District of Summerland

Water Coordination 2004 Report

Submitted to:

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Executive Summary

Geowest Environmental Consultants Ltd. was retained by the District of Summerland to provide water coordination services for the District with the goal of educating individual orchardists in ways to conserve water, and to coordinate the overall irrigation program for the summer of 2004. Geowest assigned Mr. Joe Fitzpatrick to this position. Joe is a Professional Agrologist with a soils and irrigation background who has lived and worked in the southern Okanagan Valley for nearly 20 years.

This report provides a summary of the activities undertaken during the summer of 2004 along with a discussion of the results of some of the undertakings, and a discussion of techniques for management of agricultural water demand, water supply, and other concerns that affect water use and supply.

The District's effort to conserve summer water consumption in 2004 was a resounding success. Water consumption was well within the goals set by the interim agreement for management of water in the Trout Creek system. Factors contributing to this likely include:

1. The memory of the water shortage in 2003,
2. The water education and public communication campaigns, and
3. Timely rainfall.

Total savings resulting from these practices and favorable weather in the summer of 2004 varied from 23.2 % in July to a high of 64.3 % in September; of these 27.4 and 36.8 % in the above months is attributed to improved practices compared to the 2002 season.

The most important recommendations resulting from this work are as follows:

1. Water users must pay attention to use relative to needs,
2. Water users must pay attention to the condition of their equipment,
3. Water education programs and extension should continue, and
4. Water supply should increase.

The key to demand side management is to pay attention. In a word, for farmers that means DIG! Digging and checking the soil for moisture means that the farmer is present in the field. Being present also results in the farmer checking equipment and minimizes costly errors due to unaccounted for irrigation equipment malfunctions, crop variation, and seepage. Paying attention also includes using tools such as soil moisture sensors, weather reports, atmometers, water meters, and making continuous repairs and improvements.
The most cost effective tool for demand side management is **education**. The District of Summerland should continue to emphasize water coordination activities and associated publicity. In 2004 emphasis was placed on a low technology method of irrigation scheduling. The Hand Feel method is easy to learn, easy to teach, and does not require specialized equipment. It is an extension of common sense, but because it employs the same science it can also be considered a stepping stone to more advanced methods of irrigation scheduling. This approach was suitable for the 2004 program, but in future there should be an evolution towards teaching the use of soil moisture monitoring, evapotranspiration and the Water Budget method.

*A reliable supply of water* for irrigation is key to the success of agriculture in this arid district. Water must be fully available providing for diverse agricultural activities.
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Acknowledgements

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District of Summerland staff worked with the author in the areas of public communication, data management, and water supply information. Thank you, Denis Gagnon, Jim Holtjer, Karen Jones, Scott Lee, Gill Matthews, Jo Ann Reynolds and others for assisting in the preparation of various newsletter articles, an easy-to-maintain website, an irrigation message phone, arrangements for television and radio interviews, and for development of a District of a Summerland GIS crop layer.

A special thanks to the members of the Agricultural Water Advisory Committee, including Lorraine Bennest, Arnold Boerboom, Keith Manders, Dr. Denise Neilsen, Joe Sardinha, Peter Waterman and Councilor Carla Wright who provided direction for the 2004 water coordination, and continue looking to the future of irrigation management in the District. Also, thanks also to Dr. Peter Parchomchuk for his advice.

Thanks to the farmers who agreed to participate in the metering study, which provided useful information about water use by agriculture within the District. Gord Shandler introduced me to a homemade soil auger, perhaps the simplest and easiest to use tool in demand side management. Balwinder Sandhu, despite our language barrier, communicated his interest in irrigating within his flow allotment and in improving his irrigation system.

It was not only the farmers with meters who were conscientious with water. District-wide water use from June to September 2004 was considerably lower than in previous years. These dramatic results could have been achieved only with the deeds of many people.

Ted van der Gulik and Janine Nyvall wrote the British Columbia Ministry of Agriculture, Food and Fisheries pamphlets that were used for water education and developed the models that were used for irrigation scheduling. Stacy Meech and Ted van der Gulik are currently working with the District planning department to develop an agricultural database to be employed in water use planning and to produce information for the upcoming agricultural plan.

Don Impett and www.farmwest.com were key sources of daily evapotranspiration and rainfall data. Vic Dales telephoned in rainfall measurements. Thanks, Don, for the steady supply of data.
1. INTRODUCTION

1.1 Background

The District of Summerland is located on Okanagan Lake in southern British Columbia, in the heart of the Okanagan Valley between Kelowna and Penticton. It includes the town of Summerland itself, as well as the surrounding rural land, of which at least 5,000 acres is in the Agricultural Land Reserve (ALR) and 3,520 acres is on the irrigation roll. The ALR also includes native pasture that is not irrigated.

Summerland’s population in the 1991 Census was 9,253 and in the 1996 Census the population grew to 10,584. The population increased by 14.4% and is now the fourth largest city in the Okanagan Valley. Apart from a low growth period during the first half of the 1980’s, Summerland’s population has grown rapidly at an annual rate of nearly 3.1% from 1966 to 1996. Summerland’s population in the 1991 Census was 9,253 and in the 1996 Census the population grew to 10,584. The population increased by 14.4% and is now the fourth largest city in the Okanagan Valley. Apart from a low growth period during the first half of the 1980’s, Summerland’s population has grown rapidly at an annual rate of nearly 3.1% from 1966 to 1996. It is anticipated that immigration to the valley will continue over the next decades. (Summerland Chamber of Economic Development and Tourism)

Soil texture varies widely in this District. The Trout Creek alluvial fan includes gravel to loam textures. Most of the outer benches near the lake have lacustrine origin with textures from fine sandy loam to silty clay. Jones Flat, from Garnet Valley Road to Steuart Road and the west part of Fosberry Road is typically of glacio-fluvial origin, with 20 to 30 cm layer of loam to sandy loam over gravelly sand. In Garnet Valley, most of the flat area along Eneas Creek is silt loam, while the fans along the east and west walls tend to be gravelly sandy loam. In Prairie Valley, the valley bottom ranges from fine sandy loam to silty clay loam, the hillsides are sandy loam. Sumac Ridge soils are shallow to bedrock, a mixture of angular rubble, glacial till and windblown material.

The average total annual precipitation is 326 mm (13 inches). As it rains very little in the summer, the agricultural industry depends primarily on irrigation water between mid-April and mid-October. The estimated annual water requirement of crops with high water demand irrigated with sprinklers ranges from 533 mm (21 inches) to 1067 mm (42 inches) depending on soil texture, depth of roots and the allowable soil water depletion for the crop. Trickle irrigated crops require from 533 mm (21 inches) to 686 mm (27 inches).

Most of the agricultural land must be irrigated, but there are some areas that receive significant water from seepage or a high water table. These include some sections along Eneas Creek; some parts of lower Prairie Valley from Morrow Avenue to South Victoria Road; the north end of Lewes and Monro Avenues; and the south end of Giants Head Road. Most of these areas are in pasture or hay. The large hay fields near the west end of Dale Meadows road are in Reed Canary Grass, a moisture-loving species. In most of these locations the soil is too wet or there is too much risk of frost to allow tree fruit or vine growing. Salinity in these wet sites is a problem in some parts of Prairie Valley.
Proximity to Lake Okanagan provides thermal protection in the winter, which allows farming of woody perennials such as tree fruits, vines and nut trees. These crops, along with hay and pasture, make up most of the irrigated area. As nearly all of Summerland’s crops are perennial, agriculture here is particularly vulnerable to water shortages. Economic losses can be incurred for several years, not just the drought year if crops do not receive enough water.

1.2 Water Supply

The District of Summerland provides the services of an irrigation district as well as those of a municipality. Parcels have 0.25 acre allotted for residential water, which is available year round. A parcel larger than 0.25 acre has an additional account and allotment for seasonal irrigation water. There are 1716 accounts on the irrigation roll. They include farms, golf courses, schools, playing fields, and campgrounds as well as portions of residential lots that are slightly over 0.25 acres. The area showing on the irrigation roll includes only arable land. A parcel’s roll area is allotted water by its peak flow rate allowed, which is 6 imperial gallons (or 7.5 U.S. gallons, or 27 litres) per minute per acre. In 2004 Water Coordination efforts were focused on the 477 irrigation accounts of 2 acres and up.

Summerland’s water supply can be divided into three systems. The Trout Creek system is a group of water storage dams that holds 9,373 acre-feet and supplies most of the District. The Garnet Valley system holds 1,963 acre-feet and supplies Garnet Valley. In 2004, wells were added, capable of supplying 4 acre-feet per day, which during a 180-day irrigation season would supply 720 acre-feet.

It is the Trout Creek system that was stressed in the summer of 2003. It supplies most of the residents, most of the agriculture, and there must be enough left to provide fish flow to Trout Creek below the District’s intake. These competing demands for Trout Creek water led to the formation of the Trout Creek Water Use Plan Consultative Committee, which includes representatives of Canada Department of Fisheries and Oceans, the BC Ministry of Water Land and Air Protection, District Council, District Water Supply staff and local agriculture. The committee developed an Interim Agreement, a formula for sharing water that is responsive to the supply outlook.

Outdoor residential water use restrictions are defined in stages. Stage 1 allows irrigation of lawns and ornamental plantings three times per week, and is automatically in effect regardless of water supply, during the irrigation season, which in 2004 was from April 13 to October 12.

In 2004, the Trigger graph in Figure 1.1 below was consulted for prescribing water use restrictions. The red dots show weekly storage measurements made by District Water Supply staff. With water levels (dots) in the white, Stage 1 was in effect. The August 5 measurements put the water levels just into the blue, and Council brought in Stage 2 restrictions shortly afterwards. On September 13, the District went back to Stage 1.
Figure 1. Trout Creek total reservoir storage and trigger levels for demand reductions.

As residences progress through the Stages, the Interim Agreement describes reductions in water use for irrigation and releases for fish flow. See Table 1.1.

The amount of water guaranteed for Trout Creek fish flow is Camp Creek flow multiplied by a factor of up to 10x, which depends on the Stage and the month. Under the Interim Agreement the District is committed to release sufficient water from storage to maintain proper fish flow.

Table 1. Demand reductions in effect with the interim agreement for operation of the Trout Creek Water Supply System

<table>
<thead>
<tr>
<th>Month</th>
<th>Reduction Stage</th>
<th>Fish Flow (x Camp Creek)</th>
<th>Irrigation Use (% of 2002)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
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<tr>
<td>June</td>
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<td>October</td>
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<td>10</td>
</tr>
</tbody>
</table>
With Summerland’s combined irrigation and domestic water supply system and without metering, irrigation water use cannot be properly assessed separately from other uses. Most of the water used June through October is for irrigation with total consumption being taken as an indicator of irrigation use. Unlike residential users, who are affected by bylaws with rules for water use at each stage, and fish flow, which is adjusted by District water supply staff, there are no bylaws affecting agricultural users in Stages 1 through 4. At Stage 5, there is to be no irrigation, just as there is to be no water released for Fish Flow.

1.3 Terminology

**Calculated Water Requirement (CWR)** – CWR is the water needed to make up the difference between evapotranspiration and rainfall, taking into account the weather, crop species and growth stage, and the type of irrigation system. CWR does not consider the effects of incomplete canopy coverage, or water saving practices such as mulching or irrigating only at night. It assumes that the plants are in good health, and that the goal is to have a constant adequate supply of water in the soil. It does not consider that there are many good reasons to apply less water, such as limiting disease, controlling growth or enhancing crop quality. CWR is generous with water, perhaps erring on the side of over watering, so 100% of CWR should be considered the maximum amount of water to be used.

**Demand Side Management (DSM)** – DSM is managing water needs by stretching existing capacity to support additional growth. Goals are to reduce the wasteful uses of water, use water savings to support new development in agriculture, domestic or other uses and to defer costs of expansion of water supply facilities. (Nyvall and van der Gulik, 2000)

**Evapotranspiration (ET)** – ET is the total amount of water that evaporates from the soil surface or is taken up by plants. It is usually calculated daily either by direct measurement of evaporation from pans or atmometers, or by using the Penman Monteith formula. This formula calculates ET using temperature, solar radiation, wind speed and relative humidity data. Since it is a volume used per unit of area, it can also be expressed in linear units. Don Impett’s station uses a Bellani Plate, a type of atmometer. The Farmwest stations use the Penman Monteith formula.

**Fish Flow** – Under the interim agreement, the District is committed to maintain the flow of Trout Creek at a prescribed factor larger than Camp Creek during the months of June through October. This is called Fish Flow.

**Hand Feel Method** – A method of scheduling irrigation by inspecting the soil within the root zone. A handful of soil is obtained and squeezed tightly. If it forms a ball, it is bounced three times lightly in one’s palm. The soil texture and the result of this test are used to estimate soil moisture content. The relative soil moisture can then be determined. (BCMAFF Water Conservation Fact Sheet 577.100-1).

**Irrigation Roll** – A database of water user accounts held with the District of Summerland. "Roll acres" refers to the number of acres showing on the roll and is an estimate of arable acres. It is possible for a farm to irrigate more or less area than is showing on the registry. There is a unique account number for each irrigation connection.
**Plant Water Requirement Method** – A method of scheduling trickle irrigation that adjusts the trickle system operating time by comparing the actual ET data to the theoretical Peak ET used in system design. In the Summerland area, that theoretical peak is 6.6 mm (0.26 inches) per day. Water is allotted to a plant by comparing current ET to the peak and adjusting the schedule accordingly.

**Water Budget Method** – A method of scheduling irrigation that employs knowledge of soil texture and weather information. It is an accounting system that tracks additions of water to the soil from rainfall and irrigation, and losses from the soil to evapotranspiration. Seepage is difficult to track with this method. On soils that have high water table or seepage, a method that monitors soil moisture should be used. With trickle systems, this method should be used only with row crops that are spaced close together. It is therefore not suitable for most tree fruit and grape plantings, on which part of the lanes is not irrigated. (BCMAFF Water Conservation Fact Sheet 577.100-4, page 3)

### 1.4 Objectives

The following were the stated objectives in the Geowest proposal to provide water coordination services. These were carried out as originally proposed except as noted at the end of this section.

1. Provide 175 hours per month between the months of April to October 2004. Flexible scheduling of these hours will be necessary as some evening work will be required;
2. Liaise with the Contract Administrator;
3. A contract-end report outlining the results from the program for the contract term and recommendations for follow-up in the future;
4. Organize and convey to the individual irrigation users a system of irrigation scheduling that factors the type of crop, type of soil and the irrigation system used by the individual irrigation users;
5. Coordinate the collection of parcel data from irrigation users including soil type, crop type, and irrigation system type. This information is to be prepared by the individual irrigation user for future best practices for water management by irrigation users;
6. Prepare information on water conservation measures to be included in newsletters, municipal web-site, and media releases as public education for domestic water users;
7. Liaise with the District's Bylaw Enforcement Officer to arrange with irrigation users to have required access to irrigation systems that will allow for random flow testing;
8. Participate, where requested in Public Works / Water Project Committee meetings by providing contract status reports;
9. Coordinate submissions to the Okanagan Valley wide water newsletter with Alliance Consulting for the content of general water conservation education information of a general nature;
10. Convey to the public status reports through the District's web-site, newsletters, and media releases from information provided by the Works and Utilities Department;
11. Convey to the irrigation users information regarding potential grants from government agencies on upgrades to their irrigation systems;
12. Be available to meet with the District’s Agriculture Water Advisory Committee on an as needed basis;
13. Liaise with neighboring jurisdictions regarding the sharing of water conservation data and information; and conduct educational seminars, workshops, and field days for agricultural and residential users.

The system referred to in item 4 and 5 was begun at a very basic level, with emphasis on the Hand Feel method. Crop, soil type and irrigation system information was collected and used to compile District statistics (Section 3.4) but not for helping with irrigation scheduling at the farm level. There needs to be more work done in this area, collecting precise information (such as nozzle sizes, pressure and emitter output rates).

Referring to item 7, there was little flow testing done this year, and it was done by the Bylaw Enforcement Officer alone. As the season developed, it became apparent that there was less water demand than in previous years, and that the efforts of both the Bylaw Enforcement Officer and the Water Coordinator would be better directed elsewhere.

The experimental agricultural metering program was not mentioned in the proposal, but with those meters in place, the Water Coordinator took monthly readings of water use and compared them to CWR. These measurements are included in this report.
2. ACTIVITIES

The following section details the various activities that were completed over the summer period in support of the project.

2.1 One-on-One Interviews

An attempt was made to meet with as many irrigators as possible during the 2004 irrigation season. These visits took place between April 2 and August 24. Operators of 411 of 477 (86%) parcels with 2 or more arable acres were visited. In most cases the Hand Feel method was taught. In a few cases the Water Budget method was taught. The meetings were open-ended, varying in length from 4 minutes to 4 hours, depending on the willingness of and time available to the operator. Topics discussed included any of the following:

- Current status of the water supply
- The need to conserve water during the weeks before drawing from storage and midsummer peak evapotranspiration
- A survey of soil textures and estimate of available water storage capacity
- Collecting parcel irrigation system data
- Operator's opinion on the best course of action for the District in the areas of water supply, metering, enforcement and education
- Operator's view of the history of the Summerland water supply
- Introduction to the Hand Feel method of irrigation scheduling
- Introduction to the Water Budget method of irrigation scheduling
- Other water related issues such as seepage, water treatment and wastewater management

Dr. Mangat introduced Joe Fitzpatrick to sixteen local Indo-Canadian farmers. Many were given a Punjabi language pamphlet that contained information on the Hand Feel method and reminders to keep irrigation equipment in good repair.

Results of Meetings with Operators - Some Comments

The following section provides a summary of key comments provided by individuals. The comments are organized according to the number of times similar statements were made.

1. Most Frequent Comments (10 or more interviewees)
   1. Deal effectively with abusers, with fines and shutting off water.
   2. The District itself must set an example and conserve water. The grass is cut too short, and there are numerous complaints about the cemetery watering too frequently or over watering.
   3. What ever happened to the plan to line the storage pond? Pumps in Okanagan Lake? Raising dams? It has been over a year since a shortage has been recognized but there has been no significant increase in water supply.
   4. I am very glad the water coordinator was hired.
   5. I get by with less than my allotment because a) not all the land is farmed, or b) I use trickle / t-tape / mulch, c) I have fine textured soil, or d) I have seepage.
6. I go over my allotment for one or more of the following reasons: a) because my soil texture is sand, or b) because I can run my farm better if I get the irrigation done more quickly or c) it is a very small orchard that I lease, it has 15 zones and no timer.

7. I will not be using the Water Budget Method because a) I don't have internet access or an atmometer, b) I can't be bothered, c) my soils, crops and irrigation systems are so variable, it would be too complicated, d) seepage is unaccounted for, or e) I have poor vision or do not read English.

2. Comments commonly made (3 to 9 interviewees)
1. I would welcome metering as a management tool. Or, I asked to be metered but was not picked.
2. Metering is just a way to get more money from us.
3. Why wasn't more done last year? Why wait so long to hire the water coordinator? Why no irrigation courses last winter?
4. OK I'm motivated [so stop trying to motivate me]! Now teach me!
5. You are only trying to get us to conserve water so you can build more houses. Another variation: Stop development until the water supply issue is sorted out.
6. I exceed allotment occasionally to catch up.
7. I farm more acres than are considered arable, without exceeding allotment, and do so by improving irrigation efficiency.
8. Offer a financial incentive to install water saving devices in homes. The district may be able to arrange for bulk purchases, and then sell at a discount to homeowners.
9. We (pasture people) were asked to shut off our water, so we did. Then it was decided that we could irrigate again but no one came around to tell us. In the meantime some of our grass died.
10. The portable flow meter should be used routinely to test systems for leaks and for performance. At one farm, a 4 gpm leak was detected.
11. People are being friendly to you [the Water Coordinator] and pretending to be interested but as soon as you are gone they will go back to what they were doing.
12. Do not turn my water off this year! I can't afford the consequences. (One farmer said she owes $500,000 to the banks for replanting.)
13. They say that agriculture uses 80% of the water. I don't believe it.
14. Why didn't we draw more water from storage in 2003? We still had several thousand acre-feet. At Garnet, the old earth and log dam, normally hidden underwater by the ARDA dam was still spilling late last summer, so the only water actually drawn was the difference in height between the old and the new dam, plus the volume between the two.
15. The fish in Trout Creek do not need flow; they need deep shady pools. Trout Creek often runs dry in late summer yet the fish are there. There would be more value in maintaining these pools and building more than in guaranteeing a steady flow in Trout Creek.
16. The system should be split. Irrigation water does not have to be of such high quality. Gray water could be used if the system were split.
17. I already check soil moisture, using a shovel.

3. Comments by one or two interviewees
1. Use acreage, crop type, soil texture and metering as a basis to charge for water use.
2. Metering is less important than building additional water supply or lining storage.
3. OK cut my water. So cut my water bill! Variation: you can take my naturally wet acres off the rolls if you want.
4. Councilors must set an example and conserve water at home.
5. Why am I being metered and not someone else? I don't water too much.
6. I go over my allotment because the property was subdivided and I have not replanted since before that time; each zone is matched to the old allotment. When I replant, the newly installed zones will be in compliance.
7. What became of a proposal to build an earthen dam between Headwaters and Osprey Lake, near Trout Creek Main Forest Service Road?
8. The water shortage is contrived, a way to justify increasing the charge for water.
9. I think we need a bigger water supply.
10. When will cattle be forced back from the Garnet Lake reservoir? This is bad for water quality.
11. Along the south side of Prairie Valley, the connections to the flumes could have been used to supply irrigation water if a supply pipe is run along the old right of way. Then at least for that area, there would be savings in chlorination and pumping costs. Why not?
12. The district should supply copies of the BC irrigation manuals at the Town Office.
13. Some farmers are irrigating so much in the daytime and that water is wasted, while residential water users are limited to irrigating three days a week in Stage One.
14. Teach water quality and conservation to school children.
15. Farmers should have the option to buy their own meters. That gives them the ability to shop around, and to choose meters that can also function as injectors for fertigation, hydrogen peroxide, or biopurge. The meter would have to be approved by the district, and able to be read by district staff and equipment.
16. Water users within the district should have the ability to sell their water rights for the season to another water user. This approach is very common in the USA.
17. Why should every person have to hire an irrigation system designer? Maybe the town should hire someone to help with it, or it should be part of the water coordinator's job.
18. I use very little water / no water from the District because the site is sub irrigated or irrigated with my own well. So why should I have to pay a per acre rate?

Comments - Summary
Overall, farmers see a need for increasing efforts in conservation, education and increasing the water supply. They are a willing source of suggestions of ways to conserve water.

Many see the 2003 water shortage as being the result of inaction by the District.

People seek fairness. They want enforcement. They don't like seeing what they perceive as waste.

During the interviews, water issues other than supply or conservation were occasionally discussed. Some farmers were concerned about seepage from neighbours up slope, some of whom were perceived to be over-irrigating. Others were concerned about water quality.

2.2 Public Communication
Several media were employed to inform Summerland residents of water supply, water restrictions, and recommended irrigation practices.
A public meeting for irrigation water users was held April 1, 2004. Guest speaker Dr. Denise Neilsen discussed the impact of global warming on Summerland. She reminded people to irrigate responsibly in the early season in order to save water for the hotter days in mid to late summer. John Parsons spoke about irrigation of forage crops. Mayor Tom Johnston introduced Joe Fitzpatrick, the 2004 water coordinator.

Throughout the irrigation season, there was a number of news releases, radio, television and newspaper interviews, articles in Water Wiser and the District newsletter, radio advertisements (on AM 1450), and a water conservation page in the Summerland Review. Topics included the current water supply situation, current water restrictions and tips on saving water and irrigating correctly.

In June, a set of water conservation web pages was established at www.summerland.ca. The water conservation 'front' page contained a few short paragraphs of news about current water supply and use, a photograph of a farmer paying attention, current water supply restrictions and links to bylaws. It also included a downloadable spreadsheet containing Summerland evapotranspiration and precipitation records, and links to further information about irrigation of farms and lawns.

### 2.3 Agricultural Meters

At the beginning of the 2004 irrigation season, water meters were installed at the connections to 16 agricultural parcels. They included 14 orchards and 2 hay and pasture operations. These parcels contained a variety of irrigation systems, soils, and planting densities. Participation was voluntary. Meters were read monthly. Water consumption was compared to Calculated Water Requirement for that farm's crops and irrigation systems. Farmers were given monthly water use reports but were otherwise given no more assistance than was offered to other irrigators.

All irrigators with meters applied less than their Calculated Water Requirement (CWR). See Table 2.

Several metered users irrigated at higher flow rates than is permitted by their 6 imperial gallons per minute per acre (igpm / acre) flow allocation, but at other times their water was shut off, which allowed them to save water.

One of the orchards used the metered connection to irrigated two adjacent properties with overheads. The connection for the other property irrigated both properties with trickle. 11% of the crops' CWR was met by irrigation with overhead sprinklers, the remainder presumably by trickle irrigation through the unmetered connection meant to serve the second parcel.
<table>
<thead>
<tr>
<th>Farm</th>
<th>Water Use</th>
<th>CWR(^1)</th>
<th>Water Use</th>
<th>Flow Allotment</th>
<th>Flow 2-Jul</th>
<th>Flow 3-Aug</th>
<th>Flow 1-Sep</th>
<th>Flow 28-Sep</th>
<th>Crops</th>
<th>Orchard Planting Density</th>
<th>Irrigation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>mm</td>
<td>mm</td>
<td>% of CWR</td>
<td>igpm(^2)</td>
<td>igpm(^2)</td>
<td>igpm(^2)</td>
<td>igpm(^2)</td>
<td>igpm(^2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>401</td>
<td>926</td>
<td>43</td>
<td>59</td>
<td>off</td>
<td>64</td>
<td>off</td>
<td>off</td>
<td>apple</td>
<td>standard</td>
<td>undertree</td>
</tr>
<tr>
<td>2</td>
<td>353</td>
<td>924</td>
<td>38</td>
<td>52</td>
<td>112</td>
<td>off</td>
<td>off</td>
<td>off</td>
<td>mixed orchard</td>
<td>mixed</td>
<td>overtree and microsprinkler</td>
</tr>
<tr>
<td>3</td>
<td>454</td>
<td>833</td>
<td>54</td>
<td>24</td>
<td>off</td>
<td>11</td>
<td>off</td>
<td>off</td>
<td>apple</td>
<td>mixed</td>
<td>trickle and undertree sprinkler</td>
</tr>
<tr>
<td>4</td>
<td>491</td>
<td>1037</td>
<td>47</td>
<td>47</td>
<td>off</td>
<td>51</td>
<td>off</td>
<td>off</td>
<td>apple</td>
<td>standard</td>
<td>undertree</td>
</tr>
<tr>
<td>5</td>
<td>546</td>
<td>889</td>
<td>61</td>
<td>55</td>
<td>81</td>
<td>off</td>
<td>off</td>
<td>off</td>
<td>apple, cherry</td>
<td>mixed</td>
<td>mixed</td>
</tr>
<tr>
<td>6</td>
<td>610</td>
<td>839</td>
<td>73</td>
<td>40</td>
<td>off</td>
<td>off</td>
<td>off</td>
<td>off</td>
<td>apple</td>
<td>high</td>
<td>microjet and microsprinkler</td>
</tr>
<tr>
<td>7</td>
<td>130</td>
<td>996</td>
<td>13</td>
<td>27</td>
<td>44</td>
<td>off</td>
<td>off</td>
<td>off</td>
<td>apple, cherry</td>
<td>high</td>
<td>overtree</td>
</tr>
<tr>
<td>8</td>
<td>455</td>
<td>859</td>
<td>53</td>
<td>86</td>
<td>169</td>
<td>91</td>
<td>off</td>
<td>off</td>
<td>apple, cherry</td>
<td>mixed</td>
<td>dual and overhead</td>
</tr>
<tr>
<td>9</td>
<td>603</td>
<td>948</td>
<td>64</td>
<td>29</td>
<td>67</td>
<td>77</td>
<td>off</td>
<td>off</td>
<td>hay and pasture</td>
<td>high</td>
<td>stationary gun, tripod sprinkler</td>
</tr>
<tr>
<td>10</td>
<td>592</td>
<td>762</td>
<td>73</td>
<td>26</td>
<td>67</td>
<td>77</td>
<td>off</td>
<td>off</td>
<td>apple</td>
<td>high</td>
<td>trickle</td>
</tr>
<tr>
<td>11</td>
<td>391</td>
<td>840</td>
<td>46</td>
<td>42</td>
<td>off</td>
<td>off</td>
<td>off</td>
<td>off</td>
<td>peach, apricot</td>
<td>standard</td>
<td>microsprinkler and microjet</td>
</tr>
<tr>
<td>12</td>
<td>876</td>
<td>927</td>
<td>94</td>
<td>59</td>
<td>150</td>
<td>90</td>
<td>slow</td>
<td>off</td>
<td>mixed</td>
<td>mixed</td>
<td>mixed</td>
</tr>
<tr>
<td>13</td>
<td>728</td>
<td>1023</td>
<td>71</td>
<td>33</td>
<td>off</td>
<td>off</td>
<td>off</td>
<td>off</td>
<td>apple, peach</td>
<td>mixed</td>
<td>sprinkler</td>
</tr>
<tr>
<td>14</td>
<td>494</td>
<td>769</td>
<td>64</td>
<td>70</td>
<td>8</td>
<td>58</td>
<td>off</td>
<td>17</td>
<td>apple, peach</td>
<td>mixed</td>
<td>apple trickle, peach undertree</td>
</tr>
<tr>
<td>15</td>
<td>580</td>
<td>962</td>
<td>60</td>
<td>48</td>
<td>51</td>
<td>off</td>
<td>48</td>
<td>off</td>
<td>hay and pasture</td>
<td>handmove and tripod sprinkler</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>820</td>
<td>971</td>
<td>84</td>
<td>59</td>
<td>off</td>
<td>off</td>
<td>off</td>
<td>off</td>
<td>apple, pear</td>
<td>standard</td>
<td>undertree</td>
</tr>
</tbody>
</table>

\(^1\) Calculated Water Requirement

\(^2\) Imperial Gallons per Minute
2.4 Data Collection and Management

2.4.1 Records of Interviews and Parcel Information
A number of records have been kept regarding water use, restrictions and violations over the past two irrigation seasons. Amy Rudisill kept a log of warnings for water restriction violations in 2003; Dr. Mangat and Mr. Fitzpatrick kept interview records for 2003 and 2004, respectively. In addition to these formal records, a number of orchardists submitted 2004 irrigation turn-on applications. These records are stored in binders at Planning Services.

2.4.2 Geographic Information
The District of Summerland GIS system now has an "Agricultural Crops" layer provided by the Pacific Agri-Food Research Centre (PARC). This layer combines information from Sterile Insect Release, BC Wine Institute Vineyard Database, the Okanagan Valley Tree Fruit Authority and older sources to create a map of existing crop cover. The most recent information displaced any older information for the same piece of ground. The accuracy of this map was upgraded in late 2003 by Joe Fitzpatrick and Grace Frank.

Jim Holtjer has GIS information from the most recent BC government soil survey (Wittnebeen, 1986). There is soil series, topography and agricultural capability information available.

2.4.3 Map Book
Jim Holtjer produced a book of 1:2,500 scale maps with addresses and parcel boundaries overlaid on 2001 colour air photographs. This book was kept in the Water Coordinator's vehicle, and the following parcel observations were noted in passing:

Type of irrigation system,
Crop type,
Soil texture
Operator, and
Date of observation.

2.4.4 MS Access Database
From the District's irrigation Roll, a Microsoft Access database was prepared. The roll number was used as the unique identifier for a line. Every parcel with at least 2 roll (arable) acres had information entered into the following columns in the database. See Table 2.

Sources of information for the database include Dr. Mangat's interview notes, Joe Fitzpatrick's interview notes, 2004 irrigation turn-on applications, the map book, and the Summerland GIS system. For parcels with more than one crop x irrigation combination, each was broken into its own line. This file is a powerful tool for understanding irrigation, and agriculture within the District.

While this report was being written, the database was still in development, being adapted to BC Ministry of Agriculture standards. The database will assist with water use planning and will provide information for the upcoming Agricultural plan.
Table 2. Fields added to the MS Access database

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CropArea</td>
<td>Actual crop area (acres)</td>
</tr>
<tr>
<td>CropAcRef</td>
<td>Crop name, crop area and source of additional information</td>
</tr>
<tr>
<td>IrrType</td>
<td>Types and acres of irrigation</td>
</tr>
<tr>
<td>Soil</td>
<td>Soil texture</td>
</tr>
<tr>
<td>OperatorName1</td>
<td>Operator's surname</td>
</tr>
<tr>
<td>OperatorName2</td>
<td>Operator's given name</td>
</tr>
<tr>
<td>OperatorPhone</td>
<td>Operator contact information</td>
</tr>
<tr>
<td>Applied</td>
<td></td>
</tr>
<tr>
<td>Meter</td>
<td></td>
</tr>
<tr>
<td>Op_Seen</td>
<td></td>
</tr>
</tbody>
</table>

2.4.5 File Storage

The Access databases are stored with other Water Coordination files on the District’s WATERCOORD computer.
3. OUTCOMES

3.1 District Water Use

Water Use and the Interim Agreement

2004 water consumption is shown by month (June through October) in Table 3.1 and compared to 2002 and 2003 consumption. In each month, water consumption was well below that for the previous two years. Consumption was also well below target levels (% of 2002) set by the Trout Creek Water Use Plan Consultative Committee.

Water needed for irrigation is controlled in a large part by the weather. Some method is needed to account for weather differences, so that it can be determined whether the water savings were due to weather or due to changes in water user practices. Shown in Table 3.2 is evapotranspiration and precipitation data from the Pacific Agri-Food Research Centre located at the south edge of the District of Summerland. The moisture deficit is the difference between the two values, and serves as an indicator for of amount of water needed for irrigation in each of the months shown.

To obtain a rough idea of how much water was saved due to weather, the following calculations were made: June is used here as an example. From Table 3.1: 1,119 acre feet were consumed compared to 1,738 in 2002, which is 64.3% of 2002, a 35.7% water saving. From Table 4 the moisture deficit was 126 mm compared to 146 in 2002. The moisture deficit was 86.3% of 2002, so 13.7% can be attributed to cooler or wetter weather. The remainder, 35.7% minus 13.7%, is the savings attributed to differences in water user behaviour between 2004 and 2002, 22.0% (382 acre feet). Water use in July 2004 was much lower than in July 2002, in spite of the fact that there was a higher moisture deficit.

Not all water uses are affected by weather, but irrigation is the dominant use during the months tabulated. There are small differences in population and farmed area between the years being compared. However, the point is made: there was a dramatic reduction in water use in 2004 as a result of changes in people's behaviour.

Table 3. Summerland water consumption relative to goals.

<table>
<thead>
<tr>
<th>Consumption</th>
<th>June</th>
<th>July</th>
<th>August</th>
<th>September</th>
<th>October</th>
</tr>
</thead>
<tbody>
<tr>
<td>acre feet</td>
<td>1,738</td>
<td>2,365</td>
<td>2,092</td>
<td>1,341</td>
<td>587</td>
</tr>
<tr>
<td>2002</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003</td>
<td>1,631</td>
<td>2,446</td>
<td>2,091</td>
<td>1,053</td>
<td>288</td>
</tr>
<tr>
<td>2004</td>
<td>1,119</td>
<td>1,819</td>
<td>1,375</td>
<td>479</td>
<td></td>
</tr>
<tr>
<td>2004 goal</td>
<td>&lt; 1,564</td>
<td>&lt; 2,129</td>
<td>&lt; 1,778</td>
<td>&lt; 1,207</td>
<td>&lt; 294</td>
</tr>
<tr>
<td>% of 2002</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2004 goal</td>
<td>&lt; 90.0%</td>
<td>&lt; 90.0%</td>
<td>&lt; 85.0%</td>
<td>&lt; 85.0%</td>
<td>&lt; 50%</td>
</tr>
<tr>
<td>2004 actual</td>
<td>64.3%</td>
<td>76.8%</td>
<td>65.7%</td>
<td>35.7%</td>
<td></td>
</tr>
<tr>
<td>2004 vs. 2002</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Saved by weather</td>
<td>13.7%</td>
<td>-4.2%</td>
<td>25.4%</td>
<td>27.5%</td>
<td></td>
</tr>
<tr>
<td>Saved by practices</td>
<td>22.0%</td>
<td>27.4%</td>
<td>8.9%</td>
<td>36.8%</td>
<td></td>
</tr>
<tr>
<td>Total savings</td>
<td>35.7%</td>
<td>23.2%</td>
<td>34.3%</td>
<td>64.3%</td>
<td></td>
</tr>
</tbody>
</table>
Table 4. Weather effects on crop water demand at the Pacific Agri-Food Research Centre.

<table>
<thead>
<tr>
<th></th>
<th>June</th>
<th>July</th>
<th>August</th>
<th>September</th>
<th>October</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>148</td>
<td>168</td>
<td>140</td>
<td>91</td>
<td>48</td>
</tr>
<tr>
<td>Evapotranspiration</td>
<td>146</td>
<td>165</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Effective Precipitation</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Moisture Deficit</td>
<td>156</td>
<td>181</td>
<td>156</td>
<td>97</td>
<td>53</td>
</tr>
<tr>
<td>2003</td>
<td>156</td>
<td>181</td>
<td>156</td>
<td>97</td>
<td>53</td>
</tr>
<tr>
<td>Evapotranspiration</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>Effective Precipitation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moisture Deficit</td>
<td>156</td>
<td>181</td>
<td>156</td>
<td>97</td>
<td>44</td>
</tr>
<tr>
<td>2004</td>
<td>148</td>
<td>172</td>
<td>139</td>
<td>77</td>
<td>51</td>
</tr>
<tr>
<td>Evapotranspiration</td>
<td>126</td>
<td>172</td>
<td>103</td>
<td>66</td>
<td>48</td>
</tr>
<tr>
<td>Effective Precipitation</td>
<td>22</td>
<td>0</td>
<td>36</td>
<td>11</td>
<td>3</td>
</tr>
<tr>
<td>Moisture Deficit</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Observations of Agricultural Water Use Patterns

A number of key observations were made during the summer, including:

Extreme over watering seems to be rare. One hay field was being over irrigated by about 50%. One leased orchard was irrigated for at least 48 hours straight, applying about ten times the amount of water the soil could accept. A second leased orchard was irrigated for at least 48 hours straight, with at least 4 times the required amount of water being applied. All of these farmers were consulted and educated about soil water storage capacity and water application rates. In the first four cases, management will likely improve. In the latter two, there is a risk that over watering will reoccur because they have no irrigation timers and neither the property owners nor the operators reside in Summerland. Joe, this is a very important statement, especially the last sentence where you say that neither operator is local to the farm – emphasize this, I know that you bring it out as a recommendation to some extent.

Vineyards use very little irrigation water. For maximum growth they demand half to three quarters of what grass naturally requires, but normally vineyard managers control vegetative growth to ensure good fruit quality by limiting water use even further. Vineyards need water in October to provide thermal protection for the winter. Because the water demand is so low, trickle is a suitable method for irrigating where frost protection is not needed. Some vineyard operators find it bothersome that they use so little water, yet have to pay an additional $30 fee to have their water left turned on in the fall when they finally need it.

Pastures vary in the amount and efficiency of irrigation. On some parcels, operators apply only enough water to keep the grass green. On others, operators take a very professional approach: they have a designed system in place, and want to maximize yields to reduce the amount of hay they have to purchase.
3.2 Crop Area and Type of Irrigation

As was stated in Section 2.4 information from several sources was collated and entered into a Microsoft Access database. That information was exported to Microsoft Excel, where parcels with more than one crop or irrigation were further broken down into one crop x irrigation type per line. For the 477 parcels with at least 2 acres on the Irrigation Roll, the area of each crop cover and irrigation type combination is shown in acres in Table 5 and in per cent (%) of area in Table.

The District also has 1,239 irrigation accounts that have less than 2 acres on the roll. They total 516.1 acres, which is 14.7% of the District's total Irrigation Roll area. The crop and irrigation type was not determined for these parcels. They could be unused, parts of lawns, or farmed with adjacent parcels.

Of the area under apples 42.3% is irrigated with water saving methods such as trickle and microjet. There are also some acres in the sprinkler total that are actually irrigated with efficient microsprinklers. Over 240 acres are planted with two irrigation systems on the same piece, usually trickle and sprinkler. With these dual systems trickle can be used to apply fertilizer, and can apply irrigation efficiently. Overhead sprinklers offer sunburn protection if they are controlled with timers and the blocks are irrigated frequently in short cycles during hot weather. Some orchardists operate the overheads without timers, simply to provide water to lane vegetation and to reduce reflection of radiation from the soil. An orchardist who has these two systems typically meets from 10 to 50% of CWR with overheads, the remainder with trickle.

Cherry blocks almost always are irrigated with sprinklers. Nearly all of the newest cherry plantings have microsprinkler systems.

The young apple and cherry blocks were planted with assistance from the Replant Program. See Section 4.6 for additional discussion of this program. With the new plantings came new, more efficient irrigation systems. This demonstrates that the program has the indirect effect of improving irrigation efficiency in the District.
Table 5. Areas of crops and irrigation systems on the Irrigation Roll

<table>
<thead>
<tr>
<th>Crop</th>
<th>Sprinkler</th>
<th>Trickle</th>
<th>Dual</th>
<th>Microjet</th>
<th>Plastic</th>
<th>Gun</th>
<th>None</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apple</td>
<td>652.65</td>
<td>209.18</td>
<td>240.52</td>
<td>29.13</td>
<td>1.20</td>
<td>-</td>
<td>-</td>
<td>1132.66</td>
</tr>
<tr>
<td>Apricot</td>
<td>23.41</td>
<td>4.40</td>
<td>0.35</td>
<td>3.76</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>31.92</td>
</tr>
<tr>
<td>Cherry</td>
<td>188.99</td>
<td>9.16</td>
<td>5.70</td>
<td>0.75</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>204.60</td>
</tr>
<tr>
<td>Cropland¹</td>
<td>74.30</td>
<td>-</td>
<td>-</td>
<td>4.25</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>78.55</td>
</tr>
<tr>
<td>Nectarine</td>
<td>2.28</td>
<td>1.26</td>
<td>0.50</td>
<td>1.50</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>5.54</td>
</tr>
<tr>
<td>Non Ag Island²</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2.54</td>
</tr>
<tr>
<td>None³</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>107.58</td>
</tr>
<tr>
<td>None⁴</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>314.65</td>
</tr>
<tr>
<td>Ornamental⁵</td>
<td>28.25</td>
<td>-</td>
<td>-</td>
<td>3.95</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>32.20</td>
</tr>
<tr>
<td>Pasture⁶</td>
<td>518.83</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>157.76</td>
<td>17.09</td>
<td>-</td>
<td>693.68</td>
</tr>
<tr>
<td>Peach</td>
<td>77.39</td>
<td>3.83</td>
<td>19.45</td>
<td>11.83</td>
<td>0.50</td>
<td>-</td>
<td>-</td>
<td>113.00</td>
</tr>
<tr>
<td>Pear</td>
<td>48.60</td>
<td>3.14</td>
<td>7.00</td>
<td>4.00</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>62.74</td>
</tr>
<tr>
<td>Plum</td>
<td>9.17</td>
<td>0.25</td>
<td>2.13</td>
<td>5.00</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>16.55</td>
</tr>
<tr>
<td>Recreation⁷</td>
<td>91.35</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>91.35</td>
</tr>
<tr>
<td>Vine</td>
<td>53.05</td>
<td>42.60</td>
<td>11.85</td>
<td>8.83</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>116.33</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1768.27</strong></td>
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<td><strong>68.75</strong></td>
<td><strong>5.95</strong></td>
<td><strong>157.76</strong></td>
<td><strong>441.86</strong></td>
<td><strong>3003.91</strong></td>
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1 Cropland includes nurseries, vegetables, Christmas tree farms, and mixed orchards smaller than 0.25 acre
2 Non Ag Island is land that was planted according to the GIS crop layer, but has houses and driveways on the 2001 air photo
3 Parcels with no crop at all
4 Fallow portions: areas of parcels that have crops minus portions farmed in excess of roll acres. This area is the difference between roll area and the area that has been accounted for. It is assumed to be small parts of parcels that are in fallow.
5 Ornamental includes private lawns and ornamental plantings
6 Pasture includes hay, pasture, paddock, training areas, and watering of livestock
7 Recreation includes sports fields, city parks, campgrounds and golf courses.
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<th>Crop</th>
<th>Sprinkler</th>
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<th>Dual</th>
<th>Microjet</th>
<th>Plastic</th>
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<td>0.20%</td>
<td>5.25%</td>
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<td>100.00%</td>
</tr>
</tbody>
</table>

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Geowest Environmental Consultants Ltd.
4. DISCUSSION

4.1 Education

4.1.1 One-on-One Interviews
Meeting irrigators at their farms to discuss irrigation scheduling and water conservation has proven to be a very successful initiative. They indicated a strong appreciation for being shown how to properly assess irrigation requirements, rather than being given warnings and fines for violations. They also appreciated that the person conducting the interviews was knowledgeable with respect to irrigators and their needs. Punjabi speakers welcomed that the interaction and information were available in their own language.

With most of these interviews, the Hand Feel method of irrigation scheduling was introduced. It requires little effort to teach, and appeals to farmers because it is literally a hands-on approach. There is comparatively little mathematics involved.

4.1.2 Public Communication
Public communication reinforced the information being provided to the agricultural water users, and kept the general public aware of the issues as well.

4.1.3 Motivation
Now we return to the subject of paying attention. There were considerable water savings by district water users in late 2003 and in 2004. The savings in 2003 were accomplished mainly through publicity, footwork by Dr. Mangat, and the perception that there may be water shortages. The trend continued in 2004, due largely to the memory of water shortages, publicity and increased education.

These water savings were accomplished without meters and with minimal use of weather information. However, for improvement in demand side management to continue, there must be increasing reliance on technology: improved irrigation systems, a network of weather stations and a consultative service.

Will water saving behaviour continue as it has recently? It is difficult to predict. Although water savings prove useful in the short-term, the District waits for water supply to be expanded and for meters to be introduced. Eventually however, the scarcity factor will wear off, and the water supply system will need to be in good shape to face the future.

4.2 Enforcement
In most instances, extension and education work far better than enforcement. Enforcement should never be used as a means for providing information or education.

Enforcement is necessary for the worst offenders, cases where the same piece of ground has been irrigated for over 24 hours, or where there are repeat offenses. There must always be some enforcement.

Enforcement efforts should be increased during drought years, or during advanced stage water restrictions.
4.3 Allocation

Water can be allocated in two ways. First, by volume per acre per year, which can be monitored by use of meters. Or secondly, it can be allocated by peak flow rate, in volume gallons per minute per acre. Volume allocations have the effect of controlling the total amount of water used in a season, and are useful where there is heavy reliance on stored surface water. Flow can be controlled with flow control devices. Flow allocations are useful for ensuring that each farm has enough water to last through peak demand periods while allowing the water purveyor to economize on infrastructure.

4.3.1 Meters and Allotment of Volume

- Meters measure the volume of water that has been drawn by a particular parcel. They allow information to be obtained for planning and enforcement, and can provide a basis for charging for water use.
- In contrast to flow control devices, meters are useful when there is a limited quantity of water available or water is costly to supply. Flow control is useful when delivery infrastructure is limited or expensive to build.
- Farmers differ in their preferences for method of allotment. In Dr. Mangat's interviews, 42 preferred volume, 32 preferred flow and 6 either had no opinion or thought both were needed.
- Metering offers advantages to both the user and the supplier of water. Meters can be used as a tool for spot enforcement of flow restrictions, as well as for overall usage. The bylaw officer simply needs to stand by the meter for a measured period of time to calculate flow rates. Placing dole valves (flow control valves) on individual sprinkler heads can still be used by farmers as a way of evening out their water application.
- Farmers can use meters to check the delivery rate of their blocks, and know whether nozzles are getting worn, or emitters are plugged. Meters can also warn users of leaks or breaks.
- There are meters available that can also function with injection systems. It has been suggested that farmers who are to have their parcels metered should have the option to receive an allowance for a meter, and pay the cost difference for a meter that has a greater number of capabilities.

4.3.2 Flow Control Valves and Allotment of Flow

- Flow control conserves infrastructure. It ensures that adequate flow is available for all users in the District at all times.
- A disadvantage of allotment by flow is that when flow limits are designed for peak usage, irrigators are required to irrigate 24/7 at the hottest time of year. There is no choice available to irrigate only at night or when the wind is down.
- With flow limits in effect, farmers lose flexibility in their operations. A pasture cannot be quickly irrigated before animals are transferred in and the system removed to prevent damage. A fruit grower with overhead irrigation cannot irrigate quickly, apply a pesticide, and then leave the cover spray undisturbed for the maximum amount of time.
- Coarse soils have low water holding capacity, so in a district that enforces flow control, their crops are vulnerable to periods of hot weather. The Southeast Kelowna Irrigation District (SEKID) addresses this issue by allowing higher flows on parcels with coarse textured soils.
4.4 Irrigation Scheduling

"Irrigation scheduling is a systematic method by which a producer can decide on when to irrigate and how much water to apply. The goal of an effective scheduling program is to supply the plants with sufficient water while minimizing loss to deep percolation or runoff. Irrigation scheduling depends on soil, crop, atmospheric, irrigation system and operational factors." (Van der Gulik, 1997, Irrigation Scheduling Techniques)

4.4.1 Soil Moisture

- Farmers can dig to check soil moisture, except in stony or gravelly soil. Checking soils with low water holding capacity can be tedious because they need it so frequently.
- In container nurseries, water levels in styro blocks are easily monitored by weighing. This is a variant of using soil moisture for irrigation scheduling.
- Many types of devices are available for monitoring soil moisture, some of which may be used to program irrigation automatically.
- Monitoring soil moisture allows seepage, equipment problems and crop condition to be taken into account. Scheduling according to weather does not.
- Soil moisture must be monitored farm by farm, site by site. It cannot be done at the District level.
- People planning to use soil monitoring devices need instruction in their use.
- These are the devices of choice where there is seepage. Such areas can be identified with the District GIS system by creating a soil drainage layer from the 1986 soil survey.

4.4.2 Weather and Water Budget

- This method allows irrigators to use evapotranspiration, precipitation, and soil, crop and irrigation system details to schedule irrigation.
- It is a suitable method to be employed district wide, and one of the best options for scheduling the irrigation of stony or very gravelly soils.
- Historical weather and existing crops and irrigation systems can be used as a basis for volume allotments, as is the case with SEKID.
- Weather information is easily collected telemetrically, and posted on the Internet. However, many farmers do not use the Internet or do not have the time or ability for complex calculations or record keeping. The notion of having a weekly irrigation prescription from an agricultural professional is popular among farmers of many acres and parcels. The professional would need a considerable amount of information about the irrigation system, skill and habits of the client.
- A small number of farmers could do the necessary calculations themselves but do not use the Internet.

4.5 Water Supply and Agriculture

There must be water for there to be agriculture in this district. Irrigation and arability are practically synonymous. Little more than 100 acres that have seepage or a high water table could be farmed here without irrigation. Without irrigation the rest could only support pasture with a low stocking rate.
There is a social contract to supply water to agricultural land. The availability of water makes some arid Class 6 land into Class 1, 2 and 3 in the B.C. Agricultural Capability Classification system (Kenk and Cotic, 1983); and this land is held in the Agricultural Land Reserve (ALR) for the benefit of all.

In contrast to residential uses, most water used for irrigation is not discretionary. Crop yield and quality depends on its availability.

Surface water storage mimics the snow pack in a sense, because water is held back till later in summer, as is snow as it melts. With global warming, increasing water storage will help to compensate for the predicted loss of snow pack.

During interviews held in 2004, more than anything else, farmers demanded an increase in water storage.

### 4.6 Agricultural Programs

One consequence of the tree fruit Replant Program for orchards has been a modernization of irrigation systems, as well as orchards in general. Unfortunately this program is to be discontinued after 2005.

The Environmental Farm Plan (EFP) program is just beginning, and the British Columbia Fruit Growers Association (BCFGA) is one of its administrators. The EFPS will include a statement of Environmental Priorities. The farmer can apply for funding to upgrade aspects of the farm that are considered a priority. Where irrigation is so identified there may be funds available to pay for upgrading to more efficient systems, including irrigation timers.

The field service of BC Fruit Packers Cooperative is working to develop a weather information service that would prescribe for fruit growers the amount of water they should irrigate each week.
5. RECOMMENDATIONS

The following recommendations are provided based upon experience with the 2004 Water Coordination program and the data that is included in this report.

Water storage capacity in the Trout Creek system should be increased. Water conservation is useful, however an ever increasing demand for water is anticipated in this district. It takes years of lead time to construct additions to water supply.

The District of Summerland should continue with water education and extension efforts. Include the public, commercial and residential sectors as well as agriculture. Education has been proven effective for agriculture in both Summerland and SEKID. Similar success has been obtained with the WaterSmart campaign employed by neighbouring municipalities, that is directed towards residential users. Continue with public communication, coordinated with education and the current state of water supply. There should be an increase in the level of technology in irrigation education. In 2003 farmers were requested to cut back on or cease irrigation. In 2004, education emphasized attentiveness - maintaining systems properly, checking the soil and measuring application rates with catch pans. In future, there will be a need for increased efforts by the District and by farmers. Farmers who have advanced irrigation systems need assistance with scheduling properly, with the Water Budget method employed in conjunction with atmometers or weather stations, or by use of soil moisture sensors.

The District should continue enforcement with emphasis on worst cases of abuse, drought years and late stages of water restriction.

The District should introduce meters gradually. Collect information for the benefit of both the District and the user. Consider various rate structures and their impact. Charging purely for consumption would benefit those who use little water — such as farms with seepage or high water tables, vineyards, under-irrigated hobby pastures, and land held mainly for speculation; but it would be at the expense of other irrigators. Do not use meters as a way to increase charges for legitimate agricultural water use. Based on the SEKID experience, if universal agricultural metering is planned along with charging or allotting on the basis of volume, many years of lead time may be needed before there is general acceptance by the agricultural community. At the moment SEKID uses meters to enforce allotment, but charges for volume only if the annual allotment is exceeded.

The District should provide long-term warning to farmers of any change in rates. The vast majority of crops in the District are perennial, and it takes time for a farm to be able to respond to changes in water rate structures.

The District should aid the BCFGA in its lobby efforts to have the Replant Program continued. Maintain liaison with the BCFGA on the progress of Environmental Farm Plans, and seek ways to assist farmers in accessing funds to improve their irrigation systems.

With meters in place, the District should consider whether the requirement for flow control valves could be eliminated. If that is the case, work with farmers and irrigation designers to have blocks not exceed allotment. Check meters as a means of monitoring flow.
6. REFERENCES

6.1 At the District of Summerland, Unpublished


Holtjer, Jim; Frank, Grace; and Fitzpatrick, Joe. 2004. Crop Layer of Summerland GIS.


6.2 Websites

www.farmwest.com
www.getwatersmart.com
www.sekid.ca
www.summerland.ca/works/waterconservation
www.summerlandchamber.bc.ca/

6.3 Publications


6.4 BCMAFF Irrigation Pamphlets

http://www.aqf.gov.bc.ca/resmgmt/publist/500series/500310-1.pdf
Irrigation Tips to Conserve Water on the Farm

Irrigation Parameters for Efficient System Operation

http://www.aqf.gov.bc.ca/resmgmt/publist/500series/577100-1.pdf
Irrigation Scheduling Techniques.

Irrigation Scheduling with Tensiometers.

Sprinkler Irrigation Scheduling Using a Water Budget Method.

Trickle Irrigation Scheduling Using Evapotranspiration Data.

http://www.aqf.gov.bc.ca/resmgmt/publist/500series/577100-5.pdf
Crop Coefficients for Use in Irrigation Scheduling.