Sprinkler Irrigation System
Detailed Evaluation Center Pivot Lateral Worksheet

Land user _____ Field office _____

Observer _____ Date _____ Checked by _____ Date _____

Field name/number _____

Center pivot number _____ pivot location in field _____

Acres irrigated _____

Hardware inventory:

Manufacturer: name and model _____

Is design available? _____ (attach copy) Number of towers _____ Spacing of towers _____

Lateral: Material _____, Inside diameter _____ inches

Nozzle: Manufacturer _____

Position _____ Height above ground _____

Spacing _____

Is pressure regulated at each nozzle? _____ operating pressure range _____

Type of tower drive _____

System design capacity _____ gpm, system operating pressure _____ psi

Nozzle data, design:	Pivot				end
Sprinkler position number					
Manufacturer					
Model					
Type (spray, impact, etc.)					
Nozzle or orifice size					
Location					
Wetted diameter (ft)					
Nozzle discharge (gpm)					
Design pressure (psi)					
Operating pressure					

End gun make, model _____ (when continuously used in corners)

End gun capacity _____ gpm, Pressure _____ psi, boosted to _____ psi

End swing lateral capacity _____ gpm, pressure _____ psi

Field observations:

Crop uniformity _____

Runoff _____

Erosion _____

Tower rutting _____

System leaks _____

Elevation change between pivot and end tower _____

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Wind: Speed _____ mph Direction (from) _____

Line direction: From center to outer tower _____ moving _____

Time of day _____ , Humidity: _____ low _____ med _____ high, Air temp _____

Evaporation: start depth _____ inches, end depth _____ inches, Evaporation _____ inches

Crop _____, Root zone depth _____ foot, MAD[1/] _____ %, MAD _____ inches

Soil-water data (typical): (show location of sample site on soil map or sketch of field)

Moisture determiniation method _____

Soil series name, surface texture _____

Depth	Texture	*AWC (in)[1/]	*SWD (%)[1/]	*SWD (in)[1/]
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
	Totals	_____		_____

Comments about soils:

_____

_____

_____

_____

Present irrigation practices:

Typical system application:

Crop	Stage of growth percent	Hours per [2/] revolution	Speed setting	Net application (in)
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

Hours operated per day _____ hours

Approximate number of pivot revolutions per season _____

1/ MAD = Management allowed depletion, AWC = Available water capacity, SWD = Soil water deficit

2/ To calculate the hours per revolution around the field, first calculate the average speed the end tower moves per cycle (start to start) = distance in feet divided by time in seconds.

Then: hours per revolution = $\frac{2 \text{ (distance to end tower in feet)} \times \pi}{\text{(end tower speed in ft/s)} \times 3{,}600 \text{ seconds per hour}}$

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System data:

Distance from pivot point to : end tower _____ ft, wetted edge _____ ft

* End tower speed: Distance between stakes _____
  Time at first stake _____, Time at second stake _____
  Time to travel between stakes _____ min

* This method is satisfactory for a continuous moving system, but need to allow for moving in start-stop cycles. Recommend using end tower move distance and from start to star. Typically, percent speed setting for end tower represents, 60% = 36 seconds of each minute, 72 seconds of each 2 minutes, etc.

Measured system flow rate _____ gpm, method _____
Calculations: _____

Evaluation computations:

Circumference of end tower:

$$\text{Distance to end tower} \times 2\pi = \text{_____} \times \underset{(6.2832)}{6.2832} = \text{_____ ft}$$

End tower speed:

$$\frac{\text{Distance traveled (ft)}}{\text{Time in minutes}} \times 60 = \text{_____} \times 60 = \text{_____ ft/hr}$$

Hours per revolution:

$$\frac{\text{Circumference at end tower (ft)}}{\text{End tower speed (ft/hr)}} = \text{_____} = \text{_____ hr}$$

Area irrigated:

$$\frac{(\text{Distance to wetted edge})^2 \times \pi}{\text{43,560 square feet/acre}} = \text{_____} \times \underset{(3.1416)}{3.1416} = \text{_____ ac}$$

43,560

Gross application per irrigation:

$$\frac{\text{Hours per revolution} \times \text{gpm}}{435 \times \text{acres irrigated}} = \text{_____} = \text{_____ in}$$

453 x ac

Weighted system average application:

$$\frac{\text{Sum of: catch x factors}}{(\text{Sum of: factors}) \times \text{number of containers}} = \text{_____} = \text{_____ cc (ml)}$$

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Convert cc (ml) in measuring cylinder to inches depth in catch container:

_____ cc (ml) = 1 inch in catch container

Average application = $\frac{\text{Average catch (cc)}}{\text{cc/inch}}$ = _____ = _____ in

Weighted low 1/4 average application:

$\frac{\text{Sum of low 1/4 catch x factors}}{\text{(Sum of low 1/4 factors) x number of low 1/4 containers}}$ = _____ = _____ cc (ml)

Low 1/4 average application = $\frac{\text{Average low 1/4 (cc)}}{\text{cc/inch}}$ = _____ = _____ in

Distribution uniformity low 1/4 a (DU):

DU = $\frac{\text{Weighted low 1/4 average applic.}}{\text{Weighted system average application}}$ = _____ = _____ %

Approximate Christiansen uniformity (CU):

CU = 100 - [0.63 x (100 - DU)] = 100 - [0.63 x (100 - _____)] = _____%

Effective portion of water applied (R_e):

R_e = $\frac{\text{Weighted system average application (in)}}{\text{Gross applicaiton (in)}}$ = _____ = _____

Application efficiency of low 1/4 (E_q):

E_q = DU x R_e = _____ = _____ %

(Use for medium to high value crops)

Approximate application efficiency low 1/2 (E_h):

E_h = DU x R_e = _____ = _____ %

(Use for low value field and forage crops)

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Application:

$$\frac{\text{Gross application x hours operated per day x } (E_q \text{ or } E_h)}{\text{Hours per revolution x 100}}$$

= _____ = _____ in/day

Maximum average application rate:

$$\frac{\text{Maximum catch inches x 60}}{\text{Time containers are uncovered in minutes}} = \_\_\_\_\_ = \_\_\_\_\_ \text{ in/hr}$$

Pivot revolutions required t replace typical annual moisture deficit:

(Based on existing management procedures)

Annual net irrig. requirement _____ in, for _____ (crop)

Pivot revolutions required:

$$\frac{\text{Annual net irrig. requirement x 100}}{(E_q \text{ or } E_h) \text{ x gross applic. per irrig.}} = \_\_\_\_\_ = \_\_\_\_\_$$

Potential water and cost savings

Present management::
Gross applied per year = gross applied per irrig x number of irrig

= _____ = _____ in/yr

Potential management:
Potential application efficiency (E_{pq} or E_{ph}) _____ percent (from irrigation guide, NEH Sec 15, Ch 11, or other source)

$$\text{Potential annual gross applied} = \frac{\text{Annual net irrig. requirement x 100}}{\text{Potential } E_{pq} \text{ or } E_{ph}}$$

= _____ = _____ inches

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Total annual water conserved:

$$= \frac{\text{(Present gross applied - potential gross applied) x area irrig. (acre)}}{12}$$

$$= \frac{\_\_\_\_\_}{12} = \_\_\_\_\_ \text{ acre feet}$$

Cost savings:

Pumping plant efficiency _____ kind of fuel _____

Cost per unit of fuel _____ fuel cost per acre foot $ _____

Cost savings = fuel cost per acre foot x acre foot conserved per year

= _____ = $ _____

Water purchase cost:

= Cost per acre foot x acre feet saved per year = _____

= $ _____

Cost savings = pumping cost + water cost = _____ = $ _____

Recommendations:

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Container spacing _____ feet

Container No.	Container Factor	Catch (cc)	Catch (cc) x Factor	Catch (in)
1	1			
2	2			
3	3			
4	4			
5	5			
6	6			
7	7			
8	8			
9	9			
10	10			
11	11			
12	12			
13	13			
14	14			
15	15			
16	16			
17	17			
18	18			
19	19			
20	20			
21	21			
22	22			
23	23			
24	24			
25	25			
26	26			
27	27			
28	28			
29	29			
30	30			
31	31			
32	32			
33	33			
34	34			
35	35			
36	36			
37	37			
38	38			
39	39			
40	40			
41	41			
42	42			
43	43			
44	44			
45	45			
46	46			
47	47			

Container No.	Container Factor	Catch (cc)	Catch (cc) x Factor	Catch (in)
48	48			
49	49			
50	50			
51	51			
52	52			
53	53			
54	54			
55	55			
56	56			
57	57			
58	58			
59	59			
60	60			
61	61			
62	62			
63	63			
64	64			
65	65			
66	66			
67	67			
68	68			
69	69			
70	70			

Sum _____ _____

Low 1/4 summation:

Sum _____ _____

Max application rate data (5 minute catch)

1				
2				
3				
4				
5				

Max. rate = $\frac{\text{max. catch (in) x 60}}{\text{5 minutes}}$ = _____ inches/hour