

Missouri Water Use Data and Research Program Workplan

WATER USE REPORTING IN MISSOURI

Major Water Users Law

In 1983, Missouri's General Assembly passed Missouri Statute Sections 256.400 to 256.433, RSMo, requiring the Missouri Department of Natural Resources' (MDNR) Missouri Geological Survey (MGS) to collect water use data from major water users (MWU). The purpose of the MWU statute is "to provide an important part of the information required in the technical assessment of current and future requirements for the regulation of water use or consumption, or both, on a regional or statewide basis". This information will support analysis of current and future water resource management needs, and provide data to compare water demands to water availability. The statute defines a major water user as anyone who has the capability to produce 100,000 gallons of water per day (70 gallons per minute) from one or a combination of water sources, and includes both surface and groundwater sources. It is important to note that this data does not include producers who are not considered major water users (i.e. private domestic wells and any other usages that are under the 70 gpm threshold).

Current Data Collection Methods

Under the authority of the MWU statute, water use data is collected annually during a reporting period of January through March for the previous calendar year of usage. The data collected is the total amount of water produced during the calendar year as well as number of days that the water was produced. Data is submitted online, by phone, or by hardcopy registration forms. Submitted data is entered automatically into a database when submitted online, and entered by hand when submitted by phone or hardcopy form. Data parameters collected include name and contact information of the water user, location of the water withdrawal point, type of water source, number of acres irrigated (if water is used for irrigation) and volume of water produced. The data and information collected is used for water planning by municipal, state and federal governmental entities, including USGS.

In order to develop this workplan and accomplish many of the detailed goals, MGS staff have or will collaborate with multiple federal, state and local organizations. The groups include USGS (both local Missouri Water Science Center and regional water use specialists), multiple sister MDNR agencies (including Soil and Water Conservation Program, Public Drinking Water Branch, Land Reclamation Program and Water Protection Program), Missouri Department of Agriculture, University of Missouri-Columbia and the US Army Corps of Engineers.

Regulatory Authority and Challenges

In Missouri, the MWU statute does not include rule-making authority. Without the aid of regulations, the implementation of the MWU law is challenging. Many producers do not report their usage and there are no penalties for failure to report or falsely reporting water usage. However, the law does allow for an injunction to be filed with the attorney general against a MWU that would cease any unregistered water

usage. Due to the lack of regulations and because MDNR does not currently enforce the law with attorney general referral, other methods must be used to educate MWU and encourage compliance.

Water use data is often inaccurately reported or is incomplete, making the data difficult to reliably use. Some users over report because of a fear of future water use regulations. They want to establish a high amount of usage in case allotments are set in the future. Conversely, other users under report because they anticipate water taxation and they want to show less usage to avoid paying a larger production tax. Additionally, some users fail to report any usage because they simply do not want the government to know the amount of water they are using. While some users deliberately report inaccurate data, others attempt to submit real, actual information. However, if the source is not metered, the water use is estimated and often inaccurate.

Importance of Water Use Data

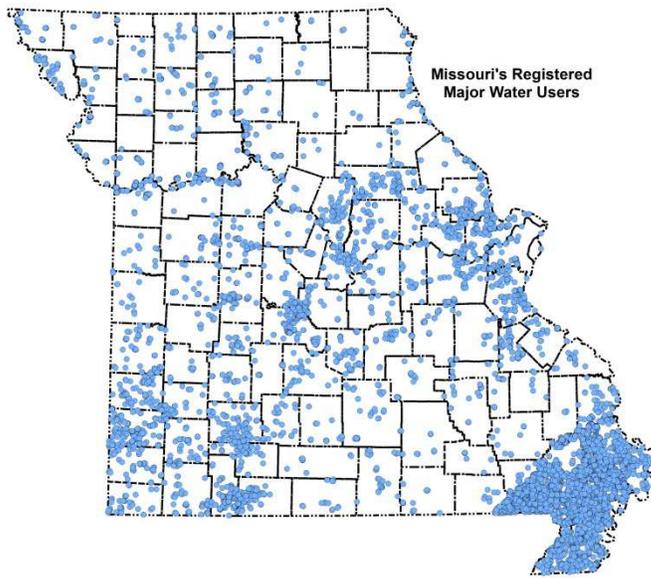
MWU currently provide water use data for nine categories including municipal, commercial, fish/wildlife, livestock, electrical, industrial, drainage/dewatering, irrigation and other usages. This water use data is a vital component for the developing water planning strategies. The Missouri Water Plan is a comprehensive program that takes inventory of water use and availability for all water sectors and develops priorities for water resource protection and development. These water sectors mimic, but do not match exactly to the MWU reporting categories. Water use sectors include public drinking water, industrial processes, agricultural irrigation and livestock, power generation, navigation and fisheries. Thus, it is critical for MDNR to support and improve MWU compliance and increase awareness among water users of the importance of having data to support water planning efforts at a local, regional and state level.

Moving water does not obey political boundaries. Therefore, it is not uncommon for states to have disputes over the use of water and the flow of water between the states. It is imperative that Missouri have accurate water use information in order to account for all water demands and establish existing uses in Missouri.

PRIORITIES FOR MISSOURI WATER USE REPORTING

Agriculture – Irrigation

The largest priority for Missouri's water use reporting is specifically targeted to the state's irrigation well producers. It is estimated that less than 15% of irrigation users statewide report their water usage. While failure to report water usage is a problem across the state, the area with the largest number of irrigation wells that have not been registered is in extreme southeastern Missouri, in the bootheel, as depicted below. It is estimated that there are well over 10,000 unregistered irrigation wells in this region, each with the capability to produce over 1,000 gallons of water per minute.



Irrigation users form the largest group of MWU in Missouri, in terms of the number of users and number of withdrawal points. In addition, the water use information that is provided by those that do report usage is often misreported. Produced water amounts are over reported by users who believe a water use allowance will be implemented in Missouri. These users over report in order to establish a high amount of water they may need so they will be allotted a larger amount if/when allowances are implemented. Conversely, a large number of irrigation MWU under report their usage. Reasoning for

under reporting focuses on the belief that Missouri will implement a water use tax. Those that under report believe this practice will lessen the amount of tax they will be required to pay in the future.

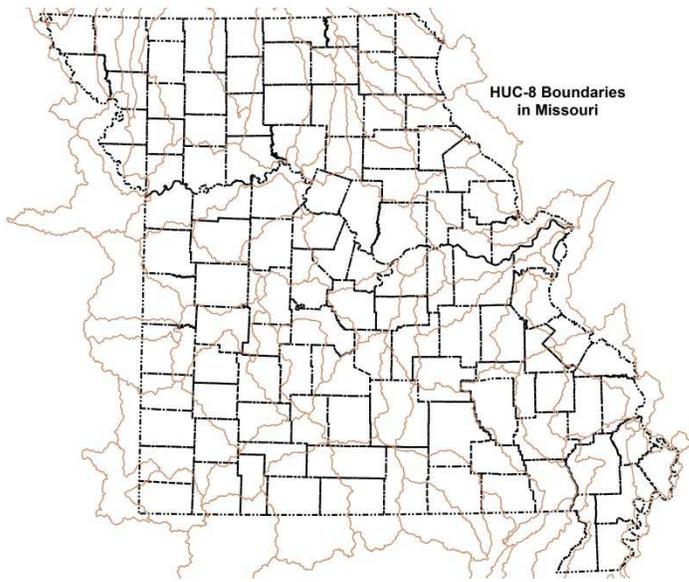
MGS believes that addressing the lack of MWU statute compliance by irrigation well users will result in the largest gain to Missouri's water use information. This will significantly increase the number of registered MWU withdrawal points in addition to increasing the accuracy and utility of the data collected.

Agriculture – Livestock

Agriculture is the leading industry in Missouri with livestock production accounting for a significant portion of the income. The 2012 USDA Census of Agriculture counted 3.4 million cattle (3.1 million beef and 250,000 dairy cattle), 2.7 million hogs, 104,000 goats, 91,000 sheep, 62.6 poultry (46.8 million meat chickens, 8.2 million laying hens, 7.7 million turkey). Because of the livestock population in the state, water needed to supply the animals on these farms is a vital component when considering the water needs of Missouri.

Development of Improved IT Application

Another priority for MGS is to develop an updated MWU database. The current database version is formatted in a web based application which can be queried using Microsoft Access. Annual water use reporting is accomplished by a MWU accessing the system online to report their annual water usage or by MGS staff entering data manually from submitted hardcopies. While this database is an improvement over the pre-2010 version, it has severe limitations when trying to enter the water use data or conducting data queries. Creating a more user friendly database is a priority for MGS in order to make the reporting process less intimidating for users which will in turn increase reporting compliance.



Identification of Water Use Sources

The current MWU database has fields for the aquifer or water basin which supply water for the withdrawal point; however, this information is not complete. Since USGS has established identification of hydrologic unit code level of 8 (HUC-8) and aquifer(s) for each water source as an additional priority, MGS will identify sources of water and populate the MWU database for national compilations.

Update of the Missouri Water Plan

Missouri has begun the process of developing and updating the state water plan. Updating the water plan is a requirement of the Missouri Water Law (RSMo 640.415) and is to be developed, maintained and periodically updated by WRC. This plan is a long-range, comprehensive, statewide program for the use of surface water and groundwater resources of the state.

This plan will aid in the assessment of and responsible use of Missouri's water resources. The water plan will assess many USGS water use data categories such as drinking water supplies (both public and domestic), agriculture usage (irrigation and livestock), electric generation (both consumptive and non-consumptive usage) and industrial/commercial usage. Improvement of data used for water planning activities will be critical for Missouri's water planning work and project implementation.

Municipal, Domestic, Commercial and Industrial Water Usage

Missouri citizens obtain their water from either public water supply systems or domestic self-supplied systems. The population of the state in 2015 was 6 million. MDNR's *2016 Census of Public Water Supply Systems* states that 5.3 million people (88.3%) obtain their water from a public system. This leaves 700,000 people (11.7%) to produce their water from a self-supplied source.

Collection of water use data to satisfy the MWU law requires the division of water use by category. Three of these categories are municipal, commercial and industrial usage. These categories correspond with those identified by USGS. In addition, USGS has set consumptive usage within public water supplies along with industrial self-supplied uses as an "additional priority" in their guidance for grant application. It is very important to identify specific uses within public water supply production in order to quantify actual per capita usage in private homes. Per capita value is especially useful in Missouri where domestic well users are not required to report their usage. This value can be used to estimate usage in rural areas where water is supplied by self-served methods.

Water Used for Electricity Generation

In Missouri, water is an important component needed to generate electricity, by both thermoelectric and hydroelectric methods. Approximately 70% of water needs in Missouri is used for thermoelectric generation and totals 2.5 trillion gallons annually. The amount of water passed through hydroelectric generators is significant as well, but not captured by MGS at this time.

Since the amount of water used for electric generation is so high, it is vital that this need is quantified and verified. Some of this water is pass through, or non-consumptive, and has the potential to be used multiple times where lakes are in succession or where multiple powerplants are located along the same river. Conversely, some water is consumed and some is lost when steam is produced during the cooling process in the thermo plants.

Mine Dewatering

Missouri has over 800 mines or quarries that operate both above and below ground. If these operations, either surface or subsurface, extend below the water table, they must dewater the mine to keep it operational. In many cases this practice removes groundwater from the mine and discharges it to a surface stream. The dewatering process essentially creates a groundwater cone of depression around the mine site while creating an abnormally high flow in the stream. While mine dewatering may be used for beneficial uses such as dust control, hydraulic mining and ore processing, the majority of the water is simply discharged.

Golf Course Irrigation

MWU reporting includes the category of irrigation. Currently, this database does not distinguish between crop and golf course irrigation. With nearly 400 golf courses in Missouri, the amount of water used at these facilities is significant. Pulling golf course irrigation usage, along with commercial and industrial usage, out of the amount of water reported by municipalities will provide a more accurate water amount to calculate per capita water usage. It is important to identify the source of water used for golf course irrigation to determine surface and groundwater sources as well as if the supply is from a municipal or self-supplied source.

METHODS FOR IMPLEMENTING WATER USE DATA PRIORITIES

The Water Use Data and Research Grant financial assistance guidance identifies 12 water use categories. MGS will utilize the three tier approach as defined by USGS to assess the level of completeness per water use category as it relates to minimum baseline goals. MGS will evaluate each category to determine the existing tier level and provide USGS with the details of how that tier is met. Missouri does not currently break water usage into the USGS categories of golf irrigation, aquaculture and wastewater treatment. Efforts will be made by MGS to coordinate between sister agencies to further define water use into divisions as defined by USGS (i.e. commercial, municipal, domestic, irrigation, etc.) and collect data needed to meet minimum tier one baseline goals for wastewater treatment and aquaculture. This assessment will aid MGS in setting priorities to enhance water use data and provide direction for MGS to move to the next tier for categories where Missouri has already met the minimum baseline goals.

Agriculture – Irrigation

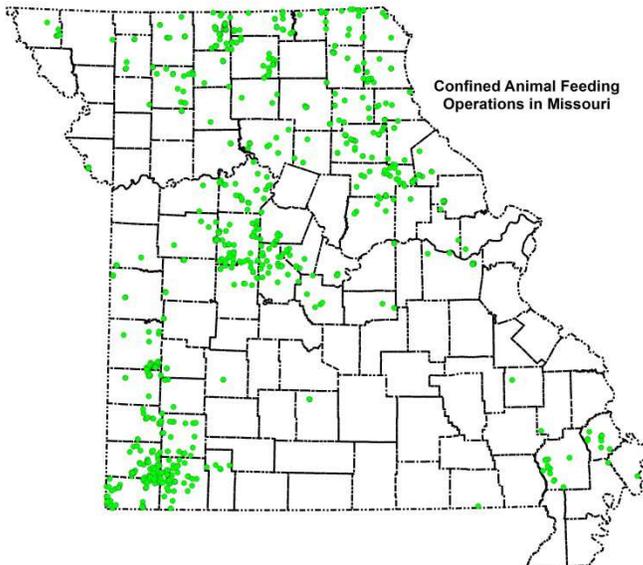
MGS proposes to address this issue with multiple initiatives. Lack of education about the MWU statute is a major obstacle in the Bootheel region of extreme southeastern Missouri. MGS will develop and provide presentations to county and area soil/water district offices, agriculture research centers and university extension offices. Educating fellow government workers who have direct contact with irrigators is the first step. Secondly, presentations will be given directly to irrigators at local commodity meetings and field day tours at research farms. Education of the requirement, need and purposes of water use reporting is a key element to increase compliance with the MWU statute.

MGS will propose to hire an additional staff member to be stationed in the Bootheel region. Being located in the region will give this staff direct contact with local irrigators and give them the opportunity to bridge the gap between the users and the regulators. This individual will be an entry level hydrologist whose duties will include making direct contact with irrigators to educate them on the MWU statute requirements and navigation of the online reporting system as well as assisting with identification of well locations and calculation of water usage.

MGS staff will also team with other MDNR staff who manage grant programs which target irrigation operations. The intended result of this partnering will make registration of irrigation wells and reporting of water usage a requirement to receive grant funding. This requirement should increase compliance with the MWU statute and thus increase the amount of information available in the MWU database for use in various applications including water planning.

Agriculture – Livestock

The MWU database specifies water use by percentage for livestock. A portion of the total amount used for this category will be determined based on this data. Currently there are nearly 800 confined animal feeding operations (CAFO) in Missouri. The number and species of livestock in these operations will be used with an average consumption rate to estimate the total amount of water used. The type and source of water will also be determined to satisfy the tier one requirement for livestock water usage for major facilities.



Identifying annual withdrawals from major facilities is a component of the tier one requirements for this category. Identifying the CAFO operations and their water source will move Missouri's livestock water use data to tier one.

Development of Improved IT Application

The MWU database is populated via an online interaction of the MWU. This interface is difficult for some to use and does not allow for needed

editing of existing water use information. New withdrawal points can be added, but the user cannot remove wells that have been plugged or surface water intakes that have been removed. Additionally, the system does not provide a way to verify the location of withdrawals. MGS proposes to coordinate with MDNR-IT staff to develop a new and improved water use reporting system. The proposed database will be interactive and include a visual map component. A user will be able to query all of their withdrawal points which will be plotted on a map. The user will then be able to change locations as needed and also insure the proper water use report is associated with the correct withdrawal location. There will be built in data quality checks to verify the amount of water reported is realistic compared to the pump capacity of the withdrawal. This system will be interactive and prompt the user with questions such as “Do you need to add a withdrawal point?”, “Do you need to edit withdrawal information?”, “Do you want to view your another year’s water use data?”, etc.

The development of this improved system will be more user-friendly and make water use reporting much easier. The improvements will lessen the burden of water use reporting on the users and thus increase both the number of MWUs and the quality of the data. The improved MWU database will provide staff the ability to more efficiently query system to provide water use data for information requests including the five year USGS water use reporting.

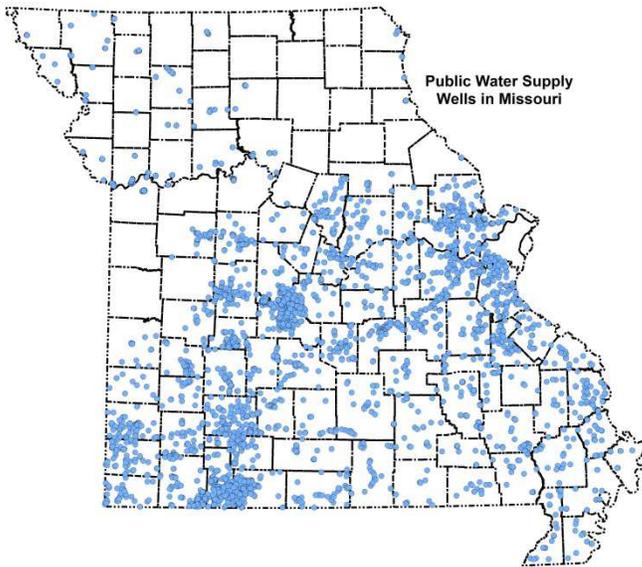
Improved data collection, quality assurance and delivery is one of the top three water use priorities for USGS. Updating of this database system will aid in addressing this issue.

Identification of Water Use Sources

One of the tier one goals for many of the water use categories is to identify the HUC-8 for surface water sources as well as identify the aquifer from which wells produce water. MGS will utilize geographic information software (GIS) to perform a spatial analysis to determine where HUC-8 withdrawal points are located and then populate the MWU database with this information. Additionally, GIS will be used to perform an analysis to determine from which aquifer wells are producing water. This will be a multiple step process including locating the well in respect to aerial extent of aquifers as well as the depth to which the well was drilled. Some wells may produce from a single aquifer while other wells may be open to multiple producing aquifers. This information will be determined and, like the HUC-8 data, entered into the MWU data where it can be queried and provided to requesters including USGS to be compiled with other national data sources.

Update of the Missouri Water Plan

In order to address the priority of an updated state water plan, MGS will develop a long-term vision to manage current water resources and chart the path for development of water resources in the future. The purpose of the state water plan is to ensure the quality and quantity of surface and groundwater resources are maintained at the highest possible level to protect public health, safety and general economic welfare of the citizens of Missouri. The plan will analyze water demand and availability, identify gaps between need and supply, and address water quality and infrastructure issues. Stakeholders will be engaged to provide input and identify priorities for infrastructure funding and water development in the future. The various sectors that will be analyzed in the state water plan are water supply, agriculture, industry, recreation, environmental protection and other needs. The development of a state water plan will



contribute to this workplan by estimating water needs of water use sectors and thus aid in the estimation of water use in the state.

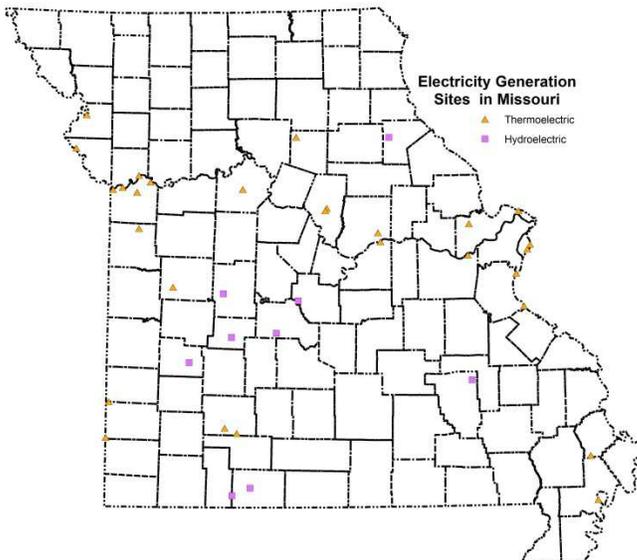
Municipal, Domestic, Commercial and Industrial Water Usage

Collection of water use data to satisfy the MWU law requires the division of water use by category. Three of these categories are municipal, commercial and industrial usage. Water usage is entered into the MWU database in total gallons produced and percentage of use by category. MGS will cross check the MWU reported amounts

from public water supplies with those reported to MDNR’s Public Drinking Water Branch. Discrepancies between sources of data will result in communication with the user to clarify usage amounts and category. Calculations will also be made to determine gallons of water used per category based on the percentage of total water produced as reported in the MWU usage submittal.

Domestic water usage is not required to be reported in Missouri. However, all wells constructed must be submitted to MGS for certification of construction. Calculations can be made based on the number of wells construction to estimate the amount of water that is produced to self-supplied domestic water usage needs. Domestic usage can be estimated for rural areas not supplied by a public system by determining the per-capita usage for residents supplied by public water systems and using that amount to assign a value to the underserved areas.

Improved estimation of how public water supplies are divided among industrial, commercial and domestic use is one of the top three priorities for USGS. This task will help satisfy this goal.



Water Used for Electricity Generation

In order to quality check the MWU data reported for electric generation, MGS will obtain a list of power generation sites from the Department of Energy and contact each owner. The plants will be separated into those producing power by hydro and thermo methods. Hydroelectric generation is

non-consumptive and tasks will center on identifying the amount of water passed through the system. Thermoelectric generation is a mixture of consumptive and non-consumptive use. MGS will query the power plants to verify amount of water produced and amount returned to the surface water system (lake or river) to obtain non-consumptive usage. Consumptive usage will be the difference between the quantity produce and the quantity discharged. Identification of water withdrawn, amount passed through or consumed, and the source of water will help satisfy tier one goals.

Mine Dewatering

The MWU database includes water produced to dewater mines. These MWU will be compared to a list of active mines to determine potential MWU who are not currently reporting water usage. Once a list of active mines who utilize dewatering practices is complete, each mine will be contacted to determine amount of water produced at the site. The water used for dewatering activities will be subdivided into beneficial use activities as well as for discharged purposes. This information will be combined with water source information to satisfy the tier one mining baseline goals.

Golf Course Irrigation

MGS will address this reporting category using two methods. First, a query of the MWU database will be performed to determine municipalities that produce water for irrigation. These cities will then be contacted to inquire if the irrigation was for a golf course. If the water produced is used to irrigate a golf course, the percentage used will be multiplied to the total volume of water to determine the amount used to irrigate the course. Another strategy is to perform an internet search for golf courses in Missouri. As with the cities, the courses will be contacted to determine the source and quantity of their irrigation water. Water source will be segregated into surface vs groundwater categories as well as municipal vs self-supplied categories. These steps will be performed to meet tier one baseline goals.

Education Efforts to Increase Knowledge of MWU Requirements

MGS proposes an increase in activity to educate MWU about Missouri's water resources and the need for associated reporting of usage. These efforts will focus on presentations to MDNR regional office staff, University of Missouri Extension, USDA Farm Service Agency and other local, state and federal staff who have a role in promoting the responsible usage of the state's water resources. MGS will propose to add a staff member specifically to address education needs to of irrigation MWU in southeastern Missouri. This individual will conduct field work to verify well location and identify unregistered wells, provide education to irrigation well users about the MWU reporting requirements and coordinate with other MGS staff by providing guidance to MWU on annual water use reporting.

SUMMARY

Missouri has a wealth of water resources, both surface and groundwater sources. Water is used in Missouri falls into nearly all of the USGS reporting categories. Much of this usage is collected by various means within the Department of Natural Resources and can be compiled for reporting. However, the two largest groups of users by numbers of withdrawal points, irrigators and domestic well users, are not captured completely or accurately.

Missouri has a Major Water Users Law which requires those capable of producing 70 gallons of water per minute or more to report their water usage to the Missouri Geological Survey. When this law is adhered to, it has the capability to produce much of the information needed to support the water use reporting requirements of USGS. However, the enforcement of this law is minimal and it does not address the users producing less than 70 gpm.

The coordinated effort between MGS and USGS to improve the quantity and quality of water use data in Missouri will be accomplished through the efforts outlined in this workplan. Specific areas will be targeted with each successive round of grant funding in order to systematically bring all categories to the minimum tier one baseline level. These areas will be identified within each grant proposal with supporting details to address methods to be employed to meet USGS goals.