METHOW RIVER BASIN SINGLE DOMESTIC INSTANTANEOUS WATER USE ESTIMATE

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EXECUTIVE SUMMARY

The basin plan adopted for the Methow River Basin in 1976, set base flows for the Methow River, and prioritized the various water uses. Two cubic feet per second (2 CFS) of water was reserved for the specific use of single domestic supply and stock water, along each of the river's seven administrative reaches. Due to statutory and administrative limitations, no mechanism for tracking single domestic appropriation of this water reservation was developed, and therefore, the amount of water withdrawn from the 2 CFS since 1976, is unknown. This report, Methow River Basin Single Domestic Instantaneous Water Use Estimate, is an effort to quantify the single domestic appropriations that have been established since the adoption of the basin plan. It is important to point out that this study is not an adjudication. It is an estimate of water use, prepared for the Methow Regulation Review Advisory Committee, and should be viewed in that light.

State and county records dealing with single domestic water withdrawals in the Methow River Basin were searched, and pertinent information was extracted and organized. Using a set of specific assumptions about the basin, the information produced a count of the post-1976 single domestic appropriations along each river reach. Hydraulic continuity to the Methow River or its tributaries for each withdrawal was approximated. A tally of single domestic systems and multiple domestic systems was created and the number of undeveloped land parcels within the basin, both platted and non-platted, was established. Only those appropriators in hydraulic continuity with the river or its tributaries, and who are not provided water by a multiple domestic or community water system, are included in computing the amount of 2 CFS water use. Based on the study's assumptions, estimated instantaneous water consumption by single domestic development, quantified by the records search, exceeds the 2 CFS allocation on the Lower Mainstem, Middle Mainstem, and Chewack River reaches.

After the records-search list of post-1976 single domestic water users was compiled, a ground truth field examination was conducted on approximately 20% of the list entries. Five of the seven reaches were visited. The ground truth examination revealed more appropriations than were cataloged by the records search. The amount of previously uncounted water users varied with each reach, from 4% to 41%, with an average under count of 22%.

INTRODUCTION

The Methow River Basin, located in North Central Washington, comprises an area of 1,794 square miles. The basin gathers the waters of the Twisp, the Chewack, and the Lost Rivers, Early Winters Creek, and numerous other perennial streams and discharges them to the Columbia River at Pateros.

The basin's complex geologic history has influenced its morphology. Hard, durable metamorphic gneiss and schist in the southern end of the Methow Valley confine the Methow River within a deep, narrow gorge. Up-valley, sedimentary and igneous volcanic rocks offer less resistance to the erosional power of the river, and the valley broadens. The premier geologic event of the basin, and one that has a direct and abiding influence upon the valley's hydraulic regime, is the Pleistocene Epoch glaciation of the recent Ice Age.

Smoothing and planing the landscape to bedrock with their down-valley movement, the glaciers created and transported immense quantities of sand, gravel, and boulders. When the ice melted, great thicknesses of these sediments mantled the slopes and valleys of the basin. In some locations, as near Mazama, preliminary geophysical evidence indicates nearly 1,000 feet of glacial debris filling the valley bottom.

Hydraulic transmissivity is the rate at which water of a prevailing density and viscosity is transmitted through a unit width of an aquifer under a unit hydraulic gradient. It is a function of the properties of the water, the aquifer, and the thickness of the aquifer. When a well and stream are in hydraulic continuity, the higher the value of the aquifer's transmissivity, the faster the stream's response to pumping of the well. Hydraulic transmissivity in the glacial-fluvial sediments of the Methow Basin is extremely high. Under this condition, the effect of pumping from a well located within these deposits is felt rapidly and over substantial distances.

BACKGROUND, PURPOSE AND SCOPE OF STUDY

The basin plan developed by the Department of Ecology, "The Water Resources Program In The Methow River Basin, WRIA 48", was a response to the pressure of development in the Methow Valley. As adopted on December 28, 1976, the plan established base flows for the Methow River and prioritized several beneficial water uses.

The plan also reserved a quantity of water, 2 cubic feet per second (2 CFS) per river reach, for the specific purpose of single domestic use and stock water. Although the basin plan, WAC 173-548, specifically addresses the surface waters of the Methow River in the allocation of the 2 CFS water reservation, it also requires that ground water in hydraulic continuity with the river be subject to the same conditions and limitations as those affecting the surface water.

State ground water law exempts from the water right permitting process single and group domestic water uses that do not exceed 5,000 gallons a day. Also exempt, are waters used for the irrigation of a lawn or non-commercial garden of less than one-half acre, and industrial uses of less than 5,000 gallons a day. These exemptions apply only to the water right permitting process and do not constitute exemptions to statutory or regulatory enactments. All other types of appropriation are required to comply with permit procedures. Exemption to the permitting process has meant that no record of the amounts of water taken for these exempt uses has been kept, and therefore, the actual quantity remaining of the 2 CFS water allotment set-aside for single domestic use, is unknown.

As a consequence of these exemptions, the only in-house information available to the Department of Ecology on these exempt withdrawals is from the well logs of wells drilled within the basin. Logs are required to be submitted after construction by the well driller, but unfortunately the requirement is not always observed. This non-compliance compounds the difficulties involved in determining the quantities of water appropriated.

The purpose of this study is to <u>estimate</u> the quantities of water withdrawn, by river reach, for single domestic supply since the adoption of the basin plan in 1976. Both directly appropriated surface water from the Methow River or its tributaries, and ground water that is in hydraulic continuity with these surface water bodies are included in this estimate. Wells not in continuity were included in the study, but were not counted against the 2 CFS water allocation. A secondary objective was to furnish information on the status of development of basin land parcels, by river reach, as part of an estimate of the basin's potential for growth. It is important to understand that the study is <u>not</u> an adjudication. It is an estimate, prepared for the Methow Regulation Review Advisory Committee, and should be viewed in that perspective.

METHODOLOGY

A. Data Collection

Information was obtained from five primary sources; Methow Basin well logs stored with the Department of Ecology, water rights data from Ecology's WRIS computer system in Olympia, Okanogan County building permits for the Methow Basin, the current tax roll print-out for the basin's lands from the Okanogan County Assessor's Office, and records of the basin's community water systems, from the Okanogan County Health Department.

B. Data Resources

Well logs from 352 wells drilled within the basin after 1976 provided details to the study of the date of construction, location, completed depth, and owner's name. As previously mentioned, compliance by drillers in submitting well logs has been less than total, so this number of logs represents fewer wells than were actually drilled.

The WRIS (Water Rights Information System) system furnished information on 73 Ecology-issued water rights applications, permits, and certificates. Included in the WRIS print-out are owner, type, location, source, surface or ground water disposition, purpose, and proposed quantity of appropriation.

Over 3,600 Okanogan County building permits were examined. Approximately 800 Methow Basin permits, those indicating the construction of a single family dwelling or a recreational cabin after the date of the basin plan adoption, were recorded in this study.

The office of the Okanogan County Assessor furnished a 2,400 page tax roll print-out for parcels within the basin, from which platted lands and developed/undeveloped parcels were determined. Maps of the platted lands were obtained from the Okanogan County Department of Public Works, to aid in locating building and well sites.

In order to discriminate between new construction served by community water systems and those new buildings with private wells, the Okanogan County Health Department records of community systems were examined. Community systems within the basin were identified and their service areas noted. New construction occurring within such a service area is assumed to be provided water by the community system, unless evidence indicates otherwise.

C. Data Base Development

The solution to managing the extensive amount of information obtained was the creation of a data base, using Smart System Software. Twenty-five separate data fields were fashioned to accommodate the variety of details that issued from the various records. The primary headings were section, township, and range, and owner. Virtually every well log, water right certificate, or building permit included at least these facts.

Using section/township/range as the organizational basis for the study, the next step was to define the entire basin in these terms. This was accomplished by the creation of a 1:100,000 topographic map, using parts of the Twisp, Omak, Robinson Mtn., and Oroville 1:100,000 U.S. Geological Survey quadrangles. The basin boundaries were defined by marking the drainage divides of those streams flowing into the basin from those draining to other areas. All or parts of 62 townships, each 36 square miles, were determined to be within the basin. Roadless or mountainous areas that could be eliminated from perusal due to their remote location were deleted from the study. The remaining lands furnished the appropriate section/township/range designations with which to scan and locate pertinent records. The river reaches, defined in WAC 173-548, also were identified and delineated on the base map, as they are integral in the determination of the water use estimate.

D. Assumptions and Criteria

Basic assumptions governing the investigation are as follows:

- December 28,1976, the adoption date for the basin plan, is used as the starting date for this study. Only those domestic water appropriations that have occurred since that date are included in the report. The information on building permits, well logs, and water rights was entered into the data base before July 10, 1990. Building or well drilling after that date is not reflected in this report, except for specific cases discovered during the ground truth examination.

- In the absence of exact data on the continuity of each of the single domestic users determined to be in high probability of continuity, a "worst case" impact scenario was developed for wells drilled and completed within the glacial-fluvial package of sediments. The extremely high transmissivity of the glacial-fluvial aquifer minimizes the aquifer's buffering effect and continuity is considered to be immediate and complete for the "worst

case". For this "worse case", ground water appropriation is considered to be the same as surface water withdrawal.

- Only those single domestic withdrawals in probable hydraulic continuity with the Methow River or its tributaries are debited against the 2 CFS single domestic and stockwater reserve. Table 4 presents the continuity determinations for single domestic supply appropriations, by river reach.

- The quantities of water used by the Department of Ecology when allocating water to the various categories of permitted single domestic use are limited by both the instantaneous rate of pumping and the volume which can be used annually. Table 5, below presents typical instantaneous rates and annual volumes. The sum of the instantaneous rates of single domestic use represents the potential impact on the stream and is used by the department to determine the amounts of water legally available. Withdrawal of water for single domestic supple can adversely effect senior rights, including instream flows.

Table 1. Typical Domestic Water Allocation by the Washington State Department of Ecology.

Typical Single Domestic Use Type	Maximum Instantaneous Rate (CFS)	Annual Volume (AF/YR)
Single Domestic With Lawn Irrigation	0.02	2
Single Domestic With No Irrigation	0.01	1

- An instantaneous discount rate of 0.015 CFS was chosen to reflect the observations made during ground truth data collection of the seasonal and vacation nature of many of the residences and the absence of lawn and garden irrigation.

- The status of land parcels within the basin as being either developed or undeveloped is determined from the Okanogan County Assessor's current tax roll. Defining

this basin property condition is important only for assessing future development that could effect the single domestic supply water reservation, and does not relate to the present water use estimate. Two tables display the developed/undeveloped condition of the basin lands. Table 2 accounts for all undeveloped parcels in the basin and includes both platted and unplatted property. We assume that lands that have been surveyed into discrete building lots and homesite acreages as part of a subdivision, have a higher potential for development than do unplatted parcels. For this reason, we have included Table 3, which specifically considers the developed/undeveloped condition of platted parcels.

- Stockwater appropriations are not addressed in this estimate. Refer to "Estimate of Water Uses in the Methow River Basin" for information on stockwater use.

- Buildings within the area of a platted development or a community, served by a community water system, are assumed to receive their water from that system, unless evidence indicates otherwise.

- A single domestic supply, for the purpose of the estimate, is assumed and counted only when at least one of the following documents or conditions exist:

  a well log indicating the construction of a domestic well, after 12/28/76, and within the boundaries of the basin,

  or

  a building permit for a single family residence or recreational cabin/summer home, also conforming to the time and location characteristics,

  and

  the well log/building permit is not located within the service area of a community or multiple domestic water system.

  Parcels containing a well but no other form of development represent less than 3% of the domestic supply estimates in this study.

E. Data Analysis

Organization and retrieval of the information recorded in the data base was focused on the section/township/range location description for every entry. Each river reach was also defined with this pattern. Print-outs listing the water appropriations, either wells

or buildings, were then created. Duplications that resulted from recording the well log and building permit for the same site became conspicuous when all the entries for a single section were listed together.

Each appropriation entry included a determination as to type; single domestic supply or multiple domestic supply, and a tally of these uses was established. Multiple domestic supply appropriations represent multi-family buildings, such as duplexes or condominiums that are served by a single well. A multiple domestic system could fall under the exemption from the permit process if the amount of water withdrawn is less than 5,000 gallons a day. Water use in quantities greater than 5,000 gallons a day requires a permit. Although included in the study's data, multiple domestic systems were <u>not</u> counted against the single domestic 2 CFS allocation, but are estimated in the report "Estimate of Water Uses in the Methow River Basin".

Community water supply systems are those which serve two or more dwellings. Twisp and Winthrop both have community systems, as do several of the large plats, including Edelweiss, Lost River Airport Tracts, and Sun Mountain Pine Forest. Section/township/range designation, along with plat name or street address helped to resolve which new construction fell within community system served areas. All of these entries were removed from the water use estimate of single domestic use but are tallied in Table 3.

The probability of hydraulic continuity with the Methow River for each well or building was determined by locating the sites on the appropriate 7½ minute topographic map. If the site location coincided with the topographic features typically associated with glacial deposits, hydraulic continuity with the river was determined to exist. While this method is generally accurate (a field check was accomplished on a portion of the entries), we acknowledge that visiting each individual well site will more effectively establish a particular well's continuity. Unfortunately, time and staffing constraints precluded this more rigorous field examination.

Tables 2 and 3 present information on undeveloped basin land. The total number of undeveloped parcels, by river reach, is displayed by Table 2. Its subset, Table 3, considers only platted parcels. The number of undeveloped parcels gives an idea of the potential for growth in the basin. The present number of single domestic supply appropriations is quite small compared to the number of potential appropriations, as indicated by Tables 2 and 3.

VERIFICATION BY GROUND TRUTH EXAMINATION

In consideration of the fact that the Water Use Estimate is entirely the product of a records search, we made an effort to develop an independent index of reliability. Over a period of seven days, 219 buildings or wells were visited as part of a ground truth examination. The number of residents, the extent of outside water use, and an estimate of the days-per-year of occupancy were established for each of the sites.

The number of site visits represents nearly 20% of our total of 942 single domestic system data entries. During the ground truth examination, we investigated portions of the Headwaters, Upper Mainstem, Middle Mainstem, Chewack, and Twisp River reaches. This field work discovered a significant number of post-1976 wells and buildings that had not been recorded during the search of state and county records. As shown on Table 6, the amount of un-counted wells and buildings ranged from 4% to 41%, depending upon river reach.

Due to the lack of time, the Lower Mainstem was not inspected. Early Winters reach has no appropriations listed, so it was deleted from the ground truth examination. We acknowledge the imperfections in this field survey. Many locations, especially those in remote areas, were not inspected. Much more time and effort is necessary to inquire into each of the data base entries.

Nevertheless, the ground truth examination resulted in the conclusion that the paper inventory underestimates the number of single domestic users by an average of 22%.

METHOW RIVER BASIN 2 CFS SINGLE DOMESTIC WATER USE ESTIMATE BASIC DATA

The following pages present, in tables and graphs, information developed by the 2 CFS Water Use Estimate. Tables 1 through 4 display data on undeveloped parcels within the basin, platted lot development status, appropriation classification, and probable hydraulic continuity for single domestic systems, respectively. Figures 1 through 4 show this same information graphically, on simple and stacked bar charts.

Table 2. Undeveloped Parcels in the Methow Basin, by River Reach. (Includes platted lots).

Methow Reach	Undeveloped Parcels
Lower	2,024
Twisp	426
Middle	1,220
Chewack	555
Upper	898
Early Winters	9
Headwaters	605

*Total of 9,164 Parcels on the Okanogan County Tax Rolls for the Methow Basin. A total of 3,427 developed parcels and 5,737 undeveloped parcels.

Table 3. Classification of Platted Lots by Development Status, by River Reach.

Methow Reach	Developed Platted Lots	Undeveloped Platted Lots	Total Number of Platted Lots
Lower	102	263	365
Twisp	16	64	80
Middle	151	612	763
Chewack	77	212	289
Upper	39	233	272
Early Winters	0	0	0
Headwaters	65	317	382
TOTAL	450	1,701	2,151

Table 4. Classification of Water System by Type and River Reach.

Methow Reach	Single Domestic	Multiple Domestic	Structures Served by Community Systems
Lower	359	7	82
Twisp	96	4	11
Middle	183	3	52
Chewack	162	10	2
Upper	99	16	45
Early Winters	0	0	0
Head-waters	43	10	31
TOTAL	942	50	223

Table 5. Classification of Single Domestic Systems by Probable Hydraulic Continuity with the Methow River, by River Reach.

Methow Reach	Single Domestic	Probability of Continuity High	Low
Lower	359	329	30
Twisp	96	93	3
Middle	183	173	10
Chewack	162	152	10
Upper	99	92	7
Early Winters	0	0	0
Headwaters	43	43	0
TOTAL	942	882	60

FIGURE 1

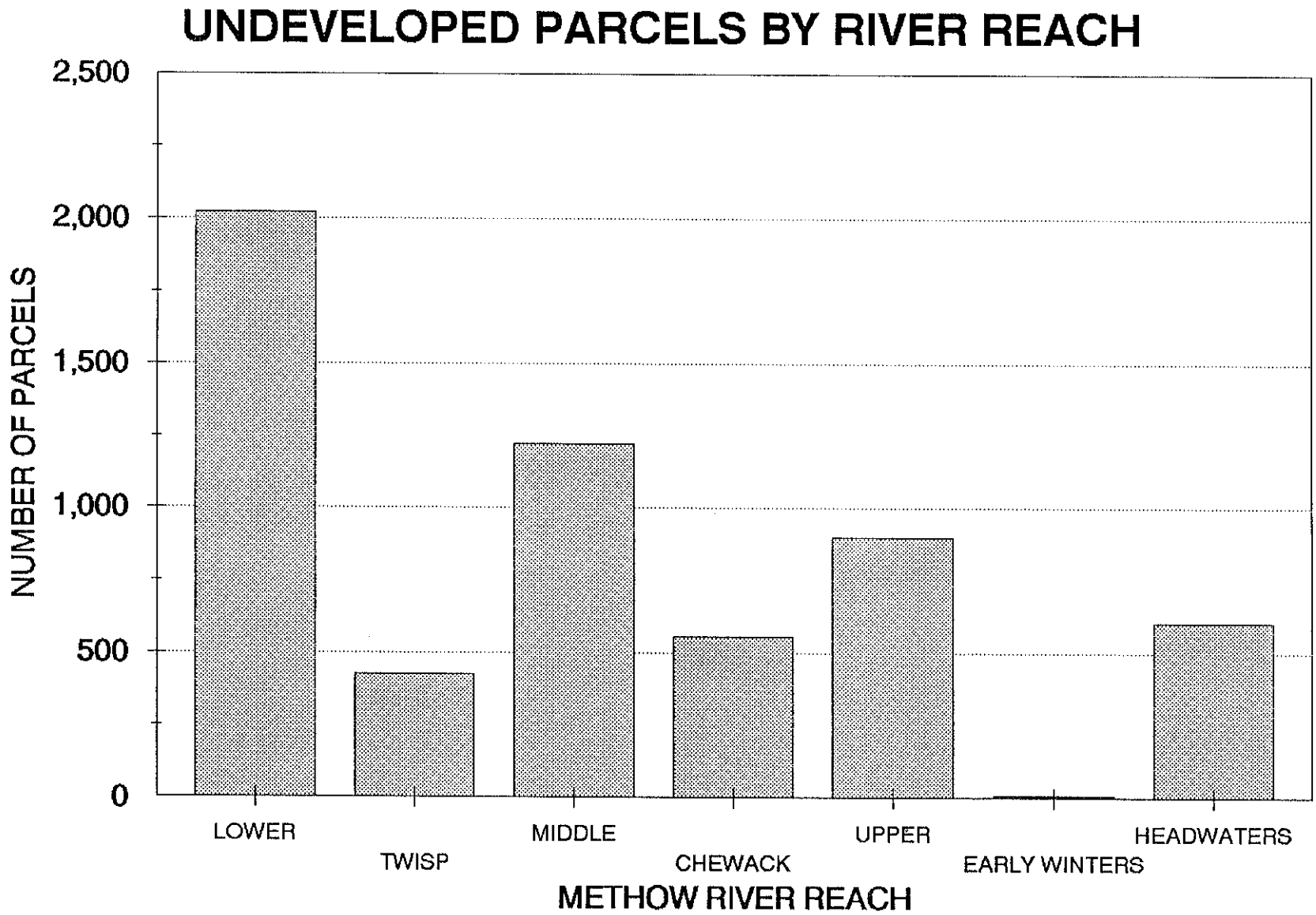

UNDEVELOPED PARCELS BY RIVER REACH
NUMBER OF PARCELS
2,500
2,000
1,500
1,000
500
0
LOWER
TWISP
MIDDLE
CHEWACK
UPPER
EARLY WINTERS
HEADWATERS
METHOW RIVER REACH

FIGURE 2

PLATTED LOT STATUS BY REACH

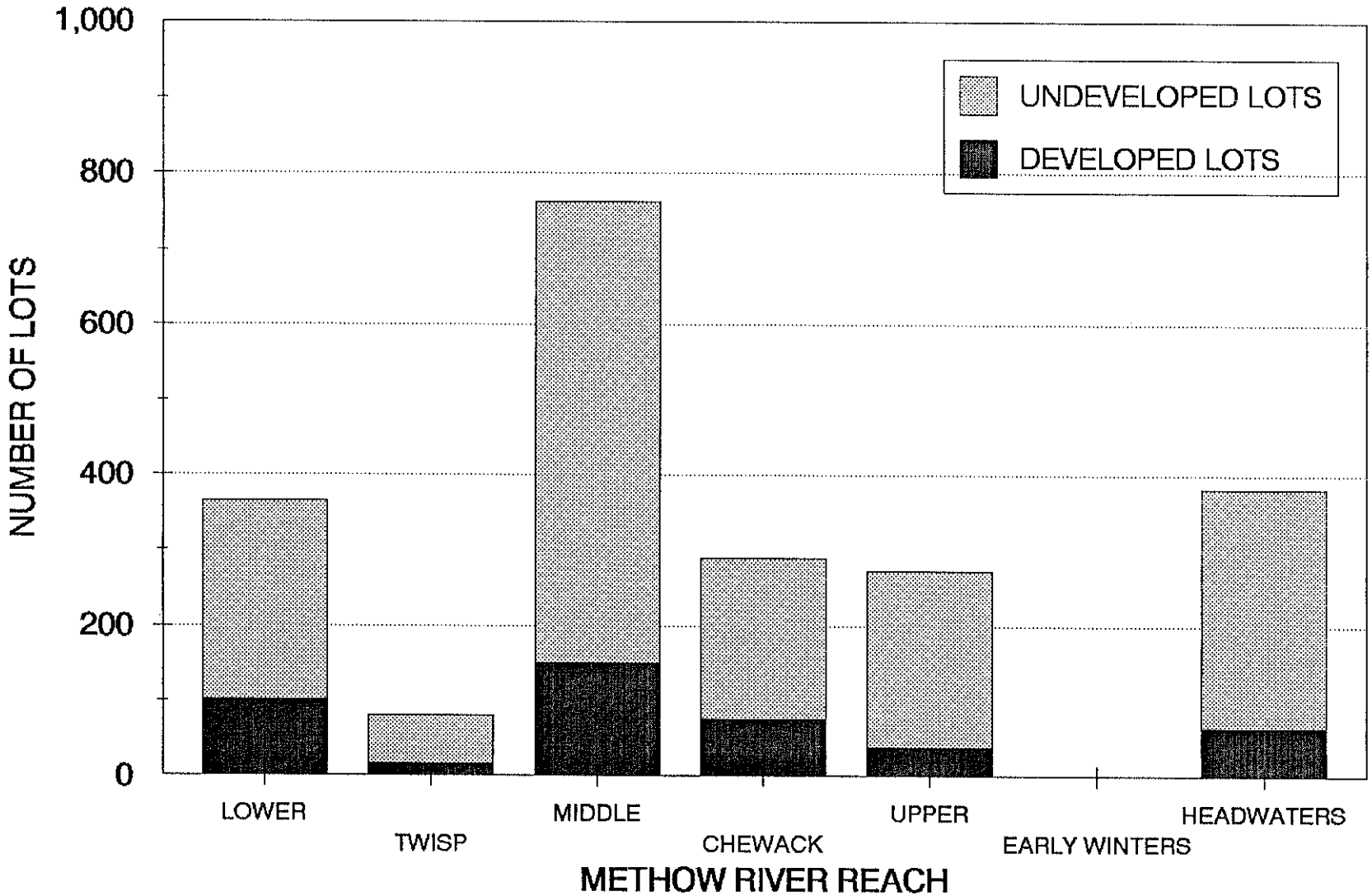


FIGURE 3

APPROPIATION CLASSIFICATION BY REACH

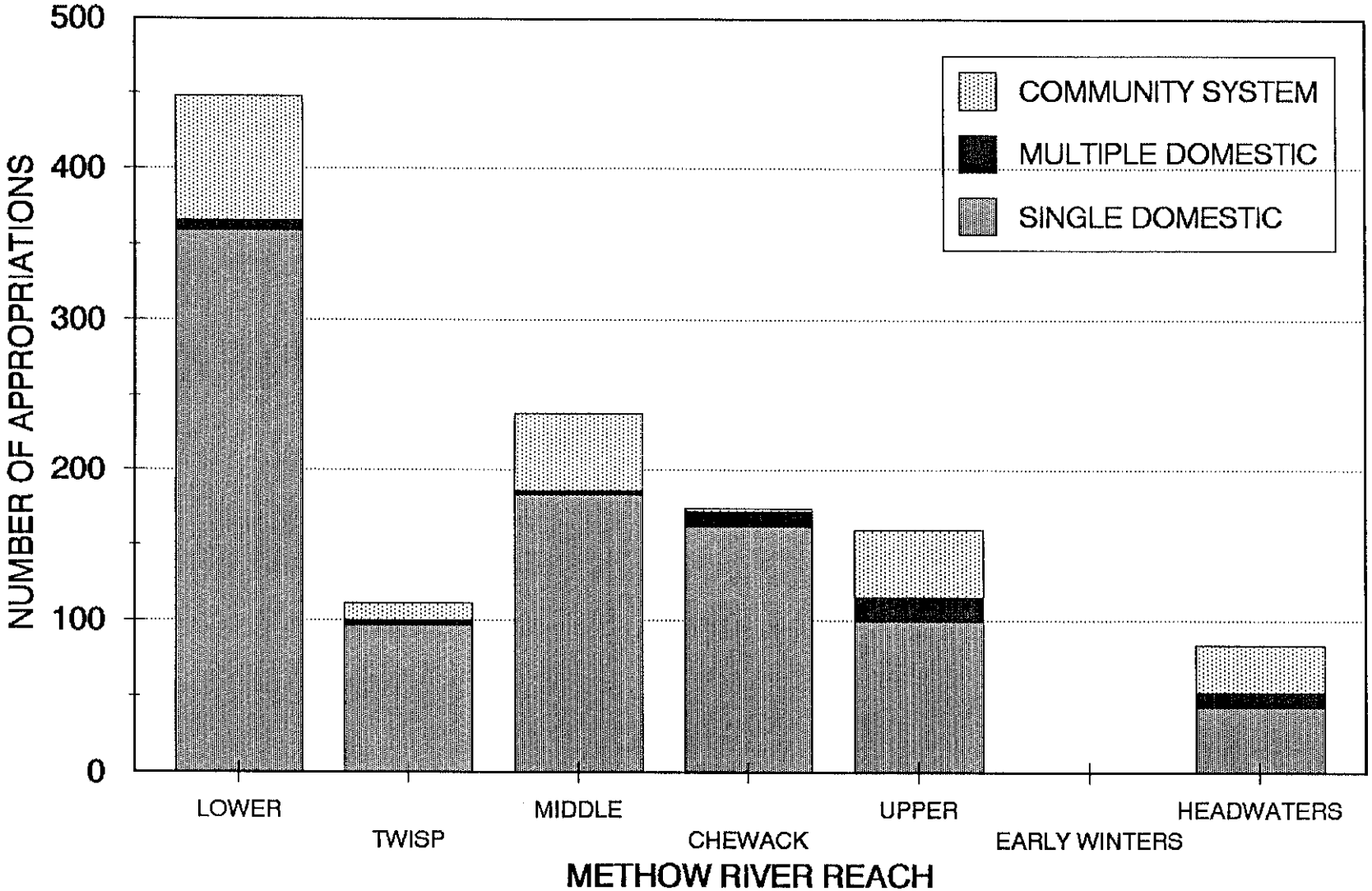
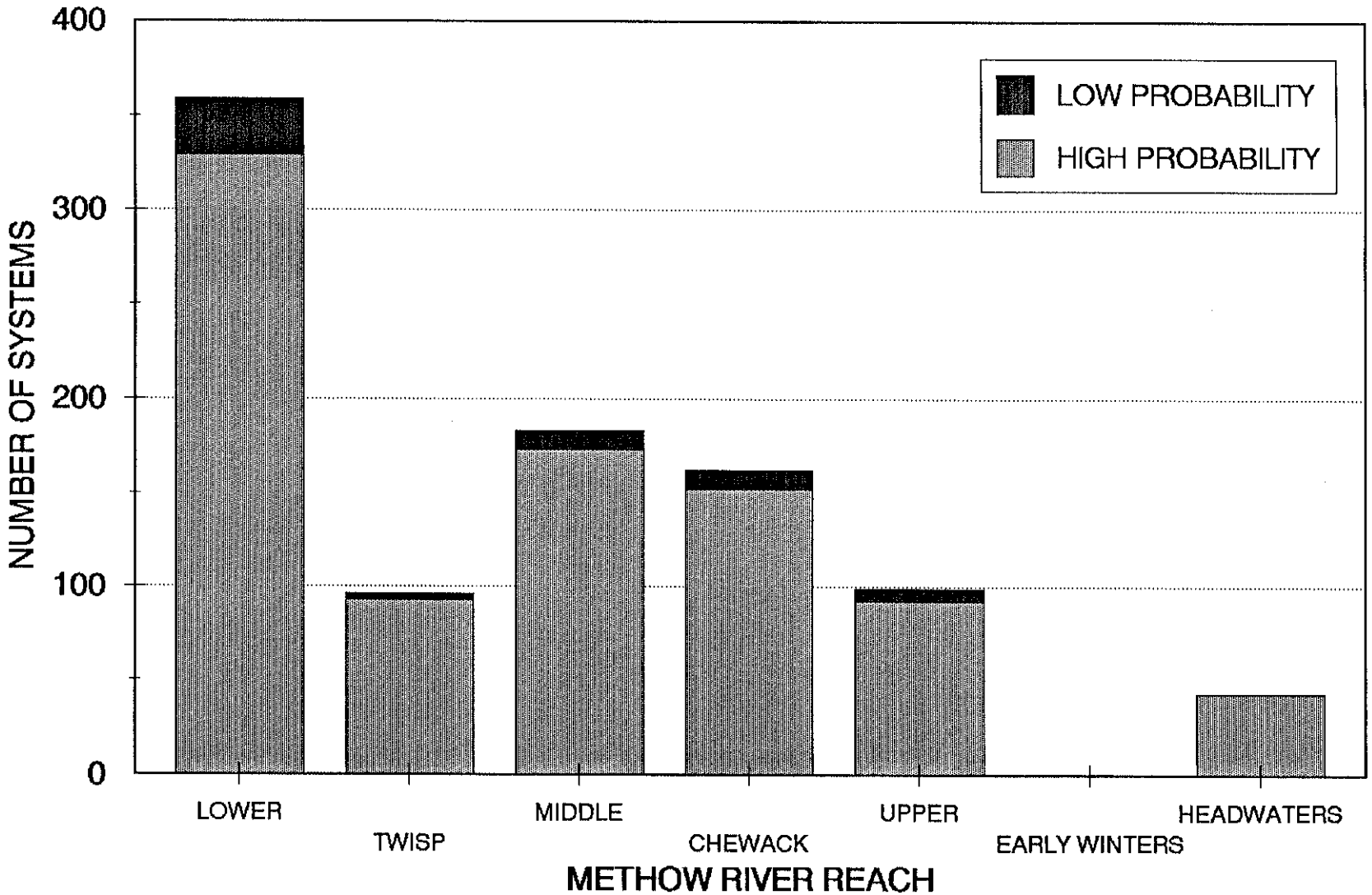


FIGURE 4

PROBABLE CONTINUITY OF SINGLE DOMESTIC SYSTEMS



METHOW BASIN 2 CFS SINGLE DOMESTIC INSTANTANEOUS WATER USE ESTIMATE

Field investigation in five of the seven river reaches revealed more water appropriations than were listed in the record-search data base. Each examined reach shows a different degree of under counting, with an average under count of 22%. For example, 15% more water users were located by the field investigation in the Headwaters Reach, than are recorded on the records-search list. The Chewack Reach showed 41% more appropriations than are listed. Each reach proved to be different.

Tables 6 and 7 of this report display estimates of instantaneous single domestic water use for each reach of the Methow River. Figure 5 presents this information in graphic form. Table 6 represents the estimated instantaneous consumption based entirely upon the list of appropriations developed from the record search. Table 7 adjusts the single domestic instantaneous water use estimates for each reach, by adding the percent of previously unreported appropriations discovered by the ground truth examination. As the Lower Reach did not receive a field visit, the average (22%) under count is used to adjust this area. Early Winters Reach listed no water uses that fit the study parameters, and was not visited.

Table 6. Estimated Single Domestic Instantaneous Use, by Methow River Reach. (Unadjusted).

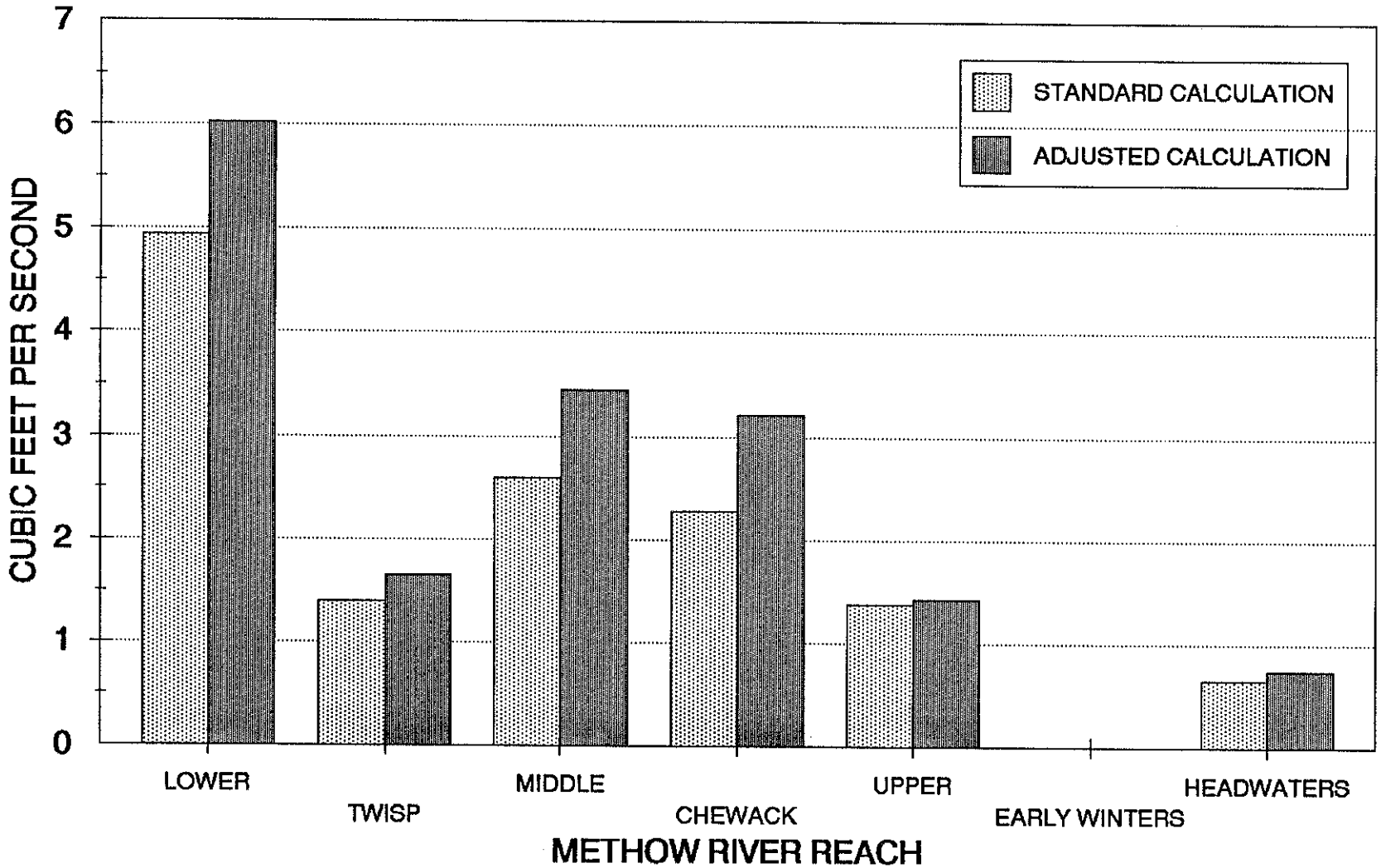
Methow Reach	Single Domestic most probably in Continuity	Water use Factor (CFS)	Estimated Consumption (CFS)
Lower	329	.015	4.94
Twisp	93	.015	1.40
Middle	173	.015	2.60
Chewack	152	.015	2.28
Upper	92	.015	1.38
Early Winters	0	.015	0.00
Headwaters	43	.015	0.65

Table 7. Estimated Single Domestic Instantaneous Use by River Reach. (Adjusted using Ground Truth Correction Factor).

Methow Reach	Ground Truth Correction	Adjusted Single Domestic most Probably in Continuity	Adjusted Estimated Consumption (CFS)
Lower	+22%	401	6.02
Twisp	+18%	110	1.65
Middle	+33%	230	3.45
Chewack	+41%	214	3.21
Upper	+4%	96	1.44
Early Winters	____	0	0.00
Headwaters	+15%	50	0.75

FIGURE 5

ESTIMATED SINGLE DOMESTIC USE



SEE TEXT FOR ADJUSTMENT CALCULATION FACTORS

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