# Stream: Purgatoire River

## Executive Summary

Water Division: 2
Water District: 19
CDOW#: 33720
CWCB ID: 08/2/A-001

**Segment:** Confluence Middle & North Forks Purgatoire River to the Confluence with Lopez Canyon

**Upper Terminus**: CONFLUENCE WITH THE MIDDLE & NORTH FORKS OF PURGATOIRE RIVER
(Latitude 37° 9’ 26.01”N) (Longitude 104° 56’ 26.53”W)

**Lower Terminus**: CONFLUENCE WITH LOPEZ CANYON
(Latitude 37° 8’ 25.05”N) (Longitude 104° 52’ 44.77”W)

**Watershed:** Purgatoire (HUC#: 11020010)
**Counties**: Las Animas
**Length**: 4.8 miles
**USGS Quad(s)**: Vigil
**Flow Recommendation:** 21.0 cfs (May 15 to August 15)
15 cfs (August 16 to September 15)
8.4 cfs (September 16 to November 30)
7.0 cfs (December 1 to April 14)
8.4 cfs (April 15 to May 14)

# Staff Analysis and Recommendation

## Summary

The information contained in this report and the associated instream flow file folder forms the basis for staff's instream flow recommendation to be considered by the Board. It is staff's opinion that the information contained in this report is sufficient to support the findings required in Rule 5.40.

Colorado's Instream Flow Program was created in 1973 when the Colorado State Legislature recognized "the need to correlate the activities of mankind with some reasonable preservation of the natural environment" (see 37-92-102 (3) C.R.S.). The statute vests the CWCB with the exclusive authority to appropriate and acquire instream flow and natural lake level water rights. In order to encourage other entities to participate in Colorado's Instream Flow Program, the statute directs the CWCB to request instream flow recommendations from other state and federal agencies. The Colorado Division of Wildlife (CDOW) recommended this segment of the Purgatoire River to the CWCB for inclusion into the Instream Flow Program. The Purgatoire River is being considered for inclusion into the Instream Flow Program because it has a natural environment that can be preserved to a reasonable degree with an instream flow water right.

Purgatoire River is approximately 200 miles long. It begins at the confluence of the Middle and North Forks of the Purgatoire River on the east side of Purgatoire Peak at an elevation of approximately 7,300 feet and terminates at the confluence with the Arkansas River at an elevation of approximately 3,850 feet. Of the 4.8 mile segment addressed by this report, approximately 40% of the segment is located on public lands. The Purgatoire River is located within Las Animas County. The total drainage area of the river is approximately 3,500 square miles. The Purgatoire River generally flows in a northeasterly direction.

The subject of this report is a segment of the Purgatoire River beginning at the confluence of the Middle & North Forks of the Purgatoire River and extending downstream to the confluence with Lopez Canyon. The proposed segment is located west of the City of Trinidad. The recommendation for this segment is discussed below.

## Instream Flow Recommendation(s)

The CDOW is recommending 21.0 cfs (May 15 to August 15); 15 cfs (August 16 to September 15); 8.4 cfs (September 16 to November 30); 7.0 cfs (December 1 to April 14) and 8.4 cfs (April 15 to May 14) based on their data collection efforts and staff's water availability analyses.

## Land Status Review

| Upper Terminus | Lower Terminus | Total Length (miles) | Land Ownership | |
|---|---|---|---|---|
| | | | % Private | % Public |
| Confluence with Middle & North Forks Purgatoire River | Confluence with Lopez Canyon | 4.8 | 60% | 40% |

100% of the public lands are managed by the CDOW.

## Biological Data

The Purgatoire River is classified as a large stream (between 36 to 59 feet wide) and fishery surveys indicate the stream environment of Purgatoire River supports populations of brown trout (*Salmo trutta*), longnose dace (*Rhinichthys cataractae*) and white sucker (*Catostomus commersoni*).

## Field Survey Data

CDOW staff used the R2Cross methodology to quantify the amount of water required to preserve the natural environment to a reasonable degree. The R2Cross method requires that stream discharge and channel profile data be collected in a riffle stream habitat type. Riffles are most easily visualized, as the stream habitat types that would dry up first should streamflow cease. This type of hydraulic data collection consists of setting up a transect, surveying the stream channel geometry, and measuring the stream discharge.

## Biological Flow Recommendation

The CWCB staff relied upon the biological expertise of the cooperating agencies to interpret output from the R2Cross data collected to develop the initial, biologic instream flow recommendation. This initial recommendation is designed to address the unique biologic requirements of each stream without regard to water availability. Three instream flow hydraulic parameters, average depth, percent wetted perimeter, and average velocity are used to develop biologic instream flow recommendations. The CDOW has determined that maintaining these three hydraulic parameters at adequate levels across riffle habitat types, aquatic habitat in pools and runs will also be maintained for most life stages of fish and aquatic invertebrates (Nehring 1979; Espegren 1996).

For this segment of stream, one data set was collected with the results shown in Table 1 below. Table 1 shows who collected the data (Party), the date the data was collected, the measured discharge at the time of the survey (Q), the accuracy range of the predicted flows based on Manning's Equation (240% and 40% of Q), the summer flow recommendation based on meeting 3 of 3 hydraulic criteria and the winter flow recommendation based upon 2 of 3 hydraulic criteria. It is believed that recommendations that fall outside of the accuracy range of the model, over 250% of the measured discharge or under 40% of the measured discharge may not give an accurate estimate of the necessary instream flow required.

Table 1: Data

| Party | Date | Q | 250%-40% | Summer (3/3) | Winter (2/3) |
|---|---|---|---|---|---|
| CDOW | 7/20/2006 | 17.9 | 44.8 – 7.2 | 21.0 | 8.4 |

CDOW = Division of Wildlife

The summer flow recommendation, which met 3 of 3 criteria and is within the accuracy range of the R2CROSS model is 21.0 cfs. The flow recommendations of 15 cfs (August 16 to September 15); 8.4 cfs (September 16 to November 30); and 8.4 cfs (April 15 to May 14) meet two of three criteria and were based on water availability limitations. The winter flow amount of 7.0 cfs (December 1 to April 14) was based on water availability limitations.

## Hydrologic Data and Analysis

After receiving the cooperating agency's biologic recommendation, the CWCB staff conducted an evaluation of the stream hydrology to determine if water was physically available for an instream flow appropriation. This evaluation was done through a computation that is, in essence, a "water balance". In concept a "water balance" computation can be viewed as an accounting exercise. When done in its most rigorous form, the water balance parses precipitation into all the avenues water pursues after it is deposited as rain, snow, or ice. In other words, given a specified amount of water deposition (input), the balance tries to account for all water depletions (losses) until a selected end point is reached. Water losses include depletions due to evaporation and transpiration, deliveries into ground water storage, temporary surface storage, incorporations into plant and animal tissue and so forth. These losses are individually or collectively subtracted from the input to reveal the net amount of stream runoff as represented by the discharge measured by stream gages. Of course, the measured stream flow need not be the end point of interest; indeed, when looking at issues of water use to extinction stream flow measurements may only describe intermediate steps in the complex accounting process that is a water balance carried out to a net value of zero.

In its analysis, CWCB staff has attempted to use this idea of balancing inputs and losses to determine if water is available for the recommended Instream Flow Appropriation. Of course, this analysis must be a practical exercise rather than a lengthy, and costly, scientific investigation. As a result, staff has simplified the process by lumping together some variables and employing certain rational and scientifically supportable assumptions. The process may be described through the following description of the steps used to complete the evaluation for this particular stream.

The first step required in determining water availability is a determination of the hydrologic regime at the Lower Terminus (LT) of the recommended ISF reach. In the best case this means looking at the data from a gage at the LT. Further, this data, in the best case, has been collected for a long period of time (the longer the better) including wet and dry periods. In the case of **Purgatoire River** there is a USGS gage record of discharge on the stream. However, the gage station is downstream from the LT. The USGS gage is PURGATOIRE RIVER AT MADRID, CO (USGS 07124200); it has a period of record (POR) of 35 years collected between 1971 and 2007. The gage is at an elevation of 6,261.61 ft above mean sea level (amsl) and has a drainage area of 505 $mi^2$. The hydrograph (plot of discharge over time) produced from this gage includes the consumptive uses of numerous diversions. However, the existence of these diversions does not preclude use of the data from the gage. To make the measured data transferable to Purgatoire River above the LT, the consumptive portions of these diversions were added back to the measured hydrograph. The resulting "adjusted" hydrograph could then be used on Purgatoire River above the LT by multiplying the "adjusted" gage discharge values by an area ratio; specifically, the area of Purgatoire River above the LT (171.2 $mi^2$) to Purgatoire River at Madrid, CO (505 $mi^2$). Next, the resulting proportioned "adjusted" hydrograph was itself "adjusted" (decreased) to reflect the numerous existing consumptive irrigation depletions on Purgatoire River upstream of the LT. The final hydrograph thus represents a distribution of flow over time that has been reduced to reflect existing human uses.

{The Following discussion is based upon the US Geological Survey's *Techniques of Water-Resources Investigations* Series, *Book 4: Hydrologic Analysis and Interpretation, Chapter A3: Statistical Methods in Water Resources* (Chapter 3: Describing Uncertainty) by D.R. Helsel and R. M. Hirsch. This technical reference provides the scientific background and guidance important to the systematic interpretation of hydrologic data. The document is available online and is a valuable aid to understanding and interpreting the analyses described here.}

The next step in producing a representation of the discharge at Purgatoire River is to compute the Geometric Mean of the area-prorated "adjusted" data values from the Purgatoire River at Madrid, CO hydrograph. This step is of value because of the inherent statistical weaknesses found in any collection of data intended to measure natural stream discharge. Without getting into the details of statistical theory, it is worth noting that a set of discharge measurements is inherently inaccurate, no matter how well collected, due to the difficulties attendant to data collection, especially hydrologic data. To give deference to this fact and to increase the value of the hydrograph product of this analysis, the Geometric Means of the data were computed and plotted along with the 95% Confidence Intervals about the data. The resultant hydrograph, including recommended Instream Flow values, is displayed in figure 1 with an enlargement displayed in figure 2. The data displayed by this hydrograph follow in Table 1.

**Fig. 1. Geometric Mean Daily Q Purgatoire R abv LT (proportioned on Purgatoire R at Madrid, Adjusted for Irr) Adjusted for Irr & ISFs**

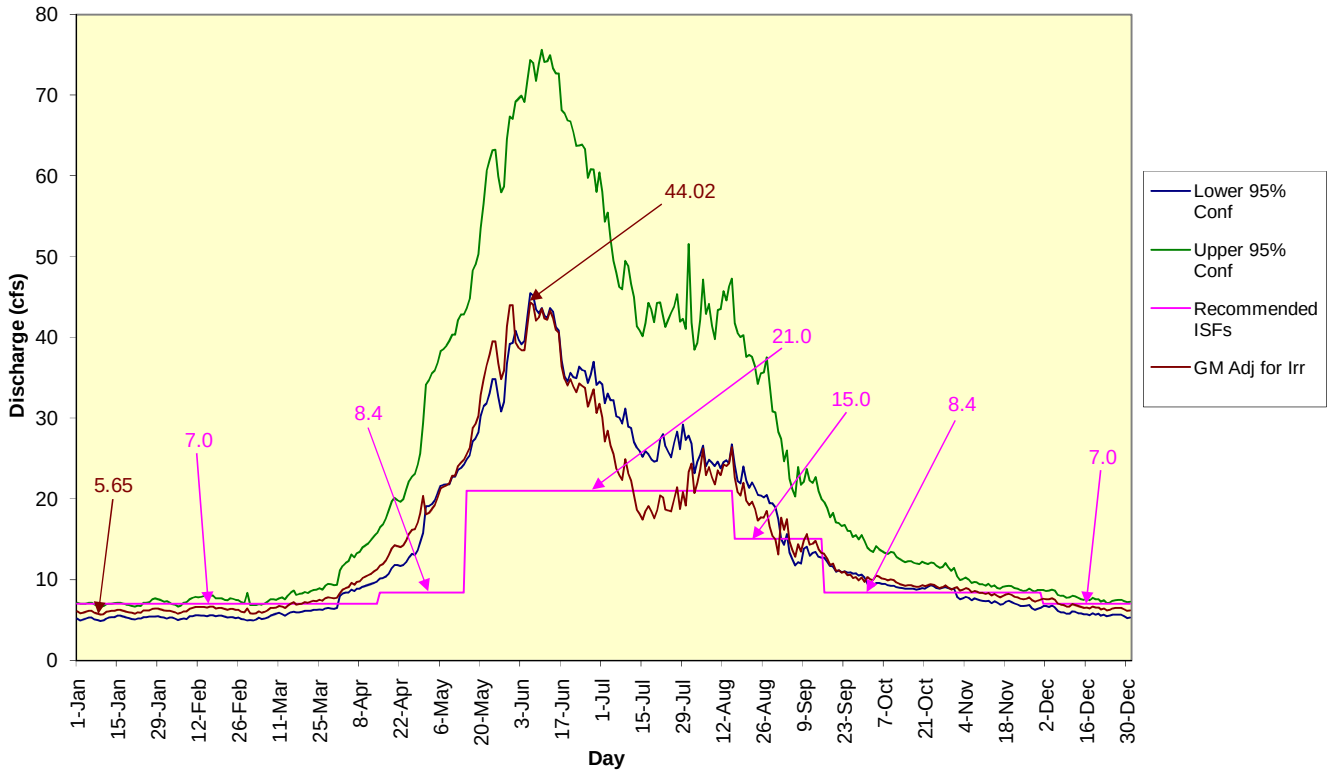
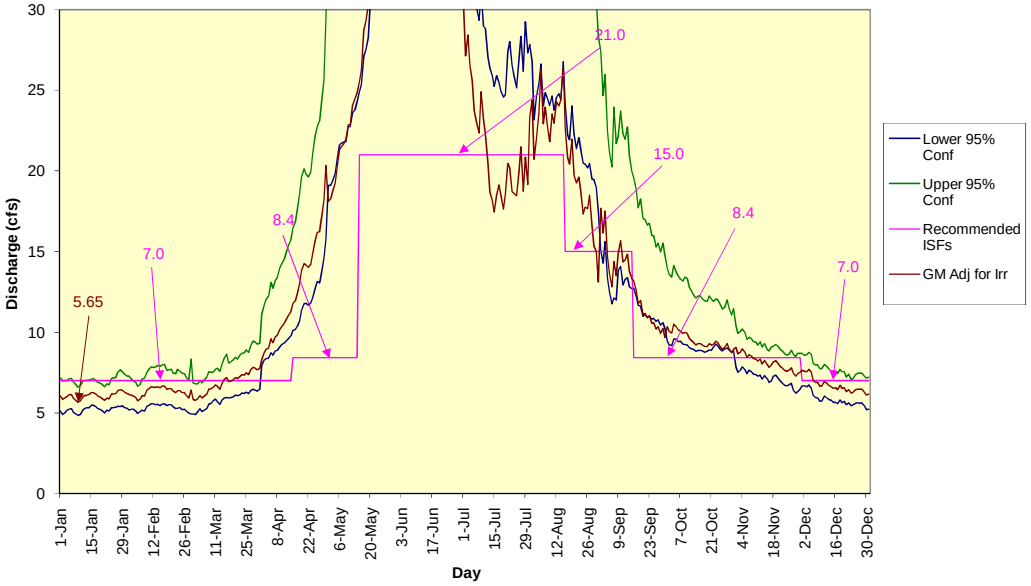


**Fig. 2. Geometric Mean Daily Q Purgatoire R abv LT (proportioned on Purgatoire R at Madrid, Adjusted for Irr), Adjusted for Irr, & ISFs**




| Table 1. Geometric Mean Discharge and Recommended Instream Flows | | |
|---|---|---|
| Date | Recommended ISF | Proportioned Adjusted GM (abv gage) Adj (-) for Irr & OoB in Purgatoire R abv LT |
| 1-Jan | 7.0 | 6.06 |
| 2-Jan | 7.0 | 5.85 |
| 3-Jan | 7.0 | 5.92 |
| 4-Jan | 7.0 | 6.02 |
| 5-Jan | 7.0 | 6.12 |
| 6-Jan | 7.0 | 6.12 |
| 7-Jan | 7.0 | 5.90 |
| 8-Jan | 7.0 | 5.77 |
| 9-Jan | 7.0 | 5.65 |
| 10-Jan | 7.0 | 5.74 |
| 11-Jan | 7.0 | 5.99 |
| 12-Jan | 7.0 | 6.08 |
| 13-Jan | 7.0 | 6.12 |
| 14-Jan | 7.0 | 6.12 |
| 15-Jan | 7.0 | 6.25 |
| 16-Jan | 7.0 | 6.25 |
| 17-Jan | 7.0 | 6.15 |

| | | |
|---|---|---|
| 18-Jan | 7.0 | 6.03 |
| 19-Jan | 7.0 | 5.98 |
| 20-Jan | 7.0 | 5.87 |
| 21-Jan | 7.0 | 5.76 |
| 22-Jan | 7.0 | 5.93 |
| 23-Jan | 7.0 | 5.88 |
| 24-Jan | 7.0 | 6.16 |
| 25-Jan | 7.0 | 6.17 |
| 26-Jan | 7.0 | 6.21 |
| 27-Jan | 7.0 | 6.39 |
| 28-Jan | 7.0 | 6.44 |
| 29-Jan | 7.0 | 6.41 |
| 30-Jan | 7.0 | 6.29 |
| 31-Jan | 7.0 | 6.20 |
| 1-Feb | 7.0 | 6.14 |
| 2-Feb | 7.0 | 6.10 |
| 3-Feb | 7.0 | 6.05 |
| 4-Feb | 7.0 | 5.94 |
| 5-Feb | 7.0 | 5.75 |
| 6-Feb | 7.0 | 5.87 |
| 7-Feb | 7.0 | 6.06 |
| 8-Feb | 7.0 | 6.05 |
| 9-Feb | 7.0 | 6.39 |
| 10-Feb | 7.0 | 6.49 |
| 11-Feb | 7.0 | 6.62 |
| 12-Feb | 7.0 | 6.60 |
| 13-Feb | 7.0 | 6.59 |
| 14-Feb | 7.0 | 6.63 |
| 15-Feb | 7.0 | 6.55 |
| 16-Feb | 7.0 | 6.66 |
| 17-Feb | 7.0 | 6.68 |
| 18-Feb | 7.0 | 6.45 |
| 19-Feb | 7.0 | 6.49 |
| 20-Feb | 7.0 | 6.51 |
| 21-Feb | 7.0 | 6.35 |
| 22-Feb | 7.0 | 6.26 |
| 23-Feb | 7.0 | 6.38 |
| 24-Feb | 7.0 | 6.36 |
| 25-Feb | 7.0 | 6.24 |
| 26-Feb | 7.0 | 6.25 |
| 27-Feb | 7.0 | 6.04 |
| 28-Feb | 7.0 | 5.94 |
| 29-Feb | 7.0 | 6.41 |
| 1-Mar | 7.0 | 5.82 |
| 2-Mar | 7.0 | 5.79 |
| 3-Mar | 7.0 | 5.86 |
| 4-Mar | 7.0 | 6.07 |
| 5-Mar | 7.0 | 5.92 |
| 6-Mar | 7.0 | 6.04 |
| 7-Mar | 7.0 | 6.17 |
| 8-Mar | 7.0 | 6.46 |

| | | |
|---|---|---|
| 9-Mar | 7.0 | 6.50 |
| 10-Mar | 7.0 | 6.57 |
| 11-Mar | 7.0 | 6.72 |
| 12-Mar | 7.0 | 6.65 |
| 13-Mar | 7.0 | 6.47 |
| 14-Mar | 7.0 | 6.80 |
| 15-Mar | 7.0 | 7.05 |
| 16-Mar | 7.0 | 7.19 |
| 17-Mar | 7.0 | 6.93 |
| 18-Mar | 7.0 | 6.98 |
| 19-Mar | 7.0 | 7.04 |
| 20-Mar | 7.0 | 7.19 |
| 21-Mar | 7.0 | 7.13 |
| 22-Mar | 7.0 | 7.24 |
| 23-Mar | 7.0 | 7.36 |
| 24-Mar | 7.0 | 7.35 |
| 25-Mar | 7.0 | 7.49 |
| 26-Mar | 7.0 | 7.37 |
| 27-Mar | 7.0 | 7.68 |
| 28-Mar | 7.0 | 7.82 |
| 29-Mar | 7.0 | 7.76 |
| 30-Mar | 7.0 | 7.67 |
| 31-Mar | 7.0 | 7.76 |
| 1-Apr | 7.0 | 8.29 |
| 2-Apr | 7.0 | 8.73 |
| 3-Apr | 7.0 | 8.94 |
| 4-Apr | 7.0 | 9.03 |
| 5-Apr | 7.0 | 9.58 |
| 6-Apr | 7.0 | 9.35 |
| 7-Apr | 7.0 | 9.71 |
| 8-Apr | 7.0 | 9.80 |
| 9-Apr | 7.0 | 10.17 |
| 10-Apr | 7.0 | 10.35 |
| 11-Apr | 7.0 | 10.53 |
| 12-Apr | 7.0 | 10.76 |
| 13-Apr | 7.0 | 11.04 |
| 14-Apr | 7.0 | 11.28 |
| 15-Apr | 8.4 | 11.78 |
| 16-Apr | 8.4 | 11.95 |
| 17-Apr | 8.4 | 12.36 |
| 18-Apr | 8.4 | 13.01 |
| 19-Apr | 8.4 | 13.82 |
| 20-Apr | 8.4 | 14.26 |
| 21-Apr | 8.4 | 14.16 |
| 22-Apr | 8.4 | 14.02 |
| 23-Apr | 8.4 | 14.23 |
| 24-Apr | 8.4 | 14.89 |
| 25-Apr | 8.4 | 15.67 |
| 26-Apr | 8.4 | 16.18 |
| 27-Apr | 8.4 | 16.24 |
| 28-Apr | 8.4 | 17.09 |

| | | |
|---|---|---|
| 29-Apr | 8.4 | 18.21 |
| 30-Apr | 8.4 | 20.35 |
| 1-May | 8.4 | 18.11 |
| 2-May | 8.4 | 18.29 |
| 3-May | 8.4 | 18.77 |
| 4-May | 8.4 | 19.22 |
| 5-May | 8.4 | 20.17 |
| 6-May | 8.4 | 21.31 |
| 7-May | 8.4 | 21.50 |
| 8-May | 8.4 | 21.69 |
| 9-May | 8.4 | 21.93 |
| 10-May | 8.4 | 22.86 |
| 11-May | 8.4 | 22.85 |
| 12-May | 8.4 | 24.10 |
| 13-May | 8.4 | 24.49 |
| 14-May | 8.4 | 24.82 |
| 15-May | 21.0 | 25.55 |
| 16-May | 21.0 | 26.26 |
| 17-May | 21.0 | 28.73 |
| 18-May | 21.0 | 29.27 |
| 19-May | 21.0 | 30.27 |
| 20-May | 21.0 | 32.87 |
| 21-May | 21.0 | 34.77 |
| 22-May | 21.0 | 36.48 |
| 23-May | 21.0 | 37.86 |
| 24-May | 21.0 | 39.47 |
| 25-May | 21.0 | 39.51 |
| 26-May | 21.0 | 36.79 |
| 27-May | 21.0 | 34.83 |
| 28-May | 21.0 | 35.91 |
| 29-May | 21.0 | 41.32 |
| 30-May | 21.0 | 44.01 |
| 31-May | 21.0 | 43.97 |
| 1-Jun | 21.0 | 39.29 |
| 2-Jun | 21.0 | 38.69 |
| 3-Jun | 21.0 | 38.44 |
| 4-Jun | 21.0 | 38.43 |
| 5-Jun | 21.0 | 41.49 |
| 6-Jun | 21.0 | 44.34 |
| 7-Jun | 21.0 | 44.02 |
| 8-Jun | 21.0 | 42.07 |
| 9-Jun | 21.0 | 42.51 |
| 10-Jun | 21.0 | 43.59 |
| 11-Jun | 21.0 | 42.39 |
| 12-Jun | 21.0 | 42.21 |
| 13-Jun | 21.0 | 43.32 |
| 14-Jun | 21.0 | 42.44 |
| 15-Jun | 21.0 | 40.90 |
| 16-Jun | 21.0 | 40.58 |
| 17-Jun | 21.0 | 36.39 |
| 18-Jun | 21.0 | 34.85 |

| | | |
|---|---|---|
| 19-Jun | 21.0 | 34.07 |
| 20-Jun | 21.0 | 34.82 |
| 21-Jun | 21.0 | 33.95 |
| 22-Jun | 21.0 | 33.24 |
| 23-Jun | 21.0 | 34.30 |
| 24-Jun | 21.0 | 34.01 |
| 25-Jun | 21.0 | 33.75 |
| 26-Jun | 21.0 | 31.44 |
| 27-Jun | 21.0 | 32.51 |
| 28-Jun | 21.0 | 33.57 |
| 29-Jun | 21.0 | 30.64 |
| 30-Jun | 21.0 | 31.79 |
| 1-Jul | 21.0 | 30.11 |
| 2-Jul | 21.0 | 27.14 |
| 3-Jul | 21.0 | 28.41 |
| 4-Jul | 21.0 | 26.57 |
| 5-Jul | 21.0 | 25.58 |
| 6-Jul | 21.0 | 23.74 |
| 7-Jul | 21.0 | 22.94 |
| 8-Jul | 21.0 | 22.33 |
| 9-Jul | 21.0 | 24.91 |
| 10-Jul | 21.0 | 23.22 |
| 11-Jul | 21.0 | 22.26 |
| 12-Jul | 21.0 | 20.47 |
| 13-Jul | 21.0 | 18.67 |
| 14-Jul | 21.0 | 18.16 |
| 15-Jul | 21.0 | 17.44 |
| 16-Jul | 21.0 | 18.50 |
| 17-Jul | 21.0 | 19.13 |
| 18-Jul | 21.0 | 18.43 |
| 19-Jul | 21.0 | 17.63 |
| 20-Jul | 21.0 | 18.58 |
| 21-Jul | 21.0 | 20.45 |
| 22-Jul | 21.0 | 20.19 |
| 23-Jul | 21.0 | 18.72 |
| 24-Jul | 21.0 | 18.59 |
| 25-Jul | 21.0 | 18.46 |
| 26-Jul | 21.0 | 19.94 |
| 27-Jul | 21.0 | 21.47 |
| 28-Jul | 21.0 | 18.73 |
| 29-Jul | 21.0 | 20.86 |
| 30-Jul | 21.0 | 19.16 |
| 31-Jul | 21.0 | 23.35 |
| 1-Aug | 21.0 | 24.38 |
| 2-Aug | 21.0 | 20.72 |
| 3-Aug | 21.0 | 21.99 |
| 4-Aug | 21.0 | 23.63 |
| 5-Aug | 21.0 | 26.24 |
| 6-Aug | 21.0 | 22.92 |
| 7-Aug | 21.0 | 23.93 |
| 8-Aug | 21.0 | 22.67 |

| | | |
|---|---|---|
| 9-Aug | 21.0 | 21.80 |
| 10-Aug | 21.0 | 23.51 |
| 11-Aug | 21.0 | 22.94 |
| 12-Aug | 21.0 | 24.28 |
| 13-Aug | 21.0 | 24.04 |
| 14-Aug | 21.0 | 24.37 |
| 15-Aug | 21.0 | 26.39 |
| 16-Aug | 15.0 | 22.61 |
| 17-Aug | 15.0 | 20.82 |
| 18-Aug | 15.0 | 20.43 |
| 19-Aug | 15.0 | 21.96 |
| 20-Aug | 15.0 | 19.77 |
| 21-Aug | 15.0 | 19.25 |
| 22-Aug | 15.0 | 19.62 |
| 23-Aug | 15.0 | 18.73 |
| 24-Aug | 15.0 | 17.33 |
| 25-Aug | 15.0 | 17.75 |
| 26-Aug | 15.0 | 17.65 |
| 27-Aug | 15.0 | 18.49 |
| 28-Aug | 15.0 | 16.62 |
| 29-Aug | 15.0 | 15.38 |
| 30-Aug | 15.0 | 15.00 |
| 31-Aug | 15.0 | 13.11 |
| 1-Sep | 15.0 | 17.68 |
| 2-Sep | 15.0 | 16.16 |
| 3-Sep | 15.0 | 17.51 |
| 4-Sep | 15.0 | 14.72 |
| 5-Sep | 15.0 | 13.65 |
| 6-Sep | 15.0 | 12.81 |
| 7-Sep | 15.0 | 14.38 |
| 8-Sep | 15.0 | 13.49 |
| 9-Sep | 15.0 | 14.89 |
| 10-Sep | 15.0 | 15.67 |
| 11-Sep | 15.0 | 14.35 |
| 12-Sep | 15.0 | 14.45 |
| 13-Sep | 15.0 | 14.82 |
| 14-Sep | 15.0 | 13.78 |
| 15-Sep | 15.0 | 13.33 |
| 16-Sep | 8.4 | 13.18 |
| 17-Sep | 8.4 | 12.57 |
| 18-Sep | 8.4 | 11.79 |
| 19-Sep | 8.4 | 11.96 |
| 20-Sep | 8.4 | 11.09 |
| 21-Sep | 8.4 | 11.16 |
| 22-Sep | 8.4 | 10.88 |
| 23-Sep | 8.4 | 11.00 |
| 24-Sep | 8.4 | 10.57 |
| 25-Sep | 8.4 | 10.59 |
| 26-Sep | 8.4 | 10.19 |
| 27-Sep | 8.4 | 10.34 |
| 28-Sep | 8.4 | 9.93 |

| | | |
|---|---|---|
| 29-Sep | 8.4 | 10.23 |
| 30-Sep | 8.4 | 9.70 |
| 1-Oct | 8.4 | 10.35 |
| 2-Oct | 8.4 | 10.04 |
| 3-Oct | 8.4 | 9.95 |
| 4-Oct | 8.4 | 10.48 |
| 5-Oct | 8.4 | 10.35 |
| 6-Oct | 8.4 | 10.15 |
| 7-Oct | 8.4 | 10.07 |
| 8-Oct | 8.4 | 9.91 |
| 9-Oct | 8.4 | 9.99 |
| 10-Oct | 8.4 | 9.93 |
| 11-Oct | 8.4 | 9.63 |
| 12-Oct | 8.4 | 9.48 |
| 13-Oct | 8.4 | 9.35 |
| 14-Oct | 8.4 | 9.22 |
| 15-Oct | 8.4 | 9.29 |
| 16-Oct | 8.4 | 9.29 |
| 17-Oct | 8.4 | 9.20 |
| 18-Oct | 8.4 | 9.10 |
| 19-Oct | 8.4 | 9.11 |
| 20-Oct | 8.4 | 9.30 |
| 21-Oct | 8.4 | 9.19 |
| 22-Oct | 8.4 | 9.27 |
| 23-Oct | 8.4 | 9.44 |
| 24-Oct | 8.4 | 9.35 |
| 25-Oct | 8.4 | 9.09 |
| 26-Oct | 8.4 | 8.93 |
| 27-Oct | 8.4 | 9.06 |
| 28-Oct | 8.4 | 9.28 |
| 29-Oct | 8.4 | 8.98 |
| 30-Oct | 8.4 | 8.73 |
| 31-Oct | 8.4 | 8.94 |
| 1-Nov | 8.4 | 9.05 |
| 2-Nov | 8.4 | 8.65 |
| 3-Nov | 8.4 | 8.76 |
| 4-Nov | 8.4 | 8.96 |
| 5-Nov | 8.4 | 8.80 |
| 6-Nov | 8.4 | 8.44 |
| 7-Nov | 8.4 | 8.60 |
| 8-Nov | 8.4 | 8.52 |
| 9-Nov | 8.4 | 8.35 |
| 10-Nov | 8.4 | 8.32 |
| 11-Nov | 8.4 | 8.20 |
| 12-Nov | 8.4 | 8.33 |
| 13-Nov | 8.4 | 8.03 |
| 14-Nov | 8.4 | 8.25 |
| 15-Nov | 8.4 | 7.99 |
| 16-Nov | 8.4 | 7.82 |
| 17-Nov | 8.4 | 7.96 |
| 18-Nov | 8.4 | 8.16 |

| | | |
|---|---|---|
| 19-Nov | 8.4 | 8.24 |
| 20-Nov | 8.4 | 8.10 |
| 21-Nov | 8.4 | 7.89 |
| 22-Nov | 8.4 | 7.79 |
| 23-Nov | 8.4 | 7.63 |
| 24-Nov | 8.4 | 7.58 |
| 25-Nov | 8.4 | 7.64 |
| 26-Nov | 8.4 | 7.79 |
| 27-Nov | 8.4 | 7.44 |
| 28-Nov | 8.4 | 7.27 |
| 29-Nov | 8.4 | 7.41 |
| 30-Nov | 8.4 | 7.51 |
| 1-Dec | 7.0 | 7.63 |
| 2-Dec | 7.0 | 7.57 |
| 3-Dec | 7.0 | 7.54 |
| 4-Dec | 7.0 | 7.69 |
| 5-Dec | 7.0 | 7.51 |
| 6-Dec | 7.0 | 7.00 |
| 7-Dec | 7.0 | 6.89 |
| 8-Dec | 7.0 | 6.87 |
| 9-Dec | 7.0 | 6.66 |
| 10-Dec | 7.0 | 6.68 |
| 11-Dec | 7.0 | 6.95 |
| 12-Dec | 7.0 | 6.87 |
| 13-Dec | 7.0 | 6.71 |
| 14-Dec | 7.0 | 6.60 |
| 15-Dec | 7.0 | 6.51 |
| 16-Dec | 7.0 | 6.56 |
| 17-Dec | 7.0 | 6.44 |
| 18-Dec | 7.0 | 6.69 |
| 19-Dec | 7.0 | 6.53 |
| 20-Dec | 7.0 | 6.57 |
| 21-Dec | 7.0 | 6.31 |
| 22-Dec | 7.0 | 6.45 |
| 23-Dec | 7.0 | 6.21 |
| 24-Dec | 7.0 | 6.27 |
| 25-Dec | 7.0 | 6.43 |
| 26-Dec | 7.0 | 6.48 |
| 27-Dec | 7.0 | 6.47 |
| 28-Dec | 7.0 | 6.48 |
| 29-Dec | 7.0 | 6.30 |
| 30-Dec | 7.0 | 6.12 |
| 31-Dec | 7.0 | 6.17 |

## Existing Water Right Information

CDOW staff has analyzed the water rights tabulation and contacted the Division Engineer's Office (DEO) to identify any potential water availability problems due to existing diversions. Records indicate that there are potentially 3 surface water diversions that are located within this reach of the Purgatoire River. They are the Samora Ditch (2.4 cfs with and 1870 appropriations), Turner Ditch (1.8 cfs with an 1872 appropriation) and the Santistevan Ditch (3.2 cfs with an 1870 appropriation). Staff has determined that water is available for appropriation on the Purgatoire River, between the confluence with the Middle and North Forks Purgatoire River and the confluence with Lopez Canyon, to preserve the natural environment to a reasonable degree without limiting or foreclosing the exercise of valid existing water rights.

CWCB Staff's Instream Flow Recommendation

Staff recommends the Board form its intent to appropriate on the following stream reach:

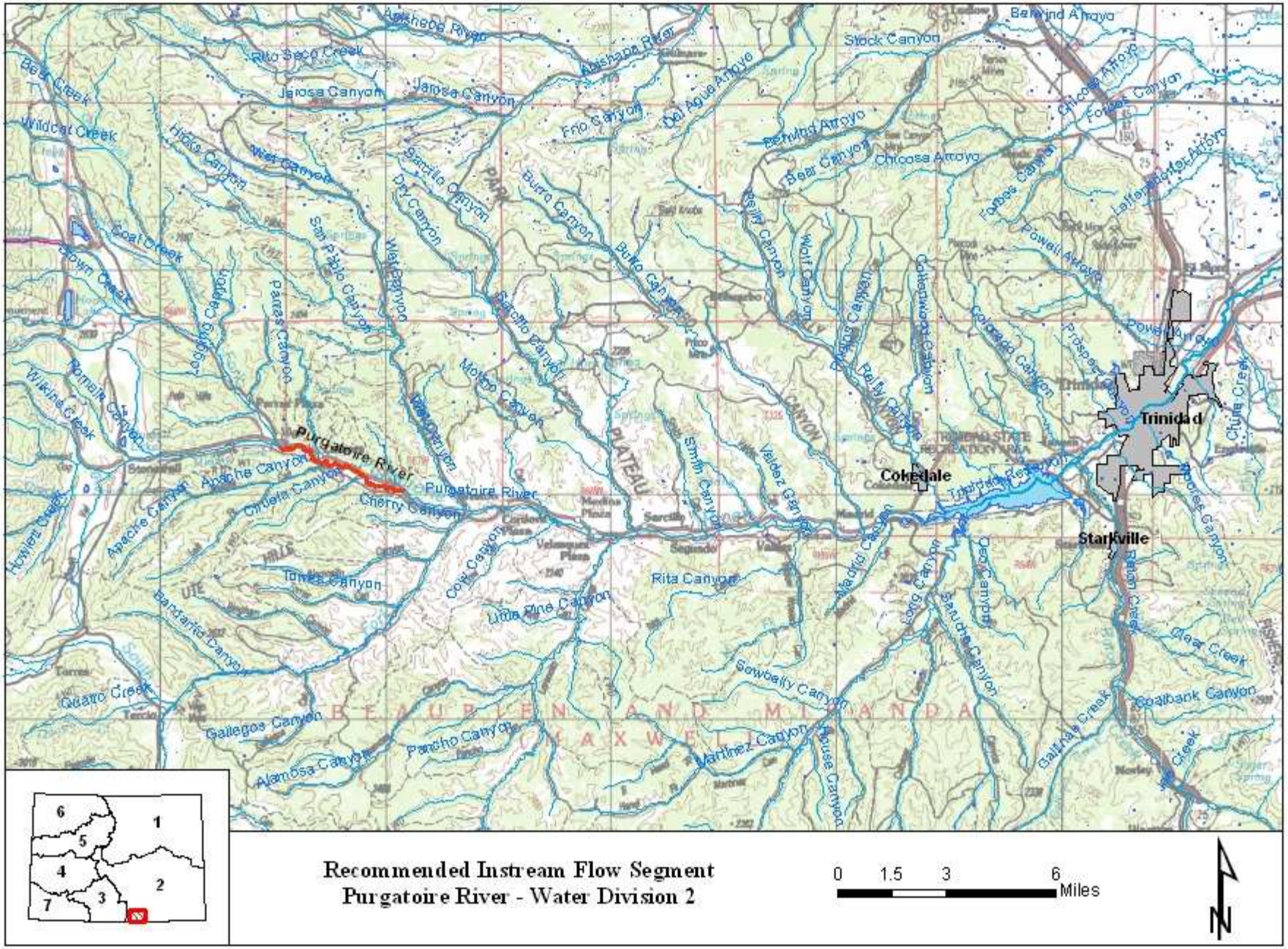
### **Segment:** Confluence Middle & North Forks Purgatoire River to the Confluence with Lopez Canyon

**Upper Terminus**: CONFLUENCE WITH THE MIDDLE & NORTH FORKS OF PURGATOIRE RIVER
(Latitude 37° 9' 26.01"N) (Longitude 104° 56' 26.53"W)
UTM North: 4112315.8 UTM East: 505265.1
SE NE S24 T33S R68W 6th PM
733' West of the East Section Line; 2490' South of the North Section Line

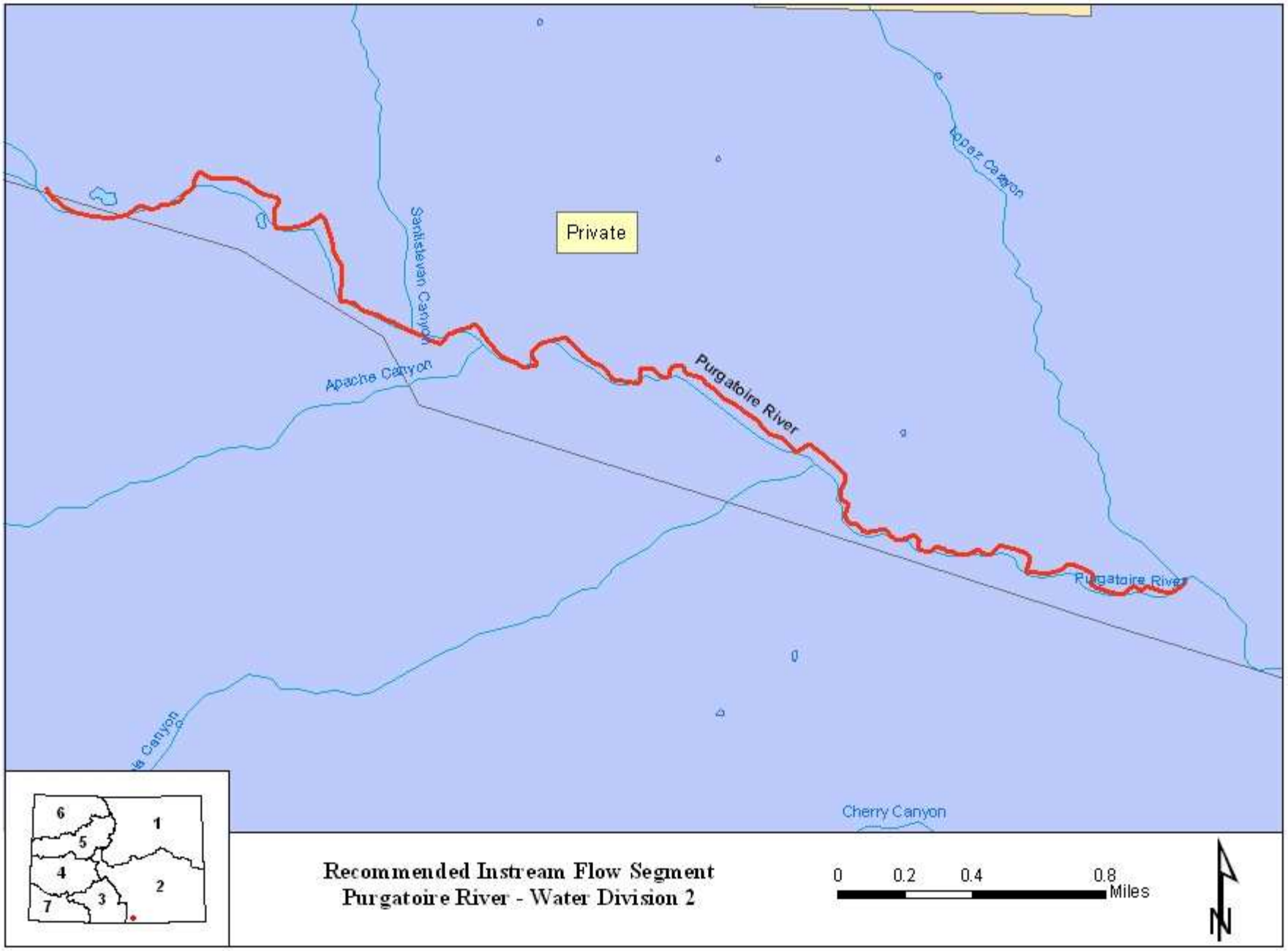
**Lower Terminus**: CONFLUENCE WITH LOPEZ CANYON
(Latitude 37° 8' 25.05"N) (Longitude 104° 52' 44.77"W)
UTM North: 4110442.4 UTM East: 510737.2
NE SW S27 T33S R67W 6th PM
1347' East of the West Section Line; 3565' South of the North Section Line

**Watershed:** Purgatoire (HUC#: 11020010)
**Counties**: Las Animas
**Length**: 4.8 miles
**USGS Quad(s)**: Vigil
**Flow Recommendation:** 21.0 cfs (May 15 to August 15)
15 cfs (August 16 to September 15)
8.4 cfs (September 16 to November 30)
7.0 cfs (December 1 to April 14)
8.4 cfs (April 15 to May 14)

# Vicinity Map



# Land Use Map


Private
Purgatoire River
Apache Canyon
Santistevan Canyon
Lopez Canyon
Cherry Canyon
Recommended Instream Flow Segment
Purgatoire River - Water Division 2
0 0.2 0.4 0.8
Miles
N
1
2
3
4
5
6
7

# Topographic & Water Rights Map