Approved 2/2/84
Date

MINUTES OF THE House COMMITTEE ON Energy and Natural Resources.

The meeting was called to order by Rep. David J. Heinemann at
Chairperson

3:30 ~~xx~~./p.m. on January 12, 1984 in room 519-S of the Capitol.

All members were present except: Representatives Charlton and Patterson (Excused)

Committee staff present:

Ramon Powers, Legislative Research
Raney Gilliland, Legislative Research
Theresa Kiernan, Revisor of Statutes
Pam Somerville, Secretary to the Committee

Conferees appearing before the committee:

Mr. Steve Melton, Acting General Counsel, Federal Energy Regulating Commission.

A copy of the final draft of the Kansas Water Plan was distributed to committee members for their review. (Attachment 1.)

The meeting was called to order by Representative Dave Heinemann. Representative Heinemann introduced Mr. Steve Melton, Acting General Counsel, Federal Energy Regulating Council (FERC) to present FERC's role in the regulation of natural gas.

Mr. Melton appeared before the committee and presented FERC's opinion on the proposal which would prohibit the sale of Kansas-produced natural gas at a price below the minimum level defined as economic waste. Mr. Melton said the minimum price in the bill would be a floating figure based on a percentage of average gas prices, now approximately $1.90 a unit, or 1,000 cubic feet.

Mr. Melton expressed oppostion to the proposal and concern regarding the constitutionality of such legislation.

In closing, Mr. Melton stated the legislation would be an "uphill fight" and hard to recommend passage.

Representative Farrar, Vice-Chairman, chaired the committee meeting in Representative Heinemann's absence, and opened the meeting to a brief question and answer period.

Several committee members expressed concern that legislation was needed to prevent further exploitation of low priced Kansas gas. Presently, in the Hugoton gas field, the second largest natural gas field in the world, maximum prices for old gas average is just over 50 cents a unit under the existing regulatory guidelines.

There being no further business before the committee, the meeting was adjounred at 4:40 p.m.

The next meeting of the Energy and Natural Resources Committee will be at 3:30 p.m., January 16, 1984 in Room 519-S.

Rep. David J. Heinemann, Chairman

Date 1-12-84

GUESTS

HOUSE ENERGY AND NATURAL RESOURCES COMMITTEE

NAME	ADDRESS	ORGANIZATION
Randal Loder	RT 2 Garden City	SW Kans Irr Assn.
Phil Bradley	Box 438 Garden City	KS Farm Bureau
Whitney B Damron	1919 Mac Topeka	K.N.R.C.
Jerry Loomis	Topeka	KG&E
Lon Stanton	Topeka	Northern Natural Gas
Bill Perdue	Topeka	KPL Gas Service

Kansas Water Plan

Sub-section: Minimum Desirable Streamflows

Kansas Water Office
109 S.W. Ninth, Suite 200
Topeka, Kansas 66612
An Equal Opportunity Employer

December, 1983 **Pages 1-13**

Final Draft

Attachment 1

MINIMUM DESIRABLE STREAMFLOWS

INTRODUCTION

In 1980, the Kansas Legislature passed a law that would protect streamflows from encroachment by new appropriation rights. (See Glossary on Page 11.) Under terms of K.S.A. 82a-703a, the Chief Engineer of the Division of Water Resources of the State Board of Agriculture shall withhold an amount of streamflow from appropriation so that the minimum desirable streamflows can be maintained. The 1983 Legislature passed Senate Concurrent Resolution 1622, directing the Kansas Water Authority and Kansas Water Office to develop procedures for the administration of minimum desirable streamflows and to conduct field tests on the Marais des Cygnes and Neosho rivers.

This section describes the general procedures of establishing, monitoring, and administering minimum desirable streamflows. Priority streams considered for minimum desirable streamflows are listed and minimum desirable streamflow standards for the Marais des Cygnes, Neosho, Cottonwood, and Little Arkansas rivers are recommended.

CONCEPTS

Minimum desirable streamflows are meant to "preserve, maintain, or enhance instream water uses relative to water quality, fish, wildlife, aquatic life, recreation, and general aesthetics" according to K.S.A. 82a-928(9).

Under the terms of K.S.A. 82a-703a, the Chief Engineer shall withhold minimum desirable streamflows from appropriation. This can be accomplished either by denying future appropriation requests or by allowing future appropriations but making them subject to being shut off when minimum desirable streamflows are not met. Minimum desirable streamflows are thus somewhat analogous to water rights. Upon the effective date of any legislatively adopted minimum desirable streamflow, that flow would have a priority established in the "first in time is first in right" concept of the Kansas Water Appropriation Act. Thus, any appropriation filed after this date (junior right) could be cut off during periods of low flow. No rights filed prior to this date (senior right) would be affected. Figure 1 displays the relation of minimum desirable streamflows to senior and junior water rights at various stream levels.

In some ways water appropriations are restricted by minimum desirable streamflow. On the other hand, the protection of appropriated water flowing toward a destination in the lower reaches of the stream where a senior water right holder is waiting to use it contributes to maintaining a minimum desirable streamflow. Thus, the uses are not always competitive. Minimum streamflows may consist of unappropriated water, water returning from upstream diversions, releases from reservoirs, and water transported to downstream appropriators. This illustrates that in some cases water uses complement each other and the water can serve several purposes.

A minimum desirable streamflow plan can't create water where water doesn't exist or help streams that are over-appropriated. In fact, to provide water in some rivers like the Arkansas River in western Kansas, it would be necessary to buy water rights and supplement streamflow at considerable expense. What minimum streamflow planning can do is help those streams where there is still some water to protect. Minimum desirable streamflow can particularly be helpful for streams that have reservoirs in place, especially those reservoirs that have water quality storage which could be used.

Only a portion of the reservoir storage would be used for minimum desirable streamflow under the proposals outlined in this section. The highest priority for reservoir waters is for water supply and emergency water quality releases. Thus, as reservoir levels drop, water available for minimum desirable streamflows

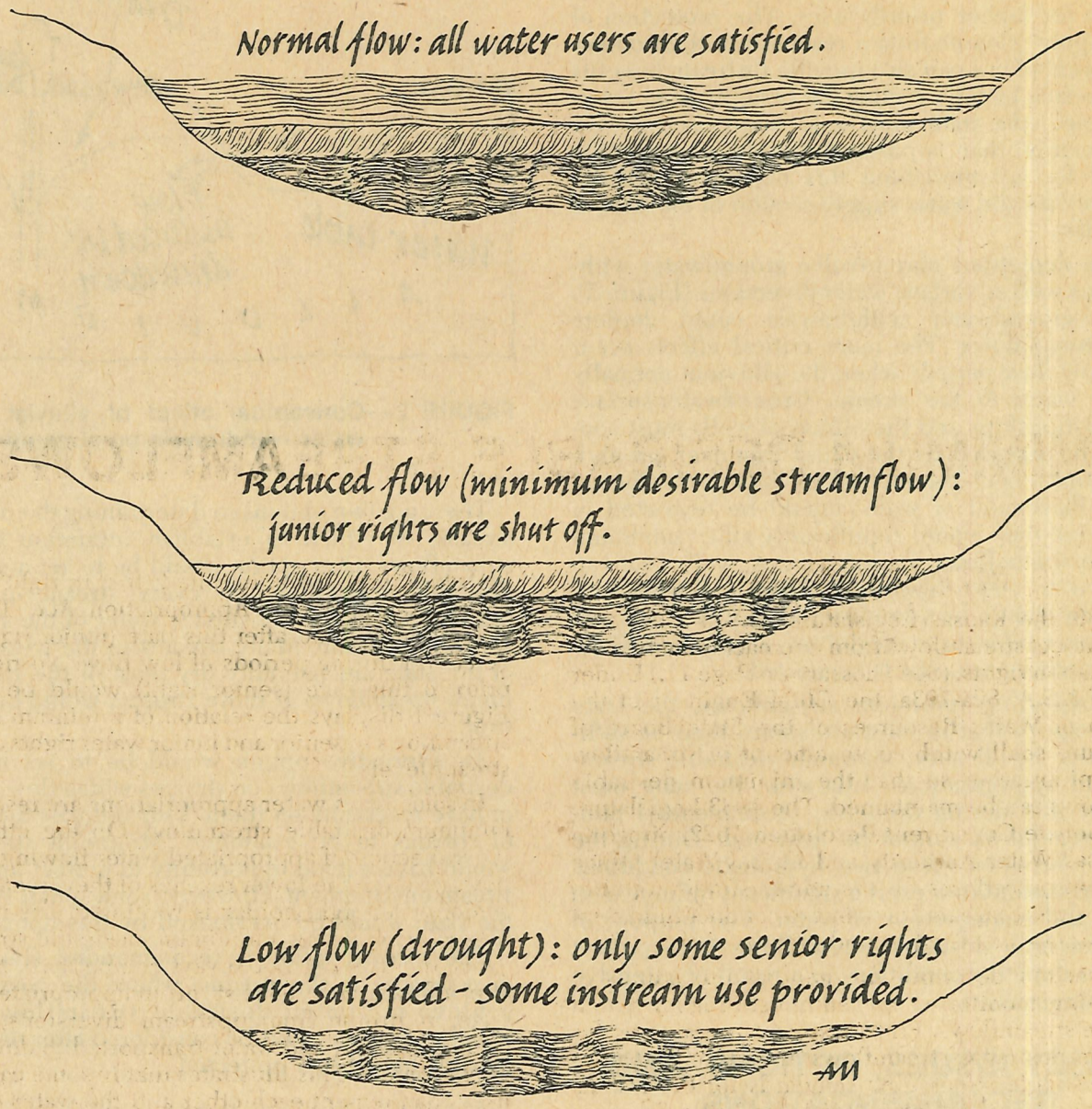

FIGURE 1.—Conceptual relations of minimum desirable streamflows and water rights at various stream levels.

would decrease so that the low flow releases would eventually cease and the remaining storage would be available for higher priority uses. The protection of water supply releases from a reservoir to their downstream point of use can also provide instream benefits to the stream. To fully realize the benefits from reservoir storage, the state must gain more control over their operation than is presently possible. A specific proposal for accomplishing this objective is being considered for the water supply section of the Kansas Water Plan.

Stream depletions may involve groundwater withdrawals as well as surface water diversions (Figure 2). Alluvial groundwater withdrawals could deplete nearby streamflows. The more critical effects occur during low flow periods when the alluvium normally supplies water to the stream. Groundwater/surface water relationships and the effects of wells must continue to be assessed by the Chief Engineer, groundwater management districts and the Kansas Geological Survey. Placement of wells should be restricted in areas where they would significantly affect minimum desirable streamflows. In some cases, wells that can be shown to exert significant direct influences on streamflow should be administered as if they were in the stream. Under these conditions, application of the alluvial corridor concept is suggested.

In establishing minimum streamflows, the state must recognize that in most situations, there is sufficient water for all uses; minimum desirable streamflows and appropriations. Likewise, the state must recognize that during droughts, recommended minimum streamflows cannot be achieved. During the transition between these two hydrologic conditions minimum streamflows exert a significant influence on the use and management of water. The purpose of these minimum desirable streamflows is to protect flow from depleted conditions as a result of extensive water appropriation.

POLICY ISSUES, OPTIONS, AND RECOMMENDATIONS

Three policy issues regarding minimum desirable streamflows need to be addressed. The issues are:

1. The number of streams on which minimum desirable streamflows will be identified;
2. The priority of existing water appropriations over minimum desirable streamflows; and
3. The enhancement of streamflows by using reservoir storage.

NUMBER OF STREAMS

The current statutes do not define the extent to which the minimum desirable streamflow concept should be applied in Kansas. Thus, minimum streamflows are not restricted only to the major streams nor are they mandated for every stream in the state.

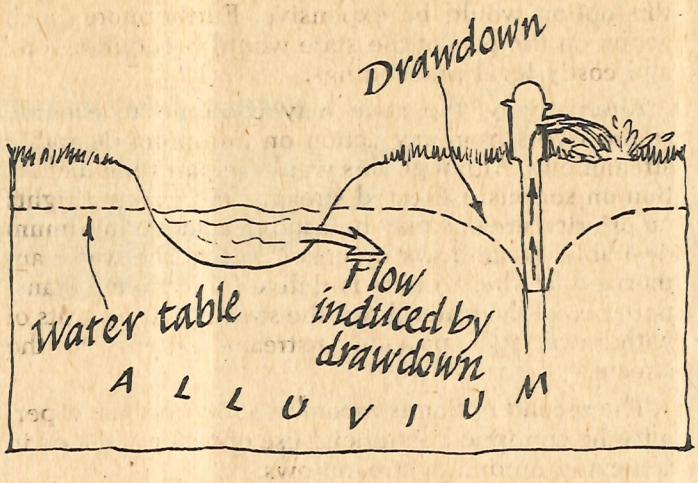

FIGURE 2.—Conceptual effect of alluvial groundwater withdrawals on streamflow.

There are two options in determining the number of streams in which to establish minimum desirable streamflows. One option would be to set a minimum desirable streamflow on every stream in Kansas, thereby protecting the surface water of the state from serious depletion. Many streams in the western third of the state are naturally dry most of the time. Minimum streamflows of those streams would be impractical.

An alternative option would be to set minimum desirable streamflows on streams which flow regularly or have reservoirs on them. This reduces the number of streams to be examined. Minimum streamflows would have a good opportunity to protect an existing stream environment. However, some small streams in the state would be overlooked by this option.

The second option is recommended since it will give priority to the streams where the possibility to achieve minimum desirable streamflows exists. Smaller streams could be considered after the priority streams have been protected.

EXISTING WATER RIGHTS

Under present state law, water appropriations filed before minimum desirable streamflows are approved retain their priority. Thus, streams currently severely impacted by appropriations, such as the Arkansas River or the Smoky Hill River below Cedar Bluff cannot be helped by setting minimum desirable streamflows.

An option would be for the state to condemn and/or purchase those senior rights in order to achieve some minimum desirable streamflows. This option would provide some streamflow by lessening the demand on that water. On some streams, such as the Upper Arkansas or Smoky Hill rivers, the buying out of existing rights might alleviate the serious lack of streamflow, although to what degree remains unknown. However,

this option would be expensive. Furthermore, such action on the part of the state would precipitate long and costly legal proceedings.

Alternatively, the state may continue to exclude senior rights from any action on minimum desirable streamflows. Although this would impair remedial action on seriously affected streams, the existing rights on priority streams may be used to achieve minimum desirable streamflows by ensuring that the water authorized for these rights is delivered to them. Transportation of the water down the stream to the points of withdrawal will provide instream benefits to the stream.

The second option is recommended because it permits the continued beneficial use of water and aids in achieving minimum streamflows.

STREAM ENHANCEMENT

K.S.A. 82a-928(7) calls for "the inclusion in publicly financed structures for the conservation, management and development of the water resources of the state of reasonable amounts of storage capacity for the regulation of the low flows of the watercourses of the state." K.S.A. 82a-928(9) states one purpose of minimum desirable streamflows is to "enhance" instream uses. Reasonable amounts of storage have not been identified in Kansas reservoirs nor has the degree of enhancement to Kansas streams been addressed in terms of the public interest in use of that water.

One option would be to maintain minimum desirable streamflows through all conditions, including drought, by using existing reservoirs. This option would provide streamflow through very dry periods, such as the droughts of the 1930's and 1950's. However, release of water from reservoirs for instream benefits would deplete the reservoirs in such stressed times and preclude the use of that water for municipal uses. Thus, enhancing minimum streamflows with reservoir storage would be implied to be a higher priority than water supply to the general public.

An alternative option would not permit any enhancement of streams, thereby holding water in reservoirs until a critical public need for that water is expressed. Streams would dry up as they historically have. Precluding the use of stored water to supplement streams during low periods is not consistent with existing state policies. Furthermore, two uses of many federal reservoirs, water quality maintenance and flow regulation, would be neglected under this option.

A third option would consider enhancement of streamflows by reservoir releases through a moderate (one-in-ten year) drought, but would restrict any supplementation as conditions worsened. This option would follow K.S.A. 82a-928(7) in using some stored water for low flow regulation, but recognizes the higher priorities of public water supply and emergency water quality releases over instream benefits as water becomes scarce. Adoption of this option would still enhance streams beyond what historically would have flowed under similar conditions. Use of stored floodwaters to enhance flows is a possibility under this option.

The third option is recommended because reasonable amounts of storage would be used for low flow regulation, some stream enhancement is allowed, and higher public needs would take priority over minimum desirable streamflows under severe drought conditions. Stream enhancement can only occur on regulated streams.

SUMMARY OF POLICY RECOMMENDATIONS

In summary, the following three options are recommended.

(1) The state should identify minimum desirable streamflows on those streams with sufficient opportunity to achieve such streamflows and with real needs to be protected from future appropriation of water.

(2) The state should not subject existing water rights to the administration of minimum desirable streamflows, but should use those rights to help achieve the minimum streamflows.

(3) The state should attempt to enhance streamflows, using reservoir water, through moderate droughts, but should forego enhancing streamflows as drought conditions worsen in favor of providing water for water supply and water quality purposes, as those needs arise.

PLAN IMPLEMENTATION

ADMINISTRATIVE ACTIONS

Minimum desirable streamflows are based on specific instream needs on specific stream reaches. Before actual streamflow values are identified, state policy and procedures must be declared on three facets of minimum desirable streamflows; the methodology of selecting streams and identifying minimum streamflows, the process of monitoring minimum streamflows, and the administration guidelines for achieving minimum streamflows. The details of these three phases are provided in the Minimum Desirable Streamflow Background Paper, available from the Kansas Water Office. The general concepts for methodology, monitoring, and administration of minimum desirable streamflows are outlined below.

Methodology

The methodology of selecting a minimum desirable streamflow depends on the instream needs, availability of streamflows, and existing appropriation rights. Unfortunately, this dependence precludes the use of a single criterion for choosing a minimum streamflow on every stream in Kansas. Therefore, minimum streamflows must be chosen on a stream-by-stream basis. The methodology must define the operating

principles and criteria for establishing minimum streamflows.

Minimum streamflow determinations should be based upon the following factors:

1. Defined hydrologic conditions under which minimum streamflows will pertain.
2. Maintenance of adequate water quality for public health and aquatic life to the extent possible under prevailing hydrologic conditions.
3. Under normal hydrologic conditions, maintenance of the aquatic habitat to support an adequate fishery biomass.
4. Maintenance of instream recreation potential under normal hydrologic conditions, recognizing the questions of trespass and limited access on many Kansas streams.
5. Protection of the wildlife and aesthetic characteristics of Kansas stream channels and their surrounding riparian areas.
6. Any proposed minimum desirable streamflow will be established with the technical advice and review of an interagency advisory committee.
7. The Kansas Water Office will recommend minimum streamflows based upon the following criteria:
   (a) the instream needs of aquatic life present in that reach,
   (b) the factors influencing the ambient water quality within the reach,
   (c) any indirect benefits such flows provide to recreation, aesthetics or the riparian ecology,
   (d) water appropriation rights which have been filed prior to the legislative session, including the quantities and location of their diversions,
   (e) availability of baseflows to meet the minimum streamflow,
   (f) expected streamflows resulting from direct runoff,
   (g) hydrologic effects of conservation and watershed projects,
   (h) the historic frequency of the minimum streamflow, reflecting the natural hydrologic capacity to meet that flow,
   (i) the relationship of existing interstate water compacts,
   (j) the effect on streamflow by significant appropriation of alluvial groundwater,
   (k) available storages in upstream reservoirs to aid in achievement of minimum streamflows, and
   (l) economic considerations of administration and future development.

Monitoring

The monitoring network for minimum desirable streamflows serves three purposes. First, the network provides adequate warning of critical flow conditions as those conditions occur. Second, the network accurately assesses the achievement of minimum desirable streamflows during those critical periods. Finally, the network produces reliable evidence to justify and support subsequent administrative actions and decisions.

The Kansas Water Office should be responsible for monitoring minimum streamflows. Gaging stations will be used as monitor sites because of their accessibility and continuous records. Telemetering and verbal reports from field personnel will be the primary source of data. The monitoring network will necessarily be modified on a stream-by-stream basis.

Administration

Administration to maintain minimum desirable streamflows is the responsibility of the Division of Water Resources. The Kansas Water Appropriation Act states in part:

> "Whenever the legislature enacts any section or amendment of the state water plan which identifies a minimum desirable streamflow for any watercourse in this state, the chief engineer shall withhold from appropriation that amount of water deemed necessary to establish and maintain for the identified watercourse the desired minimum streamflow." (K.S.A. 82a-703a)

Two situations are present in Kansas streams: natural flow in reaches unregulated by reservoirs and regulated flow in reaches below reservoirs. K.S.A. 82a-703a applies in either situation, however, reservoirs provide an additional option to supplement deficient streamflows by releasing stored water.

Administration of minimum desirable streamflows on unregulated streams would commence seven days after deficient flows were encountered, unless the deficiency in streamflow warranted immediate action. Administration would proceed as follows:

(1) Note deficiency of flows and upstream use by water appropriators.

(2) Prevent anyone not holding valid water appropriations from diverting water during this critical period.

(3) Limit diversions by water appropriators upstream of monitoring site in accordance with their water appropriations.

(4) Implement, for all users, water conservation measures that may be recommended or required by the state through policies or programs.

(5) Shut off surface water appropriations with priority dates after the date of enactment of the

minimum desirable streamflow.

(6) If necessary, restrict groundwater usage in the surrounding alluvium.

(7) Administer streamflows such that downstream vested and most senior appropriations are met, recognizing the complementary purposes of upstream instream benefits and the priority of the most senior appropriation.

Administration of minimum desirable streamflows on regulated streams would proceed as above, plus the following:

(8) Protect reservoir releases to the extent possible and provided by the agreements required in K.S.A. 82a-706b.

(9) Release and protect water quality and water supply flows, under K.S.A. 82-706b, as downstream needs dictate.

(10) Maintain administration until the situation is relieved.

FINANCIAL REQUIREMENTS

Funding for the minimum desirable streamflow program will be required for monitoring and administration. To the extent possible, the existing U.S. Geological Survey gaging station network will be used to monitor minimum streamflows. Some monitoring costs will be incurred by establishing additional gaging stations and the operation and maintenance of those stations. Establishment costs range from $1,500 to $12,000, depending on the type of gage. These are one-time costs. Annual operation and maintenance costs range from $550 to $5,500 per station. Costs will be shared by the state and the U.S. Geological Survey. For fiscal year 1985, a stream gaging station is needed for the Marais des Cygnes River near LaCygne. This station would include telemetry equipment for remote access of streamflow data. The monitoring costs for the state for the 1985 fiscal year comes to $8,700, $4,000 of which are ongoing operation and maintenance costs, including telephone usage.

Administration of minimum streamflows will incur costs to the Division of Water Resources. The actual expense incurred in administering minimum streamflows is dependent upon factors of hydrologic conditions such as drought, the number of water rights along a stream and the number of new applications to appropriate the stream water. While an accurate estimate of cost is difficult to determine, the Division of Water Resources did an analysis to simulate the effect of the drought conditions present in 1980-1982 on the four rivers with minimum streamflow recommendation. This analysis indicated that it would require approximately 24 man-months of time during a fiscal year to protect or augment minimum streamflows under these conditions. This situation would exceed present staffing capabilities of the Division. Therefore, additional personnel would be required to respond during these drought conditions. In addition, the Division of Water Resources indicated that the implementation of minimum streamflow requirements would necessitate other work such as the evaluation of the effect of new appropriations on established minimum streamflows and enforcement activities.

The total fiscal requirement for monitoring and administering minimum streamflows cannot be determined until minimum desirable streamflow standards have been established on the remaining streams. However, if minimum streamflow standards are developed similiar to those which have been established by this section, approximately 20 additional stations could be required on future streams with estimated start-up costs of $100,000 and annual operating costs of $60,000. Similarly, the Division of Water Resources estimated that administration would require approximately one man-year per major river basin under drought conditions. Assuming these factors, annual on-going expenditures for administration of minimum streamflows would be from approximately $250,000-$300,000.

TIME SCHEDULE

Recommended Minimum Desirable Streamflows

Recommendations for minimum desirable streamflows are submitted for four rivers: the Marais des Cygnes River; the Neosho River and its major tributary, the Cottonwood River; and the Little Arkansas River (Table 1). Separate technical reports for each stream are available detailing the considerations and data used in formulating the following minimum desirable streamflow recommendations.

Spawning flows for fisheries are presented on the regulated streams in April, May, and June. These flows will depend on the status of reservoir storage. If the reservoirs are in flood pool, the spawning flows will be released. When reservoirs are at conservation pool, the spawning flows will be foregone and the maintenance flows recommended during the remaining nine months will pertain to the spawning period.

MARAIS DES CYGNES RIVER

The Marais des Cygnes River is located in eastern Kansas and flows eastward into Missouri (Figure 3). Average annual flow on the river is 630 cfs at Ottawa and 1,900 cfs near the state line. The Marais des Cygnes River has been regulated since 1964 when Pomona Reservoir was completed. Two more reservoirs, Melvern and Hillsdale, have been constructed in the basin. Median flow at Ottawa has been 127 cfs since the reservoirs were completed and median flow near the state line has been 456 cfs. All three reservoirs have water quality storage currently totaling 160,000 acre-feet. Minimum streamflow recommen-

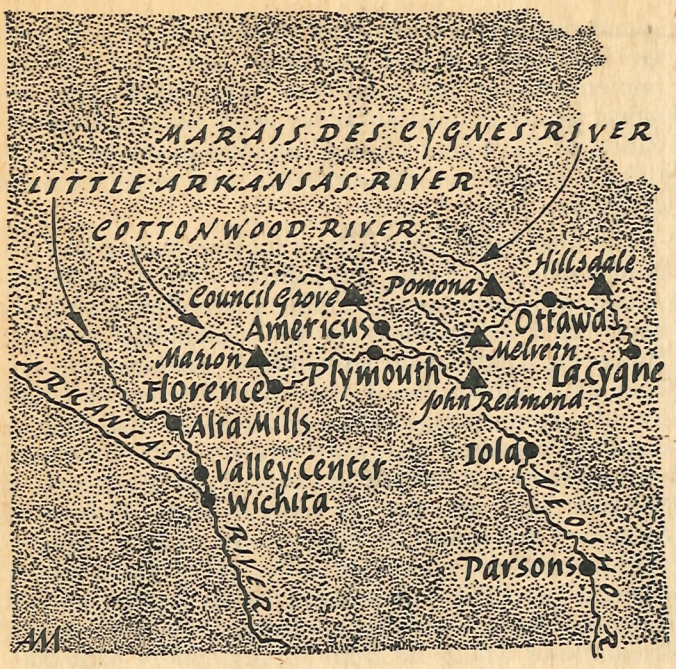

FIGURE 3.—Stream sites of recommended minimum desirable streamflows for 1984.

dations for the Marais des Cygnes are varied on a monthly basis and are keyed to stations at Ottawa and near La Cygne (Table 1). Administration of existing rights along with low flow water quality releases from Melvern, Pomona, and Hillsdale reservoirs will usually provide adequate instream benefits. Details of the minimum streamflow recommendations are provided in Minimum Desirable Streamflow Technical Report #1.

NEOSHO AND COTTONWOOD RIVERS

The Neosho and its major tributary, the Cottonwood, are located in the southeast portion of the state (Figure 3). The Cottonwood flows eastward into the Neosho above John Redmond Reservoir. The Neosho flows south into Oklahoma. Average annual flow on the Cottonwood near Plymouth is 830 cfs. Average flow on the Neosho near Americus, above the confluence of the Cottonwood River is 280 cfs. The Lower Neosho near Parsons averages 2,500 cfs annually. Median flows at these points have been 270, 68 and 710 cfs respectively. Three reservoirs are located on the Neosho and Cottonwood rivers: Marion, Council Grove, and John Redmond. Current water quality storage in these three reservoirs total 89,700 acre-feet.

The minimum desirable streamflow recommendations for the Neosho and Cottonwood rivers were made for five points: Florence and Plymouth on the Cottonwood, Americus on the Upper Neosho, and Iola

	J	F	M	A (*)	M (*)	J (*)	J	A	S	O	N	D
Marais des Cygnes												
Ottawa	15	15	15	15 (40)	20 (50)	25 (50)	25	25	20	15	15	15
LaCygne . . .	20	20	20	20 (50)	20(150)	25(150)	25	25	20	20	20	20
Neosho												
Americus . .	5	5	5	5 (20)	5 (30)	5 (30)	5	5	5	5	5	5
Iola	40	40	40	40 (60)	40(200)	40(200)	40	40	40	40	40	40
Parsons . . .	50	50	50	50(100)	50(300)	50(300)	50	50	50	50	50	50
Cottonwood												
Florence . . .	10	10	10	10 (30)	10 (60)	10 (60)	10	10	10	10	10	10
Plymouth . .	20	20	20	20 (60)	20(150)	20(150)	20	20	20	20	20	20
Little Arkansas												
Alta Mills . . .	8	8	8	8	8	8	8	8	8	8	8	8
Valley Center	20	20	20	20	20	20	20	20	20	20	20	20

* Spawning flows to be managed if reservoirs in flood pool, otherwise use lower flows.

TABLE 1.—Minimum Desirable Streamflow Recommendations (cfs)

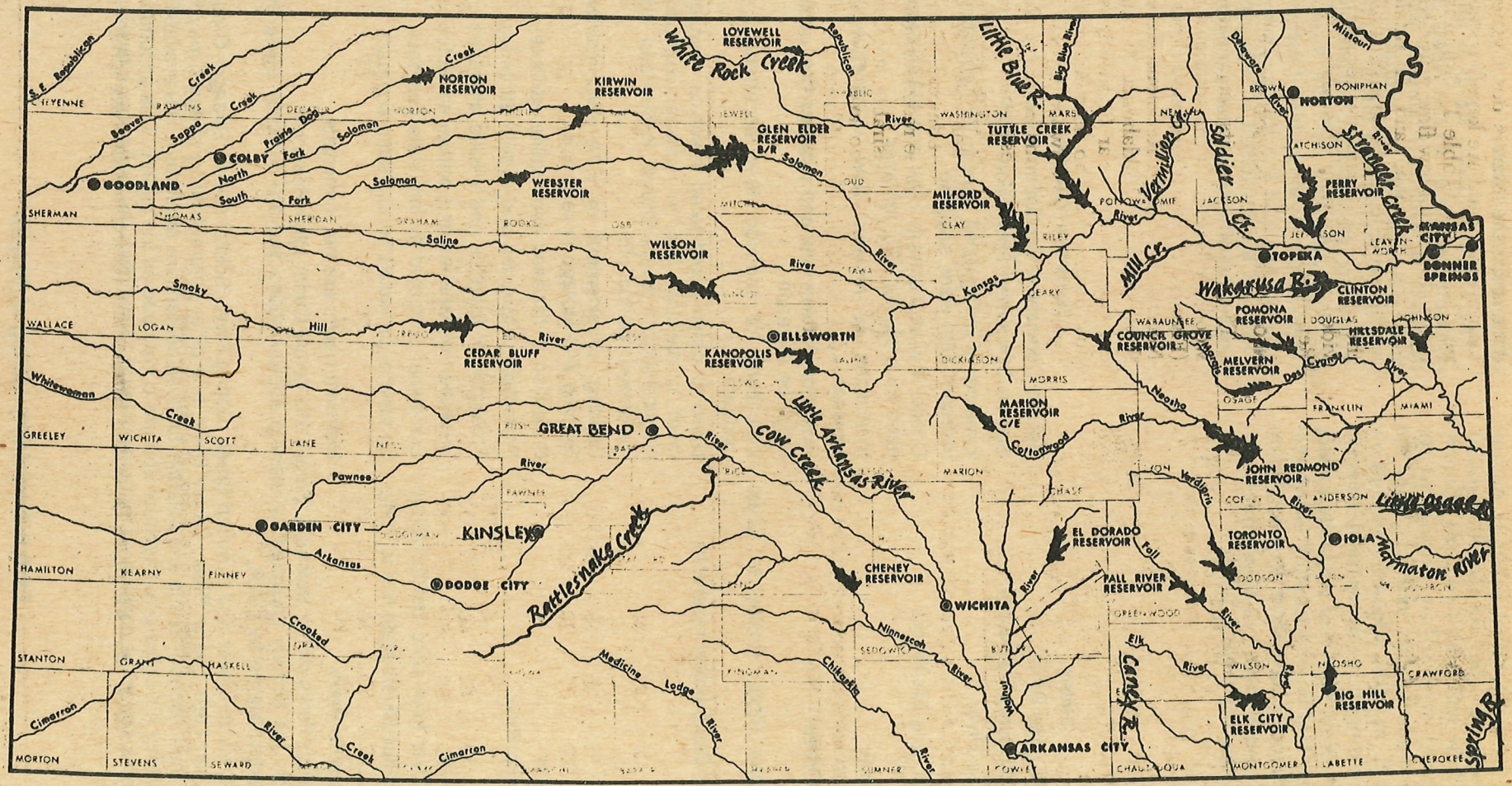

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FIGURE 4.—Kansas streams and reservoirs.

and Parsons on the Lower Neosho (Table 1). Administration of rights to ensure they receive their authorized quantities of flow will achieve a large percentage of the minimum streamflow requirements. Additionally, some water quality releases from the three reservoirs will provide adequate streamflow benefits. In severe droughts, some instream benefits will accrue due to transportation of contracted water supply releases from Marion and Council Grove reservoirs to Iola and Emporia. Details of these minimum streamflow recommendations are in Minimum Desirable Streamflow Technical Report No. 2.

LITTLE ARKANSAS RIVER

The Little Arkansas River is an unregulated (no reservoirs) tributary to the Arkansas River, meeting that river at Wichita (Figure 3). The Little Arkansas River averages 280 cfs annually. Median flow has been 57 cfs. Significant effects on the streamflow are exerted by groundwater withdrawals from the surrounding alluvium and the Equus Beds Aquifer. Groundwater Management District No. 2 currently manages much of the Little Arkansas Basin groundwater and has instituted a "safe yield" policy on the withdrawal of groundwater, recognizing the recharge

Stream	Reason for Placement	Completion
1. Marais des Cygnes River	Senate Concurrent Resolution 1622	1984
2. Neosho and Cottonwood Rivers	Senate Concurrent Resolution 1622	1984
3. Little Arkansas River	Example of unregulated stream for Legislature, instream data were available	1984
4. Verdigris, Fall, and Elk Rivers	Critical flow situations in 1980 and 1983 indicate need for protected WQ releases	1985
5. Ninnescah River	Indications of reduced flow occurrence on increase	1985
6. Rattlesnake Creek	Indications of fish kills and reduced flow occurrence on increase	1985
7. Arkansas River (from Kinsley to Great Bend)	Indications of reduced flow occurrence on increase	1985
8. Kansas River Basin below reservoirs	Need to begin coordinated reservoir management to maintain flow in Kansas, controlling chloride/sodium levels, transit losses and alluvial-stream interactions	1985
9. Walnut River	Pending development of EPA—WQ models. Existing WQ storage in reservoir	1986
10. Chikaskia River	Protection of fisheries and wildlife attributes	1986
11. Medicine Lodge River	Protection of fisheries and wildlife attributes	1986
12. Mill Creek	Protection of fisheries and wildlife attributes	1986
13. Vermillion River	Protection of fisheries and wildlife attributes	1986
14. Republican River from state line to Milford	Somewhat protected by interstate compact	1986
15. Big and Little Blue Rivers state line to Tuttle Creek	Somewhat protected by interstate compact	1986
16. Delaware River to Perry	Instream needs are not immediate	1986
17. North and South Forks of the Solomon, Smoky Hill below Cedar Bluff Reservoir. These streams are already impacted by existing appropriations and are currently being assessed and administered by DWR.		1986
18. Cow Creek, Cimarron River and Crooked Creek, Spring River, Soldier Creek, Stranger Creek, Marmaton River, Little Osage River, Caney River, and other natural-flowing streams may be considered if their instream needs and potential for development are significant. The availability of streamflow may not be as great as those streams considered as top priority. This secondary group of streams should be considered for administration of minimum desirable streamflows as needs dictate.		1986

TABLE 2.—Priority Listing of Stream

characteristics of the regional aquifer. As of yet, the quantified relation between streamflow in the Little Arkansas River and groundwater withdrawals has not been adequately assessed. Such an assessment is necessary and should be undertaken to address the effects of alluvial withdrawals and recharge on streamflows. Until then, the recommended minimum streamflows in Table 1 should be maintained, whenever possible. Minimum streamflows on the Little Arkansas will be assessed at Alta Mills and Valley Center. The minimum streamflows can be met through administration of existing rights and restriction of future diversions and well withdrawals exerting a significant influence on streamflow. Details of the recommendations for minimum desirable streamflows on the Little Arkansas River are contained in Minimum Desirable Streamflow Technical Report No. 3.

Consideration of Additional Streams

By the 1986 Legislative Session, major streams with significant instream needs should receive technical consideration on minimum desirable streamflows. Table 2 lists the significant streams in order of priority for consideration. Figure 4 shows the location of these streams. It is recommended the following streams be considered and submitted to the 1985 Legislature: Verdigris River and tributaries, Ninnescah River, Rattlesnake Creek, Arkansas River from Kinsley to Great Bend, and the Kansas River below the tributary reservoirs. Remaining streams in Table 2 would be considered for the 1986 Legislature.

GLOSSARY

Acre-foot. Volume of water needed to cover one acre with one foot of water. Equivalent to 325,851 gallons.

Aesthetics. Natural characteristics perceived as beautiful.

Alluvial Corridor. Zone of alluvium surrounding a stream where groundwater withdrawals are restricted during critical lowflow situations.

Alluvium. Zone of sediment deposited by flowing water, bordering an active stream channel, and to some degree, hydrologically connected to the streamflow within that channel.

Appropriation Right. Right to divert from a specific water supply a specific quantity of water at a specific rate of diversion to be applied to a specific beneficial use.

Aquifer. Rock or sediment in a formation, group of formations, or part of a formation which is saturated and sufficiently permeable to transmit economic quantities of water to wells and springs.

Baseflow. Sustained streamflow largely derived from groundwater seepage into the stream.

Concentration. Amount of a dissolved or suspended substance, such as sodium or oxygen, contained within a specific volume of water. Usually expressed as "milligrams per liter" (mg/l).

Conservation Storage. Storage of water in a reservoir for later release for useful purposes such as municipal and industrial water supply, water quality or irrigation.

Consumptive Appropriation. Use of water resulting in a large proportion of loss to the atmosphere by evaporation and transpiration by plants. Irrigation is a consumptive use.

Conveyance. Downstream transportation of water within the stream channel.

Cubic foot per second. Rate of discharge of one foot of water in an one foot wide channel moving at one foot per second. Equivalent to 448.8 gallons per minute.

Discharge. The flow of a stream. Usually expressed as "cubic feet per second" (cfs).

Diversion. The taking of water from a stream.

Drought. A period of deficient precipitation and runoff extending over an indefinite number of days.

Gaging Station. A particular site on a stream where systematic observations of stages or discharges are made and recorded.

Habitat. The area in which a biological population normally occurs.

Instream Uses. Uses of water such as water quality, fish maintenance, recreation, or aesthetics within the stream, requiring no diversion.

Junior Rights. Appropriation rights which are filed subsequently to a particular water right or minimum streamflow. Such rights may only appropriate water in excess of the requirements of the particular water right or minimum streamflows.

Median Flow. A discharge which is met or exceeded half of the time.

Minimum Desirable Streamflows. Streamflows that maintain or preserve instream uses of water quality, fish, wildlife, aquatic life, recreation, and aesthetics from unacceptable stream depletions by future consumptive appropriations. Minimum desirable streamflows will not be preferred to vested and senior appropriation rights filed prior to their enactment nor will they be maintained through all drought conditions.

Reach. A lengthwise section of a stream.

Reallocation. The act of designating a new purpose for a portion of reservoir storage previously used for another purpose.

Regulated Stream. A stream where flow is controlled by an upstream reservoir.

Riparian. Pertaining to the area around the banks of a stream.

Runoff. Portion of streamflow derived directly from precipitation. Distinguished from baseflow.

Senior Rights. Appropriation rights which have preference over those water rights subsequently filed or minimum streamflows subsequently adopted.

Spawning flow. Discharge necessary for fish to migrate and deposit eggs in stream.

Streamflow. The discharge occurring in a natural stream channel.

Vested Rights. Right to continue the use of water having actually been used for a beneficial use prior to June 28, 1945.

Water Quality Storage. Portion of reservoir storage federally controlled to maintain adequate downstream water quality through reservoir releases.

Water Supply Storage. Portion of reservoir storage that is sold through contracts for use by municipal, industrial, or irrigation entities.

Watershed. The area contributing runoff to a given point on a stream.

Yield. The amount of water an aquifer will release from storage upon pumping or gravity.

REFERENCES

1. Minimum Desirable Streamflow Background Paper
2. Minimum Desirable Streamflow Technical Report #1—Marais des Cygnes River
3. Minimum Desirable Streamflow Technical Report #2—Neosho and Cottonwood Rivers
4. Minimum Desirable Streamflow Technical Report #3—Little Arkansas River

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