

ArkDSS Memorandum Final

To: Bill Tyner and Kelley Thompson, Colorado Division of Water Resources
From: ParsonsWater Consulting
Subject: Task 2.1 – Amity Mutual Irrigation Company Operating Memorandum
Date: April 2019

INTRODUCTION

One of the Task 2.1 objectives is to:

Develop and document an understanding of the operations of key water use facilities in the basin in order to accurately represent the use and operations in the water rights allocation modeling. This understanding will be developed through interviews with DWR personnel, operators of large canal and reservoir systems, and representatives of federal facilities.

A number of Amity Mutual Irrigation Company operational components have been identified as key structures for the Arkansas River Decision Support System (ArkDSS) surface water modeling efforts. The purpose of this memorandum is to document physical, legal, and operational aspects of those key structures.

The information provided in this memorandum was developed from publicly accessible sources and information provided by Amity Mutual Irrigation Company. (AMIC) Information in this memorandum is believed to be accurate. However, this information should not be relied upon in any legal proceeding.

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SYSTEM OVERVIEW

Construction on the Amity Canal began in 1887 by the Amity Canal and Reservoir Company. The Amity Canal system continued to be developed through ownership of a series of land and water companies through 1936, when the AMIC was incorporated. Share ownership was originally established based on land ownership at a ratio of approximately one share per acre of irrigated land. There are currently 34,662.82 outstanding shares of stock issued in the company.

The headgate of the Amity Canal is located in Bent County on the north bank of the Arkansas River in Section 36, Township 22 South, Range 48 West of the 6th Principal Meridian, approximately 10 miles downstream from the dam of John Martin Reservoir. The Amity Canal is approximately 80 miles long, extending from its headgate to near the Colorado-Kansas

Stateline. Along the length of the canal, the company has water rights on four tributaries from which they can withdraw water for irrigation, including Big Bend Draw (aka Wiley Drain), Goulds Draw (aka Pleasant Valley Drainage), May Valley Seepage Stream, and Big Sandy Creek. The Big Sandy diversions are typically available during or after rain events, while the other diversions are typically available throughout the irrigation season.

The AMIC system is divided into four divisions that include, from west to east, the Lamar, Sand Creek, Buffalo, and Holly divisions. There are 162 laterals on the Amity Canal. The AMIC system also includes the Great Plains Reservoirs (Neesopah Reservoir; Nee Gronda Reservoir; Neenoshe Reservoir; and Neeskah Reservoir). The Great Plains Reservoirs, located in Kiowa County, are filled by water diverted from the Arkansas River through the Fort Lyon Canal to the Kicking Bird Canal, which serves as the filler ditch for the Great Plains Reservoirs. The AMIC system also has water stored in John Martin Reservoir that is released to the Amity Canal headgate on the Arkansas River.

Key facilities identified in the AMIC system are as follows. Also listed below are ditches and reservoirs which are not owned by AMIC but are part of the AMIC system and are essential to system operation.

1. Amity Canal
 - Arkansas River Diversion
 - Big Bend Draw Diversion
 - Goulds Draw Diversion
 - May Valley Diversion
 - Big Sandy Creek Diversion
2. Fort Lyon Canal and Kicking Bird Canal
3. Great Plains Reservoirs
 - Neesopah (aka Sweetwater) Reservoir
 - Nee Gronda Reservoir
 - Neenoshe Reservoir
 - Neeskah (aka Queen) Reservoir
4. John Martin Reservoir

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The general locations of the Amity Canal and Great Plains Reservoirs system and associated structures are shown on **Figure 1**.

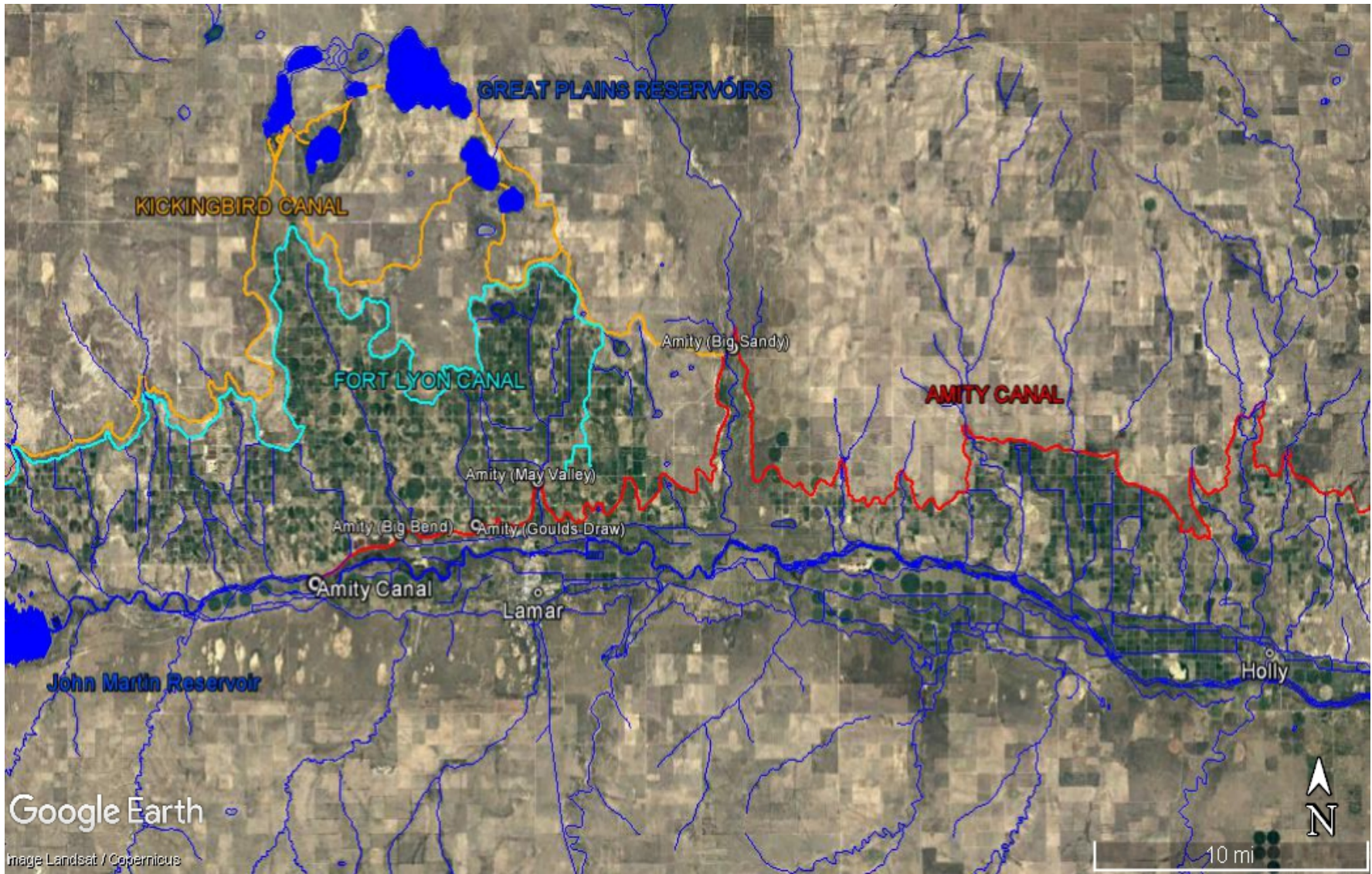


Figure 1: Amity Mutual Irrigation Company Water Resources System

PHYSICAL INFORMATION

The major structural elements in the Amity Mutual Irrigation Company's water resources system include the Amity Canal and tributary diversion points; the Great Plains Reservoirs system; and John Martin Reservoir. The Great Plains Reservoir system includes various feeder canals and delivery canals; the most significant of which are the Fort Lyon Canal and Kicking Bird Canal.

In the mid-2000s, Tri-State Generation and Transmission Association, Inc. (Tri-State) purchased close to one-half of the outstanding shares in the AMIC to support a planned Colorado Power Project (CPP) near Holly, Colorado. The CPP is anticipated to generate 1,400 megawatts of electricity and Tri-State changed the use of its shares in Case No. 07CW74 to support the industrial uses. Additional water supplies to meet the approximately 20,000 acre-feet annual projected demand at CPP include a reservoir in the Wild Horse Creek basin and both alluvial and deep wells near the power plant. Bishop-Brogden Associates, Inc. (BBA) generated a number of reports to support the water court case. No significant components of the CPP have been constructed to date.

The history, operations, and current specifications of the elements of the AMIC's water resources infrastructure are summarized below. Information and analysis from the BBA reports is included herein. Also included, for reference, is data used in the Hydrological-Institutional (H-I) Model to represent portions of the Amity Canal system.

Additional information related to a number of the structural elements and operations of nearby water districts is listed in the *Where to find more information* section at the end of this memorandum.

1. Physical Information – Amity Canal (6700607)

The Amity Canal runs along the north side of the Arkansas River. The canal is located down gradient from the Fort Lyon Canal until the Fort Lyon Canal terminates north of the town of Lamar. Three of the four tributary diversion points are in this reach, and the supply is boosted by seepage losses and return flows associated with the Fort Lyon Canal system. Beyond the end of the Fort Lyon Canal, the Amity Canal continues eastward, through Big Sandy Creek, Buffalo Creek, Wild Horse Creek and smaller northern tributaries.

Length: The length of the Amity Canal to the Kansas stateline is approximately 80 miles. The H-I Model lists a ditch length of 68 miles.

Capacity: The working capacity of the Amity Canal is approximately 500 cfs based on a review of daily records of total diversions over the 1985 to 2015 period and information from the Water Commissioner; the canal company superintendent, Terry Howland; and the Fort Lyon Canal company superintendent Jerred Hoffman. However, there are some daily records of diversions in excess of 500 cfs in 2012-2014 and higher diversion records, up to a maximum of about 650 cfs, prior to 1985.

Conveyance Efficiency: Total conveyance loss of 29.7 percent to the farm headgates is estimated

in the BBA report, based on a comparison of river diversions, storage releases, and deliveries from the main canal to AMIC laterals. The conveyance loss is weighted based on historical river diversions and Great Plains Reservoir deliveries. The H-I Model uses a loss of 30.5 percent over the 68-mile ditch length.

Conveyance losses associated with storage deliveries from the Great Plains Reservoirs system are likely less than deliveries from the Arkansas River through the main canal. Reservoir deliveries are conveyed approximately 15 miles down the Comanche Canal and delivered to the Amity Canal near Big Sandy Creek. This route is shorter than the approximately 28 miles of main canal between the Arkansas River headgate and Big Sandy Creek.

Irrigated Acreage and Crop Types: The State of Colorado's Decision Support System (CDSS) estimated 33,000 acres irrigated under the AMIC system in 2015. Additional coverages have been developed to provide snapshots of irrigated acreage over time from 1950 to 2015.

The BBA report indicates approximately 34,000 to 35,000 acres have been irrigated since appropriation, which is consistent with the value of approximately one acre irrigated per AMIC share. The majority of the acreage is under the lower reaches of the canal, near the City of Granada down to the stateline. The H-I Model uses irrigated acreage on the order of 39,000 to 40,000 acres for the 1950 to 1994 period, but actual acreage irrigated from 1995 forward is typically nearer to the 2015 value. The H-I Model acreage estimates likely include lands irrigated by numerous small irrigation rights located on tributaries below the Amity Canal that are not directly supplied by the AMIC. In addition, lands supplied solely by ground water may be included that would also result in H-I Model acreage greater than identified by the AMIC as irrigated.

According to the BBA report, the four major crops grown under the Amity Canal include alfalfa, corn (for grain), sorghum and winter wheat. Alfalfa is the predominant crop grown under the ditch, followed by somewhat equal distributions of corn, sorghum and winter wheat. The crops listed in the CDSS database for 2015 include alfalfa (~50 percent); sorghum (~20 percent); winter wheat (~13 percent), with less than 10 percent each of corn grain and grass pasture. Additional GIS coverages are being developed as part of the ArkDSS project to provide additional snapshots of irrigated acreage from 1950 to 2015.

The Division 2 office maintains more detailed coverages of total acreage, field verifications of dry up acreage, well associations, augmentation plan assignments, etc. This information may be helpful in analysis of system operations and ArkDSS consumptive use and surface water modeling.

Ground Water Use: A portion of the land served by the Amity Canal is also supplied with tributary ground water. Preliminary estimates from the CDSS coverages indicate approximately 25 percent of the AMIC lands are also supplied by tributary wells.

Return Flow Locations: Return flows from the ditch system accrue to various locations along the lower Arkansas River and some returns above the Big Sandy Creek gage. **Table 1** lists the aggregated distribution of return flows based on the general layout of the irrigated lands in relation to locations of gages and major ditch headgates (active and inactive) in Water District 67.

The layout of return flows from various canals to model network nodes should be revisited during development of the ArkDSS Surface Water Model.

Table 1: Amity Canal - Return Flow Locations

Model Node	Structure ID	Return Flow Percentage
Lamar Canal	6700614	5%
X-Y Irrigating Ditch	6700617	10%
Buffalo Canal	6700608	10%
Arkansas River near Granada gage	07134180	5%
Sisson & Stubbs Ditch	6700616	30%
Frontier Ditch	07137000	30%
Arkansas River near Coolidge gage	07137500	10%
TOTAL		100%

HydroBase Data: Diversion data are available in HydroBase for the Amity Canal from 1939 to present. Total diversions and diversions to irrigation (Use 1) are complete over the 1939 to current period. Total annual diversions from 1950 to 2015 period (see **Figure 2**) average 80,538 acre-feet per year and range from 14,114 acre-feet (2012) to over 132,000 acre-feet (1966 and 2015).

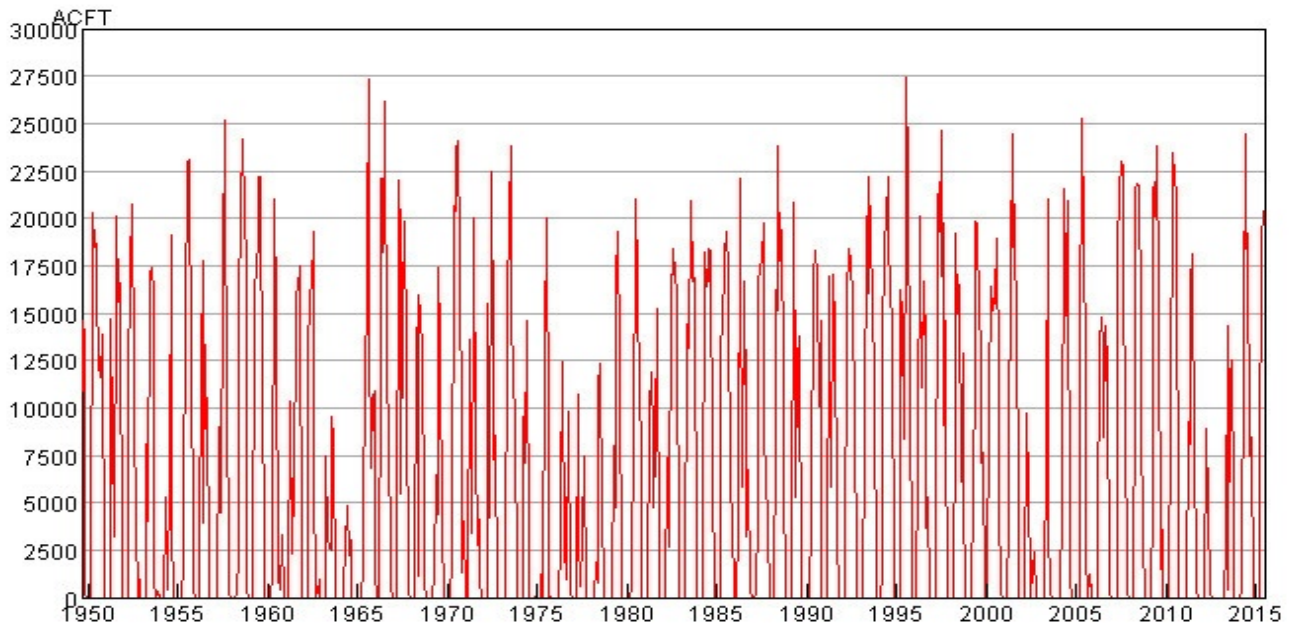


Figure 2: Amity Canal River Headgate Diversions

Storage release data from John Martin Reservoir and the specific reservoir accounts is complete from 1980 forward in the John Martin Reservoir accounting system (JMAS). Data available in HydroBase include releases (Source 2: Use 1) from 1967 to present with data missing in 1974 and 1976. The specific John Martin Reservoir account from which the release is made is generally not recorded, except for Article III water (6703564) release records for 2007 to 2010.

A hydrologic study conducted on behalf of AMIC in 1986 includes a table of 1950 to 1979 monthly Amity Canal diversions of John Martin Reservoir storage releases. The data generally matches available HydroBase data from 1967 to 1979. If needed, the data from the 1986 study should be used to fill the missing data in HydroBase for 1950 to 1966. Review of the table from the 1986 study also points to some April river diversions coded in HydroBase that may be diversions of storage releases.

Records for the four Amity Canal tributary diversions are available as infrequent records in HydroBase; however these data cover only a few years from 1950 to 2018 for each of the four tributary diversion locations. AMIC records, starting in 1971, were tabulated in support of the Tri-State change case (07CW47). The AMIC records indicate average annual total diversion from the four tributaries of 7,027 acre-feet from 1971 to 2005. The highest diversions were typically recorded at the Big Bend diversion followed, in order of decreasing magnitude, the May Valley, Goulds Draw, and Big Sandy Creek diversion locations.

2. Physical Information – Fort Lyon Canal (1700553) and Kicking Bird Canal (1700555)

The Fort Lyon Canal diverts from the Arkansas River upstream of Crooked Arroyo and the Town of La Junta. The canal runs eastward along the north side of John Martin Reservoir and the Arkansas River for about 110 miles before it terminates near the Town of Lamar. The Kicking Bird Canal leaves the main canal near the midpoint of John Martin Reservoir from where it travels approximately 27 miles to the Great Plains Reservoirs system.

Based on information outlined in the storage right decrees for the Great Plains Reservoirs, a portion of which were changed to add John Martin Reservoir (Case No. 80CW19) as an alternate place of storage, and subsequent cases, conveyance loss in the Fort Lyon Canal has been determined to be 25 percent down to the bifurcation and 15 percent additional loss for the Kicking Bird Canal (approximately 36 percent total loss from the Fort Lyon Canal headgate). Near the reservoirs, the Kicking Bird Canal delivers water to various locations: the Kicking Bird Canal goes on to Neesopah Reservoir; the Lone Wolf Canal fills Neenoshe and Nee Gronda Reservoirs; and the Satanta Canal fills Neeskah Reservoir. Losses in the Lone Wolf Canal are unknown and losses in the Satanta Canal have been determined to be 16 percent (approximately 46 percent total loss from the Fort Lyon Canal headgate). Water diverted to storage can move between different reservoirs and be subject to variable ditch loss. A total loss of 42 percent of diversions at the Fort Lyon Canal headgate (assuming an even split of deliveries to Neesopah Reservoir and the other reservoirs) is considered appropriate for modeling purposes.

HydroBase Data: Information regarding diversion data available for the Fort Lyon Canal and its correlation with the data for the Kicking Bird Canal is included in the Task 2.1 – Fort Lyon Canal memorandum. The discussion herein is focused on the Kicking Bird Canal and deliveries to the Great Plains Reservoirs, shown in **Figure 3**.

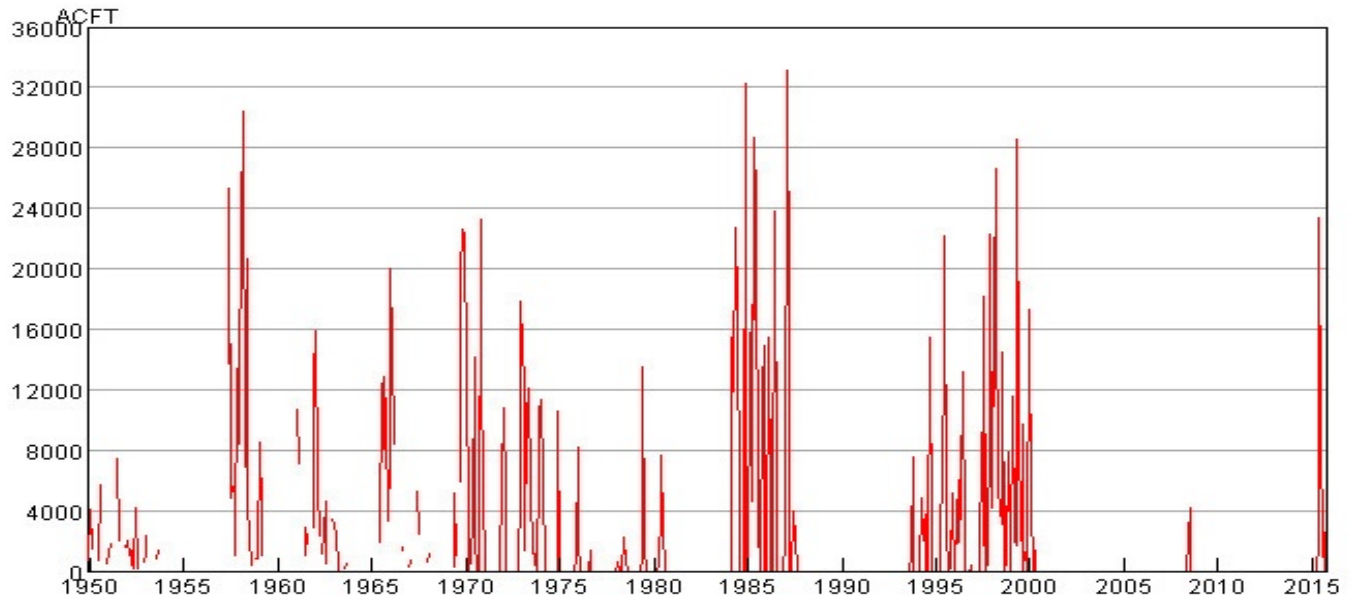


Figure 3: Kicking Bird Canal Diversions

Diversions data are available in HydroBase for the Kicking Bird Canal for all but eight years from 1970 to 2000. Data prior to 1970 is only available for parts of each year. Records are also available for 2008 and 2015. Water commissioner notes indicate Kicking Bird Canal was not used or was taken in another structure, likely John Martin Reservoir, from 2001 to 2007 and from 2009 to 2014, which corresponds with the zeroes in **Figure 3**. These comments also correspond with the reduction in available storage contents for the Great Plains Reservoirs. There are no Structure IDs in HydroBase related to either Lone Wolf Canal or Satanta Canal.

The records available in HydroBase for Kicking Bird Canal include Diversion Total, Diversion Classes, and Infrequent data and are presumed to be recorded at the bifurcation, after the estimated 25 percent ditch loss down the Fort Lyon Canal. Assuming the missing data are equal to zero during years with partial records, the total diversions available from 1950 to 2015 average 39,417 acre-feet per year, with a maximum of almost 139,000 acre-feet in 1985.

A study conducted on behalf of the Fort Lyon Canal Company (FLCC) in 1981 includes a table of monthly Kicking Bird Canal diversions from 1936 to 1974 based on FLCC Annual Reports. The data are consistent with the available HydroBase from 1950 to 1963; however the two sets of data diverge after 1963. The data from the 1986 study should be used to fill the missing data in HydroBase for water years 1954 and 1955.

Missing diversions for the early-1980s could be estimated based on a correlation with Fort Lyon Canal river diversions and available storage contents in the Great Plains Reservoirs during that period. Missing data in the late-1980s and early-1990s for the Kicking Bird Canal could be set to zero since Fort Lyon Canal diversions in HydroBase are equal to the estimated Fort Lyon Canal diversions from the H-I Model during that period. Great Plains Reservoir contents data are not available during this period and this approach should be revisited in subsequent modeling efforts.

3. Physical Information – Great Plains Reservoirs (various Structure IDs)

The AMIC system also includes the Great Plains Reservoirs (Neesopah Reservoir 1703605); Nee Gronda Reservoir 1703606; Neenoshe Reservoir 1703607; and Neeskah 1703608, aka Queen, Reservoir). The reservoirs are filled by water diverted from the Arkansas River through the Fort Lyon Canal to the Kicking Bird Canal. Water is released from the Great Plains Reservoirs through the Comanche and Pawnee Canals and delivered to the Amity Canal at a point near where it crosses Big Sandy Creek.

AMIC entered into a decree (Case No. 80CW19) that adjudicated John Martin Reservoir as an alternate place of storage for the Great Plains storage rights. The 80CW19 decree allows AMIC to store up to 50,000 acre-feet per year of water in a John Martin Reservoir Other (Section III) account. Amity chooses between the two storage locations based on a number of factors. In most years, AMIC has stored water available for diversion under the Great Plains Reservoirs water rights in John Martin Reservoir. During wet years or when Article III storage in John Martin Reservoir was expected to exceed 50,000 acre-feet, AMIC has diverted water to the Great Plains Reservoirs via the Fort Lyon and Kicking Bird Canals; while during drought periods, storage in John Martin Reservoir has typically been favored. Water stored under the Great Plains storage rights is available to AMIC shareholders. These lands are served by releases from John Martin Reservoir through the Amity Canal and releases from the Great Plains Reservoirs to the Amity Canal near Big Sandy Creek.

Capacity: Total capacity and active capacity are unknown. The storage decree for the reservoirs indicate a total combined capacity of 265,552 acre-feet, of which 183,361 acre-feet (69 percent) is “available” (active) and 82,191 acre-feet is “unavailable”. Estimated physical characteristics are presented in **Table 2**.

Table 2: Great Plains Reservoir Physical Characteristics

Reservoir	Maximum Surface Area (acres)	Maximum Capacity (acre-feet)	Active Capacity (acre-feet)
Neesopah Reservoir	3,628	36,388	25,480
Nee Gronda Reservoir	3,572	98,660	58,800
Neenoshe Reservoir	4,562	94,847	73,363
Neeskah (Queen)	1,930	35,657	25,718
TOTAL	13,692	265,552	183,361

Area/Capacity Data: Surface areas at high water line for the four reservoirs listed below are from the findings in the 2/3/1927 adjudication of the Great Plains Reservoirs storage rights.

The stage-capacity tables for Neenoshe Reservoir and Neeskah (Queen) Reservoir reflecting estimated active capacity in **Table 3** and **Table 4** were obtained from BBA. Estimates of surface area included in the tables are based on the maximum surface areas listed in **Table 2** linearly interpolated against the capacity data provided by BBA. Although the staff gages at the reservoirs were surveyed in 2016, the tables may have limited accuracy due to uncertain underlying historical survey data. Nonetheless, the **Table 3** and **Table 4** values are appropriate for use in the model since these values correspond relatively well with the decreed capacities.

Table 3: Neenoshe Reservoir Elevation – Area – Capacity

Gage Height (feet)	Surface Area (acres)	Cumulative Active Capacity (acre-feet)
0	0	0
1	16	277
2	104	1,756
3	193	3,275
4	290	4,911
5	389	6,598
6	495	8,392
7	604	10,232
8	719	12,192
9	838	14,204
10	966	16,370
11	1,097	18,602
12	1,238	20,981
13	1,382	23,422
14	1,536	26,034
15	1,694	28,719
16	1,861	31,554
17	2,032	34,452
18	2,210	37,475
19	2,392	40,553
20	2,579	43,728
21	2,769	46,945
22	2,965	50,273
23	3,164	53,648
24	3,372	57,177
25	3,584	60,771
26	3,805	64,512
27	4,029	68,315
28	4,260	72,218
29	4,492	76,162

Note: Base elevation of Gage is 3904.7 feet.

Table 4: Neeskah (Queen) Reservoir Elevation – Area – Capacity

Gage Height (feet)	Surface Area (acres)	Active Capacity (acre-feet)
0	0	0
1	34	494
2	72	1,026
3	115	1,646
4	161	2,308
5	214	3,067
6	269	3,863
7	331	4,743
8	394	5,656
9	464	6,649
10	535	7,679
11	613	8,794
12	693	9,944
13	779	11,174
14	867	12,435
15	960	13,767
16	1,055	15,127
17	1,154	16,552
18	1,255	18,004
19	1,361	19,514
20	1,468	21,051
21	1,579	22,650
22	1,693	24,277
23	1,811	25,968
24	1,930	27,680

Note: Base elevation of Gage is 3860.3 feet.

Reservoir Seepage Information: Seepage from the Great Plains Reservoirs is not routinely monitored.

HydroBase Data: There are several structure IDs in HydroBase for the Great Plains Reservoirs and outlet canals:

- Neesopah Reservoir – 1703605 (water rights, no time series data)
- Nee Gronda Reservoir – 1703606 (water rights, no time series data)
- Neenoshe Reservoir – 1703607 (diversion to storage time series, no water rights)
- Neenoshe Reservoir – 6703883 (water rights, no time series)
- Neeskah (aka Queen) Reservoir – 1703608 (water rights, no time series)
- Neeskah Reservoir – 6703513 (diversion to storage time series, no water rights)
- Great Plains Reservoirs – 6703824 (some diversions to storage and comments, no water rights)

- Pawnee Canal – 6700615
- Comanche Canal – 6700609

Historical end-of-month storage contents are sporadically available in HydroBase for the early-1950s through the mid-2000s for the WD67 IDs for the Great Plains Reservoirs. Water commissioner notes indicate Kicking Bird Canal was “Not Used” from 2001 to 2007 and from 2009 to 2010. Kicking Bird Canal data includes significant diversions during the mid-1980s, a period during which storage contents data are unavailable in HydroBase. Other sources of data, not yet identified, may also be available. Based on a preliminary review of these data and discussions with BBA personnel, it appears the available data may represent the total storage contents for some periods and just the active storage contents for other periods. Missing data were not available from the Fort Lyon Canal Company or the Amity Mutual Irrigation Company. The available storage contents data in HydroBase, tables included in the 1981 study, and comparison of storage contents data Fort Lyon Canal and Kicking Bird Canal diversion data, and other available data should be further investigated during development of the ArkDSS Surface Water Model to develop a time series of historical storage contents data for the Great Plains Reservoirs.

Neeskah Reservoir releases to the Pawnee Canal are measured below the reservoir since a new measuring flume was installed in 2016. The Pawnee Canal releases water into the Comanche Canal, which carries releases from the other reservoirs. A flume on the Comanche Canal, located up-ditch from where the water is delivered to the Amity Canal, can be used to record the combined storage releases. Releases through the Comanche Canal were tabulated and used to support the Tri-State change case (07CW47). The AMIC records include releases for about 60 percent from 1950 to 2005; with an average annual release of 9,335 acre-feet. There is release data in HydroBase for 1974 for the two outlet canals – totaling approximately 1,800 acre-feet for the Pawnee Canal and over 20,000 acre-feet for the Comanche Canal. The Comanche Canal records from HydroBase are consistent with the AMIC records.

4. Physical Information – John Martin Reservoir (6703512)

John Martin Reservoir was constructed in 1948 and provides flood control for the lower Arkansas River basin. The reservoir has enhanced the irrigation supply for both Colorado and Kansas irrigators and facilitates delivery requirements pursuant to the Colorado-Kansas Compact.

Details regarding John Martin Reservoir are described in the Task 2.1 – Notes from Water District 67 Meeting memorandum. The focus on John Martin Reservoir operations related to AMIC is discussed herein.

AMIC has three colors of water potentially in storage in two accounts in John Martin Reservoir – Conservation Storage account (Article II Water), Other Water account (Article III Water), which includes the Winter Water and Great Plains Reservoirs storage rights. The Conservation Storage is split 60 percent to Colorado and 40 percent to Kansas. AMIC is entitled to 49.5 percent of the Colorado portion of Conservation Storage. The amount of water available to the Winter Water program participants is dependent on river flows, as outlined in the 84CW179 decree that officially recognized the Winter Water Storage Program. AMIC is entitled to 13.83 percent of the first 100,000 acre-feet yield; 100 percent of the next 2,750 acre-feet yield; and 13.5 percent of any

waters stored above 103,106 acre-feet. Total yields for the Winter Water Program have ranged as low as about 75,000 acre-feet in 2003 to almost 180,000 acre-feet in 2000. AMIC’s portion of the 2000 yield amounts to about 27,000 acre-feet. Storage and releases of AMIC supply in John Martin Reservoir is discussed in the Operational Information section.

WATER RIGHTS

The AMIC owns direct flow rights on the mainstem Arkansas River and tributaries that intersect the canal along its length. Storage rights owned by AMIC include the Great Plains Reservoirs.

Direct Flow Rights

The AMIC System has a total decreed flow rate for irrigation uses of 783.58 cfs from the Arkansas River and direct flow water rights from four tributaries to the Arkansas River, as summarized in **Table 5**. Tri-State adjudicated a change of use of 48.38 percent of each of the rights in **Table 5** for industrial and other uses in Case No. 07CW47.

Table 5: Direct Flow Rights

Structure	Appropriation Date	Adjudication Date	Admin. No.	Decreed Amount (cfs)	Case No.	Notes
Amity Canal	2/21/1887	7/1/1895	13566.0	283.5	7/1/1895	Arkansas River mainstem
	4/1/1893	10/14/1918	21857.15797	500	10/14/1918	
	TOTAL ARKANSAS RIVER			783.5		
	4/1/1893	10/14/1918	21857.15797	700	10/14/1918	Big Bend
				700		Goulds Draw
	10/5/1908		21857.21462	510		Big Sandy Creek
	TOTAL TRIBUTARY			2,410		

Source: Colorado Water Rights Tabulation

Storage Rights

The storage rights associated with the Great Plains Reservoirs are summarized in **Table 6**. The four Great Plains Reservoirs have a total decree of 265,552 acre-feet. The filling right for the Great Plains Reservoirs and the conditional Hub Thompson Dam and Reservoir are also included in the table. Tri-State adjudicated a change of use of 48.38 percent of each of the Great Plains Reservoirs storage rights for industrial and other uses in Case No. 07CW47.

Table 6: Storage Rights

Storage Unit	Approp. Date	Adjudication Date	Admin. No.	Decreed Amount (acre-feet)	Case No.	Notes
Great Plains Reservoirs	8/1/1896	2/3/1927	20186.17015	36,388	2/3/1927	Neesopah Reservoir
				98,660		Nee Gronda Reservoir
				94,847		Neenoshe Reservoir
				35,657		Neeskah (Queen) Reservoir
			TOTAL	265,552		
	8/1/1896	2/3/1927	20186.17015	1,150 cfs	2/3/1927	Inflow rate at Fort Lyon Canal (1700553)
Hub Thompson Dam and Reservoir	7/31/2007	12/31/2007	57555.00000	70,000	07CW74	First fill
				15,000		Refill
			TOTAL	85,000		
	7/31/2007	12/31/2007	57555.00000	500 cfs	07CW74	Inflow rate at Amity Canal

Source: Colorado Water Rights Tabulation

In Civil Action 2158, the Fort Lyon Canal Company (FLCC) was granted preferential use of the first 5,483 acre-feet per year of the Great Plains Reservoirs storage rights yield. At the beginning of the storage season, FLCC will decide where it wants to take the “5483 Water”. Note the 5483 Water is based on flows at the Fort Lyon Canal headgate, prior to ditch losses to the storage reservoirs and/or or transit losses to John Martin Reservoir. Starting around 1944, Fort Lyon took delivery of its 5483 water from Neeskah (Queen) Reservoir until entry of Fort Lyon’s decree in 80CW51 (ca. 1987), after which John Martin Reservoir has typically been their preferred choice.

Administration

Administration of the water rights associated with the Amity Mutual Irrigation Company involves interaction with the Water District 17 and Water District 67 commissioners, the Division 2 Engineer, and the Fort Lyon Canal Company. The Superintendent of the canal company is more often in contact with these individuals during periods of storage and during periods when direct flow calls have been placed downstream on the Arkansas River.

OPERATIONAL INFORMATION

The general operating strategy for the Amity Mutual Irrigation Company System in a typical year is as follows:

Non-Irrigation Season

The Amity Canal typically shuts off by November 1, once the Winter Compact storage season begins. During the non-irrigation season, John Martin Reservoir stores water in Compact Storage and the Pueblo Winter Water Storage Program and AMIC receives a distribution from both storage pools. AMIC also stores water in the Great Plains Reservoirs via the Pueblo Winter Water Storage Program.

Irrigation Season

By April 7, or at the first call for a release of water after April 1, distribution of the winter Conservation Storage (Article II water) in John Martin Reservoir begins to Water District 67 ditches. The Amity Canal typically releases its Article II water in April until exhausted, after which it starts to divert river water. The Amity Canal has a relatively senior direct flow right and the Amity frequently places an 1887 call in late-April or early-May, depending on the type of hydrologic year.

Amity can typically divert its full 283.5 cfs senior right in average and wet years. A portion of the junior 1893 right is often diverted during the spring runoff and following rain events, at which time tributary diversions are often made. The historical record indicates diversions of 40 cfs to 120 cfs above the senior 1887 right (up to 400 cfs, total) are often diverted from the Arkansas River. These diversions include both the junior direct flow rights and supplemental storage releases from AMIC's accounts in John Martin Reservoir. To the extent there is summer Conservation Storage, Amity and the other Water District 67 ditches will promptly release that water for use so their direct flow rights can call for water above John Martin Reservoir. During drier years, the direct flow rights are not as productive and the storage releases occur earlier in the season. Although releases from the Great Plains Reservoir often occur in the early-summer (likely due to operational flexibility), these storage releases typically start in earnest in July.

Although the sequence of delivery each year varies based on hydrologic conditions, ditch operational issues and other conditions, a general order of operations for water supplies into the Amity Canal is as follows:

- Winter Conservation Storage and Summer Conservation Storage
- Direct Flow Water
- Winter Water and Great Plains Reservoirs water from John Martin Reservoir
- Great Plains Reservoirs water from Great Plains Reservoirs storage

Where to find more information:

- Additional information on ditch and reservoir operations in and around the Amity Canal and its service area, including John Martin Reservoir, is presented in the ArkDSS Water District 17 Meeting memorandum and the ArkDSS Water District 67 Meeting memorandum.
- Additional information on Fort Lyon Canal Company operations is presented in the ArkDSS Fort Lyon Canal Operations memorandum.

REFERENCES

- Meeting with Water Division 2, Water District 17 Commissioner Lonnie Spady (lonnie.spady@state.co.us, 719.250.1655).
- Meeting with Water Division 2, Water District 67 Commissioner Becky Nichols (rebecca.nichols@state.co.us, 719.688.6711).
- Communication with Amity Mutual Irrigation Company Superintendent: Terry Howland (amitysuper@gmail.com, 719.537.6627).
- Communication with Amity Mutual Irrigation Company water resources engineers: Dan Niemela and Austin Malotte (dniemela@bbawater.com, amalotte@bbawater.com, 303.806.8952).
- Description of Water-Systems and Operations in the Aransas River Basin, Colorado. USGS Water Resources Investigations Report 85-4092. P.O. Abbot. 1985.
- Documentation for the Transfer of Great Plains Reservoirs Storage to John Martin Reservoir (Case Number 80CW19), on behalf of Amity Mutual Irrigation Company. Zorich, Spronk & Associates, Inc. July 1981.
- Engineering Report Supporting the Change of Water Rights, Request for Water Rights and Plan for Augmentation, Case No. 07CW74, on behalf of Tri-State Generation and Transmission Association, Inc. Bishop-Brogden Associates, Inc. January 2008.
- Preliminary Hydrologic Study, Amity Mutual Irrigation Company. Ted Zorich & Associates, Inc. April 1986.
- Decrees, engineering reports, and associated water court material available at <http://dwrweblink.state.co.us/>
- State of Colorado, Division of Water Resources, HydroBase database.