COLORADO OIL AND GAS CONSERVATION COMMISSION (COGCC)

2018 ANNUAL REPORT

to the

WATER QUALITY CONTROL COMMISSION (WQCC)
and
WATER QUALITY CONTROL DIVISION (WQCD)
of
THE COLORADO DEPARTMENT OF
PUBLIC HEALTH AND ENVIRONMENT
(CDPHE)

COLORADO
Oil & Gas Conservation Commission

IN ACCORDANCE
with
THE AUGUST 28, 1990 MEMORANDUM OF AGREEMENT
and
THE IMPLEMENTING PROVISIONS OF SENATE BILL 89-181

December 30, 2018

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1.0 INTRODUCTION

The Colorado Oil and Gas Conservation Commission (COGCC) is an implementing agency for water quality standards and classifications adopted by the Water Quality Control Commission (WQCC) for groundwater protection. This authority was provided by Senate Bill (SB) 89-181, and is restated and clarified by a Memorandum of Agreement (MOA) that was adopted by the agencies on August 8, 1990.

Section 5.1 of the MOA specifies that the COGCC must report annually to the WQCC and the Water Quality Control Division (WQCD) about how its programs assure compliance with WQCC water quality standards and classifications for the activities that are subject to the jurisdiction of the COGCC.

This 27th annual report provides an overview of COGCC functions and a summary of calendar year 2018 activities, with a focus on groundwater protection programs. Major issues concerning the implementation of water quality standards and classifications are also reported.

2.0 WQCC/WQCD AND COGCC COORDINATION AND PUBLIC OUTREACH

2.1 Inter-agency Coordination

In 2018 the COGCC, WQCC, and WQCD coordinated implementing the provisions of SB 89-181 and the MOA. COGCC and the Colorado Department of Public Health and Environment (CDPHE) Office of Emergency Preparedness and Response staff communicated frequently through email and telephone calls regarding spills at or near oil and gas facilities when there was some question as to whether or not a spill was exploration and production (E&P) waste. COGCC took the lead for all E&P waste spills.

Following COGCC's last briefing to the WQCC on January 8, 2018, COGCC staff met with WQCD staff on February 14, May 22, August 28, and December 19 to discuss program issues. Agenda items included follow up on various active investigations, enforcement matters, and E&P waste management practices within the oil and gas industry. COGCC and WQCD staff reviewed and discussed the February 15, 2000 MOA between the agencies concerning response to and reporting of spills and releases to surface water. COGCC and WQCD also coordinated on enforcement actions in incidents impacting surface water.

2.2 Public Outreach

The COGCC employed the following strategies for effective communication with the public and the regulated industry:

Commission Hearings:
In 2018, the COGCC held two of its regular eight hearings outside of Denver: one in Greeley, Weld County (June) and one in Rifle, Garfield County (September).

Staff reports were prepared prior to all eight hearings for the COGCC Commissioners. Ongoing staff activities such as compliance and enforcement actions, environmental and landowner issues, and other topics relevant to the mission of the COGCC are summarized in these reports. The 2018 reports were distributed widely to interested parties, and they are posted on the COGCC website www.cogcc.state.co.us.

Scheduled Meetings:
COGCC staff participates in regularly scheduled meetings with the regulated community and other interested stakeholders in parts of the state with active oil and gas operations. The Gas and Oil Regulatory Team (GORT), established by COGCC Order, met in Durango two times in 2018, focusing on oil and gas operations in the San Juan basin in southwestern Colorado. A third GORT meeting, scheduled for June, was canceled due to a wildfire in the Durango area. GORT provides a forum for meaningful dialogue between operators, citizens, county and local governments, the Southern Ute Indian Tribe (SUIT), the Bureau of Land Management (BLM), the U.S. Forest Service (USFS), and the COGCC. The Northwest Colorado Oil and Gas Forum (NWCOGF) usually meets in Rifle or Grand Junction, also three times yearly, and focuses on the Piceance basin and other operations in the northwestern part of the state. The NWCOGF is co-chaired by Garfield County and the COGCC Director; other state, federal, and local government agencies, the oil and gas industry, and concerned landowners and citizens regularly participate. COGCC staff attend GORT and NWCOGF meetings and give presentations on emerging issues and hot topics, as well as routine updates on operations statewide and in the respective geographic areas.

Web-Based Interface for Complaints:
COGCC maintains a web-based interface for citizens to file complaints about oil and gas operations. This tool allows a complainant to track COGCC's progress toward resolving the complaint and increases the transparency and accountability of COGCC's complaint response process. In 2018 (through October), the COGCC responded to 509 complaints regarding issues such as noise, dust, odors, and reclamation, among others. Noise and odor complaint were the most numerous, accounting for 40% and 20% of the total, respectively. Water well concerns (21 complaints), accounted for approximately 4% of the total. The COGCC follows up on and investigates every complaint.

Stakeholder Participation:
COGCC continues to solicit participation in the regulation of oil and gas exploration and production. Stakeholders, including the oil and gas industry, local governments, citizens, other regulatory agencies, non-governmental organizations, agriculture interests, and the environmental community provide input into permitting, policy development, rulemaking, and other processes. During 2018, COGCC staff participated in approximately 55 meetings at the request of municipal, county, and other local governments, U.S. Environmental Protection Agency (USEPA), BLM, trade organizations, and special interest groups.

Local Government Designee Process:
The Local Government Designee (LGD) process was created by the COGCC in 1992 to provide a conduit of information between local governments and the COGCC. COGCC hired Local Government Liaison (LGL) Staff in 2012 to facilitate participation in the LGD program through training, answering questions, and outreach, providing information, data, and presentations about specific aspects of oil and gas operations, COGCC rules, and the COGCCs regulatory program. In total, 165 entities, including two combined city-counties (Denver and Broomfield), 53 other counties, 100 municipalities, and 10 special districts currently participate in the LGD program. In all, LGL staff provided 15 LGD trainings, facilitated 6 public meeting, and attended over 35 other events, seminars, trainings, or public meetings in 2018.

COGCC Website:
The COGCC continues to use its website to make announcements and distribute information and data. COGCC information and data systems are described further in Section 3.3.

3.0 COGCC ORGANIZATION

3.1 COGCC Commissioners

The Colorado Oil and Gas Conservation Act (The Act) specifies the composition of the Commission. The Act requires nine Commissioners, seven of whom are appointed by the Governor with the consent of the Senate, and two ex officio voting members who are the Executive Directors of the Department of Natural Resources (DNR) and the CDPHE. At least two members are appointed from west of the continental divide and the other members are appointed taking into account the need for geographical representation of other areas of the state with high levels of oil and gas activity or employment. Of the seven, three members are to have substantial experience in the oil and gas industry and at least two of these must have college degrees in petroleum geology or petroleum engineering; one member must be a local government official; one member must have formal training or substantial experience in environmental or wildlife protection; one member must have formal training or substantial experience in soil conservation or reclamation; and one member must be actively engaged in agricultural production and also be a royalty owner.

In 2018, CDPHE Interim Executive Director Karin McGowan replaced outgoing Executive Director, Dr. Larry Wolk. A chart showing the makeup of the COGCC Commission is included in Appendix 1; biographies of the Commissioners are posted on our website http://cogcc.state.co.us/about.html#/commissioners.

3.2 COGCC Staff

The COGCC has 117 full time employee (FTE) positions located in the Denver office and throughout the state in field offices. The Staff include engineers, environmental protection specialists (EPS), field inspectors, permitting technicians, hearings specialists, and a variety of other professionals. Table 3-1 summarizes each group and their primary functions. New work

groups and staff functions related to water resource protection and compliance are described in more detail in the paragraphs that follow. The current organizational chart and a series of maps showing regional areas of responsibility are included as Appendix 2.

Table 3-1. COGCC Groups and Primary Functions

Group	Number of FTE	Primary Functions
Executive	1	Director
Environmental	21	Spills, remediation projects, pit closures, complaint response, environmental projects, Oil and Gas Location Assessments & pit permitting, environmental database, special projects
Engineering	18	Permitting downhole wellbore plans, underground injection control (UIC) permitting, oil/gas facility oversight, flowline integrity
Orphaned Well Program	5	Plugging orphan wells, orphan site clean-up, site reclamation
Field Inspection	31	Inspection of oil/gas wells, facilities, and locations; complaint response; interim and final reclamation
Community Relations	7	Complaint intake, management and resolution, local government liaison, database management/support, GIS, website and eForm development/support, agency contact for responding to emergency situations and working with emergency response personnel
Permitting & Technical Services	19	Permitting oil and gas wells, bonding, production reporting and levy collection, financial assurance
Hearings	10	Hearings, rulemaking, enforcement
Financial	5	Budget management, procurement, purchasing

Community Relations – In 2018, the COGCC created the Community Relations Unit (CRU) as a new work group that includes LGL staff, complaint intake staff, data analysts, and geographic information systems (GIS) professionals. The CRU allows the COGCC to expand its interaction and communication amongst LGDs, local, state and federal government agencies, the general public, the oil and gas industry, and various other stakeholders. Under consideration since 2016, the CRU was finalized in March 2018 and allows the agency to expand its interaction and communication with local, state and federal government agencies, the general public, the oil and gas industry, and other stakeholders. The CRU is also the agency lead for responding to emergency situations and working with emergency response personnel, providing an efficient complaint intake and resolution process, and engaging with local government officials and their constituents about the state's regulatory process and what to expect when oil and gas activity is planned or occurs in the area.

Orphaned Well Program – In 2018, the COGCC established the Orphaned Well Program (OWP) as a standalone work unit. The legislature appropriated $5 million for the program to address the plugging and abandonment, environmental investigation and remediation, and final reclamation of wells and oil and gas locations where the former operator has defaulted on their

obligations to complete such work. In years past, the work was conducted under the lead of the engineering unit, and under a much smaller budget. In 2018, the OWP began hiring specialized staff to lead individual projects, developed numerous program management tools, initiated procurement on several projects from a variety of disciplines, and continued ongoing efforts on projects carried over from prior years.

Staff functions that directly relate to water resource protection and compliance with groundwater and surface water standards include the following:

Permitting – Applications for Permit to Drill (APD) are reviewed to ensure compliance with all rules related to aquifer protection. Oil and gas wells must be designed and installed to prevent the migration of fluids or gas between formations or into aquifers. Permit technicians and engineering staff review drilling permit applications for surface casing and cementing requirements, among other requirements designed to protect aquifers. As reported in the December 17, 2018 COGCC Staff Report, COGCC issued 4,429 well permits in 2018 through December 1.

Location Assessments – Under the Form 2A process, Operators are required to provide site-specific environmental information about surface locations. Consultation by the CDPHE and Colorado Division of Parks and Wildlife (CPW) with the COGCC, the surface owner, and the operator is required in some circumstances. Oil and Gas Location Assessment (OGLA) specialists in the environmental group review and evaluate Form 2A applications, as well as publicly available information, to determine whether the proposed oil and gas operations have the potential to negatively impact water resources; public health, safety and welfare; the environment; or wildlife resources. Site-specific conditions of approval (COA) may be placed on permits to minimize or mitigate potential impacts. As reported in the December 17, 2018 COGCC Staff Report, COGCC approved 461 Form 2A Oil and Gas Location Assessments in 2018 through December 1.

Underground Injection Control (UIC) Permitting – The USEPA has delegated authority to COGCC to review, approve, and monitor the injection of E&P waste into Class II UIC wells. COGCC staff works with WQCD and USEPA staff to ensure that operators of Class II injection wells in Colorado comply with groundwater standards and classifications. COGCC's staff geologic experts review UIC permits for site-specific matters, such as the occurrence of faults and potential seismic issues. UIC permits include restrictions on injection pressures and volumes based on staff analysis. Commercial and non-commercial injection operations are actively managed by the COGCC in conjunction with the U.S. Geological Survey Earthquake Notification Service, through the installation and continuous monitoring of several local seismometers to evaluate if injection of produced water has some relationship to local seismicity. COGCC has instituted a "traffic light" monitoring system, which dictates specific mitigation measures, up to requiring injection to be halted if seismic activity reaches specific levels. Through November, COGCC Staff approved 30 Class II UIC well permits in 2018.

Pit Permitting – Operators may construct pits at oil and gas locations for a variety of purposes, most commonly to contain drill cuttings, produced water and flow back, and for the reuse and recycling of produced water. COGCC is responsible for permitting pits (Form 15), inspecting their operation, and overseeing their closure. The OGLA and EPS staff review pit permits for construction and operational details, and evaluate the environmental setting to ensure that the pit can be used without causing adverse environmental impacts. The Director may apply conditions of approval with additional provisions to protect waters of the state, public health, or the environment. In 2018, COGCC approved 16 Form 15s, authorizing 2 new pits and reporting on 14 existing pits. Applications for new pits are down significantly over previous years reflecting both a decrease in new oil and gas activity in areas that traditionally have used pits for produced water disposal and widespread industry use of "pit-less" drilling and completion activities.

Centralized E&P Waste Management Facility Permitting – COGCC environmental staff permit non-commercial centralized E&P waste management facilities under Rule 908. Generally, these facilities are larger than a typical tank battery or pit that might handle wastes from only one or a few wells. These larger facilities handle wastes from many wells and often from more than one field or lease operated by a single oil and gas operator. These facilities may include lined pits, land treatment facilities, land application areas, drill cuttings solidification facilities, or tank batteries. A permit is required for these facilities and, as part of the approval process, staff evaluates the proposed site, operation, financial assurance, environmental impacts, and preliminary closure plans. These facilities are currently required to have financial assurance in an amount equal to the estimated cost for proper closure, abandonment, and reclamation. During 2018, the COGCC permitted 6 new centralized E&P waste management facilities. There are 46 active permitted centralized E&P waste management facilities in the state.

Oversight of Produced Water Disposal – Well over 300 million barrels of water are co-produced with oil and gas production annually. Approximately 50 percent of the produced water is disposed or used for enhanced recovery by underground injection. Most produced water that is not injected is disposed in evaporation and percolation pits or discharged under a Colorado Discharge Permit System (CDPS) permit. Disposal facilities may be commercial and subject to oversight by CDPHE or they may be private and subject to oversight by COGCC. A small amount of produced water is used for dust suppression on oil and gas lease roads, subject to applicable rules. To minimize waste and the use of fresh water, many operators are reusing and recycling produced water and other fluids for drilling and well completion activities including hydraulic fracturing (frac) treatment operations. COGCC staff review UIC permits, pit permits, centralized E&P waste management permits, and other proposals, including water reuse and recycling plans, to ensure that produced water is handled appropriately.

Complaint Response – COGCC responds diligently to complaints received from individuals and other agencies. Complaints are tracked in the COGCC's database and can be accessed via the COGCC website. In 2018, COGCC received 16 complaints related to groundwater or surface water issues. The environmental staff follows up, where appropriate, and collects samples for laboratory analysis. A letter report is provided to the complainant explaining the analytical

results, regardless of whether an oil and gas impact is indicated. The COGCC staff frequently observes relatively poor overall water quality in many private domestic wells, often related to nuisance bacteria, natural water conditions, or influence from shallow groundwater which may be affected by surface activities. When oil and gas impacts are identified, COGCC requires operators to perform additional investigation, remediation, and mitigation, as needed, to bring sites into compliance with soil and groundwater standards.

A total of 16 water well investigations were completed during the year that were initiated by public complaints. Of these 16 investigations, COGCC found that one had been impacted by oil and gas operations. The investigation and results are summarized in Appendix 6.

Spill/Release Response and Remediation Oversight – Spill response by the environmental staff includes onsite inspections, sample collection, remediation oversight, and review of reports, remediation plans, analytical data, and operating practices, to ensure protection of surface and groundwater, in accordance with COGCC rules and WQCC standards and classifications. Spills are tracked in COGCC's Master Records Database (MRDB) and can be accessed via the COGCC website. COGCC's oversight of spills, releases, remediation projects, and environmental investigations is discussed in more detail in Section 6 of this report.

Orphaned Well Program – COGCC engineering, environmental, and reclamation staff, with assistance from oil and gas operators on three projects, used appropriated funds and claimed financial assurance to perform plugging and abandonment, remediation, and reclamation work at orphaned oil and gas sites in 15 counties: Adams, Fremont, Garfield, Jackson, Jefferson, La Plata, Larimer, Lincoln, Logan, Mesa, Moffat, Montezuma, Montrose, Washington, and Weld. During Fiscal Year (FY) 2018, the COGCC plugged 16 wells and performed wellhead or flowline work on 24 other wells in preparation for future well plugging, commenced surface reclamation at 6 locations and performed ongoing reclamation maintenance (stormwater controls, re-seeding, or weed control) at several other locations where reclamation commenced in prior fiscal years. Environmental sampling and analysis or remediation was conducted at 15 locations by COGCC Environmental staff.

During the first half of FY 2019, the COGCC's newly-reorganized OWP focused on responses to Executive Order D 2018-012, including prioritization of an Orphaned Site List, preparation of an Annual Report for FY 2018, preparation of a Financial Assurance Workgroup Report to evaluate COGCC's financial assurance systems, and preparation of guidance for operators to become more involved with assisting the program. COGCC also hired four new OWP FTEs. The General Assembly increased the line item appropriation from $445,000 in FY 2018 to $5,011,000 in FY 2019 and granted two-year spending authority beginning in FY 2019. COGCC expects that budget increase and added spending flexibility will result in a significant increase in the volume of OWP work in the second half of FY 2019.

Enforcement – As of December 1, 2018, the Commission has issued 27 enforcement orders, including 26 Administrative Orders by Consent and one Order Finding Violation. These orders

resolved 36 Notices of Alleged Violations and imposed $3,577,796 in gross penalties, of which $498,781 was conditionally suspended.

Financial Assurance Workgroup – In response to Executive Order D 2018-12 signed by Governor Hickenlooper on July 28, 2018, COGCC established a technical working group to review financial assurance requirements and recommend changes. The working group, composed of individuals from local, state, and federal government, the environmental community, the oil and gas industry, and private citizens, met four times during the fall of 2018 and discussed COGCC rules, best practices in other states, and potential changes for COGCC rules. Key recommendations made by COGCC to the Governor's office include:

1. Increase bonding and clarify definitions for Inactive Wells;
2. Develop a risk model for use in Form 10 transfer analysis;
3. Create a plugging, remediation, and reclamation fund; and
4. Consider increases to all bond amounts included in the 700-Series Rules.

Consistent with the Executive Order, COGCC anticipates undertaking a rule-making process to implement some or all of the recommendations by September 1, 2019.

3.3 COGCC Information/Data Systems

Each year COGCC works to improve its data management systems and GIS as time and resources allow. Primary data systems that were improved or developed in 2018 include:

- eForms – additional forms developed and some existing forms revised
- Geographic Information Systems (GIS)
- Environmental Database improvements
- Data Downloads – new data sets made available
- Online Environmental Reports
- Daily Activity Dashboard on website updated

Brief descriptions of the changes for each system are provided in the following sections.

3.3.1 eForms

COGCC uses an electronic form filing system built on a Microsoft Silverlight™ platform called "eForms." The eForm application allows operators to submit applications and notices electronically, and the system also provides for automatic email notices to appropriate parties, including the applicant or operator, COGCC staff, and local governments or other regulatory entities. Because Microsoft will no longer support Silverlight™ past 2020, COGCC has begun the transition to a new electronic form system. This process commenced with the pilot development of the Form 8 – Oil and Gas Conservation Levy and will continue over the next two years. eForms currently in use or pending completion (*****) are:

Form 2 – Application for Permit to Drill
Form 2A – Oil and Gas Location Assessment
Form 4 – Sundry Notice
Form 5 – Drilling Completion Report
Form 5A – Completed Interval Report
Form 6 – Well Abandonment Report
Form 7 – Monthly Operations Report
Form 8 – Oil and Gas Conservation Levy*
Form 10 – Certificate of Clearance/Change of Operator
Form 14 – Monthly Report of Non-Produced Water Injected**
Form 14A – Authorization of Source of Class II Waste for Disposal**
Form 15 – Earthen Pit Report/Permit
Form 17 – Bradenhead Test Report
Form 19 – Spill/Release Report
Form 21 – Mechanical Integrity Test (MIT) Report
Form 22 – Accident Report
Form 23 – Well Control Report
Form 26 – Source of Produced Water for Disposal
Form 27 - Site Investigation and Remediation Workplan (release date January 1, 2017)
Form 31 – Underground Injection Formation Permit Application
Form 33 – Injection Well (UIC) Permit Application
Form 41 – Trade Secret Claim of Entitlement
Form 42 – Field Operations Notice
Form 43 – Sample Analytical and Data Form
Form 44 – Flowline Reporting
FIR – Field Inspection Report
FIRR – Field Inspection Report Resolution Form
NOAV – Notice of Alleged Violation
Warning Letter

With eForms, operators are able to submit forms and attachments electronically. COGCC staff review and approve the forms electronically, and data from the forms are uploaded to the MRDB instantaneously upon approval. For forms that require review by multiple staff members (e.g., permitting, engineering, etc.), each staff member involved in the process passes their task within the eForm system.

Two significant accomplishments in 2018 were the completion and roll out of the Form 43 – Sample Analytical and Data Form and the Form 44 – Flowline Reporting. The Form 43 allows operators to submit analytical data required by COGCC rules 318A.f, 608, and 609 as well as by condition of approval on permits, spill reports, or workplans, directly into the COENV Database (discussed later) through the same eForm platform as other forms and receive a confirmation for compliance purposes. The Form 44 was developed using a customized suite of GIS tools created

specifically for the purpose of mapping complex networks of subsurface pipelines; this form was developed following the flowline rule-making conducted earlier in 2018.

3.3.2 GIS – Geographic Information Systems

The GIS Online map is an important tool used by staff, industry, and other agencies to submit and process permits, create reports, and view information related to exploration and development. The COGCC interactive map is also a go-to resource for the general public and interested stakeholders regarding environmental concerns and siting issues related to current and planned drilling and production activity.

The GIS Online map contains over 170 spatial datasets including oil and gas well locations, permits, spacing orders, field boundaries, and useful reference information such as cities, rivers, roads, sections, land ownership, etc. Aerial photos, topographic quads, and geologic maps are also included as valuable information resources. The newest version of our online mapping system allows users to zoom to a specific street address or parcel for much of Colorado; has improved printing functionality; and includes a live connection to our environmental sampling database. To aid operators and other interested parties with their own GIS work, the COGCC website provides GIS shapefiles for download, including files that have daily updated well information, permit and pending permit data, and wellbore traces for directional and horizontal wells across Colorado. Recently added are downloads of KMZ files for well locations that can be used in Google Earth on smartphones and tablets. The COGCC's online mapping tool is regularly recognized as one of the best state-level oil and gas resources in the nation.

3.3.3 Environmental Database

The Groundwater Protection Council (GWPC) in conjunction with the COGCC has developed a publicly available, searchable database of groundwater, surface water, and soil sample analytical results from throughout the state. Referred to as the COENV database, it has been active since September 2012. The COENV database has sampling data dating back as far as 1941. The environmental database currently contains over 16,800 sample locations and 47,560 individual samples (as of December 4, 2018).

In 2018, 2,375 samples were added to the database. Since the statewide rules for groundwater sampling went into effect on May 1, 2013, COGCC has received a total of 10,760 water samples from 3,000 separate locations from operators in compliance with the rules.

The data can be accessed through the GIS Online map. Sample locations with available water and natural gas data appear as green triangles when the "Sites with Lab Data" layer is turned on. The user can double click on a sample site and gain access to the analytical data for that site. An example analytical report is included as Appendix 3.

The COENV database allows for electronic data deliverables to be used for input. New samples from COGCC staff sampling efforts; current COGCC baseline sampling rules 317B, 318A.f, 608, and 609; and older samples from COGCC Orders and the Colorado Oil and Gas Association

(COGA) Voluntary Baseline Sampling Program are accessible. In April 2014, the COENV database was made available for download in an Access database format for those who wish to query large datasets.

In October of 2018 The eForm 43 (Analytical Sample Data Submittal Form) was released. The eForm 43 includes a streamlined data upload process with built in data quality checks and a printable document (Form 43) that will serve as a receipt for information submitted to the COGCC.

3.3.4 Data Downloads

Historically, the COGCC has provided production data, spacing order data, and GIS shapefiles for download from the website. GIS data available include well surface locations and directional data (updated daily), pits, oil and gas fields, sensitive wildlife habitat, certain significant geologic information, and approximate buffers associated with COGCC Rule 317B.

In addition to GIS data listed above, and in an effort to increase transparency, the COGCC aggregates datasets directly from our MRDB and provides them for public use. The MRDB, managed and maintained by COGCC with assistance from the Governor's Office of Information Technology (OIT), is a comprehensive repository of Colorado's oil and gas data. Although all the data is available through interactive search tools on the website, these downloads allow the industry, public, non-governmental organizations, or other interested parties to access large amounts of data in searchable formats so that they may run their own analyses. These datasets are updated periodically.

The data downloads now available are:

Complaints Data
NOAV Data
Flowline Notice to Operators (NTO) Inventory
MIT Data
Spill and Release Data
Analytical Sample Data
Field Inspection Reports
Production Data
Spacing Orders
GIS Shapefiles

The COGCC is developing additional data downloads for future release, including Remediation Projects.

3.3.5 Online Environmental Reports

Written reports for COGCC-managed baseline sampling projects and other special environmental studies, such as status reports for monitoring Project Rulison in Garfield County

and the various aquifer characterizations are posted on the website under the "Library" tab where they are primarily organized by basin and available for download as portable document format (PDF) files.

In 2013, COGCC staff developed a fact sheet, *Methane in Colorado Groundwater*, to explain the differences between thermogenic and biogenic methane and briefly discuss how the COGCC determines if the source of methane in a water well is biogenic or thermogenic. This topic is addressed in detail in Section 6.2 of this report and the fact sheet is provided in Appendix 5.

Although not new, the brochure, *How Well Do You Know Your Water Well* continues to be very popular. The brochure was updated and revised in 2011 to include information about mitigating methane in water wells, current contact information for various agencies, and water well maintenance and recordkeeping. COGCC provides this useful brochure to water well owners when water samples are collected from their wells by COGCC, operators, or third party contractors.

3.3.6 Daily Activity Dashboard

In late 2016, the COGCC launched the Daily Activity Dashboard, a web-based tool designed to give local governments, the public, and other stakeholders a more efficient way to access, sort, and display the most commonly used data related to oil and gas operations. The Dashboard is a visual interactive tool that allows a user to generate custom statistical charts, graphs, tables, reports, and simple maps based on data that are updated daily.

The Dashboard does not offer any new types of oil and gas data to the public, or replace existing ways of searching for online oil and gas data in the Colorado Oil and Gas Information System, but instead provides a convenient way to access information on pending permits, well status, production, well inspections, NOAVs, active notifications, and spills. This tool can be accessed by clicking "Dashboard" in the main menu of the COGCC homepage and continues to be a popular page on our website.

3.4 COGCC Environmental Program and Project Funding

The General Assembly annually appropriates a line item within COGCC's budget for the environmental staff to respond to, investigate, prevent, monitor, or mitigate conditions that threaten or actually cause adverse impacts to air; water; soil; public health, safety, and welfare; or wildlife resources. This work includes, but is not limited to, the collection of water and soil samples, laboratory analyses of the samples, and review and analysis of laboratory results and other environmental data. In FY 2018-2019, the appropriation for this line item was $312,033.

In addition, the General Assembly annually appropriates a line item to fund special environmental protection and mitigation studies including, but not limited to, gas seepage mitigation studies, outcrop monitoring studies, soil gas surveys in the vicinity of plugged orphaned wells, and baseline water quality and subsequent follow-up studies. The intent was to provide readily available funds for special projects as the need arises. The COGCC reports all

expenditures made from this line item in the previous year to the General Assembly in its annual budget request. The appropriation for this line item in FY 2018-19 is $325,000. The FY 2018-19 special environmental projects are described in Section 8.

In addition to the foregoing, COGCC receives an annual appropriation to respond to emergencies related to oil and gas operations that threaten or cause significant adverse impacts to public health, safety, welfare, or the environment. For FY 2018-19, this appropriation is $750,000. The COGCC also receives an annual appropriation for plugging, abandoning, and reclaiming orphaned wells (PROW). The PROW appropriation line item increased from $445,000 in FY 2018 to $5,011,000 in FY 2019 and granted two-year spending authority beginning in FY 2019. For the past several years, this appropriation has been $445,000.

4.0 NEW COGCC REGULATIONS AND POLICIES

4.1 Statewide Flowline Rule-making

On February 13, 2018 the Commission approved a set of flowline rules. In creating these rules the Commission heard from a diverse group of stakeholders, including citizens, county and municipal governments, trade associations, nonprofits, and oil and gas operators. These new rules include definitions, registration, mapping, design and construction standards, integrity management, and abandonment criteria. The rule-making and rule adoption took place consistent with Governor Hickenlooper's August 22, 2017 policy initiatives. The COGCC held numerous stakeholder meetings in late 2017 and early 2018, to receive input from the parties, and the COGCC coordinated closely with the Colorado Public Utilities Commission (CPUC), which regulates certain gas gathering and distribution pipelines, and with the Federal Pipeline and Hazardous Material Safety Administration (PHMSA), which regulates larger and higher pressure pipelines and transportation pipelines. An outcome of the new rules is for all oil and gas Operators to register as Tier 1 Members of Colorado 811. The 1100-Series of COGCC's rules was significantly overhauled with much more detailed requirements for flowline design, installation, testing, operation, maintenance, and decommissioning. Taken together, the adopted flowline rules significantly improve the COGCC's regulatory position and enhance existing protections for surface and groundwater in Colorado.

The adoption of the flowline rules necessitated the development of the Form 44 – Flowline Report, which provides for registration, incident reporting, mapping, and decommissioning reporting for onsite and offsite flowlines, produced water transfer lines, and liquid gathering lines. In addition to the development of Form 44, the COGCC's flowline integrity group also expanded, adding a west slope integrity inspector and a second integrity engineer.

4.2 School Setback Rule-making

On December 18, 2018, the COGCC adopted new school setback rules in response to a petition for rulemaking submitted by the League of Oil and Gas Impacted Coloradoans (LOGIC) in December 2017. The rules adopted varied significantly from the original proposed rule language,

but included language developed by staff after receiving input from parties and stakeholders and significant measures adopted in consensus from LOGIC, Colorado Association of School Boards, local governments, individual school districts, and industry representatives. The consensus language provides a notification requirement to schools and school districts within ¼ mile of a proposed oil and gas location and sets a minimum setback of 1,000 feet to school facilities, a newly defined term inclusive of areas such as ball fields and playgrounds used as part of students' curriculum or extracurricular activities. Significantly, the COGCC included a setback from child care centers—inclusive of their outdoor areas—in the final adopted rules; this provision was added by the consensus parties and completed the closure of regulatory gaps left by the 2013 adoption of a 1,000-foot set back to high occupancy building units.

4.3 Other Administrative Rules

In addition to the significant policy rule-making efforts described above, the COGCC also increased its conservation levy on February 12, 2018. COGCC Rule 310 sets the conservation levy as a fee imposed on the value of production in accordance with the Act. The COGCC raised the conservation levy from seven-tenths of a mill to eleven-tenths of a mill to address anticipated budget shortfalls, including those caused by anticipated refunds of severance tax dollars to oil and gas operators following a court decision regarding tax deductions for pipeline infrastructure projects.

The second administrative rule-making implemented Senate Bill 18-230 changes to the pooling statute and adopted additions and amendments to the 500 Series, Rules of Practice and Procedure and other rules related to the process used to establish or manage hearing matters. The COGCC adopted the final rules on October 3, 2018, which improved the state's pooling process and clarified COGCC's rules in order to streamline the process used by operators to initiate a hearing matter for consideration by the Commission and the process used by COGCC staff to manage hearing matters.

5.0 OIL AND GAS EXPLORATION AND PRODUCTION ACTIVITY

Data used in the following discussion are current as of December 1, 2018 as reported in the December 2018 COGCC Staff Report.

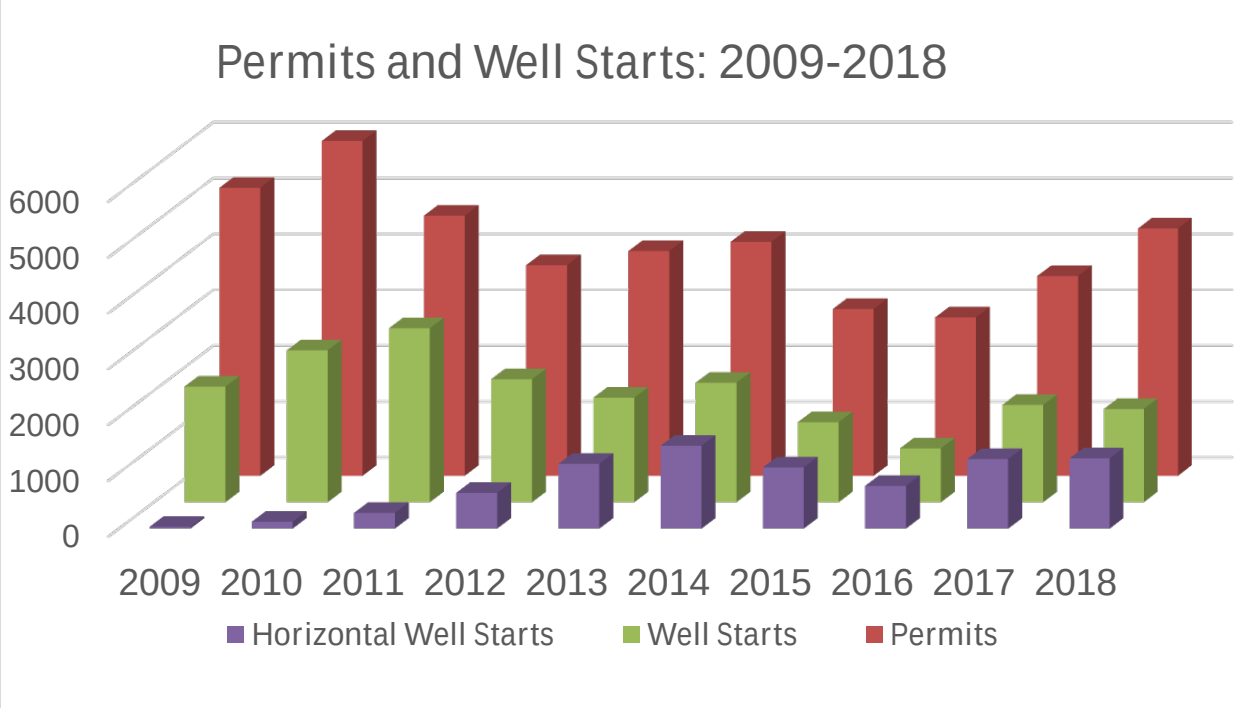
One metric used to measure exploration and development activity levels is the number of approved permits. A total of 4,429 permits to drill were issued in 2018, compared to 3,875 in 2017 and 2,835 in 2016. Most of the permits, approximately 66%, were issued in Weld County (2,945 permits) in the active shale play of the Niobrara and Codell formations. Of the 2,945 Weld County permits, 2,932 were for horizontal wells (approximately 98%). The second most active county for permits was Garfield County with 692 permits; however, only one was for a horizontal well. Adams County had the second highest horizontal well permit activity (243 permits) accounting for 100% of 2018 drilling permits for the county. Historical details of permit activity by County since 2000 are provided in Appendix 4.

Another metric to gauge activity level is the number of wells drilled; COGCC tracks well starts and, specifically, horizontal well starts. As of December 1, 2018, there were 1,669 well starts statewide, compared to 1,741 well starts in 2017. In 2018, 1,258 wells starts were for horizontal wells, or approximately 75 percent of the total well starts for the state. As in recent years, horizontal drilling associated with the Niobrara and Codell Formations in the Denver-Julesburg (DJ) Basin dominated the drilling activity. In 2018, 1,134 (90 percent) of the horizontal wells starts for the state were in Weld County targeting the Niobrara and Codell Formations. Over time, wells drilled in Colorado have shifted from a dominance of vertical wells to horizontal wells as shown in Table 5-1 and Figure 5-1, below.

Table 5-1. Annual Permit and Well Start Activity 2009 - 2018

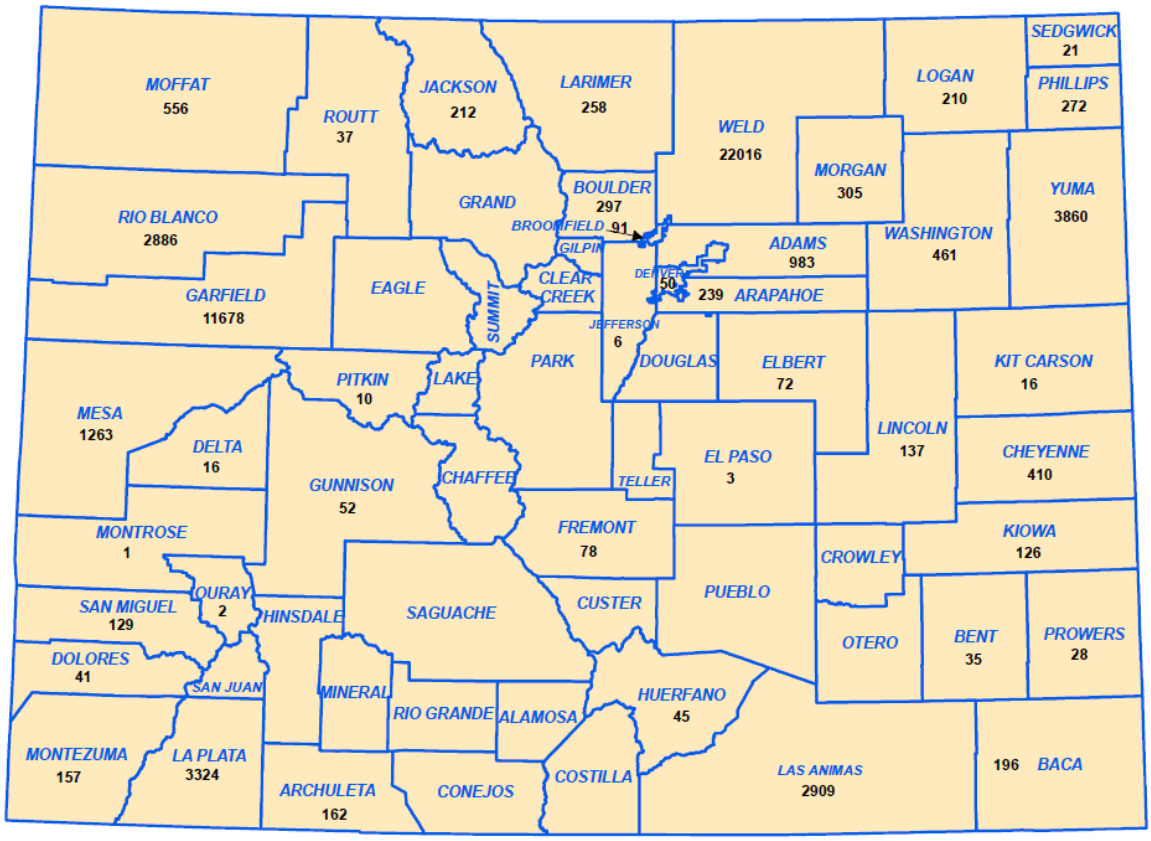
Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Permits	5159	5996	4659	3773	4025	4190	2987	2835	3578	4429
Well Starts	2071	2719	3114	2202	1872	2139	1434	964	1741	1669
Horizontal Well Starts	31	123	280	641	1160	1484	1096	764	1245	1258
Percent Horizontal	1%	5%	9%	29%	62%	69%	76%	79%	72%	75%

Figure 5-1. Annual Permit and Well Start Activity 2009 - 2018



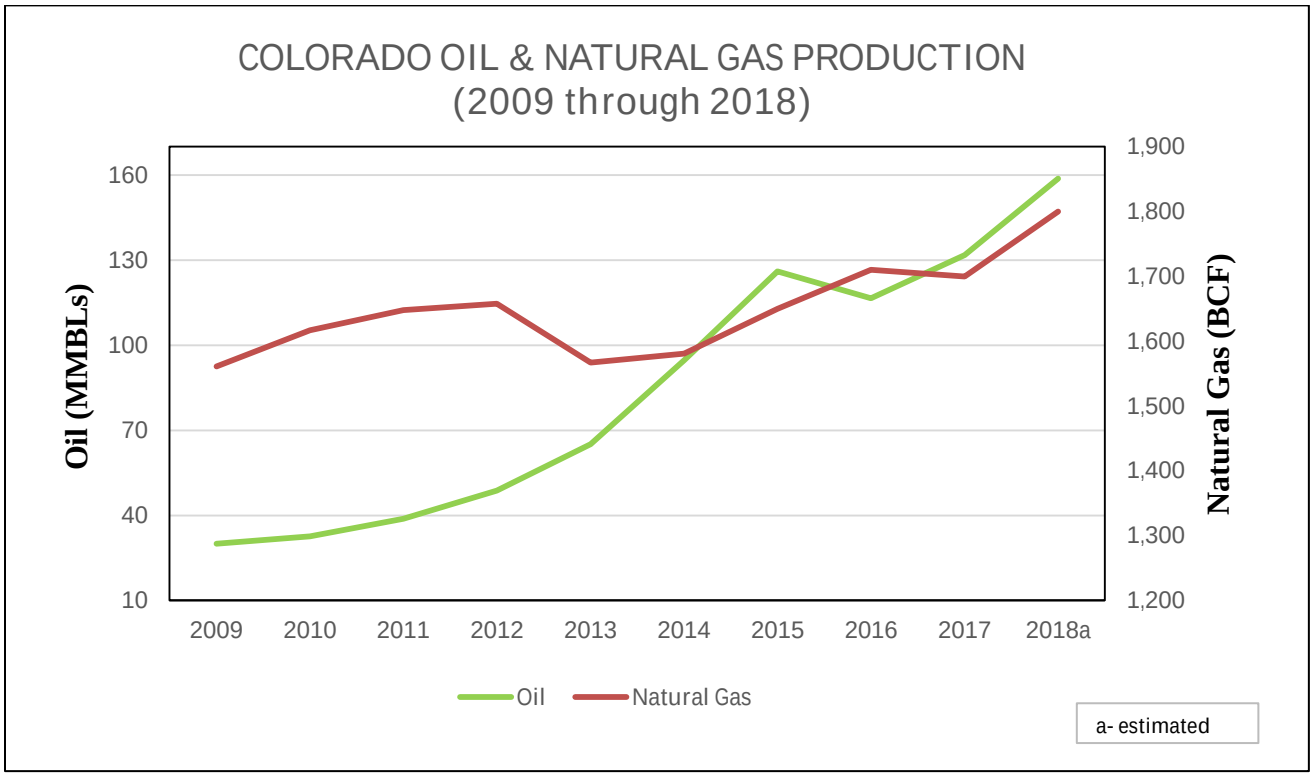
As of December 1, 2018, there were 53,470 active wells in the state. Figure 5-2 shows the number of active wells by County. Weld and Garfield counties have the most active wells, with 22,016 and 11,678 wells, respectively.

Figure 5-2. Number of Active Wells by County (2018)



Oil and gas production reports for 2018 are not yet complete and, therefore, final production figures for 2018 are not available. COGCC expects production reporting to be finalized by April 15, 2019. With that caveat, COGCC estimates that statewide oil production for 2018 will be approximately 158.7 million barrels (bbl) of oil produced after final accounting. This is the highest annual oil production on record exceeding the previous highest production record of 122.8 million bbl in 2015. Further, COGCC estimates that approximately 1.78 trillion cubic feet of natural gas will be produced in Colorado during 2018, the same volume of natural gas production reported for both 2017 and 2016. Since 2009, Colorado's oil production has dramatically increased from 30.0 million bbl to the current levels, while natural gas production has remained fairly flat (Figure 5-3).

Figure 5-3. Colorado Oil and Gas Production 2009-2018



The COGCC estimates the total dollar value for oil and natural gas produced in Colorado in 2018 to be approximately $15 billion. For comparison, the combined value was $11.5 billion in 2017 and $8.7 billion in 2016.

6.0 SPILLS/RELEASES, REMEDIATIONS, AND ENVIRONMENTAL INVESTIGATIONS

6.1 Statewide Spills/Releases and Remediation Projects

Operators are required to report E&P waste spills and releases that occur as a result of oil and gas operations in accordance with COGCC Rule 906, as revised in 2013, using a Form 19 – Spill/Release Report. Oil, condensate, and produced water are the substances most commonly spilled or released. These substances fall under the E&P waste exemption to regulation as hazardous wastes under Subtitle C of the Resource Conservation and Recovery Act (RCRA); therefore, they are subject to COGCC jurisdiction. COGCC defines spills as "any unauthorized sudden discharge of E&P waste to the environment" and releases as "any unauthorized discharge of E&P waste to the environment over time." Through December 1, 2018, 541 spills or releases were discovered and reported to the COGCC in 2018.

Although only spills and releases that meet certain thresholds require reporting, operators are required to remediate environmental impacts associated with any spill or release of E&P waste of any size. The COGCC environmental staff review and approve remediation plans, evaluate

analytical data, monitor the progress of the remediation, and ensure cleanup standards and other remediation requirements are met through verification sampling, data review, site inspections, and other measures. If operators find impacts from historical operations during the course of routine operations or facility closure, those impacts are typically reported as releases and the operator proceeds with investigation and cleanup. It is important to note that many times the operator who finds and cleans up the impact is not the operator responsible for the occurrence of those impacts. Of the 541 spills or releases, 180 were reported as releases, and 136 of those cited decommissioning, plugging, abandonment, or facility dismantling in their description of the spill.

Where groundwater has been impacted, operators are required to eliminate any continued release; investigate the extent of contamination; remove the source of contamination (such as the impacted soils in contact with groundwater or free hydrocarbon product), remediate, establish points of compliance, and monitor contaminant levels. In accordance with the MOA for Response to Spills/Releases to Surface Water, the COGCC notifies the WQCD of spills or releases impacting surface waters; in 2018, seven such spills or releases to surface waters were reported to WQCD staff.

Remediation projects are tracked in the COGCC's database and can be accessed on the COGCC website. Through December 1, 2018, the COGCC received approximately 626 new remediation plans, and closed approximately 604 remediation projects. It should be noted that not all reported spills and releases are required to be closed under an approved remediation plan, but certain facilities, like production pits and partially buried produced water vessels are required by COGCC rule to be closed in accordance with an approved plan.

7.0 SPECIAL ENVIRONMENTAL PROJECTS

This section describes projects which were completed or underway during calendar year 2018 for which funding came from the special environmental projects and mitigation studies budget line (the list below includes work completed in FY 2017-18 and ongoing for FY 2018-19):

Upper Pierre Aquifer Water Quality Study, Weld, Morgan, and Logan Counties – In FY 2018, the COGCC published Water Quality and the Presence and Origin of Methane in the Upper Pierre Aquifer in Northeastern Weld County, Morgan County and Logan County, Colorado, COGCC Special Project 2141 in the Library of the COGCC website. The COGCC undertook this study in response to a higher level of interest in the sands of the Upper Pierre Shale as a source of economic quantities of groundwater. The water-bearing sandstone intervals have collectively become known as the Upper Pierre Aquifer, and water well permit applications continue to be submitted in eastern Weld County for agricultural, commercial, and industrial uses, including applications for stock water and for oil and gas drilling and completion.

Results of the COGCC water quality study indicate the Upper Pierre Aquifer contains water suitable for industrial and stock uses, although high sodicity and high boron concentrations prevent use of the water for irrigation or untreated domestic use. Some water well owners are using the water for domestic or commercial supply with treatment. The average completion

depth of water wells sampled was 848 feet, and the maximum completion depth was 1,302 feet. The water type ranges from sodium-bicarbonate to sodium-sulfate, depending on water well location, depth, and construction. Total Dissolved Solids averages 1,430 milligrams per liter. Microbial methane was detected in the majority of the water wells sampled. Thermogenic methane and BTEX (benzene, toluene, ethylbenzene, and xylene) were not detected. The data collected in the study provide baseline groundwater quality information for future assessments and investigations.

Naturally Occurring Radioactive Materials (NORM) Produced Water Project (COGCC Special Project 10243) – Beginning in FY 2018, the COGCC Environmental Staff completed sampling of a total of 52 produced water samples and 5 production gas samples from 47 separate well sites statewide for Naturally Occurring Radioactive Materials (NORM) as part of this Special Project. The sampling targeted water production from geologic formations producing oil and gas throughout Colorado, including the Sussex, Codell, Niobrara, Muddy J, Dakota, Mesa Verde (Williams Fork), Mancos, Leadville, J and D Sand, Vermejo/Raton, Fruitland, Osage, Topeka, and Cherokee formations. Source water for hydraulic fracturing fluids along with frac "flowback" fluids were also sampled. Twenty-two oil and gas operators participated.

NORM constituents analyzed include activities of radium isotopes and concentrations of uranium and thorium in addition to general water quality parameters. All water samples were analyzed for the stable isotopes of oxygen and hydrogen (diagnostic of water sources) and a subset of water samples were analyzed for carbon-14 (^{14}C) and tritium (^{3}H) as indicators of age of waters sampled. All samples were also analyzed for a full suite of general chemistry constituents (e.g., anions, cations, metals) and hydrocarbons.

This study is a follow up to "Analysis of Naturally Occurring Radioactive Materials in Drill Cuttings, Greater Wattenberg Field, Weld County" completed in November 2014. It is also responsive to the October 2011 State Review of Oil and Natural Gas Environmental Regulations (STRONGER) review of COGCC regulations. The intent of the study is to determine whether the COGCC has adequate rules and regulations on the books to ensure that NORM are handled in a manner that is protective of public health and safety and the environment. The study will also produce data for oil and gas operators and other regulatory agencies to use in determining acceptable waste handling methodologies. The COGCC is also looking for indicator parameters that can act as surrogates for the expensive and complex-to-interpret radiochemistry analytes, so that oil and gas operators can predict when NORM may be an issue in the produced fluids they encounter.

Analytical laboratory results were completed and sent to the COGCC by the beginning of 2018. A final report is scheduled to be completed in the first quarter of 2019.

3M4M Projects, La Plata and Archuleta Counties – Between 2001 and 2010, the COGCC installed 17 monitoring wells at 11 locations along the Fruitland Formation outcrop in La Plata and Archuleta counties to monitor gas pressure changes in the Fruitland Coal. All monitoring wells are equipped with downhole pressure transducers that report data via a satellite telemetry

system to a central data center. In 2008 and 2009, the COGCC and its contractor designed and installed methane seep mitigation systems at two locations in La Plata County. The system at the South Fork Texas Creek (SFTC) site collects methane from a shallow "French drain" type network of piping and converts the methane to electricity.

The COGCC has worked with San Juan Basin operators to continue the monitoring and mitigation system and to provide ongoing operations and maintenance support to ensure the systems stay in working order and continue to relay data as designed. The COGCC and its partners and contractors have conducted the following activities:

- Performed routine operations and maintenance activities of all systems;
- Reviewed gas quality measurements stored in all data loggers;
- Collected weather station data;
- Conducted a system-wide field inspection tour;
- Collected well pressure measurements from a central data center; and
- Analyzed data and prepared the annual report.

Since May 2009, the SFTC system has collected 25,504 million cubic feet of methane and generated 282,278 kilowatt-hours of surplus electricity, which is transferred to the La Plata County Electric Association grid.

Project Rulison, Garfield County – In early FY 2018, the COGCC and its contractor completed the revision the Rulison Sampling and Analysis Plan (RSAP). In this revision of the RSAP, the Tier I boundary is unchanged. It is set at a 1-mile radius from the Project Rulison device emplacement well R-E. The Tier II boundary is redefined to take advantage of knowledge of the fracture orientation pattern and insights from subsurface modelling (Department of Energy [DOE] 2010) that have developed since the RSAP was initially published. The most significant modification to the plan is a realignment of the Tier II buffer zone from a circle to an ellipse with the major (long) axis aligned with the average hydro-geologic fracture orientation of $N75^{0}W$. The distance from the origin (emplacement well R-E) to the farthest point on the major axis of the ellipse is 2 miles. The minor (short) axis of the ellipse is perpendicular to the long axis and the distance from the origin to boundary is 1.5 miles. The draft version of this plan was distributed to various stakeholders including the CDPHE, DOE, Garfield County, and various operators for review and comment prior to the final revision.

Driving Methane Survey (Pilot Study) – In August 2017, in cooperation with the CDPHE – Air Pollution Control Division (APCD), the COGCC submitted a proposal to USEPA Region 8 to utilize its Geospatial Measurement of Air Pollution (GMAP) system for a driving air monitoring survey, primarily in Weld County. The GMAP system is capable of quantitatively detecting methane, total volatile organic constituents, and benzene while the survey vehicle is in motion, allowing for surveys of large geographic areas. The COGCC proposed this pilot study for two basic purposes as follows:

1. To determine if there are uncontrolled releases of natural gas from oil and gas producing facilities in close proximity to residential areas that could result in public safety risks;
2. To identify and stop emissions from oil and gas production facilities to protect human health and the environment in accordance with applicable air quality regulations.

Field work for the GMAP surveying took place from November 1 through 15, 2017. The GMAP system was deployed in areas selected by COGCC for several reasons, but primarily for the large number of oil and gas facilities located in close proximity to both established and expanding residential areas within municipalities such as Dacono, Frederick, Firestone, Erie and several others. The field work consisted of a total of seven days of surveying covering approximately 100 miles of roads per day.

The real-time surveying results did not identify any public safety risks. Some locations had elevated readings of methane, total volatile organic constituents, and benzene in close proximity to active oil and gas operations. EPA provided the final data to COGCC in May 2018. The COGCC is using the data to prepare a summary report of findings and evaluate the GMAP system, or a comparable technology, for additional surveys.

This study may provide valuable data for the development of an ambient methane monitoring pilot program consistent with one of the Governor's seven policy initiatives for oil and gas reform issued on August 22, 2017. COGCC anticipates finalizing the report in early 2019.

APPENDIX 1

COGCC Commissioners

Colorado Oil & Gas Conservation Commission Statutory Requirements

*Please note that information within parentheses is additional background information and not a statutory requirement

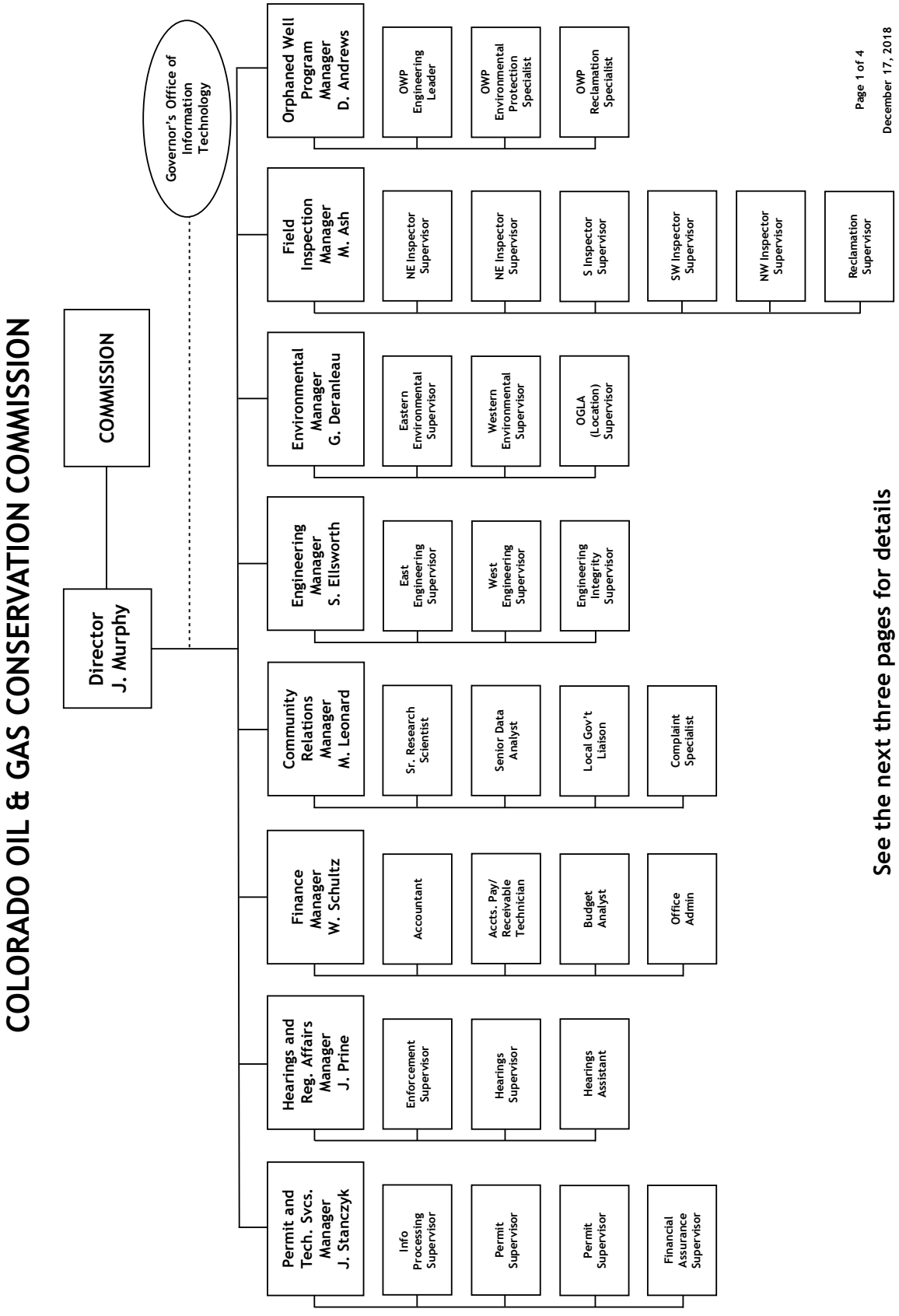
Commissioner (Officer)	**2 Executive Directors (ex-officio voting members)** (Current Employment)	**2 West of Continental Divide** (Resident County)	**3 with Substantial Oil & Gas Experience** (Employed by Oil & Gas Industry) (Current Employment)	**2 Out of 3 Must Have a College Degree in Petroleum Geology or Petroleum Engineering**	**1 Local Government Official** (Current Employment)	**1 with Substantial Environmental or Wildlife Protection Experience** (Current Employment)	**1 with Substantial Soil Conservation or Reclamation Experience** (Current Employment)	**1 engaged in Agricultural Production and a Royalty Owner** (Current Employment)	**Maximum of 4 from Same Political Party (excluding Executive Directors)**	**Current Term Expires**
Ashley L. Ager		**X** (La Plata)					**X** (Geologist)		D	7/1/2020
John H. Benton *Chair*		(Littleton)	**X**	**X**					R	7/1/2019
Howard Boignan *Vice Chair*		(Denver)	**X**						D	7/1/2020
James W. Hawkins *Vice Chair*		(Jefferson)	**X**	**X**					D	7/1/2019
Tommy Holton		(Weld)			**X** (Ft. Lupton Mayor)				R	7/1/2019
Kent Jolley		**X** (Garfield)						**X** (Rancher)	R	7/1/2020
Erin A. Overturf		(Denver)				**X** (Environmental Attorney)			D	7/1/2019
Robert W. Randall	**X** (Department of Natural Resources)	(Denver)								
Karin McGowan	**X** (Department of Public Health and Environment)	(Jefferson)								

Commissioner requrements are set by statute in the Oil and Gas Conservation Act at §34-60-104 (2) (a)(1), C.R.S. (Current as of September 18, 2018)

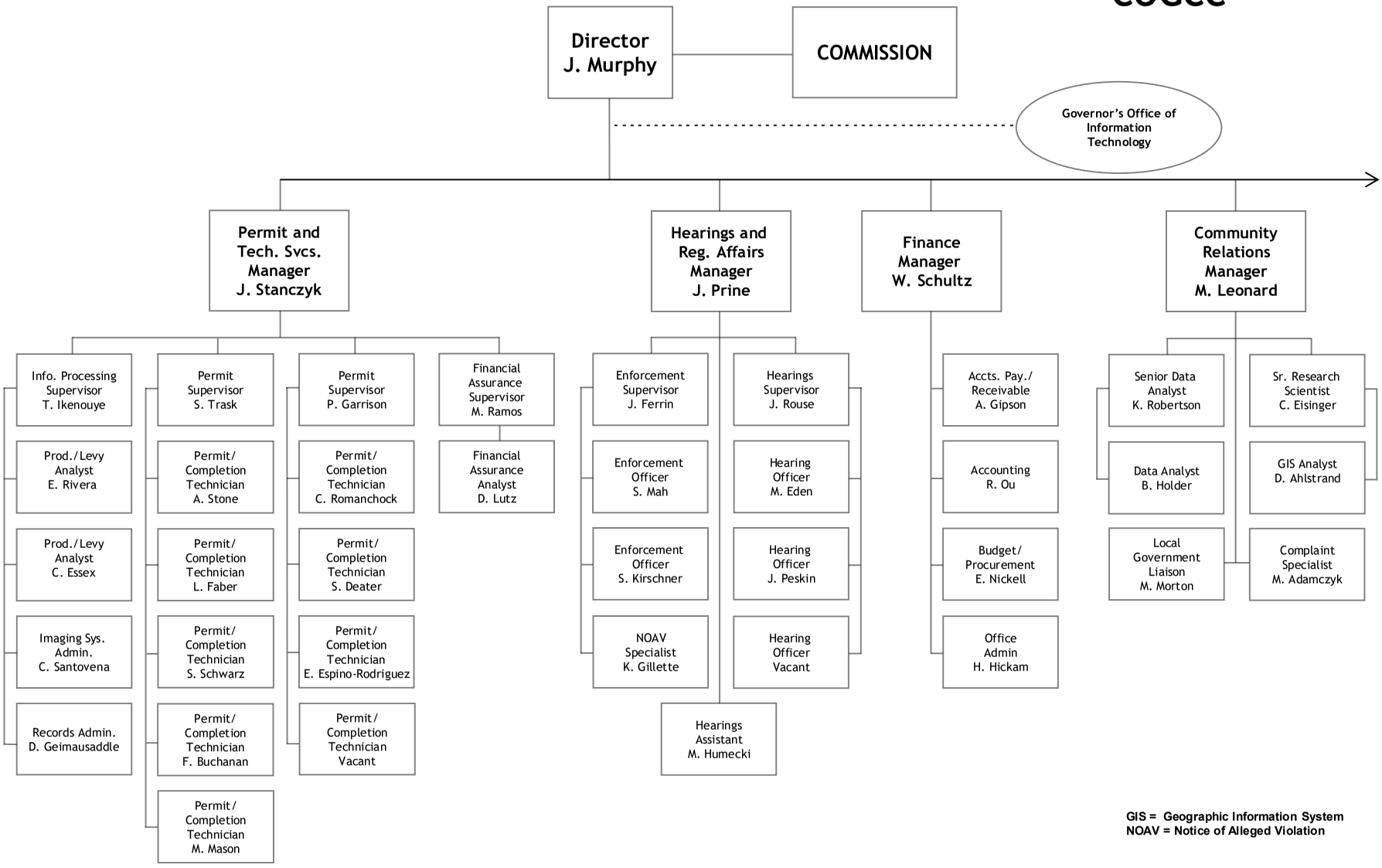
APPENDIX 2

COGCC Organizational Chart

Organizational Charts and Statistics



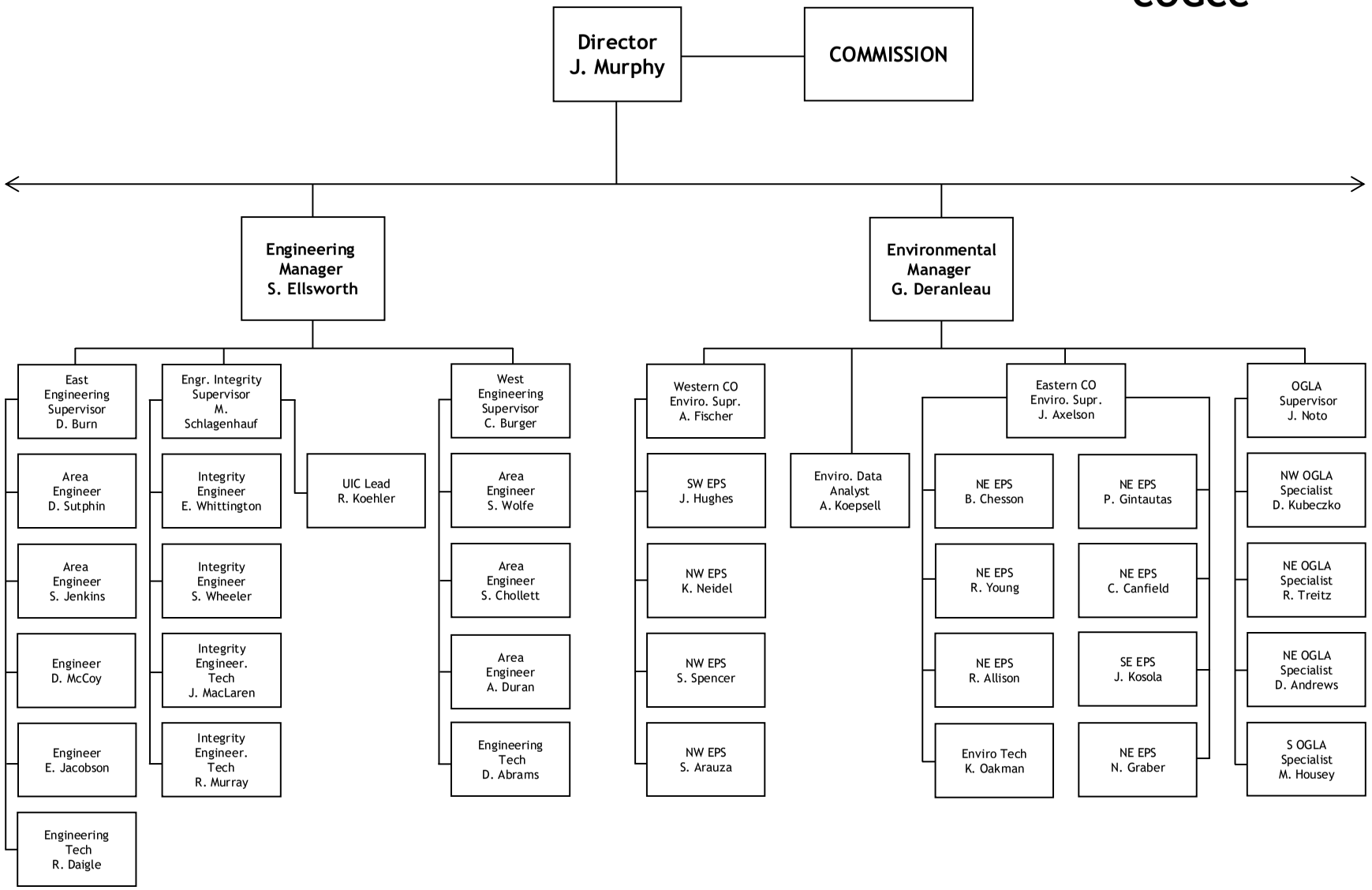
COGCC



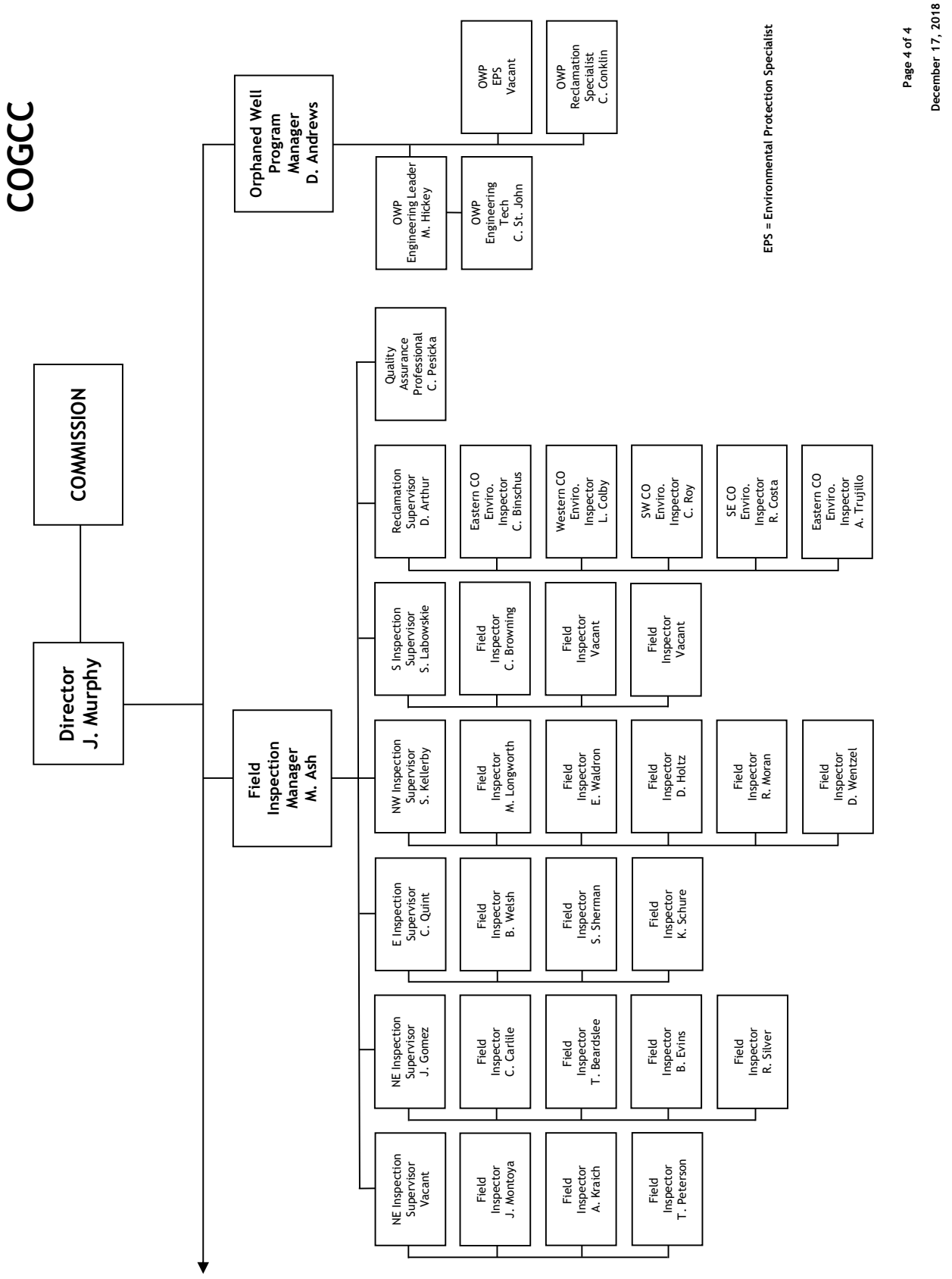
Prod = Production

GIS = Geographic Information System
NOAV = Notice of Alleged Violation

COGCC



UIC = Underground Injection Control
EPS = Environmental Protection Specialist
OGLA = Oil and Gas Location Assessment


COGCC
COMMISSION
Director
J. Murphy
Orphaned Well
Program
Manager
D. Andrews
OWP
Engineering Leader
M. Hickey
OWP
Engineering
Tech
C. St. John
OWP
EPS
Vacant
OWP
Reclamation
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C. Conklin
Field
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Manager
M. Ash
Quality
Assurance
Professional
C. Pesicka
Reclamation
Supervisor
D. Arthur
Eastern CO
Enviro.
Inspector
C. Binschus
Western CO
Enviro.
Inspector
L. Colby
SW CO
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Inspector
C. Roy
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Enviro.
Inspector
R. Costa
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A. Trujillo
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S. Labowskie
Field
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C. Browning
Field
Inspector
Vacant
Field
Inspector
Vacant
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S. Kellerby
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M. Longworth
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E. Waldron
Field
Inspector
D. Holtz
Field
Inspector
R. Moran
Field
Inspector
D. Wentzel
E Inspection
Supervisor
C. Quint
Field
Inspector
B. Welsh
Field
Inspector
S. Sherman
Field
Inspector
K. Schure
NE Inspection
Supervisor
J. Gomez
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C. Carlile
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Field
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Vacant
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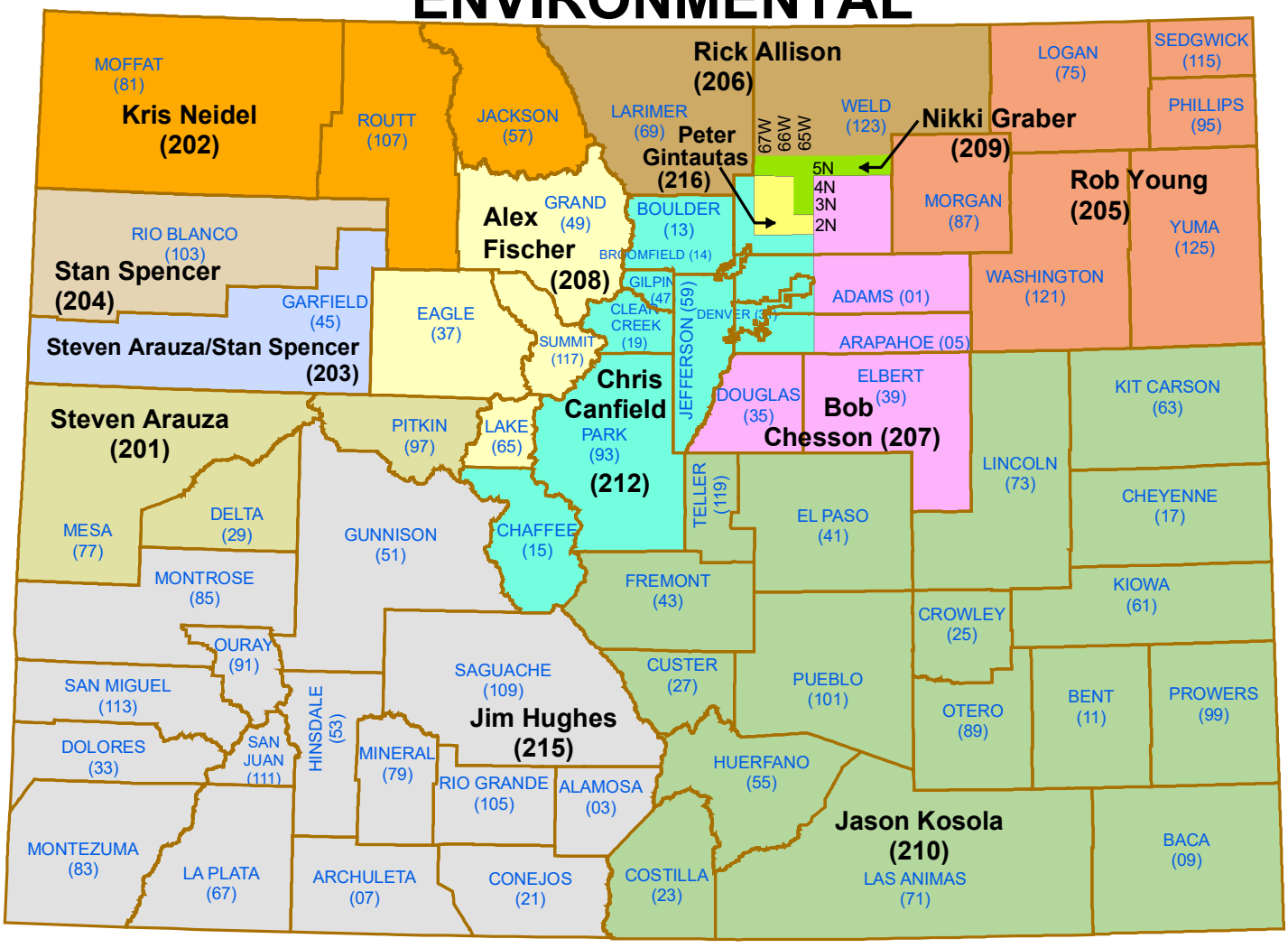
Inspector
J. Montoya
Field
Inspector
A. Kraich
Field
Inspector
T. Peterson
EPS = Environmental Protection Specialist
Page 4 of 4
December 17, 2018

ENVIRONMENTAL



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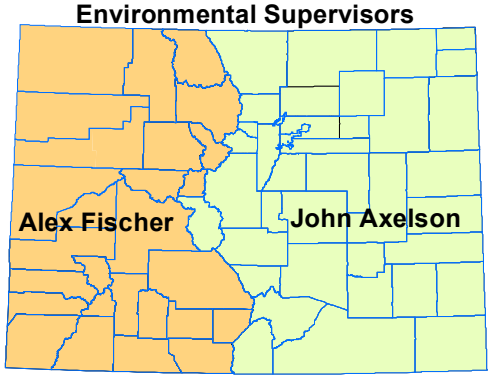

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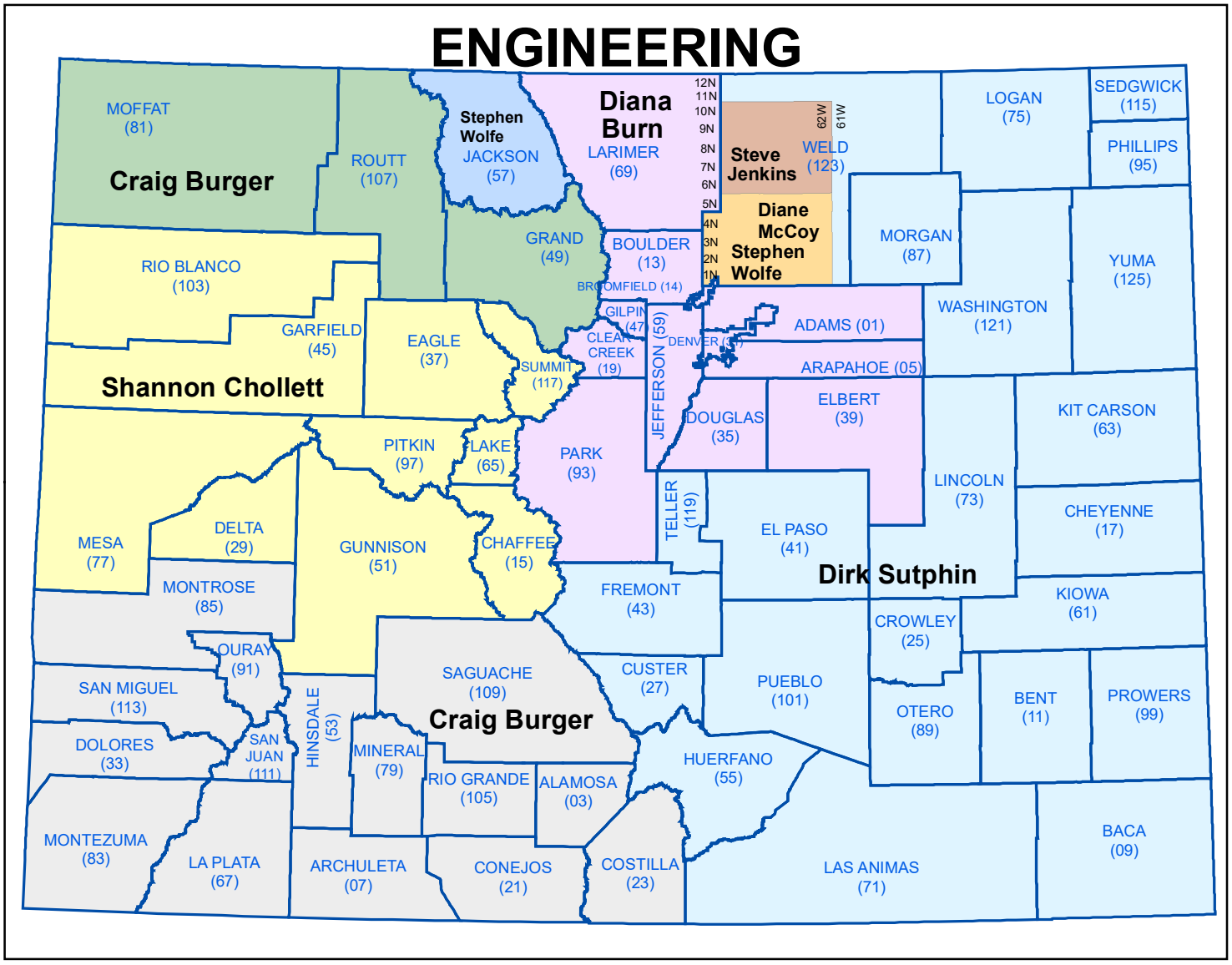
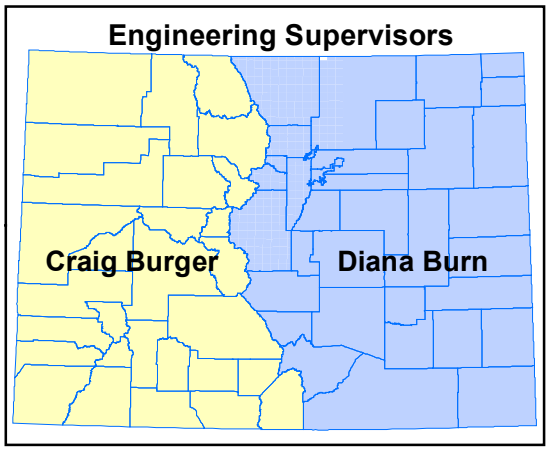
COLORADO
Oil & Gas Conservation Commission
Department of Natural Resources

COGCC: August 31, 2018

ENGINEERING





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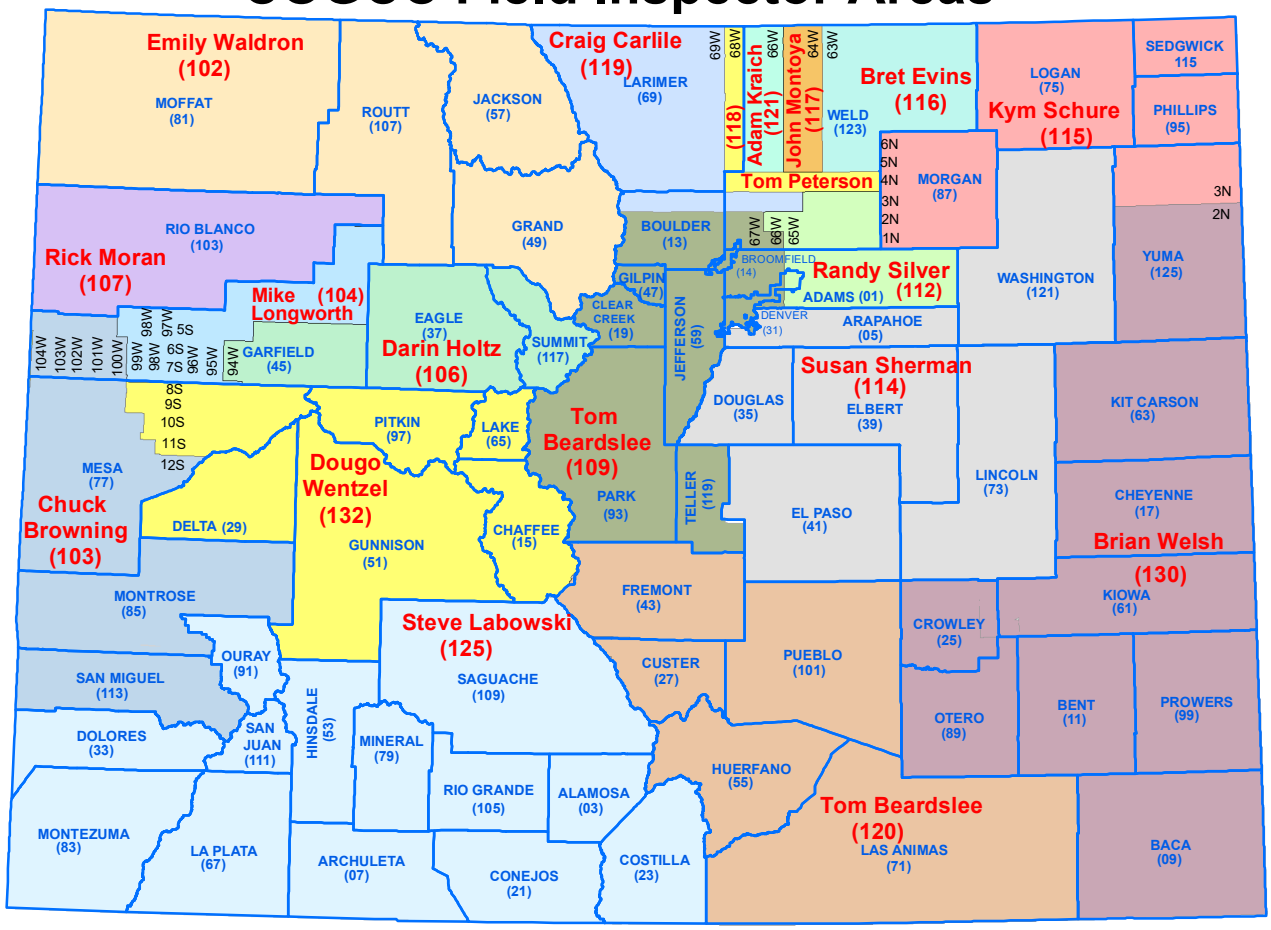
COLORADO
Oil & Gas Conservation Commission
Department of Natural Resources

COGCC Field Inspector Areas



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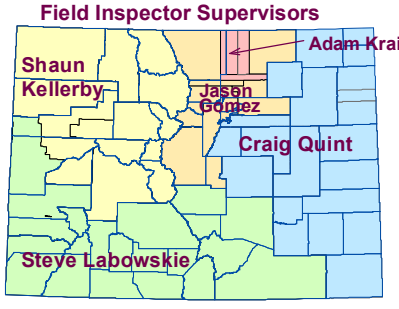

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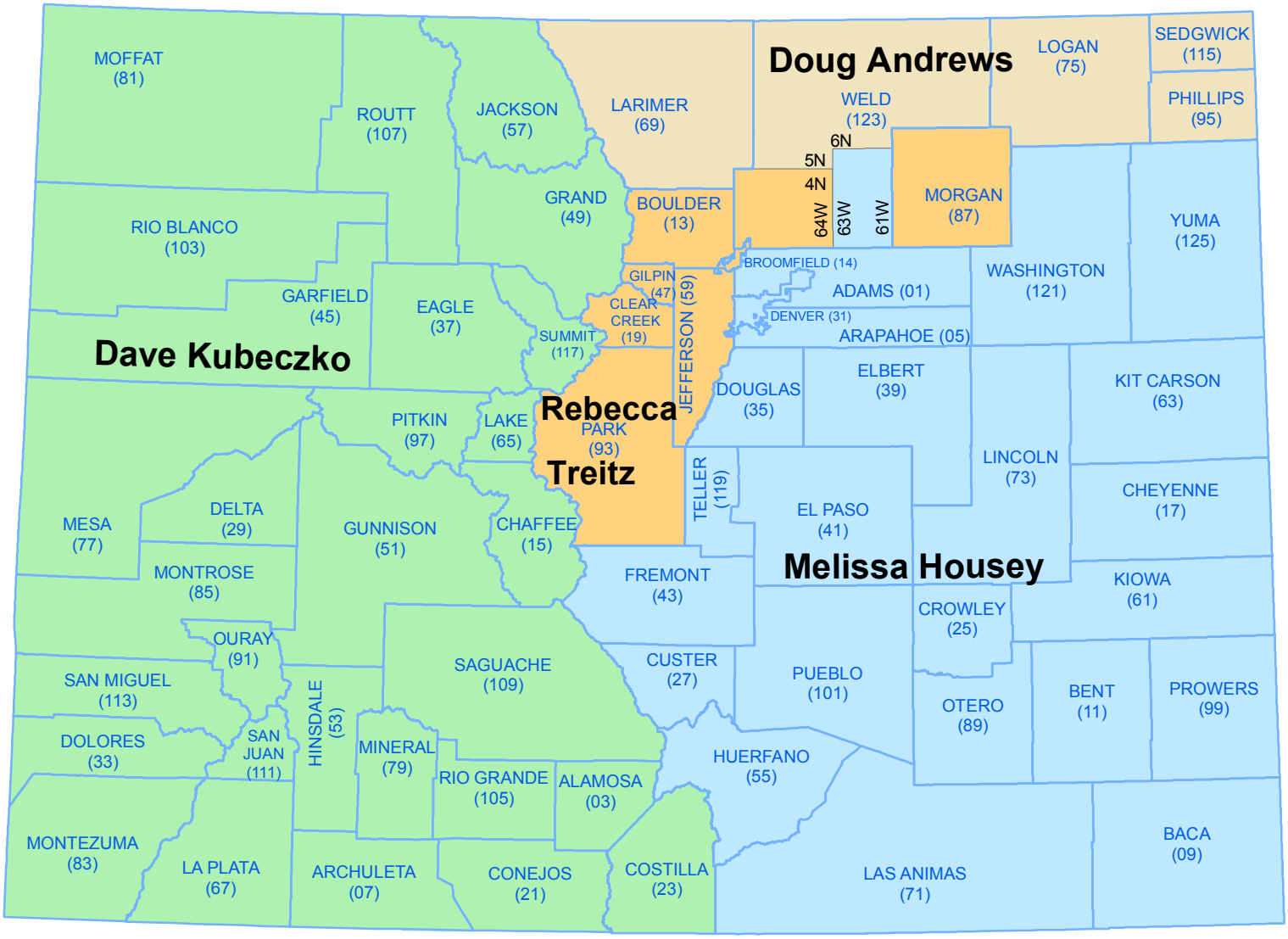
IGA Inspector

COLORADO
Oil & Gas Conservation Commission
Department of Natural Resources

December 17, 2018

OIL & GAS LOCATION ASSESSMENT



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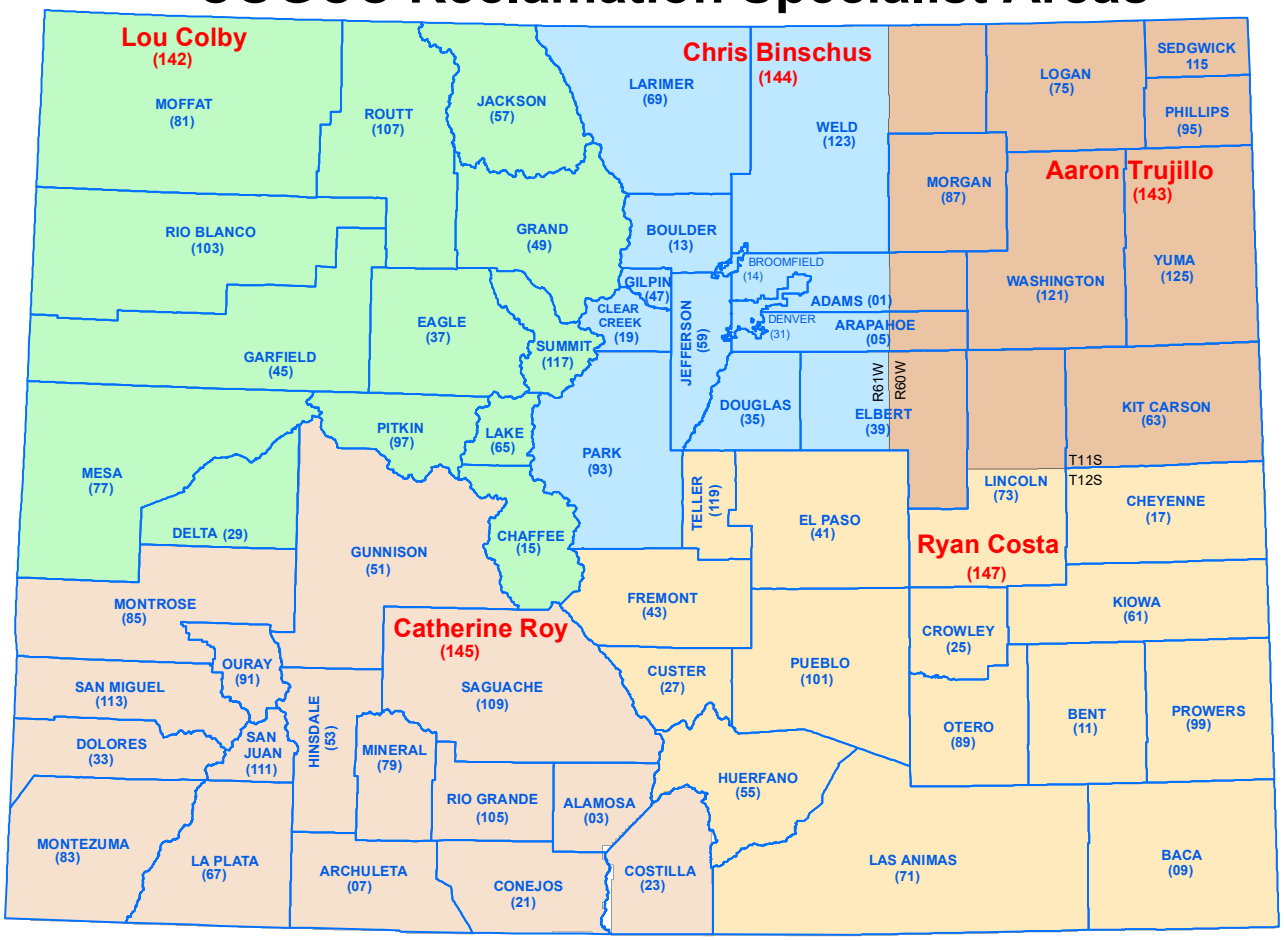
COLORADO
Oil & Gas Conservation Commission
Department of Natural Resources

COGCC, December 29, 2014

COGCC Reclamation Specialist Areas



Margaret Ash, Field Inspection Manager
(O) 303-894-2100, Ext. 5110
(C) 303 548-6298

Reclamation Specialists

Denise Arthur
Reclamation Supervisor
(O) 303-894-2100, x5195
(C) 720-630-6533

Cathrine Roy
Area 146 Reclamation Specialist
(O) 970-247-0253
(C) 970-946-9107

Ryan Costa
Area 147 Reclamation Specialist
(O) 719-868-2047
(C) 719-505-3245

Lou Colby
Area 142 Reclamation Specialist
(C) 970-989-4402

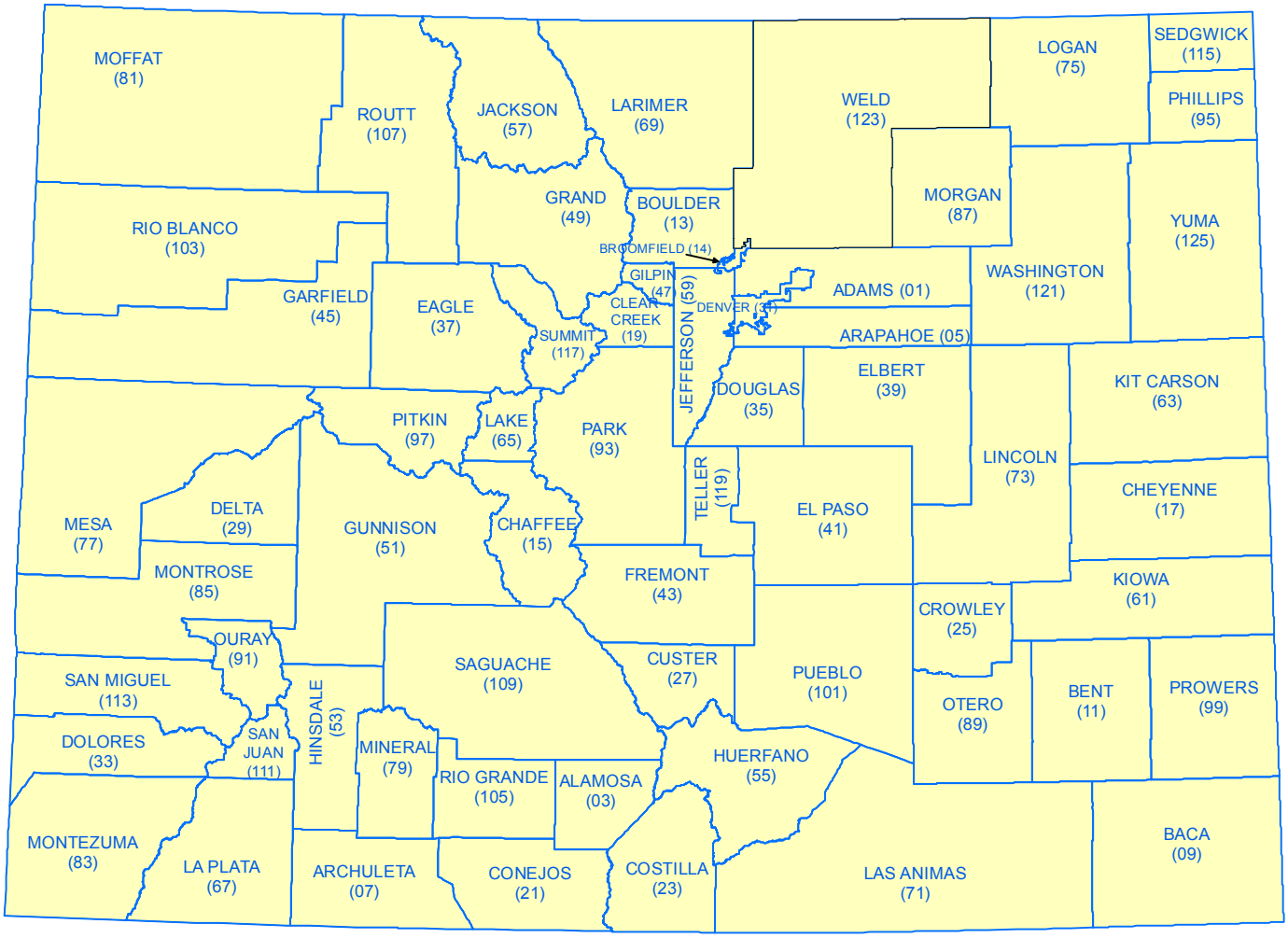
Aaron Trujillo
Area 147 Reclamation Specialist
(C) 970-441-1009

Chris Binschus
Area 144 Reclamation Specialist
(C) 970-702-3003

COLORADO
Oil & Gas Conservation Commission
Department of Natural Resources

COGCC, May, 13, 2018

Local Government Liaison: Mark Morton



Julie Murphy, Hearings Manager
303-894-2100, Ext 5152

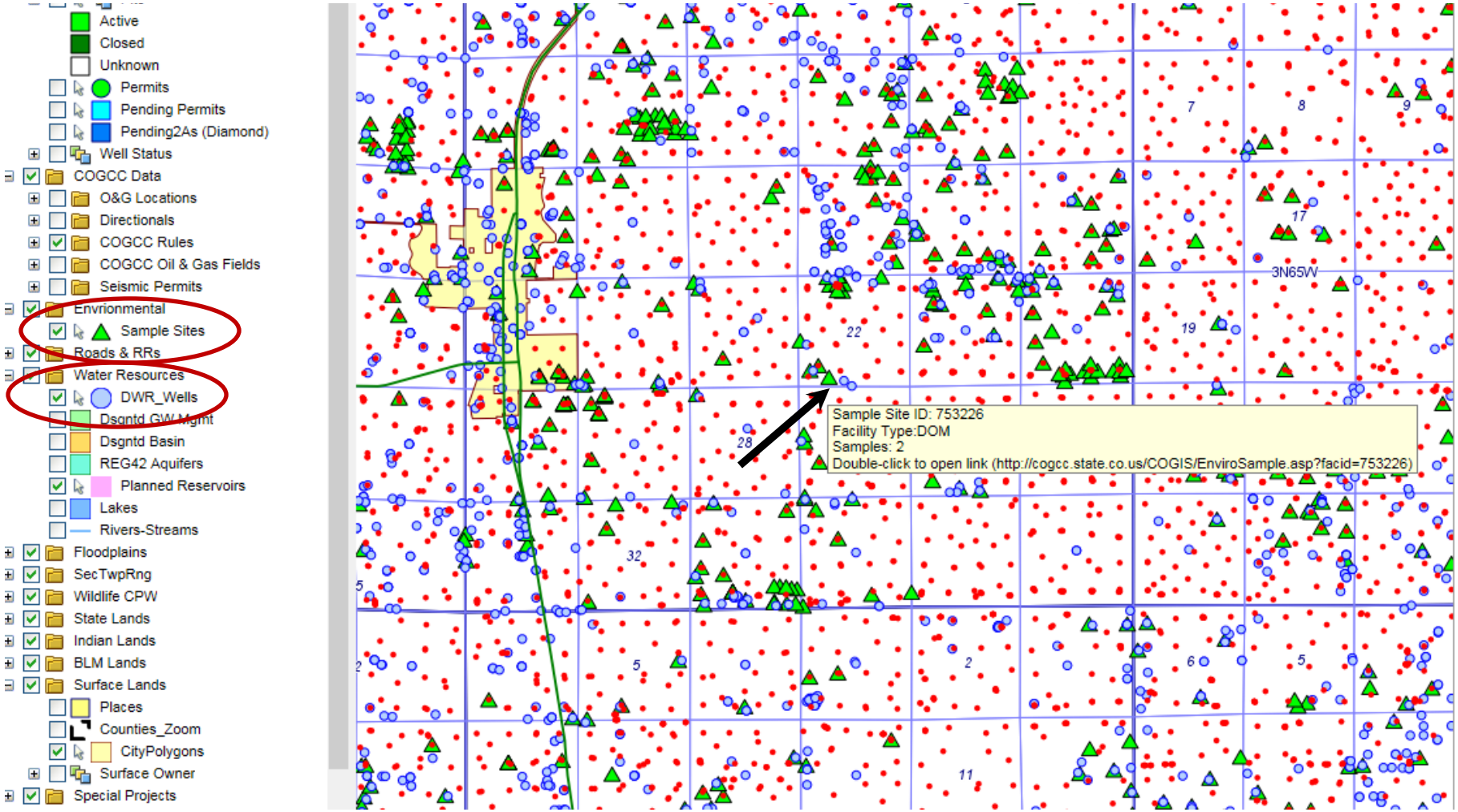
Marc Morton 303-894-2100, Ext 5132

COLORADO
Oil & Gas Conservation Commission
Department of Natural Resources

APPENDIX 3

Example Analytical Report

GIS Online Sampling Data



GIS Online Sampling Data

COGIS - Environmental Sample Site Information

Doc GIS

#753226 Information

Sample Site ID:	753226			
FacilityType:	DOM	ProjNumber:		
County:	WELD - #123	Location:	SESW 22 3N 66W	
Elevation:	5006	Lat/Long:	40.20446/-104.76767	
DWR Receipt #:	3616678	WellDepth:	300	

Related Facility/Well

NonFacility ID:	-99999	Facility Name:	No Facility	Location:
Status:	CL	Operator Name:	UNKNOWN # 1	

COGCC Water Quality Database Disclaimer:
The analytical data and other information in this database are a compilation of data collected by COGCC staff, data submitted to COGCC from a variety of third parties, and historical data. All analytical data collected by or submitted to the COGCC is public information and COGCC posts the data to this database as a public service. The data is provided for informational purposes only. COGCC does not conduct a detailed review of quality control/quality assurance protocols, chain of custody procedures, or field or laboratory methodologies on data received from third parties. The level of review performed on historical data is unknown. COGCC does not regularly perform formal data validation for any of the data posted to this database. **The COGCC makes no warranties or representations of any kind, express or implied, regarding the quality, accuracy, reliability, merchantability, or fitness for a particular purpose of the data provided herein.**

Sample(s) ☐ All Export to CSV

☐ Sample ID:	537748	Sample Date:	4/16/2014	Matrix:	WATER	Collection Point: Dom	Type: Dom	Lab:	ALS Lab Group (formerly Paragon)
☐ Sample ID:	537750	Sample Date:	4/16/2014	Matrix:	WATER	Collection Point: Dom	Type: Dom	Lab:	ALS Lab Group (formerly Paragon)

GIS Online Sampling Data

#753226 Information

Sample Site ID:	753226		
FacilityType:	DOM	ProjNumber:	
County:	WELD - #123	Location:	SESW 22 3N 66W
Elevation:	5006	Lat/Long:	40.20446/-104.76767
DWR Receipt #:	3616678	WellDepth:	300

Related Facility/Well

NonFacility ID:	-99999	Facility Name:	No Facility	Location:	
Status:	CL	Operator Name:	UNKNOWN # 1		

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Sample(s) ☐ All Export to CSV

☐ Sample ID: 537748 Sample Date: **4/16/2014** Matrix: **WATER** Collection Point: **Dom** Type: **Dom** Lab: **ALS Lab Group (formerly Paragon)**

Sample Results for Sample # 537748 ALS Lab Group (formerly Paragon) ID: 1404281-1 - Minimize

Methodcode	ParamDescription	ResultValue	Units	DetectionLimit	Qualifier
BART	BACTERIA, IRON RELATED	ND	cfu/ml	1	U
BART	BACTERIA, SLIME FORMING	2500	cfu/ml	1	
BART	BACTERIA, SULFATE REDUCING	ND	cfu/ml	1	U
E200.8	BARIUM	9.1	ug/L	1	
E200.8	BORON	61	ug/L	50	
E200.8	CALCIUM	13000	ug/L	1000	
E200.8	IRON	ND	ug/L	100	U
E200.8	MAGNESIUM	3400	ug/L	100	
E200.8	MANGANESE	28	ug/L	2	
E200.8	POTASSIUM	2700	ug/L	1000	
E200.8	SELENIUM	ND	ug/L	1	U
E200.8	SODIUM	550000	ug/L	1000	
E200.8	STRONTIUM	470	ug/L	1	
E300.0	BROMIDE	1.2	mg/L	0.4	
E300.0	CHLORIDE	87	mg/L	5	
E300.0	FLUORIDE	0.21	mg/L	0.2	
E300.0	NITRATE AS N	ND	mg/L	0.4	U
E300.0	NITRATE/NITRITE AS N	ND	mg/L	0.1	U
E300.0	NITRITE AS N	ND	mg/L	0.2	U

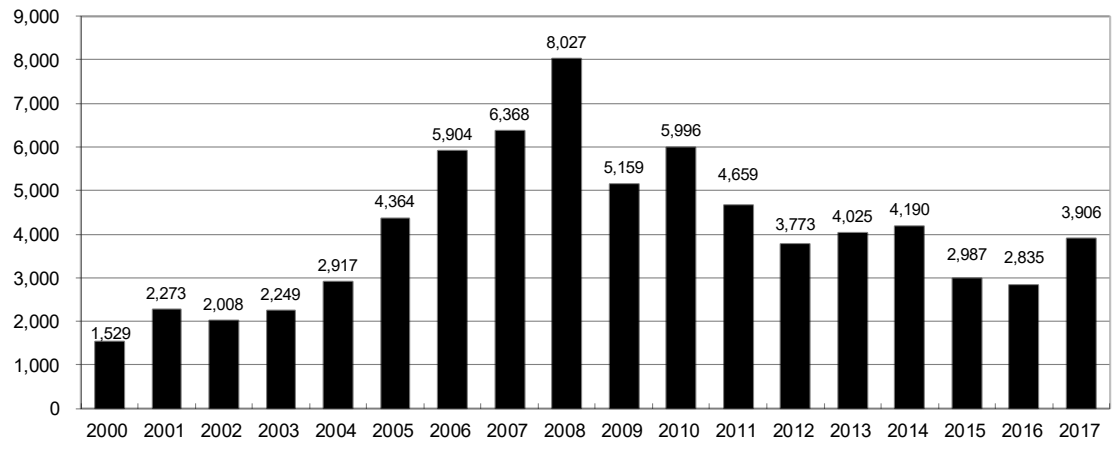
APPENDIX 4

Permit Statistics

Annual Drilling Permits by County as of December 1, 2018

County	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
ADAMS	34	37	89	51	35	21	8	40	40	51	96	74	125	243
ARAPAHOE	7	11	10	10	10	8	23	35	23	34	19	5	78	96
ARCHULETA	13	14	26	47	11	18	12	5	4	3	11	3	21	40
BACA	8	2	11	13	3	4	5	3	1	1			5	2
BENT	3	8	1	1		5		2	1					
BOULDER	13	21	37	32	35	24	30	22						
BROOMFIELD	1	1		2	33	28	11	36		31				71
CHEYENNE	10	21	15	33	12	13	16	31	50	26	9		1	1
COSTILLA														
CROWLEY										2			3	
DELTA	10	9	2			4	3	6	1	2				
DENVER		19	25	24										
DOLORES	1	6	10	12	21	8	8	13	12	3		3	2	1
EAGLE									1					
ELBERT		4			1		1	2	2	4	3	3	1	
EL PASO					2	3	3	18	1	2				
FREMONT	3	2	4	14	13	22	14	11	2	8	2	2	1	2
GARFIELD	1,509	1,845	2,550	2,888	1,981	2,037	1,323	1,046	870	1,066	532	724	612	692
GRAND														
GUNNISON	9	19	7	10	12	4	3	11	9	20	28	19	33	24
HUERFANO	2			7		2	1	9	1	13	2		2	
JACKSON	6	8	5	27	19	9	18	5	12	17	3	57	28	19
JEFFERSON		1	3	2					1					
KIOWA	1	11	9	26	7	16	17	17	12	5	3		3	2
KIT CARSON	5	4	4	13	7	3	2	6	1	2		1		
LA PLATA	115	235	251	328	298	191	99	71	32	87	106	96	108	98
LARIMER	1		5	46	12	41	8	13	2	4	28	4	30	2
LAS ANIMAS	413	500	362	303	88	92	85	11	2	1				
LINCOLN	4	1	2	58	44	48	31	36	87	129	24	5	31	20
LOGAN	13	17	14	5	9	17	8	27	4	5		1	3	2
MESA	136	265	293	501	427	306	127	150	105	74	126	7	215	63
MOFFAT	60	120	68	57	51	53	93	88	44	54	12	17	5	4
MONTEZUMA	11	5	12	22	39	19	27	29	14	25	3	3	6	3
MONTROSE		1	3	3		1	1							
MORGAN	7	3	6	2	1	6	13	5	16	6	4	28		4
OTERO														
PARK					3	4	1							
PHILLIPS	17	12	69	82	45	64	112	56		11	2			
PITKIN			1								1			
PROWERS	5	7	5	8	1	3	1			1		1		
RIO BLANCO	161	360	321	477	348	441	109	117	167	121	107	71	115	82
RIO GRANDE				1	1			2		1				
ROUTT	6	9	8	4	2	3	10	4	12	4	9			
SAGUACHE			2	1	2									
SAN JUAN														2
SAN MIGUEL	45	35	23	20	13	10	2	1		2	3			
SEDGWICK	2	7	2	1	19	11	12	2		7	1			
WASHINGTON	50	69	45	11	1	6	12	6	19	12	9	7	10	11
WELD	901	1,418	1,527	2,340	1,448	2,152	2,262	1,826	2,468	2,303	1,841	1,704	2,466	2,945
YUMA	782	797	541	545	105	299	148	11	9	53	3		2	
TOTAL	**4,364**	**5,904**	**6,368**	**8,027**	**5,159**	**5,996**	**4,659**	**3,773**	**4,025**	**4,190**	**2,987**	**2,835**	**3,906**	**4,429**

ALL COUNTIES



Horizontal Well Activity as of December 1, 2018

	Prior Years			2009		2010		2011		2012		2013		2014		2015		2016		2017		2018		Total	Completion			
County	Drilled	DA	PA	Permit	Spud	Permit	Spud	Permit	Spud	Permit	Spud	Permit	Spud	Permit	Spud	Permit	Spud	Permit	Spud	Permit	Spud	Permit	Spud	Spud	AC	PR	DA	PA
ADAMS				6	5	2	3	1		17	2	26	1	42	18	92	3	72	2	125	28	243	79	141	3	21		1
ARAPAHOE	2							10	1	22	4	11	13	22	11	9		5	1	77	15	94	20	65	2	34		1
ARCHULETA	17			7	6	15	7	10	8	5	9	2		1		6	3	2	1	17	2	27	5	63		56		
BENT											1	1												1				
BOULDER								4																				
BROOMFIELD																						71						
CHEYENNE	5		4									7	2	1	1	1	1							4		2		5
DELTA							2			6	1	1		2										2		2		
DOLORES	9			18	2	6				9	3	5	4	3	1									18		12		5
EL PASO										10																		
ELBERT										1																		1
FREMONT	7	6		6		12	5	3	4	4	1	1	1			1								11		10	7	1
GARFIELD	10		2	1	1	16	2	18	6	43	6	18	4	20	11	12	7	4		11		1	1	43		41		2
GUNNISON	1					1				3	2	2		9		18	2	10	1	24	1	19	1	8		7		
HUERFANO										4	1			2										1		1		
JACKSON	8	1	1	8		3	4	9	1	4		8	5	15	4	3		52	24	24	9	17	12	65		22		4
KIOWA										1		4	2	1										2				1
KIT CARSON	1									1		1	1											2				4
LA PLATA	28	2		11	2	28	3	18	7	12	1	5	1	43	7	42	3	67	8	83	6	69	3	93		92	1	3
LARIMER	3	2						5	1	2	1		2			22	8	4	3	29	25	2	2	42		27	2	1
LAS ANIMAS	16		2	4		1	1																	16		16		
LINCOLN				2	1	2	1	1				6		4	2									4		1		3
LOGAN	2									1														2		2		
MESA	3	2		36		22	7	24	13	14		9	2	9	1	6	3					3		30		28	2	4
MOFFAT	7	1	1	6	3	4		9	4	44	6	18	13	15	1	5	2	3	1	3		3		36		20		12
MONTEZUMA	6		1	23	6	11	2	8	2	18	6	3	4	15	2									36		29		8
MORGAN								6	2	2	1	13	1	6		4	1	28						5		5		
PARK						1	1	1																1				
RIO BLANCO	7	2				1	1	11	2	15	2	4	5	3	2	3				9		4	1	18		12	3	
ROUTT	10	6	1							1		1				3								1		1	6	1
SAN MIGUEL	1			1																				1				1
WASHINGTON	1		1																					1				1
WELD	11	3		12	5	208	84	763	229	964	594	2,114	1,099	2,215	1,423	1,789	1,063	1,671	723	2,435	1,248	2,932	1,134	7,617		5,438	13	98
YUMA	1		1	6																				1		1		
TOTAL Horizontal	156	25	14	147	31	333	123	901	280	1,203	641	2,260	1,160	2,428	1,484	2,016	1,096	1,918	764	2,837	1,334	3,485	1,258	8,330	5	5,880	34	157
Percent of Total HZ		16%	9%																						0%	71%	0%	2%
Total All Permits				5,159		5,996		4,659		3,773		4,025		4,190		2,988		2,835		3,875		4,429						
HZ Percent of Total				2.8%		5.6%		19.3%		31.9%		56.1%		57.9%		67.5%		67.7%		73.2%		78.7%						

Monthly Statistics as of December 1, 2018

YEAR and MONTH	Baker - Hughes Rig Count	Permits: Drilling Rcvd	Drilling Apvd	Recompletion Rcvd	Recompletion Apvd	Injection Rcvd	Injection Apvd	Pits Rcvd	Pits Apvd	Locations Rcvd	Locations Authz	Well Spud Notices	Active Drilling Permits	Active Wells	Public Visits: Data	Office	Internet
2011 TOTAL		**4,709**	**4,659**	**325**	**320**	**44**	**32**	**190**	**192**	**2,382**	**2,267**	**3,220**			**187**	**1,294**	**1,337,865**
2012 TOTAL		**3,982**	**3,773**	**154**	**168**	**63**	**44**	**114**	**84**	**1,373**	**1,293**	**2,297**			**159**	**1,305**	**1,324,443**
2013 TOTAL		**4,481**	**4,028**	**74**	**72**	**67**	**63**	**67**	**106**	**1,268**	**1,213**	**1,976**			**92**	**1,456**	**511,734**
2014 TOTAL		**4,223**	**4,191**	**37**	**34**	**48**	**48**	**82**	**45**	**1,113**	**1,115**	**2,255**			**130**	**1,682**	**521,685**
2015 JAN	64	349	316	3	1	2	9	3	1	60	43	197	5,060	53,195	17	114	41,502
FEB	49	324	161	3	2	5	6	9	0	73	28	115	4,750	53,309	4	117	38,245
MAR	38	246	294	1	6	1	5	7	5	44	70	161	4,983	53,414	6	146	42,513
APR	37	194	165	3	1	2	5	1	2	46	37	99	4,854	53,456	1	125	39,559
MAY	39	324	190	1	4	2	6	8	0	41	44	115	4,632	53,535	5	113	unavailable
JUN	38	327	281	4	1	0	5	2	1	52	49	141	4,726	53,608	5	138	unavailable
JUL	38	373	250	4	2	2	1	0	0	57	48	122	4,663	53,706	7	145	26,975
AUG	37	289	300	2	6	3	0	5	5	32	46	121	4,847	53,766	2	109	30,674
SEP	33	242	312	3	1	1	7	0	3	59	49	100	4,953	53,806	4	146	31,642
OCT	30	372	223	2	2	3	1	1	0	54	51	108	4,694	53,898	12	119	33,199
NOV	31	190	254	6	2	4	3	1	0	21	49	117	4,765	53,719	7	105	29,112
DEC	25	275	242	1	5	3	6	1	0	42	43	79	4,594	53,652	3	112	25,659
2015 TOTAL		**3,505**	**2,988**	**33**	**33**	**28**	**54**	**38**	**17**	**581**	**557**	**1,475**			**73**	**1,489**	**339,080**
2016 JAN	22	250	126	1	0	3	5	0	0	34	9	76	4,528	53,698	2	118	30,105
FEB	20	205	227	3	0	3	2	44	2	31	39	68	4,599	53,723	8	115	28,611
MAR	17	268	268	0	0	2	2	5	0	34	36	81	4,530	53,710	3	132	30,902
APR	17	185	224	0	1	3	4	0	0	24	39	62	4,511	53,774	4	113	27,914
MAY	16	353	217	0	2	3	1	1	1	33	24	86	4,464	53,749	4	106	26,778
JUN	16	315	233	0	0	2	3	2	1	38	30	73	4,456	53,651	2	80	27,284
JUL	20	268	249	5	0	4	4	6	6	31	30	88	4,344	53,724	5	91	24,151
AUG	21	141	150	1	3	5	3	2	0	33	23	95	4,436	53,740	1	106	29,192
SEP	19	366	270	0	2	4	2	0	6	29	24	72	4,522	53,817	4	154	25,698
OCT	19	334	297	6	1	6	3	1	0	42	29	96	4,601	53,903	1	135	25,893
NOV	20	368	304	3	3	3	3	0	1	40	45	119	4,566	53,993	2	97	25,140
DEC	26	342	267	1	4	7	5	1	2	48	25	114	4,477	54,036	5	92	23,449
2016 TOTAL		**3,395**	**2,832**	**20**	**16**	**45**	**37**	**62**	**19**	**417**	**353**	**1,030**			**41**	**1,339**	**325,117**
2017 JAN	28	442	211	8	2	2	2	0	0	42	25	139	4,492	54,111	6	79	28,702
FEB	26	701	263	2	4	4	3	0	0	62	38	142	4,543	54,194	1	97	27,715
MAR	28	510	423	2	2	7	4	3	24	71	48	200	4,714	54,322	1	152	31,952
APR	29	352	301	5	4	3	7	1	2	41	54	133	4,635	54,369	1	103	30,406
MAY	31	307	367	4	3	1	6	1	28	41	55	181	4,899	54,369	5	94	36,109
JUNE	36	493	331	3	2	6	1	1	1	58	40	162	4,947	54,605	5	109	30,644
JULY	37	508	234	2	4	2	2	1	1	45	31	186	4,999	54,699	2	80	27,025
AUG	37	572	349	9	0	8	3	1	2	53	49	180	5,000	54,814	1	143	30,715
SEP	35	528	450	2	6	5	4	1	1	56	41	153	4,976	54,925	2	114	27,402
OCT	34	550	311	0	2	2	3	0	1	58	40	153	5,022	54,989	2	174	31,995
NOV	37	438	331	12	1	13	10	1	1	47	38	168	5,016	55,062	1	124	28,802
DEC	34	479	304	4	4	4	1	0	0	44	32	152	5,039	55,151	0	100	25,556
2017 TOTAL		**5,880**	**3,875**	**53**	**34**	**57**	**46**	**10**	**61**	**618**	**491**	**1,949**			**27**	**1,369**	**357,023**
2018 JAN	34	639	218	6	3	4	3	2	0	66	19	162	4,920	55,155	4	102	34,895
FEB	33	736	217	4	3	2	8	1	5	73	22	143	4,871	55,153	2	99	30,666
MAR	30	769	463	3	8	6	9	4	2	56	50	127	5,024	54,811	2	118	32,185
APR	30	874	164	0	3	7	6	4	4	87	25	127	4,918	54,260	4	124	33,403
MAY	29	994	327	14	3	10	11	6	3	98	46	211	4,847	53,832	1	100	30,873
JUNE	33	1,040	436	5	4	7	3	3	1	109	51	128	5,017	53,738	0	138	29,244
JULY	32	738	466	1	11	5	9	1	0	50	44	136	5,133	53,708	3	138	29,781
AUG	30	978	392	2	1	9	10	1	2	71	53	145	5,400	53,602	5	121	32,801
SEP	32	613	435	4	0	11	2	3	0	56	38	169	5,451	53,732	1	130	28,323
OCT	33	1,017	596	7	0	5	6	0	0	90	52	155	5,746	53,703	3	140	34,966
NOV	33	1,158	715	2	4	2	5	2	2	135	81	166	6,300	53,470	2	105	30,698
2018 TOTAL		**9,556**	**4,429**	**48**	**40**	**68**	**72**	**27**	**19**	**891**	**481**	**1,669**			**27**	**1,315**	**347,835**

Abbreviation Key: Rcvd = Received, Apvd = Approved, Authz = Authorized

Monthly Statistics as of December 1, 2018

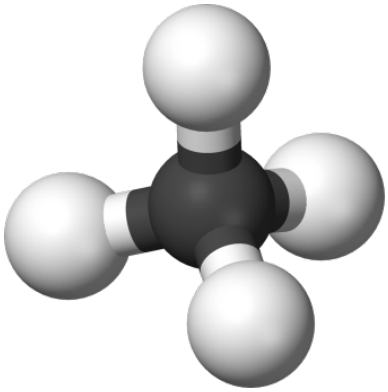
YEAR and MONTH	Well Oper Change	Operators		Bonds					Hearings		Enforcement					Remediation Projects		Inspections	
				Release			Claim												
		New	Inactive	Ind	Blnkt	Replace	Ind	Blnkt	Apps.	Orders	NOAVs	AOCs	OFVs	Cmplt	Spills	Rcvd	Comp	Wells	Locations
2011 TOTAL	**6,743**	**33**	**31**	**79**	**44**	**43**	**4**	**4**	**403**	**349**	**230**	**10**	**19**	**247**	**527**	**726**	**536**	**12,394**	**-**
2012 TOTAL	**7,546**	**47**	**37**	**70**	**46**	**33**	**3**	**0**	**482**	**396**	**157**	**9**	**2**	**244**	**402**	**690**	**641**	**19,071**	**12,670**
2013 TOTAL	**7,192**	**49**	**21**	**48**	**26**	**20**	**0**	**0**	**571**	**522**	**237**	**37**	**3**	**201**	**568**	**507**	**541**	**23,551**	**13,370**
2014 TOTAL	**10,298**	**55**	**28**	**42**	**39**	**13**	**1**	**1**	**698**	**598**	**179**	**43**	**4**	**243**	**786**	**596**	**502**	**34,208**	**18,982**
2015 JAN	727	2	3	2	3	0	0	0	76	64	15	2	1	36	64	38	58	2,491	1,246
FEB	556	5	2	2	3	1	0	0	-	-	10	-	-	22	44	34	64	2,667	1,382
MAR	183	5	3	5	2	4	2	0	72	72	33	1	1	42	76	59	94	3,469	1,738
APR	271	7	1	0	5	3	0	0	60	54	19	3	-	21	46	40	61	3,451	1,620
MAY	436	8	0	0	2	3	0	0	89	54	10	10	2	25	46	56	41	2,869	1,422
JUN	508	2	2	3	5	4	0	0	-	-	27	-	-	25	41	32	43	3,366	1,716
JUL	396	3	3	0	5	1	0	0	123	140	5	13	1	32	67	52	28	3,445	1,774
AUG	218	8	2	0	7	4	0	0	-	-	13	-	-	18	56	24	62	3,693	1,848
SEP	273	6	5	1	7	4	0	2	112	78	25	11	-	30	41	44	40	2,887	1,528
OCT	359	4	1	6	1	6	1	0	115	103	6	12	1	32	58	51	33	3,420	1,494
NOV	97	2	3	5	0	0	0	1	-	-	6	-	-	15	38	47	40	3,348	1,666
DEC	437	7	2	3	5	1	0	0	91	80	4	5	2	60	46	39	37	3,851	1,765
2015 TOTAL	**4,461**	**59**	**27**	**27**	**45**	**31**	**3**	**3**	**738**	**645**	**173**	**57**	**8**	**358**	**623**	**516**	**601**	**38,957**	**19,199**
2016 JAN	534	2	1	0	5	5	0	0	76	66	4	7	1	29	51	44	36	3,184	1,551
FEB	165	2	1	0	1	1	1	0	-	-	8	-	-	27	47	34	49	3,666	1,738
MAR	1,035	6	4	2	2	2	1	1	62	57	3	7	1	19	42	50	45	3,020	1,646
APR	245	3	3	2	7	4	0	0	34	32	6	4	2	20	40	48	90	4,046	2,117
MAY	374	2	3	6	3	3	1	0	-	-	0	-	-	20	37	41	29	3,491	2,193
JUN	272	6	3	3	4	1	1	1	67	65	3	6	2	20	36	40	77	4,099	2,330
JUL	2,234	3	2	0	2	0	0	0	-	-	10	-	-	20	41	29	56	3,483	2,068
AUG	138	3	3	3	2	1	1	1	71	43	20	4	-	20	51	39	38	4,065	2,288
SEP	321	3	1	9	3	3	0	1	-	-	8	-	-	20	37	44	22	3,527	1,788
OCT	428	1	3	7	5	1	0	0	96	74	23	7	1	21	40	34	36	3,325	1,811
NOV	552	3	0	4	0	0	3	0	-	-	19	-	-	22	40	27	50	3,855	1,912
DEC	264	4	4	1	7	2	1	1	67	60	3	8	-	23	66	31	72	3,374	1,684
2016 TOTAL	**6,562**	**38**	**28**	**37**	**41**	**23**	**9**	**5**	**473**	**397**	**107**	**43**	**7**	**261**	**528**	**461**	**600**	**43,135**	**23,126**
2017 JAN	4,210	3	3	3	3	1	0	0	80	72	1	11	1	46	48	23	11	3,007	1,447
FEB	373	1	5	2	4	2	0	3	0	0	13	0	0	74	57	34	17	3,180	1,372
MAR	1,092	6	4	2	2	2	1	1	86	65	18	3	0	44	55	49	18	3,812	1,851
APR	938	3	0	1	5	5	0	0	0	0	6	0	0	32	40	43	29	2,895	1,578
MAY	676	1	3	0	5	0	0	0	128	93	3	6	0	185	55	46	30	2,491	1,487
JUNE	775	6	1	1	2	0	0	0	107	102	2	4	1	131	63	57	26	2,532	1,680
JULY	758	5	2	2	2	0	0	1	108	104	5	3	0	66	38	29	23	2,168	1,300
AUG	654	4	2	27	13	32	0	0	0	0	3	0	0	207	55	63	51	2,903	1,712
SEP	840	1	2	9	6	6	0	1	133	74	20	1	0	212	55	64	38	2,804	1,568
OCT	1,163	1	0	0	2	2	0	0	131	79	3	5	4	237	51	37	24	2,770	1,593
NOV	627	2	0	0	0	0	0	0	0	19	1	0	0	81	51	51	34	2,570	1,191
DEC	213	4	4	11	1	7	0	0	112	72	4	3	0	43	46	42	28	2,011	1,159
2017 TOTAL	**12,319**	**37**	**26**	**58**	**45**	**57**	**1**	**6**	**885**	**680**	**79**	**36**	**6**	**1,358**	**614**	**538**	**329**	**33,143**	**17,938**
2018 JAN	649	3	9	5	6	3	1	2	105	95	11	3	0	60	54	55	39	2,381	1,257
FEB	512	3	3	2	7	1	1	0	0	0	6	0	0	52	40	51	81	1,988	1,031
MAR	331	5	0	4	0	0	0	0	159	105	16	4	0	47	55	52	52	2,512	1,548
APR	730	4	0	11	5	15	0	0	94	70	4	4	0	47	54	60	44	2,402	1,228
MAY	365	3	3	5	3	0	0	0	0	0	13	0	0	61	55	60	41	2,810	1,572
JUNE	367	4	1	1	2	1	0	0	108	74	4	2	0	27	45	53	47	2,433	1,380
JULY	262	4	2	1	5	2	1	0	128	102	9	4	0	23	52	71	77	2,729	1,576
AUG	239	2	1	1	3	0	0	0	0	0	8	0	0	55	54	54	43	2,509	1,243
SEP	209	3	2	1	2	0	0	0	73	132	6	5	0	42	41	47	59	2,159	1,314
OCT	130	7	3	1	7	0	0	0	168	124	53	5	0	34	43	63	61	3,156	1,733
NOV	16	1	4	3	3	0	0	0	0	0	3	0	0	10	44	60	60	2,452	1,366
2018 TOTAL	**3,810**	**39**	**28**	**35**	**43**	**22**	**3**	**2**	**835**	**702**	**133**	**27**	**0**	**458**	**537**	**626**	**604**	**27,531**	**15,248**

Abbreviation Key: Ind = Individual, Blnkt = Blanket, Apps = Application for Hearing, NOAV = Notice of Alleged Violation, AOC = Administrative Order of Consent, OFV = Order Finding Violation, Cmplt = Complaint, Comp = Completed

APPENDIX 5

Methane in Colorado Groundwater Fact Sheet

COGCC Fact Sheet - Methane in Colorado Groundwater



What is methane?

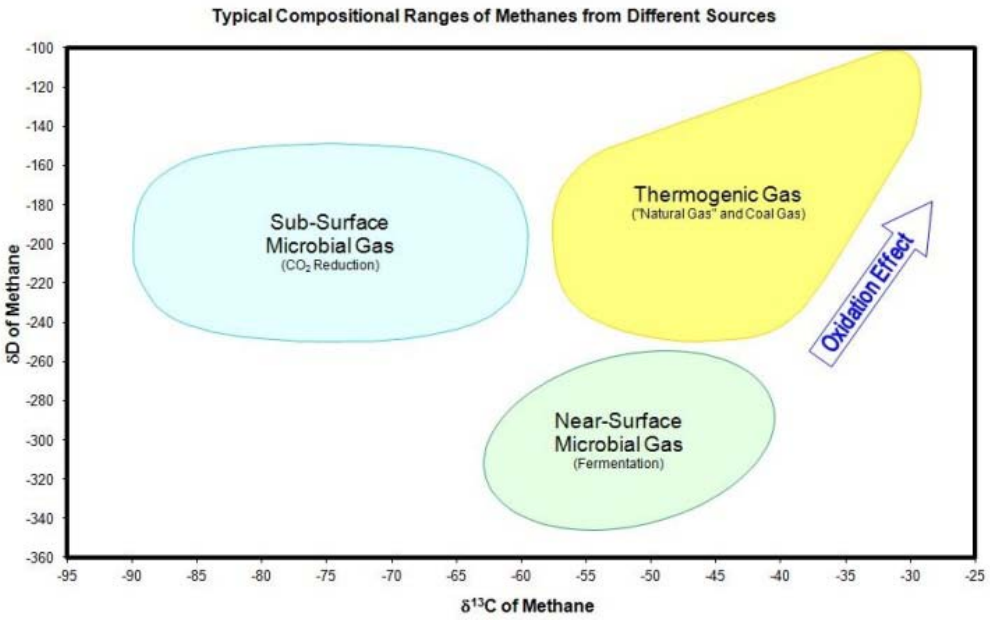
Methane (CH_4) is a simple hydrocarbon molecule of one carbon atom and four hydrogen atoms. Methane gas is colorless, tasteless, and odorless. Methane is a naturally occurring hydrocarbon gas that is flammable and explosive in certain concentrations.

Where does Methane come from?

Methane is produced either by bacteria, or by geologic processes involving heat and pressure. Methane gas can be **biogenic** or **thermogenic** depending on its origin. Biogenic methane is created by the decomposition of organic material through fermentation, as is commonly seen in wetlands, or by the chemical reduction of carbon dioxide. Biogenic methane is found in some shallow, organic rich water-bearing geologic formations, such as coal seams, into which water wells may be completed. Biogenic methane typically is not targeted for production in Colorado; however, the Niobrara gas field in Yuma County is an exception.

Thermogenic methane is created by the thermal decomposition of buried organic material. Thermogenic methane is typically found in rocks buried deeper within the earth than biogenic methane. In Colorado, thermogenic methane may be associated with oil and gas development. In certain regions of Colorado thermogenic methane may be naturally produced in water wells where formation rocks are at or close to the surface.

Different types of data analyses can be used in conjunction to help determine whether a methane gas is of biogenic or thermogenic origin, or a mixture of the two. The analytical methods used to differentiate between the two types of methane are well-known, scientifically accepted, and summarized in a well-known presentation by Dennis Coleman and papers by I.R. Kaplan and Dennis Coleman. These works, in turn, cite nearly 75 other references related to the topics of methane generation, "fingerprinting," forensic investigations, and stable isotope geochemistry.



Stable Isotopic data is used in the determination of whether a methane gas is biogenic or thermogenic. The figure to the left shows the typical isotopic ratios (δDeuterium/δCarbon^{13}) for methane produced by biogenic and thermogenic processes.

In addition to the isotopic data, compositional analysis

can be used to determine the origin of a methane gas. Naturally occurring methane gas typically contains small amounts of ethane and other hydrocarbons as well as methane. The proportion of methane to ethane in a gas can help determine its origin. Biogenic methane gas typically contains much greater percentage of methane than ethane or other hydrocarbons.

What is the Occurrence of Methane in Colorado groundwater?

Methane gas occurs naturally in groundwater in sedimentary basins in Colorado and around the world. Colorado water wells that contain methane are frequently drilled into sedimentary formations that contain coal. Wells are frequently completed in coals seams in the San Juan basin in Southwestern Colorado, the Raton Basin in Southeastern Colorado and the Laramie Fox Hills Formation in Northeastern Colorado. The included drillers log clearly shows that the screened portion of the well is placed across several coal seams, and two of those coal seams are the primary sources of groundwater in the domestic well.

The occurrence of methane in the coal bearing sedimentary formations used as water sources in Colorado has been well documented in numerous publications. For example, a 1976 publication by the Colorado Division of Water Resources states that the Laramie Fox Hills aquifer contains "troublesome amounts of . . . methane." The Raton Basin Baseline Study conducted by the COGCC from 2000 – 2003 states "methane is widely distributed in the shallow aquifers across the basin." In addition, the BLM North San Juan Basin White Paper, December 1999, discusses the historic occurrences of methane in water wells completed in the Fruitland and Menefee formations.

4. GROUND SURFACE ELEVATION _____ feet
DATE COMPLETED 4/9/2006 TOTAL DEPTH 740
DRILLING METHOD AIR ROTARY
feet DEPTH COMPLETED 740 feet

5. GEOLOGIC LOG:

Depth	Type	Grain Size	Color	Water Loc.
0-3	overburden	dirt	brn	
3-106	ss	med	gray	
106-153	sh	clay	gray	
153-192	ss	med	gray	
192-197	coal/sh	/clay	blk/gray	
197-239	sh	clay	gray	
239-293	sh/ss	clay/med	gray	
293-295	coal		blk	295
295-359	sh	clay	gray	
359-364	coal		blk	
364-412	sh	clay	gray	
412-422	ss	med	gray	
422-423	coal		blk	
423-531	sh	clay	gray	
531-533	coal		blk	
533-691	sh	clay	gray	
691-693	coal		blk	691
693-740	ss	med	gray	

Remarks: _____

6. HOLE DIAM (in.)

	From (ft)	To (ft)
83/4	0	39
61/8	39	740

7. PLAIN CASING:

OD (in)	Kind	Wall Size (in)	From (ft)	To (ft)
65/8	steel	188	+1	39
41/2	pvc	200	8	280
41/2	pvc	200	320	680

PERFORATED CASING: Screen Slot Size (in): 1/8th

41/2	pvc	200	280	320
41/2	pvc	200	680	740
37	interval	37-20's		

8. FILTER PACK:
Material none
Size
Interval

9. PACKER PLACEMENT:
Type none
Depth

10. GROUTING RECORD

Material	Amount	Density	Interval	Placement
cement	6bags	36gals	4-39	poured

Is methane in groundwater a health risk?

Studies have not linked ingestion of water containing methane to any short term (acute) or long term (chronic) health effects. When present at high concentrations, methane gas may act as an asphyxiant. Asphyxiants displace air and can cause breathing and other health problems.

At higher concentrations in the atmosphere methane gas can present an explosive hazard. Methane gas forms explosive mixtures in the atmosphere at concentrations between 5% and 15% by volume. If free methane gas or water with high concentrations of dissolved methane enter confined spaces, other factors such as water temperature, ventilation of the well, air movement inside the confined space, size of the confined space, and the percent composition

of combustible gas are factors that must be evaluated to determine if the methane gas or dissolved methane in water is capable of producing an explosive hazard.

My water well has methane in it, what should I do?

Further information regarding the treatment/mitigation of methane in groundwater can be found in "How Well Do You Know Your Water Well?" The information was prepared by Michael Matheson, P.G. with Plateau Environmental Services, Inc. and Joe Bowden, PhD, with CDS Environmental Services, LLC.

APPENDIX 6

Groundwater Well Investigation Summaries

Complaint Document #200446018

The water well owners filed a complaint with COGCC on July 6, 2018, alleging methane in their water well. This complaint was based on preliminary sampling results provided to them by Kerr McGee Oil & Gas Onshore LP (KMG) who had sampled the well on July 3, 2018, as part of their baseline groundwater sampling program before drilling new wells in the area.

After receiving the complaint, COGCC assigned the investigation to the area environmental protection specialist (EPS) and coordinated with the COGCC engineering group to start a review of surrounding oil and gas wells in the immediate area. The three oil and gas operators who had wells within 0.75-mile radius of the affected water well were contacted and required to submit information about their wells. On July 19, COGCC received final results from the KMG sample that verified the water well contained thermogenic gas based on gas composition and isotopic analysis. COGCC coordinated with KMG and K P Kauffman (KPK) who had the closest oil and gas well in proximity to the affected water well to begin providing an alternate potable water supply to mitigate the potential safety risk from gas-entrained water entering the residence.

A specific source of the stray gas has not been identified in the investigation; forensic interpretation of stray gas in the water well and gas samples from nearby oil and gas production wells did not provide an exact match. The closest oil and gas well possibly may have acted as a conduit for gas migration from producing zones to the Laramie Fox Hills aquifer in its past operations, but the oil and gas well was recently plugged and logs obtained during plugging operations did not document any current integrity issues. As part of the investigation, COGCC required the surrounding operators to collect water samples from a total of nine other domestic water wells in the area which verified no other instances of thermogenic stray gas.

Both KMG & KPK cooperated to reach an agreement with the affected water well owner to replace their water well with a new water well, thus providing a permanent water supply solution. Additional investigation information can be reviewed in the complaint file available to the public on the COGCC web-site.