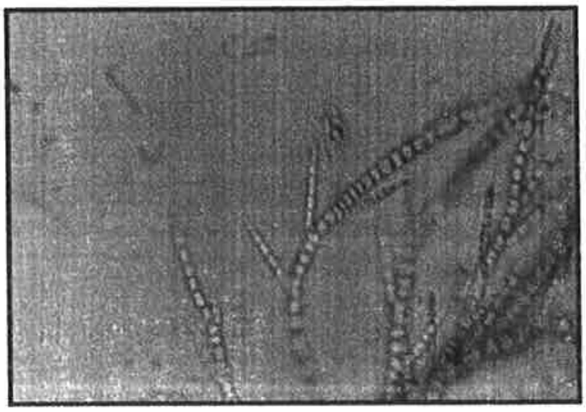


Plate No.21 *Stigoclonium sp.*

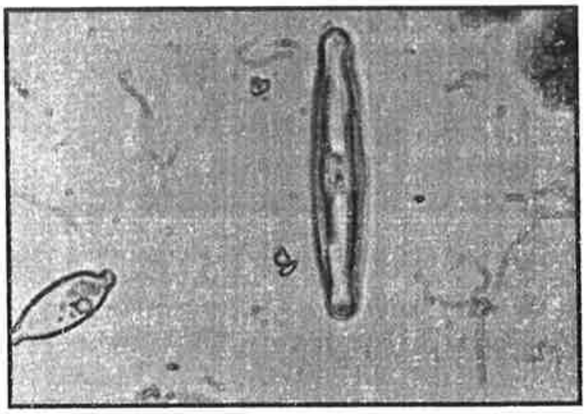


Plate No. 22 *Navicula sp. 3 & 4*

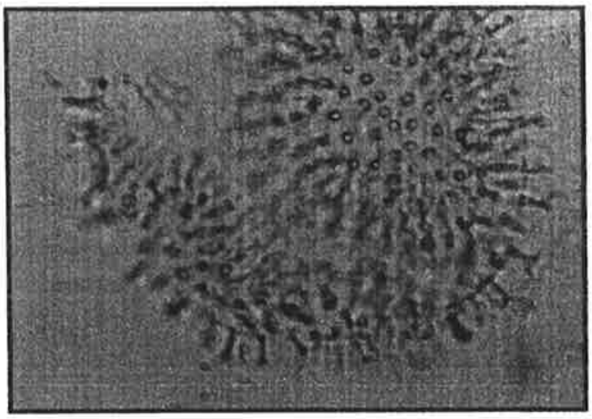


Plate No. 23 *Volvox sp.*

Zooplankton

The zooplankton community on the other hand is not that diverse as the observed phytoplankton as shown in **Table 3.3-9.** The number of individuals was also fewer as observed under the microscope.

Table 3.3-9 Zooplanktons Observed From Angat River

Genus/Species	Angat River
Ave. pH/Temp.	7.2/27.5
Brachionus sp. 1	+
Brachionus sp. 2	+
Trichocerca sp. 1	+
Trichocerca sp. 2	+
Lecane sp.	+
Lophocharis sp.	+
Rotifer	+
Unidentified	+

Plates 24 to 26 illustrates some of the zooplankton species observed in Angat River.

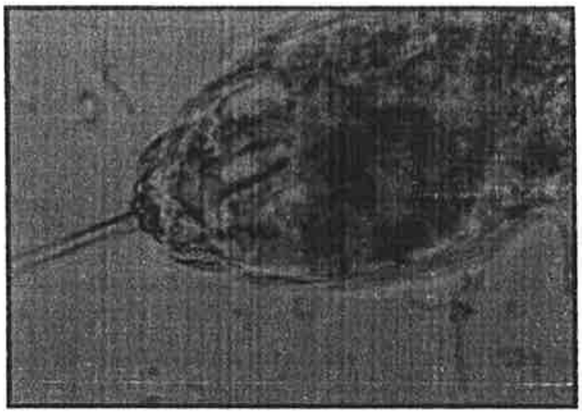


Plate No. 24 *Trichocerca sp. 1*

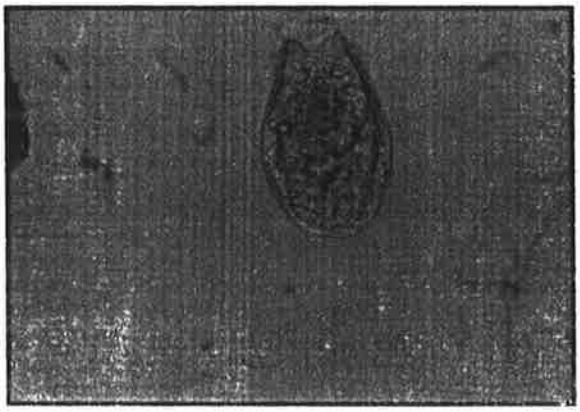


Plate No. 25 *Lophocharis sp.*

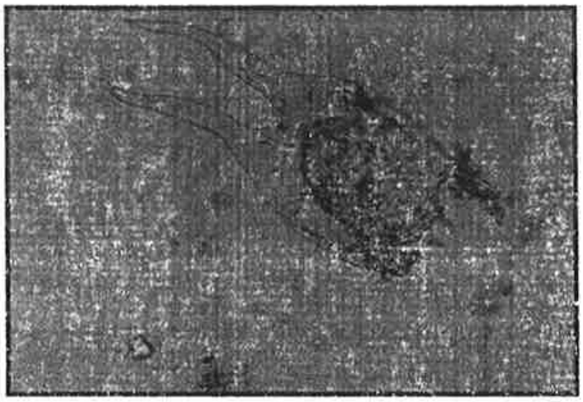


Plate No. 26 *Brachionus sp. 1*

Other organisms found in Angat River are crabs or "talangka", shrimps or "ulang", *Tilapia* sp., mudfish or "dalag", Carp, Gurami, gobby or "biya", "lokaok" and other edible fishes.

The construction of a bridge crossing the Angat River may contribute disturbance in the biotic community, creating turbid water, although this is expected to be a short-term disturbance. These organisms are resilient and can adapt to physical changes in their environment. However, changes in the chemical characteristics of the river may be deleterious to the plankton community, the macro invertebrates and larger organisms, that is the increase in the amount of nutrient input to the river systems. Possible sources of inputs are wastes, farmlands (use of pesticides), and other anthropogenic activities. Any change in the composition of the producers (phytoplankton) may also change the whole food web.

3.4 SOCIO-ECONOMIC ENVIRONMENT

This section discusses in detail the existing, as well as future socio-economic conditions of the project–affected areas. As mentioned in the Scoping Report submitted to the EMB, the proposed project is linear in nature and will not entail any large-scale levels of pollutants. Instead it would involve adverse impacts confined to specific areas, such as displacement of communities, including their means of livelihood. On the other hand, positive impacts will not only be beneficial to a confined area, such as a barangay, the Municipalities, or even the Province, but more on a regional and national scope. As such, presentation of baseline socio-economic information from the regional down to the barangay level is deemed appropriate.

3.4.1 The Central Luzon Physical Framework Plan

Central Luzon, or Region III is composed of six (6) provinces, namely Bataan, Bulacan, Nueva Ecija, Pampanga, Tarlac, and Zambales. The topography of the Region can be described as an "extremely flat area bounded by mountain ranges on the east and west sides, and an alluvial delta in the mid-lower portions. Based on its Regional Physical Framework Plan (RPFP), the Region is regarded as the *"transit line between the resource-based areas of Northern Luzon and the densely* populated *and industrialized areas of the National Capital Region (NCR).* As such, it can serve as a spill over area for population and industry from the NCR; and provide high level processing and manufacturing of goods from Northern Luzon, until these are transported to other regions, or even to other countries.

It was also mentioned in the said RPFP that the development strategy for the Region would adopt the planned implementation of the Comprehensive Conversion Program on the Alternative Uses of the Baselands as its centerpiece, with Clark (Pampanga) and Subic (Zambales) as the "hubs" of economic activities. The target would be to maximize the development of municipalities, not only in areas around the baselands, but also in the entire Region, and if possible, up to the rest of Northern Luzon. The ultimate goal is to for the people of Central Luzon to have an improved quality of life by encouraging them to actively participate in the whole development process.

The RPFP also presented the Region's specific objectives in order to realize the above-mentioned goals. Some of the pertinent concerns include: (i) to provide more investment and livelihood opportunities thus increasing income levels of the populace; (ii) to substantially increase and make available adequate quality social services particularly to the marginalized segment of the population, and (iii) to provide adequate infrastructure facilities and utilities supportive of all the thrusts and priorities being adopted, among others.

Region III has a total land area of **1,832,082** hectares. Out of this total land area, **42%**, or **771,174** hectares are classified as forestlands, whereas **58%**, or **1,051,908** hectares are Alienable and Disposable (A & D). In terms of land use, **35%** of the entire region is dedicated to cultivated croplands, which cover around **621,754** hectares. Out of these, about **512,059** hectares or **82%** are utilized for rice production. The Region produces an average of **3.3** metric tons per hectare per year, higher than the national average production of **2.7** metric tons per hectare per year. To ensure self-sufficiency of the Region and food security of the nation as well, the Department of Agriculture instituted several policies, including Administrative Orders and Memorandum Circulars designating certain prime agricultural lands as nonnegotiable for conversion to non-agricultural uses.

In the same framework plan, it was cited that in terms of settlements, the province of **Bulacan** has the **largest urbanized area** with **24,021** hectares. The main reason for this is its proximity to Metro Manila. As an absorber of spillover population from work places in Metro Manila and the rest of the National Capital Region, prime agricultural lands have been sacrificed in favor of housing projects to accommodate these settlers. As such, the Province has been facing a continuous threat on its prime agricultural lands; a problem that the Provincial Government considers as a major issue.

The RPFP also recognized the need for physical infrastructures to support the envisioned spatial development strategy. It classified the following major road networks as critical in achieving these.

(i) *NCR and Region I/CAR Link through Region III* (Manila North Road, North Luzon Expressway, Olongapo-Iba-Bugallon Road, and other alternate roads)

(ii) *NCR and Region II Link via Region III* (Cagayan Valley Road or Maharlika Highway, and other alternate roads)

(iii) Road links with Region IV

(iv) Road Links with NCR

(v) Intra-regional/Inter-regional Road Linkages

3.4.2 Bulacan: The Fastest Growing Province in Central Luzon

Bulacan Province has a total land area of **262,500** hectares, which is about **14%** of the entire Region III. It is strategically located between the National Capital Region (NCR) on the south, and the rest of Region III provinces on the north. To its east is Quezon Province, to its west, Pampanga, and Nueva Ecija to its north and northeast. The Province is made up of **24** municipalities. With regards to population distribution among the other provinces in Central Luzon, it ranked **1st** in from 1980 to 1995, making it the most populated province in the Region. Next to the province of Pampanga, Bulacan ranked 2nd in terms of population density, with **2.81** persons per hectare in 1970, **4.17** in 1980, **5.73** in 1990, and **6.80** in 1995.

In terms of population change, the Central Luzon (Regional) Physical Framework Plan (RPFP, 1993-2023) indicated that Bulacan would double its population in 22 years, the fastest among the other five provinces. In fact during the 1990-1995 censal period, its population grew by as high as **3.09%** per annum, even higher than Region III's **2.17%.** The reason for the rapid growth is attributed to the increase in influx of migrants from various points of origin, due to population and industry spill from the NCR (Please refer to **Table 3.4-1**).

Table 3.4-1 Population Size and Growth Rates of Provinces and Cities in Region III			
Province/City	**Population (1990)**	**Population (1995)**	**Growth Rate**
REGION III	5,769,004	6,518,805	2.17
Bataan	425,803	491,459	2.57
Bulacan	1,505,219	1,784,441	3.09
Nueva Ecija	1,312,680	1,505,827	2.45
Pampanga	1,295,929	1,401,756	1.36
Tarlac	859,708	945,810	1.67
Zambales	369,665	389,512	0.89
Angeles City	236,686	234,011	-0.19
Olongapo City	193,327	179,754	-0.12
Source: 2000 Philippine Statistical Yearbook			

Urban and Rural Population

As expected, Bulacan's total urban population comprises more than **75%** of the province's total population, registering a total of **1,346,950** out of **1,784, 441** in 1995. The increase from 1990's urban population of **1,125,953** represents a high annual growth rate of **3.27%**. Its rural population grew from **379,266** in 1990 to **437,491** in 1995, which is equivalent to an annual growth rate of **2.56%**. These trends provide a very strong indicator of the Province's level of development.

3.4.3 The Host Municipalities

In Bulacan's Provincial Physical Framework Plan (RPFP), the hierarchy of urban centers is classified based on function and services available in each municipality, as well as its urban population. In its 2007 Trend Hierarchy of Urban Centers, three (3) of the five (5) host municipalities were categorized as Major Urban Centers, one (1) as a Secondary Urban Center, and one (1) as a Medium Town. These are the Municipalities of Plaridel, Guiguinto, and Balagtas, Bustos, and San Rafael, respectively. In the 1995 hierarchy, Plaridel was already listed as a Major Urban Center, and is expected to remain the same until 2007. In the same year, Guiguinto and Balagtas were classified as Secondary Urban Centers. As seen from Table 3.4.2, both municipalities were elevated to the upper hierarchy level. Bustos was a only a Medium Town in that hierarchy, but was elevated as a Secondary Urban Center in the 2007 hierarchy. Surprisingly, San Rafael remained as a Medium Town from the 1995 to the 2007 hierarchy.

Table 3.4-2 Roles and Indicator Functions of Hierarchy of Host Municipalities

Level of Hierarchy (2007)	Roles	Indicator Functions	Urban Population
Major Urban Centers **PLARIDEL** **GUIGUINTO** **BALAGTAS**	Commercial and distribution center	• Comprehensive shopping • Higher education • Trade & Commerce • Secondary health and education services • Banking and related activities	>100,000
Secondary Urban Centers **BUSTOS**	Marketing and processing	• Marketing & processing • Secondary health and education services	>20,000
Medium Town **SAN RAFAEL**	Agric-related processing and services	• Secondary health and education services • Agric-based activities	<20,000

SOURCE: *Modified from the Bulacan Provincial Physical Framework Plan (1998-2007)*

Demographic Characteristics

As previously mentioned, Bulacan is the most populated province in the Region, and that next to the province of Pampanga, it ranked 2nd in terms of population density. It has also the fastest population change, among the other five provinces in Central Luzon. **Table 3.4-3** shows the historical population growth of the host municipalities in Bulacan.

It can be noted from the table that from 1990 to 1995, all Municipalities exhibited a significant decrease in growth rate except Plaridel, which grew at a rate of 4.22 in 1995 from 3.21 in 1990. This may be explained by the growing number of subdivision development not just in Plaridel but in other growing municipalities such as Norzagaray and Pandi. The decrease in the four other host municipalities may be attributed to the migration of people from these relatively less urbanized areas to the more developed and urbanized ones such as Meycauayan, Pandi, San Jose del Monte and of course, Malolos.

Table 3.4-3 Historical Population Growth of the Host Municipalities

Year	Balagtas	Ave. Growth Rate (%)	Guiguinto	Ave. Growth Rate (%)	Plaridel	Ave. Growth Rate (%)	Bustos	Ave. Growth Rate (%)	San Rafael	Ave. Growth Rate (%)
1903	8,000		3,948		7,229		7,072		6,682	
1918	9,875	1.46	4,847	1.42	8,216	0.85	6,855	-0.19	8,537	1.74
1939	12,037	1.00	6,199	1.27	11,161	1.63	8,692	1.22	12,269	1.99
1948	8,085	(3.28)	7,979	2.87	14,290	2.80	10,493	2.07	14,632	1.93
1960	10,280	2.09	10,629	2.55	18,714	2.38	13,412	2.14	19,772	2.70
1970	17,109	6.04	16,075	4.66	27,648	4.34	19,254	3.96	28,039	3.80
1975	21,422	4.20	20,590	4.68	32,613	2.99	22,622	2.92	32,342	2.56
1980	28,654	5.63	27,751	5.80	39,121	3.33	25,739	2.30	36,803	2.30
1990	42,658	4.44	44,532	5.50	52,954	3.21	34,965	3.26	49,528	3.14
1995	49,210	2.56	52,575	3.01	66,355	4.22	41,372	3.05	58,387	2.98

SOURCE: *1995 Census of Population, Socio-Economic and Demographic Characteristics of Bulacan*

Table 3.4-4 shows the number of households and population density of the host municipalities. It can be observed from this table that Guiguinto (**24.24**), Plaridel (**18.94**), and Bustos (**9.93**) showed higher population densities than Bulacan, which has only **6.79**. These figures reflect the host municipalities' increasing level of urbanization. Although the change in trends for the hierarchy of urban centers is expected to take place by 2007, these figures already seem to justify the upgrading of Guiguinto from a Secondary urban Center to a Primary Urban Center and Bustos, from a Medium Town to a Secondary Urban Center.

Table 3.4-4 Number of Households and Population Density of Bulacan and the Host Municipalities

Barangay	Number of Households	Population	Area (Ha)	Density (persons/ha)
BULACAN	359,613	1,784,441	262,540	6.79
HOST MUNICIPALITIES				
Guiguinto	14,513	60,902	2,512	24.24
Plaridel	16,596	80,481	4,250	18.94
Bustos	9,867	47,164	4,750	9.93
San Rafael	9,467	49,279	16,525	2.98

Note: no data for Balagtas

SOURCE: *Modified from the CLUPs and SEPs of Guiguinto, Plaridel, Bustos, and San Rafael*

As seen from **Table 3.4-5**, the age structure in all the host municipalities is weighted towards the younger groups. In **Balagtas**, **36.19%** of the Municipality's population is 14 years old and below; **60.99%** are between the productive ages of 15 and 64 years old; and only **2.82%** are senior citizens aged 65 years old and above. In **Guiguinto**, it's **34.27%** for 14 yrs old and below, **62.63%** for 15 to 64 years old, and **3.09%** for senior citizens. In **Plaridel**, it's **35.62%** for 14 years old and below, **60.68%** for 15 to 64 years old, and **3.70%** for senior citizens. In **Bustos**, it's **34.98%** for 14 years old and below, **60.06%** for 15 to 64 years old, and **4.22%** for senior citizens. Lastly for **San Rafael**, it's **35.73%** for ages 14 and below, **60.16%** for 15 to 64 years old, and **4.11%** for senior citizens. Based on the 1995 NSO Census of Population hese types of age structure indicate that the host municipalities' population will grow rapidly, having a high percentage of the productive age of 15-64 years old.

Table 3.4-5 Age Distribution of the Host Municipalities' Population

	Balagtas		Guiguinto		Plaridel		Bustos		San Rafael	
Age Group	No.	% to Tot	No.	% to Tot	No.	% to Tot	No.	% to Tot	No.	% to Tot
All Ages	49,210	100.00	52,575	100.00	66,355	100.00	41,372	100.00	58,387	100.00
0-9	12,488	25.38	12,459	23.70	16,456	25.79	10,185	24.61	14,257	24.42
10-14	5,320	10.81	5,560	10.58	7,177	10.82	4,589	11.09	6,603	11.31
15-19	5,246	10.66	5,836	11.10	7,065	10.65	4,521	10.93	6,356	10.89
20-24	4,713	9.58	5,516	10.49	6,197	9.34	4,020	9.72	5,429	9.30
25-29	4,554	9.25	5,013	9.53	6,028	9.08	3,803	9.19	5,193	8.89
30-34	3,853	7.83	3,956	7.52	5,089	7.67	3,079	7.44	4,342	7.44
35-39	3,441	6.99	3,423	6.51	4,487	6.76	2,575	6.22	3,740	6.41
40-44	2,600	5.28	2,934	5.58	3,626	5.46	2,126	5.14	3,049	5.22
45-49	2,193	4.46	2,441	4.64	2,923	4.41	1,705	4.12	2,462	4.22
50-54	1,401	2.85	1,589	3.02	1,927	2.90	1,240	3.00	1,818	3.11
55-59	1,191	2.42	1,327	2.52	1,639	2.47	975	2.36	1,527	2.62
60-64	820	1.67	895	1.70	1,285	1.94	806	1.95	1,209	2.07
65-69	612	1.24	650	1.24	1,006	1.52	661	1.60	880	1.51
70-74	351	0.71	431	0.82	651	0.98	466	1.13	643	1.10
75-79	219	0.45	265	0.50	403	0.61	308	0.74	421	0.72
80-84	146	0.30	176	0.33	242	0.36	189	0.46	292	0.50
85 and over	62	0.13	104	0.20	154	0.23	124	0.30	166	0.28

SOURCE: *Modified from the CLUPs and SEPs of Guiguinto, Plaridel, Bustos, and San Rafael.*

The Table further suggests that all the host municipalities has a moderate age dependency ratio of around **0.40**. Since the population is expected to have a rapid growth rate, age dependency ratio can also be expected to significantly increase in the near future. This would lower down the future living standards if there will be no corresponding economic growth in the Province.

Socioeconomic Characteristics

Based on its Provincial Physical Framework Plan, Bulacan's level of economy can be gauged from figures in its employment sector. There are three (3) major contributors namely the, (i) **services sector**; (ii) **manufacturing sector**, and (iii) **agricultural sector**. Of the total provincial figure of 603,235 in 1995, the services sector accounted for **42%**; the manufacturing sector, **19%**, and the agricultural sector, around **16%**.

Agricultural Sector

Table 3.4-6 shows the percentage distribution of agricultural areas in the host Municipalities and barangays in Bulacan. It can be discerned from this table that San Rafael and Bustos have larger areas that are classified as agricultural, with **91.5%** and **89.3%** percentage distributions, respectively.

Table 3.4-6 Percentage Distribution of Agricultural Areas in the Host Municipalities

Host Town/ Barangay	Total Land Area (Ha)	Agricultural Areas (Ha)	% Distribution
GUIGUINTO	2,148.00	1,284.46	59.8
PLARIDEL	4,100.00	2,665.48	65.0
BUSTOS	3,975.00	3,551.00	89.3
SAN RAFAEL	16,525.00	15,110.62	91.4
TOTAL	**26,748.00**	**22,611.56**	**84.5**

Note: no data for Balagtas

SOURCE: *Modified from the CLUPs and SEPs of Guiguinto, Plaridel, Bustos, and San Rafael*

Another source of livelihood for the farmers in Bulacan are livestock and poultry production. It can be noted from Table 3.4-7 that among the host towns, San Rafael has the most number of cattles and carabaos. Swine and poultry production is dominated by Bustos, and duck production by Plaridel.

Table 3.4-7 Livestock and Poultry Production at the Host Municipalities (As of 1998)

Host Town	Cattle	Carabao	Swine	Goat	Poultry	Duck
Balagtas	-	-	11,477	-	16,500	-
Guiguinto	166	14	13,935	-	31,562	906
Plaridel	-	-	35,111	-	18,210	35,111
Bustos	838	600	44,332	380	128,467	10,382
San Rafael	2,644	2,139	18,263	1,137	12,750	1,815

Note: no data for Balagtas

SOURCE: *Modified from the CLUPs and SEPs of Guiguinto, Plaridel, Bustos, and San Rafael*

Commerce and Industry

The number of commercial establishments and industries in Guiguinto, Balagtas and Bustos further supports the upgrading of these two municipalities into the next higher level of hierarchy of urban centers (See **Table 3.4-8**). However, the forecast of the Bulacan PPFP for San Rafael to remain as a Medium Town even by the year 2007 may have been an underestimation, because it of the fairly high number of commercial, industrial, and even recreational establishments.

Table 3.4-8 Number of Business Establishments by Category at the Host Municipalities

Business Category	Balagtas	Guiguinto	Plaridel	Bustos	San Rafael
Commerce and Trading	240	422	189	676	356
Recreation/Amusement	31	-	37	9	63
Industries	157	99	67	407	73
Banking/Financing	20	18	12	3	2
Service	-	146	-	30	-
Others	-	34	-	-	-
TOTAL	**448**	**719**	**305**	**1,125**	**494**

Note: no data for Balagtas

SOURCE: *Modified from the CLUPs and SEPs of Guiguinto, Plaridel, Bustos, and San Rafael*

Education

It can be noted from **Table 3.4-9** that the number of schools, offering tertiary education, whether public or privately owned is very limited in the host municipalities. Tertiary education is only available at Bustos, where the Bulacan State University is found, in Balagtas, where two colleges are available, and in San Rafael, a maritime academy. This limited number of schools offering tertiary education cannot be considered a hindrance since these municipalities are relatively near Metro Manila, and thus students who wish to continue higher education can easily access leading colleges and universities there.

Table 3.4-9 Number of Public Schools and Enrollees at the Host Communities										
	Balagtas		Guiguinto		Plaridel		Bustos		San Rafael	
Schools	**No.**	**Enrollees**	**No.**	**Enrollees**	**No.**	**Enrollees**	**No.**	**Enrollees**	**No.**	**Enrollees**
A. Public Schools										
a. Primary	-	-	-	-	-	-	11	598	6	485
b. Elementary	9	7,348	12	8,447	16	9,876	12	6,253	19	8,654
c. Secondary	1	1,047	3	4,467	3	2,397	3	2,182	2	3,521
d. Tertiary	-	-	-	-	-	-	1	1,626	-	-
e. Vocational/ Technical	-	-	-	-	-	-	-	-	-	-
B. Private Schools										
a. Primary	5	331	-	-	1	72	5	278	2	1,045
b. Elementary	2	794	1	136	1	348	-	-	2	234
c. Secondary	2	1,701	-	499	1	520	2	1,596	1	799
d. Tertiary	2	263	-	68	-	-	-	-	1	293
e. Vocational/ Technical	2	226	-	-	-	-	-	-	-	-

Note: no data for Balagtas
SOURCE: *Modified from the CLUPs and SEPs of Guiguinto, Plaridel, Bustos, and San Rafael.*

Health and Sanitation

It can be observed from **Table 3.4-10** that among the host municipalities, Guiguinto and Bustos have the most complete number of health personnel. The absence of a full pledge hospital in San Rafael is also noticeable.

Table 3.4-10 Number of Health Facilities and Personnel at the Host Municipalities

Health Facilities/ Personnel	Guiguinto	Plaridel	Bustos	San Rafael
Hospital				
Public	-	-	-	-
Private	17	4	5	-
Medical Clinics	1	15	-	2
Rural Health Units (RHUs)	-	-	-	2
Municipal Health Center	2	-	1	1
Barangay Health Stations	14	-	16	14
Health Personnel at RHU				
Doctor	2		28	3
Medical Technologist	1	1	13	3
Dentist	2	2	14	2

Table 3.4-10 Number of Health Facilities and Personnel at the Host Municipalities (continued)

Health Facilities/ Personnel	Guiguinto	Plaridel	Bustos	San Rafael
Sanitation Inspector	2	4	1	2
Nutritionist	14	-	-	-
Nurse	2	3	51	8
Midwife	18	18	87	21
Barangay Health Workers (BHWs)	64	76	150	-

Note: no data for Balagtas

SOURCE: *Modified from the CLUPs and SEPs of Guiguinto, Plaridel, Bustos, and San Rafael*

The ten leading causes of mortality in Bulacan are shown on **Table 3.4-1.** It can be discerned from the table that the top two leading causes of mortality are: (i) CAD (coronary artery disease) and (ii) Pneumonia.

Table 3.4-11 Ten Leading Causes of Mortality at the Host Municipalities

Rank	Balagtas	Plaridel	San Rafael
1	CAD	HVD	CRA
2	Hypertension	Cancer	Cerebro Vascular Accident
3	Cancer	MI	Myocardial Fraction
4	Diabetes Mellitus	TB	Accident
5	PTB	COPD	Sepsis
6	Pneumonia	Pneumonia	Pneumonia
7	CBC	CAD	Cancer
8	Accident	Diabetes	Dehydration
9	Asthmaticus & CBA	Accidents	HVA
10	Kidney Disorder	Ulcer	Congenital Heart Failure

Note: CRA – Cardio Respiratory Arrest; CVA – Cardio Vascular Accidents
HVD – Hypertension Vascular Disease; CAD – Coronary Artery Disease
TB – Tuberculosis; PTB – Pulmonary Tuberculosis; CRF – Chronic Renal Failure; CHD – Congestive Heart Disease; CHF – Congenital Heart Failure

Note: no data for Guiguinto and Bustos

SOURCE: *Modified from the CLUPs and SEPs of Guiguinto, Plaridel, Bustos, and San Rafael*

In terms of morbidity, **Table 3.4-12** presents the ten leading causes in the host municipalities. It can be noted that the top three (3) causes are (i) acute respiratory infection (ARI), (ii) diarrhea, and (iii) hypertension.

Table 3.4-12 Ten Leading Causes of Morbidity at the Host Municipalities

Rank	Balagtas	Plaridel	Bustos	San Rafael
1	ARI	ARI	ARI	ARI
2	Diarrhea	Hypertension	Diarrhea	Acute Gastroenteritis
3	Skin Disorder	Infected Wound	Influenza	URI
4	Anemia	UTI	PTB	Hypertension
5	Parasitism	PTB	UTI	Asthmatic Bronchitis
6	Pneumonia	Parasitism	Disease of the Heart	Dermatitis
7	Hypertension	IDA	Malnutrition	Bronchopneumonia
8	Wound/Injury	Bronchitis	Skin Disease/Allergy	UTI
9	Nutrition & Vitamin Deficiency	Skin Allergy		PTB
10	PTB	Asthma		Infected Wound

Note: ARI – Acute Respiratory Tract Infection; PTB – Pulmonary Tuberculosis; UTI – Urinary Tract Infection; URI – Upper Respiratory Infection

Note: no data for Balagtas

SOURCE: *Modified from the CLUPs and SEPs of Guiguinto, Plaridel, Bustos, and San Rafael*

Water Supply

It can be noted from **Table 3.4-13** that except for those in Guiguinto, not all host barangays are being served by the respective municipal water districts. For example in the Municipality of Plaridel, only San Jose and Parulan are served; Bulihan obtain its water supply groundwater sources. The same is true for Camachilihan and Liciada in Bustos, and San Roque and Maguinao in San Rafael.

Table 3.4-13 Baragays Served by Water Districts at the Host Municipalities

Host Town/ Barangay	No. of Households	No. of HH Served
GUIGUINTO		
Tiaong	1,070	41
Pulong Gubat	262	13
Cutcut	438	20
Sub-Total 1		
PLARIDEL		
San Jose	565	80
Bulihan	785	
Parulan	1,003	387
Sub-Total 2	**2,353**	**467**
BUSTOS		
Camachilihan		-
Liciada		-
Talampas		514
Malamig		354
Bonga Menor		585
Sub-Total 3		
SAN RAFAEL		
Tambubong	4,417	661
Caingin	8,379	731
San Roque	931	
Maguinao	2,461	
Sub-Total 4		
TOTAL		

Note: no data for Balagtas

SOURCE: *Modified from the CLUPs and SEPs of Guiguinto, Plaridel, Bustos, and San Rafael*

Power Supply

The entire Province of Bulacan is served by the Manila Electric Company (MERALCO). At least one sub-station is installed in each municipality. As of the end of 1996, coverage is at **97.7%; or 341,760** out of the **349,933** potential households were provided with power supply.

Road Network and Transportation

Table 3.4-14 shows the type and length of roads at the host municipalities. The table shows that San Rafael has the longest stretch of paved roads, including barangay roads, followed by Guiguinto, and Plaridel.

The main modes of transportation are buses, jeepneys, and tricycles. The Municipality of Balagtas has the most number of bus terminals with four private bus companies. These bus lines operate daily trips from Bulacan to Metro Manila and vice versa.

Table 4.3-14 Type and Length of Roads at the Host Municipalities

Host Town	Concrete	Asphalt	Gravel	Total Length
Balagtas				
National Road	-	2.86	-	2.86
Provincial Roads	8.92	0.59	-	9.51
Municipal Roads	6.63	1.40	-	8.03
Barangay Roads				
Sub-Total 1	**15.55**	**4.85**	**-**	**20.40**
Guiguinto				
National Road	12.00	-	-	12.00
Provincial Roads	2.80	-	-	2.80
Municipal Roads	0.80	0.65	-	1.45
Barangay Roads	31.03	5.90	25.20	65.00
Sub-Total 2	**46.63**	**6.55**	**25.2**	**81.25**
Plaridel				
National Road	10.60	6.10	-	16.70
Provincial Roads	9.45	8.60	-	18.05
Municipal Roads	6.31	3.25	0.85	10.41
Barangay Roads	10.85	5.25	8.75	24.85
Sub-Total 3	**37.21**	**23.20**	**9.60**	**70.01**
San Rafael				
National Road	18.00	-	-	18.00
Provincial Roads	20.50	-	12.00	32.50
Municipal Roads	4.91	-	22.45	27.36
Barangay Roads	41.16	-	276.78	317.94
Sub-Total 4	**84.57**	**-**	**311.23**	**395.80**
TOTAL				

Note: no data for Balagtas
SOURCE: *Modified from the CLUPs and SEPs of Guiguinto, Plaridel, Bustos, and San Rafael*

Development Problems and Issues

Ideally, discussion of development problems and issues are done for each host municipality, focusing on relevant sectors of the LGUs such as transportation, environment, flood control, and drainage. These are then followed by a description of the municipalities' goals, objectives, and strategies that it intends to follow to be able to cope with the said development problems and issues. However, it was so unfortunate that only two (2) out of three municipalities provided the EIA Team with a copy of their CLUP. The Municipalities of Balagtas and Bustos refused to provide the EIA Team with a copy of its CLUP. As such, its development concerns and issues shall be dicussed in terms of the entire province due to the lack of vital information regarding the future plans and strategies of each municipality.

Based on the Bulacan PPFP, the Province is confronted with the following development problems and issues. (i) Illegal conversion of prime agricultural lands into residential and commercial use; (ii) traffic congestion in major urban centers, and the (iii) absence of ideal or suitable areas for garbage disposal.

Given the rapid rate of population growth in Bulacan, the Provincial Government of Bulacan is cognizant that conversion of prime agricultural lands into commercial and residential uses will continue to prevail. One of the reasons cited in its PPFP is the **unique** setting of prime agricultural lands, wherein a conflict of usage stems from the fact that areas for protection are provided with a wide range of urban services and infrastructure that in many ways attract settlement. Aside from these, major markets and sources of employment are also located in these prime agricultural lands. Naturally, investors would take advantage of the availability of these urban amenities and thus locate their real estate development in these areas.

Another factor which aggravated the situation was when the national government designated Bulacan as a relocation site for informal settlers and slum dwellers in Metro Manila. Combine these with the setting up of service industries such as educational institutions, recreational facilities, and commercial establishments to cope with the growing population of the Province.

Another effect of rapid urban growth is the increase in volume of vehicles that slows down traffic flow, particularly at constricted roadways. This, together with other factors such as undisciplined public transportation drivers, illegal parking along shoulders, and high volume of slow moving vehicles such as tricycles and jeepneys somehow paralyze traffic movement.

Just like any other province with highly populated municipalities, solid waste management is a leading problem. At present, many of the dumps sites have reached its maximum capacity, and need to be closed down. If no alternative sites are identified soon, residents would resort to more pollutive ways such as open burning and dumping of garbage in rivers and creeks.

To address the abovementioned concerns, the following strategies are included in the Province's PPFP:

(i) The provincial and municipal governments must locate additional urban expansion areas and amenities outside prime agricultural lands;

(ii) Conduct an inventory that would identify non-built-up areas that are eligible for conversion. If it is inevitable to convert agricultural lands into urban uses, the following criteria must be satisfied: (i) if it's a rice land, it should be least productive, and (ii) it should not undermine an existing or planned irrigation system;

(iii) Municipalities that are located in the outskirts of the Province should be given sufficient access to urban centers, not only to facilitate the people's access to basic services, but also to avoid congestion in the central business districts;

(iv) Implementation of effective traffic management schemes, or the construction of circumferential and bypass roads; and

(v) Implement the Integrated Provincial Solid Waste Management Program wherein a common solid waste disposal facility will be located in the piedmont parts of the Province, far away from populated areas. One component of this program is about the promotion of recycling down at the household level

3.4.4 The Host Barangays

The following socioeconomic information on the project-affected persons (PAPs) and families are based on the census and socioeconomic survey undertaken from 17 July to 16 August 2001. A total of **173** affected persons were interviewed. Maps showing the settlements to be affected by barangay are given in **Appendix H**.

Demography and Basic Information

Household Size

Tables 3.4-15 show the household size of PAPs per barangay. As seen from the table, majority of the PAPs have an average household size of "5-7" and "1 to 4". Only **5.6%** have household size greater than 10.

Table 3.4-15 Household Size of the Respondents

Municipality/Barangay	Household Size/Percentage							
	1-4	%	5-7	%	8-10	%	>10	%
Balagtas								
Borol 2nd	-	-	3	75.0	1	25.0	-	-
Guiguinto								
Cutcut	5	33.3	9	60.0	1	6.7	-	-
Plaridel								
Bulihan	5	38.5	4	30.8	2	15.4	2	15.4
San Jose	4	36.4	6	54.5	1	9.1	-	-
Parulan	-	-	1	100.0	-	-	-	-
Bustos								
Camachilihan	1	20.0	4	80.0	-	-	-	-
Talampas	1	25.0	2	50.0	1	25.0	-	-
Malamig	5	31.3	10	62.5	1	6.3	-	-
Bonga Menor	23	37.1	28	45.2	9	14.5	2	3.2
San Rafael								
Tambobong	-	-	1	100.0	-	-	-	-
Caingin	6	46.2	5	38.5	-	-	2	15.4
San Roque	7	46.7	4	26.7	2	13.3	2	13.3
Maguinao	-	-	-	-	-	-	1	100.0
Grand Total	**57**	**35.4**	**77**	**47.8**	**18**	**11.2**	**9**	**5.6**

Educational Attainment

The levels of educational attainment of male and female spouses in the host barangays are presented in **Tables 3.4-16a** and **3.4-16b**.

Table 3.4-16a Educational Attainment of Male Spouses

	Education (Number/Percentage)							
Municipality/Brgy.	**Elem. Undergrad**	**Elem. Graduate**	**HS Undergrad**	**HS Graduate**	**Vocational Grad.**	**College Undergrad.**	**College Grad.**	**None**
Balagtas								
Borol 2nd		1						
		100.0						
Guiguinto								
Cutcut		1		1		2	1	
		20.0		20.0		40.0	20.0	
Plaridel								
Bulihan	2	1	1				3	1
	25.0	12.5	12.5				37.5	12.5
San Jose	3	1		1			1	
	50.0	16.7		16.7			16.7	
Bustos								
Camachilihan	2		1					
	66.7		33.3					
Talampas			1			1		
			50.0			50.0		
Malamig	5	2	3	2				
	41.7	16.7	25.0	16.7				
Bonga Menor	3	11	1	4		4	3	1
	11.1	40.7	3.7	14.8		14.8	11.1	3.7
San Rafael								
Caingin	1	1	2		1			
	20.0	20.0	40.0		20.0			
San Roque	1	2	1			1		
	20.0	40.0	20.0			20.0		
Grand Total	**17**	**20**	**8**	**10**	**1**	**6**	**10**	**2**
	23.0	**27.0**	**10.8**	**13.5**	**1.4**	**8.1**	**13.5**	**2.7**

Table 3.4-16b Educational Attainment of Female Spouses								
	Education (Number/Percentage)							
Municipality/Brgy.	**Elem. Undergrad**	**Elem. Graduate**	**HS Undergrad**	**HS Grad.**	**Voc. Grad.**	**College Undergrad.**	**College Grad.**	**None**
Balagtas								
Borol 2nd	-	-	-	-	-	-	1	-
	-	-	-	-	-	-	100.0	-
Guiguinto								
Cutcut	1	5	2	1	-	-	-	-
	11.1	55.6	22.2	11.1	-	-	-	-
Plaridel								
Bulihan	-	-	1	1	-	-	-	-
	-	-	50.0	50.0	-	-	-	-
San Jose	2	1	-	-	-	-	-	-
	66.7	33.3	-	-	-	-	-	-
Parulan		1	-	-	-	-	-	-
		100.0	-	-	-	-	-	-
Bustos	-	-	-	-	-	-	-	-
Camachilihan	-	-	-	-	-	1	1	-
	-	-	-	-	-	50.0	50.0	-
Malamig	-	-	2	-	-	-	-	-
	-	-	100.0	-	-	-	-	-
Bonga Menor	5	8	4	6	3	1	2	-
	17.2	27.6	13.8	20.7	10.3	3.4	6.9	-
San Rafael								-
Caingin	1	5						-
	16.7	83.3	-	-	-	-	-	
San Roque	-	-	3	4	1	-	1	-
	-	-	33.3	44.4	11.1	-	11.1	
Grand Total	**9**	**20**	**12**	**12**	**4**	**2**	**5**	
	14.1	**31.3**	**18.8**	**18.8**	**6.3**	**3.1**	**7.8**	

As seen from the Tables, majority or **31.3%** of the female spouse respondents are elementary graduates, whereas, only **14.1%** are undergraduates. Respondents who graduated and did not finish high school education comprised about **18.8%**. For the male spouses, mostly are elementary graduates (**27.0%**). High school graduates account for **13.5%** of the total respondents interviewed and those who did not attain secondary level of education composed about **10.8%.** For both sexes, only a few attained college education (**13.5%** male; and **7.8%** female). The low percentage of higher levels of education make them less eligible and competitive when it comes to landing of jobs, particularly at more urbanized areas.

Socioeconomic Characteristics

Socioeconomic characteristics of the respondents will be described in this section based on the results of the survey conducted. The PAPs' standard of living and socioeconomic status shall be evaluated using the following indicators: (i) sources of income; (ii) household income and expenditures and type of; (iii) lighting, (iv) water supply, (iii) cooking fuel, and (iv) sanitation facilities.

Primary Occupation

The PAPs' primary occupation is farming. As shown in **Table 3.4-17**, majority of the respondents are farmers **(38.5%)**. This is expected since Bulacan economy is still considered primarily agriculture-based.

Table 3.4-17 Primary Occupation of the Respondents

Municipality/Brgy.	Farmer	Hired Farm Worker	Skilled Labor	Prof. Employee	Prof. Practice	Business Operator	OFW	Others	None
Balagtas									
Borol 2nd	3	-	1	-	-	-	-	-	-
	75.0	-	25.0	-	-	-	-	-	-
Guiguinto									
Cutcut	6	-	3	-	-	2	-	4	-
	40.0	-	20.0	-	-	13.3	-	26.7	-
Plaridel									
Bulihan	6	-	-	2	-	2	-	2	1
	46.2	-	-	15.4	-	15.4	-	15.4	7.7
San Jose	11	-	-	-	-	-	-	-	-
	100.0	-	-	-	-	-	-	-	-
Parulan	1	-	-	-	-	-	-	-	-
	100.0	-	-	-	-	-	-	-	-
Bustos									
Carnachilihan	3	-	-	-	-	1	-	1	-
	60.0	-	-	-	-	20.0	-	20.0	-
Talampas	4	-	-	-	-	-	-	-	-
	100.0	-	-	-	-	-	-	-	-7
Malarnig	10	-	1	-	1	2	-	2	-
	62.5	-	6.3	-	6.3	12.5	-	12 5	-
Bonga Menor	11	1	14	2		14	-	19	2
	17.5	1.6	22.2	3.2		22.2	-	30.2	3.2
San Rafael									
Tambobong	1	-	-	-	-	-	-	-	-
	100.0	-	-	-	-	-	-	-	-
Caingin	5	-	2	-	-	2	-	3	-
	41.7	-	16.7	-	-	16.7	-	25.0	-
San Roque	1	-	1	-	-	5	3	4	1
	6.7	-	6.7	-	-	33.3	20.0	26.7	6.7
Maguinao	-	-	-	-	-	1	-	-	-
	-	-	-	-	-	100.0	-	-	-
Grand Total	**62**	**1**	**22**	**4**	**1**	**29**	**3**	**35**	**4**
	38.5	**0.6**	**13.7**	**2.5**	**0.6**	**18.0**	**1.9**	**21.7**	**2.5**

Household Income

Table 3.4.18 shows that majority of the surveyed households **(57.0%)** fall above **P71,304**, Region 3's annual poverty threshold for a family of six (based on incidences in 1997, Philippine Statistical Yearbook, 2000). Those who fall between P39, 240 and P71,304 comprise **18.6%.** The percentage falling below the annual food threshold of **P39, 239 (24.4%)** represent the PAPs who would become highly vulnerable to impoverishment if their farm income are taken away from them.

Table 3.4-18 Household Income of the Respondents

	Total Household Income					
Municipality/Barangay	**<P39,239**	**%**	**P39,240 to P71,034**	**%**	**>71,304**	**%**
Balagtas						
Borol 2nd	-	-	-	-	4	100.0
Guiguinto						
Cutcut	8	50.0	3	18.8	5	31.3
Plaridel						
Bulihan	4	30.8	1	7.7	8	61.5
San Jose	1	9.1	1	9.1	9	81.8
Parulan	-	-	-	-	1	100.0
Bustos						
Camachilihan	3	37.5			5	62.5
Talampas	1	20.0	-	-	4	80.0
Malamig	-	-	1	6.3	15	93.8
Bonga Menor	18	26.9	18	26.9	31	46.3
San Rafael						
Tambobong	-	-	-	-	1	100.0
Caingin	6	42.9	3	21.4	5	35.7
San Roque	1	6.7	5	33.3	9	60.0
Maginao	-	-	-	-	1	100.0
Grand Total	**42**	**24.4**	**32**	**18.6**	**98**	**57.0**

Household Income

Table 3.4.18 shows that majority of the surveyed households **(57.0%)** fall above **P71,304**, Region 3's annual poverty threshold for a family of six (based on incidences in 1997, Philippine Statistical Yearbook, 2000). Those who fall between P39, 240 and P71,304 comprise **18.6%.** The percentage falling below the annual food threshold of **P39, 239 (24.4%)** represent the PAPs who would become highly vulnerable to impoverishment if their farm income are taken away from them.

Table 3.4-19a Farm Income of the Respondents

	Total Farm Income					
Municipality/Barangay	**<P39,239**	**%**	**P39,240 to P71,034**	**%**	**>71,034**	**%**
Balagtas						
Borol 2nd	-	-	1	25.0	3	75.0
Guiguinto						
Cutcut1	10	66.7	2	13.3	3	20.0
Plaridel						
Bulihan	5	35.7	1	7.1	8	57.1
San Jose	2	18.2	2	18.2	7	63.6
Parulan	-	-	-	-	-	-
Bustos						
Camachilihan	5	62.5			3	37.5
Talampas	1	20.0			4	80.0
Malamig	2	12.5	2	12.5	12	75.0
Bonga Menor	53	79.1	3	4.5	11	16.4
San Rafael						
Tambobong	-	-	-	-	1	100.0
Caingin	11	78.6	-	-	3	21.4
San Roque	11	73.3	1	6.7	3	20.0
Maginao	1	100.0	-	-	-	-
Grand Total	**102**	**59.3**	**12**	**7.0**	**58**	**33.7**

Tables 3.4-19a and **3.4-19b** show the farm and non-farm income of the PAPs', respectively. **Table 3.4-19a** shows that in all barangays, if the income of the respondents would be derived from farming only, **33.7%** would still be above Region 3's poverty threshold, and **59.3%** would already fall below the threshold. If the PAPs' incomes were solely derived from non-farm sources such as those mentioned above, **54.1%** would fall below the annual food threshold, and only **31.4%** earn more than **P71,304** per annum. These figures show the PAPs' dependence on both farming and non-farming as their major means of livelihood.

Table 3.4-19b Non-Farm Income of the Respondents

	Total Non-Farm Income					
Municipality/Barangay	<P39,239	%	P39,240 to P71,034	%	>71,034	%
Balagtas						
Borol 2nd	2	50.0			2	50.0
Guiguinto						
Tiaong	-	-	-	-	-	-
Pulong Gubat	-	-	-	-	-	-
Cutcut	12	75.0	1	6.3	3	18.8
Plaridel						
Bulihan	10	71.4	-	-	4	28.6
San Jose	7	63.6	-	-	4	36.4
Parulan	-	-	-	-	-	-
Bustos						
Camachilihan	4	50.0	-	-	4	50.0
Talampas	4	80.0	-	-	1	20.0
Malamig	10	62.5	3	18.8	3	18.8
Bonga Menor	31	46.3	12	17.9	24	35.8
San Rafael						
Tambobong	1	100.0	4	-	-	-
Caingin	8	57.1	4	28.6	2	14.3
San Roque	4	26.7	5	33.3	6	40.0
Maginao	-	-	-	-	1	100.0
Sub-Total 5	*13*	*41.9*	*9*	*29.0*	*9*	*29.0*
Grand Total	**93**	**54.1**	**25**	**14.5**	**54**	**31.4**

Household and Farm Expenditures

The respondents' average annual household expenditures by barangay are shown in **Table 3.4-20**. As seen from the table, food expenses comprise bulk **(64.4%)** of the respondents' total annual expenditures in all barangays. This is followed by education, electricity, and medical expenses with **12.2%, 9.3%,** and **7.5%**, respectively. This indicates that crops obtained from the farmlands are not depended upon as sustenance, but more of a source of income.

It is important to note that aside from these household expenses, the PAPs also shell out a considerable amount of their income paying for farm labor, which totals to about **P677,515.65** or **22.0%**. The respondents also spend substantial sum of money for agro-industrial and aquaculture feeds **(19.4%)**, for buying farm supplies and implements such as seedlings, fertilizers, and pesticides (Please see **Table 3.4-21**).

Table 3.4-20 Average Annual Household Expenditures of the Respondents

	Household Expenditures							
Mun./Brgy.	**Food**	**Electricity**	**Water**	**Education**	**Taxes**	**Medical**	**Other**	**Total**
Balagtas								
Borol 2nd	419,750	76,800	-	76,000	-	-	-	572,550
	73.3	13.4	-	15.1	-	-	-	100
Guiguinto								
Cutcut	923,450	131,932	20,220	95,940	39,200	193,420	-	1,404,162
	65.8	9.4	1.4	6.8	2.8	13.8	-	100
Plaridel								
Bulihan	1,416,200	368,784	280,320	257,600	61,350	96,000	30,000	2,510,254
	56.4	14.7	11.2	10.3	2.4	3.8	1.2	100
San Jose	858,480	88,800	8,400	120,200	12,550	150,665	-	1,239,095
	69.3	7.2	0.7	9.7	1.0	12.2	-	100
Bustos								
Camachilihan	383,250	91,800	-	242,335	12,500	47,000	-	776,885
	49.3	11.9	-	31.2	1.6	6.0	-	100
Talampas	255,500	30,600	17,400	47,600	10,000	146,000	-	507,100
	50.4	6.0	3.4	9.4	2.0	28.8	-	100
Malamig	1,113,250	135,560	29,340	218,500	2,000	84,600	40,880	1,624,130
	68.5	8.4	1.8	13.5	0.1	5.2	2.5	100
Bonga Menor	3,607,375	269,852	113,749	609,952	11,713	450,100	354,000	4,808,350
San Rafael								
Tambobong	73,000	8,400	1,920	250	-	-	-	83,570
	87.3	10.0	2.3	0.3	-	-	-	100
Caingin	664,300	29,328	3,720	103,500	-	9,600	-	810,448
	82.0	3.6	0.4	12.8	-	1.2	-	100
San Roque	1,014,050	242,652	80,140	304,790	-	25,100	-	1,392,732
	60.8	14.5	4.8	18.3	-	1.5	-	100
Maguinao	255,500	120,000	-	-	-	73,000	-	448,500
	57.0	26.78	-	-	-	16.3	-	100
Grand Total	**10,984,105**	**1,594,408**	**555,209**	**2,076,667**	**149,313**	**1,275,485**	**424,880**	**17,060,067**
	64.4	**9.3**	**3.2**	**12.2**	**0.9**	**7.5**	**2.5**	**100**

Table 3.4-21 Farm Expenditures of the Respondents

Mun./Brgy.	Labor	Seedlings	Fertilizer	Pesticides	Equipment Rental	Irrigation	Feeds	Other Farm
Balagtas								
Borol 2nd	28,500	6,550	21,400	9,100	7,000	5,450	10,000	1,000
	32.0	7.3	24.0	10.2	7.9	6.1	11.2	1.1
Guiguinto								
Cutcut	29,050	6,650	23,825	19,680	16,000	5,780	38,400	
	20.8	4.8	17.1	14.1	11.5	4.1	27.5	
Plaridel								
Bulihan	83,092.85	18,592.85	58,582.85	49,243.85	13,543.85	21,143.85	208,943.85	1,644.00
	18.3	4.1	12.9	10.8	3.0	4.6	46.0	0.4
San Jose	86,504.17	57,066.67	88,541.67	67,481.67	67,216.67	47,866.67	216,000.00	21,600.00
	13.3	8.7	13.6	10.3	10.3	7.3	33.1	2.4
Bustos								
Camachilihan	53,000.00	24,800.00	55,000.00	55,000.00	-	32,000.00	-	6,000.00
	23.5	11.0	24.3	24.3	-	14.2	-	2.6
Talampas	64,900.00	54,550.00	66,640.00	54,400.00	1,568.00	20,550.00	-	800.00
	24.6	20.7	25.3	20.7	0.6	7.8		0.3
Malamig	92,314.28	32,914.28	93,514.28	49,344.28	55,064.28	34,138.28	7,714.28	5,500.00
	24.9	8.9	25.2	13.3	14.9	9.2	2.1	1.5
Bonga Menor	191,724.35	56,541.40	149,581.40	71,281.40	43,081.40	9,880.00	75,550.00	11,200.00
San Rafael								
Tambobong	12,000.00	11,250.00	5,835.00	6,000.00	-	-	-	1,080.00
	33.2	31.1	16.1	16.6	-	-	-	3.0
Caingin	24,830.00	12,250.00	27,900.00	32,900.00	2,750.00	10,000.00	1,120.00	216.00
	22.2	10.9	24.9	29.4	2.4	8.9	1.0	0.2
San Roque	11,600.00	8,200.00	20,700.00	22,300.00	5,000.00	9,000.00	38,400.00	7,000.00
	9.5	6.7	16.9	18.2	4.1	7.4	31.4	5.7
Maguinao	11,600.00	8,200.00	20,700.00	22,300.00	5,000.00	9,000.00	38,400.00	7,000.00
	9.5	6.7	16.9	18.2	4.1	7.4	31.4	5.7
Grand Total	**677,515.65**	**289,365.20**	**611,520.20**	**436,731.20**	**211,224.20**	**195,808.80**	**596,128.13**	**56,040.00**
	22.0	9.4	**19.9**	**14.2**	**6.9**	**6.4**	**19.4**	**1.8**

Net Income

Table 3.4-22 shows the PAPs' total household income, their total household expenditures, total farm expenditures, and net income. It can be observed from this table that more than **70%** of their total incomes are spent on household expenditures, whereas around **20-25%** goes to farm expenditures.

Table 3.4-22 Net Income of the Respondents

Municipality/ Barangay	Total Household Income	Total HH Expenditures	%	Total Farm Expenditures	%	Net Household Income
Balagtas						
Borol 2nd	774,000.00	572,550.00	86.55	89,000.00	13.45	112,450.00
Guiguinto						
Cutcut	1,098,050.00	1,404,062.00	90.96	139,385.00	9.04	(445,397.00)
Plaridel						
Bulihan	2,838,250.00	2,510,254.00	84.66	454,787.95	15.34	(126,791.95)
San Jose	2,158,003.00	1,239,095.00	65.51	652,277.52	34.49	266,630.48
Bustos						
Camachilihan	2,336,700.00	776,885.00	77.48	225,800.00	22.52	1,334,015.00
Talampas	1,289,250.00	507,100.00	65.81	263,408.00	34.19	518,742.00
Malamig	2,581,730.00	1,624,130.00	81.42	370,503.96	18.58	587,096.04
Bonga Menor	9,068,474.00	5,416,741.00	89.89	608,839.95	10.11	3,042,893.05
San Rafael						
Tambobong	256,250.00	83,570.00	69.79	36,165.00	30.21	136,515.00
Caingin	1,932,750.00	810,448.00	87.86	111,966.00	12.14	1,010,336.00
San Roque	2,809,575.00	1,666,732.00	93.16	122,200.00	6.84	1,020,643.00
Maguinao	1,050,000.00	448,500.00	62.39	270,331.00	37.61	601,500.00
Grand Total	**28,193,032.00**	**17,060,067.00**	**74.37**	**5,878,335.76**	**25.63**	**8,058,631.62**

Tenure

In terms of tenurial status, **Table 3.4-23** shows that majority, or **33.6%** are occupying lands with prior consent from the respective landowners, **29.6%** are tenants, and 28.3% of the total project affected persons are landowners.

Table 3.4-23 Tenurial Status of the Respondents

MunicipalityBrgy.	Owner	Lessee	Tenant	Free Occupation w/ Permit	Free Occupation w/o Permit	Others
Balagtas		-		-	-	-
Borol 2nd	1	-	3	-	-	-
	25.0	-	75.0	-	-	-
Guiguinto					-	-
Cutcut	4		4	5	-	-
	30.8		30.8	38.5	-	-
Plaridel					-	-
Bulihan	3	-	7	3	-	-
	23.1	-	53.8	23.1	-	-
San Jose	4	7	-	-	-	-
	36.4	63.6	-	-	-	-
Bustos					-	
Camachilihan	1	-	3	1	-	-
	20.0	-	60.0	20.0	-	-
Talampas	3	-	2	-	-	-
	60.0	-	40.0	-	-	-
Malamig	6	-	8	2	-	-
	37.5	-	50.0	12.5	-	-
Bonga Menor	10	7	6	31	4	-
	17.2	12.1	10.3	53.4	6.9	-
San Rafael					-	
Tambobong	-	-	1	-	-	-
	-	-	100.0	-	-	-
Caingin	-		3	6	-	1
			30.0	60.0	-	10.0
San Roque	10	1	1	3	-	-
	66.7	6.7	6.7	20.0	-	-
Maguinao	1	-	-	-	-	-
	100.0	-	-	-	-	-
Grand Total	43	8	45	51	4	1
	28.3	5.3	29.6	33.6	2.7	0.7

Availability of Basic Social Services

Results of the survey showed that high percentage, or **85.1%** of the households interviewed have access to electricity as a source of lighting. Only **6.4%** still use kerosene for illuminating their abodes (See **Table 3.4-24**). A high percentage of population being supplied with electricity strongly indicates the Municipality's level of development.

Table 3.4-24 Type of Lighting of the Respondents' Dwelling Units										
Municipality/Brgy.	**Electricity**	**%**	**Kerosene Lamp**	**%**	**Petromax**	**%**	**Oil Lamp**	**%**	**None**	**%**
Balagtas										
Borol 2nd	-	-	-	-	-	-	-	-	-	-
Guiguinto										
Cutcut	8	80.0	-	-	-	-	1	10.0	1	10.0
Plaridel										
Bulihan	5	100.0	-	-	-	-	-	-	-	-
San Jose	-	-	1	100.0	-	-	-	-	-	-
Parulan	-	-	-	-	-	-	-	-	-	-
Bustos										
Camachilihan	1	100.0	-	-	-	-	-	-	-	-
Talampas	-	-	-	-	-	-	-	-	-	-
Malamig	2	66.7	1	33.3	-	-	-	-	-	-
Bonga Menor	51	96.2	1	1.9	-	-	-	-	-	-
San Rafael										
Tambobong	-	-	-	-	-	-	-	-	-	-
Caingin	4	36.4	3	27.3	1	9.1	1	9.1	2	18.2
San Roque	9	90.0	-	-	-	-	1	10.0	-	-
Maguinao	-	-	-	-	-	-	-	-	-	-
Grand Total	**80**	**85.1**	**6**	**6.4**	**1**	**1.1**	**3**	**3.2**	**4**	**4.3**

Water Supply

In terms of source of water supply, majority or 55.3% of the respondents obtain their domestic water supply from artesian wells, whereas 23.4% are with piped connections (Refer to **Table 3.4-25**).

Table 3.4-25 Source of Water Supply of the Respondents

Municipality/ Barangay	Rain	%	Spring/ River	%	Dug Well	%	Artesian Well	%	Pump Well	%	Piped	%	None	%
Guiguinto														
Cutcut	-	-	-	-	1	10.0	4	40.0	2	20.0	2	20.0	1	10.0
Plaridel														
Bulihan	-	-	-	-	-	-	2	50.0	2	50.0	-	-	1	20.0
San Jose	-	-	-	-	-	-	1	100.0			-	-		
Bustos														
Malamig	-	-	1	33.3	-	-	-	-						
Bonga Menor	1	1.9	-	-	1	1.9	29	54.7						
San Rafael														
Caingin	-	-	-	-	-	-	9	81.8						
San Roque	-	-	-	-	-	-	7	70.0						
Grand Total	**1**	**1.1**	**1**	**1.1**	**2**	**2.1**	**52**	**55.3**	**4**		**2**		**2**	

Sanitation Facilities

Other indicators of the standard of living are deficiencies in terms of sanitation facilities. It can be observed from **Table 3.4-26** that most of the residents at the host barangays use the semi flush type **(63.8%)** of toilet. Others use the Antipolo type **(13.8%)**.

Table 3.4-26 Type of Toilet Facility of the Respondents

	Toilet Facility									
Municipality/Brgy.	**Open pit**	**%**	**Antipolo**	**%**	**Semi-flush**	**%**	**Flush**	**%**	**None**	**%**
Balagtas										
Borol 2nd	-	-	-	-	-	-	-	-	-	-
Guiguinto										
Cutcut	-	-	1	10.0	6	60.0	2	20.0	1	10.0
Plaridel										
Bulihan	-	-	1	20.0	4	80.0	-	-	-	-
San Jose	1	100.0	-	-	-	-	-	-	-	-
Parulan	-	-	-	-	-	-	-	-	-	-
Bustos										
Camachilihan	-	-	-	-	1	100.0	-	-	-	-
Talampas	-	-	-	-			-	-	-	-
Malamig	-	-	1	33.3					2	66.7
Bonga Menor	-	-	6	11.3	35	66.0	7	13.2	5	9.4
San Rafael										
Tambobong	-	-	-	-	-	-	-	-	-	-
Caingin	-	-	2	18.2	7	63.6			2	18.2
San Roque	-	-	2	20.0	7	70.0	1	10.0	-	-
Maginao	-	-	-	-	-	-	-	-	-	-
Grand Total	**1**	**1.1**	**13**	**13.8**	**60**	**63.8**	**10**	**10.6**	**10**	**10.6**

Cooking Fuel

In terms of the type of fuel used for cooking, majority of the respondent PAPs **(54.3%)** are still using kerosene to cook their food. Those who are using LPGs in their kitchens comprise **23.4%** of the total respondents. However, others are still using wood for cooking food **(17.0%)**. Please refer to **Table 3.4-27**.

Table 3.4-27 Type of Fuel Used by the Respondents

	Cooking Fuel											
Mun./Brgy.	**Wood**	**%**	**Char.**	**%**	**Kero.**	**%**	**LPG**	**%**	**Elec.**	**%**	**None**	**%**
Balagtas												
Borol 2nd	-	-	-	-	-	-	-	-	-	-	-	-
Guiguinto												
Cutcut	2	20.0	-	-	-	-	7	70.0	-	-	1	10.0
Plaridel												
Bulihan	-	-	-	-	2	40.0	3	60.0	-	-	-	-
San Jose	1	100.0	-	-	-	-	-	-	-	-	-	-
Parulan			-	-	-	-	-	-	-	-	-	-
Bustos												
Camachilihan	-	-	-	-	-	-	1	100.0	-	-	-	-
Talampas	-	-	-	-	-	-	-	-	-	-	-	-
Malamig	1	33.3			1	33.3	1	33.3	-	-	-	-
Bonga Menor	8	15.1	2	3.8	26	49.1	16	30.2	1	1.9	-	-
San Rafael												
Caingin	4	36.4	-	-	5	45.5	1	9.1	-	-	1	9.1
San Roque	-	-	-	-	8	80.0	2	20.0	-	-	-	-
Maguinao	-	-	-	-	-	-	-	-	-	-	-	-
Grand Total	**16**	**17.0**	**2**	**2.1**	**51**	**54.3**	**22**	**23.4**	**1**	**1.1**	**2**	**2.1**

Available Skills in the Community

During the construction period, one of the mitigating measures identified during the EIA process is to give top priority to project affected persons in terms of job opportunities. **Tables 3.4-28** and **3.4-29** show the available skills of both the female and male household members, respectively in the host barangays.

Female household members with knowledge in cooking comprise of **37.6%** of the total respondents asked during the perception survey. On the other hand, nearly **32.5%** have sewing abilities. There are about **14.5%** office personnel **10.5%** factory workers in the project area.

Drivers consist approximately **41.3%** of the total male respondents. Next to drivers, laborers are the second in rank with **27.5%.** Other available skills of male household members include carpentry **(17.4%)**, masonry **(8.2%)**, mechanic **(4.6%)**, and heavy equipment operator **(0.9%)**.

Table 3.4-28 Skills of Female Household Members

Municipality/Brgy.	Cooking	%	Sewing	%	Office Work	%	Seedling Caretaker	%	Factory Worker	%	Utility	%
Balagtas												
Borol 2nd	1	33.3	-	-	-	-	2	66.7	-	-	-	-
Guiguinto												
Cutcut	2	22.2	5	55.5	1	11.1	-	-	1	11.1	-	-
Plaridel												
Bulihan	1	33.3	2	66.7	-	-	-	-	-	-	-	-
San Jose	6	60.0	1	10.0	2	20.0	-	-	1	10.0	-	-
Parulan	-	-	-	-	-	-	-	-	-	-	-	-
Bustos												
Camachilihan	2	50.0	2	50.0	-	-	-	-	-			
Talampas	-	-	2	66.7	-	-	-	-	1	33.3	-	-
Malamig	3	18.7	7	43.7	5	31.3	-	-	-	-	-	-
Bonga Menor	26	57.8	9	20.0	5	11.1	-	-	4	8.9	1	6.3
San Rafael											1	2.2
Caingin	1	8.3	7	58.3	1	8.3	-	-	2	16.7	1	8.3
San Roque	2	16.7	3	25.0	3	25.0	-	-	3	25.0	1	8.3
Maginao	-	-	-	-	-	-	-	-	-	-	-	-
Grand Total	**44**	**37.6**	**38**	**32.5**	**17**	**14.5**	**2**	**1.7**	**12**	**10.5**	**4**	**3.4**

Table 3.4-29 Skills of Male Household Members

	Skills											
Municipality/ Barangay	Labor	%	Carpentry	%	Masonry	%	Heavy Equipment Operator	%	Mechanic	%	Driving	%
Balagtas												
Borol 2nd	-	-	-	-	1	100.0	-	-	-	-	-	-
Guiguinto												
Cutcut	3	42.8	2	28.6							2	28.6
Plaridel												
Bulihan	3	37.5	2	25.0	1	12.5	-	-	1	12.5	1	12.5
San Jose	-	-	3	37.5	-	-	-	-	1	12.5	4	50.0
Bustos												
Camachilihan	2	40.0	-	-	-	-	-	-	1	20.0	2	40.0
Taiampas	1	50.0	-	-	-	-	-	-	-	-	1	50.0
Malamig	4	23.5	1	5.9	1	5.9	-	-	1	5.9	10	58.8
Bonga Menor	13	29.5	7	15.9	3	6.8	1	2.3	1	2.3	19	43.2
San Rafael												
Caingin	1	11.1	3	33.3	1	11.1	-	-	-	-	4	44.4
San Roque	3	37.5	1	12.5	2	25.0	-	-	-	-	2	25.0
Grand Total	**30**	**27.5**	**19**	**17.4**	**9**	**8.2**	**1**	**0.9**	**5**	**4.6**	**45**	**41.3**

Social Acceptability

Project Awareness

The respondents' awareness of the proposed project is presented in **Table 3.4-30**. **Table 3.4-31** on the other hand shows their respective sources of information about the Project. It can be noted from the said tables that the host communities are well informed about the proposed project (**92.6%**).

Almost **38.0%** revealed that their main source of information is the DPWH. Other key informants are the LGUs with **30.1%**, neighbors/friends with **13.5%**, and the EIA Team with **12.9%**. Their relatives also informed them about the project.

Table 3.4-30 Project Awareness of the Respondents

	Informed About the Project?				
Municipality/Barangay	**Yes**	**%**	**No**	**%**	**Sub-Total**
Balagtas					
Borol 2nd	4	100.0	-	-	4
Guiguinto					
Tiaong	-	-	-	-	-
Pulong Gubat	-	-	-	-	-
Cutcut	13	86.7	2	13.3	15
Plaridel					
Bulihan	13	92.9	1	7.1	
San Jose	11	100.0	-	-	-
Parulan	-	-	-	-	-
Bustos					
Camachilihan	6	100.0	-	-	-
Talampas	5	100.0	-	-	-
Malamig	16	100.0	-	-	-
Bonga Menor	58	93.5	4	6.4	-
San Rafael					
Tambobong	1	100.0	-	-	-
Caingin	13	100.0	-	-	-
San Roque	10	66.7	5	33.3	-
Maguinao	1	100.0			
Grand Total	**151**	**92.6**	**12**	**7.4**	**163**

Table 3.4-31 Respondents' Sources of Information About the Project										
	Source of Information About the Project									
Municipality/ Barangay	LGUs	%	DPWH	%	ECOSYS Corp.	%	Relatives	%	Neighbors /Friends	%
Balagtas										
Borol 2nd	-	-	*4*	*100.0*	-	-	-	-	-	-
Guiguinto										
Cutcut	*4*	*26.7*	*8*	*53.3*	*1*	*6.7*			*2*	*13.3*
Plaridel										
Bulihan	2	14.3	9	64.3	1	7.1-		-	1	7.1
San Jose	7	63.6	3-	27.3	1	9.1	-	-	-	-
Parulan	-	-	-	-	-	-	-	-	-	-
Bustos										
Camachilihan	2	33.3	1	16.7	1	16.7	2	33.3		
Talampas	4	80.0	-	-	1	20.0	-	-	-	-
Malamig	8	50.0	5	31.3	1	6.3	1	1.6	2	12.5
Bonga Menor	13	21.0	19	30.6	11	17.7	4	6.5	14	22.6
San Rafael										
Tambobong			1	100.0						
Caingin	2	15.4	8	61.5	2	15.4	-	-	1	7.7
San Roque	6	40.0	4	26.7	2	13.3	-	-	3	6.7
Maguinao	1	100.0	-	-	-	-	-	-	-	-
Grand Total	49	30.1	62	38.0	21	12.9	9	5.5	22	13.5

Social Acceptability

There are several criteria used for evaluating the social acceptability of a project, the results of which determines whether it is issued an Environmental Compliance Certificate (ECC) or not. Some of these are environmental soundness, poverty alleviation, concurrence to land use plans, and conflict resolution. A more direct way however, is through the conduct of perception survey wherein the PAPs are asked whether they are in favor of the proposed project or not.

Based on a 100% interview of the affected communities, a very high **70.8%** of the PAPs expressed that they are **in favor** of the proposed Plaridel Bypass (Please see **Table 3.4-32**).

Table 3.4-32 Social Acceptability				
Mun./Brgy.	Yes	%	No	%
Balagtas				
Borol 2nd	3	75.0	1	25.0
Guiguinto				
Tiaong	-	-	-	-
Pulong Gubat	-	-	-	-
Cutcut	7	46.7	8	53.3
Plaridel				
Bulihan	13	92.8	1	7.1
San Jose	8	72.7	3	27.2
Parulan	-	-	-	-
Bustos				
Camachilihan	5	83.3	1	16.7
Talampas	4	80.0	1	20.0
Malamig	13	81.3	3	18.8
Bonga Menor	41	67.2	20	32.8
San Rafael				
Tambobong	1	100.0		
Caingin	11	91.7	1	8.3
San Roque	7	46.7	8	53.3
Maguinao	1	100.0		
Grand Total	**114**	**70.8**	**47**	**29.2**

When asked why they are in-favor of the Project (**Table 3.4-33**), the top **three (3)** answers are because (i) it is a government project and they cannot do anything but accept it (*Others*, **43.7%**), and (ii) the Bypass, will improve the quality of life of people, particularly those near the bypass (**27.7%**); and (iii) will improve accessibility (**14.3%**). The second and third answers indicate that the communities believe that the construction of the road will bring about progress and development in the area, and that it will be felt in terms of improved quality of life. The second reason is obvious, since the bypass would enable the people, particularly those who frequently travel from Metro Manila and other southern Tagalog regions to reach their destinations without having to go through long queues of traffic.

For those who do not favor the construction of the Bypass, the main reason is understandable; i.e., because it "*will displace people*" (Please refer to **Table 3.4-34**).

Table 3.4-33 Why the Respondents Are In Favor of the Plaridel Bypass Project

Municipality/ Barangay	Reasons													
	Improve Quality of Life	%	Improve Accessibility	%	Increase Job Opportunity	%	Improve Farm Products Delivery	%	Minimize Traffic Congestion	%	Increase Value of Land	%	Others	%
Balagtas														
Borol 2nd	-	-	-	-	-	-	-	-	-	-	2	66.7	1	33.3
Guiguinto														
Cutcut	1	14.3	-	-	-	-	-	-	-	-	-	-	6	85.7
Plaridel														
Bulihan	4	30.8	1	7.7	-	-	-	-	-	-	1	7.7	7	53.8
San Jose	4	50.0	3	37.5	-	-	-	-	-	-	1	12.5	-	-
Bustos														
Camachilihan	1	20.0	-	-	-	-	-	-	2	40.0	1	20.0	1	20.0
Talampas	4	100.0	-	-	-	-	-	-	-	-	-	-	-	-
Malamig	5	38.5	3	23.1	1	7.7	-	-	1	7.7	1	7.7	2	15.4
Bonga Menor	5	12.5	5	12.5	3	7.5	1	2.5	1	2.5	-	-	25	62.5
San Rafael														
Tambobong	1	100.0	-	-	-	-	-	-	-	-	-	-	-	-
Caingin	4	40.0	-	-	-	-	-	-	-	-	1	10.0	5	50.0
San Roque	2	28.6	3	42.9	-	-	-	-	-	-	-	-	2	28.6
Maguinao	-	-	1	100.0	-	-	-	-	-	-	-	-	-	-
Grand Total	**31**	**27.7**	**16**	**14.3**	**4**	**3.6**	**1**	**0.9**	**4**	**3.6**	**7**	**6.2**	**49**	**43.7**

Table 3.4-34 Why the Respondents Are Not In Favor of the Bypass Project

Municipality/Barangay	Displacement of People	%	Losses in Income and Land	%	Others	%
Balagtas						
Borol 2nd	-	-	1	100.0	-	-
Guiguinto						
Cutcut	5	62.5	3	37.5	-	-
Plaridel						
San Jose	-	-	3	100.0	-	-
Bustos						
Camachilihan	-	-	1	100.0	-	-
Talampas	-	-	1	100.0	-	-
Malamig	1	50.0	1	50.0	-	-
Bonga Menor	8	44.4	9	50.0	1	5.6
San Rafael						
Caingin	-	-	-	-	1	100.0
San Roque	2	40.0	2	40.0	1	20.0
Grand Total	**16**	**40.0**	**21**	**52.5**	**3**	**7.5**

Chapter 4

Future Environmental Conditions Without the Project

4 FUTURE ENVIRONMENTAL CONDITIONS WITHOUT THE PROJECT

4.1 Physical Environment

Terrain

Without the project, the existing geological features will remain as they are now observed. Only the inevitable erosion process by chemical reaction of surface water with the rock formations shall cause imperceptible topographical alterations.

Hydrology

The hydrological condition within the area is not expected to record any improvement nor deterioration.

Water Quality and Limnology

The physical and chemical characteristics of the water bodies within the project area will remain relatively the same, particularly at the Angat River, considering the continuing quarry operations in various portions of the river. There may also be a possible increase in the fecal coliform content of water, which may be due to the presence of an open garbage dumpsite in Bustos, located only around 150-200 m from the river bank.

Climate

Even without the project, major changes in terms of infrastructure, industries, as well as a rapid expansion of human settlement in the area are foreseeable in the future. Thus, changes in the local climate due to urbanization are expected to occur.

Air Quality and Noise Level

Without the proposed project, a significant increase in TSP and NO_2 concentrations and levels of noise is expected at areas adjacent to the Maharlika Highway, due to continuous aggravation of traffic congestion as a result of the natural increase in the number of vehicles plying the said road network. This may even occur earlier than expected due to the rapid rate of urbanization and industrialization in the province of Bulacan. As previously mentioned, Bulacan serves as a recipient of bulk of in-migrants as spillover from Metro Manila.

Land Use

The prevailing land use types will generally remain the same in all the host municipalities, based on their approved CLUPs, except for the Municipality of Guiguinto. It is important to note that during consultation meetings with the officials as well as stakeholders of the said municipality, they have strongly aired their disappointment over what happened in the past, when their Municipality was literally "divided" twice by a national highway. One of these is the existing North Luzon Expressway, and the other, the exit at Sta. Rita, which forms part of the Maharlika Highway. Since these major thoroughfares do not have any service roads, and thus no direct access to and from the adjacent barangays, most of the these barangays traversed were literally "cut-off" from the rest. The townspeople of Guiguinto blame these two highways as major factors, which hampered their economic development.

these two highways as major factors, which hampered their economic development.

4.2 Biological Environment

Terrestrial Flora

The present flora formation such as the common riceland and wasteland weeds grass shrubs, and herbs in the area will remain as it is even without the proposed project.

Terrestrial Fauna

Without the proposed project the type and distribution of terrestrial fauna is expected to remain the same. As previously mentioned, the study site is already significantly disturbed, and that there are no documented critical habitat areas for wildlife in the project area.

Aquatic Fauna

The level of diversity of the phytoplankton and zooplankton species as well as the other aquatic life and edible fishes found in the Angat River will remain the same without the project. Continuous changes in the chemical characteristics of the river system (i.e. increase in the amount of nutrient input) would be deleterious to the plankton community, macro invertebrates and larger organisms of the species. Possible sources of inputs are garbage, industrial wastes, farmlands (use of pesticides, particularly those along the vast floodplains), and other anthropogenic activities. Any change in the composition of the producers (phytoplankters) may also change the whole food web.

4.3 Socio Economic

Without the proposed project the following actual and envisioned benefits CANNOT be realized:

- Continuous flow of commodity, particularly from Region II towards Regions I, III, NCR, and even IV, as a result of provision of alternative route to the congested Pan-Philippine Highway;
- Reduction in transport costs of goods coming to and from Central Luzon, the rest of Bulacan, and the other Regions serviced by the Pan-Philippine Highway;
- Increase in employment opportunities as a result of urbanization and commercial development of non-agricultural and non-prime agricultural areas;
- Reduction in the levels of gaseous vehicular emissions as well as noise levels along the existing Pan-Philippine Highway, as a result of diversion of vehicular traffic to the Bypass

Chapter 5

Impact Assessment, Mitigation and Enhancement

5 IMPACT ASSESSMENT, MITIGATION, AND ENHANCEMENT

5.1 IMPACT IDENTIFICATION, PREDICTION AND EVALUATION

This Chapter discusses the impacts of proposed Plaridel Bypass to the receiving environment. Based on the evaluation of the identified impacts, appropriate mitigating measures are recommended.

5.1.1 Pre-Construction and Construction Phases

The following identified impacts as well as the recommended mitigating and enhancement measures apply to both Pre-Construction and Construction Phases of the Plaridel Bypass Project.

<u>Physical Environment</u>

Land

IMPACT:

Minimal loss of productive farmlands along the road ROW *(Long-term, negative)*

Construction of the bypass will inevitably reduce the area of productive farmlands along the alignment

MITIGATION:

- The construction of the bypass alignment will limited to the required ROW of **32 meters** along prime agricultural areas;
- Bypass sections with frontage or service roads are concentrated in areas designated or planned by the respective municipality for commercialization; and
- Fertile top soil which contain moisture-retaining organic humus will be transferred to adjacent farmlands

Hydrology

IMPACT:

Possible stream flow impediment of the waterways crossed by the bypass alignment *(Short-term, negative)*

Improper disposal of cut vegetation along the road ROW may impede the flow of the rivers, creeks, and irrigation canals traversed by the alignment

MITIGATION:

- Since the alignment will generally traverse agricultural areas with sparse trees, vegetation cover to be cut is expected to be minimal;
- Secondary cut logs will be properly surrendered to the nearest DENR Office; and
- Small pieces of logs, twigs, shrubs, etc. will be disposed accordingly at DENR-approved disposal site/s

IMPACT:

Possible increase in the rate of siltation along the waterways crossed by the bypass alignment *(Short-term, negative)*

It is important to note here that the present the sources of siltation are:

- *Continuous extraction of aggregate materials during summer;*
- *Erosion and material resuspension of sediments during peak flood periods (i.e. rainy and typhoons); and*
- *Dumping of garbage along the waterways*

MITIGATION:

- Temporary sediment traps will be constructed at critical construction areas such as those adjacent to rivers, creeks and irrigation canals to avoid the possible increase in siltation and clogging of the said waterways;
- Excavated unsuitable materials and construction spoils for temporary stockpiling will be located in designated areas away from the waterways. These will be covered with tarpaulin, canvass or sack materials to prevent run-off, particularly during high precipitation periods; and
- Excavated unsuitable materials and construction spoils will be regularly hauled and disposed at DENR-approved disposal site/s

Water Quality

IMPACT:

Possible increase in turbidity along the major waterways crossed by the bypass alignment due to bored piling at riverbed *(Short-term, negative)*

Bored piling for bridge substructure and alteration of stream/river flow to accommodate construction of work would increase the turbidity along major waterways crossed by the bypass alignment

MITIGATION:

- This impact is unavoidable but temporary in nature. Condition of the waterways will return to normal about a year or two after the construction works are completed

IMPACT:

Possible increase in the bacteriological content of local surface water bodies *(Short-term, negative)*

Increase in the in the bacteriological content, particularly coliform, of local surface water bodies due to domestic wastes generated by construction personnel.

MITIGATION:

- Temporary sanitation facilities such as portable toilets and garbage bins will be provided by the Contractors to ensure that domestic wastes generated by the construction personnel are properly handled and are not thrown into the waterways to prevent pollution of the surface water bodies

IMPACT:

Possible contamination of local surface waters *(Short-term, negative)*

Washing of construction machinery and other mobile equipment such as transit mixers and dump trucks may contaminate local surface waters. As well, improper handling of chemicals such as lubricants, fuel, paint, and other solutions for routine vehicular operation may have similar effects.

MITIGATION:

- Contractors will be prohibited from washing the construction vehicles and other mobile equipment along the waterways to prevent spillage of oil and grease and other contaminants to the receiving surface waters; and
- Lubricants, fuel, paint, and other chemicals solutions utilized for routine vehicular operation will be carefully handled and properly stored in a temporary storage area away from the waterways to prevent possible contamination of rivers, creeks, and irrigation canals

Air Quality

IMPACT:

Possible increase in the generation of dust particulates along construction sites *(Short-term, negative)*

Dozing, stripping, earthmoving, and other related activities involved during the pre-construction and construction phases of the project may possibly add to the present level of suspended particulate matters within the construction and adjacent areas.

Temporary stockpiles of excavated unsuitable and surplus materials as well as fill and embankment materials may also add to the present TSP levels.

MITIGATION:

- Exposed and cleared construction areas will be regularly sprayed with water;
- Excavated unsuitable and surplus materials will be regularly hauled and disposed at DENR-approved disposal site/s; and
- Temporary stockpiles of fill and embankment materials must be covered with tarpaulin, canvass or sack materials to prevent re-suspension of particulate matters;

IMPACT:

Possible increase in exhaust gas emission levels due to the utilization of various pre-construction and construction equipment *(Short-term, negative)*

Exhaust gas emissions such as SO_X, NO_X, CO, and other hydrocarbons emitted by the various pre-construction and construction equipment

MITIGATION:

- Contractors will be required to conduct daily routine equipment and machinery check-ups; and
- Regular tune-up and maintenance of construction equipment and machinery will be complied with

Noise Level

IMPACT:

Possible increase in noise level generated by the various heavy equipment and machinery during the pre-construction and construction phases of the project *(Short-term, negative)*

Table 5.1-1	Expected Noise Levels from the Construction Equipment and Machinery			

EQUIPMENT SOURCE	DISTANCE FROM SOURCE (m)				
	15	30	60	120	240
Front-End Loader	75	69	63	57	81
Backhoe	85	79	73	67	61
Grader/Dozer	88	83	78	72	66
Dump trucks	91	85	79	73	67
Crane	83	77	71	65	59
Generator	78	72	66	60	54
Compressor	81	75	69	63	57
Pump	76	70	64	58	52
Pile Driver	101	95	89	83	64
Jack Hammer	88	82	76	70	64

SOURCE: *ECOSYS Corporation and Katahira & Engineers International, 1999.*

MITIGATION:

- Noise suppressors, such as mufflers will be installed whenever deemed necessary to maintain the noise generated by the various heavy equipment and other construction machinery to permissible limits;

- Being direct receivers of the noise generated by the construction equipment and machinery, operators will be provided with earmuffs to avoid drastic effects; and

- High noise generating pre-construction and construction activities will be scheduled during daytime to minimize disturbance to surrounding residential areas

Biological Environment

Terrestrial Flora

IMPACT:

Minimal loss of vegetation covers along the bypass alignment *(Long-term, negative)*

MITIGATION:

- This impact is considered minimal and insignificant, since the areas traversed by the alignment are mostly agricultural with sparse of trees which are usually concentrated along the creeks and irrigation canals;

- Just compensations will be accorded to the owners of damaged agricultural crops and fruit bearing trees in accordance with the existing DPWH ROW Acquisition Guidelines; and

- Construction of the bypass alignment will be limited to the required ROW of **32 m** along sections without frontage roads and **50 m** along sections with frontage roads

Terrestrial Fauna

IMPACT:

Actual displacement of wildlife species caused by the complete habitat transformation along the areas traversed by the bypass alignment *(Long-term, negative)*

Actual field survey along the project site revealed that the area is already highly disturbed. Critical habitats such as forests and natural marshes along the actual alignment and within a 2-3 kilometer perpendicular distance on both sides of the proposed bypass are also absent. These significantly lower the projected negative effects.

Moreover, most of the identified species particularly the amphibians, reptiles and mammals are common and non-threatened and *sometimes considered commensals of people. In addition, all small non-volant mammals species recorded are considered pests, while the noted species endemic species for the four groups was low*

MITIGATION:

- The Multi-Partite Monitoring Team (MMT) that will be formed will conduct a periodic but continuous survey of wildlife vertebrates within and around the project site to obtain clearer picture of the wildlife composition. The main priority of this activity should be the endemic and threatened species;

- The concerned government agency will initiate an information and education campaign in the project area. This is to disseminate the importance of conserving and protecting the remaining wildlife species as well as their habitats. The local community must be involved in this effort; and

- The remaining critical wildlife habitats that will be intercepted by the alignment will be protected and conserved no matter how small in size

Aquatic Fauna

IMPACT:

Bored piling and related bridge works along Angat River may contribute disturbance to the biotic community thriving in the said waterway *(Short-term, negative)*

MITIGATION:

- This impact is unavoidable but temporary in nature. Condition of the waterways will return to normal about a year or two after the construction works are completed; and

- The identified organisms are resilient and can adapt to physical changes in their environment. However, changes in the chemical characteristics of the river may be deleterious to the plankton community, the macro invertebrates and larger organisms, that is the increase in the amount of nutrient input to the river systems. It also important to emphasize here that construction works along the river will have no significant effect on the species' food web

Socio-Economic Environment

IMPACT:

Limited accessibility to farmlands *(Short-term, negative)*

During construction stage of the project, farmers may experience temporary difficulty in terms of accessibility to the farmland they are cultivating

MITIGATION:

- Farmers will be provided with temporary and safe access roads and crossings for carabaos and other farm implements such as hand tractors and threshers;

IMPACT:

Disruption of irrigation water services near the construction areas *(Short-term, negative)*

Actual construction of culverts and/or bridges along irrigation canals may disrupt the supply of water to adjacent farmlands. Improper disposal of surplus materials may also impede the flow of irrigation water to farmlands adjacent to the construction areas.

MITIGATION:

- Temporary culverts and irrigation channels will be provided by the Contractors to ensure continuous supply of irrigation waters to adjacent farmlands;
- Temporary sediment traps will be constructed at critical construction areas such as irrigation canals to prevent siltation of the said waterways;
- Temporary stockpiles of excavated unsuitable materials and construction spoils will be located in designated areas to ensure that clogging of irrigation canals will not occur. These will be covered with tarpaulin, canvass or sack materials to prevent these materials from being carried away by run-off, particularly during high precipitation; and
- Excavated unsuitable materials and construction spoils will be regularly hauled and disposed at DENR-approved disposal site/s

IMPACT:

Temporary stockpiles of excavated unsuitable materials, construction spoils, and fill and embankment materials may: *(Short-term, negative)*

- ***fill adjacent farmlands; and***
- ***cause local flooding***

MITIGATION:

- Activities during pre-construction and construction phases will be restricted within the construction limit;
- Temporary stockpiles of excavated unsuitable materials, construction spoils, and embankment and fill materials will be located in designated areas. These will be covered with tarpaulin, canvass or sack materials to prevent local flooding and run-off during high precipitation periods and avoid filling up of adjacent farmlands; and
- Excavated unsuitable materials and construction spoils will be regularly hauled to and disposed at DENR-approved disposal site/s

IMPACT:

Construction of the bypass alignment will entail: *(Long-term, negative)*

- ***minimal loss of properties;***
- ***permanent displacement of residential houses; and***
- ***loss/damage to means of livelihood, especially farmers***

MITIGATION:

- The required ROW for the Plaridel Bypass is **32 m** along sections without frontage roads and **50 m** along section with frontage roads, thus permanent displacement of residential houses and damage to properties are expected to be minimal;
- Just compensation will be accorded to landowners in harmony with the existing DPWH ROW Acquisition Guidelines. Agricultural tenants and lessees will be given financial assistance and disturbance compensation, respectively also in accordance with the existing DPWH ROW Acquisition Guidelines;

- The DPWH will also offer the option to relocate the houses or structures in areas designated by the homeowners. The DPWH will also replace the affected lands with a public land of the same size available within the project area if the owner opted to have his property replaced;

- A sound Social Development Plan (SDP) packages will be designed according to the types and specific situations of population groups that may be displaced by the project. The DPWH must realize that the affected groups did not voluntarily put up their homes and properties for sale. As such, the guiding attitude should not only be towards offering acceptable packages but to open up opportunities for them to improve the affected communities' current situation;

- The DPWH will provide alternative means of livelihood to the project affected families so that they can be assured of a continuous source of income. As cited during the Public Consultation Meetings (PCMs) and Perception Survey displaced families without any other means of livelihood will be assured of a sustainable means of livelihood;

- The SDP will also include a plan that will encourage the active participation of women and other vulnerable groups (e.g. physically challenged, indigenous cultural communities, etc.); and

- Informal settlers will be transferred to the designated relocation area/s provided by the host city. The DPWH through the help of the LGUs will provide basic social services such as water supply, electricity, health facilities, and means of transportation and communication

IMPACT:

Generation of temporary employment for qualified laborers within the host barangays during the construction phase of the project *(Short-term, positive)*

ENHANCEMENT:

- Qualified workers and laborers from the host barangays will be given priority in hiring during the construction stage of the project

5.1.2 Operational Phase

The following identified impacts and the corresponding mitigating as well as enhancement measures apply to the Operational Phase of the San Jose Bypass Project.

<u>Physical Environment</u>

Air Quality

During Operational Phase of the project, the expected emissions for highway driving are estimated by Economopoulos (1993) in Assessment of Air, Water and Land Pollution. The following emission factors (kg/1000 km) are estimated from Economopoulos (1993):

Vehicular Emissions:

	TSP	SO_2	NO_2
Engine <1400cc	0.05	0.96 S	2.85
Engine 1400-2000cc	0.05	1.08 S	3.10
Engine >2000cc	0.05	1.36 S	4.09

Where S = Sulfur Content of Fuel in Percent

Fugitive Dust (kg/1000km) from Vehicle Traffic:

Local Streets	15.00
Collector Streets	10.00
Highways	4.40
Expressways	0.35

Using the above emission factors and the projected traffic of the project, a ***Gaussian Dispersion Model*** was used to predict the contribution of the project to the 1-hour average ambient ground level concentrations in the area.

The model results are presented in graphical outputs showing isolines of SO2, NO2, and TSP concentrations for four (4) most prevailing wind directions in the area. From these results, the maximum predicted GLCs are **156.8 µg/Ncm** for TSP, **71.29 µg/Ncm** for SO2, and **79.64 µg/Ncm** for NO2.

The maximum observed ambient concentrations are **60.66 µg/Ncm** for SO2 and **41.9 µg/Ncm** for NO2. Superimposing these values to the predicted contribution of the project, the total predicted values are **131.95** µg/Ncm for SO2 and **121.54 µg/Ncm** for NO2. These are within the DENR ambient standards of 340 µg/Ncm for SO2 µg/Ncm and 260 µg/Ncm for NO2.

The maximum observed background TSP concentration was **1599.8 µg/Ncm**. This already exceeds the DENR ambient standard of 300 µg/Ncm. However, when this project is completed the background concentrations are expected to improve and it is expected that the total predicted values will be within the standards.

IMPACT:

Reduction in the levels of gaseous vehicular emissions along the existing Pan-Philippine Highway *(Long-term, positive)*

Gaseous emissions in urban areas along the Pan-Philippine will be reduced as a result of the diversion of thru traffic to the newly constructed bypass route

ENHANCEMENT:

- To further improve the quality of air along the existing Pan-Philippine Highway, LGUs with relatively high local traffic volume (i.e. Plaridel, San Rafael, Gapan, Gapan, Sta. Rosa, Cabanatuan City, and San Jose City) will implement a sound traffic management plan and strictly enforce existing traffic rules and regulations

Noise Level

IMPACT:

Reduction in the levels of noise along the existing Pan-Philippine Highway *(Long-term, positive)*

The noise levels in urban areas along the Pan-Philippine will be reduced as a result of the diversion of thru traffic to the newly constructed bypass route

ENHANCEMENT:

- To further improve the level of noise along the existing Pan-Philippine Highway to permissible limits, LGUs with relatively high local traffic volume (i.e. Plaridel, San Rafael, Gapan, Gapan, Sta. Rosa, Cabanatuan City, and San Jose City) will implement a sound traffic management plan and strictly enforce existing traffic rules and regulations

Socio-Economic Environment

IMPACT:

Possible illegal conversion of agricultural lands adjacent to the newly constructed bypass alignments *(Long-term, positive)*

Remaining productive agricultural lands adjacent to the newly constructed bypass may be subjected to illegal to conversion into other uses

MITIGATION:

- Bypass sections along prime agricultural areas will be on embankment, thus providing a natural barrier discouraging commercialization of areas fronting the newly constructed alignment; and
- The Municipal Council of the concerned municipalities will pass a resolution or zoning ordinance prohibiting the conversion of prime agricultural areas along the newly constructed bypass into any other uses

IMPACT:

Increase in land values of the of areas traversed by and in the vicinity of the bypass alignments *(Long-term, positive)*

Property owners of adjacent lands to the newly constructed bypass alignment will benefit from the significant increase in land values

MITIGATION:

- This is particularly true in sections immediately fronting service roads. Although the conversion of prime agricultural lands adjacent to the newly constructed bypass roads is illegal and ribbon-type of development is discouraged, property owners would still profit from the economic benefit that will accrue to each City/Municipality once it is traversed by a National Highway

IMPACT:

The newly constructed bypass routes will: *(Long-term, positive)*

- *ensure continuous flow of commodity;*
- *ease the traffic along the Pan-Philippine Highway, particularly in urban areas;*
- *reduce transport costs due to improved traffic flow;*

ENHANCEMENT:

- The DPWH will continuously keep its regular maintenance activities to ensure optimal service and benefits to the road users

IMPACT:

Increase in employment opportunities as a result of urbanization and commercial development of non-agricultural and non-prime agricultural areas *(Long-term, positive)*

ENHANCEMENT:

- The respective Municipal Government of the areas traversed by the alignment will ensure that qualified members of the host community are given first priority in hiring of local labor force; and
- The respective municipalities will work hard towards achieving the development plans

Chapter 6

Environmental Management Plan

6 ENVIRONMENTAL MANAGEMENT PLAN

6.1 CONSTRUCTION CONTRACTOR'S ENVIRONMENTAL PROGRAM

A Construction Contractor's Environmental Program is not available at this point since the Detailed Engineering Design phase is still on-going. Nevertheless, rules, regulation and conditions stipulated in the Environmental Compliance Certificate (ECC) must be incorporated in the contract between the Proponent and whoever will be selected as Constructors. Nevertheless, **Clause 19** of the **DPWH Bid Documents Volume II,** states that the "*Contractors shall comply with the measures given in the Environmental Compliance Certificate*" issued by the Environmental Management Bureau (EMB). A copy of the said Clause is attached as **Appendix I**.

6.2 RESETTLEMENT ACTION PLAN

6.2.1 Project Affected Persons (PAPs)

Based on the socioeconomic survey undertaken from **17 July** to **05 September 2001**, there are a total of **210** project affected persons (PAPs). **Table 6.2-1** shows the distribution of project affected persons and public infrastructure facility by barangay. As shown in the table, **Brgy. Bonga Menor, in Bustos** with **67 PAPs** has the most number of affected PAPs, followed by **Tiaong** in Guiguinto with **38**, and **Malamig,** also in Bustos with **16**.

Table 6.2-1 Distribution of PAPs by Barangay

Municipality	Barangay	Number PAPs
Balagtas	Borol 2nd	4
	Sub - Total 1	*4*
Guiguinto	Tiaong	38
	Cutcut	15
	Sub - Total 2	*53*
Plaridel	Bulihan	14
	San Jose	11
	Sub - Total 3	*25*
Bustos	Cutcut	1
	Camachilihan	8
	Talampas	5
	Malamig	16
	Bonga Menor	67
	Sub Total	*97*
San Rafael	Tambobong	1
	Caingin	14
	San Roque	15
	Maguinao	1
	Sub - Total 4	*31*
	Total	**210**

The project-affected persons (PAPs) and families (PAFs) come from the following host barangays: Barangay **Burol 2nd** in Balagtas, **Tiaong** and **Cutcut** in Guiguinto, **Bulihan**, **San Jose**, and **Parulan** in Plaridel, **Camachilihan**, **Talampas**, **Malamig**, and **Bonga Menor** in Bustos, and **Tambobong**, **Caingin**, **San Roque**, and **Maguinao** in San Rafael. Three (3) main groups of PAPs were identified. These are the following:

(i) Landowners;

(ii) Tenants of the landowners; and

(iii) Improvement (houses, trees, crops, fences) owners or occupants who will be displaced because of the construction of the Bypass

Impact on Land

Impact on land would mainly be in terms of loss of residential lots, agricultural crops such as, rice and vegetables. It is important to note that names of landowners and lot numbers reflected in the cadastral maps at the respective Assessor's Office of each municipality do not match the names of the landowners obtained through interviews. As in other towns with vast agricultural lands, the discrepancy may have resulted from the partitioning of these lands into smaller parcels, either due to a natural course of action (e.g., subdivision of lots among the heirs of deceased persons), or as mandated by law (i.e., Comprehensive Agrarian Reform Law), which, were not properly updated in the records of the respective Register of Deeds. As such, a need to conduct **parcellary survey** prior to finalization of the Plan is deemed important.

Impact on Structures and Improvements

Losses to the PAPs would be in terms of the need to demolish their houses and small sari-sari stores. The number of affected structures and types of material the dwellings are made of are given in **Table 6.2-2**. The table shows that most of the materials used for building these houses are concrete **(44.3%)** and semi-concrete **(30.4%)**.

Table 6.2-2 Number and Type of Structure of PAPs' Dwelling Units to be Affected

	Type of Structure								
Municipality/Brgy.	**No. of structures**	**Light**	**%**	**Wooden**	**%**	**Semi-Concrete**	**%**	**Concrete**	**%**
Guguinto									
Tiaong	26	2	7.7	2	7.7	13	50.0	9	34.6
Cutcut	10	1	10.0	1	10.0	-	-	8	80.0
Plaridel									
Bulihan	5	-	-	-	-	2	40.0	3	60.0
San Jose	1	-	-	-	-	1	100.0	-	-
Bustos									
Camachilihan	1					1	100.0		
Malamig	3			1	33.3			2	66.7
Bonga Menor	52	5	9.6	11	21.2	13	25.0	23	44.2
San Rafael									
Caingin	7	1	14.3	3	42.9	2	28.6	1	14.3
San Roque	10	1	10.0	1	10.0	3	30.0	5	50.0
TOTAL	**115**	**10**	**8.7**	**19**	**16.5**	**35**	**30.4**	**51**	**44.3**

Out of the 210 PAPs only **115** would be losing the structures they are occupying. When asked about the ownership of the structures they occupy, **90.9%** of the PAPs stated that they own the houses they dwell in; only a few occupy the structures as sharer, renter, or free of charge (Please see **Table 6.2-3**).

Table 6.2-3 Structure Ownership of PAPs

Municipality/Barangay	Tenure					
	Owner	**%**	**Renter**	**%**	**Free Occupation with Permit**	**%**
Guiguinto						
Tiaong	23	92.0	-	-	2	8.0
Cutcut	9	100.0	-	-	-	-
Plaridel						
Bulihan	3	60.0	-	-	2	40.0
San Jose	1	100.0	-	-	-	-
Bustos						
Camachilihan	1	100.0	-	-	-	-
Malamig	3	100.0	-	-	-	-
Bonga Menor	50	92.6	3	5.6	1	1.9
San Rafael						
Caingin	10	90.9	-	-	1	9.1
San Roque	10	83.3	2	16.7	-	-
TOTAL	**110**	**90.9**	**5**	**4.1**	**6**	**5.0**

Aside from the houses and fences that will be affected, fruit trees that will be cut were also inventoried. A list of the number of fruit trees that will be cut during the pre-construction period is presented in **Table 6.2-4** in terms of ownership by the PAPs.

Table 6.2-4 Trees to be Cut Along the Alignment		
Municipality/Brgy.	**No. of Fruit Trees**	**No. of Forest Trees**
Balagtas		
Borol 2nd	8	10
Guiguinto		
Tiaong	156	55
Cutcut	37	2
Plaridel		
Bulihan	50	2
San Jose	56	24
Bustos		
Camachilihan	24	9
Talampas	6	1
Malamig	64	23
Bonga Menor	49	1,004
San Rafael		
Tambobong	5	-
Caingin	58	55
San Roque	457	30
Sub – Total 5	*520*	*85*
Total	**970**	**1,215**

6.2.2 Resettlement Plan for Landowner-PAPs

The following summary of R-O-W Acquisition Procedures (Purchase Option), based on **Republic Act 8974** of 2000 and the **DPWH Ministry Order No. 65**, Series of 1983, entitled, "Revised guidelines on the acquisition and payment of right-of-way for public works and highways projects".

Step 1: For negotiated sale, a **Contract of Sale** is executed between the Government (vendee) and the property Owner (vendor).

Step 2 When a project is already approved for implementation during a specified calendar year, the officials in charge with the R-O-W acquisition shall immediately gather all tax declarations and the corresponding sworn statements of owners relative to all lots and improvements affected by such construction.

Step 3 The owners of the property shall be notified in writing, and the just compensation **to** be paid for the affected properties shall be based on the_Standards for the Assessment of the Value of the Land as provided for in Section 5 of R.A. 8974, namely:

(i) The classification and use for which the property is suited;

(ii) The developmental costs for improving the land;

(iii) The value declared by the owners;

(iv) The current selling price of similar lands in the vicinity;

(v) The reasonable disturbance compensation for the removal and/or demolition of certain improvement on the land and for the value of improvements thereon;

(vi) The size, shape, location, tax declaration and zonal valuation of the land;

(vii) The price of the land as manifested in the ocular findings, oral; as well as documentary evidence presented; and

(viii) Such facts and events to enable the affected property owners to have sufficient funds to acquire similarly-situated lands of approximate areas as those required from them by the government, and thereby rehabilitate themselves as early as possible

Step 4 The **Deed of Sale** is prepared.

Requirements and Conditions to be Complied With in the Preparation of the Deed of Sale:

(i) If the subject property is registered or titled, the vendor must be the registered owner of the said property and must possess a clear and clean title under the *Torrens System*, free of any lien and encumbrances whatsoever. A photocopy of the title forms part of the Deed;

(ii) If the subject property is unregistered or untitled, the vendor must submit a certified true copy of the tax declaration and an indemnity bond, which must either be a surety bond or property bond. Either of these bonds shall remain in force until the government obtained the corresponding title to the subject property;

(iii) If the owner of a property is a corporation, a certified copy of the resolution of the governing board of such corporation or partnership, authorizing any of its officers to execute the deed shall be attached to the said deed. In the case of a partnership, the managing partner should execute the deed;

(iv) If the owner is already deceased, the heirs must first consolidate their ownership of the property either thru court proceedings or thru an extra-judicial settlement, subject to the provisions of Rule 74 of the New Rules of Court;

(v) If the property is under guardianship or administratorship, approval by the proper court of the deed of sale executed by the guardian or administrator/executor must first be secured. The corresponding Letters of Administratorship and/or Guardianship should be submitted as an integral part of the Deed;

(vi) If the property being sold was acquired under the Public Land Act, the government shall be entitled to a twenty (20) meters strip free under Section 112 of CA 141, or sixty (60) meters strip under P. D. 635 (January 7, 1975);

(vii) If it appears that the property is subject to the provisions of Section 4 Rule 74 of the New Rules of Court and the period of two (2) years from the registration of the consolidation or settlement has not yet expired, an indemnity bond (either surety or property bond), conditioned for the payment of any adverse claim against the property filed within the said period of two (2) years, should be posted;

(viii) If the vendor is represented by an Attorney-In-Fact, the corresponding special power of Attorney should be attached to, and made an integral part of the deed of sale. If the vendor is residing abroad at the time of the sale, such special power of attorney should be duly attested by the Philippine Consulate of the country where the vendor resides;

(ix) Where the subject property is mortgaged, the consent of the mortgagee to sale of the said property, or release of the mortgage must first be secured;

(x) If the property is a conjugal property, a deed of conveyance or sale must be executed in the proper form by the parties concerned, specifically describing the property to be sold. The marital consent of the spouse of the owner-vendor should generally be indicated in the deed; the deed of conveyance must be witnessed by at least two persons and if the vendor affixed his signature by thumb mark, same should be witnessed by two additional persons;

(xi) All Realty Estate taxes due on the property must have been paid as evidenced by a tax clearance certificate issued by the proper authority;

(xii) The accountant concerned should also witness the contract, and his signature shall be considered as constituting a certification that funds for the purpose is available (LOI 968);

(xiii) The papers and documents submitted in support of the claim in every case should be carefully verified as to their authenticity and genuineness in order to forestall fraud

Step 5 A **certificate as to the availability of funds** in the proper form, duly verified by the Auditor concerned, indicating the particular source and nature of the funds to be used in payment of the **consideration** of the sale, must be secured and attached to the Deed (Section 607, Revised Administrative Code and Section 86 of P. D. 1445);

Step 6 The Right-of-Way Engineer, in addition to verifying the ownership of the lot to be purchased, as well as any encumbrances to which such lot may have been subjected to, should likewise **verify and inspect the actual lot to be purchased** to **determine** whether the classification made by the Assessor is in accordance with the actual use of the property (Section 19, P. D. 464). A certification to this effect should be issued by the Right-of-Way Engineer;

Step 7 The Deed of Sale is **signed** by the Owner of the property, the District Engineer/Project Manager/ and or Regional Director

Step 8 The signed Deed of Sale is brought to the DPWH for **approval** of the Secretary

Step 9 Approved Deed of Sale is then **registered with the Register of Deeds** of the **Nueva Ecija** or at the **City of San Jose** where the property is located. The title of the property shall be annotated at the back if only a portion of the property is purchased by the government. If the whole property was purchased by the government, the old title will be cancelled and a new one shall be issued to the government.

Step 10 Payment of Claims

Conditions/Requirements Prior to Release of Payment

(i) Payment of lots should be effected only after the corresponding Deed of Sale had already been registered with the Register of Deeds concerned and *Torrens Title* to the subject lot is already vested in the name of the government. For parcel of lands partially affected, payments should be effected only after the corresponding Deed of Sale had already been annotated at the back of the title of the subject lot;

(ii) If the Deed of Conveyance was not signed by the owner but was signed by his duly and legally constituted agent, the owner should also be notified in writing of the amount due him as payment of his property. Accordingly, the treasury warrant or check for the payment of said property should be drawn in favor of the registered owner;

(iii) Officials or employees responsible for releasing checks or warrants should require positive identification of the payee before releasing these checks or warrants;

Note: District/City and Regional Offices as well as Project Management Offices of the DPWH shall ***act on the claim within forty eight (48) hours*** *from the time of receipt. Should there be no sufficient funds to pay all claims presented with complete documents and ready for payment, the smaller claims should be given priority in payment; and in case the amount of claim are equal, priority of payment shall be based on the period/date the property/lot was taken by the government.*

6.2.3 Resettlement Plan for Structure Occupants/Owners, Informal Settlers

Applicable Policies

There are two legal frameworks that can be used in describing the resettlement plan for structure owners/occupants and informal settlers. These are the:

(i) DPWH's Policy Framework for Land Acquisition, Resettlement, and Rehabilitation

(ii) Republic Act 7279 (Urban Development and Housing Act of 1992)

DPWH's Policy Framework for Land Acquisition, Resettlement, and Rehabilitation (LARR)

Some of the salient points of the LARR Policy are included here for reference. These are:

(i) All Project Affected Persons (PAPs) residing in, working, doing business, or cultivating land, or having rights over resources within the project area as of the date of the census surveys (Cut-off Date) are entitled to compensation for their lost assets, incomes, jobs and businesses at replacement cost;

(ii) In cases when the remaining assets of a PAP are not viable for continued use, he will be entitled to full compensation for the entire affected assets;

(iii) When payment is made for an **agricultural land** acquired by the DPWH, the landowner will be exempted from capital gains tax on the compensation paid to him; In addition, other expenses such as registration fee, transfer taxes, documentary stamp tax, and notional fees will be paid by DPWH for property transfers made through land acquisition;

(iv) Replacement agricultural land, premise/business plot will be as close as possible to the land that was lost and/or acceptable to the PAPs;

(v) All replacement land for agriculture, residential, and business will be provided with secured tenure status and without any additional cost, taxes, surcharge to the PAPs at the time of transfer;

(vi) The previous level of community services and access to resources will be maintained or improved after the resettlement;

(vii) The general mechanism for compensation of lost **residential** and **commercial** land will be through land-for-land or cash compensation at replacement cost.

(viii) Tenants are entitled to assistance to transfer to a new location

Urban Development and Housing Act of 1992 (RA 7279)

One of the main objectives of this act is to *"Provide decent shelter to the underprivileged and homeless citizens in urban areas and resettlement areas whose lives are generally marked by economic insecurities and whose occupancy of land is uncertain"*. As such, several guidelines were enacted by various government agencies such as the Housing and Land Use Regulatory Board (HLRB), Housing and Urban Development Coordinating Council (HUDCC), National Housing Authority (NHA), Land Management Bureau (LMB) and the National Mapping and Resource Information Authority (NAMRIA).

One of such is the guideline, which directed all city and municipal governments to conduct an inventory of lands and identify sites for socialized housing. Under the same Act, potential socialized housing program beneficiaries must first register with the Barangay Registration Committee (BRC) in their respective areas. It should be noted however, that not all informal settlers are entitled to be resettled in these areas. The following qualifications make applicants eligible to be included in the Master List of Underprivileged and Homeless Citizens:

(i) Must be the head of the family

(ii) Must be a Filipino citizen of legal age;

(iii) The combined family income must fall within the NEDA-defined poverty threshold;

(iv) Must not own any real property whether in the urban or rural areas and must not have been a beneficiary of any government housing program except those in leasehold or rental arrangements; and

(v) Must not be a professional squatter nor a member of a squatting syndicate

Compensation and Entitlements

For Farmer-Land Owners of Agricultural Land

Farmers who are title holders are entitled to cash compensation for lost land at replacement cost. In cases where more than 25% of the land holding is needed, or if the remaining land becomes economically unviable, the owner is entitled to full compensation for the entire affected assets at replacement cost.

"Land-for-Land" compensation can also be arranged, depending on the preference of the landowner. For this option, the new parcel of land should have equivalent productivity, free of taxes, registration, and transfer cost. The location should also be acceptable to the affected landowner and must have a long-term security of tenure.

For Farmer-Tenants of Agricultural Land

Under the DPWH LARR Policy, **Agricultural lessees** are entitled to ***"disturbance compensation"*** equivalent to five (5) times the average of the gross harvests on his landholding during the last five (5) years preceding calendar years for the land being acquired from them. **Tenants** are entitled to ***"financial assistance"*** equivalent to the average annual gross harvest for the past three (3) years but not less than P15,000.00.

For Residential and Commercial Land Owners

The titleholder will be entitled to cash payment or land-for-land compensation. The new replacement land must be of equivalent size, or at least a size acceptable to the owner, with adequate physical and social infrastructure. As in agricultural lands, replacement land would be free from taxes, registration, and transfer costs.

Where relocation is necessary, the DPWH in consultation with affected households may offer relocation option to fully developed resettlement sites, or alternative facilities to housing projects. The replacement land for resettlement will be provided in fixed plot sizes in accordance with existing zoning laws and practices. If the lost land is larger than the lot sizes for relocation, the affected landowner is entitled to receive a cash compensation to cover the difference.

For Residential Land Tenants/Renters

Residential tenants or renters are entitled to cash compensation equivalent to one (1) month rental allowance, and assistance in transferring to a new location. For tenants who built their own house, they will be entitled to be compensated in full for their affected house or structure, paid the transport allowance, and assisted in finding another site. The level of assistance will depend on the type of existing tenurial status of the affected communities.

For Crops and Trees Lost

Owners of trees lost shall be entitled to cash compensation calculated on the basis of type, age, and productive value of affected trees. For fruit-bearing trees, payment shall be based on tax declaration or schedule of values from the Office of the City/Municipal Assessor. For perennials of commercial value, valuation can be based on DENR schedule of valuation or concerned Appraisal Committee.

For Informal Settlers (Squatters)

Informal settlers or squatters who built their own house shall be entitled to compensation in full for their affected house or structure, without deduction for salvaged building materials. Professional squatters can collect salvaged materials but will not be entitled to receive compensation.

Conditions/Requirements Prior To Removal or Demolition of Improvements

(i) If the owner is willing to remove and transfer the building to another lot, then an Agreement to Demolish or Remove the Improvements should be executed at a consideration to be determined pursuant to P. D. 76 as amended.

(ii) The Agreement to Demolish or Remove the Improvements should be signed by both parties and approved by an Official of the DPWH

Payment of Improvements

The following documents must be submitted as part of the Claim:

(i) A certified true copy of tax declaration;

(ii) Certified true copy of sworn statement or a certification issued by the Assessor concerned attesting the failure of the owner to file such statement aside from the affidavit executed by the owner attesting the failure to file such sworn statement;

(iii) Tax Clearance from the Municipal/City Treasurer (Real Estate Taxes);

(iv) Picture of pictures of the improvements to be duly certified by the Project Engineer;

(v) Inspection report duly signed by the Project Engineer and the Auditor's representative; and

(vi) In case the improvements were introduced by the claimant on the land of another, the latter must execute a Quit Claim or Waiver of Claim to Improvements

Note: All Regional and District Engineering Offices must submit to the Assistant Secretary for Legal Affairs of the DPWH copies of Deeds of Sale and Agreements (for improvements), including other supporting papers. Likewise, the corresponding titles of said properties in the name of the government should be submitted and transmitted to the Records Management and Archives Office for safekeeping.

6.3 SOCIAL DEVELOPMENT PROGRAM (SDP)

The DPWH must support a Social Development Program (SDP) that will ensure that affected communities get compensated for the disturbance to their normal lives, not only in terms of monetary settlement for the damages. It is just fair that they be assisted so that the processing of payment due them can be expedited. Aside from these, DPWH must also make sure that the relocation plan is sustainable; i.e., aside from the basic amenities at the resettlement area, an alternative livelihood assistance program must be included.

6.3.1 The SDP-Beneficiaries

The criteria used for identifying beneficiaries who would be eligible to the SDP for this Project are those:

(i) whose primary occupation is farming; and

(ii) who do not have other means of livelihood.

These beneficiaries were screened from the **210** PAPs identified during the socioeconomic and perception survey. From this number, only **43,** or **20.5%** were found to be eligible SDP beneficiaries. Please note that during the conduct of the socioeconomic and perception survey, not all tenants were able to attend the scheduled interview, and so this number may still vary.

Table 6.3-1 shows the income status of these beneficiaries. It can be discerned fro this table that **28** PAPs, or **65.5%** are earning above Region 3's poverty threshold **(P71,034)** for a family of six (6), **6 or 14.0%** earn between the food and the poverty threshold, and **9** or **20.9%** are below the food threshold.

Table 6.3-1 Income of Target SDP-Beneficiaries

	<P39,239		P39,239 to P71,304		>P71,304	
	No.	%	No.	%	No.	%
Balagtas						
Borol 2nd	-	-	-	-	-	-
Guiguinto						
Tiaong	1	20.0	1	20.0	3	60.0
Cutcut	1	20.0	2	40.0	2	40.0
Plaridel						
Bulihan	1	14.3	1	14.3	5	71.4
San Jose	1	11.1	2	22.2	6	66.7
Parulan	-	-	-	-	-	-
Bustos						
Camachilihan	1	100.0	-	-	-	-
Talampas	1	50.0	-	-	1	50.0
Malamig			-	-	6	100.0
Bonga Menor	2	33.3	-	-	4	66.7
San Rafael						
Tambobong	1	100.0	-	-	-	-
Caingin	1	100.0	-	-	-	-
San Roque	-	-	-	-	-	-
Maguinao	-	-	-	-	-	-
Grand Total	**9**	**20.9**	**6**	**14.0**	**28**	**65.1**

6.3.2 Employment Opportunities and Livelihood Assistance

Employment Opportunities

Based on the socioeconomic and perception survey conducted, about **79.3%** of the target male beneficiaries have skills in construction activities (Please refer to **Table 6.3-2**). Qualified, *bonafide*, residents of the Direct Impact Areas must be given first priority in hiring during the pre-construction and construction stage of the project.

Table 6.3-2 Skills of Male Target SDP Beneficiaries

	Manufacturing		Construction		Driving & Mobile Machinery Operation	
	No.	%	No.	%	No.	%
Balagtas						
Borol 2nd	-	-	-	-	-	-
Guiguinto						
Tiaong	-	-	-	-	3	100.0
Cutcut	1	50.0	-	-	1	50.0
Plaridel						
Bulihan	1	33.3	-	-	2	66.7
San Jose	-	-	2	33.3	4	66.7
Parulan	-	-	-	-	-	-
Bustos						
Camachilihan	1	50.0	-	-	1	50.0
Talampas	-	-	-	-	-	-
Malamig	3	33.3	2	22.2	4	44.4
Bonga Menor	-	-	-	-	2	100.0
San Rafael						
Tambobong	-	-	-	-	-	-
Caingin	-	-	1	50.0	1	50.0
San Roque	-	-	-	-	-	-
Maguinao	-	-	-	-	-	-
Grand Total	**6**	**20.7**	**5**	**17.2**	**18**	**62.1**

If the proposed relocation site for affected families is close to their present location, they can still continue with their existing source of livelihood. However, if the relocation site is far away from the community's main source of livelihood, technical training must be provided to the beneficiaries to equip them in acquiring alternative means of livelihood. It can be noted from **Table 6.3-3** that **30** or **69.8%** of the targeted SDP beneficiaries are in the productive age, which is between 15 to 65 years old. This shows that majority is very much capable of undergoing various training activities

Table 6.3-3 Age Composition of Target SDP-Beneficiaries

	Non – Productive Population (<15 or >65 years old)		Productive Population (15 – 65 years old)	
	No.	**%**	**No.**	**%**
Balagtas				
Borol 2nd	-	-	-	-
Guiguinto				
Tiaong	1	20.0	4	80.0
Cutcut	1	20.0	4	80.0
Plaridel				
Bulihan	3	42.9	4	57.1
San Jose	6	66.7	3	33.3
Parulan				
Bustos				
Camachilihan	-	-	1	100.0
Talampas	-	-	2	100.0
Malamig	1	16.7	5	83.3
Bonga Menor	1	16.7	5	83.3
San Rafael				
Tambobong	-	-	1	100.0
Caingin	-	-	1	100.0
San Roque	-	-	-	-
Maguinao	-	-	-	-
Grand Total	**13**	**30.2**	**30**	**69.8**

Among the target female beneficiaries, the result of the survey showed that most of the available skills are cooking and manufacturing (Please see **Table 6.3-4**).

Table 6.3-4 Skills of Female Target SDP-Beneficiaries

	Manufacturing		Cooking	
	No.	%	No.	%
Balagtas				
Borol 2nd	-	-	-	-
Guiguinto				
Tiaong	5	83.3	1	16.7
Cutcut	1	50.0	1	50.0
Plaridel				
Bulihan	2	100.0	-	-
San Jose	2	28.6	5	71.4
Parulan	-	-	-	-
Bustos				
Camachilihan	1	100.0	-	-
Talampas	2	100.0	-	-
Malamig	1	33.3	2	66.7
Bonga Menor	2	50.0	2	50.0
San Rafael				
Tambobong	-	-	-	-
Caingin	1	100.0		
San Roque	-	-	-	-
Maguinao	-	-	-	-
Grand Total	**17**	**60.7**	**11**	**39.3**

Such being the case, it is deemed necessary that the female spouses are provided additional livelihood training activities so that they can help their husbands in augmenting their family income. These include:

(i) Livelihood Seminars on Dressmaking, Food Processing, Handicraft Making, and Crop Production Enhancement;

(ii) Productivity Skills Training; and

(iii) Gender Awareness and Self Enhancement Skills Development;

The DPWH, the LGUs, the DSWD, the NGOs operating in the area, and other concerned private entities must join hands in the realization of these proposed training programs. For example skills training in coordination with the Technical and

Educational Skills Development Administration (TESDA) can be arranged so that qualified beneficiaries may be able to avail of said trainings, without incurring too much cost on the part of the government.

6.4 WASTE MANAGEMENT AND DISPOSAL PLAN

The DPWH shall submit a waste management and disposal plan to the DENR for approval prior to the implementation of the project.

6.5 CONTINGENCY RESPONSE PLAN

During the construction of the Bypass, the Constructors must ensure that:

(i) Adequate warning signs, barricades, warning lights including traffic aides must be provided at all times during construction;

(ii) Vehicles for emergency cases are provided;

(iii) Ensure that all equipment are in good working condition;

(iv) The construction crew are using the required safety procedures/ methods and equipped with safety paraphernalia;

(v) Safety and emergency contingency programs are formulated and coordinate at all times; and

(vi) Ensure that temporary stockpiles are properly protected from re-suspension and dispersion and that construction spoils will be hauled to designated disposal sites

6.6 ABANDONMENT PLAN

Abandonment measures must be implemented after the construction activities. Upon completion of the project, all parties concerned, such as the DPWH, the DENR, and the LGUs must inspect the area to check if:

(i) Temporary structures, if not usable anymore are dismantled, and stockpiled materials are properly disposed of;

(ii) Interrupted power and water service connections, and irrigation canals are properly re-installed or re-commissioned, and in the usual functioning condition;

(iii) Construction equipment and used materials are transported back to the contractors; and

(iv) Temporary camp of the construction workers and facilities are cleared of debris

6.7 ENVIRONMENTAL MONITORING PROGRAM

6.7.1 Monitoring Activities

The following activities will be monitored during the **Construction Phase**:

(i) Implementation of approved plan/program on structural, drainage, waste disposal, TSP control, noise pollution control, tree cutting, etc.;

(ii) To minimize the dust build-up, water trucks equipped with water spraying equipment must be on stand-by;

(iii) Water quality along the waterways. Following parameters may be monitored: BOD, TSS, and oil and grease particularly at bridge sites;

(iv) Compliance to occupational health and safety regulations by the Constructor must be regularly monitored (i.e., if all equipment are in good working conditions, or if workers are equipped with safety gears at job sites);

(v) To achieve waste reduction, suitable surplus excavation of filling materials onsite will be reused (except for unsuitable materials) as well as recovery and reuse of scrap lumber, metal and concrete; and

(vi) Regular inspection of the sanitary conditions at worker camps to prevent the spread of diseases

Since the Bypass Project will be constructed in two (2) stages, the following must be monitored during the Operation Phase of Stage 1:

(i) That areas that have been acquired by the government (i.e., for Stage 2 construction) must be FREE of informal settlers, or any other structures

(ii) That adjacent prime agricultural lands are NOT illegally converted to other non-agricultural uses; and

(iii) That dust resuspension is minimized by using water trucks equipped with water spraying equipment, particularly during earthmoving activities;

(iv) Adequacy and reliability of safety features such as signal lights and other traffic signs to minimize roadside frictions involving vehicular and pedestrian traffic, particularly at Type A and B intersections;

(v) Maintenance of the road, bridge which includes the pavement, drainage system, embankments; this will be the responsibility of DPWH; and

(vi) Tree planting and its maintenance on both sides of the highway and on designated open areas

6.7.2 The Multi-Partite Monitoring Team (MMT)

As stipulated in DAO 96-37, a Multi-Partite Monitoring Team (MMT) must be formed immediately after the issuance of the Environmental Compliance Certificate (ECC). The main goal of the MMT is to monitor the DPWH as well as the Constructor's compliance to the ECC conditions, the Environmental Management Plan (EMP), and other applicable laws, rules, and regulations. In addition to these, the MMT shall also:

(i) Gather relevant data to determine possible causes of unavoidable and residual adverse impacts and validity of public complaints or concerns about the project; and

(ii) Prepare, integrate, and disseminate monitoring reports and submit recommendations to the DENR

MMT Composition

Since the project area covers a relatively long stretch of alignment, it is recommended that two **(2) MMTs** are organized, one for the Balagtas-Plaridel sections, and the other one for the Bustos-San Rafael section. The following are proposed to be included as members of the MMTs for the Balagtas-Plaridel Section:

- Concerned CENRO as Chairperson
- Municipal Planning and Development Coordinators of Plaridel, Guguinto, and Balagtas
- Barangay Captains of Bulihan, San Jose, Parulan, Tiaong, Cutcut, and Borol 2nd;
- Representative from the DPWH-Bulacan 2nd Engineering District
- Representative from an NGOs/POs operating in the area
- Representative from the women sector

For the Bustos-San Rafael Section, the following are proposed to be members of the MMT:

- Concerned CENRO as Chairperson
- Municipal Planning and Development Coordinators of San Rafael and Bustos
- Barangay Captains of Camachilihan, Talampas, Malamig, Bonga Menor, Tambobong, Caingin, San Roque, and Maguinao.
- Representative from the DPWH-Bulacan 2nd Engineering District
- Representative from an NGOs/POs operating in the area
- Representative from the women sector

6.7.3 Environmental Monitoring Matrix

Table 6.7-1 shows the proposed Environmental Monitoring Program for the implementation of the proposed Plaridel Bypass Alignment.

Table 6.7-1 Environmental Monitoring Program

Parameters to be Monitored	Stations to be Monitored	Frequency of Monitoring	Methods of Analysis/Execution	DENR Standard	Implementor
CONSTRUCTION PHASE					
PHYSICAL					
Water Quality BOD, TSS, and oil and grease of surface water	All major bridge sites, RCBC, and RCPC sites	Quarterly during construction	Standard EMPASS-EQD water quality analysis.	*Class "C"* **BOD - <10 mg/L** **TSS- <30 mg/L increase** **Oil & Grease - <3mg/L**	DENR
BIOLOGICAL					
Tree Cutting	Entire alignment where there are trees to be cut	Daily	Monitoring team must ensure that tree cutting is limited within the required ROW only	N. A.	MMT
Waste management and disposal	All portions with excavation and fill activities	Weekly during construction	Site inspection	Based on EMP	DENR
SOCIAL					
Compliance of Contractor to occupational health and safety rules and regulation	All construction areas	Weekly	Site inspection of work areas including sanitation facilities	Based on EMP	MMT
Road Safety	Signalized intersections, merging lanes	Quarterly	Site inspection	Based on DPWH Standard Operating Procedures	DPWH
OPERATIONAL PHASE					
BIOLOGICAL					
Tree planting and its maintenance on both sides of the highway, and possibly at areas designated for Stage 2 construction	Designated environmental belts/zones, and R-O-W for Stage 2 construction	Monthly	Site inspection	Based on EMP	DENR MMT
SOCIAL					
Informal settling/squatting	Acquired R-O-W for Stage 2 Construction	Weekly	Site inspection	Based on EMP	LGUs, MMT
Illegal conversion of prime agricultural land	Areas adjacent to the Bypass	Weekly	Site inspection	Based on EMP	LGUs, MMT
Road condition	Bypass road, bridge, including pavement, drainage system, embankments	Based on standard DPWH maintenance procedures	Standard DPWH road and bridges maintenance works	Based on DPWH Standard Operating Procedures	DPWH

6.8 INSTITUTIONAL PLAN

The institutional plan that will be implemented during project implementation of the project is presented in **Figure 6.8-1.**

6.9 INFORMATION, EDUCATION, AND COMMUNICATION (IEC) PROGRAM

IEC Programs shall be conducted in five (5) stages namely (i) Pre-EIA Process; (ii) EIA Proper; (iii) Pre-Relocation Phase; (iv) Relocation Phase; and (v) Post-Relocation Phase.

6.9.1 Pre-EIA Process (COMPLETED)

This activity refers to the Social Preparation Process, wherein the DPWH, with assistance from the EIS Preparer conducts consultation meetings with the concerned LGUs. During a series of meetings, the proposed project is officially presented to the Municipal Officials, Barangay Officials, and finally to the communities to be affected.

It is also during these consultative meetings that the EIS Preparer explained to the stakeholders the EIA Process, the role of the DPWH as Proponent, the role of the DENR as the Environmental Manager, the role of the EIS Preparer, and their roles as Stakeholders.

Aside from the presentations, an Open Forum was also included to allow the stakeholders to air their queries, opinion, concerns, perceptions, and apprehensions with regards to the project being proposed.

6.9.2 EIA Proper (COMPLETED)

IEC during the EIA Proper refers to the participation of the DPWH in the Scoping Process. There are two levels of Scoping under the Philippine EIS System, namely the (i) 1st Level Scoping, and (ii) Formal Scoping Session.

The **1st Level Scoping** session was conducted at the DENR-EMB Office, where the DPWH officially presented the proposed bypass project to the prospective EIA Review Committee (EIARC) members. This was held on 28 May 2001.

The **Formal Scoping Session** was held on **23 June 2001** at the **Bustos Multi-Purpose Gymnasium in Bustos, Bulacan**. It was during the Formal Scoping Session that the results of the 1st Level Scoping was presented to the stakeholders for validation and comments. Issues and concerns of the stakeholders were also presented during this session.

6.9.3 Pre ECC Phase

The DENR, upon the recommendation of the EIARC shall schedule a **Public Hearing** to obtain the views and opinions of the general public with regards to the construction of the proposed Bypass.

6.9.4 Post-ECC Phase

Community Relations Operation

Before the actual relocation, the DPWH and the LGUs through the barangay officials shall undertake the following:

(i) Establish communication and rapport with recognized resident community leaders;

(ii) Meet the affected families to explain the government's shelter program, the need to relocate families, the procedures and guidelines on relocation and resettlement, objectives and schedule of the census and tagging operation;

(iii) Introduce the project team and census enumerators to the Barangay Captain and community leaders;

(iv) After the census, the LGU and/or the DPWH authorized to demolish shall meet the qualified families for resettlement to discuss, among others, the facilities and services in the resettlement projects, and the obligations and responsibilities of the affected families;

(v) A written 3-month notice shall be issued to the affected persons or entities by the LGU or DPWH authorized to demolish together with the representative of the Presidential Commission on Urban Poor. It shall be served to and received by the addressee personally. Should the concern person refuse to acknowledge the notice, the same shall be affixed to the addressee dwelling; and

(vi) Before actual demolition, the LGU or DPWH authorized to demolish shall preside over the consultation meetings to be attended by the barangay chairman, the affected families, and the landowners or their duly designated representatives

Relocation Phase

(vii) The DPWH or LGU authorized to demolish shall issue notices of actual relocation to the affected families and shall furnish a copy of the schedule, three (3) days before relocation to the recipient LGU or the NHA.

Post Relocation Phase

(viii) Organized community-based structures shall be strengthened so as to facilitate the delivery of services in the area. The identified leaders with the assistance of the NGO shall be trained and equipped with proper organizational skills and attitudes necessary to effectively manage the affairs of the community.

(ix) To promote the general well-being of resettled families, adequate social services in health, nutrition, education, responsible parenthood, environmental sanitation, etc. shall be provided on the resettlement sites jointly or under the auspices of cooperating agencies such as, but not limited to the DECS, DOH, DSWD, and NGOs.

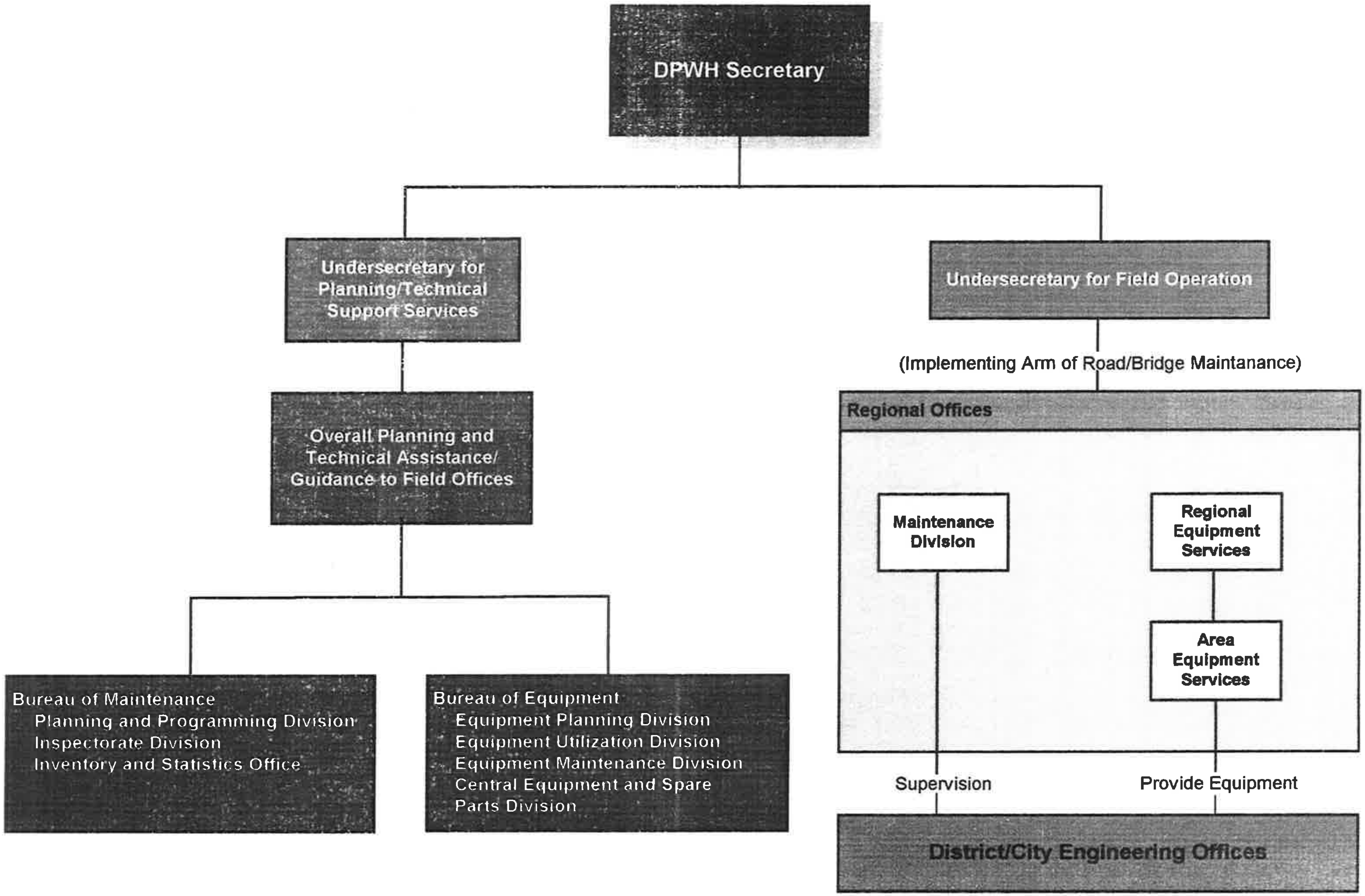


Figure 6.8-1 Institutional Plan - DPWH Organizational Setup for Bridge/Road Maintenance

Chapter 7

Engineering Geological and Geohazard Characterization

7 ENGINEERING GEOLOGICAL AND GEOHAZARD CHARACTERIZATION

7.1 PROJECT BACKGROUND

As agreed upon during a meeting with **Dr. Ricarte Javelosa** (Resource Person, EIARC) held in 20 August 2001 at the EMB Conference Room, the Proponent, through the EIS Preparer, ECOSYS Corporation will submit an Engineering Geological and Geohazard Characterization Report (EGGCR) as part of the EIS document. The said EGGCR will be in lieu of the regular EGGAR (Engineering Geological and Geohazard Assessment Report) requirement, as stipulated in DENR Administrative Order **(DAO)** Nos. **99-33** and **2000-28**, and as subsequently clarified by **Memorandum Circular 2000-21**.

The EGGCR for the San Jose Bypass, Cabanatuan Bypass, and Plaridel Bypass are integrated into one report, and is attached to this EIS as a separate volume.

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APPENDICES

Appendix A

Validation Letter of the Scoping Report

Republic of the Philippines
Department of Environment and Natural Resources
ENVIRONMENTAL MANAGEMENT BUREAU
DENR Compound, Visayas Avenue, Diliman, Quezon City 1116
Telephone: 925-47-93 to 97/928-12-15 Fax:927-15-18
"Visit us at http:\emb@psdn.org.ph\"

AUG 2 7 2001

Engr. Geronimo S. Alonzo
Project Manager III
Department of Public Works and Highways
Project Management office for Feasibility Studies
DPWH Region IV-B Compound, EDSA, Quezon City

Dear Engr. Alonzo,

This has reference to the submission of the Scoping Report for the proposed Plaridel, Cabanatuan, San Jose Bypass Road Project.

After review and evaluation of the above submitted scoping report incorporating the results of the consltative meetings, you may commence with the conduct of the EIA study taking into consideration all the issues raised as reflected in the report. Once you have completed the EIS, you are to submit one copy to the EIA Division for procedural screening.

We trust we have guided you accordingly.

Very truly yours,

Reynaldo P. Alcances
EIA-Division Chief

Cc: Annabelle N. Herrera
ECOSYS Corporation
Tel. no. 430-8676

OFFICE OF THE PROJECT MANAGER
DATE: 9/17/

Appendix B

Agreed Upon Scope of Work To Be Included in the EIA Study

AGREED UPON SCOPE OF WORK TO B E INCLUDED IN THE EIS STUDY

Project Name: Proposed Plaridel Bypass Road (Under the JICA-Assisted Detailed Design Study on Upgrading of Inter-Urban Highway System Along the Pan-Philippine Highway)
Formal Scoping Session (Level II)
23 June 2001, 1:30 p.m., Bustos Multi-Purpose Gymnasium, Bustos, Province of Bulacan

Aspect	Issues	Raised During Level 1?	Stakeholders Who Raised the Issue/Concern	Method of Assessment
ENGINEERING DESIGN NG HIGHWAY	1. Gagawa ba ng barangay o access roads?	Y	Gulguinto: Cutcut Plaridel: Bulihan Bustos: Camachilihan, & Liciada San Rafel: Caingin	To be carefully studied and considered by the Engineering Design Team; Mitigation measures will be included in the EIS
	2. May bakod ba ang gagawing bypass	Y	Balagtas: Borol 2nd Guiguinto: Tiaong Plaridel: San Jose, & Bulihan Bustos: Camachilihan, Talampas, Liciada, & Bonga MenorSan Rafael: Caingin, & Maginao	
	3. Laiagyan ba ng poste ng ilaw ang bypass	N	Plaridel: Bulihan	
	4. Magkakaroon ba ng "soil" drilling" sa mga may stakang lupa?	N	San Rafael: Caingin	
	5. Ano ang lapad ng kalsada at vertical height ng mga underpass?	Y	Plaridel: Bulihan	
	6. Kailan sisimulan ang paggawa ng highway?	Y	Balagtas: Borol 2nd Plaridel: San Jose Bustos: Talampas, & Bonga Menor San Rafael: Caingin, & San Roque	
	7. Bakit iniwasan ng kalsada ang Green State Subdivision sa Tiaong gayong wala pa namang bahayan doon?	N	Guiguinto: Tiaong	

AGREED UPON SCOPE OF WORK TO B E INCLUDED IN THE EIS STUDY

Project Name: Proposed Plaridel Bypass Road (Under the JICA-Assisted Detailed Design Study on Upgrading of Inter-Urban Highway System Along the Pan-Philippine Highway)
Formal Scoping Session (Level II)
23 June 2001, 1:30 p.m., Bustos Multi-Purpose Gymnasium, Bustos, Province of Bulacan

Aspect	Issues	Raised During Level 1?	Stakeholders Who Raised the Issue/Concern	Method of Assessment
	8. Pwede pa bang ilipat ang kalsada sa Sta. Rita para konti lang ang tatamaang properties?	N	Guiguinto: Tiaong	To be carefully studied and considered by the Engineering Design Team; Mitigation measures will be included in the EIS
	9. Alin ang mas feasible at less costly, sa Greenfields o sa kabahayan dumaan ang kalsada?	N	Guigunto: Tiaong	
	10. Elevated ba ang opening ng kalsada sa Balagtas?	N	Balagtas: Borol 2nd	
	11. Bakit di gawing "box culvert" ang underpass kaysa "pipe"?	N	Balagtas: Borol 2nd Guiguinto: Cutcut Bustos: Liciada	
	12. Ano ang gagawin sa mga malalalim na lugar?	N	Balagtas: Borol 2nd Bustos: Talampas, Liciada, & Bonga Menor San Rafael: Caingin	
	13. Bakit di pa ilampas ang dulo ng project sa Cruz na Daan, San Rafael,trapik din doon.	N	Bustos: Camachilihan San Rafael: Caingin, & Maginao	
	14. Maari pa bang ilipat ang alignment para di mapinsala ang mga bahayan?	N	Balagtas: Borol 2nd Guiguinto: Tiaong San Rafael: Tambubong, & San Roque	
SOCIO ECONOMIC				
a. Pagbabayad sa Lupa at Improvements	1. May matatanggap ba at magkano ang ibabayad sa mga namumuwisan at manggagawa?	N	Balagtas: Borol 2nd Guiguinto: Cutcut Plaridel: San Jose, Bulihan Bustos: Talampas, & Liciada San Rafael: Caingin	In accordance with Philippine laws on R-O-W acquisition. Details will be specified in the EIS

AGREED UPON SCOPE OF WORK TO B E INCLUDED IN THE EIS STUDY

Project Name: Proposed Plaridel Bypass Road (Under the JICA-Assisted Detailed Design Study on Upgrading of Inter-Urban Highway System Along the Pan-Philippine Highway)
Formal Scoping Session (Level II)
23 June 2001, 1:30 p.m., Bustos Multi-Purpose Gymnasium, Bustos, Province of Bulacan

Aspect	Issues	Raised During Level 1?	Stakeholders Who Raised the Issue/Concern	Method of Assessment
	2. Ano ang basehan at magkano ang ibabayad sa mga lupang tatamaan?	Y	Balagtas: Borol 2nd Gulguinto: Cutcut Plaridel: San Jose, Bulihan Bustos: Talampas, Camachilihan, & Liciada San Rafael: Caingin, & Maginao	
	3. Pwede bang ilipat na lang ang bahay na matatamaan?	N	Plaridel: Bulihan Guiguinto: Tiaong	
	4. Babayaran din ba ang mga mapipinsalang bahay, poso, puno, at mga pananim?	Y	Guiguinto: Pulong Gubat, Cutcut Bustos: Talampas	
	5. Paano kung wala pang title o di pa na transfer ang title ng lupa?	N	Plaridel: San Jose, & Bulihan	
	6. Paano ang bayaran sa mga lupa na under land reform?	N	Plaridel: San Jose	For verification with the Department of Agrarian Reform (DAR) and Offices of the Provincial and City Assessor
	7. Paano ang bayaran sa mga may poultry, piggery, at palaisdaan?	N	Bustos: Liciada San Rafael: Caingin	In accordance with Philippine laws on R-O-W acquisition. Details will be specified in the EIS
	8. Ano ang mga requirements o papeles na kailangan para sa bayaran ng lupa?	N	Bustos: Talampas	
	9. Hindi sapat ang bayad ng gobyerno para makabili ng bagong lupa ang naapektuhan.	Y	Guiguinto: Tiaong Plaridel: Bulihan Bustos: Bonga Menor San Rafael: Tambobong, San Roque	
	10. Ibabawas na ba sa tax declaration pag ang lupa ay nadaanan ng highway?	N	Bustos: Bonga Menor	

AGREED UPON SCOPE OF WORK TO B E INCLUDED IN THE EIS STUDY

Project Name: Proposed Plaridel Bypass Road (Under the JICA-Assisted Detailed Design Study on Upgrading of Inter-Urban Highway System Along the Pan-Philippine Highway)
Formal Scoping Session (Level II)
23 June 2001, 1:30 p.m., Bustos Multi-Purpose Gymnasium, Bustos, Province of Bulacan

Aspect	Issues	Raised During Level 1?	Stakeholders Who Raised the Issue/Concern	Method of Assessment
b. Kapakanang Pangtao	1. Kapag nabili na ang lupa o bahay may malilipatan ba kami?	Y	San Rafael: Tambobong	In accordance with Philippine laws on R-O-W acquisition. Details will be specified in the EIS
	2. Saan dadaan ang magsasaka kung sakaling mahati ang sakahan?	Y	Balagtas: Burol 2nd Guiguinto: Cutcut Plaridel: Bulihan	To be carefully studied and considered by the Engineering Design Team. Results to be included in the EIS
	3. Baka mapinsala ang mga patubig na madadaanan ng highway	Y	Bustos: Camachilihan	To be included as part of the EIS mitigation measures
	4. Paano kung hindi pumayag magbenta ng lupa ang may-ari?	Y	Guiguinto: Tiaong Plaridel: San Jose Bustos: Camachilihan, Talampas, Liciada, Bonga Menor	In accordance with Philippine laws on R-O-W acquisition. Details will be specified in the EIS
	5. Pwede bang pumasok ng trabaho sa construction?	Y	Plaridel: BulihanBustos: Bonga Menor	To be included as part of the EIS recommendation
	6. Paano kung maliit na lang ang matitirang lupa na tinamaan ng highway?	Y	Guinguinto: Pulong Gubat Bustos: Liciada San Rafael: Tambubong	In accordance with Philippine laws on R-O-W acquisition. Details will be specified in the EIS
	7. Kapag nabili na ang lupa, bahay, at piggery, may malilipatan ba kami?	Y	San Rafael: Tambubong	
	8. Paano na ang mga squatters?	Y	Bustos: Bonga Menor	
	9. Bakit ang mga squatters lang ang pwedeng i-relocate	N	Guiguinto: Tiaong	
	10. Baka tamaan ang linya ng kuryente.	N	Guiguinto: Pulong Gubat Bustos: Bonga Menor San Rafael: San Roque	To be carefully studied and considered by the Engineering Design Team. Details will be included in the EIS as mitigation measures.

Appendix C

Certification From The PENRO of Bulacan

Republic of the Philippines
DEPARTMENT OF ENVIRONMENT & NATURAL RESOURCES
PROVINCIAL ENVIRONMENT & NATURAL RESOURCES OFFICE
San Pablo, Malolos, Bulacan
Tel. No. (044) 662-0434

RELEASED
DATE: 3/19/02

CERTIFICATION

This is to certify that the Proposed Plaridel Bypass section with alignment from Sta. 0+ 600.00 to Sta. 21+ 870.683 is determined to be outside proclaimed Protected Areas and is not covered by approved CADCs.

This certification is issued upon request of Ms. Annabelle N. Herrera, President and EIA Team Leader of ECOSYS corporation dated March 8, 2002 for the required document to the Environmental Impact Statement (EIS) for the Plaridel Bypass Section, a priority project of Department of Public Works and Highways.

Issued this 11th day of March 2002 here at DENR – PENRO – Malolos, Bulacan.

JUAN P. VERTUDES
PENRO

Cert. Fee ₱ 25.00
O.R. No. ____________
Date ____________

Appendix D

Municipal Resolutions Endorsing the Project

Municipality of Guinguinto

EXCERPTS FROM THE MINUTES OF THE REGULAR SESSION OF THE SANGGUNIANG BAYAN OF GUIGUINTO, BULACAN HELD LAST JANUARY 7, 2002, AT THE GEN. GREGORIO DEL PILAR HALL.

PRESENT:

Hon. JOSE A. JOSE . . . . .Vice-Mayor
Hon. Estrelita P. Aballa . . . . . .SB Member
Hon. Edgardo DC. Ramos. . . . . . . .SB Member
Hon. Cezar L. Mendoza . . . . .SB Member
Hon. Sharon L. Agustin. . . . . . . .SB Member
Hon. Danilo V. Santos . . . . .SB Member
Hon. Pedro DC. Ramirez . . . . . . .SB Member
Hon. Noel C Enriquez . . . . .SB Member
Hon. Edilberto C. Cruz . . . . . . .SB Member
Hon. Jesus V. Mendoza . . . . . . .SB Member-President Liga ng mga Barangay
Hon. Julius V. Figueroa . . . . . . .SB Member- President Mun. SK Federation

ABSENT: None

RESOLUTION NO. 001
Series 2002

RESOLUTION

ENDORSING THE PROPOSED PLARIDEL BYPASS PROJECT, UNDER THE JICA-ASSISTED DETAILED DESIGN FOR UPGRADING INTER-URBAN HIGHWAY SYSTEMS ALONG THE PAN-PHILIPPINE HIGHWAY

WHEREAS, in the consultation meetings held with the Municipal Mayor, Hon. Ambrosio C. Cruz, Jr., the Municipal Planning and Development Coordinator, Punong Barangays Celso Gonzales of Tiaong, Librado Osorio of Cut-Cut and Crispin Ventura of Pulong-Gubat and Public Hearings conducted with their respective constituents and stakeholders of the project all apprehensions and problems that was brought out has been considered and favorably acted upon;

WHEREAS, in the design of the proposed Bypass, service roads for the entire section that would traverse the Municipality of Guiguinto has been included unlike the three major highways that literally "cut" the Municipality;

WHEREAS, the said project is consistent with the programs, policies and future development plans of the Municipal Government and surely is beneficial to the Municipality;

NOW THEREFORE:

On motion of Coun. Pedro DC Ramirez duly seconded by Coun. Cezar L. Mendoza, Coun. Estrelita P. Aballa and Coun. Danilo V. Santos.

Be it **resolved**, as it hereby **resolved** to endorse the Proposed Plaridel Bypass Project, under the JICA-assisted detailed design for upgrading Inter-Urban Highway Systems along the Pan-Philippine Highway.

Resolve further to respectfully request that the word Guiguinto be included in the naming of the proposed project.

APPROVED.

Republic of the Philippines
Province of Bulacan
Municipality of Guiguinto
~~~~~~~~~~*~~~~~*

Office of the Secretary to the Sangguniang Bayan

Continuation Res. No.001-S-2002
Page 2

I hereby certify to the correctness of the above-mentioned resolution.

RUBEN LAN RAMIREZ
Secretary to the
Sangguniang Bayan

ATTESTED BY:

JOSE A. JOSE
Municipal Vice-Mayor

APPROVED:

AMBROSIO C. CRUZ, JR.
Acting Municipal Mayor

Municipality of Plaridel

Republic of the Philippines
Province of Bulacan
MUNICIPALITY OF PLARIDEL

OFFICE OF THE SANGGUNIANG BAYAN

EXCERPT FROM THE MINUTES OF THE REGULAR SESSION OF THE SANGGUNIANG BAYAN OF PLARIDEL, BULACAN HELD AT GERARDO A. SAN DIEGO HALL ON JANUARY 8, 2002

PRESENT: HON. ROLANDO C. JAVIER - MUNICIPAL VICE-MAYOR/PRESIDING OFFICER

SANGGUNIANG BAYAN MEMBERS

COUN. LEONILO I. YAP
COUN. FRANCISCO R. TAN
COUN. BENJAMIN P. SAN DIEGO
COUN. PAULINO R. BELL JR.
COUN. LORIE V. SURIO
COUN. ARMANDO M. MARCELO
COUN. CORNELIO G. SANTOS (ABC PRES.)
COUN. DONATO C. VALERIO JR. (SK PRES.)

ABSENT: COUN. PABLO L. MARQUEZ
COUN. JOSE FRANCISCO C. RIVERA

RESOLUTION NO 02-2002

"A RESOLUTION FAVORABLY ENDORSING THE PROPOSED JICA- ASSISTED INTER- URBAN HIGHWAY SYSTEM (PLARIDEL BY-PASS) A REQUISITE IN THE PREPARATION OF AN ENVIRONMENTAL IMPACT STATEMENT (EIS) AS REQUIRED BY DENR ADMINISTRATIVE ORDER (DAO) 96-37"

WHEREAS, at present, Traffic Congestion has been one of the main problem of the Municipal Government of Plaridel due to the ever-increasing number of motor vehicles that traverse along the main roads of the town proper as evidence of growth and prosperity among its constituency and the neighboring municipality;

WHEREAS, a diversionary road is deemed the best of the solution such as that of the proposed ~~JICA~~ Assisted Inter- Urban Highway System along the Philippine Highway (Plaridel by- Pass) project;

WHEREAS, in accordance with the DAO 96-37 a Municipal Council Resolution favorably endorsing a proposed project is a very strong indicator of that project's social acceptability which is one of the main criteria that the DENR puts into consideration before an Environmental Compliance Certificate (ECC) could be issued;

NOW THEREFORE on motion of SB Councilor Paulino R. Bell, Jr. and duly seconded by SB Councilor Benjamin P. San Diego and unanimously approved by all members present;

RESOLVED, as it is hereby resolved to approved the "Resolution Favorably Endorsing the proposed JICA Assisted Inter-Urban Highway System (Plaridel by- Pass) A Requisite in the Preparation of an Environmental Impact Statement (EIS) as Required by DENR Administrative Order (DAO) 96-37."

RESOLVED FURTHER, that copies of this Resolution forwarded to Mr. Anthony Abaya, Director Environmental Management Bureau, DENR, Visayas Avenue, Quezon City "Attention" Mr. Reynaldo F. Abanilos, Chief EIA Division and other officers concerned for their information, consideration and appropriate action.

APPROVED this 8th day of January 2002.
I HEREBY CERTIFY that this resolution has been approved by the Sangguniang Bayan.

ROMEO F. GARCIA
Secretary to the Sangguniang Bayan

ATTESTED:

ROLANDO C. JAVIER
Municipal Vice-Mayor/Presiding Officer

Municipality of San Rafael

Republic of the Philippines
Province of Bulacan
Municipality of San Rafael

OFFICE OF THE VICE MAYOR

January 7, 2002

Ms. ANNABELLE N. HERRERA
President
ECOSYS Corporation
#7 Getty St., Filinvest II,
Diliman, Quezon City

Dear Ms. Herrera :

Enclosed herewith is the Municipal Resolution No. 2001-137 approved by the members of the Sangguniang Bayan of San Rafael, Bulacan dated December 07, 2001, entitled :

"A RESOLUTION FAVORABLY ENDORSING THE PROPOSED JICA-ASSISTED INTER-URBAN HIGHWAY PROJECT KNOWN AS PLARIDEL-SAN RAFAEL BYPASS, A REQUISITE IN THE PREPARATION OF AN ENVIRONMENTAL IMPACT STATEMENT (EIS) AS REQUIRED BY DENR ADMINISTRATIVE ORDER (DAO) 96-37",

In this regard, rest assure we will be most cooperative on matters like this which is our common concern .

Very truly yours,

JULITO L. YULO
Municipal Vice Mayor

Republic of the Philippines
Municipality of San Rafael
Province of Bulacan
-oOo-

EXCERPT OF THE MINUTES OF MEETING OF THE SANGGUNIANG BAYAN OF SAN RAFAEL, BULACAN AT THEIR 22[nd] REGULAR SESSION HELD AT THE MUNICIPAL SESSION HALL ON DECEMBER 7, 2001.

PRESENT:

HON. JULITO L. YULO - - - - Municipal Vice Mayor
Presiding Officer

SANGGUNIANG BAYAN MEMBERS:

HON. PEDRO J. SEVILLA, JR.
HON. RINO V. CASTRO
HON. FRANCISCO G. VIOLA, JR.
HON. JULIE ANN DB. PAULINO
HON. ROSEMARIE I. AQUINO
HON. BERNABE D. VIOLAGO
HON. FLORANTE G. DAYRIT
HON. ANIANO P. SAMANIEGO
HON. ANGELITA V. VENTURINA

ABSENT:
HON. EDUARDO H. VASALLO - - SB Member

RESOLUTION NO. 2001-137

"A RESOLUTION FAVORABLY ENDORSING THE PROPOSED JICA-ASSISTED INTER-URBAN HIGHWAY SYSTEM PROJECT KNOWN AS PLARIDEL-SAN RAFAEL BYPASS, A REQUISITE IN THE PREPARATION OF AN ENVIRONMENTAL IMPACT STATEMENT (EIS) AS REQUIRED BY DENR ADMINISTRATIVE ORDER (DAO) 96-37".

WHEREAS, recent years economic growth brought a sharp increase of road traffic in areas within the economic influence area of Metro Manila including San Rafael and neighboring municipalities;

WHEREAS, a diversionary road is deemed the best of solutions such as that of the proposed JICA - Assisted Inter - Urban Highway System along the Pan - Philippine Highway (PLARIDEL BYPASS) which will start at NLEX Burol 1[st] Balagtas, Bulacan and extended for about 21.989 km at Brgy. Maguinao, this municipality;

WHEREAS, the proposed PLARIDEL BYPASS is consistent with the Municipal Development Plans particularly the Comprehensive Land Use Plan which is one of the main criteria which the DENR puts into consideration before an Environmental Compliance Certificate (ECC) could be issued in accordance with the DENR Administrative Order No. 96-37 and Presidential Decree No. 1586;

NOW THEREFORE, upon motion of **Hon. RINO V. CASTRO/Hon. PEDRO J. SEVILLA, JR.** duly seconced by **BERNABE D. VIOLAGO** and unanimously approved by all Sangguniang Bayan members present; it is

RESOLVED as it is hereby RESOLVED, by this August body now assembled and in session to approve " A RESOLUTION FAVORABLY ENDORSING THE JICA - ASSISTED INTER - URBAN HIGHWAY SYSTEM PROJECT KNOWN AS PLARIDEL-SAN RAFAEL BYPASS, IN THE PREPARATION OF AN ENVIRONMENTAL IMPACT STATEMENT (EIS) AS REQUIRED BY DENR ADMINISTRATIVE ORDER (DAO) 96-37";

RESOLVED FURTHER, that a "Line of Trees" be requested to be installed along the Plaridel Bypass Highway System in order to promote the "Greening Project" of the present Municipal Administration;

RESOLVED FINALLY, that copies of this Resolution be forwarded to Mr. ANTHONY ABAYA, DENR, Environmental Management Bureau, DENR, Visayas Avenue, Quezon City, "Attention" Mr. REYNALDO P. ALEANCES, Chief EIA Division, Mr. JOVITO V. SAGUINSIN, Provincial ENRO, Province of Bulacan and other offices concerned for their information, consideration and appropriate action.

UNANIMOUSLY APPROVED.

I hereby certify that this resolution has been duly approved by the Sangguniang Bayan of San Rafael, Bulacan.

LOLITA R. GALVEZ
Acting Sangguniang Bayan Secretary

ATTESTED:

HON. ANIANO P. SAMANIEGO
Sangguniang Bayan Member
Temporary Presiding Officer

APROVED: December 7, 2001

HON. JAIME Y. VICEO, JR.
Municipal Vice Mayor

Appendix E

Accountability Statement of EIS Preparers

ACCOUNTABILITY STATEMENT OF EIA PREPARERS

This is to certify that all data or information contained in the enclosed **Environmental Impact Statement (EIS) for the Proposed Plaridel Bypass Project** are true to the best of our knowledge and information, and that an objective and thorough assessment of the project was undertaken in accordance with the dictates of reasonable and sound judgement. Should we learn of any information which would make the enclosed EIS inaccurate, we shall bring said information to the attention of the Department of Environment and Natural Resources Environmental Management Bureau (DENR – EMB).

We hereby bind ourselves jointly and solidarily to answer any penalties that may be imposed for any misrepresentations or failure to state material information in the enclosed EIS.

In witness whereof, we hereby set our hands this OCT 26 2001 day of ________________ at QUEZON CITY.

ANNABELLE N. HERRERA
Team Leader and
Social Preparation & Public Participation Specialist

Name	Signature
Felicia G. Rubianes *Deputy Team Leader*	
Carlo D. Dayanghirang *Geologist*	
Evangeline Enriquez *Biologist*	
Michael de Guia *Terrestrial Biologist*	
Mark T. Veloso *Social Preparation Assistant*	Mark T. Veloso
Ronaldo T. Manipol *Sr. Technical Assistant* ECOSYS Corporation	

SUBSCRIBE AND SWORN to before me this OCT 26 2001 day of ____________________, 2001 at ~~QUEZON CITY~~ affiants exhibiting to me their Community Tax Certificate (CTC), the number, date and issuance of which are set forth beside their names as herein enumerated:

Name	CTC No.	Issued at	Issued on
Annabelle N. Herrera	11896402	Quezon City	05 March 2001
Carlo D. Dayanghirang	00559395	Manila	19 April 2001
Evangeline Enriquez	13726395	Quezon City	23 March 2001
Michael de Guia	00310929	Los Baños	17 December 1999
Felicia G. Rubianes	11896417	Quezon City	05 March 2001
Mark T. Veloso	04192948	Quezon City	13 March 2001
Ronaldo T. Manipol	11896403	Quezon City	05 March 2001

Edgardo Peña

EDGARDO G. PEÑA
Notary Public
Until Dec. 31, 2002
PTR No. 1970591, 1-2-01, Q.C.

Doc. No. 1498

Page No. 101

Book No. 3

Series of 2001

Appendix F

Accountability Statement of Project Proponent

ACCOUNTABILITY STATEMENT OF PROJECT PROPONENT

This is to certify that all data or information contained in the enclosed **Environmental Impact Statement (EIS) for the Plaridel Bypass Project** are true, accurate, and complete. Should we learn of any information which would make the enclosed EIS inaccurate, we shall bring said information to the attention of the Department of Environment and Natural Resources Environmental Management Bureau (DENR–EMB).

We hereby bind ourselves jointly and solidarily to answer any penalties that may be imposed for any misrepresentations or failure to state material information in the enclosed EIS.

In witness whereof, we hereby set our hands this FEB 2 8 2002 day of __________ at __________.

QUEZON CITY

Project Proponent:

DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS

Engr. Geronimo S. Alonzo
Project Manager III

SUBSCRIBE AND SWORN to before me this __________ day of __________, 2002 at __________ affiants exhibiting to me their Community Tax Certificate (CTC), the number, date and issuance of which are set forth beside their names as herein enumerated:

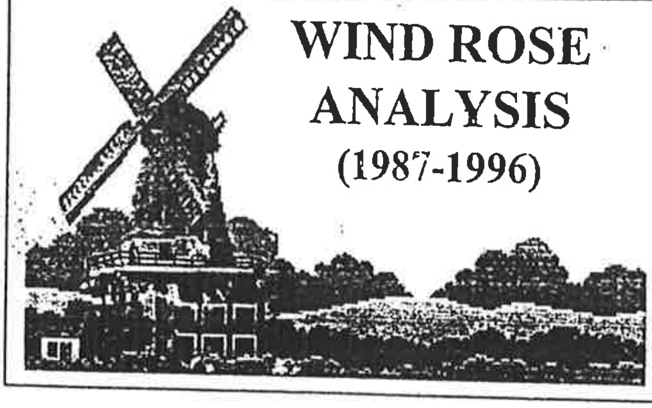
Name	CTC No.	Issued at	Issued on
Geronimo S. Alonzo	17661 w8	QC	1/14/02

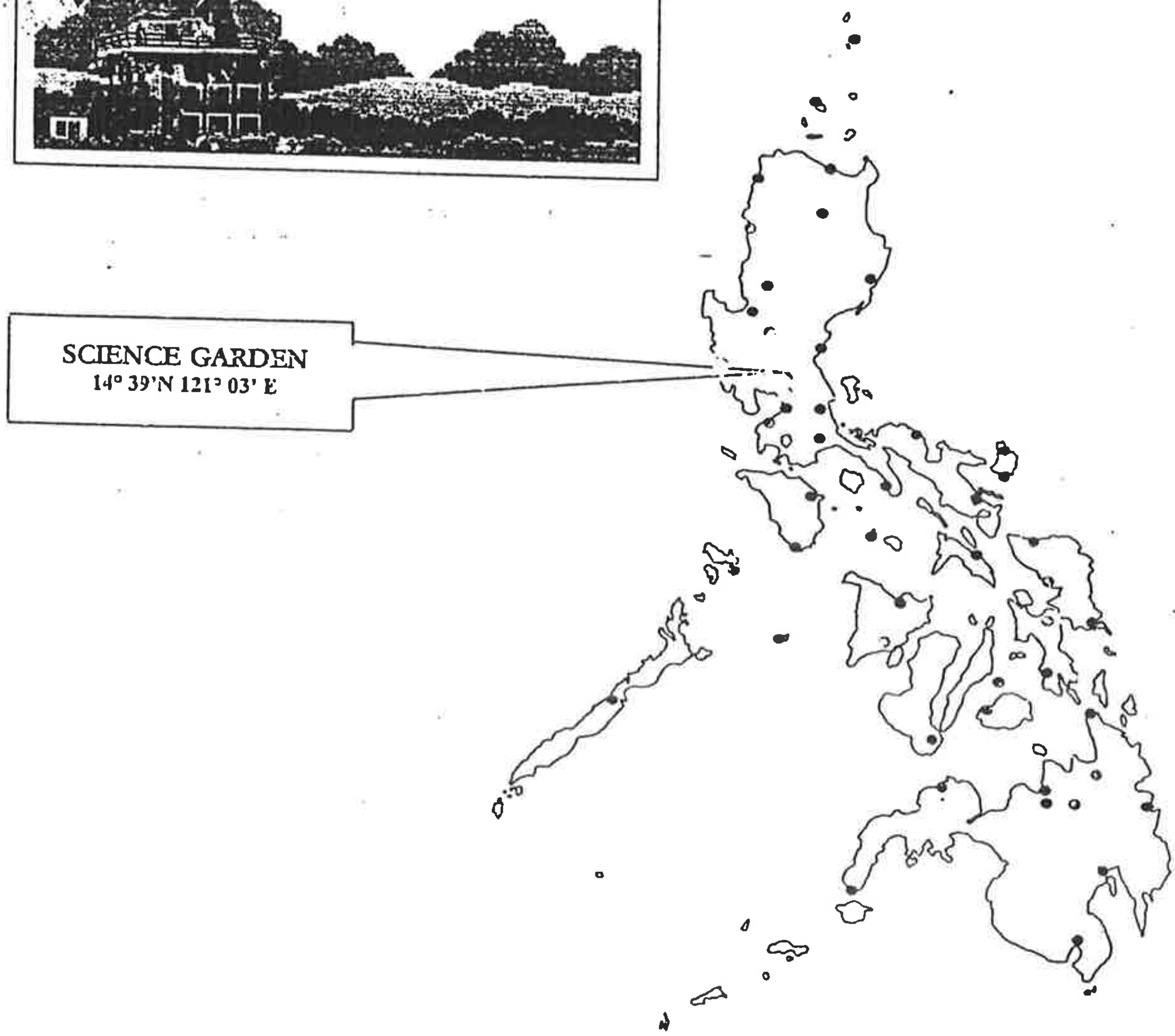
Doc. No. 18
Page No. 4
Book No. 70
Series of 2002

Appendix G

Wind Rose Diagram of Quezon City

WIND ROSE ANALYSIS
(1987-1996)





ISSUED : July 1999
Climate Data Section
Climatology & Agrometeorology Branch
P A G A S A

WIND ROSE ANALYSIS

A wind rose diagram is a graphical presentation that depicts a bi-variate frequency distribution table of wind speed and wind direction. It shows how much of the time (expressed in percent) that a certain range of wind speed certain wind direction, using the 16 points of the compass. The wind rose displays the frequency distribution data as spokes radiating from the central hub, and there is a spoke for each of the 16 direction points. The length of each speed group's segment of a spoke is related to its frequency, with longer segments representing higher frequencies.

The following legend shows the ranges of values of the mean wind speed, and their description, as used in the plot. The number of observations are used to calculate the frequency distribution.

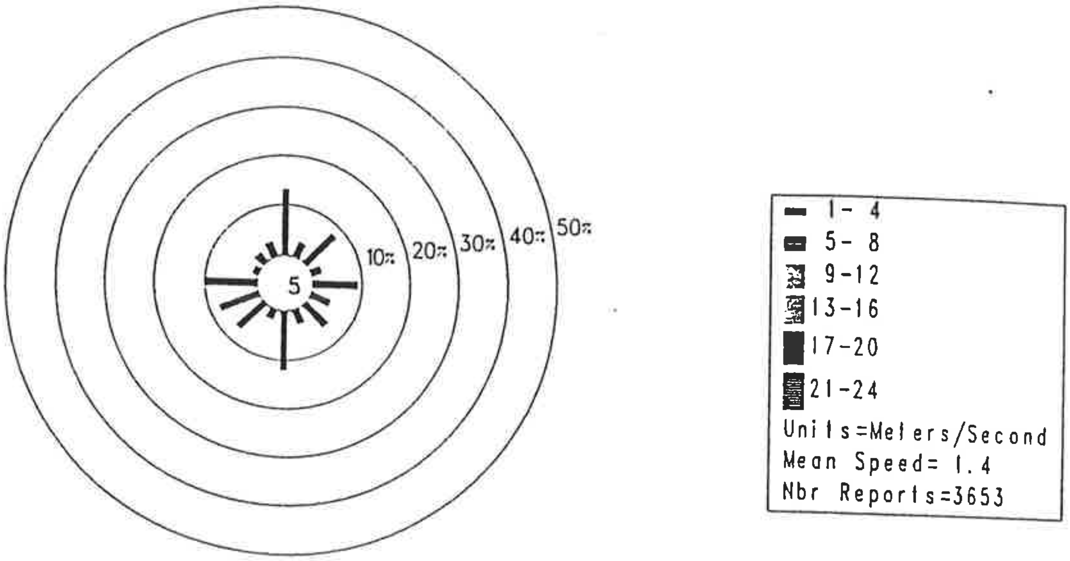
Wind speed (mps) Range	Description
1 - 4	Light
5 - 8	Moderate
9 -12	Moderate to strong
13-16	Strong
17-24	Very strong
Above 24	Violent

The wind rose analysis for Science Garden, Quezon City is taken from daily data for the period 1987 to 1996. For example the wind rose diagram for the month of July shows that 16.2 percent of the time the wind direction comes from the westsouthwest with 15.2 percent ranging from 1 to 4 meters per second (mps), 1.0 percent ranging from 5 to 8 meters per second and 0 percent of the time greater than 8 mps. Therefore the prevailing wind direction for the month of July westsouthwesterly, with an average wind speed of 1.5 mps. Calm conditions were observed for 5.8 percent of the time.

WIND ROSE DIAGRAM, 1987-1996

SCIENCE GARDEN

Annual



FREQUENCY TABLE (%)
Science Garden
Wind Speed and Direction
ANNUAL (1987 - 1996)

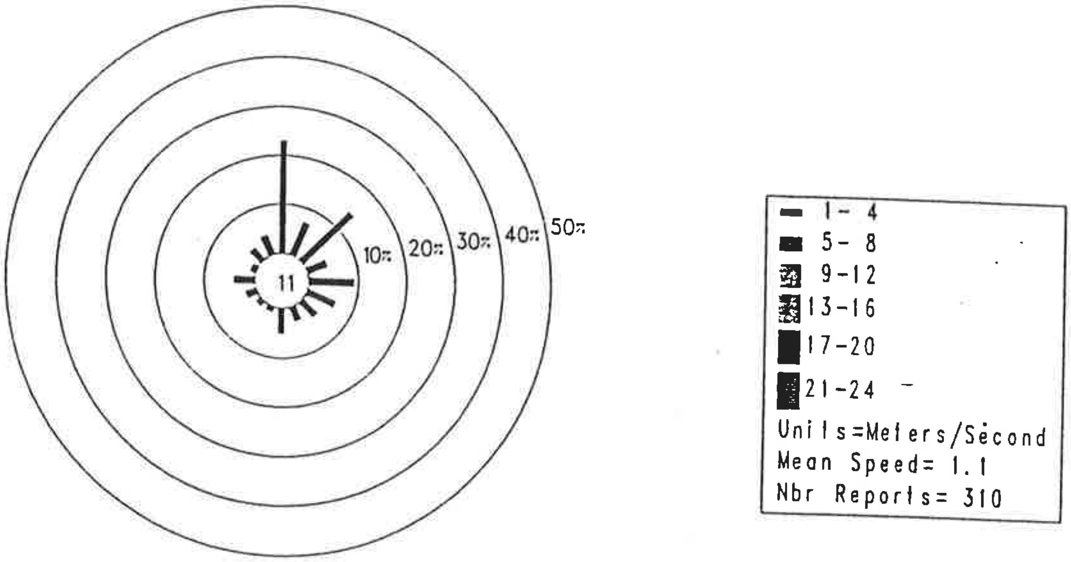
Direction / Speed (mps)	N	NNE	NE	ENE	E	ESE	SE	SSE
CALM								
1 - 4	13.2	3.0	8.3	1.8	8.9	3.9	6.4	3.2
5 -8	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0
>8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	13.3	3.0	8.3	1.8	8.9	4.0	6.4	3.2

Direction / Speed (mps)	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM									5.3
1 - 4	11.9	2.5	6.6	8.0	10.0	0.8	1.8	3.4	93.7
5 -8	0.0	0.1	0.1	0.3	0.0	0.0	0.1	0.1	0.9
>8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
TOTAL	11.9	2.6	6.7	8.3	10.0	0.8	1.9	3.5	100.0

WIND ROSE DIAGRAM, 1987-1996

SCIENCE GARDEN

January



FREQUENCY TABLE (%)
Science Garden
Wind Speed and Direction
January (1987-1996)

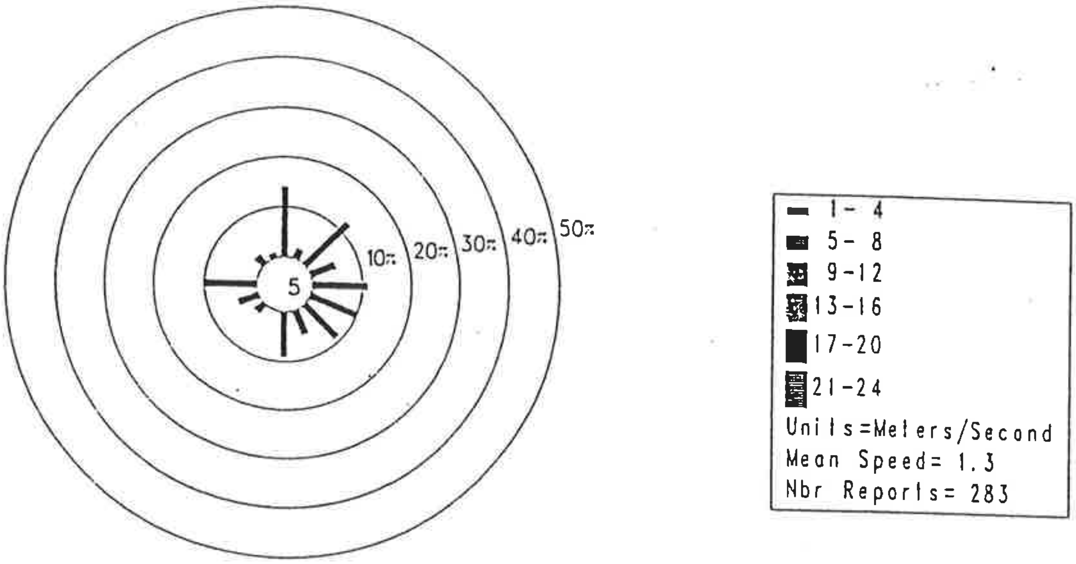
Direction / Speed (mps)	N	NNE	NE	ENE	E	ESE	SE	SSE
CALM								
1 - 4	22.6	7.1	13.5	3.5	9.4	5.8	4.2	2.9
5 -8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
>8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	22.6	7.1	13.5	3.5	9.4	5.8	4.2	2.9

Direction / Speed (mps)	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM									10.6
1 - 4	4.5	1.3	1.0	1.9	4.2	1.0	2.9	3.5	89.4
5 -8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
>8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	4.5	1.3	1.0	1.9	4.2	1.0	2.9	3.5	100.0

WIND ROSE DIAGRAM, 1987-1996

SCIENCE GARDEN

February



FREQUENCY TABLE (%)
Science Garden
Wind Speed and Direction
February (1987 - 1996)

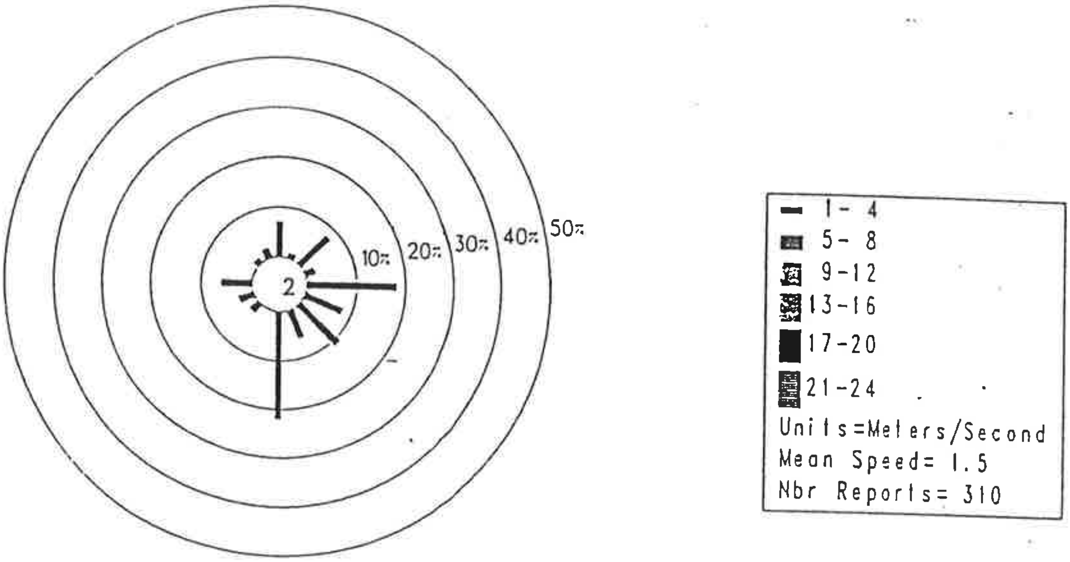
Speed (mps) \ Direction	N	NNE	NE	ENE	E	ESE	SE	SSE
CALM								
1 - 4	13.8	2.5	11.7	4.6	11.0	10.2	8.8	4.6
5 -8	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0
>8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	13.8	2.5	12.1	4.6	11.0	10.2	8.8	4.6

Speed (mps) \ Direction	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM									5.3
1 - 4	9.2	0.4	1.8	3.5	9.9	0.0	1.8	0.7	94.3
5 -8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4
>8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	9.2	0.4	1.8	3.5	9.9	0.0	1.8	0.7	100.0

WIND ROSE DIAGRAM, 1987-1996

SCIENCE GARDEN

March



FREQUENCY TABLE (%)
Science Garden
Wind Speed and Direction
March (1987 - 1996)

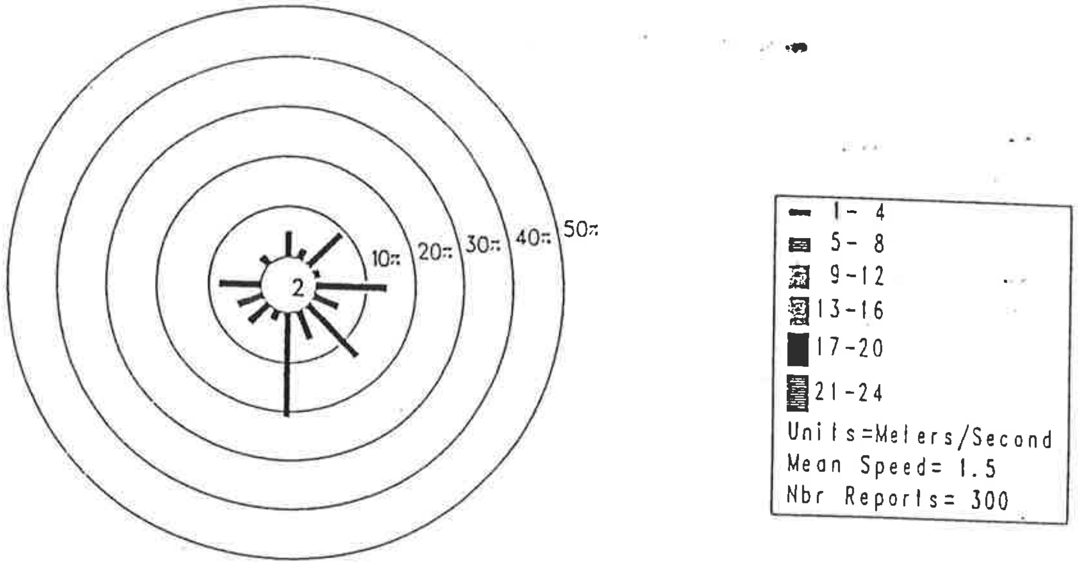
Direction / Speed (mps)	N	NNE	NE	ENE	E	ESE	SE	SSE
CALM								
1 - 4	7.1	1.0	7.7	1.9	18.4	7.7	11.0	6.5
5 -8	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0
>8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	7.1	1.0	7.7	1.9	18.4	8.0	11.0	6.5

Direction / Speed (mps)	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM									2.0
1 - 4	21.6	0.3	2.3	3.2	6.5	0.0	1.0	1.6	97.7
5 -8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
>8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	21.6	0.3	2.3	3.2	6.5	0.0	1.0	1.6	100.0

WIND ROSE DIAGRAM, 1987-1996

SCIENCE GARDEN

April



FREQUENCY TABLE (%)
Science Garden
Wind Speed and Direction
April (1987 - 1996)

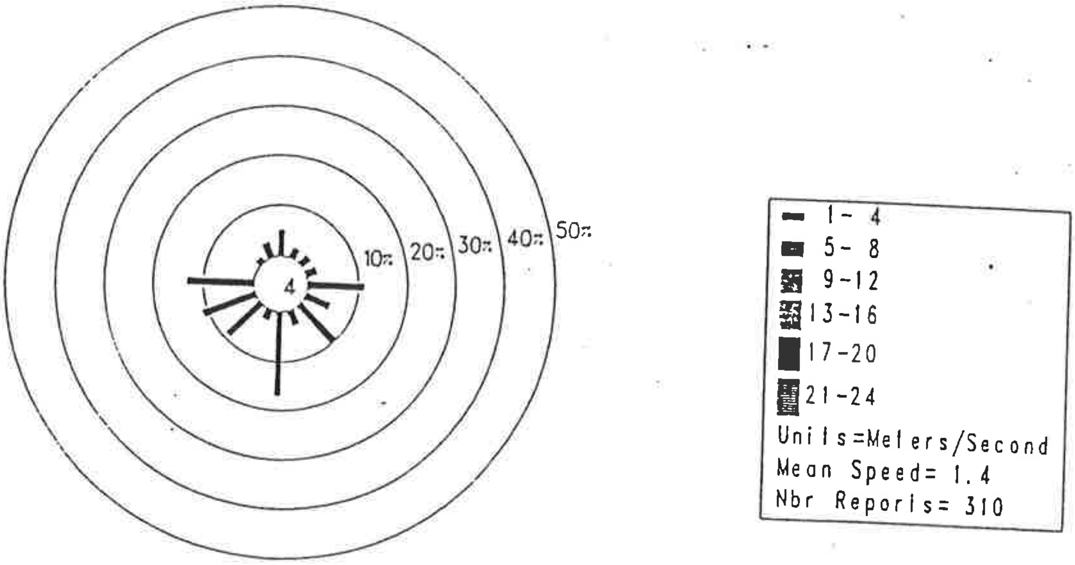
Direction / Speed (mps)	N	NNE	NE	ENE	E	ESE	SE	SSE
CALM								
1 - 4	4.7	2.0	9.0	0.7	14.0	5.3	14.0	6.3
5 -8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
>8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	4.7	2.0	9.0	0.7	14.0	5.3	14.0	6.3

Direction / Speed (mps)	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM									2.0
1 - 4	20.7	1.7	4.7	5.0	7.7	0.3	1.7	0.3	98.0
5 -8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
>8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	20.7	1.7	4.7	5.0	7.7	0.3	1.7	0.3	100.0

WIND ROSE DIAGRAM, 1987-1996

SCIENCE GARDEN

May



FREQUENCY TABLE (%)
Science Garden
Wind Speed and Direction
May (1987 - 1996)

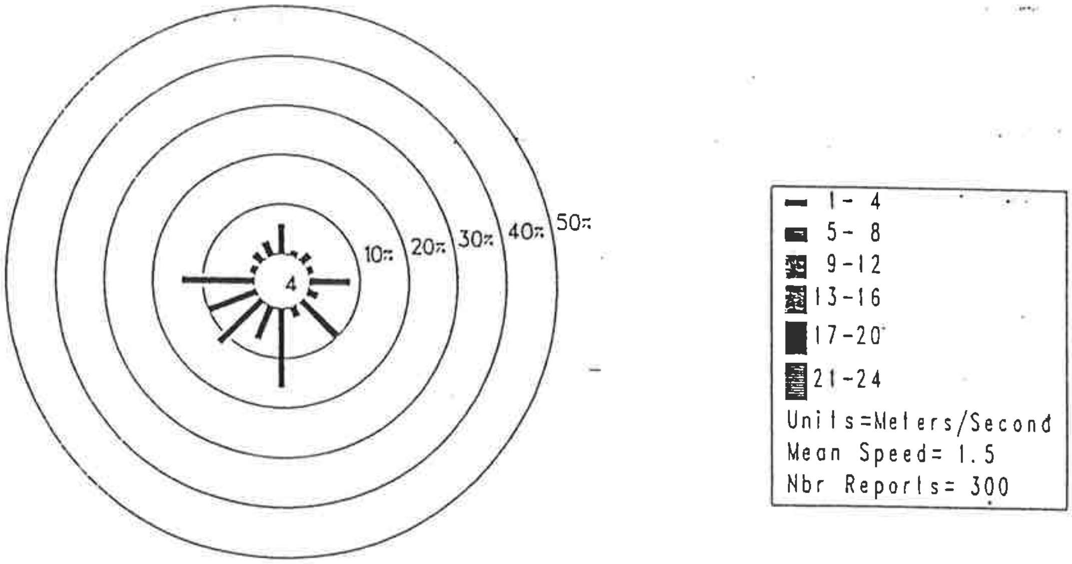
Direction / Speed (mps)	N	NNE	NE	ENE	E	ESE	SE	SSE
CALM								
1 - 4	5.5	1.6	1.9	2.3	10.6	5.2	9.7	3.2
5 -8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
>8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	5.5	1.6	1.9	2.3	10.6	5.2	9.7	3.2

Direction / Speed (mps)	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM									3.6
1 - 4	17.1	1.6	9.0	11.3	12.6	0.3	1.0	2.9	95.8
5 -8	0.3	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.6
>8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	17.4	1.6	9.0	11.3	12.6	0.3	1.3	2.9	100.0

WIND ROSE DIAGRAM, 1987-1996

SCIENCE GARDEN

June



FREQUENCY TABLE (%)
Science Garden
Wind Speed and Direction
June (1987 - 1996)

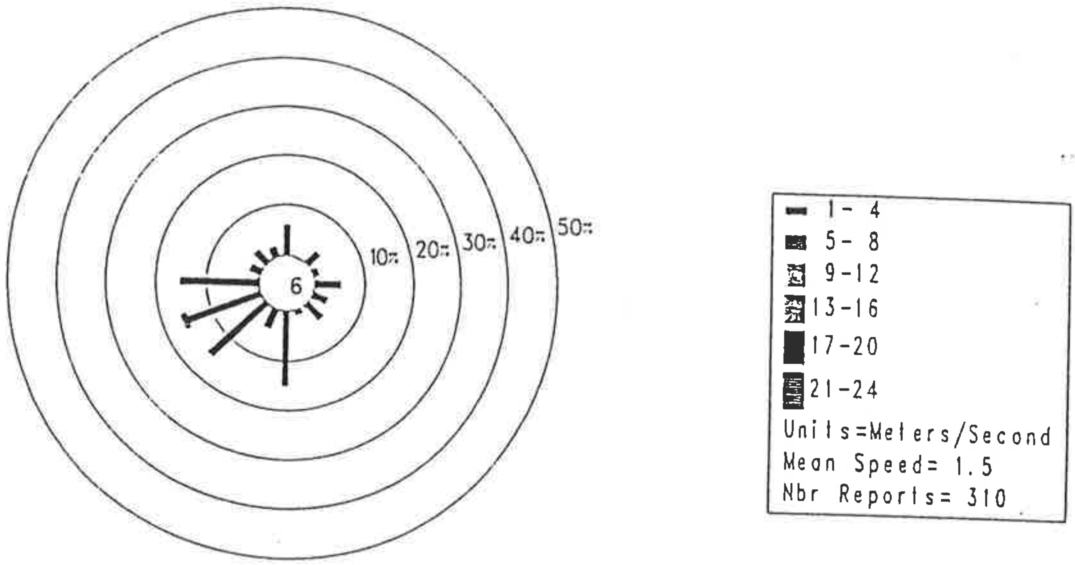
Direction / Speed (mps)	N	NNE	NE	ENE	E	ESE	SE	SSE
CALM								
1 - 4	6.0	1.3	2.3	1.3	8.3	1.7	10.0	1.7
5 -8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
>8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	6.0	1.3	2.3	1.3	8.3	1.7	10.0	1.7

Direction / Speed (mps)	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM									3.7
1 - 4	15.7	6.7	12.0	10.3	13.7	0.7	1.7	2.7	96.0
5 -8	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.3
>8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	15.7	6.7	12.3	10.3	13.7	0.7	1.7	2.7	100.0

WIND ROSE DIAGRAM, 1987-1996

SCIENCE GARDEN

July



FREQUENCY TABLE (%)
Science Garden
Wind Speed and Direction
July (1987 - 1996)

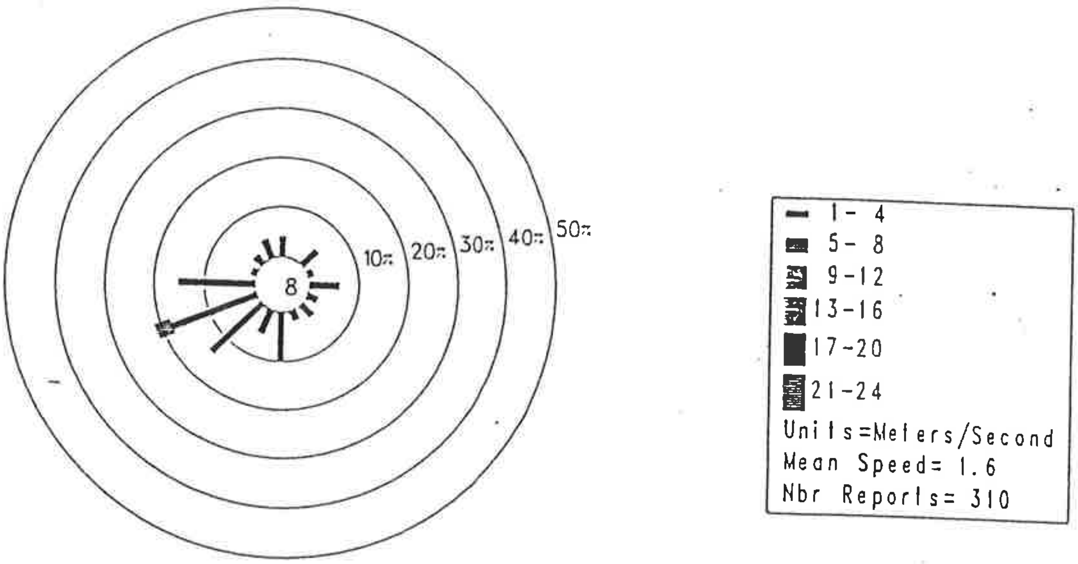
Direction / Speed (mps)	N	NNE	NE	ENE	E	ESE	SE	SSE
CALM								
1 - 4	5.8	.3	3.2	1.0	5.2	2.6	3.9	1.3
5 -8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
>8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	5.8	0.3	3.2	1.0	5.2	2.6	3.9	1.3

Direction / Speed (mps)	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM									5.8
1 - 4	14.8	3.5	15.2	15.2	14.5	1.9	2.3	1.9	92.6
5 -8	0.0	0.0	0.3	1.0	0.0	0.0	0.0	0.3	1.6
>8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	14.8	3.5	15.5	16.2	14.5	1.9	2.3	2.2	100.0

WIND ROSE DIAGRAM, 1987-1996

SCIENCE GARDEN

August



FREQUENCY TABLE (%)
Science Garden
Wind Speed and Direction
August (1987 - 1996)

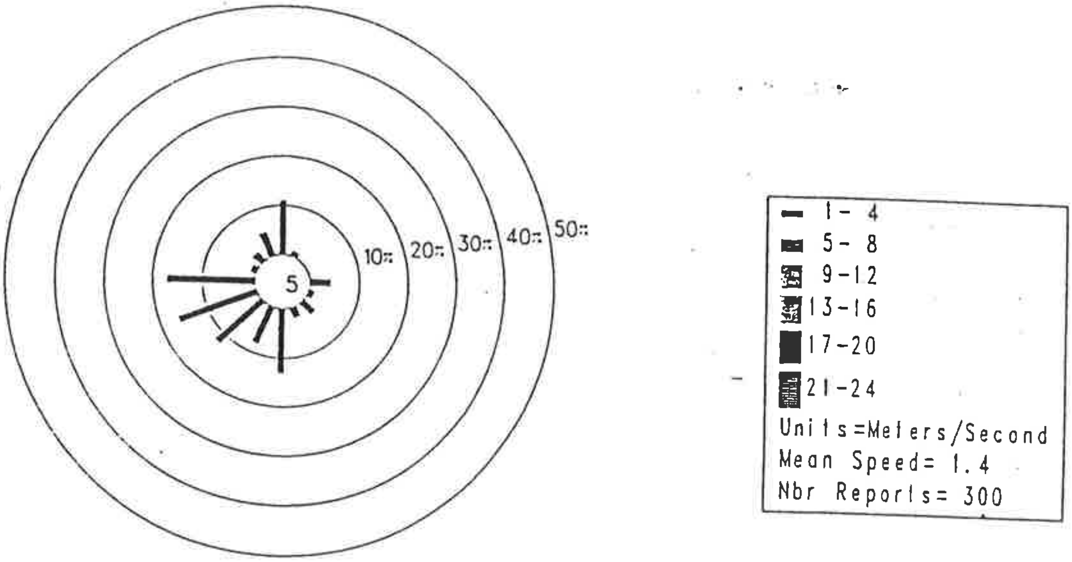
Direction / Speed (mps)	N	NNE	NE	ENE	E	ESE	SE	SSE
CALM								
1 - 4	3.9	0.0	3.9	0.6	5.8	1.6	3.2	1.6
5 -8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
>8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	3.9	0.0	3.9	0.6	5.8	1.6	3.2	1.6

Direction / Speed (mps)	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM									8.1
1 - 4	10.0	4.5	13.5	18.1	15.2	1.3	2.3	3.5	89.0
5 -8	0.0	0.3	0.0	2.6	0.0	0.0	0.0	0.0	2.9
>8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	10.0	4.8	13.5	20.7	15.2	1.3	2.3	3.5	100.0

WIND ROSE DIAGRAM, 1987-1996

SCIENCE GARDEN

September



FREQUENCY TABLE (%)
Science Garden
Wind Speed and Direction
September (1987 - 1996)

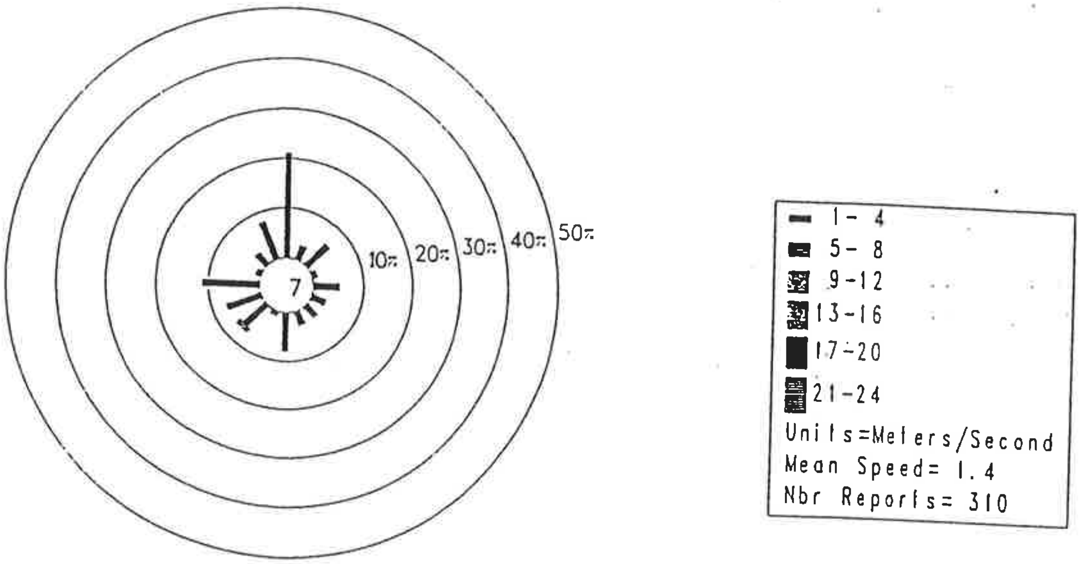
Direction / Speed (mps)	N	NNE	NE	ENE	E	ESE	SE	SSE
CALM								
1 - 4	10.7	1.3	0.0	0.3	3.7	1.0	3.0	2.0
5 -8	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
>8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	11.0	1.3	0.0	0.3	3.7	1.0	3.0	2.0

Direction / Speed (mps)	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM									4.7
1 - 4	12.7	7.7	12.3	16.3	16.7	0.7	1.7	4.7	94.7
5 -8	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.6
>8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	12.7	8.0	12.3	16.3	16.7	0.7	1.7	4.7	100

WIND ROSE DIAGRAM, 1987-1996

SCIENCE GARDEN

October



FREQUENCY TABLE (%)
Science Garden
Wind Speed and Direction
October (1987 - 1996)

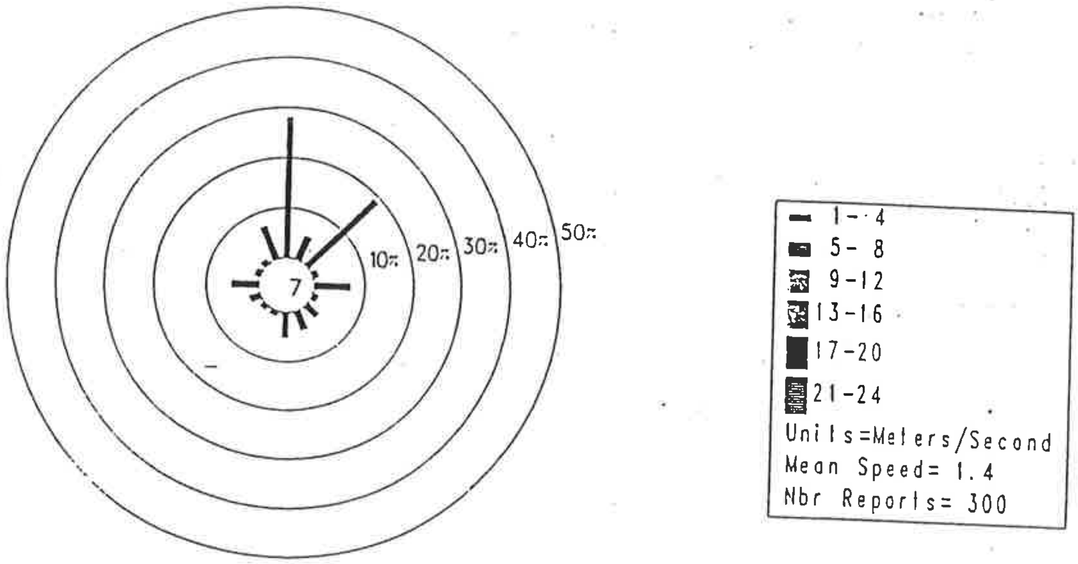
Direction / Speed (mps)	N	NNE	NE	ENE	E	ESE	SE	SSE
CALM								
1 - 4	21.3	3.2	6.1	0.6	4.5	2.9	2.9	3.2
5 - 8	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.3
>8	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0
TOTAL	21.6	3.2	6.1	0.6	4.5	2.9	3.2	3.5

Direction / Speed (mps)	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM									7.1
1 - 4	7.7	1.0	6.5	7.1	11.0	1.0	3.2	7.7	90.0
5 - 8	0.0	0.0	0.6	0.3	0.3	0.0	0.3	0.3	2.6
>8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
TOTAL	7.7	1.0	7.1	7.4	11.3	1.0	3.5	8.0	100.0

WIND ROSE DIAGRAM, 1987-1996

SCIENCE GARDEN

November



FREQUENCY TABLE (%)
Science Garden
Wind Speed and Direction
November (1987-1996)

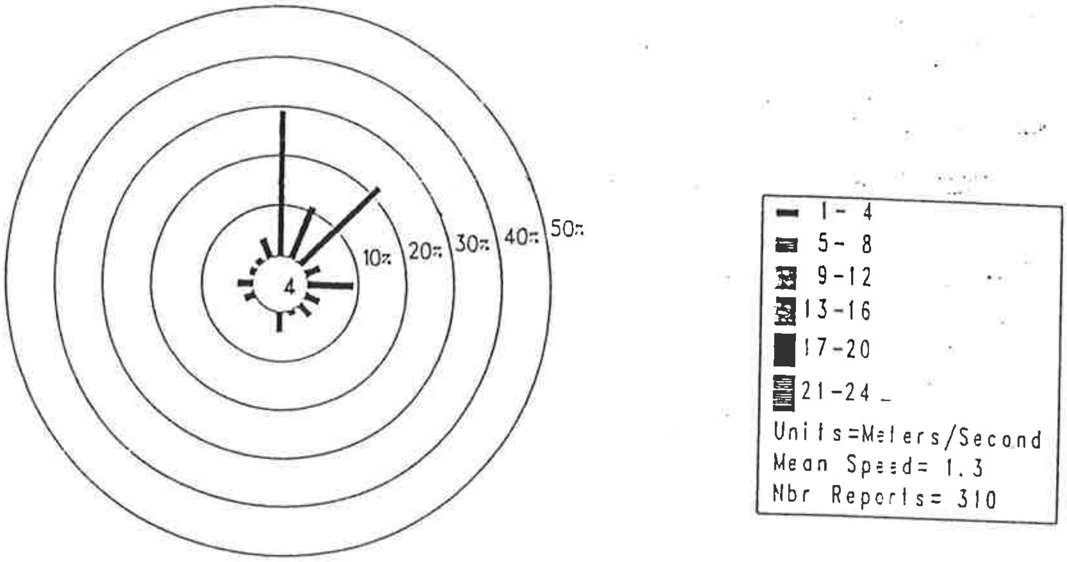
Direction / Speed (mps)	N	NNE	NE	ENE	E	ESE	SE	SSE
CALM								
1 - 4	28.0	5.3	19.0	1.3	7.3	0.7	3.0	4.3
5 -8	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.0
9-12	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0
13-16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17-20	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0
TOTAL	28.0	5.3	19.3	1.3	7.6	1.0	3.3	4.3

Direction / Speed (mps)	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM									7.0
1 - 4	5.3	0.7	0.7	1.7	5.3	1.0	1.0	7.0	91.7
5 -8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7
9-12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
13-16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17-20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
TOTAL	5.3	0.7	0.7	1.7	5.3	1.0	1.0	7.0	100.0

WIND ROSE DIAGRAM, 1987-1996

SCIENCE GARDEN

December



FREQUENCY TABLE (%)
Science Garden
Wind Speed and Direction
December (1987 - 1996)

Direction / Speed (mps)	N	NNE	NE	ENE	E	ESE	SE	SSE
CALM								
1 - 4	29.4	10.6	21.6	2.9	8.7	3.2	2.9	1.0
5 -8	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
>8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	29.7	10.6	21.6	2.9	8.7	3.2	2.9	1.0

Direction / Speed (mps)	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM									3.6
1 - 4	3.9	0.3	0.0	1.9	3.2	1.3	1.3	3.9	96.1
5 -8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
>8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	3.9	0.3	0.0	1.9	3.2	1.3	1.3	3.9	100.0

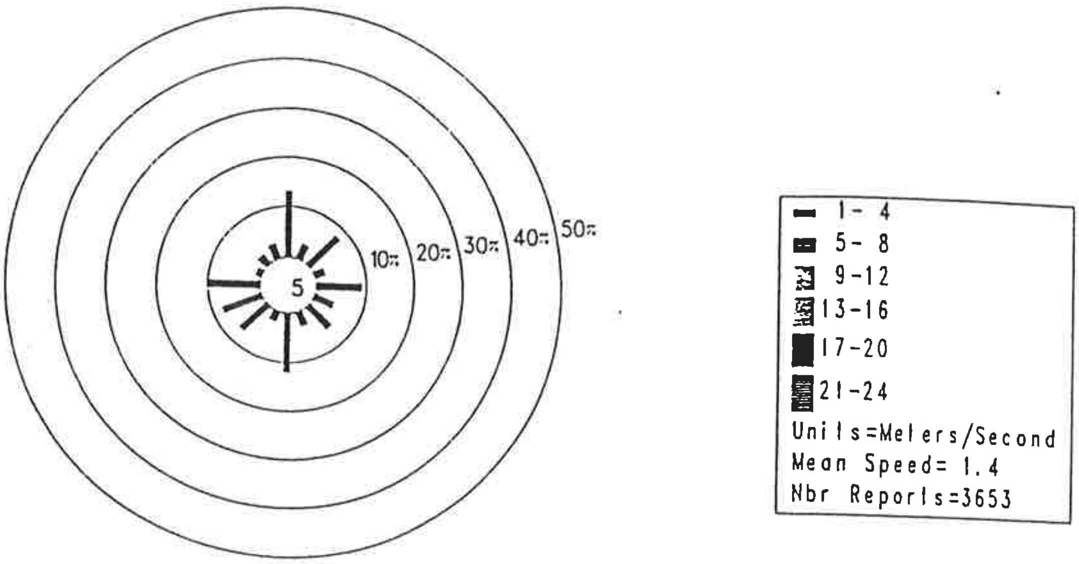
Appendix H

Barangay Settlement Maps Reflecting the Annual Wind Rose Analysis for Quezon City

WIND ROSE DIAGRAM, 1987-1996

SCIENCE GARDEN

Annual

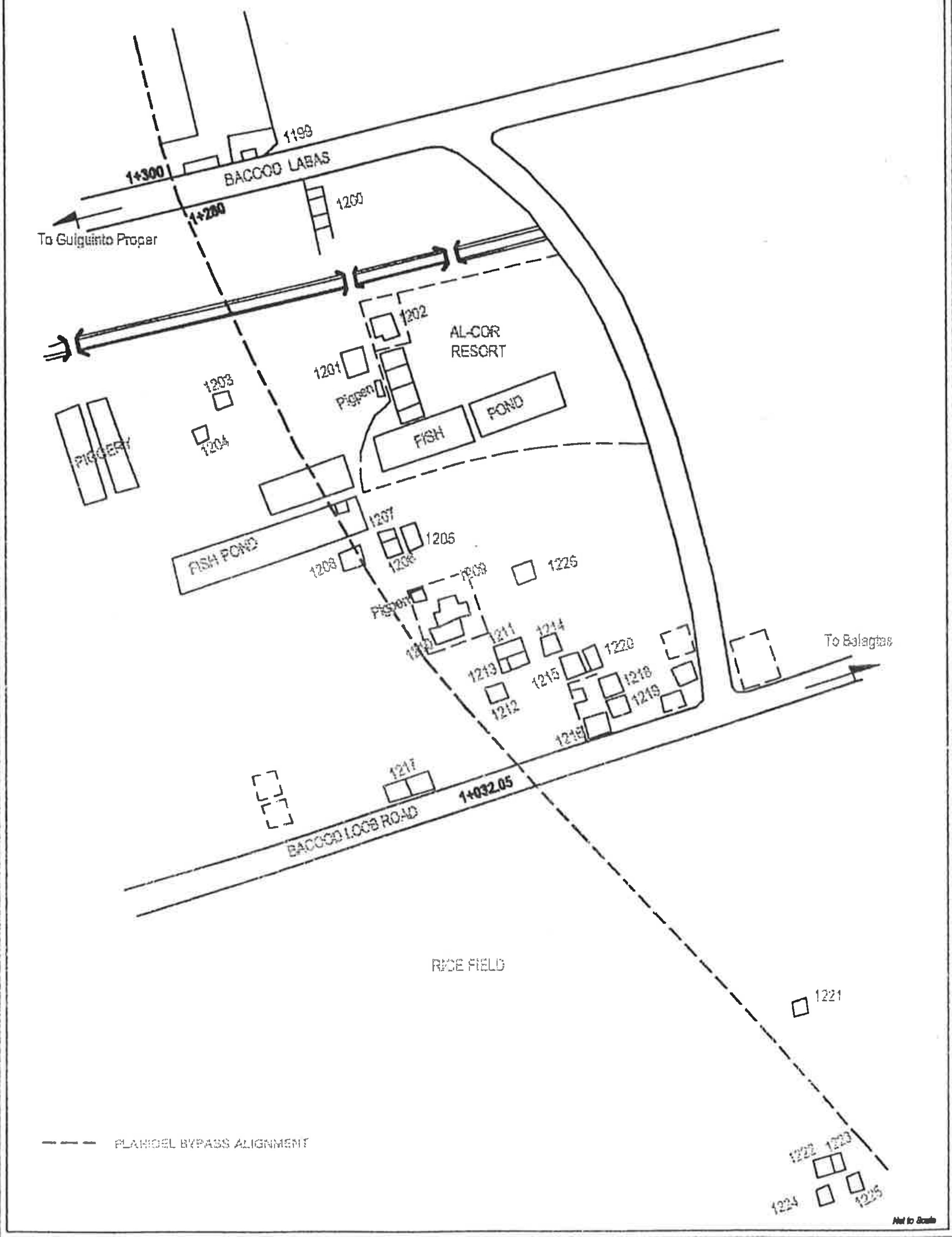


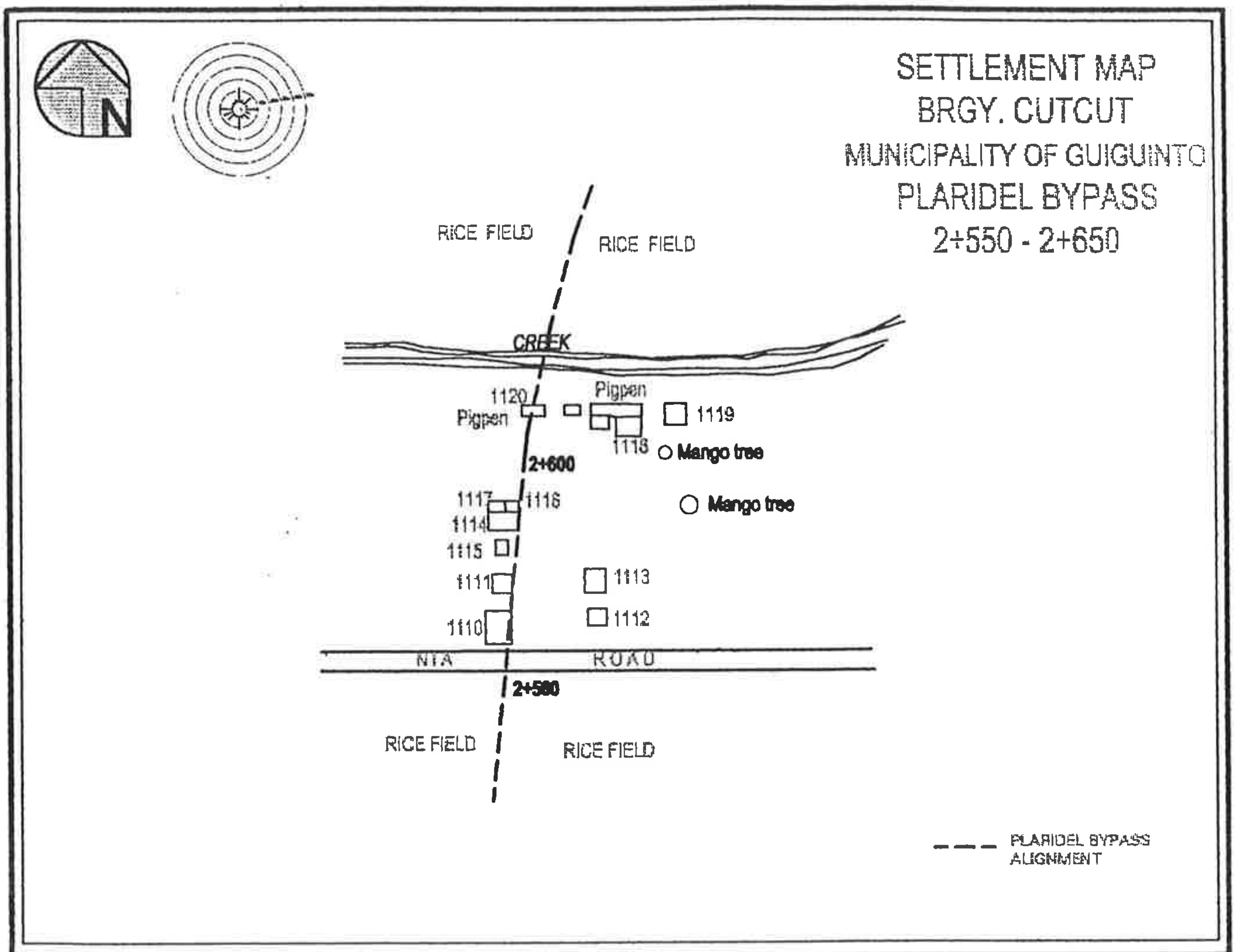
FREQUENCY TABLE (%)
Science Garden
Wind Speed and Direction
ANNUAL (1987 - 1996)

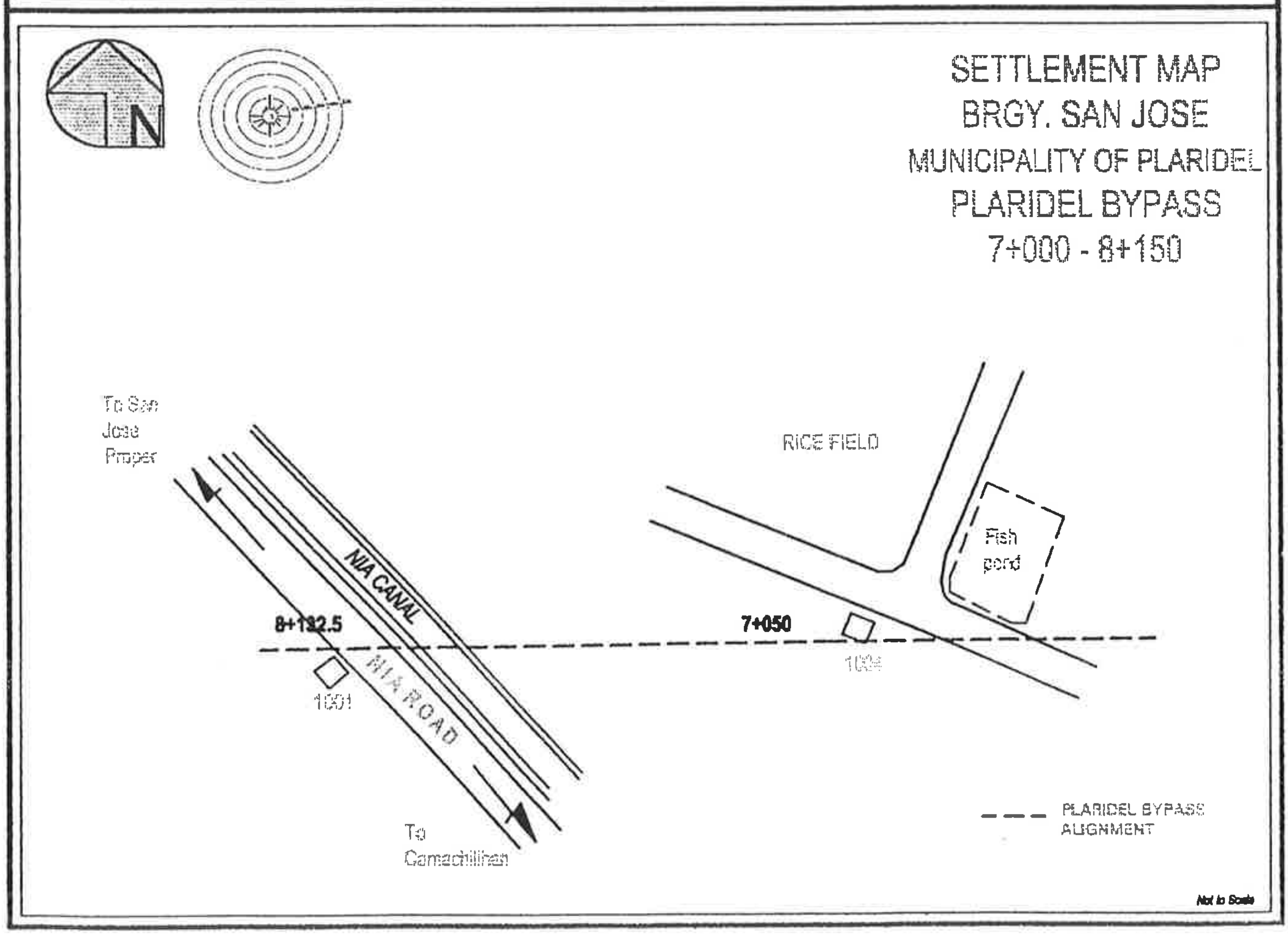
Direction / Speed (mps)	N	NNE	NE	ENE	E	ESE	SE	SSE
CALM								
1 - 4	13.2	3.0	8.3	1.8	8.9	3.9	6.4	3.2
5 -8	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0
>8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	13.3	3.0	8.3	1.8	8.9	4.0	6.4	3.2

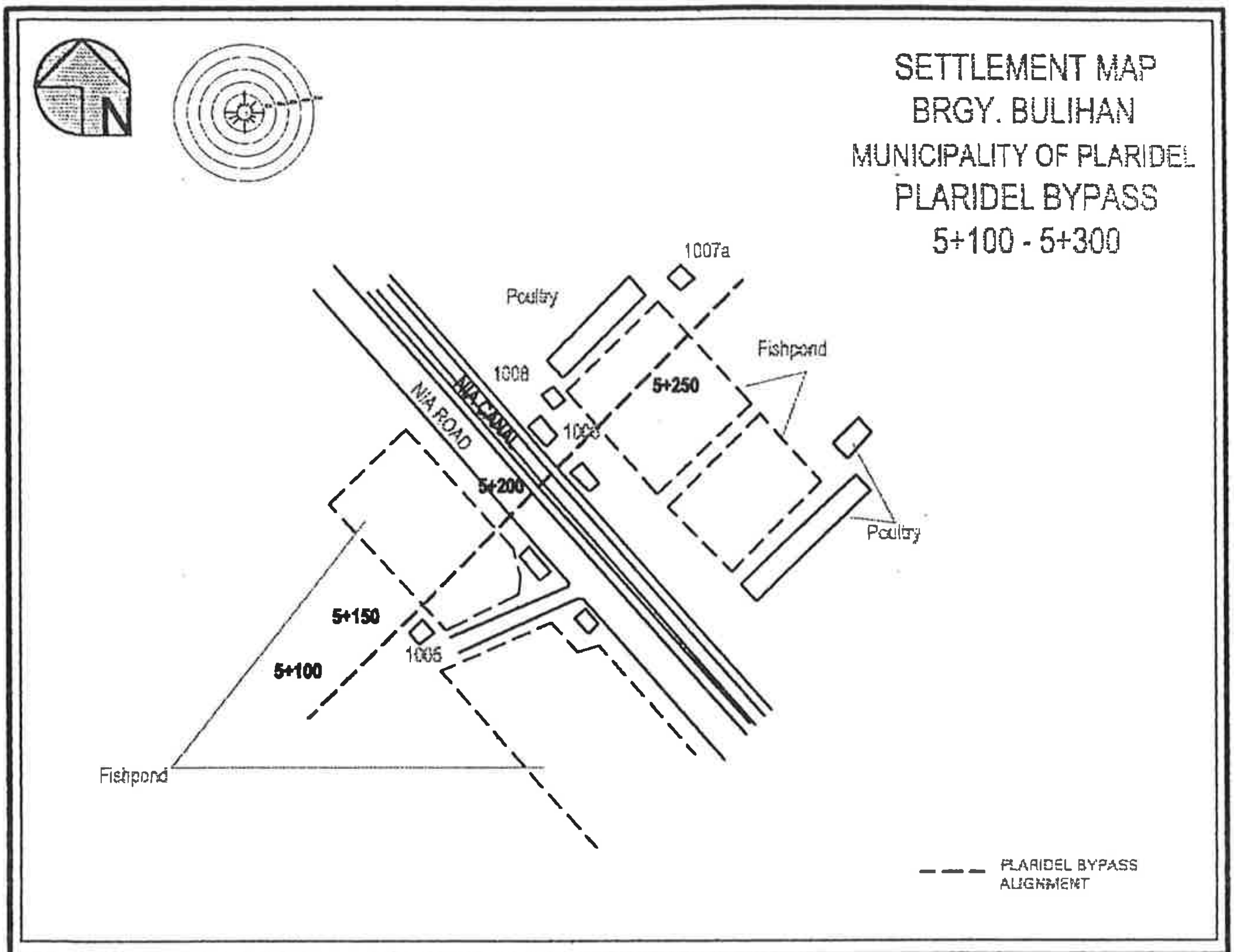
Direction / Speed (mps)	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM									5.3
1 - 4	11.9	2.5	6.6	8.0	10.0	0.8	1.8	3.4	93.7
5 -8	0.0	0.1	0.1	0.3	0.0	0.0	0.1	0.1	0.9
>8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
TOTAL	11.9	2.6	6.7	8.3	10.0	0.8	1.9	3.5	100.0

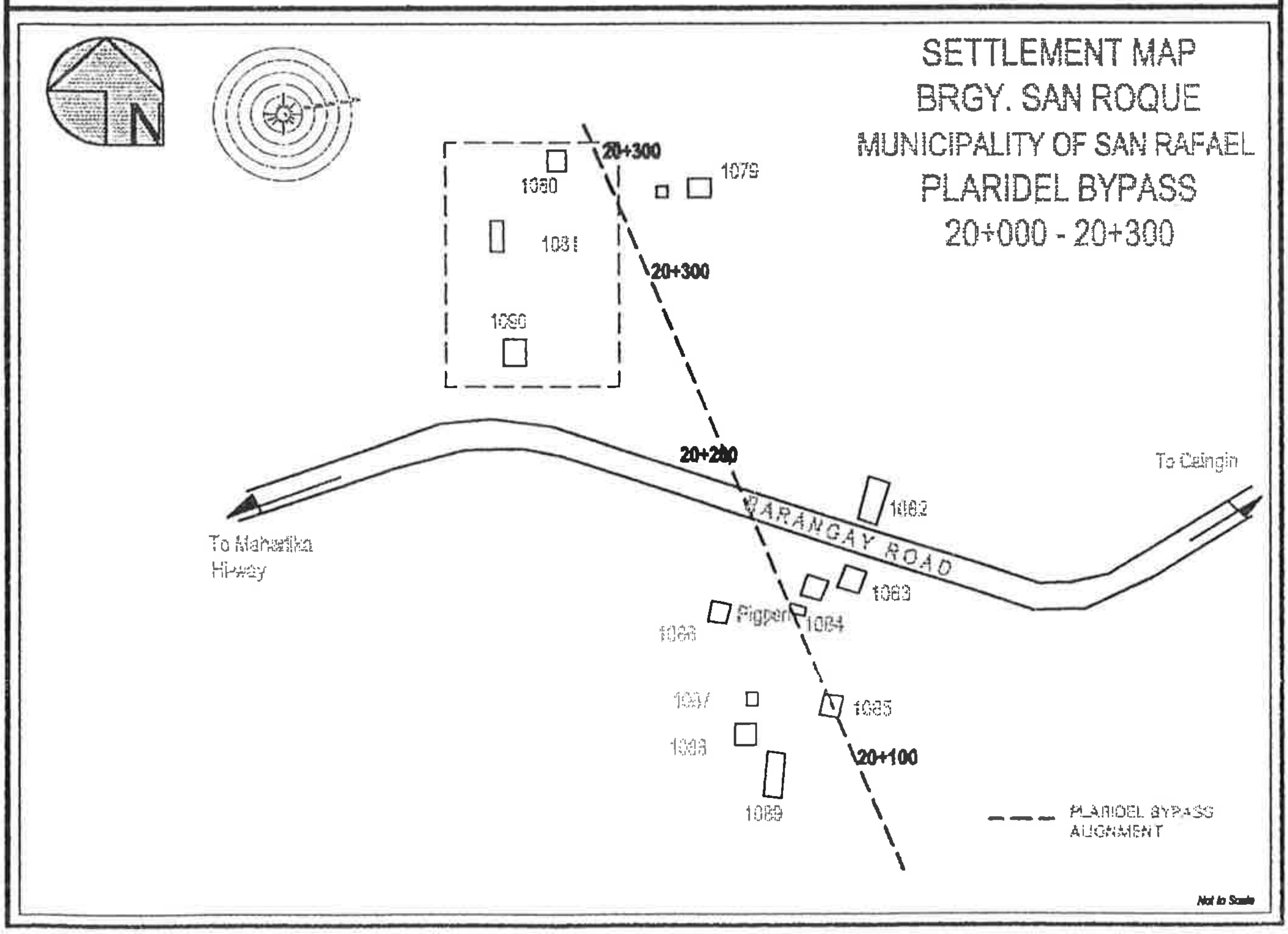
SETTLEMENT MAP
BRGY. TIAONG
MUNICIPALITY OF GUIGUINTO
PLARIDEL BYPASS
1+000 - 1+350

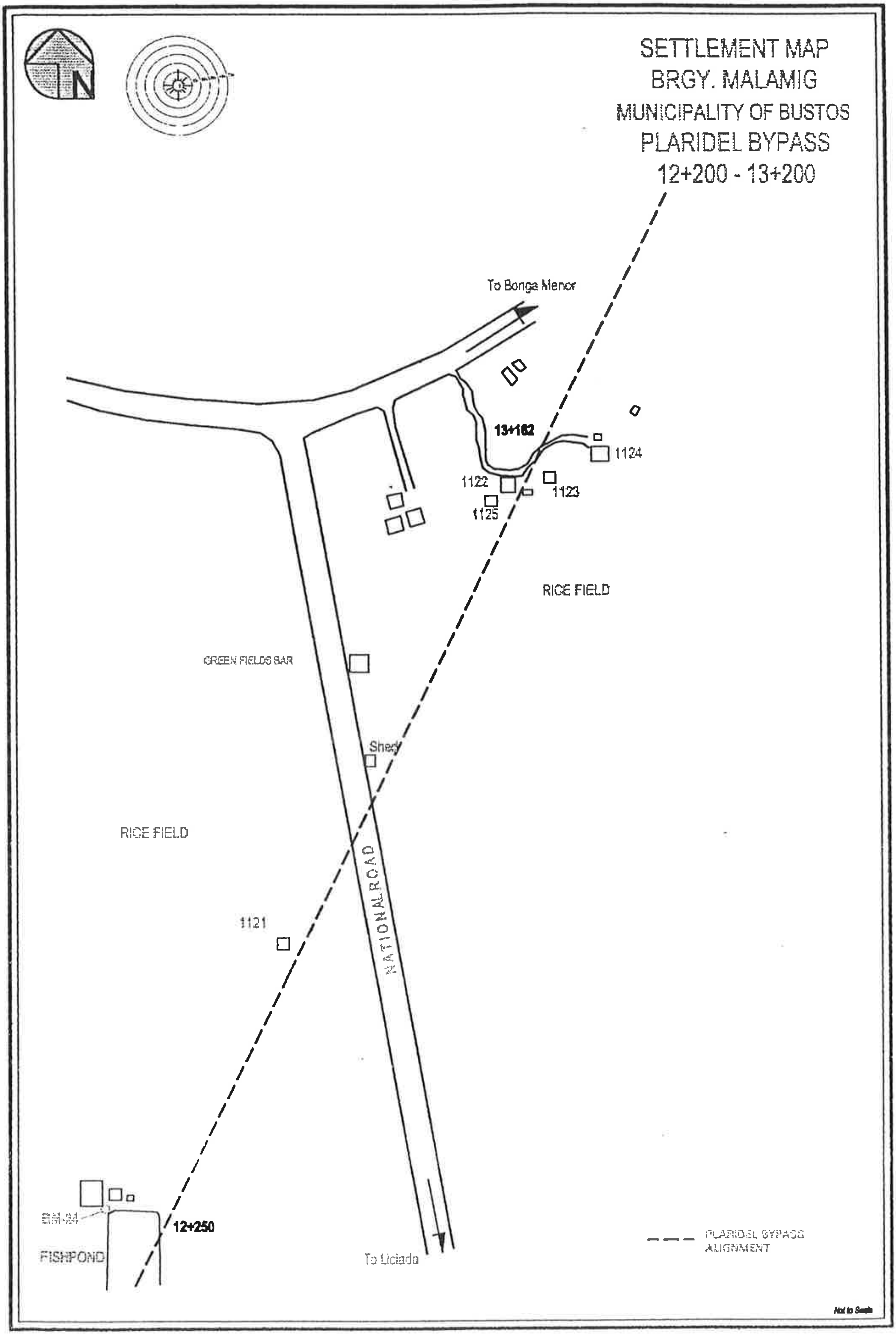



SETTLEMENT MAP
BRGY. CUTCUT
MUNICIPALITY OF GUIGUINTO
PLARIDEL BYPASS
2+550 - 2+650
RICE FIELD
RICE FIELD
CREEK
1120
Pigpen
Pigpen
1119
1118
Mango tree
2+600
Mango tree
1117
1116
1114
1115
1111
1113
1110
1112
NIA
ROAD
2+500
RICE FIELD
RICE FIELD
PLARIDEL BYPASS
ALIGNMENT


SETTLEMENT MAP
BRGY. SAN JOSE
MUNICIPALITY OF PLARIDEL
PLARIDEL BYPASS
7+000 - 8+150
To San
Jose
Proper
NIA CANAL
8+132.5
NIA ROAD
1001
To
Camachilihan
RICE FIELD
Fish
pond
7+050
1004
PLARIDEL BYPASS
ALIGNMENT
Not to Scale

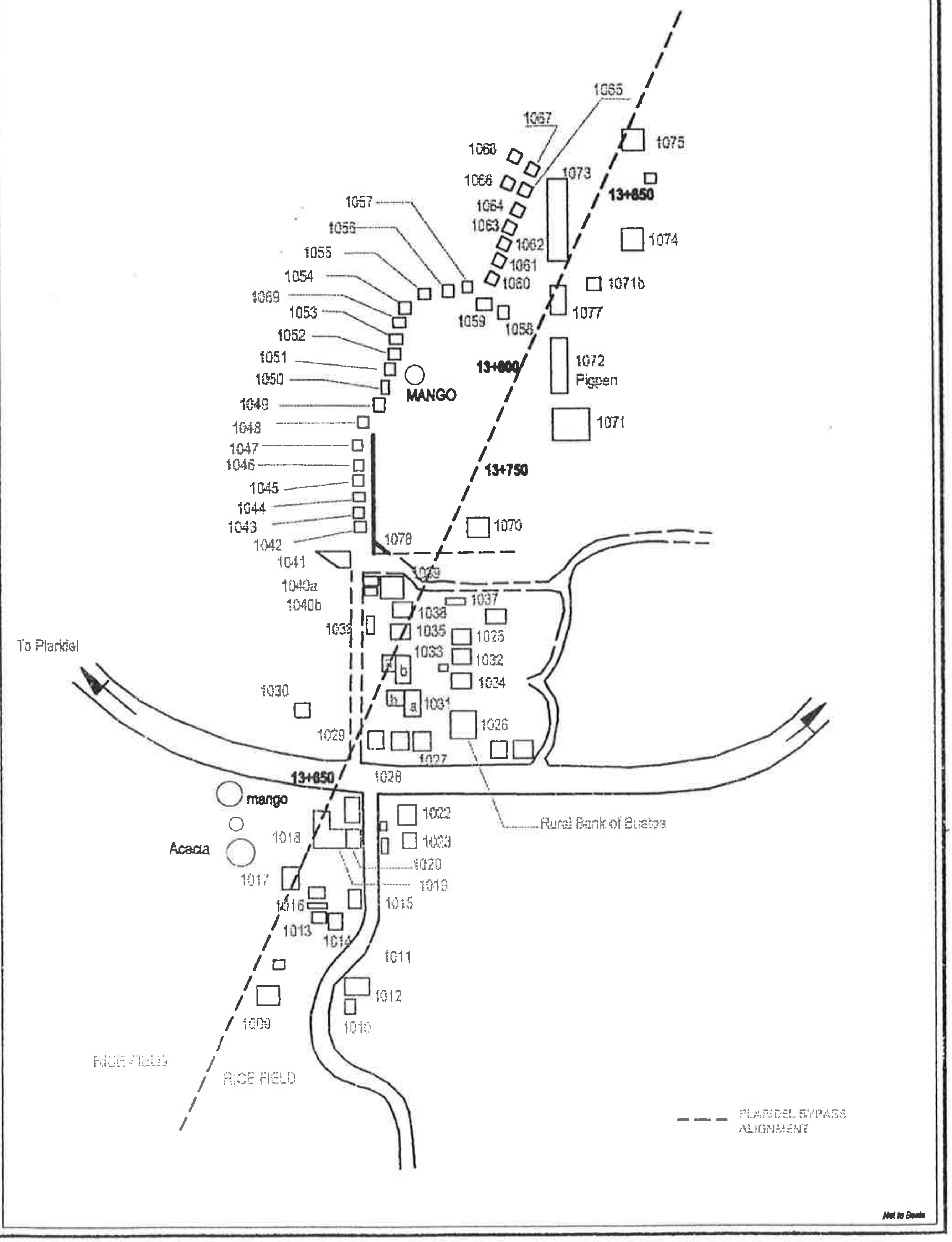

SETTLEMENT MAP
BRGY. BULIHAN
MUNICIPALITY OF PLARIDEL
PLARIDEL BYPASS
5+100 - 5+300
1007a
Poultry
Fishpond
1008
5+250
NIA CANAL
NIA ROAD
5+200
Poultry
5+150
5+100
1005
Fishpond
PLARIDEL BYPASS ALIGNMENT


SETTLEMENT MAP
BRGY. SAN ROQUE
MUNICIPALITY OF SAN RAFAEL
PLARIDEL BYPASS
20+000 - 20+300
20+300
1080
1079
1081
20+300
1090
20+200
To Caingin
1082
BARANGAY ROAD
1083
Pigpen
1084
1085
20+100
1089
PLARIDEL BYPASS ALIGNMENT
Not to Scale

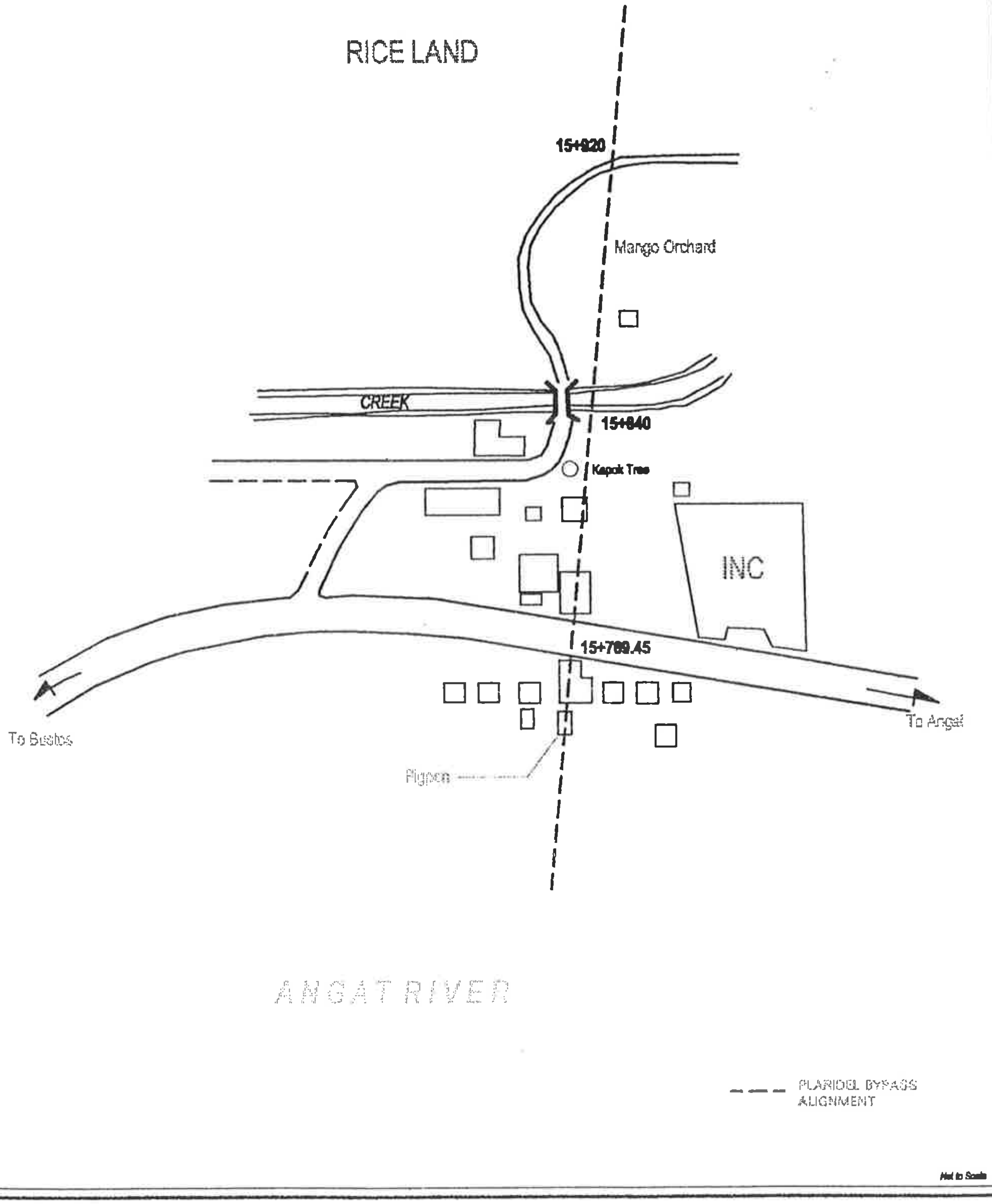


SETTLEMENT MAP
BRGY. MALAMIG
MUNICIPALITY OF BUSTOS
PLARIDEL BYPASS
12+200 - 13+200
To Bonga Menor
13+182
1124
1122
1123
1125
RICE FIELD
GREEN FIELDS BAR
Shed
RICE FIELD
NATIONAL ROAD
1121
BM-34
12+250
FISHPOND
To Lleiada
PLARIDEL BYPASS
ALIGNMENT
Not to Scale

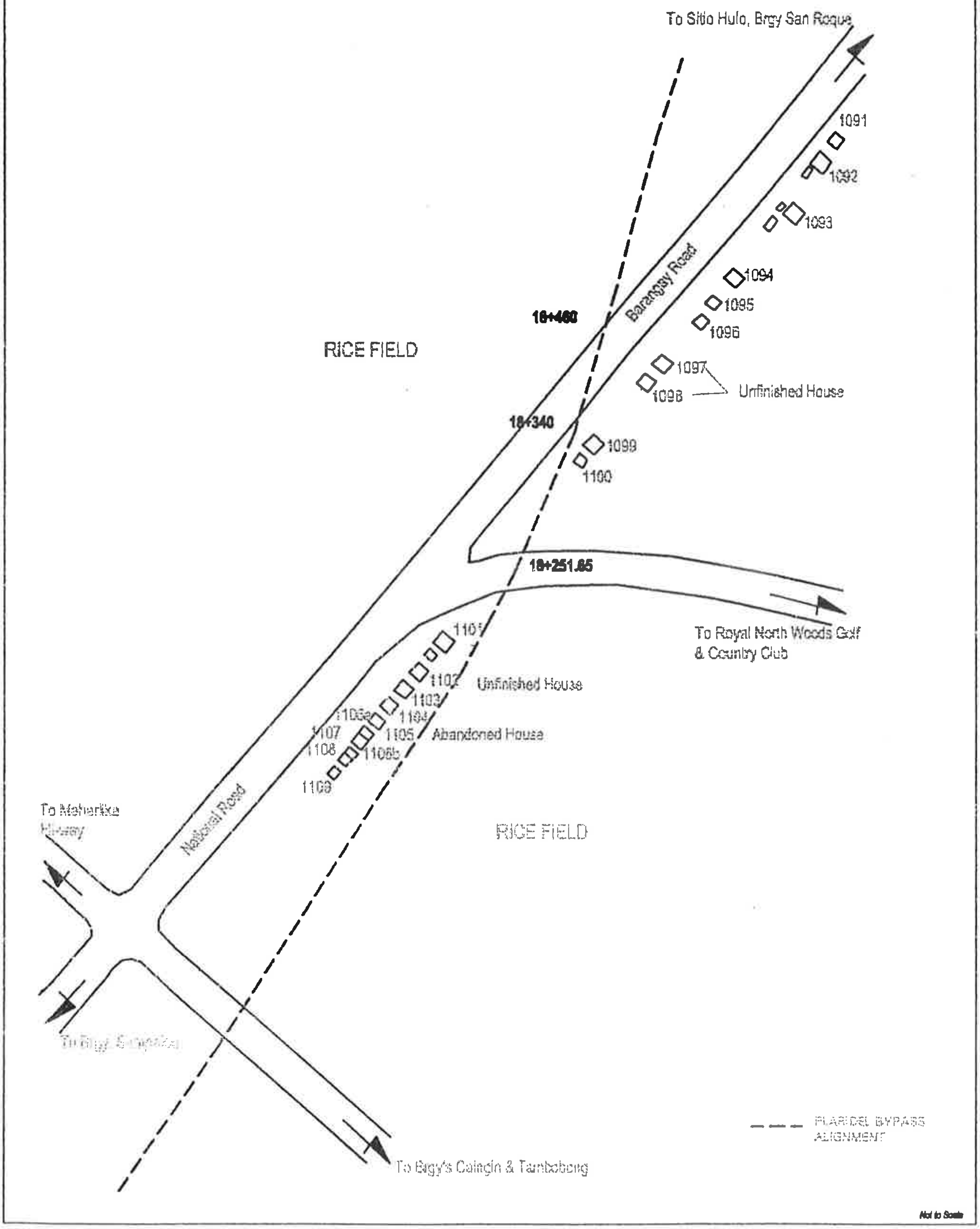
SETTLEMENT MAP
BRGY. BONGA MENOR
MUNICIPALITY OF BUSTOS
PLARIDEL BYPASS
13+500 - 13+900



SETTLEMENT MAP
BRGY. TAMBOBONG
MUNICIPALITY OF SAN RAFAEL
PLARIDEL BYPASS
15+700 - 15+950



SETTLEMENT MAP
BRGY. CAINGIN
MUNICIPALITY OF SAN RAFAEL
PLARIDEL BYPASS
17+100- 18+800



Appendix I

Clause 19 of DPWH Bid Documents Volume II

No. 3

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
REPUBLIC OF THE PHILIPPINES

DETAILED ENGINEERING DESIGN STUDY

ON

PAN-PHILIPPINE HIGHWAY IMPROVEMENT PROJECT
(MINDANAO SECTION)

FINAL REPORT

BIDDING DOCUMENTS

(Volume II)

CONDITIONS OF CONTRACT

PART II - CONDITIONS OF PARTICULAR APPLICATION

CONTRACT PACKAGES 1 TO 19

MARCH 1997

KATAHIRA & ENGINEERS INTERNATIONAL

SSF

Employment of Local Personnel   Sub-Clause 16.4

The Contractor is encouraged, to the extent practicable and reasonable, to employ staff and labor from sources within the Republic of the Philippines. The Government of the Republic of the Philippines permits only engineers skilled workers and senior management staff to get visas and permission to work in the Philippines.

Clause 17

Setting-Out   Sub-Clause 17.1

Amend the text of paragraph (c) to read as follows:

(c) The provision of all necessary survey instruments, equipment, labor, stakes, templates, batter boards, materials and supplies necessary for the setting-out of the work and maintenance thereof.

Clause 18

Boreholes and Exploratory Excavation   Sub-Clause 18.1

Amend the text under this Sub-Clause to read as follows:

If, at any time during the execution of the Works, the Engineer requires the Contractor to make boreholes or to carry out exploratory excavation, such requirement shall be ordered in writing and shall be deemed to be included in the Bill of Quantities under a Provisional Sum.

Clause 19

Safety Security and Protection of the Environment   Sub-Clause 19.1

The following paragraph and addition to sub-para. (c) is added:

"and shall comply with the measures given in the Environmental Compliance Statement issued by the Environmental Management Bureau (EMB) for this environmentally critical project and shall take all reasonable precautions to avoid harm to the living and work environment. Such precautions shall include but not be limited to the following :

(a) provision of sanitation facilities to prevent all pollution:
(b) avoidance of wanton destruction of flora and fauna including also trees, shrubs, bamboo, and other plants:

(c) avoidance of noxious gases associated with the Works:
(d) avoidance of excessive noise:
(e) protection of water courses, irrigation channels and drainage paths.

If the Engineer considers that inadequate precautions have been adopted to comply, the Contractor shall take such further precautions as the Engineer may reasonably direct.

Add the following Sub-Clauses :

Public Convenience & Safety — Sub-Clause 19.3

At all times during the conduct of the work the Contractor shall insure the least practicable obstruction to traffic. The convenience of the general public and the residents along the highway and the protection of persons and property are of prime importance and shall be provided for by the Contractor in an adequate and satisfactory manner. When it is necessary for residents living along the project to use a portion of the road under construction, the Contractor shall maintain, within the limits of the specifications, that portion of the road in a suitable condition for vehicular travel. When it is indicated on the plans or provided in the specifications that traffic shall be carried through construction, the Contractor shall provide and maintain suitable means for the movement of such traffic at all times.

The Contractor shall provide, and maintain in a safe condition, temporary approaches to and crossing of intersecting highways, railroads, private entrances and approaches to partly constructed Work.

Barricades & Warning Signs — Sub-Clause 19.4

Th Contractor shall, at his expenses and without further or other order, provide, erect and maintain at all times during the progress or temporary suspension of the Work, suitable barricades, fences, signs, and watchmen as may be necessary or as may be ordered by the Engineer to insure the safety of the public as well as those in connection with the Work.

The Contractor shall furnish and erect all detour and traffic control signs that are required by the plans and specifications. The Contractor shall furnish all posts, skids, easels, and supports and shall be required to set, move and remove all signs as directed. All signs, barricades and traffic control devices shall be approved by the Engineer prior to erection on the project. The cost of furnishing and erection of all warning signs and barricades shall be considered subsidiary to the item of the Contract for which payment is made.

All barricades and obstructions shall be protected at night by torches or red signal lights which shall be distributed in an approved manner and which shall be kept burning from sunset to sunrise. Barricades and signs shall be erected in accordance with the details shown on the plans, but in case no such details are shown, barricades shall be of substantial construction and shall be visibile at night.