



C H I N A

Water Pricing & Water User Associations Sustainability

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Telephone: 202-473-1000 Internet: www.worldbank.org/eap/environment/sea-asia E-mail: feedback@worldbank.org

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Abbreviations and Acronyms

CAB	Civil Affairs Bureau
CAD	Comprehensive Agricultural Development (Program)
ECM	End-Canal Manager (Shanxi)
ECMC	End-Canal Management Committee (Shanxi)
ID	Irrigation District
IDMB	Irrigation District Management Bureau
IAIL3	Irrigated Agricultural Intensification Loan III Project
MWR	Ministry of Water Resources
MCA	Ministry of Civil Affairs
MOF	Ministry of Finance
M&E	Monitoring and Evaluation
NDRC	National Development and Reform Commission (Ministry)
O&M	Operation and Maintenance
PB	Price Bureau
PPRWRP	Pro-Poor Rural Water Reform Project (DFID-financed project on WUAs)
SOCAD	State Office for Comprehensive Agricultural Development
WMS	Water Management Station (unit of ID)
WPRP	Water Pricing Reform Project (MWR project)
WSO	Water Supply Organization (operates ID canals and facilities)
WUA	Water Users Association
WUG	Water Users Group

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Executive Summary

Overview

1. **Improved irrigation water pricing sufficient to cover operation and maintenance (O&M) and management costs for end-canal irrigation or tertiary facilities is a vital requirement for efficient irrigation service delivery and for sustainability of WUAs.** This study investigates the key aspects of end canal water pricing for irrigation, including the composition of the water fee, water price determination, water fee collection, and water fee management. The aim of the study is to provide specific reference and guidance for policy making on irrigation water pricing and on related strengthening of farmer Water User Associations (WUAs) for better end-canal O&M. Based on the literature reviewed for China, this is the first study of its kind which is designed to support policy making on end canal water fee reform, and simultaneously to address both end-canal water pricing and WUA development in that context.

2. **The development of WUAs in China has been relatively fast since the first WUAs in 1995, growing to more than 50,000 WUAs in 2008.** The State Government has strongly supported WUA development through both domestic projects and Bank-financed projects, and it has pushed for rapid expansion of WUAs to wider areas. Starting with the first WUAs in Hubei and Hunan in 1995, the number of WUAs in China reached about 20,000 by 2004 and more than 50,000 by 2008. By the end of 2008, WUAs covered more than 20 million ha, or about 34% of China's total irrigated area of 60 million ha, and WUA coverage is vast, diverse and varied. WUA are reportedly expected to cover about 80% of the irrigated area by 2020.

3. **The World Bank and the government cooperated closely in the early development of WUAs under Bank-financed projects, and by 2009, approximately 5,000 improved WUAs had been established under Bank-financed projects.** Starting in 1995, the World Bank financed the Yangtze Basin Water Resources Project and established the first WUAs in China on a pilot basis covering seven large-scale Irrigation Districts (IDs) in Hunan and Hubei. Following the success of WUAs in Hunan and Hubei, a series of six water resource and irrigation projects financed by the Bank plus two large GEF grant-financed projects have helped support and improve WUAs and expand their development throughout China. The Pro-Poor Rural Water Reform Project (PPRWRP), financed by DFID and administered by the Bank, built on the lessons from these projects and established 497 improved demonstration and extension WUAs in 10 provinces between 2004 and 2009. Implemented jointly by the Ministry of Water Resources (MWR) and the State Office of Comprehensive Agricultural Development (SOCAD), PPRWRP provided numerous lessons on how to develop improved WUAs, their impacts and benefits, and support requirements for future WUA sustainable development, and it also provided training, support and lessons to both the MWR line and SOCAD to help them spread improved WUAs under their programs.

4. **Early WUAs produced substantial direct benefits, such as increased crop production and water saving. Building on this experience, PPRWRP was especially designed and implemented to develop and demonstrate the use of better standards for improved WUAs** to further increase WUA benefits and sustainability, and for the first time, to monitor and evaluate the specific impacts and benefits of improved, standardized WUAs using control groups

for “with and without” comparisons. The improved WUAs established under the small PPRWRP grant benefited a population of 1.3 million people, served a total area of 165,000 ha and also provided increased benefits to women and the poor. Overall, in 2008 alone and compared to control groups, these WUAs generated some 238,000 tons of incremental food production, Y 770 million in incremental agricultural income, Y 1,846 million in incremental total farm household income, 198 million m³ of water saving and Y17.8 million in water charge savings¹; increased crop and water productivity by 21% and 35% respectively; and promoted participation by women and enabled women and the poor to share equitably in water supply and WUA benefits. Compared to control groups, WUA per capita income was on average nearly 40% higher, with somewhat higher percent incremental income for poverty households. The percentage of people in poverty in the WUA areas fell from 18% to 11% with some 17,000 people being lifted out of poverty. In 2008, compared to control groups, PPRWRP WUAs generated increased crop production and water saving valued at an estimated Y 470.5 million, which was more than double the total cost for PPRWRP and vastly exceeds the direct costs for project WUAs and their establishment. As PPRWRP did not include significant investment in irrigation hardware and facilities, these benefits represent the impact of better water management and increased farmer participation using improved WUAs, compared to traditional methods.

5. WUAs fill an organizational or institutional gap in the irrigation management system and also provide significant indirect or non-quantitative benefits, in particular reduction or elimination of water conflicts and better water fee collection rates. The closure of the communes after 1980 left a gap in water delivery between the ID main systems and the farmers; there was no entity with specific responsibility for end canal O&M and for water distribution and delivery to farmers. Although villages often attempted to fill this gap, water management is not their main responsibility or mandate. Without a clear system and dedicated entity for water local management, water delivery and use was often disorganized, erratic, unreliable and inefficient. As a result, at the end canal level, water waste was high, water productivity was low, equity in water management was weak, and in particular the weaker groups like women and the poor and elderly often did not receive their share of the water. These conditions continue in much of China’s irrigation today. With improved WUAs based on participatory processes and democratic water management, however, all WUA members receive their share of the available water. Moreover, by eliminating the need to fight for water, WUAs also reduce the amount of household labor and physical “strength” needed to take and guard water which enables more farmers to out-migrate for work and the weaker households to get their water. Under PPRWRP, the number of farmers working outside more than doubled in the WUA areas compared to control group areas, and outside work provided a major source of additional income for WUA households. The WUAs also generated other important non-quantitative benefits, such as reduced burden for irrigation management and O&M on local governments and villages, and increased revenues for IDs. In 2008, water fee collection rates in PPRWRP WUA areas were 95%, compared to 70% in control group areas and only 57% on average for large and medium size IDs in China (in 2006).

6. WUAs under PPRWRP were improved compared to earlier WUAs and most WUAs in China. They were based on a set of standards and criteria developed and strictly followed

¹ Although not all of the above water savings may be considered “real” or resource water savings, the water charge savings are certainly real financial savings for the farmers and in effect raise their disposable incomes..

under the project, in particular the Five WUA Principles which were built into PPRWRP implementation and the grant legal agreement, included in the check and acceptance of project WUAs, required for reimbursement of WUA development costs under the grant, and pro-actively monitored by the project's WUA Monitoring and Evaluation (M&E) system. The Five Principles required that each WUA should: (a) be the farmers' own organization (each WUA should elect its own leaders from among their members, be registered and independent, have its own bank account, etc.); (b) be based on hydraulic rather than administrative or village boundaries; (c) have water measurement facilities and measure water received by the WUA from the supplier; (d) collect the water charge from farmer members and pay directly to the water supplier for the volume of water received; and (e) have adequate and reliable water facilities and supply. These principles and standards were based largely on the lessons and experience from WUAs under previous Bank-financed projects as well as domestic projects. Although most WUAs provide benefits, improved WUAs under PPRWRP generated much higher benefits than normal or expected and demonstrated the value of improved WUAs based on better standards. In addition, WUAs under PPRWRP had strong local policy support, which among other things gave them the right to collect water fees; and they received substantial specialized training support for farmers, which is not normally available in irrigation agency budgets. However, even these improved WUAs often had insufficient funding for sustainable O&M and management of end canal systems due to inadequate water pricing. This became clear near the end of PPRWRP and provided a primary impetus for the current study on water fees for WUA sustainability.

Key Challenges for Water Pricing and WUAs

7. Despite their rapid progress, WUAs in China still face many critical challenges, particularly on the financial, legal, and institutional sides. These challenges need to be addressed to enable WUAs to play a strong and effective role in reform of both water pricing and canal irrigation management, and to ensure WUA sustainability.

8. **Insufficient Funding for Adequate O&M and Management of End Canal Systems.** WUA income is often insufficient to cover the management and O&M costs for their end-canal water distribution systems. This directly threatens end canal and WUA sustainability as well as irrigation system performance and future WUA development. Around 67% of WUAs nationwide report having financial difficulties. And even under PPRWRP which enjoyed strong local support, 45% of the improved WUAs under the project did not have sufficient income to cover their O&M costs. Although this adversely affects both WUA and non-WUA areas, M&E of WUA financial status under PPRWRP enabled clear, quantitative identification of the end canal funding problem for the first time.

9. **The legal status, capacity and the degree of farmer participation at many WUAs are limited due to various institutional shortcomings.** Without adequate supporting laws or regulations, WUAs may lack needed legal powers, for example, to determine, collect and use water fees. Registration with the local Civil Affairs Bureau (CAB) as a "legal entity" can help and at least conveys certain legal rights, advantages and protections to WUAs, such as the ability to open a bank account and the right to own property, but only 40% of WUAs nationwide are registered. Instead of being registered, most WUAs are established under their local village. This makes them legal but not independent, and they are often controlled by the village

committees rather than the farmer members. This arrangement is easy and fast to implement but may interfere with WUA ability to handle water fees, ensure good O&M of facilities, and promote support and participation among the farmers for the WUA as their own organization rather than as a part of the village administration. This situation also hinders the ability of WUAs to deal effectively with the local ID and Water Supply Organization (WSO), who have a strong interest in proper collection of water fees to support main irrigation system O&M and management but no direct interest or responsibility in end canal O&M and water delivery to farmers.

10. **Problems exist with the estimation of end-canal irrigation costs, water price determination, water fee collection, and water fee management which directly affect WUA operations and sustainability.** The State water fee levied by IDs for water delivery differs from the end-canal water fee charged by WUAs (or villages) for O&M of end canal water distribution facilities in terms of cost estimation, price determination, water measurement, fee collection, and fee management. The water fee as fixed by the local Price Bureau (PB) often takes into account only or mainly the statutory State water fee and is therefore too low to cover end-canal O&M costs. Non-standard water fee practices may also occur, such as townships adding unrelated and unofficial levies or charges to the farmers' water fees or diverting part of the water fee for activities unrelated to irrigation. Such problems reduce the farmers' willingness to pay water charges, contribute to low water fee collection, and negatively affect O&M of end-canal irrigation facilities and water distribution, as well as the sustainable development of WUAs.

11. **To date, water pricing reform and WUAs have generally lacked adequate legal and policy support at national and local levels.** At the national level, although there are general policies supporting WUAs and a few other policies on end-canal water fees, none of the policies are specific enough on O&M cost estimation, water price determination, and water fee collection for and by the WUAs, and there is no comprehensive national law or regulation supporting WUAs. Some local governments have supporting policies for WUAs, but these are usually related to specific projects. These are essential ingredients for empowering WUAs and establishing an enabling environment for improved WUAs and for WUA water pricing reforms. Their absence is a serious constraint on sustainable WUAs and water pricing reform.

Study Focus and Approach

12. **The study focuses on water fees for end-canal or tertiary water facilities in Chinese Irrigation Districts (IDs).** It identifies typical types of water fee systems and typical types of farmer WUAs which manage end-canal systems at some IDs, suggests a specific type of water fee reform which supports WUA sustainability, and recommends a number of actions and policies needed to implement water fee reform and to strengthen WUAs and their future development which is needed for water fee reform. The study does not recommend specific levels of end canal water fees but instead suggests a more systematic approach to end canal water fee determination, collection and management utilizing improved, standardized WUAs which have been shown to improve end canal irrigation O&M, management and performance as well as water fee collection rates. Ideally, end canal water pricing reform should be considered as a part of overall reform of fiscal policy for irrigation, including tradable water rights, but that is beyond the scope of this study. The study team undertook case study field investigations on water fees at

typical WUAs in various regions. For evaluation of WUAs, the study used M&E results from PPRWRP which had developed and implemented improved standards for WUAs in 10 provinces. The study also used early results from the ongoing Water Pricing Reform Project (WPRP) under MWR. The study was designed and carried out by a team of Chinese experts who undertook field investigations in 2009 and prepared the draft report in 2010. A grant from the Bank's Water Partnership Program supported the study.

13. The study covers four key aspects of irrigation and WUA water pricing in China, and analyzes them for different types of WUAs. The research focuses on four policy-related topics in water pricing: (a) general water fee determination and collection practices by IDs and WUAs, (b) WUA water fees and their adequacy for end-canal O&M, (c) methods of WUA water price determination and fee collection, and (d) subsidy mechanism options for irrigation water fees.

14. Detailed case studies were carried out for 12 WUAs located in eight irrigation districts (IDs) in five provinces. The selected IDs represented the major agro-climatic zones in China, namely the humid southern region, the semi-humid northeast region, the dry northern region, and the arid northwest region. The case studies included structured data collected from 99 farm households in the study areas, as well as data from interviews with WUA leaders, government officials and other sources. Although not statistically representative, the case study areas were selected to investigate and illustrate specific typical types of water fee and water supply situations and WUAs.

15. Three types of WUAs were identified according to their water source: (a) Water dependent type WUAs, which depend mostly or entirely on the water supplied by the ID or WSO for their water supply; (b) Water complementary type WUAs, which have their own water sources and also use ID or WSO water to supplement their own sources; and (c) Water resource independent type WUAs, which have their own independent water sources and have no (or no need for) water supply from an ID or WSO.

16. Three types of water fee were identified. The water fee components are the State water fee to cover O&M costs of the ID canal system; and the end-canal water fee to cover WUA costs for O&M of the end-canal system. The type of water fee based on these components and greatly affects WUA sustainability, operation and management. The types are the: (a) *“two-part” water fee* - Farmers pay their water fee in two separate parts, the State water fee collected by the WSO, and the end canal water fee collected by the WUA. In some IDs, the WSO collects the entire water fee and rebates a small, usually inadequate, part back to the WUAs; (b) *comprehensive water fee* - Farmers pay a single, comprehensive water fee to the WUA covering the State water fee and the end canal water fee together. The WUA pays the State water fee part to the WSO based on the measured volume of water delivered to the WUA; and (c) *State water fee only* - Farmers pay only the State water fee which is collected by the WSO or other government unit, and do not pay any end-canal water fee. Although common in many IDs across China, this type of water fee does not cover end canal O&M costs, is not relevant to the WUA end-canal water fee and O&M problem and was not investigated or analyzed under the study.

17. The study and its recommendations focus on practices, procedures and policy support

needed for better end canal water pricing, and for improving WUAs to take on a greater role in end canal water pricing, rather than calculating quantitative water pricing values. In addition, although using the WUA as the unit of analysis, many of the water fee issues and problems investigated under the study apply to non-WUA areas as well, in particular insufficient funding for adequate end canal O&M and lack of a strong, legal entity specifically responsible, empowered and accountable for water fee determination, collection and use at the end canal level.

Findings

Water Pricing and Fee Collection Mechanisms

18. **China does not have a unified or consistent mechanism for end canal water pricing.** Water pricing methods, end canal water pricing and management, and WUA types vary between regions and IDs. Low water fee collection rates are common in all regions, and as a result both WSOs and WUAs are often financially weak. Typically, two-part water fees are more common in the North where water is scarce and WUAs are more dependent on the WSO; comprehensive water fees are more common in the South, and WUAs are less dependent on the WSO.

19. **The proportion of the State water fee versus the end canal water fee in the total water fee varies greatly among regions and IDs.** The end canal water fee generally accounts for a small part of the total in northern IDs, and a larger proportion in southern IDs. This is partly related to the relative dependence of the WUAs on the WSO for water. In the South, WUAs tend to have their own water sources, which reduces their dependence on the WSO, and also increases their independent decision-making authority compared to the North, where WUAs are commonly more dependent on the WSO which usually has a monopoly on the water source(s).

20. **WUAs are appropriate organizations to manage end canal irrigation systems and play a key role in water fee reform, but policy support for WUAs is weak.** Laws and regulations to establish the role, functions, legal status, property ownership rights and role in water fees for WUAs are lacking; only Hubei has issued a comprehensive provincial regulation specifically to support WUAs, in 2009. Many WUAs have limited or no right to determine and collect water fees and no adequate source of O&M funds, and some, especially in the Northeast, have no end-canal water fees at all. Without specification by law or regulation, the WUA chairman is often the head of the local village or the ID Water Management Station (WMS) rather than being elected by the farmers. Such weaknesses discourage farmer participation and are due partly to the lack of a clear policy and legal basis for WUAs. Such policy and legal weaknesses need to be addressed if WUAs are to be fully sustainable, improve end-canal O&M and management, and assume more responsibility in water pricing reform.

21. **Based on the study, improved and standardized WUAs established under PPRWRP performed better than other WUAs, and were able to implement comprehensive water pricing effectively.** These improved WUAs were standardized based on the Five WUA Principles (see above para. 7) and were also supported through policy, training and capacity building components which are requirements for improving WUAs and their performance.

WUA Fees and Their Adequacy for End Canal O&M

22. **Water fee determination traditionally has not considered end canal O&M costs.** Those costs were supposed to be borne by the local villages or water users, albeit with no specific organizational arrangements like WUAs or specific guidelines to enable them to do so. In most IDs across China that is still the case, and the State-only water fee is the most common fee. As a result, poor end canal O&M is one of the most serious constraints for better irrigation efficiency and performance, regardless of the size or location of the ID. WUAs are recent, and their role and financial needs for end canal O&M and management are not yet well understood.

23. **Where they are considered, end canal water fees on average are insufficient for adequate end canal O&M and management.** This is due to a number of factors, such as little or no allowance for end canal O&M costs by the local PB in calculating and approving the water fee, insufficient authority of WUAs to determine adequate end canal water fees, and weak institutional and organizational arrangements for WUAs. Low WUA water fees may also be related to farmers' willingness to pay. Field interviews indicate that farmers generally consider 5% of crop value to be roughly the borderline between acceptable and excessive water charges (although their attitude also depends on the value of the crops grown). Farmer water fees are generally more than 5% of the irrigated crop value in the North, and slightly below 5% in the South, reflecting in part different water scarcity conditions in the two regions.

24. **WUA O&M costs for the end canal systems comprise three parts and indicate the need for rehabilitation.** O&M costs comprise maintenance costs for irrigation facilities (55% on average), payment of personnel for canal management and operation (32%), and other WUA operating costs such as office expenses (13%). In general, end canal costs account for about 10% of total water fees in the North and up to about 70% in the South, largely because the State water fee component is smaller in the South. Based on the case studies, the repair expenditures for WUAs are relatively high in many areas, indicating that end-canal facilities are generally in poor condition and need rehabilitation and improvement (and completion, in many cases).

Methods of WUA Water Price Determination and Fee Collection

25. **The Comprehensive water fee system has important advantages compared to two-part water fees and especially the State water fee only.** Advantages of comprehensive water fees include reduced transaction and staff costs for the ID because the WUA collects the entire water fee for the WSO, increased revenue for WSOs due to higher water fee collection rates by WUAs (95% under PPRWRP), assured funding for both WUAs and end canal O&M which benefits farmers and increases their willingness to pay water charges, reduced water waste by WUAs and farmers because WUAs pay by volume for water from the WSO, and reduced loss of water fees to non-irrigation uses. The two-part water fee should be regarded as a transition from the state-only fee to the comprehensive-type water fee due to its various shortcomings; the traditional State water fee only system does not consider end canal costs and is insufficient.

26. **The Two-part water fee system has significant shortcomings.** These include lack of WSO capacity for measuring water and collecting two-part water fees at each farmer household, high transaction costs for water measurement and fee collection by WSOs from individual

farmers, funding shortages at most WSOs which cannot afford these extra costs, retention of water fees by WSOs rather than transfer of funds to WUAs for end canal O&M, lack of farmer “ownership” and participation in end canal O&M and management, low water fee collection rates (57% on average in China), reduction in the power and independence of the WUA, and the appearance to farmers that the WUA is a branch of the government or WSO rather than the farmers’ organization. Two-part fees have been somewhat effective in special cases where the WSO measures water to farmers, supervises use of end-canal water fees collected, and monitors and publicizes the water price, water volume received and water fees for each farmer household. However, these practices are expensive for the WSO and do not mobilize farmers, and the WSO lacks statutory authority for end canal O&M and management itself. The most common practice in China is still the State water fee only, as a single fee levied by area irrigated.

27. Under the two-part fee, the State water fee and end canal water fee are collected as two separate fees. Commonly the State water fee is collected by the WSO from farmers, and the end-canal water fee is collected by the village or the WUA. In some cases, the local WMS collects the both fees on behalf of the WSO, transfers the State fee to the WSO and retains the end canal fee for use by the WUA upon application, or the local village may collect the end canal water charge even if a WUA exists. In contrast, under comprehensive water fees, WUAs collect the entire water fee, pay the WSO for water received and use the end canal fee for their O&M.

28. In some local areas, the end-canal water fee is collected and managed by the WSO (along with the State water fee), and the WUA has to apply to the WSO to use it. With this method, the WSO controls the WUA, farmer households typically are not informed on how the water fee is used and the WUA is limited only to end canal O&M under the direction of the WSO. This method is not transparent, discourages farmer participation and makes the WUA operate (and appear to farmers) as a branch of the WSO rather than the farmers’ own organization. However, it may be useful as a temporary transition method where WUAs are weak or developing.

29. No specific policy guideline or method has been specified for calculating end canal water fees. In contrast, there are specific policy guidelines and methods for calculating the State water fee, and the methodology is generally followed by PBs in calculating water fees throughout most of China. The methodology is generally based on actual ID costs, includes full capital cost recovery/depreciation and staff and operating costs, and usually results in a relatively high calculated State water fee. Although the water price actually approved by the PB is often lower than the calculated fee, even that reduced amount is often beyond the farmers’ willingness to pay, and water fee collection rates tend to be low. For end canal water fees, however, no defined policy or method of calculation has been specified, and the method varies by ID and region. In the North, where water is scarce and costs are high, the PB generally establishes a fixed price or flexible price (price range) for the end canal water fee, sometimes expressed as a percent range of the total water price. Southern WUAs generally have more autonomy to negotiate end-canal water pricing among their members, and the PB’s role is not so strong.

30. Lack of clear policies and regulations for determination of end canal water fees, similar to the State water fee policy and guidelines, is a severe handicap for WUAs and for adequate end-canal O&M funding. Without specific regulations or guidelines, there is no

basis for the local PB (or WUA) to use in setting end canal water fees. As a result, end canal fees are often ignored or set too low by PBs, as a way to reduce the farmers' burden. Although this is understandable, setting low end canal water fees often results in insufficient funding for end canal O&M and management costs, and also limits WUA ability to establish water prices based on actual costs even when farmers are willing to pay.

31. Water measurement is needed to charge WUAs and farmers by volume and encourage water saving. Water measurement to or within WUAs tends to be used more extensively in the North and Northwest. In the South, IDs with WUAs often measure water deliveries to the WUA, but even where measurement facilities are in place they may not be used for calculating water deliveries and fees for WUAs. In Northeast IDs, water measurement to or within WUAs is rarely practiced, and each farmer or group takes from the available water supply as needed without measurement. Location of water measurement points for WUAs is also important and varies between regions. In the North and Northwest, the location of the water measuring point tends to be relatively far downstream, often inside the WUA at the WUG headgate, or in a few areas at the farm off-take channel. In the latter case, measurement of water received by the household may be possible, especially where WUAs can help with water fee collection, but this is expensive for the WSO.

32. WSO interest and the public interest are sometimes in direct conflict with regard to water saving. In Shanxi, for example, some WSOs encourage farmers to use more water because the WSO as a monopoly wants to maximize its income from water sales. Although the income of the WSO can be enhanced by this practice, it conflicts directly with the need to save water, which is critically important with scarce and expensive Yellow River water on which Shanxi depends. The public interest demands that such contradictions be identified and eliminated.

33. Some IDs use a water quota system to promote water saving, but that may have adverse impacts. The quota determines the water price to the farmer, which increases if water consumption exceeds the specified quota. However, the basic quota is usually the same throughout an ID and does not distinguish between differences in irrigation facility conditions and soil types, which can vary greatly between WUAs and even within WUAs in the same ID. This greatly influences water use and water waste, regardless of what the farmer does. For example, exceeding the quota is commonly seen in areas with poor, inefficient canal facilities which waste water, but that waste cannot be prevented by the farmers. In practice, the over-quota fee system simply provides a source of additional revenue for the WSO, discourages WSO interest in improving end canal system efficiencies, and increases the water fee burden on farmers.

34. Overall, keeping water fees low and within the farmers' willingness to pay versus the need to fund main system and WUA O&M and management adequately is the critical dilemma facing irrigation water pricing. With water fees set below actual costs, canal system maintenance is deferred, the system deteriorates, the efficiency and quality of irrigation service declines, and the farmers' ability and willingness to pay water fees, including the State water fee, falls. This is especially severe for the end canal systems which have no specified funding source or fee determination method and no empowered entity with clear responsibility for them, which

are typical in China.

Farmer Costs and Water Fee Subsidy Options

35. **For many IDs, a financing gap exists between the farmers' willingness to pay and the cost of water.** Subsidies may be needed to help fill that gap. The study identified four subsidy options to finance the gap: (a) covering the depreciation component of the State water fee; (b) covering part or all of the State water fee (depreciation plus the cost of main system O&M); (c) making direct payments to WUAs; and (d) making direct payments to farmers. The overall justifications for the subsidy include the inability or unwillingness of many farmers to pay sufficient water fees to cover full costs; the need to reduce the farmers' burden; deterioration of irrigation systems without adequate O&M funding, leading to costly rehabilitation; and national food security which depends on efficient and productive irrigation systems. According to the survey, when water fee expenditures are more than about 5% of agricultural output value, farmers generally feel they cannot afford it and the fees are beyond their willingness to pay, although this tends to be related to the water fee amount relative to agricultural production value.

Recommendations

Water Pricing and Fee Collection Mechanisms

36. **The comprehensive water fee system should be gradually implemented throughout China, and the two-part and especially the State only water fee systems should be phased out.** Comparative analysis of comprehensive water fees and two-part water fees indicates that the comprehensive water fee system is preferred and has a number of advantages for water fee reform, end canal O&M and WUA sustainability. The two-part water fees may be useful temporarily as a transition to the comprehensive water fee and in special situations, such as where WUAs are not yet well established or need to be improved. The State only water fee system provides no funding for end canal O&M and should be phased out and replaced by the comprehensive water fee as soon as possible.

37. **WUAs have a key role in comprehensive water fees, and programs are needed to provide policy support, capacity building and development and improvement for WUAs.** These could build on experience learned from projects such as PPRWRP and WPRP which have demonstrated the benefits of improved WUAs based on the Five WUA Principles and comprehensive water pricing. State and provincial governments (and lower levels) also need to provide coordinated policy and legal support (laws and/or regulations) for both WUAs and end canal water pricing reform together. This should include giving WUAs independent legal status, specified powers, rights and responsibilities, and the right to determine, charge, collect and manage water fees, and supporting development of WUA federations to further empower WUAs.

38. **MWR should draft national legislation for water fee reform and WUA support.** Initially, WUAs have generally relied on local government policy statements and regulations for the necessary policy support. Now, however, comprehensive water fee reform and WUAs need to be supported together through State and provincial laws and regulations covering both. Such draft legislation should include, *inter alia*, support for implementation of comprehensive water fees nationwide, specify the role of WUAs in water fee determination, collection and

management, define the parameters and methodology for calculating WUA water fees, provide policy and other support for improved WUAs, and ensure that government budgets and irrigation investment programs include funding for WUA development, staff and farmer training and M&E. Experience with the 2009 Hubei regulation may help provide guidance. Preparation and approval of legislation may take time; interim regulations on water fee reform and WUAs should be issued by MWR based partly on the 2005 national policy statement on WUAs (*Suggestions on Strengthening Development of Farmer Water User Associations*, Circular No. 502). SOCAD should issue similar interim supporting regulations for its own program.

39. **More immediately, interim regulations modeled on the Hubei provincial government regulation titled “WUA Management Regulation of Hubei Province” (2009) should be issued by all provinces, after adaptation to local conditions.** A similar national WUA regulation should be issued at the State level to provide national policy support and guidance. These regulations should support comprehensive water fee reform and improved WUAs, incorporate lessons and experience from PPRWRP, WPRP and this study, and give WUAs the right to determine, collect and manage water fees based on their own costs and needs. In addition, the State needs to issue guidelines for calculating end canal water prices based on WUA O&M and management costs, with related follow-up regulations by provincial and lower levels.

40. **Governments at all levels should promote and facilitate registration and support of new and existing WUAs.** WUA registration is needed strengthen their ability to carry out comprehensive water fees, and has many legal advantages. Local governments should issue their own policies and regulations for WUA support and improvement based on PPRWRP and for end-canal water fee reform. This is urgent for IDs which do not have an end canal water fee system. To strengthen WUA development, domestic and international projects with irrigation investments need to include specific components for WUA training, capacity building and development, integrated with comprehensive water fee reform. These components should incorporate the Five WUA Principles for improved WUAs, and lessons from PPRWRP, WPRP and this study.

41. **WSOs should support WUA strengthening and help make WUAs financially independent and self-managing.** This would benefit both WSOs and WUAs. WSOs should help well-established, improved WUAs determine, collect and manage end-canal water fees, upgrade their accounting financial and water fee management, and ensure that they have full responsibility and technical support as needed efficient for end canal O&M. WSOs should guide and assist but not control WUAs; weak or new WUAs would need more systematic and extensive training and support. In addition, charging and collecting water fees from farmers by organizations other than WUAs, such as villages, WSOs or contractors, should be phased out.

WUA Fees and Their Adequacy for Operation and Maintenance

42. **Under comprehensive water pricing, water fees charged by WUAs should cover WUA O&M costs.** This is essential to ensure adequate end canal O&M and management, including the cost of water purchased from the WSO which should be treated as a WUA operating cost. Water fees to be paid by farmers to the WUA should be calculated to cover all WUA operating costs. WUAs should also try to accumulate reserves for minor system repairs.

43. **PBs should include end canal O&M costs in their calculation of water fees.** Under comprehensive water fees, these calculations should cover both the cost of water supplied by the WSO and the WUA costs for O&M and management of the end canal system, and where appropriate should also include a small amount for WUA reserves for distribution system repairs.

Methods of WUA Water Price Determination and Fee Collection

44. **Water charges should be based on measured water deliveries to or within WUAs, and water measurement by WUAs should be strengthened.** Water measurement is essential for implementing comprehensive water fees. It should be done at the WUA headgate level and used to calculate water fees for all WUA members. Where possible, water may also be measured down to the WUGs to determine water charges for WUG members, and in some cases down to the farmer households for determining the household's water charges. Water measurement should be done in all regions as the basis for calculating the cost of water delivered to each WUA by the WSO; this is especially important in the dry North/Northwest regions. Inside the WUA or WUG, farmers may be charged according to irrigated area, based on the volumetric cost of water delivered to the WUA or WUG, plus the O&M costs for the WUA and WUG, or by volume.

45. **The WUA water fees should be transparent, with water prices, water volume, and water fee costs publicized and receipts issued for each farmer.** In addition, for WUAs which charge water fees through WUGs, the WUGs should provide details on payments made by farmer households, and also provide payment receipts to individual farmers. WUAs should rectify payment details and receipts to ensure consistency, accuracy and transparency in accounts.

46. **WSOs should reduce staff and other costs and improve operational efficiency.** To help reduce the cost of water, WSOs should increase efficiency, control costs, and limit staff numbers according to State standards. The State water price should be based on the *Regulation on Water Supply Cost Supervision of Hydraulic Projects (trial)*, No. 301 (2006), and WSOs should staff and budget accordingly. WSO staffing costs may decline with improved WUAs.

47. **The State should provide investment funding for WUAs to rehabilitate and improve end canal systems.** This would reduce WUA repair expenditures, leave more funds available for WUA O&M and personnel costs, reduce end canal water fees and save water. Costs for major end canal system repairs or improvement should be excluded from WUA costs in calculating end-canal water fees. WUAs should be directly involved in the planning, layout and construction stages of their end canal systems on behalf of their farmer members; farmers often contribute a part of the cost for such works (usually as labor), which produces "ownership" and also an incentive to provide proper maintenance of facilities. Such investments should include support to develop and improve WUAs, implement comprehensive water fees and provide incentives for better maintenance. Incentives should be provided to avoid the moral hazard of WUAs neglecting maintenance in anticipation of rehabilitation funding.

48. **The State should consider developing a "revenue stabilization" system for WSOs.** The system would aim to both stabilize WSO income when water sales are low in wet years, and help maintain reasonable water costs for farmers during dry years when water use and hence volumetric water charges are high. This could be done through a WSO revenue stabilization

reserve fund, WSO revenue stabilization insurance, or direct payments by the State, or a combination of the three. A WSO revenue “balancing payments” program could be implemented as part of an overall, integrated State water fee subsidy program.

49. **Over-quota water fee policies and systems should be reviewed and reformed to ensure they are not producing negative public good incentives.** Such policies and systems should actually promote verifiable water saving by farmers, and should not simply enrich WSOs. In addition, revenue from over-quota water charges should be used for a “WUA water saving investment fund” which would be used and managed by WUAs (and supervised by the ID) to improve end-canal systems, save water and reduce future over-quota fees.

Farmer Costs and Water Fee Subsidy Options

50. **The government may consider subsidizing farmer water fees based on the gap between the cost of water (State water fee plus end-canal water fee) and the farmers’ willingness to pay.** Willingness to pay should be based on farmer attitudes, and should also consider their ability to pay according to net crop income (the latter was not investigated under this study). Based on study results, if the fee exceeds the farmer’s willingness to pay (generally about 5% of the crop value), many farmers may refuse or be unable to pay. The subsidy method should be equitable, promote water saving, be limited and specific in scope, be transparent, and integrate into the comprehensive water charge system as much as possible.

51. **Based on the study results, the recommended subsidy options are (a) to exclude depreciation costs from the State water fee (i.e., eliminate capital cost recovery), and (b) to reduce or eliminate the State water fee and pay uncovered WSO management and O&M costs from government finance.** These options should be evaluated in order of preference. If the water supply cost still remains too high for farmers to pay, option (3) or direct subsidy payments to WUAs to help cover their costs may be considered, especially for WUAs without a WSO upstream. Option (4), providing a financial water fee subsidy directly to farmers in areas without a WUA, is the least preferred option and is not recommended because it does nothing to support end canal O&M or WUAs. Where appropriate, the first two or three options may be used in combination. In addition, improving the condition of water faculties and reducing excess staff should also be done to reduce the amount of subsidy needed. Key principles for subsidies are that water charges to farmers should not be eliminated entirely, subsidy systems should be designed to provide incentives for WSOs to deliver water efficiently, promote water saving by WUAs and farmers, and that as much as possible local irrigation should be self-financing and self-managing. Subsidies may be included in the design of water pricing reforms, and measures to limit the potential moral hazard of the subsidies, such as reducing them over time, should be considered.

Chapter 1: Introduction and Background

1.1 Overview

Agricultural water pricing sufficient to cover costs for WUAs to operate and maintain end-canal irrigation facilities is one of the vital requirements for sustainable WUA operation, and it is also essential for adequate long-term maintenance and quality of end-canal facilities which is necessary for efficient irrigation systems. This study investigates the key aspects of irrigation water pricing in China, including the composition of the water fee, water price determination, water fee collection, and water fee management, and the role of WUAs in water pricing.

The main purpose is to provide specific reference and guidance for policy making on water pricing and improvement of WUAs which are needed for better end canal O&M. Water pricing reform is essential for long run sustainability of high return irrigation systems, and improved WUA quality is a key component of effective water pricing reform. In addition to its policy focus, the study is also intended to help guide WUAs in various regions on the practical aspects of water price determination for WUA sustainability. Based on the literature reviewed for China, this is the first study of its kind on end canal water pricing and on WUAs, and is the first study which is designed to help guide integrated policy making on these two topics together.

This chapter introduces the problems and linkages of water pricing and WUAs sustainability, and emphasizes the importance of a rational and effective water pricing system for sustainability of both WUAs and end-canal irrigation systems, as well as for overall high performance of irrigation investments in China.

1.2 Rationale for the Study

The development speed of WUAs in China has been relatively fast, growing to more than 50,000 WUAs in 2008 and now covering about one-third of the irrigated area. Many WUAs, however, are not of high quality and only 40 percent are registered as an independent and permanent legal entity. WUAs face a common financial problem-- their income is insufficient to cover their operation and maintenance (O&M) costs. This directly influences their operation and often threatens their very survival and sustainability. It also threatens the long-term development of WUAs in general, as well as the quality of the end-canal irrigation systems on which all irrigation systems depend for efficient and reliable water delivery and use. A recent study found that some 67% of WUAs nationwide suffer from financial difficulties.

Water fees are the most important and obvious source of stable funding for WUAs to cover O&M and management costs. However, a number of substantial problems exist with regard to water fees ranging from the way water fees are calculated, collected, and managed, to the status, role and capabilities of WUAs vis-a-vis irrigation districts (IDs) and villages, to specific local and national policy support measures for improved WUAs or lack thereof. Policy support is the key issue, and to date, WUAs and WUA water pricing have lacked a unified policy support. At the national level, there are general policies supporting WUAs in various ways and a few general policies on end-canal water fees, but none of these policies cover specifically the role of WUAs,

O&M cost estimation, water price determination, water fee collection, and other such topics comprehensively. In addition, there have been many studies done separately on farmers' payment of water fees, and on the State water fees charged by IDs and water suppliers for main system O&M. However, there has been little or no investigation and analysis on end-canal water fees for O&M of water distribution systems managed by WUAs, and on the combination of the State water fee charged by IDs and water suppliers for water delivered with the end canal fees, which together comprise the total water fee cost for farmers. This study is intended to fill these gaps.

1.3 Objectives and Scope of the Study

The objectives of the study are to: (a) provide a scientific policy basis for financial measures to support WUA sustainability and adequate end-canal operation and maintenance (O&M) and management through reasonable and viable water charges and water pricing mechanisms for WUAs; and (b) help improve and reform end-canal water pricing, and strengthen the role of WUAs which is closely tied to end-canal water pricing. In addition the study identifies specific institutional and financial weaknesses in WUAs which negatively impacts end-canal water pricing, O&M and management and provides recommendations to rectify those weaknesses.

The study scope covers four key aspects of WUA water fees in China namely the composition of the water fee, water price determination, water fee collection, and water fee management. It analyzes these aspects for different water pricing methods and types of water charges faced by WUAs, and for various types of WUAs. The main content and presentation of the research focuses on four specific policy-related topics for WUAs irrigation water pricing: (a) general water fee determination and collection by IDs and WUAs; (b) WUA water fees and their adequacy for end-canal O&M; (c) methods of WUA water price determination and fee collection; and (d) subsidy mechanisms for WUA irrigation water fees.

During the study, detailed surveys of water pricing and related issues were carried out, targeting twelve WUAs located in eight irrigation districts (IDs) across five provinces. The case studies include data collected based on structured questionnaires from 99 farm households, WUA leaders, IDs staff and officials and other sources. These case studies, along with other related data sources on WUAs, provided the scientific basis for the analysis and policy guidance produced by the study. In the course of the study, substantial original data and information on specific WUAs and WUAs' development were also collected and used.

1.4 Current Status and Main Constraints for WUA Development

Since the mid-1990s when China established the first modern era farmer Water User Associations (WUAs), WUAs have developed rapidly with the promotion of water and irrigation sector reforms and the rural tax reform, as well as with the increase in hydraulic infrastructure construction and improvement in rural areas. By the end of 2008, more than 50,000 WUAs had been established nationwide, and the irrigation area under WUA management covered more than 300 million *mu* (20 million ha), accounting for 34% of the total irrigated area in the country. There are 16,800 WUAs in large-scale Irrigation Districts (IDs) covering an irrigated area of 102 million *mu* (6.8 million ha), which accounts for 40% of the irrigated area in those IDs.

Most WUAs are sponsored by Water Supply Organizations (WSOs), Water Resource Bureaus (WRBs), villages and local governments; WSOs and WRBs are water line agencies that are generally under the guidance (not control) of the Ministry of Water Resources (MWR). Most of the existing 50,000 WUAs have been established under the water line agencies or under villages, with approximately 5% established under the water line agencies in Bank-financed projects. In addition, the State Office for Comprehensive Agricultural Development (SOCAD), under the Ministry of Finance (MOF), manages China's largest investment program for on-farm and end-canal works, the Comprehensive Agricultural Development (CAD) Program. It has established over 1500 WUAs under projects financed with Bank assistance. SOCAD has a strong interest in both water pricing for end-canal and in WUAs development. Under SOCAD, 516 WUAs were established in the Bank-financed Irrigated Agriculture Intensification Loan II Project, and 1020 WUAs in the Irrigated Agriculture Intensification Loan III Project (IAIL3). Unlike WUAs under the water line agencies, SOCAD WUAs are sponsored by State projects which provide financial resources for their support and training;

From 2004-2009, MWR and SOCAD jointly implemented the DFID-financed, Bank-administered Pro-Poor rural Water Reform Project (PPRWRP) which developed improved WUA methods and standards based mainly on past experience from Bank projects in China and other countries. A total of 497 WUAs in 10 provinces were established under the project based on these improved methods and standards - 231 WUAs were formed by MWR and 266 WUAs by SOCAD-. PPRWRP also developed specialized WUA monitoring and evaluation (M&E) system which for the first time allowed for the identification and evaluation of the benefits from these improved WUAs. Based on the analysis from the PPRWRP M&E system, the improved WUAs generated large economic, social and environmental benefits. To further improve WUAs, the Water Pricing Reform Project (WPRP) of MWR and the IAIL3 project of SOCAD were designed to incorporate the lessons and experience of PPRWRP and help spread improved WUAs over wider areas (although both remain relatively small compared to the total needs).

Benefit-cost calculations done for the PPRWRP revealed significant benefits over costs for project WUAs. The measured benefits were in the form of increased food production and higher water saving, although WUAs produced many more benefits. The analysis indicated that returns to investments in improving the performance of WUAs are exceptionally high. In 2008 (i.e., for only one year), for example, the value of incremental food production and water saved for improved, standardized WUAs under the project was Y470.5 million, more than double the total project cost of Y203.6 million (grant plus counterpart funds) and far in excess of the actual costs incurred for WUA establishment under the project of only Y11.2 million. Based on these calculations, the payback period for investment in WUAs, including both direct and indirect costs (and including limited WUA infrastructure improvements), is less than six months; this is based on the comparison of WUA areas to control group areas with similar irrigation infrastructure conditions. Removal of indirect costs under the project (such as M&E) would yield much larger net incremental benefits and a shorter payback. Moreover, this doesn't take into account the large economic benefit to farm families from incremental off-farm income made possible by labor saving and reduced conflict over water due to WUAs activities.

Investment in improved, standardized WUAs clearly yields very high economic returns that are much higher than for a standalone irrigation infrastructure project. The substantial benefits from WUAs under PPRWRP also accrued to a relatively large number of beneficiaries: some 292,000 households with a total population of over 1.3 million and covering a total area of 165,100 ha.

For these beneficiaries, total WUA investments of about Y1200/ha provided incremental benefits of more than Y1600/person in 2008 alone, compared to control groups. Although these benefits relative to costs seem to be implausibly high, it should be noted that in all project WUAs (and in comparable control group areas) the irrigation facilities were reasonably adequate (or were made adequate) as required. Nevertheless, the basic lesson of PPRWRP is that with reasonably adequate infrastructure in place, there exists a potential for very high returns from relatively small investments in WUAs. Lessons learned provided a fundamental impetus for the present study. Water pricing reform to support better WUA sustainability, combined with support for improved WUA development, can yield large benefits for farmers around the country.

Despite their rapid progress and large benefits, WUAs still face a number of problems and constraints many of which, if not dealt with, would jeopardize the viability and survival of WUAs and threaten the future development of new ones. These challenges include:

- 1) Difficulties for WUA registration, without which a WUA is not an independent legal entity and cannot own property, have a bank account, sign agreements, and borrow, among other activities;
- 2) Inadequate end-canal water fees for WUAs to support operation and maintenance (O&M) and management costs;
- 3) Weak and unclear WUA legal status, property ownership rights (including ownership of their irrigation facilities), legal rights and responsibilities;
- 4) Lack of funding for training of farmers, staff and officials on improved WUAs practices.
- 5) Lack of funding to cover WUA establishment costs, including registration, office facilities, water measurement facilities, and equipment;
- 6) Aging and broken canal systems, especially the end-canal distribution systems, which are very difficult for WUAs to improve, manage, and operate efficiently;
- 7) Weak management, technical and financial capacity of WUAs which requires long-term training of farmers, for which there is no funding source; and
- 8) Limited understanding of WUAs by farmers, villages, IDs and government officials which requires long term training and raising awareness, for which no funding is available.

In addition, minimum quality standards for WUAs have not been specified by any laws or regulations at the national level. Only Hubei province has a provincial level regulation to support improved quality WUAs, the “*WUA Management Regulation of Hubei Province*”, 2009. WUA quality therefore varies greatly due to differences in motivations, backgrounds and conditions under which the WUAs are established. Some would consider only the number of WUA as the target for government performance assessment. Evaluating WUA’s success based on quantity alone is often misleading as it ignores their financial and legal situation as well as their operational performance.

In particular, inadequate water fees for O&M and management costs directly restricts the sustainable operation and future development of WUAs. At present, many WUAs depend on a small part of the water fee that is recovered from the Water Supply Organization (WSO), which

itself has an incentive to keep most of the fee due to budget constraints . Other WUAs depend mainly on subsidies from villages to cover their O&M costs. Village subsidies cover only a small portion of what is needed and are also limited due to competing village priorities. Both of these situations reduce or eliminate the independence of WUAs and discourage active farmers' participation.

The lack of adequate funding for WUAs operation is widespread. Data from the 497 WUAs under PPRWRP showed that some 45% of the WUAs lacked sufficient funding for adequate O&M costs, while a national MWR study found that some 67% of WUAs nationwide were facing financial difficulties. Owing to the variety of economic conditions where WUA are located, external financial assistance is generally not available to maintain adequate O&M by WUAs. Moreover, PPRWRP data showed that on average non-water fee income only accounted for 3% of WUAs' total income. End-canal water fee remains the primary source of funding for most WUAs.

1.5 Status and Existing Problems for Irrigation Water Pricing

The irrigation fee is composed of the State water fee and the end-canal water fee. Of the total, the State water fee is handed over to the Water Supply Organization (WSO) to cover the costs of construction, management and maintenance of the State-owned (main system) facilities, while end-canal water fee is used for management, maintenance and personnel salaries, etc. of the end-canal (distribution) system managed by WUAs. The reconstruction of end-canal facilities is generally a joint investment by the government and farmers, so the farmers have a clear "financial" interest in those facilities. In the two components of total water fees, the end-canal water fee has a direct effect on the sustainable development of WUAs and on the productivity and benefits of irrigation water supply.

At present, the irrigation water fee issue faces a serious dilemma. Most of the WSOs are running at a loss, and their financial situation has become quite difficult; as a result, many of the systems suffer from substantial deferred maintenance, which adversely affects their performance and efficiency. According to the investigation of 551 large- and medium-scale Irrigation Districts (IDs) by the Ministry of Water Resources (MWR) in 2006, the State water fee is RMB 0.065/cu m on average and covers only 38% of the actual water supply cost. In addition the actual collection rate of the State water fee is only 57% on average. So, overall, the actual receipts of the State water fee accounts for only 22% of the actual irrigation water supply cost. As a result, many WSOs, especially those only supplying irrigation water, suffer heavy losses year after year and O&M is seriously deficient. This adversely influences the normal operation, output and benefits of many State irrigation projects.

From the farmers' perspective, the water charge paid by farmers is higher than what they can afford in many areas based on returns from their crops. According to an MWR investigation of 200 farmers, the average water fee paid by farmers was RMB 42/mu, which accounted for 5% of the crop value, and for some areas the water fee exceeded RMB 80/m which accounted for more than 10% of their crop value. Moreover, with the expansion of the direct agricultural subsidy to the farmer, the farmers have become increasingly unwilling to pay the water fee. Such high water charge rates as a percentage of crop value induces a vicious cycle – they reduce the farmers' willingness to pay, which reduces water fee collections by the WSO, which further reduces funding for O&M, which reduces system performance which in turn results in lower

crop production, and further reduces the farmers' willingness to pay. WUAs are the farmers' own organization and can help break this vicious cycle's but only if they have adequate funding for O&M of their end-canal irrigation facilities, and a legal capacity to collect sufficient water fees for adequate O&M for end-canal systems. Data from PPRWRP show that improved, standardized WUAs can produce exceptionally large economic, social and environmental benefits and help reverse this downward spiral, but that depends on adequate end-canal water fees to support WUA financial sustainability. Thus, water pricing for WUA sustainability is a critical requirement for the future performance of WUAs and irrigation in meeting China's needs for food, water saving, social equity, stability and overall rural development.

1.6 Water Fee Composition, Formulation and Collection at the WUA Level

Irrigation water fee pricing is investigated in this report from the perspective of the composition of the water fee, formulation of the water price, and water fee collection and collection procedures. Based on the study research, the following situations occur with the water fee at the WUA level:

- (1) **Composition of water fee:** Four types of water fee composition exist: (a) the water fee is composed of two separate parts (two part water fee), the State water fee and end-canal water fee, and both are charged separately from the farmers at a fixed or set price for each; (b) the State water fee and end-canal water fee are combined (comprehensive water fee) into a single fee, and charged together as one fee from the farmers; (c) the water fee includes only the State water fee (State only fee) while the end-canal water fee is not specified or defined, and the O&M of the end-canal system depends on the small part of the water fee returned by the WSO to the WUA or other a small subsidy from the village to the WUA; and (d) the water fee includes only the end-canal water fee, for example, in some very small-scale IDs operated by WUAs rather than WSOs. This study deals mainly with the first two types.
- (2) **Formulation of the water price:** Two kinds of water price formulation were identified and studied, as follows: (a) the price of State water fee and the end-canal water fee are constituted and levied separately, whereby the State water fee is the official government fixed price established by local government Price Bureau (PB), while the end-canal water fee is determined through several means such as the government PB fixed price, government PB variable price (meaning government gives a price range within which the price is determined by a WUA), etc.; (b) the WUA comprehensive water price is determined by the WUA, which is calculated based on WUA costs for the State water fee paid for water delivered to the WUA plus the WUA costs for O&M of the end-canal system. Depending on the location, this may be determined solely by the WUA, or it may have to be approved by the local government PB.
- (3) **Collection agency and procedures for water fees:** Several methods of water fee collection by the collection host (agency or unit responsible for water fee collection) exist: (a) the State water fee and the end-canal water fee are collected separately, with the State water fee collected directly from farmers by the WSO while the end-canal water fee is collected by the WUA; (b) Collection of the comprehensive water fee has been implemented in some WUAs wherein the comprehensive water fee is collected by WUA, and the WUA pays the State water fee to the WSO and retains the end-canal fee portion

for its own O&M; and (c) in some areas even if a WUA has been established, the water fee is still collected by the village, township or town, and the township submits all or part of the State water fee to the WSO subsequently.

1.7 Critical Issues Faced by WUAs in End-Canal Water Pricing

The following are some of the key problems facing water pricing for the end-canal systems operated by the WUAs: (1) Some IDs have not formulated a policy for the end-canal water fee; (2) the current water fee is relatively low and cannot cover WUA O&M costs; (3) The end-canal water fee is held by government PB in some areas; (4) A single standard water price is specified by the government for use by WUAs irrespective of the differences in their conditions. (i.e., the specified single water fee does not allow for the different conditions and costs faced by different WUAs). However, in some other areas, the government neglects the oversight and monitoring of the actual end-canal water fee charged which creates conflicts, often creates inequities and discourages farmer participation; (3) The formulation of the end-canal water fee lacks participation and therefore support by the farmer water users; and (4) The units responsible for end-canal water fee collection and management are often not the WUAs. End-canal water fees should be charged and managed by the WUA which has to use the fee income directly for water supply, O&M and management, but in actual practice for various reasons the WSO often charges and manages the fee income even though the WSO has no role in end-canal O&M and management.

1.8 Rationale for Establishing a Standard WUA Water Pricing and Charging Method

Currently, there are big differences in the composition of the end-canal water fee, the unit responsible for formulation and charging of the end-canal water fee, and the charging procedure of the end-canal water fee in different local areas. The rights and responsibilities of WUAs, WSOs and local governments in water pricing are also different in different areas. As mentioned above, some WUAs have problems such as composition of the water fee, method of fee determination, responsible agency for dealing with the water fee charge, and water fee charging procedure. For the purpose of adequate water pricing for WUAs, it becomes necessary to understand the different water pricing methods for WUAs in order to develop an improved water pricing system which fits local water resources and soil conditions, irrigation facility conditions, irrigation methods, etc., and to ensure that the water fee received by WUAs is sufficient and stable for WUA end-canal O&M and management; i.e., for WUAs to manage water efficiently and survive financially. An improved water pricing system is required to:

- **Guarantee the sustainable development of WUAs and good O&M of the end-canal system.** The end-canal water fee is directly used by the WUA to cover the cost of O&M and management. The improved water pricing method for WUAs can make clear the composition of water fee, the cost calculation of O&M, and price determination, coverage of O&M costs, water fee charge procedures, etc. That will help guarantee both sustainable development of WUA s and adequate O&M of the end-canal system.
- **Promote standardization in development of WUAs in terms of both water pricing methods and WUA quality.** Different stakeholders, such as WSOs, WUAs, township governments and villages, etc., have unclear rights and responsibilities in WUA/end-

canal water pricing and irrigation facility management. The WUA collects and manages the water fee in some areas, but in other areas, the WSO or township or village is responsible for collecting the water fee while the WUA is responsible for O&M. In the latter case, it is difficult for WUA to carry out its work due to lack of funding and participation by farmers, resulting in inadequate O&M of end-canal facilities. Water fee determination and collection is one of vital aspects for the standardized development of WUAs. Once the standardized water pricing mode for WUAs is established, the rights and responsibilities of different relevant stakeholders will be clear with respect to water fee determination, collection, and management, which is beneficial to the standardized development and operation of WUAs. At the same time, it is important to that WUAs themselves be improved and standardized in quality so they are better able to handle greater responsibility for end-canal water pricing as well provide more efficient irrigation O&M and management.

- **Help eliminate the unreasonable water fee burdens on the farmers and also guarantee that the water charge is more fair, transparent and equitable, and thus will promote more participation by farmers.** Many WUAs exhibit problems related to water charges, such as unclear composition of the water fee, unscientific measurement and calculation of the WUA water supply and its cost, insufficient public participation in the formulation of the water price, irregular water fee collection procedures, and lack of the oversight by farmers during the water price formulation, water measurement and water fee collection processes. Such problems often result in overcharging of water fee, and in addition water fee collection may be affected by personal relationships, which causes inequity and conflict. As a result, they may increase the farmers' burden of water fee, and often unfair water fee formulation and collection will cause conflicts among farmer and reduced their participation. To establish a reasonable and equitable water fee formulation and collection mode for WUAs, it is necessary to clarify the composition of the water fee, supervise water measurement and calculation of the water fee and make it accurate and scientific, and encourage public participation and oversight of water price formulation, measurement and charge procedures. This will help eliminate unreasonable charges, lighten the burden on farmers and ensure impartiality and equity in the formulation and collection of the water fee.
- **Promote water saving, increased production and high productivity in irrigation.** An improved WUA water pricing system, if properly designed and standardized through improved WUAs, will help provide economic incentives for farmers to save water, increase water productivity (allocated scarce water to highest value uses), and encourage farmers to pay for water. These impacts have been clearly shown and measured in the 497 improved, standardized WUAs developed under PPRWRP. Improved, standardized WUAs are essential as the vehicle to carry out water pricing reforms, and conversely the water pricing reforms will help improve and standardize WUAs and their capability to achieve such benefits.

1.9 Policies and Regulations Related to Water Fees and Pricing

At the national level, though there are some policies for WUAs, and a few policies on end-canal water fees, but they are not specific enough when it comes to water cost estimation, water price

formulation, and water fee collection. Some lower level governments have issued certain policies regarding WUA water fees; however, in general they do not specify the WUA's role and responsibilities. Reform of these policies is needed. A review of the existing policies² and regulations reveals that WUA and end-canal water pricing generally lacks clear and adequate support, with the exception of the recent Hubei regulation, mentioned earlier

The WUA Management Regulation of Hubei Province, (2009) is the first provincial government regulation for WUAs. This regulation defines the WUA as a registered "legal person." It specifies WUA rights and responsibilities, such as for irrigation management, charging water fees from farmers, ownership or management rights for irrigation facilities, participation in end-canal water pricing, etc. It is important the WUA determine end-canal water pricing, not just participate in it. The regulation also defines the rights and responsibilities of WUA farmer members, rights and responsibilities of the WUA executive committee and WUA chairman, the main content of WUA management regulations, the responsibility of CAB and WRB in WUA registration and operation, the establishment and registration procedures for WUAs, etc. This is a highly innovative, path breaking and much needed step for WUA policy support which enables WUAs to play a much more effective role in end canal water pricing and management.

² For a complete list of national and provincial policies please consult Annex II

Chapter 2: Methodology and Analytical Framework

This chapter describes the methodology involving the case studies and the analysis that was carried out. Case studies site selection is important to ensure that the research results reflects the variability in conditions throughout the country, in particular the North, the Northwest, the Northeast and the South. Selected WUAs were sorted according to their water resource conditions and their water pricing methods. The effect of WUA water resource conditions in the various regions on water pricing methods and the WUA's degree of independence were also analyzed, along with the different kinds of WUAs across the country. This approach constituted the basis for selecting the representative IDs and WUAs for field investigation and analysis.

2.1 Field Investigation

As mentioned earlier, a total of 99 questionnaires on farmers, 12 questionnaires on WUAs, and 8 questionnaires on IDs were completed. The interviewees included: WUAs chairmen, WUG leaders, and WUA farmers; ID principals, staff, and technicians for WUA affairs, water fee collection, facility management and water distribution; ID Water Supply Organizations (WSOs); Water Management Station (WMS) chiefs and staff; Provincial Water Resource Bureaus (WRBs); and villages' leaders and local government leaders and staff (including township government chiefs, township staff, etc.).

The eight IDs were selected from Jilin, Shanxi, Xinjiang, Hubei and Hunan provinces and were divided into six large-scale IDs, one medium scale ID, and one small scale ID - A total of 12 WUAs at those sites were investigated. The investigation targeted the State WSOs, WUAs, common farmer households and the relevant township and village principals.

The IDs represent the major agro-climatic conditions in the country, particularly the humid south, the semi-humid northeast, the dry North and the arid northwest (Table 2-1). Within those IDs, the WUAs selected encompass different types of water fee composition, water sources and utilization. Though the Shanxi ID does not specifically include WUAs, it has a similar type of local irrigation organizations for end-canal management; they were included because their management system is fairly common in Northern China and because some of the improvements introduced in Shanxi could provide lessons for WUAs in other regions on water pricing.

The IDs were selected based on the following criteria:

- The water pricing method in the ID is representative of the region;
- Reform of irrigation management and water pricing is relatively advanced within the province;
- The ID has WUAs of good quality in its service area; and
- The ID can provide experience with WUA water pricing for IDs with similar conditions.

Table 2-1: Location of IDs Selected for Case Studies

Name of ID	Province	Region	Climate	Type
Dongfeng	Hubei	South	Humid	Gravity surface

Shilu	Hubei	South	Humid	Gravity surface
Liufengyan	Hubei	South	Humid	Gravity surface
Tieshan	Hunan	South	Humid	Gravity surface
Toutun River	Xinjiang	Northwest	Arid	Gravity + groundwater
Santun River	Xinjiang	Northwest	Arid	Gravity + groundwater
Qianguo	Jilin	Northeast	Semi-humid	Pumped surface
Jiamakou	Shanxi	North	Dry	Pumped surface

The main investigation for the State WSO included the rights and responsibility of the project management in ID, the water supply process in ID, water pricing policy in ID, the water fee collection process in ID, economic situation of the State WSO, management reform in the ID, the development situation of WUAs in the ID, and other related topics. The main investigation content for WUAs included the rights and responsibilities for management within the WUA, water supply process of the WUA, water fee standard and pricing method of the WUA, WUA collection process for water fees, WUA income and expenditures, and other related topics.

The main investigation of farming households included their expenditure and composition; the collection method of the water charge; water fee affordability; labor investment; agricultural investment and output; and other related problems. The sampling criteria of water users consisted of choosing three WUGs from upstream, middle and downstream in each WUA; three farmers from upstream, middle and downstream areas in each WUG. Nine farmers were selected in total for each WUA. The semi-structured discussion method was used in the investigation, and interviewees were asked questions face-to-face.

2.2 Research Content and Tasks

The different practices in water price formulation and water fee collection in various regions, IDs, and WUAs were investigated, researched, analyzed, evaluated, compared, and summarized. Good experiences and lessons were identified. WUAs were separated into different types according to their characteristics, and the study of WUA water price making and fee collection methods was carried out accordingly. Overall, the research sought to help define the best water fee source to cover WUA O&M management costs and therefore help ensure the sustainable development of WUAs and effective O&M and management of the end-canal systems. The main research tasks included the following:

- (1) Case studies of IDs and WUAs on irrigation water price formulation and water fee collection. The investigation included the components of the water fee, collection procedures for the water fee and the water fee amounts actually paid by the farmers.
- (2) Case studies on the WUA O&M and management costs. Representative WUAs were investigated and analyzed regarding the composition of and expenditures on O&M costs.
- (3) Research and develop methods for estimating and collecting WUA water fees. On the basis of the case studies and analyses, scientific and reasonable WUA water price formulation and water fee collection methods were studied for different types of WUAs. This included the components of the water fee, water fee calculation methods, charging procedures for the water fee, and water

fee management.

(4) Research on the potential subsidy mechanisms for irrigation water fees. Various methods and paths for financial subsidies of water fees were identified, analyzed and compared.

2.3 WUA Typologies Used for Water Fee Analysis

WUAs can be classified according to many factors including the utilization of water resources, composition of the water fee, service quality of WUA, or even based on the background of the chairman of the WUA (e.g., farmer or village chief), or the scale of the WUA. Classification needs to consider the factors which probably have greatest influence on the operation of WUA, and particularly on water pricing and water fee collection. .

Before starting the case study, water price formulation and water fee collection in the 497 WUAs in 10 provinces under PPRWRP project were analyzed, as well as in the MWR Water Pricing Reform Project (WPRP) which covers 155 WUAs in 11 provinces. By doing so, it was found that water source for WUA is one of the key factors that determine its operational features, management rights and responsibilities, water price formulation and water fee collection.

WUAs can be divided into three types according to their water source. The characteristics of each type are presented below.

- **Water resource dependent type of WUA.** The water resource dependent WUA refers to those basically depending on the water supply from WSO. These WUAs don't have their own water source, or their water source is only for limited supplementary use. They rely mostly on support from WSO, which monitors, supervises and may in some cases control the WUA. Since the WSO monopolizes the water supply to the WUA, it greatly influences the internal matters of WUAs, and participates or even guides their decision-making; sometimes WUA chairmen are employees of WSO. Water resource dependent WUAs are mostly located in the middle and large-scale IDs in dry Northwest and North China.
- **Water resource independent type WUA.** The water resource independent WUA refers to those having independent water sources (small-scale reservoir, dam, well or pump station), independent irrigation systems, with no water supplied from a WSO. These WUAs are mostly supported by the village organizations during the establishment and operation process. A few cross-village WUAs may need the coordination of the township government. The village cadres often act as the principals of these WUAs. WUA is responsible for the management of its own water sources, irrigation system. The operation and management way of these WUAs are comparatively simple. Since no WSO is available for water supply, the irrigation guarantee rate of the WUA is generally quite low. The water resource independent WUAs are mostly in the small-scale IDs.
- **Water resource supplementary type of WUA.** This type of WUA refers to those WUAs who have their own water sources, but also use WSO water as supplement when their own water resources are insufficient. For these WUAs, some get more water from the WSO, while others use more of their own water. This type of WUA is mostly located in the large-scale IDs in Southern China, and in the Northern IDs using both surface and groundwater. Generally, these WUAs are fully responsible for management of end-canal

system and small-scale water sources within the WUA service area.

Classification of WUAs according to Water Fee Composition. The term “water fee” refers to that fee (those fees) charged by the WSO and/or the WUA from the farmers, exclusive of the water charges charged by organizations below WUA (such as the Water User Groups (WUGs), etc.). The water fee probably may not be equal to the total irrigation cost paid by farmers, which also includes farmer labor contributions, for example. And in many areas it is quite difficult to distribute water directly to the household, regardless whether it is from the WSO or the WUA. Besides paying for the water fee to WSO and/or WUA, the farmer is likely to pay for the service of the WUG or for other water (e.g., a personal tubewell). Sometimes unreasonable fees are charged in some local areas which further complicates the situation. Therefore the irrigation cost actually paid by the farmer is called the “farmer water fee” to distinguish it from the “water fee.”

The three types of WUAs according to water fee composition identified and used in the study are as follows:

- **Two-part water-fee WUAs (State water fee + end-canal water fee).** Two-part water fee type means that the water fee paid by the farmer household comprises two parts, namely, the State water fee and end-canal water fee (some places call it a “group” management fee or “end-canal” management fee, while in some other places, the end-canal water fee is composed of several kinds of specified fees). The WSO and WUA are responsible for collecting their respective water fees from the farmers separately. The end-canal water fee is mainly used for the end-canal maintenance, water distribution labor, office work, etc.

Generally, the water supply under the two-part water-fee WUAs depends on the WSO, which means that the WUA is of “water resource dependent type”, and mostly located in the North China such as Shanxi, Shannxi and Xinjiang.

Before the current national reform of water management, many WSOs directly supplied water to the inlet of the branch canal or tertiary canal. The irrigation facilities below the branch or tertiary canal were to be managed by village groups. With the promotion of the reform, WUAs have been established to manage water distribution in place of the village, under the guidance of WSO.

Under the “two-part water-fee type” WUA, the State water fee is regulated by the government and charged from the farmer by WSO directly. The State water fee is not included in the financial costs of the WUA.

In contrast, the end-canal water fee in principle should be collected from the farmer directly by the WUA. However, it is commonly seen that the end-canal water fee is also collected by WSO along with the State fee, because a majority of WUAs have been established only for a short period of time and the relationship between the town/village and the WUA is not yet smooth; in the dry areas such as the Northwest and North, the agricultural water supply and collection of the water fee is more important, and the practice of collecting both fees by the WSO is more common. Moreover, the water price formulation, water charge, management and use of the end-canal water fee are sensitive matters for both the WSO and farmers, especially where the end-canal water fee is collected and managed totally by the WSO without farmer participation. In many cases,

where the WSO collects the whole water fee, the WUA has to apply to the WSO to use the end-canal part of the water fee collected by the WSO in order to undertake its O&M and management, which makes the WUA appear as an arm of the WSO to the farmers and discourages participation and WUA self-management.

- **Comprehensive water-fee WUAs.** WUAs under the comprehensive water-fee system collect the entire water fee from the farmers, which includes: (a) the State water fee amount, which the WUA pays to WSO as payment for water received from the WSO, and which is treated as a WUA operational cost (and is therefore included in the cost accounting of the WUA budget) as the cost of water; and (b) the end-canal water fee amount based on the costs for the WUA to cover O&M and management of the end-canal water distribution facilities. The WUA has the responsibility for facilities management and water distribution in the end-canal system as well as for collection of the water fee from the farmers. The WUA charges a single water fee from the farmers based on covering the whole cost (the sum of the above two parts). As an independent legal person, the WUA has a client relationship with the WSO and often has a Water Supply Agreement with the WSO. The WUA pays the State water fee portion to the WSO according to the agreement, usually based on the volume of water delivered to the WUA; the State WSO does not directly contact the farmer. The independent cost calculation method used within the WUA includes the cost of water purchased from the WSO, plus the WUA's internal costs for end-canal O&M and management, such as maintenance of the irrigation facilities, cost of water distribution, WUA staff, office costs, etc.; the cost estimation for the WUA water price generally does not include the depreciation and rehabilitation of end-canal facilities. Theoretically, the water price should be democratically agreed within the WUA and may be approved or recorded by the government, although in practice the government often plays a more direct role in fixing the water price.

Comprehensive water-fee system can be commonly seen mainly in “water resource independent type” and “water resource supplementary type” WUAs, especially in the southern areas such as Hunan and Hubei. The difference between “water-independent type” and “water-supplementary type” WUA is that there is no State water fee for the former type.

Some (a minority) of the “water resource dependent type” WUAs may use the comprehensive water-fee, as for example, in the MWR WPRP project in Xinjiang. The farmers pay directly to the WUA just one water charge, which combines the State water fee and the end-canal water fee together. The WUA pays the State water fee part, which is the cost of the water purchased by and delivered to the WUA, to the State WSO, and uses the end-canal water fee for its own O&M, management and other and costs.

- **State water fee-only type WUAs.** State-water-fee-only means that the farmer pays only the State water fee, without the end-canal water fee. Since these areas do not have the actual policy for the end-canal water fee, WUA depends purely on the return of a part (usually a very small part) of the State water fee for WUA O&M. The State water fee is directly collected from the farmer household by the WSO, or in some cases the WUAs may be entrusted with collection. The entrusted collection can be in various ways; for example, the personnel from the WSO collect the water charge by household in the company of WUA staff. Some WSOs may entrust WUAs with fee collection and then as

a collection fee return to the WUA specified amounts or a certain proportion of the water charge according to the amount of the fee collection; in those cases, the WUA is treated like a collection agent on behalf of the WSO, which probably does not encourage active farmer participation and support for the WUA. The amount of water fee returned is small and uncertain, and the payment is at most only sufficient to pay for WUA fee collectors and water distributors. Under these conditions, it is very difficult for the WUA to guarantee the maintenance cost of the end-canal system, which results in poor operation and maintenance conditions of end-canal system and water supply disorder at the field level. Moreover, there is no entity with recognized responsible and the mandate for end-canal O&M and management, since the WUA is only a collection agent. The WUA cannot play its basic role, and the risk for WUA sustainable development is very high. Despite these high negative risks, this system is fairly common in China, especially in some local areas particularly in the Northeast. Under the State water fee only method, there is no end-canal water pricing and the role of the WUA is non-existent. Therefore, this kind of end-canal pricing is not covered or recommended by this study, and is mentioned here only because it is a serious problem for end-canal management in urgent need of investigation and rectification.

In addition to the three water fee WUA types above, some local areas have established WUAs but do not make them responsible for water fee collection. Instead, the local government (township) or village committee carries out water fee collection, and then provides some financial support to the WUA for O&M of WUA facilities. The amount of the funding is subject to the local economic condition and depends on recognition by local officials of the financial needs of irrigation O&M and the WUA. The local government/village is not in a contract relationship with WUA, and this situation can be basically regarded as superior-subordinate relationship (i.e., the WUA is simply a branch of the village committee). This type of water fee management method can mostly be seen in some Southern areas. It is not beneficial for the independent and sustainable operation of WUAs since the WUA has no ability to manage its own affairs, and does not promote farmer participation because farmers may regard the WUA as a part of village administration.

For the purpose of summarizing the experience, the study team focused the research on the two-part water-fee and the comprehensive-water-fee as the water pricing methods for WUAs. Table 2.2 presents the basic information of the WUAs and IDs investigated in this study.

Table 2-2: Water and WUAs Conditions at IDs selected for case studies

Province	Serial number	ID	Climate type	Use of ID water supply	Main water source type of the WUAs	Main composition of water fee
Jilin	1.	Qianguo ID	Semi-humid	Purely irrigation water supply	Water resource dependent	State water fee only
Shanxi	2.	Jiamakou ID	Semi-humid	Purely irrigation water supply	Water resource dependent	Two-part water fee (State water fee + end canal water fees separately)
Xin-Jiang	3.	Toutun River ID	Dry	Mainly for irrigation/industry	Water resource dependent	Two-part water fee (State water fee + end canal water fee separately) and Comprehensive-water-fee
	4.	Santun River ID	Dry	Purely irrigation water supply	Water resource dependent or supplementary	Two-part water fee (State water fee + end canal water fee separately)
Hubei	5.	Dongfeng Canal ID	Humid	Mainly for irrigation/industry	Water resource supplementary	Comprehensive water fee
	6.	Shilu ID (medium-scale)	Humid	Purely irrigation water supply	Water resource supplementary	Comprehensive water fee
	7.	Liufengyan ID (small-scale)	Humid	Purely irrigation water supply	Water resource independent	Comprehensive-water-fee (Independent small-scale ID without State water fee)
Hunan	8.	Tieshan ID	Humid	Mainly for municipal/industry & irrigation	Water resource Supplementary	Comprehensive water fee

Chapter 3: Water Pricing and Fee Collection Mechanisms

Results from the case studies are presented in this chapter, particularly with regard to water price determination and fee collection. The focus will be on water fee composition, water pricing and fee collection, though related aspects of water fee management, water measurement and WUA operation will also be described. Current practices for water pricing, along with the processes and problems of water pricing are also described and analyzed for selected case study IDs and WUAs.

3.1 Overall Findings on WUAs and Water Pricing in Selected Case Study IDs³

Qianguo ID, Jilin Province - Northeast. The State WSO manages the primary and secondary canals. WUAs are established at the tertiary level canal. The two sample WUAs have been established in the State Farm and operate within the management framework of the State Farm and with the support of the WSO. The initial aim to establish WUA is that the WSO wants it to collect the State water fee from the farm household, but this hasn't worked. At present, the WSO collects water fee from farmers or entrusts it to the State Farm or village to do so. Overall, WUAs do not play a significant role in project management, irrigation management and/or the collection of the water charge. The WUAs mainly depend on WSO for water supply. The water fee consists only of the State water fee with no end-canal water charge.

Jiamakou ID, Shanxi Province - North. The State WSO's management extends to the inlet of tertiary canal, while below that, the "End Canal Management Committee" (ECMC, a type of partial WUA organization but with limited farmers participation) is established for the management of end canal system (tertiary and below). The End Canal Manager (in Chinese Dou Zhang) is hired by the ECMC to be responsible for the maintenance of the end canal, cleaning of the mud, and delivering water to each household. The ECMC is established under the village mandate and not registered at CAB. It is therefore not recognized as a "legal entity" and has no bank account. The ECMC in Jiamakou ID relies on the WSO for water supply. The two-part water fee which includes State water fee and end-canal water fee is adopted. The water volume is measured at the inlet of the tertiary canal (headgate of the ECMC); Water volume is subsequently measured at the household level, an invoice is issued to the household and collection is done accordingly. The end canal water fee in Jiamakou ID mainly refers to the tertiary canal management fee. Both the State water fee and end canal water fee are collected directly by the WSO which manages the end canal water fee. The ECMC applies to the WSO for the use of the end canal fee.

Toutun River ID in Xinjiang - Northwest. Most WUAs in Toutun River ID belong to the "water resource dependent" type with water supplied by the WSO. WUAs are of the two-part water fee type, with a few adopting the comprehensive water fee type. For example in Xiayingpan WUA, the water fee is implemented with two-part water fee, which means the State water fee and the end-canal water fee are calculated and collected separately, and water is measured at the branch canal inlet. Two separate water fees are directly charged from the farmer household by the WSO. The end-canal water fee part is retained by the WSO, and the WUA applies to the WSO to use it.

³ For more details, please refer to Annex III

Another WUA in Toutun River ID, the Nantougong WUA, adopts the comprehensive water fee. The WUA buys water from the WSO at the branch canal inlet at the rate of RMB 0.054/cu m, and then charges the farmers at the farm canal inlet at the rate of RMB 0.082/cu m. Measuring charging, issuing the invoice, and collecting the water fee from each household are done by the WUA.

Santun River ID in Xinjiang - Northwest. WUAs in Santun River ID mostly belong to “water resources dependent” type with water supplied by WSO. For a small number of WUAs, their water resource is mainly taken from pumping tubewells (auctioned or contracted to private operators). The water fee is a two-part water fee, which means the State water fee and end-canal water fee are calculated, charged and collected separately. Water volume is measured at the tertiary canal inlet. Two fees are directly charged and collected from the farmer households by the WSO. The end-canal water fee is managed by the WSO and the WUA applies to the WSO to use it.

Water Source Supplemental IDs and WUAs in Hubei and Hunan- South. WUAs in medium and large-scale IDs in Hubei and Hunan are generally of the “water source supplement type”, which means the WUA does not depend on the State WSO for all its water needs. WUAs or individual farmers own other water sources which provide the remainder of the water. For the supplemental portion of the water, the WUA water fee type is a comprehensive water-fee. The State WSO charges the WUA which charges the farmers for the supplemental water; the WUA may or may charge the farmers additional charges for the water it supplies from its own sources. In these IDs, some WUAs choose to charge and collect water fees directly from farmers, while others entrust their WUGs or village committees to do so.

Water Independent WUA - South. One WUA investigated - Liufengyan WUA, in Hubei in the South is within the service area of a small-scale ID, and is of the “water source independent” type. The water fee paid by farmers is the comprehensive water fee type. The WUA is self-managed by farmers; it manages the water source and the canal system; the delivery and distribution of water to farmers; and the water charge and its collection.

Table 3-1: Characteristics of WUAs Investigated in the Case Studies

Province	No	WUA	WSO	Irrigation area (mu)	Number of farm households	Number of villages covered	Main irrigated crops	Source of water resource for WUA	Type of water fee
Jilin	1	Lianhuapao WUA in Qianguo ID	Qianguo ID Management Bureau	18000	654	1	Rice	Resource Dependent type (depends on the water pumped from Songhua River in Qianguo ID)	State-water fee only
	2	Hongguang Eryingan WUA in Qianguo ID	Qianguo ID Management Bureau	38250	3800	1	Rice	Resource Dependent type (depends on water pumped from Songhua River in Qianguo ID)	State-water fee only
Shanxi	3	Zhangxian ECMC in Jiamakou ID	Jiamakou Management Bureau	4000	460	1	Apple	Resource dependent type (mainly depends on water pumped from Yellow River in Jiamakou ID)	Two-part water fee
Xinjiang	4	Nantougong WUA in Toutun River ID	Toutun River Management Office	19000	624	1	Wheat, corn, tomato	Resource dependent type (mainly depends on water diverted from Toutun River)	Two-part Water fee, 2009 shift to Comprehensive fee
	5	Xiayingpan WUA in Toutun River ID	Toutun River Management Office	8880	402	1	Wheat, corn, tomato	Resource dependent type (mainly depending on the water diverted from Toutun River)	Two-part water fee
	6	Sanqi WUA in Santun River ID	Santun River Management Office	10300	328	1	Wheat, corn, tomato	Resource dependent type (mainly depending on water diverted from Santun River, No.500 project water and 2 pump wells owned by WUA)	Two-part water fee

	7	Shuguang WUA in Santun River ID	Santun River Management Office	34500	690	1	Wheat, corn, tomato	Resource dependent type (mainly depending on water in Santun River, 55 auctioned pump wells, and 5 WUA pump wells)	Two-part water fee
Hubei	8	Zhonglou WUA in Zhijiang City	Zhijiang Shilu ID Management Office	14250	1268	4	Rice, rape	Resource supplementary type (mainly depending on WUG water sources, WUA does not own any water sources. Buys water from Shizailing ID/WSO for supplement.	Comprehensive water fee
	9	No.3 Main Canal WUA in Dongfeng Canal ID	Dongfeng ID Management Bureau	25000	3543	3 towns and 9 villages	Rice, rape	Resource supplementary type (mainly depending on WUA reservoir, WUG ponds; Dongfeng ID water is supplement	Comprehensive Water fee
	10	Liufengyan WUA in Yuanan County	No	1900	408	1	Rice, rape	Resource independent type (mainly depending on barrage owned by WUA)	Comprehensive water fee
Hunan	11	Changtang WUA in Tieshan ID	Tieshan Management Bureau	12000		11	Rice, rape	Water resource supplementary type (mainly depending on WUA reservoir, WUG ponds, with Tieshan ID water as supplement	Comprehensive Water fee
	12	Jingtang WUA in Tieshan ID	Tieshan Management Bureau	480	972	4	Rice, Watermelon	Water resource supplementary type (mainly depending on WUA reservoir, WUG ponds, with Tieshan ID water as supplement	Comprehensive water fee

Note: End-canal Management Committees (ECMCs) in Shanxi are similar to WUAs in some ways but are not WUAs. They are managed by an End-canal Manager (ECM) appointed by the village rather than leaders elected by farmers, and they are not based on democratic water management and farmer participation

3.2 Type of Water Fee System

The case study investigations found that WUAs in the Northwest (Xinjiang) and the North (Shanxi) generally use the two-part water fee system. In these cases, the State water fee is not included in WUA operating costs since it has no role in the collection or management of the State water fee; the water fee paid by the farmer household is separated into the State water fee and end-canal water fee which are charged separately. The WUA may or may not have a role in the collection and management of the end-canal water fee; in some cases it mainly handles end-canal O&M and distributes water.

In Santun River ID in Xinjiang, for example, the State water fee is RMB 0.08904/cu m for water measured at the tertiary canal inlet (at the inlet of the WUA). On the basis of that price, the State water fee is measured and charged to each household by the WSO of the ID. The end-canal water fee is specified by the government as RMB 0.024/ cu m and is also measured at the tertiary canal inlet (inlet of the WUA). Using that price, the WSO also collects the end-canal water fee and deposits it into the WUA account; to use the funds, the WUA must apply to the WSO, which therefore supervises or controls how the WUA uses the end-canal fee. The WUA in this case is only partially independent and self-managing and operates to some extent as an arm of the WSO.

Table 3-2: Water Pricing in the Two-Part Water Fee IDs or WUAs

ID (or WUA)	State water fee			End-canal water fee					
	State water price (RMB)	Measure-ment location	Charge to whom	Purpose of end-canal water fee	End-canal Water price (RMB)	Pricing method	Measure-ment location	Water fee charging and management	Charge to whom
Jiamakou ID in Shanxi	0.47/ cu m	Tertiary inlet (inlet of ECMC)	Farmer (charged by ECM)	Supplying water to household	0.03-0.05/cu m (some villages additionally charge a pumping fee, and end-canal rehabilitation fee).	Price range specified by government ECMC determines price	Tertiary inlet	WSO charges and manages, WUA apply to use	Farmer
Xiayingpan WUA in Toutun River ID in Xinjiang	0.054/cu m	Branch inlet (inlet of WUA)	Farmer	Supplying water to household	0.02/cu m	Specific price set by government	Branch inlet	WSO charge and manage, WUAs apply to use	Farmer
Santun River ID in Xinjiang	0.08904/cu m (within the quota of 480 cu m/mu; 50% added when	Tertiary inlet (inlet of WUA)	Farmer	Supplying water to household	0.024/cu m	Specific price set by government	Tertiary inlet	WSO charge and manage, WUAs apply to use	Farmer

	quota is exceeded)								
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Note: In same ID with several case study WUAs that are using same water pricing system, only one WUA is listed. ECMC is listed as a WUA, although technically it is not.

Table 3-3: Water Pricing in WUA or ID Implementing State Water Fee-only

ID (or WUA)	State water fee		
	State water price	Measurement place	Unit charged
Qianguo ID in Jilin	RMB 70/mu (comprising RMB 700/hectare for water supply, RMB 360/hectare for pumping electricity)	No measurement	Farmer household (or charged by village or State Farm on its behalf)

Note: In same ID with several case study WUAs that are using same water pricing system, only one WUA is listed.

Some WUAs in Northwest IDs use the comprehensive water fee method, such as Nantougong WUA in Toutun River ID in Xinjiang which switched from two-part to comprehensive water fees in 2009 under WPRP. The WUA directly charges the water fee from the farmer household using a price of RMB 0.082/cu m, and then pays the WSO the State water fee of RMB 0.054/cu m (measured at the branch canal or WUA inlet). The rest of water fee, RMB 0.028/cu m is managed by the WUA to cover the cost for WUA O&M and management. This method of water pricing differs from other WUAs in the same ID; they use the two-part water fee.

The study investigations indicate that WUAs in IDs in the South commonly use a comprehensive water fee, and the State water fee paid by the WUA for water delivered is the total water fee collected by the WUA and included in the WUA accounts as an operational cost. In contrast to the North, some WUA farmers in the South pay their water fee to the WUG. For example, Jingtang WUA in Tieshan ID in Hunan Province buys water at the price of RMB 0.032/cu m from the WSO (the Tieshan Canal Management Unit of Yueyang County) and considers that an operational cost of the WUA. The water fee is calculated by the WUA based its operational costs (including the water purchase fee, personnel fee, maintenance fee and management cost, etc.), which it then charges to each WUG according to the area in the WUG at about RMB 18-22/mu. The WUGs collect water the fee from the farmers and transfer to the WUA the same amount. The WUG also collects an additional water distribution fee of its own (about RMB 5-10/mu) from the farmers, since the payment for WUG personnel is not covered by the WUA water fee or included the expenditure accounts of the WUA.

Table 3-4: Water Pricing in Comprehensive Water Fee WUA or ID

ID (or WUA)	State water fee			Comprehensive-water-fee of the WUA					
	State water price	Measurement place	Charge to whom	Purpose of WUA water fee	WUA Water price	Pricing method	Measuring location	Charge unit, manager and user	Directly collected by WUA from whom
Nantougong WUA in Toutun River ID	RMB 0.054/cu m	Branch inlet (inlet of WUA)	WUA	WUA Supply water to household	RMB 0.082/cu m	Negotiate within WUA, approved by	Inlet of the farm canal	WUA	Farmers

						government			
Zhonglou WUA in Shilu ID, Zhijiang City,	RMB 0.035/cu m	Main canal inlet (inlet of WUA)	WUA	WUA Supply water to household (WUG water distributor paid by WUA)	RMB 0.047/cu m	Negotiate within WUA	Outlet from Zhonglou Main Canal to WUA (irrigation in turns among WUGs)	WUA	WUG (shared by farmer according to the area)
No.3 Main Canal WUA in Dongfeng Canal ID	RMB 0.055/cu m	No.3 main canal inlet (inlet of WUA)	WUA	WUA Supply water to household (the WUG water distributor paid by WUA)	RMB 0.055/cu m	Negotiate within WUA	Branch inlet (water inlet of WUG, within WUA)	WUA	WUG (shared by farmers according to area)
Liufengyan WUA in Yuanan County	No	No	None	WUA Supply water to household	RMB 25/mu	Negotiate within WUA	None	WUA	Farmers
Changtang WUA in Tieshan ID	RMB 0.032/cu m	Branch inlet (inlet of WUA)	Beneficiary village or WUA	Supplying water to village (village water distributor paid by WUG farmers, not included in WUA cost)	RMB 18-22/mu	Negotiate within WUA	None	WUA	Village (village responsible to collect water fee from farmers)
Jingtang WUA in Tieshan ID	RMB 0.032/cu m	Branch inlet (inlet of WUA)	WUA	Supplying water to WUG; payment to WUG water distributor is not included WUA costs	RMB 18-22/mu	Negotiate within WUA	None	WUA	WUG (WUG directly collects water fee from farmers)

Note: In same ID with several case study WUAs that are using same system, only one WUA is listed. Nantougong WUA in Toutun River ID switched from two-part to comprehensive water fees in 2009, although the rest of the ID remained on the two-part system.

For the IDs in the Northwest and North, it is common that the WSO charges water fees directly from the farmers while the WUAs may deliver water directly to the farmers; while in the South, most WUAs both deliver water to WUGs and charge water fees from (or through) WUGs, and the WUGs deliver water to and charge water fees from farmers (i.e., the WUGs act as an intermediary for the WUA). However, some small-scale WUAs in the South directly supply water to the household and then charge directly to farmer, such as Liufengyan WUA in Hubei, which is an independent small-scale ID owned and operated by the WUA.

3.3 Water Fee Determination.

Regarding the authority for water price making, the State water price is totally regulated by different levels of government through their Price Bureaus (PBs). In the Northwest and North, government water price control for the end-canal fee has been extended to the civil units, the WUAs, and the government management/control of the end-canal water fee is strict. The State WSO is responsible for charging and management of the end-canal water fee and for supervising the WUAs on behalf of the government.

In Xinjiang, for example, the end-canal fee is specified by the Provincial (Regional) government. For example, the end-canal fee in Santun River ID is RMB 0.024/cu m as measured at the tertiary canal inlet (WUA headgate); and the comprehensive water price in Nantougong WUA in Toutun River ID in Xinjiang is a total of RMB 0.082/cu m as measured at the farm canal inlet.

Another method, used by the ID in Shanxi in the North, is that the government specifies end-canal water price as a variable price (a price range) based on a percentage of the total water fee. For example, Jiamakou ID in Shanxi follows the Shanxi Provincial *Water fee Standard and Management Regulation of Hydraulic Projects* which specifies that the end-canal management fee should be 15-20% of the total water fee. In practice, however, the end-canal water fee used at Jiamakou ID is RMB is only 6%-10% of the total water fee or 0.03-0.05/cu m, which, which is justified because the irrigation system is relatively new and requires less maintenance, and also because the costs for the State water fee are relatively high due to the high pump lift from the Yellow River. The actual amount of the end-canal management fee is determined by the ECMC and the water users are informed, after which it is reviewed by the WSO in the ID and then reported to the PB. The farmers do not participate in the process of water fee determination. The ECMC and the ECM are appointed by the local village.

In the South, the WUAs have more autonomy, and the WUAs internally negotiate the water fee among their member farmers. For example, the members of Jingtang WUA in Tieshan ID negotiated among themselves RMB 19/mu as the basic price of the water fee based on the costs of the WUA. The price may fluctuate each year and can be adjusted at the semi-annual WUA representatives meeting. It was RMB 19/mu in 2008 but RMB 22/mu in 2009.

The extent of and how tightly the government controls the end-canal water fee is related to water scarcity and the relative expense of the water charge, both of which are higher in the Northwest and North compared to the South. Because of this, farmer households in the North are also more sensitive to the quality of the water supply service provided by the WSO as well as to their expenditures on water fees.

3.4 Water Fee Collection.

In some areas, the WUA itself collects the water fee directly from the household, and the related costs for water distribution within the WUG have been included in the end-canal water fee which is collected by the WUA. The WUA distributes water to each household or to the WUG, but the WUG no longer charges the farmer household an additional fee for its service (i.e., the fee charged by the WUA includes the WUG costs and is the entire fee).

Under this method, the amount of water fee to be paid by the farmers is quite transparent and easily understood by farmers. For example, in Jiamakou ID, Santun River ID and Toutun River ID, water fee collection (and water measurement) at the household level is carried out, and the end-canal water fee includes the cost of water distribution by the WUG. The WUA (or ECM or WSO, as the case may be) contacts the farmer household directly to collect the water fee; the WUG has no role in water fee collection. In Qianguo ID in Jilin, for example, although the State water fee is calculated by area and is not measured in the whole ID, the water fee is directly collected directly from each farmer household by the concerned village (or the State Farm as the

case may be). In addition, in some areas, the total charge may be quite complex; besides charges by the WSO, the actual water fee collected by the WUA from by farmers often contains charges for other water sources, such as paying the costs for the pumped tubewell water. For example, a farmer interviewed in Sanqi WUA in Santun River ID in Xinjiang owns 48 mu of land; he pays RMB 2,200 for water from Santun River ID delivered by the WSO, RMB 1,600 for pumped tubewell water from the village tubewells (RMB 80/mu), and RMB 500 for water from another government project, giving total cost for water of RMB 4,300 per year, which is an average cost of RMB 90/mu.

For medium- or large-scale IDs with complicated terrain and various water sources, which are especially common in the South, it is unrealistic at this stage to expect WUAs to measure and charge for water by household, but charging by area by the WUG is very feasible. However, to do this, the WUA management systems with regard to WUG water charge collection need to be improved and more transparent. Jingtang WUA in Tieshan ID in Hunan, for example, has an effective WUG water fee collection and supervision system. It charges the WUG by area; the procedure for water fee collection is that the farmer household pays the WUG with the fee being collected by the elected WUG leader, and the WUG then pays the WUA. The WUG issues an invoice with three copies; one copy goes to the household and another is submitted to the WUA with the water fees collected. The WUA uses their copy to match the overall water fee collected by WUG with the payments of the individual farmer households to the WUG; it then issues a WUA water fee invoice to the WUG. The WUA delivers water to the WUG on the basis of the invoice, and the WUG delivers the water to the households accordingly. Generally, the farmer household is not involved in water delivery to the field (it does not need to be involved because the crop is mainly flooded rice paddies), so the WUG charges a small additional irrigation service fee from the farmer household for the service of water delivery; this fee generally amounts to some RMB 5-10/mu which the WUG farmer households pay directly to the WUG leader. The rate of the irrigation service fee is democratically negotiated by all the farmer households in the WUG according to the irrigation area, length of the canal, complexity of the water sources, and similar factors.

3.5 Water Measurement and Comprehensive Water Pricing.

Water measurement is especially important for WUAs using comprehensive water pricing because it is the basis for calculating the State water charge portion of the comprehensive water fee which the WUA pays to the WSO for water received. The WUA is the client of the WSO and should pay the WSO the State water charge for the volume of water actually received, like a commodity; without measurement there is no accurate basis for calculating the State water charge based on the amount delivered. In addition, water measurement can also promote water saving by WUAs and can help reduce costs to members; saving water and reducing costs are important aims and benefits of WUAs, especially where water is scarce.

Use of water measurement varies widely among the regions and even among WUAs in the same region and ID, although it tends to be used more extensively where water is scarce. Some medium or large-scale IDs in the South put water measurement facilities at the boundary between WSO and WUA, for the purpose of water measurement and to determine the State water

fee collection from WUAs. Jingtang WUA in Tieshan ID is a typical example of this. However, for some WUAs, although a water measurement facility may exist at the boundary between WSO and WUA, the habit of using it is not established, or the facility has broken down, for example, at Changtang WUA, also in Tieshan ID. Some WUAs in the South also measure water delivered to their WUG and charge the WUG farmers according to the water volume delivered to the WUG, such as Dongfeng No. 3 Main Canal WUA in Hubei Province.

In the Northwestern and Northern IDs, the water measurement point varies from the WUA headgate down to the farm canal, but in general tends to be closer to the farms. For example, the measurement points of Jiamakou ID in Shanxi and Santun River ID in Xinjiang are at the inlet of the tertiary canal (the WUA headgate), while for Nantougong WUA in Toutun River ID it is at the inlet of the farm canal, which is basically measurement down to the farm household. In the Northeast, water measurement is rarely practiced; water consumption in all of Qianguo ID in Jilin Province is not measured, but rather is charged by area --- the system there is called locally the ‘big pot of water’ where all users take water according to their need rather than by measured volume, and they pay according to the area they irrigate without regard to water used. This system reportedly leads to significant waste of water as there is no incentive to save it.

3.6 Proportion of the State and End-canal Water Fee.

There is a big difference between IDs in the Northwest/North and the South in the proportion of State water fee and end-canal water fee in the total water fee, which is due in part to the different water resource conditions of WUAs in each area, including the monopoly aspect of water supply especially in the Northwest. The southern WUAs have more of their own water sources, so the State water fee proportion is low. WSOs in the North tend to manage water fees to lower levels in the system, and some even manage them down to the farm level, resulting in a higher proportion of the State water fee in the total water fee. For example, at Santun River ID in Xinjiang, the end-canal water fee accounts for only 20% of the total water charge while the State water of accounts 80%; in contrast, Jingtang WUA in Hunan uses 70% of the total water charge for end-canal O&M, while only 30% is paid to the WSO for the State water fee. The amount of the water charge available to the WUAs for end-canal O&M and management is less in the North compared to the South, in both absolute terms and as a percent of the total water charge.

The proportions of State and end-canal water fees in the total water fee are shown in Tables 3-4 and 3-5. For WUAs under the two part water fee system, the State water fee separate from the end-canal water fee and the proportion is based directly on the total of the State water price and the end-canal water price. For WUAs under comprehensive water fees, the proportion of the State water fee and the end-canal water fee can be calculated according to each WUA’s total water fee income and the cost of water purchased by the WUA from the WSO; in cases where the WUA owns all or some of their water sources, the average WUA selling price of water to farmer households is likely to be lower than the State water fee price charged by the WSO to the WUA.

**Table 3-5: Amount and Proportion of State Water Fee and End-canal Water Fee
In Two-part Water Fee WUAs**

ID (or WUA)	State water price (in RMB/cu m)	Water price of end-canal (in RMB/cu m)	Total water price (in RMB/cu m)	Proportion of the State water fee in total water fee
Jiamakou ID in Shanxi	0.47	0.04	0.51	92%
Xiapanying WUA in Toutun River ID in Xinjiang	0.054	0.02	0.074	73%
Santun River ID in Xinjiang	0.08904	0.024	0.113	79%
Nantougong WUA in Toutun River ID in Xinjiang	0.054	0.02	0.074	73%

As shown in Table 3-5, for example, the water price to farmers at Nantougong WUA in Toutun River ID is RMB 0.082/cu m at the farm canal inlet, calculated to be RMB 0.074/cu m at the branch canal inlet. In 2008, Nantougong WUA charged according to the two-part water fee, and therefore is classified in the table as a two-part water fee WUA, although it shifted to the comprehensive water fee system in 2009.

**Table 3-6 Proportion of the State Water Fee and End-canal Water Fee in
Comprehensive Water Fee WUAs**

WUA	Total income from WUA water fee (RMB)	Water purchasing fee (RMB)	Available water fee for the WUA (RMB)	Proportion of the State water fee in total water fee
Shiziling Zhonglou WUA in Zhijiang City in Hubei Province	13000	9680	3320	74%
No.3 Main Canal WUA in Dongfeng Canal ID in Hubei Province	25000	11000	14000	44%
Liufengyan WUA in Yuanan County in Hubei Province	34167	N/A	34167	N/A
Jingtang WUA in Tieshan ID in Hunan Province	78158	23834	54324	30%
Changtang Union WUA in Tieshan ID in Hunan Province	110000	28000	82000	25%

Note: N/A= not applicable. Liufangyan WUA receives no WSO water and has no State water fee. The comprehensive water fee equals the end-canal fee and must cover all costs for the WUA, including O&M of the diversion works which it owns.

Overall, the two-part water fee WUAs appear to have a relatively higher proportion of the State water fee compared to comprehensive water fee WUAs, although this may be due in part to water sources owned by many of the comprehensive water fee WUAs. Shiziling Zhonglou WUA

in Zhijiang City in Hubei Province, for example, has no water source itself and relies completely on the WSO or the farmer's own water source, and the State water fee proportion is close to that of the two-part WUAs (see Table 3-6); the WUA only resells the water purchased from the WSO to the farmers, which results a relatively higher proportion of the State water fee in the total water fee.

It should also be noted that the WUAs in Hubei and Hunan are the oldest in China, having been established under or associated with the Bank-financed Yangtze Basin Water Resources Project starting from 1995, which introduced the first WUAs and comprehensive water fee pricing for WUAs. They are therefore relatively mature and more-experienced with comprehensive pricing.

3.7 Constraints in Shifting to Comprehensive Water Fees

IDs/WSOs implementing two-part water fees are often reluctant or unwilling to shift to the comprehensive water fee system on their own. In some IDs, particularly in the Northwest and the North, governments and the WSOs have invested significant amounts of labor force, and resource to develop the works needed to supply and charge for water by volume to the household; as a result, some IDs have essentially achieved the ability to determine water pricing and charge by volume directly at the household level, and have established a relative complete system to do that. At these IDs, the State WSO is reluctant to give up the charging system which it has established with great effort and significant cost. They are also concerned that it will be difficult to reassign existing water charge personnel properly, that the collection rate of the State water fee may decrease, and moreover, that the end-canal water price policy under government management will be difficult to implement (for example, in Xinjiang). In addition, although WUAs are established in some areas, they basically fail to function in water fee price making and charging because the State WSO has already established a comparatively mature system of directly charging water fees from the farmer household, and the WSOs worry that WUAs may not have the capability to carry out collection of the water fees adequately, compared to the State WSO which manages and collects both the State water fee and the end-canal water fee directly.

At the time these systems were started, most areas had not established WUAs, and some WSOs still consider this issue purely or mainly in terms of collecting the State water fee without considering other aspects, such as their high costs involved in collecting water fees based on measured water directly from farmer households, and the cost-effective role that WUAs can play in water pricing and fee collection. Under the comprehensive water fee system, the WUA is an independent legal person in a seller/buyer market relationship with the State WSO; it pays the WSO the water fee for water purchased and then supplies water and charges the farmer users. WSOs may perceive this as a loss of control over their own financing, which depends completely on the State water fee, although the overwhelming experience with improved WUAs in China indicates that in practice collection rates and revenue with WUAs under comprehensive water fees go up, not down. Moreover, over the past few decades steps have been taken to strengthen the transparency of water use and water charges, and therefore farmer expenditures on water fees have been falling; this appears to reduce the perceived benefits of WUAs, but in fact experience with improved WUAs indicates that they reinforce and help ensure such transparency and further reduce the cost of water for farmers as well as improve irrigation service and water saving. Both

the Farmers and the WSO benefit from the combination of WUAs and comprehensive water fees.

Based on study results, comprehensive water fee should be the development direction for WUA water price making and charging. This has benefits for WSOs, WUAs and especially farmers and society. Especially in the areas where WUAs are better operated and more self-managed, the comprehensive water fee can be used; the WSO would charge the WUA, and the WUA would then charge the farmer household. This has been done successfully and shown to work well and efficiently in the Northwest under water scarcity conditions at Nantougong WUA in Toutun River ID in Xinjiang, as well as in the South at Jingtang WUA in Tieshan ID in Hunan. The two-part fee with the WSO collecting both fees from the farmers should transition gradually in a planned manner to the comprehensive fee with the WUA collecting a single fee and paying the State water fee to the WSO, with a transition plan designed to avoid disruption.

3.8 Summary of Conclusions from ID and WUA Field Study Investigations

The following identifies some good results and lessons for water pricing based on the analysis.

- 1) Some IDs have realized supplying water, price making, measuring, charging and issuing invoice to the household and implements the “three publics” or publicizing of water volume, water price and water charge. For example, Jiamakou ID in Shanxi Province, the mode of “State water fee + end-canal water fee” was adopted with water measurement at the farm household level. Measurement, charging and invoice issuing are done by the WSO directly with the assistance of End-canal Manager. Nantougong WUA in Toutun River ID in Xinjiang has adopted with “WSO-to-WUA-to-Farmer household” method for water measurement and charging. This is a significant improvement and means WSO and WUA measure at the branch inlet (WUA headgate), and the WUA and farmer households measure at lower levels within the WUAs, in this case at the farm canal inlet, which enables volumetric water pricing at the farmer level under comprehensive water pricing.
- 2) WSO management of the end-canal water fee is common in the IDs using “State water fee + end-canal water fee” or two-part water fee. The end-canal water fee part is generally charged, collected and managed by WSO on behalf of WUA, and the regulation of charging and using of end-canal water fee is regulated by the WSO. The details of the end-canal water fee expenditure are clear and the financial management is regulated. For example, at Jiamakou ID in Shanxi, Toutun River ID in Xinjiang and Santun River ID in Xinjiang, the WSO regulates the management of the end-canal water fees.
- 3) In some WUAs with innovative and strong operational experience, comprehensive water fee method is used. For example, Jingtang WUA in Tieshan ID Hunan Province regards the State water fee as one of the costs of the WUA. The standard of the WUA water fee is determined according to the cost of the WUA, and the price making and charging is scientific and democratic and done by the WUA. The water fee is verified according to and covers the WUA costs, which guarantees the sustainable operation of the WUA. Such progressive WUA water fee and accounting methods should be extended to other IDs and regions.
- 4) Some WUAs supervise water fee charging by WUG. For example, Jingtang WUA in

Tieshan ID in Hunan, the water fee charged by WUG is issued with three-copy invoice with a copy for the farmer household, the WUG and the WUA respectively, which facilitates WUA supervision of the farmer household and the water fee charged by the WUG.

- 5) Some WUAs provide complete water management services for the farmers. For instance, Liufengyan WUA in Yuanan County Hubei Province distributes water for each member household directly to the field so is not necessary for household members to manage irrigation deliveries in the field. The water distribution to all members is managed in an orderly and harmonious manner by the WUA.

The following identifies some key problems and potential solutions related to water fees and WUAs based on the study results.

- 1) The water measurement and charging situation in some IDs is poor. For example, at Qianguo ID in Jilin, there are no facilities at all for water measurement, and water is charged according to area regardless of the amount used. Such practices lack any water-saving incentive mechanism, and the water use efficiency of irrigation water is very low. For other some IDs, although water measurement facilities have been established at the boundary between WSO and WUA, the habit of using them is not well established, and some are in disrepair. Rough measurement or failure to use water measurement facilities occurs in some cases, as at Changtang WUA in Tieshan ID in Hunan.
- 2) Some WUAs do not participate in water price determination and water charging because they are not independent (i.e., are controlled by the WSO or village) or are not empowered to by policy to undertake those functions. The end-canal water price at many WUAs is mainly regulated by the government, and in such cases usually fails to cover the O&M and management costs of the WUAs under various different conditions. The operational cost of many such WUA exceeds the government determined water price; i.e., the “end-canal water fee” amount is not sufficient to cover end-canal O&M and management costs, and the WUAs dare not to charge additional fees. This results in difficulty for WUA operations due to insufficient funds. In contrast, for some WUAs with new or recently rehabilitated facilities, the operational cost is lower than the government determined price. However, the WUA has to follow the government water fee policy, even though the farmers prefer not to pay so much surplus end-canal water fee.
- 3) The management of the end-canal water fee by the WSO is related to the development stage and management level of the WUAs, and to the entrenched concepts and habits of the WSO and its lack of funds. Based on the study results, among the WUAs with regular management, the WUAs can and should determine and charge the “end-canal water fee” by themselves, with WSO support but not control or regulation.
- 4) Some WUAs do not have sufficient fees and cannot guarantee adequate O&M, and therefore are unable to perform their O&M functions. For example, the Qianguo ID in Jilin failed to implement an end-canal water fee system, so the WUAs there do not have a fixed income source to cover their O&M and management costs and therefore cannot function effectively. To reduce the farmer’s water fee burden, end-canal water fees are fixed too low; this results in insufficient WUA water fee income for O&M, inadequate

payment to WUA staff for their work, and consequently unreliable work and poor WUA irrigation service.

- 5) Unlike other farmer cooperative organizations, the WUA is an intermediate water buyer and seller with fixed costs operating as a user-owned utility, and it has no reliable market income. The WUA's water purchases and costs are fixed externally; if its water sales prices to farmers are also fixed externally and below its costs of operation, it will be unsustainable financially. The WUA and WUA members therefore need to participate fully in determining water fees for farmers based on WUA costs. This is essential for both WUA and end-canal system sustainability, and also for sustainable operation of the comprehensive water fee system.
- 6) The farmer household, WSO and the needs of society may have contradictory objectives in terms of water saving. For example, at Jiamakou ID in Shanxi Province, the WSO encourages the farmer household to use more water in order to enhance WSO income; the WSO assigned that task to the ECM, and the incentive of encouraging sale of more water to farmers is built into ECM pay scales. Although this can increase the economic benefits (income) of the WSO, it is actually in contradiction to the critical social or public need to save water, particularly in water-short Shanxi using Yellow River water. Especially in the Yellow River Basin where the water resource is seriously insufficient and the water delivery cost is relatively high, such practices and contradictions should receive special attention from the government and be corrected. The State should consider social benefits in making policy, and in this case should give the WSO and farmer households incentives to save water.
- 7) The use the end-canal water fees, financial situation, and financial management of WUAs should be made more transparent and further publicized to the farmers, and WUA financial management should be strengthened. The financial management of some WUAs is not regular, and neither the accounts book nor public financial reporting is found in some WUAs. More training for WUAs on proper financial management is needed, especially under comprehensive water fees when they will be completely responsible for their own internal financial management. Strengthening WUA financial management is a major requirement as it is needed to convince WSOs to adopt comprehensive water fees; WUA financial management was a key aspect of WUA training under PPRWRP.
- 8) With the two part water fee, the end-canal water fee is charged and collected by the WSO, the expenditure process is completed by the WSO, and WSO financial management is internally audited by the WSO or may also be audited externally by the government. Farmers, however, have no role in this process and are not informed on how the end-canal water fee which they pay is used. This can easily discourage cooperation and payment of water fees. The use, management and supervision of end-canal water fees should not be solely within the WSO; at the least, supervision by the WUAs on behalf of farmer households on how the water fee is collected and used should be implemented to increase WSO fiduciary responsibility and enhance feedback from the water users. The water fee expenditure situation should be publicized to farmers, and farmers organized by WUAs should be encouraged to participate in supervision of water fee use.

- 9) Some WUAs do not pay much attention to the supervision of their WUGs which charge farmer household directly; in particular, some WUAs in the South care only for the amount of water charges handed over from the WUG to the WUA, and do not supervise or monitor how much the WUG actually charged from the farmer households. This easily results in additional charging beyond that needed to cover WUA and WUG costs. WUAs need to establish systems which allow them to monitor and supervise the financial and field operations of their WUGs, in order to protect WUA members. In this regard, the practices of Jingtang WUA in Tieshan ID for supervising its WUGs (e.g., using invoices) should be spread, and in particular WUGs should always provide their WUAs with the details of the water payments made by each farmer household.
- 10) Policies and practices for quota-based water fees need to be improved. In some IDs, additional water fees are added when a farmer's water consumption exceeds a specified quota. Although the purpose is to promote water saving, the quota is usually the same throughout the same ID, without distinguishing between the facility conditions and soil conditions in different areas. Exceeding the quota can be commonly seen in areas with poor facilities, for example. By charging farmers for over-quota water use, the water fee burden of the farmer household is increased, and the individual farmers can do little to save water because the poor quality of irrigation facilities is out of their (or even WUA) control. For the WSO, instead of motivating water saving, the practice simply becomes an additional income source and therefore is a disincentive to improve irrigation facilities or the quota system. It is suggested that the over-quota water fees should be used to finance a "water-saving investment fund" to be used to improve facilities and water saving capabilities in areas where water use is excessive; WUAs should oversee management of the fund, should be publicized to the water users and WUAs. With this fund, the additional water fees paid by WUAs in areas exceeding the quota could be used for the water-saving improvements by those WUAs, instead of for extra income to the WSO, and would help eliminate over-quota fees and water waste in the future.
- 11) Water fee charging by the local units other than WUAs sometimes causes difficulties. Water charging by villages in some IDs negatively influences systematic water charging and the farmers' willingness to pay. Similarly, local township WMSs often face difficulties due to lack of funds; when they have to collect funds from WUAs or farmer households for funds, it negatively influences the independent operation of the WUA, causes farmer complaints and discourages payment of water fees. Water management reform at these very basic levels is extremely urgent for the sustainability of end-canal O&M and management.
- 12) Many WUAs (60% nationwide) and water user organizations such the ECMCs in Jiamakou ID are not registered as a legal person, but are instead affiliated to a village. In such cases, farmer participation in canal management, irrigation management, water fee management, etc. is low. In addition, without legal person status, such organizations do not have important capabilities, such as to have a bank account or sign a water supply contract, and they have no independent right to exist. These are key problems for the sustainable development of such organizations. To overcome this, village WUAs (and ECMCs) should be registered as independent WUAs with legal person status.
- 13) Based on the field studies, policy support at all levels is needed to help strengthen WUAs. At present, WUAs have no support under the law other than as registered

organizations, and they depend on policy support and regulations at all levels of government. So far, Hubei is the only province which has established a specific regulation to support WUAs. In addition, specific national legislation to support WUAs is needed. Strengthening of such policy support for WUAs is needed for them to carry out comprehensive water pricing effectively and be sustainable. Under PPRWRP, some 1044 policy documents were issued at all levels in support of the 497 WUAs in 10 provinces under the project. These were essential to help ensure adequate legal and government agency support for project WUAs.

- 14) The field investigations also indicated that training of farmers, staff, and government officials on WUAs is also important for strengthening WUAs to carry out comprehensive water pricing. A major lesson of PPRWRP was that adequate, good quality training was critical to the success and sustainability of WUAs, and this was verified by the field investigations; Nantougong WUA at Toutun River ID in Xinjiang was the only Xinjiang WUA in the sample which has adopted comprehensive water pricing, but this was made possible only through the training provided under WPRP. Overall, there is currently little or no budget allocated for WUA training either in project investment budgets or in agency budgets; this is standard practice which needs to change. Without appropriate and adequate training, WUAs cannot be expected to play an effective role in comprehensive water pricing, and WSOs will not believe that WUAs are competent to play that role and will continue to be reluctant to accept comprehensive water pricing as they will consider to too much risk.
- 15) The field studies further indicated that the institutional quality of many WUAs needs to be improved to enable them to take on the increased responsibilities required under comprehensive water pricing. As mentioned above the majority of WUAs in China are not even registered as independent legal persons. Most of these are “village” WUAs; that is, they were established under a village and function as an adjunct or unit of the village committee. And even relatively good quality and well-established WUAs in the same ID may function at different levels; e.g., in Tieshan ID, Jingtian WUA measures the water received from the WSO, while Changtang does not as standard practice. Under PPRWRP, specific standards and principles for improved WUAs were developed and used for all WUAs under the project; i.e., the WUAs were “standardized” based on these principles, referred to as the “Five WUA Principles.” The Five Principles required that each WUA under PPRWRP should: (a) be the farmers’ own organization (the WUA should elect its own leaders from among their members, be registered, have its own bank account, etc.); (b) be based on hydraulic rather than administrative boundaries; (c) have water measurement facilities and measure water received by the WUA from the supplier; (d) collect the water charge from farmer members and pay directly to the water supplier for the volume of water received; and (e) have adequate and reliable irrigation facilities and water supply. The principles were enforced under the project by linking them to disbursements for costs. The effect of these principles was to ensure that all WUAs under PPRWRP met certain improved quality standards which were needed for institutional sustainability and efficiency. These improved WUAs had an unusually high rate of return and produced substantial incremental benefits compared to control group areas without improved WUAs.

Chapter 4: WUA Fees and Their Adequacy for Operation and Maintenance

Details on WUA water fee pricing, their adequacy for O&M and the financial condition of WUAs are discussed in this chapter. The main aim of end-canal water fee collection is to ensure adequate O&M. WUA O&M costs should be the basis for estimating the end-canal water price. The WUA O&M costs under PPRWRP, WPRP, and for the case study WUAs are first investigated and compared to WUAs' income, then sources and expenditures of O&M fees by case study WUAs are further broken down and analyzed.

4.1 Analysis of O&M Fees for WUAs under PPRWRP

PPRWRP monitored total O&M fees for 497 project WUAs and, in some cases, for four years. No big change took place in the proportion of State water fee to total water fee in recent years, and the proportion for 2005, 2006, 2007 and 2008 were 89%, 92%, 92%, 90% respectively. For comparison with SOCAD WUAs under IAIL3, the proportion of the State water fee is somewhat lower on average - 87%, 79%, 76%, 75% for the same years, with the proportion also little changed. But there are differences between different regions and provinces. Data from Hunan, Hubei and Xinjiang in 2008 are 71%, 93% and 94% respectively.

It is common that most WUAs in Hunan are set up at branch canals, where they collect and retain the end-canal fee; therefore the WUA fees used for O&M of the end-canal system are higher. In contrast, some WUAs in Hubei rely on the water charge rebate from the WSO for O&M fees, which is usually small (it comes mainly out of the State water fee collected for WSO O&M). In Xinjiang the proportion of State water fee in total water fee fell from 99% in 2007 to 94% in 2008. This showed the positive effect of the new end-canal maintenance fee policy (??) which gives the WUA the right to keep part of the water fee and use it for end-canal maintenance costs.

The overall (aggregated) financial situation for all WUAs under PPRWP is summarized in the table below (see Table 4-1). It is clear the WUAs' total income and water fee income were both increasing, in conjunction with the total expenditures, because of the increase in the State water fee for water delivered to the WUA by the WSO. However, WUA O&M fee expenses decreased in those years, perhaps because end-canal conditions were improved by the rehabilitation projects in some IDs. The end-canal water fees were also not constant before 2007. They increased in 2008 because of the end-canal water pricing reform was promoted in some regions, e.g., in Xinjiang, WUAs began collecting end-canal water fee regularly as of 2008.

Although PPRWRP monitored total O&M costs for WUAs, it lacked detailed monitoring of the different components of O&M costs. This shortcoming must be addressed to improve the M&E of WUA O&M and end-canal water fees in the future.

Table 4-1: Summary of Overall Financial Situation for All WUAs under PPRWRP

Year	Income (RMB/year)			Actual Costs (RMB/year)			Income from end-canal water fee (RMB)	State water fee paid to WSO as proportion of water fee income
	Total income	Water fee income	Other income	Total expenditures	Paid to WSO	WUA O&M expenditures		
2005	133747	129256	4491	133956	114926	19030	14330	89%
2006	135783	131391	4392	135839	120435	15404	10956	92%
2007	138120	133320	4800	136334	122861	13473	10459	92%
2008	143687	140110	3577	140032	125567	14465	14543	90%

From 2005 to 2008, WUA O&M fee expenses decreased steadily and the net/profit increased. This is because end-canal conditions were improved through rehabilitation projects and also WUA management skill was enhanced through training and support provided under PPRWRP (see Table 4-2 below). During the same period, the farmer's water fee (RMB/mu) remained stable, while water consumption fell by 20%, from 687cu m/mu in 2005 to 560cu m/mu in 2008 indicating a substantial water saving benefit from better WUA management of end-canal systems.

Table 4-2: O&M Expenditures and End-canal Fee Income for WUAs under PPRWRP

Year	O&M Fee expense/WUA (RMB)	Income from end-canal water fee (RMB)	Balance (RMB)	Water fee (RMB)/mu
2005	17533	14330	-3203	34
2006	13595	10956	-2639	30
2007	12255	10459	-1796	31
2008	11045	14543	3498	31

4.2 Analysis of O&M Fees for WUAs under MWR Water Pricing Reform Project

Starting in 2008, the MWR Water Pricing Reform Project (WPRP) has established and monitored WUA O&M fees for 155 improved WUA in 11 provinces. The data for year 2009 was collected and analyzed (see Table 4-3). The data show that generally, WUA O&M fees were mainly used for maintenance and repair, which accounted for 57.6% of total WUA costs (excluding the cost of water purchased from the WSO), followed by expenditures for personnel which accounted for 31.8%, and then for administration costs which accounted for 10.6%.

**Table 4-3 WUA O&M Expenditures under MWR WPRP
(RMB 000)**

No.	Province	Total O&M expenditures	Repair	Percent	Personnel	Percent	Administration	Percent
1.	Shanxi	49.90	31.53	63.2%	11.28	22.6%	7.09	14.2%
2.	Inner Mongolia	30.50	14.41	47.2%	14.79	48.5%	1.30	4.3%
3.	Jilin	41.50	29.00	69.9%	4.50	10.8%	8.00	19.3%
4.	Heilongjiang	7.95	3.78	47.5%	2.67	33.6%	1.50	18.9%
5.	Anhui	17.80	14.20	79.8%	2.30	12.9%	1.30	7.3%
6.	Jiangxi	21.81	4.63	21.2%	15.09	69.2%	2.09	9.6%
7.	Shandong	20.44	3.54	17.3%	14.60	71.4%	2.30	11.3%
8.	Henan	21.58	13.02	60.3%	6.40	29.7%	2.16	10.0%
9.	Hunan	56.88	31.75	55.8%	19.39	34.1%	5.74	10.1%
10.	Sichuan	4.35	2.60	59.8%	1.45	33.3%	0.30	6.9%
11.	Xinjiang	49.95	37.25	74.6%	10.23	20.5%	2.47	4.9%
	Average			57.6%		31.8%		10.6%

4.3 Source and Expenditure of O&M fees in Case Study WUAs

The sufficiency of the O&M fee (mainly from the end-canal fee, although sometimes with small amounts from the WSO or the village) of WUA directly influences its sustainable operation. The end-canal O&M fee should be kept at a reasonable level, neither too low to prevent guarantee of normal operation of the WUA nor too high to add burden to the farmer household. Generally speaking, end-canal O&M fee should be kept adequate to cover O&M expenditures. The source of the O&M fee should be the total water fee paid by the farmer households after deducting the State water fee (some WUAs have other income or donations which are not considered here). The incidental income or expenditures, and the facility construction investment should not be regarded as O&M fee, and they should be excluded from the O&M finance data of the WUA. The expenditure of the O&M fee should mainly be used for end-canal system maintenance and repair, salaries of WUA personnel, WUA administration, etc. Reconstruction and rehabilitation are beyond the scope of end-canal O&M.

Table 4-4: Source and Expenditure of O&M Fees for Case Study WUAs (RMB)

No	WUA	Income		Water Pur-chased	Expenditure of O&M fee			Surplus/ Deficit	
		Water Fee	Other		Total	Repair	Personnel Salaries		Administration Cost
1.	Wei Village ECMC in Jiamakou ID	RMB 1,942 (end-canal water fee)	0	0	2147	277 (13%)	RMB 1,490 (69%) (water distribution, canal protection and mud cleaning)	RMB 380 (18%)	-205
2.	Bantan ECMC in Jiamakou ID	RMB 3,543 (end-canal water fee)	0	0	3674	676 (18%)	RMB 2,457 (67%) (water distribution, canal protection and mud cleaning)	RMB 541 (15%)	-131
3.	Nantougong WUA in Toutun River ID	RMB 45,309 (end-canal water fee)	0	0	65150	16807 (26%)	RMB 40,507 (62%) (water distributor reward, the executive personnel do not get salary from the WUA)	RMB 7,773 (12%) (for administration, meeting, payment and exemption of the water charge, etc.)	-19778
4.	Xiayingpan WUA in Toutun River ID	RMB 47,483 (end-canal water fee)	0	0	71749	42821 (60%)	RMB 26,100 (36%) (water distributor reward, the executive personnel do not get salary from the WUA)	2828 (4%)	-24266
5.	Sanqi WUA in Santun River ID	RMB 47,699 (end-canal water fee)	0	0	39932	26457 (66%)	RMB 10,700 (27%) (reward of the water distributor, RMB 0.05yuan/cu m. The executive personnel do not get salary from the WUA)	2775 (7%)	7767
6.	Shuguang WUA in Santun River ID	RMB 60,464 (end-canal water fee)	0	0	70056	47555 (68%)	RMB 11,660 (17%) (reward of the water distributor RMB 0.03yuan/cu m. The executive personnel do not get salary from the WUA)	RMB 10,841 (15%)	-9592
7.	Zhonglou WUA in Shilu ID Zhijiang City Hubei Province	13,000	0	9680	1650	0 (0%)	RMB 1,650 (100%) (the expense of 4 canal protection personnel, RMB 250/person/year, the fee of the water distributor, at 5% of the water fee)	0 (0%)	1670
8.	No.3 Main Canal WUA in Dongfeng Canal ID	RMB 25,000 (on average for several years)	5500 (fishin g)	11000	22828	0 (0%)	RMB 16,108 (71%) (salary of the chairman of RMB 6,000, insurance of RMB 4,038 and the salary of the executive personnel and water distributor of RMB 5,800)	RMB 6,720 (29%)	-3328
9.	Liufengyan WUA in Yuanan County Hubei Province	34,167	0	0	25900	10000 (39%)	RMB 15,900 (61%) (the chairman, cashier and the accountant each RMB 2,000 for each year, and the water distributor of RMB 9 for each mu)	RMB 0 (0%) (expended by village party committee)	8267
10.	Jingtang WUA in Tieshan ID in Hunan	78,158	7700	23834	64482	26230 (41%)	RMB 27,110 (32%) (chairman of RMB 4,400/year, accountant of RMB 4,000/year and other 3 executive personnel of RMB 3,600/year respectively)	RMB 11,142 (17%) (for office, meeting and exemption of the water charge, etc.)	-2458

	Province								
11.	Changtang WUA in Tieshan ID in Hunan Province	110,000	13000	28000	72000	10000 (14%)	RMB 40,000 (56%) (chairman, accountant and cashier at RMB 30,000 in total and 6 water administrators at RMB 10,000 total)	RMB 22,000 (31%) (2% of water fee paid to village to collect water fee, RMB 2,000, and RMB 20,000 management fee paid to town WMS for local reservoir water.	23000
Average (%)						32%	55%	13%	

Note: For above WUAs using two-part water-fee, "Income from Water Fee" refers to the end-canal water fee; for WUAs with a comprehensive water fee, it means the water fee that the farmer household pays to the WUA, while "Water Purchased" means the expenditure on water purchased from the WSO (the State water fee that the WUA pays to the State WSO) for water delivered to the WUA.

Based on the analysis of the case studies and WPRP data, the repair expenditures of WUAs are relatively high in most cases, which indicates that WUA facilities are generally in bad condition. Government should provide investment funding to rehabilitate end-canal systems; this would reduce WUA repair costs, enable more WUA spending on maintenance and personnel costs and salaries, and improve WUA operational performance and benefits to farmers. WUAs should budget O&M expenditures according to actual costs within the limits of WUA water fee income.

In Jiamakou ID, the expenditure situation of the end canal water fee is recorded respectively for each farm canal. The end-canal water fee is collected and managed by the State WSO, and each farm canal is managed by the ECM employed by the ECMC. The expenditure of the end canal water fee is deposited into the WSO account by the ECM.

Nantougong WUA in Toutun River ID in 2008 had a two-part water fee previously but has been using a comprehensive water fee since 2009.

Economic conditions permitting, WUAs should always pay the salary of executive personnel rather than depend on village cadres. However sometimes, this is done to reduce WUA costs, at the expense of the WUA's financial and operational independence, especially if the cadres are village committee leaders or members. Under the study, Xinjiang WUAs in particular do not pay a salary to executive personnel because the WUA executive personnel are usually village leaders and already have their salaries. WUA affairs become part of their daily duties, but their work burden has increased substantially due to the increased participation in WUA affairs and operations, without any additional pay for their time. In addition to Xinjiang, this practice also occurs in other provinces. However, village chiefs and leaders are already over-burdened, and in many cases they may not be able or willing to apply sufficient time to WUA affairs, especially without extra pay. In WUAs which pay their executive personnel, the payment is often called locally a "work stoppage allowance," which reflects the sometimes high opportunity cost to leaders and farmers of time required for WUA affairs. Moreover, there is the potential for conflict of interest between what the village wants and the good of the WUA, and under such circumstances it may be difficult for village leaders to adequately represent the interests of the WUA and WUA farmers.

The existence of water sources within the WUA may also complicate WUA operations and management. Zhonglou WUA in Zhijiang City in Hubei, for example, is only responsible for canal operation and water distribution for water purchased from the ID. The small-scale water sources within the WUA are not under the control of the WUA; instead, different WUGs or farmer households manage them independently. In high rainfall years, the farmers seldom use the water of the ID, and the WUA thus has no income (and no other income sources), and therefore the normal operation of the WUA cannot be guaranteed. For example, the income of the water fee in 2008 was RMB 13,000 while in 2009, the farmers did not use water from WSO, and the WUA had no income at all, resulting in stagnation of WUA operations. This threatens the sustainability of WUAs, weakens the WSOs financially and in particular discourages WUA leaders who have to try to maintain the WUA in those years but receive no income for their efforts.

Differing from other WUAs in the study, the five executive committee personnel in Jingtang WUA in Hunan are themselves responsible to undertake management, water distribution and maintenance of three main canals which results in a larger working load compared to the level of salary compared to other WUAs where the executive personnel organize the farmers to do the

work rather than do it themselves; moreover, no subsidy is paid by the village to augment the WUA salaries at Jingtang.

In their operation, WUAs generally determine their expenditures based on their income, and they generally keep their basic operations within their income and avoid debt. The surplus/deficit situation of O&M fees is for the year of the study and just for reference; it is the actual outcome will be different and does not reflect the operation quality of the WUAs.

O&M expenditures of WUAs mainly have three parts: (1) facility maintenance and repair, which generally includes material costs exclusive of personnel costs; (2) personnel salaries, which mainly refers to the salary of the water distributor as well as the salary of the executive committee personnel, accountant and cashier of the WUA. The pay standards are determined by the democratic negotiation within the WUA; and (3) administration and other costs, such as management, office space rental and upkeep, water fee assistance to poverty households, etc. For case study WUAs, the breakdown in use of the O&M fee (excluding water fee paid to WSO) was 55% for personnel, 32% for repair, and 13% for other expenditures (e.g., administration, etc.).

Among all the case study WUAs, the expenditure proportion of different expenses differs one from another due to differences in local conditions, standard of the personnel pay and complication of the system management. In some WUAs where the O&M fee is mainly used for personnel salaries, there are two common situations: (a) the O&M fee income is low and WUA pays salaries to maintain simple operation but has insufficient funds for maintenance and repair of facilities, such as at Zhonglou WUA in Zhijiang City Hubei Province; or (b) the WUA has excellent facilities without much need for maintenance, such as the Wei Village ECMC in Jiamakou ID, where the personnel salary accounts for 69% of the end-canal water fee. As for WUAs in Santun River ID in Xinjiang, the O&M fee is mainly used for facilities repair, accounting for 68% of the fee. The administration expenditure of some WUA is higher, such as Changtang Union WUA in Tieshan ID in Hunan Province, the expenditure on administration cost accounts for 31% of the O&M cost, of which most is due to administration cost of the town WMS paid by the WUA for reservoir management.

Chapter 5: Methods of WUA Water Price Determination and Fee Collection

5.1 Introduction

On the basis of the study investigation and evaluation of different IDs and WUAs in different regions, the current water pricing systems used by various types of WUAs and their actual experience and problems with water pricing, along with the adequacy of water fees for WUA O&M, were described and analyzed in the previous two chapters. Water price calculation and determination and water fee collection for the two kinds of water pricing methods applicable to WUAs, the comprehensive water fee system and the two-part water fee system, are the topic of this chapter. The focus is particularly on the needs for water price determination and water fee collection for WUAs under the comprehensive water fee system, although the two-part system is also covered.

The water pricing method should be based on the principle of being fair and equitable, and should promote water saving and also improvement of the present systems. The study has identified and analyzed four aspects of WUA water pricing namely (a) calculation and determination of the water price, (b) composition or components of the water charge components, (c) charging procedures for the water fee, and (d) collection and management of water fees.

As explained previously, the water fee is generally composed of the State water fee and end-canal water fee. In the IDs/WUAs using the two-part water fee method, the two expenses/fees are usually collected from the farmer household separately by the WSO and WUA (although in some cases the WSO collects the entire fee and rebates a small part to the WUA). On the other hand, in IDs/WUAs using the comprehensive water fee method, the State water fee and end-canal water fee are integrated and collected together from the farmers by the WUA. In small-scale IDs which basically comprise the WUA only, the WUA owns the irrigation system and water supply and does not have to collect or pay a State water fee.

The water price of the State WSO (State water fee) is well supported by overall and specific policies, and the calculation method is specified through specific policy documents and proven methods, such as the policy document *Management Regulation of Water Supply Price of Hydraulic Projects*. At present, there is very little policy support for end-canal water fees. A similar level of general and specific policy support is needed for the end-canal fee and its calculation.

The discussion here focuses especially on pricing calculations for the end-canal water fee as required for WUA sustainability, especially for the comprehensive water fee type WUAs. At present, in some areas, particularly in the North, the end-canal water price is gradually being brought under the scope of government price management, as indicated by *Notification on Strengthening the Water Price of the End-canal* which was issued by NDRC and MWR to require that the end-canal water price should be brought under the scope of government management. The unknown at this stage is exactly what this means in terms of water pricing calculations, since that has not been dealt with in the above notification.

The study results indicate that specifying a range for the end-canal water price by government as a price range would be quite favorable, regardless of whether two-part or comprehensive water

pricing is used. But if the government instead tries to determine a fixed, detailed price for the end-canal water fee, it may be very much sub-optimal as it would be difficult or impossible to make sure the detailed water price fits the need for each individual WUA, not to mention inflation. Even using an average end-canal water price for a whole ID would probably not be suitable for all the WUAs in the ID in most cases because of differing conditions within the ID. For various reasons, some WUAs may have costs which exceed a specific government approved price, and therefore the calculated end-canal price would not cover their O&M costs. Moreover, *Management Regulation of Water Supply Price of Hydraulic Projects* also specifies that “the water supply price of the civil hydraulic project be applied by the government as a price range or variable price”... which supports use of a price range. The study investigations suggest that established WUAs should be granted the right of formulating the end-canal water price themselves based on simple policy guidelines and based on a price range, and that that would be an important and much needed reform.

The following analyzes the water pricing methods for WUAs for comprehensive water fee and two-part water fee WUAs. Although the State water fee system only is used in many areas, it is not beneficial or relevant here. It has no role in good O&M of end-canal facilities or for the sustainable development of WUAs since it does not provide for specific end-canal O&M funding. It therefore is not considered as an option in this study, and it is considered that the State water fee only method be phased out in a planned manner and gradually replaced by the comprehensive water fee system.

5.2 Water Price Calculation and Charging for Comprehensive Water Fee WUAs

The difference in water source and delivery conditions in the North and South is significant. The water from WSO in northern IDs is directly discharged from the canal system to the fields. In the South, however, it is comparatively more complicated. Water from the WSO often comes into some small reservoirs or ponds and then is distributed to farmers along with the WUA’s own or purchased water. Therefore, the calculation method for the comprehensive water fee is slightly different in these two cases. For the WUAs in the South, the expenditure of purchasing water from WSO by the WUA is included as a WUA operational cost along with other end-canal O&M and management costs, and the “comprehensive water price” is calculated based on all the operating costs of the WUA, including the cost of water purchased from the State WSO. For WUAs in the North, the end-canal water price is calculated first, and then combined with (added to) the WSO’s State water price to make a “comprehensive water price.”

Calculation of Comprehensive Water Fees in Southern WUAs. There are two ways used to calculation the water price for WUAs in the South: by water volume or by irrigation area, as follows:

$$WUA \text{ water price per cu m (RMB/cu m)} = WUA \text{ cost}/WUA \text{ water supply volume}$$

Or

$$WUA \text{ water price per mu (RMB/mu)} = WUA \text{ cost}/WUA \text{ water supply area}$$

The costs of the WUA include the water purchasing cost, personnel payments, O&M and repairs, administration expense, etc. The following presents the water price calculations for Jingtang WUA as an example.

Table 5-1: Water Price Calculation for Jingtang WUA

Item No.	a) Calculation of WUA Costs and Water Price	Cost Factors	Amount (RMB)
①	Water purchased from WSO	Price RMB 0.032/cu m, volume 745000 cu m	RMB 23840
②	Maintenance and repair		RMB 26230
③	Personnel Payment	Chairman 4400, accountant 4000, other 3 executives 3600 each, other 7910	RMB 27110
④	Administration	Office, meeting, water fee exemption	RMB 11142
⑤	Total	a) +②+③+④	RMB 88322
⑥	b) WUA water supply area	From WUA statistics	4800 mu
⑦	c) WUA water price (by area)	⑤/⑥	Y 18.4 /mu
⑧	d) WUA water supply volume	From WUA statistics	3.6 million cu m
⑨	e) Calculate WUA water price (by volume at WUA main canal inlet)	⑤/⑧	Y 0.024/cu m

Charging and Collection of Comprehensive Water Fees in Southern WUAs. The basic principle of the charging procedure is that the water fee should be public and fair and done with a standard mechanism, and also that a supervision mechanism should be setup. In southern WUAs using the comprehensive water fee, the State water fee is paid according to the volume and price is regulated by a water supply contract between the WUA and the State WSO. Two charging methods for the water fee are recommended for WUAs to charge from the farmers, as follows.

The first method is that the WUA directly charges the water fee from the farmer household directly. This is especially applicable to relatively small-scale WUAs. The WUA should issue the water fee receipt to the farmer household and publicize the payment situation for all farmers. The second method is that the WUA charges the farmer household with the help of the WUG. This method is applies to large-scale WUAs. The WUG provides the WUA with the list of confirmed of water fees charged and paid by all farmer households, and guarantees/confirms that the amount on the list corresponds to the amounts submitted to the WUA. The preferred method is that the WUG issues water fee invoice to the farmer household, and submits an original copy of each invoice to the WUA together with the water fee, which provides proof that the water fee was paid and the amount paid. The invoice copies also allow the WUA to monitor the financial activities of the WUG to ensure fairness and compliance with WUA water fee policies.

The payment situation of different farmer households within the WUGs should be publicized by the WUA, and the WUA should also show the payment situation of different WUGs to the public. The water fees are deposited into WUA's bank account which is under the control of the WUA independently.

The study also suggests that larger size WUAs in the south, say WUAs with more than 3,000 - 5,000 mu, should measure the water volume delivered to each WUG and use those measurements in calculating the water fees for each WUG's farmers. The water source conditions differ between WUGs, and in particular some WUGs own water sources while others

do not, which results in huge differences in the water volume supplied by the WUA to different WUGs. Fairness cannot be achieved if water charges are calculated only according to the overall area.

The WUA “comprehensive water price” does not include the WUG service fee. The WUG can collect a justified service fee for water distribution from the farmer households, but the fee must be decided on the basis of the principle of democratic negotiation between farmers with the coordination of the WUA.

Calculation of Comprehensive Water Fees in Northern WUAs. The comprehensive water fee in northern areas has evolved from the two-part water fee, which means that it is formed by combining the original “State water fee” and “end-canal water fee”. The comprehensive water fee integrates the two as one fee to be paid by the farmer household directly. In order to explain clearly, some terms are defined as follows:

P: WUA Comprehensive water price (RMB/cu m)

P1: State water price (RMB/cu m)

P2: End- canal water price (RMB/cu m)

W1: Water volume supplied from WSO to WUA (cu m)

W2: Water volume at the last measurement site for end-canal system (cu m)

N: Water delivery (canal) efficiency for end-canal system (%)

In the northern area, the water sources are rare and the water price is higher, we suggest that in relatively large WUA the measurement site between the WUA and the farmer household shall be set at the branch or tertiary canal inside the WUA, for the purpose of fair charging and also water management and saving. The measurement site between the State WSO and WUA should remain unchanged at WUA headgate. The study refers to this as two-level measurement. It would be even better if the WUA could measure water to each farmer. But if that is too difficult, measurement can be applied to several households. When the WUA is operating with two-level measurement, the comprehensive water price is:

$$P = (W1 * P1 + W2 * P2) / W2$$

When the measurement place between WUA and the farmer household is identical to that of the State WSO and WUA, which is called single-level measurement, then the comprehensive water price is much simpler:

$$P = P1 + P2$$

Canal delivery efficiency of end-canal system refers to the delivery efficiency for canal water between the two measurement sites.

$$N = W2 / W1$$

The canals between the two measurement sites levels should be managed by the WUA, and they are covered by the end-canal water fee - i.e., the end-canal water fee is used to calculate water fees there. The canals below the second measurement point should be managed by the WUGs farmer households.

At present, very few northern WUAs have entered into the seller and buyer relationship with the

WSO. However, comprehensive water price directly to the farmer is on trial in some areas, such as Nantougong WUA in Toutun River ID in Xinjiang.

The cost of the end-canal water price includes the costs for personnel salaries, project O&M, and administration/management, excluding the cost of water purchasing from the State WSO.

The following is the water price calculation of Nantougong WUA as an example. The State water fee is based on water measurement at the branch canal inlet of the WUA (WUA headgate). The end-canal water fee for farmers is determined by water measurement at the farm canal inlet. The comprehensive water fee to be paid by the farmer, comprising both the State water fee and the end-canal water fee, is based on water measurement at the farm canal inlet.

Table 5-2: Water Price Calculation for Nantougong WUA

a) Calculate water volume at farm canal inlet W_2			
1	WUA Water volume purchased from WSO W_1 (at branch canal inlet/WUA headgate)	Measured by WUA and WSO	6.79 million cu m
2	End-canal water delivery efficiency from branch canal inlet to farm canal inlet) N	Measured by field test	0.85
3	Water volume at farm canal inlet W_2	$1*2$	5.77 million cu m
b) calculate WUA O&M cost			
4	Project maintenance and repair	Average of 3 years	Y 102900
5	Personnel salaries	Average	Y 33300
6	Administration cost	Average	Y 10000
7	WUA O&M cost totally		Y 146200
c) Calculate end-canal water price P_2			
8	End-canal water price (farm canal inlet) P_2	$7/3$	Y 0.0253/cu m
d) State water price P_1			
9	State water price (branch canal inlet) P_1	Regulated by government	Y 0.054/cu m
e) Calculate WUA comprehensive water price P			
10	WUA comprehensive water price for farmer (at farm canal inlet)	$(1*9+3*8) /3$	Y 0.0888/cu m

In principle, the water price that the WUA charges from the farmer household is measured and implemented according to the method above. However, the “comprehensive water price” as currently implemented in northern IDs and WUAs is also brought into the government management and many are under government (PB) pricing and control. For example, at Nantougong WUA (Toutun River ID in Xinjiang) above, the comprehensive water price as measured (at farm canal inlet) is RMB 0.088/cu m, but the price approved by the PB is RMB 0.082/cu m. Because the State water price is unchanged and the approved total comprehensive price is lower than calculated, the actual end-canal water price in the water fees collected is lower than calculated. It therefore cannot fully cover actual WUA costs for end-canal O&M and management.

Based on the above, the government should not implement unified price making for the comprehensive water price of WUAs or for the end-canal water price. At present, since the operation of WUA is not standardized and the discussion among farmers and stakeholders is not sufficient or democratic, it is necessary that the comprehensive water price of the WUA and in particular the water price of the end-canal water fee be specified with a price range by the government. With the gradual improvement of WUA operation, the government should gradually stop management of the comprehensive water price and the end-canal water price for the WUAs, and it should simply establish the framework for end-canal water pricing, and focus

on monitoring and supervision of the water fee to ensure that water fee calculation follows the framework, is implemented equitably and does not produce adverse incentives (e.g., to waste water).

Charging and Collection of Comprehensive Water Fees in Northern WUAs. For WUAs using the comprehensive water fee, the State water fee should be paid by the WUA directly to the State WSO according to the price calculated according to policy and approved by the PB, and the State water fee price and the water volume should be specified in the water supply contract between the WSO and the WUAs. The farmer household should submit all the water charge payments directly to the WUA. The WUA can directly charge the water fee from the farmer household and issue the special water invoice to the farmer household. The payment situation of all the farmer households should be publicized.

For small size WUAs, measurement at one level – the WUA intake - is sufficient. For large size WUAs, two-level measurement may be needed. If rotational irrigation is used, the duration of the irrigation cycle for each household should be recorded and measured, so that the water volume provided during that cycle can be calculated (assuming the flow rate is known or at least constant, and leakage losses are very small. If not, the number households who are irrigated should be recorded, and the water volume should be allocated for each farmer household according to the household's proportion of the total irrigation area or time.

It should be noted that the even measuring to the farmer household cannot guarantee absolute fairness, due to technical variables such as canal seepage losses, extend and condition of canal lining, condition of facilities, soil conditions, etc. Generally speaking, measuring at the outlet to the field of each farmer household is hard to achieve and expensive, therefore measuring at the farm canal inlet is done. And farmer households far away from the measurement point will suffer heavy water losses if canals are in poor condition or unlined, while farmers close to the point will have an advantage, which means that different farmers on the same canal have to pay different amounts for the same volume of water. Measuring close to the farm gate does not automatically mean more equity, and it is important to consider other conditions and factors when determining the optimal point to measure water.

5.3 Water Price Calculation and Charging for Two-part Water Fee WUAs

“Two-part water fee” means the State water fee and the end-canal water fee comprise the total of the water fees but are collected from farmers separately by the WSO and WUA, although the latter fee is sometimes collected by the WSO on behalf of the WUA. Because State water pricing is by government according to the State regulation and is already specified, the study focused more on the end-canal water fee calculation.

For the end-canal water price, the common practice at present is to bring it under the government price management and implement the fixed price or the price range system by the government. End-canal water fee is charged and managed by the WSO along with the State fee and then rebated (all or in part) to the WUA and used by the WUA.

The calculation of the end-canal water price in two-part water fee is the same as for the comprehensive water fee for northern WUAs (see above).

Two charging methods for the two-part water fee are described below.

Two-part Water Fee with State and End-canal Water Fees Managed by the WSO. At present, the end-canal water fee of most WUAs implementing a two-part water fee is charged and managed by the State WSO. The State water price part is determined by the government. The State water fee is directly charged from the farmer household by WSO. How the end-canal part of the water fee is determined, however, is variable and usually does not reflect actual WUA costs.

According to WUA accounts, the water price of end-canal is implemented with a fixed price or a price range by the government. For example, Santun River ID in Xinjiang, the water price of end-canal is specified as a fixed price by the government with a unified price of RMB 0.024/cu m as measured at the tertiary canal inlet (WUA headgate), at the same measurement point as the State water price. In contrast, the end-canal water price specified by the government in Jiamakou ID in Shanxi Province is a price range percentage of the total water price. According to the standard regulation *Water fee Standard and Management Regulation of Hydraulic Project in Shanxi Province*, the end-canal water price should be up to 15-20% of the total water price, although Jiamakou ID actually uses RMB 0.03-0.05/cu m which accounts for only 6%-10% of the total water price because of less maintenance needed for new facilities. The end-canal water fee is determined by the ECMC and publicized to the water users, and is moreover verified by the WSO of the ID and reported to the PB for record keeping. Regardless of whether the government specifies an end-canal water price that is fixed or is a price range percentage, it should be approved by the representative meeting of the ECMC. If it is not possible to measure water to each farmer, it should be measured in a small area to several farmers at the same time as a group (within only one branch canal or farm canal), with each farmer charged according to his area. The State water fee and the end-canal water fee should be similarly allocated within the small group according to the water volume or the area. At present, in the northern regions, particularly in the Northwest, this method of measurement is widely adopted and the effect is satisfactory.

Under this system, the end-canal water fee is collected by the State WSO from the farmer household together with the State water fee. Two water supply invoices are issued to the farmer household, one for the amount of the State water fee and the other for the end-canal water fee. The end-canal water fee is managed by the State WSO and a special account in the name of by WUA is established by the WSO (or it's WMS). The WUA applies to the WSO for using the end-canal fee funds according to the specified procedures and get reimbursed from the WSO. The application situation for use of the end-canal water fee is publicized to the farmer households and is supervised by them. At present, many WUAs use standardized end-canal water fee management as above since the end-canal water fee is managed by the WSO, but the publication to the farmer household is not sufficient. Few farmer households participate in end-canal water fee management, which is one of the shortcomings of this method. Another shortcoming is that the only measurement is between the WSO and the WUA, instead of moving the measurement point downstream to the WUG or near or at the farm canal inlet.

Two-part Water Fee with End-canal Water Fee Managed by the WUA. In this two-part water fee method, the WUA manages the end-canal water fee by itself, and the water price of end-canal should be determined by the WUA according to the WUA operational costs through democratic decision making within the WUA. The end-canal water fee is collected and managed by the WUA, while the State water fee should be directly collected from the farmer household by the WSO separately. Although two-part water fee WUAs which manage the end-canal water fee by

themselves are few at present, they can act as the transition from the two-part water fee to the comprehensive water fee.

5.4 Calculation of WUA Operational Costs

WUA operational costs need to be the basis for calculation of the end canal fee. As indicated above, the operating costs for the WUA includes the cost of water purchased from the WSO, personnel salary payments, facilities maintenance, office expenses, etc. The WUA budget should be made at the beginning of the year based on previous experience with costs to estimate end canal water fees needed to cover costs (including allowance for inflation), and the final water price should be determined at the end of the year based on actual costs incurred. If operational costs change during the season (e.g., the amount of water purchased from the WSO is more than estimated), the final water price may vary somewhat from the original estimate.

Water Purchased from WSO. The water purchased from the State WSO cost can be budgeted based on the average amount of water delivered for several past years valued at the current State water fee (this is another reason why it is important to measure and record water deliveries consistently at the WUA intake). If the WUA is newly setup, water use can be estimated according to the crop patterns, irrigation quota, normal rainfall, the WUA's own water sources, etc.

Personnel Salary and Payments. The main factors which determine personnel payments are the number of personnel, working days and the pay standards. The personnel who get paid from the WUA consist of the executive personnel, cashier, accountant, and water distributors (water guards). The payment of the executive personnel, cashier, and accountant may be paid all or on part as a fixed salary. The water distributor should normally be paid according to the work load (water distribution area or the quantity of water) or working days. Personnel pay should be determined according to the local economy and development situation and the pay scales for personnel and common labor. How much payment will be granted and what standard is used should be negotiated and approved by the WUA representatives meeting.

For well-established WUAs, the personnel payment can be based on the previous year. For new WUAs, the distributors can be estimated using 3-5 persons/10,000 mu. The administration personnel can be estimated at 5 persons for WUAs up to about 10,000 mu in size, and 3 persons for WUAs less than about 5000 mu.

Maintenance and Repair Costs. The maintenance cost of the project should be determined according to actual needs, and it is difficult to set a standard amount due to the differing project conditions. Some experts recommend that a percentage of the WUA asset value in the canals (say 3-5 % for new facilities) should be used as a rough estimate for the maintenance cost for the end canal system. In practice, deciding this percentage is difficult because the asset value formed by the old field works is not easy to know (and may be irrelevant) if the system is very old, in which case replacement cost may be used. Especially for older systems, it is best to determine this cost by estimating the actual needs or based on the actual experience for several past years if possible.

Administration and Management Expenses. The administration expense should also be based on the experience accumulated over several years and it should not exceed about 15% of the estimated O&M costs (exclusive of the water purchasing costs).

5.5 Comprehensive vs. Two-Part Water Fees for Future WUA Water Pricing

At present, the end-canal water fee for most WUAs using the two-part water fee is charged and managed by the State WSO, and the State water fee and end-canal water fee in two-part water fee are measured in the same place, usually the WUA headgate. With many IDs using the two-part water fee, the area controlled by the measurement point between the State WSO and the WUA is large. The irrigation area of some of these WUAs exceeds than 10,000 mu. It is difficult to measure water volume directly to farmer households, but it is also difficult to achieve fairness of water distribution among the farmer households and promote the awareness of water saving with measuring at the WUA headgate. Therefore, the measurement point for estimating water consumption by the farmer household should be moved downstream into the WUA as far as is feasible. The actual management authority of the State WSO stops at the measurement point of the WUA inlet, and moreover financial and labor constraints make it difficult for the WSO difficult to measure water consistently and effectively below the WUA inlet. For example, Santun River ID in Xinjiang, although the policy of charging the end-canal water fee to the farmer is issued and requires measuring at the farm canal inlet, in practice the WSO is only able measure at the tertiary canal inlet, that is at the boundary of the State WSO and WUA (the WUA headgate). This is a common occurrence simply because of the technical, manpower and financial constraints faced by WSOs.

In practice, a two-level measurement system is needed – the first at the WUA headgate, and the second further down into the WUA system, for example at the WUG level or at the farm gate. The second level measurement point in the WUA area can only be done by the WUA and would be the basis for charging the water fee to the farmer household, even if it is at the WUG level and not directly at the farm household headgate. In this case, the WUA should be responsible for charging the farmer the entire water fee, including both the State water fee and end-canal water fee. The difficulty for the WSO to do this is that the previous State water fee takes the boundary of the State WSO and WUA as the measurement point, and that point may be far from the second measurement point and also from the farm canal, and water losses in between the two may be significant. The problem for the WSO is to determine the “equivalent State water price” at the second level measurement point taking into account the water losses. The water losses between the two levels of measurement points make the calculations complicated and introduce more inaccuracy as the distance between the two points increases and as conditions vary within the WUA area.

Under the current allocation of management rights and responsibility for projects, the measurement point of the State water fee by the WSO cannot be moved downward into the end-canal areas or the WUA. Indeed, in practical terms it is unnecessary to do that. The solution is to change the WSO’s charging focus of the State water fee from the farmer household level to the WUA level, while making the WUA responsible for charging the farmer based on the second level measurement point inside the WUA. This would move State water fee charging closer to the farm headgate, with the WUA acting on behalf of the WSO to collect the State water fee (as well as its own end-canal fee), but at no cost to the WSO. In effect, this would also change the water fee charging method from the two-part water fee to the comprehensive water fee.

It is very clear from the study results that it is impossible in practice for WSOs to consistently and on a large scale measure water and collect volumetric water charges accurately and fairly at

the household level under the two-part water fee system, especially if the area under the measurement point between the State WSO and WUA (WUA headgate) is large. It is also clear that to do so would require an inordinately large amount of additional staff and financial resources for the WSOs. Only in IDs where the control area of the first measurement point is relatively small can the WSO actually measure water volume to each household accurately as a standard practice (i.e., the first level measurement point is close enough to the household to be reasonably accurate). In that case, the two-part water fee is feasible, although still the WUAs as independent legal persons could manage this by itself. With the gradual improvement of WUAs and standardization of their operation, management water fee determination and collection can be handed over to the WUAs, and a contractual relationship between WUA and WSO established using a water supply contract to ensure correct payment of the State water fee to the WSO.

Through this gradual improvement process, the comprehensive water fee also can become the standard method for water pricing. And the comprehensive water fee type would at the same time make WUAs more independent in water pricing and water fee collection, help ensure better funding of end-canal O&M, encourage increased farmer participation, and promote sustainable WUAs and WUA development, as well as help improve the WSOs' financial condition through reduced costs and increased water fee collection rates (which is common with improved WUAs). The following table summarizes the features and advantages and disadvantages of comprehensive water fees compared to two-part water fees (see Table 5-3).

Table 5-3: Comparison of Comprehensive Water Fee and Two-part water fee

Item	Comprehensive Water Fee	Two-part water fee
Features of Water Pricing		
Who fixes end-canal water price	WUA self-determination	Government
Who collects water fee from farmer	WUA	WSO
Who manages end-canal water fee	WUA	WSO
The possible most downstream measurement site	Connection between farmer and WUA (point of delivery to farmer)	Connection between WUA and WSO (WUA headgate)
Advantages and Disadvantages		
WUA's right in end-canal water price determination	Strong	Weak
WUA's role in water fee collection	Strong	Weak
WUA's role in end-canal water fee management	Strong	Weak
Water measurement to farmers	Measure to farmer household by WUA, if that is necessary	Difficult to measure to household, especially in large WUAs
WSO staff required for end-canal	Few	Many

affairs		
WSO costs for water fee collection	Low/minimal (only need measure water at WUA headgate, and charge WUA)	High (measure water at headgate and/or lower levels, collect and manage water charge, disburse to WUA for O&M after application)
WSO water fee collection rate	High with improved WUAs, but risk of reduction with weak WUAs	Fairly high with low risk
Transparency of farmer’s water fee	High with improved WUAs, but risk of over-charging in some weak WUAs (especially village WUAs)	Relatively transparent for State water fee, but not for end-canal water fee

From the above comparison, it is clear that the comprehensive water fee system can incorporate and promote WUA self-management and legal person status much more easily than the two-part water fee, provide significant benefits and reduced costs for WSOs, and encourage the “WSO + WUA + Farmer” form of ID management which is now favored. However, these and other advantages depend heavily on the quality of the WUAs. Indeed, the comprehensive water fee method necessitates a much stronger and important role for WUAs, and highlights the urgent need to improve and “standardize” WUAs and their capabilities. Improved WUAs under the comprehensive water fee method can, for example, implement water measurement even to the farmer household by measuring at a point between the WUA headgate and farmer’s field inlet or at the farmer’s inlet, which is rarely done by WSOs. WUAs can also implement comprehensive water pricing which covers both the State water fee to be paid to the WSO and the end-canal water fee to cover end-canal O&M, and some WUAs already operate in this manner. For weaker and less developed WUAs, however, the authority to determine and implement comprehensive water fees should be transferred to them gradually with the guidance and support of the WSOs, while at the same time they are being strengthened and improved (e.g., through application of the “Five WUA Principles,” policy support, training, etc.) to take on the increased responsibility.

It is also clear that success with comprehensive water pricing and a larger role for WUAs will depend heavily on strong and effective support by the WSOs and the IDs. The transfer of more responsibility to WUAs and introduction of comprehensive water fees will benefit the WSOs, as well as the WUAs and farmers. Support for WUAs should therefore be considered by WSOs as an investment in the future which would help them improve their operational efficiency and performance and also reduce their costs.

Finally, and as mentioned previously, the State water fee-only type of water pricing should be phased out as rapidly as possible but in a strategically planned manner since it is currently the most common type of water fee system. This is an urgently needed reform because this system includes no specific component for the end-canal fee. It supports neither end-canal O&M and management nor WUAs to take on that responsibility, and where used it threatens the performance of IDs due to poor end-canal O&M as well as the financial survival of WUAs.

5.6 Selection of WUA Pricing Method for Different IDs

Another topic that is critical to the effective introduction of comprehensive water fees – the selection or design of the end-canal pricing method based on the different conditions in northern and southern IDs and WUAs. The northern areas differ substantially from the southern areas in water scarcity, climate, soils, crop patterns, irrigation methods, project management, engrained habits, etc., and in some cases in project scale. It is clear that the pricing system needs to be sufficiently flexible to adapt to local conditions, and that comprehensive water pricing can be adapted to various different conditions. It is also clear from Table 5-3, above, that both comprehensive water pricing and two-part water pricing have certain advantages and limitations, but in general comprehensive water pricing appears to be more flexible and can significantly reduce WSO costs. However, it requires WUAs, and improvement of WUAs in particular, to reduce risks for the WSOs. Based on the study investigations, comprehensive water pricing and WUAs can be adapted to a wide range of conditions. WUAs under PPRWRP, for example, covered 10 provinces under a wide variety of conditions, and most used some form of comprehensive water pricing.

In northern IDs, two-part water fees are common. WUAs are frequently the water dependent type because of water scarcity and high water cost, and the WSOs often prefer to maintain control over water charges to ensure their own costs are covered. However, WSOs are supposed to measure water and charge farmers volumetrically in many cases. If the irrigation area below the first level of water measurement (measurement between the WSO and the WUA) is small, measuring and charging at the household (or WUG) level by the WSO can be realized. In that case, the two-part water-fee is practical, as at Jiamakou ID in Shanxi, although the comprehensive water fee could also be applied in such situations. However, if the irrigation area below the first water measurement point (between the WSO and the WUA) is large, exceeding say 5,000 mu or even 10,000 mu, calculating the water fee by volume for the households cannot be accomplished by depending on the first level water measurement alone. Actual measurement at the household or WUG level is expensive and difficult (or in some cases impossible) for the WSO to carry out in practice, and the two-part fee system is not very workable, cost-effective or equitable. Under such circumstances, the comprehensive water fee system is well suited and should be introduced and used.

In the South, with abundant water sources, the comprehensive water fee is already used in many IDs. Because water is not scarce, southern WUAs usually do not measure to or near the farmer household, but rather allocate the water fee according to the area irrigated, and State water fees are relatively low compared to the North. For larger WUAs, measurement is applied down to the WUG, and the water fee is calculated by means of the WUG's water volume and WUA total costs based, in proportion to the WUG area irrigated. WUGs then allocate their water fee among WUA members based on area irrigated. However, for small WUAs, the water price may be calculated for individual households based on their irrigated area and WUA costs.

Based on field investigations, it is also important for WUAs to have the full right for water pricing and fee collection inside the WUA area. This is especially important in terms of farmer willingness to pay water charges; water charge collection rates go up when improved WUAs are established, based on PPRWRP data. If the end-canal water price is determined by the WUA itself based on its own costs (including water purchase costs), the farmers can understand that the end-canal water fee is necessary for proper O&M and that paying the end-canal water fee will

benefit them. But if the end-canal water price inside the WUA is determined by the government (i.e., by the WSO or the township), the farmers will consider that establishment of the WUA simply increased the water charge and added to the farmers' water fee expenses (even though in actual fact the end-canal O&M costs exist regardless of the WUA). This will reduce their willingness to pay water fees and participate in the WUA. And if they think the government increased the water price (as needed to include the end-canal water fee), and then they may be unwilling to pay. The better option is to introduce comprehensive water pricing along with WUAs as an integral part of WUA development (or improve WUAs as a part of water pricing reform) so that water costs, price determination and water charge collection are transparent, easily understood and not done by government or the WSO but by the farmers themselves.

Chapter 6: Farmer Costs and Water Fee Subsidy Options

6.1 Introduction

The lack of water fee revenue will reduce WUA end-canal O&M and management, while higher water fees will add to the farmer's burden. This is a fundamental dilemma facing irrigation water pricing. Both WUA sustainable operation and the farmers' water fee burden should be taken into account in the water pricing process. To the extent that the government wishes to reduce the farmer's burden, it may for policy purposes also choose to subsidize irrigation costs, rather than charging the farmers the full cost of irrigation services. In this chapter, the farmers' irrigation water costs and crop values are investigated, analyzed and compared based on data from PPRWRP, WPRP and especially the case study field investigations. The ratio of the farmers' irrigation water costs to agricultural production input and output values are analyzed based on farmer attitudes as a way to measure the burden of irrigation expenses on the farmers. From these analyses, it is found that the burden on farmers is relatively high and beyond farmer's capacity and willingness to pay in some areas, especially in the North. The question is how to fund adequate O&M of both main and end-canal irrigation systems. Based on the study results, government subsidies are suggested to ensure both sustainable operation of State projects and end-canal systems, and to reduce farmer's irrigation expense as well. Four water fee subsidy methods are presented and analyzed according to water pricing methods and project types, several important issues are identified.

6.2 Farmer Water Fee Expenditures under PPRWRP

Under PPRWRP because of WUA water fee collection and pricing reforms under the project, farmer water fee expenditures have fallen. PPRWRP has been monitoring farmer water fee expenditures in the 497 project WUAs starting from 2005. Farmer water fee expenditures in 2008 were on average RMB 31/mu, which is RMB 3/mu less than in 2005 and RMB 5/mu than similar non-WUA areas in 2008.

In addition, under PPRWRP more farmers pay volumetric water charges. Water charges based on water volume used by farmers have increased annually, and the figure increased from 70% in 2005 to 84% in 2008 for PPRWRP WUAs. There is a big difference between different regions in terms of volumetric water fees, especially between the dry North and the humid South, because of different water resource conditions, climate and crops. For example, 100% WUA charge water fee from farmers was by volume in Xinjiang, while for Hunan it was 56%.

Under PPRWRP, use of WUAs also reduced the intermediate "procedures" or middlemen for water charges, sometimes referred to as the middle-links, and the water fee collection rate has increased gradually each year. In 2008, the water charge collection rate was 95%, an increase of 4% comparing with that of 2005, and 25% higher than non-WUA area (see Table 6-1).

Table 6-1: Comparison of Water Fees for WUA and Non-WUA Areas under PPRWRP

Year	Percent Charging by Volume		Water Fee Collection Rate		Water Fee Expenditures (RMB/mu)	
	WUA	Non-WUA	WUA	Non-WUA	WUA	Non-WUA
2005	70%	29%	91%	54%	34	37
2006	85%	42%	92%	57%	30	40
2007	88%	36%	94%	65%	31	42
2008	84%	43%	95%	70%	31	36

Meanwhile, farmer water fee expenditures as a percent of irrigation crop production value have been relatively stable in recent years, about 4.9% in 2008 (see Table 6-2 below). PPWRP monitored water fee costs in general and compared them the value of crop production for WUA and non-WUA areas. However, it lacked monitoring detail on water fee composition, price making, collection procedures, etc. These points were investigated in the case studies.

Table 6-2: Water Fee Expenditures and Crop Production Value under PPRWRP

Year	Crop Production (RMB/mu)①	Water Fee Expenditure (RMB/mu) ②	Percent ②/①
2005	561	32.94	5.9%
2006	585	29.3	5.0%
2007	595	29.8	5.0%
2008	642	31.2	4.9%

6.3 Farmer Water Fee Expenditures under the MWR WPRP Project

WPRP started in 2008, with 155 WUA in 11 provinces which were monitored as to farmer water fee expenditures. The data for 2009 was collected and analyzed under this study. The rate of farmer irrigation costs to the value of grain production averages 5.1%, while that for cash crops is 2.5%. From the average data, these rates seem relatively low. However the rates are significantly higher in some provinces, such as Shanxi at 14.9% and Xinjiang at 9.3% compared to grain crops. In most IDs and depending on crops grown, such high rates are considered to be beyond farmer's willingness to pay. The proportion of irrigation costs in total crop production costs is on average 10.9% for grain (Shanxi is highest by far at 22.2% for grain) and 6.6% for cash crop (see Table 6-3 below).

Table 6-3: Water Fee Expenditures Compared with Crop Value for WPRP WUAs

No.	Province	Grain			Cash Crops		
		Water fee expenditures (RMB/mu)	Water Fee Compared to Crop Value (%)	Water Fee Compared to Crop Production Cost (%)	Water Fee Expenditures (RMB/mu)	Water Fee Compared to Crop Value (%)	Water Fee Compared to Crop Production Cost (%)
1	Shanxi	62.4	14.9	22.2	90.0	3.7	6.2
2	Inner Mongolia	41.1	4.5	15.7	29.2	2.8	12.3
3	Jilin	41.6	3.9	9.4			
4	Heilongjiang	31.0	3.5	7.5			
5	Anhui	32.1	4.2	10.5	17.6	2.1	9.8
6	Jiangxi	19.3	1.5	2.7	14.4	0.6	0.7
7	Shandong	44.1	3.8	8.4	37.1	1.9	4.8
8	Henan	34.6	4.4	11.9	27.2	2.5	3.9
9	Hunan	22.2	1.9	6.5	5.0	0.3	5.6
10	Sichuan	35.9	4.3	7.9	21.4	2.9	4.9
11	Xinjiang	59.3	9.3	17.6	56.0	5.7	11.1
Average		38.5	5.1	10.9	33.1	2.5	6.6

6.4 Actual Costs of Irrigation for Farmers under the Study

The water fee paid by the farmer does not include farmer's labor or cash input for project maintenance and repair. So, it is not correct to only refer to the water fee that the WUA collects from the farmer household when measuring the burden that the farmer household assumes by receiving the irrigation service. Instead, the actual costs for the farmer household should also include the non-paid labor input by the farmer household for irrigation application and canal maintenance. For the WUA with a high professional management level and in-depth management, the WUA water fee may be a little bit higher, but the service fee that the farmer household pays to the WUG will be lower or even not needed.

The farmers are quite clear about how much they have paid for the water fee, but have no idea where the money goes and how much is distributed to the WUG, WUA and State WSO. As for the WUA, it knows how much water fee is collected, but some WUAs maybe cannot tell how much each farmer household pays, because some irrigation services may be provided to the farmer household by the WUG which charges its fees for the service directly; this is not registered with the WUA. The WUA may not carry out statistics on how much fee that the WUG charges from the farmer household. Therefore, the overall income of the water fee for the WUA is not consistent with the total water costs for the farmers. Only when the WUA serves and charges to the household are the WUA water fee income and farmers' water fee expenditures consistent.

Due to the many different water fee charging methods used in different IDs and WUAs, as well as the various water resources used, the actual water fee expenditures and costs of the farmer

household cannot be determined with statistics from the accounts of the WSOs or WUAs. This can only be found through field investigation of the farmer households. This is particularly the situation in some southern IDs. The northern IDs are a little simpler on the composition of the water charges. Because the northern IDs provide direct water supply to the household, the WSO or WUA has each farmer's water fee data that on payment for WSO water. The water fee paid for other water sources beyond the WUA management scope, such as tubewells and ponds, will be external to the WUA statistics. The example farmer in Chapter 3 above, Mr. Sun Minye from Sanqi WUA in Santun River ID, had three different sources of water, but water delivered by the WUA accounts for only about half of his water costs, which total some RMB 90/mu on average. Another example is Jingtang WUA in Tieshan ID in Hunan where the WUA charges the farmer household RMB 19-22/mu, but the household also pays a RMB 5-10/mu water distribution fee to the WUG in addition.

Thus, to analyze the actual water fee expenditure situation of the farmers, accurate data and understanding can be obtained only by means of field investigation of each household. Sampling and selection of the investigated farmer households for each case study was done as follows: three WUGs were selected according to upstream and downstream locations in each WUA, among which, two or three households were selected according to location in the upstream and downstream areas. A total of six to nine households were selected in each WUA.

The results of the study investigations on actual water fee costs and comparison of those costs to crop production value and crop production costs, as well as the impact of non-paid labor inputs on the costs of irrigation, are shown below for the case study WUAs, based on the farmer household data collected (see Table 6-4 below). Also summarized below are the attitudes toward the water fee by farmers interviewed (see Table 6-5 below). It must be kept in mind, however, that most farmers tend to say and feel costs are too high.

Table 6-4: Water and Crop Costs and Comparisons under the Study

No .	WUA	Number of Farmer Households Investigated	Main Cops	Irrigated Crop production Value (RMB/mu)	Overall Crop Production Cost (RMB/mu)	Water fee expenditure (RMB /mu)	Water Fee Compared to Crop Production Value (%)	Water Fee Compared to Crop Production Cost (%)	No-pay Labor Value (RMB /mu)	Water Fee + No-Paid Labor Value (RMB/mu)
1.	Lianhuapao WUA, Qianguo ID, Jilin	9	Rice	1114	620	71	6.4%	11.5%	40	111
2.	Eryingan WUA, Qianguo ID, Jilin	9	Rice	1213	489	71	5.9%	14.5%	20	91
3.	Linjin ECMC, Jiamakou ID, Shanxi	6	Apple	2600	1264	155	5.9%	12.2%	11	166
4.	Dongzhang ECMC, Jiamakou ID, Shanxi	8	Apple	2265	991	131	5.8%	13.2%	12	143
5.	Nantougong WUA, Toutun River ID	9	Cotton ,wheat	1001	437	28	2.8%	6.4%	2	30

6.	Xiayingpan WUA, Toutun River ID, Xinjiang	9	Cotton, wheat	1090	559	44	4.0%	7.9%	27	71
7.	Sanqi WUA, Santun River ID, Xinjiang	8	Tomato, wheat, cotton	1131	693	66	5.9%	9.6%	10	76
8.	Shuguang WUA, Santun River ID, Xinjiang	8	Tomato, cotton	1081	757	102	9.4%	13.4%	4	106
9.	Zhonglou WUA Shilu ID, Hubei	6	Rice, rape, wheat	1940	788	34	1.8%	4.6%	16	50
10.	Dongfeng No.3 Main Canal WUA, Hubei	7	Rice, rape	1376	363	10	0.7%	2.6%	11	21
11.	Liufengyan WUA, Yuanan County, Hubei	6	Rice, rape	1713	568	25	1.5%	6.5%	0	25
12.	Changtang WUA, Tieshan ID, Hunan	7	Dual-reason rice	1445	613	18	1.2%	2.9%	28	46
13.	Jingtang WUA, Tieshan ID, Hunan	7	Dual-reason rice	1803	693	30	1.7%	4.3%	42	72
	Total	99		1521	680	60	4.08%	8.43%	17	78

Note: A second ECMC was interviewed in Shanxi for this topic to verify the high costs in Shanxi; the data is included here, making a total of 13 WUAs listed in the table above and in the following table.

Table 6-5: Farmer's Attitudes on Water Fee Expenditures

No.	WUA	Number of farmer Households Investigated	Water Fee Expenditures (RMB/mu)	Water Fees Compared to Crop Production	Number of Farmers Who Think Water Fee Acceptable	Number of Farmers Who Think Water Fee Relatively High	Number of Farmers Who Think Water Fee is Too High
1.	Lianhuapao WUA, Qianguo ID, Jilin	9	71	6.4%	2	4	3
2.	Eryingan WUA, Qianguo ID, Jilin	9	71	5.9%	3	3	3
3.	Linjin ECMC, Jiamakou ID, Shanxi	6	155	5.9%	2	3	1
4.	Dongzhang ECMC, Jiamakou ID, Shanxi	8	131	5.8%	3	3	2
5.	Nantougong WUA, Toutun River ID	9	28	2.8%	5	3	1
6.	Xiayingpan WUA, Toutun River ID, Xinjiang	9	44	4.0%	3	5	1
7.	Sanqi WUA, Santun River ID, Xinjiang	8	66	5.9%	2	4	2
8.	Shuguang WUA, Santun River ID, Xinjiang	8	102	9.4%	1	2	5

9.	Zhonglou WUA Shilu ID, Xinjiang	6	34	1.8%	5	1	0
10.	Dongfeng No.3 Main Canal WUA, Hubei	7	10	0.7%	7	0	0
11.	Liufengyan WUA, Yuanan County, Hubei	6	25	1.5%	4	2	0
12.	Changtang WUA, Tieshan ID, Hunan	7	18	1.2%	5	1	1
13.	Jingtang WUA, Tieshan ID, Hunan	7	30	1.7%	6	1	0
	Total	99	60	4.08%	48	32	19

6.5 Summary of Investigation Results on Farmer O&M Water Fee Expenditures

Face-to-face questionnaire investigations and in-depth discussions were conducted with the 99 farmer households in 11 WUAs and two ECMCs (in Jiamakou ID) regarding water fee expenditures. The average water fee expenditure of the farmer household is RMB 60/mu, accounting for 4.08% of the overall value of agricultural production. If the non-paid labor that the farmer household invests due to the irrigation is included, the overall irrigation cost is RMB 78/mu, accounting for 5.13% of the overall value of agricultural production.

The expenditures on water fees by farmer households in the North are usually higher than that in the South. Among the investigated IDs, the absolute value of the water fee paid by the ECMC farmer households in Jiamakou ID in Shanxi Province is the highest. For Linjin sub-WUA (ECMC), the expenditure on the water fee by the farmer household averages RMB 155/mu. Due to the high value cash crop (apples), the farmer household is able to bear that high water fee, at least at present.

According to the investigation of the study samples, the expenditure of the water fee in the North is also generally higher than 5% of the crop value, and the average for the North is 5.8%. For example, in Shuguang WUA in Santun River ID in Xinjiang, the expenditure of the average water fee for the farmer household is 9.4% of the agricultural output value. In comparison the ratio in the South is generally within 5%, and the average in South was only 1.4% according to the field investigation data.

The investigation of farmer attitudes shows that among the 99 households, 48 can accept the water fee expenditure, while 32 think the expenditure is relatively high, and 19 think it is beyond their payment capability. It is found that farmer's willingness to pay is effected by the rate of water fee to crop production, not just the absolute value of water fee. When the rate is under 5%, only 3 farmers think water fee is unacceptable, 13 think the fee is relatively high, and these two views account for only 36% of the 44 farmers. Meanwhile, when the rate is beyond 5%, 16 farmers think water fee is unacceptable, 19 think the fee is relatively high, and these two views account for 64% of the 55 farmers.

As a rule of thumb, the acceptable rate of water fee to crop production value is about 5%. This investigation confirmed that, although it does not apply for higher value crops. Most farmers considered during the investigation that if the price of agricultural product could be kept stable (i.e., not fall), the present water fee levels are acceptable or at least relatively acceptable.

The agricultural subsidy to farmers, however, has changed their psychology. According to the interviews, farmers are not as willing as before to pay water fees. While the government offers them an agricultural subsidy, the government charges them a water fee. This is not understandable for the farmers. Moreover, providing the subsidy and charging the water the fee entail increased government working costs as well as time for the farmers, which is also hard for them to understand. The agricultural subsidy is intended to defray the farmers' agricultural costs and keep them happy, but it has had a negative effect on their psychology for paying water fees. This matter deserves careful monitoring, more investigation and also great effort by government to explain that the agriculture subsidy to farmers and its relation to water fees are not the same. As a partial answer, some WUAs suggest that the WUA should receive the agricultural subsidy, deduct it from the farmer's water fee and use the subsidy in place of the water fee to cover WUA O&M costs and management. This would make charging water fee more acceptable, but it is not permitted by current policies. Overall, a major issue for any such scheme, in fact for any agricultural subsidy system, would be how to preserve farmer incentives for water saving, which is a high priority for China.

6.6 Rationale and Background on Water Fee Subsidies

Based on data presented above on farmer costs and also farmer attitudes and willingness to pay water fees, consideration of water fee subsidies is justified, as a possible means to support both WSOs and also WUAs financially. Although there have been some studies in China on irrigation water fee subsidies using various methods of subsidizing, most of those studies lack analysis of the preconditions for the different subsidy methods. The lack of studies based on different kinds of subsidy objectives and different kinds of current water charging methods makes it difficult to decide on a reasonable subsidizing method; this chapter attempts to fill this gap.

As indicated above, the water fee faces a serious dilemma at present. WSO losses are widespread and severe, and continued operation of the WSOs is becoming increasingly difficult, while at the same time the farmers' willingness and ability to pay are limited and government does not want to raise the farmers' burden. **According to the investigation of 551 medium and large-size IDs by MWR in 2006, the State water price averages RMB 0.065/cu m, accounting for only 38% of the actual water supply cost, and the actual water fee collection rate is 57.37% on average. That is to say, the actual receipt of the water fee only accounts for 22% of the actual water supply cost.** Many WSOs, particularly those only for agricultural water supply, suffer heavy losses, and the management operation fee is seriously insufficient.

This situation adversely affects the operation of many hydraulic projects across China. According to the study investigations, for example, the approved price of water supply in Qianguo ID in Jilin Province in the North is RMB 0.025/cu m (excluding pumping costs which are additional charges), while the actual water supply cost measured by the WSO in 2008 was RMB 0.091/cu m (excluding pumping costs). Overall, the actual price only accounts for 27.2% of the actual cost, and WSO employee salaries are paid at only 60% of stated rates. At the same time, the farmer's water fee is RMB 71/mu, which is not low and is difficult to increase any more. Another example is Dongfeng Canal ID in Hubei in the South, where the water price for agricultural water supply is RMB 0.055/cu m and the actual cost is RMB 0.143/cu m; the actual water price is only 38% of the cost. Luckily, Dongfeng Canal ID also provides urban and

hydraulic power generation water, which subsidizes losses on the agricultural water supply, and the WSO can maintain basic daily operations.

On the payment side, the water charge is already beyond the farmers' ability to bear in some local areas. Moreover, with the expansion of the direct agriculture subsidy to the farmer, the farmers have become unwilling to pay the water fees set by government. The field investigation found that the actual water fee for the farmer households is RMB 60/ mu on average, accounting for 4.08% of the total agricultural output value. If the non-paid labor of the farmer household used in irrigation is included, the total cost is RMB 78/mu on average, accounting for 5.13% of the total agricultural output value. The water fee expenditure of the farmer household in the North often amounts to much more than 5% of the total agricultural output value, such as at Shuguang WUA in Santun River ID in Xinjiang, where the water fee expenditure of farmer households average 9.4% of the agricultural output value.

Since the water fee expenditure of the farmers at present is high (and considered too high by farmers), there is little room for increasing either the State water price or the end-canal water fee. At the WUA level, the funds needed for end-canal maintenance are short, and payment of the working personnel in WUA is difficult; both restrict the normal operation of the end-canal system and the sustainable development of WUAs.

In view of this water fee dilemma, MWR started WPRP project in 2007 to help reduce the water fee burden of the farmers, ensure the normal operation of irrigation facilities and save water resources. The overall long-term goal of WPRP is to help ensure the national grain security. The key objectives are to increase the input of capital for the improvement of end-canal systems, and to intensify measures to realize direct farmer water pricing. These would improve the irrigation guarantee rate through the improvement of ID end-canals, and reduce the loss of water and also water consumption which would lower farmer water fee expenditures. However, the WPRP investment each year is only sufficient for a few pilot projects, and it is far from satisfying the true requirements for solving the dilemma of water pricing.

Based on the above, the current study has concluded that it is necessary to implement an explicit financial subsidy program for water fees, eventually on a national scale. There are four direct objectives: (1) to reduce the burden of water charges on the farmers; (2) to reverse the long-term loss status of WSOs and ensure the sustainable operation of IDs; (3) to ensure the normal O&M and management of end-canal systems and the sustainable development of WUAs; and (4) to save water resources and ensure an equitable allocation of benefits between the WSO and the water users.

Under the WTO 'Agriculture Agreement', infrastructure construction for water supply and drainage systems and subsidies for agricultural facilities such as irrigation is allowed. It is therefore important to study rural water subsidies policies in other countries and understand their approaches. From a global perspective, although the potential future water crisis is underlined, users' awareness needs to increase on the need for water saving, investments for water projects and their operating costs, and reduction in the government's financial burden via water price adjustment. Various developed and developing countries have adopted high rural water subsidies policies. According to Demoor and Calamai's estimation on subsidies for drinking water and irrigation water in 1997, about US\$4.5 billion are used annually for water subsidies in developing countries.

Summary of Financial Subsidies for Agricultural Water in Developing Countries. World Bank research data on developing countries provide various examples. In Armenia, surface water is mainly used in irrigation systems, which are under the management of large collective farms. Most of groundwater irrigation is under private management. The Armenian government provides subsidies for pumping irrigation water charges. Water charges determined and are collected by area, and they accounts for only 27% of water supply cost. In Egypt, each year about US\$5 billion are used as irrigation subsidies, and farmers do not need to pay water bills; they are only responsible for drainage and irrigation system maintenance in their fields. India's annual subsidy for irrigation is about US\$1.2 billion, and the overall price level is low, even the high charge rate is only about US\$6 -7/ha. Indonesian farmers also do not need to pay water bills, as farmers are only responsible for the maintenance of irrigation systems in their fields. Since 1950s in Mexico, the annual irrigation system O&M costs accounted for 0.5% of its GDP. In Moldova, the government has covered all the cost of water supply. In Pakistan, subsidies for irrigation each year are about US\$600 million, with diverse ways of charging.

Summary of Financial Subsidies for Agricultural Water in Developed Countries. In California, U.S.A, the water price varies greatly in different IDs. Usually water users have tradable water rights and the integrated rural subsidies in U.S. are relatively high. In Canada, water charging is a common phenomenon and water price is about 14% of the water supply cost, with other costs being subsidized by the government. In France, a seasonal price policy has been generally adopted in dry and rainy periods, and water price rises at peak season demand; 50% of the water supply costs are subsidized by the government. Israeli farmers use water based on the annual distribution of rainfall and water resources, and water price only covers a very small portion of the water supply cost.

Since 1950s, countries around the world have faced problems of water shortage and inefficient use of irrigation water. As a result, there is a common demand for improving water resources usage efficiency by increasing water price among international communities. However, the water price has to be based on volume of water if a price increase to result in saving of water, and it seems that direct irrigation water subsidies are on a decreasing trend as a way to discourage overuse of water. However, to cover all the water supply cost through irrigation water fee often does not seem seem common or politically possible in developed countries which have market economies and richer farmers, much less in developing countries where farmers' ability to pay is generally much more limited. Consequently, different countries have attached great importance to protect the stability of agricultural production and food security. Support and protections have therefore been given to the agricultural industry by strengthening infra-structure construction for rural water supply and providing financial subsidies.

6.7 Principles for Water Fee Subsidies

Subsidies for agricultural water fees should be in line with the following principles:

- 1) Improve the project first and subsidize the water fee later. First, the project condition for the normal irrigation should be ensured. As for the project where conditions are inferior and failing to satisfy the normal irrigation, the project shall be improved first and the water fee subsidy shall be considered later.
- 2) A water fee subsidy program should be based on the appropriate reform of the water

management system. Staff numbers and positions should be fixed, and staff costs and maintenance fees should be controlled by local government to avoid unnecessary costs.

- 3) The water fee should not be completely canceled. This is important both to minimize the subsidy required and to ensure that other objectives are met, such as maintaining incentives for reducing costs and saving water. Under the condition that the water fee is completely canceled, the economic leverage of the water fee for water saving and use efficiency will be lost, which is not good for the water resource conservation. Most developed countries do not fully cancel water fees. For irrigation and water delivery projects directly managed by the government or entrusted to an enterprise for management in some developed countries, the government covers the construction and operation expenditure of the main system; water fees for those capital costs are not collected from the water users, but the O&M of the project are paid by the users.

The minimum water fee subsidy should help ensure that the farmer household can afford the water charge. Meanwhile, the WSO shall ensure collection of 100% of the receivable water charge, no matter from the household or from the governmental subsidy. According to the study investigation, the average value of the actual water fee expenditure of the farmer household accounts for 4.08% of the total agricultural output value, and it can often exceed 5% in North and in one study reached 9%. In comparison, the water fee expenditure of farmer households in developed countries accounts for only about 2% - 3% of the agricultural output value, which provides a rough general target for a water fee subsidy.

In addition, according to the study investigation, the actual collection rate of the water fee in the State medium and large-scale ID WSOs is only 57% on average at present. If it could reach 100%, the economic condition of the State WSOs would be greatly improved even if the water price is not increased. To assist this is one objective of improved WUAs using the comprehensive water fee because they pay the water charge to the WSO directly, and experience indicates that water fee collection rates by improved WUAs is substantially higher than the norm.

- 4) A universal approach to water subsidies should not be used for all different situations; the subsidy method should be studied and based on the different situations. Hydraulic projects used by farmer households come in various forms, such as end-canals in the middle and large-scaled ID, weirs, pond, pumped wells and pump stations. The composition of the water fee paid by the farmer household is therefore different depending on the water sources. The water fee is composed of the State water fee and the end-canal water fee in some places; while in other places, the water fee is a single fee. And in some areas both a basic water fee per mu and a measured volumetric water fee are charged. The water fee collector is also different; in some places it is the State WSO, while others it is the WUA, village or WMS.
- 5) Water fee subsidies may be given to the WSO or WUA, but directly to the farmer household is not preferred. The amount of the water fee subsidy may cover only the State water fee cost or it may cover the end-canal water fee as well. The amount of the subsidy and its coverage are key questions. The water fee burden is common for the farmer households in different in different regions, but how to determine the amount of the subsidy for different levels of burden varies. All these problems need to be considered

carefully with the various objectives such as water saving and WUA self-management in mind. The method, objectives, scope and amount of the water fee subsidy should be designed for different water charging situations. And the subsidy should embody equity and should produce positive impacts, as well as reduce the farmer's burden and WSO loses.

- 6) Water price reform is the basis of and an integral part of any water fee subsidy program. At present, the charging process of the water fee on farmers is not transparent in many places. Although the government has regulated the State water price, the relationship between the actual water price to the farmer household and the State water price is not clear, resulting in an unclear composition of the actual water fee. The collector of the water fee is diverse and sometimes unreliable; water fees collected through villages or townships in some places are subject to diversion and extra charging exists. Implementation of a subsidy system should be done in concert with reform of the present water charging system, clarification of the composition of the water fee system, determination of the optimal collection methods and collector, and specification of the rights and responsibilities of different stakeholders.
- 7) The subsidy of water fee should be used to promote better irrigation. In addition to reducing the burden of the water fee on the farmers, the water fee subsidy should encourage the farmers to participate in farmland hydraulic construction and save water. The water fee subsidy is not only simply giving the money to the farmer household but should be used for the water fee and construction, management and maintenance of the field projects. The water fee subsidy shall not directly be granted to the farmer households unconditionally.
- 8) The water fee subsidy should first cover all or most of the State project construction costs and then perhaps WSO O&M fee. Next, a part of end-canal construction and O&M costs may also be covered by the subsidy. A part of end-canal construction and most of end-canal O&M costs should be covered by the farmer households if possible.
- 9) The management scope of the State WSO and the proportion of the State water fee and end-canal water fee in the composition of the water fee are different in various IDs and regions, and therefore the specific amount of the subsidy should be decided in part based on the present situation of the water fee composition and local conditions.
- 10) The subsidy should be designed to ensure sustainable development of State WSOs, normal operation of State projects, sustainable development of WUA and normal operation of end-canal systems. The objective of the water fee subsidy is to assist both farmer households and the State WSOs. Most State WSOs are in a deficit status, the State hydraulic projects cannot provide proper maintenance, the guarantee rate of the water supply is therefore low, and farmer households thus have low payment capacity and willingness to pay; and normally they cannot buy a better quality water supply service even if they have money. The benefits from investment in IDs come from the State's main irrigation systems together with the farmers' end-canal systems at the same time; both are required equally for high irrigation benefits. Therefore, the water fee subsidy should integrate the State WSO, farmer households, State systems and end-canal systems all together.
- 11) Ensure that the water fee subsidy promotes the water saving. This is a critical need for

China. Whether the implementation of the water fee subsidy will weaken the water-saving consciousness of the farmer household is a problem that seriously worries policy makers at all levels. To promote water saving, experience under PPRWRP and with PPRWRP WUAs which purchase water by volume from the WSO and charge their farmers accordingly indicates that this type of “volumetric water charge” has the largest and most direct effect on the farmers’ incentives to save water, and the farmer’s respond appropriately and strongly. In addition, the WSO can provide the water to the WUAs and regulate the water volume through an agreement, and water saving can be promoted through, for example, the intensity of water quota management and over-quota charges. However, volumetric pricing of water is the most important tool to promote water saving; simply increasing water charges based on area or exceeding the quota (e.g., when facilities are poor) does little to promote water saving and only increases the farmers’ water charge burden.

- 12) Water fee subsidies should be adjusted flexibly according to the differences in behavior on water saving. The WSO and the water users often have the conflicts in attitudes and behavior on water saving. In some IDs, especially the purely-agricultural IDs, the WSO may often encourage water users to use more water in rainy year when crops need less irrigation to maintain the WSO’s water fee income. Otherwise, the WSO will suffer financial loss if the water requirement is less than the designed water supply capability of the ID. Therefore, these ID WSOs focus on selling more water volume and make that the goal of their affiliated WMSs. For example, in Jiamakou ID in Shanxi Province, the water user consuming more water will be provided with a water price discount in some ECMCs. Although the rainy year is beneficial for farmer households, it is not good for the WSO. Although more water used unnecessarily by farmer households can improve the financial condition of the WSO, that goes against the social public benefit of water saving, especially for Yellow River IDs such as Jiamakou ID where the overall water resource is in severe shortage and the water pump lift costs are very high. The government should monitor and correct the negative practice of promoting use of more water. The WSOs, as well as farmers, need to be given a financial incentive to save water, while at the same time WSO financial integrity needs to be preserved.
- 13) In contrast, when the water supply fails to satisfy the water requirement in a dry year, the ID often limits water consumption by the water user through increasing the water price and other measures, such as an over-quota price and seasonal water price. Although beneficial for the WSO financially, the burden of the farmer’s water fee may increased substantially in years. The WSO is favored in a dry year as long as its water resource is guaranteed. For example, at Santun River ID in Changji City, Xinjiang, the extra-quota price is used; 480 m³/mu are regarded as quota, and the extra price is 50% more if the quota is exceeded. Most farmer households indicate that they want to save water, but the condition of the project field facilities is too poor for them to save water. In addition, the quota is not enough for planting. The theoretical intention of the quota policy is good, but some simple details were ignored in the process of policy making and implementation, such as whether the farmers can actually respond, the regulated quota is rational and scientific, how to cope with the different project conditions or the different climate conditions, and how to manage the extra-quota water charge.
- 14) A monitoring and coordination mechanism is needed to ensure that water suppliers and

water users actually save water through economic measures. Although the relevant State laws and policies that regulate the ID WSOs have the intention of water saving, the economic incentives often produce perverse effects on water resource consumption by both the WSO and the water user. This phenomenon is not beneficial to the water saving or to the society as a whole. The basic income of the WSOs and the charge expenditure of the farmer household should not vary too much in either dry year or rainy year. Water consumption should be reduced in the rainy year and the government should give the appropriate subsidy to the WSO to maintain its O&M. The average water supply volume in IDs for several years shall be checked and verified, and then the government can calculate the proper subsidy according to the percentage of insufficient water supply volume. The specific percentage can be calculated according to cost of the water supply and reduced water sales income. The water consumption of the farmer household increases in the dry year and the government should give a proper subsidy to the farmer household to ensure adequate livelihood even in years when water fees paid are very high. The average water fee for several years can be checked and verified, and the extra part can be paid through a subsidy from the government; or the extra-quota water fee caused by the climate change could be paid through the subsidy of the government. The farmer household should not have to be fully responsible for the extra-quota water consumption caused by poor project conditions or climate changes. A water saving fund should be set up for water saving investments using the extra water fee income from over-quota water consumption. Over-quota water fees collected from farmers should be used for farmers' benefit and should not be a disguised channel to increase WSO income.

6.8 Comparison of Water Fee Subsidy Options

The analysis has revealed four possible options for the subsidy, as presented below:

- (1) **Subsidy covers depreciation component of State water fee.** This is the preferred subsidy option, and should be the first subsidy option considered for implementation. This type subsidy has an advantage in that depreciation is an accounting charge based on capital cost recovery, rather than a real operational cost, so in effect it is not a direct budget outlay for government. However, for many IDs, water charge collection rates are low, and this would not help those WSOs, and of course it would not reduce the burden on farmers who are not paying their water charges. And where the actual present water price is much lower than the calculated cost (including depreciation), excluding depreciation may not reduce the effective water price for farmers. Nevertheless, for many IDs, recalculation of the State water fee without depreciation should result in a lower State water fee for farmers; whether it would make any difference to the WSO or is simply an accounting change would depend on how the depreciation charge was treated financially by the WSO.
- (2) **Subsidy covers part or all of State water fee.** This option reduces or eliminates payment of the State water fee by farmers. It would benefit farmers when the water fee is recalculated and provide a reliable source of revenue to support WSO operation and management. It could be applied in all medium and large-scale IDs through simple government budget transfers to the WSO, but it would require provision for those subsidy funds in government budgets for each WSO. The specific amount of the State water fee

reduction should be decided according to the composition of the water fee (the proportion of the State water fee in the total water fee) for each WSO, the need to maintain a client service orientation by the WSO, local economic conditions and especially the farmers' willingness to pay, current water fee collection rates, and other such factors. Care must be taken to encourage payment of the remaining water fees and water saving by water users.

- (3) **Provide subsidy directly to WUAs.** This would give all or part of the water fee subsidy directly to the WUAs. Under comprehensive water fees, this could be used to defray farmer water fee costs. This subsidy should be used only in IDs where the WUAs are operated efficiently and the water fee is collected by the WUAs, and it is especially appropriate and easy for WUAs under the comprehensive water fee. This method may be used effectively in combination with the previous two methods, but it depends in part on improving WUA quality and capacity to handle the subsidy efficiently and correctly.
- (4) **Provide subsidy directly to farmer households.** This method would give the water fee subsidy directly to farmer households, is not widely applicable, is not preferred and would have to be carefully designed for each ID to ensure water saving and equity. However, this may be the only way possible in the locations without a State WSO or WUAs, and also in small hydraulic projects where the WUAs are weak.

Based on the study and investigations, Options (1) and (2) are considered the most feasible and preferred among the water fee subsidy methods, and are in line with the general international practice which can help justify public finance support. If the proportion of the State water fee in the total water fee is low and the burden of the water fee on farmers is not obviously reduced after the State water fee is canceled, the subsidy can be extended to the end-canal water fee also. Subsidizing of the end-canal water fee could also be done through Option (3) or possibly (4). In that case, Option (3) of providing the subsidy directly to the WUA should be the priority, and could be introduced starting with the WUAs with the good operation, pilot subsidy programs and extension based on the pilots; the basic requirement for this Option to work effectively in practice, however, is that WUAs must be effective and improved, especially in financial management. Option (4), direct subsidy to farmer households, should be used with caution as it may be counterproductive for WUAs and end-canal O&M. Whatever subsidy Option is chosen, it ideally should be essentially invisible to farmers, who would see their water costs reduced by the subsidy but not see the subsidy itself, and who would still have incentives to save water.

Chapter 7: Conclusions and Recommendations

7.1 Overview

The main conclusions of the study are that: (a) the comprehensive water fee is the preferred approach to irrigation water pricing in China; and (b) WUAs should be an integral part of end-canal water pricing reform based on the comprehensive water fee. The comprehensive water fee is preferred to the traditional two part State only water fees for both technical and institutional reasons. Furthermore, based on the study results, the two part water fee should be considered a transition to the comprehensive water fee. The State water fee type should be phased out.

The efficiency of WUAs is a critical factor for effective end-canal pricing reform and O&M, especially for the implementation of the comprehensive water fee. However, WUAs and WUA development will need to be strengthened and supported to enable WUAs take on this enhanced role effectively. Based on the results of this study and also PPRWRP and WPRP, WUAs need to be improved using standardized principles, like the Five WUA Principles under PPRWRP.

7.2 Findings

A. Water fee determination and collection by IDs and WUAs:

- 1) There is no unified or consistent system or method for agricultural water pricing in China. WUAs, water pricing methods and end-canal water pricing and management all vary substantially from region to region. The variation is partly due to water scarcity and local conditions and partly due to history and tradition, and it is a significant factor in designing policy for end-canal management and water pricing. However, the three types of water fee system used in the WUA typology for this study broadly represent the types of water fee systems currently used throughout China.
- 2) The proportion of the State water fee versus the end-canal water fee in the total water fee paid by the farmers also varies greatly among IDs. Based on both PPRWRP and WPRP WUAs, the end-canal water fee accounts for about 10% of the total water fee. The actual percentage depends largely on the WUA's alternative water sources and degree of dependence on the WSO. WUAs in the South generally have greater management independence and a higher percentage of end-canal fees in the total water fees paid as compared to the North. And most WUAs in the South have their own water sources, which reduces their demand for water from and dependence on the WSO, and also increases the WUAs' management scope while decreasing the WSO's. This gives WUAs in the South generally more independent decision-making authority compared to WUAs in the North, where WUAs are commonly more dependent on the WSO which usually has a monopoly on the water source(s).

- 3) The financial interests of the WSO and the WUA and public interest can sometimes in be direct conflict with regard to water saving. Under the ECMCs in Shanxi, the WSO requires the ECM to encourage the farmers to use more water because the WSO wants to maximize its income from water sales. Although the income of the WSO can be enhanced by this practice, it encourages water waste and conflicts directly with the need of society to save water, which is a critically important objective in the water-scarce North. Particularly in the Yellow River basin where water scarcity is severe, water delivery costs are relatively high and water saving is at a premium, such practices need to be identified and monitored carefully and evaluated by the government to prevent anomalies which are against the public interest.
- 4) To promote water saving, some IDs use a water quota system in which a farmer's water price increases if his water consumption exceeds a specified quota. However, the basic quota is usually the same throughout the same ID, and it does not distinguish between differences in irrigation facility conditions and soil types, which can vary greatly between WUAs and even within a single WUA. In areas with poor canal facilities, for example, much water is wasted, and it cannot be prevented by farmers. As a result, the quota system simply increases the fee burden on the farmers and provides a "windfall" source of additional revenue for the WSO, and it provides a financial incentive for the WSO not to improve the facilities and increase efficiency.
- 5) WUA's are the most appropriate organization to manage end-canal irrigation systems in China, and the end-canal water fee is the most important and rational source of funding for WUA costs for O&M and management of end-canal systems. Fair determination, standardized and equitable collection, and efficient use of end-canal water fees are essential for the sustainable development of WUAs and their long term survival, and indeed for high efficiency and returns from irrigation systems.
- 6) Although WUAs have a key role to play in improved end-canal water pricing and O&M, their ability to do so is currently relatively limited both by the extend of WUA development achieved currently and by the weak quality of many WUAs. The role, functions, property ownership rights and legal status of WUAs and their role in water fee (water price) determination, collection and management have in general not yet been established and standardized through policy support, laws and regulations. Although a general national guideline on WUAs was issued in 2005, there are no specific national WUA water laws or regulations on WUAs, and among the provinces only Hubei has issued a provincial WUA regulation (in 2009). Most WUAs rely on local "interim" policies for their legal support and only 40% of them are independent legal entities. Most have been established under villages' mandates and operate under the authority of the village committees. These and other limitations need to be corrected through improved WUAs.
- 7) The improved, standardized WUAs under PPRWRP are closer to the ideal quality, performed better than other WUAs and used comprehensive water pricing effectively and efficiently. All WUAs under PPRWRP (497 WUAs in 10 provinces) were based on specified uniform principles and criteria, and the incremental benefits from such WUAs

are very large, with project investment costs for WUAs recovered in less than six months. PPRWRP demonstrated the benefits, potential and methodology for expansion of improved WUAs on a large scale. WPRP absorbed PPRWRP's lessons and experiences, such as WUA registration, facilities ownership transfer, and specialized M&E, and is spreading them to additional areas. However, compared to the 50,000 WUAs already established, the project scale is very small, and it needs to be expanded substantially.

- 8) Some WUAs, especially in the Northeast, have no end-canal water fee system at all, have no stable source of O&M funds and are therefore severely constrained financially. Many of these WUAs may depend entirely on the local WSO to rebate a small part of the State water fee back to the WUAs. However, the State water fee includes no allowance for end-canal O&M costs and in most cases does not even cover the WSO's costs, so the WSO is unlikely to rebate to WUAs amounts sufficient to cover end-canal O&M costs.
- 9) Training and capacity building are key requirements for improved, standardized WUAs which provide large benefits to farmers and society and are needed to play an expanded and effective role in comprehensive water pricing. At present, no funds are included in government budgets for the training of farmers on WUAs or for the establishment of WUAs. Little or no funding is provided for training of irrigation staff and of local and village leaders and officials on WUAs matters. One reason for the success of WUAs under Bank-financed projects and under PPRWRP is that funding was allocated for these activities.

B. WUA water fees and their adequacy for end-canal O&M:

- 1) Farmer expenditures on water fees vary by region and are generally higher in the North compared to the South, in absolute value and also relative to the value of crops grown. Based on field investigation data and on average, the water fee paid by the farmers is RMB 60/mu (1 mu=1/15 ha), accounting for 4.08% of the total value of the irrigated crops. If the farmer labor contributed is added, the average value of the overall irrigation fee (water fee plus farmer's labor value) is RMB 78/mu, accounting for 5.13% of the total value of the crops grown. Farmer expenditures on water fees in the North are generally more than 5% of the value of irrigated crops, while the proportion is below 5% in the South.
- 2) WUA O&M internal costs, excluding cost for water supplied by the WSO, comprise mainly three parts: maintenance costs for irrigation facilities (55% on average for the sample WUAs), payment of personnel for management and operation (32%), and other WUA operating costs such as office expenses (13%). The proportion of these expenditures varies among WUAs. Farmers' labor input, such as for canal maintenance and cleaning, which is contributed to the WUA (with or without pay) is typically decided by mutual agreement among WUA members.

C. Methods of WUA water price determination and fee collection:

- 1) The two-part water fee has a number of serious shortcomings and weaknesses, and should be regarded only as a transition to the comprehensive-type water fee. It has been

somewhat effective mainly where the WSO supervises the use of the end-canal water fees collected, and where the water price, water volume received, and water fee for each farmer are monitored and publicized. However, these practices are not widespread, do not mobilize farmers, and are also difficult and expensive for the WSO, since it has no legal role in management of end-canal facilities.

- 2) The key weaknesses of the two-part fee are that: (a) WSOs have limited capabilities for collecting two-part water fees from each individual farmer household based on water measurement; (b) intensive water fee collection and water measurement by the WSOs is very expensive and difficult; (c) the WSOs themselves are generally starved for funds and therefore tend to retain as much as possible of any water fees they collect rather than transferring them to the WUAs for end-canal O&M; (d) water fee collection completely by the WSO does not promote farmer participation in the WUA and increased payment of water charges; and (e) rights and responsibilities of WUAs are not specified by law or regulations, which means that the WUAs' role in end-canal O&M, management and water pricing is not defined, also that the WUAs are at a severe disadvantage in dealing with the WSO, village and township regarding end-canal water fee determination and collection. Moreover, with two-part water fees, there is generally no water supply contract between the WSO and the WUA, and the legal relationship and respective rights and responsibilities between these two are not defined.
- 3) The lack of clear policies and regulations for setting end-canal water fees, similar to the current State water fee guidelines, generally results in insufficient water pricing to support adequate end-canal O&M and consequent financial difficulties for WUAs. Without such policies or guidelines, the local PB generally establishes the end-canal fee on the basis of ad hoc investigation with the primary objective of lowering the farmer's burden, or it may consider only the State water fee and exclude the end-canal water fee entirely. These general practices are followed in most IDs across China at present.
- 4) The role of the PB in deciding the end-canal water price and its method of specifying the end-canal water price vary by region and from place to place, and especially between the North and South. How tightly the government PB manages the end-canal water fee is related to both water scarcity and the farmers' expenses for water charges. In northern areas where water is scarce and costs are high, the PB generally sets a fixed price or flexible price (a price range) for the end-canal water price, sometimes expressed as a percent range of the total water price. In contrast, WUAs in the South generally have more independence to negotiate end-canal water pricing among their farmer members according to their needs since they usually have alternative water sources.
- 5) Many WUAs employ water measurement, which is required for volumetric water charges which encourage water saving by farmers. Water measurement and its location in WUAs is a key factor in water pricing, and varies substantially from region to region; it is practiced more intensively in the dry North and arid Northwest (e.g., Xinjiang), and less intensively in the South. For some southern WUAs, facilities to measure water received from the ID are in place but not used, often because they have alternative water sources. However, those WUAs cannot charge for water according to the amount of water used

and encourage efficient water use. Water measurement in Northeast IDs is rarely practiced.

- 6) Under the two-part fee, the State water fee and end-canal water fee are charged separately in some locations. The State water fee is charged directly from farmers by the WSO, and the end-canal water fee is charged by the village or the WUA, although in many places the village collects the end-canal water charge regardless of the WUA; in some cases the local WMS collects both fees on behalf of the WSO and retains them for use by the WUA upon application. Such practices not only increase the working load on the WSOs but they also fail to motivate farmers and WUAs and these practices do not ensure that WUA operating costs and end-canal O&M costs are met. Villages and townships also often collect water fees, but that often results in “leakage” of water fee revenue into other uses and should be avoided.
- 7) With regard to WUA water fee collection, some WUAs where WUGs charge farmer households directly do not supervise their WUGs adequately. For example, some WUAs in southern IDs seem mainly concerned for how much water charge is handed over from the WUG to the WUA, and do not monitor how much is actually charged from the farmer households. This practice sometimes results in additional charges beyond WUA costs, discourages farmer participation in the WUA and does not ensure coverage of WSO and WUA costs for irrigation services provided.
- 8) Regarding the management of the water fee, the end-canal water fee in some local areas is collected and managed by the WSO along with the State water fee, and the WUA has to apply to the WSO to use it. The WSO independently controls WUA expenses and financial management, and farmer households are not informed on how the water fee is used. This method is not transparent, discourages farmer participation and makes the WUA operate (and appear) as a branch of the WSO rather than the farmers’ own organization. This method may be useful at most only as a transition process when WUAs are new and WUA operations are not yet well established and still need WSO support, but the risk is that the WSO will not wish to give up control.
- 9) At present, calculation of the State water price for the WSO is based on WSO actual costs (including full capital cost recovery/depreciation as well as operating costs). Although the State water price approved by the PB is often lower than this actual cost, even that water fee amount is often beyond the farmers’ willingness (and probably ability) to pay in some areas. As a result, the water fee collection rate in those areas is generally quite low, the WSO has inadequate funds for O&M, and the main irrigation system efficiency is low. This situation causes both a heavy burden for farmers who do pay the fee, and also financial difficulties for the WSO.

C. Subsidy mechanism options for WUA water fees:

- 1) According to the farmer survey results, when the farmers’ water fee expenditures account for more than about 5% of the agricultural output value, the farmers feel it is beyond their willingness to pay. However, despite this attitude, the farmers’ actual willingness to pay seems to be more affected by the value of the crops and the amount of the water fee

relative to agricultural production value, rather than just the absolute value of the water fee or its percentage of the crop value.

7.3 Recommendations

A. Water fee determination and collection by IDs and WUAs:

- 1) The comprehensive water fee system should be gradually implemented throughout China, and the two-part and State only water fee systems should be phased out. This would require a policy decision at the State level, and policy and regulations (and budgets) to implement it at Provincial and lower levels.
- 2) WUAs have a key role in the comprehensive water fee system, and State and Provincial governments need to develop, fund and implement programs to develop, strengthen and improve WUAs to enable them to play that role. PPRWRP in particular demonstrated how to develop improved WUAs, and the lessons and experience from both PPRWRP and WPRP should be used to help guide design and implementation such programs. PPRWRP in particular showed that improved WUAs which were “standardized” based on specific quality standards and principles greatly improved WUA operations, governance, benefits and sustainability across a broad range of conditions and regions, and also demonstrated the role for such WUAs in implementing comprehensive water fees.
- 3) State and provincial governments (and lower levels) also need to provide coordinated policy and legal support (laws and/or regulations) for both end-canal water pricing reform and WUAs. This support should be designed to help improve WUAs nationwide, enable them to play a stronger and more independent role in end-canal water pricing and management, and help ensure that the end-canal O&M and management costs of WUAs are covered. Policy support should include giving WUAs independent legal status, specified powers, rights and responsibilities, and the right to determine charge and collect end-canal water fees. For comprehensive support of WUAs in the long run, a specific national law covering end-canal water pricing and WUAs together should be sought.
- 4) More immediately, a general regulation modeled after the Hubei provincial government regulation titled “*WUA Management Regulation of Hubei Province*” (2009) should be adapted to local conditions and issued by all provinces, and a similar general WUA regulation should be issued by the State. These regulations should incorporate the lessons and experience from PPRWRP, WPRP and this study, and in particular should give WUAs the right to determine and manage end-canal water pricing. To help guide this process, the implementation and impact of Hubei’s regulation should be monitored and evaluated.
- 5) Guidelines for calculating end-canal water prices based on WUA O&M and management costs (similar to the guidelines for calculating the State water fee) should be issued by State, provincial and lower levels as appropriate, in coordination with policy support for WUAs. Such guidelines should specify, among other things, that the end-canal water price/fee should be calculated by WUAs based WUA costs, determined and collected

from farmers by WUAs, and informed to government (PB and/or WSO) by the WUAs; and also that WUAs should collect the comprehensive water fee from farmer members, and pay the State water fee portion directly to IDs/WSOs based on water volumes delivered. This would help ensure that WUA O&M and management costs are covered, and also strengthen the WUAs' ability to deal effectively with concerned government agencies.

- 6) Governments at all levels should promote and facilitate registration of new and existing WUAs. Regulations under the Ministry of Civil Affairs have been issued to facilitate WUA registration and should be used. Registration has many advantages for WUAs, and in particular conveys "legal person" status under the law, strengthens the ability of WUAs to carry out comprehensive water fees, gives them greater independence to manage their own financial and irrigation affairs, promotes greater farmer participation, and enables WUAs to own property and have bank accounts.
- 7) In the interim before higher level policies and regulations on water fees and WUAs can be issued, local governments should issue their own WUA policies and regulations for end-canal water fees based on the above principles. Among other things, these local government policies and regulations should enable WUAs to implement comprehensive water fees and in particular determine and collect end-canal water fees from farmers based on their O&M and management costs. This is most urgently needed in IDs where WUAs at present have no suitable existing end-canal water fee system (e.g., have State only water fees).
- 8) To help strengthen WUA development, all domestic and international projects and programs involving end-canal irrigation investments should include a specific component for WUA development and support with funding and plans for improved, standardized WUAs based on PPRWRP lessons and experience. Such funding should be sufficient to cover at least the costs of training for farmers, staff and local officials; capacity building; WUA establishment; demonstration and extension WUAs; and basic monitoring and evaluation, as well as policy support. This should include investments under both MWR line and MOF/SOCAD.

B. WUA water fees and their adequacy for end-canal O&M:

- 1) The government should provide investment funding for WUAs to rehabilitate and improve end-canal systems, which would reduce WUA repair expenditures, leave more funds available for WUA O&M and personnel payments, save water and perhaps reduce the farmers' end-canal water fees and burden. Costs for major end-canal system repairs, rehabilitation, upgrading or expansion are generally beyond the farmers' willingness (and probably ability) to pay based on crop prices and net crop incomes, and should therefore be excluded from WUA costs used in calculating the end-canal water fee. However, farmers commonly contribute a part (say one-third, usually as labor) of the cost for such works, and in effect they are part "owner" of the works. WUAs should be directly involved in the planning, layout and construction stages of their end-canal systems on behalf of their farmer members.

- 2) The State should consider developing a “revenue stabilization” system for WSOs, which would stabilize WSO income during low water use years and help maintain reasonable water charges for farmers which are within their willingness to pay based on net crop income. In wet years, when water demand is low, the State should provide payments to the WSO. In dry years when crops consume more water, water fee payments by farmers to the WSO increase, the government payments could stabilize the cost of the State water fee for the farmer households. This type of payments system could be combined with a subsidy program for the State water fee.
- 3) The over-quota water fee policy and systems should be reviewed and revised to ensure they do not produce negative public good incentives, and revenue from over-quota water charges should be used to finance a “WUA water saving investment” fund rather than simply increasing ID revenues. Over-quota water fee payments should be used and managed by WUAs to establish and operate the water saving fund which would finance improvements in end-canal systems to save water and reduce future over-quota fees. Over-quota water fees should also be adjusted according to the condition of the end-canal systems and soil types, should not unfairly increase the farmers’ burden, and should not be used to increase WSO income (which produces perverse incentives for the WSO).

C. Methods of WUA water price determination and fee collection:

- 1) Under comprehensive water pricing, water fees charged by WUAs should be based on actual WUA cost conditions (e.g., pay scales, personal needed, equipment operating costs, condition of facilities, etc.) as needed to ensure adequate end-canal O&M and management, and should also cover the cost of water purchased from the WSO which should be treated as a WUA operating cost. All such costs should be included in WUA operating budgets on which water charges paid by farmers are based. Over time, WUAs should also try to accumulate a small, separate reserve account which should be set aside in their budgets for minor system repairs and emergencies.
- 2) Comparatively well-established, improved WUAs should manage end-canal water fee collection and use by themselves, upgrade WUA accounting management and water fee management, and they should be guided, supervised and audited by the farmer members and monitored by the local WSO/WMS or WRB, as appropriate. The WSO should support this process and help make the WUAs independent and self-managing, rather than promoting their continued dependence on the WSO. The collection and expenditure of end-canal water fees should be publicized to WUA farmers.
- 3) Charging and collecting water fees from farmers by organizations other than WUAs, such as villages, WSOs or contractors, should be avoided, and where possible no longer allowed.
- 4) Water charges to farmers should be based on measured water deliveries, and water measurement at WUAs should be expanded and strengthened. Water measurement is essential for implementing comprehensive water fees. It should at least be done at the WUA headgate(s) and used to calculate water fees for all the WUA’s members. Where

possible, water should be measured down to the WUGs to determine water charges for WUG members, and perhaps even down to each WUA farmer household for determining the household's water charges. Water measurement is especially important in the dry North and Northwest regions. But even in the wet South and Northeast regions, water fees should include the cost of the water delivered by the WSO to each WUA. Inside the WUA or WUG, each farmer may be charged according to his irrigation area, based in part on the cost of water delivered to the WUA or WUG.

- 4) The water fee process by WUAs should be transparent, and therefore water prices, water volume, and water fee costs for each farmer should be publicized and receipts issued to each farmer, as in Santun River ID in Xinjiang. In addition, especially for WUAs which charge water fees to farmers through WUGs, the WUG should provide the WUA with details on the payments made by each farmer household, and also provide payment receipts to individual farmers. Those payment details and payment receipts should then be compared by the WUA to ensure consistency between what the farmers pay to WUG and what the WUG pays to the WUA; this method was used effectively at Jingtang WUA in Tieshan ID in Hunan Province.
- 5) To help reduce the farmers' burden, WSOs should increase efficiency, control costs, and limit staff numbers according to State standards. The State water price should be based on the *Regulation on Water Supply Cost Supervision of Hydraulic Projects (trial)* (FA GAI JIA GE [2006] No. 301), and WSOs should staff and budget accordingly.

D. Subsidy mechanism options for WUA water fees:

- 1) The government should consider subsidizing farmer water fees based on the gap between the cost of water (State water fee plus end-canal water fee) and the farmers' willingness and also ability to pay. Farmer willingness to pay is based on both attitudes and ability to pay, which depends on net crop incomes (ability to pay was not investigated in this study). Both are important. If the fee exceeds the farmer's willingness to pay (say, about 5% of the crop value), many farmers may refuse to pay; and if it exceeds farmer ability to pay, many farmers will be unable to pay. Moreover, the subsidy method should be equitable, promote water saving and be limited to/incorporated into the water charge system as much as possible.
- 2) The study analyses suggest the following subsidy options in order of priority: (a) excluding depreciation costs (i.e., elimination of capital cost recovery) from the State water fee; (b) reducing or eliminating the State water fee and covering some or all of WSO operating costs from government finance, if the water supply cost after eliminating depreciation remains higher than the farmer's willingness and/or ability to pay; (c) subsidizing WUA costs directly, especially if needed for WUAs without a WSO upstream; and (d) providing a financial water fee subsidy directly to farmers, in areas without a WUA (not a preferred option). These options may be used in combination, and they should not eliminate incentives for WSOs to deliver water efficiently and for WUAs and farmers to save water. In addition, a major objective of WUAs is to make local irrigation management as self-financing and self-managing as possible, and subsidies

options should be chosen and designed to be consistent with that objective.

7.4 Next Steps

Next steps for follow-up need to support and integrate two general goals: (a) end-canal water fee reform; (b) WUA strengthening and improvement. For lasting success, these two goals and activities needed to reach them should be planned, coordinated and implemented together. In addition, enhanced democratic operation of WUAs is vital because it is essential for effective WUA self-management, self-pricing of water and operation and sustainability as an independent legal person, and it should be incorporated as key objective in WUA improvement.

The discussion below suggests a process of steps and some key activities that need to be undertaken to help attain the goals above. WMR has direct responsibility for the water resources sector and also for issues like comprehensive water pricing and WUAs. However, other agencies such as SOCAD and also MOF and NDRC also have strong interests in these topics, and they should therefore be closely involved in all aspects of the follow up process from the beginning.

Policy Workshop

To help raise awareness and start the process of follow-up, a high level policy workshop focused on the two topics above should be held. The workshop should target the concerned key policy-level officials at both the central and provincial levels. The main purposes of the workshop would be to present and disseminate the findings of the study research, which are highly original, and to obtain feedback on policy level views and how best to proceed. The workshop should also include selected presentations on end-canal water fee reforms to illustrate specific aspects of the study results, such as the introduction of comprehensive water pricing at Nantougong WUA in Xinjiang and long term operation of comprehensive water pricing at Jingtang WUA in Hunan. An important objective of the workshop would be to reach a consensus on the outline of an overall plan for end-canal water fee reform and WUA improvement which would, among other things, follow up on the study results.

Development of Concept and Program Plans

Based on that agreed outline, a brief concept plan should be prepared and disseminated for comment, and used for reaching general consensus and agreement on a specific program plan aimed at water pricing reform and WUA improvement. The program plan should also incorporate plans for water fee subsidies, based on the investigations of this and other studies. The program plan should also specify staffing, funding and other resources needed to carry out the plan. Bank and/or other international funding may be sought to support this process and implementation of the program plan. Given its long experience in China with WUAs and the agencies involved and its close involvement with the study, Bank involvement could provide substantial support for and a significant contribution in this process.

Water Pricing Reform Pilot Projects

A key follow-up activity would be to develop and carry out a series of comprehensive water fee reform pilot projects at selected IDs and sites across the country. Under the pilot projects, comprehensive water pricing would be introduced, improved WUAs would be established and/or existing WUAs strengthened, and where appropriate limited subsidies could be tested and applied. Overall these pilot operations would incorporate the extensive experience and lessons from PPRWRP and WPRP, as well as the specific results of this study. In particular, improved WUAs under the pilot would be “standardized” based on the “Five WUA Principles” developed and proved under PPRWRP and provided with appropriate policy support, adequate training and capacity building support, and a purpose-designed M&E system. The M&E system should in particular be designed to measure impact and benefits based on “with and without” conditions (i.e., incorporate control groups) as well as “before and after” conditions.

Some of the pilot projects should cover entire IDs or large sections of IDs. In those IDs and sections, the complete “WSO + WUA + Farmer” management system would be set up and used and comprehensive water fee-type, improved WUAs would be implemented (e.g., the WSO would charge the State water fee from the WUAs, and WUAs would charge the comprehensive water fee (the combined State and end-canal water fee) from the farmers. This should be carried out in all regions (especially North and South), and could be tried initially along canals covered by WUAs with large areas in selected IDs, where the results would be more meaningful than for a lot of small WUAs.

Follow-up Research

Another key activity would be follow-up research on water pricing based on the present study, incorporating the lessons and experience of this study but applying them over wider areas. A larger number of IDs, WUAs and farm households should be included, typical sites selected and more regions and sub-regions covered to give a representative sample of case studies as much as possible.

Initiating Program Plan Activities Early under WPRP

WPRB is currently ongoing, has funding and is closely related to the issues of end-canal water pricing and WUAs. To the extent possible, the findings, recommendations and suggestions above should be incorporated in WPRP activities. WPRP could in particular be used initially to carry out some of the pilot projects, based on the lessons and experience of this study as well as its ongoing activities. Since WPRP is ongoing, this would enable work on the pilot projects to start almost immediately and probably with limited incremental costs.

Based on the results of the pilot projects as well as this study, PPRWRP, WPRP and other sources and research, the detailed program plan for comprehensive water pricing should be revised, finalized and presented to the appropriate government agencies for follow-up and funding. This detailed plan could provide the basis for a project proposal for a Bank-financed project, which could combine water pricing reform with WUA development and appropriate hardware investments.

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Annex I: Literature Review and Existing Research on WUAs

The total irrigation water fee is (or should be) composed of the State water fee and the end-canal water fee, the latter to be used solely for O&M of the end- canal facilities.

For the pricing of the State water fee for ID main systems operation and management, the State government has issued special regulations on which much research has been conducted, such as Zheng Tonghan's *Lecture on Regulation of Water Supply Price for Hydraulic Projects*, which details the cost estimation, price formulation, collection and using of water fees for State hydraulic projects. In addition, there is also some research on irrigation water fees in which the research objective concerns the farmer's expenditure on water fees. For example, *Investigation on Farmers' Irrigation Water Consumption in Groundwater Irrigation IDs in North China*, by Liu Changshu, describes the water using situation, expenditure of the water fee as well as the influence of the water fee on the farmers. *Bearing Capacity of Irrigation Water Users and their Attitudes on Water Price Reform*, by Nian Zili, compared the expenditure of the water fee with the agriculture income, in order to estimate the water fee bearing capacity of farmers. *Discussion on Charging and Management of Water Fees*, by Liu Chenxia, analyzed the collection and using of water fee, pointed out the main existing problems and made a proposal to regulate water fee collection, using, and water saving compensation mechanism. Prof. Wang Zhinong made a five year study on farmer water fee expenditure, agricultural investment, and agricultural output, and analyzed the proportion of water fee compared to agricultural costs, to agricultural output, and to agricultural net income. Ms. Wang Jinxia made a study on groundwater user water fees in North China, and analyzed water price's effects on farmer's willingness to use irrigation.

In 2002, MWR organized a large-scale investigation on water prices in nearly a hundred large and medium-scale IDs, which mainly covered State hydraulic projects, focused mostly on the State water fee rather than the end-canal water fee. Based on the investigation, it was suggested that the management scope of the government should be extended to include the end-canal water fee, putting it under the government management purview. The suggestion produced a positive impact on solving the problems of irregular charges for the end-canal water fees which were common and severe at that time. However, this suggestion at the same time also reduced WUAs pricing authority for the end-canal water fees, and it is still on effect.

Up to now, the primary, relatively systematic source on the end-canal water fee is the *Research on Calculation of Water Supply Price of Hydraulic Project* by Zheng Tonghan and other researchers, who carried out investigation and research on the end-canal water fee in the northern regions (such as Shannxi, Hebei and Xinjiang), and advocated the concept of the farmer water fees based on measured water received by the farmer, in contrast to the traditional measure which is based on area irrigated. Suggestions have been also put forward for the cost estimation, pricing, collection and management of the end-canal water fee. They suggest strengthening government management and oversight of the end-canal water fee. However, at the time, research on WUA's role in water price making and collection was not sufficient to allow WUAs to be taken into account. Moreover, the research has been done only in northern regions, and the

research findings cannot fit the whole country.

The MWR Water Pricing Reform Project started from 2008, and is monitoring WUA water fee collection in 155 WUAs in 11 provinces. Large amounts of data on WUA water fees has been collected, such as related to farmer water price based on measured water volume, water measurement site, farmer's water fee expenditures, farmers' agricultural inputs and outputs, etc. Similar to the findings above, however, WPRP has found that the research findings for northern regions were difficult to use in guiding water pricing reform in the southern regions where conditions are much different. And there is a dearth of other research on end-canal water fees as related to WUAs.

PPRWRP carried out detailed monitoring and evaluation (M&E) for 497 project WUAs on water prices for project WUAs and on the water fee collection issue, such as State water price, farmer's expenditure on water, water fee collection unit, WUA expenditure, and WUA water fee collection rates. Large amounts of data on WUA water fees were collected. However, the M&E data did not cover the WUA water measurement location, water fee collection procedures, costs for WUA O&M, the role of different stakeholders in water pricing, etc. which were needed to evaluate WUA water pricing to cover end-canal O&M and management costs, water fees according to water volume, and other key questions for WUA water pricing.

PPRWRP itself played a major role in stimulating this study. In its closing years, it became obvious (and was documented) that even the PPRWRP WUAs with their strong policy and institutional support were facing major financial difficulties. This was primarily due to end-canal low water fee income which was insufficient to support adequate O&M and management for many WUAs.

In summary, there have been many studies on farmer's payment of water fees, as well as on the State water fee. However, there have been no studies which investigate the State water fee combined with the end-canal water fee, which together make up the total WUA water fee paid by the farmers; i.e., no studies which analyze and evaluate the State fee and the end-canal water fee together and its impact on farmers. Water cost estimation, water price formulation, water measurement, water fee collection, and water fee management are all different for these two prices, and there are few if any studies from this point of view and from the WUA perspective. Research on the composition (State and end-canal), price formulation, measurement, collection and management of the water fee for WUAs is rarely conducted, and the many aspects of the differences among the various regions have not been considered. Moreover, there have been no studies which combined this topic in relation to WUAs and their conditions, quality and needs. Therefore, it is very important to carry out the study of WUA water pricing from the view of the water fee components; i.e., of both the State water fee and the end-canal water fee. This approach can clearly show the water fee reforms needed both for end-canal water pricing and for WUAs, and the role of key stakeholders in water fee affairs.

Annex II: Policies and Regulations Related to Water Fees and Pricing

Key National Policies. The national level regulations and policies on water fees and water fees on which the research is based mainly include:

- *Management Regulation on Water Supply Price for Hydraulic Projects (2006)*. The description related to WUA water price: water supply price of the civil managed and operated hydraulic project should implement the Government Guidance Price. That means for the WUAs, as the subject of the civil hydraulic project, that the water price for WUA is not suitable to be carried out by the government; instead, it should be made by WUAs and guided by the government.
- *Notification on Strengthening the Water Price of the End-Canal*, issued by National Development and Reform Commission (NDRC) and MWR in 2005. It requires that the water pricing for the end-canal works brought into the scope of government management, to gradually promote water measurement in collection of the irrigation water fee, and make water price based on the farmers measured volume of water use. Water fees the end-canal should be calculated according to the O&M cost of the end-canal, and all the end-canal water fees should be used for the O&M of the end-canal facilities. Invoices for water fees supervised by the government should be issued to farmers when water fee is charged. Without the invoice, it shall be regarded as illegal collection, and the farmers have right to refuse payment of the charges. The end-canal water fee collections shall be shown publicly.

Under the above policy, different interpretations have been posed for the phrase “the water price of end-canal is brought into the price management scope of the government”. Some people think it means that the government is responsible for fee making for end-canal facilities, which is obviously inconsistent with the above *Management Regulation on Water Supply Price for Hydraulic Projects*. The study results indicated that “brought into the price management scope of the government” should be interpreted as a government decided variable price (a price range for end-canal water fees), and that the government can and should assign specific responsibility for end-canal water price management and fees to WUAs.

- *Regulation on Water Supply Cost Supervision of Hydraulic Project (trial)* (FA GAI JIA GE [2006] No. 301), issued by NDRC and MWR, the water supply cost monitoring of the hydraulic project refers to the responsibility of the PB to check the costs of water supply on the basis of investigating, measuring and reviewing the costs of the WSO. The regulation is applied to the State hydraulic projects and civil projects (including WUA). The policy shows that WUA water price is guided by the government; i.e., it is controlled by the PB.

Key Provincial and Local Regulations. Examples of the key provincial and local level policies and regulations on WUAs and end-canal water fees in the concerned provinces as used in the study are as follows:

- 1) *Water Fee Standard and Management Regulation of Hydraulic Projects*, Shanxi Provincial Government. It regulates not only the water price making of State-owned hydraulic projects, but also non-State projects such as individual WUA project. It

- specifies that the end-canal water fee shall be 15-20% of the total water fee.
- 2) *Regulation of Water Supply Price Management*, Jilin Provincial Government. It regulates only the water pricing for the State-owned hydraulic projects; the water fees for civil projects such as WUAs are not covered in the regulation.
 - 3) *Notification on Adjustment of Water Price of Hydraulic Project* (JI SHENG JIA GONG ZI [2002] No.8), by Jilin Province Price Bureau and Jilin Provincial Water Bureau. It only regulates the water pricing of the State-owned hydraulic projects, and the water fees for civil projects such as WUA are not covered.
 - 4) *Notification of Adjustment of Qianguo ID Water Supply Price*, issued by Qianguo County Government in 2006, which converted the State-owned water fee paid by the farmer to a volumetric water fee in accordance with the area conditions.
 - 5) *Regulation of Water Supply Price Management*, by Hubei Provincial Government. It regulates the water pricing of the State-owned hydraulic projects. It also specifies that township governments are excluded from water fee collection from farmers.
 - 6) *Regulation of Water fee Pricing and Management of Hydraulic Project*, by Hunan Provincial Government. It only specifies water pricing for the State-owned hydraulic projects, and the water fee for the civil projects such as WUA is not covered.
 - 7) *Regulation of Water Supply Price Management*, by Xinjiang Provincial Government. It only specifies water pricing for the State-owned hydraulic projects, and the water fee for the civil projects such as WUAs is not covered.
 - 8) *Proposals on Strengthening Supervision and Management of End-Canal Maintenance Fee*, by Xinjiang Water Bureau and Xinjiang Development and Reform Commission. It is the principal regulation for the price making process, water measurement, water fee collection, and use of end-canal maintenance fees.
 - 9) *On the Reply to the Execution of the Maintenance Fee Standard for ID End-Canal Systems* (CHANG ZHOU ZHENG HAN [2006] No.95), by Changji Prefecture Government, Xinjiang. It regulates (makes standard) the end-canal maintenance fee at RMB 0.024/m³, and it also makes regulates the measurement, collection and use of the end-canal maintenance fee.

Annex III: Detailed Description of Selected IDs, WUAs & their Water Pricing Systems

Two-Part Water Fee IDs and WUAs

Two-part Water Fee - Jiamakou ID in Shanxi

Summary Description of Jiamakou ID. Jiamakou ID is a large-scale ID pumping water from the Yellow River with irrigation area of 503,000 mu (33,500 ha). The water supply of the ID is purely for irrigation. The main crops in the ID are apples (80% of area) and cotton (15% area). The State WSO's management extends down to the inlet of tertiary canal, while below that, the "End-canal Management Committee" (ECMC) is established for the management of the end-canal distribution system. The ECMC is established based on the village and is not registered with CAB. It therefore cannot be a legal person with a bank account. The first ECMC was setup in 2000 and there are in total 155 through 2009. The diagram below illustrates the end-canal layout, water measurement point and position of the WSO and ECMC (see Diagram 3-1).

Jiamakou ID is different from other IDs under the study in that it has no registered WUAs for end-canal management but instead uses ECMCs. Jiamakou represents typical irrigation management conditions of North China, and it is therefore considered important for the study despite having no WUAs. The first ECMCs were setup in Jiamakou in 2000, having taken over from an end-canal contractor employed by the WSO, and by 2009 a total of 155 had been established in the ID. The ECMCs are established for collecting the water fee and for O&M of the end-canal system (tertiary canals in Jiamakou ID). The ECMCs are established based on the villages perhaps covering several canals, and they are not registered with the CAB and not legal persons. The service area of one ECME may include several canals. The members of each ECMC are selected by the farmers, and include the ECMC Director, End-canal Manager (ECM), and farmer representatives, and similar to a WUA, each ECMC has its own charter and regulations which govern its management and operation. The ECM is elected by farmers and hired and paid by the ECMC from the end-canal water fees held by the local WMS on behalf of the WSO. The ECM is responsible for supplying water to each household, charging water fees from each household, and ensuring canal operation and maintenance. The ECMCs are unregistered water user organizations established by a village, are independent of the WSO, and are similar to the unregistered WUAs which are under village control and which are common in northern IDs.

The water pricing method in Jiamakou ID based on ECMCs is also typical of many IDs in the North. The ECMC and village are responsible for determination of the end-canal water price (within the scope of government guidance), making a budget for use of the end-canal water fee, and making and carrying out the end-canal maintenance plan. Jiamakou ID was the first northern ID to implement the "three publics"; i.e., to publicize the water price, water volume and water fee for each farmer household, a practice which has since spread to many IDs in other northern provinces, like Shaanxi, Hebei, and Xinjiang.

Although an improvement over traditional end-canal management, the ECMC suffers from shortcomings similar to unregistered and/or village WUAs under the two-part water fee system, and from significant problems related to sustainability of end-canal water pricing, in particular:

management of the end-canal water fee (both use and amount of the fee) is done by the WSO instead of by the ECMC itself; the ECMC is not registered and therefore is not a legal person and cannot own property, sign a contract or have a bank account; and farmer participation and “ownership” in irrigation and canal management are very weak or non-existent. The problems faced by ECMCs in Jiamakou ID in Shanxi are common among unregistered WUAs or village WUAs elsewhere and can provide lessons on problems to avoid for similar IDs in the North and elsewhere.

Since the overall objective of the study is to help promote sustainable end-canal water pricing for all types of WUAs, ECMCs have been included and treated in the study as WUAs, although they are not WUAs. For ECMCs to carry out sustainable end-canal water pricing, they will need to improve and resolve their problems through registration and increased farmer participation, for example, similar to the improvements and strengthening needed for unregistered/village WUAs. The study provides guidance on what needs to be done to improve both unregistered/village WUAs and ECMCs. Including the Jiamakou ID ECMCs in the study does not imply agreement with the concept of unregistered ECMCs, or unregistered/village WUAs, but the ECMC experience does provide useful lessons for improving WUAs and end-canal water fees, and those should be identified and disseminated to help promote improved WUAs and sustainable end-canal water pricing.

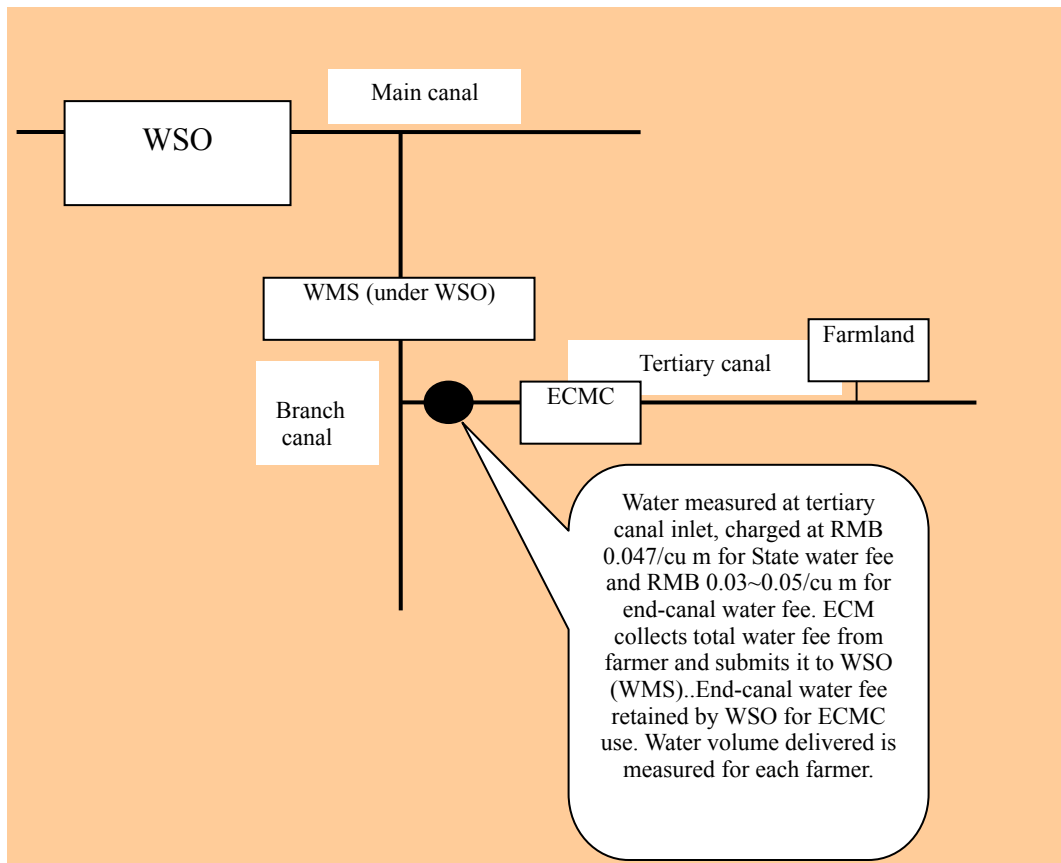


Diagram 3-1: End-canal System Layout in Jiamakou ID

Current Water Pricing and Fee System at Jiamakou ID. The water price in Jiamakou ID is a two

part water price, separated into the State water price and the end-canal water price. The State water price is determined by the WSO and approved by the government PB. The existing State water price is RMB 0.47/cu m with the measurement point at tertiary inlet. According to estimates in 2006 the total cost of the water supply by the WSO is RMB 0.62/ cu m, comprising depreciation of RMB 0.11/cu m and O&M cost of RMB 0.51/cu m. Based on these estimates, the cost of WSO water substantially exceeds the implemented water price of RMB 0.47/cu m and also exceeds the estimated costs excluding depreciation (i.e., for O&M alone). Although actual O&M costs may to some extent be overestimated because of excess staff, high legacy costs, inefficiencies, etc., it is likely that even the high water fee at Jiamakou leaves the WSO itself short of funds to cover O&M.

The end-canal water fee usually refers to the tertiary canal system O&M and management fee. At Jiamakou, some villages also include the pumping cost and the end-canal rehabilitation fee in end-canal fees. In accordance with *Water Fee Standard and Management Regulation of Hydraulic Projects*, the water price for the end-canal should be as much as 15-20% of the total price, but the actual end-canal water price implemented in Jiamakou ID is RMB 0.03-0.05/cu m, which is only 6%-10% of the total water price. The end-canal water price is determined by the ECMC first and then announced to the water users, and then reported to the PB for backup after review by WSO in the ID. The end-canal water fee is composed of the water distribution fee, canal maintenance fee, office cost, repair fee and mud cleaning costs, etc.

The total water price actually paid by the farmer users is: State water price (RMB 0.47/cu m) + end-canal management fee (RMB 0.03-0.05/cu m) + end-canal rehabilitation fee (part villages) + pumping fee (part village). The State water fee is charged and collected by the WSO; the end-canal water fee, rehabilitation fee and pumping fees are charged and collected together by the ECM who is employed by the ECMC and the WSO. These fees are managed by WSO. Water volume is measured at the farm canal inlet and charged according to the cu m. The diagram below illustrates the composition and use of water fees (see Diagram 3-2).

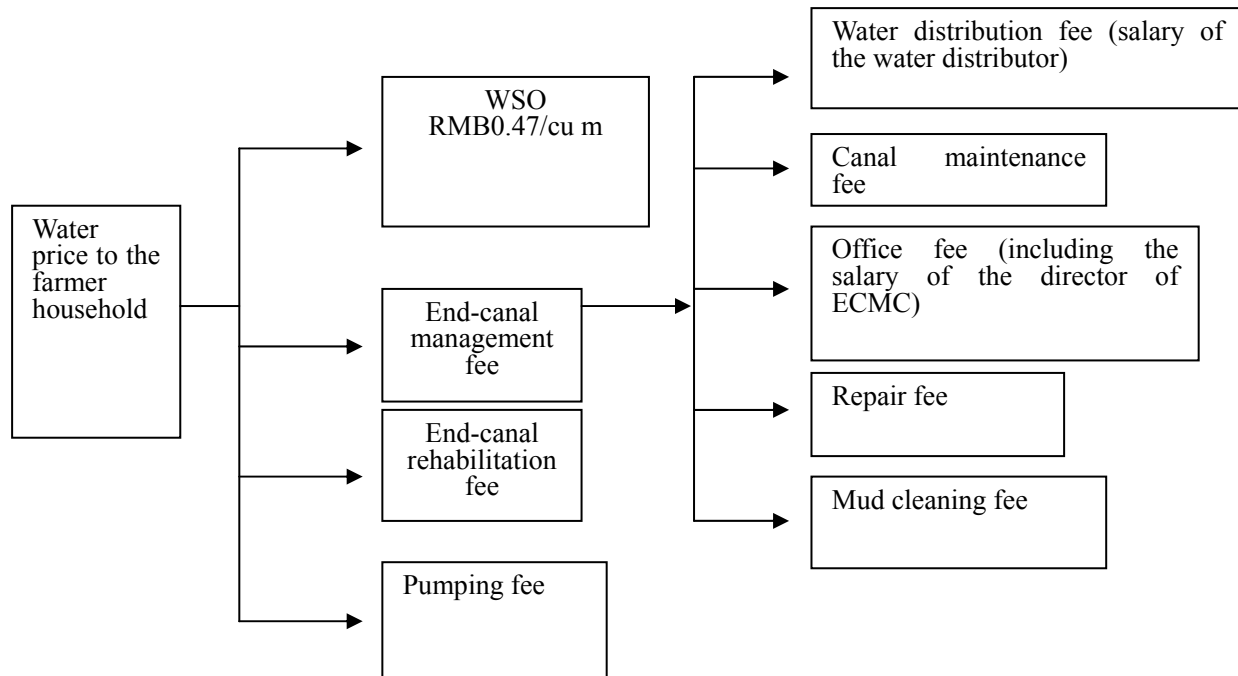


Diagram 3-2: Diagram of Composition of Water Fees in Jiamakou ID

Water Fee Charging and Management at Jiamakou ID. The water fee at Jiamakou ID includes the State water fee and the end-canal water fee (plus pumping and rehabilitation fees where appropriate) which are collected together. Water fee charging, verification, and publicizing are carried out for each round of irrigation. The collection procedure for the water fee for each round of irrigation is as follows:

The ECM compiles statistics on the water demand of each household and then pays to WSO's WMS a specified part of water fee in advance to buy the water ticket prior to irrigation application. The WSO pays the ECM a fee of 1% of the advance water fee paid by the ECM as an in partial payment to the ECM for his services (based on 1% of the State water fee).

The ECM receives water at the tertiary inlet (ECMC headgate) using the water ticket and is responsible for distributing water to each household. After using water, the farmer household signs on a Water Using Table to confirm with the ECM the water volume received and the water fee to be paid.

After irrigation, the ECM takes the confirmed Water Using Table to the WSO WMS to print the water fee invoice for each farmer, and then charges and collects the water fee from the farmer household according to the water fee invoice.

After collecting all water fees, the ECM settles the water fee balance due which is paid to WSO's WMS. A surplus is returned to the farmers and a deficit is paid by the farmers.

After each round of irrigation, WSO's MWS announces publicly the water price, water fee and water volume of each farmer household.

The State water fee is submitted to the WSO by the WMS. The end-canal water fee, end-canal rehabilitation fee and pumping water fee collected by the ECM are paid to the WMS and managed by it. Each WMS has a general account of the end-canal water fee and separate accounts for each ECMC. The diagram below illustrates this process (see Diagram 3-3).

The ID has implemented farm-gate water pricing and issuing of water invoices directly to individual farmer households, which is a significant innovation. An information inquiry system by telephone or touch screen computer is setup in the villages or WMS for farmers to check their water fees. The collection rate of the water fee in Jiamakou ID has been 100% since 1998.

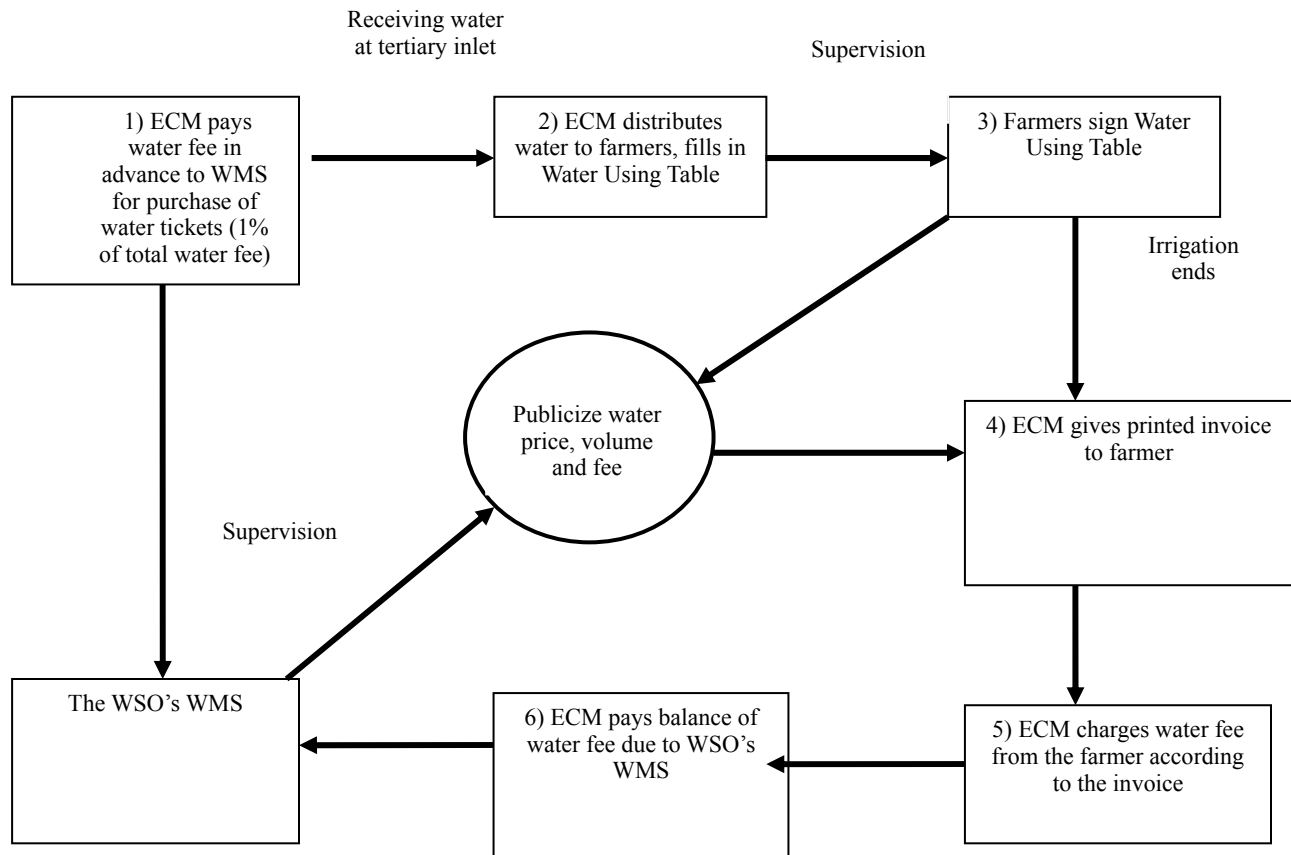


Figure 3-3: Diagram of Water Delivery and Charging in Jiamakou ID

The end-canal water fee is managed by WSO's WMS and used by the ECM directly. It includes the labor fee for water distribution, canal maintenance fee, office costs, repair costs, and canal mud (obstacle) cleaning costs, and for some villages also includes the pumping fee and rehabilitation fee. The procedure to apply for use of the end-canal water fee is as follows: the ECM applies for fee to the ECMC, which then reports to the WMS for review (with any relevant expenditure invoices attached). The WMS reports to Jiamakou WSO for approval, and then pays the amount approved to the ECM. This process is illustrated in the diagram below (see Diagram 3-4).

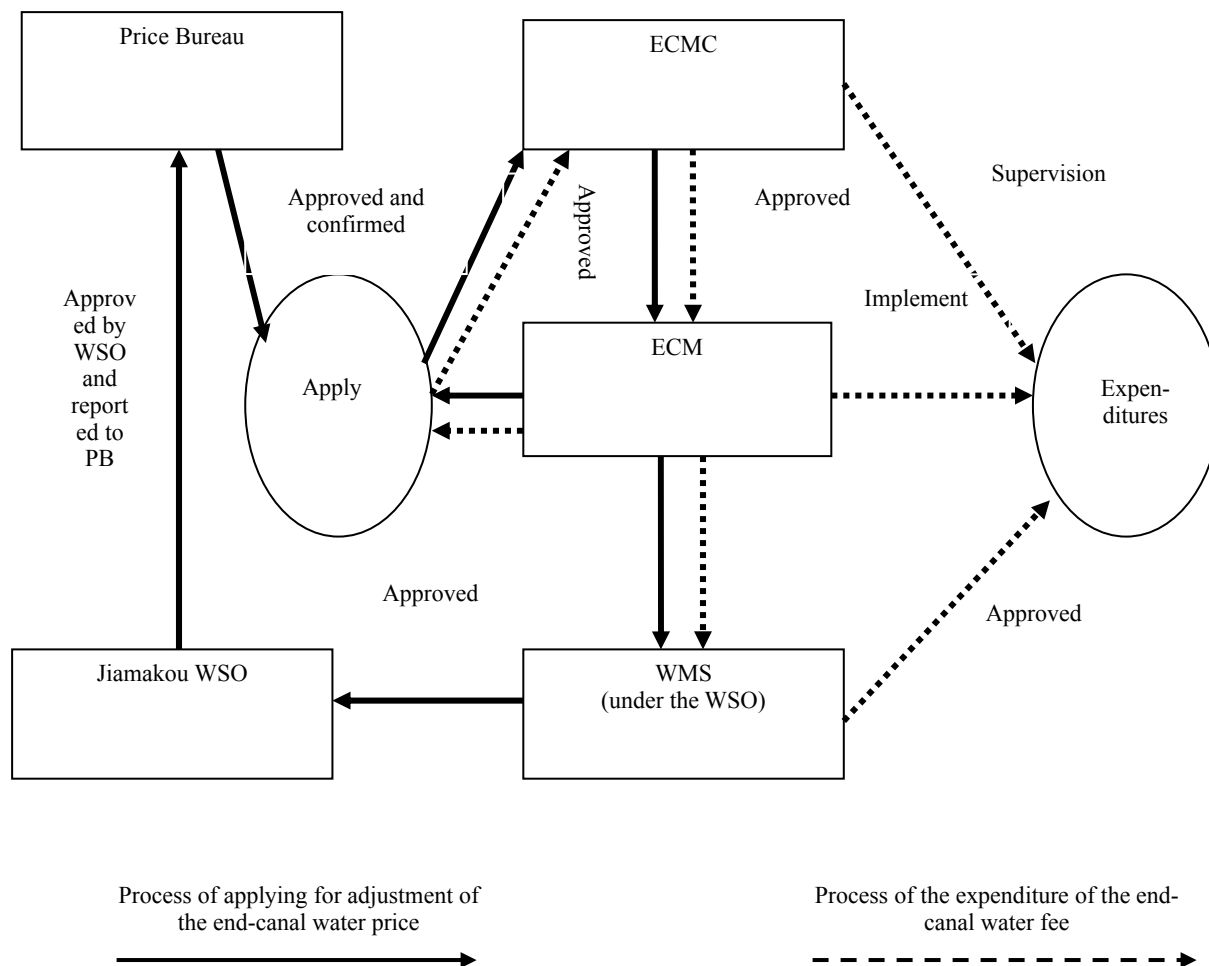


Diagram 3-4: End-canal Water Fee Determination and Cost and Expenditure Process

Two-Part Water Fee – Santun River ID in Xinjiang

Summary Description of Santun River ID. **The irrigation area of Santun River ID is 776800 mu (51,800) including a large PLA Farm. The local (non-PLA Farm) irrigation area is 470,000 mu (31,300 ha) of wheat, corn, cotton, and tomato. 38 WUAs have setup since 2005, among which 33 were setup under the PPRWRP project; WUAs cover 100% of the local irrigated area (excluding the PLA Farm).**

Santun River ID is managed by Changji City and a special river basin WSO has been established – the Santun River Basin Management Office. The WSO is responsible for the Santun River reservoir, head works, main canal. The branch canal is jointly managed by WSO and the town, although the property ownership of the branch canal is not clear. The O&M expenses of the branch canal are not included in WSO costs and budgets. All this means that the management responsibility of the branch canal is not yet clear. Water is delivered to the WUAs at their tertiary canal (end-canal) headgates, and the downstream canals are managed by the WUAs. After the personnel of township WMS were transferred to the WSO, the water measurement

point was moved to the inlet of the tertiary canal for measurement of water delivered to each WUA. Canal management responsibility and canal layout and water measurement are illustrated below (see Diagrams 3-5 and 3-6).

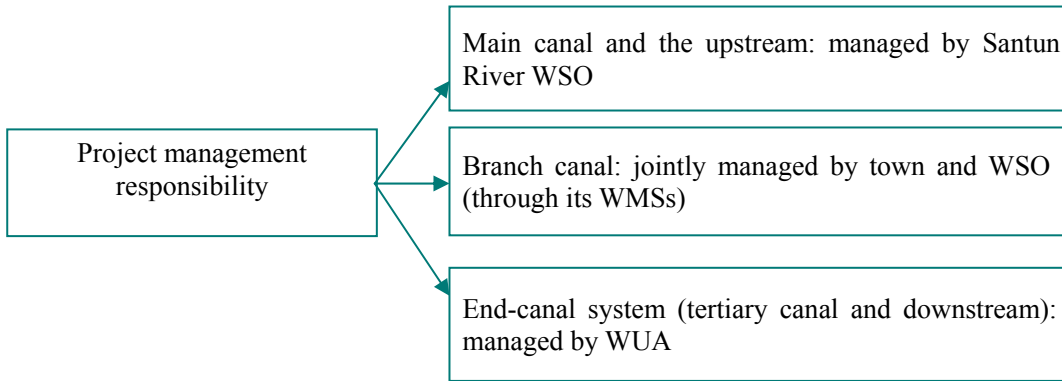


Diagram 3-5: Canal System Management Responsibility in Santun River ID

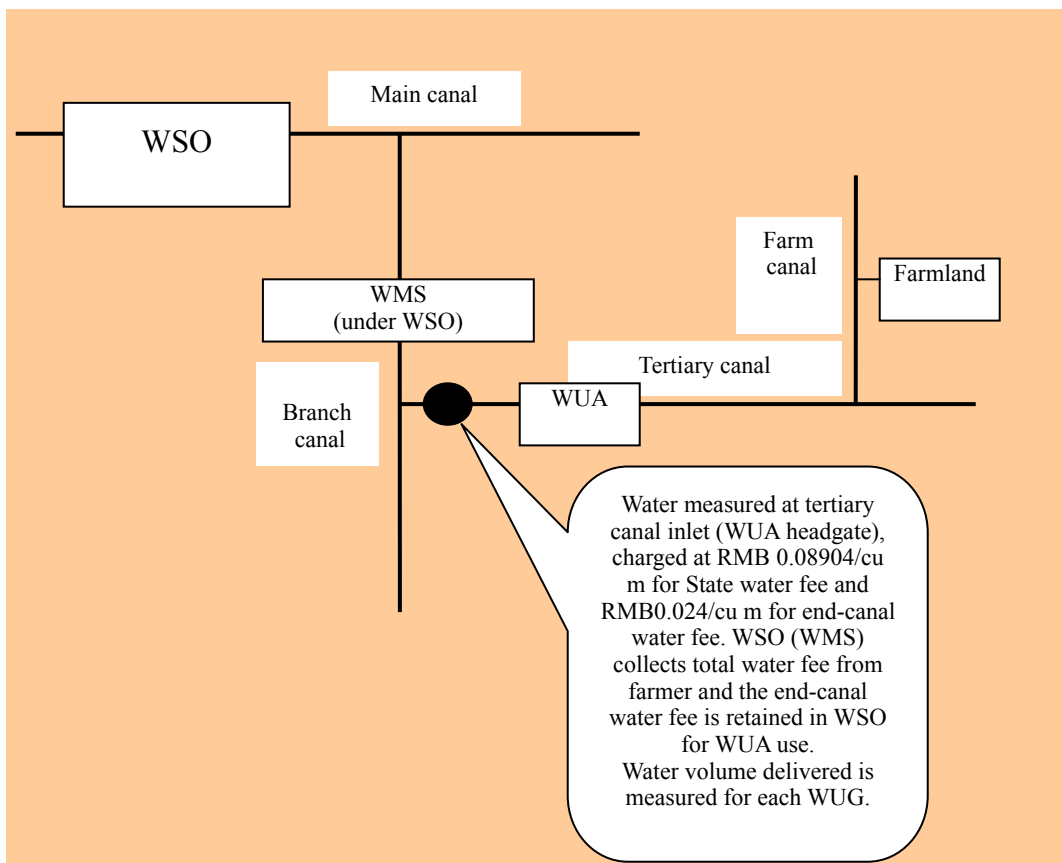


Diagram 3-6: End-canal System Layout at Santun River ID

Water Pricing in Santun ID. The State water price has been fixed at RMB 0.08904/cu m since

2005 measured at the WUA headgate (tertiary inlet). In addition, the ID implements water volume quota management and progressively increases the charge for exceeding quota. The quota is 480 cu m/mu over the whole ID based on water volume measured at tertiary inlet, and 1.5 times the standard price will be charged for exceeding the quota; i.e., RMB 0.134/cu m. Additional land in addition to land under household contract is also charged at RMB 0.134 Yuan/cu m. According to the document *On the Reply to the Execution of the Maintenance Fee Standard of ID End-canal System* (CHANG ZHOU ZHENG HAN [2006] No.95), the end-canal water price has been fixed at RMB 0.024/cu m since 2006. The water charge paid by farmers totals RMB 0.11304/cu m if within quota or RMB 0.174/cu m if over quota. Water fees amounts are illustrated below (see Diagram 3-7).

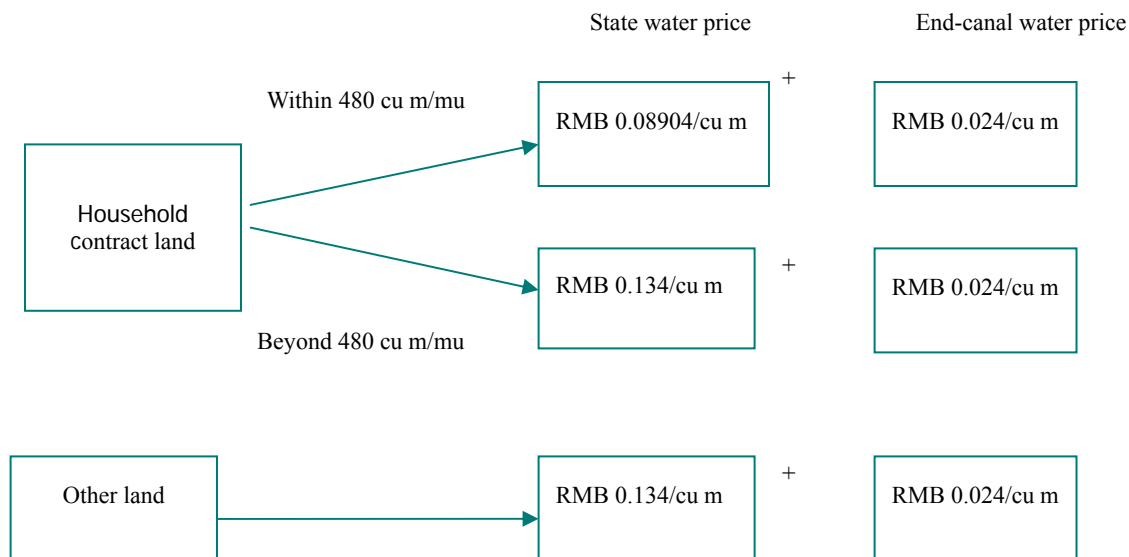


Diagram 3-7: Composition of Water Fee in Santun River ID

The overall cost of the WSO was RMB 0.148/cu m in 2008, including an irrigation O&M and water delivery cost of RMB 0.09/cu m. The actual cost of end-canal O&M is estimated RMB 0.027/cu m.

Water Fee Charging and Management in Santun ID. Generally, rotation irrigation is used in the WUA; water volume is measured to each WUG by the WSO and WUA water distributor together. The water volume for each farmer is estimated according to his irrigation area in the WUG.

Based on that estimate, the State water fee is directly collected from the farmer household by the WSO through its fee collection office that is set up in each township and WUA by WSO. Before each round of irrigation, the farmers pay the water fee in advance, and the WSO issues a “non-tax income invoice” (type of receipt) to the farmers. The WSO submits the State water fee to the local Finance Bureau which provides the WSO budget funds.

The end-canal water fee is collected together with the State water fee by the WSO. The WSO issues a special invoice for payment of the end-canal water fee to the farmers (invoice is

supervised by the WSO and stamped by the WUA). The end water fee is deposited in the WUA bank account.

The procedure for use of the end-canal water fee is as follows: the WUA makes application for use of the end-canal water fee after “one issue, one discussion” (a method of democratic discussion and decision making among the WUA farmers) among the farmers. The application is approved by the group leader of the village financial group, village secretary, WUA chairman, and director of the WSO’s WMS. Expenditures of more than RMB 2,000 need to be approved by the vice mayor of the town. The WUA pays RMB 600 to WSO’s WMS annually for the management of the end-canal water fee.

Santun River WSO has established a computer system to record and manage the water volume and water fee for each household for each round of irrigation. Each WMS can contact with the central management station in WSO by means of a network to monitor and revise data.

After each round of irrigation, the WSO prints the list showing water consumption by each farmer household and send to each WUA for public posting; the list includes water volume and water fee paid for each farmer household. Water fees and the fee collection process are illustrated below (see Diagram 3-8).

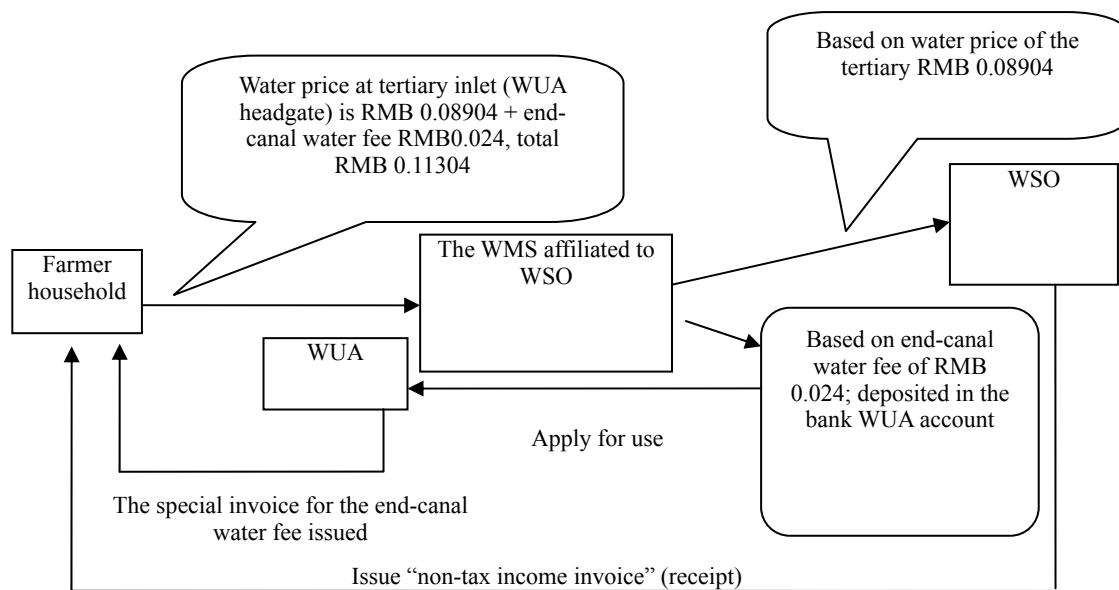


Diagram 3-8: Water Fees and Collection Process in Santun River ID

Comprehensive Water Fee IDs and WUAs

Comprehensive Water Fee -Toutun River ID, Nantougong WUA in Xinjiang

Summary of Description and Water Pricing for Toutun River ID. **Irrigation area of Toutun River ID is 420,000 mu (28,000 ha), which is composed of east and west parts. The WSO - Toutun River Basin Management Office - is affiliated with Xinjiang Provincial Water**

Resources Bureau.

The WSO manages the main canal and upstream while the branch canal and downstream are managed by water users. The eastern ID is mainly covered by the Army Farm and managed as an enterprise, while the western part is held and managed by local farmers.

The WSO has two classes of water supply management. In the east ID, the WSO distributes the water to different farms (sub-farms of the large Army Farm) and the farms distribute water to their users. The water price is RMB 0.0540/cu m which is approved by the Provincial Development and Reform Committee (Planning Commission). The internal secondary (end-canal) water price within the farms is determined by the different farms and ranges from about RMB 0.15/cu m to RMB 0.2/cu m. In the eastern ID, the farms more or less take the place of WUAs and are managed as an integrated enterprise.

The western ID is the local farmer's ID. Four WUA have been established in the western ID, covering area up to 64% of total area there. The water fee management method in areas there is a WUA is: WSO + WUA+ farmer; the management method in areas without a WUA is: WSO + town WMS + village + farmer. The State water fee is RMB 0.054/cu m (same as for Army Farms) and the end-canal water fee is RMB 0.02/cu m, and both are measured at branch canal inlet (WUA headgate). The total water price is RMB 0.074/cu m. Established in 2004, Nantougong WUA became a pilot project of MWR WPRP on reform of water pricing in 2008 (see details below).

After the WUA was established, it became responsible for the management of the branch canal. The WUGs under the WUA manage the tertiary canals and the beneficiary farmers are responsible for the farm canals by segments. The WUA distributes water from the branch canal to WUG on the tertiary canal, and then the WUG distributes water to farmer households. The end-canal water fee is collected and managed by WSO, and is deposited in an independent bank which is owned by the WSO. The end-canal water fee is also charged with for income tax by the WSO. Because of the income tax, the WSO is reluctant manage the end-canal water fee, but the government has required it to do so.

Where the WUA is not established, the local town WMS undertakes the task of branch canal management, and the village is responsible for the tertiary canal, while the farm canal is managed by the beneficiary farmers. The water is distributed from the branch canal to the tertiary canal by the town WMS, and the village distributes it to the farmer household. 45% of the end-canal water fee is spent for O&M by the town WMS, and remainder by the villages.

Summary Description of Nantougong WUA. Located in Sangong Town of Changji City, Nantougong WUA was established in 2004 and has been a pilot project for the MWR WPRP from 2008. The WUA covers the whole village and 9 WUGs have been setup with an irrigated area of 19,000 mu (1,267 ha), 624 household and 3,125 people. The main food crops are wheat, corn, tomatoes, cotton and grapes.

The end-canal system in the WUA comprises the upper and lower branch canal systems. There are five tertiary canals and 30 farm canals in the upper branch system, while the lower branch consists of four tertiary canals and 26 farm canals. The overall length of the branch, tertiary and farm canals in the WUA is 97.5 kilometer. The branch and tertiary canals and part of the farm

canals are lined.

The annual water consumption of the WUA was 9.74 million cu m on average from 2004 to 2007, of which, 6.79 million cu m was supplied by the WSO, while other 2.95 million cu m came from industrial sewage and floods in spring and winter. In 2007, the average water consumption measured at the branch canal inlet was 464 cu m/mu, and the farmers paid a total water fee of RMB 34.8/mu on average.

Water Pricing in Nantougong WUA. According to (XIN JI JIA FEI [2002] No. 668), the water price of the farmers in Toutun River ID is “State water price + end-canal water price” and the end-canal water price is required to be RMB 0.02/cu m and measured at farm canal inlet. However, due to the lack of measurement facilities at the farm canal, the actual measurement point is the inlet of the branch canal, and the total water price at that place is RMB 0.074/cu m (the State water price RMB 0.054 plus the end-canal water price RMB 0.02). In 2009, as the pilot project of MWR WPRP, Nantougong WUA implemented a water pricing reform, which included: calculation of the end-canal water price according to WUA O&M cost, measurement of water and water charging at the farm canal inlet, and combining of the end-canal water price at farm canal inlet with State water price at branch canal inlet together into a single “comprehensive water price”, which is what the farmer pays. Based on cost accounting, the end-canal fee for water measured at farm canal inlet is RMB 0.0253/cu m, the State water price at the farm canal inlet is RMB 0.0635/cu m, and therefore the comprehensive water price at farm canal inlet is RMB 0.0888/cu m. Canal layout and water pricing and charging at Nantougong WUA are illustrated below (see Diagram 3-9, below).

In 2008, the Provincial PB and Provincial WRB organized a hearing on the comprehensive water price, and RMB 0.082/cu m was finally approved (measured in the inlet of the farm canal). Thus the actually implemented end-canal water price is RMB 0.0185/cu m in the inlet of the farm canal, which is lower than calculated value based on costs of 0.0253, while the remainder fully covers the real estimated cost for the State water price of RMB 0.0635 measured at the farm canal inlet, above. The effect of the price approved by the Provincial PB is actually to reduce the end-canal water fee and leave the State water fee unchanged. Reduced income will reduce funds available for O&M of the end-canal facilities under the WUAs. This situation is likely to bring financial and operational stress on the WUAs and make them unsustainable in the long run), and it needs to be revisited to ensure that WUA end-canal costs are covered.

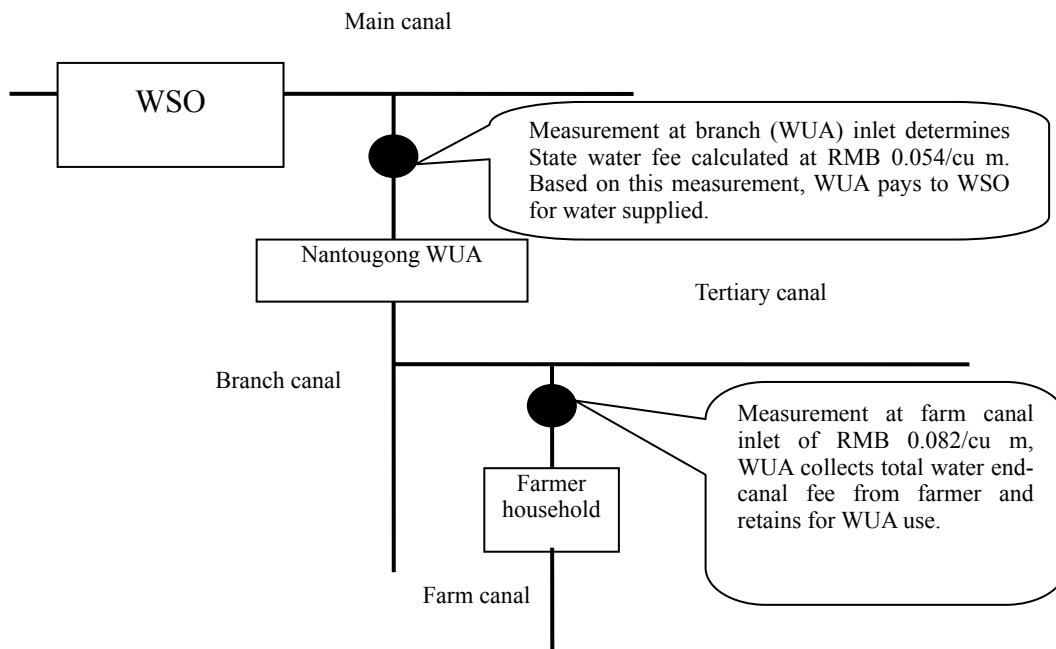


Diagram 3-9: Canal Layout and Water Pricing and Charging at Nantougong WUA

Water Fee Charging and Management in Nantougong WUA. As the WPRP project planned, after the water pricing reform was implemented, water pricing has changed. Originally, the water price was RMB 0.074/cu m at the branch canal inlet would be changed into RMB 0.082/cu m at farm canal inlet which is the water priced to household measured directly. This may or may not increase the per mu cost of water to the farmer depending on canal and other water distribution losses.

The water fee collection procedure is as follows: WUA pays water fee to WSO by volume measured by WUA and WSO together at the branch inlet (WUA headgate) at the rate of RMB 0.054/cu m. WUA charges water fee from farmers by volume measured by WUA water distributor and farmer at farm canal inlet of RMB 0.082/cu m. The difference has to cover water losses and WUA costs.

Farmers have to pay the water fee prior to each round of irrigation. The WUA give a special invoice to the farmer household for payment of the water fee in advance (at the rate of RMB 0.082/cubic meter to be measured at the farm canal inlet). The State water fee portion (RMB 0.054/cu m, measured at the branch canal inlet) and deposited in the WSO bank account which must be balanced and finalized by the end of the year. The end-canal water fee (RMB 0.0185/cu m, measured in the farm canal inlet) is deposited in the independent bank account of the WUA and managed by the WUA. Both accounts must be balanced at the end of the irrigation year since prepayments were based on estimated water deliveries.

The Water Using Table is used by each farmer and WUA to record irrigation time of each round

of irrigation, and water volume is calculated by time and water flow in order to calculate the water charge for each household. The process is illustrated below (see Diagram 3-10).

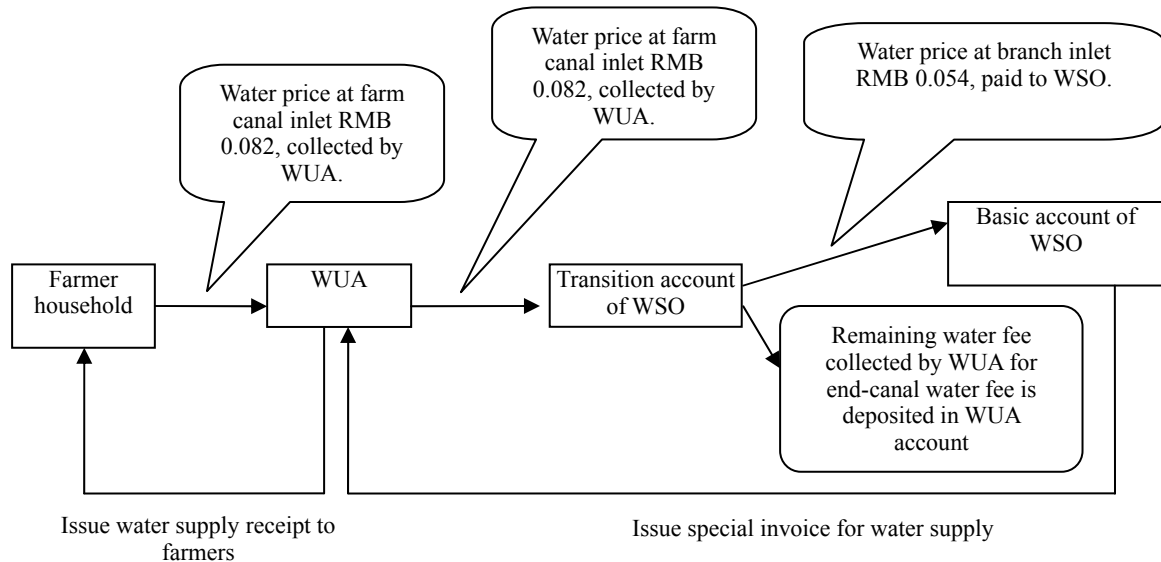


Diagram 3-10 Water charging process and flow of funds in Nantougong WUA

Comprehensive Water Fee - Tieshan (Large-scale) ID, Jingtang WUA in Hunan

Summary of Description and Water Pricing in Tieshan ID. Tieshan ID in Yueyang City has irrigation area of 950,000 mu (63,300 ha). Tieshan ID was one of the first two IDs in China to set up WUAs in 1995, and also was a demonstration ID for PPRWRP. Starting in 1995, Tieshan WUAs were originally set up in North Tieshan under a Bank-finance project and eventually covered most of the North Tieshan area. Based early success with WUAs in North Tieshan ID, the WSO started setting up WUAs in the South Tieshan ID in 1998. 60 WUAs have been established in Tieshan ID covering an irrigation area of 368,000 mu, which accounts for some 40 % of the total ID irrigation area and includes most of the North Tieshan area.

Canal systems in Tieshan ID are managed at different levels. The Tieshan Water Supply Project Management Bureau (Tieshan WSO) is responsible for the reservoir, North and South general main canals, and five main canals (two main canals in Yueyang County are managed by the Yueyang County WSO). The branch canals and the downstream project canals are managed by WUAs or the local town, with more WUA management in North Tieshan. Water fee collection methods vary, and three methods are most commonly used depending on location:

- Tieshan WSO → Yueyang County WSO → town (or WUA) → farmer household.
- Tieshan WSO → WUA (according to the water volume or area) → farmer household.
- Tieshan WSO → town (according to the water volume or area) → farmer household.

Water fee charging is different for North Tieshan compared to South Tieshan. Not all of the WUAs in the ID charge water fee; instead, some township WMSs do that. Some township WMS entrust the WUA to charge water fee and pay to the WMS, then the WMS will return part of the water fee to the WUA for end-canal O&M. Since the northern ID was constructed quite recently (completed in 2000) and under a World Bank, the management system introduced that the WUAs should charge can collect the water fee; therefore, in North Tieshan, very few towns charge the water fee. In contrast, South Tieshan has been in operation for a very long time, and more towns charge the water fee directly, which is the traditional method and a difficult habit to break. According to the investigation, among all the established WUAs for North and South Tieshan together, only 40% of the WUAs charge the water fee while for the other WUAs the water fee is charged by the town or village. In the North 13 out of the total of 19 WUAs charge and collect the water fee, while in the South it is a smaller proportion, 13 out of 41 WUAs.

Summary Description of Jingtang WUA. Jingtang WUA is located in the downstream reach of Bengshan Main Canal within the boundary of Gangkou Town in Yueyang County. The WUA was established on September 18, 1998 as the first WUA in South Tieshan and was particularly intended to promote the spread of WUA development from North Tieshan to South Tieshan. It was also a water-saving demonstration WUA in Yueyang City, and was later used as a demonstration WUA under PPRWRP because of its exceptional performance.

The WUA covers four administrative villages, 37 farmer groups (WUGs), 972 beneficiary farmer households, 3632 people, 4,800 mu of paddy land and 650 mu of dry land, and plants two crops of rice as well as watermelons, vegetables and other economic crops.

The WUA water system and facilities are as follows: there is a diversion canal for the WUA to divert water from Bengshan Main Canal. At the diversion inlet (WUA intake headgate), the WUA and Yueyang County WSO measure water for payment of the water fee. The diversion canal connects to Jingtang Reservoir (1.5 MCM storage) and Qitang Reservoir (less than 1 MCM) and diverts the water bought from WSO to these two reservoirs, which are both under WUA management. The WUA owns and manages the middle, eastern and western three main canals below the reservoirs with the overall length of 7,500 meters (all with U-shape lining). Below the main canals, 13 branch canals are owned and managed by the WUA and 108 farm canals are managed by the farmers; these canals have an overall length of 33,700 meters. Two small reservoirs, 87 ponds and 3 pump stations are also owned and managed by the WUA. The WUA is managed by different levels with clear responsibilities specified.

Jingtang's management and WUA operational regulations are more detailed and clear compared to most other WUAs. They provide a good example for other WUAs to learn from. In addition, at Jingtang the four villages are within the WUA. The village leaders are representatives in the WUA, and the villages coordinate among the WUGs in the village, all under the WUA's overall coordination – the WUA has become the leader of the villages! This is also a good example for other WUAs, because WUAs need to be based on hydraulic considerations rather than villages for hydraulic efficiency and need to coordinate with and among villages. The three management levels under Jingtang WUA are as follows and illustrated in the diagram below (see Diagram 3-11, below):

Five executive personnel in the WUA are responsible for the daily care and operation of the

diversion canal, two reservoirs, 3 main canals and 3 pump station. Three guarantees are implemented, such as troubleshooting, maintenance, and mud cleaning (the farmer household does not need to pay for or contribute labor); safety flood season; and irrigation water distribution (distributing water to the WUGs).

The branch canal is in the charge of different administrative villages for maintenance, and each WUG organizes labor for maintenance according to its irrigation area. The WUG leaders and village leaders comprise most of the representative council for the WUA.

87 ponds and farm canals are maintained by different WUGs by organizing farmers and provide alternative water sources for the WUA and WUGs.

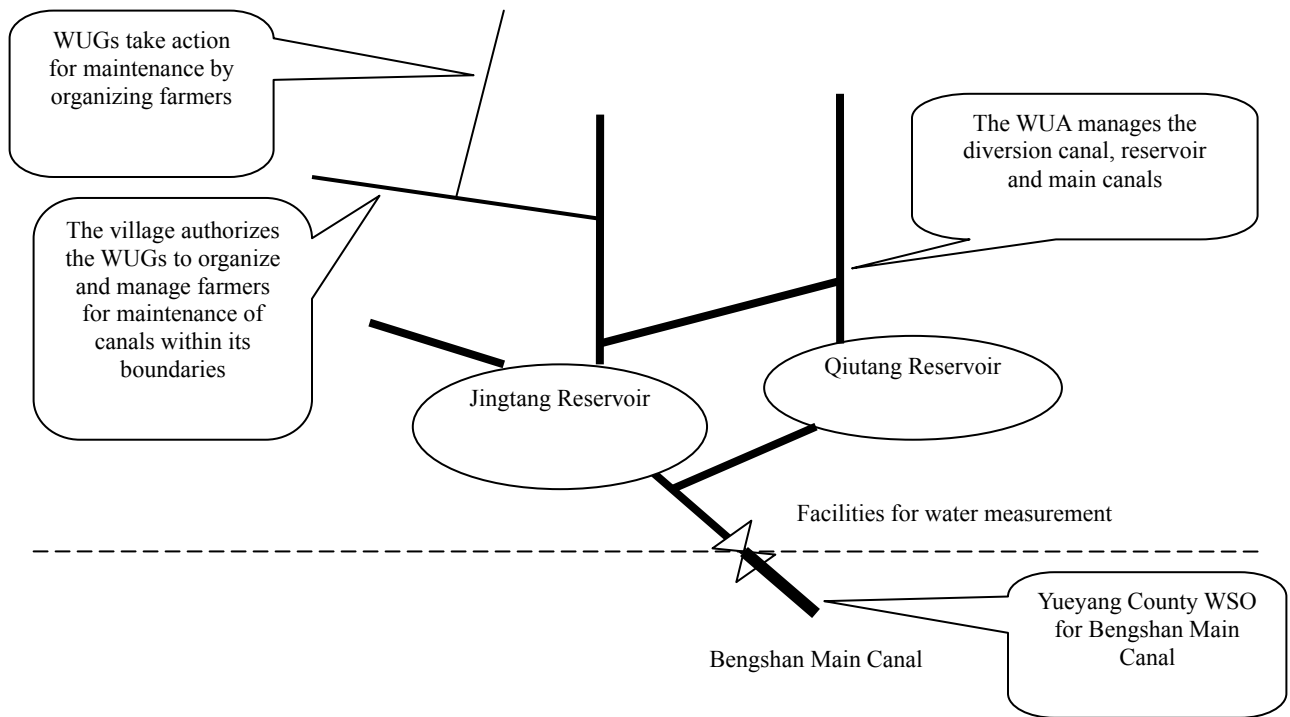


Figure 3-11: Water Supply and Management in Jingtang WUA

The water consumption for irrigation is about 3.6 million cu m in normal years. Of that, about 2.8 million cu m on average is from the WUA's own water resources, and about 0.8 million cu m is purchased from the WSO as supplemental water.

The situation about the personnel in WUA organization: there are five Executive Committee personnel, including one chairman, two vice-chairmen one of which one also acts as the part-time accountant, one engineer responsible for O&M and water operations, and one cashier responsible for financial affairs of the WUA. In addition, there are 49 representatives elected by the WUA members which comprise the five 5 executive personnel (elected by the representatives), 37 WUG leaders and seven village leaders in the four administrative villages. The representatives meet periodically and make decisions as needed on behalf of the total WUA membership, which itself may meet once or twice a year. The personnel receiving a salary from the WUA include only the five executive personnel.

Differing from many WUAs in the study, Jingtang WUA directly collects water charges from farmers (though the WUGs), instead of through a village. Before 2001, the water fee was collected by the village and then handed over to the WUA. But debt problem existed between the village and the farmers, so it was difficult for the village to collect fee from farmers. Therefore, since 2001, the WUA has charged the farmers directly though the WUGs, which seems to work efficiently.

The WUGs hold meetings annually prior to start of each irrigation season to discuss the following matters: (a) elect the leader of the WUG by farmers under the supervision of two village committee members; (b) determine the water distribution payment of the WUG leader, which is and generally RMB 5-10/mu which is apportioned among the farmer households; and (c) determine the labor quantity from farmers for maintenance and mud cleaning of the branch and farm canals, and usually is half day labor for each mu irrigated. Two village committee members authorize the WUG leader to organize the farmers to give labor, or if farmer prefers not to give labor the WUG can entrust others to provide labor at the rate of RMB 40/day.

Water Pricing at Jingtang WUA. The irrigation fee paid by the farmer households at Jingtang includes two parts: the water fee paid to the WUA, and the irrigation service fee paid to WUG leader. The water fee for the WUA is fixed and verified according to WUA costs, which comprise: cost of buying water from WSO, salaries of the executive committee, operating and maintenance fees of the project (including the pumping cost), the office management cost, etc. The WUA purchases water from Yueyang County WSO according to RMB 0.032/cu m which is measured at the inlet of the WUA diversion canal from the WSO's main canal. Generally, the WUA will put forward the water demand plan to the WSO in June and pay water fee in advance before water supply.

The water fees comprising the above costs are charged by the WUA is according to the area each farmer irrigates. Three branch canals inside the WUA are all installed with water measurement facility as the basis of water distribution but not for charges. The basic water price is determined according to WUA costs by democratically negotiating among WUA members. The basic water price will vary each year and is adjusted at the WUA representatives meeting. For example, the average for the overall WUA was RMB 19/mu in 2008 but RMB 22/mu in 2009. The WUA determines the water fee for each WUG according to the water sources (ponds) each WUG owns; WUGs with more water sources will pay less water fee to the WUA. The basic price and the water fee each WUG shall pay are determined at the WUA representatives meeting at the end of

each year.

The procedure of water fee charging (flow of funds) is: farmer household → WUG (collected by the WUG leader) → WUA. The WUG issues a receipt (in three copies) to each household and submits one copy to the WUA for accounting for the water fee that each farmer household paid. The WUA issues a water fee receipt to each WUG for the water fee amount received. At the end of each year, the WUA publicizes the water consumption situation and the payments for each WUG, and WUGs will publicize the water consumption situation and the payment for each farmer. The farmers generally pay estimated water fees in September of each year and then pay the balance based on actual water use it at the end of each year. If the WUA needs to divert large quantities of water from WSO, the farmers will be required to pay before peak water consumption in July in order for the WUA to pay the WSO.

Since the WUG leader is responsible for water distribution below the branch canal inlet and distributing water to each farmer household, generally the farmers don't need to go to the field to handle irrigation (Jingtang irrigation is mainly for paddy rice); the WUG water distributor handles the water delivery. Therefore, an irrigation service fee will be charged by the WUG from the farmer household for this service. The WUG irrigation service fee is based on the irrigation area, canal length, and the complexity of water sources in the WUG, and is determined by all the farmer households in the WUG through democratic negotiation. It is approximately RMB 5-10/mu generally, and the farmer household pays it to the WUG leader directly.

At Jingtang WUA, water fee charging is quite clear and good supervision of WUGs is in place. The water fee paid by the farmer households is actually the sum of the WUA water fee and the WUG service fee, which is about 25-32 in total. The WUA and WUG together are able to guarantee good irrigation service quality. The water fee charging system at Jingtang WUAs is illustrated below (see Diagram 3-12).

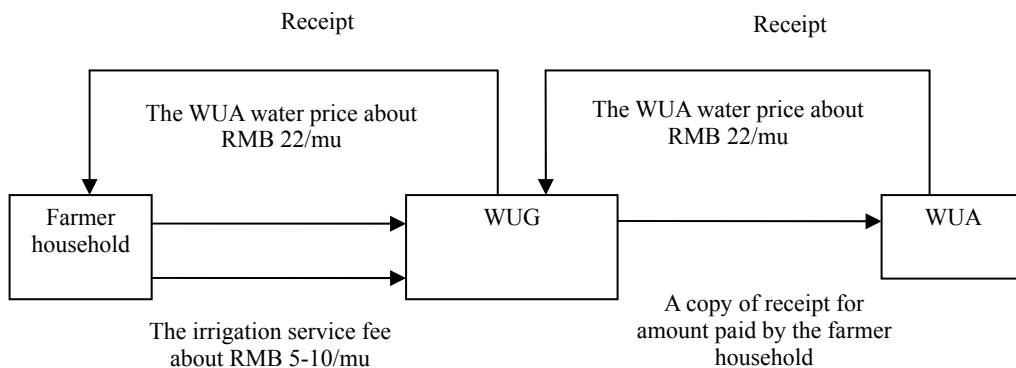


Diagram 3-12: Water Fee Charging and Accounting Method at Jingtang WUA

Comprehensive Water Fee WUA in Small-scale ID - Yuan Liufengyan WUA, Hubei

Liufengyan is an independent small-scale ID and located in Yuanan County in Hubei Province. Liufengyan WUA was established in the period of Qianlong during the Qing Dynasty. A small weir was built in Juhe River to divert water for irrigation. The overall length of the weir is 200 meters and the main canal is 3.8 kilometers, two branch canals are 10.6 kilometers long, and the irrigation area is 3,252 mu (217 ha) in three villages, among which Sanban Village is the largest with has 1,100 mu of gravity irrigation and 800 mu of pumping irrigation. Sanban village registered Liufengyan WUA with the local CAB in 2001 with 408 households and 1,160 villagers (citizens above the age of 18) as members. In 2001, the village party committee raised RMB 400,000 and more than 5,000 labor days to rebuild the Liufengyan weir. The WUA members elect the Executive Committee comprising the WUA director and two committee members who also act as the cashier and accountant respectively. Three other people are on a supervision committee which monitors the WUA Executive Committee members. Three WUGs have four water distributors (operates the gates to supply water), and 25 WUA representatives. The water distributor is responsible for distributing water to each household who therefore do not need to do the irrigation in the field themselves (because of rice paddy culture).

Management at Yuan Liufengyan WUA. The main canal is managed by the three WUA committee members and the branch canals are managed by the water distributors. Repair work is carried out once a year; the WUA organizes the farmers for canal mud and grass cleaning and other maintenance work. Management of the enlarged, newly-built and rehabilitated weir is organized by the village. The WUA is responsible for delivering and distributing water, daily management and maintenance of the scheme, water fee charging, flood prevention, etc.

Water Fee Charging at Yuan Liufengyan WUA. The water fee is RMB 25 for each mu starting from 2009. This was determined by the WUA representatives meeting and is the maximum allowed; the standard water fee price in the area as regulated by Yichang PB and WRB and is limited to no more than RMB 25/mu. For the pumping area, the water fee is RMB 8.3/mu as a separate fee, with the electricity fee also paid as an additional charge. The water fee is charged by the WUA from the farm households directly, and the WUA issues a receipt for the water fee payment to each farmer household.

The labor costs for mud cleaning and maintenance by the farmers are paid by the WUA (Note: farmer labor was freed from the previous compulsory labor obligation in 2001). The labor input cost by the farmer can be deducted from the farmer's water fee, and at present, the WUA is still in debt to the farmers for labor costs. WUA members are also paid RMB 10/person for holding meeting of half day, and the village makes that payment instead of the WUA.

The WUA finances are independent of the village. The water distributors are responsible for water distribution but not for charging water fees. Farmers go to WUA to pay water fee to the WUA accountant. The water fee collection rate is high, 100% in 2009. The water fee budget is calculated and determined in the beginning of the year; account reconciliation is carried out in the middle and end of each year, and the WUA financial expenditure situation report is issued by the WUA at the end of the year.

WUA management system is comprehensive, simple and very concrete, and is in a close connection with the actual situation. WUA finances are transparent and under the supervision of the village party committee; the WUA needs the approval of the village party committee for expenditure exceeding RMB 1,000. The diagram below illustrates the WUA's water charging system (see Diagram 3-13).

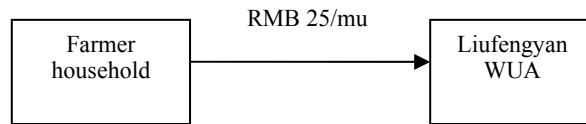


Diagram 3-13: Water Fee Charging System at Liufengyan WUA



**Sustainable Development Department
East Asia and Pacific Region**

THE WORLD BANK

1818 H Street, N.W.
Washington, D.C. 20433, USA

Telephone: 202 473 1000
Facsimile: 202 522 1666
Internet sites: www.worldbank.org/eaprrural