IIMI-SCOR

SHARED CONTROL OF NATURAL RESOURCES (SCOR)

WATER MANAGEMENT IN A WATER-STRESSED WATERSHED: EXPERIENCE IN MAHA 94/95 SEASON

by

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SCOR seeks to increase the users' share of control of natural resources in selected watersheds through partnerships between the state and users that contribute to greater production while conserving the natural resources base. SCOR will promote integrated planning for the use of land and water resources in two pilot watersheds with spread effects to other areas. The SCOR project is a collaborative effort of the Government of Sri Lanka, the United States Agency for International Development (USAID) and the IIMI.

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CHAPTER I

INTRODUCTION

1.1 Background

The concepts and vision underlying the notion "Shared Control of Natural Resources (SCOR)" can be clarified and elaborated in many ways. SCOR focuses on the management of two mutually dependent natural resources, i.e. Land and Water. It addresses how users of land and water resources can actively involve in the management of natural resources within a watershed unit and how best the interactions of users with the resources base can be disciplined to achieve feasible and acceptable levels of agricultural production, income, and sustainable protection of the resources base itself. It is geared to understanding, developing, innovating, testing and adopting feasible and acceptable technological packages and organizational models that will guide and direct the interactions of users with land and water resources to ensure the sustainable use and productivity of the two resources, while increasing benefits being generated to the resources users. Shared Control of Natural Resources, therefore, means the management of land and water resources within a watershed in resource productive, economically profitable and environmentally sustainable manner, with enhanced control of the resources by its users through effective and sustainable partnership arrangements between the users and the State. Integrated water management is one component or theme of intervention in a package of strategies adopted by SCOR to achieve those goals.

A few decades ago, the focus of water management was on "on-farm water management", i.e., to improve water use efficiency and water productivity by adopting various agronomic and operational interventions at on-farm level. Application of water, land and water management within the farm, and removal of drainage water were the main areas of attention of this mode. But as our understanding about on-farm water management grew, the focus of attention too expanded to managing water within an entire irrigation system, covering not only on-farm water management, but also acquisition, storage, conveyance, distribution, application and management of water within an individual farm, and removal of excess water from individual farm allotments. In this mode, main system operation and management, rotational delivery of water, pre-planned irrigation water distribution and delivery schedules, development and application of computer soft-ware models for main system operation were the key areas of attention. However, as our understanding on water management further grew, the overall framework of water management too expanded encompassing not only on-farm water management and main system management, but management of water in conjunction with other complementary inputs such as seeds, farm power, fertilizers and agro-chemicals, and institutional arrangements for credit and marketing management and farmers organizations. This phase was called irrigation management phase. However, the focus of irrigation management mode too was limited to physical and socio-economic boundaries of a single irrigation project and not beyond it (Fernando, 1993).

At present, the focus is on "integrated watershed water management". Thus, the term "integrated water management" becomes a special notion. The "integrated water management" not only encompasses on-farm water management, main system water management and irrigation management, but also expands its scope and area of focus beyond geographical and socio-economic boundaries of a single irrigation project to cover all of the above water management ingredients within a larger geographical and socio-economic context, i.e. a single watershed. In Phase I of the SCOR Project, Huruluwewa Watershed was the focus for specific interventions.

While, focusing on a geographical land area embodied within a watershed unit, Integrated Water Management attempts to address the key issues that affect land and water productivity and economic profitability of irrigated crop production. In that respect, main aspects that have to be addressed through the integrated water management interventions are improving: cropping intensities; crop yields per unit of land and water; land and water management and use; and extent cultivated in any given season and income to users and conserving water both on rainfed highlands and irrigated command areas. At present, the achievements in respect of these tasks are found to be at sub optimal levels. In a more broader context, integrated water management attempts to address the conservation of water through various land conservation measures and conjunctive use modes to ensure long term availability of water for crop production. These concerns are crucial to Huruluwewa Watershed, as well as to the entire dry zone typically.

1.2 Overview of Huruluwewa Watershed and Integrated Water Management

1.2.1 Huruluwewa watershed

The definition of the term "watershed" as used by SCOR is novel and can be considered a further elaboration of the conventional definitions adopted by hydrologists, geographers and planners. In the conventional definition, the terms "watershed", "catchment area" and "drainage basin" are used to describe a geographically delineated area that drains into a watercourse, as measured with reference to a specific single downstream point on a river of a stream. The "SCOR" definition for the term "watershed" not only encompasses this conventional definition, but also identifies five main components or mosaics of a typical dry zone watershed. These five watershed land use components are catchment area, reservoir water spread area, irrigated command area, highland area above irrigated command area, and the drainage area.

"Huruluwewa watershed", as defined by SCOR, is shown in Figure 1. It is a narrow elongated watershed bounded by Ritigala Hill range to the West. Conventionally, it is the upper part of "Yan Oya" river basin in the Dry Zone of Sri Lanka. The land area enclosed within the two boundaries of Figure 1 does not follow strictly the watershed definition originally defined for SCOR purposes. But yet, this land unit is designated as "Huruluwewa Watershed" for special reasons.

"Huruluwewa watershed", as seen from Figure 1, includes Huruluwewa reservoir, which is the only major tank[1] in the watershed. It receives water from an adjoining watershed by a trans-basin supply canal (i.e. Bowatenna-Huruluwewa Feeder Canal).

In defining the Huruluwewa watershed, the total area that drains to Yan Oya at "Ilukwewa" anicut, a point below the tail-end lands of the command area of

[1] A "major tank" means a reservoir which provides irrigation water for a command area more than 400 ha for agriculture production.

Huruluwewa reservoir, has been considered the key area of attention. "Ilukwewa" anicut is situated at the tail end of the command area to pick up drainage return flows of Huruluwewa command area. This area not only includes the catchment area, reservoir water spread area, irrigated command area, highlands above the command area and drainage area, but also the adjoining areas of the Bowatenna-Huruluwewa Feeder Canal as well.

Huruluwewa Feeder Canal is supposed to convey trans-basin, augmentative water supplies from Bowatenna reservoir to Huruluwewa tank. The Feeder Canal and its land and water use system is linked to Huruluwewa tank and its land and water use system both hydrologically, economically and socially. Hence, when one considers the concept of SCOR and its approaches, the inclusion of the Feeder Canal and its land and water use system as a legitimate component of Huruluwewa Watershed is justifiable. Descriptions of each component as well as their present land and water management problems are given in detail later in this chapter.

1.2.2 Water resources

Water resource exists as three different kinds in four different sources in the Huruluwewa watershed. The **different kinds of water are rainfall, surface water and ground water**. These three kinds exists in four **different sources** in the watershed as: **rainfall**-received distinctly as Yala (dry) and maha (wet) seasonal rainfall; **surface water**-stored in Huruluwewa tank and in about 200 minor tanks in the watershed, and that flow as river and stream flow in Yan Oya and its tributaries, as drainage return flows in drainage channels, and as irrigation diversions through the Huruluwewa Feeder Canal; and **groundwater** extracted from about 850 (as on March 1994) large diameter, shallows, open dug-wells, which are commonly called "agro-wells." Out of the 850 wells, about 500 dug-wells are in the irrigated command area of Huruluwewa scheme.

The term "integration" is broadly used here to mean a package of notions. In the dry zone of Sri Lanka, where water being the most limited resource in quantity and both water and land being the limiting resources in quality, "integration" means, in the first instance, conservation (protection connotation) and utilization (production connotation) of water in a manner conducive to improving, if not sustaining, the quality and productivity of the land resource with the conservation and utilization of limited available water, while generating high and sustainable incomes (profits) to the users. Thus, in a very broad sense, integrated water management means a mutually complementary management mode for land and water resources in a watershed unit.

The term "integration" also means establishing appropriate hydrological, organizational and socio-economic linkages between the upstream and downstream areas of a watershed to strike a proper balance between sustainability, productivity, profitability and equity of land and water resources use. This definition of integrated water management is applicable to a single irrigation tank, a cascade of tanks, a river basin or any other hydrologically inter-related geographic unit. There exists a greater need and a potential to implement integrated water management in Huruluwewa Watershed under the notion of upstream and downstream integration. The term "integration" means many other notions (Fernando, 1993). for the purpose of this research report only the above two notions were highlighted here.

1.3 Objectives of this Paper

Integrated Water Management is one of the six themes of the SCOR work plan prepared for phase I period for Huruluwewa Watershed. SCOR Workplan envisaged a number of activities to be performed in its first phase under the theme "Integrated Water Management". In more broader terms, the activities include:

(a) forming and strengthening of Farmers Organizations (FOs) for improved water management in a watershed context;

(b) establishing proper institutional arrangements to facilitate decision-making, allocating and utilizing water for agricultural production;

(c) establishing appropriate cropping systems, crop diversification practices and market linkages and arrangements;

(d) improving on-farm water management practices;

(e) seasonal planning of cultivation including timely commencement of cultivation season and pre-season irrigation scheduling;

(f) conjunctive use of surface water, groundwater and rainfall;

(g) coordination of water management between Huruluwewa tank system and the small tanks lying within the Huruluwewa Command area.

SCOR has initiated a package of action research interventions in the watershed integrating the above activity areas to improve water use efficiency and land and water productivity with the limited available water in the irrigated areas as well as in the highland areas. In broader terms, the efforts are being geared to:

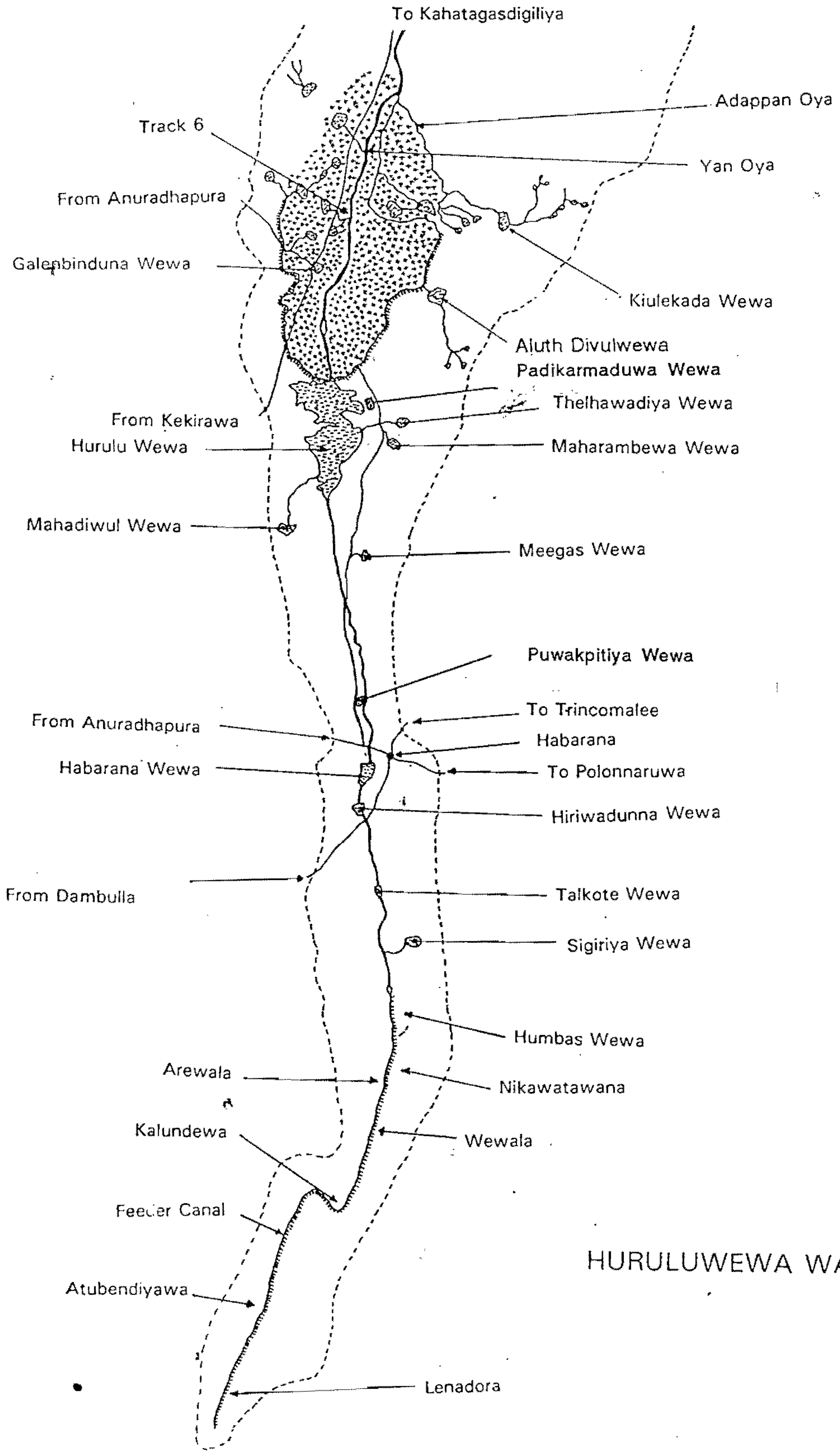
- form new user groups and FOs and strengthen the existing FOs in the irrigated command areas;
- establish formal linkages between the Fos that are operative in different spatial locations of the watershed, which are hydrologically and socio-economically interlinked;
- promote and establish institutional arrangements between the water users, commercial private sector, and relevant agencies for allocation, conveyance, distribution, delivery of irrigation water, and for delivering inputs services and marketing arrangements.

The purpose of this paper is to document and highlight the impact of some selected interventions carried out by the SCOR implementation team in Huruluwewa watershed in the maha 1994/95 season. A detail description of the interventions and the process adopted by SCOR in carrying out the interventions are described in detail in Chapter 3.

The specific achievement focused in this paper is how timely cultivation and conjunctive use of surface water and rainfall contributed to improving land and water productivity in a few sample locations where specific interventions were carried out during maha 1994/95 season. The sample locations covered in this paper are Huruluwewa Feeder Canal; Huruluwewa Command area and three minor tanks namely, Pandikaramaduwa, Mahameegaswewa and Puwakpitiya (see later in this paper for description of the sample areas). The paper addresses how a package of SCOR interventions resulted in improved water use efficiency, water duty, water productivity and total agricultural production.

In addition, the paper also reports some preliminary achievements or the present trends and directions in forming and strengthening Fos for improved water management in Huruluwewa watershed and establishing appropriate institutional arrangements for decision-making, allocating and utilizing water for agricultural production. It also attempts to quantify the performance of the maha 94/95 season in terms of water use efficiency, adequacy and equity of water use, water productivity, water allocation, sharing and distribution taking the Feeder Canal, Huruluwewa tank scheme, Mahameegassagama tank, Puwakpitiya tank and Pandikaramaduwa tank as samples.

Figure 1



HURULUWEWA WATERSHED

CHAPTER 2

INTERVENTION AREAS AND PRESENT NATURAL RESOURCES MANAGEMENT STATUS

2.1 Description of the Intervention Areas

2.1.1 Huruluwewa Tank Scheme

Huruluwewa tank was an ancient abandoned tank which was rehabilitated during 1949 - 1954 and commissioned in 1954 with the settlement of 2371 farm families. It is estimated that the number of farm families has now increased to approximately 4500. The original command area covered 3489 ha (8621 acres), which was later increased to 3867 ha (9552 acres) without increasing tank storage. It is now believed that the cultivated command area has now increased to approximately 4654 ha (11,500 acres) with the encroachments.

A schematic diagram of Huruluwewa tank and its command area is shown in Figure 2. The tank has a catchment area of 19,940 ha (66 sq.mls) and has been designed to retain a maximum storage of 67.9 million cubic meters (mcm) (55,000 ac.ft) of water with a maximum water depth of 8.4 m (27.5 ft). Out of the total command area, only 3639 ha (9243 ac) are fed by the tank, while the balance 228 ha (579 ac) are directly fed by Kiulekada tank, a tank situated on the Right Bank (RB) tail end of the scheme and above command of the RB main canal. Thus, the actual command area of the tank is 3639 ha, out of which 2309 ha (5864 ac) lie on the Right Bank and 1330 ha (3378 ac) on the Left Bank (LB). The balance 20 ha (51 ac) is fed by a small canal taking off from the center sluice. The RB command area is divided to 13 tracts, while the LB command area to 6 tracts. A notable feature of the LB and RB of the Huruluwewa tank scheme is that a larger number of minor tanks and tank cascades exist in the area above command of the LB canal compared to the above command area of the RB canal, while a larger number of open-dug wells have proliferated in the irrigated command area of the RB canal compared to those in the irrigated command area of the LB canal. The exact reasons for this contrasting difference in the water harvesting potential is the Left and Right Banks are not clearly known as yet.

Reliable records and data are not available to assess the baseline status of irrigation water management under Huruluwewa tank scheme over the full range of its operation since 1954 to date. However, Huruluwewa tank is well noted both by the farmers as well as the officials of the Irrigation Department of Sri Lanka as a highly water-deficit tank in the dry zone. It is said that, since its commissioning in 1954, the tank did spill only five times up to 1993 out of the entire 40 years of its operation, registering a "spilling index" of 1/8 (once in every 8 years). The tank spilled in the year 1957, a year which recorded an extremely high rainfall, which resulted in the breaching of a large number of dry zone tanks including Huruluwewa tank bund. The latest spilling was witnessed during December 1993 and January 1994, the time SCOR interventions took-off from ground in the area.

Figure 2

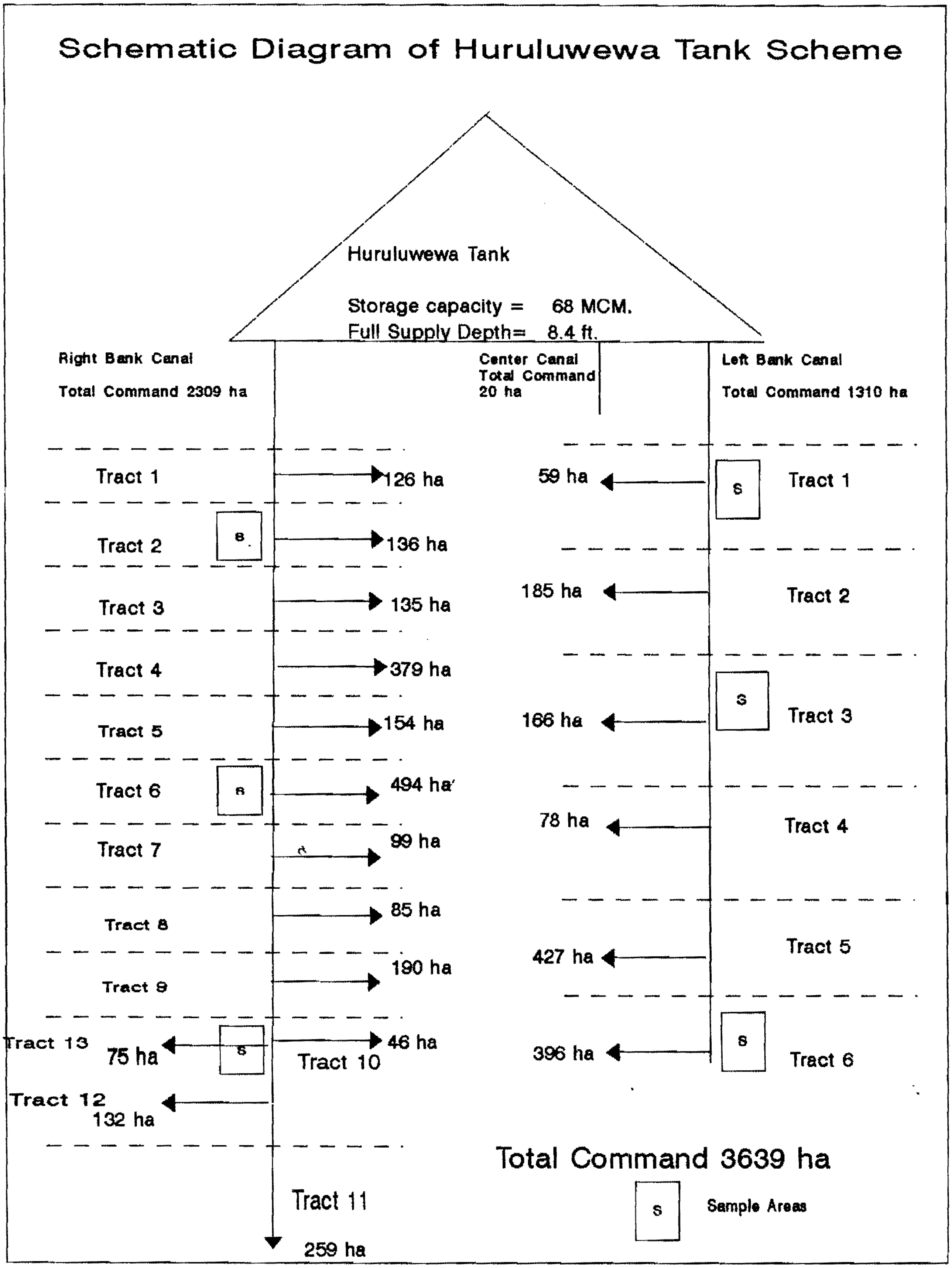
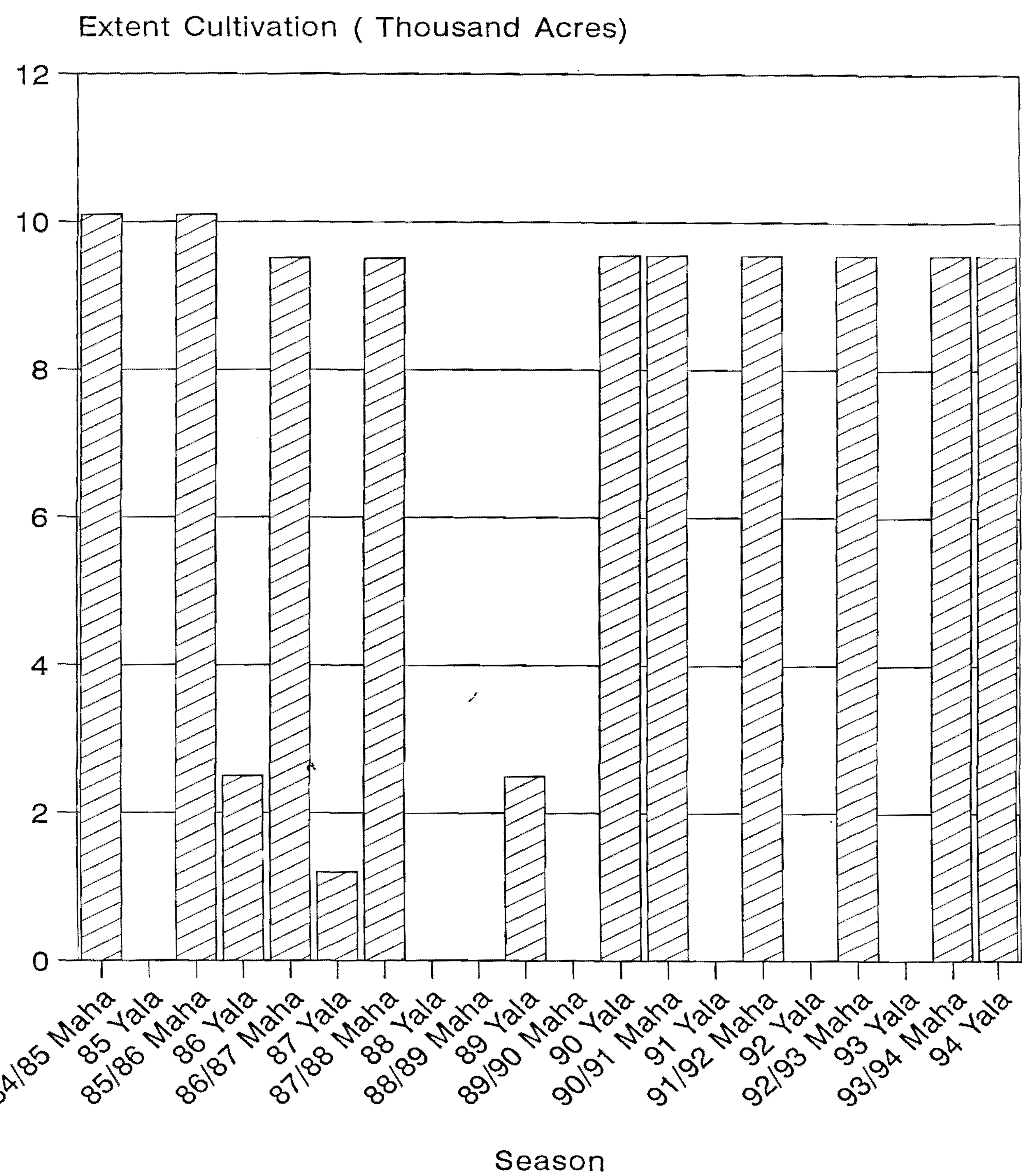

Schematic Diagram of Huruluwewa Tank Scheme
Huruluwewa Tank
Storage capacity = 68 MCM.
Full Supply Depth= 8.4 ft.
Right Bank Canal
Total Command 2309 ha
Center Canal
Total Command
20 ha
Left Bank Canal
Total Command 1310 ha
Tract 1
126 ha
Tract 2
136 ha
Tract 3
135 ha
Tract 4
379 ha
Tract 5
154 ha
Tract 6
494 ha
Tract 7
99 ha
Tract 8
85 ha
Tract 9
190 ha
Tract 13
75 ha
46 ha
Tract 10
Tract 12
132 ha
Tract 11
259 ha
59 ha
Tract 1
185 ha
Tract 2
166 ha
Tract 3
78 ha
Tract 4
427 ha
Tract 5
396 ha
Tract 6
Total Command 3639 ha
S
Sample Areas

Figure 3

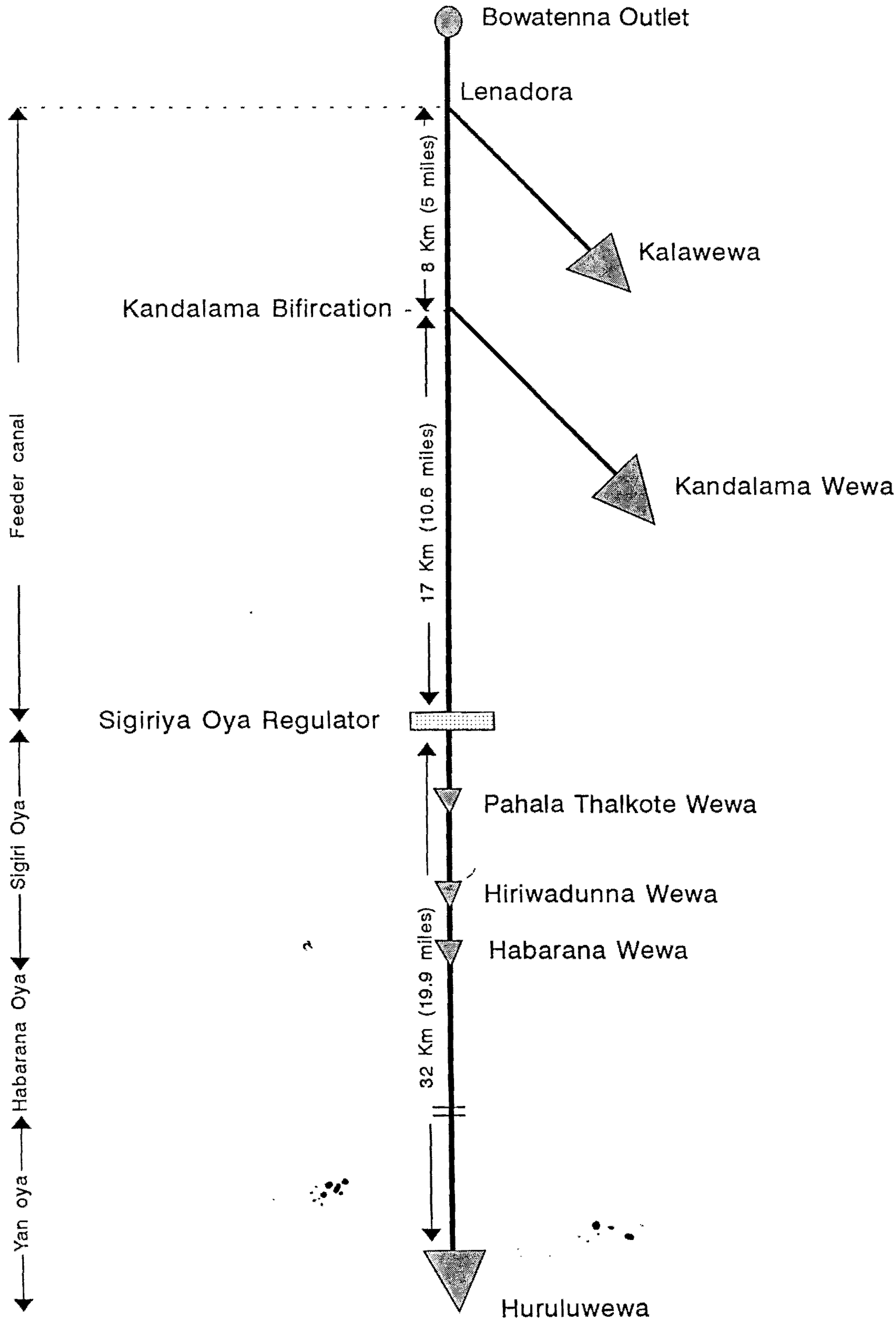
Cultivation Progress of Huruluwewa Tank



Courtesy :- IE. (Huruluwewa)

Figure 4

SCHEMATIC LAYOUT OF HURULUWEWA FEEDER CANAL - HURULUWEWA TANK SYSTEM



(Distances indicated above are estimates)
(not to scale)

Figure 3 shows the cultivation progress in yala and maha seasons under Huruluwewa tank scheme for the last eleven years from 1983-1994. It is seen that out of the eleven maha seasons previous to 1994/95 maha season, cultivation has taken place only in nine maha seasons. No crop was grown in two seasons due to shortage of water. Out of the "successful" nine maha seasons, the full extent was sown with rice only in eight seasons, while in one season (1992/93 maha), only about 15 percent of the command area (587 ha/1452 ac) was cultivated with non-rice crops, which was mainly soya bean. This corresponds to a "Maha Cultivation Success" (MCS)[2] of 0.74[3]. Out of those eight maha seasons too, three seasons (1984/85, 1990/91 and 1992/93 maha seasons) were "meda" seasons, which means that the cultivation begun only in January, because the farmers felt the tank storage prevailed in early months of the maha season were inadequate to begin the season in September or October. Out of the eleven yala seasons that passed by during 1983-1994, no cultivation took place in seven yala seasons. The average cropping intensity for other four "successful" seasons was about 25 percent. The full extent was cropped with rice only in 1994 yala season, because Huruluwewa tank was almost full around April after an exceptionally higher rainfall experienced in the previous maha 1993/94 season.

2.1.2 Huruluwewa Feeder Canal Area

A schematic diagram of the Huruluwewa Feeder Canal is shown in Figure 4. The Feeder Canal was a man-made canal which was commissioned in 1976 to augment Huruluwewa tank from Bowatenna reservoir.

The Feeder Canal takes off from Bowatenna reservoir with a designed discharge capacity of 28.3 cumecs (1000 cusecs). It then bifurcates to two branches at a place called "Lenadora". The right branch of the canal, which is called "Kandalama-Huruluwewa Feeder Canal", takes off from this bifurcation with a design discharge capacity of 9.9 cumecs (350 cusecs). This canal bifurcates again to two branches another 8 km below (at Kandalama bifurcation) from the first bifurcation point at "Lenadora". One branch canal takes off to Kandalama tank (Kandalama canal) with a designed discharge capacity of 5.6 cumecs (200 cusecs) and the other takes off to Huruluwewa tank (Kandalama-Huruluwewa Feeder Canal) with a designed discharge capacity of 4.25 cumecs (150 cusecs).

Kandalama-Huruluwewa Feeder Canal, which will hereafter be called as "Feeder Canal" is one of the areas of attention in this paper. This canal traverses through arable lands enroute for 17.4 km up to "Milaththewa" before it confluences

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[2] "Cultivation Success" is defined here as "the ratio" between "total area of the command grown with any crop under irrigation from the tank" and "total extent that was available for growing crops" during either "maha" season or "yala" season, for the total period under consideration.

[3] Maha Cultivation Success (MCS) is computed as follows.
MCS = (3865.7 x 8 + 587 x 1) / (3865.7 x 11) = 0.74

to "Sigiri Oya[4]", which is a natural branch stream of Yan Oya. The water confluencing to Sigiri Oya then travels through a cascade of three minor tanks namely Pahalatalkote, Hiriwadunna and Habarana tanks enroute before water reaches Huruluwewa tank. (Figures 1 and 4). A detail description of these three tanks is given later in this Chapter. The land area that lie on the Left Bank of the Feeder Canal had been inhibited by about 800 farm families who migrated from the adjoining areas both before and after the commissioning of the canal. Those farm families who migrated before the commissioning of the Feeder Canal grew rice in maha season under about 13 village tanks in a total extent of about 723 ha (1787 acres) (Ariyaratne, 1995).

2.1.3 Cascade of three tanks

Before the Feeder Canal came into existence, the three tanks mentioned in the previous section had been fed by their independent catchments, the main inflow stream to the tanks being Sigiri Oya. Sigiri Oya is the uppermost natural branch stream of "Yan Oya". It receives an extra supply of water from the Feeder Canal, first to feed the cascade of the tanks and then to transport the excess flow down to Huruluwewa tank along "Habarana Oya" and then along "Yan Oya". "Habarana Oya" is the name that is in use to describe the intermediate reach of the main river that lie between Habarana tank to some unspecified distance along the main river. Thereafter, the natural river is called "Yan Oya". The first drop of Mahaweli water reached the tanks in 1976.

Pahala Talkote wewa

Elderly farmers of the area recall that, even in the year 1935, Pahala Talkote wewa had been in existence as a very small tank. The tank had been not in use as a reliable source of supplementary water for agriculture as it had been in need of repairs and improvements. Around 1935, the farmers renovated the tank and strengthened the bund by utilizing their own labour and meager financial assistance received under government sponsored drought-relief and other financial assistance programmes. In 1935, there had been 31 farmers under the tank who owned a total command area of 12.5 ha (31 acres). The tank breached during 1957 floods and was repaired in the following year by the Irrigation Department. Also, around 1965, the full supply level of the tank was raised by 0.75 m ($2\frac{1}{2}$ ft) because the farmers found it difficult to irrigate the available extent (12.5 ha) in yala season with the tank capacity available at that time. In 1976, with the commissioning of the Feeder Canal, a new sluice called "Mahaweli Sluice" ("Mahaweli sorrowwa") was constructed to regulate and release water down to Huruluwewa tank.

Until 1976, the total extent regularly cultivated under the tank remained at 12.5 ha. The farmers used to cultivate the entire extent with rice during maha season. The farmers did not cultivate some maha seasons successfully, because the rice lands got inundated by water due to excessive seasonal river discharge of Sigiriya Oya. In some maha seasons they suffered water shortages too. After the receipt of Mahaweli water from the Feeder Canal, rice is cultivated in about 81 ha (200 acres) regularly in maha season, and about 10 to 12 ha (25-30 acres) of non-rice

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[4] "Oya" is the sinhalese term used to describe a second/third order stream draining to a major river.

crops, mainly B-onions, are cultivated regularly in yala. The cultivated area at present includes the original irrigated command area of the tank and additional lands that lie along the banks of Sigiriya Oya from the tail-end of the tank-irrigated command area up to the foreshore of the water spread area of Hiriwadunna tank, which is the next downstream tank of the cascade. The rice cultivation in maha season in those lands along the river bank is done by diverting water from the main river channel by constructing temporary stick dams at a number of locations.

Hiriwadunna Wewa

By about the year 1935, Hiriwadunna tank had been in working condition. According to the farmers, it had only one sluice and a single irrigation canal at that time. The tank breached in 1957 floods and was subsequently repaired in 1958. In 1976, with the commissioning of the Feeder Canal, a special sluice ("Mahaweli sluice") was constructed to regulate and release Mahaweli water down to Huruluwewa tank. More recently, the tank was rehabilitated under the Village Irrigation Rehabilitation Programme (VIRP) and, as a result, the old single irrigation sluice was replaced with two new irrigation sluices with control facilities.

The original extent under the tank had been 49 ha (122 acres). Until 1976, the farmers used to cultivate about 24 ha (60 acres) of rice during yala. Maha season cultivation was not normally practiced due to undesirable inundation of lands by flood water in the season. At present, the total cultivable extent is about 54 ha (135 acres). The full extent is cultivated regularly with rice in maha season, while about 24-30 ha (60-75 acres) are cultivated regularly with both rice and non-rice crops (B-onions) in yala. In some years, farmers used to grow three crops a year as well. During the yala 1994 season, about 6 ha and 24 ha (15 and 60 acres) were cultivated with B-onions and rice respectively.

Habarana wewa

Much historical details of Habarana tank could not be obtained. However, the tank was rehabilitated recently under the VIRP and the bund and the irrigation sluices were repaired. "Mahaweli sluice" of the tank was constructed in 1976 under the Feeder Canal construction programme.

The total cultivable extent under the tank is reported 65 ha (160 acres). The full extent is grown with rice in maha. During the yala 1994 season, about 16 ha (40 acres) and 24 ha (60 acres) were cultivated with B-onions and rice.

2.1.4 Mahameegaswewa tank

The location of Mahameegaswewa tank is shown in Figure 1. It is the tank that serves Mahameegaswewa village in the catchment of Huruluwewa reservoir. It is the last tank of a small cascade consisting of three tanks namely, Madugaswewa, Achchiriyawa and Palugahagodawela.

There are 65 families in the Mahameegaswewa village with a population of 313. The village has 63 homesteads and chena areas as well. A majority of people in the village have lands in the irrigated command area of Mahameegaswewa tank, while a few have lands under Madugaswewa and Achchiriyawa tanks. Some have lands in two or all the tanks (LUPPD, 1995).

The tank is an ancient tank having a storage capacity of about 0.275mcm (162 acre feet) at a full supply depth of about 3.5m (11.5 ft). It has a gross catchment area of 285 ha and a net catchment area of 195.2ha excluding the catchment area of Madugaswewa tank, which drains to Mahameegaswewa tank due to their relative positions in the cascade. The tank feeds a command area of 16.9 ha (42 acres) according to the topographic sheets, but at present, the total command area is about 22 ha (55 acres). Farmers hardly cultivate yala season. Even in maha, the full extent is cultivated only occasionally. The average maha cropping intensity is about 0.6-0.8. No agro wells are found the command area.

2.1.5 Pandikaramaduwa tank

The location of Pandikaramaduwa tank is shown in Figure 1. It is situated in the right foreshore area of Huruluwewa tank. It is one tank in a cascade of four minor tanks namely: Pandikaramaduwa, Puwakpitiya, Itchantottama and Methgama. Itchantottama is an abandoned minor tank.

There are 75 families in the village with a total population of 315 (SCOR survey). Out of the 75 families only 26 farmers own lands in the irrigated command area of Pandikaramaduwa tank. Some of them have lands under Puwakpitiya and Methgama tanks as well.

The tank has a gross catchment area of 207 ha. The tank can store about 0.23mcm (187 ac.ft) at full capacity. The tank feeds a command area of 19 ha (49 acres). A limited extent is cultivated with other field crops in yala due to shortage of water. The maha cropping intensity too is as low as 0.6-0.7. Two agro wells are used to supplement tank water for growing crops in the command area.

2.1.6 Puwakpitiya tank

The location of Puwakpitiya tank is shown in Figure 1. It is situated in the upper catchment area of Huruluwewa reservoir. It is the tank that feeds Puwakpitiya village. There are 83 families in the village. Farmers in the village do both chena cultivation and rice cultivation in the irrigated command area.

The tank has a storage capacity of about 0.23 mcm (189 are feet) at full depth. It feeds a command area of about 21 ha (54 acres). There are 8 dug wells in the command area used by 8 farmers for supplementary irrigation of field crops in yala season. In yala season, the cropping intensity is about 0.3 with about 7 being grown with other field crops. In maha cropping intensity is in the range of 0.80-0.90.

2.2 Administration of the Feeder Canal and Lands

Administration of the lands in the watershed area is the responsibility of four Divisional Secretary's (DS) divisions at Naula, Dambulla, Palugaswewa and Galenbindunuwewa. The lands of the upper portion of the Feeder Canal is administered by Naula DS Division. The remaining land area under the Feeder Canal and the first tank of the cascade (Pahala Talkote Wewa) fall under the administration of Dambulla DS Division, while lands under the other two tanks fall under Palugaswewa DS Division. The command area of Huruluwewa tank and the highlands in the adjoining areas are administered by Galenbindunuwewa DS Division.

The first reach of the canal from "Lenadora" to Kandalama bifurcation is managed by the Mahaweli Authority of Sri Lanka (MASL) for both operation and maintenance purposes, while the section beyond the Kandalama bifurcation to the tail end at "Mailaththewa" is managed by the Irrigation Department (ID). The interesting point to note here is that the operation and maintenance functions of the latter reach of the canal is done by two separate divisional offices of the ID. The operations are done by the Irrigation Engineer (IE) of Galenbindunuwewa office, while the maintenance is done by the IE of Dambulla office.

Although the cascade of three tanks have been incorporated in the Feeder Canal - Huruluwewa Conveyance system as a regulating and facilitating mechanism to deliver water to Huruluwewa tank, the administration and management of this regulating tank cascade system is very weak. It appears that the ID is supposed to be responsible for managing the cascade system. This aspect is discussed later in the following sections in this chapter.

2.3. Prevailing land and water use problems of the Feeder Canal Area

The soils of the Feeder Canal consists of both poorly drained, Low-Humic Gley (LHG) soils and moderately to well drained, Reddish-Brown Earth (RBE) soils. These soil types make a high potential for growing rice and other field crops (OFCs) respectively under irrigated conditions. Agriculture that prevailed in the area before the commissioning of the Feeder Canal was purely a subsistence level farming which were limited to chena and rainfed rice cultivation in maha as well as for irrigated rice cultivation in about 723 ha (1787 acres) under 13 village tanks. The Feeder Canal cut across many of the original cultivable lands of the native inhabitants, and in certain areas, the natural feeder streams of small village tanks. However, five of the 13 original village tanks were provided with inlets from the Feeder Canal to release water from the Feeder Canal to those tanks.

Commissioning of the Feeder Canal in 1976 took place at a time when a larger extent of new lands were being opened in the adjoining areas (Mahaweli system H) for irrigated agriculture under the Accelerated Mahaweli Development Programme. With this new adventure, high value and highly profitable crops such as chillies and big onions were introduced in the adjoining areas. As a result, a large number of enterprising people from outside acres encroached the lands of the Feeder Canal area for growing both rice and high value crops using water of the Feeder Canal (Ariyaratne, 1995).

Since then, there have been a progressive increase of the opening of lands enroute of the Feeder Canal for irrigated agriculture by "encroachers" from outside as well as by the traditional inhabitants, by tapping water from the Feeder Canal by syphoning through 50 mm (2") diameter PVC pipes and 50 mm, small head lift pumps. Consequently, land area under irrigated agriculture and the number of water tapping syphons continued to increase at a rapid pace season by season. By about the year 1993, just before the SCOR interventions began, it was found that the water flowing into Sigiri Oya at the end of the man-made reach of the Feeder Canal (Milleththawa) was only a trickle.

Figure 5 shows the effect of illicit tapping of water from the Feeder Canal on the water received at Huruluwewa tank. It shows the average monthly water releases issued from Bowatenna reservoir at Kandalama bifurcation structure and

Figure 5

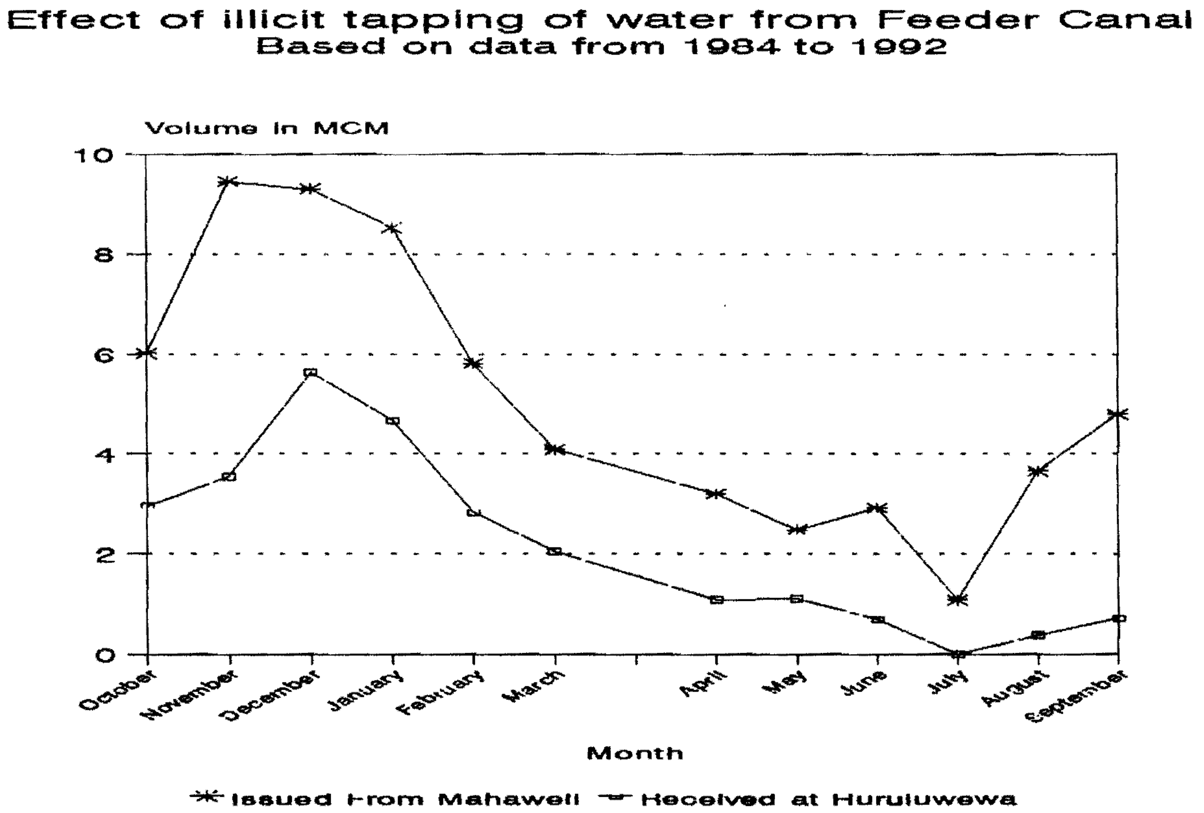
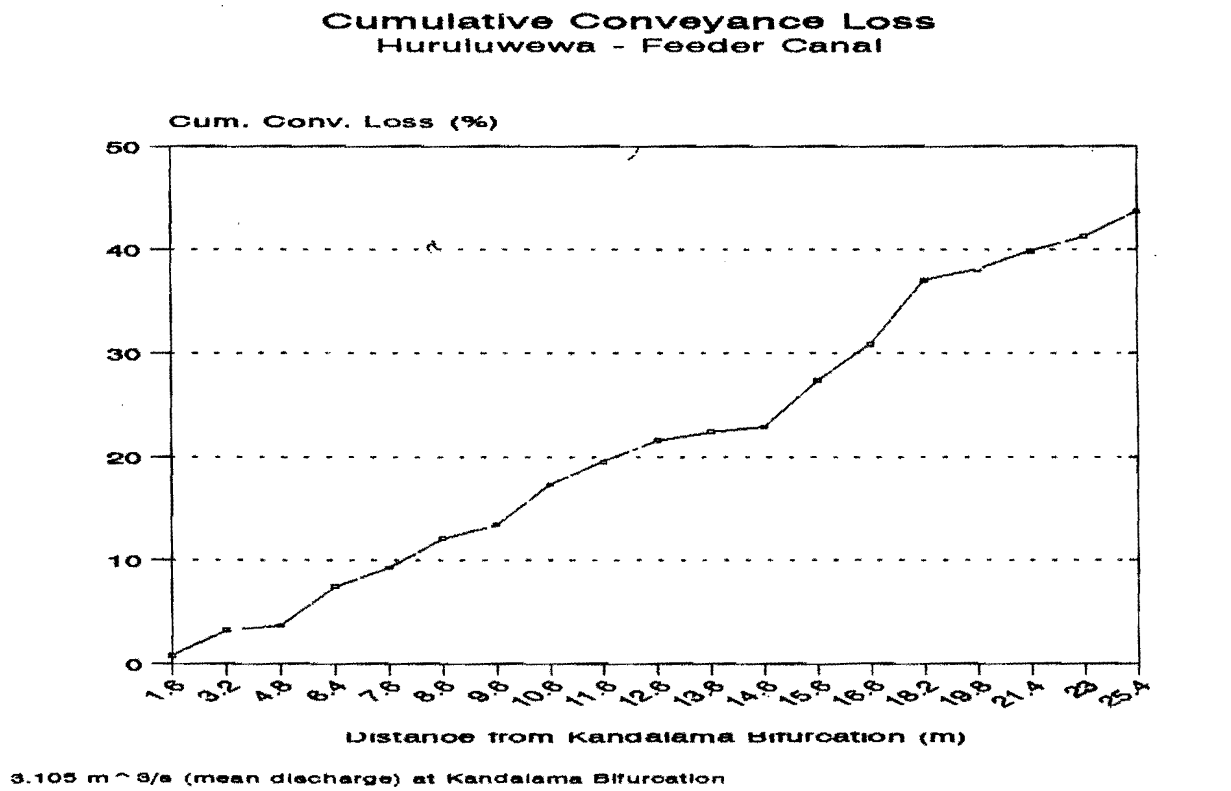


Figure 6



average monthly water receipts at Huruluwewa tank. Figure 5 is constructed using the data available with the Water Management Secretariat (WMS) and the ID for the period 1984-1992. It shows that, on average, only 45 percent of the total volume of water released from Bowatenna at Kandalama bifurcation point have reached Huruluwewa tank in Maha and 22 percent in Yala season. Although, these percentages represent the overall average of a 10 successive years, illegitimate tapping of water increased alarmingly over this period. At the time SCOR intervention began in 1993, hardly any water reached Huruluwewa tank in yala, while less than 10 percent of water reached in maha season.

Figure 6 shows the cumulative conveyance loss of water along the Feeder Canal shown against the distance. This is constructed on the basis of a conveyance loss study conducted by hydrological study consultants for the Major Irrigation Rehabilitation Project (MIRP) in October 1989 during which no water was taken off from the canal for irrigation. It shows the reaches with excessive conveyance losses. The cumulative conveyance loss estimated by the study was 43.7 percent. This means, if 150 cusecs is released at Kandalama bifurcation, only about 60 cusecs is lost due to canal seepage losses and only about 90 cusecs can be expected at the tail end of the canal which is 25 km away from the bifurcation. When low flows are released, the cumulative conveyance loss of water should be lower than this percentage due to reduction of wetted perimeter of the canal. There is no doubt that, when the full discharge is released to the Feeder Canal, a significant volume of water gets lost on the way, and with illicit tapping this amount is further reduced significantly.

2.4 Present status of O & M, Water Management of the Intervention areas

2.4.1 Water Allocation Planning and Releasing to Huruluwewa tank scheme

For Bowatenna-Huruluwewa Feeder Canal, the responsibility for planning water allocations to Huruluwewa Feeder Canal from Bowatenna reservoir lies with the Water Management Secretariat (WMS) of the Mahaweli Authority of Sri Lanka (MASL). The planning takes place in a few sequential stages.

The macro-level seasonal planning begins prior to the commencement of each cultivation season, i.e. yala and maha seasons. Prior to the commencement of each cultivation season, by August for maha season and by February - March for yala season, the WMS prepares a draft plan for allocating water from the entire Mahaweli Complex for both irrigation and power generation. This draft plan is prepared in consultation with all relevant agencies receiving Mahaweli water including the Irrigation Department as well. The draft plan is prepared on the basis of draft cultivation plans, which include tentative dates of commencement of the season, anticipated areal extents to be grown with crops, crop types and varieties etc. for each irrigation system that receive water from Mahaweli System. In respect of Huruluwewa Tank Scheme, the first draft seasonal cultivation proposal is submitted by the IE of Galenbindunuwewa in consultation with the Farmers Organizations through the existing Project Management Committee (PMC) mechanism. Having received the draft proposals for cultivations for all relevant irrigation schemes that receive Mahaweli water, the WMS synthesizes the information to prepare a document which is named as "Draft Seasonal Operation Plan (SOP)". The Draft SOP is developed on the basis of a computer model which has the capability to analyze previous climatic data and cultivation and water availability statistics and to simulate different water availability and cropping scenarios for a range of rainfall probabilities that would be likely for the forthcoming season. The draft SOP recommends in respect of each irrigation scheme, areal extents that could be grown, crops, dates of commencement and termination of the cultivation season, and volumes of water that would be released from Mahaweli reservoirs and diverted at the key nodal diversion points of the Mahaweli irrigation water conveyance and distribution network. In respect of Bowatenna-Kandalama-Huruluwewa conveyance system, the SOP indicates the planned monthly volumes of water that would be released from Bowatenna reservoir to Kandalama tank and Huruluwewa tank separately, at the Kandalama bifurcation point. The draft SOP is then distributed among all relevant agencies including the Irrigation Engineers and the Project Managers of the IMD for review and discussion with the farmers.

An interesting feature of the SOP is that, although the WMS is well aware of the tapping of water from the Feeder Canal for irrigating crops grown on the adjoining lands, neither the irrigation water requirements of those lands nor the tapping of water from the Feeder Canal and their adverse impacts on the allocation of water to Huruluwewa tank are considered in developing the SOP recommendations. Apparently, the realistic situation of the Feeder Canal is not appraised for the development of SOP and eventually, the question of tapping of water from the Feeder Canal and the consequences and adverse effects of such tapping of water on the anticipated seasonal plan of Huruluwewa tank is conveniently ignored in macro-level planning.

A formal discussion is subsequently held to ratify the draft SOP. The assembly of the participants summoned to this meeting is called "Mahaweli Water Management Panel (WMP)". The WMP comprises of key head quarters officials of the government agencies benefitted by Mahaweli water and who are responsible for providing crop production inputs and services. The WMP includes the District Secretaries (formerly Government Agents), relevant Members of Parliament, relevant Divisional Secretaries, key project level officials of the irrigation schemes receiving Mahaweli water and the representatives of the Farmers Organizations. The WMP is chaired by the Director General of the MASL. The secretary to the WMP is the Director of the WMS. In respect of Bowatenna-Huruluwewa Feeder Canal and Huruluwewa tank schemes, the WMP is represented by the Engineer in Charge (EIC) of Bowatenna reservoir, IEs of Galenbindunuwewa and Dambulla. Divisional Secretaries of Naula, Dambulla and Galenbindunuwewa and the Chairman of the Project Management Committee of Huruluwewa tank scheme. An important point to note here is that farmer representatives of the Feeder Canal area and the three tanks are not summoned for this meeting as they are not considered as formal members of the WMP. Neither the cultivation along the banks of the Feeder Canal nor the quantum of water tapped illegitimately from the Feeder Canal nor the adverse consequences of that practice on the proposed quantum of water allocated to Huruluwewa tank for a season, are formally discussed at the WMP assembly. The main purpose of the WMP discussion is to review and amend the SOP and to ratify it finally.

The next stage of the implementation of SOP recommendations takes place weekly. The implementation of the SOP recommendations is monitored weekly by a separate panel operating from Colombo, which is constituted by the middle level officials of the representative agencies. This panel is chaired by the Director of the WMS. It reviews the progress made in respect of the cultivation of each irrigation scheme and water releases and diversions made at each key nodal point of the Mahaweli system. It also compares the planned and actual bulk water releases and diversions, reconciles the quantum of water diverted at the sources and received at the target points, discusses operational and implementational constraints for the foregoing week, and based on those reviews and the anticipated operational and climatic conditions, reaches consensus on the weekly bulk water releases and diversions for the forthcoming week.

In respect of our study area, the WMS sends instructions to the EIC at Bowatenna in respect of how much water should be released by him from Bowatenna reservoir to Huruluwewa tank scheme at Kandalama bifurcation point for each week. However, the IE at Galenbindunuwea is not notified of the weekly decisions of water releases by the WMS directly. Thus, the IE at Galenbindunuwewa is not aware of the quantum of water that he should expect from Bowatenna reservoir at Huruluwewa tank for each week. Neither he is notified of the quantum of water that would be released to Huruluwewa tank from Kandalama bifurcation point. The situation is further aggravated by the complete absence of a formal organizational arrangement at watershed level, a formal arrangement to review the water releases as well as receipts and make necessary field level adjustments to the macro-level plans with the participation of the stakeholders of the entire system including the farmers, Divisional Secretaries and the Irrigation Engineers. As a result, although water releases are made from Kandalama bifurcation to the Feeder Canal, the management of water along its conveyance route up to Huruluwewa tank and planning cultivation are done loosely without any systematic monitoring and feed back.

2.4.2 Water management in the Feeder Canal - Huruluwewa Water Conveyance Route

Since the commissioning of Mahaweli diversions of water to Huruluwewa tank in 1976, the Mahaweli Authority of Sri Lanka (MASL) was responsible for the water management of the entire Feeder Canal up to the inlet to Huruluwewa including these three tank systems. This responsibility was transferred to the ID in 1981. According to the farmers, the ID is responsible for the water management of the Feeder Canal below Kandalama bifurcation to Huruluwewa tank. The farmers report that, during 1976-1981 period, water management within the system had been satisfactory. They are of the opinion that the MASL ensured the conveyance of a designated quantity of water from Lenadora to Huruluwewa by discouraging illegitimate tapping of water enroute by exercising closer scrutiny, monitoring and stern and timely action against any offender. MASL stationed a labourer at each of the above tanks to monitor daily inflow to each tank from Mahaweli Feeder Canal and release a pre-determined quantum of water downstream through "Mahaweli sluices". Also, daily water flow in Yan Oya had been monitored at Palugaswewa before the entry of water to Huruluwewa tank. The labourers had been provided with charts and necessary operational guidelines for this purpose. Apparently, this practice was continued after the transfer of the management from the MASL to the ID in the year 1981.

For a period of about two years, since the transfer of inter-provincial irrigation schemes to the North Central Province (NCP) Provincial Council in 1989-1990, those tanks had been under the overall custody of the Provincial Irrigation Department. But, considering the operational and hydrological inter-linkage of the three tanks with a major conveyance canal and two major reservoirs (Bowatenna and Huruluwewa), the responsibility for O & M of the three tanks was transferred back to the ID. Subsequently, the responsibility for O&M of the minor tanks and ensuring the safety of headworks as well as for intra-tank water management of the three tank system, is now vested with the ID. IE of Galenbindunuwewa division is functionally responsible for this task on behalf of the ID.

Although, the cascade of three tanks is considered an integral component of the major irrigation conveyance system, there exists no specific and formal guidelines that govern the operation of the three tanks. The ID claims that some guidelines in respect of specific operational rules for the irrigation sluices and Mahaweli sluices of the three tanks and minimum operational storages and water levels that could be retained in the tanks at any given time are in existence. But, apparently, those guidelines are not available in any documented form for easy reference and use. No official records in respect of operational rules and intra-tank water management guidelines could be traced. Even if such guidelines exist, those are not implemented in day to day operations. But, there is a general understanding that, at any time, it is not permitted to keep more than 1.8 m (6 ft) depth of water in the tanks and any extra storage that corresponds to a tank water height of over and above of 1.8m (6 ft) have to be released downstream. There is hardly any evidence to comment on the adoption of those operational guidelines or any other systematic organizational and technical arrangements for day to day operation of the cascade.

It is clear that little efforts are made for O & M and water management between the three tanks within this reach. This is evident from the fact that none of the three Mahaweli sluices cannot be properly operated and have not been systematically operated for years. According to the farmers, during floods the sluice gates have to be lifted haphazardly, sometimes by means of lifting with iron chain blocks with great effort, to safeguard the tanks against breaching. Nevertheless, each tank has to spill over to convey excess water to downstream.

On the other hand, one may argue that during Mahaweli management, proper intra-tank water management was essential then, because unlike now, there had been a fair delivery of water from the Feeder Canal to Sigiri Oya, as irrigated agriculture enroute of the Feeder Canal had not been fully developed then. The same intensity of daily water management in the three tanks system may not be required now, particularly during yala season, as the flow of water delivered by the Feeder Canal to Sigiriya Oya is very little. The farmers of Talkote Wewa report that, during the yala 1994 season, they did not receive Mahaweli water for not more than 6-7 days. Hiriwadunna and Habarana tanks have not got a single issue of water. The records of water flow at our water flow measurement points located upstream and downstream of each tank justify the water flow pattern observed by farmers. Consequently, Huruluwewa tank too did not receive a single drop of water from Mahaweli during yala 1994 season. This unusual reduction of flow to Huruluwewa tank in yala 1994 season shows the progressive but sharp increase of the extent brought under irrigated agriculture on lands both above and below the Feeder Canal and consequent tapping of water from the Feeder Canal. In this scenario, the operation of Mahaweli sluices may be crucial during maha season to release bulk issues or to safeguard the tank during heavy storms or both.

The recorded active storage of Hiriwadunna and Habarana tanks at the full supply levels are 0.55 and 0.79 mcm (445 and 640 ac.ft) respectively. The design capacity of Talkote wewa is not known as official records could not be traced.

However, it should be in the order of 0.3 - 0.37 mcm (50-300 ac.ft). However, the actual storage of the tanks should be at least 5-10 percent lower than these figures due to visible siltation of the tanks. The effective storage of all three tanks are so small that a continuous flow of about 1.4 cumecs (50 cusecs) would bring the empty tanks to spilling stage within a matter of few days. Talkote tank would fill completely in 2-3 days, whereas, other two tanks would fill completely in 5-6 days each, if a continuous discharge of about 1.4 cusecs is sent.

The storage capacity and depth of water of the three tanks are comparatively small so that, theoretically, their influence on the conveyance of water from the Feeder Canal to Huruluwewa during water abundant maha season may not be very significant. But, what happens in practice is, in a crisis situation, when it is required to augment Huruluwewa tank by bringing water from the Bowatenna reservoir, each tank had to be completely filled with water one after the other. Two factors complicate the operation of the three tanks in a crisis situation. Firstly, the Mahaweli sluices are not in proper working condition. Secondly, there exist no clear operational guidelines that are acceptable both to the farmers and the ID. As a result, the farmers usually oppose the deliberate opening of Mahaweli sluices to facilitate downstream releases from the three tanks.

In yala season, during which the normal flow leaving the Feeder Canal is typically small, the intermediate storage in the three tanks can significantly effect the flow to Huruluwewa. However, the Mahaweli sluice gates of all three tanks should be unkept in proper working condition to enable water issues to Huruluwewa in both seasons and to ensure the safety of tanks against failure during the north-east monsoon.

A specified volume of water is usually allocated to Huruluwewa for yala and maha season by the Mahaweli Water Management Panel in its Seasonal Operational Plan prepared and distributed among the relevant agencies prior to the commencement of each cultivation season. Also, bulk issues are made from Lenadora to Huruluwewa in both seasons. However, the Huruluwewa tank cannot enjoy the full benefit of its share of water due to excessive use of water along the Feeder Canal. It has been noted in the foregoing yala 94 season that, when 4.25 cumecs (150 cusecs) was issued from Kandalama bifurcation, not more than a discharge of 0.4 cumecs (15 cusecs) reached the tail end of the Feeder Canal. During dry weather in yala the conveyance losses make the flow in Sigiri Oya to a trickle. According to the records of the Water Management Secretariat of the MASL, about 28.5 mcm (23,100 ac.ft) of water were issued from Kandalama bifurcation to Huruluwewa from March to July 1994. The total including the release in January and February was 39.2 mcm (31,750 ac.ft).

Also, this volume of water was claimed to have been issued to Huruluwewa tank, the tank did not receive any water at all during this period. In other words, about 24.7 mcm (20,000 ac.ft) of water (allowing for a total conveyance loss of about 40 percent -- See Figure 6) were consumed for irrigating rice and non-rice crops en-route of the Feeder Canal, although the official records of the Seasonal Summary Reports of the WMS credit this total water allocation to the Huruluwewa account.

It is evident from the foregoing review that neither the Huruluwewa tank nor the three tanks are benefitted by Mahaweli water during yala 1994 season. Farmers under the three tanks say that without any extra issues from Mahaweli Feeder Canal, they can manage yala season. Even if more Mahaweli issues are available, unless there are continuous water issues, they cannot increase the yala extent more than what they cultivate now, because the tanks cannot store much water. If continuous Mahaweli water releases are available, perhaps, the yala extent under the three tanks may get increased slightly due to increased availability of continuous water flow.

Another point that deserves attention is that, although, the three tanks are hydrologically and socially interlinked with each other and with the main water conveyance system, the cultivation seasons and crop production activities under the tanks are not planned, coordinated, facilitated and implemented to fall in line with the cultivation activities of the Feeder Canal and the Huruluwewa tank scheme. Cultivation meetings for each tank are held individually and the Department of Agrarian Services (DAS) takes the lead role in seasonal planning with virtually less coordination and collaboration with the ID and farmers.

Thus, if any water releases are made from the Feeder Canal to Huruluwewa tank in yala, it appears best that bulk releases be made continuously for about 10 days a month on a pre-planned schedule. This allocation shall be released exclusively for the Huruluwewa tank, and the Feeder Canal farmers should collectively agree to close all Feeder Canal outlets and other tapping points and allow the full delivery of water to Huruluwewa tank during this period. Also the farmers together with the ID and MASL should have a special arrangement at field level to make water allocation planning decisions and implement the decisions. Such a field level working arrangement can be forged only through the mutual understanding and coordination among the farmers organizations of both Huruluwewa tank, the Feeder Canal and the three tanks as well as between the FOs and the officials. Proper operation and maintenance of the entire system, therefore, depend on the shared control of the water available to the system and shared management of the infrastructure that facilitate the conveyance of water from Bowatenna reservoir to Huruluwewa tank via the three tanks. Also, the increased agricultural productivity of the entire system depend on identifying the agronomically suitable and economically crops and cropping patterns that match with the available water resources which have to be promoted and adopted through the consensus of all stakeholders, facilitated through the shared control and management mechanisms. It is in this context SCOR interventions have been launched in the Feeder Canal - 3 tanks and Huruluwewa Command area system.

2.5 Problems and Constraints related to land and water management in Huruluwewa watershed: Some key issues

Although, some land and water management problems related with the Feeder Canal were described earlier, a description of the problems and constraints in relation to the land and water management problems in the entire watershed is given in this section. It should be noted that, during the Phase I, the focus of the SCOR interventions under the integrated water management theme was to improve land and water management in respect of the Feeder Canal, Huruluwewa tank scheme and three selected minor tanks elsewhere in the watershed (Meegaswewa, Pandikaramaduwa and Puwakpitiya tanks) and not on the entire geographical area of the watershed. For convenience the key problems and constraints are summarized below:

(a) No formal institutional arrangement exists to facilitate the shared decisions making and control in respect of allocation, distribution, conveyance of water for agricultural production in the entire system including the Feeder Canal, three tanks an the Huruluwewa tank.

(b) The land productivity of the Feeder Canal is high while the water and use efficiency and water productivity is low. In contrary, the land productivity of the Huruluwewa tank scheme is low, while the water efficiency and water productivity is high. It is possible to maximize the land and water productivity and water use efficiency of the entire system as well as at individual systems by adopting appropriate crops, cropping patterns and rational water allocation and sharing practices through mutual cooperation and collaboration of farmers of all sub-systems and the agency officials through formal organizational and institutional arrangements.

(c) A considerable part of the water released to Huruluwewa tank is consumed en-route by the Feeder Canal farmers within 25 km reach of the Feeder Canal to irrigate crops.

(d) Typically, the daily discharge rate and the total volume of water released from Bowatenna reservoir to Huruluwewa tank for a season is less than the desired daily discharge rate 4.25 mcm (150 cusecs) and the planned/allocated volume of water. In maha 94/95 season, the average daily discharge rate was only 30 percent (1.4 mcm) and the actual volume of water released was also only 30 percent, i.e. 45.3 mcm against a planned volume of 49.5 mcm measured at downstream of Kandalama bifurcations stricture.

(e) As a result, the amount of flow of water entering Yan Oya at the tail end of Feeder Canal (at Sigirimulana) is very low. In yala 94 season, actually no flow entered Yan Oya and in maha 94/95 season, only 16 percent of the volume of water released to Huruluwewa tank at Kandalama bifurcation structure entered Yan Oya at Sigirimulana. Average daily discharge rate measured during 94/95 maha season at Sigirimulana was 0.70 cumecs (25 cusecs).

(f) Although, the authorities (Mahaweli Water Management Panel) is aware of this situation, no extra water allocations are made both during planning and operations to compensate for the loss of water released to Huruluwewa tank due to illegitimate consumption en-route. Even the official records (Seasonal Summary Reports of the Water Management Secretariat) makes no mention about this fact. Instead, the entire quantum of water released to Kandalama - Huruluwewa Feeder Canal are considered as having released and consumed by Huruluwewa Scheme.

(g) As mentioned earlier, the water use efficiency along the Feeder Canal is very low. The water is drawn from the Feeder Canal through thirty six, parallel field canals which are designed to release 30 liters per second (1 cusec) and which were recently constructed by the Irrigation Department. Also water is illicitly drawn through a large number of 50 mm (2") alkathene pipes by syphoning, and by 50 mm water pumps through lifting and pumping. The latter device is used to irrigated cash crops mainly on the right/upper bank of the canal while the other two devices for irrigating both rice and cash crops on the left/lower bank of the canal. However, 50 mm lift pumps are now increasingly used for irrigating crops on the lower bank as well. It was estimated that, approximately, the total consumption of water for growing chillies and B-onions was equivalent to 1.76 m (or 5.78 ac.ft/acre) in yala 94 season. This is after accounting for the conveyance losses of the canal, which was estimated as 44 percent of the total volume of water released to the canal. With the conveyance losses, the total Feeder Canal duty in yala 94 season was estimated as 2.9 m (9.5 ac.ft/ac).

(h) Some parallel FCs are defunct due to design and construction shortcomings. As a result, farmers are compelled to use alkathene pipes to draw water from the canal. On the other hand, there is no on-farm irrigation infrastructure in the Feeder Canal command area. This situation compels an uncoordinated, unsystematic and wasteful management of water leading to low water use efficiency and deprivation of the legitimate share of water to farmers of Huruluwewa tank scheme.

(i) Food crops grown in the Feeder Canal area are mainly rice and B-onions. Rice too is grown on highly permeable soils leading to over use of water. Seasonal crops too are grown without much effort to conserve soil and water. There is a lack of technical understanding on the specific areas that are suitable for seasonal cropping and specific crop types, and of a proper mix of seasonal and non-seasonal cropping that would both save water and improve cash-flow and net return to farmers. This is further aggravated due to lack of opportunities for collecting and marketing of the production and enterprise development.

(j) The cascade of three tank system below the Feeder Canal poses a number of constraints to achieving integrated land and water management as described before. The status of water management in this reach is very poor. The old guidelines for operating the tanks to release Mahaweli water to Huruluwewa tank are not formally implemented. On the other hand, the control gates of the water releasing sluices are defective and cannot be smoothly handled and operated. In between the tanks, farmers put up temporary stick dams across Yan Oya to divert water to irrigate seasonal crops (paddy and B-onions mainly) grown on the reservation lands adjoining to the river banks. In this reach too, the areas suitable for seasonal cropping and perennial cropping and for different crop types are not clearly known. Opportunities for collective marketing and enterprise development are not available.

(k) In the Yan Oya reach between Habarana tank and Huruluwewa tank, about 80 - 100 ha of lands on the banks of Yan Oya are cultivated with seasonal cash crops by encroaches and second and third generations of the original settlers of the Huruluwewa Scheme and three tanks. Water abstraction takes place mainly through lifting by 50 mm water pumps and also diversion by temporary stick dams at a number of places.

Initial attempts have already been taken to establish links between the farmers in the Feeder Canal, three tanks and Huruluwewa scheme to promote integrated water management and seasonal planning and cultivation. However, the farmers in this lower reach of Yan Oya operate in isolation as yet. The constraints in respect of seasonal and perennial cropping, marketing and enterprise development that are typical to other areas exist in this reach too.

(l) The main constraint to agricultural productivity in Huruluwewa tank scheme is inadequacy of water for cultivating the full extent in both seasons of the year. As already mentioned, during 1983 - 1994, maha cultivation took place in nine seasons out of the eleven seasons, the average cultivation success in maha season being 0.74. But out of those nine successful maha seasons, three seasons were "meda" seasons, which means that cultivation began in January due to inadequate tank storage to begin the season in time. Out of the eleven yala seasons, no cultivation took place at all during seven yala seasons. Full extent was cultivated with paddy in 1994 yala. The average cropping intensity for the other "successful" seasons was 0.25.

(m) Within the command area of Huruluwewa, there exist a number of small tanks, managed by farmer organizations established under the Agrarian Services Act (Amendment) of 1991. It is potentially possible to link those farmers with the farmers of main Huruluwewa scheme through an organizational linkage and to promote conjunctive use and management of water in the subsystem to improve water use efficiency, cropping intensity, extent cultivated and farmer incomes. However, the techniques and modes of achieving this status is not clearly known as yet and have to be tested in an action research mode.

(n) Within the command area there are nearly about 500 large diameter, open, shallow dug wells (agro-wells). When water issues are made from the tank to irrigate a crop in the command area, majority of farmers utilize canal water to grow paddy or a field crop and use agro-wells only as a supplementary source to meet deficits in the supply. On the other hand, when water issues are not made at all from the tank, typically in a water-stressed yala season, or when the extent cultivated is limited and confined to a pre-determined area of the scheme as (as for a bethma cultivation), the farmers usually use agro-wells to grow a cash crop. However, from water management point of view, there could be better modes of using the available overall water resources in the command area in conjunction, including the in-situ rainfall. These modes of operation are yet to be developed.

(o) In addition, recycling of drainage water take place in the tail end drainage area of the scheme. Drainage water is picked up by temporary and semi-permanent pick up anicuts constructed across Yan Oya and subsidiary drainage streams and recycled to areas of Huruluwewa command to meet the irrigation supply from Huruluwewa tank. The crop mainly cultivated is rice in maha and OFCs in yala. Drainage water is also picked up by 50 mm water pumps through lifting during yala to grow onions and chillies. However, the efficiency of utilization of drainage water can be further improved and more area can be grown to increase farmer income.

(p) In a large number of minor tanks that lie outside the command area of Huruluwewa Tank, both the annual cropping intensity and maha cropping intensity are typically low. There is typically no cultivation in yala. It is potentially possible to increase the income to farmers by increasing cropping intensities by introducing soil and water conservation, appropriate cropping patterns, water management and relevant institutional and organizational arrangements including establishment of farmer organizations and the promotion of marketing etc.

The issues listed above throw light to some potential interventions on integrated water management that are likely to improve the shared control of natural resources and, through it, the sustainable income to farming community. However, in Phase I, the SCOR interventions were confined to a limited number of aspects which primarily focussed on diagnosing, quantifying and qualifying the actual problem and a few action-oriented interventions in the Feeder Canal Huruluwewa tank scheme and a few village tanks in the watershed. This report covers only the impact of those interventions.

CHAPTER 3

DATA COLLECTION AND RESEARCH FRAMEWORK

3.1 Specific Objectives

The key objectives of this action-research programme is to:

(i) establish the baseline status of integrated water management in Huruluwewa in respect of: water allocation to Huruluwewa tank scheme from Mahaweli system (Bowatenna reservoir); water conveyance, distribution and use in the Feeder Canal area; water management and use for agricultural production in the Huruluwewa tank scheme and selected village tanks in Huruluwewa watershed; and

(ii) monitor and assess the impact of the specific SCOR interventions carried out in maha 1993/94 season to enhance seasonal planning, water allocation and sharing, decision making and water management to improve land and water productivity in the Feeder Canal, Huruluwewa tank scheme and three village tanks (Mahameegaswewa, Puwakpitiya and Pandikaramaduwa tanks);

3.2 Hypothesis being tested

The hypothesis that were tested by this action-research study are as follows:

(i) Land and water productivity and water use efficiency of the Feeder Canal, Huruluwewa watershed and selected village tanks can be improved by adopting appropriate seasonal planning, conjunctive use of rainfall and tank water and by implementing the seasonal plan through shared control and management.

(ii) Land and Water productivity and water use efficiency of the study area can be progressively improved by strengthening the user groups, linking the user groups of both upstream and downstream and linking the user groups with the relevant field level agency operating staff for shared control and management modes.

3.3 Indicators and Variables

The following indicators and variables are used to assess the impact of specific interventions carried out in maha 1993/94 season.

3.3.1 Irrigation water duty

Irrigation water duty is the ratio between the total quantum of water and for crop production during a crop season and the total area harvested during the same season using that quantum of water in a given irrigated command area. It can be expressed as:

$$\text{Irrigation water duty} = \frac{\text{Quantum of irrigation water used (ha)}}{\text{Harvested crop area (ha)}}$$

When the area considered consist of the full command area of a tank, this ratio is called "tank duty".

3.3.2 Irrigation Water Productivity

Irrigation water productivity is defined here as the ratio between the total harvested yield of a given crop from a given irrigated area and the total quantum of irrigation water used for producing the harvested yield. The latter may be used with or without considering the effective rainfall used in conjunction with irrigation water for producing the crop. It can be expressed as:

$$\text{Irrigation water productivity} = \frac{\text{Total harvested crop yield (kg)}}{\text{Total quantum of irrigation water used (m}^3\text{)}}$$

Strictly speaking, it is not appropriate to use this indicator, as it implicitly assumes that crop yield is a function of irrigation water only, which is not true. This is only a rude measure of the factor productivity of water.

3.3.3 Relative Water Supply (RWS)

Relative water supply is the ratio between the theoretical irrigation requirement and the actual amount of water used for producing a crop in a given irrigated command area. It is a dimensionless parameter. It is expressed as:

$$\text{Relative Water Supply (RWS)} = \frac{\text{Irrigation Requirement (m)}}{\text{Water used (m)}}$$

3.3.4 Cropping Intensity (CI)

Cropping Intensity is the ratio between the total area harvested and the total cultivable extent under command of irrigation source. Cropping Intensity may be computed either on annual basis or separately for yala and maha seasons. For minor tanks, yala CI is very low and therefore, it is logical to use maha CI as the suitable indicator rather than the annual CI.

3.3.5 Staggering Index (SI)

Staggering Index is the time gap between the date of commencement of land preparation and the date of completion of land preparation in any given irrigated command area.

3.3.6 Delivery Performance Ratio (DPR)

Delivery Performance Ratio is the ratio between the quantum of actual and planned delivery of water during a given time period at any given location of a water conveyance system.

3.3.7 Huruluwewa augmentation Index (HAI)

This indicator is used to assess the degree of water tapping along the Feeder Canal. It is defined as the quantity of water delivered to the Huruluwewa Feeder Canal as its head end and the quantity of water reached its tail end and/or Huruluwewa tank during a given period of time.

3.4 Monitoring Data Collection and Measurements

In order to assess the performance in terms of the indicators mentioned section above, a number of variables were measured at selected sample points. This section describes the variables, measurement points and methodology adopted for measuring and collecting data. Basically, three methods were used for acquiring the necessary data i.e. (i) direct measurements, (ii) farm data collection, and (iii) secondly data collected by other research staff.

3.4.1 Direct Measurements

The variables measured directly were: Tank water levels, stream/canal flows, rainfall and evaporation. Those variables were measured directly at the required locations. Irrigation flows were measured by measuring water levels by timber staff gauges followed by subsequent current metering and converting the staff gauge readings to discharges by the use of location specific stage-discharge relationships. Rainfall and evaporation were measured by manual rain gauges and class "A" evaporation pan respectively.

3.4.2 Farm Data Collection

The variables monitored by collecting primary data are:

Farm areas irrigated, crops grown and individual areas grown with each crop; first and last dates of land preparation and land preparation progress. Proportion of well drained and poorly drained soils in each farm were obtained by interpreting the available soil maps of the command areas and by field verifications. Crop yield data were collected using both crop cut surveys and by obtaining farmer reported yields.

3.4.3 Secondary Data

The process adopted in organizing farmers and establishing institutional arrangements for water management practices was documented by the social scientist. The process presented in Chapter 4 of this report is based on this process documentation.

3.4.4 Direct Data Collection Points

Direct data measurement points are shown in the schematic diagram in Figure 7. These are briefly explained below:

<u>Huruluwewa Feeder Canal</u>: Water inflows from Bowatenna reservoir discharge before and after the bifurcation to Kandalama tank, discharge at the confluence of the Feeder Canal to Habarana Oya.

<u>Huruluwewa Tank</u>: Daily water levels of the tank, daily water issues from the three sluices including sluice opening time and closing times and inflow from Yan Oya were measured.

<u>Huruluwewa Command</u>: Tracts 1, 3 and 6 of LB and tracts 1, 6, 10 and 13 of RB were the sample tracts selected to represent head, middle and tail of the

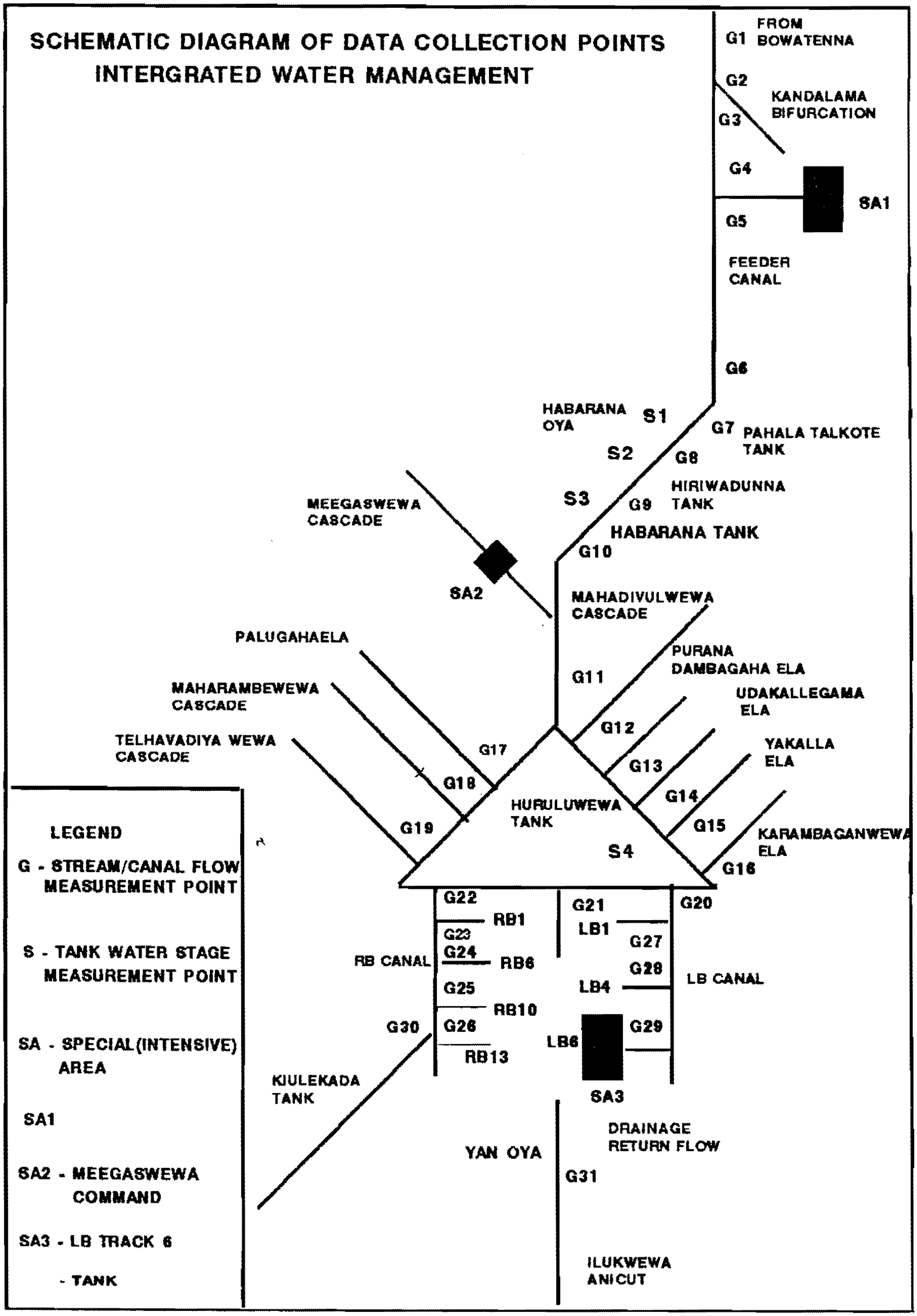
Left and Right banks of the scheme. Water releases are measured at the off take points from the main canals at the inlet points to sample tracts and inflow from Kiulekada tank to RB tract 13. Drainage return flows of Huruluwewa command were measured at a point downstream near Ilukwewa anicut.

LB Tract 6 (intensive sample): Rainfall, proportion of well drained and poorly drained soils in each allotment, dates of commencement and completion of land preparation, crops grown and individual areas grown with different crops, daily discharges to distribution canals, and daily discharges of 3 FCs (representing head, middle and tail) were measured daily.

Mahameegaswewa, Puwakpitiya and Pandikaramaduwa tanks: All data collected for LB tract 6 (except the discharges in DCs and FCs)

In addition, the water issue tree diagram and the Blocking out Plan (BOP) of the entire Huruluwewa scheme were updated, as the available issue tree diagrams and the BOP were erroneous. This exercise was carried out on the basis of the information provided by the farmers on land holding size, location, proportionate area of RBE and LHG soils within each farm allotments, number and area of farms served by each FC etc.

Figure 7


SCHEMATIC DIAGRAM OF DATA COLLECTION POINTS
INTERGRATED WATER MANAGEMENT
FROM BOWATENNA
G1
G2
G3
KANDALAMA BIFURCATION
G4
G5
SA1
FEEDER CANAL
G6
HABARANA OYA
S1
S2
S3
G7
PAHALA TALKOTE TANK
G8
G9
HIRIWADUNNA TANK
HABARANA TANK
G10
MEEGASWEWA CASCADE
SA2
MAHADIVULWEWA CASCADE
PALUGAHAELA
PURANA DAMBAGAHA ELA
G11
MAHARAMBEWEWA CASCADE
UDAKALLEGAMA ELA
G12
TELHAVADIYA WEWA CASCADE
G17
G13
YAKALLA ELA
G18
G14
HURULUWEWA TANK
G19
G15
KARAMBAGANWEWA ELA
S4
G16
G22
G21
G20
RB1
LB1
G23
G24
G27
RB CANAL
RB6
G28
LB CANAL
G25
LB4
RB10
G30
G26
G29
LB6
RB13
SA3
KIULEKADA TANK
DRAINAGE RETURN FLOW
YAN OYA
G31
ILUKWEWA ANICUT
LEGEND
G - STREAM/CANAL FLOW MEASUREMENT POINT
S - TANK WATER STAGE MEASUREMENT POINT
SA - SPECIAL(INTENSIVE) AREA
SA1
SA2 - MEEGASWEWA COMMAND
SA3 - LB TRACK 6
- TANK

CHAPTER 4

INTERVENTIONS CARRIED OUT IN MAHA 94/95 SEASON

4.1 Major interventions attempted

The major intervention attempted in maha 94/95 season in different sub systems i.e. Feeder Canal, Huruluwewa Irrigation system and small village tank systems in Huruluwewa watershed were to ensure:

(a) Maximum use of rainfall for land preparation - This is a key intervention attempted in all three sub systems. In small tank villages farmers give priority to chena cultivation with on set of rains. In the three village tanks, farmers were motivated to commence land preparation for maha rice cultivation. Attempts were made to promote dry land preparation for rice cultivation ("kakulan") in these systems. In Huruluwewa command and Feeder Canal area, attempts were made to introduce OFCs and semi permanent and permanent crops in well drained soils and highlands with rain and initiated farmers to use rainfall for land preparation in poorly drained soils;

(b) Adherence to cropping calendar - Though cultivation meetings are held prior to the season in small tank system and Huruluwewa Irrigation system, they tended not to follow them. As a result, water issues had to be extended beyond the date agreed upon at the "kanna" meeting in Huruluwewa irrigation system. In small tanks, the farmers completely emptied down the tank by staggered cultivation here and there in the command areas. Therefore, it was attempted through organizational arrangements and coordination of services and input supplies to make the farmers to follow a previously agreed upon cultivation calendar. For this purpose participatory planning of the cultivation season was attempted.

4.2 Seasonal planning process

4.2.1 Historic seasonal planning meeting

The Water Resource Management Team (WRMT) initiated by SCOR to coordinate and integrate watershed level planning held a workshop and a meeting at Dambulla Divisional Secretary's Division on 6th September 1994 to make initial cultivation and water allocation planning for maha 1994/95 for the entire Huruluwewa watershed comprising of Huruluwewa Feeder Canal, three minor tanks (Pahala Talkote wewa, Hiriwadunna wewa and Sigiriya wewa), other minor tank systems and Huruluwewa Irrigation Scheme. This was a historic meeting in the sense that it was for the first time that all stakeholders of a complex land and water use system met under one roof to discuss a common seasonal cropping plan and to exchange opinions as to how the available land and water resources can best be utilized for the season.

The meeting was attended by the four Divisional Secretaries (Dambulla, Galenbidunuwewa, Naula and Palugaswewa), Farmer Representatives from Feeder Canal area, Huruluwewa command area and minor tank systems, Irrigation Engineers from the Department of Irrigation and Mahaweli Authority, Agricultural Instructors of the Department of Agriculture serving in the respective Agrarian Service Divisions, Project Manager of the Irrigation Management Division in charge of Huruluwewa Scheme and the members of SCOR team.

This meeting was arranged to discuss issues pertaining to integrated cultivation planning for Huruluwewa watershed, water mànagement in Huruluwewa command and Feeder Canal and institutional coordination. It was revealed at this meeting that the total extent of irrigated lands and highlands in Feeder Canal area is 1944 and 2790 acres respectively. Even though the farmers in the Feeder Canal claimed that they used only 0.9m (3-4 ac.ft) for rice, it was also revealed that the actual water duty was more than 3m (10 ac.ft) The discussion revealed the following:

- lack of systematic cultivation planning in Feeder Canal area, this has led to staggered cultivation in the system;
- also farmers cultivated both long and as short aged rice varieties requiring haphazard changes to the agreed upon water distribution plans;
- increase in the utilization of encroached lands in the Right Bnk of the Feeder Canal for cultivation;
- siltation of the Feeder Canal, non-availability of controlling structures, gates etc. in the Feeder Canal;
- problems associated with the acquisition of required quantities of water from Mahaweli Authority;
- problems associated with inequity in size of land holdings, ownership rights etc. in the Feeder Canal area;
- problems associated with the marketing of agricultural produce;

4.2.2 Seasonal planning dêcisions

The farmers and the officials jointly agreed to undertake the following solutions to ease off the situation both in the short and the long run.

- cultivation of OFCs, semi permanent and permanent crops in lands which are not suitable for rice;
- providing a credit scheme for OFCs
- allocation of the lands in Feeder Canal area equally among the people living in the area;
- demarkation of canal reservations;
- increase the seasonal quota of water allocated to Huruluwewa scheme by Mahaweli Authority, taking into account the cultivation that take place in the Feeder Canal area;

- follow a similar kind of a cropping plan in both Huruluwewa Irrigation Scheme and Feeder Canal area or forgoing of a cultivation by each party in turn to take the best use of the limited available seasonal quantity of water;

- request the Water Management Panel (WMP) to include farmer representatives of the Feeder Canal and the three tank system in the membership of the WMP.

At this meeting the cropping plans both for Huruluwewa Feeder Canal and three tank system were agreed upon. For the Feeder Canal, plan was to grow non-rice crops in 173 ha (441 acres) and rice in 500 ha (1500 acres). The possibility of beginning water issues to Feeder Canal area by 30 October and stop water issues by 15 February 1995 too was discussed by the farmers and the officials.

For the three tanks of the cascade, dry land preparation for rice cultivation with the on set of rains were suggested. At this meeting, possible interventions were discussed with SCOR catalysts. Modalities for planning for the season too were discussed with the relevant farmer communities.

4.2.3 Follow-up activities

After this first WRMT meeting held at Dambulla, a series of meetings were held with farmers in the Feeder Canal area. Towards the end of September, pre-kanna meeting too was held. This was a new experience for the farmers in the area who earlier used to start cultivation activities only when water issues to Huruluwewa along the Feeder Canal started in January. At these meetings farmers were motivated to start cultivation activities with the on set of maha rainfall.

However, by the time these meetings were held, no decision had been taken on the date of commencement of Mahaweli water issues to Huruluwewa from Bowatenna.

A second meeting was held on 13 October, at Dambulla with the participation of Divisional Secretaries of Dambulla and Matale, FRs of the Feeder Canal FOs, Mahaweli Engineers, PM (IMD) and FRs of the consolidated farmer organization for the Feeder Canal.

It was decided to start cultivation activities in the Feeder Canal area with the onset of rain and make water issues from the Feeder Canal for crops from 1 January 1995 to 28 February 1995 only. It was also decided that 177 ha (450 acres) should be cultivated with non-rice crops and 1000 ha (2550 acres) with rice. Farmer organizations put forward the following suggestions at this meeting:

- the farmers who migrate to the Feeder Canal area during the season from outside for cultivation of land should obtain the approval of the FO in the area to obtain water from the Feeder Canal and grow a crop;

- legal action should be taken against those who cultivate in the Right Bank of the Feeder Canal as well as those who destroy forests;

- tapping of water from Feeder Canal should be done in a planned way. It should be done under the guidance and approval of the respective FOs in the area.

The cultivation calendar agreed at the kanna meeting was to grow 4½, 4, 3½ and 3 months rice varieties (for 4½ months varieties last date for sowing was 15 October, while it was 31 October and 15 November for 4 and 3½ months rice varieties respectively). Crop establishment was to be made with on set of rains. First and last water issues were to be made from the Feeder Canal on 1 January 1995 and 28 February 1995 respectively.

4.2.4 Response of farmers

As reported by SCOR catalysts, most of the farmers started land preparation for rice in the command area after 15 November 1994. The farmers who cultivate under small tanks, streams etc. in Feeder Canal area cultivated rice in their lands by using rain fall and water from tanks, streams etc.

However, farmers depending solely on the Feeder Canal for water delayed their land preparation work as they could not trust that they would get Mahaweli water in time after crop establishment. Also in some areas farmers depended solely on rainfall for cultivation and as a result there was a delay in crop establishment.

In addition to rice and non-rice cultivation, permanent crops and semi permanent crops were cultivated in some areas [Welangolla (2 acres of banana), Mahasanagama (12 acres of banana) and Sigirimulana (5 acres of banana)] in lands which had been previously used for cultivation of rice. Though the extent cultivated with such crops is not significantly large in this season, it can be considered as a fair attempt in the right direction.

4.3 Seasonal decision making and implementation for Village tank systems

4.3.1 Pandikaramaduwa Tank

With the intention of initiating farmers to start cultivation with the on set of rains, SCOR catalyst working in the area organized a preliminary meeting with the help of the leaders of the existing farmer organization. The meeting was attended by the farmers as well as by the Divisional Officer (DO) of the Agrarian Service Department, Agriculture Instructor (AI) of the Department of Agriculture working in the area and some members of the SCOR team in Huruluwewa.

At this meeting, the necessity of integrating chena and rice cultivation by taking the maximum use of maha rains was emphasized. Preparing land for rice under dry conditions ("Kakulan") was one of the best options proposed for saving water. It was also emphasized that the farmers could do some non-rice crops in the next yala season on bethma basis with the water saved in this season. The following cultivation calendar was agreed upon by the farmers at this cultivation meeting.

cleaning of canals and canals bunds	- 12.10.1994
last date for crop establishment	- 25.10.1994
last date for harvesting	- 28.02.1995
paddy varieties	- 3-3½ months

However, the farmers did not commence cultivation activities as agreed at the kanna meeting. Therefore, another meeting was organized by the SCOR catalyst. At this meeting farmers pointed out that they did not have capital to hire tractors and buy seed paddy. They expected SCOR to provide them a grant for this purpose as they had initially agreed. As some of the SCOR team members pointed out, the organization was so weak that they hesitated to provide a grant to the organization at that stage. In the point of view of the secretary of the FO, kakulan cultivation was a new practice requiring changes in the existing technologies used for land preparation i.e. the use of tractors for dry land plowing. As the farmers could not organize credit for hiring tractors and purchase seed paddy, they failed to do "kakulan", according to the secretary of the FO.

As the data on progress of land preparation shows the Land preparation activities under this tank extended over a period of 2 months between October and December. Land preparation activities were somewhat systematic in some parts of the command where the cultivation activities started early in mid October. However, the delay in land preparation cannot be purely attributed to the problem of acquisition of credit alone even though it was a factor significantly affecting the progress of land preparation. As our interviews with farmers show, there were many reasons for the delay. Firstly, the farmers in Pandikaramaduwa were engaged in chena and other highland cultivations for which they depend solely on maha rainfall. They faced difficulties in organizing labour to attend to both activities simultaneously. One alternative for this was to use tractors for land preparation work in the rice fields to enable the farmers to do "kakulan", thereby reducing labour requirements. But there was only one tractor in the entire village. Majority of farmers did not have enough capital to hire tractors from outside villages. Also, because of the small size of the rice land holdings that the farmers owned, there was a tendency to give priority to chena cultivation or highland cultivation for better economic returns. There are many other reasons why farmers preferred chena cultivation. It should also be noted that a significant number of farmers who own land in Pandikaramaduwa tank also owned lands under Dambagaswewa, another village tank that exists in the village Pandikaramaduwa. The average size of land holding under this tank is about 0.4 ha (1 acre). This tank was being rehabilitated during this period. When it was filled up after maha rainfall, the farmers wanted to cultivate the lands under this tank as well even though the repairs to the sluice gate had not been completed by then. With the consent of the Department of Agrarian Services, they cultivated those lands in November concurrently with the cultivation of some lands in "Puranawela" of Pandikaramaduwa tank. This too delayed land preparation activities in Pandikaramaduwa tank. However, the farmers did not use tank water for land preparation because the maha rains continued. Only four water issues were released from the tank during the crop growth period in this season. Harvesting in this area started towards the end of February and continued till the end of March.

4.3.2 Mahameegaswewa tank

As in the case of Pandikaramaduwa tank, the key intervention attempted in Mahameegaswewa tank was the integration of chena and paddy cultivation to enable the maximum use of maha rainfall.

With this objective in mind, the SCOR catalyst working in the area met farmers individually as well as at group meetings to motivate them to prepare land for rice cultivation under dry conditions with the on set of maha rains. At a meeting held on 9 September 1994, this was discussed with the farmers in great detail. The farmers under this tank had never attempted dry land paddy in the lands under this tank previously. However, it was possible to promote this idea at that time, as the water level in the tank was at a very low level. The farmers requested that they be provided with credit facilities for the purchase of seed paddy, fertilizer and agro chemicals for this purpose. Farmers agreed to make their own arrangements to hire tractors. SCOR team members who attended this meeting agreed to make possible arrangements to supply credit facilities to the farmer organization for this purpose.

Pre-kanna meeting for the tank was held on 15 September 1994 with the participation of SCOR team members, Grama Niladari in charge of the village and 66 farmers (49 members and 17 non-members).

At this meeting the decisions were taken to:

- cultivate 4 months paddy varieties (BG 450 and 1/400) after dry plowing

- cultivate the entire extent of land under the command of Mahameegaswewa tank and Madugaswewa (another small tank in the village).

  However, a decision was taken to delay the cultivation of Puranawela area in Mahameegaswewa until the spilling of the tank ended to avoid damage to crops that result due to tank spilling. (This tank spills into the command area under Puranawela - old paddy fields); and

- provide credit facilities for the purchase of inputs and hiring of tractors

It was decided to hold the "kanna meeting" on 27 September 1994, but had to be postponed on the request of the Divisional Secretary's office. The kanna meeting was finally held on 2 October 1994. It was at this meeting that a decision was taken to do dry land rice (kakulan) with the on set of rains.

However, it is noteworthy that some initial rains had occurred by the time the kanna meetings was held but none of the farmers had started land preparation activities with rain during this period. This is because they had no money to hire tractors for land preparation. Even by 7 October 1994, the FO had not received the grant that they expected from SCOR. Therefore, the Catalyst and some farmer representatives met a tractor owner to arrange a tractor with the expectation of making the tractor hire charges after receiving the grant. Even though the tractor owner agreed to undertake the task, he refused later when cultivation activities started in the other areas of the sub -watershed. The Catalyst had to make a great effort himself to find tractors.

At the FO meeting held on 12 October 1994, SCOR team members informed farmers that a grant of Rs. 325,250.00 had been made to the FO. Rs.180,000.00 out of this was set apart for rice cultivation. After receiving the grant, rice lands under Madugaswewa were ploughed first.

Land preparation activities in Meegaswewa commenced on 15 October 1995.

However, the tractor which was used for land preparation in Mahameegaswewa returned to work after one day because land had not been sufficiently wet for dry plowing. Mean while the land preparation activities in Madugaswewa was completed on 16 October.

Farmers were able to resume land preparation at Mahameegaswewa on 21 October using the same tractor and completed ploughing by 2 November 1994. However, because of the heavy rains experienced during this period, farmers had to do wet ploughing.

The farmers could not obtain seed paddy from the department of Agriculture even by 20 October. SCOR team members had to discuss with DOA officials to obtain seed paddy. It was also agreed to provide other inputs like fertilizer, agro-chemicals etc. through the FO on credit basis to avoid delays in input supply. The Department of Agriculture (DOA) supplied seed paddy on 22 October and farmers in Madugaswewa completed sowing by 31 October 1994. However, seeds did not germinate because the farmers did not know the technology of seedling preparation. Consequently, they had to sow for the second time. In Mahameegaswewa sowing started on 11 November and ended on 30 November 1994.

The land preparation activities in puranwela area under Mahameegaswewa tank stated on 27 December 1994 and completed on 10 January 1995. The FO organized tractors and provided other inputs to farmers on credit basis for this cultivation too. Harvesting in both tanks started on 5 March 1995. In puranawela under Mahameegaswewa harvesting started in April and continued till the end of the month.

Farmers in Mahameegaswewa used only a very minimum quantity of tank water during this season. The first water issue had been made on 3 January 1995 after land preparation activities were over.

4.3.3 Puwakpitiya tank

In the Puwakpitiya tank too the intervention attempted was the integration of chena with maha rice cultivation with maximum use of rainfall for land preparation under the tank. With this aim, catalysts attempted to introduce dry land preparation for rice cultivation to the farmers under this tank. Pre-kanna meeting for the tank was held on 24 September 1994 with the participation of Assistant Director (extension) (AD) and the AI of the DOA, Grama Niladari, DO of the Department of Agrarian Service (DAS).

Colonization officer attached to the Divisional Secretary's office and some members of the SCOR team and 54 farmers from Puwakpitiya.

The decisions taken at this meeting were to:

- commence sowing on 5 October and complete by 15 October 1994;
- cultivate 4 - 4½ month rice varieties and if this is not possible, to cultivate 3 - 3½ month rice varieties; and
- obtain seed from the Department of Agriculture and farmer the organization to prepare a list of farmers who required seed.

The first rainfall occurred in the area on 16 September prior to the "pre-kanna" meeting. By 6 October 1994, the farmers had completed "kakulan" cultivation in "Akkarawela". However, the farmers in upper portion of Puranawela could not do dry land ploughing because of heavy rains. They had to do wet ploughing and therefore, the cultivation was delayed by about one month. Harvesting in Akkarawela was completed by 15 February while in Puranawela it continued from 15 February to 1 March 1995. It is important that except one farmer who used tank water to irrigate his allotment on 24 February 1995 for a period of 8 hours, none of the farmers used tank water for irrigating maha crops. The particular farmer had obtained the sluice gate key from "vel vidane" and opened the gate. The FRs did not intervene in this and the Catalyst closed the door himself to save water which was the fruit of his commitment and hard work during the whole season.

4.4. Decision making in Huruluwewa Irrigation Scheme

4.4.1 Initial discussions

A Project Management Committee (PMC) meeting was held at Divisional Secretary's office, Galenbidunuwewa on 11 September 1994 to discuss modalities for the forthcoming maha 1994/95 season. the members of the Project Committee proposed that non-rice crops, rice and banana be cultivated in 11.80, 730 and 60 ha respectively (3000, 1850 and 150 acres respectively).

There were no much resistance from the farmer representatives (FRs) to the proposed cropping plan, as the water level in the reservoir was very low on the day this meeting was held. However, the FRs pointed out that stray cattle and marketing were crucial factors that should be considered when cultivating non-rice crops. Agriculture Instructors (AIs) proposed that non-rice crops be grown in 1920 ha (5000 acres) in Huruluwewa command in the maha 1994/95 season. A series of meetings were held subsequently at Distributory Canal Organization (DCO) levels to explain the non-rice cultivation program to farmers. The officials could not see much resistance from farmer community to the program.

4.4.2 "Pre-kanna meeting" decisions

On 21 September 1994, pre-kanna meeting was held at the office of the Project Manager (IMD) with the participation of DCO representatives from Huruluwewa command, DO (Galenbidunuwewa), AI (Huruluwewa) and some SCOR team members. The following matters were discussed at the meeting:

- It was scheduled to commence Mahaweli water issues to Huruluwewa tank on 1 November 1994. This would continue till 31 March 1995. Mahaweli Water Management Panel (WMP) meeting was to be held on 30 September.

- The FRs had been nominated from Huruluwewa scheme to attend this meeting. There had been no favourable response from farmers to the suggestion to cultivate non-rice crops and rice on bethma basis in Huruluwewa command.

- IE forecasted that tank water level would reach 15-20 ft. by December 1994. The participants recommended the cultivation of non-rice crops with the use of maha rainfall.

- The FRs represented the opinion of the farmers and pointed out that they were not prepared to do bethma in maha season.

- Instead, they were prepared to cultivate non-rice crops in well drained soils and rice in poorly drained soils in a limited extent using the limited available tank water. Bethma was rejected by many farmers as land had been fragmented. All the FRs unanimously agreed to do dry land preparation for rice cultivation.

- Project Manager announced that cultivation target for the maha season in Huruluwewa according to the Seasonal Operation Plan (SOP) prepared by the Water Management Secretaries was 84 percent.

Also the FRs requested that as the yala harvesting activities had been started in the Feeder Canal area by them, they requested PM (IMD) to discuss with Mahaweli Authority to get Mahaweli water issues to Huruluwewa before harvesting in the Feeder Canal area was completed. The idea behind this suggestion was that the Feeder Canal farmers would not tap water from the Feeder Canal during harvesting and if water was released, the bulk of the water would reach Huruluwewa tank.

4.4.3 Cultivation meeting decisions

The "kanna" meeting for Huruluwewa command area was held at Galenbidunu wewa Maha Vidyalaya on 28 September 1994 under the chairmanship of Divisional Secretary, Galenbidunuwewa. At this meeting, a historic decision was taken by the farmers to begin land preparation using rainfall and to cultivate the entire extent with rice. They also decided that no water issues should be made from the tank for land preparation and subsequent crop growth period until the rainfall would not be sufficient enough to meet the irrigation water requirements. This decision was a result of the continuous dialogue that the SCOR team and ID officials had with the FRs and farmers at DCO level to maximize the utilization of maha seasonal rainfall for cultivation. The untiring efforts were culminated at this meting by taking the historic decision to begin land preparation using maha rainfall. Accordingly, it was agreed that the first water issue from the tank shall not be released until 15 January 1995. The following decisions were made at this meeting:

Extent of the area to be cultivated	- 3866 ha (9592 acres) {entire extent}
Rice varieties	- 3 to 3½
Last date for sowing	- 30 November 1994
First date for water issues	- 15 January 1995
Last date of water issuing	- 28 February 1995
Last date for harvesting	- 15 March 1995

4.4.4 Post cultivation meeting discussions

As agreed at the Cultivation Meeting, water releases were not made from the tank and the farmers began land preparation using seasonal rainfall. The sluice gates were kept fully closed throughout October and November.

A PMC meeting was summoned on 4 December 1994 because the farmers requested the ID to begin water issues immediately as the rainfall had declined by then. (Rainfall data collected by us reveal this fact. See sections 5.3 and 5.4). Thus, although the decision was to make the first water issue on 15 January 1995, the original decision had to be reviewed at this meeting in the light of the prevailed situation. Accordingly, a decision was taken to make a few water issues during December.

At the next PMC meeting held on 14 January 1995, the FRs and the officials suggested that a water distribution time table had to be prepared and implemented in the season. Technical Assistant of the ID who attended this meeting agreed to prepare and distribute a schedule for the main system to enable the FRs to prepare distribution schedules for the respective DCO areas. Two Water Management Committees were established for the LB and RB. The Water Management Committee of the Left Bank was functional to some extent and contributed to the preparation and implementation of DCO level water distribution schedules during this period. In the Right Bank area the committee did not function properly and, therefore, water distribution schedules could not be properly implemented. However, the involvement of LB water management committee contributed to a greater extent for saving water and reducing water shortage problems during the period. Subsequently, at the PMC meetings, the FRs were repeatedly informed by IE and PM (IMD) that water issues would not be extended beyond 28 February as agreed previously. The farmers were informed that even politicians had been requested not to intervene in extending the last date of water issues. The IE could enforce strict and controlled water management practices with the cooperation of the farmers.

However, by the end of February, some areas of the command area needed an extra issue to save the crop of late cultivations. At the PMC meeting held on 2 March 1995, it was agreed to release one more extra issue only for the late cultivators. As the plan was to save as much as water to do a bethma cultivation in yala 1995 season, not more than a single extra issue was entertained both by the farmer and the ID.

4.5. The role of the Resource User Groups (RUGs) and agencies in implementing seasonal decisions at three village tanks

The responsibility of system maintenance and water management in the three small tanks was vested with "vel vidane". No serious problems could be observed in common canal maintenance, tank bund maintenance etc. However, there were problems in system operation and water management when "vel vidane" worked independently. This could be seen in Puwakpitiya. Also it should be noted that not much efforts were required for water management in this season because cultivation was done without using tank water.

Except in case of Mahameegaswewa, the FOs of other two tanks did not involve much in input supply, credit arrangements and marketing. In case of Puwakpitiya, such arrangements were not required as they could make such arrangements themselves. When compared with the other two communities in Mahaweegaswewa and Puwakpitiya tanks, most of the farmers (nearly about 80%) were better off and engaged in non-rice cultivations. However, they needed some marketing arrangements but the farmer's organization was not well equipped to handle such responsibilities. In Mahameegaswewa, the SCOR financial grant played a very important role in making the innovations successful. This indicated that a very traditional and marginal community like the one in Mahameegaswewa could not be induced to take up this type of innovations without financial inducement.

In Pandikaramaduwa, innovation was not very successful even though the farmers did not use tank water for cultivation. However, they could have achieved the same result as in case of Mahameegaswewa farmers with financial inducement for taking up this innovation.

In Huruluwewa command, the most of the existing farmers organizations could be effectively used for introducing the innovations and to save water. In Feeder Canal area where organizations were weak and farmers had not much trust on agency officers, the innovation was not very successful as expected. However, on the influence of FOs, there were attempts by the farmers to adhere to the cultivation calendar even though many could not do so due to water problems.

4.6 Results and achievements

In three small tanks studied, the water level could be maintained nearly at spill level by the end of maha season due to the introduction of the practice of using rain-water for land preparation. Though dry ploughing could not be introduced due to too much rain fall, water could be saved in the tank for the farmers to do OFCs in Yala 1995. In short, the cropping intensity of these tanks increased due to this intervention. As the President of the FO of Mahameegaswewa explained, there is potential to cultivate their lands thrice a year (maha kanna in Akkarawela, "mada kanna" in Puranawela and OFCs in Akkarawela and paddy in puranawela in yala. However, the extent to which the farmers were benefitted from the innovation need to be studied further, as it sets limits to other activities like chena cultivation which is another income source of dry zone farmers.

The achievements in Huruluwewa command is significant. This is reflected in the reduction of water consumption during the season with the use of rainfall for land preparation work and also during crop growth period. As a result, Huruluwewa farmers have the opportunity to cultivate some OFCs on bethma basis in yala 1995.

In Feeder Canal area, the most significant achievement is the involvement of Feeder Canal farmers in decision making regarding the season. Thereby the farmers have been initiated to make their cultivation activities much more planned and systematic in this maha season.

The next chapter will present a picture of the seasonal performance in a greater detail.

CHAPTER 5

SEASONAL PERFORMANCE

This chapter presents the impact of specific SCOR interventions carried out at Feeder Canal, village tank systems and Huruluwewa tank scheme during maha 1994/95 season. The impact is measured using a set of indicators as explained in Chapter 3. The use of the indicators and associated variables to interpret the seasonal performance are discussed in detail in the respective sections of this chapter.

A. Feeder Canal

5.1 Delivery Performance Ratio (DPR)

Delivery Performance Ratio (DPR) is defined as the ratio between the volume of actual and planned delivery of water at any given location for the same period of time. In respect of Huruluwewa Feeder Canal it can be represented as:

$$\text{DPR} = \frac{\text{Weekly/monthly volume of water } \underline{\text{actually}} \text{ released from Bowatenna Reservoir to Huruluwewa Feeder Canal as measured at Kandalama Bifurcation.}}{\text{Planned weekly/monthly volumes of water } \underline{\text{planned}} \text{ to be released to Huruluwewa Feeder Canal from Kandalama bifurcation.}}$$

In order to evaluate the degree to which the actual releases matched with the plan at the Kandalama bifurcation, two sets of data can be used for the planned volume of water

(i) as indicated in Chapter 3, the planned monthly volume of water as indicated in the Seasonal Operation Plan (SOP); and

(ii) the revised planned weekly volumes of water to be released based on the weekly instructions sent by the Water Management Secretariat (WMS) to the Engineer at Bowatenna, based on the decisions of weekly water management review meetings.

The above two sets of data were obtained from the SOP and the weekly records respectively, which were available at the WMS office at Colombo.

In addition, those records were compared with the weekly water delivery records maintained by the Engineer at Bowatenna based on the actual releases, and the records maintained by SCOR research team based on the actual, twice daily monitoring of canal discharges at Kandalama bifurcation point.

Figure 8 indicates separately, the actual volumes of water released from Bowatenna reservoir to Huruluwewa tank at Kandalama bifurcation point, based on the measurement of MASL as well as by SCOR researchers for this study. Figure 9 indicates the actual volume of water reached at the tail end of the Feeder Canal, after having been subject to tapping en-route and undergone losses due to evaporation and bund seepage losses (conveyance losses). The actual volumes of

Figure 8

Huruluwewa Feeder Canal Discharge
At Kandalama Bifurcation
1994/95 Maha Season

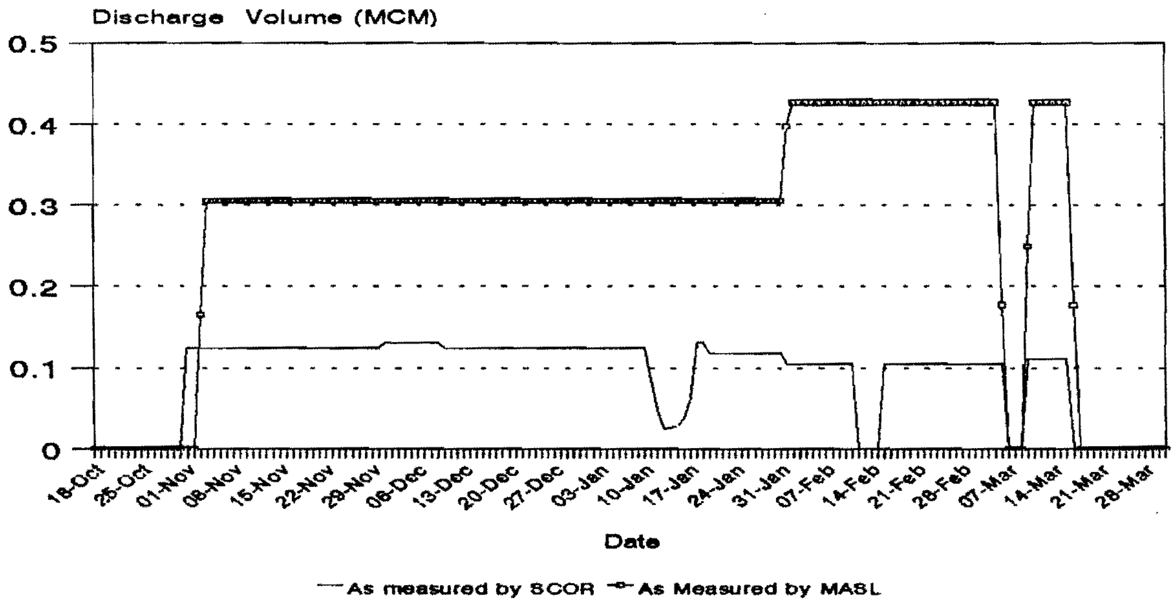
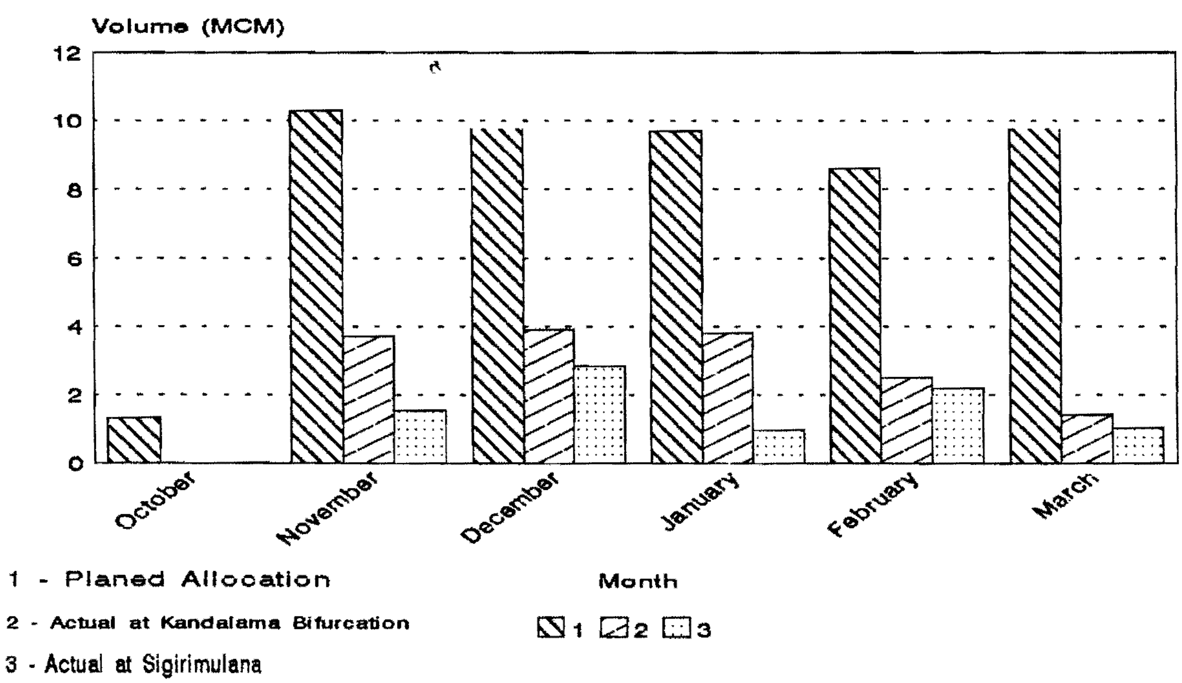


Figure 9

Irrigation Supply to Huruluwewa by Feeder Canal
1994/95 Maha Season



water reached the tail end are based on the SCOR research measurements as the MASL does not monitor the Feeder Canal discharges at its tail end.

Table 1 shows the planned and actually monthly volumes of water released to Huruluwewa tank as measured at Kandalama bifurcation point. The planned delivery is shown in two sets of data i.e. (i) monthly volumes earmarked in the SOP; and (ii) monthly volumes of water to be released, as decided at the weekly water management panel review meetings and notified to the Engineer at Bowatenna for weekly action. It is noted that the planned deliveries based on the weekly water management panel reviews are slightly higher than the deliveries planned at the time of the preparation of the SOP. The actual delivery is shown in two sets of data, i.e. monthly volumes of water computed on the basis of daily measurements conducted by the MASL and (ii) monthly volumes of water computed on the basis of twice daily monitoring of SCOR researchers. Thus, four different values of DPR may be computed using these data. But for simplicity, two sets of DPR are shown in Table 1 using the second set of planned monthly volumes and comparing it with both sets of actual discharge/flow volume data.

A line diagram and a bar chart showing the weekly DPR values based on the actual measured values by SCOR researchers are shown in Figure 10. Examination of the data and results in Table 1 and Figure 10 indicate the following.

(i) The monthly volume of water planned to be released to Huruluwewa tank based on the weekly review of the WMS meetings varies slightly from the initial monthly quantity of water included in the Seasonal Operation Plan (SOP). The former is only 1.2 percent higher than the latter for the total seasonal deliveries.

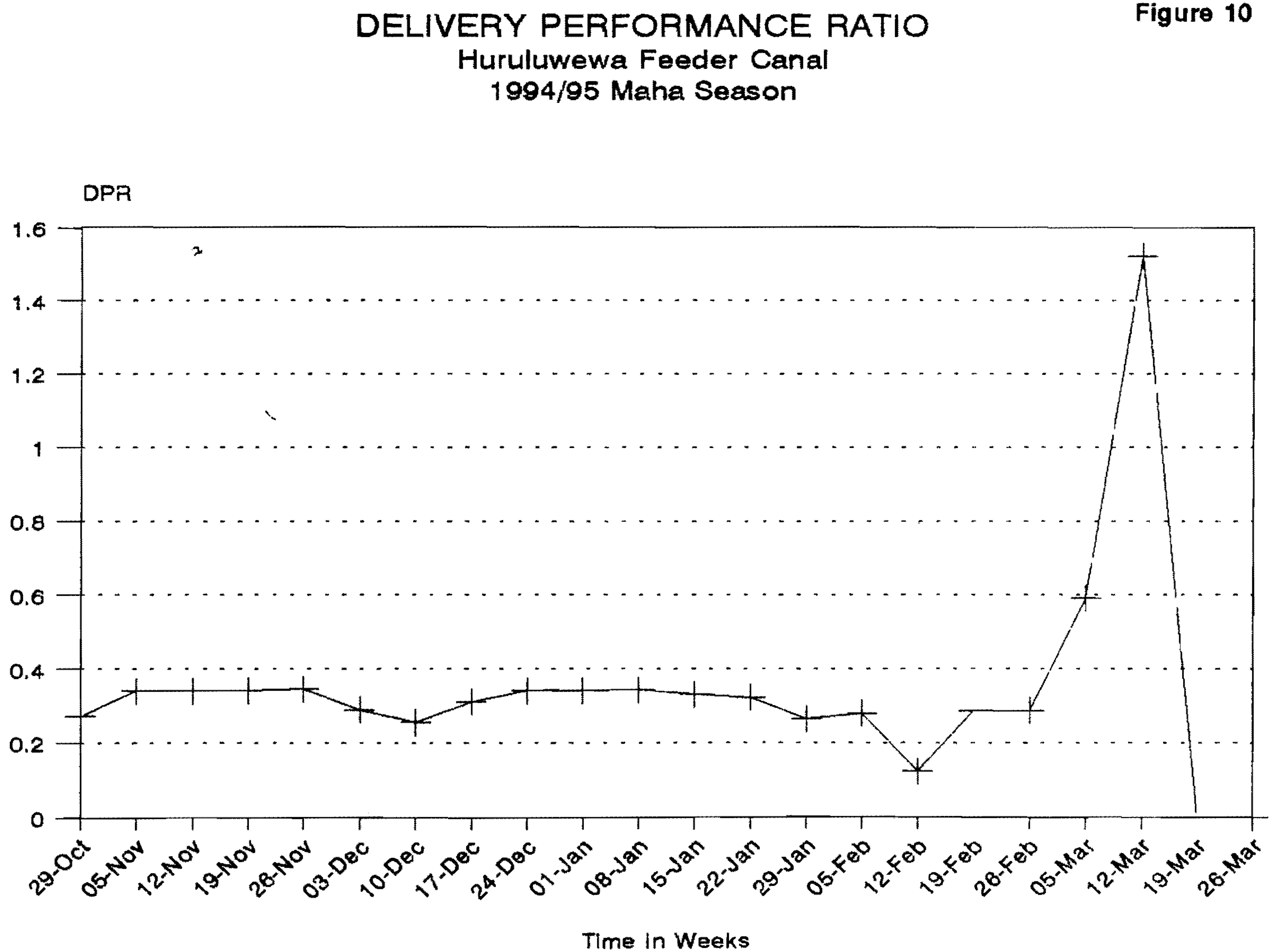
(ii) Comparison of the actual monthly releases to Huruluwewa tank based on the discharge measured by the MASL does not show a satisfactory level of compliance to the Plan when compared with the weekly planned values. For example, except for March, the DPR were 82, 97, 98 and 139 percent for November, December, January and February respectively. It exceeded 139 percent in February but was only 54 percent in March. But on average, the DPR for the entire season was 90 percent, based on the measurements carried out by the MASL.

(iii) However, there is a mismatch between the actual monthly water releases deduced from the discharge values measured by MASL and by SCOR researches. This mismatch is observed because the discharge values measured by SCOR are always lower than the discharges measured by MASL for the same discharge events. On average, the values measured by SCOR has been only about 43 percent of the values measured by MASL during the first four months and about 15 percent for the last two months of the season. For the entire season, the discharges measured by SCOR are only 34 percent of the MASL measurements. Consequently, when the DPR values are computed on the basis of the values measured by SCOR, they show significantly lower values throughout the season, indicating unsatisfactory compliance to the plan in releasing water to Huruluwewa tanks. For example, DPR computed on the basis of the weekly planned values and the actual values measured by SCOR indicate 0.31 which is very low compared to 0.90

Table 1: Water Releases from Bowatenna To Huruluwewa Tank (Maha 94/95 seasom)

Month	October	November	December	January	February	March	Total
Planned Allocation Volumes							
(i) Based on SOP (mcm)	1.3	10.3	9.8	9.7	8.6	9.8	49.5
(ii) Based on adjusted weekly values (mcm)	0.37	11.01	13.08	11.50	10.58	2.57	49.1
Actually Released Volumes							
(i) As measured by MASL (mcm)	0.0	8.4	9.5	9.5	11.9	5.3	44.6
(ii) As measured by SCOR (mcm)	0.0	3.7	3.9	3.8	2.5	1.4	15.4
Delevery Performance Ratio (DPR)							
(i) Based on MASL measurements	0.00	0.77	0.72	0.83	1.13	2.06	0.91
(i) Based on SCOR measurements	0.00	0.34	0.30	0.33	0.24	0.55	0.31

Figure 10



Based on SCOR measurements

computed on the basis of the SOP Plan and the actual values measured by MASL. For the months of November, December, January and February the computed DPR were 36, 40, 39 and 29 percent respectively.

Before adopting this observation conclusively, it is essential to investigate the causes and conditions that would have resulted in the above state of affairs. Some possible hypothesis are listed below:

(a) The calibration curve used by the MASL to convert the staff gauge readings to flow discharge may be outdated and invalid, either due to change of channel cross section or siltation of channel bed or the vertical displacement of the gauge post or any combination of the above factors.

(b) The calibration curve used by SCOR to convert the staff gauge readings to discharge values may be inaccurate due to insufficient data points used for developing the calibration curves for the discharge measurement points.

(c) The stage discharge relationship used by the MASL is based on a calibration done by them at the beginning of the season immediately after attending to seasonal canal maintenance. The Feeder Canal is free of aquatic weeds during this time. The aquatic weed growth in the Feeder Canal takes place so fast that within few weeks after the maintenance the flow in the canal is substantially retarded by the algae formation and aquatic weeds. Thus, there is a possibility that the stage discharge relationship developed for the weed free canal can give substantially higher discharges than the actual conditions that prevailed in a weed infested canal.

It is not possible to attribute any of the above reasons conclusively to explain the difference in Feeder Canal discharges at Kandalama bifurcation point as measured by SCOR and the MASL. Frequent verification of the stage-discharge relationship by carrying out frequent current metering at the discharge measurement points are required to eliminate such uncertainties. It is effective if the measurements are conducted jointly by the MASL and the ID with closer scrutiny of water releases. However, from operational point of view, all stakeholders including the Irrigation Department, Mahaweli Authority and the farmers should realize that Huruluwewa tank may be deprived of their due share of water unless the above hypothesis are investigated scientifically.

B. Huruluwewa Tank Scheme

5.2 Huruluwewa Augmentation Index (HAI)

Huruluwewa Augmentation Index (HAI) is defined as the ratio between the volume of water delivered at its head-end at Kandalama bifurcation and the volume of water actually reached at its target point for a given period of time. It can be expressed as follows.

$$\text{HAI} = \frac{\text{Volume of water reached at the tail-end of Feeder Canal (or at Huruluwewa tank inlet}}{\text{Volume of water released to Huruluwewa tank from Bowatenna at Kandalama bifurcation point}}$$

In evaluating the HAI, the enumerator of the above expression can be used in two ways, i.e. either (i) the planned volume of water, or (ii) the actually delivered volume of water may be used. For the purpose of this analysis both the planned volume of water based on the weekly review decisions of the WMS and the actually delivered volumes of water based on SCOR measurements are used. To evaluate the denominator of the above expression, the volume of water reached the tail end of the Feeder Canal was used. Ideally, for the best representation of HAI, the actual volume of water reached Huruluwewa tank should be used. But accurate measurement of this posed a number of difficulties within the resources available, which are not explained here. Therefore the volume of water reached the tail end of the Feeder Canal was used as the denominator.

Table 2 indicates the monthly and seasonal HAI and the data used for the evaluation of HAI.

The computed values of HAI indicate the following:

(i) The percentage volume of water reached the tail end of the Feeder Canal was only 20 percent of the plan and 50 percent of the volume of water released to Huruluwewa reservoir at Kandalama bifurcation. This shows that the augmentation of Huruluwewa reservoir by the Feeder Canal is severely affected by the tapping of water enroute. It is the task of the SCOR implementation team to increase the HAI significantly if the water releases to Huruluwewa tank is to be improved.

5.3 Climatological Variables

As in the other parts of the dry zone of Sri Lanka, Huruluwewa tank area receives two rainy seasons per year, corresponding roughly to the north-west and south-west monsoon. The north-west monsoon, corresponds with the "maha" or wet season and the south-east monsoon with the "yala" or dry season. The season under study is maha season which usually spreads over September to March.

In order to evaluate the irrigation water requirements at system level, daily rainfall was measured at five locations and daily open water evaporation was measured at two locations in the watershed in and around the Huruluwewa Irrigation system during the study period.

Figure 11 shows the variation of average weekly rainfall and evapotranspiration. The total rainfall for the season (September 1994 to March 1995) is 918.0mm with the rainfall distributed over September, October, November, December, January, February and March as 134, 308, 311, 54, 86, 25 and 0 of the seasonal rainfall respectively. It is evident from Figure 11 that, the period over which a reasonable excess of rainfall over evapotranspiration was confined to months of October, November, December. The other three months of the maha season i.e. January, February and March shows a rainfall deficit over the evapotranspiration. If the difference between the evapotranspiration and rainfall is considered as a crude

Table 2: HAI for the Feeder Canal maha 1994/95 season

Month		October	November	December	January	February	March	Total
Planned Allocation (a)		1.3	10.3	9.8	9.7	8.6	9.8	49.5
Actual Volume Releases at Kandalama bifurcation (mcm) (b)		0.0	3.7	3.9	3.8	2.5	1.4	15.4
Actual volume of water reached the tail end (MCM) (c)		0.0	1.6	2.7	1.3	1.9	0.8	8.4
HAI	(c/a)	0.0	0.2	0.3	0.1	0.2	0.1	0.2
	(c/b)	0.0	0.4	0.7	0.3	0.7	0.6	0.5

Figure 11

Rainfall & Evapo-transpiration in Huruluwewa Scheme
1994 August to 1995 April

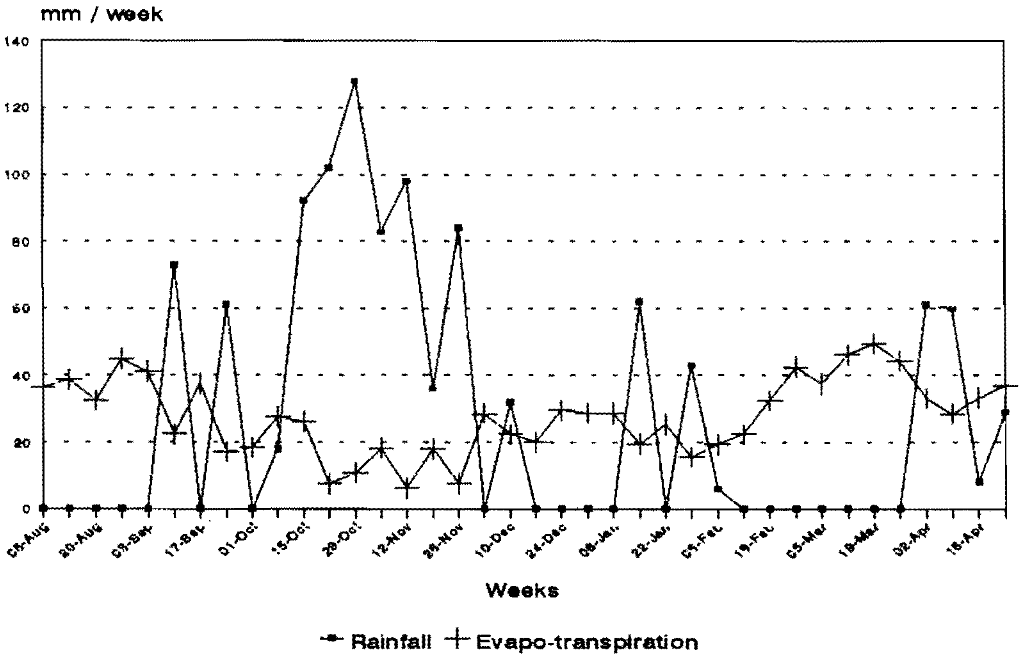
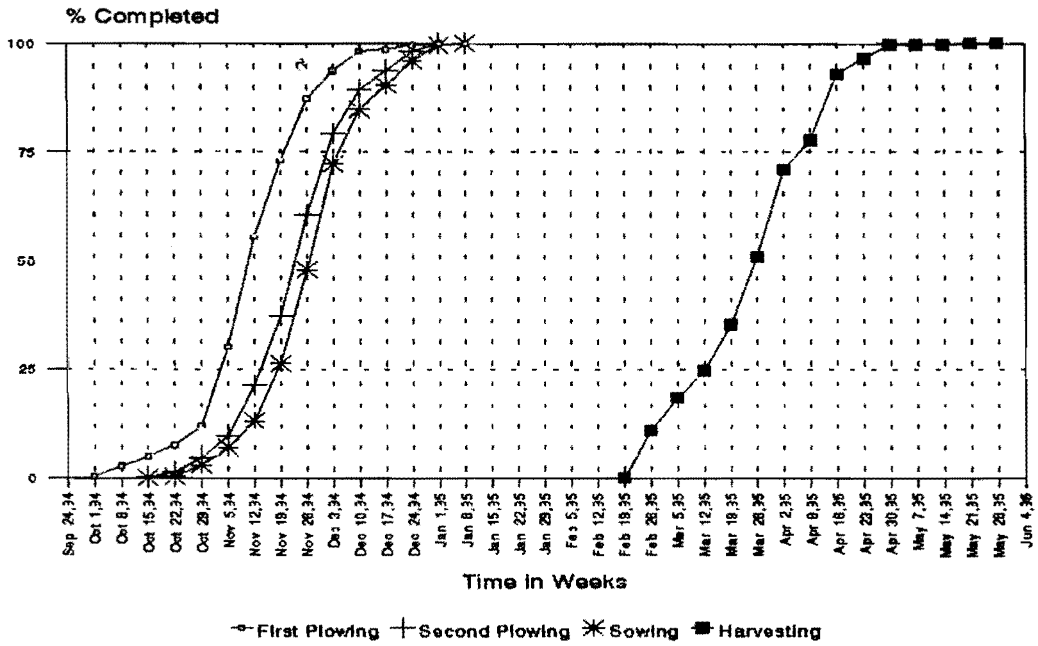


Figure 12

Land Preparation & Harvesting Progress
1994/95 Maha Season - Huruluwewa Tank Scheme



from a sample of 507 responded farmers

measure of the moisture deficit, this means that, theoretically the supplementary water issues for rice cultivation in Huruluwewa scheme should have been released for maha 94/95 maha cultivation only during January, February and March and the latter half of December. Thus, the seasonal planning decision taken at the cultivation meeting to use seasonal rainfall for land preparation and to make the first release of tank water only after 15 January 1995 was a wise and a correct decision.

5.4 Commencement and Progression of the season

It was argued in the foregoing section that from water management point of view, it would have been best if the land preparation for rice cultivation in maha 94/95 season commenced with the on-set of seasonal rainfall, preferably on the second week of October. As a considerable amount of water is usually used in ploughing the land twice before planting or broadcasting the rice plants, a considerable amount of tank water could have been saved if the land preparation for the season commenced on the second week of October.

Figure 12 shows the progress of land preparation in Huruluwewa Command area as deduced from a sample of 507 farmers out of the total 2500 farmers of the scheme. Figure 13 shows the weekly rainfall superimposed on the weekly release pattern of water from the three sluices of Huruluwewa tank.

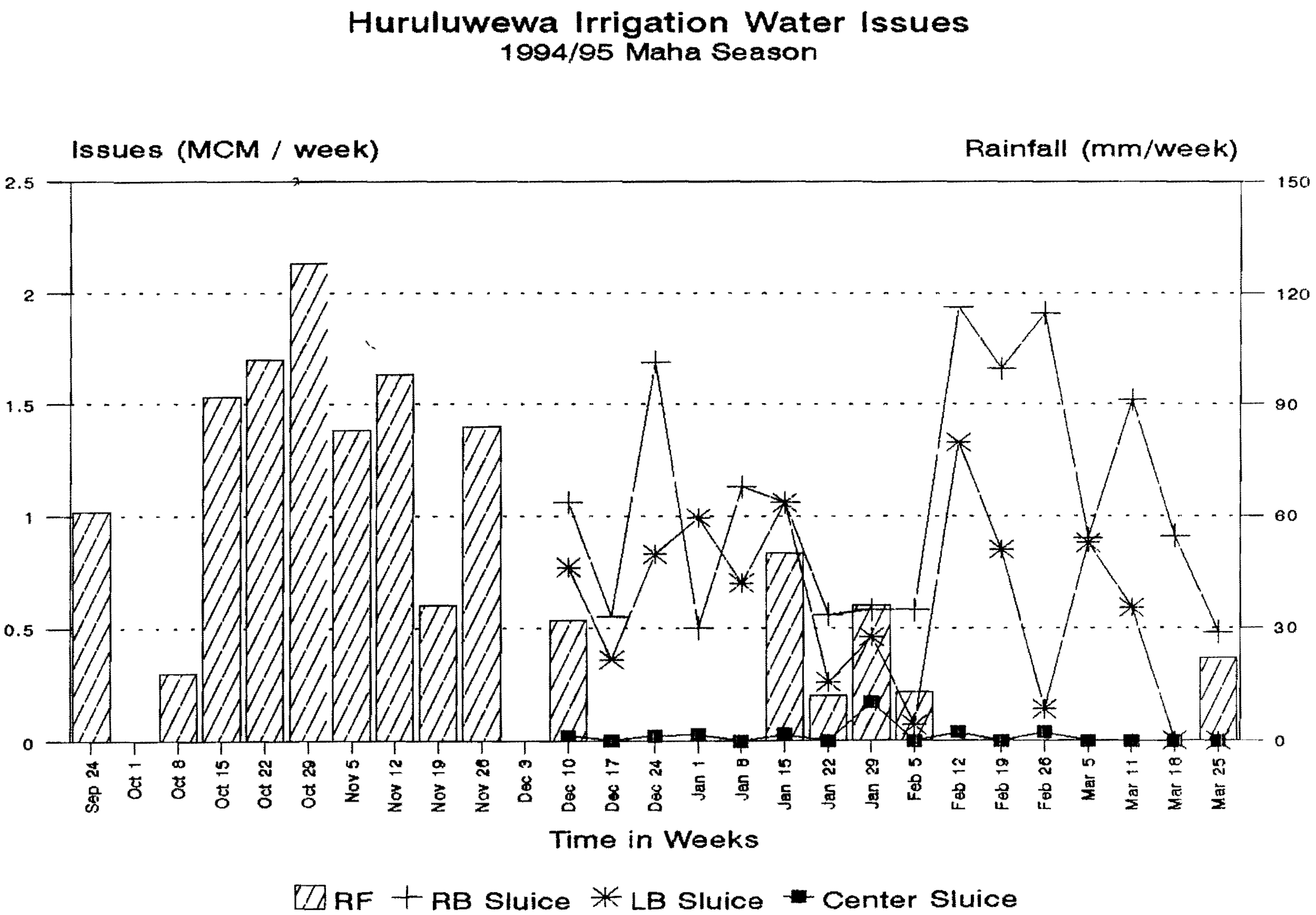
Figures 12 and 13 are jointly used to evaluate the impact of SCOR interventions carried out during the season to improve water use efficiency and save an adequate quantity of water in the tank at the end of the season to enable growing a second crop in the subsequent yala 95 season.

It will be seen later in this Chapter that unlike in the previous maha seasons, the farmers for the first time in the recent history, took the risk of beginning the land preparation with rain water with a very low tank storage. It is seen that, before the first release of tank water was made in the first week of December, 98% of the farmers completed first ploughing and 88% farmers completed even the second ploughing and 85% farmers every sowing using rainfall. This is a considerable achievement in terms of water management, pursued through the concerted efforts of the Watershed Resource Management Team and the catalytic role played by SCOR. If it is assumed that the total water requirement for land preparation of 1 ha. of rice land is 200 mm, and that with rainfall, the farmers would have hypothetically used about 150 mm of water, had the water been released from the tank, the total quantity of tank water saved by the intervention was about 5.8 mcm (4700 ac.ft). This saving is sufficient to irrigate a full maha rice crop on 617 ha (1566 acres) computed on the basis of a hypothetical tank duty of 1 m (3 ac.ft per acre).

5.5 Staggering Index

Figure 12 shows the progress of rice cultivation in maha 1994/95 season in Huruluwewa tank scheme expressed in terms of the cumulative percentage of the lands completing first ploughing, second ploughing, sowing and harvesting against the time from September 1994 to May 1995. This is constructed on the basis of 507 sample farmers of the entire scheme.

Figure 13



Huruluwewa Irrigation Water Issues
1994/95 Maha Season
Issues (MCM / week)
Rainfall (mm/week)
2.5
2
1.5
1
0.5
0
150
120
90
60
30
0
Sep 24
Oct 1
Oct 8
Oct 15
Oct 22
Oct 29
Nov 5
Nov 12
Nov 19
Nov 26
Dec 3
Dec 10
Dec 17
Dec 24
Jan 1
Jan 8
Jan 15
Jan 22
Jan 29
Feb 5
Feb 12
Feb 19
Feb 26
Mar 5
Mar 11
Mar 18
Mar 25
Time in Weeks
RF
RB Sluice
LB Sluice
Center Sluice

Staggering Index is defined as the time gap between the commencement and termination of cultivation operations in a cultivation season. Thus, it is seen that the earliest ploughing activity in the command was reported on 1 October 1994 while the latest harvesting was reported on 28 May 1995; resulting a Staggering Index of 9 months. This period looks excessive for growing a 3½ - 4 months variety of rice in maha which require theoretically about 135-150 days (5 months) from first ploughing to full maturity. However, Staggering Index indicates the spread of cultivation activities in a larger irrigation scheme where many factors other than the availability of water makes the Staggering Index to stretch from 150 days to about 220 days as in this case. Proper seasonal planning, therefore, must try to schedule all other inputs including water in such a manner to reduce the Staggering Index.

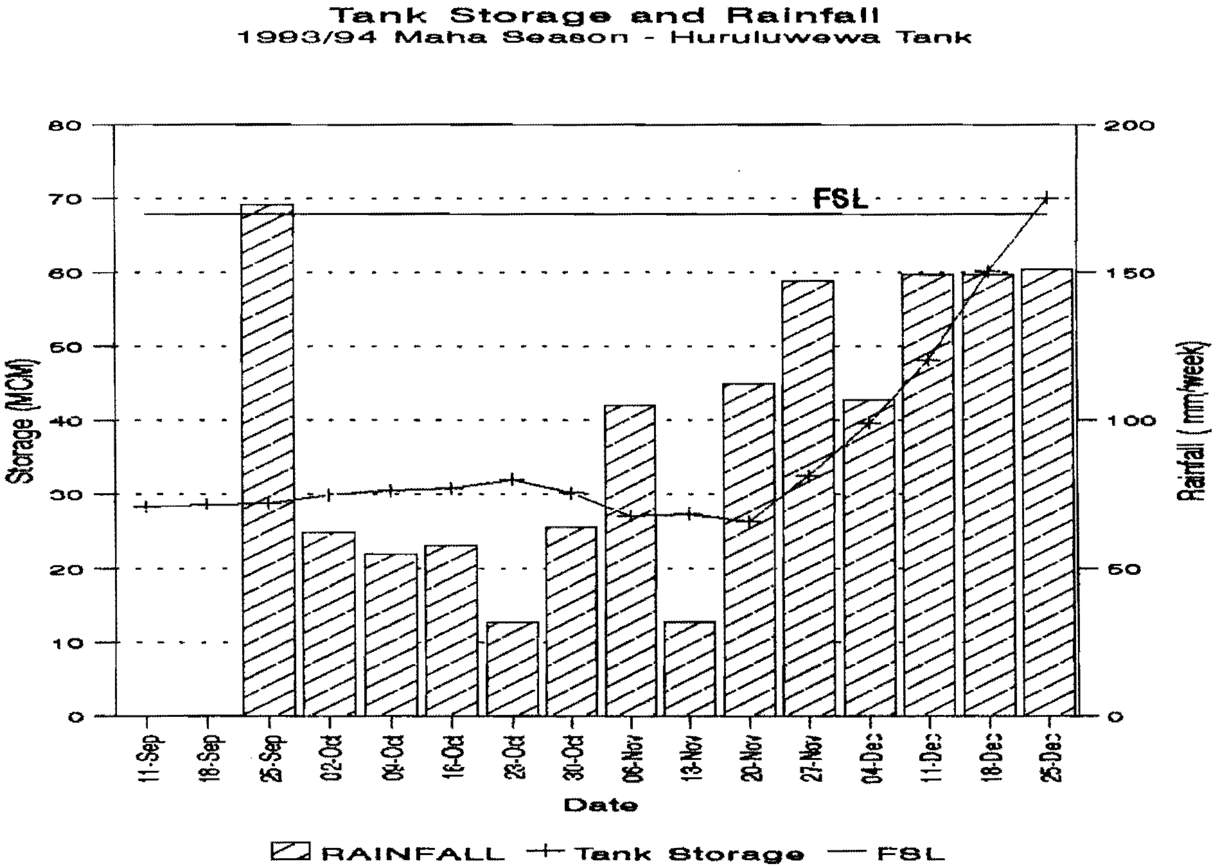
On the other hand, the cumulative frequency diagram of the cultivation progress shows a steady and uniform gradient except at the beginning and the tail end. The beginning and the tail end positions of the curve reflect a small percentage of farmers, who usually begin the cultivation very early and very late respectively. Thus, the middle portion of the curve reflect the general tendency of the scheme. If the Staggering Index is computed on the basis of this general trend, it is seen that the Staggering Index falls within the acceptable range of 135-150 days, showing a satisfactory progression of the season.

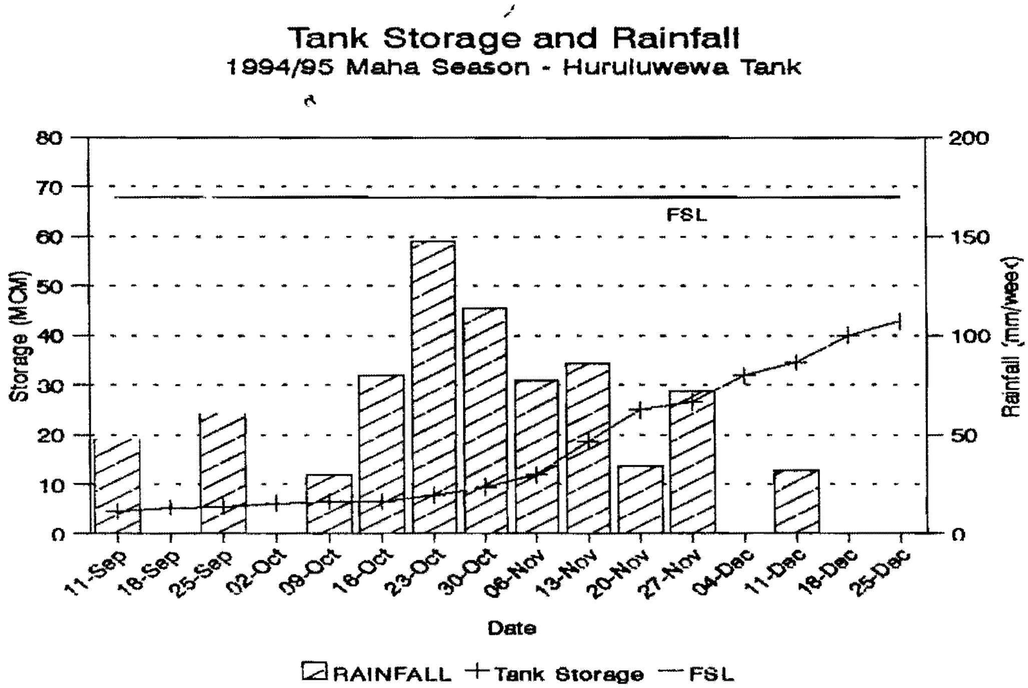
5.6 Effect on tank storage

The beneficial effect of the early commencement of the seasonal cultivation with the seasonal rainfall can be interpreted in terms of the gain of tank storage and comparing the corresponding tank storage in the previous 93/94 maha season. In both seasons the total extent was cultivated with rice. But in 93/94 maha season, the rainfall was exceptionally high for the dry season. The rainfall was so high that almost all major tanks in the dry zone as well as elsewhere (except three major tanks in the entire country) reached spilling level and eventually were spilling substantial amounts of water for a considerable period. For example, Huruluwewa tank reached spilling level on 21 December 1993 and was spilling almost continuously for about a month until the third week of January 1994. The total amount of water spilled from the tank was about three times (204 mcm) of the total storage capacity (68 mcm) of the tank. Although, Huruluwewa tank was a water short system, the monsoon that corresponded with maha 93/94 season registered the fourth time that it spilled since its commissioning in 1954. Therefore, comparison of net tank storage gain during maha 94/95 with maha 93/94 season is useful to assess the impact of early commencement of the season under study.

Figure 14 and Table 3 shows the net tank water balance in the two seasons from 11 September to 21 December each year. The first date of the time gap (11 September) was selected because it was the date on which the first rainfall occurred in 94/95 season. (The first rainfall event for the 93/94 season occurred on 25 September 943). The last date of the time gap (21 December) was selected because in the maha 93/94 season tank began spilling on that date. Therefore, this time gap is the best to compare the net tank water balance during both season and to interpret the water balance in relation to the utilization of rainfall for land preparation and tank sluice operation in both seasons.

Figure 14





FSL - Full Supply Level

Table 3: Comparison of Tank Water balance Components
in 1993/94 and 1994/95 maha seasons

1993/94 Season

	Tank Storage		Water level on 11 Sept		Catchment inflow to tank		Mahaweli inflow to tank		Sluice Issues		Rainfall	
	(MCM)	(m)	(MCM)	(ft)	(MCM)	(Acft)	(MCM)	(Acft)	(MCM)	(Acft)	(mcm)	(Inch)
On 11 Sept. 93	28.32	22947	4.96	16.3	-	-	-	-	-	-	-	-
On 21 Dec. 93	67.90	55000	8.50	27.9	70.3	56977	11.7	9512	14.15	11463	1397	55
Increase	40.58	32053	3.54	11.6								

1994/95 Season

	Tank storage		Water level on 11 Sept		Catchment inflow to tank		Mahaweli inflow to tank		Sluice Issues		Rainfall	
	(MCM)	(m)	(MCM)	(ft)	(MCM)	(Acft)	(MCM)	(Acft)	(MCM)	(Acft)	(mcm)	(Inch)
On 11 Sept. 94	4.58	3710	0.70	2.30	-	-	-	-	-	-	-	-
On 21 Dec. 94	42.90	34750	6.40	21.1	42.2	34164	2.66	2160	4.35	3525	782	30.7
Increase	38.32	31040	4.80	18.8								

It is seen from Figure 15 that in the 1993/94 maha season, sluice was kept opened from 16 October to 20 November to release water issues for land preparation in spite of the rainfall that were sufficient to meet the land preparation requirements. Table 3 shows that in maha 93/94 season, with a total rainfall of 1397 mm (55 inches) and a total inflow to the tank from its own catchment and Mahaweli diversion of 83 mcm (66469 ac.ft) the net tanks storage increased by 40.58 mcm (32053 ac.ft)

In the latter season, for a lesser rainfall of 782 mm (31 inches) and a lesser total inflow of 44.8 mcm (36324 ac.ft) the total net tank storage increased by 38.2 mcm (31040 ac.ft.) during the same period considered for this illustration. It has to be noted that the contribution from direct rainfall to tank storage and the loss from storage due to open water evaporation, bund seepage and tank bed percolation during the period under study were not considered for the tank water balance for this illustration. The net incremental tank storage expressed as a percentage of the total gross inflow to the tank for the time period considered were 51% and 85.5% for the maha 93/94 and maha 94/95 seasons respectively. Thus, the beneficial effect of the water management in the latter season is clear.

5.7 Irrigation Period

The water management during the 94/95 season resulted in a reduction of the total irrigation period, i.e. the period between he first and the last water issue from the tank for cultivation. This can be illustrated by Figure 16.

Figure 16 shows the performance of the twelve previous maha seasons from 1983/84 to 1994/95 expressed in terms of the dates of commencement and termination of tank water issues for cultivation. The data for this comparison have been obtained from the official records available with the Irrigation Department in tank storage and operation records. It should be noted that for all maha seasons, except for maha 94/95 season, the date of commencement of water issues from the tank was the official first date of commencement of the season.

It should also be noted that no cultivation were done in two successive seasons (maha 88/89 and maha 89/90) due to lack of water. This comparison brings important information.

Firstly, as revealed from the personal communication with the Irrigation Engineer at Galenbindunuwewa and farmers of the scheme, farmers never began land preparation activities until water issues were released from the tank. As a result the utilization of effective seasonal rainfall for land preparation and subsequent crop growth period was not very high. As mentioned earlier, farmers used a substantial amount of rainfall to meet land preparation water requirements in the maha 94/95 season.

Secondly, in the previous maha seasons, even if the water was issued from the tank, the commencement of land preparation did take place only when the tank water level exceeded at least about 3 m (10 ft) corresponding to a tank storage of 14.8 mcm (about 12,000 ac.ft). This was so because a majority of the farmers as well as the Irrigation Department were reluctant quite naturally to share the risk of commencing the season with a low tank level and tank storage. This reluctance compelled the farmers to delay the commencement of cultivation operations until the tank showed

Figure 15

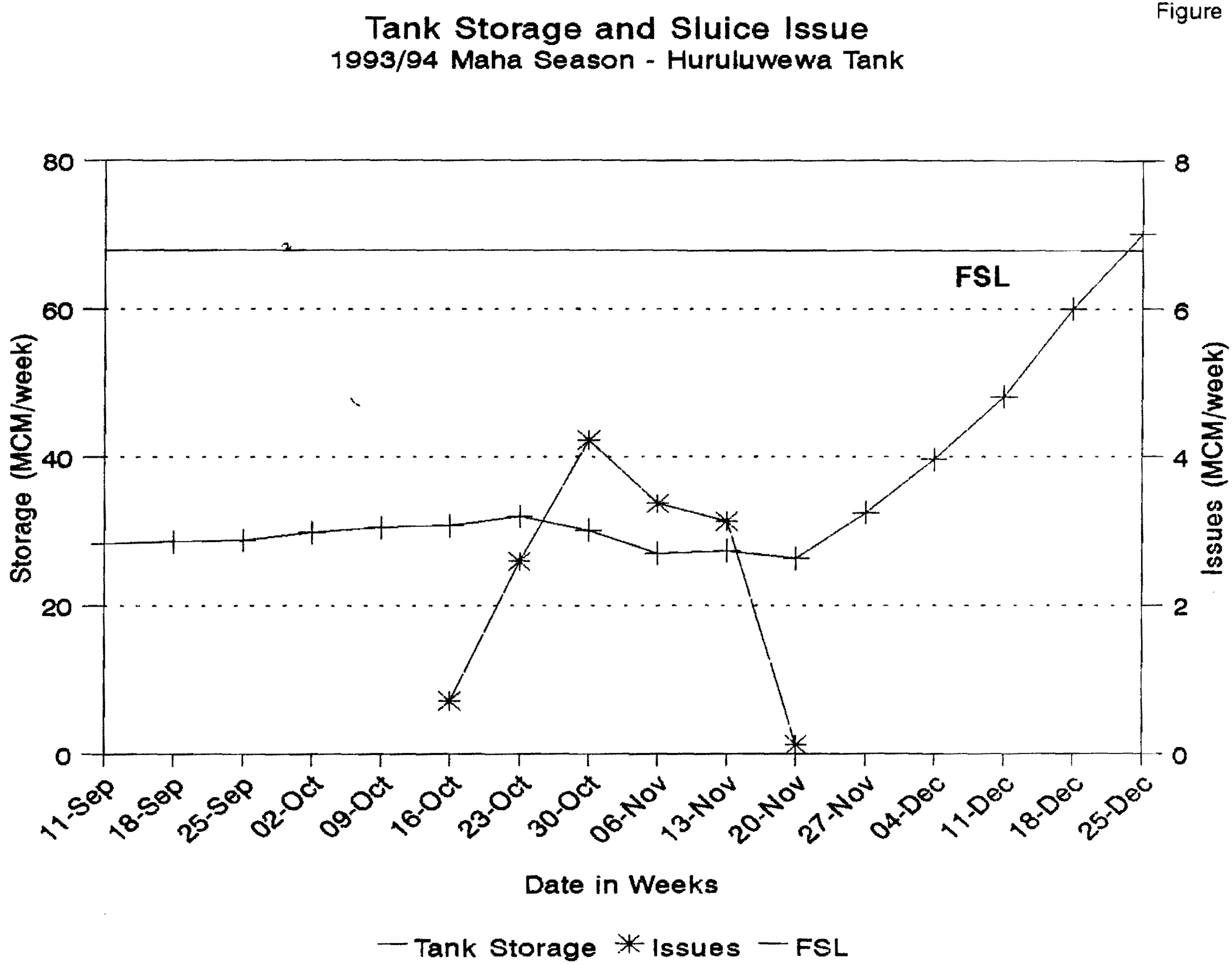

Tank Storage and Sluice Issue
1993/94 Maha Season - Huruluwewa Tank
80
60
40
20
0
8
6
4
2
0
Storage (MCM/week)
Issues (MCM/week)
FSL
11-Sep
18-Sep
25-Sep
02-Oct
09-Oct
16-Oct
23-Oct
30-Oct
06-Nov
13-Nov
20-Nov
27-Nov
04-Dec
11-Dec
18-Dec
25-Dec
Date in Weeks
Tank Storage
Issues
FSL

Fig 16

Dates of Commencement of cultivation (land preparation) and Period of Tank Water Issues

Year	Crop	Extent cultivated Ha.	Extent cultivated AC	Oct	Nov.	Dec.	Jan.	Feb.	March	Apr.	May	Water Issue Period (days)
83/84 Maha	Paddy	3865.69	9552		10 C				31 F			143
84/85 Maha	Paddy	3865.69	9552				10 C				15 F	125
85/86 Maha	Paddy	3865.69	9552		10 C					12 F		154
86/87 Maha	Paddy	3865.69	9552	20 C						10 F		173
87/88 Maha	Paddy	3865.69	9552		25 C					15 F		143
88/89 Maha	–	–	–			No Maha Cultivation No water issues						0
89/90 Maha	–	–	–			No Maha Cultivation No water issues						0
90/91 Maha	Paddy	3865.69	9552				01 C			30 F		120
91/92 Maha	Paddy	3865.69	9552	25 C					20 F			147
92/93 Maha	OFCS	587.0	1452				09 C		20 F			71
93/94 Maha	Paddy	3865.69	9552	C				F				131
94/95 Maha	**Paddy**	**3865.69**	**9552**			**C**			**F**			**94**

C = Commencement date of the tank water issues
F = Final date of tank water issues

signs of increasing water levels at a satisfactory rate, thereby allowing a considerable amount of effective rainfall to go unutilized productively. But in maha 94/95 season, both the farmers and the Irrigation Department jointly shared the risk to commence land preparation when the tank water level was only about 1m, and without waiting for the tank water level to rise up to the minimum level perceived by them. Eventually, the cultivation operation smoothly progressed without any supplementary irrigation from the tank until the first week of December.

Thirdly, the time period between the first and last date of tank water issues, which usually corresponds with the dates of commencement and termination of the rice cultivation seasons, varied from a minimum of 120 days (1990/91 maha) to a maximum of 173 days (1986/87 maha), except in 1992/93 maha during which only soya bean that require less water for a shorter period was grown in a small extent of the command area. In maha 94/95 season, this time period was reduced to 94 days. It is almost the half of the longest water issue period recorded for the last ten maha seasons for which the data are available.

5.8 Crop Yield

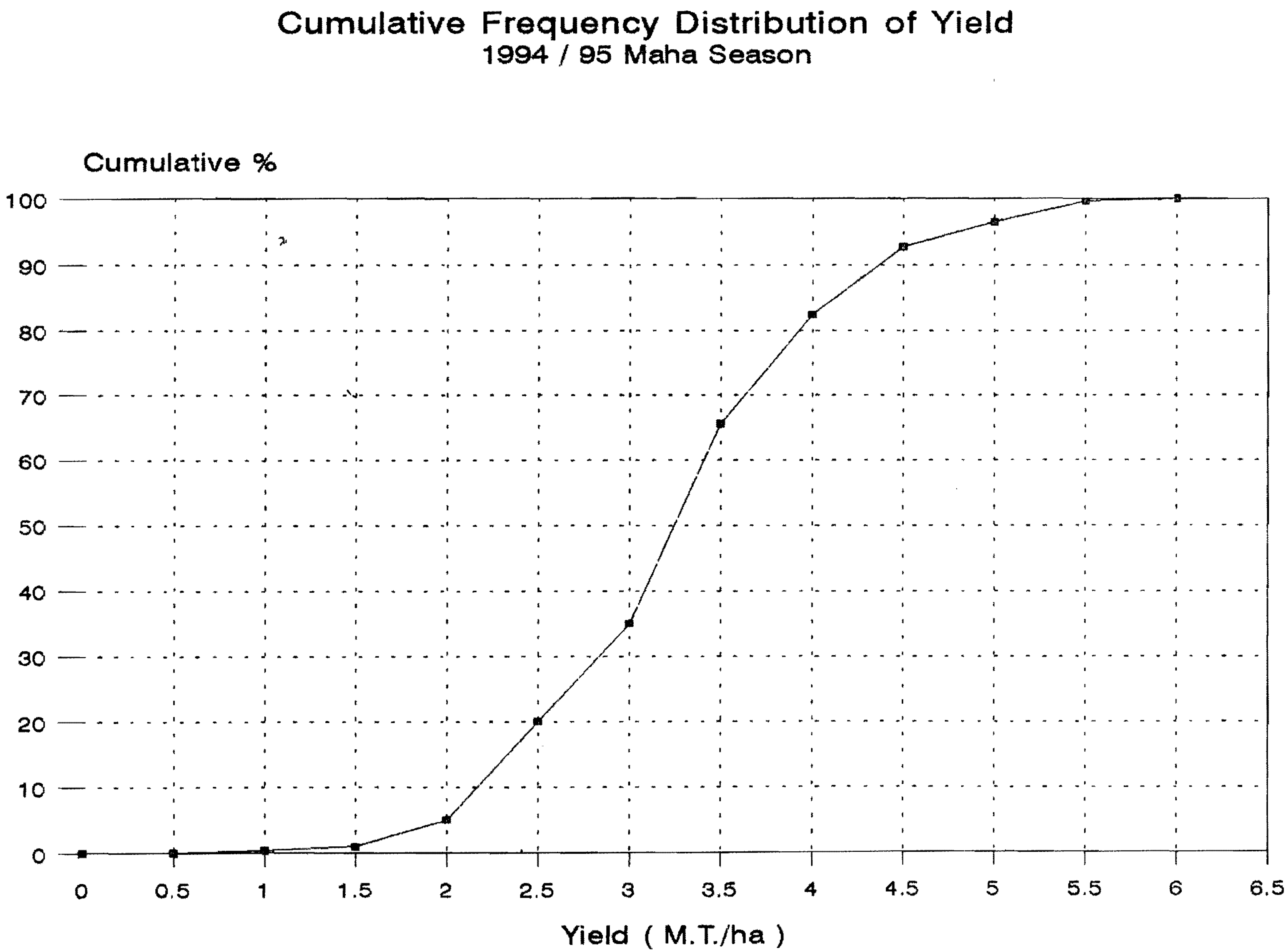
Yield of the maha rice crop was evaluated using the farmer reported data from a sample of 507 allotments. The same sample of farmers selected to evaluate the progress of the cultivation season was used for this purpose.

Figure 17 shows the cumulative frequency distribution of the rice yield as the sample. It is seen that the average yield which corresponds to the 50 percent cumulative percentage ordinate (median), is 3.2 ton/ha. It means that at least half of the farmers in the entire command area were not able to obtain a yield not more than 3.2 ton/ha. It is also seen that 20 percent of the farmers got very low yields less than 2.5 ton/ha. On the other hand, another 20 percent of the farmers got yields higher than 4 ton/ha and yields ranging from 4-6 ton/ha. This shows that the yield performance of the rice crop in maha 94/95 season is not very satisfactory as the average yield is almost half of the maximum yield obtained by a few farmers. No past reliable records of the maha rice yield in the scheme is not available for comparison with long term values.

5.9 Irrigation Water Duty

The indicator irrigation water duty is a gross measure of the efficiency of water use for irrigating a crop. It is defined as the ratio between the total quantum of water released from a tank (or sluice) to irrigate a crop and the total area for which the water was used to grow a crop. Thus, hypothetically, it evaluates the depth of irrigation water used to grow a given crop on a unit command area. Traditionally, the indicator water duty has been used to evaluate the quantum of water released from an irrigation tank (or an anicut) during a full season to asweddumize a crop. When the water duty is evaluated in respect of the tank and the full command area, it is called "tank water duty". However, the indicatpr water duty has been used in this action-research programme to evaluate the efficiency of water use in the entire scheme as a whole, for Left Bank and Right Bank areas separately and for the tract level of the command area.

Figure 17



Cumulative Frequency Distribution of Yield
1994 / 95 Maha Season
Cumulative %
100
90
80
70
60
50
40
30
20
10
0
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
6
6.5
Yield (M.T./ha)

The water duty of the entire tank scheme and water duty computed for the Left Bank command area (1310 ha) Right Bank command area (2309 ha) and the command area fed by the center sluice (20 ha) are shown in Figure 18. Also, the water duty computed for the sample tracts 2, 6, 10 and 13 of Right Bnk and tracts 1, 3 and 6) are shown in Figure 19. The results are tabulated below for easy reference:

Reference point	Water duty (m)	(ft) (ac.ft/Ac)
Tank	0.67	2.2
Right Bank sluice level	0.75	2.46
DC 2 of Tract 2	0.70	2.29
DC 2 of Tract 6	0.88	2.88
DC 10A of Tract 10	0.92	3.01
DC 13 of Tract 13	0.61	2.0
Left Bank sluice level	0.61	2.0
DC 1 of Tract 1	0.61	2.0
DC 3 of Tract 3	1.20	3.93
Tract 6	1.14	3.74
DC 10 of Tract 6	1.00	3.28
DC 10 of Tract 6	0.94	3.08
Center sluice level	0.72	2.39

The above figures present some interesting results as follows:

(a) The overall tank duty was 0.67m or 2.2 ac.ft/acre which is a very low value compared to the average duty of many irrigation schemes of the country. This was the lowest tank duty recorded during maha 94/95 season for any major irrigation scheme of the country.

(b) Although, the overall tank duty is 0.67m, the water duty of the Left Bank and Right Bank command areas over 0.61m(2.00 ac.ft/ac) and 0.75m(2.96 ac.ft/ac) respectively. The water duty of the Left Bank was even lower than the overall tank duty. This reflect the fruits of the efforts of the water management committee in implementing water delivery schedules at main canal level.

(c) However, although the water duty of the Left Bank was comparatively low, implying efficient water use, some of the sample distributory canals (DCS) of the Left Bank (DC3 of tract 3, and DC 9 of tract 6) recorded very high water duties implying efficient water use, while some sample DCs (DC1 of tract 5) recorded low water duty, implying efficient water use. This indicates that although the overall water use of the Left Bank command area was very high, efficiency of water use in the tract level and distributory canal level varied widely from 0.61m (200 Ac.ft/ac) to 1.20m (393 ac.ft/ac) implying different levels of

Figure 18

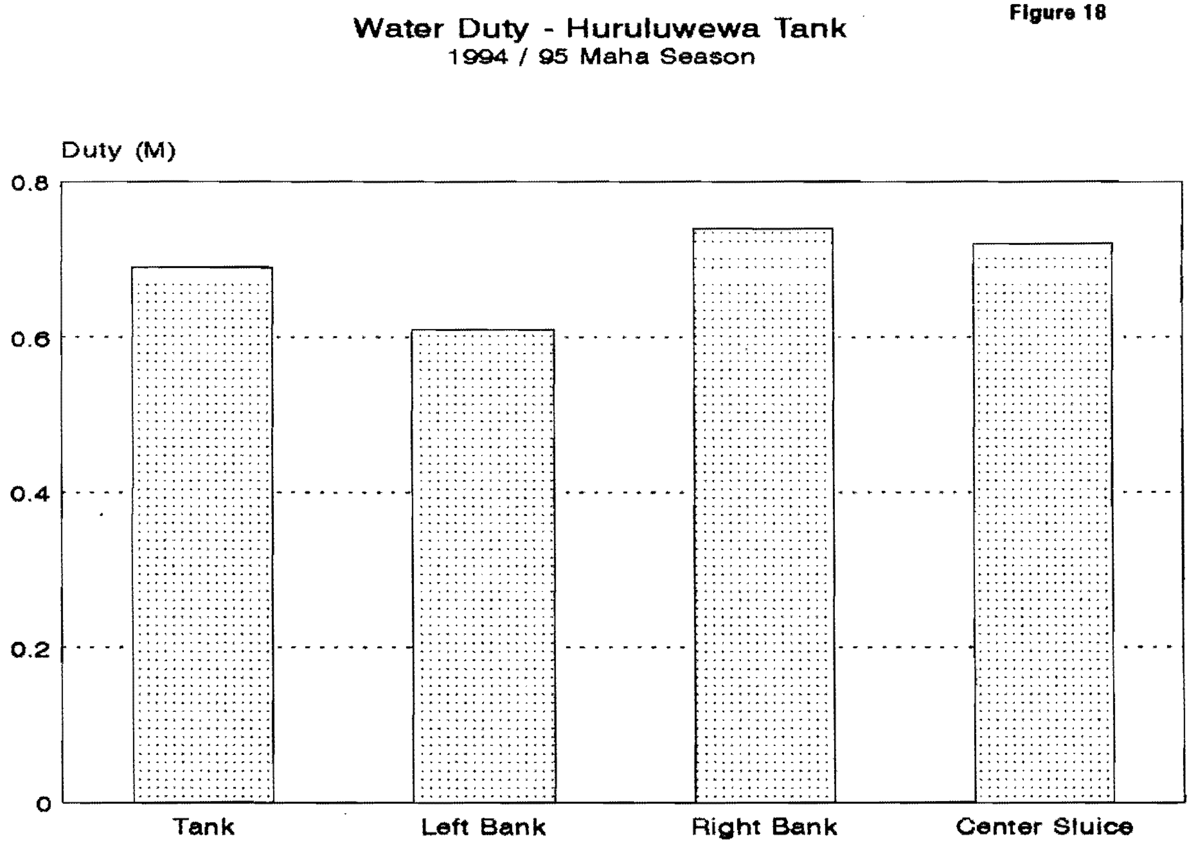
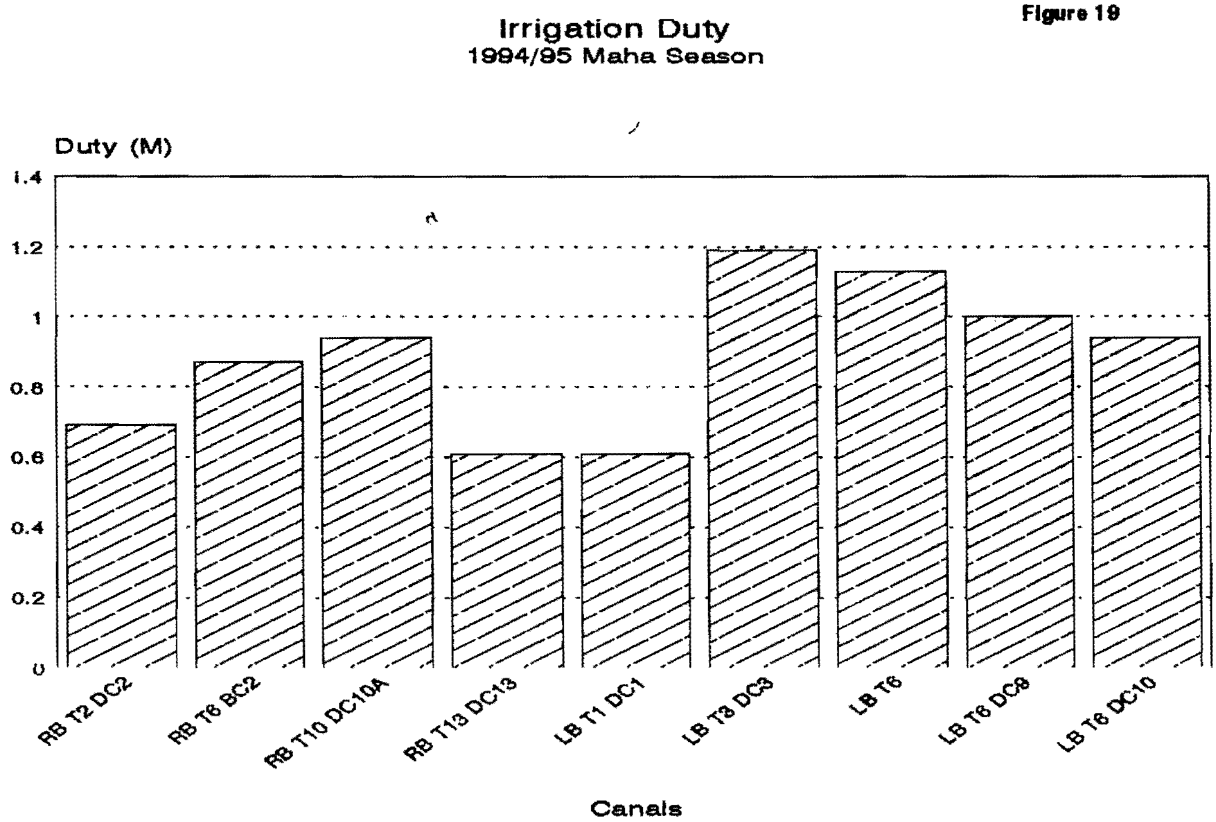


Figure 19



irrigation management. The water use efficiency of the Left Bank command area, and hence the overall tank duty could have further reduced if the water management in some of the tracts was efficient than the actual. This aspect is further reviewed later under section 5.10 on quality of water irrigation management.

(d) Also, the overall water use efficiency of the Right Bank command area 59 (0.75m) was not as good as of the Left Bank command area (0.61m). However, compared to the individual sample tracts of the Left Bank area, the sample tracts of the Right Bank monitored for this action-research study recorded low water duties, implying high water use efficiency. The water duty was high only in respect of tract 6 and tract 10.

(e) The results discussed under (iii) above are contradictory in the sense that, the overall water duty of the Left Bank was very low while the sample tracts were high. For the Right Bank command area, the water duty of the sample tracts almost fall in line with the overall water duty for the entire command area.

5.10 Quality of irrigation water management

Quality of irrigation water management means here, the degree to which the irrigation water supply, including the combined use of rainfall and tank water, matches with the actual field irrigation water requirements. In order to assess the quality of irrigation water management, the indicator, Cumulative Relative Water Supply (CRWS) is used here.

Relative Water Supply (RWS) is defined as the ratio between the irrigation water demand and irrigation water supply. It can be expressed as:

$$RWS = \frac{ET + S\&P}{IR + RF}$$

When ET = Evapotranspiration (mw)
S&P = Seepage and percolation losses from the rice field and liyadde dikes (mm)
IR = Irrigation water delivered by the irrigation system (mm)
RF = Effective rainfall (mm)

The daily open water evaporation values measured in the command area were used to obtain the crop evapotranspiration values using a pan among a coefficient and standard crop coefficients for rice for different stages of growth period. Seepage and percolation losses were not measured in the field. Instead, the S&P loss values of 5 mm/day for well drained soil and 3 mm/day for partly drained soils were applied to the actual extents of the soil categories of the sample tracts as obtained from the updated soil distribution map and the field verifications. Irrigation water deliveries (IR) were the values obtained from the daily discharges measured at the sample points. Effective rainfall was estimated using an empirical formula used by the Irrigation Department.

Figures 20, 21 and 22 indicate the plotting of weekly Cumulation Relative Water Supply (CRWS) for the tank sluice level, sample tracts of the Left Bank and Right Bank command areas respectively.

Use of Cumulative Relative Water Supply (CRWS), instead of RWS values, makes the evaluation of the quality of irrigation water management easy. For example, if the quality of irrigation water management is good, meaning the irrigation supply matches with the demand, RWS must be equal to one. the straight line shown in Figures 20, 21 and 22 shows the CRWS line which corresponds to RWS=1 for every week considered for this evaluation. The straight line position offers a basis or a criteria to compare the quality of actual irrigation management performance at different levels of the system, represented in terms of the actual CRWS values and shown as curves in each plotting. Thus, if the actual CRWS curve matches well with the theoretical or ideal CRWS curve (straight line) the irrigation water management is best, and if not, irrigation water management has resulted in either under supply or over supply depending on whether the actual CRWS curve lie below or above the reference line respectively.

Examination of the CRWS plottings at the overall tank level, Left Bank and Right Bank sluice level as shown in Figure 20, indicate a very good quality of irrigation water management at those levels. This result will agree with the water duties at those levels as shown in section 5.9 of this report. While the water duties at the overall tank level, as well as at left and Right Bank sluice levels were low, the irrigation supplies have well matched with the irrigation water requirements without either under supply or over supply. Thus, the quality of main system management is exceptionally good.

Examination of the CRWS plotting of the sample tracts of the Left and Right Bank command areas as shown in Figures 21 and 22 show different levels. In the Right Bank command area, irrigation supply has been slightly in excess of the demand, while in the Left Bank command area, the supply has been in excess of the demand in respect of the sample tracts (tracts 3 and 6), while the supply has been in deficit of the demand in respect of one tract (tract 1). It is interesting to note that the low water duty reported at LB tract was, therefore, not due to high water use efficiency but may be due to under supply of water. These CRWS plottings show that there is a higher variability of water use at tract levels and individual DCS and FCs within a tract, implying that more water can be saved by improving the quality of irrigation management at those levels.

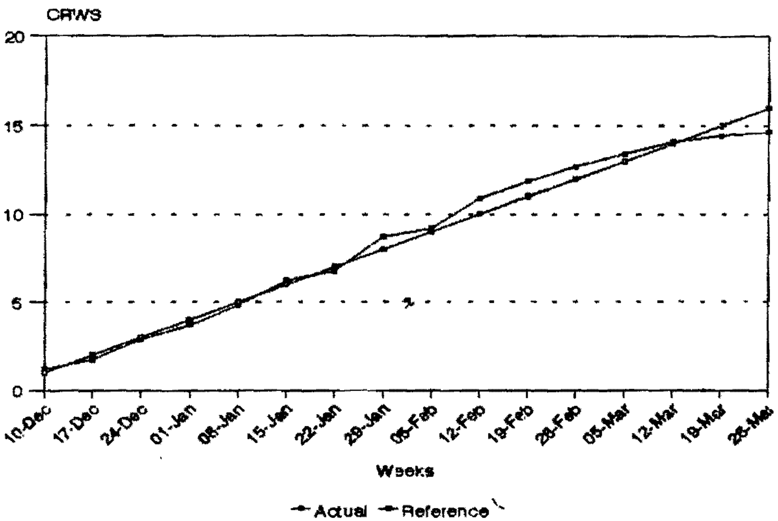
5.11 Water Productivity

Water productivity is defined as the total crop dry matter produced per unit quantity of irrigation water consumed. It is derived by diving the total crop production produced in a known command area by the total quantum of tank water delivered to that area during the season. The total production for a tract was calculated on the basis of the average yield evaluated from the sample and the actual area harvested in that tract.

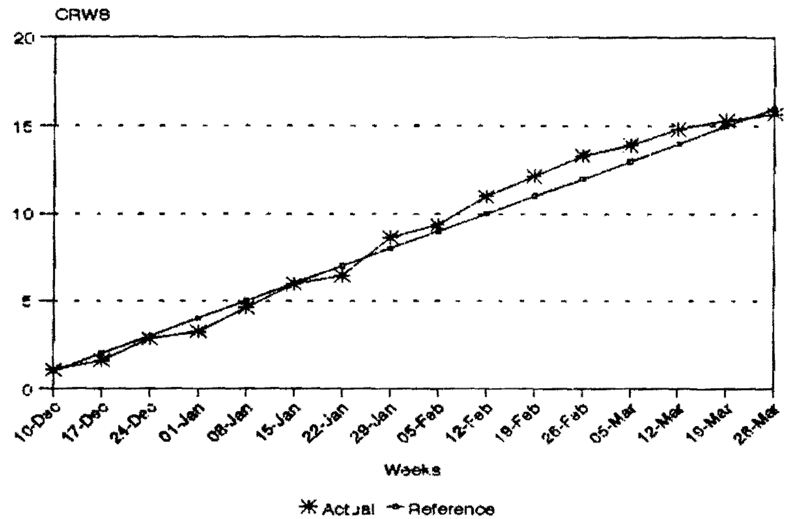
Figure 23 shows the plotting of water duty against water productivity for the overall tank levels, left and Right Bank sluice levels, and for sample tract levels. Thus, water productivity in maha 94/95 season in the Huruluwewa tank command area shows a wide variability. At tank level, the water productivity was about 5.2 tons/m

Figure 20

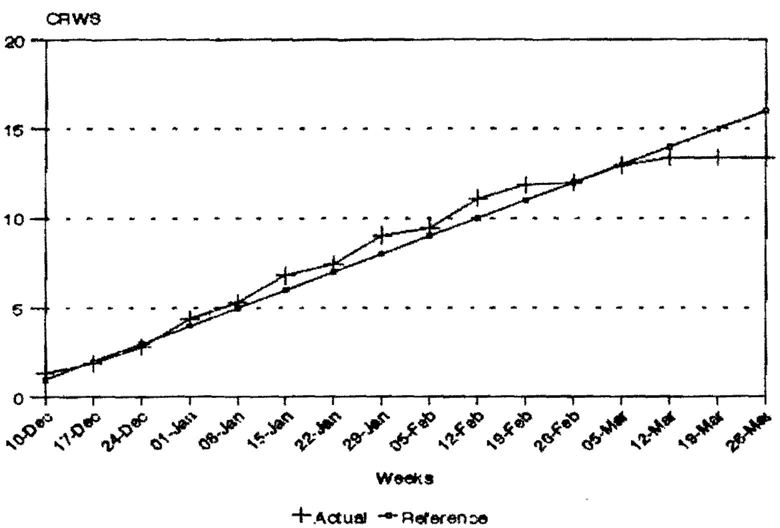
Huruluwewa Tank System



Right Bank Main Canal



Left Bank Main Canal



Center Canal

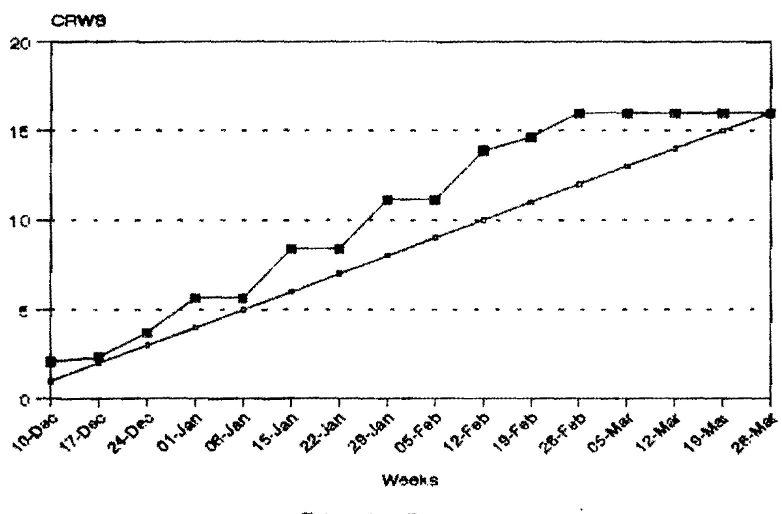
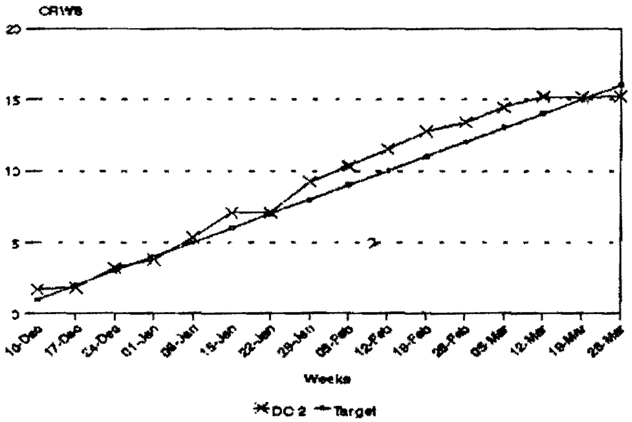


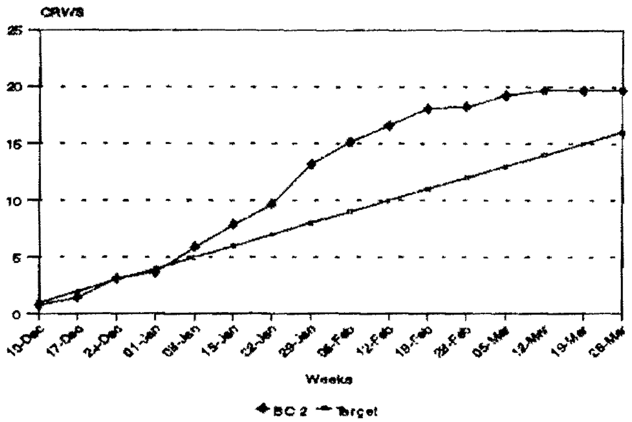
Figure 21

Cumulative Relative Water Supply (CRWS) for Right Bank 1994/95 Maha Season

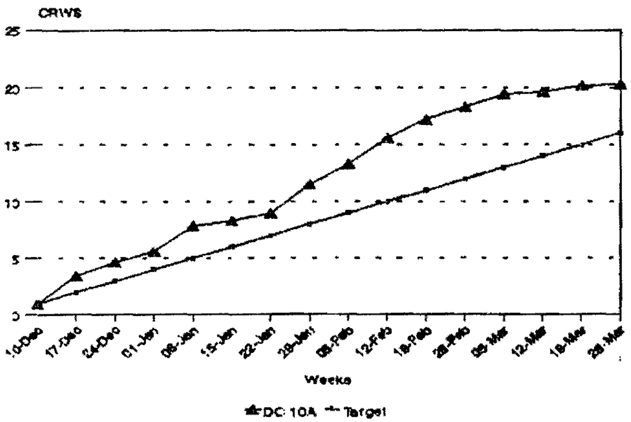
RB Tract 2 DC 2



RB Tract 6 Branch Canal 2



RB Tract 10 DC 10 A



RB Tract 13 DC 13

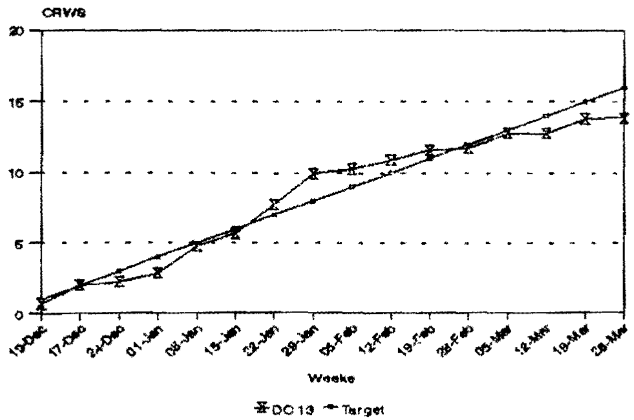


Figure 22

Cumulative Relative Water Supply (CRWS) for left Bank 1994/95 Maha Season

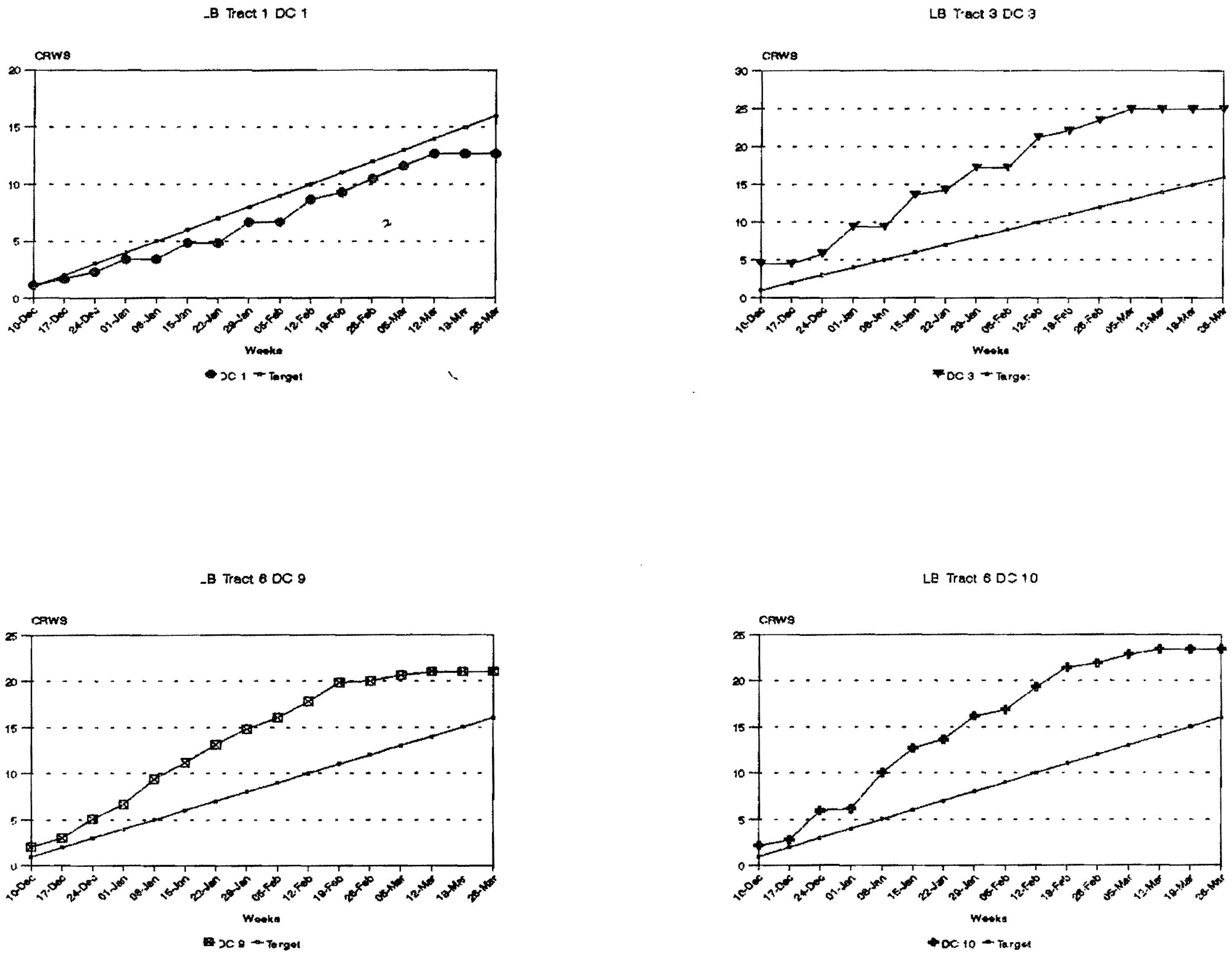
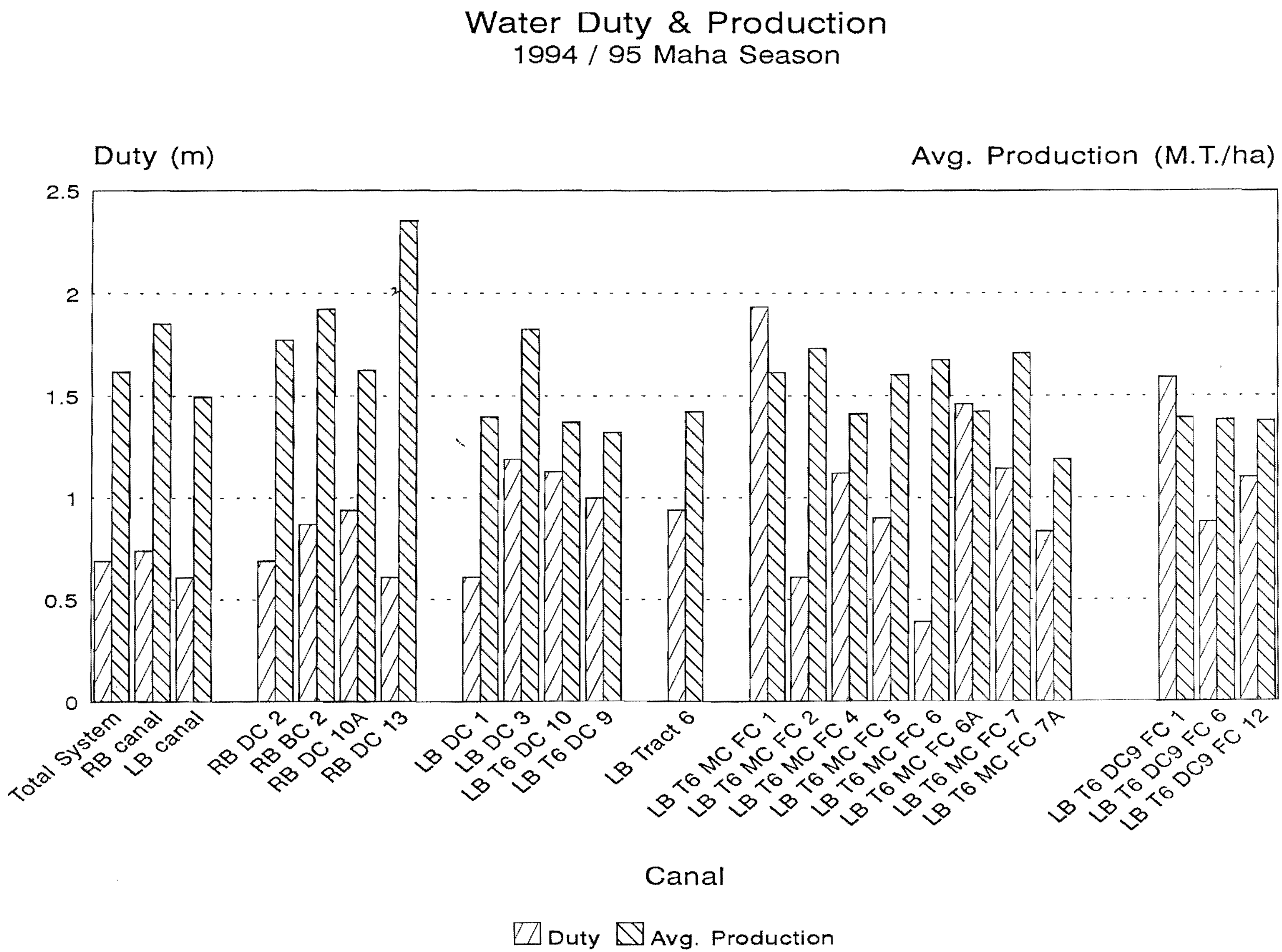


Figure 23



Water Duty & Production
1994 / 95 Maha Season
Duty (m)
Avg. Production (M.T./ha)
2.5
2
1.5
1
0.5
0
5
4
3
2
1
0
Total System
RB canal
LB canal
RB DC 2
RB BC 2
RB DC 10A
RB DC 13
LB DC 1
LB DC 3
LB T6 DC 10
LB T6 DC 9
LB Tract 6
LB T6 MC FC 1
LB T6 MC FC 2
LB T6 MC FC 4
LB T6 MC FC 5
LB T6 MC FC 6
LB T6 MC FC 6A
LB T6 MC FC 7
LB T6 MC FC 7A
LB T6 DC9 FC 1
LB T6 DC9 FC 6
LB T6 DC9 FC 12
Canal
Duty
Avg. Production

of water on average. However, at tract level in the Left Bank command area, water productivity varied from 1.8 to 8.5 tons/m, while in the right tank it varied from 3.5 to 7.8 ton/m. It is also seen that, in general, when the water duty was low water productivity was high and vice versa.

C Mahameegaswewa, Puwakpitiya and Pandikaramaduwa tanks

Achievements and Performance

The key intervention tried out at Mahameegaswewa, Puwakpitiya and Pandikaramaduwa tanks too were to motivate the farmers to commence land preparation activities with the on-set of rainfall and to minimize the use of tank water for maha cultivation.

5.12 Mahameegaswewa Tank

Figure 24 shows the land preparation progress at Mahameegaswewa tank during maha 94/95 season. Achievements and performance during the season are as follows:

(a) Farmers cultivated the entire extent with paddy with complete success. In the previous maha seasons, even in the years with satisfactory rainfall, the maha Cropping Intensity (CI) remained in the range 0.60 - 0.80. In maha 94/95 season, CI was 1.0

(b) Farmers did second plowing and sowing at the same time. Typically, farmers leave a time gap of few days between the second plowing and sowing. In the last maha season, this time gap was brought to zero.

(c) The first farmer of the scheme commenced land preparation on 15 October. All farmers completed land preparation by 19 November within a period of one month from the date on which the first land was plowed. Farmers reported that in the previous seasons, the cultivation calendar was not faithfully followed by them and as a result, the date of commencement of first plowing got delayed until the first week of December and eventually the date of completion of land preparation in the entire extent extended until mid January. The performance shown in Figure 24 is therefore, a significant achievement.

(d) Farmers wanted to do dry plowing using a common tractor hired by the Farmer Organization. Although, they began dry land plowing, early on-set of maha rainfall in mid September compelled them to revert to usual mud plowing. However, unlike in the previous seasons, farmers did not use tank water for land preparation activities.

(e) A crop cut survey and a supplement survey to obtain farmer-reported yield were conducted in the command area during and after harvesting respectively by the SCOR researchers. It was revealed that the average paddy yield was 4.22 (mt/ha) (85 bushels/Ac.) This is almost a quantum jump from the average yield of 2.27 Mt/ha (45 bushels/Acre) that the farmers used to get in a typical maha season at Mahameegaswewa (the latter figure was reported by the farmers).

Although a number of factors may have contributed to the yield increase, elimination of water stress during the tail end of the season and timely and proper application of chemical fertilizers may have affected the yield favourably.

(f) The first water issue from Mahameegaswewa tank was made on 3 January 1995 after the completion of land preparation in the entire extent. The tank water duty is calculated to be 0.6m (1.98 Ac.ft/Ac) which is a satisfactory value when compared with the standard value of 0.9m (3 Ac.ft) for minor tanks. The actual water duty is an indication for the good water management achieved by the farmers.

(g) At the end of the season, (on 22 March 1994), Mahameegaswewa tank had a residual storage of 0.23 MCM (188 Ac.ft). This corresponds to 66% of the full storage capacity (0.35 MCM) of the tank. The farmers recall that except in 1993/94 maha season, where the rainfall was exceptionally high, they could not see an almost full tank at the end of a full maha cultivation during the recent past.

5.13 Puwakpitiya Tank

(a) The story at Puwakpitiya tank is more interesting as shown in Figure 25. The CI was 1.0 as against 0.60 - 0.70 achieved in a typical maha season in the past at Puwakpitiya tank. As seen in Figure 25 the first farmer began dry land plowing on 27 August well before the onset of maha rainfall. However, only 15% of the farmers could complete dry land preparation before the on-set of maha rainfall on 10 September.

(b) The entire command area was cultivated and the land preparation in the entire extent was over by 29 October. Thus, seasonal rainfall was fully utilized for land preparation. However, the farmers have taken nearly two months to complete land preparation. However, the farmers have taken nearly two months to complete land preparation in the entire command. It is excessive.

(c) Not a single water issue was made from the tank during the subsequent period. As the land preparation was commenced very early, farmers could complete the season early without using any tank water even during crop growth period. This is a remarkable achievement.

(d) The tank retained its full storage at the end of the season. A tank retaining its full storage after having completed a full maha season was an unusual occurrence in the dry zone.

(e) The paddy yield was reported and measured as 3.12 Mt/ha (62 bushels/Ac). It compares with the average maha yield of 2.23 Mt/ha as a 27% increase. The increase can be attributed to timely cultivation, proper and timely application of chemical fertilizer and less water stress to the crop.

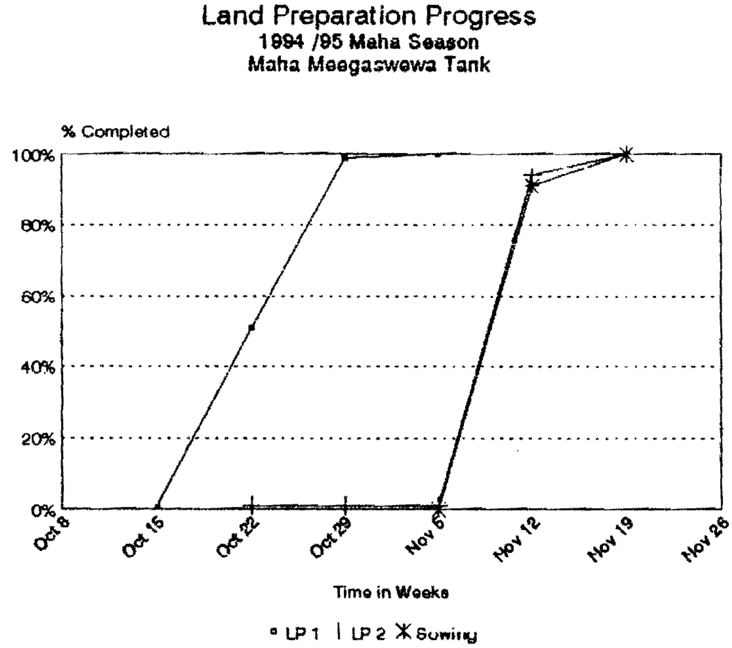


Figure 24

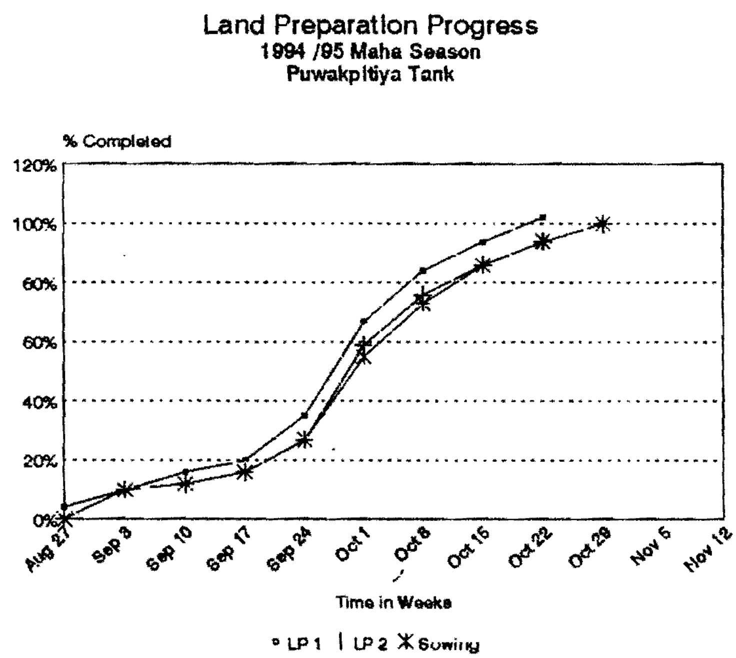


Figure 25

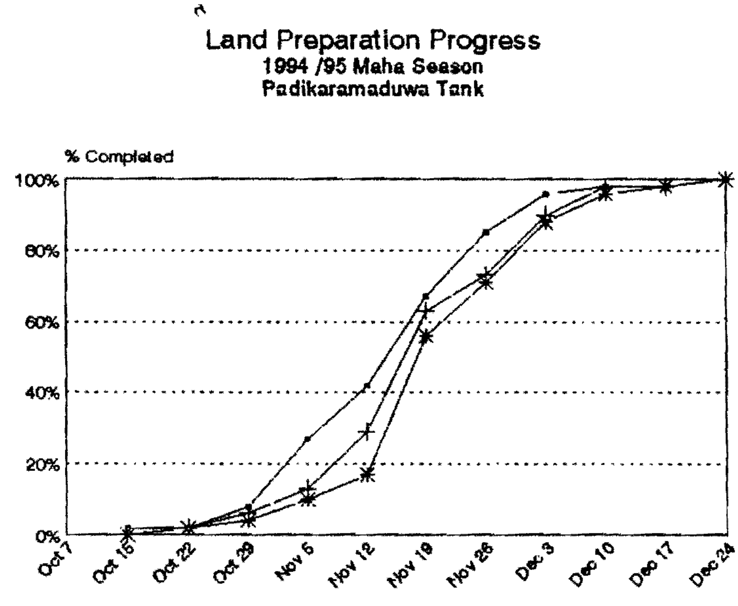


Figure 26

5.14 Pandikaramaduwa Tank

(a) The land preparation progress of Pandikaramaduwa tank is shown in Figure 26. In Pandikaramaduwa tank, the performance was not so significant as in Mahameegaswewa and Puwakpitiya tanks. The land preparation period spanned for over a period of 2 months between October and December.

(b) Farmers in Pandikaramaduwa too used maha rainfall for land preparation in the entire command area. They did not use any tank water for land preparation.

(c) Only four water issues were made from the tank for maha cultivation. The first and last water issues were made on 5 January and 9 March. It is not possible to report the tank duty and residual storage of the tank at the end of the season as those parameters could not be measured accurately during the season.