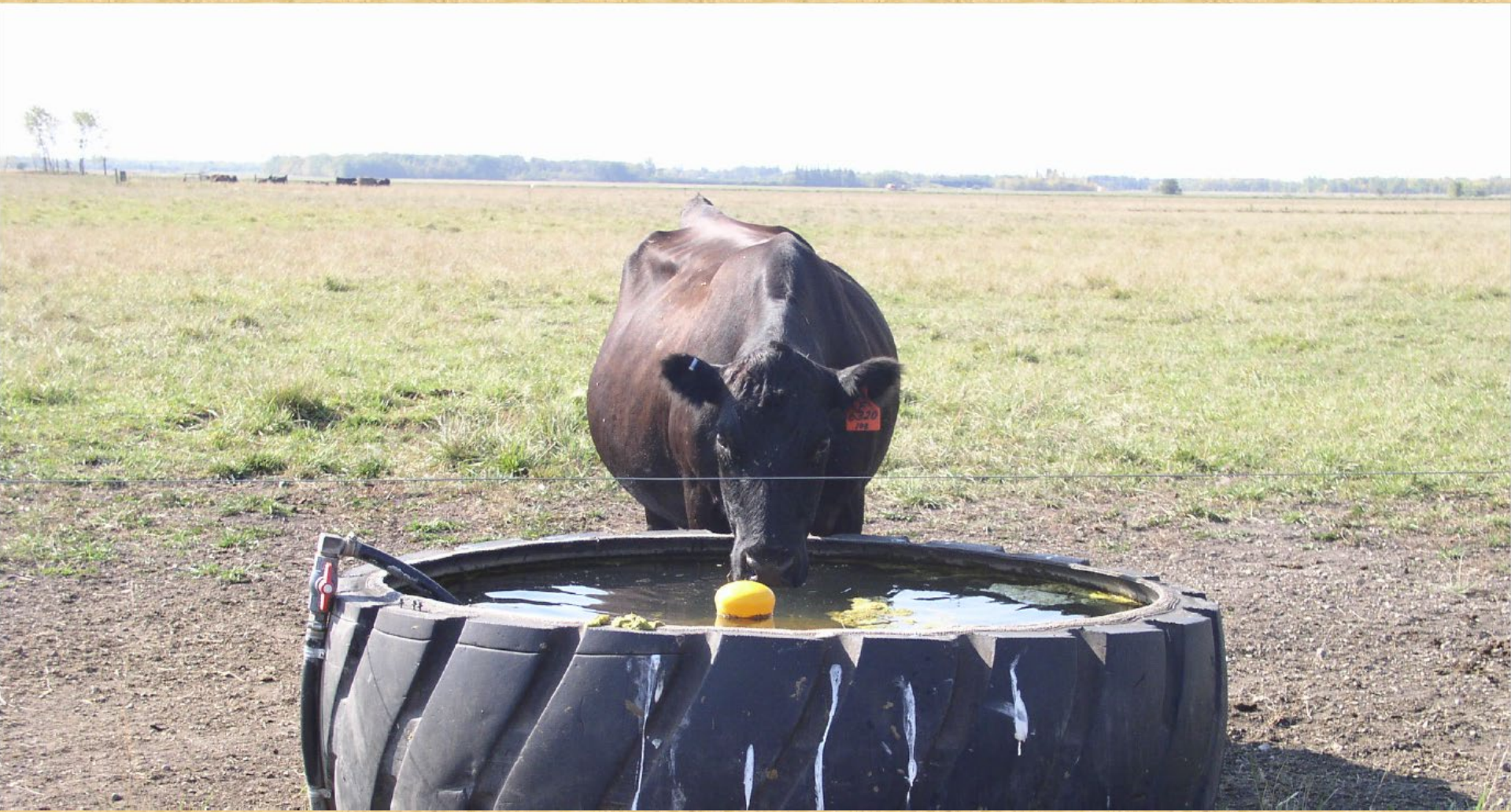
Planning Livestock Watering Systems



Introduction

Why are stockwater pipelines installed?

- Better water distribution
- Better livestock distribution
- Better livestock performance
- Better water quality
- Improve plant community
- More reliable water source
- Reduce erosion near water sources
- Promote healthy animals
- Prevent water loss (evaporation and seepage)

Planning

- Objectives
- Inventory
- Alternatives
- Implementation
- Follow up

Document File
528 Prescribed Grazing On-Site Inventory

Date:_____ Customer:_____

Service Center:_____ Conservationist:_____

Operation Goals

Acres: Existing_____ **Planned Additional (If Applicable)**_____

Animal Husbandry

Type of Operation:

- ☐ Beef
- ☐ Dairy
- ☐ Sheep
- ☐ Horse
- ☐ Bison
- ☐ Elk
- ☐ Stockers
- ☐ Goats
- ☐ Other

Specify other operation and additional notes:

Animal Inventory

Kind or Class	Number (Current / Goal)	Weight (beginning if applicable)	Weight (Ending if applicable)
	/		
	/		
	/		
	/		
	/		

Breeding:

Breeding management: ☐ Natural ☐ Artificial Insemination (AI)

Breeding ratio, females to males: ___ Females to ___ Male

Breeding dates: From:_____ To:_____

Assessing livestock water needs

- Rule of thumb
  - 20 gal/1000 pounds of herd weight
  - 2% of the animal's body weight per day

____**Number** of animals X ___**Average** weight of animals X **2%** = _____**Gallons** of water needed

- Note: Older design spreadsheets used 1.5% of the animal's body weight. Be sure you are using the most recent version.

Class Exercise: Assessing livestock water needs

- Example
  - 40 cow/calf pairs.
  - Cows weigh 1,200 lbs on average and calve starting in April
  - 40 Calves will weigh 300 lbs by August
  - 2 Bulls weigh 2,000 lbs
  - Calculate the daily water needs for the herd

____**Number** of animals X ___**Average** weight of animals X **2%** = _____**Gallons** of water needed

Class Exercise: Assessing livestock water needs

- Example
  - 40 cow/calf pairs.
  - Cows weigh 1,200 lbs on average and calve starting in April
  - Calves will weigh 300 lbs by August
  - Bulls weigh 2,000 lbs

40 Cows X **1,200 lb** average cow weight X **2%** = **960 gallons** of water per day

40 Calves X **300 lb** average calf weight X **2%** = **240 gallons** of water per day

2 Bulls X **1,800 lb** average bull weight X **2%** = **75 gallons** of water per day

  - The herd requires up to 1,275 gallons of water per day at peak use!

Class Exercise: Assessing livestock water needs

- Example

  40 ewes with lambs.

  – 40 Ewes: 165 lb average weight

  – 60 Lambs will be raised on pasture:

  – Average weight: 45 lbs

  – 2 Rams: 250 lbs average weight

Class Exercise:
Assessing livestock water needs

- Example
  - 40 ewes with lambs.
  - 60 Lambs will be raised on pasture:
    - Average weight: 45 lbs
  - 2 Rams: 250 lbs average weight

40 Ewes X **165 lb** average ewe weight X **2%** = **132 gallons** of water per day

60 Lambs X **45 lb** average lamb weight X **2%** = **54 gallons** of water per day

2 Rams X **250 lb** average ram weight X **2%** = **10 gallons** of water per day

  - The herd requires up to 196 gallons of water per day at peak use. Size matters!!!

Assessing livestock water needs

Producer: _____ **Date:** 4/14/2021

County: _____ **Designed by:** _____

Checked by: _____

Township: _____ **Date:** _____

Section: _____ **T** _____ **N** **R** _____ **W**

Planned Water Source: _____ **Herd 1 Water Need:** 20 gal/day/1000#

Travel Distance to Water: _____ Feet **Herd 2 Water Need:** 20 gal/day/1000#

Herd 1				Herd 2			
Number/Type of Livestock		Animal Weight (lbs)	Daily Water Use (Gallons)	Number/Type of Livestock		Animal Weight (lbs)	Daily Water Use (Gallons)
			0				0
			0				0
			0				0
			0				0
			0				0
			0				0
			0				0
		Daily Total	0			Daily Total	0

Water storage when travel distance is <950': 10 percent of the daily total

Water storage when travel distance is >950': 50 percent of the daily total

Herd 1		Herd 2	
Water Delivery Time (hours):		Water Delivery Time (hours):	
Suggested Minimum Watering Facility Size (gallons):		Suggested Minimum Watering Facility Size (gallons):	

Herd 1			Herd 2		
Planned Tank Size(s) (gallons)	Delivery Time (hrs)	Flow Rate (gpm)	Planned Tank Size(s) (gallons)	Delivery Time (hrs)	Flow Rate (gpm)

Existing Water Source Documentation (if applicable)

Source Max Flow Rate _____ gpm

Pressure Switch Setting - On _____ psi

Pressure Switch Setting - Off _____ psi

Herd Water Need

- 20 gal/day/1000# is recommended for summer
- 15 gal/day/1000# is recommended for fall/winter
- Provide documentation if deviating from recommend values

Special Considerations for sizing watering facilities

- Travel Distance (950') - (1 Tank / 40 Acres)
- Topography - flat vs. steep terrain
- Species - bison vs. sheep
- Animal Behavior - individual or herd
- Economics
- Watering Area/Animal Unit - fence line vs. corral
- Dependability, quality, and quantity of water source
- Landscape Obstructions - water features, wooded areas, rock outcrops
- 15 gallon minimum tank size for sheep and goats
- 50 gallon minimum tank size for cattle and horses
- Automatic drinker may be substituted for either
- Maximum tank height for sheep should be 16"

Water Delivery Time

- 12 hours is a recommended minimum (12 hrs or less)
- A shorter delivery time may be warranted if the water source and pipeline can handle higher flows. This results in a smaller required tank

Producer: _____ **Date:** 4/14/2021

County: _____ **Designed by:** _____

Checked by: _____

Township: _____ **Date:** _____

Section: _____ **T** _____ **N** **R** _____ **W**

Planned Water Source: Existing Well **Herd 1 Water Need:** 20 gal/day/1000#

Travel Distance to Water: 1200 Feet **Herd 2 Water Need:** 15 gal/day/1000#

Herd 1				Herd 2			
Number/Type of Livestock		Animal Weight (lbs)	Daily Water Use (Gallons)	Number/Type of Livestock		Animal Weight (lbs)	Daily Water Use (Gallons)
50	Cows	1350	1350	50	Cows	1350	1013
50	Calves	300	300	2	Bulls	2000	60
2	Bulls	2000	80				0
			0				0
			0				0
			0				0
			0				0
		Daily Total	1730			Daily Total	1073

Water storage when travel distance is <950': 10 percent of the daily total

Water storage when travel distance is >950': 50 percent of the daily total

Herd 1		Herd 2	
Water Delivery Time (hours):	16	Water Delivery Time (hours):	6
Suggested Minimum Watering Facility Size (gallons):	757	Suggested Minimum Watering Facility Size (gallons):	358

Herd 1			Herd 2		
Planned Tank Size(s) (gallons)	Delivery Time (hrs)	Flow Rate (gpm)	Planned Tank Size(s) (gallons)	Delivery Time (hrs)	Flow Rate (gpm)
500	6	3.5	10	6	3.0

Existing Water Source Documentation (if applicable)

Source Max Flow Rate	7	gpm
Pressure Switch Setting - On	30	psi
Pressure Switch Setting - Off	50	psi

Herd Water Need

- 20 gal/day/1000# is recommended for summer
- 15 gal/day/1000# is recommended for fall/winter
- Provide documentation if deviating from recommend values

Special Considerations for sizing watering facilities

- Travel Distance (950') - (1 Tank / 40 Acres)
- Topography - flat vs. steep terrain
- Species - bison vs. sheep
- Animal Behavior - individual or herd
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Livestock water needs planning considerations

- Typically plan for peak use (August)
- Get the water needs of every animal to be grazed!
- Size matters!

Planning Considerations: Water Source

- We are promoting pipeline water systems from wells
  - If this is not feasible, contact your grazing specialist before proceeding!!!

Planning Considerations: Water Source

Planning Considerations: Water Source

Planning Considerations: Water Source

- Existing well?
  - What is the well's capacity?
  - What is the pressure setting?
  - Age/condition of the well?
- If no well or "unusable" well….
  - Is power nearby?
  - Can we drill a well??

Access to Power

- Easiest to design for and to use when electricity is readily available
- If not available, alternative pumps need to be used
  - Refer to your Grazing Lands Specialist/Engineering staff for alternative pump options

Check the Capacity of the well

Instructions for Conducting Flowmeter Check for Pipeline Engineering Studies

It is always preferable to do the flowmeter reading at the exact location where the pipeline will be hooked up to the water supply, but this may not be possible if the hydrant has not been installed. The next best location would be at a similar elevation with unrestricted flow. Outside hose outlets on houses or other buildings usually are supplied by a ½ inch pipe which can seriously reduce flow and result in an underestimation of the true delivery rate of the well at various pressures. If you must do an initial reading for the flowmeter check at one of these, please indicate this on the Watering System Job Investigation Sheet. Go back later and attach to the hydrant where the pipeline will be hooked up and confirm that the pipeline will work.

Be wary of hydrants that have not been used recently. They usually produce large amounts of sediment laden and rusty water which can turn your flowmeter to junk. Run the hydrant for a few minutes until the water clears up. This is not a bad idea for all hydrants.

Before attaching the flowmeter to the test hydrant, the flow meter needs to be open so that water will be flowing through it when the hydrant is opened up. Be careful and don't open or close the hydrant rapidly to avoid pressure surges through the flowmeter, which can reduce its accuracy.

Slowly close the flowmeter and record the pressure with no flow. Gradually open the flow meter increasing the flow to wide open at various pressures and record the pressure and flow. Following is a table to remind you of what data to collect:

Pressure(psi)									
Flow(gpm)									

Note that as flow increases pressure will typically decrease. You can get a good idea of the pressure switch settings by observing the static pressure (while the flowmeter is closed) after running the flowmeter for some time through the on/off cycle of the well.

HINT: Before performing the flowmeter, ask the landowner if the pump is doing any larger tasks such as washing clothes, someone taking a shower in the house, a bulk milk tank being washed or someone using a power washer just to name a few. Large uses of water during a flowmeter test can cause inaccurate readings.

WARNING: If the flow meter is being used during freezing weather, make sure the flow meter does not freeze.

Example flow meter test

Instructions for Conducting Flowmeter Check for Pipeline Engineering Studies

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Pressure(psi)	10	20	30	40	50				
Flow(gpm)	8	7	6	5	4				

Note that as flow increases pressure will typically decrease. You can get a good idea of the pressure switch settings by observing the static pressure (while the flowmeter is closed) after running the flowmeter for some time through the on/off cycle of the well.

HINT: Before performing the flowmeter, ask the landowner if the pump is doing any larger tasks such as washing clothes, someone taking a shower in the house, a bulk milk tank being washed or someone using a power washer just to name a few. Large uses of water during a flowmeter test can cause inaccurate readings.

WARNING: If the flow meter is being used during freezing weather, make sure the flow meter does not freeze.

Yes or No: Does the well produce enough GPM for our planned herd size?

Herd 1				Herd 2			
Number/Type of Livestock		Animal Weight (lbs)	Daily Water Use (Gallons)	Number/Type of Livestock		Animal Weight (lbs)	Daily Water Use (Gallons)
50	Cows	1350	1350	50	Cows	1350	1013
50	Calves	300	300	2	Bulls	2000	60
2	Bulls	2000	80				0
			0				0
			0				0
			0				0
			0				0
		Daily Total	1730			Daily Total	1073

Water storage when travel distance is <950':	10	percent of the daily total
Water storage when travel distance is >950':	50	percent of the daily total

Herd 1		Herd 2	
Water Delivery Time (hours):	16	Water Delivery Time (hours):	6
Suggested Minimum Watering Facility Size (gallons):	757	Suggested Minimum Watering Facility Size (gallons):	358

Herd 1			Herd 2		
Planned Tank Size(s) (gallons)	Delivery Time (hrs)	Flow Rate (gpm)	Planned Tank Size(s) (gallons)	Delivery Time (hrs)	Flow Rate (gpm)
500	6	3.5	10	6	3.0

- Flow test results (below)

Pressure(psi)	10	20	30	40	50				
Flow(gpm)	8	7	6	5	4				

Bucket Test

- Check pressure at the pressure tank
- Time how long it takes to fill a 5 gallon bucket

Class Exercise:
Example Bucket Test

- 14 seconds to completely fill 5 gallon bucket

- Equation:

Gallons / time to fill bucket X 60 Seconds Per Minute= Gallons Per Minute

Class Exercise: Example Bucket Test

- 14 seconds to completely fill 5 gallon bucket
- Equation:

Gallons / time to fill bucket X 60 Seconds Per Minute= Gallons Per Minute

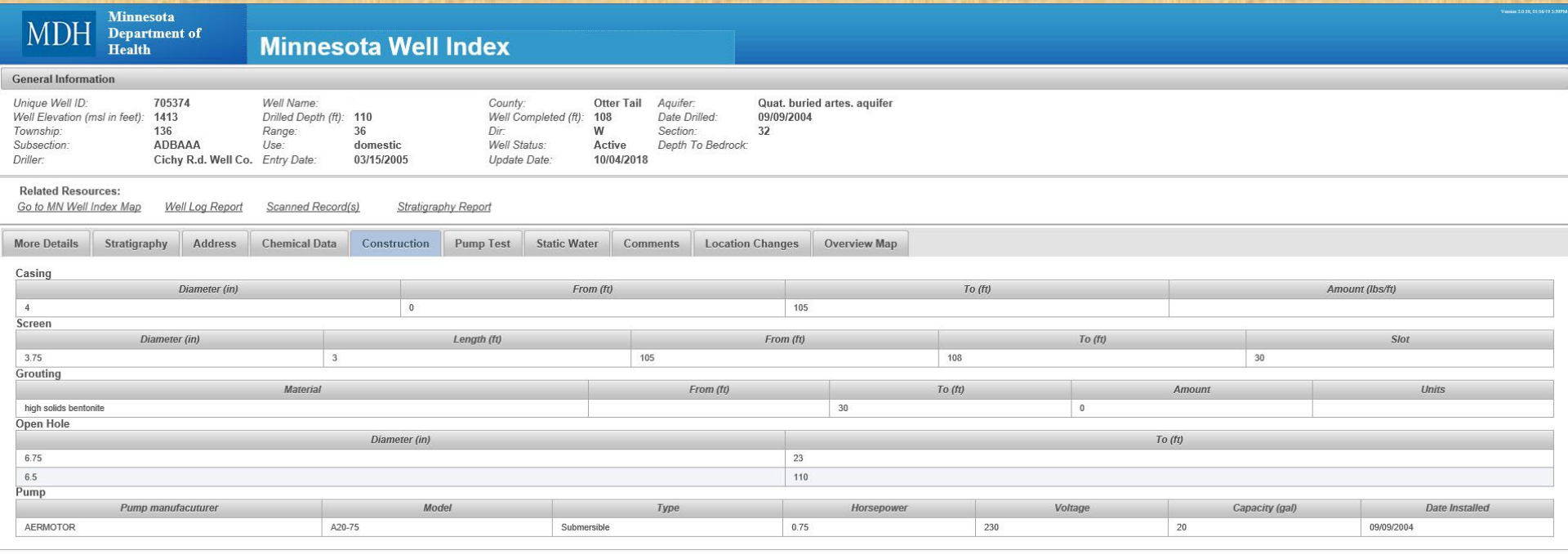
- 5 Gallons / 14 seconds X 60 Seconds Per Minute= 21.4 Gallons Per Minute

Existing Wells

Well Logs

- Minnesota Well Index Online
  - Previously called County well index

https://www.health.state.mn.us/communities/environment/water/mwi/index.html



MDH Minnesota Department of Health

Minnesota Well Index

General Information

Unique Well ID:	705374	Well Name:		County:	Otter Tail	Aquifer:	Quat. buried artes. aquifer
Well Elevation (msl in feet):	1413	Drilled Depth (ft):	110	Well Completed (ft):	108	Date Drilled:	09/09/2004
Township:	136	Range:	36	Dir:	W	Section:	32
Subsection:	ADBAAA	Use:	domestic	Well Status:	Active	Depth To Bedrock:	
Driller:	Cichy R.d. Well Co.	Entry Date:	03/15/2005	Update Date:	10/04/2018		

Related Resources:
Go to MN Well Index Map | Well Log Report | Scanned Record(s) | Stratigraphy Report

More Details | Stratigraphy | Address | Chemical Data | Construction | Pump Test | Static Water | Comments | Location Changes | Overview Map

Casing

Diameter (in)	From (ft)	To (ft)	Amount (lbs/ft)
4	0	105	

Screen

Diameter (in)	Length (ft)	From (ft)	To (ft)	Slot
3.75	3	105	108	30

Grouting

Material	From (ft)	To (ft)	Amount	Units
high solids bentonite		30	0	

Open Hole

Diameter (in)	To (ft)
6.75	23
6.5	110

Pump

Pump manufacuturer	Model	Type	Horsepower	Voltage	Capacity (gal)	Date Installed
AERMOTOR	A20-75	Submersible	0.75	230	20	09/09/2004

Well Log - Pump

Minnesota Unique Well Number: **534980**

County: Sherburne
Quad: Lake
Quad ID: 137A

MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING REPORT
Minnesota Statutes Chapter 1031

Entry Date: 05/26/1994
Update Date: 02/14/2014
Received Date:

Pumping Level (below land surface)

40 ft. 3 hrs. Pumping at 50 g.p.m.

Pump ☐ Not Installed Date Installed 10/16/1993

Manufacturer's name: AERMOTOR

Model Number: SD1250 HP: 0.5 Volt: 230

Length of drop pipe: 40 ft Capacity: 12 g.p. Typ

Pump Curves

4" SUBMERSIBLE PUMPS – 5, 8, 12, 16, 20, 22 AND 25 GPM

AERMOTOR®

A+ SUPER SUB series – stainless steel

12 GPM pump performance

Pumping capacities in gallons per minute at indicated discharge pressures in pounds per square inch.

1-1/4" NPT DISCHARGE

Model Number	HP	PSI	Depth to Water in Feet																	Shutoff Head	
			20	40	60	80	100	125	150	175	200	225	250	275	300	350	400	450	500	FEET	PSI
12-50 (8-STG)	1/2	20	–	–	15.0	14.0	13.0	11.5	9.5	7.2										265	115
		30	–	14.9	13.8	12.8	11.6	9.8	7.3												
		40	14.8	13.8	12.6	11.3	9.8	7.6													
		50	13.5	12.4	11.1	9.7	7.8														
		60	12.2	10.9	7.7	7.5															
12-75 (11-STG)	3/4	20	–	–	–	–	–	14.3	13.4	12.3	11.0	9.6	8.1	6.3						365	158
		30	–	–	–	15.0	14.4	13.5	12.4	11.2	9.8	8.2	6.5								
		40	–	–	14.9	14.3	13.6	12.5	11.2	9.8	8.3	6.6									
		50	–	14.8	14.2	13.5	12.6	11.3	9.9	8.4	6.7										
		60	14.7	14.1	13.3	12.5	11.4	10.1	8.5	6.8											
12-100 (14-STG)	1	20	–	–	–	–	–	–	15.0	14.3	13.5	12.7	11.8	10.8	9.7	7.2				467	202
		30	–	–	–	–	–	15.0	14.3	13.7	12.8	11.8	10.8	9.8	8.7						
		40	–	–	–	–	–	14.4	13.7	12.8	11.9	11.0	9.8	8.7	7.3						
		50	–	–	–	–	14.5	13.8	12.9	12.0	11.0	10.0	8.8	7.5	6.0						
		60	–	–	14.9	14.3	13.8	13.0	12.1	11.2	10.0	8.9	7.7	6.2							

4" submersible pumps

New Wells

MINNESOTA DEPARTMENT OF HEALTH WELL AND BORING RECORD REQUIRED

INSTALLED BY CERTIFIED WELL DRILLER LICENSED IN MINNESOTA

Minnesota Unique Well No.

543939

County McLeod
Quad Hutchinson East
Quad ID 108A

MINNESOTA DEPARTMENT OF HEALTH

WELL AND BORING RECORD

Minnesota Statutes Chapter 103I

Entry Date 12/19/1994
Update Date 11/06/2002
Received Date

Well Name JOECKS, VIRGINIA

Township	Range	Dir	Section	Subsections	Elevation	ft.
117	29	W	17	CBB	Elevation Method	

Well Depth	Depth Completed	Date Well Completed
205 ft.	203 ft.	09/16/1994

Drilling Method Non-specified Rotary

Drilling Fluid
--

Well Hydrofractured? ☐ Yes ☐ No
From Ft. to Ft.

Use Domestic

Casing Type Plastic Joint No Information Drive Shoe? ☐ Yes ☐ No Above/Below ft.

Casing Diameter	Weight	Hole Diameter
4 in. to 199 ft.	lbs./ft.	8.8 in. to 203 ft.

Open Hole from ft. to ft.

Screen YES Make JOHNSON Type stainless steel

Diameter	Slot/Gauze	Length	Set Between
4	30	4	199 ft. and 203 ft.

Geological Material	Color	Hardness	From	To
TOP SOIL	BLACK		0	2
CLAY	YELLOW		2	15
SANDY CLAY W/PEBBLES	BLUE		15	43
SANDY CLAY W/PEBBLES	GRAY		43	86
SAND	GRAY		86	87
ASNDY CLAY W/PEBBLES	GRAY		87	140
SANDY CLAY W/PEBBLES	GRAY		140	175
CLAY W/LIMESTONES	GRAY		175	195
GRAVEL	VARIED		195	205
GRAVEL	VARIED		205	

Static Water Level
47 ft. from Land surface Date Measured 09/16/1994

PUMPING LEVEL (below land surface)
80 ft. after hrs. pumping 100 g.p.m.

Well Head Completion
Pitless adapter manufacturer Model
☐ Casing Protection ☐ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY)

NO REMARKS

Grouting Information Well Grouted? ☑ Yes ☐ No

Grout Material: Bentonite from 7 to 30 ft.

Nearest Known Source of Contamination
60 feet S direction Septic tank/drain field type
Well disinfected upon completion? ☑ Yes ☐ No

Pump ☐ Not Installed Date Installed
Manufacturer's name Model number HP Volts
Length of drop Pipe ft. Capacity g.p.m Type Material

Abandoned Wells Does property have any not in use and not sealed well(s)? ☐ Yes ☑ No

Variance Was a variance granted from the MDH for this well? ☐ Yes ☐ No

Well Contractor Certification

Ltp Enterprises	91353	VERDECK, D.
License Business Name	Lic. Or Reg. No.	Name of Driller

First Bedrock
Last Strat
Aquifer
Depth to Bedrock ft.

Should we use the existing well or drill a new well?

- Does the farm have water flow issues currently? Drill a new well.
- What is the planned flow rate Gallons Per Minute)?
  - Under 5 GPM: Most newer wells should have pumps capable of this (unless in areas with low water availability)
  - 10 GPM: What does the current well produce?
    - More conversation with the producer regarding any current water issues.
    - The higher the flow rate, greater likelihood of needing a new well

Class Exercise: Calculating well production vs. herd's water needs on the farm

- Well: How many total gallons can a well that pumps 5 gallons per minute produce in 16 hours?
- How much water do 100 cow/calf pairs plus 4 bulls need for one day?
  - Cows: 1,350 lb average weight
  - Calves: 300 lb average weight
  - Bulls: 2,000 lb average weight

____**Number** of animals X ___**Average** weight of animals X **2%** = _____**Gallons** of water needed

- Can the existing well produce enough water???

Class Exercise: Calculating well production vs. herd's water needs on the farm

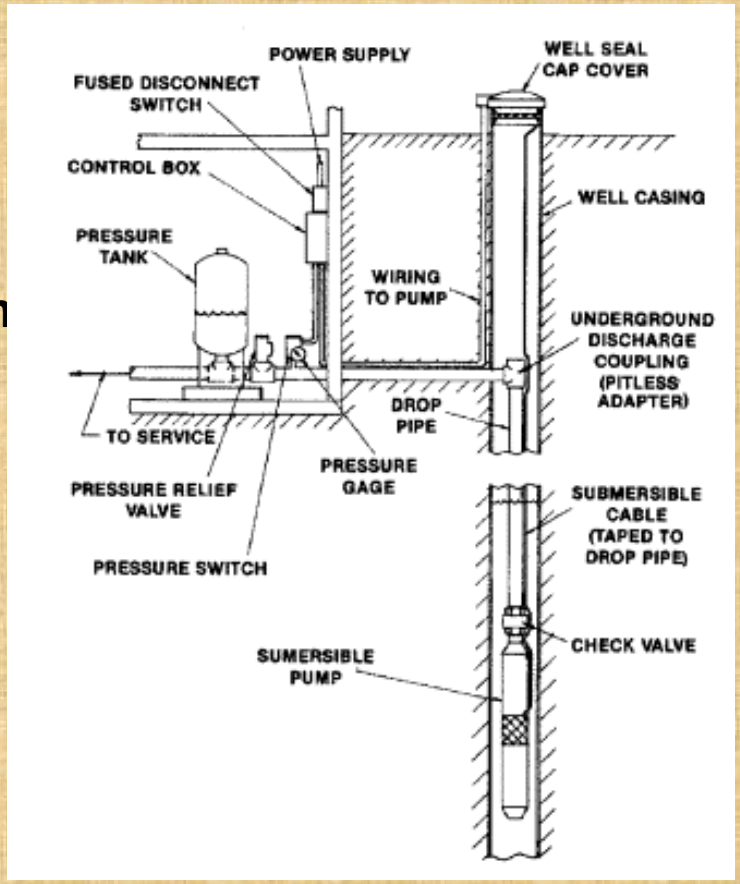
- Well: 5 GPM X 60 Minutes X 16 hours =
- 4,800 gallons
- How much water do 100 cow/calf pairs plus 4 bulls need for one day?
  - Cows: 100 X 1,350 lbs X 0.02= 2,700 Gallons/day
  - Calves: 100 X 300 lbs X 0.02= 600 Gallons/Day
  - Bulls: 4 X 2,000 lb X 0.02= 160 Gallons/Day
  - 3,460 Gallons/Day needed
- Can the existing well produce enough water? YES

Submersible Pump

Pumps

Submersible

- Deep Wells
- Most commonly used on livestock pipelines



Pumps

Jets

- Shallow Wells
- Limited to well with a depth of 25 ft

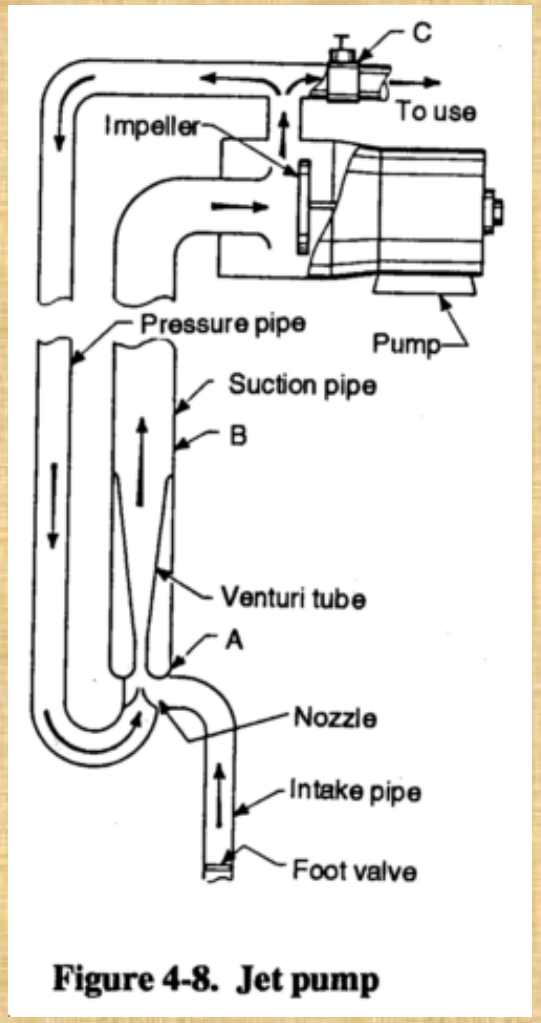
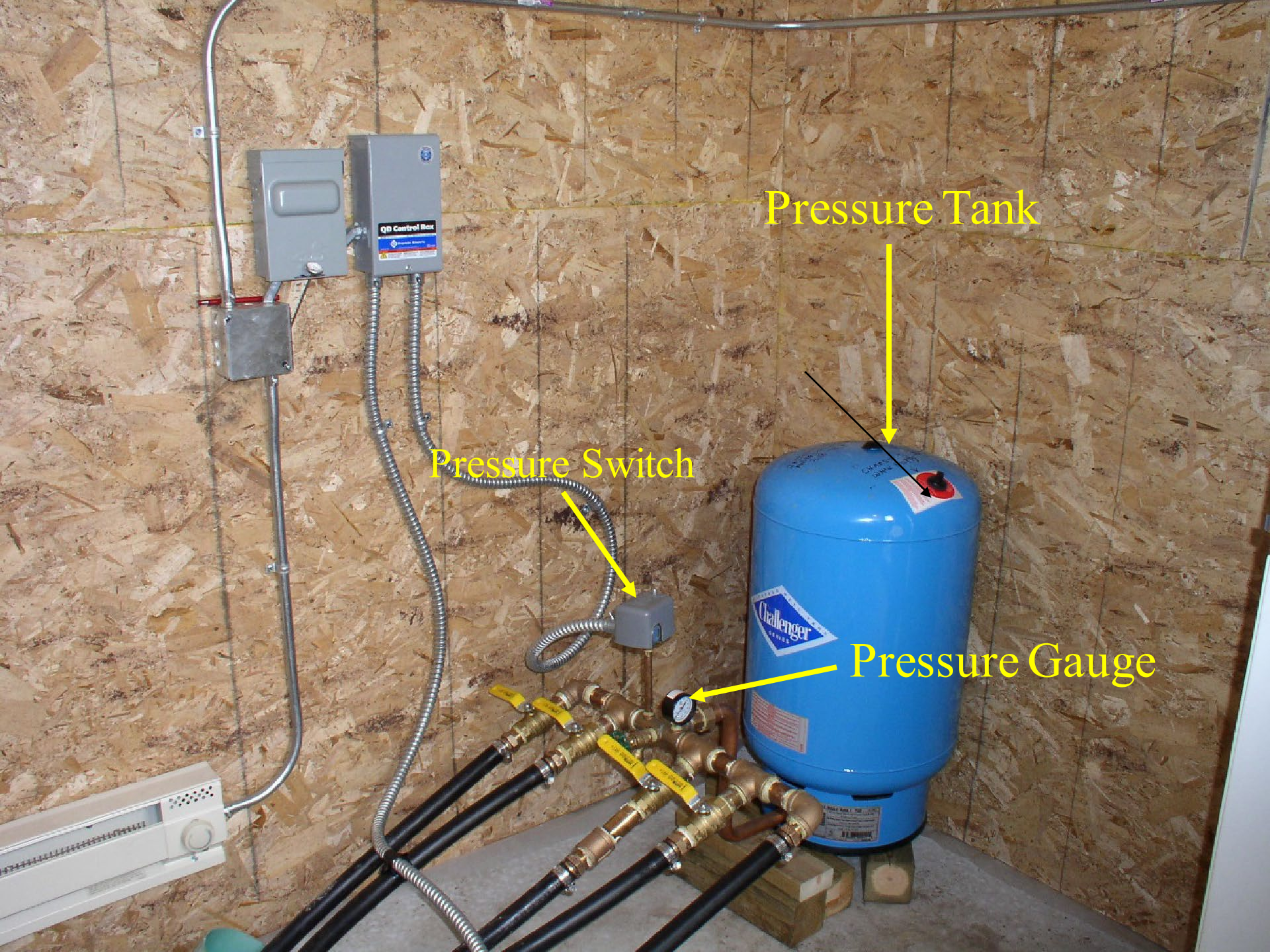
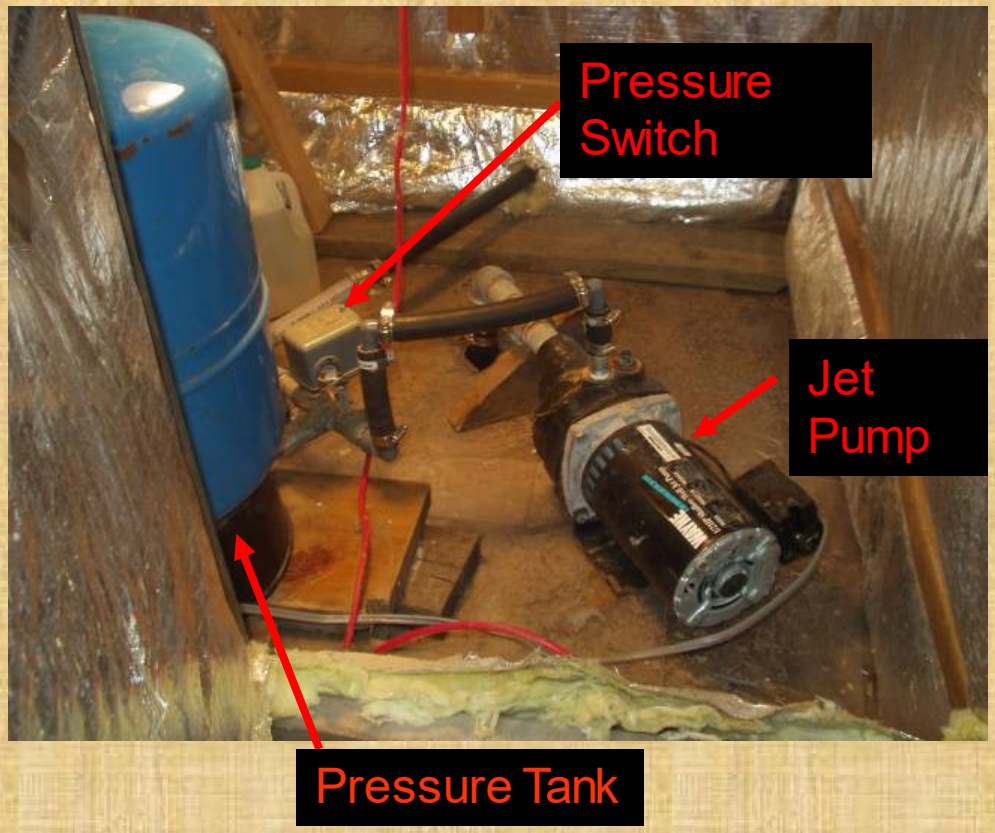


Figure 4-8. Jet pump


Pressure Tank
Pressure Switch
Pressure Gauge
QD Control Box
Challenger

Jet Pump System



Pressure Tanks

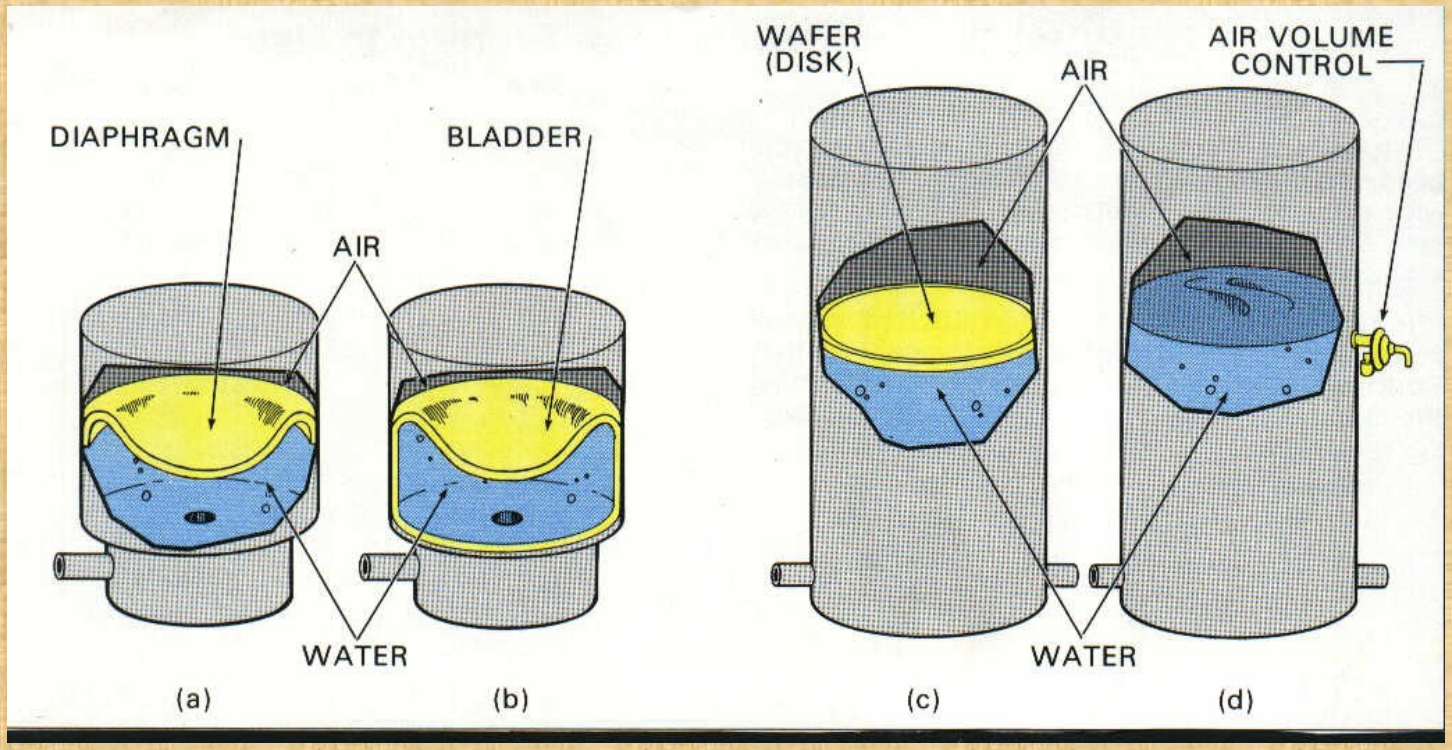
- **Protect and prolong the life of the pump by preventing rapid cycling of the pump motor**
- **Provide water under pressure for delivery between pump cycles**
- **Provide additional water storage under pressure to assist the pump in meeting the total demands of a system if the pump or well is incapable of supplying the required capacity**

Cycle Time

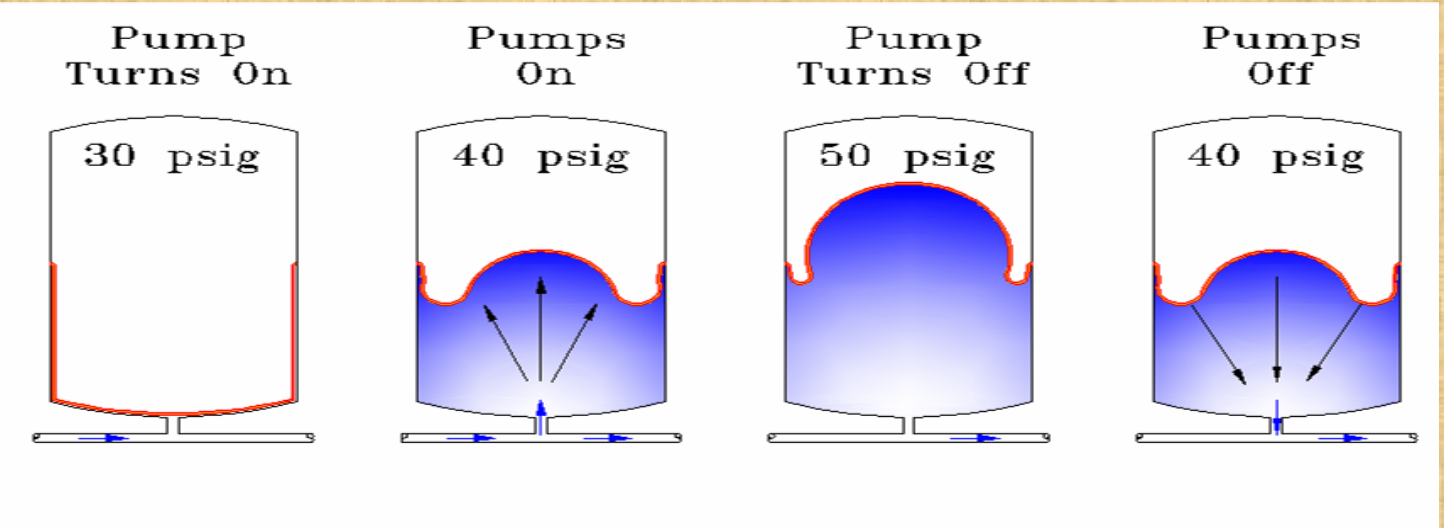
- **Conservative minimum = 1 ½ minutes as recommended by pump manufactures**

- **Rapid cycle times will damage pump and other system elements**

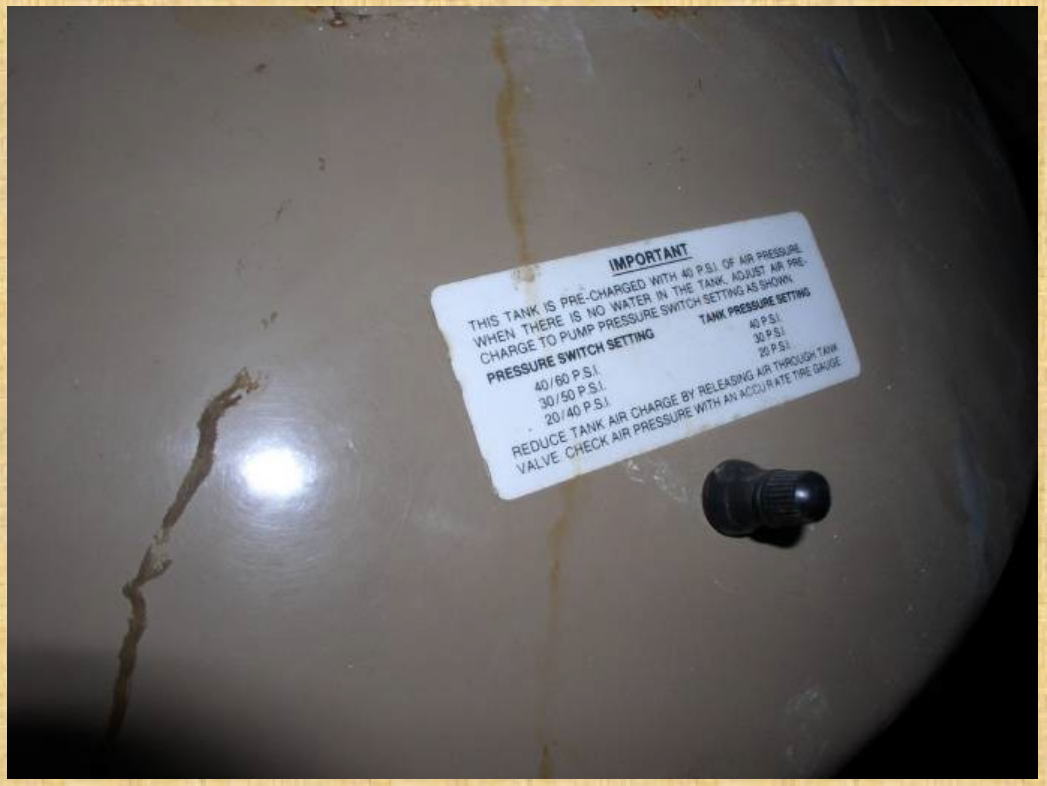
Pressure Tanks



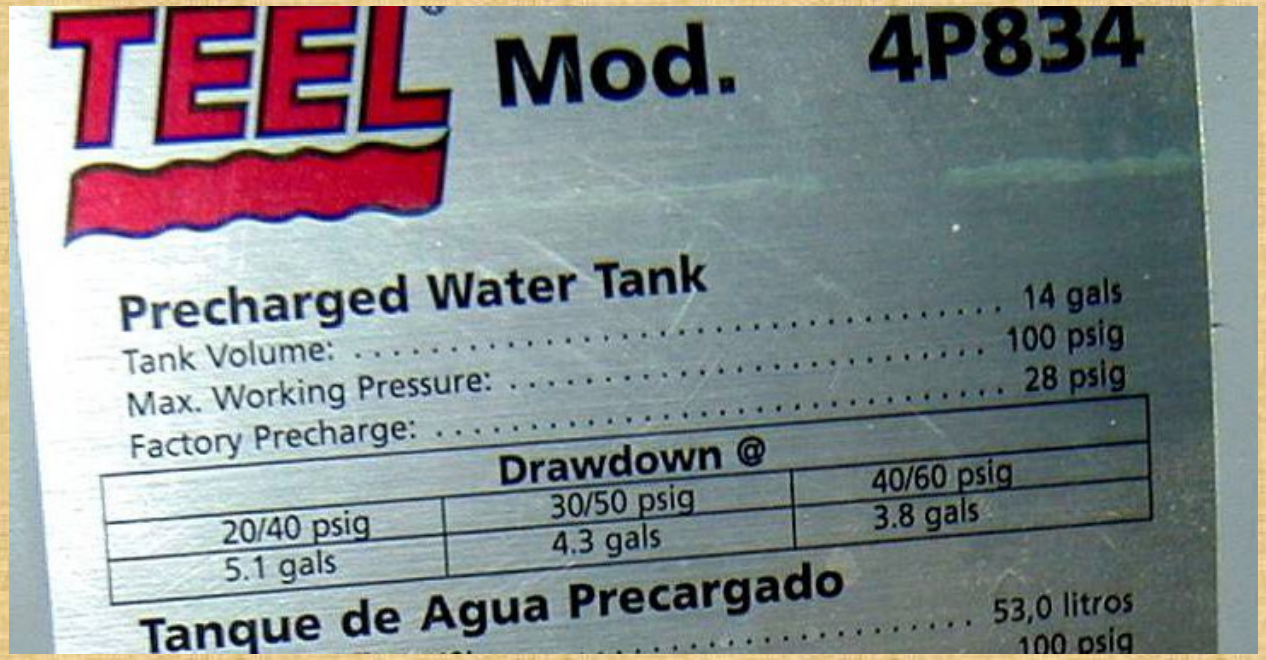
Pressure Tanks



Precharged Pressure Tank

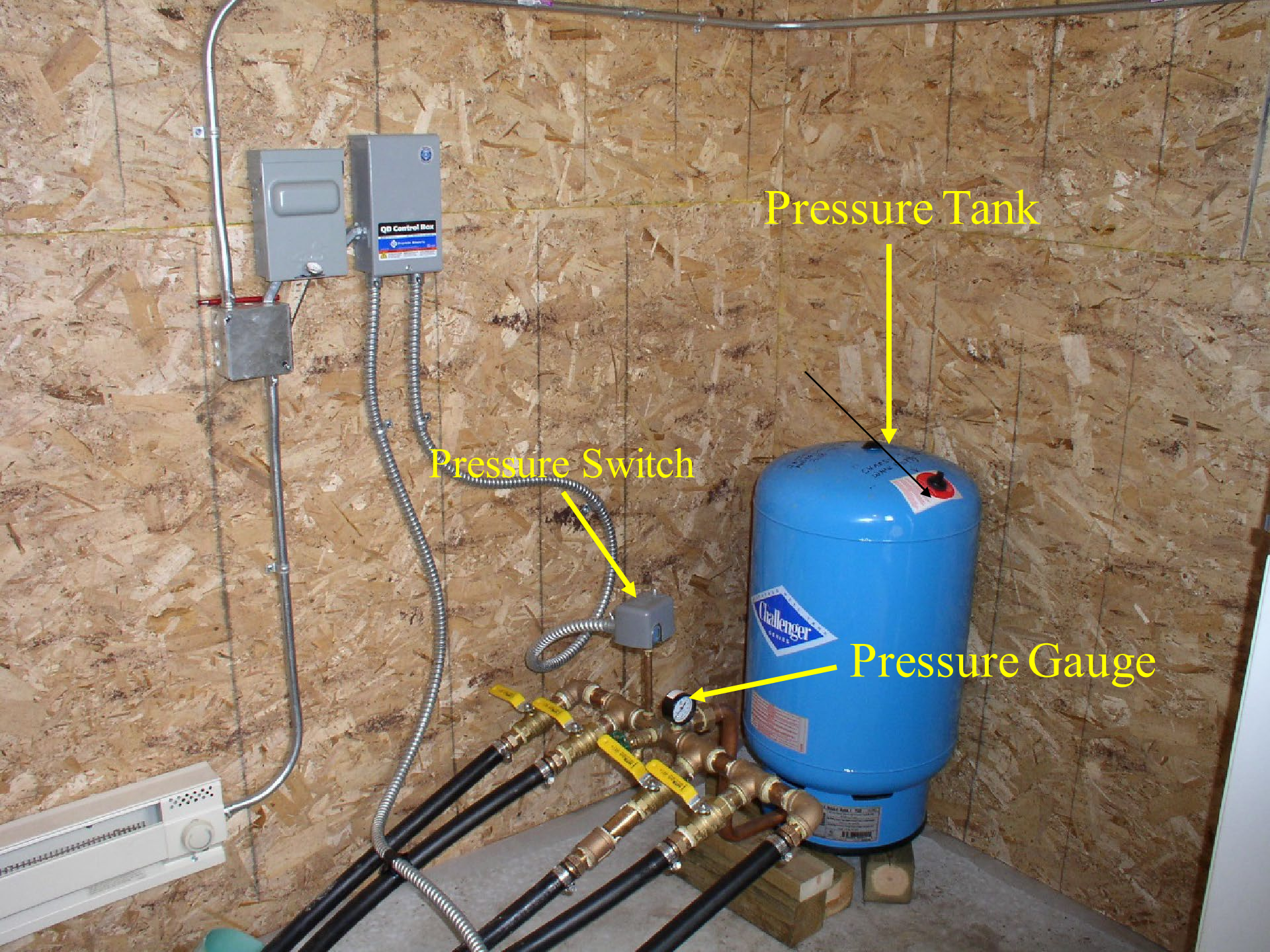


Pressure Tank Settings



Pressure Switch

- ON/Off Settings Common in 20 psi increments
- Typical Pressure Settings
  - 20/40
  - 30/50
  - 40/60


Pressure Tank
Pressure Switch
Pressure Gauge
QD Control Box
Challenger

Planning Considerations: Pipeline Delivery Systems

- Pressurized system from a pump is the most common
- Installation Methods:
  - Above ground: Requiring draining prior to freeze-up (gravity or compressed air)
  - Shallow-buried: Requiring draining to prevent freezing (usually with compressed air)
  - Deep-buried systems
    - Depth depends on location
    - Soils considerations are important

Aboveground Installation

Pros of aboveground pipe installation:

- Relatively easy to install
- Cost-effective
- Leaks are more easily found and fixed than with a buried pipe.

Cons of aboveground pipe installation:

- Must follow fence lines to reduce potential for livestock trampling.
- Line must be drained prior to freezing weather

Aboveground Pipeline delivery

Shallow-buried Installation

- Buried 1-3+ feet in the ground
- Typically install as continuous lines (no Ts) for ease of drainage/maintenance

Pros of shallow-buried pipelines

- Do not need to follow fence lines and can bury across fields and pastures
- Extends the use of the pipe later into the fall because the pipe is more protected from freezing.
- Can be a very cost effective way of installation.
- Water must be blown out of lines in the fall.

Cons of shallow-buried pipelines

- Gophers and other rodents can chew on the pipe, causing leaks. This is especially problematic when burying through idle grass, such as old CRP, or alfalfa.
- Leaks can be hard to find and you may not know you have a leak until wet spots show up at the soil surface.

Shallow-buried pipeline system

Shallow-buried pipeline end cap

Deep-buried Installation

- Buried 6+ feet in the ground
- Installation methods: Tile plows, trenchers, backhoes, directional boring
- Fittings: Brass or fusion
- Facilitates extending the grazing season and improving winter feeding methods.

Pros to deep-buried pipelines

- Needed for winter water supplies
- Does not have to be blown out in the fall
- Can provide maximum flexibility with herd and land management.

Cons of deep-buried pipelines

- Cost, especially depending on installation method
- Availability of equipment/vendors

Deep Buried Pipeline System

Directional Boring Installation

- May be needed when crossing roads or through farm yards.

Planning Considerations: Watering Facilities

- Paddock size and layout
- Herd size
- Kind and class of livestock
- Travel distance

Will the livestock come to the tank as individuals or as a herd?

What size tank do I need?

- Large/Permanent tanks
  - Large herd (greater than 30-35 cow/calf pair)
  - Large paddocks
  - Rough terrain
  - Slow delivery of water
- Small/portable tanks
  - Small herd (less than 30-35 cow/calf pairs)
  - Small paddocks
  - Rapid delivery of water
  - Intensive grazing management

Planning Considerations: Water Tank Sizes

- Generally recommend ~30% of daily water needs stored in the tank
  - Ensure adequate water availability if entire herd comes to drink
  - Depends on pump/well capacity and capabilities
  - May be less if:
    - using temporary tank sizes
    - Intensive grazing management
    - Using larger diameter pipes

Kind and class of livestock

- Portable tanks are more pertinent for docile animals (Sheep and Dairy Cows)
  - Or for intensive managed systems (for example: moving every day)
  - Or small herd sizes
- Large tanks are needed for more aggressive animals (Bison)
  - Or larger herd sizes

Planning Considerations: Miscellaneous

- Permanent tanks: Usually have one tank service up to 4 paddocks
  - Tanks along fencelines
- Large herds/large pastures
  - May centrally locate tanks to cut down on travel distance
  - May have multiple tank locations per paddock
- Travel Distance: Locate tanks to achieve a distance of less than quarter mile if possible

Tank/Trough

- Portable tank (150 gallons or less)
  - Or if using equipment to move tanks
- Permanent tank (Greater than 150 gallons)
- Winter Watering Facility
- Tank assembly (floats, valves, hook-up hose)
- Tank connection (quick couplers)

Planning Considerations: Materials

- Plastic
- Fiberglass
- Steel
- Rubber Tires
- Winter Watering facilities

Poly tank

Fiberglass

Steel Tank

Steel Tank

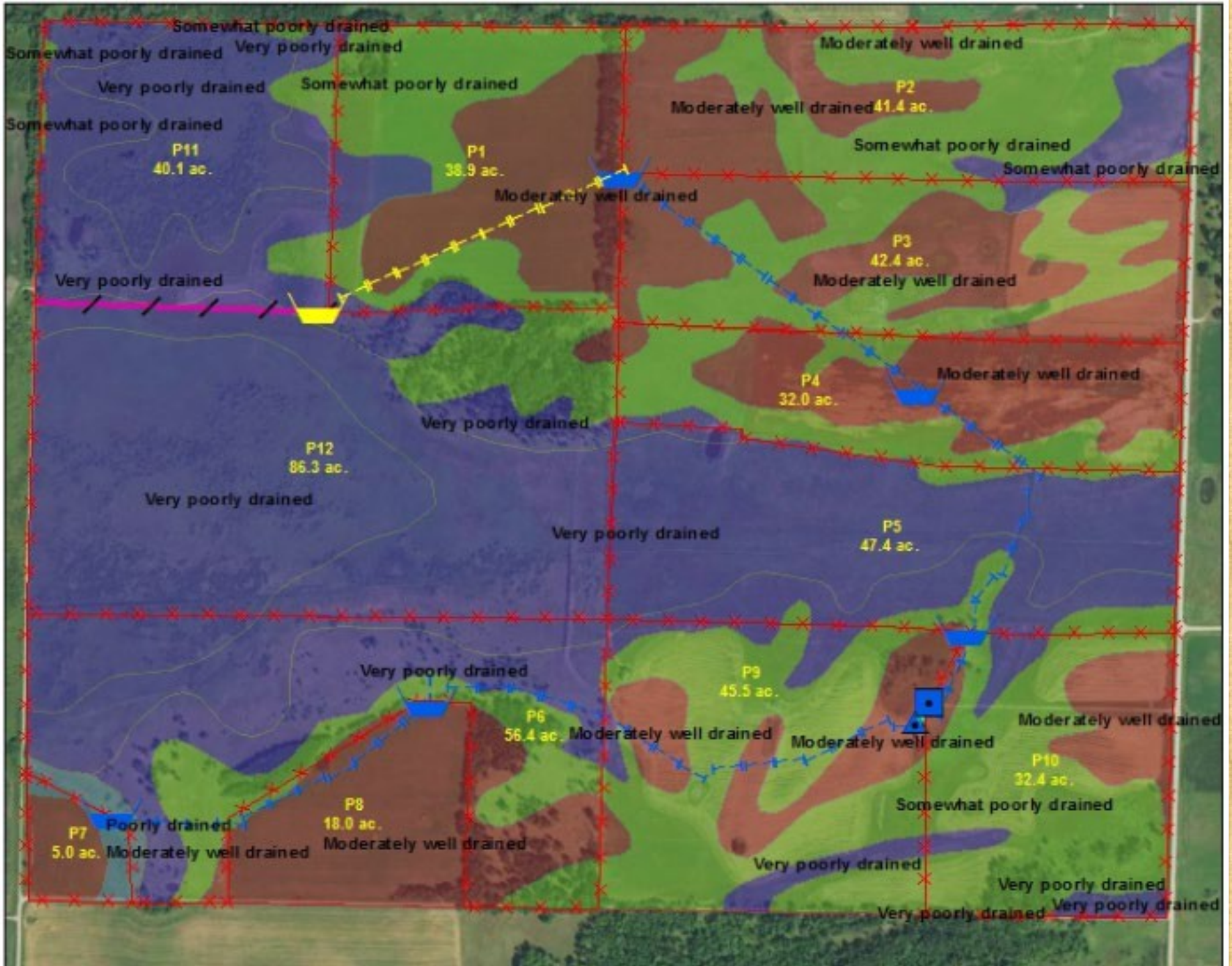
Rubber Tire Tank

Float Valves

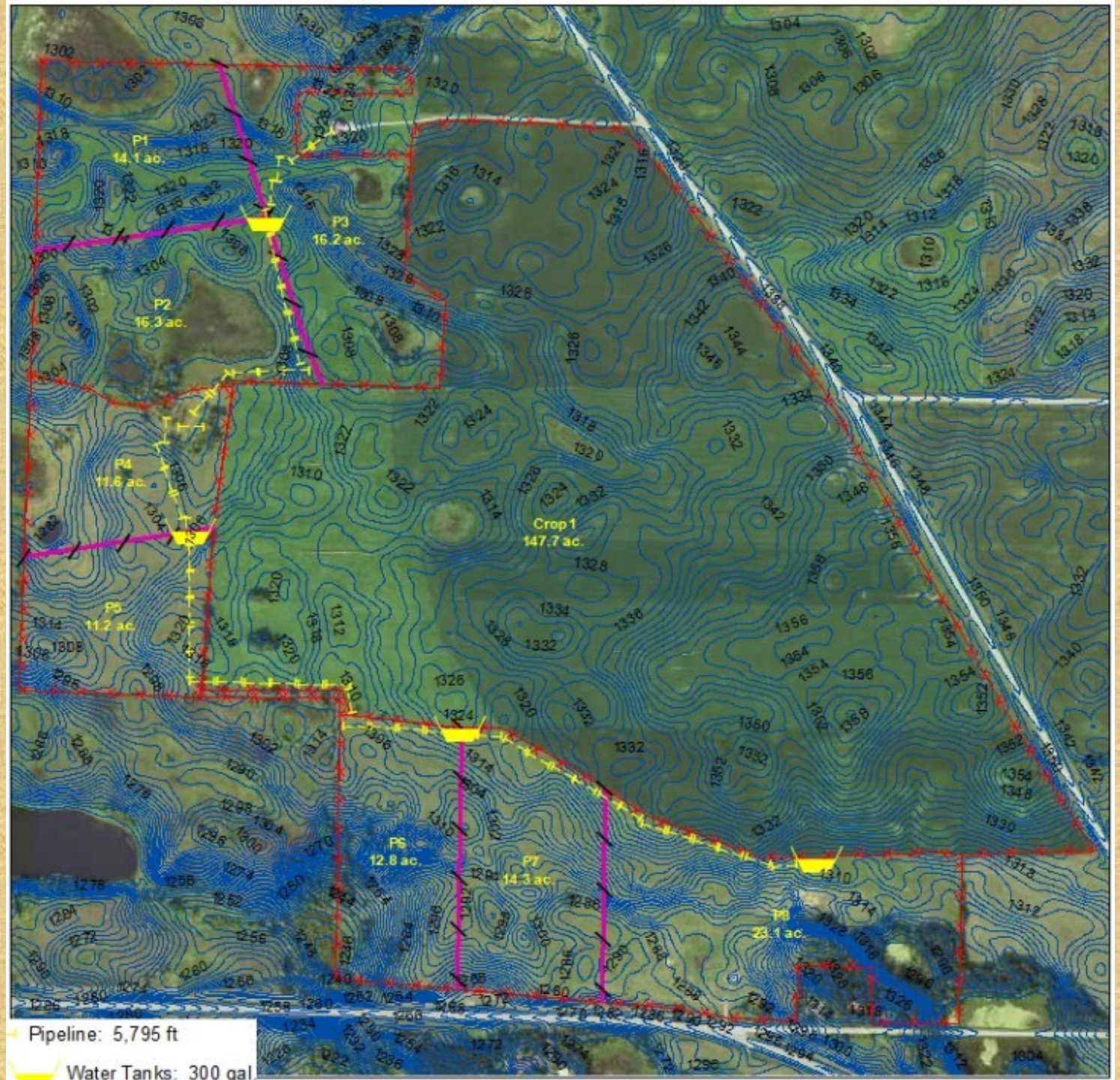
Winter Watering facility w/Concrete HUAP

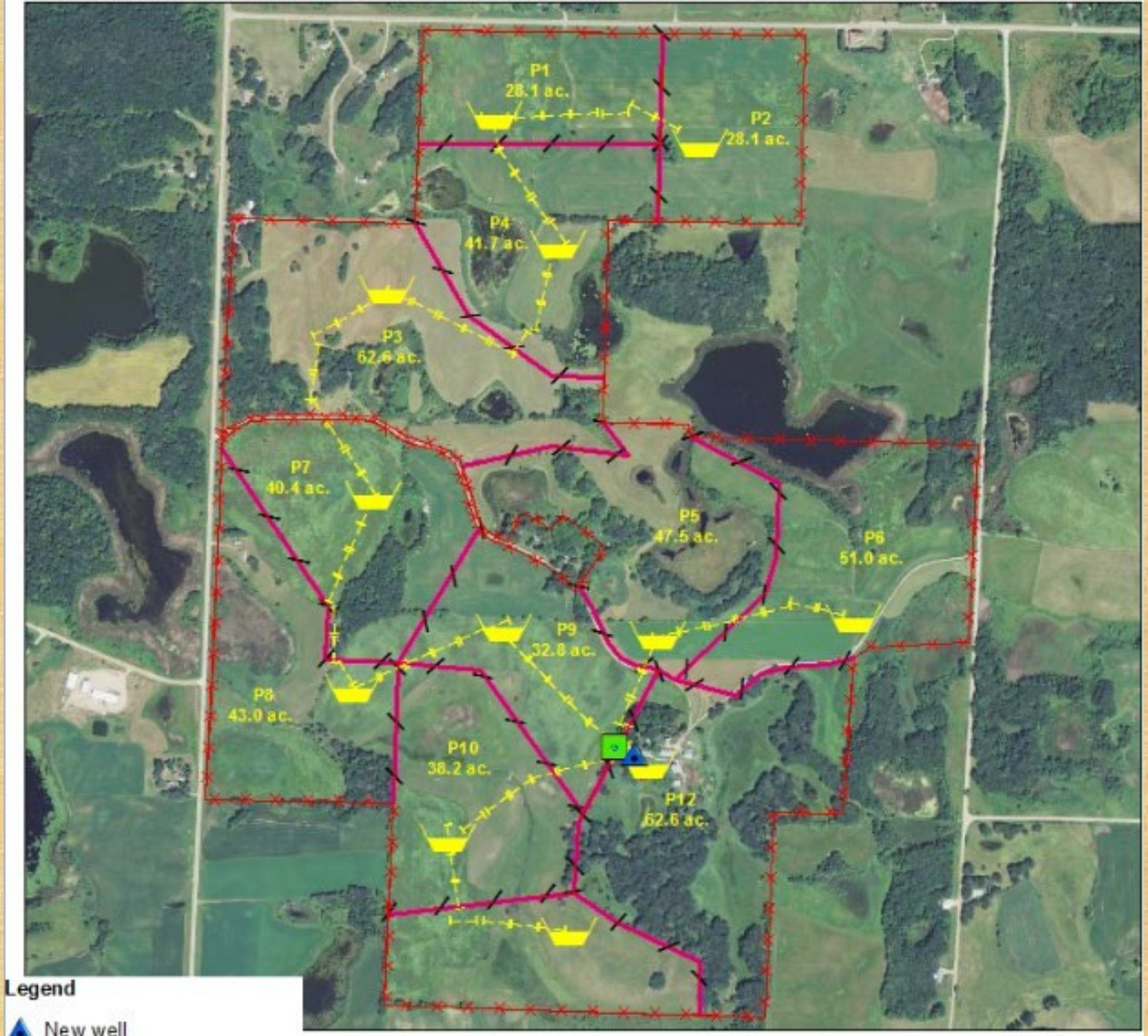
Factors affecting water tank locations

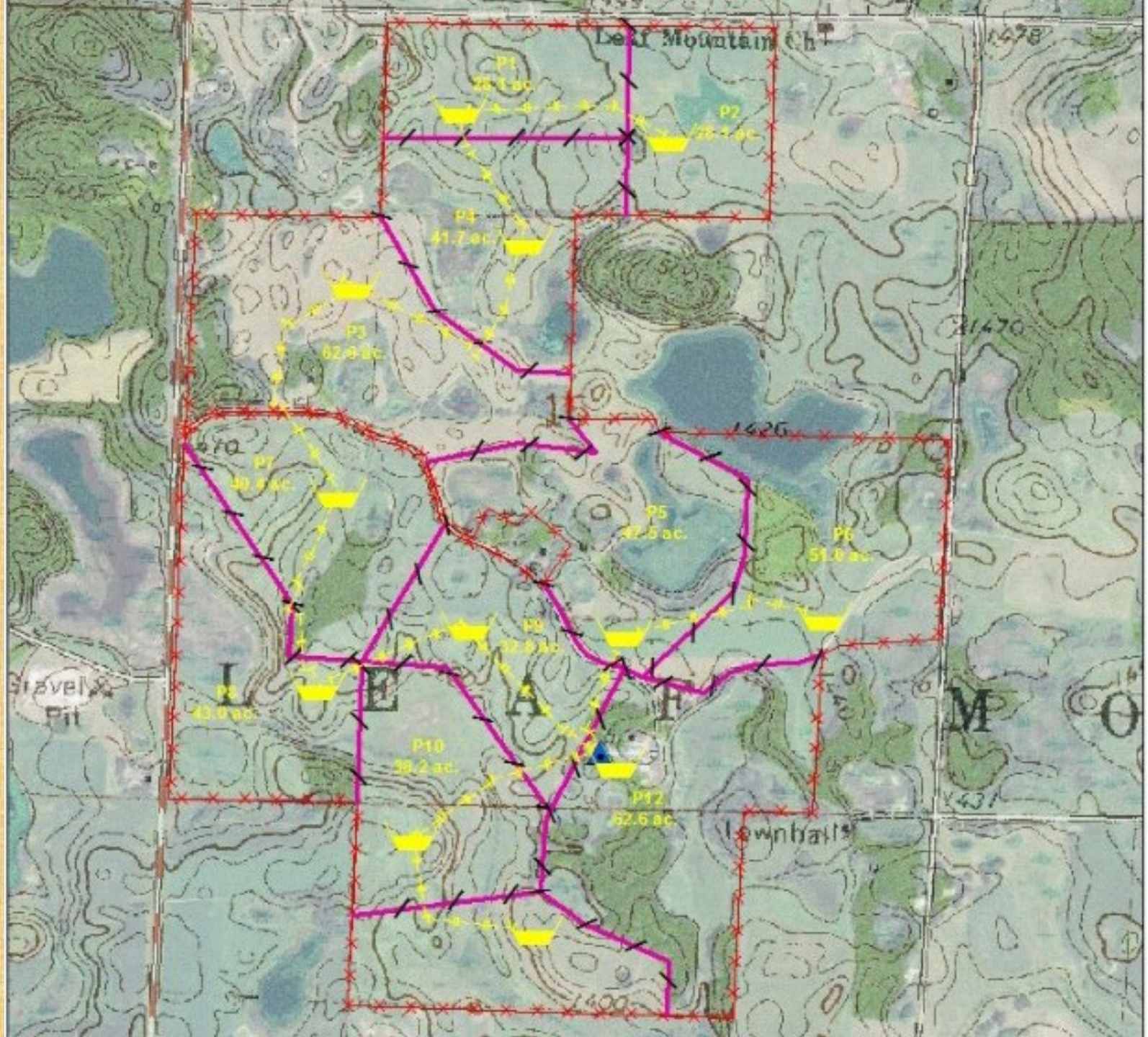
- Soil Drainage: Avoid poorly drained soils if possible
- Topography: Avoid steep hillsides
- Generally locate higher on the landscape within paddocks (hilltops vs. bottoms)
- Avoid wooded areas. Prefer siting tanks in open areas if possible.

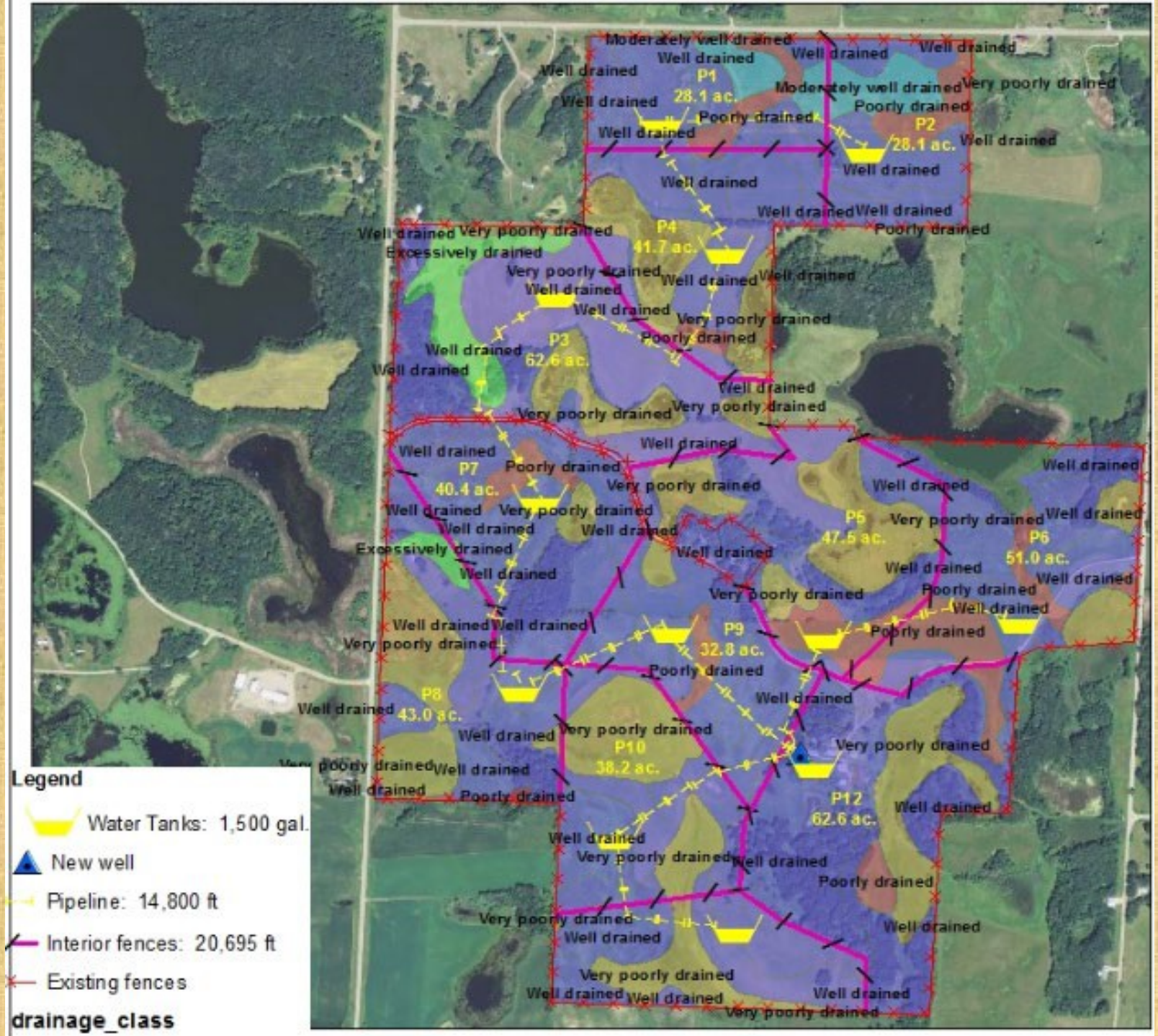

Somewhat poorly drained
Somewhat poorly drained
Very poorly drained
Somewhat poorly drained
Very poorly drained
Somewhat poorly drained
P11
40.1 ac.
P1
38.9 ac.
Moderately well drained
Moderately well drained
P2
41.4 ac.
Somewhat poorly drained
Somewhat poorly drained
P3
42.4 ac.
Moderately well drained
Very poorly drained
P4
32.0 ac.
Moderately well drained
Very poorly drained
P12
86.3 ac.
Very poorly drained
Very poorly drained
P5
47.4 ac.
Very poorly drained
P9
45.5 ac.
P6
56.4 ac.
Moderately well drained
Moderately well drained
Moderately well drained
P10
32.4 ac.
Somewhat poorly drained
P8
18.0 ac.
Moderately well drained
Poorly drained
P7
5.0 ac.
Moderately well drained
Very poorly drained
Very poorly drained
Very poorly drained
Very poorly drained

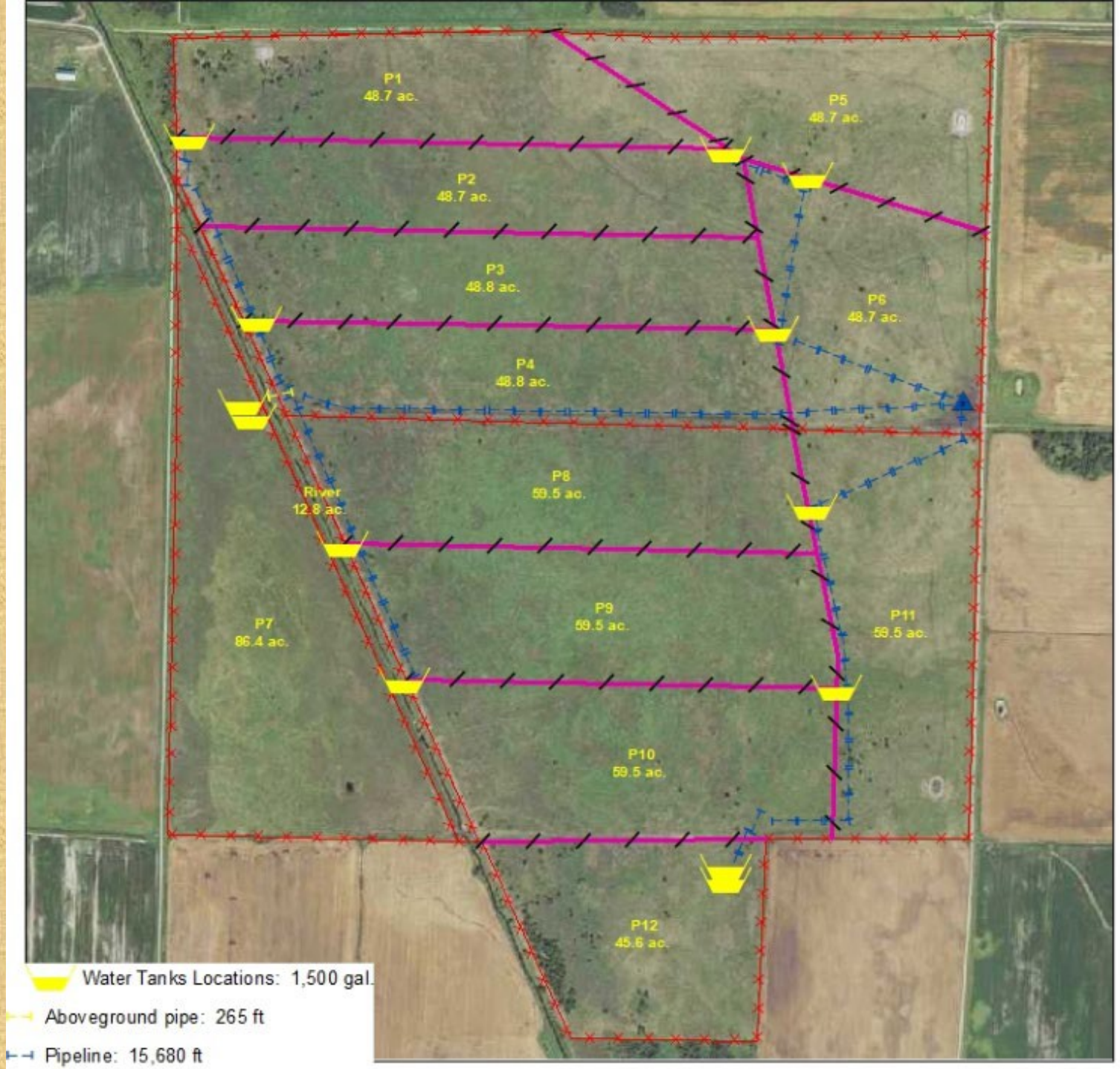

P1
P2
P3
P4
P5
P6

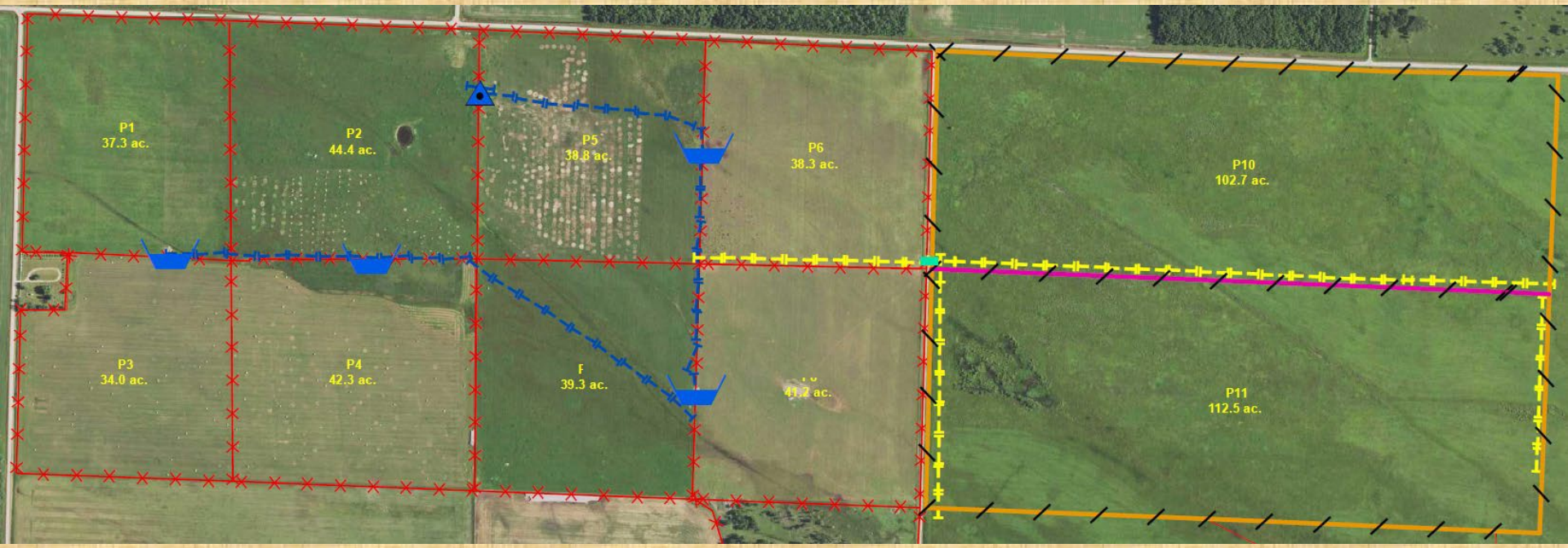

P1
14.1 ac.
P2
16.3 ac.
P3
16.2 ac.
P4
11.6 ac.
P5
11.2 ac.
Crop 1
147.7 ac.
P6
12.8 ac.
P7
14.3 ac.
P8
23.1 ac.
Pipeline: 5,795 ft
Water Tanks: 300 gal


P1
28.1 ac.
P2
28.1 ac.
P4
41.7 ac.
P3
62.6 ac.
P7
40.4 ac.
P5
47.5 ac.
P6
51.0 ac.
P9
32.8 ac.
P8
43.0 ac.
P10
38.2 ac.
P12
62.6 ac.
Legend
New well


Leaf Mountain Ch
P1
P2
P3
41.7 ac.
P3
62.6 ac.
P5
47.5 ac.
P6
51.0 ac.
P10
38.2 ac.
P12
62.6 ac.
LEAF
Gravel Pit
Lownhalls


P1
28.1 ac.
P2
28.1 ac.
P3
62.6 ac.
P4
41.7 ac.
P5
47.5 ac.
P6
51.0 ac.
P7
40.4 ac.
P8
43.0 ac.
P9
32.8 ac.
P10
38.2 ac.
P12
62.6 ac.
Legend
Water Tanks: 1,500 gal.
New well
Pipeline: 14,800 ft
Interior fences: 20,695 ft
Existing fences
drainage_class


P1
48.7 ac.
P2
48.7 ac.
P3
48.8 ac.
P4
48.8 ac.
P5
48.7 ac.
P6
48.7 ac.
P7
86.4 ac.
River
12.8 ac.
P8
59.5 ac.
P9
59.5 ac.
P10
59.5 ac.
P11
59.5 ac.
P12
45.6 ac.
Water Tanks Locations: 1,500 gal.
Aboveground pipe: 265 ft
Pipeline: 15,680 ft


P1
37.3 ac.
P2
44.4 ac.
P5
38.8 ac.
P6
38.3 ac.
P10
102.7 ac.
P3
34.0 ac.
P4
42.3 ac.
39.3 ac.
P11
112.5 ac.


P1
10.0 ac.
P2
10.0 ac.
P3
9.9 ac.
P4
10.0 ac.
P6
9.9 ac.
P8
9.9 ac.
P7
10.0 ac.
P5
10.0 ac.

What delivery time/flow rate should I use?

Water Delivery Time (hours)	Approx. % of Daily Water Requirement Stored in Tank
4	25% or less
6	20-35%
8	30-45%
10	35-50%
12	40-75%
16	70+%

Class Exercise: How is my percent tank storage?

- 50 cow/calf herd plus two bulls
  - Cows: 1,350 lb average weight
  - Calves: 300 lb average weight
  - 2 Bulls: 2,000 lb average weight
  - How much water do they need

____**Number** of animals X ___**Average** weight of animals X **2%** = _____**Gallons** of water needed

- Planned Tank size: 500 gallons
- What is my % of water stored in the tank?

Class Exercise: How is my percent tank storage?

- 50 cow/calf herd plus two bulls
  - Water Needs: 1,730 Gallons/Day
- Planned Tank size: 500 gallons
- What is my % of water stored in the tank?
  - 28.9% of the daily water needs stored in the tank.
- Equation:
  - Tank Storage / Gallons/Day needed for the herd X 100 = % Water Stored in the Tank

Factors Affecting Delivery time/Flow Rate

- Travel distance to water
  - Less than 950 feet, animal tend to water in smaller groups throughout the day
  - Greater than 950 feet, animals tend to water in larger groups
- Landscape barriers
  - Can the animals see the tank from anywhere in the paddock?
- Grazing Management
  - Herd mentality changes as intensity of management increases
  - Lower flow rates for herds moving daily?

Producer: Date: 4/14/2021

County: Designed by:

Checked by:

Township: Date:

Section: T N R W

Planned Water Source: Herd 1 Water Need: 20 gal/day/1000#

Travel Distance to Water: Feet Herd 2 Water Need: 20 gal/day/1000#

Herd 1				Herd 2			
Number/Type of Livestock		Animal Weight (lbs)	Daily Water Use (Gallons)	Number/Type of Livestock		Animal Weight (lbs)	Daily Water Use (Gallons)
			0				0
			0				0
			0				0
			0				0
			0				0
			0				0
			0				0
Daily Total			0	Daily Total			0

Water storage when travel distance is <950': 10 percent of the daily total

Water storage when travel distance is >950': 50 percent of the daily total

Herd 1		Herd 2	
Water Delivery Time (hours):		Water Delivery Time (hours):	
Suggested Minimum Watering Facility Size (gallons):		Suggested Minimum Watering Facility Size (gallons):	

Herd 1			Herd 2		
Planned Tank Size(s) (gallons)	Delivery Time (hrs)	Flow Rate (gpm)	Planned Tank Size(s) (gallons)	Delivery Time (hrs)	Flow Rate (gpm)

Existing Water Source Documentation (if applicable)

Source Max Flow Rate gpm

Pressure Switch Setting - On psi

Pressure Switch Setting - Off psi

Herd Water Need

- 20 gal/day/1000# is recommended for summer
- 15 gal/day/1000# is recommended for fall/winter
- Provide documentation if deviating from recommend values

Special Considerations for sizing watering facilities

- Travel Distance (950') - (1 Tank / 40 Acres)
- Topography - flat vs. steep terrain
- Species - bison vs. sheep
- Animal Behavior - individual or herd
- Economics
- Watering Area/Animal Unit - fence line vs. corral
- Dependability, quality, and quantity of water source
- Landscape Obstructions - water features, wooded areas, rock outcrops
- 15 gallon minimum tank size for sheep and goats
- 50 gallon minimum tank size for cattle and horses
- Automatic drinker may be substituted for either
- Maximum tank height for sheep should be 16"

Water Delivery Time

- 12 hours is a recommended minimum (12 hrs or less)
- A shorter delivery time may be warranted if the water source and pipeline can handle higher flows. This results in a smaller required tank

Heavy Use Area Protection Purpose

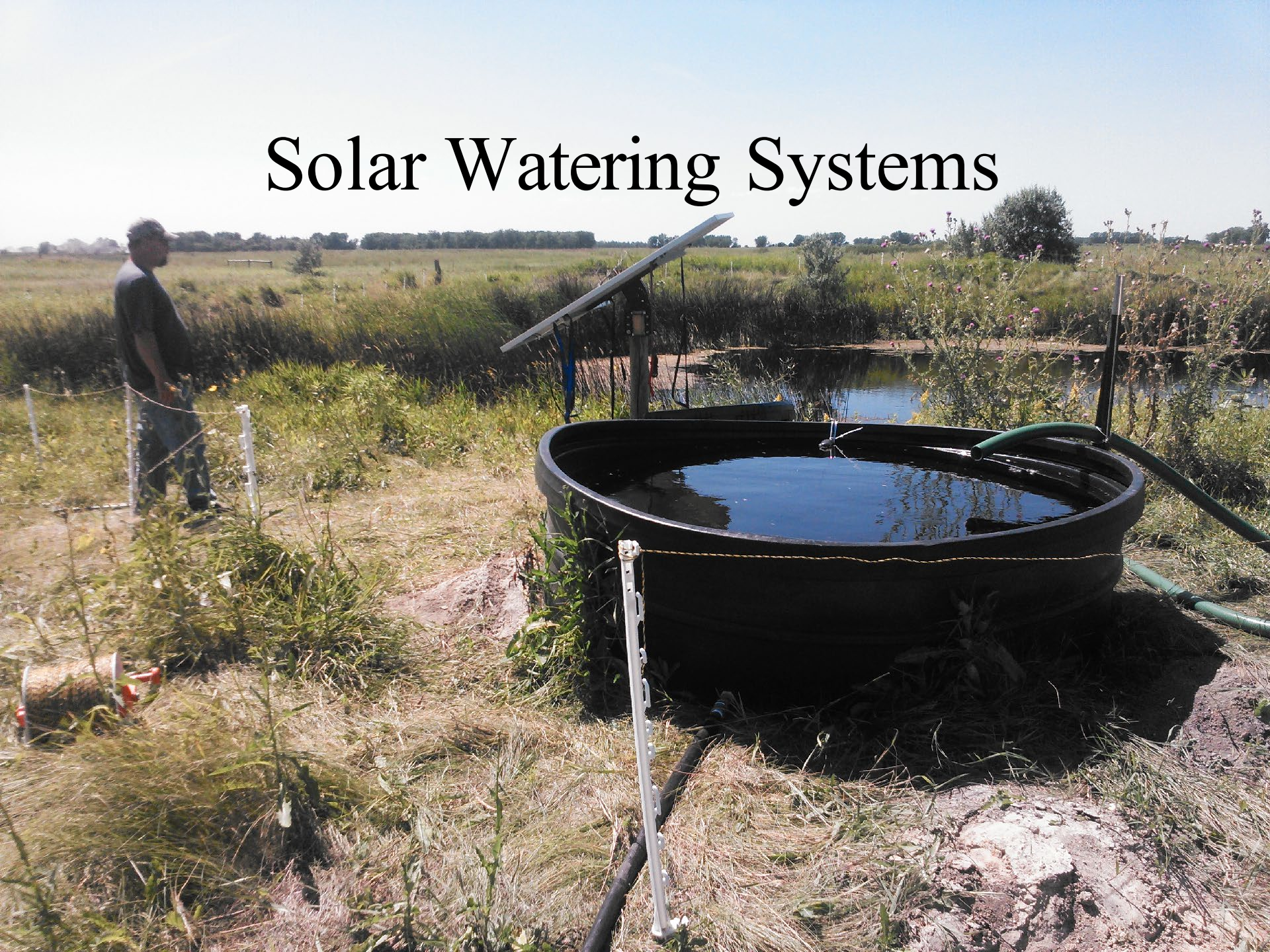
- To provide a stable, non-eroding surface for areas frequently used by animals, people or vehicles
- To protect or improve water quality

Heavy Use Area Protection (HUAP)

- Permanent summer water tanks
  - Typically gravel
- Winter water sources
  - Typically concrete

Winter Watering facility w/Concrete HUAP

Solar Watering Systems



Solar Watering Systems

- Secondary option!!
- Look to hook onto permanent power first.
- If permanent power is not feasible, then solar can be an option.

•Needs storage in water

Tanks, batteries or both

Solar Watering Systems: Information needed

- Gallons per day
- Depth of Well
- Farthest distance pump needs to move water away from the well
- Elevation increase away from the well
- Planned Tank storage

Solar Watering Systems
Other Considerations

- Ability to hook a battery into the system
- Ability to pressurize the system

Key Points to remember…

- What are the livestock water needs (gal./day)
- Tank Storage
- Well capacity/capability
- Flow rate needed
- Pressure Settings
- Soils
- Topography
- Other landscape features
- Planned Grazing Management

Questions??

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218-346-4260 Ext. 3
jeff.duchene@usda.gov