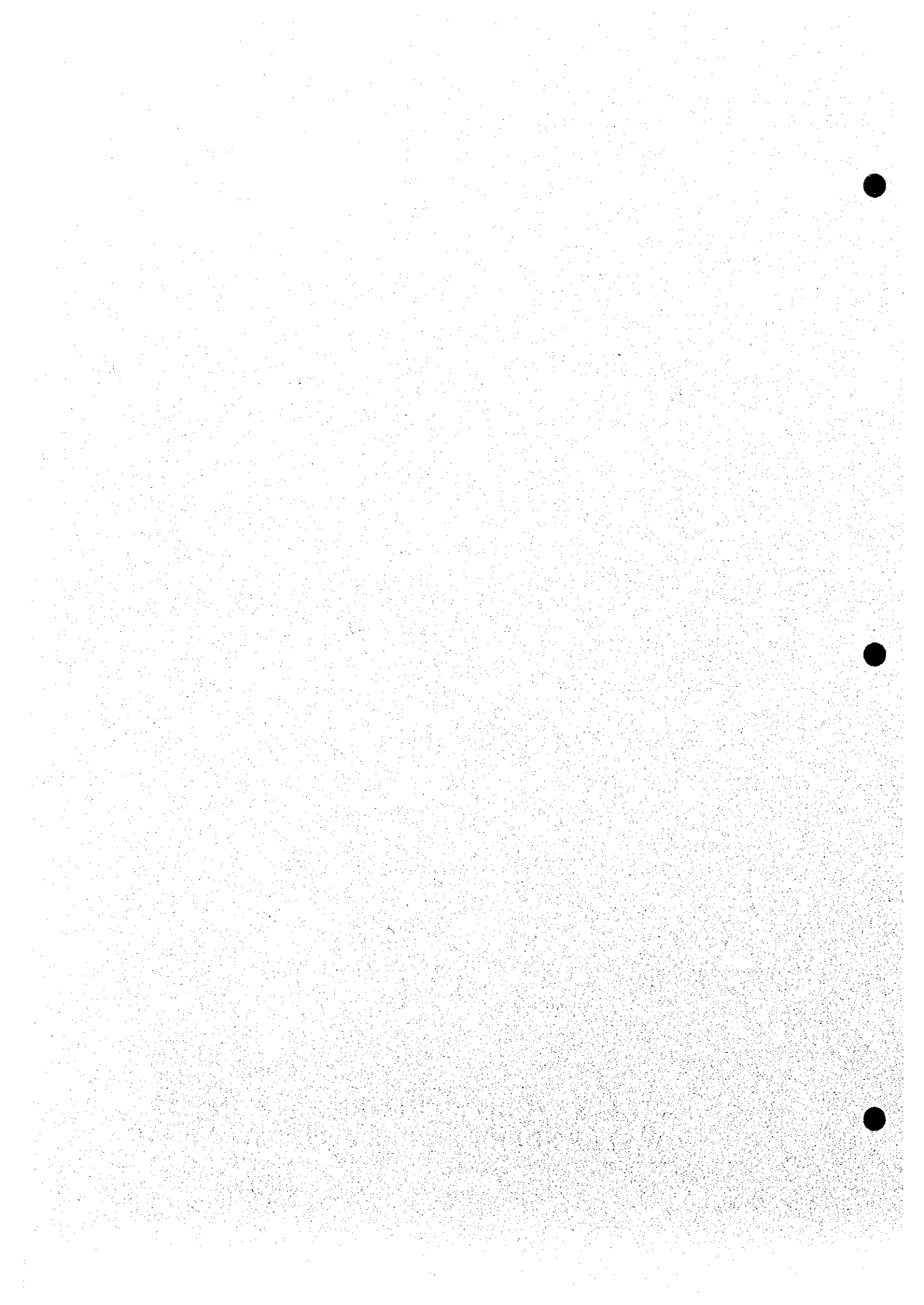


Chapter

6

---

**PAST FINANCIAL PERFORMANCE IN  
WATER SUPPLY AND SANITATION**



## **6. PAST FINANCIAL PERFORMANCE IN WATER SUPPLY AND SANITATION**

### **6.1. General**

Based on the Local Government Code of 1991 and NEDA Board Resolution No. 4 (1994), the locally funded programs and projects for the water supply and sanitation sector have been devolved from the central government agencies to the LGUs since 1992. However, the central government still retains its role of providing support to LGUs in the form of technical, institutional capacity building and limited financial assistance.

The financial arrangements which have been adopted and implemented, since the sector's devolution to the LGUs, by the province with a special attention to the subject sector are reviewed and discussed in this chapter. The past experience serves as the basis to formulate for appropriate financial arrangements for the medium term development. The essential study components are: (1) LGUs' past financial performance; (2) past public investment and present plans; (3) LGUs' present financing sources and management participation in the sector, (4) existing practices by the LGUs on cost recovery and (5) affordability by users.

### **6.2 LGU's Past Financial Performance**

The provincial government's past financial performance for the period covering the years 1995 to 1999 was investigated. Actual financial data were obtained for the years 1995 to 1998, while the financial figures in 1999 are only budgetary estimates. The municipalities' past financial performance in the same period (1995 to 1998) are presented in the Supporting Report.

#### **6.2.1 Sources and Uses of Funds**

##### **(1) Sources of Funds in the Province**

The sources of income of the LGU are Internal Revenue Allotments (IRA), local tax revenues, non-tax revenues such as grants, aids and subsidies, as shown below. At the present time, IRA is a major financial source of the LGUs.

- (a) IRA – LGU's share in the national internal revenue taxes is based on the collection of the 3<sup>rd</sup> fiscal year preceding the current fiscal year and is shown as follows: 1<sup>st</sup> year of effectivity of the LGC of 1991- 30% (1992), 2<sup>nd</sup> year (1993) – 35% and on the 3<sup>rd</sup> year (1994) and thereafter is 40% of the gross national internal revenue collections. A

standard formula, which considers parameters such as population (50%), land area (25%), and equal sharing (25%) is used to determine the LGU share in the IRA. Provided, however, that in the 1<sup>st</sup> year LGUs were, in addition to the 30% IRA which included the cost of devolved functions for essential public services, entitled to receive the amount equivalent to the cost of devolved personnel services.

- (b) Tax Revenues – mainly consist of real property tax, accounting for an average of 5.53% of the total income of the province.
- (c) Grants, Aids and Subsidies – There are no grants and subsidies reported by the province. However, there are national projects being contracted by the province that are considered grants.
- (d) Other Income – there are no economic enterprises, but receives minimal income from various fees and charges on certain services.

Based on the Local Government Code of 1991, 40% of the national internal revenue taxes of the 3<sup>rd</sup> fiscal year preceding the current year (from 1994 onwards) is allocated to the LGUs nationwide, specifically to the administrative units of (1) province (23%); (2) city (23%); (3) municipality (34%), and barangay (20%). Further, respective IRAs in different administrative levels are allotted to all administrative units concerned.

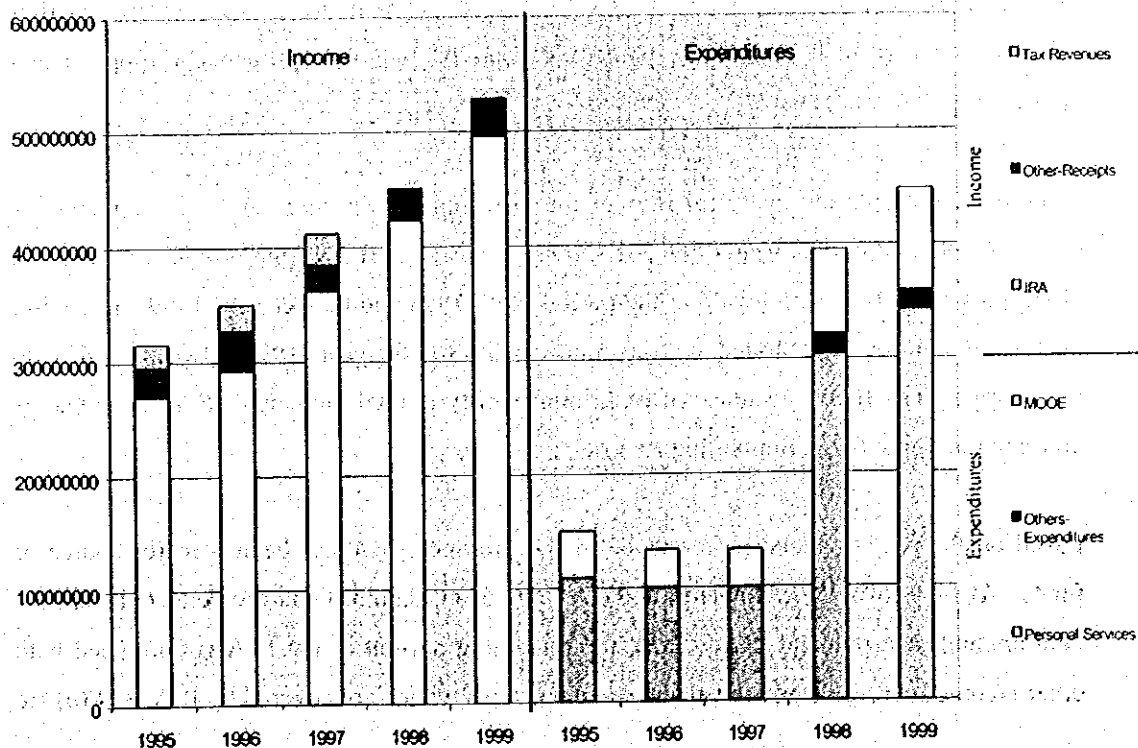
Table 6.2.1 presents the income and expenditures of Iloilo during the period 1995-1999. Local tax revenues, which were 5.53% of the total income of the province, consist of real property tax, business taxes and licenses, and miscellaneous taxes. IRA's annual average share to total income was 87.68%, which indicates that the province has historically been dependent on IRA with its low tax and non-tax revenue collections.

In order to mobilize fund sourcing, the 1987 Constitution and the 1991 Local Government Code granted the Provincial Government to have its initiative to create new revenue sources. The LGU financing options are discussed in Section 6.4 and in the Supporting Report.

Table 6.2.1 Income and Expenditures between 1995 and 1999

Province	1995	1996	1997	1998	1999
Receipts					
Tax Revenue					
- Real Property Tax	18,806,613.81	21,180,000.00	25,400,000.00	-	-
- Business Tax	1,278,321.39	1,335,000.00	1,748,000.00	-	-
- Others	-	-	-	-	-
IRA	269,948,716.00	292,713,586.57	361,623,121.00	423,420,668.00	495,663,200.00
Other (Non-tax)	25,954,703.48	34,761,000.00	22,960,000.00	26,732,815.00	32,525,819.00
Sub-total	315,988,354.68	349,989,586.57	411,731,121.00	464,358,560.00	560,434,819.00
Expenditures					
Personal Services	109,063,913.60	99,994,785.43	99,994,785.43	304,270,870.00	342,542,888.00
MOOE	40,931,819.98	33,289,942.35	33,289,942.35	74,088,179.00	88,478,146.00
Others	-	-	-	16,900,000.00	16,900,000.00
Sub-total	149,995,733.58	133,284,727.78	133,284,727.78	395,259,049.00	447,921,034.00
Net Operating Income	165,992,621.10	216,704,858.79	278,446,393.22	69,099,511.00	112,513,785.00
Add: Borrowings	-	-	-	-	-
Surplus (Income)	13,748,133.56	14,732,933.07	-	10,000,000.00	-
Less: Capital Outlays	47,632,071.25	86,019,132.70	86,019,132.70	-	-
Net Income	132,108,683.41	145,418,659.16	192,427,260.52	79,099,511.00	112,513,785.00

Figure 6.2.1  
Income and Expenditures between 1995 and 1999



(2) **Uses of Funds in the Province**

Actual expenditures of the provincial government during the period from 1995 to 1998 show that personnel expenses comprise majority of expenses with an average of 39.77% to the total revenue, as a result of devolution. Maintenance and operating expenses of the province was 11.77% of total revenues. In addition, the province has a capital outlay with an average share of 14.25% to the total revenue. The funds for the water supply sector were part of the capital outlays of the province.

From 1995 to 1998, the province had an average of ₱182.56 million net operating income from operations. For 1999, the province has likewise projected a net operating income of ₱112.51 million. After deducting capital outlay and non-office expenditures, the province projects a net income of ₱9.44 million (or 6.89% of the total revenues).

**6.2.2 Availability of Funds**

As previously noted, the IRA comprises 87.68% of the total income of the province, which is tapped to finance most of its expenditures including capital outlays and even non-office expenses (incidental). According to the Provincial Treasurer's Office, the amount of IRA that will be received by the province is known in advance before the end of the preceding year. Thus, for budgeting purposes, the province just uses the actual amount of IRA it received in the preceding year as its estimate of IRA for the budget year. In the case where the IRA received is larger than that of the preceding year, the province prepares a supplemental budget.

Table 6.2.2 presents the historical IRA of the provincial government and its municipalities between 1995 and budget year 1999. As shown, the average IRA of the province was 2.07% of the provincial IRA nationwide in the period 1995-1998 and budget year 1999. Likewise, the total amount of IRA allotted to all its municipalities in the years 1995-1999 was 2.43% in the average. The IRA percentage of each municipality to total municipal IRA nationwide is presented in Table 6.2.2, Supporting Report.

Based on the past financial performance of the province, IRA has been a major source of funds. At first, 20% Development Fund (DF) and 5% Calamity Fund are deducted from the total amount of provincial IRA. Then, the remaining portion of the IRA is combined with other income sources. Contractual and statutory items, which are covered by R.A. 324 (b) are

deducted from the pooled income (75% IRA + all other income) before other appropriations are made.

Based on the income statement of the province, available funds of the province are mainly spent to cover personnel salaries, benefits, the MOOE and capital expenditures. The provincial government's combined income from IRA and its tax, and non-tax revenues are more than sufficient to cover operating, capital and non-office expenses. Surplus income, which averaged ₱51.78 million from 1996 to 1999, can be tapped for additional capital expenditures.

For the planned capital expenditures of the province, the 20% Development Fund (DF) of the IRA are appropriated. The percentages allotted as the DF are the minimum requirement that should be arranged for capital projects as stated in the memorandum circulars of the DILG.

Table 6.2.3 presents the allotted funds for capital expenditures (20% DF) between 1995 and 1999. The 20% DF of the province were sufficient to cover the actual expenditures for the years 1995 to 1998. For 1999, it is projected that the 20% DF amounting to ₱99.13 million will be more than adequate to cover the capital expenditures of the province, which is projected at ₱45.30 million. Thus, the province has a surplus in funding of about ₱53.83 million in 1999.

### **6.2.3 Financial Indicators**

In order to determine the debt servicing capability of the province, the formula used by the Bureau of Local Government Finance (BLGF) under the Department of Finance (DF) was employed. It takes into account the regular income of the LGU referring to revenues (real property and business taxes), receipts from economic enterprises, as well as fees and charges that are collected regularly. Receipts from borrowings, grants and inter-fund transfers are not considered as regular income.

Table 6.2.2 Past Internal Revenue Allotment to Province from Central Government

Unit: Pesos

Distribution of IRA		1995	1996	1997	1998	1999
National	1. National Total of IRA	55,202,000,000	58,022,990,000	71,049,000,000	80,990,763,000	96,780,000,000
	a) IRA to All Provinces	12,696,644,000	13,755,011,803	17,813,000,000	20,054,018,925	22,259,400,000
	b) IRA to All Cities	12,696,460,000	13,345,287,700	16,341,270,000	18,627,875,490	22,259,400,000
	c) IRA to All Municipalities	18,768,952,000	19,607,715,553	24,849,000,000	28,245,815,434	32,905,200,000
Provincial	2. IRA to Iloilo Province					
	a) Total: (b)+(c)+(d)	712,774,879	793,341,559	1,012,749,372	1,030,067,470	1,413,843,499
	b) Provincial Government	269,948,716	290,571,839	377,830,835	381,296,417	473,510,594
	Percentage of 1.a)	(2.13)	(2.11)	(2.12)	(1.90)	(2.13)
	c) Cities (excluding Iloilo City)					141,076,998
	Percentage of 1.b)	(0.00)	(0.00)	(0.00)	(0.00)	(0.63)
	d) Municipalities	442,826,163	502,769,720	634,918,537	648,771,053	799,255,907
	Percentage of 1.c)	(2.36)	(2.56)	(2.56)	(2.30)	(2.43)
3. Total Revenue of Prov. Gov't.	329,466,488	364,722,520	411,731,121	474,358,560	560,434,819	
Percentage of IRA of Prov. Gov't.	(81.94)	(79.67)	(91.77)	(80.38)	(84.49)	
Municipalities	4. IRA to Municipalities					
	Total	442,826,163	502,769,720	634,918,537	648,771,053	799,255,907
	Ajuy	12,687,600	14,167,613	17,082,184	16,917,413	21,784,019
	Alinodian	10,103,912	11,305,751	14,217,921	14,669,729	18,806,947
	Anilao	7,636,255	8,751,237	11,516,401	11,830,623	15,103,046
	Badiangan	8,119,933	9,220,073	11,494,936	11,798,347	15,104,053
	Balasan	7,574,661	8,571,785	10,868,561	11,161,434	14,336,348
	Banate	8,999,366	10,164,189	12,836,738	13,211,474	16,902,886
	Barotac Nuevo	11,682,688	13,386,219	16,557,277	16,966,063	21,796,285
	Barotac Viejo	10,895,728	12,264,716	16,164,044	16,658,860	21,358,174
	Batad	6,203,352	7,060,317	9,097,922	9,331,790	11,923,071
	Bingawan	6,163,964	6,954,961	8,817,586	9,072,801	11,537,902
	Cabatuan	11,713,181	13,359,100	16,996,725	17,462,904	22,466,193
	Calinog	14,018,029	15,709,666	21,512,024	20,705,225	26,575,429
	Carles	12,484,291	13,882,602	17,996,372	17,739,995	22,944,296
	Concepcion	9,598,373	10,711,640	13,325,284	13,734,370	17,674,640
	Dingle	10,618,578	12,450,806	15,167,575	15,517,063	19,933,425
	Dueñas	9,522,249	10,778,628	13,240,438	13,600,951	17,450,172
	Dumangas	13,908,638	15,811,678	19,338,106	19,852,507	25,570,156
	Estancia	8,408,326	9,752,651	12,715,066	12,936,318	16,618,831
	Guimbal	7,900,019	9,207,297	12,017,684	12,267,590	15,704,179
	Igaras	9,859,381	11,020,404	13,627,151	13,995,923	17,910,124
	Janiuay	14,351,920	16,037,614	19,900,087	20,536,207	26,460,529
	Lambunao	16,875,317	18,736,250	23,224,192	24,024,953	30,967,427
	Leganes	6,789,265	8,312,141	10,801,801	10,913,847	13,812,869
	Lemery	8,369,760	9,327,996	11,630,313	12,003,532	15,359,758
	Leon	11,848,222	13,417,533	17,213,898	17,712,724	22,762,757
	Maasin	10,627,605	11,874,033	14,529,998	14,995,848	18,544,456
	Miagao	14,490,767	16,498,622	20,477,765	21,048,716	27,074,585
	Mina	6,456,027	7,521,253	9,546,130	9,735,397	12,396,511
	New Lucena	6,671,657	7,816,596	9,793,932	9,974,623	12,686,861
	Oton	13,835,327	16,030,279	20,504,486	20,969,145	26,194,402
	Passi City	17,374,735	19,251,269	23,439,047	24,263,676	31,107,998
	Pavia	7,819,468	9,284,676	12,243,775	12,450,540	15,435,010
Pototan	14,291,699	16,617,909	20,751,075	21,135,720	27,172,183	
San Dionisio	9,219,964	10,187,417	12,644,531	13,074,633	16,788,833	
San Enrique	8,783,672	9,973,375	12,405,489	13,162,687	16,853,315	
San Joaquin	13,781,992	15,079,656	19,084,262	19,815,155	25,539,253	
San Miguel	6,459,294	7,449,680	9,646,053	9,860,207	12,620,867	
San Rafael	7,140,549	7,878,880	9,948,925	8,821,920	11,231,366	
Santa Barbara	11,049,411	12,868,524	16,233,009	17,604,329	22,550,110	
Sara	12,447,996	13,882,708	17,236,316	17,803,581	22,869,842	
Tigbauan	11,949,470	13,731,734	17,324,708	17,731,908	22,855,359	
Tubungan	7,109,111	8,249,515	10,908,686	11,163,902	14,206,100	
Zarraga	6,984,411	8,210,727	10,840,064	10,536,423	13,373,338	



**Table 6.2.3 Actual Funds for Capital Expenditures (20% DF), 1994-1999**

Unit: Pesos

Year	IRA of the Province (a)	Planned 20% DF <sup>1/</sup> (b)	Actual Expenditures on 20% DF <sup>2/</sup> (c)	Surplus/(Deficit)
1995	269,948,716.00	53,989,743.20	48,916,247.32	5,073,495.88
1996	292,713,586.57	58,542,717.31	51,373,580.00	7,169,137.31
1997	361,623,121.00	72,324,624.20	68,397,798.97	3,926,825.23
1998	423,420,668.00	84,684,133.60	73,422,124.90	11,262,008.70
1999 <sup>3/</sup>	495,663,200.00	99,132,640.00	45,299,238.63	53,833,401.37

Source: Provincial Treasurer's Office

<sup>1/</sup> The 20% DF allotted may not be equal to the computed 20% of IRA.

<sup>2/</sup> These figures are not necessarily similar with the capital expenditures shown in Table 6.2.1 from Provincial Accountant's Office. Includes current and previous years. For 1999, no expenditures incurred have not been consolidated.

<sup>3/</sup> Actual expenditures for 1999 is the non-office expenditures in Table 6.2.1

The following is the formula adopted by BLGF in computing the debt servicing capacity. According to the MDF Policy Governing Board Resolution 4-95, the average annual growth rate to be used should not exceed 15%.

$$DSC = \{ [RINC 1 (1+AGR) + RINC 1] + IRA 2 \} \times 20\% - AMORT$$

Where:

DSC = debt servicing capacity of the LGU

RINC = regular income

AGR = average growth rate

IRA = internal revenue allotment

20% = debt servicing ceiling percentage imposed by the Local Government Code of 1991 under Section 324 (b).

AMORT = amortization of the LGU's outstanding loan

1 =current year

2 =preceding year

Based on the above formula, the amount of the debt servicing capacity of the provincial government was computed to be ₱97.6 million for the year 1999. This amount reflects the maximum loan that can be availed of from MDF. The local tax income (current year) and IRA of the province are projected at ₱32.25 million and ₱432.42 million (preceding year), respectively. The province has not incurred any loan.

### **6.3 Past Public Investment and Present Plans**

#### **6.3.1 Past and Current Annual Investment Plans**

The past and recent development of the water supply and sanitation sector in the province was undertaken by the province, DILG, DOH, DPWH. Based on the limited available data, there were minimal investments on water supply and sanitation sector for the period 1995-1998.

The bulk of investments in the sector, around 55%, was allocated to Level I systems. Level II, Level III, and Sanitation accounted for 13.57%, 19.68% and 11.54%, respectively, of the total sector investments.

##### **(1) Budgetary Allocation to the Sector**

The Budget Office of the province consolidates the budget proposal submitted by all offices of the Provincial Government. While, the DBM issues a Local Budget Memorandum every October of the preceding budget year to guide the provinces in their budget preparation. The sector obtains allotment from the 20% DF allocation by the Provincial Development Council (PDC).

Once the budgetary arrangement is completed, the local chief executive (Governor) endorses it to the SP for approval and appropriation. The SP usually approves the budget, ideally before January of the budget year. In case the budget is not approved, the province operates on a re-enacted budget, which is based on the last year's budget, until the budget for the current year is approved.

##### **(2) Capital Expenditures in the Sector**

The projects programmed for implementation in the province by sector, by funding source, and by implementing agency are consolidated and presented by the PPDO in the Provincial Annual Investment Plan (AIP). The AIP is based on the planned investment of the province, as well as on the submission to the PPDO from the municipalities on their planned investments for the coming year. The AIP of Iloilo for the sector from 1995 to 1999 are presented in Tables 6.3.2 and 6.3.3.

Table 6.3.1 Previous Sector Investment to the Province by Concerned Agencies

Item		1995 - 1999				
Agency	Source of Funds	Level I	Level II	Level III	Sub-total	Sanitation
Unit: Pesos						
DILG	PAF-2	9,083,997.00			9,083,997.00	2,766,100.00
DPWH I						
DPWH II	CDF	90,000.00	522,500.00	1,290,000.00	1,902,500.00	
	OECS - RWS	3,146,000.00			3,146,000.00	
		232,000.00	530,000.00	1,350,000.00	2,112,000.00	
DPWH III	CDF	675,000.00	2,200,000.00	2,075,000.00	4,950,000.00	
LWUA						
DOH (1996-1998)	FW4SP - WB	158,235.29	170,773.76		329,009.05	1,401,732.00
Province						
City						
Municipality						
<b>Total</b>		<b>13,385,232.29</b>	<b>3,423,273.76</b>	<b>4,715,000.00</b>	<b>21,523,506.05</b>	<b>4,167,832.00</b>

Figure 6.3.1  
Actual Amount of Sectoral Investments to  
the Province, 1995-1999

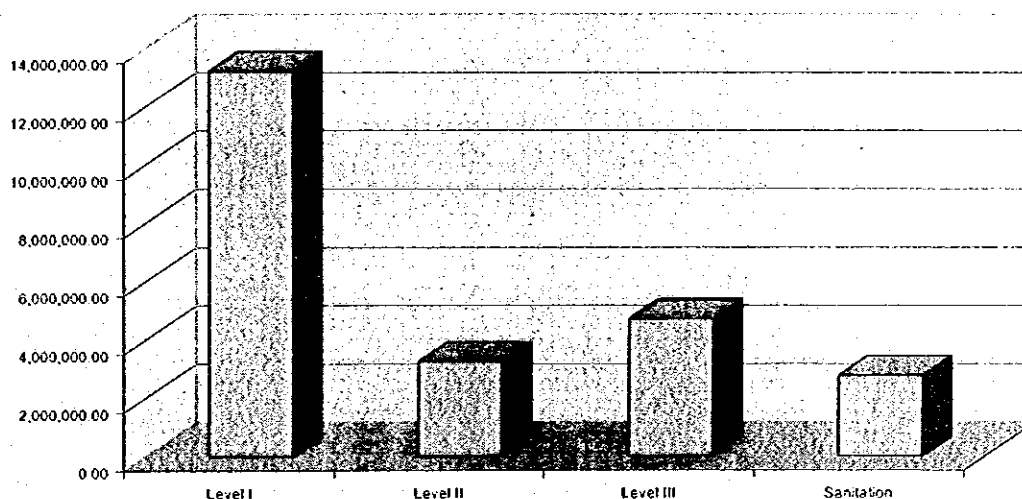


Table 6.3.2 shows the annual planned activities in the water supply sector; the corresponding funding sources and the amount of investment from 1995 to 1999, while Table 6.3.3 summarizes annual sector investment by service level. Levels II and III had the largest fund allocation, with a 1995-1999 amount of ₱3.42 million out of total sector allocation of around ₱5.875 million. Sanitation only accounted for 11.1% of the allocation, or ₱ 655,000 out of ₱ 5.875 million.

Referring to Table 6.3.4, it is shown however that actual expenditures for the sector out of the 20% DF was very small at only ₱ 423,000.

### 6.3.2 Past and Current Breakdown of 20% Development Fund

The allocation of the 20% DF is guided by DILG Memorandum Circular No.95-215 as amended by Memorandum Circular No. 96-263 issuing 'the Policies and Guidelines on the utilization of the DF and other related matters'. As presented in Table 6.3.4 and graphically shown in Figure 6.3.4, the infrastructure sector obtained 50% of the DF in 1998 (i.e. ₱36.76 million out of ₱73.42 million actual expenditures). However, the WATSAN sector was not a priority sector and it was only in 1998 that the provincial government provided some funds for WATSAN projects.

Table 6.3.2 Annual Activities in the Water Supply Sector

Item	1995			1996			1997			1998			1999		
	IA	Fund Source	Amount (P '000)	IA	Fund Source	Amount (P '000)	IA	Fund Source	Amount (P '000)	IA	Fund Source	Amount (P '000)	IA	Fund Source	Amount (P '000)
Construction (DW, SW, Spring Box, Reservoir, Tank)															
Various Foreign Assisted															
National		DWPH & DILG	4,286		DPWH & DILG	1,833		DPWH & DILG	2,007		DPWH & DILG	2,575		DILG	2,684
Various Local Funding		DOH & Prov.	100					DOH & Prov.	53		Prov.	270			
Construction of Rain Collectors/Water Tank															
Develop Spring Sources															
Various Foreign Assisted															
National															
Various Local Funding															
Spring Development with Level II															
Various Foreign Assisted															
National															
Various Local Funding															
Spring Development with Level III															
Spring Dev. w/ pipes, water tank															
Construction Level II/III															
Various Foreign Assisted															
National		DWPH	2,790		DWPH	1,350		DPWH	200		DPWH	375			
Various Local Funding					Prov.	1,200									
Loan															
Maintains/Rehab./improve Level I/II/III & SD															
Expansion of Level II/III															
Construction of Health Center/BHS															
Water Disinfection/Chlorination of Water Sources															
Barangay Sanitation		DILG & DOH	888		DILG & DOH	812		DILG & DOH	1,202		DILG	500		DILG	766
Construction of School/Public Toilet															

**Table 6.3.3 Sector Allocation in the Annual Investment Plan**

Item	1995	1996	1997	1998	1999	Total
Unit: '000 Pesos						
Level I Facility						
Foreign Assisted	none					
National						
Local (Provincial)			400.00	1,200.00	200.00	1,800.00
Level II/III System						
Foreign Assisted	1,500.00	800.00		320.00	800.00	3,420.00
National						
Local						
Loan - DBP/I.BP						
Expansion						
Repair/Maintenance	100.00	100.00	100.00	100.00	100.00	500.00
Health Centers	20.00	25.00	30.00	50.00	30.00	155.00
Water Quality	none					
<i>Total - Water Supply</i>	1,500.00	800.00	400.00	1,520.00	1,000.00	5,220.00
<i>Total - Sanitation (Health)</i>	120.00	125.00	130.00	150.00	130.00	655.00
<b>Grand Total</b>	<b>1,620.00</b>	<b>925.00</b>	<b>530.00</b>	<b>1,670.00</b>	<b>1,130.00</b>	<b>5,875.00</b>

**Table 6.3.4 Allocation of the 20% Development Fund, 1995-1999**

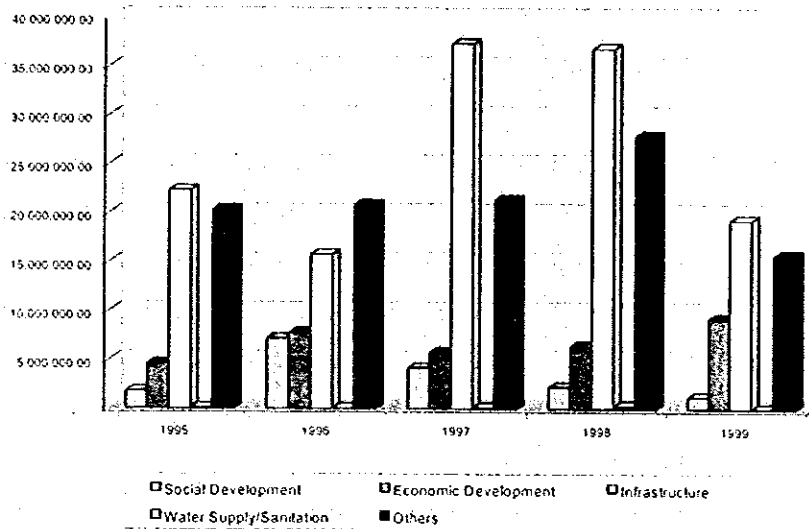
Unit: Pesos

Year	Planned 20% Dev't. Fund	Actual Expenditures						% of Water Supply to Actual Disbursed Amount of 20% DF
		Social Development	Economic Development	Infrastructure	Water Supply/ Sanitation	Others	Sub-Total	
1995	53,989,743.20	1,777,500.00	4,556,250.00	22,254,847.32	100,000.00	20,227,650.00	48,916,247.32	0.20%
1996	58,542,717.31	7,170,600.00	7,720,000.00	15,722,500.00	-	20,760,480.00	51,373,580.00	-
1997	72,324,624.20	4,153,840.17	5,681,928.74	37,227,178.29	53,000.00	21,281,851.77	68,397,798.97	0.08%
1998	84,684,133.60	2,209,900.00	6,360,320.00	36,765,513.00	270,000.00	27,816,411.90	73,422,144.90	0.37%
1999	99,132,640.00	1,211,360.00	9,197,000.00	19,251,168.63	-	15,639,710.00	45,299,238.63	-

Source: Provincial Budget Office and Provincial Accountant's Office.

<sup>1</sup> The 1999 figures for expenditures are allotted amounts only. Actual figures are not available.

Figure 6.3.4  
Allocation of the 20% Development Fund, 1995-1999



In 1998, out of the planned 20% DF of ₱ 84.68 million, only the amount of ₱270,000 was disbursed to WATSAN sector (which is equivalent to 0.32% of the planned 20% DF or 0.37% of the actual total disbursements from 20% DF).

### 6.3.3 Existing Plans of the LGUs for the Sector

#### (a) Logistic support with required funding

The LGUs through the course of project implementation shall ensure the provision of adequate logistic support with financial arrangements. The LGUs have not given priority to the requirements considering the budgetary constraint. The AIP needs to include the plan for the logistic support entailing manpower and vehicle allocation.

Also, the province shall determine financial arrangements for the implementation of Medium-Term Development Plan (2000-2004) to be prepared, entailing the share to the relevant sector from development fund of IRA and other financial sources to be availed of.

#### (b) Raising funds and provision of subsidies to support capital development in municipalities

The province provides the subsidies to support capital development at the municipal and barangay levels through its 20% DF. However, barangays and municipalities that request

funding must be prompt in submitting the necessary documents to PPDO for processing. Out of the 20% DF, the province may provide logistics for manpower requirement for devolved functions.

Based on the policy of the province, the following annual activities are undertaken in the province:

- Project proposals from the different municipalities and barangays are compiled;
- Consultation with the representatives of municipalities and barangays as to prioritization of the sector projects. During the occasion, the Governor announces the policy on the sector project implementation including budgetary allocation, the planned and implemented projects, and the obligation of the people/ beneficiaries (cost-sharing between province and municipalities according to financial capabilities of the municipalities concerned).
- For Level I and II water supply, LGUs implement the projects based on the available fund. Generally, projects are initiated by the BC. In case that project needs (finance, technology, etc.) exceed the capacity of BC, the request is made to municipality followed by action by the province. There are cases when BCs directly request projects to Governor's Office.

#### **6.4 LGUs' Present Financing Sources and Management Participation in the Sector**

##### **6.4.1 Cost Sharing Arrangements / Counterpart Funding**

The implementation of water supply projects funded by UNICEF was previously undertaken by PPDO, PEO and PHO. The PEO receives requests for assistance from barangay people although planning the sector projects is under the PPDO. The request, however, are granted on a case to case basis, usually if the manpower, materials and budget are available. It was assigned to the PEO for project implementation (Level I and II) since the PEO can undertake the design, construction and provide O & M assistance.

Cost sharing among concerned parties (LGUs, central government agencies and barangay people) has been made within realistic arrangement/ current capacity (though the level of the practice is far from present GOP policy).

The following are other financial arrangements and issues:

- a) There is no priority list of projects for the municipalities and no budget allocation was made in advance to reflect in the AIP. There is a Local Finance Committee to decide on priority projects for their financing, the members of which come from Budget Office,



Treasurer's Office, PPDO and Accounting Office. All projects must have barangay resolutions. The PDC (Provincial Development Council) also prepares its justification for the prioritization of projects.

- b) The PEO implements the Provincial government-funded projects under the General Fund. The implementation of these projects is closely monitored with reference to progressive disbursements. For the sector implementation, the following are the local funding sources and corresponding implementing agencies.

<u>Funding Source</u>	<u>Implementing Agency</u>
Provincial Government	PEO
CDF (Congressmen)	DPWH – District Office
Municipal Government	Municipal Government

A new cost-sharing scheme was authorized in 1998 in accordance with the policy on national government grants. It is stated that "this scheme shall be applied to all new ODA-assisted projects that are currently being packaged in support of LGUs". Programs of central government agencies that involve devolved functions, particularly those that have social and/or

environmental objectives are implemented through a cost-sharing arrangement between the central government agency and LGUs.

For any central government grants that are provided for the development of Level I water supply systems and sanitation facilities to the limited classes of municipalities, the LGUs and beneficiaries concerned shall share the capital cost required. No subsidies from the central government will be provided for the construction of Level II and III water supply systems.

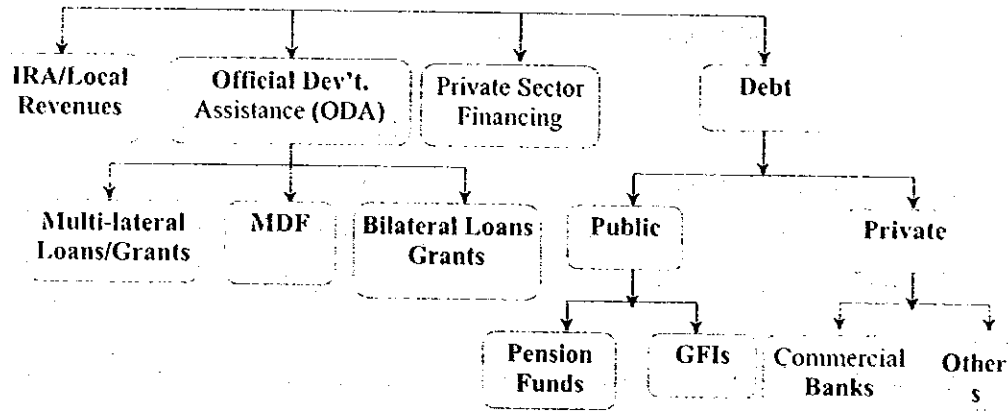
#### **6.4.2 ODA Assisted Projects and Grant/Aid**

Other external source of funds of the province is foreign assisted projects either directly coursed through the province as in the case of the UNICEF funds (grant) and JICA (grant).

Water districts in the province likewise avail of funding through loans that are directly obtained from LWUA.

LGUs have the following financing options (refer to Figure 6.4.1): IRA, ODA, private sector financing and debt (both public and private sector debts). A more detailed discussion of the different financing options is presented in the Supporting Report. Below are the major commonly availed or financing options by LGUs.

Figure 6.4.1 LGU Financing Options



#### Arrangement through Conduits

##### (1) Municipal Development Fund (MDF)

The MDF is a revolving fund created under Presidential Decree No. 1914 to provide LGUs access to foreign loans, assistance or grants. Operations of the MDF, as well as the evaluation and control of local government transactions of the fund, are guided by the financial policies defined in the Joint Circular No. 6-87 of the DOF, COA and DBM. The policies include, among others, the following:

- On-lending terms for local governments or government corporations to be in accordance with the terms and conditions of the international agreements with foreign financial institutions;
- Loan repayments to conform with the terms and conditions of the corresponding Loan and Project Agreements;
- Annual debt service liabilities to all creditors to be at least 120 per cent of total net annual revenues from all sources after operating costs, unless otherwise provided in a mutual agreement among all parties concerned;
- Repayment to MDF to take precedence over all subsequent borrowings incurred;

- Payment of additional interest, charges and fees on amounts to be relented to local governments may be required by the Secretary of Finance in consultation or agreement with foreign lending institutions and LGUs/Project Cities to cover foreign exchange risks, commitment charges and front-end fees applied on foreign borrowings by lending institutions; and
- Internal revenue/specific tax allotments to be withheld by the DOF in case of default or arrears for more than three (3) months.

The Policy on accessing loans through the MDF is currently under review by the central government to make the terms and conditions more concessional towards the lower classes of LGUs, such as the 4<sup>th</sup> to 6<sup>th</sup> class municipalities.

## (2) Governmental Financing Institutions (GFI)

In the past, the LGUs could not access financing institutions for direct assistance. But with the devolution of the sector to the LGUs, the LGUs could now access direct financing from banks and other financing institutions.

Among the GFIs through which LGUs can access ODA loans are the Land Bank of the Philippines (LBP), Philippine National Bank and the Development Bank of the Philippines (DBP). For the LGU to enter into a loan, the respective legislative council (Sangguniang Panlalawigan, SP for the Province; Sangguniang Panglunsod, SP for the City; and Sangguniang Bayan, SB for the Municipality) will authorize the Chief Executive Officer (Governor or Mayor, as the case may be). The collateral that the LGU may use in order to avail of loans from the bank could be any of the following: deposit hold out, public land and assignment of IRA.

In a deposit hold out loan, loanable amount is based on the amount in the time deposit account of the LGU in the bank. The LGU is allowed a maximum loanable amount of up to 90 per cent of the total amount of its time deposit account in the bank. One of the terms for this kind of loan includes deduction of the amount due from the LGU's IRA deposited in that bank.

Another condition that the bank usually imposes on the loan is the signing of a MOA between the LGU and the bank, where the LGU guarantees that the loan will be honored despite a change in administration in the next election. Interest rate is not fixed.

Loanable amount may be based on the amount of time deposit of the province in the bank.

Other collaterals accepted by the bank are: public land and assignment of IRA. Interest rate is not fixed but fluctuating depending on the current interest rates prevailing during repayment. Penalty charges are imposed whenever the IRA of the province is delayed.

### (3) Foreign Lending Agencies

The external assistance to the Sector in the province comes from foreign assisted projects. Before the devolution of the sector, the province was a beneficiary of UNICEF and JICA health services. After the devolution, the province became the direct recipient of foreign grants.

There is currently a World Bank-assisted project, the Local Government Unit-Urban Water and Sanitation Project (LGUWSP), which was conceived in mid-1995 by the Government thru the DILG. The project is based on two underlying principles: "demand-driven approach in project development and implementation (the project shall provide services that the consumers want and are willing to pay for and that the services shall be managed at the lowest appropriate levels); and the "adoption of commercial principles" in the management/ operation of the water utilities by involving the private sector or the facilities must be operated as commercial entities, and water treated as an economic commodity.

The project promotes full cost recovery; that is, the tariff to be paid by the consumers should cover the cost of operation and maintenance and the repayment of the LGU DBP loan. The system shall be operated by a private operator under a long-term lease contract with the LGU. It aims to support the water supply requirement in the urban centers of approximately 250 small and medium sized municipalities, benefiting about 6 million people. There are two (2) sets of target markets, namely:

- (1) Municipalities/ cities, irrespective of income class, which have not formed a water district; and
- (2) Municipalities/ cities, irrespective of income class, which have water districts but are not in LWUA's current program of assistance (in which case, the LGU should secure a certification/ clearance to that effect). In the event that the local water

district is receiving a loan from LWUA, it shall seek clearance from LWUA prior to entering into an agreement with LGU concerned in any program of system expansion/rehabilitation. The LGU equity ranges from 10-25% of the total project cost.

The overall cost estimated nationwide and implementation time table of the project are as follows:

Phase	Unit:US\$ Million		
	World Bank	LGU	Total
1999 – 2002	23.3	13.7	37.0
2000 – 2004	60.0	20.0	80.0
2003 – 2006	100.0	33.0	133.0
<b>Total</b>	<b>183.3</b>	<b>66.7</b>	<b>250.0</b>

Relending Terms are as follows:

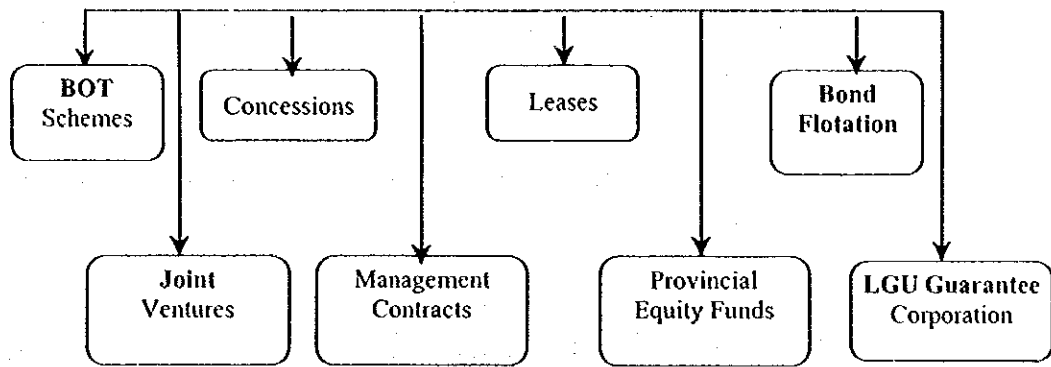
- 1) World Bank funds shall be channelled thru the Development Bank of the Philippines (DBP) which shall relend them as sub-project loans to the LGUs.
- 2) The DBP sub-project loan shall include the cost of feasibility study, technical design and construction of the water supply facility.
- 3) Basic terms of the loan are:
  - Interest per annum; 15%
  - Amortization Period; 15 years with 3-year grace period.

#### (4) Private Sector Financing Schemes

There are several private sector financing modalities that can be promoted to finance WATSAN sector projects particularly in urban areas, where existing service area coverage may warrant viability of WATSAN investments for a profit by the private sector proponent. Further, Level III water supply expansion projects are now increasingly financed thru private sector financing mainly thru concession contracts and BOT schemes.

Figure 6.4.2 presents the different modalities for private sector financing that may be tapped by LGUs for financing water supply and sanitation sector projects. A more detailed discussion of the private sector financing schemes is presented in the Supporting Report.

**Figure 6.4.2 Private Sector Financing**



### 6.4.3 LGU-Financed and Managed Waterworks and Water District

As presented in Table 6.4.1, there are fourteen (14) WDs in the province with Metro Iloilo Water District having the largest number of metered connections at more than 13,000 connections.

The WDs adopted progressive charge method and have achieved relatively high efficiency of water charge collection, which range from 67 to 100%. The average monthly consumption per connection is 29.6 cu.m. per month.

Shown in Table 6.4.2, is the status of existing loans of provincial/municipal waterworks. Janiway WD had the highest loan amount availed to be paid in 26 years. However, the Estancia and Leon WD are paying the highest amortizations, at to ₱30,500, and ₱ 40,000, respectively.

## 6.5 Existing Practices by the LGU on Cost Recovery

### 6.5.1 Capital Cost

In the previous arrangements, the capital cost for Level I systems was free to the community. As for Level II systems, the capital cost was shouldered by the RWSA through loan or grants. Water charges collected by each association cover the cost of operation and maintenance and loan amortization. According to the Loan Department of LWUA, the new loan disbursement to RWSAs has been stopped.

Table 6.4.1 Financial Indicators of WD/Waterworks

Water District/Waterworks	Number of Metered Connections	Number of Flat Rate Connections	Average Monthly Rate	Average Consumption per Connection	Average O&M Cost	Average Revenue	Collection Efficiency
	Number	Number	Pesos/m <sup>3</sup>	m <sup>3</sup> /Month	Pesos/Month	Pesos/Month	Percent (%)
Ajuy WD	365	5	9.33	23.00	64,171.56	14,851.99	
Alimodian WD	541	2	10.55	11.00	47,853.87	94,329.68	67.00
Anilao WD	242		6.00	29.00	28,415.81	34,013.65	80.34
Badiangan WW							
Acuit Waterworks							
Dumangas-Btac. Nuevo WD	2,283		12.64	24.00	406,460.00	567,074.95	92.43
Lanas Waterworks							
Barotac Viejo WD	495	10	10.30	12.00	45,306.51	54,108.25	86.00
Batad Rural WW	133		10.00	17.50	72,000.00	10,000.00	80.00
Metro Iloilo WD	13,675		13.25	34.09			85.00
Calinog WD	319		9.00	12.03	259,782.74		82.27
Agsalanan Waterworks							
Dingle-Pototan WD	3,116			23.41	413,462.00	552,425.00	88.00
Dueñas WD	325		6.66	17.99	747,107.95	932,763.43	73.40
Estancia WD	514		8.90	13.65	83,989.15	85,199.77	100.00
Guimbal Rural Waterwork	642		6.11	26.00	86,800.00	102,000.00	70.00
Janiuay WD	449			13.97		73,924.35	84.87
Leganes WD							
Buga WW							
Leon WD	363		12.00	20.20	2,000.00	6,000.00	80.00
Miagao WD	297	46	12.50	18.00	66,000.00	76,000.00	87.00
New Lucena WW	45		5.00	18.00	2,250.00		
Agdayao Waterwork							
Jaguimitan Waterwork							
Passi WD	351	18		27.00	30,366.00	27,414.00	78.00
Pal-agon-Mali-ao-Amparo RWSA							
San Dionisio WW	466						97.82
San Joaquin - LGU	339		0.60	15.00	20,340.00	20,340.00	80.00
Sinogbuan Waterwork							
Sara Mun. WS	57						

Table 6.4.2 Loan Status of Water District

Water District	Description			
	Total Loan Availed (in '000 Pesos)	Remaining Payment Period (months)	Average Monthly Amortization (in Pesos)	Current Arrears (in '000 Pesos)
Ajuy WD	480.00	82.00	7,125.00	14.25
Alimodian WD	355.69	64.00	3,822.00	191.58
Anilao WD	70.08	18.00	3,185.00	53.66
Dumangas-Btac. Nuevo WD (a)				
Barotac Viejo WD				
Metro Iloilo WD (a)				
Calinog WD	2,900.00	300.00	21,741.00	
Dingle-Pototan WD (a)	2,337.44	474.00	22,343.00	
Dueñas WD			10,640.00	
Estancia WD	3,800.00	120.00	30,449.00	1,066.00
Janiuay WD	4,662.45	312.00	16,498.00	5,147.41
Leon WD	3,400.00	312.00	40,000.00	
Miagao WD	747,073.74	312.00	7,967.00	
Passi WD	2,200.00		10,371.00	5,200.00

For Level III system, WDs or RWSAs bear the entire capital cost financed by LWUA through loans with concessional terms of 8.5%-12.5% interest rate and repayment period extending up to thirty (30) years. Less capable WDs are granted soft loans that are interest free during the first five (5) years operation. In the occasion of the first assistance by LWUA, the loan for the full investment required could be provided for the WDs.

For the expansion/rehabilitation works of the WDs, 90% of required investment may be granted by a loan and the remaining 10% shall be arranged by the equity of WDs. The cost of amortizing the loan and operation and maintenance of the system is recovered through monthly water bills. In case of LGU's operating Level III systems, the capital cost is managed by the LGU using part of DF and other financial sources (borrowings and aids).

Regarding the sanitation sector, the construction of the superstructure and the depository of household toilets is through self-help.

#### **6.5.2 Operation and Maintenance Cost**

The operation and maintenance cost for Level I and II water supply systems is envisioned to be the responsibility of the users. As such, the users shall form an organization (or association) to handle the collection of water charges.

When DPWH had been undertaking the construction of Level I water supply facilities, the DPWH through DEOs and PEOs assisted to form many BWSAs. However, most of these BWSAs are no longer functioning, due to the non-collection of water fees. As a consequence, the users had to go to the LGUs (usually barangay or municipal governments) to address the problem. In some cases, the users likewise requested the PEOs for assistance.

Although the DEO had no budget for operation and maintenance, it extended assistance in the form of materials (such as gaskets or joint pipes) from their supplies, if these items are available. Because of this situation, the emphasis was placed on the need of monthly contributions from the users for the O & M. While, some of the active BWSAs for Level I water supply collected monthly fees ranging from ₱5.00 to as much as ₱20.00 per household per month.



Cost recovery for Level III systems, particularly those covered by Water Districts is managed through different systems. The households covered by the Water District can be disconnected in case of no payment by the users.

The water rate structure is based on LWUA's guidelines for water rate setting. Water rates are socialized, based on O&M, operating expenses and capital expenditure requirements of the system for the period, and it should not exceed 5% of the low-income group's household income. Water rates are kept minimal since the Water District should be service-oriented and not profit-oriented.

## **6.6 Affordability of Users**

This sub-section presents the affordability of users by sector service level. However, base information for the analysis is limited to the results from field survey at selected barangays and from the water districts in the province.

### **6.6.1 Capital Cost Contribution**

Based on the results of the key informant survey, all the respondents indicated that all the barangay councils are willing to participate in sector projects by initiating the formation of a water and sanitation association. The respondents indicated the people willingness to contribute in cash or in kind for the construction of WATSAN facilities in their respective barangays.

Referring to the group interview results for Level I and II water supply conducted in this study, 19.5% of the have participated by providing labor in past water supply construction projects. Only a few (5.5% of respondents) have contributed either cash, materials or donated site. For future projects, the respondents, as a whole, were willing to participate and/or contribute for future WATSAN projects. There were a few who volunteered to participate depending on the activity to be undertaken such as in the formulation of water rates and in the selection of sites.

With respect to the construction cost of private toilet, its cost seems to be expensive as compared with the family income. The estimated cost of flush type toilet facility is about 6.58 times higher than the median monthly family income in the province and since this is the case, subsidy may be provided by the LGU concerned.

## 6.6.2 Operation and Maintenance Cost

Based on the key informant survey for Level I services, the most common problems cited by the respondents were the defective pumps and absence of maintenance work for these facilities due to the lack of sufficient funds to operate and maintain WATSAN facilities. It is noted by the respondents that most barangays were recipients of financial and institutional development assistance from the provincial and municipal government. The assistance included the funds for repair and maintenance of WATSAN facilities and the provision of various training programs.

Referring to the results of the group interview survey (Level I services), some of the respondents (7.5%) claimed it was the private owner that shouldered the cost of O & M of WATSAN facilities. Almost all of the respondents expressed willingness to pay for the O & M of future WATSAN facilities. Of those who were willing to pay, 25% of the total respondents claimed they could pay from ₱41 to around ₱50. Around 20.5% are willing to pay from ₱11 to around ₱30, and the rest of the respondents could pay only ₱10 and below.

In the water districts or Level III waterworks, O & M expenses are basically covered by the user fees depending on the amount charged for water consumption by water user category. The water tariff system was established by LWUA to compel water districts to be self-sufficient, financially viable and be able to repay any loans obtained to improve water supply services. Table 6.6.1 presents the affordability of households by service level. At present, the current water bills in the province seem to be within an affordable range based on experience, although the actual income level varies from municipality to municipality and barangay to barangay (urban barangay population have higher income than those in rural barangays, because of the more diverse economic and commercial activities).

**Table 6.6.1 Affordability in Water Supply and Sanitation Services**

Income/ Level of Service	Amount (Pesos)	% to Monthly Income	Affordable Range (%) <sup>5</sup>
Median of Monthly Income <sup>1</sup>	3,497.33		
Average Level III: Monthly Water Bill <sup>2</sup>	116.59	3.34	5.0 or less
Average Level II: Monthly Water Bill <sup>2</sup>			2.0 -3.0
Mo. Level I Expenditures <sup>3</sup>			1.0 or less
Private Toilet Construction Cost – Flush Type Toilet <sup>4</sup>	23,000.00	6.58 x Monthly Income	

Notes:

<sup>1</sup> 1994 Family Income and Expenditures Survey, NSO.

<sup>2</sup> Data from PSPT; It is assumed that 28.63 cu.m. will be consumed per family.

<sup>3</sup> No data available

<sup>4</sup> Current prices estimated in this study

<sup>5</sup> Based on the experiences mainly from LWUA, DPWH and DILG.

Chapter

---

**WATER SOURCE DEVELOPMENT**

**7**



## 7. WATER SOURCE DEVELOPMENT

### 7.1 General

The study on water source development covers the entire province in order to come up with water source potential exploitable mainly as domestic water supply. Emphasis is placed on groundwater availability due to its prevalent use and comparatively conservative development expected through the future in the jurisdiction of the provincial government. It is also advantageous to utilize groundwater for domestic water supply because of better quality and economical use. Nevertheless, with reference to river basin water resources management, surface water potential of major rivers was studied to provide information for the future use.

A "Groundwater Availability Map" was prepared, which identifies the areas with available potable water sources. The study has two major components: (1) interpretation of existing geologic and groundwater conditions and (2) preparation of Groundwater Availability Map to show groundwater potential areas under three categorized areas. Furthermore, standard well specifications by municipality were also established to reflect in the medium-term sector development plan.

The major data used in the study were obtained from concerned agencies (NAMRIA, BMGS, NWRB, LWUA, DPWH and PPDO) and supplemented by the information gathered through questionnaires from relevant local offices in the field (including spring inventories with verifications). The field information directly collected by the Study Team was also used to increase the accuracy of the Map. Among the information, the Geologic Map published by BMGS, the Water Resource Investigation Report and the Well Inventory Database of NWRB are essential for the analysis of geological characteristics, projection of high yielding area and possible area with saline water intrusion, and classification of groundwater potential areas, respectively (details are referred to Table 7.1.2, Data Report).

The Groundwater Availability Map may be used for provincial level master plan and feasibility study at present. However, recommendations on the required investigations were presented for specific areas with scope of survey, as reference for LGUs, to conduct these prior to D/D and construction work. Aside from the requirements, updating the map is a requisite to gain more information on prevailing groundwater conditions using the questionnaires prepared for the study. An annual review and updating of the database will enable the LGUs to implement water source development on a project site basis.

An overview on current groundwater use with the conditions is summarized in Table 7.1.1 (well data collected from each municipality are presented in Table 7.1.1, Water Source Information, Data Report). There are 34,875 shallow wells, 8,989 deep wells and 911 developed springs in the province (functional sources). Majority of the wells is shallow wells. About 35% of these water sources are public facilities. Of the total existing wells, 980 shallow/deep wells are not functional at present. In addition to the above sources, 36 untapped springs are accounted.

**Table 7.1.1 Existing Groundwater Sources in the Province**

Category and Classification	Shallow Well	Deep Well	Spring	Total
1. Water source being availed				
a. Public sources	11,913	2,875	911	15,699
b. Privately owned sources	22,962	6,114	0	29,076
c. Number of water sources	34,875	8,989	900	44,775
d. % share of different sources	78%	20%	2%	100%
2. Water sources with problems and non-functional facilities				
a. Water quality problems*	10,463	0	0	10,463
b. Non-functional	809	171	38	1,081
3. Spring source information				
a. Undeveloped	-	-	0	0
b. Untapped	-	-	36	36

Note. 1: Number of water sources being availed at present including those with water quality problems.

2: Number of existing water sources with problems: being used, but with water quality problem/abandoned wells.

3: Number of springs availed, but not adequately protected; and those as candidate sources to be developed.

\*: Assumed number of sources (unsafe category) based on the study on existing water supply facilities in Chapter 4.

## 7.2 Geology

The geology of Iloilo province located in the southeastern part of Panay islands is complex and is mainly attributed to tectonic and magnetic actions generated from Cretaceous to Quaternary period. Based on stratigraphic correlation, the oldest rocks in the area are the completely folded and faulted assemblage of igneous and metamorphic rocks. During late Miocene epoch, serpentinized igneous rocks of Cretaceous period to Oligocene epoch are assumed to have intruded through old fractures accompanied by faulting.

Overlying unconformably the basement complex is the Tertiary sequence of volcanic and sedimentary rocks. Middle Miocene volcanism intervened with the deposition of the younger Oligocene to middle Miocene sedimentary rocks. Continuous accumulation of sediments in

this subsiding basin gave rise to the formulation of late Miocene to Pliocene sedimentary sequence, composed of sandstone, shale, limestone, mudstone and conglomerate. Last to be deposited before upliftment to the area are the Plio-Pleistocene claystone, sandstone, siltstone, conglomerate lenses, limestone and calcarenite lenses.

Physiographic configuration is an expression of structures that are formed throughout the complex geologic evolution of the province and the whole of Panay and Guimaras Island. The main structures trend more or less, N-S, NE and NW. The Tertiary systems are generally affected by folding and faulting, while Quaternary systems are affected by normal or gravity faulting. In general, the structural trend of the province is attributed to steeply sloping terrains and moderate to steep dips.

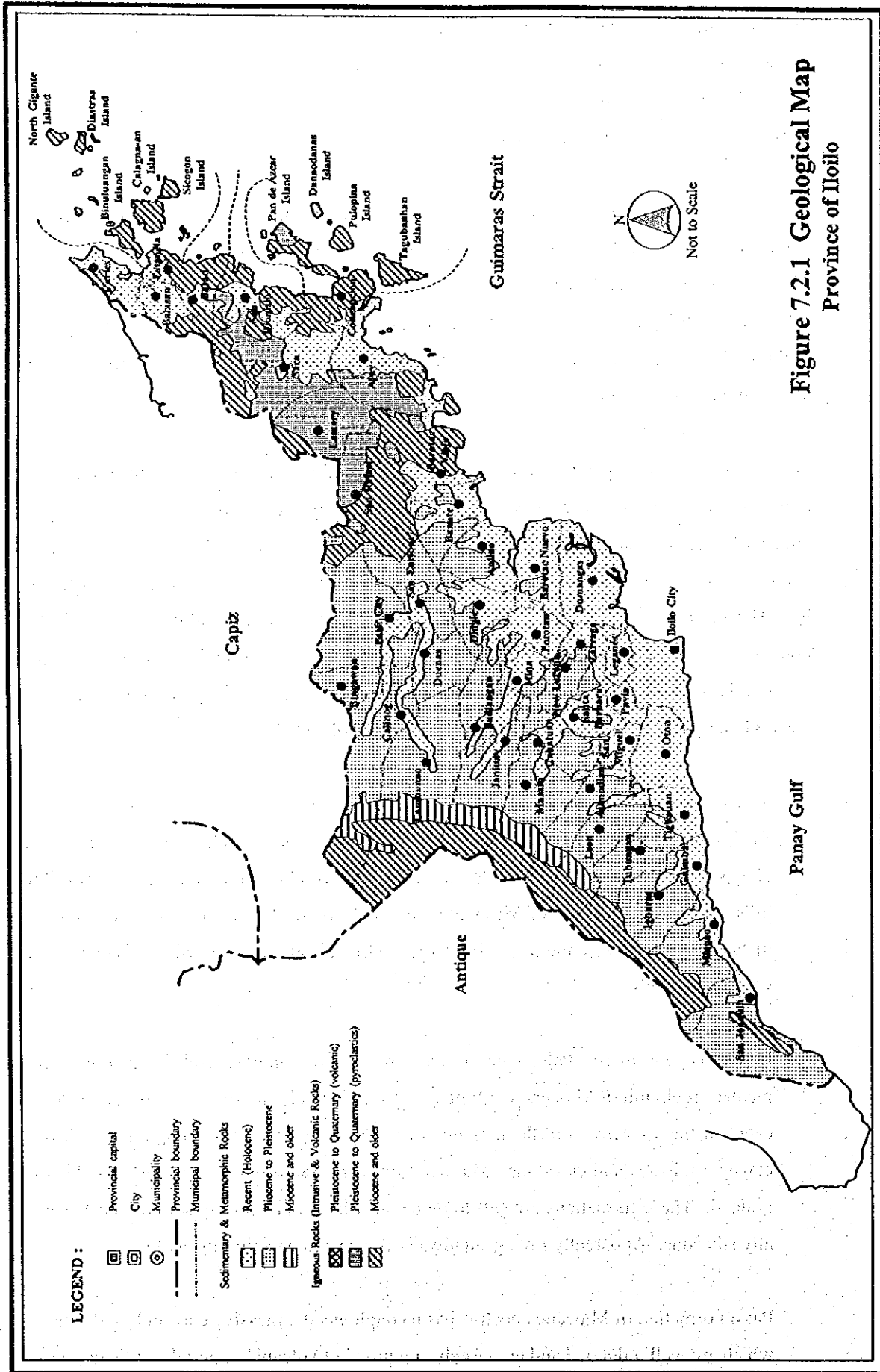
For the purpose of preparing the Groundwater Availability Map of the province, only rock units significant to groundwater storage and permeability are briefly described. The rock units in the province are classified into 3 main groups based on the geologic ages. In geologic age these are; the Miocene and Older Systems, the Plio-Pleistocene Series and Recent Deposits. The grouping of rock units is related to their potential as groundwater sources. The younger rocks are essential in groundwater development because of their porosity and permeability relative to the older rocks. The distribution of these rock groups is shown in Figure 7.2.1, Geological Map. Its geological features are described below.

#### (1) Miocene and Older Systems

Rock units of Miocene and older systems are impermeable, which are classified as aquicludes. These rock systems are found in the western Cordillera and the eastern rolling hills. Basement complex of Mesozoic era is composed of serpentine, basalt flows, and metamorphic rocks, commonly fractures. Groundwater is limited to fractured and weathered zones.

Early Neogene to late Paleogene systems are classified into several formations. Sedimentary rock unit of Miocene to Oligocene epoch, namely Singit and Taro Formation located in the western Cordillera, is massive sandstone with some conglomerate layers, clayey sandstone and claystone. Massive fine coarse sandstone is well sorted and is fine grained. These formations are soft to moderately hard. The poorly sorted matrix is usually siliceous. Apparently little groundwater is available in solution cavities.

Passi Formation of Miocene epoch is basin conglomerate, massive clay and sandstone, which are well indurated and are largely composed of volcanic material. Little ground-



**Figure 7.2.1 Geological Map  
Province of Iloilo**



water can be obtained from rocks since they are well cemented. Sedimentary rock unit of Miocene epoch in Dingle is sporadic limestone reefs interbedded with marl, sands and clays. This formation is porous or cavernous and may contain pumpable water at shallow depths. Mountain limestone of upper Miocene epoch is hard and compact. These formations are belonging to the eastern rolling hills. Solution cavities at shallow depths may yield groundwater.

## (2) Plio-Pleistocene Series

Sedimentary rocks of this series have various ranges of permeability. Sedimentary rock unit of Pliocene epoch includes conglomerates, clays and sands. This formation is tuffaceous material in matrix, which is found in the western end of the Iloilo Plain. Groundwater may be available for domestic supply. The other sedimentary rock unit of Pliocene epoch is massive blue clay with thickness of 200 to 400m that is mainly distributed in the northern portion of the Iloilo Plain.

Semi-consolidated formation of Plio-Pleistocene epoch can be divided into three members. From upper to lower, silt member in Santa Barbara has 50m in thickness (massive poorly loaded siltstone). Sandstone member has next 70m in thickness where groundwater may be developed up to the amount of 10 lps at 120m in depth. Lowest member is clay with 150m of thick-bedded claystone.

## (3) Recent Deposits (Holocene Series)

The alluvium consists of lenticular, intertonguing loose coastal and river deposits of boulders, cobbles, pebbles, granules, sands, silt and mud. These are the detrital fragments weathered and eroded from the pre-existing rocks. They occur at the coastal plains, flood plains, beaches, swamplands and offshore areas. The thickness varies as much as 30m with varying width and length. The river valley sand deposits are partly confined by a dense clay deposit.

The sand and gravel with clay and silt in minor proportions are considered permeable. However, top layers of Alluvial sediments in the Iloilo Plain consist predominantly of silt and clay layers. These members are considered semi permeable to impermeable, with occasional lenses of permeable sand and gravel. These finer sediments were deposited into shallow sea during final stage of isostatic uplifting of the landmass. Therefore, recharge capacity of Alluvial sediments in the plain is considered to be poor.

### **7.3 Groundwater Sources**

#### **7.3.1 Classification of Groundwater Availability**

For planning purpose, the provincial area is divided into the following sub-areas in terms of groundwater availability.

(1) Solo shallow well area

Solo shallow well area is defined in this study as the area where only shallow well is available. These areas have water bearing rock formations extending not more than 20m in depth below the ground surface. Solo shallow well areas are usually located in alluvial, coastal plains and inland small basins, where recent unconsolidated materials overlie on the impervious rocks at shallow depth. The extent of completely solo shallow well area is limited, because most of the recent formations are thick or deposited on the Late Plio-Pleistocene series that usually have multiple aquifers located at greater depths.

(2) Deep well area

In deep well areas, the lower aquifers are located more than 20m below the ground surface. These areas could be found in portions underlain by the Plio-Pleistocene series and Recent formations. Most of these areas have several aquifers occurring at various depths. In this area, shallow wells can also be developed.

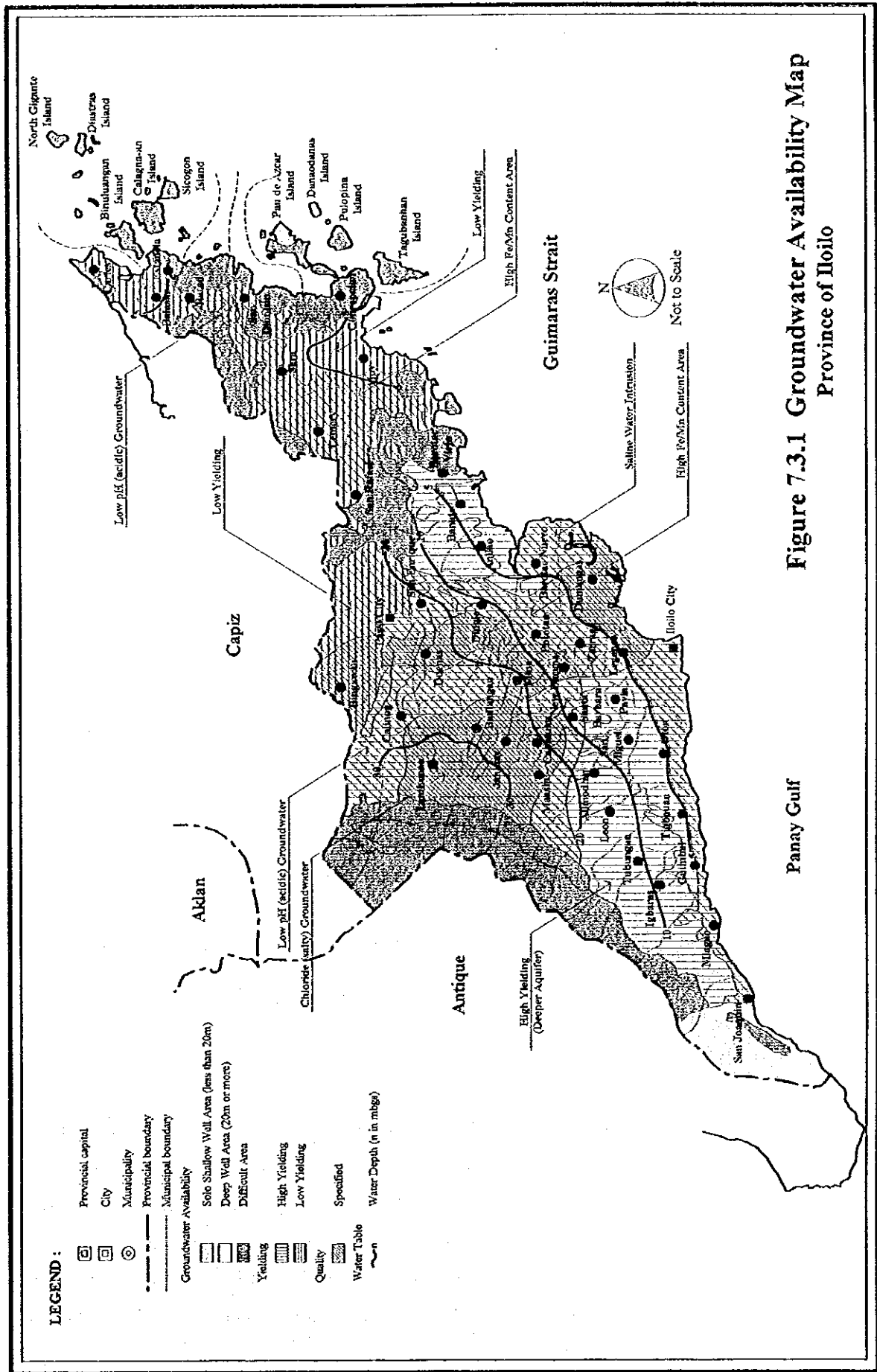
(3) Difficult area

This area is not suitable for well development. The areas under this category largely consist of rock formations older than Miocene epoch. The groundwater availability in the aforesaid rocks is very low and water is rarely released in the opened rock fractures. Springs are the common sources of water supply in these areas.

In addition to the above classification, potential areas to have high yielding deep aquifers are presented based on NWRB's geo-resistivity survey.

#### **7.3.2 Groundwater Availability in the Province**

The Groundwater Availability Map is presented in Figure 7.3.1. The major databases used in the preparation of the map were obtained from BMGS and NWRB. The methodology and study procedures with respective outputs are discussed in 7.3.2, Supporting Report.



**Figure 7.3.1 Groundwater Availability Map Province of Iloilo**

Technical information on the wells by municipality is also shown in the Data Report. The groundwater development potential areas in the province for the future are summarized.

(1) Solo shallow well area

Solo shallow well areas in the province are limited in the eastern islets. The development of shallow wells is, however, possible in the "Deep Well Area" (recent alluvium and beach deposits), where shallow aquifers usually occur.

The essential definition of shallow well is to develop an unconfined aquifer. However, it is difficult to classify an aquifer into confined or unconfined. In this study, therefore, the well classification was made referred to the well depth of 20m as the boundary. The depths of shallow wells in the province were assumed ranging from 0.9m to 19.6m. The static water levels are from 0.9 to 15.0 mbgs and specific capacities from 0.1 lpsm to 12.3 lpsm.

(2) Deep well Area

The deep well area covers approximately 75% of the province, widely distributed in central part of the province – Iloilo Plain. The deep well area is composed of alluvial plain and low hills made of sedimentary rocks. The alluvial plain is composed of recent deposits of clay, silt, sand and gravel, which form a groundwater storage basin for some aquifers. While, the sedimentary formations of Plio-Pleistocene epoch consist of conglomerates, sandstone, and shale with limestone in the northern part of the Iloilo Plain.

Considering the geological formation, the Iloilo Plain except northern portion is categorized as a high potential area for deep well development. While the eastern rolling hills of Plio-Pleistocene epoch including small alluvial plains and the northern portion of the Iloilo Plain are classified as a low-yielding area. In these deep well areas, the average depth of the existing deep wells is 34.8 m with an average water level of 7.8 mbgs. The average specific capacity is 0.4 lpsm.

In the eastern rolling hills area made of Plio-Pleistocene series and partly covered by alluvial deposits, groundwater development in deeper portion has not yet been performed sufficiently due to none availability of well drilling rig, although shallow well is available in the barangay proper. Deep well development is necessary in this area to secure the safe water source. The average depth of deep wells is projected at about 40 m with an average water level of 10 mbgs. However, the specific capacity of the deep wells may be enough for only Level-I service.

### (3) Difficult area

About 25% of the provincial area are classified as the difficult area to exploit groundwater, in which the mountain range and rolling hills areas exist. These are located in the western and eastern portions of the province.

The geology is made up of 1) serpentine, basalt flows and metamorphic rocks of Mesozoic era and 2) volcanic rock units of Oligocene epoch. These rocks and formations are in dense, massive and consolidated conditions and have impervious characteristics. Groundwater occurs only in fissures or fault fracture zones.

### 7.3.3 Groundwater Quality

The water quality problem in deep wells is found in the Iloilo Plain and eastern rolling hills (details are referred to Table 7.3.2, Data Report). Major water quality problem is ironic and acidic groundwater. The results of water resources investigation for the province conducted by NWRB and the general information from DPWH-DEO and PPDO revealed these problem areas and are shown in the Groundwater Availability Map in Figure 7.3.1.

Among the water quality problems of the province, ironic water is serious with a high percentage of affected existing wells (more than half of the numbers of deep wells) in populated area. The problem is extended to most of the Iloilo Plain and eastern rolling hills. The municipalities fall on this problem are Bingawan, Passi City, San Enrique, Duenas, Dingle, Mina, Pototan, New Lucena, Zarraga, Dumangas and Leganes in the Iloilo Plain, while Batad, San Dionisio, Sara, Lemery, San Rafael and Ajuy in the rolling hills. Acidic groundwater is confirmed in the western Iloilo Plain and San Dionisio. Groundwater with saline water intrusion is reported in southern seashore facing to Panay Gulf from Barotac Nuevo to San Joaquin. High chloride content in groundwater was also reported in the municipality of Lambunao, which is believed as the cause of fossil water.

### 7.4 Spring Sources

Spring is a natural outlet of groundwater at the ground surface. It occurs when water table intersects the ground surface, usually along the contacts of pervious and impervious rock formation and through rock features. Because of the intense fracturing, particularly older formation, and the presence of large solution openings in limestone, secondary permeability is induced to the rocks that favors spring development.

For the study, springs are categorized into developed, undeveloped and untapped springs. A developed spring is utilized with sanitary protection provided, otherwise it is classified as undeveloped spring, which is considered as unsafe water source. An untapped spring, as the name implies, is unutilized and flowing in its natural state.

Based on the inventory of water sources prepared throughout the study, the province has 900 developed springs currently serving the province. Such spring sources come out from the mountain range and rolling hills areas in the western and eastern parts of the province. Of these springs, 41 have discharge rates of less than 2.0 lps (2.0 lps is enough for Level II water supply with service population of about 2,000 and can be applicable for small Level III water supply), while 229 springs exceed discharge rates of 2.0 lps. The other 630 developed springs have no data available on discharge rates at present. Most of these springs are not dried up during a drought year or dry season, though yields varying from 0.01 lps to 51 lps. The technical information of springs in each municipality is presented in Table 7.4.1 Existing Spring Sources, Supporting Report.

## 7.5 Surface Water Sources

The major surface water sources in the province are Jalaur, Jaro and Sibalom Rivers. The Suage, Ulian, Tigum and Aganan rivers are tributaries of the major rivers. There are 5 gauging stations at the major rivers in the province.

Surface water amount used in the province totaled to 63.6 m<sup>3</sup>/sec according to the NWRB's water rights registration database as of March 1997. Of this usage, 99.3% of the water rights were registered for irrigation. The diversions for major flume, which are operated by NIA, are located at Barotac Viejo, the Barotac Viejo River; at Dingle, the Jalaur River; at Oton, the Aganan River; at Pototan, the Suage River; and Santa Barbara, the Tigum River, respectively. Other surface water rights are lodged to private companies for domestic, industrial (San Miguel Corporation) and fishery uses. For domestic water use, the Sea Fish Development Corporation (SEAFDEC) had a registration of 0.05 m<sup>3</sup>/sec intake amount at Guimbal in 1978 from the Guimbal River, but most of water has been used for the breeding laboratory. Actually, several waterworks fed surface water with total amount of 0.32 m<sup>3</sup>/sec (27,630 m<sup>3</sup>/day on actual data base) without registration of water rights in the province. Of this total amount, the Metropolitan Iloilo Water District utilizes river water of 0.30 m<sup>3</sup>/sec (26,300 m<sup>3</sup>/day) from Tigum River. Other waterworks are Passi City Water District, Ajuy Water District, Miagao Water District and Sara Municipal Water Supply.

Data on river flow including maintenance flow and water use of the major rivers/streams were obtained from available runoff records at the gauging stations (refer to Table 7.5.1, Supporting Report). The inflow to and the outflow from the respective municipalities are estimated as the exploitable potential of the major rivers in the province as shown in Table 7.5.2, Supporting Report.

Water quality analyses at selected rivers were conducted during this study. The examined water quality at each river meets the Class B limitation of "DENR Fresh Water Quality Criteria". It is noted that the river water in the Iloilo Plain is turbid and colored because of limy formation in the upstream and clayey topsoil in the downstream distributed.

## 7.6 Future Development Potential of Water Sources

### (1) Groundwater

Based on the study of existing water sources, groundwater is considered as a safe and more economical source for future rural water supply requirements of the province.

Shallow wells are the possible source for Level-I service. Considering the existing wells in the province, the potential aquifers for shallow wells occur between 0.9 to 19.6 mbgs. One disadvantage of shallow wells is the lowering of water level during dry season that reduces the discharge rate of the wells or disturbs the hand-pump operation. Another disadvantage is the usual high susceptibility of shallow aquifers to direct infiltration of surface pollutants.

In general, deep wells have better water quality and invariable yields when developed with appropriate technology. This depends if the wells tap to comparatively deeper aquifer. It reduces the hazards of groundwater pollution. In addition, lowering of static groundwater level does not affect the discharge rate and the hand-pump operation. In Recent deposits and Plio-Pleistocene series, good aquifers apparently occur from 20 mbgs to 118 mbgs in depth.

Additional wells can still be developed to meet future water supply demand of the province. For future planning purpose, the Groundwater Availability Map includes basic information for municipal groundwater development with the following information: well type, well yield, water quality and static water level. Aquifer formations are shown in Table 7.6.2, Supporting Report. The groundwater development potential in the province is shown in Table 7.6.1.

Table 7.6.1 Groundwater Development Potential in the Province

Area	Groundwater Development Potential	Water Quality	Area Feature
Eastern Rolling Hills	Majority of the existing wells is constructed by driven method with shallow depths. However, most of this district is classified as deep well area. Generally, well productivity is slightly lower than that of the Iloilo Plain. Groundwater levels both deep and shallow wells are about 10 mbgs in depth. The difficult areas are distributed in the eastern seashore belt and the western hillside. The eastern islets are classified into difficult area or solo shallow well area. Very few spring sources are found in the limestone hills.	Slight ironic groundwater is confirmed. Acidic spring source in San Dionisio is reported.	This area covers the eastern part of the province consisting of nine (9) municipalities from Carles to San Rafael with topographic features of small plateaus and plains. In the eastern edge of the province, there are several volcanic islets. Of these islets, Bacot and Bolubadangan islets are classified as inactive volcanoes.
Central Iloilo Plain	This area is classified as deep well area. Majority of the existing wells in this district is deep wells with depths of 20 to 118m. The production capacity of deep wells is generally high. In the northern portion of the Iloilo Plain where limestone formed small plateaus in Passi City and Bingawan, most deep wells have low yields. There are some spring sources in the said small plateaus.	Groundwater quality problems are high mineral contents in the central plain, low pH value along the eastern slope of the Cordillera and saline water intrusion. High chloride in groundwater is also reported in Lambunao.	This plain area covers the central to southwestern part of the province consisting of thirty-three (33) municipalities and two (2) cities. The topographical features are extensive plain and small scale of plateaus and terraces. This area is almost flat compared with the other districts.
Western Cordillera	This district is classified as difficult area. Fissure water can be developed locally. Potential water source is poor, only scattered spring sources may be encountered. Many rainwater collector facilities are found.	The groundwater both in wells and springs is reported to be slightly acidic.	This district covers the western mountain part of the province consisting of the mountain area of eight (8) municipalities from Lambunao to Miagao. The dominant topographical features are highland hills and mountain peaks. Area on the northwestern side, facing the province of Antique, is rugged highlands commonly known as the western Cordillera.



The well design with gravel placement is required for additional well development. However, the natural gravel packed well for Level-I water supply is also adaptable within limited areas in the province. However, the area where the natural gravel packed well is applicable for the future plan could not be identified due to lack of information available on the sieve analysis and no construction experiences of this method by concerned agencies in the province. Therefore, the construction ratio of natural gravel packed well to the total requirements of the province is assumed to be nil at present. However, the expected municipality areas, in which there is still possibility to apply the natural gravel packed wells, are projected as shown in Table 7.6.3, Supporting Report for the future reference.

Most of the Level-I deep well facilities had been designed with well materials made of either galvanized iron, mild steel or low carbon steel. However, in the area where groundwater with acidic pH is observed, anti-metallic (polyvinyl chloride; PVC) for well casing pipes and screens, and anti-corrosive metals (stainless steel; SUS) for pump facility are required. The municipalities requiring such countermeasures are recommended in Table 7.6.4, Supporting Report. The ratio of deep wells using PVC materials to the total requirements of the province is assumed at about 30%.

## (2) Spring

A total of 36 untapped spring sources identified by the PSPT is listed in Table 7.6.5 Untapped Spring Source Identification, Supporting Report. The list includes detailed data on barangay name, owner, discharge rate in dry season, transmission line length and relative elevation between spring source and served area. Such springs are located in the western Cordillera and eastern rolling hills of the province. Of these springs, 25 untapped springs with discharge rates ranging from 0.5 lps to 5.0 lps (actual data base) are generally applicable for Level-II water supply. Spring development potential in the province is shown in Table 7.6.5, Supporting Report.

## (3) Surface Water

The potential surface water volume exploitable from major rivers for the use of domestic water supply was estimated by municipality. It was arranged in this calculation to ensure maintenance flow of the rivers under the drought flow in the 10-year return period with due consideration of the present water rights.

The calculation results are shown in Table 7.5.2, Supporting Report. In particular, municipalities situated in the Jalaur, Jaro and Sibalom River basins are privileged to use

large amount of river water.

The MIWD has a plan to develop additional water source with about 30,000 m<sup>3</sup>/day for the expansion of its franchise service area by the year 2010. Water sources to be developed are surface water from Tigum River and groundwater at Santa Barbara well field. According to the MIWD, this plan will be implemented through the BOT scheme.

## **7.7 Water Source Development for Medium-Term Development Plan**

For the preparation of the medium-term development plan in terms of water source development, standard specifications of wells by municipality were prepared. The parameters, such as: proportion of well type, well depth, static water level and specific capacity are shown in Table 7.7.1. These were established using the well information from NWRB and the province (detailed database is included in Table 7.1.1, Data Report), and the hydrogeological assessment presented in Table 7.6.2, Supporting Report.

Groundwater source availability (well and spring) is reflected in Table 7.7.1 that was assumed based on water sources study considering the limited information on geology, topography, water sources inventory, etc. The groundwater source availability indicates the general profile of the different types of groundwater source available in the municipalities. Hence, the descriptions have no projected meaning on future development values of its groundwater source. Considering the present water sources utilization, the percentages of spring development compared with well development for the future demand of the entire province are studied in Chapter 8 of this report.

Shallow wells are currently used in some municipalities. The municipal areas are categorized into deep well and solo shallow well areas considering the on-going practices. The proportions (%) by deep well and shallow well area are determined with reference to groundwater development potential in the Groundwater Availability Map. Furthermore, well locations are assumed in terms of rural and urban areas by municipality using the classification of rural and urban barangays.

For municipalities without any well data, the well parameters are estimated using the data of adjoining towns, provided they have similar hydrogeologic features.

Table 7.7.1 Standard Specification of Wells by Municipality

Municipalities With Classification		Type	Proportion (%)	Standard Specification			Availability of Sources	
				Depth Range (m)		SWL (m)		Sp. Cap. (lpsm)
Ajuy	Rural	SW	0	-	<D<	-	-	Poor DW and Few SP
		DW	80	20.0	<D<	50.0	8	
	Urban	SW	0	-	<D<	-	-	Good DW and Few SP
		DW	100	20.0	<D<	50.0	8	
Alimodian	Rural	SW	0	-	<D<	-	-	Good DW and Few SP
		DW	50	20.0	<D<	50.0	7	
	Urban	SW	0	-	<D<	-	-	Good DW and Few SP
		DW	100	20.0	<D<	50.0	7	
Anilao	Rural	SW	0	-	<D<	-	-	Good DW and Few SP
		DW	100	20.0	<D<	50.0	5	
	Urban	SW	0	-	<D<	-	-	Good DW and Few SP
		DW	100	20.0	<D<	50.0	5	
Badiangan	Rural	SW	0	-	<D<	-	-	Good DW and Few SP
		DW	100	22.0	<D<	66.0	30	
	Urban	SW	0	-	<D<	-	-	Good DW and Few SP
		DW	100	80.0	<D<	-	25	
Balasan	Rural	SW	0	-	<D<	-	-	Poor DW and Few SP
		DW	80	23.0	<D<	40.0	7	
	Urban	SW	0	-	<D<	-	-	Poor DW and Few SP
		DW	100	40.0	<D<	-	7	
Banate	Rural	SW	0	-	<D<	-	-	Good DW and Few SP
		DW	100	20.0	<D<	30.0	3	
	Urban	SW	0	-	<D<	-	-	Good DW and Few SP
		DW	100	40.0	<D<	-	3	
Barotac Nuevo	Rural	SW	0	-	<D<	-	-	Good DW and Poor SP
		DW	100	20.0	<D<	30.0	6	
	Urban	SW	0	-	<D<	-	-	Good DW and Poor SP
		DW	100	40.0	<D<	-	6	
Barotac Viejo	Rural	SW	0	-	<D<	-	-	Poor DW and Few SP
		DW	20	20.0	<D<	30.0	3	
	Urban	SW	0	-	<D<	-	-	Poor DW and Few SP
		DW	50	40.0	<D<	-	3	
Batad	Rural	SW	0	-	<D<	-	-	Poor DW and Few SP
		DW	30	40.0	<D<	-	5	
	Urban	SW	0	-	<D<	-	-	Poor DW and Few SP
		DW	50	40.0	<D<	-	5	
Bingawan	Rural	SW	0	-	<D<	-	-	Poor DW and Few SP
		DW	100	80.0	<D<	-	25	
	Urban	SW	0	-	<D<	-	-	Poor DW and Few SP
		DW	100	80.0	<D<	-	25	
Cabatuan	Rural	SW	0	-	<D<	-	-	Good DW and Poor SP
		DW	100	80.0	<D<	-	18	
	Urban	SW	0	-	<D<	-	-	Good DW and Poor SP
		DW	100	23.0	<D<	66.0	18	
Calinog	Rural	SW	0	-	<D<	-	-	Fair DW and Few SP
		DW	70	80.0	<D<	-	30	
	Urban	SW	0	-	<D<	-	-	Fair DW and Few SP
		DW	100	80.0	<D<	-	25	
Carles	Rural	SW	0	-	<D<	-	-	Poor DW and Poor SP
		DW	60	40.0	<D<	-	5	
	Urban	SW	0	-	<D<	-	-	Poor DW and Poor SP
		DW	50	40.0	<D<	-	5	

Table 7.7.1 Standard Specification of Wells by Municipality

(cont'd)

Municipalities With Classification		Type	Proportion (%)	Standard Specification			Availability of Sources		
				Depth Range (m)		SWL (m)		Sp. Cap. (lpsm)	
Concepcion	Rural	SW	20	12.0	<D<	18.0	1	0.2	Risky DW and Few SP
		DW	10	20.0	<D<	50.0	3	0.2	
	Urban	SW	0	-	<D<	-	-	-	
		DW	30	20.0	<D<	50.0	3	0.4	
Dingle	Rural	SW	0	-	<D<	-	-	-	Good DW and Few SP
		DW	100	40.0	<D<	-	10	1.0	
	Urban	SW	0	-	<D<	-	-	-	
		DW	100	40.0	<D<	-	10	2.0	
Duenas	Rural	SW	0	-	<D<	-	-	-	Fair DW and Poor SP
		DW	100	22.0	<D<	60.0	24	0.8	
	Urban	SW	0	-	<D<	-	-	-	
		DW	100	40.0	<D<	-	24	1.0	
Dumangas	Rural	SW	0	-	<D<	-	-	-	Good DW and Poor SP
		DW	100	22.0	<D<	66.0	8	1.0	
	Urban	SW	0	-	<D<	-	-	-	
		DW	100	40.0	<D<	-	8	2.0	
Estancia	Rural	SW	0	-	<D<	-	-	-	Poor DW and Few SP
		DW	20	40.0	<D<	-	5	0.2	
	Urban	SW	0	-	<D<	-	-	-	
		DW	100	40.0	<D<	-	5	0.4	
Guimbal	Rural	SW	0	-	<D<	-	-	-	Good DW and Few SP
		DW	100	40.0	<D<	-	10	2.0	
	Urban	SW	0	-	<D<	-	-	-	
		DW	100	40.0	<D<	-	5	2.0	
Igaras	Rural	SW	0	-	<D<	-	-	-	Good DW and Few SP
		DW	70	80.0	<D<	-	15	1.0	
	Urban	SW	0	-	<D<	-	-	-	
		DW	100	40.0	<D<	-	10	2.0	
Janiuay	Rural	SW	0	-	<D<	-	-	-	Good DW and Few SP
		DW	50	80.0	<D<	-	30	0.8	
	Urban	SW	0	-	<D<	-	-	-	
		DW	100	80.0	<D<	-	25	1.0	
Lambunao	Rural	SW	0	-	<D<	-	-	-	Fair DW and Few SP
		DW	60	80.0	<D<	-	35	0.6	
	Urban	SW	0	-	<D<	-	-	-	
		DW	100	80.0	<D<	-	30	1.0	
Leganes	Rural	SW	0	-	<D<	-	-	-	Good DW and Poor SP
		DW	100	20.0	<D<	50.0	6	2.0	
	Urban	SW	0	-	<D<	-	-	-	
		DW	100	40.0	<D<	-	6	2.0	
Lemery	Rural	SW	0	-	<D<	-	-	-	Poor DW and Few SP
		DW	80	40.0	<D<	-	10	0.2	
	Urban	SW	0	-	<D<	-	-	-	
		DW	100	40.0	<D<	-	10	0.2	
Leon	Rural	SW	0	-	<D<	-	-	-	Good DW and Few SP
		DW	50	20.0	<D<	50.0	10	0.8	
	Urban	SW	0	-	<D<	-	-	-	
		DW	100	40.0	<D<	-	10	1.0	
Maasin	Rural	SW	0	-	<D<	-	-	-	Good DW and Few SP
		DW	50	30.0	<D<	60.0	15	0.8	
	Urban	SW	0	-	<D<	-	-	-	
		DW	100	80.0	<D<	-	20	1.0	

Table 7.7.1 Standard Specification of Wells by Municipality

(cont'd)

Municipalities With Classification		Type	Proportion (%)	Standard Specification			Availability of Sources	
				Depth Range (m)		SWL (m)		Sp. Cap. (lpsm)
Miagao	Rural	SW	0	-	<D<	-	-	Good DW and Few SP
		DW	70	20.0	<D<	30.0	5	
	Urban	SW	0	-	<D<	-	-	Good DW and Poor SP
		DW	100	40.0	<D<	-	3	
Mina	Rural	SW	0	-	<D<	-	-	Good DW and Poor SP
		DW	10	40.0	<D<	60.0	20	
	Urban	SW	0	-	<D<	-	-	Good DW and Poor SP
		DW	100	80.0	<D<	-	20	
New Lucena	Rural	SW	0	-	<D<	-	-	Good DW and Poor SP
		DW	100	23.0	<D<	76.0	6	
	Urban	SW	0	-	<D<	-	-	Good DW and Poor SP
		DW	100	80.0	<D<	-	6	
Oton	Rural	SW	0	-	<D<	-	-	Good DW and Poor SP
		DW	100	40.0	<D<	-	5	
	Urban	SW	0	-	<D<	-	-	Good DW and Poor SP
		DW	100	40.0	<D<	-	3	
Passi City	Rural	SW	0	-	<D<	-	-	Poor DW and Few SP
		DW	80	40.0	<D<	80.0	25	
	Urban	SW	0	-	<D<	-	-	Poor DW and Few SP
		DW	100	80.0	<D<	-	25	
Pavia	Rural	SW	0	-	<D<	-	-	Good DW and Poor SP
		DW	100	20.0	<D<	50.0	10	
	Urban	SW	0	-	<D<	-	-	Good DW and Poor SP
		DW	100	40.0	<D<	-	5	
Pototan	Rural	SW	0	-	<D<	-	-	Good DW and Poor SP
		DW	100	20.0	<D<	50.0	5	
	Urban	SW	0	-	<D<	-	-	Good DW and Poor SP
		DW	100	40.0	<D<	-	10	
San Dionisio	Rural	SW	0	-	<D<	-	-	Poor DW and Few SP
		DW	50	40.0	<D<	-	10	
	Urban	SW	0	-	<D<	-	-	Poor DW and Few SP
		DW	70	40.0	<D<	-	5	
San Enrique	Rural	SW	0	-	<D<	-	-	Fair DW and Few SP
		DW	80	40.0	<D<	80.0	20	
	Urban	SW	0	-	<D<	-	-	Fair DW and Few SP
		DW	100	80.0	<D<	-	20	
San Joaquin	Rural	SW	0	-	<D<	-	-	Fair DW and Few SP
		DW	90	40.0	<D<	-	10	
	Urban	SW	0	-	<D<	-	-	Fair DW and Few SP
		DW	100	40.0	<D<	-	3	
San Miguel	Rural	SW	0	-	<D<	-	-	Good DW and Poor SP
		DW	100	60.0	<D<	80.0	10	
	Urban	SW	0	-	<D<	-	-	Good DW and Poor SP
		DW	100	80.0	<D<	-	5	
San Rafael	Rural	SW	0	-	<D<	-	-	Poor DW and Few SP
		DW	40	25.0	<D<	45.0	15	
	Urban	SW	0	-	<D<	-	-	Poor DW and Few SP
		DW	60	40.0	<D<	-	10	
Santa Barbara	Rural	SW	0	-	<D<	-	-	Good DW and Poor SP
		DW	100	20.0	<D<	40.0	10	
	Urban	SW	0	-	<D<	-	-	Good DW and Poor SP
		DW	100	30.0	<D<	40.0	6	

**Table 7.7.1 Standard Specification of Wells by Municipality**

(cont'd)

Municipalities With Classification		Type	Proportion (%)	Standard Specification			Availability of Sources	
				Depth Range (m)	SWL (m)	Sp. Cap. (lpsm)		
Sara	Rural	SW DW	0 70	- <D< 40.0 <D<	- -	- 10	0.2	Poor DW and Few SP
	Urban	SW DW	0 100	- <D< 40.0 <D<	- -	- 6	- 0.4	
Tigbauan	Rural	SW DW	0 100	- <D< 20.0 <D<	- 25.0	- 5	- 2.0	Good DW and Poor SP
	Urban	SW DW	0 100	- <D< 40.0 <D<	- -	- 3	- 2.0	
Tubungan	Rural	SW DW	0 40	- <D< 20.0 <D<	- 50.0	- 15	- 0.8	Good DW and Few SP
	Urban	SW DW	0 100	- <D< 40.0 <D<	- -	- 10	- 1.0	
Zarraga	Rural	SW DW	0 100	- <D< 40.0 <D<	- -	- 10	- 2.0	Good DW and Poor SP
	Urban	SW DW	0 100	- <D< 40.0 <D<	- -	- 5	- 2.0	

For the furtherance in collecting accurate information to design the concrete specifications of the planned wells, the following recommendations are made (details are referred to Chapter 7.7.1, Supporting Report). Prior to the detailed design or pre-construction stages, additional detailed groundwater investigations entailing the construction of test wells shall be conducted. The entire province falls on this investigation area. Table 7.7.2 summarizes these requirements.

**Table 7.7.2 Detailed Groundwater Investigation Required**

Municipality	Area	Investigation Activities and Specification
Municipalities Within Eastern Rolling Hills	Urban & Rural	Electric Prospecting; sounding depth of 100m at 70 points Test Wells; 5 deep wells, depths of 40m to 80m, diameter of 150 mm and length of well screen 9m and 15m pumping test & water quality examination (Fe, Mn, pH, etc.)
Municipalities & Cities Within Central Iloilo Plain	Urban & Rural	Groundwater Database; log data, well structures, SWL, discharge and water quality (Fe, Mn, Ca, Mg, Cl, pH, etc.) Hydraulic Database; precipitation, river flow and water quality (Fe, Mn, pH, SO <sub>4</sub> , P, N, Hg, etc.) Electric Prospecting; sounding depth of 300m and at 40 points Test Wells; (monitoring wells) 1 deep well, depth of 50m to 100m (depending on the result of prospecting), diameter of 250 mm pumping test & periodical water quality monitoring (Fe, Mn, Ca, Mg, Cl, pH, etc.)

Groundwater development for water supply in urban areas (Level-II and -III systems) may require the construction of deep wells with larger casing diameter of 6 inches or more to ensure larger production rates. In these cases, short spacing intervals between the adjacent wells often cause the well interference due to the large lowering of pumping water level when the adjacent wells are operated simultaneously in a longer period. As the remedy of the problem pump-operation with excess electric consumption and deterioration of deep well life may be obliged. Thus, appropriate spacing interval and number of wells to be constructed per km<sup>2</sup> shall be considered. Table 7.7.1, Supporting Report presents reference information on spacing arrangements for planned wells.

Spring sources, proposed by barangay level, for future developments are shown in Table 7.6.4, Supporting Report. They shall also be investigated to confirm the development possibility in the following items: (1) location and type of spring sources, (2) fluctuation of discharge rates throughout the year, (3) distance from spring sources and proposed served areas, and (4) relative elevation between the two points (spring source and proposed served area).

The groundwater development using deep well is very risky in the eastern islets and western mountain ranges. Furthermore, spring inventories prepared by the PSPT for this study and the information from the DPWH indicated that there are few untapped spring sources scattered in this area. Thus, improved rainwater collector (roof materials, reservoir with sand filtration and chlorination system) shall be promoted for the future rural water supply.