Rivercourse Irrigation Systems Inventory (RISI): An Experience from West Sumatra, Indonesia

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INTRODUCTION

The increasing concern about the performance of irrigation projects has increased the need for better project plans and designs. Many irrigation projects do not perform as planned because of the failure to take socio-technical aspect into account in the planning phase. Improving irrigation project planning requires the availability of information related to irrigation system development. Rivercourse irrigation systems inventory (RISI) is seen as one of the alternatives to provide adequate information for irrigation development planning.

In the province of West Sumatra, Indonesia, the irrigation systems inventory has been done since 1986. The inventory focuses on providing information about irrigation systems along rivercourses. The rivercourse was chosen as a basis for doing inventory for two reasons. First, West Sumatra is a hilly/mountainous area. The topographic situation limits the area that could be irrigated by any particular irrigation systems. Therefore, small-scale irrigation systems will continue to play a major role in future irrigation system development. Second, intersystem linkages arise when multiple system use water from the same source. Therefore, availability of information regarding irrigation systems along a particular river will help improve intersystem water allocation and distribution.

The RISI in West Sumatra consists of five main activities, namely: (1) preparation (including training for field staff and acquisition of maps), (2) interview, (3) walkthrough along the river, (4) system irrigated area estimation and (5) data processing and presentation. There are four forms of RISI results: (a) rivercourse schema, (b) weir dispersion location on topographic map, (c) schematic presentation of the weirs along a particular river and (d) matrix presentation of information on irrigation systems.

The inventory data are currently used for planning provincial government assistance for village irrigation systems. In the long run the data could be used as basic information for planning government assistance to avoid any negative impact on inter-system water distribution and to establish water right policy and regulations.

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THE EMERGING IDEA OF RIVERCOURSE INVENTORY

A series of research activities by Andalas University on the management of irrigation has been undertaken in the province of West Sumatra, Indonesia since 1982. The research has been undertaken to understand the dynamics of irrigation systems management and the impact of government assistance on traditional farmer-managed irrigation systems. The second research project in 1984 aimed to compare the dynamics of the management of several systems located in the upstream, midstream and downstream of a particular rivercourse. In undertaking the research, a pair of sample systems were selected from each location (upstream, midstream and downstream). The sample systems were also representative of the two groups of irrigation systems, namely those that have received assistance from the government and those that did not receive any assistance (traditional farmer-managed irrigation system).

In the effort to select the sample systems, secondary data from the provincial irrigation service and its branch office in the district level were gathered. When it came to choose the sample systems there were difficulties in finding a pair of a government assisted system and a farmer-managed irrigation system in each location. This was because, based on secondary data, the number of farmer-managed irrigation systems that had not received any assistance was limited. On the other hand, interviews with the farmers and field observation indicated that the number of FMIS must be more than the available recorded data. The researchers at that time agreed to do an inventory along selected river in the research site. Therefore, the objective of the first inventory was to select the research site.

With the gained knowledge on the dynamics of system management, the researchers realized that there is a broader need for doing and inventory for purposes other than just site selection for research purposes. First, intersystem linkages in using water from the same source existed. Therefore, knowing all the systems drawing water from the same source would be helpful in improving coordination in distributing water among the irrigation systems. Second, government assistance to a particular system has negative impacts on the traditional arrangement among the systems in using water from the same river because the government did not recognize the existence of other systems outside their record. With the inventory data, the government would have a basis for planning and implementing a stronger assistance to small-scale irrigation systems.

THE DEVELOPMENT OF THE RISI METHODOLOGY IN WEST SUMATRA

Learning to be Effective

When this issue was brought to the provincial irrigation service, this agency recognized the importance of doing rivercourse irrigation systems inventory in West Sumatra. The main reasons were as follows:

> First, the West Sumatra province is a hilly/mountainous area. The topographic situation limits the area that could be irrigated by any particular irrigation system. Therefore, along a particular river, a large number of small irrigation

systems can be found. A case in point is the Tampo River in the District of Tanah Danar which is 32 km in length and flows from an area of about 1,000 meters above sea level down to 183 meters above sea level. It has 65 irrigation systems located in the middle portion of the river which is only about 19.5 kilometers in length. It shows a 3.3 density of irrigation offtake per kilometer length of the river. The high density of irrigation offtakes along a particular rivercourse requires careful planning to maintain or improve the performance of the systems.

Second, the physical environment of the irrigation systems as explained above also exerts some influence on irrigation system management. This, in turn, affects the institutional arrangements of intersystem water distribution. Planning an intervention to develop a single irrigation system needs to take the whole network into account. Therefore, knowing the configuration of irrigation systems existing along a river course would help to improve the efficiency and equity of water used from the same source.

In short, the irrigation system inventory along the rivercourse aimed to generate information on both the physical and social conditions of irrigation systems. The information would be used to support irrigation systems development and to improve its management in the future.

In the effort to develop the RISI methodology and to give its researchers fresh experience in how to undertake the inventory, Andalas University spearheaded an inventory of irrigation systems. The activities started with a small workshop which was attended by the researchers. The objective of the workshop was to develop a framework for inventory activities and discuss in detail the techniques and equipment. From the workshop, the researcher realized that at least three types of skills and equipment have to be obtained, namely: 1) the skill to read topographic maps and the availability of the maps preferably with the scale of 1:20.000 or less; 2) interview skill and the interview instrument; 3) walkthrough skill and the walkthrough equipment; 4) the skill of estimating the command area by using simple equipment; and 5) the skill of making simple maps and schemas for reporting.

Based on the skills needed, it appeared that training was an important element in the inventory activities. Consequently, training materials were prepared in line with the agreement between Andalas University and the Directorate of Irrigation I (DOI I) in preparation for a pilot inventory.

It was agreed that the pilot activity would cover an area under the jurisdiction of Batusangkar District Irrigation Service. Since the main intention of the pilot inventory was to develop the RISI methodology, the researchers from Andalas University played a major role. The staff of Batusangkar District Irrigation Service were also involved in the field data collection. They were trained prior to the actual collection of field data. Based on the experiences and results of the pilot activities, a book on RISI methodology was prepared which was used for the next RISI activities in different districts.

Learning to be Efficient

As mentioned above, the first ISI undertaken as a pilot project in the Batusangkar District Irrigation Service was in fiscal year 1986/1987. This activity was then continued in the Payakumbuh District Irrigation Service in fiscal year 1989/1990.

There is an important difference between the RISI undertaken in Batusangkar District and in Payakumbuh District. The objective of the RISI activity in Batusangkar District was to develop the RISI methodology, therefore, researchers from Andalas University played a major role in undertaking this activity. On the other hand, the RISI in the Payakumbuh District aimed to develop the capacity of the agency staff to do RISI on their own. As such, the involvement of the researchers from Andalas University in the latter was limited to training, monitoring and providing guidance while the major roles in field data collection and data processing were carried out by the staff of the District Irrigation Service.

The following are some interesting experiences with regard to the second phase of the RISI activities:

1) Field staff felt that their involvement in RISI improved their familiarity with their own area of jurisdiction. This in turn enabled them to perform their tasks better.

2) Since RISI was only one of the several activities that have to be handled by the field staff, the longer time taken for them to conduct the RISI would help ensure better quality of data collected.

THE CONDUCT OF RISI

As mentioned above, there were five main activities in RISI: preparation (including training) and acquisition of maps, interview, walkthrough along the river, system irrigated area estimation and data processing and report writing.

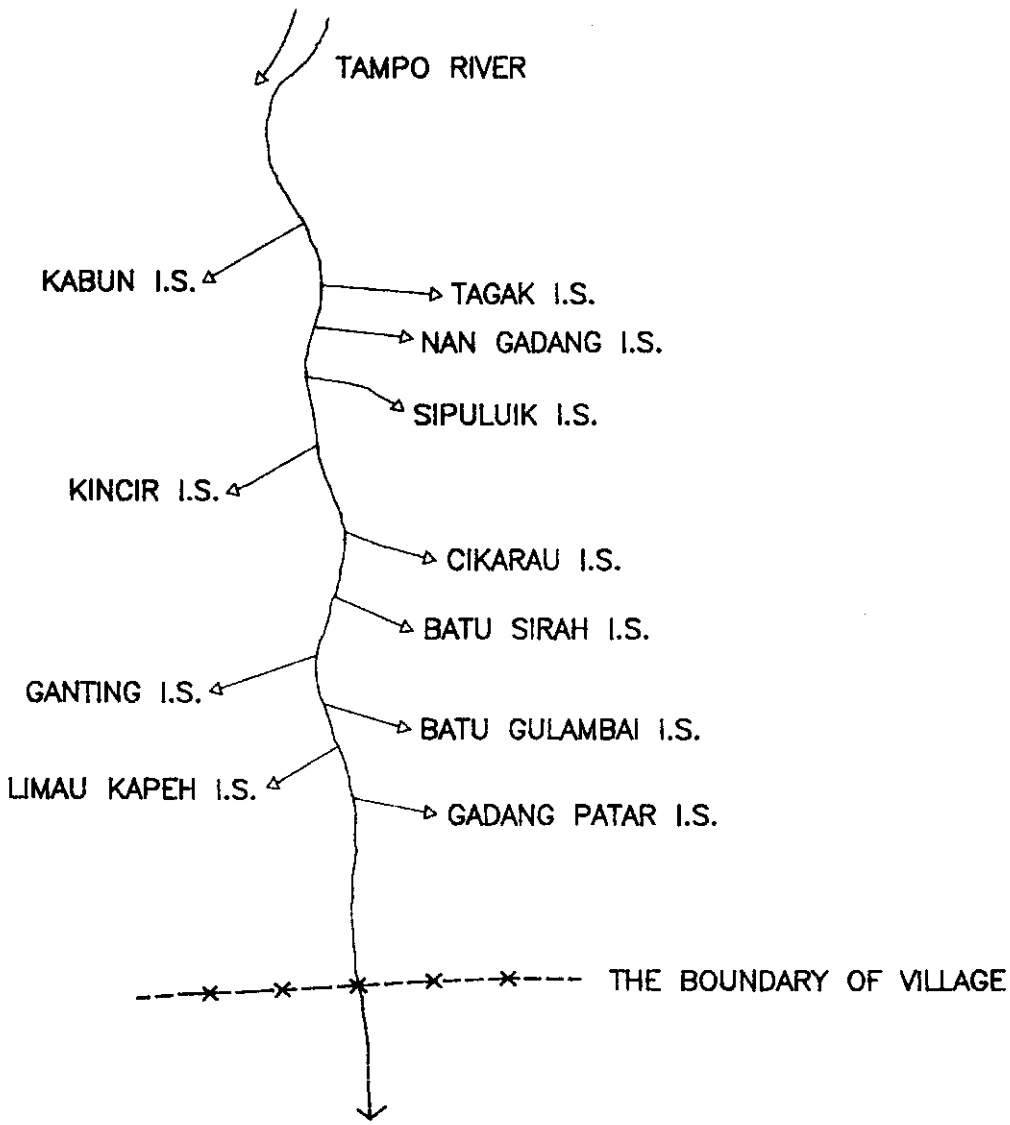
1. In the preparation of the maps, the equipment needed were first made available. Then the maps were surveyed to determine the length of the river and establish local administrative boundaries. Based on the information available from the maps, initial RISI workplan was made.

2. Field interviews were basically done based on village boundaries. Key informants, who have knowledge of irrigation systems were interviewed to get technical as well as social information on the systems located in the particular village. A rough sketch map of the systems along a portion of a river which traverse through the village was then prepared (see Figure 1).

3. To validate the results of the interview, a walkthrough was done. The walkthrough also aimed at plotting the weir position on the topographic map.

4. The fourth activity is the estimation of the irrigated area for each irrigation system in a village (nagari) or a community with smaller coverage. The estimation was facilitated by the key informant who made a list of the command area of the systems in the village which reflected the ranking of the command area based on their relative size. The estimation of the command area was done in the form of a proportion by comparing the command area of each system to any system whose command area was known to the key informant. The researchers themselves, then, measured the area of the system by converting the proportion form into hectarage with the aide of simple equipment e.g. compass and meter band. This information was thought to be helpful in planning water use in a particular area.

Figure 1. Rough sketch map of a portion of Tampo River in Batu Bulek Village



I.S. = STAND FOR IRRIGATION SYSTEM

THE RESULT OF RISL

The series of activities mentioned above were done in all rivercourses and the result is presented in several forms: (1) rivercourse schema; (2) the weir location dispersion on topographic maps; (3) schematic presentation of the weirs along a particular river; and (4) matrix presentation of information on irrigation systems. The rivercourse schema contains the name of the rivers, direction of flow, and code number of each river (see Figure 2). The weir location dispersion show the direction of water diversion from the river, the ricefield served by the systems, administrative boundaries, settlement areas, roads and other natural marks like lake, hills, etc. (see Figure 3). The schematic presentation of the weirs along a particular river show the direction of diversion, the name of each irrigation system, code number, area served and distances among the weirs along the river (see Figure 4).

The matrix of information contains code numbers of the system, system name, management status of the system, name of village and subdistrict where the weir is located, type and construction of weir/flushing gate intake, the width of the river at the weir location, percentage of ricefield irrigated in dry season, hydrological linkages in using water from the river with other irrigation systems upstream and/or downstream, intersystems conflict, possibility for area expansion, the name of water user organization and key informants for a particular system (see Figure 5).

Figure 2. The rivercourse scheme

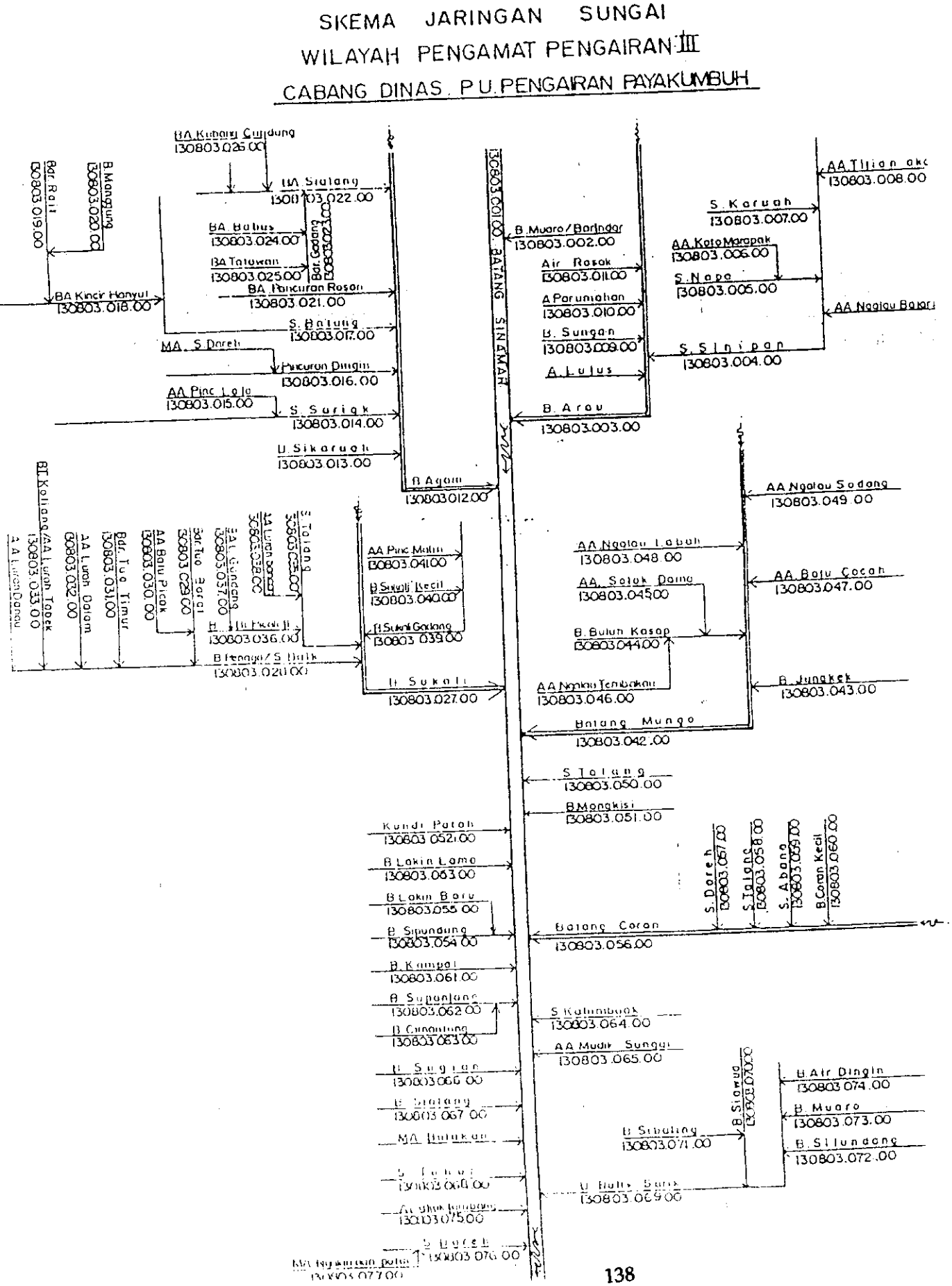


Figure 3. The weir location dispersion on topographic map

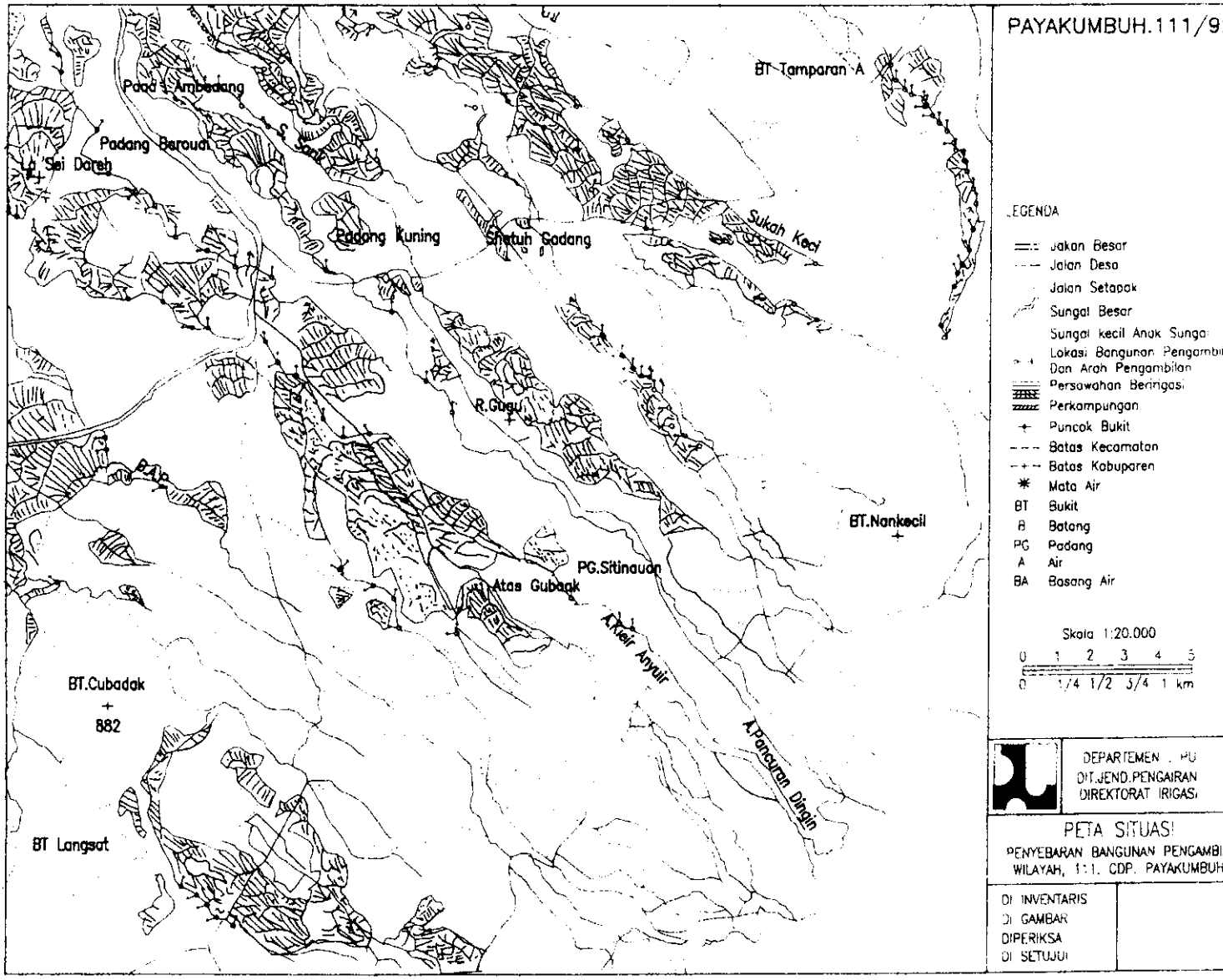


Figure 4. Schematic presentation of the weir along a particular river

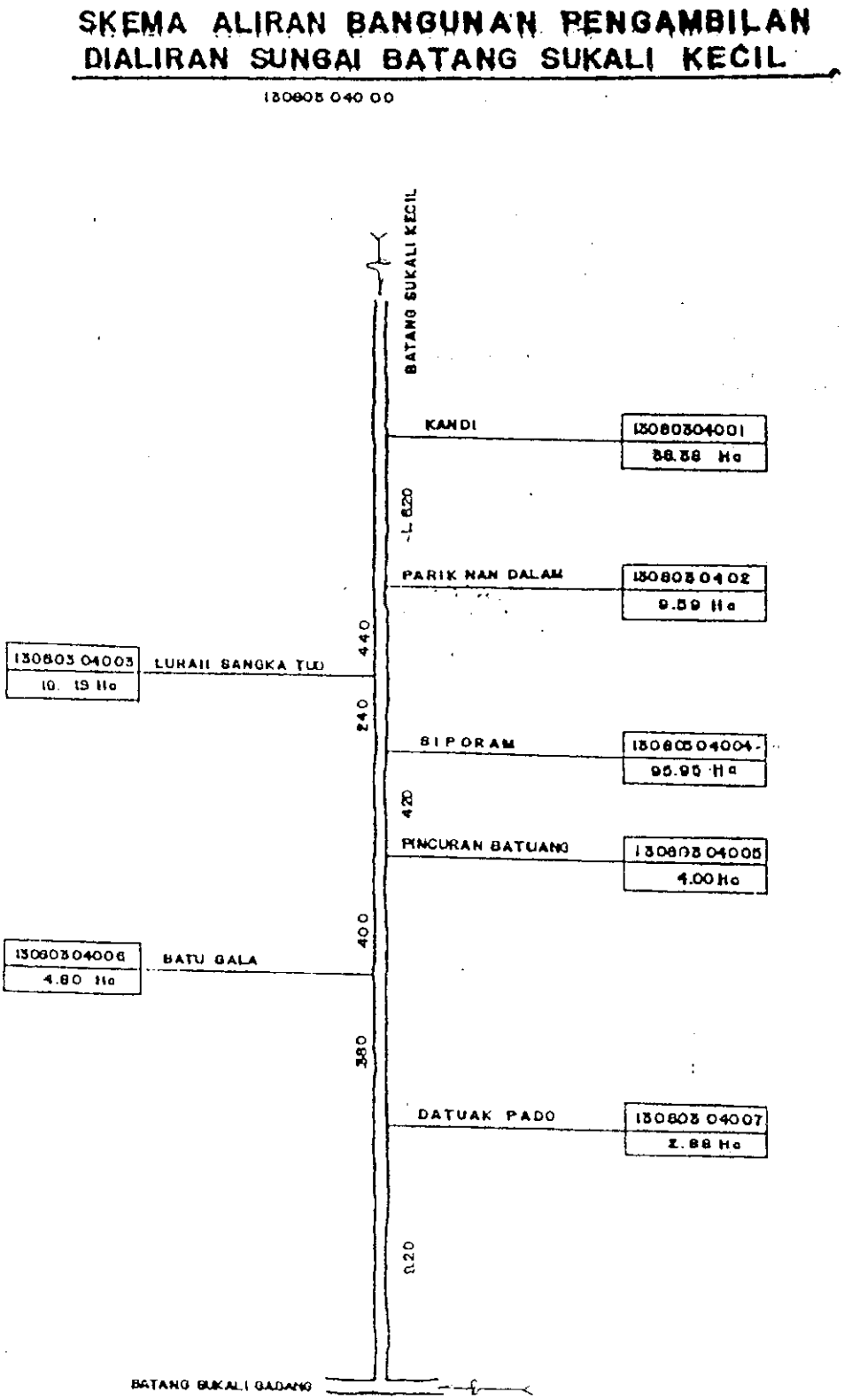


Figure 5. Matrix presentation of irrigation system information along a particular river

MATRIK DAERAH IRIGASI DI ALIRAN SUNGAI B. SUKALI KECIL

WILAYAH PENGAMAT [I] CABANG DINAS PU PENGAIRAN PAYAKUMBUH

13080304000

Nomor Kode	Nama DI	Klasifikasi		Bangunan Pengambilan							
		PU	Desa	Lokasi Pengambilan Desa / Kecamatan	Peninggi Muka Air: Jenis	Peninggi Muka Air: Konstruksi	Penguras: Dengan/Tanpa Pintu	Penguras: Konstruksi	Intake: Dengan/Tanpa Pintu	Intake: Konstruksi	Lebar Sungai (m)
1	2	3	4	5	6	7	8	9	10	11	12
13080304001	K a n d i		x	Situjuh Gadang / Kec.Luhak	Peliritan	Batu susun	Tidak ada	0	Tanpa Pintu	Tanah	2.6
13080304002	Parak Nan Dalam		x	Situjuh Gadang/Luhak	Peliritan	Batu susun	Tidak ada	0	Tanpa Pintu	Tanah	2.7
13080304003	Lurah Sangka Duo		x	Situjuh Gadang/Luhak	Peliritan	Batu susun	Tidak ada	0	Tanpa Pintu	Tanah	2.9
13080304004	S i p o r a a		x	Bulakan Tinggi/Luhak	Peliritan	Batu susun	Tidak ada	0	Tanpa Pintu	Tanah	2.8
13080304005	Pincuran Batuang		x	Bulakan Tinggi/Luhak	Peliritan	Batu susun	Tidak ada	0	Tanpa Pintu	Tanah	3.5
13080304006	Batu Gala		x	Bulakan Tinggi/Luhak	Peliritan	Batu susun	Tidak ada	0	Tanpa Pintu	Tanah	3.7
13080304007	Datuak Padu		x	Situjuh Gadang/Luhak	Peliritan	Batu susun	Tidak ada	0	Tanpa Pintu	Tanah	3.5

13080304000

Nomor Kode	Sawah: Desa / Kecamatan	Sawah: Luas sawah (Ha)	Sawah: Pola Tanam	Sawah: Intensitas tanam padi	Sawah: % sawah terairi pd musim kemarau	Hubungan Koordinasi dg.Oi lain: Pemakai Air: Hulu	Pemakai Air: Hilir	Pemeliharaan: Hulu	Pemeliharaan: Hilir	Konflik: Dalam Oi	Konflik: Antar Oi	Kekosongan per luasan areal	Pengelola: Nama/Organisasi pengelola	Pengelola: Nama Key Informan	Keterangan
1	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
13080304001	Situjuh Gadang / Kec.Luhak	38.32	Padi-padi	1.35	35	Tdk Ada	Tdk Ada	Tdk Ada	Tdk Ada	Tdk Ada	Tdk Ada	0	Masyarakat	Ot.Haro Itam	
13080304002	Situjuh Gadang/Luhak	9.59	Padi-padi	1.33	33	Tdk Ada	Tdk Ada	Tdk Ada	Tdk Ada	Tdk Ada	Tdk Ada	0	Masyarakat	Ot.Mangkuto Nan Panjang	
13080304003	Situjuh Gadang/Luhak	19.19	Padi-padi	1.65	65	Tdk Ada	Tdk Ada	Tdk Ada	Tdk Ada	Tdk Ada	Tdk Ada	0	Masyarakat	Ot. Kacu	
13080304004	Bulakan Tinggi/Luhak	95.95	Padi-padi	1.37	37	Tdk Ada	Tdk Ada	Tdk Ada	Tdk Ada	Tdk Ada	Tdk Ada	0	Masyarakat	Ot. Bandaro Panjang	
13080304005	Bulakan Tinggi/Luhak	4.8	Padi-padi	2.5	100	Tdk Ada	Tdk Ada	Tdk Ada	Tdk Ada	Tdk Ada	Tdk Ada	0	Masyarakat	Ot.Rajo Adil	
13080304006	Bulakan Tinggi/Luhak	4.8	Padi-padi	2.5	100	Tdk Ada	Tdk Ada	Tdk Ada	Tdk Ada	Tdk Ada	Tdk Ada	0	Masyarakat	Dauri	
13080304007	Situjuh Gadang/Luhak	2.83	Padi-padi	2.5	100	Tdk Ada	Tdk Ada	Tdk Ada	Tdk Ada	Tdk Ada	Tdk Ada	0	Masyarakat	Ot.Pado	

The selected data of the inventory results both from Batusangkar District and Payakumbuh District are presented in Table 1.

Table 1. Selected data of inventory results from Batusangkar District and Payakumbuh District

NO.	TYPE OF DATA	BATUSANGKAR DISTRICT	PAYAKUMBUH DISTRICT	TOTAL
1	Number of river	189	321	510
2	Total length of the river (km)	1,062	1,158	2,220
3	Total number of irrigation systems	2,413	2,202*	4,615
	> GMIS	128	86	214
	> FMIS	2,085	1,614	
4	Average length of the river (km)	5.62	3.61	4.35
5	The average number of irrigation system per river.	12.77	6.86	9.05
6	The density of irrigation system per kilometer length of the river.	2.27	1.90	2.08
7	Total area served (ha.)	26,874	24,870	

Source: PSI-Unand (1988) and PSI-Unand (1991)

* include 502 waterwheel

The main difference of the RISI findings with the government record is the number of farmer-managed irrigation systems. The record of the district irrigation service shows about 50 to 100 fewer FMIS than the RISI findings.

THE USE OF THE DATA

The inventory data are currently used for the purpose of implementation of the Governor Assistance Program for village irrigation systems in West Sumatra. For the long term, the data could be used as basic information for at least two purposes: (1) for planning assistance to the irrigation systems; and (2) for developing a policy and regulations on water rights.

1. *Planning Assistance to Irrigation Systems.* As mentioned earlier, government assistance programs which focus only on individual systems has caused negative impacts on intersystem water distribution. Inventory data give initial information on the possible impact of the assistance to individual irrigation systems.

2 *Developing a Policy and Regulation on Water Right.* As the availability of water becomes scarce and the demand for water for various uses increases, conflict over water use from the source would consequently rise. In order to overcome conflicts over water use, there is a need to establish water right regulations. The inventory data provides information on how the water from the source is currently being tapped, as input to the formulation of policies and regulations on water rights.

CONCLUDING REMARKS

This paper has discussed the development and use of the RISI methodology in West Sumatra. Since little attention has been given in the past to the availability of basic information for irrigation system development planning, there is a need to develop and improve the methodology the meet such information needs. The RISI methodology in its present form still needs improvement to meet the specific data need for irrigation development planning. We hope that it can contribute in enriching the available methodology forconducting irrigation system inventories.