JASA TIRTA II PUBLIC CORPORATION'S EXPERIENCE IN THE INTERMITTENT PROVISION OF IRRIGATION WATER FOR CITARUM RIVER BASIN EFFICIENCY
JASA TIRTA II SOCIÉTÉ PUBLIQUE EXPÉRIENCE DANS LA FOURNITURE D'EAU D'IRRIGATION INTERMITTENT DE L'EFFICACITE DU BASSIN DE LA RIVIÈRE CITARUM

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ABSTRACT

Water resources in Citarum River Basin is used for various purposes such as irrigation, raw water for drinking to PAM JAYA DKI, PDAM in Regency/City, municipal and industry. Irrigated agriculture accounts for approximately 90% of water consumption in Indonesia as in Citarum River Basin. Demand for irrigation water will increase in line with the increase of food demand as population growth in the future. On the other side, water should be allocated to fulfill water demand for domestics, municipal and industry. It means that water for irrigation will be scarce so that water usage for irrigation should be carried out in more efficient way as consequence. Jasa Tirta II Public Corporation as one of institution who manages Citarum River basin has an experience in intermittent irrigation since 1973, especially in Southern Jatiluhur irrigation area which has no reservoir to regulate the water. This method is implemented in the water shortage areas or when the available irrigation water in critical condition. There are three ways to be conducted for intermittent irrigation as called "Gilir Berselang" (Intermittent Alternately), "Gilir Gelontor" (Intermittent Flushing) and "Gilir Giring" (Intermittent Lead). The implementation of intermittent irrigation in this area has given any benefits such as solving the water scarce and providing water supply efficiency until 53.7% through "Gilir Giring" (Intermittent Lead) way. By considering that the future will occur in addition to increasing water demand for not irrigation water (domestic, urban and industrial), then the way of intermittent provision of irrigation water can be developed in other regions in order to reach water saving, irrigation water efficiency and to increase the allocation of water for outside irrigation.

Key Words: efficiency, irrigation water, intermittent irrigation

RÉSUMÉS ET LES CONCLUSIONS

Hydrographique Citarum situé dans une partie de l'ouest de Java en Indonésie dont la zone de 12.000 km2, qui répond aux besoins d'eau dans les bassins hydrographiques Citarum, en particulier pour la zone d'irrigation de 296.000 hectares et la fourniture d'eau brute pour boire à PAM JAYA DKI, PDAM au Regency / Ville, de

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l'eau municipale et industrielle le long du corridor entre DKI Jakarta jusqu'à Balongan - Indramayu.

L'agriculture irriguée d'environ 90% de la consommation d'eau en Indonésie comme dans Citarum bassin de la rivière. Avec le pourcentage de la consommation d'eau très grand, les économies d'utilisation de l'eau d'irrigation donnera un impact énorme sur les économies d'eau en général. En raison de la plus grande proportion de la consommation d'eau d'irrigation pour la consommation globale de l'eau, donc les efforts de l'efficacité d'utilisation de l'eau d'irrigation deviennent sujet très important. La demande en eau d'irrigation augmenteront en ligne avec l'augmentation de la demande alimentaire que la croissance démographique dans l'avenir. De l'autre côté, l'eau devrait être allouées pour remplir la demande en eau pour les domestiques, municipales et l'industrie. Cela signifie que l'eau pour l'irrigation seront rares pour que l'utilisation d'eau pour l'irrigation devrait être effectuée de manière plus efficace comme conséquence. Dans ce cas, les économies d'eau devient obligatoire effort pour atteindre l'efficacité d'utilisation de l'eau.

Jasa Tirta II société publique (PJT II) comme l'un des établissement qui gère Citarum bassin de la rivière la mise en œuvre d'économies d'eau en trois étapes, comme la disposition des plan d'irrigation annuels, la mise en œuvre de la fourniture d'eau d'irrigation et de l'exécution de l'irrigation intermittente. En particulier dans l'irrigation intermittente, il a une expérience depuis 1973, se concentrant dans la région du Sud irrigation Jatiluhur qui n'a pas de réservoir de réglementer l'eau et de compter l'eau qui provient de sources locales à travers le déversoir qui ne fonctionnent pas comme stockage. Cette méthode est mise en œuvre dans les domaines de la pénurie d'eau ou lorsque l'eau d'irrigation disponible dans un état critique. Il existe trois façons d'être menée pour l'irrigation intermittente comme l'a demandé "Gilir Berselang" (intermittents en alternance), "Gilir Gelontor" (intermittents Flushing) et "Gilir Giring" (intermittents plomb). Trois façons pour l'irrigation intermittente doit être exécuté avec ces conditions "Gilir Berselang" (intermittent en alternance) l'état des ressources en eau de 60% - 80%, "Gilir Gelontor" (chasse d'eau intermittente) l'état d'eau de 40% - 60% et "Gilir Giring" (plomb intermittent) condition d'eau de moins de 40%.

Pour mettre en œuvre intermittente d'approvisionnement en eau d'irrigation, doit impliquer toutes les parties prenantes, à savoir les agents (les agents de l'irrigation, l'agriculture, district, village et P3A Mitra Cai / "Ulu-Ulu"), outre le rôle nécessaire des agriculteurs de partager l'eau en fonction de le calendrier de certains.

Sur la base des résultats des recherches menées à l'Espace Cileuleuy irrigation, l'irrigation du Sud Jatiluhur zone, qui est inclus dans la zone de travail de Jasa Tirta II société publique, la mise en œuvre de "Gilir Giring" (plomb intermittent) ainsi est capable de transformer l'eau Efficacité de l'approvisionnement de 53,7% par rapport à l'approvisionnement en eau en continu (Ir. tukul Santoso, 1983, Perum Otorita Jatiluhur) et de résoudre les maigres ressources en eau. Quelque chose qui importe aussi et d'être chose de valeur est l'approvisionnement en eau d'irrigation grâce à cette méthode s'adapte toujours aux besoins des agriculteurs, même la disponibilité d'eau d'irrigation dans un état critique. Mise en oeuvre de "Gilir Giring" (plomb

intermittent) peut être fait lorsque la disponibilité en eau est inférieure n'est donc pas tenir compte de l'approvisionnement en eau de façon continue, mais les agriculteurs peuvent effectivement recevoir des intermittents du système d'approvisionnement en eau à cette condition.

En considérant que l'avenir aura lieu en outre à la demande croissante d'eau pour ne pas l'eau d'irrigation (domestiques, urbaines et industrielles), puis la voie de la fourniture intermittente de l'eau d'irrigation peut être développée dans d'autres régions afin de parvenir à économiser l'eau, l'efficacité de l'eau d'irrigation et d'augmenter l'allocation de l'eau pour l'irrigation à l'extérieur.

INTRODUCTION

Citarum river basin located in part of West Java area of 12,000 km^2, serving the needs of water in Citarum river basin, especially for irrigation area of 296,000 hectares and the provision of raw water for drinking and industrial water along the corridor between DKI Jakarta until Balongan – Indramayu. The Citarum River Basin location shown on Figure below.

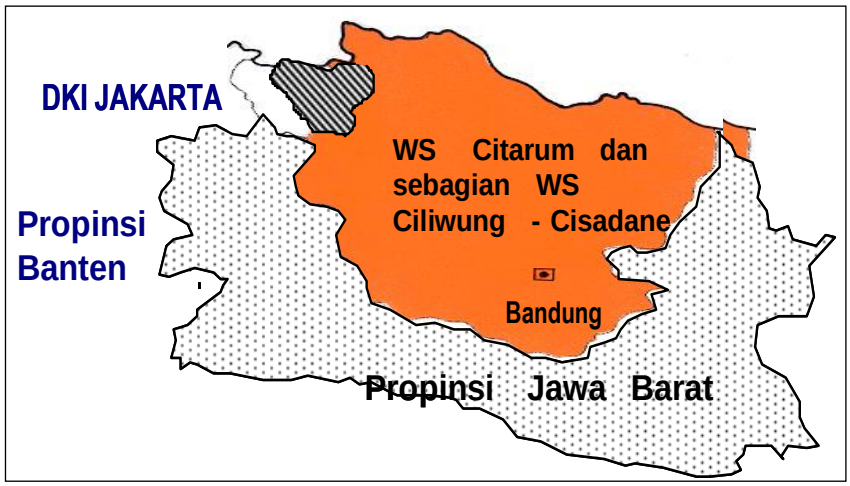

Figure 1. Citarum river basin location (Lieu Citarum bassin de la rivière)

Citarum river water source originated from a spring on Mount Wayang and the tributaries of the Citarum scattered in several places. Catchment area of the Citarum river basin covers an area of 4,543.40 km^2 which covers several districts in West Java Indonesia, which is part of Bandung Regency, Sumedang Regency, Cianjur Regency, and the entire city of Bandung.

Water Resources Development in an integrated Citarum river basin for various purposes has been started since the introduction of Jatiluhur Multipurpose Project Implementation by Ir. H. Djuanda, Prime Minister of the Republic of Indonesia, in 1956. First phase of development completed in 1967 declared by General Soeharto, then as Acting President of the Republic of Indonesia. Development of an integrated water resources management is intended to harness the potential of rivers in the plains of Northern West Java for a variety of interests. The rivers are Bekasi, Cikarang, Cilemah Abang, Cibeet, Citarum, Ciherang, Cilamaya, Cijengkol, Ciasem, Cigadung, Cipunegara

and Cilalanang. Those rivers forming a hydrological unity and Citarum as its main source.

After the end of development Jatiluhur Multipurpose Project, named after the operation of dams and hydropower and most of the irrigation system, it is considered the need for organizing and managing the arising potential in the form of business entities. This business entity entrusted and has obligations to mobilize funds and manpower to complete, improve and maintain the infrastructure and development outcomes, with the main objective to increase national food production as one of the social function in addition to flood control and flushing the city. For this purpose on July 24, 1967 established the Jatiluhur State Enterprise (PN Jatiluhur) under Government Regulation No. 8 year 1967 which was then amended in 1970 to form Public Corporation, which is named "Jatiluhur Authority" and further ruled by Government Regulation Number 94 Year 1999 changed the name became Jasa Tirta II Public Corporation than abbreviated as PJT II.

PJT II work area covers 72 rivers and tributaries that become one hydrological unit in the northern part of West Java Indonesia located in Citarum river basin and parts of Ciliwung – Cisadane river basin, covers an area of approximately 12,000 km^2. Jasa Tirta II Public Corporation's service area covers two provinces namely West Java and DKI Jakarta, which covers several regencies/cities they are Bekasi, Karawang, Purwakarta, Cianjur, Subang, Bogor and Indramayu. Thus Jasa Tirta II Public Corporation accommodates service tasks across regencies and cities, even carries out the services in two provinces. Figure below shown the work area of PJT II.

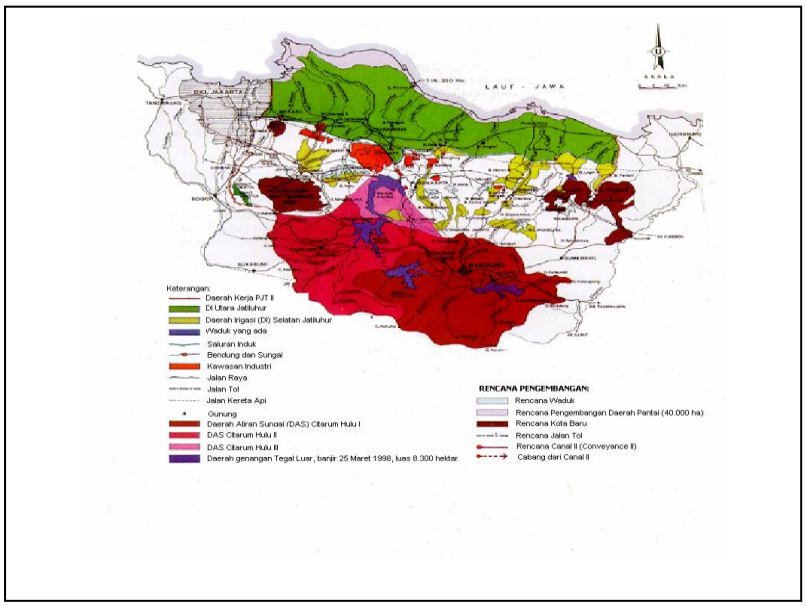

Figure 2. The Work Area of Jasa Tirta II Public Corporation (La zone de travail de Jasa Tirta II société publique)

Total flow of water in one year in Citarum river basin at an average 12.95 billion m^3, Citarum 6.0 billion m^3, and other river 6.95 billion m^3. With the existing infrastructure about 7.65 billion m^3 has been controlled, including Citarum 5.85 billion m^3 and the local source/other rivers 1.80 billion m^3. The water that has been recently

exploited for irrigation is 6.0 billion m^3 per year average and for drinking water and industry 0.75 billion m^3 (Table 1). This illustrates that not all the water has been fully exploited. Based on the results of the study (BCEOM, 1990), water availability can meet the needs until the year 2015. To meet the demand after the year 2015 should be increased ability to control or building reservoirs, such as building Cipunegara Reservoir (Nippon Koei, 1983) and increase water use efficiency. Table below describes water utilization projection in Citarum river basin.

Table 1. Water Utilization Projection in Citarum River Basin (Projection d'utilisation de l'eau dans le bassin de la rivière Citarum)

No	Description	1990		2005		2025	
1.	Source :	m^3/s	10^6m^3	m^3/s	10^6m^3	m^3/s	10^6m^3
	Citarum and Reservoir	182.33	5,750.00	182.33	5,750.00	182.33	5,750.00
	Other River	60.25	1,900.00	61.83	1,950.00	63.42	2,000.00
2.	Needs :						
	Irrigation	177.30	5,591.71	175.00	5,518.80	168.00	5298.05
	Industry	7.91	249.45	15.00	473.04	25.00	788.40
	Drinking Water	9.77	308.11	21.30	671.72	45.00	1419.12
	Fishery	1.00	31.54	10.00	315.36	20.00	630.72
	Flushing	2.00	63.07	10.00	315.36	15.00	473.04
	Electrical Peak Load	9.51	300.00	3.17	100.00	0.00	0.00
3.	Balance :						
	Source	242.58	7,650.00	244.16	7,700.00	245.75	7,750.00
	Needs	207.49	6,543.88	234.47	7,394.28	273.00	8,609.33
	Source - Needs	35.09	1,106.12	9.69	305.72	(27.25)	(859.33)

Potential Water Resources in the Citarum river basin be used for various purposes namely irrigation water, raw water for drinking to PAM DKI, PDAM in Regency/ City and industry. The use of irrigation water is the biggest water use $\pm$ 90% from the overall water demand. Due to the biggest percentage of irrigation water usage to overall water consumption, therefore the efforts of irrigation water use efficiency become very important subject. Provision of water for irrigation is influenced by several factors, such as : the location of water resources, water resources infrastructure condition, timeliness utilization. Loss of water to be reckoned such as: the natural evaporation, levee seepage, structure leaks (leakage), preparation of land and the implementation of the planting.

WATER SAVING IN IRRIGATION

Water is a very important resource for agriculture. Compared with fertilizers and pesticides, water has a wider aspect, which not only affects productivity, but also affects the exploitation of agricultural commodities.

Future water demand will rise, in line with the increase of population. Increasing water demand will rise to competition between irrigation water requirements with non-irrigation water such as: domestic and industrial water demand that from year to year trend shows ascension rapidly. This proves that the saving of water usage must get serious attention.

Until now, the irrigation water demand is still very dominant compared with other water needs. In Indonesia the level of irrigation water demand reaches ± 90% of the total, Australia reaches 70% (Marsden Jacob Associates-Land & Water Australia, 2003), while Japan ± 40% (Japan Water Agency, 2004). With the percentage of very large water usage, saving irrigation water usage will give a huge impact on the overall water savings. Saving irrigation water usage to be done, due to :

1. The limitation of water.
   This condition is usually done in the irrigation area which needs the water at certain times greater than availability. Irrigation area in which the water supplied from a weir at certain times face water crisis.
2. Water resources conservation.
   Conservation is required in order to maintain the sustainability of water and water sources, including the potential contained therein. Irrigation which utilizes ground water is usually more efficient in water usage relatively.
3. Economic water value.
   The economic value of water will increase in line with time. Saving irrigation water means to be able to increase the water allocation for other needs.

The benefits of saving irrigation water, such as:

1. Increasing ability to meet the needs of other water, along with the increase of water demand level for household, industrial and urban.
2. Improved crop production. Example: (a) The System of Rice Intensification (SRI), increased production 50% - 100% and water savings 30-50% from conventional systems (DISIMP) and Integrated Crop Management (ICM), increased production 24% - 37% and water savings 30% - 40% of conventional systems (Center for Food Crop Research and Development).

Some efforts usually done in saving irrigation water :

1. Maintenance of water resources infrastructure so that water losses due to seepages and leaks can be reduced as small as possible.
2. Provision of agricultural inputs in order to the farmers do not suffer delays in planting.
3. Structuring post-harvest mechanism better that farmers can sell crops on time with a reasonable price so that the capital ready for the next planting.
4. Social approaches, such as soul togetherness and willing to implement agricultural cultivation on time. Because of late planting induces provided water become wasted, means a waste or a low efficiency of water utilization.

Until now, the savings that have been implemented in the work area of Jasa Tirta II Public Corporation is limited on irrigation water savings due to the availability of limited water at certain time.

SETTINGS AND METHODS OF IRRIGATION WATER SAVINGS FOR EFFICIENCY

Arrangement of annual irrigation plan

In order to ensure the provision of irrigation water including effort of irrigation water savings, so every the beginning of the year prepared irrigation water supply planning based on Planting Plan. Technical plans of irrigation water supply prepared by

head of section together with observer in the form of Planting Plan and Classification Plan for Water Provision by considering:

1. Distribution of class planting time (planting time divided into three up to five groups to avoid the buildup of peak water demand while beginning work on soil wetting at a same time).
2. Cropping patterns of each class, for example : Rice – Rice – Secondary Crops or Rice – Rice.
3. Irrigation schedule.

Technical plan was discussed in the annual meeting of the District Irrigation Committee, to comply with the preparedness of other agencies. The improvement plan results disseminated further to the village and discussed to get a deal with farmers who are represented by "P3A Mitra Cai". After receiving the correction and then prepared to set as the Regency Irrigation Committee's decision material.

Implementation of Irrigation Water Provision

Operation of irrigation based on the irrigation plan that includes:

1. Planted Area and Water Giving Classification Plan.
2. Plan of Provision Irrigation Water.
3. Forecast of Water Availability in Water Resource.

Because of the availability of water resources based on hydrological forecast technically less, then based on the fact of water discharge development reality (from observation of river discharge), the implementation of irrigation services is done by intermittent system as described below :

a. Normal condition
   Normal conditon are :
   - The reality of time and planting areas in accordance with the plan.
   - Availability of water in water sources in accordance with estimates.
     In this condition operation of irrigation held by the Section with routine procedures. Discharge of water into the fields provided in accordance with the water supply plan with a change every two weeks, but with various reasons the normal condition like this is rare.

b. Planting conditions that do not conform with the planting plan.
   The supply of water adjusted to the reality of planting.

c. Actual discharge of water on the water sources less than the water discharge plan.
   The implementation of intermittent irrigation must be executed as shown on table below:

Table 2. Criteria of intermittent irrigation execution (Critères d'exécution irrigation intermittente)

Water condition	Intermittent Irrigation
60 % - 80 %	"Gilir berselang" (intermittent alternately) 3-4 days
40 % - 60 %	"Gilir gelontor" (intermittent flushing) 2-3 days with flushing combination.
Less than 40 %	"Gilir giring" (intermittent lead) with a convoy of water

	in the area of according plot shifts by the officers concerned with local farmers.

In other case, because of limited water in the planting season of rice “MT Gadu” (dry season) so that the plan of planting area “MT Gadu” adjusted with river discharge forecasts in the dry season. This affects early planting plan of rice “MT Gadu” always smaller than early planting plan at “MT Rendeng” (wet season). From the records of activities in the field, there are some farmers that their area is not included in the plan, force to plant rice at “MT Gadu”. The approach taken is to develop tolerance to the farmers who do not include “MT Gadu Plan”, to get water through intermittent system.

Execution of intermittent irrigation

In the work area of Jasa Tirta II Public Corporation, particularly in the Cileuleuy irrigation area which is part of Southern Jatiluhur Irrigation Area, since 1973 has been implemented water saving effort for irrigation usage, especially at difficult times of water (gadu season) and known as "gilir berselang” (intermittent alternately), “gilir gelontor” (intermittent flushing), and “gilir giring” (intermittent lead). This method is then disseminated to others in the work area of Jasa Tirta II Public Corporation, in order to overcome the limitations of water availability. The supply of water intermittently, the essence is the disjointed provision of water with inundation plot. This method is implemented in the water shortage areas or when the available irrigation water in critical condition.

In the implementation this way should be coordinated with all stakeholders, with stages done by Jasa Tirta II Public Corporation as the following below :

1. Gilir Berselang (intermittent alternately) condition of water resources 60% - 80%, installed a green flag, and in the provision of water regulated by the discharge of water in turns day and night, with the provision of water during the day made for the upstream areas and at night to downstream areas.
2. Gilir Gelontor (intermittent flushing) condition of water 40% - 60%, placed a yellow flag, with provision for upstream areas during the daylight time and night time in the downstream areas, but added with a flushing water taken from the provision of water in the daylight time. So the water in the upstream areas minus two days during each Tuesday afternoon and Friday afternoon. And the water on Tuesday afternoon to irrigate the area's most tip (left), while for Friday afternoon to fill a pond. The quantity of water in this “gilir gelontor” (intermittent flushing) turn arranged as follows:

   For Tuesday afternoon and Friday afternoon :

   • tertiary plot with an area smaller than 150 ha were not given water at all.
   • tertiary plot with an area of more than 150 ha was given the maximum water 50% of the existing water (depending on wide of their area).
3. Gilir Giring (intermittent lead) condition of water less than 40%, install a red flag, which is applicable by the distribution of shared water tap in each intake building. While for each tertiary plot is set again by the irrigation officers together with P3A Mitra Cai.

Water sharing arrangements and intermittent water allocation a whole must involve all stakeholders. Among the three way of intermittent, the highest level of difficulty is “gilir giring” (intermittent lead). “Gilir giring” (intermittent lead) is the technique of allocation the irrigation water to meet water requirements for plants with special efforts in the form of leading available water to the irrigation system to gain the confidence that the water reaches the end of destination, once recorded the destruction of irrigation networks and other barriers and improve upon it.

Requirements for implementing “gilir giring” (intermittent lead), described the following below :

1. The physical condition of all irrigation networks ranging from primary to tertiary network is relatively good.
2. Implementation of the system as much as possible from the quarter channel directly to the rice field by pressing a minimum of plot to plot.
3. Requires concerted efforts of all officials of irrigation, agriculture, villages and “P3A Mitra Cai” and “Ulu-Ulu”.
4. Participation of farmers in allocating water according to the schedule that set is needed.
5. Before the implementation of “gilir giring” (intermittent lead), first meeting was held for “gilir giring” (intermittent lead) plan.

Based on the results of research conducted at the Cileuleuy Irrigation Area, Jatiluhur Southern Irrigation Area, which is included in the work area of Jasa Tirta II Public Corporation, the implementation of “gilir giring” (intermittent lead) is able to turn the water supply efficiency of 53.7% compared with continuous water supply (Ir. Tukul Santoso, 1983, Perum Otorita Jatiluhur) and solving the water scarce. Something that also important and to be valuable thing is irrigation water provision through this method still accommodates the needs of farmers even availability of irrigation water in critical condition. Implementation of “gilir giring” (intermittent lead) can be done when the water availability is less therefore does not accommodate of water supply continuously but the farmers actually can receive intermittent water supply system at this condition.

CONCLUSION

Implementation of intermittent water supply focusing in The Southern Jatiluhur irrigation area as do not get supply from the Ir.H.Djuanda reservoir, because irrigation in this area reckon the water that comes from local sources through the weir that not function as storage.

In order to implement intermittent irrigation water supply, needs to involve all stakeholders, namely officers (officers of irrigation, agriculture, district, village and P3A Mitra Cai / “Ulu-Ulu”), besides the necessary role of farmers to share water according to the certain schedule.

Based on the results of research conducted at the Cileuleuy Irrigation Area, Jatiluhur Southern Irrigation Area, which is included in the work area of Jasa Tirta II Public Corporation, the implementation of “gilir giring” (intermittent lead) is able to

turn the water supply efficiency of 53.7% compared with continuous water supply (Ir. Tukul Santoso, 1983, Perum Otorita Jatiluhur). The most important and to be valuable thing is irrigation water provision through this method still accommodates the needs of farmers even availability of irrigation water in critical condition and also the farmers actually can receive intermittent water supply system at this condition.

By considering that the future will occur in addition to increasing water demand for not irrigation water (domestic, urban and industrial), then the way of intermittent provision of irrigation water can be developed in other regions in order to reach water saving, irrigation water efficiency and to increase the allocation of water for outside irrigation.

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