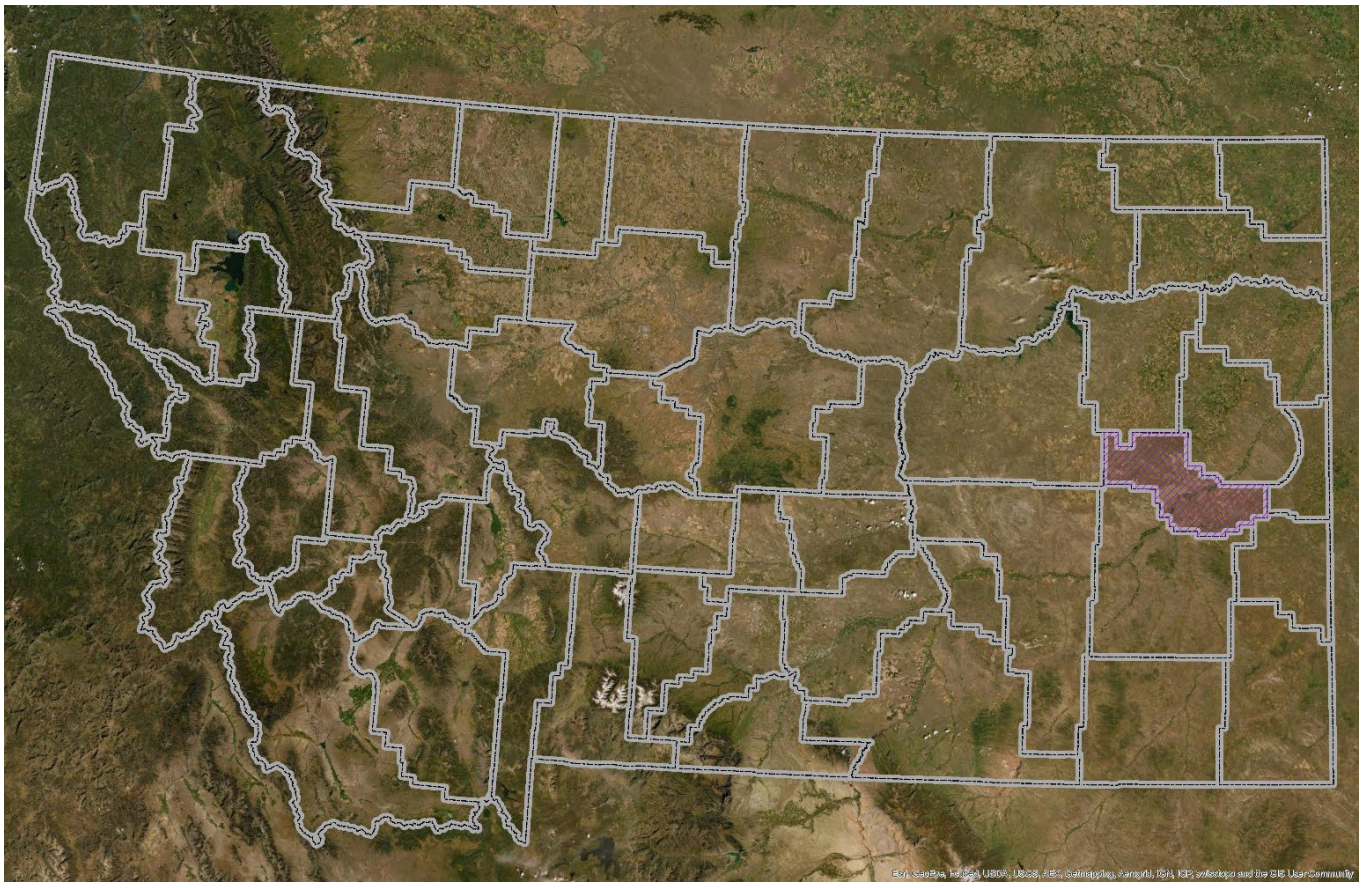
Control & Renovation of Existing Flowing Wells

Prairie County

Terry Field Office

2023 - 2027



Goal: To reduce the rate of ground water use from free-flowing artesian wells.

Overview/Background Information

This TIP will be focused in the area of Prairie County that contains the bulk of the free-flowing wells – in the Cabin Creek, O'Fallon Creek, Whitney Creek, Powder River and Yellowstone River corridors – as well as the remainder of the county. The TIP boundary is shown in Figure 1.

Participants of the Prairie County Local Working Group (LWG) meetings held in May 2019 and August 2021 determined that controlling the flow on free-flowing artesian wells and rejuvenating them to reduce groundwater depletion was a priority resource concern to be addressed. Addressing the resource concerns associated with the wells and the subsequent groundwater depletion is referenced on page 40 of the Prairie County Long Range Plan[1].

Problem Statement

Since the arrival of modern well drilling equipment in Prairie County in the early 1940's, wells were drilled in remote areas of the county to the Fox Hills aquifer to use as free-flowing water for livestock. These wells were never capped or controlled, and many continue to free-flow. This uncontrolled flow not only depletes the aquifer faster than it can recover, but also brings a phenomenal quantity of salt to the surface. Total dissolved solids in the Fox Hills Aquifer average about 1,460 mg/L[2]. While this level isn't toxic on its own, it does contribute in large part to saline areas where free-flowing wells daylight and multiple wells in one area all contribute to higher surface water total dissolved solids.

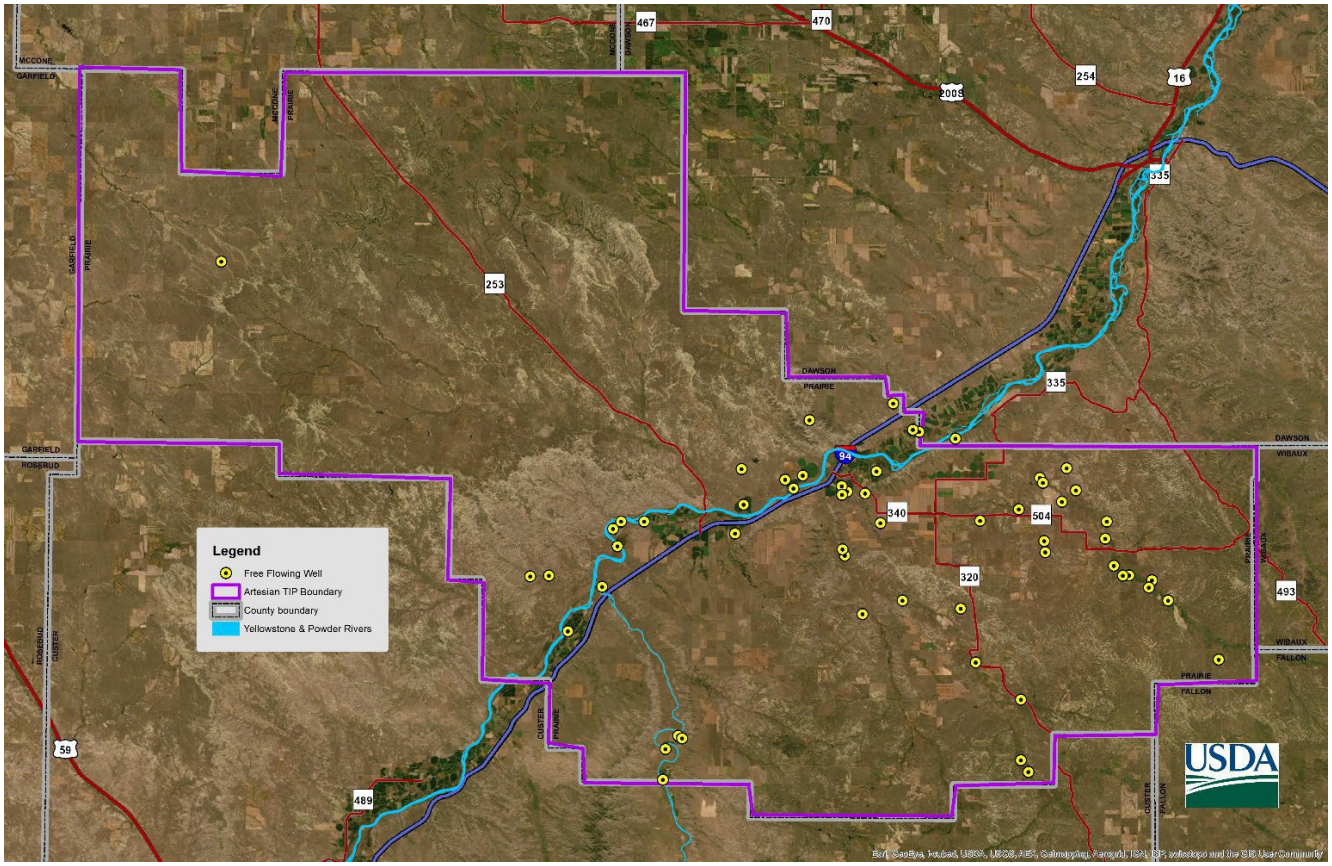


Figure 1: GWIC recorded free-flowing artesian wells with the TIP boundary.

Data from the Montana Groundwater Information Center show a total of 58 free-flowing stock water artesian wells in Prairie County with an average flow of 20 gallons per minute (Figure 1). Those wells listed for

domestic, irrigation and public use were removed from consideration. We estimate that only one third of those remaining have been renovated or controlled. Wells that have stopped flowing and were not renovated are often abandoned in place, leaving the casing open to contamination. The well in Figure 2 formerly flowed up from the casing and filled the culvert, which then overflowed into a small reservoir. When the well stopped, the casing remained open and is now buried under sediment (Figure 3).

Figure 2: Abandoned artesian well

Figure 3: Sediment accumulated inside the culvert.

The remainder run twenty-four hours a day, seven days a week. If left in their current state, the outflow of each well (approximately 10,512,000 gallons, or just over 241 acre-feet, per year) from the Fox Hills aquifer will continue to deplete the ground water reserve faster than it is able to recharge. The ground water assessment by Smith et al. indicate that the Fox Hills Aquifer is being depleted by one foot per year[2]. This finding is reinforced by Fischer, who predicts that the Fox Hills will drop by nearly 800 feet by 2039[3]. By comparison, the use for a 200 head cow herd at 20 gallons per head per day over a sixty-day grazing season is 240,000 gallons. Controlling a single free-flowing well, while still allowing for stock water use, would prevent 10,272,000 gallons from being removed from the aquifer unnecessarily.

Figure 4 Existing free-flowing artesian well - 20 gpm flow rate

Figure 5: Overflow

The impacts to the landscape can be far reaching; free-flowing artesian wells can create several acres of water-logged soils. In Figure 6, the overflowing tank from a free-flowing artesian well has impacted 3½ acres of rangeland. The implications can also affect neighbors, as seen in Figure 7 below. This particular case starts in a similar fashion as Figure 6, overflow out of a tank connected to a free-flowing artesian well. The water crosses the landowner's pasture, one set of railroad tracks, his neighbor's land, Interstate 94, a second neighbor's land, another set of railroad tracks and finally flows into the Yellowstone River.

Figure 6: Aerial photo of impacted rangeland.

Figure 7: Impact on neighbors.

Sometimes the impacts of the free-flowing artesian well don't seem large, until the flow is followed downslope to an adjacent low spot. In Figure 8 below, the impact near the tank site is under two acres in size. However, when the flow is traced you can see the incredible amount of standing water created by this single well (Figure 9).

Figure 8: Another example of the landscape impacts of an uncontrolled free-flowing artesian well.

Figure 9: The downslope effects of the well shown in Figure 8, outlined in red. As you can see, it has created a large, eroding head cut in the rangeland after passing under the highway in addition to a large pool of standing water. All sediment and contaminants picked up by this flow will enter the Yellowstone River just over a mile from the well location.

Goals and Objectives

The primary goal of this TIP is to stop the depletion of groundwater by controlling free-flowing artesian wells. Free-flowing wells in Prairie County flow an average of 20 gallons per minute, at that rate over 28,800 gallons of groundwater being removed from the aquifer each day which equates to 10,512,000 gallons per year per well. That's the equivalent of just over 15.5 Olympic-sized swimming pools each year! Water quality testing will be conducted on wells to ensure they are safe for livestock use. Based on data gathered from producers in Prairie County many of their free-flowing wells are slowing in flow rate; some have stopped completely. Therefore, the aquifer is not recharging as quickly as it is being depleted.

Alternatives

Alternative 1 – No Action: No financial assistance will be provided to producers in the TIP boundary area. Producers will allow free-flowing artesian wells to continue flowing without restriction. Groundwater depletion will continue until these wells no longer function. Once wells stop flowing, livestock and wildlife will no longer have sufficient water and the potential for contamination within the aquifer grows. Often, nonflowing wells are not capped or decommissioned; they are simply left as an open casing, which contributes to the possibility of groundwater contamination.

Alternative 2 – Preferred: NRCS will provide financial and technical assistance to those producers interested in controlling well flow rates to reduce depletion of groundwater. This will be accomplished using those practices listed in the next section of this document.

Alternative 3 – Not Selected: NRCS will provide financial and technical assistance to those producers interested in controlling flowing wells in three phases. First, mailings and outreach will be conducted to determine the level of interest in the program. Second, interested producers will have those flowing wells assessed by a

certified driller to determine feasibility of renovation or the need for decommissioning. This will require an out-of-pocket expense from producers as there is no cost-share component for an assessment. Further, availability of certified drillers to make an extra field visit currently is low. The final phase will be either decommissioning or renovating the well in question.

Proposed Solutions and Actions

The proposed solution is to offer producers a suite of NRCS practices with the core practice being 800, controlling existing flowing wells, which will be applied to those free-flowing artesian wells within the TIP boundary. Supporting practices listed below will assist in implementation and renovation of wells.

Core Practice:

- 800 – Controlling Existing Flowing Wells

Supporting Practices:

- 351 – Well Decommissioning
  - Drilled well, greater than 300-foot depth
- 355 – Groundwater Testing
  - Basic water quality test
- 516 – Livestock Pipeline
  - Below frost PVC, HDPE, IPS, PE
- 533 – Pumping Plant
  - Photovoltaic-powered pump
- 614 – Watering Facility
  - Permanent drinking with storage
  - Storage tank
  - Winter with storage

Partnerships and Other Funding Sources

NRCS will be the primary agency providing financial assistance for this project with the support of partners in Prairie County.

Partners include:

- Prairie County Conservation District
- Montana DNRC
- MSU Prairie County Extension Service

NRCS will be handling the technical components of the project along with the financial assistance, partners will assist with outreach. The Prairie County Conservation District assists with mailings and outreach at their regular meetings. MSU Prairie County Extension Service assists with outreach by allowing NRCS time at meetings each year as well as assisting producers with water quality testing. Montana DNRC has provided the base data for flowing wells within the county and will continue to partner for data sharing as the project progresses.

Implementation and Budget

The implementation of this TIP will take place over a five-year period from 2023-2027 with signups in the first three fiscal years. Many producers have expressed interest in the project, and the extended time frame will allow additional producers to participate. Table 1 lists practices expected for a typical TIP conservation plan. Well decommissioning is not factored into the total cost per system but appears for reference if the producer

chooses to decommission the well instead of renovating it. Livestock pipeline would be included if the flowing well is in a riparian area or environmentally sensitive area and relocating the watering facility to higher ground is required.

Table 1: Approximate NRCS financial contributions expected for a typical project.

Cost Share Estimate (Artesian TIP 2023)					
EXAMPLE				*Average Well Depth = 708 ft*	
By: Terry Field Office	December 2021	Checked By:		Date:	
Item		***Unit***	***Amount***	***PR Unit Cost***	***Total Cost***
Well Decommissioning (351) ***if needed**					
	Drilled Well, greater than 300-foot depth	ft	708	$6.33	$ 4,481.64
Groundwater Testing (355)					
	Basic Water Quality Test	ea	1	$214.47	$ 214.47
Livestock Pipeline (516)					
	Below Frost PVC, HDPE, IPS, PE	ft	1320	$2.15	$ 2,838.00
Pumping Plant (533)					
	Photovoltaic-Powered Pump, greater than 400 ft total head	No	1	$6,458.37	$ 6,458.37
Watering Facility (614)					
	Permanent Drinking with Storage, 1,000 to 5,000 Gallons	gal	1400	$2.37	$ 3,318.00
Controlling Existing Flowing Wells (800)					
	Standard Flowing Well	ea	1	$10,849.15	$ 10,849.15
				Total Cost Per System	**$ 23,677.99**

The conversions of free-flowing uncontrolled wells will address groundwater depletion in the TIP area. Our goal is to address the resource concern on 15 systems. If there is more interest in the county, we will write another TIP to address it. Table 2 lists the number of contracts and expected cost through 2025.

Table 2: TIP funds requested

TIP Funds			
Fiscal Year	**Number of Contracts**	**Average Expected Cost Per System**	**Total**
2023	5	$23,667.99	$118,339.95
2024	5	$23,667.99	$118,339.95
2025	5	$23,667.99	$118,339.95
TOTALS	**15**		**$355,019.85**

The Field Office staff currently available in the Broadus/Miles City/Terry Work Units have the proper Job Approval Authority (JAA) to design and approve all supporting practices. The core practice does not require JAA due to the requirement in CPS 800 that it be completed by a certified well driller. Field Office staff will not be required to obtain any additional JAA.

Ranking and Prioritization

Prioritization

Application prioritization will be done using the current year program screening bulletin when it becomes available.

Ranking

The following questions will be used to rank all eligible applications for this TIP:

1) What is the current flow rate of the existing free-flowing artesian well?

- 20 gallons per minute (gpm) or higher
- 10-19 gpm
- 5-9 gpm
- Under 5 gpm

2) Are 100% of the flowing artesian wells within the operation on private land offered for contract?

- Yes
- No

Progress Evaluation and Monitoring

Progress will be measured by tracking the number of wells controlled or renovated each fiscal year. Each well controlled will result in over ten million gallons remaining in the aquifer.

References

[1] Prairie County Long Range Plan, 2019. Montana USDA-NRCS Terry Field Office.

[2] Smith, L.N., LaFave, J.I., Patton, T.W., Rose, J.C., and McKenna, D.P. Ground Water Resources of the Lower Yellowstone River Area: Dawson, Fallon, Prairie, Richland and Wibaux Counties, Montana. January 2000. Montana Bureau of Mines and Geology.

[3] Fischer, K. Groundwater Flow Model Inversion to Assess Water Availability in the Fox Hills-Hell Creek Aquifer. 2013. ND State Water Commission.