

The Groundwater Management Program

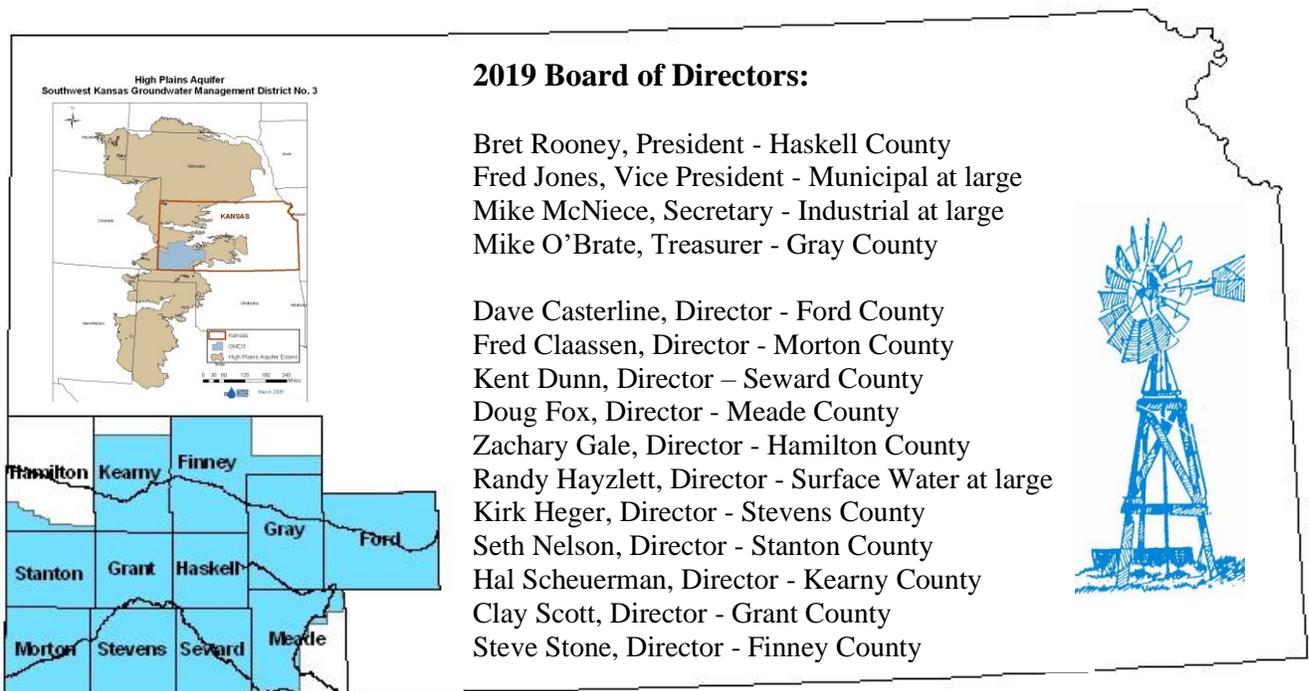
of the
**Southwest Kansas Groundwater Management
District Number 3 (GMD3)**

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URL: [HTTP://www.gmd3.org](http://www.gmd3.org)

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All policy and opinion expressed herein are of GMD3 and not necessarily that of other agencies.
Additional program implementation documents may exist as posted on the GMD3 website.



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Water

EXECUTIVE SUMMARY

GMD3 is a special district that conducts activities in water planning, policy development, water use and supply evaluation, participates in state administration matters affecting groundwater use and economy and represents membership interests in matters concerning groundwater management. GMD3 prepares and adopts the management program for local groundwater resources and makes recommendations to members, state and federal officials, the Governor, Kansas Legislature and to Congress.

PURPOSE FOR LOCAL GROUNDWATER MANAGEMENT - SUMMARY

Southwest Kansas features some of the most fertile agricultural land in the United States, but it typically receives less rainfall than necessary to consistently grow the crops and livestock that sustains the backbone of the economy. Water use fuels this agriculture-based economy. However, overdrafts on storage and insufficient groundwater replenishment have created a depleting groundwater supply condition and a threatened water dependent economy. Future economy and water services depend on the local management program activities implemented as a public interest.

Public Interest. As declared in the Kansas Groundwater Management District (GMD) Act, the Kansas legislature established the right of local water users and land owners to form, fund and operate a local groundwater management agency to address common concerns regarding water use affecting district members rights, health and wellbeing, and for proper management of local groundwater in affairs of local, state, and national government. The will to invest in ourselves is necessary to encourage others to invest in us. A **lead from local need** approach relies on a formal elected board to provides program oversight and management direction in water use affecting natural resources and economy. A GMD in Kansas is a special district independent special-purpose governmental unit that exist separately from other local governments such as county, municipal, township or school district governments, with substantial administrative and fiscal independence to perform a set of governmental functions identified by the Kansas legislature or consistent with the GMD Act.

Regular meetings. In more than 500 monthly meetings, the volunteer elected Board of Directors of the Southwest Kansas Groundwater Management District Number 3 (GMD3) has identified district water supply and policy problems and considered the nature and methods of addressing them with the assistance of members, professional staff, consultants, state officials and other important partners in Kansas groundwater management. Individual well yields, and the number of irrigated fields have declined dramatically in many areas and reduced pumping rates indiscriminately and adversely impact livestock feeding operations, dairies, ethanol plants, and municipal and industrial members, making it more difficult for them to meet demands for water. But there are areas where the groundwater reservoir supply and recharge rates offer hope for sustainable economic activity made possible through enhanced management and value of water.

Management Program. This regional management program document contains a description of the nature and methods undertaken to address water supply problems in the district. It is not written as an action plan but is intended to provide the basis for goals, coordinated action, water planning and addressing water program funding needs. The GMD3 governing body follows a prescribed process to adopt a program update that can be referenced and considered by all administrative, planning, program and project managers having activities affecting district

groundwater. GMD3 regularly adopts resolutions creating Board policy and selects supply and policy problems for resources and funding to address goals and action plans that are SMART FOR GMDs. Policy statements contained herein are GMD3 policies and practices for the management program and are not intended as a description of the policies of other agencies.

GMD3 MISSION, OBJECTIVES & PRINCIPLES - SUMMARY

MISSION: Act on a shared commitment to conserve and develop water supply to grow the social, economic and natural resources well-being for current members and future generations in the public interest.

Kansas water rights. Water is used in the district according to water rights established or perfected under Kansas law as supervised by the state Department of Agriculture's Chief Engineer and Division of Water Resources (DWR) and assisted locally by GMD3 for matters of concern occurring within the district. The management program describes key public interest in ascertaining, among other things, whether a proposed water use (or change in use) may impair other water rights or prejudicially and unreasonably affect the public interest. The GMD Act in K.S.A. 82a-1028(m) provide enumerated authority to GMD3 to "provide advice and assistance in the management of drainage problems, storage, groundwater recharge, surface water management, and all other appropriate matters of concern to the district." GMD3 participation in review of water use proposals is "advice and assistance in the management" of groundwater in "storage" and "all other appropriate matters of concern to the district."

The GMD Act and "the right" to manage groundwater use. It is the opinion of GMD3 that Kansas water policy in the GMD Act (K.S.A. 82a-1020 et. seq.) establishes "the right" to determine the destiny of district groundwater use as a power, privilege, faculty, or demand, inherent in a GMD and incident upon others in support of the public interest. The legislature recently added policy in K.S.A. 82a-1042 regarding the impact of proposed rules and regulations on a local groundwater management program, providing that when state agency rules and regulations are proposed which may change an adopted local groundwater management program or impact groundwater use in a GMD, the state official "*...shall notify ... of such requested management program change or proposed rules and regulations. Upon such notice, the board of directors shall prepare a response ... and ... shall follow the provisions of K.S.A. 82a-1029, and amendments thereto, for revising active groundwater management programs.*"

GMD3 PROGRAM ACTIVITIES - NATURE AND METHODS SUMMARY

Locally prudent groundwater management decision-making and activities are authorized by the Kansas legislature guided by a formal elected board and management program **to lead from the local need** and play an ancillary water administration role. The federal **High Plains Study** is an example of support exploring the feasibility of various management strategy alternatives to assure adequate water supplies. GMD3 will seek appropriate updates evaluating elements forward.

GMD3 Water Rights Administration Summary

GMD3 members use water dedicated by law to the people of the state according to members real property rights under basic water use doctrines. The customary use of these doctrines by members and the state, not their mere codification, determine their meaning in practice. So, the activities of the GMD3 management program identifies key public interest considerations for water rights administration under the Kansas Water Appropriations (KWA) Act and the GMD Act and other law affecting the district portion of Kansas. So, GMD3 activities that "*determine their destiny with respect to water use*" and economy necessarily involves participating in state water right administration affecting the area. The basic legislative goal for water use is found in

the KWA Act in K.S.A. 82a-711(a) “...to the end that the highest public benefit and maximum economical development may result from the use of such water.” Just and proper administration of water rights under the management program requires a **multi-generational set of values** applied to water appropriation doctrine and groundwater management law in the public interest. The review of all applications and projects by GMD3 occurs to evaluate conditions and inform members and management partners of changes in groundwater supply that affect all member appropriators for at least one generation, or 25 years. The GMD3 evaluations increase transparency, inform capitol market participants, identify injury and impact concerns, quantify possible mitigation, and help manage transaction costs and risk associated with changing water use and conservation. **It is the opinion of GMD3** that “*all other matters pertaining to the question*” of public interest under the KWA Act in K.S.A. 82a-711(b)(5) necessarily must include the legislative declaration of public interest in the GMD Act under K.S.A. 82a-1020 and to consider the management program. Additionally, a GMD must review and approve any conservation plan required by the Chief Engineer under the KWA Act per subsection (g) of K.S.A 82a-733. The public interest in the management program and recommendations of the governing body are required considerations in water rights administration under the KWA Act. Today, improved data and evaluation tools inform member interests to provide enhanced water management services for private water infrastructure investment and public partner needs in an ever-changing supply outlook.

GMD3 Water Rights Administration Principles:

- A. Preserve basic water use doctrine and lead from local need
- B. Conserve to preserve supply.
- C. A closed groundwater reservoir dedicates native supply to existing usufruct rights.
- D. Safe drinking water is a priority.
- E. Contributions to future supply have no penalty.
- F. Communicate and exchange information and expert evaluations.
- G. Seek mutual benefits and good will.
- H. Ensure necessary investment stability and intervene when needed.
- I. Promote free enterprise in acquiring use rights to available supply.

GMD3 Guidelines for evaluation of well drawdown estimates. To address the varied and diverse groundwater reservoir conditions across the district, GMD3 will use guidelines for well drawdown estimates to enable members to identify and consider reasonable water table lowering and critical wells with prior rights to the local source of supply, outlined as follows:

- A. **Drawdown Allowance.** Drawdown allowance (DA) is considered a reasonable water level or de minimis effect to allow some redrills and changes among critical wells.
- B. **Critical wells.** Wells in which economic and/or physical constraints are exceeded, indicating threatened water right impairment.
- C. **Economical Drawdown Constraint.** The GMD3 40% in 25 years maximum allowable rate of depletion or the percent of initial water column that can be lost before the well loses economical viability, generally 70%, whichever is more conservative.
- D. **Physical Drawdown Constraint.** Physical hardship is the loss of the required well yield due to excessive water level and well yield decline.
- E. **Domestic wells.** Assumed to have an appropriation right and to need 20 feet above the base of the water column to function.

Additional management program considerations. Board deliberations and recommendations on the management program, statute and rule standards governing groundwater supply include:

- A. **Public and domestic drinking water supplies.**
- B. **Water usability depletion.** A lowering of quality depletes usability.
- C. **Local groundwater supply clock** (depletion rate).
- D. **Maximum allowable rate of groundwater reservoir depletion.**
- E. **Water right priority contribution.** Not calling priority right to share limited supply.
- F. **Use of lesser quality water where economically and technologically feasible.**
- G. **Member property agreements in water use.** Agreements resolve disputes.
- H. **Economy use value.** Some consideration is inevitably applied to use-values that grow the value of the water used and of future supply.
- I. **Alternate supply.** Water imports and lesser quality water source treatment for use.
- J. **Improved groundwater inventory estimates.** Adding data and model estimates.
- K. **Water imports.** Outside capture transported into district supply.
- L. **Flexible use of prior well allocations.** May add use efficiency but subject to adequate evaluation to avoid adding critical well problems (impairment concerns).

GMD3 Water Conservation Summary

Wise use. Conservation is not so much about prohibiting or defeating consumption as using water wisely. GMD3 is a cooperating agency with partners to lead from local need for conservation that includes information, proper resource administration, program development, funding, supporting legislation, and working with members and project beneficiaries for water.

Water Conservation defined: (1.) Use efficiency and (2.) Groundwater reservoir maintenance.

Use efficiency: Use efficiency is the amount of valued output per unit of water diverted.

Maintaining aquifer storage: Defined as less native storage depletion or more future supply for a more sustainable groundwater reservoir infrastructure. In other words, encouraging voluntary choices for demand reduction and groundwater reservoir imports for improved future supply.

Unwise use and waste of water. Demands to discourage unwise use increase with decreasing groundwater storage. Activity that may unreasonably diminish groundwater value and/or be consumed with an efficiency well below what is now considered technologically and economically feasible may receive due consideration as impairment of the GMD3 management program by preventable waste of water.

Conserve-to-preserve factor. Used in evaluating water conservation, the groundwater conservation factor or conserve-to-preserve factor requires a separation of inevitable non-use (insufficient supply) from real groundwater supply maintenance decisions that add future supply.

GE&P Act. GMD3 works with KDHE and other partners in the implementation of the Groundwater Exploration and Protection Act for safe lawful well drilling, data collection and water protection from contamination or water usability depletion.

Drought resiliency. The Management Program provides ongoing drought resiliency strategy.

State mandated water conservation plans. Water conservation under Kansas Water Office water conservation plan guidelines focus on type (1) conservation for use efficiency defined as:

“The utilization of cost-effective water use efficiency practices to curtail the waste of water and to ensure that water use does not exceed reasonable needs.” Hundreds of members have been required to implement conservation plans. GMD3 will emphasize type (2) water conservation.

MYFA conservation considerations. Under the GMD3 management program, a groundwater conservation factor calculation is needed to implement the Multi-Year Flex Account (MYFA) calculation based on previously implemented groundwater conservation activity in the district.

Due consideration for past management or conservation measures. Statewide legislative policy in the KWA Act (K.S.A. 82a-744) requires “due consideration” to implemented

management and conservation measures when the Chief Engineer implements new limits on a member water right after July 1, 2015. The management program interprets this to include a specific set of public interest considerations in the management program.

Rivers flow to groundwater storage. Linking natural and constructed water infrastructure to preserve water supply is an intended activity of the GMD3 water conservation program that exceeds state conservation plan guidance and emphasizes type (2) water conservation activities to maintain working groundwater reservoirs across the district.

Conservation storage in pore space. As waters of the state are declared a public good dedicated to the use of the people of the state subject to appropriation (K.S.A. 82a-702), so too is aquifer pore space a necessary consideration under the public good of the GMD Act for the geological formations having pore space with natural or artificial water storage potential.

Groundwater conservation preparing for major water imports. Available surface water flow in excess of prior rights presents an opportunity to conserve rather than waste transient water by developing water transportation lines and utilizing available groundwater reservoir storage for more sustainable drought resiliency.

Additional wells vs. supplemental wells and “chasing water.” Additional wells may be necessary to allow a partial sale and change of water right use. But additional well activity is distinguishable from adding supplemental wells to restore reservoir extraction rate and capacity in shared declining aquifer supply, which raises concerns for changing purpose and strategy of the management program, causing a disproportionate local rate of groundwater reservoir depletion, anti-Type 2 water conservation activity and a “chasing water” concern to eventual complete depletion of supply to all. A “standby well” is a source security condition under the terms and limits on a lawful primary well should catastrophic failure occur. A standby well meets well spacing from the primary well of other water rights and emergency pumping is limited to 60 days. A primary well is not required to meet well spacing from its standby well.

GMD3 Upper Arkansas River IGUCA. The Upper Arkansas River IGUCA was requested by the GMD3 Board in 1984 as a groundwater management area (GMA) to replace the 1977 moratorium on new appropriations and to extend corrective controls from the Colorado and Kansas Stateline across GMD3 along the river corridor. The GMD3 management program and the IGUCA order are key public interest concerns for regular updates with GMD3 participation.

Corrective controls. Corrective controls are additional new type (2) water conservation commitments that add future groundwater reservoir supply consistent with the management program and state law. Any provisions necessary to effectuate agreed-upon water conservation goals consistent with the public interest of the GMD3 management program.

GMD3 LEMA plans. GMD3 adopted a LEMA plan policy that any proposal should be recommended to the GMD3 Board by members as a priority GMA to be further managed with infrastructure development and/or corrective controls and specific considerations.

Adopting or changing WCA plans and agreements. GMD3 encourages voluntary groundwater reservoir maintaining corrective controls in Water Conservation Area (WCA) consent agreements between members and the Chief Engineer that are consistent with the rules and policies of the GMD3 Board and management program in the public interest.

Multi-well use flexibility in GMD3. New multi-well water use flexibility has been authorized by state policy in the KWA Act. Waivers of rules or local appropriation limits should include enough well evaluation affects for members to ensure future supply improvement to all prior rights and/or appropriate private consent agreements. Legislative policy for WCA’s in K.S.A. 82a-745 further provides the following: *(m) Notwithstanding K.S.A. 82a-1039, and amendments thereto, nothing in this section shall be construed as limiting or affecting any duty or power of a groundwater management district granted to such district by the Kansas groundwater*

management district act. This assures “the right” of GMD3 vested by the legislature to make decisions and recommendations that will determine the destiny of the area. GMD3 well evaluation guidelines are used to limit “paper water” on the poor wells (incapable of providing the water) from moving to better wells (a concept termed “chasing water”) to protect the benefits of Type (2) water conservation activity and limit hardships imposed on others.

GMD3 Ark River Management Summary.

The GMD3 management program includes the Arkansas (Ark) River. Authority for GMD3 Ark River Management Program activities are included in the GMD Act management “right” and in the list of district powers in K.S.A. 82a-1028 in paragraphs (g), (i), (m), (n) and (u).

GMD3 Upper Ark GMA. The portion of the basin above Garden City to the Colorado and Kansas Stateline that includes the IGUCA, ditch service areas and tributary underflow affecting supply is considered the GMD3 Upper Ark Groundwater Management Area (GMA) for purposes of the management program. This includes the paleo river channel fresh groundwater reservoir.

Resource crisis from water usability depletion. Changes in the basin water resource system have created mounting water management and usable supply concerns all along the basin that include very low-quality river water deep percolating into the subsurface, replenishing and contaminating the groundwater reservoirs. The saline mineralizing nature of the water reduces its usability, reducing crop yields and creating a drinking water public health and welfare concern.

Managing pre-compact water rights supply. There are existing vested rights (pre-1945) and pre-compact (pre-1949) water rights in the portion of the Arkansas River IGUCA below Garden City that are authorized over 200 cubic feet per second (CFS), creating a 200 CFS at Garden City and flow at Dodge City administrative threshold practice adopted to preserve supply to pre-compact water rights in the GMD3 Upper and Lower Ark GMA during wet river conditions.

River navigability for title. The obvious effect of “normal high-water mark” consideration on water development from a resource reality that one cannot manage what one cannot define.

GMD3 riparian interest and administrative river boundaries. GMD3 may propose river administration or easement boundaries that are consistent with prior administrative boundary determinations, working with the Secretary of State, Director of Kansas Water Office, the Chief Engineer of the Kansas Department of Agriculture and others in the public interest.

Managing GMD3 upper and lower Ark River GMA’s for conservation storage. Records indicate the GMD3 Ark river system can store about 200,000 acre-feet per month in groundwater reservoir space when river flows occur across the district. The natural recharge opportunities of the Upper Ark IGUCA hold significant promise for imports and enhanced water management.

Additional Program Areas.

The remaining program activities include water-based **Economy Preservation and Development** that recognizes the business of water governance with an understanding of public infrastructure and how it plays a role in development of economy, and the inevitable water costs to Kansas affecting wellbeing; converting undervalued supply to long term economic growth. Without it, annual economic loss could drop gross state product by \$18 million annually, with \$10 million of that coming from the GMD3 area. Also covered in the document are activities for **GMD3 Outreach, Advocacy and Public Education; GMD3 State Water Planning Coordination** to meet the state planning and state project needs of the district; **GMD3 Interstate Water Coordination** to meet the interstate needs of the management program; **GMD3 Models, Investigations and Research; and GMD3 Water Quality Protection** to address the data, water usability protection and remediation needs of southwest Kansas.

GMD3 MANAGEMENT PROGRAM



I. PURPOSE FOR LOCAL GROUNDWATER MANAGEMENT

Southwest Kansas runs on water. Water is a great connector in that everyone uses it and relies on its availability. Water has always been the key resource for the prosperity of all. There are other resources which may mean the difference between wealth and poverty, such as oil or gas or fertile soil, but none is like water as a fundamental necessity for our existence and nearly all other economic development. Our inheritance in both experience and knowledge from the past is far more than we know or realize. Abundant groundwater and energy supply in southwest Kansas historically allowed a significant development of private infrastructure and demand for water. Wise use and local management of groundwater supply requires the will to act on an essential service of leadership to adapt use and secure future water inventory with significant cooperative assistance from many partners in the public interest. Ultimately, all water supply depends on precipitation, transport and storage; managing stored water or parking transient surface water for later use. Overdraft on underground reservoir storage without parking additional supply creates a depleted groundwater source and a threatened economy. The challenges of a declining water table and groundwater contamination in some areas is pushing policymakers to integrate groundwater and surface water strategies in management activities. The extent of future economy and water services depend on the planning, integrity and brave action of members and partners implementing the management program.

The necessity for local groundwater government. Kansas water planning study recognized in 1958 (Cimarron basin study) a need for formal local groundwater management activity to work with the centralized administration of state water resources; a **lead from local need** perspective. Regular local policy review aids in avoiding institutional fragmentation, lack of coordinated decision-making, and encourages good practices of transparency and accountability. State administration of water in Kansas is mainly divided among three state agencies: Division of Water Resources of the Department of Agriculture with responsibilities for water appropriation and water rights; Bureau of Water of the Department of Health and Environment with responsibilities for water quality protection; and Kansas Water Office with duties of water planning and water programs coordination with support from the Kansas Water Authority. It should be noted that a number of other state agencies have a lesser but important role in the state administration of water, including: the Adjutant General's Department; the Kansas Biological Survey; the Kansas Corporation Commission; the Kansas Department of Wildlife, Parks and Tourism; the Kansas Geological Survey; Kansas State University Research and Extension; the State Conservation Commission/Division of Conservation of the Department of Agriculture; and the Secretary of State. Rapid private development and state permitting of groundwater use without locally adopted standards in the 1950s and 60s demonstrated a public interest need in Kansas for formal local groundwater management activity under a program locally adopted, funded and operated in coordination with state duties.

Purposes. There are several purposes for proper water management decisions affecting agriculture and supporting groundwater use. They are for the conservation of groundwater resources; for the prevention of economic deterioration; for associated endeavors within the state

of Kansas through the stabilization of agriculture; and to secure for Kansas the benefit of its fertile soils and favorable location with respect to national and world markets. These purposes identified by the Kansas legislature made it necessary to establish groundwater policy and provide for the formation of GMD's as a necessary and advisable instrument of public interest.

Groundwater management program policy. Policy statements contained herein are an expression of local government and the management program and are not intended as an expression of any state agency policies. The Southwest Kansas Groundwater Management District No. 3 (GMD3) is intended to steer the course of public water management activities to meet the goals of the legislature and demands for water as the key public resource important to all. This management program provides an orientation and basis for the formal and informal policy norms and practices adopted for groundwater management purposes considered to be compatible with basic Kansas laws and policies (See K.S.A. 82a-1020, K.S.A. 82a-1029 and K.S.A.82a-1039). Accordingly, this document is a written report of the characteristics of the district and the nature and methods of activities dealing with groundwater supply problems of the district as provisioned in state law for that purpose. Guidance and implementation documents that target strategic activities with available funding and other resource partners will be publicly considered and posted on the GMD3 website when adopted by the governing body of GMD3.

Regular program review and revision. An up-to-date management program document is required by K.S.A. 82a-1029. If it is proposed that the management program be revised, the board shall complete the management program proposed revision and transmit a copy to the chief engineer with a request for his or her approval. The chief engineer shall examine and study the management program and, if he or she finds that it is compatible with K.S.A. 82a-701 et. seq., and any other state laws or policies, he or she shall approve it and notify the board of his or her action. The Board then follows a notice and hearing process before adopting the document and seeking any needed rule revisions to implement the revised management program.

Resource management. Demand increases to grow use value as water supplies decline. So too, demand grows to take significant steps to add water and drought resiliency into the future of district agricultural production systems. Data indicates a direct correlation between timely rainfall and groundwater pumping, where soil moisture deficits and dry cycles must be balanced with the conservation opportunities associated with wet cycles and surface water availability.

Groundwater governance can be difficult for many reasons that include:

1. Groundwater is a shared resource;
2. Groundwater inflows and outflows are difficult to observe and cannot be measured directly;
3. Surface water and groundwater are interconnected;
4. Groundwater reservoir boundaries and characteristics may be locally unknown or poorly defined;
5. Groundwater management requires specialized model tools;
6. Groundwater conditions can vary on multiple time scales;
7. Groundwater use can pit present needs against future needs; especially in declining groundwater reservoir supplies;
8. Diverse local, state and federal interests, institutions and authorities require significant coordination activity for productive partnerships.

II. GMD3 MISSION, OBJECTIVES & PRINCIPLES



MISSION: Act on a shared commitment to conserve and develop water supply to grow the social, economic and natural resources well-being of current members and future generations in the public interest.

Kansas Water Law. It is important to know some basics of Kansas water law that set the framework for policy and water management decisions. The core of Kansas water law is comprised of several Acts or bodies of law that include the Kansas Water Appropriation (KWA) Act body of water use law, the Groundwater Management District (GMD) Act body of groundwater management law, and the Water Exploration and Protection (WEP) Act body of well construction and groundwater protection law. These Acts and amendments and other policies are intertwined in the history of the development of the state. So, to gain perspective of how to proceed with managing water use going forward, it is advisable to know some history and basics of Kansas water law beyond this management program document. **See: Water Primer, Part 5: Water Law, Kansas State University, January 2013.**

<https://www.bookstore.ksre.ksu.edu/pubs/mf3024.pdf> ; and **Water Law Basics.**

<https://agriculture.ks.gov/divisions-programs/dwr/water-appropriation/water-law-basics>

Kansas water rights. A water right in Kansas water law refers to the right of a person to take water under control from a Kansas public water source for beneficial use, such as from a groundwater reservoir, and to have that right continue unimpaired into the future subject to senior water right demands of prior rights to use available supply. The western US water law doctrine of prior appropriation (or “first in time is first in right”) has been a part of water policy in Kansas since the mid 1800’s (See Appendix for *Kansas Water Law and History Notes*). Uniform prior appropriation policy was not fully adopted for all usable water sources until the Kansas Water Appropriation (KWA) Act of 1945, whereby ownership of the water is dedicated to the people of Kansas as a public good, but the right to use the public water is a private right created under an application and state grant. The grant included water user actions and investment to apply the water to authorized beneficial uses that are certified as a real property right. Water rights may be recorded as developed and established real property rights that are part of a traditional "bundle of legal rights" transferred with land from seller to buyer as an appurtenance to the land, or a water right can be separated from the land and conveyed by evidence of a separate deed or lease. Domestic rights are not required to be recorded with the state. Domestic use has an implied Appropriation Right under the law for domestic use to the extent of actual use, and with all the protections of right under the KWA Act and management program participation assured under the GMD Act.

Impaired water rights. One water user can affect another’s ability to exercise their prior right to enjoy resource benefits in a limited supply setting. This affect is assured in a declining groundwater reservoir where a well can become critically unable to meet investment backed authorized use demands within a reasonable prospective period of time and within reasonable economic limits (critical well). So, a system of concepts and customary practice has evolved and been adopted to implement the KWA Act in southwest Kansas. This includes evaluating the effects of proposed use on other use rights for any new appropriation or change to authorized use, and to resolve complaints as to first right to the available local source of supply. The

principle of prior appropriation is basic Kansas water use doctrine where water rights are each assigned a priority date to establish who has first right to water. The KWA Act is administered by the Kansas Department of Agriculture's Division of Water Resources (DWR), which issues permits to appropriate water, regulates usage, and keeps records of all water rights, which are real property rights in Kansas. Short term permits are also issued by the state. The maintenance of water right and permit records allows Kansas water use to be defined, apportioned legally and managed fairly. In times of plentiful local supply, there may be enough water to satisfy all water rights. However, in times of water scarcity, like in a declining local groundwater reservoir, those who have earlier more senior water rights may be entitled to be satisfied before those who have rights junior to them. Except for domestic use, public water cannot be unlawfully appropriated, or even threatened to be appropriated, without first making application and receiving approval by the state. Local and state agencies can collect and share data on water use and water rights and take steps to fairly and efficiently administer use. Appropriate steps can increase transparency, inform market participants, clarify injury and impacts, quantify mitigation, and reduce transaction costs associated with the exercise of water rights. The job of the state is guided by ascertaining whether a proposed use (or change in use) will prejudicially and unreasonably affect the public interest, which includes consideration of the management program for the aquifer area served by GMD3.

Groundwater depletion. By the late 1960's, the legislature had become concerned with the groundwater "mining" (depletion) conditions of Kansas groundwater reservoirs and passed legislation in 1968 to enable the creation of groundwater management districts. When this legislation produced no GMD's, the legislature enacted the GMD Act of 1972. This Act deemed that in addition to water appropriation for beneficial use as a public good, it is also a public good "...to preserve basic water use doctrine and to establish the right of local water users to determine their destiny with respect to the use of the groundwater..." in providing for the formation and funding of GMD's by the groundwater users and land owners of the area.

The GMD Act and "the right" to manage groundwater use. The GMD Act established the public interest "... need for the creation of special districts for the proper management of the groundwater resources of the state; for the conservation of groundwater resources; for the prevention of economic deterioration; for associated endeavors within the state of Kansas through the stabilization of agriculture; and to secure for Kansas the benefit of its fertile soils and favorable location with respect to national and world markets (K.S.A. 82a-1020)." In that statute, the legislature set two elements of policy in law for groundwater management: "...to preserve basic water use doctrine and to establish the right of local water users to determine their destiny with respect to the use of the groundwater insofar as it does not conflict with the basic laws and policies of the state of Kansas." **It is the opinion of GMD3** that the GMD Act establishes "the right" as a noun. According to Black's Law Dictionary, 6th addition, pg. 1324, "**Right** ... As a noun, and taken in a concrete sense, a power, privilege, faculty, or demand, inherent in one person and incident upon another." Applied to the plain language of the statute, this definition indicates a duly formed GMD3 governing body has the power, privilege, faculty, or demand vested by the legislature to make decisions and provide recommendations and conduct activities and have standing that determines the destiny of the area with respect to the use of the groundwater as a declared matter of public interest, provided it is done in a manner compatible with the other laws and policies of the state.

State duties. The GMD Act does not alter any duty or power of the chief state official (Chief Engineer) responsible for administering Kansas water rights as per the KWA Act (K.S.A.82a-1039) nor does it alter the duties or powers of other state water officials. Nor does it form a basis to prevent anyone from upholding basic Kansas water use doctrine (notwithstanding Gove County District Court Case No. 2018 CV 000010). The GMD Act declares a public interest in local government for groundwater management and also stipulates the process required to form, fund and operate the GMD and groundwater management program with direction for government activities either required or eligible to be undertaken.

Coordination of administrative rules. The Kansas legislature added policy in 2016 to the GMD Act (K.S.A. 82a-1042) to further implement its provisions that when rules and regulations are proposed by the Kansas Secretary of Agriculture or the Chief Engineer that may change an adopted local groundwater management program or impact groundwater use in a GMD, the state official “...shall notify the groundwater management district board of directors of such requested management program change or proposed rules and regulations. Upon such notice, the board of directors shall prepare a response of intended board actions. The board of directors shall follow the provisions of K.S.A. 82a-1029, and amendments thereto, for revising active groundwater management programs.”

Expressed Powers. To conduct the affairs of groundwater management as a public agency, a GMD must have a management program, sources of funding, regular meetings of the elected Board and members, respond to proposed management program changes, and exercise a list of enumerated powers (See K.S.A. 82a-1028) to accomplish the purposes of groundwater management:

1. Construct and operate works for drainage, recharge, storage, distribution or importation of water and all other appropriate facilities of concern to the district;
2. Levy groundwater user charges and land assessments, issue bonds and incur indebtedness;
3. Contract with persons, firms, or agencies of state or federal governments or private entities;
4. Conduct or participate in research and demonstration projects;
5. Sue and be sued;
6. Maintain equip, staff and an office;
7. Extend or reduce district boundaries;
8. Hold and sell certain property and water rights;
9. Require installation and reading of meters or gauges;
10. Provide management assistance of drainage, storage, recharge, surface water and all other appropriate matters of concern to the district;
11. Recommend to state officials’ rules and regulations necessary to implement and enforce Board policies that are not inconsistent with law, which relate to the conservation and management of groundwater within the district;
12. Enforce by suitable action, administrative or otherwise, rules and regulations adopted;
13. Enter upon private property for inspection purposes to determine conformance with policies;
14. Seek and accept grants or other financial assistance from federal, public or private sources;
15. Recommend to the chief engineer the initiation of proceedings to establish special groundwater management areas, including an IGUCA, a LEMA and a WCA.

Other GMD powers may exist as necessarily and fairly implied in the statutory grant, such as the power to manage groundwater, and powers essential to the right and purposes of the GMD Act.

GMD3 membership. A GMD3 member is an eligible voter as described in K.S.A. 82a-1021(a)(5):

"Eligible voter" means a natural person 18 years of age or older, or a public or private corporation, municipality or any other legal or commercial entity that:(A) Is a landowner that owns, of record, any land, or any interest in land, comprising 40 or more contiguous acres located within the boundaries of the district and not within the corporate limits of any municipality; or (B) withdraws or uses groundwater from within the boundaries of the district in an amount of one acre-foot or more per year.

An acre-foot of water is equal to 325,851 gallons, so nearly all domestic well users in the district divert or use at least that amount of groundwater in a year and can be considered eligible voters and members of the district.

Objectives of the legislature for GMDs (GMD Act):

1. Proper management of the groundwater resources of the state;
2. Conservation of groundwater resources;
3. Prevention of economic deterioration;
4. Associated endeavors within the state of Kansas through the stabilization of agriculture;
5. To secure for Kansas the benefit of its fertile soils and favorable location with respect to national and world markets

Purposes for which GMD3 was organized in 1976:

1. To organize and develop the efforts of the entire Groundwater Management District for the proper management and conservation of its groundwater resources;
2. Provide local input into the use and management of groundwater;
3. Provide for the greatest total social and economic benefits from the development, use and management of groundwater;
4. Support research and education concerning proper water management;
5. Work cooperatively with all federal, state, and local units of government to accomplish the objectives of the district and the GMD Act and amendments thereto.

GMD3 Management Program Guiding Principles:

1. **Represent** all district members (eligible voters) for water management purposes;
2. **Grow trust** and community involvement in water conservation to meet supply needs;
3. **Seek adequate funding** to protect and enhance access to safe and usable water;
4. **Pursue the highest value** for the groundwater consumed using a portfolio of approaches;
5. **Develop accurate data** and information to support prudent water management decisions;
6. **Target management** program activity with performance metrics to meet water management needs for today and in the future;
7. **Justly advise stakeholders** in the use protection of water quantity and quality and the administration of water rights as real property rights owned by eligible voters of the district.
8. **Intervene** with purposeful public policy and actions for steering the course of use to improve management program implementation and effect.

III. ORGANIZATIONAL HISTORY OF THE DISTRICT



Lead from local need. In the 1960's, good, creative, local problem-solving folks saw that unregulated groundwater use was hastening the decline of local groundwater supplies. As stated earlier, mandatory permitting for all non-domestic uses was not yet provisioned in Kansas law until 1978. These local leaders insisted on the adoption of mandatory standards for groundwater water rights, use limits, minimum well spacing and special management area authority in their interest for protecting the health and welfare of Kansans. Good state and local action followed.

Steering committee. After local advocacy and the passage of the GMD Act, a series of informational meetings were sponsored by the Southwest Kansas Irrigation Association in the fall of 1973 to determine the will of the people relative to the formation of a local groundwater management district, also commonly referred to as a GMD. As a result of these meetings a steering committee was formed to carry out the organization of the GMD according to procedures provided in the GMD Act. On December 4, 1974, the steering committee filed a declaration of intent, along with a map of the proposed district to the secretary of state, who accepted it and passed it to the Chief Engineer for certain technical determinations. On August 25, 1975, the Chief Engineer issued a report that certified the description of the lands proposed to be included in the third such special district of the State with the official name *Southwest Kansas Groundwater Management District Number three* and found that the public interest would be served by the creation of the proposed district.

Petition. The steering committee circulated a petition which was submitted to the Secretary of State for approval. The petition was approved on October 13, 1975 and was followed by an election that was held on February 24, 1976. The election resulted in 1,155 voters in favor and 230 opposed. The Secretary of State was compelled by the election results to issue a Certificate of Incorporation on March 23, 1976. The Certificate of Incorporation has been filed at each county's Register of Deeds Office that is located within the district. An organizational meeting to elect the initial Board of Directors was held in Garden City, Kansas on April 6, 1976. The second Annual Meeting was held March 23, 1977 and now all annual meetings are held on the second Wednesday of March unless appropriately changed with notice.

Governing body. GMD3 is governed by a 15-member volunteer Board of Directors that is elected by a general constituency of the qualified voters present at an annual meeting. Each county is represented on the Board by one director who must reside in that county. Accordingly, any type of "water user", as defined in K.S.A. 82a-1021(k), may be elected to serve as one of the 12 county positions. In addition, there are also 3 "at-large" Board positions that are designated to represent that single type of water usage. These "at-large" water use types include Municipal, Surface water, and Industrial use. All qualified voters present at an annual meeting may vote on each position up for election.

District financing. GMD3 activity is financed by an annual land assessment and groundwater user fee that is levied against the landowners and water users in the district. This is accomplished through an annual budgeting process that includes a review of the GMD3 financial status, management program and draft budget for the ensuing year at the annual meeting. A public

hearing of the proposed budget and level of assessments to finance the budget is also conducted annually with notice (usually in July). For 2017 through 2019, the land assessment has been \$0.05 per acre and the water user fee has been \$0.14 per acre foot and may change without updates to this management program document. Currently, a user fee of \$0.02 generates about \$70,000 to the GMD3 general fund. The maximum land assessment allowed under the GMD Act is \$0.05 per acre and the maximum user fee per acre foot is \$2.00. If needed, debt funding of bonds for infrastructure improvements is also authorized for GMD3. Groundwater User fees are generally certified to the tract of land containing the well.

Eligible land for GMD3 land assessment and water appropriations for the water user fee

<u>County</u>	<u>Total Assessable Acres</u>	<u>Assessed Acres</u>	<u>Excluded Acres</u>	<u>Wells</u>	<u>Authorized Appropriation in Acre Feet</u>
Finney	625,637.27	624,438.81	1,198.46	1,085	581,233.00
Ford	662,719.10	662,006.70	712.40	660	200,531.00
Grant	357,715.95	357,570.35	145.60	642	328,266.00
Gray	536,554.15	536,063.78	490.37	1,303	420,880.00
Hamilton	71,209.95	71,209.95	0.00	73	40,871.00
Haskell	359,790.37	359,696.36	94.01	907	461,581.00
Kearny	449,230.77	448,767.60	463.17	494	233,298.00
Meade	399,646.59	399,449.21	197.38	553	278,636.00
Morton	481,659.65	481,414.11	245.54	307	129,058.00
Seward	381,891.63	381,566.10	325.53	501	281,904.00
Stanton	439,975.96	439,848.76	127.20	625	333,354.00
Stevens	467,219.07	467,018.89	200.18	705	383,949.00
<u>GMD3 totals</u>	<u>5,233,250.46</u>	<u>5,229,050.62</u>	<u>4,199.84</u>	<u>7,855</u>	<u>3,673,561.00</u>

**All information from GMD3 2018 Assessment Information. Wells are those with permanent non-domestic water rights. Other uses of water may be assessed subject to board resolution. Numbers are subject to change. Completed 9-4-2018 **

Federal agency members and their user fee assessments. Under the definitions of the GMD Act, federal offices who meet the definitions of water user and/or landowner in the district may be considered persons subject to the district funding structure of the Kansas GMD Act. A problem occurs in the prescribed manor in which GMD funding is collected to operate a management program in that the GMD water user fee and land assessment is certified to each county clerk and placed on the county parcel assessments along with “other taxes.” Federal entities are not generally subject to paying taxes, much like where states and their political subdivisions are not generally subject to federal tax. Alternative methods of collecting water user and other fees from federal members to secure their participation in local decisions affecting the management program may require further consideration in fairness to all members.

Charitable contributions to support the work of the GMD3 are tax-deductible under section 170(c)(1) of the Internal Revenue Code if made for a public purpose. Partnerships with foundations and other private groundwater management interests are management considerations of the governing body of the district.

Home office. The GMD3 office is in Garden City, Kansas. The Board conducts regular monthly business meetings on the second Wednesday of each month (unless changed for cause) and an Annual meeting for the election of Board members held on the same day as the regular March Board meeting. Public hearings are regularly conducted by the Board or conducted by others on district matters where GMD3 is a participant, to allow input on the budget, management program activities, and other pertinent public interest activities for the district. A detailed set of bylaws has been adopted that are revised by the Board as necessary.

GMD3 working committees and advisory groups. Each year GMD3 Board members are appointed by the Board president to serve on at least one sub-committee of the governing body. Each Board committee addresses issues on an as-needed basis. The Board committees include:

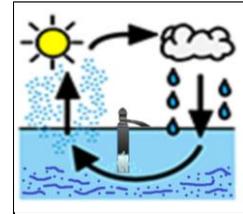
Executive;	Research and Development;
Policy and Legal;	Renewable Supplies; and
Finance;	Annual Meeting/Nominations.

In addition to formal Board committees, there are special project committees appointed or required by contract or other management activity. For example, the Western Water Conservation Projects Fund Advisory Committee. See: <http://www.gmd3.org/about/special-meetings-and-committees/>

GMD3 also works with numerous other public and private member advisory groups on water management concerns. Such advisory groups contribute to and affect the implementation of the GMD3 management program and the governing body of GMD3. Example groups include:

- The Associated Ditches of Kansas;
- 12 County Commissions and staff for county areas in the district;
- 12 County Conservation District (CCD) Boards for CCD areas within GMD3 (See Conservation Districts Directory at: <http://agriculture.ks.gov/docs/default-source/doc--directories/cd-directory-for-web-2013FB46A7A690AA.pdf?sfvrsn=46>);
- Drainage, Watershed and Water Supply District Boards having areas within GMD3;
- All classes of cities, towns and communities in the district as eligible voting members;
- Upper Arkansas Regional Advisory Committee (RAC) to the Kansas Water Office and Water Authority (KWO-KWA) (see: <https://kwo.ks.gov/about-the-kwo/regional-advisory-committees/upper-arkansas-regional-advisory-committee>);
- Cimarron Regional Advisory Committee (RAC) to KWO-KWA (see: <https://kwo.ks.gov/about-the-kwo/regional-advisory-committees/cimarron-regional-advisory-committee>);
- Southwest Kansas Local Environmental Planning Group (see: <http://www.lepg.net/index.html>);
- Southwest Kansas Irrigation Association;
- Kearny-Finney LEMA steering committee initiative (See <https://kfl2017.weebly.com/>);
- State and Federal agencies with land or water rights in the district; and
- Numerous other agricultural, business, commodity, service, finance, policy, trade and natural resource organization partners.

IV. CHARACTERISTICS OF THE DISTRICT



General Characteristics. The district area includes approximately 5,338,334 acres, or approximately 8,341 square miles of land. This includes all of Morton, Stevens, Seward, Stanton, Grant, Haskell, Gray, and Ford Counties as well as parts of Meade, Finney, Kearny, and Hamilton Counties in the southwest part of Kansas and the west central part of the Great Plains region of the United State. Land surface elevations range from approximately 3500 feet above sea level (ASL) in the west to less than 2300 feet ASL in the eastern side of the district. The land surface slopes in an east-southeast direction at a gradient ranging from 5 to 20 feet per mile. The district is closed to most new appropriations from the Ogallala/High Plains (OHP) Aquifer. Projects must change existing rights to meet new use needs.

Number of counties served by GMD3	12
Number of non-domestic water rights	12,500
Average annual use authorized	3.6 million acre-feet
Average annual use	2 million acre-feet
Average annual reduction in storage	776,000 acre-feet
Average annual recharge from precipitation	210,000 acre-feet
Estimated annual Domestic use	125,115 acre-feet (15 AF/section)
Estimated max. allowed annual use to avoid 40% depletion in 25 Years (40/25 rule)	1,732,832 acre-feet
Average net annual lateral groundwater reservoir inflow/outflow	6,000 acre-feet gain
Average annual return flow recharge (13%)	260,000 acre-feet returned
Irrigation-enhanced precipitation recharge, dewatered unit drainage, inflows from Dakota system, streamflow capture.	621,625 acre-feet gained or returned to the High Plains Groundwater reservoir

See *KGS Water Level Change image* and *Isolating High Plains Aquifer Change* in Appendix. Values are GMD3 gross estimates from KGS models. Model updates will improve estimates and will be added as they become available. Local data will vary significantly.

Source Water. The most common source of water for thousands of district wells is the Ogallala/ High Plains (OHP) Aquifer, or groundwater reservoir. The water comes from drainage of pores in the sediments at or below the water table. The OHP sediments are primarily comprised of the unconsolidated, unconfined Ogallala Formation, older less permeable finer grained Oligocene deposits and unconfined sub-cropping Dakota Groundwater reservoir System formations that receive very little recharge. In comparison, less than 100 non-domestic wells are authorized to tap into the confined bedrock Dakota Groundwater reservoir System of Dakota sandstone, Kiowa shall and Cheyenne sandstone sediment formations, which is commonly referred to together as the “Dakota groundwater reservoir.” The characteristics of these groundwater reservoirs can vary dramatically at points throughout the District and recharge areas are located at the sub-crop region where the Dakota Groundwater reservoir system is hydrologically connected to and under (or considered a part of) the High Plains Groundwater reservoir across the central part of the district. Also, direct recharge source areas occur generally west of the district at higher elevations in

southeast Colorado. Additional development in these areas of Colorado will likely reduce Dakota Groundwater reservoir supply to the District over time.

Water quality. The quality (or usability) of the groundwater in the High Plains and Dakota Groundwater reservoirs is generally fresh. In some locations, the salinity and/or radio-nuclei levels exceed recommended limits or maximum contaminant levels (MCLs) for drinking water established by the US Environmental Protection Agency (EPA). Poor quality sources threaten further usability depletion of existing stored fresh water supplies. River flows are declining in both quality and quantity, and declining groundwater reservoir storage tend to also decline in quality as well.

Groundwater reservoir thickness. The remaining saturated thickness of the principle groundwater reservoir, the Ogallala/High Plains Aquifer system, ranges from 20 feet to 600 feet within the district, with significant variability in the productive portions. Thus, well capacities range from a few gallons per minute (gpm) to 3,000 gpm. Historic depletion of saturated thickness locally also varies spatially across the district as documented in the Kansas Geological Survey (KGS) High Plains Aquifer Atlas. A 2010 model of the GMD3 area indicates that groundwater pumping caused a nearly 30% decrease in groundwater reservoir storage from pre-development to 2007, for an average water level decline of roughly 70 feet, which equates to roughly 10 feet of actual water removed from the pore spaces of the productive portions of the area groundwater reservoir. The resulting groundwater level declines have ended the groundwater storage discharging to streams, resulting in low to no stream flows (2014 draft Kansas Water Plan) and conservation of remaining groundwater reservoir storage and streamflow sources of supply. The dewatered groundwater reservoir space provides available storage capacity for about 63 million acre-feet (KGS model for GMD3). The 2010 GMD3 model is due for updates in 2020.

River and stream groundwater resources. The Arkansas (Ark) River flows from Colorado, across Hamilton County and into the district. It is the only river or stream with constant flow into the GMD3 area. The Ark River is highly regulated upstream of the district and deliveries of flow today rarely reach the lower portion of the basin in GMD3 (also known as the GMD3 lower Ark GMA). For all intermittent river and stream segments in the GMD3 area, flows occur as **pulse distribution** or runoff flows that interact with their respective alluvial groundwater reservoirs and the Ogallala/High Plains Groundwater reservoir to provide conservation storage as groundwater recharge to the underlying groundwater reservoirs. This means that a significant portion of any flow is lost as flow and gained as conservation storage to alluvial groundwater reservoirs and the OHP Groundwater reservoir through gravity induced deep percolation and providing a critical historical source water supply to groundwater rights in the district. Protecting pulse distribution of recharge benefits is part of the management program.

The Ark River basin. Headwaters of the Ark River are located in the Rocky Mountains above Leadville, Colorado. Fed by mountain tributaries on both the east and west slopes, the River supports reservoir storage, front range municipal demands and agriculture in Eastern Colorado before flowing into Kansas and the GMD3 area. Significant changes in the basin water resource system upstream have created mounting management and supply concerns all along the basin that include very low-quality river water deep percolating into the subsurface, replenishing and contaminating the groundwater. The increasing contaminated nature of the water delivered to Kansas has reduced its usability over time, reducing crop yields and creating a drinking water crisis of public health and safety.

Ark River interstate litigation history. Kansas has contended that agricultural development demands for irrigation and other use development upstream in Eastern Colorado have depleted water coming into Kansas to the extent that irreparable injury has been done, particularly to the agricultural interests in the western part of the state. The State of Kansas and Kansas ditch companies (holders of senior surface water rights) above Garden City brought suit against the State of Colorado that ended up before the United States Supreme Court several times. In the first half of the last century, two actions brought before the United States Supreme Court were resolved in Colorado's favor. The two states formed the Arkansas River Compact in 1948 in an effort to resolve ongoing disputes over water, particularly after the federal construction of the John Martin Reservoir in Colorado in 1946. A key purpose of the Arkansas River Compact was to resolve water disputes between Kansas and Colorado and divide the waters of the Arkansas River basin. The minimum standard concept of agreement is to preserve status quo delivery to Kansas in "usable Stateline flows" as of 1948. Pueblo and Trinidad Reservoirs were built after the compact agreement. As a result of a 1985 Kansas complaint accepted by the Supreme Court and two decades later, Colorado was found to have violated the compact by unlawfully withholding over 400,000 acre-feet (325,851 gal. per acre-foot) of water due to well development and unreplaced pumping in the basin after 1948. Settlement and damage awards of over \$34 million occurred in 2006. Nothing concerning the administration of the compact or settlement agreements have addressed water quality to date. Colorado contends the compact is a water quantity agreement only. Local Kansans disagree.

GMD3 Ark River. There are six surface water irrigation ditch systems today that have historically diverted water from the Arkansas River between the Colorado-Kansas Stateline and Garden City. Collectively, these irrigation ditch companies owned by farmer-shareholders control approximately 140,000 acre-feet of senior surface water rights from available Arkansas River flows governed by a federal court decree, vested rights and an interstate river basin compact. Surface water rights historically developed below Garden City have lost historical supply flows and now rarely receive any river flow for use. Lands below Garden City historically irrigated from surface water years ago now rely on groundwater sources or may not receive any water except for the rare large river pulse event. The GMD3 management program has adopted historical practices for management of flows at the Garden City river gage and management program activities for both above and below the gage as the GMD3 Upper and Lower Ark GMA's respectively. Additional geohydrology information can be found at:

<http://www.kgs.ku.edu/Hydro/UARC/index.html>

Interstate compacts. Both the Arkansas River and the Cimarron River sub-basin water systems (including Crooked Creek) are associated with interstate compact agreements that are both state and federal law. Each establishes an interstate administrative body with water management purposes consistent with the authorities established by each compact agreement. See compacts map in Appendix.

Colorado and Kansas Arkansas River Compact. The 1948 Colorado and Kansas Arkansas River Compact relates to the waters of the Arkansas River drainage basin primarily above Dodge City to apportion the benefits of John Martin Reservoir and to protect the usability of the basin Stateline flows available at the time of the compact. The compact is administered by an interstate administrative agency called the Colorado-Kansas Arkansas River Compact Administration (ARCA). Their website can be found at:

<http://www.co-ks-arkansasrivercompactadmin.org/resources.html>

Kansas and Oklahoma Arkansas River Compact. The 1966 Kansas and Oklahoma Arkansas River Compact limits new conservation storage capacity or water transfer amounts for each state in six major topographic sub-basins tributary to the Arkansas River basin from Wichita, Kansas to the confluence with the Arkansas River Mainstem in Oklahoma that together span the entire southern border of Kansas. The Cimarron River sub-basin, that includes Crooked Creek drainage, directly relates to the district as an upstream area. The compact also pledges cooperation between the states in man-made pollution abatements. The Kansas – Oklahoma Arkansas River Commission is the interstate administrative agency that operates this compact, and more information can be found online at: <https://agriculture.ks.gov/divisions-programs/dwr/interstate-rivers-and-compacts/kansas-oklahoma-arkansas-river-compact>.

Cimarron River Basin. Natural pulse flows from precipitation runoff events are identified historically in the hydrologic record and literature. These pulse flows should be protected and managed under the management program to assure continued groundwater recharge as an important renewable supply to GMD3 member water rights. The exception is about a 20-mile reach of the Cimarron River below Highway 54 east of Liberal, Kansas, where the river normally has base flow primarily from upper Permian natural salt springs as flow leaves the district and the state after crossing southeast Seward and Meade counties. Cimarron River flows entering Kansas in Morton County and exiting Kansas from Meade County have decreased in quantity and quality over time. Cimarron River water entering Kansas has high sulfate concentration, whereas Cimarron River flow in southern Meade County has high chloride concentration. River salinity in Morton County has increased and in Meade County has increased substantially over time. Decreased flow of the river entering Morton County is likely mainly due to irrigation use in Colorado, Oklahoma and New Mexico, although phreatophyte water consumption could contribute. Decreased flow and increased salinity of the river in Meade County is mainly from declining discharge of fresh ground water from the High Plains groundwater reservoir that dilutes discharge of natural saline water from Permian bedrock, with some impact from phreatophyte water consumption. More geohydrology information on the Cimarron basin can be found at: http://www.kgs.ku.edu/Hydro/Publications/2005/OFR05_26/OFR2005_26.pdf And http://www.kgs.ku.edu/Hydro/Publications/2005/OFR05_27/index.html

Pawnee River Basin. Portions of the headwaters of tributaries to the Pawnee River system are in eastern Finney, northeastern Gray, and northern Ford Counties of GMD3. Some spring discharge from the base of thin Ogallala deposits and precipitation runoff events provide public recreation and other services at Horse Thief Reservoir on Buckner Creek in Hodgeman County and other surface structures in the basin. A portion of Hodgeman County was originally included in the district. Controversy over water flowmeters mandated by the governing body of GMD3 drove an organized objection and request in that area to leave the district. The GMD3 Board agreed to an exclusion petition that resulted in the loss of district services in Hodgeman County. The alluvial groundwater reservoirs of these headwaters contain some water supply locally. However, projected yields are too small to be a significant water source to meet district demands for water.

Water use and available supply decline. The GMD3 area is generally blessed with available groundwater and has some of the highest-intensity groundwater use areas in the country. Total annual use in GMD3 nears half of all annual consumptive use in Kansas. This use, when combined with low groundwater recharge from rainfall and low inflow from outside the district, has created large declines in water storage that will not recover and will not sustain present use levels without new sources for groundwater reservoir replenishment yet to be developed. There is no magic or mysterious water source The resulting programs for the Ogallala/High Plains

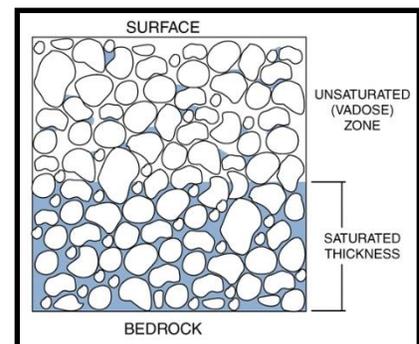
Groundwater reservoir water supply has historically been one of controlled decline and distributed demand to manage shared groundwater access and shared depletion effects within reasonable limits to implement the legislative purpose for water resource development found in K.S.A. 82a-711(a) “...to the end that the highest public benefit and maximum economical development may result from the use of such water “ and providing economic growth in each county in each county for a reasonable amount of time into the future. Though declining, the Ogallala/High Plains Groundwater reservoir remains the most productive water resource for the people within the district and for Kansas. Technology improvements for use efficiency help improve the value of supply to maintain economy with less water use.

Domestic water supply. As described earlier in *Kansas Water Rights*, ownership of the water is dedicated as a public good, but the right to use the public water is a private right created under an application and state grant. Domestic water rights are the exception in the KWA Act where domestic use is not required to have prior application and approval by the state. A domestic water right becomes a lawful appropriation of water by actual use for domestic purposes. An application to appropriate water for domestic use can be made in a manner like other appropriations, or an unquantified domestic water right can simply exist upon first use made of water. Domestic water supply is only partially managed in the GMD3 as most domestic uses are not quantified or reported in the district. Domestic use is generally estimated in the management program as 15 acre-feet annually per section of land.

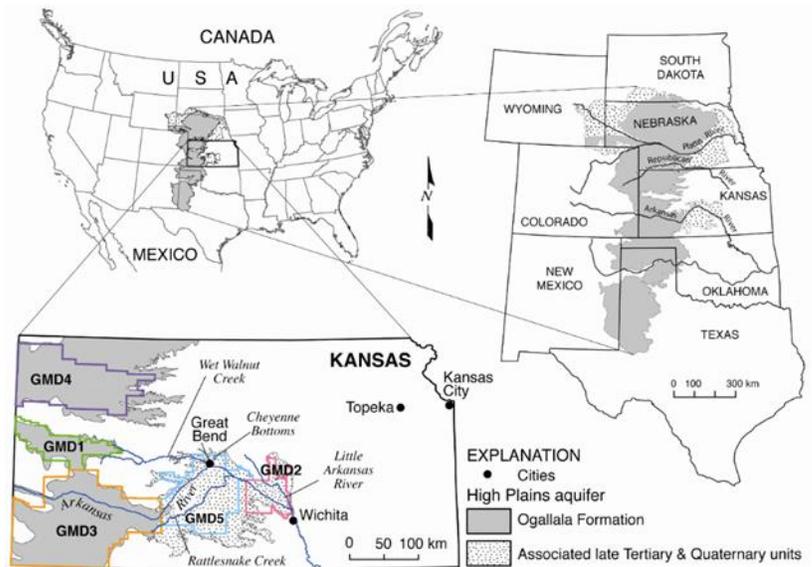
Public water supply. In Kansas, a public water supply system is defined in law by K.S.A. 65-162a and by regulation in K.A.R. 28-15a-2 as a “*system for delivery to the public of piped water for human consumption that has at least 10 service connections or regularly serves at least 25 individuals daily at least 60 days out of the year.*” These systems are regulated by the state to assure the citizenry safe and pathogen-free drinking water and are comprised of water intakes, wells, and water treatment facilities. The Kansas Department of Health and Environment (KDHE) oversees 68 public water systems in GMD3 that include municipalities, rural water districts, and privately-owned public water supply systems. If drinking water is supplied by a private water company, the Kansas Corporation Commission supervises the rates charged. There are 242 active and emergency public supply wells within the boundaries of GMD3. These systems serve anywhere from a small community of 10 or more homes to the largest cities of Garden City, Dodge City and Liberal. Groundwater sources supply all drinking water in the district.

Ogallala/High Plains Aquifer Characteristics.

Some hydrological question persists as to where the bottom of the Ogallala/High Plains (OHP) Aquifer is under the adopted administrative definition that includes all formations in hydrological contact. Generally, the OHP Aquifer is a series of groundwater reservoirs consisting mainly of a heterogeneous assortment of sand, gravel, silt, and clay of Tertiary and Quaternary age that were deposited by sluggish streams that flowed eastward from the Rocky Mountains. The groundwater reservoir sediments overlie an eroded bedrock surface of Permian and Cretaceous age. The Tertiary Ogallala Formation makes up the main part of the OHP groundwater reservoir. The Ogallala Formation is a coarse-grained unit that is highly productive from water-saturated intervals. The oldest part of the Miocene Ogallala Formation in Kansas is ~ 12 million years old.



The older Oligocene deposits (a.k.a. White River Group/High Plains Aquifer, 26 million years or older) are finer grained than the Ogallala, not nearly as productive for water and roughly coincide with the area of the thickest Tertiary deposits in SW Kansas. They also coincide with the area of the greatest water-level declines (from KGS). Because of the similarity in composition, the older Tertiary sediments are difficult to distinguish from the younger Quaternary sediments. Many recent maps can be found in the Kansas Geological Survey High Plains Aquifer Atlas, at: http://www.kgs.ku.edu/HighPlains/HPA_Atlas/



Groundwater reservoir variability. The OHP groundwater reservoir in the district varies widely in type of material, thickness, and layer continuity. Individual beds generally are not continuous and within short distances may grade laterally or vertically into material of different composition. Hydraulic conductivity and specific yield depend on sediment types and therefore also vary widely both vertically and laterally. Some layers are cemented and are referred to as mortar beds and caliche. Although the groundwater reservoir is generally unconfined, confined and semi-confined conditions may occur locally. Thick shale layers are present in areas of the OHP Groundwater reservoir where significant saturated formation thickness may only provide small amounts of water to wells and the density of wells is very low like in parts of Seward and Meade counties.

Groundwater reservoir thickness. The thickness of the unconsolidated sediments of the OHP groundwater reservoir varies greatly due mostly to the uneven bedrock surface. An estimated 63 million acre-feet of groundwater reservoir pore space has been drained of water since pre-development. Remaining saturated thickness ranges from zero to more than 500 feet as illustrated in the Kansas High Plains Aquifer Atlas (Kansas Geological Survey 2016). The areas of greatest thickness are found in the southern portions of Stevens, Seward, and Meade Counties. From the adopted definition of the OHP Aquifer, any hydrologically connected bedrock formations are considered part of the OHP reservoir, so more index well study can help answer where the bottom of the OHP Aquifer system is and how deep members should be allowed to go in relocating wells.

Groundwater rate of travel. Regional lateral flow of groundwater is generally from west to east-southeast across the district at an average rate of about 1 foot per day or less under the normal regional tilt in the static water table. Locally, a higher rate of groundwater flow can be estimated where there is a greater slope in the water table, especially during local well pumping drawdown. Groundwater travel rates can be significantly affected where water level gradient is increased near a pumping well and flow can exceed 300 feet per day (KGS). Depth to static water elevation from the land surface is highly variable and can exceed 400 feet in the district.

Rivers flow to groundwater storage. All surface water flowing into or across the district is targeted and destined to become one of three uses: direct beneficial use; evaporative loss; or groundwater reservoir storage in the pore spaces of the soils and geological formations of the GMD3 area. In some parts of the district, such as the Arkansas and Cimarron River corridors, the OHP groundwater reservoir is hydraulically connected to overlying river alluvium (river sands and sediment) and the water table is below the surface or bed of the river, causing a downward gravity flow from surface water to groundwater. For water quality purposes, Kansas Administrative Regulations (K.A.R.) broadly define groundwater as “water located under the surface of the land that is or can be the source of supply for wells, springs, or seeps, or that is held in groundwater reservoirs or the soil profile” (K.A.R. 28-16-28b(dd)). For water quantity purposes, Kansas regulations simply say “groundwater” means “water below the surface of the earth” (K.A.R. 5-1-1(ii)). Given that no water is truly static and can move both directions above and below the surface of the earth, it is useful in water rights administration to consider residency time as a measure of what may be considered a groundwater vs. surface water source of supply and whether that residency is induced by diversion activity. For example, groundwater discharged to a riverbed may, at that point, become surface water. Water in a sand pit exposed to surface evaporation is considered an excavated well of groundwater. How long must surface water travel through or reside in the ground before it is considered groundwater and vice versa? The answer may depend on the practical effect on the supply systems of the management program and the needs of water rights administration. Surface water may be groundwater on its way to storage below the surface of the earth as a matter of management program expectation, modeling and reliable system function.

Groundwater reservoir depletion rate. The rate of depletion of district groundwater reservoirs generally decreases with increased precipitation. For the OHP groundwater reservoir, the maximum allowable rate of depletion when new water permits were issued in the district has been a maximum limit potential of 40% in 25 years if all authorized use occurs. Recent figures from the GMD3 groundwater model indicate an overall decline in supply in excess of 30% since pre-development (50 years) conditions. However, that estimate is considered short of actual depletion based on observed well yield declines and an estimate to be improved under the area OHP groundwater reservoir groundwater model update scheduled for 2021.

Bedrock Aquifer Characteristics

Dakota. The Dakota Aquifer system is comprised of sandstones and shale that typically yield much smaller amounts than the yield of wells in the OHP groundwater reservoir. The Dakota groundwater reservoir underlies and is in hydraulic connection with the OHP groundwater reservoir in much of the southern part of GMD3. In western Stanton, western Morton, and southern Hamilton counties, the OHP groundwater reservoir is absent or is very thinly saturated and the Dakota groundwater reservoir (with some Morrison-Dockum strata contributing in Stanton and Morton counties) is the primary shallow groundwater reservoir. Additional Dakota groundwater reservoir information can be found at:

<http://www.kgs.ku.edu/Dakota/vol3/ofr961a/man02.htm>.

In the northern part of the district, low permeability shale and chalk overlie and hydraulically isolate the Dakota groundwater reservoir from the overlying OHP groundwater reservoir. Some wells in northern Finney County may be completed in geologic voids in the Niobrara Chalk formation and are referred to as crack wells that typically produce a good amount of water until

the crack or void is dewatered. For additional geologic information on groundwater formations above the Dakota, see: <http://www.kgs.ku.edu/Dakota/vol3/ofr961a/man03.htm> In the southernmost part of the district, Cretaceous age formations may be absent where Permian bedrock formations directly underlie the Ogallala and associated formations. For groundwater management purposes, OHP Aquifer formations include all hydrologically connected formations where hydrostatic pressures are similar and demonstrate connectivity. For more information and additional study needs, see: http://www.kgs.ku.edu/Publications/Bulletins/IRR8/05_deve.html

Morrison-Dockum. The Morrison-Dockum Formations are a distinctive sequence of Upper Jurassic Morrison and Late Triassic Dockum sedimentary formations that provide some water supply in the district that may be included as part of the OHP groundwater reservoir system where hydrostatically connected in the subsurface. They are generally composed of mudstone, sandstone, siltstone and limestone and is light gray, greenish gray, or red. The lower sandstones of the Morrison are relics of the rivers and floodplains of the Jurassic period.

Permian. The Upper Permian age red beds may contain sandstones with some usable groundwater locally and may also have water quality concerns that require careful water sample evaluation, monitoring and supervision to prevent water usability depletion of fresher groundwater supplies. Further investigation of potential uses of Permian age groundwater reservoir water for irrigation can be expensive, and some geological testing and completion of deep wells for irrigation have occurred as shallower sources become depleted and oil and gas production tests indicate some limited deeper water sources are available. Efforts to evaluate the usability, reliability and feasibility of these potential sources together with newer technologies to treat poor quality water from marginal sources to usable standards are necessary as part of the district development and management of additional supply.

Deep brackish bedrock groundwater reservoirs. KWA Act requires poor quality appropriation first, where feasible. Kansas regulations require the petroleum industry to protect fresh and usable groundwater reservoirs from contamination by confirming minimum depths for surface casing in a petroleum exploration borehole. Concern exists for old wells established early when surface casing depths were short or not fully cemented from top to bottom and may allow usable fresh water from an upper formation to flow uncontrolled to a deeper formation or vice versa. Partnerships with Kansas Corporation Commission and the petroleum industry may help protect groundwater reservoirs that become usable groundwater sources through advancements in technology for water treatment. Kansas law requires the state to put a priority on use of poor quality where feasible ahead of authorizing fresh water sources. The successful implementation of this policy may require adoption of criteria under the management program.

Precipitation recharge. The climate of southwestern Kansas is semiarid, characterized by moderate precipitation, low humidity and high evaporation. Annual precipitation increases to the east across the district and typically ranges from 16 to 24 inches annual average. Most of the precipitation falls generally during the growing season, April through September. Drought conditions can yield as little as 4 inches of annual rainfall in the southwest corner and annual pan evaporation rates are about 68 inches. Potential sources of natural groundwater reservoir recharge include precipitation during wet years, inflows of surface water deep percolating into storage from the Arkansas and Cimarron Rivers, arroyos and irrigation ditch areas, return flow from irrigation use, lateral groundwater flow, and flow from adjacent groundwater reservoirs. The most effective

recharge from rain across the district occurs on clean residue covered soils where ET, runoff and direct evaporation are minimized.

Artificial techniques to enhance the recharge process hold promise for improving water supply for the district. Local natural recharge rates are affected by evaporation, soil properties, land cover, land use and proximity to sources of recharge water. Natural replenishment estimates are low, typically less than one inch of water annually. Generally, one inch of water fills about 6 to 8 inches or more of groundwater reservoir formation to saturation, depending on the size and connectivity of sediment pore spaces. Recharge rates may be higher locally, such as beneath river and ditch corridors, fully irrigated land, and sandy soils. The overall imbalance between water use and enough recharge or alternate supply is projected to cause billions of dollars in future lost economy. Recent estimates from the Kansas Geological Survey indicate about 800,000 acre-feet net loss occurs annually on average beyond what is returned to district groundwater reservoirs.

Managed recharge. Managed groundwater reservoir recharge through natural surface water processes or by artificially enhanced processes to refill groundwater reservoir pore spaces can provide efficient and practical management of water sources in the public interest. Surface water sources known to recharge groundwater reservoir supply should be protected and managed for enhanced or sustained benefits. This activity can maximize storage, improve management of seasonal surplus surface water supplies, reduce evaporative losses and reduce depletion draw down levels resulting from use demands in targeted groundwater reservoir areas. Managed groundwater reservoir recharge projects may include managed natural groundwater reservoir infiltration areas, constructed infiltration basins, infiltration galleries, vadose zone infiltration wells or groundwater reservoir injection wells.

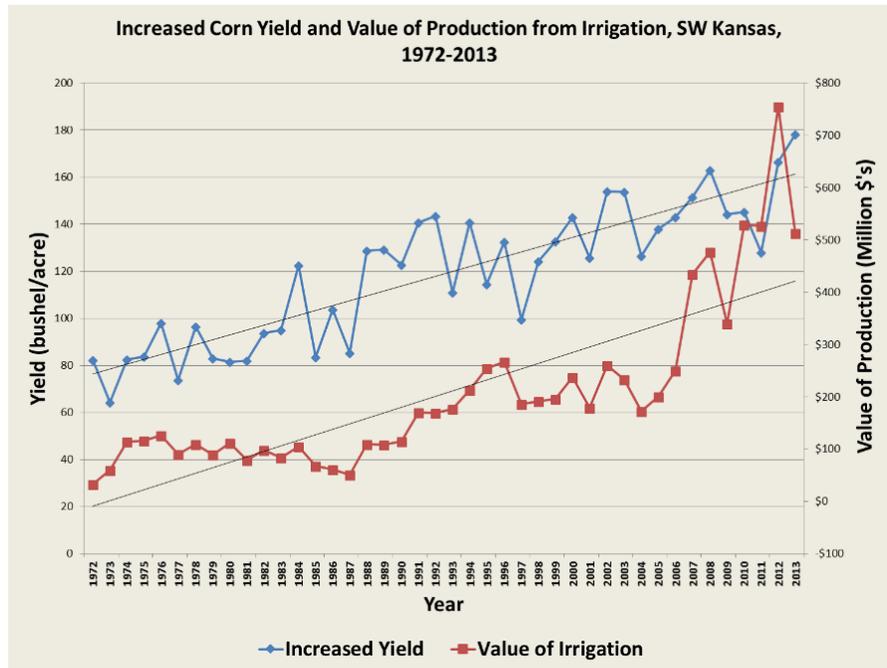
Weather modification. Contemporary sustainable water supply initiatives in water short areas may include water from air (WFA) technologies that tap the water vapor reservoir in the air. The GMD3 management program has historically provided support for a Western Kansas Weather Modification Program (originally “**Muddy Roads**” project) to increase precipitation and reduce damaging hail loss of crops and other property that reduces value from irrigation water use. GMD3 participation in weather modification occurred from 1995 through 2015 in support of counties served by GMD3 who elected to participate. Currently, no counties in Kansas participate in a weather modification program and GMD3 has suspended weather modification program support. Several other regions and water management programs around the country continue to operate weather modification programs and new programs and studies indicating program benefits are ongoing in western states. In recent years, China and the scientific community has invested heavily in weather modification technology under a **Sky River** program. GMD3 will monitor global water vapor management programs and study results for consideration in possible management program implementation activities.

Economy

Water fuels the engine of economy. Improving how water fuels future economy is an interest of the management program. In an area of the country where there is little surface water and high evaporation rate, groundwater management is an activity of water supply and economy. From the Kansas Department of Agriculture (KDA) 2016 annual report, agriculture is the largest industry, employer and economic driver in Kansas, accounting for nearly 43 percent of the state’s economy and valued at more than \$64 billion annually. In 2018, over \$3.8 billion dollars of Kansas’

agricultural goods were shipped around the globe to 74 different countries. More than 229,000 Kansans, or 12 percent of the state’s workforce, are employed in agriculture. At 28.2 million acres, Kansas has the second-most cropland of any state. GMD3 member farmers and ranchers not only manage the soils for sustainable production systems but they also work to improve management and conservation of district water resources.

The corn standard. Corn is the most popular irrigated crop in the district according to annual water use reports collected by the Chief Engineer, Kansas Department of Agriculture. The value of irrigated corn produced in southwest Kansas was \$582.77 million in 2013 and the total economic income generated by that corn was \$842 million. The Net Irrigation Requirement (NIR) for corn ranges from 13.7” in Ford County to



15.4” in Morton County; this is in addition to the average precipitation of 19 inches (K.A.R. 5-5-12, NIR at 50% chance of rainfall; K.A.R. 5-6-12, Average annual precipitation). Corn is the first irrigated crop in the district to be provided a limited irrigation risk management option in the federal crop insurance program of USDA Risk Management Agency. USDA irrigated corn yield average in Kansas 1972-2016 was 165 bushels per acre (average 32 million acres harvested) and non-irrigated average 1972-2016 was 46 bushels per acre (average 557 million acres harvested). If corn acres were all dryland the economic impact from reduced value and surety would be significant. Some years, dryland crops are lost by drought without the safety-net of irrigation.

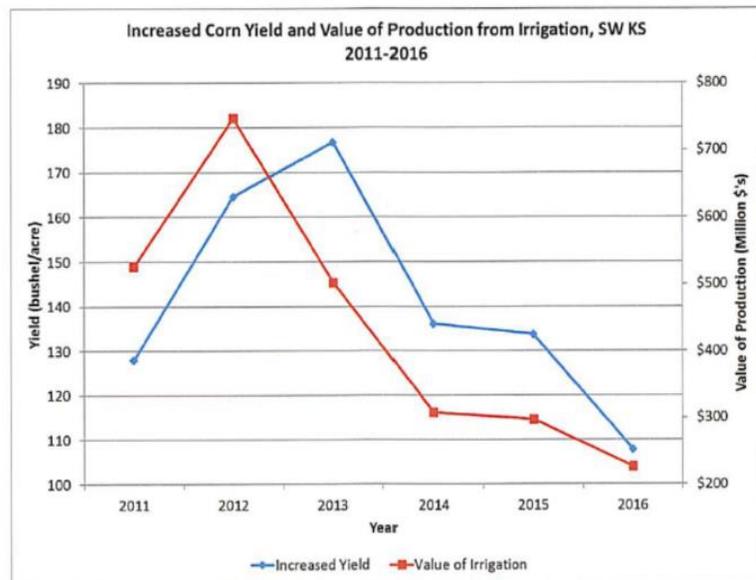
County	No. of Farms	Farm Acres	Crop Acres	Irrigated Acres	Crop Mkt Value (\$1000)	LVSTK Value (\$1000)
Finney	450	790,500	679,472	186,357	181,137	641,954
Ford	505	669,832	529,171	67,068	108,771	406,481
Grant	315	358,649	304,628	82,239	80,280	733,861
Gray	422	556,070	439,359	116,874	119,343	871,310
Hamilton	353	544,086	435,412	20,481	41,273	294,387
Haskell	207	363,751	320,883	116,962	106,168	1,052,929
Kearny	299	516,230	415,995	53,209	76,465	204,513
Meade	407	587,924	331,600	93,775	90,381	143,004
Morton	323	401,305	330,988	31,969	40,054	94,760
Seward	282	360,711	263,690	95,497	80,237	344,461
Stanton	220	435,254	396,108	54,305	72,702	60,791
Stevens	377	455,494	369,963	138,437	109,942	230,624
Total	4,160	6,039,806	4,817,269	1,057,173	1,106,753	5,079,075

From USDA 2017 Farm Facts at:

[https://www.nass.usda.gov/Publications/AgCensus/2017/Full_Report/Volume_1, Chapter_2_County_Level/Kansas/st20_2_0001_0001.pdf](https://www.nass.usda.gov/Publications/AgCensus/2017/Full_Report/Volume_1,_Chapter_2_County_Level/Kansas/st20_2_0001_0001.pdf)

Economy decline from irrigation decline. From a Kansas Department of Agriculture (KDA) presentation to the Governors economic advisory council, Dodge City, 2013 when commodity prices were strong, one less irrigated acre in Southwest Kansas will lead to an estimated loss of value to Kansas of \$2,200 land resale value and 122.5 bu of corn at \$6.78 = \$831 and 2 cattle on feed, approximately equal to 1,060 usable pounds of meat or a 2012 wholesale value of \$3,080 (assumes an average price of \$2.90/lb. of beef). This is a yearly loss of \$3,911 per irrigated acre transitioned completely to dryland. There are about 1,500,000 acres authorized for irrigation in GMD3. In the district, value added from irrigated corn and wheat production is, for SW KS, \$556,532,840 in 2013. Additional production generates income from agricultural producers and input suppliers, and this income circulates through local and state economies, creating a multiplier effect dependent on available water supply.

Market adjustments. In 2016 according to KDA, the return associated with irrigation (value of production) for corn in southwest Kansas was \$226,638,720, while the return to irrigation for wheat was \$17,227,200. Combined, the increased return to irrigation from corn and wheat in southwest Kansas in 2016 was nearly \$243.9 million. Considering generally accepted economic multipliers, the economic impact of this increased production was valued at almost \$582.2 million. It is important to note that the value of irrigation is directly impacted by commodity crop prices and dryland yields. From 2014 onward, we have seen the combination of both declining prices and increasing dryland yields, which caused a market adjustment and reduced the return associated with irrigation. However, a change in either the dryland and irrigated yield spread, or the relative price would create a notable increase for the value of irrigation. This is evident in recent year's corn yields and value. These further drives uptake of irrigation conservation technology and management to improve water value to irrigators.



Data from K. Liebsch, Economist, KDA, February 2018.

Beef, Dairy and Animal Agriculture. Kansas ranked third nationally in numbers of cattle and calves on ranches and in feed yards in 2015 with 6 million head and second in the fed cattle market in 2014 (USDA, 2016). Revenue from cattle production grew more than 36% from 2010 to 2014, with cattle providing \$7.75 billion in cash receipts in 2013 (KLA, 2016). Nearly half of the state's agricultural cash receipts in 2013 came from the sale of cattle and calves. Kansas ranked 16th nationally in milk production in 2015 when milk production was valued at \$746 million (USDA, 2016). District animal agriculture provides a significant portion of these state numbers, due to reliability of irrigated grains and forage. The district is one of the fastest growing regions for dairy production in the United States with the advantages of open spaces, favorable climate, irrigation for consistent high-quality forage, and abundant groundwater at a safe depth that separates nutrient management activity from the hydrologic cycle. The district is now home

to the largest milk drying plant in North America, located in Garden City. Other significant animal production sectors in the district include pigs, sheep, and goats.

Economic analysis. Economic analysis drives water use and water development projects. It is a critical element of the water resources planning and management processes because it not only evaluates the economic justification of plans, but it can assist in plan formulation and alternatives. Although economic analysis is traditionally performed by economists, the implications of the economic analysis (which often can dictate whether a project is implemented) make it imperative that the concepts, methods, and tools used in the economic analysis be understandable to (a) the other specialists involved in the feasibility studies, (b) management who must make a decision concerning the proposed project, and (c) the various stakeholders who are involved in the planning process and who will ultimately be affected by the project or be asked to fund it in whole or in part. For example, a cost to benefit analysis is included in water conservation plan guidelines of the Kansas Water Office.

Opportunity cost of water. Opportunity cost is a key concept in economics and has been described as expressing "the basic relationship between scarcity and choice". The notion of opportunity cost plays a crucial part in attempts to ensure that scarce water resources of Kansas are used efficiently. Opportunity costs are not restricted to monetary or financial costs: the real cost of output forgone, lost time, pleasure, water quality or any other benefit that provides utility should also be considered an opportunity cost. The opportunity cost of water dependent products or services is the revenue or economy that could be earned by its alternative use. In other words, opportunity cost is the cost of the next best alternative use of water. Projects and plans involve multiple factors to evaluate a mix of alternatives to arrive at the best management strategy.

Value of water in GMD3. Water is widely considered to be undervalued. Especially when considering security of future water supply. There are several factors that influence the value of district water. GMD3 commissioned a study by the Docking Institute of Public Affairs in 2000 to examine through 2020 "*The economic impact of an acre-foot of water on the economy of Southwest Kansas* (2001)." Five scenarios of water utilization and economic impact were developed and analyzed. The first scenario modeled the farming and water utilization practices. This scenario found that excluding government subsidies, the average net present value per section over 20 years (2020) is \$ -150,000, while the saturated thickness of the groundwater reservoir would decrease by about 30%. Including subsidies from external sources, the study found that on an annual basis, the total economic impact on the GMD3 area from irrigation was estimated at \$188,496,000 in 1998 dollars. This equals about \$80 per acre foot. Over the course of the 20-year period of the study, the net present value of this impact in current dollars was estimated at \$3,769,920,000. The most viable scenario for achieving near zero depletion under this study result was one that changed all flood irrigation to center pivot and reduced the water utilization for corn by 50%. Significantly, the reduced water for corn would only result in a 10% reduction in yield. However, the cost to the irrigator of these changes would have a net present value per section of -\$4,200 annually, or -\$84,000 over the course of the 20-year study. The total cost of this near zero depletion scenario would be about \$11 million (1998 dollars) annually (\$4,200 X 2618 sections). Of course, government subsidies and low interest loans will substantially lower the cost to members of GMD3 and the cost for individual irrigators will vary by specific circumstances related to their operations. An evaluation of predictions and update of the study outcome is **due for consideration in 2020**.

Conservation cost in valuing water. Both private and public conservation program activities have a cost associated with water conserved. This provides another method of establishing the

present value of an acre foot of groundwater left in storage for future use. Dividing the amount of water actually conserved by voluntary incentive-based program participation into the actual public and private costs can provide a value of an acre foot of water left in storage unused.

Damage claim example of deficient groundwater valuation. Of the many studies of the economic value of district groundwater supply, the most comparable to the Docking study example is the “Kansas’ Expert Reports in Support of its Claim for Money Damages for Colorado’s Violations of the Arkansas River Compact 1950-94” (1998). Using only classic cost-benefit analysis, the experts found that the value of Arkansas River water in 1998 dollars was an average \$514 per acre foot for all uses (irrigation agriculture, industrial, and municipal). However, a notable deficiency of the cost-benefit analysis for groundwater occurred when experts were unable to identify present value lost for the over 400,000 acre-feet of stored groundwater found absent from district groundwater storage and used to replaced supply shortages of Arkansas River basin water from Colorado. The missing groundwater itself was considered to have no present value as a lost future supply when projected market use values (in 50 years) were discounted back to present value. The resulting present value estimate of the sizeable missing future supply from storage was determined near zero.

Proper groundwater valuation. An extreme future supply shortage should find stored water value significantly elevated and at a premium. A “no present value” view of a future groundwater supply is highly counter intuitive and inconsistent with the management program activities of GMD3 and with partners at every level of government. Such an economic theory strikes at the very heart of present conservation program expenditures and efforts to leave water in storage to meet higher future value demand and inappropriately implies significant waste of public program investments to conserve and extend groundwater supply. The recognition of error in the “no present value” theory also suggests vigilance is needed in the application of public water policy to protect against value judgements that may prejudicially and unreasonably affect the public interest. Groundwater valuation should adequately consider that storage and use have elements of both market and non-market services and product over time. Monetizing and quantifying the services of groundwater and surface water that recharges groundwater inventories for the district area over time should consider the broader natural and intrinsic values that result in usable water storage existing and profoundly influencing the future destiny of an area dependent on access to supply and not just consider it a free good under all scenarios.

Groundwater value and “tragedy of the commons” theory. Tragedy of the commons is an economic theory that describes “a problem that occurs when individuals exploit a shared resource to the extent that demand overwhelms supply, and the resource becomes unavailable to some or all,” according to an oft-cited 1968 article in the journal Science. If groundwater value is only measured by its production cost to meet near-term needs, the value will always appear cheap until we look at cost to replace or we get close to depletion, for which we did not protect or replenish supply and the loss of both market and non-market values become evident. Fixing an “overwhelmed supply” in GMD3 must involve the program activities described herein, including being wise in the management of both export, diminishment and importation of supply.

Usability factor in valuing water. The usability of water as a water quality factor that must be considered when assessing the value of water supply. Models used for estimating water supply and economic value rarely apply adequate assumptions to address water quality decline over time; what is referred to here as “**water usability depletion.**” Water usability depletion is when value

of use for historical supply is lessened or impaired by a decline in the water quality, causing a material depletion in the utility of the water. This depletion makes it necessary to increase the amount of water and incur higher costs to achieve similar present and future valued services. For example, membrane filtration water treatment necessary to remove radio-nuclei contaminants requires additional energy expense and eliminates about 15% of the water as waste permeate disposed of through injection into deep geological formations. As stated earlier, such water usability depletion factors are missing from most economic models. A water usability factor should be employed in each water project or compact risk evaluation in the district.

Replacement costs in valuing water. Replacement cost analysis is another way of valuing stored water inventory in the district as well as the value benefit of waste reduction costs. The water importation strategy to replace or replenish groundwater reservoir supply figures prominently as a key bulk water source that pushes replacement cost analysis for the district to new heights. The debate for the future economy over importing water produced goods vs. water itself may suffer from similar water valuing deficiencies in value methodology used in projecting future lost opportunity cost as in the KS vs CO damage case. More happens with water than with goods.

Energy costs in valuing water. One cost of water is the cost of energy to transport water from storage to beneficial use. For example, groundwater pumping in the district uses a great deal of energy just in lifting costs in order to use the groundwater. Well depths average about 300 feet of lift. Of the 12,826 authorized non-domestic wells in the district, about 8,480 are used annually for providing irrigation water supply. If the estimated energy used by those wells is expressed in terms of electric power, the total energy required annually in the district for irrigation would be approximately 1679.04 gigawatt hours to move 2,000,000 acre-feet (Pioneer Electric Coop and state well data). Actual energy sources used include Electricity, Natural Gas, Propane, and Diesel fuel.

Infrastructure cost in valuing water. Water is part of infrastructure. All water supply and use rely on both natural and constructed infrastructure. Valuing water infrastructure properly is a critical activity to support present and future infrastructure development to balance the multiple uses and services provided over multiple timeframes and with multiple partners. Pricing is not synonymous with value but is one way of covering costs, reflecting part of the value of these water use costs, and ensuring adequate consideration of resources needed for new source feasibility. Water infrastructure is an economic force multiplier. US Reclamation estimates that for every \$1 spent in Reclamation infrastructure programs, \$20 of direct economic benefit and about \$40 of secondary benefits occur. When a project's benefits are estimated in terms of the growth of the national economy, rather than "cost benefit" fiscal return, the true value of a project can be measured (EIR report, Pick-Sloan: The Missouri River Development Project, 2011).

Meet needs and preserve storage when possible. The water conservation program of GMD3 seeks to have members use what they need under modern efficiencies and leave or replace in storage what they can in order to improve future value of stored water supply. Whether used to meet a valuable service, preserved as reserved water left in the groundwater reservoir or appropriated as new source development, water management with a proper water valuing tool can inform decisions and markets about allocating water across multiple uses and services to maximize Kansans future well-being. Properly valuing water by members, GMD3 and program partners can make the cost of usability depletion and waste apparent and can promote greater efficiency and drive improved use and conservation practices.

V. GMD3 PROGRAM ACTIVITIES - NATURE AND METHODS

GMD3 conducts groundwater supply evaluation, local water planning, policy development, participates in state water administration activities and economy review to represent district water users and landowners in matters concerning groundwater management. It prepares and adopts the Management Program and needed policy for the groundwater resources of the district and makes recommendations to members, state and federal officials, the Governor & the Legislature.



Elements of the Groundwater Management Program

1. **Working relationships** with members and other local, state and federal agencies;
2. **Facilitate planning** of surface water and groundwater conjunctive use operations;
3. **Collaborating** to achieve efficient infrastructure and natural resource management investment;
4. **Harmonizing activities** of the GMD3 Management Program with state and federal activities of administering programs of water rights, natural resource conservation, water planning, water quality protection, infrastructure development and other government services;
5. **Managing** activities with good process and appropriate enforceable policies;
6. **Monitoring** groundwater levels and storage inventory;
7. **Mitigating** conditions of overdraft by encouraging conservation, exploring additional sources of supply and remediation of contaminated groundwater;
8. **Protecting** rights, recharge sources, infiltration areas, wellhead and groundwater reservoirs;
9. **Developing imported supply** for use services and groundwater conservation storage replenishment;
10. **Demonstrating leadership** to intervene and guide, or construct and operate groundwater supply, contamination cleanup, recharge, storage, conservation, water recycling, and extraction projects;
11. **Corrective Control** of depletions, including mineralized water intrusion into fresh supplies; and,
12. **Review and recommendation** on surface water, groundwater reservoir use and land use plans and work of other planning agencies to harmonize activities which may create opportunity or risk.

The Kansas Legislature provided for locally prudent groundwater decision-making guided by a formal elected board and management program to lead from the local need and play an ancillary administrative role in Kansas water interests and groundwater management. In more than 500 monthly meetings, the 15-member volunteer Board of Directors of GMD3 has identified district water use and supply problems and considered the nature and methods of addressing those supply problems, assisted by professional staff, consultants, state officials and other important partners in groundwater management. Even with the significant progress achieved, individual well yields and the number of irrigated fields have declined dramatically in many areas. Reduced pumping rates and unproductive wells are real and current events in an increasing area of western Kansas that indiscriminately and adversely impact livestock feeding operations, dairies, ethanol plants, and municipal and industrial users, making it more difficult for them to meet demands for water. There are district areas where the groundwater column and recharge rates offer hope for sustainable economic activity and growth through development of unused or uncommitted sources of Kansas water.

The High Plains Study example. In the year GMD3 formed (1976), the problem of depleting Ogallala Aquifer water supplies to support 15 million acres of irrigation crop farming in the High Plains region of the United States was addressed by Congress in Section 193, Public Law 94-587. The Intent was clear and concise in directing the Secretary of Commerce ". . . to examine the feasibility of various alternatives to provide adequate water supplies" for the High Plains Region, and ". . . to assure the continued economic growth and vitality of the region." To carry out the Congressional directives concerning the Ogallala/High Plains region and to fulfill a High Plains Study Council objective, two incremental management strategies to reduce water demands in the Region and three strategies to increase regional or sub-regional water supplies were formulated. The Framework for High Plains Study Management Policy Impact Assessment were to establish a "**Baseline**" trend projection of currently available water conservation and use technology and practices already in use to some extent at the time, with no new purposeful public policy to intervene with action programs for altering the course of irrigation water consumption (the Baseline). Then use the baseline condition to evaluate five strategies as follows.

- 1) A strategy which would **stimulate voluntary action** to reduce water demands through research, education, demonstration programs and incentives, using technology and practices either not considered Baseline practices or rates of implementation purposefully accelerated. (Management Strategy One)
- 2) A strategy which assumes Strategy One policies and programs and adds further water demand reduction by **mandatory programs** of a regulatory nature to control water use. (Management Strategy Two)
- 3) A strategy to add **local water supply augmentation** to demand reduction efforts. These actions included local practices such as cloud-seeding, local storage, ground water recharge, desalination, and snowpack and vegetation management. (Management Strategy Three)
- 4) A strategy of **intra-state surface water interbasin transfers**, importing water into the High Plains Region in accordance with State Water Plans. (Management Strategy Four)
- 5) A strategy of **interstate surface water transfers**, importing water from sources in areas adjacent to the Ogallala/High Plains Region by means of large-scale federal-state or federal projects to restore and maintain irrigation of the acreage that would have reverted to dryland farming by 2020 under Strategy One or Two. (Management Strategy Five)

Results of the Department of Commerce High Plains Study released in 1982 with a 40 page Executive Summary provides several analyses synthesized and available at: <https://scholar.law.colorado.edu/cgi/viewcontent.cgi?referer=&httpsredir=1&article=1007&context=new-sources-of-water-for-energy-development-and-growth-interbasin-transfers> Projected outcomes aid in making policy choices and choosing methods for translating policy into program administration. GMD3 utilizes this information to develop management program activities.

New High Plains study and planning can provide new cost and benefit projections that will further aid in making project, policy and program choices. GMD3 participated in a 2015 update of the 1982 High Plains Study Route B Water Transfer Element which identified significantly more Missouri River water available originally estimated. See: http://www.circleofblue.org/wp-content/uploads/2015/01/KansasAqueduct_DRAFT_Final_1982_Update_011615.pdf The GMD3 participation was not to promote the 1982 project as originally envisioned. GMD3 seeks to establish a set of transfer concepts from which Kansas and other western partners can work from to establish drought resiliency and further consider energy and water services obtainable from the conservation of the significant transient surface water flows available for management and transfer across Kansas to overcome present demand shortage and provide for future water needs, services, storage and drought resiliency.



GMD3 Water Rights Administration Program

For members to corporately act through their GMD according to groundwater law, GMD3 must be closely involved as a party in the water rights administration activities affecting district membership. The tools are available to support resource conservation and management activities; the most urgent need being policy consensus on the relative priorities of competing socially beneficial uses of Ogallala/High Plains Aquifer inventories and the practices for evaluating water rights. Kansas law requires the Chief Engineer decide on the question of impairment of prior water rights before approving a water application or proposal. GMD3 assists state water officials as a person with associational standing and statutory rights embodied in K.S.A. 82a-1020 for the proper management and conservation of groundwater resources, the prevention of economic deterioration and associated endeavors that can be invaded if not allowed to participate in review or a proposal impairs another water right or conflicts with the management program. The partnership of local groundwater government and state water officials, like the Chief Engineer, includes a shared effort to carry out the purposes of basic water use doctrine and the right declared in the GMD Act, where the Chief Engineer is to serve the public interest with powers to conduct specific duties as a neutral expert administrative judge.

State and local judgement. Because water rights are real property rights, the importance of transparent enforceable policy and expert judgement on questions of possible water right impairment should be emphasized to protect the public interest recognized in this management program and to uphold both basic water use doctrine and the right and purposes of the GMD Act. Accordingly, the Chief Engineer and agency staff of the Kansas Department of Agriculture are key partners in the GMD3 Water Rights Administration Program activities.

Public interest in proper management considers the science-based present and future conditions of an over-committed supply to satisfy water right claims for beneficial use with reasonable effects on declining water levels of storage dedicated to investment backed private property. To conduct proper management and conservation, GMD3 has an associational and legal right to be party to all matters affecting basic water use doctrine and the management program that may suffer cognizable injury if impaired or ignored. This public interest concern is based on a recognition that declining groundwater supplies are causing re-aridification of farms and communities as before groundwater development. For changes to water rights, the traditional “net effect” evaluation preserves re-aridification and is inadequate to prevent impairment in most groundwater use settings that are subject to this management program. Given that “impair” is not defined in statute, a more precise method or basis of evaluation is provided for whatever numbers are chosen using the application of objective hydrologic principles applicable by all rather than as a matter of enforcing subjective rules favoring one party over another.

Proper timing. The submittal of a water proposal to the state is a proper time to evaluate the local complexities of water rights, use demands, supply, management program and wise investments for water use and management improvement. The GMD3 management program for southwest Kansas is a key public interest element for consideration by water officials. All water users of an acre foot or more of groundwater pumped per year from within the district are eligible voter members who use waters of the state according to their water rights. So, GMD3 activities that determine the destiny of water use and economy per K.S.A. 82a-1020 necessarily involves

participation in all matters of water administration, including changes or allotments for water use. Under authority of the GMD Act, GMD3 adopted limits on the density and movement of pumping authority between wells and for proposed well locations based on well spacing and GMD3 site specific evaluations. Groundwater reservoir depletion limits not to exceed 40% of supply in 25 years were set. GMD3 calculations became recommendations relied on by the state Chief Engineer, Division of Water Resources. The outcome of application approval for thousands of water project proposals can profoundly affect the future success of the management program and local groundwater conservation efforts.

Improved data. Today thanks to efforts of many partners, improved data and GMD3 groundwater reservoir evaluation tools add value to member interests and support the prescribed review of the state under Kansas law K.S.A. 82a-711 and other laws. The GMD3 “711” evaluations serve the application review process to assist member water management and private infrastructure investment needs by applying expert study, fact finding, analytical and numerical calculations and other work intended to inform and support member interests and aid in addressing key proposal questions of well pumping and water supply effects under present use and declining groundwater level conditions.

No free lunch. Relocating wells or pumping authority for better well yield simply adds to the rate of decline of the dwindling groundwater supply. There is no free lunch. Someone’s well(s) will pay the price of changing appropriation locations. The circumstances require an indication of what the price will be. So, GMD3 critical well concerns extend over a future evaluation period to look beyond traditional minimum average condition based spacing rules to include other public interest considerations of scarcity and security. Some response in the management program through innovation and collaboration is key to addressing water scarcity. The GMD3 board plays a critical Kansas role of responsibility and local accountability to members for both preserving basic water use doctrine and for the implementation of the locally adopted management program. Acts opposed to either could cause irreparable harm to the district water supply and economy.

No one wants regulations but most want protections from scarcity. Nobody wants to see anybody lose any groundwater, but people are. Nobody wants to see that hardship come to anybody, but there is going to be hardship (well yield decline, stored supply decline and increased water costs). Reality is a harsh reminder of the cruelty of water shortage. The question is how we deal with it and how members and partners accept responsibility for the economic and social burdens of water shortage with brave action.

1. **GMD3 Water Rights Administration Guiding Principles:**

- A. **Preserve basic water use doctrine and lead from local need.** An implied legislative purpose of the GMD Act.
- B. **Good public record for good decisions.** Complete and transparent public record of facts, science and policy provides for good public decisions.
- C. **Conserve to preserve supply** – Engage members to grow present and future benefits from preserved or replenished supply. In the depleting groundwater reservoir, limiting “paper water” on poor wells (incapable of providing the water) from moving to good wells (a concept termed “chasing water”) will protect conservation benefits and avoid imposing added hardship on member wells.
- D. **A closed groundwater reservoir dedicates native supply to existing usufruct rights** – Groundwater reservoir inventory and recharge sources closed to most new

appropriation becomes dedicated to users having existing real property rights owned by eligible voters. New appropriations should be offset by non-use of prior rights or replaced to assure a net zero or less change in depletion rate supply.

- E. **Drinking water necessity**- Safe drinking water is a fundamental necessity of every person which must be considered in member management activity for future supply, with considerable assistance from GMD3 and all partners. It is an anomaly in the law and in proper management of groundwater if one person can for individual profit destroy the community and render the neighborhood uninhabitable.
- F. **Contributions to future supply** - An unexercised right to enjoy an acre foot or more of groundwater from a declining groundwater reservoir supply in the district that is physically and lawfully divertible from an existing operable well has a present groundwater conservation value resulting in voluntary conservation measures that GMD3 can recognize as a contribution to future district supply under the management program.
- G. **Communicate to exchange information** - Good and effective communications between GMD3, its members and state and federal regulators are necessary for productive partnerships that implement the management program.
- H. **Seek mutual benefits and good will** - All water users and landowners can make water right decisions, agreements or stipulations between property right interests that promote mutual benefits and goodwill in the use and conservation of the groundwater supply in the district for a reasonable future period. Annual “call” administration between rights to groundwater storage is not practicable.
- I. **Ensure necessary investment stability** - Spur wise water-resource development and intervene to protect the interests of all members.
- J. **Promote free enterprise** – Enable a market-based system of water rights administration of available supply.

Members use waters of the state of Kansas according to their water rights. Water rights are granted by statute or by statutory process with private investment in order to be granted vested or appropriation rights. Those rights are known and have value in the market place. Water use is supervised administratively by the state Department of Agriculture, Division of Water Resources in the GMD3 area in a manner consistent with the rights of GMD3 members according to the KWA Act and the management and public interest under the GMD Act. A key legislative policy for such activity that pre-dates the GMD Act is found in K.S.A. 82a-711(a) “...to the end that the highest public benefit and maximum economical development may result from the use of such water.” Once granted, a water right becomes a real private property right to use available water in a manner consistent with the terms, limitations or conditions of authorized and perfected use. A water right is not a guarantee of a water supply and is subject to available supply not needed to satisfy demands for water by owners of prior rights. The question of whether a hardship or injury to water supply may be realized under member use or threatened by new use proposals for pumping wells from depleting local supply has always been a public interest concern of GMD3 to fairly share use and to conserve and extend supply.

Kansas Law K.S.A.82a-706b(a) provides in pertinent part: *“It shall be unlawful for any person to prevent, by diversion or otherwise, any waters of this state from moving to a person having a prior right to use the same...”*

Also, K.S.A.82a-711(c) provides in pertinent part: *“With regard to whether a proposed use will impair a use under an existing water right, impairment shall include the unreasonable raising or lowering of the static water level or the unreasonable increase or decrease of the streamflow or the unreasonable deterioration of the water quality at the water user’s point of diversion beyond a reasonable economic limit.”*

It is widely accepted that the KWA Act endows the Chief Engineer with certain statutory duties to grant and protect water rights according to the doctrine of prior appropriation under prescribed considerations. These include the effects on other wells within reasonable economic limits as described above and to consider all matters pertaining to public interest per K.S.A.82a-711(b) as follows: *“(b) In ascertaining whether a proposed use will prejudicially and unreasonably affect the public interest, the chief engineer shall take into consideration:*

- (1) Established minimum desirable streamflow requirements;*
- (2) the area, safe yield and recharge rate of the appropriate water supply;*
- (3) the priority of existing claims of all persons to use the water of the water supply;*
- (4) the amount of each claim to use water from the appropriate water supply; and*
- (5) all other matters pertaining to such question.”* (Emphasis added)

It is the opinion of GMD3 that for “a proposed use” within the GMD3 area, “all other matters pertaining to the question” under K.S.A. 82a-711(b)(5) necessarily must include the management program and board recommendations as a legislative declaration of public interest in K.S.A. 82a-1020 of the GMD Act and declaration of the Chief Engineer in the formation of GMD3 per K.S.A. 82a-1024. In addition, K.S.A. 82a-733(g) provides the following: *“(g) Any conservation plans and practices required pursuant to this section with regard to any groundwater right or permit to appropriate groundwater from within the boundaries of a groundwater management district shall be subject to approval by both the chief engineer and the board of directors of the groundwater management district unless such plans and practices are incorporated in the groundwater management district's management program which has been approved by the chief engineer pursuant to K.S.A. 82a-1029 and amendments thereto.”* Legislative policy in K.S.A. 82a-745 of the KWA Act further assures the intended ancillary role of the GMD3 management program and consideration by the Chief Engineer for the district area as follows: *“(m) Notwithstanding K.S.A. 82a-1039, and amendments thereto, nothing in this section shall be construed as limiting or affecting any duty or power of a groundwater management district granted to such district by the Kansas groundwater management district act.”* (emphasis added).

These and other provision of law illustrate legislative intent to preserve the right, purposes and public interest declared in the GMD Act for GMD3 to make decisions and provide recommendations that guide public interest and the destiny of the GMD3 area with respect to the use of the groundwater, and part of the prescribed considerations of the Chief Engineer under his duties in both the KWA Act and the GMD Act and further provides

standing in such matters. This includes the provision for changing water rights under K.S.A. 82a-708b where “...*The chief engineer shall approve or reject the application for change in accordance with the provisions and procedures prescribed for processing original applications for permission to appropriate water.*” Preserving the K.S.A. 82a-711 (711) provisions and procedures in changing water rights also preserves the considerations of the management program as a key water administration public interest.

Just and proper administration. Just and proper administration of water use under the activities of the district management program and state partners has been a fundamental reason for the formation and operation of the district by the water users and landowners. The customary use of basic water use doctrines, not their mere codification, determines their meaning in practice. It is therefore necessary for GMD3 to review applications and projects, guided by adopted review process, evaluation guidelines, and rules to provide the necessary information and program services to member water users and others who are affecting the groundwater reservoir conditions upon which all members depend. These activities are to both satisfy water rights and apply due consideration for efforts to conserve water and any extent management efforts may be undermined by any activities proposed or otherwise. More than 40 years of additional data, custom, law and input has influenced the management program since GMD3 formed in 1976.

2. GMD3 will provide comments and recommendations of the management program.

As local groundwater reservoirs decline, the value of available usable water goes up. K.S.A. 82a-1028(m) authorizes GMD3 to "provide advice and assistance in the management of drainage problems, storage, groundwater recharge, surface water management, and all other appropriate matters of concern to the district." GMD3's position is that participating in a hearing on the issue of whether a proposed permit or water right change will impair existing water rights is "advice and assistance in the management" of groundwater in "storage" and "all other appropriate matters of concern to the district." To operate the management program, GMD3 will seek to build good record on which good decisions are made by providing comments and recommendations. The Board of GMD3 may include the following considerations in their deliberations and recommendations of the management program and standards governing groundwater use.

- A. **Public and domestic drinking water supplies.** Steps to ensure quality drinking water is available locally for people and animals is recognized as a necessary element of the groundwater management program. No modification to historic terms of groundwater use should contribute to unreasonable or unsafe drinking water supply conditions, including deteriorating drinking water quality (Water Usability Depletion).
- B. **Water usability depletion.** Water usability depletion is when the value of use of water supply is lessened or impaired by a decline in water quality, causing a material depletion in the utility of the water. The degradation of quality can either restrict or eliminate the beneficial use or reuse of water or require additional “fresh” water use to dilute or replace the degraded water. People clearly understand the situation of water flowing into a salty sea, but poorly understand “the equivalent amount of water” lost when “good” groundwater reservoirs suffer a loss in water quality.

- C. **Maximum allowable rate of groundwater reservoir depletion.** For groundwater management purposes, available supply from the OHP groundwater reservoir is subject to a maximum allowable rate of depletion not to exceed 40% in 25 years; a limit adopted by GMD3 on July 12, 1978 and made enforceable by rule of the Chief Engineer for new appropriations. This depletion rate cap set the maximum allowable local consumption rate of the OHP groundwater reservoir. Preserved in rule for evaluating closure of entire areas, the depletion rate cap is applied here as a groundwater reservoir public interest and economic constraint under the management program, given that the entire groundwater reservoir is considered closed to most new appropriations unless offset by unused prior right commitments whose use is not already constrained by conservation corrective controls or physical lack of accessible supply (paper water).
- D. **Well drawdown estimates.** Conducting well evaluations in declining groundwater reservoirs to identify critical wells (supply hardship wells) will provide a framework where analytical tools such as a Theis Calculation and numerical tools such as the GMD3 Groundwater Model can be applied and considered to inform water right administrative decisions where critical wells may be strong candidates for impairment of associated water rights.
- E. **Local source of supply.** In the history of the GMD3 management program, GMD3 has used local source areas of groundwater reservoir supply ranging from a section centered on a 9 square mile block to a two-mile radius circle centered on a well to calculate supply availability or maximum allowable depletion rate. Administrative practice and hydrological constraints suggest a local source of supply for a K.S.A.82a-708b(a)(3) demonstration should not allow a move beyond a 2-mile radius circle. Management program rules and guidelines may further constrain changes or change-like evaluations affecting groundwater management.
- F. **Water right priority contribution.** GMD3 member-owners of senior water right interests who stipulate conditions, provide forbearance agreements or otherwise withhold priority call against other users in a local source of supply provide mutual benefits and good will to be recognized as supporting the management program.
- G. **Use of lessor quality water.** Under state law (K.S.A.82a-711), lessor quality water with a lower usability factor must be considered for uses over better quality water where technology and economics will allow it.
- H. **Member agreements contributing to the Management Program.** GMD3 members seeking rule waivers or negotiated water management plans who enter into agreements that support neighbors' needs when developing a conservation proposal, and who meet the requirements of K.S.A. 82a-711 and K.S.A.82a-706b to satisfy prior rights for at least 25 years, may be recognized as contributing to the GMD3 management program.
- I. **Economic use value.** Influencing water management as an economic public interest is a key element of the management program and an important way of achieving efficient and equitable groundwater use without waste to realize the

greatest value for the water used. Plans or proposals that significantly increase groundwater use value while lessening actual decline rates should be recognized as contributing to the GMD3 management program in the public interest.

- J. **Alternate supply development.** Proposals to conserve Ogallala/High Plains groundwater reservoir water by seeking an economically and technologically feasible lesser quality alternative groundwater source should be recognized as contributing to the GMD3 management program.
- K. **Groundwater inventory estimate improvements.** Information provided by members that improves knowledge of usable supply estimates, including donating geological test well logs and other data, should be recognized as contributing to the GMD3 management program.
- L. **Water imports and transportation of water.** Where the demand for water within the district exceeds long term groundwater supply, any member pursuit of additional sources of water to meet sustainable agriculture water needs may be recognized as securing water services in the district, the state and the region in the public interest.
- M. **New flexible use among wells and their prior allocations.** New use flexibility between wells presents a significant potential for new added pumping onto the remaining producing wells in a declining local source, and for new effects on other wells with prior use rights. Also, with improvements to type (1) water conservation (efficiencies), there is risk that no real type (2) water conservation (groundwater reservoir maintenance) is achieved to mitigate use effect on the neighbor. Especially where “paper water” may be re-allotted to a productive supply well. For more information on flexible use of appropriation rights, see *Out-of-Priority Water Use: Adding Flexibility to the Water Appropriation System*, Lawrence J. MacDonnell, Nebraska law review, 2004. See: <http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1272&context=nlr>

3. **GMD3 will use physical and economic well constraints to identify critical wells. Evaluation service to inform members.** Kansas law requires member water right applicants to demonstrate their proposal will not impair prior rights. Guidelines will be employed for performing investigations and to provide information for program consideration that may include the following:

- drawdown and/or stream depletion due to a proposed well pumping;
- drawdown due to use under existing water rights;
- impact of drawdown on existing well completions;
- potential to obtain the rate and/or quantity of water sought;
- water availability;
- water quality;
- other information needed to support decision making.

New proposals that alter conditions of well use for local water supply simply propose new effects on other wells. State rules requested by GMD3 and adopted for the area have provided minimum standards for well spacing and move limits that aid in implementing statutory policy absent better demonstration or investigation. Significant additional data and information are now available to evaluate today’s water use proposals that adds value

to proposal considerations for all members. GMD3 guidelines for hydrologic investigation can be employed to provide a consistent format to evaluate project proposals on a case-by-case basis and include the unique characteristics of each application and groundwater reservoir use setting and use effects. GMD3 well evaluations are performed to inform all members and others of estimated drawdown effects and the local public interest view.

Well drawdown evaluation guidelines. Well drawdown evaluation guideline may be updated and posted on the GMD3 website as deemed necessary outside the management program revision process. Guidelines are necessary for the following reasons:

- Member water rights are real and private property that can be impaired.
- Groundwater depletion is provisioned in law and practice for the district.
- Hydrogeology is sufficiently understood.
- Mutual well interference is prevalent.
- A regional groundwater flow model (and any revisions) has been employed.
- Application and proposal reviews occur regularly.
- Minimum well spacing rules are not adequate to protect rights in many cases.

Guidelines will have a settling effect on the general controversy of what may indicate impairment of prior groundwater rights. Guidelines simply serve as a framework for judgments on whether to investigate or to require more demonstration of local hydrology and well effects or special terms or conditions to protect all member interests. Under a physical solution to well hardship or injury in a declining groundwater source, the objective often is to enable an existing junior use proposal, but in using less water. This is explicitly based on the understanding that it is the beneficial use that is protected by a senior water right and not necessarily any fixed quantity of water.

A. **Drawdown Allowance.** In a process for review of new proposals affecting water use in a depleting supply area, preventing any level of new impact on a well is impractical, as this would result in the denial of all applications including those causing small or de minimis impacts. A drawdown allowance will be used as **a maximum reasonable lowering of a critical wells water table** and to define a relatively small impact due to a proposed diversion that may be allowed to occur on wells in which economical and/or physical constraints are exceeded. A drawdown allowance can also be used as a screening tool for additional evaluation.

RECOMMENDED ADDED DRAWDOWN ALLOWANCE
FOR AREA WITH NO IMPAIRMENT CLAIM

AVERAGE AQUIFER THICKNESS IN THE VICINITY OF A PROPOSED WELL (ft)	TOTAL DRAWDOWN ALLOWANCE OVER 50 YRS (ft)
0 - 50	1.0
>50 - 75	1.5
>75 – 100	2.0
>100 – 125	2.5
>125 – 150	3.0
>150 – 200	3.5
>200	4.0

For up-to-date allowances, see GMD3 posted guidelines at: at:

<http://www.gmd3.org/wp-content/uploads/2019/04/DRAWDOWN-ASSESSMENT-GUIDELINES-for-GMD3-2019.docx>

- B. **Critical wells.** Critical wells have high risk of suffering excessive supply decline and water right impairment. Wells in which economic and/or physical or other constraints are exceeded due to adopted criteria are referred to as “critical wells.” Adopted criteria are used unless better site-specific information is available. Wells may become critical due to the use of existing water rights in a declining supply alone or the combined effects of dynamic drawdown, existing uses, and proposed uses if one or more of the drawdown constraints are exceeded.
- C. **Economical Drawdown Constraint.** The economical drawdown constraint is calculated in two ways, with the more conservative result used. Constraint (1) is based on the percent of initial useable water column that can be lost before the well falls below economical viability. In the absence of more reliable data, a value of 70 percent of the initial water column may be assumed as the economical drawdown constraint where from a theoretical (hydraulic) standpoint, it is impractical to pump a well in an unconfined groundwater reservoir at a drawdown that exceeds two-thirds of the thickness of the water-bearing formation (Groundwater and Wells, Third Addition, Johnson Screens, 2007, page 429). Constraint (2) for the OHP Aquifer uses a maximum allowable rate of depletion calculation as a standard under the management program for over 40 years. The GMD3 40/25 calculation will be used to ensure proposals will not result in exceeding nor increase and exceeding the maximum rate of groundwater reservoir depletion.
- D. **Physical Drawdown Constraint.** Physical hardship is the loss of the required well yield due to excessive usable water level decline. The physical drawdown constraint is the difference between the depth to the current static water level (or depth to the potentiometric surface) and depth to the **Lowest Practical Pumping Level (LPPL)**. The LPPL depends on the availability of well completion information such as the depth and thickness of the water bearing zone or confining unit, pump setting, and screen setting. For non-domestic wells in an unconfined groundwater reservoir, the LPPL may be assumed to be 60 feet above the base of the water column. If the screen interval and/or pump setting is unknown, a different LPPL may be determined to address reasonable concerns such as cascading water or other physical well concerns. The LPPL for non-domestic wells in a confined bedrock groundwater reservoir may be assumed at the base of the upper confining unit unless this assumption is unreasonable (Sterrett, 2007). If the total drawdown extends below the LPPL that well becomes a critical well.
- E. **Domestic wells.** Due to the relatively low volume of water produced by domestic wells, and other construction factors, some wells may be constructed with pumps set within the screen interval or close to the bottom of the well. The LPPL is typically assumed to be 20 feet above the base of the water column for domestic wells unless a different value is supported. At least 20 feet may be necessary to maintain submerged conditions, avoid sediment problems, and allow for dynamic drawdown, etc.(length of pump and net positive suction head).
- F. **Water usability constraint.** Usable water column for well evaluations can be significantly reduced by unusable water quality, or water usability depletion of supply. Usability constraints will be addressed as available information dictates.

Local source management. In closed and declining groundwater areas, the management program can avoid wasteful infrastructure investments and objectionable clustering of wells mining remaining reservoir “hot spots.” Adding depletion to local sources by moving “paper water” from adjoining unproductive areas has been referred to as “**chasing water.**” Critical well conditions can be viewed as having drought-like warning or emergency conditions. Water rights that authorize use in depleting areas may be held to existing use terms in response to critical well or drought-like warning conditions. A well drawdown evaluation system implementing the KWA Act in GMD3 will inform the destiny of water use for any needed **corrective controls** or drought-like response to further implement the GMD Act.

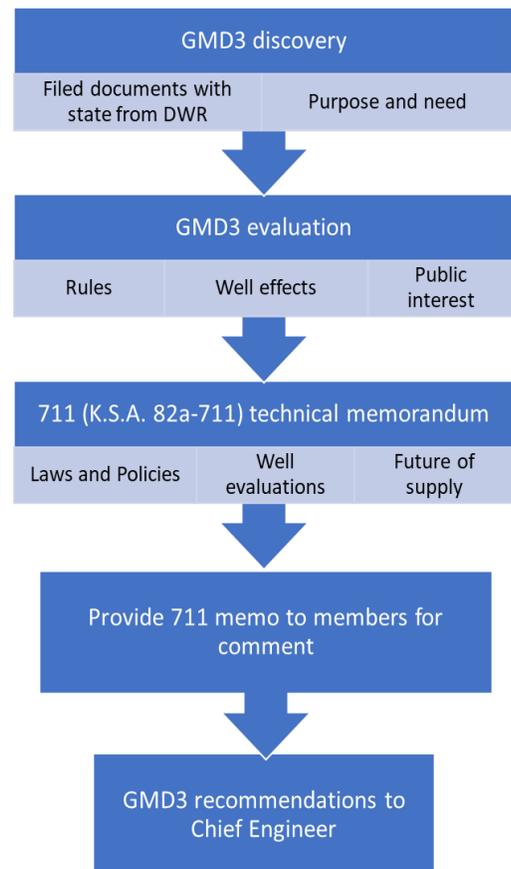
4. **GMD3 will assist in the preparation of applications.** Assistance provided by GMD3 staff may be for completing an application for a state permit or for other such water-rights related member project planning and paperwork, but it shall be the responsibility of the proposer to review all such information and to submit it to the Chief Engineer as required by law and as advised by their own independent legal counsel and/or technical expert.
5. **GMD3 will review water right proposals.** Analytical and numerical tools and results will be provided when considering effects of use proposals or plans that affect supply to member prior rights for consistency with water use doctrine and the management program.
6. **GMD3 will advise.** Recommendations will be provided to the Chief Engineer or other appropriate local, state or federal officials for actions, policies, or terms of water use to implement the management program and policies adopted by the GMD3 governing body.
7. **GMD3 will work with members and officials.** GMD3 will provide program compliance assistance and options to address uncertainty in water rights administration and future supply concerns that may include seeking facilitated consent agreement to be recognized by water officials. Activity may include review of use proposals or supply complaints using a 25-year prospective supply evaluation period.
8. **GMD3 will monitor annual water use.** GMD3 will work with partners to improve the water use and reporting process as needed to support member interests and public interest in implementing the groundwater management program.
9. **GMD3 will provide on-site diversion inspection services to members.** Installed water flowmeters and other devices have been required by the governing body of GMD3 on all non-domestic wells since the early 1990s. On-site services assure good water measurement assistance and ensures groundwater programs are based on good use data.
10. **Multi-well use flexibility (MUF) in GMD3.** Someone’s well(s) always pays a price when changing pumping allotment locations in a shared declining local source of supply. So, care is needed implementing new multi-well use flexibility in the declining aquifers of GMD3. Support will be provided to evaluate and ensure MUF is done lawfully regarding critical well concerns and with voluntary corrective controls that are consistent with the management program. Reallocating water right allotments between wells where new water appropriation is otherwise not allowed under Kansas administrative law or the

management program is not advisable unless enough well and groundwater reservoir evaluation and district oversight occurs to ensure that future supply improvement under type (2) water conservation will protect prior water rights from impairment. As an example of granting new use flexibility for better water management, the statewide WCA law limitations include in K.S.A.82a-745(e)(2): *“the management plan may allow, in any given calendar year, the water use of an individual water right or rights to exceed the annual authorized quantity of the individual water right or rights participating in the management plan, provided that the water use shall not exceed the total annual authorized aggregate quantity and rate of all the water rights participating in the management plan in any given calendar year.”*

This optional WCA flex use provision can threaten wells with prior rights in GMD3 areas if used to propose adding critical well conditions to a declining local source of supply committed to prior water rights. GMD3 well-to-well objective hydrological evaluation is a necessary part of WCA implementation under the GMD3 management program. An example of selective legislative provision with limited application in GMD3 is the MYFA as disallowed by the Chief Engineer in parts of the Arkansas River IGUCA. The WCA tool will be encouraged in the GMD3 area for new conserve-to-preserve corrective controls and to avoid adding critical well concerns to supply areas; a problem that was common prior to the formation of GMD3 and the management program. Activities will seek to assure real Type (2) water conservation if new flex use is proposed.

11. **Time for GMD3 review process.** A GMD3 application review process will be conducted with efficient use of time to respect the needs of all members and to add value and confidence in groundwater project investments by applying rigor and relevance in the evaluations of local groundwater supply conditions, well operating needs and private property rights to use the available water supply for a reasonable period of time. Accordingly, some review time to a recommendation may range from **less than 15 days to significantly more time** depending on a number of factors that may include:

- legal setting;
- physical setting;
- insufficient information provided;
- request for rule waiver;
- extent of available data;
- number of calculations to complete
- communication time
- concerns from other members;
- proposal revisions;
- GMD3 committee and board review;
- mitigation of impairment concerns;
- Need for a hearing.



GMD3 Water Conservation Program

Wise use. Under the GMD3 management program to address depleting groundwater resources, water has generally become a commodity to be weighed, measured, allotted and metered out by the gallon or acre foot. These are important management program activities. But a better leading public policy strategy might be devised than one that only conveys the message that water use is something to be minimized or even defeated by water conservation. Instead it should be stressed that conservation is not so much about prohibiting water use as using all water wisely, even during flood and drought conditions. Such uses are many and include an understanding of water risk, and the emotional and aesthetic power of water. The GMD3 water conservation program will encourage activities that conserve and extend use of developed water supply sources while also developing added control and conservation of new supply sources to replace or replenish district groundwater reservoir inventory. Both forms of conservation are equally key and necessary elements of the management program activities adopted by GMD3 to move the Kansas economy forward. Strengthening links between natural infrastructure (Rivers, streams, playa lakes and groundwater reservoirs) with private, community and public constructed infrastructure (Wells, tanks, pipelines, canals, pits, lakes, and surface reservoirs) will help build climate and drought resilience all across Kansas.



• **Water Conservation** - has two types of activity under the GMD3 management program:

(1.) **Use efficiency**

- the amount of valued output per unit of water consumed.

(2.) **Maintaining aquifer storage**

- preserves and/or replenishes future useable storage.

Type (1) Water Conservation = Use Efficiency. Use efficiency is the amount of valued output per unit of consumed water. This type of activity improves wise use by adding present economic value and benefits to each unit of water diverted from storage. But it also adds risk in greater capacity to consume every drop available from declining groundwater reservoir supply. Efficient water use technologies, products and services are an effective means of increasing or sustaining GMD3 economy and member water project bottom line. Use efficiency is the first activity generally attributed to water conservation for wise use without waste. As the cost of water increases, the business incentives and benefits associated with efficient use increase. However, as efficiencies increase, historical return flow back to the groundwater reservoir decrease. So, in a declining groundwater reservoir, type (1) conservation activity adds present supply value and opportunity for both groundwater reservoir maintenance and groundwater reservoir consumption. So improved use efficiency by itself does not assure aquifer storage maintenance for the future.

Type (2) Water Conservation = Maintaining Aquifer Storage. Maintaining aquifer or groundwater reservoir storage requires conserve-to-preserve activities for future water supply value. Supply maintenance activity includes protecting renewable recharge sources, adopting lower project demands, adjusting local use corrective controls and administering the exercise of water rights based on the long view while also seeking replacement sources. All are effective means of Type (2) water conservation. Groundwater reservoir maintenance activity may be coupled with type (1) use efficiency activity. But a conserve-to-preserve factor evaluation is necessary in order to determine useable preserved or replaced storage amounts vs. unusable or unavailable paper water right amounts.

Unwise use and waste of water. GMD3 member activities that don't promote Type (1) and Type (2) water conservation should receive due consideration under the management program as prejudicially and unreasonably affecting the public interest. As a general principle, equity abhors waste, and delights to restrain it. In the Western states, water is so scarce and the possible beneficial uses thereof so great, that it is reasonable to believe such allegations will, as time goes on, be more and more strictly construed against those shown to be guilty. Demands to discourage unwise use increases as supplies dwindle. Activity that may unreasonably diminish groundwater value and/or used with an efficiency below what is now considered technologically and economically feasible may receive due consideration for impairing the GMD3 management program with preventable waste of water. Surface water flows or delivered quantifiable gains to groundwater reservoir storage are historical sources of groundwater supply considered an important source of water conservation under district management program. Groundwater reservoir recharge flows from surface flows are therefore not considered a waste of water, unless manageable water quality or preventable evaporative waste problems locally dictate otherwise.

Conserve-to-preserve factor. Conserving to preserve or replenish "wet water" supply may be considered the conserve-to-preserve storage factor (or water conservation factor) of a plan or program, expressed in an acre-foot amount. A water conservation factor is a calculation that requires a separation of the inevitable non-use of a water right (inaccessible or depleted supply) from groundwater reservoir maintenance actions (demand reduction choice or groundwater reservoir replenishment actions that preserve physically and legally available storage) that most agree is adding future supply. The management program requires consideration of every acre foot of water stored or available for management. Of the 3.6 million acre-feet of perfected annual authorized groundwater use from the declining district inventories, generally about 44% is not used for various reasons, including voluntary groundwater conservation activity or diminished well yields from depleted groundwater reservoir conditions. Wells generally perform under several factors affecting well yield. Well yield is rate in GPM that a well can reliably produce water under normal operating conditions. The water that the well provides may differ from the authorized maximum allowable conditions of a water right. For diminished well yields, there is a significant amount of "**paper water**" (water rights on paper only, due to diminished well yield). So, it will be necessary to determine through a practice suitability audit and appropriate data review to determine the actual water conservation factor or conserve-to-preserve factor for any accounting of credit or due consideration provided in the GMD3 area.

Conserve-to-preserve water accounting. GMD3 may account (determine, record and audit) for voluntary conserve-to-preserve or water conservation factor amounts under management program activities. Development of water conservation factor calculations have several considerations that

may be best developed and implemented through separate GMD3 program guidance documentation further implementing the management program. Such an accounting activity may enable the tracking of groundwater reservoir storage maintenance on a project or on a regional scale to determine the level of groundwater reservoir maintenance water conservation.

Reporting conserve-to-preserve amounts. Water management based on use requires water use reporting. Water management based on conservation requires water conservation reporting. Water management actions that conserve-to-preserve supply should be routinely documented for member benefits; benefits realized either in extended supply, monetary incentives or in matters of water right administration. No-call or non-exercising of a senior right to use available supply generally goes undocumented or is not fully considered in state water planning, administration or legislative policy development.

No non-use of available supply penalty. Member or government complaints that non-use demonstrates lack of need or loss of benefits may not be a proper basis for management accounting of conservation decisions that conserve-to-preserve groundwater supply. Water planning documents tend to describe water demand in terms of water use and fail to account for voluntary decisions for non-use of groundwater storage nor adequately describe the unmet demand and lost opportunity costs for lack of available supply. There is little standardized data available to quantify the extent of water conservation occurring now in the district. GMD3 members with water conservation activities may be encouraged to voluntarily submit annual water conservation reports for their water right record and to assist the management program to receive due consideration for contributing to the groundwater management program.

Every manager a water conserver initiative. As private family and corporate water dependent managers juggle many related business concerns, each GMD3 member actions to manage climate variability and project water supply with wise use is where real water conservation happens to improve their bottom line. So, members are encouraged to make it a priority to be their own leader in groundwater conservation and determining the destiny of their use and water dependent enterprise. GMD3 will provide support consistent with the management program. The actions of every manager a water conserver (EMAWC) may ultimately determine the fate of all reliance on the groundwater supply for the farms and industry of the GMD3 area. Regular water system evaluation and appropriate conversion to gain maximum efficiency is highly encouraged Type (1) water conservation for the district and a core activity in developing home-grown management plans.

Home-grown plans. Being climate resilient involves incorporating climate risks into plans that anticipate, prepare for, and respond to hazardous water related events, trends, or disturbances related to climate. With local groundwater storage generally slow in lateral flow, each member can expect benefits of their managed conserve-to-preserve activities to stay home. It is fundamental groundwater management that each project manager conserve-to-preserve supply where possible and to develop a water budget strategy that defines and secures project benefits; incorporating actual use need, water sources and identified conservation opportunities with a long view of water supply. This activity benefits both the member and the GMD3 management program. An EMAWC activity can incorporate actual well conditions, supply management, recharge, and alternate sources into a bottom-line water strategy. Using measured farm data, water rights analysis and available expert assistance, an EMAWC activity on the farm can yield benefits and provide baseline awareness of changes in use by other water users in the local supply

neighborhood. Managing rain benefits and evaporation loss is an excellent place to start, with use of irrigation scheduling and sensor technologies that places each member on the front lines of water responsibility to protect the Ag industry and communities with wise water systems.

Groundwater Exploration and Protection (GE&P) Act. The GE&P Act is a body of Kansas law to provide for the exploration and protection of groundwater through the licensing and regulation of water well contractors in Kansas to protect the health and general welfare of the citizens of the state; to protect groundwater resources from waste and contamination by requiring proper description of the location, drilling and well construction, and proper plugging of abandoned water wells and test holes; and to provide data on water supplies through well logs, well pumping tests and water quality tests which will permit the economic and efficient utilization and management of the water resources of this state. In order to achieve these objectives, the Kansas Department of Health and Environment (KDHE) Bureau of Water handles licensing of water well contractors; provides for enforceable standards for well construction, reconstruction, treatment and plugging; requires each licensed water well contractor to keep and transmit to the state, upon request, a copy of the log of the well, pump test data if available, and water quality samples, and maintains within the Kansas Geological Survey (KGS) a record system of well logs and water quality data available to the public. GMD3 utilizes the information made available and works with KDHE to accomplish the purposes of the GE&P Act and the management program.

GMD3 Drought Resiliency



Drought. Drought affects southwest Kansas frequently with a subtle onset that develops significant impacts over time. Long-term historical climate variability estimates over the last 1000 years produced by Layzell and others at the KGS indicating significant climate variability historically well beyond modern experience and data. Vast development of local groundwater reservoir storage pumped to replace rain deficiencies has provided great drought resiliency and agribusiness advantage for the region. But groundwater reservoir depletion is also a reality that is causing a re-aridification of irrigated farms consistent with the subtle onset of drought as reserves are mined and projects are forced to adapt to a new water supply condition outlook. In that sense, the GMD3 Management Program provides the ongoing regional drought resiliency program. The severity of local drought under the management program relates both directly to the three drought stages of Watch, Warning and Emergency described in Tables 2 and 3 of the Kansas Drought Operations Plan, and also to the extent local groundwater reservoir inventory and infrastructure has capacity to mitigate local water shortage conditions. The Kansas Drought Operations Plan can be accessed at: <https://kwo.ks.gov/reports2/climate-and-drought-monitoring-response> The Kansas 2007 Municipal Water Conservation Plan Guidelines reflect the drought response stages in the Kansas Drought Operation Plan. No response activities other than those contained in local municipal water conservation plans are currently directly tied to these stages. It is recommended that water conservation plans be reviewed and updated regularly.

U.S. Drought Monitor – The U.S. Drought Monitor is produced weekly through a joint effort of the U.S. Department of Agriculture, The U.S. Department of Commerce – National Oceanic and Atmospheric Administration and the National Drought Mitigation Center. Advice from local experts throughout the nation, including the Kansas State Climatologist, is used in producing the Monitor. This composite drought map incorporates information and products from hundreds of experts from many entities and levels of government in an effort to represent the extent, magnitude, impacts and probability of occurrence. GMD3 will work to develop water use, climate and conservation feedback to members utilizing annual water use report, site visits and other data

to inform and assist members in their decisions affecting their drought resiliency. Both short term management program drought response tools like Multi-Year Flex Accounts and long-term strategies for type 2 groundwater reservoir maintenance will be employed to help determine the destiny of water use in the district.

State mandated water conservation plans. There are many mandated irrigation water conservation plans in the district intended to encourage type (1) water conservation originating from a joint state and district initiative beginning in year 1990, with legislation passed the following Kansas legislative session. Under that law (K.S.A. 82a-733), the state Chief Engineer may require applicants for permits to appropriate water, water users with relatively high use, and water users applying for any state administered grant, loan or cost-share moneys for water-related projects to develop water conservation plans. Plans have been required and made a condition of water use for hundreds of irrigation water rights in GMD3. GMD3 has historically aided members with completion of conservation plan requirements assisted by State Water Plan funding.

The Kansas Water Office (KWO) is a study, program coordinating and planning partner of the GMD3 management program. Millions of dollars are paid into the state Water Plan Fund each year from the district area. One activity of the KWO is in developing and maintaining guidelines for water conservation plans under responsibilities and duties per K.S.A.74-2608 as follows:

“74-2608. Duties of office. The Kansas water office shall:

(a) Collect and compile information pertaining to climate, water and soil as related to the usage of water for agricultural, industrial and municipal purposes and the availability of water supplies in the several watersheds of the state, and, in so doing, the office shall collect and compile the information obtainable from other agencies, instrumentalities of the state, political subdivisions of the state and the federal government.

(b) Develop a state plan of water resources management, conservation and development for water planning areas as determined by the office, and cooperate with any agency or instrumentality of the state or federal government now or hereafter engaged in the development of plans or having developed plans affecting any such area of the state.

(c) Develop and maintain guidelines for water conservation plans and practices. Such guidelines shall:

(1) Not prejudicially or unreasonably affect the public interest;

(2) be technologically and economically feasible for each water user to implement;

(3) be designed to curtail the waste of water;

(4) consider the use of other water if the use of freshwater is not necessary;

(5) not require curtailment in water use which will not benefit other water users or the public interest;

(6) not result in the unreasonable deterioration of the quality of the waters of the state;

(7) consider the reasonable needs of the water user at the time;

(8) not conflict with the provisions of the Kansas water appropriation act and the state water planning act;

(9) be limited to practices of water use efficiency except for drought contingency plans for municipal users; and

(10) take into consideration drought contingency plans for municipal and industrial users.

When developing such guidelines, the Kansas water office shall consider existing guidelines of groundwater management districts and the cost to benefit ratio effect of any plan.

(d) The Kansas water office, with the approval of the Kansas water authority, shall establish guidelines as to when conditions indicative of drought exist. When the Kansas water office determines that such conditions exist in an area, it shall so advise the governor and shall recommend the assembling of the governor's drought response team.”

Current state guidelines for irrigation conservation plans are available at:

<https://kwo.ks.gov/docs/default-source/reports-page/water-conservation-reports/2006-kansas-irrigation-wcp-guidelines-jan2006.pdf?sfvrsn=6>

And for municipal (public water supply) use available at:

<https://kwo.ks.gov/docs/default-source/reports-page/water-conservation-reports/2007-municipal-wcp-guidelines-aug2007.pdf?sfvrsn=4>

Water conservation under state guidelines. Under Kansas Water Office water conservation plan guidelines, water conservation is defined as: *“The utilization of cost-effective water use efficiency practices to curtail the waste of water and to ensure that water use does not exceed reasonable needs.*

This general definition to implement K.S.A. 82a-733 of the KWA Act and other water use considerations of the Kansas Water Office addresses use efficiency; which is type (1) water conservation activity under the GMD3 management program. Type (2) water conservation activity under the management program requires other guidelines for the added benefits of conservation and corrective controls. GMD3 will seek to develop district guidance and assist members in an understanding of the terms, limitations and conditions of water use under their water right, water use agreements and/or GMD3 management program activities. Per Subsection (g) and (h) of K.S.A 82a-733, GMD3 will review and consider approval of conservation plans and practices required pursuant to this section unless such plans and practices are incorporated in the groundwater management district's management program which has been approved pursuant to K.S.A. 82a-1029 and amendments thereto.

GMD3 water conservation plan guidelines. GMD3 guidelines will be investigated, developed and updated as needed under separate guidance documentation to this management program that achieve the following:

1. Provide a plan template that can be used to develop a water conservation plan to meet the requirements of GMD3 management program, the state, and/or other partners, federal interests, institutions and authorities.
2. Provide considerable flexibility to develop and monitor water conservation plans based on management program desires and initiatives;
3. Provide Internet access to the Guidelines and the Plan template, so that members, consultants and other management partners can easily download the template or develop a Plan.
4. Include a subsection on source conditions and management goals.
5. Plans more useful to member water managers, so that the majority of GMD3 water users can be directly involved in the management of their local water sources and use destiny;
6. Provide for an efficient, source benefiting, and consistent water conservation plan format; and
7. Curtail waste of water using readily available best practices that ensure that water use does not exceed reasonable needs.

Benefit-to-cost ratio effect of conservation plans. K.S.A 82a-733 requires benefit-to-cost review for conservation plan guidelines. The more documentation obtained on the actual benefits from water conservation, the more believable are the results from a cost-benefit analysis of potential programs or activities. Once benefits and costs over the projected life of the water conservation plan have been estimated and discounted to their present value equivalents, it is straightforward to determine whether a project's conservation plan benefits would be expected to

exceed its costs under classic economic theory. A common way to compare the benefits and costs of a conservation plan is to divide total benefits by total costs. The result is called the benefit-to-cost ratio, or B/C ratio. A B/C ratio greater than one indicates that benefits are greater than costs while a B/C ratio less than one indicates that costs are greater than benefits. A B/C ratio exactly equal to one indicates that costs are expected to exactly balance benefits of the water conservation plan. Alternative conservation projects can be ranked by their net benefits or B/C ratios to identify which projects are expected to provide the greatest amount of benefit to members and the district. More information on B/C ratio calculations may be provided in separate guidance documentation of the management program.

Water flowmeters. The GMD Act under K.S.A. 82a-1028(1) provides a GMD has the power to “*install or require the installation of meters, gauges, or other measuring devices and read or require water users to read and report those readings as may be necessary to determine the quantity of water withdrawn.*” GMD3 works with members and partners to provide the expert judgement in flow measurement and practical program administration to accomplish this management activity. Water measurement in its various forms is much more than just a water right compliance activity. Recognizing the difficulties of managing what is not measured, the GMD3 board was an early leader in advocating for and requiring water flowmeters and measurement reporting on all non-domestic water uses in 1991. Thousands of flowmeter inspections are conducted by GMD3 each year and feedback is provided as a service to members. See inspection video at: <https://www.youtube.com/watch?v=exmaiZAEMnE&t=1s> Measurements identify opportunities for water project improvement, showcases examples of efficient use, ties use to water level response and other valued data uses for members and the management program. Use measurement at the project level empowers and demonstrates water stewardship. Metering water use is an important management tool to adequately monitor and evaluate the effectiveness of groundwater management at the project level and regionally as a district. Hefty GMD3 seals are installed as a member service when light weight manufacture seals are in place in order to preserve the durability of rule presumptions of existing seals.

Infrastructure performance and conservation awareness. A key response to the problem of achieving greater water conservation is in awareness of risk and opportunity. Well performance decline, supply constraints and supply outlook are important to review in the routine exchanges between members and government staff to update everyone on current use and supply conditions and any concerns with the future of their local source of water supply. From recent water use data for nondomestic wells in the district, nearly one quarter (23%) of the authorized wells are not used annually (about 2440 wells) and about 1.6 million acre-feet of authorized groundwater use does not occur annually on average. Water conservation activity that has been occurring in many forms within the district will continue to improve as new technology, new water project feasibility formulations and new evaluation tools add value to wise use of present opportunity to secure the needed future supply.

Capping new appropriations to conserve and extend groundwater supply. Once water rights were made mandatory in the state, GMD3 adopted conservation measures and conducted maximum allowable depletion rate water availability calculations and made recommendations to the Chief Engineer for each new water appropriation application. The Chief Engineer relied upon GMD3 calculations to grant or deny new water rights in the district based on a maximum allowable rate of depletion not to exceed 40% in 25 years. This conservation partnership includes recent GMD3 action to adopt a closed groundwater reservoir policy and to request that the Chief Engineer close the Ogallala/High Plains groundwater reservoir to new water rights with some

small use exceptions. Those small use exceptions have subsequently been reviewed by GMD3 and Board resolution 2018-5 was passed to require a minimum of offsets for any new non-domestic water right to help avoid nullifying member local source conservation efforts and not inflate appropriation totals. In addition, GMD3 will be working with well owners in a review process to reveal and evaluate current well and groundwater reservoir conditions with each administrative request to the state. The fundamental conservation policy of GMD3 in such cases is that there is no additional water available from the source beyond what is needed to satisfy existing water rights under the management program.

GMD3 member water conservation stewardship. There are extensive undocumented groundwater conservation activities by individual members within the district that are implemented as a matter of good practice and personal resource conservation stewardship. A full review of the many water conservation activities is too lengthy to list here and may be enumerated in separate GMD3 implementation documents. Voluntary water conservation efforts in the district include:

- Water use measurement, management, reporting and evaluation.
- No-till farming methods which improve soil moisture retention.
- Crop selection and rotations that require less water than historically needed.
- Improved irrigation system efficiency technology.
- Enrollment in voluntary sponsored programs of GMD3, state and federal partners.
- Local conjunctive management practices of surface water and groundwater.
- Voluntary member conservation, including non-use of viable wells.
- Reuse of wastewater and effluent left over from primary beneficial uses.
- Use of lessor quality water where economically and technologically feasible.

GMD3 water conservation leadership. Public policy can and does accelerate the adoption of conservation products and services through incentives, including cost sharing, regulatory relief, tax credits, rebates and technical assistance. GMD3 will continue to provide leadership and support activities for water conservation as defined in this management program in coordination with other local, state and federal partners to conserve, extend and replenish the groundwater inventory of the district. Recent examples include:

- Over 2500 project diversion site visits occur annually by GMD3, including flowmeter instillation checks, management plan audits and groundwater pump flow testing.
- Western Water Conservation Projects Fund (**WWCPF**) projects working through a nearly \$10 million grant (2008) from the Kansas legislature to relocate interstate supply damages from SGF through a legislative budget proviso and grant agreement with the Kansas Water Office.
- Conservation Reserve Enhancement Program (**CREP**) working with the state and federal Farm Service Agency and partners to retire water rights and transition irrigated agriculture to native grassland in parts of the Ark River basin, contributing cash and in-kind services;
- Water Transition Assistance Program (**WaterTAP**) was promoted by GMD3, Kansas Water Congress and partners authorized under K.S.A. 2-1930 for state conservation incentives to be administered by the State Conservation Commission supported by GMD3 and partners.
- Agricultural Water Enhancement Program (**AWEP**) agreement with USDA/NRCS to transition irrigated acres to dryland agriculture (completed) with ongoing use of Environmental Quality Initiative Program (**EQIP**) conservation tools and opportunities;

- Regional Conservation Partnership Program (**RCPP**) agreement with USDA. In 2015, GMD3 was awarded a \$2.4 million-dollar grant from the NRCS to help incentivize Advanced Irrigation Water Management across the region through telemetry technology, remote soil moisture and flowmeter monitoring as added conservation activities;
- Conservation Innovation Grant (**CIG**) agreement (2016 - 19) with NRCS that evaluated mobile drip irrigation and other application innovations with the goal of federal implemented assistance for uptake of mobile drip water conservation technology in a thousand fields;
- System Optimization Review (**SOR**) with the US Department of Interior, Bureau of Reclamation (Reclamation), which evaluated the irrigation ditch delivery systems along the Arkansas River corridor for targeted efficiency improvement projects;
- Local Enhanced Management Area (**LEMA**) discussions and surveys with members to consider local mandatory and voluntary groundwater conservation strategies with corrective controls in priority areas of the district;
- Water Conservation Area (**WCA**) review and policy development to assist members and the state in developing voluntary water conservation plans for real corrective controls and appropriate project groundwater management consistent with state law;
- Planning Assistance to States (**PAS**) partnering with the Kansas Water Office and the US Army Corps of Engineers in 2015 to update a 1982 High Plains Study Water Transfer Element for conserving waters of the state normally lost annually from use in Kansas.
- Public Water Supply (**PWS**) 2014 WaterSMART study grant working with Reclamation and Kansas Water Office to examine public water supply options for systems to maintain safe drinking water in the depleting usability of the GMD3 Upper Ark basin groundwater supply that includes the IGUCA above Garden City.
- Basin Plan of Study (**POS**) effort in 2015 with Reclamation seeking Ark River basin planning partners in the Arkansas River basin spanning the Stateline with Colorado and includes the Hamilton County river corridor outside the district for collaborative efforts addressing contaminated water and other water concerns in the shared resource that set the stage for 2019 legislative resolutions requesting partnerships and other state and federal cooperative action.
- Value of Water (**VOW**) evaluations with the Docking Institute for Public Policy (2000) and the Kansas Aqueduct Coalition and Apparet Analytics, LLC (2015) on the value of water to Kansas and the GMD3 area.

Rain capture, re-use and recycled water. As members confront the challenges of capturing and delivering enough freshwater to meet the needs of agricultural, industrial, municipal and environmental users, one way of expanding the usable supply of water is using harvested, recycled and/or reclaimed water for irrigation and other purposes. In some cases, potable water has been the only water resource available for irrigation, either because of infrastructure constraints or regulation. Under suitable conditions, irrigating crops, landscapes and recreational areas with harvested, recycled and/or reclaimed water will not only increase the water available for health and human safety, but will also support the environment through economic, social and environmental benefits. Limited water usability will necessitate treatment to gain appropriate purity levels for use and the effects on supply of other users should be adequately evaluated.

Non-potable water conservation. Like potable water, non-potable water is a vital and limited resource that requires management to avoid waste in valuable water resources. GMD3 will encourage additional study and implementation of recycling and reuse projects that have

historically occurred as part of water resource management activity in the water short environments and economy of the GMD3 area.

MYFA conservation. Starting in 2001 and revised several times in subsequent years in response to widespread drought, the Kansas legislature provided a **Multi-Year Flex Account, or MYFA** water management policy for owners of groundwater rights and authority for the Chief Engineer in the KWA Act. The MYFA law provides for flexible groundwater use from the same well over five years as follows: **K.S.A. 82a-736. Multi-year flex accounts; term permits.** *(a) It is hereby recognized that an opportunity exists to improve water management by enabling multi-year flexibility in the use of water authorized to be diverted under a groundwater water right, provided, that such flexibility neither impairs existing water rights, nor increases the total amount of water diverted, so that such flexibility has no long-term negative effect on the source of supply.* The updated law contains two provisions for considering past implemented water management and conservation. Under the GMD3 management program, a groundwater conservation factor calculation is needed in order to properly implement the MYFA provision for considering member implemented groundwater conservation activity in the district.

Due consideration for past management or conservation measures. In 2015, the Kansas legislature added the following policy to the Water Appropriation Act. **K.S.A. 82a-744. Water management and conservation measures; due consideration by chief engineer.** *(a) The chief engineer shall give due consideration to water management or conservation measures previously implemented by a water right holder when implementing any further limitations on a water right pursuant to any program established or implemented on and after July 1, 2015. The chief engineer shall take into account reductions in water use, changes in water management practices and other measures undertaken by such water right holder.*

This statewide policy under the KWA Act requires “due consideration” to previously implemented management and conservation measures when the Chief Engineer implements new limits on a member water right for any new water conservation program after July 1, 2015. Under the GMD3 management program and the unique considerations of the district, **it is the opinion of GMD3** this means the Chief Engineer will sit down and think about a number of public interest considerations that include: priority of right; the water management or conservation measures previously implemented by a member water user or water right holder; account for changes in groundwater use practice improvements under the water right; consider the condition of the local source of supply; consider the guidance and advice of the management program and GMD3; and decided how to implement the new program in the GMD3 area in a manner consistent with the management program or any proposed revision as required in K.S.A. 82a-1042 of the GMD Act.

Surface water conservation storage as groundwater. Linking natural and constructed water infrastructure to conserve and manage water supply is a key activity to add water value and to manage sustainable supply systems for Kansas. State water policy and management should maximize the use of surface water supply and groundwater storage space assets. Operational integration of surface and groundwater storage will increase water supply for all users. The significant demand annually for water (3.6 million acre-feet developed in SW Kansas alone), and the more that 60 million acre-feet of available groundwater reservoir storage space in GMD3 compels action on the water extremes in Kansas flood and drought conditions to secure minimal value supplies to meet higher value needs. The untapped potential of a cooperative groundwater reservoir storage initiative may identify opportunities for storage when surface water reservoirs are unable to accommodate the opportunities for Kansas. Today on average, more than eight times the annual amount of groundwater used in Kansas leaves the state annually as river flow.

So, the conservation and management of available surface water presents significant opportunity for leadership that will find the opportunities to divert, transport and store water in the groundwater reservoir pore space in the GMD3 area. Available surface water flow is a limited time supply opportunity that should be harvested and conserved and managed accordingly to meet demand and to replenish groundwater inventories. Any GMD3 management program activity looking to include future agreements or contracts to purchase and transfer excess water from local, state or federal surface water conservation capacity may carry a requirement to adopt and implement water conservation plans and practices that are consistent with the state guidelines as per K.S.A. 82a-1311a. It is a purpose of the GMD3 water conservation program to exceed state standards for type (1) efficiency and waste elimination activity with type (2) water conservation storage activities.

Conservation storage in groundwater reservoir pore space in GMD3. In recent years the issues surrounding geological formation pore space and rock structure ownership has been raised in discussions generally connected to oil and gas operations for carbon capture sequestration into subsurface geologic formations and for ownership and management rights in topics of water rights administration, federal reserved water rights, deep formation disposal projects and in artificial storage and recovery of water. With water being an exception in Kansas, generally ownership of the surface of the land includes ownership of all that lies beneath the surface boundaries, to include mineral, rock structures and voids (David Pierce, Washburn Law School, legislative briefing, 2011).

Estate ownership. Ownership of the surface estate of land can be separated from one or more mineral estates below the surface of the earth, which is where one finds groundwater. The owner of the surface estate generally retains ownership of minerals not expressly encompassed by the conveyed mineral estate. Owners of minerals (oil and gas) also have the right to access the rock structure where the oil and gas are found so they can be developed, even though the mineral owner may not “own” the minerals comprising the rock structure. Similarly, a water right to use groundwater may be a right to access the water in the pore space even though the user may not own either the surface or the mineral estate. Recall a water right is a usufruct right of use where ownership is not conveyed in the corpus of the water or the channel of the stream or groundwater rock formation. Regardless of who owns the pore space of the rock formation, it is going to be connected and one cannot control where it goes. Pore space structure, like oil and gas reservoirs or groundwater reservoirs, is not compartmentalized beneath a single tract of land but is interconnected by body of rock. The naturally stored usable water within the rock formations is a part of the “waters of the state” governed under the provisions of the KWA Act and the GMD Act and the management program. The GMD Act in K.S.A.82a-1021(a)(7) defines a “land owner” but includes the following: *“Owners of oil leases, gas leases, mineral rights, easements, or mortgages shall not be considered landowners by reason of such ownership.”*

In groundwater management affairs, the risks associated with ownership in either the surface estate or one or more mineral estates may be intertwined with several factors that include land use, the quality and quantity of available water supply, the effects of mineral estate exploitation on usable groundwater supply, and the opportunity to participate in groundwater management activities as an eligible voter of GMD3. A natural groundwater reservoir may contain a native body of public water subject to the public processes of appropriation and groundwater management, but artificial conservation storage in geological formation pore space owned by another for personal control of the water may be something different. For example, ownership of a surface reservoir storage space comes from acquiring the use of the surface estate and construction of the storage space for conserved surface water. Use of a natural water course is

provided in Kansas policy for private conveyance of water (K.S.A. 42-303) but a constructed surface reservoir on a surface water course for controlled use of conservation storage requires easement or ownership of the surface estate. Groundwater reservoir pore space may be replenished or filled with non-native water under a managed program where there is reasonable effect on the satisfaction of prior groundwater rights to native supply. This is based on the theory that no owner of either the mineral estate or the surface estate or of a water right should be allowed to hold management improvements to natural water storage in underground reservoir pore space for ransom. Ownership and use of natural recharge infrastructure vs. artificially constructed recharge infrastructure, and the retained ownership of artificial conservation storage in formation pore space owned by another, may be key factors as to the question of whether any pore space use easement may be necessary.

Conservation in preparing for water imports. As society confronts the challenges of capturing and delivering enough fresh water to meet the needs of agricultural, municipal, industrial, and environmental users, multiple sources must be managed with type (2) conservation from transferred sources. The Kansas Water Transfer Act in K.S.A. 82a-1502(b) and (c) state:

(b) “No water transfer shall be approved under the provision of this act: (1) if such transfer would impair water reservation rights, vested rights, appropriation rights or prior applications for permits to appropriate water; and (2) unless the hearing officer determines that the applicant has adopted and implemented conservation plans and practices that (A) are consistent with the guidelines developed and maintained by the Kansas water office pursuant to K.S.A. 74-2608 and amendments thereto, (B) have been in effect for not less than 12 consecutive months immediately prior to the filing of the application on which the hearing is being held.”

(c) “To determine whether the benefits to the state for approving the transfer outweigh the benefits to the state for not approving the transfer, the hearing officer shall consider all matter pertaining thereto, including specifically: ... (7) the effectiveness of conservation plans and practices adopted and implemented by the applicant and any other entities to be supplied water by the applicant; (8) the conservation plans and practices adopted and implemented by any persons protesting or potentially affected by the proposed transfer, which plans and practices shall be consistent with the guidelines for conservation plans and practices developed and maintained by the Kansas water office pursuant to K.S.A 74-2608 and amendments thereto.”

The conserve-to-preserve water activity under the GMD3 management program will fulfill the purposes of the KWA Act and Water Transfer Act to exceed statewide guidelines emphasizing type (2) conservation for groundwater reservoir maintenance to ensure the needed conservation of existing supply and allow new storage of transient surface water captured and transferred into the 60 million acre-feet of available storage space managed under the GMD Act in GMD3.

Additional wells vs. supplemental wells and “chasing water.” Additional wells may be necessary to allow a partial sale and change of water right use from irrigation to a higher value beneficial use. This additional well activity is distinguishable in the management program from efforts to add one or more wells to a water right authorized annual quantity in order to supplement or restore aquifer extraction rate capacity as sources to replace lost capacity due to general water level decline. This raises concerns for changing purpose and strategy of the management program, causing a disproportionate local rate of aquifer depletion and a “chasing water” concern to eventual complete depletion of supply to all. At a minimum, careful evaluation procedures are necessary to identify critical wells under such proposals. A **Standby well** is different yet as a source security condition documented on the water right of a primary well, should catastrophic

failure occur. A standby well meets standard spacing from the primary well of other water rights. A primary well is not required to meet well spacing from its standby well and emergency operation is for 60 days.

Local rule-based conservation. Local management program strategies cannot succeed as intended if local rules are waived in favor of statewide initiatives without careful evaluation of the effects on the management program purposes. **“Paper water”** is considered a legitimate water right on paper but lacks divertible supply from the authorized source. “Paper water” on wells in a depleted local source of supply must be allowed to remain dry and the junior demand unsatisfied in the absence of new water to replenish depleted supply or unreasonable effects on senior water rights. “Paper water” does not carry a right to chase remaining water supply and create a functional equivalent of new appropriation outside the local source of supply under the management program for type (2) conservation efforts. Moving “paper water” may deny supply to other members wells with prior rights to depleting future supply unless evaluated carefully.

Culture of conservation. Growing the market for water conservation in a culture of market driven use involves a strategy of reaching out to specific industry groups and locales which have comparatively low rates of participation and engagement around water conservation and efficiency. As more members participate, vendors can develop economies of scale and more cost-effectively run active and passive programs. “Growing the culture” naturally occurs as participation rates increase across the district. While programs might lose their potential for scale as more members participate, the proportion of the population engaged increases.

Targeting water conservation to a Groundwater Management Area (GMA).



GMA. GMA is a general term for any targeted area in the district identified for unique specified groundwater management program activity. GMD3 conservation and/or management activity may exist to accomplish a special private, corporate or governance goal and use one or more institutional tools uniquely applied through the district management program in each GMA.

Conservation barriers. GMD3 and other Kansas GMD’s pursued forming special GMAs for corrective controls in 1977, but found a lack of local and state authority, which was considered barriers in attempting to manage groundwater supply and use. Local or state permitting of all non-domestic water use was not required in Kansas at the time and the extent of water use was not known. The GMD3 Board immediately requested an official moratorium on granting new water rights by the Chief Engineer for an area in the Arkansas River basin above Garden City to allow work for data and policy development on over-allocated water short areas. The difficulty of managing what is not defined was recognized and addressed.

Mandated permitting and IGUCAs. Legislation was successful in 1978 to add state policy in the KWA Act requiring permitting of all water rights to define water use across the state and to add policy in the GMD Act providing authority for a GMD or a group of GMD members to initiate special GMA corrective control action in their GMD. That GMA tool was called an Intensive Groundwater Use Control Area, or “IGUCA.” It was designed as a request made to the Chief Engineer, who then must conduct a process to consider the need and formation of the IGUCA. The IGUCA tool, once requested by a GMD, involves a prescribed review and fact-finding process where the Chief Engineer conducts one or more public hearings and can result in an order of the Chief Engineer imposing corrective controls on water use. For areas outside

GMD's, the legislature extended the IGUCA tool for the chief engineer to initiate proceedings on his own initiative. A few IGUCA management orders have been developed and issued to implement mandatory corrective controls onto groundwater rights in GMA's across the state.

GMD3 Upper Arkansas River IGUCA. The Upper Arkansas River IGUCA was requested by GMD3 in 1984 as a GMA to replace the GMD3 requested 1977 moratorium on new appropriations in certain counties with high vested right amounts. The request was to extend corrective controls from the Colorado and Kansas Stateline in a corridor along the river across GMD3. This IGUCA was ordered after significant public process, testimony and recommendations of the Board and district members to the Chief Engineer. See map of the IGUCA area in the Appendix. Any revision action should include GMD3 review. Additional state information on the Upper Arkansas River IGUCA is available at:

<http://agriculture.ks.gov/divisions-programs/dwr/managing-kansas-water-resources/intensive-groundwater-use-control-areas/arkansas-iguca>

Corrective controls. Water right administration under the prior appropriations doctrine is the most direct form of corrective control provided by the Kansas legislature for water short supply conditions. Protecting a prior right generally involves a complaint, opposition to an administrative action or a request to secure a water entitlement. Beyond water right administration, corrective controls are considered new program actions to secure corrections to water supply decline problems. Corrective controls are intended to benefit future supply in addition to present use constraints. It is well established that the supply problem conditions set forth in K.S.A.82a-1038 of the GMD Act exist across the entire GMD3 area for the OHP groundwater reservoir. These conditions have been perpetuated in the routine approval decisions of the Chief Engineer in applications made to the state. Corrective controls in the declining OHP aquifer must add new controls as Type (2) water conservation to maintain aquifer storage and improve future supply under the management program. Proper corrective controls ensure that member benefits fall both to members seeking use improvements do not already have higher use than their peers from the same supply area with comparable circumstances. Members may not benefit from higher groundwater use than their peers in the application of additional use benefits from voluntary corrective controls. GMD3 management program guidance documents may provide further standards and mitigation methods for securing proper corrective controls.

Targeted water rights buy-back. State buy-back of water rights can occur, if funded, under K.S.A. 2-1915. In pertinent part, "... (c) *Subject to the provisions of K.S.A. 2-1919, and amendments thereto, any holder of a water right, as defined by subsection (g) of K.S.A. 82a-701, and amendments thereto, who is willing to voluntarily return all or a part of the water right to the state shall be eligible for a grant not to exceed 80% of the total cost of the purchase price for such water right. The state conservation commission shall administer this cost-share program with funds appropriated by the legislature for such purpose. The chief engineer shall certify... in accordance with the criteria established in K.S.A. 2-1919, and amendments thereto. ... (g) (1) The state conservation commission shall make water right transition grants available only in areas that have been designated as target or high priority areas by the groundwater management districts and the chief engineer... or priority areas outside the groundwater management districts as designated by the chief engineer...*"

LEMA. The Legislature added a new GMA tool in 2012 for GMD's after more than a decade of development work by Northwest Kansas GMD4 and partners. The Local Enhanced Management

Area (LEMA) statute (K.S.A. 82a-1041) provides a procedural structure for the development of LEMA management plans that are to be consistent with state law. These plans can be developed and requested by a GMD governing body to the Chief Engineer for needed area corrective controls. If accepted after a public process, enforcement occurs by the state.

LEMA plans. A LEMA plan is intended to further empower local leaders and the GMD3 governing body to address local groundwater concerns. Local water right owners and other members of GMD3 can come together to seek ways to reduce the rate of groundwater decline. The GMD3 Board has the authority to recommend a plan of a LEMA to the chief engineer, who must consider only the requested plan for adoption. GMD3 has adopted LEMA plan policy that a proposal should be recommended to the GMD3 Board by members as a priority GMA to be further managed with infrastructure development and/or corrective controls in the public interest. Basic steps for establishing a GMD3 LEMA involve formulation of a plan generally accepted by area members, presentation of the plan to the Board, Board adoption of the proposed plan, Board request for a LEMA to the Chief Engineer based on the plan, two prescribed public hearings considering the proposed plan, and a decision order of the Chief Engineer approving, returning, or rejecting the LEMA. Any LEMA plan proposed to the Board for adoption shall include: 1) A clear groundwater management goal; 2) A basis for the proposed boundaries; 3) Evidence in the record of plan development that multiple alternatives were formulated for setting corrective controls on member water rights, including use of the principle of prior appropriation; 4) Reasoning for the use or rejection of each alternative; and, 5) The recommended strategy for determining the will of the eligible voters of the district having property rights within the proposed LEMA area. GMD3 staff will support the development of a LEMA by members and will identify facilitation resources for beneficial conservation plans and evaluate impacts of goals for corrective controls, including effects on present and future property valuation and economy.

Special rule conservation areas. Another GMA tool identified by the management program is a special rule conservation area with controls established or requested as an enforceable policy or state rule area of corrective controls. These concerns may be quantity, usability or use practice related concerns that require administrative standards to manage or encourage efficient groundwater use while protecting useable supply. K.A.R. 5-23-4(c) is a special rule for a water quality control area in parts of Seward and Meade Counties. The potential for upwelling of naturally occurring saltwater in Upper Permian Age formations to invade into the overlying connected Ogallala groundwater reservoir formation threatens water usability depletion.

Voluntary consent agreements. A voluntary agreement can be a highly effective tool to obtain regulatory, conservation or other water management needed outcomes. This tool was used early in a federal court consent decree of 1910 to establish the Associated Ditches of Kansas along the Upper Arkansas River. A local leadership role was recommended in state water planning for groundwater management in a 1958 Cimarron Basin Water Resources Report. Voluntary agreements for water management consistent with the management program are highly supported and encouraged by GMD3. Today, the voluntary consent agreement tool includes various forms in conservation plans, water banking and other water management activities that benefit from voluntary consent agreement.

“Water Conservation Area.” In 2015, the Legislature provided an additional GMA tool called a “Water Conservation Area (WCA)”. A WCA is a KWA Act tool where any water right owner, or group of owners can develop a water conservation plan for consideration and agreement of the

Chief Engineer to commit water rights to conservation through voluntary corrective controls consistent with other laws and the public interest. As described earlier in the management program, public interest includes the GMD Act and GMD3 management program and recommendations of the governing body. By order of the Chief Engineer, a WCA plan consent agreement becomes new authority that temporarily changes water use conditions without changing base water rights, as base rights are viewed as becoming suspended during the period of the WCA. WCAs are intended to encourage conservation through volunteered corrective controls and are best used under the management program to document voluntary water conservation.

Changing WCA plans and agreements. With the consent of all participating water right owners in a WCA, the Chief Engineer may amend the agreement and order to modify corrective controls or boundaries, add or remove water rights, terminate the WCA or make other changes requested by the water right owner(s). Under the management program, GMD3 will review each proposal, WCA change or extension and provide recommendations to the chief engineer to implement the management program. GMD3 supports and encourages the voluntary implementation of groundwater reservoir maintaining corrective controls in WCA consent agreements that are consistent with the policies of the GMD3 Board and management program. GMD3 will adopt and enforce policy as needed to implement the Management program and WCA's and for other purposes as provided in state law. For more state information on the WCA tool, see:

<http://agriculture.ks.gov/divisions-programs/dwr/managing-kansas-water-resources/wca>.

Water bank conservation and review. Water banking policy has different application in declining vs. non-declining groundwater reservoir areas. A water bank can have many elements that have both good and bad implications on the management program. Similarly, some statewide statutory provisions, such as "Flex Accounts", LEMAs, WCA's can affect groundwater reservoir use and groundwater reservoir storage and can authorize elements of water banking. These can have a profound impact on the management program. GMD3 will review each water bank or bank-like proposal to determine effects on district groundwater reservoir supply and consistency with the management program and public interest.

Mobile Drip Irrigation. Irrigation by the drop on the High Plains of southwest Kansas.



Mobile Drip

A combination of price and non-price strategies are needed for supply security improvement. Planning, regulation, education and the uptake of water efficient technologies are important in the GMD3 management program where drops of water matter.

See video at: <https://www.youtube.com/watch?v=3yT9yiyjB-4>



GMD3 Ark River Management Program

The management program for Southwest Kansas includes management considerations and activities associated with the Arkansas (Ark) River. Ark River flows from upstream snow melt, runoff events, groundwater reservoir discharge and surface reservoir storage release. The Ark River is a historically significant source of renewable water supply for southwest Kansas use and storage in a highly developed and regulated basin that necessitates management activity by GMD3 in the public interest. In the decade of the 1970s, the mining of groundwater near the Ark River added groundwater storage space that has captured and conserved available river flows for district storage, effectively adding a terminal groundwater reservoir at the lower end of the basin affected by the Kansas and Colorado interstate compact.

Authority. Relevant authority for the GMD3 Ark River Management (ARM) program activities are in statutes that include without limit:

- K.S.A. 82a-1020 declaring the purposes of the GMD Act and establishing the right of water users to determine their destiny regarding water use;
- K.S.A. 82a-1028(g) to construct, operate and maintain such works as may be determined necessary for drainage, recharge, storage, distribution or importation of water, and all other appropriate facilities of concern to the district;
- K.S.A. 82a-1028(i) to contract with persons, firms, associations, partnerships, corporations or agencies of the federal government, and enter into cooperative agreements with any of them;
- K.S.A. 82a-1028 (m) provide advice and assistance in the management of drainage problems, storage, groundwater recharge, surface water management, and all other appropriate matters of concern to the district;
- K.S.A. 82a-1028 (n) adopt administrative standards and policies relating to the management of the district which are not inconsistent with the provisions of the GMD or the KWA Acts;
- K.S.A. 82a-1028(o) and (p) to recommend rules and regulations for the conservation and management of groundwater resources;
- K.S.A. 82a-1028(q) to enforce by suitable action, administrative or otherwise, rules and regulations adopted as provided by subsection (o) or (p);
- K.S.A. 82a-1028(r) to enter upon private property within the district for inspection purposes, to determine conformance of the use of water with established rules and regulations, including measurements of flow, depth of water, water wastage and for such other purposes as are necessary and not inconsistent with the purposes of the GMD Act;
- K.S.A. 82a-1028(u) to recommend to the chief engineer the initiation of proceedings for the designation of a certain area within the district as an intensive groundwater use control area.
- K.S.A. 82a-1029 adopt the official management program for the district area
- K.S.A. 82a-1041 to recommend Local Enhanced Management Areas;

Basin water resource change. Over time, hydrological change has occurred in the basin from a variety of activities, including development of surface water reservoir storage, re-regulation of river flows, direct diversion development, groundwater well pumping development, land use changes and water use efficiency changes. These have caused fewer and less intense rain runoff flows, riverbed and banks to narrow, diminished beneficial system flushing, diminished recharge to adjacent groundwater reservoirs, cottonwoods and tamarisk salt cedar to proliferate, floodways to fill with sediment and water quality to decline. Changes in the resource system have created mounting water management and supply concerns all along the basin. Opportunities exist to

provide leadership and management assistance in the district to address natural resource concerns as part of a GMD3 ARM program.



An Ark River problem breach of the riverbank between Garden City and Holcomb, Kansas

Water development. Some of the water management concerns that influenced the two states of Colorado and Kansas to enter into a compact agreement also influenced the adoption of the GMD Act in Kansas in 1972 and the formation of GMD3 in 1976. Immediate action was taken by GMD3, working with local and state partners to address special GMA needs as discussed earlier in the GMD3 Water Conservation Program section. Significant additional need and opportunity exists for GMD3 to continue collaborative work with other local, state and federal interests, institutions and authorities to address the unique water resource needs of Arkansas River basin water management within GMD3 and upstream of the district that affect water supply and water usability under the management program.

GMD3 Upper Ark GMA. The portion of the basin above Garden City to the Colorado and Kansas Stateline that include the IGUCA, ditch service areas and tributary underflow affecting supply within a 25-year prospective evaluation period is considered the GMD3 Upper Ark GMA for the purposes of the management program; an area to be further defined by mapping from the next update of the GMD3 groundwater model in 2020. For this area, native river flow, runoff events, reservoir deliveries, reservoir spill supply, groundwater reservoir water level management, irrigation return flow management and other activities upstream generally maintain river flow year-round to a point near the Kearny–Finney County line above Garden City. The problems of dwindling supply, river sediment accumulation and water usability depletion due to poor river water quality are significant growing concerns in the GMD3 Upper Ark river reach.

Upstream reservoir development. The loss of large spring freshet flows out of Colorado that historically flushed the river system down the basin has now left few options for affordable local solutions to river basin problems under a highly regulated river flow regime. Sediment load transported to points of water delivery and diversion cause accumulation of remaining sediment load that fills the floodway, increases flood risk and restrict surface water diversion and operating capacity of distribution systems. In addition, the river’s poor and declining water quality also

creates water usability depletion of the water resources of GMD3, affecting the fertility of soils receiving irrigation water within river water delivery areas and in adjacent groundwater use areas. Under such conditions, land valuation is diminished, and water quality threatens public health and the health of the local economy.

Lake McKinney. Lake McKinney is a private irrigation water storage lake owned by the Garden City Company. From study conducted by Lee Rolfs during the KS v. CO Original Action #105 case, Lake McKinney originally cost \$350,000 in 1906 and was the largest manmade lake in Kansas at the time. It was called Reservoir No. 5 at first but was renamed after J.R. McKinney, the sugar beet pioneer. In 1909, capacity increased to 31,063 acre-feet at a gage height of 3,030 feet above mean sea level, a maximum depth of 30 feet and surface area of 3,200 acres. At the time of vested right determination for the associated Great Eastern ditch system, all water deliveries had to pass through the lake, and transit loss needs associated with Lake McKinney operations factored into the determination of the vested right. The capacity of Lake McKinney has since been significantly reduced due in large part to declining available river flows in the basin in the 1970s. Lake McKinney remains an important local groundwater management feature of a ditch system that provides deep percolation losses that replenish area groundwater supplies.

Water quality. Arkansas River basin lateral flow into the state and district as Ogallala/High Plains (OHP) groundwater reservoir underflow is generally of good quality. However, water entering the state as Arkansas River flow is has seen high levels of contamination from a number of elements that include sulfate salinity and uranium. In addition to concerns of other contaminants, high radio nuclei levels have a significant effect on water treatment costs to restore water usability for public water supply and other systems. Estimates from the Kansas Geological Survey of the weight of uranium coming into Kansas annually from Colorado via the Arkansas River are concerning, indicating 10 tons annually delivered to Kansas each of 2017 and 2018.

Colorado Uranium delivery estimate results for the Arkansas River near Coolidge. Data and estimates for approach A, based on average annual flow, average annual specific conductance, and estimated average annual uranium concentration for each year (from D. Whittemore, KGS Open-File Report 2017-2, updated January 2019).

Year	Average annual Sp.C., $\mu\text{S}/\text{cm}$	Average annual uranium concentration, $\mu\text{g}/\text{L}$	Average annual flow, ft^3/sec	Average daily uranium load, kg/day	Annual uranium load, metric ton/yr	Annual uranium load, ton/yr	Annual uranium load, lbs/yr
2012	4,271	73.0	28.7	5.13	1.88	2.07	4,140
2013	4,395	75.9	26.9	5.00	1.82	2.01	4,020
2014	3,813	62.7	92.1	14.1	5.14	5.68	11,400
2015	3,230	50.1	196.1	24.1	8.78	9.68	19,400
2016	3,285	51.3	201.5	25.3	9.25	10.20	20,400
2017	3,324	52.1	234.6	29.9	10.92	12.03	24,100
2018	3,409	53.9	206.6	27.2	9.95	10.96	21,900

Water contamination reduces usability. The contamination of the Arkansas River basin water is diminishing the utility of the water and in some instances creates problems that must be addressed

at significant cost to local water users. Local irrigators who rely on surface water from river flows must run water through plastic pipes beneath their pivot systems because the saline river water is highly corrosive and will collapse a galvanized steel pipe sometimes within a single growing season. Higher volumes of river water must be used for irrigation than would be the case if the water were less saline, and often producers must either blend or run groundwater onto their fields after applying the water from the river to mitigate the effect of the salinity of the river water.

Water usability depletion. As reviewed in the 2015 federal Reclamation Basin Plan of Study, the contaminated river water from Colorado deep percolates into the subsurface and replenishes and contaminates the groundwater under the riverbed and ditch service areas of the basin. The saline nature of the water reduces its safe use and reduces crop yields. Mitigation efforts are employed to dilute the river water with fresher local groundwater for irrigation in the ditch service areas where possible, with return flows back to the groundwater reservoir continuing the water usability depletion of the OHP groundwater reservoir. The declining surface water and groundwater quality also greatly increases the operation and maintenance cost of irrigation systems due to its corrosive effects on water diversion works.

Public drinking water supplies. Within GMD3, the cities of Lakin, Deerfield, Holcomb and Garden City have experienced a decline in water quality due to infiltration of river water near their city well fields. District member City of Lakin recently had to construct a nanofiltration water treatment facility at great local expense to get their drinking water within the Environmental Protection Agency's (EPA) maximum contaminant limit (MCL) for uranium. The community must now bear an ongoing water usability depletion cost of millions of dollars and 15% loss of supply permanently disposed. The water extracted from the Deerfield and Holcomb wellfields has been within safe drinking water standards. However, it has been deteriorating and water usability is depleting. Those cities must develop additional freshwater sources and treatment solution and explore additional sources of reuse supply.

Federal partners. GMD3 worked with the US Department of Interior, Bureau of Reclamation (Reclamation) and Kansas Water Office to evaluate public water sources in the river basin above Garden City. The purpose was to help identify a plan, considering the deteriorating water quality and declining groundwater reservoir levels. The 2014 study included the cities of Coolidge, Syracuse, Kendall, Lakin, Deerfield, and Holcomb to identify possible solutions, including construction of new facilities, infrastructure, and collaboration efforts. The 2014 study identified local potential options for future public drinking water supply and need for added study.

Federal boundaries. Federal agencies have regional administrative area boundaries that may unintentionally function as institutional barriers limiting communications and collaboration within the proposed study area by potential partners and stakeholders. Each area office has developed its own set of stakeholder partners that may not normally be involved in issues or project concerns outside of the agency office area. Viable solutions to address the water quality problems across the proposed interstate study area may depend significantly on an added level of success in overcoming operational boundaries of federal agencies and other potential study partners in the study area. Federal agencies with operation office boundaries that end at the Colorado-Kansas Stateline in the proposed basin study area include: Reclamation, US Army Corps of Engineers, EPA, US Geological Survey, and the US Fish and Wildlife Service.

Kansas Legislative Resolutions. SR1729 and HR6018 were identical in message as passed by the respective houses of the Kansas legislature in 2019 session. They requested the federal government aid in addressing water quality issues in the Arkansas River Basin in Southeast Colorado and Southwest Kansas and for state and local partners, including GMD3, to cooperate in addressing the prevalence of radionuclides in the waters of the Arkansas River Basin. See SR1729 in the appendix. In response, the Kansas Water Office, Kansas Department of Health and Environment and the Kansas Department of Agriculture worked with the Kansas Geological Survey and GMD3 in a two-year Mineralization Study, with free drinking water testing provided to participating well owners. Additional work is needed with federal and interstate partners.

Compact. The Kansas-Colorado Arkansas River Compact (Compact) was negotiated in 1948 between the States of Kansas and Colorado. Article I of the Compact provides its purpose:

- Settle existing disputes and remove causes of future controversy between the states of Colorado and Kansas, and between citizens of one and citizens of the other state, concerning the waters of the Arkansas River and their control, conservation and utilization for irrigation and other beneficial purposes.
- Equitably divide and apportion between the states of Colorado and Kansas the waters of the Arkansas River and their utilization as well as the benefits arising from the construction, operation and maintenance by the United States of John Martin Reservoir Project for water conservation purposes.

The Compact does not allocate specific quantities of water to each state, but rather provides for maximum release rates for each State from the conservation pool. A provision of the Compact requires releases from John Martin Reservoir (JMR) storage be applied directly to beneficial use, without storage after release.

The reservoir is located approximately 60 miles west of the Stateline and has an available capacity for irrigation water supply of approximately 338,000 ac-ft. The JMR has an effective priority date in Colorado of 1948, though the Compact operations are not subject of a Colorado Water Court Decree but is state law in each state and also federal law.

Additionally, the Arkansas River Compact Administration (ARCA) operates the Compact and develops interstate agreements as resolutions. Resolutions include those Concerning the Operating Plan for John Martin Reservoir (1980 Operating Plan) as amended which establishes separate accounts in the JMR for users in Colorado and for Kansas along with related operating provisions affecting basin water use. ARCA also adopted a Resolution Concerning an Offset Account in John Martin Reservoir for Colorado Pumping as Amended March 30, 1998 (Offset Account). The Offset Account is provided to allow Colorado replacements to stream flow depletions caused by post-compact well pumping. As such, the Offset Account is not an additional water supply, but water that Kansas should have received if not for the junior Colorado groundwater pumping. Additional operating accounts are regularly requested by the state of Colorado that require careful study to consider further development in Colorado and Kansas. GMD3 has identified need for an interstate water management support account for Kansas.

Kansas Western Water Conservation Projects Fund. The KS v. CO original action no. 105 cash damage award to Kansas, after reimbursing the state for cost to litigate, was split 1/3 to the State Water Plan Fund (SWPF) and 2/3 to the Water Conservation Projects Fund (WCPF) for use

in the area affected by the compact violations. The statewide Water Plan portion was used primarily as state cash cost share funding to create the Kansas Conservation Reserve Enhancement Program (CREP) under contract with USDA. However, several state legislative budget cycles resulted in removal of most of those damage funds from the Kansas CREP.

Local leadership. The 2008 Kansas Legislature provided for GMD3 to administer WCPF to assure those public funds would be preserved from legislative budget sweeps for the intended purposes and created an efficient way to accomplish the purposes of the WCPF. This also allowed the investment interest on the principle fund to also accrue to those purposes under the fiduciary care of GMD3. Projects funded in whole or in part by the WWCPF must be in the area impacted by the Arkansas River Compact and meet eligibility requirements and goals in K.S.A. 821-1803 and Senate Bill 534. The WCPF became the Western Water Conservation Projects Fund (WWCPF) with project goals to do the following:

1. *Maximize general public good (public interest).*
2. *Maximize efficiency of call water for ditch irrigation (low transit losses).*
3. *Maximize benefits of high river flows to improve recharge.*
4. *Mitigate water quality problems in surface and groundwater.*
5. *Reduce consumptive use of water to help stabilize the system.*
6. *Improve the stability of the hydrologic system for irrigators.*
7. *Address compact compliance.*

Under a state legislative budget proviso in SB 534 and KWO Grant Agreement, the Arkansas River Litigation Fund Committee established in 2005 became the advisory committee to the GMD3 board, who in turn manages the funds, approves projects and expenditures, and makes requests to the KWO Director for approval as consistent with grant purposes, in consultation with the Chief Engineer, KDA/DWR. An annual audit and activities report to the legislature is provided by GMD3. The 2019 GMD3 Legislative Report may be found at:

<http://www.gmd3.org/about/special-meetings-and-committees/>

Ark River Watershed Group. GMD3 may continue to provide leadership to consider developing an Ark River Watershed group. All stakeholders share concerns regarding declining surface and groundwater quality, insufficient water supply, occasional flood flows, state and private land management, natural resources management, and intermittent and interruptible streamflow. The water quality within the upper portion of the Arkansas River in Kansas is very poor due largely to diminished stream flows, underlying geology of irrigated fields upstream of the proposed area, and other uses. The Kansas Department of Health and Environment (KDHE) has identified this stretch of the river as impaired waters due to gross alpha (bundled with uranium), fluoride, total suspended solids, boron, selenium, and sulfate.

GMD3 Lower Ark GMA. The river reach below Garden City and adjacent areas of the IGUCA and tributary flows affecting the benefits arising from the existing natural and constructed water infrastructure and system operations under the GMD3 management program is considered the GMD3 lower Ark GMA. This area is to be further defined by mapping in the next update of the GMD3 groundwater model in 2020. River flow at the Garden City USGS river gage is now a rare occurrence beyond local public infrastructure discharge. The river reach below Garden City has essentially become a closed basin where all flows enter the area become planned and accounted transit loss to conservation storage in the OHP groundwater reservoir. Little or no discharge occurs downstream out of the district below Dodge City. Groundwater development and loss of

surface inflows to the GMD3 Lower Ark GMA that used to replenish adjacent groundwater reservoir supplies occurred historically prior to regional mining and the formation of GMD3, making it necessary to apply groundwater management activities immediately upon the formation of GMD3 to mitigate problems, limit additional appropriations and address issues associated with the relocating of wells closer to the river channel. Transit loss river inflows to groundwater storage is not just something that happens but are waters accounted for as part of the management program water budget and activities for storage and use efficiency improvements.

Declining pulse flows. Pulse flows are flows from runoff events down normally dry streams. Over time, the GMD3 Lower Ark GMA river reach has lost the seasonal flushing flows from upstream spring snow melt and runoff events. Declining pulse flows diminish supply to area GMD3 member water rights. Groundwater mining has nearly eliminated groundwater reservoir discharge losses except for a reach of perched alluvial water table in the vicinity of the town of Cimarron following surface water diversions by ditch rights when pulse flow supply becomes available. The rare pulse flow that does occur in the GMD3 Lower Ark GMA deep percolates into adjacent groundwater reservoirs as critical groundwater reservoir storage for the area. The lack of regular river flow also creates similar land management and flood control problems as occur in the GMD3 Upper Ark GMA. See graph of *Difference in Arkansas River Flow Between Syracuse and Dodge City Adjusted for Irrigation Diversions* (KGS 2018) in appendix.

Pre-compact water rights. There are existing vested rights (pre-1945) and pre-compact (1949) water rights in the portion of the Arkansas River IGUCA between Garden City and Dodge City that are authorized a cumulative rate of diversion of more than 200 cubic feet per second (CFS). Since the time of the formation of the district and upstream reservoir construction, only a few large extended river flow events have occurred in the reach of the GMD3 Lower Ark River GMA to Dodge City to supply those water demands. In actions that seek to meet pre-compact water supply needs during wet river conditions, state permits have authorized up to an additional acre foot per acre for existing surface water ditch company irrigated acreage in the GMD3 Upper Ark GMA without exceeding the total authorized amount of all vested water rights of said irrigation ditch companies, but only when 200 CFS average daily flow is measured at Garden City with continuous river flow measured to the Dodge City river gage. **In the opinion of GMD3, this GMD3 Lower Ark GMA senior flow criteria has become a standard of practice adopted for management activity that preserves a river supply to pre-compact water rights during wet river conditions or as a delivery of an historical source of supply to member water rights.**

Ark River IGUCA review and revision. The Arkansas River IGUCA within GMD3 currently applies little additional corrective control not already superseded by administrative rules or practices. Relocating groundwater wells closer to the river channel in excess of ten percent (10%) is a remaining administrative limitation in place under the IGUCA order that has recently been waived in WCA cases and may be best converted to administrative rule or re-evaluated. Several modifications to the first IGUCA order from the GMD3 request and hearing process have occurred without the benefit of public process or GMD3 management program recommendations. Under statewide rules adopted by the Chief Engineer, the Arkansas River IGUCA is required to have periodic formal review but is more than three years past the 7-year agency deadline.

Administrative judge. The role of the Chief Engineer in the efforts of GMD3 to carry out its purposes includes to act as a neutral expert judge regarding the facts, goals and corrective controls in the public interest consistent with Kansas law. The Chief Engineer works with the GMD3

board and members to determine the proper corrective controls necessary to meet the provisions of the GMD Act. State staff provide knowledge and expertise as a friend of local government and water right interests, local agreements or requested proceedings implementing the GMD Act. GMD3 will assist and advise the Chief Engineer in any proceeding or review to consider changes to the Upper Ark River IGUCA corrective controls established more than 32 years ago and provide recommendations of the governing body.

River navigability for title and management program activity. The Ark River in the GMD3 area should be fully utilized for groundwater reservoir recharge purposes and other natural and managed resources benefits. The obvious effect of water use development in the basin on what may be considered “normal high-water mark” raises a resource management reality that “one cannot manage what one cannot define.” Management challenges today include the lack of delegation by the Kansas legislature to any person or office to manage the state-owned land in title as a navigable stream defined and conveyed to the state by the federal government at the time of statehood; a federal doctrine called “navigability for title.” According to the Land Title Institute (2001):

Navigability (For Title Purposes) means a body of water, existing naturally at the time of statehood that was used or is susceptible of being used in its ordinary condition, for commerce, navigation, fisheries, and more recently in other general statewide public uses such as canoeing, swimming, diving and similar related uses.

For Kansas and GMD3, this ownership issue starts with the 1874 survey conducted shortly after the January 1861 time of statehood. The terminology on most land deeds include the phrase “plus or minus accretions” which is a further source of confusion in a diminishing flow river regime. Boundaries raise a set of property boundary and easement questions that are intertwined together with the history of river flow changes under the activities of man and navigable stream law for the basin across GMD3.

GMD3 riparian interest and administrative river boundaries. The GMD3 Ark River riparian interests under the management program include the use of the river supply and natural infrastructure for the purposes of water supply delivery and diversion, groundwater reservoir recharge benefits and the equitable management activity and address associated supply concerns of water usability depletion. Functional and consistent state land boundary determinations along the Arkansas River in GMD3 is needed for water management purposes, including bed and bank maintenance, easements, water control and distribution, water quality and groundwater reservoir recharge activities. In western states, depleted groundwater reservoirs are used to store water by substituting surface water use for groundwater pumpage (conjunctive use) or recharging groundwater with surface water (managed groundwater reservoir recharge). Improved management activity to enhance natural and ditch area infrastructure use can improve management program results in the GMD3 Upper and Lower Ark GMA’s and near other surface water flow features.

GMD3 will identify and analyze the river issues associated with groundwater management in the district and tackle the complex issues to provide leadership and collaborative support and capacity for activities that can meet the water resource needs of members and partners. These efforts are not assessing involuntary compact curtailments. Rather, they are seeking to avoid compact deficits and public health and welfare problems.



GMD3 Economic Preservation and Development Program

Southwest Kansas runs on water. It is said that the business of water is not one of physical shortage but, rather, one of governance. Governance is matching demand with supply, of ensuring that there is water at the right location, and the right time of year, and at a cost that people will be able to afford and will be willing to pay for. Developing future business and economy that relies on groundwater supply requires development and understanding of the long view of future dollars and demands. Water profoundly influences the daily lives of every person. Western US areas that include southwest Kansas view water management and infrastructure development as a means for parking water to capture the future water value beyond just safely evacuating flood flows away to the sea. With agriculture as the key industry of the economy, the GMD3 area is an example where decoupling economy from rainfall and climate variability through use of stored groundwater for irrigation has promoted significant gains in both personal and community wealth and added gross state and national product. Sustaining these benefits at or near present levels with other sustainable water sources is a key interest of the management program activities.

Business water risk. Private and public sector institutions face three different types of water-related risk. First, there are the physical risks of water: The risk that a region may lack sufficient supply, or that the local water supply might be of poor or unstable quality. Second, local water regulations or regulatory changes, or lack of regulatory surety might challenge some companies' ability to do business. Finally, companies and communities face risks to their reputation—they need to consider how their use of water will be viewed by the broader communities. One can attempt to quantify the business value at risk from those three dimensions, and that drives companies to develop water stewardship strategies and make investments to manage that risk.

Economic growth. The purposes of GMD3 and partners in line with the interests of Kansas and the central High Plains region is to grow the economy and preserve access to water necessary for agribusiness, requiring both types of water conservation to (1) add efficiency and economic value to the water used and (2) improve future groundwater reservoir storage. If use plans or enforceable policy does not expand net use value or add water to future supply stock, then a conflict with the management program may exist.

Authority for GMD3 Economic Preservation & Development activities include without limit:

- K.S.A. 82a-1020 declaring the economic purposes of the GMD Act and establishing the right of water users to determine their destiny regarding water use;
- K.S.A. 82a-1029 adopt the official management program for the district area;
- K.S.A. 82a-1028(g), (i), and (m).

Water Infrastructure Investment. A personal investment in water infrastructure like a well or water distribution system is a personal decision to provide personal and public benefits. Being climate resilient involves incorporating climate risks to anticipate, prepare for, and respond to hazardous water circumstances, trends, or disturbances related to climate. In a similar way, public activity and funding devoted to major water infrastructure can carry major public benefits and a powerful economic driver that can provide a significant return on investment long term for both public and private interests. Economic studies indicate water infrastructure is a force multiplier.

An investment in sustainable water and wastewater infrastructure has a six-fold return (5 U.S. Chamber of Commerce, Why Water Infrastructure Investment Would Make A Big Splash) – proving that investing in water infrastructure is sound fiscal policy. US Reclamation estimates that for every dollar spent in a reclamation program, \$20 of direct benefit is realized. Secondary benefits may be as high as \$40. Investing in water is not just about economic return. It is also about the health and wellbeing of communities across this nation, this state and this district. New surface reservoirs that cover up land may be more difficult to consider than to utilize dry rivers and replenishment of vast groundwater reservoir storage space in Kansas, especially in our southwest Kansas district. Where new large surface reservoir recreation, fisheries, and wildlife services are unlikely, similar services may be realized from moving water west to flow in river reaches and waiting aquifer storage space and restoring prairie riverine habitat and public water features in rural areas of Kansas.

Water West. The future of our district investment-based economy is directly tied to safe and reliable water supply and best use of both natural and engineered water infrastructure. This necessitates GMD3 undertaking a gathering of partners with knowledge and interest in sustainable water and power to evolve water policy, planning and infrastructure development; an effort initiated in the High Plains Study to address the national interests and obvious path of valued water and inadequate future supply for each person in the west who reaches for a water tap. These are shared needs with sister states and western communities, including shared concerns in the Arkansas River basin with Colorado. GMD3 is committed to encourage careful evaluation and to participate with partners in activities that build understanding of present and future risks, needed water management partnerships and energy development and financing opportunities that will move Kansas and partners to seek infrastructure development across Kansas for water west.

Funding water management activities. Under the theory that an ounce of prevention is worth a pound of cure, additional steps to extending future surface water storage capacity and water quality with sediment reduction, better use of surface reservoirs, water transport features and significant available groundwater reservoir storage space demand prudent investments in evaluation towards future economic and ecological growth not left to chance. The extent of funding water conservation and supply improvements will determine the extent to which the Kansas economy will grow, if an appropriate level of water supply can be sourced over the next 50 years. Without these Water Vision strategies and local, state, interstate and federal partner investments, GMD3 consultants estimate annual future economic loss could see reductions in gross state product of approximately \$18 million annually, with a \$10 million portion of that annual amount lost in GMD3 if current trends continue for the next generation in Kansas.

Supply & Demand management. For the GMD3 declining groundwater inventory, supply and demand are generally considered two sides of the same water use “coin.” For planning purposes, demand tends to be viewed as use absent the unmet demand variable. Unmet demand is evident in the development of groundwater that resulted in perfected annual groundwater use totaling 3.6 million acre-feet in GMD3, but with recent average annual reported use of 1.8 million acre-feet. More work is needed in evaluating opportunity costs in the present met and unmet demands for fresh and other quality water from available stocks. Crop water demands are generally strategically planned by project managers based on expected product markets, quantity and quality of source well yields and available risk management tools. It is fundamentally important to enhance planning, operation and maintenance capacity while reducing liabilities in the form of water and energy waste. Part of supply management is improving the capacity of the workforce to

understand and operate water systems efficiently for greatest value. This activity will be encouraged in an education advocacy program for informed water investment planning and use improvements. All alternatives to increase usable water supply must be analyzed considering the entire infrastructure life cycle of diversion to tap and returns.

Investments in less water intensive methods of production and more efficient use helps lead to a more sustainable water-based economy. Concrete possibilities of economic savings, social benefits and a range of incentivized environmental gains through local, state and federal programs make the adoption of water efficient technologies viable and advisable. However, newly created water restrictions without a change in supply or better implementation of existing law may be especially difficult for the local governed to accept without new source development in the mix. Regardless of what solutions may be considered, significant additional costs are inevitable for Kansas and for the GMD3 area, bring forward the questions of who will pay and for what good and when this good will occur. Long term, tools to evaluate opportunity costs to the public should be a priority planning activity of GMD3 and of Kansas.

Comprehensive planning and coordinated initiatives. A growing economy that is reliant on declining water supply involves a sequence of comprehensive planning and coordinated actions with a long view of no less than 25 years to avoid isolated or silo strategies that can squander public resources. The generation before us was very good at developing infrastructure projects and people today have reaped the benefits of that previous work. GMD3 will work with state partners to create mechanisms of reasonable participation, regulation, conservation incentives, water project feasibility and finance investment security for an aggressive use of public resources to assure future water supply opportunity. GMD3 will provide leadership in developing an understanding of public infrastructure and how it plays a profound role in developing economy.

Public water places in a semi-arid climate. The role of water as the key resource for community sense of wellbeing places a burden on the management program to support collaborative activities that encourage well managed public drinking water systems, enjoyable public water features and for places that educate and inform on the importance of water. Wise water use includes encouraging a respect and understanding for the emotional and aesthetic power of water that comes from places of water enjoyment and education. Water places are needed in conjunction with direct uses, green fields and local products for healthy communities and enjoyment of water services. Water places such as water bodies, water displays, playa lake education sites, water walks, and multi-purpose sites along natural or constructed water features enhance water value awareness and encourages responsible personal and community water management.

Water Management Funding diagram. The Kansas water funding flower Venn Diagram at right illustrates necessary intersections of water management activities and funding sources to provide sustainable water resources for the GMD3 area and for Kansas.





GMD3 Outreach, Advocacy and Public Education Program

Policies, programs, newsletters, presentations, documentary specials, public meetings, school courses, testimony and other educational efforts are all an integral part of the GMD3 outreach program. Purposes of GMD3 under K.S.A. 82a-1020 are to promote the management, conservation and use of the district groundwater resources for the stabilization and improvement of agribusiness benefits relative to national and world markets. GMD3 has a responsibility to represent and inform members and partners on local, state, regional and national issues affecting the interests of member water users and land owners of the district.

1. Through pro-active involvement and dedication of resources, GMD3 will seek to inform, shape and influence public policy and legislation affecting local groundwater management, district member interests, and the operations and funding of the district management program.
2. GMD3 will enhance and expand partnerships and working relationships with key elected and appointed officials to advance Southwest Kansas perspectives on proposed legislation and regulations at the state, interstate and federal levels that may affect water resources interests.
3. Member and public support will be required in order to achieve the various activities and methods of the management program described in this document. GMD3 will expand its efforts to actively engage members and the public through original initiatives and cooperative activities for:
 - a. Promotions of program activities and access to program implementation documents, website postings and other social media, including a YouTube channel of informational videos, with a purpose of reaching and engaging all generations of water users, young professionals and potential partners.
 - b. On-site project signage, resource education stations, community public water awareness features and water and agriculture benefit promotions.
 - c. Conduct education activities within the District to push water savings measures and practices, particularly those which maintain the economic benefits of water use, such as alternate crops, use of technology and irrigation scheduling to reduce waste.
 - d. GMD3 support and the results of research on water conservation methods.
 - e. Stories and strategies from those who are using less water than their peers.
 - f. Use demonstration projects to help producers to economically reduce net water supply loss. (CIG project with USDA, Master Water Manager Certification, K-State Research and Extension farm projects and other water management projects to provide valuable examples to encourage uptake in water saving efforts.)

The overall emphasis for these activities is on the widest possible method of disseminating information that promotes water awareness, supply and the elements of the management program.



GMD3 State Water Planning Coordination Program

GMD3 is a special district that conducts local activities in water planning, policy development, water use and supply, participates in state administration matters affecting groundwater supply and economy and represents members in matters concerning groundwater management. GMD3 prepares and adopts the management program for district groundwater resources and makes recommendations to members, state and federal officials, the Governor, Kansas Legislature and to Congress. This includes coordinating with the Kansas Water Office, Kansas Water Authority and providing input on the State Water Plan and policies for Kansas.

Authority. Relevant authority for GMD3 State Water planning Coordination activities include:

- K.S.A. 82a-1020 declaring the purposes of the GMD Act and the established right of water users to determine their destiny regarding water use;
- K.S.A. 82a-1029 adopt the official groundwater management program for the district area;
- K.S.A. 82a-1028(g) to construct, operate and maintain such works as may be determined necessary for drainage, recharge, storage, distribution or importation of water, and all other appropriate facilities of concern to the district;
- K.S.A. 82a-1028(i) to contract with persons, firms, associations, partnerships, corporations or agencies of the federal government, and enter into cooperative agreements with any of them;
- K.S.A. 82a-1028 (m) provide advice and assistance in the management of drainage problems, storage, groundwater recharge, surface water management, and all other appropriate matters of concern to the district.

State Water Plan Fund, Kansas Water Authority, and State Water Plan. For as long as Kansas has been a state, water has been an issue for policymakers, and for many years the Legislature has passed legislation dealing with the regulation of water. Nine years after the passage of the GMD Act, two years after making state water permits mandatory and one year before the release of the US Commerce Departments' 6 states High Plains Study that contemplated major interstate water transfers, the 1981 Legislature created the Kansas Water Authority and Kansas Water office per the State Water Resources Planning Act (K.S.A. 82a-901 to 82a-945), declaring:

"the people of the state can best achieve the proper utilization and control of the water resources of the state through comprehensive planning which coordinates and provides guidance for the management, conservation and development of the state's water resources."

GMD3 will seek to turn the tap of knowledge in state water planning activity and agency assistance by encouraging state comprehensive long view planning and funding needed for the management, conservation and development of the state's water resources to meet Kansas needs that including the purposes and activities of the GMD3 management program.

Kansas Water Authority. The Kansas Water Authority is a 24-member board which provides water policy advice to the Governor, Legislature, and the Director of the Kansas Water Office. The Authority is responsible for approving water storage sales, the State Water Plan, federal water contracts, and regulations and legislation proposed by the Kansas Water Office. The Authority meets quarterly. The Authority consists of 13 private citizens and 11 ex officio state water agency advisors. Private citizen membership includes:

One member appointed by the Governor (also serving as Chairperson);
One member appointed by the President of the Senate;
One member appointed by the Speaker of the House;
A representative of large municipal water users;
A representative of small municipal water users;
A board member of a western Kansas GMD (including districts 1, 3, and 4);
A board member of a central Kansas GMD (including districts 2 and 5);
A member of the Kansas Association of Conservation Districts;
A representative of industrial water users;
A member of the State Association of Watershed Districts;
A member with a demonstrated background and interest in water use, conservation, and environmental issues; and
Two representatives of the general public.

One role of the Kansas Water Authority and Water Office, is to formulate policy recommendations for inclusion in a publicly developed State Water Plan under the general purpose of accomplishing the coordinated management, conservation and development of the water resources of the state to benefit Kansas citizens, including GMD3 members. The State Water Plan Fund was created in 1989 to fund the state water-related projects and programs which are necessary to achieve the long-range goals and objectives set forth in K.S.A. 82a-927, and amendments thereto, which are:

- “(a) The development, to meet the anticipated future needs of the people of the state, of sufficient supplies of water for beneficial purposes;*
(b) the reduction of damaging floods and of losses resulting from floods;
(c) the protection and the improvement of the quality of the water supplies of the state;
(d) the sound management, both public and private, of the atmospheric, surface, and groundwater supplies of the state;
(e) the prevention of the waste of the water supplies of the state;
(f) the prevention of the pollution of the water supplies of the state;
(g) the efficient, economic distribution of the water supplies of the state;
(h) the sound coordination of the development of the water resources of the state with the development of the other resources of the state; and
(i) the protection of the public interest through the conservation of the water resources of the state in a technologically and economically feasible manner.”

GMD3 encouragement. K.S.A. 82a-928(p) makes it state policy to achieve the listed long-range goals, including: *“the encouragement of local initiative in the planning, implementation, funding and operation of local water programs to the extent that the same are supportive of state water programs;”*

K.S.A. 82a-929. **[State water plan]; state responsibility for water.** *The state of Kansas hereby recognizes its responsibility and jurisdiction to protect, conserve, and control all waters affecting (emphasis added) the people of the state... ”*

In formulating the State Water Plan under K.S.A. 82a-907, the KWO considerations that directly relate to the GMD3 management program include:

- “(a) The management, conservation and development of the water resources of the state for the benefit of the state as a whole;*
(b) the benefits to be derived from development of reservoir sites for the combined purposes of flood control, water supply storage and recreation; ...

- (d) the water development policies, whenever possible, consistent with the beneficial development of other natural resources;
- (e) the public health and general welfare of the people of the state;
- (f) all appropriation and other rights to the use of water that exist pursuant to the Kansas water appropriation act and the state water plan storage act;
- (g) the interrelationship of groundwater and surface water supplies and the effects of evapotranspiration on water supply;
- (h) the alternative plans, programs and projects in the interest of effective water resource management, conservation and development; ...
- (j) the use of waters to augment the flow of surface streams for the support of aquatic and other wildlife and to improve the water quality of the stream and to protect the public health; ...
- (m) plans, projects and recommendations of public corporations, the federal government and state agencies prepared pursuant to statutory authority(emphasis added); ... and
- (p) such other matters as the office deems proper or desirable.”

To aid the Kansas long view of state water plan projects, revenues and expenditures per K.S.A. 82a-920, the Kansas Water Office shall: “... maintain in continuous process and revision tentative projected costs of water management projects for the coming years covering a total period of not less than 25 years, which projected costs the office shall submit with its annual budget request. In preparing such projections, the office shall include all items for which payment is expected to be made from state funds and anticipated revenues expected to be paid to the state.” Overcoming obstacles to achieve this policy is a public interest goal of the management program.

For intergovernmental coordination of water planning with GMD3 and others, K.S.A. 82a-931 provides: “ As a matter of basic policy concerning the water resources of the state, the state of Kansas hereby declares its intention to coordinate state planning with local and national planning and, in safeguarding the interests of the state and its people, to undertake the resolution of any conflicts that may arise between the water policies, plans, and projects of the federal government and the water policies, plans, and projects of the state and its people.” This is considered a vital state activity for implementing the GMD3 management program.

To aid in research related to Kansas water resources per K.S.A. 82a-941 it is state policy that: “all agencies of the state having responsibilities affecting the water resources of the state shall, insofar as circumstances permit, carry on basic data collection, research, and analyses concerning climate, streamflow, water quality, groundwater levels, character and geographical extent of groundwater reservoirs and their relation to both surface and underground waters, interrelation of surface and groundwaters, methods and techniques for recharging groundwater reservoirs, probable yields from surface and groundwater reservoirs, seepage and evapotranspiration losses, and such other matters that relate to the water resources of the state, and **those agencies shall direct their attention to the problems of water distribution, quality, pollution, supply variability, floods, and supply in relation to demand.**”

In coordinating the above, two primary responsibilities of the Kansas Water Authority identified here are to consider and approve policy for inclusion in the State Water Plan and to recommend budgeting of the State Water Plan Fund with the long view of no less than 25 years. The Plan includes recommendations on priority issues statewide, regional and for each of the 14 planning areas in Kansas, for which the district covers most of the Upper Arkansas and Cimarron planning areas.

Water Plan Fund Budgetary Process. In spring, the State Water Plan Fund Consensus Revenue Estimating Group meets to review past and current receipts and expenditures from the Fund as well as to estimate sources and amounts of revenue for the upcoming budget year. The group consists of representatives of the Kansas Water Office, Department of Revenue, Department of

Agriculture, Department of Health and Environment, Division of the Budget, and the Legislative Research Department.

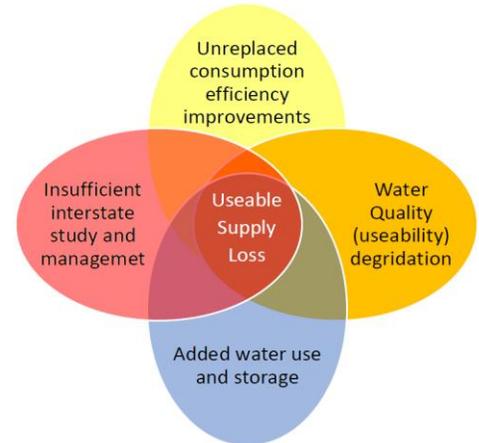
Budgeting programs and projects. Historically, the Division of the Budget has assigned allocations to each agency for the expenditure of State Water Plan Fund monies. Beginning with the FY 2008 budget cycle, the Kansas Water Authority and the Division of the Budget agreed to allow the Water Authority to develop a budget recommendation in lieu of the Division's allocation process. A five-member budget subcommittee of the Authority meets in the summer to develop a State Water Plan Fund budget proposal. The budget is presented to the full Kansas Water Authority in August. The Authority-approved budget is then used by state agencies in their budget efforts. The Governor's budget includes recommended expenditures for the State Water Plan Fund when it is presented to the Legislature each January. Appropriations from the State Water Plan Fund are made by the Legislature. GMD3 will seek to directly advise the State Water Plan Fund budget and policy process. In 2019, efforts by the Kansas Water Authority were initiated to improve the Water Plan Fund budget development process and to update and incorporate the Kansas Water Vision into a revised State Water Plan. GMD3 will provide recommendations to meet the needs of the management program and the following activities:

1. Per K.S.A.82a-928(p), GMD3 will seek encouragement and support for local initiative in planning, implementation, funding and operating local water programs, and will work with the Kansas Water Authority and Regional Advisory Committees (RAC's) for understanding and support of the management program.
2. GMD3 Kansas Water Plan activities will seek to further implement the long-term goals and objectives of the legislature and the district management program.
3. GMD3 will work with RAC members and advisors across the state to enhance understanding of any differing perspectives of common long-term water supply interests and concerns.
4. GMD3 will work with legislative partners to achieve a consistent and informed perspective on GMD Act implementation, needed water planning and interstate supply management activities, including cost and risk considerations and funding sources.
5. GMD3 will work to restore dedicated state funding for timely interstate water management support studies and evaluations needed to inform Kansas staff and interstate partners, assure compact administration and other interstate water management purposes.
6. GMD3 will support comprehensive future natural and constructed infrastructure planning for a minimum of 25 years through its Renewable Supplies Committee to include water transportation and storage infrastructure and groundwater reservoir replenishment. (e.g. January 22, 2018 letter from GMD3 President Kirk Heger to Dr. Dan Devlin, Kansas Water Resources Institute, Tracy Streeter, Kansas Water Office and Gary Harshberger, Chairman, Kansas Water Authority transmitting 23 requested Water Vision activities).
7. GMD3 will provide annual project and funding requests and recommendations to the Kansas Water Office and Kansas Water Authority.
8. GMD3 will seek state water planning and funding support at a level commensurate with what is paid into the Water Plan Fund from the GMD3 area in order to carry out the legislative purposes for the GMD Act and management program.
9. GMD3 will work to improve and sustain effective Water Plan budgeting process for budget recommendations to the Governor and Legislature that are coordinated with local programs and planning in support of the management program covering 25 years of projected costs and revenues.



GMD3 Interstate Water Management Program

GMD3 water management concerns extend beyond district and state boundaries and include the Stateline's with Oklahoma and Colorado. GMD3 historically receives replenishing surface flows from both the Arkansas River and Cimarron River basins and lateral flow of basin groundwater reservoirs. The **sources of useable interstate supply loss** Venn Diagram at right illustrates activities that carry a threshold of significant harm and allow depletion of usable water supply to Kansas if not adequately managed. GMD3 will seek state and interstate collaboration and study that benefit local interstate partners.



Authority for GMD3 Interstate Water Management activities include without limit:

- K.S.A. 82a-1020 declaring the purposes of the GMD Act and the established right of water users to determine their destiny regarding water use;
- K.S.A. 82a-1029 adopt the official groundwater management program for the district area;
- K.S.A. 82a-1028(g), (i) and (m) [referenced in earlier sections of the management program].

Compacts. Two interstate compacts are in place with administrative bodies staffed by officials from Kansas and each respective sister state bordering the district. While each Compact and administrative body is a forum for the states to pursue “interstate comity,” the purposes of these compacts must be read within the express terms of each compact. Each compact administrative body provides a portal and forum for GMD3 communications to express interests and concerns. GMD3 will seek the development of needed interstate agreements consistent with the management program. No compact yet exists to protect the Cimarron River basin historical water supply to the district. Nor is there a groundwater reservoir compact to govern lateral flows into Kansas and surface water runoff pulse flows and the associated groundwater reservoir recharge. Sustaining underflow and surface runoff supplies are modeled and important considerations for successful partnerships to secure and improve the future of area water supply.

1. Interstate groundwater reservoir management coordination is appropriate activity under the management program where the OHP Aquifer, Arkansas River and Cimarron River management is regionally closed to most additional appropriations, yet large additional new appropriations are allowed in the adjacent areas in upstream or upgradient areas of sister states. GMD3 will seek opportunities to reduce water speculation add long view value.
2. GMD3 will encourage interstate partnerships and collaborative efforts to manage and restore the quantity and usability of existing and new source water supply, including investment participation in the water administration of other states where allowed, and work with landowners of properties outside the district and state as needed.
3. Interstate water management activity of GMD3 will be based on reliable data and professional technical and legal judgement to collaborate with partners for wise use of shared resources.



GMD3 Models, Investigations and Research Program

Groundwater management requires specialized model tools. Models that are used by the district in management program activities include models of district groundwater reservoirs, wells, surface water resources and economy. They are necessary management tools. The nature of models is that they are a work in progress. It is important to the success of the district groundwater management program to create and update models based on the most up to date information available. Each model is a tool designed to represent a simplified version of reality. The reliability of the tools depends on how well the model approximates field conditions. It should be remembered that some extreme events or conditions may be beyond the calibration of a model. Additional study of index wells established in multiple groundwater reservoirs will help with proper modeling and policy development, especially in deeper bedrock groundwater reservoirs that may or may not be confined.

1. **Resources for new models and model updates.** GMD3 will work with state and other partners to apply the appropriate resources to use and improve important analytical and numerical models that elevate the district groundwater knowledge base and improve water application evaluations and management activities for GMD3 members and partners.
2. **GMD3 area Ogallala/High Plains Aquifer model update.** The KGS groundwater model for the GMD3 area is slated for updating in 2020. GMD3 will partner with the KGS and others to complete a successful update project. Additional data is needed for improving the model function and utility. They include:
 - a. Index well measurements of groundwater exchange between formations.
 - b. Groundwater gage measurements of recharge benefits from surface water flow.
 - c. Groundwater gage measurements of lateral flow and quality or usability.
 - d. Data needed for improved model calibration.
 - e. Graphical user interface tools to connect members to model information.
 - f. Critical well evaluation and water project supply information tool.
 - g. GMD3 Upper and Lower Ark GMA area boundaries and conjunctive use tool.
 - h. OHP Groundwater reservoir water use and recharge estimate tool.
3. **Additional groundwater reservoir information and data.** New groundwater reservoir information and data developed by GMD3 will be shared with state and other partners to assist in the development of the best possible models. This information may include, but is not limited to, member test hole contributions, flowmeter and well tests, and use evaluation information. New information benefits the recalibration of supply and economic models as tools needed for implementing the management program.
4. **Economic and valuation models.** Economic and valuation models are a growing source of information used in policy and management program activities. GMD3 will look to develop and update economic models, such as the 20-year projection of Docking Institute Study of 2000 and the 50-year projection of Apparat Analytics LLC., according to the guidance documents and funding of the Board to further implement the management program.

Additional investigation and research activities will include but not be limited to the following topics for investigation for partnerships and funding to support initiatives and researched education concerning proper water management at all levels.

1. **Managed Groundwater Reservoir Recharge.** Managed groundwater reservoir recharge activity may involve both projects that use natural infrastructure and delivery activity and projects using artificial infrastructure and delivery to recharge or replenish groundwater inventories. GMD3 will encourage both natural and artificial project feasibility investigations and collaborative means to increase the amount and/or usability of water inventory of the district. Although the state has no formal groundwater quality standards, application of the groundwater recharge use to many classified streams is intended to prevent “statistically significant increase[s] in the concentration of any chemical or radiological contaminant or infectious microorganism in groundwater resulting from surface water infiltration or injection” (K.A.R. 28-26-28d(b)(5) and 28-16-28e(c)(5)).
2. **Water Transfers - Importation.** Western Kansas and the Great Plains region offers the nation a large food production area which has not yet reached its production potential and is losing established economy as groundwater reservoir levels decline. Other western states are experiencing significant surface water and groundwater reservoir decline. The major limiting factor in preserving and developing this National Water Reserve and food security potential is water west. Since presently stored and depleting water supplies are inadequate to fully develop or maintain the area’s production potential, transient water conserved from loss downstream to the Gulf of Mexico in other areas could be made available for conservation storage in western available surface water and groundwater reservoir space if the existing economy is to be preserved or the natural increase of future development is to have a drought resilient and sustainable water supply.

Importation of water from other areas under conditions of surplus supply seem to be technically feasible if the right to move the water under such ventures can be resolved. Some opportunities may exist with pipelines previously used for other purposes and now abandoned are re-tasked for transport of water. Some of the problems are legal in nature and deal with issues such as inter/intra basin transfers. Any significant importation of water to of through GMD3 for added conservation storage under the management program will by necessity be a larger scale project and will require the coordination of many water-related entities, and authorities to maintain productive partnerships that accomplish the many steps to water transportation and energy management that will be necessary to power water transportation forward. Other smaller-scale in-state transfers will also take considerable coordination and planning to pilot such projects.

GMD3 shall take a leadership role with partner agencies, organizations and other partner to accomplish the long-range planning and study for projects which may become economically feasible under future dollars and which offer potential for the importation of water into southwest Kansas to meet future resource service needs in the district.

3. **Water exports.** The Board shall involve itself with any proposed direct exportation of groundwater from the district to any area or location outside the district to ensure that all management program purposes are met and to seek opportunities to meet the needs for present and future water supply in adjoining areas in the public interest. Exported water use may be evaluated to consider assessing higher user fees than for in-district uses or for net use between imported supplies and those exported out of state.
4. **Federal Farm Programs.** As we look at the present and next farm bill through the lens of the field and farm economy, innovation and local authority implementation will remain essential for effective use by district farmers and ranchers to continue producing more food and fiber with less water. The federal farm bill research and other programs provide significant support to the implementation of the GMD3 management program for members and partners.
 - a. GMD3 will engage farm bill development, adoption and implementation, working with industry and other partners to guide national funding and program commitments that support the district groundwater management program.
 - b. GMD3 will participate in farm bill development implementing the best policies to preserve and enhance water conservation incentives. Water conservation programs should incentivize and reward measurable water conservation. Using historic water usage without prior conservation credit may incentivize maximum water use records prior to enrollment, which is contrary to the district Management Program. Those who work to steward groundwater conservation in their declining supply have a greater burden to achieve added conservation valued in addressing resource concerns. Partnerships and programs that demonstrate new water conservation, efficiency technology and crop variety choices are revolutionizing groundwater management on the High Plains, including mobile drip irrigation, new soil moisture probe monitoring systems, and other project level sensor and data management tools.
 - c. Risk management is a key influence of the farm bill on the district groundwater management program activities. Input and potential partnerships with RMA and others will be encouraged to further develop useful risk management products for limited irrigation and supported to limit unnecessary irrigation in declining groundwater areas.
 - d. GMD3 will advocate for flexibility in the use of field level crop bases to encourage conservation of water use over program elements that economically force members to continue high water use to preserve crop bases.
5. **State water conservation incentive programs.** GMD3 will continue to encourage and develop additional partner activities in state sponsored water conservation incentive programs to be made available to members and investigate opportunities to leverage management program activities with incentivized conservation activities that further the purposes of the management program for the district. Programs considered include:
 - a. The Conservation Reserve Enhancement Program (CREP) that as of September 30, 2017, a total of 112 state CREP contracts on 18,659 acres have been approved by the State of Kansas (with the addition of 385 acres this year). These contracts have resulted in the permanent retirement of 37,999 acre-feet of annual

water appropriation on 135 water rights from 166 wells, mostly in GMD3. The contracts represent a total of \$1,210,511 in state sign-up payments to producers over the past ten years. These payments are matched by annual rental payments to producers from FSA totaling about \$2,191,213 in FY2017.

- b. The Water Transition Assistance Program (WaterTAP) is a voluntary, incentive-based program that has permanently retired a hand full of privately held irrigation water rights in exchange for payment by the State of Kansas. It is intended to help restore groundwater reservoirs and recover stream flows in critically depleted target areas. The 2012 Kansas Legislature extended WTAP until June 30, 2022 based on past results of the recent pilot project. GMD3 will consider options to target the modest funds available under this program.
- c. Regional Conservation Partnership Program (RCPP). RCPP promotes coordination of NRCS conservation activities with GMD3 and other partners that offer value-added contributions to expand the collective ability to address on-farm, watershed, and regional natural resource concerns. Through RCPP, NRCS seeks to co-invest with GMD3 and other partners to implement projects that demonstrate innovative solutions to conservation challenges and provide measurable improvements and outcomes tied to the resource concerns the management program seeks to address.

6. **Brackish water use technology and feasibility.** Brackish water or briny water is water more saline than fresh water, but not as much as seawater. In GMD3, it may occur in deep geologic formations or in Arkansas River surface water from Colorado or in Cimarron river flows from the district into Oklahoma. Brackish waters are viewed recently as potential and viable resources to alleviate water scarcity and overcome water budget deficits for some project uses. Kansas law requires consideration of such water sources used first during water appropriation permitting per K.S.A. 82a- 711, where “ *...the chief engineer shall not approve any application submitted for the proposed use of fresh water in any case where other waters are available for such proposed use and the use thereof is technologically and economically feasible.*” The evaluation of various desalination technologies will be encouraged as one of many options to conserve and manage district surface and groundwater supply.
7. **Private well safe drinking water study.** High radio nuclei and other pollutants in some groundwater supply areas of the district require added study to determine the best management practices and programs that will adequately address the needs and activities to secure the health, safety and welfare of district members, working with state water agency partners that include KDHE, KDA, KWO and KGS.
8. **Strategic and environmental area planning.** GMD3 participation and outreach support of planning efforts by local authorities and their targeted interests in water related economic development planning and environmental protection activities is a necessary and desirable activity of the GMD3 to effectively implement the management program. Coordinating with other local government entities provides efficiency of resource management in support of members and the leadership of cities, counties and special districts affecting GMD3 management to ensure conditions for member health, safety and welfare are maintained.

9. **Water reuse information support.** Since first use of water is the use authorized and reported under water rights, little comprehensive data is available on water reuse in the district. The management program supports the efficient first use and appropriate reuse of water resources for irrigation. Efforts to increase water use value through reuse is an important response to dwindling local supplies and increasing water costs. Water reuse can also be a source of depletion of historical return flows to local groundwater reservoir areas that may be an important sustaining source for other water rights. In recognition that GMD3 can't manage what isn't measure, GMD3 will work to develop methods for tracking the extent of water reuse and assist in developing feasibility studies and researching water recycling projects as requested by members or required by grant opportunities to benefit the management program.
10. **Data Collection and exchange.** The data collection needs of GMD3 are expected to be very broad as various plans and programs are implemented. Data needs will range from water quantity and water quality issues, to research and investigation needs, to land ownership records and socio-economic and use value needs as necessary to implement the groundwater management program. This could include at any time additional supply, water use, cropping, soils or well and water flowmeter data needed to support improved supply, water use efficiency, conservation efforts and program compliance. GMD3 will communicate and cooperate with local, state and federal interests for data exchange to accomplish the purposes of the groundwater management program and mutual support of partner initiatives. Such cooperative efforts with partner organizations can be an efficient use of GMD3 manpower, technical and financial resources.
11. **Smart Device Application tools and software.** GMD3 will look to improve data base resources, software and hardware tools for efficient field data collection and information mining. With todays technology for communicating between application software and data sources, significant opportunity exists to serve the water project manager in the field with field inputs and data processing for near real time record keeping and information processing that can identify opportunities to save water and use expenses. Under development are apps that with a picture of a flowmeter using a smart device, a manager can have access to water, climate, soil moisture, crop and financial information, including information from similar projects in the region.



KGS/GMD3 Cimarron Stateline Groundwater Gage technology. Promoting real-time field water supply technology



GMD3 Water Quality Protection Program

Water quality is both a water usability question and public health, safety and welfare concern for Kansas citizens, including members of GMD3. GMD3 will monitor and look to implement and address the following water quality activities in coordination with local, state and federal partners:

1. **Existing Pollution Problems.** Known pollution problems that pose a direct threat to the usability of groundwater supply within the district will be researched and evaluated by staff, in conjunction with KDHE programs and other potential partners to seek adequate mitigation and/or remediation for restored supply conditions or net improvement. Where identified concerns exist, staff will present its recommendations to the Board for consideration of appropriate action and funding measures.
2. **Pollution risk.** The water quality program activity will work to conserve groundwater by preventing future degradation of groundwater quality that will cause water usability depletion. GMD3 will work to identify the major sources of water usability depletion, and address concerns in targeted local sources of supply before they create significant water usability depletion of district groundwater or surface water and risk to public health, safety and welfare. For example, groundwater reservoir recharge activity from wastewater and nutrient management effluent activities can pose water pollution risk that will be addressed with practical member and industry management consistent with enforceable state water policies and adequate administrative practices. Within the domestic beneficial use classification is a sub-group containing nonpublic household water wells. Management program activities will advance drinking water quality monitoring and supply protection with recommended triggering events for drinking water wells inspection and for testing water quality.
3. **Oil and gas industry water use and supply risk.** GMD3 should consider accessing data on historical oil and gas activity in the district assisted by Kansas Corporation Commission for review of information with appropriate state officials to screen for groundwater treats or casing failures that can create freshwater drains to deeper less-fresh formations and water usability depletion. Additionally, opportunities for new technology-based water treatment to improve usability of low-quality water and safe waste disposal will be reviewed periodically.
4. **Abandoned water wells and test holes.** With about 1/4th of non-domestic wells idle per annum, GMD3 coordinate with KDHE Bureau of Water in their implementation of the Groundwater Exploration and Protection Act and permitting of temporarily abandoned water wells to assist members in the management of wells and boreholes to manage well equities, groundwater protection, monitoring well data collection opportunities and on-site safety concerns of GMD3 membership.
5. **Groundwater gage network.** GMD3 will continue to develop a district monitoring well network and obtained water samples that were analyzed for contaminants. GMD3 has worked with partners to establish Stateline groundwater gages to provide quantity and quality data to

support interstate supply managers and secure cooperative agreements and funding sources for needed gage data. GMD3 continues work to set up a network of observation wells in any area that additional water level, flow and water quality data is needed to support the management program and partner activities.

6. **The Local Environmental Protection Program (LEPP).** LEPP, established in 1990, has been supported by GMD3 staff and Board resources. The LEPP provided funding to enable local authorities to develop water protection plans that complemented other water quality efforts being waged by state and federal agencies. State Water Plan Funding to counties was discontinued in 2012 Adoption and enforcement of county environmental codes with an emphasis on onsite wastewater systems (OWWS) and private water wells (PWW) is an activity of each county in GMD3, and the management program will support efforts of county sanitarians and partners as needed with available resources.

7. **Ark River and other recharge areas.** Significant need exists to address the water quality issues of the Arkansas River basin affecting both drinking water safety and agribusiness productivity in Colorado and in Kansas. In-state, interstate and federal planning and partnership is needed to address poor quality basin water that is impacting or threatening additional public and private water supply wells along the Arkansas River corridor and over the Ogallala Groundwater reservoir. Additional protection of the fresh groundwater in the region is critical for safe drinking water and for municipal, industrial and agricultural uses. Kansas 2019 legislative resolutions HR6018 and SR1729 (see copy in appendix) were passed seeking such partnerships and interstate cooperation to address this major multi-state contaminated basin water concern. GMD3 will participate in study and project activity responding to the 2019 resolutions.



VI. CONCLUSION

All policy discussions of this management program document are those of the governing body of GMD3 and are not intended to describe policy of other agencies. Activities of GMD3 are conducted with due consideration and appreciation for the diverse local, state and federal institutions and partner interests, including district members. The activities for groundwater management pursuant to the GMD ACT, and all rights and powers granted by the Kansas Legislature to GMD3 under groundwater law, are fully retained here. Activities are implemented in a manner consistent with state and federal law through the elected Board supervision of the adopted Management Program, additional guidance documents, Board by-laws and resolutions, enforceable policies, state official orders issued for the district, and other actions of the governing body to provide guidance and services. Separate documents implementing various funded management program activities, such as the GMD3 well evaluation guidelines, will be developed publicly and posted on the GMD3 website for access and reference.

APPENDIX

Kansas water law and planning legislation history notes.

Selected from work by **John Peck** who provides a water rights and planning history outline in his writing on drought concern and Kansas water law: *Legal Responses to Drought in Kansas*, Kansas Law Review, Vol. 62, No. 1141, 2014, University of Kansas - School of Law.

Legislation

A. Pre-1945 water statutes: Drought not mentioned specifically, but perhaps can be inferred as one of the background reasons for some legislation:

1. 1866 (irrigation companies empowered to construct canals)
2. 1886 (stream water may be used for irrigation by appropriation, and first in time is first in right)
3. 1889 (ditch and canal companies empowered to condemn water rights)
4. 1891 (waters west of 99th meridian to be devoted first to irrigation use, subject to domestic, 2nd to industrial use; irrigation districts may be created)
5. 1899 (irrigation companies empowered to condemn to aid in establishing reservoirs, lakes, or ponds for water storage)
6. 1917 (Kansas Water Commission established to investigate problems of, *inter alia*, domestic water supply and irrigation; to establish river gaging stations; to make general plan for development of river basins; repealed 1927)
7. 1919 (Division of Irrigation created in State Board of Agriculture (BOA), under control of commissioner of irrigation; duties of commissioner included gathering data, visiting sites, and making quarterly reports to BOA)
8. 1927 (legislature abolished Water Commission and Division of Irrigation; Division of Water Resources (DWR) created to take over duties) [chief engineer position created]
9. 1933 (Chief Engineer made head of DWR)

B. The 1945 Water Appropriation Act: Activity related to and resulting from 1930s drought: Richard Pfister, WATER RESOURCES AND IRRIGATION, PART IV OF ECONOMIC DEVELOPMENT IN SOUTHWESTERN KANSAS, KU School of Business (March 1955)

1. 1940 (Governor appointed committee and held conference to study problems and make recommendations; committee report recognized need for a state plan to control the water resources)
2. 1941 (legislature repeals part of 1886 Act and established administrative procedures for handling applications for water appropriations)
3. 1944 (*State ex rel. Peterson v. Kansas State Board of Agriculture*, 158 Kan. 603, 149 P.2d 604 (1944) (affirmed common law doctrine of absolute ownership for groundwater; concluded that the chief engineer had been given no power over groundwater allocation))
4. 1944 (Governor appoints committee to study state water law, which produces "The Appropriation of Water for Beneficial Purposes: A Report to the Governor" (Dec. 1944) recommending adoption of Doctrine of Prior Appropriation)
5. 1945 (legislation adopts the Water Appropriation Act (WAA)) [Now all Kansas water rights to follow one doctrine and unused water is dedicated to the people of the state subject to beneficial appropriation as provided in WAA]

6. 1956 (clarify water rights as changeable real property that must tolerate reasonable economic effects between users)
7. 1972 GMD Act (legislature dedicates local groundwater management rights)
8. 1978 (legislature restrict all non-domestic use without first obtaining state permission and adds Intensive Groundwater Use Control Area provision in GMD Act)
9. 1986 (mandated annual water use reports by March 1st each year subject to fines)
10. Water right management tools developed since then.
 - [2012: Local Enhanced Management Areas (LEMA's) allowed]
 - [2012: Eliminating forfeiture of groundwater rights for non-use in closed areas]
 - [2015: Water Conservation Areas (WCA's) allowed]
 - [2015: Requirement for chief engineer to give due consideration of past management and voluntary conservation in new conservation programs.]

Kansas Water Planning Acts

1. 1917 (Kansas Water Commission established to investigate problems of, *inter alia*, domestic water supply and irrigation; to establish river gaging stations; to make general plan for development of river basins; repealed 1927)
2. 1955 (Kansas Water Resources Board and executive director established)
 - a. Charged with working on and working out a state water plan of water resources development.
 - b. Background: "The State of Kansas had no sooner recovered from the spectacular floods of 1951 when it plunged into one of the most severe droughts in Kansas history from 1952 through 1956. This sequence of disasters led to legislative creation of the Kansas Water Resources Board in 1955 as a move to try to do something to avert or at least alleviate future crises through aggressive planning.
3. 1963 (State Water Plan Act, 82a-901 *et seq.*)
4. 1981 (Kansas Water Resources Board replaced by the Kansas Water Authority, the Kansas Water Office, and the director of the Kansas Water Office)
5. 1984 (State Water Resource Planning Act: major amendments to K.S.A. 82a-901a, *et seq.*)
6. 1985 (K.S.A. 82a-906 amended to provide dynamic planning process, under which KWO presents annual water plan and recommendations to the legislature)

End of Legislation History notes.

Maps and groundwater model information

The following maps display the pumping density distribution, the percent loss in saturated thickness, and the remaining saturated thickness of the High Plains Groundwater reservoir in Kansas. The High Plains Aquifer Atlas can be found at:

http://www.kgs.ku.edu/HighPlains/HPA_Atlas/Water%20Rights%20and%20Water%20Use/index.html

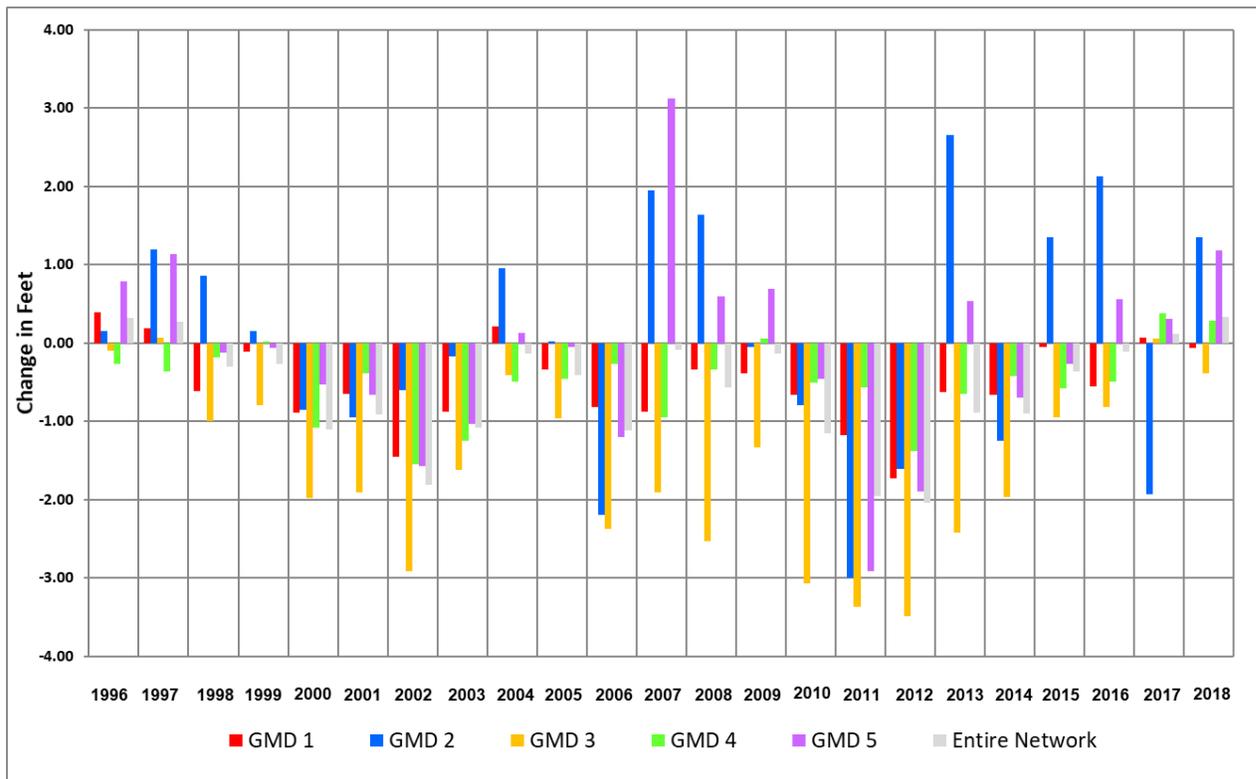
The most recent GMD3 groundwater model information can be found at the following urls:

GMD3 Ground-Water Model: http://www.kgs.ku.edu/Hydro/Publications/2010/OFR10_18/

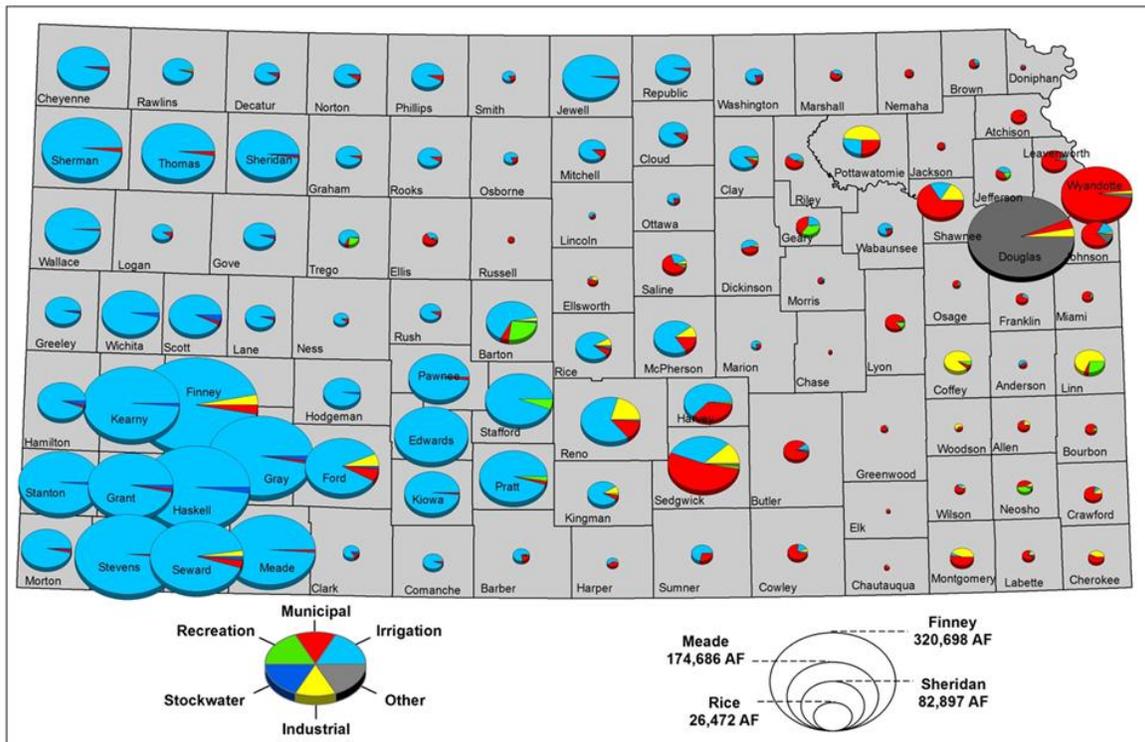
GMD3 Model Future Scenarios: http://www.kgs.ku.edu/Hydro/Publications/2012/OFR12_3/

Potential economic impacts of water-use changes in Southwest Kansas:

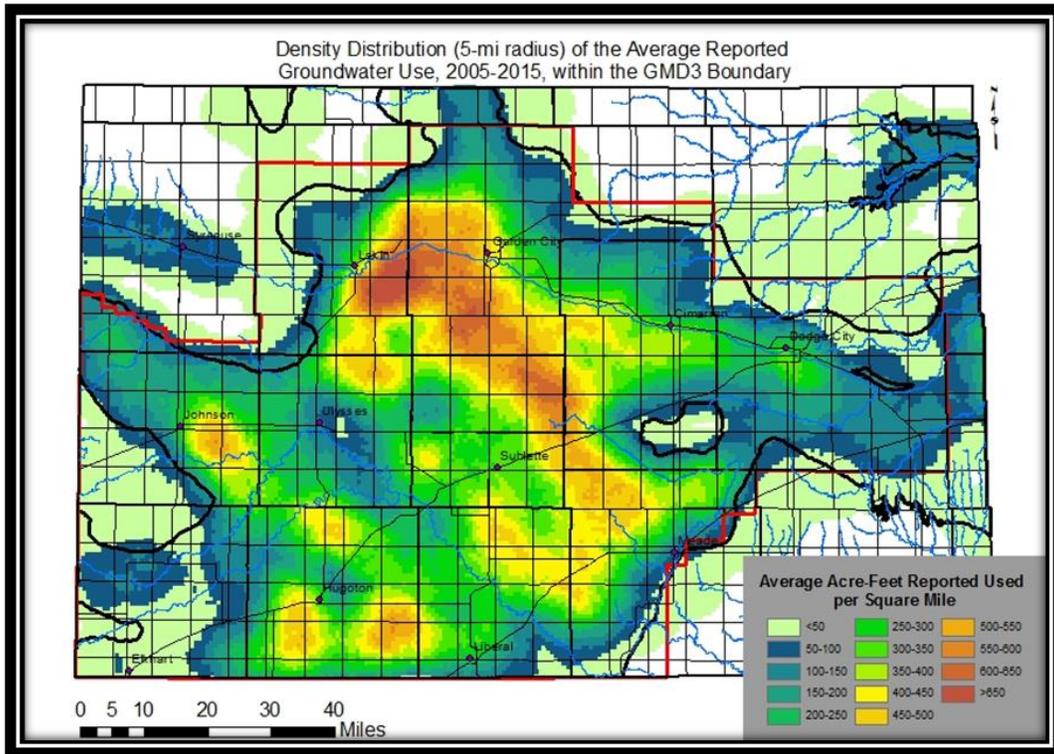
<http://www.tandfonline.com/doi/abs/10.1080/19390459.2013.811855>



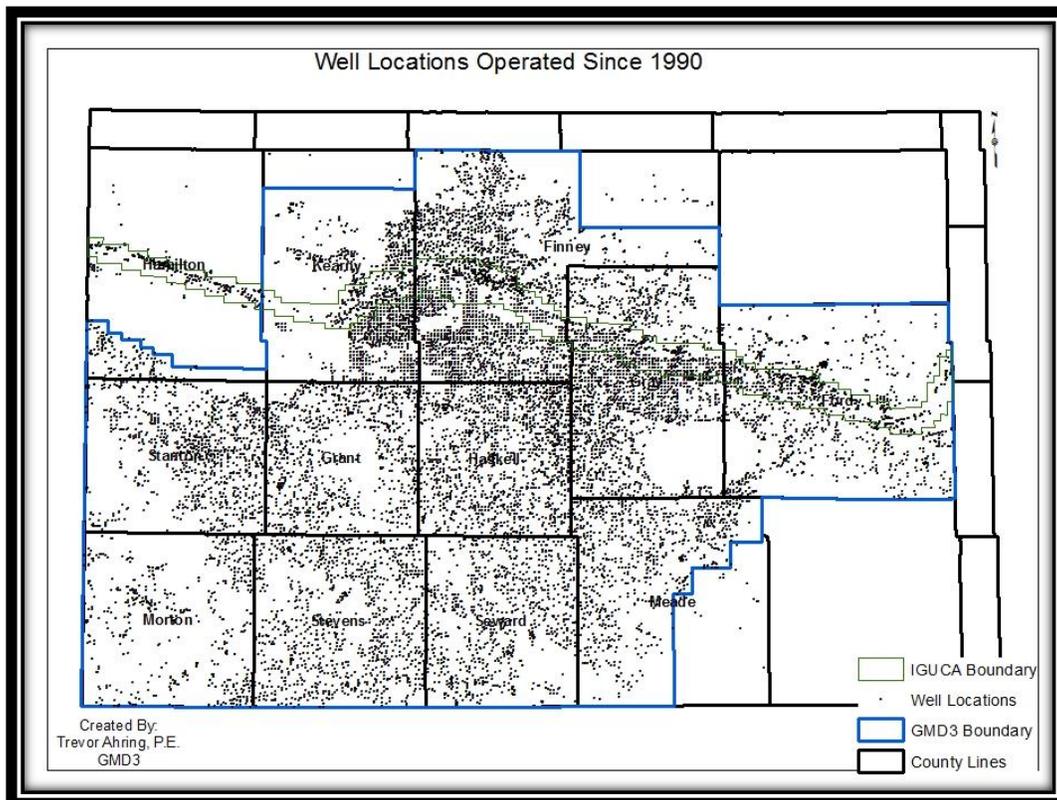
Average change Results are based only on the cooperative network (KGS and KDA-DWR) and do not include sub-regional networks from the KDA-DWR, KGS, or local GMDs. 2019 water levels are provisional.



Average annual reported water use 1995 to 2014 influenced by the precipitation patterns and available groundwater. “Other” use is primarily flow through hydropower. Source: KGS.

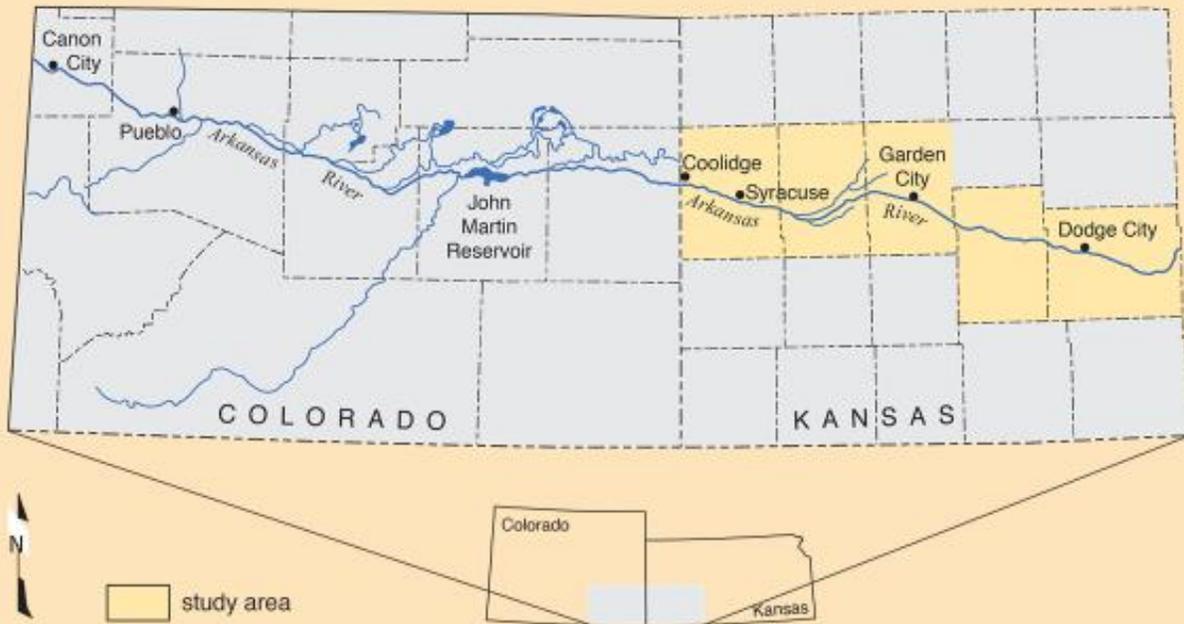


Pumping Density of the High Plains Groundwater reservoir in Kansas. Source: Kansas Geological Survey.

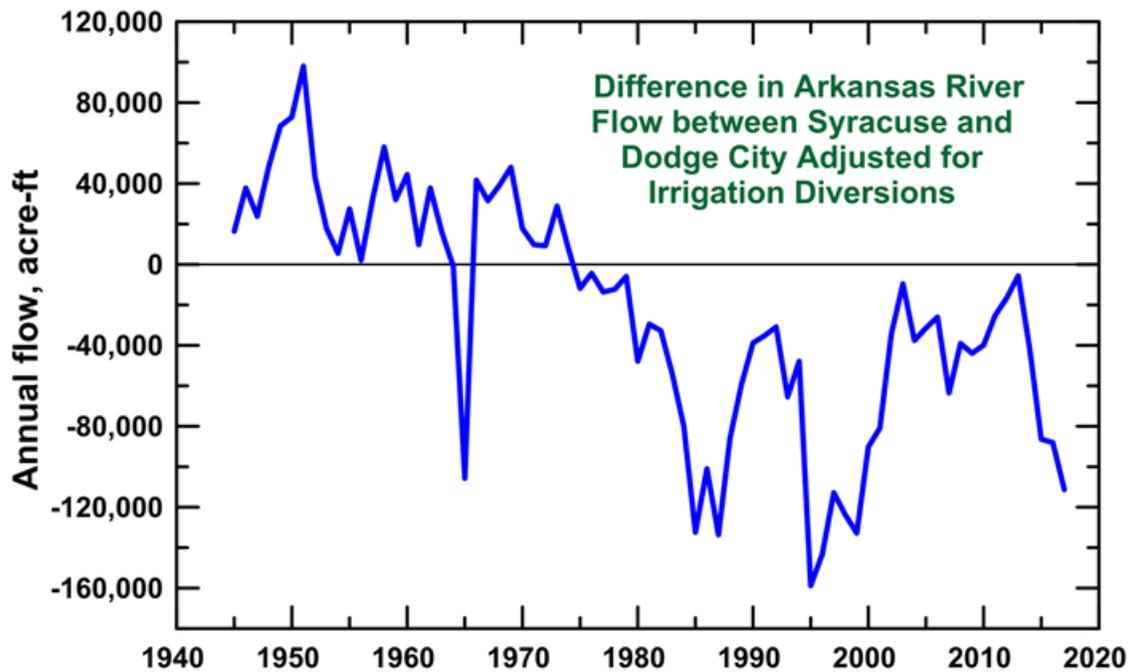


Active Non-Domestic Water Wells in GMD3

Natural Drainage and Irrigation Canals in the Upper Arkansas River Basin



Evapotranspiration in the area of irrigation diversions and reservoirs in eastern Colorado substantially decreases the river flow before it enters Kansas. A smaller extent of irrigation ditches also divert river water in the GMD3 area.



Before the mid-1970s, the Arkansas River nearly always gained flow (represented by positive values on the graph) between the area of ditch diversions and Dodge City. Now the river recharges the HPA, with recharge exceeding 100,000 acre-ft during years of higher flows. We've created a closed basin [natural surface water storage in vacated groundwater reservoir pore space]. KGS 2018

SENATE RESOLUTION No. 1729

A RESOLUTION requesting the federal government address water quality issues in the Arkansas River Basin in Southeast Colorado and Southwest Kansas and the prevalence of radionuclides in the waters of the Arkansas River Basin.

WHEREAS, The waters of the Arkansas River are declining in quality, due to naturally occurring sources that are exacerbated by irrigation and return flow practices concentrated in the Arkansas River Valley, east of Pueblo, Colorado; and

WHEREAS, In each of the last two years, approximately 10 tons of uranium have been delivered in downstream river flows from Colorado to groundwater in Southwest Kansas. The affected region in Kansas includes Hamilton, Kearny and Finney counties; and

WHEREAS, Affected communities in Colorado and Kansas require assistance to remedy decades of poor water quality, which continues to worsen; and

WHEREAS, Federal standards on safe drinking water are intended to protect the health and safety of the public. Accordingly, it is within the interest of the federal government to partner with state and local water providers to develop remedies for the Basin; and

WHEREAS, Public assistance is vital to providing safe drinking water to Kansans in the Basin, whose water supply is currently contaminated in affected communities and is threatened to be contaminated in other communities by naturally occurring radionuclides beyond the standards established by the Safe Drinking Water Act, public law 93-523; and

WHEREAS, Without additional funding, Kansas' affected communities cannot develop water management practices and necessary infrastructure to address the water quality concerns; and

WHEREAS, The U.S. Bureau of Reclamation has an established interest in providing alternative fresh water sources to portions of the affected Basin in Colorado. Currently, efforts are underway to accomplish this goal; and

WHEREAS, In 2014, the U.S. Bureau of Reclamation completed an Upper Arkansas River Basin Public Water Supply Alternatives Viability Analysis of Water Supply Alternatives for Hamilton, Kearny and Finney counties in Kansas. The analysis addressed water quality and availability in the Basin and identified alternatives, including the regionalization of supply pipeline alternatives. However, such supply pipeline alternatives are largely unaffordable due to participants' inability to cover construction costs; and

WHEREAS, In 2015, the U.S. Bureau of Reclamation completed an Arkansas Basin from John Martin Reservoir to Garden City, Kansas, Final Plan of Study, acknowledging the shared water quality problems in Colorado and Kansas: Now, therefore,

Be it resolved by the Senate of the State of Kansas: That the State of Kansas hereby requests that the Kansas congressional delegation work with the U.S. Congress to provide funding and direction to the U.S. Bureau of Reclamation to implement the efforts identified in the 2014 and 2015 studies, including, but not limited to:

1. Further compiling information on existing, usable sources and projected demands;
2. developing Basin tools, including scientifically defensible hydrologic and economic modeling tools;
3. completing system reliability and impact analyses to assess the current and future capability of existing natural and manmade infrastructure and operations to meet demands and useable water supply challenges;
4. identifying adaptation strategies to improve operations and infrastructure and to address current and future water availability and quality challenges in the Basin; and
5. developing recommendations to address the water quality challenges and to provide reliable, clean sources of drinking water in the affected areas of the Basin; and

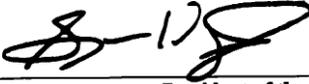
Be it further resolved: That we request the Kansas Water Office, Southwest Kansas Groundwater Management District No. 3, and other state and local partners in Kansas and Colorado to work with the U.S. Bureau of Reclamation to complete these tasks and to address the concerns regarding the contamination of the Arkansas River Basin; and

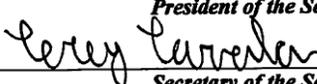
Be it further resolved: That the Secretary of the Senate shall send enrolled copies of this resolution to Kansas Governor Laura Kelly, each member of Kansas' congressional delegation, the Kansas Water Office, Southwest Kansas Groundwater Management District No. 3, the Arkansas River Compact Administration, the U.S. Bureau of Reclamation and the current U.S. Secretary of the Interior.

Senate Resolution No. 1729 was sponsored by Senator John Doll.

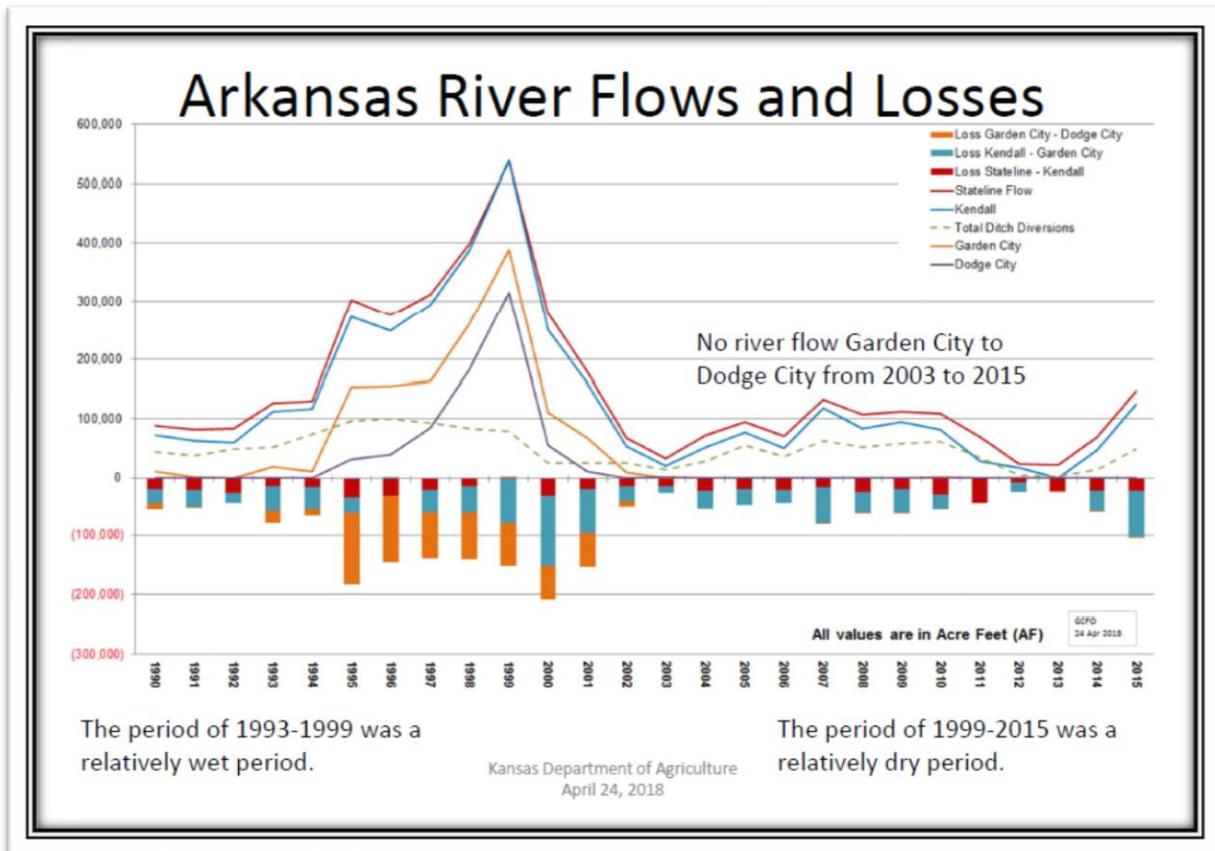
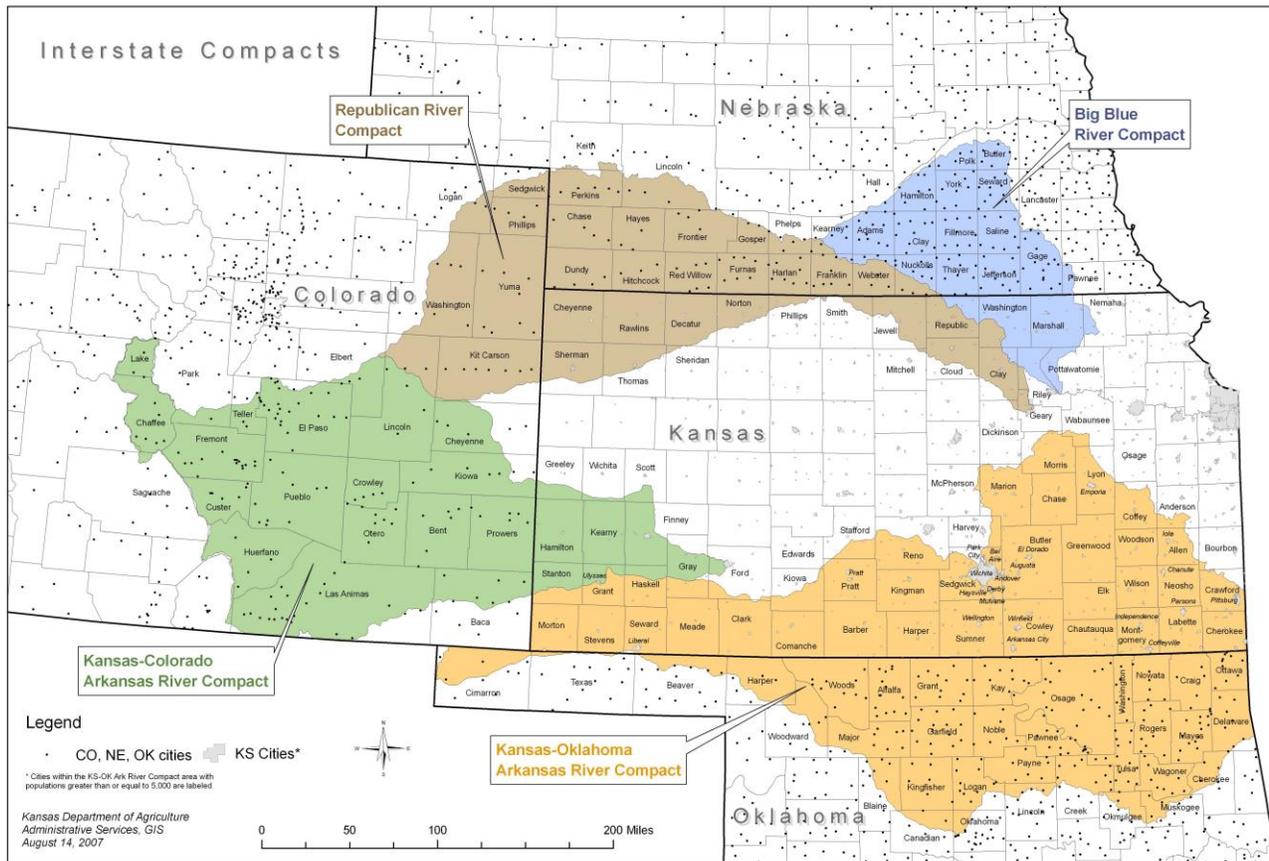
I hereby certify that the above RESOLUTION originated in the SENATE, and was adopted by that body

March 21, 2019



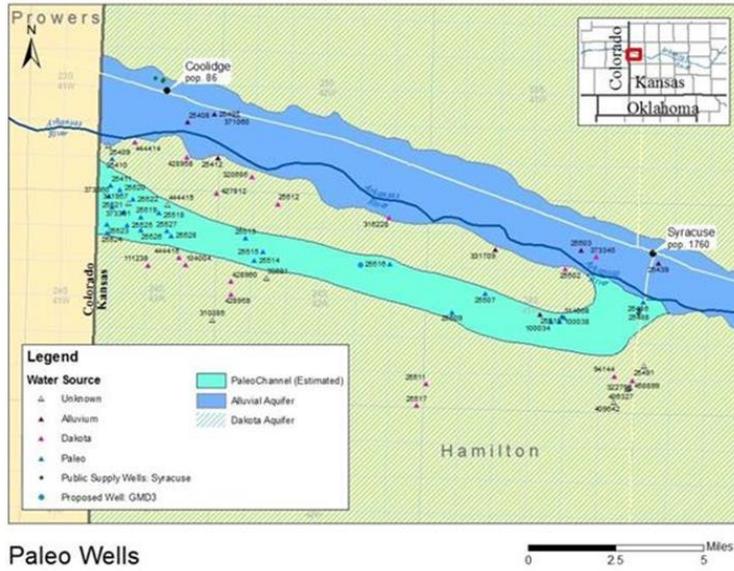
President of the Senate.


Secretary of the Senate.



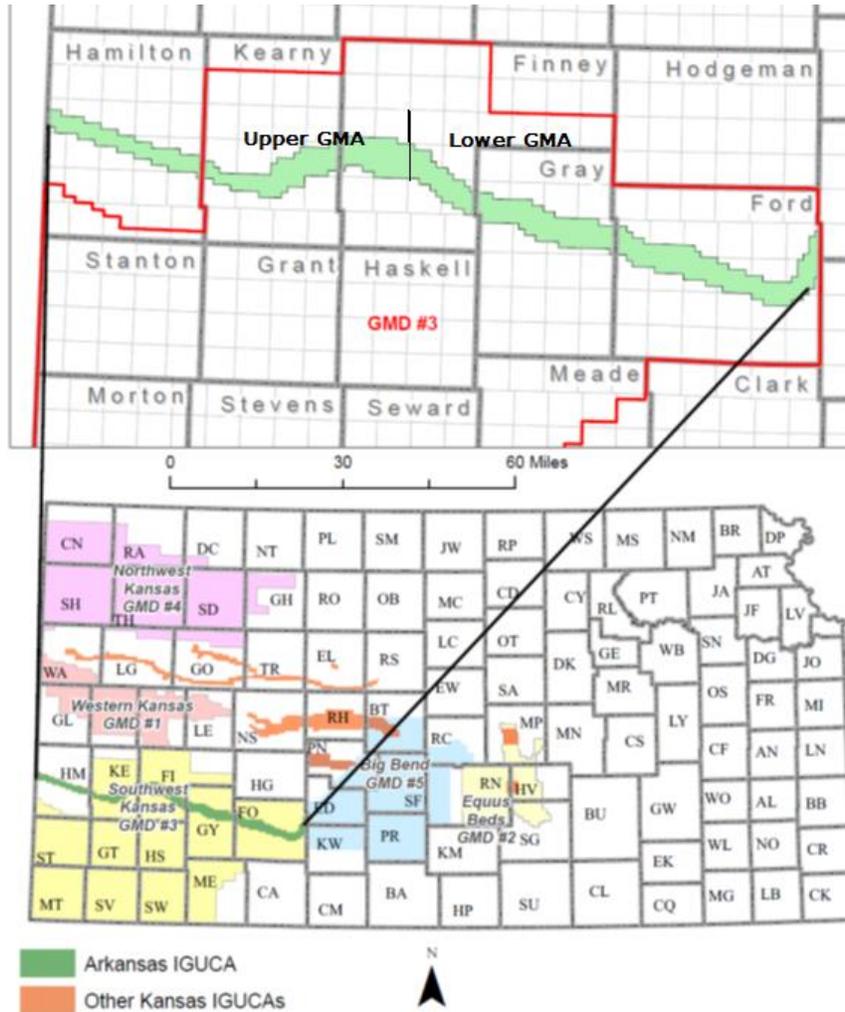
Arkansas River flow/loss chart. Source: KDA/Div. of Water Resources

Local Stateline Hamilton County freshwater groundwater reservoir in need of groundwater

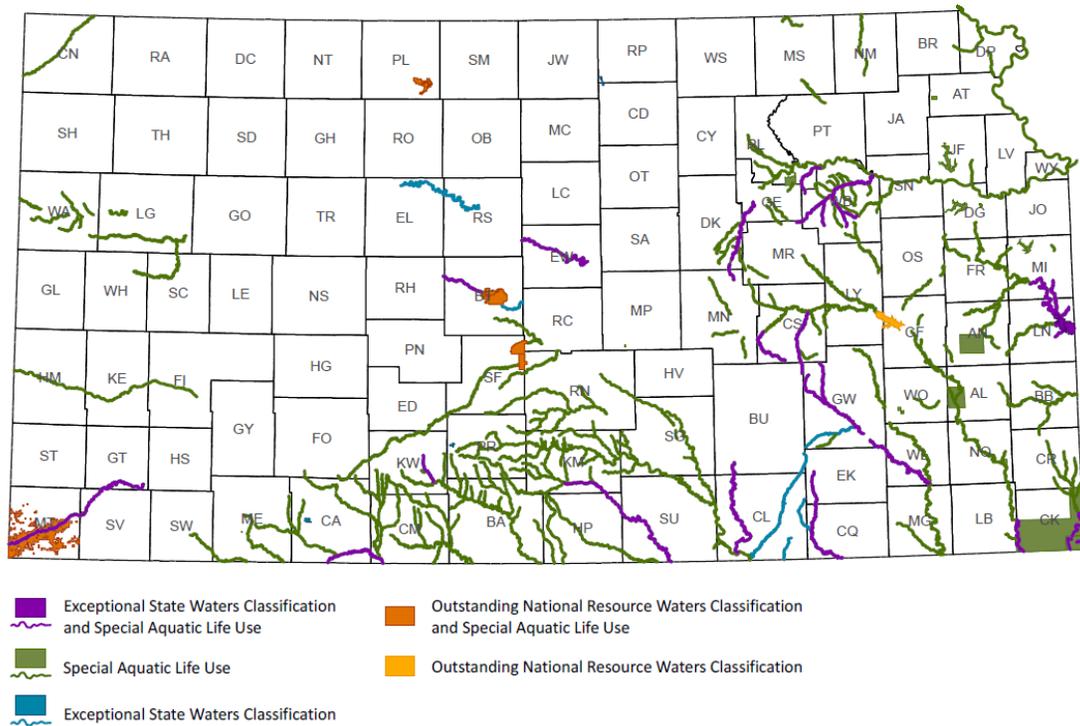


management. Paleo Wells

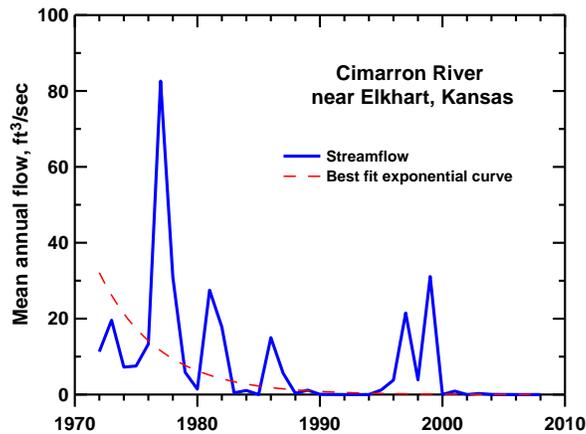
Ark River IGUCA



High Value Surface Water Designations within Kansas



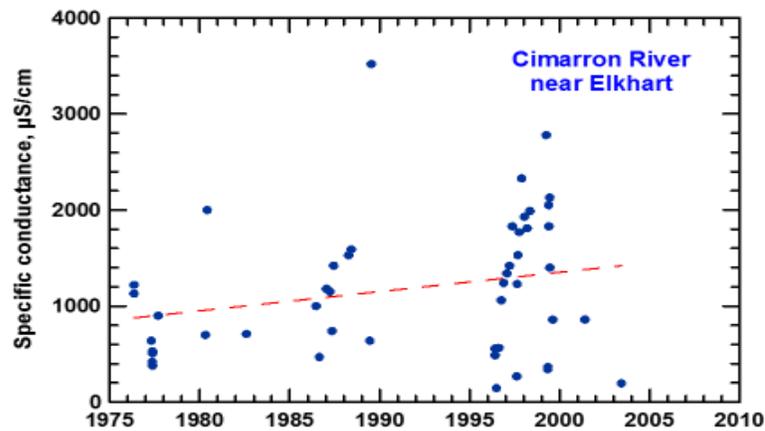
Map showing Exceptional State Waters and Outstanding National Resource Waters of the Cimarron River and National Grassland. Source: KDHE, 2010



Cimarron River entering Kansas in Morton County

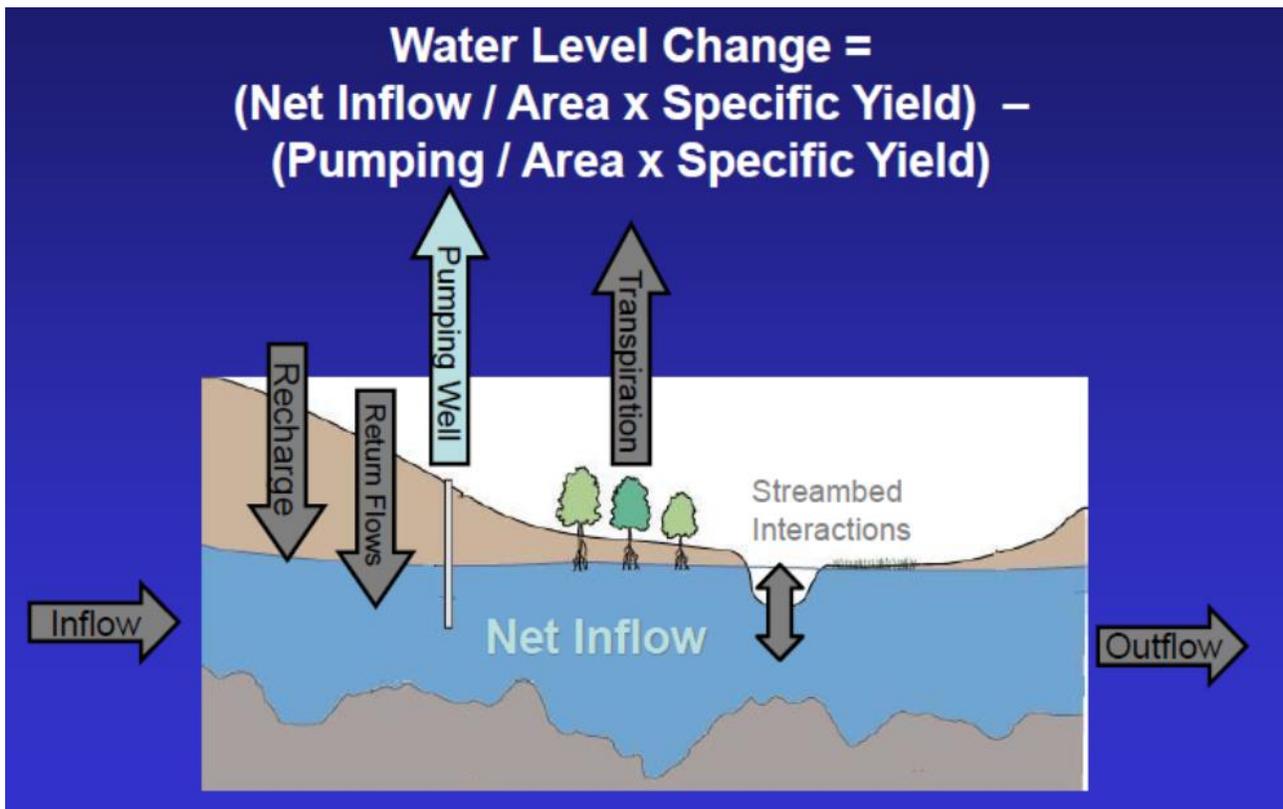
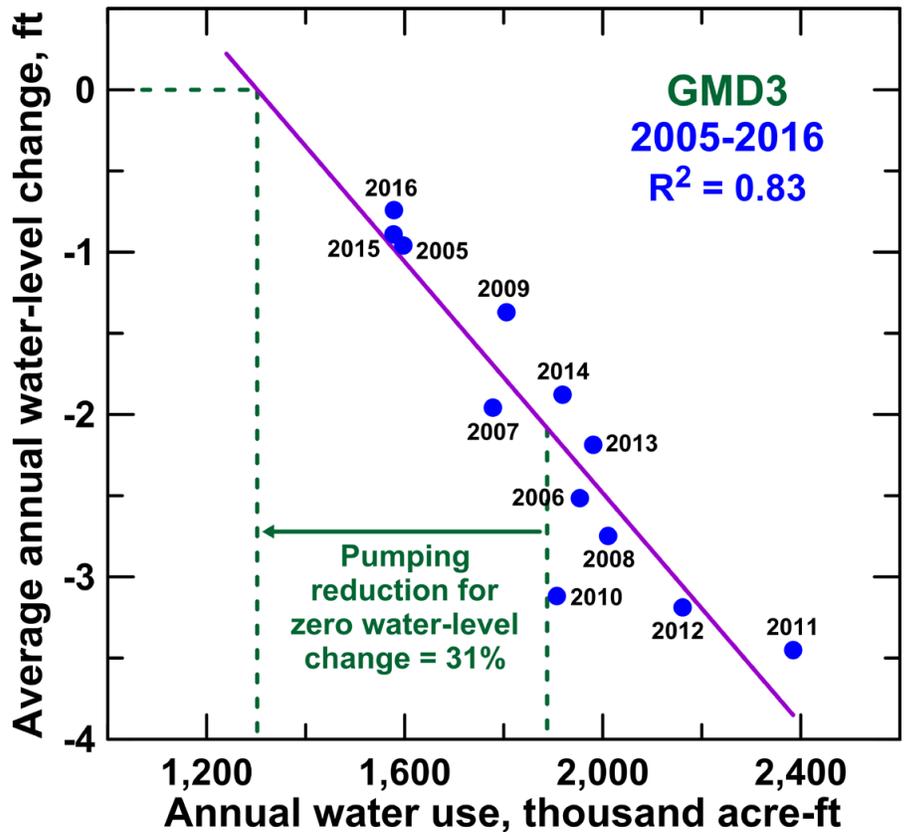
Water use in the Cimarron River valley upstream of Kansas has decreased flow and increased salinity in the river entering Kansas. The river no longer usually flows, thus, impact of saline (high sulfate) river water on groundwater in Kansas is minimal.

From Kansas Geological Survey Open File Report 2005-27



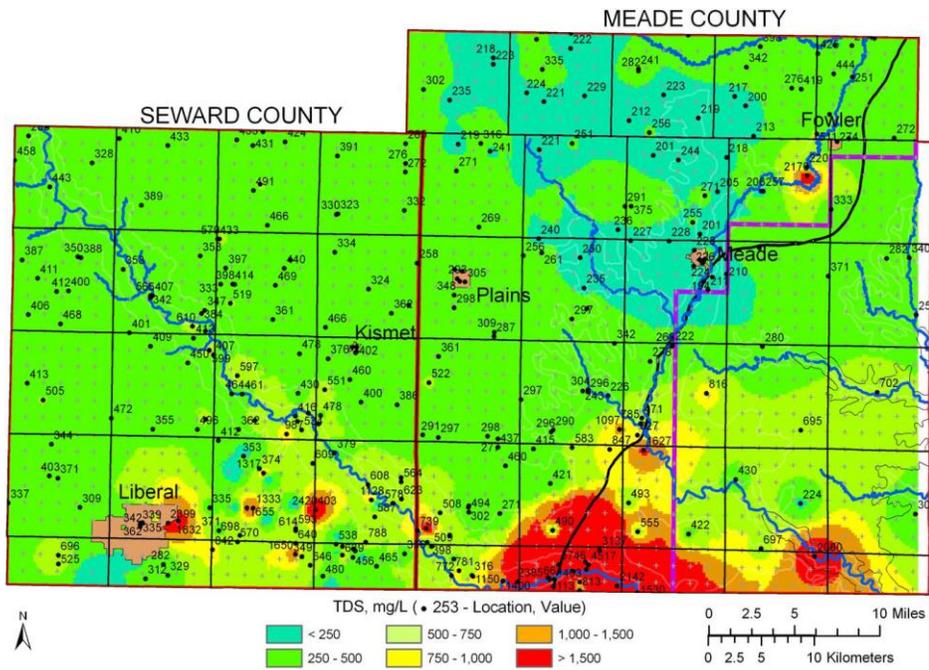
How close to sustainable?

Average annual water-level change versus annual water use for GMD3 for 2005–2016. Water-level data are for KGS-DWR cooperative network wells measured each winter during the period. The solid line is the best-fit straight line to the plot. The pumping reduction from the average water use for 2005–2016 to that needed to achieve a zero water-level change is shown by the vertical dashed green lines. From *Status of the High Plains Aquifer in Kansas* | Whittemore, Butler, & Wilson, KGS Technical series 22, 2018.



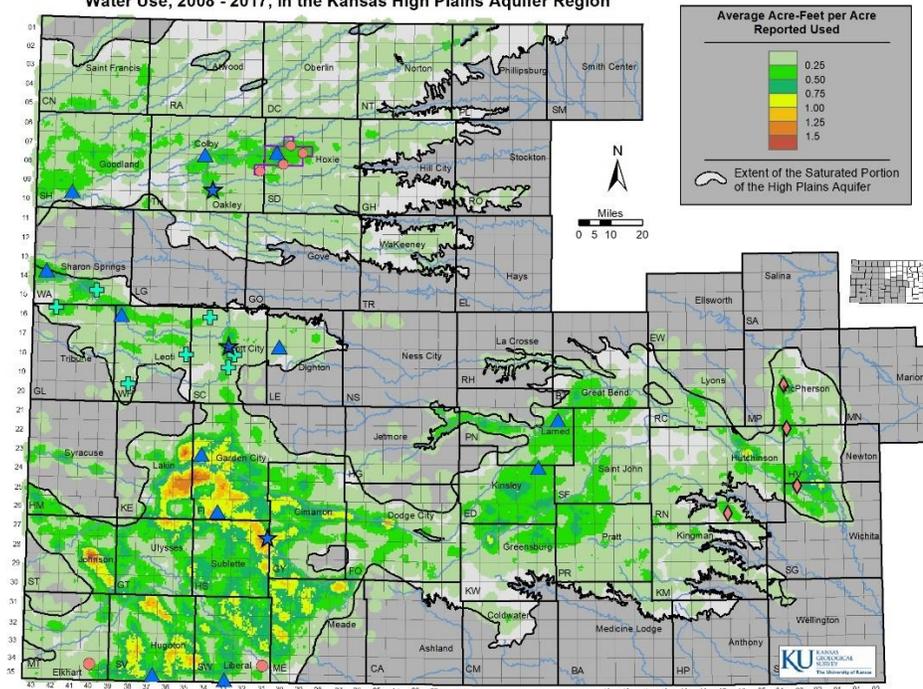
Source: Kansas Geological Survey

GMD3 Special Rule GMA (Water Quality Control Area)

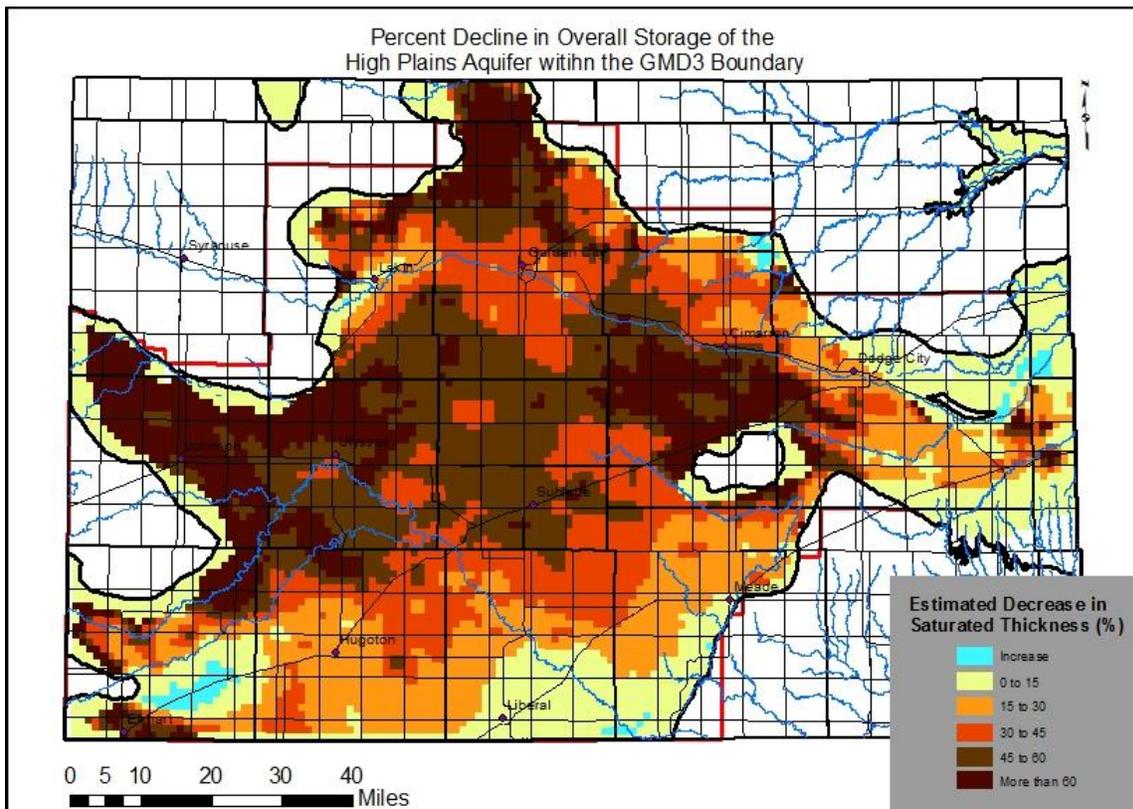


Distribution of chloride concentration in groundwater in groundwater reservoirs in Seward and Meade counties. The blue line extending from northwest to southeast Seward County and through southwest Meade County is the Cimarron River. Most of the blue lines in northern, central, and southeast Meade County are streams that are part of the Crooked Creek drainage basin. The vertical red line is the boundary between Seward and Meade counties. The purple line within Meade County is part of the eastern boundary of GMD3. The black line extending from southwest to northeast Meade County represents the eastern extent of the saturated part of the High Plains Aquifer in the figure. From KGS Open File Report 2005-27.

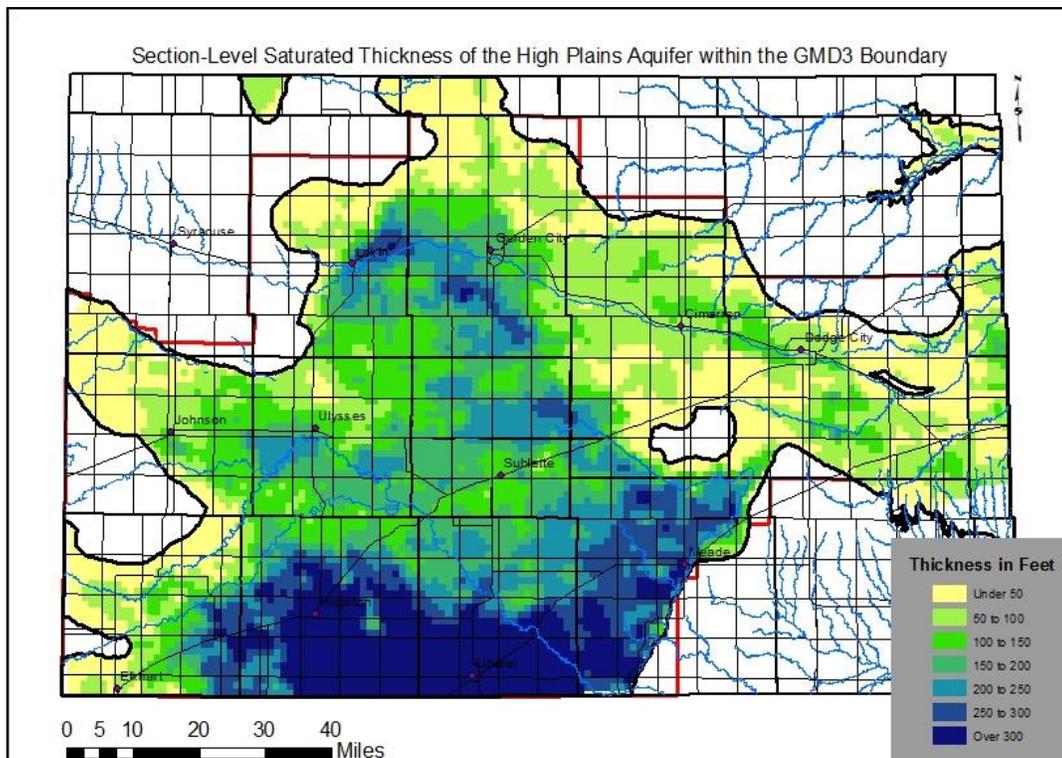
Density Distribution (2-mi radius) of the Average Reported Groundwater Use, 2008 - 2017, in the Kansas High Plains Aquifer Region



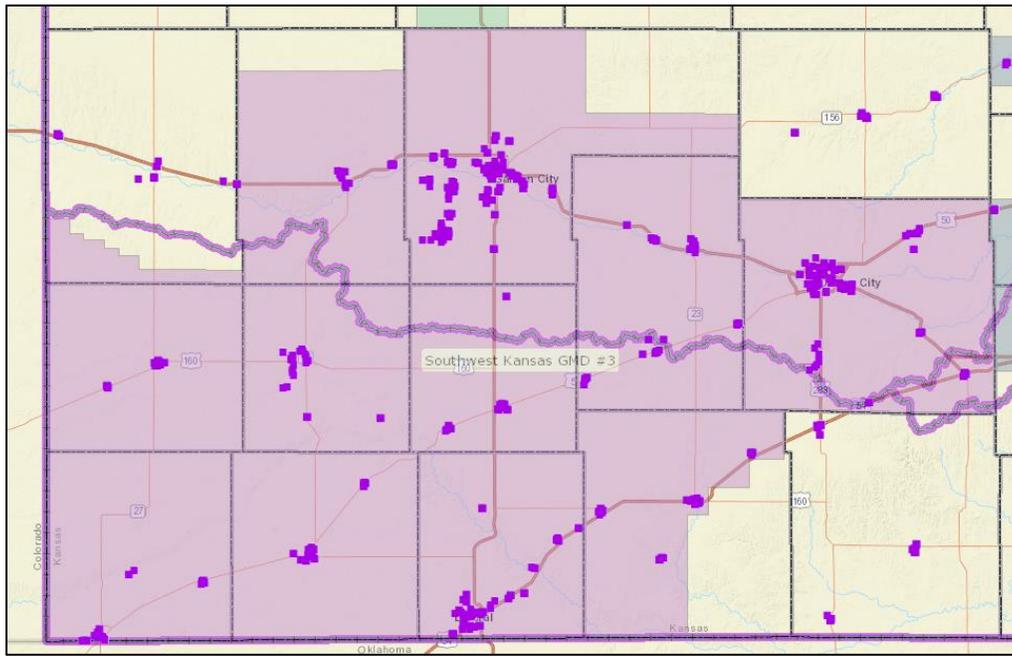
Kansas High Plains Groundwater reservoir detailed pumping density and location of KGS index wells in 2019.



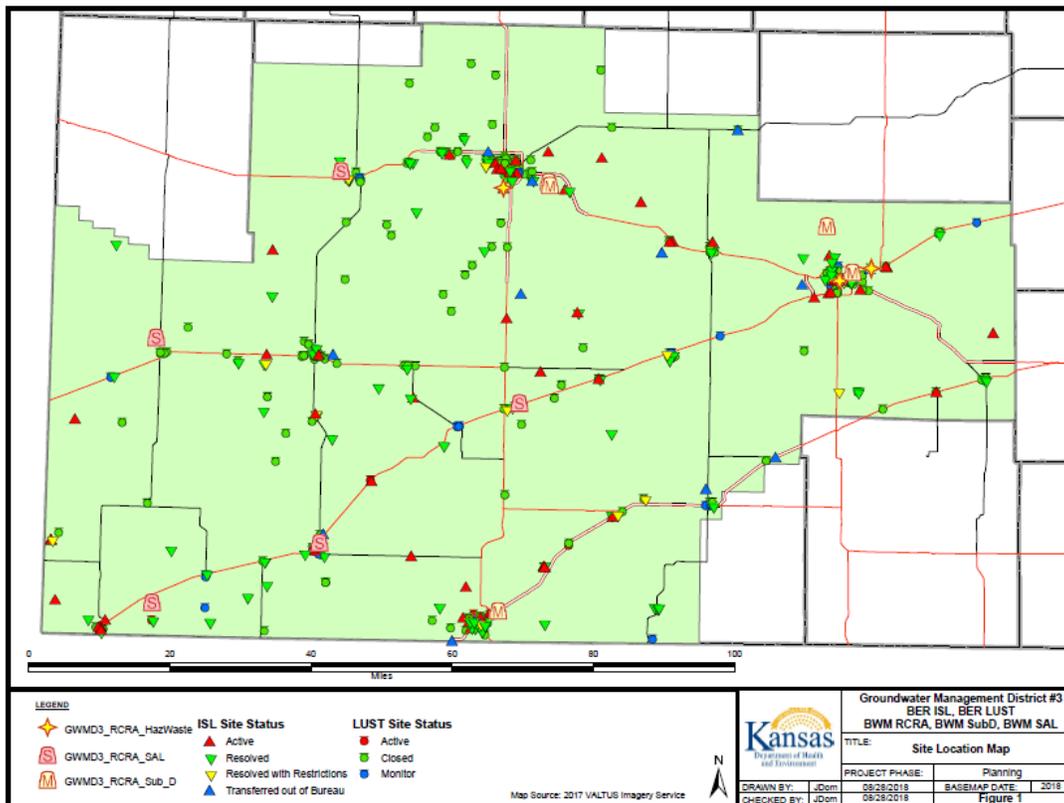
Section level percent decline in storage (since 1950) of the High Plains Aquifer in GMD3.
 Source: KGS, <http://www.kgs.ku.edu/Publications/pic18/index.html>



Saturated Thickness of the Ogallala/High Plains Aquifer, 2015. Source: KGS,
<http://www.kgs.ku.edu/Publications/pic18/index.html>



2018 KDHE map of the 67 public water system infrastructure locations within or near GMD3. Map includes the boundary through the district between the Upper Ark and the Cimarron basins. Southeast Ford County includes the upper Rattlesnake Creek basin.



KDHE 2018 map of contaminated sites documented in the Identified Site List (ISL) and Leaking Underground Storage Tanks (LUST). A subset of these are “orphaned sites” with no identified responsible entity for site cleanup, including groundwater remediation.

GMD3 Draft WCA Conservation Plan Executive Summary

Example for the GMD3 management program appendix

The Proposal: Water Conservation Area plan for Southwest Kansas

New state law allows water users to develop management plans with flexibilities that substantially exceed the limitations of current water rights in return for achievement of measurable corrective controls for water conservation. Under the management program, corrective controls are considered type (2) groundwater reservoir maintenance. A 15-member team formed in early 1974 explored the development of a GMD. The team has changed with elections and voluntary service of individuals over time, investing more than 500 monthly meetings and thousands of hours in this process. They have provided their own funds and obtained support from the Kansas legislature and local, state and federal agencies to guide their process. The present elected board and staff is comprised of industry representatives, community leaders, city commissioners, school board members, COOP board members, and surface water and groundwater managers. The result is a management program and formal local agency to oversee a Southwest Kansas GMD3 Water Conservation Area that receives significant partner activity and member support.

The Issue: Water

Our communities, economy, and quality of life depend upon water. The Ogallala groundwater reservoir is our primary and most important water resource. Overall, about 38% of the water stored in the Ogallala groundwater reservoir underlying southwest Kansas has been used. Irrigation accounts for 96% of the water withdrawn from the groundwater reservoir. Despite a diminishing number of wells and reduced pumping capacity, our groundwater reservoir water level continues to decline at an average rate of about 24 inches per year, or about 3.6 inches of actual water decline per year over the productive groundwater reservoir areas. Some areas exceed the maximum allowable depletion rate adopted by GMD3 of 40% in 25 years.

The Solution: Type 2 Water Conservation

Conserve water now through a coordinated, district-wide water management program that extends the life of our portion of the Ogallala/ High Plains Groundwater reservoir by reducing irrigation use while groundwater replenishing supply is developed and made available. This approach extends the life of the groundwater reservoir to provide time for new technologies to emerge and for businesses to adapt to changing conditions while renewable sources infrastructure is developed to transfer water for conservation storage in the 60 million acre-feet of available district Ogallala groundwater reservoir pore space.

Key Features of the GMD3 WCA Water Management Plan

- Developed by district water users for the benefit of their own communities
- Provides a process based on local and state conditions to achieve conservation goals
- Participation is voluntary
- The WCA management plan is reviewed, amended, and governed by participants and a locally elected board
- Includes provisions to hold participants accountable so that commitments can be fulfilled

Goal of a WCA Water Management Plan

- Implement water conservation activity in the WCA to exceed state conservation guidelines and capture transient surface waters of the state for transfer and conservation storage into groundwater reservoirs to meet established supply demand and add drought resiliency.

Details of the GMD3 WCA Water Management Plan

- Annual conservation allocations are based on existing water use capacity and adjusted to your priority of right portion of a 25-year supply evaluation period, not to exceed 40% depletion in one generation of 25 years, providing viable supply while groundwater reservoir replenishment sources are developed and transferred for preferred sustainable water supply activities.
- Uses incremental steps to achieve groundwater conservation program compliance and assure work on a new conservation sources of supply can bridge the supply and demand gap when transfer delivery and conservation storage as groundwater can occur.
- The initiation of one or more applications of permits to appropriate water for conservation storage from renewable sources to the 60 million acre-feet of available groundwater reservoir pool space.
- Each incremental step is for a period or term of 5 years; this is the period of commitment.
- Includes provisions for continuous enrollment or participation with a graduated structure of limits based on supply but without loss of the developed water rights while alternate sources to meet the total demonstrated vested and appropriated demands can be developed and delivered.
- Substantial flexibility is considerable for place of use and water may be used for any legal beneficial use while replenishment supply is being developed, subject to neighborhood participations and critical well evaluations.
- Multiple wells may be grouped into a management unit that is subject to one overall allocation of water, subject to state permitting and critical well evaluations.
- Unused annual allocations may be carried forward for use in the future – a form of water banking or groundwater reservoir maintenance credit.
- Includes provisions for establishing an annual allocation for wells that were operated under groundwater reservoir preserving voluntary conservation or were enrolled in a state or federal conservation program that preserved groundwater reservoir supply.
- The management plan is reviewed every year by the GMD3 board and can be revised to incorporate lessons learned through experience and to accommodate changes in technology and partner support.
- Works in harmony with local, state and federal officials and agricultural associations.

Credit: This document is a draft concept adapted from work of the Wichita County WCA proponents. It is included here in recognition of the civic minded leadership of local individuals who exercised their right established under the Kansas GMD Act by the legislature to locally guide water use and future of groundwater supply using the tools and provisions of the GMD Act and Water Appropriations Act.

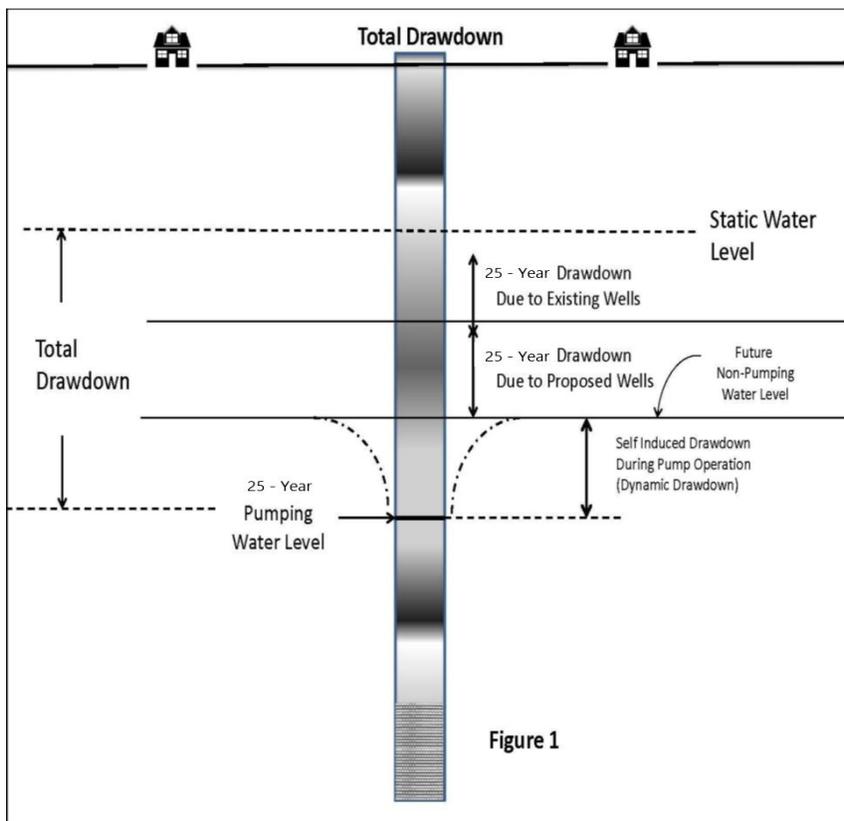


Figure 1 is adapted from *Guidelines for the Assessment of Drawdown Estimates for Water Right Application Processing* (New Mexico Office of the State Engineer Hydrology Bureau Report 05-17, May 10, 2017, by Tom Morrison, et. al.). GMD3 may use a 25-year period of pumping to be consistent with GMD3 Board policy on maximum allowable rate of groundwater reservoir depletion.

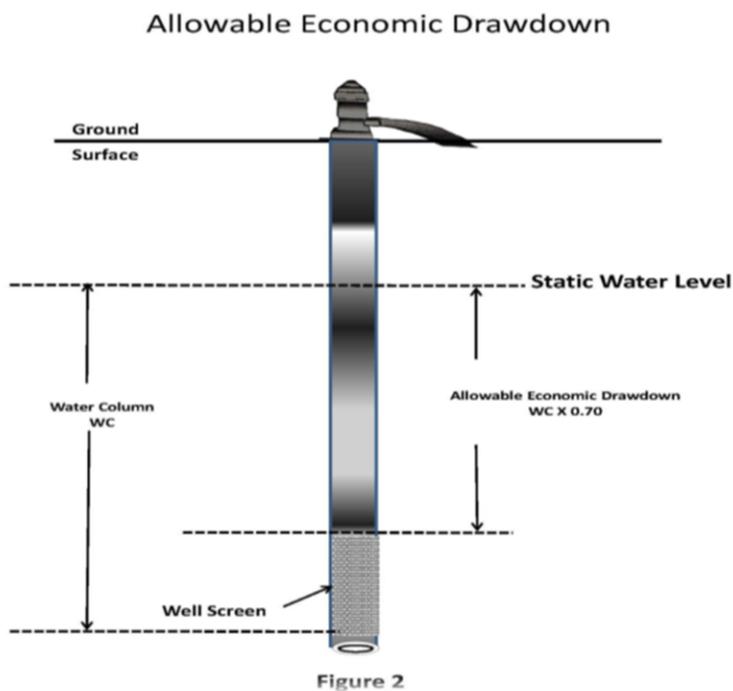


Figure 2 is adapted from: *Guidelines for the Assessment of Drawdown Estimates for Water Right Application Processing* (New Mexico Office of the State Engineer Hydrology Bureau Report 05-17, May 10, 2017, by Tom Morrison, et. al.).

See: *GUIDELINES FOR THE ASSESSMENT OF WELL DRAWDOWN ESTIMATES FOR WATER RIGHT APPLICATION PROCESSING, GMD3 2019*
Also, not depicted is **Dynamic Drawdown (Self-Induced Drawdown)**

- The Theis equation estimates drawdown in the aquifer but not inside of the well casing.
- Dynamic drawdown represents drawdown inside of casing, including well inefficiencies.
- Dynamic drawdown represents fluctuating drawdown as pumps are cycled on and off.

See: <http://www.gmd3.org/wp-content/uploads/2019/04/DRAWDOWN-ASSESSMENT-GUIDELINES-for-GMD3-2019.docx>