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Assessing the Resurgent Irrigation Development Program of the Philippines – Communal Irrigation Systems Component

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Abstract

The project aims to evaluate the effectiveness and efficiency of the government's irrigation program with focus on the technical, physical, and institutional aspects of performance of communal irrigation systems (CIS). Cycle 1 involved the assessment of 66 communal irrigation systems (CIS) from 11 provinces in Luzon, while Cycle 2 covered 12 CIS from 4 provinces in the Visayas, and 12 CIS from 4 provinces in Mindanao. Provinces were selected based on the total FUSA served by CIS, while the selection of sample CIS per province were based on size category of service areas: small (50 ha and below), medium (between 50 and 100 ha), and large (above 100 ha). They were then characterized based on water source, type of extraction/ distribution technology (gravity, pump), FUSA, operational status and cropping intensity.

Primary and secondary data were collected. Key informant interviews (KII) of the RIO or IMO Managers, as well as other key actors such as NIA-IDOs and the IA President, were conducted using a structured questionnaire. Focus group discussions with IA officers/ members were likewise carried out. Walkthroughs to gauge the physical conditions of the systems were conducted in 2 of the 6 selected CIS from the 11 provinces in Luzon for a total of 22, and in all the 24 CIS selected in Visayas and Mindanao.

Majority of the selected CIS are gravity systems except in some provinces where there are more pump irrigation systems. Water sources of the CIS are lakes, rivers, creeks, springs, runoff and ground water. While some rivers tapped have adequate flows for irrigation even during the dry seasons, unreliable water supply is a major problem for majority of the CIS who tap water from less dependable small rivers and creeks, or rely on springs and runoff. In most of the CIS visited, farmers resort to conjunctive use of STWs with their CIS especially during long dry periods. Many CIS where found to be in slope greater that 3%, and as such, it is recommended to include all areas within 8% slope, minus the built-up and other protected areas as potential irrigable areas. The presence of a dependable surface water source and a good shallow aquifer, as well as the soil type and its suitability to different type of crops, should also be used as major criteria for irrigation development.

On the problem of water supply sources, there should be a concerted and united effort on the part of concerned government agencies like NWRB, NIA, BSWM, and the academe to identify potential sites for diversion dams and storage reservoirs. The estimation of dependable (low) water supply and flood (high) discharges for rivers is very important. As such, the shelved proposal for the institution of the National Water Resources Management Office under the Office of the President should be revived and reformulated. The institution of Water Resources Centers in selected state colleges and universities (SCUs), who can continuously gather, analyze and manage water resources data would be significant in building hydrologic database. All accumulated water resources data should be housed in a database center within the proposed super body.

There are a host of technical problems that confronts the IAs and the performance of their CIS. Most run-of-the-river type dams are old, and some with sediments almost at the crest level. Damaged sluice and intake gates are usually replaced with wooden flashboards, sand bags or stones, and defective lifting mechanisms are either left open or fitted with chain blocks. Sedimentation due to catchment denudation, mining, lahar, among others, is a major problem decreasing dam storage potential and canal carrying capacity. A positive aspect is that most CIS have concrete-lined main canals and laterals, and their conditions depend on the IA O&M and cleanup mechanisms. At any rate, sediment discharge estimation should be a prerequisite in feasibility studies and provision of silt control devices should be included in the design for sediment laden rivers.

Control structures include simple cross regulators, check gates, drop structures, division boxes and farm turnouts most of which uses wooden flashboards for water level control. Most service roads are in bad conditions with some dams accessible only by walking or by motorcycles. As in most irrigation systems, flow measurements are not conducted and there are no specific drainage canals at the CIS leading to flooding problems in some systems during the rainy season. Water distribution is usually from paddy to paddy, with few farm ditches contributing to large application losses.

Rehabilitation works have been performed through NIA's technical assistance and mostly done to correct damaged dams and headworks, lining of canals, and dredging of sediments. With the recent availability of low-cost HDPE pipes, the feasibility of using these materials for subsurface conveyance of irrigation to the fields, should be looked into.

Most IAs believe that they receive adequate water at the right time though frequent delays and inequitable flow distribution still abound. The IAs also generally rate their systems high in terms of water delivery, flexibility, reliability and equitability, and themselves in terms of water distribution and canal maintenance, indicating the high relative impact of NIA to the farmers.

There is no distinct pattern based on size of FUSA on the performance of CIS and functionality of IAs. Crucial is the capacity of each IA to harness its organizational capacity to build human, financial, social capital, thus, the need for continuous capacity building. CIS development remains dependent on government (i.e., NIA) assistance and the planned management transfer to LGUs based on AFMA is rarely implemented, if at all. Problems of sustainability of irrigation infrastructure loom due to persistent environmental problems (watershed degradation, siltation, extreme climate-related events). IAs apparently have none or limited role in watershed management but these can serve as partners in watershed management programs. The role of IDOs is very crucial but even with a heavy workload they are not getting adequate incentives (e.g. security of tenure and other benefits. Most often, IDOs are hired on job order basis with salaries drawn from CIS project budget.

All of the IAs interviewed were grateful for the FISA since they are relieved from paying the cost of their CIS. The IAs continued to collect fees from their members for their O&M, referring to them as irrigation management fee (IMF) or association service charge (ASC). However, some IA members are reluctant to pay any fee citing the implementation of FISA. IA's concerns in O&M and inadequate funds are persistent. FISA declared that O&M cost shall be provided by the national government. Therefore, there should be clear guidelines or provisions on this. FISA maintains the significant role of NIA in providing technical support to IAs and in building IAs' capacity to sustain their functionality. Thus, linkage between NIA and IAs should be sustained.

Keywords: communal irrigation systems, technical assessment, institutional assessment, Free Irrigation Service Act

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Assessing the Resurgent Irrigation Development Program of the Philippines—Communal irrigation systems component

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1. Introduction

1.1. Rationale

Irrigation projects are important components of sustainable agricultural and rural development. Irrigation enables farmers to exercise better control over their crop production environment. On the average, irrigation increases crop yield up to about 60 percent of the potential or optimum levels. Irrigation sector development in the Philippines has been a key policy instrument in addressing rice insufficiency which the country has been experiencing especially in times of high world prices, calamities and El Nino episodes. The most recent example is the Department of Agriculture's (DA) food staple sufficiency program (FSSP) which was essentially irrigation for rice despite pronouncements of diversification and provision of other support services in agriculture.

Irrigation development and management in the country has historically been the single biggest item of public expenditure for agriculture, accounting for about a third of the total since the 1960's. In the 1970s and early 1980s, as well as in recent years when world rice prices rose at unprecedented levels, this ratio averaged at close to half of total public expenditures for agriculture. Between 2011 to 2015, irrigation has taken up 31 to 46% of the budget of the Department of Agriculture (DA). This heavy bias on irrigation investment as a tool for addressing food insufficiency has been largely embraced by the recent administration with massive increases in funding for irrigation in 2017 and 2018. Appropriations for irrigation rose from ₱8 billion in 2008 to ₱24.4 billion in 2012. Over the next five years, funding for the irrigation program averaged ₱25 billion a year.

The Philippine Development Plan 2017-22 aims at an irrigation area ratio of 65.07 percent by 2022, up from 57.33 percent in 2015, or an additional 233,700 ha of irrigated area over a six-year period (corresponding to ₱70.2 billion at ₱300,000 development cost per ha) In view of the importance of irrigation in terms of national budget allocation and its expected contributions to agriculture and food self-sufficiency, it is only fitting to examine what is exactly happening in this sector, where the money is going, what will be delivered and whether the investments will increase productivity and be sustainable.

Many irrigation projects perform far below expectations primarily because of low water use efficiency. Available information indicate irrigation water use efficiencies in the order of 30% to 40% compared to design assumption overall efficiency of 50% or more. The end result is low cropping intensity (less than 130% for Philippines) and very low unit area productivity (David, 2003). A host of other issues and problems include unsuitable design philosophy and criteria, cost of operation and maintenance, inadequate support services, and institutional and governance issues. Sustainable irrigation development requires sound planning, design and operation and maintenance of irrigation facilities and effective delivery of irrigated agriculture support services and functions. Such services and functions include policy formulation and

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adjustments to promote a favorable environment for the development of efficient and effective irrigation facilities, agricultural and agro-industrial extension, capacity building at the grassroots level, credit and marketing facilities and inputs supply and distribution.

1.2. Objectives

The project aims to evaluate the effectiveness and efficiency of the government's irrigation program. It will focus on the technical, physical, and institutional aspects of performance of both national (NIS) and communal irrigation systems (CIS), and selected case studies. Technical and institutional evaluation will be conducted along the stages of the project cycle, namely: project identification; project preparation, appraisal, and selection; project implementation; operations maintenance; and monitoring and evaluation.

To establish baseline information for and provide preliminary evaluation of investments in CIS, this component of the project seeks to meet the following specific objectives:

a) Assess the performance of CIS based on field investigation covering the following systems:

i. In the Visayas, three (3) CIS each in Leyte, Capiz, Iloilo, Bohol, and if budget allows, Negros Occidental;
ii. In Mindanao, three (3) CIS each in North Cotabato, South Cotabato, Davao del Sur, Bukidnon, and if budget allows, Agusan del Norte.

b) Prepare a report on CIS evaluation that covers the following:

i. List of CIS under the Irrigation Management Offices (IMOs) and available data including functionality survey results;
ii. Technical data (i.e. physical state, service area, irrigation efficiency, source of water, access to and availability of water, year constructed and start of operations, construction cost, rehabilitation cost, other major investments, yield, cropping calendar, cropping intensity; and, where available, rainfall and other climatic data;
iii. Status of IAs (i.e. profile/institutional report of IAs, source of funding, financial status/viability, program of works (POWs) for all available years, and communal irrigation system performance (CISPER);
iv. Assistance provided by NIA and other agencies to IAs;
v. Where available, technical references including feasibility studies, technical drawings, network maps will be obtained and reviewed covering technical specifications, canal layout, location and functions of irrigation structures, and irrigated and built-up areas;
vi. Status and current conditions of the main canal, selected secondary, and tertiary canals;
vii. Socio-economic characteristics of farmer-members, institutional capacity of IA, problems and constraints in managing the CIS by the IAs;
viii. Conduct walk-throughs and actual measurements for a subset of the sample CIS to gauge the physical conditions of the systems;
    - current vs. designed dam/reservoir capacity; length and efficiencies of lined vs. unlined canals; legal and illegal turnouts, including functionality; for pump systems: fully, partially operational, or non-operational pumps; among others).
    - identify, geo-tag and evaluate dam, water control, measuring and conveyance structures;

ix. Characterize and evaluate the incidence of individual pump usage within or near the selected CIS, in terms of effectiveness and cost, in relation to gravity irrigation users, and;

c) With inputs from the socio-economist, integrate the findings of Cycle 1 and 2 into a single assessment report. Where applicable, the assessment shall cover operational and institutional factors related to construction and management of CIS. The report shall also include a set of recommendations for project implementation and systems management for CIS.

d) Present the preliminary results in an internal Research Workshop at PIDS, and the final paper at a public seminar organized by PIDS.

e) Discuss the problems/issues encountered by the IAs and farmers in relation to the operation and management of the irrigation system, access to funds for rehabilitation (LGU, NIA, other government agencies), access to production credit (including providers), technical support from NIA, support services from the DA, and their access to water (quantity and timeliness).

2. Conceptual Framework

The CIS assessment will be based on the rapid appraisal procedure (RAP) of irrigation projects by Burt and Styles (1999) and mapping systems and services for canal operation techniques (MASSCOTE) of FAO (Renault et al. 2007). The procedure provides a holistic overview of irrigation projects to show the factors affecting service delivery of irrigation systems (Figure 1). The framework maps the service to users taking into account the constraints, the opportunities for water management improvement, and the costs. This mapping in turn serves as an input in formulating strategies for water management service delivery, canal operation and modernization.

The framework describes a rapid appraisal process that take into account the various hardware design and management factors that affect service and correspondingly, the physical and institutional constraints which include aspects of water supply and sources of water and capacities of parties involved, availability and flexibility of funding, respectively.

Figure 1 shows some of the major inter-relationships which affect outputs from irrigation projects/systems. The RAP builds knowledge on the constraints and opportunities that the system management has to consider. Earlier applications in irrigation projects demonstrate that RAP, if developed and conducted properly, is a valuable diagnostic tool for a process and performance assessment. The RAP examines the hardware and processes used to convey and distribute water internally to all levels within the project (from the source to the fields).

This study will be limited to the application of the RAP and not the entire MASSCOTE approach because of the expected inadequate data. The RAP outputs include external and internal indicators. External indicators examine inputs and outputs of the whole project/system while internal indicators examine processes and hardware within the project/system. The internal indicators identify key factors related to water control throughout a project/system. They define level of water delivery service provided to users and examine specific hardware and management techniques and processes used in the control and distribution of water. The external indicators include ratios or percentages comparing project inputs and outputs to describe performance, measures of forms of efficiencies related to budgets, water, yields, etc.

Some questions on water users' association from MASSCOTE will be used in the assessment. This includes IA items on land ownership, IA budget and expenditures, basis of water charges, rating on IA's enforcement of rules, and on financial strength.

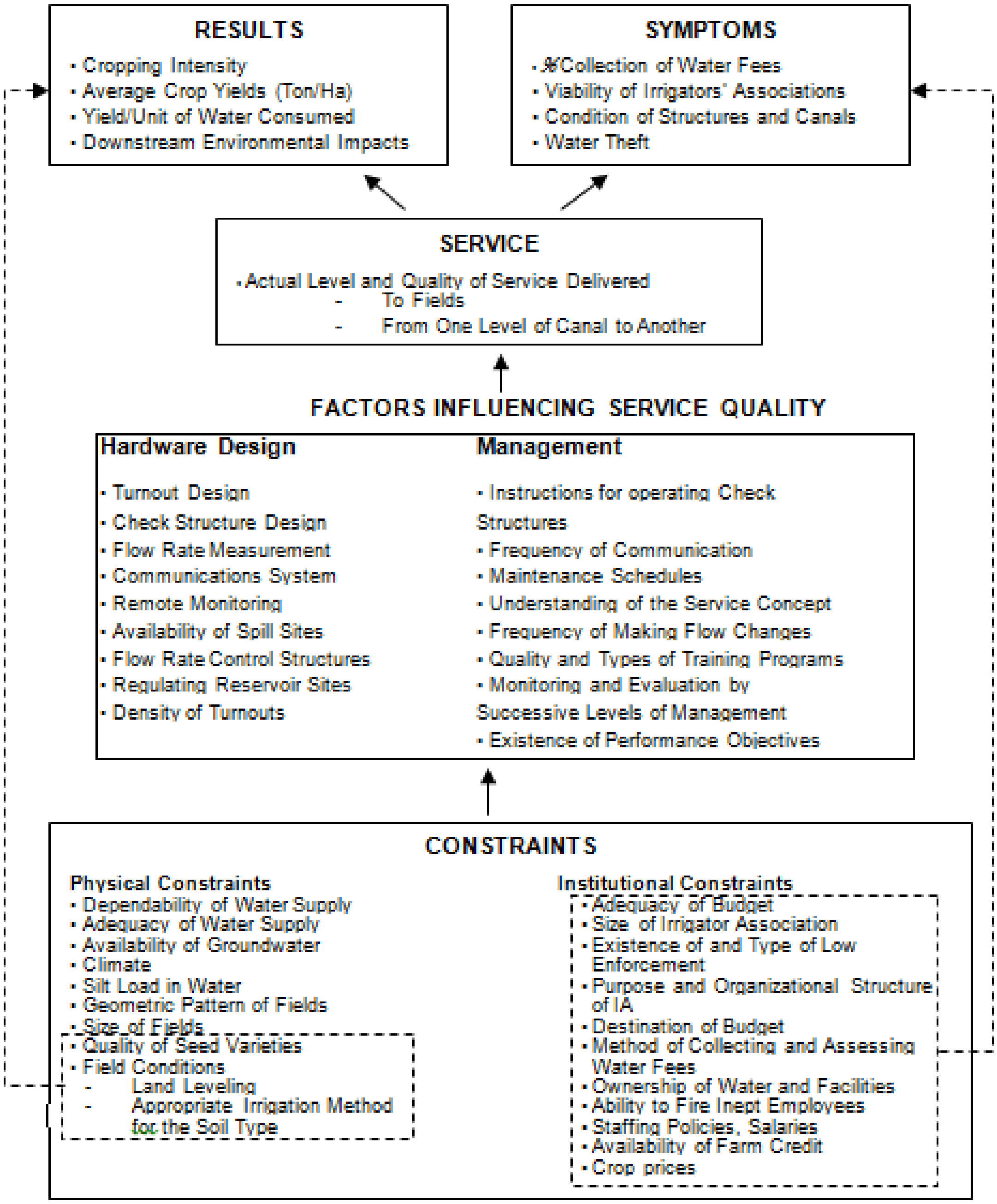

Figure 1. Conceptual framework of rapid appraisal procedure (RAP) and MASSCOTE.
Source: Burt and Styles (1999) and Renault et al. (2007).

3. Review of Literature

3.1. Status of Communal Irrigation Systems

NIA defines an irrigation service area as an area with irrigation facilities. The NIA service area refers to the target irrigable area during project development stage and should be differentiated from the irrigation command area or the actual area irrigated. The three types of irrigation are distinguished by its size, source of water, technology of water extraction and distribution, and the nature of governance.

Irrigation development in the Philippines has attained over 60% of total irrigable area of 3.1 million ha. Communal irrigation system covered approximately 663 thousand hectares, accounting for 35% of the total area served by irrigation systems in the country (Table 1). Development of irrigation system lags in the Mindanao region considering the large irrigable area, relative to Luzon and Visayas region.

Communal Irrigation Systems have service areas that are generally below 1,000 ha. At least 95% of CIS are gravity systems obtaining water from rivers or streams, though a few have been given funding support for medium sized pumps to also abstract and distribute water from a river. While most CIS are constructed by NIA, the IA is responsible for management and maintenance of the system.

David (2003) noted that from the early 1970s through mid-1980s, the government invested heavily in gravity irrigation systems development. In some years during this period, the investment in irrigation facilities accounted for more than 10% of the national budget for infrastructure. This heavy spending resulted in significant increase of the level of irrigation development, peaking at about 33% in 1993. However, the level of irrigation development went down to as low as 27% in 1994 and has been fluctuating from 27% to 30% since then.

The viability and effectiveness of an irrigation system depends on the design criteria used in planning and development. For instance, field observations in Ilocos Norte revealed that design shortcomings contributed to the poor operation and maintenance, and performance of gravity irrigation systems. This includes include errors in estimating design floods and sediment loads of rivers, lack of head control structures, ungated intake structures, and faulty design of farm ditches. The rate of deterioration at 140,000 ha per year of both NIS and CIS between 1996 and 2004 casts doubt on the sustainability of irrigation systems in the country. Institutional and policy reforms have to be effectively pursued (DA-UPLBFI 2007).

Table 1. Status of irrigation development in the Philippines as of December 31, 2017

REGION	ESTIMATED TOTAL IRRIGABLE AREA a/	Service Area (ha.)				Total	%	TOTAL REMAINING AREA TO BE DEVELOPED
		NATIONAL IRRIGATION SYSTEM	COMMUNAL IRRIGATION SYSTEM	PRIVATE IRRIGATION SYSTEM	OTHER GOVERNMENT AGENCY ASSISTED			
CAR	**111,295.65**	15,936.64	55,293.89	23,376.34	3,606.82	98,213.69	88.25	13,081.96
REGION 1	**264,491.00**	61,499.44	57,519.40	20,788.45	50,575.83	190,383.12	71.98	74,107.88
REGION 2	**457,246.76**	176,273.28	54,734.49	44,501.34	21,021.12	296,530.23	64.85	160,716.53
REGION 3	**483,830.18**	219,165.30	75,964.06	9,343.65	19,481.79	323,954.80	66.96	159,875.38
REGION 4A	**85,929.00**	29,034.00	22,778.00	7,288.00	2,553.00	61,653.00	71.75	24,276.00
REGION 4B	**143,558.95**	29,130.59	39,372.92	14,973.91	12,596.00	96,073.42	66.92	47,485.53
REGION 5	**239,440.00**	24,016.05	74,613.04	25,059.00	15,966.30	139,654.39	58.33	99,785.61
REGION 6	**191,253.16**	53,935.08	39,035.13	15,309.81	15,012.30	123,292.32	64.47	67,960.84
REGION 7	**53,674.35**	12,210.99	31,510.00	4,068.00	1,496.00	49,284.99	91.82	4,389.36
REGION 8	**91,982.90**	25,877.00	38,573.90	5,915.75	2,765.00	73,131.65	79.51	18,851.25
REGION 9	**93,706.00**	19,049.59	25,826.15	1,957.00	3,481.00	50,313.74	53.69	43,392.26
REGION 10	**121,122.69**	32,164.82	29,072.05	4,930.54	4,784.25	70,951.66	58.58	50,171.03
REGION 11	**177,546.92**	38,567.98	29,267.33	1,291.00	1,675.27	70,801.58	39.88	106,745.34
REGION 12	**293,226.24**	71,299.41	39,756.18	2,840.00	10,256.00	124,151.59	42.34	169,074.65
REGION 13	**160,176.75**	32,029.70	28,672.00	3,137.00	6,418.00	70,256.70	43.86	89,920.05
ARMM	**160,150.45**	27,712.86	21,241.75	90.00	295.00	49,339.61	30.81	110,810.84
Total	**3,128,631.00**	867,902.74	663,230.28	184,869.79	171,983.68	1,887,986.49	60.35	1,240,644.51

al - Estimated Total Irrigable Area (ETIA) is based on the 3% slope criteria.
For provinces with service areas greater than the ETIA, it means that more area are now irrigated beyond the ETIA.
* CAR. Region 7. Region 8, Region 9, Region 10, Region 13, and ARMM generated 13,963 ha. of new areas but not yet operational.
Source: www.nia.gov.ph

In an earlier study (delos Reyes and Jopillo 1986), one important factor in the existence of more functional canals and structures is the involvement of farmers in planning the irrigation system. The interventions (e.g., organizational structure, leadership, and systems management) of NIA in the irrigators' associations yielded positive impacts such as higher productivity, stronger associations, improved water distribution, and better compliance with government policy.

Government investments in irrigation suffer from numerous design, implementation, and maintenance issues, including failure to take into account counter-factual and conjunctive individual investments in irrigation. Political pressures, rent-seeking, and corruption perpetuate technical and economic inefficiencies in the irrigation and water sector (Wade, 1982; Repetto, 1986; Araral, 2005; Huppert, 2013). Huppert (2013) notes that local and international professionals in the water sector compete for the promotion or protection of their common interests, and resort to rent-seeking. These professionals are in the bureaucracy, foreign lending agencies, consulting firms, and even local and international academic institutions dependent on the irrigation agencies and international donors for funding. In the Philippines as perhaps elsewhere, politicians interfere in project selection, construction, and rehabilitation, distribution of water, and staff appointments and promotions. This is not just due to concerns for constituents, but because they are themselves are landowners, contractors, or can manipulate the contracting process.

The poor performance of irrigation systems has been attributed to several factors including: inadequate database for planning; inadequate institutional capacity and mechanisms for development; design mistakes; poor quality of construction; inadequate and fragmented support services for irrigated-agriculture; and complexity of operation including the socio-economic and institutional management (David, 2003).

3.2. Communal Irrigation Systems Development

CIS may be built with or without government assistance. While many CIS started as private initiatives, they have now mostly received some government funding support for the cost of rehabilitation and new construction. With the rising cost of investment in CIS, farmers are increasingly seeking assistance from the government. During the period between 1955-1959, the government completed 59 CIS serving 7,500 ha and after 20 years, there were more than 900 CIS government-assisted projects remarkably expanding irrigated area to more than 300,000 ha (World Bank 1982).

The increasing government assistance to CIS projects between the 1950s and 1980s was disrupted by the economic crisis in 1983-1985. Budget allocation of ₱130M per annum for CIS program was reduced to ₱80M. This again increased in 1987 (World Bank 1990). Foreign financing of CIS projects came in the mid-1970 as a component of rural development projects. The Asian Development Bank assistance to CIS (to serve 3,000 has) in conjunction with NIS project was the Mindoro Rural Development Project in 1975 followed by a Samar Rural Development Project.

CIDP1 implemented in 1982 was followed by another project in 1990 (World Bank 1992). NIA obtained loans from the International Bank for Reconstruction and Development (IBRD) and International Fund for Agriculture and Development (IFAD). The four project components were construction and rehabilitation of CIS; development of Communal IAs; institutional development of NIA on communal irrigation; and agricultural development planning. The project also aimed to strengthen the capability of Provincial Irrigation Offices for CIS development, operation and maintenance. NIA's role was limited to financial and technical assistance in the design and construction of the CIS and organizing and training of IAs. CIS would be turned over to IAs who will own, operate and manage the system. They had to amortize with no interest the chargeable cost (excluding roads, buildings, overhead) of the CIS project.

The World Bank project was based on a participatory approach developed by NIA in 1976 under a Special Communal Irrigation Pilot Project. Farmers were organized into IAs and registered with the Securities and Exchange Commission (SEC), and training was provided. However, in later years, the IA's financial capacity and skills were not adequate to meet the major repairs needed which had to wait for NIA to source funds. The major weakness was in the O&M function. Low equity and amortization collection efficiency was due to behavioral factors. Before CIDP, all CIS projects were constructed by the government free of charge to farmer beneficiaries. Until the early 1970s, funds for CIS came from appropriation to Congressional representatives and were not required to be repaid (Word Bank 1990).

The second CIDP project also aimed at institutional strengthening for long-term sustainability of the CISs. The devolution of CIS to LGU with the issuance of Local Government Code slowed down the project but the government decided eventually to have NIA execute the project. The agricultural support services component of the project also got support from concerned LGUs and complemented by DA programs (World Bank 2000).

Between 1984 and 1988, NIA's achievement for CIS averaged to 7,200 ha per year for new construction and 19,200 ha per year for rehabilitation for a five-year total of 132,000 ha. Locally funded projects have been subjected to political influence sometimes resulting in substandard quality construction and cost control (World Bank 1990).

The construction and maintenance of CIS was devolved to LGUs pursuant to the Local Government Code of 1991 (Republic Act 7160). Before the Code's enactment, the NIA implemented locally-funded CIS with budget allocation of ₱518 million through the GAA. This fund was transferred to the LGUs in 1992 through their internal revenue allotment (IRA). However, many LGUs had no capacity to undertake CIS projects and the construction and rehabilitation of CIS had been stalled. For several years beginning 1994, the government has to appropriate additional funds in the GAA including ₱320 million to complete the construction of several new CIS to irrigate additional 2,500 ha, and the repair and rehabilitation of existing CIS irrigating 5,000 ha.

Republic Act No. 8435, or the Agriculture and Fisheries Modernization Act (AFMA) of 1997 (Section 31) again emphasized the devolution of planning, design and management of CIS to LGUs. It also mandated NIA to continue providing technical assistance to the LGUs even after complete transfer of NIA's assets and resources in relation to CIS to the LGU.

The average cost of this CIS construction and rehabilitation was over ₱42,000 per hectare. Between 2001 and 2011, serviceable area of CIS slowly grew by 11% from 0.511 M ha to 0.566 M ha. Inocencio (2014) noted the increasing trends in investments in CIS from 1995 to 2010. One reason for this is that there are more areas that can be developed for CIS compared to NIS

Average collection efficiency did not improve at around 40% level until 2014 when it rose to 60%. Collection efficiency presented here is the ratio of actual amortization collection (current

+ back) to the estimated amortization collectibles expressed in percent. Cost recovery in the Philippines reportedly can never approach 100% because of the 50-year amortization period without interest (World Bank 1982). This government policy favors irrigators. Repayments in cash or in kind are valued at current market (NFA) price, and therefore roughly indexed to inflation rate (World Bank 1982). Under the CIDP I, collection efficiency was about 50% for new systems and 36% for rehabilitation. But nationwide collection was only at 6-7% of obligations. NIA did not charge for O&M (World Bank 1990). With the enactment of Republic Act No. 10969 or the Free Irrigation Service Act, the policy landscape drastically changed. All farmers with landholdings of eight (8) hectares and below are exempted from paying irrigation service fees (ISF). All unpaid ISF, all loans, past due accounts and the corresponding interests and penalties, are also condoned and written off from the books of NIA.

Problems of sustainability of irrigation infrastructure include very optimistic benefit cost-estimation during the planning stage of the project. For instance, the area estimated to be served by the irrigation system is generally much larger than what is actually served. Projected yields are also overestimated but water use efficiency declines over the years. Another cause is lack of investments in recurrent costs associated with operation and maintenance (O&M) activities once construction is completed (Ostrom 1992). Donors normally restrict their involvement to design and construction and view O&M as a responsibility of the recipient of the system. Routine maintenance is delayed until deterioration of the system is large enough to require rehabilitation.

While O&M problems affect individual users, the challenge is distributing water to all sections of the system. The persistent problem in water distribution is due not only to technical aspects of the system but also due to institutional factors governing water allocation. These relate to availability, reliability, predictability, manageability and equality. The first three relate to water rights wherein the user expects to get water at a timely and predictable schedule. Manageability refers to the combined control of users over quantity and timing of water deliveries. Equality refers to sharing of benefits commensurate to fees paid and services rendered. Achieving equality in distribution of water is difficult to achieve due to the technology of irrigation system itself and existing socio-economic conditions. The 'tail-end syndrome' indicates the positional advantage of upstream versus downstream due to topographic and conveyance conditions. The unequal tenurial, social and political status leads to differential access to water (Cruz 1982).

In compliance with the intent of the local government code, the national government has been implementing irrigation development programs which involved LGUs. These included the Poverty Alleviation Fund (PAF), Balikatan Sagip Patubig Program (BSPP), and the Southern Philippines Irrigation Sector Project (SPISP). However, LGU's accomplishment on CIS development and management under the BSPP has been minimal.

The AFMA of 1997 also mandated that the DA, particularly through the NIA and the Agricultural Training Institute (ATI) in collaboration with the Department of Finance (DOF) and the Department of Interior and Local Government (DILG), shall conduct a capability building program for the LGUs, including technical and financial assistance, logistical support, and training, to enable LGUs to independently and successfully sustain the CIS. This task was however not accomplished due to lack of coordinated efforts to improve technical capacity of LGUs and lack of political will to implement the AFMA. Specifically, on the part of NIA, there was also the lack of interest to fully implement the AFMA. There has really been limited capacity-building for LGUs and IAs.

The Comprehensive Agrarian Reform Program (CARP) spearheaded by the Department of Agrarian Reform (DAR) also has an irrigation component. It targets to complete improvement of existing CIS and construction of new CIPs by 2014 that will serve over 34,000 ha (NIA Annual Report 2013). Another project implemented by DAR is the Agrarian Reform Infrastructure Support Project (ARISP) with support from the Japanese government through the Japan Bank for International Cooperation. The project started in 2008 that covered 228 agrarian reform communities in the first two phases. ARISP Phase 3 aims to develop 129 ARCs in 54 provinces. In collaboration with NIA, the project aims to design/construct/ rehabilitate 111 CIP/CIS, provide on-farm facilities and access roads that will benefit more than 21,000 ha of farm lands.

NIA also supports the DA's Food Staple Sufficiency Program (FSSP) to accelerate food productivity in agriculture. NIA is implementing a special program within the critical three-year period 2011-2013 targeting 50-55% irrigation development, 5-6% growth within the period. DA requires NIA to contribute 35% of the incremental 4.57 million MT for the critical period (nia.gov.ph).

Yields in CIS are lower by 30-40 percent than in the NIS because of uncertainty in water supply in the small catchment areas where CIS is located (FAO 2011). In Asia, the most significant irrigation system that emerged in the past decade has been atomistic irrigation. This involves farmers' use of locally adapted technologies to source water from surface water and groundwater. Atomistic irrigation in Southeast Asia has been found to have a much larger impact on poverty reduction than any irrigation government program (Facon and Mukherji 2010).

Figures from the FAO AQUASTAT (FAO, 2011) showed that under the BSWM and NIS scheme, the average cost of irrigation development for new schemes, cost of rehabilitating existing schemes, and annual cost of O&M are about US$3,277/ha, US$1,608/ha, US$98/ha, respectively. In private schemes, the average cost of irrigation development and the cost for rehabilitation are around US$556/ha, and US$156/ha, respectively.

Facon and Mukherji (2010) identifies a number of factors in irrigation investments such as Water productivity, economic costs and benefits. poverty reduction, environmental impacts, and institutional actors. For instance, in rainfed areas where yield is low and potential to increase productivity is high, the gain from irrigation could be very high. Meanwhile, Barker and Molle (2004) pointed out that the success of a community irrigation system depends most importantly on the felt need of the community of water users. Community cooperation is crucial in order to gain access to and share water, and to minimize conflicts in areas with limited water supplies (Ostrom 1992; Barker and Molle 2004). The system of communal management still offers a convincing and appealing option for water management, as opposed to more commonplace emphases on state- or market-driven modes of regulation (Ostrom 1994).

3.3. Rehabilitation

NIA defines an irrigation rehabilitation project as one that focuses on the repair and/or replacement of deteriorated and/or damaged irrigation and drainage facilities (canals, structures, roads and buildings) to improve irrigation water delivery efficiency and adequacy in the irrigation area. A restoration project, on the other hand, involves development of additional water source to restore irrigation services in inactive sections of irrigation areas.

According to key informants from NIA, new CIS project costs about ₱300,000/ha; rehabilitation project cost about ₱60,000 to ₱80,000/ha; and restoration project cost about ₱100,000-120,000/ha.

It has been estimated that an average of 55,000 ha of CIS and NIS service areas must be rehabilitated each year in order to maintain the same level of NIS and CIS development in the late 1980s (David 2003). An average of about 70,000 ha per year must be rehabilitated or renovated in order to maintain the same level of NIS and CIS development during the period from 1992 to 1996. In a practical sense, the need for rehabilitation resulted from cumulative operation and maintenance (O&M) neglect and design mistakes. Improvement in NIS and CIS operation and maintenance will be more cost-effective than rehabilitation. Therefore, it is but logical that the focus in the case of NIS and CIS under AFMA should not only be on rehabilitation but also on improvement of O&M as well.

David (2003) also noted that due to the poor performance of NIS and CIS, the government funds for irrigation since the late 1980s has mostly supported the rehabilitation of such systems. However, conventional rehabilitation of restoring the irrigation infrastructure to its original design without rectifying apparent unrealistic design considerations have not been very effective.

David (2009) analyzed the impact of AFMA on the performance of canal irrigation systems during the post-AFMA years from 1998 to 2004. The accomplishments in terms of new service area generated and rehabilitated were 132,382 ha and 1,043,574 ha, respectively, for a total of about 1,175,956 ha, or about 168,000 ha/yr. This amounted to a total irrigation service area increase of only 62,000 ha, or about 9,000 ha/yr. This finding implies a rate of deterioration of around 159,000 ha/yr, a significant increase from 70,000 ha/yr during the pre-AFMA years from 1992-1996 earlier reported by David (2003). The total new area generated and rehabilitated for the period was about 96% of the total service area at the end of 2004. David (2009) showed that from 1995-2005 there was a very slow annual rate of increase of only about 10,000 ha in the actual NIS and CIS service areas despite massive efforts of rehabilitating an average of 125,597 ha/yr and constructing new irrigation facilities at 19,285 ha/yr. For this period the annual deterioration rate is about 134,000 ha/yr.

Table 2 shows the generated and rehabilitated areas accomplished by NIA for the period 2006-2013. The new area generated averaged about 24,000 ha which lags behind the target of more than 40,000 ha/yr. The rehabilitated areas averaged about 140,000 ha/yr, which exceeded the target especially at the latter part of the period. This value is double than the rehabilitated area during the period from 1992-1996. What is more disturbing is that the total rehabilitated areas of 1.133 M ha from 2006-2013 is about 86% of the total NIS and CIS FUSA for 2013. This implies that it is possible that even new service areas generated had to be rehabilitated within 10 years notwithstanding the fact that NIS and CIS are usually designed to have at least 15 years economic life span. The reasons for this include design mistakes, poor construction, O&M neglect, and shifting hydrographs as a result of the degradation of critical watersheds (David, 2003). Despite massive efforts and funds, the increase in irrigation area is minimal. It seems that in order to expand the irrigation base, new irrigable areas must come from small scale systems like CIS, STWs and SWIPs.

Table 2. Generated and Rehabilitated Areas by NIA from 2006-2013

Year	Generated Area (ha)		Rehabilitated Area (ha)	
	Target	Accomplishment	Target	Accomplishment
2006	22,639	8,989	53,071	57,088
2007	19,530	15,037	122,716	97,038
2008	22,562	13,481	92,230	87,305
2009	18,457	9,909	105,929	174,506
2010	12,989	6,603	248,565	196,075
2011	33,431	23,923	128,567	137,062
2012	100,994	55,500	112,370	206,897
2013	108,145	58,632	155,629	176,763

Source: 2006-2013 NIA Annual

4. Methodology

4.1. Analytical Tools and Approach

For the evaluation of performance of CIS, three (3) representative CIS were selected in each of four (4) provinces selected in the Visayas, and another 3 CIS in each of 4 provinces selected in Mindanao (see Annex 1). Based on the total irrigation service area per province, Leyte, Iloilo, Capiz, and Bohol were selected for Visayas, and North Cotabato, South Cotabato, Davao del Sur, and Bukidnon were selected for Mindanao. For each representative CIS, the research shall include: 1) characterization of the current physical state of the CIS including its dams or headworks and various control structures; 2) a more detailed assessment of CIS design specifications, and engineering performance indicators; 3) evaluation of operation and maintenance activities; 4) analysis of the nature, cost of repairs, restoration and rehabilitation; 5) assessment of the effectiveness of irrigators' associations, and; 6) rapid appraisal of farmers' opinion about the quality of the irrigation service and the reasons behind low ISF collection rates. For the analysis, the results of this evaluation were combined with the evaluation already made in Cycle 1 for Luzon CIS, except for item number 6 since the FISA has not been enacted then.

Similar to Cycle 1, selection of CIS per province was based on size of firmed-up service areas (FUSA) in hectares (ha) as follow: small (50 ha and below), medium (between 50 and 100 ha), and large (above 100 ha) – considering one for each size category. Depending on groundwater potential, at least one pump irrigation system (PIS) was also selected for the provinces considered. Walkthroughs were conducted in all CIS per province.

Based on data from the NIA inventory of 2013 (Luzon) and 2017 (Visayas and Mindanao), CIS have service areas that are generally below 1,000 ha (see Tables 3a to 3c). While many CIS are constructed by National Irrigation Administration (NIA), the IA is responsible for management and maintenance of the constructed system. The CIS are categorized into small (50 ha and below), medium (51 to 100 ha) and large (above 100 ha) so as to capture possible differences in characteristics. Over 70% of the CIS in the 10 provinces are small. The large and medium sized systems are 15% and 14%, respectively. The 3 CIS which will be selected can represent each of the sizes.

In addition to presentation of descriptive tables and historical trends based on secondary data, a combination of the Geographic Information Systems (GIS) analysis technique were used. Selected CIS were characterized based on the geographic distribution, hydrogeological and agro-ecological conditions (rainfall patterns, aquifer characteristics, open water sources, soil type, elevation, availability of gravity irrigation systems, etc.) and socio-economic factors that affect demand for irrigation.

4.2. Sources of Data

Secondary data were collected from the NIA Central Office, Regional Irrigation Offices (RIOs), and Irrigation Management Offices (IMOs). These data include the list of all CIS under each IMOs and all available data at system level including functionality survey results, status/profile of IAs, source of funding, technical support and assistance from NIA and other concerned agencies, program of works (POWs) for all available years, and communal irrigation system performance (CISPER), among others. Technical data related to the CIS include physical state, service area, source of water, access to and availability of water, year constructed, construction cost, rehabilitation cost, other major investments, yield, cropping calendar, cropping intensity, etc. Whenever available, feasibility studies, technical drawings, network maps (irrigated and built-up areas), canal layouts, and other technical reports were also obtained from the IMOs and NIA offices.

To complement secondary data and get deeper insights on the different aspects of development, management, and operation and maintenance of the CIS system, key informant interviews (KII) of the Regional Managers of the RIOs and Managers of IMOs, as well as other key actors, such as NIA institutional development officers (IDOs) and IA Presidents, were conducted using a structured questionnaire (see Annex 6). Focus group discussions with IA officers and farmer beneficiaries were likewise carried out.

Walk-throughs and actual measurements were made for all the sample CIS in Visayas and Mindanao to gauge the physical conditions of the systems. Walkthroughs on a subset of all sample CIS was done in the Luzon Cycle. Assessment was done on key system structures/facilities and their respective conditions (e.g., actual vs. designed reservoir capacity; lengths and efficiencies of lined and unlined canals; presence of legal and illegal turnouts; and for pumps: fully-, partially- or non-operational pumps; among others).

For CIS pumping water from water sources or where pumps are utilized within and in the vicinity of selected CIS, the following was established: (a) technical description of the pump system (engine, pump, pipes, discharge), (b) fund source, (c) pump irrigation technology and practices used, (d) nature of usage, (e) operation of pump rental market (pump renting or lending activities and terms of payment), (f) costs and returns, and (g) problems associated with operation of irrigation pumps. The hydro-geologic characteristics of the area were also taken from existing groundwater potential maps.

Findings from Cycle 1 of Project "Technical Evaluation of National and Communal Irrigation Systems" were referenced particularly on the assessment of construction, operation and management of CIS.

5. Major Policy Reform for Communal Irrigation Systems

5.1. Republic Act No. 10969 – Free Irrigation Service Act

RA No. 10969, also known as the Free Irrigation Service Act, is a milestone in the policy landscape for the Communal Irrigation System. It was passed in 2017 by the Senate and House of Representatives and signed by the President in February 2, 2018.

Before the passage of the free irrigation Service Act, Communal irrigation systems, farmers amortize the chargeable cost of the CIS for a period not exceeding 50 years without interest. The O&M of the CIS is turned over to the IA upon project completion subject to a cost recovery arrangement. With the Free Irrigation Service Act, all farmers with landholdings of eight (8) hectares and below are exempted from paying irrigation service fees (ISF). It covers both national irrigation systems (NIS) and communal irrigation systems (CIS) funded, constructed, maintained and administered by the National Irrigation Administration (NIA) and other government agencies, including those that have been turned over to irrigators associations (IAs). All unpaid ISF, all loans, past due accounts and the corresponding interests and penalties of exempt IAs to NIA, are also condoned and written off from the books of NIA.

In lieu of the ISF that are no longer billed from exempted farmers, the national government shall provide the equivalent funds for the operation and maintenance (O&M) of CIS. NIA and other government agencies shall provide technical assistance to IAs on the O&M of national and communal irrigation systems and on farm enterprises management. NIA shall issue the necessary guidelines on the collection and use of ISF, including unpaid ISF, of those not exempted under this Act.

5.2. NIA Memorandum Circular No. 13, series of 2017 - Guidelines on Free Irrigation Service

The NIA Board of Directors through Resolution No. 8396-17 series of 2017 has approved the Guidelines on Free Irrigation Service provided in NIA Memorandum Circular No. 13, series of 2017. The guidelines pertinent to CIS include the following:

- Free irrigation service will commence on the first cropping season of Crop Year 2017. Under the General Appropriations Act of 2017 or Republic Act 10924, an amount of ₱2 Billion was provided in the budget of the NIA as Irrigation Fee subsidy. However, fund for 0 & M of CIS is not covered under GAA2017 subsidy. Thus, IAs should still collect from their members the amount needed for the proper operation and upkeep of their respective irrigation systems.

- NIA will stop collecting amortization and equity payments from farmers and/or IAs for projects on CIS, small irrigation systems (SIS) pump irrigation systems (PIS), including shallow tube wells (STWs), and small reservoir irrigation systems (SRIS). For projects with local government units' (LGU) participation, the equity requirement from the concerned LGU will be maintained.

- All back accounts or unpaid ISF, amortization and equity payments before the effectivity of RA 10924 remain as liabilities of farmers and IAs. The collection of such liabilities shall still be pursued by NIA in collaboration with the Office of the Solicitor General and Office of the Government Corporate Counsel. The IAs may also be tapped by NIA in this collection undertaking subject to terms and conditions agreed by both parties.

- Starting Fiscal Year 2018, NIA shall include in its annual proposal the total requirements for Personal Services, MOOE, Capital Outlays for implementation of irrigation projects and office operations, including incentives and remuneration to IAs in all types of irrigation systems constructed, administered and/or assisted by NIA.

- IAs, as part of their internal policies, may collect additional amount from members on top of the regular dues (membership fees, annual dues, capital buildup, etc.) to cover or augment their O&M budget. Such collection must be approved by their respective General Assemblies.

- O&M and management of CIS and pump irrigation systems shall be fully handed over to their respective IAS.

- NIA shall continue to provide technical support in the planning, design, construction, rehabilitation, restoration and O&M to the IAs as necessary. Moreover, the Agency will continue to provide capacity building programs and trainings to sustain lA functionality.

- For NIS, the IAs will be compensated based on the length of canal section transferred to them by NIA for maintenance. The equivalent of one (1) canal section shall be: lined canal = 3.5 km of earth main or lateral canal; lined canal = 7.0 km of concreted main or lateral canal. For each canal section, the lA, after satisfactorily complying with its maintenance obligations stated in the contract, shall be paid Pl,750 per month for a maximum of six (6) months in a year. For operations-related responsibilities, the IAs/Federation will be paid P150/ha per cropping of irrigated and planted areas. The Guidelines, however do not explicitly mention if this provision also applies to CIS.

5.3. NIA Memorandum Circular No. 68, series of 2017 – Amendment to MC #13 S. 2017 RE: Guidelines on Free Irrigation Service

Through MC No. 68, series of 2017, the NIA Board of Directors amended the Guidelines under MC 13 s. 2017 by deleting the following provision:

> *IAs, as part of their internal policies, may collect additional amount from members on top of the regular dues (membership fees, annual dues, capital buildup, etc.) to cover or augment their O& M budget. Such collection must be approved by their respective General Assemblies.*

This is to allow the IAs, independent and private organizations to tackle the matter themselves. NIA has been receiving several complaints from farmers on the continued collection of certain fees by officers of IAs despite the pronouncement of the national government that irrigation service will be free starting 2017.

It should be noted that the Free irrigation Service Act still requires the equity payment for projects with LGU participation. Again, the AFMA of 1997 provides for the devolution of CIS to LGUs.

6. Communal Irrigation Systems at the IMO Level

Based on 2017 NIA Annual Report, there are 9,196 CIS nationwide with a firmed-up service area (FUSA) of 574,007 ha, or an average of 62.42 ha per CIS. In calendar year 2016-2017, the total irrigated area in the CISs was 804,540 hectares equivalent to a cropping intensity of 124.08% based on service area or 140.16% based on FUSA.

This section presents information of CIS and IAs listed in the selected 11 IMOs in Luzon (1,606 CIS) covered in Cycle 1); 4 IMOs in Visayas (464 CIS); and 4 IMOs in Mindanao (176 CIS). Findings were based on secondary data and key informant interviews of IMO officials and staff.

Information on the CIS includes firmed-up service area, type of technology (gravity or pump), operational status, and cropping intensity. The summary of CIS data for all the IMOs visited are listed in Tables 3a to 3c for Luzon, Visayas and Mindanao. Figures 2 to 20 feature the performance of all the CIS with time based on the FUSA, Irrigated Area (Wet and Dry Season) and Cropping Intensity from 2005 to 2014 for the 11 Luzon provinces, and 2014 to 2017 for the 4 Visayas and 4 Mindanao provinces.

Information on the communal irrigators' associations includes functionality rating of the IAs, and cost payment schemes (e.g., amortizing, 30% equity payment during the Cycle 1 and before FISA was implemented).

6.1. Firmed-up Service Area

In developing irrigation project, design area is estimated based on survey of the potential area that can be irrigated and available water. Firmed-up service area (FUSA) is the actual service area with irrigation facilities. Irrigated area may be equal to or less than FUSA depending on adequacy of facilities and management. FUSA is usually lower than design area because it no longer includes areas with higher elevation, convertible areas but which landowner does not want to be converted, e.g., sugar land because of land reform.

Table 3a. Communal irrigation systems by sample provinces (IMOs) in Luzon

Item\Province	Ilocos Norte		Pangasinan		Benguet		Isabela		Cagayan		Nueva Vizcaya	
	No. of CIS	%	No. of CIS	%	No. of CIS	%	No. of CIS	%	No. of CIS	%	No. of CIS	%
Size of FUSA												
Small (<50 ha)	71	58.2	122	42.7	418	93.5	88	61.5	199	63.4	171	66.8
Medium (50-100 ha)	28	23	87	30.4	22	4.9	24	16.8	57	18.2	47	18.4
Large (>100 ha)	23	18.8	77	26.9	7	1.6	31	21.7	58	18.5	38	14.8
Type of Technology												
Gravity	120	98.4	194	67.8	400	89.5	50	35	149	47.5	193	75.4
Pump	1	0.8	90	31.5	47	10.5	93	65	165	52.5	63	24.6
Reservoir	0	0	1	0	0	0	0	0	0	0	0	0
Others	1	0.8	1	0.34	0	0	0	0	0	0	0	0
Operational status												
Totally non-operational	7	5.7	81	28.3	18	4	3	2.1	12	3.8	3	1.2
50% and below operational	15	12.3	104	36.4	29	6.5	11	7.7	28	8.9	11	4.3
Above 50% operational	107	87.7	182	63.6	400	89.5	129	90.2	274	87.3	242	94.5
FUSA (ha)	8,280.20		29,783.00		9,614.88		11,448		19,266		15,375.10	
Operational (ha)	7,216.20		20,812.00		8,593.15		7,988		13,665		13,964.10	
Operational (%)	87.2		69.9		89.4		69.8		70.9		90.8	

Source: NIA data as of December 31, 2013

(Cont.) Table 3a. Communal irrigation systems by sample provinces (IMOs) in Luzon

Item\Province	Nueva Ecija		Pampanga		Camarines Sur		Laguna		Occidental Mindoro	
	No. of CIS	%	No. of CIS	%	No. of CIS	%	No. of CIS	%	No. of CIS	%
Size of FUSA										
Small (<50 ha)	20	28.2	24	24	135	48.6	34	55.7	19	38.8
Medium (50-100 ha)	17	23.9	23	23	55	19.8	17	27.9	6	12.2
Large (>100 ha)	34	47.9	53	53	88	31.7	10	16.4	24	49
Type of Technology										
Gravity	40	56.3	70	70	115	41.4	53	86.9	33	67.3
Pump	31	43.7	29	29	163	58.6	8	13.1	16	32.7
Reservoir	0	0	0	0	0	0	0	0	0	0
Others	0	0	1	1	0	0	0	0	0	0
Operational status										
Totally non-operational	3	4.2	28	28	60	21.6	5	8.2	18	36.7
50% and below operational	8	11.3	51	51	31	11.2	4	6.6	0	0
Above 50% operational	63	88.7	49	49	187	67.3	52	85.2	31	63.3
FUSA (ha)	14,687.83		14,398.41		43,729.65		3,968.00		9,466.00	
Operational (ha)	12,984.63		7,323.64		17,328.05		3,112.00		6,630.00	
Operational (%)	88.4		50.9		39.6		78.4		70	

Source: NIA data as of December 31, 2013

Table 3b. Communal irrigation systems by sample provinces (IMOs) in Visayas

Item\Province	Bohol		Capiz		Leyte		Iloilo	
	No. of CIS	%	No. of CIS	%	No. of CIS	%	No. of CIS	%
Size of FUSA								
Small (<50 ha)	67	62.62	26	44.83	53	29.12	70	59.83
Medium (50-100 ha)	29	27.10	20	34.48	65	35.71	34	29.06
Large (>100 ha)	11	10.28	12	20.69	64	35.16	13	11.11
Type of Technology								
Gravity	103	96.26	34	58.62	180	98.90	84	71.79
Pump	4	3.74	23	39.66	2	1.10	29	24.79
Reservoir	0	0	1	1.72	0	0	4	3.42
Operational status								
No Data	1	0.009	3	5.17	2	1.10	14	11.79
Totally non-operational	0	0	1	1.72	13	7.14	12	10.26
50% and below operational	1	0.009	5	8.62	38	20.88	10	8.55
Above 50% operational	105	98.13	49	84.48	129	70.88	81	69.23
FUSA (ha)	5,786		4,829.98		20,655		6,551	
Operational (ha)	5,726		4,066.49		14,065.25		4,857.5	
Operational (%)	99.07		86.99		76.42		87.38	

Source: Inventory of National, Communal, Private and OGA Irrigation System as of December 31, 2017

Table 3c. Communal irrigation systems by sample provinces (IMOs) in Mindanao

Item\Province	Bukidnon		Davao del Sur		North Cotabato		South Cotabato	
	No. of CIS	%	No. of CIS	%	No. of CIS	%	No. of CIS	%
Size of FUSA								
Small (<50 ha)	3	7.50	5	11.63	9	16.36	9	23.68
Medium (50-100 ha)	16	40	17	39.53	16	29.09	15	39.47
Large (>100 ha)	21	52.50	21	48.84	30	54.55	14	36.84
Type of Technology								
Gravity	40	100	43	100	55	100	38	100
Pump	0	0	0	0	0	0	0	0
Reservoir	0	0	0	0	0	0	0	0
Operational status								
No Data	0	0	1	2.33	0	0	0	0
Totally non-operational	0	0	1	2.33	0	0	0	0
50% and below operational	9	22.5	5	11.63	3	5.45	3	7.89
Above 50% operational	31	77.5	36	83.72	52	94.55	35	92.11
FUSA (ha)	6,698		9,514		9,054		6,679.32	
Operational (ha)	5,058		8,080		8,153		6,164.72	
Operational (%)	73.53		85.44		89.23		91.79	

Source: Inventory of National, Communal, Private and OGA Irrigation System as of December 31, 2017

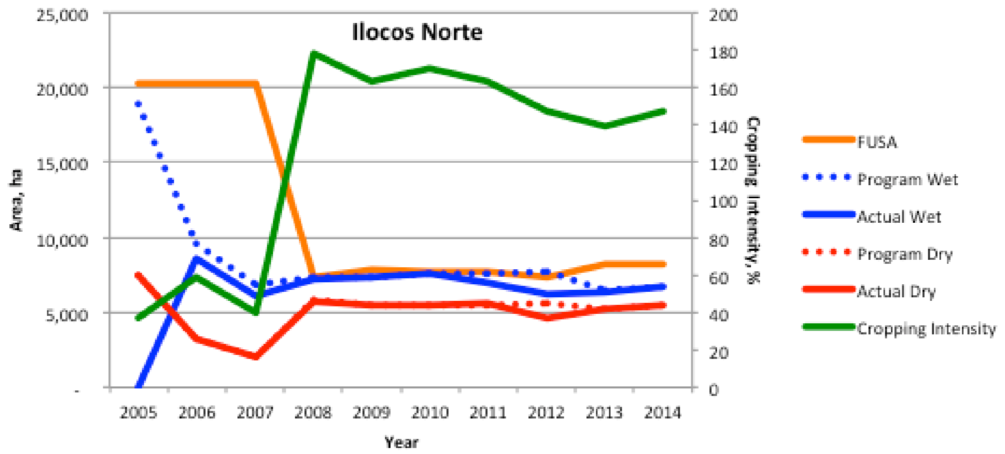

Figure 2. CIS Performance (FUSA, Irrigated Area and Cropping Intensity) of Ilocos Norte from 2005-2014

Source: Seasonal Operational and Maintenance Report of Respective Irrigation Management Offices

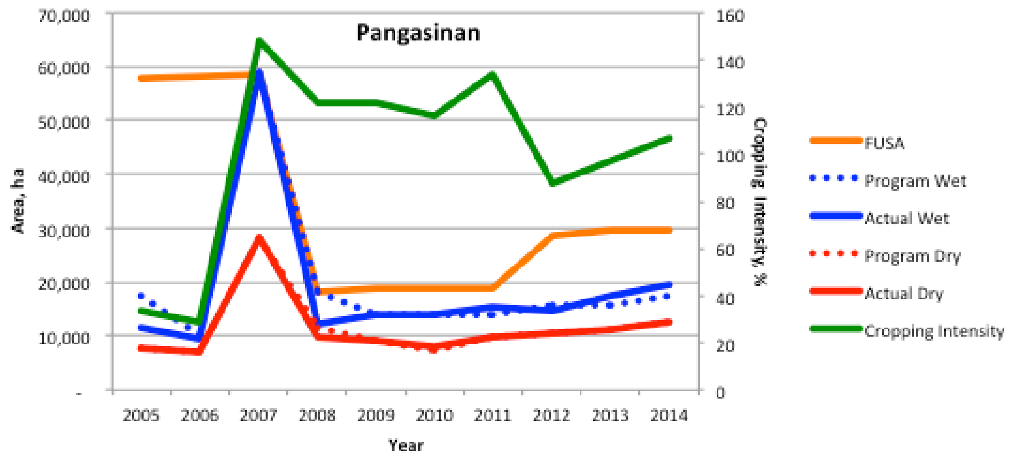

Figure 3. CIS Performance of Pangasinan from 2005-2014

Source: Seasonal Operational and Maintenance Report of Respective Irrigation Management Offices

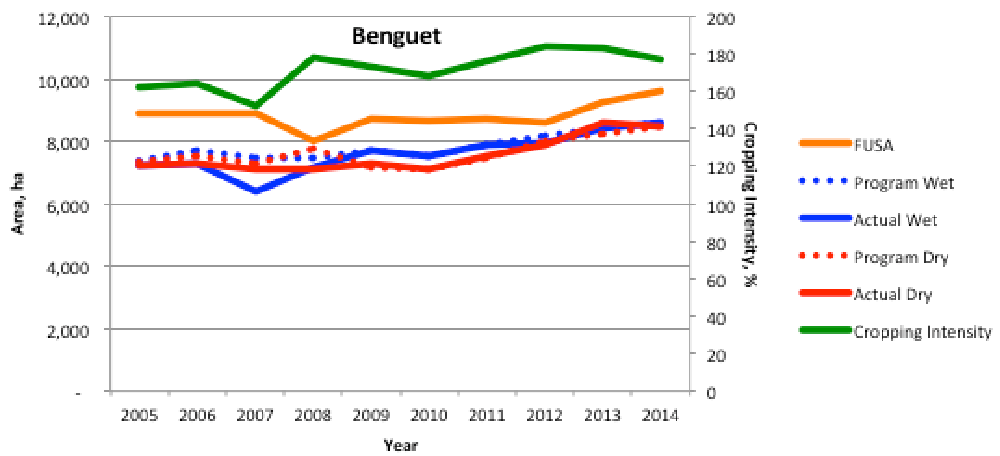

Figure 4. CIS Performance of Benguet from 2005-2014

Source: Seasonal Operational and Maintenance Report of Respective Irrigation Management Offices

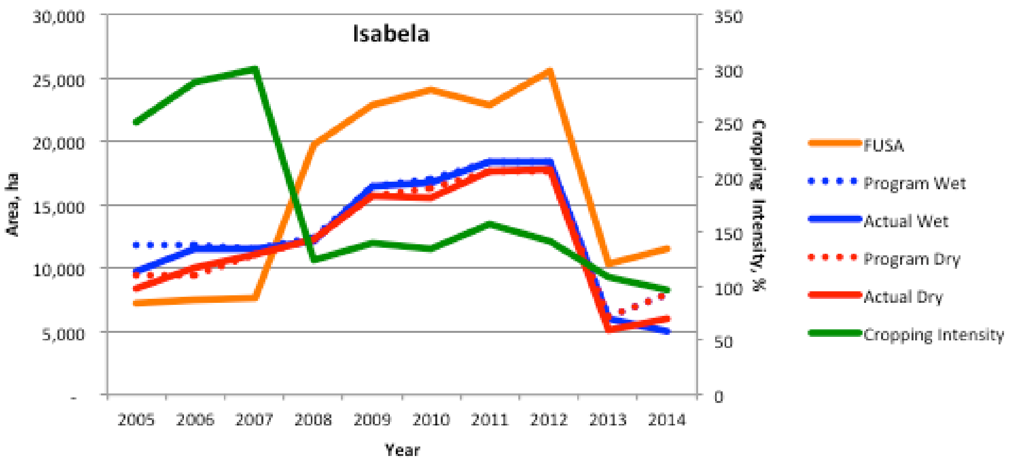

Figure 5. CIS Performance of Isabela from 2005-2014

Source: Seasonal Operational and Maintenance Report of Respective Irrigation Management Offices

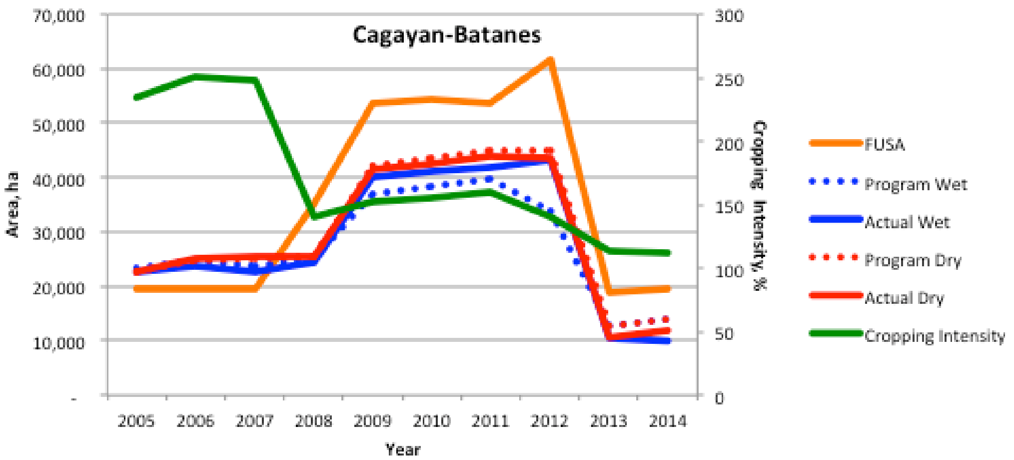

Figure 6. CIS Performance of Cagayan-Batanes from 2005-2014

Source: Seasonal Operational and Maintenance Report of Respective Irrigation Management Offices

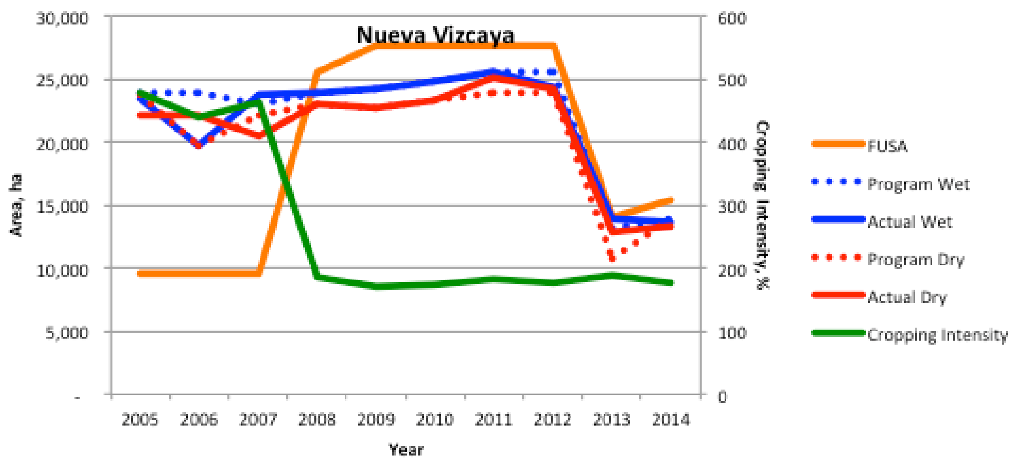

Figure 7. CIS Performance of Nueva Vizcaya from 2005-2014

Source: Seasonal Operational and Maintenance Report of Respective Irrigation Management Offices

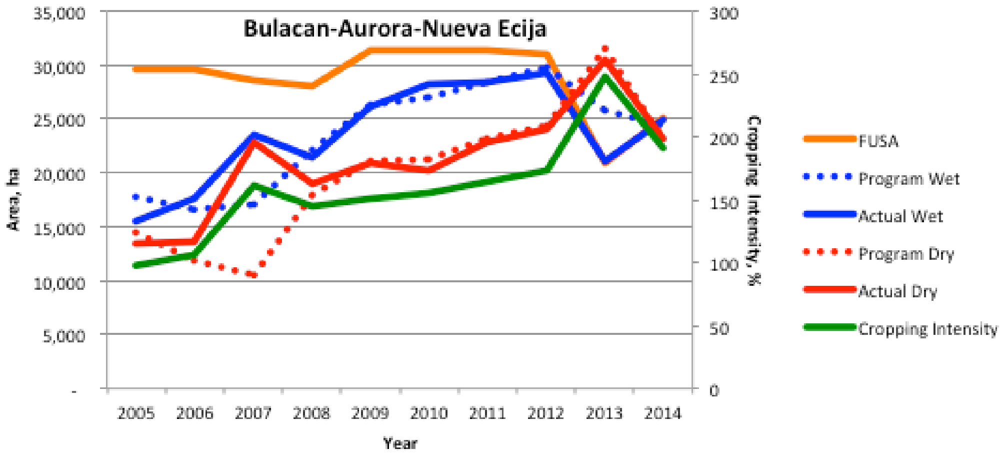

Figure 8. CIS Performance of Bulacan-Aurora-Nueva Ecija from 2005-2014

Source: Seasonal Operational and Maintenance Report of Respective Irrigation Management Offices

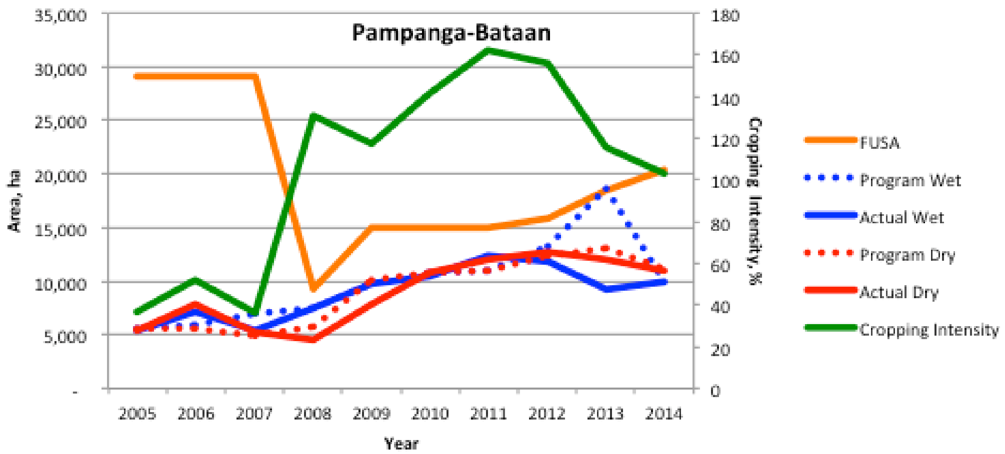

Figure 9. CIS Performance of Pampanga-Bataan from 2005-2014

Source: Seasonal Operational and Maintenance Report of Respective Irrigation Management Offices

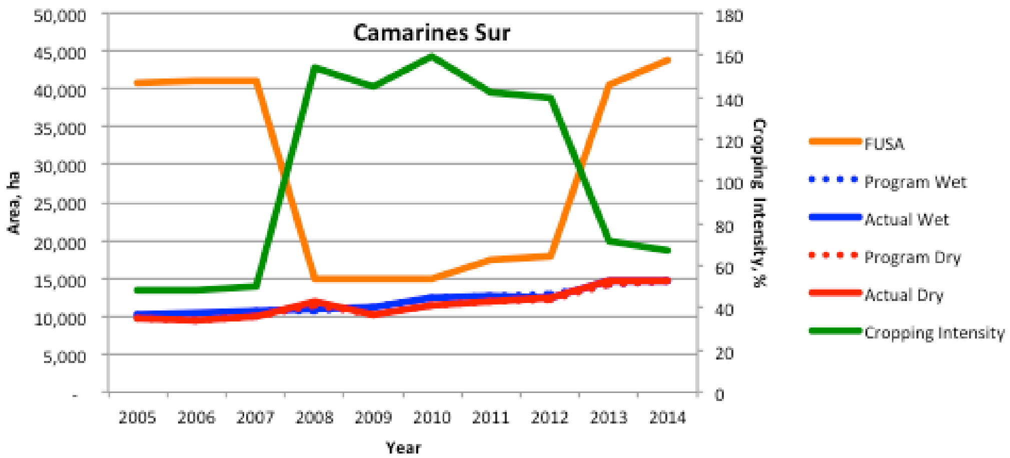

Figure 10. CIS Performance of Camarines Sur from 2005-2014

Source: Seasonal Operational and Maintenance Report of Respective Irrigation Management Offices

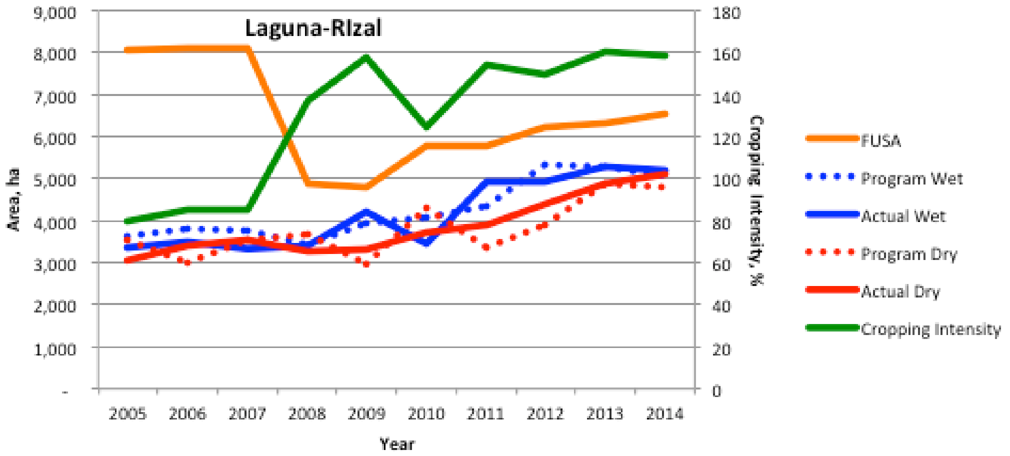

Figure 11. CIS Performance of Laguna-Rizal from 2005-2014

Source: Seasonal Operational and Maintenance Report of Respective Irrigation Management Offices

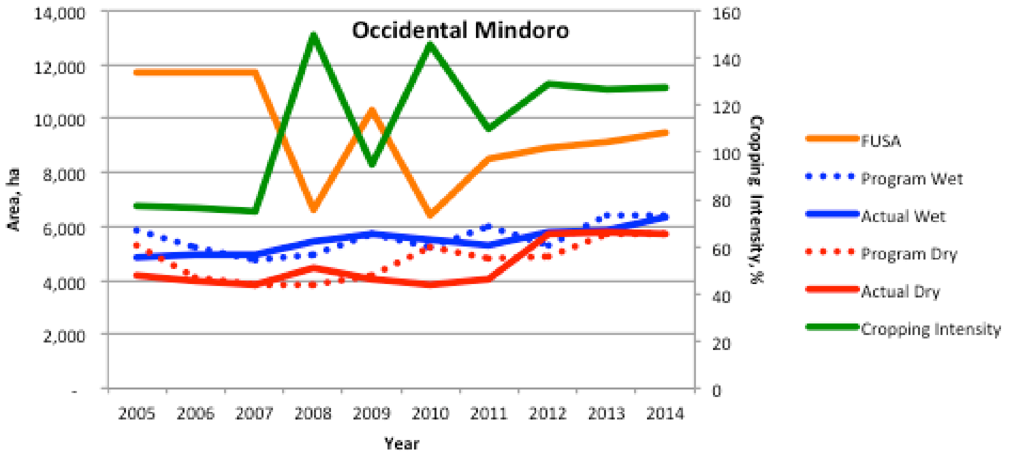

Figure 12. CIS Performance of Occidental Mindoro from 2005-2014

Source: Seasonal Operational and Maintenance Report of Respective Irrigation Management Offices

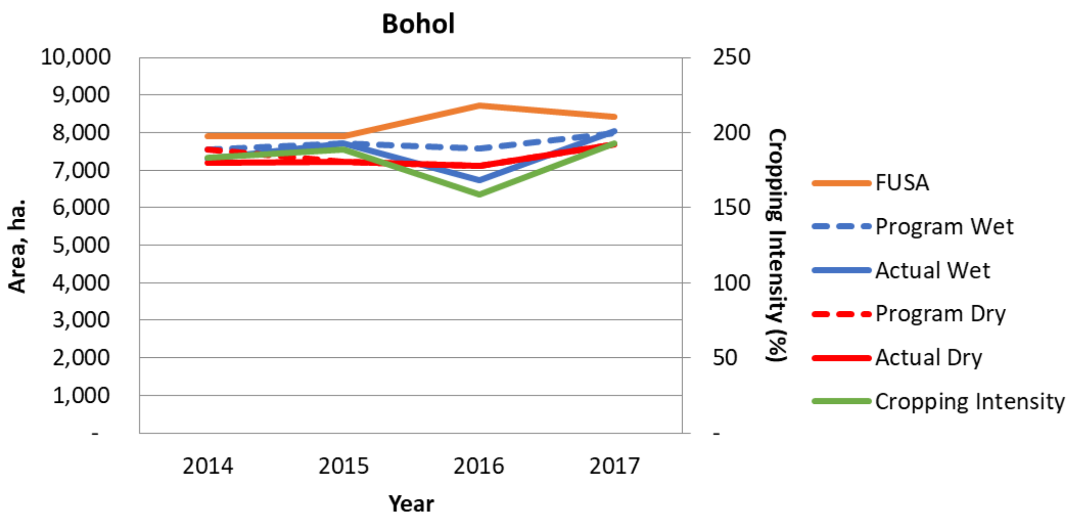

Figure 13. CIS Performance of Bohol from 2014-2017

Source: Seasonal Operational and Maintenance Report of Respective Irrigation Management Offices

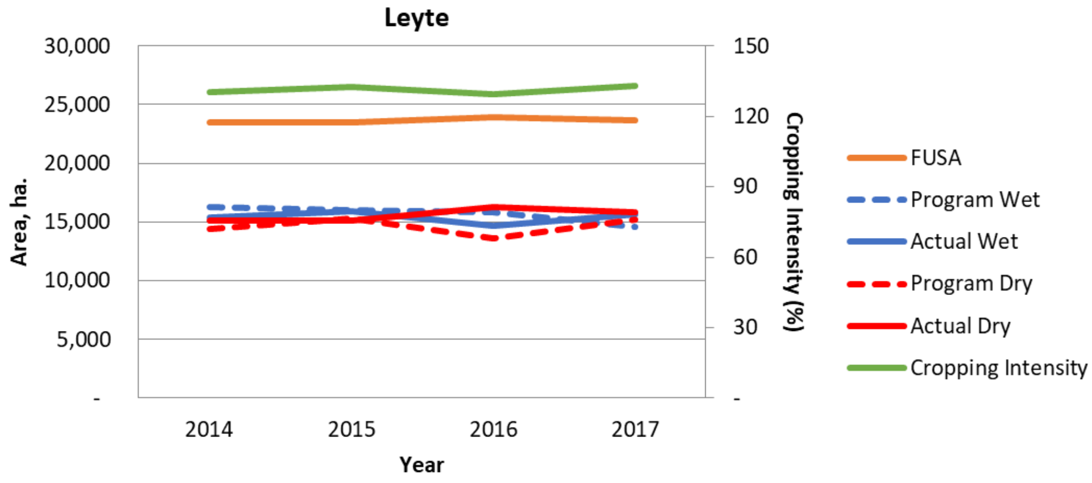

Figure 14. CIS Performance of Leyte from 2014-2017
Source: Seasonal Operational and Maintenance Report of Respective Irrigation Management Offices

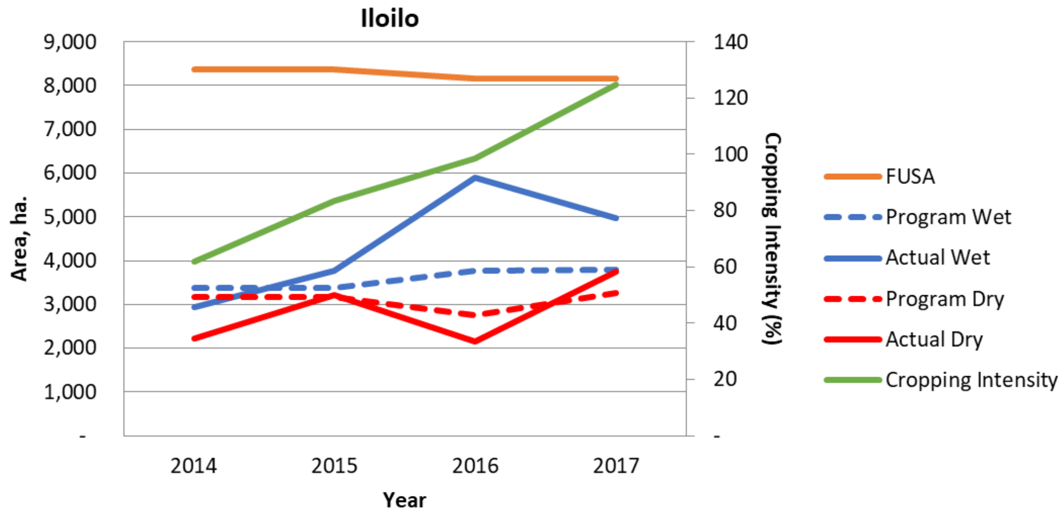

Figure 15. CIS Performance of Iloilo from 2014-2017
Source: Seasonal Operational and Maintenance Report of Respective Irrigation Management Offices

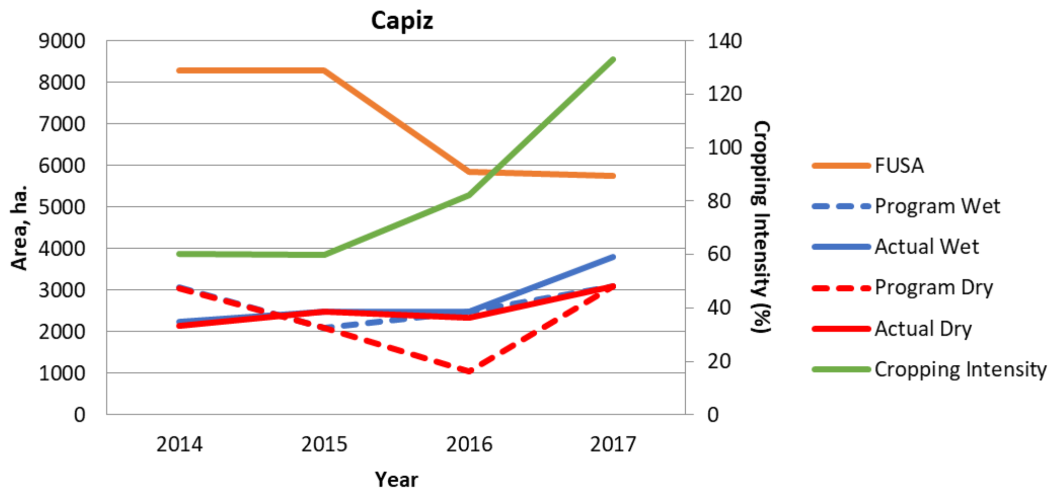

Figure 16. CIS Performance of Capiz from 2014-2017
Source: Seasonal Operational and Maintenance Report of Respective Irrigation Management Offices

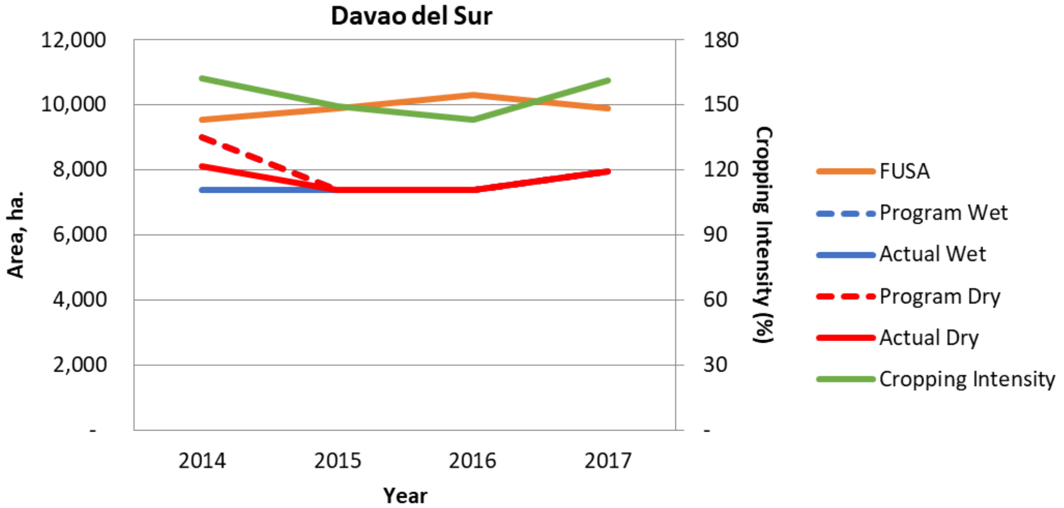

Figure 17. CIS Performance of Davao del Sur from 2014-2017
Source: Seasonal Operational and Maintenance Report of Respective Irrigation Management Offices

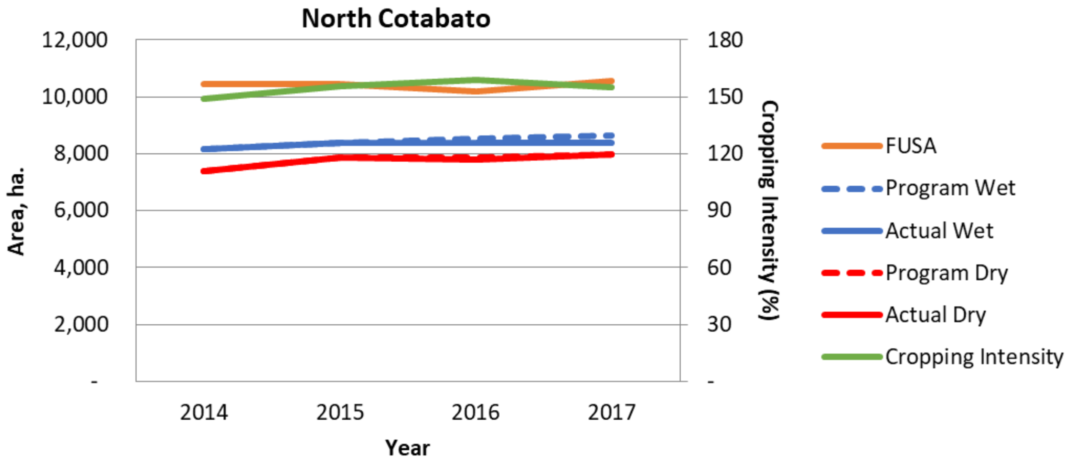

Figure 18. CIS Performance of North Cotabato from 2014-2017
Source: Seasonal Operational and Maintenance Report of Respective Irrigation Management Offices

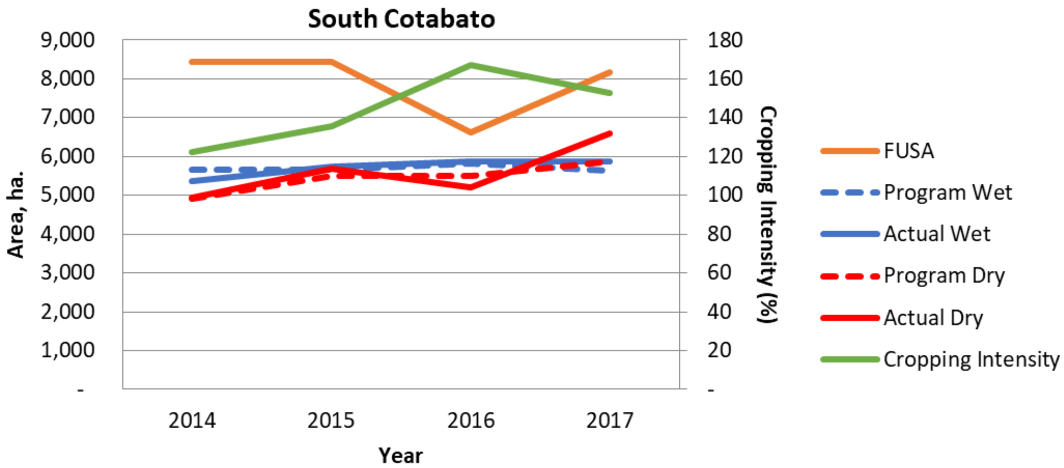

Figure 19. CIS Performance of South Cotabato from 2014-2017
Source: Seasonal Operational and Maintenance Report of Respective Irrigation Management Offices

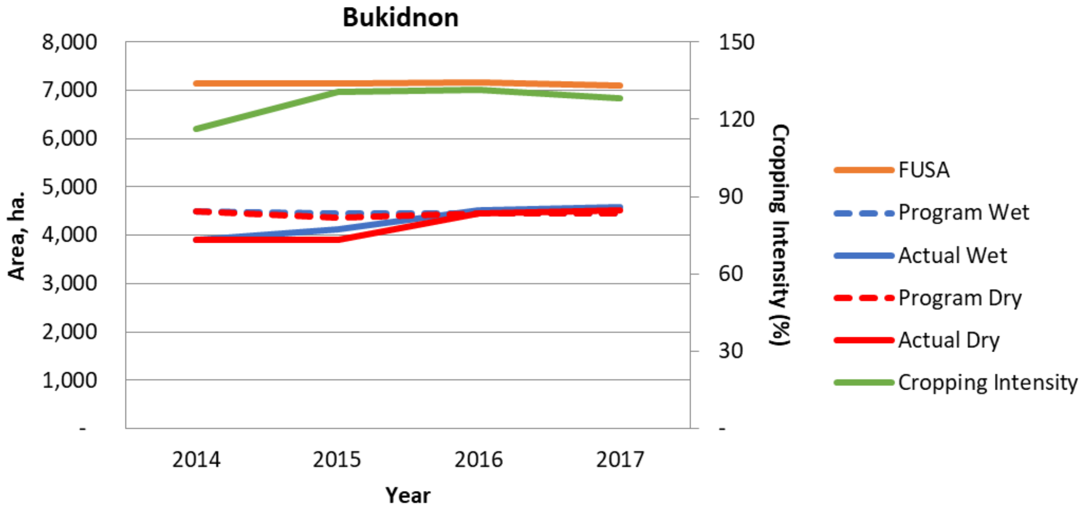

Figure 20. CIS Performance of Bukidnon from 2014-2017

Source: Seasonal Operational and Maintenance Report of Respective Irrigation Management Offices

Based on the time series profile from 2005 to 2014, the performance indicators from 2005-2007 are somewhat erroneous or at the least have different basis than from 2008 onwards. This issue would still have to be resolved with NIA. The FUSA for Benguet shows a steady increase as well as the FUSA of Ilocos Norte, Pangasinan and Pangasinan. The FUSA of Region II (Cagayan-Batanes, Isabela, Nueva Vizcaya), on the other hand, increased until 2012 when it suddenly dipped to just above 2007 levels. Decrease in FUSA may be attributed to one or combination of the following: conversion of CIS to NIS specifically the Visitacion IS in Cagayan; some irrigation systems were under rehabilitation wherein the areas being rehabilitated were not considered in the current FUSA; and also because of errors in reporting. Overall, the FUSA for Luzon shows a decline from the 2005 to the 2014 level. The actual service areas based on the individual interviews of the IA's are more or less consistent with the service areas reported. However, the field surveys showed otherwise, with limited water flow or dried water sources, aside from the dilapidated structures, during the visit. The high dry season areas probably could have been achieved with the use of STWs and LLP/OSPs for supplemental irrigation, or the areas are planted with vegetables or other non-rice crops.

The CIS performance with time for Visayas and Mindanao were based on 2014 to 2017 data only. A major decrease of about 2000 ha can be seen for Capiz from 2015 to 2016 possibly due to land conversion although the cropping intensity doubled from 60 in 2015 to 130% in 2017. The FUSA of South Cotabato also decreased from 2015 t0 2016 but recovered in 2017.

The wet and dry season areas for Benguet, Cagayan-Batanes, Isabela, Nueva Vizcaya, Laguna-Rizal and Camarines Sur are almost identical, as well as the program and actual areas. For Benguet, this is because the CIS are mostly small, and the mountain rivers and spring sources never run out of water. For Laguna-Rizal, this is because of the abundant river sources with high dependable flows even during the dry season. For Camarines Sur and Region II, however, the field surveys showed otherwise. At the very least for Camarines Sur, the Type II (no pronounced dry season) climate and the ubiquitous typhoons could help achieve this similarity if the irrigation facilities are in good condition. The wet and dry areas for these regions show gradual increase with time. For Region II, the wet and dry areas increased until 2011 then drastically decreased by 2012, although the actual areas were almost the same as the program area. For Laguna-Rizal, the wet and dry areas show a steady increase, but after 2010, the dry season area lagged that of the wet season areas. The difference between the wet and dry season irrigated areas are considerable for Regions Ilocos Norte, Pangasinan, Bulacan-Aurora-Nueva Ecija and Occidental Mindoro mainly because of Type I climate (pronounced wet and dry season). For Visayas and Mindanao, the actual irrigated (both wet and dry) are very close to the programmed area, in some instances even being surpassed.

Table 4 shows the frequency distribution of the CIS based on the different identified parameters in the sample IMOs for Luzon, Visayas and Mindanao. Over 40% of the 1,606 CIS under the 11 sample IMOs in Luzon; and 464 CIS in 4 sample IMOs in Visayas have FUSA below 50 ha (small) while over 50% have 50 ha and above (medium to large). In contrast, 85% of the 176 CIS in the 4 sample IMOs in Mindanao have medium to large FUSA.

Table 4. Frequency distribution of CIS by size of FUSA and technology type in all the sample Irrigation Management Offices

CIS	FUSA			Technology			Operational status		
	Small <50 ha	Medium 50-100 ha	Large >100 ha	Gravity	Pump	Others[1]	≤50% operational	> 50% operational	Others[2]
Luzon (n = 1606)									
No. of CIS	660	411	535	1279	286	41	76	1202	328
% of CIS	41.10	25.59	33.31	79.64	17.81	2.55	4.73	74.84	20.42
Visayas (n=464)									
No. of CIS	216	148	100	401	58	5	54	364	46
% of CIS	46.55	31.90	21.55	86.42	12.5	1.08	11.64	78.45	9.91
Mindanao (n=176)									
No. of CIS	26	64	86	176	0	0	20	154	2
% of CIS	14.77	36.36	48.86	100	0	0	11.36	87.5	1.14

1- Not Classified
2-Partially Operational/On-Going/Deferred/Not Yet Operational
Source: IA Profile in respective Irrigation Management Offices (as of 2013, 2014 for Luzon and 2017 in Visayas and Mindanao)

Based on secondary data from the IMOs, majority of the CIS have FUSA of less than 50 ha, particularly in Benguet (73%), Laguna-Rizal (55%), and Nueva Vizcaya (54%) (Figure 21a). Around 33% of CIS in the 11 IMOs are over 100 ha particularly in the provinces of Occidental Mindoro, Nueva Vizcaya, and Ilocos Norte. In the Visayas, small FUSA dominates in Bohol, Capiz and Iloilo provinces while medium to large FUSA are more prominent in Leyte (Figure 21b). In Mindanao, CIS in Bukidnon, Davao del Sur, and North Cotabato have predominantly large FUSA. South Cotabato has over 70% medium to large farms (Figure 21c).

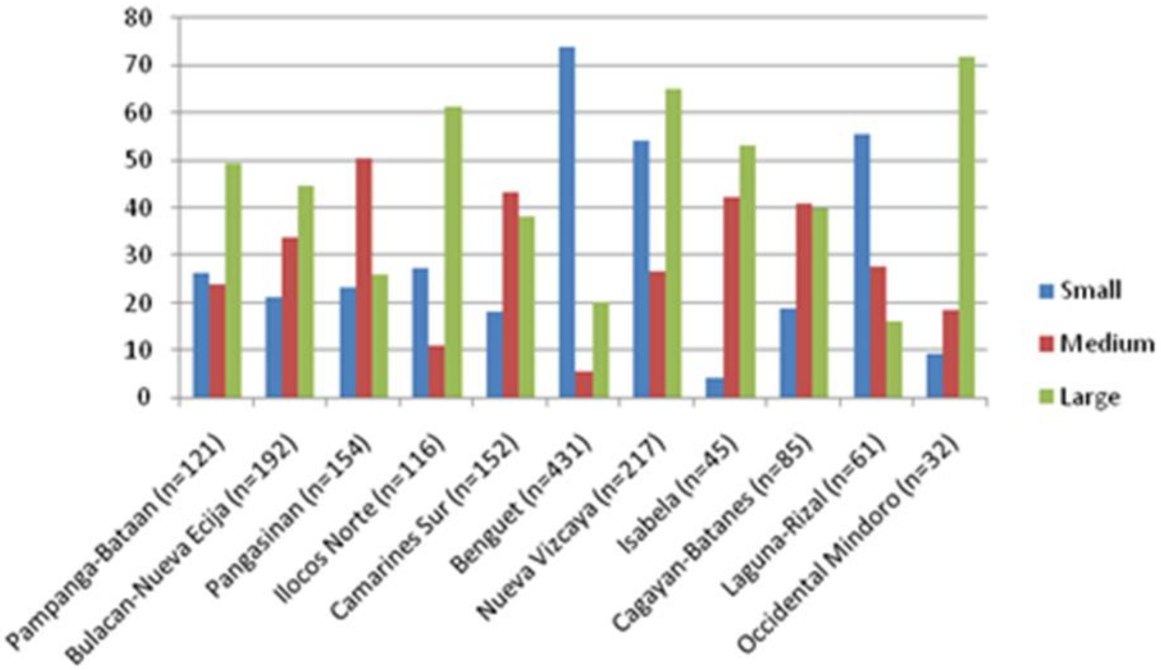

Figure 21a. Percent distribution of CIS by firmed-up service area and province in the 11 selected IMOs in Luzon

Source: IA Profile in respective Irrigation Management Offices (as of 2013, 2014)

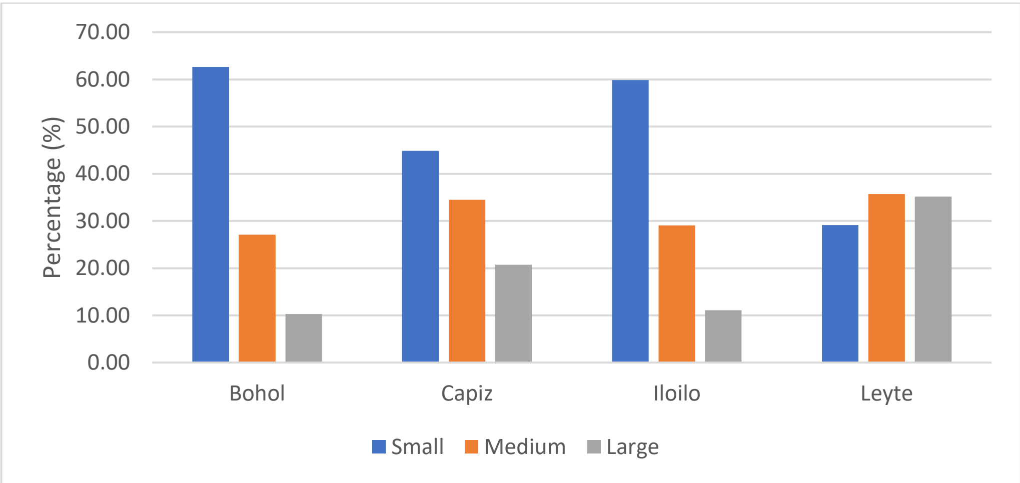

Figure 21b. Percent distribution of CIS by firmed-up service area and province in the 4 selected IMOs in Visayas

Source: IA Profile in respective Irrigation Management Offices (as of 2017)

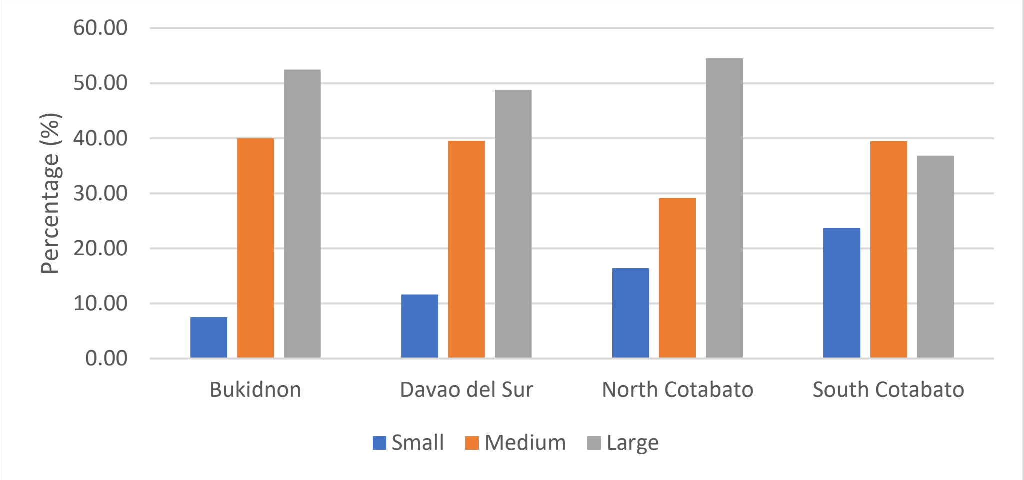

Figure 21c. Percent distribution of CIS by firmed-up service area and province in the 4 selected IMOs in Mindanao

Source: IA Profile in respective Irrigation Management Offices (as of 2017)

6.2. Type of Technology and Operational Status

Majority of the CIS in all IMOs are gravity type CIS with Mindanao at 100%. Just over 10% use pumps in Luzon and Visayas. This is not to say that there are no STWs, PISOS, or no shallow aquifer systems in Mindanao. In fact, many farmers take advantage of the vast shallow aquifer systems in Mindanao and use STWs for supplement irrigation. Most however were private initiatives or distributed from other government agencies.

Over 70% of all CIS in Luzon and Visayas and 87% in Mindanao are above 50% operational. In Luzon, around 20% are partially operational, or on-going, deferred, or not yet operational systems. Around 5% are below 50% operational due to defective/inadequate facilities. Partially operational, on-going, deferred, or not yet operational CIS are more notable in Ilocos Norte, Bulacan-Neva Ecija, and Cagayan-Batanes. Non-operational CIS was reported higher in Occidental Mindoro and Isabela. The causes of these conditions are discussed in the Technical review based on the walkthroughs of the sample systems.

6.3. Cropping Intensity

Cropping intensity is the ratio of area irrigated to the FUSA (or design area in some cases) of the CIS. Annual cropping intensity could also be the ratio of area irrigated during the dry and wet seasons to the area irrigated during the wet season expressed in percentage. According to NIA Camarines Sur IMO, cropping intensity should be at least 130%, i.e., 100% for wet and 30% for dry season. Thus, with irrigation, it should be more than 130%. The national average cropping intensity dropped from 133 in 2013 to 129 in 2014. In 2017, the national average cropping intensity based on FUSA is 144.5%; and 127 based on service area (NIA Annual Report 2017).

For most of the IMO's time series profiles, the cropping intensity increases with decreasing FUSA. A cropping intensity less than a 100% was observed in Isabela in 2013 and 2014 however a consistently highly cropping intensity, average of 179%, was observed in the adjacent province Nueva Vizcaya. And except for Region II where the programmed and actual wet and dry season irrigated areas steeply declined, all IMOs showed increased cropping intensity from 2005 levels. The very high computed cropping intensity for Region II again clearly showed some erroneous data particularly prior to 2008. For Visayas, the cropping intensities of Capiz and Iloilo were very low (60%) in 2014 but doubled in two years. The cropping intensities in Mindanao are relatively higher.

The average cropping intensity of all the CIS in all the IMOs visited are shown in Table 5. In the selected 11 IMOs in Luzon, the average annual cropping intensity of CIS is 158%, higher than the national average. Of the total 1,151 CIS reported by the IMOs, 81% have cropping intensity higher than 130%, indicating they are better than the national average. The average cropping intensity is slightly higher in Mindanao (160%) than in Luzon (157%) and Visayas (158%). Among the sample IMOs in the three regions, Visayas has the least percentage of CIS with cropping intensity above 130%.

Table 5. Average cropping intensity of the CIS from the different IMOs visited

Luzon (2014 data)		
Average cropping intensity in the 11 sample provinces	158%	
	Number	Percent
IAs with cropping intensity below 130%	155	12%
IAs with cropping intensity above 130%	923	81%
No available data	73	7%
Visayas (2017 data)		
Average cropping intensity in the 4 sample provinces	157%	
	Number	Percent
IAs with cropping intensity below 130%	105	22.63%
IAs with cropping intensity above 130%	297	64.01%
No available data	62	13.36%
Mindanao (2017 data)		
Average cropping intensity in the 4 sample provinces	160%	
	Number	Percent
IAs with cropping intensity below 130%	43	24.43%
IAs with cropping intensity above 130%	129	73.30%
No available data	4	2.27%

Source: Seasonal Operational and Maintenance Report of Respective Irrigation Management Offices

Table 6 shows the number and percentage (based on total in Luzon, Visayas and Mindanao samples, respectively) of CIS based on cropping intensity brackets for the wet and dry seasons. Majority of the CIS in Luzon, Visayas and Mindanao have cropping intensity of over 95% during the wet season and dry season. In Luzon, the CIS in Bulacan-Nueva Ecija has lower cropping intensity relative to the other provinces during wet season. In Visayas, Bohol has the highest percentage of CIS with above 95% cropping intensity during wet season while Capiz and Leyte account for most CIS with low cropping intensity of below 54% during wet season. In Mindanao, Bukidnon accounts for the lowest percentage of CIS with 95% and above cropping intensity and the highest percentage in cropping intensity below 54%.

Table 6. Number of CIS based on cropping intensity brackets under wet and dry seasons for all the IMOs visited

IMO	Wet season						Dry season					
	No Data	<54%	55% - 69%	70% - 79%	80% - 94%	>95%	No Data	<54%	55% - 69%	70% - 79%	80% - 94%	>95%
Luzon (n=1151); 2014 data												
No.	578	98	67	66	264	17	609	106	70	61	200	73
%	50.22	8.51	5.82	5.73	22.94	1.48	52.91	9.21	6.08	5.30	17.38	6.34
Visayas (n=464); 2017 data												
No.	217	54	33	30	67	63	155	84	30	39	77	79
%	46.77	11.64	7.11	6.47	14.44	13.58	33.41	18.1	6.47	8.41	16.59	17.03
Mindanao (n=176); 2017 data												
No.	92	18	9	23	31	3	85	18	14	19	34	6
%	52.27	10.23	5.11	13.07	17.61	1.70	48.30	10.23	7.95	10.8	19.32	3.41

Source: Seasonal Operational and Maintenance Report of Respective Irrigation Management Offices

6.4. Yield

According to the KIIs, palay yield without irrigation is 50 cavans/ha; with irrigation, it should range from 80 to 100 cavans/ha. Table 7 shows the average palay yield (cavans per hectare) in all the selected IMOs. In the 11 IMOs in Luzon, the average yield ranged from 51 to 96 cavans/ha. The lowest yield is in Benguet for both wet and dry seasons at around 50 cavans. In Visayas, lowest yield is in Iloilo and Leyte (Table 9b) while in Mindanao, lowest yield is in North and South Cotabato (Table 9c). Davao del Sur has the highest yield over 100 cavans/ha during both wet and dry seasons.

Table 7. Average palay yield in all the selected Irrigation Management Offices

IMO	Cavans/Hectare	
	Wet Season	Dry Season
Luzon (2014 data)		
Pampanga-Bataan	87.26	71.34
Bulacan-Aurora-Nueva Ecija	72.20	95.51
Pangasinan	80.82	81.12
Ilocos Norte	78.33	79.03
Camarines Sur	83.68	79.65
Benguet	51.45	53.73
Nueva Vizcaya	88.00	88.00
Isabela	95.00	96.00
Cagayan-Batanes	91.00	89.00
Laguna	no data	90.16
Occidental Mindoro	80.00	no data
Visayas (2017 data)		
Bohol	91	103
Leyte	85	90

Iloilo	82	78
Capiz	97	97
Mindanao (2017 data)		
Davao del Sur	100.77	124.41
South Cotabato	80.45	79.83
North Cotabato	88.72	77.69
Bukidnon	86.58	85.83

Source: Secondary data from respective IMOs

6.5. Functionality of Communal Irrigators' Associations

NIA (with the involvement of the IDO) assesses the functionality of IAs based on parameters related to O&M performance, organization, financial, and organizational discipline. Results of the annual or seasonal functionality survey are used in the search for outstanding IAs at the provincial, regional and national level. This is a good motivation to the IAs and its members. It also helps NIA in identifying appropriate strategies to enhance IA's capabilities. The rating is done through discussions/consultation with IAs.

Recently, indicators used in rating IA functionality included the following factors - O&M with 35% weight; financial, 26%; organization and organizational discipline, 29%; assistance program/agri-support services/linkages (6%); and special features (4%). O&M indicators include O&M planning and implementation, and performance such as annual cropping intensity, irrigated area vs. programmed area, status of irrigation facilities and structures, yield, and collection efficiency. Financial performance includes income generation and fund utilization, and viability index. Organization and organizational discipline include information on membership, meetings, recording/filing system; attendance in meetings and group work, holding of regular elections, conflict resolution, and imposition of discipline. The overall score indicates the following functionality rating: Outstanding – 95-100; Very satisfactory (VS) - 85-94; Satisfactory (S) - 75-84; Fair - 65-74; Poor (P) - below 65.

Table 8 shows the average functionality rating of the CIS Irrigators' Associations in all the sample IMOs. Based on reports gathered from the IMOs, majority (around 76%) of the IAs in the 11 sample IMOs in Luzon as well as in Visayas have satisfactory to very satisfactory ratings. Around 19% of IAs in sample IMOs in both regions have fair to poor rating. In Mindanao, over 16% of IAs in the sample IMOs are outstanding and over 14% have fair to poor rating.

Table 8. Average functionality rating of the communal irrigators' associations in all the sample IMOs

Rating	Outstanding	Very Satisfactory	Satisfactory	Fair	Poor
Luzon (n = 838); (2014 data)					
No.	36	287	353	126	36
%	4.30	34.25	42.12	15.04	4.30
Visayas (n = 288); (2017 data)					
No.	14	130	86	50	8
%	4.86	45.14	29.86	17.36	2.78
Mindanao (n =170); (2017 data)					
No.	28	81	36	13	12
%	16.47	47.65	21.18	7.65	7.06

Source: Secondary data from respective IMOs

On a per IMO basis, IAs in Isabela, Nueva Vizcaya, and Pampanga-Bataan (PAMBAT) have very satisfactory rating. Fair to poor rating, on the other hand, goes to IAs in Laguna-Rizal, Occidental Mindoro, and Camarines Sur during wet season (the province had seasonal functionality survey during the period (Figure 22a). In Visayas, 80% of Bohol IAs have very satisfactory rating. In contrast, only Leyte has IAs with poor rating (Figure 22b). In Mindanao, all IAs in South Cotabato have very satisfactory rating but over 40% of IAs in South Cotabato were rated outstanding. Poor IAs were noted in North and South Cotabato, and Bukidnon (Figure 22c).

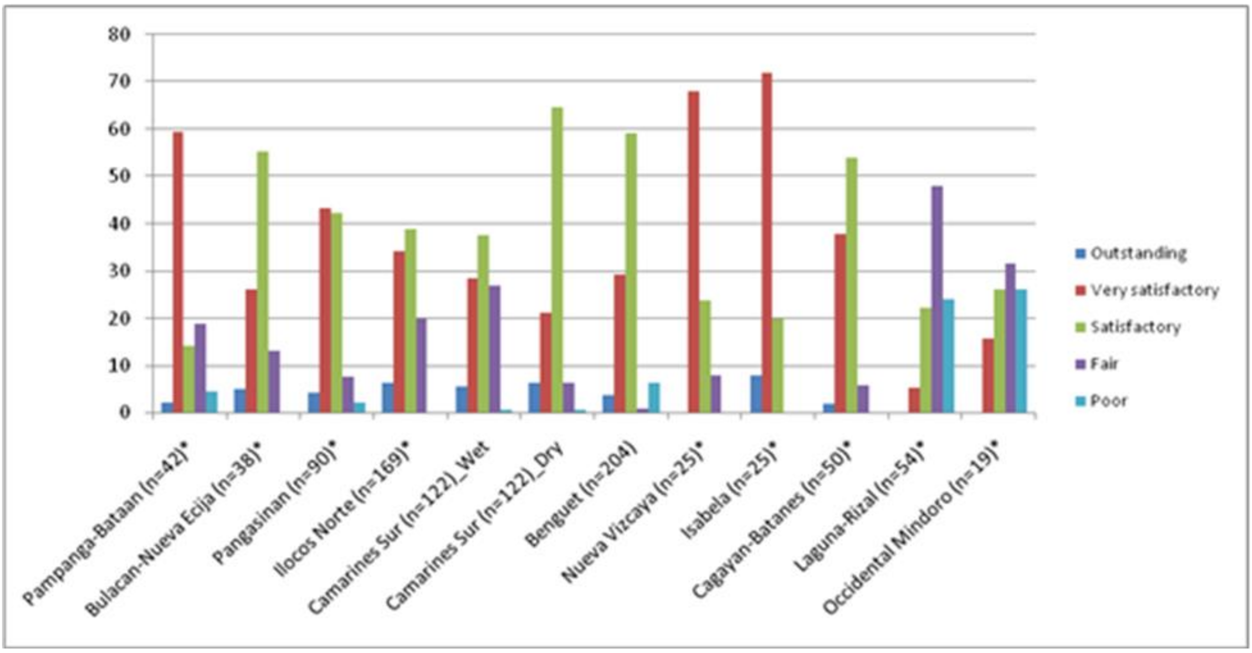

Figure 22a. Percentage distribution of Communal IAs by functionality rating and province in 11 sample IMOs in Luzon, 2014

*Functionality Survey done only once a year except in Camarines Sur where it is done every wet and dry season
Source: Functionality survey reports from respective IMOs of the Provinces (as of 2013, 2014)

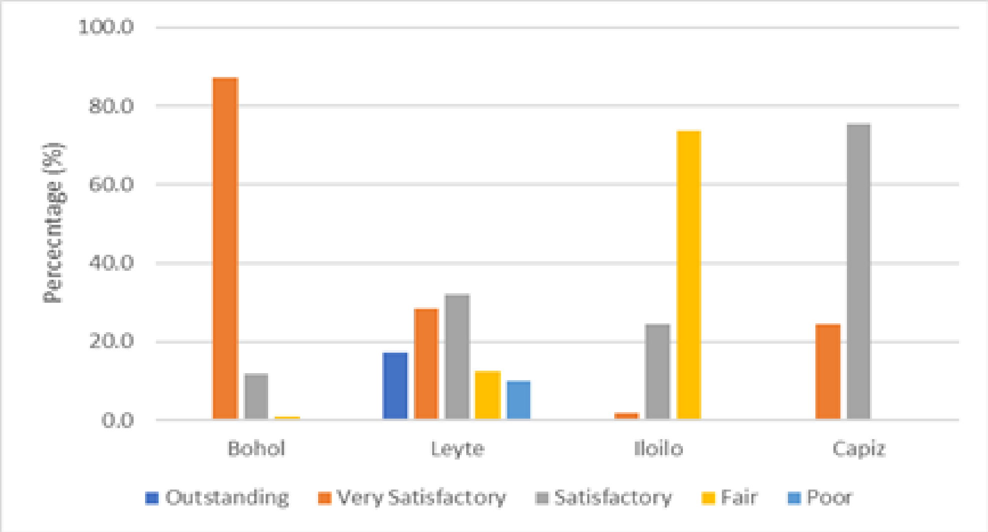

Figure 22b. Percentage distribution of Communal IAs by functionality rating and province in 4 sample IMOs in Visayas, 2017

Source: Functionality survey reports from respective IMOs of the Provinces (as of 2017)

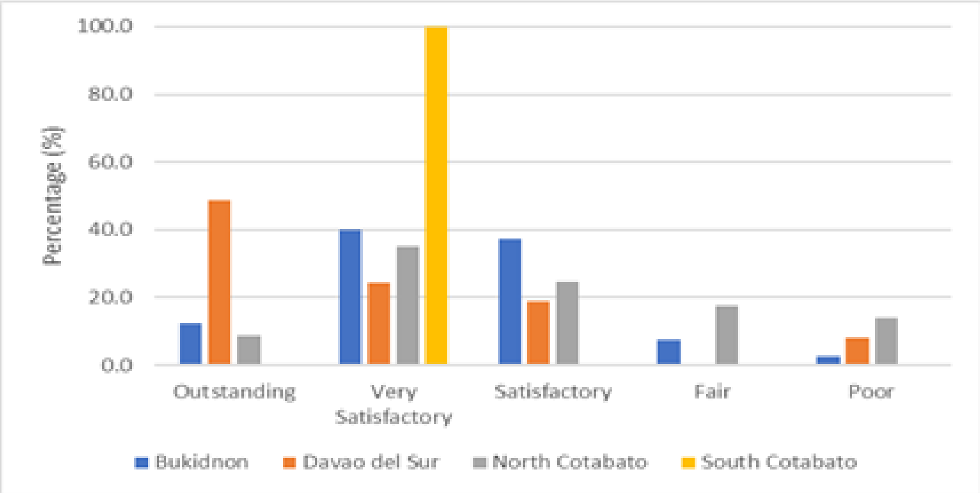

Figure 22c. Percentage distribution of Communal IAs by functionality rating and province in 4 sample IMOs in Mindanao, 2017

Source: Functionality survey reports from respective IMOs of the Provinces (as of 2017)

6.6. Deployment of Institutional Development Officers

Table 9 shows the number and deployment of institutional development officers to CIS in each of selected IMOs. The role of an IDO is very crucial to the IAs' institutional development. Based on key informant interviews with IDOs and IDD officials, the IDOs' work load is quite heavy. For instance, in Luzon, most of the IMOs have less than 10 IDOs with some assigned to both CIS and NIS projects. There are 68 gravity CIS and 28 Pump CIS in Pampanga, and 4 are under preconstruction. There is 1 Senior IDO for CIS and 1 Community Relation Assistant (CRA). In Pangasinan, the Supervising IDO is the overall supervisor for both NIS and CIS IDOs. There are 8 IDOs assigned to CIS in 6 districts.

At present, IDOs still have heavy load but are not getting adequate incentives such as security of tenure and other benefits. In Visayas, one IDO is assigned 14 to 20 CIS. IDOs in Mindanao have a lighter load with one IDO in charge of 3-8 CIS.

Table 9. Deployment of institutional development officers (IDOs) to CIS in all the sample IMOs

IMO	No. of CIS/IAs	No. of IDOs
Luzon (2014 data)		
Pampanga	68	1 Sr. IDO for CIS and 1 Community Relation Assistant (CRA)
Nueva Ecija	60	7 IDOs with CRAs helping
Pangasinan	120	8 IDOs are assigned to CIS in 6 districts
Ilocos Norte	116	4 IDOs assigned to CIS; 5 IDOs to both CIS/NIS; two (2) farmers' Irrigators' organizers
Benguet	431	3 IDOs
Camarines Sur	152	2 IDOs for CARP and SRIP; 6 Research Assistant B position covering 5 districts
Nueva Vizcaya	217	4 IDOs are assigned CIS/IAs
Isabela	45	1 assigned to CIS project but there are many radiation projects
Cagayan	673	3 IDOs
Laguna	13	3 IDOs in 3 districts
Occidental Mindoro	32	5 IDOs
Visayas (2017 data)		
Bohol	213	14
Leyte	186	13
Iloilo	123	7
Capiz	62	3
Mindanao (2017 data)		
Davao del Sur	77	10
South Cotabato	35	10
North Cotabato	68	12
Bukidnon	40	14

Source: Secondary data from respective IMOs

6.7. Cost Payment Schemes

Before the implementation of FISA, majority of IAs in the three regions were amortizing. Table 10 shows the number of CIS availing the different cost payment schemes. The non-amortizing IAs were either able to raise the 30% equity or got the system as a grant through government programs in the past. Percentage of IAs who have fully amortized were highest in Mindanao.

Table 10. Cost payment schemes of irrigators associations in the selected IMOs

IMO	Amortizing	Non-Amortizing	Fully amortized	30% Equity paid	Dole Out – Luzon; Newly Constructed - Visayas	Others*
Luzon (n = 1467); 2013, 2014 data						
No.	577	313	34	395	5	143
%	39.33	21.34	2.32	26.93	0.34	9.75
Visayas (n = 239); 2017 data						
No.	167	5	5	23	11	27
%	69.87	2.09	2.09	9.62	4.60	11.30
Mindanao (n =87); 2017 data						
No.	65	0	13	2	-	7
%	74.71	0	14.94	2.30	-	8.05

*Non-functional systems, deferred, under construction
Source of basic data: IA Profile in respective IMOs (as of 2013, 2014 and 2017)

On an individual IMO basis, almost all IAs in Pangasinan are amortizing while in Benguet, majority have paid the 30% equity. Devolution of CIS to local government unit (LGU) as per AFMA is rarely implemented. Different political agenda, low priority to agriculture, limited budget, and lack of expertise/manpower are the main reason why LGUs could not manage CIS. Assistance from politicians is usually through provision of funds for new or rehabilitation projects.

7. Results of Technical Survey of Selected Communal Irrigation Systems

Tables 11a to 11c show the profile of the 66 selected CIS from 11 selected provinces in Luzon (Cycle 1) and the 12 sample CIS from 4 selected provinces in Visayas and 12 sample CIS from 4 selected provinces also in Mindanao. The highlights of the interviews with IA officials and members and the findings from walkthroughs of each individual CIS are shown in Annex 16.1A and B. The location of the selected CIS relative to a slope map are shown on Annex 16.2A and B. It is unfortunate that shape files of the delineated areas of all the CIS are not available from NIA. Any available maps are not accurate and geotagged, while the limited time during the surveys prevented any form of area delineation except for some point reference of the location of the dam and several important irrigation structures.

Table 11a. Profile of the 66 selected CIS in Luzon

Province/CIS	Technology	Source of Water Supply	FUSA (Size)	Irrig. Area Operational (SA)	Percent Operational (%)	Irrigated Area Wet (ha)	Irrigated Area Dry (ha)
Ilocos Norte							
Dangdangla CIS	Gravity	Baruyen River	24.0	24.0	100.0	19.0	18.0
Tanap A Dakkel CIS	Gravity	Cabacanan River	434.0	434.0	100.0	434.0	400.0
Palompong CIS	Gravity	Palongpong Creek	150.0	60.0	40.0	60.0	20.0
Baay CIS	Gravity	Paoay Lake	163.2	163.2	100.0	113.0	105.0
Zanjanera Bangsirit CIS	Gravity	Co-Ca River	200.0	200.0	100.0	200.0	200.0
Der-Apsaoit CIS	Gravity	Buraan River	100.0	80.0	80.0	80.0	80.0
Pangasinan							
San Angel SRIP	Reservoir	Rainfall and Spring	160.0	160.0	100.0	160.0	80.0
Don Oftociano Sr. CIS	Gravity	Creek	72.0	72.0	100.0	72.0	36.0
Sapid CIS	Gravity	Sapid Creek	50.0	40.0	80.0	40.0	20.0
Nama CIS	Gravity	Aloragat River	369.0	311.0	84.3	300.0	220.0
Convento CIS	Pump	Concordia River	60.0	45.0	75.0	45.0	22.0
Ngayaongaoan CIS	Gravity	Aloragat River	90.0	90.0	100.0	90.0	65.0
Benguet							
Labney CIS	Gravity	Piyas Creek	168.2	168.2	100.0	164.0	166.0
Parasipis CIS	Gravity	Bodahao Creek	133.0	133.0	100.0	133.0	133.0
Taloy Sur CIS	Gravity	Alitang Creek	30.0	30.0	100.0	30.0	30.0
Bineng Japos CIS	Gravity	Balili River	46.5	46.5	100.0	46.5	46.5
Longlong CIS	Pump	Longlong Creek	32.0	32.0	100.0	32.0	32.0
Lasong CIS	Gravity	Ampusa Creek	14.0	10.0	71.4	10.0	10.0
Cagayan							
Abaca CIS	Gravity	Abaca Creek	119.0	37.0	31.1	37.0	37.0
Calusit CIS	Gravity	Pangul Creek	125.0	125.0	100.0	70.0	0.0

Province/CIS	Technology	Source of Water Supply	FUSA (Size)	Irrig. Area Operational (SA)	Percent Operational (%)	Irrigated Area Wet (ha)	Irrigated Area Dry (ha)
Tappakan Baraccaoit CIS	Pump	Tappakan River	42.0	42.0	100.0	42.0	42.0
Gumarang CIS	Gravity	Gumarang Creek	98.0	98.0	100.0	0.0	0.0
Garab CIS	Gravity	Swip	160.0	105.0	65.6	105.0	105.0
Naddungan CIS	Gravity	Creek	120.0	90.0	75.0	90.0	90.0
Isabela							
Viola CIS	Pump	Surface Runoff, Groundwater	550.0	550.0	100.0	550.0	550.0
Masipi West CIS	Gravity	Masipi Creek	70.0	70.0	100.0	70.0	70.0
Masipi East CIS	Gravity	Balasig River	62.0	62.0	100.0	62.0	62.0
Casilagan Ballacong CIS	Gravity	Bintacan River	175.0	155.0	88.6	155.0	155.0
Cumabao CIS	Gravity	Balasig River, Sinabuloan Creek	190.0	190.0	100.0	190.0	130.0
Cabaruan CIS	Pump	Surface Run-Off, Ground Water	96.0	50.0	52.1	50.0	26.0
Nueva Vizcaya							
Lumannap Aurora CIS	Gravity	Angadanan River	110.0	105.0	95.5	110.0	110.0
Nangalisan-Paniki-Pieza CIS	Gravity	Lamut River	650.0	612.0	94.2	490.0	490.0
Magapuy CIS	Gravity	Magat River	40.0	40.0	100.0	40.0	40.0
Boliwao CIS	Gravity	Boliwao River	73.0	73.0	100.0	70.0	70.0
Paoac Barobbob CIS	Gravity	Bayombong Creek	336.0	336.0	100.0	336.0	336.0
Duruarog CIS	Gravity	Duruarog Creek	10.0	10.0	100.0	10.0	5.0
Nueva Ecija							
Cordero CIS	Gravity	Groundwater	50.0	50.0	100.0	50.0	30.0
Inasan CIS	Gravity	Inasan River	110.0	110.0	100.0	110.0	80.0
Parang-Bugnan CIS	Gravity	Bugnan River	220.0	220.0	100.0	220.0	190.0
Sta. Lucia-Old CIS	Gravity	Malabog Creek	400.0	400.0	100.0	350.0	400.0
Macapulo Bongabon CIS	Pump	Creek	60.0	60.0	100.0	12.0	12.0
Tedtedtilingit CIS	Gravity	Bato Ferry	249.0	249.0	100.0	130.0	130.0
Pampanga							

Province/CIS	Technology	Source of Water Supply	FUSA (Size)	Irrig. Area Operational (SA)	Percent Operational (%)	Irrigated Area Wet (ha)	Irrigated Area Dry (ha)
Sitio Ipil PIS	Pump	Pampanga River	79.0	35.0	44.3	35.0	35.0
Sapa-San Vicente PIS	Pump	Minalin Creek; Pampanga River	90.0	90.0	100.0	90.0	90.0
Anao CIS	Gravity	Abacan River	438.1	409.1	93.4	24.1	24.1
Lusung CIS	Gravity	Gagu Creek	94.0	94.0	100.0	94.0	94.0
Gulap PIS	Pump	Pampanga River	358.7	358.7	100.0	0.0	331.0
Hacienda Dolores PIS	Gravity	Porac River	50.0	37.0	74.0	37.0	37.0
Laguna							
Maria Pelaez CIS	Gravity	San Nicolas River	86.0	86.0	100.0	86.0	86.0
San Benito CIS	Gravity	Santol Creek	137.0	137.0	100.0	137.0	137.0
Balanga CIS	Gravity	Balanga River	36.0	36.0	100.0	36.0	36.0
San Roque Pump CIS	Pump	Groundwater	90.0	51.0	56.7	45.0	45.0
Maravilla CIS	Gravity	Maimpez River	40.0	40.0	100.0	40.0	40.0
Bañadero CIS	Gravity	Bañadero River	129.0	129.0	100.0	129.0	129.0
Occidental Mindoro							
Bombongan CIS	Gravity	Anahawin River	386.0	350.0	90.7	250.0	200.0
New Ilocos Tamaraw CIS	Gravity	Lumintao River	1,000.0	1,000.0	100.0	900.0	850.0
Samahang Magpapatubig Ng Batasan Inc. CIS	Gravity	Busuanga River	285.0	285.0	100.0	285.0	280.0
Manuot CIS	Gravity	Busuanga River	623.0	490.0	78.7	450.0	400.0
Limlim CIS	Gravity	Lumintao River	600.0	576.0	96.0	576.0	576.0
Monteclaro CIS	Gravity	Kayakyan River	229.0	229.0	100.0	229.0	229.0
Camarines Sur							
Maybatang CIS	Gravity	Maybatang River/ Camaslog Creek	317.0	260.7	82.2	260.7	260.7
Lanipga PIS	Pump	Pawili River	150.0	78.0	52.0	42.0	42.0

Province/CIS	Technology	Source of Water Supply	FUSA (Size)	Irrig. Area Operational (SA)	Percent Operational (%)	Irrigated Area Wet (ha)	Irrigated Area Dry (ha)
San Agustin-San Ramon PIS	Pump	Bicol River	586.0	419.0	71.5	419.0	419.0
Inansagan CIS	Gravity	Lagonoy River	50.0	50.0	100.0	33.0	33.0
Suha San Antonio CIS	Gravity	Cagmanaba Creek Kinakabikabihan Creek	100.0	100.0	100.0	100.0	100.0
Aslong CIS	Gravity	Aslong River	250.0	250.0	100.0	250.0	250.0

Source: FGD with IA officers/members and secondary data from respective IMO, 2015

Table 11b. Profile of the 12 selected CIS in Visayas

Province/CIS	Technology	Source of Water Supply	FUSA (Size)	Irrig. Area Operational (SA)	Percent Operational (%)	Irrigated Area Wet (ha)	Irrigated Area Dry (ha)
Bohol							
Gabayan CIS	Gravity	Gabayan River	290	290	100	290	250
Cambuyo CIP	Gravity	Aghuban Spring	100	100	100	100	75
Loboc Groundwater	Pump	Groundwater	20	20	100	20	5
Leyte							
Tagbawto CIS	Gravity	Hilusig and Tagbawto Rivers	723	723	100	723	723
Sta. Elena CIS	Gravity	Kiloon Creek	112	112	100	112	112
Maljo CIS	Gravity	Taon-Taon River	46	46	100	46	46
Iloilo							
Siwaragan CIS	Gravity	Siwaragan River	197	195	98.98	195	185
Tumagboc CIS	Gravity	Tumagbok River	65	65	100	65	45
Nalundan/ Particion CIP	Pump	Tangyan River	50	50	100	50	25
Capiz							
Maayon CIP	Gravity	Maayon River	592	592	100	592	592
Salcedo CIS	Gravity	Mali-ao Creek	128	128	100	128	128

Province/CIS	Technology	Source of Water Supply	FUSA (Size)	Irrig. Area Operational (SA)	Percent Operational (%)	Irrigated Area Wet (ha)	Irrigated Area Dry (ha)
Sigma Sur PCIS	Pump	Mambusao River	35	35	100	35	35

Source: FGD with IA officers/members and secondary data from respective IMO, 2018

Table 11c. Profile of the 12 selected CIS in Mindanao

Province/CIS	Technology	Source of Water Supply	FUSA (Size)	Irrig. Area Operational (SA)	Percent Operational (%)	Irrigated Area Wet (ha)	Irrigated Area Dry (ha)
Davao del Sur							
New Katipunan CIS	Gravity	Bakungan Creek	100	100	100	100	100
UNIFARM CIS	Gravity	Matanao River, Darapuay River, Dolo River, Marapang Creek	400	400	100	400	400
Butilon CIS	Gravity	Butilon River	46	46	100	46	46
North Cotabato							
Del Carmen CIS	Gravity	Marbel River	516	516	100	516	516
Hervilla CIS	Gravity	Tuael River	103	103	100	103	103
Sta. Maria – Minamaeng CIS	Gravity	Linao Creek	100	100	100	100	100
South Cotabato							
LMT CIS	Gravity	Tapland River	1026	1026	100	1026	1026
Bunao CIS	Gravity	Bunao Creek	75	75	100	75	75
Mani CIS	Gravity	Mani Creek	425.25	425.25	100	425.25	425.25
Bukidnon							
Delapa CIS	Gravity	Delapa Creek	330	330	100	330	330
Magsaysay CIS	Gravity	Magsaysay Spring	50	50	100	50	50
Miglamin CIS	Gravity	Miglamin Creek	52	52	100	52	52

Source: FGD with IA officers/members and secondary data from respective IMO, 2018

The slope maps showed that some CIS are irrigating rice areas with slope greater than 3%, particularly those areas outside large NIS like UPRIIS and MARIIS. In some cases, the CIS are irrigating small patches of areas under 3% slope. The 3.1 M potential irrigable areas as defined by NIA based on the 0-3% slope and 100 ha contiguous, are quite low and that there is a vast potential for small scale irrigation development if there is a good surface water source or a good aquifer present. This lends credence to a World Bank study which included areas up to 8% slope increasing the irrigable areas to more than 6.1 M ha. These show that the basis for the delineation of potential irrigable areas should be revisited.

7.1. Sources of Water

One of the main reasons for the low performance of irrigation systems is the lack of water during dry season. During the feasibility study, historical records of river discharge (low flows) is subjected to hydrologic frequency analysis (HFA) and usually the 4 in 5 year low or 80% dependable flow is used in the design. However, most of our river systems have not been gauged since the 1980's and the last published reference for major rivers is the Philippine Water Resources Summary Data Volume 1: Streamflow and Lake or River Stage by the then National Water Resources Council (now NWRB) in 1980. The last records stated in this reference is December 31, 1970. It is only recently that monitoring of river flows on most rivers were continued due to the floods and calamities that recently befell the country. In the absence of data, engineers usually rely on empirical equations (e.g. Rational equation, and other site-specific case studies), water balance methods or synthetic data generated using hydrologic models (e.g. HEC-HMS, SWAT). The reliability of these methods should always be tested and the results calibrated with actual data. Also, historical data may not reflect the actual condition especially if the watershed and land use upstream have been modified.

The water source for the surveyed CIS include lakes, rivers, creeks, springs, groundwater and runoff or a combination of one or more source. Rivers, creeks, and springs are the major sources of irrigation water in Luzon. Groundwater is particularly used in Pampanga, Isabela, Laguna. In the Visayas, only one sample CIS in Bohol use groundwater as additional source. For Mindanao sample CIS, rivers are the only water source in Davao del Sur while the other provinces have either springs or creeks as other sources. Except for some large rivers, there are no historical records of the discharges of the river and creek sources for CIS. Historical flow records or at least synthetically generated flow data should be included in the feasibility analyses, but no such report have been furnished by the NIA for all the CIS visited.

Surface Sources
Paoay Lake in Ilocos Norte, which is the source of Baay CIS through a dike and intake tunnel structure, is the only lake source for any of the CIS surveyed. No storage or water level records are available for Paoay Lake.

Some rivers have adequate water supply with a dependable (low) flow that can sustain irrigation on both wet and dry seasons. For Luzon, these rivers and the CIS drawing irrigation water from them include: Pampanga (Sitio Ipil PIS; Gulap PIS), Porac (Hacienda Dolores PIS), Inasan (Inasan CIS), Bugnan (Parang Bugnan CIS), Baruyen (Dangdangla CIS), Co-ca (Zanjanera Bangsirit CIS), Maybatang (Maybatang CIS), Camaslog (Maybatang CIS), Aslong (Aslong CIS), Magat (Magapuy CIS), Boliwao (Boliwao CIS), Angadanan (Aurora CIS), Bintacan (Casilagan CIS), Bicol (San Ramon PIS), Pawili (Lanipga PIS), Lagonoy (Inansagan CIS), San Nicolas (Maria Pelaez CIS), Maimpez (Maravilla CIS), Bañadero (Bañadero CIS) and Busuanga (Samahang Magpapatubig Ng Batasan Inc. CIS; Manuot CIS) Rivers. In Visayas and Mindanao, these rivers and the CIS drawing irrigation water from them include: Gabayan (Gabayan CIS), Tagbawto (Tagbawto CIS), Siwaragan (Siwaragan CIS), Maayon (Maayon CIS), Mambusao (Sigma Sur PCIS), Marbel (Del Carmen CIS)and Taplan (LMT CIS) Rivers. Some rivers are large with very high flows like the Pampanga, Porac, Bicol, Pawili and Mambusao Rivers that supplies irrigation for CIS through large pumps.

Some rivers have dry season flows that are very low compared to the wet season flows. This assessment was based on the interviews of the IAs and IDOs since no records of the river flows are available. For Luzon, these include the Abacan (Anao CIS), Aloragat (Nama CIS), Concordia (Convento CIS), Cabacanan (Tanap a Dakkel CIS), Buraan (Der-Ap Saoit CIS), Lamot (Nangalisan CIS), Masipi (Masipi West CIS), Tappakan (Tappakan Baraccoit CIS), Balanga (Balanga CIS), and Anahawin (Bombongan CIS) Rivers. For Visayas and Mindanao, these include: Taon-Taon (Maljo CIS), Tangyan (Particion PIS), Matanao (Unifarm CIS), Butilon (Butilon CIS), and Tuael (Hervilla CIS) Rivers. These rivers can only sustain full irrigation supply during the wet season and have very low dry season flows such that only a portion of the CIS FUSA can be irrigated. The Abakan River in Pampanga is affected by lahar such that its storage capacity is reduced. There is also the quarrying problem upstream and downstream of the dam which was one of the causes of the tilting or collapse of the previous dam. The CIS Design manual specifically stated that there should be no quarrying of the river within 1-km upstream and 1-km downstream of the proposed diversion dam.

More common in Visayas and Mindanao are the occasional flash floods with the consequent boulders, rocks and sediment deposition that damaged the dam and appurtenances (e.g. Tagbawto, Siwaragan, Matanao, Marbel and Taplan Rivers). The watershed of some of these rivers are either denuded or have some mining concessions.

Most of the large rivers mentioned now have streamflow gaging stations installed by the various government projects (e.g. LiDAR Project) so estimation of dependable water supply for the computation of water duties and design areas for new irrigation systems will be facilitated in the future. In the meantime, however, when records are still inadequate, hydrologic modeling may be required to generate dependable flow estimates.

Smaller rivers with adequate dependable flows are usually equipped with run-of-the-river type dams to raise the water level and distribute irrigation water by gravity. A common characteristic of these rivers is that their watersheds have all good forest cover. In some cases, however, while the river flows are adequate, less water is deliverable because the storage capacity of the dam has already been reduced since the dam is already filled with sediments.

All the mountain rivers in Benguet have dependable flows even during the dry season, but because of their small discharge these can only sustain small areas. In some CIS, they are only used for supplementary irrigation because the main water source are springs, whose waters are also used for drinking.

Some creeks have adequate flows for small areas during the wet season but have very low or at times no flow during the dry season. For Luzon, these include the Minalin (Sapa-San Vincente PIS), Arimal (Cordero CIS), Gagu (Lusung CIS), Sapid (Sapid CIS), Bato Ferry (Tedtedtilingit CIS), Palongpong (Palongpong CIS), Cagdaga (Suha San Antonio CIS), Cagmanaba (Suha San Antonio CIS), Kinakabikabihan (Suha San Antonio CIS), Bayombong (Paoac Barobbob CIS), Duruarog (Duruarog CIS), Sinabuloan (Cumabao CIS), Pangul (Calusit CIS), and Gumarang (Gumarang CIS) creeks. Arimal and Pangul Creeks have no flows during the site visit, and the IAs said that the forest in the watershed are already denuded due to slash and burn agriculture (kaingin). Even then the dry season flow of the creek is very low but recently no water flows during the dry season. In the case of the Sapid creek, the operation of a cement company upstream resulted to little or no water during the dry season. For Visayas and Mindanao, these include Kiloon (Sta. Elena CIS), Mali-ao (Salcedo CIS), Bakungan (Katipunan CIS), Linao (Sta. Maria-Minamaeng CIS), Bunao (Bunao CIS), Mani (Mani CIS), Delapa (Delapa CIS) and Miglamin (Miglamin CIS) Creeks. During low flows when not enough water enters the dam intake structures, the same rivers or creeks are sometimes used directly as supplemental water sources using low-lift pumps or open-source pumps (LLPs/OSPs).

Only 29 out of the 90 CIS visited, or about 32%, have rivers sources that were deemed capable of providing irrigation even during dry seasons. Seven of these rivers are very large and provide water for large NIS as well. If the CIS are sourced from these rivers, then dry season crops are more or less assured of irrigation 80% of the time, and only siltation and hardware problems are left to deal with. However, majority of the CIS are sourced from less dependable small rivers and creeks, as well as springs and runoff (rainfall excess), which do not even have historical records of flows to form as basis for sensible engineering designs. In these cases, the source of water is a major problem. This is compounded by environmental problems such as denuded watershed cover due to logging and kaingin, land use conversion, etc. Moreover, the flow records show that even during the 1970's, the minimum measured flows are way below the mean daily discharge indicating that in some cases, even large rivers may not be able to supply irrigation during the dry season, say 1 in 5 yrs (20% probability of non-exceedance). This is expected to be much less at present.

Groundwater

The Philippines is blessed with about 5 million ha of shallow aquifers. Annex 16.3A and B shows the groundwater potential for each province selected in the survey. Fairly extensive and productive aquifers are present in parts of Isabela, Pampanga, Pangasinan, Ilocos Norte, Laguna, Leyte, Iloilo, Davao del Sur, North and South Cotabato, while localized productive aquifers are present in Cagayan and other parts of Isabela, Camarines Sur, Benguet, and Occidental Mindoro, Bohol, Leyte, Iloilo, Capiz, Davao del Sur, North and South Cotabato. For Benguet, the localized aquifers are the sources of springs. Bohol, on the other hand, have many springs due to the Karst formations underlying the province. Nueva Vizcaya and Nueva Ecija, particularly since the visited CIS are located at the outskirts of the Pampanga River Basin, are without significant or limited pumpable groundwater.

While groundwater is usually tapped for irrigation by private initiatives using shallow tubewells (STWs), NIA and other government agencies like DA, BSWM and DAR have funded projects in support of STWs. Some CIS are directly irrigated by NIA funded STWs like the Viola Estate CIS and Cabaruan CPIS both in Isabela, and San Roque PIS in Victoria, Laguna. Viola Estate CIS is a collection of 134 units of STWs constructed by NIA and turned-over for management to the ARBA multi-purpose cooperative. Cabaruan CPIS only consists of 24 pump units, with each STW designed to irrigate a minimum of 3 ha. Tapping groundwater using STWs is also one of the main modes for supplemental irrigation for the CIS during the dry season including Don Oftociano and Cordero CIS, in which only 50% of FUSA is irrigated during the dry season, Anao, Sapa-San Vicente, Lusung, Nama, Palongpong, Zanjanera Bangsirit, Calusit, San Benito and Monteclaro CIS. There were no CIS using groundwater in Mindanao and only Loboc CIS in Bohol is using groundwater for irrigation. However, several farmers and IAs that have creeks as water sources have standby STWs which they used for supplemental irrigation. In fact, the NIA IMO of North Cotabato maintain standby STWs which they use only during periods of prolonged droughts.

While using STW pumps and engines may incur additional fuel costs, these are reliable water sources even during intense drought periods or El Niño episodes, and farmers have control of irrigation schedules and flows. The practice of supplementing gravity irrigation with groundwater from STWs should be encouraged in areas underlain by good shallow aquifers, especially if the surface water sources (i.e. creeks) have very low dependable flows during the dry season.

Springs are the principal water sources of most CIS in Benguet, supplemented only by river water when the flow becomes inadequate for their areas. Springs are also the sources of irrigation water for Lusung PIS, San Angel CIS and Abaca CIS. Since the spring discharge are usually low, they are supplemented by other sources like creeks for Lusung PIS and Abaca CIS and runoff for San Angel CIS. Spring from solution channels on Karst formation (e.g., Ughuban spring in Bohol, and other springs in Maljo CIS in Leyte, and Sta. Maria-Minamaeng CIS in North Cotabato) are also reliable sources for irrigation. While the Magsaysay CIS in Bukidnon has a spring source, its discharge have already been drastically reduced and the reservoir created by the spring is heavily silted.

Excess runoffs (rainfall excess) are also sometimes stored in reservoir or small water impoundments for use in irrigation. These include: San Angel CIS, which is a reservoir type that store runoff and water from two springs; Naddungan CIS, which impounds runoff in support of the Naddungan creek; and Garab CIS, which is a small water impounding project.

A review of the river basin masterplans of the Cagayan, Pampanga, Pasig-Laguna and Bicol River Basins were also conducted to determine development and management plans with regards to increased irrigated agriculture and water supply sources in the river basin. All of them projected an increase in irrigated areas, which are based potentially on the 3% slope irrigable areas, and proposed several strategies, including watershed protection, due to the consequent decline in water supply for all sectors. The Cagayan River Basin master plan proposed 9 irrigation development and 5 irrigation rehabilitation schemes to fully develop the lowlands. They have also proposed agricultural development schemes, water use management strategies and climate change impact and adaptation strategies and actions in their Integrated Water Resources Management (IWRM) Plan Framework. The Laguna de Bay master plan suggested that the lake and its watershed be zoned into three main areas, the industrial, watershed protection and shoreland zones in order to ensure the sustainability of the lake and its resources, in response to a foreseen decline in water supply. The formulation of a water resources utilization policy is suggested in light of the study to use Laguna Lake as potential domestic water supply source. A groundwater management project was also proposed. The Bicol River Basin master plan proposed to rehabilitate and develop watershed resources with improved governance, including the establishment of water allocation mechanism and considering the water needs of irrigated areas. The Pampanga River Basin master plan provided more detailed study and specific action plans. The masterplan noted that there are 186 functional CISs with 37,100 ha of service area in the river basin, however, 95 systems with the total service area of 16,830 ha are nonfunctional. Water shortage is also observed in many paddy fields served by the existing NIS/CIS. They cited that the main reasons of water shortage are: (a) the recent climate change causing unstable rainfall pattern; (b) the limited water resource development; (c) the deterioration of irrigation facilities due to insufficient maintenance; and (d) the lack of small-scale irrigation systems including water impounding facilities, etc. The degradation of the watershed due to illegal logging and slash/burn agriculture is deemed to be also one of the reasons of unstable water resource for irrigated cultivation.

What is sorely missing are specific plans regarding the year on year increase in irrigated areas based the dependable water supply of the rivers in the basin. In fact, only the Pampanga RB master plan presented a study on channel flow capacity at different sections of the Pampanga River, with an average flow of 2,569 m^3/s and probable peak flood runoff discharge for a 5-yr and 10-yr return period of 2,498 and 3,177 m^3/s, respectively.

Recently, the River Basin Control Office of DENR (RBCO-DENR) have commissioned the development and climate proofing of new river basin master plans for the 18 major river basins and several clustered watersheds. The University of the Philippines Los Baños through the College of Forestry and Natural Resources and other colleges were assigned six major river basins namely Cagayan, Agno, Mindanao, Buayan-Malungon, Agus (Ranao) and Tagaloan River Basins, as well as eight clustered watersheds in various regions of the country. These Master Plans include assessment of the water supply and water demand from the agricultural, domestic and industrial sectors, using water balance method. Hydrologic frequency analysis or flood duration analysis were performed for areas with adequate streamflow data. Hydrologic modeling, on the other hand, were performed for areas without or with limited streamflow data. The latest PAGASA climate change projections were adapted. The water balance analysis conducted in these river basin master plans would be a good starting point in the estimation of water duties for new areas for irrigation development.

7.2. Water Delivery Performance

After assessing the water supply sources, the IAs were asked during the KIIs to rank the water delivery performance in their CIS based on flexibility, reliability and equitability (Table 12). Flexibility, in this sense, refers to the ability of the CIS to deviate from an established irrigation schedule. This is different from the Flexibility of water control structures, which is the ratio of the change of discharge of the offtake to the rate of change of discharge of the continuing supply canal. The average Flexibility Index was computed at 3.3 in Luzon and 3.7 in both Visayas and Mindanao, indicating that the flexibility is quite high. The highest is 4 in Benguet, Bohol, Capiz, Davao del Sur and North and South Cotabato, and the lowest is 1.5 in Nueva Ecija. The lowest in Mindanao is in Bukidnon which is still 2.7. Most of the interviewed IAs have defined schedules for water releases especially during the dry season when water is limiting but are rather flexible during the wet season when water is more than sufficient. Some IAs have strict rules and penalties for non-compliance or water stealing. Flexibility in larger IS may be limited by the lack of control structures to divide or divert flows between zones.

Reliability is an expression of confidence by the irrigation system to deliver water as promised (Murray-Rust and Snellen, 1993). It is also the degree to which the irrigation system conforms to prior expectations of its users (Rao, 1993). The average score for Luzon based on the KII is a high 3.5 but it is much higher at 3.7 in both Visayas and Mindanao, indicating reliable water delivery. It should be noted that reliability is based on an expected or promised water delivery. Some farmers are resigned to the fact that water is scarce during a certain dry period and they will not receive water, so they usually find other water sources like STWs or LLPs. The almost uniform rainfall distribution in Mindanao and the reliable water sources in both Visayas and Mindanao are plus factors.

Equitability or in some literatures Equity is the spatial uniformity of the ratio of the delivered amount to the required amount (Molden and Gates, 1990). It is also an expression of the share for each individual or group that is considered fair by all system members (Murray-Rust and Snellen, 1993). Based on the KIIs, the average Equitability Index score in Luzon and Visayas is also quite high at 3.7 and just a bit lower of 3.5 in Mindanao. This means that the members considered the distribution of water among members per IA as equitable. This is however, biased since those questioned are the IA Presidents and Officers who naturally would rate this index as high in support of their leadership, but perhaps the result would be different if the members, particularly those in the downstream end of the system were questioned instead. At any rate, most IAs interviewed practiced 'downstream first' irrigation scheduling during dry periods so this result may actually be true. Water delivery flexibility, reliability and equitability is not a problem in Benguet because all CIS are sourced from springs and mountain rivers and stored on a series of storage tanks, and distributed to individual patches of lands with the use of high-density polyethylene hoses (HDPs). The reliability of water source is the main reason for the high index ratings of CIS in Bohol, Capiz, Davao del Sur, North Cotabato and South Cotabato.

Table 12. Water delivery performance indices in all the IMOs visited

IMO	Flexibility Index	Reliability Index	Equitability Index
Luzon (2015)			
Pampanga	3.8	3.2	3.7
Nueva Ecija	1.5	3.2	3
Pangasinan	3.7	3.5	3.8
Ilocos Norte	3.3	3.2	3.8
Benguet	4	3.8	3.8
Camarines Sur	3.2	3.8	3.7
Nueva Vizcaya	4	3.8	4
Isabela	3	3.6	3.8
Cagayan	3	2.8	3.3
Occidental Mindoro	2.7	3.8	3.8
Laguna	3.7	3.3	4
Average	3.3	3.5	3.7
Visayas (2018)			
Bohol	4	4	4
Leyte	3.7	3.7	3.7
Iloilo	3	3	3
Capiz	4	4	4
Average	3.7	3.7	3.7
Mindanao (2018)			
Davao del Sur	4	4	4
South Cotabato	4	4	4
North Cotabato	4	4	4
Bukidnon	2.7	2.7	2
Average	3.7	3.7	3.5

Source: KII of the IA officers/members

7.3. Water Management Practices

The lack of proper water management practices, both by the farmers and the related agencies, has been identified as one of the reasons of the low irrigation efficiency. In order to enhance such low irrigation efficiency, it is suggested that capacity development and the introduction of new water saving technologies be required. The IAs were also asked how they conserve water or cope with expected water deficits. Specifically, they were asked if they practice alternate wetting and drying (AWD) or if they reuse drainage water for irrigation. In Luzon, 27 out of 64 IAs or about 42% say they practice AWD. This is value is 6 out of 12 or 50% in Visayas and 9 out of 12 or 75% in Mindanao. They said they learned the technology by attending trainings by PhilRice or IRRI and sponsored by NIA. In Benguet, AWD in not applicable because the crops planted are not rice. Only 6 out 62 IAs in Luzon reuse drainage water for irrigation. While this is again 50% in Visayas and a very high 10 out of 12 or 83% in Mindanao. Other IAs have no idea whether they practice AWD or drainage reuse or not. Table 13 shows the result of the KII.

Table 13. Water management practices in all the IMOs visited

IMO	Practicing AWD		Reusing Drainage Water	
	YES	NO	YES	NO
Luzon (2015)				
Pampanga	5	1	2	2
Nueva Ecija	1	5	0	6
Pangasinan	2	4	0	6
Ilocos Norte	2	4	0	6
Benguet	3	3	3	3
Camarines Sur	4	2	0	6
Nueva Vizcaya	0	5	0	5
Isabela	2	3	0	5
Cagayan	3	3	0	6
Occidental Mindoro	2	4	0	6
Laguna	3	3	1	5
Total	27	37	6	56
Visayas (2018)				
Bohol	0	3	3	0
Leyte	2	1	0	3
Iloilo	3	0	3	0
Capiz	1	2	0	3
Total	6	6	6	6
Mindanao (2018)				
Davao del Sur	3	0	3	0
South Cotabato	3	0	3	0
North Cotabato	3	0	3	0
Bukidnon	0	3	1	2
Total	9	3	10	2

Source: KII of the IA officers/members

7.4. Sedimentation Problems

Concerned with the continuous deterioration of the NIS and the declining water yield during dry seasons as well as the increasing sedimentation problems involving millions of pesos annually for desilting, the NIA proposed the inclusion of the catchment management program to address the said problems under the World Bank assisted Water Resources Development Project (WRDP-NIA, 1998). Catchment assessment for all NIS and relevant CIS were included in the second part of this study, although the assessment for the CIS was not completed due to limited time and inadequate information. The study found that another main reason for the low performance is sedimentation of the canal system.

Identified as sources of sediments are: (a) sidehills, (b) drainage/creeks, (c) side slopes of irrigation canals, and (d) catchment. Concrete examples of sidehills sedimentation, especially where the canal passes through the foot of the hills, are the Naddungan and Abaca CIS in Cagayan, and Delapa and Magsaysay CIS in Bukidnon, where the canals passes through sidehills planted with corn. In worst cases the entire canal is rendered useless after being completely filled up by eroded or collapsed soils. Some canals of most CIS serve as drainage of roads and communities, where the canal pass along the national highway or serving as drainage outlet of the barangay. When creeks are tapped for additional water as in Cumabao or Suha San Antonio CIS, sediments are directly added into the system. Side slopes of irrigation canals sometimes are also sources of sediments including the return of improperly disposed desilted sediments back to the canals. Of course, sediments in canals are unavoidable, and in some cases, actually desired especially in fields with sandy soils, but extreme amount of sediments blocked and reduce the carrying capacity of canals. In Casilagan CIS in Isabela, the IA cannot have full flow of the main canal because the farmers fear that the backfill of the downstream portion of the main canal will collapse if it is in full flow.

The catchment is where the bulk of sediments, including rocks and boulders, came from. This is especially when the forest cover have been denuded, if kaingin was practiced and the area is cultivated, and if mining concessions are awarded. The above study assumed that the wider the open cultivated area the more serious the erosion will be and the lesser the catchment water holding capacity.

The report also cited operational lapses which showed that field personnel do not consider sedimentation as a major system problem. These include full opening of intake gates and closing of sluice gates to maximize water intake even with high sediment inflows. Flushing sediments by opening the sluice gates during high flows or flash floods are not done because the gate keepers are usually not around. The IAs have confirmed these in most of the interviews. Engr. Bonifacio S. Labiano, former Division Manager of the Irrigation Engineering Center, noted on a personal communication dated June 3, 2015, that by design, sluice gates of run-of-the-river type dams (e.g. ogee) should be closed during high flows and floods, and the water is let to pass over the dam. This is because the downstream apron of sluice gates is usually not built to withstand large flows and there are no dissipators so the turbulence may cause damage or scouring downstream. The spillways of most dams are built to withstand large and high velocity flows and they have baffles and dissipators to relieve the kinetic energy and turbulence of the flow. This is true and the intake gates should be closed during these times. However, when the water is still high, and while the intake gate is still closed, the sluicegates should be opened to release sediments from the dam storage areas.

Defective lifting mechanisms or replacing steel sluice gates permanently by flashboard or stones maximizes water inflow into the system but also effectively increases sediment inflows. In the surveyed CIS, Anao, Inasan, Parag-Bugnan, Ngayaongaon, Der-Ap Saoit, Zanjanera Bangsirit, Boliwao, Casilagan and Batasan CIS have either broken or defective sluice gates, head gates, intake gates or all of them. In Sta. Elena CIS in Leyte, the steel sluice gates were not even installed, so the IAs have to use flashboard from coco lumber. In some of them, the broken gates are permanently replaced by flashboards. The purpose of the wingwalls is to divert sediment flow from the dam storage area to the sluice gates. The sluice gates are opened or closed not only to control water level at the dam but also to flush out unwanted sediments and prevent it from entering the intake gates into the system. The intake gates are elevated above the sluice openings so that sediments moving at the bed will not enter the intake gates. If the sluice gates are always closed, then the purpose is defeated and more sediments are either trapped upstream of the dam or flow into the canal system. In these cited CIS, the sediments are almost at the crest of the dam, reducing its storage capacity.

Based on NIA studies, the sedimentation rate per area served/irrigated ranges from less than 0.8 to 61 tons/ha/yr. At 2000 rates, the costs would range from ₱1.0 to ₱483/ha/yr. These represents only a small percentage of actual sedimentation in the system. In terms of catchment size, the estimated erosion rate based by NIA on the volume of sediment extracted ranges from 0.03 to 6 tons/ha/yr.

Annex 16.4A and B shows the relative location of all the surveyed CIS based on the soil erosion susceptibility maps. All of the CIS in Benguet are either under severe erosion or moderate erosion. In Cagayan, the visited CIS are observed to be located in slight and moderate erosion susceptible areas based on the maps. However, based on the walkthroughs (e.g. Naddungan CIS), the uplands are already barren due to kaingin and most hills are planted to corn which also contributes to high soil erosion. Isabela also fell under no apparent or slight erosion except for Casilagan CIS (moderate erosion), but based on the walkthroughs and KII, siltation is a major problem in the system. Camarines Sur and Ilocos Norte fall into slight to moderate erosion areas and this is supported by observations during the field visits. Nueva Vizcaya belongs to moderate to severe erosion areas which are consistent with the walkthroughs and KII where denuded forests were pointed out to be the main cause. Pangasinan also fell under moderate to severe erosion and the walkthroughs points to the case of Ngayao-ngaoan CIS as an example, where sedimentation really affects their water delivery. Pampanga and Laguna fell under no apparent erosion areas although the main cause of siltation in Pampanga is lahar. The CIS in the Visayas and Mindanao mostly fell under no apparent, slight or moderate erosion areas. However, the effects of reduced forest lands and presence of mining concessions in some areas contribute heavily on the sedimentation and rocks/boulders deposition in the dam areas of some CIS (e.g. LMT, Unifarm, Del Carmen CIS). Road construction near the dam site of Tagbawto CIS in Iloilo, led to the accumulation of rock and sediments on the dam and siltation on the canals. The IAs are hoping that the contractor would rehabilitate the system once road construction is finished.

The Pampanga RB master plan estimated that of the lahar produced by the Mt. Pinatubo eruption in 1991, there still remains a volume of about 900 MCM in the upper reaches of the river basin, from which the sediment continues to flow to the downstream river stretches. The current sediment runoff volume into the river channels is estimated at about four times of those before eruption of Mt. Pinatubo. A substantial part of these sediment runoff would accumulate in the river channel causing reduction of the channel flow capacity, unless certain countermeasures are taken such as river dredging and reforestation to reduce the sediment runoff. Sedimentation in the irrigation system is compounded by unregulated quarrying in the river channels both upstream and downstream of the IS (e.g. Anao CIS).

During the KII, the silt and seepage level in the CIS canals were asked based on the MASSCOTE. The results for each province are shown in Table 14. The IAs from Pangasinan, Camarines Sur, Bohol, North Cotabato, South Cotabato and Bukidnon rate their silt level as high, which verify the observations from the walkthroughs. Silt levels in canals are also high Nueva Vizcaya, but the values assigned by the IAs are relatively low because the members conduct regular cleaning of the canals since CIS canals are small and does not require renting a backhoe unlike that in NIS. The KII only asked silt level in canal, however heavy siltation is mostly observed in the dams of most systems during the walk-throughs. The IAs also answered relatively high undesired seepage primarily because most of the IAs still want all their canals to be concrete-lined.

Table 14. Silt and seepage levels in the canals of CIS for each IMOs

IMO	Silt Level Grade	Undesired Seepage Grade
Luzon (2015)		
Pampanga	1.5	2.8
Nueva Ecija	1.8	3.8
Pangasinan	3.0	2.7
Ilocos Norte	1.3	2.5
Benguet	0.8	3.7
Camarines Sur	3.3	2.0
Nueva Vizcaya	0.7	2
Isabela	1.5	2.8
Cagayan	1.7	2.5
Occidental Mindoro	2.7	0.5
Laguna	0.6	4
Average	1.7	2.7
Visayas (2018)		
Bohol	3.3	3.3
Leyte	0	4
Iloilo	2	3
Capiz	0	4
Average	1.3	3.6
Mindanao (2018)		
Davao del Sur	0	0
South Cotabato	4	4
North Cotabato	4	4
Bukidnon	3.3	2.7
Average	2.8	2.7
	Note: 0 = low, 4 = high	Note: 0 = high, 4 = very low seepage

Source: KII of the IA officers/members

7.5. Silt Control Devices

Sediment transported by a stream can be divided into bed load and suspended load. Bed load are usually large particles that moves by rolling or sliding along the channel bed in almost constant contact with the bed. Suspended load are usually fine sand particles that are suspended by the turbulence of the flow away from the bed. In terms of grain size, there are wash loads which are usually clay and silt that are transported uniformly throughout the flow.

The provision of silt control devices is not included in the CIS design manual of NIA. Estimation of sediment load discharge as a proportion of the total discharge of a river is not even conducted during the project feasibility phase. However, several silt control devices were encountered during the field visits, but all are in Mindanao. This is quite understandable since the catchment management program of the WRDP (1998) was piloted in Mindanao. This project conducted rehabilitation works on several NIS, focusing on modification of diversion works, construction of silt excluder as well as sediment monitoring. An example of rehabilitation works conducted under the WRDP are those at the Malasila River Irrigation System (MalRIS) in North Cotabato. It was envisioned that with the provision of silt excluder (Figure 23) the settling of sediments in main canal and laterals would be minimized. Sediment sampling and monitoring was also conducted at the Malasila River and the main canal (Figure 24). This include discharge measurement, silt and sand sampling, bed load sampling and silt monitoring at the main canal. Another is the provision of a settling basin and silt ejector at the Mlang RIS also in North Cotabato. A settling basin (Figure 25) is an oversized section of the canal where flow velocities can be reduced to a level low enough to allow the suspended particles to settle. During fallow period, clearing of the settling basin is carried out by combined manual and hydraulic flushing using the silt ejector (Figure 26). Examples of silt control devices in Del Carmen CIS (Marbel River in N. Cotabato) and LMT CIS (Taplan River, N. Cotabato) both in Mindanao are shown in Figure 27. These are installed under the IAs own initiatives with technical help from NIA.

The study at the MALRIS pointed out that silt excluder reduced the intrusion of sediment (sand) in the main canal. The provision of settling basin in the main canal of Mlang RIS reduced the rehabilitation costs on a yearly basis, specifically, on dredging activities or canal de-silting. These silt control devices, and a host of many others (e.g. King's silt vanes, Gibb's groyne, curved wing with silt vanes, silt platforms, vortex tube sand trap and sloping sill sand screen) can be used to reduce or flush out silts from the canal and the river itself. However, if large bed loads, including rocks and boulders are present upstream, the use of Sabo dams may be employed. But the more important measure is to promote a community-based project in cooperation with local DENR (MENRO, PENRO) to protect and conserve the watershed area.

Figure 23. Construction of silt excluder at the MalRIS
Source: Engr. Rory Abance, NIA

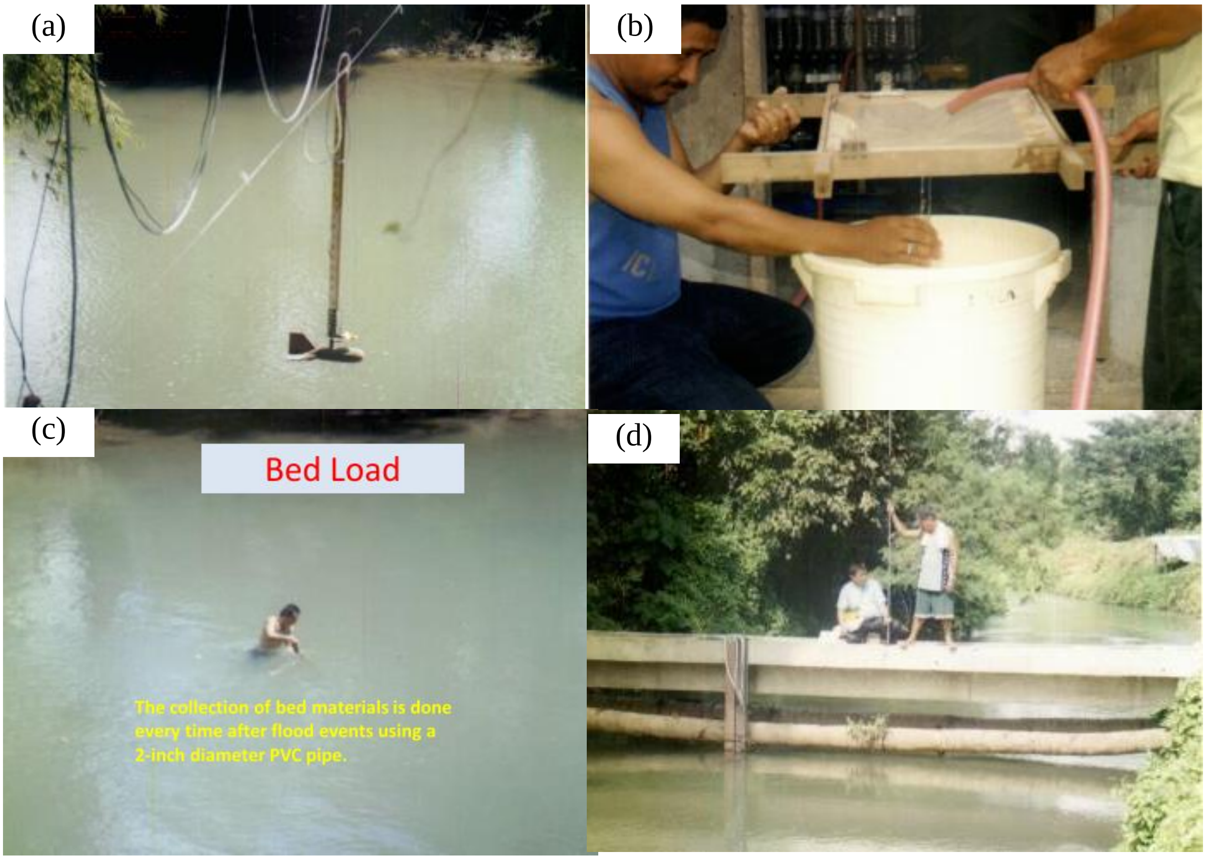

Figure 24. Sediment sampling and monitoring at MalRIS including: (a) discharge measurement at the Malasila River, (b) silt and sand sampling, (c) bed load sampling after as flood event and (d) silt monitoring at the main canal
Source: Engr. Rory Abance, NIA

Figure 25. Settling basin at the Mlang RIS
Source: Engr. Rory Abance, NIA

Figure 26. Clearing of the settling basin by combined manual and hydraulic flushing using the silt ejector during the fallow period.
Source: Author’s capture

Figure 27. Silt control device in (a) Del Carmen CIS (Marbel River, N. Cotabato) and (b) LMT CIS (Taplan River, S. Cotabato).

Source: Author's capture

7.6. Technical or Hardware Design Considerations

The Pampanga RB master plan noted that the current low irrigation efficiency is caused by various reasons such as: (a) deterioration of canals and related facilities due to lack of maintenance; (b) insufficient water control facilities including discharge measuring devises; and (c) high water conveyance loss in the unlined canals. Low irrigation efficiency leads to low collection efficiency on irrigation service fees. Based on interviews with the IA officers/members and walkthroughs of some systems, the following are some technical issues/problems generally confronting the IAs and the performance of their CIS.

<u>Dam design</u>

The CIS dams are mostly run-of-the-river type which are quite old, with exposed rock cores, damaged spillways, or silted storage area. Since the river flows are relatively low, compared to NIS, the dam designs are simple with some ogee-type spillways, gated weirs and gabions. Most of the dams visited (e.g. Anao, Cordero, Parang-Bugnan, Ngayao-ngaoan, Boliwao, Casilagan Balacong, Maljo, Tumagboc, Salcedo, Unifarm, Butilon, Del Carmen, Hervilla, LMT, Delapa, and Miglamin) have sediments almost at the crest level. These would require dredging to increase the storage capacity of the dam and increase water available for irrigation. Large scale silt problems that will require the use of backhoe needs the assistance of NIA and costs much.

The Anao dam (Annex A) needs major rehabilitation to prevent possible tilting or collapse. Quarrying activities immediately downstream of the dam should be stopped so as not to compromise the stability of the dam. It should be noted that the previous dam has already tilted due to scouring at the downstream face of the dam and replaced by the current dam at a cost of ~₱ 70 M. During the visit, scouring at the downstream apron and damaged gabions were already observed. The dam storage area is heavily silted, so the sluice gates remains close to be able to divert water into the canals. Manual dredging of canals and selling the collected sand are major sources of extra incomes for locals in North and South Cotabato (e.g. Del Carmen, Unifarm and LMT CIS) but these pose no danger to the dam itself and are just tolerated.

The Cordero dam (Annex 16.1A) seems to be haphazardly designed and constructed. The dam is made up of gabions and plastered with concrete here and there and cost ₱4.4 M including the lined canals. It is now completely filled up with sediments almost at the dam crest level, which the guide said occurred just after three heavy rainfall. Another heavy rain and the sediments may overtop the dam. No such examples were encountered in the Visayas and Mindanao surveys. The IA attributed this to kaingin operations at the mountain by the indigenous people and illegal logging. In the last rainy season of 2014, water flow was not stored in the dam but rather seeped underneath and at the side of the dam, prompting the IA to comment that the dam is not properly designed. Some of the gabions of the dam itself and at the embankments are already damaged and may cause the dam to collapse. The detailed engineering design (DED) of the dam was requested to the NIA office to check the actual design specifications. The dam needs to be replaced but if there are no water flowing in the creek during the dry season, then it would be an exercise in futility. The watershed of the creek needs reforestation and protection.

Another case is the reservoir dam of the San Angel SRIP (Annex B). It is an earth-filled dam that stores water from runoff and two spring sources and designed to irrigate 160 ha but only half of it (74 ha from the map) is irrigated during the dry season due to less rainfall and diminished spring flow. The original project cost listed in a map acquired by the team was ₱12,808,800 but the approved firmed up estimate is ₱14,006,985.18. These probably are partial costs only (maybe just the earth dam) because the project cost based on the same map was ₱79,100,000. The IA on the other hand said the project is worth ₱150 million. These differences in costs will have to be resolved with NIA. The dam is deemed over-designed and too costly for a relatively small area. This is just an initial thought pending the acquisition of the requested detailed engineering design (DED) of the system. More details are included in Annex A. A similar setup is the Magsaysay CIS in Bukidnon where water comes from Magsaysay spring and excess rainfall. However, the dam cost is relatively much less and the CIS can still supply the necessary irrigation to its intended FUSA.

Dam specifications should be based on historical records of low flows, which will be subjected to hydrologic frequency analysis to determine 80% dependable flow. In the absence of these data, empirical equations or water balance models may be used. In all the existing CIS with large dam structures and all proposed CIS, the flow analysis used as basis for the dam design and estimation of irrigable areas should be reviewed and thoroughly checked, to avoid white elephant CIS with large structures and canal networks but without water for irrigation.

Sluice Gates and Intake Gates

The sluice gates are used to control the water level at the dam and also to flush out sediments preventing it from entering the intake gates into the system. Intake gates, on the other hand, controls the amount of water entering the system, and are positioned at a higher elevation (provided with a sill) than the sluice opening to limit the entry of bed flow sediments. In coordination with the opening of intake gates, water is being fed into the system at optimum command (or head) with minimum sediment intake. Most of the sluice gates and intake gates that are usually made of steel are now replaced with flashboards, sand bags or stones. In Sta. Elena CIS (Leyte), the steel sluice gates were not even installed. In some relatively larger CIS, the lifting mechanisms are defective or rather slow. The IAs in Visayas and Mindanao resort to using second-hand or rented chain blocks to facilitate lifting and closing the gates. These gates should be repaired or replaced to ensure proper control of the water and sediment intake. If the sluice gates are not replaced and are always closed, then more sediments will be either trapped upstream of the dam or enter into the system. If the intake gates are defective or are always open, then sediment entry into the system as well as the occurrence of flooding in the fields during high river flows cannot be avoided.

Canal Networks

Since CIS involves small FUSA, the dam is usually small run-of-the-river type, so there are less infrastructure costs for the dam and more for canal linings and control structures. Most of the CIS visited have lined main canals and some up to the laterals. In terms of the size and capacity, main canals of CIS may be comparable to small laterals in NIS, and they are mostly lined in CIS. The conditions of the lined and unlined canals depend primarily with the IA themselves whether they have good O&M and cleanup activities. Siltation is a major problem but usually, the IA can manage to clean the canals themselves. However, there are some cases where rampant kaingin and planting of corn in sloping lands are the main cause of siltation and these would require major policy/governance solutions. In canals passing through heavily eroded sidehills, the IAs are requesting that these canals be covered or replaced with culverts.

Water Control Structures

Since the discharge capacity is just small, only simple structures are found in most CIS and while some are well maintained, others have deteriorated and the control structures are not functioning well or as originally intended. These include cross regulators, check gates, drop structures, division boxes and farm turnouts. Cross regulators are found only in the main canals of some large CIS and are composed of 2 or 3 steel gates of less than 1-m wide each. They are used to raise the upstream water level in a canal above its natural level to enable water to flow to the different canals branching from it. Check gates on small main canals and laterals are more common. They regulate the flow towards offtakes. In most new CIS, the steel gates are in good condition and the screws and turning wheels are still operating. In older and improperly managed CIS, the gates are already damaged and replaced by wooden slabs or in some cases none at all. The IAs were asked to rate the general condition, ease of operation and the presence of a system of operation of their cross regulators.

Based on the KIIs, the cross regulators were generally considered to be in good condition in Luzon, Visayas and Mindanao, based on scores of 3.1, 3.4 and 3.6, respectively. Moreover, the cross regulators were generally considered as easy to operate. The IAs of Nueva Vizcaya rated the lowest score for their regulators with a score of 1.7 in General Condition and 1.6 for Ease of Operation. Out of 59 IAs in Luzon, 40 said that they have a system of operation for their cross regulators. While all responded affirmatively in Visayas and Mindanao.

Drop structures are ubiquitous in most systems and are used to conduct water from a higher to a lower elevation and to diffuse the force of the falling water; hence it is constructed on steeply sloping land to prevent channel scouring and erosion. The inlet of the structure also serves as a control to regulate the water depth in the canal upstream so they are often combined with check gates and division boxes to minimize costs. Division boxes are rectangular structures usually built along the main farm ditch to divide and distribute the flow to the supplementary farm ditches. It is usually made of concrete with slots for wooden slabs, which serves as control gates. The IAs said that the control of flow direction is done by the water master based on agreed upon irrigation schedules. Turnouts serves as the outlet of water from a parent canal to a smaller canal, or from a lateral to the main farm ditch. The density of farm turnouts depends on the FUSA of the CIS and together with the check gates influences the flexibility and efficiency of water delivery within the system. However, only four CIS were able to provide maps of their CIS and some of the maps do not indicate the kind of structures present in the system. Some CIS (e.g. Gulap, Parang-Bugnan, Boliwao, Cumabao, Gabayan, Del Carmen, among others) have inverted siphons channeling water under road, rivers or creeks. Most of these structures have been rehabilitated or de-silted already and some are still being requested to be repaired. Elevated flumes can also be found in some CIS (e.g. Unifarm and the under-designed one in Siwaragan CIS). The San Angel SRIP reservoir dam has a spillway to prevent overtopping of the dam crest.

Table 15. Condition of the cross regulators in all IMOS visited

Province	General condition	Ease of Operation	Presence of Existing System of Operation	
			YES	NO
Luzon (2015)				
Pampanga	3.5	4	6	0
Nueva Ecija	3.3	3.8	3	3
Pangasinan	3.2	3.7	5	1
Ilocos Norte	2.8	2.3	3	3
Camarines Sur	3.5	3.7	5	1
Nueva Vizcaya	1.7	1.6	3	3
Benguet	4	3.5	3	0
Isabela	3	3.5	2	2
Cagayan	2.6	3.3	3	2
Occidental Mindoro	3.7	3	4	2
Laguna	2.8	3	3	2
Average/Total	3.1	3.2	40	19
Visayas (2018)				
Bohol	3	4	3	0
Leyte	3.7	3.7	3	0
Iloilo	3	3	3	0
Capiz	4	4	3	0
Average/Total	3.4	3.7	12	0

Province	General condition	Ease of Operation	Presence of Existing System of Operation	
			YES	NO
Mindanao (2018)				
Davao del Sur	4	4	3	0
South Cotabato	4	4	3	0
North Cotabato	4	4	3	0
Bukidnon	2.3	2.7	3	0
Average/Total	3.6	3.7	12	0
	Note: 0 = worst, 4 = excellent	Note: 0 = impossible to operate, 4 = very easy to operate		

Source: KII of the IA officers/members

Flow Measuring Structures

While some cross or check regulators may be initially intended to measure discharges, there are no more staff gages to measure water levels and the rating curve are either missing or not calibrated in all the CIS visited. A Parshall flume at the head gate of the San Ramon PIS in Bicol is not used to measure discharge. Any form of flow measurements is only done at the head works, but even then these are only based on staff gage readings and rating curve, most of which have not been recalibrated since the CIS construction. The Pampanga RB master plan again cited that the discharges in the existing irrigation networks both for NISs and CISs are not accurately and adequately monitored due to: (a) inadequate number and malfunction of discharge measuring devices; (b) inadequate calibration of conversion tables (H-Q curve or rating curve) of water discharge against water level or gate opening height; and (c) inadequate communication system between the sites and the gate control offices. As a result, the monitored data are not well utilized for effective water management.

Miscellaneous Structures

Other miscellaneous or appurtenant structures that are commonly found in all the CIS include road and thresher crossings, end checks and service roads. The IAs generally regarded poorly the availability of roads along canals. Most service roads are rough roads with most dams accessible only by walking or by motorcycles, which add more cost to the farmers to deliver their harvest to rice mills and storage facilities. One of the main requests of IAs is the provision of farm to market roads to ease this burden.

Operation and Maintenance

The operation and maintenance of CIS is turned over to IAs upon project completion. While many CIS started as private initiatives, most received some government funding support for the cost of rehabilitation and new construction but these were mostly coursed directly to the IAs and not through the LGUs as stipulated in the AFMA. In a stakeholders meeting during the development of the Pampanga RB master plan, it has been pointed out that the role of the LGUs is weak, especially in the implementation and operation and maintenance of CIS.

In order to assess the water management capability and the effectiveness of the operation and maintenance of the IAs, they were asked to rate the water delivery service performance of the

CIS with a rating of 1- meaning all farms do not receive sufficient water when needed and 4- meaning all farms receive the required volume of water at the right time. Table 16 shows the results for each province.

Table 16. Water delivery service performance of CIS in all IMOS visited

Province	Water Delivery Service				
	1	2	3	4	Average
Luzon (2015)					
Benguet	0	3	1	2	2.8
Ilocos Norte	1	2	1	2	2.7
Pangasinan	0	2	3	1	2.8
Cagayan	1	3	1	1	2.3
Isabela	0	2	0	4	3.3
Nueva Vizcaya	1	2	2	1	2.5
Pampanga	0	1	3	2	3.2
Nueva Ecija	1	1	1	3	3
Camarines Sur	0	0	2	4	3.7
Laguna	1	0	0	5	3.5
Occ. Mindoro	0	1	4	1	3
Total	5	17	18	26	3.0
Visayas (2018)					
Bohol	0	2	1	0	2.3
Leyte	0	0	1	2	3.7
Iloilo	0	0	0	3	4
Capiz	0	0	2	1	3.3
Total	0	2	4	6	3.3
Mindanao (2018)					
Davao del Sur	0	1	1	1	3
South Cotabato	0	0	0	3	4
North Cotabato	0	0	0	3	4
Bukidnon	0	0	0	3	4
Total	0	1	1	10	3.8

Note: 4 – all farms receive the required volume of water at the right time
3 – all farms receive the required volume of water but with occasional delay
2 – not all farms receive the required water more often
1 – all farms do not receive sufficient water when needed

Source: KII of the IA officers/members

The results show that more IA think that they receive the required volume of water at the right time for an average rated score of 3.0 in Luzon, where the highest rating is in Camarines Sur and Laguna at 3.7 and 3.5, respectively. The rating is higher in the Visayas with an average of 3.3, where the highest is in Iloilo at 4. Mindanao IAs scored the highest average of 3.8, with all province except Davao del Sur gave a rating of 4. Although we cannot discount the 17 CIS in Luzon, 2 in Visayas and 1 in Mindanao, who remarked that not all farms receive the required water more often, and the 23 (18, 4 and 1 for the 3 main island groups) CIS whose farms receive the required volume of water but with occasional delays. These results showed there are more room for improvement in the water management of the CIS.

The IAs were also asked to rate the performance of the CIS in terms of water distribution, and the maintenance of canals and control structures, with a rate of 0- being very poor and 4- being excellent. The results shown in Table 17, indicate that most IAs regard the water distribution as more than satisfactory with an average rating of 3.2 in Luzon, 3/5 in the Visayas and 3.4 in Mindanao. The results also showed that the canals and control structures were deemed well maintained. This is a testament to the management and policy implementation of the individual IAs themselves. A major contributing factor here is also the small size of the CIS, which makes it easier to manage and maintain, even with the occurrence of high siltation in the canals.

Table 17. Performance on water distribution, maintenance of canals, and maintenance of control structures in all the IMOs visited

Province	Water Distribution	Maintenance of Canals	Maintenance of Control Structures
Luzon (2015)			
Ilocos Norte	2.7	3	2
Pangasinan	3	2.8	3
Cagayan	2.7	2.8	3
Isabela	3.2	3.5	2.8
Nueva Viscaya	2.7	2.8	2.8
Pampanga	3.7	3.3	3.5
Nueva Ecija	3.5	3.7	3.2
Camarines Sur	3.3	3.2	3.2
Laguna	4	3.4	3.6
Occidental Mindoro	3.2	2.7	2.5
Benguet	3	2.8	2.8
Average	3.2	3.1	2.9
Visayas (2018)			
Bohol	4	3	3
Leyte	4	4	4
Iloilo	3	3	3
Capiz	3	3	3.3
Average	3.5	3.3	3.4
Mindanao (2018)			
Davao del Sur	4	4	4
South Cotabato	3.7	3.7	3.7
North Cotabato	3	3	3
Bukidnon	2.7	2.7	2.3
Average	3.4	3.4	3.3

Note: 0 Very Poor; 1 Poor; 2 Average; 3 Satisfactory; 4 Excellent

Source: KII of the IA officers/members

<u>Drainage</u>

There are no specific drainage canals at the CIS. Normally, the downstream farm ditches receive the excess water from paddies, which is sometimes used to irrigate downstream areas. In most systems, water distribution downstream is from paddy to paddy, without individual farm ditch for each paddy. Again, the downstream canal serves as the drainage canal. These are usually done to maximize areas devoted to planting. However, the absence of drainage canals more often contributes to flooding or the longer time for flood recession.

Pumps

The main problem for CIS with pumps tapping water from rivers or creeks is that the pumping units are quite old and need frequent repairs. There are usually no reserve pump sets if the main unit breaks down, which causes delay in irrigation. The Sitio Ipil and Gulap PIS taps water from the Pampanga River using large diameter (e.g. at least 10" – 16") submersible or mixed flow pumps, driven by 60-Hp electric motors or 80-90 Hp diesel engines. These engines are very old and needs constant repairs, aside from the high fuel consumption and low efficiency. There is also the problem of heavy siltation from the river which sometimes clogged the intake pit and the pumps. The damaged submersible pump of the Particion PIS was replaced by a 6" diameter centrifugal pump driven by a diesel engine loaned by NIA. The cost of operation increased not because of the IA's fault but due to faulty design and absence of safety mechanism in the electrical wiring. Moreover, it was found that the awarded pump is only second-hand where the contract stipulated brand new pump.

For STWs and LLPs, the commonly used pumps are 3"x 3" or 4"x 4" centrifugal pumps. They are usually driven by 8-12 Hp water-cooled diesel engines, which are also used for threshers, hand tractors and local transport (kuliglig). Depending on the water level and the capacity of the shallow aquifer, each STW may be expected to irrigate from 3-5 ha of rice field depending on soil type.

8. Results of Survey of Selected Communal Irrigators' Associations

This section present results of the survey of 66 sample IAs in 11 selected provinces in Luzon in Cycle 1; and 12 sample IAs in both Visayas and Mindanao. Information includes profile of the IAs, description of their CIS, performance in terms of yield and cropping intensity, and functionality. Some highlights of IA interviews are in Annex 16.1A and B.

8.1. Size of Irrigators' Associations and Tenure Status of Members

Table 18 shows the number of members and tenure status of all the IAs interviewed. The average size of IA in Luzon is around 120 members, ranging from 62 (Benguet) to 206 (Ilocos Norte). In terms of tenure status, 46% (Isabela) to 98% (Benguet) of the members are owner-operators of the land they are tilling. Correspondingly, major portion of the service area of the CIS are owned by the members. This is compliant to the CIS guideline that 60% of the potential area should not be owned by only one landowner.

In Visayas, Capiz has the highest average number of members per IA with Iloilo, the lowest. Majority of members are tenants or lessees. Only Bohol IAs provided data on percentage of land by tenure status, i.e., 83% are owned by operators.

In Mindanao, Bukidnon has the lowest average number of members but all provinces have majority of members as owner-operators. Only South Cotabato and Bukidnon IAs provided data on land area by tenure status showing that a bigger portion is under owner-operator status.

Table 18. Number of members of IAs and tenure status of members in all provinces visited

Province	Ave. no. of members	% members by tenure status				% land area by tenure			
		Owner-operator	Tenant	Lessee	Others	Owner-operator	Tenant	Lessee	Others
Luzon (2015)									
Pampanga	67.33	60.15	1.23	2.48	31.64	79.17	1.67	3.33	15.83
Nueva Ecija	105.33	64.76	50.48	-	-	77.00	30.75	-	-
Pangasinan	106	66.35	37.92	0.15	-	62.17	51.80	0.15	n/a
Ilocos Norte	206.67	55.74	48.06	-	-	73.40	33.25	-	-
Camarines Sur	199.50	49.50	12.00	42.50	5.83	54.20	18.33	20.80	11.67
Benguet	62.83	98.15	0.53	0.53	-	93.20	3.33	4.00	-
Nueva Vizcaya	151.83	53.64	49.66	17.88	-	53.67	35.00	20.75	-
Isabela	137.67	46.72	54.01	25.55	-	44.5	50.60	25.00	-
Cagayan	82.17	71.95	42.68	-	-	68.33	47.5	-	-
Laguna	64.17	46.87	68.75	3.64	15.36	25.40	72.60	3.67	7.00
Occidental Mindoro	143.17	73.43	46.15	-	-	67.50	48.75	-	-
Visayas (2018)									
Bohol	238.33	50	53	-	-	87	13.33	-	-
Leyte	204.67	30	65	5	-	-	-	-	-
Iloilo	131	17	80	3.33	-	-	-	-	-
Capiz	340.67	32	36.67	31.67	-	-	-	-	-
Mindanao (2018)									
Davao del Sur	162	86	3.33	11.11	-	-	-	-	-
North Cotabato	216.67	95	5	-	-	89	10.7	-	-
South Cotabato	260	73	26.67	-	-	-	-	-	-
Bukidnon	85.67	77	17.33	5.56	-	68	7.5	10	-

Note: There are multiple responses in some provinces since members are both owner-operators and tenants.
Source FGD with IA officials/members

8.2. Firmed-up Service Area and Type of Technology

Table 19 shows the frequency distribution of all the sample CIS by FUSA and type of technology. Around 51% of the 66 sample CIS in Luzon have FUSA over 100 ha on average. Majority (83%) of the sample CIS are of the gravity-type (run-off the river) system, particularly for large systems. CIS using pumps are in Pampanga, Camarines Sur, Nueva Ecija, Pangasinan, Isabela, and Laguna. Average area served by pump CIS (170ha) is higher than that served by gravity CIS (151 ha). Examples are Gulap Pump CIS in Pampanga with 420 ha; San Agustin-San Ramon pump CIS with 419 ha in Camarines Sur, Viola pump CIS in Isabela with 500 ha.

Similarly, in Visayas and Mindanao, 50% of the 12 sample CIS serve large FUSA and majority in Visayas and all CIS in Mindanao are of the gravity-type system. Pumps are used only in small and medium-sized farms in Visayas except Leyte where the sample CIS have gravity-type system.

Table 19. Frequency distribution of the sample CIS by FUSA and type of technology in all selected provinces

Item	FUSA			Technology							
	Small (<50 ha)	Medium (50-100 ha)	Large (>100 ha)	Gravity				Pump			
				Small	Medium	Large	Total	Small	Medium	Large	Total
Luzon (2015)											
No. of CIS	15	17	34	10	17	28	55	5	1	5	11
% of CIS	22.73	25.76	51.52	83.33				16.67			
Average area (ha)	33.61	79.56	257.34	151				170			
Visayas (2018)											
No. of CIS	3	3	6	1	2	6	9	2	1	0	3
% of CIS	25	25	50	75				25			
Average area (ha)	33.67	71.67	340.33	250.33				35			
Mindanao (2018)											
No. of CIS	1	5	6	1	5	6	12				
% of CIS	8.33	41.67	50	100							
Average area (ha)	46	75.4	466.71	268.60							

Note: No CIS uses pump in Mindanao
Source: FGD with IA officials/members

On a per province basis, all CIS samples in Occidental Mindoro have large FUSA ranging from 110 to 600 ha. In contrast, majority of sample CIS in Benguet have small FUSA. Of the 66 CIS/IAs surveyed in Luzon, average landholding per member is around 1.2 ha. In the Visayas, more than 60% of the sample CIS in Leyte and Capiz have large FUSA. Over 30% of CIS in Bohol, Leyte and Capiz have small CIS while Iloilo does not have CIS with small FUSA. In Mindanao, large FUSA dominates the CIS of North and South Cotabato while medium FUSA dominates Davao del Sur and Bukidnon.

Serving more than one barangay has some implications in operating and managing the CIS, particularly when the barangays are spread out upstream, midstream and downstream. In Luzon, over 56% of the 66 sample CIS each covers only one barangay for its service area. The rest covers 2-5 barangays. In Visayas, over 33% of the sample 12 CIS cover only one barangay but 41% cover 4 or more barangays. In Mindanao, over 58% covers 2-5 barangays.

Table 20. Frequency distribution of CIS by number of barangays covered in all selected provinces

Province	No. of barangays		
	1	2-3	4-5
Luzon (2015)			
Pampanga	3	3	-
Nueva Ecija	5	1	-
Pangasinan	4	1	1
Ilocos Norte	1	2	3
Camarines Sur	2	2	2
Nueva Vizcaya	3	2	1
Benguet	6		-
Isabela	3	2	1
Cagayan	3	3	-
Laguna	1	5	-
Occ. Mindoro	6		-
All	37	21	8
%	56.06	31.82	12.12
Visayas (2018)			
Bohol	2	0	0
Leyte	0	2	0
Iloilo	1	0	1
Capiz	1	1	0
All	4	3	1
%	33.33	25.00	8.33
Mindanao (2018)			
Davao del Sur	2	0	1
North Cotabato	0	2	1
South Cotabato	2	1	0
Bukidnon	1	1	1
All	5	4	3

Source: FGD with IA officials/members

8.3. Water Permit and Registration with the Securities and Exchange Commission

Based on the provisions of the Water Code of the Philippines, the IA has to obtain a water permit to avail of water rights, i.e., use of water from a specific source. The lifetime water permit is the document serving as evidence of the water right, the privilege granted by the government (through NWRB) to appropriate and use water. The water permit specifies the purpose for which water may be used, the water source and location, amount of water which may be diverted or withdrawn, and the maximum rate of diversion or withdrawal.

The CIS Manual reiterates this provision for the IA to be able to obtain rights to the use of water and the authority to allocate and distribute water. However, the Manual also states that the IA has to register first with the SEC to give it a legal personality to file the necessary application for water permit; and to enter into contract with NIA prior to system construction. The IA legal personality will also aid it in negotiating for assistance from other agencies.

In the survey of 66 IAs in Luzon, over 68% have water permit. Among IAs with large systems (>100 ha), 55% have permits, higher than those with medium (27%) and small (18%) systems. By province, Isabela, Camarines Sur, Pangasinan, and Benguet have majority of IAs with water permit. Pampanga, Cagayan, and Laguna have half of the sample IAs without water permit.

In Visayas, only 5 (41.7%) of the sample 12 IAs have water permit and 3 (25%) do not know if they have. Majority of those with permits have large FUSA, and so with those without permit. By province, all sample IAs in Leyte have water permit while IAs in Bohol either have no permit or have no knowledge if they have. All IAs in Mindanao have water permits.

Table 21. Frequency distribution of CIS IAs with water permit in all selected provinces

CIS	Yes			No			Don't Know		
Luzon (2015)									
No.	45			20			1		
%	68.18			30.30			1.52		
In terms of Size	S	M	L	S	M	L	S	M	L
No.	8	12	25	8	4	8	1	0	0
%	18	27	55	40	20	40	100	0	0
Visayas (2018)									
No.	5			4			3		
%	41.67			33.33			25		
In terms of Size	S	M	L	S	M	L	S	M	L
No.	1	1	3	1	1	3	1	1	3
%	20	20	60	20	20	60	20	20	60
Mindanao (2018)									
No.	12			0			0		
%	100			0			0		
In terms of Size	S	M	L	S	M	L	S	M	L
No.	1	5	6						
%	8.33	41.67	50						

Source: FGD with IA officials/members

Around 95% of the IAs in Luzon are registered with SEC, with around 40% registered in 2000 while the rest registered between the 70s and 90s. There is usually a time lag between the year the IA registered with SEC and the year the CIS started operation. Around 46% of the CIS started operation between 2000 and 2010; and 13% in the 70s (Table 29a).

In the Visayas, around 50% of sample IAs registered with SEC and started CIS operation around 2010. Over 24% started operation in the 1970s. In Mindanao, almost 42% o the sample CIS started operation in the 1980s and 25% around 2010. There were also 25% operating since the 1970s.

Table 22. Frequency distribution of IAs in all selected provinces that registered with the Securities and Exchange Commission (SEC) and the start of operation of the CIS

Item	Year registered with SEC							Others*
	Before 1970	1970s	1980s	1990s	2000	2010	Total IAs registered with SEC	
Luzon (2015)								
No. of IAs	3	9	14	10	27		63	3
%	4.55	13.64	21.21	15.15	40.91		95.46	4.54
CIS Started Operation								
No. of IAs	3	6	13	15	16			16
%	4.55	9.09	19.69	22.72	24.24			24.24
Visayas (2018)								
No. of IAs	0	0	1	1	1	7	10	2
%	0	0	8.33	8.33	8.33	58.33	83.33	16.67
CIS Started Operation								
No. of IAs	1	2	2	0	1	6		
%	8.33	16.67	16.67	0	8.33	50		
Mindanao (2018)								
No. of IAs	1	1	4	2	1	3	12	
%	8.33	8.33	33.33	16.67	8.33	25	100	
CIS Started Operation								
No. of IAs	0	3	5	1	0	3		
%	0	25	41.67	8.33	0	25		

*Don't know, Not registered
Source: FGD with IA officials/members

8.4. Cropping Season

In Luzon, IAs usually adopt two cropping seasons, referred to as wet and dry season. Wet season starts in May to June while dry season starts in October to December. Some IAs do third cropping between March and June. While rice is the main or sole crop planted in the wet season, some IAs plant other crops such as corn, peanut, mung bean during the dry season thus reducing the area planted to rice. In Benguet, vegetable production is whole year round (Table 23a).

In the Visayas, rice is also the dominant crop for both cropping seasons. Other crops planted such as onion, watermelon and corn were only in Iloilo from October to January (Table 23b). In Mindanao, also with rice as the dominant crop, only South Cotabato plant other crops such as corn, banana and papaya (Table 23c).

Table 23a. Cropping calendar of the 66 sample IAs in 11 provinces in Luzon (2015)

<table>
<tr><th>Province</th><th>Jan</th><th>Feb</th><th>Mar</th><th>Apr</th><th>May</th><th>Jun</th><th>Jul</th><th>Aug</th><th>Sep</th><th>Oct</th><th>Nov</th><th>Dec</th></tr>
<tr><td rowspan="3">Pampanga</td><td colspan="5"></td><td colspan="7">Rice</td></tr>
<tr><td colspan="7">Corn, Watermelon</td><td colspan="4"></td><td>Rice</td></tr>
<tr><td colspan="4"></td><td colspan="3">Rice, Corn, Watermelon</td><td colspan="5"></td></tr>
<tr><td rowspan="3">Nueva Ecija</td><td colspan="5"></td><td colspan="7">Rice</td></tr>
<tr><td colspan="4">Corn, Onion</td><td colspan="6"></td><td colspan="2">Rice,</td></tr>
<tr><td colspan="3"></td><td colspan="5">Rice, Corn, Onion</td><td colspan="4"></td></tr>
<tr><td rowspan="3">Pangasinan</td><td colspan="5"></td><td colspan="6">Rice</td><td></td></tr>
<tr><td colspan="2">Rice, Peanut,</td><td colspan="7"></td><td colspan="3">Corn, Mung bean</td></tr>
<tr><td colspan="2"></td><td colspan="4">Rice, Corn, Peanut, Mung bean</td><td colspan="6"></td></tr>
<tr><td rowspan="3">Ilocos Norte</td><td colspan="5"></td><td colspan="7">Rice</td></tr>
<tr><td colspan="4">Corn, Garlic, Onion</td><td colspan="7"></td><td>Rice</td></tr>
<tr><td colspan="2"></td><td colspan="4">Rice, Corn, Garlic, Onion</td><td colspan="6"></td></tr>
<tr><td rowspan="3">Camarines Sur</td><td colspan="4"></td><td colspan="8">Rice</td></tr>
<tr><td colspan="5">Sugarcane</td><td colspan="6"></td><td>Rice</td></tr>
<tr><td colspan="3"></td><td colspan="9">Rice, Sugarcane</td></tr>
<tr><td rowspan="3">Benguet</td><td colspan="12">Various Vegetables, Root Crops, Cut Flowers, Coffee (whole year round)</td></tr>
<tr><td colspan="5"></td><td colspan="7">Rice</td></tr>
<tr><td colspan="4"></td><td colspan="7"></td><td>Rice</td></tr>
<tr><td rowspan="3">Nueva Vizcaya</td><td colspan="5"></td><td colspan="7">Rice</td></tr>
<tr><td colspan="4">Corn</td><td colspan="5"></td><td colspan="3">Rice,</td></tr>
<tr><td colspan="7"></td><td colspan="5">Rice, Corn</td></tr>
<tr><td rowspan="3">Isabela</td><td colspan="4"></td><td colspan="7">Rice</td><td></td></tr>
<tr><td colspan="4">Corn, Tobacco</td><td colspan="6"></td><td colspan="2">Rice,</td></tr>
<tr><td colspan="8"></td><td colspan="3">Rice, Corn, Tobacco</td><td></td></tr>
<tr><td rowspan="3">Cagayan</td><td colspan="5"></td><td colspan="7">Rice</td></tr>
<tr><td colspan="5">Corn</td><td colspan="6"></td><td>Rice</td></tr>
<tr><td colspan="2"></td><td colspan="4">Rice, Corn</td><td colspan="6"></td></tr>
<tr><td rowspan="2">Laguna</td><td colspan="5"></td><td colspan="5">Rice</td><td colspan="2"></td></tr>
<tr><td colspan="4">String beans</td><td colspan="6"></td><td colspan="2">Rice,</td></tr>
<tr><td rowspan="2">Occidental Mindoro</td><td colspan="5"></td><td colspan="6">Rice</td><td></td></tr>
<tr><td colspan="4">Corn, Tobacco, Onion</td><td colspan="6"></td><td colspan="2">Rice,</td></tr>
</table>

Source: FGD with IA officials/members

Table 23b. Cropping calendar of the 12 sample IAs in 4 selected provinces in Visayas (2018)

<table>
<tr><th>Province</th><th>Jan</th><th>Feb</th><th>Mar</th><th>Apr</th><th>May</th><th>Jun</th><th>Jul</th><th>Aug</th><th>Sep</th><th>Oct</th><th>Nov</th><th>Dec</th></tr>
<tr><td rowspan="2">Bohol</td><td colspan="5"></td><td colspan="5">Rice</td><td colspan="2"></td></tr>
<tr><td colspan="5">Rice</td><td colspan="5"></td><td colspan="2">Rice</td></tr>
<tr><td>Leyte</td><td colspan="5">Rice</td><td colspan="6">Rice</td><td>Rice</td></tr>
<tr><td rowspan="4">Iloilo</td><td>Rice</td><td colspan="2"></td><td colspan="6" rowspan="2">Rice</td><td colspan="3">Rice</td></tr>
<tr><td>Corn</td><td colspan="2"></td><td colspan="3">Onion, Watermelon,</td></tr>
<tr><td colspan="5"></td><td colspan="7">Rice</td></tr>
<tr><td colspan="8">Rice</td><td colspan="3">Rice</td><td></td></tr>
<tr><td rowspan="2">Capiz</td><td colspan="3">Rice</td><td colspan="2"></td><td colspan="4">Rice</td><td colspan="3">Rice</td></tr>
<tr><td colspan="2">Rice</td><td></td><td colspan="7">Rice</td><td colspan="2">Rice</td></tr>
</table>

Source: FGD with IA officials/members

Table 23c. Cropping calendar of the 12 sample IAs in 4 selected provinces in Mindanao (2018)

<table>
<tr><th>Province</th><th>Jan</th><th>Feb</th><th>Mar</th><th>Apr</th><th>May</th><th>Jun</th><th>Jul</th><th>Aug</th><th>Sep</th><th>Oct</th><th>Nov</th><th>Dec</th></tr>
<tr><td rowspan="2">Davao del Sur</td><td colspan="3"></td><td colspan="7">Rice</td><td colspan="2"></td></tr>
<tr><td colspan="4">Rice</td><td colspan="5"></td><td colspan="3">Rice</td></tr>
<tr><td rowspan="4">North Cotabato</td><td colspan="2">Rice</td><td colspan="5"></td><td colspan="5">Rice</td></tr>
<tr><td colspan="8">Rice</td><td colspan="4"></td></tr>
<tr><td colspan="5"></td><td colspan="5">Rice</td><td colspan="2"></td></tr>
<tr><td colspan="3">Rice</td><td colspan="6"></td><td colspan="3">Rice</td></tr>
<tr><td rowspan="7">South Cotabato</td><td colspan="2">Corn</td><td colspan="5">Corn</td><td colspan="2"></td><td colspan="3">Corn</td></tr>
<tr><td></td><td colspan="6">Corn</td><td colspan="5">Corn</td></tr>
<tr><td colspan="7">Banana, papaya</td><td colspan="2"></td><td colspan="3">Banana, papaya</td></tr>
<tr><td colspan="2">Rice</td><td colspan="6"></td><td colspan="4">Rice</td></tr>
<tr><td colspan="3"></td><td colspan="6">Rice</td><td colspan="3"></td></tr>
<tr><td colspan="3">Rice</td><td colspan="6"></td><td colspan="3">Rice</td></tr>
<tr><td colspan="5"></td><td colspan="5">Rice</td><td colspan="2"></td></tr>
<tr><td>Bukidnon</td><td colspan="3">Rice</td><td colspan="7">Rice</td><td colspan="2">Rice</td></tr>
<tr><td colspan="13">WET SEASON RICE</td></tr>
<tr><td colspan="13">DRY SEASON RICE</td></tr>
</table>

Source: FGD with IA officials/members

8.5. Firmed-up Service Area, Area Actually Irrigated, and Cropping Intensity

Table 24 summarizes the average FUSA, average actual irrigated area and cropping intensity for all the selected CIS. In Luzon, the average FUSA for all sample CIS is 156 ha with size category ranging from 33 to 257 ha. The area actually irrigated during the wet season is around 15% lower than FUSA. During the dry season, the average area actually irrigated is reduced by 27%. Cropping intensity is generally higher during the wet season than the dry season; and relatively higher in small farms than in medium and large farms.

The average FUSA in Visayas and Mindanao are 196 and 296 ha, respectively, with size category widely ranging from 33 to 500 ha. Cropping intensity during the wet season is almost 100% and more than 90% during dry season.

Table 24. Average firmed up service area, average area actually irrigated during wet and dry season, and cropping intensity for all sample IAs in all selected provinces

Item	Small	Medium	Large	All
Luzon (2015)				
Average FUSA	33.61	79.56	257.34	156.62
Area actually irrigated, wet season	29.96	67.67	217.15	133.01
% difference from FUSA	10.86%	14.94%	15.62%	15.08%
Area actually irrigated, dry season	24.97	51.83	191.24	113.44
% difference from FUSA	25.71%	34.85%	25.68%	27.57%
% difference from area actually irrigated in wet season	16.65	23.41	11.93	15.04
Cropping intensity (%)				
Wet season	89.14	85.06	84.38	84.93
Dry season	74.29	65.15	74.31	72.43
Visayas (2018)				
Average FUSA	33.67	71.67	340.33	196.5
Area actually irrigated, wet season	33.67	71.67	340	196.33
% difference from FUSA	0	0	0.0001	0.0009
Area actually irrigated, dry season	28.67	48.33	331.67	185.08
% difference from FUSA	14.85	32.57	2.54	5.81
% difference from area actually irrigated in wet season	14.85	32.57	2.45	5.73
Cropping intensity (%)				
Wet season	100	100	99.83	99.92
Dry season	75	64.74	96.69	83.28
Mindanao (2018)				
Average FUSA	46	75.4	466.71	268.60
Area actually irrigated, wet season	46	75.4	466.71	268.60
% difference from FUSA	0	0	0	0
Area actually irrigated, dry season	46	70.8	457.21	261.94
% difference from FUSA	0	6.1	2.03	2.48
% difference from area actually irrigated in wet season	0	6.1	2.03	2.48
Cropping intensity (%)				
Wet season	100	100	100	100
Dry season	100	91.20	97.12	94.89

Source: FGD with IA officials/members

In Luzon, IAs in Mindoro have the largest service area while Benguet have the smallest. Most often, the areas planted are reduced during the dry season except in Nueva Ecija, Benguet, and Isabela which have higher areas actually irrigated during the dry season. In the Visayas, the average area actually irrigated during both wet and dry season is almost 100% except in Bohol and Leyte during dry season. This is similar to Mindanao with Bukidnon experiencing reduction in actually irrigated area during dry season.

Relative to FUSA, the cropping intensity of the sample IAs in the 11 provinces in Luzon ranged from 108% (Isabela) to 190% (Occidental Mindoro). The average is 157%, higher than the 2014 national average of 129%. The average cropping intensity in the Visayas is a very high 183% with almost 200% for Leyte and Capiz. In Mindanao, the average cropping intensity is an even higher 195% owing to almost 200% in Davao del Sur, North and South Cotabato. The national average cropping intensity is around 140% (NIA Annual Report 2017).

Based on size of FUSA, there are more small irrigation systems (94%) in Luzon with cropping intensity equal to or higher than 130% compared to medium and large systems. In contrast, only one small CIS have cropping intensity lower than 130% in the Visayas and Mindanao.

Table 25. Average cropping intensity by size of firmed up service area of all sample IAs in the selected provinces

Item	Small		Medium		Large		All	
	No.	%	No.	%	No.	%	No.	%
Luzon (2015)								
Average cropping intensity (%)	177		155		157		157	
No. of IAs w/ CI below 130%	1	5.88	2	12.5	5	15.15	8	12.12
No. of IAs w/CI equal to/above 130%	16	94.12	14	87.5	28	84.85	58	87.88
Total	17		16		33		66	
Visayas (2018)								
Average cropping intensity (%)	175		164.74		196.52		183.19	
No. of IAs w/ CI below 130%	1	33.33	0	0	0	0	1	8.33
No. of IAs w/CI equal to/above 130%	2	66.67	3	100	6	100	11	91.67
Total	17		3		6		12	
Mindanao (2018)								
Average cropping intensity (%)	200		191.2		197.12		194.89	
No. of IAs w/ CI below 130%	0	0	0	0	0	0	0	0
No. of IAs w/ CI equal to/above 130%	1	100	5	100	6	100	12	100
Total	1		5		6		12	

Source: FGD with IA officials/members

8.6. Palay Yield

In Luzon, during wet season, majority (56%) of the IAs got a yield of 65-99 cavans/ha and 54% got more than 100 cavans/ha during the dry season. Nueva Ecija and Nueva Vizcaya have majority of IAs getting more than 100 cavans during the wet season. On average, dry season yield is higher than wet season yield by only nine cavans (Table 26). By province, Nueva Ecija and Ilocos Norte have higher average yield during the wet season.

Table 26. Frequency distribution of the sample CIS by rice yield in all selected provinces

Province	Wet season (cavans/ha)					Dry season (cavans/ha)				
	≤40	41-64	65-99	100≥	Ave.	≤40	41-64	65-99	100≥	Ave.
Luzon (2015)										
Pampanga	1	1	2	2	78.33	0	0	2	3	96.00
Nueva Ecija	0	0	2	4	103.33	0	0	2	1	95.00
Pangasinan	0	0	4	2	97.08	0	1	3	1	90.00
Ilocos Norte	0	0	3	3	116.25	0	1	2	2	115.5
Camarines Sur	0	0	5	1	83.75	0	0	5	1	91.25
Benguet: Rice	0	1	0	1	75.00	0	1	0	1	92.5
Vegetables (kg/ha)										75,192.8
Nueva Vizcaya	0	0	2	4	89.33	0	0	2	4	97.17
Isabela	0	0	3	3	100.83	0	0	2	3	121.25
Cagayan	0	0	6	0	81.67	0	0	3	3	95.00
Laguna	0	0	5	1	75.83	0	0	1	5	99.17
Occidental Mindoro	0	0	3	3	102.50	0	0	0	6	112.83
No. of IAs	1	2	35	24	91.26	0	3	22	30	100.51
%	1.61	3.23	56.45	38.71		0.00	5.45	40.00	54.55	
Visayas (2018)										
Bohol	1	1	0	1	60	2	0	1	0	45
Leyte	0	0	0	3	150	0	0	1	2	124.33
Iloilo	0	0	2	1	91.67	0	0	3	0	76.67
Capiz	0	0	2	1	95	0	0	3	0	85
No. of IAs	1	1	4	6	99.17	2	0	8	2	82.75
%	8.33	8.33	33.33	50		16.67	0	66.67	16.67	
Mindanao (2018)										
Davao del Sur	1	0	0	2	102	0	1	1	1	89
North Cotabato	0	1	2	0	70.67	0	2	1	0	61.67
South Cotabato: Rice	0	0	2	0	85	0	0	2	0	81.25
HVC				1	3900				1	3700
Corn				1	1000				1	1000
Papaya (kg/wk)				1	1800				1	1800
Bukidnon	0	0	2	1	98.33	0	0	2	1	85
No. of IAs	1	1	6	3	89.36	0	3	6	2	79.05
%	9.10	9.10	54.55	27.27		0	27.27	54.55	18.18	

Source: FGD with IA officials/members

Based on FUSA size of Luzon CIS samples, large CIS have higher average dry season yield (105 cav/ha) than small and medium CIS (90 cav/ha). However, small CIS generates consistently high yield at an average of 102 cav/ha in both wet and dry seasons (Table 27). This indicates that small systems could adapt more easily with the cropping season than large systems.

In the Visayas, CIS with large FUSA have the highest yield, but CIS with small FUSA have higher yield than medium FUSA. Similarly, in Mindanao, majority of large FUSA have higher yield particularly during wet season. Yield is relatively higher in Leyte and lowest in Bohol. In Mindanao, yield is lowest in North Cotabato.

Table 27. Frequency distribution of the rice yields during wet and dry seasons according to firmed-up service area of the sample CIS in all selected provinces

FUSA Size	Wet season (cav/ha)					Dry season (cav/ha)				
	No. of CIS				Ave yield	No. of CIS				Ave yield
	≤40	41-64	65-99	100≥		≤40	41-64	65-99	100≥	
Luzon (2015)										
Small	0	0	6	8	102.32	0	2	4	4	102.50
Medium	0	0	12	4	88.20	0	0	11	5	90.31
Large	1	2	17	12	87.95	0	1	7	21	105.45
No. of IAs	1	2	35	24	91.26	0	3	22	30	100.51
%	1.61	3.23	56.45	38.71		0.00	5.45	40.00	54.55	
Visayas (2018)										
Small	1	0	1	1	95	1	0	1	1	80
Medium	0	1	1	1	85	1	0	2	0	63.33
Large	0	0	2	4	108.33	0	0	5	1	93.83
No. of IAs	1	1	4	6	99.17	2	0	8	2	82.75
%	8.33	8.33	33.33	50		16.67	0	66.67	16.67	
Mindanao (2018)										
Small	0	1	0	0	60	0	1	0	0	50
Medium	0	0	2	2	95	0	1	2	1	77
Large	0	1	4	1	90.5	0	1	4	1	85.25
No. of IAs	0	2	6	3	89.36	0	3	6	2	79.05
%	0	18.18	54.55	27.27		0	27.27	54.55	18.18	

Source: FGD with IA officials/members

8.7. Cost Payment Schemes

Despite the AFMA provision that CIS are to be devolved to LGUs, majority of IAs are operating/managing their respective CIS. When the survey of IAs was conducted in Luzon, FISA was not yet implemented. Majority of IAs have entered into the amortization scheme except the IAs in Benguet and Ilocos Norte where most entered into the 30% equity scheme (Table 28). Politicians and LGUs have reportedly supported the IAs by providing financial assistance, e.g., raising equity for the CIS project. LGUs also have been involved in irrigation development programs by providing financial support to IAs. One IA in Cagayan and Occidental Mindoro got their CIS for free. In Visayas and Mindanao, around 83% of IAs were amortizing their CIS cost. With the FISA implementation in 2017, all of them stopped paying amortization. According to FUSA size, majority of IAs amortizing have large FUSA in all three major island groups.

Table 28. Cost payment schemes of all sample IAs in all selected provinces

Province	Before FISA			After FISA
	Amortizing	Paid 30% equity	Grant	
Luzon (2015)				
Pampanga	5	1	0	
Nueva Ecija	5	1	0	
Pangasinan	5	1	0	
Ilocos Norte	1	5	0	
Camarines Sur	6	0	0	
Benguet	0	6	0	
Nueva Vizcaya	4	2	0	
Isabela	5	1	0	
Cagayan	5	0	1	
Laguna	5	1	0	
Occ. Mindoro	5	0	1	
Total No. of CIS	46	18	2	
%	69.69	27.27	3.03	
Visayas (2018)	**Amortizing**	**Paid 30% equity**	**Fully paid**	**Stopped paying Amortization**
Bohol	3	0	0	3
Leyte	2	1	0	2
Iloilo	3	0	0	3
Capiz	2	0	1	2
Total No. of CIS	10	1	1	10
%	83.33	8.33	8.33	
Mindanao (2018)	**Amortizing**	**Paid 30% equity**	**Fully paid**	**Stopped paying Amortization**
Davao del Sur	3	0	0	3
North Cotabato	1	0	2	1
South Cotabato	3	0	0	3
Bukidnon	3	0	0	3
Total No. of CIS	10	0	2	10
%	83.33	0	16.67	

Source: FGD with IA officials/members

Table 29 shows the average loan amount for all the sample IAs. The average loan was ₱9 M with the lowest (₱1.5 M) in Ilocos Norte and the highest (₱28.7M) in Pangasinan). Based on FUSA per province, the average loan per ha is ₱9,000 to ₱254,000. The high average in Pangasinan is due to an IA with a loan of ₱150 M for a SRIP project with a service area of only 160 ha for a development cost of almost ₱1 M per ha. In the Visayas, the average loan amount is ₱29 M, with Capiz getting the highest amount of ₱67 M. Mindanao IAs have the lowest average loan of ₱8.2 M.

Table 29. Average amount of loan for all sample IAs in all selected provinces

Province	Amount of Loan (₱)	FUSA	Loan (₱)/ha
Luzon (2015)			
Pampanga	1,625,000	149.00	10,906
Nueva Ecija	7,391,426	160.33	46,101
Pangasinan	28,735,086	113.00	254,293
Ilocos Norte	1,500,000	156.17	9,605
Camarines Sur	14,458,647	200.00	72,293
Nueva Vizcaya	4,170,238	198.00	21,062
Benguet	-	67.00	-
Isabela	6,380,666	178.00	35,846
Cagayan	13,253,757	97.00	136,637
Laguna	3,466,519	105.00	33,014
Occ. Mindoro	10,066,666	300.00	33,556
All	9,104,800	156.68	58,111
Visayas (2018)			
Bohol	7,182,933	136.67	81,993
Leyte	43,005,271	293.67	85,876
Iloilo	4,156,674	104	54,912
Capiz	67,743,670	251.67	123,737
All	29,387,307	196.5	86,698
Mindanao (2018)			
Davao del Sur	5,265,340	182	65,811
North Cotabato	11,548,795	239.67	75,466
South Cotabato	14,888,219	508.75	46,222
Bukidnon	2,369,823	144	15,200
All	8,242,522	268.6	48,421

Source: Secondary data from respective IMOs

On average, IAs with small CIS expectedly have lower amount of loans than IAs with larger systems. However, on per hectare basis, they have the highest loan while those with large systems have the lowest (Table 30). The amount of loans in the provinces indicates the financial obligation that IAs will be relieved of due to the provision of FISA.

Table 30. Average amounts of loan by FUSA size of sample IAs in the selected provinces

FUSA Size	Amount of Loan (₱)	Ave FUSA	Loan (₱)/ha
Luzon (2015)			
Small	3,636,635	33.61	108,201
Medium	5,275,752	79.56	66,312
Large	7,290,702	257.34	28,331
All	9,104,800	156.68	58,111
Visayas (2018)			
Small	1,833,696.64	33.67	82,904.50
Medium	4,391,499.38	71.67	65,899.76
Large	51,069,748.35	340.33	98,362.82
All	29,387,307.41	196.5	86,698.65

FUSA Size	Amount of Loan (₱)	Ave FUSA	Loan (₱)/ha
Mindanao (2018)			
Small	7,957,920.77	46	172,998.28
Medium	2,322,904.01	75.4	32,724.01
Large	12,236,367.63	466.71	38,123.32
All	8,242,522.05	268.6	48,421.29

Source: Secondary data from respective IMOs

8.8. IAs' Perception on FISA

The IAs appreciated the implementation of FISA because of the following reasons: (a) their loans are condoned, (b) they will stop paying irrigation fee, and (c) there will be funds allocated for O&M (Table 31). However, about 50% of the IAs are worried that the IAs may have less funds for O&M since they can no longer collect from farmer-members. Apparently, the IAs' knowledge about FISA is more on the financial aspects of it than on its implications on the IA.

Table 31. Frequency distribution on the effects of the implementation of FISA to the sample IAs in the selected provinces in Visayas and Mindanao (2018)

Province	Condonation of loan amortization	Additional income to farmers/ Additional funds to the association	Full allocation of funds to O&M	Members stop paying irrigation service fee	Low collection rate/ Less funds for O&M
Visayas					
Bohol	3	0	1	0	0
Leyte	3	1	0	2	2
Iloilo	3	1	0	1	1
Capiz	3	1	0	0	0
No.	12	3	1	3	3
%	100	25	8.33	25	25
Mindanao					
Davao del Sur	2	0	0	0	1
North Cotabato	0	1	0	1	1
South Cotabato	0	0	0	1	2
Bukidnon	1	1	0	2	2
No.	3	2	0	4	6
%	25	16.67	0	33.33	50

*Multiple response
Source: FGD with IA officials/members

8.9. Collection Efficiency

Collection efficiency in this discussion refers to the IA's percentage of actual collection out of the target collectibles. Majority (30%) of IAs in Luzon were able to collect from members 80% and above the target collectibles (Table 32). This indicates a higher rate than the national average of 61%.

With the passage of FISA in 2017, IAs in Visayas and Mindanao stopped paying amortization but continued to collect fees, now usually referred to as irrigation management fee (IMF) or association service charge (ASC) for the operation and maintenance of their respective irrigation system. This ranged from ₱500/ha to ₱1,000/ha. In Visayas, 50% of the sample IAs had a collection efficiency of 80% and above. However, 33% of the IAs had 54% and below. In Mindanao, around 58% of IAs had a collection efficiency of 80% and above. However, 33% of IAs had collection rate of 69% and below for the same reason cited in the Visayas.

Table 32. Frequency distribution of collection efficiency of all sample IAs in the selected provinces

Province	95% and above	80%-94%	70%-79%	55%-69%	54% and below	Others*
Luzon (2015)						
Pampanga	3	0	0	0	2	1
Nueva Ecija	1	0	1	0	3	1
Pangasinan	2	1	1	0	1	1
Ilocos Norte	1	0	1	0	0	4
Camarines Sur	2	2	0	2	0	0
Nueva Vizcaya	0	2	1	1	0	2
Benguet	0	0	0	0	0	6
Isabela	2	0	2	1	0	1
Cagayan	0	3	2	1	0	0
Laguna	2	1	2	0	0	1
Occ. Mindoro	2	1	0	3	0	0
Total No. of IAs	15	10	10	8	6	17
%	22.73	15.15	15.15	12.12	9.09	25.76
Visayas (2018)						
Bohol	1	0	0	0	2	
Leyte	1	1	0	0	1	
Iloilo	2	0	1	0	0	
Capiz	1	0	1	0	1	
Total No. of IAs	5	1	2	0	4	
%	41.67	8.33	16.67	0	33.33	
Mindanao (2018)						**
Davao del Sur	2	1	0	0	0	0
North Cotabato	0	2	0	0	0	1
South Cotabato	0	0	0	2	1	0
Bukidnon	0	2	0	0	1	0
Total No. of IAs	2	5	0	2	2	1
%	16.67	41.67	0	16.67	16.67	8.33

*Others refer to those not paying amortization
**LGU assisted
Source: FGD with IA officials/members

Based on size of FUSA, IAs with large systems represent 42% of IAs in Luzon that have 70% and above collection efficiency. Small CIS represents 31% and medium, 26%, indicating they are better than national average. But among IAs with 95% and higher collection efficiency, both small and large CIS comprise both 40% (Table 33). Among IAs with below 54% collection efficiency, 50% have large CIS, 33% have medium and 17% have small CIS, indicating that small CIS are doing better in terms of collection.

In the Visayas, IAs with small FUSA have remarkably high collection efficiency while IAs with medium to large FUSA have collection efficiencies of 54% and below. In Mindanao, IAs with medium to large FUSA have high collection efficiencies. However, IAs with large FUSA also equally represent those with low collection efficiency.

Table 33. Frequency distribution of collection efficiency by FUSA of all sample IAs in the selected provinces

FUSA Size	95% and above	80%-94%	70%-79%	55%-69%	54% and below	Others*
Luzon (2015)						
Small IAs	6	3	2	0	1	5
% of IAs	40	30	20	-	17	29
Medium IAs	3	4	2	2	2	3
% of IAs	20	40	20	25	33	18
Large IAs	6	3	6	6	3	9
% of IAs	40	30	60	75	50	53
All IAs	15	10	10	8	6	17
%	22.73	15.15	15.15	12.12	9.10	25.76
Visayas (2018)						
Small IAs	3	0	0	0	0	
% of IAs	60	0	0	0	0	
Medium IAs	1	0	1	0	1	
% of IAs	20	0	50	0	25	
Large IAs	1	1	1	0	3	
% of IAs	20	100	50	0	75	
All IAs	5	1	2	0	4	
%	41.67	8.33	16.67	0	33.33	
Mindanao (2018)						
Small IAs	0	1	0	0	0	0
% of IAs	0	20	0	0	0	0
Medium IAs	1	1	0	0	2	1
% of IAs	50	20	0	0	100	100
Large IAs	1	3	0	2	0	0
% of IAs	50	60	0	100	0	0
All IAs	2	5	0	2	2	1
%	16.67	41.67	0	16.67	16.67	8.33

*Others refer to those not collecting/paying amortization
Source: FGD with IA officials/members

In the 2015 survey (Cycle 1), low collection efficiency is due to different reasons. One is the attitude and perception of farmers. Those not willing to pay, although they can afford it, claim that providing irrigation is the responsibility of the government to the farmers. They claim that IAs served by NIS are only paying ISF, not the cost of irrigation project which is paid by CIS IAs. Another reason is that there are politicians who committed to the farmers that they will be in charge of paying the project cost but failed to do so. Other colleagues also influence farmers not to pay. Other IAs do not pay amortization because they claim that there is not enough water to cater to the needs of its members, especially during dry season. The capability of farmers to pay goes hand in hand with the condition of the CIS.

In Camarines Sur, calamity is the usual reason for non-payment of amortization. There is a policy that in case 60% of the crop is damaged, the IA can request for postponement of repayment. This should be supported by an IA resolution and certification from DA on the crop damage. The penalty is one-half (0.5) of one (1) percent per month for delayed payment.

There were IAs applying for conversion into a National Irrigation System, implying also a shift from amortization scheme to ISF scheme. With this shift, collection rate dropped to 50% since half of the members did not agree to the new collection scheme.

With the passage of FISA, some IA members in Visayas and Mindanao were no longer willing to pay any irrigation fee as they claim that it is no longer their obligation to the IA. With the implementation of FISA, collection rate has gone down to 20-30%. Some IAs opted to reduce the fees collected but were worried where to source out funds for O&M.

8.10. Financial Status of Viability of IAs

The viability of IA also affects its capacity to pay its dues. Their main source of funds is collection from farmers, the bulk of which usually goes to equity/amortization payments (before FISA). Meanwhile, there are regular costs that the IAs should pay, e.g., O&M for CIS, wages for water tender or pump operators, cleaning canals. O&M involves different activities, e.g., minor repair, routine maintenance, emergency, and annual repairs. IAs do not include all of these in their collection targets as they usually refer to canal cleaning for their O&M activity. Moreover, NIA's financial assistance to CIS projects is for main diversion and main conveyance facilities. Farm level facilities, e.g., turnouts, are not included in the project cost and have to be developed by the farmers. Thus, even if collection efficiency is high relative to amortization payments, the IAs find it difficult to collect other dues from its members. There is also an annual fee for NWRB. An IA in Ilocos Norte also has to pay environmental fee to DENR (PAMB) for sourcing water from Paoay lake which has been declared as a protected area. The IAs are no longer capable to pay these dues.

The average income of IAs (both amortizing and non-amortizing) hardly meets the IAs' expenses. Average viability index of the 66 sample IAs in Luzon is 0.95, lower than the 2014 national average of 1.25 (Table 34). For the amortizing IAs alone, average income is ₱1,301,341 and average amortization is ₱1,181,807 which is approximately 90% of the IAs' income. Visayas and Mindanao, on average have a viability index of 1.52 and 1.06, respectively. However, in Mindanao, IAs in Bukidnon have a viability index below 1. The IAs in Bohol did not provide financial statement nor any information on income and expenses. Two IAs in Leyte, 1 each in Iloilo and Capiz provided financial statements. IAs that did not provide information have new sets of officers (e.g., Treasurer) who did not get the book of accounts from former officers.

Table 34. Average income, expenditures and viability of all sample IAs in the selected provinces

Province	Average income	Average expenses	Viability index (income/Expenses)
Luzon (2015 data)			
Pampanga	1,525,499	1,595,831	0.74
Nueva Ecija	261,523	408,850	0.64
Pangasinan	277,914	297,158	0.91
Ilocos Norte	46,100	67,183	0.70
Camarines Sur	3,315,945	3,228,336	0.95
Nueva Vizcaya	239,575	258,241	0.95
Benguet	9,820	9,900	0.98
Isabela	358,389	369,105	0.81
Cagayan	146,983	270,066	0.76
Laguna	96,791	98,491	0.79
Occidental Mindoro	424,117	449,783	0.90
All	609,332	641,111	0.95
Visayas (2017 data)			
Bohol	-	-	-
Leyte	178,547	165,557.52	1.13
Iloilo	37,024	35,444	1.04
Capiz	49,313	17,920	2.75
All	110,857	96,119.76	1.52
Mindanao (2017 data)			
Davao del Sur	518,199.13	434,954.14	1.13
North Cotabato	663,339.50	588,434.40	1.04
South Cotabato	369,597.90	315,559.26	1.13
Bukidnon	229,563.20	225,624.05	0.94
All	445,174.93	391,142.96	1.06

Source: FGD with IA officials/members and Financial Statements provided by the IAs
Note: Income comes mainly from collection of fees from farmer-members; expenses cover mainly O&M activities such as cleaning canals, and wages for water tended/pump operators.

Based on size of FUSA, IAs with small systems in Luzon have lower viability index on average than those with medium and large systems. In the Visayas, IAs with small and medium size systems are equally viable but still large systems fare better. This suggests prioritizing the need for improving financial management of IAs with small systems. In contrast, IAs with small systems have higher viability index than medium and large systems (Table 35).

However, based on frequency distribution of the 66 IAs in Luzon, around 56% have a viability index between one and two. The IAs (34%) with low viability suggests that the income of these IAs is not enough to meet their expenditures (Table 36).

In Visayas, all (4) IAs that provided data have a viability index above 1. In Mindanao, 25% of the 12 sample IAs have a viability index below 1 (Table 36).

Table 35. Average income, expenditures and viability of all sample IAs by FUSA size

FUSA Size	Average income	Average expenses	Viability index (income/Expenses)
Luzon (2015 data)			
Small	38,347.78	82,433.74	0.46
Medium	190,891.34	228,212.59	0.84
Large	1,106,357.08	1,129,107.60	0.98
All	609,332	641,111	0.95
Visayas (2017 data)			
Small	274,227	263,606.04	1.04
Medium	37,024	35,444	1.04
Large	66,090	42,714.5	1.99
All	110,857	96,119.76	1.52
Mindanao (2017 data)			
Small	113,120.15	92,677.45	1.22
Medium	95,099.26	102,875.25	0.94
Large	792,247.12	681,110.30	1.14
All	445,174.93	391,142.96	1.06

Source: FGD with IA officials/members and Financial Statements provided by the IAs

Table 36. Frequency distribution of all sample IAs by viability ratio in the selected provinces

Province	Viability index (income/expenditures)			
	<1	1	>1-2	NA*
Luzon (2015 data)				
Pampanga	2	2	1	1
Nueva Ecija	3	2	0	1
Pangasinan	2	3	1	0
Ilocos Norte	2	3	0	1
Camarines Sur	1	3	2	0
Nueva Vizcaya	3	3	0	0
Benguet	1	4	1	0
Isabela	2	2	1	1
Cagayan	3	3	0	0
Laguna	1	3	1	1
Occ. Mindoro	3	3	0	0
All	23	31	7	5
%	34.85	46.97	10.61	7.58
Visayas (2017 data)				
Bohol	0	0	0	3
Leyte	0	0	2	1
Iloilo	0	0	1	2
Capiz	0	0	1	2
All	0	0	4	8
%	0	0	33.33	66.67

Province	Viability index (income/expenditures)			
	<1	1	>1-2	NA*
Mindanao (2017 data)				
Davao del Sur	1	0	2	0
North Cotabato	1	1	1	0
South Cotabato	0	1	2	0
Bukidnon	1	0	2	0
All	3	2	7	0
%	25	16.67	58.33	0

*Note: The IAs has no regular income and expenditures. Members contribute only when the need arises
Source: FGD with IA officials/members and Financial Statements provided by the IAs

Based on size of FUSA, there are relatively larger IAs (28.7% of 66 IAs) in Luzon with viability index between 1 and 2 (Table 37). However, there are also relatively smaller IAs (13% of 66 IAs) than medium IAs with viability index of 1.

In Visayas, of the 4 IAs that provided data, two IAs with large system have a viability index higher than 1. One IA with small, and 1 IA with medium CIS also have higher than 1 index. In Mindanao, 5 of the 12 IAs with large systems are highly viable; but one IA with large system has an index below 1. Two IAs with medium system have low viability (Table 37).

Table 37. Frequency of sample IAs by viability ratio and size of firmed-up service area

Size of FUSA	Viability index (income/expenditures)							
	<1		1		>1 -2		NA*	
	No.	%	No.	%	No.	%	No.	%
Luzon (2015 data)								
Small	3	4.55	9	13.64	3	4.55	2	3.03
Medium	8	12.12	4	6.06	3	4.55	1	1.52
Large	12	18.18	18	27.27	1	1.52	2	3.03
All	23	34.85	31	46.97	7	10.61	5	7.58
Visayas (2017 data)								
Small	0	0	0	0	1	8.33	2	16.67
Medium	0	0	0	0	1	8.33	2	16.67
Large	0	0	0	0	2	16.67	4	33.33
All	0	0	0	0	4	33.33	8	66.67
Mindanao (2017 data)								
Small	0	0	0	0	1	8.33	0	0
Medium	2	16.67	2	16.67	1	8.33	0	0
Large	1	8.33	0	0	5	41.67	0	0
All	3	25	2	16.67	7	58.33	0	0

Source: FGD with IA officials/members and Financial Statements provided by the IAs

Cost and returns provide indication of profitability and capacity of farmers to pay dues to the IA. This information is also a requirement in documents, e.g., agro-economic data for feasibility study of CIS projects.

Based on the annual production cost and returns of the sample IAs, net profit per hectare ranged from ₱25,000 (Ilocos Norte) for palay to ₱440,000 (Benguet) coming mainly from vegetable production (Table 38a). For amortizing IAs, the annual instalment shall be the money value of 1.5 cavans (50kg/cavan) multiplied by the wet season actually benefitted area. At ₱17/kg of palay, the money value of this will be ₱1,275 per hectare (assuming this is the actually benefitted area). For an average FUSA of 156 ha, annual amortization at this rate will be ₱198,900. For 50 years, this will pay a loan of ₱9.9M, close to the average loan of the sample IAs. In the Visayas, net profit is highest in Leyte and Capiz at around ₱58,000/ha. for two cropping seasons. It is lowest in Iloilo at ₱34,000 due to reduced crop area and production during the dry season (Table 38b). In Mindanao, net profit for two seasons is highest in North Cotabato (over ₱115,000/ha) and lowest in South Cotabato at over ₱40,000 per ha (Table 38c).

Table 38a. Average production cost and returns per ha of the 66 sample IAs in 11 selected provinces in Luzon (2015)

Province	Area Wet	Area Dry	Total Production (kg)	Yield (kg/ha)	Total Production cost /ha (₱)	Gross Profit/ha (₱)	Net Profit/ha (₱)
Luzon							
Pampanga	112.5	50.60	857,736	5,258.96	42,417	109,937	67,519
Nueva Ecija	160.33	117.00	1,890,878	6,818.15	50,576	126,940	76,363
Pangasinan	107.83	107.40	791,048	3,675.36	28,109	81,072	52,962
Ilocos Norte	156.17	141.00	992,475	3,339.76	34,816	60,356	25,539
Camarines Sur	184.00	184.00	1,768,461	4,805.60	46,022	102,864	56,842
Nueva Vizcaya	179.17	151.33	1,614,865	4,886.13	37,152	87,157	50,004
Benguet	48.00	48.00	4,717,049	49,135.93	130,813	570,948	440,134
Isabela	100.00	87.50	919,123	4,901.99	33,176	84,754	51,577
Cagayan	67.33	63.17	586,967	4,497.83	36,403	88,778	52,375
Laguna	87.33	73.67	1,445,097	8,975.76	47,319	97,342	50,022
Occidental Mindoro	289.17	283.50	2,994,300	5,228.67	28,713	83,630	54,916
All	135.62	118.83	1,688,909	9,229.47	46,865	135,798	88,932

Source: FGD with IA officials/members

Table 38b. Average production cost and returns per ha of the 12 sample IAs in 4 selected provinces in the Visayas (2018)

Province	Effective Area Planted	Effective Area Harvested	Total Production (in kg)	Yield (kg/ha)	Total Production cost/ha (₱)	Gross Profit/ha (₱)	Net Profit/ha (₱)
Wet season, palay							
Bohol	136.67	128	475,117	2,320	20,000	39,800	19,800
Leyte	293.67	293.67	1,344,698	5,376	27,667	59,000	29,000
Iloilo	103.33	103.33	359,500	3,737	25,667	43,333	17,667
Capiz	251.67	251.67	989,950	4,140	18,333	43,333	28,333
All	196.33	194.17	792,316	3,893	22,917	45,218	23,218

Province	Effective Area Planted	Effective Area Harvested	Total Production (in kg)	Yield (kg/ha)	Total Production cost/ha (₱)	Gross Profit/ha (₱)	Net Profit/ha (₱)
Dry season, palay							
Bohol	110	97.67	319,400	2,320	26,667	44,200	17,533
Leyte	293.67	293.67	1,678,520	6,540	28,000	59,000	29,000
Iloilo	85	85	258,000	3,120	25,667	42,667	17,000
Capiz	251.67	251.67	938,750	3,740	19,000	48,333	29,333
All	185.08	182	798,668	3,930	24,833	47,600	22,691

Source: FGD with IA officials/members

Table 38c. Average production cost and returns per ha of the 12 sample IAs in 4 selected provinces in Mindanao (2018)

Province	Effective Area Planted	Effective Area Harvested	Total Production (in kg)	Yield (kg/ha)	Total Production cost/ha (₱)	Gross Profit/ha (₱)	Net Profit/ha (₱)
Wet season, palay							
Davao del Sur	182	182	996,240	4,284	31,000	78,933	47,933
North Cotabato	221.67	221.67	614,586	2,968	22,833	78,311	55,311
South Cotabato	425.25	425.25	1,608,390	3,780	25,000	45,000	20,000
Bukidnon	142.33	142.33	514,360	4,130	29,167	64,333	36,000
All	242.81	242.81	933,394	3,790.5	27,000.00	66,644.2	39,811
Dry season, palay							
Davao del Sur	182	182	932,400	3,738	31,000	52,500	21,667
North Cotabato	221.67	221.67	578,956	2,618	22,833	83,620	60,620
South Cotabato	425.25	425.25	1,608,390	3,780	25,000	45,000	20,000
Bukidnon	137.33	137.33	446,740	3,570	29,167	71,333	43,000
All	241.56	241.56	891,621.5	3,426.5	27,000.00	63,113.2	36,322
Dry Season, Corn							
South Cotabato	25.75	10	10 (tons/yr)		25,000	131,541.8	106,542
Papaya							
South Cotabato	45.75	27.5	1,800 (kg/wk)		150,000	650,000	200,000

Source: FGD with IA officials/members

Note: Corn and Papaya (South Cotabato) are produced in different farm areas from those planted to Rice but are irrigated by the CIS.

The market price of land may also be encouraging to farmers to sell their farms. Based on the 2015 survey in Luzon, Benguet has the highest average price of ₱18 million per hectare (M/ha). Isabela and Ilocos Norte come next at over ₱12 M/ha and ₱8 M/ha, respectively (Figure 28a).

In the Visayas as of 2018, Iloilo and Bohol command the highest price of land approaching ₱1.2 M/ha. (Figure 28b). This is almost the same as in Davao del Sur in Mindanao. In the other sample provinces, prices approach to ₱800,000/ha (Figure 28c).

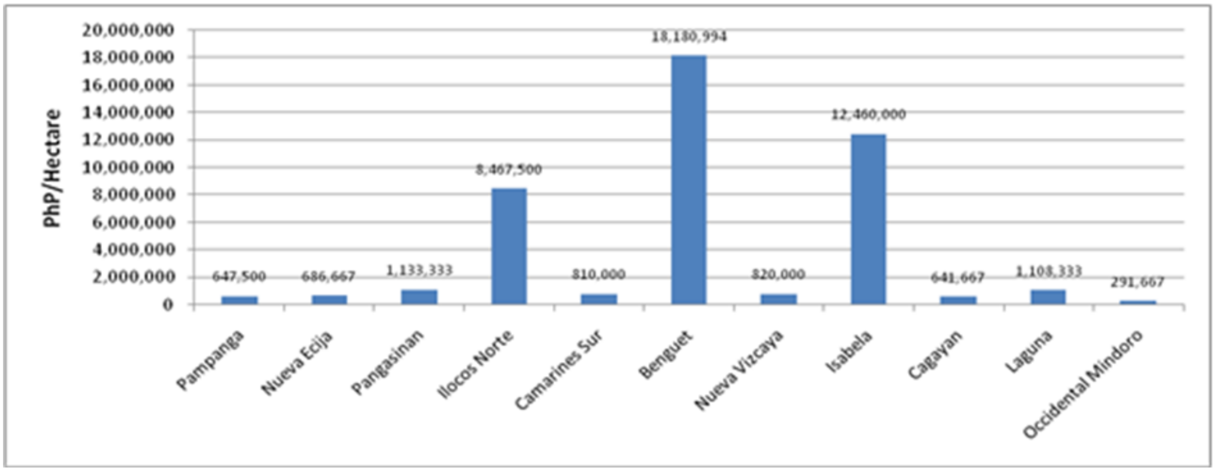

Figure 28a. Current market price (₱/ha) of land reported by IAs in 11 selected provinces in Luzon (2015)

Source: FGD with IA officials/members

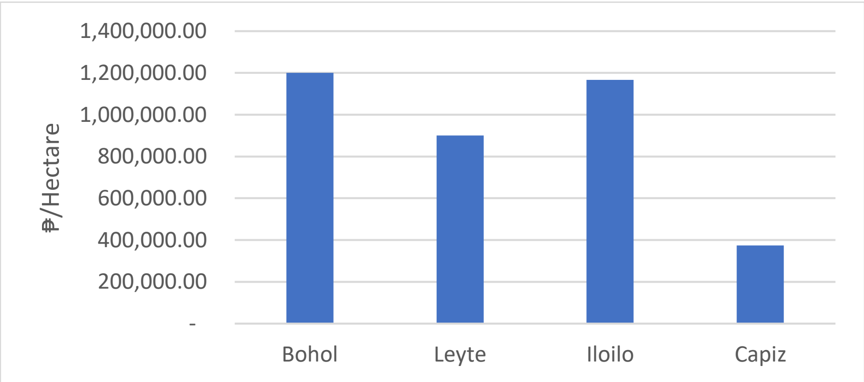

Figure 28b. Average current market price (₱/ha) of land reported by IAs in 4 selected provinces in Visayas (2018)

Source: FGD with IA officials/members

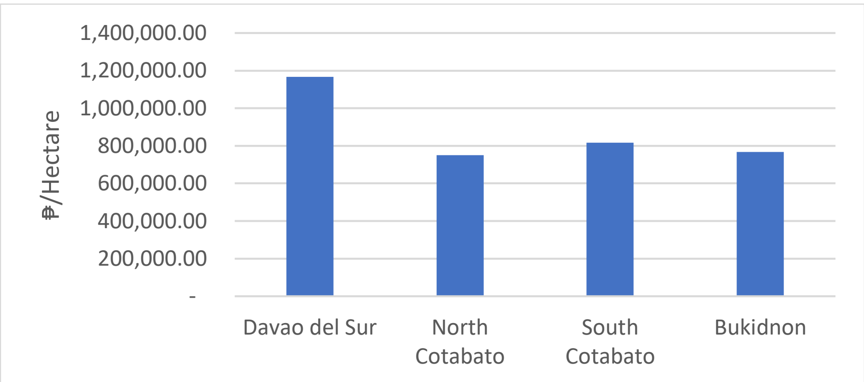

Figure 28c. Average current market price (₱/ha) of land reported by IAs in 4 selected provinces in Mindanao (2018)

Source: FGD with IA officials/members

8.11. Pump Usage

As mentioned earlier, CIS using pumps serves around 18% of the total FUSA covered by the 66 sample irrigation systems in Luzon, and around 25% in Visayas, and none in Mindanao. The pump CIS being referred to here are those systems tapping water from rivers or creeks using either turbine or large centrifugal pumps and usually powered by large diesel engines. Generally, these CIS are costlier to manage (operate and maintain) than gravity CIS. There are also successful IAs managing pump CIS, being able to source support through institutional networking. LGUs also provide financial assistance to IAs in establishing pump CIS.

Installation of shallow tube wells (STWs) is practiced as an alternative source when there are many facilities that need to be repaired; and/or there is inadequacy of water supply such as in the dry season. Pump systems are also common in some storage or diversion schemes to lift water to irrigate areas on higher elevation, or pump groundwater to supplement available supply from the river.

Problems with pump CIS include high cost of maintenance and fuel cost. Pump run by electricity entails a cost of ₱0.5M for one season. In a Pampanga CIS, farmers pay 8-12 cavan/ha/season for use of the pump. In a Nueva Ecija CIS, a 65-75 Hp pump costing ₱5.4M (as of 2013) can serve 50-60 ha. Fuel cost is ₱3,000/ha/cropping. Per IA policy on the use of pump, the farmer has to replace the fuel used so that it's always kept full tank. Farmers share the cost of repair and maintenance.

In a Cagayan CIS, a 7-8Hp pump that can serve 3 ha costs ₱140,000. For 10-50 ha, deep well is the alternative. Service fee is direct cost for amortization. Amortization is 10cav/ha/season; for shallow water levels (lower head) where consumption is lower, it is 7.5 cav/ha; for higher head, rate is 10cav/ha. For regular maintenance, fee is 0.5 cav/ha.

In the 11 selected provinces in Luzon, average yield from gravity CIS is higher than yield from pump CIS by almost 10 cavans during wet season and by 13 cavans during dry season. Only three provinces used pump during the dry season. Isabela has the highest average yield for pump CIS with 94cav/ha during wet season and Pampanga with 96cav/ha during dry season. Lowest yield during wet season is in Pampanga with 68cav/ha and during dry season in Isabela at 70cav/ha.

In Loboc PIS in Bohol, the pump used electricity to store water to the two reservoirs. The association paid electric bill amounting to ₱3,000 per month during cropping season. Members paid ₱20 per cubic meter before but with the passage of FISA the cooperative decided to reduce it to ₱15 per cubic meter.

In Particion CIS in Iloilo, the association found out that the pump provided by the contractor was secondhand when the pump started to breakdown. It costs them ₱70,000 for the repair but it is no longer operational. The NIA then provided them with a diesel-engine powered centrifugal pump. The association used the pump 8hrs a day especially during dry season when water from the river is scarce. Thirty to forty liters of gasoline can be consumed by the pump engine per hectare increasing total production cost and decreasing net profit of the farmers. Before the FISA, the association collected operation management fee of ₱10 per cavan for each cropping season from each member but reduced to ₱5 per cavan with the passage of FISA.

In Sigma Sur PIS in Capiz, the pump provided by the NIA is operated a maximum of 14 hour per day. Members of the association paid the operator a ₱30 per hour rate. The association implement "no receipt, no water" and "first come, first serve basis" policy for the water distribution and delivery. Members shouldered the fuel expense for the irrigation of their respective rice fields. One hectare can be fully irrigated in 5 hrs with 3 liters/hr rate of gasoline consumption.

In Visayas, only Leyte did not use pump. Average yield difference between gravity and pump CIS is over 38cav/ha for wet season; and 26cav/ha for dry season. Pump CIS in Bohol has the lowest yield (15-20 cav/ha).

9. Success Indicators of IAs

According to key informants at the IMOs, success of IA is largely based on regular payment of amortization, successful collection of ISF from IA members, and how active or functional the IA is. ISF in the case of CIS used to include fees for IA amortization, O&M activities and wages for water tender. With FISA, as earlier mentioned, IA collection is referred to as irrigation management fee (IMF) or association service charge (ASC). But there are IA members who are no longer willing to pay any fees. An IA is considered active if it sees to it that the system is working well in order to meet expectations. Being active considers the functionality indicators discussed below.

9.1. Functionality of Irrigators' Associations

A sustained irrigation system is connected with functionality, a composite of financial, O&M, organization and organizational discipline factors which later included assistance program/linkage, and special features. O&M and financial conditions are interconnected and could also affect the organization and organizational discipline. Financial viability indicates that the IA's income is sufficient to cover its expenditures and they can pay NIA its amortization.

IAs differ in terms of organizational discipline and depends on the IA leadership. Some IAs may be active in conducting regular meetings while others are not conducting meeting if the IDO is not around. Active IAs also exert effort, e.g., seeking assistance from different sources, to remedy problems with the system. The IA is non-functional if it has poor response to its needs and non-active; O&M is only good in plan but not in implementation, e.g., cropping calendar is not followed; facilities not maintained; collection of amortizations is a problem.

Based on the functionality reports of IMOs in Luzon, 51% of the sample IAs covered by the study have very satisfactory (44%) to outstanding ratings (7%). Around 7% were rated fair (Table 49a). In Visayas, around 7% were outstanding; and 42% were very satisfactory. Around 16% were fair. (Table 49b). Mindanao also has high functionality rating with almost 17% outstanding and 42% very satisfactory. Only 8% were rated fair (Table 49c).

Considering size of FUSA, there are relatively more IAs with large systems in Luzon that are rated very satisfactory to outstanding. In contrast, among IAs with fair rating, 40% are IAs with small CIS. In Visayas, small and large systems are outstanding. Only the medium system got a fair rating. In Mindanao, majority of large systems got outstanding or very satisfactory rating. Only the medium system also got a fair rating.

Table 39. Frequency distribution of sample IAs by functionality rating in all selected provinces

Province	Outstanding	Very Satisfactory	Satisfactory	Fair	No data
Luzon					
Pampanga	1	5	0	0	0
Nueva Ecija	0	4	2	0	0
Pangasinan	0	3	2	0	1
Ilocos Norte	0	2	2	1	1
Camarines Sur	2	2	2	0	0
Nueva Vizcaya	0	2	1	1	2
Benguet	1	4	0	0	1
Isabela	1	3	0	0	2
Cagayan	0	1	2	0	3
Laguna	0	2	3	1	0
Occ. Mindoro	0	1	0	2	3
All	5	29	14	5	13
%	7.58	43.94	21.21	7.58	19.70
Visayas					
Bohol	0	3	0	0	
Leyte	2	0	1	0	
Iloilo	0	1	0	2	
Capiz	0	1	2	0	
All	2	5	3	2	
%	16.67	41.67	25	16.67	
Mindanao					
Davao del Sur	1	1	0	0	1
North Cotabato	2	0	0	1	0
South Cotabato	0	2	0	0	1
Bukidnon	0	2	1	0	0
All	3	5	1	1	2
%	25	42	8	8	17

Source: Functionality survey reports of respective IMOs (as of 2014 in Luzon while 2017 in Visayas and Mindanao)

Based on specific indicators of functionality, IAs in Luzon are getting relatively lower rating on O&M and financial indicators, compared to organization and organizational discipline. On average, majority of the provinces have IAs far from the 40% score for O&M and 30% for financial. IAs have scores closer to organization-related indicators (Table 40a).

In the Visayas, only Iloilo got an overall fair rating. Its IAs have the lowest average score on the different indicators except organizational discipline where it is highest. Leyte has the highest rating in O&M, Capiz on financial; and Bohol on assistance program and linkages (Table 40b).

In Mindanao, only Davao del Sur got an overall rating of outstanding, getting the highest score on O&M and financial. The other provinces' IAs also did well with a very satisfactory rating. Bukidnon was the highest in linkaging (Table 40c).

Table 40a. Average rating of the individual indicators for IAs' functionality rating in 11 selected provinces in Luzon

Province	O&M (40%)	Organiza-tion (15%)	Financial (30%)	Organization-al Discipline (15%)	Average Scores in add'l indicators	Final Rating (Total)	Final Rating (Adjective)
Pampanga	30.88	12.67	24.69	12.89	2.58	83.71	Satisfactory
Nueva Ecija	30.90	12.75	20.91	12.24	3.79	80.62	Satisfactory
Pangasinan	32.58	12.25	18.40	12.48	6.16	81.87	Satisfactory
Ilocos Norte	32.87	14.21	20.58	14.69	7.72	82.95	Satisfactory
Camarines Sur	29.45	13.37	19.67	13.71	3.25	79.42	Satisfactory
Benguet*	-	-	-	-	-	83.51	Satisfactory
Nueva Vizcaya	34.60	12.85	22.10	12.39	3.76	85.69	Very Satisfactory
Isabela	35.47	13.03	21.09	12.67	2.79	87.83	Very Satisfactory
Cagayan	32.51	12.43	19.35	13.26	5.50	83.05	Satisfactory
Laguna	27.96	11.05	17.49	11.48	4.12	72.10	Fair
Occidental Mindoro	23.18	11.54	21.38	11.40	4.50	72.00	Fair
ALL	31.04	12.62	20.57	12.72	4.42	81.16	Satisfactory

*Note: For the province of Benguet, only the final ratings are presented

Source: Functionality survey reports of 11 IMOs (as of 2014)

Table 40b. Average rating of the individual indicators for IAs' functionality rating in 4 selected provinces in Visayas

Province	O&M (35%)	Financial (26%)	Organizational Discipline (25%)	Assistance Program/ Linkages (10%)	Special Features (4%)	Final Rating (Total)	Final Rating (Adjective)
Bohol	31.33	22	22.67	9	2.33	88.33	Very Satisfactory
Leyte	35.07	23.5	22.76	8.67	2.37	91.58	Very Satisfactory
Iloilo	28.4	17.12	23.53	4.4	0.35	73.8	Fair
Capiz	31.2	24.5	22.77	4.67	1.67	84.8	Satisfactory
ALL	31.5	21.78	22.93	6.68	1.68	84.63	Satisfactory

Source: Functionality survey reports of 4 IMOs (as of 2017)

Table 40c. Average rating of the individual indicators for IAs' functionality rating in 4 selected provinces in Mindanao

Province	O&M (35%)	Financial (26%)	Organizational Discipline (25%)	Assistance Program/ Linkages (10%)	Special Features (4%)	Final Rating (Total)	Final Rating (Adjective)
Davao del Sur	34.5	24	28.55	6	3.5	96.55	Outstanding
North Cotabato	33.53	18.43	27.07	5.48	3.75	88.27	Very Satisfactory
South Cotabato	32.05	21.25	24.35	4.9	2.63	85.18	Very Satisfactory
Bukidnon	32.07	22.33	22.9	7.5	2.28	87.08	Very Satisfactory
ALL	32.99	21.28	25.57	6.075	3.035	88.95	Very Satisfactory

Source: Functionality survey reports of 4 IMOs (as of 2017)

Based on self-rating of IAs in the field interviews in Luzon, around 55% of the IAs claimed that they are completely and sufficiently financed or self-sustaining. Around 53% also rated their collection of ISF satisfactory to excellent while 41% rated the same for collection of other fees (Table 41a).

In Visayas, around 41% of IAs rated themselves 1 claiming Inadequate, but enough funds to replace and maintain key structures. Insufficient funds to do much of the basic maintenance needed. Around 25% of IAs claimed that they are completely and sufficiently self-sustaining. Around 50% claimed their fee collection from members was satisfactory (Table 41b).

In Mindanao, about 50% of IAs are either completely and sufficiently self-sustaining or sufficiently financed. Majority also rated their collection performance as satisfactory to excellent (Table 41c).

Table 41a. Self-rating by IAs of their financial strength in 11 selected provinces in Luzon (2015)

Province	Financial strength*					Collection of ISF**				
	0	1	2	3	4	0	1	2	3	4
Pampanga	1	0	1	3	1	0	1	1	1	1
Nueva Ecija	3	0	1	1	1	1	1	2	2	0
Pangasinan	0	0	0	5	1	0	0	3	2	1
Ilocos Norte	2	1	2	0	1	0	0	1	1	1
Camarines Sur	0	0	1	0	5	0	0	1	2	3
Benguet	0	0	3	2	1	0	0	0	0	2
Nueva Vizcaya	0	0	3	3	0	0	1	3	1	0
Isabela	2	0	1	1	2	0	2	0	1	1
Cagayan	0	1	2	2	1	0	1	2	3	0

Province	Financial strength*					Collection of ISF**				
	0	1	2	3	4	0	1	2	3	4
Laguna	1	0	2	2	1	0	0	1	3	1
Occidental Mindoro	0	0	2	2	2	0	1	2	2	0
All No.	9	2	18	21	16	1	7	16	18	10
%	13.64	3.03	27.27	31.82	24.24	1.92	13.46	30.77	34.62	19.23

Source: FGD with IA officials/members

Table 41b. Self-rating by IAs of their financial strength in 4 selected provinces in Visayas (2018)

Province	Financial strength*					Collection of ISF**				
	0	1	2	3	4	0	1	2	3	4
Bohol	1	1	0	0	1	0	1	1	1	0
Leyte	0	0	1	0	2	0	0	0	2	1
Iloilo	0	3	0	0	0	0	0	0	2	1
Capiz	1	1	0	1	0	0	1	0	1	1
All No.	2	5	1	1	3	0	2	1	6	3
%	16.67	41.67	8.33	8.33	25	0	16.67	8.33	50	25

Source: FGD with IA officials/members

Table 41c. Self-rating by IAs of their financial strength in 4 selected provinces in Mindanao (2018)

Province	Financial strength*					Collection of ISF**				
	0	1	2	3	4	0	1	2	3	4
Davao del Sur	0	2	0	1	0	0	0	0	0	3
North Cotabato	1	0	0	1	1	0	0	0	1	1
South Cotabato	0	1	0	0	2	0	1	0	1	1
Bukidnon	1	1	0	0	1	0	0	1	1	1
All No.	2	4	0	2	4	0	1	1	3	6
%	16.67	33.33	0	16.67	33.33	0	8.33	8.33	25	50

*Financial strength rating: 4 – Completely and sufficiently self-sustaining 3 – Completely and sufficiently financed 2 – Underfinanced, but not badly 1 – Inadequate, but enough funds to replace and maintain key structures. Insufficient funds to do much of the basic maintenance needed 0 – Very inadequate with funds
**Collection of ISF and other fees rating: 0 – very poor 1 – poor 2 – average 3 – satisfactory 4 – excellent
Source: FGD with IA officials/members

The IAs themselves express the problem on O&M (38%) and access to water (48%) which is related to systems facilities. IDOs also pinpointed O&M as the major concern in IAs functionality rating. IA collection is largely for amortization/ payment of project cost. Even if the IAs have additional collections these are usually for hiring of water master, canal cleaning.

The IAs must be continuously capacitated and their trainings on all aspects of systems management, O&M and financial management planning and implementation should be refreshed. As new officers are also given orientation, learnings from the trainings should be shared with the IA members. Coordination across the IS sectors should be harnessed. There also has to be a system to maintain the IAs' functionality such as through regular monitoring and review. At any rate, NIA is required by the GCG to conduct annual survey of its customers, perhaps through this the sentiments, concerns of CIS IAs can be monitored.

9.2. Examples of Good Practices

The IAs that rated their performance high cited some good practices as follows:

- In Occ. Mindoro, resourcefulness of the IA president generated funds for the IA. She took advantage of the incentive *Balik Tangkilik* (patronage refund) from selling to NFA through the Cooperative Development Incentive Fund (CDIF). The incentive is ₱15 per cavan (50 kg) sold to NFA. This amount is distributed as follows - ₱3 goes to IA; ₱5 goes to actual member of IA who sold to NFA, and ₱7 to coordinator (also an IA member) assigned by IA to bring the palay to NFA. The IA President was able to comply with the NFA requirement that the IA should have a certificate of good standing issued by SEC (which also requires yearly FSS and GIS) and BIR certification of payment (tax). The IA President reported that after receiving a grant for a CIS project, she was asked to pay tax. She clarified this with BIR and found out that the IAs may apply for tax exemption. Because of her dedication to the IA, she was able to produce the paper requirements to avail of this tax exemption.

- In Occ. Mindoro, an IA, recognizing that it has no police power formed a Systems Management Council which coordinated with the Barangay Council to adopt the IA policy (e.g., water distribution) through a barangay resolution. Thus, if the IA member violates the policy, the case can be elevated to the barangay level.

- An IA in Laguna is completely and sufficiently financed even 60% of the farms are submerged in flood during rainy season and typhoon occurrence. Their high financial viability may be attributed to their Rice Processing Center worth ₱12M given by DA in 2012, plus ₱1M operating capital, and ₱0.5M administrative funds. Likewise, the IA also received funding from DA-CARP amounting to ₱3 M in 2015 for extension of their irrigation canals.

- An IA in Benguet has a high attendance of members in quarterly meetings, general assemblies, and trainings. By-laws were all implemented adequately. Violation of rules has a fine of ₱200. All members are always able to pay their dues and the IA was named the best IA in Benguet in 2013.

- In Laguna, every harvest, farmer gives one can of palay to the IA for its savings. Or if the IA member has to pay ₱900 for amortization, the IA can add ₱100 in the collection.

- By-laws of an IA in Isabela are strictly implemented. A violation of a farmer-member would cost him a fine amounting to ₱300 pesos for the first offense. A second offense would cost the violator ₱500 and for the third time, the member's membership would be cancelled. The members of the board and the officers are also accountable for their misbehavior. An absent to a meeting of an officer or BOD would result in a fine of ₱250 while consecutive absences will result in expulsion of the officer or BOD. There is also perfect attendance of during trainings and seminars.

- In Camarines Sur, an IA (turned to multi-purpose cooperative) has a cropping intensity of 191% and was able to pay 100% of its yearly amortization. It was nominated to the Agri-Pinoy Rice Achievers Award (CIS category) in 2013. It has earlier earned the NIA Gintong Patubig Award. It was a beneficiary of various government programs such as DAR projects on CARP-IC, and DA programs where they acquired flatbed dryer, rice processing center, palay shed, and rice mill. The IA members have attended various seminars and training.

- In Camarines Sur, being late in IA meetings can cost the member ₱100 fine while an absent official would have no honorarium for a month. The IA has also received one million pesos from a Congressman and used the money to build a warehouse where the members of the association can store their palay. The irrigators' association has already eight awards.

- In Pampanga, by-laws have provisions for violation: first offense - ₱500; second offense – no water delivery for the current season; third – dismemberment from the IA.

- In Laguna, 20% of the IA collection would be allotted for maintenance and operating expenses of the system as well as the salaries of the collectors and gate keepers while the rest would be allocated to the payment of the loan amortization. The Irrigators' Association has garnered a "Hall of Fame" award from the Land Bank of the Philippines.

- In Leyte, two IAs received recognition from NIA-R8 for being outstanding IA in 2017. The collection rate of one IA is 100% with members paying on time receiving 5% discount while the collector received 10% of the collection. Even before the passage of FISA, the association was already fully paid on its financial obligation to NIA. Aside from association service charge, the association also had other sources of income. They rented out their farm equipment/machineries and sold certified seeds and commercial fertilizers to members and non-members alike. They also strictly implement their by-laws particularly provisions on water allocation and delivery: No water request, no water delivery. Violators were penalized by ₱2,500 per hectare.

- When typhoon Yolanda hit Leyte, one of the irrigation systems was severely affected. International organization like the International Labor Organization (ILO) provided assistance to the IA through cash for work program and 100 m of lateral canal were lined during the program. Excess money was used by the IA to purchase computer. The United States Agency for International Development (USAID) also donated bodega, solar dryer and the office of the association. They also received other farm equipment/machineries from the Department of Agrarian Reform and the Italian government. Free seeds and fertilizers were provided by the Department of Agriculture. The IA relied on other sources of income like rentals of farm machineries including thresher, tractor and water pump, as well as rentals of solar drier and storage. Sector leaders also waived their incentive in collecting the irrigation fee in order to have adequate funds for the operation and maintenance of the system.

- In Capiz, an IA implements "no receipt, no water" and "first come, first serve basis" policies for water distribution and delivery, which they strictly implement earning a collection rate of 100%. Members shoulder the fuel expense whenever they use the IA pump for supplemental irrigation of their respective fields. The IA also received funding from the Countryside Development Fund of a politician in concreting certain portion of lateral canal and housing of the pump.

- In Davao del Sur, an IA regularly practiced cleaning of the dam and main canals, including trimming of the grasses, prior to the start of rainy season. They also avoided using herbicide which they fear could possibly contaminate irrigation.

- In South Cotabato, an IA practiced crop rotation where they plant papaya, banana, corn, and vegetables such as cauliflower, bell pepper, bitter gourd, okra, and eggplant. The farmers harvest their crops weekly and sold them to Dole Philippines, to which they plan to be regular growers and include asparagus, broccoli and cabbage. The IA also have a resting or fallow period for their service area.

9.3. Assistance Received by Irrigators' Associations

Of the 66 IAs interviewed in Luzon, 51 reported getting continuous support from NIA. By province, Ilocos Norte, Cagayan and Laguna have the least number of IAs with support from NIA. Assistance from NIA includes the use of equipment and other services such as desilting. The Association of Regional Directors and Operation Managers (ARDOMA) has a proposal to NIA for an allocation of ₱100,000 per CIS per year for O&M from NIA budget. This is also the estimated amount for restoration project. Meanwhile all IAs in Visayas and Mindanao reported that NIA continuously provide them support.

Majority (80%) of the IAs in Luzon, Visayas and Mindanao rated NIA assistance as excellent (Figure 29a, b and c) in terms of technical, financial institutional and others. Technical assistance includes the rehabilitation of the system, concreting of canal and construction of irrigation facilities while financial assistance primarily came from the LGUs and politicians. Institutional assistance includes training and capacity building activities while other services include lending of heavy equipment. Other agencies providing assistance as cited by the IAs in Luzon, Visayas and Mindanao include the DA and its attached agencies such as BSWM.

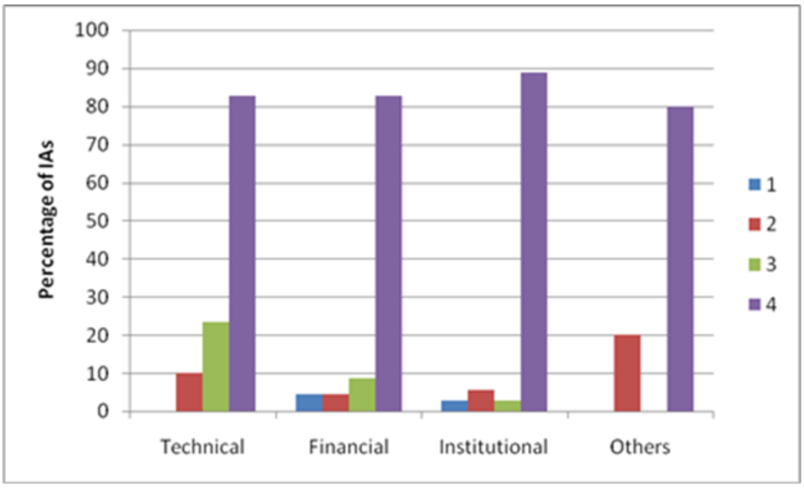

Figure 29a. Rating by the sample IAs in Luzon on the assistance provided by NIA (2015)

Note: 0 – very poor 1 – poor 2 – average 3 – satisfactory 4 – excellent

Source: FGD with IA officials/members

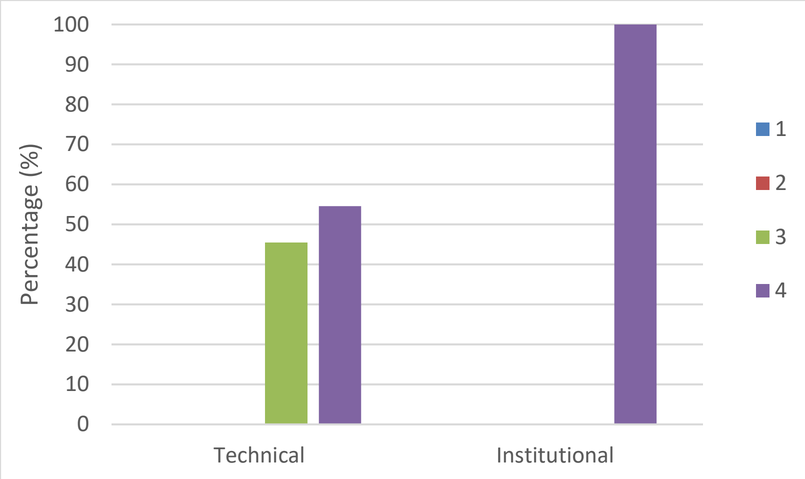

Figure 29b. Rating by the sample IAs in Visayas on the assistance provided by NIA (2018)

Note: 0 – very poor 1 – poor 2 – average 3 – satisfactory 4 – excellent

Source: FGD with IA officials/members

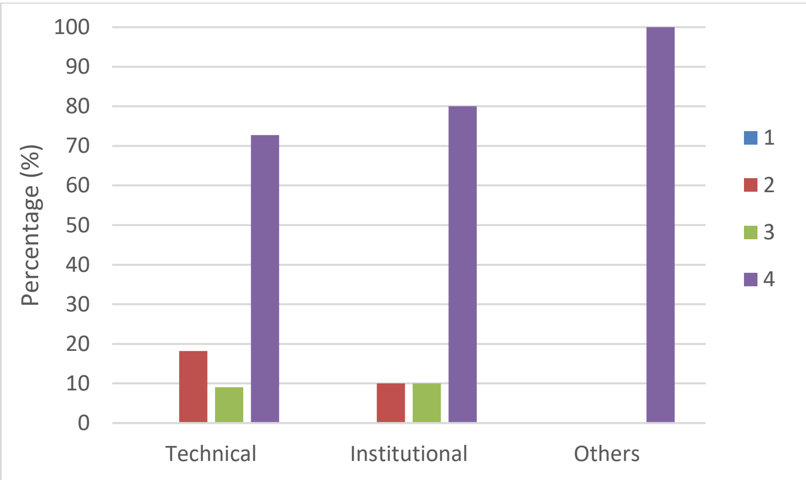

Figure 29c. Rating by the sample IAs in Mindanao on the assistance provided by NIA (2018)

Note: 0 – very poor 1 – poor 2 – average 3 – satisfactory 4 – excellent

Source: FGD with IA officials/members

9.4. Problems Encountered by Irrigators' Association

Over 48% of the IAs in Luzon reported problems related to access to water in terms of quantity and timeliness of delivery. This is related to the operation and management of the system as well as access to funds needed for rehabilitation (Table 42). Similarly, in Visayas, access to funds needed for rehabilitation was the issue raised by majority of IAs, followed by O&M. In Mindanao, access to water and access to funds were equally important issue to the IAs. O&M and access to credit were likewise aide by majority of IAs.

To supplement irrigation water supply particularly during dry spell, 34% of the IAs in Luzon use shallow tube wells (STWs), low lift pumps (LLPs/OS), or deep wells, but the members usually do this individually. IAs (25%) also adjust water scheduling or practice rotation in distributing water, or plant alternative crops (18%) such as corn, mung bean, or watermelon. Other IAs do nothing to cope with dry spell (Table 43). In the Visayas, majority planted alternative crops but 33% did nothing. In Mindanao, majority resorted to pumps or STWs, deep wells; adjusted water scheduling or practiced water rotation; or practiced alternate wetting and drying (AWD). Other IAs also planted alternate crops.

Table 42. Problems/issues reported by the sample IAs in the selected provinces

Province	Operation and management of the system	Access to funds for rehabilitation	Access to production credit	Technical support from NIA, support services from DA	Access to water (quantity and timeliness)	Others*
Luzon (2015)						
Pampanga	0	1	2	0	0	2
Nueva Ecija	1	1	0	0	3	4
Pangasinan	2	1	1	0	4	0
Ilocos Norte	3	1	0	1	4	1
Camarines Sur	4	3	1	0	1	0
Benguet	1	1	2	1	1	0
Nueva Vizcaya	2	1	2	0	3	3
Isabela	3	3	4	3	5	2
Cagayan	3	3	1	1	6	1
Laguna	3	2	1	0	0	1
Occ.Mindoro	3	2	1	0	5	0
All No.	25	19	15	6	32	14
%	37.88	28.79	22.73	9.09	48.48	21.21
Visayas (2018)						
Bohol	2	1	1	0	0	
Leyte	2	0	0	0	0	
Iloilo	0	3	1	1	1	
Capiz	0	3	0	1	0	
All No.	4	7	2	2	1	
%	33.33	58.33	16.67	16.67	8.33	
Mindanao (2018)						
Davao del Sur	1	3	2	1	2	
N. Cotabato	1	3	1	0	1	
S. Cotabato	3	1	1	1	2	
Bukidnon	2	1	1	0	3	
All No.	7	8	5	2	8	
%	58.33	66.67	41.67	16.67	66.67	

*Others include pest and diseases, flooding, collection of fees, problems in the association and in the system
Source: FGD with IA officials/members

Table 43. Frequency distribution of coping strategies of IAs during dry spell in all selected provinces

Province	Use of Pumps/LLPs/ STWs/ Deepwells	Adjust Water Scheduling/ Water Rotation/ Use of AWD	Plant Alternative Crops	Financial - Loan from Relatives	None
Luzon (2015)					
Pampanga	4	2	0	0	1
Nueva Ecija	1	0	1	0	4
Pangasinan	3	2	2	0	0
Ilocos Norte	2	0	0	1	3
Camarines Sur	0	1	1	0	4
Benguet	0	3	4	0	0
Nueva Vizcaya	3	1	0	0	2
Isabela	0	2	1	0	3
Cagayan	6	0	2	0	0
Laguna	1	3	1	0	1
Occidental Mindoro	3	3	0	0	0
All No.	23	17	12	1	18
%	34.85	25.76	18.18	1.52	27.27
Visayas (2018)					
Bohol		0	2		1
Leyte		1	2		0
Iloilo		0	1		2
Capiz		0	2		1
All No.		1	7		4
%		8.33	58.33		33.33
Mindanao (2018)					
Davao del Sur	3	0	0	0	
North Cotabato	2	1	0	0	
South Cotabato	1	1	1	0	
Bukidnon	2	1	1	0	
All No.	8	3	2	0	
%	66.67	25	16.67	0	

Source: FGD with IA officials/members

Suggestions raised by IAs in Luzon to address their concerns usually refer to physical measures to augment irrigation water supply (Table 44). These include lining of canals and rehabilitation of irrigation system or structures. In Visayas and Mindanao, IAs are concerned about canal lining, financial subsidy and other farm inputs, and road infrastructure. The IAs in Mindanao expressed their particular need for rehabilitation of their system and repair of facilities.

Table 44. Frequency distribution of sample IAs by suggestions to address their concerns

Province	Additional Pumps/ STWs	Construction of Steel Gates	Canal Lining	Financial Subsidy/ Farm Inputs/ Roads/	Siltation and Dredging/ Providing of Backhoe	Redesign/ Reroute/ Rehabilitate System/ Repair of Structures	Soil Analysis
Luzon (2015)							
Pampanga	1	0	3	2	0	4	0
Nueva Ecija	0	0	2	5	2	1	0
Pangasinan	0	0	3	1	1	1	0
Ilocos Norte	3	3	5	1	1	0	0
Camarines Sur	1	0	3	2	0	3	0
Benguet	0	0	0	2	0	5	0
Nueva Vizcaya	0	0	4	1	1	3	0
Isabela	1	0	3	1	1	5	0
Cagayan	3	0	4	0	2	1	1
Laguna	3	0	4	0	2	1	1
Occidental Mindoro	2	0	3	2	0	4	0
All No.	11	4	32	19	8	30	1
%	16.67	6.06	48.48	28.79	12.12	45.45	1.52
Visayas (2018)							
Bohol	0	1	3	1	1	1	-
Leyte	0	0	2	1	0	0	
Iloilo	1	0	2	3	0	2	
Capiz	0	0	1	3	0	0	
All No.	1	1	8	8	1	3	
%	8.33	8.33	66.67	66.67	8.33	25	
Mindanao (2018)		Water Impounding			Trainings/ Seminars		
Davao del Sur	1	0	1	3	0	1	
North Cotabato	0	0	2	3	0	1	
South Cotabato	0	0	1	3	1	1	
Bukidnon	0	1	1	2	0	2	
All No.	1	1	5	11	1	5	
%	8.33	8.33	41.67	91.67	8.33	41.67	

Source: FGD with IA officials/members

10. Emerging Issues and Concerns

Based on interviews with the IA officers/members, the issues/problems relating to organizational aspects generally confronting the IAs also affect the systems performance of the CIS, and vice-versa. The following are some institutional issues that have to be considered or addressed:

- CIS development remains dependent on government (i.e., NIA) assistance. CIS projects were often in response to request/proposals/resolutions submitted by IAs, farmer organizations, and LGUs to NIA (IMO) which, in turn, taps sources for funding. IAs' awareness/knowledge, and institutional networking is crucial in enhancing CIS programs.

- Institutional development program of NIA for IAs where the role of IDO is very crucial heavily relies on CIS project funding. IDOs have quite a heavy workload but are not getting adequate incentives such as security of tenure and other benefits. Most often, IDOs are hired on contractual/job order basis with salaries/wages drawn from CIS project budget. The IDOs are most often the link between NIA and the IAs, thus if there is no CIS project, this linkage would be affected.

- The passage of FISA relieves the IAs from paying the cost of their CIS. The sample IAs in Visayas and Mindanao mostly stopped paying amortization but continued to collect fees from their members for their CIS O&M. They now refer this collection to irrigation management fee (IMF) or association service charge (ASC) ranging from ₱700 to ₱1,500/ha. The IAs have not received yet any subsidy (which is expected since CIS was not covered in the 2017 GAA budget). However, there were IA members reluctant to pay any fee citing the implementation of FISA.

- Ownership of CIS should be clarified. Before FISA, certificate of CIS ownership was issued to the IA when it has fully paid the chargeable cost incurred in the construction of the project. This implies that the CIS project is fully turned over to the IA. With FISA, O&M and management of CIS shall be handed over to their respective IAs, referred to in the past as physical turnover. In the case of new projects, another concern is to whom (IA or NIA) should the water permit be issued.

- IA's concerns in O&M and inadequate funds are persistent. FISA declared that O&M cost shall be provided by the national government. Therefore, there should be clear guidelines or provisions on this. For example, in the case of NIS, IA gets a compensation of Pl,750 per month for maintenance activities, based on canal section for a maximum of six (6) months in a year. For operations-related responsibilities, the IAs/Federation will be paid P150/ha per cropping of irrigated and planted areas.

- With the guideline that NIA shall continue to collect from IAs all back accounts or unpaid ISF, amortization and equity payments before the effectivity of GAA 2017, key informants reported some difficulty in collecting this from IAs.

- Problems of sustainability of irrigation infrastructure loom due to persistent environmental problems (watershed degradation, siltation, extreme climate-related events). IAs apparently have none or limited role in watershed management but these can serve as partners in watershed management programs. For example, Irrigation committees may be formed within sub/watershed management councils where IAs may express their concerns. This again depends on the leadership of the IAs, social capital, the capability to establish networks; and assistance to IAs in establishing linkages.

- Climate change poses challenges on dealing with either ‘too much’ or ‘too little’ water. Management of agricultural water should incorporate the judicious use of water resources and engineering measures.

- Devolution of CIS to LGU is rarely implemented because of the apparent lack of interest of the LGU, low priority for agriculture/irrigation, or lack of capacity (financial, technical, human resource) to operate and manage CIS. With FISA, the provision that the equity requirement for CIS projects with LGU participation will be maintained with the concerned LGU, may further dampen the interest of LGUs in engaging in CIS development.

- There is no distinct pattern based on size of FUSA on the performance of CIS and functionality of IAs. Rather than size of the CIS service area, more crucial is the capacity of each IA to harness its organizational capacity to build human, financial, social capital, thus, the need for continuous capacity building. IAs would need to enhance its institutional linkage to solicit support.

- FISA maintains the significant role of NIA in providing technical support to IAs and in building IAs’ capacity to sustain their functionality. Thus, linkage between NIA and IAs should be sustained.

11. Conclusions and Recommendations

The study covered 66 CIS from 11 provinces (IMOs) in Luzon, 12 CIS from 4 provinces in the Visayas and 12 CIS from 4 provinces in Mindanao. The selection considers the size of service area, technology (gravity/pump), and operational status of CIS. Within this sample, at least two CIS in Luzon, and all CIS selected in Visayas and Mindanao, were selected for actual walkthroughs.

Majority of the CIS have run-of-the river type gravity irrigation systems except in Cagayan, Isabela and Camarines Sur where more than 50% of the systems are pump irrigation systems. There are no PIS selected in Leyte and no actual CIS using pumps in the selected provinces in Mindanao. It was also found out that some CIS are in rice areas with slope greater than 3%, particularly in areas outside large NIS like the UPRIIS and MARIIS. In Benguet, the slopes were even greater than 50% but most of these irrigation systems are devoted to vegetables and ornamentals. This information is quite useful since the expansion of the irrigation base may come from these small patches of lands to be irrigated by small scale irrigation systems like CIS, SWIPs and STWs. Related to this, there is a need to reevaluate the definition of potential irrigable areas for new irrigation development areas, to include the assessment of water supply sources, suitability of the soil to different crops, and comprehensive land use plans of the local government units.

In as much as many CIS service areas are above 0-3% slope, it is recommended that all areas within 8% slope minus the built-up and other protected areas can be considered as potential irrigable area for CIS. A second but equally important criteria is the presence of a dependable surface water source and a good shallow aquifer, which may be used as supplemental water supply. A third criteria is soil texture and its suitability to different type of crops, which would support crop diversification as provided in the recently signed Rice Tariffication law. Paddy rice is most suitable on clayey soils where percolation losses are low. Sandy soils are not recommended due to the high infiltration rate and percolation losses will be high.

One of the main reasons for the low performance of irrigation systems is the lack of water during dry season. Sources of water of the CIS visited are: lakes, rivers, creeks, springs, ground water, runoff or a combination of two or more of these sources. Some rivers are large and have adequate flows that can irrigate crops even during the dry seasons, while some rivers have very low dry season flows. Most creeks have adequate flows for small areas during wet season but have very low or at times no flow during dry season. Only 29 of the 90 surveyed CIS (32%) have river sources capable of providing irrigation during dry seasons. Seven of these rivers are very large and provide water even for large NIS. However, unreliable water supply is a major problem for majority of the CIS who tap water from less dependable small rivers and creeks, as well as springs and runoff.

Watershed Management and environmental studies are important consideration in engineering design and feasibility study of irrigation projects. The degradation of the watershed due to human activities and other factors is deemed to be one of the reasons for the unstable water resource for irrigation. In constructing new or rehabilitating old CIS, the water source should be carefully assessed in terms of dependable flow, catchment conditions and sediment discharges. Empirically derived flows should also be reviewed, with special consideration on the effect of climate change. As much as possible, small creeks with dubious historical records should be avoided as water source, or at the very least, an alternative source like groundwater should be available.

On the problem of water supply sources, there should be a concerted and united effort on the part of concerned government agencies like NWRB, NIA, BSWM, and the academe to identify potential sites for diversion dams and storage reservoirs. A set of criteria for site selection should be formulated and maps of potential sites should be generated. In rivers with high wet season flows and low dry season dependable flows, construction of storage or reservoir dams is a viable long-term solution to mitigate the problem of seasonal irrigation and help improve the reliability of irrigation water supply, however, they should be economically, environmentally, socially and technically feasible. For example, small dams with crest height not exceeding 15 m would probably be more viable than large multipurpose dams, as they pose less risks to the environment and ecosystem, and thus more socially acceptable.

The estimation of dependable (low) water supply and flood (high) discharges for rivers, potentially viable for reservoir and/or diversion dams, is very important. Streamflow data should be checked for consistency and reliability, including the effect of changing land use and climate change on the inflow and flood hydrographs. Moreover, hydrologic data acquisition and monitoring should be improved. Although, this is currently being done with the coordinated efforts of Project NOAH (Nationwide Operational Assessment of Hazards) of the Department of Science and Technology (DOST) and the Department of Public Works and Highways (DPWH), this should be expanded to smaller rivers and creeks. Possible source of baseline data are the River Basin Master Plans commissioned by the RBCO for the 18 major river basins and other clustered watersheds. Most of these plans have water supply and water demand projections using new climate change scenarios from PAGASA which can be useful in identifying new potential sites for irrigation development.

There is also a need to delineate areas served by NIS and CIS, as well as those served by minor irrigation systems (e.g. SWIP, SFR, STW). In line with this, we should identify areas where surface water and groundwater sources are technically feasible. Recently, the BSWM started a project aimed at identifying and delineating potential sites for small scale irrigation systems. The Phil-LiDAR 2 Project 1 (Agricultural Resources Assessment using LiDAR and other RS Data) of UP Diliman has also embarked on a nationwide endeavor to establish baseline inventory of resources. This entails high resolution mapping of agricultural, aquaculture and forest resources, as well as, establishing hydrologic datasets for flood modeling to generate risk maps and early warning systems. These maps may be used to finally establish the total irrigable areas in the country and help identify and zone areas where various modes of irrigation are feasible. The hydrologic data may also be used to establish dependable flows for dam or reservoir design and in the estimation of irrigation command area.

With the current NWRB setup, they have limited capability and manpower to do these. The shelved proposal for the institution of the National Water Resources Management Office under the Office of the President should be revived and reformulated. Whether this would be a Department of Water Resources or a reinvigorated NWRB acting as a water super body under the Office of the President, is up for debate based on different merits, but it has to be conceptualized and established as soon as possible. The institution of Water Resources Centers in selected state colleges and universities (SCUs), who can continuously gather, analyze and manage water resources data would be significant in building hydrologic database. All accumulated water resources data should be housed in a database center within the proposed super body.

The practice of supplementing irrigation from surface sources with groundwater from STWs should be encouraged especially for areas where the surface water sources (i.e., creeks) have very low dependable discharges during the dry season and for areas underlain by good shallow aquifers. In most of the CIS visited, farmers resort to the conjunctive use of surface water from their CIS and groundwater from STWs. The size of the centrifugal pumps commonly used for STWs and LLPs are 3"x 3" or 4"x 4". They are usually driven by 8 – 12 Hp water-cooled diesel engines. While using STW pumps and engines incurs additional fuel costs, they provide reliable water source during intense drought periods or El Niño episodes. Moreover, farmers have control of irrigation schedules and flows enabling some of them to increase cropping intensity or diversify into other crops. Some NIA IMOs have already installed standby STWs which they only use during periods of prolonged droughts. The practice of using STWs to supplement irrigation from CIS should be encouraged even at the farmer's own initiatives. This is not only as a short-term solution to improve the cropping or irrigation intensity but also to encourage crop diversification. NIA and DA is already reviving slowly their STW irrigation plan. This is logical since groundwater are the last to be depleted water supply sources.

Sedimentation is one of the main problems that cause canal deterioration and decrease in water yield during dry season. Lahar is the major source of sediments in some CIS in Pampanga. Several operational lapses, including full opening of intake gates and closing of sluice gates to maximize water intake during high sediment inflows also contribute to increased sedimentation. Despite the high sedimentation rate, the IAs rated low silt level grade and undesired seepage grade in their canals. These are because the IAs regularly conduct cleaning of the canals since CIS canals are small and manageable compared to NIS. To reduce future rehabilitation works due to desilting, provision of silt control devices, either on the head works or on main or lateral canals, should be included in the design, especially for sediment laden rivers or creeks. Estimation of sediment discharge should also be included in the feasibility study, in light of the escalating erosion of our watersheds.

There are some technical issues/problems that generally confronts the IAs and the performance of their CIS. Most run-of-the-river type dams are quite old, some with exposed rock cores, damaged spillways, and with sediments almost at the crest level. Most of the sluice gates and intake gates that are usually made of steel are now replaced with flashboards, sand bags or stones and in some CIS, the lifting mechanisms are defective. These problems also contribute to increased sedimentation. A positive aspect is that most CIS visited have concrete-lined main canals and some up to the laterals. In general, the good conditions of the lined and unlined canal networks are due to the IA themselves having good O&M and cleanup mechanisms. In some cases, heavy siltation is experienced due to watershed degradation and mining concessions, and in such cases major policy/governance solutions are required.

Cross regulators, check gates, drop structures, division boxes and farm turnouts are some of the structures found in CIS visited. Some are well maintained, while others have deteriorated and the control structures are not fully functional. Some cross or check regulators may be initially intended to measure discharges, but there are no more staff gages to measure water levels and the rating curve are either missing or not calibrated. Other miscellaneous or appurtenant structures that are commonly found in all the CIS include road and thresher crossings, end checks and service roads. Most service roads are in bad conditions with most dams accessible only by walking or by motorcycles

In the case of rehabilitation work, existing systems must be checked for design shortcomings and relate these to the operation and maintenance of such systems. The design shortcomings of several dams, specifically the Anao CIS, Cordero CIS and San Angel SRIP should be reviewed to avoid such mistakes in the future. These shortcomings included underestimation of flood flows and sediment loads, inadequate provisions for sediment control and underestimation of reservoir inflow and outflow hydrographs. Generally, the dams and control structures should be properly maintained and repaired to ensure proper water control and distribution. The dam storage area should be regularly cleared of sediments to increase storage capacity and thus extend irrigation even with diminished river flows. This should be part of regular operation and maintenance activities of the IAs. If heavy equipment is necessary, NIA should extend help to the IAs.

As in most irrigation systems, there are no specific drainage canals at the CIS. Normally, the downstream farm ditches receive the excess water from paddies, which is sometimes used to irrigate downstream areas. Water distribution downstream is usually from paddy to paddy, without individual farm ditch for each paddy, contributing to large application losses. This factor should be taken into consideration in the design criteria to avoid gross underestimation of on farm water losses, which in turn result to the over estimation of design service areas.

In CIS where the dry season flow cannot support anymore the dry season irrigation requirements, the IA may consider crop diversification, like planting non-rice crops or crops requiring less water, particularly in areas at the tail-end of the system. If rice is still preferred, direct seeding should be considered to minimize water use from conventional land soaking and land preparation. To address low irrigation efficiency, IA capacity development and the introduction of new water saving technologies such as alternate wetting and drying (AWD) should be promoted and/or sustained. Provision for rotational irrigation should also be incorporated in the design of canal system, with more checks or control gates for more efficient water distribution.

The operation and maintenance of CIS is turned over to IAs upon project completion. While more IAs believe that they receive the required volume of water at the right time, there are still frequent delays and inequitable flow distribution, which showed a need for improvement in the water management of all the CIS. The IAs generally have high regards for their systems in terms of water delivery, flexibility, reliability and equitability. Moreover, the IAs rated themselves high in terms of water distribution, and the maintenance of canals and control structures. These results indicate that the IAs are satisfied with their water delivery system. While these results may be biased, they may also indicate the high relative impact of NIA to the CIS farmers.

Common suggestions raised by IAs to address problems in their systems usually refer to physical measures including lining of canals and rehabilitation of irrigation system or structures. Generally, rehabilitation connotes lining of canals, but concreting of canals is actually impractical if the soil is clayey. With the availability now of low-cost high-density polyethylene pipes (HDPE), we believe that it is about time to look into the feasibility of using these materials for subsurface canals instead of concreting open channels to convey irrigation to the fields. The high initial cost may be offset by several factors including: (a) less O&M cost due to less rubbish and sediments in the system, (b) more areas for planting (since the canal is buried underground with risers to distribute water to farm ditches), (c) less costs for right of way acquisitions, (d) less seepage and percolation losses, so higher conveyance efficiency and more equitable water distribution, (e) easier water control in terms of command and flow, (f) more applicable for sprinkler systems and crop diversification. Of course, aside from the high initial costs, the pipes may be used as den or hiding place for rats which may cause clogging problems. A more sophisticated trash rack or sediment control at the intake is also needed to prevent clogging. Drain holes and repair vents are also needed at key locations in the systems, which again increases the investment cost.

With regards to the Free Irrigation Service Act, further clarification on its implementation on CIS is needed. This includes the following:

There should be clear guidelines on the provision of O&M cost by the national government, such as in the case of NIS where IA gets some compensation based on O&M responsibilities.

There is also the need to address collection of from IAs all back accounts or unpaid ISF, amortization and equity payments before the effectivity of GAA 2017. IAs believe their loans are already condoned with the passage of FISA.

Guidelines on ownership of CIS should be clarified. Before FISA, there is a complete turnover of CIS to the IA. With FISA, it is apparently management turnover. In the case of new projects, another concern is to whom (IA or NIA) should the water permit be issued.

The policy on devolution of CIS to LGUs needs to be revisited as this is rarely taking place. FISA may further dampen the interest of LGUs in engaging in CIS development as they are still required to pay the equity requirement.

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14. Glossary of Terms

Communal irrigation systems (CIS) – small-scale irrigation system serving an area of less than 1,000 hectares. CIS are usually run-off-the-river type dams designed and constructed by the NIA with the participation of farmer-beneficiaries through the IAs.

Irrigators Association (lA) – an associations of irrigation water users organized and developed by NlA at the various levels of an irrigation system (e.g. NIS, CIS) to include but not limited to primary lAs, Council of lAs, Federation of lAs, Confederation of lAs, and Irrigation Service Cooperatives (ISC).

lA Federation – an amalgamation of lAs within a lateral, stretch of main canal, or the entire irrigation system serving as a centralized group but having internal autonomy in each IA.

Design service area – the estimated area covered within the jurisdiction of the irrigation system or lA, as the case may be.

Firmed-up service area (FUSA) – the actual service area with irrigation facilities. FUSA is usually lower than design area because it no longer includes areas with higher elevation, convertible areas but which landowner does not want to be converted.

Cropping intensity – the ratio of area irrigated to the FUSA (or design area in some cases) of the CIS. Annual cropping intensity could also be the ratio of area irrigated during the dry and wet seasons to the area irrigated during the wet season expressed in percentage. According to NIA (Camarines Sur IMO), cropping intensity should be 130%, i.e., 100% for wet and 30% for dry season. Thus, with irrigation, it should be more than 130%.

Functionality Assessment – a systematic evaluation to establish an lA functionality in organizational, O&M and financial aspects the result of which is used in determining the lA's readiness for irrigation management.

Operation (0) – the activities involved in diverting water from the source and conveying and distributing it to the point of application in the farmers' fields. The principal tasks in operation are 1) preparation of cropping calendar and schedule of farming activities, 2) measurement of water requirements and supply, 3) conveyance and distribution of available water to headgates of lateral canals, 4) distribution of water to turnouts, 5) application of water to farm plots, and 6) drainage of excess water from fields.

Maintenance (M) – the activities undertaken for keeping the irrigation system in good operating condition at all times within the limitations of available resources to attain maximum use and economic life of the system facilities. The principal tasks in maintenance are: **1) routine** maintenance that include removal of silt at flow measuring devices, clearing of floating debris accumulated at the crests of proportioning and duckbill weirs, remedial repairs to minimize leakage from control gates and check structures, remedial measures to prevent overtopping of canal embankments, greasing or oiling of gates; and **2) periodic** maintenance that include cutting of vegetation from canal embankments, and reshaping and cleaning canal prism.

Collection efficiency – the ratio of actual amortization collection (current account +back account) to the estimated amortization collectibles expressed in percent. Current account is the dues for the current year and back account refers to past dues (NIA reports).

Irrigation projects may be new, rehabilitation, improvement, or restoration projects (CIS Manual).

New projects are proposed for areas without any or comparatively little irrigated area.

Rehabilitation projects are proposed to restore damaged or deteriorated facilities of existing irrigation systems to their original condition without adding new works or increasing the service area.

Improvement projects are for the purpose of adding new works for increasing service area or increasing performance of existing systems.

15. List of Acronyms

AFMA	Agriculture and Fisheries Modernization Act
ASC	Association Service Charge
BOT	Board of Director
BOT	Board of Trustee
CDA	Cooperative Development Authority
CIS	Communal Irrigation System
CI	Cropping intensity
DA	Department of Agriculture
DAR	Department of Agrarian Reform
FGD	Focus Group Discussion
FISA	Free Irrigation Service Act
FUSA	Firmed Up Service Area
GAA	General Appropriations Act
GIS	Geographic Information System
GOCC	Government Owned and Controlled Corporations
IA	Irrigators' Association
ISF	Irrigation Service Fee
IDD	Institutional Development Division
IDO	Institutional Development Officer
ILO	International Labor Organization
IMO	Irrigation Management Office
IMT	Irrigation Management Transfer
IRR	Implementing Rules and Regulations
ISF	Irrigation Service Fee
KII	Key Informant Interview
LGU	Local Government Unit
LLP	Low Lift Pump
MC	Memorandum Circular
MOA	Memorandum of Agreement
MOOE	Maintenance and Other Operating Expenses
NGO	Non-Government Organization
NIA	National Irrigation Administration
NIS	National Irrigation System
NWRB	National Water Resources Board
PIS	Pump irrigation system
O&M	Operation and Management
OSP	Open Source Pump
PD	Presidential Decree
PIMO	Provincial Irrigation Management Office
PO	Peoples' Organization
POW	Program of Work
PPP	Public-Private Partnership
RA	Republic Act
RIO	Regional Irrigation Office
SA	Service Area
SDD	Small Diversion Dam
SEC	Securities and Exchange Commission

SFR	Small Farm Reservoir
SRIS	Small Reservoir Irrigation System
SSIP	Small Scale Irrigation Project
STW	Shallow Tube Well
SWIP	Small Water Impounding Project
SWISA	Small Water Impounding System Association
TOR	Terms of Reference
USAID	United States Agency for International Development

16. Annexes

16.1A. Highlights of Interviews with IA Officials and Members and Walkthroughs of the Sample Communal Irrigation Systems in Luzon

Pampanga

Sitio Ipil PIS

Sitio Ipil PIS is located between Brgy.s Gulap and Sto. Rosario, in Candaba, Pampanga. The PIS started operation in 1995 tapping water from the Pampanga River. The irrigation system was constructed in 2004 with a design area of 32 ha and FUSA of 20 ha. It was improved by NIA in 2007 but complete turnover to the Sitio Ipil Irrigators Association was done on July 15, 2014. A 300-m portion of the main canal is concrete-lined but the 4 laterals are unlined. Only minor rehabilitation works like repairs of unlined canal sections have been undertaken to date and that 200-250 m canal section needs lining. The IA said that siltation usually occurs in the canals on August when the river overflows. The cross regulators were generally in good condition and there is an existing system of operation for the canal. An 8-in dia. pump powered by a diesel engine is used to pump water from the river, while 4-in dia. pumps were used to raise water from canals during low water supply. A major problem of the IA is irrigation cutoff whenever the main pump breaks down. As such the IA said that an 8-in dia. and two 4-in dia. pumps are needed as back-up.

Gulap PIS

The Gulap PIS, like the Sitio Ipil PIS taps water from the Pampanga River, but it serves Brgy.s Gulap and Para Laya. The irrigation system was constructed in the 1970s under the Farming System Development Corp. (FSDC) and its operation started in 1979. The system meanwhile was completely turned-over to the IA in the 1990s. The last project covered by NIA was in 2011 for the repair of the main canal amounting to PhP 2.4 million. An actual walkthrough was conducted on this system. The PIS has three pumps: a 10-in diameter submersible pump driven by a 60-Hp electric motor and two 16-in dia. mixed flow pumps driven by an 80 Hp and an 85 Hp Iveco diesel engines (Figures 1A-1 and 1A-2). The two diesel engines have been in use for around 10 years having undergone several repairs but is still in use from 7AM-5PM on both wet and dry season. If needed, they are operated also from 8PM-5AM during the dry season. They usually consume 15L of diesel per hour costing about PhP 3000-4000/day. The pumps have maximum capacity of 5000 gpm (at zero head) and total dynamic head (TDH) of 30 ft (at zero discharge).

The PIS has a concrete intake pit (Figure 1A-3) located at the bank of the Pampanga River where the intake pipes are lowered to pump water. The pump house is located just beside this intake pit. The discharge pipes of each pump empties into a concrete sump (Figure 1A-4) which then flows to an inverted siphon before going to the main canal (Figure 1A-5). The 1-m deep and 1-m wide main canal is concrete-lined with "buhos" channel bed and concrete hollow blocks (CHB) side walls (Figure 1A-6). It usually take 1-hr to prime the main canal after start of pump operation. The IA president said that they used to have a copy of the canal network map of the PIS but this was borrowed by an NGO and it has not been returned. The turnouts to distribute water to the laterals are usually through control gates made of wooden slabs. The laterals are unlined but the IAs are planning to and are actually requesting to the LGUs that the laterals be lined. Three water tenders are employed to implement irrigation schedules, manage water distribution and operate turnout gates. The main canal are well maintained and the control structures, consisting of slots for wooden slabs are functional, but some slabs are already old and needs replacement. There are several fishponds in the area growing tilapia with a different payment on a per hour basis.

The IA stated that the main problem of the PIS is flooding when Pampanga River overflows during rainy season submerging the crops as well as causing siltation on the intake pit of the pumps. However, the main canal has little siltation during the time of visit, indicating good maintenance from the IAs. But there are also delinquent farmers who do not pay their ISFs, as well as farmers who are reportedly stealing water. Even if the water discharged by the pumps are high, some parts of the system gets low water supply due to the large FUSA. In order to solve this problem, NIA together with a planned resolution from the IA, plans to include the tail-end portion of the CIS to the Pampanga Delta irrigation system. The IA reportedly does not pay amortization. They also have not been paying water permit to the NWRB and are not renewing their SEC registration anymore. The IA suggests farm to market roads, as well as the cementing the rest of their main and lateral canals.

Figure 1A-1. The two 16" dia. mixed flow pumps (one is being repaired); at the foreground is the 10" dia. pipe of the submersible pump

Source: Author's capture

Figure 1A-2. One of 2 Iveco diesel engines for the mixed flow pumps; at the background is the Pampanga River where the PIS derive its waters

Source: Author's capture

Figure 1A-3. The concrete intake pit for the suction pipes of the Gulap Pump Irrigation System; also shown is the 10-in pipe of the submersible pump

Source: Author's capture

Figure 1A-4. The concrete sump where the discharge pipes of the 3 pumps empties before distribution to the main canal; the middle pump is being repaired; the water is sediment laden

Source: Author's capture

Figure 1A-5. The outlet of the inverted siphon under the road across the concrete sump and pump house; this channels the water into the main canal

Source: Author's capture

Figure 1A-6. The 1-m wide, 1-m deep concrete lined main canal of the Gulap PIS. The main canal and structures are well built since the IA said that they monitored the actual construction

Source: Author's capture

Figure 1A-7. (a) A typical control structure combining a turnout (using wooden slabs), a drop and a road crossing; (b) one of several fishponds being served by the PIS; (c) a typical unlined lateral; (d) continuation of the concrete-lined main canal with control structure combining turnout (wooden slabs) and drop structure; (e) the end check of the main canal, from here on the canals are unlined.

Source: Author's capture

Sapa-San Vicente PIS

Sapa-San Vicente PIS is located in Brgy. Sto. Nino, Sto. Tomas, Pampanga. The system was designed and constructed by NIA in 1990 but did not operate until year 2000. It was turned over by NIA to Sapa-San Vicente IA on May 16, 2013. The PIS takes water from the Minalin Creek which drains into the Pampanga River Delta. The design area is 20 ha and FUSA was estimated to be 15 ha. A quick walkthrough was conducted on the PIS. The system uses an 8-in dia. centrifugal pump driven by a 4DR5 diesel engine. Only minor repairs and maintenance have been done in the pump and engine. The IA officers said that there were instances before when saltwater from the sea intruded into the creek, damaging the crops during those times. The main canal has a 300-m concrete-lined and 100-m unlined sections. Some siltation were observed from the main canal and the turnouts uses wooden slabs. The longer lateral canals are unlined. Some fields in the downstream part of the system get their irrigation directly from the creek using individual centrifugal pumps.

Figure 1A-8. The 8-in dia. centrifugal pump powered by a 4DR5 diesel engine of the Sapa-San Vicente PIS

Source: Author's capture

Figure 1A-9. The Minalin Creek where the Sapa-San Vicente PIS gets its water for irrigation; in some instances, saltwater from the Pampanga River delta intrudes into this creek damaging the crops

Source: Author's capture

Figure 1A-10. The concrete-lined main canal with a simple turnout gate using slots and wooden slabs as gate

Source: Author's capture

Figure 1A-11. Siltation and garbage observed from the portion of the main canal near the pump

Source: Author's capture

Figure 1A-12. A typical pumpset with a 4×4 self-priming centrifugal pump driven by an 8-Hp Kubota diesel engine (RK80-1S)

Source: Author's capture

Anao CIS

The Anao CIS is located in Brgy. Anao, Mexico, Pampanga. It gets its water from Abakan River, one of those rivers affected by lahar. The original brush dam was replaced by NIA in 1990 with a concrete one but it got overturned during one calamity because the base has been scoured by successive high flows and probably due to quarrying downstream of the dam. A new dam was constructed with an estimated project cost of PhP 70 million. The team visited the dam site and conducted a walkthrough of some canal sections and control structures.

The dam is now heavily silted and the downstream apron is already damaged and the river bed scoured (Figures 1A-13 to 1A-16). The gabions used to support the downstream apron and prevent scouring are already damaged and accumulating garbage. Since the technical engineering design has not been furnished yet by the IDO, it cannot be determined if there are cutoff walls upstream and downstream or whether these are already damaged. But the NIA IDO who accompanied the team told of water seeping underneath the dam indicating underground scouring which makes the dam in danger again of possible collapse. Quarrying is still operational upstream and especially downstream of the current dam. The sluice gates and intake gate are still fully functional but inefficient because of the heavy siltation (Figure 1A-17).

NIA operates and maintains the main canal while the laterals are managed by Anao Farmers Irrigator Association. The main canal concrete-lined and the shape is rectangular along the mega-dike and trapezoidal thereafter (Figure 1A-18). The canals along the sections visited by the team are relatively well maintained, with functional control and distribution structures (Figure 1A-19). The IA said that there are two more dams downstream of the main dam. The team were able to visit what they termed as “Dam 2” which turned out to be a weir which acts as a check gate for further distribution of water to several laterals (Figure 1A-20).

The walkthrough team observed several shallow tubewells (STW) downstream of the CIS area (Figures 1A-21) and were able to interview two farmers who used STWs for supplemental irrigation. An estimated 100 STWs are scattered along the CIS. The groundwater level was about 10 ft during dry season and the commonly installed pipe lengths range from 30-40 ft. Most pipes are made of G.I. steel but a few uses PVC pipes. Most use second-hand diesel engines as prime movers with normal operation of around 12 hours per day consuming about 15 liters per day. The farmers used their STWs more often during the dry season when irrigation is limited.

To help improve their system, the IA requested for financial assistance for lining of the 3.5 kilometer unlined canal and replacement of deteriorated steel gate of the 1st cross regulator. It is advised that major repairs be made on the dam particularly to arrest underground scouring by construction (or repair) of upstream and downstream cutoff walls, to lengthen and add permanent support to the downstream apron, not just gabions, and to dredge the river bed upstream of the dam to increase storage capacity.

Figure 1A-13. Front view of the Anao CIS showing the heavily silted upstream portion of the dam

Source: Author's capture

Figure 1A-14. Rear view of the Anao CIS showing the wide dam crest and the damaged and garbage-filled gabion support downstream of the dam

Source: Author's capture

Figure 1A-15. The concrete embankment at the approach to the dam, again showing heavy siltation

Source: Author's capture

Figure 1A-16. Clockwise from left: (a) scouring at the downstream apron, the sluice gates and intake structures are seen at the middle of the dam; (b) the gabions are damaged and accumulating garbage; (c) the quarry operations just downstream of the dam location

Source: Author's capture

Figure 1A-17. Clockwise from left: (a) the two sluice gates showing some siltation and leakage, also shown are the baffle blocks; (b) The intake structure was designed to be near the middle of the river, the intake gates are still functional; (c) the approach to the sluice gates and intake gates are heavily silted

Source: Author's capture

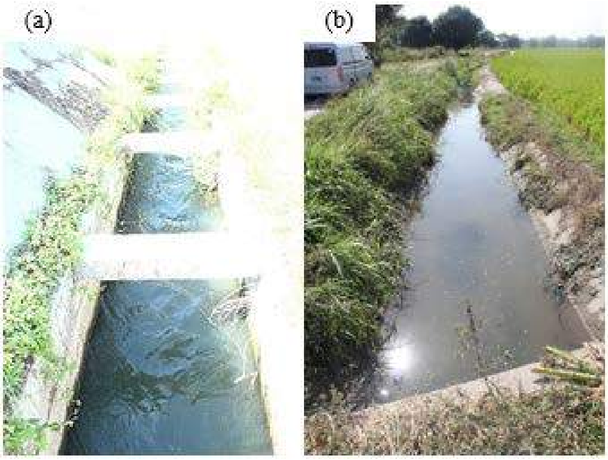

Figure 1A-18. (a) Rectangular portion of the main canal parallel the mega-dike immediately downstream of the dam; (b) trapezoidal portion of the main canal

Source: Author's capture

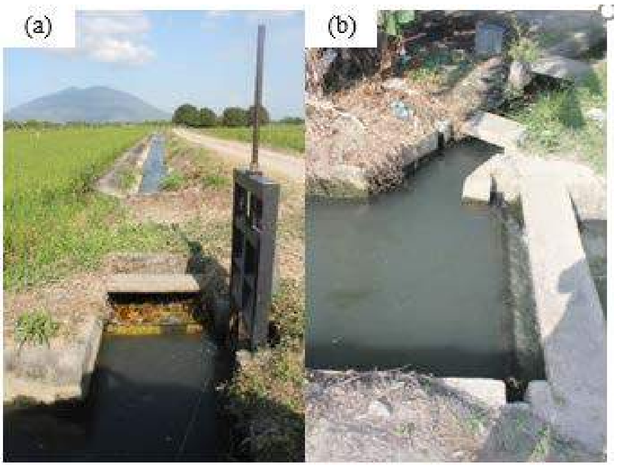

Figure 1A-19. (a) A check gate that serves as a turnout for distributing water to a secondary lateral; (b) a flow dividing structure to a lined lateral; the control has slots for wooden slabs and combined with a shallow drop

Source: Author's capture

Figure 1A-20. (a) The check gate which the IA refers to as "Dam 2" is used to increase the head at the main canal for distribution to secondary laterals; (b) one of the laterals (concrete-lined) served by the check gate

Source: Author's capture

Figure 1A-21. (a) A shallow tubewell (STW) pump house in Anao CIS; (b) an operating STW pump set with a 4-in non-self-priming centrifugal pump driven by a second-hand 9-Hp Kubota water-cooled diesel engine; the discharge was estimated at ~16 lps

Source: Author's capture

Lusung PIS

The Lusung PIS is located in Sta. Rita, Pampanga but covers three municipalities. The Lusung Dam was constructed 1992, improved by NIA in 2008 ending in 2010 with a PhP 1.5M budget. The IA was organized since 1980. The water source for the dam comes from a spring instead of from a river. The Lusung Dam IA already paid their equity back in the 1990s and the members will just chip in for the maintenance and repair expenses. Supplementary irrigation comes from STWs, which at times were operated as much as 20 hrs/day. For the improvement of the system, the IA's priority is to address the damage in the main canal.

Hacienda Dolores CIS

The Hacienda Dolores CIS is located at Porac, Pampanga and gets its water from Porac River. The CIS was constructed in 1999 and started its operation that same year. The system was also turned over completely to the Hacienda Dolores IA in 1999. The NIA provided a brush dam at a cost of about PhP 900,000. The IA suggested that NIA build its lateral canal so that the system can control the flow of its water but the main problem of the IA is how they will pay for that construction given that most of their members could not pay the amortization.

Nueva Ecija

Cordero CIS

Cordero CIS is located in Brgy. Cordero, Lupao, Nueva Ecija. The PhP 4.2 million project budget was first intended for Brgy. Baybayabas but the area was included in the service area of UPRIIS Division I so the allotted budget was requested by a politician to be diverted to Cordero. The IA, Cordero SSIS FFS Active Farmer's Association, rendered labor during the construction of the system in 2012 thus reducing the equity by about PhP 500,000.

The dam is made up of gabions and plastered with concrete here and there (Figure 1A-22). It is now completely filled up with sediments almost at the dam crest level, which the guide said occurred just after three heavy rainfall (Figure 1A-23). Another heavy rain and the sediments may overtop the dam. The IA attributed this to kaingin operations at the mountain by the Igorots and illegal logging. During the 1960's, the guide said the creek is full of water all year round and never dries up. Starting 1980's the flow of the creek decreased until now where the creek only has water during the wet season, which in some cases tends to overflow. Last 2014 rainy season, water flow was not stored in the dam but rather seeped underneath and at the side of the dam, prompting the IA to comment that the dam is not properly designed. Some of the gabions of the dam itself and at the embankments are already damaged and may cause the dam to collapse. The sluice gate and intake gate use only wooden slabs for water level control (Figures 1A-24 to 1A-26). The main canal is concrete-lined (Figure 1A-27). The detailed engineering design (DED) of the dam was requested to the NIA office to check the actual design specifications. The dam needs to be replaced but if there are no water flowing in the creek during the dry season, then it would be an exercise in futility. The watershed of the creek needs reforestation and protection.

Only about 50% of the FUSA is irrigated in the dry season mainly because of lack of water supply. To augment their water supply, they requested from NIA about 22 pump units a year ago but the units have not arrived yet. Around 6 members have their own STW and the others borrow from them. The water level is around 6 m below ground surface (mbgs).

Figure 1A-22. The Cordero CIS dam along Arimal creek is made up of gabions and plastered with cement at the crest; shown at the left side are the damaged gabions where water seeped underneath the dam

Source: Author's capture

Figure 1A-23. There is no water in the creek during the time of visit and the sediments are almost up to the dam crest

Source: Author's capture

Figure 1A-24. The intake gate upstream of the dam use wooden slabs as gates; the gabions serving as side embankments of the dam are damaged; sand bags used to divert the depleting water last cropping are also shown

Source: Author's capture

Figure 1A-25. The sluice gate is made of concrete with slots for wooden slabs serving as gates; the background is the downstream portion of the dam

Source: Author's capture

Figure 1A-26. The intake structure with the slots for the wooden gates

Source: Author's capture

Figure 1A-27. The concrete-lined rectangular main canal
Source: Author's capture

Inasan CIS

Inasan CIS is located in Brgy. Ligaya, Gabaldon, Nueva Ecija. It gets its water upstream of the Inasan River near the mountains where the dam was originally constructed as part of a World Bank project. It. The system was turnover by NIA to IA last July 3, 1996, for which the Inasan Irrigators Association is paying amortization for 50 years.

The dam was anchored between two large rocks in the river, but during one flashflood in 2012, one of the rocks was dislodged and a large hole underneath the dam was created. The dam was repaired with rocks and concrete configuration that stands to this day (Figure 1A-28). The river portion where the dam is located is filled with rocks and boulders. The sluice gate is made of wooden slabs stack together on slots (Figure 1A-29). There are two intake gates, with dimensions 1-m depth and 2-m width, leading into the main canal where the initial section is tunneled underground (Figure 1A-30). The water permit granted is 299 lps. Steel grills can be inserted at the intake gate entrance to prevent debris and rocks from entering the underground main canal.

The IA has a map of the canal networks and the team were able to take a picture of it (Figure 1A-31). The main canal is trapezoidal and concrete-lined up to the main highway. Upon emergence from underground it has dimensions of 0.7-m water depth, 0.8-m bottom width, 1-m inclined depth, and 2-m top width (Figure 1A-32). The canal bottom is laden with small rocks (Figure 1A-33). Near the main highway, damages on the concrete lining of the main canal were observed (Figure 1A-34). Some laterals are concrete-lined, some especially near the highway have ripraps, but still others are unlined (Figure 1A-35). The IA would like to request in a resolution the repair of these sections and the concrete-lining of the unlined main canal across the road, as well as all laterals.

Figure 1A-28. Left: The Inasan CIS dam along the upstream of the Inasan River made of rock and concrete; Right: boulders and rocks downstream of the dam

Source: Author's capture

Figure 1A-29. The sluice gate is made of wooden slabs stacked together in a slot serving as water level control gate

Source: Author's capture

Figure 1A-30. The intake structure leading to the underground tunnel into the main canal

Source: Author's capture

Figure 1A-31. The map of the Inasan CIS canal network
Source: Author's capture

Figure 1A-32. The main canal coming from the underground tunnel from the dam
Source: Author's capture

Figure 1A-33. The trapezoidal main canal; the canal bottom is filled with small rocks
Source: Author's capture

Figure 1A-34. Some portion of the main canal near the highway with damaged side walls and rock laden canal bottom

Source: Author's capture

Figure 1A-35. (a) An unlined secondary canal; (b) a concrete check gate and inlet to a road crossing; (c) a lateral at the side of the highway which has a riprap side wall; (d) an unlined lateral at the side of the highway; (e) a concrete check gate in a lateral; (f) a concrete-lined lateral; (g) domestic water supply flexible pipes along a lined lateral

Source: Author's capture

Parang-Bugnan CIS

Parang-Bugnan CIS gets its water from Bugnan River. The CIS is located at Brgy. Bugnan, Gabaldon, Nueva Ecija. Construction of the dam and canal system started in 1972 from a loan made by the IA. In 2011, they made a second loan for the rehabilitation of their dam and inverted siphon which were damaged by typhoons and for lining of about 2 km of canals. The loan amount is PhP 10 million to be amortized for 25 years. They are currently applying for a third loan for the lining of 5 km more of their canals.

The dam is currently in under disrepair with damaged ogee spillway and downstream apron (Figure 1A-36). The core of rocks and boulders are already exposed and the sediments are almost at crest level. The sluice gate is now made up of piled rocks, woods and sand bags (Figure 1A-37). But enough water is still entering the intake structure (Figure 1A-38) at the time of the survey. The intake structure channels water through an intake channel that lines one side of the river, which then leads into the main canal (Figure 1A-39). Flow to the main canal is controlled by a check gate and the excess water is reverted back to the river through another check gate (Figure 1A-40). The main canal is fairly well maintained with minor siltation and at the time of the survey, the discharge was measured at (Figure 1A-41). Part of the water flowing on the main canal is diverted across the river through an inverted siphon (Figure 1A-42) to irrigate farms in that area. This siphon has been repaired and unclogged once before and still functional during the visit. The IA wants to have an additional siphon to prevent disruption of operation and also to line their unlined canal to increase efficiency of the system.

Figure 1A-36. The Parang-Bugnan CIS dam; the damage at the ogee spillway exposes the dam core made of rocks and boulders; the sediments are almost at the dam crest level

Source: Author’s capture

Figure 1A-37. The damaged sluice gate now made up of piled wood, rocks and sand bags

Source: Author's capture

Figure 1A-38. The intake structure showing damaged concrete parts where water flow is guided to the inlet by piles of sand bags

Source: Author's capture

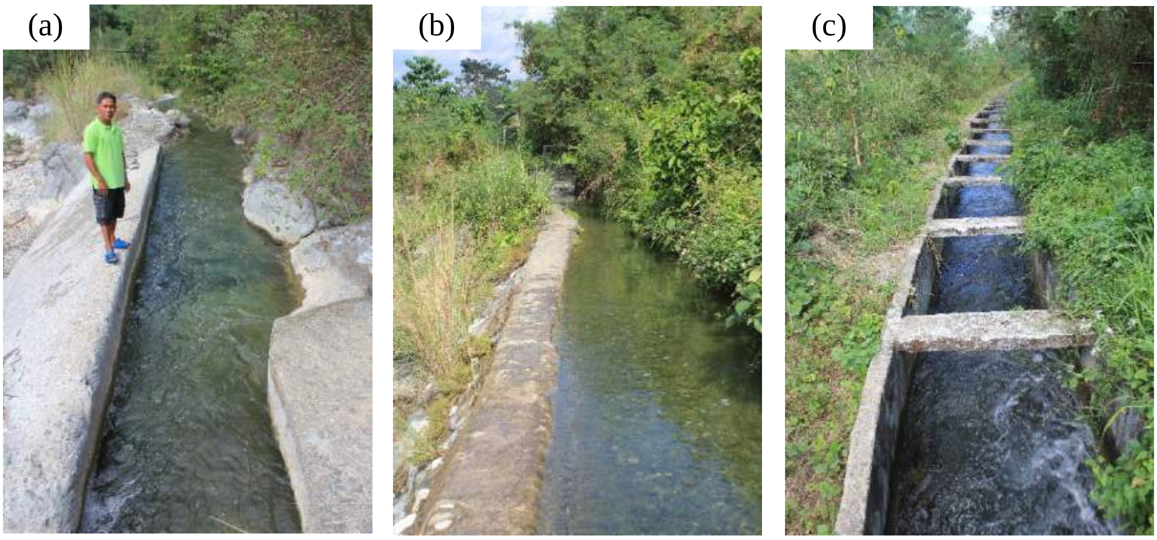

Figure 1A-39. (a) Intake channel at the side of the river just after the dam; (b) continuation of the intake channel; (c) the main canal just after the check gate

Source: Author's capture

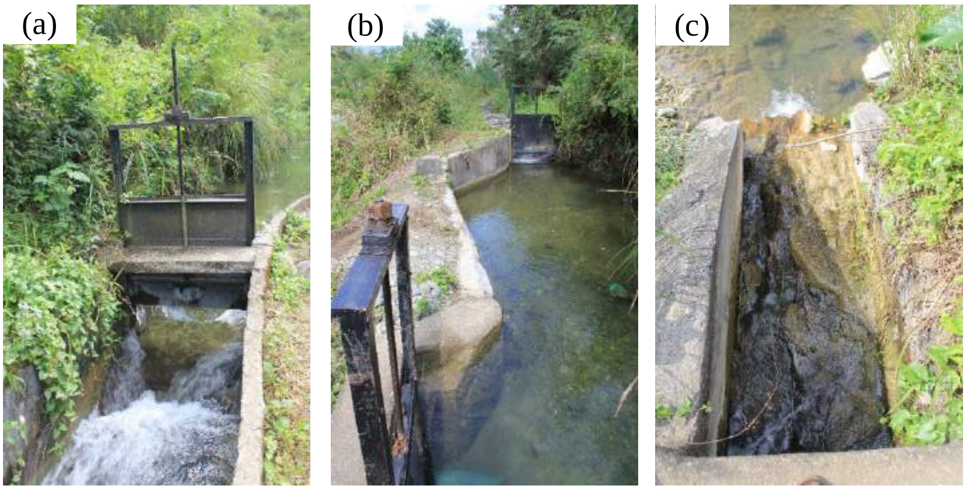

Figure 1A-40. (a) Check gate to control the flow to the main canal; (b) the gate at the top controls the flow to the main canal while the left gate controls return flow to the river; (c) guide chute for excess water reverted back to the river

Source: Author's capture

Figure 1A-41. Measuring discharge at the main canal during the walkthrough

Source: Author's capture

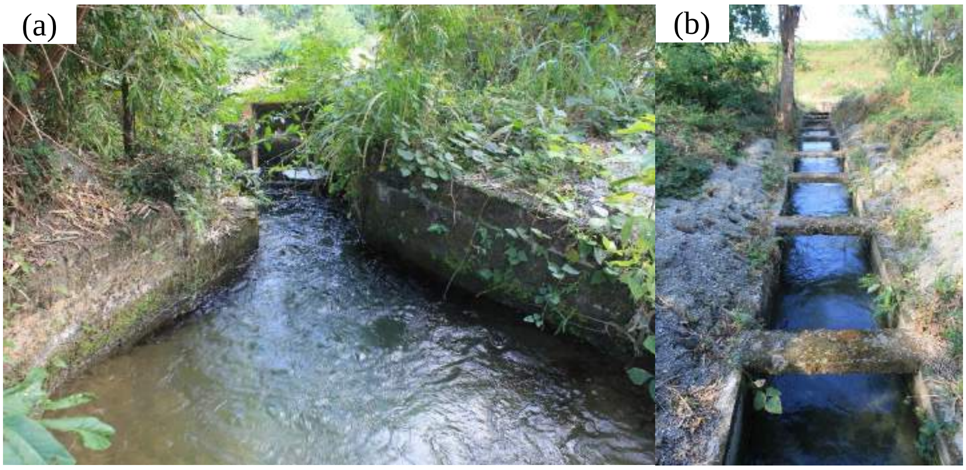

Figure 1A-42. (a) Outlet of the inverted siphon under the river; (b) the concrete-lined lateral canal after the outlet of the inverted siphon used to distribute the water to Parang-Bugnan CIS area across the river

Source: Author's capture

Sta. Lucia-Old CIS

The Sta. Lucia-Old CIS is located in the municipality of Zaragoza in the province of Nueva Ecija which started its construction and operation in 1979 and was rehabilitated in 2002. The association does not pay amortization for the cost of the construction of the dam as well as the irrigation canals and drainage canals since the old management had completed paying the equity worth PhP60,000 pesos.

The president and the governing board are elected for a four-year term and no compensation is given to the officers. There are written rules about the proper behavior of the farmers but the provisions holding the water users accountable are not clear. An example is the suspension of the privileges of the water users which is not really implemented because of the occurrence of calamities such as typhoons and droughts. Meanwhile, there are fines for the officers who do not attend meetings. In terms of enforcement, it is up to the association to impose its laws.

The ISF of the farmers was PhP1000 per hectare per member per year which is used to pay the gate keeper as well as for maintenance and operation expenses. In addition, the ISF also covers the improvement and modernization of the structures along with the rehabilitation of the system since the IA already paid its equity.

The typical issues the IA discussed were the collection of fees and the scheduling of water delivery. The IA needs assistance on the removal of silt in the canals and the deepening of waterways for improvement.

Macapulo Bongabon CIS

The Macapulo Bongabon CIS is located in barangay Vega, in the municipality of Bongabon in the province of Nueva Ecija. The irrigation system was constructed in 2009 with NIA covering the design and construction of the main canal amounting to an estimate of PhP10 million. It started its operation in 2010, same year the irrigation system's management was turned over to the Macapulo Bongabon Irrigators' Association.

In terms of the selection of the governing board and the officers, an election is held every four years. The members of the board as well as the officers can be elected again with no term limit. There are no compensations to the officers or the governing board. There are no written rules concerning the proper behavior of the water users as well as the officers.

In the Macapulo Bongabon CIS, since there are no written rules about proper behavior, water allocation problems occur. Farmers become competitive in terms of getting their water and stealing of water is also a problem. Farmers tend to bring their own pump to get water. The supply of water also dwindles during the dry season, resulting in the delinquency of farmers to pay the water charges.

IA members pay PhP2,600 per hectare per year to be paid to NIA for the yearly amortization. Collection of the water charge is the usual problem of the IA. The IA needs donation of land tractor for easier land preparation.

Tedtedtilingit CIS

The municipality of Laur in the province of Nueva Ecija is the home of the Tedtedtilingit CIS which provides irrigation to the three barangays of Siklong, San Fernando and San Vicente. The irrigation system was constructed and started functioning in the year 2010. The National Irrigation Administration constructed the dam and the main canal that costs about PhP5 million. The system was turned over to the Tedtedtilingit Irrigators' Association in May 2011. Another PhP7 million was allocated for repair in 2013.

The members elect the officers as well as the governing board and there is no term limit. The current president of the association has been president for seven years. There are no compensations or incentives for the officers. The association also has written rules about the proper behavior of both the water users and the officials and shall be given sanctions or penalties when they disobey.

Since the irrigators' association was not able to pay the PhP1.3 million-peso equity, they entered into the amortization scheme. The farmers pay PhP3,000 per year per hectare to cover the yearly amortization while an additional PhP100 pesos per member is also collected to cover additional expenses. The biggest problem of the IA is the collection of these fees.

Pangasinan

San Angel CIS

San Angel CIS is a Small Reservoir Impounding Project located at Brgy. San Angel, Rosales, Pangasinan. It was constructed by NIA in March 2010 and finished in December 2011. The original project cost listed in a map acquired by the team was PhP 12,808,800 but the approved firmed up estimate is PhP 14,006,985.18. These probably are partial costs only (maybe just the earth dam) because the project cost based on the same map was PhP 79,100,000. The IA on the other hand said the project is worth PhP 150 million. These differences in costs will have to be resolved with NIA. The reservoir stores water from rainfall-runoff and two spring sources, one near the reservoir and one in Acop. The FUSA is 160 ha but only half of it (74 ha from the map) is irrigated during the dry season due to less rainfall and diminished spring flow.

The dam crest is 13.5 m high, 120 m long and 6 m in width. It is most likely made of compacted soil and lined with boulders (Figures 1A-43 to 1A-44). The dam and reservoir, including the cost of course, is deemed pretty big for a 160-ha FUSA. The reservoir is shown in Figure 1A-45. The storage capacity is determined based on the water level (stage) measured from a concrete gage meter (Figure 1A-46). The IA did not have a stage-storage curve or rating curve of the reservoir. The spillway is made of concrete and has a hump in the middle for extra storage (Figure 1A-47). The box inlet is submerged underwater with the pipe passing under the dam and the outlet emerging on the downstream face of the dam (Figure 1A-48).

The team was able to obtain a map of the proposed San Angel SRIP (Figure 1A-49). The main canal is divided into two branches. The left main canal is 1.798 km long and one lateral (Lat. A) 1.72 km long branch out of it. The right main canal is 1.214 km long with two laterals, Lat. A – 0.5169 km and Lat. A-1 – 0.982 km, branching out of it. The main canal and some laterals are concrete-lined but some damaged canals were observed during the visit which the IA said was due to the numerous trucks passing the area during the construction of the TPLEX. The map also listed a total of 90 control structures within the system including a combined siphon and division box, several head gates, turnouts, drops, elevated flumes, thresher and road crossings, and end checks. The detailed engineering design of the dam was requested from NIA, including the dependable flow from the spring, but these have not been given yet as of this writing. The IA said that the designed height of the dam was lessened because the backwater effect may flood the mayor's golf course. The IA would have liked to increase the storage capacity to increase the area irrigated. At any rate, the dam and spillway design should be assessed based on dependable flows of runoff and of the spring when the requested data has been acquired.

Figure 1A-43. The dam of the San Angel SRIP
Source: Author's capture

Figure 1A-44. The road atop the dam crest
Source: Author's capture

Figure 1A-45. The reservoir of the San Angel SRIP; also shown are the rocks lining the slopes of the upstream face of the dam
Source: Author's capture

Figure 1A-46. The water level gage meter made of concrete reservoir of the San Angel SRIP; also shown are the rocks lining the slopes of the upstream face of the dam

Source: Author's capture

Figure 1A-47. (a) The entranceway to the concrete spillway; (b) the level spillway channel; (c) the hump along the spillway channel to increase storage capacity of the dam; (d) the spillway chute to channel excess water from the dam to a creek

Source: Author's capture

Figure 1A-48. (a) The outlet emerging at the downstream face of the dam, which is covered with sod; (b) the outlet is housed in a concrete shed; shown also is the canal where the water leads to the main canals; (c) the outlet pipe emerging from the shed; (d) the canal leads to the combined siphon and division box which divides the flow to the left and right main canals

Source: Author's capture

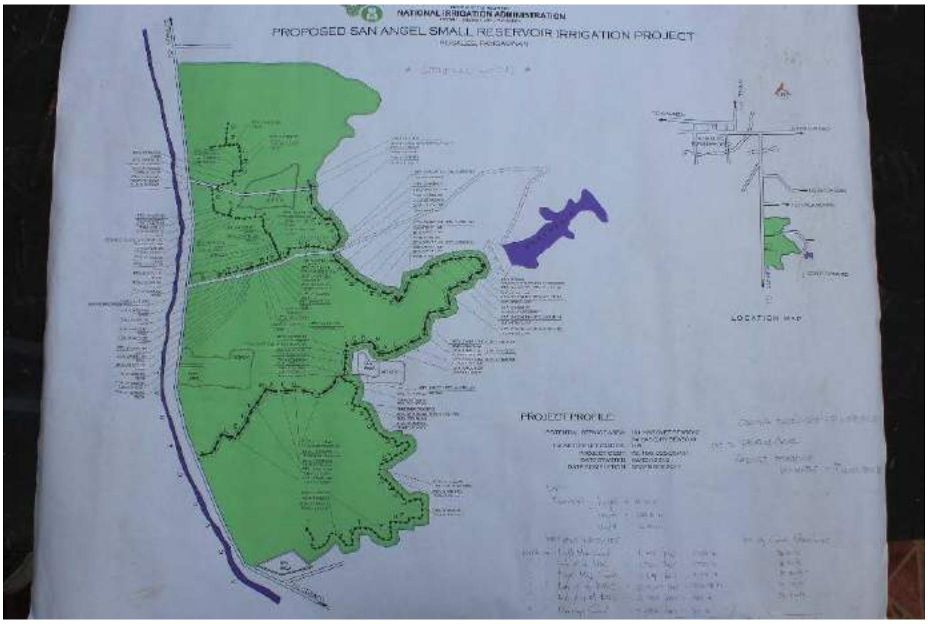

Figure 1A-49. The map of the San Angel SRIP showing canal layout, control structures, and other physical descriptions

Source: Author's capture

Don Oftociano Sr. CIS

Don Oftociano Sr. CIS is located in Brgy. Umingan, Balungao, Pangasinan. The system was constructed in 1969 by NIA but turned over to the IA only in 2001. The project cost was PhP 4million but the IA was able pay the 30% equity and currently just collects annual dues of PhP 100 per member for O&M purposes. Only 50% of FUSA is irrigated during the dry season and as such they rely on STWs. There was a time when they borrowed 500 pump units from the LGU and 100 units from the DA to save their crops due to a prolonged dry spell. The IA is currently having problem in the attendance of its members during maintenance work. Fortunately, the municipal government allows them to borrow backhoe for dredging work near the intake.

Sapid CIS

Sapid CIS gets is water from Sapid Creek. It is located in Brgy. Labayug, Sison, Pangasinan. It was constructed by NIA in 1998 with a project cost of PhP 3,010,519.86 as per record of IA. It was turned over to the IA in 1999.

During the dry season, the water supply from the canal becomes very little or none at all. The IA said the problem started when the Northern Cement Corporation (NCC) started its operation upstream of the river from the IA. As mitigation, the NCC donated a pump but which is now not operational. After that there's no more assistance given by NCC to the IA. Thus, the IA uses STWs to irrigate about 25 ha and diversify to other crops like corn and peanuts which use less water. The municipal government also extended help by giving them a pump. The IA pays amortization of PhP 60,210.40 per year for a period of 50 years. They also collect annual dues of PhP 50 per member per year for O&M since siltation level is high near the dam especially after a typhoon which sometimes required renting a backhoe.

Nama CIS

The Nama CIS is located in Brgy. Nama, Pozorrubio, Pangasinan. In 2014, NIA improved the system with the lining of canal. The system is not yet turnover by NIA. The main issue which causes conflicts among member is water scheduling. NIA assisted in resolving this problem. Also, to prevent biases in water distribution, the IA hired a water master who is not a member of the IA giving a 25,000 yearly salary. During dry season, less water is available irrigating only half of the FUSA. So, the IA diverts to other crops like peanuts, mongo and maiz which need less water. Also, about 10 to 15 ha is irrigated by pumping water from STWs.

IA has a very low collection rate of about 30% for amortization. The reason of most members for not paying is that the system is not yet turnover to them. They also collects annual due of P50/member/year for O&M since siltation level is high near the dam specially after a typhoon which required the use of a backhoe. Also, the LGU extends financial assistance during major desiltation work.

Convento CIS

The Convento CIS provides water to three barangays in the municipality of Pozorrubio in the province of Pangasinan which started its operation in 1971 and was developed by NIA in 2003. Worth 1.4 million pesos, NIA provided the system its dam and main canal. A complete turnover of the system to the Convento Irrigators' Association took place in 2003. The governing board and the officials are chosen via election and will have a three year term. There are provisions in the rule that the water users would be accountable and would have penalties and sanctions for their misbehavior but there are none for the officials. The members each pay PhP 955 per hectare per year for the association's amortization since they were not able to pay the equity. The main problem of the irrigation system is its siltation and dredging and they wish to address those problems.

NgayaoNgaoan CIS

The Ngayao-ngaoan CIS is located at Sison, Pangasinan. It gets water from the Aloragat River. The ogee dam is already damaged and completely filled with sediments (Figure 1A-50), but the concrete embankments and structure for the sluice gate is still in good condition (Figures 1A-50 to 1A-51). The sluice gate however is broken so they use bamboo and sandbags just to divert water into the intake gate. The intake has no check gate, only a steel grill to prevent large debris and stones from entering into the main canal (Figure 1A-52). There are several lined canals and control structures and some have ripraps but most are unlined (Figure 1A-53). The canals are heavily silted and the IA reported several illegal offtakes.

Figure 1A-50. The Ngayao-ngaoan CIS dam showing damaged ogee spillway and silts up to the dam crest; also shown is the sluice gate now made of bamboo

Source: Author's capture

Figure 1A-51. The sluice gate structure and side embankments are still in good condition but the sluice gate itself is now replaced with bamboo and sand bags

Source: Author's capture

Figure 1A-52. (a) The intake structure with a steel grill to prevent entry of large debris and stones into the main canal; (b) the intake channel at the bottom of the embankment

Source: Author's capture

Figure 1A-53. (a-d) Pictures of the canal system with some having concrete lining, some have ripraps and most are unlined; most canals exhibit heavy siltation

Source: Author's capture

Ilocos Norte

Dangdangla CIS

The Dangdangla CIS is located at Brgys. Tagipuro, Utol and Baruyen, in Bangui, Ilocos Norte. It gets its water from the Baruyen River. The IA did not pay anything since the said system is a project of Senator Alvarez with an estimated project cost of PhP 23 million.

In the 1st cropping, rice is mainly the crop irrigated while in the 2nd cropping, rice and corn are the irrigated crops. The system produces high yields for rice averaging about 200 cavans per ha for 1st cropping and 250 cavans per ha during 2nd cropping. The IA does not collect any fees from its member. All members just contribute during maintenance work and payment for the annual water permit. Due to abundant water supply, flood control is their major concern.

Tanap A Dakkela CIS

Tanap A Dakkel CIS gets its water from Cabakanan River. It covers Brgys Baduang, Borayo, Poblacion II, Ligaya and Tamag Aggas in Pagudpud, Ilocos Norte.

Less area is irrigated during dry season due to diminished water supply. Yield is also reduced averaging only 60 cavans per ha. The IA has fully paid the loan but has not yet signed a formal MOA/MOU with NIA. The IA only collects Equal Sharing Fee of PhP 100/year per member. Seventy percent of the collected funds is used for maintenance of the canal, 15% for improvement and 15% for saving. The IA suggested that NIA give them a water impounding project in order to augment their water supply.

Palongpong CIS

Palongpong CIS is located in Brgy. Palongpong, Batac, Ilocos Norte and gets its water from the Palongpong Creek. The system was constructed in 1993 as a project of Balikatan Sagip Patubig Program of the national government in which the IA members rendered labor.

During the dry season, there’s no water in the canal so they do not plant rice but crops which require less water like corn and tomato. They also extract water from STWs and rely on rain to irrigate their crops.

Baay CIS

The Baay CIS is located at Batac, ILocos Norte. It gets its water from the Paoay Lake (Figure 1A-54). The dike and intake was constructed starting November 3, 1986 and completed November 11, 1987. In 2000, the IA asked financial support from the LGU for the repair of the main canal and installation of steel gate along it.

The intake structure (Figure 1A-55) and main canal is connected by a rectangular tunnel (Figure 1A-56) approximately 500 m long. The IA requests lining of the main canal since majority of the stretch is unlined where both siltation and seepage are heavy (Figure 1A-57).

Figure 1A-54. Paoay Lake where the Baay CIS gets its water
Source: Author's capture

Figure 1A-55. The Baay CIS intake structure
Source: Author's capture

Figure 1A-56. The end of the tunnel connecting the from intake and main canal
Source: Author's capture

Figure 57. The main canal is unlined and heavy with siltation
Source: Author's capture

Zanajera Bangsirit CIS

The Zanjanera Bangsirit CIS is located at Bacarra, Ilocos Norte with its run-of-the-river dam located at the Co-ca River. The dam (Figure 1A-58) was rehabilitated by NIA and US AID. Heavy siltation can be observed near the dam and intake. The IA do not desilt the structures.

The IA was able to generate PhP 250,000 from LGUs last 2010 for riprapping. They also raised PhP 280,000 in 2013 to install/repair three sets of gates. Heavy siltation occurs on the first set of gates near the intake structure (Figure 1A-59). In the second set of gates (upstream), one of two check gates is broken and a wooden plank is used as replacement (Figure 1A-60). In the third set of gates (midstream), the three gates are damaged and non-operational because a tree fell on it last 2014 during typhoon Mario (Figure 1A-61). It has not been fixed yet though the IA has been requesting for repair since. Since the third set of gates were broken, the IA have experienced water shortage in the downstream portion of the system. There is no water master/tender so the officers just take turns in operating the gates. The IA uses both STW and LLP for other crops (tobacco, garlic, onion). But illegal pumping from the main and lateral canals occurs. Some farmers pumping water are not even members of the IA. Some lateral canals have unwanted grasses growing at the bottom and banks.

Figure 1A-58. The Zanjanera Bangsirit CIS dam
Source: Author's capture

Figure 1A-59. The intake structure of the dam

Source: Author’s capture

Figure 1A-60. A check gate with one steel gate damaged and replaced with wooden plank

Source: Author's capture

Figure 1A-61. Damaged and non-operational gates due to a tree falling on it during the typhoon Mario in 2014.

Source: Author's capture

Figure 1A-62. Lateral canals: Left – grasses are growing at the channel bottom; Right – a low-lift pump (LLP) extracting water from the canal (according to the farmer interviewed, the owner of this pump is not a member of the IA).

Source: Author's capture

Der-Ap Saoit CIS

The Der-Ap Saoit CIS is located at Burgos, Ilocos Norte. It gets its water from Buraan River, from which the LGU started getting water in 2000 for domestic water supply. Since then the IA experienced water shortage for irrigation.

The dam is a simple concrete dike (Figure 1A-63). The intake gate is broken and only wooden planks are used (Figure 1A-64). The main canal have patches of concrete lining (Figure 1A-65). Holes were made in the main canal to serve as turnouts to lateral canals where rocks are used to control the flow of water. A part of the main canal is along the national highway where some rocks from the highway contribute to the canal's sediments. Heavy siltation also occurs in a road crossing especially during the wet season clogging it. The IA spends at least a day to clean the clogged culvert.

Figure 1A-63. The simple concrete dam of the Der-Ap Saoit CIS

Source: Author's capture

Figure 1A-64. The intake structure with no gate; wooden planks are placed to regulate the flow of water

Source: Author's capture

Figure 1A-65. Concrete sections of the main canal upstream (left) and midstream (middle); holes in the concrete canal serving as turnouts for distributing water to laterals; rocks are used to control the flow from the canal (right).

Source: Author's capture

Camarines Sur

Maybatang CIS

The Maybatang CIS is located at Brgy. San Antonio, Buhi, Camarines Sur and managed by the San Antonio Farmers' Irrigators Multi-Purpose Cooperative. The system was constructed in the 1979 from a loan made by the IA with NIA. The CIS has two sources of water, the Maybatang River in Polangui, Albay and Camaslog River in Camarines Sur. For the months of February-June, the NWRB water permit granted to the IA from the Maybatang and Camaslog River are 191 lps and 27 lps, respectively. While for the months of July-January, the approved water rights are 277.5 lps and 82.30 lps, respectively. However, Lidot CIS, located in Polangui, Albay obtains water from the main canal of the Maybatang CIS decreasing the discharge from the Maybatang River. With this water sharing, the Maybatang CIS has an average discharge of 260.326 lps for a year from both the river sources.

The Maybatang dam (Figure 1A-66) is a run-of-the-river dam originally constructed in 1980. The system was rehabilitated in 2009. Heavy siltation were observed in both the upstream and downstream portion of the dam, with the sediment nearly reaching the level of the crest upstream. The sluice gates of the intakes and spillway are properly maintained and well lubricated for ease of operation, as the Cooperative allots PhP 50,000 per year for the maintenance of irrigation structures. The intake structure and the main canal is connected by a culvert approximately 50 m long. The stretch of the main canal after the culvert has a rectangular cross-section with dimensions of 1m by 1m (Figure 1A-67). However, reductions in dimensions of the main canal were observed as it approaches the downstream portion. The cooperative has a budget of PhP. 110,100 per year for the clearing and desilting of canals.

Figure 1A-66. Maybatang Dam
Source: Author's capture

Figure 1A-67. Left: Upstream portion; Right: downstream portion of the rectangular main canal
Source: Author's capture

Aslong CIS

Aslong Communal Irrigation System is a gravity irrigation system covering four barangays, namely, San Isidro, Bahay, Aslong and Palangon. It is located in the municipality of Libmanan in the province of Camarines Sur. The system was constructed and operational in 1980 by NIA. The construction cost together with the rehabilitation cost from 1980 to 2014 is PhP 34,915,240.48 with Fund 101, RREIS and Fund 501 as sources of funding. The IA's annual rate of remittance to pay the loan through amortization for a period of 50 years is PhP 46,666. The IA rendered labor during the various project constructions to lessen the loan amount. Due to a 69% collection efficiency, the IA was able to initiate a 1-kilometer canal extension using their own fund.

The main irrigated crop is rice with a higher average yield of 90 cavans per ha during wet season and a slightly lower yield of 85 cavans per ha during dry season. The IA practiced a downstream-to-upstream irrigation scheduling scheme.

From the IA's Irrigation Service Fee of PhP 2,125/ha/season, the IA is able to generate enough funds for amortization, maintenance, improvements and compensation of its officers and key personnel. But, about 31% of its members are not able to pay due damaged crops caused mainly by rat infestation.

The IA officers are elected with a 3-year term. IA officers and BOD conduct monthly meetings with 100% attendance and about 80% of its members attend the annual general assembly meeting. The IA received trainings from NIA almost yearly due to the consecutive projects received by the IA.

Even if the IA rarely implements their written rules to their members and officers, their members including the officers rarely deviate from their policies/rules. The IA also possess good conflict resolution ability. The IA only seeks the assistance of NIA, DA and/or LGU in severe conflicts among members.

Aside from NIA, other institutions like DA and LGU also provided assistance to the IA. As a consistent awardee, the IA wants to further improve their system. They suggested the following: Farm-to-Market Road (FMR) and canal lining of 6 kilometer lateral canals.

San Ramon PIS

The San Ramon PIS, located at Brgys. San Ramon and San Agustin, Bula, Camarines Sur, is under the management of the San Agustin-San Ramon Farmers' Cooperative. The PIS taps water from the Bicol River and has a service area and FUSA of 586 ha and 419 ha, respectively. The PIS has two identical pumps: each with a submersible pump driven by a 200-hp electric motor sheltered in a pump house.

An actual walk-through was conducted in this system. The main canal is 2.9 km long, the lateral canal has an accumulated length of 11.1 km while the supplementary farm ditches has a total length of 15.3 km. The system was constructed in September 1, 1990 under a project covered by NIA amounting to PhP 3,604,961.46. In 1998, the system was rehabilitated with a cost of PhP 599,450, also a project by NIA. From 2012-2014, the PIS have undergone: a) cleaning and desilting of lateral canal amounting to PhP. 300,300 and; b) concreting of lateral canal worth

PhP 4.3 M, both project implemented by NIA. The concreting of the rectangular canal covered a stretch of 2.28 km.

The system pumps water from the river 20 hours a day with each pump alternately operating at 10 h each. One operating pump is enough to obtain a full flow of the main canal (Figure 1A-68) during rotational irrigation. A spillway (Figure 1A-69) exiting back to the Bicol River is located after the discharge pipes of the pumps. This spillway is utilized once a day during the turn-over of operation from one pump to another because there will be a time where the two pumps will be running simultaneously during the turn-over. The upstream portion of the main canal has a Parshall flume (Figure 1A-70), however the Manager of the PIS stated that they do not use the flume for measuring the discharge of the main canal. The PIS is divided into four zones where a water master operates the check gates and turnouts of the main canal and a field coordinator operates the offtakes and turnouts (steel gates). Two persons operate the two pumps. Most of the lateral canals are lined since the last lateral canal-lining project implemented by NIA. Most farm ditches in the upstream portion of the system are lined (Figure 1A-71) while farm ditches in the downstream portion are still unlined (Figure 1A-71). The PIS has not experienced water shortage even during the dry season for the past 20 years.

Figure 1A-68. The San Ramon PIS pumping water from the Bicol River; shown here is the discharge from one pump, which is enough to fill the canal to capacity

Source: Author's capture

Figure 1A-69. The spillway leading excess water back to the Bicol River

Source: Author's capture

Figure 1A-70. Parshall flume in the upstream part of the main canal
Source: Author's capture

Figure 1A-71. Left: lined; Right: unlined farm ditches
Source: Author's capture

Lanipga PIP

The Lanipga PIP, located in Brgy. Lanipga, Bula, Camarines Sur, taps water from the Pawili River. The PIP was constructed in 1999 with cost of PhP 11.56 M and was turned-over last December 27, 2000. It has undergone rehabilitation in 2009. The PIP is managed by the PECUARIA Development Cooperative Inc. The project consisted the acquisition of four pumps driven by 45-hp electric motors and the construction of main and lateral canals. The service area is divided into four sectors where a pump services each sector. The PIP does not have a definite irrigation schedule; the schedule is based on the agreements of the farmers on the sequence of irrigation based on the stages of the cropping. The farmer pays for the cost of electricity during the irrigation, which is usually PhP 1500-2000/ha/cropping for the wet season and PhP 3000/ha/cropping during the dry season.

In 2006, all the pumps were damaged during the Typhoon Reming, and two pumps rendered fully non-operational. A rehabilitation project worth PhP 2,000,000 was done by NIA last 2008 improving the condition of the two pumps and electric motors as well as the additional lining of the lateral canals. Last 2014, the cooperative requested for the rehabilitation of the pumps amounting to PhP 600,000.

Suha San Antonio CIS

Suha San Anotion Communal Irrigation System is a gravity irrigation system getting its water source from Cagdaga Creek, Cagmanaba Creek and Kinabikabihan Creek. It is situated in Barangay San Antonio in the municipality of Ocampo in the province of Camarines Sur. The system was constructed in 1989 by NIA a cost amounting to PhP 889,932.88. From 1990 to 2011, NIA improved the system by canalization works, concreting works and construction of canal structures and facilities. The total rehabilitation cost is PhP 4,235,609.10. The IA's annual rate of remittance to pay the loan through amortization for a period of 50 years is PhP 72,000. To lessen the loan amount, the IA rendered labor during the various project constructions.

Inansagan CIS

Inansagan Communal Irrigation System is located in the municipality of Lagonoy in the province of Camarines Sur. The system covers barangay Gubat and Himagtukon. It was constructed by the national irrigation administration (NIA) in 1977 with a construction cost of P105,688.67. In 1988, NIA performed a minor rehabilitation work amounting only to P29,572. But in 2012, a major rehabilitation was performed by NIA amounting to PhP 2,718,000. The IA already paid their previous loans. They intend to amortize their latest loan of PhP 2.7 million in 2012 for a period of 50 years after the turnover by NIA.

Nueva Vizcaya

Magapuy CIS

The Magapuy CIS is located at Brgy. Magapuy, Bayombong, Nueva Vizcaya. The CIS diverts water from the Magat River (Figure 1A-72) however the IA does not have a water permit from the NWRB. Embankments (Figure 1A-73) were made along the side of the river to raise the water level and divert some of the river flow to the intake gate. The diverted water is directed to the intake gate, road crossing culvert and then the main canal. The stretch of main canal after the culvert is unlined with heavy siltation and vegetation. There are no existing control structures for the lateral turnouts. The turnouts are just covered with earth and rocks to regulate the discharge along the lateral canals. Illegal turnouts (Figure 1A-73) were also observed along the stretch of the main canal. The CIS have sufficient water during the dry season, however, an IA official pointed out that they experience water shortage during the wet season especially after events of heavy rainfall. This is because siltation from upstream of the Magat River fill the culvert and the intake gates preventing water entry to the main. The IA conducts dredging operations by renting backhoe from NIA for PhP 2000/hour.

Since the construction of the system in 1960, only a 63-m stretch in the midstream portion of the main canal was lined last 2012 with funding from NIA. After this lining project, the IA have requested for more lining as they experience both heavy siltation and high seepage losses.

In 2012 and 2013, NIA conducted rehabilitation projects amounting to PhP 461,000 and PhP 285,000 for canal lining of 50 m and 45 m stretch along the main canal, respectively. The rehabilitation project regained 22 ha and 40 ha of the service area, respectively. Excess water from the Magapuy CIS goes directly to the intake gate of a neighboring Latuyot CIS.

Figure 1A-72. Magat River and the diversion canal of the CIS (left bank)

Source: Author's capture

Figure 1A-73. Left: unlined portion of the main canal; Right: lined portion of the main canal with illegal turnout

Source: Author's capture

Boliwao CIS

The Boliwao CIS is located at Brgy. Boliwao, Bayombong, Nueva Vizcaya. It diverts water from the Boliwao River and serves 73 hectares with 66 farmer beneficiaries. Siltation at the dam (Figure 1A-74) is nearly level with the dam crest. The downstream portion is also heavily silted, with islands already formed in the center of the river. The sluiceway (Figure 1A-74) currently has no gate hence water is constantly flowing through it, except for garbage which restricts the flow. According to an IA official, dredging operations have not yet been done on the system since the construction of the dam. Heavy siltation comes from the deforested mountain covers upstream.

Figure 1A-74. Left: Boliwao dam with high level of siltation; Right: sluiceway
Source: Author's capture

The main canal of the CIS is concrete-lined with a 1m by1m rectangular cross-section. Illegal pumps (Figure 1A-75) were observed along the main canal. There are no existing control structures for the lateral canal turnouts but some holes were observed at the main canal and earthen embankments (Figure 1A-75). Problems encountered by the CIS include clogging of the two siphons in the system during heavy rainfall events and water shortage during the dry season. In 2012, NIA completed a canal lining rehabilitation project worth PhP 285,000. The project targeted the restoration of 5 ha and rehabilitation of 15 ha of the service area.

Figure 1A-75. Portions of the main canal with illegal pumps (left) and improvised lateral turnouts (right)
Source: Author's capture

Aurora CIS

The Aurora CIS is located in Quezon, Nueva Vizcaya with Angadanan River as its primary source of water. The CIS was established in 1991 and began operating on 1992. The NIA provided for the lining of main canal and construction of the intake that costs PhP 4M. Water is abundant in the area but during prolonged dry spells, LLPs and STWs are used for supplementary irrigation, which on the average operate for 12 h/day/ha. Due to rapid flow of water from the river, the IA said that a dam is impractical and costly to be built; embankments made of sandbags where lined to the intake instead. One particular problem raised by the IA is the mining operation approximately 5 km away. They reported health hazards such as farmers having scabies and the effect on their harvest such as the palay turning yellowish or irrigation water turning turbid. Among the suggestion of the IA to NIA and LGUs include improvement of intake, canals, a backhoe for repair and maintenance.

Nangalisan Paniki Bagabag CIS

Located in Bagabag, Nueva Vizcaya, Nangalisan Paniki Bagabag CIS caters both the municipalities of Bagabag and Villaverde. The irrigation system was established on 1990 and started its operation on 1991. The dam diverts water from the Lamot River, which is also silt laden. About 2m of the 3.5m depth of canal upstream is silted. The canal cross regulator is a huge piece of wood plank that is partially broken and is hard to operate especially when the flow of water is high. Since it covers 2 municipalities, irrigation water sometimes is not sufficient to meet all the needs of its members. One solution that the IA proposed is the lining of the whole canal to improve water delivery downstream. Though there is an on-going lining of the canal by NIA, the IA thought it would be best if the whole canal will be lined. During the dry season, irrigation water is insufficient and LLPs pumping water from the creek are used to supplement irrigation. On the average, the operation lasts 8 hours in a day per hectare.

Paoac Barobbob CIS

Located in the municipality of Bayombong in the province of Nueva Vizcaya, lies the Paoac Barobbob Communal Irrigation System. The system covers barangay Masoc, La Torre South & North, Luyang and Magsaysay. It was constructed and operated in 1974. The project cost around P1 million which the IA paid off through equity. In 2013, the main intake structure was damaged by a typhoon but was repaired by NIA in the same year. But, the IA is not yet paying amortization for this loan.

The main crop irrigated is rice with an average yield of 80 cavans per hectare during the wet season and only 40 cavans per hectare during the dry season. Due to lack of water supply, only 50% of the service area is irrigated during dry season. About 30 hectares pump water from shallow tube wells (STW) as a supplementary mode of irrigation.

Duruarog CIS

Duruarog Communal Irrigation System is located in the municipality of Diadi in the province of Nueva Vizcaya covering two barangays, namely, Balite and Duruarog. The project cost was about PhP 100,000 when it was constructed in 1976 by NIA. Previous IA officers did not pay the amortization thinking that it was for free. Thus, currently, the IA is paying the accumulated back accounts and the PhP 5,000 yearly amortization for a period of 50 years.

Rice is the main crop irrigated. Their average yield in wet season is 100 cavans per hectare and slightly less during the dry season at 90 cavans per ha. Due to lack of water supply during dry season, about 10 hectares are not reached by irrigation and 2 hectares pump water directly from the river.

Benguet

Longlong CIS

Located La Trinidad, Benguet, the Longlong CIS services an area of 32 hectares planted with upland vegetables and ornamental crops such as broccoli, tomato, poinsettia and anthurium. The CIS, constructed in 2012, is managed by the Kangao Irrigators' Association. The service area (Figure 1A-76) is located along the water source, Longlong Creek, which was lined by NIA to serve as the main canal. The 420 m long lined portion was a trapezoidal channel with bottom width of 1.5m and top width of 2m.

Figure 1A-76. A portion of the service area with the main canal (natural creek)
Source: Author's capture

The farmers pump water to the service area from the creek through 0.5"-1.5" pumps driven by either private diesel engines or electric motors (Figure 1A-77). Common sizes of the diesel engines and electric motors used by the farmers are 1.5hp and 3hp, respectively. Since the CIS services upland crops, the engine/motors require 3 hours to sufficiently irrigate 1 ha. Modifications have been done by the IA to improve the pumping of water; the IA excavated sumps (Figure 1A-77) in the main canal to store water for easier pumping. Aside from the direct pumping to farms, some farmers pump water into storage tanks (Figure 1A-78) which then is used to distribute water by gravity. The IA requests for further lining of the upstream portion of the creek to reduce siltation in the lined canals and losses through seepage.

Figure 1A-77. Left: electric motor along the unlined portion of the creek; Right: diesel engines sheltered in pump houses and cavity made by the farmers at the bottom of the main canal

Source: Author's capture

Figure 1A-78. A portion of the service area with the main canal (natural creek)

Source: Author's capture

Bineng Japos CIS

Bineng Japos CIS is situated in Baranggay Bineng, La Trinidad, Benguet and acquires its irrigation water from the river. In year 2000 construction of tanks and connections of HDPs as main and lateral canals were done by NIA and on the next year, the irrigation system became operational. Their primary crops are vegetables and ornamentals that is why not much water for irrigation is needed. There is not much problem raised in terms of the physical characteristics of the system aside from replacement of some HDPs that are leaking. Sufficiency of irrigation water is not a problem within the IS even in dry season so no mode of supplementary irrigation is done. The IA however suggested that additional lines of irrigation would be of help to improve the area to be planted.

Lasong CIS

Located in Tuba, Benguet, Lasong CIS gets it water from 2 rivers. The IS was established on 1980 and started operating on 1981. The CIS has two different intakes which were derived from two rivers that converge in a tank (Figure 1A-79). The original project was done in 1978 through the FSDC. The tank and upstream parts of the main canal were damaged during the 1990 earthquake when a fraction of the mountain collapsed. It was repaired in 1995 at a cost of PhP 563,346.4 through the GATT. Subsequent improvements conducted by the NIA include 0.72 km 3-in HDP and a 1.936 km ¾-in lateral worth PhP 1M in 2012 and 0.42 km 3-in HDP and 2.85 km ¾-in lateral worth PhP 1,085,187 in 2013.

From the main concrete tank, water is then distributed to several concrete tanks (five 8x8x8 m and one 10x10x10) for storage and distribution to individual farms. The IA used furrow irrigation and sprinklers for irrigating rose plants. During the wet season, water from one river is diverted to an unlined canal to irrigate rice (Figure 1A-80). The IA suggested that NIA have the upstream part of their main canal lined so that water deliveries would be improved. Also, construction of tanks (Figure 1A-80) as water impounding structures in midstream would help them increase irrigation water for midstream and downstream during dry season.

Figure 1A-79. The main tank showing flow of water from the source and the distribution pipes to the other tanks.

Source: Author's capture

Figure 1A-80. (a) Unlined main canal used to irrigate rice (b); (c) some of the concrete tanks

Source: Author's capture

Labney CIS

Originally the system only involves Labney but since its service area increased it now includes Balangabang, Mabosas and Laget. The system is found in barangay Tabaan Norte in the municipality of Tuba, in the province of Benguet. NIA constructed the system in 1989 with a construction cost of PhP1.2 million. The IA already paid off the 30% equity by rendering labor. Beans, cucumber, taro (gabi), sweet pepper and sweet potato are the crops irrigated by the system. During dry season where less water is available, the IA performs water scheduling among its members.

Parasipis CIS

Parasipis CIS is located in Tuba, Benguet. It gets its water primarily from a spring but also taps water from a river during the dry season when the spring flow is low. The spring water was certified as Class A by the DENR. The river flow, on the other hand, gets murky during the rainy season. A small pool is created at the source where water enters a screened inlet and distributed using 119 rolls (60 m/roll) of 2-in dia. HDPs. From this main line, water is diverted to four concrete tanks (three 8x8x8 m and one 4x4x4 m). Each of these tanks (Figure 1A-81), has an overflow pipe for channeling excess water and an opening at the top where a man can enter for tank cleaning. Water is distributed to each farms from a distribution assembly (Figure 1A-82) at the tank and using individual HDPs. They have no gate valves in each distribution pipe so they use wood stems to plug each pipe when not in use.

Figure 1A-81. One of several concrete storage tanks showing overflow pipe

Source: Author's capture

Figure 1A-82. The distribution pipe assembly showing wooden plugs
Source: Author's capture

Taloy Sur CIS

Taloy Sur CIS is located in Tuba, Benguet. It gets its water from a mountain river (Figure 1A-83) and distributes it using HDPs and several storage tanks (Figure 1A-84). When the distribution lines pass through depressions, the IA replaced the HDPs with G.I. pipes. They also installed union patentes and gate valves (Figure 1A-85) in their distribution assembly using IA funds to improve water delivery. The IA is an awardee of most outstanding CIS in CAR. They have complete documentations, including maps and pictures of every event (earthquakes, typhoons, repairs) that affected their CIS (Figure 1A-86).

Figure 1A-83. The mountain river source of the Taloy Sur CIS
Source: Taloy Sur IA

Figure 1A-84. One of the concrete storage tanks of the Taloy Sur CIS showing the entry point for tank cleaners

Source: Author's capture

Figure 1A-85. Sample of the union patentes, gate valves and improved distribution assemblies of the Taloy Sur CIS

Source: Author's capture

Figure 1A-86. Complete documentation of the Taloy Sur CIS including maps, receipts and pictures

Source: Taloy Sur IA

Isabela

Masipi West CIS

Masipi west CIS shares the same source of water for its dam with Masipi east CIS. Both CIS are located in the same barangay at Cabagan, Isabela. The NIA provided for the lining of about 2.5km main canal, however, the IA sees that the unlined 1.5km main canal is still a problem to delivering water in downstream. Upstream part of their main canal is a culvert, when heavy rains occur, siltation is a problem, especially when parts of the concrete pipes collapsed. Backhoe is needed in times of desilting because a shovel takes much time and harder to perform. When experiencing insufficient water for irrigation, LLPs and STWs are being used. The operating hours for LLPs and STWs on the average are 3 hours/day/ha and 6 hours/day/ha respectively.

Masipi East CIS

Masipi East CIS as the pioneer CIS in Barangay Masipi East, Cabagan, Isabela derives its water from Masipi river. The NIA provided the design and construction of the intake, main canal and lateral canal that costs PhP 4M. Main canal of approximately 800m is a culvert that is heavily silted during heavy rains. This culvert is also their problem when it collapsed after years of service. However, the IA, from their savings provided for its repair in year 2011 that costs them of about PhP 50,000. Lining of the whole canal and constructions of water impounding structures in midstream are what they were suggesting to NIA. Since nearby CIS is sharing the water source with them, irrigation water is sometimes insufficient especially in dry season, to cope with this problem, supplementary irrigation via LLPs are being used. An average of 24 hours/service/ha is the operating time of the pump.

Casilagan Balacong CIS

The Casiligan Balacong CIS derives its water from the Bintakan River and has a service area of 175 ha. The old dam (Figure 1A-87) was constructed in 1982 but it was damaged by two typhoons Goring and Iliang. The dam was repaired by NIA in 1996 but this include only the concreting of one side of the dam, construction of a new intake to replace the old one which was a siphon but was fully filled with rocks and sediments during the typhoons, and the dredging and lining of some canals. The dam is filled with sediments and the intake has no screen so the intake canal at the side of the river leading to the main canal is also filled with sediments (Figure 1A-88). The IA guide during the walkthrough said that the original depth of this intake canal may be about 2 man standing on top of another but is now about 3-ft deep. This intake canal was originally covered with concrete slabs but it was removed during one dredging operation and never put back again (Figure 1A-89). The intake canal leads to an intake gate then to a long underground culvert then to the main canal. The gates controlling water flowing to the main canal are still operational but the entry is filled with sediments (Figure 1A-90). The main canal is unlined and the only lateral which runs along the foothills is not only unlined (Figure 1A-91) but is constantly filled with silts from the hills. So the IA are requesting that their canals be lined and the lateral be covered to prevent siltation. There are 6 drops along the main canal.

Figure 1A-87. The old dam (top) and the repaired part (bottom); the old intake can be seen in between the two

Source: Author's capture

Figure 1A-88. The intake at the side of the dam has no screens and are filled with sediments

Source: Author's capture

Figure 1A-89. The old intake siphon but was filled with sediments during the typhoons Goring and Iliang

Source: Author's capture

Figure 1A-90. The intake canal filled with sediments and the intake gate where the entry way is also filled with sediments

Source: Author's capture

Figure 1A-91. The unlined main and lateral canal and one of the drop structure combined with siphon

Source: Author's capture

Cumabao CIS

Cumabao CIS is located at the municipality of Tumauini, Isabela. The CIS taps river from the Balasig River/Creek and services an area of 160 ha. It was granted a water permit of 240 lps. In 1999, the CIS undergone repair and rehabilitation with the project costing Php 2.3 M loaned from NIA. The project included: a.) repair of dam, b.) repair of two siphons, c.) repair of drainage culvert, and d.) re-excavation of canals (6.12 km). After four years, another rehabilitation project was conducted worth Php 3.127 M with similar work items: dam repair, canalization, canal structures and institutional development program. The ogee dam is 2-m high and crest width is 20 m. The IA reported under scouring so the upstream apron and cutoff wall was one those repaired during one rehabilitation roject. The sluiceway is made of flashboards but the intake gate is made of steel. The main canal is concrete-lined at 2.5 km and trapezoidal. Since the area is crisscrossed with the creek, the main canal passes through many culvert pipelines and siphons.

Viola Estate STW

This CIS is a collection of 134 units of STWs constructed by NIA and turned-over for management to the ARBA multi-purpose cooperative. The CIS visited was the Santiago cooperative which manage only 45 STW units (Figure 1A-92). Each STW was designed to irrigate 3-ha and the location was based on a survey by NIA. For each STW, 9 m (1 ½ pipe) 4-in dia. PVC pipe was installed with the bottom 3 m perforated, but the total drill depth is around 25 m. The pipe was installed by hammering instead of gravel packing which is usual for NIA STWs. At the surface instead of the usual elbow, a tee was installed but plugged at one end. At the other end, a reducer is installed for a 3-in rubber hose. The STWs use 3x3 self-priming centrifugal pumps (NS-80) (Figure 1A-93). For repair of the packing seal, they use that of a 4x4 pump. The engines used include 7 Hp Yanmar, Mitsubishi and Kubota (Figure 1A-93) and they usually operate below half throttle setting. They only use clay covered with plastic for sealing leaks on pipes and connections.

Figure 1A-92. One of the STW units; covered with plastic is the installed 4" PVC pipe, tee and reducer; visible is the 3" discharge pipe where the rubber hose of the pump is attached

Source: Author's capture

Figure 1A-93. The STWs use 3x3 self-priming centrifugal pumps (left) and 7 Hp Kubota engine (right)

Source: Author's capture

Cabaruan CPIS

Cabaruan Communal Pump Irrigation System consists of 24 pump units. It is covers barangay Cabaruan and Minanga in the municipality of Naguilian in the province of Isabela. The shallow tube wells (STWs) and pump sets were constructed by NIA in 2007 with project cost amounting to PhP 2.6 million which the IA paid off through equity. One STW is designed to irrigate a minimum of 3 has.

The main crop irrigated is rice. The average yield for both wet and dry season is 90 cavans per ha. Aside from STW, other members also pumps water from springs and small impounding holes located near or in their fields.

The IA seemed to be collapsing. They don't collect any fees from their members. Only 70% of its officers attend their meetings. They do not have written rules/policies or even implement one. The members seemed to be individualized tending only to their own needs.
Their main suggestion to address their concern is the construction of a water impounding dam which will give them a reliable and cheaper source of water.

Cagayan

Abaca CIS

Abaca CIS is managed by Bicaca Irrigators Association which is located at Peñablanca, Cagayan. The primary source of water is a spring. A service area of around 100 hectares is irrigable during wet season but only 10% or 10 ha are being irrigated during dry season. The primary concern of their IA is the level of water during dry season that made their irrigable area reduced from 100 ha to 10 ha. The IA recommended that NIA should give additional supplementary irrigation via STWs that can augment the water during dry season. Some members of the IA can afford to buy a pumpset and use it as LLPs/OSPs to pump water from the Pinakanawanan River to supplement their needs for irrigation water. The average operating hours of these LLPs are 5 days continuous for a 2-ha land.

Calusit CIS

Calusit CIS is located in Enrile, Cagayan and diverts water from Pangul Creek. The creek is the boundary between Cagayan and Kalinga and the watershed is located in Kalinga. The ogee type dam (Figure 1A-94) was constructed on early 1960s and was improved by NIA on 2013. The regulator of the intake is completely broken (Figure 1A-95). The upstream is flooded when there are heavy rains, so another intake was made to divert water and bypass the ogee dam (Figure 1A-94). The IA was granted a water permit to divert 300 lps which good for more or less 200 ha of service area but only about half are being irrigated. The IA suggested to NIA that canal lining will help in increasing the irrigable area of their system. Now the system has 4 km lined trapezoidal canal (Figure 1A-96) and a 0.4 km lined rectangular canal. The IS is amortized for 50 years with payment of 100 kg/ ha during wet and 150 kg/ha during the dry season per member.

During the visit to the dam, there are no water flowing at the creek. LLPs and STWs are used as a supplementary irrigation when needed. There are about 50 units of STW, where each STW consists of 24 m of GI pipe, 36 m of actual drill depth and 6 m water level. They use 3x3 and 4x4 centrifugal pumps and 8- to 10-Hp Kubota or Yanmar engines for prime movers. The drilling fee ranged from PhP 8,000 to 10,000. They operate on average 12 hours per hectare.

Figure 1A-94. The ogee dam exposed because there are no water on Pangul Creek during the visit; also shown is the bypass inlet used to divert water downstream during high flows

Source: Author's capture

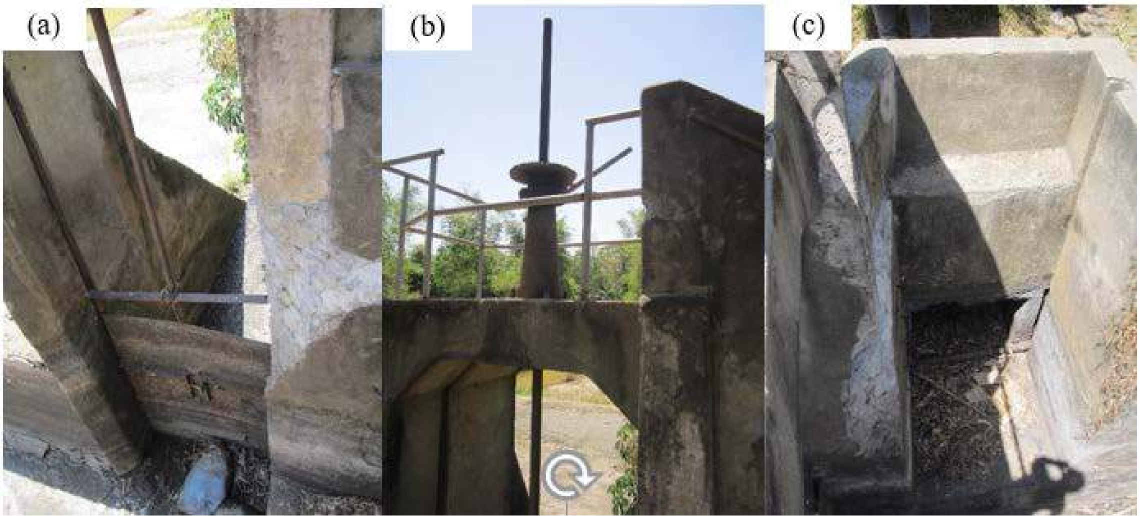

Figure 1A-95. (a) The wooden sluicegate; (b) the operating screw of the sluicegate; (c) the intake gate with broken regulator

Source: Author's capture

Figure 1A-96. The trapezoidal lined main canal, shown with some sediments at the bottom

Source: Author's capture

Tappakan Baraccaoit CIS

Tappakan Baraccaoit CIS is located in Gattaran, Cagayan with Tappakan River as their primary source of water. A total of PhP 3M was allocated by NIA for the construction of the "mini-dam" and lining of the canals to the IS. The main canal from the intake is at the foot of the hill where corns are planted. Even during light rains, silts collapsing from the hills can clog the main canal. The IA is asking that these canals be converted to culvert pipe lines instead. LLPs tapping water from the river are used when water is not sufficient using 3 Hp diesel and gasoline engines. They operate at 12 hr/day/ha on average.

Naddungan CIS

The Naddungan CIS is also located Gattaran, Cagayan. It is an impounding type (Figure 1A-97) which traps runoff from the ephemeral Naddungan Creek. The dam (Figure 1A-98) was constructed in 1986 with a crest of about 25 wide and a service area of 112 ha. There is heavy siltation coming from the watershed due to kaingin and corn planted on steeply sloping lands. It has undergone dredging last 2014. The intake structure (Figure 1A-99) is covered and the gate opens to a 48-in culvert leading to the trapezoidal main canal (Figure 1A-100). The main canal is heavily silted especially in stretches where the canal passes through the foothills. A brush dam (Figure 1A-101) is located downstream of the main dam where it leads to a canal constructed by the IA themselves in 2012 using their own funds. The canal has dimensions of 0.9m wide 1.2m deep and 28m long. Water flow is very low during the visit and a pump set was being used to divert water into the canal. It services about 30 ha. NIA is set to continue the lining project of about 200 m canal and was staking the line during the field visit.

Figure 1A-97. The impounding reservoir filled with water lilies indicating heavy siltation
Source: Author's capture

Figure 1A-98. The impounding dam upstream (left) showing crest height increased by a few feet where the overflow water goes downstream (right) to the brush dam

Source: Author's capture

Figure 1A-99. The intake structure with cover (left); the intake gate inside

Source: Author's capture

Figure 1A-100. The outlet from the intake gate leading to the trapezoidal main canal

Source: Author's capture

Figure 1A-101. The brush dam now made of concrete and the rectangular lined canal constructed by the IA; water is pumped to the canal due to low flow

Source: Author's capture

Gumarang CIS

Gumarang Communal Irrigation System is located in the municipality of Marobbob in the province of Cagayan covering two barangays, namely, Marobbob and Gangauan. The project cost was about PhP 3.5 million when it was constructed in 1987 by NIA. But, the operation was only short live. It stopped its operation in 1995 due to a landslide calamity causing heavy siltation and damaged to the canal system. In 2007, NIA rehabilitated the system costing around PhP 4 million but, unfortunately, was damaged again by a typhoon. In 2013, NIA rehabilitated the system again incurring about PhP 7.1 million. But, instead of servicing 98 hectares, only 10 hectares are actually irrigated since about 2 kilometers of the canal was again damaged by a landslide. So, basically, there's no operation from 1995 to 2013. The IA is currently amortizing the loan with an annual remittance rate of PhP 55,000 for a period of 50 years.

Rice is the main crop irrigated with an average yield of 70 cavans per hectare during wet season and a higher yield of 1000 cavans per hctare in the dry season. The irrigated 10 hectares pump water from the canal to force water into their field since the level of water in the canal is lower. Thus, increasing their production cost by PhP 7,000 to PhP 9,000 per hectare per cropping season.

Garab CIS

Garab Communal Irrigation System is a small water impounding irrigation project constructed by NIA in 2013. It is located in the municipality of Iguig in the province of Cagayan covering 3 barangays, namely, Garab, Manaong and Ocampo. The overall project cost was P24,768,786.55. The system is not turn over yet to the IA which was re-organized in 2013. They opt to amortize the loan for a period of 50 years.

Rice is the main crop irrigated with an average yield of 80 cavans per ha for both wet season and dry season. During dry season, about 50% of the service area pumps water from STWs and creek as supplementary source of water during dry season.

Laguna

Maria Pelaez CIS

Situated in Baranggay Dila, Bay, Laguna, Maria Pelaez CIS was constructed on April 1988 that costs PhP 700,000 and was turned-over on the following year. The Irrigation System was funded by the Japan Bank International Cooperation (JBIC) under the Agrarian Reform Infrastructure Support Project II (ARISP II). Another project implemented by NIA includes repair and rehabilitation of the system, particularly the linings of the main canal, was on 2004 amounting to PhP 2M. Designed to service 86 hectares of land, Maria Pelaez CIS taps irrigation water from San Nicolas River. The intake (Figure 1A-102) has no permanent gate but a wooden slab or a corrugated GI sheet is used in case the intake is needed to be closed. Bamboos that is set just before the intake serves as strainer for the intake not to be clogged. The 1-m deep and 1-m wide main canal just after the intake is concrete-lined with "buhos" channel bed and concrete hollow blocks (CHB) side walls (Figure 1A-103). Water from main canal is then distributed through division boxes (Figure 1A-104) controlled by gates made of corrugated GI sheet. There are no scheduling of water deliveries are assigned however a water tender is assigned for closing the intake (whenever needed) and monitoring the main canals and turnouts. A map of the whole system (Figure 1A-105) was provided by the IA.

According to the IA, they hadn't experience yet shortage in water even when there is a prolonged dry spell. No supplementary irrigations like pumps are currently being used by any of their members due to more than enough supply of water. Flooding downstream is often especially during wet season. Installation of intake gate and replacement of turnout control gates are their concern as well for them to control their irrigation water better.

Figure 1A-102. The intake of the Maria Pelaez Communal Irrigation System
Source: Author's capture

Figure 1A-103. The 1-m wide, 1-m deep concrete-lined main canal of Maria Pelaez CIS
Source: Author's capture

Figure 1A-104. One of the division boxes of the irrigation system with corrugated GI as control gate
Source: Author's capture

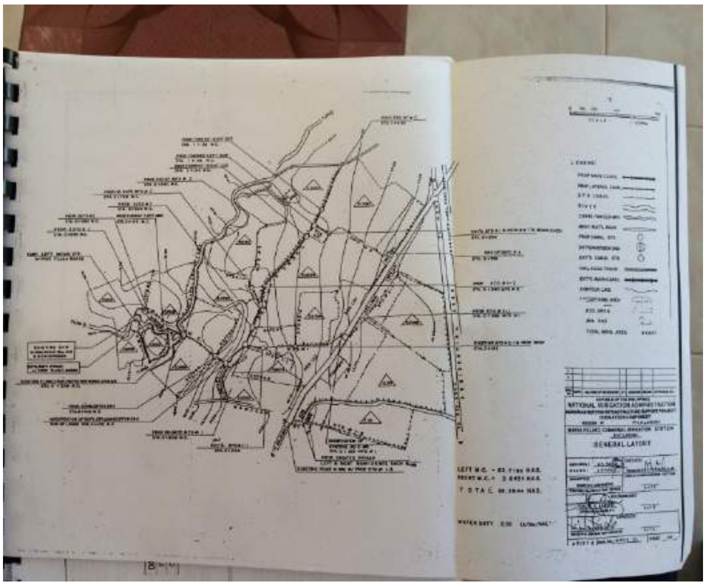

Figure 1A-105. A screenshot of a map of the whole area that is covered by Maria Pelaez CIS
Source: Author's capture

San Benito CIS

Funded by Japan Bank International Cooperation (JBIC) under the project of Agrarian Reform Infrastructure Support Program (ARISP II), San Benito CIS became operational on 2001. The CIS is located in the municipality of Victoria in the province of Laguna. With over 14 years of operation, the dam now has two sluice gates (Figure 1A-106) that are not operational and the reservoir of the dam is full of water lilies (Figure 1A-107). Another problem raised by the IA is that their steel gates and locks for the laterals were stolen (Figure 1A-108). Residential houses are also visible alongside the canal (Figure 1A-109), that is why wastes are directed on the main canal. Illegal turnouts directly tapped from the main canal (Figure 1A-110) are also one of the IA's concerns. Uncooperative and irresponsible members are the main problem of the IA. Whenever there is shortage of water, especially during dry season, LLPs are used as supplementary irrigation with a pump size of 3"-4" via 10-12hp diesel engines. In 4 months of cropping they usually pump water from their main and lateral canals once a month for 24 hours continuously for a 5 hectare field.

Figure 1A-106. The San Benito CIS Dam
Source: Author's capture

Figure 1A-107. Downstream portion of the dam that is full of water lilies
Source: Author's capture

Figure 1A-108. Lateral canal without gate and lock
Source: Author's capture

Figure A1-109. A drainage outlet of a house alongside of the main canal
Source: Author's capture

Figure 1A-110. Illegal turnouts directly tapped on main canal
Source: Author's capture

Balanga CIS

The City of San Pablo in the province of Laguna houses the Balanga Communal Irrigation System. The system has a firmed up service area of 36 hectares and is being run by the Balanga Irrigators' Association which was organized in 1977 and now consists of about 38 members. The association is paying loan amortization which amounted to 5 million pesos to the National Irrigation Administration. An irrigation service fee of 1,200 pesos per hectare per year is solely devoted to paying the yearly amortization and there are thirty more years to pay in the case of the Balanga CIS.

The main crop of the members is palay and the first cropping season would be the dry season that starts either in the month of February or March and ends in either the month of April or May. The second cropping season which would be the wet season would begin in either the month of May or June and ends in either the month of August or September. During the first cropping season, the average yield per hectare is 100 cavans with 1 cavan equal to fifty kilograms while a lower yield of 70 cavans per hectare on the average is harvested in the second season.

San Roque Pump CIS

San Roque Pump Communal Irrigation System is a pump irrigation system located in the municipality of Victoria in the province of Laguna. It gets its water from STWs constructed by NIA in the 1990s. The IA already paid-off the 30% equity. Currently, most of the old pumps units from NIA are now replaced with privately owned pumps.

Rice is the main crop irrigated with an average yield of 105 cavans/ha during wet season and a lower yield of 75 cavans per ha during dry season. Only half of 2000 ha service area is irrigated due to lack of water supply.

Maravilla CIS

Maravilla Communal Irrigation System is a gravity irrigation system located in the municipality of Magdelana in the province of Laguna. The system covers barangay Maravilla, Malinao and Alipit. The system was constructed through "bayanihan" effort with the assistance of the local mayor. In 2011, it was improved by NIA with a cost amounting to P1,159,000.67 in which the IA is paying an annual amortization of P80,000 for a period of 50 years.

Rice is the main irrigated crop with an average yield of 70 cavans per ha for both wet and dry seasons. This is relatively low yield even though the system have sufficient water supply for both seasons. Because they have sufficient water, the IA does not practice water scheduling.

Bañadero CIS

Bañadero Communal Irrigation System is a gravity irrigation system getting its water source from Bañadero River. It is located in the municipality of San Pablo in the province of Laguna. The system covers 3 barangays, namely, Santa Maria, Santisimo Rosario and San Isidro. It was constructed by NIA with a cost amounting to P7 Mn. The system is currently managed by Nagkakaisang Magsasaka ng Bañadero IA. The IA consist of 10% are landowners and 90% tenants. The IA opted to pay equity to start in 2016.

During the wet season, rice is the main crop irrigated. But, during dry season, aside from rice, various crops like “ampala”, “talong”, “okra”, tomato, “pechay” and “mustasa” are alos irrigated. Rice have a relatively good yield averaging at 100 cavans per ha during both wet and dry seasons. The IA only collects annual dues since there are yet to start their amortization next year. The collected fund is allocated for O&M and annual water rights fee.

Occidental Mindoro

Bongbongan CIS

Situated in the municipality of Calintaan from the province of Occidental Mindoro, Bongbongan CIS taps its water from Anahawin River. The Bombonga CIS dam (Figure 1A-111) was constructed on 1995 with the help National Irrigation Association. From Anahawin river, the water upstream is diverted (Figure 1A-112) to the dam’s intake. The 2.5-m wide and 3-m deep concrete-lined main canal (Figure 1A-113) are silted with a lot of bushes grown inside it. Some part of the main canal is unlined (Figure 1A-114). Lateral canals are also unlined. Clearing operations after heavy rains are burden to the IA, they are requesting backhoe and bulldozer because their main canal collapsed result. Lining of main canal and delinquency of its members are also the concern of the IA. Privately-acquired, 7.5hp diesel engines for STWs and LLPs are used as supplementary irrigation by some members. Four-inch pumps are used for both. For a 110-day cropping period, STWs and LLPs average usage/day/ha are 4hrs at thrice a week/cropping and 5hrs at twice a week/cropping respectively. River, swamp and main canal are the sources of water for LLPs.

Figure 1A-111. The Bongbongan CIS Dam
Source: Author's capture

Figure 1A-112. Water diverted from Anahawin River to the intake
Source: Author's capture

Figure 1A-113. The 2.5-m wide and 3-m deep concrete-lined main canal
Source: Author's capture

Figure 1A-114. Unlined main canal
Source: Author's capture

Batasan CIS

Batasan CIS was established on early 1980s in San Jose, Occidental Mindoro. Having their first mini dam damaged (Figure 1A-115), the National Irrigation Association helped the Samahang Magpapatubig ng Batasan Incorporated Irrigator's Association put up a new dam last 2014 (Figure 1A-116). With just months from its construction, two sluice gates are already broken (Figure 1A-116) and the other 3 gates are nearly broken. Diesel engines (Figure 1A-117) are used to operate the gates but since it was broken and costly, they rarely use them. Part of the main canal inspected was completely broken (Figure 1A-118) by typhoon Glenda that decreases their water delivery efficiency. The 1-m wide and 1-m deep lateral canal is well-maintained. The concern of the IA is the broken main canal and the lining of some lateral canal. Privately-acquired and DA-granted, 8hp diesel engines for STWs and LLPs are used as supplementary irrigation by some members. Four-inch and 3-4" are used for LLPs and STWs respectively. For a 110-day cropping period, STWs and LLPs average usage/day/ha are both 8hrs at twice a week/cropping. River and creek are the sources of water for LLPs.

Figure 1A-115. The former Batasan CIS dam that was broken
Source: Author's capture

Figure 1A-116. The Batasan CIS dam that was only built last October 2014
Source: Author's capture

Figure 1A-117. Diesel engines used to control the sluice gates
Source: Author's capture

Figure 1A-118. Detached Main canal due to typhoon Glenda
Source: Author's capture

New Ilocos Tamaraw CIS

Being one of the CIS in Barangay Poypoy, Calintaan, Occidental Mindoro, New Ilocos Tamaraw CIS, like Bongbongan CIS, taps its water from Anahawin River. Constructed in 1975, the CIS became operational on the same year. Privately-acquired and LGU-granted, 7hp diesel engines for STWs and LLPs are used as supplementary irrigation by some members. Four-inch pumps are used for both. For a 110-day cropping period, STWs and LLPs average usage/day/ha are both 6hrs at once a week/cropping. River, swamp and main canal are the sources of water for LLPs.

Manuot CIS

Manuot Communal Irrigation System is a gravity irrigation system located in municipality of Rizal in the province of Occidental Mindoro. The system gets its water source from Busuanga River. It was constructed by NIA in 1990 with a cost amounting to P6 Mn. The system is managed by Amaling Manuot IA with members who are all landowners. The IA opted to pay the 30% equity.

Rice is the main crop irrigated with an average yield of 140 cavans/ha for both wet and dry seasons. During dry season, only 315 ha are irrigated out of the 535.15 has. This is mainly due to lack of water supply during dry season. To cope up from this problem, about 150 ha pump water from the STWs.

Limlim CIS

Limlim Communal Irrigation System is a gravity irrigation system located in municipality of Rizal in the province of Occidental Mindoro. The Barangay Rizal Rizal Occidental Mindoro IA is the one currently managing the system. The IA was not able to use the canal system constructed by NIA since it was damaged by a typhoon during its construction. They are still waiting for the completion of the project.

Rice is the main crop irrigated with an average yield of 100 cavans/ha during wet season and 110 cavans per ha during dry season. Other crops like corn, tobacco, mongo, onion, peanut & sweet potato are also irrigated during wet and dry seasons. During dry season, about 76 ha pump from STWs due to lack of water supply.

Monteclaro CIS

Monteclaro Communal Irrigation System gets its water from Kayakyan River. It is a gravity irrigation system located in municipality of San Jose in the province of Occidental Mindoro. It was constructed by NIA in 1980 with a cost amounting to P1.2 Mn. NIA, then, improved the system in 2014 incurring a cost of P5 Mn. The IA is currently paying the yearly loan amortization of about P100,000.

Rice is the main crop irrigated with an average yield of 100 cavans/ha during wet season and 125 cavans during dry season. Other crops like corn, onion and garlic are also irrigated during dry season. During dry season, about 50 has pumps from the river, canal and STWs as a mode of supplementary irrigation

16.1B. Highlights of Interviews with IA Officials and Members and Walkthroughs of the Sample Communal Irrigation Systems in Visayas

Bohol

Gabayan CIS

Gabayan CIS gets water from Gabayan river. The system has 290 ha firmed-up service area (FUSA) and covers 7 barangays namely Tubod, Anoling, Pagahat, La Union, San Isidro, Lungsudaan, Panadtaran, Buyoan and Poblacion, in the municipality of Candijay, Bohol Province. The system started its operation in 1982 and turned over by NIA to Candijay-Gabayan Irrigator's Services Association on December 20, 1982. At present, the association has 350 farmer-members.

IA officials and governing board are chosen by consensus among the members and have a 2-year term. They are not compensated for their positions. Only the collector from each sector received incentive of 15% of each total collection. The Local Government Unit (LGU) of Candijay took over in collecting irrigation service fee (ISF) but later turned-over to IA due to low collection rate. They also provided assistance in rehabilitating and desilting of lateral canals.

Before the passage of Free Irrigation Service Act (FISA), the association allocated ₱50,000 per year for loan repayment from the ISF collected from the members. IA officials had a hard time collecting ISF as farmers argued that they did not receive irrigation from the canal. They have a balance of ₱12 M that was condoned by the implementation of FISA. Currently, the IA allocated the ISF for the operation and maintenance of the system. However, more farmers no longer pay the ISF.

The dam (Figure 1B-1) was built in 1982 and is still fully operational with some rehabilitations done on the intake gate and several turnouts. About 4.5 km of the main canal and some portions of the lateral canals are lined (Figure 1B-2). There is minimal siltation observed although the inverted siphon passing underneath a creek was clogged preventing the conveyance of water from the main canal to about 40 ha downstream. The IAs wants NIA to use GI pipes to convey the water over the bridge instead to continue servicing water in the affected farms. The river has enough water to irrigate all the service area as long as there are no broken or nonoperational canals. Water flowing to Kanumantad falls comes from the dam so when the intake gate is fully opened, no water flows on the falls. Some farmers use pumps to supplement water from the system. Saline intrusion and sedimentation are also problems encountered by the farmers in the downstream sector. The IA suggests to complete concreting of canal lining and desilting of Gabayan river.

Figure 1B-1. The main dam of the Gabayan CIS
Source: Author's capture

Figure 1B-2. The main canal of the Gabayan CIS
Source: Author's capture

Figure 1B-3. Proposed alternative conveyance to the damaged inverted siphon of Gabayan CIS

Source: Author's capture

Loboc Groundwater IP

The Loboc Groundwater Irrigation Pump provides water to the members of the Oy Multipurpose Cooperative in Loboc, Bohol. It has a total of 20 ha FUSA with 119 members. Well drilling started in 2009 and the system with the first reservoir was turned over in 2011. A new reservoir was added in 2017. The first well drilling was unsuccessful and so drilling was transferred to the current site. The current IAs do not know the actual depth of the well but they use a 2 Hp submersible pump. The water from the system was also tested for its quality but it failed and not safe for drinking, indicating that the aquifer source is just shallow.

This system has two pump sources. When an earthquake hit the area, one of the well source lost water probably the supply of water into the aquifer in that area was blocked during the earthquake. It can still be used now but it is not sustainable so the IA decided to schedule the supply of water. The water supplies two hours in the morning at 6-8 AM, and two hours in the afternoon at 4-6 PM. The electricity cost of the pump when there are crops is about ₱3,000 per month. The main use of this pump system is for domestic use. Irrigating 20 ha of high value crops – corn, eggplant, and cacao during wet season is just secondary. During dry season, it can only irrigate about 5 ha of the service area. The irrigation of the rice field is the tertiary purpose of the system. Members paid ₱20 per m^3 before but with the passage of FISA the cooperative decided to reduce it to ₱15 per m^3.

The water from the well is pumped to two concrete reservoirs located on top of a small hill (Figure 1B-5), and water is distributed by gravity to its intended use. The pipeline is 1200 m to the service area. Only one reservoir was originally built but was deemed not enough so another reservoir was built in 2017.

Figure 1B-4. The well source of Loboc Groundwater IP showing the two reservoirs
Source: Author's capture

Figure 1B-5. The main (2m x 2m) and additional (2.5m x 2.5m) reservoirs of the system
Source: Author's capture

Cambuyo CIP

The Cambuyo CIP can be found in Brgy Cambuyo in the municipality of Garcia-Hernandez. The system was managed by Cambuyo Irrigators Association which was organized in 1984. The IA has a 120-ha service area which are devoted to irrigated rice. The construction of the diversion dam started in 2012 (Figure 1B- 8) and became operational the following year. Canal lining was constructed in 2017.

The source of water of the CIS is the Ughuban Spring (Figure 1B-6) which spills to become the Ugbuhan Creek. There are actually two springs connected by solution channels underground. The spring discharge is quite high and can service the domestic water supply of the adjacent barangays, the High School in the area and some other private uses (Figure 1B-7).

During heavy rains or typhoons, the water from the spring as well as the creek above overflows adding water to the main source. The service area of the system is 120 ha but the farmer-members continually build and develop terraced paddies in the area. The IA used a ram pump for some of their service area. The main and some of the lateral canals of the CIS is lined and already concreted.

Figure 1B- 6. Ughuban spring, the source of water of Cambuyo CIP. The depth of the pipe in the source is 40 ft

Source: Author's capture

Figure 1B- 7. The three pipes also tapping water from the spring to provide water for the barangay (6”), ram pump for the High School (3”), and a private service area (3”)

Source: Author's capture

Figure 1B- 8. The diversion dam of the Cambuyo CIP
Source: Author's capture

Leyte

Maljo CIS

The Maljo CIS in Inopacan, Leyte serves farm areas in barangays Maljo, Esperanza and Jubasan. The Maljo, Esperanza and Jubasan Irrigators Association, Inc (MEJIA) was organized and started its operation in the 1960s with the construction of the original dam and irrigation system (Figure 1B- 10). The IA was registered with SEC in 2010 and currently has 108 farmer-members. They were awarded as the regional outstanding IA for the CIS category in 2017. The system gets water from Taon-Taon river and has a 46-hectare service area devoted for irrigated rice.

IA officials and governing board are elected for a one-year term and they are compensated the amount of ₱300 per month. The water tender and dam caretaker also received payment of ₱200 each per month. The association assigned a collector to prepare the billing and collect the payment of annual dues amounting to ₱50 and association service charge (ASC) amounting to ₱1,000 per ha. This amount was fixed after the enactment of the FISA. Before FISA, the IA charge 1.2kg per cavan for each member per cropping season. Members paying on-time received 5% discount while the collector received 10% of the total collection. Collection rate of the association is 100%. Even before the passage of FISA, the association was already fully paid of its financial obligation to NIA.

Aside from the ASC, the association also had other sources of income. They rented out their farm equipment/machineries and sold certified seeds and commercial fertilizers to members and non-members of the association. They also strictly implement their by-laws particularly provisions on water allocation and delivery. No water request, no water delivery. Violators will be penalized by ₱2,500 per hectare.

The current dam was constructed in 2012 (Figure 1B- 9) upstream of the original dam and the new main canal was constructed along the original main canal, using the old concreted side walls as support. The dam has a duckbill-type weir to increase crest length and reduce backwater flow effect with increase in flow. This is necessary to prevent flooding in nearby farms during high water flows which frequently occur in the area.

The association plans to extend the coverage of the service area to Brgy. Taon-Taon which will cover additional 15-20 ha with a proposal for a new diversion dam downstream. They currently use a temporary brush dam in the proposed site.

Figure 1B- 9. The new dam of the Maljo CIS constructed in 2012. It is a run-of-the-river type dam with a duckbill crest

Source: Author's capture

Figure 1B- 10. The original dam constructed in 1960 downstream of the new site. The main canal of the new dam is seen on the right side

Source: Author's capture

Tagbawto CIS

Tagbawto CIS is in the municipality of Hilongos is a gravity irrigation system with FUSA of 723 ha covering seven barangays namely, Concepcion, Liberty, Tejero, Manaul, Campina, San Roque and Eastern. The system gets water from Tagbawto and Hilusig rivers. The system is managed by Tagbawto-Hilusig Communal Irrigators Association, Inc with current member of 405.

The IA is strongly supported by the LGU of Hilongos e.g., it aided with the rehabilitation of canal lining with the budget coming from the Quick Response Fund (QRF) of the LGU (Figures 1B-11 and 1B-12). The IA officials also think that the LGU could manage the irrigation system.

The CIS has two dams, one of which is already operational (Figures 1B-13 and 1B-14) while the other is under-construction. The diversion dam spillway, aprons, sidewalls and sluice gates are all properly maintained and in good conditions. There is visible sedimentation in the storage area of the dam but since the water is still enough to service the required water of the CIS, no dredging is being done by the IA (Figure 1B- 15).

Another dam is being constructed downstream to service an additional 100 ha. The construction of the dam started September 2017 and the expected date of completion was May 2018 (Figure 1B- 16). However, the construction was stopped since there is no more budget allotted. The association also have to negotiate for the right of way during the construction of canal. The start of dry cropping season was already delayed due to the dam construction.

The governing board are elected by consensus among members. The board of trustees (BOT) will then select the officers of the association. They can serve the association for 3 years and can be re-elected for 2 terms. Officials received compensation of ₱300 per meeting. The assigned collector per sector prepares the billing and collects the irrigation fee of ₱1,200 per member. Collectors received 10% of the total collection. Water master and gate keeper are paid ₱2,000 and ₱1,000 per month, respectively. Before the passage of FISA, the association allocated 60% for loan amortization and 40% for operation and maintenance of the total irrigation fee. Officials believed that they are now underfinanced with low collection rate of 30% due to the implementation of FISA. Some members stop paying the irrigation fee. They impose higher penalty for delinquent member amounting to ₱2,500.

Figure 1B- 11. Main canal of Tagbawto CIS with width of 100 cm and height of 80 cm
Source: Author's capture

Figure 1B- 12. Ongoing canal construction with width of 2 m and depth of 1.25 m
Source: Author's capture

Figure 1B- 13. The diversion dam of Tagbawto CIS with a width of 100 m
Source: Author's capture

Figure 1B- 14. Two steel gates of the dam which measured 1.5 m each
Source: Author's capture

Figure 1B- 15. Dam site showing that dredging is not practiced
Source: Author's capture

Figure 1B- 16. Construction of the new dam
Source: Author's capture

Sta. Elena CIS

The Sta. Elena CIS in Tanauan, Leyte provides water to the members of the Sta. Elena Irrigators Service Association which was organized on January 1, 1996. The IA get its water from Kiloon Creek. The system has a 112 ha FUSA and covers the barangays of Sta. Elena, Cabarasan-Guti and Guindadg-an.

The original temporary brush dam was constructed in 1996, but the current dam was constructed in 2011 and became operational the following year. The dam is a buttress dam and is technically a reuse dam of a NIS upstream (Figure 1B- 17). The dam has no steel spillway gates provided so the IAs used planks made of coco lumber to hold and raise the water to canal level (Figure 1B- 19). New steel gates are said to be installed this July 2018. A wing wall of the dam is being repaired when the team visited. Main canals are lined and cemented (Figure 1B- 19).

The system and the association were severely affected by Typhoon Yolanda in 2013. International organization like International Labor Organization (ILO) provided cash for work program with about 100m of lateral canal constructed during the program. Excess money was used by the association to purchase a computer. The US Agency for International Development (USAID) donated the storage house, solar dryer and the office of the association. They also received farm equipment/machineries from the Department of Agrarian Reform and the Italian government. Free seeds and fertilizers were provided by the Department of Agriculture.

The president and the governing board of trustees (BOT) are chosen by consensus among the members and have a 3-year term. IA Officers and BOTs are not compensated for their positions. The treasurer/secretary prepares the billing while sector leaders collect the irrigation service fee of ₱1,000 per ha before the passage of FISA. Sector leaders received 10% of the total collection collected to their sector. With FISA, the association initially reduced the fee to ₱700 until they decided to finally reduce it to ₱500 per ha. Collection rate also decreased from 60-80% before to 20% after the FISA was implemented.

The association relied on other sources of income like rental of farm machineries such as thresher, tractor, water pump, as well as the rentals of solar drier and storage house. Sector leaders also waived their incentive in collecting the irrigation fee in order to have adequate funds for the operation and maintenance of the system. The association do not have much support from the local government due to politics.

Figure 1B- 17. The buttress dam of Sta. Elena CIS. The IAs use wooden planks since no steel gates were installed

Source: Author's capture

Figure 1B- 18. Intake of Sta. Elena CIS going to the main canal
Source: Author's capture

Figure 1B- 19. Main canal of Sta. Elena CIS
Source: Author's capture

Iloilo

Particion PIS

Particion Pump Irrigation System is located in the municipality of Guimbal. The system has a 50 ha FUSA and managed by the Particion Pump Irrigators' Association, Inc. The IA was organized in the 1970's with a current member of 34.

The CIS pumps water from Igcocolo Creek (Tangyan River) and was built in 2013. The main canal and some laterals are lined with a few remaining earthen canals. The original submersible pump was a 35 Hp Ebara pump powered by 3-phase electricity. The system even has its own transformer. Unfortunately, it was later found out that there were no conductors or circuit breaker to prevent damage from power surges, so the wires and the pump were damaged in 2015 and is currently nonoperational. The association paid ₱70,000 for repair and also later found out that the unit provided to them by the contractor was second-hand. They can also no longer locate the contractor. As remedy, the NIA provided a diesel-engine submersible pump to the IA. The association used the pump 8 hours a day especially during dry season when water from the river is scarce. This resulted to higher fuel cost increasing total production cost and decreasing net profit of the farmers. The association already prepared a resolution for the rehabilitation of the system.

The governing board are elected by consensus among members. The board of trustees (BOT) will then select the officers of the association. They can serve the association for 2 years and can be re-elected for 2 terms. Officials are not compensated in their position.

Before the FISA, the treasurer or BOT collects operation management fee of ₱10 per cavan for each cropping season from each member. Collection rate is 100% of which 25% is allocated to O&M and 75% for loan amortization. With the passage of FISA, the association reduced the management fee to ₱5 per cavan. Officials are worried that some members will stop paying management fee so the O&M budget was reduced.

Figure 1B- 20. Main canal of the CIS
Source: Author's capture

Figure 1B- 21. The 10" pipe connected to the original pump that delivers water to the main canal
Source: Author's capture

Figure 1B- 22. The 10" pipe (a) connected to the original pump and the 6" pipe (b) connected to the alternative pump

Source: Author's capture

Figure 1B- 23. The transformer for the submersible pump of the CIS

Source: Author's capture

Tumagboc CIS

Tumagboc CIS in Miag-ao, Iloilo is managed by the Banbanan, Aguianan, Cubay, Tan-agan Irrigators Service Association (BACTISA). The association was organized in 1970's and currently have 115 members. The source of water of the system is the Tumagboc River. The new run-of-the-river ogee dam (Figure 1B- 24) was actually the third dam built upstream of the first two. The original dam was built in the 1970s which was rehabilitated to create the second dam in 1980. However, it was damaged by typhoon Undang. The current dam was constructed in year 2000. The inlet and main canal of the current dam is partially covered by a road widening currently being done by the DPWH, decreasing the conveyed water into the system. Main canals of the system were all lined (Figure 1B- 25) but they have problems of small diameter culverts underneath roads leading to clogging and hence low and interrupted flows downstream. Last May 2018, a new lined lateral canal was built servicing an additional 5-ha field (Figure 1B- 26).

The president and governing board are elected by consensus among members with a 2-year term. Officials are not compensated in their position. The BOT prepares the billing and collects irrigation fee of ₱670 for each member. Ten percent of the total collection is the incentive of the collector of irrigation fee. Collection rate is 70% of which 10% is they allocated for O&M and 90% for the loan amortization. With the implementation of FISA, IA officials planned to reduce the irrigation fee to ₱200.

Figure 1B- 24. The Tumagboc CIS dam affected by a road construction on the left
Source: Author's capture

Figure 1B- 25. Main canal of Tumagboc CIS with width of 60 cm and depth of 60 cm
Source: Author's capture

Figure 1B- 26. The newly built lateral canal of the system
Source: Author's capture

Siwaragan CIS

The Siwaragan CIS in San Joaquin, Iloilo has a FUSA of 197 ha covering 6 barangays namely Kadulduan, Siwaragan, Igburi, Baybay, Poblacion and Mayunok. The system was constructed in 1980 and started its operation a year after. It was managed by Siwaragan Irrigators' Association organized in 1979 with 244 current members. The IA gets water from Siwaragan river.

The original service area is about 238 ha but water cannot reach downstream sites (Camarin to Siwaragan) because there is an ongoing construction in the area. Previous construction was unsuccessful since the canal cannot convey the capacity of the Mayonoc (Suba River) but during the visit, the canal was already operational. The system also has an elevated flume (Figure 1B- 27) conveying water from the main canal over a depression 100 m in length but the flume has a smaller capacity than the main canals it connects (Figure 1B- 28) causing water to overflow and reducing the water delivered downstream. The association did not sign the completion of work of the contractor of the project. They argued that the contractors did not follow the specified designs indicated in the contract. They already brought the issue to the regional office of NIA to take applicable actions.

IA officials and governing board are chosen by consensus among the members and have a 3-year term. Officials are compensated ₱20 per month. Treasurer prepares the billing while the sector leader collects 2 cavans per hectare per cropping season as irrigation fee. Ten percent of the total collection is paid to water tender. Sector leaders are also compensated 15% of the collection from their sector. Collection rate is 100% which the association allocated 25% to operation and maintenance and 75% to loan amortization. With the passage of FISA, officials of the association are worried that members will no longer pay the irrigation service fee.

Figure 1B- 27. Elevated flume of Siwaragan CIS
Source: Author's capture

Figure 1B- 28. Connection of the main canal and the elevated flume showing the difference in width and height

Source: Author's capture

Capiz

Maayon CIS

Maayon CIP is a relatively large gravity irrigation system serving farms in seven barangays of Maayon namely Alayunan, Batabat, Poblacion Ilaya, Salgan, Piña, Poblacion Ilawod and Fernandez, and two barangays Cabugao and Cabangahan in Panitan. The system has a FUSA of 592 ha and managed by the Maayon-Panitan Irrigators Association (MA-PA), Inc. The IA was organized in 2003 when the original dam was built and now consists of 874 members. The new dam (Figure 1B- 29) was constructed starting in 2010 and turned-over to the IA in 2017 with a total project cost of ₱201,450,000.00 divided into three phases. The association availed 10% equity payable in 50 years.

The CIP has a 12-km main canal and all but a few stretches are not lined yet, although there are several concrete control gates within the system (Figure 1B- 30). The design service area was 780 ha and the IA is working out for the right of way on Poblacion Ilaya to allow the construction of line canal to traverse it to Poblacion Ilawod and Fernandez. There are also some parts where the main and lateral canals are not connected yet. The system still has sufficient water even during summer. Since the main and lateral canals are unlined, they are easily damaged by strong flows. There are also two sluice gates on the dam but only one machine is fully functioning to operate them. The dam is not silted, and dredging is not needed.

The president and governing board are chosen by consensus among the members and have a two-year term. Officials are not compensated in their positions. The association only started to collect 2-cavans per hectare as irrigation service fee last cropping season in 2017. The system only became operational that year. Only 50% is the collection rate of the association.

The passage of FISA was very timely to the operation of the newly constructed dam. Loan amortization was condoned and the association allotted its ISF to O&M. Officials are worried that collection rate for the next cropping season will be lower than the current rate and they are contemplating on implementing a fix-rate of ₱1,000 per ha this coming season upon approval of its members.

The association will request to NIA the concreting of the main and lateral canals. Officials of the association admitted lack of support from the local government unit.


Figure 1B- 29. The dam of Maayon CIS
Source: Author's capture


Figure 1B- 30. The unlined main (left) and lateral (right) canal with some control structure
Source: Author's capture

Salcedo CIS

Salcedo CIS in the municipality of Dumarao is managed by the Salcedo-Cubi-Pob. Ilawod IA, Inc. The water source is the Maliaw Creek and serves 128 ha covering Barangays Salcedo, Cubi and Poblacion Ilawod. The dam was constructed in 1972 through Farm System

Development Council (FSDC). Rehabilitation and riprapping was conducted in 2013 and 2015, respectively.

The dam is already silted although water is not limiting. Every cropping, the IA cleans and removes the grass, plants, and other flow obstruction in the canals. Some portion of the main canal are still not lined. A box-type underground canal from the dam inlet gate to the main canal was built in 2017 and completed last March 2018.

The association was organized in 1978 and currently consists of 117 members. IA officials and governing board are elected by majority of the members. They can serve for 2 years and can be re-elected for 3 consecutive terms. They are also compensated ₱100 per month. The association collect annual dues of ₱20 and irrigation fee of 2 cavans per ha. The treasurer prepares the billing while the sector leaders collect the fee. Ten percent of the total collection is paid to the water tender. Sector leaders are also compensated 15% of the collection from their sector. Although the collection rate is between 70-80%, the association allots 25% to O&M and 75% to loan amortization. Members paying on time were given certificate of recognition during their annual Christmas party celebration.

Even before the passage of FISA, the association was already fully paid and received recognition from NIA. The association also received farm machineries from the Department of Agriculture.

Figure 1B- 31. Dam of Salcedo CIS
Source: Author's capture

Figure 1B- 32. Main canal of Salcedo CIS
Source: Author's capture

Figure 1B- 33. Lateral canal A and division box of the system
Source: Author's capture

Sigma Sur PCIS

The Sigma Sur PCIS pumps water from the Mambusao River to irrigate 35 ha FUSA covering Barangay Poblacion Sur. The system was installed in 2004 and at the same year became operational. The pump is a 6”x6” centrifugal pump (Dynaflo) driven by a 4DR5 (Isuzu) diesel engine. This system replaced the original Kirloskar pump and engine, which was working until 2017. The IA uses the pump for a maximum of 14 hours per day starting at 5 AM until 9 PM when it should be stopped in consideration of the noise it produces since the pump is located at a crowded neighborhood. The engine oil is changed every 25 days using about 6 L of oil. The machine also consumes 3L per hour of diesel fuel. There is a 2.5 km lined canal connected to a 2 km earthen canal on the field.

The IA officials and governing board are elected by the members with a 2-year term and a maximum of 2 terms. They are not compensated in their position. The IA paid the pump operator a ₱30 per hour rate. They also implement a “no receipt, no water” and “first come, first serve basis” policy for the water distribution and delivery. Members shouldered the fuel expense for the irrigation of their respective rice fields. They also paid annual dues and irrigation fees which they paid to the treasurer. They strictly implement these provisions in their by-laws hence, collection rate is 100%.

Before FISA, the irrigation service fee charged to members is 2 cavans per hectare per cropping season. The IA allocated 60% of the total irrigation fees to O&M of the pump and line canals and 40% to loan amortization. With FISA, the association continued to collect irrigation fee allotted only for O&M. They decided to have a fix rate of ₱800 per cropping season. The association plan to convene to reduce the current irrigation fee to ₱500.

The IA received funding from the Countryside Development Fund of a politician in concreting certain portion of lateral canal and housing of the pump. They are proposing to NIA another project for the concreting of 400 m line canal which will irrigate an additional 7 ha. Among the issues encountered by the IA are the conversion of agricultural land area to commercial land and flooding. The rice fields of the members of the association are located in flood-prone area. Some of them availed crop insurance while others can’t afford it.

Figure 1B- 34. The 6” suction pipe used in drawing water from the Mambusao River
Source: Author's capture

Figure 1B- 35. The centrifugal pump and the diesel engine of the Sigma Sur PCIS
Source: Author's capture

Figure 1B- 36. The main canal of the system as the canal emerged from an inverted siphon across a road
Source: Author's capture

16.1C. Highlights of Interviews with IA Officials and Members and Walkthroughs of the Sample Communal Irrigation Systems in Mindanao

Davao del Sur

United Farmers Association, Inc. (UNIFARM CIS)

UNIFARM CIS is a relatively large IS with a FUSA of 400 ha covering Barangays Marber, Sto. Niño, Linawan, Dolo, and Rizal, in the municipality of Bansalan. It has a total of 3 diversion dams drawing waters from Matanao River, Darapuay River, Dolo River, and Marapangi Creek. Four CIS are drawing water from the Matanao river upstream of Unifarm CIS. The original dam was a brush dam constructed in the 1960s by Ilocano settlers, which was then concreted in the 1970s through the FSDC, before the current dam was constructed by NIA in 1993. The repair of the current dam, construction of a new dam upstream, canal lining, and the provision of an elevated flume to join the two systems, were done in two tranches 2009 and 2015. The third dam upstream was not visited due to security issues. The whole system is managed by the United Farmers Association Inc. which currently have a total of 360 farmer-beneficiaries whose main crop is rice.

The 1-m high Marapangi dam (Figure 1C-1) is already filled with sand and rocks and the sidewalls and downstream apron were damaged by boulders that were washed downstream during frequent floods. According to the IAs, this is caused by the denuded forest watershed. The IAs conduct regular dredging of the dam and main canal. The water drawn from Matanao dam (Figure 1C-2) located upstream and the third dam (further upstream) is conveyed through a lined canal, passing through a 1m x 1m elevated flume (Figure 1C-3), and converging with the main canal of Marapangi dam. Some ripraps protecting the bench flumes were damaged by the floods 3 days after construction was completed (Figure 1C-4). The IA also added a side weir to prevent overflow of water from this main canal, which usually floods adjacent Durian farms (the IA paid about ₱60,000 to the durian farmer in one flood event). Most of the main and lateral canals are lined. During prolonged dry spells, the IAs have several centrifugal pumps that members can use to support irrigation. Members pay ₱700/ha for O&M fee.

The IA reported that they're already fully-paid with their loan even if it costs a lot. They used to allot ₱378,000 annually for loan repayment getting its budget mainly from collection fees, but also from assistance by the provincial government and some politicians. Their office building, in fact, was constructed with the assistance of a politician.

To assist in the management of the IS, the IA President and board members are chosen every two (2) years by the General Assembly. They have no monthly salary but they are paid every time they attend a meeting scheduled by the IA. Only the water master has a monthly salary which is ₱3,000 per month. The treasurer/collector, on the other hand, gets 12% of the total collection of the ISF. Every collection period, an average of 98% of members pay for their dues. When asked for their financial strength, the IA members stated that they are completely and sufficiently financed. They are able to maintain their irrigation systems. They reported, however, that their dam is too old and some of their canals remain unlined and thus, sometimes the water distribution is affected. The IA suggested that more subsidies and assistance be given to them to resolve their problems with regards to cropping and irrigation.

Figure 1C-1. Marapangi Dam of Unifarm CIS showing sedimentation and damaged downstream apron of the dam

Source: Author's capture

Figure 1C-2. Matanao Dam of Unifarm CIS

Source: Author's capture

Figure 1C-3. Elevated flume from Matanao dam
Source: Author's capture

Figure 1C-4. Riprap of bench flume damaged by floods
Source: Author's capture

New Katipunan CIS

The New Katipunan CIS has a 100 ha FUSA in Barangay New Katipunan, Matanao, Davao del Sur. The CIS draws water from Bacungan Creek and Sapa Maloni. Even during summer, water in the dam does not dry up but there are areas that cannot be irrigated so the IA pumps water from Balatukan and Blucon Rivers.

The dam (Figure 1C-5) was built in 1979 and started operation a year after. After completion of the project, however, problems emerged including no steels and unstable trapezoidal canals. Many parts of the main canal are still unlined and there is a broken section in the lined part (Figure 1C-6). The system was turned over to the IA in 1990. It is managed by Latale New Katipunan IA and at present have 81 rice farmer-beneficiaries.

The IA practiced cleaning of the dam every before flooding season. Some parts of the dam are still deep and some parts are filled with sediments, though dredging is not practiced. Cleaning of the main canals and trimming of the grasses are done every May to June. The IA avoids the use of herbicide since the soil will erode into the canals. The IA owns non-self-priming pumps with ratings of 8 hp, 10 hp, and 12 hp (Figure 1C-7).

The IA officials and governing board are chosen by the General Assembly every year. A new set of officers is elected annually, including the President, Vice President, Secretary, Treasurer, and five (5) Board of Directors (BOD). Officials are compensated based on the total gross income per harvest of the whole IA, e.g., the President gets 3%, and the Treasurer and Secretary gets 5% of the total gross income from rice yield per cropping of the whole IA. Members of the BOD are paid a fixed amount of ₱ 3,000 per ha.

Before the passage of Free Irrigation Service Act (FISA), the association collects 2 cavans (60 kg/cav) per ha of each. The selling price of rice in the area is usually ₱22/kg. Every year, the IA allots ₱12,000 for loan amortization. The rest goes to salaries of officials and O&M of their irrigation system. Even though all members pay their fees every cropping, their financial capacity is still inadequate. The IA said that they have enough funds to maintain key structures but have insufficient funds to do much of the regular maintenance of the IS. Among the problems and issues reported by the IA access to funds for O&M and rehabilitation, access to production credit, and quantity and timeliness of water. The IA also wants a new supplementary dam for irrigation support.

Figure 1C-5. The dam of New Katipunan CIS with the head gates
Source: Author's capture

Figure 1C-6. The unlined and broken portions of the main canal
Source: Author's capture

Figure 1C-7. The pumps of the New Katipunan Irrigator's Association
Source: Author's capture

Butilon CIS

Butilon CIS, in Magsaysay, Davao del Sur, draws its waters from Butilon Creek and serving a FUSA of 40 ha, covering Barangay Cabasagan. The CIS is managed by Butilon IA, Inc. with 45 rice farmer beneficiaries as of July 2018. The water delivered is not sufficient even in the rainy season though the dam does not dry up completely during summer season. The IA rents a pump for ₱100.00/hr. When there is too much rain during the rainy season, water on the dam overflows flooding the area near the dam. The watershed is said to be already denuded with the creek carrying much floating debris and causing siltation in the dam.

The old dam, built through FSDC in the 1980's, was an ogee-type dam with a wooden plank serving as the gate. After the rehabilitation in 2013, the buttress dam with a sluice gate was constructed (Figure 1C-8), the upstream and downstream apron and side walls were extended, the spillway and intake were repaired, additional concrete lining of 4 km of canal, and a rest area for the water master above the dam was added. The rehabilitation cost a little less than ₱8 M, and complete turn-over to the IA was done in 2015. The previous screw-type sluice gate was then replaced by the IA with a chain block for faster lifting costing them ₱4500. The main canal (Figure 1C-9) is lined but the lateral canals of the system are still earthen.

The President and other IA officials as well as the governing board, are elected every year by the General Assembly. All IA officials are not compensated because they considered the work as public service. Before the passage of the FISA, the IA collects 150kg/ha/season from members. Annually, ₱75,000 is allocated for loan repayment/amortization. Only around 80%, however, are able to regularly pay their dues and the percentage goes even lower if harvest is lean. About ₱1000/ha per season is collected for O&M of the system. With regards to their financial capacity, the IA members said that they are underfinanced and they recently created a resolution seeking assistance from NIA. Common problems stated by the IA include access to funds for rehabilitation, access to production credit, and insufficient water. The IA requested lining of canals, water pumps, provision of subsidies (fertilizer and seeds), and financial assistance from NIA to resolve their problems.

Figure 1C-8. The dam of Butilon CIS with the extended apron and side wall
Source: Author's capture

Figure 1C-9. Lined main canal of the Butilon CIS
Source: Author's capture

North Cotabato

Del Carmen CIS

The Del Carmen CIS in President Roxas, North Cotabato was originally constructed in the 1970s through the FSDC and gets its water from Marbel River. It has a total FUSA of 536 ha covering 5 barangays namely Del Carmen, Lamonay, La Esperanza, Kamarahan, and Salvacion. It is managed by Del Carmen IA, Inc. with 425 farmer-beneficiaries.

The current dam (Figure 1C-10), including the steel sluice gates and intake gates (Figure 1C-), were constructed by NIA in the 1990's. There were problems of sediments and debris flow so the IA added a silt control structure (Figure 1C-11) costing the IA about ₱50,000. The same problem caused damaged to the sluice gate and the IA repaired it at a cost of a little less than ₱30,000. The dam structure and lining require some repair due to debris and boulder laden flow and the IA conduct regular dam cleaning and desilting. The single gated sluice gate was deemed insufficient and the direction of the training wall is causing more sediments to flow to the intake gates than be flushed through the sluice gates. Most of the main canal is lined although some parts, particularly near the dam, are submerged while some are damaged causing leakages (Figure 1C-12). Sands that accumulate in the main canals are collected and sold by farmers.

The IA President and Board of Directors are elected every 2 years. They do not have monthly salaries but honorarium and incentives are given to the officers. All farmer-members are rice farmers. They have 5 cropping in 2 years. The first cropping is usually August to February, followed immediately by the second planting, and so on. The cropping calendar of the IA though was based on water availability.

With regards to water delivery, all farms receive the required amount of water at the right time. The policy on water distribution is clear and is being followed effectively. Typical problems discussed by the IA is mostly on solid waste management. There are still some people who throws their wastes in the canals of the irrigation system. Furthermore, some also use the canals for other purposes such as taking a bath and doing the laundry. and crop failure in times of drought.

Before FISA, members used to allot ₱225,000 a year for loan repayment/ amortization. They have a 90-95% collection rate and do not really have problems with regards to ISF collection. When drought occurs, however, there really comes a time when farmers cannot pay for their fees due to crop failure. They said that they are completely and sufficiently self-sustaining. They can maintain their irrigation systems well and they do not also have problems with regards to replacing and maintaining key structures. They propose rehabilitation of old structures to further improve water delivery and distribution and provision of machineries and other farm inputs.

Figure 1C-10. The dam of Del Carmen CIS
Source: Author's capture

Figure 1C-11. The intake gates with the silt control structure funded by the IA
Source: Author's capture

Figure 1C-12. Main canal of the system
Source: Author's capture

Sta. Maria – Minamaeng CIS

The Sta. Maria – Minamaeng CIS is in the municipality of Matalam and has a FUSA of 100 ha covering the two barangays bearing its name. The main water source of the system is the Linao Creek although there are many springs downstream that adds water to the canals. The dam (Figure 1C-13) was built in 2005 under then Gov. Manny Piñol and then rehabilitated by NIA in 2014. It is managed by the Sta. Maria-Minameing FIA, Inc. with 100 rice farmer beneficiaries.

The area is surrounded by hills and mountains, serving as a catch basin during rainy season causing floods in most of the service area. However, water from the river is insufficient to irrigate the whole system during dry season, causing the IA to borrow or rent pumps and draw water from nearby springs. Because of the water added from the springs, the width of the main canal was increased from 0.6 from the source to 1-m downstream (Figure 1C-14). Since the area is with spring sources (Figure 1C-15), the farmers initially were not in favor to be under NIA since they will be required to pay for the water which is originally free. However, they need and want NIA to construct several control gates to increase the water level from these springs so they can be used for irrigation without using pumps and increase the serviced area.

The dam is already silted due to erosion from the surrounding hills which are planted with banana and pineapple. The IA members clean their canals every two months, although they only remove the grasses or overgrown plants on the sides of the canal and not the silts or sands. About 3 km of the main canal are lined and about 1-km still unlined. Some portion of the fields are slightly higher and require a pump to be irrigated.

The Sta. Maria-Minamaeng is unique in a sense because it is LGU-assisted and thus, they do not really have to worry about loan repayment. Members of the IA usually plant rice from June to October and November to March. Their average yield is 60-70 cavans per ha during wet season and 50-65 cavans during the dry season. Problems encountered include infestation of black bugs, unsuitability of seeds given to their soil, and lack of water during dry season. Other concerns raised include lack of farm-to-market roads and rice mills, and difficulties with regards to trading and looking for market. IA members said that the IA does not have their own pumps.

The IA President have served since 2011 and said people appoint whoever they want and there are no term limits. Officers stay in position as long as members of the IA wants them. Members of the body are not compensated but nonetheless, officers still do their best to serve the IA. So far there had not been any issues with the members. IA officials said that they do not have conflicts with regards to the maintenance of the IS. There are no conflicts among members too. All members attend the General Assembly every year and structures of the IS are well-maintained.

Figure 1C-13. The dam of Sta. Maria – Minamaeng CIS
Source: Author's capture

Figure 1C-14. The main canal near the dam and at the end of concrete lining
Source: Author's capture

Figure 1C-15. One of several spring sources downstream
Source: Author's capture

Figure 1C-16. Where the IA pumps water to reach the other side of the field
Source: Author's capture

Figure 1C-17. The proposed site of the IA office
Source: Author's capture

Hervilla CIS

The Hervilla CIS in the municipality of President Roxas gets its waters from Tuael Creek. The dam is constructed in the 1980's covering 143 ha in 2 barangays namely Poblacion and Cabangbangan. It is managed by the Hervilla Memorial CIS, Inc. and as of July 2018, have a total of 125 rice farmer beneficiaries.

While the dam (Figure 1C-18) is still in good condition and the control gates are still working properly, the river is sediment laden and usually carry floating debris and rubbish (Figure 1C-19). The IA regularly conducts cleaning operation. The IA was granted a loan amounting to ₱13,622,922.22 in 1983, the equity being the labor of the farmers. Source of funds for equity payment mainly comes from IA-owned funds. The Hervilla CIS is already fully paid with their share in the construction of the IS. When asked regarding the FISA, the members interviewed said that there might be possible dissolution of IAs if collection rate of O&M fees will continue to decrease.

The IA President and the governing board is elected every year by the General Assembly. Each sector has its own BOD and since Hervilla CIS has 7 irrigation sectors, the IA has 7 BODs. Common problems being tackled by the IA during general assembly include pest infestation (black bugs, stem borer, rat, green bugs), collection of O&M fees, and payment of water bills. After the FISA was implemented, the IA continued to ask their members for fees. The current IA officials do not exactly know the rate of amortization when they were still paying for their loan. The IA do not have any problems with regards to water delivery and distribution among members. What worries the IA, however, is the declining O&M fee collection. Since the IA members know that there will be a subsidy given to them, they do not want to pay for O&M fees anymore. According to one of the officials, the IA's dedication on the system maintenance somehow decreased because a number of members believe that the government will already take care of it through subsidies. The members of the IA suggested an increase in the amount of subsidy that will be given to them and the improvement of their canal linings and control structures. They are also seeking for help with regards to new information regarding rice farming since they really find it hard to resolve their cropping problems whenever a pest infestation occurs.

Figure 1C-18. The dam of Hervilla CIS
Source: Author's capture

Figure 1C-19. The sluice gate of the dam
Source: Author's capture

Figure 1C-20. The main canal and division box to divide flow from to different zones
Source: Author's capture

Figure 1C-21. Main canal of the system after the culvert road crossing
Source: Author's capture

South Cotabato

LMT (Liberty-Magtana-Tampakan) CIS

LMT CIS, in the municipality of Tampakan, South Cotabato draws water from Taplan River and has a total FUSA of 1,026 ha covering 4 barangays. They were granted water rights for 750 lps from May-December. The CIS is managed by the Tampakan Irrigators Service Development Association (TISDA) with a total of 322 farmer-beneficiaries.

The IA said that the dam was originally built in the 1950's through the FSDC, then rehabilitated by NIA in 1976, and was turned over in 1978. The previous dam is ogee-type but was redesigned by NIA to its current dam where the river flow was diverted. The dam (Figure 1C-22) is full of rocks and boulders because of a mining concession in the watershed and quarry upstream. The IA sought the help of NIA to design a sediment control structure (Figure 1C-23), which the IA funded at a cost of ₱25,000. The IA also replaced the rusted steel intake gates. The IA already obtained a permit to use backhoe for dredging, which they always do to prevent the river from flowing back to its original course. The permit is for 1000 m^3 of rocks and boulders. River flow is reduced by 25% during summer according to the IA.

Starting 2003, several rehabilitation works have already been done to the system with a total program cost of ₱36 M as of June 16, 2010, ₱33 M of which is direct cost. These include 900-km lined main and lateral canals funded by NIA and a 7-km lined main canal funded by DAR. Only 3 km of the lateral canal are unlined. There are 2 reuse dams downstream also constructed. The IA president wishes to rehabilitate the main canals since it is already silted. The turnouts of the system are also made of wood planks since there are no more steel gates. They have schedules for main canal cleaning.

The farmers plants rice, corn, banana, and high value crops such as papaya, pineapple, coconut, and banana. The area devoted to high value crops is more than 120 ha. The IA also provides irrigation water for Global Company which manages around 256 ha planted to banana, coconut and pineapple. They are paid ₱780,000 per year by Global Company. They are not exempted from the free irrigation policy and they used this fund for equity payment on top of their own funds.

The cropping calendar followed by the members were finalized with the help of the IDOs from NIA, and is different from that of Global Co. Because of the different water requirements for each crop, payment of irrigation service varies from one user to another. The rates are ₱780/ha per cropping for rice, ₱500/ha per flushing for corn, and ₱2,000/ha per flushing for papaya, banana, and guava.

The President and governing board are chosen every 2 years by the General Assembly. Every of the 11 sectors or irrigation zones have their own BOD. The President, Vice-President and Board members/kaka leaders/sector leaders are being paid ₱1,000 per month, while the water tenders and gatekeepers are paid ₱2,500/month. Despite the expenses, the IA believes that they are still completely and sufficiently self-sustaining, essentially because of the Global Company.

During General Assembly, the typical issues being discussed by the IA include O&M collection from individual farmers (they do not have a problem with regards to asking Global Company for its share), waste management, and machinery needs. There was a time when a conflict occurred between water users. Those who tapped water illegally where called for a meeting/dialogue and was immediately resolved. The officers of the IA said that cooperation is very important.

Figure 1C-22. The dam of LMT CIS filled with sediments
Source: Author's capture

Figure 1C-23. The silt control structure and intake gate
Source: Author's capture

Figure 1C-24. Main canal of the system
Source: Author's capture

Mani CIS

Mani CIS in Koronadal City draws its water from the Mani River serving a FUSA of 425.25 ha covering 3 barangays namely San Jose, Mabini, and Rotonda. The CIS is managed by the San Jose Mabini CIS, Inc. with a total of 408 farmer-beneficiaries.

The original brush dam was built in 1956 but underwent several repairs including bank protection in 1976, and dam rehabilitation by NIA in 1999, when the dam was destroyed due to water seepage underneath. The system was also improved by NIA in 2016 because of scouring of the side walls approaching the dam (Figure 1C-25). The dam crest is 2 m and it is not silted yet but the intake gate is permanently open because the lifting mechanism is damaged (Figure 1C-26). As such, the main canal is slightly silted with sand. Monthly cleaning of the main canal to remove the grasses and sand is practiced either with a budget for the service or through *bayanihan*. The 2-m wide sluice gate is still operational. The IA practiced monthly cleaning of the dam. During high flows, the river overflows oftentimes destroying the riprap banks and flooding the adjacent areas. The river flow does not completely dry up during summer, but the IA practice rotational irrigation to more than 400 ha. The IA said that this area is 500 ha originally, but several areas have been built-up or converted to coconut plantations.

Around 3.5 km of the main canals are lined but the laterals of the system are still unlined. There was one main problem where the main canal narrowed causing the water to overflow. There are also some damaged portions of the main canal causing water leakage. There are no illegal turnouts for the system but some farmers do not follow the imposed schedule when there is not enough water.

The President and IA officials are selected by the general assembly every 2 years, but there are no real term limits. The IA officials are paid on a monthly basis. The President, Secretary, and Treasurer are paid ₱1,000 per month, the VP ₱800 per month and the BODs ₱700 per month. The water tender receives ₱2,000 per month while the gate keeper receives ₱1,500 per month.

Before the FISA, the IA has to allot ₱78,000 annually for loan repayment., which is hard according to the IA since they only have 65-70% collection efficiency. The IA rated their financial strength a lowly 1.0 meaning their funds are inadequate and is insufficient to do much of the basic maintenance needed. The extra funds for the system was used to construct the shed within the IA office. There were also some batch dryers and transplanter/seeder donated by the DA OPAG but were not used by the IA. Other typical issues being settled and discussed by the IA include insufficiency of water during dry season. According to them, the FISA is very helpful to them since they do not have to worry about loan repayment anymore. Most of the encountered problems relates to O&M of the irrigation, access to funds for rehabilitation, and access to water (quantity and timeliness). The IA requested an increase in O&M subsidy, increase support from LGU, and legal assistance from LGU in implementing their policies.

Figure 1C-25. The dam of Mani CIS with a sluice gate of 2 m width
Source: Author's capture

Figure 1C-26. The intake gate that is permanently open
Source: Author's capture

Figure 1C-27. The main canal of Mani CIS from the dam
Source: Author's capture

Figure 1C-28. Division box to several laterals
Source: Author's capture

Bunao CIS

Bunao CIS is a relatively new CIS located in Tupi, South Cotabato drawing water from Bunao Creek to irrigate 100 ha. it is managed by the Sitio Pagasa Communal Irrigators Association, Inc. with 50 farmer-beneficiaries, mostly planting high value crops, covering Barangay Crossing Rubber. The dam (Figure 1C-29) is a simple weir with a slot for a steel gate to increase head during summer. The previous dam was washed out by flood, so the construction of the new dam was initiated by Japanese Overseas Cooperative Volunteers (now JICA) in 2012. BSWM also donated about ₱ 3-6 M. The dam and the system were turned over in 2014. Dam clearing is done once every month or two months while cleaning is done monthly.
When there is too much rain, the water in the dam rises up to half its height.

The IA practiced crop rotation and they plant papaya, banana, corn, and other vegetables such as cauliflower, bell pepper, bitter gourd, okra, and eggplant. The area devoted for papaya (Solo variety) is about 40-50 ha. The farmers harvest their crops weekly and sold them to Dole Phil. The IA also have a resting or fallow period for their service area. The IA plans to be the grower for Dole for which they would plant papaya, asparagus, cauliflower, eggplant, broccoli, and cabbage. The IA president also plants corn and the said vegetables.

A new set of officers is chosen by the GA every 2 years. The IS has 4 irrigation zones and each has its own representative to the BOD. Bunao CIS is not included in the Free Irrigation Policy since they are not planting rice and the FISA only covers rice farmers. Every year, the IA has to pay ₱202,000, which the IA admit is quite hard since only 40% of the members actually pay their dues.

The 3-km main canal and the laterals are all lined with concrete. The IA used wooden planks covered with plastic as control gates to raise water level in the canal and deliver water to the fields via small holes acting as turnouts. Although some farmers complain of lack of turnouts for their farms, but the basic issue actually is low water level during dry months.

Water delivery sometimes become a problem during summer or months with less water, so the IA either practiced scheduling by request or they plant other crops that are more drought resistant. The water distribution protocol is clear but sometimes they do encounter problems with regards to water flow since some areas have high elevation and not reached by the low irrigation water level. This is one of the reasons for lack the motivation to pay their dues.

Problems related to cropping include occurrence of pests and fungi, low financing, lack of farm equipment and machineries, and high cost of hired labor.
With regards to LGUs taking over the maintenance of the IS, the IA officials said that they believe that it is still better that it is the IA who takes care of their own systems since they are the direct users and beneficiaries and thus, they know their needs better. Some of the issues discussed by the IA include difficulty in synchronizing planting and lack of turnout in other areas due to elevation and lack of water. To resolve their issues and to strengthen their IA, the officials suggested that the design of the CIS be improved and if possible, the problem with regards to water turnout be resolved. They also requested that vegetable farmers be given better consideration. They requested farm machineries, post-harvest facilities, expansion of canal linings, trainings/seminars/workshops, and subsidies (vegetable seeds, fertilizer, etc.).

Figure 1C-29. The simple gated dam of Bunao CIS
Source: Author's capture

Figure 1C-30. The lined main canal of the system
Source: Author's capture

Figure 1C-31. Simple hole turnout and improvised gate
Source: Author's capture

Bukidnon

Delapa CIS

The Delapa CIS in the municipality of Quezon in Bukidnon gets its water from the Delapa Creek. There is also a spring that adds water downstream. The CIS has a FUSA of 330 ha and the system can water all of these during wet season but only 273 ha during the dry season. The CIS is managed by the DMSIA Dilapa Mibantang Sta.Cruz CIA, Inc. with a total of 200 rice farmer beneficiaries.

The original dam was built in 1975 through the FSDC and the previous gates were made of wood. The dam was 4-ft deep before but was filled with rocks and boulders starting 2003. It was replaced by NIA in 2013 with a new dam (Figure 1C-32), including steel sluice gates and intake gates on both sides, and lined canals. Last 2017, the dam was damaged due to typhoon Vinta and the dam storage is again filled with rocks and boulders. The downstream apron of the dam is also damaged with scoured concrete lining and exposed steel frames (Figure 1C-33). The lifting mechanisms of the gates were replaced with secondhand chain blocks bought by the IA at ₱6,000 for the 5-ton capacity and ₱5,000 for the 3 tonners.

The river does not dry up during summer, but there are areas which cannot be irrigated so the farmers or IA used pumps for irrigation. The IA has a pump given by DA, other members have their own pumps as well. During rainy season, the water in the dam overflows. The IA's request for a backhoe from the local government of Quezon was already approved, but no schedule is finalized yet to dredge the dam. There are corn and banana plantation on the mountains where the river flows causing much of the erosion and sediments in the dam. The local water district also gets water from river upstream near the mountain decreasing the flow towards the dam to lessen.

About 6 km of the main canal is lined leaving only about 2.5 km unlined. The lateral canals of the system are also lined. Most of the control gates in the canals have no steel gates but are fitted only with wood slabs to increase water levels. The main canal is already silted, so the IA remove the accumulated sand when the intake gates are closed. Portions of the main canal were also rehabilitated by NIA because water overflow in these parts. There is one dam keeper and three water tenders, one for each of the three irrigation zones, A, B, and C. There are box culverts in the intake of the three zones. Zone A services more than 100 ha while Zones B and C services more than 300 ha so the main canals of Zones B and C are larger than the main canal of Zone A. The lateral canal of Zone C has a 500-m length bench flume downstream and instead of having drops, chutes are used by the system.

The crops planted in the service area of the system is hybrid rice 150. The IA practiced regular cleaning every three months including the clearing of the grasses. During the wet season, all farms receive the required water at the right time. For the dry season, however, occasional delays occur. There is a clear policy on the water distribution scheme. Delapa CIS has two intake gates and main canals. The first one goes to Zone A and the second one goes to Zone B (upstream) and Zone C (downstream). If water will be limited, 60% of the available water will go to Zone A, and the remaining 40% is distributed to Zone B and Zone C. Decisions on water allocation is made by the respective water tenders of each zone with coordination to the IA President. In deciding water delivery schedule, data used include water availability and demand for water of every zone.

The General Assembly elects a new governing board every 3 years. For every sector, 2 representatives are chosen, a zone leader and a sector leader. With 3 zones, the IA have a total of 6 BODs. Each zone also has their own water tender and sector President, among whom the President of the whole IA will be chosen. Similar with the BOD, the term of the President is 3 years.

The IA members interviewed cannot remember the amount of ISF collected since they were newly elected. With FISA implementation, the IA collects 100 kg/ha per cropping. Because of the FISA, they said they were able to focus more on O&M. They are hoping, however, that the amount of subsidy increases. Other issues discussed by the IA include solid waste management, limited water, and canal linings. The IA also requested to have water impounding to resolve their concerns.

Figure 1C-32. The dam of Delapa CIS
Source: Author's capture

Figure 1C-33. The damaged downstream apron of the dam
Source: Author's capture

Figure 1C-34. The left sluice gate and intake gate of the dam
Source: Author's capture

Figure 1C-35. Trapezoidal main canal of the system
Source: Author's capture

Magsaysay CIS

The Magsaysay CIS in the municipality of Maramag, Bukidnon draws its water from the Magsaysay Spring which fills into a reservoir created by a dam. The dam was built in 1987 to collect the spring flow and rainfall and now served a total FUSA of 60 ha rice farms owned by 27 beneficiaries.

When the dam was proposed, it was supposed to service 300-400 ha of area based on the water supply assessment but when it was built and operational, it only serviced 100 ha. The dam has two intake gates leading to the right and left main canals. One of the main reasons for the low FUSA is the damaged right main canal near the dam, where after irrigating just about 10 ha, water from the canal just spills to the creek and could not serve several hundred hectares downstream. The reservoir is now also heavily silted as indicated by the abundance of water lilies. The spring discharge has now decreased said the IA and during summer, there are areas which cannot be irrigated. Farmers do not have pumps to use for supplementary irrigation. During rainy season, the area does not flood and excess water only flows through the dam. There are two water tenders for the system. Canal cleaning is done once or twice a month, previously through *bayanihan* but now they pay for the service.

Magsaysay IA manages Magsaysay CIS. The President and the governing board are elected by the General Assembly every 2 years. The President receives ₱100 per month while the BOD receives ₱50 a month. Before FISA, the IA collects ₱ 1,125 per ha per cropping from its members. They set aside a budget every year for NWRB payment, SEC registration, salaries of officials, loan repayment, and collector incentives. All remaining money from collection goes to O&M. After FISA, the IA continued collecting fees for the sustained management of the CIS but the new rate is just ₱500 per ha per cropping for O&M as agreed upon by the GA. But even with the lower rate, the collection rate dropped from 98-100% to 50% as more farmers do not want to pay for O&M fees anymore.

When the IA were asked to rate their financial strength, the members gave themselves a rating of zero which means they have inadequate funds and they are not able to cover key structures and basic maintenance of the irrigation system. Because of this, issues with regards to collection of fees and the need for repairs regarding their dam and canals are always raised during meetings. When asked about their suggestions, however, the IA focused on their cropping needs including fertilizer and seed subsidy, provision of farm machinery, and financial assistance from the government.

Figure 1C-36. The reservoir of Magsaysay CIS
Source: Author's capture

Figure 1C-37. The dam of the system
Source: Author's capture

Figure 1C-38. Right main canal intake with 0.5 m width
Source: Author's capture

Figure 1C-39. Left main canal intake with 1 m width
Source: Author's capture

Figure 1C-40. Right main canal of Magsaysay CIS
Source: Author's capture

Figure 1C-41. Left main canal of the CIS
Source: Author's capture

Figure 1C-42. Lateral canal which waters only 10 ha of field
Source: Author's capture

Figure 1C-43. Lateral canal which is broken and no controls
Source: Author's capture

Miglamin CIS

Miglamin CIS in Malaybalay City has a FUSA of 52 ha of rice field. The CIS is managed by the Miglamin Farmers Irrigators' Association, which as of July 2018, has 30 farmer-beneficiaries. The system consists of two dams, Dam 1 drawing water from Miglamin Creek and Dam 2 from Liwas Creek. Both dams were about 5-6 ft deep before but are now almost filled with rocks and boulders. This is due to the denuded mountains in the watershed. Dam 2 was built in the 1970's through the FSDC and was rehabilitated during 1980's. Dam 2 is the main water source except during summer when Dam 1 is mainly used. The IA already requested for a backhoe to clean and remove the siltation in both dams. The IA wants to build a dike upstream of the dam to control siltation. During heavy rains, the water overflows in both dams. In the last El Niño in 2016, the IA practiced water scheduling.

The main canals of the system are all lined but the lateral canals are still earthen. The main canal of Dam 2 is 3.5 km in length with a trapezoidal cross section. The main canal of Dam 1 is 2 km in length and has no major problem like siltation. The silt ejector in the canal of Dam 1 is effective better than the one connected to Dam 2. The planting of corn on the slopes adjacent to the canals are a major source of siltation in canals. The IA practiced *bayanihan* to clean the canals every summer and they are requesting for a riprap to stabilize the slopes near canals.

Election of the IA President and the governing board is done every 2 years. The current president, however, has been the president of the IA since 2007. Officials are not compensated but are only given allowances every meetings. According to IA officials, they are effective in implementing their accountability provisions with regards to water use and allocation.

The need for rehabilitation of their main canal and the need for lining of their dam is usually what IA members discuss during IA meetings. With regards to water delivery service, they believe that all farmers receive the required volume of water at the right time during the wet season. The water distribution scheme they follow is clear and adequately implemented. Among the functions of IAs, it is in the maintenance of control structures that they deemed they are least performing, pointing to inadequate funds to cover all repair and maintenance needs.

Before FISA, IA members give 100 kg/ha per cropping. The collection rate is relatively high at 95% with the remaining 5% sometimes unable to pay due to crop failure and damages. After the FISA was implemented, ₱1,000 is still being collected per ha per cropping and collection rate dropped to 80%. The IA is requesting funds to rehabilitate their dams and canals, as well as increased subsidy for operation and maintenance.

Figure 1C-44. Dam 1 of Miglamin CIS
Source: Author's capture

Figure 1C-45. Dam 2 of the system wherein the sand also enters the intake gate
Source: Author's capture

Figure 1C-46. Silt ejector in main canal connected to Dam 1
Source: Author's capture

Figure 1C-47. Main canal connected to Dam 1
Source: Author's capture

Figure 1C-48. Ejector for silts in main canal connected in Dam 2
Source: Author's capture

Figure 1C-49. Silted main canal connected to Dam 2
Source: Author's capture

16.2A. Location of the Communal Irrigation Systems in Luzon based on Slope Map

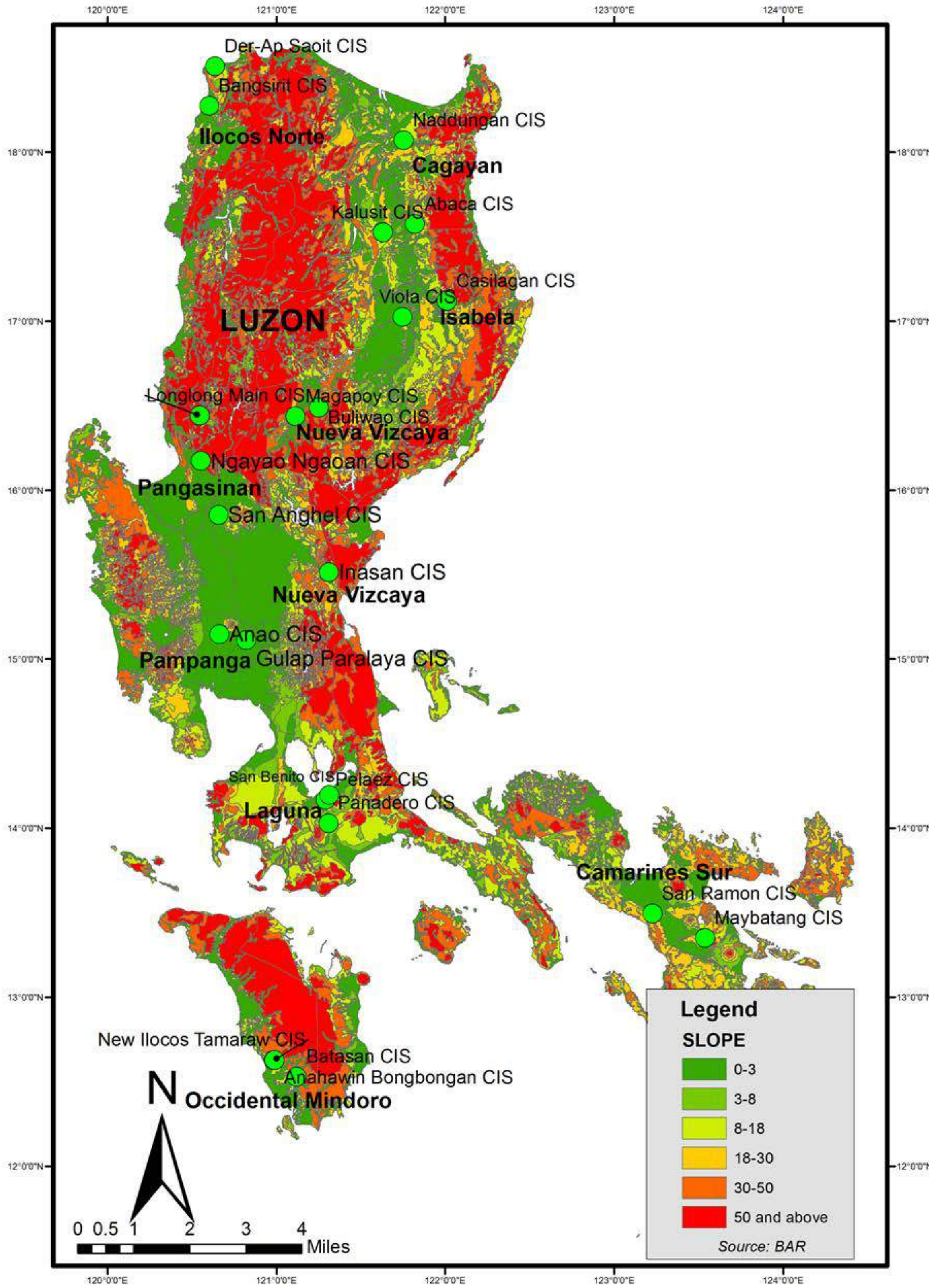

Figure 2A-1. Location of the CIS in Luzon
Source: www.philgis.org

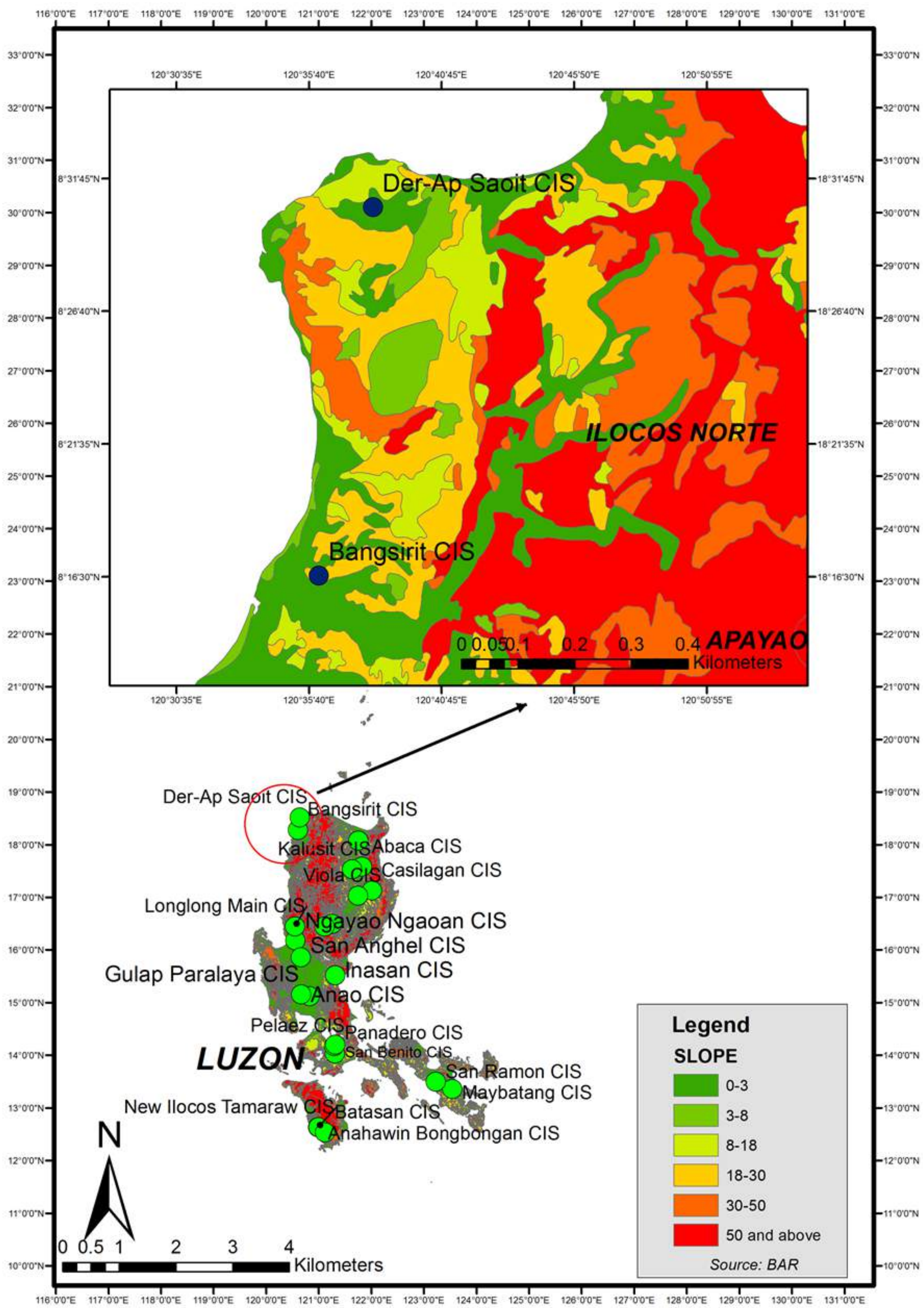

Figure 2A-2. Location of the CIS in Ilocos Norte

Source: www.philgis.org

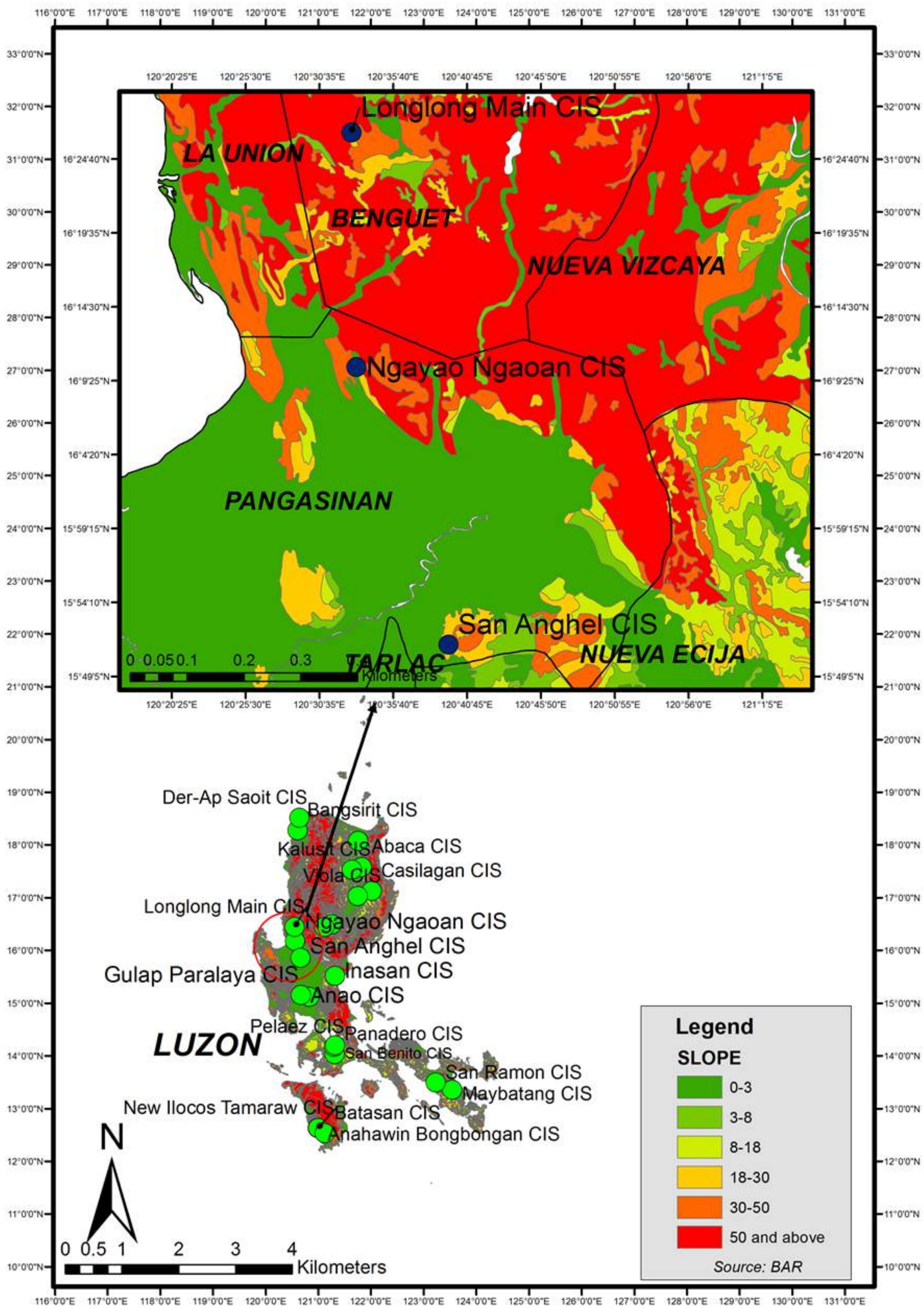

Figure 2A-3. Location of the CIS in Benguet and Pangasinan

Source: www.philgis.org

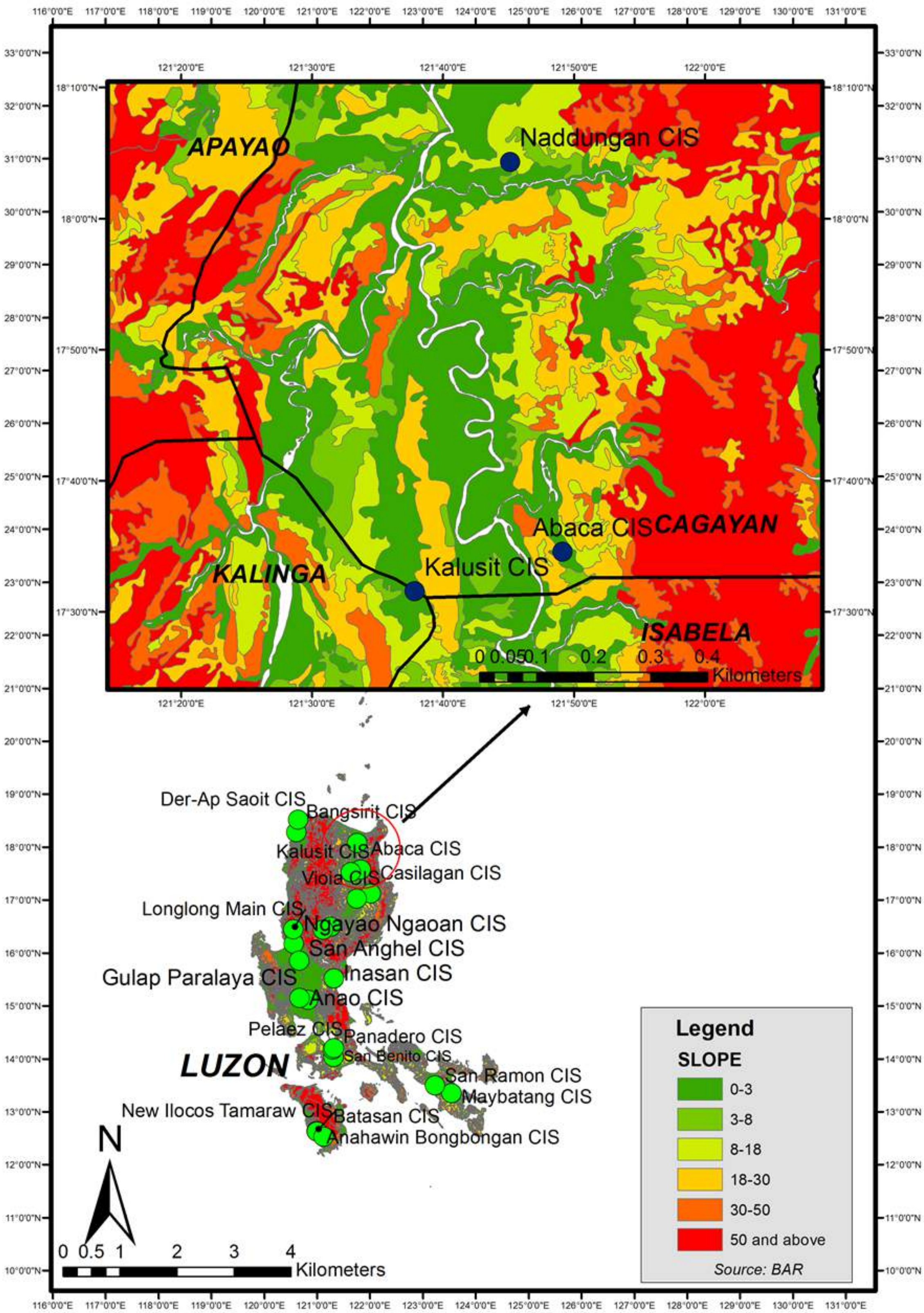

Figure 2A-4. Location of the CIS in Cagayan
Source: www.philgis.org

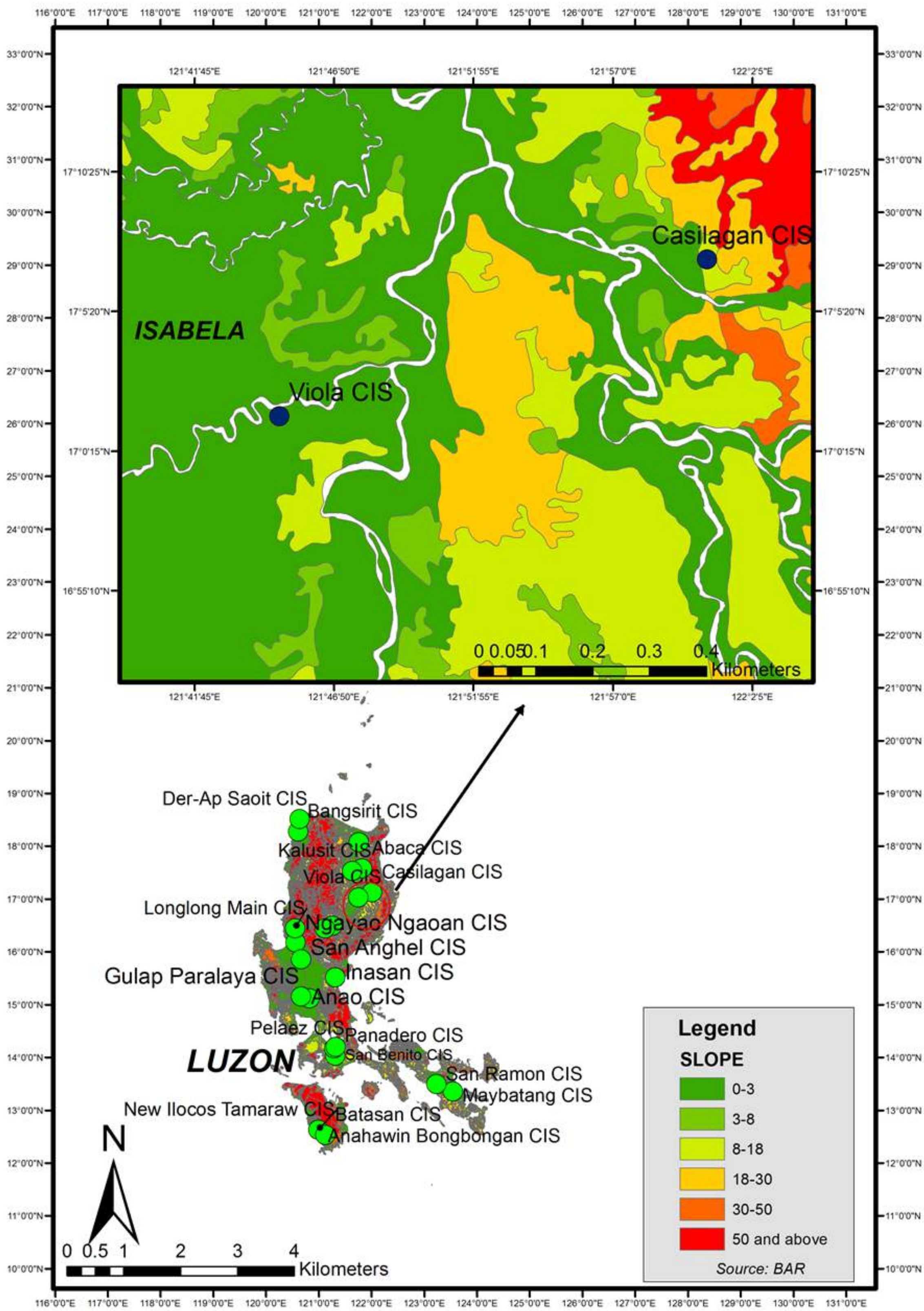

Figure 2A-5. Location of the CIS in Isabela
Source: www.philgis.org

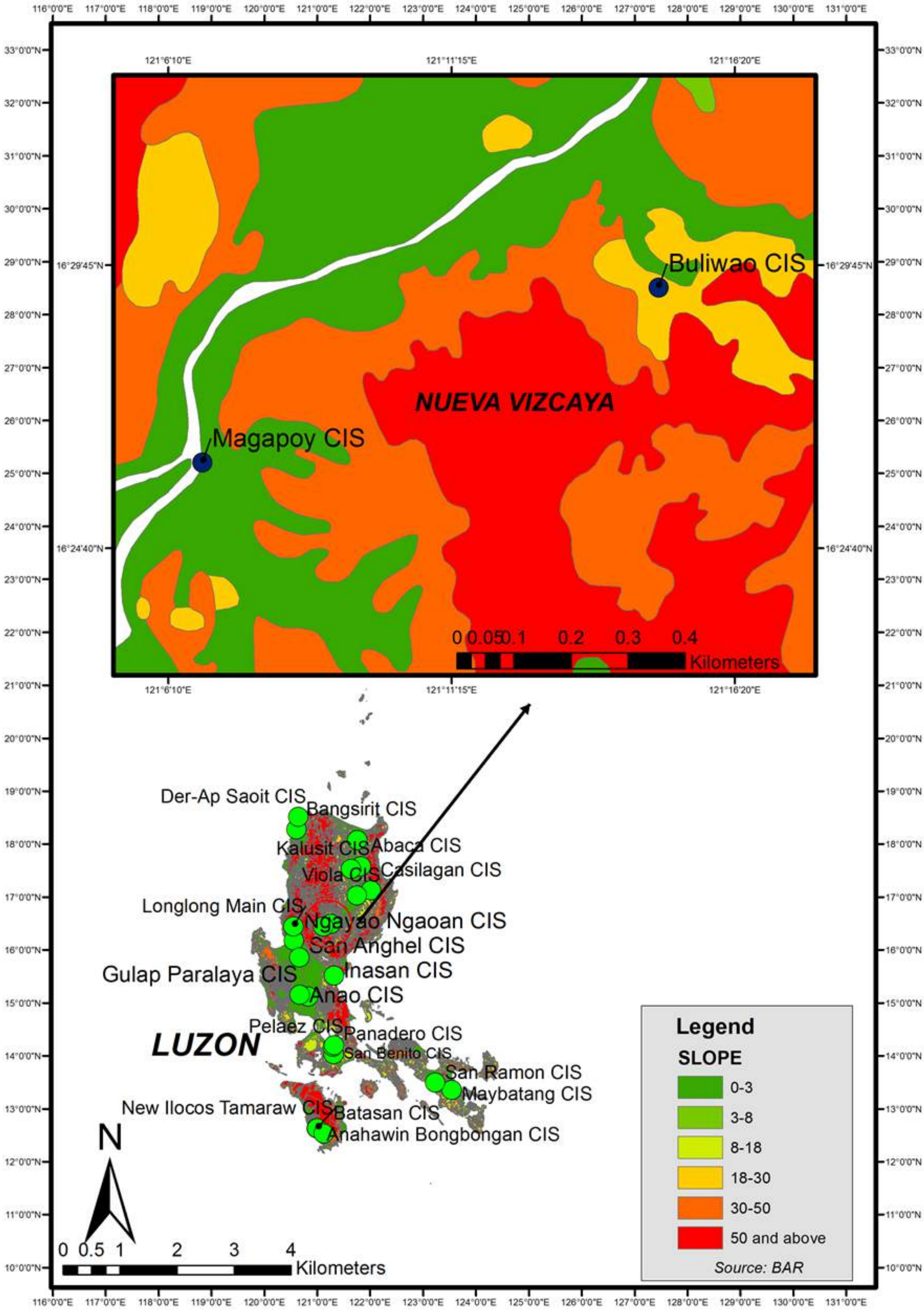

Figure 2A-6. Location of the CIS in Nueva Vizcaya
Source: www.philgis.org

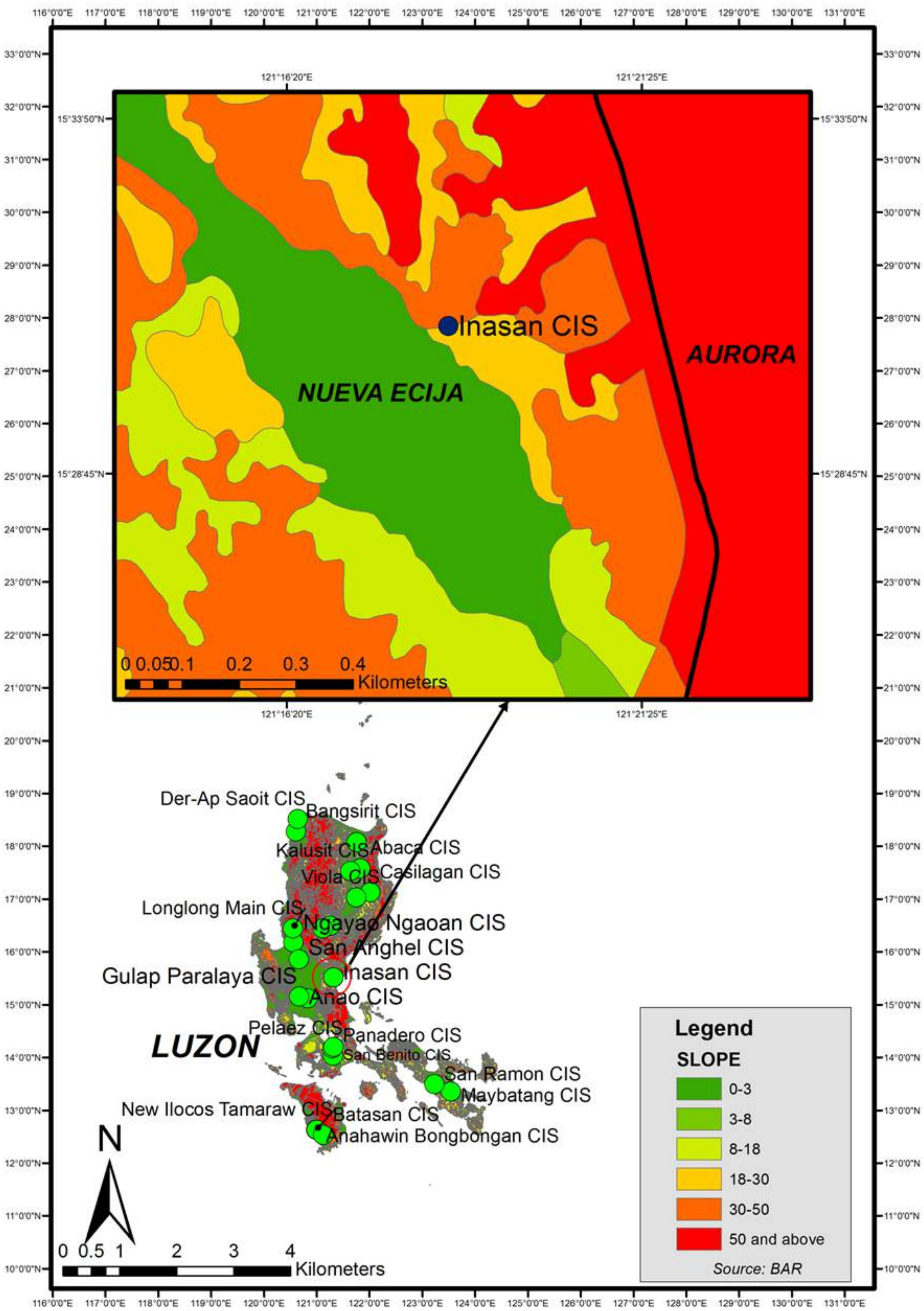

Figure 2A-7. Location of the CIS in South Nueva Ecija
Source: www.philgis.org

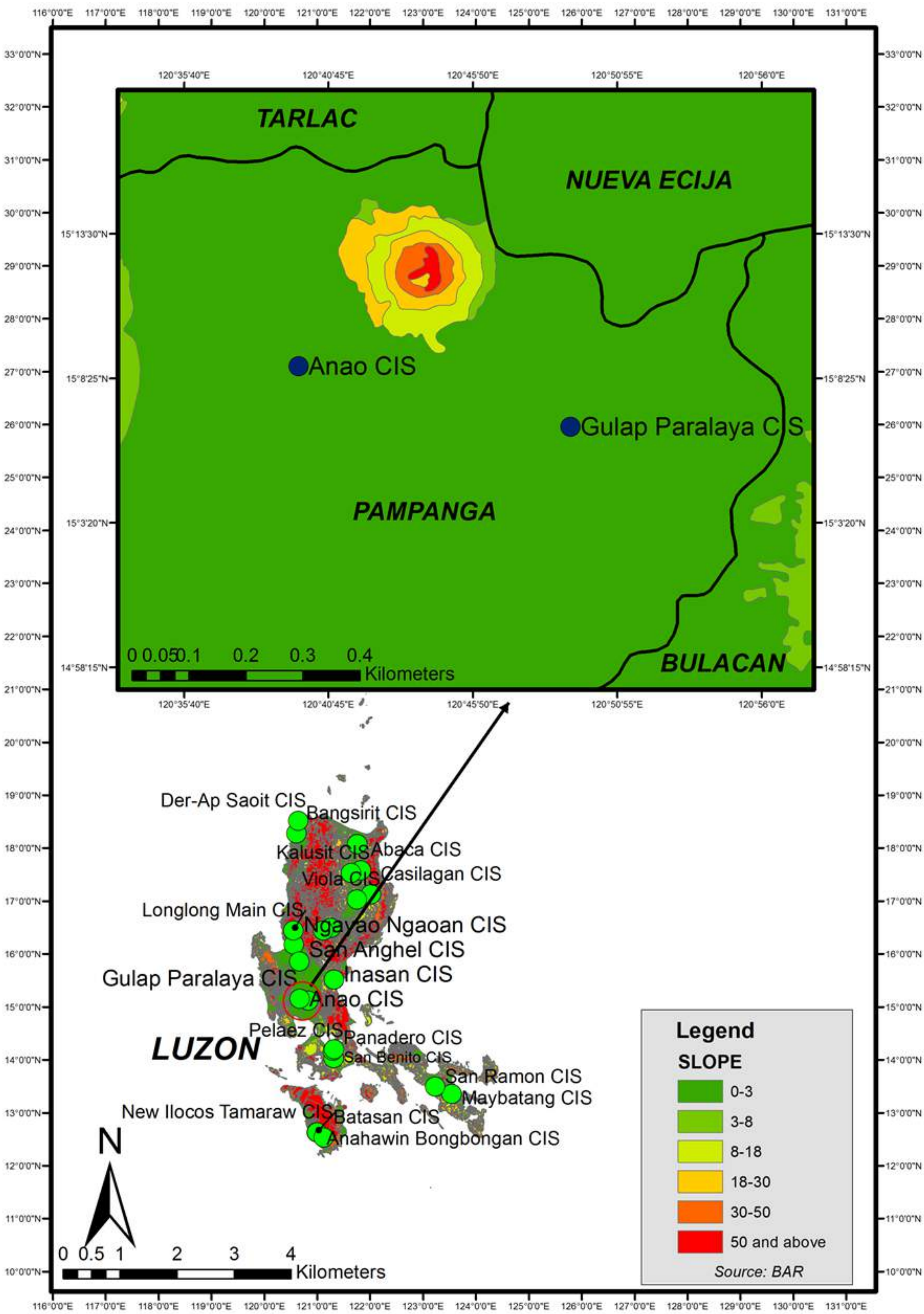

Figure 2A-8. Location of the CIS in Pampanga
Source: www.philgis.org

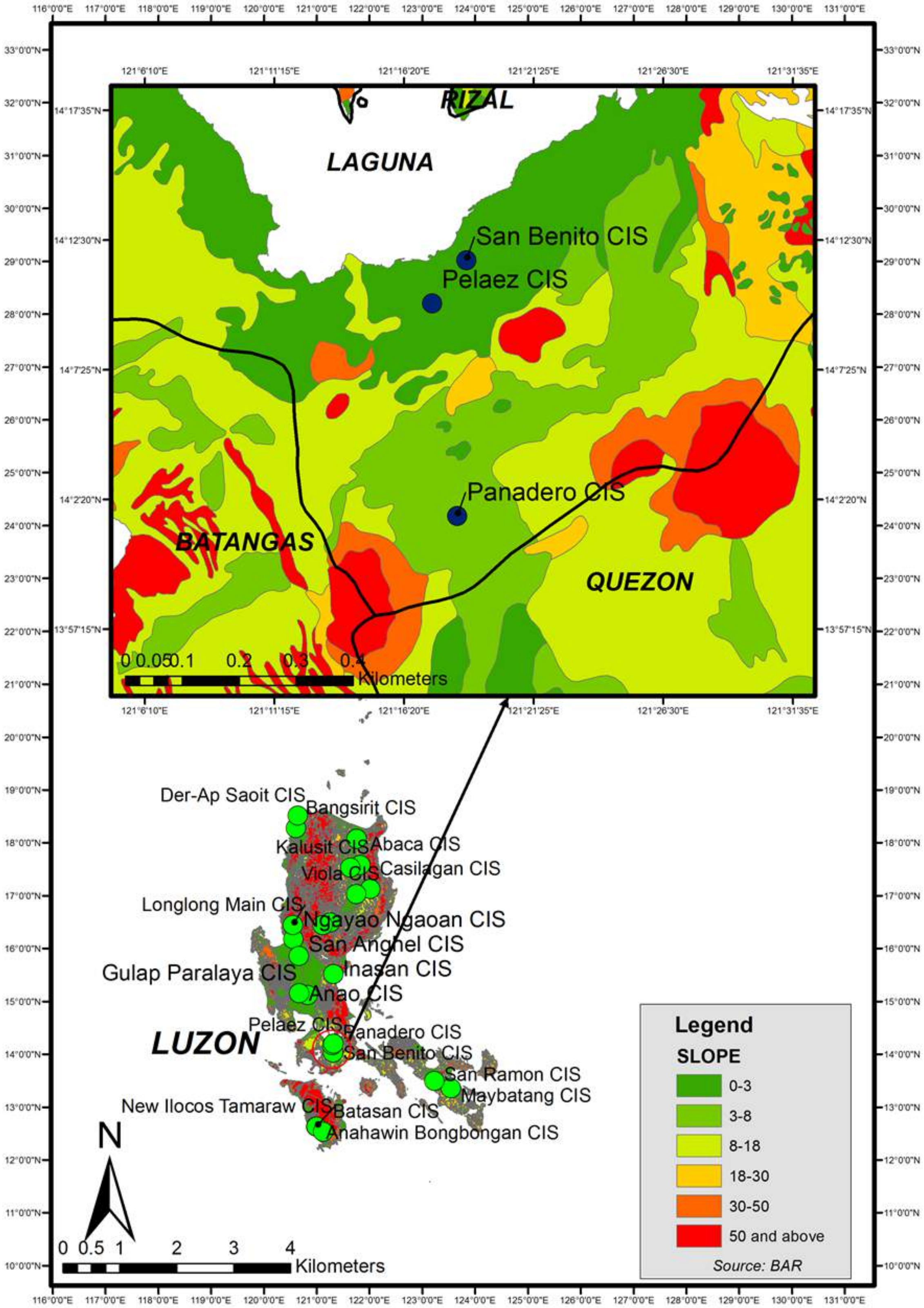

Figure 2A-9. Location of the CIS in Laguna
Source: www.philgis.org

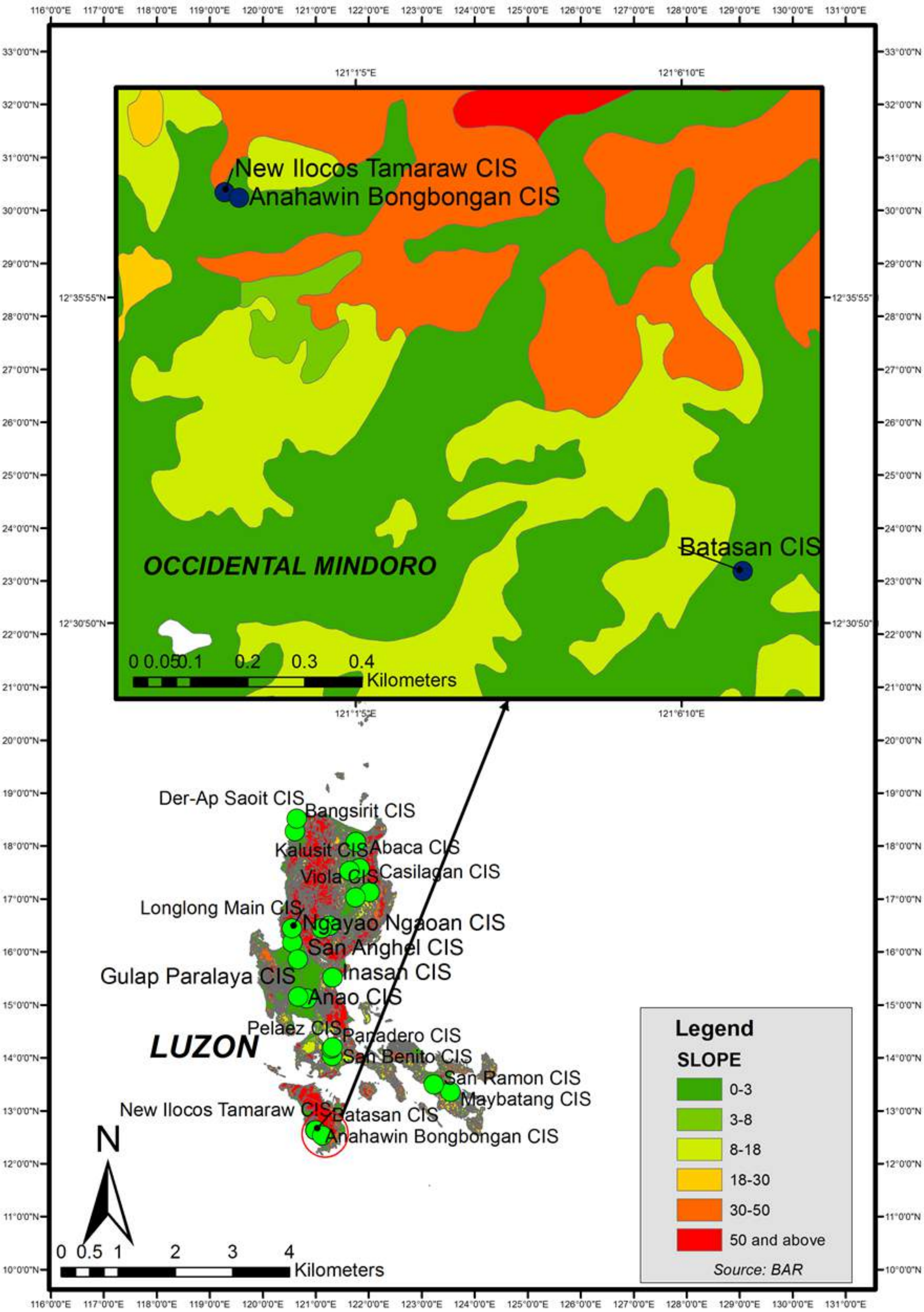

Figure 2A-10. Location of the CIS in Occidental Mindoro
Source: www.philgis.org

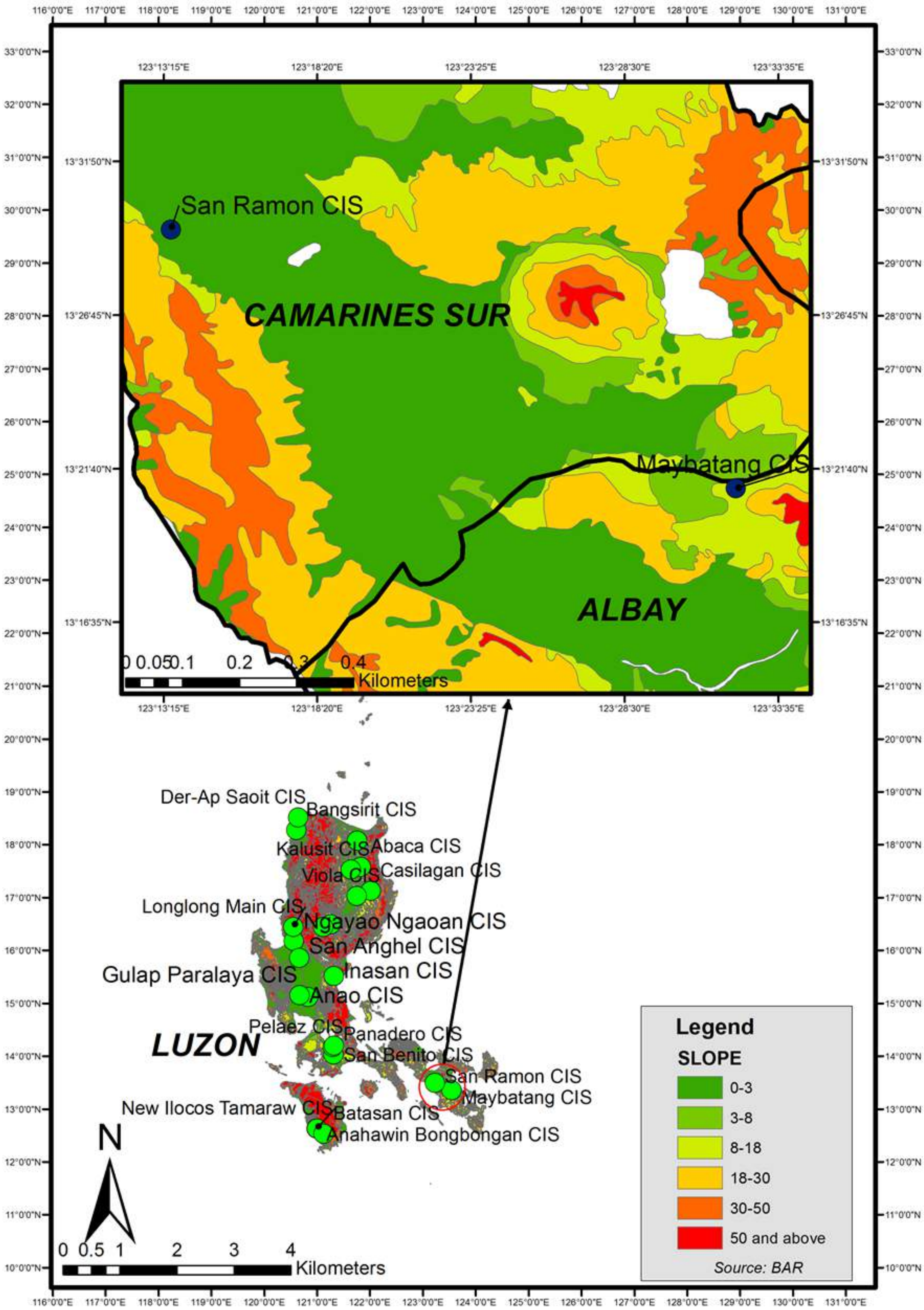

Figure 2A-11. Location of the CIS in Camarines Sur
Source: www.philgis.org

16.2B. Location of the Communal Irrigation Systems in Visayas and Mindanao based on Slope Map

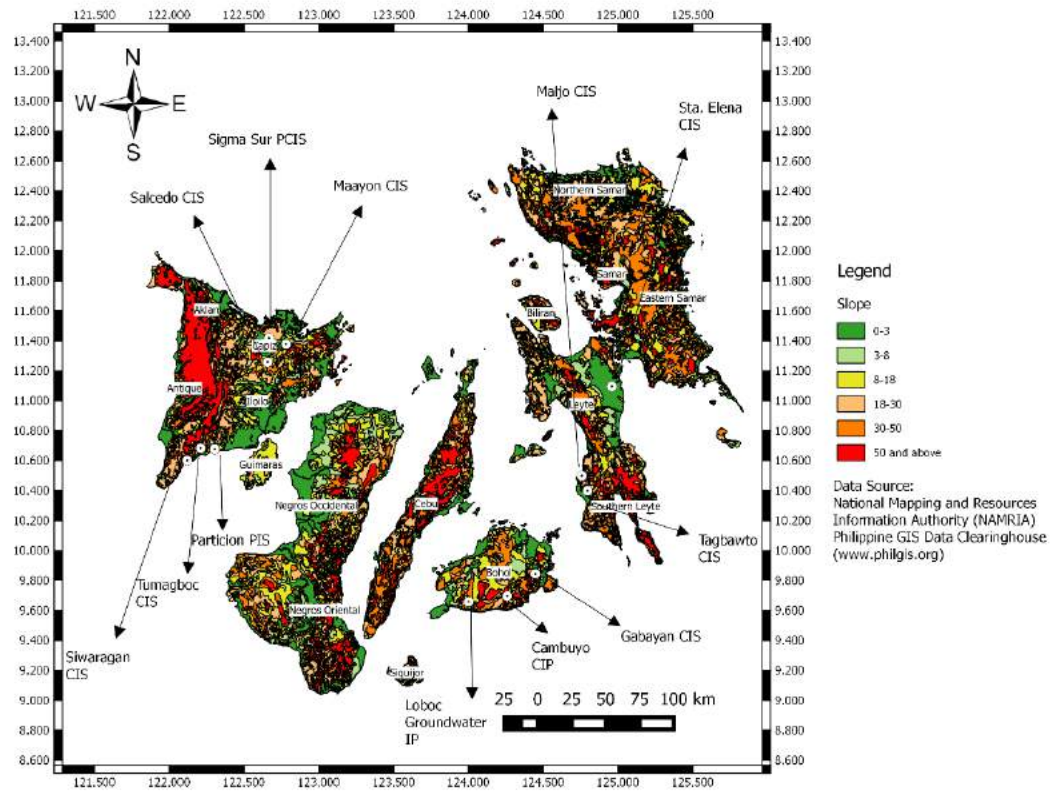

Figure 2B-1. Location of the CIS in Visayas
Source: www.philgis.org

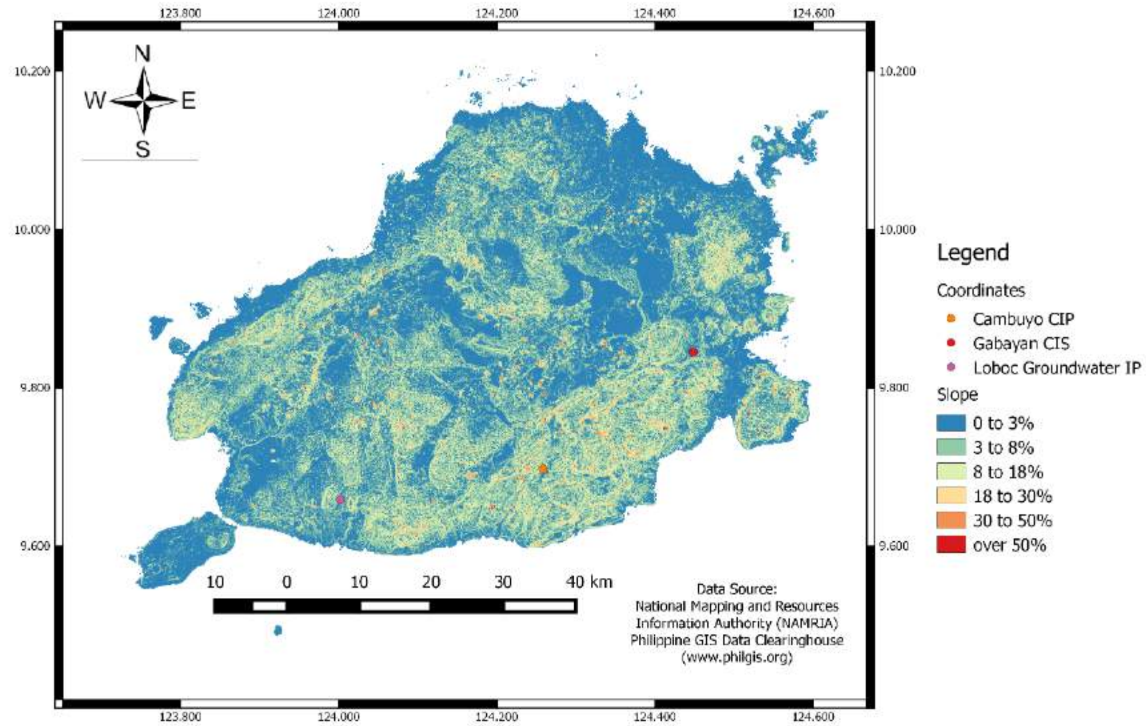

Figure 2B-2. Location of the CIS in Bohol
Source: www.philgis.org

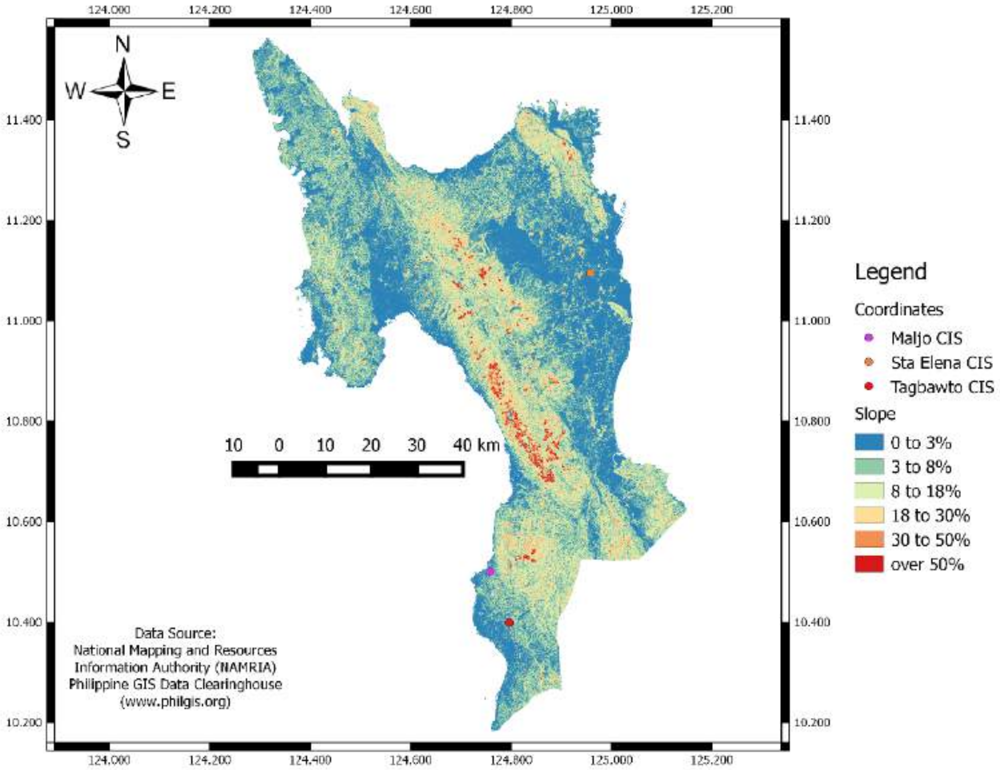

Figure 2B-3. Location of the CIS in Leyte
Source: www.philgis.org

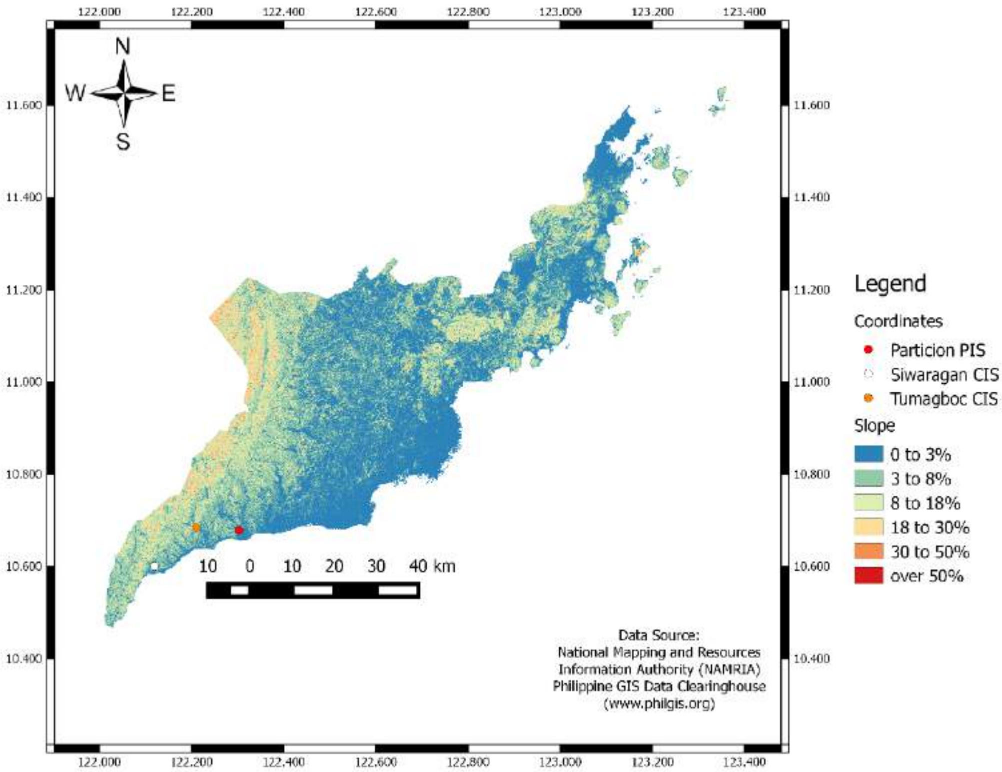

Figure 2B-4. Location of the CIS in Iloilo
Source: www.philgis.org

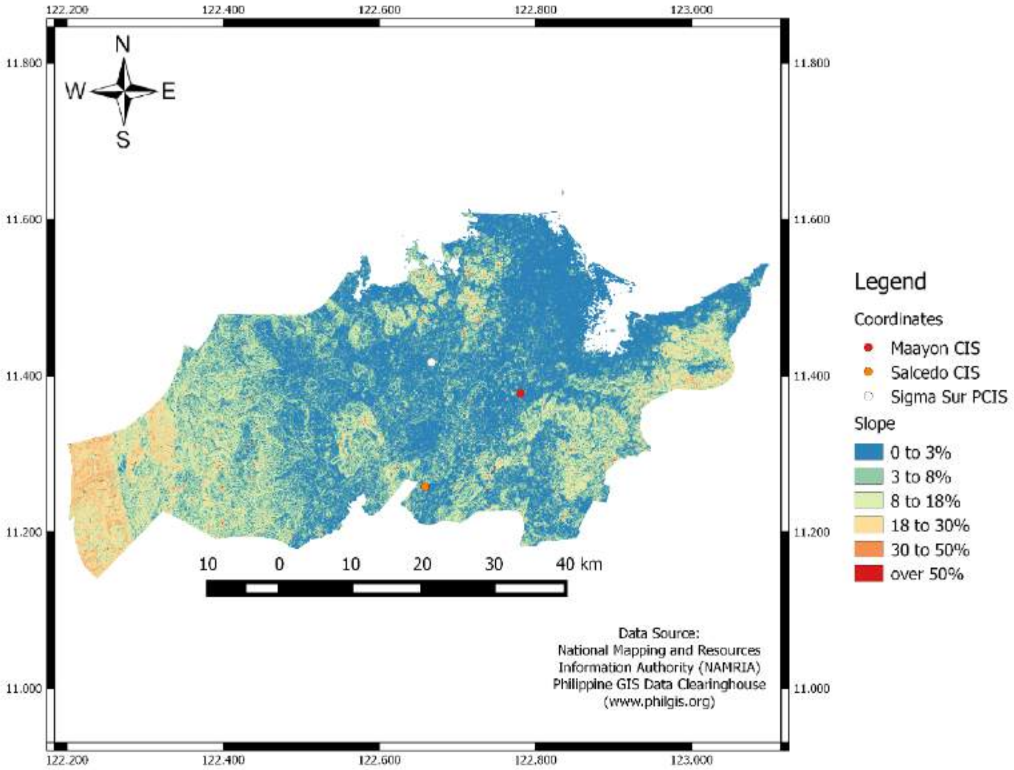

Figure 2B-5. Location of the CIS in Capiz
Source: www.philgis.org

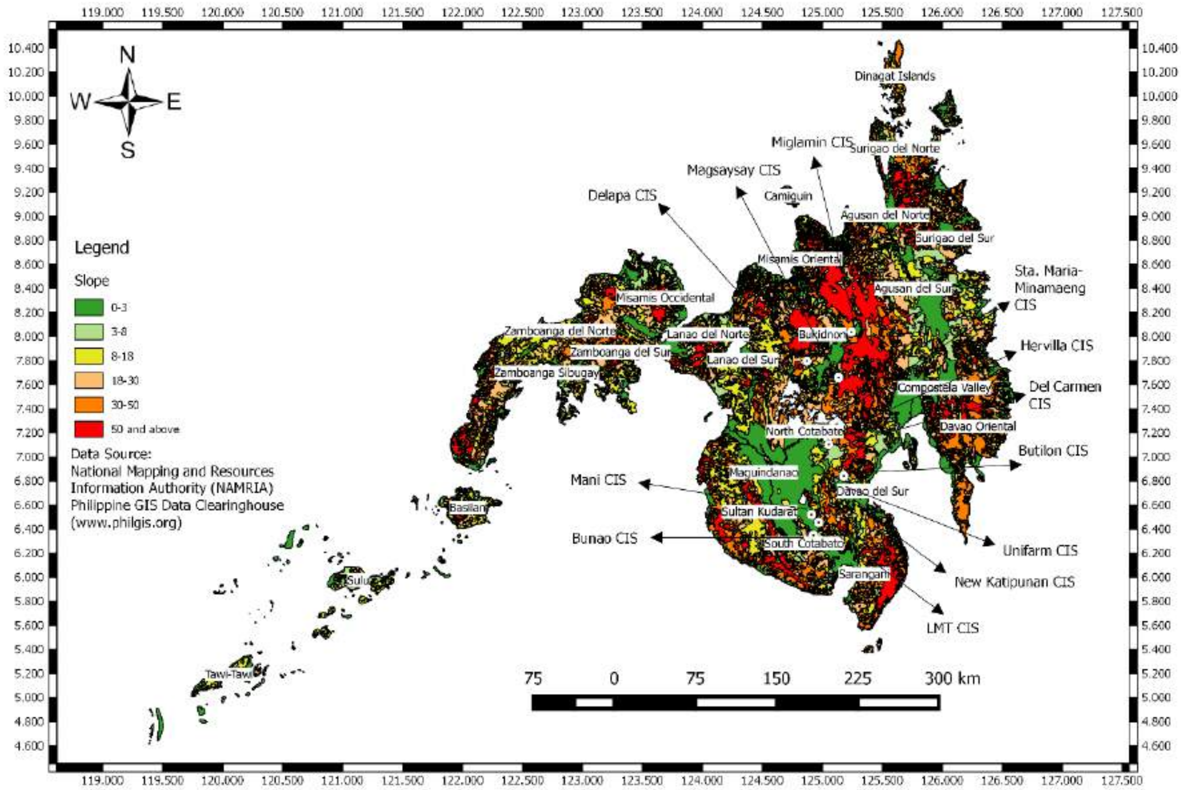

Figure 2B-6. Location of the CIS in Mindanao
Source: www.philgis.org

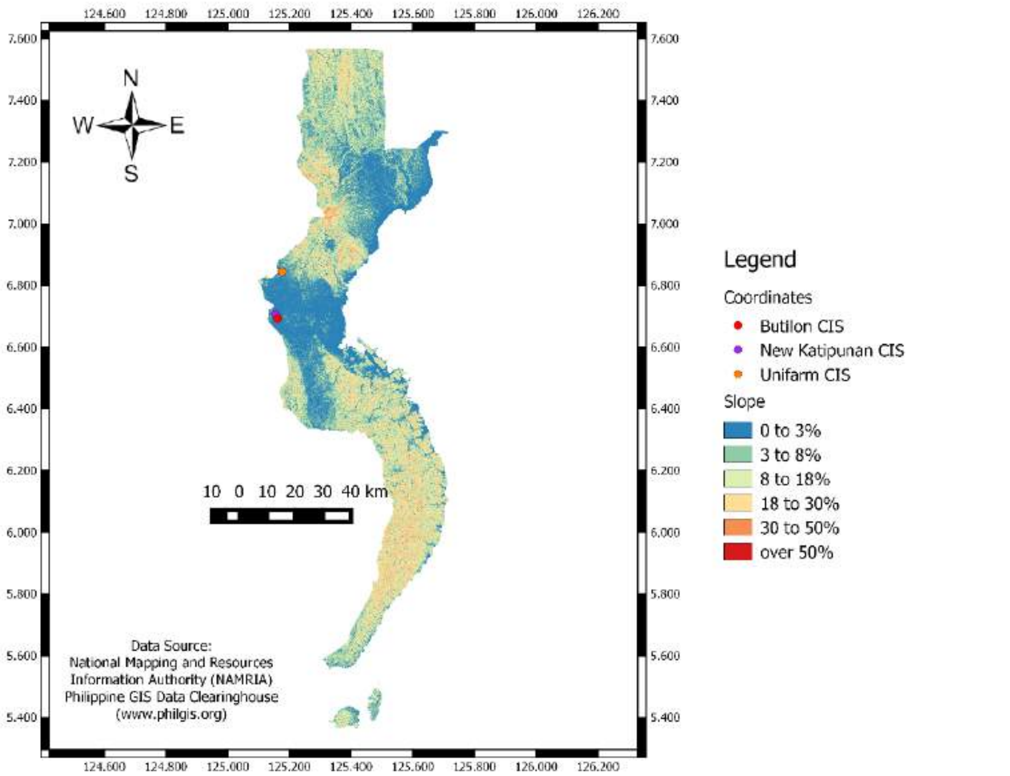

Figure 2B-7. Location of the CIS in Davao del Sur
Source: www.philgis.org

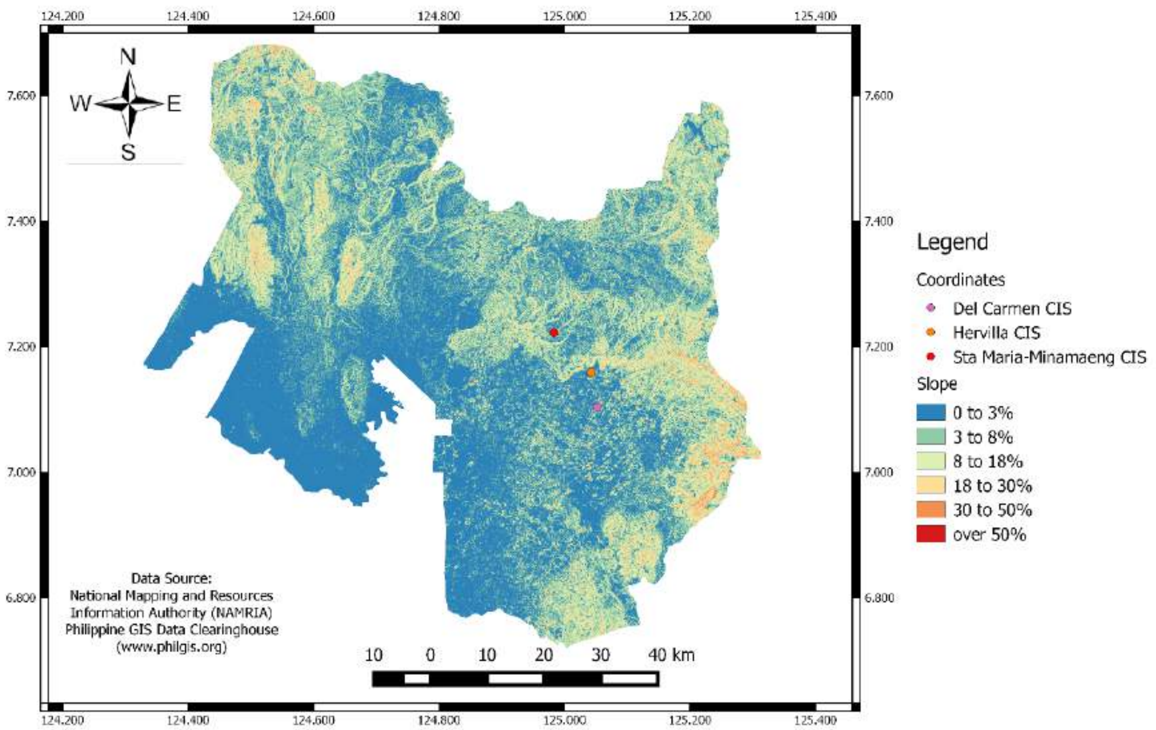

Figure 2B-8. Location of the CIS in North Cotabato
Source: www.philgis.org

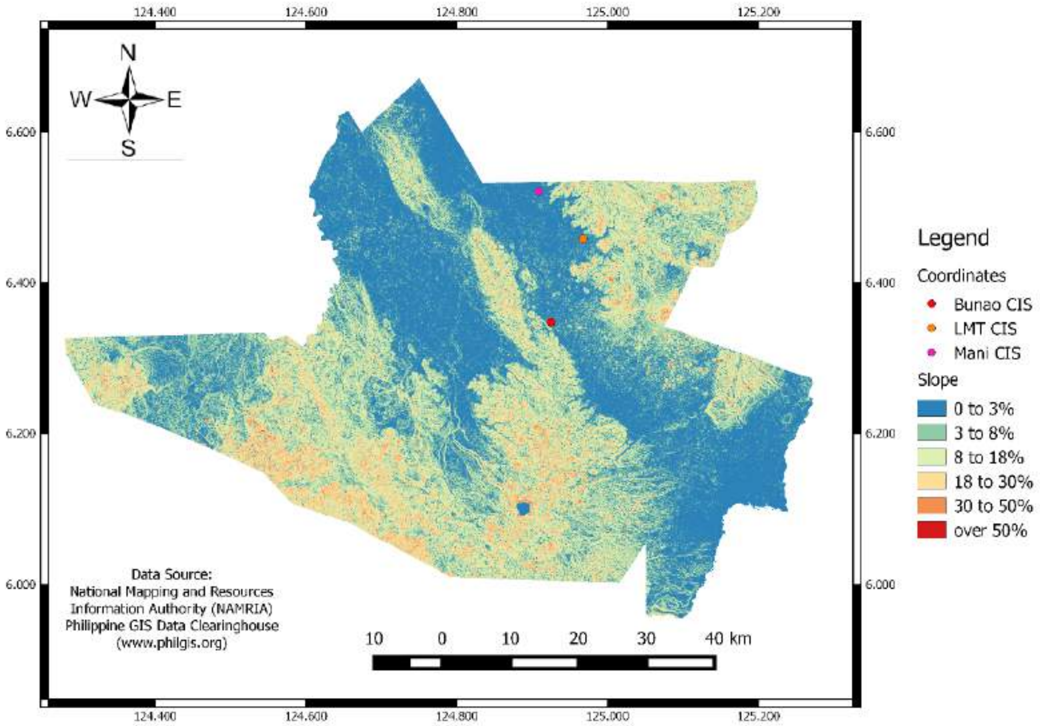

Figure 2B-9. Location of the CIS in South Cotabato
Source: www.philgis.org

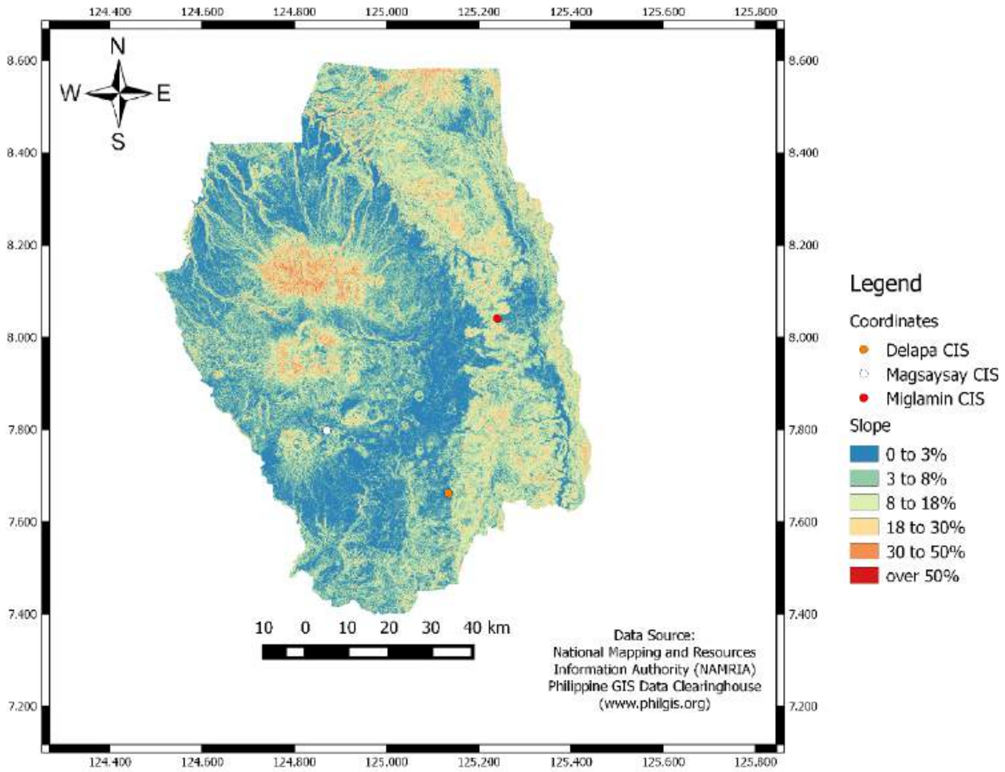

Figure 2B-10. Location of the CIS in Bukidnon
Source: www.philgis.org

16.3A. Location of the Communal Irrigation Systems in Luzon based on Groundwater Potential Map

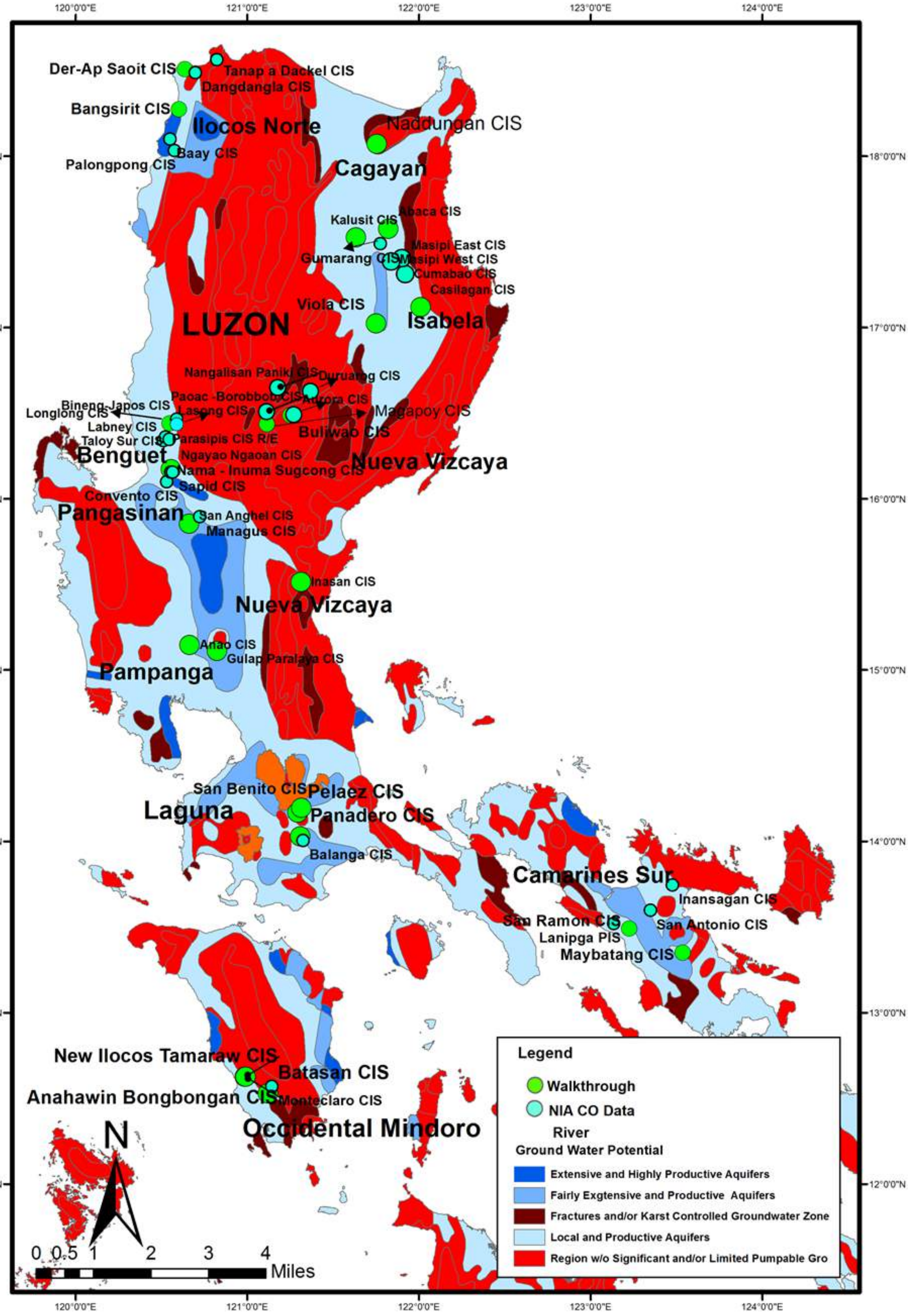

Figure 3A-1. Location of the CIS in Luzon
Source: www.philgis.org

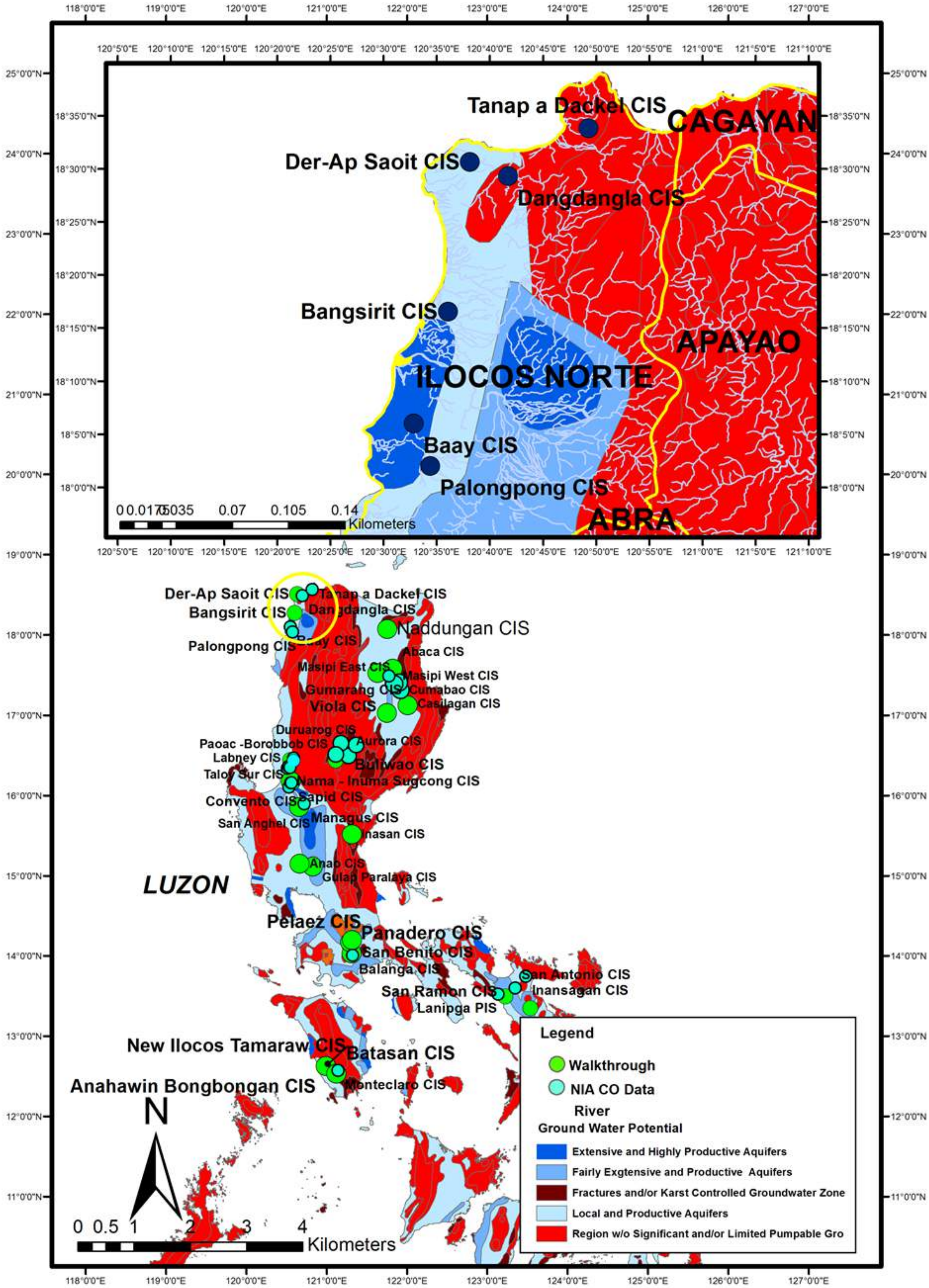

Figure 3A-2. Location of the CIS in Ilocos Norte
Source: www.philgis.org

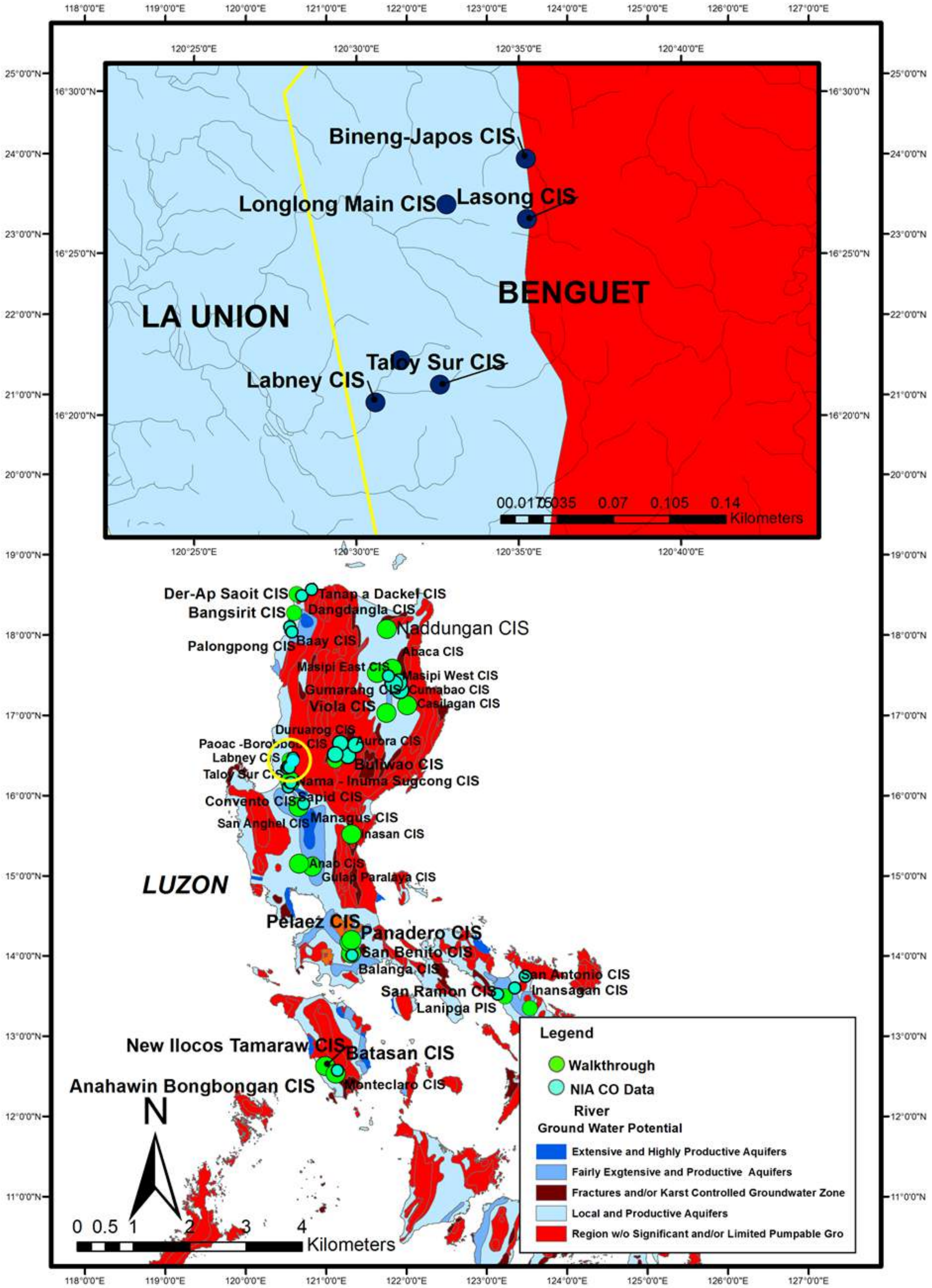

Figure 3A-3. Location of the CIS in Benguet
Source: www.philgis.org

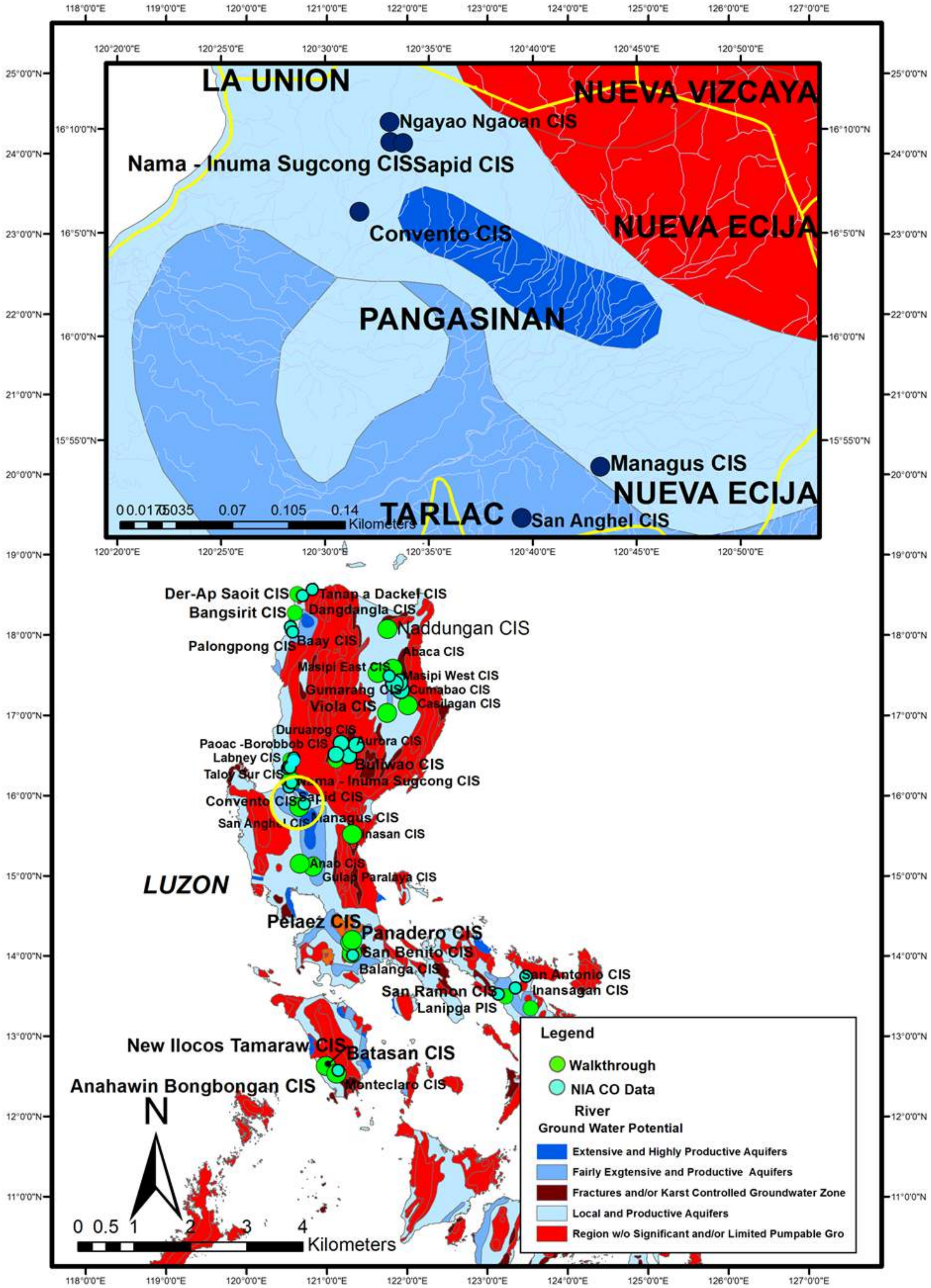

Figure 3A-4. Location of the CIS in Pangasinan
Source: www.philgis.org

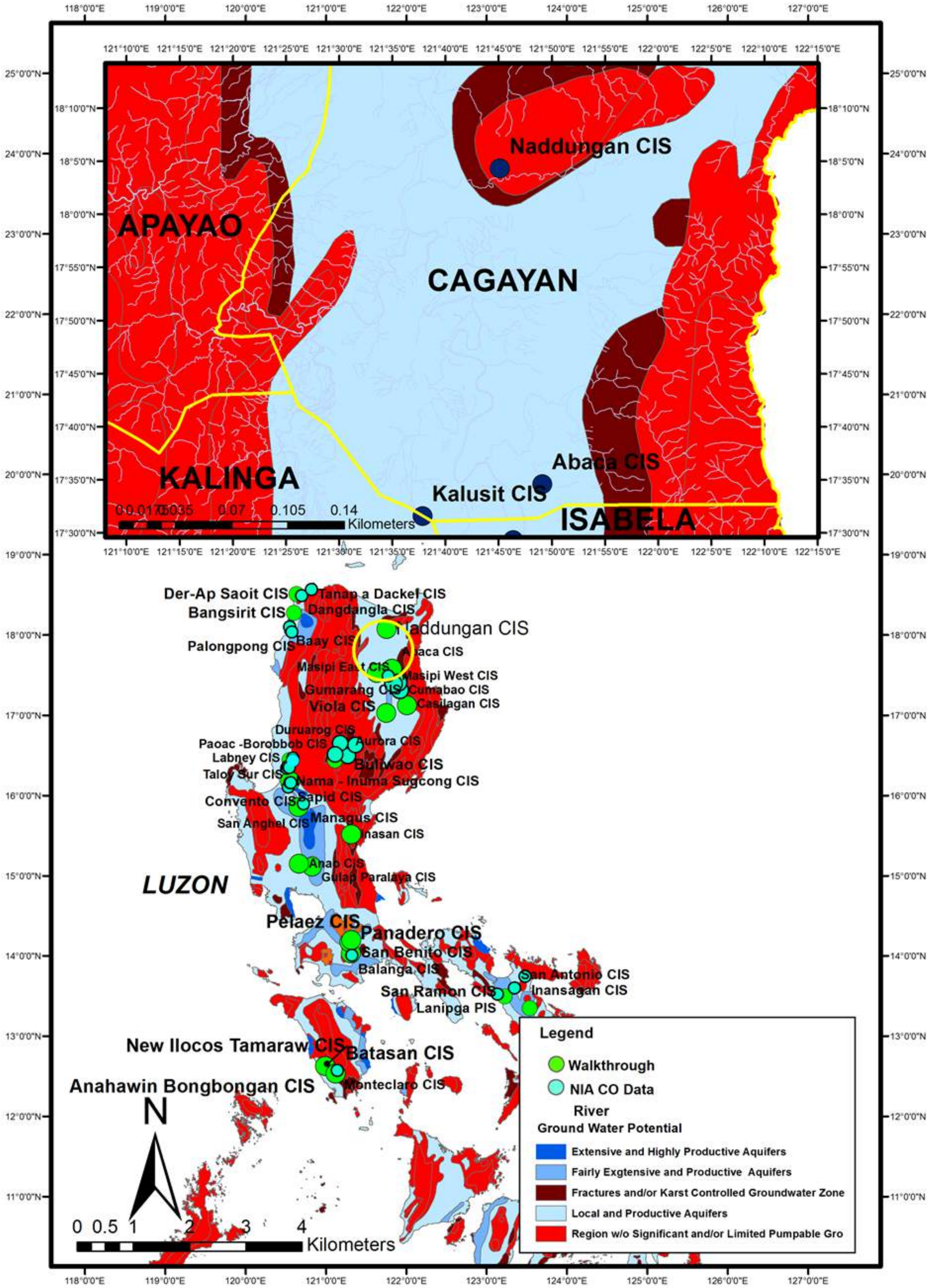

Figure 3A-5. Location of the CIS in Cagayan
Source: www.philgis.org

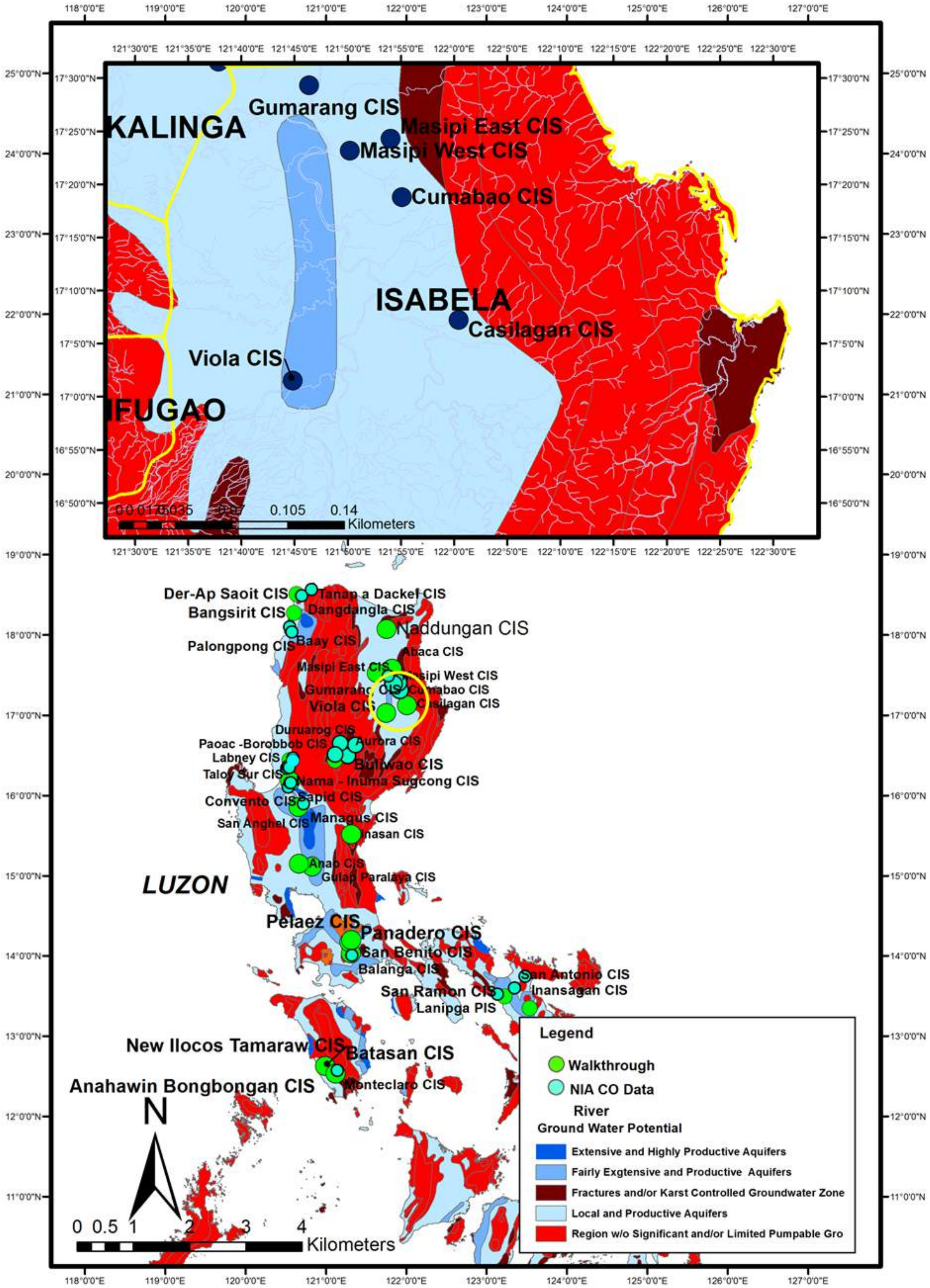

Figure 3A-6. Location of the CIS in Isabela
Source: www.philgis.org

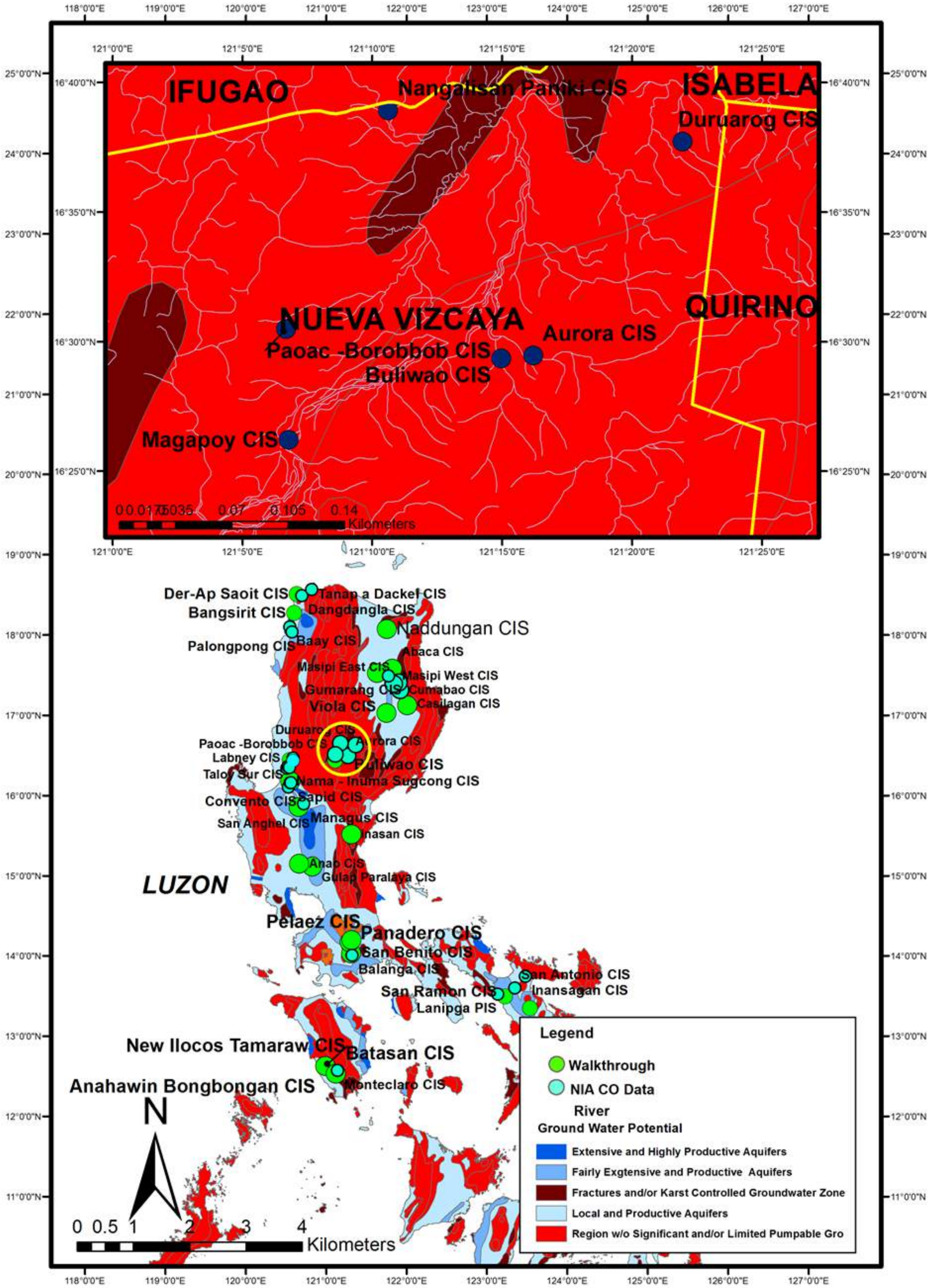

Figure 3A-7. Location of the CIS in Nueva Vizcaya
Source: www.philgis.org

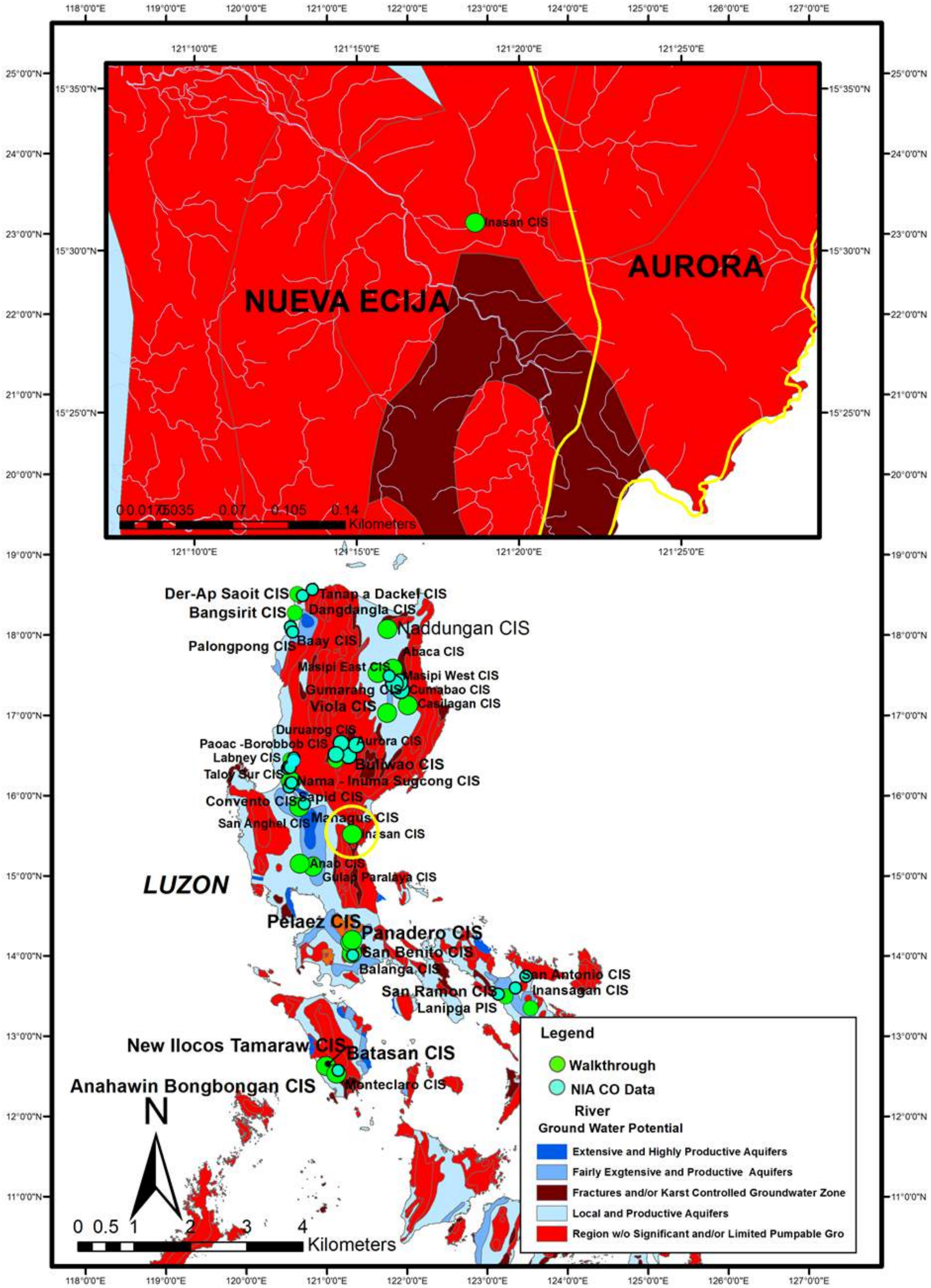

Figure 3A-8. Location of the CIS in South Nueva Ecija
Source: www.philgis.org

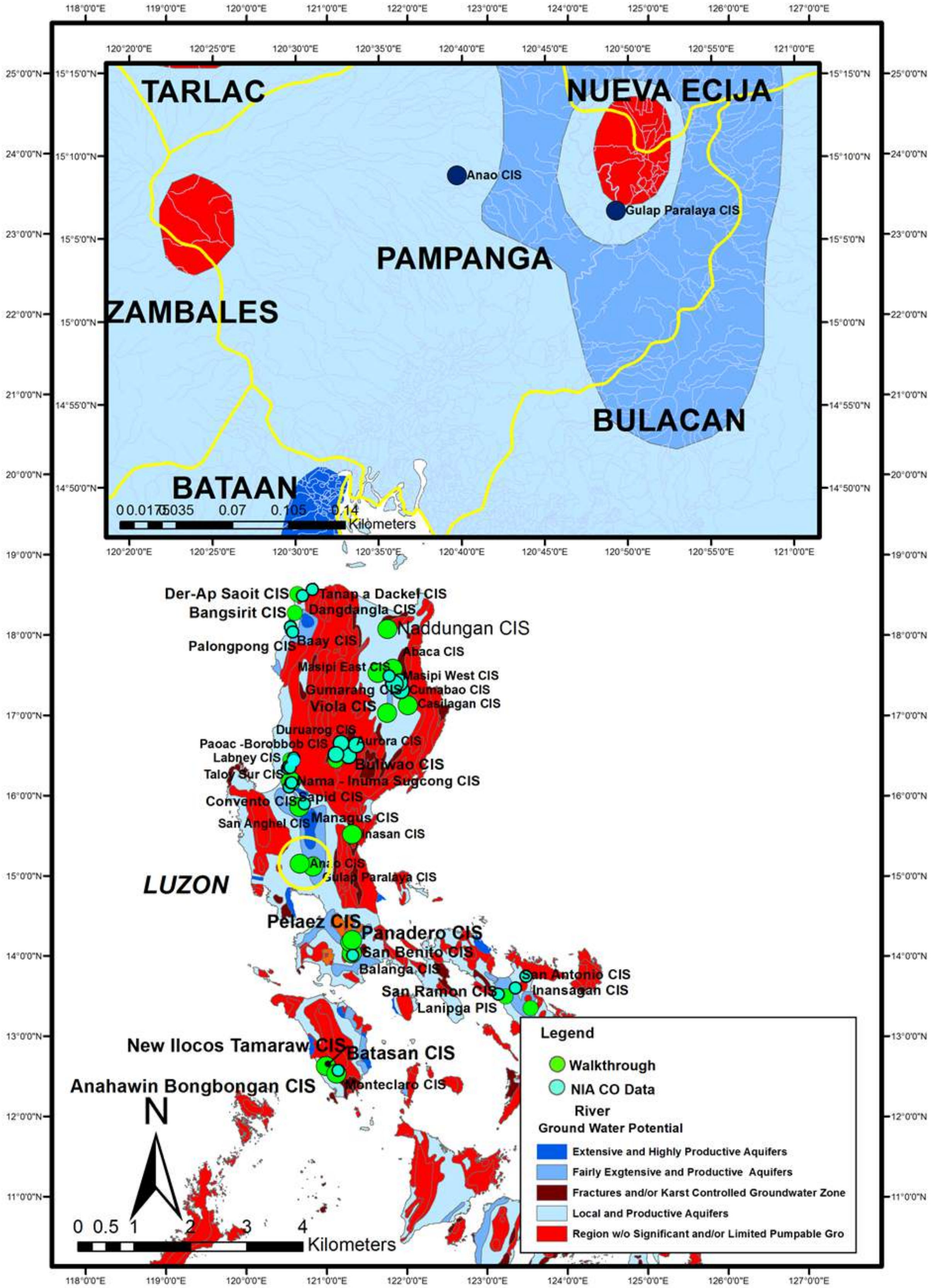

Figure 3A-9. Location of the CIS in Pampanga

Source: www.philgis.org

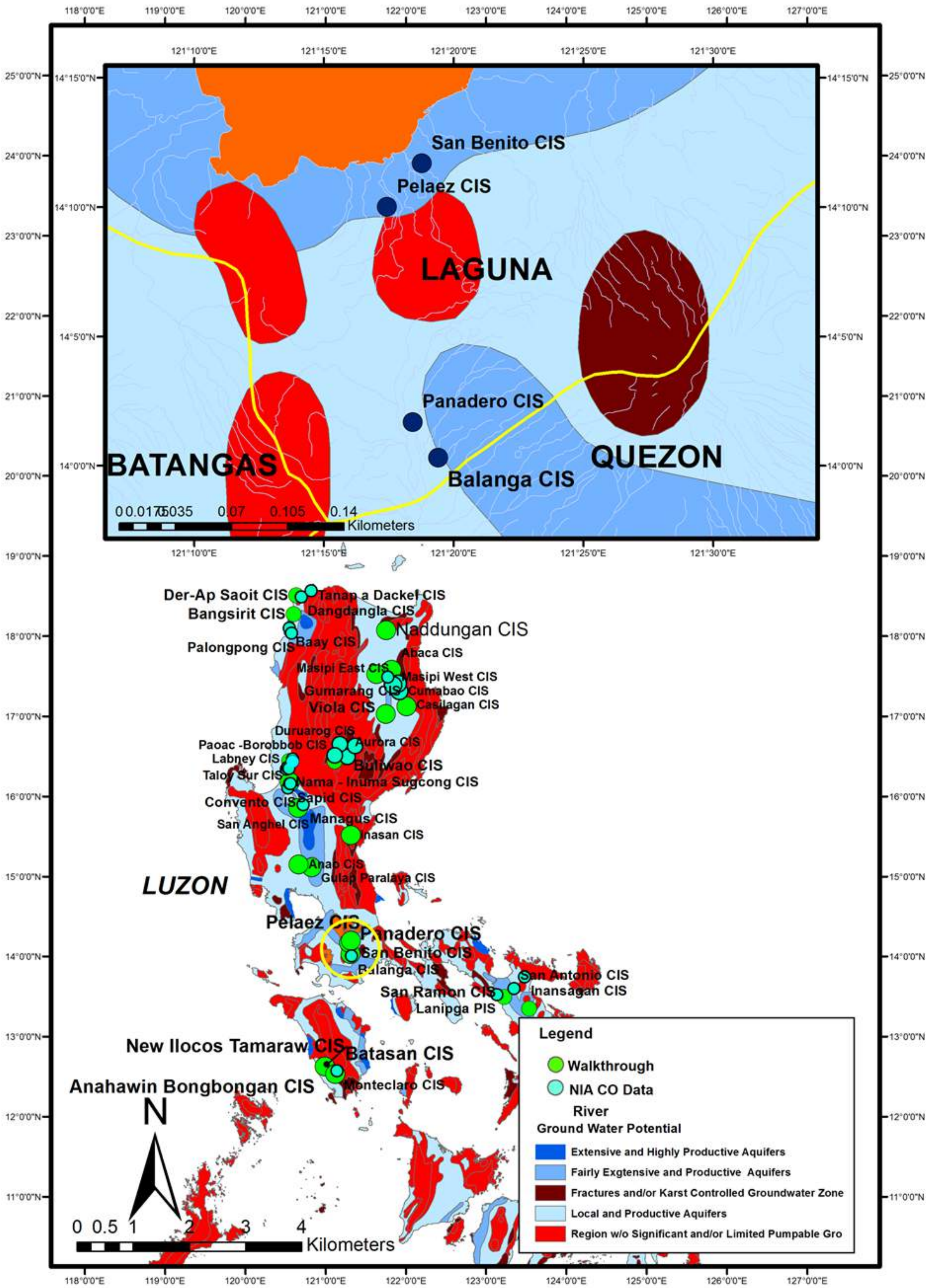

Figure 3A-10. Location of the CIS in Laguna
Source: www.philgis.org

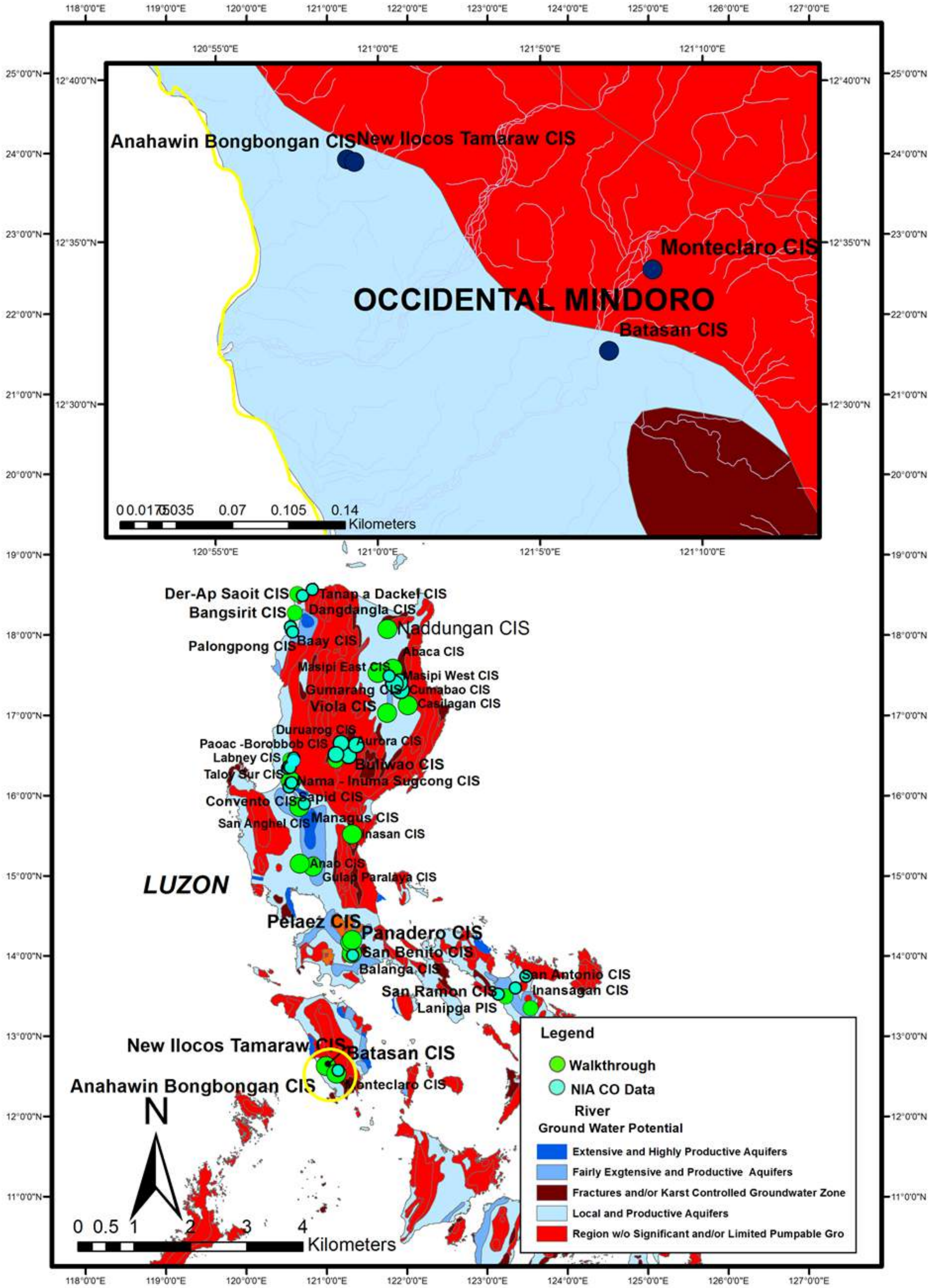

Figure 3A-11. Location of the CIS in Occidental Mindoro

Source: www.philgis.org

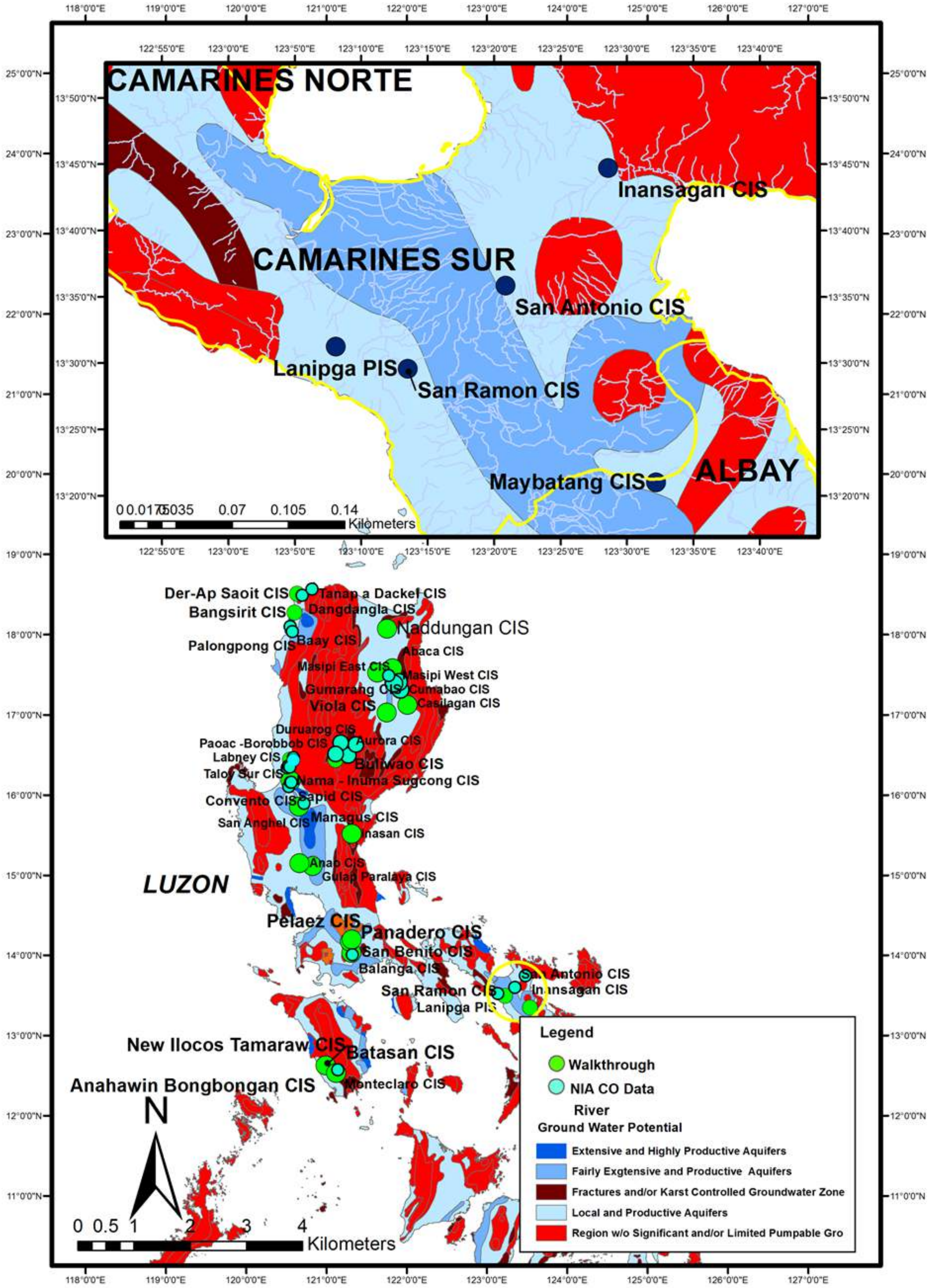

Figure 3A-12. Location of the CIS in Camarines Sur
Source: www.philgis.org

16.3B. Location of the Communal Irrigation Systems in Visayas and Mindanao based on Groundwater Potential Map

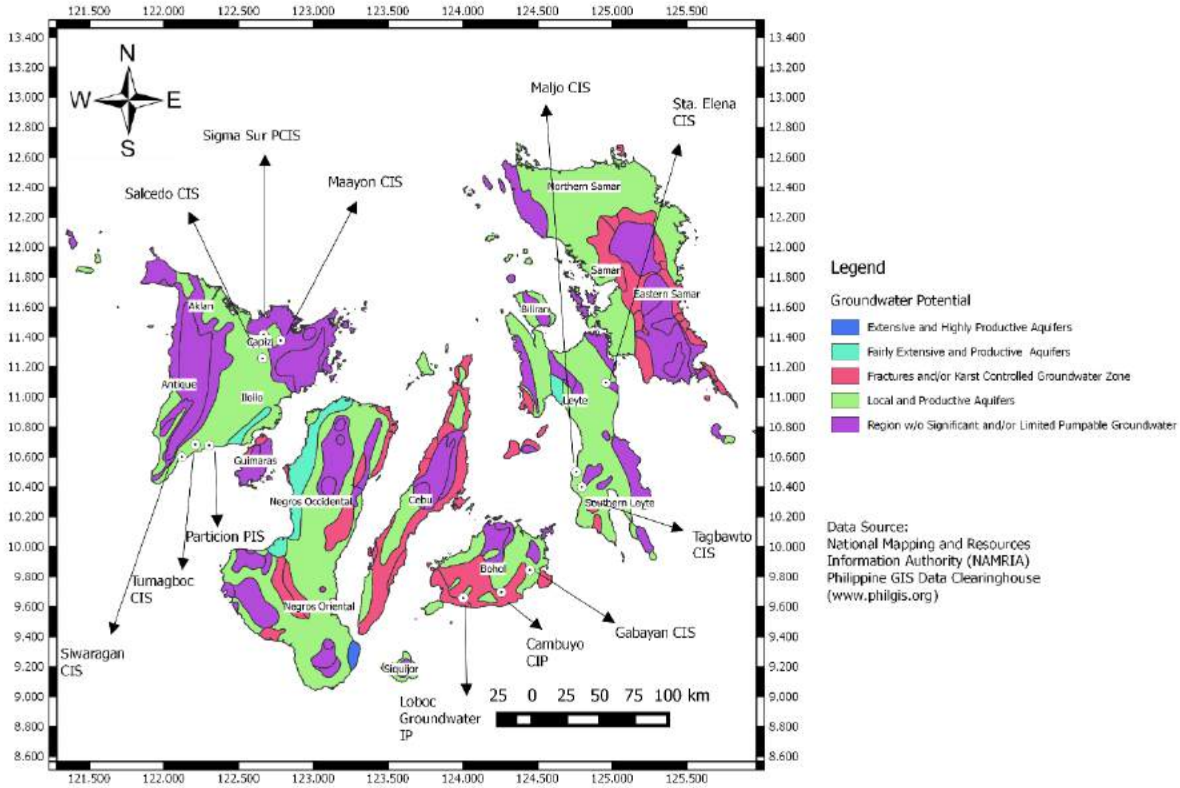

Figure 3B-1. Location of the CIS in Visayas
Source: www.philgis.org

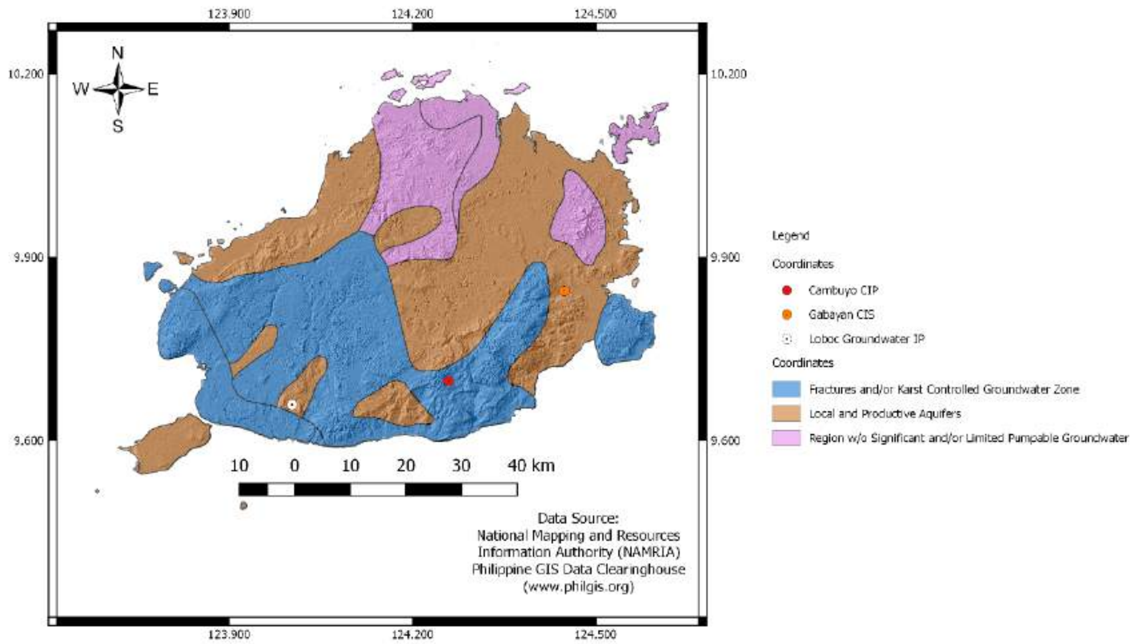

Figure 3B-2. Location of the CIS in Bohol
Source: www.philgis.org

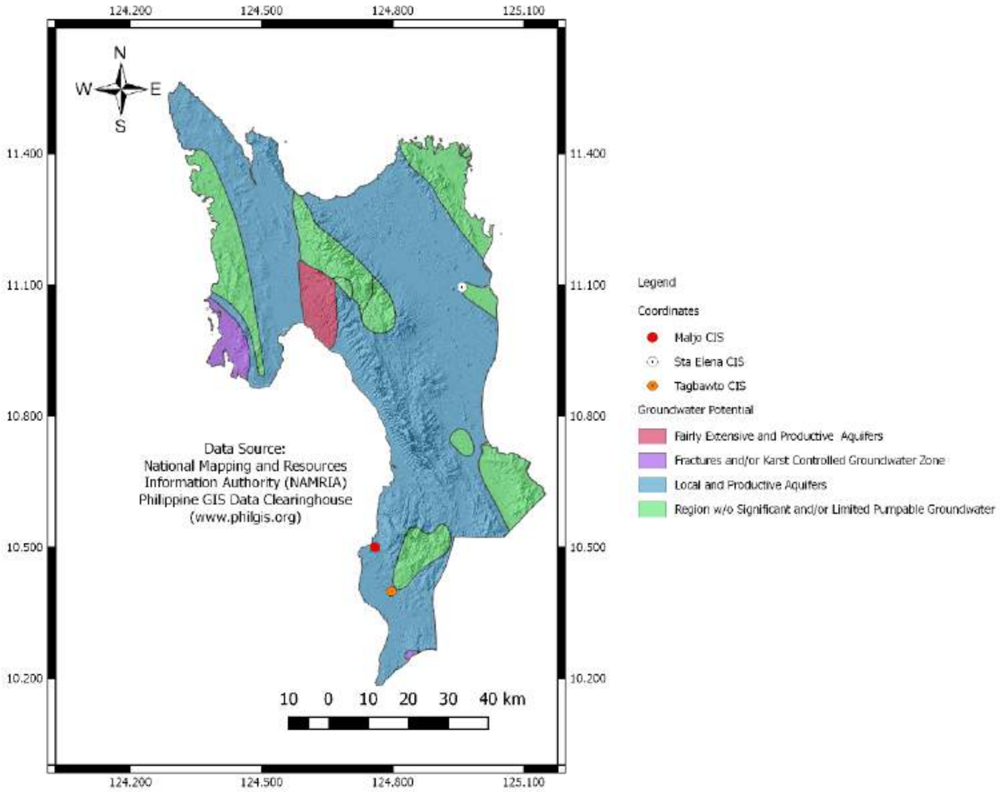

Figure 3B-3. Location of the CIS in Leyte
Source: www.philgis.org

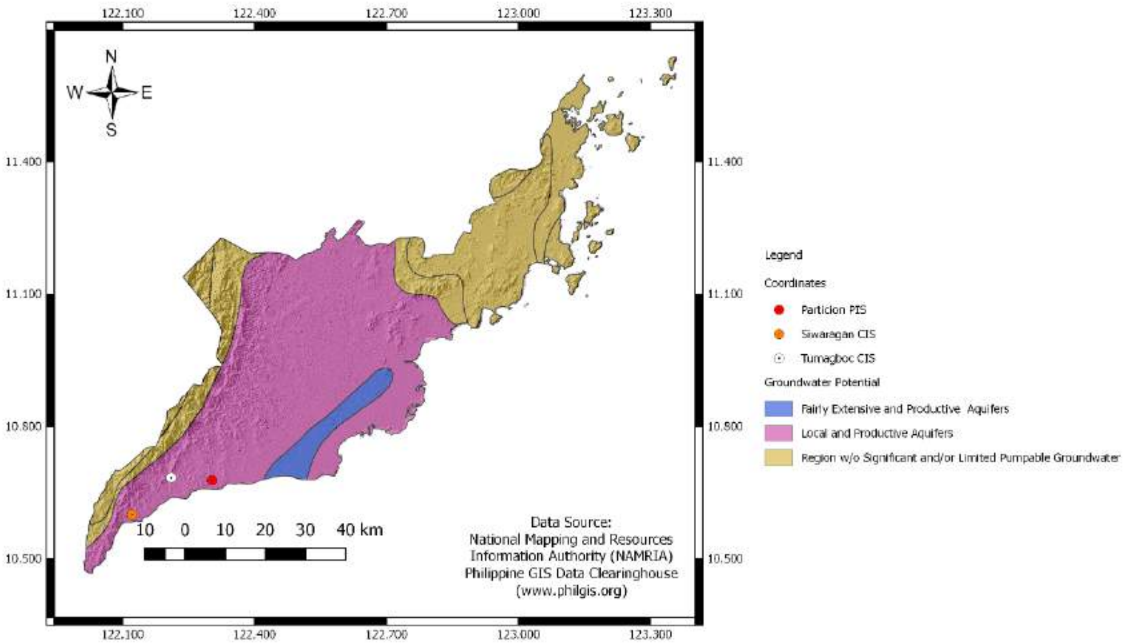

Figure 3B-4. Location of the CIS in Iloilo
Source: www.philgis.org

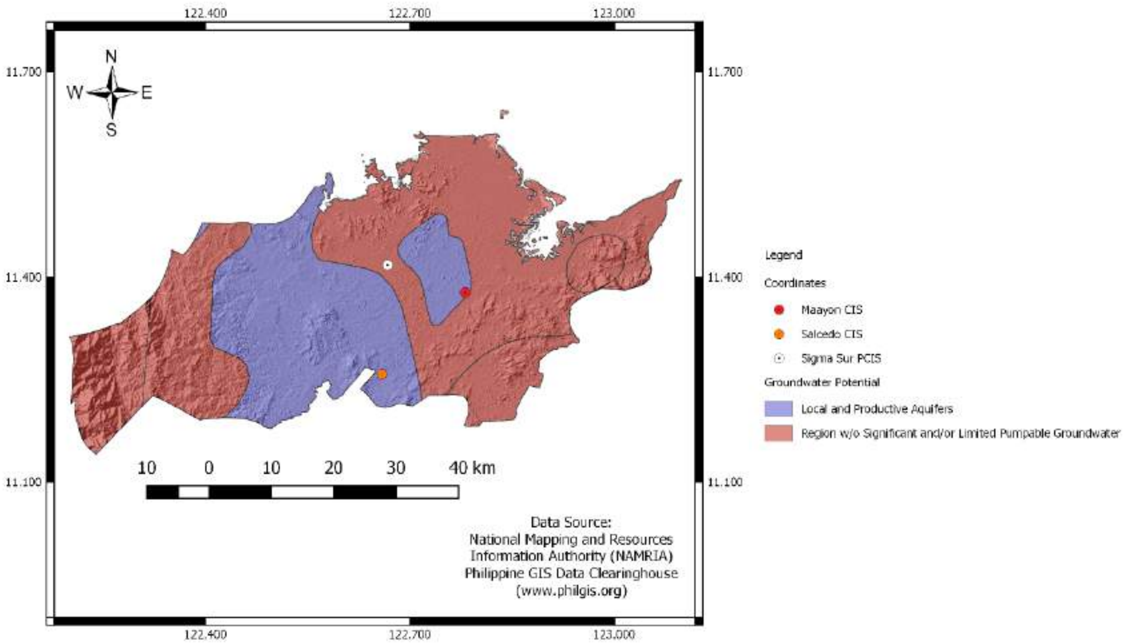

Figure 3B-5. Location of the CIS in Capiz
Source: www.philgis.org

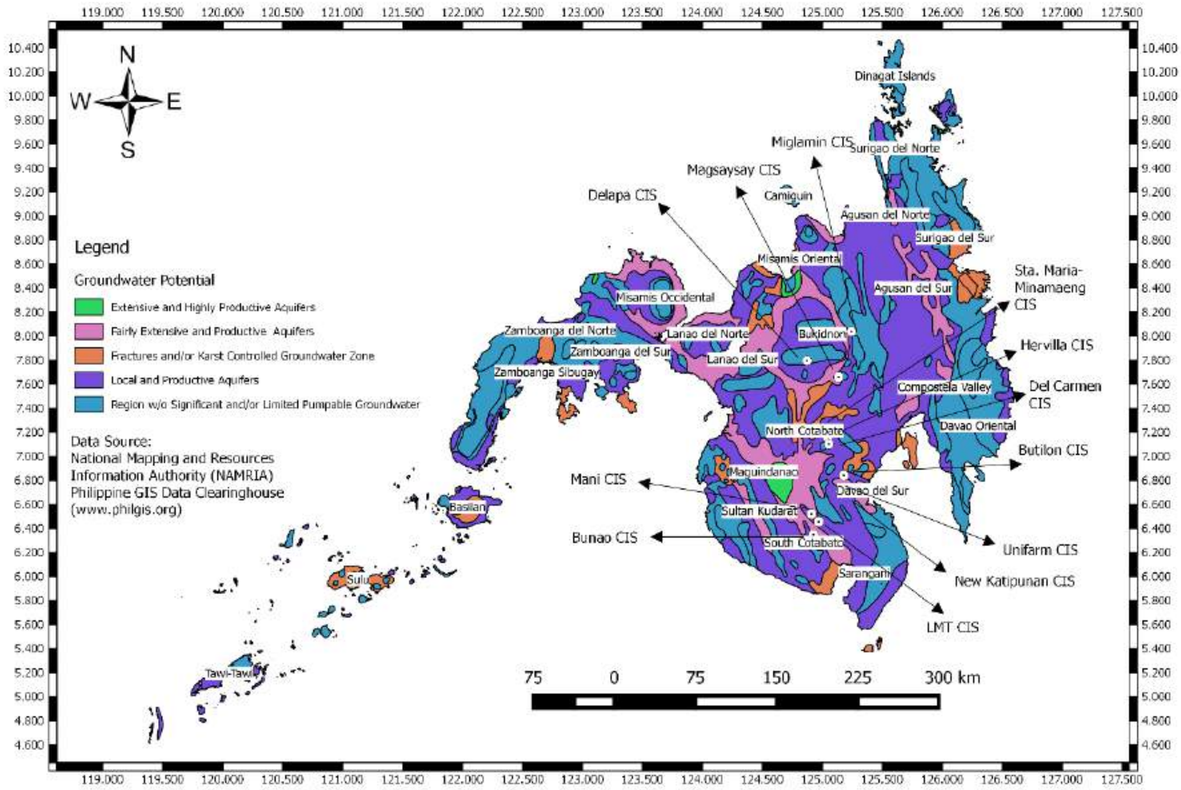

Figure 3B-6. Location of the CIS in Mindanao
Source: www.philgis.org

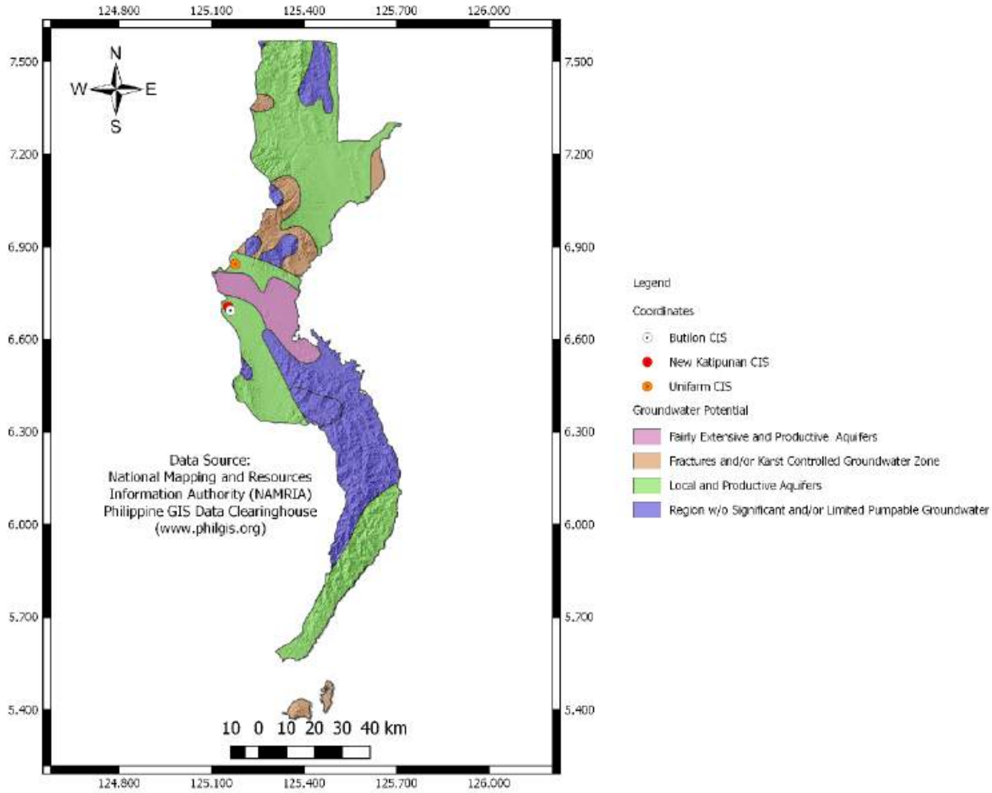

Figure 3B-7. Location of the CIS in Davao del Sur

Source: www.philgis.org

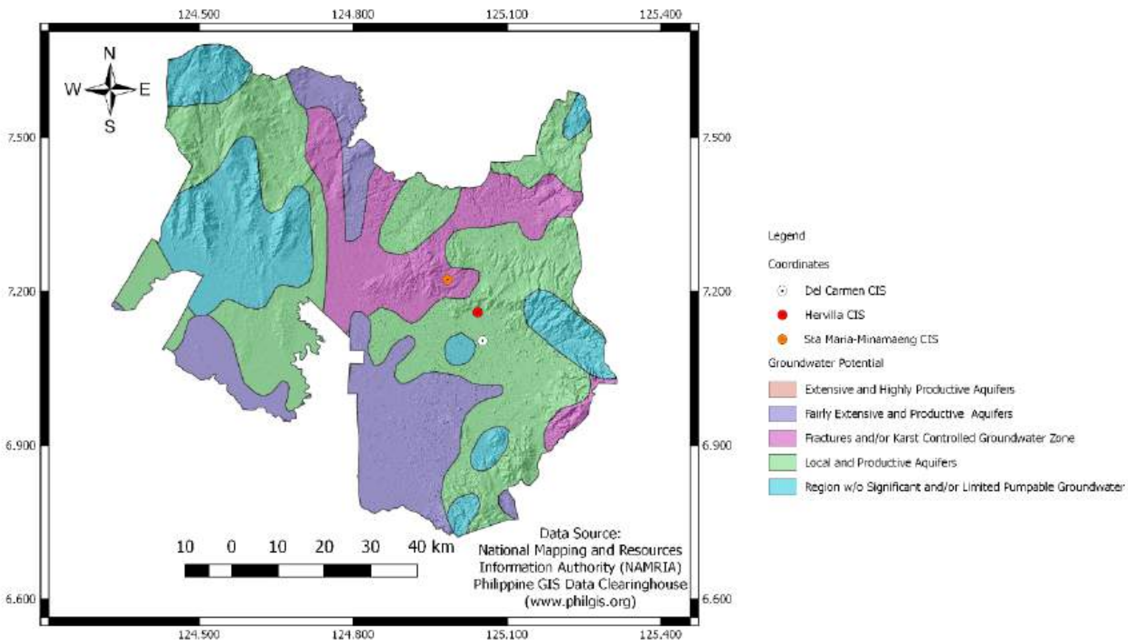

Figure 3B-8. Location of the CIS in North Cotabato

Source: www.philgis.org

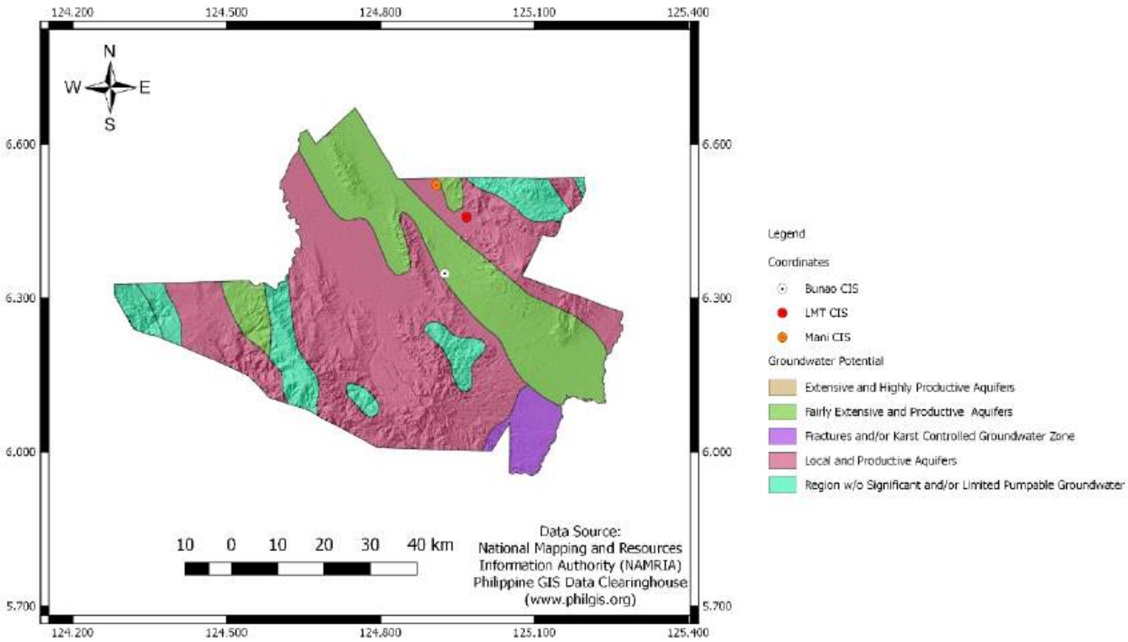

Figure 3B-9. Location of the CIS in South Cotabato
Source: www.philgis.org

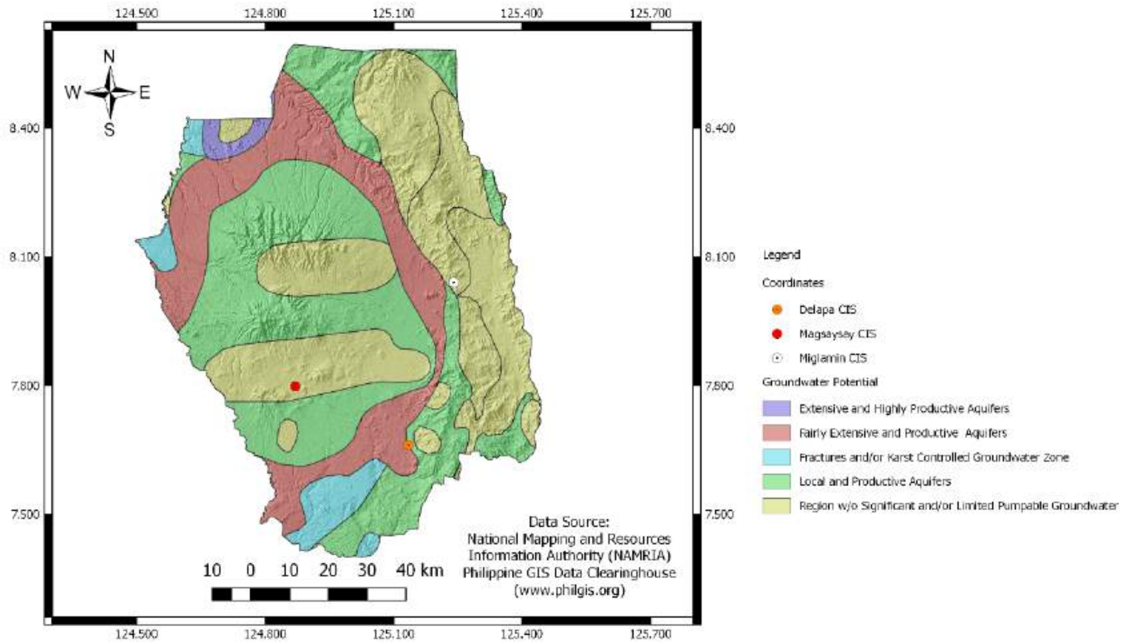

Figure 3B-10. Location of the CIS in Bukidnon
Source: www.philgis.org

16.4A. Location of the Communal Irrigation Systems in Luzon based on Soil Erosion Map

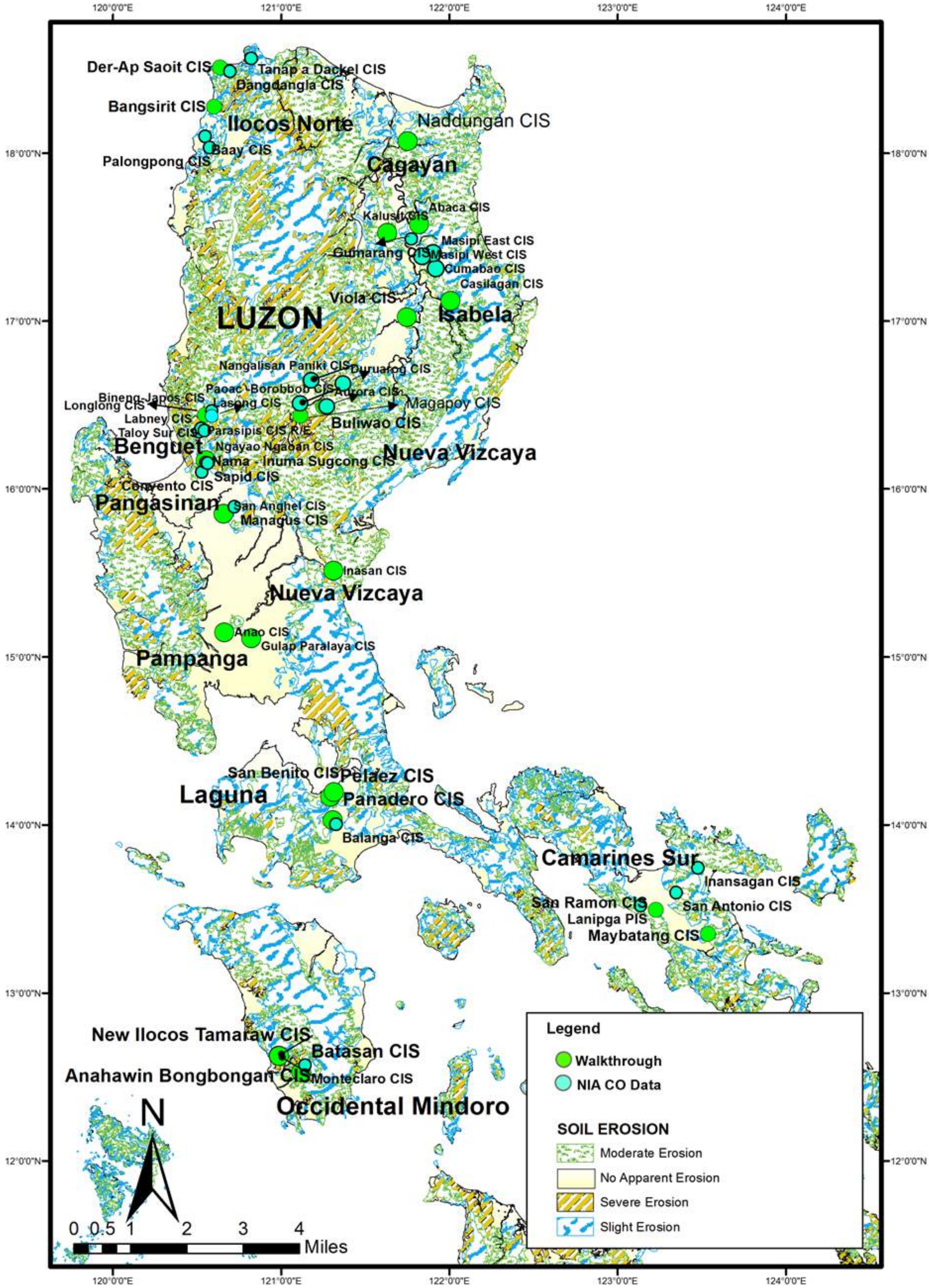

Figure 4A-1. Location of the CIS in Luzon

Source: www.philgis.org

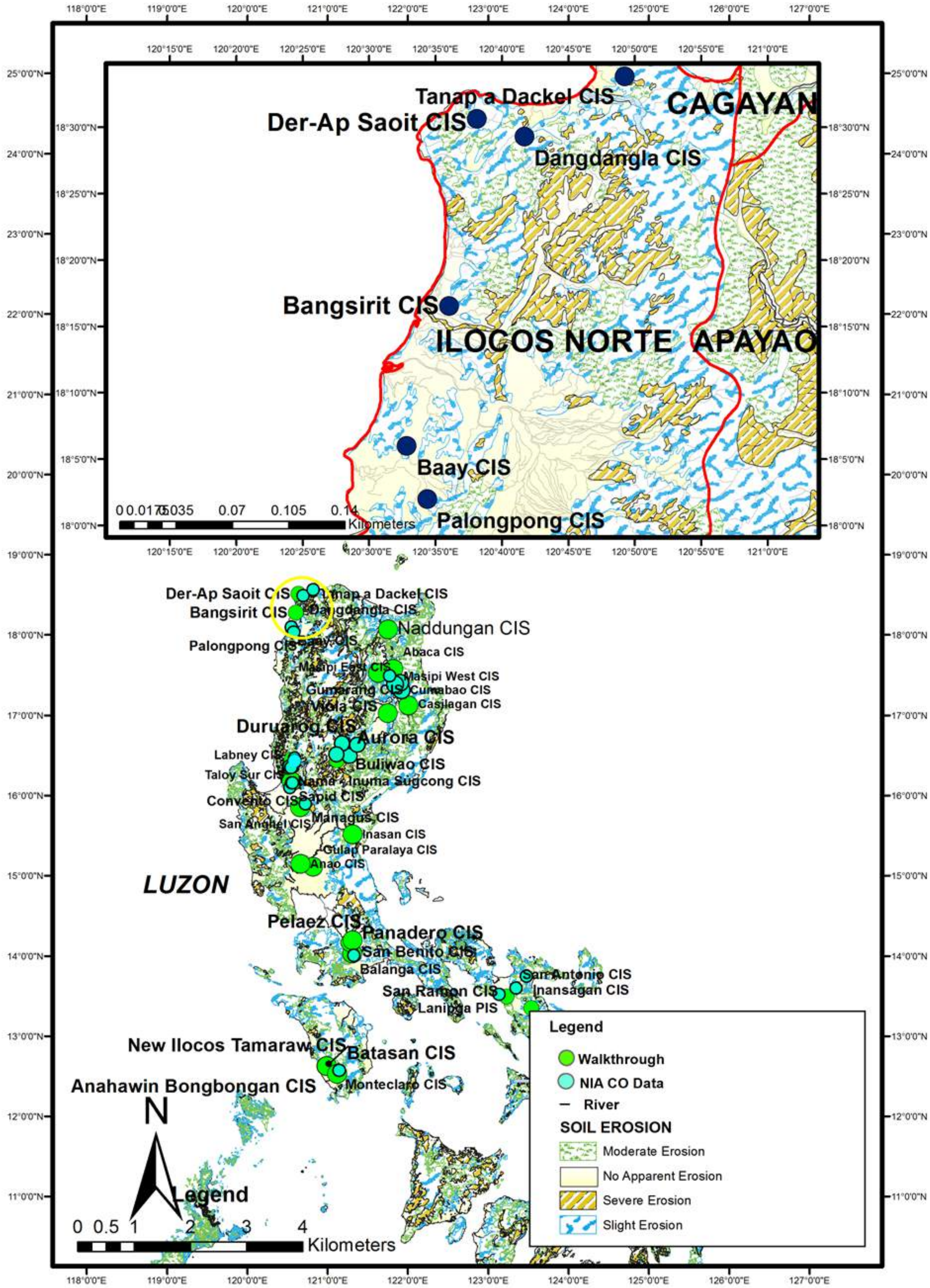

Figure 4A-2. Location of the CIS in Ilocos Norte
Source: www.philgis.org

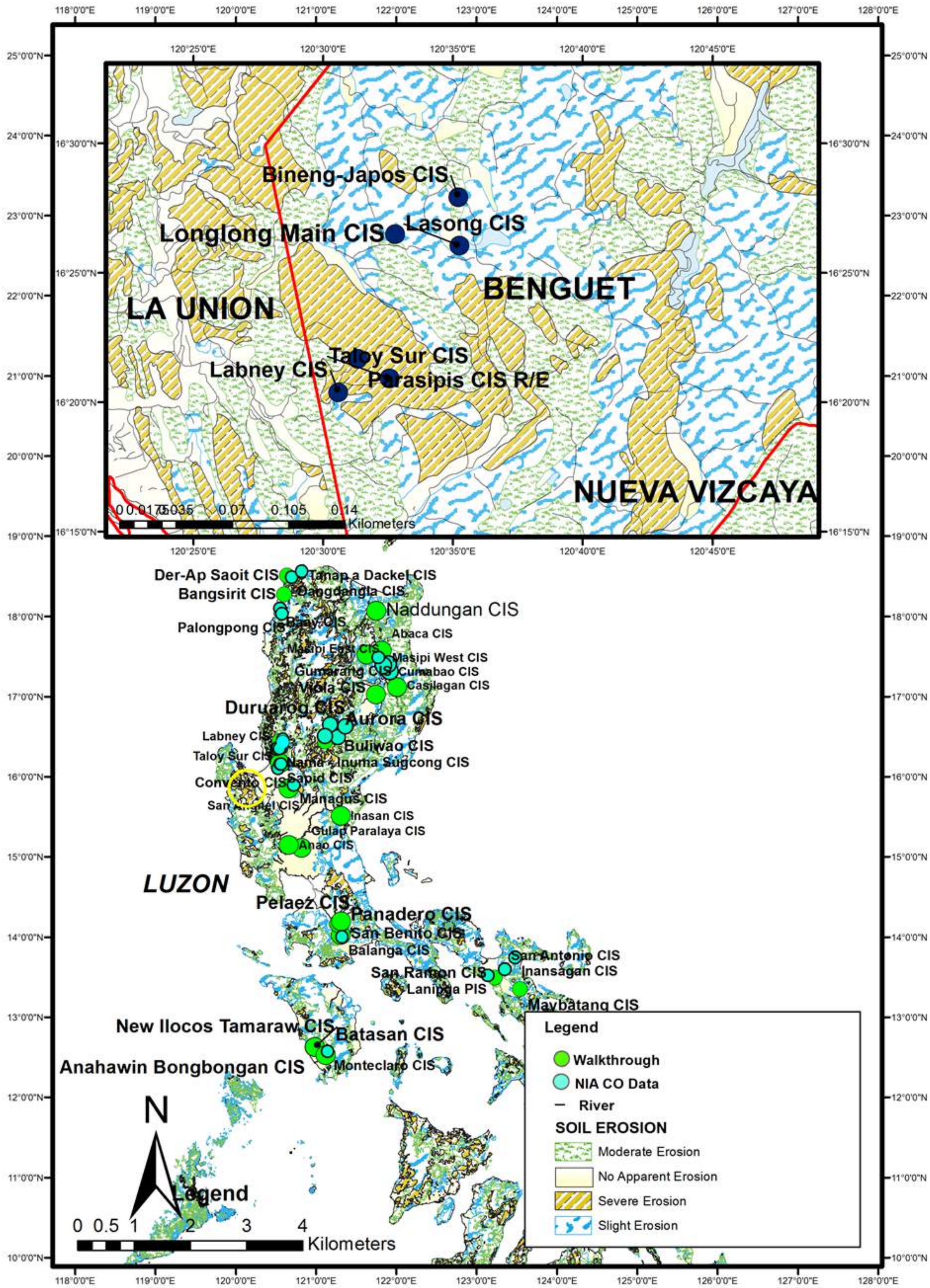

Figure 4A-3. Location of the CIS in Benguet
Source: www.philgis.org

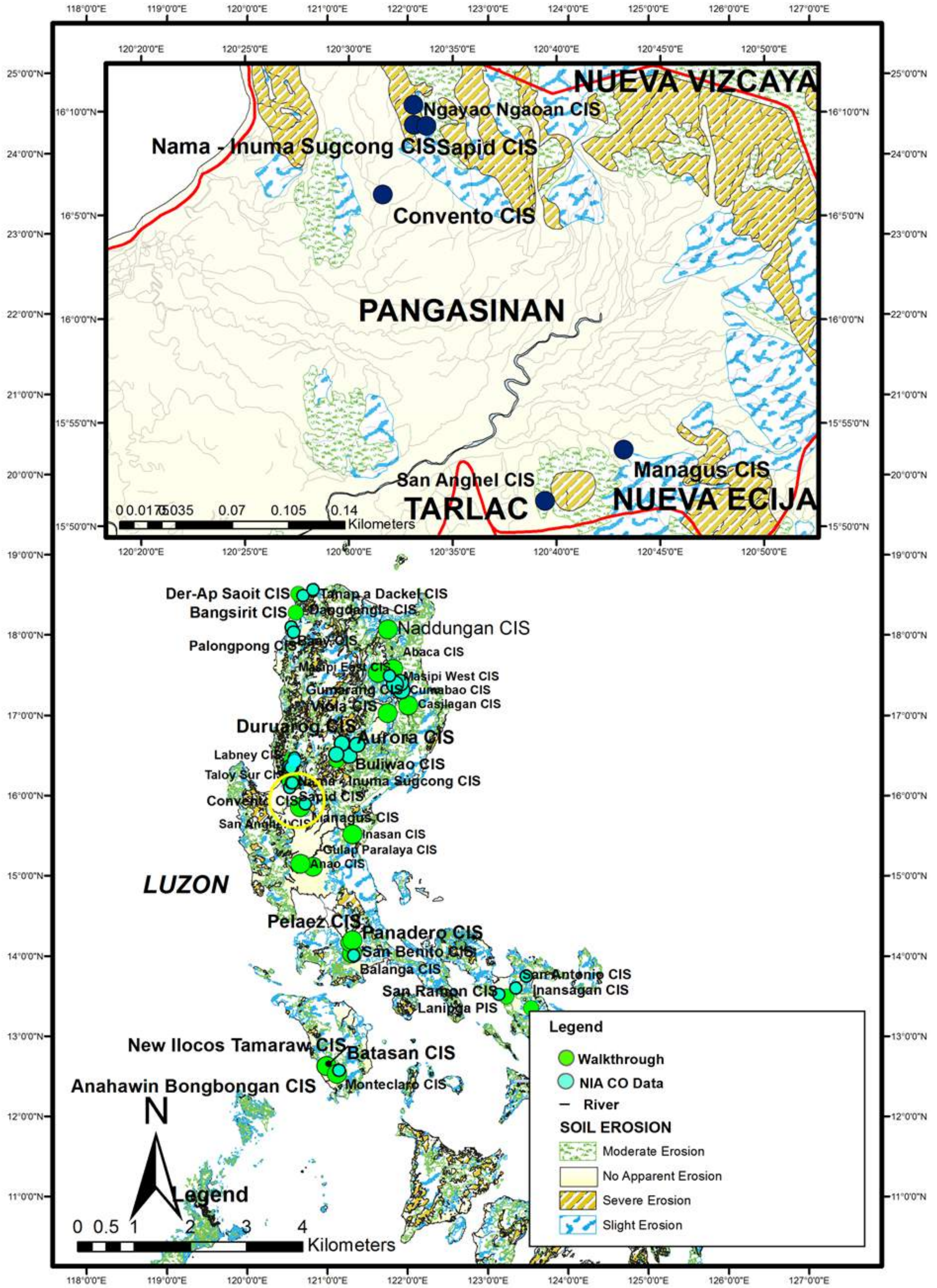

Figure 4A-4. Location of the CIS in Pangasinan
Source: www.philgis.org

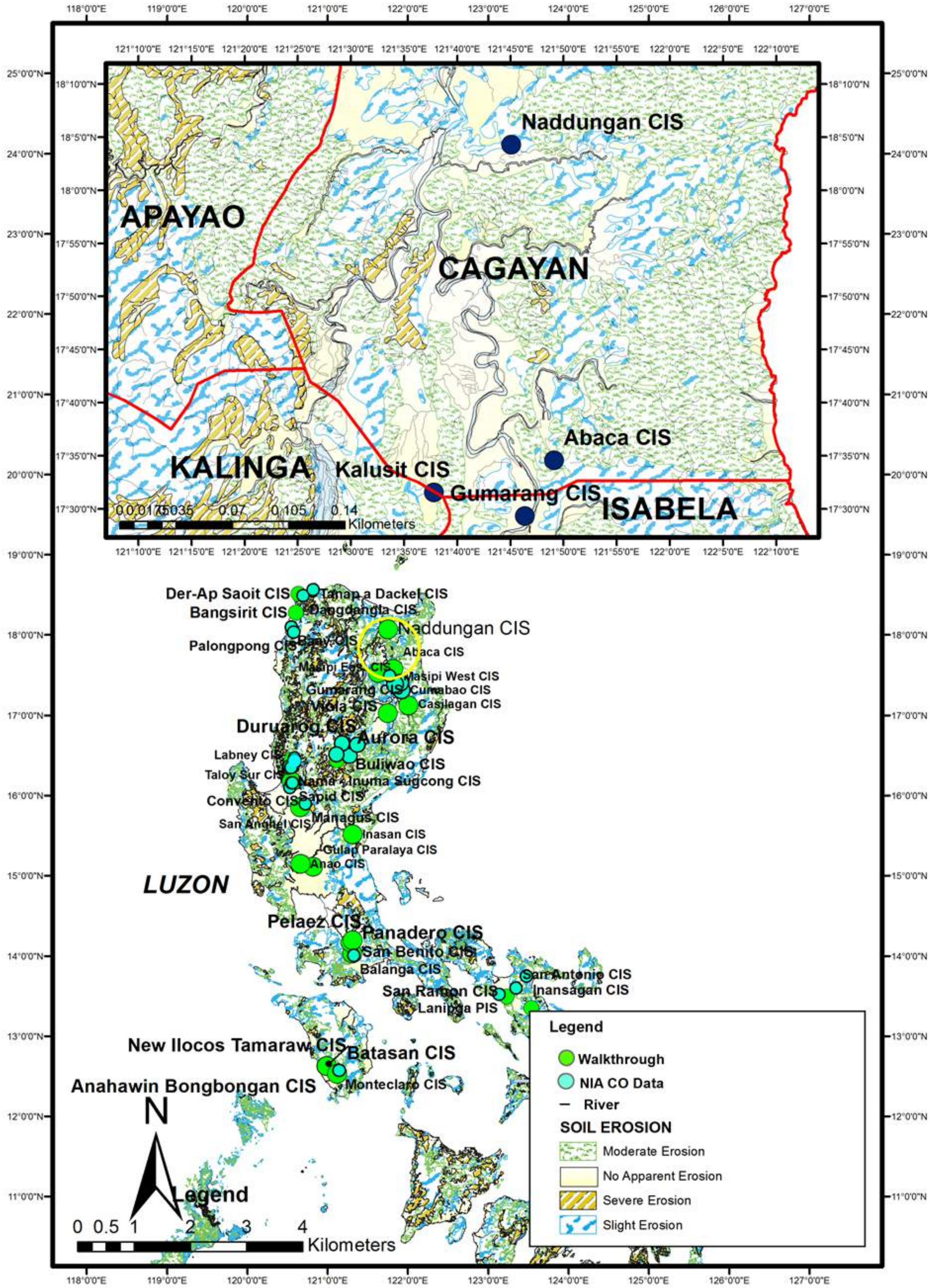

Figure 4A-5. Location of the CIS in Cagayan

Source: www.philgis.org

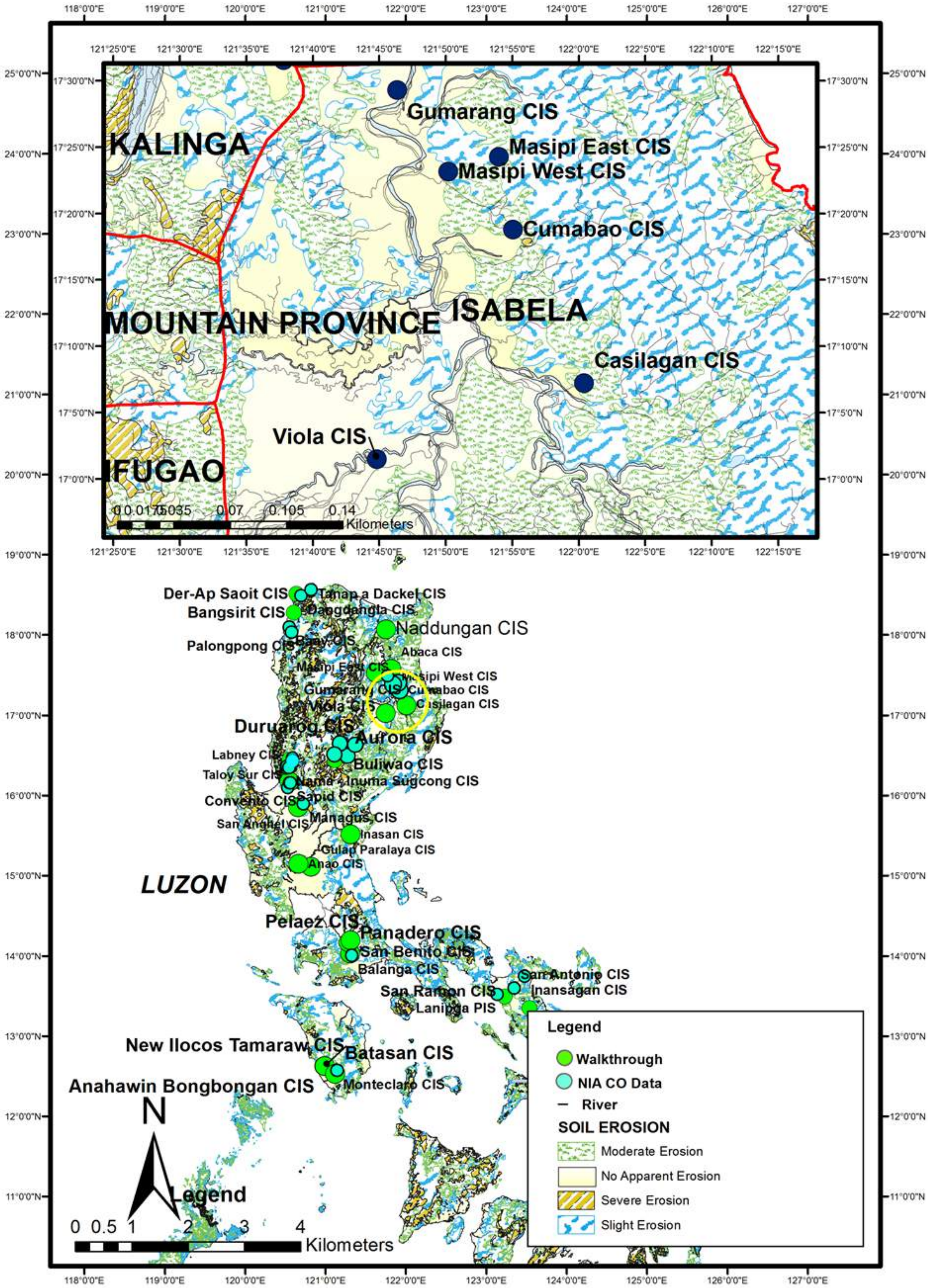

Figure 4A-6. Location of the CIS in Isabela
Source: www.philgis.org

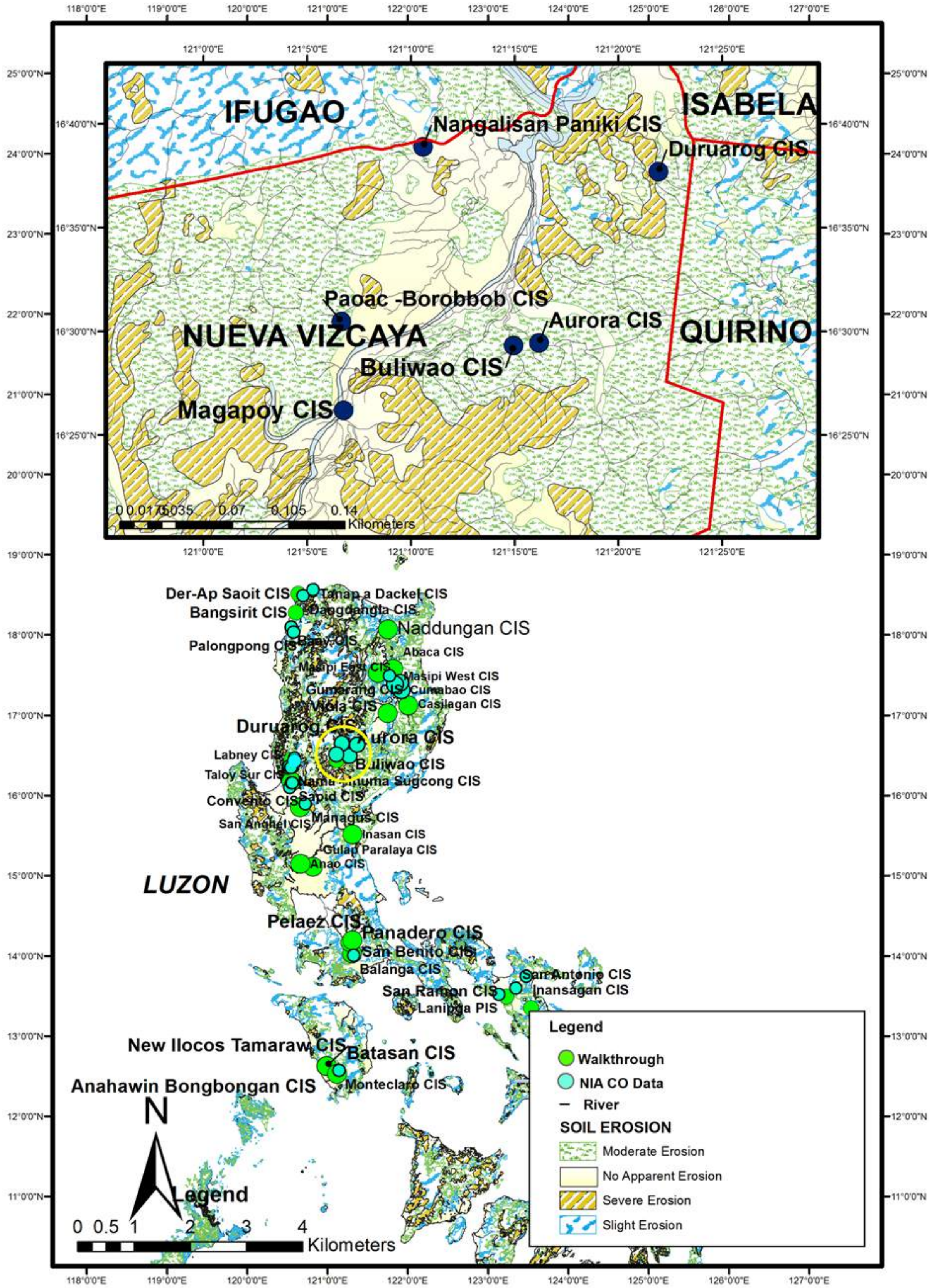

Figure 4A-7. Location of the CIS in Nueva Vizcaya
Source: www.philgis.org

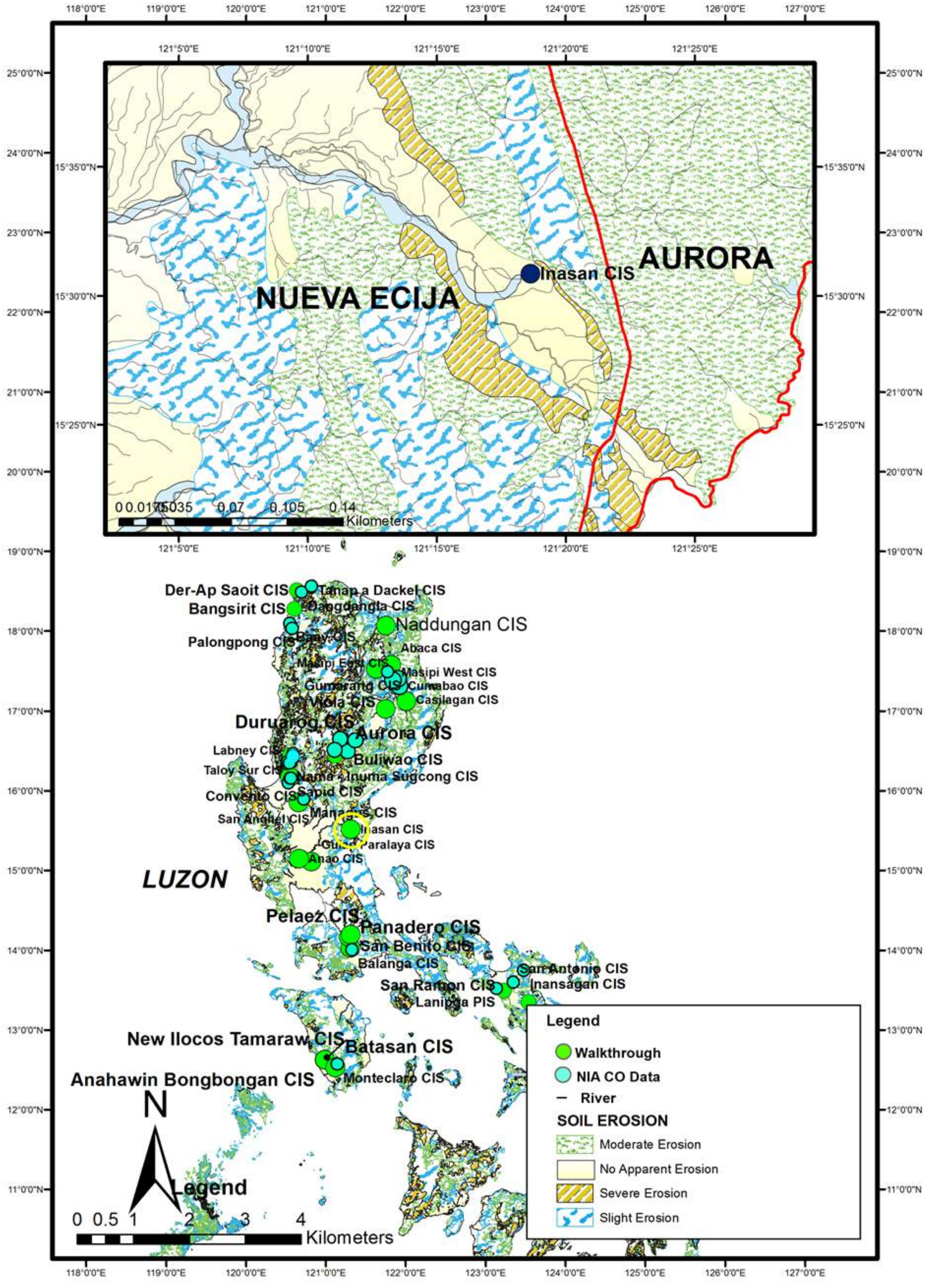

Figure 4A-8. Location of the CIS in South Nueva Ecija
Source: www.philgis.org

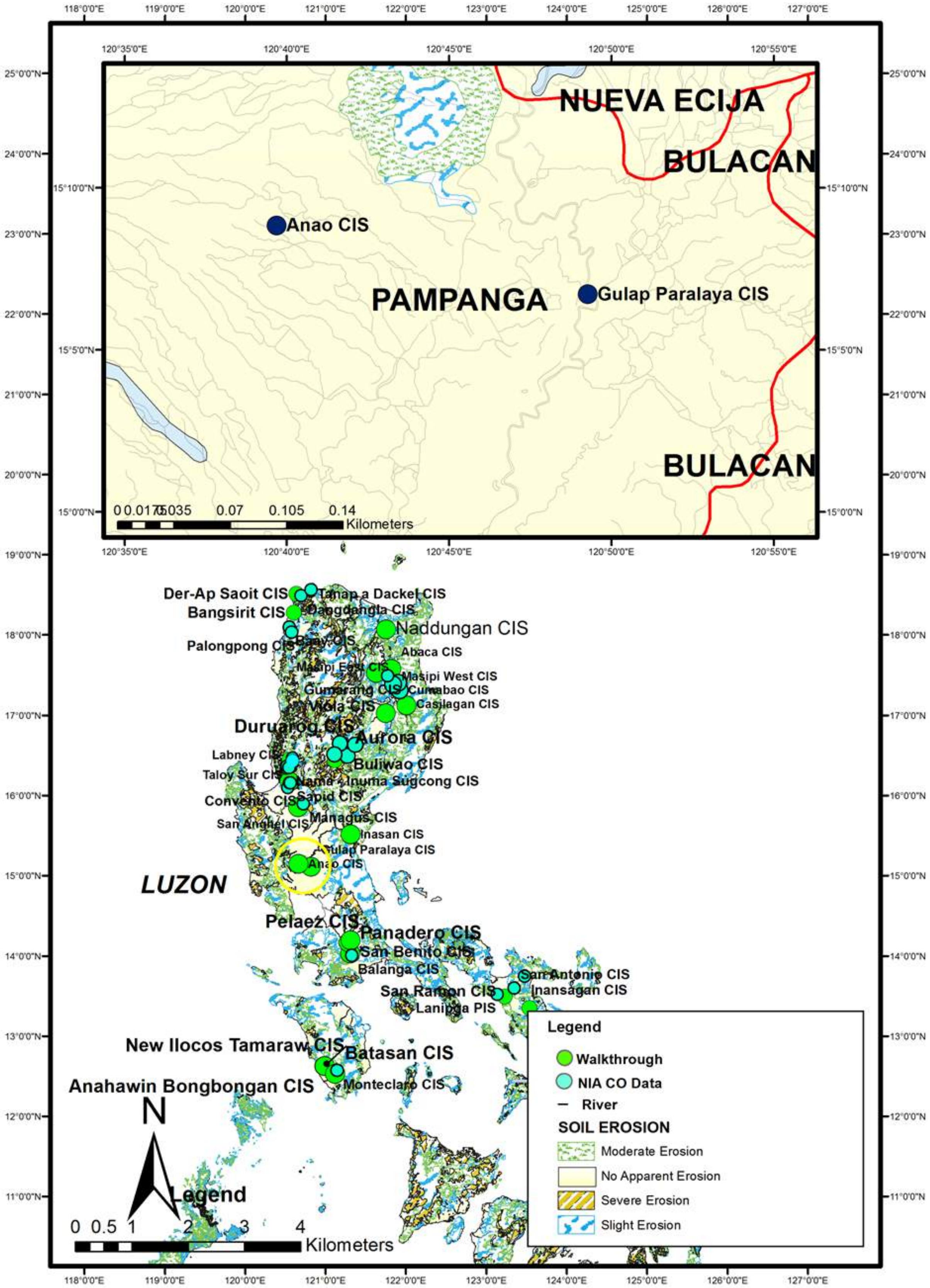

Figure 4A-9. Location of the CIS in Pampanga
Source: www.philgis.org

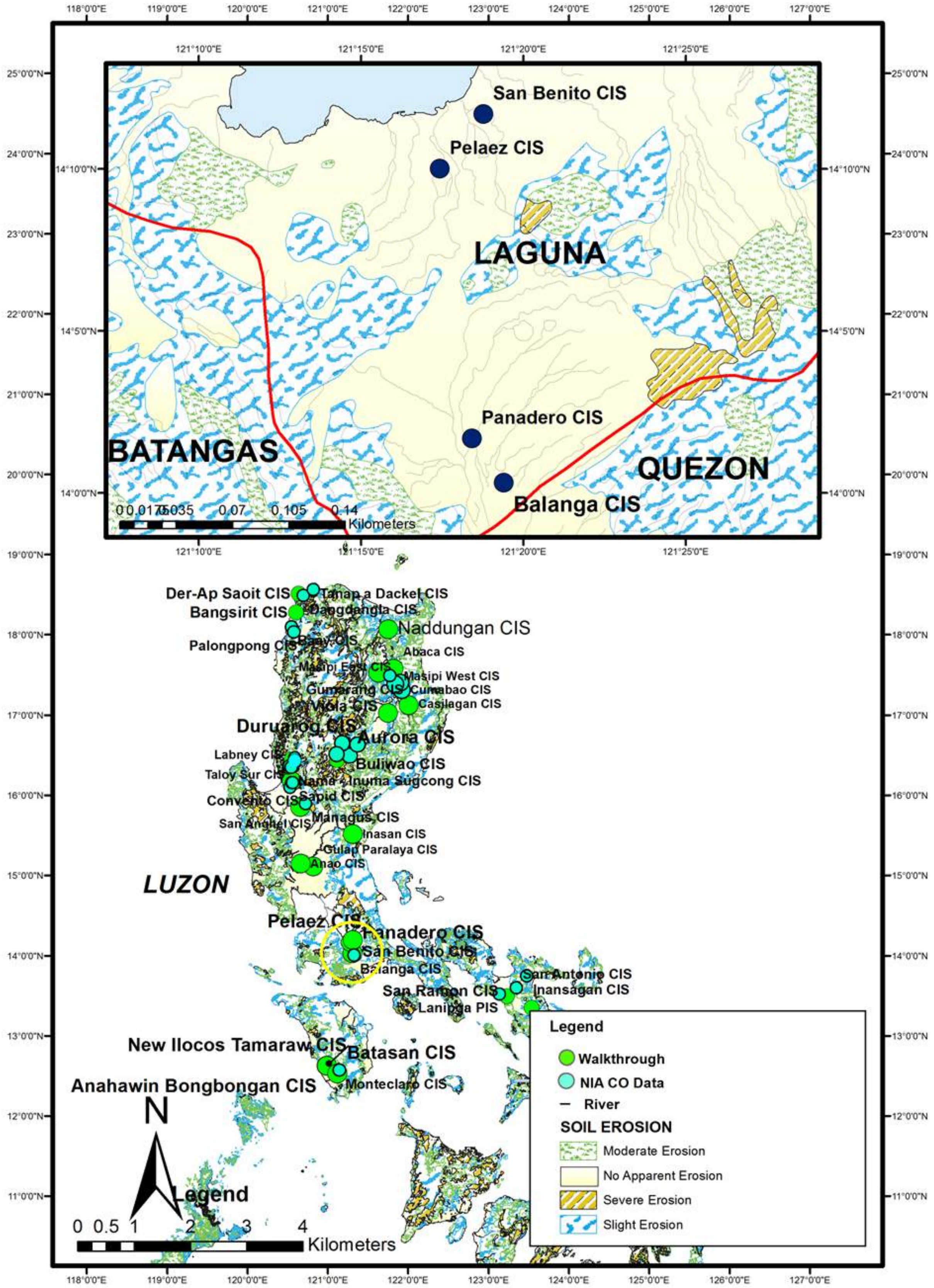

Figure 4A-10. Location of the CIS in Laguna
Source: www.philgis.org

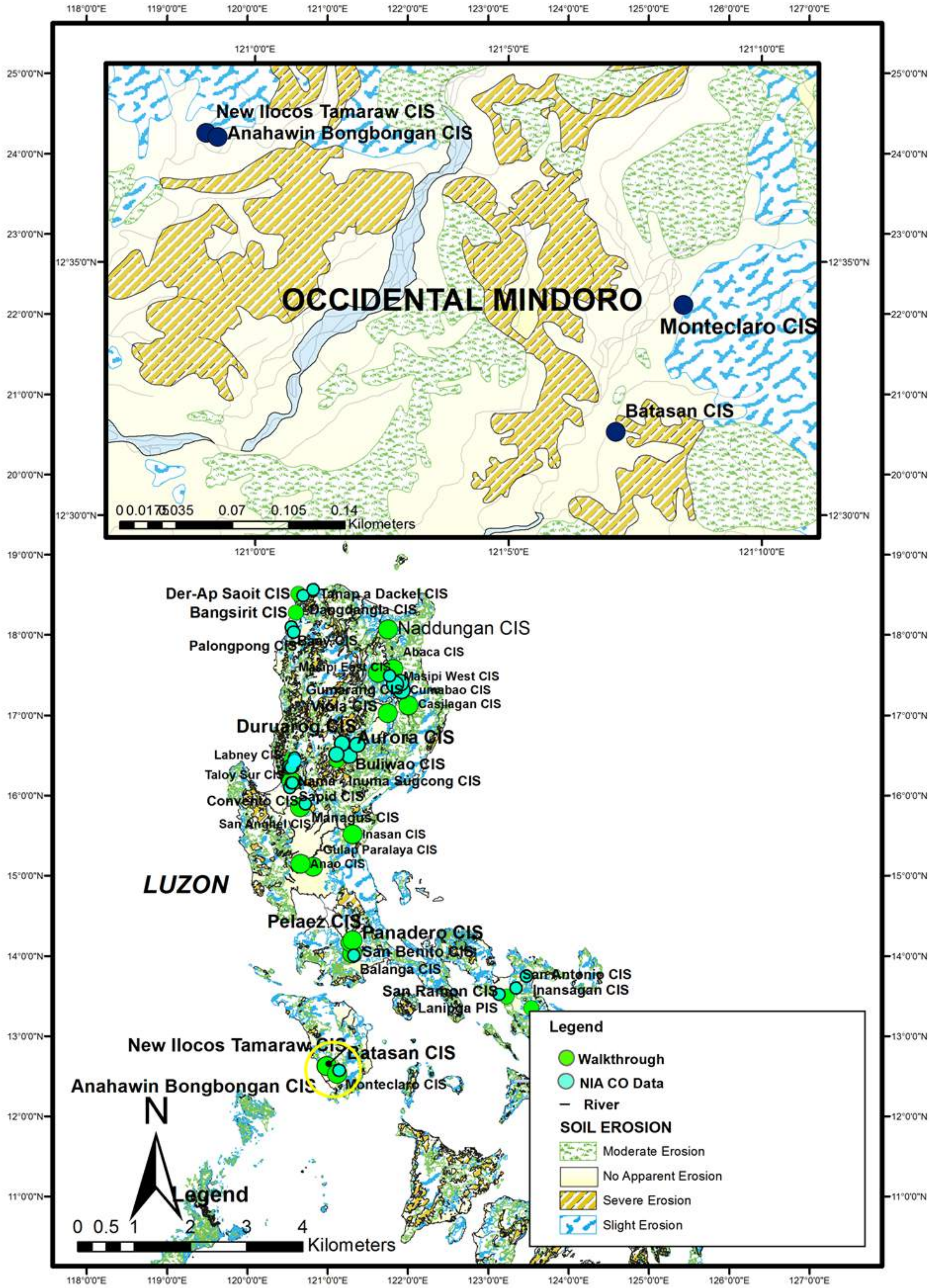

Figure 4A-11. Location of the CIS in Occidental Mindoro
Source: www.philgis.org

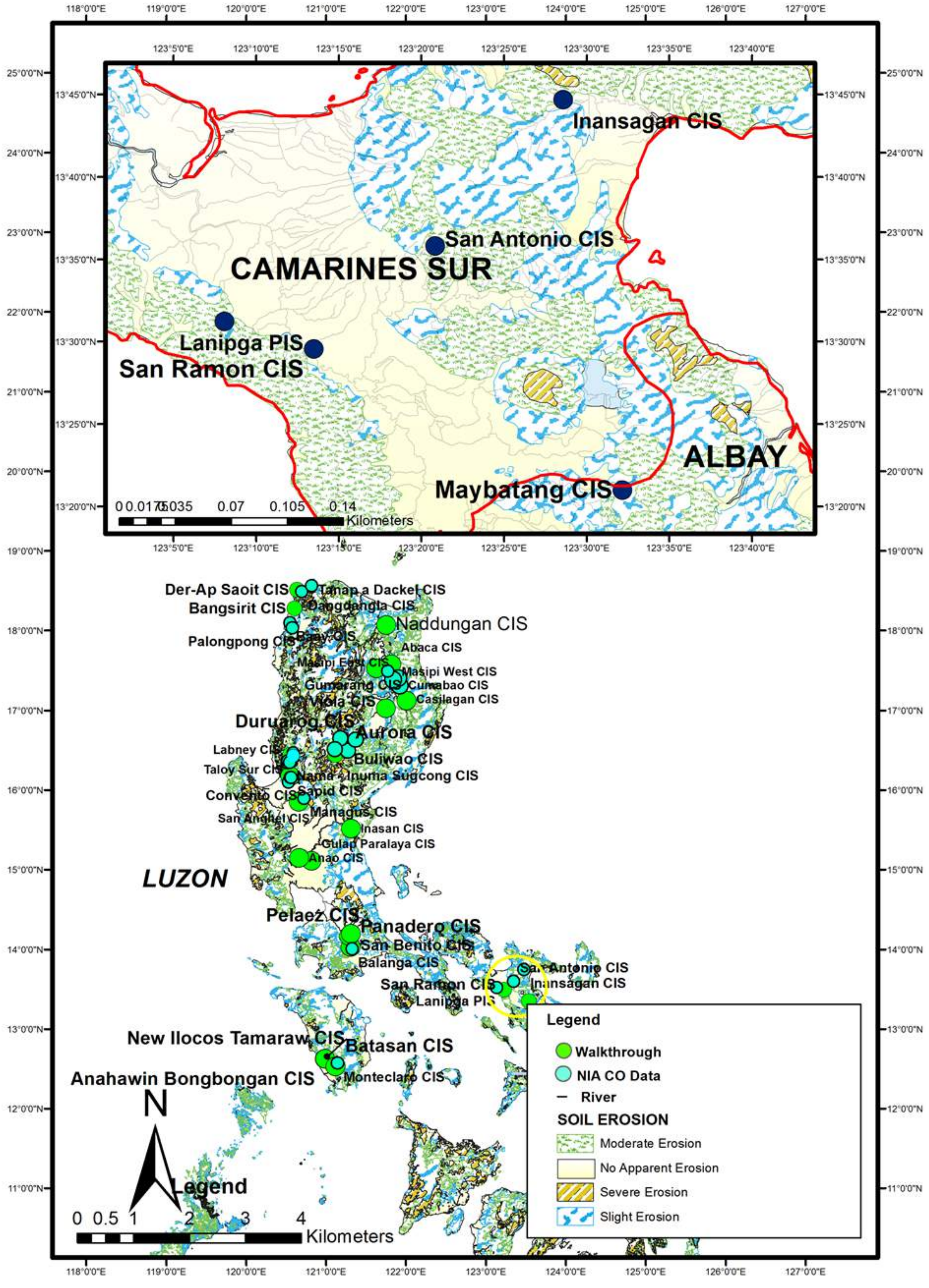

Figure 4A-12. Location of the CIS in Camarines Sur

Source: www.philgis.org

16.4B. Location of the Communal Irrigation Systems in Visayas and Mindanao based on Soil Erosion Map

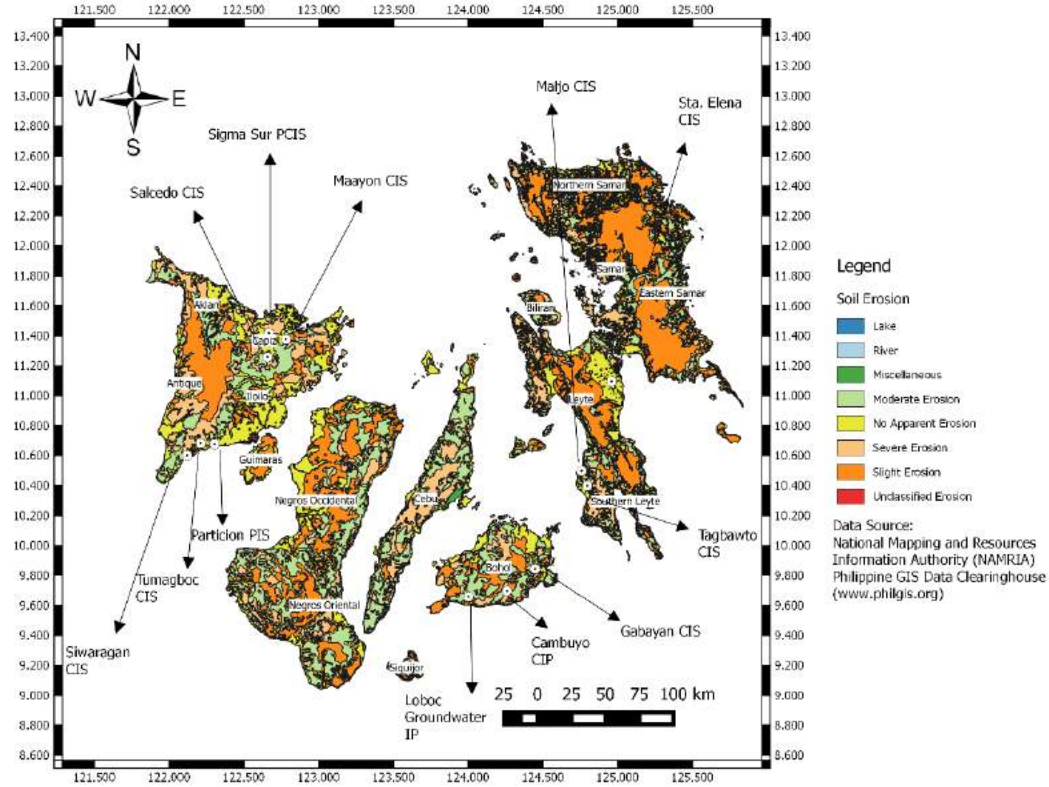

Figure 4B-1. Location of the CIS in Visayas
Source: www.philgis.org

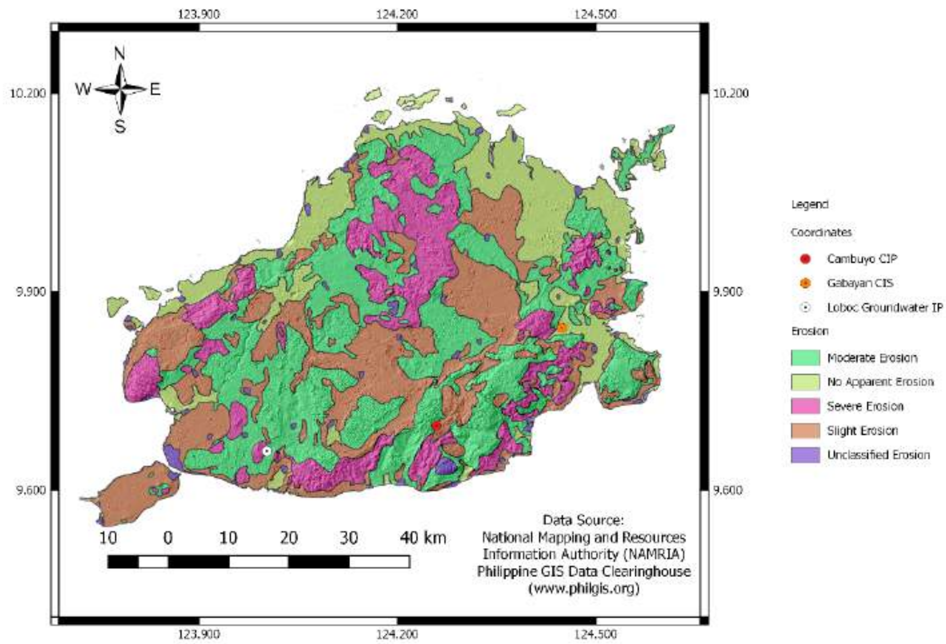

Figure 4B-2. Location of the CIS in Bohol
Source: www.philgis.org

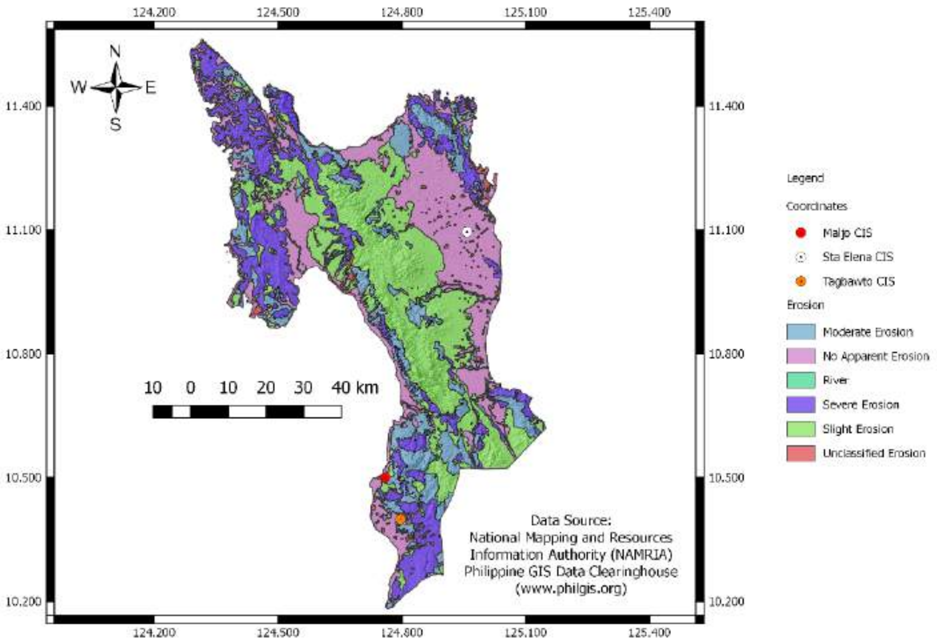

Figure 4B-3. Location of the CIS in Leyte
Source: www.philgis.org

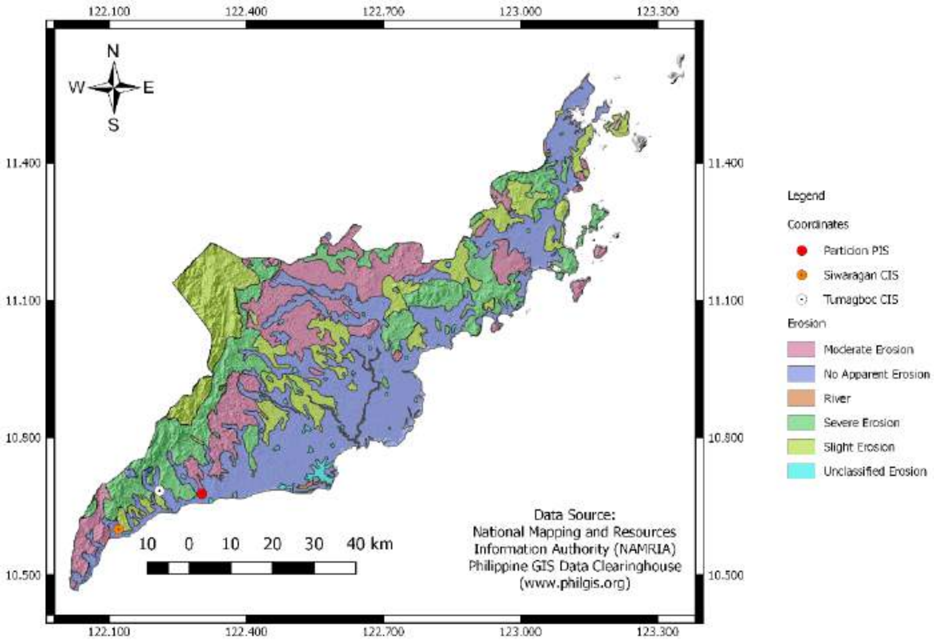

Figure 4B-4. Location of the CIS in Iloilo
Source: www.philgis.org

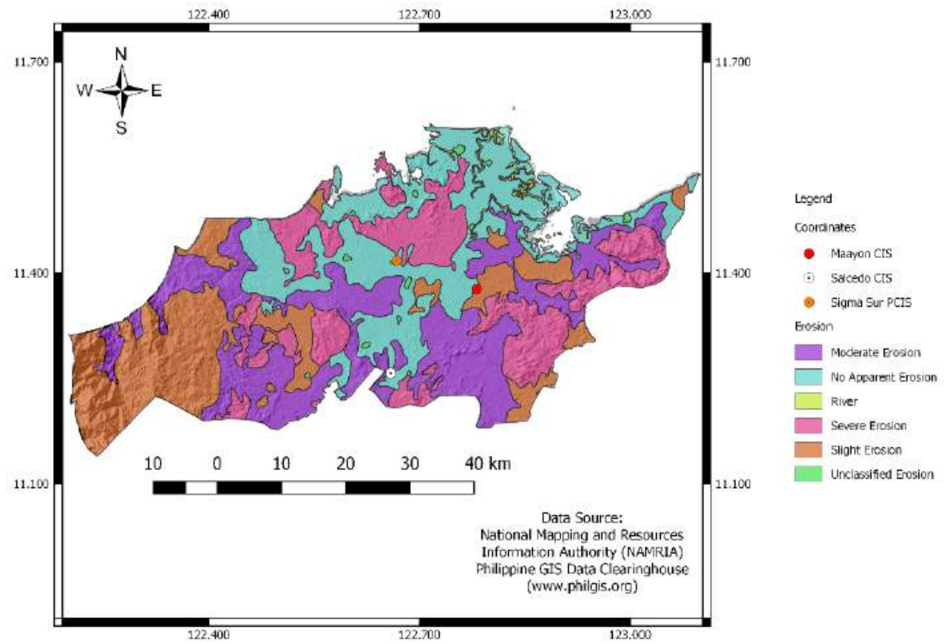

Figure 4B-5. Location of the CIS in Capiz
Source: www.philgis.org

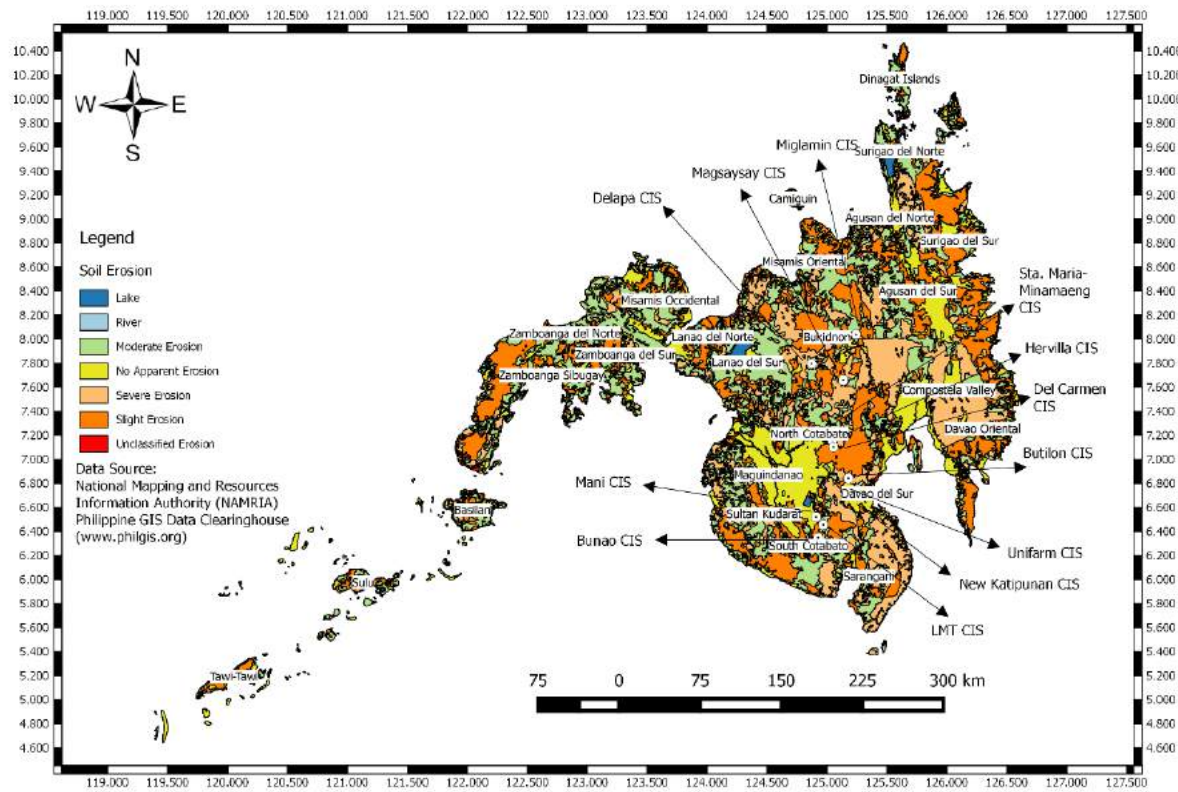

Figure 4B-6. Location of the CIS in Mindanao
Source: www.philgis.org

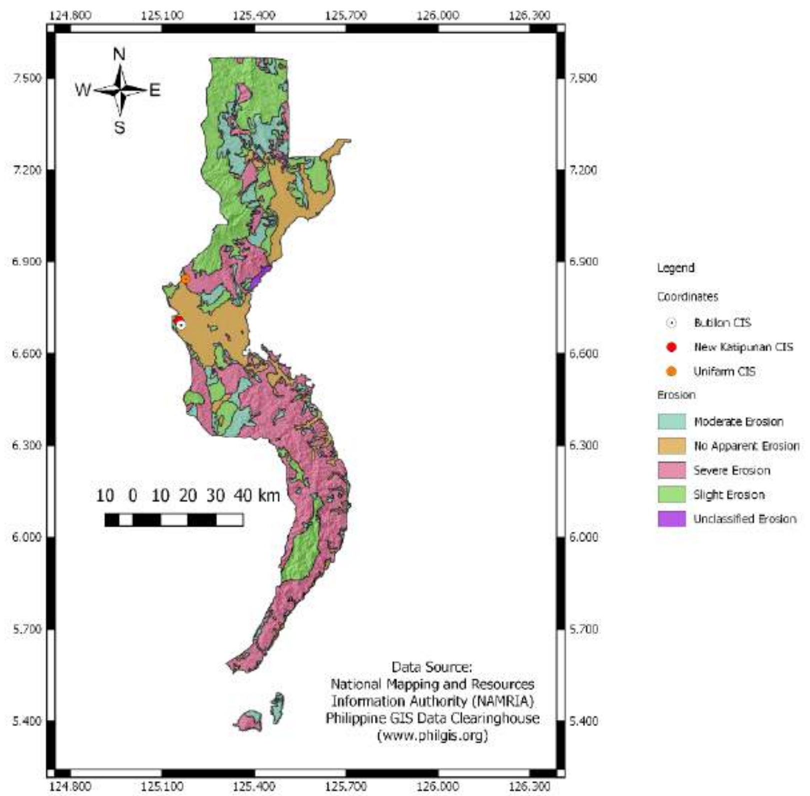

Figure 4B-7. Location of the CIS in Davao del Sur
Source: www.philgis.org

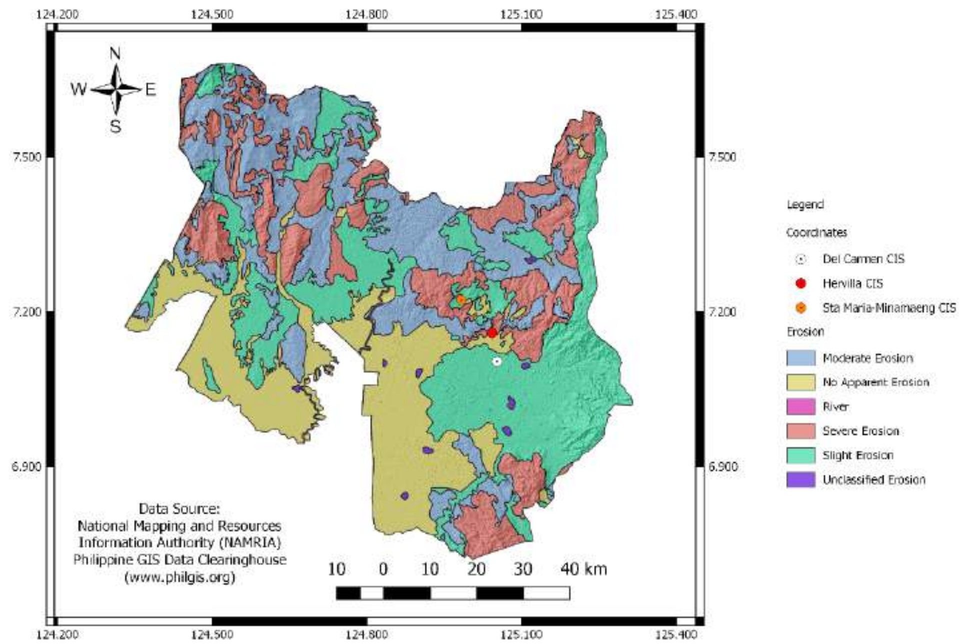

Figure 4B-8. Location of the CIS in North Cotabato
Source: www.philgis.org

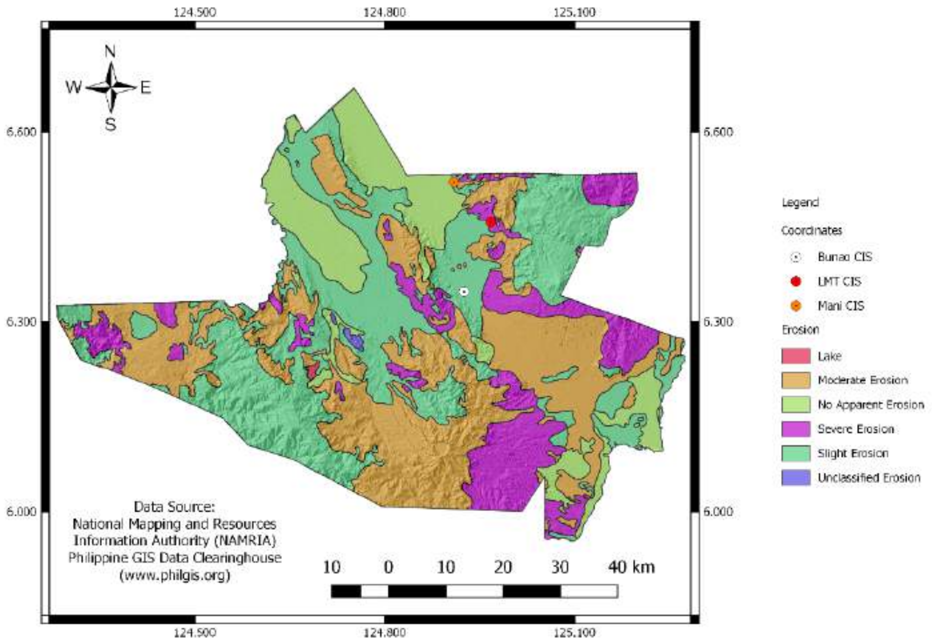

Figure 4B-9. Location of the CIS in South Cotabato
Source: www.philgis.org

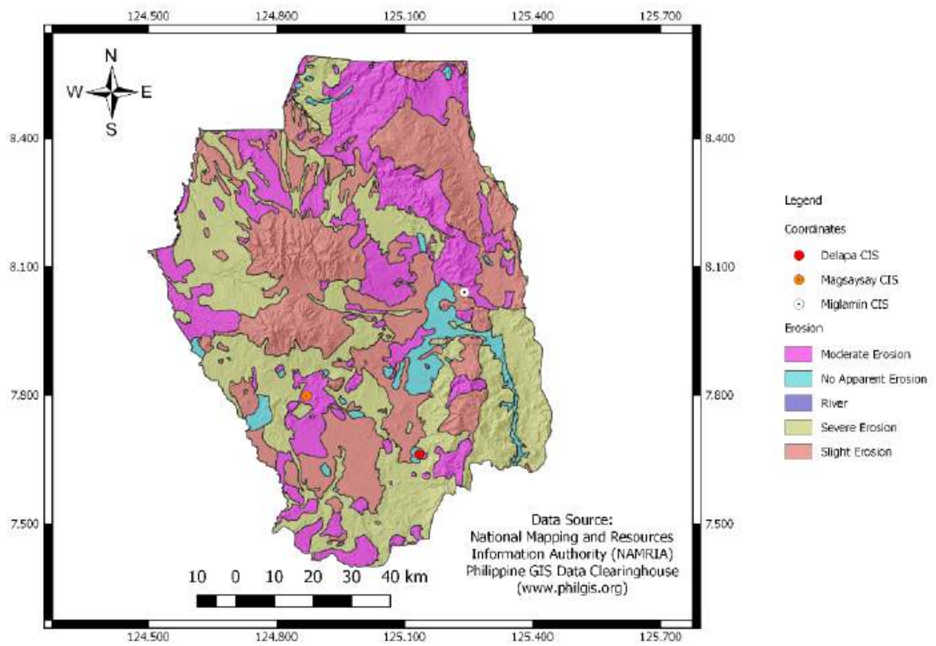

Figure 4B-10. Location of the CIS in Bukidnon
Source: www.philgis.org

16.5. Revised Focus Group Discussion Questionnaire

Focus Group Discussion
Irrigators' Association - CIS
Guide Questions

Province___________________ Date ____________________
Municipality ___________________ Interviewer ____________________
Barangay ___________________

I. IA profile
(Ask IA copies of institutional report, financial report, by-laws, other relevant documents)

1. Name of IA ____
2. Date IA Organized ____
3. Date IA registered with SEC or with CDA (if IA is a cooperative) ____
4. No. of farmer-members ________________
5. Current tenure status: How many farmers and % area under each tenure status

	No. of Farmers	**% of service area**
a. landowner-operators	________________	_________
b. tenants	________________	_________
c. lessees	________________	_________
d. other status (specify)________	________________	_________

6. Tenancy arrangement with landlord (e.g. 70% share of tenant-30% landowner) ________
   Leasehold arrangement per year (e.g., PhP/ha) _____
7. Does the IA have a water permit to access/use water? ___Yes ___No ____ Don't Know

   7.1. If yes, in what form is it? __Individual __Group/collective ___Others, specify _________

   7.2. When did the IA obtain the permit? _________

II. Irrigation system profile

8. Name of Irrigation system (IS) __________________________________
9. Year IS was constructed ______________
10. Year IS operation started ______________
11. Specify coverage of IS:
    - **a.** Barangay(s) ______________
    - **b.** Municipality ______________
    - **c.** Province ______________
12. Design service area (ha) ______________
13. Firmed-up service area ______________
14. Area actually irrigated (ha) Year _______ 1st crop _________
    2nd crop _________
    3rd crop _________
15. Type of technology: _____ Gravity _____ Pump
16. Source of water: _____ River _____ Creek _____ Groundwater _____ NIS canals

III. Operational Aspects

17. Is there a formal memorandum of acceptance or understanding (MOU/MOA) between NIA and IA regarding the turnover of system/component(s) of the system? ___Yes ___No

17.1 If yes, is the CIS ownership fully turned over to the IA? Yes ____ When ____

17.2 If No, is the IA still paying amortization of the CIS? ___Yes ___No

18. Have you heard of the Free Irrigation Act exempting farmers from payment of irrigation service fee? ___Yes ___No

a. If yes, when did you get the information? _________________

From whom? ______________

b. Is the free irrigation service fee already being implemented in your area?

___Yes (proceed to No. 19)

___No (proceed to No. 20)

19. If YES and the IA has not yet fully paid the cost of the CIS,

19.1. did the IA stop paying the amortization to NIA? ___Yes ___No

19.2. have you received any funding for your O&M activities? ___Yes ___No

19.3. from whom did the funding come from? ______________

20. If NO and IA is still paying loan amortization, pls. provide the following info:

20.1. Amount of loan: __________________________

20.2. Equity: _______________________________

20.3. Source of funds for equity payment:

20.3.1. _____IA owned funds

20.3.2. _____Landlord

20.3.3. _____Grant from Municipal

20.3.4. _____Grant from Provincial

20.3.5. _____Grant from politicians (specify) ______________

20.3.6. _____Others (specify) _____________

20.4. Year loan was granted: _____________

20.5. No. of years for amortization: ______________________

20.6. Rate of amortization (Peso/season or Peso/year):________________

20.7. How many more years to pay? ______________________________

20.8. Problems related to loan amortization ________________________

20.9. For tenants and leaseholders, does the landlord/owner share the payment of

20.9.1. Equity? ___No ___ Yes How much is their share? PhP_____

20.9.2. Amortization cost? ___No ___ Yes How much is their share? PhP_____

20.10. Other remarks: ___________________

21. If the Free Irrigation Act will be implemented, what will be its effects on your IA and your CIS?

____

____

22. What regular activity/support/assistance (technical financial, etc.) is continually provided by the NIA and other agencies/organizations with regard to the irrigation system?___Yes ___No

Agency	**Specify assistance provided**	**Rating** 4- Very satisfactory to 0- very unsatisfactory	**Improvement in performance**
NIA			
DA (e.g., BSWM)			
Local			
Others (specify)			

23. Role of IA in CIS Project Phases

A. **Identification, investigation and selection phase (e.g., provide physical and institutional data for feasibility study and engineering design; survey guide)**
Rate degree of participation: 4 Strong 3 Moderate 2 Limited 1 No participation
Reason for rating ____

B. **Pre-construction phase (Finalized Program of Works, MOA signing) (e.g., attend pre-conference, training, provide socio-economic data for irrigation profile**
Rate degree of participation: 4 Strong 3 Moderate 2 Limited 1 No participation
Reason for rating ____

Governance - Planning and Design Stage:

a. When planning for new irrigation, does the IA draft the resolution? Yes__ No__
b. Who decides on the location of the new systems? Are farmers consulted on the location of the irrigation structure? ____________________________________
c. Is the location suggested by the IAs always followed? Yes ____ No ___
d. Is water availability part of the criterion? Yes ____ No ____
e. Who writes the proposal? _____________________________________
f. Who decides on the size of the structure? __________________________
g. Is social acceptability by the community part of the assessment? Yes __ No __
h. Are farmers consulted on the location of the irrigation structure? Yes __ No __
i. Who validates the list of farmer beneficiaries?
____
j. Who validates the tenure of farmers?
____

C. **Construction phase monitor construction activities (e.g., participate in the conduct of test run of facilities; Participate in the pre- O&M conference)**
Rate degree of participation: 4 Strong 3 Moderate 2 Limited 1 No participation
Reason for rating ____

Governance - Project implementation stage:

a. Do you participate during the project implementation? Yes ____ No _____
b. What are the roles of farmers during project implementation?
____
____
c. Who involves you in this role?
____
d. Are construction timelines being met by all concerned?
____
e. When is the IAs formally formed?
____

D. **Operation and maintenance phase (e.g., attend IA trainings – FMS, SMT, BLDC; Prepare and implement O&M plans**
Rate degree of participation: 4 Strong 3 Moderate 2 Limited 1 No participation
Reason for rating ____

Governance - Operations and Maintenance stage:

a. Did the new policy affect the maintenance and operations of the IAs? Yes___ No ___
If yes, how? ____
b. Are you aware that there is now a rate for the O and M of the system?
Yes _____ No _____
c. Have you already received actual payments in 2017? Yes ___ No ___
d. Is this enough for your system's needs? Yes ___ No ___
If no, how do you cope with the gap? ___________________________
e. Will the management of the system be more efficient with free irrigation policy? Yes ___ No ___

a. If yes, why? ______________________________________
b. If no, why not? ____

f. In addition to the amortization payments, what other benefits is your IA getting from the NIA under the new policy? ____
g. Do you have links with the LGU? Yes __ No__
h. How is the LGU, who is mandated to oversee the CIS, affected by the free irrigation policy? ____

Governance - Monitoring and Evaluation

a. If there are problems in the flow rates, or other issues, are these reported to the IA management? Yes ___ No ____
If yes, what does the IA management do to follow up?
____
____
b. If there are system repairs needed, how timely is this done?
Always________ Sometimes ___________ Never _________
c. Does the IA monitor the service area of the system? Yes ____ No____
If yes, how? ____
d. For allocation of irrigation water for the next season, who decides?
____
e. What is the role of the IAs in this decision? ________________________
f. Is there still enough personnel within the IAs now to monitor the structures of the system for maintenance and operations? Yes ___ No ___

24. Do you think the LGUs could manage CIS? __Yes ___No
25. What is your opinion about the devolution of CIS to LGUs?
____
____

IV. Cropping information

26. Crops irrigated ____
27. Cropping calendar followed (pls. indicate crop and months):
1st cropping _________________
2nd cropping _________________
3rd cropping _________________
Annual _____________________
Others _____________________

Note: Ask for drawing/chart of cropping pattern; water delivery schedule

28. How is the cropping calendar decided? ________________________________
29. What data are used in deciding cropping calendar? _____________________________

30. Crop Production and Profit (per season, per ha (in a normal year)

a. Current market price of land (PhP/ha) _______

Cropping season	Effective Area Planted	Effective Area Harvested	Total Production (in kg)	Price per kilogram (In Pesos)	Total Production cost (In Pesos)	Gross Profit (In Pesos)	Net Profit (In Pesos)
Palay							
1st crop							
2nd crop							
3rd crop							
Other crops							

31. Pump usage

Where pumps are used:

a. Provide details/describe pump technology and practices used ________________________

____

b. Why is the IA using pump or what factors made the IA adopt pump? __________________

____

c. Cost of the unit ____________ Fund source ________________

If loan, specify terms of payment _________________ IA's Equity ____

b. Pump rental: Does the IA rent the pump? __ Yes__ No

b.1. Is there a special charge for private well usage? ___ Yes ___ No

If yes, what is the charge? ____

b.2 Describe the item (e.g., fuel cost, pump rental) that is charged for ___________________

b.3 If so, what percentage of these charges is collected? ____________________________

e. Costs involved in O&M of the pump (e.g., PhP /year for fuel, PhP for O&M)

____

f. Problems associated with operation of irrigation pumps______________________________

____

32. In case of prolonged dry spell, what are the coping strategies adopted by the IA? ___________

____

____

33. Problems encountered related to cropping: ____

____

____

V. Organizational Aspects

A. Human Resource

34. Does the IA have a President? ___Yes ___No

35. How is the president chosen? What is their term of office? ______________________________

____

____

36. How is the governing board chosen? What is their term of office? _______________________

____

____

37. How are the members of this body compensated? ___________________________________

____

38. How much are they paid per month? __________ per meeting? ___________

39. Frequency of meetings:

i. IA officers: __________________

ii. BOD: _______________________

iii. General Assembly: ____________

40. Average % participation in meetings

i. IA officers: __________________

ii. BOD: _______________________

iii. General Assembly: ____________

41. Is the IA member of an IA federation? ___Yes ___No

41.1. If yes, specify: ____

41.2. Frequency of federation meeting:_______________

42. What training relevant to irrigation have IA officers/members attended? ___________________

____

____

42.1. How often do IA officers/members attend trainings? ______________________________

43. How many per cent of the members attended such training? ____________________________

B. Policies/Accountability

44. Are there written rules (e.g. by laws) in the IA regarding proper behavior of farmers and employees?
___Yes ___No
44.1. What provisions are not implemented adequately and why? ________________________
____

45. How are decisions (e.g., resolutions on water allocation) made by the IA?
a. Is there a quorum? ___Yes ___No
b. By all famers (1 vote/farmer)? ___Yes ___No
c. Or by what percent of members? ___Yes ___No

46. Are there provisions in the rule/ordinance holding water users accountable?
___ Yes ___No ____Not clear ____Don't Know

46.1. If yes, please check how they are held accountable:
______ **a.** penalty provisions (fines)
______ b. sanctions (suspension of rights and/or privileges)
______ **c**. action by local government, irrigator association, water district, waterworks, water cooperative (Please specify what action) ____________________________________

47. Are there provisions in the rule/ordinance holding IA officials (President, Board members) accountable?___ Yes ___No ____Not clear ____Don't Know
47.1. If yes, please check which ones are applicable:
______ **a.** penalty provisions
______ b. administrative sanctions
______ **c**. others, please specify ____

48. In a scale of 0 to 4 (with 0 not at all effective; 1- rarely; 2 – sometimes; 3 – frequent; 4 very effective always), please rate the effectiveness of these accountability provisions. ______

49. Ability of the IA to seek for outside help for enforcement of its rules. ________
(Rate from 0 – 4, with 4 being the most influential)
4 – No problem. Just call up local authorities. The local authorities come out right away and effectively prosecute wrong-doers.
3 – The local authorities will come and are moderately successful with prosecutions.
2 – Sometimes, for very serious cases, the authorities will come. But they are not very effective or helpful.
1 – Although some enabling laws have been written by the government, it is up to the IA to enforce those laws. There is no help with enforcement from outside the IA.
0 – There are no enabling laws, and no outside assistance with enforcement. Everything depends on the IA.

C. Water distribution

50. How many irrigation zones or farm groups do you have in the service area? _______________
50.1. How are the zones divided (e.g. per lateral)? __________

51. How are decisions on water allocation made by the IA? ____________
a. Is there a quorum? ___ Yes ___No
b. By all famers (1 vote/farmer)? ___ Yes ___No
c. Or by what percent of members? ___ %
51.1. How are decisions made on water delivery schedule? __________
51.2. What data are used in deciding water delivery schedule? __________

52. Do you practice irrigation scheduling or rotational irrigation for these zones or farm groups?
___ Yes ___No
52.1. Please explain (e.g., downstream-upstream; upstream-downstream) ________________
____

53. Rate water delivery service (1-4) ________
4 – all farms receive the required volume of water at the right time
3 - all farms receive the required volume of water but with occasional delay

2 - all farms fail to receive the required water often
1 - no farm receives sufficient water when needed

54. Rate (0-4) the IA policy on water distribution scheme ________
4 – clear policy and adequately implemented
3 – clear policy but not implemented sometimes
2 – clear policy but not implemented oftentimes
1 – unclear policy
0 - no policy

55. Other uses of water source
______ a. None
______ b. Recreation
______ c. Domestic
______ d. Aquaculture
______ e. Others (specify)______________________

D. Conflict Resolution

56. What are the typical issues solved/discussed by the IA? List three.
____
____

57. If and when conflicts arise between water users, are there any *conflict resolution mechanisms*?
___ Yes ___ No ___ Don't Know

58. Describe conflicts encountered and how it was resolved or not resolved:
a. Conflict on water distribution/use ____
____
____
b. Conflict on management of the IS ____
____
____
c. Others (specify) ____
____
____

59. Are there any legally specified mechanisms for inter-municipality/trans-boundary and multiple-use conflicts? ___ Yes ___ No ___ Don't Know
59.1. If yes, please describe the mechanisms. ____
____
____
59.2. Who/what agency does the IA ask for help to resolve conflict? ______________________

60. Rate IA's ability on conflict resolution __________
4 – Very effective such that conflict rarely happens
3 – Moderately successful as the conflict repeatedly happens
2 – Not very effective as the conflict happens occasionally
1 – Not effective at all since the conflicts are not resolved
0 – nothing done by IA to resolve conflict

E. Financial aspects (If possible, get IA records/reports)

61. IA funds and sources (average over the last 5 years)

	PhP/year
a. National government	____________________
b. Local government funds	____________________
c. Foreign funds	____________________
d. Irrigation service fee from farmers	

d.1. Cash ____________________
d.2. In-kind (quantity ____) ____________________

e. Other fees paid by farmers ____________________
f. Other water charges ____________________
g. Development cost contribution (DCC)/amortization ____________________
h. Other sources (specify) ____________________ ____________________

62. Annual IA budget allocation (average over the last 5 years) – (PhP/yr)

a. Total Salaries _________________
b. M&O E _________________
c. Improvement of structures, modernization _________________
d. Rehabilitation _________________
e. Administration and others (including salaries and external contracts) _______________
f. Funds for loan repayment/amortization ________________

<u>Governance Questions on Incentive Mechanisms</u>

a. What is the immediate effect of not paying any amortization for the CIS systems ____
b. If there are savings, are these channeled to buy other inputs? Yes ___ No ___
c. Has the IA been more dedicated to the system maintenance now that they don't have to pay amortization? Yes ___ No __
d. With the free irrigation, do you expect to receive O and M funds?
e. Before the new policy, are farmers getting paid for operating and maintaining their systems? Yes ____ No _____
f. Are farmers more likely to irrigate or use more water per area than before the free irrigation? Yes ____ No ____
g. How is free irrigation contributing to improving lives of farmers?

Benefits	**Yes**	**No**
Increasing yield		
Increasing Income		
Increasing cropping intensity		
Increasing land area for production		
Others, please specify:		

h. In your opinion, is the irrigation policy more beneficial than the previous policy of paying for the amortization? Yes ____ No ___
If yes, why? ____
____
If no, why not? ____
____

Water Pricing and Cost Recovery

63. Is water charge/pricing based on: (*Please check*)

Pricing	

Full cost recovery	
Partial cost recovery (operating cost only)	
Full subsidy (government-paid)	
Others	

64. Who decides water charges (e.g., irrigation fee)? ____

65. How often are water charges/prices revised (*Please check*)?

Frequency	
Every year	
Every 3 years	
Every 5 years or more	
Revised since ___ (state the year)	
Not revised since organization was founded	

66. How much is/are the fee(s)?*(If in-kind, state quantity and estimated value)*

Fees	**1st cropping season:**	**2nd cropping season:**	**3rd cropping season:**
ISF			
Rice	__ PhP	__ PhP	__ PhP
	__ In kind	__ In kind	__ In kind
Other crops (specify)	__ PhP	__ PhP	__ PhP
	__ In kind	__ In kind	__ In kind
DCC/amortization			
Rice	__ PhP	__ PhP	__ PhP
	__ In kind	__ In kind	__ In kind
Other crops (specify)	__ PhP	__ PhP	__ PhP
	__ In kind	__ In kind	__ In kind
Other fees collected			
	__ PhP	__ PhP	__ PhP
	__ In kind	__ In kind	__ In kind
	__ PhP	__ PhP	__ PhP
	__ In kind	__ In kind	__ In kind

Collection System

67. Who prepares the billing? ____
68. Who collects the ISF from the farmers? _____
69. What percentage of total ISF target is actually collected (% collection rate)? ___ %
70. % of total IA members not able to pay irrigation service fee (% of delinquent farmers) _______
71. Reason for delinquency? ____
72. What is the penalty for delinquency? ____
73. Is there any incentive to the members for paying on time? ___ Yes ___ No
73.1. If Yes, specify ____
____

74. Collection per year for loan amortization PhP_____
75. Who collects the loan amortization from the farmers? ____________________________________

76. Who collects the loan amortization from the IA? ______________________________________
77. % of total members not able to pay for loan amortization (% of delinquent farmers) __________
78. Reason for delinquency? ____
79. What is the penalty for delinquency? ____
80. Is there any incentive to the members for paying on time? ___ Yes ___ No
80.1. If Yes, specify ____

81. Is there any incentive to the collector? ___ Yes ___ No
81.1. If Yes, specify ____

82. Rate your IA's financial strength. (Rate from 0 – 4, with 4 being very strong) ______

4 – Completely and sufficiently self-sustaining.
3 – Completely and sufficiently financed.
2 – Underfinanced, but not badly.
1 – Inadequate, but enough funds to replace and maintain key structures. Insufficient funds to do much of the basic maintenance needed.
0 –Inadequate to cover key structures and basic maintennace

83. What in-kind services or contributions are provided by water users (IA members/farmers)?

Item	Frequency of in-kind service	Value/unit	Total Value
Labor (specify, e.g., cleaning canal)	No. of mandays/year __	PhP/MD w/ meals ___	
		PhP/MD w/o meals ___	
	No. of times/year __		
Construction Materials (specify)	No. of times /year _		
Others (specify)	No. of times/year __		

84. What percentage of farmers participates in the in-kind services? ________________________
85. Reason of members for not being able to participate ____________________
____
____

86. Rate IA performance of the following functions of IA
(4 – excellent; 3 – satisfactory; 2 – average; 1 – poor; 0 – very poor)
a. Distribution of water in its area ___________________
b. Maintenance of canals ___________________
c. Maintenance of control structures ___________________
d. Construction of facilities in the area ___________________
e. Collection of irrigation service fee ___________________
f. Collection of other fees (specify) ______________________ ___________________
g. Technical advice to farmers ___________________
h. Others (specify) ____________________________________ ___________________

87. Has the IA received any award related to its operation/performance? ___ Yes ___ No
a. If yes, specify ____
____
____

88. Problems/issues encountered by the IAs and farmers in relation to the:
_____a. Operation and management (O&M) of the irrigation
_____b. Access to funds for rehabilitation (LGU, NIA, other government agencies)
_____c. Access to production credit (including providers)
_____d. Technical support from NIA, support services from the Department of Agriculture (DA)
_____e. Access to water (quantity and timeliness)
_____f. Others (specify) ____

F. Technical capacity

89. What data or information do you use for planning? ____________
90. How adequate and reliable are the data used for planning purposes? Please rate from a scale of 1 to 4, with 4 being the most adequate/reliable.

	Rate	**Don't know**
a) Adequacy		
b) Reliability		

91. Does your IA have an office/office space? ____ Yes ___ No
a. If yes, where is it located? ____

92. Suggestions to address IA concerns ____________________________________