North Agency Plains Conservation Implementation Strategy (CIS)

Outcomes Report

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Prepared For: Natural Resources Conservation Service (NRCS)

Prepared on: January 9th, 2020

Introduction

The North Agency Plains Irrigation Improvement CIS was developed in 2013 after Jefferson Soil and Water Conservation District (JSWCD), the Confederated Tribes of Warm Springs, landowners, and stakeholders prioritized addressing resource concerns associated with irrigation runoff in the North Agency Plains portion of Jefferson County. The importance of irrigation water conservation was also identified at annual NRCS Local Working Group meetings. The CIS provides a comprehensive overview of the resource concerns, outcomes, partnerships, budget, conservation and practices and was used as a reference during the development of this report. The goal of the CIS was to:

1) Improve irrigation water efficiency on croplands northwest of Madras

2) Reduce irrigation tailwater runoff to the Deschutes River below Pelton Dam

Given the complexity of accurately measuring water conservation, this report will focus on JSWCD's water quality monitoring effort. JSWCD has been collecting water quality data intermittently in the Agency Plains area for over a decade. In 2012, JSWCD completed data collection specifically for Rattlesnake Canyon. That data was utilized to assist in the development of the North Agency Plains CIS and is considered baseline data for the purposes of this report. In 2019, JSWCD collected data for the fourth consecutive year in Rattlesnake Canyon. Monitoring was completed once every two weeks during the irrigation season (April to October) and once a month during the non-irrigation season (November to May). Of the several monitoring locations (see Figure 1), the only location that is monitored and provides drainage for the North Agency Plains CIS area is the Rattlesnake Canyon drainage. See Attachment A for relevant data.

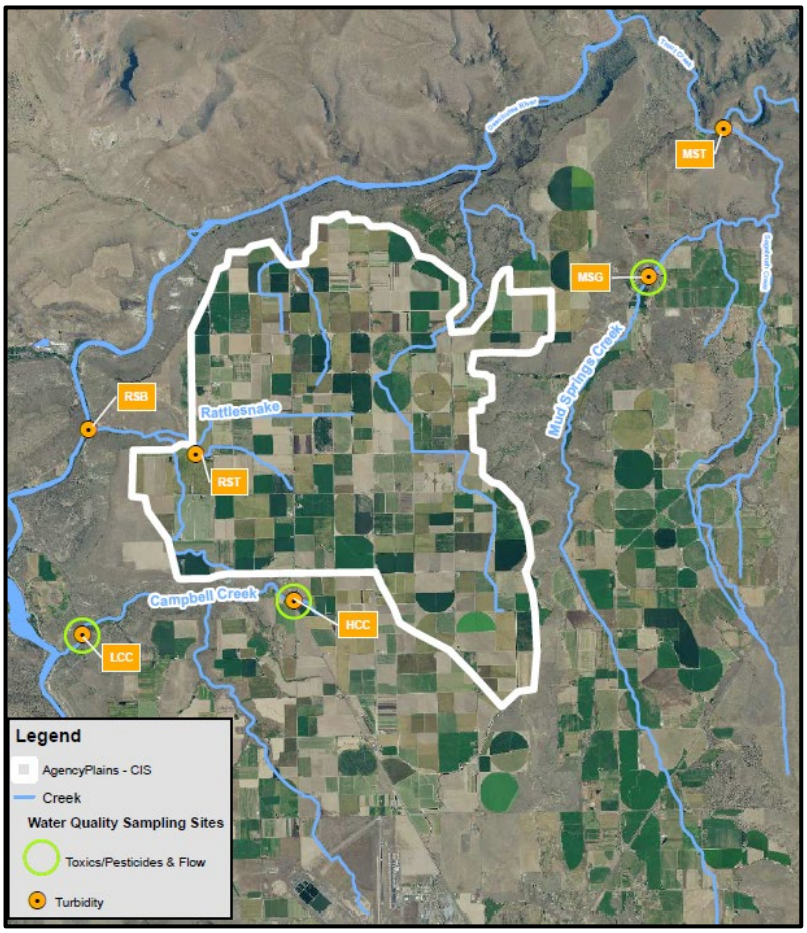


Figure 1. Water quality monitoring locations.

Purpose/Objectives

The purpose of this outcomes report is to assess the effectiveness of the North Agency Plains CIS to improve irrigation water efficiency and reduce excessive sediment in surface waters. Objectives include:

1) Compare findings from the data collected in 2012 to the 2019 data (i.e. baseline vs. post implementation)

2) Identify the status and trend of the water quality in Rattlesnake Canyon

3) Compare irrigation practices in 2013 to practices in 2019

Water Quality Monitoring Data

In 2012, the irrigation season began on April 11th and it is assumed that the season ended around October 15th. The Rattlesnake Top (RST) sampling location is located below the overflow of a large pond. This monitoring location has intermittent flow compared to the Rattlesnake Bottom (RSB) sampling location as there are some significant spring sources located further down the canyon. The accumulated precipitation for the 2012 water year at the AgriMet weather station was approximately 8 inches. Approximately 4 inches of the total precipitation for the year arrived during the spring. The following conclusions can be made:

- Turbidity began to increase at both locations (most notably at RSB) once the irrigation season began
- Turbidity peaked on May 3rd with values reaching 161 and 81 NTU for RSB and RST, respectively
- Three weeks passed until the second measurement in May which was also relatively high (55 NTU RSB)
- Water quality was its poorest during the spring and exceeded the OWEB guideline of 50 NTU at both locations

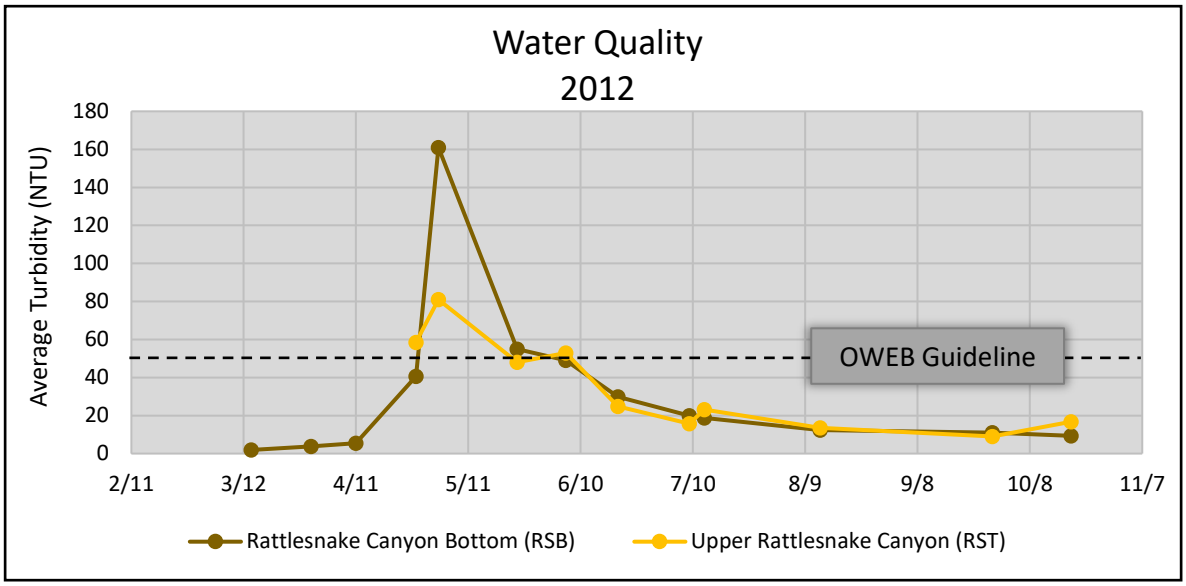


Figure 2. Water quality data collected in 2012 at Rattlesnake Canyon.

In 2019, the irrigation season began on May 1st and ended October 22nd. Irrigation water began priming canals as early as the last week of April. A late winter left inches of snow into April. The associated snow melt was witnessed throughout March and up until April 15th. The accumulated precipitation for the 2019 water year at the AgriMet weather station was approximately 12 inches. Approximately 4 inches of the total precipitation for the year arrived during the spring. The following conclusions can be made:

- Turbidity was its highest in March at RST and marginally at RSB due to snowmelt
- Values at RSB increased again more rapidly once the irrigation season began May 1st
- Turbidity peaked on May 6th with values reaching 53 NTU at RSB and 32 NTU at RST
- Nine days passed until the second measurement in May which showed a significant decrease (19 NTU at RSB and 25 NTU at RST)
- Two weeks later, the third measurement in May was recorded and values remained steady (16 NTU at RSB) yet declined as the irrigation season continued
- Water quality was poorest during the spring and only slightly exceeded the OWEB guideline of 50 NTU at the mouth to the Deschutes River

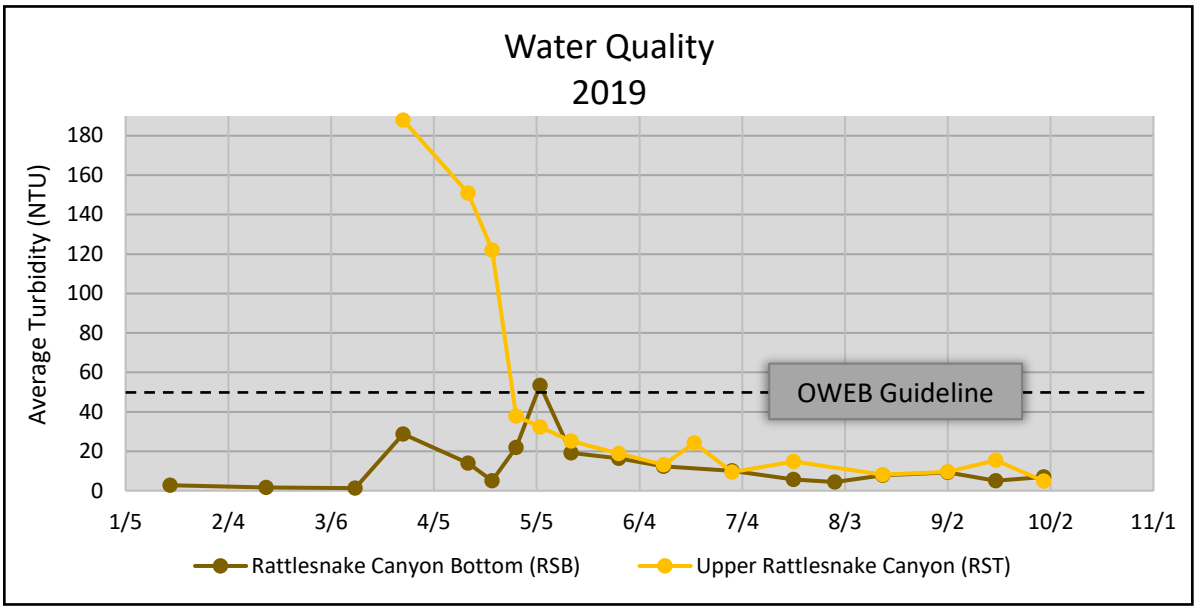


Figure 3. Water quality data collected in 2019 at Rattlesnake Canyon.

Statistical analysis of the status of water quality in 2019 shows significant improvement since 2012 (see Figure 4). The sample size and sampling frequency increased in 2019 in order to more adequately characterize the peak event for that year and compare it to 2012 conditions. A significant decrease in the peak event in 2019 exposes significant improvement in agricultural water quality since 2012. Specifically, the peak event in 2012 was over 220% above the OWEB threshold, whereas the peak event in 2019 was only 6% higher. The improvement in water quality is also apparent when considering the statistical significance of the 2019 data compared to that of 2012.

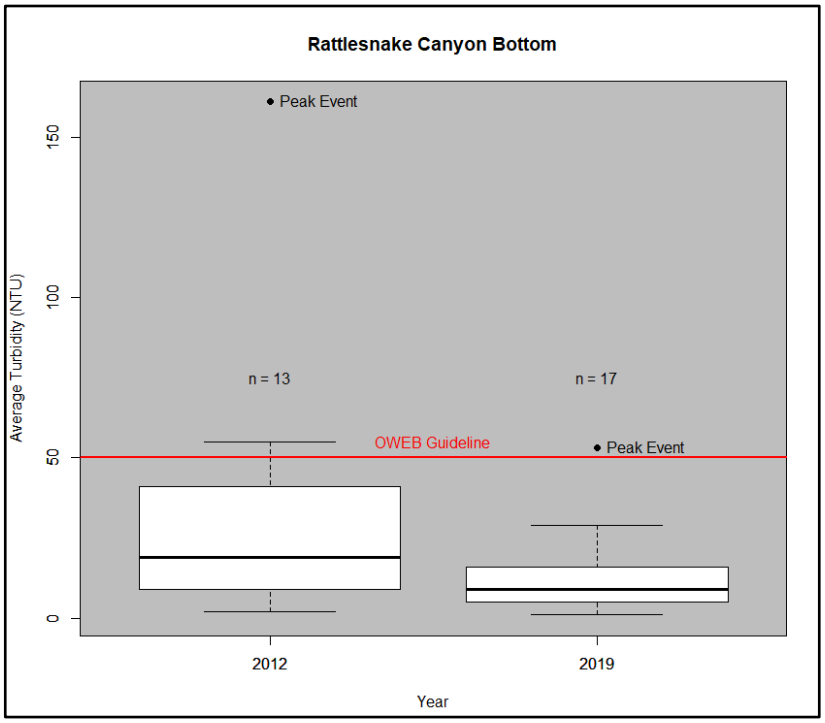


Figure 4. Statistical analysis of water quality data collected in 2012 and 2019.

Irrigation Water Management

The improvement in irrigation water management that has been provided through implementation of the North Agency Plains CIS has reduced irrigation tailwater and transport of sediment to the Deschutes River. This shift in irrigation water management was been documented in order to track the progress and improvement to agricultural water quality. Figure 5 below illustrates the transition from flood irrigation to more efficient forms of irrigation including wheel line and pivot sprinkler applications. The differences in irrigation water management are apparent as over 800 acres, or 8% of the flood irrigated cropland transitioned to sprinkler. In the Rattlesnake Canyon Sub-Watershed alone, approximately 700 acres, or 14% of the total irrigated acres in that sub-watershed transitioned to sprinkler irrigation (see Table 1 and Figure 6).

Rattlesnake Sub-Watershed

2013 Irrigation Type

Type	Acres	Percent
Flood	2,230	44%
Wheel Line or Hand	1,313	26%
Pivot or Linear	1,512	30%

2019 Irrigation Type

Type	Acres	Percent
Flood	1,523	30%
Wheel Line or Hand	1,616	32%
Pivot or Linear	1,920	38%

Table 1. Irrigation application type in 2013 vs. 2019 in the Rattlesnake Sub-Watershed.

Conclusion

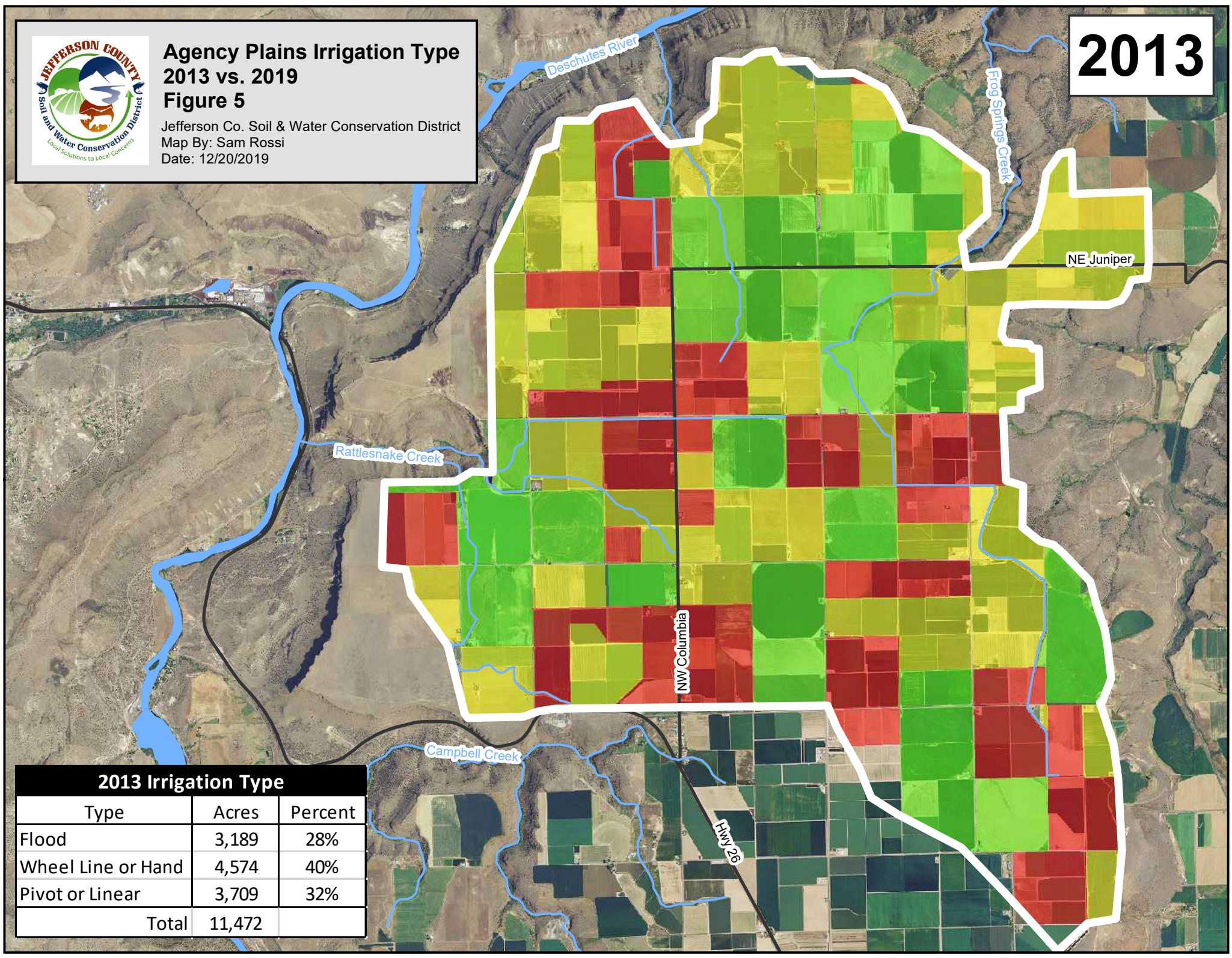
Water quality monitoring in Rattlesnake Canyon has provided the JSWCD and NRCS with compelling data that identifies the benefit to water quality such a program can have. The North Agency Plains CIS has been implemented for over five years and has contributed to agriculture's successful improvement to agricultural water quality entering the Deschutes River.

The water quality data collected in 2012 captured poor water quality entering the Deschutes River over a sustained period of time during the spring when the irrigation season began. Turbidity values regularly exceeded the OWEB threshold of 50 NTU for over a month and then gradually decreased. Approximately 22% of the 23 samples recorded that year were above the threshold. Water quality data collected in 2019 shows a significant reduction in sediment being transported to surface water. Again, the poorest water quality at the mouth of the canyon was observed during the spring and corresponded with the start of the irrigation season. The impact snow melt had on water quality at the mouth of the drainage was insignificant even though values at the top of the canyon reached 188 NTU. The amount of flow associated with this event is unknown, yet determined to be inconsequential compared to the flow at the bottom of the canyon based on turbidity records. The peak event witnessed in the spring of 2019 was only 3 NTUs above the threshold and was sustained for little over a week before decreasing. Approximately 13% of the 31 samples recorded were above the threshold.

The conversion of 700 acres (14%) under furrow irrigation corresponds with the improvement to water quality data collected in 2012 and 2019 in the Rattlesnake Sub-Watershed. This data provides an indication that the tailwater concern has been reduced. The water quality problem has not been resolved entirely, however, real progress has been made to improve agriculture's use of water resources and reduce the amount of irrigation tailwater runoff entering the Deschutes River. Factors worth investigating further include how precipitation events might exacerbate sediment loading, the importance of reuse and retention ponds, and how soil cover may armor the soil surface in the non-irrigation season to prevent field and ditch erosion during the spring.

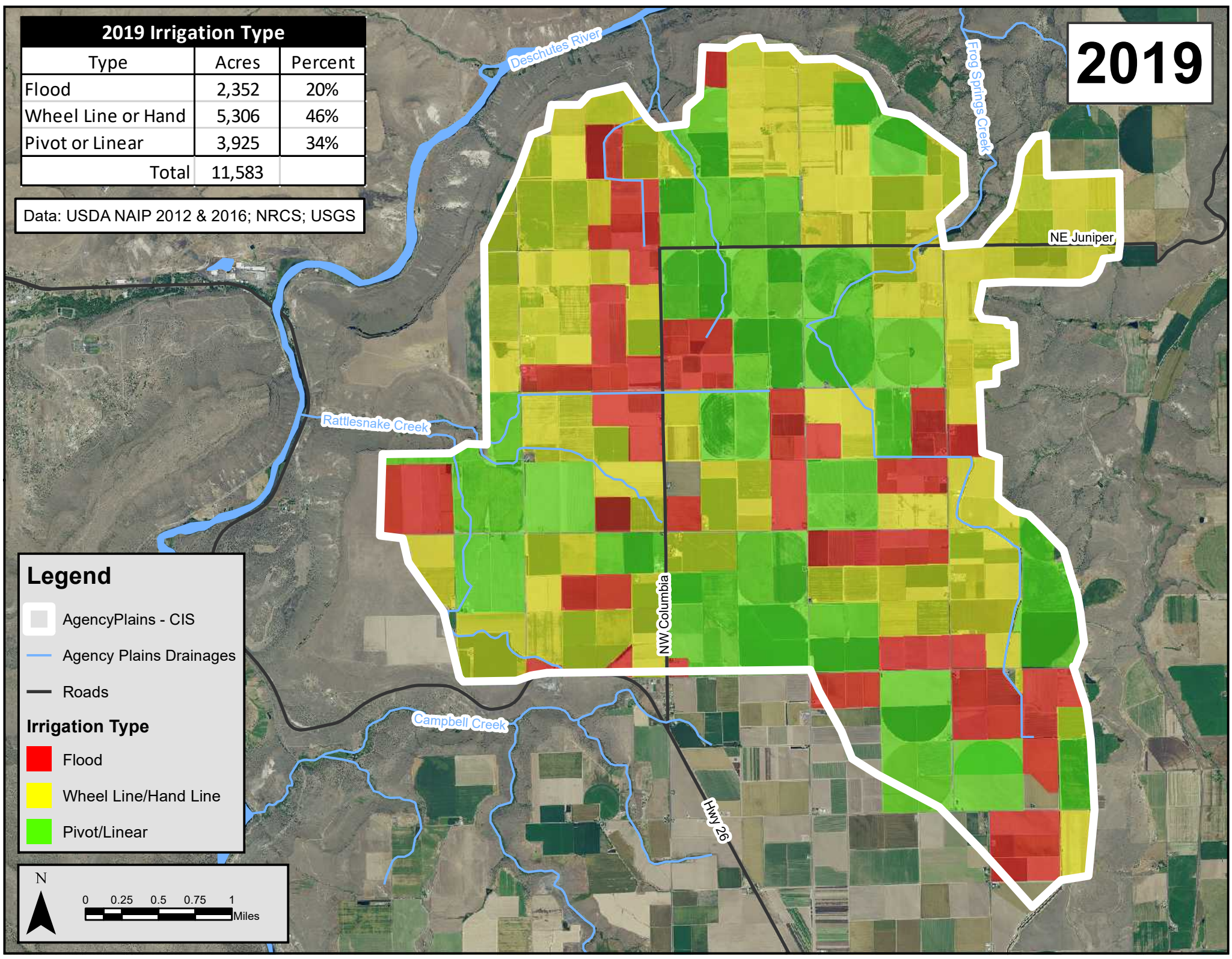
Agency Plains Irrigation Type 2013 vs. 2019 Figure 5

Jefferson Co. Soil & Water Conservation District
Map By: Sam Rossi
Date: 12/20/2019



2013 Irrigation Type

Type	Acres	Percent
Flood	3,189	28%
Wheel Line or Hand	4,574	40%
Pivot or Linear	3,709	32%
Total	11,472	



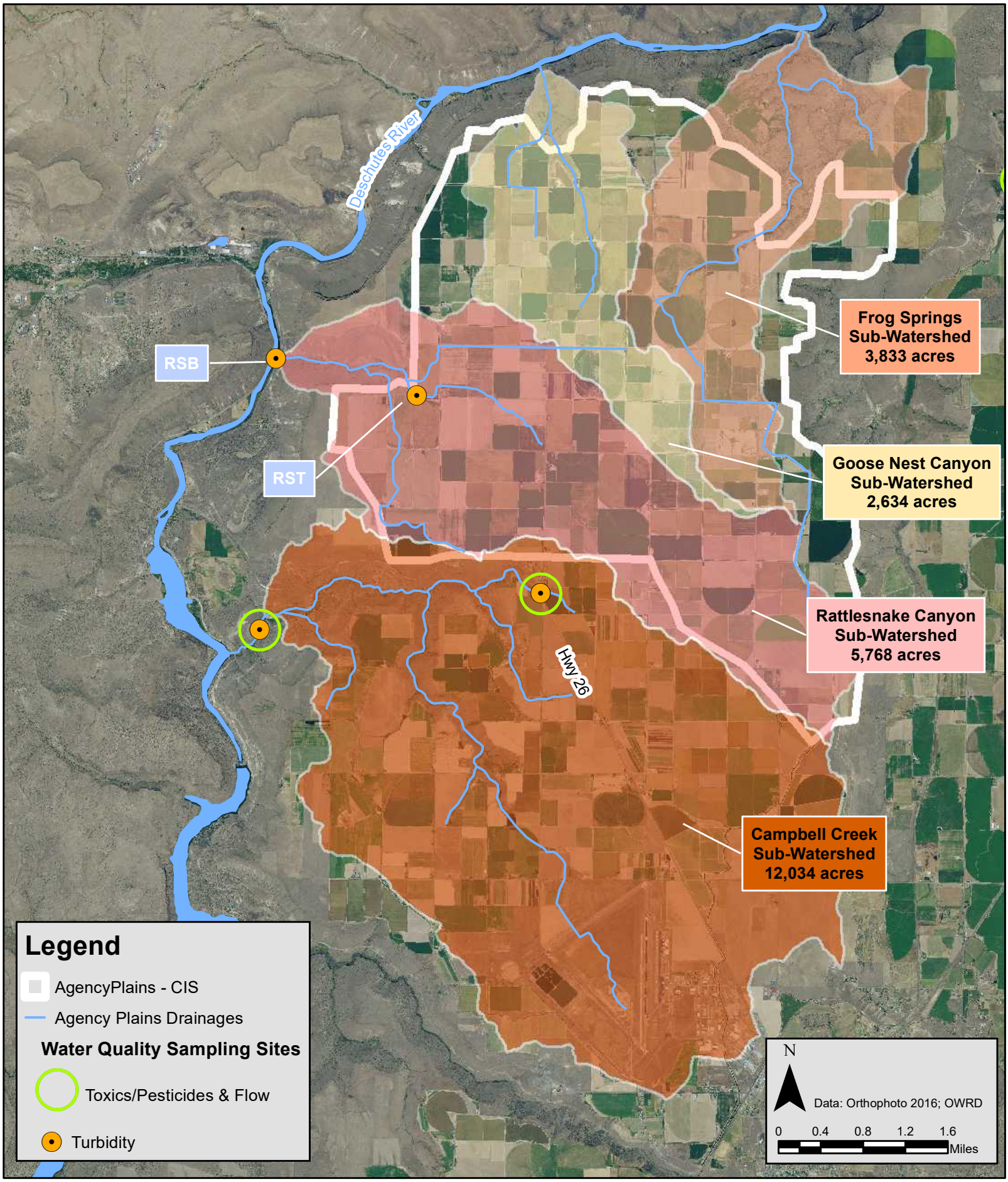
2019 Irrigation Type

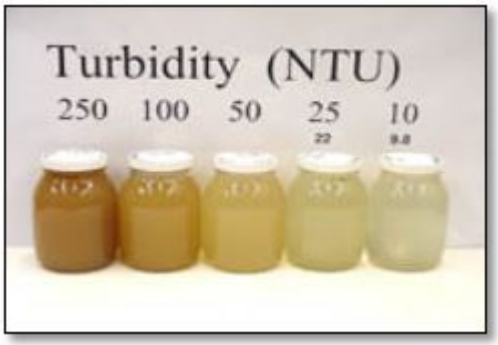
Type	Acres	Percent
Flood	2,352	20%
Wheel Line or Hand	5,306	46%
Pivot or Linear	3,925	34%
Total	11,583	

Data: USDA NAIP 2012 & 2016; NRCS; USGS

North Agency Plains CIS
Sub-Watershed Map
Figure 6

Date: 12/3/2019
Map By: Sam Rossi
Jefferson Co. Soil & Water Conservation District



Attachment A

Date:	Rattlesnake Canyon at Hwy26 - "RSB" (Average NTU)	Upper Rattlesnake Canyon - "RST" (Average NTU)
3/14/2012	2	
3/30/2012	4	
4/11/2012	5	
4/27/2012	41	58
5/3/2012	161	81
5/24/2012	55	48
6/6/2012	49	53
6/20/2012	30	25
7/9/2012	20	16
7/13/2012	19	23
8/13/2012	12	14
9/28/2012	11	9
10/19/2012	9	17
3/13/2019	1	-
3/27/2019	29	188
4/15/2019	14	151
4/22/2019	5	122
4/29/2019	22	38
5/6/2019	53	32
5/15/2019	19	25
5/29/2019	16	19
6/11/2019	12	13
6/20/2019	-	24
7/1/2019	10	10
7/19/2019	6	15
7/31/2019	4	-
8/14/2019	8	8
9/2/2019	9	10
9/16/2019	5	15
9/30/2019	7	5