

The Ruby Ranch Subdivision
2019-2021 Irrigation and Meadow Management Plan
Summit County, Silverthorne Colorado

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Introduction

The purpose of this document is to provide the community with a comprehensive document on the subdivision's irrigation system, meadow maintenance, and hay operations. This document also provides guidance and minimum requirements for Boards, Committees, and Service Providers to properly managing these assets. The governing boards maintain these assets per the Covenants, and in a manner that helps achieve the owner's strategic vision of Ruby Ranch as a unique equestrian community.

Stable, Irrigation & Hay Committee's Vision Statement

We envision a unique equestrian community where collaborative stewardship results in a well-maintained stable, secure water rights, healthy meadows, high quality hay, and increased value for Ruby Ranch owners.

This plan was originally constructed from past/current practices, input from local specialist, and recommendation from agricultural experts. It was adopted in December of 2019 and implemented throughout the 2020 season. Creation, implementation, and ongoing operations have required a highly collaborative effort between the Ruby Ranch Owners Association (RROA), the Stable, Irrigation, and Hay (SIH) committee, the Willow Brook Metro District (WBMD), and key service providers.

Multiple irrigation and hay operation models have been used over the years, including those that leveraged different independent contractors for irrigation management versus hay harvesting, and those that leveraged a single independent contractor for both. Although it is ideal to have a single person responsible for all of these operations, both have been and can be successful when properly managed by the Boards. The WBMD will determine the best way to manage these assets based on the resources available and in pursuit of the following goals;

- ✓ Protect Agricultural Status and Water Rights
- ✓ Maximize Water Right Usage
- ✓ Improve Meadow Soil and Grass Health
- ✓ Improve Hay Quality and Increase Yield
- ✓ Improve Operations Efficiency & Value for Owners

These goals are accomplished over time, through the implementation of this management plan and completion of specific Board approved improvement projects (Annex G).

Irrigation Management

The Ruby Ranch subdivision has the benefit of flood irrigation rights on three ditches within Colorado's Water Division 5; the Sawmill Ditch, the Ruth Ditch, and the Ruby Ditch. A total of 7.4 cubic feet per second (c.f.s.) of water is deeded to the Ranch out of these ditches for the purpose of agricultural use only. The 7.4 c.f.s. equates to 199,281 gallons per hour or 4.8m

gallons per day and is one of the subdivisions most valuable natural resources. The source water for the ditches is the Willow Creek, which is a tributary of the Blue River.

Article III, Section 2 (a) and (d) include the provisions that dedicate common Tracts to WBMD, and the water rights to the RROA. Article VII, Section 7 of the Covenants grants the RROA ownership of “all of the hay in the irrigated meadows of the subdivision...”, together with the responsibility “for irrigation of the meadows and fertilization, cutting and harvesting of the hay each season.” In September of 1999, by resolution of the Board of Directors, the RROA confirmed that it retains title to all water rights, but transferred the responsibility for operating and maintaining the irrigation system in the manner directed by the Covenants (Annex D) to the WBMD. Additionally, the ranch is zoned R-P in Summit County and complies with requirements stating that; “The existing open hay meadows of the site will remain open and undeveloped and will be held in common ownership by the homeowners of the project for pasturing of horses and other open recreational uses. “

The Boards now leverage the SIH committee to care for the day-to-day management of irrigation and hay operations, improvements, and to provide recommendations and support as needed.

Adequate water is the most important input for the healthy soil and plant growth, weed control and to reduce erosion. Flood irrigation is a tried-and-true irrigation method that dates back to 6000 BC, and has been the legacy method of irrigation used here on the Ranch since 1908. The irrigation Head Gates capture source water from Willow Creek, the Ditches carry this water down to our hay meadows, and the laterals carry the water across the target meadow. This subsurface water not only waters our meadows but it also replenishes our wells and supports our diverse vegetation throughout the Ranch. Flood irrigation uses the soil surface and pitch to flow a sheet of water across the field, from the upper end to the lowest end, replenishing soil water storage in the plant root zone through methods other than natural precipitation. The advantage of this method is that it is inexpensive, both in terms of system costs and energy costs. The disadvantage is that it is the most difficult irrigation method to manage efficiently because performance depends strongly on soil properties, infiltration rate, grade, irrigation infrastructure conditions, and surface roughness.

Irrigation must be systematically managed throughout the season to ensure the right areas receive an adequate volume of water while avoiding overwatering, pooling, and excessive surface run off. If this isn't done properly, we have seen poor grass quality, meadow erosion, rodent and weed infestations, and low hay yields.

Historically, the irrigation system is operational from the April melt through October in Filing 2, and May through October in Filing 1. Once the ditches are clear of snow and debris in the spring, the Head Gates can be fully opened to the granted c.f.s. level. Ideally, the Head Gates should not be closed and the main traverse of the ditches should not be allowed to dry out until they are closed in October. The entire system runs most efficiently and requires less maintenance when the ditches run continuously at their full c.f.s.. Each time the ditches dry

out there is additional work to reopen them and a large volume of water is lost to absorption into the ditch walls and surrounding soil. Instead of closing the Head Gates to dry out the meadows, the water should be diverted to another meadow or into one of the laterals that run off the property.

Each ditch has a unique profile, set of assets, and management considerations for properly operating and making improvements. Irrigation cycles and durations should be re-established each season by considering a number of factors, including water flow volumes, ditch and soil composition, meadow pitch, moisture depletion rates, construction impacts, and hay harvesting schedules. Plans should ensure the irrigation water is continuously rotated through each of the meadows, flooding the meadow for a number of days throughout the season. Water should be redirected to the next meadow once desired saturation levels are reached in the lowest section of the meadow. Meadows should be allowed dry out down to the plants root in-between cycles, but complete depletion should be avoided.

Ditch Profiles

All ditches are tributaries of Willow Creek, Division #5, Water District #36, Summit County.

Ruby Ditch (CDSS Ditch #3600793) provides irrigation water to;

- North K, the 6+ acres located in the north end of Filing 2 by the emergency exit and the boundary of Smith Ranch.
- This ditch and acreage are lower than 8820 feet in elevation so they are the first to thaw and require management each season. As early as April the runoff can be used to irrigate North K. The head gates are normally opened in May.
- Head Gate Location Description
 - i* There are two Head Gate structures, one from Willow Creek into the ditch, and one from the pond into the ditch. Both are located off of the subdivision on the Lowe ranch. Access via easement through the Lowe Ranch gate and road.
 - ii* Latitude 39.649696, Longitude -106.093557. South or right bank of Willow Creek at a point whence the north quarter cor. Sec. 2, T. 5 S., R. 78 W of the 6th P. M. bears N. 8' 05'E. 1109 ft.
- Water Right
 - i* 1 c.f.s. decreed 3/10/1952 to the Ruby Ditch, #269, priority #346, appropriation date of May 15, 1938
- Asset Inventory
 - i* Head Gate (on the east side of the Lowe property)
 - ii* Water recess structure (2 pipes and 2 Head Gates) below the pond
 - iii* 9" Metal Parshall Flume (below the water recess structure)
- Water diversion structures
 - i* Water recess structure below the pond either diverts water back into Willowbrook or east into a metal Parshall Flume.

- ii* Diversion laterals in the west end of Lower Tract K hay meadow send water down the north and south sides of the meadow. The south lateral takes the water off the property and into a Smith Ranch ditch.
 - iii* Diversion laterals in the west end of Lower Tract K hay meadow send water down the north and south sides of the meadow.
- Special Features and Management Considerations
 - i* The headgate and a good portion of the ditch are on the Lowe property so special care and communications are needed on material improvements. No special communications or access approvals are needed for seasonal management and operations.
 - ii* The north lateral runs along the meadow access road and dissipates at the end of the east end of the meadow. Rodent tunnels between the ditch and the road often cause flooding so ongoing work is required to repair the ditch sidewalls and plug the leakage points in the road.
 - iii* To dry out the North K meadow, water should be diverted off the property using the southern e/w running lateral of North K and into the Smith Ranch ditch

Ruth Ditch (CDSS Ditch #3600794) provides irrigation water to;

- Filing 2 hay and grazing meadows in Tracts O, P, M and K.
- This acreage is all lower than 9050 feet in elevation and normally requires work in early May to manage the runoff and irrigate Tract P. The head gates are normally opened by the end of May.
 - iv* The ditch and laterals traverses through Lots 46, 45, 44, 43, 31, 50
- Head Gate Location Descriptions
 - i* N/W edge of the subdivision and can be accessed via the trailhead located on the north of Lot 42 below the pump station
 - ii* Latitude 39.647788, Longitude -106.101452. N ½ corner of Section 2, Township 5 S, Range 78 W of the 6th P.M., bears N 55'35' E 3250 ft.
- Water Right
 - i* 2.4 c.f.s. of the 3.0 c.f.s. decreed 12/23/1920 absolute and 1 c.f.s. decreed 12/23/1920 conditionally to the Ruth Ditch, #202, Basin Rank #2330, for domestic irrigation use, appropriation May 31, 1908
 - District Court, Water Division of the State of Colorado, Case #84-CW-284. Decreed on August 31, 1988. The Town of Silverthorne was decreed .6 c.f.s. of the Ruth's total 3 c.f.s. (20% of the absolute decree, or 9.2 acres worth) for domestic and municipal use. The decreed diversion can only be used from June 1st through to October 31st. The diversion shall take place at N ½ corner of Section 2, Township 5 S, Range 78 W of the 6th P.M., bears N 55'35' E 3250 ft.
 - a. From 1988 prior, the total amount of historic consumptive use resulting from the irrigation practices under the Ruth

Ditch water right had amounted to 62.6 acre-feet per year in an average rain year, and 78.7 acre-feet in a dry year. The .6 c.f.s. equates to 9.2 acres of land that will no longer be irrigated.

- Asset Inventory
 - i* Water transportation and diversion structures;
 - Steel Head Gate
 - 18" Metal Parshall Flume installed directly below Head Gate
 - Metal Head Gate behind the house on Lot 31. It diverts water north to Lot 50, Tract O hay meadow, Tract M, and eventually north Tract K hay meadow.
 - A diversion lateral and a large metal pipe just below the Head Gate on Lot 31 are used to divert water to either the northern edge of Tract P and into a pipe that runs parallel to Emerald Road and over to the top of Tract K grazing meadow, OR east into Tract P hay meadow and down into the eastern lateral in the Tract K grazing meadow.
 - Diversion laterals on the top of Tract K that divert water to the outer edges of the grazing meadow.
 - Special Features and Management Considerations
 - i* The ditch is lined with half and full culverts along the western boarder of Lots 46, 45, 44. The intake of each pipe needs to be cleaned regularly.
 - ii* The ditch goes into a grate and underground into a pipe at the southern tip of Lot 43 and ends behind the house on Lot 31. This intake grate must be cleared regularly.
 - iii* Tract K is divided into several sections (Top of K, North K, and South K) and each section has unique considerations
 - The only way to get water to the Top of K or South K is to run it through/past Tract P at full volume.
 - There is excessive pooling, erosion, and water loss on the Top of K. Work should continue on correcting the design of the laterals so that more acreage is properly flooded and erosion is reduced.
 - Irrigation of the north slope of Top of K must be redirected when the tail water reaches the abandoned wagon trail. Ground slumping will occur on the lower slopes if water is allowed to flow below the trail.
 - iv* Control ditch volumes to reduce flooding of Emerald and Ruby roads
 - at the grate above Lot 43
 - across from Lot 50 where the water goes down the waterfall
 - along the edges of Tract O and P
 - along the Ruby Road, under Tract O where it runs along the road
 - v* To dry out the meadows, water should be diverted into the south lateral of North K via Tract O (to Smith Ranch ditch) and/or the south lateral of

South K (City of Silverthorne ditch). Both of these routes take the water off the property.

Sawmill Ditch (CDSS Ditch #3600797) provides irrigation water to;

- Filing 1 hay and grazing meadows in Tracts A, B, C, H, and residential wells
- Most of this ditch and associated meadows are above 9,000 feet in elevation so this is the last Head Gate to be opened and the first to be closed each season. This section normally requires work in early May to manage the runoff in the lower portions of the subdivision (Lot 8, Lot 8, Tract B). The head gates are normally opened by June 1st.
- The ditch and laterals traverse through Lots 1, 24, 23, 22, 7, 8, 9, 10, 17, 6
- Head Gate Location Description
 - i* Head Gate is approximately 2 miles into the wilderness area, beyond the S/W boarder of the subdivision.
 - ii* Latitude 39.635133, Longitude -106.112392. SE ½ of Section 3, S ½ of Section 10, NW ¼ Section of 11, T. 5 S., R. 78 W., 6th Principal Meridian
- Water Right
 - i* 4.0 c.f.s. of Sawmill Ditch, # 222, priority #235, decreed 10/26/1937, appropriation date 05/01/1918, for irrigation use, reserving to grantor 1.833 c.f.s. of Sawmill Ditch No. 84, Priority 85, for domestic use, decree 10/26/1937 with appropriation date of 05/01/1918.
 - ii* 0.167 cfs of Sawmill Ditch No. 84, Priority 85, decreed 10/26/37 with appropriation date of 05/01/1918 was transferred to the wells of the Willowbrook Metropolitan District in consolidated Cases 80CW31 and 80CW200 by decree of the Water Court for Water Division 5, State of Colorado dated January 22, 1981
 - iii* Easement Length (7,620 ft), Width (20 ft), Area (3.5 acres)
- Asset Inventory
 - i* Head Gate (Wilderness Area)
 - ii* 24" Metal Parshall Flume (below Head Gate in Wilderness Area)
 - iii* Water diversion structures;
 - Wooden flume above the pond on Lot 24 diverts water south through Lot 1 and down to Tract A hay meadow and Lot 7, OR east to lot 23.
 - There are three diversion laterals on the south run down to Tract A. They all go into culverts under Jade Road into Tract A.
 - Water recess structure with two Head Gates. One to release water east towards Lot 7, and one releasing water south into the aspen glade and center of Tract A
 - Wooden flume on Lot 23 diverts water north through Lot 23 over to the north side of Lot 22.
 - Diversion lateral on the north end of Lott 22 diverts water either south on Lot 22 or northeast to Tract H hay meadow.

- Diversion lateral on the southwest corner of Tract H diverts water east to Lot 10 and Tract C hay meadow.
 - A new diversion route was created in 2020 on the Ruby Road edge of Lot 8. This should be manually blocked (dirt, rock, tarps) to send water to the northern section of Tract B.
- Special Features and Management Considerations
 - i* This is the subdivisions longest, most complicated ditch. Due to Wilderness restrictions no motorized or gas-powered equipment or transport can be used to maintain, operate or make improvements.
 - ii* There are breaks in the sidewalls at the Head Gate making it difficult to capture water granted c.f.s. out of Willow Creek, and breaks along the run, making it difficult to efficiently transport water to destination meadows. There are large tree/rocks blockages along the run that dramatically impact water flow and volumes. Ongoing work is needed to improve the system enough to reduce operational overhead and maximize water right usage.
 - iii* Ditch is lined with full and half cut culverts at various locations in the Wilderness Area, and on Lots 7 and 6. The intakes/grates into these pipes must be cleared regularly.
 - iv* The diversion point flume above Lot 24s pond is broken and does not divert water properly. Water should be diverted away from this section until it is repaired/replaced and the ditch cleared and repaired.
 - v* Ditch lined (plastic with rock) from end of Lot 7 piping to the ledge above Ruby Road on the eastern boarder of Lot 8.
 - vi* The most northern lateral in Tract C is on Lot 17 and should not be used. This lateral should be blocked and water diverted so that Lot 17 is undisturbed.
 - vii* There is a marshy area in the center of the northern section of Tract C tends to hold water and should likely have an additional lateral established to drain it.
 - viii* To dry out the meadows, water should be diverted into one of the other meadows or the laterals leading off the property; culvert from Tract C under Topaz Road, Lot 10 to culvert under Ruby Road, Northern E/W running lateral of Tract B, Tract A to natural spring and culvert under South Ruby Road

Meadow Management

There are seven Tracts designated for hay production and/or grazing. Each season the SIH committee will identify which Tracts will be harvested versus available for grazing. Article III, Section 2 (a) and (d) include the provisions that dedicate common Tracts to WBMD, and the water rights to the RROA. Article VII, Section 7 of the Covenants grants the RROA ownership of “all of the hay in the irrigated meadows of the subdivision...”, together with the responsibility “for irrigation of the meadows and fertilization, cutting and harvesting of the hay each season.” The

WBMD is responsible for ensuring the meadows are maintained and harvested in the manner directed by the Covenants, while the RROA maintains ownership of all water rights.

Meadow Profiles

Tract	Location Reference	Total Acreage	Acreage Hayed	Primary Purpose
Filing 1				
A	<i>Lots 1, 2, 7, Jade, Ruby</i>	11.53	11.53	Hay
B	<i>Lots 9, 11, Ruby</i>	16.10	16.10	Hay
C	<i>Lots 16, 17, Ruby, Topaz</i>	5.78	5.78	Hay
H	<i>Lot 20, 21, Ruby, Jade</i>	2.22	2.22	Hay
Filing 2				
K	<i>South K - Stable pasture</i>	36.13	0.00	Graze
	<i>North K - N/E Boundary</i>	7.96	7.96	Hay
	<i>Top of K - Above Stables</i>			Graze
O	<i>Lot 50, Ruby, Emerald</i>	1.27	1.27	Hay
P	<i>Lots 30, 31, Ruby, Emerald</i>	3.74	3.74	Hay

The RROA, through the SIH committee, supports WBMD by working with the service providers throughout the season to irrigate, maintain and improve the meadows, develop Grazing Plans each season, and communicate changes or issues with owners. Meadow management and grazing plans should consider and address the following;

- Grazing and harvesting rights are vested by covenant, and hay is owned by the WBMD
- Historically, approximately 50 acres (Tracts A, B, C, H, O, P, and K) are designated for hay harvesting and/or grazing
- The SIH committee works with the service providers to determine which of these Tracts will be harvested each year and notifies horse owners of the decisions, timing, and pricing.
- Each spring, before the Head Gates are opened, a drag harrow should be used in the meadows to break up the thatch, manure, and spread hay seed
- After harrowing, all rocks should be removed, rodents exterminated, holes filled with top soil and compacted.
- Meadow soil should be regularly tested to confirm soil health and address composition issues as needed, specifically the addition or balancing of critical minerals like nitrogen via fertilization (chemical, manure, compost) and seeding
- Weed spraying should take place in the spring and fall as directed by a certified weed technician.
- Big improvements and/or maintenance should be scheduled the ditches are dry
- Commonly owned hay meadows have priority for irrigation and improvement investment over owner owned meadows

- The WBMD can agree to allow outside livestock graze common meadows with RROA approval
- As permitted by the covenants, the RROA, which has delegated the responsibility to the SIH committee, owners may seek approval from the SIH committee to graze their horses in the common meadows, once the harvest is complete, with special attention to not overgrazing
- Owner must provide appropriate fencing to contain animals in designated areas, if no permanent fencing exists

Key Metrics/ Performance Indicators

Performance Measurement Name	Result	Notes
# of Common Meadows	9	A, B, C, H, O, P, nK, tK, sK
# of Meadows Harvested	7	2020: A, Lot 7 & 8, O, P, nK, tK
Square Bales per Year (S.B.Y.)	937	10-year average
Square Bales per Acre (S.B.A.)	19	10-year average
# of Tracts Irrigated	12	A, B, C, H, O, P, nK, tK, sK, Lot 7, 8, & 10
Acres Harvested	52	2020: A, O, P, nK, tK, L7 & 8
# of Ditches Open	3	2020: Sawmill, Ruth, Ruby
Sawmill Delivery Rate	tbd	2021 - distribution efficiency
Ruth Delivery Rate	tbd	2021 - distribution efficiency
Ruby Deliver Rate	tbd	2021 - distribution efficiency

Hay Meadow Production Log

In 2020, an independent contractor handled both the irrigation management and the hay harvest. A total of 26 large rounds were bailed, 5 rounds were purchased by owners, and the rest were removed from the property at \$40 per ton. Tracts H and B were rested this year, but Top of K and the Lots 7 & 8 were harvested. Overall hay yield was dramatically lower than usual due to drought conditions and an inability to water property on Filing 1 (due to home construction and Sawmill ditch issues). Each round weighs a bit more than a ton and the contractor paid WBMD \$40 per ton on the hay removed from the property which equated to \$420.

2020 Production Data

Drag Meadows	7 meadows at 10 hours
Meadows Harvested	7
Cut Hay	20 hours
Dry Meadows Out	2 days
Rake Hay	20 hours
Bail Hay	10 hours
Tonnage	26+
Load & Transport	6 hours

Tract	Location Reference	Total Acreage	Acreage Hayed	Yearly Hay Harvest Data																		
				2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Filing 1																						
A	Lots 1, 2, 7, Jade, Ruby	11.53	11.53										258		406	332	332	314	332	332	3	
B	Lots 9, 11, Ruby	16.10	16.10	0	83	0	131	184	154	89	364	78	218	29	185	240					0	
C	Lots 16, 17, Ruby, Topaz	5.78	5.78	0	283	0	336	313	225	251	198	104	280	77	96	295	298		258	258	0	
H	Lot 20, 21, Ruby, Jade	2.22	2.22																		18	
L7/8	Lots 7 & 8																				3	
Sub-Total of Bales				0	366	0	467	497	379	340	562	182	498	364	96	886	870	332	572	591	480	12
Filing 2																						
K	South K - Stable pasture	36.13	0.00																		1	
	North K - N/E Boundary	7.96	7.96	0	313	0	362	337	362	424	375	429	190	0	0	349	262	325	205	204	0	
	Top of K - Above Stables																					
O	Lot 50, Ruby, Emerald	1.27	1.27	0	199	0	65	73	111	86	76	114	72	55	42	64	71	74	40	46	80	
P	Lots 30, 31, Ruby, Emerald	3.74	3.74	0	60	0	147	243	281	195	158	160	146	0	200	202	204	194	94	117	120	
Sub-Total of Bales				0	572	0	574	653	754	705	609	703	408	55	242	615	537	593	339	367	402	14
Acreege Totals		84.73	48.60																			
TOTAL BALES (Filing 1 & 2)		49.10	48.60	0	938	0	1041	1150	1133	1045	1171	885	906	419	338	1501	1407	925	911	958	882	
																						26

(ANNEX C for calculations and conversion keys)

Delegation of Authority

The RROA owns the water rights and, by covenant, the right to irrigate and harvest the hay on private lots and the WBMD owns the hay in the public meadows and the right to harvest and graze them.

- Day-to-day operational issues = Irrigator working with the SIH committee
 - The irrigator is the only person authorized to move or turn off water.
 - Water Rights Deeded Ownership -> RROA
 - Irrigation Management and Hay Harvesting -> WBMD
- Improvement Priorities = SIH committee -> RROA
- Funding, Contracts, Liability Approval = SIH committee -> RROA -> WBMD

ANNEXES

ANNEX A: References, Contacts and Resources

FLOOD IRRIGATION OF ALFALFA: HOW DOES IT BEHAVE? Blaine Hanson and Dan Putnam1, ABSTRACT, <https://alfalfa.ucdavis.edu/+symposium/proceedings/2004/04-159.pdf>

Irrigation Term Glossary, <http://irrigation.wsu.edu/Content/Resources/Irrigation-Glossary.php>

https://www-static.bouldercolorado.gov/docs/Ditch_FAQ_FINAL-1-201608291052.pdf

Small Acreage Irrigation Guide, Water Rights and Irrigation Management, February 2019, by Boyd Byelich, Jennifer Cook, Chayla Rowley, USDA NRCS & CSU, <https://sam.extension.colostate.edu/wp-content/uploads/sites/2/2017/04/sam-irr-guide.pdf>

USDA - Natural Resources Conservation Services (NRCS) Toolbox; <http://irrigationtoolbox.com/WebPages/Chapter%204.html>

Stable, Irrigation & Hay Committee

- TBD (Chair)
- John Longhill (Vice Chair)
- Jon Rovick
- Jon Anderson
- Marilyn Nadeau
- Becky Richmond
- Jane Peterson

2021 Irrigator

Jon Anderson
Ruby Ranch Owner Lot 6
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Community Resource Services of Colorado, LLC

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Water District 26

Troy Wineland, Water Commissioner, troy.wineland@state.co.us
(970) 355-4516

GIS Mapping

Trip McLaughlin, Project Manager
Karlie Kendall, GIS Analyst
North Line GIS
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International Commission on Irrigation and Drainage (ICID)

USDA - Natural Resources Conservation Services (NRCS)

Derrick Wyle, Soil Conservationist, Derrick.wyle@usda.gov
258 Center Dr., Glenwood Springs, CO 81601
(970)457-0675 Cell; (970) 945-5494 Office
<https://www.nrcs.usda.gov/wps/portal/nrcs/site/national/home/>

Ditch & Reservoir Company Alliance (DARCA)

Amber Weber, Executive Director
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GPS Lidar Mapping

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Colorado Water Trust

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Top Notch Fencing

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Matt Hill (970) 376-3538, Office/Heidi Hill (970) 724-9402

ANNEX B: Scope of Work – Irrigator and Hay Harvester

Review, understand and manage the irrigation and hay operations in accordance with Ruby Ranch water rights, Covenants & Conditions, Strategic Plan and priorities, the Irrigation and Meadow Management Plan, and this scope of work.

Irrigation Responsibilities

Water will begin flowing through the system as the melt occurs. This takes place as early as April in the lower elevations. Some ditch and lateral maintenance and water diversion attention will be required to avoid flooding and erosion during this period.

All Head Gates should be opened in the spring once the ditches are clear of snow melt and debris. The Gates should be closed early enough in the fall to allow the ditches to dry up before the hard freeze. The Head Gates are historically open from May through to the middle of October and should not be closed until the end of the season. The meadows can continue to be watered after the harvest and should be grazed to help spread the hay seed and balance critical soil minerals.

Maintain and improve the irrigation system from the Head Gates down to each designated meadow.

- Control and regulate water flow by operating the Head Gates, diversion and laterals. Leverage best practice techniques to effectively and efficiently convey water to designated areas for the flood irrigation of hay Tracts, common meadows, and (pre-approved) private owner Tracts.
 - Run water at as high of c.f.s as the ditch and laterals can handle for high efficiency and to reduce water loss.
 - Actively manage and monitor flows to ensure water is reaching the end of the designated fields, plus has time to infiltrate the roots (2-5 ft deep). Infiltration rates should be measured with a Water Stick to ensure the water is absorbing deep enough (i.e., 10 ft at the top of the field and 5 ft at the bottom).
 - Ensure that roadway ditches and culverts do not overflow onto the roadways. When tail water is observed within 50 feet of a roadway, move the headwater to another meadow location.
 - Avoid over-irrigation and dig diversion channels to fix wet areas, swamp grass, and erosion.
- Complete ongoing maintenance and repairs as needed
 - Walk the ditches at least once a week, more if needed to remove blockages. Identify issues, fix leaks and breaks, remove vegetation, obstructions, and sediment, reconstruct banks and diversions, address washouts, exterminate rodents, erosion, fill/compact holes, level and grading, repair / replace culverts, piping and diversion boxes, dig new laterals or diversions, etc.
 - Large repairs should be scheduled/budgeted for the fall, after the harvest when water can be diverted or shut off (August -October).

- Complete pre-approved, major improvements as directed by the SIH committee and approved by the Board
 - Submit a written detailed estimate to the SIH committee for approval before making major repairs that are not included in the contract and require funding
 - Submit approved contractor and other invoices to the District Manager for payment, per the District Managers payout schedule
 - Assume responsibility for all ditch equipment and supplies

- Monitor and manage ditch right-of-way for trespass and unauthorized usage
 - Notify the SIH committee of violations that cannot be resolved independently
 - No owner or service provider should re-direct or divert water, alter ditch/lateral structures, or re-route water (only the irrigator or designated parties are allowed to do this)
 - Coordinate private property irrigation requests and approved water diversions
 - The irrigation of private lots is the lowest priority and will only be allowed if flows can support the irrigation of designated Tracts. Water will be allocated based on flow volumes and watering priorities;
 1. Hay Meadows
 2. Grazing/Common Meadows
 3. Owner Meadows
 - Home construction projects that need to have the irrigation water turned off or plan to impact a ditches or lateral require prior permission from the SIH committee and ARC. Irrigation of the meadows takes priority over individual property owner needs.

Measure, record, and inform the SIH committee and Boards on operational issues and needs

- Measure, compute, and record flow quantities each week from each Head Gate for Diversion Reporting. This reporting is a record of water flow in cubic feet per second for a ditch and is a regulatory requirement. The Diversion Report should be submitted to the subdivision's management company point of contact, Sue Blair, within two weeks of the ditches being turned off in the fall. Sue will submit it into the Summit County Water Commissioner.
 - The SIH committee chair will help Sue coordinate diversions, calls on water, and Diversion Report actions with the Summit County Water Commissioner if needed
 - Sue will share reporting, relevant information from these discussions, and decision making with the SIH committee on items that pertain to their committee area.

May			
Day	Gauge	CFS	Comment
1	0.00	0.0000	
2	0.00	0.0000	

Ditch	Year	open date	close date	Total Days	Total Cubic Yards	Max Gauge	Flume Width
Sawmill	2012	5/16/2013	8/15/2012	78	6975.7	0.34	24
Sawmill	2013	5/16/2013	8/15/2013	97	5373.2	0.3	24
Sawmill	2014	5/28/2014	8/28/2014	75	6510.9	0.35	24
Sawmill	2015	5/10/2015	10/15/2015	127	15101.1	0.4	24
Sawmill	2016	6/1/2016	8/31/2016	91	10833.9	0.38	24
Sawmill	2017	6/1/2017	10/19/2017	141	15139.9	0.4	24
Sawmill	2018	5/25/2018	9/19/2018	118	12735.4	0.4	24
Ruby	2012	5/7/2012	7/23/2012	78	1117.9	0.17	9
Ruby	2013	6/5/2013	8/24/2013	80	1138.7	0.17	9
Ruby	2014	5/28/2014	8/28/2014	92	1707.7	0.2	9
Ruby	2015	5/15/2015	8/15/2015	92	1178.0	0.15	9
Ruby	2016	6/1/2016	8/31/2016	98	2714.7	0.25	9
Ruby	2017	6/1/2017	10/1/2017	102	3454.0	0.3	9
Ruby	2018	5/25/2018	10/1/2018	122	5827.0	0.4	9
Ruth	2012	5/24/2012	8/1/2012	69	3605.2	0.28	18
Ruth	2013	5/6/2013	9/10/2013	97	5373.2	0.3	18
Ruth	2014	5/28/2014	8/28/2014	101	6608.9	0.4	18
Ruth	2015	5/15/2015	10/15/2015	122	6177.9	0.3	18
Ruth	2016	6/5/2016	8/1/2016	57	2839.3	0.25	18
Ruth	2017	6/1/2017	10/15/2017	95	5436.1	0.3	18
Ruth	2018	6/2/2018	10/1/2018	114	10599.5	0.4	18

- Record work performed daily (hours worked, tasks by area, mileage, major issues/emergencies associated with the work). Submit a copy of work hours to the SIH committee and Sue Blair for payment.
- Provide information, assessments, proposals, or data to the SIH Committee on system issues, equipment needs, or other repairs as requested.
- Assist in the capture and recording of various irrigation centric performance metrics as requested by the Boards or SIH committee.
- Provide operational updates to the SIH committee who will then report out at Board meetings. If major proposals or issues will be presented, attendance at the meeting may be required.
- Once the Head Gate is closed, walk the entire ditch to ensure that all water has stopped flowing and that the laterals are open in preparation for spring runoff.
- Develop an ongoing communication process with other stakeholders and service providers to the subdivision (...Stable Manager, CRS, RKR, ARC, etc.) to coordinate watering schedules and turn water on and off as needed throughout the season for weed spraying, dragging, seeding, harvesting, etc.

Irrigation Tools

- Shovel, Pick, Ax
- Long Handled Fork Rake
- Long Handled Trimmers (loppers)
- Saws & trimmers
- Hammer
- Nails/Screws
- Treated wood
- Bentonite (50-75 sacks)
- Canvas Dam Building Materials: 6-8 2x4s; 6-8 4'x4' square pieces of canvas or waterproof tarp
- Sand Bags
- Ditch digging equipment

Typical Irrigator Schedule and Hours

# of Weeks			Estimated Hours Per Week	
1	2-May	8-May	15	
2	9-May	15-May	15	
3	16-May	22-May	15	
4	23-May	29-May	15	
5	30-May	5-Jun	15	
6	6-Jun	12-Jun	15	
7	13-Jun	19-Jun	15	
8	20-Jun	26-Jun	15	
9	27-Jun	3-Jul	15	
10	4-Jul	10-Jul	15	
11	11-Jul	17-Jul	0	Estimated Date - Water Off / Hay Harvest
12	18-Jul	24-Jul	0	Estimated Date - Water Off / Hay Harvest
13	25-Jul	31-Jul	0	Estimated Date - Water Off / Hay Harvest
14	1-Aug	7-Aug	15	Water Back On
15	8-Aug	14-Aug	15	
16	15-Aug	21-Aug	15	
17	22-Aug	28-Aug	15	
18	29-Aug	4-Sep	15	
19	5-Sep	11-Sep	15	
20	12-Sep	18-Sep	15	
21	19-Sep	25-Sep	15	
22	26-Sep	2-Oct	15	
23	3-Oct	9-Oct	15	
24	10-Oct	16-Oct	15	
25	17-Oct	23-Oct	15	Estimated Date - Water Off
Total Hours			330	
Pay Per Hour			\$ 25	
Estimated Spend			\$ 8,250	

***NOTE THAT THE HAY HARVESTING AND GRAZING MAY NOT BE THE DIRECT RESPONSIBILITY OF THE IRRIGATOR, BUT AWARENESS AND COLLABORATION ON THESE IS CRUCIAL**

Hay Harvesting Responsibilities

- Yearly soil testing should be used to determine soil health needs and address issues
 - Addition of nitrogen to improve soil health (graze, seed with protein rich organics mix)
 - Kill weeds, remove rocks, exterminate rodents and fill/compact holes with top soil
- Each spring a drag harrow should be used in the meadows to break up the thatch, manure, and spread hay seed. Rocks and debris should be removed and all holes filled and compacted.
- Hay is typically harvested in late July/early August.
 - Notify SIH committee chair at least seven days prior to harvesting the hay
 - Divert water and dry out the meadows at least two weeks prior to harvesting

- Harvest hay when purple tops sprout (this is the highest level of protein in hay)
- Graze meadows after harvest if possible
- Offer the subdivisions owners the first right of refusal to purchase Ranch hay at the going price in the valley minus transport charges. The harvester should work with each resident who purchases hay to coordinate payment and delivery.
- Baled hay should be removed from Ruby Ranch within 30 days of harvesting
- Large improvements and repairs should be scheduled in the spring when the grass is low and, in the fall, when the ditches can be dried out

Meadow & Hay Tools

- Tractor
- Sickle Mower, Hay Rake, Baler
- Soil Test Kit
- Drag Harrow
- Seeder

Grazing

- Assist the SIH committee in the determination of grazing opportunities each season
 - The two southern K Tracts should be reserved for horse only grazing unless otherwise approved
 - Livestock will graze as many of the meadows as possible with attention to not overgrazing
 - Owners may seek approval from the SIH committee to graze their horses in the common meadows, once the harvest is complete, with special attention to not overgrazing
 - Owner must provide appropriate fencing to contain animals in designated areas, if no permanent fencing exists
 - Owners are required to maintain their private meadows in a manner that maintains the viability of the soil and grasses
 - The plan should be based on grass quality and capacity by location and develop a standard grazing plan to include refinement of key elements, including the following;
 - *Is a variance needed to Art VII, Section 5 "No animal shall be kept on any lands in the subdivision except ordinary household pets and horses ..." to allow cattle?*
 - *How many livestock can graze for how many consecutive days on which meadows. This depends on the season, forage quality, composition, and type of livestock. For example, a horse needs 30lbs of dry matter per day, so depending on the grass available, a herd of x horses/x cattle should be able to graze x to x acres for a period of x consecutive days.*
 - *The herd should not be allowed to graze an area being irrigated, but rather moved to another meadow or restricted from the irrigation area*

ANNEX C: Definitions and Calculations

Water Right Appropriation Date is the date an owner is granted the said water right.

Irrigation management is the determination of when to irrigate, where to irrigate, and how much water to apply to target locations for specific durations.

Head Gate is the primary gate or valve at aqueduct or other source that can be opened or closed to regulate the flow of water entering an irrigation system (of lesser gated canals and irrigation ditches).

Diversion Box is a structure, often wooden, that is used to change the direction of water flow.

Ditches divert water from a creek or other large water source. They are larger than laterals and are designed to convey water to smaller laterals or diversion areas.

Laterals branch off of the main ditch and carries less water for delivery to specific meadow.

Prescriptive Easement allows for reasonable access by water right users to maintain and operate a ditch. The standard easement allows 15' of access on either side of the ditch and requires the landowner to be notified prior to crossing property lines.

Head- measurement of the energy in a fluid. Units are typically length.

- Total head at a given point is the sum of three components
 - Elevation head, which is equal to the elevation of the point above a datum
 - Pressure head, which is the height of a column of static water that can be supported by the static pressure at the point
 - Velocity head, which is the height to which the kinetic energy of the liquid is capable of lifting the liquid

Flow rate units can be expressed in the following ways;

- Volume/time
 - Open channel flow
 - Cubic feet per second (c.f.s.)
 - second-feet
 - Pipe flow
 - Gallons per minute (g.p.m.)
- Or, Area x Depth or depth
 - Acre-foot = volume of water that would cover 1 acre to a depth of 1 foot
 - 12 acre-inches
 - 43,560 cubic feet
 - 325,851 gallons
 - Conversion factor calculations

- 1 c.f.s. for 24 hours ≈ 2 acre-feet, or 1 c.f.s. ≈ 1 ac-in/hr.
- 1 c.f.s. = 448.8 g.p.m.
- Miner’s inches, 38.4 miner’s inches = 1 c.f.s. (Colorado)

Colorado Decision Support System (CDSS) is a water management system developed by the Colorado Water Conservation Board (CWCB) and the Colorado Division of Water Resources (DWR) for each of Colorado’s major water basins. It can be accessed at <https://dwr.state.co.us/Tools/Structures/>

Agricultural purposes are typically defined as the raising, cultivation, drying, or storage of agricultural products for sale, or the storage of machinery or equipment used in support of agricultural production by the same farm entity. For a property to be classified as ‘agricultural’ based only on the drying or storage of agricultural products, the products being dried or stored must have been produced by the same farm entity as the entity operating the drying or storage facility.

Overwatering is deep percolation below the root zone

Hay Calculations

- Hay Production Table Key
 - 1 US Ton = 2000 pounds
 - Large Round Bales (5 x 6) = average 1200 pounds each, or 18.4 square bales. These have been converted into Square Bale counts (see hidden comments in each cell for round bale counts).
 - Square Bales (16 x 19 x 36') = average 65 pounds each
- Round Bale to Square Bale Conversion: # Rounds x 1200 lbs. / 65 lbs. = # square bales
 - *Large round bale weights and counts provided by John Longhill*
- Tonnage Calculation:
 - Large round Bale Weight Average (# Rounds x 1200 lbs. / 2000 lbs.)
 - Square Bale (# Bales x 65 lbs. / 2000 lbs.)

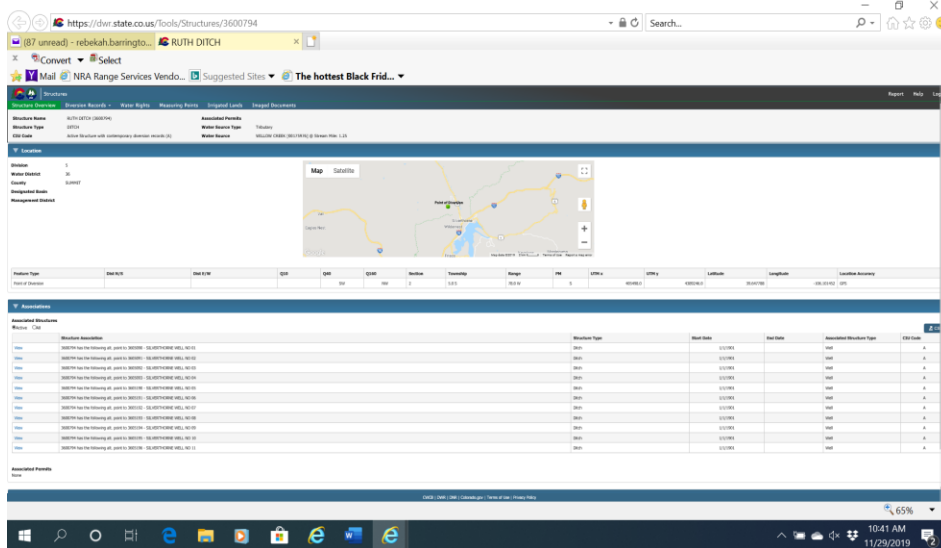
Ruby Ranch Domestic Well Profiles

Structure Type	Structure Name	Structure ID	Originatio n Date	Permit #	Permit Status	Issuance Date	Source
Well	Well #1	3605159	1/1/1901	25333-F	Active - Renewed	3/2/2015	Sawmill Groundwater
Well	Well #2	3605160	1/1/1901	8618-AD	Active - Denied	5/27/1982	Sawmill Groundwater
Well	Well #8	3605157	1/1/1901	Historical Structure	Inactive	n/a	Sawmill Groundwater
Well	Well #11	3605158	1/1/1901	25332-F-R	Active - Renewed	9/16/1983	Sawmill Groundwater

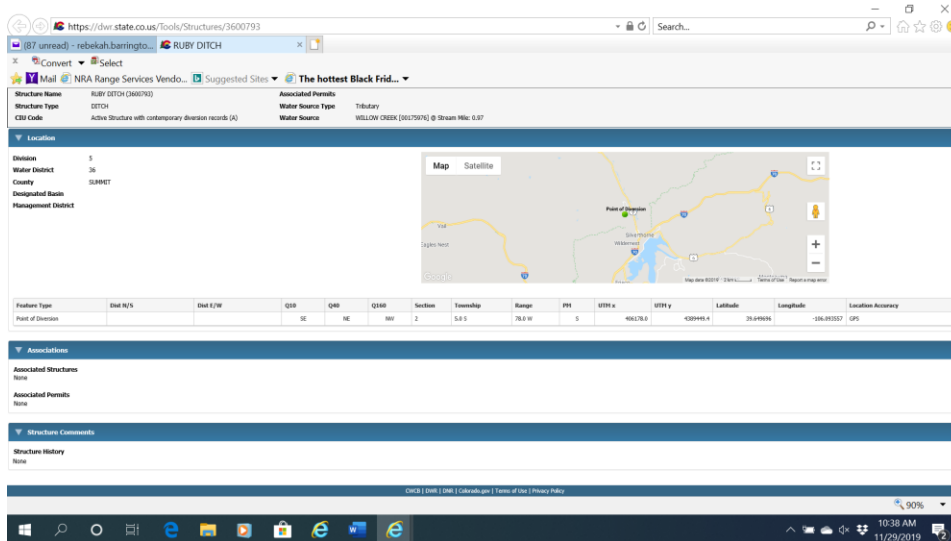
ANNEX D: Rights, Easements, and Agreements

Colorado Decision Support System (CDSS) Records

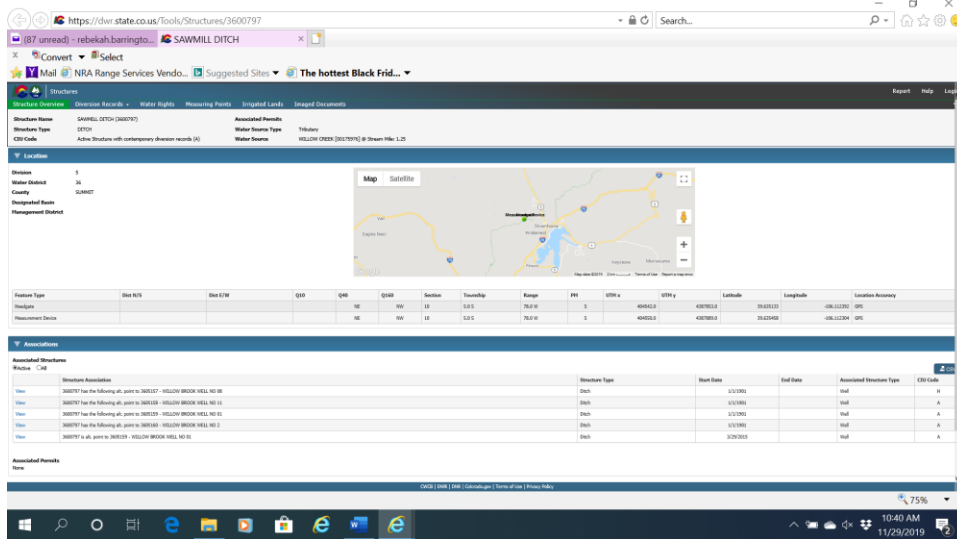
Ruth Ditch Record (reference CDSS Ditch #3600794)



Ruby Ditch Record (reference CDSS Ditch #3600793)



Sawmill Ditch Record (reference CDSS Ditch #3600797)



- **JMC – Ruby Ranch Water Rights Quit Claim Deed** (See paper copy in RROA files)
- **Case No.: 84-CW-284, September 31, 1988** (See paper copy in RROA files)
Grants .6 c.f.s of the Ruth Ditch’s 3.0 c.f.s water rights to the Town of Silverthorne (20% of water right) for domestic and municipal use.
- **Relevant Covenants**

Article III - PROPERTY RIGHTS

Section 2 (a) and (d): include the provisions that dedicate common Tracts to WBMD, and the water rights to the RROA. **Article VII - GENERAL RESTRICTIONS on ALL TRACTS**

Section 5: Restricts the type and number of animal’s owners are allowed to keep on their property to domestic pets (2 dogs, 2 cats) and horses

Section 6: Limits the number of horses allowed on any residential lot to four (4), requires that the animals be owned or leased by the lot owner or other members of the lot owner’s household, that additional food source to grazing are provided so that overgrazing is avoided

Section 7: Grants the Owners first right of purchase on hay and the Owners Association ownership of “all of the hay in the irrigated meadows of the subdivision...”, together with the responsibility “for irrigation of the meadows and fertilization, cutting and harvesting of the hay each season.” This was revised as follows:

- **Ruby Ranch Covenants - Resolution Dated September 27, 1999** (See paper copy in RROA files)

- Revises Article VII, Section 7 of the Covenants, transferring the common hay meadows from the RROA, over to the WBMD. It also states that the RROA retains title to the water rights associated with the three irrigation ditches, but gives the WBMD the right to manage/maintain the ditches and harvest the hay in the manner directed in Article VII, Section 7 of the Covenants.

ARTICLE X - EASEMENTS RESERVED

Section 2: Details the Easements and Rights Reserved for irrigation management. It aligns to federal regulations and assigns a perpetual easements 20 feet in width across all of the lands in the subdivision for the purpose of construction, maintaining, and operating irrigation ditches and laterals

Ruby Ditch access via the Lowe Ranch is provided via the Prescriptive Easement referenced above

ANNEX E: Master Irrigation Map

[Mapping In progress: This map will be replaced by a GPS - Lidar map of the Ruby Ranch Irrigation system up into Eagles Nest Wilderness Area with 100 ft markers]

Mapping POCs

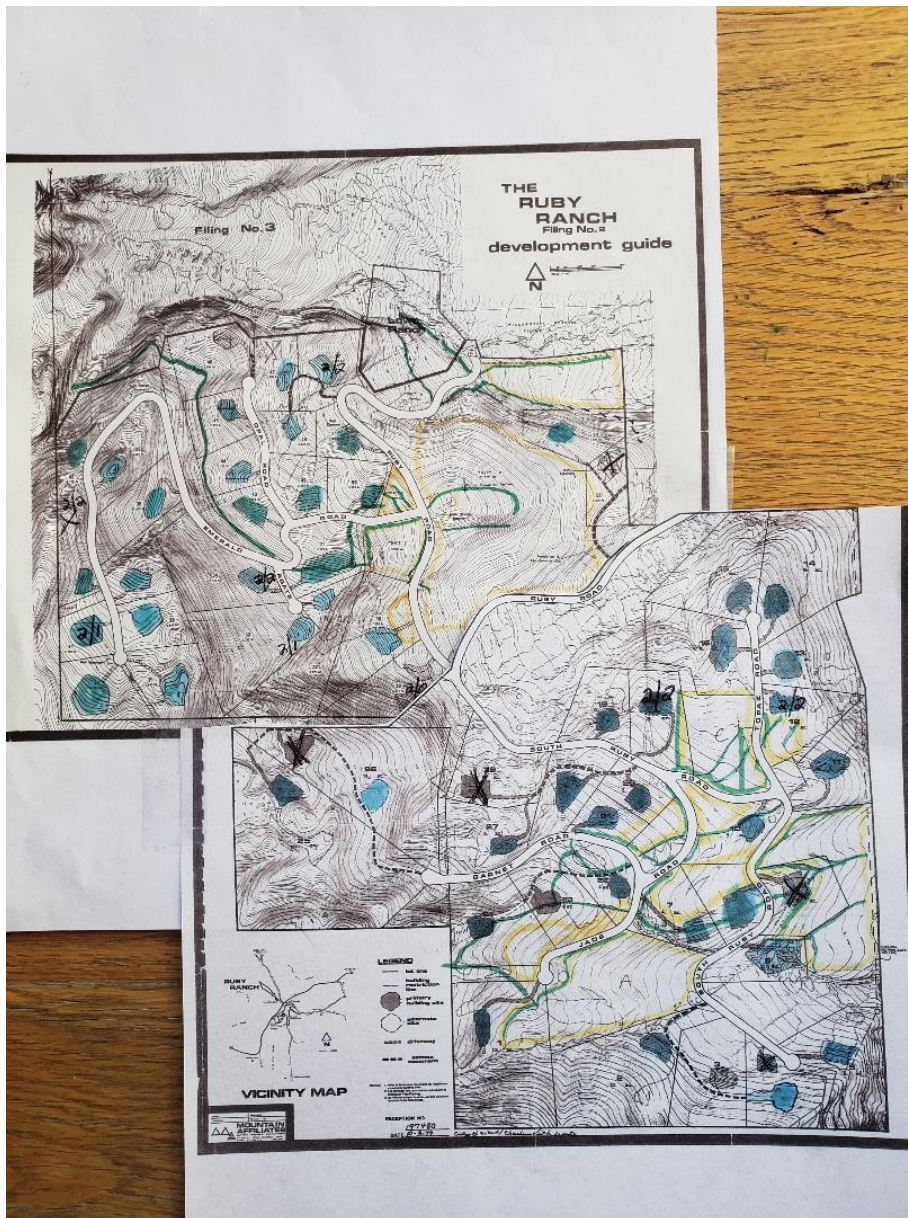
Trip McLaughlin, Project Manager

Karlie Kendall, GIS Analyst

North Line GIS

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ANNEX F: Studies and Research

USDA - Natural Resources Conservation Services (NRCS) Summary

Date: August 21, 2019

NRCS Lead: Derrick Wyle, Soil Conservationist, Derrick.wyle@usda.gov
258 Center Dr, Glenwood Springs, CO 81601
(970)457-0675 Cell; (970) 945-5494 Office
<https://www.nrcs.usda.gov/wps/portal/nrcs/site/national/home/>

SIH Attendees: John Longhill, Jon Rovik, Becky Richmond, Rebekah Barrington

Overview

Derrick and his associate, Kathleen Knight, conducted an on-site visit with four SIH committee members for over three hours. He was given an overview of the subdivision history, management and operations structures, the Irrigation & Meadow Management plan, and strategic improvement goals (maximizing water right usage; increasing hay yield; improving meadow and soil health).

The main objectives of this visit were to:

- obtain a current state assessment on the irrigation system, meadow grass and soil health
- identify improvement opportunities
- design solutions that help achieve improvement goals

Following the overview, the group completed a physical tour of the irrigation system, examined known issue areas, and reviewed a list of predefined questions. The committee found the visit to be extremely informative and instructive.

Current State Summary

The current system has historic value and despite repair needs, it is working fairly well on the three hay meadows in Filing 2. Several improvements opportunities were identified in Filing 2, but the majority of work needed is on the Filing 1 portion of the ditches and laterals. The main issues include:

- **Water conveyance and leakage** in ditches and laterals that is resulting in water loss, low flow volumes, and erosion. Possible solutions include;
 - Reestablish (trench/dig) ditches and associated laterals, redefining the trenches, removing silt, and vegetation
 - Alternative techniques will be needed to properly clear the Sawmill between the ranch boundary and the Head Gate in the Wilderness area.
 - Run water at a higher capacity/volume (maximize water right flows) based on soil type, slope, length of run and quantity of water available.

- The committee noted that despite having 4.0 c.f.s. of rights on the Sawmill ditch, many sections of this ditch and the others can't handle a full load without flooding. This will need to be fixed.
 - Replace/repair several (3) wooden diversion boxes. Derrick affirmed that the use of wood is an effective material that is still used in irrigation system design.
 - Add piping to improve water flow in eroded or steep elevations
- **Soil composition** should be tested and steps taken, as needed to achieve the right balance of minerals, organic matter, water and air. Nitrogen is an important element in fertile, healthy soil. It is essential for plant health and growth. Plants use it to make their DNA, proteins, and amino acids. Plants with a nitrogen deficiency will stop growing even if they have enough water. Soils that are acidic, with a pH level of less than 7, are often lacking in nitrogen. Possible solutions for nitrogen deficient soils include;
 - Add a nitrogen-rich fertilizer.
 - Some committee members raised concerns over the negative effects of using nitrogen rich fertilizers. Derrick confirmed that problems can occur if too much nitrogen is present in the soil but this is not a likely risk for us.
 - Excess nitrogen can result in the loss of certain plant species, depletion of soil nutrients, an increase in algae, and an overall dependency on usage if excessive. An imbalance of soil nutrients causes a depletion of other important minerals such as calcium, phosphorus and magnesium. When the nitrogen abundance reduces important minerals, toxic elements such as aluminum can proliferate and harm plants and aquatic life.
 - Add compost. Leverage the decomposing process that creates nitrogen and can be added to the soil to boost levels. This can be accomplished by adding compost or grazing animals, which is the ideal solution.
 - Plant nitrogen fixing plants (broadleaf, legumes, clover mix) that pull nitrogen from the air and store it in their roots. The roots develop nitrogen nodules which look like little lumps. The actual growing of these plants doesn't help a nitrogen deficiency, the decomposition of these plants do. When the plant starts to die, the nitrogen nodules release stored nitrogen.
- **Weed, Mole/Vole infestations** causing erosion, noxious weed growth and water waste
 - The meadows should be sprayed for weeds in accordance with the Colorado Department of Agriculture's recommendations and weed fact sheet methods
 - Vermin infestations should be exterminated and holes filled with top soil and compacted

- **No current map of the irrigation system** so it is difficult to track assets, issues and improvements. An up to date and accurate mapping is an important management tool for tracking and setting priorities.
 - Create a master irrigation map using the Lidar technology (as currently prototyped on the Sawmill w/ numbered pointers every 100 ft) and mark existing inventory, issues, and improvements.

Other Recommendations and Best Practice Techniques

- Graze as many of the meadows as much as possible to improve soil and grass health naturally, without overgrazing
- The swamp grass is high in protein (Nebraska Hay) and is not bad for hay
- Investigate opportunities to use excess irrigation water to help reduce fire danger and/or fight a fire
- A Ditch Plough, mini excavator, saw blade, or Ditch Witch are the best tools to use to reestablish ditches and their associated laterals.
- The standard 'rule of thumb' measurement for irrigation is 1 c.f.s irrigates 40-acres. This can be refined by calculating the consumptive use of the crop; irrigation input = crop usage + evaporative losses. Availability versus usage metrics for the Ranch's 7.4 c.f.s. should be refined.
- In order to keep water velocities safe and limit ditch erosion ditch grades should be set at 0.2ft of vertical drop per 100 feet of length. Any ditch grade steeper than 0.5ft drop/100ft of length risks severe erosion/downcutting.
 - Accurately measuring irrigation conveyance flow and overall system inefficiency/water loss and absorption is not easy but it is important. The goal is to achieve a high level of Irrigation Efficiency (IE) coupled with Irrigation Uniformity (IU) IU looks at how evenly water was applied across the entire field. Bad UI tends to lead to poor efficiency. It is difficult to get good uniformity on our steep, undulating slopes. The goal is for the least watered part of the field to receive an amount equal to the desired amount, or that you need to meet the crops water needs at the toughest part of the field at the expense of over-irrigating the easiest to water areas. Most water measurement devices either sense or measure velocity (current meters, propeller meters, vane deflection meters, float and stopwatch), or measure either head or pressure (Flumes, Orifices, Venturi meters, Weirs). Measuring tools, tables, charts, or equations are then used to calculate the corresponding discharge.
 - The decision for how long to run the water should be guided by measurements or at least the use of an Irrigation Infiltration Probe (Water Stick). The irrigation water should be turned on at the top of the meadow and run until the lower portion of the meadow is saturated. Saturation will likely be much deeper at the top of the meadow (i.e., 10 ft deep) versus at

the bottom (i.e., 5 ft deep). Most meadow vegetation in our region has 2-5 feet of root base the water must reach on a regular basis.

- The key measurement starts with water volume at the Head Gate/Parshall Flume and then periodic measures at various points downline in the system that calculate water loss and/or absorption.
- The most effective measure for reducing surface runoff is to decrease the cutoff time.
- The most effective measure for reducing excessive percolation is to reduce the check length by $\frac{1}{2}$ along with a corresponding reduction in cutoff time due to a decreased advance time compared to the original check length. This measure, however, may increase the surface runoff compared to that of the original length.
- Leveraging water diversion tools will increase water conveyance efficiencies, enabling more of the meadows to be watered with less c.f.s.
 - Flumes are currently used and should be repaired to increase productivity
 - Sand bags or natural obstructions
 - Canvas dams have been used in the past and should be leveraged in the future for water diversion. Approach is to lay canvas dam across the ditch and run enough water to fill up the ditch behind the dam, slurry the Bentonite in the water, let it sit until it drains or settles out. IF it rapidly drains, fill the ditch back up and add more Bentonite. Once there is little drainage, move the canvas dam downstream and repeat four or five times, moving down the ditch. Two or three dams can be simultaneously set and filled in at least two locations at a time.
- Reducing sediment load in the ditches and laterals will increase water flows and reduce absorption within the trench. Possible solutions include;
 - Reducing surface runoff
 - Redesigning inlets into tailwater ditches
 - Redesigning tailwater ditches
 - Lining of tailwater ditches
 - Injection of polyacrylamides (PAM) into the surface runoff (PAM causes fine soil particles to flocculate, settle, and seal the ditch)
 - Sediment ponds to allow sediments to settle out of the water
 - Grass strips at the end of the field to trap sediment. A strip of grass will increase friction of surface water, slow the water, and allow the sediment to deposit rather than be carried off the field.
 - Grass lined drainage ditches
 - Recirculation systems or storage/reuse systems to prevent the runoff from leaving the field
- The NRCS and DARCA have Farm Bill grants available for design, equipment, and improvement work but our subdivision does not qualify for these since the assets are owned by WBMD (a government entity) and our residence are typically in a higher income bracket than edibility allows.

Additional Research

- 2020 Project: Researched the idea of moving from the Ruby to the Buffalo Ditch. Historically the Buffalo ditch was a diversion off of Willow Creek near the Lowe homestead and was used to irrigate the Smith Ranch meadows, the meadow east of the Gatehouse, and the willows running along the north side of Ruby road leading up to the gate. Silverthorne purchased the Buffalo Ditch water right, revised its designated usage to municipal, pulled the Head Gate, and abandoned the ditch. This ditch is not currently operational and the Ranch has no legal interest in it. Based on this research project, it is not recommended to move over to the Buffalo ditch and abandon the Ruby Ditch. The Ruby Ditch is the most direct and efficient way to source from Willow Creek and convey it to the 6+ acres of hay meadow in North K.

For future reference, there are a number of things involved with getting a water right transferred to a new ditch; legal determination, Board approval, the prosecution of a water court case, negotiations with the property owners, and then the physical work. If the Ranch were able to use the Buffalo Ditch Head Gate it could only be used to convey water to Lower Tract K for irrigation and could not be used to irrigate any portion of the former Smith Ranch or willows running along Ruby Road.

ANNEX G: 2019-2021 Improvement Plans

3 Year Goals

- Protect Agricultural Water Rights
- Maximize Water Right Usage
- Improve Soil & Meadow Grass Health
- Eliminate Meadow Weeds & Erosion
- Increase Hay Yield
- Improve Operational Efficiencies & Value

+++++

Year 1 (2019) Focus Areas & Progress

- **100% Complete** - re-establish the SIH committee, protocol, and assign irrigation & hay leads
- **100% Complete** - contract a ditch rider to manage the irrigation system for the 2019 season
- **100% Complete** - contract a harvester to cut/bale/deliver the hay in 2019
- **100% Complete** - document historical and current irrigation and hay operations
- **100% Complete** - engage environmental experts, local specialist, and resources to assess current state conditions and provide recommendations on future state improvements
- **100% Complete** - document, design, and plan improvements
- **100% Complete** - start working on improvement projects
-
- **100% Complete** - create an inventory of irrigation and meadow assets
- **100% Complete** - develop and begin implementation of an Irrigation and Meadow Management Plan (IMMP)
- **100% Complete** - contract with a single service provider who will manage the irrigation, improve the assets, harvest hay, and provide livestock for grazing in the 2020 season
- **25% Complete** - repair existing wire fencing between Tract K grazing meadow and north Tract K hay meadow to secure boundary for livestock grazing
- **25% Complete** repair wood fencing on the eastern boarder of Tract K and along Ruby Road
- **25% Complete** - create a Master Irrigation map showing the entire irrigation infrastructure, assets, and issue areas
- **25% Complete** - re-establish ditches/laterals and repair irrigation assets to improve current operations
- **25% Complete** - implementation of the Irrigation and Meadow Management Plan (IMMP)

Year 2 (2020) Focus Areas & Progress

- **100% Complete** - confirm what is required to obtain a variance from the RROA to Article VII, Section 5 of the covenants that prohibits any livestock, outside of horses, from being 'kept' on the lands, so that cattle can be brought in for a few months to graze
- **100% Complete** develop an approach and plan for grazing meadows (with and w/o permanent fencing)
- **100% Complete** - research and make a determination on moving from the Ruby Ditch to the Buffalo Ditch for irrigation of the North K hay meadow.
- **100% Complete** – implementation of the Irrigation & Meadow Management Plan (IMMP)
 - continue to improve the ditches and laterals so they can carry the volume of water decreed
 - continue to make meadow improvements that improve soil health, increase hay quality and harvest volumes
 - research options to use excess irrigation water for the recharging of our potable water wells
 - continue to prioritize, obtain approvals, and implement the IMMP Improvement Log
- **50% Complete** - repair existing wire fencing between Tract K grazing meadow and north Tract K hay meadow to secure boundary for livestock grazing
- **50% Complete** repair wood fencing on the eastern boarder of Tract K and along Ruby Road
- **25% Complete** - validate common track acreage data versus acreage that can be hayed and update reporting
- **25% Complete** - create a Master Irrigation map showing the entire irrigation infrastructure, assets, and issue areas
- **25% Complete** - re-establish ditches/laterals and repair irrigation assets to improve current operations
- **0% Complete** review and enhance guidelines and rules for the irrigation, hay harvest, and grazing on owner Tracts
- **0% Complete** - create an Owner focused irrigation orientation session to review the IMMP and operations

Year 3 (2021) Focus Areas & Progress

- Ongoing management of the irrigation and hay harvesting per the Irrigation & Meadow Management Plan (IMMP)
 - continue to improve the ditches and laterals so they can carry the volume of water decreed and improve current operations
 - continue to improve soil health, increase hay quality and harvest volumes
 - research options to use excess irrigation water for the recharging of our potable water wells

- continue to prioritize, obtain approvals, and implement the IMMP Improvement Log
- finish repair of the existing wire fencing between Top of K grazing meadow and North K hay meadow to secure boundary for livestock
- finish repair of the wood fencing on the western boarder of Top of K, and the eastern boarder of South K and Ruby Road
- improve reporting (1) re-validate the acreage of the common tracks and confirm acreage being hayed, (2) add a health score to each common track to help prioritize improvements
- finalize the GPS Master Irrigation map showing the entire irrigation infrastructure, assets, and issue areas
- review and enhance guidelines and rules for the irrigation, hay harvest, and grazing on owner owned Tracts
- create an owner focused irrigation orientation session to review the IMMP and operations

2021 Irrigation and Meadow Budget

WMBD 2021 GENERAL FUND for SIH	2021 Budget Request	Description
Irrigation		
Ditch, Lateral, Diversion, Pond Repair/Creation	\$ 5,000	Irrigation Improvements - Sawmill, A, K
Master Irrigation Map (Lidar w/100' markers)	\$ 750	Digitizing/Printing of map once it is completed
Irrigation Management (Irrigator)	\$ 8,500	Irrigator/Ditchrider wage
sub-total	\$ 14,250	
Hay Meadows & Fencing		
Meadow Fencing & Repairs (Remainder ok K)	\$ 7,000	2020 estimate, repair wire and wood fences in K
Rock Removal / Fill / Compact	\$ 500	Tract A, B, C
Drag / Spray Weeds/ Soil Test & Treatment	\$ 8,300	Tracts A, B, C, H, K, O, P
Equipment Rental	\$ 1,500	Rental of various equipment (backhoe, mini-ex, etc.)
sub-total	\$ 17,300	

IMPROVEMENT LOG

Filing	Tract/ Lot	Ditch	Issue Description	Recommended Improvement	Timing	Estimated Cost
1 & 2	All	All	2021 Independent Contractors needed for Irrigation and Hay Operations.	Identify and complete contracts for these services	Spring 2021	
	All	All	Water not flowing efficiently through all laterals in the target meadow	Continue to repair and improve the ditch, laterals, and diversions	2021	
	All	All	No master map of the irrigation and hay infrastructure exists	Finish translating the manual master map into the GPS tool.	2021	
2	Top of K	Ruth	There is excessive pooling, erosion, and water loss across the top section, even when the irrigation is diverted.	Work should continue on correcting the design of the laterals so that more acreage is properly flooded and erosion is reduced.	2021	
	North K	Ruby	The north lateral runs along the meadow access road and dissipates at the end of the east end of the meadow. Rodent tunnels between the ditch and the road often cause flooding.	Repair the ditch sidewalls and plug the leakage points in the road	2021	
	South K, Top of K	n/a	Existing wire fencing between Tract K grazing meadow and north Tract K hay meadow, AND the wood fencing on the eastern boarder of Tract K and along Ruby Road need repair	Replace or repair wire and wood meadow fencing as recommended.	2021	
1	A	Sawmill	Hay not cut in some areas	Remove rocks from meadow and fill/compact holes w/ topsoil	Spring 2021	
	C	Sawmill	Hay not cut in some areas	Remove rocks, especially from N/E side and fill/compact holes w/ topsoil; address marshy area by creating additional diversion channels	Spring 2021	
	Lot 24	Sawmill	The diversion point flume above Lot 24s pond is broken and does not divert water properly. Water has to be diverted away from this section.	Repair or replace the diversion structures, clear the ditch and repaired sidewalls.	2021	
	Lot 7	Sawmill	Wet/marshy area in the N/W corner, poor grass quality, erosion, and thistles. No connection into the northern lateral that runs into Lot 10.	Re-establish the connection between the western and northern laterals	2021	
	A, C, H, B, Lot 7, 8, 10	Sawmill	There are breaks in the sidewalls at the Head Gate making it difficult to capture water granted c.f.s. out of Willow Creek, and breaks along the run, making it difficult to efficiently transport water to destination meadows. There are large tree/rocks blockages along the run that dramatically impact water flow and volumes.	Ongoing work is needed to improve the system enough to reduce operational overhead and maximize water right usage on Filing 1	2021	
T&M ESTIMATE						\$ -