

CHAPTER II HAZARDOUS FLOOD AND ITS FLOODED COMMUNITIES

This chapter will describe the pattern of hazardous flood and the profile of communities affected by flood in the municipality of Bandung.

HAZARDOUS FLOOD AND ITS PROBLEMS IN BANDUNG

Three conditions will be presented in this sub-chapter : 1) history of flood-stricken area in Bandung; 2) identification of flood impact, and; 3) a formal mechanism to get help from the local government.

2.1.1 Hazardous Flood History in Bandung

The Bandung Basin is a plain surrounded by mountains. When Herman Willem Daendels built a post road (*Groote postweg*), connecting Anyer on the west side of Java island and Panarukan on the east side of Java island (1810-1816), *Tatar Bandung*¹ consisted of jungles, small lakes exists in between, and the rest were swamp areas. In local language, swamp is called 'ranca' (Kunto, 1992). In 1930's lakes in Southern Bandung could be found in the form of large and deep swamps called Rawa Ciloeun and Ranca Gede. Besides Ranca Gede, there was a swamp located in Ciendog near Rancaekek and Gedebage known as Geger Hanjuang. Fifteen small rivers, including Cinambo river, flew toward a swamp called Geger Hanjuang. Most of human settlements were on lowlands leaving untouched the hilly areas and green belts surrounding the settlements.

Change of land use in southern and eastern Bandung which has occurred have cut down the size of the forests. Such development has increased the impermeability of the soil, thus decrease the quantity of rainwater discharged that would flow to lower areas. Based on written documentation (Kunto, 1992), most parts of the flood plain in the Bandung Basin have been flooded yearly during the rainy season since 1970's.

The plain is located in Sapan, Dayeuhkolot, Bale Endah, Galih Pawerti and in the Eastern part of the city includes Ujungberung, Cisaranten, Guru Minda housing, Gedebage and Rancaekek. Data on hazardous floods which have occurred in Bandung are presented below.

¹ *Tatar Bandung* is known as Bandung Plain. According to the East Indies Government, in the nineteenth centuries *Tatar Bandung* covered what is currently known as downtown and districts surrounding it. At the time *Tatar Bandung* was an ideal place to exile soldiers, criminals, or guilty government officials (Kunto, 1984:10). After the expansion in 1989, *Tatar Bandung* covers the city and its surrounding areas known as Greater Bandung.

TABLE II-1
HAZARDOUS FLOOD DOCUMENTED IN BANDUNG AREA, FROM 1921-1986

Year	Inundated Area (Ha)	Depth (m)	Duration (day)	Number of Houses Damaged	Location
1921	8250	-	-	-	Dayeuhkolot, Majalaya, Cicalengka, Ciparay
1931	9300	-	-	-	Dayeuhkolot, Majalaya
1945	-	-	-	-	
1949	-	-	-	-	
1980	-	1.5	4	4500	Buahbatu, Dayeuhkolot, Cikeruh, Citepus, Cisangkuy
1981	-	1.5	6	300	Buahbatu, Ciparay, Dayeuhkolot, Baleendah
1982	-	1.5	14	1500	Buahbatu, Cicadas, Ciparay, Ujungberung, Dayeuhkolot
1983	-	1.5	18	2100	Ujungberung, Buahbatu, Ciparay, Baleendah, Nyengseret, Padasuka, Babakan
1984	8088	1.8	26	-	Majalaya, Rancaekek, Dayeuhkolot, Ciparay, Buahbatu, Baleendah, Sapan, Cicalengka
1986	7249	1.6	21	-	Dayeuhkolot, Rancaekek, Ciparay, Majalaya, Buahbatu

Source : Department of Public Works in Rudy Suhendar, 1997²

²There is no explanation for the empty columns (-).

Table II.1 adopted from Environmental Geology Bulletin, identifies hazardous floods occurred from 1921 until 1986. From existing locations, Dayeuhkolot, Majalaya, Ujungberung, Cicalengka, and Ciparay have become flood-stricken areas. Based on the duration and the depth of the flood, it is said that the intensity of hazardous floods in Bandung has increased. According to data collected between 1999 and 2000, hazardous floods occurred in the communities being researched have also increased.

Table II.2
Hazardous Floods Documented in Kelurahan Cisaranten Kidul
In 1999-2001

Year	Explanation	Location
2001	<ol style="list-style-type: none"> 1. The depth was approximately 50 centimetres in RT 01 and 30 centimetres in RT 02 RW 09. 2. The depth was approximately 15 centimetres inundated in RT 2, RT 4, RT 5, and RT 6 RW 14. 	RW 09 and RW 14
2000	<ol style="list-style-type: none"> 1. The depth was approximately 70 cms. 2. Dwelling units that were inundated approximately 40-60 cms. 3. The disaster took place for about 46 days. 	RW 09
1999	<ol style="list-style-type: none"> 1. Similar occurrences as in the year 2000 2. 14 people had to be treated after the flood occurred. 	RW 09 and RW 14

Source : PRA outcomes, 2001

Table II.2 shows the incidents of flood as memorized by the communities. Based on their experiences, the most serious condition caused by the hazardous flood happened in the early of 2000. It took place for approximately 46 days with an average depth of 70 centimetres. While the last hazardous flood took place in January 2001, wherein the depth was 50 centimetres in RW 09 and was 15 centimetres in RW 14.

However, the latest flood occurrences that have gotten some aid, took place on 29th October 2000, which inundated RW 07, 08, and RW 09 in *Kelurahan Cisaranten Kidul*. The details are presented below³.

³ Letter of Reporting and Requesting Aid for Hazardous Flood No. 300/282/Cam.Rs from Head of Sub-District Rancasari to the Secretary of Satlak PB Bandung.

Table II.3
Hazardous Floods Documented in Kelurahan Cisaranten Kidul
on 29th October 2000

Location	Causes	Consequences	Response	Note
RW 07	Continuously heavy rains and overflowing of Cisaranten river	60 dwelling units were inundated; skin and itchy diseases sprang up	Channel dike was made from plastic sack and cleaning waterworks	The flood is 50 centimetres depth
RW 08	Continuously heavy rains and overflowing of Cisaranten river	10 dwelling units were inundated ; skin diseases sprang up	Channel dike was made from plastic sack and cleaning waterworks	The flood is 50 centimetres depth
RW 09	Continuously heavy rains and overflowing of Cisaranten river	20 dwelling units; farmlands were inundated	Preparing location for evacuation and medicine procurement	The flood is 75 centimetres depth

Source : Letter of Reporting and Requesting Aid for Hazardous Flood No. 300/282/Cam.Rs from Head of Sub-District Rancasari to The Secretary of Satlak PB Bandung. 2000.

Based on table II.3, especially in RW 09, the hazardous flood caused 20 dwelling units and farmlands were inundated with average depth of 75 centimetres. The response done by the municipality was to prepare location for evacuation.

2.1.2. Identification of Hazardous Effects

Flood, according to Water Resources Management Office (BPSDA) Citarum, Department of Public Works of West Java Province⁴ defines as a large quantity of water. Hazardous flood takes place when inflow is faster than outflow. Inflow consists of river flow and rainflow and flow from the drainage systems. The problem of an overflowed inlet causes flood in particular areas which causes great loss to people and sometimes takes casualties. The hazardous flood are generally caused by two issues, i.e :

1. Natural factors, such as rainfall, vegetations, geological and topographical features, and;
2. man-made factors which trigger the hazard, such as dumping the garbage into the river and houses located on the river's edge or houses located on conservation areas as a result of population pressure toward the land.

Aside from it, limited capacity of drainage and irrigation systems is one of the engineering-oriented cause of hazardous flood. There are some side effects caused by flood, i.e :

1. Economic impacts in the relation to the loss of : a) productive activities, especially to farmers whose farmlands are inundated or people whose production units and livestock,

⁴ Effendi. A. 2001. Direct Interview.

- such as ducks, fish, and sheep are lost to flood, and; b) loss of equipments, or supply that disrupt consumptive activities, such as cooking equipment, food supply, and textbooks;
2. psychological impacts, bring about anxiety especially during the rainy season when flood can comes unexpectedly;
 3. physical impacts are the damage of houses, roads, communication lines, and household equipments because they are often inundated for along time and requires time to repair back, and;
 4. health impacts, cause the emergence of diseases such as skin disease, diarrhea, and fever in flood-stricken areas.

2.1.3. Local Government's Response to Hazardous Flood

In response to hazardous flood that took place almost every rainy season, the local government has improved their response mechanism to deal with “save and rescue” the victims

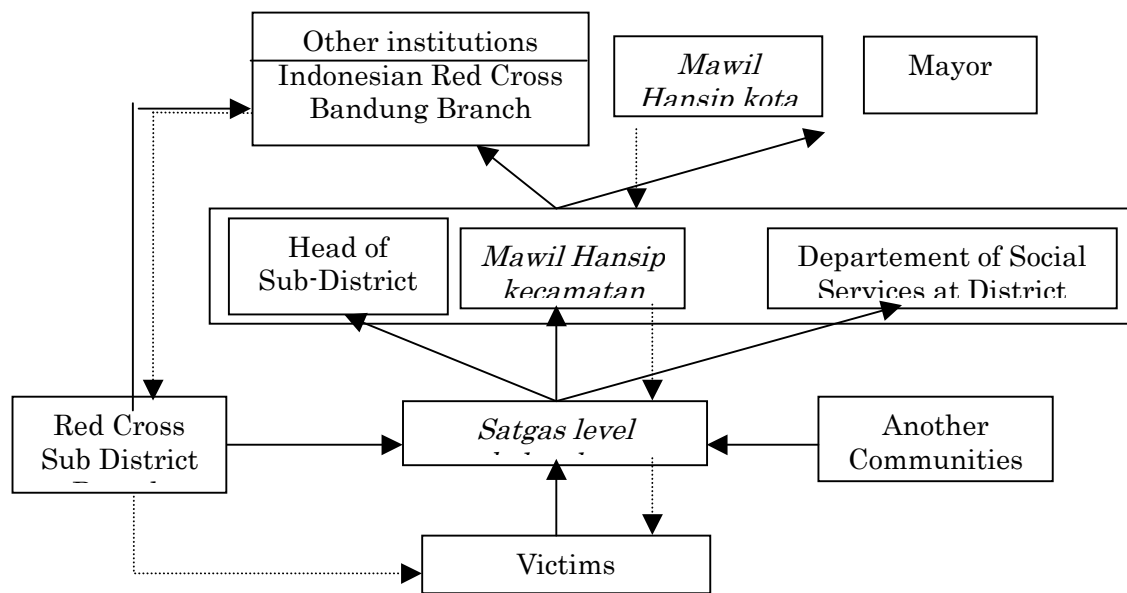


Figure 2.1
Reporting and Aid-giving Mechanism to The Flooded Communities in Bandung Municipality

Notes :

.....➔ Aid-giving procedure

————➔ Hazardous flood reporting procedure

Report on hazardous flood which consist of data on the time occurrence, and the victims can come from either the communities (victims) themselves or from *kelurahan*, and the aid is in accordance with the victim's request. *Kelurahan* then informs the *Mawil Hansip* in *kecamatan* who also report to *Mawil Hansip* in the municipality. Administrative NGOs such as Indonesian Red Cross⁵, other communities and NGOs give the aid directly after they have got the report from *Mawil Hansip* on district level on the magnitude of the hazard and the needs of victims. Most of the aid are given in the form of in-kind goods, instead of money.

⁵ The Red Cross provides medicines and first aid help which will be given for maximum 3 days after the disaster strikes.

The aid-giving mechanism starts from the top. Based on the report, the municipality will give physical help which is distributed through the district government. The follow up action of district government is to cooperate with *Mawil Hansip* in sub district and community organization in giving help directly in the location. They also gather volunteers from another communities to help the affected communities.

This case study of the project is in kelurahan of Cisaranten Kidul, Sub-District of Rancasari, i.e:

- 1) RW 09 or called Rancabayawak, and;
- 2) RW 14 in Riung Bandung Housing Estate

Based on the flooded area map made by Bandung Branch Office of Public Works and Water Resources in 1999, the widest flooded area in Bandung municipality is in the *kecamatan* Rancasari.

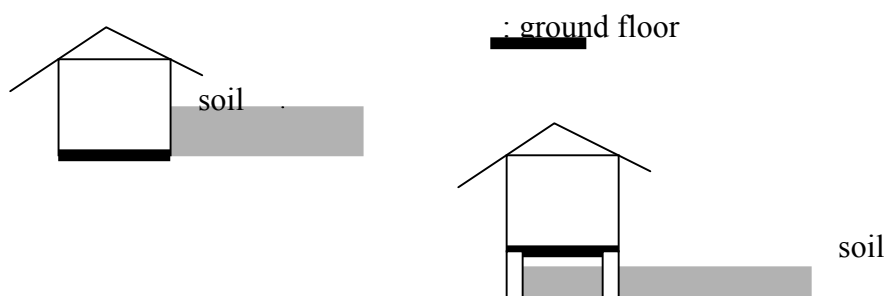
COMMUNITY PROFILING

Community profiling is obtained through examining community vulnerability, community cohesiveness, and economic activities. Community vulnerability is measured by the age/sex structure of the population, the condition of dwelling units and the location of dwelling units. Population structure can be observed from structure of ages and gender, in which those who are the most vulnerable, are under 5 years old and above 65 years old, whereas other vulnerable age group is about 5 to 12 years old. The population between 17 and 65 years old is the least vulnerable population. Women are seen as more vulnerable than men.

Community vulnerability observed from dwelling observation condition can be categorized based on data obtained in the field. The conditions represented community efforts to protect their dwelling unit from the hazard. The vulnerability of housing condition can be divided into five levels, i.e :

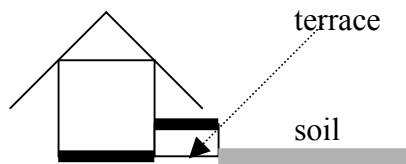
1. Level 1

Is considered to be the most vulnerable dwelling unit because the floor inside the unit is lower than the soil surface. Platform house made of bamboo, woods or other materials is included to this level because of its semi-permanent construction. The inside condition of the house becomes damp and susceptible to weather changes, for example wind and velocity or stream flow change.



2. Level 2

Includes the houses whose terrace is higher than the street surface and the floor inside the house. The flow of flood won't directly get into the house but it can leak through the floor. After the hazard strikes, although the flood has subsided but the water trapped inside should be thrown away outside.



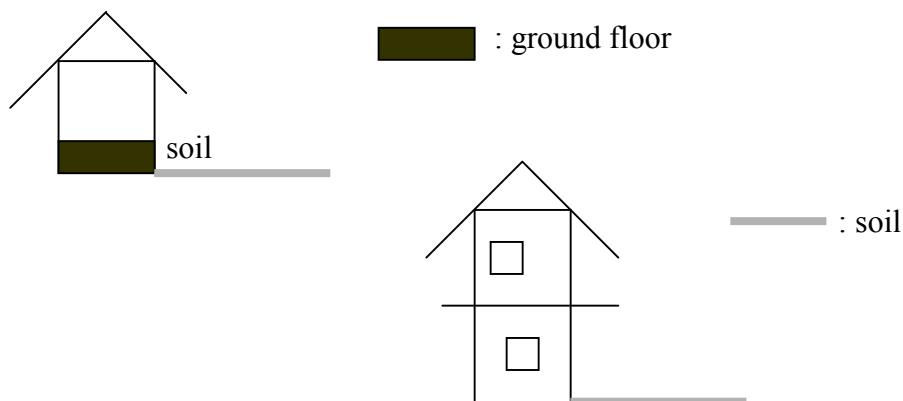
3. *Level 3*

Is a condition in which the floor inside the house has the same elevation as the frontyard. If the hazard occurred, the flood that would overflow to the frontyard will flow inside the house as well. As if the flood subsides, the water inside the house will subside as well.



4. *Level 4*

Is one of the anticipating action made by the community members to minimize the effects caused by hazardous flood. The ground floor of the house is made higher than the terrace and frontyard. The other type is a two-storey house. During floods, the second floor can be a substitute for the functions in the first floor. After the hazard, the flood can subside faster than those in other houses.



Based on the location of the dwelling units, the houses which located near the river are more vulnerable than those located close to the dry soil; the houses located near septic tank are more vulnerable than those located far away from it; and houses located on lowlands are more vulnerable than those located on highlands.

Community cohesiveness will be identified by: 1) Individual coping mechanism in the communities; 2) Community motivating process; 3) Inter-community relationship when facing with the hazard; and 4) community cohesiveness in facing the hazard. Individual coping mechanism is used as an indicator of community cohesiveness with assumption that if each family in the community has developed coping mechanism, it is said that the community have individual cohesiveness. When the hazard occurs, this type of cohesiveness allows the community members to remain on their houses. The other three types of community cohesiveness describe community tenacity, especially in facing with the hazard. The level of community tenacity is different for each location and it can't be quantitatively measured.

Community profiling based on economic activities focused on means of their livelihood and their activities in spare time. It will show whether or not their activity of occupation is dependent on the flood.

2.2.1. RW 09

RW 09, Rancabayawak, is located on the border of Bandung regency and Bandung Municipality, and in the south is bounded by Padaleunyi toll road. This administrative unit is one of the area flooded yearly. It is susceptible to hazardous flood because it is located near the meeting of two rivers: Cisaranten and Cinambo. Mud and garbage sedimentation has caused silting up and constriction of both rivers. Besides, the stream flow head for the south is blocked because of low construction of the bridge on the toll road and limited capacity of water channel underneath the toll road⁶. Consequently, the overflow of water is flooding the surrounding area.

The most serious hazardous flood informed by community happened in 1999-2000, wherein the water inundated at about 40-70 cms for 46 days⁷. It had negative impacts on the activities of local community and, diseases such as diarrhea, skin diseases, and diarrhea and vomiting sprang up there.

The hazardous flood happened on 23rd March 1998 with the average depth of 60-100 cms was caused by⁸ :

- a. Long-time rainfall (7 days);
- b. the capacity of river can't fulfill water discharged, and;
- c. local drainage is not suitable for flowing the run-off water.

RW 09 is physically bordered by farmlands and secluded from its surroundings. The community of RW 09 think that effective mitigation towards floods is to build a retaining wall on both edge of the river. According to the Departement of Public Works of West Java Province, a retaining wall is a solution for improve the condition of the river, because it can't avoid the existing silting up. The most helpful effort to reduce flood in RW 09 is the normalization of upper Citarum river, so it won't block the stream flow from small rivers, including Cinambo and Cisaranten. In fact, the retaining wall is built to stabilize the soil on the river edge.

The community of RW 09 still have traditional train of thought, especially in coping with the hazard. They take the flood as God-given trait, and it is accepted for what it is. They tend not to get panic and frightened of losing their properties when the flood hits their areas.

2.2.1.1. Community Cohesiveness

Community cohesiveness in RW 09 is relatively strong, it can be seen through individual coping mechanism that was done by almost all community members. Individual coping mechanism is done in either as done toward their belongings or through evacuation.

1. Physical. It is divided into coping action and mitigating action. Individual coping mechanism in a mitigative way is to heighten the soil surface/terrace, to set aside a small boat or to build a two-storey house. They usually build stumbling block from the sand sack to block the streamflow into the house, and make wooden couch to put essential goods on it, such as a stove.
2. Non-physical. This includes choosing evacuation place for their children and women, accumulating food, packing clothes in plastic bags and saving precious important personal documents such as landholding letters or marriage license in a safe place.

⁶ Bandung Branch Office of Water Resources and Public Works. 1999.

⁷ PRA outcomes. Historical plot. 2001

⁸ Letter of Announcement from PSAPB Citarum Departement of Public Works to Project Leader PWS Citarum No. UM 03.04-06/PSAPBC/1998 on 25th March 1998

Besides individual coping mechanism, the community in RW 09 has owned inter-group cohesiveness. It can be seen when the hazard occurs, the chief of RT 01 can motivate the community members, especially women and children, to evacuate to the safer place, whereas some families move to their neighbour who owns two-storey houses or houses that aren't affected by flood.

2.2.1.2. Community Vulnerability

It is observed from the structure of population in RW 09. Productive ages between 20-65 years old are dominant. It means that the area has its own potential human resources to help themselves and other vulnerable community members. The population structure will be presented in details below.

Table II.4
Population Based on Age Group in RT 01 RW 09
2001

Age (years)	Men (person)	Women (person)	Total
<5	7	8	15
5-12	35	45	80
12-17	3	7	10
17-35	20	5	25
35-65	52	60	112
>65	2	8	10
Total	119	133	252

Source: Unpublished Data of Chief RT 01RW 09

Based on table II.4, population data in RT 01 RW 09 is shown in graphic as follows.

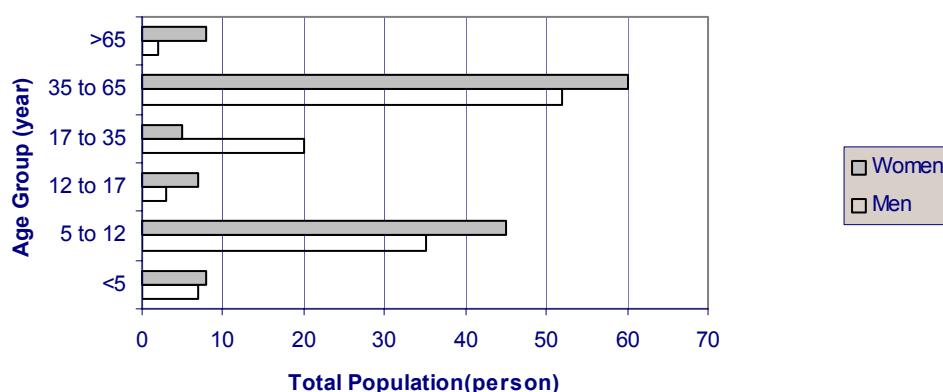


Figure 2.2
Age Group Based on Gender in RT 01 RW 09, 2001

For RT 02, population data⁹ is not according to structure of ages, but it is based on the structure of sex, which consists of 80 men and 76 women. In total the number of community member in

⁹ Unpublished data of chief RT 02 RW 09

RT 02 is about 156 persons, with only 13 young men. There are few people above 50 years old, and widows in RT 02. This data is shown in the graphic below.

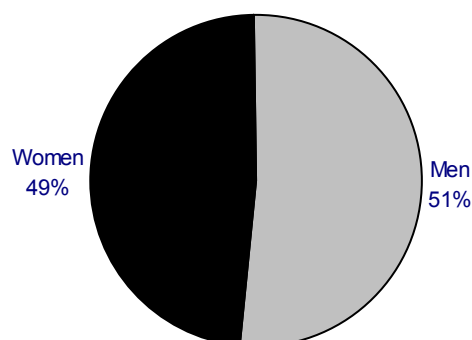


Figure 2.3
Population Composition Based on Sex in RT 02 RW 09, 2001

Based on table II.4 social vulnerability is not so glaring. Table II.5 shows the most vulnerable age group compare with the least vulnerable age group in RT 10 RW 09.

Table II.5
Population Ratio between Vulnerable and Invulnerable Ages
In RT 01 RW 09, 2001

Age Group (year)	Vulnerability	Population (person)			Ratio	(%)
		Men	Women	Total		
>65 and <5	Most Vulnerable	9	16	25	0.18	18
5-17	Vulnerable (school ages)	38	52	90	0.66	66
17-65	Invulnerable (productive ages)	72	65	137		
Total		119	133	252		

Source : Calculation result

From table II.5 above, the number of least vulnerable age group is higher than the most vulnerable age group plus the vulnerable age group. In RT 02, the number of men and women are equal so we can say that the community is not vulnerable.

Vulnerability based on dwelling unit condition, show that some houses¹⁰ are almost buried.

¹⁰ Surveillance Report. The example of vulnerable house level 1 is Mr. Maman's house in RT 02 which ground floor inside the house is lower than the soil surface.

Those houses have lower ground than the soil surface of the yard because the yard has been heaped up by mud, while the foundation of the house is not heightened (vulnerable condition level 1). The coping mechanism for this type of house is to block the border between the house and the yard by making stumbling block made of wood to decrease the input of mud into the house. Besides, semi-permanent houses is included to level 1. In the community there are also houses with higher terrace¹¹ (vulnerable condition level 2), or permanent house with the yard equals at the same level¹² (vulnerable condition level 3) and two-storey house with higher floor inside the house¹³ (vulnerable condition level 4).

Most of the houses haven't had an appropriate drainage system. Instead, they made their own drainage system only by digging up the soil that can look like a channel. Almost every household owns a toilet inside the house, and the rest still use public bathing, washing, and toilet facilities. We can conclude that the more permanent the house and the higher their income are, the possibility of having own latrines is bigger.

RT 02 is located near the river's fusion of Cinambo and Cisaranten river while RT 01 is surrounded by farmlands and inundated farms. So both neighbourhood units have high vulnerability of being flooded.

2.2.1.3. Economic activities

Most of RW 09 community members work as farmers and duck breeders. Their livelihood is very vulnerable because if the hazard occurs, the farmlands and animal husbandry will be inundated, as consequence they can't earn money. Most of them work as farmer with average income of about Rp 1.660.000,00 for each harvesting season (approximately 4 months)¹⁴. If their plant is attacked by plant disease or inundated they can't earn money whereas the capital for the farming of about Rp 1.840.000,00 fade away.

In the duck husbandry, the capital is about Rp 2.000.000,00 for three months but they only earn Rp 1.548.000,00 for a total of three months. It is less than the capital invested. Although they suffer losses but they only have those skills and they want to make the use of it. The hazardous flood has made their opportunity of using the skills decreased. Thus, from their means of livelihood, the community of RW 09 is economically vulnerable. The other livelihood is fishfarming, but it doesn't give proper income especially during the flood, the fish can spread up everywhere. They don't get any incomes.

The hazard is exceptionally beneficial to some people as they can make money out of fish being washed away from fishfarming. Some instant fishermen are not even the locals, but those who come to do just that.

2.2.2. RW 14

RW 14 is located in Riung Bandung Housing Estate. This research will be focused on RT 02, RT 03, RT 04, RT 05, and RT 06. Those neighbourhood units have been chosen because they will suffer the most serious damaged when the hazardous flood comes. The most serious condition in RW 14 happened in 1998 with average depth of about 70 centimetres took place for three days. The hazard took place because the dike of Cisaranten river was broken down. Besides, this housing complex hasn't had suitable drainage channel, so the rainfall usually overflows to the street. Every time it comes, diseases such as diarrhea, typhus, and dysentery emerges.

¹¹ Vulnerable house level 2 is Mr. Didi's house in RT 01.

¹² Vulnerable house level 3 is Mr. Ujang's house in RT 01.

¹³ Vulnerable house level 4 are Mr. Ade's house and Mr. Suryana's house in RT 01.

¹⁴ Based on livelihood analysis (AMP). PRA. 2001.

According to the explanation of the community, the hazardous flood happened because there is no primary channel on the downstream for housing outlet channel of the Riung Bandung settlement. Land use in RW 14 Riung Bandung consists of housing and farmland with cistern irrigation system. To irrigate the farm in dry season, the farmer closes the small river. Close to the rainy season, the dike is not opened by the farmer, so the water will overflow to the settlement. The conflict of interests between the community and the farmers emerges.

The main problem of RW 14 is the unhierarchical drainage channel and the topography of the river where the main river is higher than the settlement drainage.

2.2.2.1. Community cohesiveness

To cope with the hazardous flood, they make their own dike to close the leaking from the local system. They also have their own coping mechanism for themselves, such as :

1. By heightening the structure of houses
2. by making a fence higher than the street.

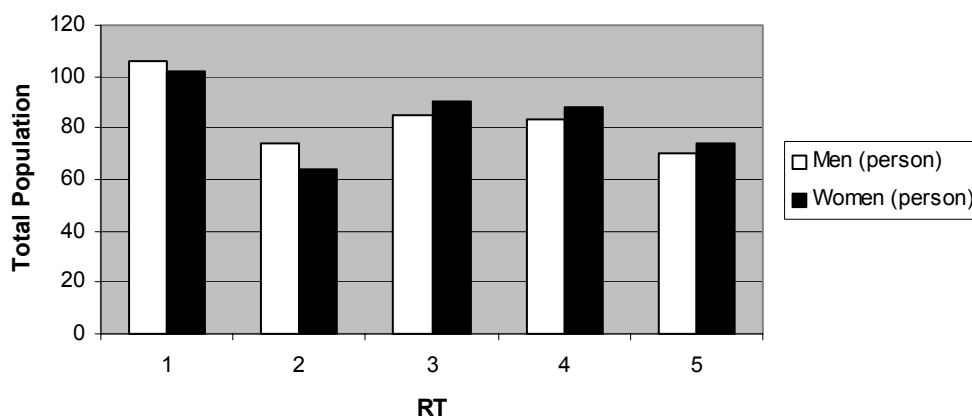
Besides, they help each other by allowing some neighbours to move to their neighbours if the hazard comes. Local administrative unit has an essential role in helping the community to cope with flood. However, the real estate developer of Riung Bandung who is supposed to be responsible for the public utility system, have not given any help. RW 14 community assumes that the developer think the society of Riung Bandung is able overcome the problem financially. This is the following data of population in RT 02, RT 03, RT 04, RT 05, and RT 06.

Table II.6
Total Population per RT in RW 14 in Riung Bandung Estate 2001

RT	Men (person)	Women (person)
02	106	102
03	74	64
04	85	90
05	83	88
06	70	74
Total	418	418

Source : Unpublished data of RW 14

The ratio of men and women in RW 14 is presented as follows.



Picture 2.4
The population based on Gender in RW 14, 2001

2.2.2.2.Community Vulnerability

The percentage of men and women is equal, and there are nine widows in RT 02 and five widows in RT 03. Average number of youth every RT is ten persons. Toddler and children is about a quarter of the total population (209 persons). Based on the data above, RW 14 community is not so vulnerable because there are only few old people and children. The location of RT 04, RT 05, and RT 06 is more vulnerable to flood than that of the others because they are located near the river and there is no suitable drainage channel to distribute streamflow that is accumulated in water reservoir. Most of the house in Riung Bandung are vulnerable because the flood can leak through the floor slowly and inundate the house.

2.2.2.3.Economic activities

Based on the livelihood analysis held in PRA, 40% are retired, 25% work in the private sector, 20% work as an entrepreneur, 10% work as government officials, and the last 5 % are unemployed. The hazardous flood influences the working opportunity of entrepreneur because they usually put their raw materials at home and it will be damaged if the flood inundated their houses. For those who work in private worker or as government officials, the hazard doesn't affect them, especially those whose productivity or income is determined by attendance in the office.

2.2.3. Summary

Both communities are vulnerable because they are located in the basin area and are affected by the rivers from Northern Bandung whose width is getting narrow toward on the down stream, so the water inundates RW 14 and RW 09. The flood is also aggravated by the condition of both locations which didn't have suitable drainage channel.

They have, however, already had a good individual coping mechanism that represent the cohesiveness of the community. In other words, if there is an intention to live in flood-stricken area each individual should posses coping mechanism that is usually done by flooded communities. Togetherness and inter-group relationship is quite good because each member of the community help each other and wants to be helped by the neighbours around.

From their economic activities, the hazard influences RW 09 community livelihood much more than that in RW 14. Most of people in RW 14 are workers whose income are determined by the company where they work, whereas most of RW 09 people work as farmers and duck breeders whose place of work are in areas vulnerable by flood.