EXECUTIVE SUMMARY

The main goal of this pilot research project was to investigate the *factors which influence the acceptance of irrigation scheduling with specific reference to scheduling models*. Within this framework the objectives of this research were to:

- measure the perception of the practice of irrigation scheduling in general
- identify the human and environmental factors which influence the acceptability of irrigation scheduling models in general
- identify the specific human and environmental factors which influence the use of the models
- give guidelines concerning the changes needed to be made to irrigation scheduling models to improve the acceptability of the models
- make initial technical changes to the models.

To effect these objectives, three sites were chosen, viz.:

- The Rust de Winter Irrigation Scheme, which is representative of a typical land redistribution situation.
- The Riet River Irrigation Scheme, which represents a site where an irrigation scheduling model was introduced a number of years ago.
- The Loskop Irrigation Scheme, which represents an irrigation scheme where SWB, representing a new computer-based irrigation scheduling model, is being released.

The research focus at each of the three sites was slightly different. At Rust de Winter, the focus was on the main goal, viz. factors which influence the acceptance of irrigation scheduling with specific reference to scheduling models. At Riet River and the Loskop Irrigation Scheme, the focus was on the objectives as shown above.

Since Rust de Winter differs from the other sites in terms of its socio-economic circumstances, *different research methodologies* were employed at the sites. Rust de Winter required a range of typical Participatory Rural Appraisal (PRA) techniques, while at Riet

River and Loskop questionnaire based semi-formal interviews were used. At Rust de Winter the combinations of PRA techniques that were used were; transect walks, semi-structured interviews with key informants, historical timelines, Venn diagram, seasonal calendar, constraint identification and ranking and scoring and prioritisation. Based on a problem conceptualisation the traditional questionnaire was constructed. The latter was focused specifically on achieving the goal of the research.

The results of the **Rust de Winter** investigation are shown in Chapter 2. They can be summarised as follows:

- The history of irrigation at Rust de Winter tells a tale of intentional but sadly unsuccessful political involvement and intervention that started almost 20 years ago.
- Since the political involvement, the administration of the Scheme was not up to standard and the land administration processes proved to cause prolonged inconveniences for and uncertainty with irrigation farmers. The area falls in two provinces, which administratively worsens the situation.
- The socio-political issues at Rust de Winter effectively smother one initiative after the other, leading to irrigation scheduling being so low on the priority list of irrigation farmers that it hardly features. The historical time line shows how the current irrigation farmers moved in and actually squatted on their land and started farming. After years of waiting for bureaucracy to take decisions and give meaningful direction, they could not wait longer. The current plans to subdivide a piece of land into circa 350 smaller plots seem to create a lot of uncertainty and unrest among the local irrigation farmers. It will substantially decrease irrigation water availability.
- Effectively there are five communities, four ethnic groups and two farmers' organisations that find it difficult to co-operate and therefore find great difficulty to agree on many issues of mutual concern.
- The irrigation farmers are (generally speaking) poor and cannot afford to buy the land or agricultural inputs. Few tractors and agricultural implements are available.
- Infrastructure has deteriorated at a steady pace since the middle 1980s when the previous white landowners started leaving the area. The canals are in disrepair and there

seem to be attempts by the Department of Water Affairs and Forestry to restore them. Citrus orchards are also run down and no longer economically viable. When the previous farmers left, there were about 21 pivot systems that remained on the land. Only one or two are in use today.

- Two agricultural co-operatives have been formed, but neither has managed to start functioning.
- The climate is conducive to agricultural production, but water availability is problematic. The area is unsuitable for rain-fed crop production. Groundnuts do not do well because of the high clay content of the soil. Vegetable production has excellent potential.
- The situation at Rust de Winter is complex and difficult to analyse. It seems to have a high degree of socio-political fluidity, which makes investigations and general extension work very difficult.
- Land tenure arrangements and the concomitant insecurity are creating big problems for irrigation farmers. Farmers complain that many decisions are still taken in a top-down fashion in Pretoria and Johannesburg.
- Access to agricultural credit and agricultural inputs barely exist. Farmers borrow irrigation equipment from the Department of Agriculture. Those are not used appropriately looked after and farmers complain of a general lack of labour to shift irrigation pipes. Flood irrigation is not a suitable practice at Rust de Winter, but some farmers use it. Lack of proper irrigation equipment leads to considerable inefficiencies. "Fixed programmes" of moving irrigation pipes are very commonly found.
- It was found that the general agricultural knowledge of irrigation farmers was poor and they conceded to this by complaining (priority number 1) that they do not have access to effective extension advice nor servicing. Their working knowledge of specific crops was acceptable to farm with those crops. Irrigation scheduling did not feature in the needs analysis.
- Irrigation farmers' main restrictions are lack of access to credit, high inputs costs, water availability and price. Game also damage crops. Farmers regard the cost of water and

its availability as very important, and as restricting crop production for long periods during the cropping season.

- Only one farmer has a computer, which he uses for record keeping for a beef herd of cattle. Another is available at the local extension office.

The results of the **Riet River Settlement** investigation are shown in Chapter 3. They can be summarised as follows:

- The area has two soil types, viz. heavier greyish alluvial soil and red sandy soil. Both are generally deficient in nitrogen and phosphorous.
- The PUTU and BEWAB irrigation scheduling models were introduced to Riet River during 1989. The launching took place at a farmers' day.
- Most farmers (69.9%) are younger than 60 years. There are no significant age differences between those who schedule and non-schedulers.
- Significantly more farmers with larger irrigation plots were scheduling than those with smaller plots.
- Level of education did not show significant difference between schedulers and non-schedulers, nor did farming experience.
- Riet River has a water-table problem.
- The availability of computers is a problem at Riet River. Only eight farmers use computers for farming activities, one of which for irrigation.
- Almost 35% respondents are computer illiterate and did not own one, while 30.2% said they were not interested in computers.
- Only two respondents said they had not heard of irrigation scheduling before.
- The local co-operative seems to play an important role in scheduling servicing and scheduling information supply, since 51.2% respondents had heard of scheduling from its staff.
- The majority (60.5%) respondents said the main purpose of scheduling is the optimum application of water.
- There is some scheduling discontinuance at Riet River. The reasons given, however, are inconsequential.

- An agricultural extension agent spoilt the farmers by doing too much for them and taking too much responsibility. Therefore the current scheduling activities seem more agent driven than driven by irrigation farmers.
- Respondents are very positive about irrigation scheduling. They mentioned variety in soil types, water-table problems and lack of infrastructure as hindering scheduling. Yet, they did not respond very positively to the attributes of computer-based irrigation scheduling models. It seemed that many (42.9%) are quite satisfied with the current (low) levels of sophistication of irrigation scheduling they were having.
- Respondents seem to be divided regarding irrigation scheduling with a computer, with 28.1% perceiving it as very difficult. More than 70% agreed that scheduling can save water and money.
- Only ten respondents had not heard of BEWAB, but all had a very limited and vague knowledge of how it worked and what it entailed. Only one farmer is still using BEWAB, and this application is an adapted version thereof. Most (72.1%) seemed to have a clear understanding of the fundamental principles of scheduling.
- Quality of irrigation water needs to get more attention in future. It is beginning to show problems with overhead irrigation systems, since the levels of weed, algae, sludge and mud are sometimes too high for these systems.
- Respondents are very sure of their current and future lawful water rights.
- There were no problems concerning the amounts of water asked and received, and only 32.6% did not trust the sluice system of water delivery.
- Farmers pay for their full quota of water, whether they use it or not. This has negative effects on sustainable water use. Most (67.4%) farmers would prefer volumetric payment for water, and only for what they use.
- Erratic electricity supply seems to impact on general farming and scheduling activities.
- Farmers say that irrigation water is too expensive at Riet River. They also complained about the cleaning of the canal system, saying it is ineffective and overly expensive.
- Only five respondents want subsidies on water in future. The price of water at Riet River is a topic of much discussion.

- Farm layout limited irrigation scheduling at 14 respondents' properties, but 60.4% said that the settlement is well designed and can accommodate scheduling activities.
- Farmers were divided regarding whether the Irrigation Board was a successful endeavour. Consultants indicated that farmers are unhappy with the influence of their representatives to the Irrigation Board. They had a variety of ideas on how to manage the Scheme more effectively, but there was no consensus about the matter.
- According to irrigation farmers there is a need for qualified irrigation scheduling advisors. They had mixed feelings about the state extension services. Most (76.7%) said that extension could play a role to alleviate the non-scheduling problem at Riet River.
- Thirty-three respondents had a reasonable idea of the plant requirement and root depth at different growth stages, while only 12 had a reasonable idea of the field capacity of their soil types. Other aspects of knowledge of their soils were also low. They did not have an acceptable level of sophisticated knowledge required to understand the details of scheduling.

The results of the **Loskop Irrigation Scheme** are shown in Chapter 4. They can be summarised as follows:

- Only one respondent is older than 60 years, and the average age was 44 years.
- All the respondents had a matric level of education, while 42% had obtained post-school qualifications.
- A total number of 20 respondents (64.5%) have a total number of 21 years or more experience, while 45% have more than 20 years' farming experience.
- There are 18% respondents with plots larger than 120 hectares, while 23% have plots smaller than 40 hectares.
- No significant differences were found between age, land size, experience or education between irrigation schedulers and non-schedulers. Respondents believe they do scheduling when they use time-based water application.
- Tobacco seems to be the most popular crop in terms of income and cotton the second most popular. Permanent crops seem to gaining popularity.

- The pivot system is seen as "the ultimate" and most wanted in irrigation technology, while conventional manual sprinkler irrigation is the most widely used. Pivots and conventional manual sprinkler irrigation function in tandem.
- Of the 71% respondents who have computers, 96% use them in their farming. Forty-five percent of the total number of respondents uses computers in irrigation scheduling activities. Twenty-nine percent respondents do not have computers nor access to it.
- Only three respondents said they have never heard of irrigation scheduling before. Extension agents seemed to have played the major role in propagating irrigation scheduling at Loskop.
- Sixty-two percent respondents had an idea of what scheduling is, while 19% knew what it is.
- Seventy-three percent of the respondents claim that they apply irrigation scheduling. There is a relationship between the practice of scheduling and knowledge thereof. Six respondents have an intimate knowledge of scheduling, yet only four of them apply it. The reasons are unknown.
- Respondents perceive scheduling as important, and link scheduling with sustainable water use, saving money and securing crop yields.
- Only 22.6% respondents claim scheduling to be "not easy" to apply. There is a relationship between respondents' perception of the importance of scheduling and applying it.
- Respondents (77.7%) who said scheduling "is easy" to apply are applying it.
- Respondents are well aware of the need to save water in future and indicated that scheduling can play a big role in this regard.
- Farmers pay for their full quota of water, whether they use it or not. This propagates against sustainable water use.
- Loskop farmers are politically aware, but not up to date with the current debates on water rights and security. Many (70%) seemed apathetic and cynical about the changes that are coming.
- Sixty-five percent respondents are very sure that they get the water they pay and ask for, while 29% said there are chances of water being stolen. They did not say that theft

actually occurs. There is a general trust in the Irrigation Board and fellow farmers concerning this matter.

- Respondents (58%) say that irrigation water is expensive and there is no consensus as to how to pay for water.
- The issue of water subsidies is not controversial and respondents seem to anticipate government not to subsidise them any longer.
- The overall management of Loskop is well accepted and appreciated by respondents.
- Most (94%) respondents say that extension can play a meaningful role to address the situation of non-scheduling at Loskop, but could not come up with any significant plans to effect this. However, they have to be consulted on this issue in future.
- There are no significant complaints that the outlay of Loskop, nor its administration, hinders irrigation scheduling.
- Specialists and extension practitioners were asked which knowledge farmers need to apply scheduling in a proper manner. Generally, respondents did not have this required level of knowledge concerning plants, the soil or the climate. Several (19.4%) respondents make use of irrigation consultants, only 9.6% respondents had a good knowledge of plants and the soil, and 51.6% did not have any knowledge or were very unsure.
- Not many (35.5%) respondents integrated rain-meters well with their scheduling activities, while 25% integrated mini-maxi temperature well with scheduling.
- Respondents perceived the attributes of SWB very well, and it is estimated that 13% respondents will adopt it very easily.
- Only one respondent was unwilling to pay for scheduling advice. There is no consensus on how to pay for such a service, but respondents are inclined to link payment with increases in crop yields and/or income.
- The reasons why Loskop irrigation farmers do not use scheduling revolve around time, costs, ease-of-use, irrigation system design, field layout and availability of computers. Assistance and/or advice must be timeous, regular and continuous.
- Several technical changes were requested and are being made to the SWB model. They all have to do with the practical implementation and application of the model.

During this project technology transfer was effected in several ways. At **Rust de Winter** the farmers were engaged in dialogue and extensive discussions about irrigation. They were made aware of the need for appropriate scheduling and the principles of the application were explained to and discussed with them on an individual basis. At **Riet River** farmers were engaged in discussions about scheduling and the need thereof. The need for them to take more responsibility for data and scheduling was discussed with some of the farmers and they were made aware of the need to upgrade their scheduling skills and applications.

At **Loskop** the following steps were taken:

- extension workers and irrigation consultants were trained to install and run SWB, to install soil moisture pipes, to use a Neutron probe and to link with the SWB programmers
- a Neutron probe of the University of Pretoria was made available to Loskop project co-workers
- farmers were then introduced to SWB
- farmers are still being provided with advice and assistance concerning the use of SWB
- Hoedspruit farmers were also linked with SWB application
- farmers were made aware of the proper application of scheduling.

The implications of these findings are that:

- irrigation scheduling technology is available,
- irrigation farmers' knowledge seems to be deficient and
- extension can play a role to alleviate this problem.

It must be stated that irrigation scheduling cannot be practised effectively in the absence of appropriate and sustainable crop farming practices e.g. soil preparation. Irrigation scheduling is not a panacea to irrigation problems and its effectiveness depends on its inter-relatedness with appropriate and sustainable farming practices.

This research has focused on selected irrigation scheduling models. It is recommended that further research should be done to include the whole country and other irrigation scheduling models.

As discussed above, it is clear that sufficient progress has been made towards achieving the main goal and each of the objectives. Therefore it can be concluded that the goal of this research has been achieved.