

HENRY

Hydraulic Engineering Repository

Ein Service der Bundesanstalt für Wasserbau

Conference Paper, Published Version

Inoue, Kazunori; Takeya, Kimio; Matsumaru, Ryo; Chaverri, Paulina
Good Practice Regarding Community-Based Flood
Monitoring and Early Warning System in Soacha
Municipality in the Republic of Colombia

Zur Verfügung gestellt in Kooperation mit/Provided in Cooperation with:
Kuratorium für Forschung im Küsteningenieurwesen (KFKI)

Verfügbar unter/Available at: <https://hdl.handle.net/20.500.11970/110073>

Vorgeschlagene Zitierweise/Suggested citation:

Inoue, Kazunori; Takeya, Kimio; Matsumaru, Ryo; Chaverri, Paulina (2008): Good Practice Regarding Community-Based Flood Monitoring and Early Warning System in Soacha Municipality in the Republic of Colombia. In: Wang, Sam S. Y. (Hg.): ICHE 2008. Proceedings of the 8th International Conference on Hydro-Science and Engineering, September 9-12, 2008, Nagoya, Japan. Nagoya: Nagoya Hydraulic Research Institute for River Basin Management.

Standardnutzungsbedingungen/Terms of Use:

Die Dokumente in HENRY stehen unter der Creative Commons Lizenz CC BY 4.0, sofern keine abweichenden Nutzungsbedingungen getroffen wurden. Damit ist sowohl die kommerzielle Nutzung als auch das Teilen, die Weiterbearbeitung und Speicherung erlaubt. Das Verwenden und das Bearbeiten stehen unter der Bedingung der Namensnennung. Im Einzelfall kann eine restriktivere Lizenz gelten; dann gelten abweichend von den obigen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Documents in HENRY are made available under the Creative Commons License CC BY 4.0, if no other license is applicable. Under CC BY 4.0 commercial use and sharing, remixing, transforming, and building upon the material of the work is permitted. In some cases a different, more restrictive license may apply; if applicable the terms of the restrictive license will be binding.

GOOD PRACTICE REGARDING COMMUNITY-BASED FLOOD MONITORING AND EARLY WARNING SYSTEM IN SOACHA MUNICIPALITY IN THE REPUBLIC OF COLOMBIA

Kazunori INOUE¹, Kimio TAKEYA², Ryo MATSUMARU³, Paulina CHAVERRI⁴

¹ Project Manager, Waterworks Department, Pacific Consultants International
1-7-5 Sekido, Tama City Tokyo Japan, 206-9550

² President, Pacific Consultants International, 1-7-5 Sekido, Tama City Tokyo Japan, 206-9550

³ President, IRM Ltd, Setagaya ward, Tokyo, Japan

⁴ International Community and Regional Planner, P.O.Box 419-1250, Escazú, Costa Rica

ABSTRACT

Soacha Municipality having about 400,000 populations is located in the suburbs of Bogota, Colombia, suffering from frequent flood disasters in Soacha River. To improve the situation, Japan International Cooperation Agency (JICA) undertook a two-years study from 2006 to 2008 as a part of the Study on Monitoring and Early Warning System for Landslides and Floods in the Republic of Colombia (herein after called “the Study”). In the Study, unique hydrological characteristics of the Soacha River basin, technical requirements, and social conditions including the flood management capacity of Soacha Municipality were reviewed. As a result, community-based flood monitoring early warning system was considered the most effective and efficient system to mitigate the flood damage for this particular area. In the course of the planning, the municipality and foreign experts on flood and community planning undertook a series of community-based activities to set a collaborative mechanism for the flood monitoring and early warning in community basis. The activities were aiming at developing/enhancing the capacity of the community people as well as municipality officials. As a result, an effective community based flood monitoring and early warning system was established. This paper presents good practice - how and what is a key to establish a sustainable community-based monitoring and early warning system for flash flood for a local city in a developing country under the condition with few technical, financial and human resources.

Keywords: community-based monitoring, early warning system, community disaster prevention plan, flash flood, technical cooperation

1. CHARACTERISTICS OF THE TARGET AREA

1.1 River and Flood

The Soacha River (Figure 1) goes through the urban area of Soacha Municipality. The catchment area is about 40 km² and the principal river length is 24 km having short flood concentration time. As the rainfall pattern is quite local, the rainfall amount is quite different among the upstream and the downstream. For example, the affected people in 2006 flood did not know the heavy rainfall in the upstream until the overflow took place in their places. The Soacha river basin does have few hydrological monitoring stations, nor does have enough capacity to manage and mitigate the flood problem, however, the communities in Soacha city have high awareness for the disaster prevention activities.

In May 2006 the City experienced the most serious flood in recent 20 years. In the Soacha river basin, IDEAM(Colombian Meteorological Agency)'s San Jorge Station is located in the upper part of the basin. The daily rainfall of May 11, 2006 at San Jorge was 20 mm. The maximum hourly rainfall in May 11, 2006 was 7.5 mm from 8:40AM to 9:40AM.

The flood level at Fusunga was about 50 cm above the left side ground elevation. The peak water level took place at 11:45 AM in May 11, 2006 and lasted about 4 hours according to a resident living beside of the river. Also at 8:00AM the water level was just 1 meter 40 cm on the staff gauge and the heavy rainfall happened at 10:30 AM in that day.

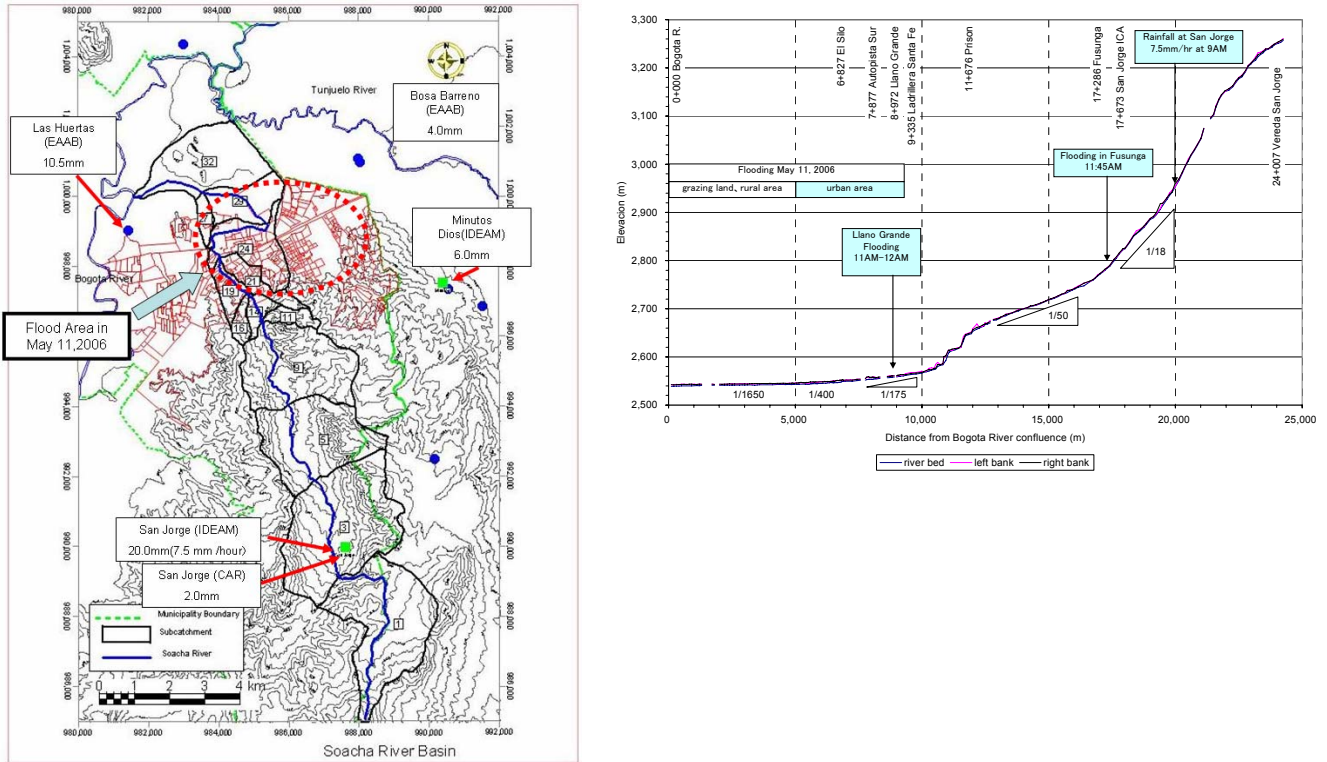


Figure 1 Daily Rainfall (left) and Flooding Time (right) in May 11, 2006 in Soacha River

The flooding in Llano Grande (El Cardal to Autopista Sur, see Figure 1 and 2) took place from 11AM to 12AM. According to the communities in Llano Grande, there was no rain in their area and the river overflow suddenly happened.

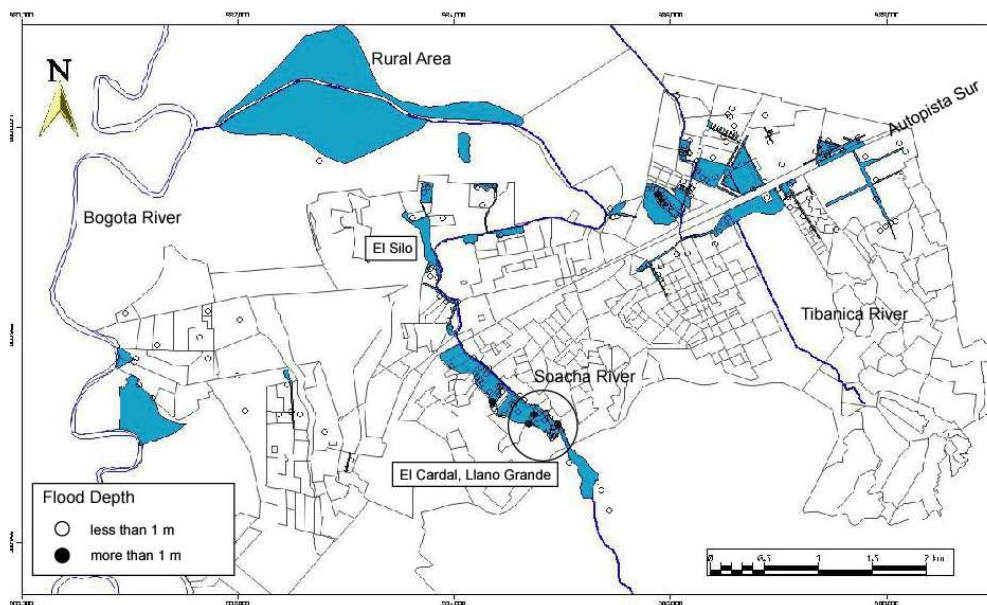


Figure 2 Flood Area and Depth for May 11, 2006 in Soacha River and Tibanica River

1.2 Community

Many external organizations including international organizations carried out social, economic, educational and cultural work in Soacha Municipality as the most vulnerable areas, and producing a number of social studies and assessments about the conditions and needs that the population has to face.

With respect to the topic of disaster, studies about disaster prevention activities involving communities are quite limited. Practically, Community Based Disaster Prevention activities were not found in the area. In this sense, it is fair to state that one of the preliminary studies on community conditions from the perspective of disaster prevention was the Community Survey on Disaster Prevention, completed by this Study.

(1) Community Survey

In September 2006 the Community Survey Field Work in Soacha took place. A total of 24 barrios (“barrio” is a Spanish word, generally low income neighbourhood) mainly in Communes 2, 4 and 6 (only one survey occurred in a barrio of Commune 5) and five rural communes were surveyed. Prior to the full scale survey, an experimental survey were done to detect inconsistencies. In the full scale survey, a total of three hundred sixty three surveys were completed between September 19th and September 29, 2006.

The Community Survey contents addressed five topics: Location, Respondent and Housing Characteristics; Experience in Disasters and Risk Perception; Self help and Community organization in Disaster Prevention; Involvement and Active participation, all these distributed in seventy one questions.

The results of the survey were summarized as follows:

- People in high vulnerability have been only recently living in Soacha (12 years). The majority of respondents were women and elders.
- Households contain large and extended families with unstable income and high illiteracy rates
- The majority of people surveyed had experienced emergencies or disasters, and expressed being fully aware of their exposure at the locations where they live.
- Self help and network ties appeared insufficient, and access to information or training on disaster prevention was recognized as neglected. Willingness to get involved in prevention and preparedness activities appeared high, being higher the interest of adults rather than youth.
- Time availability to voluntarily participate in community based flood monitoring and early warning system was found to be high, particularly in a daily basis.

(2) Focus Groups

Focus groups as participatory research methods were used for the planning process. The purpose of the Focus Groups was to expand knowledge on qualitative information difficult to gather through other means, such as the quantitative survey. Also it served the purpose to understand the relations among issues (emergencies and disaster, development, and resources), and to create a scenario where the participants could set their own vision of priorities, actions and actors in disaster management activities.

Two Focus Groups were implemented for the flood component: one in the area of Tibanica River and the other one in Soacha River, including people coming from the upper stream as well as those directly affected by May 2006 floods while initially three Focus groups were considered.

Each session started with an explanation about what is a Focus Group. Two questions were addressed in all four events about community perceptions on disaster preparedness for the study: 1) What are the priority actions to be addressed in the area with

respect to community based disaster prevention, and 2) Who are the most likely agents to be involved in the topic of preparedness. In addition, a topic was posed by the facilitators, as a free topic because leaders have their own questions and topics to discuss, which tend to stem out from collective discussions. In each session, the last half an hour was devoted to an “emerging” topic, which proved to be convenient in rounding up some of the ideas that were talked about during the session.

Summary ideas of the Focus Groups:

The communities, based on the opinions of their representatives attending the events, appear to know and be fully aware of their risks and their reality. They understand quite well the need to organize themselves to improve their living conditions and their surrounding environment. At the same time they visualize larger -rather than partial- solutions as acceptable. They prefer physical works rather than soft measures only. They see practical training rather than information and awareness rising only as needed.

Agreement was found on the need to visually demark the areas of high, middle and low risk. This task is a key as an initial task on community based disaster prevention work. Easy to understand explanatory messages located in public visual places in the risky areas was regarded as highly necessary. Following this boundary delimitation, public works needed to take place: sanitary pipes channeling the sewerage effluents from the neighborhood, separately from the river flow, in case of flood disasters; and safety recovery works on slope areas abandoned by former mining practices.

Community members explained and strongly requested the urgency of resolving the vicious circle (cause-effect) of investment in high risk slope areas, and the people’s exposure to the risk itself. The lack of infrastructure works to channel fluids draining over the top of the hills is one of the most important solutions to stop the hazard created by these types of water. The communities exposure to landslides are created by the lack of infrastructure works controlling the spontaneous drainage and infiltration of the sewerage, grey waters and rain runoff.

The attendees envision the population at risk to be resettled in a different safe place, permanently rather than temporarily. With respect to the collaborative efforts, the community members understand and are willing to organize the neighbors, but do request proper promotion and facilitation tools, accompanied of the willingness from the municipal authorities to address the issues above mentioned.

The final idea is that collaborative efforts between neighboring barrios are possible. Coordination was regarded as highly necessary. Collaborative settings would lead community leaders and municipal authorities to work side by side. This framework would allow building trust amongst each other, setting a consensus-based agenda and advancing on the improvement of the hazardous conditions in an organized manner, again, under clear communication settings between all stakeholders.

2. PLANNING PROCESS FOR MONITORING AND EARLY WARNING SYSTEM

2.1 Planning Principle

The Study Team proposed the following basic principles for the planning.

Table 1 Principle for Monitoring and Early Warning System Planning

- | |
|---|
| <ul style="list-style-type: none">a) The purpose of the proposed plan is to prevent the people in the previously affected area from the same flood damage in near future, or mitigate the future damage by the plan.b) Thus, as a tool for the above, monitoring of hydro-meteorological conditions by equipment and preparation of early warning system based on the monitored data are required. |
|---|

- c) Therefore, it should be pointed out that the people who should evacuate in an event of flood understand the meaning of the early warning system and they take necessary actions are quite important. In this sense, unless the people understand the importance of the system and can make use of the system actually, any expensive equipment for the monitoring and early warning is meaningless.
- d) Those of communities and the government who understand the meaning of early warning criteria should exchange and transfer information on rainfall and waterlevel both in normal and critical time. The establishment of information transfer system among communities is the most important.

It should be certain that the introduction of advanced technology such as telemeter system is not denied, however, considering the current resources and communities readiness of the Municipality, the Study Team has studied and discussed what to do at first in Soacha in order to achieve the study purposes believing that installation of monitoring equipment in the study area is just a tool.

2.2 Planning Concept

In order to formulate the effective monitoring and early warning plan, the following planning concepts are applied.

- Provision of warning and evacuation information to communities in secure and timely manner
- Maximum utilization of existing information monitored by other organizations
- Maximum mobilization of local resources
- Set appropriate warning criteria

The planning process for the monitoring and early warning system is characterized by the series of community workshops listed in Table 3. In the course of these workshops (Figure 6), the mechanism illustrated in Figure 4 was established.

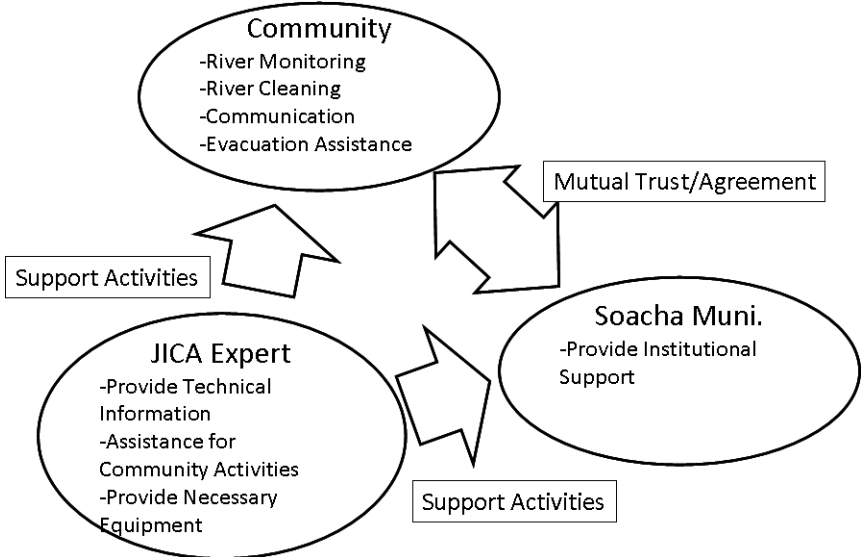


Figure 4 Established Collaboration Mechanism

2.3 Overall System Planning

The proposed monitoring and early warning system for Soacha Municipality is a total system composed of four sub-systems namely, 1) Monitoring and Data Gathering System, 2) Data Analysis and Processing System, 3) Information Dissemination System, 4) Warning Criteria, with community based evacuation planning.

The overall system planning (schematic diagram of information flow and system components) is shown in Figure 5, and brief descriptions of each sub-system are shown in

Table 2.

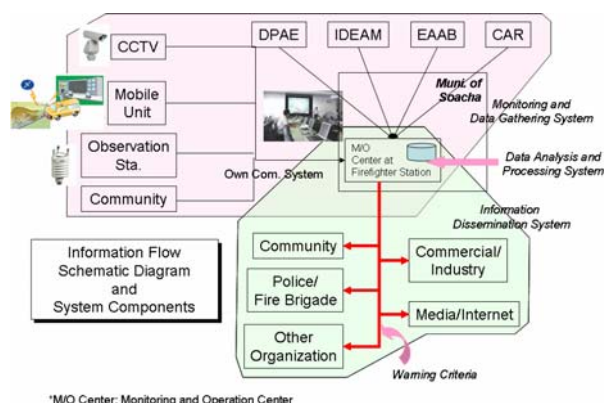


Figure 5 Overall System Planning (Future Image)

(note: “DPAE, IDEAM, EAAB, CAR are other , higher governmental organizations)

Table 2 Brief Descriptions of Sub-Systems

| Name of Sub-System | Description |
|--------------------------------------|---|
| Monitoring and Data Gathering System | To collect the information related to issuing the warning, this sub-system consists of monitoring network with other organizations, monitoring station, and communication network between station and Soacha Municipality office. |
| Data Analysis and Processing System | The collected information are processed and analyzed in Soacha Municipality office which plays a center of monitoring and operation. Based on the analysis and the Warning Criteria, Soacha Municipality is to issue warnings. |
| Information Dissemination System | To disseminate warnings and related information, communication network with community people and concerned organizations with certain methods for warning is installed. |
| Warning Criteria | Warning criteria includes threshold levels which are determined by hydrological analysis, organizational arrangements by warning phase, and form of warning. |

Table 3 List of Community Workshops

| Date | Contents |
|----------------|--|
| 2007/2/18 | Past floods in Soacha river and community map |
| 2007/5/18 | Soacha river monitoring and early warning system |
| 2007/6/2 | Community plan, setting of preliminary responsible for waterlevel monitoring |
| 2007/6/13 | Community prevention plan, information transfer |
| 2007/6/23 | Community prevention plan, evacuation meeting points |
| 2007/6/27 | Community prevention plan, time estimation for evacuation, shelter conditions and preparing of community meeting for July 2007 |
| 2007/July | Community meetings held by communities themselves. 170 people attended for 5 meetings. |
| 2007/September | Preparation, training and drill simulation, evacuation drill |
| 2007/November | 2 nd evacuation drill. Approx. 1,600 people attended in the drill. |

During the Study, a set of activities were done to advance the Community Based Disaster Management Plan in the pilot area of Soacha River Basin as a pilot activity.

The activities were mainly done at the area where was affected during the May 2006 flood disaster. At that time eight neighborhoods were inundated and all neighborhoods are located at the left side of the Soacha River. A rough estimation of the population in this affected area is five thousand.

These activities were mainly community based workshops, building community hazard and resources map for disaster prevention; field visits to confirm the existing situation or to learn about the upper stream conditions of the watershed; community based monitoring trainings, interagency coordination meetings, and self prepared neighborhood meetings.

The most constant activities were the set of community workshops - an iterative process where most of the leaders of the neighborhood associations (JACs; Junta de Acción Comunal) built collaboratively the contents of their Community Disaster Prevention Plans.

The workshops were initiated by identifying the hazard condition, the flood scenario and their exposure during the May 2006 emergency. They went through the remembering what happened, how did they act, what were the types of affectation. This information was reflected in Community Maps by neighborhoods.



On September 17th 2007 the communities worked on their own to define their evacuation plan. Each group of neighbourhood members discussed their specific ways to involve their neighbours and themselves, particularly those at higher risk. Fire fighters were present to give the support needed during the session. Children and youngsters were part of the plan.



Figure 6 Community Workshop

During the following activities, the Community Map would be improved until reflecting best the current status of the neighborhoods, in disaster prevention matter.

During the month of May and June in 2007, the leaders started building and setting up their prevention strategies and the actions to be taken in order to avoid experiencing again the regretful situation and consequences suffered during May 2006. The process of workshops allowed creating an environment where capacity was strengthened and confidence was gained.

During the workshops, knowledge was collaboratively constructed, whether coming from community members, firefighter, Red Cross volunteers, JAC leaders or CLOPAD (Comité Local para la Prevención y Atención de Desastres) /Alcaldía officers. A sense of wide cooperation was gained over time during the month of June. This consequently leads the community leaders to commit to prepare and execute community meetings during the month of July on their own. All the spatial information collected and created during the workshops was consistently added to the set of community maps, and used for the community meetings. At the same time, handouts were given out to members to each one of the neighborhoods, with specific data such as contact persons and phone numbers of leaders on their area. The handouts contained also a photo of the map of their area, and simple key messages explaining how to be prepared.

A First Respondent Training Course coordinated with Red Cross Trainers, an Evacuation Simulation Session, and several preparation meetings lead to the first Community

Based Flood Evacuation Drill which took place on September 22nd. Six neighborhoods participated in the Drill. Approximately 530 people participated in the evacuation, lead by 50 to 60 leaders.

An evaluation session held after the Drill revealed both the satisfaction for the growth experience and the desire to improve key aspects. More community involvement, improved encouragement strategies towards the public, better coordination between JAC leaders, street and meeting point coordinators, better assessment of families at the meeting points, were some aspects mentioned. The presence of the police or security persons was mentioned as a factor that could have given confidence to families that refused to participate, to leave their homes and join the evacuation exercise.

3. Proved Effectiveness of the Planning Process

The effectiveness of the above activities was proved by the following.

- 1) Starting of rainfall, waterlevel and riverbed monitoring in voluntary basis by the communities along the Soacha river,
- 2) Establishment of information transfer system among communities and the city through the radio provided by the city, to share the real-time monitoring information.

Regarding the above 2 effectiveness, the community members and leaders established themselves responsibilities on prevention activities; monitoring of whether, the rain and water level gauges and the river bed elevation, setting and testing the communication equipment, learning the procedures of formal communication between stations and with the Firefighter Station (Figure 7). Also getting acquainted between neighbours, through informal means about how to raise awareness into the family members of each one the neighbourhood streets. In the course of workshops, the City decided to provide with community leaders the official handy radio receivers which are used between Police, Firefighter and the City. Through the radio communication system the leaders were able to inform themselves, and inform the Firefighter Station about the conditions of the river.

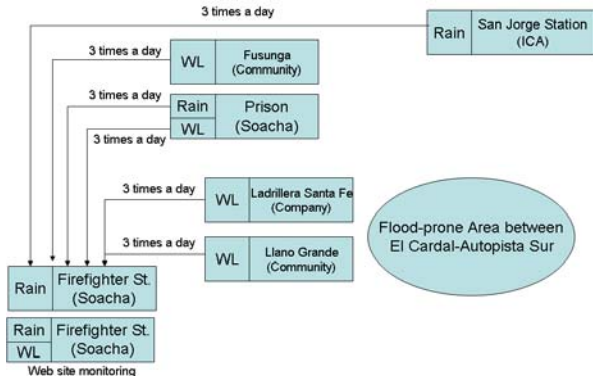


Figure 7 Information Transfer Flow Diagram

- 3) Starting of community meetings by community members themselves (July 2007).

The communities organized and held their own meetings from July 2007 after the Study Team guided to set up the initial community workshops from January 2007.

- 4) The city officials such as city engineers and fire fighters become familiar with the watershed conditions and monitoring person’s daily activities.

The observers at monitoring station inform the current data to Firefighter station as shown in Figure 7. The Firefighters and communities communicate daily and exchange information on watershed conditions. By this communication system, the Firefighter can get other important information quickly on local accidents, forest fire, etc. and start response

more rapidly.

5) The most remarkable evidence of the effectiveness was that in Nov. 2007 more than 1,600 people participated in the flood evacuation drill organized by the city and the communities themselves based on the planning process executed by the JICA Study.



During the field visit recognition of the watershed, leaders from up and down stream exchanged names and phone numbers to keep in touch for any abnormal behaviour of the river



Left: Alcaldía, Red Cross, Civil Defence and Firefighter's setting up their roles as CLOPAD – disaster prevention local committee. Right: CLOPAD's work, building the first draft of the Scenario for the September 22nd Flood Evacuation Drill.



On September 20th Red Cross staff held a Training event for the community leaders of all neighbourhoods prone to affection due to the river Soacha. The topic was First Community Responder. After the training, the leaders met in subgroups to discuss about how to address the response in each one of the streets.

Figure 8 CLOPAD preparation sessions

On November 8th, 2007, the second and complete evacuation drill took place. All parts of the Early Warning System, the upstream stations, the Firefighter Station; the central information location and the affected communities downstream, were included in the exercise. An evaluation of this exercise suggests the important lessons learned from the experience, shedding light to final recommendations for the future activities to be continued by the CLOPAD members and Community Leaders themselves.

The final activity to wrap the entire plan was the Seminar held on November 13th. CLOPAD members and community leaders and other officers attended the Seminar, and were able to listen to the contributions offered by the selected lecturers of a community observer from the upstream of Soacha River, a JAC leader from the affected downstream area, the firefighter head officer, and a Civil Defence representative. As a closure of the Seminar, all parties signed a commitment Agreement to continue the monitoring work, the improvement of the river and the inter-community and inter-institutional coordination for disaster prevention.

4. Applicability of the Planning Process to Other Similar Areas

In order to establish the effective, efficient and sustainable system, a strong involvement and mutual collaboration at the community is required, and to do so, collective activities with communities, city government and foreign experts in the planning process were taken.

The river engineer clarified the flood mechanism of the river set preliminary warning criteria, letting community understand the flood phenomena through a series of workshops organized by the community expert. The city government supported the activity by providing their resources. The series of workshops were held to enhance the knowledge of flood mechanism that covered town watching, community based hazard mapping and training of monitoring activity. Finally, the community based monitoring and early system has been established as an output of the collective work of planning process. The early warning system plan covers from monitoring to evacuation.

This good practice would be beneficial and applicable to the sustainability of the monitoring and early warning system. This JICA Study revealed that this kind of technical cooperation is able to contribute capacity development. Therefore the methodology, experience and activities in this JICA Study could be expanded to other municipalities as well as to similar situation's local communities in foreign countries for flood risk reduction.

ACKNOWLEDGMENTS

It is appreciated that JICA Headquarters approved to present this paper in this conference. Also a very special thanks goes out to officials and community people of Soacha Municipality. In conclusion it is recognized that this paper would not have been possible without the cooperation of all related with the JICA Study.

REFERENCES

JICA (2008), Study on Monitoring and Early Warning System for landslides and Floods in the Republic of Colombia, Final Report.