

ArkDSS Memorandum

Final

To: Bill Tyner and Kelley Thompson, Colorado Division of Water Resources
From: Wilson Water Group
Subject: Task 2.1 – Trinidad Project and Purgatoire River Water Conservancy District Operating Memorandum
Date: April 2019

INTRODUCTION

One of the Task 2 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.

Key water use facilities include diversion structures, transmountain diversions, and reservoirs.

- Diversion structures include structures that divert native Purgatoire River water and water from the Trinidad Project.
- Key reservoirs include reservoirs that store and release water within the Purgatoire River Water Conservancy District (PRWCD or District).

A number of components in the District have been identified as key structures for the Arkansas 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 discussions with Steve Kastner, District General Manager, and Jeff Montoya, the Water District 19 commissioner. Information in this memorandum is believed to be accurate; however, this information should not be relied upon in any legal proceeding.

Table of Contents	Page
Introduction	1
System Overview	2
Physical Information	4
Water Rights	16
Operational Information	19
References	23

SYSTEM OVERVIEW

The Purgatoire River Water Conservancy District (District) was created in 1960 to as a legal entity capable of contracting with the United States for repayment of the irrigation, municipal, and industrial components assigned to the Trinidad Project (Project) and to provide a management entity to oversee the Project¹. The Project includes Trinidad Reservoir; ten “Project Ditches” that receive Project supplies; and up to approximately 19,500 irrigated acres served by the Project Ditches. The District boundaries encompass the Project Ditches and their associated irrigated acreage, and generally extend from downstream of Trinidad Reservoir to the confluence of Frijole Creek and the Purgatoire River, as shown in **Figure 1**.

The City of Trinidad was the major proponent of Trinidad Reservoir, lobbying for the construction of the reservoir after a large flood in the 1950s on the Purgatoire River caused significant damage to the city. The Project received Congressional authorization in the Flood Control Act of 1958. Although flood control was the impetus for constructing the reservoir, Reclamation’s original design contemplated additional uses, including irrigation and recreation.

In order to offset the costs associated with constructing and maintaining the reservoir, both Reclamation and the City of Trinidad met with ditch companies downstream of the proposed reservoir site to encourage them to participate in the Project. Ultimately, ten ditch companies² listed in **Table 1**, and shown on **Figure 1**, signed contracts with Reclamation to be part of the Project and are administered as Project Ditches. The terms and conditions of each contract varied, and those ditch companies that signed last generally received the more favorable contracts.

Table 1: Trinidad Project Ditches

Model Ditch (1900552)	Johns Flood Ditch (1900572)
Baca Irrigation Ditch (1900783)	Hoehne Ditch (1900571)
Picketwire Ditch (1900584)	Burns & Duncan Ditch (1900585)
Chilili Ditch (1900590)	Lewelling – McCormick Ditch (1900575)
El Moro Ditch (1900596)	Southside Enlarged Ditch (1900598)

¹ Purgatoire River Water Conservancy District (prwcd.org)

² Water users under the Salas North Ditch originally signed a contract to be a part of the Project; the project acreage was later transferred to Lewelling Ditch and the Salas North Ditch is not currently administered as a Project Ditch.

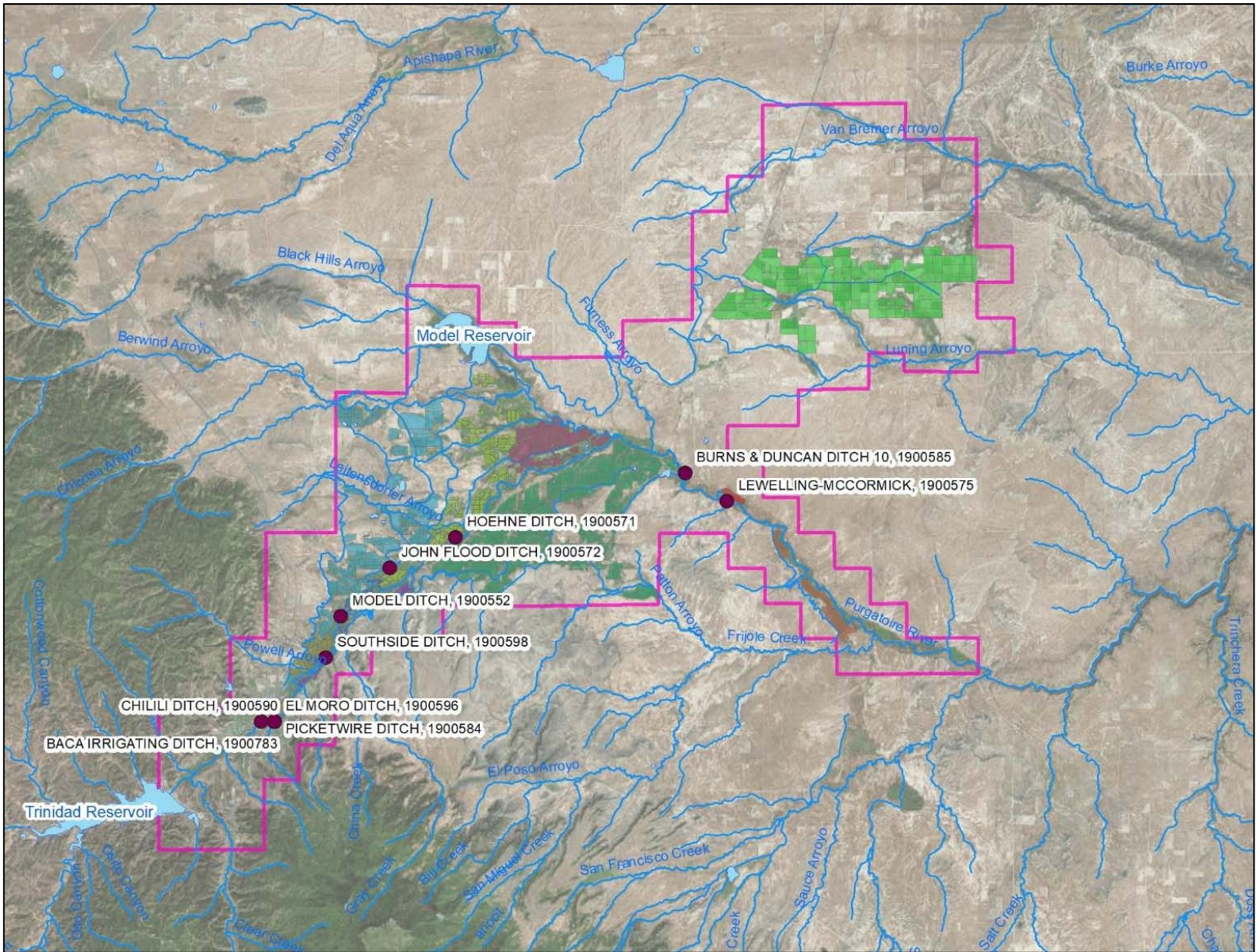


Figure 1: Purgatoire River Water Conservancy District Boundary and Key Structures

Trinidad Reservoir is the primary storage component of the Project. The on-channel reservoir is located on the Purgatoire River upstream and southwest of the City of Trinidad. Trinidad Reservoir is operated and maintained by the Army Corps of Engineers. The District and Division 2 staff provide administration, accounting, and reporting of Project uses. The reservoir has a capacity of 125,967 acre-feet divided into four primary storage accounts; the Irrigation and M&I and Joint Use accounts provide storage supply to Project Ditches. The remaining two accounts are used for flood control and as a permanent fishery pool.

Administration and operation of Trinidad Reservoir and the Project are defined by several operating criteria, including the *Purgatoire River Water Conservancy District Operating Criteria* and the *Operating Principles Trinidad Dam and Reservoir Project (Amended 2004)* (<https://www.usbr.gov/gp/eca/trinidad/>). These documents outline Project water rights; Trinidad Reservoir operations for Project, municipal, flood control, and recreational uses; Project operations during the irrigation and non-irrigation season; and limitations to Project water uses. Every ten years the Operating Principles and Criteria are reviewed to ensure optimum beneficial use of the water available to the Project. During the review process, Project participants can request changes to the guidelines.

In general, the Project is administered such that Project Ditches relinquish control of their direct water rights during the irrigation season (April 1st to October 15th) each year to benefit the Project and receive Project water in return, including direct diversions and Trinidad Reservoir storage supplies. The District generally allocates Project water to the Project Ditches based on the irrigated acreage included in their annual contracts each year. Trinidad Reservoir generally stores water throughout the winter; non-irrigation season uses include small releases from storage for stock and M&I purposes.

Key structures identified in the District below are:

1. Trinidad Reservoir
2. Model Ditch
3. Model Reservoir
4. Project Ditches

PHYSICAL INFORMATION

A physical description of the Project supplies, associated water rights, and operations are detailed below.

1. Physical Information – Trinidad Reservoir (WDID 1903935)

Trinidad Reservoir is an on-channel reservoir located on the Purgatoire River approximately three miles upstream of the City of Trinidad. After significant flooding occurred in the 1950s on

the Purgatoire River, Congress authorized the construction of a reservoir in the Flood Control Act of 1958. The reservoir was completed in 1976; the first irrigation deliveries were made in 1983. In addition to flood control, the reservoir provides storage for irrigation, M&I, and recreational uses by the District, Colorado Parks and Wildlife (CPW), and the City of Trinidad.



Trinidad Reservoir has a capacity of 125,967 acre-feet and impounds native streamflow from the Purgatoire River and smaller Reilly Canyon and Long Creek behind a 208-foot-high earthen fill dam. The reservoir, dam, and outlet are operated and maintained by the Army Corps of Engineers. There are several measurements taken daily to account for reservoir operations. The United States Geological Survey (USGS) has a contract to measure reservoir height using a pressure transducer and to maintain and record measurements for the streamflow gages upstream and downstream of the reservoir. Reservoir outflow is measured at the Purgatoire River below Trinidad Lake (07124410) streamflow gage located directly downstream of the reservoir. Daily reservoir inflow from the Purgatoire River is measured at the Purgatoire River at Madrid (07124200) streamflow gage. Additional calculations are performed for ungaged tributary inflows for the daily accounting. Daily evaporation rates are determined from measurements at the Trinidad Lake evaporation pan (USC00058436) site. Additional calculations are necessary to determine total evaporation at the reservoir and to pro-rate the evaporation to each reservoir account. The District and Division 2 staff provide administration, accounting, and reporting of Project uses.

Trinidad Reservoir was designed to release up to 5,500 cubic feet per second (cfs), however approximately 3,000 cfs reportedly causes damage to bridges and infrastructure along the Purgatoire River downstream of the reservoir. The maximum release on record of approximately 2,000 cfs occurred in May of 2017.

Capacity: Total storage capacity in the reservoir is 125,967 acre-feet. Table 2 shows the capacity allocated to the four primary accounts in the reservoir. The Water Rights and Operational Information sections below provide additional information on accounts.

Table 2: Trinidad Reservoir Accounts

Account	Capacity (acre-feet)
Flood Control	51,000
Irrigation and M&I	20,000
Permanent Fishery Pool	15,967
Joint Use*	39,000
Total	125,967

* For irrigation, M&I, and sediment accumulation

Area/Capacity Data: Multiple area/capacity curves have been developed for Trinidad Reservoir to account for sedimentation accumulation in the reservoir. Surveys are generally completed every 10 years, and the area/capacity table for the reservoir is adjusted to account for sedimentation that has accumulated since the last survey. Based on the surveys, approximately 200 acre-feet of sedimentation accumulates annually, which is significantly less than the 500 acre-feet of annual sedimentation estimated during design of the reservoir. There have been four area/capacity tables developed for the reservoir to date. The most recent survey completed in 2011 is shown in **Figure 2**.

Sediment accumulation is charged against the Joint Use account in the reservoir, and as a result decreases the available storage in that account and the reservoir as a whole. The revised account volumes are not adjusted retroactively. The 2011 area/capacity curve is currently in use by the Army Corps of Engineers, DWR, and the District for reservoir accounting.

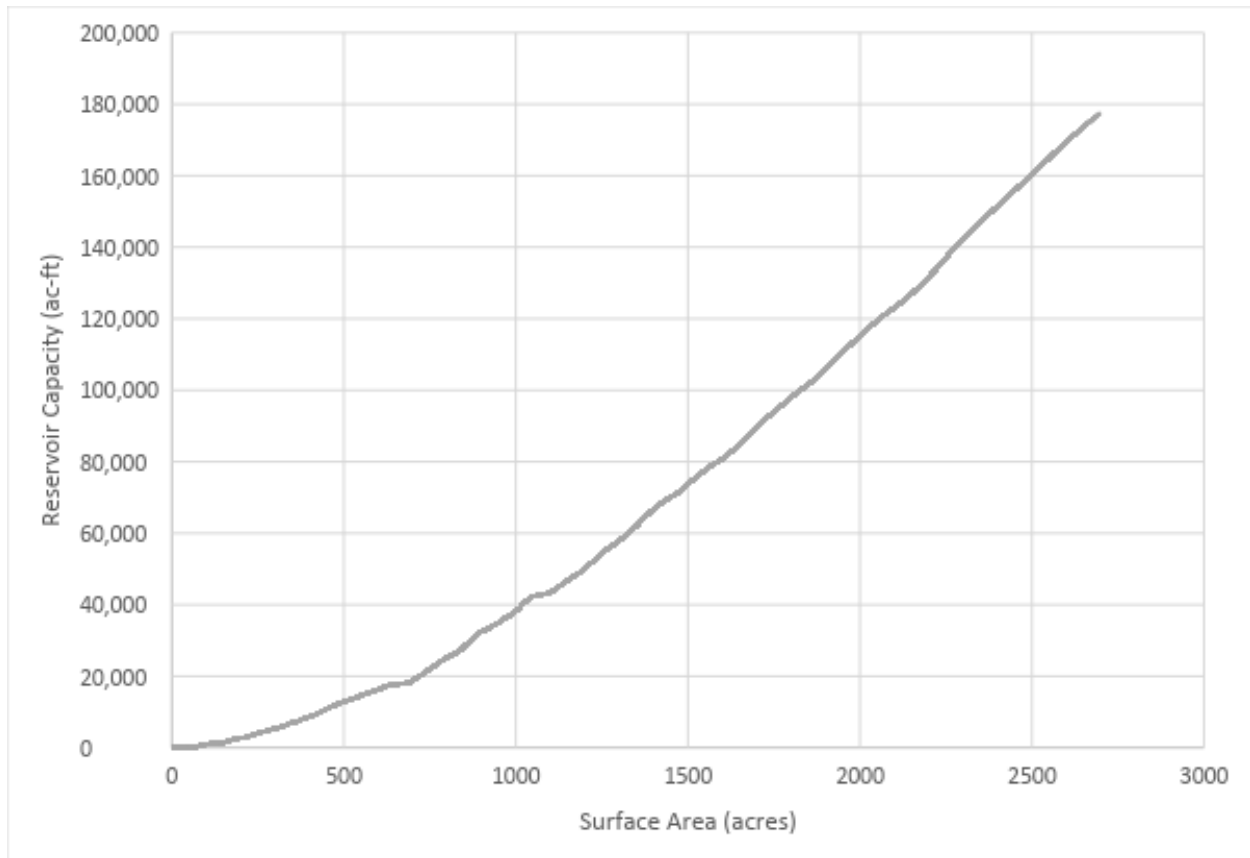


Figure 2: Trinidad Reservoir 2011 Area/Capacity Curve

Reservoir Seepage/Evaporation Information: Daily evaporation and precipitation are measured at the Trinidad Lake evaporation pan (USC00058436) site. Reservoir accounting reflects gross evaporation less effective precipitation to determine net evaporation at the reservoir. Evaporative losses are charged to the Irrigation and Permanent Fishery Pool accounts. Evaporative losses attributed to the Irrigation account are pro-rated based on the water surface area of the Irrigation account only. The remaining evaporative losses are assigned to the Permanent Fishery Pool.

Trinidad Reservoir experiences minimal seepage, estimated to be less than 1 cfs based on streamflow records at the Purgatoire River below Trinidad Lake gage during periods when no reservoir releases are occurring. Reservoir seepage loss is charged pro-rata to the four accounts based on the daily storage in each account. The District’s Operating Criteria outlines how seepage losses should be further distributed between in the Joint Use pool.

Reservoir Storage Measurement: Reservoir storage is calculated daily based on:

- streamflow measurements at the Purgatoire River at Madrid (07124200) gage
- reservoir gage height measured by a pressure transducer at the reservoir
- gross evaporation and effective precipitation

- releases from the reservoir, including seepage, measured at the Purgatoire River below Trinidad Lake (07124410) streamflow gage

Readings are recorded daily and the Army Corps of Engineers reports the daily elevation along with the calculated inflow, measured releases, and calculated evaporation to DWR and the District every weekday morning.

HydroBase Data: Trinidad Reservoir’s daily storage content is currently available in HydroBase for the 1977 through 1984 and 2009 through 2010 periods. Daily hard-copy records from 1977 to 2002 were available from the Division 2 office, and 2002 to 2016 records were available in the Trinidad Reservoir Accounting summaries. The additional reservoir data was compiled and provided to the DWR for inclusion in HydroBase. **Figure 3** shows the end-of-month content for the Trinidad Reservoir from 1977 to 2017.

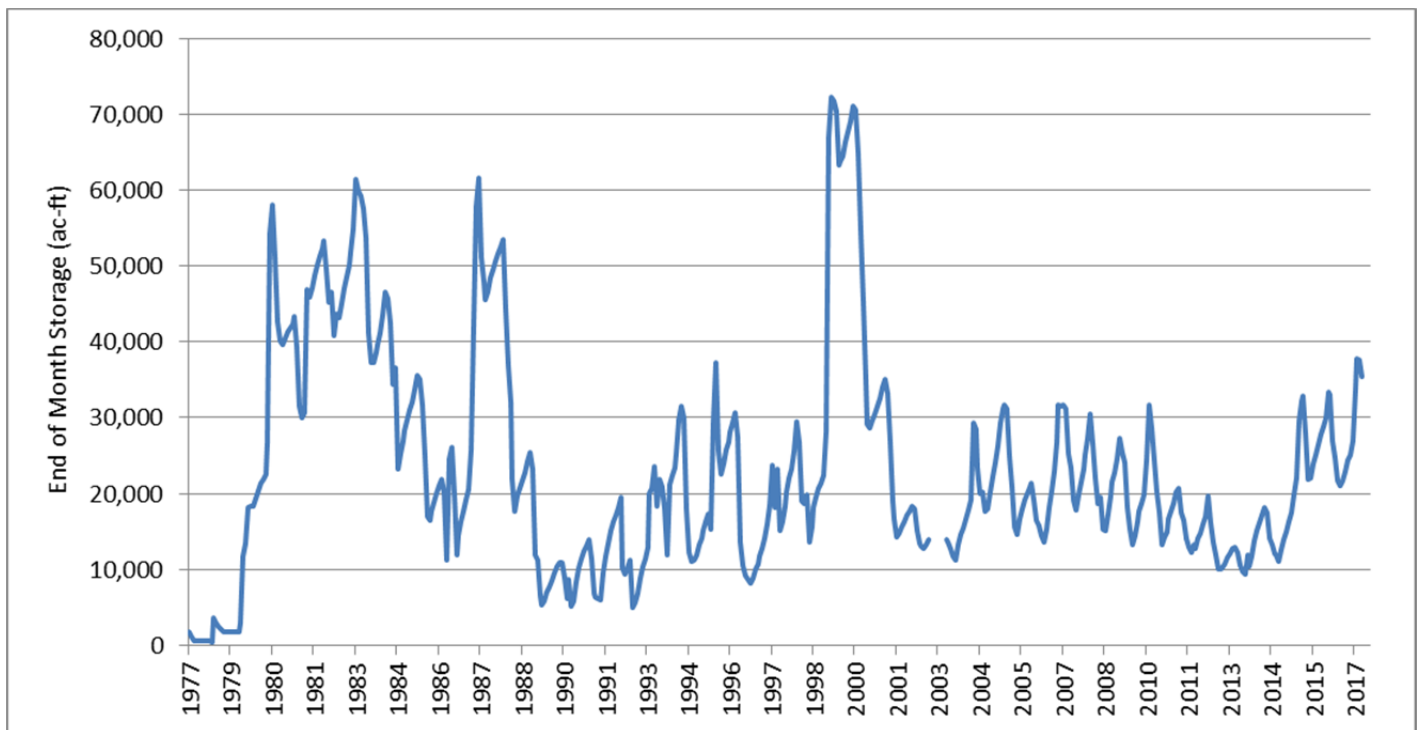


Figure 3: Trinidad Reservoir End of Month Contents

2. Physical Information – Model Ditch (WDID 1900552) and Johns Flood Ditch (WDID 1900572)

Model Ditch diverts from the Purgatoire River approximately 7 miles downstream of Trinidad Reservoir. The ditch currently diverts primarily for irrigation and carries water over 35 miles to serve approximately 2,075³ irrigated acres. Historically, Model Ditch carried diversions to storage in Model Reservoir, located approximately 13 miles down-ditch, for irrigation of approximately 6,000 acres. The Model Reservoir storage right was transferred to Trinidad Reservoir and served as a critical component to the construction of the Project. In the mid-1940s, Johns Flood Ditch washed out and the water rights were transferred to the Model Ditch; they now share a common river diversion structure. The Johns Flood Ditch currently carries irrigation supplies to approximately 1,020⁴ acres.

Over 2,000 acres have been dried up under Model Ditch and Johns Flood Ditch as entities have changed the irrigation water rights for other uses. A joint augmentation station is located just downstream of the shared headgate and accounts for return flow obligations associated with the changed shares in these ditches (see Water Rights section below for more information).

Length: The Model Ditch is approximately 31 miles long. The ditch carries water approximately 13 miles to the now-breached Model Reservoir, and an additional 18 miles from the reservoir outlet to the end of the canal. The Johns Flood Ditch water is carried in the Model Ditch for approximately 2 miles, at which point the carried water is turned out to the Johns Flood Ditch, where it extends another 10 miles to the end of the canal.

Capacity: Historically, the combined headgate at the Purgatoire River was capable of diverting 660 cfs to meet daily diversions for both ditches. More recently, the combined headgate can divert a maximum of 410 cfs. Similarly, Model Ditch historically diverted up to 600 cfs but more recently diverts up to 350 cfs; Johns Flood Ditch historically diverted 225 cfs but the current maximum is closer to 140 cfs.

Measurement Device: The Model Ditch has a 10-foot Parshall flume located just downstream of the headgate. The Johns Flood Ditch has a separate 6 foot Parshall Flume that is located just after the bifurcation from the Model Ditch (approximately 2.4 miles down-ditch from the Model headgate).

Conveyance Efficiency: Gains and losses for many of the Project Ditches were calculated by the USGS from 2000 to 2004. The associated report reflects that the Model Ditch losses are smaller

³ Source: PRWCD Acreage Verification Survey, 2016

⁴ Source: PRWCD Acreage Verification Survey, 2016

upstream of the reservoir, ranging from 1 to 5 percent. Losses are more significant downstream of Model Reservoir, ranging from 8 to 59 percent. The Model Ditch Company has recently worked on the ditch to reduce canal loss, including lining a portion of the canal, and believes the efficiency to be closer to 90 percent. Division 2 estimates 80 percent efficiency for Model Ditch for accounting purposes. The USGS report indicates Johns Flood Ditch has reaches that gain inflow, while other reaches lose from 1 to 13 percent. Division 2 estimates 90 percent efficiency for Johns Flood Ditch for accounting purposes.

Return Flow Locations: The Model Ditch and the Johns Flood Ditch losses generally accrue to the Purgatoire River either through subsurface returns or via the multiple arroyos the canals cross. Irrigation return flows from the Model Ditch lands generally accrue to Luning Arroyo, which flows in the Purgatoire River downstream of the District boundary. Irrigation return flows from the Johns Flood Ditch lands accrue to the Purgatoire River near the Town of Hoehne or directly to lands irrigated by the Hoehne Ditch.

Irrigated Crops: Irrigated acreage for the Project ditches is verified annually by the District and Division 2. **Table 3** shows the irrigated acreage from the Project’s acreage verification survey over the 2008 to 2016 period. Grass hay is the primary crop type; however lands served by Model Ditch also grow winter wheat. The Operational Information section below provides additional information for Project Ditch contract acreage. Currently, land under the project is mostly flood irrigated, however pivot sprinklers have been installed in the past few years under the Enlarged Southside Ditch and Model Ditch. Model Ditch has several parcels with multi-cropping, particularly with winter wheat.

Table 3: Johns Flood and Model Ditch Irrigated Acreage from 2008-2016

Year	Irrigated Acreage (acres)	
	Johns Flood Ditch	Model Ditch
2008	1,405	5,520
2009	841	3,172
2010	1,149	1,425
2011	1,027	1,744
2012	996	961
2013	919	1,040
2014	984	1,928
2015	925	1,640
2016	1,021	2,075

HydroBase Data: Historical diversion records for the Model Ditch are generally available in HydroBase for the 1950 to 2016 study period; however records are missing from 1976 to 1981. Total diversions average approximately 11,100 acre-feet annually. Diversion coding for Model

Ditch indicates diversions to stock and irrigation for recent years from multiple sources (S:9); the source of the water (i.e. Trinidad Reservoir releases, Project deliveries⁵) is not consistently recorded. Historical diversion coding intermittently reflects diversions to storage, however there is not a corresponding record for diversions to irrigation, therefore it is likely these records reflect total diversions. For modeling purposes, diversions to storage can be developed based on change in content at Model Reservoir and canal efficiency, and then compared to the total diversions to the Model Ditch.

Similar records are available for the Johns Flood Ditch. Diversion records available in HydroBase are complete for the 1950 to 2016 period. Coding reflects diversions to irrigation and stock, however the source of the water is not consistently provided. Figure 4 shows total monthly diversions reported for both the Model Ditch and Johns Flood Ditch.

Diversions for augmentation are available in HydroBase for the Model/Johns Flood Ditch Augmentation Station (1900772) for 2016 only.

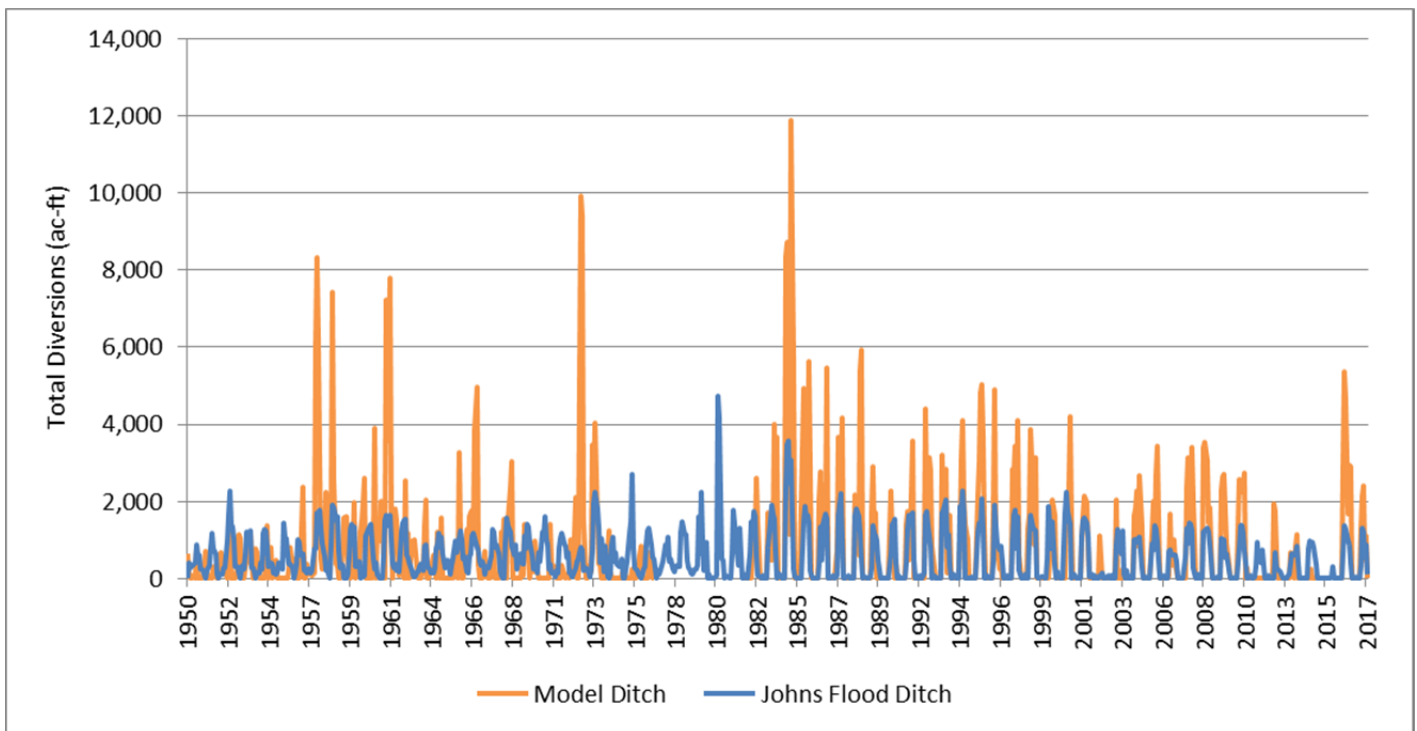


Figure 4: Johns Flood and Model Ditch Historical Diversions

⁵ Diversion coding of Project deliveries have historically referenced several Project identifiers: Trinidad Reservoir Transmountain (1903936), Trinidad Reservoir (1903935); and PRWCD Project Water (1903934). In the 1980's Project deliveries were typically coded under 1903936, however, in the 1990's to 2000's, Project deliveries are coded under 1903934.

3. Physical Information – Model Reservoir (WDID 1903797)

Model Reservoir, also known as Black Hills Reservoir (WDID 1903782), is an off-channel reservoir historically used as a supplemental irrigation supply for lands served by the Model Ditch near the abandoned Town of Model. The reservoir is located approximately 13 miles downstream of the Model Ditch headgate. Storage supplies were primarily provided by Model Ditch diversions from the Purgatoire River, however the reservoir could also capture and store intermittent flows on Black Hills Arroyo, Chicosa Arroyo, and Leitensdorfer Arroyo.

Model Reservoir historically stored under a 1908 water right decreed for 20,000 acre-feet. This right was transferred to the Trinidad Reservoir in 1965 to benefit the Project. After the transfer of the senior right, a shareholder in the Model Land and Irrigation Company filed for a junior 24,123 acre-feet storage right in the reservoir. Only 1,303 acre-feet of this junior storage right was made absolute and the remainder was abandoned. The reservoir was breached in 2013 by a large rain event; Model Ditch still runs through the now-empty reservoir.

Capacity: Model Reservoir’s original capacity was intended to be 20,000 acre-feet. Based on historical records, the maximum storage was 6,650 acre-feet prior to the transfer of the senior water rights.

Area/Capacity Data: No historical area/capacity table was found for Model Reservoir; it is unclear whether a survey was ever performed.

Reservoir Seepage/Evaporation Information: There are no studies quantifying seepage losses or evaporation from Model Reservoir. Seepage losses were experienced, but were not documented. Seepage from the Reservoir most likely accrued back into the Model Ditch that came out of the outlet of the dam.

Reservoir Storage Measurements: Reservoir content measurements are available in HydroBase and generally complete over the study period. As noted above, the measurements generally reflect no storage for the years after the water right was transferred to the Trinidad Project. **Figure 5** shows the end-of-month contents reported under Black Hills Reservoir.

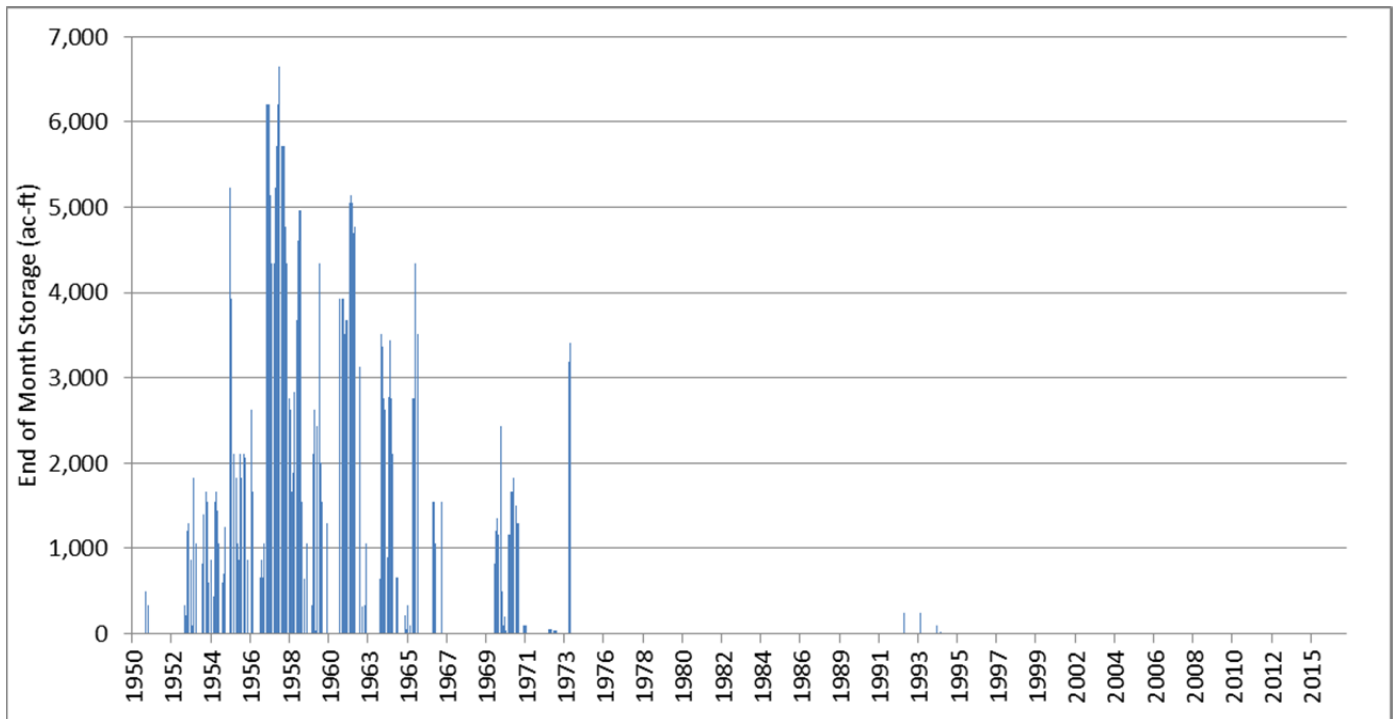


Figure 5: Model Reservoir End-of-Month Content

Irrigated Crops: Model Reservoir provided supplemental supplies to irrigated lands served by the Model Ditch. Model Ditch historically irrigated up to 6,000 acres and currently irrigates 2,075 acres.

4. Physical Information - Project Ditches

There are a total of ten Project Ditches that participate in the Project. As the Model Ditch and Johns Flood Ditch are discussed above, this section summarizes physical information on the other eight Project ditches (other Project ditches) listed in **Table 4**.

Table 4: Trinidad Project Ditches (not including Model Ditch or Johns Flood Ditch)

Baca Irrigation Ditch (1900783)	Hoehne Ditch (1900571)
Picketwire Ditch (1900584)	Burns & Duncan Ditch (1900585)
Chilili Ditch (1900590)	Lewelling – McCormick Ditch (1900575)
El Moro Ditch (1900596)	Southside Enlarged Ditch (1900598)

In general, the other Project ditches divert from the Purgatoire River primarily for irrigation purposes. With the exception of the Hoehne Ditch, the other Project ditches also divert stock water throughout the winter. The Hoehne Ditch’s rights to stock water deliveries or up to 300

acre-feet were terminated in Case No. 86CW25, leaving a 1,200 acre-feet annual limit for stock water deliveries⁶ from the Project.

The condition and configuration of headgate structures and canals varies across the District.

- Water diverted into the **Picketwire Canal** is used to supply **Picketwire, Baca Irrigation,** and **El Moro** canals with water for irrigation and stock purposes. An 8-foot Parshall is used to measure diversions at the Picketwire Canal headgate, and a 9-inch Parshall flume is used to measure diversions turned out to the El Moro headgate. Delivery is made to the Baca Irrigation Ditch lands through a series of lateral turnouts from the main Picketwire Canal, and each Baca turnout is equipped with a Parshall flume⁷.
- **Chilili Ditch** does not have a permanent diversion dam on the Purgatoire; a diversion structure is constructed annually by piling dirt to create enough head to divert water into their ditch.
- **Burns & Duncan Ditch** uses a pump to divert water from the Purgatoire.

Canal Length/Capacity/Measurement Device:

The canal length, capacity, and measurement device for the other Project Ditches are documented in **Table 5**.

Table 5: Other Project Ditch Length/Capacity/Measurement Devices

Ditch	Approx. Length (miles)⁸	Approx. Capacity (cfs)⁸	Measurement Device⁸
Picketwire Ditch	16	140	8 foot Parshall Flume
Baca Irrigating Ditch	2	20	Multiple Lateral Turnouts
El Moro Ditch	1.6	9	9 inch Parshall Flume
Chilili Ditch	5	10	2 foot Parshall Flume
Enlarged Southside Ditch	13	250	10 foot Parshall Flume
Hoehne Ditch	5	40	4 foot Parshall Flume
Lewelling-McCormick Ditch	4	33.2	30 inch Parshall Flume
Burns & Duncan Ditch	5	3.25	Flow Meter

⁶ The 1,200 ac-ft annual limit on stock water deliveries from the Project includes deliveries to all the Project Ditches, excluding Hoehne Ditch.

⁷ Source: Losses and Gains for Eight Unlined Canals Along the Purgatoire River near Trinidad, Colorado, 2000–2004 (U.S. Geological Survey SIR 2006-5164)

⁸ Ditch Capacities from the Water Rights Decree for Case 8/10/1903, daily diversions in HydroBase, and Losses and Gains for Eight Unlined Canals Along the Purgatoire River near Trinidad, Colorado report.

Conveyance Efficiency: Gains and losses for many of the Project Ditches were calculated by the USGS from 2000 to 2004. The associated report reflects canal losses for several of the other Project Ditches. There was large variability in the results for the ditches analyzed in the study, ranging from 2 to 34 percent. The District does not currently rely on these loss estimates, rather assumes a conveyance efficiency of 80 percent.

Return Flow Locations: Return flows from the remaining Project Ditches generally accrue to the Purgatoire River either through subsurface returns or via multiple arroyos the canals cross. In general, most of the return flows accrue to the river between Hoehne Ditch and Burns & Duncan Ditch headgates. Exceptions include return flows from the Enlarged Southside Ditch that collect in and return to Gagliardi Reservoir (1903530) via Barney Arroyo.

Irrigated Crops: Irrigated acreage for the Project Ditches is verified annually by the District and Division 2. **Table 6** below reflects the irrigated acreage from the Project’s acreage verification survey over the 2008 to 2016 period for the other Project Ditches. Grass hay is the primary crop type; however some lands also have limited alfalfa and corn crops. A majority of the acreage is flood irrigated; only the Southside Ditch has two center pivots. Note that Salas North Ditch historically received project deliveries for 56.8 acres. In 1994 these acres were transferred to Lewelling-McCormick Ditch.

Table 6: Project Ditches Irrigated Acreage from 2008 to 2016

Year	Irrigated Acreage							
	Baca	Burns & Duncan	Chilili	El Moro	Enl. South Side	Hoehne	Lewelling & McCormick	Picketwire
2008	319	165	202	160	5,825	990	551	2,910
2009	320	91	99	98	4,232	1,093	409	1,440
2010	188	0	136	133	3,622	1,111	230	1,080
2011	307	91	141	159	4,288	1,058	410	1,893
2012	287	85	152	153	1,911	1,056	393	679
2013	315	91	156	157	2,800	1,030	418	944
2014	272	91	146	129	4,007	1,033	398	1,448
2015	299	91	125	152	3,936	1,122	381	1,455
2016	267	91	125	131	3,851	1,056	411	1,351

HydroBase Data: Diversion records are available in HydroBase for the remaining Project Ditches. As with Model and Johns Flood Ditches, diversion coding generally reflects diversions to stock and irrigation in recent years; however the source of water (i.e. Trinidad Reservoir

releases, Project deliveries)⁹ is not consistently recorded. Diversions outside of the April 1 to October 15 irrigation season can be considered diversions to stock, regardless of diversion coding. Below are notes regarding the availability of records for each ditch.

- **Baca Irrigating Ditch** has data available from 1912 to 2016 with missing data in 1955, 1956 to 1963, and 1964 to 1978. Diversion records pre-1957 appear to reflect total diversions under Picketwire Ditch, a portion of which were delivered to Baca Irrigation Ditch.
- **Picketwire Ditch** has data available from 1954 to 2016 and is missing data in 1956. There appears to be an errant data point on 7/28/1990. Pre-1978 diversions appear to reflect the combined diversions for Picketwire Ditch and Baca Irrigation Ditch; the diversions will need to be partitioned for modeling purposes to create separate records for each structure.
- **Chilili Ditch** has some data available from 1912 to 2016 and is complete over the 1950 to 2016 period.
- **Hoehne Ditch** has data available from 1912 to 2016 and is missing data in 1962.
- **Burns & Duncan Ditch** has data available from 1964 to 2016 with missing data in 1969 and from 1983 to 2006.
- **Lewelling & McCormick Ditch** has some data available from 1915 to 2016 and is complete after 1951.
- **Enlarged Southside Ditch** has some data available from 1912 to 2016 and is complete over the 1950 to 2016 period.
- **El Moro Ditch** has some data available from 1912 to 2016 and is complete over the 1950 to 2016 period.

WATER RIGHTS

Direct Flow Rights

Each ditch has ownership over its own direct flow water rights, but relinquishes control of the water rights to the District during “Project Administration”. **Table 7** reflects the direct flow rights under contract with the District. Note that information listed in the Priority Number, Priority Date, Contracted Amount (cfs), and Contracting User reflect information from the Trinidad Operating Principles. The Current Project Ditch reflects the current Project Ditch at which the water right is diverted and Administration Number reflects the priority of the water right in a format necessary for modeling purposes. Project water rights total 638.62 cfs, although over 300 cfs of that total have relatively junior priorities.

⁹ Diversion coding of Project deliveries have historically referenced several Project identifiers: Trinidad Reservoir Transmountain (1903936), Trinidad Reservoir (1903935); and PRWCD Project Water (1903934). In the 1980s, Project deliveries were typically coded under 1903936; however, starting in the 1990s, Project deliveries are coded under 1903934.

Table 7: Trinidad Project Direct Diversion Water Rights

Priority Number	Priority Date	Contracted Amount (cfs)	Contracting User	Current Project Ditch	Admin. Number
3	11/30/1861	4	Baca Irrigation Ditch	Baca Irrigation Ditch	4352.00000
3	11/30/1861	2	Chicosa, Lujan & Northside	Baca Irrigating Ditch	4352.00000
5	03/20/1862	4	Johns Flood	Model Ditch	4462.00000
7	4/3/1862	7	Chilili	Chilili	4503.00000
8	11/15/1862	1.55	El Moro Water Users	El Moro Ditch	4702.00000
8	11/15/1862	1.18	El Moro	El Moro Ditch	4702.00000
9	01/01/1863	1.28	Johns Flood	Model Ditch	4749.00000
9	01/01/1863	4.72	Hoehne	Model Ditch	4749.00000
12	06/30/1863	0.5	Enlarged Southside	Enlarged Southside	4929.00000
13	01/01/1864	1.25	Johns Flood	Johns Flood	5114.00000
13	01/01/1864	3.75	R. Lacy	Lewelling McCormick (2.5 cfs) & Model Ditch (1.25 cfs)	5114.00000
15	4/10/1864	5.1	Johns Flood	Model Ditch	5214.00000
15	4/10/1864	0.8	Hoehne	Hoehne Ditch	5214.00000
19	06/01/1865	4	R. Lacy	Lewelling McCormick	5631.00000
20	10/07/1865	7.35	Johns Flood	Model Ditch	5759.00000
20	10/07/1865	16.65	Hoehne	Hoehne Ditch	5759.00000
21	01/01/1866	3.25	R. Lacy	Burns and Duncan	5845.00000
27	05/31/1866	2.25	Johns Flood	Model Ditch	5995.00000
40	04/30/1868	0.77	Enlarged Southside	Enlarged Southside	6695.00000
64	04/01/1873	2.4	Johns Flood	Model Ditch	8492.00000
73	11/01/1875	6	Enlarged Southside	Enlarged Southside	9436.00000
74	02/17/1876	34	Enlarged Southside	Enlarged Southside	9544.00000
75	12/25/1876	4	Enlarged Southside	Enlarged Southside	9856.00000
77	03/11/1877	1.3	El Moro	Baca Irrigating Ditch	9932.00000
77	03/11/1877	2.7	El Moro Water Users	Baca Irrigating Ditch	9932.00000
80	04/07/1877	18.6	Enlarged Southside	Enlarged Southside (10.23 cfs) & Florida Ditch (8.37 cfs)	9959.00000
93	12/15/1882	4	Enlarged Southside	Enlarged Southside	12037.00000
95	11/04/1883	14.39	Chicosa, Lujan & Northside	Baca Irrigating Ditch	12361.00000
96	11/23/1883	16.84	Enlarged Southside	Enlarged Southside	12380.00000
98	04/30/1884	60	Enlarged Southside	Enlarged Southside	12539.00000
103	06/21/1886	14.73	Chicosa, Lujan &	Baca Irrigating Ditch	13321.00000

Priority Number	Priority Date	Contracted Amount (cfs)	Contracting User	Current Project Ditch	Admin. Number
			Northside		
104	10/21/1886	10	R. Lacy	Lewelling McCormick	13443.00000
106	03/12/1887	15	Chicosa, Lujan & Northside	Baca Irrigating Ditch	13585.00000
108	02/15/1888	9.7	Enlarged Southside	Enlarged Southside	13925.00000
109	03/01/1888	8	Enlarged Southside	Enlarged Southside	13940.00000
145	10/20/1902	100	Johns Flood	Model Ditch	19579.19285
168	1/22/1908	200	Model	Model Ditch	21205.00000
242.5	6/12/1920	45.56	Chicosa, Lujan & Northside	Baca Irrigating Ditch	25730.00000

Notes:

Enlarged Southside Ditch water rights are included in HydroBase under Pulaski Ditch (1900660).

Florida Ditch no longer exists, however the water rights are included as a Project Right

Picketwire Ditch water rights are listed in HydroBase under Baca Irrigating Ditch.

Storage Rights

Table 8 lists Trinidad Reservoir’s water rights summarized by account and additional comments or restrictions on the use of each water right.

Table 8: Trinidad Project Storage Water Rights

Account	Water Right	Approp. Date	Admin. Number	Comments
Irrigation and M&I	161 ac-ft	10/1/1879	10866.00000	Transferred from Madrid Reservoir; owned by City of Trinidad; alt. point to North Lake
Irrigation and M&I	20,000 ac-ft	1/22/1908	21205.00000	Transferred from Model Reservoir; stored under Project Direct Rights priorities up to the 20,000 AF limit
Joint Use	39,000 ac-ft	12/31/1992	51864.50895	36,189.03 acre-feet made absolute, remaining conditional
Permanent Fishery Pool	8 cfs	11/1/1861	4323.00000	City of Trinidad changed Antonio Lopez Ditch (88CW0062), limited to 141 acre-feet annually
Permanent Fishery Pool	28 cfs	1/22/1908	21205.00000	CPW changed 14 percent of Model Ditch (03CW0108) limited to 1,708 acre-feet annually
Permanent Fishery Pool and/or Irrigation and M&I	68.5% of Johns Flood Ditch & 6.2% of Model Ditch	Multiple, Refer to Table 7		Water allocated to irrigate 373.7 of 6,000 acres (6.2 percent) under the Model Ditch, City of Trinidad changed shares (88CW0061) limited to 2,802 acre-feet annually

Note that the City of Trinidad has additional decreed exchanges for storage in Trinidad Reservoir; however these exchanges are operated infrequently and, therefore, not explicitly reflected as storage rights in the Reservoir.

Transbasin Water

The District, as well as other Trinidad Reservoir entities, occasionally lease transmountain supplies from Colorado Springs Utilities (CSU) and exchange these supplies to Trinidad Reservoir for storage in the Joint Use and Permanent Fishery Pool accounts. These transmountain supplies are used as Project supplies or to replace evaporation and seepage.

OPERATIONAL INFORMATION

As discussed above, administration and operation of Trinidad Reservoir and the Project are defined by the *Purgatoire River Water Conservancy District Operating Criteria* and the *Operating Principles Trinidad Reservoir Project (Amended 2004)*. These documents outline Project water rights; Trinidad Reservoir operations for Project, municipal, flood control, and recreational uses; Project operations during the irrigation and non-irrigation season; and limitations to Project water uses.

For more information:

- Reclamation performs a Ten-Year Review of the Trinidad Project; more information can be found in their reports (<https://www.usbr.gov/gp/eca0/trinidad/index.html>).

The Project is administered such that Project Ditches relinquish control of their direct water rights during the irrigation season, defined as April 1 to October 15, to benefit the Project and receive Project water in return. Project supplies consist of direct diversions of Purgatoire River streamflow under the Project water rights (**Table 7**) or releases of Trinidad Reservoir water stored under as “irrigation capacity”, as defined in the Operating Principles. The District allocates Project water to the Project Ditches based on the irrigated acreage included in their annual contracts each year. Annual contracts are drawn up annually in March and the District then develops an estimated allocation of Project water based on streamflow projections and “irrigation capacity” in the reservoir. **Table 9** summarizes the 2016 contract acreage for each Project Ditch.

Table 9: 2016 Contract Acreage by Project Ditch

Ditch	Percent of Total Acreage	2016 Contract Acreage
Baca	2%	320
Burns & Duncan	1%	230
Chilili	1%	300
El Moro	1%	177
Enlarged Southside	31%	6,300
Hoehne	6%	1,200
Johns Flood	11%	2,171
Lewelling & McCormick	2%	468
Model	34%	7,029
Picketwire	12%	2,415
Total Acres		20,608

Review of available contract acreage records over the 2009 to 2016 period indicate that the percent of allocation to Project Ditches has not changed significantly over time. In comparing the actual irrigated acreage to contracted acreage, it was noted that the Model Ditch generally contracts a greater number of acres than actually irrigated. The District indicated plans to address this inconsistency in the future.

The Hoehne Ditch generally requests Project supplies on April 1st each year, beginning Project Administration and delivery of Project supplies. The remaining Project Ditches generally wait until Trinidad Reservoir storage rights are out of priority before calling for their Project supplies. The full headgate demand for the Project Ditches is approximately 300 cfs, however daily Project delivery averages approximately 150 cfs depending on streamflow, reservoir storage, requests from Project Ditches, and downstream calls. There is not a minimum threshold for requested Project deliveries, and each ditch varies their requested amount depending on individual irrigators' requests, the amount of storage available, and the seniority of their water rights. Ditches with junior water rights benefit from the Project operation more than ditches with senior water rights because they are able to divert a portion of the senior water rights.

Daily diversions are limited to the crop demand plus conveyance losses, discussed in the Physical Information section above, as estimated by the District. The exception to this is the Hoehne Ditch, who is entitled to 4.2 acre-feet of Project deliveries per irrigated acre. The District maintains individual accounting for each Project Ditch and tracks each ditch's Project allocation and deliveries. The District works with the Water District 19 commissioner and the Army Corps of Engineers for daily Project administration and releases from Trinidad Reservoir for Project deliveries.

Runoff in the Purgatoire River basin typically occurs in April and May, and streamflow is generally sufficient to store in the Irrigation and M&I account in Trinidad Reservoir and to meet the average daily Project diversion demand in average and wet years. The Irrigation and M&I account does not fill every year; average years typically yield 8,000 to 12,000 acre-feet of storage. As Trinidad Reservoir is filling under the senior Project water rights during this time, downstream calls from Water District 17 and mainstem Arkansas River calls generally do not impact storage in this account in April and May. During wet years, runoff may be sufficient to also allow for storage in the Joint Use account, however this is rare.

Project Ditches rely first on direct diversion of Project supplies, and then call for releases of stored supplies after the runoff season. A total of 83 cfs of Project water rights are senior to the downstream Highland Canal calling right and are generally in priority most of the irrigation season during average years. Reservoir water stored as “irrigation capacity” in either the Irrigation and M&I or Joint Use accounts are allocated to Project Ditches based on contract acreage, and any remaining stored allocations in the Project Ditch’s accounts at the end of the irrigation season are redistributed the following year (i.e. no individual Project Ditch carry-over).

There are two exceptions to these general operations; the Hoehne Ditch and the Model Ditch.

- The Hoehne Ditch’s original Project contract indicates the ditch is entitled to 5,028 acre-feet of total Project supplies, therefore the ditch will generally receive their storage supplies first, particularly in dry years, in order to meet this set-aside amount. The contract does allow for a “step-down” allocation if storage supplies or streamflow is limited.
- The Model Ditch maintains a separate 6,000 acre-feet account in the Irrigation and M&I account, termed the Model Account. Inflows to the reservoir in excess of 300 cfs can be stored in Model Account, and any remaining storage in the account at the end of the irrigation season can be carried over. Note that the City of Trinidad owns the first 500 acre-feet stored in the Model Account; however allows Model Ditch to use this water in return for augmentation operations at the ditch. Additionally, 0.8 percent of the Model Account is dedicated to irrigation at the River Canyon Ranch, currently served under the Lewelling-McCormick Ditch. Releases to the River Canyon Ranch are rarely made however, and are carried over from year-to-year.

Project administration continues through the irrigation season, however once a single Project Ditch’s account in the Irrigation and M&I account has emptied, the District declares the “Project Empty”. Once the Project is declared empty, Project ditches can continue to divert under their direct flow water rights when they are in priority and call for their remaining storage in Trinidad Reservoir, if available. In average years, the Project is generally declared empty in mid-July. If Trinidad Reservoir is able to store additional supplies over the summer, the District can go back

into Project Administration. The District declares the end of the irrigation season on October 15 and Trinidad Reservoir will begin to store under its storage rights on October 16.

Per the Operating Principles, Purgatoire River flows in excess of 5,000 cfs are considered to be potentially damaging and will be temporarily detained to reduce the flows to a non-damaging level. Prior to 2017, the maximum recorded release was approximately 1,100 cfs. Reservoir releases in May of 2017, however, reached 2,400 cfs and there was some damage to the downstream channel. Water stored under flooding conditions is released as quickly as possible, unless John Martin Reservoir is full, then flood flows can be legally stored in Trinidad Reservoir.

During the non-irrigation season from October 16 to March 31, the gates on Trinidad Reservoir remain closed except for releases for stock to Project ditches or delayed return flows. Rarely are the gates opened to pass water for a downstream calling right. Project Ditches typically have a total stock water demand of approximately 20 cfs throughout the winter. Historically, stock diversions were limited to a 5 cfs rate limit. Currently the rate is not limited, but the total volume is limited to 1,200 acre-feet. Natural gains and lagged return flows in the river downstream of the reservoir can be used to meet this demand; however if additional supplies are needed, releases are made from the Model Account. Any releases from the Model Account are generally refilled during the runoff season when the Irrigation and M&I account is storing. As mentioned above, the Hoehne Ditch cannot receive stock water due to a stipulation in Case No. 86CW25.

Storage levels in the Permanent Fishery Pool are generally maintained through the CPW and the City of Trinidad's changed water rights, as summarized in Table 8. Specifically, the City of Trinidad is obligated to maintain 4,500 acre-feet in the Permanent Fishery Pool. Delayed return flow obligations associated with these changed water rights are stored in the Joint Use Pool and released throughout the winter. In addition to delayed return flows, the City of Trinidad also uses up to 3,000 acre-feet of storage in the Joint Use Pool for augmentation purposes of other changed water rights used to meet municipal demands. In the future, the District will use the Joint Use Pool for more delayed return flows as sprinklers begin to be installed.

Where to find more information:

- Additional information on the City of Trinidad's operations is included in the ArkDSS Water District 19 memorandum.
- The final model representation of the Trinidad Project and associated operations will be documented in the Arkansas River Surface Water Model User's Manual.

REFERENCES

- Interview with Steve Kastner, Purgatoire Water Conservancy District General Manager
- Operating Principles Trinidad Dam and Reservoir Project, Amended 2004.
- Purgatoire River Water Conservancy District Operating Criteria
- Losses and Gains for Eight Unlined Canals Along the Purgatoire River near Trinidad, Colorado, 2000–2004 (U.S. Geological Survey SIR 2006-5164)
- Various Decrees available from Division of Water Resources including 03CW0108, 88CW0061, and 88CW0062