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**Republic of the Philippines**

**DOTC*MMDA*DPWH*NEDA*PNP-NCR*HUDCC*UP-NCTS*EMB**
**Japan International Cooperation Agency (JICA)**

# METRO MANILA URBAN TRANSPORTATION INTEGRATION STUDY

## TECHNICAL REPORT NO. 12

# WATER TRANSPORT IN METRO MANILA

**March 1999**

**MMUTIS STUDY TEAM**

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# 1. INTRODUCTION

Waterborne transportation is a neglected field in urban planning. While most cities are built beside bodies of water to take advantage of cheap freight costs, most activities eventually adapt to land-based transportation and the speeds associated with it. Land-based travel demand rises until it strains capacity, and the speed advantage is lost. Once congestion reaches high levels and travel times become unbearably long, water transportation becomes an attractive option once more.

Metro Manila is no exception. There are only a few thousand water-borne trips a day in a population of more than 12 million. Most of these trips are to Cavite and Bataan. However, there are a large number of passengers taking one-minute *banca* rides across the rivers. Many ships also carry freight through the Pasig River and Laguna de Bay.

Because of the dearth of information regarding water transportation in Metro Manila, this paper is intended partly as a reference, a "fact book" for those who are interested in water transportation (eg. planners, regulatory officials, or prospective operators). The last chapter summarizes the study and provides some useful insights on the state of water-borne transportation in Metro Manila. The report ends by presenting a set of recommendations to increase the availability of waterborne transportation in the metropolis.

# 2. EXISTING WATER TRANSPORTATION

The Pasig River supports a variety of passenger, freight and other traffic. The greatest interest lies in the creation of a passenger ferry service running the length of the river. *Bancas* shuttling passengers back and forth across the river provide passenger service at key points in the river. Movement in goods to industries is also significant.

This chapter will describe these different transport modes currently operating on the river. A section covering public transportation on Laguna de Bay and Manila Bay will also be provided.

## 2.1 Pasig River Ferry Service

In the past, several ferry operators had provided service on the river. Their efforts, however, were short-lived. A ferry service had operated between Santa Cruz and Santa Ana in 1969. This operation eventually stopped and nothing much more is known about the service.

Official interest to provide transport service on the Pasig River started in the 80s. The then Ministry of Transport and Communications conducted feasibility studies of passenger traffic in 1980 and again in 1989. However, it was only in the early 90s when the first ferry service, the Metro Ferry, started operations. Established by the Magsaysay Lines, the service ran the route from Guadalupe (on the Pasig near EDSA) and Escolta (in Chinatown, across from the Post Office). The Philippines Ports Authority (PPA) provided the piers for the Metro Ferry.

The Star Craft Ferry and the bancas uses most of those piers today. (Metro Ferry's operations eventually stopped) Star Craft Ferry presented proposals to provide passenger service on the Pasig River in mid-1995. Its operations began in October 1997. At present, the StarCraft Ferry Corporation is the only ferry operator on the Pasig River.

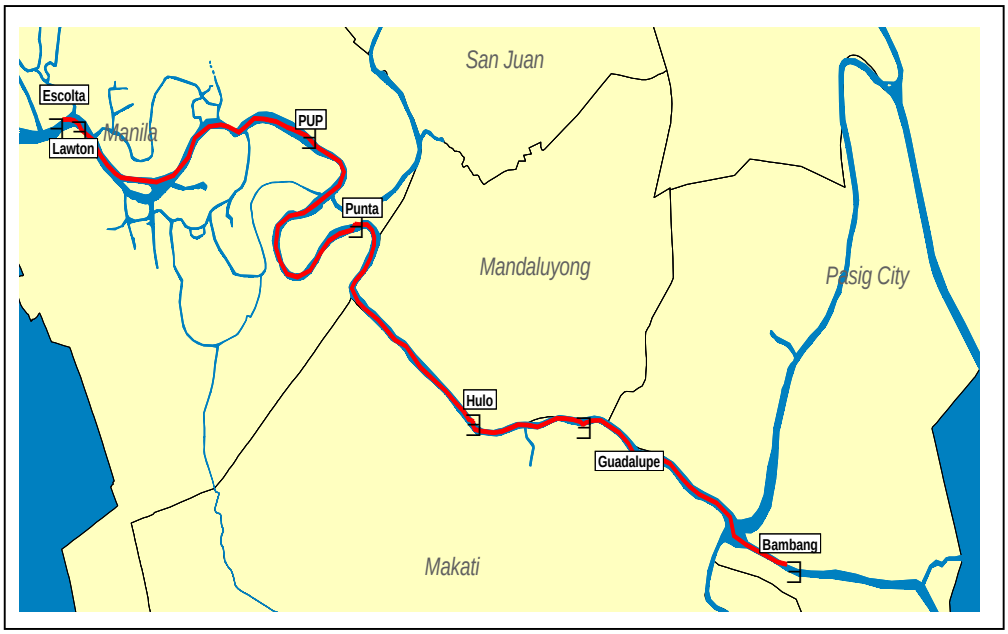
Another company, Marilag--- subsidiary of the Uniwide group, a retailer--- came forward with plans in early 1996 for service along the Pasig River as well as Cavite and Baclaran using foreign-made boats. The company hoped to provide service to their shopping centers and thus attract customers. However, the prospects of commercial tie-ins began to appear unfeasible, and the government policy of prohibiting the use of foreign-made boats rendered the project unattractive. As a result, Marilag dropped its plans.

In October 1997, President Fidel V. Ramos formed an interagency committee composed of national government agencies and local government units in response to concerns about competing ferry operations on the Pasig River. These national agencies include DOTC, DENR, PPA, DPWH, MARINA, the Coast Guards, MMDA and LLDA, and other agencies. The responsibilities of the committee are *(a)* to prepare guidelines for ferryboat service on the Pasig River; and *(b)* plan interconnections with the Laguna de Bay service.

### 2.1.1 Existing Ferry Operations

The only passenger service operating the length of the river began in October 1997. The StarCraft Ferry Company owns and operates the service. The route is 16.2 kilometers and comprises seven piers (Figure 2.1).

**FIGURE 2.1**
**THE 16-KILOMETER ROUTE OF THE STARCRAFT FERRY**




The duration of trips is 45-50 minutes. Each pier is in radio contact with the boats. If one pier has no passengers waiting, the boats may skip the pier. Most people travel almost the entire route from Guadalupe to Escolta. Other information on StarCraft Ferry's operation is detailed in Table 2.1.

**TABLE 2.1**
**BASIC INFORMATION ON STARCRAFT FERRY'S OPERATIONS**

| | |
|---|---|
| Total Length: | 16.2 km |
| Total Time: | 45 – 50 min. |
| Speeds: | 18 – 27 km / h |
| Dwell Times: | 2 – 5 minutes |
| Headway: | 15 – 20 minutes (peak); 30 min. (off peak) |
| Capacity: | 32 passengers / vessel |
| Average Load Factor: | 80% |
| Fares | 10 – 30 Pesos |
| Service Begun | October, 1997 |

The Star Craft Ferry designed Manta Boats to operate on the river. These are 12 meter, 32-seat boats of fiberglass construction built in the Philippines. They house 200 horsepower Volvo engines. Their maximum speeds are 27 knots (50 km/h), but normal operating speeds are about 10-15 knots.

**FIGURE 2.2**
**A MANTA BOAT OPERATED BY STARCRAFT**


There are 19 such boats in operation. Unfortunately, many have been damaged by debris chipping or clogging of propellers. Almost three-fourths of the boats are out of commission at any one time. Larger catamaran-style boats originally designed for Laguna de Bay are now plying the river.

The fares StarCraft charges for its service are shown in Table 2.2.

**TABLE 2.2**
**STARCRAFT FERRY'S FARE STRUCTURE**

| | |
|---|---|
| 1 stop | 10 pesos |
| Typical (Escolta – Guadalupe) | 25 pesos |
| Highest (Escolta – Bambang) | 30 pesos |

As shown in the Table 2.2, the ferry service is expensive relative to land transport systems. The LRT charges only 10 pesos and air-conditioned buses about the same. Jeepneys are charging 2.50 pesos per ride. Most passengers are office workers, professionals, or skilled workers. This indicates that passengers would be more likely to ride air-conditioned buses or the LRT.

The company's two greatest expenses (each accounting for almost one-third of total expenses) are insurance and maintenance.

StarCraft Ferry employs about 80 people: about half are crew on the boats, a quarter at the terminals, twelve work in the maintenance crew, and another twelve in their head office.

### 2.1.2 Ferry Ridership

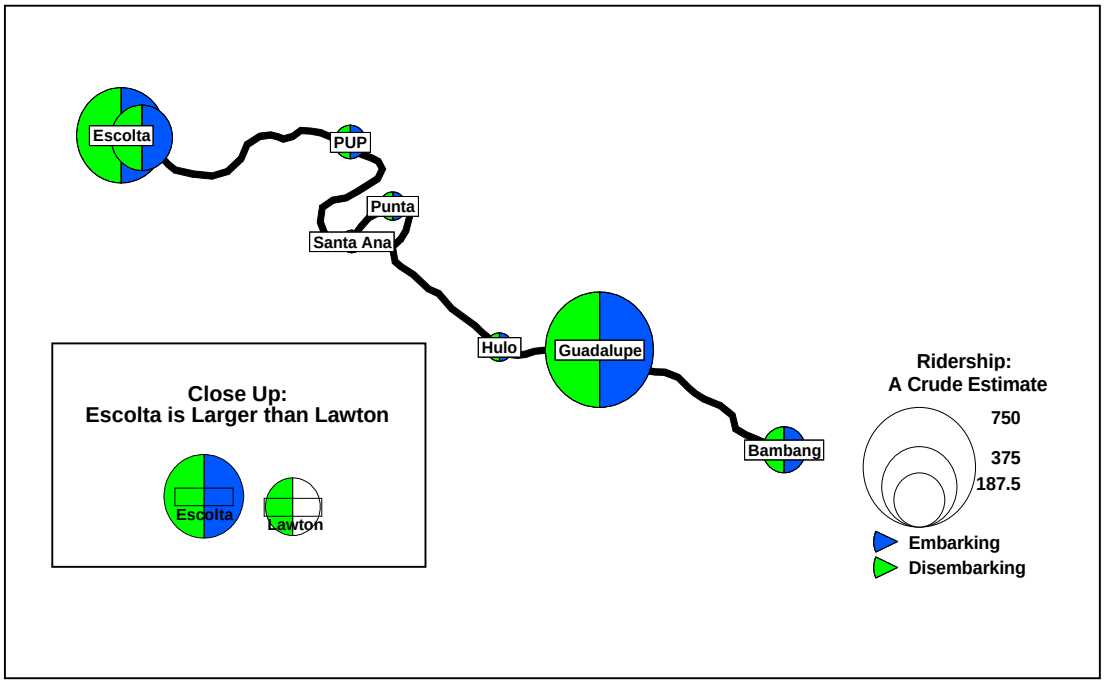
Current ridership range from 900 to 1,200 passengers per day. The company hopes to at least double that ridership (Table 2.3). Interestingly enough, ridership seems to increase on rainy days.

**TABLE 2.3**
**RIDERSHIP TARGET OF STARCRAFT FERRY**

| | |
|---|---|
| Current | 900 - 1,200 passengers / day |
| Targeting | 2,400 passengers / day |
| Optimistic Projection | 4,000 passengers / day |

Origin and destination data is not available as of yet. Nonetheless, it is clear from casual observation that ridership is greatest at three points: Guadalupe (east), Escolta (west), and Lawton (west). Bambang is a distant fourth. The typical trip is between Guadalupe in the east, and Escolta or Lawton in the west. Estimates of the ridership in these areas are shown in Figure 2.3.

**FIGURE 2.3**
**ESTIMATES OF FERRY RIDERSHIP AT VARIOUS POINTS ON THE PASIG RIVER**



A separate study surveyed 44 passengers and asked them the time required to travel between their origin and destination by ferry, jeepney and by bus. There is a great deal of variation in the data, but the most obvious trend is that most trips tend to be faster by ferry.

It would seem that most passengers travel on the ferry only if *both* their origin and destination are close to the river. This indicates that the advantage of time is lost if passengers must travel very far to the ferry piers.

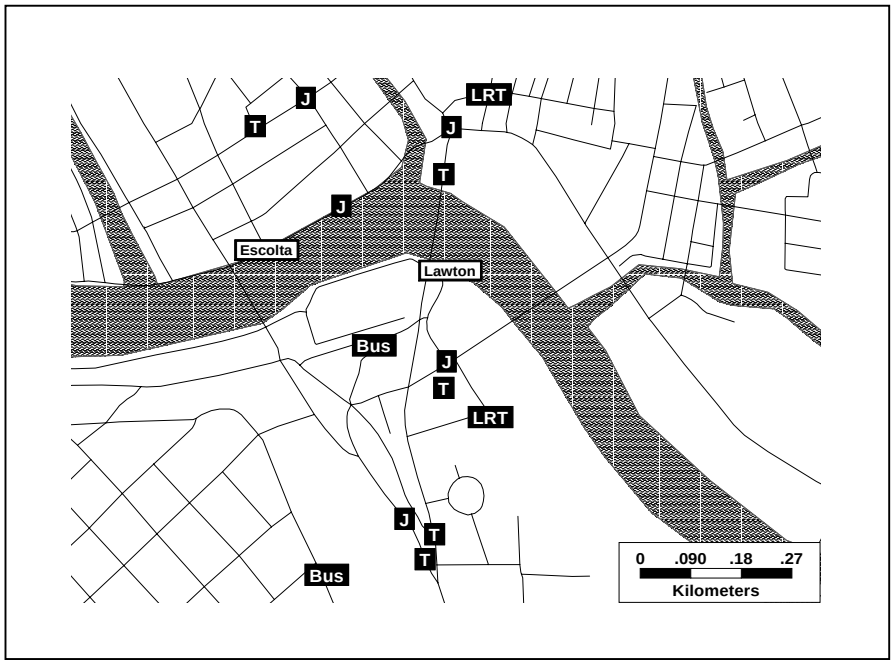
In addition, almost all respondents could report the equivalent jeepney travel time, but less than one-fourth could report the equivalent bus travel time. This confirms the observations that boat passengers travel by jeepney and then transfer to boats. This is a bit incongruous, considering the high ferry fares would lead us to assume most passengers match a profile of those who would prefer LRT, Tamaraw FX, or air-conditioned bus. Perhaps, this is because only one pier — Lawton — is near bus service.

The following factors may best explain the ridership patterns: immediate access to frequent jeepney service, and large commercial employment.

### 2.1.3 Inter-Modalism

Figure 2.4 shows that high ridership in Escolta and Lawton are explained by transfer.

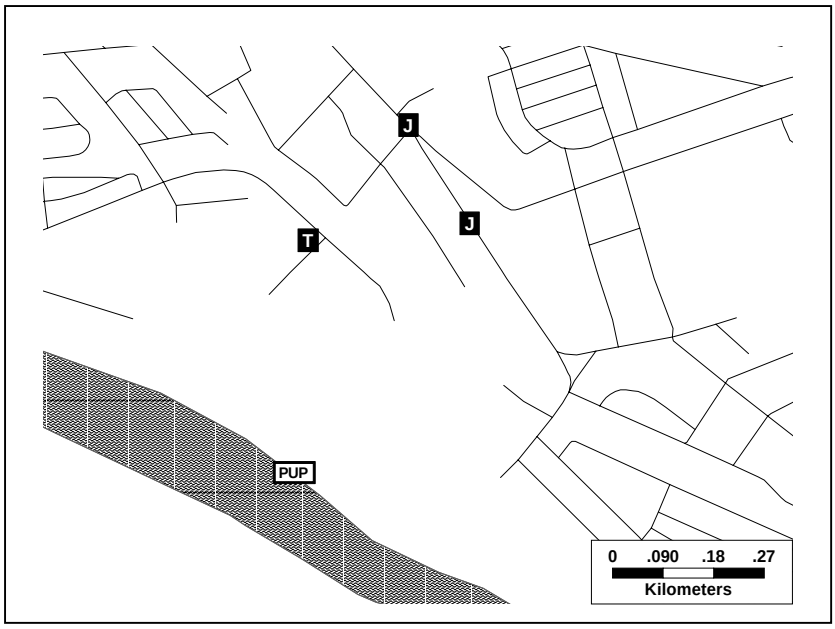
**FIGURE 2.4**
**ACCESS OF ESCOLTA AND LAWTON PIERS TO OTHER MODES OF TRANSPORT**



Escolta has immediate access to jeepneys and Tamaraw, while Lawton has a profusion of jeepneys, Tamaraw FX, and buses a few hundred meters from the piers. (Escolta also has a huge number of commercial employments) Guadalupe also has an enormous number of jeepneys stopping a few meters from the peer.

PUP provides a particularly good example of weak inter-modalism. Its low ridership at PUP is explained by the very poor access to other modes within 500 meters, and little employment.

**FIGURE 2.5**
**LOCATION OF JEEPNEY SERVICES IN RELATION TO THE PUP PIER**




It has been observed that the ridership catchment area extends one kilometer from the pier. That is the distance patrons would be willing to travel by an inexpensive mode of transit — jeepney or tricycle — to another mode and reach the river ferry.

In short, ridership is greatest when *(a)* the origin and destination are both near the river, or *(b)* access to other transit modes is favorable.

### 2.1.4 Land Use Associated with Ferry Ridership

Land use along the river is largely industrial and urban poor (i.e. "Squatter") settlements. But initial information indicates that riders are riding to and from middle-/upper-income and "white collar" workplaces. The only place with commercial employment is Escolta. Ridership will possibly increase if a pier is built near Rockwell Center to the west of Guadalupe.

## 2.2 Bancas on the Pasig River

*Bancas* are small outrigger boats equipped with small inboard engines. Utilized for many different purposes throughout the Philippines, they are used on the Pasig River to carry passengers across the banks. They serve as a shortcut linking two points not readily accessible by road.

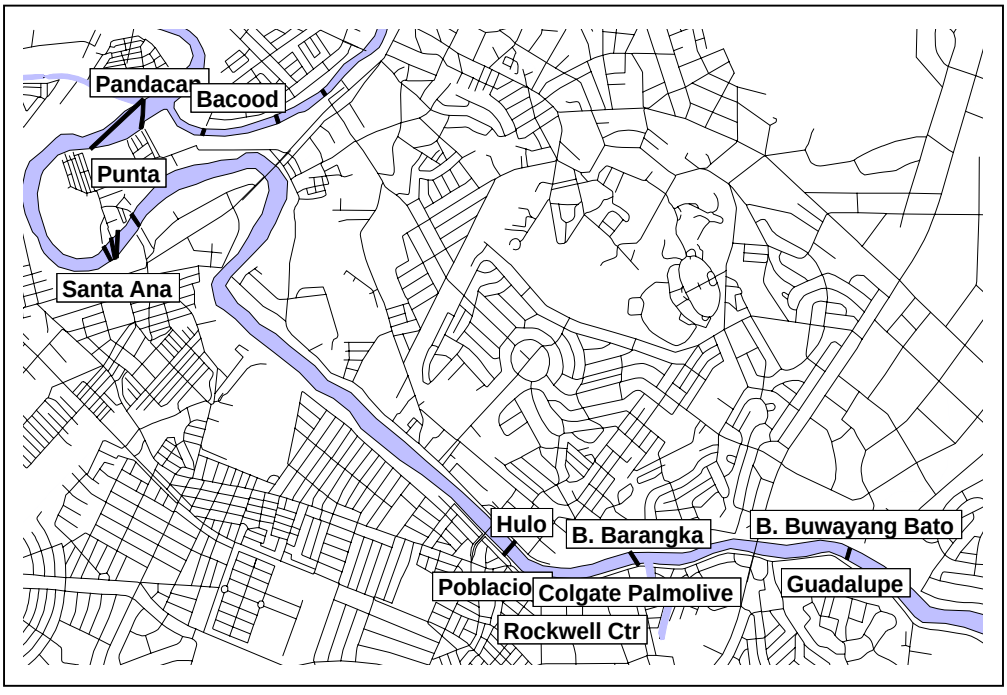
There is wide variation in the size, quality, and age of *bancas.* The type operating on the San Juan River use paddles.

*Bancas* are unstable craft. Larger boats passing at high speeds stall their operations for about two minutes. The wakes causes the *bancas* to shake up and down with the movement of waves, and could even capsize them.

### 2.2.1 Banca Operations

There are nine *bancas* providing transport to the public at five points on the Pasig River (Figure 2.6). There are probably more to the east of Bambang, but services are infrequent. It is difficult to distinguish between bancas for public transport and those privately-owned/ operated which households use for fishing or other purposes.

**FIGURE 2.6**
**LOCATIONS OF BANCA OPERATIONS ALONG THE PASIG RIVER**




There are also three more *bancas* at Bacood near the mouth of the San Juan River. They are non-motorized.

*Banca* traffic is rapid. Each trip takes about one minute from one bank to the other. It takes about one minute to board passengers. Dwell times are longer during off-peak times, as the boat will wait longer to board enough passengers to maximize the trip. In total, round trips occur almost every five minutes.

The typical *banca* seats 20-24 passengers. However, it is not uncommon for more passengers to stand inside the cabin or on the boats' prows. Passengers often carry large bags, "*taho*", and even bicycles on board.

Passengers only need to wait long enough for the *banca* to dock, board it, and begin the short trip to the river's other bank. During peak hours however, capacity is temporarily less than demand. Passengers may have to wait five extra minutes to make the trip. During a short period in the morning, that extra waiting time may extend to ten minutes.

A banca fare is one peso. This is easily the cheapest form of public transportation available in Manila. It may only be a short trip (one-minute), but it represents great savings in time.

*Bancas* are privately operated. The operation comprises a skipper; two men responsible for guiding the boat into the pier and later pushing it away from shore (a demanding task apparently requiring two shifts), and one or two people on shore to collect the fares. The specific arrangements differ from pier to pier and boat to boat. Services with smaller volumes require smaller staff.

### 2.2.2 Conflicts between Bancas and Other Modes

There is a great deal of conflict between the *bancas* and other large and higher speed boats. The latter create the wakes which may disturb or even capsize the former. *Banca* operators have been accused of throwing stones, fish and other objects at passing boats.

Even if they are not registered, it is recognized that *bancas* provide a useful service to the public. This is the reason why Star Craft Ferry Corporation in seeking to build good relations with the *bancas*. As a step towards this direction, the ferry (usually) slows down whenever proximate to a banca so as to minimize disturbance to the *bancas*. An issue that needs to be explored is the sharing of piers to improve transfer between the ferry and *bancas*.

### 2.2.3 Legality of Bancas

Questions have been raised on the legality of *banca* service. Some *bancas* have been registered with the appropriate government agencies like the Maritime Industry Authority (MARINA), the Philippine Coast Guard (PCG) and the Local Government. Registered *bancas* bear their registration numbers clearly on their hull and follow safety regulations. Other bancas are unregistered.

Vessels less than 3 tons are not required to register with the PPA or PCG. This may have contributed to the notion that *bancas* are illegitimate.

### 2.2.4 Banca Ridership

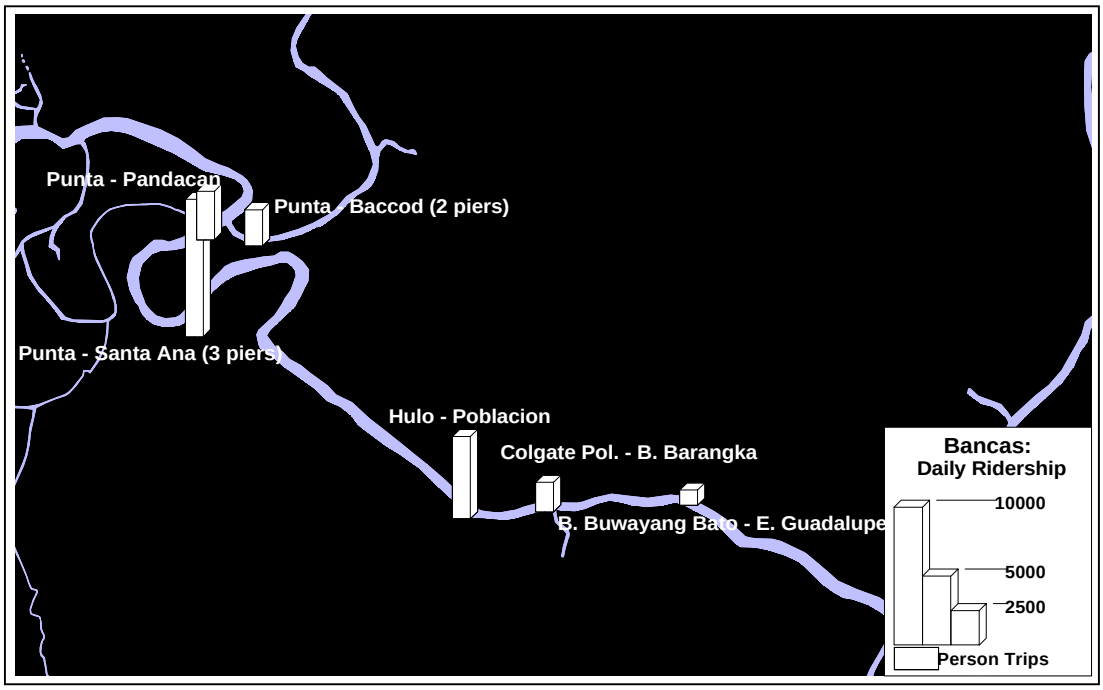
The study team conducted a survey to obtain some estimates of ridership on *bancas*. Table 2.4 shows the survey results.

**TABLE 2.4**
**ESTIMATES OF RIDERHSIP ON BANCAS**

| *Banca Pier* | *Daily Passengers* |
|---|---|
| Punta - Santa Ana (3 piers) | 9,967 |
| Punta - Baccod (2 piers) | 2,637 |
| Punta – Pandacan | 3,528 |
| Hulo – Poblacion | 5,956 |
| Colgate Pal' - B. Barangka | 2,146 |
| B. Buwayang Bato - E. Guadalupe | 1,114 |
| **Total** | **25,348** |

The data is based on a full day's (from 5:30 AM – 9:30 PM) count of passenger's boarding and disembarking from one pier--- Hulo. Counts at other piers were made for a few hours during morning peak, evening peak and off-peak hours. Estimates of ridership during intervening periods were also made. As shown in Table 2.4, the ridership estimates are conservative. Analysis of variance is difficult, but this report is confident (90% confidence interval) that ridership is between 20,000 and 32,000 a day.

**FIGURE 2.7**
**ESTIMATES OF BANCA RIDERSHIP AT VARIOUS POINTS ON THE PASIG RIVER**



The hourly ridership during the morning peak is more than 2,000 passengers per hour. That is more than double Star Craft's daily ridership.

*Bancas* serve as important "shortcuts" where access to bridges are long and inconvenient. Therefore, *bancas* help relieve congestion on the bridges. The key determinants of ridership are: *(a)* distance from bridges; *(b)* access to jeepneys, tricycles and other low-cost transit; *(c)* proximity to schools; and *(d)* proximity to low-income communities.

The presence of low-cost transit is partly a function of *banca* piers. That is, if a new *banca* pier were installed, jeepneys and tricycles would queue for riders. Low-income riders are attracted by the low (one-peso) *banca* fares, but then most of the riverbank residents are low-income, and one bank usually has little or no residential land use.

### 2.2.5 Inter-Modalism

An interesting feature from an urban transit-planning perspective is that *bancas* form an important link in the transit network. *Bancas* feed commuters onto other transit modes leading into employment centers in Makati and Manila. Figures 2.8 to 2.11 illustrate this point.

In the case of Hulo, the Makati-Mandaluyong Bridge is near the pier. Hoiwever, jeepenys are not allowed to operate on the bridge. Jeepneys waiting in the Poblacion provide direct access to Ayala Center and other points in Makati CBD.

**FIGURE 2.8**
**LINKS BETWEEN BANCAS AND JEEPNEYS IN MAKATI**

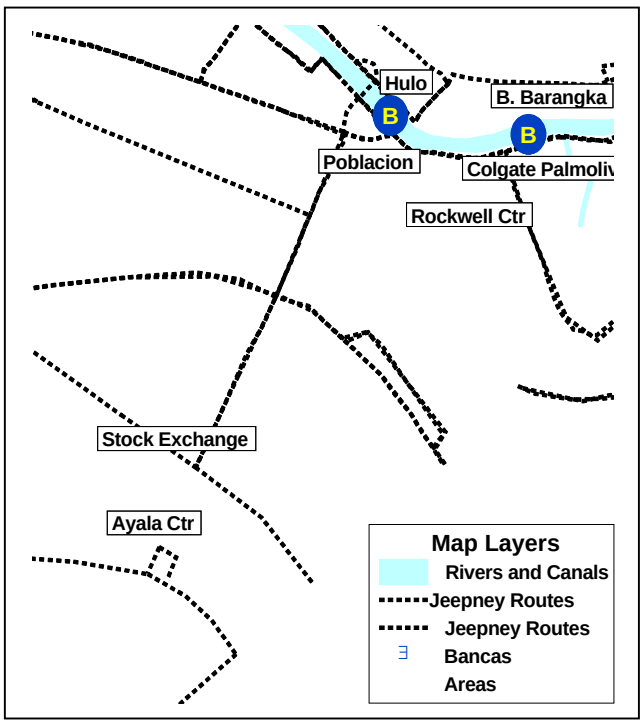


Figure 2.9 below shows the *banca* routes connecting Punta with Pandacan's bus routes and Santa Ana's jeepneys. These jeepney and bus routes, in turn, are directly linked to Ermita, Malate and other important employment centers in Manila (Fig. 2.10). There are observations that people avel on *bancas* primarily for short trips only, not links in larger trips. There is no doubt that student ridership on the *bancas* is high, and most of them simply travel from residences to schools near the river. Similarly, some people travel by *banca* to markets and back home again. That may be true, but there are markets on both sides of the river. While the market in Santa Ana is larger and more diversified, Punta's market — located right next to the pier — is large enough that many residents wouldn't bother to travel to Santa Ana for their common needs.

**FIGURE 2.9**
**LINKS BETWEEN BANCAS AND LAND-BASED TRANSPORT MODES IN PUNTA AND STA. ANA, MANILA**

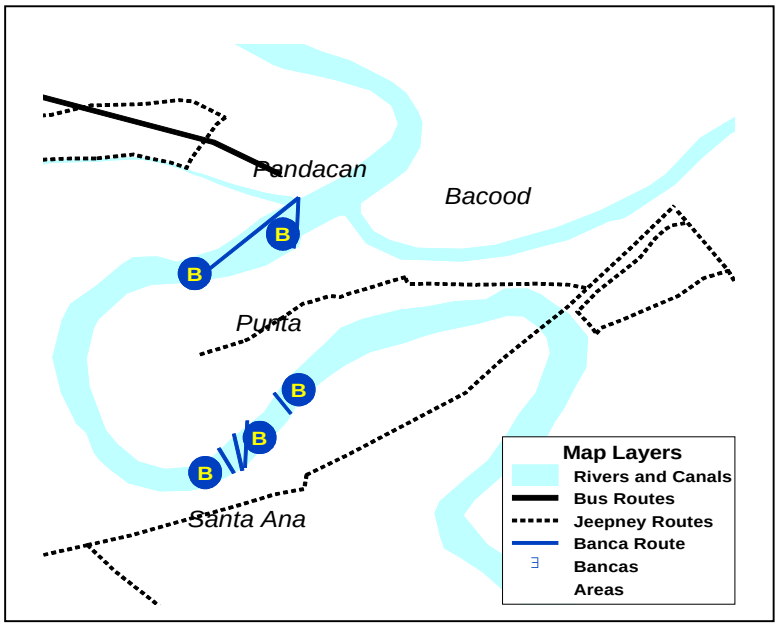


**FIGURE 2.10**
**JEEPNEY AND BUS ROUTES CONNECTING PANDACAN AND PUNTA WITH EMPLOYMENT CENTERS IN ERMITA AND MALATE**

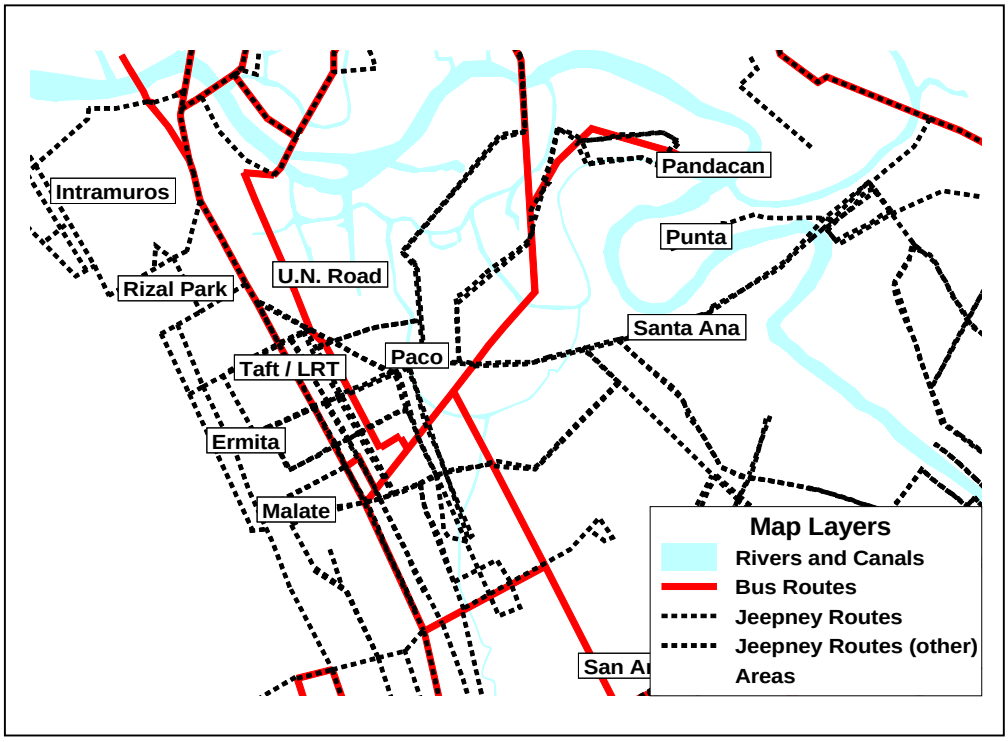



**FIGURE 2.11**
**BANCA RIDERSHIP IN HULO**

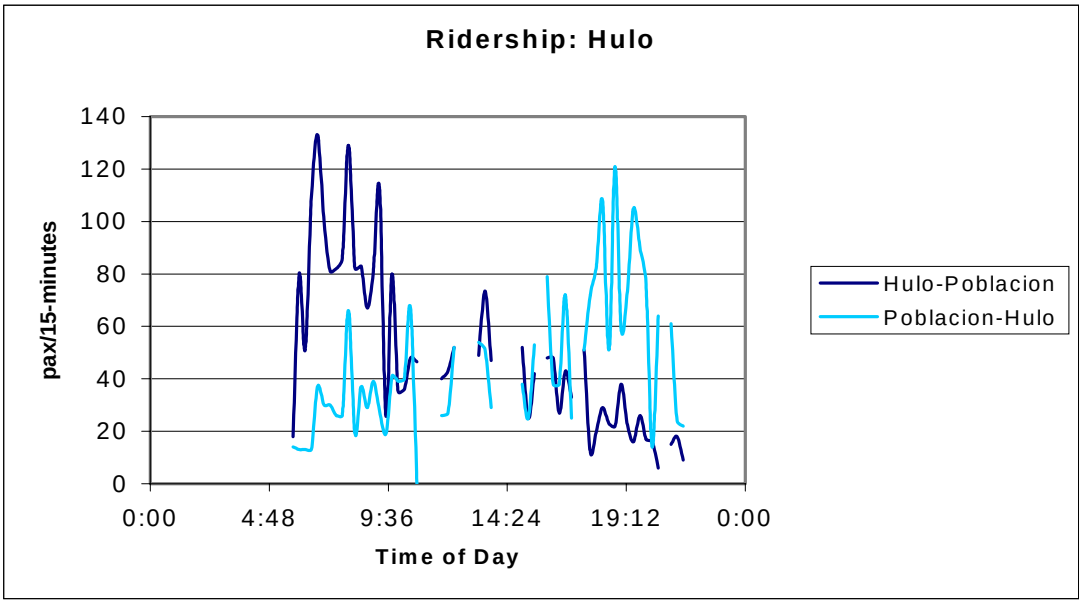


Figure 2.11 shows the ridership in Hulo in the morning and evening peaks. The flows are associated with people traveling to work. Passenger riding *bancas* in the morning from Hulo (residential) into Poblacion (and then to work in Makati or Rockwell Center) greatly outnumber those making other trips in the morning. In the evening, the reverse is true: passengers travel from work (in Makati or Rockwell Center) to the ferry landing in Poblacion, and to their homes in Hulo or nearby. Mid-day off-peak hours reveal that passengers traveling to or from school or for other non-work purposes are about equal in both directions.

*Banca* riders tend to be disproportionately lower-income classes. This is partly because bancas tend to operate in squatter settlements, especially Punta. (And it is probably a squatter area because poor accessibility makes Punta unattractive to those with greater purchasing power.)

## 2.3 Movement in Goods on the Pasig River

This paper is concerned with passenger traffic. However, the barges and other freight traffic plying the river's length affect the operations of the river's ferry and banca services. A report on the Pasig River, therefore, would not be complete without a discussion of the movement in goods. It is related to the issue of land use along the riverbank, discussed in chapters 4, 5.

### 2.3.1 Description

A wide variety of freight traffic goes through the Pasig River. Most are wide barges with tugs towing them. A number of barges and of tugs are chained together. Many are "lighters" transferring freight from large freighters docked in Manila Bay to piers along the river. There are also self-propelled barges. This category includes tugboats traveling without barges (even if they are not necessarily carrying freight.)

No data exists concerning the speed of barges. It varies greatly depending on the power of individual tugs and barges, and the loads they are carrying. Watching from the shore, it would seem many barges travel at only a few knots.

Most boats deliver inputs to factories along the riverbank. Most typical are those hauling grains to flour- and feed-mills, and sugar to distilleries. Perhaps just as many barges carry fuel to Caltex, Mobil and other oil companies' fuel depots. A large number of barges haul coal. These vessels are supplying large power generation sites along Laguna de Bay.

### 2.3.2 Freight Volumes

Table 2.5 shows the movement in goods along the Pasig River. Most of the freight goes to private ports operated by factories. By way of comparison, the Pasig River's handles as much freight as South Harbor ports, and almost half that of North Port.

**TABLE 2.5**
**VOLUME OF GOODS MOVING THROUGH THE PASIG RIVER**

| | Million MT (1996) |
|---|---|
| Pasig River, Gov't Ports | 1.7 |
| Pasig River, Private Ports | 5.6 |
| *Comparison:* | |
| North Harbor | 15.1 |
| South Harbor | 6.4 |

Note: the Pasig River piers reported in the first two entries refer to those east of Jones Bridge. Traffic at the river's mouth is reported as South Harbor.)

Perhaps the most compelling notion arising from the above figures is that a large portion of Manila's industry is dependent upon the river to deliver raw materials and transport their finished products.

### 2.3.3 Freight Capacity

Table 2.6 shows the estimates of the Philippines Port Authority (PPA) on the capacity utilization of existing piers along the Pasig River.

**TABLE 2.6**
**ESTIMATES OF CAPACITY UTILIZATION OF PIERS LOCATED ALONG PASIG RIVER**

| | Piers | Total Length | Capacity Utilization |
|---|---|---|---|
| Present | 26 | 1,100 m | 155% |
| Planning Target | 60 | 2,500 m | 70% |

## 2.4 Other Traffic on the Pasig River

Other forms of boat traffic observed along the Pasig River are:

- Motorized fishing boats: large - perhaps 20 - 30 meter - boats which plies the Pasig at impressive speeds. The vessels create large wakes.

- Artisanal Fishing Boats: bancas similar to those described above, though usually a little smaller. These are located almost exclusively east of Bambang, near Laguna de Bay.

## 2.5 Traffic Capacity on the River

Large barges can block other traffic. It is possible for two barges to pass each other moving in opposite directions on the Pasig, assuming they are not near bridges or areas with shallow water. The Star Craft Ferry may be forced to slow down before it can pass a barge traveling in the same direction. Bancas must stay close to shore until barges pass resulting in a delay of two or more minutes.

In short, the Pasig River suffers from congestion more often associated with 4-way traffic on city streets. The passage of one vessel often interferes with the others.

## 2.6 Laguna de Bay Ferry Service

### 2.6.1 Description

Laguna Star Ferry is a sister company of StarCraft Ferry Corporation and has provided a variety of services between Escolta in Manila and Los Baños in Laguna Province.

The Laguna Star Ferry previously operated a service linking Escolta with Los Baños. The service was discontinued for what the company describes as a technicality: faults in the way papers were filed. The company expects to begin service to Los Baños again soon. It plans to operate four high-speed boats at half-hour headways during peak periods.

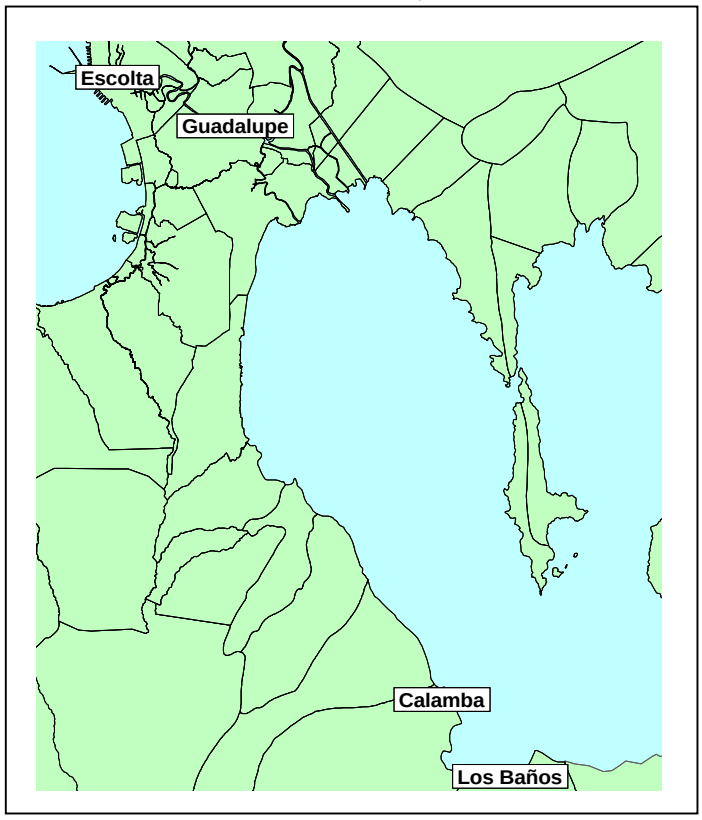
Laguna Star Ferry comprises four catamarans much larger than the Manta boats operated on the Pasig. The "River Cats" are slightly shorter (11.13 meters) but twice as broad (4.2 meters.) They seat 64 passengers. They can obtain speeds of 37 knots (i.e. 69 km/h), but typically operates at 18-20 knots. Like the Manta boats, they are of fiberglass construction and shallow drafts. River Cats have two 230 horsepower Volvo engines.

The intention is to provide four regular trips a day in each direction linking Los Baños in the south of Laguna de Bay with Guadalupe and Escolta (Figure 2.12). Los Baños is a community of 72 thousand persons (1995.) Housing the University of the Philippines' Los Baños (UPLB), it has a natural link with Metro Manila and offers tourist attractions. Los Baños is also home to the International Rice Research Institute and is near Calamba, a bustling community of 219,000 persons.

### 2.6.2 Immediate Plans of Laguna Star Ferry

Laguna Star Ferry began operation in early 1998. The start-up was facilitated by President Ramos' "fast tract" approval. Unfortunately, the regulatory body — Laguna Lake Development Authority (LLDA) — later revoked Laguna Star Ferry's license, stating that not all the necessary papers had been submitted. The Laguna Star Ferry is eager to resume operations as soon as possible. It hopes to operate four trips in each direction per day.

**FIGURE 2.12**
**LOCATION MAP OF LOS BAÑOS, LAGUNA PROVINCE**




The company however operates some charter services to Los Baños. It also hopes to operate a tourist service to Los Baños, Pagsanjan and other places of historical interest.

### 2.6.3 Other Forms of Traffic In Laguna de Bay

Other forms of traffic on Laguna Lake are fishing boats, fishing bancas, and barges. The first two groups are too numerous to count. Large fishing ponds surrounded by extremely large nets occupy much of Laguna De Bay and so there are many boats traveling to the different nets. Barges supplying power plants near Alabang and Muntinlupa travel the Pasig River to Laguna de Bay.

## 2.7 Manila Bay Ports

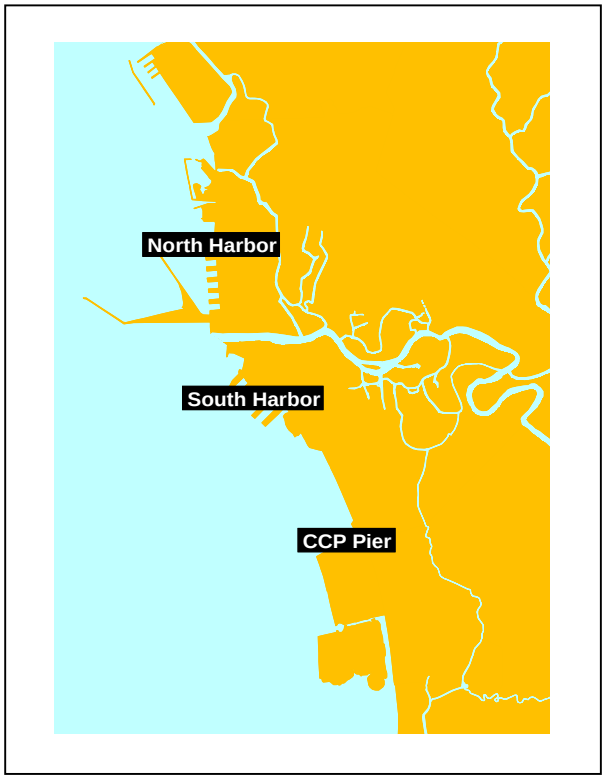
### 2.7.1 Background

Manila Bay is the nation's largest freight port. However, it also supports inter-island passenger service in and out of Manila. It provides passenger service to Cavite and Bataan. Some background is provided concerning the other services, but most of this section covers passenger service within Manila Bay.

### 2.7.1.1 Freight

Most freight moves through North and South Harbor (Figure 2.13). North Harbor handles more than 15.1 million metric tons a year. South Harbor handles less than half of that. No data is available on Navotas harbor to the north, but it is thought to be much smaller.

**FIGURE 2.13**
**LOCATION OF NORTH AND SOUTH HARBOR**




The South pier was built long before World War II and suffers from under-capacity. There are plans to expand the piers through reclamation and convert the existing piers to real estate and cruise-boat docks.

### 2.7.1.2 Long Distance Passengers

In addition to being the center of freight traffic, North Pier provides the only place where long-distance passengers arrive in and depart from Manila.

## 2.7.2 Manila Bay Passenger Service

Compared to the North and South Harbor, CCP pier is smaller and handles passenger service in Manila Bay only. Passengers are typically travelling to Bataan and Cavite. As shown in Table 2 there are boat services linking Manila to other points along Manila Bay.

**TABLE 2.7**
**OTHER BOAT SERVICES LINKING MANILA TO OTHER POINTS ALONG MANILA BAY**

| Company | Destination | Duration | Boat Capacity | Frequency of Service | Fare (Pesos) |
|---|---|---|---|---|---|
| Marilag | Cavite | 25 min. | 40 - 56 | 18 / daily | 40 |
| Mt Samaat | Lamao / Orion | 110 min. | 202 | 7 / daily | 130 / 140 |
| Grand Seaway | Lamao / Orion | 50 min. | 345 | 5 / daily | 100 / 110 |
| Jet Ferry | Mariveles | 130 min. | n.a. | 4 / daily | 160 / 200 |
| Eagle Ferries | Subic | n.a. | 154 | n.a. | n.a. |
| Blue Ferries | Cavite | n.a. | 100 | n.a. | n.a. |

The destination "Lamao / Orion" refers to different piers in Bataan. All boats servicing Bataan seem to be diverting from the ports at Point Lamao, and docking a few dozen kilometers to the north at Orion instead. This may be only a temporary measure. Fares vary slightly between business and economy classes. Children, students, and are given discounts by as much as 50%.

Bullet Express operated another five ferries daily to Bataan until recently, but has ceased operations.

### 2.7.3 Manila Bay Ridership

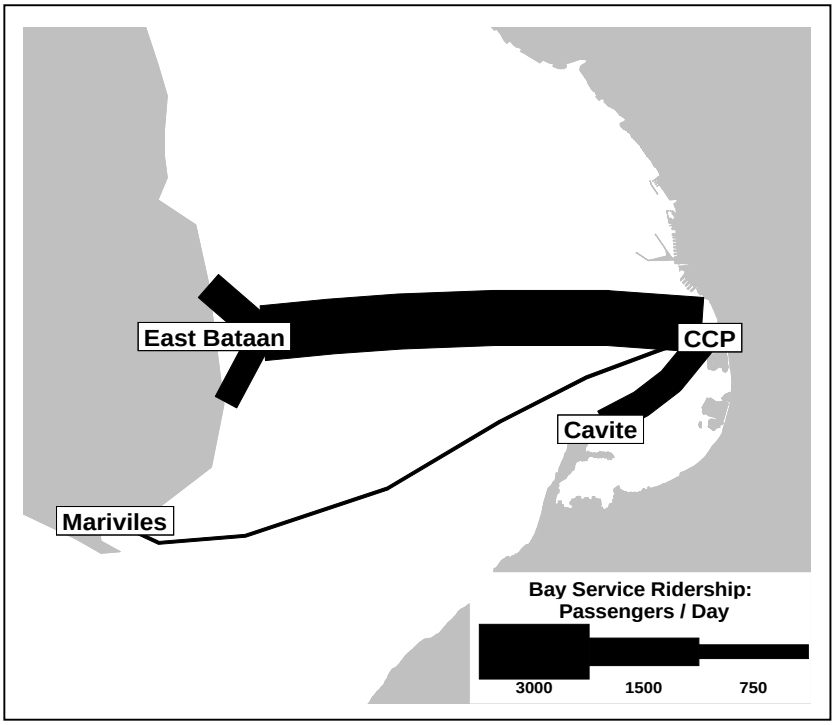
The study team conducted a simple survey to obtain some estimates of ridership on boats serving Cavite and Bataan across Manila Bay. The survey covered all trips on one day, with the exception of a few very early boats. The numbers shown in Table 2.8 should be treated as minimum daily ridership.

**TABLE 2.8**
**ESTIMATES OF MANILA BAY RIDERSHIP**

| | Arriving Passengers | Departing Passengers | Total Passengers/ Day |
|---|---|---|---|
| Cavite | 900 | 580 | 1,480 |
| Bataan | 1,490 | 1,690 | 3,180 |
| Total: | 2,390 | 2,270 | 4,669 |

Most passengers appear to be making incidental trips: visiting relatives, going on vacation, foreign tourists, and so on. A good share are either commuting to or from Manila, or perhaps traveling to one location or the other as part of their business (e.g. a sales visit.) The 25-minute Cavite service appears to have a high number of such travelers. It has been observed that the service providers seem to be changing piers they operate from in east Bataan: Orion or Lamao, or possibly even Port Kin Patpat (Figure 2.14).

**FIGURE 2.14**
**VOLUME OF RIDERSHIP FROM CCP PIER TO BATAAN**




### 2.7.4 Inter-Modalism

There is no access to public transport at the CCP area, other than some old-style, non-air-conditioned, Tamaraw FX. It is a 5-10 minute walk to Roxas Boulevard. Roxas of course handles a profusion of public transport.

## 2.8 Summary of Manila's Existing Water Transportation

As shown in Table 2.9, there are a variety of different water transportation services in Manila serving different places and purposes.

**TABLE 2.9**
**SUMMARY OF EXISTING WATER TRANSPORTATION IN MANILA**

| *Service* | *Place* | *Purpose* |
|---|---|---|
| ***StarCraft*** | Pasig River | Passengers traveling downtown and along Pasig River. |
| ***Bancas*** | Pasig River | Short-cut crossing river. |
| ***Barges, tugs…*** | Pasig, Laguna de Bay | Goods to factory. |
| ***Fishing boats*** | Pasig, Laguna de Bay | Fishing, to market. |
| ***Laguna Star Ferry*** | Laguna de Bay | Passengers from Los Baños to Makati, Manila |
| ***Manila Bay Ferry*** | CCP (Manila) to Cavite and Bataan | Passengers |

Some of these modes are in conflict with each other. In particular, the ferry, barges, tugs and fishing boats traveling the length of the river often disrupt and delay *bancas* crossing the river. Some larger boats care to not pass the *bancas* too quickly, but that also delays their operations.

*Bancas* are an informal sector operation providing a useful service to 25,000 passengers per day. Freight traffic is substantial.

Otherwise, ridership on the river, Laguna and Manila Bay services are remarkably low. Initial studies by MMUTIS (Table 2.9) indicate the time saved traveling through the Pasig River should attract more commuters.

**TABLE 2.10**
**CURRENT AND POTENTIAL RIDERSHIP ALONG THE PASIG RIVER**

| Origin | Potential Ridership (to central Manila, Makati) | Current Ridership |
|---|---|---|
| Cavite | 10,000 – 20,000 | 1,500 |
| Los Baños | 25,000 – 30,000 | Low |
| Alabang | 2,000 – 5,000 | n.a. |

The ridership estimates shown in Table 2.9 are based upon total demand, distance, travel times and a balance of congestion levels: a “traffic assignment” model. Fare structure was not considered in the projections. South Superhighway linking Alabang and Los Baños to Manila is congested. Considering the distance, ferry service should be very time-competitive with the South Super Highway. The same applies to the coastal road linking Cavite with Metro Manila.

One of the largest impediments to higher ridership in Manila is the lack of access. Most people riding the service are traveling to and from two points near the river. However, ridership is high when it links with other transit modes. The high ridership on *bancas* is a result of their access to jeepneys traveling into Manila and Makati. Improved transfer between boat and other transit should improve waterborne passenger ridership.

The best way to increase waterborne ridership would be to improve transfer between different services operating on the water. One pier (or two neighboring piers) offers the most natural transfer. Another idea that needs to be explored (which will be discussed in following chapters) is the possibility of expanding service on different water bodies and thus creating a “water network.”

# 3. THE ROLE OF THE GOVERNMENT IN WATER TRANSPORTATION

The government has three major roles in water transportation: *(a)* regulatory; *(b)* encouraging passenger service on the Pasig River and Laguna de Bay; *(c)* and improving the environmental conditions on the Pasig River and its watershed.

The regulatory role is a long-standing one and part of a much larger effort to ensure safety and proper practices within the shipping industry. A year ago, President Fidel V. Ramos spurred the initiatives that led to the establishment of passenger service in and around Manila. The efforts to improve the river's environmental standards are partly intended to make the Pasig navigable and appealing to would travelers.

## 3.1 Concerned Bodies

Table 3.1 lists all government bodies concerned with water transportation and their corresponding responsibilities.

**TABLE 3.1**
**LIST OF GOVERNMENT AGENCIES CONCERNED WITH WATER TRANSPORTATION**

| *Agency* | *Responsible for:* |
|---|---|
| Dept. Environment and Natural Resources Environmental Management Bureau (Board) "DENR-EMB" | Reviews EIA<br>Issue Environmental Compliance Certificate<br>Zoning uses which effect the environment |
| Coast Guards (PCG) | Guidelines for operation of ferry services along Pasig River and Laguna de Bay.<br>Establish rules of navigation.<br>Inspect vessels, issue certificates and licenses.<br>Inspect piers ("Certificate of Safe Inspection.")<br>Security patrol; search and rescue.<br>Accident reporting.<br>Planning and coordination: transport development.<br>Plan, operate and maintain navigation aids<br>Pollution control. |
| Department of Interior and Local Governments | n.a. |
| DOTC | Nationwide planning and development.<br>Umbrella organization for management of MARINA, PPA and other agencies. |

| *Agency* | *Responsible for:* |
|---|---|
| DPWH (Department of Public Works and Highways) | Responsible for dredging and maintenance of river walls.<br><br>Builds and maintains bridges. |
| LLDA (Laguna Lake Development Authority) | Establish es rules of navigation on Laguna de Bay;<br><br>Chairs inter-agency working group on Manila water transportation. |
| MARINA (Maritime Industry Authority) | Regulations and Guidelines<br><br>Issue CPC ("Certificate of Public Convenience")<br><br>Issue Safety Certificate.<br><br>Special Certificate of Inspection: proof of life saving equipment.<br><br>Issue PO ("Permission to Operate"): proof that the crew has training.<br><br>Approve franchises.<br><br>Inspect piers.<br><br>Planning and coordination: transport development, navigational aids. |
| MMDA (Metro Manila Development Authority) | Supporting infrastructure (e.g. pedestrian access.)<br><br>Cleaning of Pasig River. |
| Municipalities (e.g. Manila) | Supporting infrastructure (e.g. pedestrian access.)<br><br>Controls dumping of solid waste. |
| MMUTIS (DOTC) | Passenger Market Study |
| PPA (Philippines Ports Authority) | Approve construction of piers on the river.<br><br>Plans expansion of shipping capacity. |
| Provincial Government | n.a. |
| Office of the President | Creation of a presidential task force in support of the industry, rationalization of the Pasig River as a means of transportation, conduit for socioeconomic progress, etc… |
| PTA (Philippine Tourism Authority) | Approve construction of piers on Manila Bay. |

## 3.2 Regulatory

The regulatory functions listed in Table 3.1 revolve around the issue of safety. That includes life-saving equipment, training, insurance, and the condition of boats and piers. The agencies most concerned with these matters are MARINA and the Coast Guards. The Coast Guards also creates rules of navigation.

The LLDA has a great deal of authority over traffic on Laguna de Bay. It issues licenses and sets rules concerning pollution and transport of hazardous wastes. The LLDA also chairs the working group on Pasig River Transportation. LLDA's Implementing Rules and Regulations (IRR) on navigation rules for Laguna de Bay were adopted by the Pasig River working to manage traffic on that river.

## 3.3 Enabling Efforts

In 1997 President Ramos started an initiative to ensure smooth operation of passenger transportation on the Pasig River. Its objectives are to *(a)* create an alternate transportation route, *(b)* provide faster, more efficient service, *(c)* assist in Pasig River's rehabilitation.

President Ramos formed an inter-agency working group comprising the Department of Transport and Communications (DOTC), Department of Public Works and Housing (DPWH), MARINA (Maritime Industry Authority), Metro Manila Development Authority (MMDA), Laguna Lake Development Authority (LLDA), the Coast Guards, and different concerned municipalities.

The working group's activities are divided into two phases. Phase I was drawn up with the aim of completing the following tasks between the first quarter of 1997 and the first quarter of 1998: *(a)* provide air-conditioned ferry service on Pasig River; *(b)* extend service to Pasig City; *(c)* rehabilitate piers; *(d)* create amenities near piers (i.e. transit-oriented development or "TOD"); *(e)* improve access to piers (e.g. build access stairway from MacArthur bridge to Lawton Terminal, widen roads near Guadalupe and other terminals; *(f)* encourage inter-modalism.

As of the writing of this report, the working group has successfully introduced policies facilitating the use of air-conditioned service (i.e. StarCraft) and the rehabilitation of piers. The Star Craft Ferry Corporation recently received approval for a BOT scheme in which they will build three-story TODs at their piers, with fast-food restaurants and other stores above the passenger waiting areas.

Phase II of the working group's brief includes the following: *(a)* extending the service to piers on the north and south coasts of Laguna de Bay; *(b)* reducing fares and providing discounts for students and senior citizens.

The agencies most concerned are DOTC, MARINA and the Coast Guards. MARINA also inspects operations and issue permits to ensure the safety of operations. The Cost Guards have similar responsibilities.

The government collects no taxes or fees on riverboat services. There is no charge for pier usage, as there would be for a boat operating on Manila Bay or elsewhere in the nation. There are no concessions paid for franchises. In fact, the government has granted ferry operator 4- to 6-year tax holiday.

Other efforts include conversion of land use. Manila has already granted approval for the construction of a boardwalk along the Pasig River. The PRRP, DPWH and others are trying to remove squatters from the river. The MMDA is beginning to formulate a plan to phase out industry along the Pasig. That is part of a larger effort to revitalize land along the Pasig River.

Related effort included the generation of funds to rehabilitate the Pasig River, increase environmental awareness, prevent further pollution, and encourage the local ship building industry (ie., all boats operating in-land and over short-distances in the Philippines must be locally manufactured.)

## 3.4 Environmental Improvement through PRRP

The Pasig River Rehabilitation Program (PRRP) was conceived in 1989 with a grant from the Danish aid agency, DANIDA.

Work began the next year when the Department of Environment and Natural Resources (DENR) began monitoring water quality at 9 sample stations. The biochemical oxygen demand on the Pasig was gauged to be 327 metric tons per day. A feasibility study was drawn up to lower the BOD to 200-220 metric tons per day. President Ramos officially launched the “Presidential Task Force on Pasig River Rehabilitation” in 1993. It has a 15-year time horizon. Ming Ramos, wife of the former president, was the chairwoman and launched the clean-up efforts during his presidency.

The PRRP has several committees, including:

- Waste Management;
- Water Quality;
- Sunken Vessels;
- Riverside Management.

Each of the committees includes representative from all concerned national, provincial and municipal governments. The project’s activities are described in Table 3.2.

**TABLE 3.2**
**COMMITTEES AND ACTIVITIES OF PRRP**

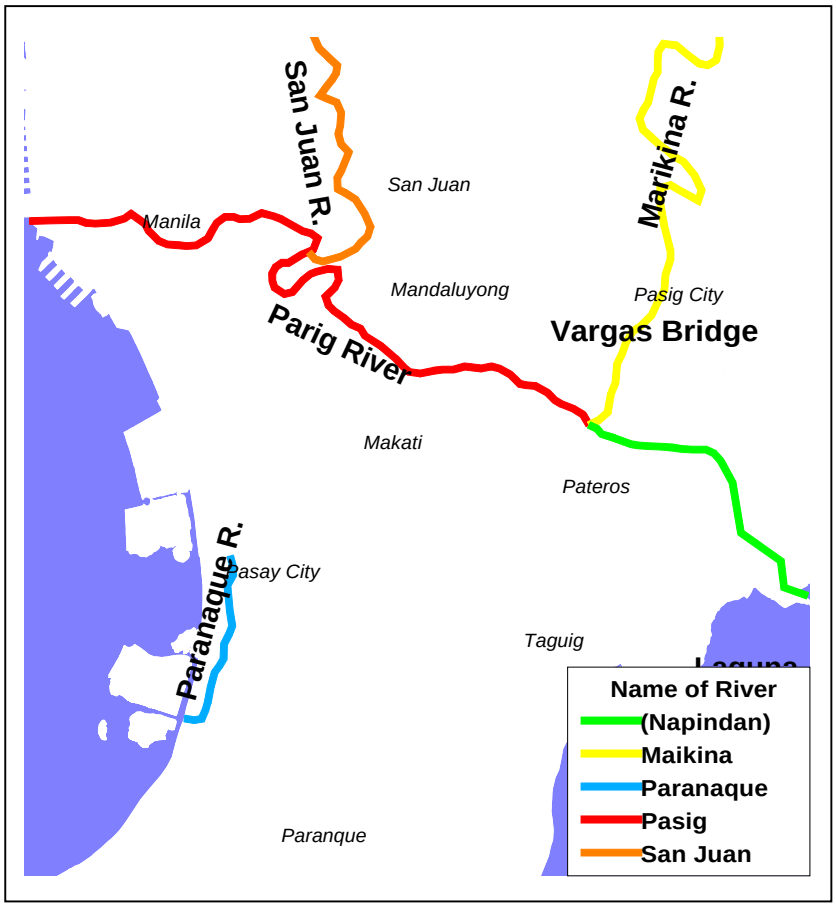
| *Approach* | *Actions* |
|---|---|
| Solid Waste Management | Campaigns to remove floating garbage; |
| | Boats to "skim" garbage. |
| | Collection of solid waste in inaccessible areas. |
| | Promotion of integrated solid waste management. |
| | Recycling. |
| | JICA study on solid waste management. |
| Industrial Programs | Voluntary reductions in liquid industrial wastes. |
| | Compliance monitoring. |
| | Database of industrial polluters. |
| Sewage | US$ 57 million World Bank loan |
| Squatter Resettlement | Plans to re-house/ re-locate12,800 squatter families living over river or on river's easement (i.e. 10-meter set-back.) |
| | Resettlement process includes a package of housing materials, loans, skills training and job placement. |
| | 3,380 families were resettled by year-end 1997. PRRP claims widespread satisfaction (60 – 75%, depending upon question asked.) |
| | 1998 elections slowed down eviction process. |
| Riverside Parks | Municipal and community efforts to: |
| | Rehabilitate existing parks |
| | Construct linear parks ("boardwalks') |
| Public Awareness Campaign | Mock "Poisoner of the Pasig" awards to greatest polluters. |
| | SPM — Save the Pasig Movement — a network of 175 community organizations, created in 1993. |
| | "Piso Para sa Pasig" — A Peso for the Pasig — established 1995; commemorative postage stamp issued; 50 MM pesos generated 1995-97. |
| | Community-based waste management projects in 19 sites. |

The PRRP project has been criticized for not producing a master plan. Critics say some of the efforts are good, but they are not part of an integrated program. Others have criticized the PRRP because it requires excessive consolidation of government bodies. Still, those observing events closely say that there have been concrete improvements in the Pasig River's environmental conditions. The results of PRRP's efforts are discussed in the next chapter of this report.

# 4. PHYSICAL AND ENVIRONMENTAL CONDITIONS OF METRO MANILA'S RIVERS

This section on physical conditions covers four rivers — Pasig River, Marikina, San Juan, and Parañaque — and explains why navigation is possible only on the Pasig River. The Pasig River is 17 kilometers. (Part of what is often referred to as the Pasig River service actually extends a few more kilometers to the east of the Marikina down the Napindan River to Bambang.) The second part of this chapter describes environmental conditions on the Pasig in detail.

**FIGURE 4.1**
**LOCATION MAP OF PASIG, MARIKINA, SAN JUAN, AND PARAÑAQUE RIVERS**




## 4.1 Physical Conditions

### 4.1.1 Pasig River Watershed

There are five river basins forming the Pasig River: *(a)* Taguig-Napindan; *(b)* Marikina downstream; *(c)* Pasig Upstream; *(d)* Pasig Downstream; and *(e)* San Juan. These river basins represent a 215 $km^2$ area crossing 11 municipalities (Figure 4.2).

### 4.1.2 Depths

The depths of rivers are a little difficult to characterize because they vary greatly from one river to the next. On average, Pasig River's depth is 4 meters. (This compares to 8 meters at the turn of the century.)

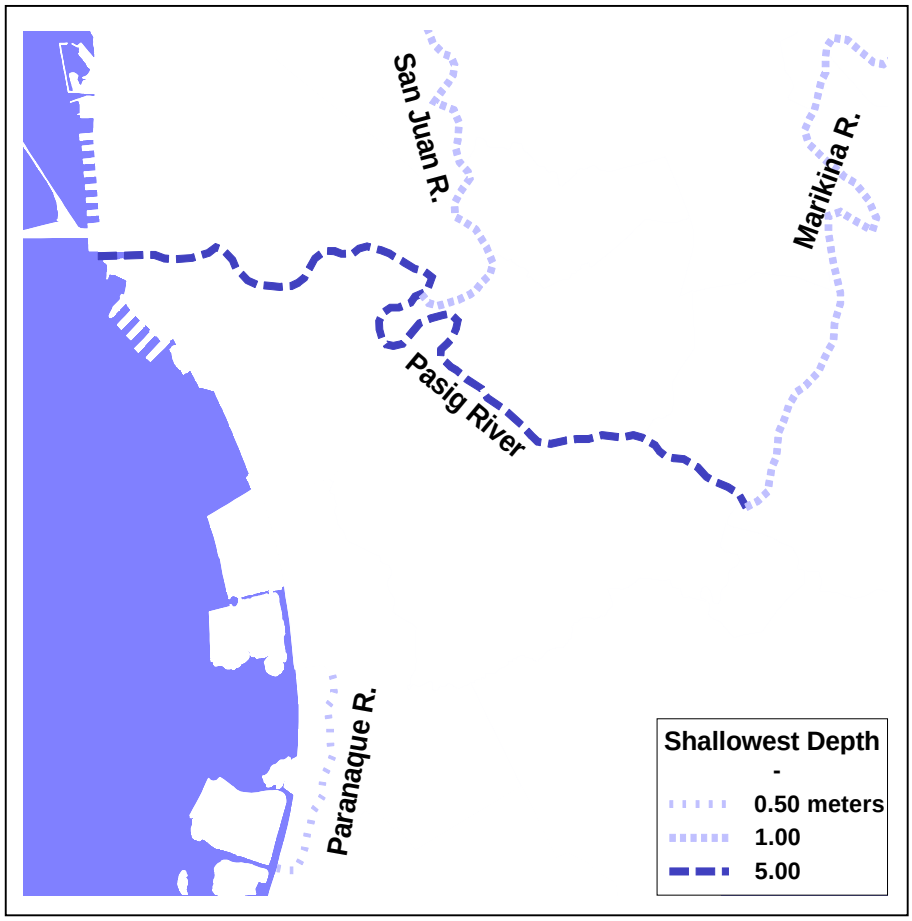
**FIGURE 4.2**
**THE RIVER BASINS FORMING THE PASIG RIVER**


The lowest depths will block navigation. Boats such as the StarCraft Ferry's Manta and River Catboats require at least 1.22 meter's depth, and three-to-four meters is very much preferred. Figure 4.3 shows the lowest depths on the four rivers.

The Marikina River is particularly shallow near Vargas, not far up-stream on the Pasig River. Some large boulders have been reported closer to the mouth of the river. Only the Pasig River has the requisite depth to support boats such as the StarCraft Ferry.

Dredging is the responsibility of the Department of Public Works and Highways (DPWH.) The department has removed 652,000 $m^3$ of silt from the Pasig River in 1993-97 as part of the PRRP.

IGURE 4.3
THE LOWEST DEPTHS OF THE PASIG, MARIKINA, AND PARAÑAQUE RIVERS




### 4.1.3 Sunken Vessels

Besides shallow depths at certain parts of the river, sunken vessels or "sunken derelicts" also pose serious hazards to navigation. In fact, Laguna Star Ferry's largest catamaran suffered serious damage after it ran over a submerged vessel.

Fortunately, the PRRP (Pasig River Rehabilitation Project) has removed this problem. A total of 25 known vessels were removed between 1993 and 1997. Two more vessels, discovered as part of removal efforts, remain in river.

The removal of such vessels has made the river suitable for navigation again. It has also contributed to greater flows of water.

### 4.1.4 Widths

The widths of rivers are important factors in navigation. Boats have a large turning radius and can not turn around unless the river is broad enough. Without such liberty of movement, a boat can only go one direction. The widths of Manila's rivers are shown in Table 4.1. Figure 4.4 shows the narrowest sections of the four rivers.

**TABLE 4.1**
**WIDTHS OF MANILA'S RIVERS**

| *River* | *Narrowest Breadth* | *Widest Breadth* |
|---|---|---|
| Marikina | 70 m | 100 m |
| San Juan | 44 m | 65 m |
| Parañaque | 22 m | 50 m |
| Pasig | 50 m | 90 m |

(Note: the hydraulic flood control gate where the Pasig becomes the Napindan River is less than 20 meters wide.)

**FIGURE 4.4**
**THE NARROWEST SECTIONS OF MANILA'S RIVERS**

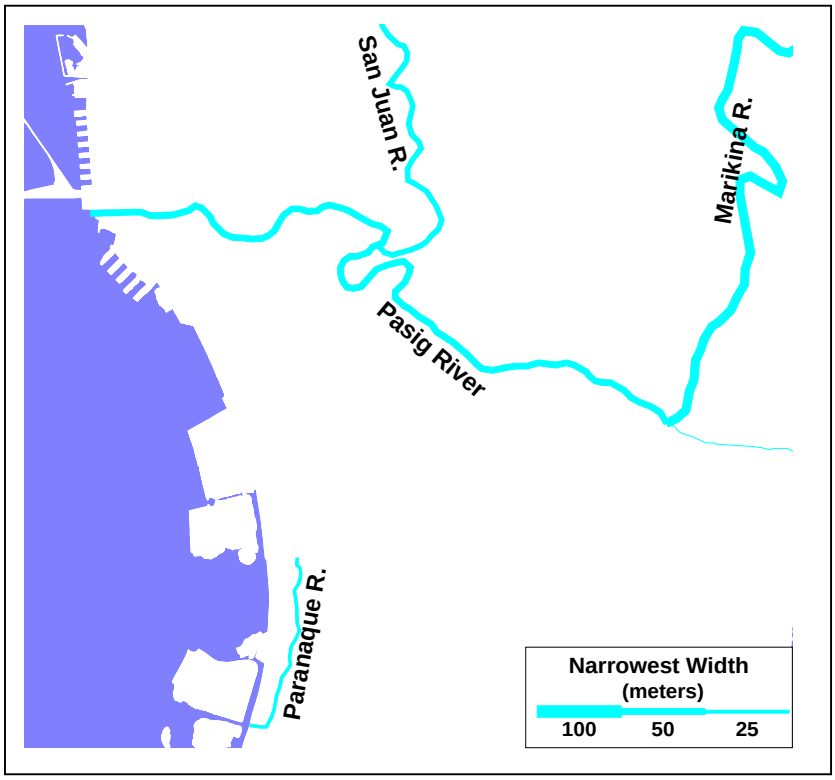



Figure 4.4 shows that in terms of widths all of Manila's rivers could accommodate the boats. Certain craft, however, might have trouble reversing at the narrowest points on the Parañaque River, but smaller boats could be used to facilitate navigation.

### 4.1.5 Bridge Clearance

Figures 4.4 to 4.47 shows the vertical clearance between mean high waters and the bridge structure. This information was obtained from the 1970 Coast and Geodetic Survey map. Values are believed to be current. However, some bridges shown do not have any associated information concerning bridge height.

**FIGURE 4.5**
**CLEARANCE OF BRIDGES AT VARIOUS POINTS OF THE PASIG RIVER:**
**DEL PAN, JONES, MACARTHUR, AYALA, NAGTAHAN, AND PANDACAN BRIDGES**

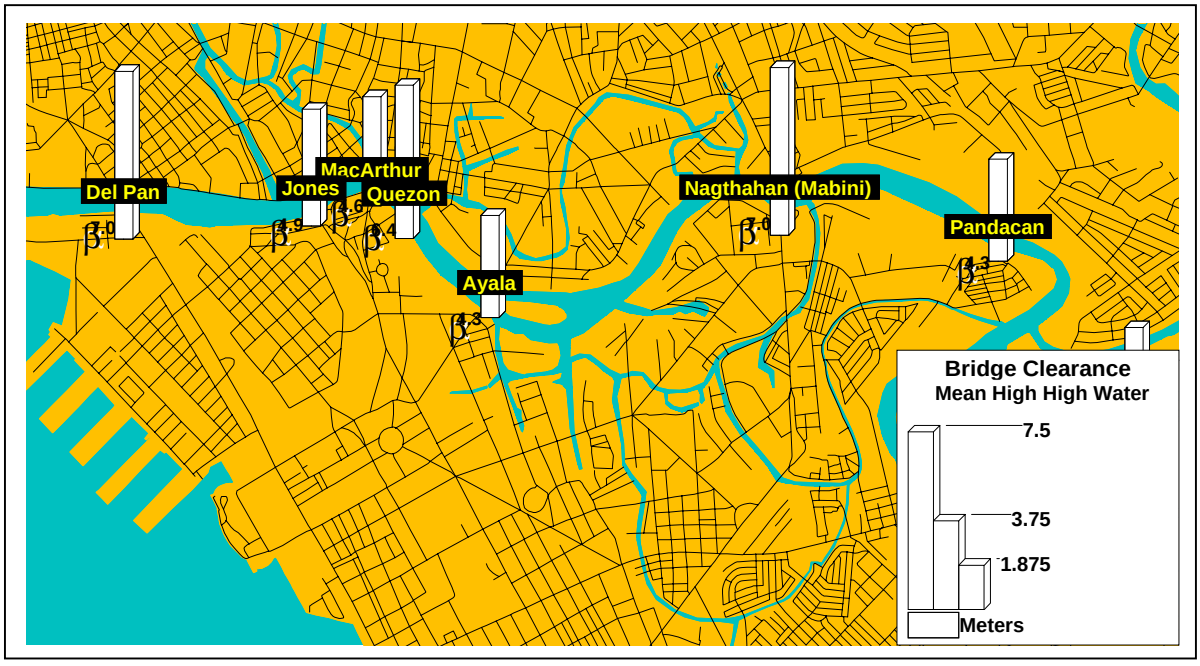
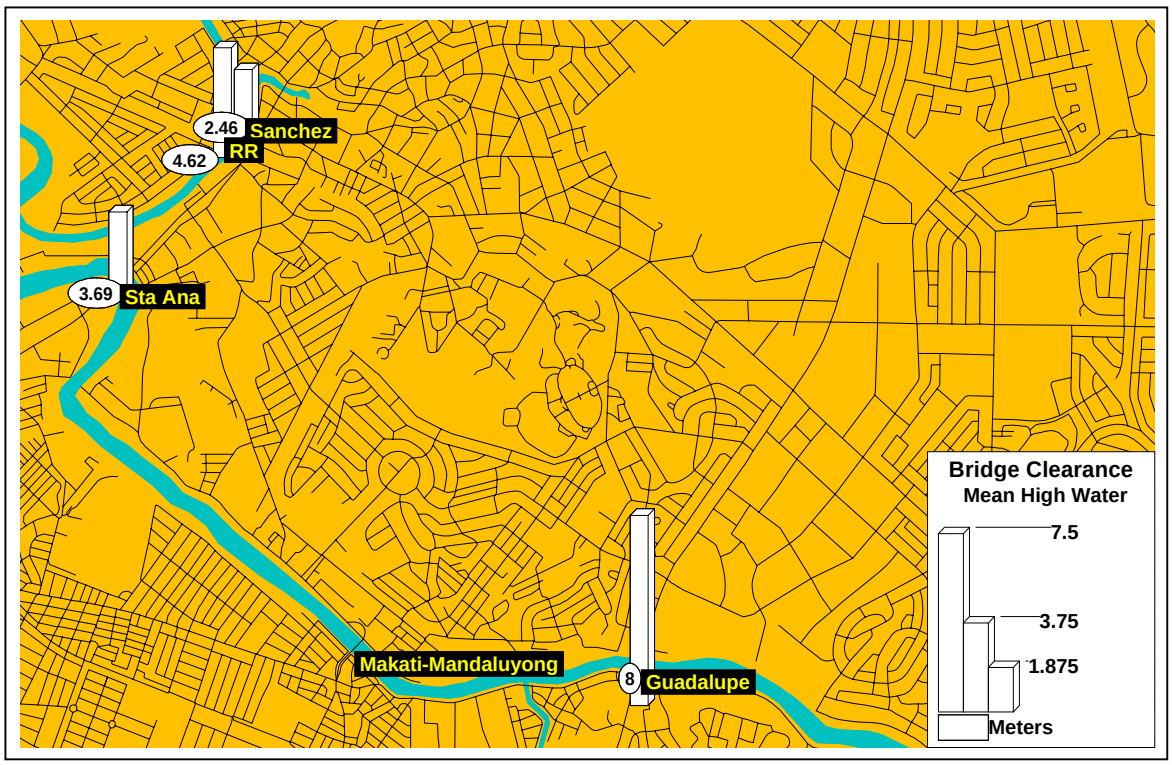
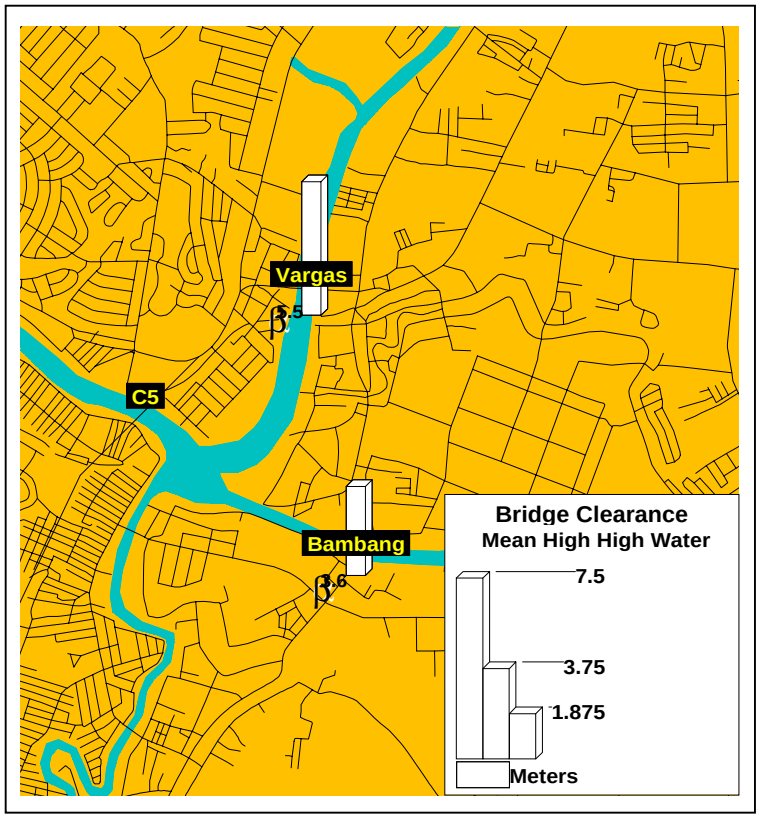



**FIGURE 4.6**
**CLEARANCE OF BRIDGES AT VARIOUS POINTS OF THE PASIG RIVER: SANCHEZ, STA. ANA, MAKATI-MANDALUYONG, AND GUADALUPE BRIDGES**



**IGURE 4.7**
**CLEARANCE OF BRIDGES AT VARIOUS POINTS OF THE PASIG RIVER: VARGAS, C-5, AND BAMBANG BRIDGES**




### 4.1.6 Flood Conditions

Figure 4.8 shows the flood conditions of Manila's four rivers. It shows that strong currents during typhoons with heavy rains are experienced along Marikina River. Overflowing during heavy floods are experienced in San Juan River. These problems are not felt in Pasig River.

### 4.1.7 Embankments

Strong river embankments prevent erosion of the riverbanks and siltation. In other words, it helps to create a consistent channel for river traffic. However, negative effects arise when volumes of river traffic approach capacity. Waves created by the wake of passing boats reverberate against the river walls. Such movement effects navigation. As shown in Figure 4.8, the watershed seems to be largely protected by river walls.

However, the river walls need to be maintained. From 1993 to 1997, the DPWH had repaired 2,309 meters of river walls. These efforts appear to be inadequate as concrete embankments can be seen cracking and crumbling in many places.

IGURE 4.8
FLOOD CONDITIONS ON METRO MANILA'S FOUR RIVERS

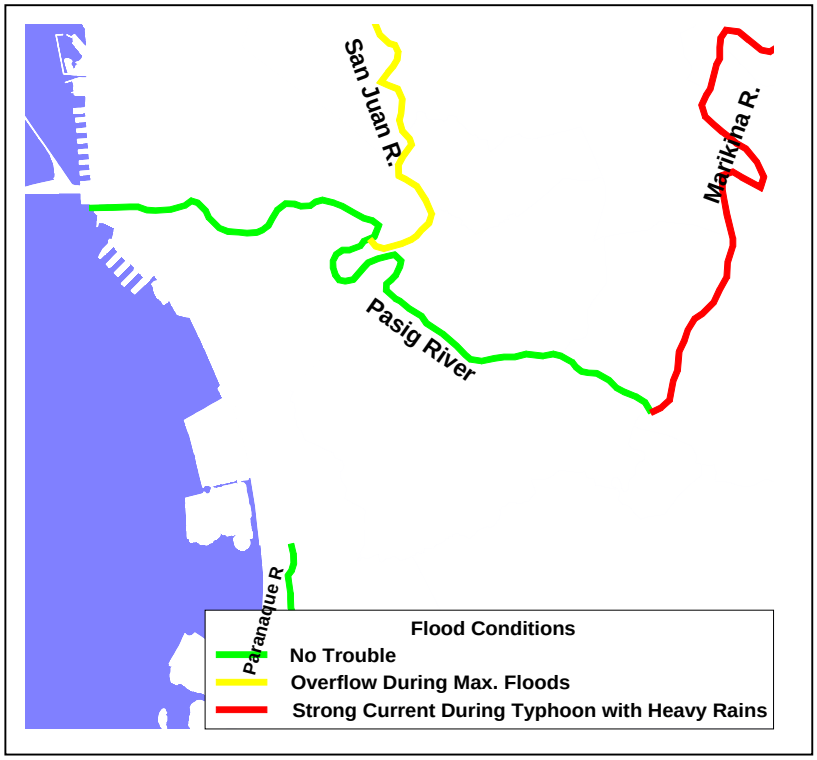
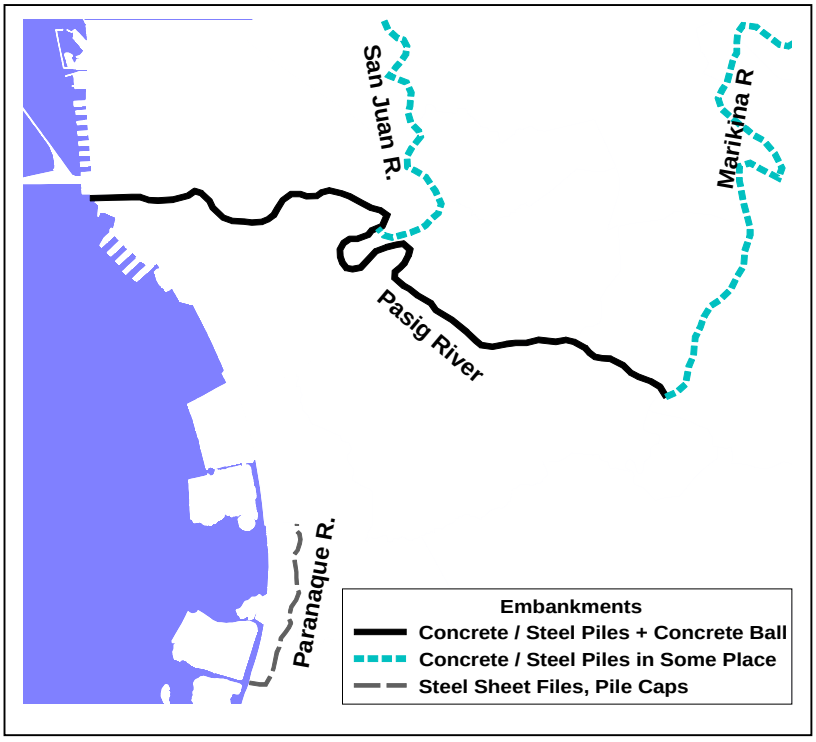



FIGURE 4.9
QUALITY OF EMBANKMENTS OF METRO MANILA'S RIVERS



### 4.1.8 Summary of Physical Conditions

Table 4.2 summarizes the physical conditions of Metro Manila's four rivers.

**TABLE 4.2**
**PHYSICAL CONDITIONS OF MANILA'S RIVERS**

| | *Pasig* | *Marikina* | *San Juan* | *Parañaque* |
|---|---|---|---|---|
| ***Depths (meters)*** | 5 – 8 | 1 – 8 | 1 - 6 | 0.5 – 3.5 |
| ***Widths (meters)*** | 50 - 90 | 70 - 100 | 40 - 60 | 22 – 50 |
| ***Lowest Bridge Clearance (meters)*** | 4.3 | 5.5 at Vargas (others n. avail) | 2.5 | n. avail. |
| ***Flood Conditions*** | No Problem | Strong Current | Overflows | No Trouble |

Due to narrow depths and other problems, DPWH recommends no navigation on the Marikina, San Juan or Parañaque rivers. Only the Pasig River has the suitable physical conditions for navigation.

## 4.2 Environmental Conditions

### 4.2.1 Issues

There are two major environmental concerns effecting the operation of passenger boats on the Pasig River: solid waste and smell.

Solid waste effects navigation. Plastic bags are floating in Manila's waterways, and can get caught on propeller shafts, jam them, and cause the engines to overheat. Wood and other hard objects floating in the river can damage the propellers. More than three-quarters of the StarCraft's Manta boat fleet have been decommissioned for these reasons.

The foul odor deters passengers who find it nauseating (especially during the dry season). StarCraft operation is considered an important advancement over the Metro Ferry. StarCraft ferryboats are air-conditioned. Still, many passengers could not bear standing beside the river while waiting for the boats.

### 4.2.2 General Observations

Overall, it is felt that the pollution level in 1996 is no better than what it was in 1990. However, the source and composition appears to have changed. Industrial wastes have been reduced and solid wastes better managed, but liquid emissions from household sources have increased. This is shown in Table 4.3.

**TABLE 4.3**
**PERCENTAGE CONTRIBUTION OF VARIOUS POLLUTANTS IN PASIG RIVER**

| | 1990 | 1996 |
|---|---|---|
| liquid industrial waste | 45% | 35% |
| liquid domestic waste | 45% | 60% |
| solid waste | 10% | 5% |

### 4.2.3 Solid Waste

One of the greatest impediments to navigation on the Pasig and other rivers is the dumping of solid wastes in the river. Plastic garbage clogs propellers, while wood and other large objects can damage this key equipment. Because of these problems, only four out of StarCraft's Manta Boats are presently in operation.
Some general observations regarding solid wastes are the following:

- The greatest deterrent to smooth operation of a boat service — plastic — accounts for 49 % of wastes and debris found in the watercourse during the *dry* season.

- Plastic accounts for 26 – 31 % of wastes and debris found in the watercourse during the *wet* season.

- Other solid wastes such as wood and textiles also pose significant hazards to river navigation.

Most of these wastes come from households. Unclear rules and regulations are blamed for illegal dumping of wastes. Some households throw garbage (often wrapped in plastic bags) directly into the river. Other residents use neighborhood solid waste dumps, but these are not well managed. The water quality near such dumpsites is substandard.

The SPM project (a program related to PRRP) worked with local communities to remove garbage from inaccessible *barangays*. Recycling programs have also reduced the levels of solid wastes accumulated.

From 1994 until 1997, PRRP has removed 116,676 cubic meter from the rivers and 1,711 cubic meters from barangays.

Twenty to thirty small-scale companies in and around Manila recycle plastics. However, the market for recycled plastics is small.

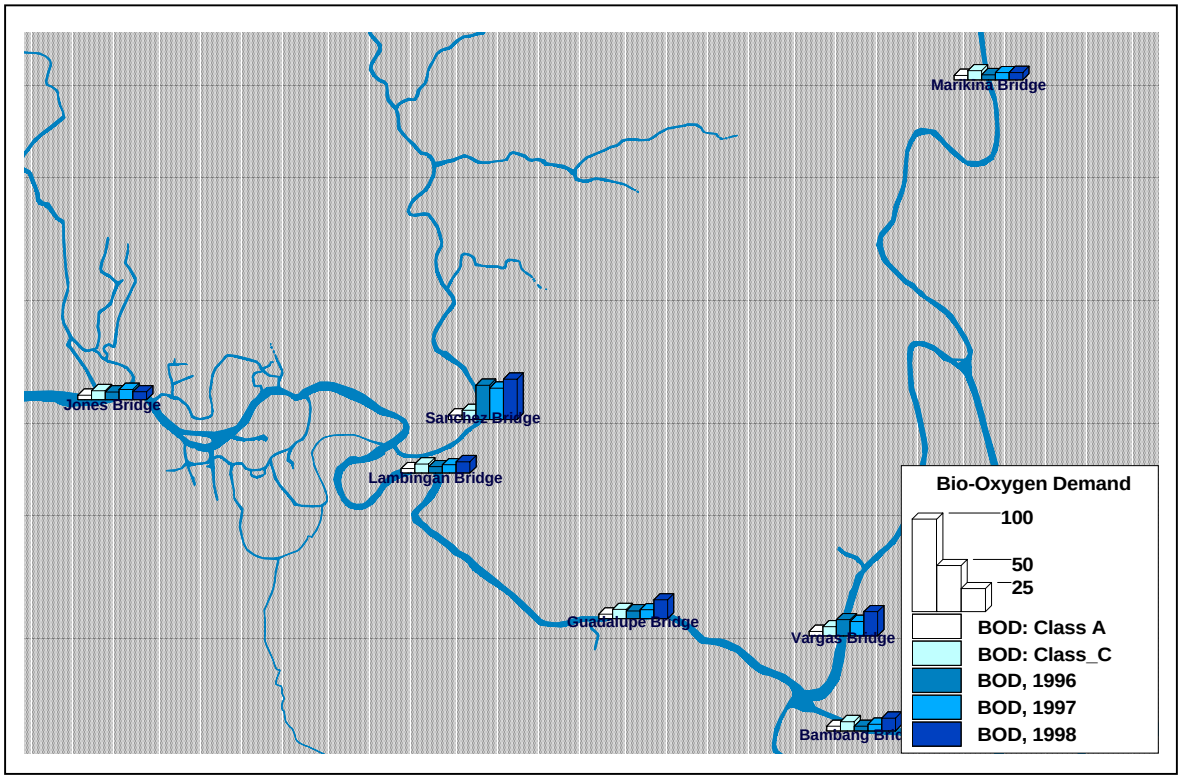
The mismanagement of solid waste associated with low-income communities along the Pasig River is one of the major reasons behind squatter relocation programs. A JICA-funded project on solid waste management in and around Manila recommends many other measures besides squatter removal: institutional strengthening and local capacity building; development of integrated plans; creation of more transfer stations, composting, incineration, recycling and sanitary landfill infrastructure.

### 4.2.4 Sewage and Water Quality

The DENR classifies water into Class — water suitable for public supply after complete treatment — and class C — water suitable for growing fish, boating, and as inputs to industrial processes. The Pasig River has been classified as class C.

As shown in Figure 4.10, oxygen deficiency in the Pasig River as indicated levels of biochemical oxygen demand (BOD) is great. BOD is the amount of oxygen that would have to be pumped into the river to sustain life forms.

**FIGURE 4.10**
**BOD LEVELS T VARIOUS POINTS IN THE PASIG RIVER**




(Source: DENR, Environment Management Bureau)

In fact, BOD is increasing. The figure indicates that conditions on the San Juan and upstream Marikina rivers are several times worse than on the Pasig. BOD is the chief harmful effect associated with the different food and beverage processing industries located along the Pasig's riverbank.

Phosphates and nitrates as well as coliform contribute to eutrophication. This is a process disrupts the ecosystem's equilibrium. The most visible manifestation is the presence of large water plants seen floating in the Pasig River. Although no one has complained of it, this can disturb navigation and clog propellers. (The situation is particularly bad near the Rosario bridge in Marikina River.)

Nitrates, phosphates, and coliform are also among the major Pasig River pollutants. Levels of nitrates and phospates that come from fertilizers and other agricultural run-off are shown in Figures 4.11 and 4.12. Coliform is associated with animal and especially human wastes, and acts as vectors of parasites and disease (Figure 4.13).

**FIGURE 4.11**
**PHOSPHATE LEVELS AT VARIOUS POINTS ALONG THE PASIG RIVER**

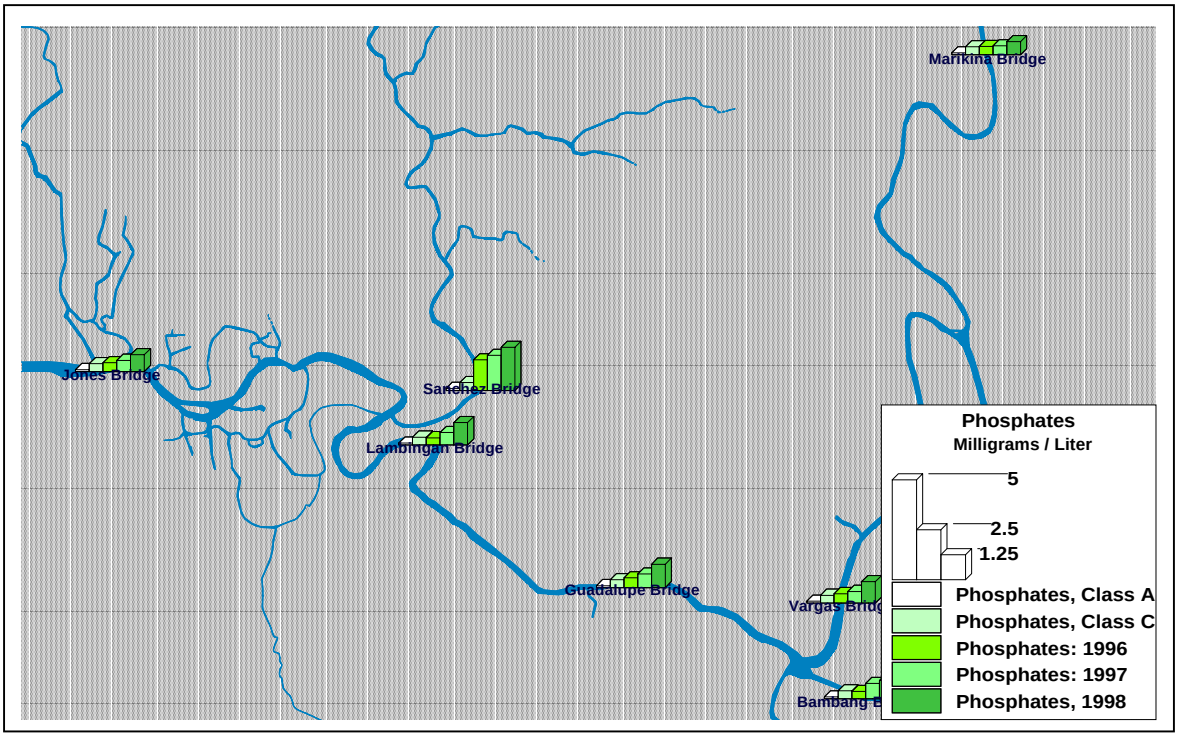
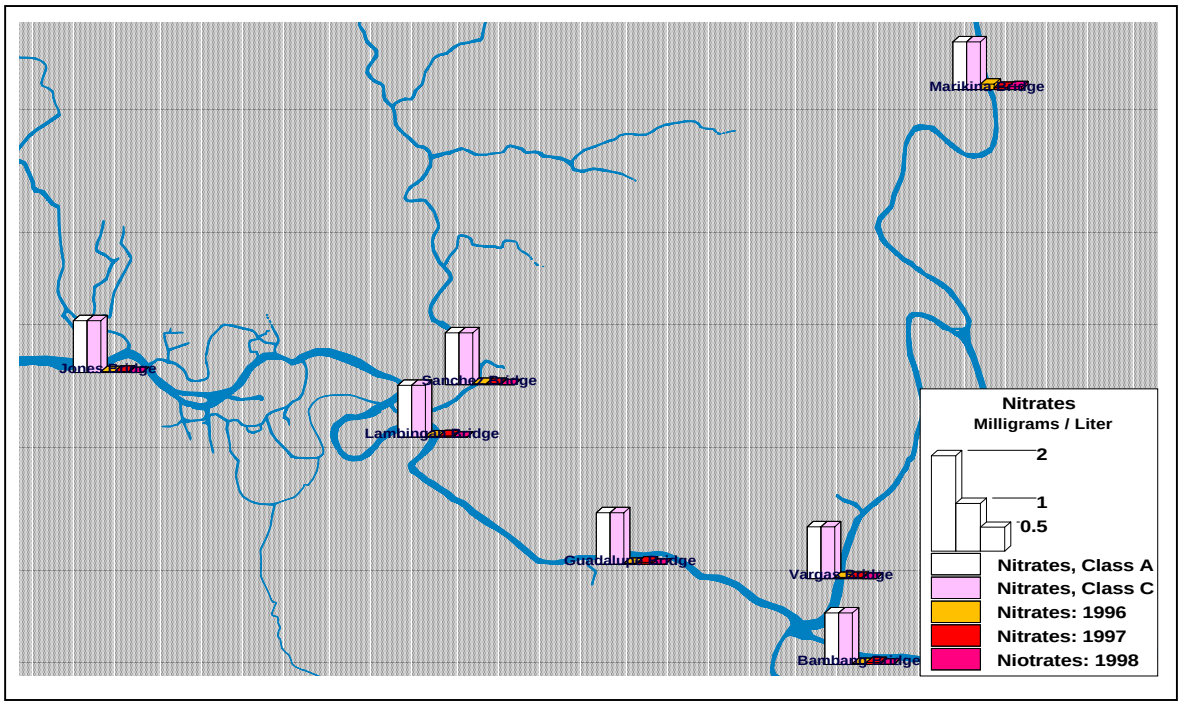
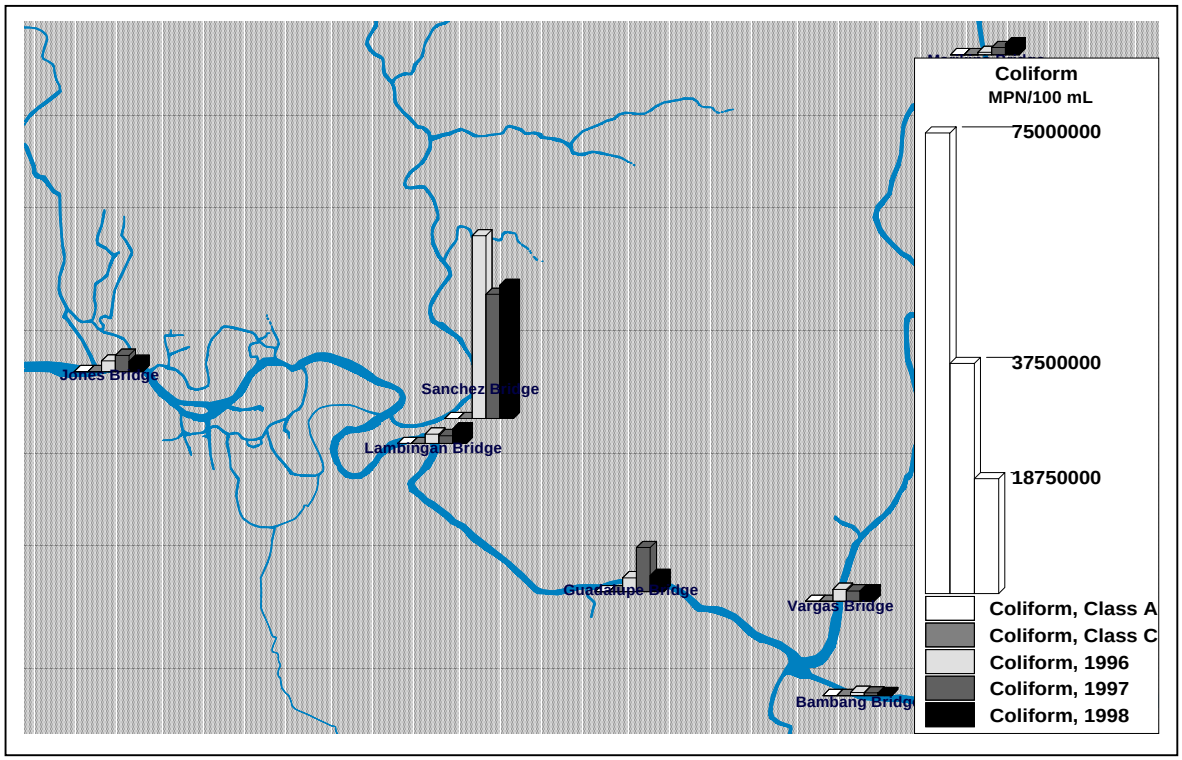



**FIGURE 4.12**
**LEVELS OF NITRATES AT VARIOUS POINTS ALONG THE PASIG RIVER**



**IGURE 4.13**
**COLIFORM COUNTS AT VARIOUS POINTS ALONG PASIG RIVER**




(Source: DENR, Environmental Management Bureau)

Coliform counts are particularly high at the Sanchez bridge near the mouth of the San Juan River. Still, coliform levels are 50 – 100 times what is considered acceptable for class C water.

At present, only 7% of Metro Manila's households are connected to septic or other sewage treatment facilities.

Local treatment of household wastes will begin only in 1999. Developers of high-rise housing projects will be required to present environmental impact statements, including facilities to treat human wastes.

In addition to PRRP, there exist many other plans to help control sewage:

- The World Bank has provided US$ 57 million for the "Manila Second Sewerage Project" in 1994 for the upgrading of septic facilities, dislodging, and the establishment of treatment plants. Still, efforts suffer from the lack of suitable disposal sites and achievements are far behind target.
- WMP – Waste Minimization Program – targeting food manufacturers, textiles, hotels and shopping centers. This is a program designed to help industries voluntarily reduce liquid wastes. PRRP provides technical assistance in measuring and treating water quality. It had 56 participating companies in 1996. The program claims responsibility for reducing industry BOD contamination from 145 to 110.5 metric tons.
- The DENR and LLDA are monitoring industrial emission sources and maintain databases.

## 4.3 Land Use

### 4.3.1 Population

As shown in Table 4.4 population in the Pasig River watershed is growing.

**TABLE 4.4**
**POPULATION LEVELS AT THE PASIG RIVER WATERSHED**

| Year | Total Population | Squatters | Other |
|---|---|---|---|
| **1990** | 4,400,000 | 1,600,000 | 2,800,000 |
| **1995** | 5,840,000 | n.a. | n.a. |

In particular, 12,800 squatter families are located along the Pasig's riverbank. Houses are sometimes built on stilts directly over the river.

### 4.3.2 Industry

A total of 2,000 industrial sites, about one-eight of all factories in Metro Manila, are discharging wastes into the Pasig River watershed. About 320 are serious polluters. Typical industries along the Pasig River are flour and feedmill . Sugar and distillers of alcoholic spirits also figure prominently. These industries tend to increase BOD in nearby waters.

Another important industrial land use is the storage and transportation of fuel. There are several large fuel depots along the river. No evidence has been produced to suggest high levels of discharges from these sources.

### 4.3.3 Efforts to Convert Land Use

Government planners are considering the conversion of current industrial and squatter settlements into multi-story housing equipped with better sewage and solid waste treatment facilities. Industries will be phased out. Ultimately, this will reduce emissions along the Pasig River.

Squatter settlements will be replaced by housing for upper-income groups. So far, 1,267 of squatters (about 72% of the total) living on stilts over the water have been relocated. Industry would have to be phased out gradually. New industries will not be allowed along the Pasig River.

It is not yet clear whether or not these measures would improve the river's environmental quality. Land uses along tributary rivers are still allowing industrial emissions. Squatter settlements in the upstream part of the river are still present.