July 8, 2008

Subject: 2008 On-Farm Efficiency Conservation Pilot Program for Irrigation Scheduling and Event Management

Dear IID Water User:

The Imperial Irrigation District (IID) is initiating an On-Farm Efficiency Conservation Pilot Program for Irrigation Scheduling and Event Management (Pilot Program). The purpose of this Pilot Program is to test various on-farm efficiency conservation program components under consideration to implement IID’s Quantification Settlement Agreement (QSA) obligations. It will also allow growers an earlier opportunity to participate in IID’s water conservation efforts. The short-term Pilot Program is designed to generate 1,500 to 2,000 acre-feet of conserved water from start-up through the end of 2008. The conserved water will be credited towards the payback of IID’s 2006 and 2007 overruns as required by the Bureau of Reclamation's Inadvertent Overrun and Payback Policy (IOPP).

IID is currently inviting owners and lessees of eligible fields to participate in the 2008 On-Farm Efficiency Conservation Pilot Program (see back page for program summary and eligibility criteria). If you are interested in implementing irrigation scheduling and event management recommendations on an eligible field, please contact Vince Brooke, IID Water Transfer Key Customer Coordinator, at (760) 339-9765 as soon as possible to be considered for participation in the 2008 Pilot Program. Interested participants with eligible fields will be scheduled for a pre-selection consultation with IID staff to brief potential participants on important Pilot Program details, including a review and verification of pertinent support documentation that will be utilized to achieve the goals of the 2008 Pilot Program.

Another on-farm efficiency conservation pilot program will be initiated in 2009, under which additional on-farm conservation methods will be considered. The focus of the 2009 pilot program will be the broader testing of various aspects of the longer-term on-farm efficiency conservation program, including contracts, payment methods, and conserved water verification methods. Details of the 2009 pilot program are currently being developed. Additional information for the 2008 Pilot Program and other water conservation implementation activities and programs can be accessed from IID’s website at http://www.iid.com/Water/WaterConservationImplementation as soon as they are available.

Sincerely,

MICHAEL L. KING
Water Manager

MLK/DF/mn
Program Outline

- To enroll in the Pilot Program, growers are required to schedule a consultation with IID staff to establish eligibility (see Eligibility Requirements below) and to discuss program details, prior to entering into a contractual agreement.
- Participating growers will be required to hire an IID pre-qualified consulting firm to provide recommendations regarding the scheduling, design, and management of irrigation events. IID will provide a list of pre-qualified firms.
- IID will provide a Scope of Services to participating growers that will describe the services required of the consulting firms in order to fulfill the obligations of the IID-Grower contract.
- Participants will receive an initial payment of $4,000 at the beginning of the Pilot Program to reimburse the grower for the cost of hiring a pre-qualified consulting firm. Participants may also receive a second payment of up to $45 per acre at the end of the Pilot Program, depending on the amount of water conserved on-farm. The second payment is designed to provide an incentive to conserve water through irrigation efficiency improvements as well as to reimburse growers for the anticipated increase in on-farm labor and management costs associated with the Pilot Program.

Eligibility Requirements

- Minimum field size is 65 acres as defined by Farm Service Agency (FSA) acreage values. (In the event more fields are submitted for consideration to IID than necessary to meet the overall 2008 Pilot Program participation goal of 1,500 to 2,000 acre-feet of conserved water, enrollment priority will be given to larger, contiguous fields.)
- All fields served by a gate must be enrolled in the program.
- Eligible crops are perennial forage (alfalfa, Bermuda grass, Klein grass) and citrus crops. Forage crops must be for hay production during the contract term; seed production is not allowed.

Contact Information

Vince Brooke
IID Water Transfer Key Customer Coordinator
(760)339-9765
vbrooke@iid.com
I. Purpose
The 2008 On-Farm Efficiency Conservation Pilot Program (Program) will serve to test various on-farm efficiency conservation program components under consideration to implement the Imperial Irrigation District’s (IID) Quantification Settlement Agreement obligations. It will also provide growers an earlier opportunity to participate in IID’s water conservation efforts. The short-term Pilot Program is designed to generate 1,500-2,000 acre-feet of conserved water by the end of 2008. The conserved water will be credited toward the payback of IID’s 2006 and 2007 overruns as required by the Bureau of Reclamation’s Inadvertent Overrun and Payback Policy.

II. Organization
IID will be responsible for the administration of the Pilot Program. The Water Department Manager will direct the Program and assign and/or hire staff and consultants as needed to carry out the activities of the Program. IID will cooperate with participating growers (Growers) and irrigation scheduling consulting firms (Firms) to implement and evaluate the Program. The Water Conservation Advisory Board (WCAB) will provide feedback before, during, and after the implementation of the Program.

III. Process
IID will invite owners and lessees of eligible fields (see Section IV) to participate in the Program. Potential participants must participate in a consultation with IID staff to establish eligibility and to discuss Program details as they relate to each field. Participating growers must enter a contractual agreement with IID (see Appendix 1: IID-Grower Agreement) and hire a qualified irrigation scheduling and event management firm (Firm) to provide recommendations regarding the scheduling, design, and management of irrigation events. Firms interested in participating were screened for qualifications using IID’s Qualification Request process (see Appendix 2: IID QR #646 Qualifications Information). Breach of the Program contract may result in the Conserving Party being deemed ineligible for future conservation programs at the discretion of the Water Department Manager.

Growers will receive payment for participating in the Program. An initial payment will be made within 30 days of execution of the contract between the Grower and IID. This payment is intended to reimburse the Grower for the cost of hiring a Firm. A final payment will be made to the Grower within 90 days of termination of the contract. This payment will be based on the Verified Conserved Water (see Determination of Water Savings) and is intended to reimburse Growers for the anticipated increase in on-farm labor and management costs associated with the Program and provide incentive to conserve water through efficiency improvements. A maximum allowable payment will be imposed in an effort to prevent conservation by deficit irrigation.

IID will provide specifications (see Appendix 3) to the Growers that will describe the services that the Growers must require of the Firms in order to fulfill the obligations of the IID-Grower contract. Growers shall be required to submit copies of the Grower-Firm contract to IID. Furthermore, Growers must require that Firms submit reports to IID describing recommendations made to
Growers. In addition, IID may require that Growers instruct Firms to meet with IID for periodic coordination and verification. Upon completion of the Program, both Growers and Firms will provide brief written feedback to IID to assist in planning of future on-farm efficiency conservation programs.

IV. Field Selection Criteria

Based on the water conservation requirement of 1,500-2,000 acre-feet, approximately 30-50 fields will be enrolled. Eligibility requirements have been selected to help achieve required water savings, reduce costs, and ease program administration and verification:

- Each field must be at least 65 acres as certified by Farm Service Agency (FSA).
  - In the event that more fields are submitted for consideration than are required to meet the overall conservation requirement, enrollment priority will be given to larger, contiguous fields that will be irrigated during the entire contract term.
- All fields served by a gate must be enrolled in the program.
- Eligible crops are perennial forage (alfalfa, Bermuda grass, Klein grass) and citrus crops.
  - Forage crops must be for hay production; seed production is not allowed.
  - Other crops may be considered on a case-by-case basis if they will be irrigated during the entire contract term.

V. Determination of Water Savings

Growers invited to participate will receive an estimated baseline calculated from average weather conditions and the water use history of the field for the crop to be grown under the program. This estimated baseline, termed the Crop-Field History, may be contested during the pre-contract consultation.

During the Program, water delivery will be measured by zanjeros using the traditional measurement techniques. Spot checks may be performed periodically by IID during deliveries to monitor changes in delivery flow rate and increase confidence in the zanjero measurements. Upon termination of the Program, the total volume delivered to participating fields during the contract period will be computed (IID’s new billing system will allow Growers to track water use throughout the season). The Crop-Field History provided to Growers prior to contract execution will be updated to reflect actual weather conditions recorded by California Irrigation Management Information System (CIMIS) stations and actual crop planting dates. The actual water deliveries will be subtracted from this updated baseline, the Efficiency Conservation Baseline, to compute the Verified Conserved Water, upon which the final payment will be based.

VI. Schedule

The enrollment process is expected to begin in July 2008 with the contracts executed in August. All contracts will terminate December 31, 2008, with the option of extension by mutual agreement.

†The event management component of the Program requires that Firms perform a technical evaluation of one irrigation event. The evaluation procedure described in Appendix 3 shall be the minimum acceptable method. The more complex procedure described in Attachment 2 of Appendix 2 may assist Firms in providing recommendations that could lead to enhanced water conservation and thus increased payment to the Grower under the terms of Appendix 1. Should a Grower elect to invest in the more detailed evaluation, any and all costs associated with the upgrade shall be the sole obligation of the Grower.
Appendix 1: IID-Grower Agreement
AGREEMENT TO PARTICIPATE IN AN EFFICIENCY CONSERVATION PILOT PROGRAM BY IMPLEMENTING IRRIGATION SCHEDULING AND EVENT MANAGEMENT IN THE IMPERIAL IRRIGATION DISTRICT

THIS AGREEMENT TO PARTICIPATE IN AN EFFICIENCY CONSERVATION PILOT PROGRAM ("Program") BY IMPLEMENTING IRRIGATION SCHEDULING AND EVENT MANAGEMENT IN THE IMPERIAL IRRIGATION DISTRICT ("Agreement") is made and entered into as of the _______ day of _____________ 2008, by the Imperial Irrigation District ("IID") and the person(s) or entity referred to as “Conserving Party” listed on the signature page of this Agreement (collectively, “Parties”), each of which is at times referred to individually as “Party”.

RECITALS

A. IID, as a trustee under the California Irrigation District Law, holds water rights to and diverts water from the Colorado River for distribution and use within its service area.

B. IID has completed an environmental assessment of proposed water conservation and transfer activities and diversion limitations pursuant to the California Environmental Quality Act ("CEQA"), as set forth in a Final EIR/EIS for the IID Water Conservation and Transfer Project certified by IID in June 2003, as supplemented by an Amended and Restated Addendum thereto certified by IID in October 2003 (collectively, "Transfer EIR").

C. IID has entered into an agreement with the United States and others to limit its diversions under Priority 3 and to repay inadvertent overruns on a certain schedule. For purposes of meeting these agreements, IID will create conserved water by efficiency conservation for use as Inadvertent Overrun Payback and/or Intentionally Created Surplus.

D. Conserving Party owns or leases agricultural property within the IID service area described and/or depicted on Exhibit A attached hereto ("Participating Fields").

E. If Conserving Party is a lessee of the Participating Fields, the identity of the lessor, any sublessor, any sublessee, and the fee owner, and the remaining term of the lease or sublease is identified on Exhibit B attached hereto.

F. Conserving Party is willing to implement efficiency conservation on the Participating Fields for the limited time period specified in Section 1 and in accordance with the other terms and conditions set forth herein, in order to assist IID in meeting its obligations described above.

G. This Agreement is part of the implementation of a temporary program of efficiency conservation through irrigation scheduling and event management described in the 2008 On-Farm Efficiency Conservation Pilot Program Description ("Program Description") that can be accessed at http://www.iid.com/Water/WaterConservationImplementation. The Parties understand and agree that participation in this Agreement does not imply or guarantee participation in any subsequent efficiency conservation agreements. Further, the Parties understand that IID has developed eligibility and participation requirements, payment schedules, and measurement and verification requirements specific to this temporary program as described in the Program Description, to which this Agreement is appended. These provisions may not represent implementation features of future efficiency conservation programs or long-term agreements.
H. Parties agree that participation in the Program will not alter the Conserving Party’s baseline delivered water for future efficiency conservation or fallowing agreements. That is, when water delivery history is used to compute baselines for future efficiency conservation or fallowing programs, the water delivery history for Participating Fields shall include the Verified Conserved Water computed for this Program as described below.

NOW, THEREFORE, IN CONSIDERATION OF THE ABOVE RECITALS AND THE COVENANTS AND OBLIGATIONS SET FORTH HEREIN, THE PARTIES AGREE AS FOLLOWS:

1. Term

The term of this Agreement ("Term") shall commence on ______________, 2008 ("Start Date") and expire on December 31, 2008. This term may be extended by mutual written agreement of the Parties.

2. Verified Conserved Water and Payment

A. Crop-Field History, Efficiency Conservation Baseline, and Verified Conserved Water

Verified Conserved Water shall be calculated for each Participating Field subject to this Agreement as follows:

(1) The Crop-Field History is a crop- and field-specific average gross water use calculated for each participating field. The Crop-Field History will be determined by IID based on delivered water and cropping records held by IID for the Participating Field, as shown in Exhibit C. Detailed Crop-Field historical data utilized in the calculations can only be provided to the potential Conserving Party if the Landowner has authorized the Conserving Party’s access to this data prior to entering into the Agreement. Historical data may be disputed during the mandatory, one-on-one consultation between an IID representative and a representative for the Conserving Party or prior to the execution of this Agreement.

(2) The Efficiency Conservation Baseline calculation method is defined in Exhibit C and will be applied after the term of this Agreement and prior to the final payment. It is based on the Crop-Field History and crop water requirements (evapotranspiration) adjusted for the actual Agreement Start Date, actual planting and harvesting dates, and weather effects.

(3) The Verified Conserved Water will be calculated as the Efficiency Conservation Baseline for the Participating Field minus the actual delivered water to the Participating Field as measured by IID over the term of this Agreement.

B. Payment

As consideration for the Conserving Party’s performance of its obligations hereunder, IID shall make payments to the Conserving Party in the following manner.
Payment for Efficiency Conservation: The total payment shall be divided into two payments as specified in Exhibit D, including:

1. The initial payment of $4,000 per Participating Field, totaling $________ for this Agreement, will be made within 30 days of execution of this Agreement and submittal of proof of retention by the Conserving Party of an irrigation scheduling and event management consulting firm (“Firm”) listed in Exhibit E to compensate for costs incurred for irrigation scheduling and irrigation event management consultation services on the Participating Field(s).

2. The final payment in the amount of $45 per acre-foot as specified in Exhibit D shall be based on the Verified Conserved Water calculated for each Participating Field. The final payment shall be made within 90 days after the end of the Agreement provided that IID has verified that Conserving Party has fulfilled all of its obligations under this Agreement. If at any time the IID determines that Conserving Party is in noncompliance with this Agreement or delinquent on any water accounts, the final payment may be suspended as provided in Sections 4 and 11.

3. Conserving Party Representations and Warranties

The Conserving Party represents and warrants to IID the following and acknowledges that IID is relying on the following representations and warranties:

A. The Participating Fields are within the IID Service Area receiving water and the requisite IID Water Cards have been signed and presented to IID.

B. Conserving Party is the fee title owner, the lessee, or the sublessee of the Participating Field(s) and has the full right, power and authority to execute this Agreement and to carry out each and every obligation hereunder. To the best knowledge of Conserving Party, no legal impediment exists regarding the Participating Fields to prevent Conserving Party from entering into or performing under this Agreement; this Agreement will be a legal and binding obligation of Conserving Party enforceable against Conserving Party in accordance with its terms and will not violate any provisions of any agreement to which Conserving Party is a party or to which Conserving Party is subject; and Conserving Party’s agreement to implement Efficiency Conservation on the Participating Fields does not and will not violate applicable laws or recorded documents affecting the Participating Fields.

C. A Participating Field is a whole field equal to or greater than 65 irrigable acres defined by Farm Service Agency (“FSA”) with defined historical boundaries. In order to facilitate measurement and verification of savings, the Conserving Party warrants that every irrigated field served by the delivery gate designated in Exhibit A will be included as a Participating Field under this Agreement. In other words, the delivery gate serving a Participating Field cannot serve non-participating fields during the term of the Agreement unless field-level measurement acceptable to IID is provided by the Conserving Party for the Participating Field prior to the Agreement Start Date.

D. All information submitted by the Conserving Party to the IID to implement Efficiency Conservation is true and correct as of the time of submittal and the Agreement Start Date. This contract is only valid for the Conserving Party submitting the information and is not transferable prior to execution.
E. The Participating Fields are zoned for agriculture and Conserving Party will take no action to cause or support a change in such zoning during the term of the Agreement.

F. Conserving Party acknowledges that IID retains all water rights to the Colorado River in its name and control as a trustee under the California Irrigation District Law, and no water rights or other rights to water are created by this Agreement.

4. **Obligations of Conserving Party**

A. **Efficiency Conservation**

Conserving Party shall implement Efficiency Conservation as Irrigation Scheduling and Event Management on the Participating Fields during the Term defined in this Agreement.

1. Conserving Party will contract with an irrigation scheduling and event management consulting firm (“Firm”) pre-qualified by IID and listed in Exhibit E.

2. Conserving Party will utilize the irrigation scheduling and event management recommendations provided by Firm and implement those that are reasonable and consistent with the Conserving Party’s objective to produce a profitable crop.

3. Conserving Party will provide, or direct Firm to provide, to IID the scheduler’s recommendations and any other pertinent documentation during the term of the Agreement. Conserving Party agrees that IID may use this information along with the Conserving Party’s water orders for the Participating Fields, to assess implementation of the Firm’s recommendations and Program success.

4. Conserving Party will require that the Scope of Services appended to the Program Description, to which this Agreement is also an appendix, be fulfilled by Firm.

5. Conserving Party will participate in an exit interview with IID staff to assess the effectiveness of the Pilot Program and irrigation scheduling and event management services.

6. Conserving Party agrees, and will make necessary efforts to assure, that water conserved under this agreement is the result of implementing Efficiency Conservation measures and not a deliberate reduction in crop evapotranspiration and/or crop yield.

B. **Water Charges and Fees**

Conserving Party shall continue to be responsible for all water delivery and water availability charges on lands owned and leased within the IID service area subject to IID’s Regulation No. 11 as if this Agreement were not in effect, and all such charges shall be timely paid before they become delinquent or IID may withhold Payments under this Agreement until such time that the Conserving Party is current on such charges.
C. **Taxes**

All real and personal property taxes, assessments or other charges of every description levied on or assessed against the Participating Fields or improvements on the Participating Fields shall remain the sole responsibility of the Conserving Party. All tax payments shall be made directly to the charging authority prior to delinquency.

D. **Insurance**

Conserving Party shall acquire and maintain liability insurance coverage on the Participating Fields in the amount of $1,000,000 and shall name IID as an additional insured on each such policy. Proof of such insurance coverage shall be provided to IID by a copy of an applicable document from the insurer at the time of execution of this Agreement and upon renewal of the policy during the term of the Agreement. Each proof of insurance shall also specifically identify each Participating Field by its canal and gate delivery point.

E. **Right of Entry**

Conserving Party agrees that IID and its designees shall have the right to enter the Participating Fields and, to the extent necessary, other land owned or leased by Conserving Party for the purpose of verification, monitoring, and enforcement of compliance with this Agreement.

F. **If Land is Already Subject to Leases or Contracts**

Conserving Party shall be responsible for compliance with the terms, covenants and conditions of any existing leases and/or contracts affecting the Participating Fields, and shall defend, indemnify and hold IID harmless from any and all claims by third parties for damages allegedly related to this agreement or to the performance thereof.

5. **Governing Law**

This Agreement shall be interpreted, governed by and construed under the laws of the State of California.

6. **No Third-Party Rights**

The Parties do not intend to create rights in or to grant remedies to any third party as a beneficiary of this Agreement.

7. **Assignment of Agreement**

This Agreement shall be binding upon and inure to the benefit of the Parties and their permitted successors and assigns. No Party may assign or transfer its rights or obligations under this Agreement without the prior written consent of the other Party hereto. Formal consent shall require that the parties fully execute a separate agreement as provided by the IID.

8. **Change in Legal Status Affecting Participating Fields**

Notwithstanding that which is provided in Section 7, any activity affecting the legal status of the Participating Fields during the term of this Agreement shall carry forward all obligations provided in the Agreement. Any party acquiring title to the Participating Fields or taking assignment or
sublease of the lease of the Participating Fields shall be bound to the Term of this Agreement as if a signatory. Conserving Party shall give notice of this obligation to any such party prior to effecting any change in the legal status of the Participating Fields. In the event of any change affecting the legal status of the Participating Fields, Conserving Party shall notify IID in writing within ten (10) days of such change.

9. **Legal Effect on Participating Fields**

   Except as otherwise expressly stated herein, nothing herein shall be construed as affecting the legal status of the Participating Fields, including, but not limited to, the effect of liens, encumbrances, statutory or regulatory requirements, or entitlements. Conserving Party agrees that IID is not responsible for, and no action or conduct of IID, its staff or other representatives, shall be construed as advice or identification of the legal effect or consequences, if any, of the Conserving Party’s decision regarding efficiency conservation.

10. **Non-precedent**

   Nothing contained in this Agreement, nor the execution of this Agreement, shall be deemed to give the Conserving Party any rights to obtain any similar agreement after the expiration of the Term. In addition, IID reserves the right to change any rules governing the Efficiency Conservation Program in any future agreement and to determine the provisions of any future agreement relating to efficiency conservation.

11. **Noncompliance with Terms of Agreement**

   If IID determines at any time that the Conserving Party is in noncompliance with or has breached this Agreement, the Conserving Party will be provided notice of such noncompliance or breach at the address or contact information provided in Section 15, and shall have twenty-four (24) hours from the time of such notice to cure the noncompliance or breach. If the noncompliance or breach is not timely cured, remaining payments may be withheld by IID. In addition, Conserving Party will be responsible for any other losses suffered by IID as a result of the noncompliance or breach including reimbursement of staff time and administrative expenses associated with the remedy of any noncompliance or breach as well as financial penalties and costs associated with the replacement of lost water conservation yield as a result of the breach incident. Nothing contained herein shall preclude the IID from exercising any other available remedy in law or equity, including specific performance.

   In addition, noncompliance with this agreement may influence the Conserving Party’s eligibility for future voluntary programs offered by IID.

12. **Early Termination**

   This Agreement may be terminated early by mutual agreement. Reasons may include, but are not limited to, crop failure, natural disaster, or severe financial distress of the Conserving Party, and which decision IID may make in its sole discretion. IID will judge each case individually to determine its agreement to terminate early. All water savings committed to or reasonably expected from the remaining term of this Agreement shall be assigned to IID.
13. **Entire Agreement**

The entire understanding of the Parties to this Agreement is constituted by the Program Description and its appendices, which include this Agreement and its Exhibits.

14. **Amendment**

This Agreement may not be modified or amended except in writing executed by the Parties.

15. **Contacts**

A. All notices, requests, demands, payments, and other communications required or permitted under this Agreement shall be in writing and shall be deemed to have been received either when delivered or on the fifth (5th) business day following the mailing, by registered or certified mail, postage prepaid return receipt requested, whichever is earlier, addressed as set forth below:

   (1) If to IID:

   Manager, Water Department  
   Imperial Irrigation District  
   333 East Barioni Boulevard  
   P.O. Box 937  
   Imperial, CA 92251

   (2) If to Conserving Party (please print):

   Name ____________________________________________

   Address ____________________________________________

   Phone ____________________________________________

   Fax ____________________________________________

B. Any Party may change the addressee or address to which communications or copies are to be sent by giving notice of such change of addressee or address in conformity with the provision of this Paragraph 15 for the giving of notice.

16. **Counterparts**

This Agreement may be executed in counterparts, each of which, when executed and delivered, shall be an original and all of which together shall constitute one instrument with the same force and effect as though all signatures appeared on a single document.
17. **Recording of Memorandum of Agreement**

Conserving Party agrees that IID may, and Conserving Party will cooperate to permit, a memorandum identifying the existence and summary of this Agreement to be recorded in the real property records for the County of Imperial.

IN WITNESS WHEREOF, the Parties hereto have executed this Agreement on the day and year first above written.

**IMPERIAL IRRIGATION DISTRICT**

Manager, Water

CONSERVING PARTY as
- □ Lessee of Participating Fields
- □ Owner of Participating Fields

Signature __________________________________________
Print Name________________________________________

Signature __________________________________________
Print Name________________________________________
EXHIBIT A

DESCRIPTION OF PARTICIPATING FIELDS
FOR 2008 ON-FARM EFFICIENCY CONSERVATION PILOT PROGRAM
Sheet ____ of ____ (One form required for each gate having one or more participating fields.)

Submitted by

Canal _______________________________ Gate _______________________________
IID Account Number ____________________________
Total Number of Fields at Gate ______  Number of Participating Fields at Gate ______

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<thead>
<tr>
<th>Field Identification and Ownership</th>
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<tr>
<td>Field ID</td>
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<tr>
<th>Field Acreage and Crop Selection</th>
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<tr>
<td>Field ID</td>
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Total Acres (FSA)

*Provided by IID during mandatory consultation. (Other information provided will be checked for consistency with IID records.)

Have any of these fields participated in an IID Fallowing Program?  □ Yes  □ No

Have any of these fields participated in any other efficiency conservation programs?  □ Yes  □ No

If Yes to either question above please describe field participation: ____________________________

______________________________
EXHIBIT B

IDENTIFICATION OF LESSOR/LESSEE FOR PARTICIPATING FIELDS
FOR 2008 ON-FARM EFFICIENCY CONSERVATION PILOT PROGRAM
(One form required for each lessor/lessee combination, attach additional pages as necessary.
Landowner(s) signature is required only if detailed field information is requested by Conserving Party.)

Conserving Party:

Participating Field IDs (must also be listed and described in Exhibit A):

We the undersigned certify that any lease agreement(s) for the above listed Participating Field(s) are in force for the entire term of this Efficiency Conservation Agreement. We also certify that: 1) we are current on all IID water delivery and availability charges subject to IID’s Regulation No. 11; 2) there are no prior contracts or commitments attached to the Participating Fields which would affect our ability to implement Efficiency Conservation and satisfy the provisions of this Agreement; and 3) we have the legal authority to implement Efficiency Conservation on the Participating Fields and to execute a contract to do the same.

Tenant (Lessee)

Print Name:  
Signature:  
Address:  
Phone / Fax:  
Email:  

In addition, we the undersigned Landowner(s) also authorize IID to share and release to the Conserving Party the Participating Field historical data including water delivery records, cropping data and other information for the Participating Field(s) as necessary to calculate Efficiency Conservation Baselines or implement other provisions of this Agreement.

Owner

Print Name:  
Signature:  
Address:  
Phone / Fax:  
Email:  
EXHIBIT C

EFFICIENCY CONSERVATION BASELINE AND MEASUREMENT PERIOD FOR CROP(S) TO BE GROWN UNDER THE 2008 ON-FARM EFFICIENCY CONSERVATION PILOT PROGRAM; ADJUSTMENT PROCEDURE FOR EFFICIENCY CONSERVATION BASELINE

1. **Crop-Field History**

   The Crop-Field History is the average delivered water history (based on IID’s quality-controlled records) specific to the Participating Field(s) and crop(s) identified in Exhibit A for the periods of August 1 - December 31, 1998-2005, as follows:

<table>
<thead>
<tr>
<th>Field ID</th>
<th>Crop(s)</th>
<th>*Crop-Field History (AF/ac)</th>
<th>*Historical Crop Water Use (actual evapotranspiration, AF/ac)</th>
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</thead>
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*Provided by IID during mandatory consultation. (Other information provided will be checked for consistency with IID records.)*

2. **Measurement Period**

   The Measurement Period for this Agreement shall be the same as the term of the Agreement. Verified Conserved Water shall be measured based on total deliveries to Participating Field(s) between the Start Date and the Agreement expiration date.

3. **Calculation Procedure for Efficiency Conservation Baseline**

   A. The actual crop evapotranspiration for the Measurement Period will be calculated for each crop and Participating Field at the expiration of the Agreement based on the actual crop grown, weather conditions, planting date, and harvest date. (Detailed evapotranspiration calculation procedures are described in Appendix 2.C of the Final Report on the Efficiency Conservation Definite Plan. This report can be accessed from IID’s website at http://www.iid.com/Water/EfficiencyConservationProgram.)

   B. The Efficiency Conservation Baseline will be computed as the Crop-Field History multiplied by the ratio of actual crop evapotranspiration for the Measurement Period to Historical Crop Water Use.
EXHIBIT D

PAYMENT AMOUNTS AND SCHEDULE FOR THE 2008 ON-FARM EFFICIENCY CONSERVATION PILOT PROGRAM

1. Initial Payment per Acre

An initial payment of $4,000 per Participating Field will be made following execution of this Agreement, once evidence has been provided that an approved irrigation scheduling consulting firm (listed in Exhibit E) has been contracted to provide the required services for the Participating Field(s). Evidence may be provided by submitting a copy of a signed agreement between the Conserving Party and the Firm to the District.

2. Final Payment per Acre

Verified Conserved Water, as described in Section 2 of the Agreement, shall be the basis for the final payment according to the table below. In no case shall IID pay for savings in excess of 1 acre-foot per acre or for savings that IID determines is a result of deliberate reduction in crop evapotranspiration or crop yield.

<table>
<thead>
<tr>
<th>Verified Conserved Water (AF/FSA acre)</th>
<th>Final Payment ($/FSA acre)</th>
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</thead>
<tbody>
<tr>
<td>Less than 0.2</td>
<td>$0</td>
</tr>
<tr>
<td>0.2 up to and including 1.0</td>
<td>($45/AF x Verified Conserved Water)</td>
</tr>
<tr>
<td>Greater than 1.0</td>
<td>$45</td>
</tr>
</tbody>
</table>

3. Total Payment

The total of all payments to the Conserving Party for each Participating Field will be the initial payment plus the Participating Field’s FSA acres times its final payment per acre:

\[
\text{Total Payment per field} = \text{Initial Payment per field} + (\text{FSA acres} \times \text{Final Payment per acre})
\]

In no case shall the Total Payment exceed $106.54 per FSA acre (based on minimum field size of 65 FSA acres).
EXHIBIT E

LIST OF PRE-QUALIFIED IRRIGATION SCHEDULING AND EVENT MANAGEMENT CONSULTING FIRMS

JMLord, Inc.

Alan Jackson
86695 Avenue 54 Ste J
Coachella, CA 92236-3810
(760) 399-8424

http://www.jmlordinc.com
jmlord@jmlordinc.com

Stanworth Crop Consultants, Inc.

Aron Quist
14151 W Hobsonway
Blythe, CA 92225-3312
(760) 922-3106

http://www.stanworth.net
info@stanworth.net
Appendix 2: IID Qualifications Request #646
Imperial Irrigation District

QUALIFICATIONS REQUEST #646

QUALIFICATIONS INFORMATION

FOR

IRRIGATION SCHEDULING AND IRRIGATION EVENT MANAGEMENT SERVICES

2008 Pilot Program
Qualifications Request
for
Irrigation Scheduling and Irrigation Event Management Services
2008 Pilot Program

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Background

The Imperial Irrigation District (IID), an irrigation district established under Division 11 of the California Water Code, Sections 20500 et seq. that provides non-potable water, farm drainage and power services to the lower southeastern portion of California's desert, is requesting qualifications from highly qualified consultants to provide irrigation scheduling and irrigation event management services.

The Quantification Settlement Agreement (QSA) and Related Agreements are a set of inter-related contracts that settle certain disputes among the United States, the State of California, the Imperial Irrigation District (IID), Metropolitan Water District (MWD), Coachella Valley Water District (CVWD) and the San Diego County Water Authority (SDCWA) that became effective in October 2003. The agreements resolve, for a period of 35 to 75 years, issues regarding the reasonable and beneficial use of Colorado River water; the ability to conserve, transfer and acquire conserved Colorado River water; the quantification and priority of Priorities 3 and 6 within California for the use of Colorado River water; and the obligation to implement and fund environmental impact mitigation related to the above.

Conserved water transfer agreements between IID and SDCWA, IID and CVWD and IID and MWD are all part of the QSA and Related Agreements. These contracts identify the conserved water volumes and transfer schedules for IID along with the price and payment terms. As specified in the agreements, IID will transfer to SDCWA up to 200,000 acre-feet per year (AFY) and to CVWD and MWD combined up to 103,000 AFY of water conserved from delivery system improvements and on-farm efficiency improvements.

In 2007, IID completed its Efficiency Conservation Definite Plan (Definite Plan) that outlined strategies for both delivery system and on-farm water savings. Water savings generated on-farm will result from voluntary enrollment of growers and landowners in a program designed to provide financial incentives for implementation of conservation measures. Among the conservation measures growers are likely to consider are improved irrigation management (irrigation scheduling and event management), tailwater recovery systems, level basin irrigation, and pressurized irrigation.

In addition to the water transfer obligations of the QSA, IID has an obligation to implement efficiency conservation in order to “pay back” inadvertent overruns as part of the Bureau of Reclamation’s Inadvertent Overrun Payback Policy (IOPP). As a means of achieving extraordinary conservation to pay back overruns and gaining insights to aid the development of the long term voluntary on-farm conservation program, IID will initiate a small scale irrigation scheduling pilot program in 2008. The goal of the program will be to conserve 2,000 acre-feet of water through increased irrigation efficiency. It is estimated that approximately 3,000 to 5,000 acres will be enrolled. Based on typical net field sizes of 70 to 140 acres in IID, it is estimated that approximately 30 to 50 fields will be enrolled.

Increased irrigation efficiency will be achieved through scientific irrigation scheduling, with an emphasis on assisting participating growers with the design of surface irrigation events, including the selection of delivery flow rates, set sizes, and event durations. An emphasis on event design is needed because flexibility in irrigation timing is limited due to cropping practices, particularly for
forage crops (alfalfa, Bermuda, Sudan, etc.), which are expected to be the main crops for participating fields.

The following sections of this Qualifications Request (QR) provide additional information describing the services to be provided by the Irrigation Scheduling Consultant, project schedule, information to be furnished by IID, elements to be addressed in submitted qualifications, and criteria for selection of the pre-qualified Irrigation Scheduling Consultant(s).

Additional information describing the 2008 Irrigation Scheduling Pilot Program is provided in Attachment 1 of this Qualifications Request.

**Irrigation Scheduling Service Specifications**

As a minimum, the following requirements of the irrigation scheduling service shall be met:

1. **Root Zone Water Budget Approach.** Irrigation recommendations are to be developed based on a daily root zone water balance approach, including quantification of crop evapotranspiration (ET) based on the Kc x ETo approach. The water balance must also be updated regularly based on field observations of soil moisture content.

2. **ET0 by CIMIS.** Reference evapotranspiration data used in the water balance shall be derived from CIMIS weather data. Other local weather stations may be used, provided that they are equipped and positioned equivalent to CIMIS.

3. **Crop Coefficients.** Crop coefficients to be used for ET calculations shall be recognized values reported by FAO, UCCE, or other reputable sources. Additionally, IID will provide crop curves developed in the Imperial Valley for a variety of crops based on satellite remote sensing of actual crop ET under field conditions.

4. **Stress Coefficients.** Estimates of ET developed using the root zone water budget must account for the effect of moisture stress on crop ET. The daily water budget must include a stress coefficient, Ks, to account for ET reduction due to stress. The stress coefficient is needed, particularly for forage crops, to accurately predict ET during periods when water cannot be applied for irrigation due to cultural practices such as cutting.

5. **Field Visits.** The irrigation scheduling consultant is required, at a minimum, to visit each enrolled field once per week or three times between irrigation events, whichever is less. During each field visit, estimates of soil moisture content, percent ground cover, crop growth stage, and other physiological stress indicators of the crop are to be recorded, along with other relevant observations. Observations are to be made at multiple locations to ensure the results are representative of the field.

6. **System Evaluation.** For each field, evaluation of an irrigation event is to be conducted for at least one irrigation event during the irrigation season. The system evaluation is to be completed within 45 days of entering into an irrigation scheduling agreement with each grower. For surface irrigated fields, the evaluation shall be conducted in accordance with the instructions of Attachment 2, developed from guidelines of the NRCS National Irrigation Guide. For pressurized irrigation, the evaluation shall be conducted in accordance with the evaluation methodology promoted by the Irrigation Training and Research Center (ITRC) at Cal Poly San Luis Obispo.
7. Irrigation Scheduling Recommendations. The Irrigation Scheduling consultant shall develop written recommendations on a weekly or more frequent basis for each field including, at a minimum, the following information:
   a. Field Information. Grower, Gate ID, Field ID, Acres, Run Length, Irrigation Method, Soil Type or Types, Available Waterholding Capacity, Crop
   b. Current Conditions. Crop Stage/Percent Cover, Root Depth, Soil Moisture Depletion, Management Allowable Depletion, Reference ET, Crop Coefficient, Crop ET
   c. Irrigation Recommendations. Next Irrigation Date, Target Application Efficiency, Gross Depth to Be Applied, Target Infiltrated Depth, Number of Sets, Flow Rate, Duration.
   d. Summary of Season to Date. Cumulative Applied Water, Cumulative ET, Number of Irrigations.

8. Reporting Requirements. Written recommendations shall be submitted weekly for each field to both the grower and IID. Copies submitted to IID must be provided in both written and digital (e.g., pdf) format.

9. Post Season Report. Written report providing observations related to the following:
   a. Extent to which the grower adopted the irrigation recommendations or otherwise modified irrigation practices.
   b. Description of physical field characteristics that limit potential application efficiency and the benefits of irrigation scheduling.
   c. Recommendations for scaling up and institutionalizing irrigation scheduling within the Imperial Valley.

10. Meetings. The consultant shall be available to meet with IID at least monthly for up to four hours to review progress of the irrigation scheduling pilot program. Meeting locations, dates and formats will be established by mutual agreement between the consultant and IID.

Schedule
The deadline for submittal of Qualifications is April 30, 2008. It is anticipated that interviews will be scheduled for the week of May 5, 2008 with the top three firms submitting qualifications based on an initial review of Technical Qualifications.

It is anticipated that the qualified irrigation scheduling consultant(s) will be selected by early May 2008. The program will begin in June and continue through December 2008, with the possibility of being extended into 2009. During this time, growers selected by the District to participate in the program will be eligible to receive reimbursement for irrigation scheduling services, provided that they enter into contract with one of the pre-qualified irrigation scheduling consultant(s) to receive the services specified herein. Growers will not be required to follow the recommendations of the irrigation scheduling consultant, but will be required to participate in the program by meeting with the irrigation scheduler at the start of the scheduling period for each field and by cooperating with the system evaluation. All contracts entered into as a result of this Qualifications Request shall be between the grower and the pre-qualified irrigation scheduling consultant.

Information Furnished by IID
The following information will be provided by IID to support the development of irrigation recommendations:
1. Imperial Valley Crop Coefficients. Crop coefficients developed from remote sensing of the 1998 water year (October 1997 – September 1998) will be provided for a variety of crops. For each crop, a distribution of crop coefficients among fields will be provided for various times during the season to provide the irrigation scheduler with the range of crop coefficients observed, along with typical and maximum expected values.

2. SIRMOD Calibration File and Guidelines. Following completion of the surface irrigation evaluation specified in Attachment 1 and submittal of evaluation data to IID, IID staff plan to calibrate the SIRMOD model, developed at Utah State University by Dr. Wynn Walker, to provide a calibration file containing the physical and hydraulic characteristics of the field for the evaluated event to allow for simulation and design of irrigation events to increase application efficiency. IID staff additionally plan to provide the results of parameterized model runs to provide guidelines for irrigation event design. The objective of surface irrigation modeling support to the irrigation scheduling consultant is to provide tools and information that may be used by the consultant to design irrigation events and to demonstrate event dynamics to the grower.

**Statement of Qualifications Elements**

Statements of Qualifications (SOQs) to provide irrigation scheduling consulting services as part of the 2008 irrigation scheduling program must include both a Technical Proposal and a separate sealed Cost Proposal included in your response documentation. Each element of the proposal must identify the name of the Irrigation Scheduling Consultant submitting qualifications and the element of the proposal, Technical or Cost.

All technical proposals submitted by the solicitation deadline of April 30 will be considered. **Interviews will be scheduled for the week of May 5** with the top three firms, based on an initial review of the Technical Qualifications. Following selection of one or more qualified Irrigation Scheduling Consultants, cost proposals for qualified consultants will be reviewed to determine whether they are consistent with the financial capabilities of the program.

Respondent shall be fully capable, qualified, insured, and licensed as required to provide these services. Respondent shall complete and return the **Business Statement** located in the Qualifications Request Response Forms Section.

All services provided by the Respondent shall be completed under one unified management effort led by the Respondent.

Consultant shall be responsible for all services performed under a Contract with IID-contracted growers (please see Attachment 1 for a description of the proposed contracting method). If Subconsultant services are utilized they must be: (1) identified in the scope of work together with the services performed, and (2) identified in the fee schedule together with their billing rate.

Consultant shall not assign or transfer its interest in any contract or subcontract for any services without amending the Contract.
Respondent shall identify all Key and Consulting Personnel used in the performance of these services along with the type of work to be performed, the estimated hours and percentage of their time to be spent on the project.

Any substitution of Key or Consulting Personnel must be requested in writing, along with a statement of qualifications, who they will replace and the amount of time commitment that will be replaced. This request must be approved in writing in advance by IID’s Project Director. After receiving written approval the Contract shall be amended to reflect the changes. Changes in the use of subconsultants shall not affect: (1) the proposed procedures and methodology to be used, and (2) the cost of services provided.

**Technical Proposal**

The proposal shall be:

- Concise, well organized and demonstrate the proposer’s qualifications and experience applicable to the Project.

Bound and submitted in a sealed package and addressed as directed in the Invitation Letter.

Limited to 12 one-sided pages (8 ½" x 11"), inclusive of cover, cover letter, resumes, graphics, forms, pictures, photographs, dividers, front and back. Extraneous, excessive or irrelevant material will not be favorably considered. This limitation does NOT apply to the “Proposal Response Forms” which may be included as part of this solicitation. Therefore, the “Proposal Response Forms” do not count against the limitation of pages alluded to in this paragraph.

Submitted along with five copies (in addition to the original).

Evaluated based on the information submitted in accordance with this section and with the evaluation criteria outlined below.

IID shall not be responsible for submittals that are delinquent, lost, mismarked, and sent to an address other than that given, or sent by mail or courier service.

Technical Proposals shall include the following information:

1. IID Response Forms Section of the complete QR package.
2. Firm Experience and History. Provide a brief history of the firm, describing similar experience. Provide brief summaries of similar projects underway or completed, including the names and contact information for available references.
3. Key Individuals. List key individuals committed to the project. Include resumes, and identify any relevant licenses, certifications, or other credentials.
4. Irrigation Scheduling Software Program or Spreadsheet Tool. Describe the software program, spreadsheet tool, or other method to be used for performance of the daily root zone water balance. Demonstrate that the software is capable of performing over a range of crops and
irrigation methods. Describe the methodology by which the daily root zone water balance is performed. Provide screenshots as appropriate, as well as a sample set of recommendations.

5. **Strategy for Increasing Application Efficiency through Improved Event Design.** Describe the approach to be used for developing recommendations of delivery flow rates, set sizes, and event durations to maximize application efficiency while maintaining irrigation adequacy. This may include proven field techniques, surface irrigation modeling, or other approaches. Please provide a description of past experience with the approach.

6. **Sample Irrigation Scheduling Contract.** Provide a sample grower contract to serve as a template for irrigation scheduling services provided under this program. Following preliminary identification of a qualified irrigation scheduling consultant, it is anticipated that the agreement will need to be modified to ensure that services provided are in compliance with those specified herein.

7. **Staffing, Management and Quality Control Plan.** Provide a staffing plan including an organizational chart for all supervisory and field personnel to be involved in the project. Where individuals have not yet been identified, indicate the position to be filled. Indicate the day-to-day location of each individual to provide evidence that personnel will be locally available during the course of the project. For individuals based outside of the Imperial Valley, describe the frequency that they will be dispatched to the Valley to allow for evaluation of the responsiveness of the services to be provided. Describe provisions to be applied with your organization to ensure the reliability of recommendations.

8. **Conflicts of Interest.** Provide a statement that the firm and all individuals proposed to provide irrigation scheduling services are free from any competing professional or personal interests that could in any way affect their ability to complete the work specified herein impartially.

**Cost Proposal (provided in a sealed envelope)**

As previously specified, the cost proposal must be submitted in a separate, sealed envelope identifying the submitting firm and identifying it as the firm’s Cost Proposal. For the Cost Proposal, please complete and return the schedule of costs provided in Attachment 3. These costs represent not to exceed costs to provide irrigation scheduling services. Costs are expected to vary based primarily on crop due to differences in irrigation practices. Costs will not be used as criteria to judge the most qualified Irrigation Scheduling Consultant, but rather will be used by IID for financial planning. Please include documentation of all assumptions and supporting information used in the determination of costs.

**Evaluation Criteria and Selection Process**

**General**

To receive consideration, all responses shall be received by the time and date indicated in the Invitation Letter (April 30, 2008). Evaluation of the Respondent’s ability to provide these services will be based upon the written materials submitted and based upon interviews to be held during the week of May 5, 2008.

**Qualifications Evaluation**

Responsive SOQs will be evaluated based on the criteria and weights listed in Table 1. The pre-qualified irrigation scheduling consultant(s) will be the firm(s) receiving the highest total score(s) while meeting the minimum requirements specified.
Following are factors to be used for evaluation and selection of the Consultant(s):

1. Understanding of the work to be performed as described herein.
2. Experience and technical competence of project team when performing the requested services on similar projects.
3. Project organization and key consulting personnel. Education, qualifications, and experience of project team members.
4. Geographic limitations. Project team staff located in Southern California.
5. Proposed method to accomplish the work.
6. Knowledge and understanding of local “environment.” The “environment” includes but is not limited to: Imperial Valley, Coachella Valley, Palo Verde Valley, Yuma Valley, and San Diego County and local agencies regulations and policies. Past performance history with IID, other public agencies, and entities.
7. Ability to perform the work on time and within budget.

Table 1. SOQ Evaluation Criteria and Relative Weights.

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Firm Experience and References (refer to items 2 - 5 under Technical Proposal)</td>
<td>20</td>
</tr>
<tr>
<td>Qualifications of Key Individuals (refer to item 3 under Technical Proposal)</td>
<td>40</td>
</tr>
<tr>
<td>Irrigation Scheduling Software (refer to item 4 under Technical Proposal)</td>
<td>15</td>
</tr>
<tr>
<td>Availability/Proximity of Key Personnel (refer to item 7 under Technical Proposal)</td>
<td>25</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

IID reserves the right to verify all information submitted in the proposal, reject any or all proposals, to select a short-list of the most qualified Proposers to this QR, or to select the proposal that is most advantageous (Highest Evaluated Proposal) to IID. The decision shall be final, and there shall be no obligation by IID to provide justification for its decision.

If a mutually agreed scope of services and fee are arrived at, the Evaluation Team will make a selection of one or more pre-qualified irrigation scheduling consultants. Following such determination by IID, the selected Consultant(s) will be notified in writing. Those Consultants not selected will also be notified in writing.
Attachment 1: Summary of Program Features for 2008 Irrigation Scheduling Pilot Program

Overview
This document describes the 2008 irrigation scheduling pilot program to be implemented in the second half of 2008. The pilot program will serve to test various aspects of longer-term on-farm conservation programs in IID while providing growers with an opportunity for early implementation of conservation measures. Savings will be credited to IID as extraordinary conservation through the IOPP process.

Targeted Water Savings and Margin of Safety
- Targeted Savings for 2008: 1500 ac-ft
- Margin of Safety: 500 ac-ft
- Total Design Savings: 2000 ac-ft

Timing, Contracted Savings, Acres, and Fields
- Contract structured to target a minimum conservation amount per field (baseline – minimum conservation = upper delivery target) while providing incentives to conserve additional water, up to a maximum amount
  - Encourages that savings are achieved, without sacrificing crop production
  - Provides relatively firm minimum and maximum conservation amounts
- Implement in June and run through end of 2008 (7 months)
  - Focus on improved event design (increased application efficiency) for forage crops
  - Allow enrollment of Fall crops if sufficient savings are not being achieved through the crops enrolled in June
- Enter contracts for estimated conservation amount
  - Subject to revision during the enrollment consultation process for each field
  - Seek to maximize conservation per acre to decrease the number of fields that need to be enrolled, decreasing irrigation scheduling costs and administrative burdens

Contracting Arrangements
- District prequalifies irrigation scheduler(s)
- District enters into agreements with growers for individual fields following consultation
- Growers contract independently with qualified irrigation scheduling consultant, but include conditions requiring consultant complies with program, per IID’s RFQ

Payment Amounts
- All payments made by District to growers, who in turn pay for irrigation scheduling service
- Growers will receive a “sign-up” payment to cover estimated cost of irrigation scheduling services, including startup, weekly services, and irrigation evaluation plus estimated on-farm startup costs of improved irrigation management
- A final payment will also be made to growers to cover increased management and irrigation labor costs

Payment Schedule
- Initial payment to growers participating in program
  - Approximately 3/5 of total payments
Covers scheduling and some on-farm operations costs

Additional incentive payment to growers meeting minimum conservation target
  - Additional incentive determined based on actual savings
  - Remaining 2/5 of total payments
  - Contingent upon meeting minimum conservation target

**Eligibility Requirements**

Eligibility requirements have been selected for the first set of fields to be enrolled to support achievement of target water savings, reduce costs, and ease of program administration and verification:

- Fields must be at least 65 FSA acres
- All fields at a gate must be enrolled
- Targeted crops, initially, are forage (e.g., alfalfa, Bermuda, Sudan, etc.) and citrus
  - Alfalfa fields must be 2nd year or younger
  - Forage crops must be for hay production; seed production not allowed
  - These are high water use crops during the summer months
  - This preference may be broadened as part of the consultation process with growers
  - Additionally, if the program includes enrollment of Fall crops, the requirements will be broadened

**Monitoring and Verification**

The following monitoring and verification activities will be undertaken:

- Monitoring of Implementation
  - Verify grower contract with irrigation scheduler
  - Verify irrigation scheduling recommendations provided
  - Verify cropping consistent with agreement (including planting and harvest dates)
  - Perform exit interviews with grower and irrigation scheduling consultant to verify implementation and gather input

- Measurement for Verification of Savings and Payment
  - Rely primarily on zanjero delivery measurements
  - Possible spot check with periodic measurements of delivery flows
  - Possible continuous measurements by Irrigation Management and Monitoring Unit (IMMU) for cases where participating gates are randomly selected for Tailwater Education Program (TEP)
  - Possible additional improved measurement through pilot delivery measurement improvement program
  - Calculate conserved water amount as baseline, adjusted for actual weather, minus actual water use
    - Baseline will be estimated based on historical delivered water to field for crop grown, adjusted for differences in weather

**Scope of Services for Irrigation Scheduling Consultant**

See QUALIFICATIONS REQUEST #646.
Attachment 2: Instructions for Surface Irrigation Evaluations

These instructions have been developed based on the evaluation procedures of the NRCS National Engineering Handbook Irrigation Guide, Part 652.0904. Much of the text from the Irrigation Guide has been reproduced verbatim. The procedures for surface irrigation evaluations have been designed to provide adequate background to allow for immediate assessment of opportunities for improved surface irrigation event design to increase application efficiency including selection of set size, flow rate, and duration, while providing sufficiently detailed information to allow for calibration of a surface irrigation model such as SIRMOD or WinSRFR.

General

The effectiveness of irrigators’ irrigation water management practices can be determined by making field observations and evaluations. The results of these observations and evaluations are used to help improve water management techniques, upgrade the irrigation system, or both. Improvements to operations and management can conserve water; reduce labor, energy, and nutrient losses; improve crop yields, biomass, and product quality; and reduce existing or potential water pollution. The following principles apply to all irrigation methods and systems.

- Irrigation should be completed in a timely manner to maintain a favorable soil-water content for desired crop growth. An exception may be made where the water supply is limited. In this situation, water should be applied in a manner that maximizes water use benefits.
- The amount of water applied should be sufficient to bring the crop root zone to field capacity minus allowable storage for potential rainfall events.
- Water should be applied at a rate that will not cause waste, erosion, or contamination of ground water and downstream surface water.
- Improving management of the existing system is always the first increment of change for improved water management. Each irrigation evaluation should consider a change in water management decisions only, and then a change in water management decisions and irrigation system performance.

Evaluation is the analysis of any irrigation system and management based on measurements taken in the field under conditions and practices normally used. It is expected that the evaluation will be based on consultation with the grower and irrigator as well as on field observations during the system evaluation.

Irrigation System Evaluations

First step

Many important factors concerning how well an irrigation system is operating and how well it is being managed can be determined with a few simple observations and evaluation procedures. These procedures are used the first step in any system evaluation.

For any irrigation method or system, equipment needed to check soil moisture and compacted layers is a soil auger, push tube sampler, or soil probe. If the soil is rocky, a shovel (sharp shooter) is also needed. Surface irrigation systems require measuring devices to check furrow and border inflow and outflow. All such equipment is to be provided by the irrigation scheduling consultant.
Evaluation procedures

Step 1
Determine basic data about the irrigation system and management from the irrigation decisionmaker. Questions to be answered include:

- Who is the irrigation decisionmaker, and how is the decision when to irrigate and how much water to apply made?
- How is the length of time for each irrigation set determined?
- How is the time to shut water off determined?
- How long does it take for water to reach the end of borders or furrows? Early vs. late in the season? With and without cultivation prior to the irrigation event?
- How is flow rate determined?
- What is the rate of flow onto each border or into a furrow? into the system? How does it change over the course of the season?
- What problems (or concerns) have the irrigator experienced with the system?
- Are there dry spots in the field? wet spots? Are large areas of the field under irrigated? overirrigated?
- Crop production:
  - What is the average production of the field?
  - Does it meet or exceed county or area averages?
  - Does production vary across the field? If so, what does the irrigation decisionmaker feel are the causes (irrigation system, field surface nonuniformity, water supply amount and location of source or delivery, soil, fertilizer, chemigation, pests)?
- How much control does the irrigator have over when and how much irrigation water is available? delivery schedule?
- What are farm manager’s objectives?
- What is the skill level, timing, and amount of labor available?
- Can water be changed at night? during the middle of the day? at odd hours?

Step 2
Observe the field in question. Look at other fields. Look at the supply system. Look for and ask:

- Are there erosion or sediment deposition areas?
- Are there indications of excessive runoff from part or all of the field?
- Are there problems (or benefits) created by excessive irrigation tailwater or field runoff?
- Do leaky ditches and pipelines appear to have excessive water loss (seeps or leaks)?
- Are crops uneven or discolored? Do they show obvious stress?
- Are there water loving plants and weeds present?
- Are there saline or swampy areas?
- Are there poorly maintained diversion or turnout gates, leaks, uneven flows from siphon tubes or gated pipe gates, uneven irrigation heads, weeds, and trash?
Step 3
With the irrigation decisionmaker, auger or probe several holes at selected locations in the field. This is the best time to start talking to the farm manager or irrigation decisionmaker about proper irrigation water management. The feel and appearance method of moisture determination can also be demonstrated. Look for such information as:

- Is there evidence of an excessive high water table or indications of a fluctuating water table?
- Locate hard pans, compacted layers, mineral layers, or other characteristics that can restrict root growth and the movement of water in the soil. What is the apparent cause(s) of each restriction?
- Does soil texture change at various levels in the soil profile?
- Observe water content of each soil layer. Demonstrate the feel and appearance method of moisture determination to the irrigation decisionmaker. Is the location of wetted soil shallow (typically under irrigated) or deep (typically overirrigated) in the soil profile?
- Are root development patterns normal (unrestricted by soil compaction, overirrigation) for the time of year and stage of crop growth?
- Is soil condition favorable for plant growth?

Step 4
Discuss with the irrigation decisionmaker the findings and information so far obtained. Listen for management reasons. Make recommendations if enough information is available to do so. Make sure there is a true communication with the farm manager or irrigator. Use sketches and narratives, if appropriate. Are decisions based on tradition or field observations and measurements?

Water Management and Irrigation System Evaluations
The purpose of the water management and irrigation system evaluation is to help identify opportunities to improve irrigation performance and to provide data for calibration of the SIRMOD model to aid in development of field-specific guidelines to aid irrigation event design.

Graded or level border (basin)

Equipment
Equipment needed for a graded or level border evaluation includes:

- Soil auger, probe, push type core sampler.
- Survey level and rod.
- Watch, 100-foot tape.
- Lath or wire flags for marking stations.
- Portable water measuring device, such as Parshall flume, Replogle flume, sharp crested weir, and pipe flow meter. Capacities needed depends on typical inflows and outflows for the fields.

Procedures
The following procedures are to be followed.

Before start of irrigation:
• Estimate the soil-water deficit (SWD) at several locations down the border being investigated. Use feel and appearance or another approved method.
• Set flags or stakes at uniform distances down the border (generally 100-foot spacing).
• Measure the mainfall (slope along the borders) for the borders to be evaluated. Take a series of measurements at approximately 100 foot intervals along the entire border. Calculate the slope for each segment and the average slope along the entire border.
• Measure the width of each border and the total width of the irrigation set.
• Collect measurements of the crop height and photos to show the crop density.
• Lay a tape measure or measuring stick on the ground surface. Count the number of surface cracks per yard and the average width of cracks at more than one location.

**During irrigation:**
• Observe and record how uniformly water spreads across the border (basin) width. The soil surface should not have excessively high or low spots, and no intermittent ponding should occur.
• Observe and record the time when the water reaches each station. These times will be used later in plotting an advance rate curve.
• Record the time and location of the water front at the moment when inflow is turned off.
• Record the time when 90 percent of the soil surface area is no longer covered by water at each station. These times will be used later in plotting a recession curve. No long time ponding should occur.
• Measure the volume of runoff regularly to establish a runoff hydrograph for the border (or borders) being irrigated. Calculate the total runoff in terms of percent of inflow volume.
• Probe following irrigation (once the field is accessible), the soil profile down the border strip to check uniformity of water penetration. Where soil and crops are uniform, a previously irrigated border strip may be used for this purpose.
• Determine adequacy of the irrigation with an additional simple based on the rate of inflow. Use the basic equation QT = DA to calculate the gross depth of irrigation application from the known rate of inflow, duration of irrigation, and length and width of a border strip or the entire irrigation set. An example to determine gross application depth, D, for a border strip 100 feet wide and 1,200 feet long, with 3 cubic feet per second inflow for a set inflow time of 4.5 hours, would be:

\[
D = \frac{(Q \times T)}{A}
\]

\[
D = \frac{(3.0 \text{ ft}^3/\text{s}) \times (4.5 \text{ hr})}{A} = 4.9 \text{ in.}
\]

where:

\[
A = \frac{(100 \text{ ft}) \times (1,200 \text{ ft})}{43,560 \text{ ft}^2/\text{acre}} = 2.75 \text{ acres}
\]

When the gross depth of application, D = 4.9 inches, is multiplied by the estimated overall application efficiency (decimal), average net depth of irrigation can be estimated. The field technician...
needs to have experience in ranges of average application efficiencies for the farm or in the general area.

\[ \text{Ave. net depth} = 4.9 \times 60\% = 3 \text{ inches (approx.)} \]

**Use of field data**

The following steps are to be followed to evaluate the field data:

- **Step 1**—Using distance down the border (stations) and elapsed time in minutes, plot advance and recession curves for the border (fig. 9–12). Show the time when water was shutoff and location of water front at that time. The opportunity time is the time water was in contact with the soil surface (the interval between the advance and recession curves) at any given point (station) along the border. With basins, the water front at various times is plotted on an area basis, similar to topographic contour lines. Advance and recession curves can be plotted at select locations radiating away from the water supply onto the field. Large variations in opportunity times along the length of the border indicate changes need to be made in the rate of flow, duration of flow, or field surface conditions.

![Figure 9-12: Plot of example advance and recession curves](image)

- **Step 2**—Compare probe depths at various locations down the border (basin) keeping in mind that water movement through the soil may not be complete. Does it appear that parts of the border (basin) have had too short an opportunity time?

**Graded or level furrows**

**Equipment**

The equipment needed includes:

- Soil auger, probe, push type core sampler, shovel.
- Survey level and rod.
- 100-ft measuring tape, carpenter’s tape measure
• Portable flow measuring devices (Parshall flume, Replogle flume, vee-notch flume, vee-notch sharpcrested weir, orifice flow plate, siphon tubes, flow meter in a short length of pipe, bucket).
• Watch with second hand or stop watch.
• Stakes or wire flags for locating stations.

At least three furrows should be evaluated. Alternatively, the entire irrigation set can be evaluated. Included should be the correct proportion of wheel rows, nonwheel rows, and guess rows. A judgment decision must be whether these few furrows adequately represent the entire field.

**Procedures**
The following procedures are to be followed.

**Before the start of irrigation:**
• Estimate the soil-water deficit (SWD) at several locations down furrows being investigated (use feel and appearance method). Check soil moisture in the root zone (not necessarily in the center of the furrow). Is it dry enough to irrigate?
• Measure the mainfall (slope along the furrows) for the furrows to be evaluated. Take a series of measurements at approximately 100 foot intervals along the entire furrow. Calculate the slope for each segment and the average slope along the entire furrow.
• Note the condition of furrows. Has there been a cultivation since the last irrigation?
• Measure the geometry of the furrows including furrow spacing, top width, middle width, bottom width, and depth (see data forms at end of these specifications)
• Set stakes or wire flags at 100-foot stations down the length of each furrow evaluated.
• Collect photos to show the crop density.
• Lay a tape measure or measuring stick on the ground surface. Count the number of surface cracks per yard and the average width of cracks at more than one location.

**During an irrigation:**
• Measure the inflow rate (example 9–1). If siphon tubes are used, a siphon tube head-discharge chart can be used to estimate inflow. If total inflow is known, divide total inflow by the number of furrows being irrigated. Timing furrow flow catch in a bucket of known capacity or using a portable furrow flow measuring device are both accurate methods.
Observe the time it takes water to reach each station (lath or wire flag) and to reach the lower end of each furrow evaluated.

Measure furrow outflow with a portable flow measuring device regularly during the runoff phase to establish a runoff hydrograph for the furrows being irrigated. Calculate the total runoff in terms of percent of inflow volume.

Check for erosion and sedimentation in the furrow or tailwater collection facilities.

Dig a trench across a furrow (plant stem to plant stem) to be irrigated by the next set. The wetted bulb can also be observed following an irrigation. Observe conditions, such as:
  o Actual root development, location, and pattern
  o Compaction layers—identify cause (cultivation, wheel type equipment, plowing, disking)
  o Soil textural changes
Salt accumulation and location

- About 24 hours following irrigation, probe the length of a representative furrow to check uniformity of water penetration. Where soil and crops are uniform, a previously irrigated furrow set can be used for this purpose.

**Use of field data**

The following steps are to be followed to evaluate the field data:

- **Step 1**—Was the soil dry enough to start irrigating? What was the soil-water deficit in the root zone at various points along the furrow before irrigating?
- **Step 2**—Did water penetrate uniformly along the length of each furrow? Good uniformity usually is achieved if the stream progresses uniformly and reaches the lower end of the furrow without erosion in about a quarter to a third of the total inflow time. Should furrow length be reduced? increased? Should inflow rate be changed?

Plot the advance curve for the furrow (see fig. 9–12). Plotting of the furrow advance curve is basically the same as the plot of the border advance curve. Shape of advance curve can indicate adequacy of inflow rates in relation to soil intake characteristics for that specific length of furrow. Estimates for adjustments in furrow irrigation operation values can be made using inflow and advance rate estimates.

- **Step 3**—Was there runoff? How much? Water ponding with blocked end nearly level furrows or running off at the lower end of nonblocked furrows is essential for practical operation and a full, uniform irrigation.
- **Step 4**—Are the water supply and conveyance systems capable of delivering enough water for efficient and convenient use of both water and labor? Supplies should be large enough and flexible in both rate and duration. Furrow streams should be adjustable to the degree that flow will reach the end of most furrows in about a quarter to a third of the total inflow time.

**Observations**

Did soil in the crop root zone contain all of the irrigation water applied? Is there still a soil-water deficit in the root zone or is deep percolation below the root zone occurring? A simple before and after soil-water content check can provide data to estimate amounts before and after irrigation. However, this does not account for uniformity or nonuniformity in application depths throughout the length of the furrow. By simple soil probing or push core sampling throughout the length of the furrow the next day following an irrigation (or on a previous set), depth of water penetration along the furrow can be observed.

With some field experience, inflow rate and set time adjustments can be recommended to improve depth of water penetration and uniformity of water penetration along the furrow length.

Was the soil dry enough to start irrigating? Was it too dry? Compare the SWD to application. How does the crop look? Is there evidence of under irrigation, salinity problems, overirrigation? Are there obvious dry spots? dry strips?

Is there soil erosion? water translocation? or runoff? Is it general or only at specific locations? A solution may be to improve irrigation water or tillage management.
Sample Data Forms

Sample data forms to be used for surface irrigation evaluations are provided on the following pages.
Canal_Gate: __________________________  Evaluator: __________________________

Field ID(s): __________________________  Date: __________________________

**FIELD BACKGROUND INFORMATION**

- Crop: __________________________
- Run Length: __________________________
- Irrigation Method: __________________________
- Field Width: __________________________
- Bed/Furrow Spacing:
  (at least 10 rows): __________________________

**SLOPE MEASUREMENT**

<table>
<thead>
<tr>
<th>Station</th>
<th>Reading</th>
<th>Lat.</th>
<th>Long.</th>
<th>Elev.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Slope Direction</th>
<th>Upper El</th>
<th>Lower El</th>
<th>Distance (ft)</th>
<th>Slope (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N-S</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>E-W</td>
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</table>

**FIELD SKETCH** (Include field orientation and dimensions, turnout, tailwater box, survey points, head ditch, head and tail layout, furrow x-section, slope directions)

**PHOTO LOG**

<table>
<thead>
<tr>
<th>Photo ID</th>
<th>Description</th>
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<tbody>
<tr>
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<tr>
<td>Field ID(s):</td>
<td>Date:</td>
</tr>
<tr>
<td>-------------</td>
<td>------</td>
</tr>
</tbody>
</table>

**FIELD BACKGROUND INFORMATION**

- **Crop:**
- **Irrigation Method:**
- **Bed/Furrow Spacing:** (at least 10 rows):
- **Crop Height:**
- **Run Length:**
- **Field Width:**
- **Crack width and spacing:**
- **Crack depth:**

**EVENT BACKGROUND INFORMATION**

- **Zanjero Flow:** cfs
- **Delivery Type (over vs. undershot):**
- **Gate Width:** in
- **Tailwater Box Width:** in
- **Set Width:** feet/borders/furrows (circle one)
- **Start Time:**
- **Advance Time:**
- **Cutoff Time:**
- **W.S. Elev. @ cutoff:** in
- **Time of Depletion:**

**INFLOW MEASUREMENT**

<table>
<thead>
<tr>
<th>Time</th>
<th>Flow Type</th>
<th>Upstr.</th>
<th>Downstr.</th>
<th>Flow (cfs)</th>
</tr>
</thead>
<tbody>
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</tbody>
</table>

**TAILWATER MEASUREMENT**

<table>
<thead>
<tr>
<th>Time</th>
<th>Flow Type</th>
<th>Upstr.</th>
<th>Flow (cfs)</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>

**ADVANCE/RECESSION DATA**

<table>
<thead>
<tr>
<th>Furrow Location:</th>
<th>Advance Station</th>
<th>Advance Clock</th>
<th>Advance Cum.</th>
<th>Recession Station</th>
<th>Recession Clock</th>
<th>Recession Cum.</th>
</tr>
</thead>
<tbody>
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</table>

**PHOTO LOG**

<table>
<thead>
<tr>
<th>Photo ID</th>
<th>Description</th>
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</tbody>
</table>
IRRIGATOR INTERVIEW QUESTIONS

1. How long are the irrigation sets? (If differing lengths, describe strategy)

2. What is the method used to determine when and how much to reduce or stop the inflow? If flow is reduced, what is impact on next set?

3. Are tailwater boards, temporary dams, furrow dams, etc. used to hold water at the ends of the borders/furrows? If so, describe how water is held and when it is released relative to reaching the end of the border/furrow.

(The following questions in this section are for furrow irrigation only.)

4. Are wheel rows handled differently from non-wheel rows? How is the inflow adjusted for uniform advance? Is this possible for a mature crop with full cover?

5. How many wheel rows are there relative to non-wheel rows? (This may be observable without asking the irrigator.)

GENERAL OBSERVATIONS
Rate each of the following 1 - 4 with 1 = strongly disagree, 4 = strongly agree.
1. High and low spots cause one or more of the following (circle): nonuniform advance, standing water in mid-field low spots, large difference in top width of water surface in furrows.

2. Erosion occurs at the head of the border/furrow and/or along the border/furrow.

4. Borders/furrows are overtopping with water.

5. Water crosses into dry furrows when irrigating every other furrow.

6. Crop height differs along the border/furrow.

7. There is excessive side fall across the border.

NOTES
Attachment 3: Cost Schedule

The cost schedule represents not-to-exceed costs to provide irrigation scheduling, event evaluation, and event design services. Scheduling costs are expected to vary based primarily on crop due to differences in irrigation practices. Please include documentation of all assumptions and supporting information used in the determination of costs.

**Irrigation Scheduling Service**

Please indicate the lump sum monthly cost per field for providing the irrigation scheduling services specified herein, excluding the cost of performing the surface irrigation evaluation as specified in Attachment 1. For convenience, an estimate of the typical season length has been provided.

<table>
<thead>
<tr>
<th>Crop</th>
<th>Irrigation Method</th>
<th>Typical Season Length (mo)</th>
<th>Lump Sum Monthly Cost per Field</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alfalfa</td>
<td>Flat(^1)</td>
<td>11 - 12</td>
<td></td>
</tr>
<tr>
<td>Alfalfa</td>
<td>Row(^2)</td>
<td>11 - 12</td>
<td></td>
</tr>
<tr>
<td>Bermuda</td>
<td>Flat</td>
<td>11 - 12</td>
<td></td>
</tr>
<tr>
<td>Sudan</td>
<td>Flat</td>
<td>3 - 5</td>
<td></td>
</tr>
<tr>
<td>Sudan</td>
<td>Row</td>
<td>6 - 10</td>
<td></td>
</tr>
<tr>
<td>Sugarbeet</td>
<td>Row</td>
<td>6 - 10</td>
<td></td>
</tr>
<tr>
<td>Wheat</td>
<td>Flat</td>
<td>3 - 6</td>
<td></td>
</tr>
<tr>
<td>Onion</td>
<td>Row</td>
<td>6 - 8</td>
<td></td>
</tr>
<tr>
<td>Carrot</td>
<td>Row</td>
<td>4 - 7</td>
<td></td>
</tr>
<tr>
<td>Lettuce</td>
<td>Row</td>
<td>3 - 5</td>
<td></td>
</tr>
<tr>
<td>Cotton</td>
<td>Row</td>
<td>5 - 7</td>
<td></td>
</tr>
<tr>
<td>Asparagus</td>
<td>Row</td>
<td>11 - 12</td>
<td></td>
</tr>
<tr>
<td>Cole Crops (Broccoli, Cauliflower, Cabbage)</td>
<td>Row</td>
<td>3 - 5</td>
<td></td>
</tr>
<tr>
<td>Melons</td>
<td>Row</td>
<td>3 - 5</td>
<td></td>
</tr>
<tr>
<td>Citrus</td>
<td>Micro</td>
<td>11 - 12</td>
<td></td>
</tr>
<tr>
<td>Corn</td>
<td>Row</td>
<td>3 - 5</td>
<td></td>
</tr>
</tbody>
</table>

1. Graded border.
2. Graded furrow.

**Irrigation System Evaluation**

Please indicate the lump sum cost of performing an irrigation system evaluation as specified herein for a field.

Total Lump Sum Cost Per Field: ____________________________
Appendix 3: Irrigation Scheduling and Event Management Specifications
Part 1: Specifications for Irrigation Scheduling

Overview

These specifications have been prepared for irrigation scheduling services to be provided as part of the 2008 Irrigation Scheduling and Event Management Pilot Program to be implemented as part of IID’s Efficiency Conservation Program. These specifications provide minimum requirements for irrigation scheduling services. An estimate of the amount of time required to provide the specified services has additionally been included.

Source of Specifications and Estimate of Time Required

These specifications for irrigation scheduling have been developed by the Imperial Irrigation District based on standard irrigation scheduling practices using a combined water-budget and soil moisture monitoring approach. Estimated time requirements to provide the specified irrigation scheduling services are provided in Table 1.

<table>
<thead>
<tr>
<th>Task</th>
<th>Estimated Hours</th>
<th>Estimated Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial Grower Meeting</td>
<td>1.5</td>
<td>Once</td>
</tr>
<tr>
<td>Field Visit and Preparation of Recommendations</td>
<td>1</td>
<td>Weekly</td>
</tr>
<tr>
<td>Grower Meetings</td>
<td>1</td>
<td>Monthly</td>
</tr>
<tr>
<td>Preparation of Post-Season Report</td>
<td>1</td>
<td>Once</td>
</tr>
</tbody>
</table>

Additionally, as specified, the irrigation scheduling consultant is required to meet with IID staff for up to four hours per month.

Irrigation Scheduling Service

As a minimum, the following requirements of the irrigation scheduling service shall be met:

1. Root Zone Water Budget Approach. Irrigation recommendations are to be developed based on a daily root zone water balance approach, including quantification of crop evapotranspiration (ET) based on the Kc x ETo approach. The water balance must also be updated weekly based on field observations of soil moisture content.
2. ETo by CIMIS. Reference evapotranspiration data used in the water balance shall be derived from CIMIS weather data. Other local weather stations may be used, provided that they are equipped and positioned equivalent to CIMIS.
3. Crop Coefficients. Crop coefficients to be used for ET calculations shall be recognized values reported by FAO, UCCE, or other reputable sources. Additionally, IID will provide crop curves developed in the Imperial Valley for a variety of crops based on satellite remote sensing of actual crop ET under field conditions.
4. Stress Coefficients. Estimates of ET developed using the root zone water budget must account for the effect of moisture stress on crop ET. The daily water budget must include a stress coefficient, Ks, to account for ET reduction due to stress. The stress coefficient is
needed, particularly for forage crops, to accurately predict ET during periods when water
cannot be applied for irrigation due to cultural practices such as cutting.

5. Field Visits. The irrigation scheduling consultant is required, at a minimum, to visit each
enrolled field once per week or three times between irrigation events, whichever is less.
During each field visit, estimates of soil moisture content, percent ground cover, crop growth
stage, and other physiological stress indicators of the crop are to be recorded, along with other
relevant observations. Observations are to be made at multiple locations to ensure the results
are representative of the field.

6. System Evaluation. For each field, evaluation of an irrigation event is to be conducted for at
least one irrigation event during the irrigation season. The system evaluation is to be
completed within 45 days of entering into an irrigation scheduling agreement with each
grower. The irrigation evaluations shall be conducted in accordance with Attachment 2:
Specifications for Irrigation Evaluations, to be included as an attachment to the Grower-
Consultant Contract.

7. Irrigation Scheduling Recommendations. The Irrigation Scheduling consultant shall develop
written recommendations on a weekly or more frequent basis for each field including, at a
minimum, the following information:
   a. Field Information. Grower, Gate ID, Field ID, Acres, Irrigation Method, Soil Type or
      Types, Available Waterholding Capacity, Crop
   b. Current Conditions. Crop Stage/Percent Cover, Root Depth, Soil Moisture Depletion,
      Management Allowable Depletion, Reference ET, Crop Coefficient, Crop ET
   c. Irrigation Recommendations. Next Irrigation Date, Target Application Efficiency,
      Gross Depth to Be Applied, Target Infiltrated Depth, Number of Sets, Flow Rate,
      Duration.
   d. Summary of Season to Date. Cumulative Applied Water, Cumulative ET, Number of
      Irrigations.

8. Reporting Requirements. Written recommendations shall be submitted weekly for each field
to both the grower and IID. Copies submitted to IID must be provided in digital (e.g., pdf)
format.

   a. A written post season report, approximately 1-page in length shall be prepared by the
      irrigation scheduling consultant for each participating grower.
   b. The written report shall provide observations related to the following:
      i. Extent to which the grower adopted the irrigation recommendations or
         otherwise modified irrigation practices.
      ii. Description of physical field characteristics that limit potential application
          efficiency and the benefits of irrigation scheduling.
      iii. Recommendations for scaling up and institutionalizing irrigation scheduling
          within the Imperial Valley.
   c. A sample report template is provided in the following section

10. Meetings. The irrigation scheduling consultant shall be available to meet with IID at least
    monthly for up to four hours to review progress of the irrigation scheduling pilot program.
    Meeting locations, dates and formats will be established by mutual agreement between the
    consultant and IID.

*Post Season Report Format*

The following template is provided as a sample for preparation of the post season report:
IID Efficiency Conservation Program
2008 Pilot Irrigation Scheduling Program
Exit Interview Questionnaire for Irrigation Scheduling Consultant

Scheduler: __________________________  Interviewer: ________________

Participating Grower: __________________________  Date: ________________

Participation Summary

<table>
<thead>
<tr>
<th>Gate/Field</th>
<th>Acres</th>
<th>Crop</th>
<th>Plant Date</th>
<th>Harvest Date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</table>

Interview Questions

1. Did the grower modify irrigation practices based on the recommendations? Please explain briefly.

2. What limitations were there to increasing application efficiency or otherwise benefiting from irrigation scheduling?

3. Please comment on the overall effectiveness of the program and opportunities to scale-up irrigation scheduling in the Imperial Valley.
Part 2: Specifications for Irrigation Evaluations

Overview
These specifications have been prepared for irrigation evaluations to be conducted as part of the 2008 Irrigation Scheduling and Event Management Pilot Program to be implemented as part of IID’s Efficiency Conservation Program. These specifications provide minimum requirements for evaluation of graded border, graded furrow, and micro (drip or microspray) irrigation systems. For each evaluation type, procedures are provided. Additionally, an estimate of the amount of time required to perform the evaluation has been included.

Source of Evaluation Procedures and Estimate of Time Required
Evaluations shall be conducted in accordance with the procedures developed by the Irrigation and Training Research Center (ITRC) as part of the Irrigation Evaluation manual and software package. The evaluation procedures and software are available from ITRC at www.itrc.org at a cost of $120. The estimated time requirements for the evaluations are provided in Table 1.

Table 1. Estimated Time Requirements for Irrigation Evaluations.

<table>
<thead>
<tr>
<th>Task</th>
<th>Engineer/ Agronomist</th>
<th>Field Technician</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meet w/Grower prior to Evaluation</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Meet w/Irrigator</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Collect Field Data</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>Compile and Analyze Data</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Prepare Recommendations</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Meet w/Grower following Evaluation</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>10</strong></td>
<td><strong>8</strong></td>
</tr>
</tbody>
</table>

Evaluation Procedures
As previously described, evaluations shall be conducted in accordance with the procedures developed by the Irrigation and Training Research Center (ITRC) as part of the Irrigation Evaluation manual and software package. The following appendices are included providing documentation of the evaluation approach for each irrigation method:

Appendix 3.2A – Evaluation Procedures for Graded Borders
Appendix 3.2B – Evaluation Procedures for Graded Furrows
Appendix 3.2C – Evaluation Procedures for Microirrigation Systems
### Appendix 3.2A: Documentation of ITRC Graded Border Evaluation Procedures

#### Graded Border Strip Documentation

**GRADED BORDER STRIP**

<table>
<thead>
<tr>
<th>QUESTIONS:</th>
<th>EXPLANATIONS:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SYSTEM DESCRIPTION</strong></td>
<td></td>
</tr>
<tr>
<td>1. Water is delivered to the field by (1-3):</td>
<td>1. Identify the type system used to deliver water to the field. A system is considered &quot;Low Pressure&quot; if it has a pressure of 10 psi or less. A &quot;High Pressure&quot; system has a pressure greater than 10 psi. Select one of the following system types: 1 = Open ditch 2 = Low pressure pipe 3 = High pressure pipe</td>
</tr>
<tr>
<td>2. Is there irrigation runoff? (Yes/No):</td>
<td>2. Runoff estimates should include water that runs off from the end of the border strip and any water spilled at the head ditch.</td>
</tr>
<tr>
<td>3. Is the runoff collected for reuse on the farm? (Y/N):</td>
<td>3. Runoff water collected and reused on the farm is not a loss.</td>
</tr>
<tr>
<td>4. Runoff not collected for reuse, as a percent of the depth water applied (%):</td>
<td>4. The total runoff from all sets evaluated not collected and reused on the farm.</td>
</tr>
<tr>
<td>5. Are border strip ends blocked? (Y/N):</td>
<td>5. Is water prevented from draining freely from the border strip?</td>
</tr>
</tbody>
</table>

**PUMPING PLANT MEASUREMENT**

| | |
| 1. Pressure loss across automatic control valves (psi): | 1. An automatic control valve is designed to provide slow opening and closing, pressure regulation, and/or check functions. Enter the total loss across the valve, the difference between the inlet and outlet pressures of the valve. Pressure losses greater than 5 psi are considered to be excessive. |
| 2. Pressure loss across throttled manual valves (psi): | 2. Enter the total loss across the manual valve. |
METHODS USED TO DECIDE WHEN TO IRRIGATE

1. Use good ET or soil moisture measurements (variable frequency)? (Y/N):

2. Visual indications of crop stress, no measurements (variable frequency)? (Y/N):

3. Fixed schedule (constant frequency)? (Y/N):

METHODS USED TO DETERMINE WHEN TO TURN THE WATER OFF

1. Probe the soil both during and after irrigation for depth of water penetration? (Y/N):

2. Soil moisture measurements after set is completed? (Y/N):

3. Estimate, no measurement? (Y/N):

4. Measured depth applied with runoff returned to the same set (controlled volume)? (Y/N):

5. When water has advanced to a certain point down the field? (Y/N):

SET TIMES

A maximum of two set times can be used to describe one complete irrigation cycle. Time measurements are cumulative time in minutes. Time zero (0) for all points is when the set begins, i.e., when the water is started. The advance time and recession time are to be made at beginning of the border strip (0% of the strip length), and 25%, 50%, 75%, and 100% of the strip length.

SET #1:

1. Percent of the Total Area (%): 1. To calculate, use the following equation:

   \[ \frac{\text{area of this set}}{\text{sum of the area of sets one and two}} \times 100 \]
2. **Advance Time** (min.): 2. **Advance Time** (min.) = the total elapsed time \((T = 0)\) when water begins to flow into the set) when the irrigation water reaches each location.

3. **Recession Time** (min.): 3. **Recession Time** (min.) = the total elapsed time \((T = 0)\) when water begins to flow into the set) when the water is no longer on the soil surface at each location.

---

**Location of measurement as a % of total length**

<table>
<thead>
<tr>
<th>Advance (min.)</th>
<th>0%</th>
<th>25%</th>
<th>50%</th>
<th>75%</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recession (min.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4. **Time water turned off** (min.): 4. The total elapsed time when water is shut off and is no longer being applied to the border strip.

---

**SET #2:**

1. **Percent of The Total Area (%)**:

   NOTE: Data for the second set should be collected if daytime and nighttime sets are significantly different.

2. **Advance Time** (min):

3. **Recession Time** (min):

   **Location of measurement as a % of total length**

<table>
<thead>
<tr>
<th>Advance (min.)</th>
<th>0%</th>
<th>25%</th>
<th>50%</th>
<th>75%</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recession (min.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4. **Time water turned off** (min):

---

**SOILS**

The intake characteristics of the soils \((K\) and \(n\) from the Kostiakov equation) must be known or estimated. This program has "default" values of \(K\) and \(n\) for various soil types, but the ideal procedure on a uniform soil is to determine actual values from field measurements with double ring cylinder infiltrometers. Although the "\(K\)" values are often quite different between individual cylinders, the "\(n\)" values are often similar.

It is crucial that the units be the same as those used in the program. Program units for the intake rate are:

\[
\frac{\text{in}}{\text{hr}} = K T^n
\]

where \(T\) is opportunity time, in minutes.
In the table below, the "percent" column must be filled in to indicate the extent of soil variability in the field. If the "K" and "n" values have been determined in the field, enter those values also. The sum of the values in the percent column must equal 100%.

The program user can enter his own estimates of K and n or use the default values listed in the table below. If the default values are to be used, all that is required is to enter the "percent" of the total area being evaluated covered by each soil. Basic soil classifications can be identified by field inspection and/or published soil survey data.

A maximum of five sets of K and n values can be used to replace the default values. If only one set of values are available, but more than one soil type has been identified, enter the values you have and the % of the area covered by each soil. If only one set of K and n values are available, but more than one soil type has been identified, enter the values you have and the % of the area covered by each soil. The missing values of K and n will be estimated using the K and n values entered and the default values. When entering K and n values follow these basic rules:

1. The sum of the percent of the area must equal 100%.
2. If a K value for a soil is entered a corresponding n value must also be entered, and the percent area for this soil must be greater than zero.
3. If an n value for a soil is entered, a corresponding K value must also be entered, and the percent area must be greater than zero.

<table>
<thead>
<tr>
<th>Soil Type</th>
<th>K</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cracking Clay</td>
<td>2.5</td>
<td>0.1</td>
</tr>
<tr>
<td>Clay, Silty Clay, Sandy Clay</td>
<td>0.0244</td>
<td>0.661</td>
</tr>
<tr>
<td>Clay Loam, Silty Clay Loam</td>
<td>0.0364</td>
<td>0.7204</td>
</tr>
<tr>
<td>Loam, Silty Loam</td>
<td>0.0471</td>
<td>0.7475</td>
</tr>
<tr>
<td>Loamy Sand, Sard</td>
<td>0.0659</td>
<td>0.7792</td>
</tr>
</tbody>
</table>

**BORDER STRIP OPERATION**

Use the following scale (1-4) for the next questions:

1. High and low spots or uneven grade in the border strip (1-4):
2. High and low spots may be indicated by:
   - nonuniform advance rate
   - water remains standing in part of the border strip after it has disappeared from soil surface both upstream and downstream of that location.

The 1 to 4 is a subjective rating of problems observed in the field while conducting the evaluation.

1. There is no problem, or if visible, it has no effect.
2. The problem is visible, but of little effect.
3. The problem is apparent and is a factor affecting the performance of the irrigation system.
4. The problem is severe and is a dominant factor affecting the performance of the irrigation system.
2. Excessive cross slope in the border strip (1-4):

3. Erosion at the head of the border strip (1-4):

4. Erosion along the border strip (1-4):

5. Buried pipe risers operating at full capacity (1-4):

6. Excessive pressure at pipe outlets (1-4):

7. Border strip flowing at full capacity (1-4):

8. Water cross over into dry border strip (1-4):

2. Water will remain on the low side of the border strip longer than on the high side.

3. Indicated by the clarity of the water, deposition of the eroded material on the border strip or in the drain ditches at the end of the field.

4. Indicated by the clarity of the water, deposition of the eroded material on the border strip or in the drain ditches at the end of the field.

5. The valve is operating in the full open position.

6. Minor valve or gate changes result in large changes in flow rate.

7. Water flow is at or near the top of the border.

8. Cracks or lack of adequate border height allow water to cross over into adjacent border strips.

FIELD OBSERVATIONS

Use the following scale (1-4) for the next questions:

1 - Little or no problem
2 - Slight problem
3 - Moderate problem
4 - Severe problem

1. Difference in crop height along the border strip (1-4):

2. Poor surface drainage at the lower end of the border strip (1-4):

3. Water advance down the border strip is uneven (1-4):

4. Variation in the water deliver flow rate (1-4):

5. Water penetration problems at the end of the irrigation season (1-4):

1. Indication of non-uniform water application.

2. May be affecting crop growth.

3. Advance may be unequal from one side to the other side of the border strip or may advance down the strip at different rates.

4. Flow rate varies with time due to changes beyond the irrigator's easy control.

5. It is difficult to infiltrate sufficient water at the end of the irrigation season.
## Appendix 3.2B: Documentation of ITRC Graded Furrow Evaluation Procedures

### Furrow Documentation

<table>
<thead>
<tr>
<th>QUESTIONS:</th>
<th>EXPLANATIONS:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SYSTEM DESCRIPTION</strong></td>
<td></td>
</tr>
<tr>
<td>1. Type of furrow (Enter 1-3):</td>
<td>1. &quot;Type of furrow&quot; refers to the slope of the furrow. This information is not used in computations. Select one of the following: 1 = Sloping 2 = Level 3 = Sloping with level or blocked ends</td>
</tr>
<tr>
<td>2. Water delivered to furrows by (Enter 1-3):</td>
<td>2. This information is not used in the computations. Choose one of the following: 1 = Open ditch 2 = Low pressure buried pipe 3 = Gated pipe</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>BASIC INFORMATION</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Flow rate going onto field:</td>
<td>1. The flow rate is a crucial value used in the computations. The estimate of the intake rate constants is dependent upon the depth infiltrated, which is computed using this flow rate (minus runoff) information. If the flow rate changes with time, the AVERAGE flow rate during the FIELD irrigation should be given.</td>
</tr>
<tr>
<td>Units of flow (1-2):</td>
<td>Choose a unit for the flow rate: 1 = GPM 2 = CFS</td>
</tr>
<tr>
<td>2. Number of days this flow is applied to the field to completely irrigate the field:</td>
<td>2. This is the second crucial value (along with flow rate) which determines the volume of water applied to the field.</td>
</tr>
<tr>
<td>3. Number of furrows irrigated at once:</td>
<td>3. This is not used anywhere in computations. If the answer varies between sets, put down the &quot;average&quot; value.</td>
</tr>
<tr>
<td>4. Typical furrow length (feet):</td>
<td>4. This is not used anywhere in computations. If the answer varies between sets, put down the &quot;average&quot; value.</td>
</tr>
<tr>
<td>5. Total field irrigated area (acres):</td>
<td>5. This is the third crucial value. When combined with flow rate and time the field is irrigated, this allows the computation of the average depth applied to the field.</td>
</tr>
</tbody>
</table>

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6. Distance (center-to-center) between wet furrows (feet):

6. A "wet furrow" is a furrow with water deliberately running down it. The intake rate (in inches/hr) will be different for a widely spaced furrow as compared to a narrow furrow spacing, even though the intake rate (GPM/100') will be the same. This value is used in the intake rate constant estimates.

The program uses the following intake equation:

\[
\frac{\text{in}}{\text{hr}} = K T^n
\]

where "K" and "n" are the "intake rate constants"

7. Wetted perimeter of the wetted furrow (inches):

7. The wetted perimeter is the cross section LENGTH of soil actually covered by water in the furrow.

---

SET TIME INFORMATION

These times, in hours, establish the opportunity time for infiltration at each point along the furrow. In general, the values do not need to be accurate within the closest 15 minutes, but should be reasonably accurate. Make an estimate if you do not have the exact numbers.

Information is allowed for two sets. Often, the night set is irrigated differently than the day set because of the labor schedule. **It is very important to include this aspect of non-uniformity.**
### Furrow Documentation

<table>
<thead>
<tr>
<th>Number of hours for:</th>
<th>SET 1</th>
<th>SET 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water applied to head of furrow:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Advance to mid-field (from head):</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Advance to tail end of furrow (from head):</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extra hours past shut off that:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water sits at head end of furrow before disappearing:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water sits at mid-field before disappearing:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water sits at tail end before disappearing:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Tailwater Information

1. **Destination of tailwater (1-5):**
   - This information is used in conjunction with the flow rate, acres, and duration to estimate how much water INFILTRATES into the field. Use the answer which most closely matches the field condition. Basically, these questions are trying to determine how much of the APPLIED water left the field. Select one of the following:
   1. Recirculated on this field
   2. No tailwater; blocked ends
   3. Not recovered on this or any other field
   4. Recovered in sump on another field & not returned to this field during this irrigation
   5. Spread out on another field, but not collected in a sump.
   
   IF Tailwater answer above was 3, 4, or 5, answer the following questions:

2. **Do you know the percentage of applied water which ran off the field? (Y/N):**
   - If so, what percentage of applied water ran off the field (%):

   If you know the approximate percentage of runoff, put it down here. Otherwise, the program will estimate the amount of runoff based upon the % of time which water ran off, and how many times the irrigators adjusted the onflow to minimize runoff.

---

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- If not, how many times during a set was the flow into a furrow "cutback" to reduce tailwater?:

A "cutback" is a reduction of individual furrow flow rates (made at the head end of the field) in an effort to reduce tailwater runoff. Irrigators often do this by removing one or more of the siphons from each furrow, by opening more furrows on the next set, and/or by partially closing the gates on gated pipe. In general, it is not recommended to have cutbacks if it requires that new furrows be opened up to discharge the water which is no longer being applied to the original furrows.

WHEEL ROW INFORMATION

A "wheel row" is a row which is compacted due to sequential tractor tire traffic. For example, with a tractor using a tool bar for 6 rows, 2 of the rows will always be compacted by the tractor tires, and will have significantly lower intake rates than the other ("non-wheel row") furrows. A "guess row" is the row on the outside of the tool bar.

1. Are only wheel row or only non-wheel rows irrigated? (Y/N):

1. Some farmers will only irrigate wheel rows, if they want to apply a very small depth of water during an early irrigation. This is effective if every other furrow is a wheel row.

Other farmers irrigate the wheel rows during one pass through the field, and then next irrigate the non-wheel rows on the second pass. They will use completely different furrow flow rates and durations, and irrigate the two types of furrows as if they were different fields, because the intake characteristics are so different. This can be a very effective irrigation management strategy.

2. Is every other furrow a wheel row? (Y/N):

3. How many furrows form a group of non-wheel, wheel, and guess row furrows (a repeatable pattern determined by the tractor tool bar width):

4. How many of those are wheel rows?

5. How many of those are non-wheel or guess row furrows? (The total of these last two must equal the "group" total)

5. The program weighs the relative importance of wheel and non-wheel rows to assign a component of non-uniformity to this factor.

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6. Assume that a non-wheel row has a relative intake rate of 1.0. The wheel rows have a lower relative intake rate of (answer is between 0 and 1):  

6. As an example, a non-wheel row may require 2 siphons to have the same advance rate as a wheel row, which only requires 1 siphon. The wheel row would probably be assigned a relative intake rate of 0.5 (i.e., half of the non-wheel row) in that case.

### SOILS

You may use your own values, or values from the table below to estimate the relative intake rates of various soils. This analysis is for different soil types in various sets. It does not adequately handle differences in intake rates down a single furrow. That point comes later. The RDI is the "Relative Depth Infiltrated for the duration of the irrigation."

<table>
<thead>
<tr>
<th>Soil Type</th>
<th>RDI</th>
<th>Soil Type</th>
<th>RDI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coarse Sand</td>
<td>10</td>
<td>Loam</td>
<td>3.5</td>
</tr>
<tr>
<td>Fine sand</td>
<td>7</td>
<td>Clay Loam</td>
<td>3.0</td>
</tr>
<tr>
<td>Loamy sand</td>
<td>5</td>
<td>Silt Loam</td>
<td>2.5</td>
</tr>
<tr>
<td>Sandy loam</td>
<td>4</td>
<td>Clay</td>
<td>1.0</td>
</tr>
</tbody>
</table>

The "RDI" means the following: If a loamy sand would infiltrate 5 inches in an irrigation of a certain duration, a loam would infiltrate 3.5 inches in the same duration. It is suggested that you use the RDI assigned in the table above for the soil type which is predominante on the field, and adjust the RDI of the second soil type (if you feel it should be different from the table value) to reflect the difference between the soil types. The absolute RDI's numbers are not important; it is the ratio of the two RDI's which the program uses.

1. Soil RDI's on this field (always answer these first three questions):
   - Is there a relatively low intake soil:
     - Percentage of the field with this soil type (the two percentages must add to 100%; if only one soil type is used, the percentage listed should be 100%).
   - Relative Depth Infiltrated, RDI, for this soil type:

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### 2. Does this field have a distinct cracking-clay soil which seals up? (Y/N):

### 2. If a cracking clay soil exists, the exponent for the Kostiakov equation is automatically assigned as 0.10

\[
\text{Depth} = K T^{0.10}
\]

Actually, soils other than clays can exhibit the same characteristics. Answer "Y" if the soil has a very large infiltration rate initially, and if the soil "seals up" after the cracks are filled up. Such a soil can usually be identified through the nature of the advance rate. On "normal" soils, the rate of advance slows with time. For "cracking" soils, the advance is linear with time. That is, it takes about the same amount of time to advance the last half of the field length as it did to advance the first half of the length.

### METHOD USED TO DETERMINE SHUT OFF

What is the predominate method used to determine when to shut off the water during the majority of the year? (1-7):

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
</table>
| 1. Past history of average depth infiltrated and present SMD at this time of the year: | 1. This is considered the "best" method (rating = 10/10) because it recognizes that the infiltration rates vary during each irrigation. In this case, the farmer notes the average depth infiltrated and information about advance time and furrow flow rates and durations, and then uses that information the next year or next irrigation to make decisions. WITH FURROW IRRIGATION, THE SOIL DICTATES HOW MUCH WATER WILL INFILTRATE. Therefore, this year the infiltration will be about the same as last year at this time if everything else stays constant.

**If the furrow spacing is changed, the GPM/100' intake rate will be about the same, but the in/hr intake rate will be different by a factor of the furrow spacing ratio.**
2. Probe the soil during irrigation for depth of water penetration:

This is given a rating of 8/10. It is very good, but the problem is that the irrigator may find that the proper set duration is 18 hours, which doesn’t fit into a convenient labor schedule. The idea here is to have an irrigator use a blunt probe near the tail end of the field, and “follow the wetting front” down as it goes into the soil horizons. If the root zone is 5’ deep, the irrigator may begin a new set (and turn the water off in the old set) when the wetted front has reached 4’ at the tail end of the field. The water in the soil above field capacity, plus the water still remaining in the furrow, will probably allow the wetted front to go down the additional 1’.

3. Measured depth applied/set: all runoff returned to the same set:

This is given 8/10. It is the correct answer for level furrows, and there may be a few “controlled volume” sloping furrow systems around. However, it is unlikely that this will be the answer to a sloping furrow. If this strategy is used in conjunction with the first strategy of looking at past history, choose the first strategy as your answer to get a higher rating.

The idea of this answer is as follows: Each set (plus its runoff) is completely isolated from all other sets. Therefore, the volume applied to a set is equal to the volume infiltrated. This is exactly the way level furrows work, because there is no tailwater. On sloping furrows, the tailwater from one set would have to be completely returned to the set on which it originated. That would require 2 tailwater systems on the same field, which would be very expensive.

4. Beds wet all the way across:

Worth 3/10. This method does have merit during germination (in fact, it is essential at that time), but later in the season it is really just a convenient set of instructions given to the irrigator rather than an indicator that the proper depth has infiltrated.
5. When the water reaches the lower end of the furrow:

5. Worth 2/10. This is a common method of irrigation, but typically results in very low DU's because of a long opportunity time at the head of the furrows, and very little opportunity time at about the 7/8ths point along the furrow. Usually the tail ends are blocked to try to infiltrate enough water at the very end of the furrow. The fact that the water reaches the tail end has very little to do with the proper irrigation time to refill the root zone.

**Also use this answer if the sole criteria is a 12 or 24 hour set and does not take into account the past infiltration history.

6. Estimated, but no measurement:

6. Worth 4/10. At least the depth infiltrated is estimated. This can be better than the prior 2 measurements, in which the depth infiltrated is a secondary matter.

7. Other:

7. Worth 5/10. The assumption is that something worthwhile is being used. **The key on these values is the relative value a technique has in properly matching the set time to filling the SMD at the tail end of the furrows. Many rules deal more with trying to spread water or trying to minimize labor or tailwater than trying to fill the root zone properly and uniformly.

**GENERAL OBSERVATIONS**

Rate the following observations using one of the choices (1-4) to the right:

All of the observations are capable of triggering recommendation paragraphs in the output. Select one of the following choices for each observation:

1 = indicates little or no problem
2 = slight problem
3 = moderate problem
4 = severe problem

- High and low spots in the furrow:

High and low spots can be indicated by:
- non uniform advance along the furrow
- water remains standing in part of the furrow after it has disappeared from the furrow both upstream and downstream of that location
- large variations in the top width of the water surface along the furrow.

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- Furrow erosion
  - At the head of the furrow: Erosion at the head of the furrow indicates the need for socks on gated pipe, or burlap bags or lower head on siphons.
  - Along the furrow: Erosion along the furrow itself is indicated by very cloudy water and deposition of silt in the tailwater ditches and sump. This erosion is indicative of an excessively high flow rate.

- Buried pipe risers operating at full capacity: Orchard risers typically have this problem. The "DG’s", or distributing gates, are often very small and open pot risers are not tall enough to provide sufficient head to deliver large flow rates. When open pipe risers are operating at full capacity, they are almost overflowing at the top.

- Excessive pressure at pipe outlet: In this case, minor valve or gate changes result in large changes in flow rate. This may result in erosion at the pipe outlet.

- Furrows flowing at full capacity: If the water is at or near the top of the furrow, it doesn’t make much sense to recommend that the farmer use higher furrow flow rates.

- Furrows do not maintain their shape during irrigation: Furrow cross section is changed as the furrows lose their shape due to the instability of the soil structure.

- Water crosses over into dry furrows when irrigating alternate furrows: Cracks or lack of furrow capacity allow water to cross over into adjacent furrows. If this happens, it is not recommended that the farmer try to irrigate with alternate furrows.

- Difference in crop height along the furrow: This indicates non-uniform water infiltration or poor land grading which resulted in non-uniform germination, or possible fertility/salt problems.

- Poor surface drainage at the lower end of the furrows: This may affect crop growth.

- Water advance down the furrow is uneven: Indicates a change in slope or soil type along the furrow, or it may indicate that the incoming flow rate changes with time.

- Variation in the water delivery flow rate during a set: If the delivery flow rate changes, it may be difficult for the irrigator to do a good job.

- Water penetration problems at the end of the irrigation season: In many soils, the infiltration rates decrease dramatically toward the end of the season. It may be caused by tractor compaction, water compaction, or soil chemistry changes.
Appendix 3.2C: Documentation of ITRC Microirrigation Evaluation Procedures
### QUESTIONS:  

**EMITTER**

1. Manufacturer:  
2. Model:  
3. Units of nominal flow rate  
   \( (1 = \text{gph}; 2 = \text{lph}) \):  
4. Nominal flow per emitter  
   \( \text{gph or lph} \):  
5. Emitter path type (1 – 8):  

<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Long, smooth path</td>
</tr>
<tr>
<td>2</td>
<td>Pressure compensating</td>
</tr>
<tr>
<td>3</td>
<td>Vortex</td>
</tr>
<tr>
<td>4</td>
<td>Orifice</td>
</tr>
<tr>
<td>5</td>
<td>Tortuous path</td>
</tr>
<tr>
<td>6</td>
<td>Mult. flexible orifice</td>
</tr>
<tr>
<td>7</td>
<td>Spinning microsprinkler</td>
</tr>
<tr>
<td>8</td>
<td>Non-rotating microsprayer</td>
</tr>
</tbody>
</table>

The information in this section is non-functional. It is for user reference only.

**EMITTER SPACING**  
*If there is only one spacing, only fill out one column.*

1. Area with this combination (acres):  

These questions examine the possibility of unequal irrigation due to different tree and/or emitter spacing throughout an orchard or vineyard. That is, they are used to compute the component of DU block due to "unequal spacing" or improper irrigation scheduling.

A common misconception which this section addresses is the idea that a tree needs a certain number of gallons/day, regardless of its spacing. Research and practical irrigation scheduling show that Evapotranspiration (ET) should be calculated on an AREA basis. For a mature orchard of oranges on a 20' \( \times \) 20' spacing will have the same water use per acre  
(i.e., INCHES of water) as a mature orchard of oranges on a 22' \( \times \) 22' spacing. This means that the gallons of daily water use per tree is greater for a big mature tree than for a small mature tree, but that the inches/day of ET is the same for both.
Popular publications may present ET as gallons/day per tree, but this is only good for one particular tree spacing. It was calculated using the following formula:

\[
gallons/day = 0.62 \times (ET) \times \text{(tree spacing)}
\]

where
- gallons/day is a NET value (not gross)
- ET rate is in inches/day
- Tree spacing is in square feet.

1. Area with this combination (acres):
   (continued)

Once the canopy of an orchard covers about 70% of the ground surface, the ET rate is considered to be 100% of that possible for the trees themselves. Further shading will not increase the ET rate. However, if a cover crop or weeds grow, the ET will increase beyond the rate for trees only.

Note that any non-uniformity due to “unequal spacing” can generally be avoided by properly adjusting the hours/week of irrigation for each block, so that the INCHES of water applied per block are the same.

The answers are also used to make a very quick check regarding the adequacy of irrigation scheduling during the periods of peak ET. Especially with microsprinklers and microsprayers, irrigations are often incorrectly managed as infrequent, heavy applications. The restricted root zone, due to the small wetted area, may not be able to hold all of the water which is applied.

The output on scheduling has nothing to do with the DU computation, but it is a rather simple computation and was inserted in the program in the early days of its use to assist persons who were evaluating avocado microspray systems in the San Diego, California area. In that case, the root system was typically very shallow, and irrigators had the practice of putting the correct amount of water on per week, but only in one irrigation per week. The problem was that the soil held only enough water for a few days.
2. Area per plant (sq ft):

Measure the total area which a tree occupies. This is NOT the area under the canopy, but the area of the field dedicated to an individual tree. For example, if there are 100 trees per acre, the area per plant is:

\[
\text{Area} = \frac{43560 \text{ sq ft}}{100 \text{ trees}} = 435.6 \text{ sq ft/tree}
\]

For rectangular plantings, measure the distance trunk-to-trunk between 4 plants to get an "average" of the three distances in each direction (down and across the row). Never measure the distances using trees on the outside of the orchard, because the end rows and end plants are often squeezed into an unusual spacing.

3. Number of emitters per plant:

This is not always an integer (e.g.: 3, 4, 5). However, the minimum number is 1. Determine this number by counting the number of emitters along a row, using a sample area of five plants.

Drip systems on vegetables and row crops (as opposed to trees and vines) require some special consideration. For those crops, one must consider the spread of water in the soil. If every other emitter was plugged and all plants would still get water, then the number of emitters per plant should be considered "2" rather than "1", even though there may actually be several plants per emitter.

4. Units of flow rate (1 gph; 2 lph):

Select either gallons per hour or liters per hour. Gallons per minute are not acceptable input for the program.

5. Average flow per emitter (gph or lph):

The "average" emitter flow rate in each area (of different plant or emitter spacing) needs to be determined. The measurements necessary to find these flows are not built into any other part of the program. In each area with a different spacing, determine this value by choosing a "typical" location and obtaining the average flow rate from a group of at least 15 emitters. This is NOT a "nominal" flow rate such as 1.0 gph—it is the ACTUAL flow rate. No data collection sheets or spaces are provided for this computation within this program.
6. Wetted area per emitter (sq ft): This number may be a little difficult to obtain because it requires some checking with augers or shovels, and/or the assistance of a backhoe. The wetted area is not the area just on the soil surface. It is the average soil area wetted by a single emitter, and can be estimated by probing the soil to find how far out from the emitter the soil is wet at a depth of no more than 1.5 feet below the soil surface.

7. Root zone available water holding capacity (in): The Available Water Holding Capacity (AWHC) answer for this question is in units of INCHES. It can be determined with the help of a Soil Survey by the USDA or Soil Conservation Service, or by using the estimating table provided below.

Root zone AWHC =

\[
\text{inches of AWHC} \div \text{foot of soil} \times (\text{Root zone depth, ft})
\]

<table>
<thead>
<tr>
<th>Soil texture</th>
<th>Estimate of AWHC (in/ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sand</td>
<td>0.5</td>
</tr>
<tr>
<td>Sandy Loam</td>
<td>1.2</td>
</tr>
<tr>
<td>Loam</td>
<td>1.6</td>
</tr>
<tr>
<td>Clay Loam</td>
<td>2.2</td>
</tr>
</tbody>
</table>
Do not make any adjustment for the fact that not all of the soil is wet. The program will make that adjustment automatically, considering the wetted area per emitter, and the emitter and tree spacing.

The root zone AWHC should consider a reasonable, manageable root zone depth. For example, tree roots may grow to a depth of 10', but for a tree such as avocado, it may be best to manage only the upper 2 to 3 feet, because that is where most of the root activity is centered. In that case, the proper value to enter may be 2' or 3'.

8. Set duration during peak ET (hrs): 8. Set (block) irrigation durations may be varied to compensate for the different application rates in areas of different tree/emitter spacing. Check the irrigation controller (time clock) and also with the irrigation foreman for this value. Information is asked for specifically during the period of the highest ET (middle of summer) in order to coincide with the questions asked later in this section about ET rates.

9. Irrigation frequency at peak ET (days):
   9. If the block is irrigated once/day, the answer is “1”. If the block is irrigated three times a week, the answer is:
   
   \[
   \text{Days} = \frac{7 \text{ days}}{3 \text{ times/week}} = 2.33
   \]

10. Crop ET during peak ET period (in/day):
   10. See the description of ET in the sections above. This number will depend upon the crop type, weather, and crop age. Sources such as irrigation extension agents and consultants active in irrigation scheduling can provide this number.
Cases #1 and #2 above are typical configurations in drip and microirrigation pipeline networks. Typical locations of pressure regulation points are:

**Case #1**
- Entrance to each submain (either automatic or manual adjustment) or Entrance to each manifold (automatic regulator).

**Case #2**
- Entrance to each submain (either automatic or manual adjustment) or Beginning of each hose.

In some systems a single molecule will pass through several regulators before reaching its final destination. In general, that results in excessive pressure losses, higher pumping bills, and more moving parts to repair. However, in some cases it is necessary. Very steep topography can generate sufficient pressure differences that may damage fittings.

**VALVING**

Some systems have several layers of pressure regulators in a series. The pressure regulators may be automatic (large adjustable valves near the pump, or small pre-set, non-adjustable regulators at hose entrances, or small adjustable regulators at hose entrances or manifolds), manually adjusted valves, or both. To answer these questions, the pipe path must be followed from the pump to the emitters, AND the irrigation supervisor should be asked where pressure adjustments have been made.

1. Number of automatic pressure control valves near the filter and pump (0 for none):
2. Is there a throttled manual valve at the pump? (Yes or No)

1. Drip and microirrigation systems sometimes have one or more automatic valves near the pump and filter station. There may be one before and after the filters. For example, there may be a pressure regulation valve upstream of filters and a pressure sustaining valve downstream of the filters. This question refers specifically to PRESSURE control valves. Standard check valves or slow opening/closing valves without pressure regulation features are not considered “pressure control” valves.

2. A “throttled manual valve” is one which is partly closed to reduce the pressure going into the irrigation system. Manual valves are usually gate or butterfly valves. If a valve is continuously throttled, the pump is oversized and the impeller should be trimmed so that the pump will consume less energy. This answer does not affect any DU computation—it is used instead to indicate energy efficiency.
3. Are manifold pressures regulated individually? (Yes or No)

4. Are hose pressures regulated individually? (Yes or No)

5. Is there a flow meter? (Yes or No)

3. Manifold or submain inlet pressures are sometimes adjusted with manual gate valves or automatic valves, and this adjustment is not always obvious unless the irrigation supervisor lets the evaluator know about it.

4. One regulator per three to five hoses would qualify for a “Y” answer on this question, in addition to the more typical situation with just one hose per regulator.

5. The answer to this question will not affect the DU computations. However, flow meters are certainly basic required elements for effective management.

---

**PUMP STATION MEASUREMENTS**

1. Pump discharge pressure (psi):
   - This is not the total dynamic head of the pump, but the pressure measured right at the pump outlet. For this and the next measurements, use the same pressure gauge. Do not rely on pressure gauges installed on the pipelines. Generally, one must tap into the pipe and install Schrader valves threaded into the pipe walls.

2. Pressure downstream of filters and control valves (psi):
   - This should be measured right before the pipe goes into the ground.

3. Optional pressure values:
   - Total filter loss (psi):
   - Total pump control valve loss (psi):
   - Loss from throttled manual valves (psi):
   - If there is a large difference between the previous two values, additional measurements can be made to determine where the loss occurs. The program has “acceptable” values of pressure loss for different types of filters and pump control valves. The “acceptable” loss across a throttled manual valve is zero, because there shouldn’t be one on the system unless the pump is used for another function at other times.
FILTRATION

1. Automatic flush on the primary filter? (Yes or No)
   1. An automatic flushing mechanism would be controlled by a timer and/or pressure differential sensor/switch.

   In the case of a system with both a media filter and screen, the media filter would be considered the "primary filter".

2. Type of Filter (Select all that apply):
   - Tubular screen? (Yes or No)
   - Overflow screen? (Yes or No)
   - Media filter? (Yes or No)
   - Sand (centrifugal) separator? (Yes or No)
   - Disc filter? (Yes or No)
   - “Vacuum-cleaned” tubular screen? (Yes or No)

   A “✓” can be used for more than one filter type below. Hose screen washers and small screens at hose inlets do not qualify for a “✓” answer in this question.

CHEMICAL INJECTION SYSTEM

1. Location of injector with respect to filter (1 – 5):
   1. Use the following to answer this question:

   1 = No injection system
   2 = Downstream
   3 = Upstream of filter

   Fertilizer injectors should be located upstream of filters. However, injectors for strong acids are often placed downstream of the filters. If the acid is not mixed well with the water, it can corrode the internal components of some filters.

   If no injection system, bypass the next two (2) questions.
2. Does the injection system use a throttling valve on the main line? (Yes or No)

2. Irrigators often plumb a fertilizer injector across a gate valve, and then close down (throttle) the gate valve to force water through the injector. If this is done temporarily during injection only, or if a valve is permanently throttled for no reason other than to provide a pressure differential for injection, the answer is "Y". If the injector is plumbed across a device such as a sand separator or automatic control valve which is needed anyway and happens to have a pressure drop, the answer is "N".

A "Y" is undesirable, because it can indicate an unnecessary energy requirement. More importantly, however, is if a valve is temporarily closed off just to inject fertilizer, the fertilizer will go into the system, but it will be distributed through the system with a poor uniformity. Therefore, we STRONGLY recommend against this.

3. Is injection possible at a constant flow rate? (Yes or No)

3. Most injectors such as the Mazzei™, Amiad™, or electrical piston pumps rate a "Y". A pressure differential tank would get an "N". Diaphragm and some gas-powered injectors will vary their discharge rates if the system pressure changes. Pressures in the mainline can change with time as filters plug, and as blocks of different sizes are irrigated. In general, it is highly desirable to be able to inject chemicals at a constant, known flow rate.

4. Frequency of chlorine, acid, etc. injection (1 – 4): 

Question 4 and 5 are used to trigger recommendation paragraphs. In general, "never" and "annually" are unacceptable choices.

Use a rating of 1 to 4 as follows to answer these questions.

1 = Never  
2 = Annually  
3 = Monthly  
4 = Weekly or more

If automatic flushing hose ends are used, the answer to this question is "4".

5. Frequency of hose lateral flushing (1 – 4):
UNEQUAL DRAINAGE

On sloping ground the emitters in low parts of the field will continue to discharge water long after the majority of the field is dry. This question deals with that problem of unequal drainage. If the emitters on the whole field continue to drain for 10 minutes after pump shutoff, with no difference in drain time, the answer to the time question below is “0” minutes.

1. Time some emitters run after most emitters stop (min):
   In a field with unequal drainage, the “Time” will not be the same everywhere. Your first problem is to estimate the average time of unequal drainage. The next problem is to estimate the average percentage of emitters that do this. Fortunately, precision is not required on this measurement, because there is usually only a few emitters which drain, and that only occurs for a short period, which gives a very small effect of a small percentage.

   However, this can be a serious problem if a grower decides to go to “Pulse irrigation” in which emitters may only by on for an hour or so and then shut off for an hour, and then restarted. This matter of uneven drainage is brought up because in some cases it can be a serious DU problem.

   In other fields, the long drainage times at low points can be a real management headache although it doesn’t decrease the irrigation efficiency that much for the whole field. A recommendation paragraph discusses possible remedies.

   Use a watch with a second hand to observe the time necessary for the water to turn clear when a hose is flushed. This observation can be combined with a later one (Question 1, Contaminants and Plugging/Leaks) which asks about the type of contaminants in the hose. The system must be running when the hose is flushed.

2. Percentage of emitters that do this (%):
CONTAMINANTS AND PLUGGING/LEAKS

1. Flushing time to get clear water from the lowest, most distant hose end (sec):

2. Rate the amount of material caught in nylon sock when flushing hoses.
   - Sand (1 – 4):
   - Clay (1 – 4):
   - Bacteria/algae (1 – 4):

3. Rate the following causes of emitter plugging. (For this question, remove five emitters at distant hose ends. Take them apart to inspect for clogging.)
   - Sand (1 – 4):
   - Precipitate (bubbles with acid drop) (1 – 4):
   - Bacteria (1 – 4):
   - Insects (1 – 4):
   - Plastic parts (1 – 4):
   - Rate the visible signs of abnormal emitter flow, due to cracked hoses, barb leaks, etc. (1 – 4):

1. This measurement can be combined with an earlier observation of the time required to flush a hose to get clear water.

2. Use the following scale for the next questions.
   - 1 = None
   - 2 = Slight
   - 3 = Medium
   - 4 = Major

Purchase some knee-high nylon stockings to catch the water as it flows from the hose end. This is a purely qualitative observation, but after some experience on different fields, a judgment scale will be developed by the evaluator.

The flow differences due to plugging and manufacturing variation and temperature differences are all lumped together on the summary sheet. The qualitative observations noted here help to form the basis for the various recommendation paragraphs and statements which are printed out.

3. Before removing five emitters or micro-sprinklers, the evaluator should check with the irrigator to make sure enough spare parts are on hand to repair the damage which will be done. This step justifies bringing a bag of spare emitters, hose pieces, and couplings for various hose sizes with you.

Carbonate precipitates can be detected by putting a drop of acid (hydrochloric, also known as muriatic, is recommended) onto an emitter. If the white or brownish deposits or sludges fizzle, you have a positive identification of “precipitate”.

This observation can set a warning flag to output a recommendation paragraph. To deserve a “1”, there must be absolutely no problems evident.
<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Age of the system (years):</td>
<td>1. The age of the system is not used in the calculations. It is for information only. This answer does not influence any computations.</td>
</tr>
<tr>
<td>2. Is there a water penetration problem? (Yes or No)</td>
<td>2. This response can trigger output of a recommendation paragraph on solutions to water penetration problems. It is not used in any computations.</td>
</tr>
<tr>
<td>3. Is there undulating topography? (Yes or No)</td>
<td>3. This not used in the calculations. It is for information only.</td>
</tr>
<tr>
<td>4. Percentage of applied water which runs off field (%):</td>
<td>4. Runoff can be a major problem in some microirrigation fields. If the runoff is not collected in a sump and used on this or other fields, an estimate should be entered. It will require installing flume and some shovel work.</td>
</tr>
<tr>
<td></td>
<td>In this evaluation no attempt is made to measure the “catch can uniformity” of microsprinklers because it does not effect the relative amounts of water received by each plant. However, the uneven spread of microsprinklers does effect runoff problems. Microsprinklers which concentrate water in small areas can have runoff problems sooner than other designs. For that reason, the “catch can uniformity” can provide useful information in comparing microsprinkler models. However, it is not a factor in calculating the system uniformity.</td>
</tr>
<tr>
<td>5. Number of models or emitter designs used in the system:</td>
<td>5. A number greater than 1 will trigger a warning that the system probably has a high plugging problem, or there were problems with the original design. Another recommendation presented as a one-liner on the first page of the summary will state that the evaluation results are approximate only. How do you make a race car out of a vehicle that is a combination of a train, a horse buggy, and a car?? Some systems are so mixed up that there isn’t any hope in fine tuning them.</td>
</tr>
</tbody>
</table>

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There are two cases for which an answer greater than 1 will not give a problem:

a. If all of the emitters have the same discharge exponent and average flow rate, or
b. If every tree has the same combination of emitters.

For example, each tree may have one emitter plus one microsprinkler. The emitter may have been installed when the trees were planted. However, if this is the case, special attention must be given to the flow rate measurements taken in the later section. The flows from the emitter and microsprinkler must be combined into one value, or the program will interpret it as a major non-uniformity in flow rates.

6. Type of water source (1 – 3):

6. If the water source was a well, but the water was put into a reservoir before going into the drip system, it is classified as a reservoir, not as a well source.

1 = Well  3 = Both
2 = Surface

EMITTER FLOW MEASUREMENTS  (all values are in milliliters)

The idea is to measure the flows in three (3) different areas of the field with different probabilities of plugging. The areas should be (relatively) the cleanest, average, and dirtiest points throughout the field.

At each LOCATION, all of the emitters should be of the same pressure for a test. This is EXTREMELY important to understand. The three locations do not need to have the same pressure.

At a particular location, use emitters from two (2) adjacent hoses if an emitter group along one hose has a pressure difference of greater than 1 psi. On drip hoses, there is generally quite a bit of friction loss along the first 40% of hose length, so flows should not be measured there (see instructions on the data sheet). If the system has microsprinklers, there often aren’t enough sprinklers at the specified locations on only one hose. Therefore, one has to measure sprinklers from several adjacent hoses.

**Make sure that the pressures are the same on the different hoses if this has to be done. Adjust the hose inlet pressures if necessary. The pressures do not have to be the “natural” pressures for this flow data, but should not be changed too much.

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There is no choice about the number of flow measurements to be taken. Every spot must be filled in. If there is a blank data spot, the program will interpret it as a zero flow rate for an emitter and the calculations will give the wrong answer. It is possible that some emitters will be completely plugged. If so, enter the data for those emitters as zeros. Data should include leakage from around emitter barbs.

Test #1. Location – Middle of one of the closest hoses (hydraulically) to the pump.

Collection time (min.):
Average emitter pressure (psi):

1:____ 5:____ 9:____ 13:____
2:____ 6:____ 10:____ 14:____
3:____ 7:____ 11:____ 15:____
4:____ 8:____ 12:____ 16:____

1. It helps to have a map of the system design before selecting the various locations. The hoses which run right past the pump may actually be supplied by the end of a submain that began quite some distance away from the pump. A close hose (hydraulically) means the first hose that water would reach after leaving the pump and filters. This location was selected as the spot which is typically least likely to have plugging. If in fact you know that another spot in the system is the cleanest, select that location for Test #1.

The minimum time should be 5 minutes. For drip systems, set collection cans out in 5 to 10 second intervals and then pull them out about 5 minutes later. Microspray systems take more time because a container must be held over individual emission devices for the specified time.

Test #2. Location – Same emitters as Test #1, but adjust hose pressure so that the average emitter pressure is 25% lower or greater than for Test #1.

Collection time (min.):
Average emitter pressure (psi):

1:____ 5:____ 9:____ 13:____
2:____ 6:____ 10:____ 14:____
3:____ 7:____ 11:____ 15:____
4:____ 8:____ 12:____ 16:____

2. The same emitters used in Test #1 must be used here. The data does not have to be entered in the same order, however. Create a 25% pressure difference, greater or lower than used in Tests #1. If the average emitter pressure was 8 to 12 psi in Test #1, try to increase the pressure (temporarily) at the emitters by adjusting pressure regulators or shutting down some of the other hoses. If the pressures were in the 20 psi range, drop the pressure by 25% to get the measurements on Test #2.
Test #3. Location — Middle of an average hose on an average submain.

Collection time (min.):
Average emitter pressure (psi):
1: ___ 5: ___ 9: ___ 13: ___
2: ___ 6: ___ 10: ___ 14: ___
3: ___ 7: ___ 11: ___ 15: ___
4: ___ 8: ___ 12: ___ 16: ___

Test #4. Location — From end of the hose farthest from the pump.

Collection time (min.):
Average emitter pressure (psi):
1: ___ 8: ___ 15: ___ 22: ___
2: ___ 9: ___ 16: ___ 23: ___
3: ___ 10: ___ 17: ___ 24: ___
4: ___ 11: ___ 18: ___ 25: ___
5: ___ 12: ___ 19: ___ 26: ___
7: ___ 14: ___ 21: ___ 28: ___

FIELD PRESSURE MEASUREMENTS

Water must be flowing through the hoses when the measurements are made.

Location #1 — Submain or regulated manifold close to the pump.

Closest hose to the inlet of the submain (or regulated manifold).

Hose inlet pressure (psi):
Downstream end pressure uphill (psi):

Middle pressure uphill (psi):
Downstream end pressure downhill (psi):
Middle pressure downhill (psi):

The purpose of these measurements is to determine the differences in:
   a. Pressure regulator settings.
   b. Pressure between hoses downstream of a pressure regulation point.
   c. Pressure along the hoses.

Therefore, to satisfy the intent of “a”, the “locations” should be selected so that they evaluate the similarity of different pressure settings on automatic or manually throttled valves, or the similarity of pressures due to the proper pipe sizing in the case of a design with no regulators.

To satisfy the intent of “b”, two hoses are evaluated downstream of each pressure regulation point.

If no pressure regulators are used, the beginning of each submain will generally qualify as a “pressure regulation point” for the purposes of evaluation.
Most distant hose from the inlet of the submain (or regulated manifold).

Hose inlet pressure (psi):

Downstream end pressure uphill (psi):

Middle pressure uphill (psi):

Downstream end pressure downhill (psi):

Middle pressure downhill (psi):

***For mathematical accuracy, it is desirable to have as many pressure measurements as possible. On a very small system there may only be one submain. In that case, collect data from as many hoses as possible and fill in the blanks from other "locations", even though the data is actually from the same manifold.

Use the same pressure gauge for all measurements. This means one person will take all pressure measurements.

UPHILL vs. DOWNHILL hoses.
Actually, the program does not care if a hose goes uphill vs. downhill. The wording is used only to account for the possibility that a single riser can supply hoses in two directions. One is arbitrarily called the "downhill" hose. If a riser feeds a hose in only one direction, consider it as "downhill".

If no values are provided for any points, then the program assumes that such hoses do not exist. It does not interpret the value as a pressure of 0.0, as opposed to the way the program interpreted flow rate values in the previous section.

Location # 2 – Submain or regulated manifold most distant from the pump, or where the pressure is the lowest.

Location # 3 – Intermediate submain or regulated manifold.

Note: The measurements at Locations 4, 5 and 6 are recommended for larger systems, but optional for smaller systems.

Location # 4 – Submain or regulated manifold closest to the pump.

Location # 5 – Submain or regulated manifold most distant from the pump, or regulated manifold.

Location # 6 – Intermediate submain or regulated manifold.
Average loss across hose entrance screens in the field (psi): This measurement should be taken as follows:

First, measure the pressure in the HOSE with the screen in. Then shut off the water, remove the screen, and turn on the water again. Measure the pressure in the HOSE with the screen out. The loss is the difference between the two measurements.
Appendix 1: IID-Grower Agreement
AGREEMENT TO PARTICIPATE IN AN EFFICIENCY CONSERVATION PILOT PROGRAM BY IMPLEMENTING IRRIGATION SCHEDULING AND EVENT MANAGEMENT IN THE IMPERIAL IRRIGATION DISTRICT

THIS AGREEMENT TO PARTICIPATE IN AN EFFICIENCY CONSERVATION PILOT PROGRAM ("Program") BY IMPLEMENTING IRRIGATION SCHEDULING AND EVENT MANAGEMENT IN THE IMPERIAL IRRIGATION DISTRICT ("Agreement") is made and entered into as of the ______ day of _____________ 2008, by the Imperial Irrigation District ("IID") and the person(s) or entity referred to as “Conserving Party” listed on the signature page of this Agreement (collectively, “Parties”), each of which is at times referred to individually as “Party”.

RECITALS

A. IID, as a trustee under the California Irrigation District Law, holds water rights to and diverts water from the Colorado River for distribution and use within its service area.

B. IID has completed an environmental assessment of proposed water conservation and transfer activities and diversion limitations pursuant to the California Environmental Quality Act ("CEQA"), as set forth in a Final EIR/EIS for the IID Water Conservation and Transfer Project certified by IID in June 2003, as supplemented by an Amended and Restated Addendum thereto certified by IID in October 2003 (collectively, "Transfer EIR").

C. IID has entered into an agreement with the United States and others to limit its diversions under Priority 3 and to repay inadvertent overruns on a certain schedule. For purposes of meeting these agreements, IID will create conserved water by efficiency conservation for use as Inadvertent Overrun Payback and/or Intentionally Created Surplus.

D. Conserving Party owns or leases agricultural property within the IID service area described and/or depicted on Exhibit A attached hereto (“Participating Fields”).

E. If Conserving Party is a lessee of the Participating Fields, the identity of the lessor, any sublessor, any sublessee, and the fee owner, and the remaining term of the lease or sublease is identified on Exhibit B attached hereto.

F. Conserving Party is willing to implement efficiency conservation on the Participating Fields for the limited time period specified in Section 1 and in accordance with the other terms and conditions set forth herein, in order to assist IID in meeting its obligations described above.

G. This Agreement is part of the implementation of a temporary program of efficiency conservation through irrigation scheduling and event management described in the 2008 On-Farm Efficiency Conservation Pilot Program Description ("Program Description") that can be accessed at http://www.iid.com/Water/WaterConservationImplementation. The Parties understand and agree that participation in this Agreement does not imply or guarantee participation in any subsequent efficiency conservation agreements. Further, the Parties understand that IID has developed eligibility and participation requirements, payment schedules, and measurement and verification requirements specific to this temporary program as described in the Program Description, to which this Agreement is appended. These provisions may not represent implementation features of future efficiency conservation programs or long-term agreements.
H. Parties agree that participation in the Program will not alter the Conserving Party’s baseline delivered water for future efficiency conservation or fallowing agreements. That is, when water delivery history is used to compute baselines for future efficiency conservation or fallowing programs, the water delivery history for Participating Fields shall include the Verified Conserved Water computed for this Program as described below.

NOW, THEREFORE, IN CONSIDERATION OF THE ABOVE RECITALS AND THE COVENANTS AND OBLIGATIONS SET FORTH HEREN, THE PARTIES AGREE AS FOLLOWS:

1. **Term**

   The term of this Agreement ("Term") shall commence on ______________, 2008 ("Start Date") and expire on December 31, 2008. This term may be extended by mutual written agreement of the Parties.

2. **Verified Conserved Water and Payment**

   **A. Crop-Field History, Efficiency Conservation Baseline, and Verified Conserved Water**

   Verified Conserved Water shall be calculated for each Participating Field subject to this Agreement as follows:

   (1) The Crop-Field History is a crop- and field-specific average gross water use calculated for each participating field. The Crop-Field History will be determined by IID based on delivered water and cropping records held by IID for the Participating Field, as shown in Exhibit C. Detailed Crop-Field historical data utilized in the calculations can only be provided to the potential Conserving Party if the Landowner has authorized the Conserving Party’s access to this data prior to entering into the Agreement. Historical data may be disputed during the mandatory, one-on-one consultation between an IID representative and a representative for the Conserving Party or prior to the execution of this Agreement.

   (2) The Efficiency Conservation Baseline calculation method is defined in Exhibit C and will be applied after the term of this Agreement and prior to the final payment. It is based on the Crop-Field History and crop water requirements (evapotranspiration) adjusted for the actual Agreement Start Date, actual planting and harvesting dates, and weather effects.

   (3) The Verified Conserved Water will be calculated as the Efficiency Conservation Baseline for the Participating Field minus the actual delivered water to the Participating Field as measured by IID over the term of this Agreement.

   **B. Payment**

   As consideration for the Conserving Party’s performance of its obligations hereunder, IID shall make payments to the Conserving Party in the following manner.
Payment for Efficiency Conservation: The total payment shall be divided into two payments as specified in Exhibit D, including:

(1) The initial payment of $4,000 per Participating Field, totaling $______ for this Agreement, will be made within 30 days of execution of this Agreement and submittal of proof of retention by the Conserving Party of an irrigation scheduling and event management consulting firm (“Firm”) listed in Exhibit E to compensate for costs incurred for irrigation scheduling and irrigation event management consultation services on the Participating Field(s).

(2) The final payment in the amount of $45 per acre-foot as specified in Exhibit D shall be based on the Verified Conserved Water calculated for each Participating Field. The final payment shall be made within 90 days after the end of the Agreement provided that IID has verified that Conserving Party has fulfilled all of its obligations under this Agreement. If at any time the IID determines that Conserving Party is in noncompliance with this Agreement or delinquent on any water accounts, the final payment may be suspended as provided in Sections 4 and 11.

3. Conserving Party Representations and Warranties

The Conserving Party represents and warrants to IID the following and acknowledges that IID is relying on the following representations and warranties:

A. The Participating Fields are within the IID Service Area receiving water and the requisite IID Water Cards have been signed and presented to IID.

B. Conserving Party is the fee title owner, the lessee, or the sublessee of the Participating Field(s) and has the full right, power and authority to execute this Agreement and to carry out each and every obligation hereunder. To the best knowledge of Conserving Party, no legal impediment exists regarding the Participating Fields to prevent Conserving Party from entering into or performing under this Agreement; this Agreement will be a legal and binding obligation of Conserving Party enforceable against Conserving Party in accordance with its terms and will not violate any provisions of any agreement to which Conserving Party is a party or to which Conserving Party is subject; and Conserving Party’s agreement to implement Efficiency Conservation on the Participating Fields does not and will not violate applicable laws or recorded documents affecting the Participating Fields.

C. A Participating Field is a whole field equal to or greater than 65 irrigable acres defined by Farm Service Agency (“FSA”) with defined historical boundaries. In order to facilitate measurement and verification of savings, the Conserving Party warrants that every irrigated field served by the delivery gate designated in Exhibit A will be included as a Participating Field under this Agreement. In other words, the delivery gate serving a Participating Field cannot serve non-participating fields during the term of the Agreement unless field-level measurement acceptable to IID is provided by the Conserving Party for the Participating Field prior to the Agreement Start Date.

D. All information submitted by the Conserving Party to the IID to implement Efficiency Conservation is true and correct as of the time of submittal and the Agreement Start Date. This contract is only valid for the Conserving Party submitting the information and is not transferable prior to execution.
E. The Participating Fields are zoned for agriculture and Conserving Party will take no action to cause or support a change in such zoning during the term of the Agreement.

F. Conserving Party acknowledges that IID retains all water rights to the Colorado River in its name and control as a trustee under the California Irrigation District Law, and no water rights or other rights to water are created by this Agreement.

4. **Obligations of Conserving Party**

A. **Efficiency Conservation**

Conserving Party shall implement Efficiency Conservation as Irrigation Scheduling and Event Management on the Participating Fields during the Term defined in this Agreement.

(1) Conserving Party will contract with an irrigation scheduling and event management consulting firm (“Firm”) pre-qualified by IID and listed in Exhibit E.

(2) Conserving Party will utilize the irrigation scheduling and event management recommendations provided by Firm and implement those that are reasonable and consistent with the Conserving Party’s objective to produce a profitable crop.

(3) Conserving Party will provide, or direct Firm to provide, to IID the scheduler’s recommendations and any other pertinent documentation during the term of the Agreement. Conserving Party agrees that IID may use this information along with the Conserving Party’s water orders for the Participating Fields, to assess implementation of the Firm’s recommendations and Program success.

(4) Conserving Party will require that the Scope of Services appended to the Program Description, to which this Agreement is also an appendix, be fulfilled by Firm.

(5) Conserving Party will participate in an exit interview with IID staff to assess the effectiveness of the Pilot Program and irrigation scheduling and event management services.

(6) Conserving Party agrees, and will make necessary efforts to assure, that water conserved under this agreement is the result of implementing Efficiency Conservation measures and not a deliberate reduction in crop evapotranspiration and/or crop yield.

B. **Water Charges and Fees**

Conserving Party shall continue to be responsible for all water delivery and water availability charges on lands owned and leased within the IID service area subject to IID’s Regulation No. 11 as if this Agreement were not in effect, and all such charges shall be timely paid before they become delinquent or IID may withhold Payments under this Agreement until such time that the Conserving Party is current on such charges.
C. Taxes

All real and personal property taxes, assessments or other charges of every description levied on or assessed against the Participating Fields or improvements on the Participating Fields shall remain the sole responsibility of the Conserving Party. All tax payments shall be made directly to the charging authority prior to delinquency.

D. Insurance

Conserving Party shall acquire and maintain liability insurance coverage on the Participating Fields in the amount of $1,000,000 and shall name IID as an additional insured on each such policy. Proof of such insurance coverage shall be provided to IID by a copy of an applicable document from the insurer at the time of execution of this Agreement and upon renewal of the policy during the term of the Agreement. Each proof of insurance shall also specifically identify each Participating Field by its canal and gate delivery point.

E. Right of Entry

Conserving Party agrees that IID and its designees shall have the right to enter the Participating Fields and, to the extent necessary, other land owned or leased by Conserving Party for the purpose of verification, monitoring, and enforcement of compliance with this Agreement.

F. If Land is Already Subject to Leases or Contracts

Conserving Party shall be responsible for compliance with the terms, covenants and conditions of any existing leases and/or contracts affecting the Participating Fields, and shall defend, indemnify and hold IID harmless from any and all claims by third parties for damages allegedly related to this agreement or to the performance thereof.

5. Governing Law

This Agreement shall be interpreted, governed by and construed under the laws of the State of California.

6. No Third-Party Rights

The Parties do not intend to create rights in or to grant remedies to any third party as a beneficiary of this Agreement.

7. Assignment of Agreement

This Agreement shall be binding upon and inure to the benefit of the Parties and their permitted successors and assigns. No Party may assign or transfer its rights or obligations under this Agreement without the prior written consent of the other Party hereto. Formal consent shall require that the parties fully execute a separate agreement as provided by the IID.

8. Change in Legal Status Affecting Participating Fields

Notwithstanding that which is provided in Section 7, any activity affecting the legal status of the Participating Fields during the term of this Agreement shall carry forward all obligations provided in the Agreement. Any party acquiring title to the Participating Fields or taking assignment or
sublease of the lease of the Participating Fields shall be bound to the Term of this Agreement as if a
signatory. Conserving Party shall give notice of this obligation to any such party prior to effecting any
change in the legal status of the Participating Fields. In the event of any change affecting the legal
status of the Participating Fields, Conserving Party shall notify IID in writing within ten (10) days of
such change.

9. **Legal Effect on Participating Fields**

   Except as otherwise expressly stated herein, nothing herein shall be construed as affecting the
legal status of the Participating Fields, including, but not limited to, the effect of liens, encumbrances,
statutory or regulatory requirements, or entitlements. Conserving Party agrees that IID is not
responsible for, and no action or conduct of IID, its staff or other representatives, shall be construed as
advice or identification of the legal effect or consequences, if any, of the Conserving Party’s decision
regarding efficiency conservation.

10. **Non-precedent**

   Nothing contained in this Agreement, nor the execution of this Agreement, shall be deemed to
give the Conserving Party any rights to obtain any similar agreement after the expiration of the Term.
In addition, IID reserves the right to change any rules governing the Efficiency Conservation Program
in any future agreement and to determine the provisions of any future agreement relating to efficiency
conservation.

11. **Noncompliance with Terms of Agreement**

   If IID determines at any time that the Conserving Party is in noncompliance with or has
breached this Agreement, the Conserving Party will be provided notice of such noncompliance or
breach at the address or contact information provided in Section 15, and shall have twenty-four (24)
hours from the time of such notice to cure the noncompliance or breach. If the noncompliance or
breach is not timely cured, remaining payments may be withheld by IID. In addition, Conserving
Party will be responsible for any other losses suffered by IID as a result of the noncompliance or
breach including reimbursement of staff time and administrative expenses associated with the remedy
of any noncompliance or breach as well as financial penalties and costs associated with the
replacement of lost water conservation yield as a result of the breach incident. Nothing contained
herein shall preclude the IID from exercising any other available remedy in law or equity, including
specific performance.

   In addition, noncompliance with this agreement may influence the Conserving Party’s
eligibility for future voluntary programs offered by IID.

12. **Early Termination**

   This Agreement may be terminated early by mutual agreement. Reasons may include, but are
not limited to, crop failure, natural disaster, or severe financial distress of the Conserving Party, and
which decision IID may make in its sole discretion. IID will judge each case individually to determine
its agreement to terminate early. All water savings committed to or reasonably expected from the
remaining term of this Agreement shall be assigned to IID.
13. **Entire Agreement**

   The entire understanding of the Parties to this Agreement is constituted by the Program Description and its appendices, which include this Agreement and its Exhibits.

14. **Amendment**

   This Agreement may not be modified or amended except in writing executed by the Parties.

15. **Contacts**

   A. All notices, requests, demands, payments, and other communications required or permitted under this Agreement shall be in writing and shall be deemed to have been received either when delivered or on the fifth (5th) business day following the mailing, by registered or certified mail, postage prepaid return receipt requested, whichever is earlier, addressed as set forth below:

   (1) If to IID:

      Manager, Water Department  
      Imperial Irrigation District  
      333 East Barioni Boulevard  
      P.O. Box 937  
      Imperial, CA 92251

   (2) If to Conserving Party (please print):

      Name ____________________________________________

      Address ____________________________________________

      ____________________________________________

      Phone ____________________________________________

      Fax ____________________________________________

   B. Any Party may change the addressee or address to which communications or copies are to be sent by giving notice of such change of addressee or address in conformity with the provision of this Paragraph 15 for the giving of notice.

16. **Counterparts**

   This Agreement may be executed in counterparts, each of which, when executed and delivered, shall be an original and all of which together shall constitute one instrument with the same force and effect as though all signatures appeared on a single document.
17. **Recording of Memorandum of Agreement**

Conserving Party agrees that IID may, and Conserving Party will cooperate to permit, a memorandum identifying the existence and summary of this Agreement to be recorded in the real property records for the County of Imperial.

IN WITNESS WHEREOF, the Parties hereto have executed this Agreement on the day and year first above written.

---

**IMPERIAL IRRIGATION DISTRICT**

____________________________________________  
Manager, Water

CONSERVING PARTY as  
☐ Lessee of Participating Fields  
☐ Owner of Participating Fields

Signature  

Print Name  

Signature  

Print Name  

---
### EXHIBIT A

**DESCRIPTION OF PARTICIPATING FIELDS**
FOR 2008 ON-FARM EFFICIENCY CONSERVATION PILOT PROGRAM
Sheet ____ of ____ (One form required for each gate having one or more participating fields.)

Submitted by __________________________________________________________________
_______________________________________________
Canal _______________________________ Gate _______________________________
IID Account Number ____________________________

Total Number of Fields at Gate ______  Number of Participating Fields at Gate ______

#### Field Identification and Ownership

<table>
<thead>
<tr>
<th>Field ID</th>
<th>Owner</th>
<th>Tenant</th>
<th>Lessor (if other than Owner)</th>
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#### Field Acreage and Crop Selection

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<thead>
<tr>
<th>Field ID</th>
<th>Crop</th>
<th>*FSA Acres</th>
<th>Planting Date</th>
<th>Harvest Date(s) (expected)</th>
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Total Acres (FSA)

*Provided by IID during mandatory consultation. (Other information provided will be checked for consistency with IID records.)*

Have any of these fields participated in an IID Fallowing Program? □ Yes □ No

Have any of these fields participated in any other efficiency conservation programs? □ Yes □ No

If Yes to either question above please describe field participation: __________________________

__________________________________________

IID 2008 On-Farm Efficiency Conservation Pilot Program Agreement  Page 9 of 13
EXHIBIT B

IDENTIFICATION OF LESSOR/LESSEE FOR PARTICIPATING FIELDS FOR 2008 ON-FARM EFFICIENCY CONSERVATION PILOT PROGRAM

(One form required for each lessor/lessee combination, attach additional pages as necessary. Landowner(s) signature is required only if detailed field information is requested by Conserving Party.)

Conserving Party:

Participating Field IDs (must also be listed and described in Exhibit A):

We the undersigned certify that any lease agreement(s) for the above listed Participating Field(s) are in force for the entire term of this Efficiency Conservation Agreement. We also certify that: 1) we are current on all IID water delivery and availability charges subject to IID’s Regulation No. 11; 2) there are no prior contracts or commitments attached to the Participating Fields which would affect our ability to implement Efficiency Conservation and satisfy the provisions of this Agreement; and 3) we have the legal authority to implement Efficiency Conservation on the Participating Fields and to execute a contract to do the same.

Tenant (Lessee)

Print Name: 

Signature: 

Address: 

Phone / Fax: 

Email: 

In addition, we the undersigned Landowner(s) also authorize IID to share and release to the Conserving Party the Participating Field historical data including water delivery records, cropping data and other information for the Participating Field(s) as necessary to calculate Efficiency Conservation Baselines or implement other provisions of this Agreement.

Owner

Print Name: 

Signature: 

Address: 

Phone / Fax: 

Email: 

IID 2008 On-Farm Efficiency Conservation Pilot Program Agreement  Page 10 of 13
EXHIBIT C

EFFICIENCY CONSERVATION BASELINE AND MEASUREMENT PERIOD FOR CROP(S) TO BE GROWN UNDER THE 2008 ON-FARM EFFICIENCY CONSERVATION PILOT PROGRAM; ADJUSTMENT PROCEDURE FOR EFFICIENCY CONSERVATION BASELINE

1. Crop-Field History

The Crop-Field History is the average delivered water history (based on IID’s quality-controlled records) specific to the Participating Field(s) and crop(s) identified in Exhibit A for the periods of August 1 - December 31, 1998-2005, as follows:

<table>
<thead>
<tr>
<th>Field ID</th>
<th>Crop(s)</th>
<th>*Crop-Field History (AF/ac)</th>
<th>*Historical Crop Water Use (actual evapotranspiration, AF/ac)</th>
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*Provided by IID during mandatory consultation. (Other information provided will be checked for consistency with IID records.)

2. Measurement Period

The Measurement Period for this Agreement shall be the same as the term of the Agreement. Verified Conserved Water shall be measured based on total deliveries to Participating Field(s) between the Start Date and the Agreement expiration date.

3. Calculation Procedure for Efficiency Conservation Baseline

A. The actual crop evapotranspiration for the Measurement Period will be calculated for each crop and Participating Field at the expiration of the Agreement based on the actual crop grown, weather conditions, planting date, and harvest date. (Detailed evapotranspiration calculation procedures are described in Appendix 2.C of the Final Report on the Efficiency Conservation Definite Plan. This report can be accessed from IID’s website at http://www.iid.com/Water/EfficiencyConservationProgram.)

B. The Efficiency Conservation Baseline will be computed as the Crop-Field History multiplied by the ratio of actual crop evapotranspiration for the Measurement Period to Historical Crop Water Use.
EXHIBIT D
PAYMENT AMOUNTS AND SCHEDULE FOR THE 2008 ON-FARM EFFICIENCY CONSERVATION PILOT PROGRAM

1. Initial Payment per Acre

An initial payment of $4,000 per Participating Field will be made following execution of this Agreement, once evidence has been provided that an approved irrigation scheduling consulting firm (listed in Exhibit E) has been contracted to provide the required services for the Participating Field(s). Evidence may be provided by submitting a copy of a signed agreement between the Conserving Party and the Firm to the District.

2. Final Payment per Acre

Verified Conserved Water, as described in Section 2 of the Agreement, shall be the basis for the final payment according to the table below. In no case shall IID pay for savings in excess of 1 acre-foot per acre or for savings that IID determines is a result of deliberate reduction in crop evapotranspiration or crop yield.

<table>
<thead>
<tr>
<th>Verified Conserved Water (AF/FSA acre)</th>
<th>Final Payment ($/FSA acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 0.2</td>
<td>$0</td>
</tr>
<tr>
<td>0.2 up to and including 1.0</td>
<td>($45/AF x Verified Conserved Water)</td>
</tr>
<tr>
<td>Greater than 1.0</td>
<td>$45</td>
</tr>
</tbody>
</table>

3. Total Payment

The total of all payments to the Conserving Party for each Participating Field will be the initial payment plus the Participating Field’s FSA acres times its final payment per acre:

Total Payment per field = Initial Payment per field + (FSA acres x Final Payment per acre)

In no case shall the Total Payment exceed $106.54 per FSA acre (based on minimum field size of 65 FSA acres).
EXHIBIT E

LIST OF PRE-QUALIFIED IRRIGATION SCHEDULING AND EVENT MANAGEMENT CONSULTING FIRMS

JMLord, Inc.

Alan Jackson
86695 Avenue 54 Ste J
Coachella, CA 92236-3810
(760) 399-8424

http://www.jmlordinc.com
jmlord@jmlordinc.com

Stanworth Crop Consultants, Inc.

Aron Quist
14151 W Hobsonway
Blythe, CA 92225-3312
(760) 922-3106

http://www.stanworth.net
info@stanworth.net