# CHAPTER 6. Water Conservation Report

## 6.1 Introduction

The MILs who actively participate in the Statewide MIL Irrigation Conservation Committee (ICC) and abide by this MIL Handbook are trained to provide a variety of recommendations to an owner or operator of an irrigation system, in order to conserve water. These recommendations can vary from the utilization of soil moisture sensors, to repairs, to modifications in the irrigation schedule, to a new irrigation system, depending on the type of irrigation system being used and managed.

Not all of these recommendations lend themselves at this time to an MIL quantifying the potential or actual water saved from each of them. Therefore, at this time the MILs are documenting water savings for the following scenarios: the improvement of the Distribution Uniformity (DU) or Emission Uniformity (EU) of the irrigation system itself and/or its associated actual or potential reduction in irrigation system run time (irrigation schedule); irrigation scheduling changes; and the potential or actual repair of leaks and/or irrigation system components.

More methods to document actual or potential water savings under other scenarios will be added to this MIL Handbook as the MILs get trained on their implementation, and the methods are recognized as valid by the ICC and its partners, the irrigation industry and the research community.

## 6.2 Determining the Maximum and Actual Distribution and/or Emission Uniformities of a Pressurized Pipe Irrigation System:

Distribution Uniformity (DU) and Emission Uniformity (EU) were already discussed in Chapter 4 of this Handbook; so did Potential or Maximum DU or EU. Therefore, the reader is encouraged to go to that chapter regarding those topics.

Each type of pressurized pipe irrigation system has the potential to achieve a Maximum DU or EU. That potential or maximum DU or EU has been identified over the years for each irrigation system via a record of on-going tests done by irrigation manufacturers, the research community and/or the MILs themselves. Such information is summarized in table 6.1 below. Since newly introduced irrigation system components, techniques, and/or technologies could improve those optimum or maximum EU's or DU's from time to time, table 6.1 may need to be updated in the future accordingly.

In order for a maximum EU or DU to be changed in table 6.1 the MILs must have obtained themselves a history of those same maximum/optimum values via numerous evaluations of their own, to verify that such new EU's or DU's can in fact be obtained under Florida conditions. Such history shall be kept by each MIL in a separate folder entitled "Log of Maximum DU's or EU's and presented to the MIL ICC for discussion and approval, before any maximum/optimum DU or EU numbers are changed in table 6.1. Only until those values are changed in table 6.1 and the MIL Handbook is officially revised by the MIL ICC, will any MIL be allowed to use such revised values to calculate PWS or AWS.

**Table 8 – Maximum Potential System Uniformity**

| Irrigation Method/System | | Maximum Potential System DU or EU (%) |
|---|---|---|
| Sprinkler Irrigation (Traveling Gun) | | 65 |
| Sprinkler Irrigation (Periodic Move gun type or boom sprinklers) | | 60 |
| Sprinkler Irrigation (Handmove Portable) | | 75 |
| Sprinkler Irrigation (Solid Set) | | 86 |
| Sprinkler Irrigation (Center Pivot, Standard) | | 85 |
| Sprinkler Irrigation Low Pressure Nozzles (LPN) –(center pivot and lateral move) | | 94 |
| Sprinkler Irrigation Low Energy Precision Application (LEPA) Center Pivot or Linear Move | | 95 |
| Sprinkler Irrigation (Linear Move) | | 87 |
| Sprinkler Irrigation (Periodic Move Lateral) | | 75 |
| Microirrigation (Spray Emitters) | | 95 |

| Irrigation Method/System | | Maximum Potential System DU or EU (%) |
|---|---|---|
| Microirrigation<br>(Point Source Emitters) | | 90 |
| Microirrigation<br>(Line Source Emitters) | | 90 |
| Open Ditch (Irrigating Laterals and Furrows)<br>(Flow Through) | | 80 |
| Open Ditch (Irrigating Laterals and Furrows)<br>(Backup) | | 75 |
| Open Ditch (Irrigating Laterals and Furrows)<br>(Crown Flood) | | 80 |
| Surface Irrigation, Graded Furrow | | 80 |
| Surface Irrigation, Level Furrow | | 85 |

References:

NRCS National Engineering Handbook, Part 652, National Irrigation Guide, Chapter 15, Florida Supplement, Table FL15 – 1,

May 4 and 5 2010 MIL ICC Meeting.

Chapter 4 in this Handbook indentifies the procedures all MILs are to follow to determine the actual DU or EU of any pressurized irrigation system. Part of those procedures are associated with the following equations, which are also in that chapter and are taken from NRCS National Engineering Handbook (NEH) Part 652, Irrigation Guide, Chapter 9 and Chapter 5 of this Handbook.

**Distribution Uniformity (DU):**

For Center Pivots:

$$DU\ (\%) = \left(\frac{Weighted\ low\frac{1}{4}\ average\ application}{Weighted\ system\ average\ application}\right) \times 100$$

$$Weighted\ low\frac{1}{4}\ average\ application\ (in)\ = \frac{Sum\ Low\frac{1}{4}\ weighted\ catches}{Sum\ low\frac{1}{4}\ factors}$$

$$Weighted\ system\ average\ application\ (in)\ = \frac{Sum\ all\ weighted\ catches}{Sum\ all\ position\ \#'used}$$

For Linear Move, Periodic Move, and Fixed Solid Set Sprinklers:

$$DU\ (\%) = \left(\frac{Average\ low\frac{1}{4} depth\ of\ water\ recieved}{Average\ depth\ of\ water\ recieved}\right) \times 100$$

**Emission Uniformity (EU):**

For Microirrigation Systems:

$$EU\ (\%) = \left(\frac{Minimum\ rate\ of\ discharge\ per\ plant}{Average\ rate\ of\ discharge\ per\ plant}\right) \times 100$$

**Application:**

$$Average\ Application\ Rate\ \left({}^{in}/_{hr}\right) = \frac{volume\ collected\ (ml)}{area\ \times time} \times 5775$$

OR

$$Average\ Application\ Rate\ \left({}^{in}/_{hr}\right) = \frac{total\ discharge\ per\ sprinkler\ ({}^{gpm}/_{spk})}{Area\ (sq.ft.)} \times 96.3$$

OR

If a water meter is present, another method can be used to determine the average application rate. Record the meter reading with the system turned off. Turn one zone on for a specified period of time (1 or 2 minutes) then turn the system off and record the meter reading again. The average application rate can be calculated by the following equation:

$$Average\ Application\ Rate\ \left({}^{in}/_{hr}\right)\ = \frac{final\ meter\ reading - intial\ meter\ reading}{Area\ (sq.ft.) \times\ time} \times 96.3$$

If only a catch can test is performed (no pressure and flow check),

$$Average\ Application\ Rate\ \left({}^{in}/_{hr}\right) = \frac{Volume}{D^2\ \times time} \times 4.66$$

Where Volume = average volume of water collected per catch (ml)

D = diameter of the top of the catch can (in)
Time = Time of operation (min)

$$Effective\ Application\ Rate\ \left({}^{in}/_{hr}\right) = \frac{DU}{100} \times Average\ Application\ Rate$$

$$Irrigation\ Duration\ (minutes) = \frac{Plant\ Water\ Requirement\ (in)}{Effective\ Application\ Rate\ \left({}^{in}/_{hr}\right)} \times 60\ \left({}^{min}/_{hr}\right)$$

**6.3 Calculating Potential Water Savings (PWS):**

**PWS** is the maximum amount of irrigation water that could be saved annually, if all MIL recommendations derived from the **initial evaluation** of the irrigation system are followed by the irrigation system operator or owner.

The only time when any MIL is to determine PWS is when the MIL is conducting an **initial evaluation** of an irrigation system. Any follow up evaluations to that same irrigation system shall be used by the MIL to determine Actual Water Savings (AWS) only, which is the portion of the PWS of that same irrigation system which has actually been saved via a follow up evaluation.

For purposes of this Handbook, PWS will be divided into the following three defined categories:

**PWS Due to Irrigation System Efficiency Improvements (ac-ft):** The amount of irrigation water that can be saved annually by improving the DU or EU of the irrigation system, which should lead to a reduction in hours of irrigation needed.

**PWS Due to Irrigation System Scheduling (ac-ft):** The amount of irrigation water that can be saved annually if schedule changes (run time and frequency) alone are implemented.

**PWS Due to the Repair of Leaks and/or any Applicable Irrigation System Components (ac-ft):** the amount of irrigation water that can be saved annually by repairing irrigation system leaks or components, or replacing faulty irrigation system components.

In order to calculate PWS, it is important to also define the following terms:

**Net Irrigation Requirement (NIR, inches):**

The minimum amount of irrigation water required by irrigation to satisfy plant or crop evapotranspiration and auxiliary needs that are not stored in the soil profile or precipitation annually, based on the area of the State it is grown, and the **average or normal** climatic condition under which it is grown.

The NIR for common crops in Florida grown under **average or normal** climatic conditions can be found in NRCS NEH, Part 652, National Irrigation Guide (NIG), Florida Supplement, Chapter 4. This handbook can be downloaded at the following web address:
http://www.fl.nrcs.usda.gov/technical/irrigation.html

There are some crops/plants where no NIR has been identified by the NRCS reference listed above, but has been determined via other peer reviewed documents produced by research institutions such as the University of Florida Institute of Food and Agricultural Services (IFAS). The MILs will be

allowed to use such NIRs as long as the documents referring to those NIRs have been officially included in Appendix E of this Handbook.

The Normal Year NIR is defined as:

$$= Normal\ Year\ Crop\ water\ requirements\ (inches) - Normal\ Year\ Effective\ Rainfall\ (inches)$$

**Actual Water Used (AWU, Inches):**

The actual amount of water used annually for irrigation of a plant or crop, based on **documented** irrigation flowmeter **and** irrigation scheduling information provided by the farmer or obtained by the MIL. **Verbal hear-say information is not acceptable AWU.**

**Following are the only three acceptable ways for the MILs to document Annual Actual Water Use:**

- A complete accounting of annual water use via **documented** readings from a water meter that is working properly, has been calibrated, and is permanently installed on the irrigation system.

OR

- A complete accounting of water use via **documented** and consistent irrigation schedules and irrigation times throughout the year, **AND** the temporary use of the MIL's portable flow meter on the irrigation system to determine its flow rate in gallons per minute.

OR

- A complete **documentation** and accounting of **water discharged from each and all of the water application devices** in the irrigation system being evaluated (sprinklers, sprayers, drippers, etc) **AND** leaks (if applicable) via:
    - Physical catches into a cylinder, bucket or container that can be used to measure each of those catches or leaks accurately; or
    - If **each and all** of the water application devices in the irrigation system being evaluated are **in good operating condition**: the physical measurement of the pressure at **each and all** of the water application devices in the irrigation system being evaluated (sprinklers, sprayers, drippers, etc), in combination with the **official manufacturer's** design discharge specification sheets for **each and all** of those water application devices; or
    - A combination of physical catches for some water application devices and leaks, and pressure readings for the reminder application devices in that same irrigation system being evaluated, depending on the condition of each application device.

**If an MIL cannot document actual water use using any of the three ways described above, then the MIL shall not use actual water use to determine PWS associated with the improvement of the DU or EU of the irrigation system being evaluated.**

**There are three ways in which PWS associated only with irrigation system DU or EU efficiency improvement can be calculated by the MIL**, depending on the actual or estimated water use information available to the MIL at the time of the initial evaluation. Those three methods are outlined below, and are listed in the priority in which they should be used. **Only one of these three methods shall be identified and used by the MIL.** As mentioned previously in this chapter, as more methods to quantify other water conservation activities become available and are officially approved by the ICC and its partners, they will be added to this Handbook.

**The PWS via an initial evaluation associated only with irrigation system DU or EU efficiency improvements, NIR, and AWU information will be quantified and documented by the MILs as follows:**

$\text{PWS, Efficiency, AWU and NIR}_{(\text{ac-ft})}$:

$$= \left(\frac{Actual\ Water\ Used\ (in.)}{DU\ or\ EU_{initial\ eval}} - \frac{NIR\ (in.)}{DU\ or\ EU_{max}}\right) \times \left(\frac{irrigated\ acres}{12}\right)$$

If the MIL chooses this method, no additional PWS associated with irrigation schedule changes can be calculated and reported by the MIL, because those are already incorporated into this method. Additional PWS associated with leak and irrigation system component repairs could still be possible, if the irrigation system being initially evaluated has such problems and they can be quantified.

**The PWS via an initial evaluation associated only with irrigation system DU or EU efficiency improvements and AWU information will be quantified and documented by the MILs as follows:**

$PWS, Efficiency, AWU_{(ac-ft)}$:

$$= \left(\frac{Actual\ Water\ Used}{DU\ or\ EU_{initial\ eval}} - \frac{Actual\ Water\ Used}{DU\ or\ EU_{max}}\right) \times \left(\frac{irrigated\ acres}{12}\right)$$

If the MIL chooses this method, additional PWS associated with irrigation schedule changes can also be calculated and reported by the MIL as applicable. Additional PWS associated with leak and irrigation system component repairs could still be possible, if the irrigation system being initially evaluated has such problems and they can be quantified.

**The PWS via an initial evaluation associated only with irrigation system DU or EU efficiency improvements and NIR information will be quantified and documented by the MILs as follows:**

$PWS\ Efficiency, NIR_{(ac-ft)}$:

$$= \left(\frac{NIR}{DU\ or\ EU_{initial\ eval}} - \frac{NIR}{DU\ or\ EU_{max}}\right) \times \left(\frac{irrigated\ acres}{12}\right)$$

If the MIL chooses this method, additional PWS associated with irrigation schedule changes can also be calculated and reported by the MIL as applicable. Additional PWS associated with leak and irrigation system component repairs could still be possible, if the irrigation system being initially evaluated has such problems and they can be quantified.

If any MIL's conducting an evaluation obtain unusually low EU or DU values of less than 50%, they will consult with their partner agencies prior to reporting the PWS associated with such values.

**The PWS associated only with a change in irrigation schedule** will be quantified and documented by the MILs as follows and as applicable: it shall be the difference in volume of water

used on an annual basis, due to the potential reduction in irrigation system hours of operation. That reduction in hours of operation must be from a **documented and supported** potential reduction on irrigation system irrigation event frequency, and/or irrigation system run time per irrigation event. The associated PWS volume **must** be quantified by the MIL as follows: multiplying the number of potential hours associated with the use reduction, by the **documented** flow rate (obtained via the MIL evaluation) of the irrigation system. **The use of verbal hear-say flow rate and/or hour reduction information to calculate this type of PWS is not acceptable. In that case, this PWS should be reported as zero.**

**The PWS of an evaluation associated only with repairs of leaks, repairs of irrigation heads, and/or replacements of irrigation heads** can only be quantified as applicable by using a valid method to determine the volume of water lost to leaks and/or disrepairs. **The MIL must use methods that physically measure those volumes on the field using flow meters or equivalent devices and not rely on "paper estimates" or hear-say; except for irrigation system emitters or heads where the official manufacturer design flow information can be used.** This volume can be determined by using the **documented** flow rate of the leaks or disrepairs, and multiplying it by the **documented** number of hours the irrigation system is used on an annual basis. **If this cannot be done, then this PWS should be reported as zero.**

### 6.4 Calculating Actual Water Savings (AWS)

**Actual Water Savings (AWS)** is defined as the total amount of water saved on an annual basis, due to following any or all of the recommendations derived from irrigation system evaluation(s) by the MIL.

There are two instances when an MIL can quantify AWS:

- When the MIL is conducting a **follow up evaluation of the same irrigation system** it initially evaluated.
- When the **original irrigation system evaluated by the MIL has been completely replaced by a more efficient and new irrigation system**.

The AWS determined from a **follow up evaluation** of an irrigation system is defined as the portion of the PWS of that same irrigation system which has actually been saved due to implementation of some or all MIL recommendations, which is quantified via follow up evaluations. The PWS obtained from the one and only initial evaluation to that same irrigation system (see Section 6.2 above) shall always be used by the MIL as a reference for any AWS obtained from follow up evaluations.

The AWS determined from an **original irrigation system being completely replaced by a more efficient and new irrigation system** is the difference between the amount of water that the old irrigation system was using on an annual basis (per the **last** evaluation done by the MIL on that system), and the amount of water being used on an annual basis by the new irrigation system (per the **initial** evaluation done by the MIL on that system). Such AWS results shall be associated with the new irrigation system for purposes of reporting (not the old irrigation system), and shall be reported separately from the PWS of the new irrigation system.

For purposes of this Handbook, AWS will be divided into the following three defined categories:

**AWS Due to Irrigation System Efficiency Improvements (ac-ft):** The documented amount of irrigation water saved annually by improving the DU or EU of the irrigation system, which should lead to a reduction in hours of irrigation needed.

**AWS Due to Irrigation System Scheduling (ac-ft):** The documented amount of irrigation water saved annually due to documented schedule changes (run time and frequency).

**AWS Due to the Repair of Leaks and/or any Applicable Irrigation System Components (ac-ft):** The documented amount of irrigation water saved annually from documented repairs of irrigation system leaks or components, or the documented replacement of faulty irrigation system components.

In order to calculate AWS, it is important to also define the following terms:

**Net Irrigation Requirement (NIR, inches):**

The minimum amount of irrigation water required/necessary for a plant or crop annually, based on the area of the State it is grown, and the **average or normal** climatic condition under which it is grown.

The NIR for common crops grown in Florida under **average or normal** conditions can be found in NEH, Part 652, National Irrigation Guide (NIG), Florida Supplement, Chapter 4. This handbook can be downloaded at the following web address:
http://www.fl.nrcs.usda.gov/technical/irrigation.html

The Normal Year NIR is defined as:

= Normal Year Crop water requirement (inches) – Normal Year Effective Rainfall (inches)

**Actual Water Used (AWU, Inches):**

The actual amount of water used annually for irrigation of a plant or crop, based on **documented** irrigation flowmeter **and** irrigation scheduling information provided by the farmer or obtained by the MIL. **Verbal hear-say information is not acceptable AWU.**

Only the AWS associated with **documented** irrigation system DU or EU efficiency improvements, **documented** irrigation management/schedules, and/or **documented** repair of leaks and/or irrigation system components will be quantified at this time. As mentioned previously in this chapter, as more methods to quantify other water conservation activities become available and are officially approved by the ICC and its partners, they will be added to this Handbook.

**Calculating AWS Due to DU or EU Efficiency Improvements:**

**There are two methods by which AWS associated only with irrigation system DU or EU efficiency improvement can be calculated by the MIL**, depending on the NIR or annual actual water use information available to the MIL at the time of the follow up evaluation. **Only one of these two methods shall be identified and used by the MIL.**:

For MILs Using NIR:

$AWS, Efficency, NIR_{(ac-ft)}$ :

$$= \left(\left(\left(\frac{NIR_{initial\ eval}}{DU\ or\ EU_{initial\ eval}}\right) \times \left(\frac{irrigated\ acres_{initial\ eval}}{12}\right)\right) - \left(\left(\frac{NIR_{follow-up\ eval}}{DU\ or\ EU_{follow-up\ eval}}\right) \times \left(\frac{irrigated\ acres_{follow-up\ eval}}{12}\right)\right)\right)$$

For MILs Using AWU:

$AWS, Efficency, AWU_{(ac-ft)}$:

$$= \left( \left( \left( \frac{\text{AWU}_{\text{initial eval}}}{\text{DU or EU}_{\text{initial eval}}} \right) \times \left( \frac{\text{irrigated acres}_{\text{initial eval}}}{12} \right) \right) - \left( \left( \frac{\text{AWU}_{\text{follow-up eval}}}{\text{DU or EU}_{\text{follow-up eval}}} \right) \times \left( \frac{\text{irrigated acres}_{\text{follow-up eval}}}{12} \right) \right) \right)$$

**Any follow up evaluation AWS calculated by an MIL using a follow up evaluation DU or EU that is higher than the Max DU or EU in Table 6.1, will still be valid and shall still be reported by the MIL to the ICC partner agencies using the approved standard reporting forms shown in Section 6.6 of this Handbook.**

There are instances where the DU or EU obtained from the follow up evaluation of a particular irrigation system may be too low and the AWS results using the two methods above will not be valid. If MILs conducting a follow up evaluation obtain EU or DU values that are less than 50%, they will consult with their partnering agencies prior to reporting the AWS values obtained from such evaluations.

**Calculating AWS Associated with a Change in Irrigation Schedule:**

The AWS associated only with a change in irrigation schedule will be quantified and **documented** by the MILs as applicable, and shall be the difference in volume of water used **on an annual basis**, due to the actual reduction in irrigation system hours of operation.

That reduction in hours of operation must be from a **documented and supported** reduction on irrigation system irrigation event frequency, and/or irrigation system run time per irrigation event.

The associated AWS volume **must** be quantified by the MIL as follows: multiplying the actual number of **documented** hours associated with the use reduction, by the **documented** flow rate (obtained via the MIL evaluation) of the irrigation system.

**The use of verbal hear-say flow rate and/or hour reduction information to calculate this type of AWS is not acceptable and shall not be reported by the MIL to its partner agencies. In that case, this AWS shall be reported by the MIL as zero.**

**Calculating AWS Associated with Repairs or Parts Replacements:**

The AWS of an evaluation associated only with repairs of leaks, repairs of irrigation heads, and/or replacements of irrigation heads can only be quantified as applicable, by using a valid method to determine the volume of water actually saved **on an annual basis.**

**The MIL must use methods that physically measure those volumes on the field using flow meters or equivalent devices and not rely on "paper estimates" or hear-say; except for irrigation system emitters or heads where the official manufacturer design flow information can be used.**

This volume can be determined by using the **documented** flow rate of the leaks or disrepairs, and multiplying it by the **documented** number of hours the irrigation system is used **on an annual basis.**

**If this cannot be done, then this AWS shall be reported by the MIL to the partner agencies as zero.**

### 6.5 Calculating Immediate Water Savings (IWS)

Immediate Water Savings (IWS) can be achieved if same day repairs are made per the MIL recommendations, or if irrigation schedule changes are made at the time of the evaluation or when the report is delivered.

Those water savings are typically quantified by comparing a water meter reading after repairs and/or adjustments are completed, against a water meter reading before the repairs and/or adjustments were completed. That difference in water meter readings shall be used by the MILs in combination with the annual irrigation schedule of the system, to come up with an annual volume of water saved.

Water savings resulting from repairs and/or adjustments (per the MIL evaluation and recommendations report) that do not occur on the same day of the evaluation need to be documented via future follow-up evaluations.

### 6.6 Reporting Water Conservation Results to Partner Agencies

All agricultural MILs are responsible for providing their contract and/or in-kind services partners (such as the local NRCS District Conservationist and the FDACS) with the water savings results they obtained via their evaluations (initial and follow up). Urban MILs may or may not have the same requirements, depending on any contractual obligations they may or may not have with any partner agencies.

Appendix A lists the forms the MILs are currently using with their partner agencies, to report such water savings results. They are:

- **Condensed Quarterly Report Form - MILs**
- **Attachment 1a** - Irrigation System Evaluations: Water Savings, Data and Results, per MIL Handbook
- **Attachment 1b** – Irrigation System Water Source, Pumping Station, and other Info
- **Attachment 2** –Tracking Table for Initial Evaluations, Follow Up Evaluations, or Replacements
- **Attachment 3** – MIL Evaluation Waiting List
- **Attachment 4** – MIL Conservation Education and Outreach Report

Attachments 1a, 1b, 2, 3, and the Condensed Quarterly Report Form are required of all MILs. The Attachment 4 form is required of some MILs.

### 6.7 Typical Water Conservation Report to the Farmer or Client

MIL's develop a report of findings and recommendations required for the irrigation system to operate properly and efficiently. As a minimum, that water conservation report should include a cover letter, evaluation data, problems encountered, potential water savings or actual water savings, water quality analysis (if conducted), and recommendations.

The following sections contain typical water conservation reports for evaluations performed on both agricultural and urban irrigation systems.

### 6.7.1 Agricultural

#### 6.7.1.1 Center Pivot Irrigation System Evaluation

January 23, 2006

I'm Thirsty Farms
Drytown, Florida

Dear Mr. Thirsty

Reference: The Dry Place Center Pivot Irrigation System

Thank you for allowing the XXX Mobile Irrigation Lab the opportunity to provide evaluation services for the above referenced irrigation system.

The XXX Mobile Irrigation Lab is one of many members of the XXX Partnership. The MIL is now into the $X^{th}$ year of operation and has recently expanded services into XX counties. Our services remain free of any charge.

Many factors can influence the performance of the irrigation system. The MIL evaluation process is designed to test the overall ability of the system to evenly distribute water and measure the percentage of application loss. It is the desire of this MIL to represent the system in an unbiased report using USDA, Natural Resource Conservation Service (NRCS) guidelines as standards. Potential Water Savings (PWS) and Actual Water Savings (AWS) are calculated using Net Irrigation Requirements (NIR). Net Irrigation Requirements are defined as the amount of irrigation required to grow the crop, after consideration for estimated rainfall amounts. Crops on North Florida soils can be difficult to manage as significant rainfall or over applications of irrigation can quickly move nutrients below the root zone.

Thank you for your help in scheduling and assisting in the evaluation process. Should you have other systems that need testing or have questions or suggestions about our reporting format, please contact us.

XXX MIL

Enclosure

**Recommendations: I'm Thirsty Farms / The Dry Place / January 23, 2006**

The following recommendations will improve the Distribution Uniformity (DU) and Application Efficiency (AE) of this center pivot irrigation system. *The DU% is a score given after an MIL evaluation that indicates how evenly irrigation water is distributed across your field. The DU score is important because the lower the score the more uneven irrigation water is applied and this can affect your crop's health and production. The Application Efficiency (AE) % expressed here is a measure of the amount of water pumped versus the amount of water that actually reaches the crop canopy. These losses occur through evaporation, drift and/or leaks.* Any changes made to the irrigation system should be re-evaluated as it will change the Application Chart and uniformity pattern.

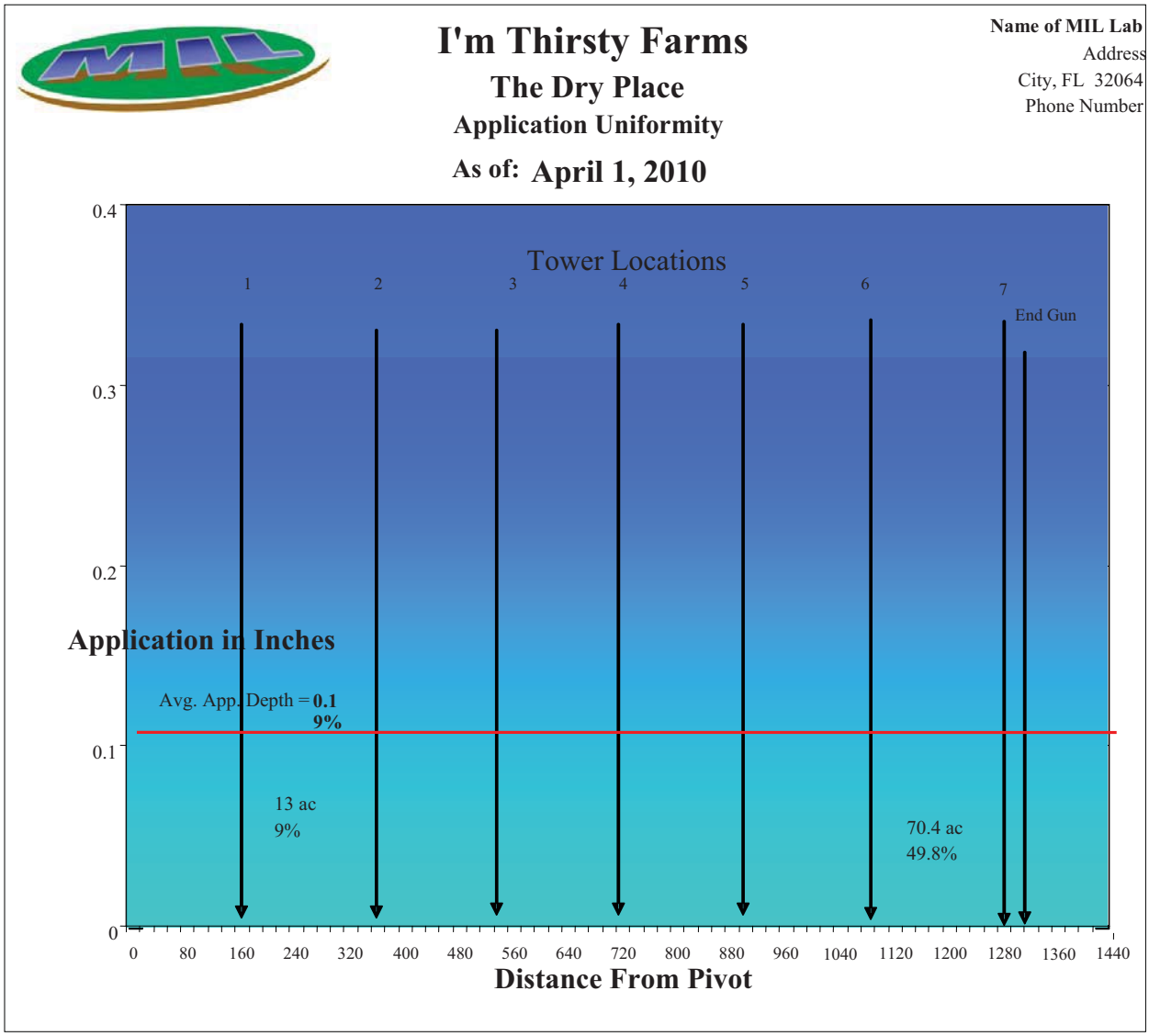
1) The End Gun application represents a large percentage of the field. The Distribution Uniformity (DU) % reported here includes the End Gun application within the overall score.
2) As noted at the bottom of page one, the End Gun should be adjusted to the recommended rotation. This rotation change will likely correct the application rate and could improve DU%.
3) Any retrofit to an upgraded nozzle package must be matched to the known, gallons per minute (GPM) flow rate of the well/pump and system operating pressure at the pivot.
4) Page (4) is the customized Application Chart which is an irrigation management tool. The application amount indicated in the highlighted column is what you can expect after efficiency losses are considered and the hours per revolution at the chosen timer setting.
5) As indicated by the enclosed uniformity graph, pressure regulators are failing.
   a) Manufacturers suggest 2 to 4 years of good service can be expected from pressure regulators.
   b) Failing pressure regulators can result in heavy irrigation application in certain areas of the field while depriving other areas of the field. Review the enclosed graph and note the areas by the tower locations that have contrasting application rates. The crop may be suffering from a low water application in some areas or nitrogen may be leaching quickly past the root zone due to a high application rate in others. In either case crop grade and yield may suffer.
   c) It is NOT recommended to replace only a few pressure regulators but to consider a complete, matched nozzle and pressure regulator retrofit package.
6) The following nozzles are plugged or are not working.
   a) Span# 2 Nozzle# 4
   b) Span# 4 Nozzle# 12
7) Towers are out of alignment.
   a) Consult your irrigation vendor to troubleshoot the cause of misalignment.
8) Missing guard for PTO shaft.
   a) To practice safety, it is a good idea to place a shield over all exposed PTO shafts.
9) Broken pressure gauge.
   a) The pressure gauge takes the pulse of the irrigation system. For proper irrigation management it is important to maintain the system designed pressure.
   b) Consider maintaining working pressure gauges at the beginning and end of the system to verify working pressure.
10) Standing water in the field.

a) There are drainage problems in certain areas of the field, application rates should be considered over these areas.

11) Soil compaction was measured with a penetrometer.
   a) In this case the hardpan was measured at xxx inches.
   b) Soil compaction can prevent crop roots from reaching available moisture.

12) Because of obstructions in the field the pivot could not make a complete circle, however the Timer Chart enclosed here considers the partial circle on next page.

13) Plugging the first nozzle will lower high application near the pivot point.



**Distribution Uniformity 66%**

**Distributution Uniformity without End Gun 65%**

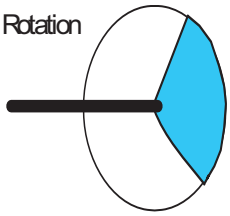
| | | | | |
|---|---|---|---|---|
| General Info | Date of Eval / Pre / Post / % | January 23, 2006 | pre | 0 |
| | System Model / Nozzle Type | Valley / 6000 / Diesel | Valley / Sprays / On drops | |
| | Wetted Length (ft) / Acres est. / GPS meas. ac | 1400 | 141 | 0 |
| | Temperature / Wind / Weather | 72 | | |
| | Timer Setting (%) / Rotation (%) | 70 | 78% | |

| | | | |
|---|---|---|---|
| System Output | System Flow @ Pivot Point (GPM) | 900 | |
| | System Pressure (psi) / Engine RPM | 24 | 1800 |
| | Total System Output (in) / Effective Irrigation | 0.22 | 0.19 |
| | Loss to Evaporation, Drift and Leaks | 0.03 | 14.50% |
| | Application Efficiency | 86% | |

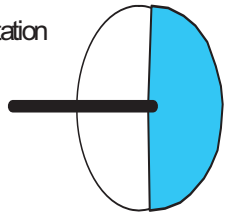
| | | | |
|---|---|---|---|
| Operating Cost | 7 GPH @ $2.50 & 0 0 $0.00 | $17.50 | Estimated cost Per Hr |
| | Loss to Evaporation, Drift and Leaks | $2.54 | 14.50% |
| | Loss to Displaced Water Dist DU *95%* | $5.06 | 28.90% |
| | Total $ Losses /Hr | $7.59 | 43.40% |

| | | |
|---|---|---|
| Savings | Potential Water Savings (million gal. / crop) | 12.91 |
| | Potential Reduced Pumping Hrs. (per crop) | 239.1 |
| | Potential Savings (via reduced per crop) | $4,184 |
| | Actual Water Savings (million gal. per crop) | NA |

Present End Gun Rotation



Recommended End Gun Rotation



Distribution Uniformity (DU%) measured here is expressed as the percent ratio of the average depth of the low quarter of the catches to the overall average: DU= LQ/M, where: LQ=average of the lowest 1/4 of the irrigation amounts: M=average of all irrigation amounts. Potential Water Savings, Reduced Pumping Hours, and Potential Savings are based on Mobile Irrigation Lab Standards, and USDA / NRCS Irrigation Standards for crop water use. Actual Water Savings are based on the Post DU%

**Date of Eval:**

**April 1, 2010**

**Application Chart**

| Percent Timer Setting | Hours Per Revolution @ Rotation | Avg. Inches per Rotation (Potential) | Avg. In. @ 5% Loss (Overcast) | Avg. In. @ 10% Loss (Sunny, Calm) | Avg. In. @ 15% Loss (Sunny, Windy) |
|---|---|---|---|---|---|
| 100 | 11.11 | 0.16 | 0.15 | 0.14 | 0.13 |
| 95 | 11.69 | 0.17 | 0.16 | 0.15 | 0.14 |
| 90 | 12.34 | 0.17 | 0.17 | 0.16 | 0.15 |
| 85 | 13.07 | 0.18 | 0.18 | 0.17 | 0.16 |
| 80 | 13.88 | 0.20 | 0.19 | 0.18 | 0.17 |
| 75 | 14.81 | 0.21 | 0.20 | 0.19 | 0.18 |
| 70 | 15.87 | 0.22 | 0.21 | 0.20 | 0.19 |
| 65 | 17.09 | 0.24 | 0.23 | 0.22 | 0.21 |
| 60 | 18.51 | 0.26 | 0.25 | 0.24 | 0.22 |
| 55 | 20.19 | 0.29 | 0.27 | 0.26 | 0.24 |
| 50 | 22.21 | 0.31 | 0.30 | 0.28 | 0.27 |
| 45 | 24.68 | 0.35 | 0.33 | 0.31 | 0.30 |
| 40 | 27.77 | 0.39 | 0.37 | 0.35 | 0.33 |
| 35 | 31.73 | 0.45 | 0.43 | 0.40 | 0.38 |
| 30 | 37.02 | 0.52 | 0.50 | 0.47 | 0.45 |
| 25 | 44.43 | 0.63 | 0.60 | 0.57 | 0.53 |
| 20 | 55.54 | 0.79 | 0.75 | 0.71 | 0.67 |
| 15 | 74.05 | 1.05 | 1.00 | 0.94 | 0.89 |
| 10 | 111.07 | 1.57 | 1.49 | 1.41 | 1.34 |
| 5 | 222.14 | 3.14 | 2.99 | 2.83 | 2.67 |
| 1 | 1110.70 | 15.71 | 14.93 | 14.14 | 13.36 |

Percentages of loss according to weather conditions is determined by current and actual conditions as measured by the Mobile Irrigation Lab in numerous irrigation system evaluations. However due to the unpredictability of the changing weather conditions, these losses are only a guide for your scheduling. Irrigation during the night time hours will be the most efficient.

### 6.7.1.2 Microirrigation System Evaluation

# IRRIGATION SYSTEM EVALUATION REPORT

AND

# IRRIGATION WATER MANAGEMENT PLAN

## Hurry I. Dry Grove

Need Water Rd

Manatee County, FL

Report Date: October 1, 2009

Prepared by:
NRCS Mobile Irrigation Lab

USDA/NRCS
State Office
2614 NW 43rd Street
Gainesville, FL 33873
Tel. 352-338-9562

USDA NRCS
United States Department of Agriculture
Natural Resources Conservation Service

USDA NRCS
United States Department of Agriculture
Natural Resources Conservation Service

2614 NW. 43rd Street
Gainesville, FL 33873
Phone 352-338-9562
FAX 352-338-9578

# Irrigation System Evaluation Report

October 1, 2009

Hurry I. Dry
Duette, FL

Dear Mr. Dry:

Thank you very much for your interest in water conservation. The results of the evaluation of the irrigation systems at the Need Water Road grove in Manatee County, FL are enclosed.

This report includes an Irrigation Water Management (IWM) Plan, a list of problems found during the evaluation, and improvement recommendations. The IWM Plan includes an irrigation scheduling guide for each grove. The scheduling guides indicate the duration and frequency of irrigation, and delay days after rainfall. These guides were developed based on current field and system conditions specific to this site and are the first step toward Irrigation Water Management (IWM). Adjustments to these guides will be necessary as you evaluate your crop's response to irrigation. A new scheduling guide should be created any time changes are made to the irrigation system.

The Natural Resources Conservation Service (NRCS) recommend the use of soil moisture sensors such as tensiometers as a valuable tool to improve your irrigation water management. Please let us know if you need assistance in the use of these devices.

Call the NRCS Mobile Irrigation Lab at 352-338-9562 for questions about this report or other irrigation water management issues.

Sincerely,

Erie Gator
Agricultural Engineer
NRCS Mobile Irrigation Lab

United States Department of Agriculture
NRCS Natural Resources Conservation Service

**Hurry I. Grove**
Need Water Rd
Manatee County, FL

**EMISSION UNIFORMITY (EU)**

| Grove | Evaluation Date | System Pressure | EU |
|---|---|---|---|
| Need Water Rd Grove | October 1, 2009 | 21 psi | 86 % |

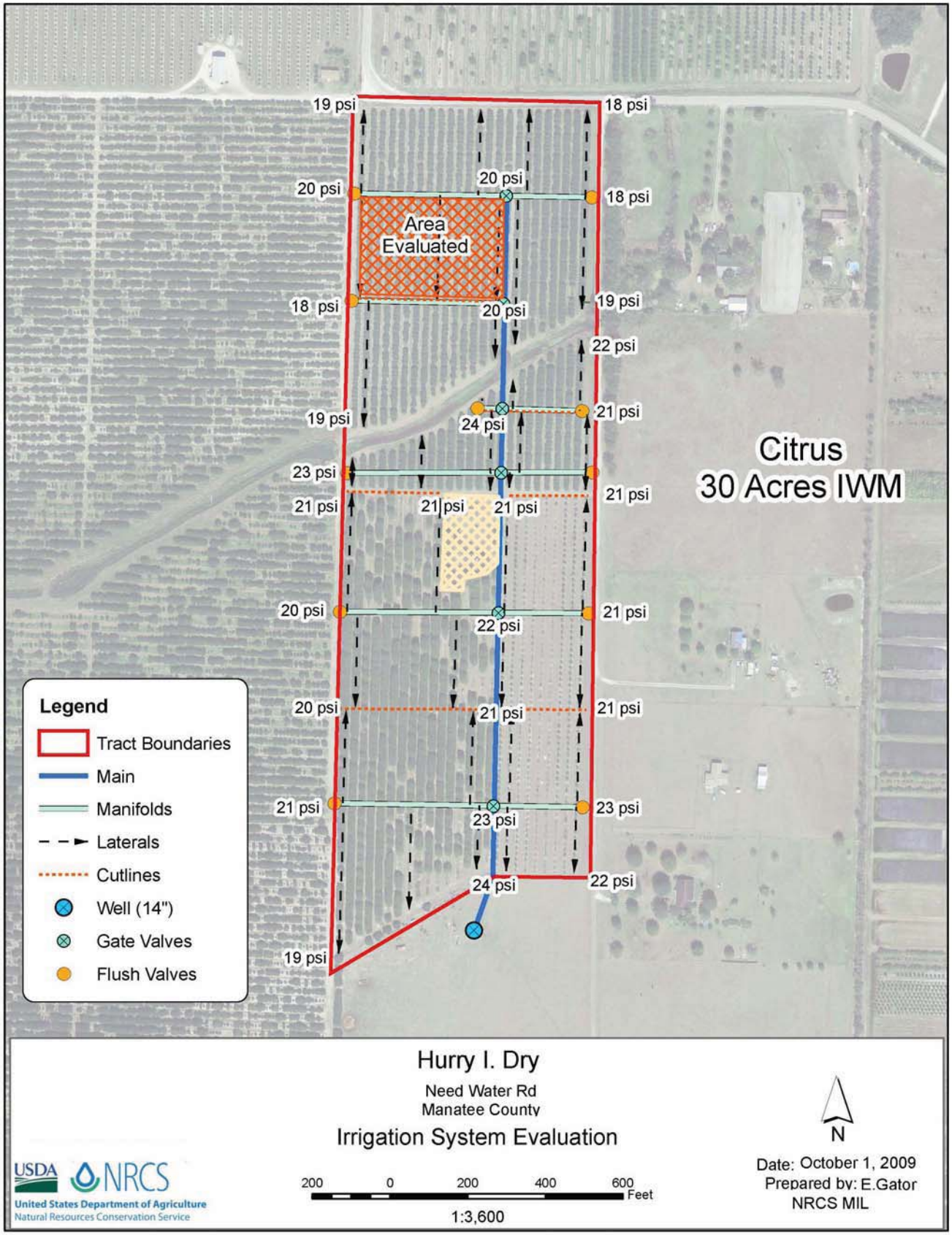
## Problems and Recommendations

**Clogged Emitters** - Many emitters were clogged, especially at the ends of the lateral lines. Clogging can be reduced by flushing the laterals more often, using self-flushing end caps, or in severe cases, injecting chlorine, with the injection program based on sulfide and iron concentrations.

**Mixed Emitters** - Emitters with differing discharge rates are being used. The system design should be reviewed to determine the correct discharge rate and number of emitters to use. Using the correct emitter is necessary to allow good pressure and flow distribution for a particular pipe design. One model of emitter should be used throughout the system, since different models and makes could have different flow rates.

**Broken Pipes and Leaks** - Cuts and breaks were found in the lateral lines. Even small leaks can significantly reduce pressure in downstream sections. Repairing breaks will improve discharge uniformity and increase overall pressure.

**Bad Filter Gauges** - The pressure gauges before and after the filter are not working and should be replace. These gauges provide and indication of the system pressure and the condition of the filter. A drop of more than 5 psi across the filter is an indication that the filter is clogged and should be flush and/or clean.


19 psi
18 psi
20 psi
20 psi
18 psi
Area
Evaluated
18 psi
20 psi
19 psi
22 psi
19 psi
24 psi
21 psi
23 psi
21 psi
21 psi
21 psi
21 psi
Citrus
30 Acres IWM
20 psi
22 psi
21 psi
20 psi
21 psi
21 psi
21 psi
23 psi
23 psi
24 psi
22 psi
19 psi
Legend
Tract Boundaries
Main
Manifolds
Laterals
Cutlines
Well (14")
Gate Valves
Flush Valves
Hurry I. Dry
Need Water Rd
Manatee County
Irrigation System Evaluation
USDA
NRCS
United States Department of Agriculture
Natural Resources Conservation Service
200 0 200 400 600 Feet
1:3,600
N
Date: October 1, 2009
Prepared by: E.Gator
NRCS MIL

USDA NRCS
United States Department of Agriculture
Natural Resources Conservation Service

2614 NW. 43rd Street
Gainesville, FL 33873
Phone 352-338-9562

**Hurry I. Dry Grove**
Need Water Rd, Manatee County
October 1, 2009

USDA NRCS
United States Department of Agriculture
Natural Resources Conservation Service

2614 NW. 43rd Street
Gainesville, FL 33873
Phone 352-338-9562

**Hurry I. Dry Grove**
Need Water Rd, Manatee County
October 1, 2009

United States Department of Agriculture
NRCS Natural Resources Conservation Service

NRCS Mobile Irrigation Lab (MIL)
2614 NW 43rd Street
Gainesville, FL 32606
Tel: (352) 338-9562

# MICROIRRIGATION EVALUATION Ver 1.1

## IDENTIFICATION

| | | | |
|---|---|---|---|
| Farmer/Operator: | Hurry I. Dry | Technicians: | Erie Gator |
| Address: | Need Water Rd | Date: | 10/1/09 |
| | Home Grove | Evaluation Date: | 10/1/09 |
| Phone: | | Field Office: | Sarasota |
| County: | Manatee | Field ID: | Home |
| Field Area (acres): | 30.0 | Field No: | All |
| Filename: | | | |

## SYSTEM INVENTORY

| | | | |
|---|---|---|---|
| **SYSTEM** | | | |
| Type (Drip, Spray or Line Source): | Spray | Age (years): | 5+ |
| **EMITTER** | | Make: | Maxijets |
| Type: | Yellow | Pressure Compensating (Y or N): | N |
| Model: | 14 -Stream | Design Discharge (gph): | 19.8 |
| Design Pressure (psi): | 20 | Spacing (ft): | 10 |
| Number of Emitters per plant: | 1 | Discharge Exponent (Blank=unk.): | |
| **SYSTEM DATA** | | | |
| Pump rpm | 1600 | Capacity (gpm): | ? |
| Flow Meter? (Y or N): | N | Number of Zones: | 1 |
| **LATERAL (TUBING)** | | Length (ft): | |
| Number of laterals/row: | 1 | Inside Diameter (in): | 1.049 |
| **CHEMIGATION** | | | |
| Fertilizer? (Y or N) | Y | Chlorine or Acid? (Y or N): | Y |
| **FILTERS** | | | |
| Sand Media? (Y or N) | N | Screen? (Y or N): | Y |
| Centrifugal Separator? (Y or N): | N | Automatic flushing? (Y or N): | N |
| **PRESSURE REGULATED** | | | |
| Automatic at head? (Y or N): | N | Manual Throttle at Head? (Y or N): | Y |
| At entrance to manifolds? (Y or N): | N | At Entrance to Laterals? (Y or N): | Y |
| **CROP** | | | |
| Type: | Citrus | Transpiration Ratio (1 to 1.1): | 1.11 |
| Row spacing (ft): | 25 | Plant Spacing (ft): | 10 |
| Canopy Dimensions (ft): Diameter | 16.00 | Age (years) | 5+ |
| Length | | (months) | |
| Width | | Root Depth (in): | 18 |
| Peak Water Requirement (in/day): | 0.19 | Annual Irrigation Required (in/yr): | 15.83 |
| **SOIL** | | | |
| Series: | 45-Tavares | Texture: | FS |
| Water Holding Capacity (in/in): | 0.04 | | |
| **IRRIGATION OPERATION** | | | |
| Peak Irrigation Duration (hrs): | 4 | Frequency (whole days): | Tens. |
| MAD (Management Allowed Deficit) (%): | 50 | | |
| **WATER SOURCE** -(well or surface): | 14" - Well | **PUMP TYPE:** | Turb |

United States Department of Agriculture
NRCS Natural Resources Conservation Service

| FARM IRRIGATION RATING METHOD - FLORIDA (FIRM-FL) Ver. 1.0 | | |
|---|---|---|
| Cooperator: | Hurry I. Dry | |
| Farm Name/Field No.: | Home Grove | |
| Identification No.: | | |
| Location: | Need Water Road | |
| County: | Manatee | |
| Soil and Water Conservation District: | | |
| Water Management District: | | |
| Field Office: | NRCS MIL | |
| Prepared by: | Erie H. Gator | |
| Date: | 10/1/09 | |
| Checked by : | EOC | |
| Date: | 10/1/09 | |
| | | |
| | **Present** | **Improved** |
| Type of Irrigation System | Microirrigation-Spray | Microirrigation-Spray |
| POTENTIAL EFFICIENCY (E) | Microirrigation-Spray = 0.85 | Microirrigation-Spray = 0.85 |
| Measuring Devices (Md) | None = 0.90 | Farm Delivery = 0.98 |
| Soil Moisture Monitoring and Scheduling (S) | Soil Moisture Monitoring and Scheduling = 1.00 | Soil Moisture Monitoring and Scheduling = 1.00 |
| Irrigation Skill (I) | Full time, Trained/Auto = 1.00 | Full time, Trained/Auto = 1.00 |
| Maintenance (M) | Good = 0.950 | Excellent = 0.975 |
| Water Delivery (W) | Unrestricted = 1.00 | Unrestricted = 1.00 |
| Soil Condition (Sc) | All Other Land Use = 1.00 | All Other Land Use = 1.00 |
| **MANAGEMENT ELEMENT(Md)(Sx)(I)(M)(W)(Sc)** | 0.86 | 0.96 |
| Sprinkler: Use Only (F)(U)(D)(C)<br>Subirrigation: Use Only(F)(U)(D)(L)(T)<br>Microirrigation: Use Only (F)(A)(D)<br>Surface: Use Only (F)(U)(L)(T) | Microirrigation-Spray | Microirrigation-Spray |
| Farm Conveyance (F) -----> | Underground Pipeline - Leak = 0.95 | Underground Pipeline - Sound =1.00 |
| Uniformity (U) | | |
| % Root Zone Wetted (A) -----> | Tree & Shrub 40% = 0.95 | Tree & Shrub 40% = 0.95 |
| Delivery (D) -----> | Variance of emit. discharge rates+/- 10%=1.00 | Variance of emit. discharge rates+/- 5%=1.05 |
| Land Surface (L) | | |
| Tailwater Loss - % of Water Applied | | |
| % of Tailwater Reused | | |
| Tailwater (T) | | |
| Climate Effect (C) | | |
| **SYSTEM ELEMENT** | | |
| Sprinkler-(F)(U)(D)(C) | | |
| Subirrigation-(F)(U)(D)(L)(T) | | |
| Microirrigation-(F)(A)(D) | 0.90 | 1.00 |
| Surface-(F)(U)(L)(T) | | |
| **FIRM-(E)x(ManagementElement)x (System Element)** | 0.66 | 0.81 |
| Normal Net Irrigation Requirement (in.) | 15.8 | 15.8 |
| **Gross Irrigation Requirement (inches) NNIR/FIRM** | 24.1 | 19.5 |
| **Water Conserved (Present - Improved) (in.)** | 4.6 | |
| Area Irrigated (acres) | 30.0 | |
| **Total Water Conserved (ac-in)** | 137.9 | |

Available Water Capacity—Manatee County, Florida
(Hurry I. Dry)

USDA Natural Resources Conservation Service

Web Soil Survey
National Cooperative Soil Survey

8/31/2009
Page 1 of 4

# Available Water Capacity

| Available Water Capacity— Summary by Map Unit — Manatee County, Florida | | | | |
|---|---|---|---|---|
| Map unit symbol | Map unit name | Rating (centimeters per centimeter) | Acres in AOI | Percent of AOI |
| 18 | Delray-Pomona complex | 0.12 | 4.0 | 12.8% |
| 36 | Orlando fine sand, moderately wet, 0 to 2 percent slopes | 0.06 | 6.9 | 22.2% |
| 45 | Tavares fine sand, 0 to 5 percent slopes | 0.04 | 19.7 | 63.7% |
| 55 | Zolfo fine sand, 2 to 5 percent slopes | 0.07 | 0.4 | 1.2% |
| **Totals for Area of Interest** | | | **30.9** | **100.0%** |

## Description

Available water capacity (AWC) refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in centimeters of water per centimeter of soil for each soil layer. The capacity varies, depending on soil properties that affect retention of water. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure, with corrections for salinity and rock fragments. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. It is not an estimate of the quantity of water actually available to plants at any given time.

Available water supply (AWS) is computed as AWC times the thickness of the soil. For example, if AWC is 0.15 cm/cm, the available water supply for 25 centimeters of soil would be 0.15 x 25, or 3.75 centimeters of water.

For each soil layer, AWC is recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

## Rating Options

*Units of Measure:* centimeters per centimeter

*Aggregation Method:* Dominant Component

*Component Percent Cutoff:* *None Specified*

*Tie-break Rule:* Higher

*Interpret Nulls as Zero:* No

*Layer Options:* Depth Range

*Top Depth:* 0

*Bottom Depth:* 18

## MAP LEGEND

**Area of Interest (AOI)**

- Area of Interest (AOI)

**Soils**

- Soil Map Units

**Soil Ratings**

- <= 0.04
- > 0.04 AND <= 0.06
- > 0.06 AND <= 0.07
- > 0.07 AND <= 0.12
- Not rated or not available

**Political Features**

- Cities

**Water Features**

- Oceans
- Streams and Canals

**Transportation**

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

## MAP INFORMATION

Map Scale: 1:3,640 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 17N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Manatee County, Florida
Survey Area Data: Version 6, Oct 3, 2008

Date(s) aerial images were photographed: 8/8/2007

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

# Hurry I. Dry Grove - Need Water Rd

## System Information

| | | | |
|---|---|---|---|
| **Crop** | Citrus | **Peak Water Requirement** | 0.19 in/day |
| **Soil** | Tavares | **Wetted Diameter (Area)** | 16 ft ( 201 $ft^2$ ) |
| **Water Source** | 16" Well | **Canopy Diameter (Area)** | 16 ft ( 201 $ft^2$ ) |
| **Pump rpm** | 1600 | **Emitters per Tree** | 1 |
| **Filter** | Screen | **Emitter Type** | Maxi - Yellow (Mix) |
| **Zones** | 1 | **Net Average Discharge** | 15.64 gph |
| **Total Acres** | 30 | **Spacing (Row x Trees)** | 25 ft x 10 ft |
| **Trees Age** | 5 yrs + | **Root Depth** | 18 in |
| **System Pressure** | 21 | **Water Holding Capacity** | 0.04 in/in |

## Irrigation Scheduling Guide

| | Irrigation | | | Rainfall | |
|---|---|---|---|---|---|
| | **Management Allowed Deficit** | **Operating Time*** | **Interval** | **Delay per 1/4 inch rainfall** | **Maximum Delay** |
| **Month** | **(%)** | **(Hrs:Min)** | **(Days)** | **(Days)** | **(Days)** |
| January | 30 | 1:45 | 4 | 4 | 4 |
| February | 30 | 1:45 | 3 | 4 | 3 |
| March | 30 | 1:45 | 3 | 3 | 3 |
| April | 30 | 1:45 | 2 | 2 | 2 |
| May | 30 | 1:45 | 2 | 2 | 2 |
| June | 30 | 1:45 | 1 | 2 | 1 |
| July | 50 | 3:00 | 2 | 2 | 2 |
| August | 50 | 3:00 | 2 | 2 | 2 |
| September | 50 | 3:00 | 3 | 2 | 3 |
| October | 50 | 3:00 | 4 | 2 | 3 |
| November | 50 | 3:00 | 5 | 3 | 5 |
| December | 50 | 3:00 | 6 | 4 | 6 |

* Operating time rounded to the nearest 15 minutes.

USDA NRCS
United States Department of Agriculture
Natural Resources Conservation Service

NRCS Mobile Irrigation Lab
2614 NW 43rd Street
Gainesville, FL 32606
Tel: 352-338-9562

# Irrigation Water Management Plan

**Cooperator:** Hurry I. Dry
**Date:** October 1, 2009
**Location:** Need Water Rd
**Prepared by:** Erie Gator
**County:** Manatee
**Title:** Agricultural Engineer

Irrigation water management (IWM) is the process of determining and controlling the volume, frequency, and application rate of irrigation water in a planned and efficient manner. The objective is to maintain soil moisture at levels conducive to optimal plant growth and maximize irrigation efficiency. The most important aspect of IWM is to monitor the crop and soil moisture relationship. This can better be accomplished by the use of soil moisture sensors such as tensiometers.

This IWM plan describes the techniques and strategies you will use to determine when and how much to irrigate. Changes in the system would affect the recommended operating times. If changes are made to the irrigation system, a new evaluation should be made. If you would like to change or correct this IWM Plan, please let us know by calling your NRCS Service Center.

| Irrigation system type | Uniformity of water application will be determined by |
|---|---|
| X Sprayjets | X System evaluation |
| Sprinkler | X Observation of water distribution |
| Drip | X Observation of wetted area |
| Subsurface | X Periodic pressure measurement |
| **Water Source** | **Runoff caused by irrigation will be estimated by** |
| X 14" Well | Measurement of stream size |
| Surface | Observation |
| Other | X Does not occur |
| **Method used to determine when to irrigate** | **Method used to determine quantity of water needed** |
| X Tensiometers | X Tensiometers |
| Evaporation pan | X Soil feel and appearance |
| X Soil feel and appearance | X Leaf wilt |
| X Leaf wilt | X Scheduling guide |
| X Scheduling guide | Water table depth |
| X Rainfall | X Rainfall |
| **Application rate will be determined by** | **Soil erosion caused by irrigation will be estimated by** |
| X System evaluation | Measurement |
| X Emitter or sprinkler specs | Observation |
| Flowmeter | Calculation |
| X Manifold Pressure | X Does not occur |

## Method Used to Determine When to Irrigate

The need for irrigation will be determine by the use of tensiometers, weather conditions, leaf wilt, and feel and appearance method. The Irrigation Scheduling Guide provided for each zone indicates the duration and frequency of irrigation, and delay days after rainfall.

The Irrigation Guides were developed base on field and system conditions specific for the site and are the first step toward Irrigation Water Management (IWM). Adjustments to these guides will be necessary as you evaluate your crop's response to irrigation.

During the bloom and fruit set period irrigation is applied when the six-inch tensiometers reach 15 centibars (cb). During the remainder of the year irrigation is applied at 20 cb.

The operating time can also be modified by the use of tensiometers that reach the bottom of the root system. For citrus, 18-inch tensiometers are suitable for this use. Operating time can be decreased if the 18-inch tensiometers drop below 10 cb and increased if readings rise above 15 cb during the bloom and fruit set period. During the rest of the year, operating time can be decreased if the 18-inch tensiometers drop below 10 cb and increased if they rise above 20 cb. These are general guidelines that may vary by soil type.

## Method Used to Determine Quantity of Water Needed

The approximate number of hours to operate the system for water to reach the depth of the root zone is shown on the irrigation guide and on the above table. The schedule will be modified based on tensiometer readings, observations of the soil, and weather conditions. If it is necessary to follow a set schedule for the days to irrigate, for example, two times per week, then the duration of the irrigation is adjusted based on the observations of leaf wilt and soil moisture at the next scheduled irrigation time.

These are estimates that are to be confirmed or modified, based on observations of soil and weather conditions.

## Climatic Data

Local climatic data was used to develop the scheduling guide. Modifications to the scheduling guide could be made by tracking current weather conditions. Additional and current weather information related to agricultural operations could be obtain at the Florida Automated Weather Network (FAWN) website at:

**http://fawn.ifas.ufl.edu/**

## Application Rate and Uniformity of Application

Individual sprayjet flow measurements will be conducted periodically to ensure proper application rate. The application rate could also be verified by the use of a flowmeter for a zone. The number of emitters within a zone should deliver a consistent volume within a period of time.

System pressure and emitter wetted pattern will be monitored to ensure current application rate. Manifold pressure should be check occasionally for proper sprayjet operation at or near the 20 psi range. Frequent pressure checks and the use of pressure gauges in key places of your system (e.g. pump and filters) will help recognize and solve problems. A pressure drop of 5 psi or more across the filter indicates that the filter is clogged.

Checking for leaks and observing the diameter and uniformity of coverage of the spray patterns will help maintain system performance. Cleaning clogged emitters and replacing broken emitters with emitters of the same type will maintain system uniformity.

Follow the Operation and Maintenance (O&M) provided with your Conservation Plan folder to ensure your system is operating properly.

| | **Need Water Rd Grove** |
|---|---|
| **Crop** | Citrus |
| **Net Irrigation Requirement** | 15.83 in/yr |
| **System Emission Uniformity (EU)** | 86% |
| **Potential Application Efficiency ( = EU x 0.9 )** | 77% |
| **Present Operating Pressure** | 21 psi |
| **Soil Type** | Tavares FS |
| **Soil Water Holding Capacity** | 0.04 in/in |
| **Root Zone Depth** | 18" |
| **Water Content at Field Capacity** | 0.72" (90 Gal) |
| **Wetted Diameter (Area)** | 16' (201 $ft^2$) |
| **Canopy Diameter (Area)** | 16' (201 $ft^2$) |
| **Emitter Type** | Maxijet - Yellow 360 |
| **Net Average Emitter Discharge** | 15.64 gph |
| **30 % Depletion** | 0.22" (27 Gal) |
| **Operating Time to Replace 30 %** | 1 Hr - 45 mins |
| **50 % Depletion** | 0.36" (45 Gal) |
| **Operating Time to Replace 50 %** | 3 Hrs |

## Runoff and Soil Erosion

By maintaining vegetative cover and accurate irrigation scheduling, runoff and erosion will be kept to a minimum. Flush valve areas will be monitored to prevent soil erosion.

## Operation and Maintenance

Frequent maintenance is essential to keep emitters functioning at design flow. Typical maintenance items include but are not limited to:

- Flush lateral lines at least annually.
- Check applicator discharge often. Cleaning clogged emitters and replacing broken emitters with the same type will maintain system uniformity.
- Frequent pressure checks and the use of pressure gauges in key places of your system (e.g. pump and filters) will help recognize and solve problems. A pressure drop of 5 psi or more across the filter indicates that the filter is clogged.
- Check pressure gauges to ensure proper operation; repair/replace damaged gauges.
- Inject chemicals as required to prevent precipitate buildup and algae growth.
- Check and assure proper operation of backflow protection devices.
- Check emitter integrity often to ensure proper performance. Emitter stake should be straight and weeds should be control to maintain good wetted area and pattern.
- Perform all operations in a safe manner and in accordance with all applicable safety regulations.

### 6.7.2.1 Urban Irrigation System Evaluation

**Name of SWCD**
**Mobile Irrigation Laboratory**
Address
Phone Number

June 14, 2006

Landowner
Address

Dear Mr. Landowner:

Thank you for participating in the MOBILE IRRIGATION LABORATORY EVALUATION PROGRAM. This program is designed to evaluate how well your irrigation system is operating and to offer guidance on managing the system. Our goal is to assist in determining the proper amount of water required by the landscape while, at the same time, conserving water.

This program is operated by the XXX SOIL and WATER CONSERVATION DISTRICT in cooperation with the NATURAL RESOURCES CONSERVATION SERVICE. This project is funded by the SOUTH FLORIDA WATER MANAGEMENT DISTRICT and FLORIDA DEPARTMENT OF AGRICULTURE AND CONSUMER SERVICES.

Field observations were made to determine the uniformity and efficiency of the irrigation system. These observations allow us to make recommendations that should enhance the landscape and conserve water. The estimated efficiency of your system was 65%. By improving the uniformity of the system it can be run for less time and therefore use less water and money. Please review the following pages of information and recommendations on your sprinkler system.

If you need additional information, please contact me at XXX-XXXX.

Sincerely,

Your Name

M.I.L. Coordinator

## IRRIGATION SYSTEM INFORMATION

**Fully automatic** - Your irrigation system is fully automatic. The controller selects the number of days between irrigations, time to start the irrigation for each zone, and the amount of time to irrigate each zone.

In order to conserve water and maintain a healthy landscape, adjustments to the controller are required. These adjustments include:
1) Changing the number of days between irrigations as the seasons (and water needs) change.
2) Adjusting the number of days between irrigations when there is rainfall between irrigations.

Your **Rain Sensor**, which can automatically delay the start of the system based on rainfall, is set too low. The sensor will prevent the system from watering during the rain or too soon after the rain without any manual adjustments to the controller. For best results the mounting location, the shut-off setting, and the vent setting are all important. Mount the rain sensor in a location that will receive direct rainfall and sunlight, will not receive water from the sprinkler system, and is not close to the air conditioner's exhaust fan. A shut-off setting of 0.5 inches will shut the system down as soon as the lawn has received sufficient rainfall. Keeping both of the bottom vents closed will prevent the system from coming on too soon after the rainfall.

The distribution uniformity (D.U.) is a measure of how evenly the water is applied over the area being irrigated. A well designed irrigation system under optimum conditions will have a D.U. of 85%. As the D.U. decreases, the efficiency of the system decreases since some of the plants or turf areas will receive insufficient water and others will be over watered. Recommended values of D.U. are a function of the value of the plants being grown (See table below).

| Type of Vegetation Recommended | D.U. |
|---|---|
| High value plants (ornamental, greens) with little supplemental rainfall. | DU > 80% |
| Typical. (Lawn) | 70% - 80% |
| Deep rooted plants (trees, deep rooted grasses) where supplemental rainfall is substantial. | 55% - 70% |

The estimated efficiency of your system was 65%. With some adjustments the system could be operating with an efficiency of 75%. Once the system adjustments and schedule adjustments are made, the water savings could be 94,074 gallons per year. You have immediate water saving of 133,681 gallons from changes to your zone run times on your controller. Irrigation time can be reduced by increasing the uniformity. Please see our recommendations listed below.

OUR RECOMMENDATIONS ARE:

Please note: The recommendations given below should help to improve the uniformity of your system. In some cases, the changes that are recommended will increase or decrease the output of a zone. These kinds of changes may adversely affect your system. If you are unsure, please contact a licensed irrigation contractor. For a list of licensed irrigation contractors in your area, you can contact the Florida Irrigation Society at 1-800-441-5341.

## PLANTS

Plants recommended for Southwest Florida landscapes are considered "natural" by the SFWMD plant guide. This means that once established, they will survive on natural rainfall alone. Significant reductions in water consumption will occur if entire zones are landscaped with natural shrubs and ground covers. These zones can then be skipped during most irrigation cycles.

### ZONE 1
(Front landscaping and front left lawn)

**Obstructed sprinklers -** Some of the sprinklers were blocked or covered by turf, blocked by plants, and/or blocked by other items. Clearing around, raising up, or moving the sprinkler heads will help the obstructed sprinklers.

**Excessive water overflow** - A significant amount of irrigation water is being applied into your landscaping areas between the sidewalk and house. The sprinklers should be adjusted to prevent wasting water.

**Plant beds with lawn area** - Plant beds generally require less water than lawn areas. Separate irrigation zones should be used for optimum watering efficiency. With established plantings it may be possible to turn off or cap the sprinklers in the plant beds because these plants can survive on natural rainfall.

Four steps to improve the watering efficiency of this zone:

1) I recommend closing the front (SST) nozzle by the Liriope grass in the front landscaping area.
2) I recommend raising some of the lawn pop-up spray heads so they can pop up through the grass and water evenly.
3) I recommend a 20 minute run time for this zone.
4) This zone was set at 30 minutes from 60 minutes for an immediate savings of 35,444 gallons per year.

### ZONE 2
(Right side back spray heads)

**Obstructed sprinklers -** Some of the sprinklers were blocked or covered by turf, blocked by plants, and/or blocked by other items. Clearing around, raising up, or moving the sprinkler heads will help the obstructed sprinklers.

**Plant beds with lawn area** - Plant beds generally require less water than lawn areas. Separate irrigation zones should be used for optimum watering efficiency. With established plantings it may be possible to turn off or cap the sprinklers in the plant beds because these plants can survive on natural rainfall.

Four steps to improve the watering efficiency of this zone:

1) I recommend raising a few pop up spray heads so they pop up through the grass.
2) I recommend a 20 minute run time for this zone.
3) This zone was set at 30 minutes from 60 minutes with an immediate water savings of 34,472 gallons per year.
4) I recommend as you replace broken sprinklers to stay with the same type and same manufacture.

ZONE 3
(Front lawn left of driveway)

**Excessive pavement water overflow** - A significant amount of irrigation water is being applied onto the driveway and street. The wetting pattern of the sprinklers should be adjusted to prevent wasting water. Reducing the watering distance and reducing or changing the wetting patterns will reduce the pavement overflow.

**Sprinkler precipitation is not matched -** Sprinklers in the same zone with different watering patterns (i.e. full, half, and quarter circle patterns) need to have their nozzle sizes adjusted. One of the most common causes of low uniformity is due to mismatched sprinklers nozzles in an irrigation unit. For example, if a zone has a full circle sprinkler with a four gallon per minute nozzle then any half circle sprinklers should have a two gallon per minute nozzle, and any quarter circle sprinklers should have a one gallon per minute nozzle. Mismatched precipitation from the sprinklers may be caused by: 1) mixing sprinklers in a zone, 2) improper replacement of worn nozzles, 3) errors in installation or design.

Three steps to improve the watering efficiency of this zone:

1) I recommend using a larger nozzle in the one full circle rotor in the front lawn. I recommend a (6.0) Rain Bird 5000 series nozzle.
2) TO match precipitation rates I recommend using a (6.) Rain Bird 5000 nozzle in the full circle rotor on this zone. This may also help keep your pump from cycling on and off during the zones run period.
3) I recommend a 60 minute run time for this zone.

ZONE 4
(Left front lawn)

**Sprinkler precipitation is not matched -** Sprinklers in the same zone with different watering patterns (i.e. full, half, and quarter circle patterns) need to have their nozzle sizes adjusted. One of the most common causes of low uniformity is due to mismatched sprinklers nozzles in an irrigation unit. For example, if a zone has a full circle sprinkler with a four gallon per minute nozzle then any half circle sprinklers should have a two gallon per minute nozzle, and any quarter circle sprinklers should have a one gallon per minute nozzle. Mismatched precipitation from the sprinklers may be caused by: 1) mixing sprinklers in a zone, 2) improper replacement of worn nozzles, 3) errors in installation or design.

Three steps to improve the watering efficiency of this zone:

1) I recommend using a (6.0) Rain Bird 5000 series nozzle in the full circle rotor.
2) I recommend a 60 minute run time for this zone.
3) As you replace broken sprinklers stay with the same type and same manufacture throughout each zone.

ZONE 5
(Back right lawn area by shop)

**Excessive pavement water overflow** - A significant amount of irrigation water is being applied onto shop on the right side. Adjustments in the sprinkler system's design may be required.

**Sprinkler precipitation is not matched -** Sprinklers in the same zone with different watering patterns (i.e. full, half, and quarter circle patterns) need to have their nozzle sizes adjusted. One of the most common causes of low uniformity is due to mismatched sprinklers nozzles in an irrigation unit. For example, if a zone has a full circle sprinkler with a four gallon per minute nozzle then any half circle sprinklers should have a two gallon per minute nozzle, and any quarter circle sprinklers should have a one gallon per minute nozzle. Mismatched precipitation from the sprinklers may be caused by: 1) mixing sprinklers in a zone, 2) improper replacement of worn nozzles, 3) errors in installation or design.

Four steps to improve the watering efficiency of this zone:

1) I recommend replacing the one rotor sprinkler on the right side property line with two smaller Rain Bird 3500 series rotors next to the shop to eliminate watering onto the building.
2) I recommend spacing the new Rain Bird 3500 series rotors 15'-20' apart next to the shop set at 180 degrees.
3) Since the distance to the adjoining property is less than 15 feet I recommend using (2.0) gallon 3500 series nozzles and tone down the streams so they water in your lawn only. This area would normally be irrigated by spray heads but since zone #5 is a rotor zone you must stay with rotor type sprinklers.
4) I recommend a 40 minute run time for this zone.

ZONE 6
(Back and back left)

**Obstructed sprinklers -** Some of the sprinklers were blocked or covered by turf, blocked by plants, and/or blocked by other items. Clearing around, raising up, or moving the sprinkler heads will help the obstructed sprinklers.

Four steps to improve the watering efficiency of this zone:

1) I recommend raising a few spray heads by the seawall and left back property line.
2) I recommend a 20 minute run time for this zone.
3) You may consider lowering the flow rate on the SST nozzle in the back planter.
4) Rain Bird (SST) Side strip nozzles apply 1.21 gallons per minute @ 30 psi. In a contained area that is a lot of water!

If you change any of the sprinklers to improve the watering efficiency of your system, be sure to use the same brand of sprinkler within each zone. Different sprinkler brands and different sprinkler types within the same zone will cause uniformity problems and therefore waste water.

Once a month you should check the sprinkler system. Turn on each irrigation zone and look for leaks, sprinklers that are not turning, sprinklers that are watering paved areas/buildings/the neighbors yard, grass and bushes that have grown over the sprinklers, and other things that will affect the system's performance. Five minutes of operating time for each zone is allowed for this inspection. Some problems can be corrected right away (such as wetting pattern adjustment), but for others you will probably want to take some notes and correct them later (such as broken pipes or sprinklers).

**PLEASE KEEP OUR FLORIDA CONSERVATION EFFORTS IN MIND AS YOU WATER.**
**FOR ALL WATERING GUIDELINES CALL S.F.W.M.D. 1-(239-338-2929)**

## RECOMMENDED IRRIGATION SCHEDULE

Based on the program's calculations of your current system, I recommend the following schedule for each zone. The operating times reflect the fact that sprayheads deliver more water than rotor sprinklers. This irrigation duration should allow for a deeper development of turf roots, greater soil moisture storage, and promote a more drought tolerant turf. Observe local water restrictions and regulations. **It is best to water during the morning hours before sunrise.**

ZONE 1: 20 minutes
ZONE 2: 20 minutes
ZONE 3: 60 minutes
ZONE 4: 60 minutes
ZONE 5: 40 minutes
ZONE 6: 20 minutes

Based on your lawn type and soil type, I recommend the following schedule for the number of days between water applications. The differences in the number of days between irrigations reflect the fact that less water is required during the winter months than the summer months. **Water can be applied by rainfall or your sprinkler system.**

| Month | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Irrigation Interval(days) | 5 | 4 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 4 | 4 |

This schedule alone represents a 33% reduction in water use versus your current schedule. Once the system adjustments mentioned above are made, even more water savings can be produced. A follow-up evaluation can be scheduled once the adjustments to your system and schedule are complete. The follow-up evaluation will allow us to show you how much water was saved by your adjustments.

When there is significant rainfall (greater than half an inch) between irrigations, do not use the sprinklers until the correct number of days have passed since the rainfall. This will require manual adjustments to automatic systems unless the system is equipped with a rain shut-off device.

**Monitor the appearance of your lawn and use this schedule as a guide for best results on your turf management.**

| Current Schedule | | | New Schedule | | |
|---|---|---|---|---|---|
| Zone | Run Time (min) | Irrigations per year | Run Time (min) | Irrigations per year | Water Savings (gallons) |
| 1 | 60 | 104 | 20 | 120 | 48194 |
| 2 | 60 | 104 | 20 | 120 | 50229 |
| 3 | 60 | 104 | 60 | 120 | -26770 |
| 4 | 60 | 104 | 60 | 120 | -26643 |
| 5 | 60 | 104 | 40 | 120 | -1204 |
| 6 | 60 | 104 | 20 | 120 | 50268 |

## WATER TEST RESULTS

Your irrigation water has been tested for Total Dissolved Solids (TDS) and pH. This test does not check for bacteria.

Water Analysis:

| | Tests Results | Normal Range |
|---|---|---|
| pH | 7.6 | 7.0-8.0 |
| TDS* | 3100 | <500 ppm |

* Total Dissolved Solids
(ppm) parts per million

The water analysis portion of the irrigation evaluation program was designed for use with irrigation systems in agriculture fields. The test results are provided for your general information. Please contact your local health department for testing water that is to be used in the home.

The following is a table of safe TDS levels for commonly grown plants:

| **Plant** | **TDS Level (ppm)** |
|---|---|
| Vegetables | <600 |
| Citrus foliage | <900 |
| Flowers, azaleas and tender plant foliage | <900 |
| Orchids | <300 |
| Succulent plants | <1200 |
| Bahia grass | <1500 |
| Root systems of woody plants, including citrus | <1800 |

St. Augustine grass will tolerate levels greater than 2,000 ppm, but injury may occur to surrounding shrubs.

## ST. AUGUSTINE GRASS BMP'S - "BEST MANAGEMENT PRACTICES"

MOW 3-4 INCHES HIGH - The higher a lawn is mowed, the deeper the root system will grow. A deep, extensive root system is able to reach moisture deeper in the soil and is more capable of withstanding damage from soil-borne pests like nematodes and root diseases. A high cut also shades and discourages weeds.

RECYCLE GRASS CLIPPINGS - Lawn clippings can be left on the lawn to recycle nutrients. A plastic bag full of grass clippings contains as much as 1/4 pound of organic nitrogen. Recycling clippings reduces the fertilizer needs of the lawn and also reduces solid waste loads to landfills.

FERTILIZE THE RIGHT WAY - A minimum of two fertilizations a year (March and September) may be all that is necessary to maintain your St. Augustine grass lawn. Apply a complete fertilizer such as 10-10-10 or 16-4-8. The last number on the fertilizer bag represents Potassium which supports root growth and drought resistance. The potassium level should never be less than half the amount of nitrogen. Additional applications of nitrogen may be made during the year if desired; however, maintenance requirements and pest problems will increase accordingly.

LET YOUR LAWN TELL YOU WHEN TO WATER - Your St. Augustine lawn will signal a need for water by folding the grass blades together. When 30%-40% of the lawn shows this symptom of wilt, it's time to water. Research has shown irrigating "as needed" can save significant amounts of water and will not diminish the quality of the lawn.

CONTROL PEST PROBLEMS - Nematodes are microscopic parasites that attack the roots of St. Augustine grass. This also diminishes the lawn's ability to absorb and conduct water. Watch for areas of lawn that wilt prematurely, thin out, and become weedy. A nematode test kit can be requested from the Cooperative Extension Service office in your county. Other insect pests of St. Augustine to watch out for are chinch bugs, caterpillars, and mole crickets.

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**SUMMARY TABLE**

| RECOMMENDED PRACTICE | OPERATOR PRACTICE Yes/No |
|---|---|
| Automatic system | Y |
| Rain shut off | Y |
| No systems leaks | Y |
| Rain gauge | N |
| Controller Battery Back-up | N |
| Allow the lawn to wilt between irrigations | N |
| Mulching | Y |
| Irrigation stream clear of obstacles | N |
| All sprinkler heads are from the same manufacturer | Y |
| Minimum pressure 25 psi | N |
| Sprinklers are undamaged and operating properly | Y |
| Head orientation (up-right) | Y |
| Proper coverage | Y |
| Matched emitters | N |
| Rotors are in separate zones from spray heads | Y |
| Plant beds are in separate zones from turf | N |

The summary table above lists some water conservation practices that, if followed, can decrease your water use. Practices that are currently being followed are indicated by the "Y" symbol.

## 6.8 Irrigation Water Management Plans

Irrigation water management is the process of determining and controlling the volume, frequency, and application rate of irrigation water in a planned, efficient manner. Crop, soil and irrigation system information is used to develop an irrigation schedule that maintains soil moisture at a level that is optimum for plant growth, without a loss of water, soil or plant nutrients.

As identified in the NRCS Conservation Practice Standard, Code 449, Irrigation Water Management, and the NEH, Part 652, NIG, Florida Supplement, Chapter 10. This chapter can be downloaded at the following web address: http://www.fl.nrcs.usda.gov/technical/irrigation.html

Florida Supplement to the Irrigation Guide, irrigation water management plans shall include the following as applicable:

1. Timing of irrigation.
2. Method for measuring soil moisture.
3. Method for adjusting irrigation to compensate for changes in the soil infiltration rate.
4. Method for evaluating irrigation system uniformity.
5. Method for measuring irrigation system application rate.
6. Method for evaluating soil erosion.
7. Method for adjusting the irrigation schedule(s) for chemical application.
8. Method for recognizing excess runoff.

### 6.8.1 Sample Irrigation Water Management Plan for Center Pivot Sprinkler Irrigation System

**IRRIGATION WATER MANAGEMENT PLAN**

| | |
|---|---|
| **DATE:** | 4/04 |
| **COOPERATOR:** | Hurry I. Dry |
| **LOCATION:** | Bellville |
| **FIELD NUMBERS:** | 1 |
| **CROP:** | Corn |
| **GROWING SEASON:** | February 15 – June 20 |
| **ROOTING DEPTH:** | 36 in |
| **PEAK CONSUMPTIVE USE RATE:** | 0.23 in/day |
| **IRRIGATION SYSTEM:** | Center pivot - 1314' span length, Pivot pressure = 38 psi, Capacity = 1100 GPM |
| **WATER SUPPLY:** | Well |
| **PREDOMINANT SOIL SERIES:** | Alpin sand |

**Table 1: Operating Times for Various Rooting Depths and 50%MAD**

| Crop | Rooting Depth (inches) | 1/ AWC (in) | 2/ MAD (in) | 3/ Gross Application Irrigation (in) | Critical Irrigation Period | 4/ Dial Setting | 4/ Time per Revolution (hours) |
|---|---|---|---|---|---|---|---|
| Corn | 12" | 0.67 | 0.34 | 0.40 | Tasseling through silk stage until kernels become firm | 88 | 20.60 |
| | 24" | 1.27 | 0.64 | 0.75 | | 47 | 38.57 |
| | 36" | 1.87 | 0.94 | 1.11 | | 32 | 56.66 |

1/ *Available Water Capacity within the root zone (AWC).*
2/ *Management Allowable Depletion (MAD)*
3/ *Application depth necessary to replace water used by crop assuming an application efficiency of 85%*
4/ *Calculated from manufacturer's data. This should be re-calculated after checkout or evaluation.*

**CURRENT MANAGEMENT PRACTICE:** None

**RECOMMENDATIONS:**

The most important aspect of irrigation water management is properly evaluating and monitoring the available soil moisture for the particular crop. By observing moisture levels in the soil, the operator can determine how long and how much water to apply. The landowner will be using the feel and appearance method. See attached feel and appearance worksheets.

The system is designed to meet peak consumptive use for corn on 125 acres.

Moisture should always be available above the MAD for the planned crops. The critical period is from tasseling through silk stage until the kernels become firm. The soil moisture should be checked to determine how much irrigation water should be applied for each irrigation. Prior to planting, or soon thereafter, the 12 inch root zone should be brought up to field capacity. If operated properly, irrigation can result in high crop production. The system should be managed to maintain a high moisture level in the root zone.

For planned crop yield, irrigation should commence when the available soil moisture drops below the MAD and should continue until the soil reaches field capacity. See Table 1 for how long to operate the system for various rooting depths and a MAD of 50%.

The irrigation system should be checked periodically to ensure proper operation of the pump, pipeline and sprinklers. No puddling should occur in the system. A visual inspection should be performed during operation to determine if any puddling or other irrigation-induced erosion is occurring. If so, increase the speed of the center pivot and the frequency of irrigation until no erosion occurs.

Check the condition of the crop to see if there is growth and if the crop looks consistent in color and height to determine adequacy and uniformity of the irrigation system.

Table 2 can be used to determine the time required per revolution, gross application and net application for various dial settings.

If there is change in the soil moisture monitoring method or irrigation method, contact the NRCS field office in Jasper, Florida.

**TABLE 2: Time Required per Revolution, Gross Application, and Net Application**

| Dial Setting | Time Required per Revolution-Hours | Gross Application inches | Net Application inches |
|---|---|---|---|
| 100 | 18.13 | 0.35 | 0.30 |
| 90 | 20.14 | 0.39 | 0.33 |
| 80 | 22.66 | 0.44 | 0.37 |
| 70 | 25.90 | 0.50 | 0.43 |
| 60 | 30.21 | 0.59 | 0.50 |
| 50 | 36.25 | 0.70 | 0.60 |
| 40 | 45.32 | 0.88 | 0.75 |
| 30 | 60.42 | 1.17 | 1.00 |
| 20 | 90.64 | 1.76 | 1.50 |
| 10 | 181.27 | 3.52 | 2.99 |

Cooperator: Hurry I. Dry Field No. 1 Location: Bellville

Format for figuring the net amount of water needed for an irrigation using the feel and appearance method of soil moisture measurements.

| 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|
| **Depth** | **Soil Series Alpin** | **Available Water Capacity** | **Soil Water Content Before Irrigation** | | **Soil Water deficiency** |
| **feet** | **Texture** | **inches** | **percent** | **inches** | **inches** |
| 0-1 | Coarse | 0.67 | | | |
| 1-2 | Coarse | 0.60 | | | |
| 2-3 | Coarse | 0.60 | | | |
| | | | | | |
| Total | | 1.87 | | | |

Column 1, the depth increment sampled.

Column 2, the soil texture of the sample.

Column 3, the available water capacity based on the texture of the sample.

Column 4, the percent of soil water content (remaining)

0-25% - AWC - Dry, loose, will hold together if not disturbed, loose sand grains on fingers with applied pressure.

25-50% - AWC – Slightly moist, forms a very weak ball with well-defined finger marks, light coating of loose and aggregated sand grains remains on fingers.

50-75% - AWC Moist, forms a weak ball with loose and aggregated sand grains, darkened color, moderate water staining on fingers, will not ribbon.

75-100% - AWC – Wet, forms a weak ball, loose and aggregated sand grains remain on fingers, darkened color, heavy water staining on fingers, will not ribbon.

100% - AWC – Wet, forms a weak ball, moderate to heavy soil/water coatings on fingers, wet outline of soft ball remains on hand.

Column 5, Column 3 x Column 4, the soil-moisture balance, inches.

Column 6, Column 3 - Column 5, soil-moisture deficiency or net irrigation requirement.

### 6.8.2 Sample Irrigation Water Management Plan for Traveling Gun Sprinkler Irrigation System

**IRRIGATION WATER MANAGEMENT PLAN**

| | |
|---|---|
| **DATE:** | 4/04 |
| **COOPERATOR:** | T.O. Dry, Jr. |
| **LOCATION:** | T1N,R12E,S14, S.W. Jasper & S. of SR 6 |
| **FIELD NUMBER:** | 1 |
| **CROP:** | Watermelons |
| **GROWING SEASON:** | March 15 – June 15 |
| **ROOTING DEPTH:** | 36 in |
| **PEAK CONSUMPTIVE USE RATE:** | 0.19 in/day |
| **IRRIGATION SYSTEM:** | Cable tow traveling gun with a 418 ft. wetted diameter and 260' lane spacing using a Nelson 200 gun, 1.5-inch nozzle, 24 degree, at 85-psi nozzle pressure. Capacity = 460 GPM |
| **WATER SUPPLY:** | 10” diameter well |
| **PREDOMINATE SOIL SERIES:** | Alpin sand |

**Table 1: Operating Times for Various Rooting Depths and 50% MAD**

| Crop | Rooting Depth (inches) | 1/ AWC (inches) | 2/ MAD (in) | 3/ Gross application per irrigation (inches) | Critical Irrigation Period | 4/ Travel Speed (ft/min) | 4/ Time per 660' (hr.) |
|---|---|---|---|---|---|---|---|
| Watermelons | 12” | 0.67 | 0.34 | 0.52 | Bloom to harvest | 5.46 | 2.01 |
| | 24” | 1.27 | 0.64 | 0.98 | | 2.90 | 3.79 |
| | 36” | 1.87 | 0.94 | 1.45 | | 1.96 | 5.61 |

1/ *Available Water Capacity within the root zone (AWC).*
2/ *Management Allowed Depletion (MAD) of 50%.*
3/ *Application depth necessary to replace water used by crop assuming an application efficiency of 65%.*
4/ *Some travelers will not reach the higher travel speeds. In this case, use the fastest speed available to keep water waste to a minimum.*

**CURRENT MANAGEMENT PRACTICE:** None

**RECOMMENDATIONS:**

The most important aspect of irrigation water management is properly evaluating and monitoring the available soil moisture for the particular crop. The feel and appearance method will be used for determining soil moisture and when irrigation is needed. See attached feel and appearance worksheets.

The system is designed to provide irrigation water to meet peak consumptive use for watermelons in field 1 provided the acreage grown is not increased beyond 40 acres.

Moisture should always be available above the MAD for the planned crops. The critical periods for adequate available water are from blossom to harvest. The soil moisture should be checked to determine how much irrigation water should be applied for each irrigation. Prior to planting, or soon thereafter, the 12 inch root zone should be brought up to field capacity. If operated properly, irrigation can result in high crop production. The system should be managed to maintain a high moisture level in the root zone.

For planned crop yield, irrigation should commence when the available soil moisture drops below the MAD and should continue until the soil reaches field capacity. See Table 1 for how long to operate the system for various rooting depths and a MAD of 50%.

The irrigation system should be checked periodically to ensure proper operation of the pump, pipeline, risers and traveling gun. A visual inspection should be performed during operation to determine if significant puddling, runoff or other irrigation induced erosion is occurring. If so, increase the speed of the traveling gun and the frequency of the irrigation until no erosion occurs.

Check the condition of the crop to ensure that growth is occurring and that the crop looks consistent in color and height to determine adequacy and uniformity of irrigation. If the application is not uniform, a system evaluation should be performed.

If there is change in the soil moisture monitoring method or irrigation method, the NRCS office in Jasper, Florida should be contacted.

Cooperator: _____ Field No. ____ Location: _____

Format for figuring the net amount of water needed for an irrigation using the feel and appearance method of soil moisture measurements.

| 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|
| **Depth** | **Soil Series Alpin** | **Available Water Capacity** | **Soil Water Content Before Irrigation** | | **Soil Water deficiency** |
| **feet** | **Texture** | **inches** | **percent** | **inches** | **inches** |
| 0-1 | Coarse | 0.67 | | | |
| 1-2 | Coarse | 0.60 | | | |
| 2-3 | Coarse | 0.60 | | | |
| | | | | | |
| Total | | 1.87 | | | |

Column 1, the depth increment sampled.
Column 2, the soil texture of the sample.
Column 3, the available water capacity based on the texture of the sample.
Column 4, the percent of soil water content (remaining)

0-25% - AWC - Dry, loose, will hold together if not disturbed, loose sand grains on fingers with applied pressure.

25-50% - AWC – Slightly moist, forms a very weak ball with well-defined finger marks, light coating of loose and aggregated sand grains remains on fingers.

50-75% - AWC Moist, forms a weak ball with loose and aggregated sand grains, darkened color, moderate water staining on fingers, will not ribbon.

75-100% - AWC – Wet, forms a weak ball, loose and aggregated sand grains remain on fingers, darkened color, heavy water staining on fingers, will not ribbon.

100% - AWC – Wet, forms a weak ball, moderate to heavy soil/water coatings on fingers, wet outline of soft ball remains on hand.

Column 5, Column 3 x Column 4, the soil-moisture balance, inches.

Column 6, Column 3 - Column 5, soil-moisture deficiency or net irrigation requirement.

### 6.8.3 Sample Irrigation Water Management Plan for Microirrigation System

USDA NRCS
United States Department of Agriculture
Natural Resources Conservation Service

NRCS Mobile Irrigation Lab
2614 NW 43rd Street
Gainesville, FL 32606
Tel: 352-338-9562

## Irrigation Water Management Plan

**Cooperator:** Hurry I. Dry **Date:** October 1, 2009
**Location:** Need Water Rd **Prepared by:** Erie Gator
**County:** Manatee **Title:** Agricultural Engineer

Irrigation water management (IWM) is the process of determining and controlling the volume, frequency, and application rate of irrigation water in a planned and efficient manner. The objective is to maintain soil moisture at levels conducive to optimal plant growth and maximize irrigation efficiency. The most important aspect of IWM is to monitor the crop and soil moisture relationship. This can better be accomplished by the use of soil moisture sensors such as tensiometers.

This IWM plan describes the techniques and strategies you will use to determine when and how much to irrigate. Changes in the system would affect the recommended operating times. If changes are made to the irrigation system, a new evaluation should be made. If you would like to change or correct this IWM Plan, please let us know by calling your NRCS Service Center.

| Irrigation system type | Uniformity of water application will be determined by |
|---|---|
| X Sprayjets | X System evaluation |
| Sprinkler | X Observation of water distribution |
| Drip | X Observation of wetted area |
| Subsurface | X Periodic pressure measurement |
| **Water Source** | **Runoff caused by irrigation will be estimated by** |
| X 14" Well | Measurement of stream size |
| Surface | Observation |
| Other | X Does not occur |
| **Method used to determine when to irrigate** | **Method used to determine quantity of water needed** |
| X Tensiometers | X Tensiometers |
| Evaporation pan | X Soil feel and appearance |
| X Soil feel and appearance | X Leaf wilt |
| X Leaf wilt | X Scheduling guide |
| X Scheduling guide | Water table depth |
| X Rainfall | X Rainfall |
| **Application rate will be determined by** | **Soil erosion caused by irrigation will be estimated by** |
| X System evaluation | Measurement |
| X Emitter or sprinkler specs | Observation |
| Flowmeter | Calculation |
| X Manifold Pressure | X Does not occur |

### 6.8.4 Sample Irrigation Water Management Plan for Subsurface – Flow Through Irrigation System

**IRRIGATION WATER MANAGEMENT PLAN**

| | |
|---|---|
| **DATE:** | 4/06 |
| **COOPERATOR:** | T.O. Dry, Jr. |
| **LOCATION:** | Sebring, Highlands County |
| **FIELD NUMBER:** | 1 |
| **CROP:** | Small Vegetables |
| **GROWING SEASON:** | December 1 – March 31 |
| **ROOTING DEPTH:** | 18 in |
| **PEAK CONSUMPTIVE USE RATE:** | 0.18 in/day |
| **IRRIGATION SYSTEM:** | Flow-through subirrigation system with 28 furrows of different lengths on 60-foot spacing requiring a total of 161 gpm. Well capacity = 300 GPM at 5 ft drawdown. |
| **WATER SUPPLY:** | 6” diameter well |
| **PREDOMINATE SOIL SERIES:** | Immokalee fine sand |

A flow-through subirrigation system is to be installed. A minimum water delivery rate of 7 gpm/acre shall be available in order that your irrigation system meets the peak water demand period of the crop. A system which is capable of delivering 10 gpm/acre gives you more management options and allows you to meet the peak water demand of the crop without running the pump for 24 hours a day.

The system shall be operated with the water table controlled within a range of 18 to 24 inches during crop establishment. Based on a peak consumptive use rate of 0.18 in/day, and a rate of upflux equal to 0.36 in/day, you should allow the water table depth to recede to no lower than 28 inches below the top of the bed.

The water table depth from the top of the bed shall be determined using observation wells placed within the field. The observation wells can be made from 4" PVC sand point (see enclosed observation well sheet) or with 4" drain tile with sock. The wells are approximately 40" long and installed in the ground until the top of the well is level with the top of the bed. Two observation wells shall be installed at the highest and lowest areas of the field.

The system shall be operated until the water table is approximately 18" from the top of the bed. This point will be reached after an outflow (tailwater) of 1 - 2 hours has occurred at the downstream end of the field. At that time, the system shall be turned off. When the water table recedes to a depth of approximately 24", the system shall be started again. Most of the water savings during the season will be possible during the early part of the season before the plants demand a great deal of water.

Using a water table depth range to determine the irrigation cycle is more practical and more accurately reflects the plant water use than trying to establish a regular irrigation interval such as two days on/one day off.

Soil moisture feel and appearance can be used to determine when to irrigate as per enclosed measuring soil moisture content sheet. Irrigate when soil moisture is 50% or less. Shut off irrigation system based on experience. It is recommended that observation wells be used in conjunction with the feel and appearance method.

The operator should consider correlating results from water table observation wells with those from soil moisture feel and appearance.

The irrigation system should be checked periodically to ensure proper operation of the system and to identify any problems with the system layout. A visual inspection should be performed during operation to determine if there are excessive tailwater losses to the system or significant erosion is occurring in furrows or ditches. Tailwater losses can be reduced by installing water table control structures in outlet drainage ditches, or allowing the water table to fluctuate within an allowable range. Water erosion can be controlled by structures at the ends of laterals, reducing the irrigation stream, structures in open ditches, and/or changing system layout to reduce slope in direction of irrigation.

Check the condition of the crop to ensure that growth is occurring and that the crop looks consistent in color and height to determine adequacy and uniformity of irrigation. If the application is not uniform, a system evaluation should be performed.

If there is change in the soil moisture monitoring method or irrigation method, the NRCS office in Sebring, Florida should be contacted.