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ROCK CREEK

INSTREAM FLOW STUDY



Rock Creek Instream Flow, TFN 33 1/276

Prepared for:

Wyoming Water Development Commission

By:

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November 30, 2007

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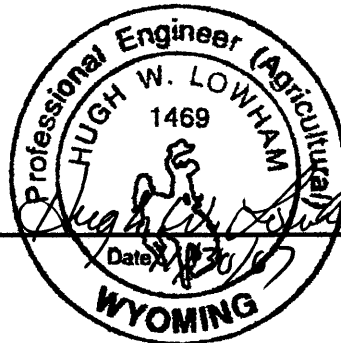


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Filing Number 33 1/276

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General Flow Analysis

Introduction

An instream flow request was filed by the Wyoming Water Development Commission (WWDC) at the request of the Wyoming Game and Fish Department (WGF) for a reach of Rock Creek, tributary to the Medicine Bow River. The feasibility of an instream flow request must be determined through independent analysis. The WWDC contracted Lowham Engineering LLC of Lander, WY to perform an analysis of the Rock Creek instream flow request.

The instream flow reach on Rock Creek covers approximately 3.9 stream miles and is located just upstream of the U.S. Geological Survey (USGS) streamflow gage near Arlington, WY. The reach extends from the NE ¼ NE ¼ of Section 15, T18N, R79W, to the north boundary of the NE ¼ NE ¼ of Section 36, T19N, R79W. The requested instream flow amounts are presented in Table 1 from the permit application to the Wyoming State Engineer's Office (see Appendix A). A topographic based map of the instream flow location is presented in Figure 1 and a schematic of the tributary sequences showing locations of diversions and pertinent features is presented in Figure 2. An overview topographic based map can be found in Appendix B.

Table 1. Instream flow request for Rock Creek (cfs)

Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
21	17	15	13	13	13	30	60	60	21	21	21

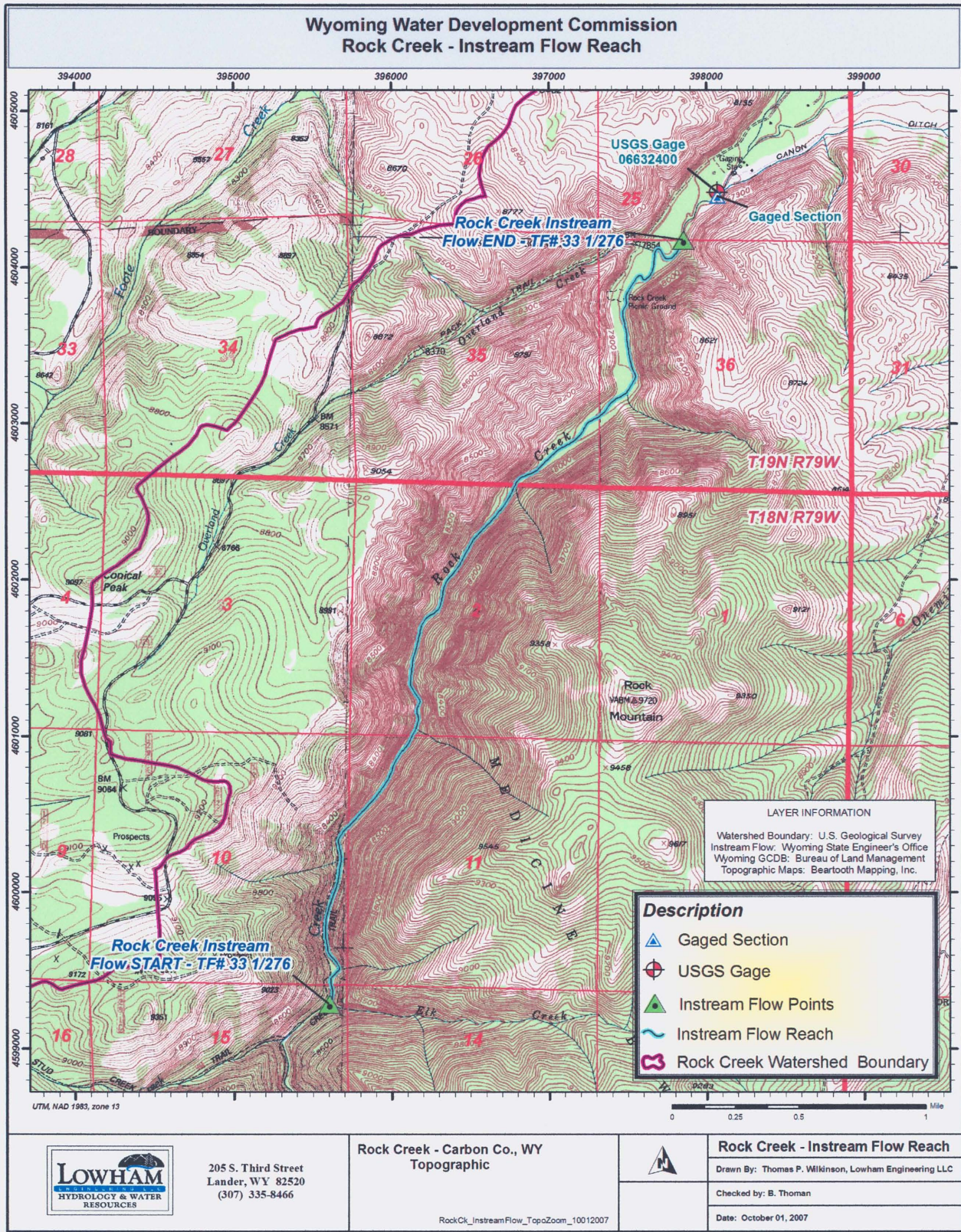


Figure 1. Location of the instream flow request on Rock Creek

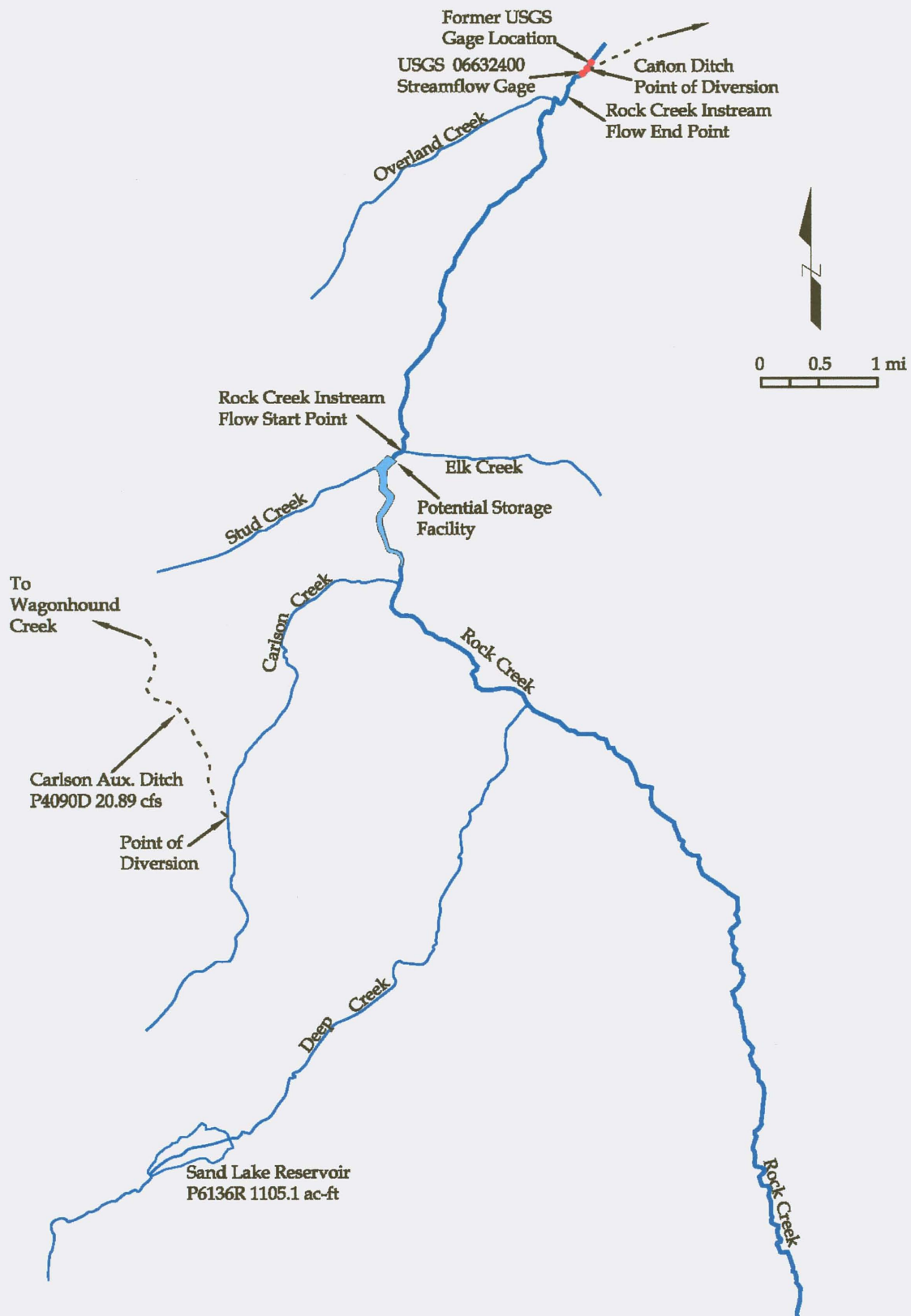


Figure 2. Schematic of the Rock Creek drainage

Water Rights

A search for water rights on Rock Creek above the USGS streamflow gage was completed. A summary of the water rights are presented in Table 2.

Table 2. Water rights summary above the USGS Rock Creek gage

Permit	Facility Name	Priority	Status	Acres	Rate/Amount	Source
P4090D	Carlson Auxiliary Ditch	1902	ADJ	900	12.86 cfs	Carlson Creek
P4090D	Carlson Auxiliary Ditch	1902	ADJ-SUP	80	1.14 cfs	Carlson Creek
P4090D	Carlson Auxiliary Ditch	1902	ADJ	315	4.50 cfs	Carlson Creek
P4090D	Carlson Auxiliary Ditch	1902	ADJ-SUP	167	2.39 cfs	Carlson Creek
P19646D	Sand Lake Resort Ditch	1941	ADJ	-	0.1 cfs	Deep Creek
P19647D	Sand Lake Campground Pipeline	1941	ADJ	-	0.3 cfs	Deep Creek
P6136R	Sand Lake Reservoir	1954	ADJ	-	1105.1 ac-ft	Deep Creek
D - Ditch; R - Reservoir; ADJ - Adjudicated; SUP - Supplemental						

The Sand Lake Resort Ditch and Campground Pipeline account for a combined discharge of 0.4 cfs for domestic use, and were not included in the analysis. The resort has been abandoned for some time and none of the buildings are present at this location.

Flow Records

Streamflow data from the USGS 06632400 gage, Rock Creek above the Cañon Ditch, near Arlington, WY were used to characterize the historic flows in Rock Creek. The gage has a record of streamflow data from 1954 to the present, with a drainage area of 62.9 square miles. Streamflow data from 1954-1965 were adjusted to account for diversions in Cañon Ditch, before the gage was moved upstream of the ditch (Swanson et al., 2000; see Figure 2). The USGS reports (incorrectly) that there are no diversions upstream of the gage. However, they do note that minor regulation in runoff can be attributed to seasonal releases from Sand Lake Reservoir (Swanson et al., 2000).

Historical monthly discharge data downloaded from the USGS website are presented in Table 3.

Table 3. Mean monthly flows for USGS 06632400, Rock Creek

Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
16	13	11	10	9.8	10	23	232	466	115	28	20

A search for the water rights on Rock Creek found active rights for 17.36 cfs of direct flow, 3.53 cfs of supplemental flow, and 1105.1 ac-ft of storage. The flow rights

are included in the Carlson Auxiliary Ditch, which transfers water from Carlson Creek, a tributary of Rock Creek, into Wagonhound Creek to the northwest (Figure 3). Historic discharge records are not available for this ditch based on communication with the State Engineer's Office Board of Control representative for the area, Rod Oliver (Personal Communication, September 2007). Flow in Carlson Creek was estimated at 0.5 cfs during a site visit on September 21, 2007, or approximately five percent of the flow recorded at the USGS gage on Rock Creek during the same time period. A drainage area ratio of Carlson Creek above the point of diversion to Rock Creek at the gage is also approximately five percent. For this study it was assumed that the estimated diversion out of Carlson Creek was approximately five percent of the discharge at the gage, up to the full appropriation. Since the diversion transfers water out of the Rock Creek basin, return flows would not occur.

Storage rights also exist in the Rock Creek drainage in the Sand Lake Reservoir. Sand Lake Reservoir is used by the Wheatland Irrigation District to provide water to the Cañon Ditch for irrigation. Operation of the Sand Lake Reservoir typically entails releasing water beginning around June 21st at a rate of 40 cfs, plus any inflow into the reservoir. The reservoir is most often drained by the 15th of July.



Figure 3. Point of diversion for the Carlson Auxiliary Ditch on Carlson Creek

Hydrology

The USGS 06632400 Rock Creek streamflow gage data were considered to be an accurate representation of the flows in Rock Creek. A check measurement was made on September 21, 2007, by Lowham Engineering LLC to verify the gage rating. A discharge of 8.78 cfs was obtained through a direct measurement of Rock Creek at the USGS gage direct measurement location (Figure 4). Real-time data obtained from the USGS website for the Rock Creek gage during the time of the measurement reported a discharge of 9.4 cfs, as shown in Figure 5.

The discharge measurement was considered poor due to large rocks affecting flow at the gaged section, but was within eight percent of the USGS recorded discharge. This is within the range of measurement error for a rating of “fair” based on USGS methodology. Therefore, the USGS gage data at Rock Creek were found to be accurate based on the discharge measurement and no correction was deemed necessary.



Figure 4. Gaged cross section on Rock Creek

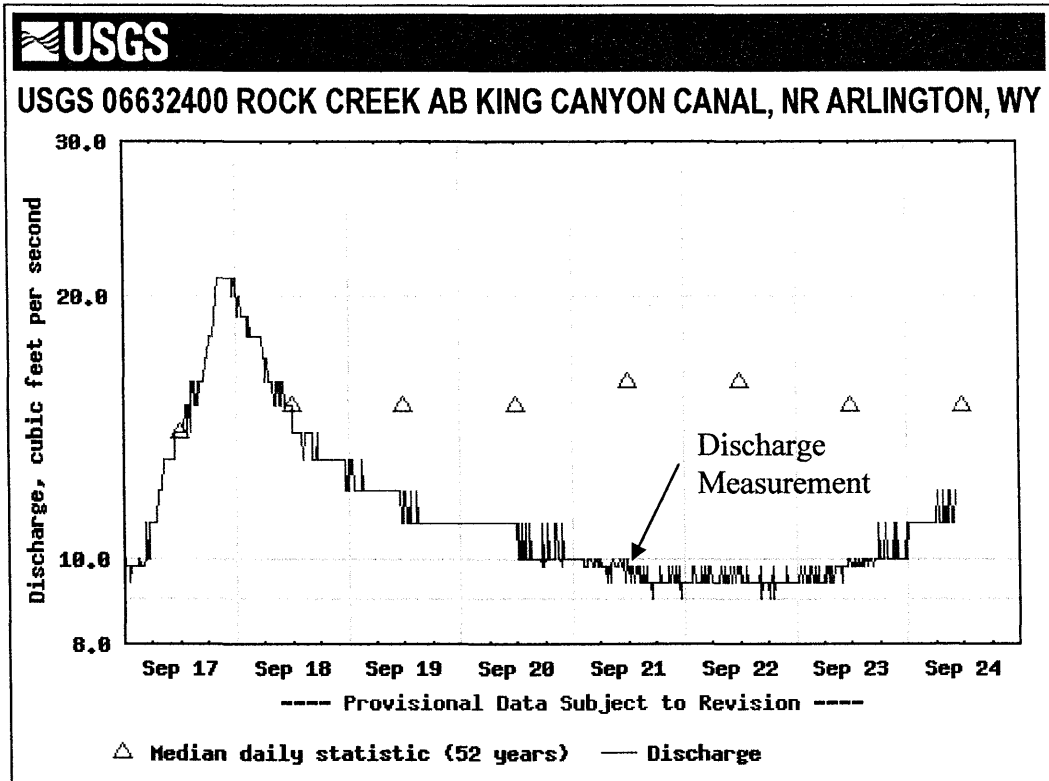


Figure 5. USGS real-time data for September 2007

Storage in Sand Lake Reservoir may impact the virgin flows and impart some regulation on Rock Creek. In addition to providing flows for irrigation, regulation of Sand Lake Reservoir also benefits instream flows.

Unappropriated Direct Flow Analysis

Summary

An analysis of the unappropriated flows on Rock Creek was completed to determine the feasibility of an instream flow request. Mean monthly streamflow data were used to determine the unappropriated flow during an average year, the driest year, and the driest months. A summary of the flows are presented in Table 4.

Table 4. Summary of mean shortage/surplus flows in Rock Creek (cfs)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Requested Direct Flow	13	13	13	30	60	60	21	21	21	21	17	15
Unappropriated Flow	10	9.8	10	23	232	427	109	27	19	16	13	11
Shortage/Surplus	-3	-3.2	-3	-7	172	367	88	6	-2	-5	-4	-4
Shortage/Surplus (ac-ft)	-184	-178	-184	-417	10576	21811	5425	344	-118	-307	-238	-246

An exceedance analysis was also completed to determine what percent of the unappropriated flows would be exceeded by the requested flow. Fifty percent exceedance is of particular interest to the WWDC to determine the feasibility of the request. Table 5 summarizes the findings of the exceedance analysis.

Table 5. Summary of exceedance analysis

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Requested Direct Flow (cfs)	13	13	13	30	60	60	21	21	21	21	17	15
Percent Exceedance	16.1	14.8	15.0	19.6	77	95	89.2	47.2	26.0	19.5	18.2	15.9
50% Exceedance (cfs)	9.7	9.0	9.6	17.0	160	371	58.2	20.6	14.0	14.0	12.0	10.0

Mean Monthly Flow Analysis

The mean monthly flow analysis for the Rock Creek instream flow reach was adjusted for two upstream diversions: Carlson Auxiliary Ditch and Sand Lake Reservoir. Flow in Carlson Creek was estimated to provide five percent of the flow in Rock Creek at the USGS streamflow gage, as described in the “Flow Records” section. The appropriations of Carlson Ditch were assumed to be equal to the flow in Carlson Creek, up to the maximum permitted amount. Appropriated flows in Carlson Creek were subtracted from the Rock Creek USGS streamflow gage mean monthly flows for the irrigation months of June through September. Storage in Sand Lake Reservoir was converted to a flowrate and similarly subtracted from the mean monthly value for June. Table 6 summarizes the mean monthly flow analysis and Figures 6 and 7 give a graphical representation of the data.

Table 6. Mean monthly flow analysis for Rock Creek (cfs)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean Monthly Flow	10.0	9.8	10.0	23.0	232.0	466.0	115.0	28.0	20.0	16.0	13.0	11.0
Appropriated Flow*	0.0	0.0	0.0	0.0	0.0	39.5	5.8	1.4	1.0	0.0	0.0	0.0
Unappropriated Flow	10.0	9.8	10.0	23.0	232.0	426.5	109.2	26.6	19.0	16.0	13.0	11.0
Requested Flow	13.0	13.0	13.0	30.0	60.0	60.0	21.0	21.0	21.0	21.0	17.0	15.0
Shortage/Surplus	-3.0	-3.2	-3.0	-7.0	172.0	366.5	88.2	5.6	-2.0	-5.0	-4.0	-4.0
Shortage/Surplus (ac-ft)	-184	-178	-184	-417	10576	21811	5425	344	-118	-307	-238	-246

* Flows available for appropriation for the Carlson Aux. Ditch were estimated at 5% of the Rock Creek gaged flow

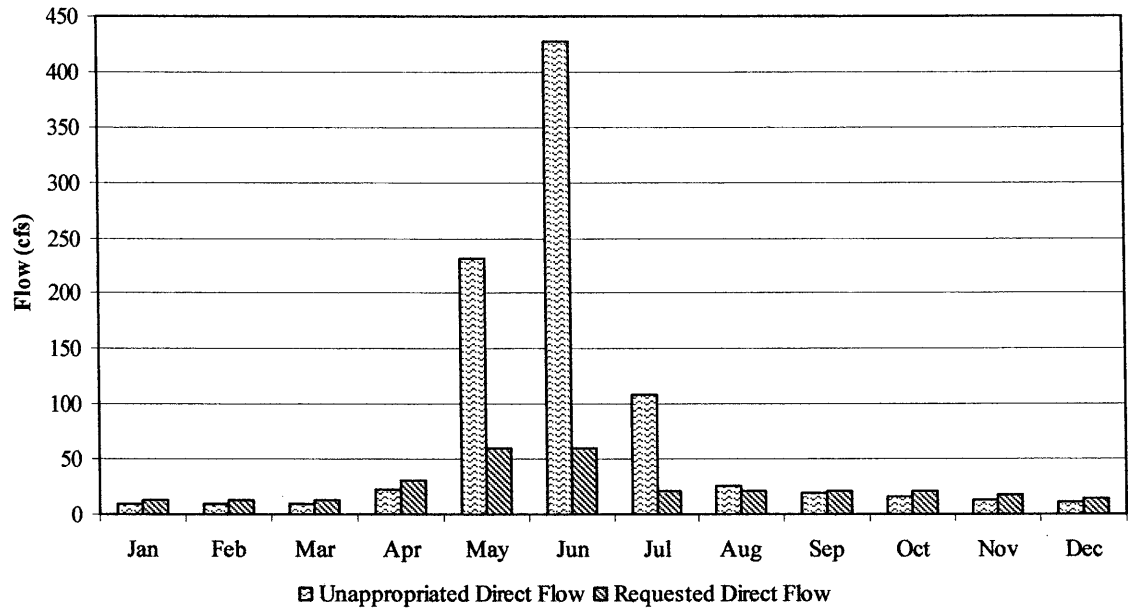


Figure 6. Mean monthly flow analysis for Rock Creek (direct unappropriated flows)

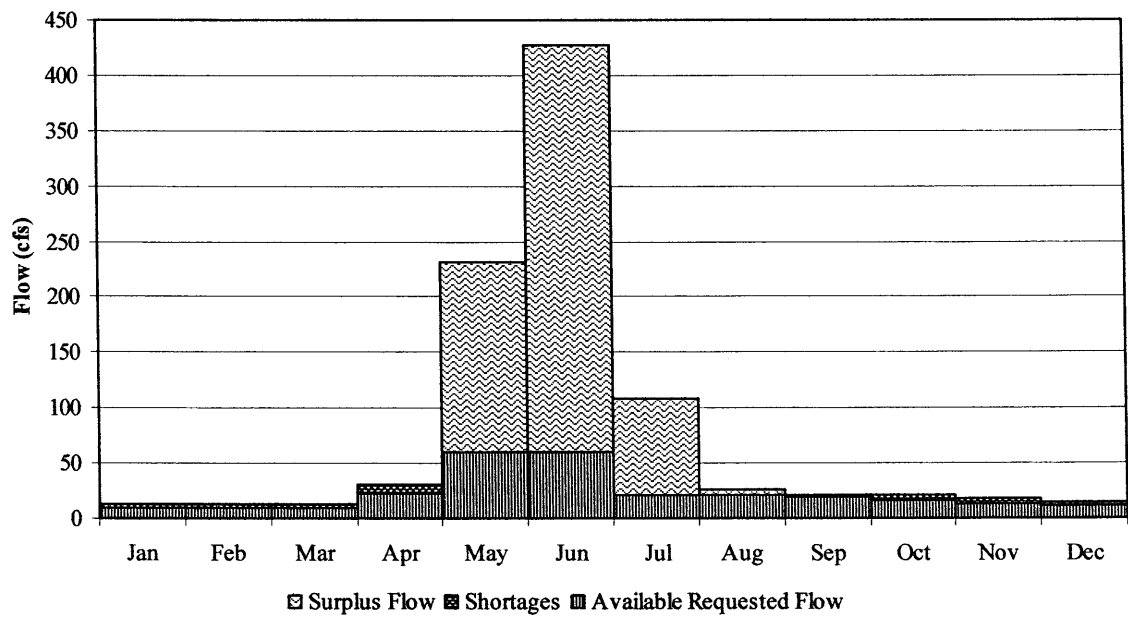


Figure 7. Mean monthly flow analysis for Rock Creek (surplus/shortages)

Driest Year Monthly Flow Analysis

The driest year monthly flow analysis was completed using data from the USGS streamflow gage on Rock Creek. The driest year on record for this gage occurred in 2002. Table 7 summarizes the driest year monthly flow analysis and Figures 8 and 9 give a graphical representation of the data.

Table 7. Driest year monthly flow analysis for Rock Creek (cfs)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean Monthly Flow	8.4	7.4	6.8	16.4	124.4	140.7	21.3	9.4	7.2	8.8	8.0	7.7
Appropriated Flow*	0.0	0.0	0.0	0.0	0.0	25.6	1.1	0.5	0.4	0.0	0.0	0.0
Unappropriated Flow	8.4	7.4	6.8	16.4	124.4	115.1	20.2	8.9	6.8	8.8	8.0	7.7
Requested Flow	13.0	13.0	13.0	30.0	60.0	60.0	21.0	21.0	21.0	21.0	17.0	15.0
Shortage/Surplus	-4.6	-5.6	-6.2	-13.6	64.4	55.1	-0.8	-12.1	-14.2	-12.2	-9.0	-7.3
Shortage/Surplus (ac-ft)	-283	-311	-381	-809	3960	3278	-47	-743	-843	-749	-538	-451

* Flows available for appropriation for the Carlson Aux. Ditch were estimated at 5% of the Rock Creek gaged flow

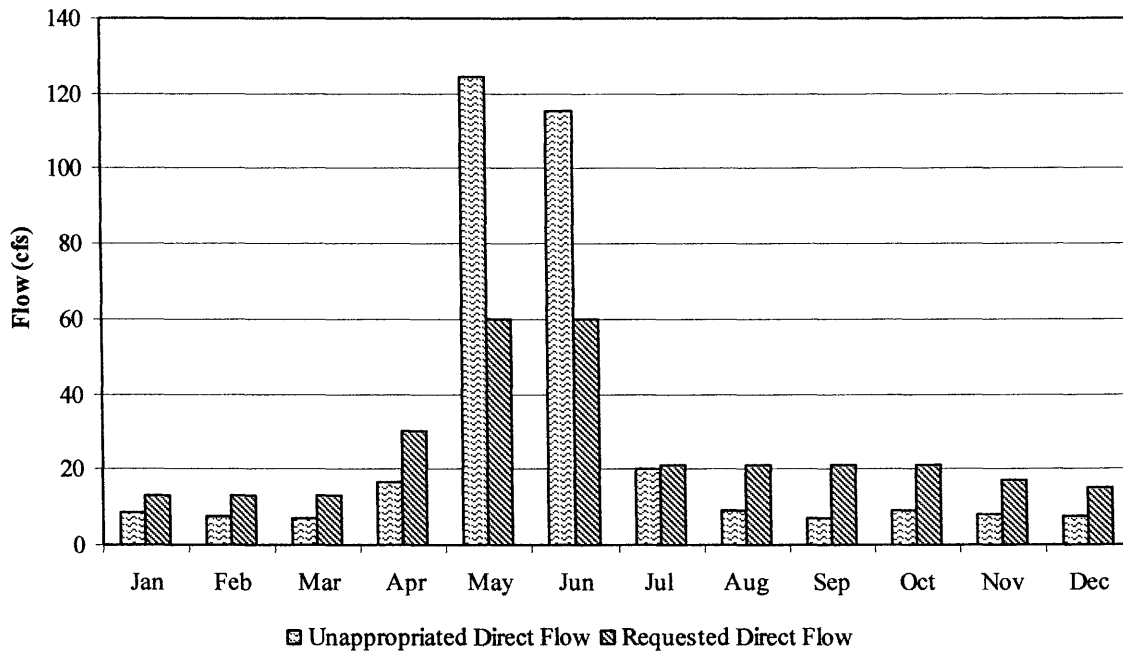


Figure 8. Driest year monthly flow analysis for Rock Creek (direct unappropriated flows)

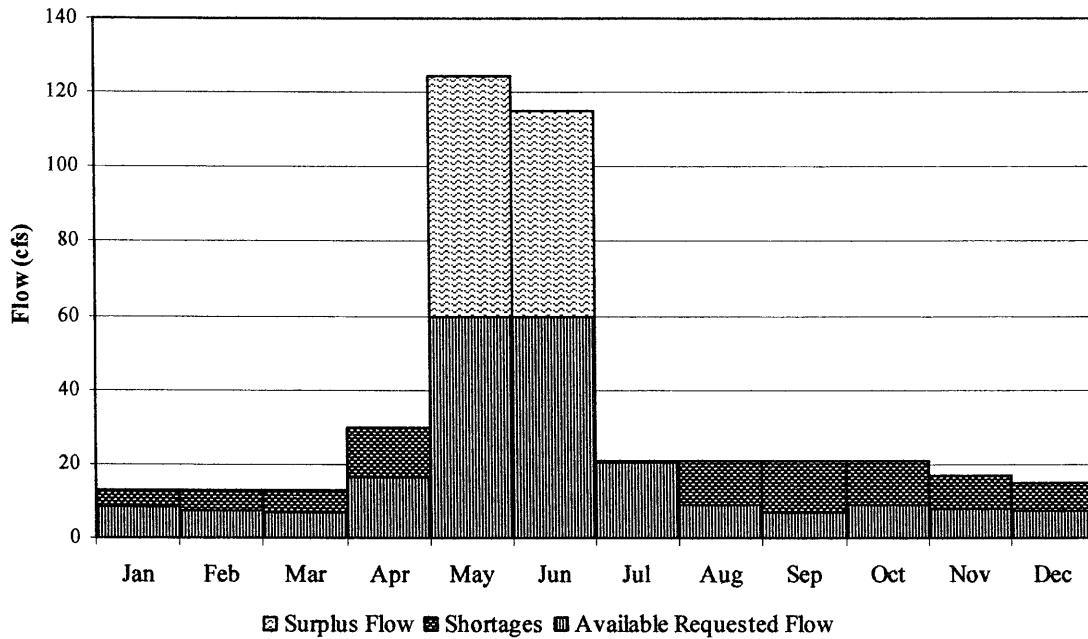


Figure 9. Driest year monthly flow analysis for Rock Creek (surplus/shortages)

Driest Month Flow Analysis

The driest month flow analysis was completed using the driest monthly flow on record for that particular month. Table 8 summarizes the driest monthly flow analysis and Figures 10 and 11 give a graphical representation of the data.

Table 8. Driest month flow analysis for Rock Creek (cfs)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Year of Driest Month	1955	1955	1955	1995	1968	2002	2002	2002	2002	1956	1954	1954
Mean Monthly Flow	6.0	5.6	6.7	10.9	59.3	140.7	21.3	9.4	7.2	7.7	5.7	6.6
Appropriated Flow*	0.0	0.0	0.0	0.0	0.0	25.6	1.1	0.5	0.4	0.0	0.0	0.0
Unappropriated Flow	6.0	5.6	6.7	10.9	59.3	115.1	20.2	8.9	6.8	7.7	5.7	6.6
Requested Flow	13.0	13.0	13.0	30.0	60.0	60.0	21.0	21.0	21.0	21.0	17.0	15.0
Shortage/Surplus	-7.0	-7.4	-6.4	-19.1	-0.7	55.1	-0.8	-12.1	-14.2	-13.3	-11.4	-8.4
Shortage/Surplus (ac-ft)	-430	-413	-390	-1137	-43	3278	-47	-743	-843	-817	-675	-514

* Flows available for appropriation for the Carlson Aux. Ditch were estimated at 5% of the Rock Creek gaged flow

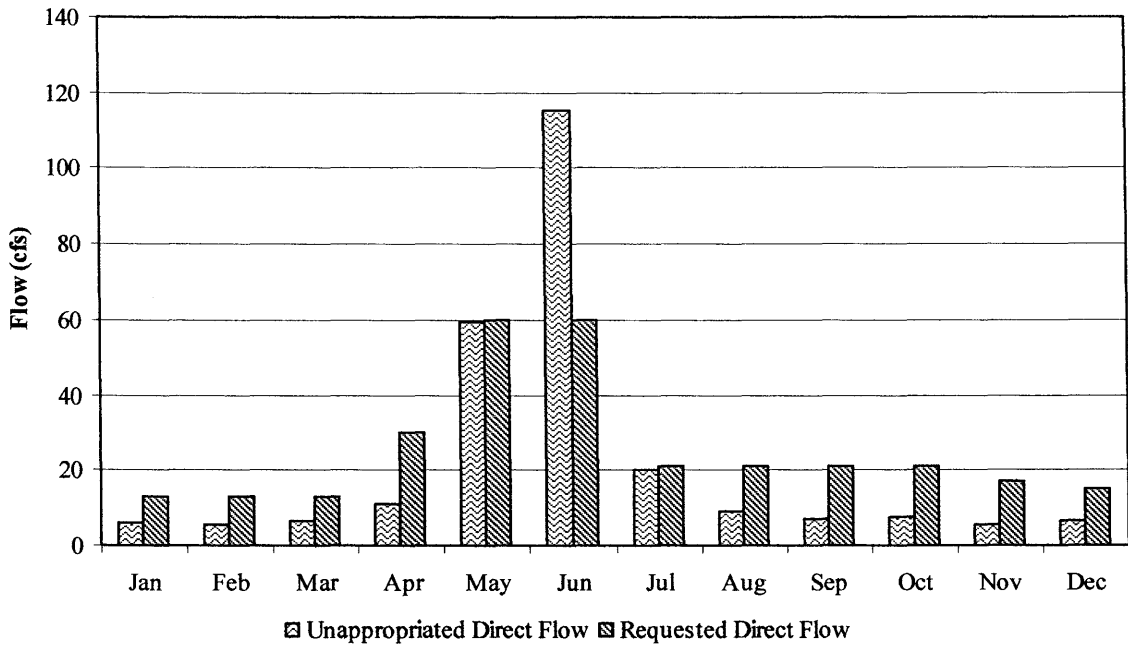


Figure 10. Driest month flow analysis for Rock Creek (direct unappropriated flows)

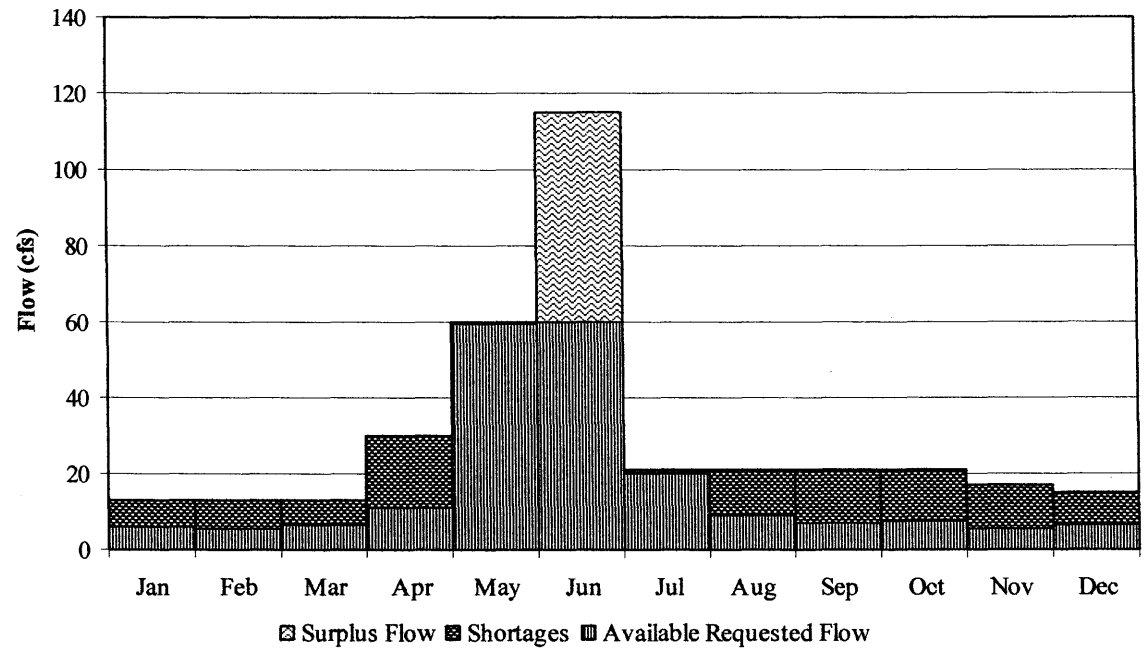


Figure 11. Driest month flow analysis for Rock Creek (surplus/shortages)

Flow Shortage and Storage Analysis

A flow shortage analysis was performed on the Rock Creek instream flow reach to determine if reservoir storage could be used to store surplus flows to release during

flow shortages. Shortages were determined for all three scenarios: average year, driest year, and driest month. Tables 9-11 show the shortage and storage analysis for Rock Creek. Shortages could be stored during the average year and the driest year, but would not be possible during the driest month.

Table 9. Average year flow shortage and storage analysis for Rock Creek (acre-feet)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Excess or Deficit	-184	-178	-184	-417	10576	21811	5425	344	-118	-307	-238	-246
Res Op 1st yr	0	0	0	0	10576	32386	37812	38156	38038	37731	37493	37247
Res Op 2nd yr	37062	36885	36700	36284	46859	68670	74095	74440	74322	74014	73776	73530
Res Op 3rd yr	73346	73168	72984	72567	83143	104954	110379	110723	110605	110298	110060	109814

Storage Required = 1872 ac-ft Target storage can be met

Table 10. Driest year flow shortage analysis for Rock Creek (acre-feet)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Excess or Deficit	-283	-311	-381	-809	3960	3278	-47	-743	-843	-749	-538	-451
Res Op 1st yr	0	0	0	0	3960	7238	7191	6448	5605	4856	4318	3868
Res Op 2nd yr	3585	3274	2893	2084	6044	9322	9275	8532	7689	6940	6402	5952
Res Op 3rd yr	5669	5358	4977	4168	8128	11406	11359	10616	9773	9024	8486	8035

Storage Required = 5154 ac-ft Target storage can be met

Table 11. Driest month flow shortage analysis for Rock Creek (acre-feet)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Excess or Deficit	-430	-413	-390	-1137	-43.0	3278	-47	-743	-843	-817	-675	-514
Res Op 1st yr	0	0	0	0	0	3278	3231	2488	1645	828	153	0
Res Op 2nd yr	0	0	0	0	0	3278	3231	2488	1645	828	153	0
Res Op 3rd yr	0	0	0	0	0	3278	3231	2488	1645	828	153	0

Storage Required = 6053 ac-ft Target storage can not be met

A storage facility already exists on a tributary of Rock Creek. The Sand Lake Reservoir on Deep Creek is used for storage of irrigation water. Releases from the Sand Lake Reservoir typically occur in late June. For the average year, storage of 1872 ac-ft (Table 9) would be required to provide the requested instream flows throughout the year. The capacity of this reservoir is less than the storage required to make up for the instream flow shortages during the average year. Different goals may also include different release strategies, which most likely would not be accepted if the reservoir were to be used to provide instream flows. Construction of new storage facilities would be difficult due to the steep terrain and the numerous appropriations with senior rights downstream

on Rock Creek. A location was chosen just upstream of the instream flow reach for a potential storage facility (see Figure 2). The facility would need an approximate dam height of 90 feet to store the average year shortages of 1872 ac-ft.

Daily Flow Exceedance Analysis

A daily flow exceedance analysis was completed to determine the percentage of unappropriated flows that exceed the requested instream flow. The WWDC considers an instream flow request feasible if the requested flow is available from unappropriated flows at least fifty percent of the time. A summary of the exceedance analysis is presented in Table 12. Graphs of the exceedance analysis for each month are presented in Figures 12-23.

Table 12. Summary of the daily flow exceedance analysis

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Requested Direct Flow (cfs)	13	13	13	30	60	60	21	21	21	21	17	15
Percent Exceedance	16.1	14.8	15.0	19.6	77	95	89.2	47.2	26.0	19.5	18.2	15.9
50% Exceedance (cfs)	9.7	9.0	9.6	17.0	160	371	58.2	20.6	14.0	14.0	12.0	10.0

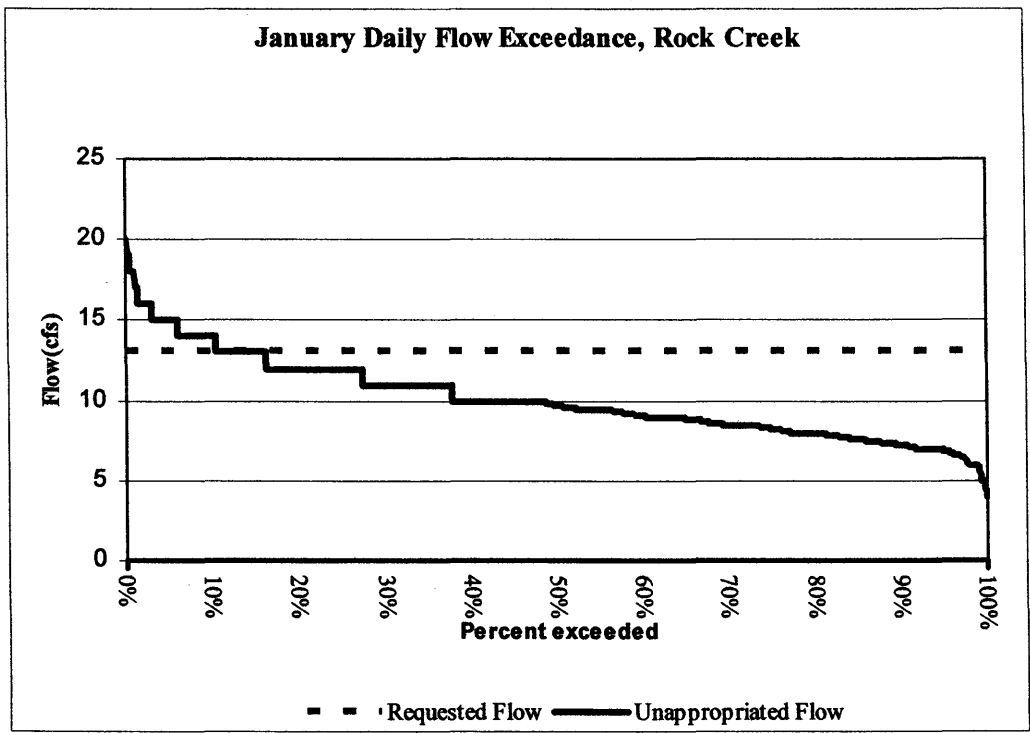


Figure 12. January daily flow exceedance for Rock Creek

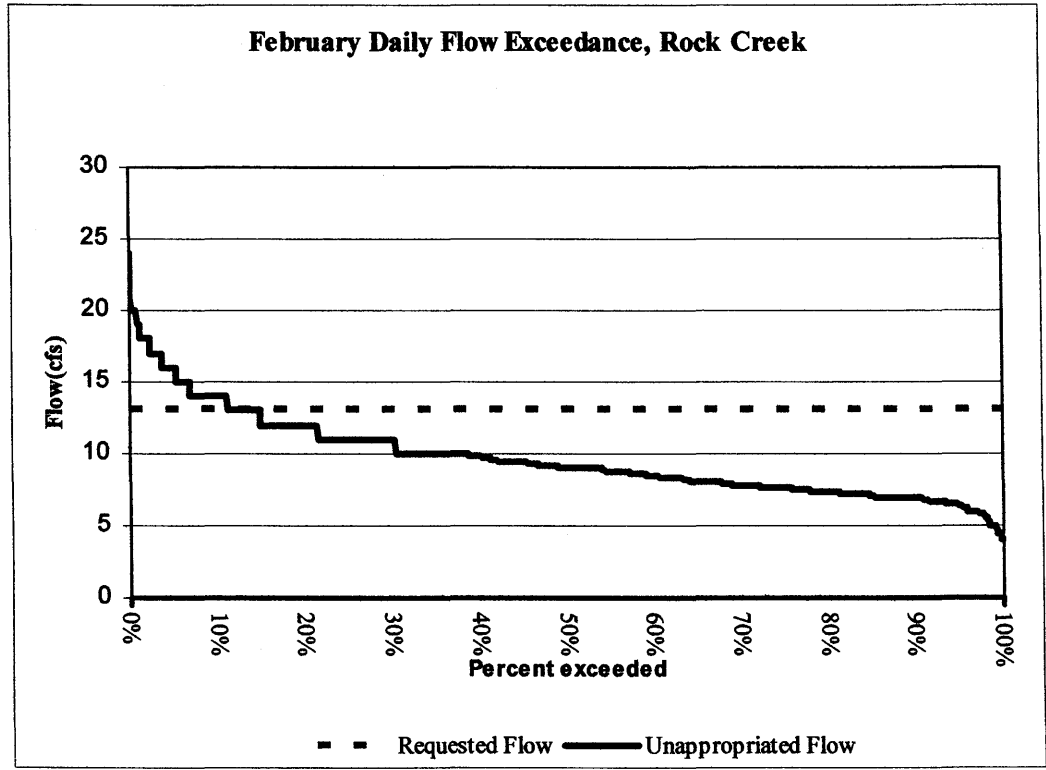


Figure 13. February daily flow exceedance for Rock Creek

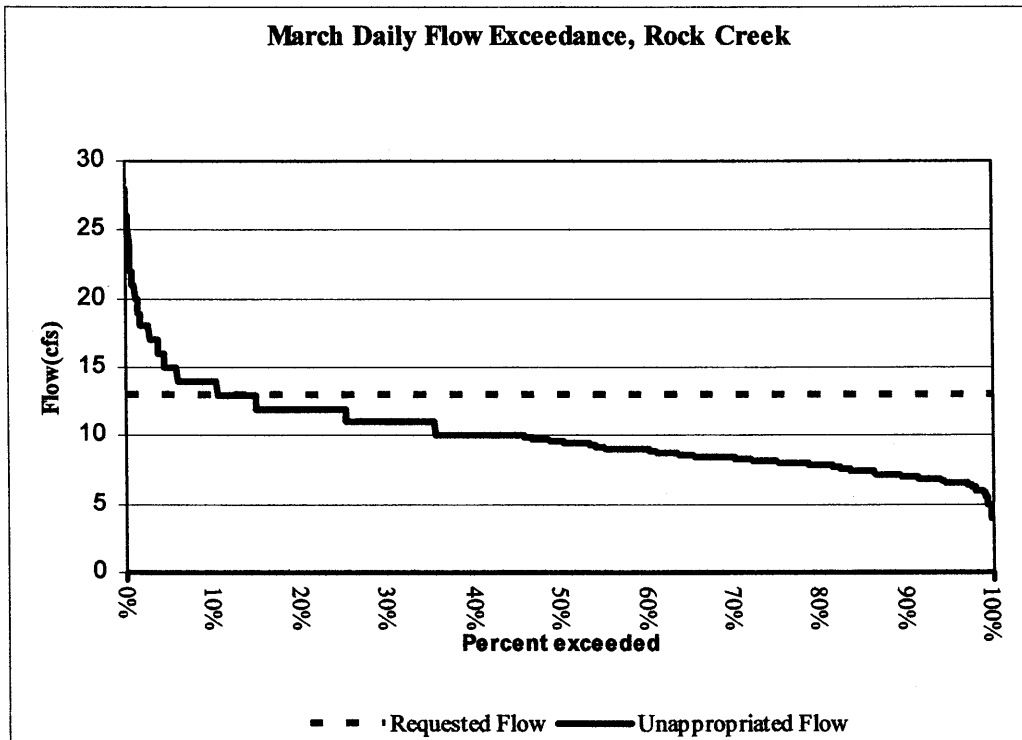


Figure 14. March daily flow exceedance for Rock Creek

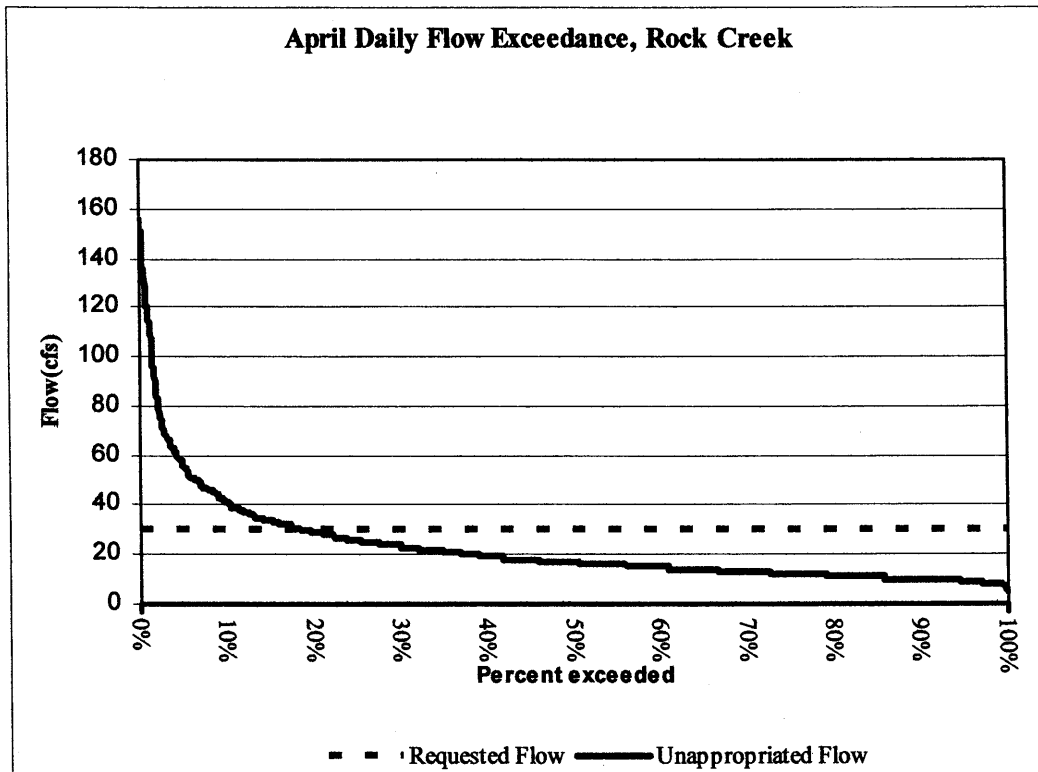


Figure 15. April daily flow exceedance for Rock Creek

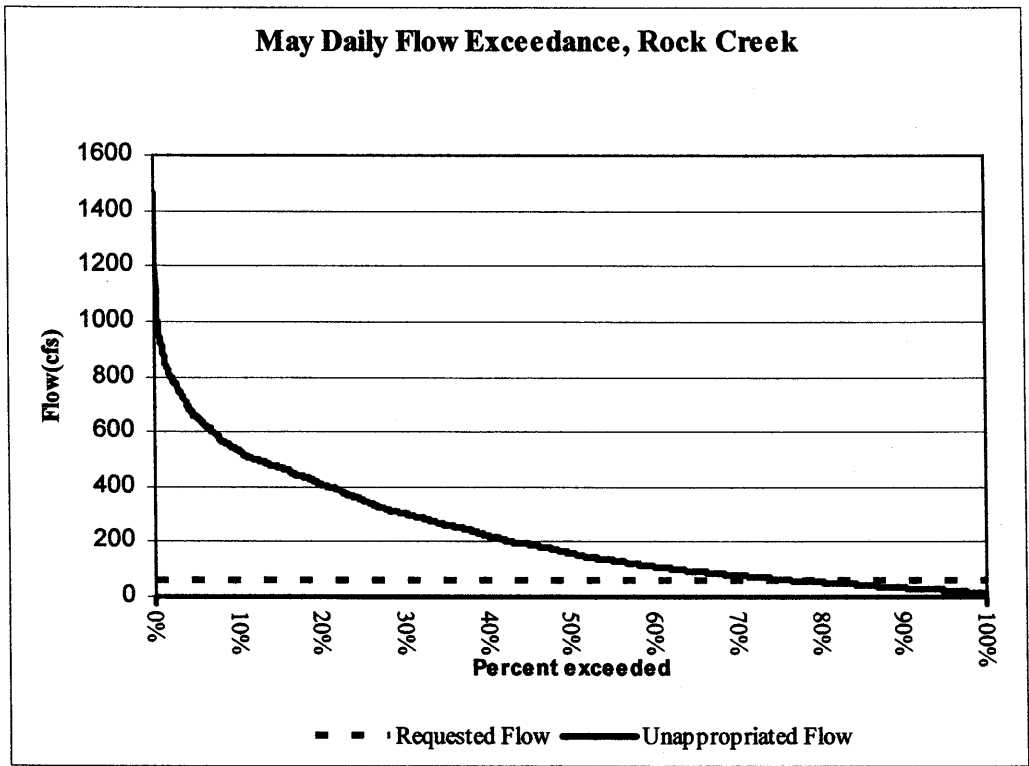


Figure 16. May daily flow exceedance for Rock Creek

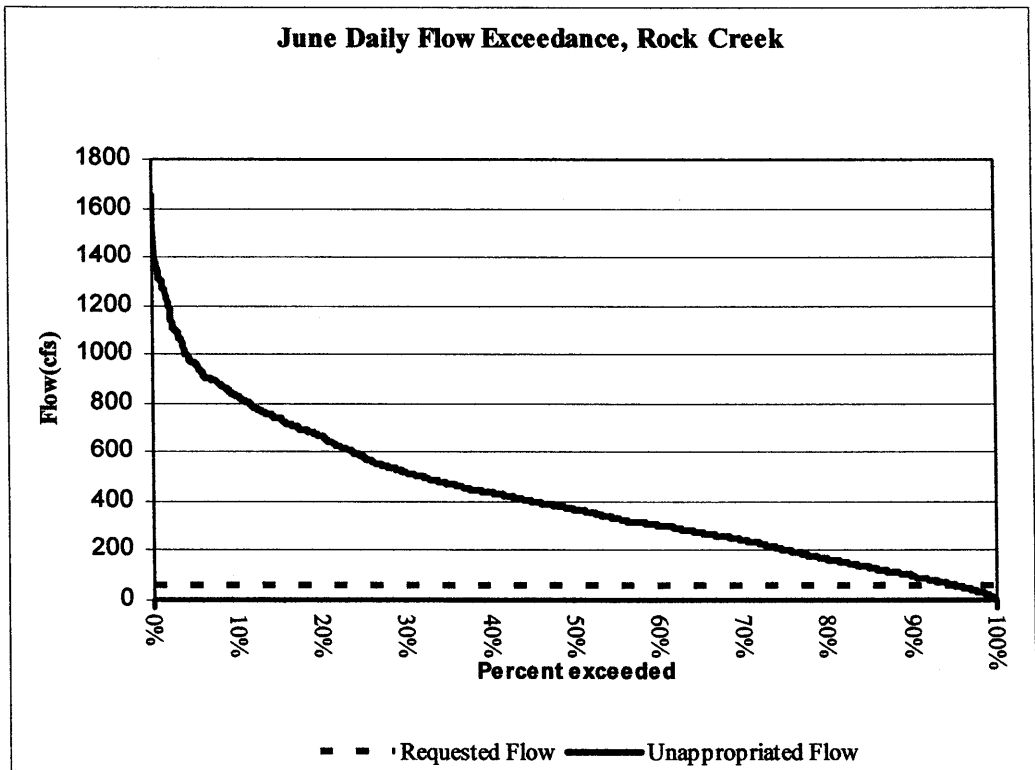


Figure 17. June daily flow exceedance for Rock Creek

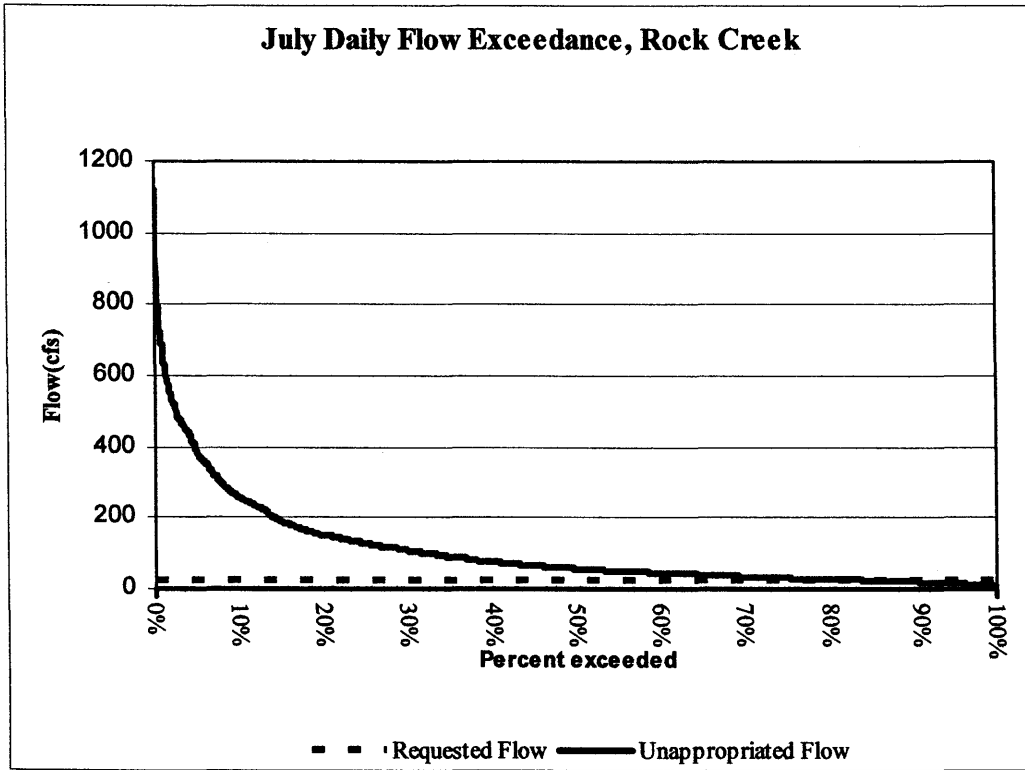


Figure 18. July daily flow exceedance for Rock Creek

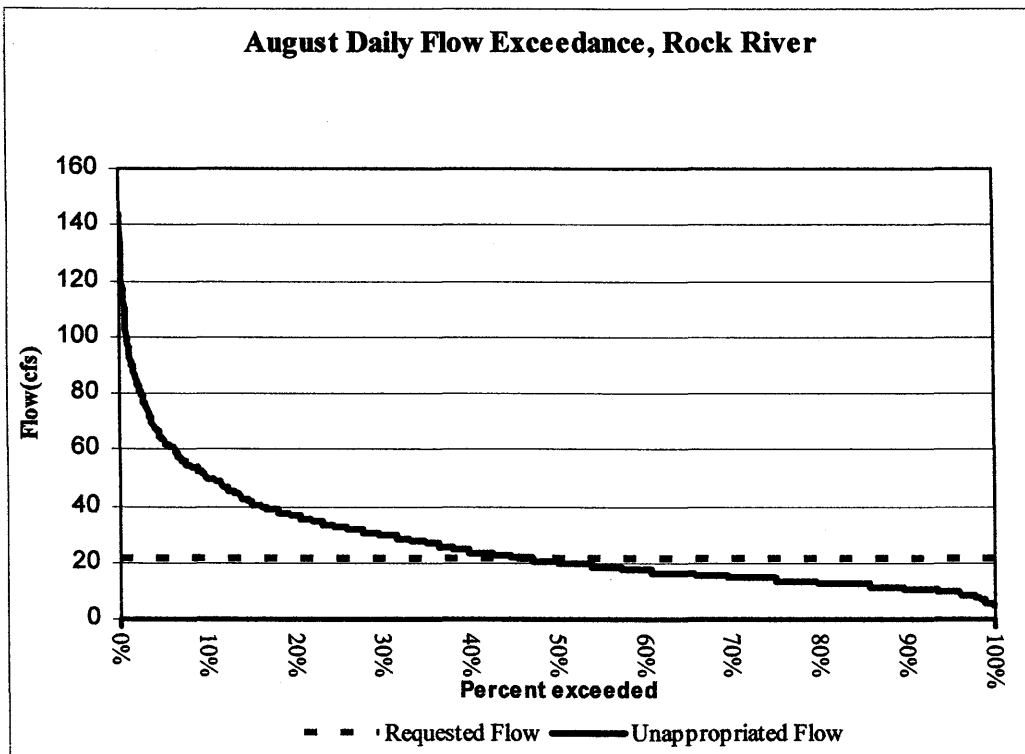


Figure 19. August daily flow exceedance for Rock Creek

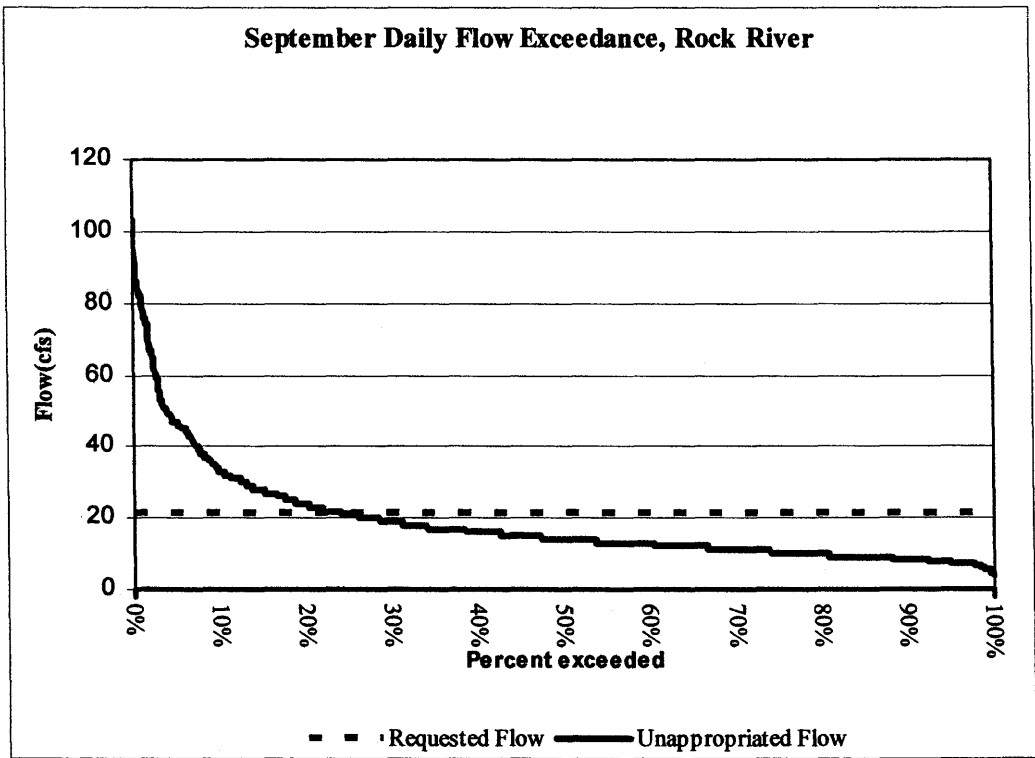


Figure 20. September daily flow exceedance for Rock Creek

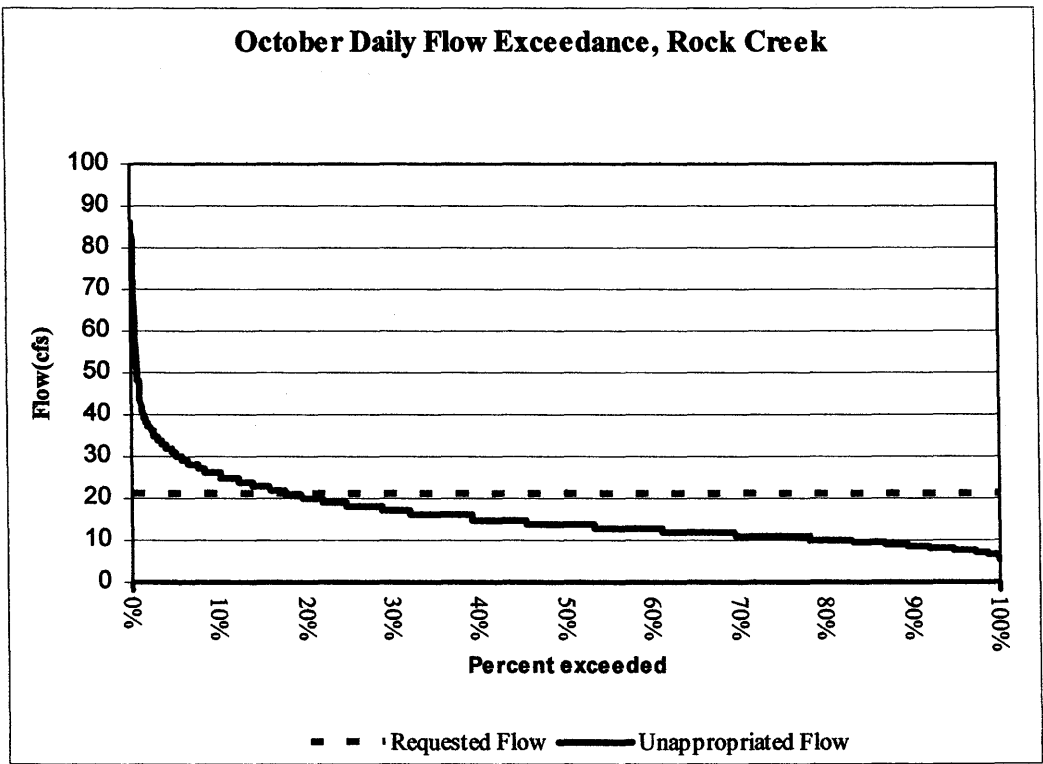


Figure 21. October daily flow exceedance for Rock Creek

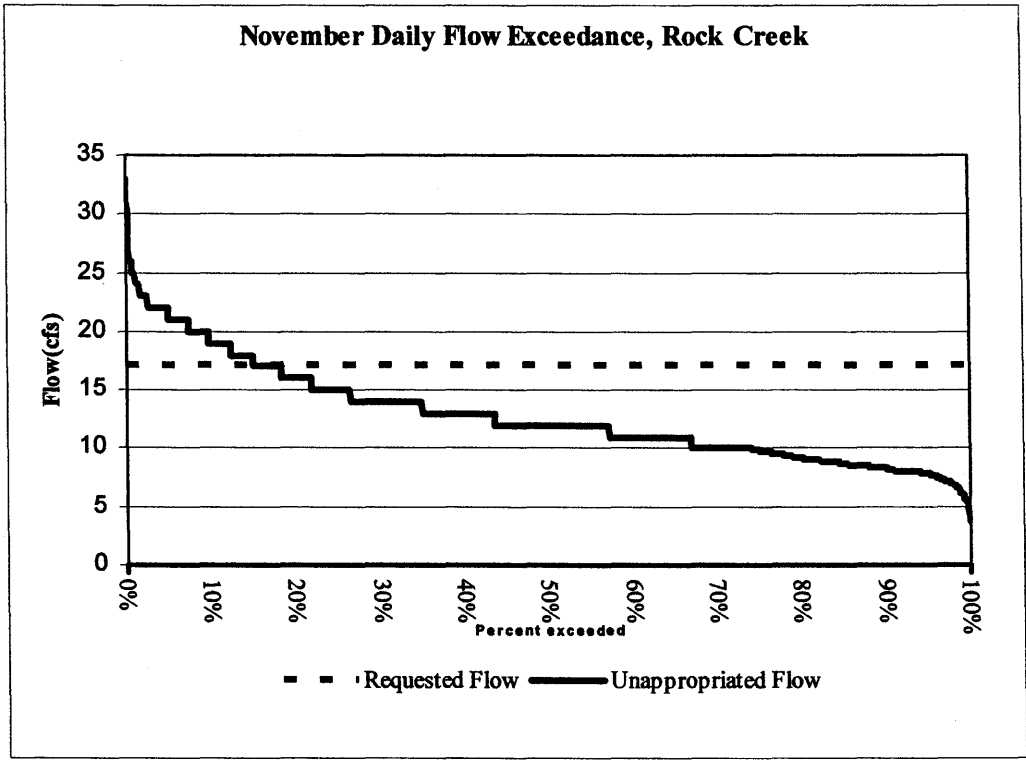


Figure 22. November daily flow exceedance for Rock Creek

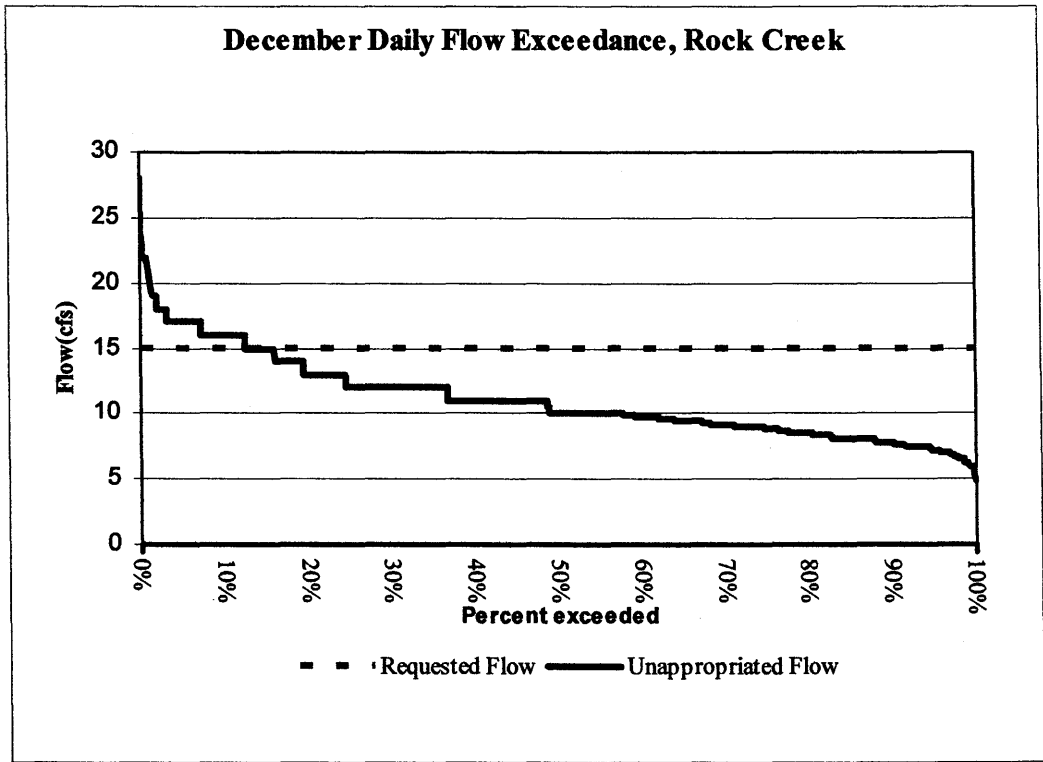


Figure 23. December daily flow exceedance for Rock Creek

Conclusions

The mean monthly flow analysis indicates that shortages will occur throughout most of the year for the instream flow request. The requested flows will only be met for a couple of months during late spring and early summer for the driest year and driest month analysis. The daily flow exceedance analysis indicates that the requested direct flow exceeds less than fifty percent of the unappropriated flows for August through April. Only the May, June, and July unappropriated flows are sufficient to provide the requested instream flow amounts.

Secondary Storage Analysis

No secondary storage rights exist above the instream flow reach on Rock Creek that could be used to supplement the shortages in the instream flow request.

REFERENCES

- Dey, P. D. and Annear, T. C. (2006). "Rock Creek, tributary to Medicine Bow River, instream flow studies." *Administrative Report AW-LE-5UM-511*, Wyoming Game and Fish Department, Fish Division, Cheyenne, WY.
- Searcy, J. K. (1963). "Flow duration curves, manual of hydrology: Part II, low flow techniques." *Report 1542-A*, U. S. Geological Survey, Cheyenne, WY.
- U. S. Geological Survey. (2006). "Water resources data for Wyoming, Volume 1, surface water." (Annual series; reports for previous years published with similar titles; data also available from the USGS website at: <http://waterdata.usgs.gov/nwis/sw>)

Appendix A – Instream Flow Request – Wyoming State

Engineer's Office Temporary Filing Number 33 1/276

PV 040 L266165 A001
SD.00
6/16/06

NOTE: Do not fold this form. Use type-
writer or print neatly with black
ink.

STATE OF WYOMING

OFFICE OF THE STATE ENGINEER APPLICATION FOR PERMIT TO APPROPRIATE SURFACE WATER

THIS SECTION IS NOT TO BE FILLED IN BY APPLICANT

Filing/Priority Date _____

THE STATE OF WYOMING, }
STATE ENGINEER'S OFFICE } SS.

This instrument was received and filed for record on the 16th day of June, A.D. 2006, at 1:25 o'clock P M.

John R. Barnes
JOHN R. BARNES for State Engineer

Recorded in Book _____ of Ditch Permits, on Page _____

Fee Paid \$ 50.00 Map Filed E

WATER DIVISION NO. 1 DISTRICT NO. 9 Temp. Filing No. 33 1/276

PERMIT NO. _____

NAME OF FACILITY Rock Creek Instream Flow

1. Name(s), mailing address and phone no. of applicant(s) is/are Wyoming Water Development Commission
6920 Yellowtail Rd.
Cheyenne, Wyoming 82009 307-777-7626

(If more than one applicant, designate one to act as Agent for the others.)

2. Name & address of agent to receive correspondence and notices Wyoming Game & Fish Commission
5400 Bishop Blvd., Cheyenne, Wyoming 82006

3. (a) The use to which the water is to be applied is INSTREAM FLOW

(b) If more than one beneficial use of water is applied for, the location and ownership of the point of use must be shown in item 10 of the application and the details of the facilities used to divert and convey the appropriation must be shown on the map in sufficient detail to allow the State Engineer to establish the amount of appropriation. In multiple use applications, stock and domestic purposes are limited to 0.056 cubic feet per second.

4. The source of the proposed appropriation is Rock Creek, Trib. Medicine Bow River, Trib. North Plate Ri

The Segment of Instream Flow is from the confluence of drainages in
5. ~~The point of diversion of the proposed works is located~~ Section 15, T. 18, N. R. 79, W. 1/4 NE 1/4 to the
from the NE 1/4 NE 1/4 corner of Section 15 T. 18 N. R. 79 W. 1/4 NE 1/4
North Boundary of the NE 1/4 NE 1/4 of Section 35 T. 19 N. R. 79 W.
Lot _____ Block _____ Subdivision Name _____

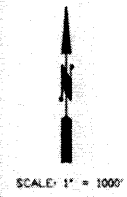
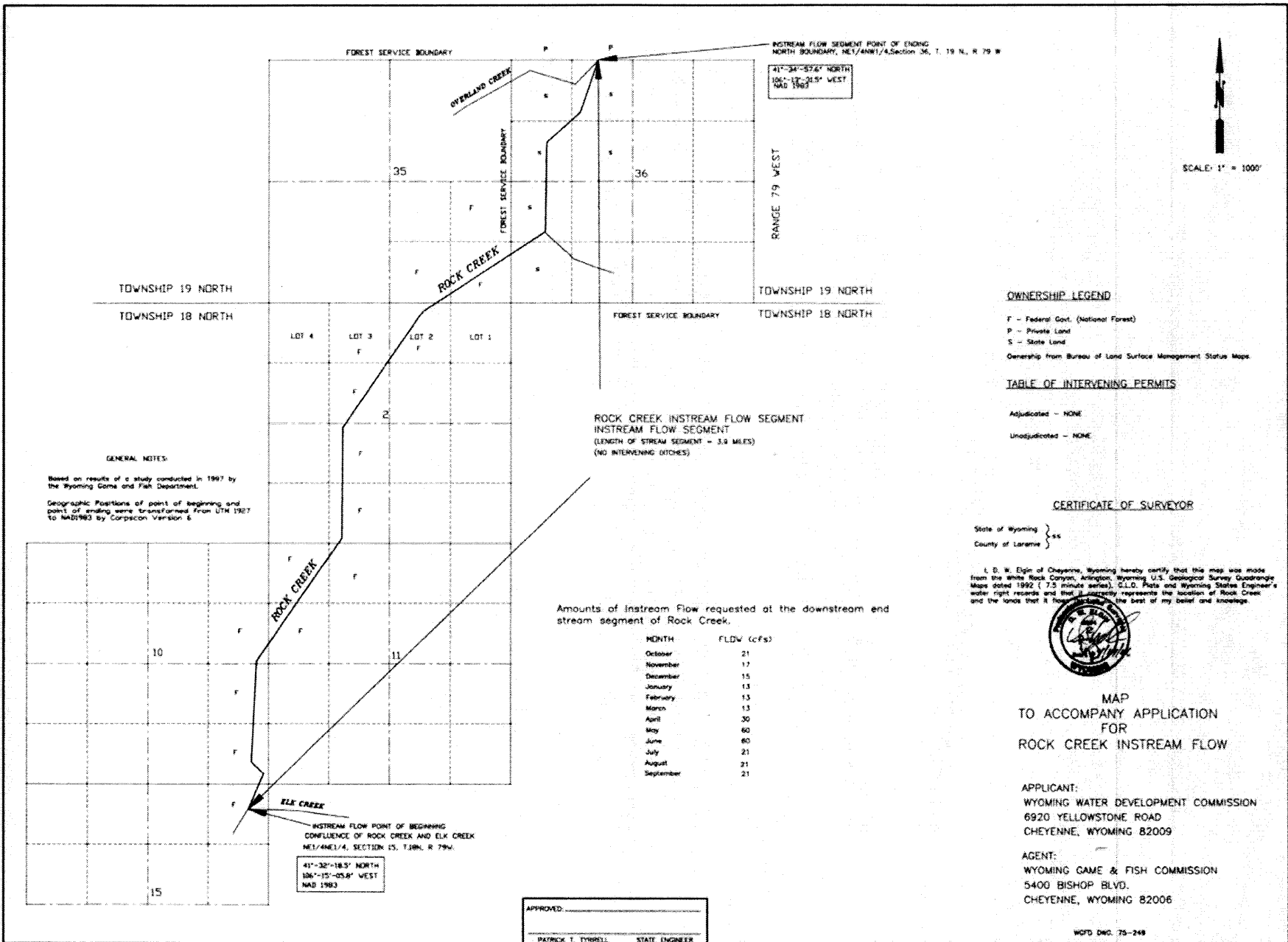
6. Are any of the lands crossed by the proposed facility owned by the State or Federal government? If so, describe lands and indicate whether State or Federally owned.

Section 36, T19N R79 W State Land, ALL
Section 2, T18N, R79 W Federal - ALL
Section 10, " " "
Sections, 11, 15 " " "

7. The carrying capacity of the ditch, canal, pipeline or other facility at the point of diversion is See Remarks 60 cubic feet per second.

8. The accompanying map is prepared in accordance with the State Engineer's Manual of Regulations and Instructions for filing applications and is hereby declared a part of this application. The State Engineer may require the filing of detailed construction plans.

9. The estimated time required for the completion of construction is 30 Days, and to complete the application of water to the beneficial uses stated in this application is 30 Days from Issue.



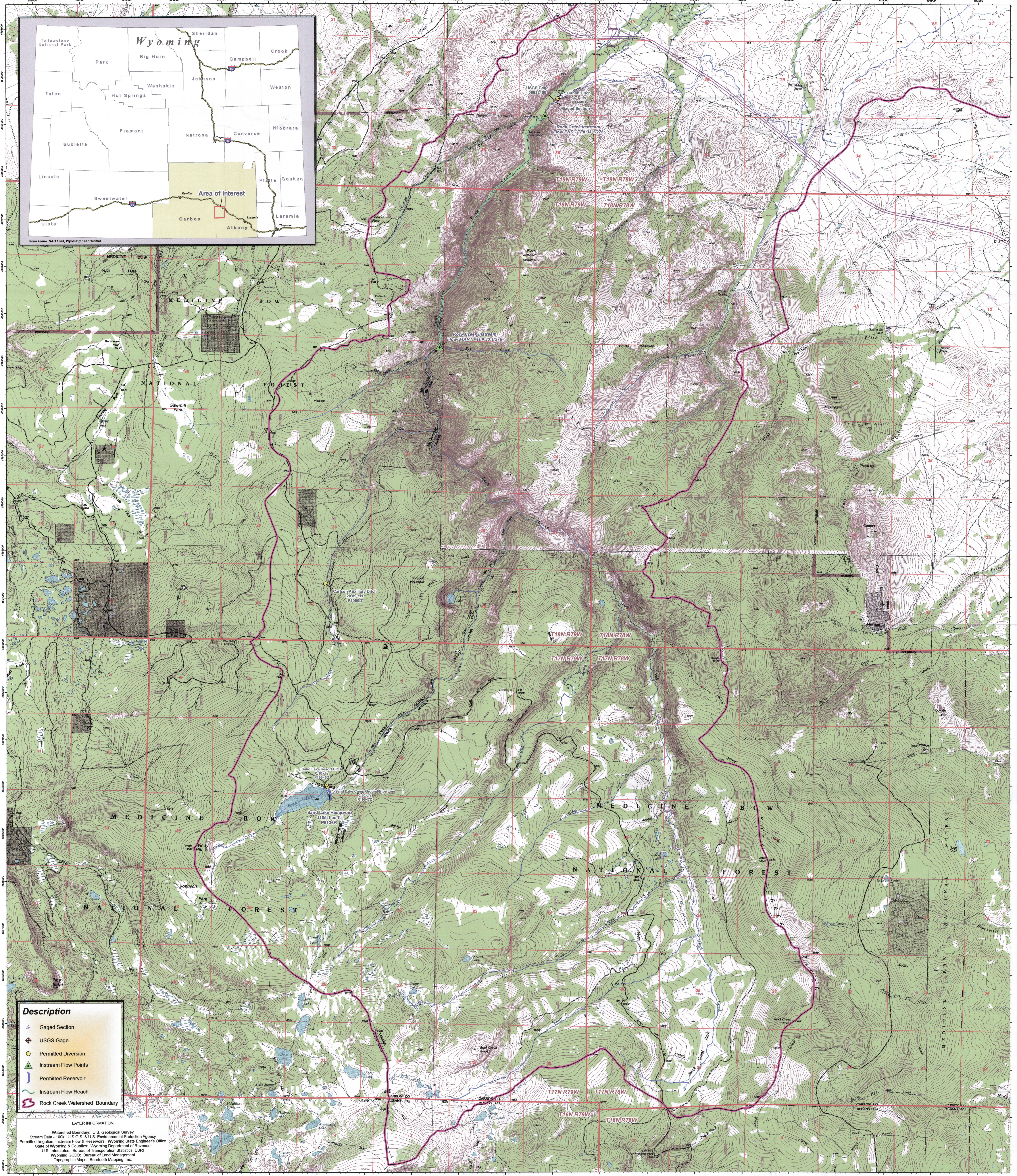
OWNERSHIP LEGEND
 F - Federal Govt. (National Forest)
 P - Private Land
 S - State Land
 Ownership from Bureau of Land Surface Management Status Maps

TABLE OF INTERVENING PERMITS

Adjudicated - NONE
 Unadjudicated - NONE

TF 33/676

**Appendix B – Rock Creek – Carbon and Albany Co., WY –
Topographic Overview Map**

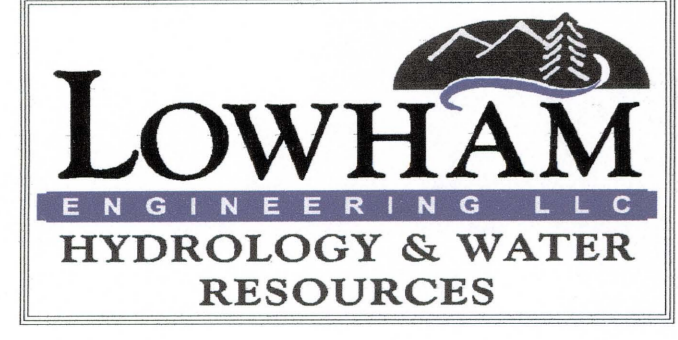
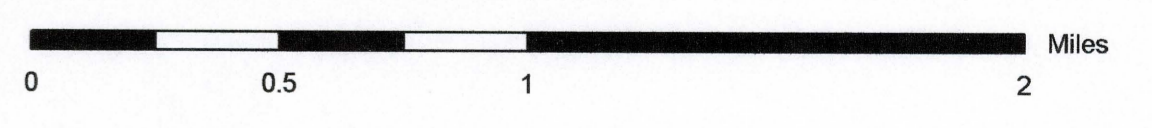


- Description**
- Gaged Section
 - USGS Gage
 - Permitted Diversion
 - Instream Flow Points
 - Permitted Reservoir
 - Instream Flow Reach
 - Rock Creek Watershed Boundary

LAYER INFORMATION

Watershed Boundary: U.S. Geological Survey
 Stream Data - 10k: U.S.G.S. & U.S. Environmental Protection Agency
 Permitted Irrigation, Instream Flow & Reservoirs: Wyoming State Engineer's Office
 State of Wyoming & Counties: Wyoming Department of Revenue
 U.S. Interstates: Bureau of Transportation Statistics, ESRI
 Wyoming GCDB: Bureau of Land Management
 Topographic Maps: BearSoft Mapping, Inc.

UTM, NAD 1983, zone 13



205 S. Third Street
 Lander, WY 82520
 (307) 335-8466

Wyoming Water Development Commission
 Rock Creek - Instream Flow Reach

Topographic Overview Map



Rock Creek - Carbon & Albany Co., WY

Drawn By: Thomas P. Wilkinson, Lowham Engineering LLC

Checked by: B. Thoman

Date: November 30th, 2007

Map No. 1

RockCk_InstreamFlow_TopoOverview_11-30-2007