**STATE OF COLORADO**

**Bill Ritter, Jr., Governor**
**DEPARTMENT OF NATURAL RESOURCES**
# DIVISION OF WILDLIFE
AN EQUAL OPPORTUNITY EMPLOYER

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*For Wildlife-*
*For People*

January 8, 2010

Ms. Linda Bassi
Colorado Water Conservation Board
Stream and Lake Protection Section
1313 Sherman Street, Room 723
Denver, Colorado 80203

**Re: Colorado Division of Wildlife Instream Flow Recommendations for Middle Creek.**

Dear Linda,

The purpose of this letter is to formally transmit the Colorado Division of Wildlife's (CDOW) Instream Flow Recommendations for Middle Creek pursuant to Rule 5n of the Rules Concerning the Colorado Instream Flow and Natural Lake Levels. The CDOW believes that Middle Creek should be considered for inclusion into the Instream Flow Program (ISFP) because it has a natural environment that can be preserved to a reasonable degree with an instream flow water right. As you know, the State of Colorado's Instream Flow Program (ISFP) 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 Colorado Water Conservation Board (Board) 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 ISFP, the statute directs the Board to request instream flow recommendations from other state and federal agencies.

**Location and Land Status**

The Middle Creek instream flow recommendations begin at the headwaters of Middle Creek and extend downstream to the Beulah Water Works Diversion. The Middle Creek instream flow recommendation was segmented at the confluence with Ophir Creek. The proposed instream flow segments are located west of the Town of Beulah. 80% of the proposed upper segment (headwaters to Ophir Creek) is located on public lands and 65% of the proposed lower segment (Ophir Creek to Beulah Water Works Diversion) is located on public lands.

**Biological Summary and R2CROSS Analysis**

The CDOW, in September of 1997, collected stream cross section information, natural environment data, and other data needed to quantify the instream flow needs for this reach of the Middle Creek. Middle Creek is classified as a medium stream (between 20 to 35 feet wide) and fishery surveys indicate the stream environment of the Middle Creek supports rainbow trout (*Oncorhynchus mykiss*) and brook trout (*Salvelinus fontinalis*). The Board staff relies 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).

The results of the R2CROSS data collection efforts for the upper segment indicate that an instream flow recommendation of 3.4 cfs, is required to maintain the three principal hydraulic criteria of average depth, average velocity and percent wetted perimeter, and 1.0 cfs, is required to maintain two of the three principal hydraulic criteria. The results of the R2CROSS data collection efforts for the lower segment indicate that an instream flow recommendation of 5.1 cfs, is required to maintain the three principal hydraulic criteria of average depth, average velocity and percent wetted perimeter, and 2.8 cfs, is required to maintain two of the three principal hydraulic criteria. However, these results are only based on the physical and biological data collected to date and do not incorporate any water availability constraints.

**Water Availability Analysis and Instream Flow Recommendation**

The CDOW staff conducted a preliminary evaluation of the stream hydrology to determine if water was physically available for an instream flow appropriation based on data collected at the USGS stream gage for the St. Charles River at San Isabel, CO (#07107000). Subsequent to this preliminary analysis, the CWCB completed their geometric mean analysis of daily flows for Middle Creek. We have used the CWCB's water availability analysis to adjust the seasonality and quantities of the R2CROSS instream flow recommendation so that the estimated daily flow of Middle Creek reasonably exceeds the recommended instream flow amounts. These seasonal adjustments are reflected in the final instream flow recommendations shown below:

Headwaters to Ophir Creek

- 3.4 cfs (April 15 through June 30)
- 2.0 cfs (July 1 through August 31)
- 1.0 cfs (September 1 through April 14)

Ophir Creek to Beulah Water Works Diversion

- 5.1 cfs (April 1 through August 31)
- 2.8 cfs (September 1 through March 31)

**Relationship to State Policy**

The CDOW supports the Instream Flow Program because the appropriation of instream flow water rights helps the CDOW meet our statutory mission as described in Title 33 of the Colorado Revised Statutes (CRS):

> §33-1-101 – "It is the policy of the state of Colorado that the wildlife and their environment are to be protected, preserved, enhanced, and managed for the use, benefit, and enjoyment of the people of this state and its visitors … that there shall be provided a comprehensive program designed to offer the greatest possible variety of wildlife-related recreational opportunity to the people of this state and its visitors and that, to carry out such program and policy, there shall be a continuous operation of planning, acquisition, and development of wildlife habitats and facilities for wildlife related opportunities."
>
> §33-2-106 – "(1) The division [of Wildlife] shall establish such programs including acquisition of land or aquatic habitat as are deemed necessary for management of nongame, endangered, or threatened wildlife. (2) … the division may enter into agreements with federal agencies or political subdivisions of this state or with private persons for administration and management of any area established under this section or utilized for management of nongame, endangered, or threatened wildlife."
>
> §33-5-101 – "It is declared to be the policy of the state that its fish and wildlife resources, and particularly the fishing waters within the state, are to be protected and preserved from the actions of any state agency to the end that they be available for all time and without change in their natural existing state, except as may be necessary and appropriate after due consideration of all factors involved."

In addition to meeting the state policy discussed above Middle Creek satisfies criteria identified by the CWCB for ISF appropriations, including:

a) The recommendations have broad public support;

b) The proposed appropriations will have a positive impact on state or local economies;

c) The recommendations are part of a water acquisition strategy;

d) The recommendations are part of a collaborative solution to a unique natural resource issue with federal, state or local partners; and

e) The instream flow amount and timing recommended by CDOW and CWCB staff:

- Is based upon standard scientific methodology and an accurate R2CROSS analysis;
- Reflects the amount of water available for appropriation as an instream flow water right; and
- Is required to preserve the natural environment to a reasonable degree.

I have also attached copies of the field data sheets, the R2CROSS modeling runs, and stream photographs. If you have any questions regarding the attached information or the instream flow recommendations please contact me at (303)-291-7267.

Sincerely,

Mark Uppendahl
Colorado Division of Wildlife
Instream Flow Program Coordinator

Cc: Grady McNeill, CDOW Resource Support Section Manager – w/o attachments
Jay Skinner, CDOW Water Unit Program Manager – w/o attachments
John Tonko, CDOW Water Resource Specialist – w/o attachments
Dave Krieger, CDOW Senior Aquatic Biologist – w/o attachments
Dan Prenzlow, CDOW Southeast Regional Manager - w/o attachments
Jim Melby, CDOW Aquatic Biologist – w/o attachments
Mike Trujillo, CDOW AWM Area 11 – w/o attachments

# Stream: Middle Creek

## Executive Summary

Water Division: 2
Water District: 15
CDOW#: 30368

## Segment: Headwaters to Ophir Creek

**Upper Terminus: Headwaters**
Latitude: 38º 02’ 45.0”N Longitude: 105º 10’ 31.6"W

**Lower Terminus: Ophir Creek**
Latitude: 38º 03’ 56.1”N Longitude: 105º 06’ 19.9"W

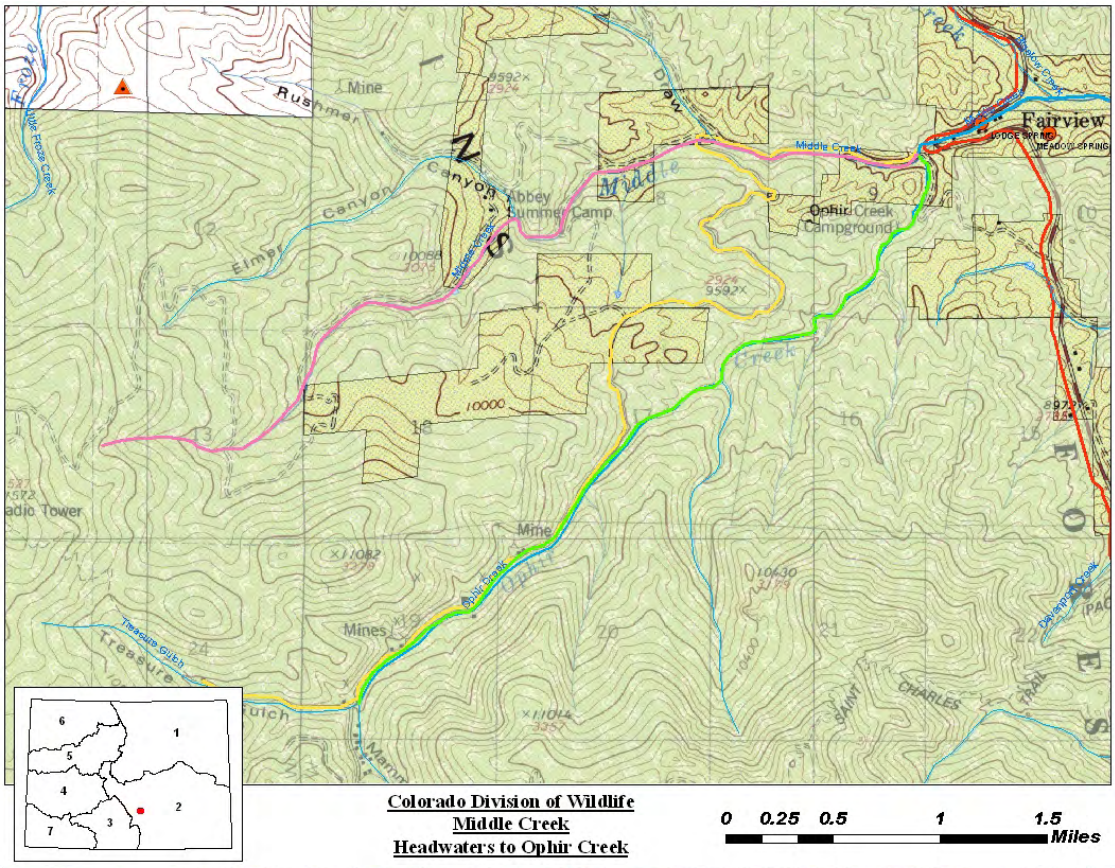
ISF Appropriation: 1.6 cfs (04/01 – 07/15)
0.9 cfs (07/16 – 09/15)
0.4 cfs (09/16 – 03/31)

## Segment: Ophir Creek to Beulah Water Works

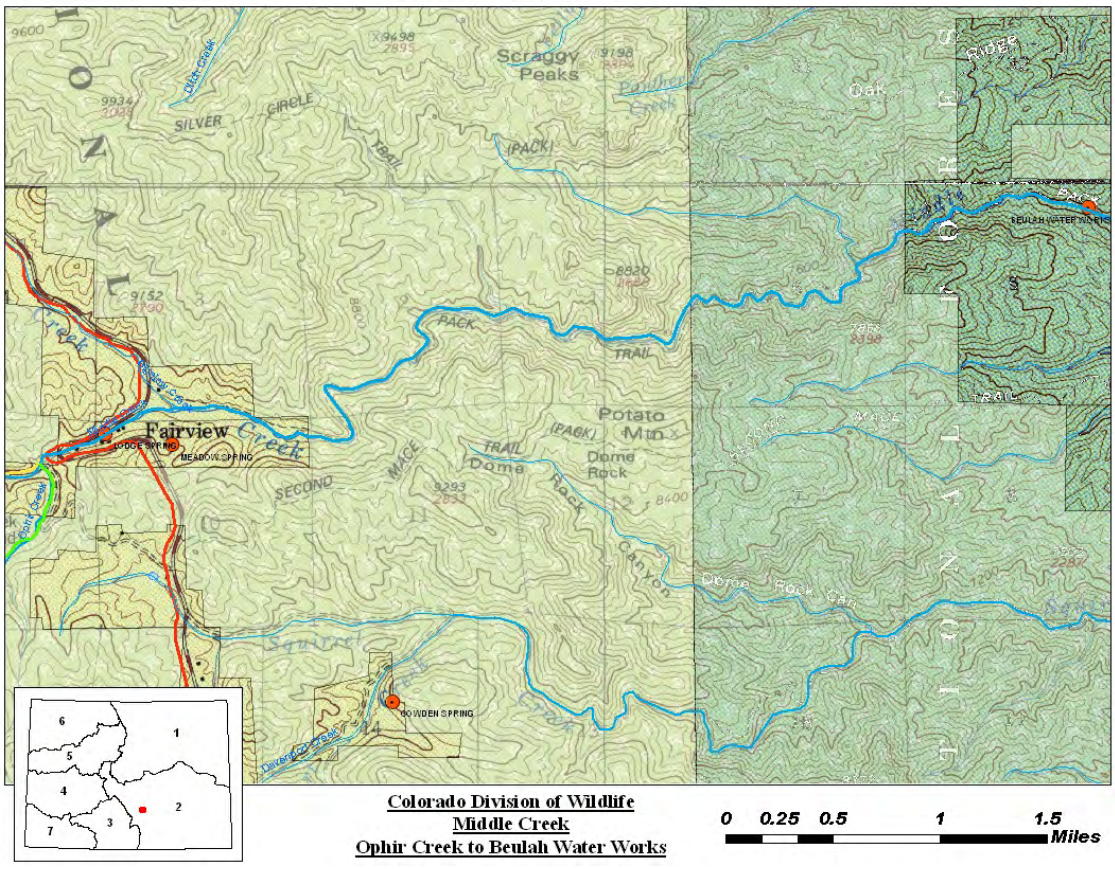
**Upper Terminus: Ophir Creek**
Latitude: 38º 03’ 56.1”N Longitude: 105º 06’ 19.9"W

**Lower Terminus: Beulah Water Works**
Latitude: 38º 04’ 57.8”N Longitude: 105º 00’ 57.9"W

ISF Appropriation: 5.1 cfs (04/01 – 07/15)
2.8 cfs (07/16 – 09/15)
1.4 cfs (09/16 – 03/31)




Colorado Division of Wildlife
Middle Creek
Headwaters to Ophir Creek




Colorado Division of Wildlife
Middle Creek
Ophir Creek to Beulah Water Works

The information contained in this report and the associated instream flow file folder forms the basis for the instream flow recommendation to be considered by the Colorado Water Conservation Board (Board). It is the Colorado Division of Wildlife (CDOW) staff's opinion that the information contained in this report is sufficient for the Board's staff to begin the investigations required to support the findings required in Rule 5(i) of the Instream Flow Rules.

The State of Colorado's Instream Flow Program (ISFP) 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 Board 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 ISFP, the statute directs the Board to request instream flow recommendations from other state and federal agencies. The CDOW is recommending this segment of Middle Creek to the Board for inclusion into the ISFP. Middle Creek should be considered for inclusion into the ISFP because it has a natural environment that can be preserved to a reasonable degree with an instream flow water right.

The CDOW is forwarding this stream flow recommendation to the Board to meet Colorado's policy "… that the wildlife and their environment are to be protected, preserved, enhanced, and managed for the use, benefit, and enjoyment of the people of this state and its visitors … and that, to carry out such program and policy, there shall be a continuous operation of planning, acquisition, and development of wildlife habitats and facilities for wildlife-related opportunities" (See §33-1-101 (1) C.R.S.). The CDOW Strategic Plan states "[h]ealthy aquatic environments are essential to maintain healthy and viable fisheries, and critical for self-sustaining populations. The [CDOW] desires to protect and enhance the quality and quantity of aquatic habitats."

The subject of this report are two segments of Middle Creek beginning at its headwaters and extending downstream to the Beulah Water Works Diversion. The proposed segments are located west of the Town of Beulah. The recommendations for these segments are discussed below.

## Instream Flow Recommendation(s)

The CDOW is recommending 1.6 cfs for the upper segment and 5.1 cfs for the lower segment, summer, and 0.9 cfs the upper segment and 2.8 cfs for the lower segment, winter, based on their data collection efforts. This recommendation is based on the physical and biological data collected to date and does not incorporate any water availability constraints.

Upper Segment (Headwaters to Ophir Creek – estimated flow recommendation)

- 1.6 cubic feet per second is required to maintain the three principal hydraulic criteria of average depth, average velocity and percent wetted perimeter;
- 0.9 cubic feet per second is required to maintain two of the three principal hydraulic criteria.

Lower Segment (Ophir Creek to Beulah Water Works Diversion)

- 5.1 cubic feet per second is required to maintain the three principal hydraulic criteria of average depth, average velocity and percent wetted perimeter;
- 2.8 cubic feet per second is required to maintain two of the three principal hydraulic criteria.

The modeling results from this survey effort are within the confidence interval produced by the R2CROSS model (see Table 1).

## Land Status Review

| Upper Terminus | Lower Terminus | Total Length (miles) | Land Ownership | |
|---|---|---|---|---|
| | | | % Private | % Public |
| Headwaters | Ophir Creek | 4.7 | 20% | 80% |
| Ophir Creek | Beulah Water Works Diversion | 6.0 | 35% | 65% |

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

## Biological and Field Survey Data

The USFS, in September of 1997, collected stream cross section information, natural environment data, and other data needed to quantify the instream flow needs for this reach of the Middle Creek. Middle Creek is classified as a medium stream (between 20 to 35 feet wide) and fishery surveys indicate the stream environment of the Middle Creek supports rainbow trout (*Oncorhynchus mykiss*) and brook trout (*Salvelinus fontinalis*) (See CDOW Fish Survey in Appendix B).

## 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. Appendix B contains copies of field data collected for this proposed segment.

## Biological Flow Recommendation

The Board staff relies 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, three data sets were 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.

Table 1: Data

| Party | Date | Q | 250%-40% | Summer (3/3) | Winter (2/3) |
|---|---|---|---|---|---|
| USFS | 9/5/97 | 2.8 | 7.1 – 1.1 | 5.1 | 2.8 |

DOW = Division of Wildlife R = Outside of R2X Accuracy Range

Biologic Flow Recommendation

The summer flow recommendations which met 3 of 3 criteria are 1.6 cfs (estimated) and 5.1 cfs. 1.6 cfs (estimated) and 5.1 cfs are within the accuracy range of the R2CROSS model. The winter flow recommendations which met 2 of 3 criteria are 0.9 cfs (estimated) and 2.8 cfs. 0.9 cfs (estimated) and 2.8 cfs are within the accuracy range of the R2CROSS model (See Table 1).

## Hydrologic Data

The CDOW staff conducted a preliminary evaluation of the stream hydrology to determine if water was physically available for an instream flow appropriation. The hydrograph below was derived from data collected by the USGS stream gage for the St. Charles River at San Isabel, CO (#07107000), which has a drainage area of 16 square miles (See Gage Summary in Appendix C). The total drainage area upstream of these ISF segments on Middle Creek is 7.0 square miles (upstream of Ophir Creek) and 22 square miles (upstream of the Beulah diversion). The period of record for the St. Charles River gage was 1937 to 1941, the period of record used by staff in their analysis was 1937 to 1941, or 4 years of record. Tables 2 and 3 below displays the estimated flow of Middle Creek at the lower terminus of the upper and lower instream flow reaches in terms of a percentage of exceedence.

Table 2: Estimated Stream Flow for Middle Creek

Upper Segment Middle Creek

| Exceedences | January | February | March | April | May | June | July | August | September | October | November | December |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1% | 1.2 | 1.2 | 1.8 | 56.7 | 76.7 | 44.4 | 31.1 | 28.8 | 5.9 | 5.4 | 2.3 | 1.7 |
| 5% | 1.0 | 0.8 | 1.5 | 21.2 | 45.5 | 28.4 | 17.9 | 10.9 | 3.7 | 2.5 | 1.5 | 1.3 |
| 10% | 0.8 | 0.6 | 1.4 | 14.9 | 38.1 | 21.9 | 14.4 | 6.3 | 3.0 | 2.1 | 1.4 | 1.1 |
| 20% | 0.7 | 0.6 | 1.0 | 10.1 | 20.1 | 16.6 | 10.9 | 3.7 | 2.4 | 1.1 | 1.1 | 0.8 |
| 50% | 0.4 | 0.4 | 0.6 | 2.7 | 10.1 | 5.3 | 2.0 | 1.0 | 1.0 | 0.8 | 0.8 | 0.6 |
| 80% | 0.2 | 0.2 | 0.5 | 1.3 | 5.3 | 1.9 | 0.9 | 0.5 | 0.6 | 0.6 | 0.6 | 0.3 |
| 90% | 0.2 | 0.2 | 0.4 | 0.9 | 2.8 | 0.9 | 0.4 | 0.3 | 0.4 | 0.5 | 0.5 | 0.2 |
| 95% | 0.1 | 0.2 | 0.4 | 0.7 | 2.6 | 0.5 | 0.3 | 0.3 | 0.2 | 0.5 | 0.4 | 0.1 |
| 99% | 0.1 | 0.1 | 0.4 | 0.7 | 2.0 | 0.4 | 0.2 | 0.2 | 0.2 | 0.5 | 0.3 | 0.1 |

Table 2 shows that the estimated summer flow recommendation of 1.6 cfs is available at least 50% of the time for the months of April through July. The estimated winter flow recommendation of 0.9 cfs is not available at least 50% of the time from November through March. After incorporating the above water availability constraints, the original instream flow recommendation was modified to the following:

- 1.6 cubic feet per second is recommended from April 1 through July 15;
- 0.90 cubic feet per second is recommended from July 16 through September 15;
- 0.40 cubic feet per second is recommended from September 16 through March 31;

Table 3: Estimated Stream Flow for Middle Creek

Lower Segment Middle Creek

| Exceedences | January | February | March | April | May | June | July | August | September | October | November | December |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1% | 3.9 | 3.9 | 5.7 | 178.1 | 241.0 | 139.6 | 97.6 | 90.5 | 18.6 | 16.9 | 7.2 | 5.2 |
| 5% | 3.2 | 2.4 | 4.7 | 66.7 | 143.0 | 89.4 | 56.4 | 34.4 | 11.6 | 7.9 | 4.8 | 4.1 |
| 10% | 2.4 | 1.9 | 4.5 | 46.8 | 119.6 | 68.8 | 45.4 | 19.9 | 9.4 | 6.6 | 4.4 | 3.4 |
| 20% | 2.2 | 1.8 | 3.2 | 31.6 | 63.3 | 52.3 | 34.4 | 11.7 | 7.4 | 3.5 | 3.6 | 2.6 |
| 50% | 1.4 | 1.4 | 1.9 | 8.4 | 31.6 | 16.5 | 6.2 | 3.2 | 3.0 | 2.6 | 2.5 | 1.9 |
| 80% | 0.7 | 0.7 | 1.5 | 4.1 | 16.5 | 6.1 | 2.8 | 1.7 | 1.8 | 1.8 | 1.9 | 1.0 |
| 90% | 0.6 | 0.7 | 1.4 | 2.9 | 8.7 | 2.9 | 1.2 | 1.0 | 1.4 | 1.7 | 1.5 | 0.7 |
| 95% | 0.4 | 0.7 | 1.4 | 2.3 | 8.2 | 1.7 | 0.9 | 0.8 | 0.8 | 1.7 | 1.4 | 0.4 |
| 99% | 0.4 | 0.4 | 1.1 | 2.1 | 6.1 | 1.2 | 0.6 | 0.6 | 0.6 | 1.5 | 1.0 | 0.3 |

Table 3 shows that the summer flow recommendation of 5.1 cfs is available at least 50% of the time for the months of April through July. The winter flow recommendation of 2.8 cfs is not available at least 50% of the time from November through March. After incorporating the above water availability constraints, the original instream flow recommendation was modified to the following:

- 5.1 cubic feet per second is recommended from April 1 through July 15;
- 2.80 cubic feet per second is recommended from July 16 through September 15;
- 1.40 cubic feet per second is recommended from September 16 through March 31;

However, if additional water is determined to be available in further investigations, the CDOW would recommend appropriating the additional water up to the recommended flow amounts to preserve the natural environment to a reasonable degree.

Precipitation Data

CDOW staff identified 4 local precipitation data sets located near the Middle Creek Drainage: Wetmore 8 SW, Wetmore 9 S, Rye 1 SW and Rye (see Precipitation Data in Appendix C).

## Existing Water Right Information

CDOW staff has analyzed the water rights tabulation and will consult with the Division Engineer's Office (DEO) to identify any potential water availability problems due to existing diversions. Records indicate that there are 0 surface water diversions that are located within this reach of Middle Creek.

# Stream: Middle Creek

## Executive Summary

Water Division: 2
Water District: 15
CDOW#: 30368

## Segment: Headwaters to Ophir Creek

**Upper Terminus: Headwaters**
Latitude: 38º 02’ 45.0”N Longitude: 105º 10’ 31.6"W

**Lower Terminus: Ophir Creek**
Latitude: 38º 03’ 56.1”N Longitude: 105º 06’ 19.9"W

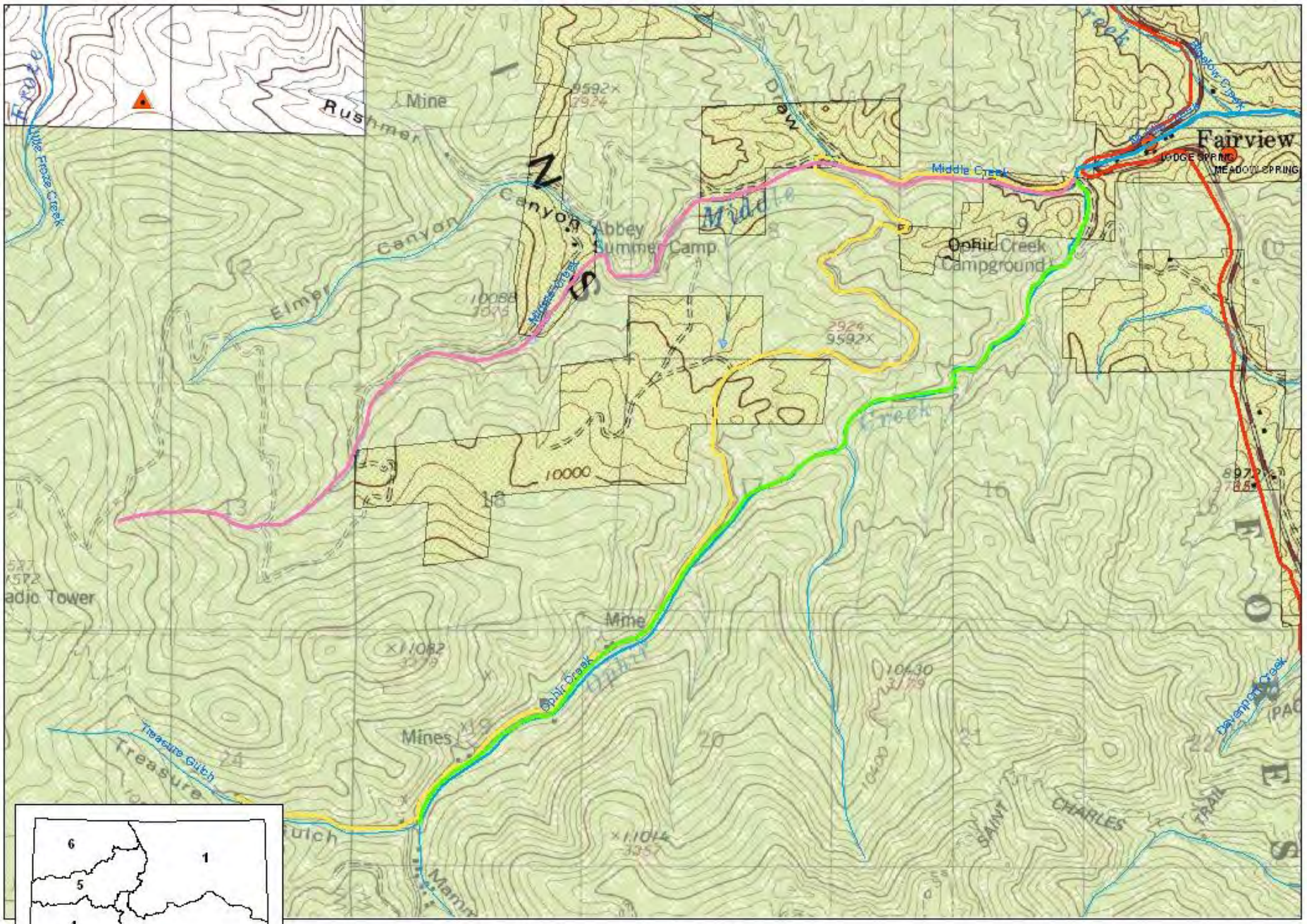
ISF Appropriation: 1.6 cfs (04/15 – 07/15)
0.7 cfs (07/16 – 09/15)
0.3 cfs (09/16 – 04/14)

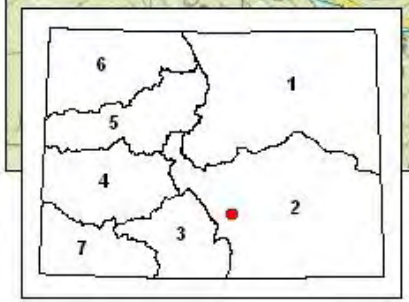
## Segment: Ophir Creek to Beulah Water Works

Upper Terminus: **Ophir Creek**
Latitude: 38º 03’ 56.1”N Longitude: 105º 06’ 19.9"W

**Lower Terminus: Beulah Water Works**
Latitude: 38º 04’ 57.8”N Longitude: 105º 00’ 57.9"W

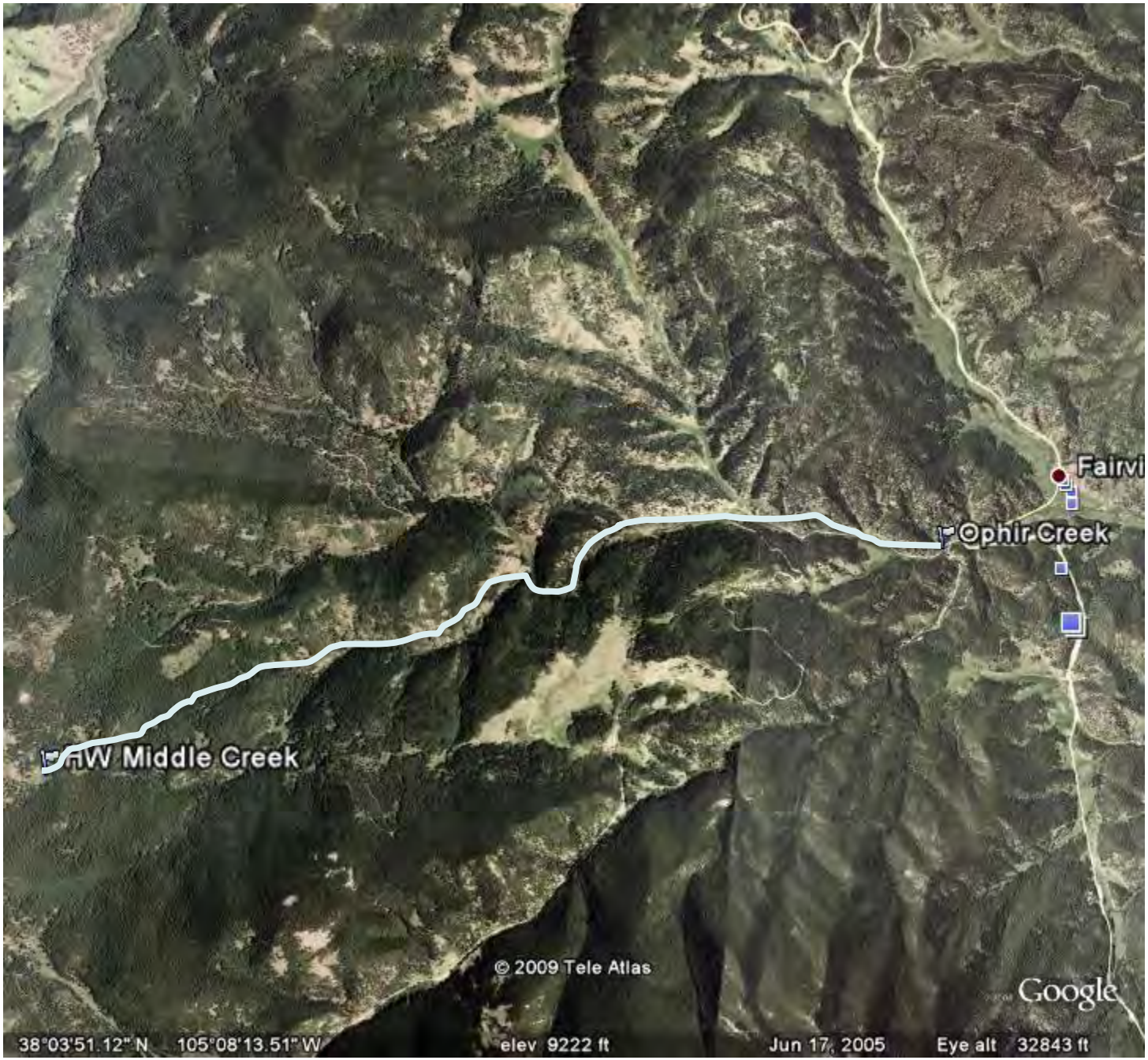
Counties: Custer and Pueblo
ISF Appropriation: 5.1 cfs (04/15 – 07/15)
2.2 cfs (07/16 – 09/15)
1.0 cfs (09/16 – 04/14)




**Colorado Division of Wildlife**
**Middle Creek**
**Headwaters to Ophir Creek**

0 0.25 0.5 1 1.5 Miles


Fairvi
Ophir Creek
HW Middle Creek
© 2009 Tele Atlas
Google
38°03'51.12" N 105°08'13.51" W elev 9222 ft Jun 17, 2005 Eye alt 32843 ft


**Colorado Division of Wildlife**
**Middle Creek**
**Ophir Creek to Beulah Water Works**

0 0.25 0.5 1 1.5 Miles


Beulah Water Works
Ophir Creek
Google
38°04'58.91" N 105°03'01.84" W
Jun 17, 2005 Eye alt 40592 ft