OIL AND NATURAL GAS EXPLORATION AND PRODUCTION WATER SOURCES AND DEMAND STUDY

Colorado, Montana, New Mexico, North Dakota, Utah, and Wyoming

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1.0 INTRODUCTION

Water is essential to the development of oil and natural gas resources, and like many other industries, water represents a critical component of the supply chain. Water supports a wide variety of oil and natural gas activities, ranging from well site construction to well drilling and completion, and enhanced hydrocarbon recovery. Unconventional oil and gas development represents the largest water demand because the process typically involves hydraulic fracturing of tight hydrocarbon reservoirs thousands of feet below the surface using water injected under high pressure. Since the water demand occurs only during initial well field development and is not sustained over the entire life of a project, most operators either purchase or temporarily lease water resources from other owners or providers to meet their needs during the term of development.

Even though the demand from the oil and natural gas industry is not perpetual, many urban and rural communities are concerned that large volumes of water are being diverted away from limited supplies that are already stressed by drought or over-allocated i.e., there is no remaining water available to grant new water rights without affecting other users. This is of particular concern in western states that are experiencing the highest level of oil and gas development.

Responsible management of water resources is a priority for all users and is necessary for economic growth, community development, and healthy ecosystems. In order to engage in constructive dialogue regarding water management, understanding the volume of water diverted for oil and natural gas activities and the impact on other users is imperative. The following study, performed by Golder Associates Inc. (Golder) on behalf of Western Energy Alliance (the Alliance) was conducted to provide information to the public on the volumes of water used for oil and natural gas activities in six western states that are experiencing an increased level of oil and natural gas development, and to identify the regulatory issues associated with using various sources in each respective state.

The member states evaluated in this study include: Colorado, Montana, New Mexico, North Dakota, Utah, and Wyoming. The most currently available water usage data for oil and natural gas activities in each of the referenced states is presented in this report, along with a comparison of the amount of water used for oil and natural gas activities relative to other uses, such as agricultural, municipal, industrial, recreational, etc.

In conducting this study, it was determined that each of the six states monitors water use differently and reports water use over different time periods. Additionally it was found that some of the states don’t currently monitor or publicly disclose water use. For those states that do report use, they may either track it as “consumptive use” or as “total water withdrawn” or diverted from the surface water or groundwater source. These two types of use are quite different. For example, if the total amount used for an agricultural activity is reported as 1,000 acre-feet (ac-ft), meaning that a total of 1,000 ac-ft are withdrawn
or diverted from a groundwater or surface water source, the consumptive use portion of that water may only be 550 acre-feet. That is because consumptive use accounts only for the portion of water consumed or taken up through activities such as evaporation, transpiration, uptake by crops or vegetation, consumption by humans or livestock, or consumption in an industrial or commercial process. States that measure consumptive use are measuring only the amount of water that is permanently removed from the immediate water environment. Consequently, their water use numbers will be lower than a state that reports the total amount of water withdrawn or diverted.

Another complication in making direct water use comparisons between states is that one of the states does not report water use, but only reports water rights issued. Since a water right may not be exercised during a reporting year (for example a water right owner may not use it for several years or only use a portion of what is allotted), there is no way of knowing how much water was actually diverted or consumptively used, only that a certain volume of water was allocated for use.

Despite these unique challenges, a direct comparison of the data is possible for states that report or disclose state-wide water use for oil and natural gas activities. These states are Colorado, New Mexico, and Wyoming. The results of the study therefore indicate that the amount of water used for oil and natural gas activities in each of these three states is less than 1% of the total amount of water used state-wide.

The detailed reports for each state as well as a summary of the regulations associated with the use of various water sources for oil and natural gas activities are provided in the following sections:

- Section 2.0 – Colorado
- Section 3.0 – Montana
- Section 4.0 – New Mexico
- Section 5.0 – North Dakota
- Section 6.0 – Utah
- Section 7.0 – Wyoming

The water sources evaluated in this study include surface water, groundwater, irrigation water, water purchased from third party water providers or vendors, treated wastewater (municipal, industrial, or produced water from a centralized treatment system), produced water, and interstate water transfers.

1.1 Water Use
At the time of this study, annual water use data from 2013 were not available from any of the six states. Only Colorado and North Dakota track and record water use annually. The data for 2013 are expected to be available later this year (2014). The most recent water use data from New Mexico and Utah are from
2010. New Mexico and Utah update water use data every 5 years. The next update is planned to start in 2015, but results are not anticipated to be published until 2017 at the earliest. Water use is not monitored in Montana; instead water rights volumes are managed and tracked. This information is current through January 7, 2013. Water use is expected to be included in the Montana Water Plan, which is anticipated to be published this summer. Water use in Wyoming is managed and tracked by river basin. Wyoming is divided into seven river basins with different availability of data by year ranging from 2002 to 2011. Updates to the water use data in Wyoming are not anticipated until interstate water disputes are resolved.

The definition of water use varies by state. Water use data is either defined as “water use” or “consumptive use.” The definition of each, according to the USGS, is as follows (USGS Circular 1344):

- **Water Use** – “In a restrictive sense, the term refers to water that is withdrawn for a specific purpose, such as for public supply, domestic use, irrigation, thermoelectric-power cooling, or industrial processing…More broadly, water use pertains to the interaction of humans with and influence on the hydrologic cycle, and includes elements such as water withdrawal, delivery, consumptive use, wastewater release, reclaimed wastewater, return flow, and in stream use.”

- **Consumptive Use** – “The part of water withdrawn that is evaporated, transpired, incorporated into products or crops, consumed by humans or livestock, or otherwise removed from the immediate water environment…Also referred to as water consumed.” In other words, water that is removed from the available supply and not returned to the source.

According to these definitions, Colorado, New Mexico, and Utah report water use. North Dakota reports consumptive water use, and Wyoming reports both water use and consumptive use.

### 1.2 Water Rights Systems

There are two prominent water rights systems in the United States. The Riparian Doctrine is the basis for water rights in the eastern United States, while the Prior Appropriation Doctrine is the basis for water rights in the western United States.

Each of the states included in this study regulates water appropriation within its borders. The primary tenet of the prior appropriation doctrine is that the first person to beneficially use a water right owns that right, commonly summarized as “first in time, first in right.” Historically, surface water was used prior to groundwater due to ease of access. Therefore, early law primarily addressed surface water rights. Groundwater rights were developed after surface water rights, resulting in more variations of groundwater regulations between states. In theory, surface water or groundwater rights can be permitted for any use including, but not limited to: domestic, municipal, irrigation, livestock, industrial, and fish, wildlife, or recreational. Specific state restrictions, primarily on produced water reuse and water treatment plant effluent uses, are identified in each state’s summary.

The general principles of western states’ water rights are as follows:
Water is owned by the state for beneficial resident use.

Water rights are the rights to use the state’s water.

Water appropriation involves physically diverting water and putting it to beneficial use.

Water rights are subject to appropriation and unused water rights may be redistributed by the state.

According to the prior appropriation doctrine, water rights are granted to the person or entity that first beneficially uses the water. The ability to use the water allocated in the water right is decided according to priority (i.e., senior rights versus junior rights); the earliest person to use water from a particular surface water body or aquifer has the first right to future use of the water. In drought years, a senior water right holder will be granted the full water allocation for their respective right. A junior water right holder will only be allowed to use their water right if water remains after senior holders have received their full allotment. A water right’s priority date is typically the water right application date.

Water rights are finalized through adjudication or permit application, depending on state laws. Adjudicated water rights have been confirmed by court decree, while non-adjudicated rights are processed through a non-judicial (i.e., permit) system.

A water right is a type of property right and can be bought, sold, leased, exchanged, moved, and put to different uses so long as that the change does not harm the vested rights of others and state specific requirements are met.

Colorado, Montana, New Mexico, North Dakota, Utah, and Wyoming all contain tribal lands. Water rights on tribal lands are considered granted to the tribe for administration as of the reservation establishment date. Tribal water rights may not be lost through non-use, whereas water rights granted by a state to an individual may be lost through non-use. Disputes concerning water rights that border or pass through tribal lands are resolved by the federal government and tribal courts.

Cooperating states allocate water that flows through their common borders by creating interstate compacts. Conflicts regarding allocation between states are resolved by Congressional action, new interstate compacts, or the United States Supreme Court.
2.0 COLORADO

2.1 Water Use

Water use in Colorado during water year 2012 is defined as total withdrawals, beginning November 1, 2011 to October 30, 2012. According to the Colorado Division of Water Resources (Colorado DWR), updated water use volumes for the 2013 water year will be available sometime later this year (2014) (Colorado DWR, 2014).

Water use for oil and natural gas is not specifically tracked in Colorado, but is included within the industrial water use category. The industrial water use category includes manufacturing and processing of products (including foods, beverages, steel, machinery, chemicals and paper), golf course maintenance, mining, and extraction of minerals, coal, and oil and natural gas. The Colorado Water Conservation Board State of Colorado 2050 Municipal and Industrial Water Use Projections (July 2010) identified the largest industrial users as Coors Brewing Company, Colorado Steel Company, Cargill, Swift Company, Kodak, mining facilities, and golf courses.

The volume of water use by category is presented in Table 1 and a graphical comparison of water use by category is provided in Figure 1. The total industrial water use reported in Colorado for water year 2012 accounts for 0.8 percent (i.e., less than 1%) of the total water use reported for the state (Colorado DWR, 2012). Since oil and natural gas is just a subset of that industrial category, total use is lower than 0.8 percent, but the exact number is not possible to discern from the available data. However, according to the Deputy State Engineer, the amount of water used for hydraulic fracturing in 2012 was less than 14,000 ac-ft (Colorado DWR, 2013). This represents 0.07% of all water used statewide or 0.16% of non-agricultural water use. It should be noted that the amount used in 2012 was actually less than the amount projected in the joint report prepared by the Colorado DWR, Colorado Water Conservation Board and COGCC, which was estimated at 16,000 acre-feet (Colorado DWR et al., 2012).

2.2 Potential Water Sources

All water use in the State of Colorado must comply with the State’s water rights laws, which are administered by the Colorado DWR, also known as the State Engineer’s office. The State is divided into seven water divisions that are managed by Division Engineers who are appointed by the State Engineer. Colorado water rights are confirmed through the division water courts (e.g., adjudicated), rather than through a permitting process. The water courts have jurisdiction over water right decree applications for surface water and groundwater, including new diversions as well as augmentation, change of water rights, conditional, and exchange decrees. Detailed information regarding the administration of Colorado water rights can be found at www.water.state.co.us.
Beneficial uses of water include: agricultural, mining, domestic, manufacturing, stock watering, mechanical, commercial, municipal, recreation, minimum stream flows, wildlife watering, irrigation, industrial (including oil and gas), fire protection, and dust suppression.

Water use in Colorado is not listed according to preference or rank; water rights are based on the Prior Appropriation Doctrine and water is appropriated according to priority date. Water rights in Colorado are property rights and can be bought, sold, moved, and applied to different uses without limitation as long as others are not affected and the transaction complies with the State’s water rights laws.

2.1.1 Surface Water
The majority of surface waters in Colorado are over-appropriated, meaning that the water rights decreed exceed the available supply. New diversions (absolute decrees) are junior to all other rights and may be curtailed if senior water rights are called during periods of high demand, low flow, or drought conditions.

To secure a more reliable water source, an existing senior surface water right may be purchased or leased. If the surface water right is not designated for industrial use (e.g., it is designated for agricultural use), or the point of diversion or place of intended use will change, this will require filing a “change of water right.” The amount of consumptive water use that can be decreed under a water right change is limited to the beneficial historical consumptive use of the original water right.

In order to obtain a water right change decree or an absolute decree, an application must be filed with the water court clerk in the appropriate division. The water right change or absolute decree may be granted directly by the water court, unless the application is protested, in which case it must go to a water court judge for trial, decision and decree. A granted water right is considered a decreed or conditional water right. These rights can take anywhere from 4 months to over 2 years to acquire, depending on whether or not there is opposition.

2.1.2 Groundwater
There are various types of groundwater including tributary groundwater or deep groundwater, which is either non-tributary, designated, or Denver Basin groundwater. Any wells that divert groundwater require a permit to drill from the Division of Water Resources. Groundwater use within a designated basin is administered through the Colorado Ground Water Commission. The Ground Water Commission has established eight designated basins in the state, all located on the eastern plains. Designated basins are areas with very little surface water, and groundwater is the primary water supply. Many designated basins have been declared over-appropriated. There are 13 local groundwater management districts within the eight designated basins that have authority to adopt rules to further
manage and administer diversions. These groundwater management districts provide recommendations to the Ground Water Commission on any given application.

Outside of the designated groundwater basins, groundwater is considered to be tributary to surface water (unless proven otherwise) and is therefore subject to administration by the Division of Water Resources. In some areas of Colorado, a well permit will first require an augmentation plan. An augmentation plan is a court-approved plan, which is designed to protect existing water rights by replacing the water used in a new project. Having an augmentation plan allows the plan operator to take water outside of the prior appropriation system. Because the water being used is replenished, the removed water does not affect senior water rights holders. In drought conditions when water may be unavailable to junior holders, those permit holders with approved augmentation plans may continue using their right. The State Engineer has the authority to approve temporary operation of an augmentation plan while the plan is pending approval in water court.

2.1.3 Irrigation Water
A landowner that currently has a surface water right designated for agricultural use may enter into an agreement to sell or lease a portion of that water for use in oil and natural gas activities by obtaining a change of water rights decree through the divisional water court. The amount of water available for use is limited to the amount of water that was historically consumptively used for irrigation and cannot be expanded beyond that volume. However, the change of water rights decree can allow the user to change the location of the diversion as well as the place of use while retaining the senior priority of the original water right.

2.1.4 Purchase on the Open Market
Water may be purchased through water providers, municipalities, or from water rights owners. The type of use listed on the water right must be industrial.

2.1.4.1 Raw or Treated Water Leased or Purchased from a Water Provider
Raw or treated water may be leased or purchased from raw water providers (i.e., municipalities) as long as the type of use (i.e., industrial) is included in the water provider’s water right.

2.1.4.2 Wastewater Leased or Purchased from a Water Provider
Municipalities and other water providers can sell or lease water that has been used by the public and treated as a wastewater. For many municipalities and other water providers, a portion of the effluent they typically discharge back into the water priority system is characterized as reusable. For oil and natural gas activities, the reusable water could be diverted from the surface water body originally discharged into if approval is obtained from the Division of Water Resources’ Division Engineer and the original water right includes industrial use.
2.1.4.3 **Water Purchased from a Vendor or Third Party Provider**

Water vendors or third party providers may sell water that individual water rights owners have put up for sale. The contract will only be permissible for oil and natural gas activities if industrial use is listed on the water right owner’s water right. Otherwise, a change of water rights decree will be necessary.

2.1.5 **Produced Water**

Water that is produced from oil and natural gas wells is either designated as tributary or non-tributary by the State Engineer’s Office. The State Engineer’s Office has identified areas throughout the State where produced water is considered non-tributary. If oil and natural gas activities are occurring in a non-tributary area, then an operator may reuse the water for their own oil and natural gas activities, without obtaining a water well permit and without filing an augmentation plan. If the oil and natural gas activities are conducted in an area that has not yet been designated as non-tributary, in order to reuse the water without a permit or augmentation plan, the operator would need to file a petition with the State Engineer’s Office that includes sufficient data demonstrating that the produced water is non-tributary. Any produced water generated from a tributary source requires a water well permit and if senior water rights are affected, an augmentation plan must be submitted and approved.

2.1.6 **Transfer Between States**

Water may be taken out of state if an export permit has been approved; however, water may be brought into the state without further permitting requirements.
Table 1: Colorado Water Use

<table>
<thead>
<tr>
<th>Category</th>
<th>Total Use (acre-feet)</th>
<th>% of Total Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>11,182,068</td>
<td>56.1%</td>
</tr>
<tr>
<td>Storage</td>
<td>1,488,496</td>
<td>13.3%</td>
</tr>
<tr>
<td>Irrigation</td>
<td>9,457,944</td>
<td>84.6%</td>
</tr>
<tr>
<td>Stock</td>
<td>82,073</td>
<td>0.7%</td>
</tr>
<tr>
<td>Augmentation</td>
<td>153,555</td>
<td>1.4%</td>
</tr>
<tr>
<td>Municipal</td>
<td>753,660</td>
<td>3.8%</td>
</tr>
<tr>
<td>Municipal</td>
<td>724,734</td>
<td>96.2%</td>
</tr>
<tr>
<td>Domestic</td>
<td>13,424</td>
<td>1.8%</td>
</tr>
<tr>
<td>Commercial</td>
<td>15,502</td>
<td>2.1%</td>
</tr>
<tr>
<td>Industrial</td>
<td>163,778</td>
<td>0.8%</td>
</tr>
<tr>
<td>Power Generation</td>
<td>5,860,497</td>
<td>29.4%</td>
</tr>
<tr>
<td>Other</td>
<td>1,966,821</td>
<td>9.9%</td>
</tr>
<tr>
<td>Recreation</td>
<td>155,315</td>
<td>7.9%</td>
</tr>
<tr>
<td>Fishery</td>
<td>292,319</td>
<td>14.9%</td>
</tr>
<tr>
<td>Change of Use Return Flows</td>
<td>45,778</td>
<td>2.3%</td>
</tr>
<tr>
<td>Evaporation</td>
<td>185,405</td>
<td>9.4%</td>
</tr>
<tr>
<td>Geothermal</td>
<td>3,056</td>
<td>0.2%</td>
</tr>
<tr>
<td>Snow Making</td>
<td>5,381</td>
<td>0.3%</td>
</tr>
<tr>
<td>Minimum stream flow/lake level</td>
<td>112,113</td>
<td>5.7%</td>
</tr>
<tr>
<td>Recharge</td>
<td>153,077</td>
<td>7.8%</td>
</tr>
<tr>
<td>Export from State</td>
<td>67,049</td>
<td>3.4%</td>
</tr>
<tr>
<td>Transbasin export</td>
<td>930,275</td>
<td>47.3%</td>
</tr>
<tr>
<td>Wildlife</td>
<td>17,053</td>
<td>0.9%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>19,926,824</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

Notes:
1 Water use is defined as total withdrawals from water year 2012, which is November 1, 2011 to October 30, 2012. Updated water use volumes will be available later this year, the exact date was not provided.

2 The water use category matches the classification of the water rights.

3 Beginning in Water Year 2012 and retroactive to all previous years, reservoir water that is released from storage only to be stored in another reservoir is only counted as “Storage” once. Previously, the “Storage” in the second reservoir would have also been included in the total.

4 Industrial water rights apply to all industrial users and are not further subdivided to indicate the specific percentage of water used for oil and gas.

5 Sub-categories are % water use of the main category.

Reference:
Figure 1: Colorado Water Use

Colorado: Water Use

Agriculture, 56.1%
Power, 29.4%
Other, 9.9%
Industrial, 0.8%
Municipal, 3.8%

Colorado: Water Use
3.0 MONTANA

3.1 Water Use

Water use is not currently monitored in Montana. Instead, water rights are reported, which does not indicate the actual amount of water that is used, only the amount that is authorized for use. It is not possible to estimate the actual total amount of water rights for oil and natural gas activities because such activities are not a type of “water right purpose” tracked by the Montana Department of Natural Resources and Conservation (DNRC), with the exception of oil well flooding. According to the DNRC, consumptive water use will be reported in the State Water Plan, which is scheduled for publication in the summer of 2014 (Montana DNRC, 2014).

A summary of the active water rights in Montana is provided in Table 2 and a graphical comparison of the water rights by category is provided in Figures 2a and 2b. Water rights are current through January 7, 2013. Oil well flooding is included in the “other” category under the subcategory of miscellaneous due to the low volume of water used for this activity (Montana DNRC, 2013). The use of water rights for all other oil and natural gas activities is not recorded. However, potential water right categories where water may be used for oil and natural gas activities may include industrial, sale, municipal (water depots), and/or miscellaneous. The volume of water rights in these categories combined accounts for 7.3% of the total water rights allocated. Since oil and natural gas is just a potential subset of these categories, the total allocation for oil and gas natural use is lower than 7.3%, but the exact volume is not possible to discern from the available data.

3.2 Potential Water Sources

The Montana Water Court is a specialized court that has sole jurisdiction over the adjudication of pre-1973 water right claims. Post-1973 water right claims are adjudicated by Montana District Courts. Each District Court supervises water use within its jurisdiction. A District Court may appoint one or more water commissioners to measure, record, and distribute water rights. The District Courts issue final water right decrees; the DNRC issues a Certificate of Water Right to the decreed water right holder and administers water uses.

Water rights in Montana are property rights, and “appurtenant” (i.e., goes with the property) to the land. Water use in Montana is not listed according to preference or rank. The State of Montana owns the waters within the state and citizens can possess a legal right to use the water; however, the water must be put to a beneficial use. Examples of beneficial uses of water include, but are not limited to: agriculture (including stock water), domestic, fish and wildlife, industrial, irrigation, mining, municipal, power, commercial, recreational uses, and oil well flooding.
The Montana Reserved Water Rights Compact Commission negotiates on behalf of the state with federal and tribal entities to apportion the federal and tribal reserved water rights. Detailed information regarding the administration of water rights in Montana can be found on the Montana DNRC, Water Resources Division’s website at www.dnrc.mt.gov/wrd.

3.2.1 Surface Water
Montana has closed some hydrologic basins to new water rights due to over-appropriation; new water rights may still be obtained in hydrologic basins that are not over-appropriated. In order to obtain a water right, an application must be filed with the Montana DNRC. An interim permit may be issued while the application is being reviewed. Once the DNRC officially accepts the permit application and issues a “provisional permit”, a water right will be granted with a Certificate of Water Right. The timeframe to obtain the provisional permit varies and is dependent on the process of public notices, hearings with the DNRC, and appeals to the District Court. The initial application review process by the DNRC takes 4 to 6 months.

New water rights are junior to all other rights and may be curtailed if senior water rights are called during periods of high demand or during low flow or drought conditions. The priority date of the water right in Montana is the date of the provisional permit (i.e., application approval from the DNRC). The owner of a water right, permit, certificate, or reservation may change the diversion, place or purpose of use by submitting an application to the DNRC.

To secure a more reliable water source, an existing senior surface water right may be purchased. Additionally, although water rights abandonment is not a common procedure in Montana, a junior water right owner could initiate legal abandonment of a senior water right by proving the owner’s intent to abandon and petition the district court. This abandonment will retire the senior water right that may be preventing water appropriation to the junior water right. There is no statutory time limit for non-use in the state; however, non-use for 10 years or more has been affirmed in court as evidence of intent to abandon.

A temporary permit to appropriate water may be approved for up to 10 years with an opportunity to renew for an additional 10 years. Temporary permits are not adjudicated and the application is processed in the same manner as a provisional permit.

3.2.2 Groundwater
Montana designates “controlled groundwater areas” in cases where groundwater has been over-appropriated or where it is necessary to protect water quality or existing water rights. There are currently 15 permanent controlled groundwater areas and one temporary controlled groundwater area in the state. Additional procedural requirements to procure a water right will vary by controlled groundwater area and the intended water use.
The best alternative for permitting the use of groundwater within a closed hydrologic basin (as defined in Section 3.2.1) is to purchase an existing water right or retire an existing right to mitigate surface water impacts. A hydrogeologic assessment is required for groundwater appropriation in a closed hydrologic basin to assess impacts or depletions to other groundwater wells and surface waters. If needed, surface water can be purchased for use as aquifer recharge and mitigation if groundwater use has been permitted. In other words, groundwater can be extracted and used from the permitted location and if impacts are observed (i.e., depletions in the aquifer or surface water); surface water can be purchased from another area to restore the depleted surface water or groundwater.

For groundwater rights, the priority date is the date the DNRC issues the Certificate of Water Right. The application process is the same as for surface water, with the addition that an applicant for groundwater rights may be required to submit a plan for mitigation or aquifer recharge. All permitted groundwater uses require metering to record the total volume of water used. A meter is provided by the DNRC after the provisional permit is issued. The owner of a water right, permit, certificate, or reservation may change the diversion, place, or purpose of use by submitting an application to the DNRC. Similar to the process for surface water, groundwater rights can also be obtained with a temporary permit.

### 3.2.3 Irrigation or Industrial Water

It is best to assume that in all instances, a Department-approved change will be required for use of irrigation or industrial water for oil and natural gas activities. Changing an irrigation or industrial water right to allow for use in oil and natural gas activities requires a change to the place of use and purpose of use, and possibly the point of diversion and place of storage. Irrigation water rights typically have a period of diversion throughout the growing season only. Therefore, year-round use for oil and natural gas activities is not permissible for most irrigation rights. An exception is if storage becomes a component of the changed water use, then the period of use may be expanded to year-round.

### 3.2.4 Purchase on the Open Market

Water may be purchased if marketing is listed as a use on the permit (e.g., "sale" from Table 2). As previously discussed, surface water can be marketed (e.g., leased) or sold for use as aquifer recharge and mitigation in areas of permitted groundwater use.

#### 3.2.4.1 Raw or Treated Water Leased or Purchased from a Water Provider

Raw or treated water may be purchased from water providers (i.e., municipalities). Municipalities may only sell or lease their raw or treated water if the point of sale (water depot) is within the area the municipality has historically sold water. A change authorization would be required from the DNRC if a municipality sold water to an oil and natural gas operator at a point of sale outside of the municipality’s historic range.
3.2.4.2 Wastewater Leased or Purchased from a Water Provider
Municipalities and other water providers can sell or lease water that has been used by the public and treated as a wastewater. Municipalities may only sell or lease their treated wastewater if the point of sale (water depot) is within the area the municipality has historically sold water. A change authorization would be required from the DNRC if an oil and natural gas operator contracted with a municipality at a point of sale outside of the municipality’s historic range.

3.2.4.3 Water Purchased from a Vendor or Third Party Provider
Water vendors or third party providers (i.e., water depot operators) can sell water that individual water rights owners have sold or leased (e.g., marketed) to the vendor or third party provider. The sale will only be permissible if the appropriate “water right purpose” that the water will be used for is listed on the water right owner’s water right.

3.2.5 Produced Water
The Montana Board of Oil and Gas Conservation regulates the oil and natural gas industry. Produced water may be beneficially reused; however, because produced water is considered part of the total downstream volume available for allocation, the producer will need to apply for a provisional permit to use the produced water. This process to obtain a provisional permit was described in Section 3.2.1. A water user who implements a water-saving method may retain the right to the salvaged water for a beneficial use. If the re-use is not for a purpose or place listed on the original permit, DNRC approval is required.

3.2.6 Transfer Between States
Water may be transferred into Montana without a permit. To take water out of the state, an applicant must meet strict requirements that prove beneficial use before the DNRC will issue a permit for such activity. As of March 2014, Montana DNRC has granted one such permit.
### Table 2: Montana Active Water Rights

<table>
<thead>
<tr>
<th>Category</th>
<th>Water Rights $^1$ (acre-feet)</th>
<th>% of Total Rights $^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic</td>
<td>2,063,563</td>
<td>0.01%</td>
</tr>
<tr>
<td>Irrigation</td>
<td>32,090,008,743</td>
<td>82%</td>
</tr>
<tr>
<td>Municipal</td>
<td>380,690,726</td>
<td>1%</td>
</tr>
<tr>
<td>Other</td>
<td>6,586,788,015</td>
<td>17%</td>
</tr>
<tr>
<td>Commercial</td>
<td>1,508,480,491</td>
<td>22.9%</td>
</tr>
<tr>
<td>Fish and Wildlife</td>
<td>1,191,324,281</td>
<td>18.1%</td>
</tr>
<tr>
<td>Flood Control</td>
<td>89,502,473</td>
<td>1.4%</td>
</tr>
<tr>
<td>Industrial</td>
<td>73,640,704</td>
<td>1.1%</td>
</tr>
<tr>
<td>Multiple Domestic</td>
<td>58,795,318</td>
<td>0.9%</td>
</tr>
<tr>
<td>Power Generation, consumptive</td>
<td>115,849,569</td>
<td>1.8%</td>
</tr>
<tr>
<td>Recreation</td>
<td>612,224,394</td>
<td>9.3%</td>
</tr>
<tr>
<td>Sale</td>
<td>2,340,828,714</td>
<td>35.5%</td>
</tr>
<tr>
<td>Storage</td>
<td>544,022,800</td>
<td>8.3%</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>52,119,273</td>
<td>0.8%</td>
</tr>
<tr>
<td>Stock</td>
<td>18,732,034</td>
<td>0.05%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>39,078,283,081</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

2,847,279,416

**Notes:**

1 Water rights are reported in Montana, not water use or water consumption; therefore, categorizing and/or quantifying water use for oil and gas is not possible.

2 Sub-categories are % water use of other water rights.

It is not possible to estimate the actual water rights used for oil and gas activities because oil and gas activities are not a type of “water right purpose” tracked by the Montana Department of Natural Resources and Conservation (DNRC). Oil well flooding is a water right purpose tracked by the DNRC and water rights total 101,411 ac-ft. This purpose is grouped with other/miscellaneous due to the low volume of water used for this activity.

According to the Montana Department of Natural Resources, consumptive water use will be reported in the State Water Plan, which is scheduled for publication in the summer of 2014.

**Reference:**

Montana Department of Natural Resources and Conservation Water Resources Division, 4/15/2013.
Potential oil and gas active water right categories where water may be used for oil and natural gas activities include: industrial, sale, municipal (water depots), and/or miscellaneous. Since oil and natural gas is just a potential subset of these categories, the total allocation for oil and gas natural use is lower than 7.3%, but the exact volume is not possible to discern from the available data.
Figure 2b: Montana Active Water Rights

Montana: Active Water Rights

Montana: Other Active Water Rights
4.0 NEW MEXICO

4.1 Water Use
Water use in New Mexico is defined as the total amount of water withdrawn. Currently available water use volumes are reported for 2010. The next update is planned to start in 2015, but results may not be published until 2017, at the earliest, due to the time needed to collect, consolidate, and finalize the data (New Mexico OSE, 2014).

In New Mexico, water use for oil and natural gas activities is tracked within the mining category. Oil and natural gas activities use 0.06 percent of the total water in New Mexico (New Mexico OSE, 2013). The volume of water use by category is presented in Table 3 and a graphical comparison of water use by category is provided in Figures 3a and 3b.

4.2 Potential Water Sources
The water rights process in New Mexico involves two phases: technical and legal. The technical phase includes the supervision and administration of the water rights, which is completed by the office of the State Engineer (OSE). Within the OSE is the Water Rights Division, which consists of seven district offices. These seven district offices administer surface water and groundwater rights, and process applications for water rights. The legal phase is necessary because the State must bring a lawsuit to court to adjudicate a water right.

The classification of a water right correlates to the stage of the application process and includes: declared, permitted, licensed, or adjudicated. Additional information regarding water rights can be accessed from the OSE website at www.ose.state.nm.us.

In New Mexico, the state constitution makes priority of the water right the basis for water administration; under the state constitution, senior water rights have priority over junior water rights. Water rights in New Mexico are property rights, and “appurtenant” (i.e., go with the property) to the land.

In New Mexico, all natural waters flowing in streams and water courses belong to the public and are subject to appropriation for beneficial use. Water use in New Mexico is not listed according to preference or rank. In order to obtain a water right, the water must be put to beneficial use. Recognized beneficial uses of water include, but are not limited to: agriculture, commercial, domestic, industrial, livestock watering, mining (including oil and natural gas), and power.

4.2.1 Surface Water
Most surface water in New Mexico has been appropriated and currently, new rights are not permitted. Surface water can only be obtained through water transfers, lease or purchase of existing water rights. Changes in diversion, place or purpose of use requires a permit from the State Engineer.
A water right owner may lease all or part of their right for up to 10 years. A 40-year planning entity may lease water rights for up to 40 years. Any difference in change in point of diversion, place of use, or purpose of use from the original right requires a permit from the OSE. Each water use application is unique and the time to process each application varies.

Water use in New Mexico is managed through priority administration, which refers to the temporary curtailment of junior water rights in times of shortage, so that more senior water rights can be served by the available water supply. In New Mexico, the more senior water right holders typically include Native Americans, acequias (i.e., community canals), and agricultural water users. Junior water right holders typically include municipalities, as well as industrial, residential, and recreational water users.

A new diversion could potentially be obtained through non-use if a water right is not used for four successive years when water is available. Under these circumstances, the OSE may issue a notice of non-use, resulting in forfeiture of the water right, making it available to new water use applications. If a new diversion is obtained, new water rights are junior to all other rights; the date on the application for a permit establishes the priority of the water use.

### 4.2.2 Groundwater

Permits for new groundwater use in any of New Mexico’s 33 declared basins typically require offsets. Meaning, a right to draw groundwater will require a corresponding reduction in another surface water or groundwater right in the same aquifer or drainage. If groundwater is available for appropriation in a basin, it may be used to supplement surface water rights; however, surface water rights may only be augmented with groundwater if the surface water is used beneficially. Upon approval of a supplemental well, the OSE requires metering and reporting of diversions from both sources. As previously mentioned for surface water, temporary groundwater rights can be obtained with a temporary permit or forfeiture of an existing right.

### 4.2.3 Irrigation Water

Water permitted for irrigation can be changed for oil and natural gas water use purposes. Only the consumptive use established and available may be considered for transfer to the new purpose of use.

### 4.2.4 Purchase on the Open Market

Water may be purchased through the municipalities or from water rights owners. For a water right to be available for purchase, “sale” must be a listed use on the water permit. Any new use, including adding “sale” as a use, must be permitted through the OSE.
4.2.4.1 Raw or Treated Water Leased or Purchased from a Water Provider
Operators may contract with water providers (i.e., municipalities and water rights owners) to lease or purchase raw or treated water from the water provider. A transfer application must be submitted to the OSE for approval. Agriculturally permitted water may be used for oil and natural gas activities if the water is used in accordance with the New Mexico regulations.

4.2.4.2 Wastewater Leased or Purchased from a Water Provider
Municipalities and other water providers can sell or lease water that has been used by the public and treated as a wastewater; however the allowed uses are limited for the oil and natural gas industry. Class 2 treated wastewater may be used for dust control, soil compaction, and concrete mixing. Requests to use it for oil and natural gas activities would be considered on a case-by-case basis and would depend upon the wastewater treatment plant effluent water quality, additional permitting requirements (potential need for a groundwater discharge permit), and regulatory jurisdiction between the state Environment Department and Oil Conservation Division.

4.2.4.3 Water Purchased from a Vendor or Third Party Provider
New Mexico does not have formal water markets like dedicated auctions or clearinghouses for the sale and transfer of water due to physical, legal, and political impediments. Water rights owners and buyers must individually advertise or work through small private firms.

4.2.5 Produced Water
The Oil Conservation Division (OCD) in the New Mexico Energy, Minerals and Natural Resources Department regulates oil and natural gas and geothermal operations and administers Water Quality Act regulations. Beneficial re-use of treated produced water must be permitted through the OCD.

The volume of water permitted for use on a water right is the maximum allowed volume for the permit holder. Although return flow credits are issued to permit holders that inject their treated wastewater into groundwater disposal wells, the return flow credit does not increase the total volume the permit holder may extract from the aquifer.

Applications to receive return flow credits can be submitted to the OSE. A permit from the OSE is required to receive this credit. According to the OSE, “surface water return flow is that percentage of the total diversion of surface water that has been applied to beneficial use pursuant to a water right or permit and returned to the same surface water stream from which it was appropriated.” If the permit applicant can demonstrate return flow, a credit will be provided to the operator as long as the consumptive water use amount is not increased, and all applicable standards and regulations are met.
4.2.6 Transfer between States

Water appropriated for use in New Mexico may not be taken out of the state. New Mexico will allow water to be brought into the state, but a permit is required for the right to use the water in the state. There are currently only two active permits that allow water to be brought into the state, both on the Animus River.
Table 3: New Mexico Water Use

<table>
<thead>
<tr>
<th>Category</th>
<th>Surface Water (acre-feet)</th>
<th>Groundwater (acre-feet)</th>
<th>Total (acre-feet)</th>
<th>% of Total Use²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public Water Supply</td>
<td>81,114</td>
<td>236,296</td>
<td>317,410</td>
<td>8.3%</td>
</tr>
<tr>
<td>Domestic</td>
<td>-</td>
<td>28,952</td>
<td>28,952</td>
<td>0.8%</td>
</tr>
<tr>
<td>Irrigated Agriculture</td>
<td>1,633,940</td>
<td>1,366,215</td>
<td>3,000,155</td>
<td>79%</td>
</tr>
<tr>
<td>Livestock</td>
<td>3,431</td>
<td>36,749</td>
<td>40,180</td>
<td>1.1%</td>
</tr>
<tr>
<td>Commercial</td>
<td>1,938</td>
<td>52,755</td>
<td>54,693</td>
<td>1.4%</td>
</tr>
<tr>
<td>Industrial</td>
<td>926</td>
<td>11,541</td>
<td>12,467</td>
<td>0.3%</td>
</tr>
<tr>
<td>Mining</td>
<td>10,845</td>
<td>30,714</td>
<td>41,559</td>
<td>1.1%</td>
</tr>
<tr>
<td>Metals</td>
<td>-</td>
<td>-</td>
<td>26,598</td>
<td>64%</td>
</tr>
<tr>
<td>Oil and Gas³</td>
<td>-</td>
<td>-</td>
<td>2,244</td>
<td>5.4%</td>
</tr>
<tr>
<td>Potash</td>
<td>-</td>
<td>-</td>
<td>9,143</td>
<td>22%</td>
</tr>
<tr>
<td>Aggregate</td>
<td>-</td>
<td>-</td>
<td>1,579</td>
<td>3.8%</td>
</tr>
<tr>
<td>Industrial</td>
<td>-</td>
<td>-</td>
<td>1,039</td>
<td>2.5%</td>
</tr>
<tr>
<td>Coal</td>
<td>-</td>
<td>-</td>
<td>956</td>
<td>2.3%</td>
</tr>
<tr>
<td>Geothermal</td>
<td>-</td>
<td>-</td>
<td>trace</td>
<td></td>
</tr>
<tr>
<td>Power</td>
<td>47,434</td>
<td>10,905</td>
<td>58,339</td>
<td>1.5%</td>
</tr>
<tr>
<td>Reservoir Evaporation</td>
<td>262,216</td>
<td>262,216</td>
<td></td>
<td>6.9%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2,041,844</strong></td>
<td><strong>1,774,127</strong></td>
<td><strong>3,815,971</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

**Notes:**

1 Water use is defined as the total amount of water withdrawn. The water use volumes are from 2010. The next update is scheduled to start in 2015.

2 Sub-categories within mining are % water use of mining.

3 Oil and gas water use is 0.06% of the total water use.

**Reference:**

Figure 3a: New Mexico Water Use

New Mexico: Water Use

- Irrigated Agriculture, 79%
- Public Water Supply, 8%
- Reservoir Evaporation, 6.9%
- Power, 1.5%
- Mining, 1.1%
- Livestock, 1.1%
- Commercial, 1.4%
- Industrial, 0.3%

Metals, 64%
- Potash, 22.0%
- Aggregate, 3.8%
- Oil and Gas, 5.4%
- Coal, 2.3%
- Industrial, 2.5%
- Mining, 1.1%
Figure 3b: New Mexico Water Use

New Mexico: Water Use

- Public Water Supply
- Domestic
- Irrigated Agriculture
- Livestock
- Commercial
- Industrial
- Mining
- Power
- Reservoir Evaporation

Water Use, acre-feet

New Mexico: Mining Water Use

- Metals
- Oil and Gas
- Potash
- Aggregate
- Industrial
- Coal

Water Use, acre-feet
5.0 NORTH DAKOTA

5.1 Water Use
Consumptive water use is monitored and tracked in North Dakota. The most recent consumptive water use volumes reported are from 2012; 2013 consumptive water use volumes are expected to be published by summer 2014 (North Dakota SWC, 2014a). As previously defined, consumptive use is water removed from the available supply and not returned to the immediate water environment. Because consumptive use tracks a small proportion of the total water used in a state, the proportion from oil and natural gas is larger than in other states that track total water use.

Oil and natural gas activities in North Dakota are within the industrial water use category. The industrial category is sub-divided as industrial non-fracking and industrial fracking. Fracking includes water specifically used for hydraulic fracturing activities. Industrial non-fracking use includes all other industrial uses; maintenance water used by the oil and natural gas industry and other industrial uses such as: manufacturing, mining, and processing. Industrial non-fracking water use is 6 percent of the total consumptive water use in North Dakota, and industrial fracking is 4 percent (North Dakota SWC, 2014b). This number represents a relatively larger percentage in North Dakota, due to the fact that the state is more sparsely populated and total water use is orders of magnitude less than the amount of water the State of Colorado uses (352,000 acre-feet vs. 19.9M acre-feet in 2012). In actuality, the volume of water withdrawn for hydraulic fracturing activity in North Dakota is slightly less than the amount withdrawn in Colorado over the same time period—12,629 acre-feet versus less than 14,000 acre-feet respectively. If you apply a similar definition of consumptive water use to the 2012 Colorado water use data and consider municipal (Colorado DWR, 2007) and agricultural consumptive uses (USGS, 2010), the removal of 14,000 acre-feet from the source would increase from 0.07% water use to 0.22% consumptive water use, still representing a small fraction of the overall use in the State.

A summary of the currently available consumptive water use data in North Dakota is provided on Table 4. A comparison of the water usage by category is presented graphically in Figures 4a and 4b.

5.2 Potential Water Sources
The North Dakota State Water Commission (SWC) regulates water resource development. The North Dakota State Engineer operates under the umbrella of the SWC. The State Engineer administers the procedure for obtaining a water right. The SWC does not have regional divisions or districts to support the State Engineer. If an adjudication proceeding is requested, the State Engineer will designate a time and place. Once water is put to beneficial use and inspected by the State Engineer, a “perfected permit” is issued and a record can be created at the county records office resulting in a water right. For further information regarding the water rights and permitting process in North Dakota visit the SWC website at http://www.swc.state.nd.us.
Water rights are based on the Prior Appropriation Doctrine; the priority date is established when the application is received by the State Engineer. Water rights in North Dakota are property rights.

Waters within the State of North Dakota belong to the public and are subject to appropriation for beneficial use. In order to obtain a water right, the water must be put to beneficial use. Beneficial water use in North Dakota is prioritized according to the following preference order:

1. Domestic
2. Municipal
3. Livestock
4. Irrigation
5. Industrial
6. Fish, wildlife or recreational.

If applications for the same water source are received by the State Engineer within 90 days of each other, the applications are considered competing and priority will be given according to the above listed beneficial water use preference order.

5.2.1 Surface Water

Surface water can be obtained by acquiring a new water right. New diversions are junior to all other rights and may be curtailed if senior water rights are called during periods of high demand or during low flow or drought conditions.

A senior surface water right may be obtained through purchase or lease. The senior water right will require a name or type-of-use transfer. A permit holder may change the point of diversion or purpose of use without affecting the priority date if the change is approved by the State Engineer. A name or type-of-use transfer can be accomplished in two weeks or less. A hydrologic analysis is required to transfer the water use location to ensure other water users will not be affected. The administrative time to complete a location transfer will vary. A water right change will only be approved if other water users are not affected. Water use can only be changed to a water use of higher beneficial water use preference, as listed in Section 5.2, with the exception of a temporary use permit described below.

Surface water can be obtained through a temporary water use permit for up to 12 months, and available for renewal. The temporary water use must be listed on the permit. To temporarily change a water use from irrigation to industrial, the applicant (i.e., seller or leaser) must forego irrigation of one tract of land associated with the water right for one calendar year; industrial water use has a lower beneficial water use preference than irrigation water in North Dakota.
Junior water rights may move up the priority list through water right forfeiture. A surface water right not used for three successive years when water is available may be considered forfeited. The State Engineer must conduct a hearing to bring about legal forfeiture. The water will then be defined as unappropriated and available for new use.

5.2.2 Groundwater

Groundwater can be obtained in the same manner as described previously for surface water.

5.2.3 Irrigation Water

Water use for irrigation can be changed to a water use of higher preference, as listed in Section 5.2. Although industrial use is a lower preference than irrigation use, North Dakota allows for irrigation permitted water to be used for industrial purposes through a standard temporary water permit application. As previously stated, to temporarily change a water use from irrigation to industrial, the applicant (i.e., seller or leaser) must forego irrigation of one tract of land associated with the water right for one calendar year.

5.2.4 Purchase on the Open Market

5.2.4.1 Raw or Treated Water Leased or Purchased from a Water Provider

Operators may contract with water providers (i.e., municipalities, rural water systems, and water rights owners) to lease or purchase raw or treated water from the water provider. The sale of excess water must be approved by the State Engineer.

5.2.4.2 Wastewater Leased or Purchased from a Water Provider

Municipalities and other water providers can sell or lease water that has been used by the public and treated as a wastewater. The Operator would need to follow the North Dakota Department of Health (NDDH) regulations to lease or purchase the treated wastewater. The NDDH does not have a formal water reuse program, but considers each reuse request on a case-by-case basis.

5.2.4.3 Water Purchased from a Vendor or Third Party Provider

Operators may contract with water vendors or third party providers (i.e., water depot operators) to purchase water that individual water rights owners have sold or leased to the vendor or third party provider. Several companies operate numerous water depots throughout North Dakota and offer a variety of contractual methods, such as annual subscriptions, direct water transfers, and pay-as-you-go self-service accounts.

5.2.5 Produced Water

The North Dakota Industrial Commission, Oil and Gas Division (NDIC) regulates the oil and natural gas industry. Produced water may be treated and reused or sold. The beneficial reuse of treated produced
water does not require a permit. However, the treatment plant (mobile or stationary) must be permitted through the NDIC.

5.2.6 Transfer Between States

Water may be transferred into and out of North Dakota without additional permit requirements.
Table 4: North Dakota Water Use

<table>
<thead>
<tr>
<th>Category</th>
<th>Water Use¹</th>
<th></th>
<th>% of Non-Irrigated Total Use</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Volume (acre-feet)</td>
<td>% of Total Use</td>
<td></td>
</tr>
<tr>
<td>Municipal</td>
<td>75,683</td>
<td>21%</td>
<td>48%</td>
</tr>
<tr>
<td>Power</td>
<td>33,207</td>
<td>9%</td>
<td>21%</td>
</tr>
<tr>
<td>Industrial (non-fracking)²,³</td>
<td>21,830</td>
<td>6%</td>
<td>14%</td>
</tr>
<tr>
<td>Industrial (fracking)²,³</td>
<td>12,629</td>
<td>4%</td>
<td>8%</td>
</tr>
<tr>
<td>Rural Water</td>
<td>11,932</td>
<td>3%</td>
<td>8%</td>
</tr>
<tr>
<td>Multi-Use, Bottling Commercial &amp; Domestic</td>
<td>1,230</td>
<td>0%</td>
<td>1%</td>
</tr>
<tr>
<td>Irrigation</td>
<td>195,581</td>
<td>56%</td>
<td>-</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>352,092</strong></td>
<td><strong>100%</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

Notes:
¹ Water use in North Dakota is defined as consumptive water use, which is water removed from available supplies without return to the system. The consumptive water use volumes are from 2012; 2013 consumptive water use volumes are expected to be published by summer 2014.
² Industrial water use is designated as fracking or non-fracking. Fracking includes water specifically used for hydraulic fracturing activities. Industrial non-fracking use includes all other industrial uses, including, maintenance water used by the oil and gas industry.

Reference:
Figure 4a: North Dakota Water Use

North Dakota: Consumptive Water Use

- Irrigation, 56%
- Municipal, 21%
- Power, 9%
- Industrial (non-fracking), 6%
- Industrial (fracking), 4%
- Multi-Use, Bottling Commercial & Domestic, 0.3%
- Rural Water, 3%

North Dakota: Non-Irrigation Consumptive Water Use

- Municipal, 48%
- Power, 21%
- Rural Water, 8%
- Industrial (fracking), 8%
- Industrial (non-fracking), 14%
- Multi-Use, Bottling Commercial & Domestic, 0.8%
Figure 4b: North Dakota Water Use

North Dakota: Consumptive Water Use

North Dakota: Non-Irrigation Consumptive Water Use
6.0 UTAH

6.1 Water Use

Water use in Utah is defined as total water use. The most recently available water use volumes are from 2001 for irrigation water and 2010 for all other water uses. The next update of water use data is planned to start in 2015, but results may not be published until 2017, at the earliest, due to the time needed to collect, consolidate, and finalize the data (Utah DWR, 2014).

Water uses in Utah are categorized as public community, public non-community, self-supplied industry, private domestic, and irrigation. Oil and natural gas water use is not specifically monitored in Utah, and falls within the self-supplied industrial water use category. Water use volumes for the self-supplied industry category are collected annually. The volume of water reported by each industrial user is considered proprietary and is confidential; total water use volumes are tabulated and made publicly available on a county basis. Water use for the self-supplied industry category in Utah is 4.6 percent of the total water use (Utah DWR, 2013). Self-supplied industry includes: manufacturing plants, oil and natural gas, mining, mink farms, and dairies. A summary of the currently available water use data is provided on Table 5. A comparison of the water usage by category is presented graphically in Figures 5a through 5b.

6.2 Potential Water Sources

The Division of Water Rights (DWR) is an agency within the Department of Natural Resources and regulates the appropriation and distribution of water in the state of Utah; the Utah Division of Water Rights (DWR) is led by the State Engineer. The DWR is subdivided into seven water divisions, each with permitting and regulatory authority for their respective areas. Water right ownership public records are held in the county recorder’s office for the county(ies) in which the water is diverted and the county in which the water is used. Additional information regarding water rights in Utah can be accessed from the DWR website at http://naturalresources.utah.gov/divisions/water-rights.html

Water is the property of the public in Utah. In order to obtain a water right to use the water, the water must be put to beneficial use. Beneficial use in Utah is not listed according to preference or rank. Beneficial uses of water include: irrigation, stock watering, domestic, municipal, mining, power, industrial (which includes oil and natural gas), and other.

Water rights are based on the Prior Appropriation Doctrine and water is appropriated according to priority date. Water rights in Utah are obtained through a permitting process and adjudication. The State Engineer is a party to the adjudication process and prepares a proposed determination of water rights, which serves as the basis for the court decree. A water right is a permanent right as long as the use persists and is transferred by deed.
6.2.1 Surface Water

Many areas of Utah are administratively closed to new appropriations for water. New diversions and water uses can be obtained by modification of existing water rights purchased or leased from current owners. If a buyer plans to amend a right or a portion of a right to include a new source, nature of use, and/or place of use, a change application must be filed with and approved by the State Engineer. If the water is leased, a temporary change application is required for any short-term change in use or point of diversion. The owner of the water right files the temporary change application with the appropriate division. A temporary change will be effective for one year.

A new surface water appropriation also may be obtained through a temporary application directly to the DWR. Temporary water appropriation may extend to one year. The temporary application will need to be approved by the State Engineer and applies only to currently unappropriated water.

Another method to obtain a new diversion (i.e., water right) is through unused rights. A surface water or groundwater right not used for 7 years when water is available may be considered forfeited and may be challenged for non-use; however, an owner may file a non-use application with the State Engineer to maintain water rights past 7 years of non-use. Water lost through abandonment reverts back to the public and is subject to appropriation.

6.2.2 Groundwater

As previously mentioned, many areas of Utah are administratively closed to new appropriations of water; thus to obtain a water right for groundwater, modification of an existing water right, which will likely need to be purchased or leased from a current owner, will be required. If a new water right for groundwater is pursued, groundwater appropriation is administered using policies and guidelines specific to the administering water division and will vary among the seven water divisions.

6.2.3 Irrigation Water

Irrigation water can be purchased or leased in the same manner described for obtaining surface water. A change application must be filed with and approved by the State Engineer if: the water right needs to be amended, or a portion of the right will include a new source, nature of use, and/or place of use.

6.2.4 Purchase on the Open Market

Water may be purchased from any water right holder. If the desired use is not the permitted use, a change application must be filed with and approved by the State Engineer. Once water is purchased it may be reused on-site for the permitted purpose and/or sold as long as the permit holder/water purchaser maintains control of the water. Once water leaves the site, the permit holder/water purchaser forfeits their right to the water.
6.2.4.1 Raw or Treated Water Leased or Purchased from a Water Provider
Operators may contract with water providers (i.e., municipalities and water rights owners) to lease or purchase raw or treated water from the water provider. If the original water permit was for agricultural, municipal, or industrial purposes, a permit from the State Engineer is required. With some lease and/or reuse rights, the new permit will show a reduced quantity for oil and natural gas applications transferred from irrigation use because the new use is considered consumptive and will not be returned to the source. The volume of water designated as consumptive use is decided on a case-by-case basis by the water divisions. Their decision depends on numerous factors including the area the water will be removed from, the current drought conditions, and the originally permitted use.

6.2.4.2 Wastewater Leased or Purchased from a Water Provider
Municipalities and other water providers can sell or lease water that has been used by the public and treated as a wastewater. The Director of the Division of Water Quality must approve industrial wastewater reuse requests prior to commencement of its use.

6.2.4.3 Water Purchased from a Vendor or Third Party Provider
Operators may contract with water vendors or third party providers to purchase water that individual water rights owners have sold or leased to the vendor or third party provider. The original permitted use must be “industrial” for the water to be used in the oil and natural gas industry; otherwise, a change application must be filed with and approved by the SEO. Water is commonly available for use in the oil and natural gas industry through private entities and the State’s water conservancy districts.

6.2.5 Produced Water
Utah’s Division of Oil, Gas and Mining administers oil and natural gas regulations. Beneficial reuse of produced water requires following the water right permitting process described above; applicants must file proof of beneficial use with the DWR.

6.2.6 Transfer Between States
Water may be brought into the state unpermitted, but must have the proper permits from the DWR to be taken out of Utah.
Table 5: Utah Water Use

<table>
<thead>
<tr>
<th>Category</th>
<th>Potable Volume (acre-feet)</th>
<th>Non-Potable Volume (acre-feet)</th>
<th>Total (acre-feet)</th>
<th>% of Total Use</th>
<th>% of Non-Irrigated Total Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public Community²</td>
<td>566,845</td>
<td>171,343</td>
<td>738,188</td>
<td>14.1%</td>
<td>74%</td>
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<tr>
<td>Residential</td>
<td>387,504</td>
<td>121,183</td>
<td>508,687</td>
<td>9.7%</td>
<td>51%</td>
</tr>
<tr>
<td>Commercial</td>
<td>104,468</td>
<td>18,171</td>
<td>122,639</td>
<td>2.3%</td>
<td>12%</td>
</tr>
<tr>
<td>Institutional³</td>
<td>55,968</td>
<td>31,082</td>
<td>87,049</td>
<td>1.7%</td>
<td>8.7%</td>
</tr>
<tr>
<td>Industrial⁴</td>
<td>18,905</td>
<td>408</td>
<td>19,313</td>
<td>0.4%</td>
<td>1.9%</td>
</tr>
<tr>
<td>Public Non-Community⁵</td>
<td>9,370</td>
<td>4,194</td>
<td>13,563</td>
<td>0.3%</td>
<td>1.4%</td>
</tr>
<tr>
<td>Self-Supplied Industry⁶</td>
<td>162,899</td>
<td>79,139</td>
<td>242,038</td>
<td>4.6%</td>
<td>24%</td>
</tr>
<tr>
<td>Private Domestic⁷</td>
<td>6,967</td>
<td></td>
<td>6,967</td>
<td>0.1%</td>
<td>0.7%</td>
</tr>
<tr>
<td>Irrigation¹</td>
<td></td>
<td>4,221,000</td>
<td>4,221,000</td>
<td>80.8%</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>4,967,081</td>
<td>254,675</td>
<td>5,221,757</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Notes:
1 Water use is defined as a developed water supply that is delivered by the distribution system from surface or subsurface sources. In other words, total water withdrawals, not water consumption volumes. Irrigation water use volumes are from 2001. All other water use volumes are from 2010. Water use volumes will be updated in 2015. The summary report is expected to be published in 2017.
2 Public community water system: Provides potable and/or non-potable water by either a privately or publicly owned water system which serves at least 15 service connections used by year-round residents or regularly serves at least 25 year-round residents.
3 Institutional refers to use normally associated with general operation of various public agencies and institutions (i.e. schools, municipal buildings, churches).
4 The industrial use category indicates the industrial water supplied only by public community water systems.
5 Public non-community water system: These systems provide potable and/or non-potable water by either a privately or publicly owned water system to one of two types: transient and non-transient. Transient systems are systems that do not serve 25 of the same non-resident persons per day for more than six months per year. Examples include campgrounds, RV parks, restaurants, convenience stores, etc. Nontransient systems are systems that regularly serve 25 of the same non-resident persons per day for more than six months per year. Examples include churches, schools and industries.
6 Self-supplied industrial: These systems provide potable and/or non-potable water for use by individual privately owned industries (usually from their own wells or springs). Water use volumes are collected annually, but this information is confidential. Only county water use totals are published. Examples of self-supplied industries are: manufacturing plants, oil and gas, mining, mink farms, and dairies.
7 Private domestic: These systems provide potable and/or non-potable water from privately owned wells and/or springs for use by individual homes.
8 Water use for public community, public non-community, self-supplied industries, and private domestic are from Table 3-1 of the 2010 Statewide Water Use Study. Subcategories within the public community water use volumes are from Table 3-3. The water use volumes from Table 3-3 are inconsistent with the water use volumes from Table 3-1. The total water use volumes from Table 3-1 are presented herein.

Reference:
State of Utah Municipal and Industrial Water Supply and Use Study Summary 2010, Utah Division of Water Resources, December 2013
Figure 5a: Utah Water Use

Utah: Water Use

- Irrigation: 81%
- Residential: 10%
- Commercial: 2.3%
- Institutional: 2%
- Industrial: 0.4%
- Public Non-Community: 0.3%
- Self-Supplied Industrial: 4.6%
- Private Domestic: 0.1%

Utah: Non-Irrigation Water Use

- Residential: 51%
- Commercial: 12%
- Industrial: 1.9%
- Institutional: 9%
- Public Non-Community: 1.4%
- Self-Supplied Industrial: 24%
- Private Domestic: 0.7%
Figure 5b: Utah Water Use

Utah: Water Use

- Public Community
- Public Non-Community
- Self-Supplied Industrial
- Private Domestic
- Irrigation

Utah: Non-Irrigation Water Use

- Residential
- Commercial
- Institutional
- Industrial
- Public Non-Community
- Self-Supplied Industrial
- Private Domestic
7.0 WYOMING

7.1 Water Use

Water use in Wyoming is managed and tracked by river basin. Wyoming is divided into seven river basins: Bear, Green, Northeast, Platte, Powder/Tongue, Snake/Salt, and Wind/Bighorn. Wyoming reports both total water use and consumptive use. For this study, total water use is presented.

The river basins are presented separately in this report because current use data, as determined in each river basin plan, is from various years. The year shown for each river basin is the year the Basin Water Plan was published and does not reflect that year’s water use; however, the volumes presented herein are what the State Water Plan considers “current water use” for each river basin. The individual river basin plans were published from 2002 to 2011. Updates to the water use data in Wyoming are not anticipated until interstate water disputes are resolved (WSGS, 2014).

A summary of the currently available consumptive water use and water use data for each river basin is provided on Table 6. A comparison of the water usage by category is presented graphically in Figures 6a through 6k. As shown on the graphs, the volume of water used for oil and natural gas activities in Wyoming is minimal relative to the other water uses in the state. Oil and natural gas use for each river basin in Wyoming is as follows (WWDO, 2014):

- Bear – 0.05%
- Green – 0.3%
- Northeast – 4.9%
- Platte – 1.2%
- Powder/Tongue – 9%
- Snake/Salt – 0%
- Wind/Bighorn – 0%

According to the data available in the Wyoming State Water Plan the Snake/Salt Basin Plan published in 2003 did not report any water use for oil and natural gas activities. Likewise, the Wind/Bighorn Basin Plan published in 2010 did not report any water use for oil and natural gas activities.

7.2 Potential Water Sources

The State Engineer is the chief administrator of Wyoming waters. The superintendent of each of Wyoming’s four regional water divisions and the State Engineer constitute the State Board of Control (BOC). In addition to the regional water divisions, the State Engineer’s Office (SEO) contains a surface water division and groundwater division. Each water division is responsible for reviewing permit applications prior to adjudication by the BOC and for administering water use agreements; all water rights
exchange petitions are filed with the SEO. The BOC adjudicates water rights and addresses other water right and appropriation matters. Additional information on Wyoming water rights can be accessed from the SEO website at [http://seo.wyo.gov/](http://seo.wyo.gov/).

In Wyoming, all natural waters within the state boundaries are property of the state. In order to obtain a water right to use the water, the water must be put to beneficial use. Water use in Wyoming is not listed according to preference or rank. Beneficial uses of water include: irrigation, municipal, domestic, and industrial, which includes: power, oil and natural gas, mining, manufacturing, road bridge construction, and miscellaneous.

Water rights are based on the Prior Appropriation Doctrine and water is appropriated according to priority date. Water rights are obtained through permitting and adjudication. Wyoming water law prohibits the sale of water rights. Water rights in Wyoming are permanently attached to the specific land or place of use and cannot be removed except by action of the BOC. Water rights can be included in the sale of the land; thus to obtain an existing water right, the land that the right is associated with must be purchased.

### 7.2.1 Surface Water

Surface water can be obtained through a new diversion, which requires a water right. In most circumstances surface water and groundwater rights are separate water sources. However, if the groundwater and surface water sources are so interconnected as to be one water supply, a single schedule of priorities governs the water supply.

To obtain a new diversion (i.e., surface water right), a permit application must be filed with the SEO. The adjudicated water right takes its place in the list of priorities for that stream. To keep a water right valid when changes are made in the point of diversion, permission must be received from the BOC if the water is adjudicated or the SEO if the water is not adjudicated.

Additional methods to secure surface water are through temporary use agreements and/or abandonment. Any portion of an adjudicated water right or an unappropriated water right is available through temporary use agreements. A temporary water use agreement may extend up to two years. At the end of two years, a new permit for temporary use may be authorized. Only the water that is consumptively used may be diverted for temporary use. The state generally considers 50% of a given water right to be consumptively used; therefore, a temporary appropriator is typically required to reserve two times the volume of water needed for use. Temporary water use agreements are processed under the surface water division and are typically processed within five days of filing.

A surface water or groundwater water right not used for five successive years when water is available may be considered abandoned. Water right abandonment procedures must be started either by an
affected water user who has a priority equal or junior to the right being abandoned or by the State Engineer. If a right is declared abandoned, the water again becomes subject to appropriation.

7.2.2 Groundwater
Obtaining groundwater for oil and natural gas use follows the same general procedure as for surface water. A permit to construct a well will generally be granted as a matter of course by the State Engineer, unless the well is located in a groundwater control area. Groundwater control areas are established to provide an additional level of review involving public notice and recommendation from a 5-member elected Advisory Board (i.e., 5 property owners within the control area) prior to approval of any applications for a well exceeding a pumping rate of 25 gallons per minute. Currently, three control areas have been established in the southeast portion of Wyoming, but control areas are subject to change by the BOC at any time.

A well location may be changed within the same aquifer, in the vicinity of the original location, or at the original well depth, with approval from the BOC if the groundwater right has been adjudicated or applied to beneficial use. If the right is not adjudicated and the water has not been applied to beneficial use, approval for the change in location must be granted by the State Engineer. As mentioned above, if the groundwater and surface water are so interconnected as to be one water supply, a single schedule of priorities governs the water supply.

7.2.3 Irrigation
Irrigation water can be purchased or leased in the same manner described for obtaining surface water. If the water right or a portion of the water right will be amended to include a new source, nature of use, and/or place of use, a change application must be filed with and approved by the State Engineer.

7.2.4 Water Purchase on the Open Market
An owner with an existing water right can sell the appropriation as long as the new intended use is listed in the original permit. For a use not listed in the original permit, the owner must first file for an amendment with the State Engineer’s Office.

7.2.4.1 Raw or Treated Water Leased or Purchased from a Water Provider
The State of Wyoming has not yet addressed purchasing or leasing raw or treated water from a water provider because a formal request has not been made to date (May 2014). Should the interest arise and if it is beneficial to both the water provider and Operator, the State Engineer’s Office and District water engineers would take up the issue.
7.2.4.2 Wastewater Leased or Purchased from a Water Provider
The State of Wyoming has not yet addressed purchasing or leasing wastewater from a water provider because a formal request has not been made to date (May 2014). Should the interest arise and if it is beneficial to both the water provider and Operator, the SEO and District water engineers would take up the issue.

7.2.4.3 Water Purchased from a Vendor or Third Party Provider
The SEO does not currently have a process for obtaining water from water vendors or third party providers, and was not aware of any water vendors operating in the state. Oil and natural gas companies may contract with individual water rights owners to allocate a portion of the original water right through a temporary water use agreement that must be approved by the SEO.

7.2.5 Produced Water
The Wyoming Oil and Gas Conservation Commission regulates oil and gas waste. Water rights for produced water may be obtained for beneficial re-use of the produced water and are permitted through the SEO.

7.2.6 Transfer between States
Water being taken out of the state is limited to 1,000 acre-feet per year (ac-ft/yr). Any quantity over 1,000 ac-ft must be authorized by the state legislature. Wyoming does not restrict the volume of water that may be brought into the state.
**Table 6: Wyoming Water Use**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total (acre-feet)</td>
<td>% of Total Use</td>
<td>Total (acre-feet)</td>
<td>% of Total Use</td>
<td>Total (acre-feet)</td>
<td>% of Total Use</td>
<td>Total (acre-feet)</td>
</tr>
<tr>
<td>Irrigation</td>
<td>286,368</td>
<td>98.7%</td>
<td>396,246</td>
<td>83%</td>
<td>152,000</td>
<td>71.5%</td>
<td>1,553,000</td>
</tr>
<tr>
<td></td>
<td>349,000</td>
<td>82.9%</td>
<td>363,000</td>
<td>97.5%</td>
<td>2,926,600</td>
<td></td>
<td></td>
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<tr>
<td>Municipal &amp; Domestic</td>
<td>3,632</td>
<td>1.25%</td>
<td>24,771</td>
<td>5%</td>
<td>10,639</td>
<td>5.0%</td>
<td>24,501</td>
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<tr>
<td></td>
<td>24,771</td>
<td>5%</td>
<td>10,639</td>
<td>5.0%</td>
<td>24,501</td>
<td>1.5%</td>
<td>9,092</td>
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<tr>
<td>Industrial</td>
<td>132</td>
<td>0.05%</td>
<td>58,433</td>
<td>12%</td>
<td>49,900</td>
<td>23.5%</td>
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<td></td>
<td>140</td>
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<td>21,304</td>
<td>0.7%</td>
<td>91,908</td>
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<td></td>
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<tr>
<td>Coal-Fired Electric Power</td>
<td>-</td>
<td>0%</td>
<td>39,674</td>
<td>68%</td>
<td>-</td>
<td>0%</td>
<td>-</td>
</tr>
<tr>
<td>Oil and Gas</td>
<td>132</td>
<td>100%</td>
<td>1,616</td>
<td>3%</td>
<td>10,400</td>
<td>21%</td>
<td>38,000</td>
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<tr>
<td>Mining and Mine Reclamation</td>
<td>-</td>
<td>0%</td>
<td>2,700</td>
<td>5%</td>
<td>17,950</td>
<td>16%</td>
<td>-</td>
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<tr>
<td>Trona Mining/Soda Ash</td>
<td>-</td>
<td>0%</td>
<td>16,538</td>
<td>28%</td>
<td>-</td>
<td>0%</td>
<td>-</td>
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<tr>
<td>Coal Bed Methane</td>
<td>-</td>
<td>0%</td>
<td>35,600</td>
<td>71%</td>
<td>-</td>
<td>0%</td>
<td>24,300</td>
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<tr>
<td>Manufacturing</td>
<td>-</td>
<td>0%</td>
<td>605</td>
<td>1%</td>
<td>-</td>
<td>0%</td>
<td>140</td>
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<tr>
<td>Miscellaneous</td>
<td>-</td>
<td>0%</td>
<td>13,900</td>
<td>14%</td>
<td>-</td>
<td>0%</td>
<td>-</td>
</tr>
<tr>
<td>Aggregate/ Cement/ Concrete</td>
<td>-</td>
<td>0%</td>
<td>11,780</td>
<td>12%</td>
<td>-</td>
<td>0%</td>
<td>-</td>
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<tr>
<td>Road and Bridge Construction</td>
<td>-</td>
<td>0%</td>
<td>2,000</td>
<td>2%</td>
<td>-</td>
<td>0%</td>
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<td></td>
<td>421,015</td>
<td>100%</td>
<td>372,232</td>
<td>100%</td>
<td>3,039,812</td>
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<td></td>
</tr>
</tbody>
</table>

Notes:

1. Water use in Wyoming is recorded by river basin. The river basins are presented separately because current use data is from various years. The year shown is the year the Basin Water Plan was published.
2. The volume of water used for irrigation is the overall average annual surface water diversion from the long-term average for the period of record. The overall average historical diversion provided the most consistent data set across the seven river basins.
3. Due to lack of data, the normal historical diversion volume was used for the Green River Basin irrigation water volume.
4. The Platte River Basin irrigation diversions do not distinguish between surface water and groundwater.
5. Municipal and domestic, and industrial volumes represent total water use and includes groundwater and surface water.
6. Green River Basin coal mining water use is included in power generation.
7. Estimates for miscellaneous, aggregate/cement/concrete, and road and bridge construction uses was made only for the Platte River Basin.
8. Coalbed methane water consumption is water extracted during the gas production phase.
9. Water use associated with coalbed methane has likely increased since this data was published.
10. Sub-categories within industrial are reported as % industrial water use.
11. Of the total water use, oil and gas water use in: Bear River Basin is 0.05%; Green River Basin is 0.3%; Northeast River Basin is 4.9%; Platte River Basin is 1.2%; Powder/Tongue is 9.0%; Snake/Salt is 0%; and Wind/Bighorn is 0%.

Source:

Figure 6b: Wyoming - Bear River Basin Water Use

Wyoming - Bear River Basin: Water Use

- Irrigation, 99%
- Municipal & Domestic, 1%
- Industrial (includes only oil and gas and no other industries), 0.05%

Wyoming - Bear River Basin: Water Use

- Irrigation: 300,000
- Municipal & Domestic: 0
- Industrial (all oil and gas): 0
Figure 6c: Wyoming - Green River Basin Water Use

Wyoming - Green River Basin: Water Use

- Irrigation, 83%
- Industrial, 12%
- Municipal & Domestic, 5%
- Trona Mining/Soda Ash, 28%
- Manufacturing, 1%
- Oil and Gas, 3%
- Coal-Fired Electric Power, 68%

Coal-Fired Electric Power, 68%
Trona Mining/Soda Ash, 28%
Manufacturing, 1%
Oil and Gas, 3%
Industrial, 12%
Municipal & Domestic, 5%
Irrigation, 83%
Figure 6d: Wyoming - Green River Basin Water Use

Wyoming - Green River Basin: Water Use

Wyoming - Green River Basin: Industrial Water Use
Figure 6e: Wyoming - Northeast River Basin Water Use

Wyoming - Northeast River Basin: Water Use

- Irrigation, 72%
- Industrial, 23%
- Municipal & Domestic, 5%
- Coal-Fired Electric Power, 2%
- Oil and Gas, 21%
- Mining and Mine Reclamation, 5%
- Coal Bed Methane, 71%
Figure 6f: Wyoming - Northeast River Basin Water Use

Wyoming - Northeast River Basin: Water Use

- Irrigation
- Municipal & Domestic
- Industrial

Wyoming - Northeast River Basin: Industrial Water Use

- Coal-Fired Electric Power
- Oil and Gas
- Mining and Mine Reclamation
- Trona Mining/Soda Ash
- Coal Bed Methane
- Manufacturing
- Miscellaneous
- Aggregate/Cement/Concrete
- Road and Bridge Construction
Figure 6g: Wyoming - Platte River Basin Water Use

**Wyoming - Platte River Basin: Water Use**

- **Irrigation, 93%**
- **Industrial, 6%**
- **Municipal & Domestic, 1%**
- **Coal-Fired Electric Power, 33%**
- **Oil and Gas, 21%**
- **Mining and Mine Reclamation, 18%**
- **Aggregate/Cement/Concrete, 12%**
- **Miscellaneous, 14%**
- **Road and Bridge Construction, 2%**

[Diagram showing water use breakdown]
Figure 6h: Wyoming - Platte River Basin Water Use

Wyoming - Platte River Basin: Water Use

Wyoming - Platte River Basin: Industrial Water Use
Figure 6i: Wyoming - Powder/Tongue River Basin Water Use

Wyoming - Powder/Tongue River Basin: Water Use

- Irrigation, 83%
- Municipal & Domestic, 2%
- Oil and Gas, 61%
- Coal Bed Methane, 39%
- Industrial, 15%
Figure 6j: Wyoming - Powder/Tongue River Basin Water Use

Wyoming - Powder/Tongue River Basin: Water Use

<table>
<thead>
<tr>
<th>Category</th>
<th>Water Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irrigation</td>
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</tr>
<tr>
<td>Municipal &amp; Domestic</td>
<td>50,000</td>
</tr>
<tr>
<td>Industrial</td>
<td>40,000</td>
</tr>
</tbody>
</table>

Wyoming - Powder/Tongue River Basin: Industrial Water Use

<table>
<thead>
<tr>
<th>Industry</th>
<th>Water Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil and Gas</td>
<td>35,000</td>
</tr>
<tr>
<td>Trona Mining/Soda Ash</td>
<td>25,000</td>
</tr>
<tr>
<td>Coal Bed Methane</td>
<td>20,000</td>
</tr>
<tr>
<td>Aggregate/Cement/Concrete</td>
<td>15,000</td>
</tr>
<tr>
<td>Road and Bridge Construction</td>
<td></td>
</tr>
<tr>
<td>Miscellaneous</td>
<td></td>
</tr>
<tr>
<td>Manufacturing</td>
<td></td>
</tr>
<tr>
<td>Coal-Fired Electric Power</td>
<td></td>
</tr>
<tr>
<td>Mining and Mine Reclamation</td>
<td></td>
</tr>
</tbody>
</table>

Golder Associates
Figure 6k: Wyoming - Snake/Salt River Basin Water Use

Wyoming - Snake/Salt River Basin: Water Use

Irrigation, 98%

Municipal & Domestic, 2%

Industrial (all manufacturing), 0.04%

Wyoming - Snake/Salt River Basin: Water Use

<table>
<thead>
<tr>
<th>Water Use Type</th>
<th>Water Use (in thousands)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irrigation</td>
<td>400,000</td>
</tr>
<tr>
<td>Municipal &amp; Domestic</td>
<td>50,000</td>
</tr>
<tr>
<td>Industrial (all manufacturing)</td>
<td>20,000</td>
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</tbody>
</table>
Figure 61: Wyoming - Wind/Bighorn River Basin Water Use

Wyoming - Wind/Bighorn River Basin: Water Use

- Irrigation, 96%
- Mining and Mine Reclamation, 99%
- Miscellaneous, 1%
- Municipal & Domestic, 1%
- Industrial, 3%
- 3% Industrial
Figure 6m: Wyoming - Wind/Bighorn River Basin Water Use

Wyoming - Wind/Bighorn River Basin: Water Use

Wyoming - Wind/Bighorn River Basin: Industrial Water Use
8.0 REFERENCES


Montana DNRC, 2014. Discussions with Montana Department of Natural Resources and Conservation (DNRC) staff.


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