## (2) RESULT OF GROUP INTERVIEW – DAVAO DEL NORTE

### A. General

Group interviews were conducted in two selected barangays representing two municipalities in the province of Davao del Norte. The objectives of the group survey/interviews were to identify potential service population and service level desired by the community, to assess the degree of involvement of both men and women in planning, managing, operating and maintaining WATSAN projects, and the willingness and capacity to pay of potential users.

The Project Team conducted the interviews on two sets of interviewees: an all female group and an all male group, each consisting of a minimum of 10 and a maximum of 20 participants. None of the respondents belonged to the same household. Answers to interview questionnaires were made by raising of hands. The group interviews were conducted in the following barangays: Sagayen (Asuncion) and Monte Dujali (Kapalong).

### B Demographic Profile

#### 1. Population

The aggregate population in the two barangays totaled 5,594, breakdown of which is as follows: Sagayen, 4,198 (1,932 males, 2,266 females) and Monte Dujali, 1,396, (650 males, 746 females).

#### 2. Households

As indicated by the respondents, there are 1,014 households in the two barangays. Breakdown per barangay is: Sagayen, 741 and Monte Dujali, 273. The figure represents an average of five members per household.

**TABLE 1: TOTAL POPULATION OF BARANGAYS AND NUMBER OF HOUSEHOLDS**

| BARANGAY (MUNICIPALITY) | M | F | T | NO. OF HH |
|---|---|---|---|---|
| 1. Sagayen (Asuncion) | 1,932 | 2,266 | 4,198 | 741 |
| 2. Monte Dujali (Kapalong) | 650 | 746 | 1,396 | 273 |
| **TOTAL** | **2,582** | **3,012** | **5,594** | **1,014** |
| | **(46%)** | **(54%)** | **(100%)** | |

#### 3. Composition of Barangay Councils

There are 15 barangay council members in the two barangays. Of the barangay council members, twelve are males and three females. All barangay captains are males.

## A. Respondents' Profile

### 1. Number and Gender of Respondents

There were 41 respondents in the group interviews. Of these, 20 or 49 percent were males and 21, or 51 percent were females. Below is the breakdown of the number of respondents by gender for each barangay:

TABLE 2: NUMBER OF RESPONDENTS

| BARANGAY (MUNICIPALITY) | M | F | T |
|---|---|---|---|
| 1. Sagayen (Asuncion) | 10 | 10 | 20 |
| 2. Monte Dujali (Kapalong) | 10 | 11 | 21 |
| TOTAL | 20 (49%) | 21 (51%) | 41 (100%) |

### 2. Age Bracket

The majority of the respondents or 25, belonged to 15 to 45 age bracket, with females outnumbering males, 15 to 10. A total of 15 (9 males, 6 females) were under the 46 to 60 age bracket, while 1 male respondent, belonged to 60 and above age bracket.

TABLE 3: AGES OF THE RESPONDENTS

| AGE BRACKET | M | F | T | % |
|---|---|---|---|---|
| 15 and Below | - | - | - | - |
| 15-45 | 10 | 15 | 25 | 61 |
| 46-60 | 9 | 6 | 15 | 37 |
| 60 and above | 1 | - | 1 | 2 |
| TOTAL | 20 | 21 | 41 | 100 |

### 3. Level of Education

Twenty respondents (12 females and 8 males) were elementary education graduates. Another 11 respondents (6 males, 5 females) graduated from high school, and four (1 male, 3 females) were college degree holders. One female respondent pursued vocational course, while five male interviewees took up post-graduate courses.

TABLE 4: RESPONDENT'S LEVEL OF EDUCATION

| EDUCATION LEVEL | M | F | T | % |
|---|---|---|---|---|
| 1. Elementary Level | - | - | - | - |
| 2. Elementary Graduate | 8 | 12 | 20 | 49 |
| 3. High School Level | - | - | - | - |
| 4. High School Graduate | 6 | 5 | 11 | 27 |
| 5. College Level | - | - | - | - |
| 6. College Graduate | 1 | 3 | 4 | 10 |
| 7. Vocational | - | 1 | 1 | 2 |
| 8. Post Graduate | 5 | - | 5 | 12 |
| 9. Not Indicated | - | - | - | - |
| TOTAL | 20 | 21 | 41 | 100 |

### 4. Occupation

The majority of the respondents (28) were engaged in either farming or fishing during the time of the survey. The males outnumbered the females in this work category, 19 to 9. One female respondent had a professional job and one male interviewee was a technician. Twelve female respondents or 30 percent were doing other jobs not included in the list.

TABLE 5: OCCUPATION OF RESPONDENTS

| OCCUPATION | M | F | T | % |
|---|---|---|---|---|
| 1. Farmer/Fisherfolk | 19 | 9 | 28 | 68 |
| 2. Laborer | - | - | - | - |
| 3. Service Worker | - | - | - | - |
| 4. Businessman/woman | - | - | - | - |
| 5. Professional | - | 1 | 1 | 2 |
| 6. Office Worker | - | - | - | - |
| 7. Tech. EquipmentOperator | 1 | - | - | - |
| 8. Others | - | 11 | 12 | 30 |
| TOTAL | 20 | 21 | 41 | 100 |

## D. Socio Economic Profile

### 1. Number of Household Members

As indicated by the respondents, the total number of their household members was 226. Males outnumber females, 123 to 103. The figures represent an average of almost six members per household.

TABLE 6: NUMBER OF HOUSEHOLD MEMBERS

| NO. OF HH MEMBERS | MALE HOUSEHOLD MEMBERS | | FEMALE HOUSEHOLD MEMBERS | | TOTAL HOUSEHOLD MEMBERS |
|---|---|---|---|---|---|
| | NO. OF RESPON-DENTS | TOTAL MALE HH MEMBERS | NO. OF RESPON-DENTS | TOTAL FEMALE HH MEMBERS | |
| 1 | 4 | 4 | 4 | 4 | 8 |
| 2 | 11 | 22 | 14 | 28 | 50 |
| 3 | 12 | 36 | 39 | 39 | 75 |
| 4 | 7 | 28 | 13 | 32 | 60 |
| 5 | 3 | 15 | 8 | 0 | 15 |
| 6 | 3 | 18 | - | - | 18 |
| 7 | - | - | - | - | - |
| 8 | - | - | - | - | - |
| 9 | - | - | - | - | - |
| TOTAL | | 123 | | 103 | 226 |

## 2. Age Levels of Household Members

As pointed out by the most of the male, together with 25 female, the majority of the household members belonged to the 15-and-below age bracket. Meanwhile, the majority of female members (28) were on the 15-45 age group, together with 24 male members. The 15-45 age level was the second largest age group, as indicated by 63% of the respondents; the 46-60 age bracket had a low 11%; while the 60 and above level had the least number in it with 2.5% of the interviewees responding.

TABLE 7: AGE LEVELS OF HH MEMBERS

| AGES | MALE RESPONDENTS | | FEMALE RESPONDENTS | | TOTAL | |
|---|---|---|---|---|---|---|
| | M | F | M | F | M | F |
| 15 and Below | 16 | 12 | 16 | 12 | 32 | 25 |
| 15-45 | 14 | 12 | 10 | 16 | 24 | 28 |
| 46-60 | 2 | - | 6 | 1 | 8 | 1 |
| 60 and above | 1 | - | - | - | 1 | - |

## 3. Level of Education of Household Members

Most of the household members (18 males and 18 females) finished elementary education. A big number also had reached the high school level (16 males and 17 females). Fifteen (9 males and 6 females) household members pursued college education. Few had attended vocational course.

TABLE 8: LEVEL OF EDUCATION OF HH MEMBERS

| EDUCATIONAL LEVEL | MALE RESPONDENTS | | | FEMALE RESPONDENTS | | |
|---|---|---|---|---|---|---|
| | M | F | T | M | F | T |
| 1. Elementary Level | - | - | - | - | - | - |
| 2. Elementary Graduate | 13 | 5 | 18 | 12 | 6 | 18 |
| 3. High School Level | 11 | 5 | 16 | 9 | 8 | 17 |
| 4. High School Graduate | - | - | - | - | - | - |
| 5. College Level | 4 | 5 | - | 2 | 4 | 6 |
| 6. College Graduate | - | - | - | - | - | - |
| 7. Vocational | 1 | - | 1 | 1 | 4 | 5 |
| 8. Post Graduate | - | - | - | - | - | - |
| 9. Not Indicated | - | - | - | - | - | - |

**4. Employed Household Members**

There were only 28 among the respondents' household members who were gainfully employed or had a regular source of income. Employed men outnumbered working women, 21 to 7. The majority of these productive people belonged to the 15 to 45 age bracket with 14 males and 6 females, for a total of 20. There were 2 members, or 2 males belonging to the 15 and below age who were likewise employed. On the other hand, six family members under the 60 years old and above were employed.

TABLE 9: EMPLOYED HH MEMBERS

| RESPONSE | M | F | T |
|---|---|---|---|
| 15 and Below | 2 | - | 2 |
| 15-45 | 14 | 6 | 20 |
| 46-60 | 5 | 1 | 6 |
| 60 and above | - | - | - |
| **TOTAL** | **21** | **7** | **28** |

**5. Occupation of Household Heads and Other Members**

The majority of the household heads and members were engaged in either farming or fishing where they derived income. Male and female respondents have equal number of workers in this field at 26 each. There were also laborers (2 males), service workers (4) while other respondents are engaged in other occupations such as technician, equipment operator, vendors, carpenters and businessmen/women.

TABLE 10: OCCUPATION OF HH MEMBERS

| OCCUPATION | M | F | T |
|---|---|---|---|
| 1. Farmer/Fisherfolk | 26 | 26 | 52 |
| 2. Laborer | 2 | - | 2 |
| 3. Service Worker | 1 | 3 | 4 |
| 4. Businessman/woman | 1 | 1 | 2 |
| 5. Professional | 1 | - | 1 |
| 6. Office Worker | 4 | 1 | 5 |
| 7. Dressmaker | 2 | - | 2 |
| 8. Others | 1 | - | 1 |
| TOTAL | 38 | 31 | 69 |

6. **Average Monthly Income**

The majority of the respondents (25) indicated that the average monthly income of a family was P5,000 or below. Fifteen respondents said their family members earned a monthly income amounting from P5,000 to P14,999. Only one respondents reported an income of P15,000 to P 24,000 a month.

TABLE 11: AVERAGE MONTHLY INCOME OF HH MEMBERS

| ITEM | M | F | T | % |
|---|---|---|---|---|
| Below P5,000 | 18 | 7 | 25 | 61 |
| P 5,000 to 14,999 | 2 | 13 | 15 | 37 |
| P 15,000 to 24,999 | - | 1 | 1 | 2 |
| Above P 25,000 | - | - | - | - |
| TOTAL | 20 | 21 | 41 | 100 |

7. **Average Expenditures of Household**

As indicated by the majority of male respondents (18), the average monthly expenditure of a family was below P5,000.00. For the majority of the female interviewees (11), the average monthly expenditures ranged from P 5,000.00 to P 14,999.00.

TABLE 12: AVERAGE MONTHLY EXPENSES OF HH MEMBERS

| EXPENDITURE | M | F | T | % |
|---|---|---|---|---|
| Below P 5,000 | 18 | 10 | 28 | 68 |
| P 5,000 to 14,999 | 2 | 11 | 13 | 32 |
| P 15,000 to 24,999 | - | - | - | - |
| Above P 25,000 | - | - | - | - |
| TOTAL | 20 | 21 | 41 | 100 |

## 8. Practices

*Source of Drinking Water.* The majority of the respondents (21) indicated that the people get their source of drinking water from communal faucet (Level II system). Other sources mentioned were: communal shallow well (13 respondents), communal dug well (4), private shallow well (2) and communal deep well (1).

TABLE 13: SOURCES OF DRINKING WATER

| SOURCES | USER/ RESPONDENT | | T | % |
|---|---|---|---|---|
| | M | F | | |
| 1. Communal Shallow Well | 6 | 7 | 13 | 32 |
| 2. Communal Deep Well | - | 1 | 1 | 2 |
| 3. Communal Dug Well | 2 | 2 | 4 | 10 |
| 4. Communal Faucet | 10 | 11 | 21 | 51 |
| 5. Private Shallow Well | 2 | - | 2 | 5 |
| 6. Private Deep Well | - | - | - | - |
| 7. Piped Water Supply | - | - | - | - |
| 8. Others | - | - | - | - |
| TOTAL | 20 | 21 | 41 | 100 |

*Responsible for Fetching Water.* The majority of the respondents, 14 males and 7 females for a total of 21, said that the husband is the one responsible for fetching water for family use. The women also shared the burden as ten respondents, two males and eight females, indicated that the wives are doing the task. Six respondents (2 males, 4 females) reported the task belonged to the male children, while four (2 males, 2 females) interviewees said the female children were doing the job.

TABLE 14: RESPONSIBLE FOR FETCHING DRINKING WATER

| FAMILY MEMBER | USER/RESPONDENT | | T | % |
|---|---|---|---|---|
| | M | F | | |
| 1. Husband | 14 | 7 | 21 | 51 |
| 2. Wife | 2 | 8 | 10 | 24 |
| 3. Male Children | 2 | 4 | 6 | 15 |
| 4. Female Children | 2 | 2 | 4 | 10 |
| 5. Others | - | - | - | - |
| 6. Uncertain | - | - | - | - |
| TOTAL | 20 | 21 | 41 | 100 |

*Frequency of Fetching Water.* The majority of the respondents 6 males and 7 females indicated that families fetch water for domestic use three times a day. Eleven respondents (4 males, 7 females) said that, it takes twice a day; six interviewees (1 male, 5 females)

said once and another six (5 males, 1 female) said four times a day. Three (2 males, 1 female) indicated more than 4 time a day while two respondents did not respond on this topic.

**TABLE 15: FREQUENCY OF FETCHING DRINKING WATER**

| DURATION | RESPONDENTS | | T | % |
|---|---|---|---|---|
| | M | F | | |
| 1. Once a Day | 1 | 5 | 6 | 14.6 |
| 2. Twice a Day | 4 | 7 | 11 | 26.8 |
| 3. 3x a Day | 6 | 7 | 13 | 31.7 |
| 4. 4x a Day | 5 | 1 | 6 | 14.7 |
| 5. More than 4 times a day | 2 | 1 | 3 | 7.3 |
| 6. No Response | 2 | - | 2 | 4.9 |
| **TOTAL** | **20** | **21** | **41** | **100** |

*Duration of Fetching Water.* For most of the respondents (8 males and 8 females or a total of 16), it takes about 20 minutes to fetch water from the source to their house. Fifteen respondents (7 males, 8 females) indicated 10 minutes; six respondents said it takes about 30 minutes while four said more than 35 minutes.

**TABLE 16: DURATION FOR FETCHING DRINKING WATER**

| DURATION | RESPONDENTS | | T | % |
|---|---|---|---|---|
| | M | F | | |
| 1. About 10 Minutes | 7 | 8 | 15 | 36.6 |
| 2. About 20 Minutes | 8 | 8 | 16 | 39.0 |
| 3. About 30 Minutes | 2 | 4 | 6 | 14.7 |
| 4. More Than 30 Minutes | - | - | - | - |
| 5. No Response | 3 | 1 | 4 | 9.7 |
| **TOTAL** | **20** | **21** | **41** | **100** |

*Problems with Source.* All of the respondents admitted that they have problems with the current water source.

**TABLE 17: PROBLEM WITH SOURCE OF WATER**

| RESPONSE | RESPONDENTS | | T | % |
|---|---|---|---|---|
| | M | F | | |
| 1. No Problem | 0 | 0 | 0 | 0 |
| 2. There are problems | 20 | 21 | 41 | 100 |
| **TOTAL** | **20** | **21** | **41** | **100** |

## E. Institutional

### 1. Presence of BWSA

Nobody among the respondents was aware of the existence of BWSA in his or her community.

TABLE 18: KNOWLEDGE OF THE EXISTENCE OF BWSA

| RESPONSE | RESPONDENTS | | T | % |
|---|---|---|---|---|
| | M | F | | |
| 1. Yes | 0 | 0 | 0 | 0 |
| 2. No | 20 | 21 | 41 | 100 |
| TOTAL | 20 | 21 | 41 | 100 |

As such, nobody among the respondents indicated that he or she is BWSA officer or a member. The respondents also said that they are not actively involved in the affairs of the BWSA.

TABLE 19: MEMBERSHIP TO THE BWSA

| RESPONSE | RESPONDENTS | | T | % |
|---|---|---|---|---|
| | M | F | | |
| 1. Yes | 0 | 0 | 0 | 0 |
| 2. No | 20 | 21 | 41 | 100 |
| TOTAL | 20 | 21 | 41 | 100 |

TABLE 20: HOW ACTIVELY ARE YOU INVOLVE IN THE AFFAIRS OF THE BWSA

| RESPONSE | RESPONDENTS | | T | % |
|---|---|---|---|---|
| | M | F | | |
| 1. As BWSA Officer | - | - | - | - |
| 2. As Collection Officer | - | - | - | - |
| 3. Assist in the repair maintenance of facilities | - | - | - | - |
| 4. Attend/ Facilitate Training | - | - | - | - |
| 5. Not active | 20 | 21 | 41 | 100 |
| TOTAL | 20 | 21 | 41 | 100 |

### 2. Who maintains the facilities of the BWSA?

All of the respondents could not determine the people responsible for maintaining the facilities.

TABLE 21: RESPONSIBLE FOR MAINTAING FACILITIES OF THE BWSA

| RESPONSE | RESPONDENTS | | T | % |
|---|---|---|---|---|
| | M | F | | |
| 1. Someone in the Barangay | - | - | - | - |
| 2. Professional caretaker | - | - | - | - |
| 3. Someone from the BWSA | - | - | - | - |
| 4. No one | - | - | - | - |
| 5. Don't know | 20 | 21 | 41 | 100 |
| TOTAL | 20 | 21 | 41 | 100 |

3. **Interested to be a member of BWSA**

Significantly, all respondents indicated interest in becoming a member of BWSA once it is formed and/or activated in their respective barangays.

TABLE 22: INTEREST OF RESPONDENTS TO JOIN BWSA

| RESPONSE | RESPONDENTS | | T | % |
|---|---|---|---|---|
| | M | F | | |
| 1. Interested | 20 | 21 | 41 | 100 |
| 2. Not Interested | | - | - | - |
| 3. No Response | | - | - | - |
| TOTAL | 20 | 21 | 41 | 100 |

4. **How can respondents become actively involve in BWSA affairs?**

All of the respondents expressed willingness to play an active role in the BWSA affairs once it is organized in the community. The majority of them, 20 males and 8 females for a total of 28, would be willing to contribute free labor; four females would like to be involved in the collection of fees; while another four (2 males, 2 females) would like to be officers. Nineteen interviewees (11 females, 8 males) signified intention to be just members.

TABLE 23: HOW RESPONDENTS CAN BECOME ACTIVELY INVOLVED IN WATSAN PROJECTS

| RESPONSE | RESPONDENTS | | T |
|---|---|---|---|
| | M | F | |
| 1. Contribute Cash | - | - | - |
| 2. Contribute labor | 20 | 8 | 28 |
| 3. Be Officer | 2 | 2 | 4 |
| 4. Collection of Fees | - | 4 | 4 |
| 5. Do Repair/Maintenance | - | - | - |
| 6. Just Member | 8 | 11 | 19 |

5. **If not interested, where to get source of water**

All respondents were uncertain as to the source of their drinking water once they failed to join the BWSA.

TABLE 24: SOURCES OF DRINKING WATER OF NON-BWSA MEMBERS

| SOURCE OF WATER | RESPONDENTS | | T | % |
|---|---|---|---|---|
| | M | F | | |
| 1. Private Well | - | - | - | - |
| 2. Communal Well | - | - | - | - |
| 3. Spring Water | - | - | - | - |
| 4. Buy from vendor | - | - | - | - |
| 5. Others | - | - | - | - |
| 6. Uncertain | 20 | 21 | 41 | 100 |
| TOTAL | 20 | 21 | 41 | 100 |

6. **Responsible for minor repairs of water facilities**

Someone in the barangay, according to the majority of the respondents (21), was responsible for doing minor repairs of the family's water supply facility. However for 10 respondents, the male member is doing the repair works. Another 10 interviewees were uncertain as to the responsible person.

TABLE 25: RESPONSIBLE FOR MINOR REPAIRS

| SOURCE OF WATER | RESPONDENTS | | T | % |
|---|---|---|---|---|
| | M | F | | |
| 1. Female Member | - | - | - | - |
| 2. Male Member | - | 10 | 10 | 24.4 |
| 3. Somebody in the Brgy. | 10 | 11 | 21 | 51.3 |
| 4. Professional Caretaker | - | - | - | - |
| 5. Owner of the Well | - | - | - | - |
| 6. Uncertain | 10 | - | 10 | 24.3 |
| TOTAL | 20 | 21 | 41 | 100 |

## F. Training Activities

### 1. Training Program attended in 1997

Majority of the respondents, 15 male and 11 female or total of 26 respondents, said they attended training programs in 1997. For 5 male and 10 female interviewees, they were not able to attend any training programs.

TABLE 26: TRAINING ATTENDED BY RESPONDENTS IN 1997

| RESPONSE | RESPONDENTS | | T | % |
|---|---|---|---|---|
| | M | F | | |
| 1. Yes | 15 | 11 | 26 | 63 |
| 2. No | 5 | 10 | 15 | 134 |
| TOTAL | 20 | 21 | 41 | 100 |

## 2. Kinds of Training Program

The respondents attended various training programs in 1997. Table 27 summarizes the training programs/seminars attended by the respondents during the year.

TABLE 27: TRAINING COURSES ATTENDED BY RESPONDENTS IN 1997

| BARANGAY | MALE | FEMALE |
|---|---|---|
| 1. Sagayen (Asuncion) | | |
| 2. Monte Dujali (Kapalong) | 1. Swine Production<br>2. BARC<br>3. Agrarian | 1. Cultural Minorities Dev't Program<br>2. Barangay Research |

## 3. On BWSA Training

Only about 31% of the respondents were aware of the training programs being offered by BWSA members. A high 69% did not know of any training programs being offered through BWSA. However, all respondents wanted to attend in any BWSA training program for the barangay.

TABLE 28: AWARENESS ON THE FOLLOWING TRAINING FOR BWSA

| TRAINING PROGRAM | YES | | NO | |
|---|---|---|---|---|
| | M | F | M | F |
| 1. Caretaker's Training | 2 | 11 | 18 | 10 |
| 2. Collection/Finance | - | 11 | 18 | 10 |
| 3. Repair/O&M | 2 | 11 | 16 | 10 |

TABLE 29: WILLINGNESS TO ATTEND BWSA-RELATED TRAINING PROGRAMS

| RESPONSE | RESPONDENTS | | T | % |
|---|---|---|---|---|
| | M | F | | |
| 1. Yes | 20 | 21 | 41 | 100 |
| 2. No | - | - | - | - |
| 3. Uncertain | - | - | - | - |
| TOTAL | 20 | 21 | 41 | 100 |

4. **Training on Health Education**

The majority of the respondents, or 16 males and 14 females have attended health education training program. The other interviewees, or four males and seven females have not heard of any health training program. If given a chance, however, the respondents wanted to attend WATSAN related training programs such as: Operation and Maintenance of Water System, Water Supply Management and on General Sanitation.

**TABLE 30: PARTICIPATION IN HEALTH EDUCATION AND TRAINING**

| RESPONSE | RESPONDENTS | | T | % |
|---|---|---|---|---|
| | M | F | | |
| 1. Yes | 16 | 14 | 30 | 73 |
| 2. No | 4 | 7 | 11 | 27 |
| 3. Uncertain | - | - | - | - |
| TOTAL | 20 | 21 | 41 | 100 |

**TABLE 31: TYPES OF TRAINING RESPONDENTS WISH TO ATTEND**

| BARANGAY | MALE | FEMALE |
|---|---|---|
| 1. Sagayen (Asuncion) | How to organize BWSA Water Management<br>O&M<br>Disaster Operation | O&M<br>WS Management<br>Sanitation |
| 2. Monte Dujali (Kapalong) | | |

In relation to this, majority of the respondents (11 males, 12 females) wanted to attend training programs that would be conducted for one day. The rest had varied responses; 7 interviewees opted for two days; another 7 liked more than three days. Three wanted three days while one respondent desired just one day.

**TABLE 32: DESIRABLE TRAINING PERIOD**

| RESPONSE | RESPONDENTS | | T | % |
|---|---|---|---|---|
| | M | F | | |
| 1. Less Than 1 Day | - | 1 | 1 | 2 |
| 2. One (1) Day | 11 | 12 | 23 | 57 |
| 3. Two (2) Days | - | 7 | 7 | 17 |
| 4. Three (3) Days | 3 | - | 3 | 7 |
| 5. More Than Three Days | 6 | 1 | 7 | 17 |
| 6. Uncertain | - | - | - | - |
| TOTAL | 20 | 21 | 41 | 100 |

## G Community Development

### 1. CBOs and Contact Persons

As pointed out by all the respondents, some community-based organizations have been doing different development works in the barangays. Table 34 lists down these NGOs/CBOs and their contact persons:

TABLE 33: ARE THERE NGOs WORKING IN THE BARANGAY

| RESPONSE | RESPONDENTS | | T | % |
|---|---|---|---|---|
| | M | F | | |
| 1. Yes | 20 | 21 | 41 | 100 |
| 2. No | - | - | - | - |
| 3. Uncertain | - | - | - | - |
| TOTAL | 20 | 21 | 41 | 100 |

TABLE 34: NGOS/CBOS IN THE BARANGAYS

| BARANGAY | CONTACT PERSON |
|---|---|
| MALE | |
| 1. GKK | Mr. Suaybaguio |
| 2. COOP | Myrna Bojo |
| 3. CARD | |
| FEMALE | |
| 1. Coop | Sister Suaybaguio |
| 2. CADEWDA | Mr. Dumaging |
| 3. Tribal Group | Mr. Decano |
| 4. GKK | Mr. Mariano Mateo |
| 5. Council of Women | Sister Suaybaguio |

### 2. Were the respondents consulted on their respective roles and responsibilities?

The majority of the respondents indicated they were consulted and/or briefed on their proposed roles and responsibilities on the planning, design construction, and financing of their water supply facilities. This is also true for the operation and maintenance and financing aspects of the system where the male respondents claimed they were consulted.

Likewise, the majority of the female respondents reported that they were consulted when the BWSA was formed in their respective barangays although both the male and female respondents were not involved when the water fee was decided upon, and the level or type of service was agreed upon. Only when the facilities were constructed that the majority of the male respondents were consulted. However, the female interviewees were not involved during the construction.

TABLE 35: RESPONDENTS CONSULTED/INVOLVED IN PAST WATSAN PROJECTS

| BWSA ACTIVITIES | YES | | NO | |
|---|---|---|---|---|
| | M | F | M | F |
| 1. Planning & Design | 16 | 11 | 4 | 10 |
| 2. Construction Facilities | 17 | 11 | 3 | 10 |
| 3. O&M of the System | 20 | 11 | - | 10 |
| 4. Financing of the System | 19 | 11 | 1 | 10 |

TABLE 36: WERE YOU CONSULTED WHEN:

| ACTIVITIES | YES | | NO | |
|---|---|---|---|---|
| | M | F | M | F |
| 1. BWSA was formed in the Brgy. | - | 11 | 20 | 10 |
| 2. Water fee was decided upon | - | - | 20 | 21 |
| 3. Level or type of service was agreed upon | - | - | 20 | 21 |
| 4. Facilities were constructed | 10 | - | 10 | 21 |

**3. How did the respondents participate in past construction projects?**

The majority of the respondents (21) participated in the construction of previous WATSAN facilities by providing labor, sites and materials. Eleven female interviewees were uncertain on this issue.

TABLE 37: PARTICIPATION IN PAST CONSTRUCTION PROJECTS

| TYPE OF PARTICIPATION | RESPONDENTS | | T |
|---|---|---|---|
| | M | F | |
| 1. Contributed Cash | 3 | 2 | 5 |
| 2. Provided labor | 16 | 4 | 20 |
| 3. Donated Site | 1 | 3 | 4 |
| 4. Provided Materials | - | 1 | 1 |
| 5. Uncertain | - | 11 | 11 |
| TOTAL | 20 | 21 | 41 |

**4. Will the respondents participate in future projects?**

For future projects, however, all the respondents indicated that they would participate and/or contribute for all activities. For the formation of BWSA, all female respondents will participate alongside with the male respondents. This is also true to other project activities, such as; water rates formulation, selection of sites, construction of facilities and in the operation and maintenance.

TABLE 38: WILLINGNESS/TYPE OF PARTICIPATION IN FUTURE PROJECTS

| PROJECT ACTIVITIES | YES | | NO | |
|---|---|---|---|---|
| | M | F | M | F |
| 1. Formation of BWSA | 20 | 21 | - | - |
| 2. Formulation of water rates | 20 | 21 | - | - |
| 3. Selection of sites and levels of services | 20 | 21 | - | - |
| 4. Construction of facilities | 20 | 21 | - | - |
| 5. Operation and maintenance | 20 | 21 | - | - |

## H. Financial Aspects

### 1. Are respondents presently paying for their water supply?

All the female respondents, together with 21 male interviewees claimed they were paying for their water supply. Only one male interviewee indicated he was not paying.

TABLE 39: NUMBER OF RESPONDENTS PRESENTLY PAYING WATER FEE

| RESPONSE | RESPONDENTS | | T | % |
|---|---|---|---|---|
| | M | F | | |
| 1. Yes | 19 | 21 | 40 | 98 |
| 2. No | 1 | - | 1 | 2 |
| TOTAL | 20 | 21 | 41 | 100 |

### 2. If so, how much per household?

Of those presently paying, 85 percent or 35 of the respondents indicated that they were paying only below P 5.00. Five interviewees claimed they pay above P 50.00 while another one indicated payment from P 6.00 to P 10.00.

TABLE 40: WATER FEES PAID

| WATER FEES | RESPONDENTS | | T | % |
|---|---|---|---|---|
| | M | F | | |
| Below P 5.00 | 19 | 16 | 35 | 85 |
| P 6.00 to P 10.00 | - | 1 | 1 | 2 |
| P 11.00 to P 20.00 | - | - | - | - |
| P 21.00 to P 30.00 | - | - | - | - |
| P 31.00 to P 40.00 | - | - | - | - |
| P 41.00 to P 50.00 | - | - | - | - |
| Above P 50.00 | 1 | 4 | 5 | 13 |
| TOTAL | 20 | 21 | 41 | 100 |

**3. Is the water fee enough for O&M?**

For respondents who were paying water fees, the majority (31) agreed that the fees being collected were enough to operate and maintain the facilities. Twenty-one respondents indicated the water fees inadequate. One male interviewee did not respond.

TABLE 41: ADEQUACY OF WATER FEE FOR O&M

| RESPONSE | RESPONDENTS | | T | % |
|---|---|---|---|---|
| | M | F | | |
| 1. Yes | 10 | 21 | 31 | 76 |
| 2. No | 21 | - | 21 | 22 |
| 3. No response | 1 | - | 1 | 2 |
| **TOTAL** | **20** | **21** | **41** | **100** |

**4. State the reasons**

About 58% or 24 of the interviewees did not respond to this issue. However, eight interviewees said that reason could be that the water fee is low and 9 believed not all users pay.

TABLE 42: IF NOT ADEQUATE, STATE THE REASON/S

| REASON/S | M | F | T | % |
|---|---|---|---|---|
| 1. Water fee is low | 8 | - | 8 | 20 |
| 2. O&M cost is too high | - | - | - | - |
| 3. Not all water users pay their Water fee | 9 | - | 9 | 22 |
| 4. Others | - | - | - | - |
| 5. No Response | 3 | 21 | 24 | 58 |
| **TOTAL** | **20** | **21** | **41** | **100** |

**5. Who shoulders the O&M of Facilities?**

About 49 % of the respondents could not determine which group/s in the community shoulder the operation and maintenance of the water supply facilities. For 10 males and 11 females, the barangay council is the one responsible.

TABLE 43: RESPONSIBILITY FOR SHOULDERING THE O&M COSTS

| PERSON | RESPONDENTS | | T | % |
|---|---|---|---|---|
| | M | F | | |
| 1. Barangay Council | 10 | 11 | 21 | 51 |
| 2. WATSAN Association | - | - | - | - |
| 3. Private Owner | - | - | - | - |
| 4. Don't know/Uncertain | 10 | 10 | 20 | 49 |
| **TOTAL** | **20** | **21** | **41** | **100** |

6. **Are the people willing to pay for O&M of future facilities?**

Almost all the respondents expressed willingness to pay/contribute for the operation and maintenance of future facilities. Only 1 male interviewee would not pay.

TABLE 44: RESPONDENTS' WILLINGNESS TO PAY FOR FUTURE FACILITIES

| RESPONSE | RESPONDENTS | | T | % |
|---|---|---|---|---|
| | M | F | | |
| 1. Yes | 19 | 21 | 40 | 98 |
| 2. No | 1 | - | 1 | 2 |
| 3. No response | - | - | - | - |
| TOTAL | 20 | 21 | 41 | 100 |

7. **How much are respondents willing to pay?**

Of those who are willing to pay, the majority (28) claimed they could only pay not more than P5.00. Eleven respondents agreed to pay water fees ranging from P 6.00 to P10.00, while one male interviewees believed he can pay from P 11.00 to P 20.00.

TABLE 45: AMOUNT RESPONDENTS ARE WILLING TO PAY

| RESPONSE | RESPONDENTS | | T | % |
|---|---|---|---|---|
| | M | F | | |
| Below P 5.00 | 11 | 17 | 28 | 69 |
| P 6.00 to P 10.00 | 7 | 4 | 11 | 27 |
| P 11.00 to P 20.00 | 1 | - | 1 | 2 |
| P 21.00 to P 30.00 | - | - | - | - |
| P 31.00 to P 40.00 | - | - | - | - |
| P 41.00 to P 50.00 | - | - | - | - |
| Above P 50.00 | - | - | - | - |
| No response | 1 | - | 1 | 2 |
| TOTAL | 20 | 21 | 41 | 100 |

8. **Are you willing to contribute for future projects?**

Except one, all of the respondents indicated willingness to contribute in cash or kind for the construction of WATSAN facilities in their respective barangays. The majority (33) would be willing to assist in the construction (free labor), 14 would provide materials, and 12 would donate sites.

TABLE 46: WILLINGNESS TO RESPONDENTS TO CONTRIBUTE FOR FUTURE FACILITIES

| RESPONSE | RESPONDENTS | | T | % |
|---|---|---|---|---|
| | M | F | | |
| 1. Yes | 19 | 21 | 40 | 98 |
| 2. No | 1 | - | 1 | 2 |
| TOTAL | 20 | 21 | 41 | 10 |

TABLE 47: TYPE OF CONTRIBUTION

| RESPONSE | RESPONDENTS | | T |
|---|---|---|---|
| | M | F | |
| 1. Provide free labor | 12 | 21 | 33 |
| 2. Donate site | 2 | 10 | 12 |
| 3. Private materials | 4 | 10 | 14 |
| 4. Other (Specify) | 1 | - | 1 |

## I. Health and Sanitation

### 1. Type of toilet

The majority of the respondents (20) indicated that private pit latrine was widely used in the community. The next popular type of toilet in the area was the one which flushes to septic tank on the site. People also use toilets which flushes/drops to the sea and the Antipolo type.

TABLE 48: TYPES OF TOILETS RESPONDENTS USE

| RESPONSE | RESPONDENTS | | T | % |
|---|---|---|---|---|
| | M | F | | |
| 1. Toilet w/ flushes to septic tank on the site | 9 | 10 | 19 | 47 |
| 2. Toilet w/ flushes/ drops straight to sea | 1 | - | 1 | 2 |
| 3. Private pit latrine | 10 | 10 | 20 | 49 |
| 4. Shared flush toilet w/ septic tank | - | - | - | - |
| 5. Public toilet | - | - | - | - |
| 6. Bush or other open outdoor site/Antipolo | - | 1 | 1 | 2 |
| TOTAL | 20 | 21 | 41 | |

### 2. Who got sick during the past year? What sickness?

The women were most afflicted with these water-related diseases during the year. Most susceptible were the female children and the wife as indicated by nine respondents.

The respondents indicated that in 1997, the leading types of illnesses were skin disease, cholera and gastroenteritis.

TABLE 49: HOUSEHOLD MEMBERS FREQUENTLY GOT SICK IN 1997

| RESPONSE | RESPONDENTS | | T | % |
|---|---|---|---|---|
| | M | F | | |
| 1. Husband | - | 1 | 1 | 2 |
| 2. Wife | 3 | 1 | 4 | 10 |
| 3. Father | - | - | - | - |
| 4. Mother | - | - | - | - |
| 5. Male Children | 2 | - | 2 | 5 |
| 6. Female Children | 4 | 1 | 5 | 12 |
| 7. Grandmother | - | - | - | - |
| 8. Grandfather | - | - | - | - |
| 9. Others | 10 | 11 | 21 | 51 |
| 10. No Response | 1 | 7 | 8 | 20 |
| TOTAL | 20 | 21 | 41 | 100 |

TABLE 50: WATER-RELATED ILLNESSES

| DISEASE | RESPONDENTS | | |
|---|---|---|---|
| | M | F | T |
| 1. Diarrhea | 20 | 12 | 32 |
| 2. Kidney trouble | - | 1 | 1 |
| 3. Gastro-enteritis | - | 3 | 3 |
| 4. Cholera | 10 | - | 10 |
| 5. Typhoid fever | - | - | - |
| 6. Malaria | 20 | 12 | 32 |
| 7. Skin Disease | 10 | 11 | 21 |
| 8. Schistosomiasis | - | 1 | 1 |
| 9. Others | 10 | - | 10 |

### 3. Health and hygiene practices

All respondents recognized the importance of good health and hygiene practices. They learned about health and sanitation matters mostly from health workers, radio and television. NGOs as well as the school, were also good sources of information, as indicated by the respondents. (Refer to Table 52).

TABLE 51: DO YOU RECEIVE/GET INFORMATION ABOUT HEALTH AND SANITATION

| RESPONSE | RESPONDENTS | | T | % |
|---|---|---|---|---|
| | M | F | | |
| 1. Yes | 20 | 21 | 41 | 100 |
| 2. No | - | - | - | - |
| TOTAL | 20 | 21 | 41 | 100 |

TABLE 52: WHERE PEOPLE LEARNED HEALTH AND HYGIENE EDUCATION

| RESPONSE | RESPONDENTS | | T | % |
|---|---|---|---|---|
| | M | F | | |
| 1. Radio | 10 | 10 | 20 | 41 |
| 2. Newspapers | - | 5 | 5 | 12 |
| 3. Television | - | 10 | 10 | 41 |
| 4. NGOs | 10 | 10 | 21 | 24 |
| 5. Family and Friends | - | 2 | 2 | 5 |
| 6. Health Sanitations/Clinics/Hospitals | 10 | 10 | 20 | 41 |
| 7. Health workers/inspection | 20 | 21 | 41 | 100 |
| 8. School | - | 10 | 10 | 24 |
| 9. Others/HMO | 10 | - | 10 | 24 |

### 5.8.5 Utilization of NGOs

**List of NGOs/CBOs for Davao del Norte**

| NAME OF NGOS/PSO'S/PO'S | CONTACT PERSONS | ADDRESS / TEL. # |
|---|---|---|
| 1. Provincial Cooperative Union | Mrs. Juliet Fuentes | DCB building, Tagum City<br>Tel.: |
| 2. Community Action for Rural Development – Davao Foundation (CARD-DAVAO) | Mrs. Myrna Bajo | Poblacion, Maniki Kapalong, Davao del Norte<br>Tel.: |
| 3. Cooperative Foundation of the Philippines Inc. (CFPI) | Mr. Apologio P. Tabigue | Mirafuentes Avenue Suaybaguio District, Tagum City<br>Tel.: 400 1017 |
| | Mr. Myron Gawigawin<br>Executive Director | Philippine Cooperative Center, No. 90, Balite Drive, Quezon City<br>Tel.: 725-2129 |

### 5.8.6 Existing Community Development Process

**Detailed Typical CD Process in Agusan del Sur**

1) **Make courtesy calls.** Courtesy calls are made to barangay/sitio officials prior to the conduct of meetings with the community. Then, a series of meetings and community assemblies are done where the WATSAN program is introduced, its significance and impact taken up and the importance of organizing promoted. This is followed by a more detailed presentation/orientation of the project – its concept, features, history, stakeholders, and the CO process utilized. Depending on the level of community awareness regarding the program/project, two or three meetings/assemblies are needed before doing the baseline survey.

2) **Preparation of profile (secondary information) and survey forms.**

*(a)* ***General information.*** Distance from barangay to poblacion, mode of travel, time and fare; no. of sitio/purok; dominant ethnic groups, common occupation of residents; demographic data (no. of household, male and female population) by sitio/purok, no. of dwelling structures, school buildings, other buildings, availability of electricity by sitio/purok.

*(b)* ***Barangay WATSAN status.*** Existing water supply systems, by sitio/purok, by type and service level, no. of facilities (functioning), potability, no. of HH served, who installed, who operates, user charges, if any; HHs toilet facilities, by sitio/purok, no. of HHs with private toilets by type, no. of HH using shared toilets by type, no. of HH without toilets; no. of community waste disposal systems by sitio/purok, by method and wastewater system; no. of reported morbidity and mortality cases of water-borne/contact/vector-borne diseases of barangay residents.

c) ***WATSAN related programs and projects in the barangay.*** Existing WATSAN programs/project by type of activity, implementing organization/agency, sponsoring funding agency, specify years when operated in barangay, name of community association organized, if any; past WATSAN programs/projects by type of activity, implementing organization/agency, sponsoring funding agency, specify years when operated, name of community association organized, if any; Community organizations in the barangay, watsan related groups/organization and other community organizations, its name of group/organization, sitios where members are, sponsoring agencies, year organized and status; other barangay facilities.

*(d)* ***Resources for barangay water supply and toilet facilities fabrication.*** Brief description of water sources-undeveloped springs, streams and other water sources which can be tapped and developed, sources which can be improved including estimated distance to center of HHs to be served, availability of water, estimated flows during dry and wet seasons; water and well depths by sitio/purok, by season; availability of construction materials for water supply and toilet if available for free at barangay or at hardware/other stores, its sources, name and address of store, materials available, distance from barangay and means of transport for materials; sources of pumps and spare parts for pumps – name and address of dealer/store, types of pumps/parts available and distance from barangay; barangay residents with skills in water supply system construction and maintenance, type of skill, no. of persons and remarks; well drillers and water supply contractors who can be tapped for barangay works, their name address, services rendered and charging rates; local fabricators of toilet bowls, their name, location, type/description of toilet bowl.

3. **Identify community volunteers.** As an initial step in community organizing, a core group of about 7 persons consisting of community leaders is formed. This is the formation of an informal community organization that will assist the CD worker in the preparation of CO strategies, community profiling, identification of project sites, and other work.

4. **Conduct baseline survey.** In the conduct of this survey, focus group discussion was applied and the results validated during barangay spot mapping. The barangay spot map reflects the location of structures (scaled) and different facilities/infrastructure. This serves as a planning tool in the development of WATSAN program for the area.

5. **Inspect/identify project sites and validate projects.** An assembly is called again to present the results of the survey, its profile, assessment and needs. The CD team situates the community, i.e., *where they are now in the sector*. A member of the CD team will then facilitate the surfacing of thoughts from the group in terms of identifying the needs for WATSAN facilities, how project will be implemented in their area, how the facility will be designed and constructed, and how the community perceives their role in the project. In some cases, the community request technical assistance from the Center on site selection of identified areas.

6. **Conduct technical and community consultative meetings** of members and officers together with barangay officials. By this time, the core group has already specific

projects to be implemented. Together with these interim officers, meetings with barangay officials are undertaken to determine local counterpart funding support to the program/project.

7. **Facilitate project implementation.** After funding has been assured, the CD team facilitates the implementation of the project through supervision and monitoring progress of construction. Contribution from the community comes in the form of free labor (*pahina*).

8. **Consolidate BWSA Organization.** The core group formulates the by-laws and policies of the organization and have these ratified by the members. The election of BWSA officers follows. A barangay resolution is passed endorsing the association and submitted to the Municipal Development Council/Sangguniang Bayan for registration/accreditation. Parallel to this activity is the completion of the facility and in most cases, the turn-over of the facility to the newly-organized BWSA, which can coincide with the swearing-in of BWSA officials.

9. **Conduct training on skills and management to BWSA officials** by the Center. The module includes topics on: human resource development (self and group awareness, communication skills, group facilitation and conducting meeting, effective community work, leadership skills and roles of officers and members, and conflict management); technical (hydrogeology and site selection, well construction and identification of handpump parts, equipment plumbing tools and materials for construction and repairs, hand pump principles of operation, maintenance and approach in trouble shooting, spring development, types of spring, their characteristics and method of developing, operation and maintenance of tank, spring box and distribution line, excreta, liquid and solid disposal system, water related diseases-prevention/control and water quality surveillance); financial management; project planning management; and action planning.

10. **Undertake follow-up activities.** The CD team after the construction of the WATSAN facilities undertakes follow-up activities such as monitoring and evaluation and the provision of recommendations/adjustments on the O&M of the facilities, where needed.

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Source: DILG/WATSAN UNDP-PHI as modified by Province of Agusan del Sur

# 6. Past Financial Performance in Water Supply and Sanitation

## 6.2 Past Public Investment

### 6.2.1 Sources of Local Fund

**Table 6.2.1 Income and Expenditure of Davao del Norte, 1994-1998**

| Municipality | 1994 | 1995 | 1996 | 1997 | 1998 |
|---|---|---|---|---|---|
| 1. Asuncion | | | | | |
| RECEIPTS | | | | | |
| Real Property Taxes | 1,026,218.17 | 698,145.99 | 624,147.70 | 737,347.26 | 2,376,281.00 |
| Local Taxes | 707,485.65 | 675,401.57 | 878,916.54 | 1,016,349.27 | 1,125,089.00 |
| Revenues | 1,127,685.00 | 1,147,547.12 | 1,191,223.09 | 1,799,828.05 | 5,635,605.00 |
| IRA | 16,601,797.00 | 18,497,475.00 | 19,998,997.00 | 24,875,821.00 | 24,875,821.00 |
| Other Income | - | - | - | | |
| Total Revenues | 19,463,185.82 | 21,018,569.68 | 22,693,284.33 | 28,429,345.58 | 34,012,796.00 |
| Expenditures | | | | | |
| Current Operating Expenditures: | 19,033,703.17 | 25,223,750.10 | 23,008,531.29 | 29,548,652.60 | 39,612,796.00 |
| General Services 1/ | 14,073,125.93 | 15,293,301.79 | 14,697,441.00 | 17,542,464.81 | - |
| Social Services | 1,089,559.42 | 4,342,691.89 | 4,304,977.22 | 5,935,865.22 | - |
| Economic Services | 3,870,857.82 | 4,665,406.07 | 3,980,113.07 | 792,992.88 | - |
| Other Purposes | 160.00 | 922,350.35 | 26,000.00 | - | - |
| NET INCOME | 429,482.65 | (4,205,180.42) | (315,246.96) | (1,119,307.02) | (5,600,000.00) |
| Add: Other Receipts | - | - | | | |
| Adjustments | - | 24,162.67 | 108,753.00 | 1,363,513.46 | - |
| Borrowings | - | 1,875,000.00 | - | - | 5,600,000.00 |
| Grants/ Aids | - | 46,900.00 | - | - | - |
| Sub-total Other Receipts | - | 1,946,062.67 | 108,753.00 | 1,363,513.46 | 5,600,000.00 |
| Net Income | 429,482.65 | (2,259,117.75) | (206,493.96) | 244,206.44 | - |
| 2. Babak | | | | | |
| RECEIPTS | | | | | |
| Real Property Taxes | 576,237.87 | 204,659.62 | 324,818.03 | 356,622.10 | 645,000.00 |
| Local Taxes | 721,235.12 | 1,134,942.78 | 1,249,100.10 | 1,355,643.09 | 1,489,000.00 |
| Revenues | 965,386.62 | 1,298,867.75 | 1,652,326.12 | 1,819,067.68 | 2,029,300.00 |
| IRA | 8,170,234.00 | 9,099,617.00 | 9,856,825.00 | 13,359,680.00 | 13,309,640.00 |
| Other Income | - | - | - | - | - |
| Total Revenues | 10,433,093.61 | 11,738,087.15 | 13,083,069.25 | 16,891,012.87 | 17,472,940.00 |
| Expenditures | | | | | |
| Current Operating Expenditures: | 9,055,128.39 | 11,830,612.44 | 13,154,157.47 | 15,054,394.37 | 14,219,207.98 |
| General Services 1/ | 5,353,207.59 | 6,920,620.43 | 7,595,097.40 | 8,751,739.33 | 9,123,523.94 |
| Social Services | 1,497,755.08 | 2,398,993.41 | 2,856,586.74 | 3,564,135.95 | 2,785,915.28 |
| Economic Services | 2,204,165.72 | 2,466,783.40 | 2,621,673.33 | 2,738,519.50 | 2,309,768.76 |
| Other Purposes | - | 44,215.20 | 80,800.00 | - | - |
| NET INCOME | 1,377,965.22 | (92,525.29) | (71,088.22) | 1,836,618.50 | 3,253,732.02 |
| Add: Other Receipts | - | - | - | - | - |
| Adjustments | - | - | - | 37,976.03 | - |
| Borrowings | - | - | - | - | - |
| Grants/ Aids | - | - | - | - | - |
| Sub-total Other Receipts | - | - | - | 37,976.03 | - |
| Net Income | 1,377,965.22 | (92,525.29) | (71,088.22) | 1,874,594.53 | 3,253,732.02 |
| 3 Braulio E. Dujali | | | | | |
| RECEIPTS | | | | | |
| Real Property Taxes | | | | | 1,080,400.00 |
| Local Taxes | | | | | 215,000.00 |
| Revenues | | | | | 125,000.00 |
| IRA | | | | | 5,999,895.00 |
| Other Income | | | | | - |
| Total Revenues | | | | | 7,422,293.00 |
| Expenditures | | | | | |
| Current Operating Expenditures: | | | | | 7,420,295.00 |
| General Services 1/ | | | | | 5,456,369.89 |
| Social Services | | | | | 128,607.12 |
| Economic Services | | | | | 264,324.24 |
| Other Purposes | | | | | 1,570,993.75 |
| NET INCOME | | | | | 1,998.00 |
| Add: Other Receipts | | | | | |
| Adjustments | | | | | |
| Borrowings | | | | | |
| Grants/ Aids | | | | | |
| Sub-total Other Receipts | | | | | |
| Net Income | | | | | 1,998.00 |

## Table 6.2.1 Income and Expenditure of Davao del Norte, 1994-1998

| Municipality | 1994 | 1995 | 1996 | 1997 | 1998 |
|---|---|---|---|---|---|
| 4. Carmen | | | | | |
| RECEIPTS | | | | | |
| Real Property Taxes | 1,185,100.73 | 809,967.72 | 881,280.39 | 755,617.25 | 1,900,000.00 |
| Local Taxes | 972,773.08 | 1,195,402.54 | 1,233,543.57 | 1,285,440.07 | 1,726,200.00 |
| Revenues | 1,859,447.20 | 1,987,770.49 | 2,143,135.37 | 2,129,781.33 | 3,334,900.00 |
| IRA | 14,745,491.00 | 17,922,113.00 | 17,788,104.00 | 22,658,957.00 | 21,079,350.41 |
| Other Income | - | - | - | - | - |
| Total Revenues | 18,762,812.01 | 21,915,253.75 | 22,046,063.33 | 26,829,795.65 | 28,040,450.41 |
| Expenditures | | | | | |
| Current Operating Expenditures: | 17,901,769.73 | 24,313,121.61 | 21,617,363.72 | 33,565,827.74 | 28,040,450.41 |
| General Services 1/ | 10,877,965.49 | 14,521,238.35 | 13,268,728.28 | 16,809,507.59 | 16,256,779.00 |
| Social Services | 2,776,652.81 | 3,436,844.13 | 3,644,984.55 | 4,685,721.94 | 6,073,518.00 |
| Economic Services | 4,242,382.43 | 4,562,947.69 | 2,499,794.23 | 9,086,133.36 | 4,115,412.00 |
| Other Purposes | 4,769.00 | 1,792,091.44 | 2,203,856.66 | 2,984,464.85 | 1,594,741.41 |
| NET INCOME | 861,042.28 | (2,397,867.86) | 428,699.61 | (6,736,032.09) | - |
| Add: Other Receipts | - | - | - | - | - |
| Adjustments | 209,588.40 | - | - | 822,394.88 | - |
| Borrowings | - | - | - | 5,200,000.00 | - |
| Grants/ Aids | - | - | - | - | - |
| Sub-total Other Receipts | 209,588.40 | - | - | 6,022,394.88 | - |
| Net Income | 1,070,630.68 | (2,397,867.86) | 428,699.61 | (713,637.21) | - |
| 5. Kapalong | | | | | |
| RECEIPTS | | | | | |
| Real Property Taxes | 894,061.16 | 625,722.61 | 610,370.18 | 388,890.19 | 1,000,000.00 |
| Local Taxes | 1,899,789.34 | 2,291,265.77 | 2,020,437.69 | 2,116,023.73 | 3,045,000.00 |
| Revenues | 2,445,614.70 | 9,080,899.61 | 4,704,030.00 | 3,931,507.94 | 5,983,029.00 |
| IRA | 33,644,731.00 | 36,855,927.00 | 39,282,628.00 | 47,777,068.08 | 45,228,527.00 |
| Other Income | | - | - | 1,069.50 | n.a. |
| Total Revenues | 38,884,196.20 | 48,853,814.99 | 46,617,465.87 | 54,214,559.44 | 55,256,556.00 |
| Expenditures | | | | | |
| Current Operating Expenditures: | 36,100,611.97 | 42,463,678.03 | 54,821,552.88 | 54,272,856.33 | 54,538,362.00 |
| General Services 1/ | 18,585,973.87 | 24,365,524.82 | 23,621,901.02 | 29,118,169.56 | 15,248,145.00 |
| Social Services | 6,626,967.63 | 6,312,587.55 | 12,602,122.13 | 11,395,433.77 | 8,741,778.00 |
| Economic Services | 10,887,670.47 | 10,817,961.26 | 10,852,311.70 | 11,840,125.22 | 12,403,752.00 |
| Other Purposes | - | 967,604.40 | 7,745,218.03 | 1,919,127.78 | 7,033,576.00 |
| NET INCOME | 2,783,584.23 | 6,390,136.96 | (8,204,087.01) | (58,296.89) | 718,194.00 |
| Add: Other Receipts | - | - | - | - | - |
| Adjustments | 3,462.53 | - | - | - | - |
| Borrowings | - | - | 3,800,000.00 | 1,619,603.10 | - |
| Grants/ Aids | - | - | - | - | - |
| Sub-total Other Receipts | 3,462.53 | - | 3,800,000.00 | 1,619,603.10 | - |
| Net Income | 2,787,046.76 | 6,390,136.96 | (4,404,087.01) | 1,561,306.21 | 718,194.00 |
| 6. Kapatian | | | | | |
| RECEIPTS | | | | | |
| Real Property Taxes | 653,023.21 | 373,990.94 | 350,343.22 | 250,807.92 | 500000 |
| Local Taxes | 271,266.37 | 435,310.70 | 624,307.34 | 1,581,220.29 | 1021000 |
| Revenues | 336,122.04 | 1,588,802.91 | 988,220.18 | 1,003,647.88 | 950,700.00 |
| IRA | 8,426,975.00 | 9,378,104.00 | 10,148,384.00 | 13,008,427.00 | 14,906,204.55 |
| Other Income | - | - | | | |
| Total Revenues | 9,687,386.62 | 11,776,208.55 | 12,111,254.74 | 15,844,103.09 | 17,377,904.55 |
| Expenditures | | | | | |
| Current Operating Expenditures: | 8,546,248.65 | 12,354,268.78 | 13,051,458.04 | 15,164,202.53 | 17,377,509.74 |
| General Services 1/ | 5,637,690.71 | 7,154,143.26 | 7,090,212.30 | 9,205,114.45 | 10,450,355.99 |
| Social Services | 1,624,419.51 | 2,679,726.14 | 3,212,122.46 | 3,113,509.91 | 4,517,554.95 |
| Economic Services | 1,284,138.43 | 2,505,399.38 | 1,837,784.78 | 2,271,405.51 | 2,273,117.80 |
| Other Purposes | - | 15,000.00 | 911,338.50 | 574,172.66 | 136,481.00 |
| NET INCOME | 1,141,137.97 | (578,060.23) | (940,203.30) | 679,900.56 | 394.81 |
| Add: Other Receipts | - | - | - | - | - |
| Adjustments | - | - | - | 67,531.86 | - |
| Borrowings | - | - | - | - | - |
| Grants/ Aids | - | - | - | - | - |
| Sub-total Other Receipts | - | - | - | 67,531.86 | - |
| Net Income | 1,141,137.97 | (578,060.23) | (940,203.30) | 747,432.42 | 394.81 |

## Table 6.2.1 Income and Expenditure of Davao del Norte, 1994-1998

| Municipality | 1994 | 1995 | 1996 | 1997 | 1998 |
|---|---|---|---|---|---|
| 7. New Corella | | | | | |
| RECEIPTS | | | | | |
| Real Property Taxes | 880,422.57 | 391,423.05 | 254,129.46 | 450,971.99 | 530,000.00 |
| Local Taxes | 895,303.94 | 970,442.09 | 1,023,822.17 | 1,121,218.94 | 1,112,200.00 |
| Revenues | 786,966.41 | 1,062,403.81 | 1,673,767.46 | 1,197,810.03 | 1,643,500.00 |
| IRA | 11,690,046.00 | 13,000,717.00 | 14,050,273.00 | 18,220,535.00 | 18,150,084.00 |
| Other Income | - | - | - | - | - |
| Total Revenues | 14,252,738.92 | 15,424,985.95 | 17,001,992.09 | 20,990,535.96 | 21,435,784.00 |
| Expenditures | | | | | |
| Current Operating Expenditures: | 14,267,045.78 | 17,489,268.27 | 8,559,018.20 | 19,952,185.71 | 21,335,998.08 |
| General Services 1/ | 10,265,737.00 | 11,287,154.64 | 2,568,205.73 | 13,218,143.74 | 11,548,267.84 |
| Social Services | 2,459,657.72 | 2,284,080.34 | 2,568,205.73 | 3,861,091.55 | 2,856,216.80 |
| Economic Services | 1,541,651.06 | 3,195,037.80 | 2,936,685.20 | 2,872,950.42 | 4,610,410.36 |
| Other Purposes | - | 722,995.49 | 485,921.54 | - | 2,321,103.08 |
| NET INCOME | (14,306.86) | (2,064,282.32) | 8,442,973.89 | 1,038,350.25 | 99,785.92 |
| Add: Other Receipts | - | - | - | - | - |
| Adjustments | - | - | - | 133,134.50 | - |
| Borrowings | - | - | - | - | - |
| Transfer | 1,396,390.56 | - | - | - | - |
| Sub-total Other Receipts | 1,396,390.56 | - | - | 133,134.50 | - |
| Net Income | 1,382,083.70 | (2,064,282.32) | 8,442,973.89 | 1,171,484.75 | 99,785.92 |
| 8. Panabo | | | | | |
| RECEIPTS | | | | | |
| Real Property Taxes | 2,932,256.46 | 1,608,843.41 | 2,188,848.14 | 2,584,882.08 | 3,050,000.00 |
| Local Taxes | 4,996,740.55 | 4,576,067.34 | 5,901,214.46 | 7,709,005.92 | 9,480,000.00 |
| Revenues | 8,229,442.24 | 9,695,092.78 | 10,613,791.76 | 12,077,535.14 | 18,907,000.00 |
| IRA | 24,215,630.00 | 27,044,842.55 | 29,359,156.00 | 38,786,369.00 | 34,144,243.59 |
| Other Income | - | - | - | - | - |
| Total Revenues | 40,374,069.25 | 42,924,846.08 | 48,063,010.36 | 61,157,792.14 | 65,581,243.59 |
| Expenditures | | | | | |
| Current Operating Expenditures: | 41,945,838.68 | 43,755,744.22 | 56,088,024.34 | 60,335,647.49 | 63,133,732.00 |
| General Services 1/ | 21,180,558.89 | 21,625,360.70 | 28,158,524.30 | 31,311,499.16 | 25,536,438.00 |
| Social Services | 4,732,070.48 | 4,273,273.89 | 5,836,364.01 | 7,565,779.02 | 5,608,462.00 |
| Economic Services | 16,033,209.31 | 17,857,109.63 | 21,010,749.94 | 16,237,476.06 | 13,825,332.00 |
| Other Purposes | - | - | 1,082,386.09 | 5,220,893.25 | 18,163,500.00 |
| NET INCOME | (1,571,769.43) | (830,898.14) | (8,025,013.98) | 822,144.65 | 2,447,511.59 |
| Add: Other Receipts | - | - | - | - | - |
| Adjustments | 415,606.37 | - | 6,500,000.00 | 1,224,353.05 | - |
| Borrowings | - | - | - | 4,747,375.00 | - |
| Grants/ Aids | - | - | - | - | - |
| Sub-total Other Receipts | 415,606.37 | - | 6,500,000.00 | 5,971,728.05 | - |
| Net Income | (1,156,163.06) | (830,898.14) | (1,525,013.98) | 6,793,872.70 | 2,447,511.59 |
| 9. Samal | | | | | |
| RECEIPTS | | | | | |
| Real Property Taxes | 559,744.11 | 304,631.46 | 337,996.17 | 343,121.18 | 343,121.18 |
| Local Taxes | 408,560.42 | 527,085.51 | 529,920.28 | 604,527.39 | 604,527.39 |
| Revenues | 563,574.19 | 801,597.51 | 962,242.71 | 855,239.60 | 855,239.60 |
| IRA | 7,414,544.00 | 8,125,380.00 | 8,921,961.25 | 11,308,363.00 | 11,308,363.00 |
| Other Income | - | - | - | - | - |
| Total Revenues | 8,946,422.72 | 9,758,694.48 | 10,752,120.41 | 13,111,251.17 | 13,111,251.17 |
| Expenditures | | | | | |
| Current Operating Expenditures: | 8,102,627.14 | 10,002,942.73 | 10,858,145.31 | 13,490,806.06 | 13,111,251.17 |
| General Services 1/ | 5,661,213.68 | 6,778,054.41 | 7,097,134.04 | 8,265,363.64 | 7,885,808.75 |
| Social Services | 1,477,873.48 | 1,928,876.02 | 1,965,133.52 | 2,480,622.12 | 2,480,622.12 |
| Economic Services | 963,539.98 | 1,241,253.76 | 1,760,469.42 | 2,729,820.30 | 2,729,820.30 |
| Other Purposes | - | 54,758.54 | 35,408.33 | 15,000.00 | 15,000.00 |
| NET INCOME | 843,795.58 | (244,248.25) | (106,024.90) | (379,554.89) | - |
| Add: Other Receipts | - | - | - | - | - |
| Adjustments | - | - | - | 1,529.00 | - |
| Borrowings | - | - | - | - | - |
| Grants/ Aids | - | - | - | - | - |
| Sub-total Other Receipts | - | - | - | 1,529.00 | - |
| Net Income | 843,795.58 | (244,248.25) | (106,024.90) | (378,025.89) | - |

## Table 6.2.1 Income and Expenditure of Davao del Norte, 1994-1998

| Municipality | 1994 | 1995 | 1996 | 1997 | 1998 |
|---|---|---|---|---|---|
| 10. Sto. Tomas | | | | | |
| RECEIPTS | | | | | |
| Real Property Taxes | 1,225,742.26 | 981,379.46 | 1,045,289.34 | 1,487,867.76 | 932,000.00 |
| Local Taxes | 3,630,259.34 | 3,974,600.99 | 4,598,140.71 | 4,979,892.84 | 4,643,000.00 |
| Revenues | 3,003,960.97 | 4,864,958.58 | 6,280,640.81 | 7,445,583.28 | 6,000,100.00 |
| IRA | 17,018,694.00 | 19,075,445.00 | 20,719,545.00 | 26,479,721.00 | 31,618,420.50 |
| Other Income | - | - | - | - | - |
| Total Revenues | 24,878,656.57 | 28,896,384.03 | 32,643,615.86 | 40,393,064.88 | 43,193,520.50 |
| Expenditures | | | | | |
| Current Operating Expenditures: | 25,525,670.47 | 29,205,349.21 | 28,226,726.44 | 47,788,821.15 | 43,253,520.50 |
| General Services 1/ | 12,056,133.57 | 12,634,531.96 | 14,624,918.99 | 19,548,086.08 | 17,812,714.52 |
| Social Services | 3,380,859.55 | 5,117,142.16 | 4,748,159.50 | 10,442,191.77 | 7,538,168.26 |
| Economic Services | 8,952,884.42 | 8,790,435.31 | 7,998,231.00 | 15,995,248.82 | 13,562,241.04 |
| Other Purposes | 1,135,792.93 | 2,663,239.78 | 855,416.95 | 1,803,294.48 | 4,340,396.68 |
| NET INCOME | (647,013.90) | (308,965.18) | 4,416,889.42 | (7,395,756.27) | (60,000.00) |
| Add: Other Receipts | - | - | - | - | - |
| Adjustments | 223,796.04 | - | - | 78,312.46 | 60,000.00 |
| Borrowings | 1,500,000.00 | - | - | 5,294,200.00 | - |
| National Wealth | 124,847.77 | - | - | - | - |
| Extra. Ord. Income | 117,669.21 | - | - | - | - |
| Sub-total Other Receipts | 1,966,313.02 | - | - | 5,372,512.46 | 60,000.00 |
| Net Income | 1,319,299.12 | (308,965.18) | 4,416,889.42 | (2,023,243.81) | - |
| 11. Tagum | | | | | |
| RECEIPTS | | | | | |
| Real Property Taxes | 4,262,758.75 | 4,010,352.24 | 3,656,064.63 | 4,240,404.06 | 4,800,000.00 |
| Local Taxes | 11,566,990.73 | 14,483,440.50 | 18,205,171.88 | 21,418,404.04 | 25,917,250.00 |
| Revenues | 8,396,099.99 | 19,943,565.00 | 11,703,132.76 | 13,424,505.98 | 10,372,750.00 |
| IRA | 27,970,028.00 | 31,689,338.00 | 34,409,812.00 | 44,687,115.00 | 55,000,000.00 |
| Other Income | - | - | - | - | 18,910,000.00 |
| Total Revenues | 52,195,877.47 | 70,126,695.74 | 67,974,181.27 | 83,770,429.08 | 115,000,000.00 |
| Expenditures | | | | | |
| Current Operating Expenditures: | 49,366,707.13 | 81,446,184.79 | 65,077,172.21 | 90,240,309.66 | 114,999,923.00 |
| General Services 1/ | 29,521,095.85 | 38,442,198.92 | 33,507,034.17 | 51,492,460.54 | 58,038,071.00 |
| Social Services | 10,081,611.34 | 11,081,781.29 | 15,386,405.68 | 15,833,002.48 | 11,047,039.00 |
| Economic Services | 8,159,983.40 | 16,530,112.37 | 9,575,292.50 | 14,023,000.16 | 28,893,888.00 |
| Other Purposes | 1,604,016.54 | 15,392,092.21 | 6,608,439.86 | 8,891,846.48 | 17,020,925.00 |
| NET INCOME | 2,829,170.34 | (11,319,489.05) | 2,897,009.06 | (6,469,880.58) | 77.00 |
| Add: Other Receipts | - | - | - | - | - |
| Adjustments | 348,716.30 | - | - | 2,200,000.00 | - |
| Borrowings | 10,500,000.00 | - | - | 4,563,850.00 | - |
| Grants/ Aids | - | - | - | - | - |
| Sub-total Other Receipts | 10,848,716.30 | - | - | 6,763,850.00 | - |
| Net Income | 13,677,886.64 | (11,319,489.05) | 2,897,009.06 | 293,969.42 | 77.00 |
| 12. Talaingod | | | | | |
| RECEIPTS | | | | | |
| Real Property Taxes | 42,779.32 | 32,066.33 | 17,101.77 | 19,916.28 | 47,500.00 |
| Local Taxes | 109,415.69 | 195,482.81 | 116,538.76 | 90,485.68 | 155,000.00 |
| Revenues | 84,134.48 | 69,702.92 | 218,463.88 | 145,909.01 | 118,500.00 |
| IRA | 9,435,335.00 | 10,342,841.49 | 11,045,163.60 | 14,277,735.00 | 14,222,180.00 |
| Other Income | - | - | - | - | - |
| Total Revenues | 9,671,664.49 | 10,640,093.55 | 11,397,268.01 | 14,534,045.97 | 14,543,180.00 |
| Expenditures | | | | | |
| Current Operating Expenditures: | 10,325,798.67 | 10,490,679.61 | 12,400,505.50 | 13,290,231.98 | 14,542,252.18 |
| General Services 1/ | 9,672,460.80 | 7,076,967.92 | 9,127,302.39 | 9,235,639.42 | 8,879,448.30 |
| Social Services | 161,248.70 | 1,055,960.91 | 1,156,324.77 | 1,508,539.26 | 764,944.36 |
| Economic Services | 492,089.17 | 1,878,513.53 | 1,306,262.31 | 2,544,808.59 | 3,744,221.06 |
| Other Purposes | - | 479,237.25 | 810,616.03 | 1,244.71 | 1,153,638.46 |
| NET INCOME | (654,134.18) | 149,413.94 | (1,003,237.49) | 1,243,813.99 | 927.82 |
| Add: Other Receipts | - | - | - | - | - |
| Adjustments | - | - | - | 7,035.70 | - |
| Borrowings | - | - | - | - | - |
| Grants/ Aids | - | - | - | - | - |
| Sub-total Other Receipts | - | - | - | 7,035.70 | - |
| Net Income | (654,134.18) | 149,413.94 | (1,003,237.49) | 1,250,849.69 | 927.82 |

1/ **Includes Personnel services and MOOE.**

N.A. - no available data

Table 6.2.2 Past Internal Revenue Allotment for the Province of Davao del Norte

| | Item | 1994 | 1995 | 1996 | 1997 | 1998 |
|---|---|---|---|---|---|---|
| 1. | **IRA to All Municipalities (National )** | 16,325,888,074.00 | 18,768,925,000.00 | 19,607,715,553.00 | 24,849,000,000.00 | 28,245,815,434.00 |
| 2. | **IRA by Municipality** | 179,333,505.00 | 201,031,800.04 | 215,580,848.85 | 275,439,791.08 | 289,842,729.05 |
| | **Island Garden City** | 24,011,753.00 | 26,603,101.00 | 28,927,170.25 | 37,676,470.00 | 39,524,207.55 |
| | Babak | 8,170,234.00 | 9,099,617.00 | 9,856,825.00 | 13,359,680.00 | 13,309,640.00 |
| | Kaputian | 8,426,975.00 | 9,378,104.00 | 10,148,384.00 | 13,008,427.00 | 14,906,204.55 |
| | Samal | 7,414,544.00 | 8,125,380.00 | 8,921,961.25 | 11,308,363.00 | 11,308,363.00 |
| | **Braulio Dujali** | | | | | 5,999,895.00 |
| | Carmen | 14,745,491.00 | 17,922,113.00 | 17,788,104.00 | 22,658,957.00 | 21,079,350.41 |
| | Panabo | 24,215,630.00 | 27,044,842.55 | 29,359,156.00 | 38,786,369.00 | 34,144,243.59 |
| | Asuncion | 16,601,797.00 | 18,497,475.00 | 19,998,997.00 | 24,875,821.00 | 24,875,821.00 |
| | Kapalong | 33,644,731.00 | 36,855,927.00 | 39,282,628.00 | 47,777,068.08 | 45,228,527.00 |
| | New Corella | 11,690,046.00 | 13,000,717.00 | 14,050,273.00 | 18,220,535.00 | 18,150,084.00 |
| | Santo Tomas | 17,018,694.00 | 19,075,445.00 | 20,719,545.00 | 26,479,721.00 | 31,618,420.50 |
| | Tagum | 27,970,028.00 | 31,689,338.00 | 34,409,812.00 | 44,687,115.00 | 55,000,000.00 |
| | Talaingod | 9,435,335.00 | 10,342,841.49 | 11,045,163.60 | 14,277,735.00 | 14,222,180.00 |
| 3. | **% Share by Municipality** | 1.10 | 1.07 | 1.10 | 1.11 | 1.03 |
| | **Island Garden City** | 13.39 | 13.23 | 13.42 | 13.68 | 13.64 |
| | Babak | 4.56 | 4.53 | 4.57 | 4.85 | 4.59 |
| | Kaputian | 4.70 | 4.66 | 4.71 | 4.72 | 5.14 |
| | Samal | 4.13 | 4.04 | 4.14 | 4.11 | 3.90 |
| | **Braulio Dujali** | 0.00 | 0.00 | 0.00 | 0.00 | 2.07 |
| | Carmen | 8.22 | 8.92 | 8.25 | 8.23 | 7.27 |
| | Panabo | 13.50 | 13.45 | 13.62 | 14.08 | 11.78 |
| | Asuncion | 9.26 | 9.20 | 9.28 | 9.03 | 8.58 |
| | Kapalong | 18.76 | 18.33 | 18.22 | 17.35 | 15.60 |
| | New Corella | 6.52 | 6.47 | 6.52 | 6.62 | 6.26 |
| | Santo Tomas | 9.49 | 9.49 | 9.61 | 9.61 | 10.91 |
| | Tagum | 15.60 | 15.76 | 15.96 | 16.22 | 18.98 |
| | Talaingod | 5.26 | 5.14 | 5.12 | 5.18 | 4.91 |

# 7. WATER SOURCE DEVELOPMENT

## 7.3 Groundwater Sources

### 7.3.2 Groundwater Availability in the Province

(1) Major Information and References

The Groundwater Availability Map was prepared using the following information and reference (detailed list of reference is presented in Table 7.3.1, Data Report):

- Administrative and Topographical Maps of the Province published by NAMRIA with scales of 1:250,000 and 1:50,000, respectively.
- Geological Map of the Philippines published by BMGS with a scale of 1:1,000,000.
- Water Resource Investigation conducted by NWRB, 1986.
- Well Inventory Database prepared by NWRB, LWUA and DPWH.
- Well Inventory Database in the province.
- General information on groundwater condition by DPWH-DEO and PPDO.
- Well Log Data by DPWH-DEO and PEO.
- Water source information by Water Districts.

(2) Approach and Methodology

The procedure in preparing the Groundwater Availability Map is explained below with workflow depicted in Figure 7.3.1.

1) Prepare a base map with an approximate scale of 1:600,000 (fit to the A4 map size). The topographical map of NAMRIA (1:250,000) was used as a reference map. Basic information including rivers and provincial and municipal boundaries are indicated in the prepared base map.

2) The groundwater potential areas, based on the geology of the province, are delineated on the base map. The Recent alluvial and/or beach deposits, Pliocene-Quaternary sedimentary formation (clay, silt, sand and gravel) and Pliocene-Quaternary volcanic rock units (pyroclastics, debris flow and tuff) are regarded as possible aquifers considering their high porosity and permeability.

Boundaries between groundwater development potential area and difficult area were defined and delineated as presented in Figure 7.3.1, Main Report.

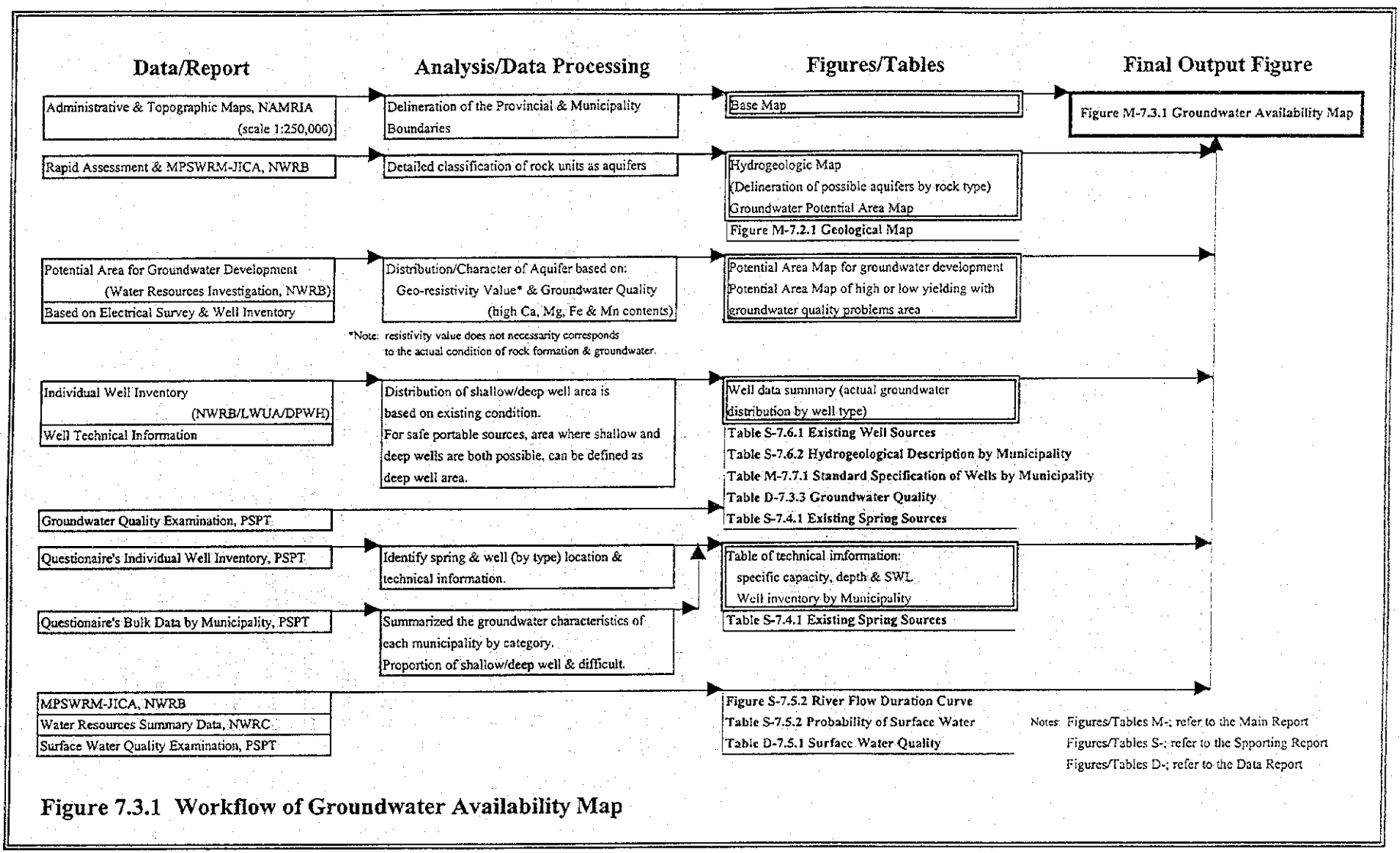


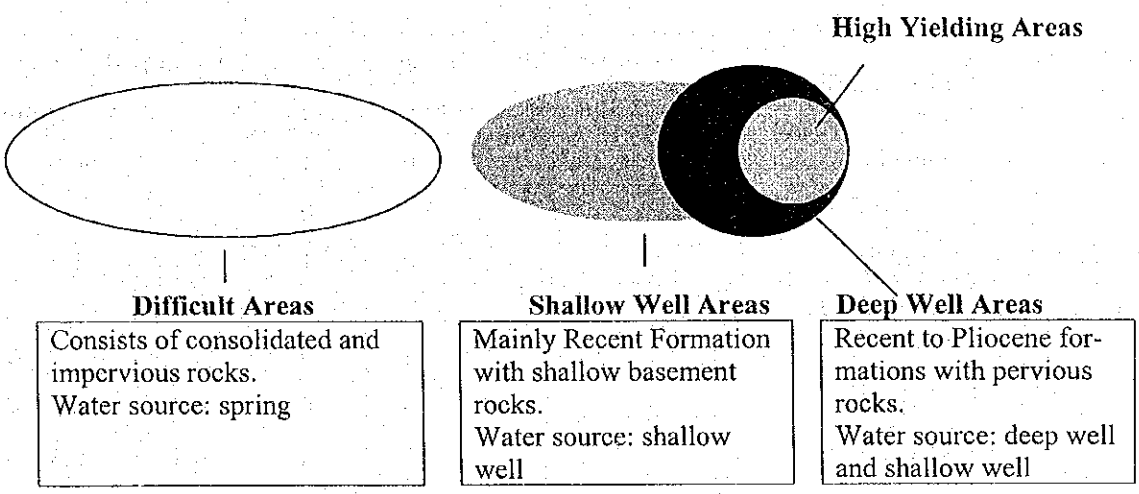

**Figure 7.3.1 Workflow of Groundwater Availability Map**

3) Areas with potential high yielding aquifer in the Water Resources Investigation of NWRB are reflected in the defined groundwater potential areas.

Based on the results of electric resistivity survey of the above investigation, resistivity values from 20 to 210 ohm-meter indicate a potential high yielding formation. Values less than 10 ohm-meter suggest clayey layer. Figure 7.3.1, Main Report, shows the boundaries of areas with high and low yielding aquifers.

4) Delineate shallow and deep well areas based on well database of NWRB and DPWH-central office, well inventory of DPWH-DEO (refer to Table 7.3.1, Data Report) and rock distribution. Figure 7.3.2 presents the categorization in terms of groundwater utilization.

**Figure 7.3.2 Area Category by Groundwater Utilization**




Solo shallow well areas are defined on the following basis:

(a) Predominance of serviceable shallow wells and presence of deep wells with water quality problem and/or low yielding aquifers.

(b) Occurrence of impervious rocks beneath the Recent formation at shallow depth.

5) Based on the information provided by NWRB's well inventory and the data obtained through the questionnaires, well specification for each municipality is established as shown in the map. These specifications are used as references in evaluating the groundwater availability in each locality. Individual well locations with technical information are presented in Figure 7.6.1, Data Report.

(3) Future updating and utilization of the map

For future updating of the map, the following procedure shall be employed.

1) Referring to the results of any supplementary water sources investigation by various agencies, re-define the potential area for groundwater development by applying the aforementioned procedures.
2) Update the provincial database using the questionnaire made for the study to make necessary revision of the delineated boundaries of groundwater categories.

## 7.4 Spring Sources

The numbers and discharge of developed and untapped springs by municipality are shown in Table 7.4.1. The data are derived from and the information obtained through the questionnaires and Table 7.1.1 Water Sources Information, Data Report.

**Table 7.4.1 Existing Spring Sources**

| Municipality/City | No. of Developed Spring | | Untapped Spring | | |
|---|---|---|---|---|---|
| | Q<2.8lps | Q>2.8lps | No. | Ave. lps | Range lps |
| Asuncion | 27 | 0 | 1 | 66.0 | 66.0 ~ 66.0 |
| Braulio E. Dujali | 0 | 0 | 0 | - | - ~ - |
| Carmen | 0 | 0 | 1 | 7.7 | 7.7 ~ 7.7 |
| Island Garden City of Samal | 34 | 5 | 0 | - | - ~ - |
| Kapalong | 15 | 0 | 5 | 0.9 | 0.2 ~ 3.3 |
| New Corella | 32 | 1 | 8 | 0.4 | 0.3 ~ 0.5 |
| Panabo | 20 | 0 | 0 | - | - ~ - |
| Santo Tomas | 3 | 0 | 0 | - | - ~ - |
| Tagum | 7 | 0 | 0 | - | - ~ - |
| Talaingod | 13 | 0 | 11 | 4.2 | 0.1 ~ 15.0 |

Notes; "Ave. lps" & "Range lps" mean the average discharge and the range of discharges in lps (liter/second).

## 7.5 Surface Water Sources

The major rivers in the province were selected to evaluate their potential as water supply sources to meet the future water needs of the province. The following criteria were adopted for the selection:

- rivers currently utilized for domestic water supply
- rivers which have gauging stations, and

- rivers with watershed of 100 $km^2$ or more.

Based on the above criteria, the selected major rivers were the Hijo, Tagum and Lasang Rivers as shown in Table 7.5.1. The Hijo River originates from Compostela Valley. The Lasang River originates from this province, flows through Davao del Sur and back to this province.

The gauging stations in the province are located at the Hijo and Tagum Rivers, which are shown in Figure 7.5.1. The runoff records are obtained from the "Philippine Water Resources Summary Data" prepared by the NWRC in 1980. The information on the gauging stations and the present uses (water rights) of the major rivers in the province is summarized in Table 7.5.1.

(1) Surface Water Utilization/Water Rights

As seen in Table 7.5.1, the present water utilization in the watersheds of the Hijo, Tagum and Lasang rivers totals 37.6 $m^3$/sec. Of this total, all the water rights are registered in the province. The actual surface water use for domestic water supply in the Hijo River basin is only 0.05%.

(2) River Flow Analysis

The flow duration curves, derived from the available runoff records, are shown in Figure 7.5.2. The stream flow, maintenance flow, diversion flow and return flow are usually used to estimate the exploitable surface water potential. In this study, the stream flow was considered as flow potential for domestic use and the diversion flow value was treated as the equivalent to the discharge of water rights registration in surface water use. No detailed study on the return flow has been performed yet due to the difficulties in investigating the irrigation, evapotranspiration and recharge value to groundwater, etc. within the entire watersheds in the province. Therefore, the return flow was not considered for the estimation of exploitable potential.

It is generally accepted that to secure the required volume for water supply, each water use sector adopts the different return periods. Usually, the dependability of domestic water supply is taken to be 90% or higher (10-year or longer return-period) of the whole hydrological period.

## Table 7.5.1 Gauging Station & River Water Use by Major River Basins

| River Basin | | Information from Gauging Station | | | | | | Surface Water Use (Water Rights) in Watershed | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Major River | Systme & Main Stream | Drainage*1 sq.km | Location No. in Figure 7.5.1 | River Flow Rate (Q: cum/sec) Peak $Q_p$ | Max. $Q_{dx}$ | Mini. $Q_{dn}$ | Data Period | Municipality in watershed | Domestic cum/sec | Industrial cum/sec | Irrigation cum/sec | Others*3 cum/sec |
| Hijo | | 617.00 | (1): upstream | 150.95 | 102.48 | 8.29 | 1951-'70 | (Compostera Valley)*5 | NR*4 | NR*4 | NR*4 | NR*4 |
| | | | | | | | | Tagum | 0.02 | 0.00 | 0.23 | 0.00 |
| Tagum | Limbaan | 2,326.00 | (2): upstream | 654.68 | 601.87 | 24.13 | 1949-'69 | New Corella | 0.00 | 0.00 | 1.75 | 0.00 |
| | | | | | | | | Tagum | 0.00 | 0.00 | 0.00 | 0.00 |
| | Saug | Gauging Station is not existed in watershed. | | | | | | (Compostera Valley)*5 | NR*4 | NR*4 | NR*4 | NR*4 |
| | | | | | | | | Asuncion | 0.00 | 0.00 | 0.33 | 0.00 |
| | | | | | | | | Tagum | 0.00 | 0.00 | 0.00 | 0.00 |
| | Salao | Gauging Station is not existed in watershed. | | | | | | Talaingod | 0.00 | 0.00 | 0.00 | 0.00 |
| | | | | | | | | Kapalong | 0.70 | 0.00 | 20.55 | 0.00 |
| | | | | | | | | Sto. Tomas | 0.00 | 0.00 | 3.91 | 0.00 |
| | | | | | | | | Braulio E. Dujali | NR*4 | NR*4 | NR*4 | NR*4 |
| | | | | | | | | Carmen | 0.00 | 0.00 | 1.24 | 0.00 |
| | Main | Gauging Station is not existed in watershed. | | | | | | Talaingod | NR*4 | NR*4 | NR*4 | NR*4 |
| | | | | | | | | Kapalong | 0.00 | 0.00 | 0.00 | 0.00 |
| | | | | | | | | Asuncion | 0.00 | 0.00 | 0.00 | 0.00 |
| | | | | | | | | Sto. Tomas | 0.00 | 0.00 | 0.00 | 0.00 |
| | | | | | | | | Braulio E. Dujali | 0.00 | 0.00 | 0.00 | 0.00 |
| | | | | | | | | Tagum | 0.00 | 0.00 | 0.29 | 0.02 |
| | | | | | | | | Carmen | 0.00 | 0.00 | 0.00 | 0.00 |
| Lasang | | Gauging Station is not existed in watershed. | | | | | | Talaingod | 0.00 | 0.00 | 0.00 | 0.00 |
| | | | | | | | | (Davao del Sur)*5 | NR*4 | NR*4 | NR*4 | NR*4 |
| | | | | | | | | Panabo | 0.00 | 0.00 | 8.59 | 0.00 |

Sourc Philippine Water Resources Summary Data, established January 1980 by NWRC

Notes Drainage*1 : Watershed Area at Gauging Station
NA*2 : Recorded River Gauge Hight only
$Q_p$ : Peak Discharge of Daily Maximum Discharge
$Q_{dx}$ : Maximum Daily Discharge of Weighted Daily Discharge
$Q_{dn}$ : Minimum Daily Discharge of Weighted Daily Discharge
Others*3 : Including Livestock, Recreation & Fisheries
NR*4 : Surface water utilization was not registered in NWRB Database, as of March 1997.
(Province)*5 : Out of Applicable Area

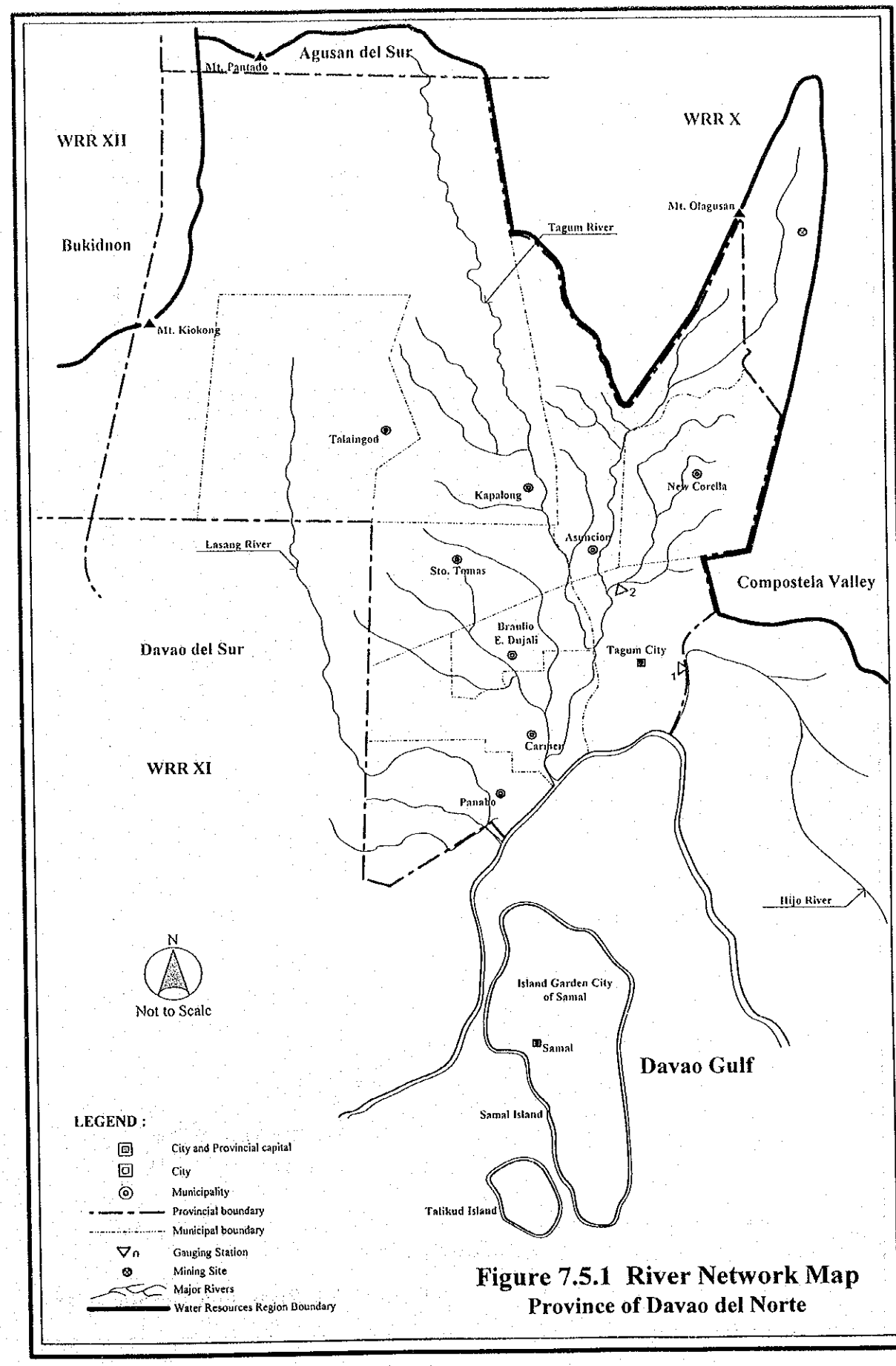



**Figure 7.5.1 River Network Map**
**Province of Davao del Norte**

| Percent of Time (%) (No. in Figure 7.5.1) | Specific Discharge (cum/sec/100sq.km) Hijo 1 | Tagum 2 |
|---|---|---|
| 10% | 4.08 | 8.38 |
| 20% | 3.56 | 7.11 |
| 30% | 3.22 | 6.04 |
| 40% | 3.09 | 5.34 |
| 50% | 2.87 | 4.67 |
| 60% | 2.60 | 4.12 |
| 70% | 2.39 | 3.78 |
| 80% | 2.14 | 2.98 |
| 90% | 1.83 | 2.46 |
| 100% | 0.80 | 1.01 |
| Period of Data Used | 1951-'70 | 1949-'69 |

Source; Philippine Water Resources Summary Data, as of Jan. 1980 by NWRC
Interim Report, Master Plan Study on Water Resources Management, as of Oct. 1997 by NWRB

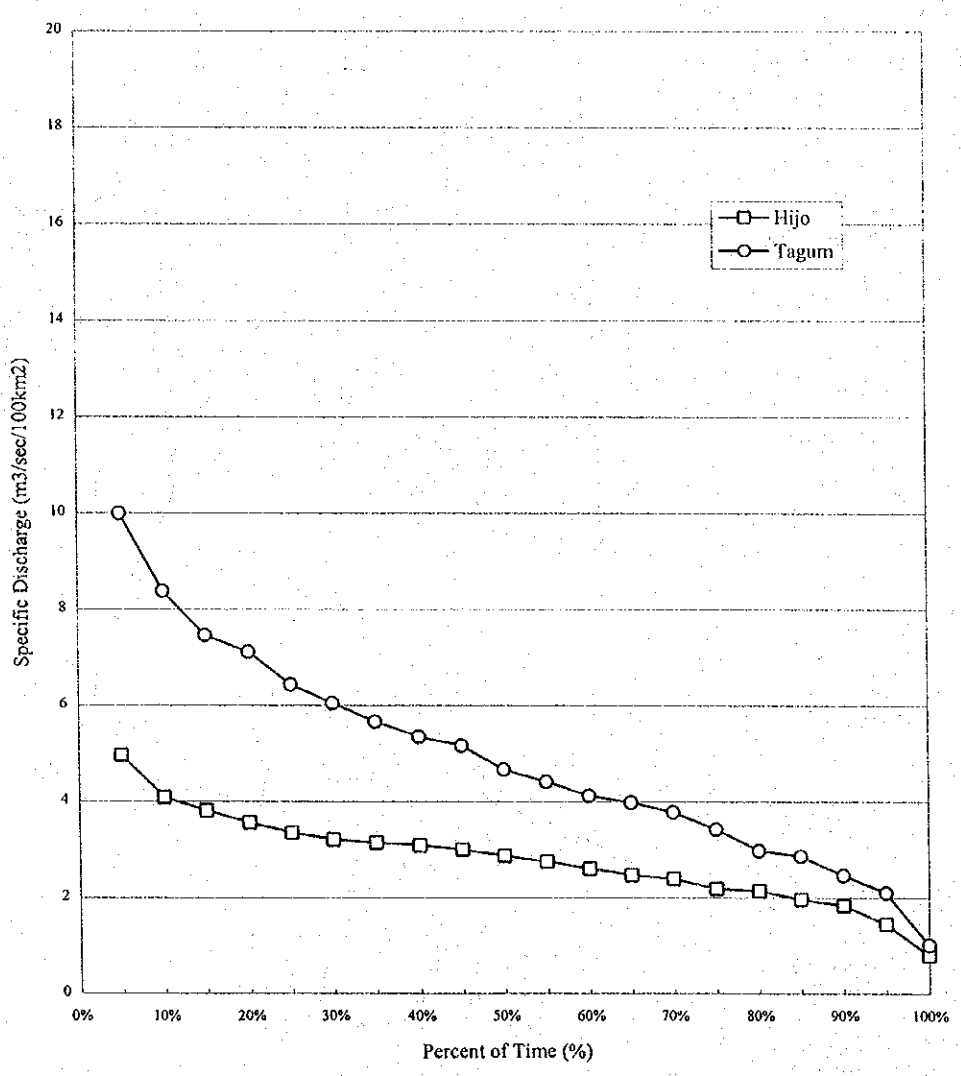



**Figure 7.5.2 River Flow Duration Curve**

## Table 7.5.2 Probability of Surface Water

| Surface Water | | Related Data | | | | | | Probability of Surface Water (10-year returen-period) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Watershed Area | | Sp.D (return-period) | | Inlet Flow to Municipality | | | | Outlet Flow from Municipality | | | |
| Major River | System & Main | Location Municipality & other Province | River Connection | Location (1) | Upstream (2) | 10-year (3) | 5-year (4) | S/Flow (5) (2)x(3)/100 | M/Flow (6) (2)x(4)/100x10% | Use (7) | **Potential (8)** (5)-(6)-(7) | S/Flow (9) (5)-(1)x(3)/100 | M/Flow (10) (6)+(1)x(4)/100x10% | Use (11) | **Potential (12)** (9)-(10)-(11) |
| | | upstream to down | outlet or inlet | sq.km | sq.km | Q | Q | cu.m/sec | cu.m/sec | cu.m/sec | cu.m/sec | cu.m/sec | cu.m/sec | cu.m/sec | cu.m/sec |
| Hijo | | Compostela Valley | | 594.00 | 0.00 | 1.83 | 2.14 | 0.00 | 0.00 | 0.00 | **0.00** | 10.87 | 1.27 | 0.00 | **9.60** |
| | | Tagum | | 31.33 | 594.00 | 1.83 | 2.14 | 10.87 | 1.27 | 0.00 | **9.60** | 11.44 | 1.34 | 0.25 | **9.86** |
| Tagum | Limbaan | New Corella | | 314.57 | 0.00 | 2.46 | 2.98 | 0.00 | 0.00 | 0.00 | **0.00** | 7.74 | 0.94 | 1.75 | **5.05** |
| | | Tagum | to Main | 33.29 | 314.57 | 2.46 | 2.98 | 7.74 | 0.94 | 1.75 | **5.05** | 8.56 | 1.04 | 1.75 | **5.77** |
| | Saug | Compostela Valley | | 265.00 | 0.00 | 2.46 | 2.98 | 0.00 | 0.00 | 0.00 | **0.00** | 6.52 | 0.79 | 0.00 | **5.73** |
| | | Asuncion | | 153.44 | 265.00 | 2.46 | 2.98 | 6.52 | 0.79 | 0.00 | **5.73** | 10.29 | 1.25 | 0.33 | **8.72** |
| | | Tagum | to Main | 7.83 | 418.44 | 2.46 | 2.98 | 10.29 | 1.25 | 0.33 | **8.72** | 10.49 | 1.27 | 0.33 | **8.89** |
| | Salao | Talaingod | | 131.94 | 133.00 | 2.46 | 2.98 | 3.27 | 0.40 | 0.00 | **2.88** | 6.52 | 0.79 | 0.00 | **5.73** |
| | | Kapalong | NIA Diversion | 66.77 | 264.94 | 2.46 | 2.98 | 6.52 | 0.79 | 0.00 | **5.73** | 8.16 | 0.99 | 7.10 | **0.07** |
| | | Sto. Tomas | | 281.96 | 331.71 | 2.46 | 2.98 | 8.16 | 0.99 | 7.10 | **0.07** | 15.10 | 1.83 | 11.01 | **2.26** |
| | | Braulio E. Dujali | | 143.70 | 613.67 | 2.46 | 2.98 | 15.10 | 1.83 | 11.01 | **2.26** | 18.63 | 2.26 | 11.01 | **5.36** |
| | | Carmen | to Main | 254.63 | 757.37 | 2.46 | 2.98 | 18.63 | 2.26 | 11.01 | **5.36** | 24.90 | 3.02 | 12.25 | **9.63** |
| | Main | Talaingod | | 127.39 | 142.00 | 2.46 | 2.98 | 3.49 | 0.42 | 0.00 | **3.07** | 6.63 | 0.80 | 0.00 | **5.82** |
| | | Kapalong | | 790.10 | 269.39 | 2.46 | 2.98 | 6.63 | 0.80 | 0.00 | **5.82** | 26.06 | 3.16 | 0.00 | **22.91** |
| | | Asuncion | | 33.68 | 1,059.49 | 2.46 | 2.98 | 26.06 | 3.16 | 0.00 | **22.91** | 26.89 | 3.26 | 0.00 | **23.63** |
| | | Sto. Tomas | | 38.45 | 1,093.17 | 2.46 | 2.98 | 26.89 | 3.26 | 0.00 | **23.63** | 27.84 | 3.37 | 0.00 | **24.47** |
| | | Braulio E. Dujali | | 17.76 | 1,131.62 | 2.46 | 2.98 | 27.84 | 3.37 | 0.00 | **24.47** | 28.27 | 3.43 | 0.00 | **24.85** |
| | | Tagum | from Saug/Salao | 82.24 | 1,149.38 | 2.46 | 2.98 | 63.66 | 7.71 | 12.58 | **43.36** | 65.68 | 7.96 | 12.89 | **44.83** |
| | | Carmen | from Limbaan | 46.02 | 1,231.62 | 2.46 | 2.98 | 74.24 | 8.99 | 14.64 | **50.60** | 75.37 | 9.13 | 14.64 | **51.60** |
| Lasang | | Talaingod | | 122.84 | 0.00 | 2.46 | 2.98 | 0.00 | 0.00 | 0.00 | **0.00** | 3.02 | 0.37 | 0.00 | **2.66** |
| | | Davao del Sur | | 448.00 | 122.84 | 2.46 | 2.98 | 3.02 | 0.37 | 0.00 | **2.66** | 14.04 | 1.70 | 0.00 | **12.34** |
| | | Panabo | NIA Diversion | 237.03 | 570.84 | 2.46 | 2.98 | 14.04 | 1.70 | 0.00 | **12.34** | 19.87 | 2.41 | 8.59 | **8.88** |

Notes; Sp. D (Specific Discharge) was analyzed by monthly mean flow records from gauging station.
S/Flow (Stream Flow) was estimated specific discharge (10-year return-period) multiplied by upstream area.
M/Flow (Maintenance Flow) was estimated 10% of river flow in case of 5-year return-period.
Sp.D (10-year or 5-year return-period) without gauging station was adopted by the other analysis result from near gauging station.
Inlet & outlet "Use" (Water Rights) are summed up by NWRB Database, as of March 1997.
Unit Q for Specific Discharge is cu.m/sec/100 sq.km.
S/Flow, M/Flow & Use in final outlet flow of each stream system was added to respective inlet flows' of main system.

In determining the river maintenance flow, such factors as runoff characteristics, navigation, fishing, picturesque scenery, salt water intrusion, clogging of river mouth, riparian structures, groundwater table, flora and fauna, and river water quality shall be considered to maintain the normal function of the river. In the Philippines, 10% of the dependable flow of the river is at least required as minimum maintenance flow. Therefore, the maintenance flow was calculated as the dependable flow for irrigation, which equals to 80% (5-year return-period) of the whole hydrological period.

Finally, the exploitable potential of surface water in the province was studied in the case of inflow to and outflow from the respective municipalities. The results are summarized in Table 7.5.2.

(3) Surface Water Quality

There are mining sites upstream of the Tagum River watershed that is operating for chromite development. The location of the mining site is shown in Figure 7.5.1.

The results of the water quality analysis are summarized in Table 7.5.1, Data Report. The sampling locations were selected upstream of the respective municipalities. In the said table, Class AA and Class A of the DENR "Water Quality Criteria for Fresh Water" are shown as reference for raw water evaluation. The PNSDW-1994 is also used to evaluate water quality with reference to turbidity and trace elements. Except for Hijo River that was found to have high Fe and Mn contents in the analysis of this study, the water quality of the selected rivers is classified as class "AA", although the parameters tested are limited.

## 7.6 Future Development Potential of Water Sources

(1) Groundwater

A well inventory covering all the municipalities shows that there are 10,321 existing wells in the province, while 177 wells are recorded in the inventory prepared by PSPT (See Table 7.1.1 and 7.3.2, Data Report). Despite the smaller number of wells included in the PSPT data, these were used in the analysis, since these provided technical information. Of the total 177 wells, 77 have complete information: depth, static water level and specific capacity. Data are summarized in Table 7.6.1 Existing Well Sources.

Table 7.6.1 Existing Well Sources

| Municipality/City | Type | No. | Depth (m) | | SWL (mbgs) | | Sp. Cap. (lpsm) | |
|---|---|---|---|---|---|---|---|---|
| | | | Ave. | Range | Ave. | Range | Ave. | Range |
| Asuncion | DW | 12 | 58.6 | 35.0 - 85.0 | 10.6 | 3.0 - 28.0 | - | - - - |
| | SW | 18 | 16.7 | 5.0 - 20.0 | 2.9 | 2.0 - 4.6 | - | - - - |
| Braulio E. Dujali | DW | 0 | - | - - - | - | - - - | - | - - - |
| | SW | 2 | 18.0 | 18.0 - 18.0 | 3.0 | 3.0 - 3.0 | - | - - - |
| Carmen | DW | 4 | 49.7 | 40.0 - 61.0 | 5.5 | 1.7 - 10.0 | 0.54 | 0.36 - 1.17 |
| | SW | 1 | 18.0 | 18.0 - 18.0 | 6.0 | 6.0 - 6.0 | - | - - - |
| Island Garden City | DW | 20 | 73.8 | 26.0 - 96.0 | 51.5 | 12.0 - 84.0 | 0.30 | 0.30 - 0.30 |
| | SW | 0 | - | - - - | - | - - - | - | - - - |
| Kapalong | DW | 14 | 57.4 | 48.0 - 72.0 | 10.5 | 6.0 - 20.0 | 1.14 | 1.14 - 1.14 |
| | SW | 9 | 19.5 | 18.0 - 20.0 | 6.4 | 4.5 - 12.0 | - | - - - |
| New Corella | DW | 4 | 26.1 | 21.0 - 36.0 | 5.7 | 4.5 - 6.0 | - | - - - |
| | SW | 11 | 12.3 | 6.0 - 20.0 | 3.3 | 2.0 - 6.0 | - | - - - |
| Panabo | DW | 18 | 49.5 | 24.0 - 97.0 | 8.7 | 3.0 - 60.0 | 3.64 | 0.43 - 4.73 |
| | SW | 9 | 8.9 | 5.0 - 18.0 | 3.7 | 2.5 - 8.5 | - | - - - |
| Santo Tomas | DW | 13 | 59.8 | 33.0 - 79.3 | 5.4 | 3.0 - 9.0 | 1.97 | 0.25 - 2.82 |
| | SW | 13 | 14.2 | 10.0 - 20.0 | 3.6 | 2.5 - 4.0 | - | - - - |
| Tagum City | DW | 16 | 71.9 | 42.0 - 180.0 | 10.4 | FF* - 36.0 | - | - - - |
| | SW | 9 | 12.7 | 5.0 - 16.0 | 5.1 | 3.0 - 6.0 | - | - - - |
| Talaingod | DW | 3 | 28.4 | 21.0 - 54.0 | 6.7 | 6.0 - 9.0 | - | - - - |
| | SW | 1 | 15.0 | 15.0 - 15.0 | 5.0 | 5.0 - 5.0 | - | - - - |

Notes; The values of "Ave. depth, SWL and Sp.Cap." by municipality are estimated using the weighted average based on 1995 census population in respective barangays at well location.
The static water level with mark "FF" means that deep well has free flowing discharge.
Legend; SWL=static water level, Sp.Cap.=specific capacity, Ave.=average, SW=shallow well and DW=deep well

Considering the well information, the most productive wells are those having depths ranging from 9m to 18m and from 24m to 97m. The good yielding wells have static water levels varying from about 3 to 20 mbgs and specific capacity of about 0.4 lpsm to 4.7 lpsm.

Based on the hydraulic characteristics and location of wells in Davao del Norte, aquifers are widely distributed along the Tagum River, crossing in the central part of the province from north to south. Shallow well area is not distributed in the province. The Miocene and older rock units are distributed in the northwestern part of the province and in the mountainous areas that are classified as difficult area for groundwater development.

As indicated in Figure 7.3.1 Main Report, the province faces the Davao Gulf. Saline water intrusion is observed on the western seashore of Samal Island. Groundwater quality with high Ca and Mg contents is reported in the limestone plateaus of this area. In the alluvial plain, groundwater quality problems of brackish water and high Fe/Mn contents are experienced. About 70% of the confined aquifers in the alluvial plain are reported to produce brackish water from deep wells. Therefore, the majority of the potable groundwater is extracted from the shallow wells. On the other hand, groundwater with high Fe and Mn contents is believed to flow from the northeastern mountainous area in Compostela. These water characteristics originates from rich volcanic sediments.

As alternative water sources, the untapped springs can be developed for future use. These are the most reliable sources for water supply in the province because groundwater quality has serious problems, such as saline water intrusion, brackish water and high Fe, Mn, Ca and Mg contents. The existing spring sources of 157 are utilized for water supply and these originate from the high mountains in the northwestern part of the province and Samal Island. The 26 untapped springs are proposed as future water sources in the areas of Asuncion, Carmen, Kapalong, New Corella and Talaingod.

The detailed hydrogeological characteristics of each municipality are summarized in Table 7.6.2, while the individual well location with technical information are shown in Figure 7.6.1, Individual Well Location and Specification Map, Data Report.

Additional wells shall be designed employing "gravel packed well" with a filtration thickness at annular space of about 50mm or more depending on the grain sizes of aquifers and pumping capacity. While, natural gravel packed well may be adopted within the areas where well-sorted natural gravel formation is distributed at the expected aquifer. Such areas are usually the upstream areas of alluvial fans or plains in the province. The formations suitable for natural gravel packed method can be observed mostly at shallower depth. The application of such method for Level I well is also justifiable, since the inflow velocity of groundwater through the screen is very low because of minimal pumping rate by means of hand-pump operation.

Generally, the shallower well has higher possibility to be constructed by the natural gravel packed method than the deeper one in areas formed by recent deposits. This is because the layers at different depths of alluvial plain or fan deposits had been formed by different conditions of transportation and sedimentation between varied grain sizes.

## Table 7.6.2 Hydrogeological Descriptions by Municipality

| Municipality | Ground Information | | | | | | | | Well Information | | | | | | Groundwater Information | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Topography | | | Geology | | | | | Depth | | SWL | | Sp.Cap. | L-III | Availability | | | Potential | | Quality | | |
| | Area Proportion (%) | | | Lithofacies (Major Aquifers) | Stratigraphy of Geological Age* | | | | m | | mbgs | | lpsm | | Area Proportion (%) | | | Comparative | | Area Feature | | |
| | Plain-Plateau | Hilly-Piedmont | Mountain | | Q | Tertiary Neo. | Tertiary Paleo. | C | mini. | max. | mini. | max. | ave. | well | SW | DW | Diff. | Wells | Springs | Problem | Pollutants |
| Asuncion | 21% | 79% | 0% | recent deposits & sandstone | x | x | | | 35.0 | 85.0 | 3.0 | 28.0 | - | 2 | 0% | 100% | 0% | partly good | poor | Fe/Mn, brackish | |
| Braulio E. Dujali | 100% | 0% | 0% | recent deposits | x | x | | | - | - | - | - | - | 0 | 0% | 100% | 0% | good | poor | brackish | |
| Carmen | 86% | 14% | 0% | recent deposits & sandstone | x | x | | | 40.0 | 61.0 | 1.7 | 10.0 | 0.54 | 4 | 0% | 100% | 0% | good | poor | brackish | |
| Island Garden | 6% | 89% | 5% | recnt deposits & limestone | x | x | | | 26.0 | 96.0 | 12.0 | 84.0 | 0.30 | 0 | 0% | 100% | 0% | fair | rich | Ca/Mg, saline | |
| Kapalong | 5% | 52% | 43% | recent deposits & sandstone | x | x | | | 48.0 | 72.0 | 6.0 | 20.0 | 1.14 | 1 | 0% | 57% | 43% | partly good | few | brackish | |
| New Corella | 35% | 56% | 9% | recent deposits & sandstone | x | x | | | 21.0 | 36.0 | 4.5 | 6.0 | - | 0 | 0% | 91% | 9% | good | few | Fe/Mn, brackish | mining |
| Panabo | 32% | 68% | 0% | recent deposits & sandstone | x | x | | | 24.0 | 97.0 | 3.0 | 60.0 | 3.64 | 4 | 0% | 100% | 0% | partly good | poor | brackish | |
| Santo Tomas | 47% | 53% | 0% | recent deposits & sandstone | x | x | | | 33.0 | 79.3 | 3.0 | 9.0 | 1.97 | 4 | 0% | 100% | 0% | partly good | poor | brackish | |
| Tagum | 88% | 12% | 0% | recent deposits & sandstone | x | x | | | 42.0 | 180.0 | Free Flowing | 36.0 | - | 11 | 0% | 100% | 0% | good | poor | Fe/Mn, brackish | |
| Talaingod | 37% | 0% | 63% | conglomerate & sandstone | | x | x | x | 21.0 | 54.0 | 6.0 | 9.0 | - | 0 | 0% | 37% | 63% | fair | few | Portable | |

Legend; Geological Age, Q=Quaternary, Neo.=Neogene, Paleo.=Paleogene, C=Cretaceous
Well Information, SWL=static water level, Sp.Cap.=specific capacity, L-III=wells operated for L-III service
Groundwater Information, SW=solo shallow well area, DW=deep well area, Diff.=difficult area

Therefore, the availability of the natural packed well development in the province is experimentally assumed considering the limited information such as topography, geology, static water levels, etc., as shown in Table 7.6.3. However, the different proportions of the 2 kinds of deep well structures (gravel packed and natural gravel packed wells) are not estimated by the accurate results based on the hydrogeological study.

**Table 7.6.3 Proportion of Gravel Packed and Natural Gravel Packed Wells**

| Municipality (only potential area) | Proposed Well Depth | Proportion (%) of Level-I Deep Wells | |
|---|---|---|---|
| | | Gravel Packed | Natural Gravel Packed |
| Asuncion | 40 m | 80 % | 20 % |
| Braulio E. Dujali | 40 m | 90 % | 15 % |
| Carmen | 40 m | 90 % | 10 % |
| Kapalong | 40 m | 80 % | 20 % |
| New Corella | 40 m | 80 % | 20 % |
| Panabo | 40 m | 90 % | 10 % |
| Santo Tomas | 40 m | 80 % | 20 % |
| Tagum | 40 m | 90 % | 10 % |

Examination on the effective grain sizes and uniformity coefficient by sieve analysis at influential aquifers (composed of coarse sand and/or fine gravel) shall be conducted during the implementation period. Such analysis and actual well construction results are very helpful in considering the natural gravel packed method for the future planning.

(2) Spring

Untapped spring source identification data are shown in Table 7.6.4. These data were collected and tabulated by questionnaire sheets on untapped spring information format, Data Report. Data also include the parameters of barangay name, owner, discharge, transmission line length, and elevation difference.

## Table 7.6.4 Untapped Spring Source Identification

| Location | | Identification of Untapped Spring | | | |
|---|---|---|---|---|---|
| Municipality | Barangay | Owner | Discharge (lps) | T.L.L.* (km) | Elevation Difference (m) |
| Asuncion | Buan (Sitio Bugak) | NA | 66.0 | 1.5 | NA |
| Carmen | Tibulao | NA | 7.7 | 0.2 | NA |
| Kapalong | Dacudao | NA | 0.3 | 0.1 | NA |
| | Dacudao | NA | 0.3 | 0.2 | NA |
| | Florida | NA | 0.2 | 0.4 | NA |
| | Florida | NA | 0.3 | 0.1 | NA |
| | Linao | NA | 3.3 | 0.0 | NA |
| New Corella | Cabidianan | NA | 0.3 | 4.0 | NA |
| | Carcor | NA | 0.5 | 4.0 | NA |
| | Del Monte | NA | 0.3 | 4.0 | NA |
| | Limba-an | NA | 0.5 | 3.0 | NA |
| | Macgum | NA | 0.5 | 4.0 | NA |
| | New Bohol | NA | 0.3 | 3.0 | NA |
| | San Jose | NA | 0.5 | 3.0 | NA |
| | Santa Fe | NA | 0.5 | 2.0 | NA |
| Talaingod | Dagohoy | NA | 0.2 | 0.2 | NA |
| | Dagohoy | NA | 0.1 | 0.2 | NA |
| | Dagohoy (Sitio Tugas) | NA | 0.3 | 0.1 | NA |
| | Dagohoy | NA | 0.1 | 0.1 | NA |
| | Dagohoy (Sitio Tugas) | NA | 0.4 | 2.0 | NA |
| | Santo Nino | NA | 0.4 | 0.1 | NA |
| | Santo Nino | NA | 0.1 | 0.3 | NA |
| | Santo Nino | NA | 15.0 | 10.0 | NA |
| | Santo Nino | NA | 15.0 | 7.0 | NA |
| | Santo Nino | NA | 15.0 | 2.5 | NA |
| | Santo Nino | NA | 0.1 | 0.5 | NA |

Note: T.L.L.; Transmission line length
NA; Data not available

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

### 7.7.1 Detailed Groundwater Investigation Required

(1) Test Well Investigation on Potable Groundwater Potential in Alluvial Plain

All of the urban areas except those in the Garden Island City of Samal are concentrated in the alluvial plain. These urbanized areas may be covered by Level-III services, while the

existing water supply systems may be expanded or combined to meet the future demands. Presently, the 1995 census indicated about a total population of 155,000 in the said urban barangays. Most of the potential water sources in this area are deep wells. Groundwater quality problems, however, are observed, such as the brackish water in the confined aquifers within about 70% of the area and the high Fe and Mn contents area in the northern part of alluvial plain.

For the future sustainable groundwater development in term of quantity and quality, therefore, the study on sustainable yield of potable groundwater shall be conducted. The recommended tasks are the test wells with pumping tests, the water quality analysis, etc. as specified below.

- Study Area; about 110 $km^2$ in the northern part of the alluvial plain
- Review of Electrical Prospecting Survey; Groundwater Investigation, 1982 by NWRC
- Test Well Sites; in the urban areas of Tagum City
- Test Wells; two deep wells
- Tentative Well Design; depth of 120m, diameter of 250mm and screen length of 30m
- Pumping Test; Time Draw-down and Recovery Test with maximum discharge of 2,000 $m^3$/day
- Water Quality Examination; to include Fe, Mn and Cl
- Results; potable groundwater potential

(2) Test Well Investigation on Recoverable Groundwater Potential in the Northern Part of Samal Island

The water supply in the Island Garden City of Samal shall be covered by Level-III service in the near future. The present water supply systems may be improved or expanded to meet future demands. Deep wells are major water sources for the future development that have the same well designs as the present facilities. The deep well fields are located in the plateaus made of reef limestone, which are in the upland areas of Babak and Samal.

Based on the preliminary estimate on groundwater potential, the groundwater recoverable potential is calculated at 3.3 million $m^3$/year without considering seasonal variation. The given natural conditions to the said calculation are:

- Groundwater Recharge Area; 40 $km^2$ at the northwestern plateau areas of Samal Island

- Average Rainfall; 1,677 mm/year at the Davao City Synoptic Station 1951 to 1995
- Groundwater Recharge Rate; 5% as a rough assumption rate
- Recoverable Potential; 3.3 million $m^3$/year (40 $km^2$ x 1,677 mm/year x 5%)

This groundwater value is available to be utilized for the Level-III water supply with a served population of about 25,000, in case the unaccounted for water is 30% and the water consumption rate is 250 lpcd.

Therefore, groundwater investigation shall be conducted to ascertain the limitation of deep well development for the future demands. The recommended tasks are the test wells, the pumping test, the water quality analysis, etc. as specified below:

- Study Area; about 40 $km^2$ in the northern part of the reef limestone plateaus
- Radioactive Prospecting (as recommended method for fissure water); 20 $km^2$
- Test Well Sites; in the platcaus of Babak and Samal
- Number of Test Wells; two deep wells
- Tentative Well Design; depth of 150m, diameter of 250mm and screen length of 40m
- Pumping Test; Time Draw-down and Recovery Test with maximum discharge of 2,000 $m^3$/day
- Water Quality Examination; to include Ca, Mg and Cl
- River Flow; run-off measurement, consideration of maintenance flow, etc.
- Meteorological Analysis; precipitation, etc.
- Results; recoverable groundwater potential

### 7.7.2 Spacing Allocation for Level II and III Wells

The pumping rates required for Level I facilities are fairly lower than that for Level II and III systems. The well interference in Level I facilities need not be studied in terms of spacing of wells and production rate, since most formations in shallow and deep well areas generally have enough groundwater development potential. As Level II and III wells are usually expected to produce larger discharges to meet the water demand, the spacing of wells to avoid well interference has to be considered. Spacing allocation for Level II and III wells was examined considering specific capacity, pumping rate, and assumed drawdown of 1cm at the interference radius for a pumping duration of 16 hours.

(1) Specific Capacity

According to the existing well source information, specific capacity was considered with ranges from 0.5 lpsm to 6.5 lpsm. To simplify the calculation, an average value in each range is adopted in the calculation of interference radius.

(2) Pumping Rate

The pumping rate was estimated by assuming a drawdown of 10m with the average value of specific capacity and pump operation of 16 hours/day. The formula used to determine proper well spacing is the Jacob modified equation. Drawdown at the interference boundary is assumed 1cm after a pumping duration of 16 hours.

Table 7.7.1 presents the estimated spacing requirements and the number of wells to be constructed within a well field of 1 $km^2$. The spacing interval between adjacent wells to avoid well interference is planned to be more than twice the distances of the calculated interference radius.

**Table 7.7.1 Spacing Arrangements for Planned Wells**

| Range of Specific Capacity (lpsm) | Estimated Pumping Rate ($m^3$/day) | Estimated Interference Radius (m) | Estimated Number of wells/$km^2$ |
|---|---|---|---|
| 0.5 - 1.5 | 500 | 80 | 45 |
| 1.5 - 3.0 | 1,000 | 120 | 20 |
| 3.0 - 4.5 | 2,000 | 160 | 11 |
| 4.5 - 6.0 | 2,500 | 200 | 7 |
| > 6.0 | >2,500 | >200 | >7 |