U.S. DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
NORTH DAKOTA

WINDMILL DATA SHEET [1] – (Using Windmill Pumping Capacity Tables)

ENGINEERING JOB CLASS ___________

Owner/Operator: ____________________ **Location: ______________________________________**

Project County: ______________________ **Nearest NDAWN Station ___________________________**

1) Determine the required watering demand for the system in Gallons per Hour (GPH).

Required Pumping Capacity =	**_______ GPD**	**/**	**24hrs/day**	**=**	**______GPH**
	For GPM: GPH	**/**	**60min/hour**	**=**	**______GPM**

2) Determine the pumping depth of the windmill. Pumping depth is the lift, in feet, from the pumping water level in the well to the windmill outlet into the watering facility.

Required Pumping Depth = _______ Ft.

3) Determine the average wind speed for the project site using the nearest NDAWN Station.

Wind Speed Average = ____________ MPH (Use the Yearly Wind Speed Average; See Figure 1)

4) Is the average wind speed of the NDAWN Station less than 15-mph and greater than 12-MPH? **YES NO**

If Yes then the pump design flow will be increased by 20%: [2] **______GPH**	**/0.80**		**=**	**______GPH**
For GPM: GPH	**/**	**60min/hour**	**=**	**______GPM**

If No then go to Step 5.

5) Is the average wind speed of the NDAWN Station less than 12-mph? **YES NO**

If Yes then the pump design flow will be increased by 38%: [2] **______GPH**	**/0.62**		**=**	**______GPH**
For GPM: GPH	**/**	**60min/hour**	**=**	**______GPM**

If No then use the full system water demand.

6) For the windmill, determine the Sucker Rod Type and Size to be used. For planning purposes use Table 1.

Sucker Rod Size: _____________ Type: __________________________

7) With the corresponding Capacity Table for sucker rod being used, use a 6-ft. mill (Column 2) and find the minimum cylinder diameter in Column 1 that will give the needed flow rate in GPH.

Answer: ___________ in.

8) Will a 6-ft mill (Column 4) raise the water from the needed pumping depth from Step 2 for the cylinder diameter of Step 7?

Answer: ___________ If yes, this is the minimum required windmill size. Proceed to Step 11.

9) If no, look at the 8-16 Ft. mills in Column 3 and find the minimum size cylinder diameter in Column 1 that will give the needed flow rate in GPH. [3]

Answer: ___________ in.

10) Using mill diameters in Columns 5-9 determine what diameter mill will raise the water from the needed elevation? [3]

Answer: ___________ Ft.

11) Use answers from Step 8 or Steps 9 & 10 for the required windmill sizes. [4]

Cylinder Diameter = _________ in. Mill Diameter = __________ Ft.

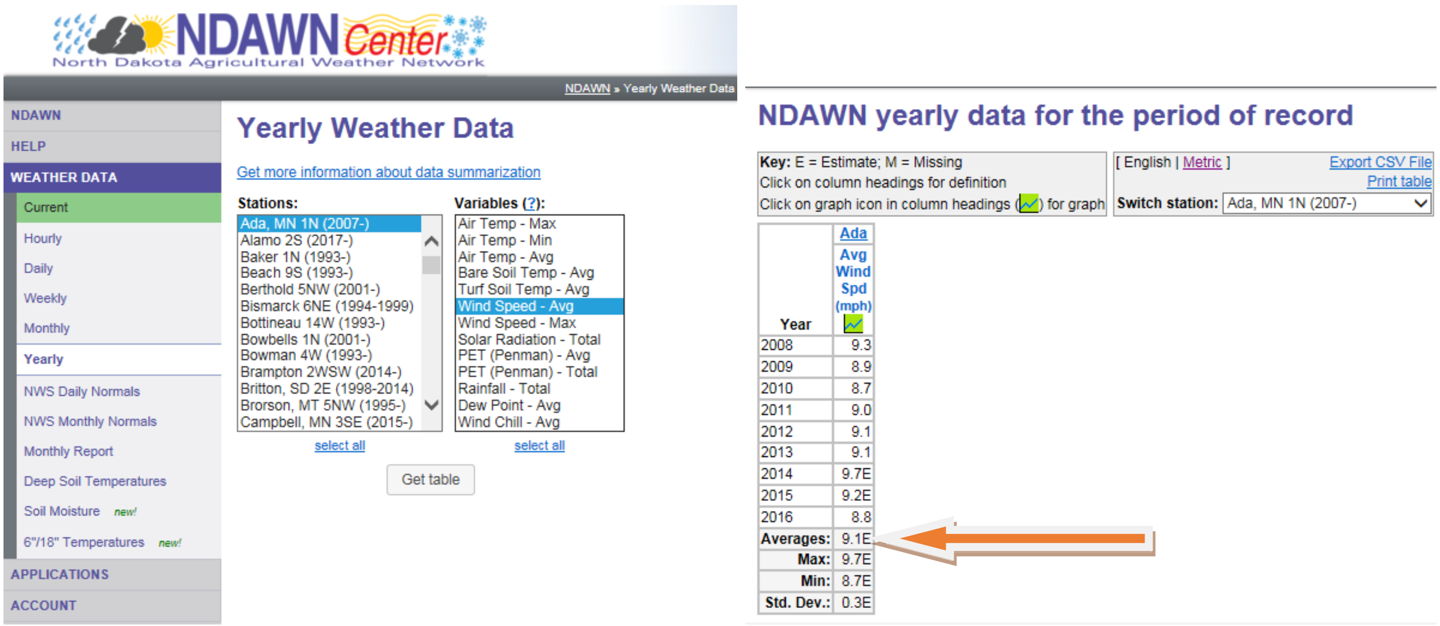

Figure 1 – NDAWN Database

Notes:

[1]This form is to be an attachment as a supplement to a complete watering system design package.

[2]The calculations for the increase in pump design flow of Steps 4 and 5 adjust the needed flow (GPH) in order to still meet the required water demand (GPD).

[3]If windmill is set on short stroke, the windmill pumping depth will be increased by 33% and the windmill pumping capacity will be reduced by 25%.

[4]Optimum tower siting is determined by the location of the windmill with respect to the surrounding structures and the prevailing wind direction. To obtain optimum performance, the windmill should be located 400-ft from the nearest structure and the top of the tower should be 15-ft taller than the surrounding structure.

Comments:

Computations By	**Date**	**Checked By**	**Date**

WINDMILL CAPACITIES TABLES

DIAMETER OF CYLINDER IN INCHES	CAPACITY PER HOUR IN GALLONS		Total Elevation in Feet SIZE					
	6 Ft	8-16 Ft	6 Ft	8 Ft	10 Ft	12 Ft	14 Ft	16 Ft
1¾	105	150	130	185	280	420	600	1,000
1⅞	125	180	120	175	260	390	560	920
2	130	190	95	140	215	320	460	750
2¼	180	260	77	112	170	250	360	590
2½	225	325	65	94	140	210	300	490
2¾	265	385	56	80	120	180	260	425
3	320	470	47	68	100	155	220	360
3¼	—	550	—	—	88	130	185	305
3½	440	640	35	50	76	115	160	265
3¾	—	730	—	—	65	98	143	230
4	570	830	27	39	58	86	125	200
4¼	—	940	—	—	51	76	110	180
4½	725	1,050	21	30	46	68	98	160
4¾	—	1,170	—	—	—	61	88	140
5	900	1,300	17	25	37	55	80	130
5¾	—	1,700	—	—	—	40	60	100
6	—	1,875	—	17	25	38	55	85
7	—	2,550	—	—	19	28	41	65
8	—	3,300	—	—	14	22	31	50

Capacities shown in the above table are approximate, based on the mill set on the long stroke, operating in a 15 to 20 mile-an-hour wind. The short stroke increases elevation by one-third and reduces pumping capacity one-fourth.

Table 1:
For 1 1/8", 1 3/8", 1 5/8" Wood; ½" #1 Steel "Airtight"; and 7/8" Solid Steel Sucker Rods

Diameter of Cylinder (inches)	PumpingCapacity (Gallons per Hour)		Pumping Elevation (Feet) Wheel Diameter					
	6′ Ft.	8-16′ Ft.	6′	8′	10′	12′	14′	16′
Long Stroke								
1 3/4"	105	150	152′	216′	328′	491′	702′	1170′
1 7/8"	125	180	140′	205′	304′	456′	655′	1076′
2"	130	190	111′	164′	252′	374′	538′	878′
2 1/4"	180	260	90′	129′	199′	293′	421′	690′
2 1/2"	225	325	76′	111′	164′	246′	351′	573′
2 3/4"	265	385	66′	94′	140′	211′	304′	467′
3"	320	470	55′	80′	117′	181′	257′	421′
3 1/4"	370	550	48′	68′	105′	152′	216′	357′
3 1/2"	440	650	41′	59′	89′	135′	187′	310′
3 3/4"	500	730	35′	51′	76′	117′	170′	269′
4"	570	830	32′	46′	68′	99′	146′	234′
4 1/4"	***	940	***	40′	60′	89′	129′	211′
4 1/2"	725	1050	25′	35′	54′	80′	117′	187′
4 3/4"	***	1170	***	***	48′	71′	105′	164′
5"	***	1300	20′	29′	43′	64′	94′	152′
5 3/4"	***	1700	***	***	***	47′	70′	117′
6"	***	1875	***	20′	29′	44′	64′	99′
7"	***	2550	***	***	22′	33′	48′	76′
8"	***	3300	***	***	16′	26′	36′	59′

Table 2:
For 5/8" AquaFlex (Fiberglass) Sucker Rods

Diameter of Cylinder (inches)	PumpingCapacity (Gallons per Hour)		Pumping Elevation (Feet) Wheel Diameter					
	6′ Ft.	8-16′ Ft.	6′	8′	10′	12′	14′	16′
Long Stroke								
1 3/4"	105	150	146′	207′	314′	470′	672′	1120′
1 7/8"	125	180	134′	196′	291′	437′	627′	1030′
2"	130	190	106′	157′	241′	358′	515′	840′
2 1/4"	180	260	86′	123′	263’	280′	403′	661′
2 1/2"	225	325	73′	106′	216’	235′	336′	549′
2 3/4"	265	385	63′	90′	187’	202′	291′	476′
3"	320	470	53′	76′	158’	174′	246′	403′
3 1/4"	370	550	46′	65′	140’	146′	207′	342′
3 1/2"	440	650	39′	56′	117’	129′	179′	297′
3 3/4"	500	730	34′	49′	99’	112′	162′	258′
4"	570	830	30′	44′	90’	95′	140′	224′
4 1/4"	***	940	***	38′	80’	85′	123′	202′
4 1/2"	725	1050	24′	34′	71’	76′	112′	179′
4 3/4"	***	1170	***	***	64’	68′	101′	157′
5"	900	1300	19′	28′	57’	62′	90′	146′
5 3/4"	***	1700	***	***	***	45′	67′	112′
6"	***	1875	***	19′	39’	43′	62′	95′
7"	***	2550	***	***	22’	31′	46′	73′
8"	***	3300	***	***	22’	25′	35′	56′

Table 3:
For 3/4” AquaFlex (Fiberglass) Sucker Rods

Diameter of Cylinder (inches)	PumpingCapacity (Gallons per Hour)		Pumping Elevation (Feet) Wheel Diameter					
	6′ Ft.	8-16′ Ft.	6′	8′	10′	12′	14′	16′
Long Stroke								
1 3/4"	105	150	94′	133′	202′	302′	432′	720′
1 7/8"	125	180	86′	126′	187′	281′	403′	662′
2"	130	190	68′	101′	155′	230′	331′	540′
2 1/4"	180	260	55′	79′	122′	180′	259′	425′
2 1/2"	225	325	47′	68′	101′	151′	216′	353′
2 3/4"	265	385	40′	58′	86′	130′	187′	306′
3"	320	470	34′	49′	72′	112′	158′	259′
3 1/4"	370	550	30′	42′	65′	94′	133′	220′
3 1/2"	440	650	25′	36′	55′	83′	115′	191′
3 3/4"	500	730	22′	32′	47′	72′	104′	166′
4"	570	830	19′	28′	42′	61′	90′	144′
4 1/4"	***	940	***	24′	37′	55′	79′	130′
4 1/2"	725	1050	15′	22′	33′	49′	72′	115′
4 3/4"	***	1170	***	***	30′	44′	65′	101′
5"	***	1300	12′	18′	27′	40′	58′	94′
5 3/4"	***	1700	***	***	***	29′	43′	72′
6"	***	1875	***	12′	18′	27′	40′	61′
7"	***	2550	***	***	14′	20′	30′	47′
8"	***	3300	***	***	10′	16′	22′	36′

Table 4:
For 3/4” #2 Steel Hollow “Airtight” Sucker Rods