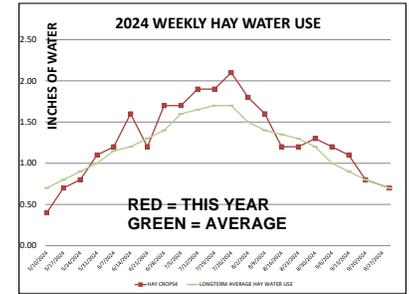




BLACKFOOT CHALLENGE IRRIGATION SCHEDULING PROGRAM ANNUAL REPORT 2024

Barry Dutton Soil Scientist



PROGRAM SUMMARY

This was our 15th year providing information to irrigators in the Blackfoot watershed and together we've learned a lot. Our goal is to help apply the right amount of water at the right time to meet crop goals and watershed objectives. Weekly reports are circulated to over 100 irrigators and water managers that include crop water use, irrigation tips, drought strategies, soil and crop management options, soil health concerns and other information. Reports are also posted on the Blackfoot Challenge website. Over the past six years we helped install, calibrate, and use soil moisture sensors for instant readings by irrigators and to capture permanent records for year-to-year comparisons. Our work together has identified irrigation practices and drought strategies that can provide both good crop production and adequate late-season stream flows during dry years. This year was especially challenging due to hot, dry conditions, low snowpack, low streamflows and our longest period of drought plan implementation.

2024 HIGHLIGHTS

- Snowpack started out at 57% of normal on May 1 and mostly melted by early July.
- April was warm and dry, May cold and wet then in mid-June it turned hot and dry through September. It rained very little in July – good for haying but tough for irrigating.
- 5-8 inches of rain fell on Blackfoot croplands during the 2024 growing season depending on location, almost half in May alone (the historic average is about 7 inches).
- Soil moisture fell throughout April then was boosted to capacity in most fields by May rain and irrigation. It then became a struggle to keep moisture levels high due to hot, dry weather and many irrigators cut back irrigation significantly as sources dried up and drought plans were implemented.
- 2024 potential crop water use was above average: hay = 28 inches, pasture = 24, grains = 17-20. Weekly crop water use was below average in May and early June then mostly above average until the end of September (graph at upper right).
- This year a lack of available water and voluntary irrigation cutbacks significantly reduced crop production highlighting the “*shared sacrifice*” local irrigators make when they voluntarily reduce irrigation.
- Blackfoot River stream flows fell in April and early May, were boosted for a couple weeks by rain then fell precipitously for the rest of the year into the 400-500 CFS range. Late season rainfall seemed to be less effective at boosting streamflows than in past years perhaps due to a very dry landscape.
- This year saw the Blackfoot Challenge Drought Plan in effect for its longest period July 12 – October 15.
- Blackfoot irrigators continue soil moisture monitoring for instant answers and year-to-year comparisons.

**BLACKFOOT CHALLENGE
WEEKLY IRRIGATION REPORT**
Friday August 5, 2022

Blackfoot watershed croplands again had little or no rain this week and sunny skies. Temperatures were in the upper 80s and the wind was gusty. Soil moisture fell about 2 inches unless irrigated. Crop water use continues to be above average. Remember the water use drops for two weeks after haying stop. Irrigation thresholds are below average and expected to reach the 700 CFS drought response trigger level this week. We have continued to assist food and forage producers due to crop water shortages.

HOTTEST WEATHER THIS YEAR
The hot and dry weather this week and the highest temperatures of the year with some rain reaching 100°. Hay crops dried quickly. Pasture areas will again be dry with high temperatures in the 90s and 100s in the days ahead. The 30-day forecast has average rainfall and temperatures. The 30-day forecast says average rainfall and above average temperatures.

CROP WATER USE - ABOVE AVERAGE WITH HOT WEATHER
Crop water use continues to be above average due to hot weather. Most crops will again use about 2 inches of soil moisture next week (see chart below). Pasture crop water use this year is about 2 weeks behind last year. Analyze these figures by 20% the first week after cutting hay and by 10% the second week.

TYPE OF USE	INCHES	LAST WEEK	TOTAL	LAST YEAR	TOTAL
PASTURE	2.4	1.5	21	12.2	12.2
GRAIN CROPS	1.8	1.2	17	17	17
HAY CROPS	2.8	2.0	28	19.4	19.4
AVERAGE	2.0	1.4	17	17	17

SOIL MOISTURE AGAIN DROPS 2 INCHES UNLESS IRRIGATED OR CUT
Soil moisture again dropped by about 2 inches this week unless irrigated. Moisture will drop about the same next week. Continue to check your moisture and soil conditions as much as possible as the weekly crop water use. Remember that crop water use drops by 20% the first week after cutting hay and by 10% the second week after cutting. Irrigation is a good idea to replenish moisture when the soil gets too dry to reduce and there is less foliage to catch and intercept water.

2024 WEATHER

This has been one of the hottest, driest and waterless years on record. The snowpack was low (57% on May 1) and streamflows were very low all season. Blackfoot croplands had warm, dry weather in April with only 75% of average rainfall. May saw a cold, wet period with 2-4 inches of rain (and some snow) on croplands. June and July had little rain and warm temperatures. August had a little more rain, but the temperatures were so hot it was less effective at making it to crops plants. Crop water use was very high. Rainfall for the entire season was two inches above average on most croplands (**Figure 1**) and mostly fell in May, August and September. **Figure 3** lists weekly rainfall throughout the 2024 season. Remember that these rainfall figures are a rough average for croplands across the entire

watershed and vary considerably during individual events and by specific locations. Irrigators are reminded to rely on their own rain gauges. Temperatures were above average in April, below in May and above all the way into October. I guess the days of early September snowstorms are gone. The snowpack on May 1 was 57% of average compared with 88% and 96% the last two years.

FIGURE 1. POTENTIAL CROP WATER USE FOR HAY AND GROWING SEASON RAINFALL ON BLACKFOOT WATERSHED CROPLANDS 2010-2024



2024 POTENTIAL CROP WATER USE APRIL 1 TO OCTOBER 1 = 27.5 INCHES (25.7 AVERAGE)

This is an average across the entire watershed and does not vary as much as rainfall at individual sites. It shows a steady increase over these 15 years. Dashed line represents the general upward trend over time.

2024 CROPLAND RAINFALL APRIL 1 TO OCTOBER 1 = 5.4 INCHES (5.7 AVERAGE)

This is a rough average of cropland rainfall across the entire watershed and varies widely by individual location. It does however, represent the general pattern for rainfall over these years which has remained relatively steady.

2024 CROP WATER USE

Figure 1 above shows that rainfall was almost average in 2024 and potential crop water use was above average. Figure 2 below shows that weekly hay water use in 2024 (red line) stayed above average (green line) for most of the season. Hay and small grain crops used ½ inch of water in a single day on July 25. Irrigators struggled to boost soil moisture during this hot, dry period of high crop water use. Figure 3 lists weekly water use for each crop throughout the irrigation season.

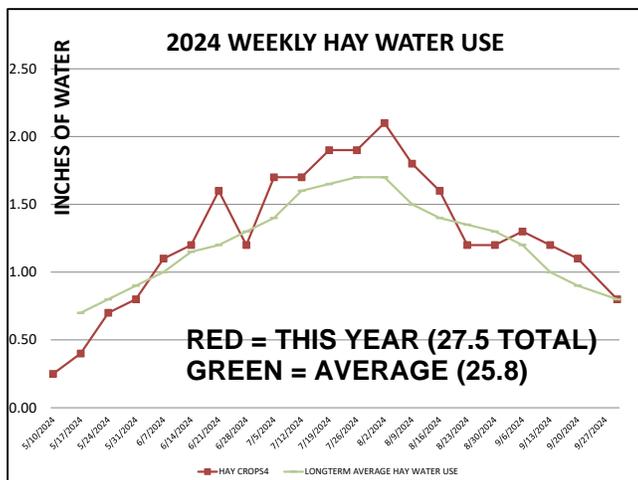


FIGURE 2. WEEKLY POTENTIAL HAY WATER USE IN 2024 COMPARED WITH THE AVERAGE

It's important to remember that these *potential crop water use* figures are for a dense, robust stand that is well-irrigated, well-fertilized and mostly disease/insect free. Crops not in such good condition use less water. Actual crop water use across the watershed varies due to water availability, fertilizer, stand quality, micro-climate, management style, and many other factors.

FIGURE 3. POTENTIAL WEEKLY CROP WATER USE THROUGHOUT THE 2024 IRRIGATION SEASON FOR ALL CROPS INCLUDING COMPARISONS TO AVERAGE, HOT AND COOL WEEKS

BLACKFOOT 2024 GROWING SEASON WEEKLY RAINFALL & CROP WATER USE (INCHES OF WATER)										
WEEK ENDING	RAIN ¹	2024 WEEKLY POTENTIAL CROP WATER USE ²						AVERAGE WEEKLY CROP WATER USE ³		
	RAIN	HAY CROPS ⁴	PASTURE	SPRING GRAINS 5-1 START	SPRING GRAINS 5-15 START	WINTER WHEAT	LAWNS	LONGTERM AVERAGE HAY WATER USE	HOT WEEK HAY WATER USE	COOL WEEK HAY WATER USE
APRIL	0.50	0.25	0.25			0.25	0.25			
5/10/2024	0.50	0.40	0.50			0.50	0.60	0.70	1.00	0.40
5/17/2024	0.10	0.70	0.80			1.00	1.00	0.80	1.10	0.60
5/24/2024	1.00	0.80	0.80	0.30	0.20	0.90	0.90	0.90	1.20	0.70
5/31/2024	0.50	1.10	0.90	0.50	0.40	1.20	1.20	1.00	1.30	0.70
6/7/2024	0.10	1.20	1.00	0.70	0.50	1.30	1.20	1.15	1.50	0.80
6/14/2024	0.01	1.60	1.40	1.10	0.90	1.70	1.50	1.20	1.70	0.80
6/21/2024	0.25	1.20	1.10	1.00	0.90	1.30	1.20	1.30	1.90	0.90
6/28/2024	0.10	1.70	1.40	1.60	1.40	1.80	1.60	1.40	2.00	1.00
7/5/2024	0.01	1.70	1.40	1.70	1.70	1.90	1.60	1.60	2.10	1.10
7/12/2024	0.01	1.90	1.60	2.10	2.10	2.10	1.80	1.65	2.20	1.10
7/19/2024	0.00	1.90	1.60	2.10	2.10	2.10	1.80	1.70	2.20	1.10
7/26/2024	0.25	2.10	1.80	2.50	2.50	1.80	2.00	1.70	2.20	1.10
8/2/2024	0.25	1.80	1.50	1.80	2.10	1.30	1.70	1.50	2.20	1.00
8/9/2024	0.50	1.60	1.30	1.00	1.60	0.70	1.50	1.40	2.20	1.00
8/16/2024	0.40	1.20	1.00	0.50	1.20	0.20	1.20	1.35	2.00	0.90
8/23/2024	0.30	1.20	1.00	0.00	1.10	0.00	1.10	1.30	2.00	0.90
8/30/2024	0.10	1.30	1.10	0.00	0.70	0.00	1.20	1.20	1.80	0.90
9/6/2024	0.01	1.20	1.00	0.00	0.50	0.00	1.10	1.00	1.40	0.60
9/13/2024	0.75	1.10	1.00	0.00	0.00	0.00	1.00	0.90	1.40	0.50
9/20/2024	0.20	0.80	0.60	0.00	0.00	0.00	0.70	0.80	1.20	0.50
9/30/2024	0.01	0.70	0.50	0.00	0.00	0.00	0.60	0.70	1.00	0.40
TOTAL	5.35	27.45	23.55	16.90	19.90	20.05	26.75	25.25	35.60	17.00

¹ Average across watershed (50-80% gets to the crop depending on irrigation method, weather, evaporation from crop and soil surfaces)

² This years potential water use by healthy crops that are well-fertilized and irrigated, disease and insect-free. Varies across watershed.

³ Longterm average water use for each crop each week based on long-term historic data.

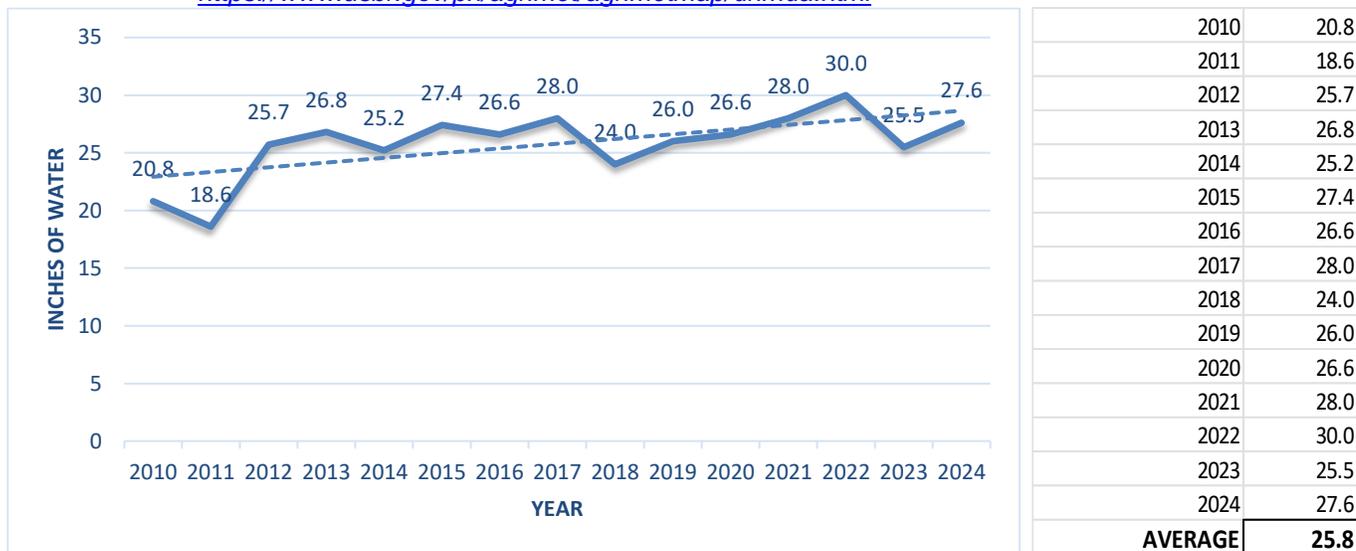
⁴ Hay Crop water use drops from these figures approximately 2/3 the first week after cutting, 1/2 the second and 1/3 the third.

CROP WATER USE TRENDS

Potential crop water use for hay in 2024 was 27.5 inches, which is slightly higher than the 25.7 inch average over the past 15 years of this program (Figure 1). There is a general increase in crop water use across all years with 2018 the most recent dip. This trend of increasing water use is also reflected in the Deer Lodge Agrimet weather station data (Figure 4). These two sources suggest the local crop water use for hay is now 25-33 inches per year depending on weather. It's interesting to note that the local NRCS irrigation guides from the 1980s listed crop water use for hay as only 15 inches. With all water rights already allocated in the Blackfoot watershed it will be increasingly important for irrigators, especially those with junior rights, to recognize seasonal conditions early and take advantage of above average water years. Another important consideration is year-to-year variation. Crop water use for hay ranged from 19 inches to 30 inches in both our data and the Deer Lodge Agrimet Station.

FIGURE 4. ANNUAL POTENTIAL CROP WATER USE FOR ALFALFA HAY SHOWING AN UPWARD TREND OVER THE PAST 15 YEARS. Data from Deer Lodge Agrimet Weather Station

<https://www.usbr.gov/pn/agrimet/agrimetmap/drlmda.html>

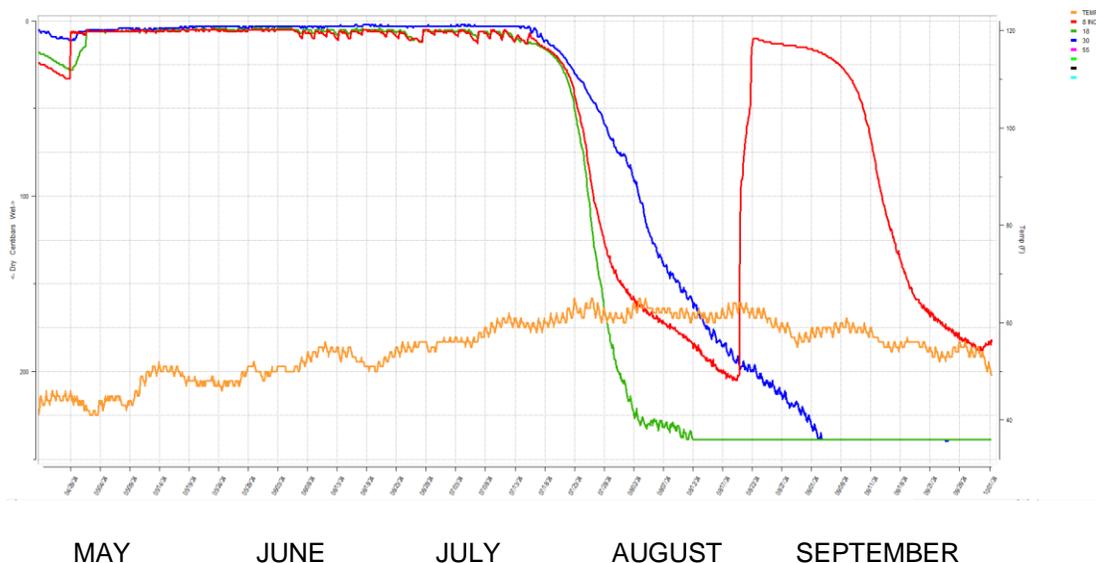


2024 SOIL MOISTURE

Cropland soil moisture levels fell throughout April and early May this year then got a boost from May rains. Many irrigators took advantage of the cool, rainy May period to boost soil moisture to its full water holding capacity. The rest of the season presented a challenge to keep up soil moisture levels due to little rain and hot temperatures. Low streamflows triggered drought response in mid-June, a full month earlier than last year. This lasted until mid-October. Many irrigators this year could not irrigate at all after the first hay cutting. Most could not boost soil moisture at the end of the season to help regrowth.

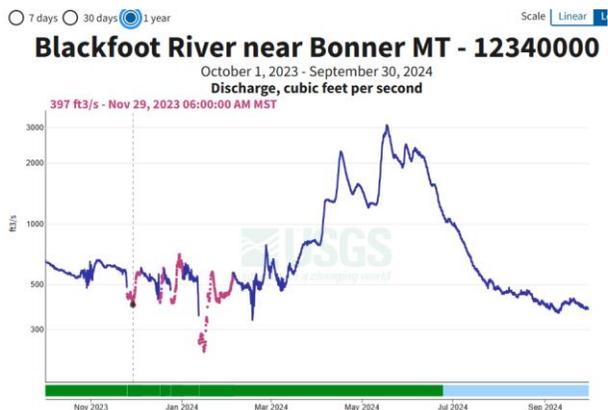


Figure 5. Example soil moisture chart for an alfalfa field in 2024. Soil moisture falls in April then is boosted at all depths in May. A series of irrigations keeps moisture levels high until cutting in mid-July when levels fall to exhaustion in August. One late-August irrigation boosts soil moisture but only in the surface layer (red). It's recommended that you irrigate once after cutting to help the plants rebound but many could not do this in 2024 because of no water or drought plan restrictions.



STREAMFLOWS and DROUGHT

The snowpack was 57% on May 1 and despite some rain in May and August, drought came early and stayed late. **The Blackfoot Challenge Drought Response Plan was implemented July 12 and not ended until October 15 - the longest period yet.** Streamflows at Bonner fluctuated in the 400-500 CFS range from August through mid-October. Streamflows did not seem to rise as much with rainstorms as in the past. Drought response was ended when cold weather ended irrigation and not because flows came up. These weekly irrigation reports illustrated stream flow conditions and provided irrigation options to reduce water diversions. **Thanks to all those irrigators who cut back using water they are legally entitled to under our concept of “shared sacrifice” - it’s works!**



2024 IRRIGATION TIPS AND SPECIAL EFFORTS

Irrigation tips were provided each week according to crop stage, weather conditions and other factors. This year’s tips concentrated on early season good moisture conditions, irrigation during cooler periods (May and June), later season drought concerns and irrigation during hot weather (July – September). Drought conditions here and elsewhere were highlighted. Other tips this year discussed soil health concerns, soil moisture monitoring equipment and biochar.

Soil Moisture Sensor Program for Irrigators

The Challenge continued to help irrigators calibrate maintain and monitor soil moisture sensors at 18 sites throughout the watershed. These sensors provide instant soil moisture and temperature readouts at each field. Data recorders collect moisture readings from several depths and provide a permanent record for year-to-year comparisons. New options are now available for instant reporting to cell phones where coverage is adequate. Contact Clancy Jandreau if you are interested in sensors for your fields.



Best Management Strategy for Blackfoot Irrigators

We continue to refine an over-all Best Management Strategy for both individual irrigators and water management across the entire watershed. We combine experience from the best local irrigators with irrigation science to fine-tune recommendations. Individual recommendations have come together in an overall strategy for irrigation that can **provide both good crop production and late-season stream flows** for fish and recreationists. This strategy is condensed into our irrigation calendar (page 8) and its main points are:

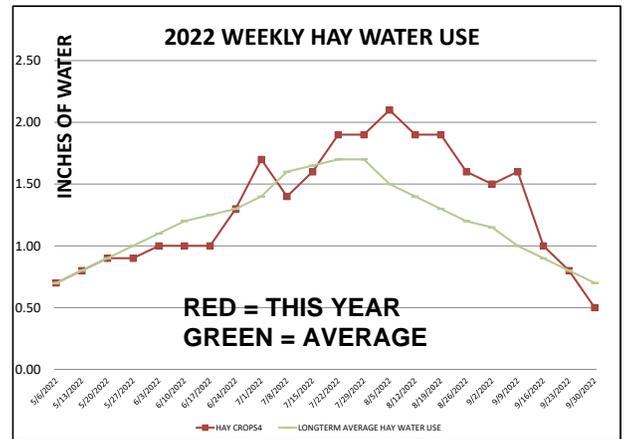
- early evaluation of the coming irrigation season in April – pay attention early,
- heavy irrigation early in the season to fill up the soil water holding capacity,
- heavy irrigation throughout May and June up to first cutting in early-mid July

- reduced irrigation or no irrigation during low water flows in late July and September
- taking advantage of available water in wet years for 2nd cuttings, new plantings, cover crops and to help fields recover from extremely dry conditions

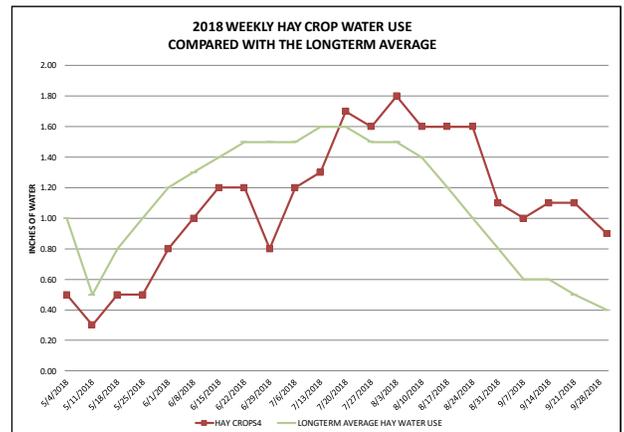
In dry years, irrigators who applied water early and kept pouring it on up until haying in mid-July had excellent crops. In moist years like 2020, irrigators who took advantage of the abundant moisture and longer growing season had great production, great second cuttings and abundant fall pasture. There is little doubt that the future will only get more challenging for Blackfoot irrigators. However, there will likely come opportunities to influence critical water decisions and participate in future water markets from here to the Pacific Ocean. All while living and irrigating in a great place so enjoy it!

A Look At Crop Water Use Over the Past Decade

Figure 6 shows weekly crop water use throughout the irrigation season for the past 13 years. The red line is crop water use for that year and the green line is average. Note that 2022 (at right), the year of **highest** annual crop water use, had below average weekly crop water use until late June. Then use was very high until late September.



In 2018 (at right), the year with the **lowest** annual crop water use, the cool, wet period lasted until the end of July. But even though annual water use was low, it still was above average after in August and September. It appears from Figure 6 that we can expect to have hot, dry conditions and increasingly above-average crop water use in July, August and September.

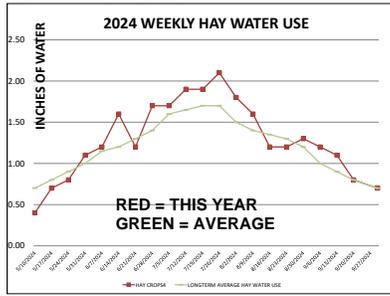


A New Average?

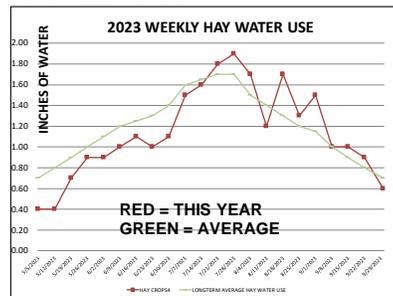
This may require a recalculation of the “average” crop water use in the same way that the NRCS recalculates streamflow averages each 20 years. However, this hides the reality of changing conditions whether rainfall, temperatures or crop water use. What we can be sure of is that it’s getting hotter and drier with less snowpack and rainfall. As a result, crops are needing more water to reach their potential.

Figure 6. Annual Crop Water Use in inches from May 1 to September 30 over the past decade. Graphs show weekly hay crop water use throughout each season. Green line is average weekly hay water use.

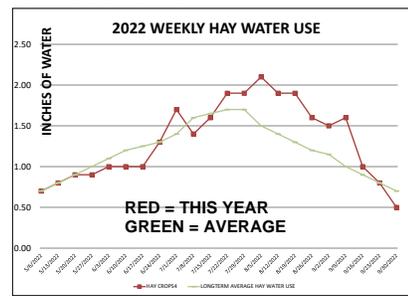
2024 27.6 inches



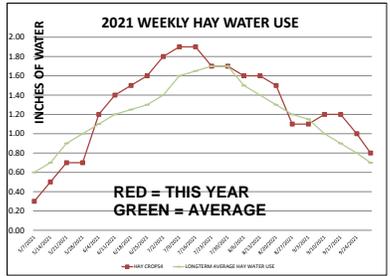
2023 25.5 inches



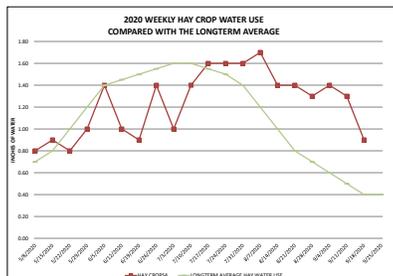
2022 30.0 inches



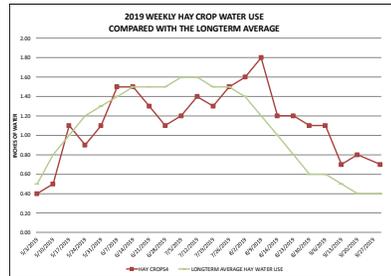
2021 28.0 inches



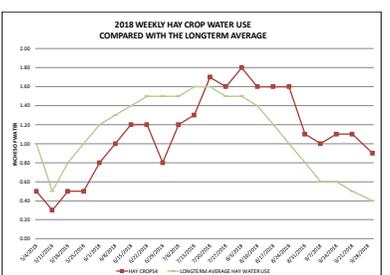
2020 26.6 inches



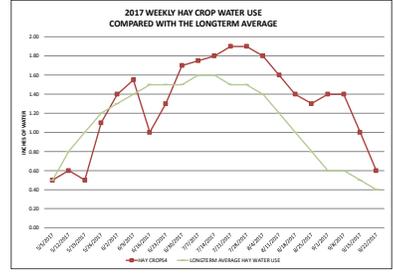
2019 26.0 inches



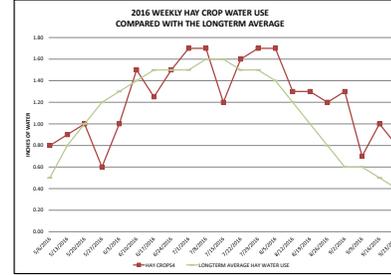
2018 24.0 inches



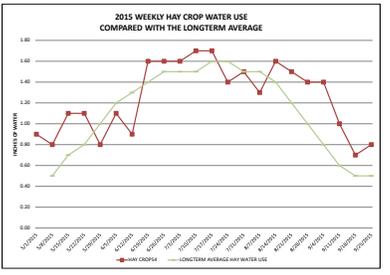
2017 28.0 inches



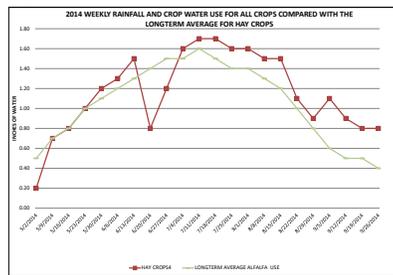
2016 26.6 inches



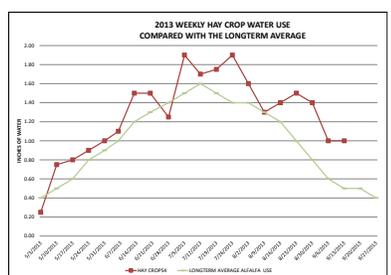
2015 27.4 inches



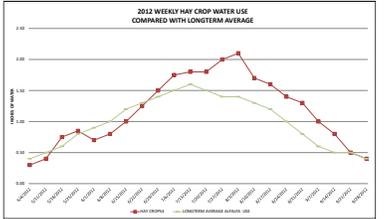
2014 25.2 inches



2013 26.8 inches



2012 25.7 inches



THE BLACKFOOT WATERSHED IRRIGATION SEASON IN BRIEF

This is a summary of general activities and recommendations with more detail provided throughout our irrigation guide.

APRIL – GET READY AND PLAN YOUR IRRIGATION STRATEGY!

- Get your irrigation system ready, evaluate spring soil moisture and weather to determine start date.
- Evaluate season weather predictions then plan for drought if needed, start irrigating if dry.



MAY – CHECK SOIL MOISTURE & BE READY FOR UNUSUAL HEAT OR COLD!

- Check the soil moisture content at the start of growing season (May 1) and fill up the soil to its water holding capacity during early irrigations (2-4 inches).
- Watch for dry soil conditions, especially with new plantings and apply water to ensure good germination and emergence.
- Irrigate deeply at least once early in the season to promote deep root growth.
- Apply 2-5 inches of irrigation to hay and pasture crops in May depending on weather. Apply 0-2 inches to spring grains and new plantings as needed based on weather and growth. Apply extra water to fill up the soil (2-4 in).

JUNE – THIS IS THE TIME TO MAKE YOUR BIGGEST EFFORT SO POUR IT ON!

- Apply 6-8 inches of irrigation in June to hay and pasture crops and winter wheat depending on weather.
- Apply 5-8 inches to spring grains and new plantings as needed based on weather and growth.
- Consider irrigating deeply to fill up soil root zone and promote deep root growth.
- Be sure small grains are irrigated well during their critical periods of boot, bloom and early heading.



JULY – POUR IT ON UNTIL HARVEST AND RETURN QUICKLY

- Apply 1 - 2 ½ inches of irrigation per week in July to all crops - depending on weather.
- Cutting is a critical stress period for hay crops, especially alfalfa so irrigate deeply to fill up the root zone before cutting then get back across the field quickly after cutting. Crop water use declines when hay is cut so this is a good opportunity to fill up the soil again. Irrigate at least once after cutting.
- Stop irrigating small grains at the milk to soft dough stage but be sure there are 1- 2 inches of soil moisture left at this stage to prevent kernels from shrinking.

AUGUST- BE DROUGHT AWARE!

- Stop irrigating if you can during drought periods or irrigate less often.
- Apply 1 - 2 inches of irrigation per week in August to hay and pasture crops for full production depending on weather. Irrigate new plantings as needed.
- Many folks irrigate for pasture following their one hay cutting. Irrigate according to how much pasture you seek and with consideration for other water needs in the watershed, especially in drought years.
- Reduce river withdrawals by rotating systems and reducing the amount of irrigation at one time. This is the least efficient time to irrigate (lots of water lost to evaporation) so don't irrigate unless you need to.



SEPTEMBER – APPLY AS NEEDED/AVAILABLE & GET READY FOR SPRING!

- Stop irrigating if you can during drought periods.
- Apply ½ - 1 ½ inches of irrigation per week in September to hay and pasture crops for full production depending on weather. Irrigate new plantings as needed. Prepare the system for winter and an early start next spring.