NEW MEXICO PRODUCED WATER CONFERENCE - 2018

"Policy, Regulations, and Economics to Support Total Resource Recovery"

Summary Report

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The New Mexico Desalination Association is a 501-C6 non-profit corporation established to promote and assist the desalination industry in New Mexico and the Southwest by developing professional and stakeholder knowledge of current and emerging desalination approaches, technologies, and applications. The goal of the New Mexico Desalination Association is to unite and educate stakeholders on desalination's potential in New Mexico, and on creating new water supplies through desalination of non-traditional brackish water resources that will support long-term economic growth, while protecting the environment and maintaining the social and cultural traditions of New Mexico.

The produced water conference and this report were developed for the Oil Conservation Division of the New Mexico Energy Minerals and Natural Resources Department in cooperation with Petroleum Resources Research Center at the New Mexico Institute of Mining and Technology.

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The 2018 New Mexico Produced Water Conference “Policy, Regulations, and Economics to Support Total Resource Recovery” was a success because of participation by a broad spectrum of stakeholders including; federal and New Mexico regulatory and policy agencies, oil and gas industry organizations and companies, water and land resource agencies and associations, universities, and the general public.

The planning and coordination of the conference was accomplished by a dedicated group of volunteers with encouragement from several State of New Mexico officials and employees. The report authors would like to thank the following individuals for their support and directions in the conference planning and execution:

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1. CONFERENCE OVERVIEW

The oil & gas industry in New Mexico faces two major challenges associated with water management that threaten to limit future oil and gas development: acquiring fresh water for drilling and development of new wells; and management of produced water. At the same time, New Mexico is facing increasingly prolonged and severe arid conditions across the state. These challenges are especially critical in southeastern New Mexico, which is arid, has limited fresh water resources, and where produced water disposal by deep well injection is becoming constrained by dwindling geologic disposal capacity and concerns regarding induced seismicity.

To help address these issues, New Mexico recently entered a Memorandum of Understanding (MOU) with the U.S. Environmental Protection Agency (EPA) to clarify the existing regulatory and permitting frameworks related to the way produced water from oil and gas extraction can be re-used, recycled, and renewed for other purposes. As part of this MOU, the EPA and the State of New Mexico jointly developed and published a draft White Paper "Oil and Natural Gas Governance in the State of New Mexico" on November 9, 2018. The White Paper identified existing regulatory requirements associated with the reuse and recycling of produced water in New Mexico and options and approaches to recycle and reuse produced water. The MOU, white paper (draft) and public comments can be found at: https://www.epa.gov/uog/memorandum-understanding-between-state-new-mexico-and-epa-governance-produced-water-new-mexico.

Concurrently with the execution of the MOU and publication of the draft white paper, the New Mexico Desalination Association in cooperation with the New Mexico Oil Conservation Division and the Petroleum Resource Research Center at New Mexico Tech, coordinated a conference on the topic of "Produced Water: Policy, Regulations, and Economics to Support Total Resource Recovery."

As noted in the EPA press release about the MOU, "While underground injection certainly has its utility and place, alternatives are available that treat wastewater from oil and natural gas extraction for re-introduction into the hydrologic cycle which is especially important in arid areas suffering from drought like New Mexico."

And from state of New Mexico officials:

- "New Mexico is currently the third largest oil producer in the United States and that oil is accompanied by even larger quantities of water. Clarifying the state and federal regulatory frameworks associated with its recycling and reuse is of the

utmost importance," New Mexico Energy, Minerals and Natural Resources Cabinet Secretary Ken McQueen.

- "Reuse of this water in appropriate applications has the potential to relieve the growing demand on our ground and surface water sources. For that reason alone, this effort makes absolute sense," New Mexico State Engineer Tom Blaine.
- "If there are better, viable uses of this water, it is important to ensure the framework is adequate to both facilitate reuse and protect public health and the environment – this MOU targets these objectives," New Mexico Environment Department Cabinet Secretary Butch Tongate.

The conference was held in Santa Fe, New Mexico, on November 15 and 16, 2018, with over 150 participants and 17 sponsors participating in the two days of presentations and discussions. The goal of the conference was to solicit input from the public and industry, including oil and gas, water treatment and management, environmental, and economic development professionals, about the issues, challenges, and opportunities for expanding and extending fresh water supplies in New Mexico by the reuse and recycling of produced water.

The conference was organized to facilitate greater collaboration among stakeholders to synthesize and improve New Mexico and federal regulatory and environmental frameworks; and to foster identification of economically viable opportunities to enhance fresh water conservation, produced water resource recovery, and produced water beneficial use. Finally, another primary objective of the meeting was to solicit thoughts and ideas from conference attendees and compile them into policy and guidance points and suggestions that can be passed on to Governor Michelle Lujan Grisham's administration.

This Report summarizes the conference content, presentations, discussions and recommendations. All of the conference presentations and this report are available for review and downloading from the New Mexico Desalination Association web site at www.nmdesalassociation.com.

2. SESSION TOPICS AND SPEAKERS

Topical sessions were developed and adjusted as speakers were invited and their availability established. The Final Agenda included these major policy, regulatory, and technical sessions:

- *Plenary Session – State Administrators and federal EPA national and regional representatives*
- *Current Issues, Policies & Regulations Regarding Produced Water*
- *"The Art of the Possible": Technical & Economic Challenges and Opportunities for Produced Water Recovery, Use & Reuse*
- *Infrastructure Build-Out for Multiple Users: Financial/Capital, Engineering, Legal and Market Considerations*
- *Produced Water Reuse: Why? And How?*
- *A policy development listening session at the end of the meeting.*

The final session of the conference consisted of a moderated discussion of the administrative, policy, and regulatory needs to facilitate improved produced water management in New Mexico and involved the entire audience. Notes taken during the session and comments received after the session are included in Appendix C.

Speakers included:

- Administrators from New Mexico, EPA Region 6, and EPA Office of Water who shared their perspectives on produced water challenges.
- Representatives from the oil and gas industry and midstream companies discussing reuse of produced water, and technical and policy challenges in New Mexico.
- Technical experts on emerging produced water treatment approaches, reuse, economics, engineering, and resource recovery options.
- Private equity, legal, and state infrastructure experts on the requirements, logistics, regional economic development opportunities, and viable cost structures to industry and developers.

A copy of the Agenda and a list of speakers is attached in Appendix A. A list of attendees is provided in Appendix B.

Abstracts and presentations are posted on the NM Desal website at:

https://nmdesalassociation.com/nm-produced-water-conference-2018/

Some comments received at the conference were addressed to the EPA draft white paper content. While the draft white paper information and general concepts presented were discussed in the conference, those comments were sent separately to the draft white paper authors to include as input to the EPA on the draft white paper. Those comments are not included in this report.

3. POLICY DISCUSSIONS AND PARTICIPANT SUGGESTIONS

The policy development session was held at the end of the conference. The speakers in the previous sessions provided a broad range of background information and described critical challenges including injection well constraints on produced water disposal, water use in the oil and gas industry, regional issues including agricultural and water supply problems, and economic and data needs that could help define and clarify fresh water supply and produced water management. The session consisted of a moderated discussion and involved the entire audience. The following text summarizes five policy points that arose from this session, as well as some important additional issues that were documented.

The New Mexico Desalination Association Board of Directors, and the Session Chairs have reviewed this report. However, any policies that may be developed from this work should be considered with an eye to regulatory requirements, and practicality of use from the involved Agencies (EMNRD/OCD, NMED, and the Office of the State Engineer). The questions were broken into five categories and discussed in sequence. A compiled summary for each one is presented below.

POLICY QUESTION #1: HOW DO WE DEFINE PURIFIED PRODUCED WATER?

Defining produced water quality and the level of purification needed for various uses was discussed extensively. This topic contributes to the development of public trust in using produced water instead of disposing it. The current regulatory and analytical frameworks for drinking water and municipal and industrial wastewaters were developed for “fresh” (non-saline) waters and for chemicals that were of concern during the development of discharge standards through the Water Quality Act 30 years ago. Since that time, standards have not kept up for drinking water and various wastewaters. The concept of turning a waste product, produced water, into a resource was only first presented about 15 years ago. There are no current standards for treatment and discharge of produced water other than what can be derived from existing drinking water standards, irrigation water standards and wastewater discharge standards (State and EPA). In other words, standards for treatment and discharge of produced water depend on its final use or disposal. In addition, drinking water standards presume that the water is at least “fresh” (non-saline or less than ~1,000 mg/L dissolved solids).

Therefore, regulatory standards and criteria that apply to (usually saline) produced water will need to be developed. Research, including laboratory testing and method development, has begun in academia and should continue in order to address the

complex mixture of constituents in produced water. The audience comments suggested that technologies are available now to treat these constituents, regardless of complexity. However, comments also indicated that there is an incomplete understanding of what chemicals should be analyzed and possibly regulated in the treated water. A review of federal and state standards, feasibility testing, toxicity assessments, and risk assessments will be needed to determine what levels of constituents are appropriate for discharge. To enable research, the cooperation of producers will be needed in order to obtain enough samples for testing. Quality assurance and quality control protocols for sampling and analysis, much like those developed for drinking water and wastewater, will be needed.

One source of current data may be the Frac Focus database managed by the Ground Water Protection Council. Currently, sampling and analysis of produced water is performed to support oil and gas industry uses and is limited to measurement of a few parameters such as TDS, electrical conductivity, pH, and, to a limited extent, major constituents in the wastewater. This is not enough to evaluate the water for outside uses. In addition, the water should be tested for useful and salable coproducts, such as lithium. An additional factor is the viewpoint of the oil and gas industry. Often, produced water is regarded as a potential liability. Analysis of the water could present additional liability issues for handling and disposal of the water.

Additional analytical requirements would be very costly. While reporting of these results could be made to state or federal agencies, it would entail considerable data management time and effort. One possibility presented would require disclosure of produced water quality information to treatment companies. These companies would then use the data to best treat the water. Possible regulation of water quality would then occur at the point of discharge via permitting requirements and would depend on whether the final use or disposal of the wastewater is subject to state or federal laws. This regulation would also entail additional time and effort from an agency standpoint.

POLICY QUESTION #2: HOW DO WE DEAL WITH SOLID AND LIQUID WASTES AND PRODUCT STREAMS?

A critical point made by many commentators was the lack of understanding related to ownership of both produced water and coproducts, though this was discussed by Bill Brancard, General Counsel to EMNRD. Currently ownership is not defined by state regulations in New Mexico, although “possession” is described. Therefore, “ownership” becomes a contractual issue between entities handling and using produced water and its coproducts. It was suggested that producers (and, we believe, mineral rights holders including the State Land Office) should scrutinize existing and future contracts to be sure that they are covered for coproduct sales. It was also suggested that any

regulatory or legislative changes should contemplate Agency jurisdiction. Knowing that produced water has shared governance between three state agencies (EMNRD, NMED, and OSE) as well as the EPA, depending on its final use or disposal, ongoing clarity is needed. A discussion of the regulatory framework for different final uses has been provided in the joint federal and state governance white paper developed in response to the MOU between EPA and the state of New Mexico. It took several months to determine which agency has jurisdiction with the current regulatory landscape for the white paper, for example.

A commentator included this information on the "ownership" of produced water: "while under control of the producer, they (the producer) can determine how to dispose by use. Hence, a producer can sell the water or use it for beneficial reuse. Once comingled with public state waters, it becomes public, not owned. The OSE has a statue that could describe produced water: "72-5.27 Artificial Water". "Primarily private and subject beneficial use by the owner or developer thereof….provided, (sic) no appropriator can acquire a right excepting by contract….against the owner or developer….to continue such water supply."

The recent white paper between EPA and the state agencies includes a detailed discussion regarding when ownership or possession of the water and the coproducts changes. Liabilities associated with wastes will need to be addressed in policy and regulation development. Statutory jurisdiction and subsequent regulations pertaining to wastes produced during treatment of produced water is not well understood by the oil and gas industry. Suggestions were offered during the meeting that clarification of this issue would help the industry develop compliance strategies to reduce uncertainty as it develops future water and commodity recovery processes. Development of a white paper on this topic was mentioned during the meeting, however, the white paper from the joint MOU is already quite detailed.

Market development for residual solids, minerals, and salts is nascent. While there is concern about the feasibility and cost-effectiveness of breaking in to traditional markets for salts (e.g., road salt, pool salt, and other salt commodities) there is also some hearsay indication that salt suppliers may be interested in the quality benefits of non-mined salt sources. It was noted in the technical presentations that others products and minerals from the high levels of salinity being experienced with unconventional oil and natural gas produced water could be processed into other valuable chemicals than just salt. Chemicals such as caustic soda and hydrochloric acid, commonly used in the oil and gas sector, can and are being manufactured from the produced brines in several locations. Also, minerals such as lithium, rare earths, and magnesium were suggested as being particularly valuable if available in large enough quantities in the produced brines.

Currently, exempt, non-hazardous solid wastes from oilfield operations are disposed in OCD-permitted landfills. Resource refining and processing of the salts and minerals from the produced waters would help reduce future solids handling and disposal volumes. An exacerbating problem is transportation of the produced water solid wastes or recovered products or minerals. At present the volumes of solid waste produced are relatively small and are disposed of in about 30 commercial surface waste management facilities in NM as well as a number of private facilities. However, if large-scale treatment of produced water comes into play, transportation and disposal of the resulting produced water solid wastes or recovered products or minerals may be problematic. Significant assessment of the transportation, refining, and handling requirements and associated infrastructure development required for any potential solids handling and treatment solutions will be needed.

Disposal of produced water and brines is almost exclusively done by underground injection in Class II salt water disposal wells. These wells are governed by existing rules through the OCD. Other rules such as the Pit rule and Rule 34 govern storage and recycling facilities. However, new methods for handling liquid wastes may circumvent these rules, and so vigilance to new technology or methodology is needed, with a willingness to utilize improved handling and transportation methods to minimize risks to human health and the environment. In turn, regulators can create more certainty for producers and those extracting coproducts for sale, by defining and addressing perceived liabilities.

Technology development to improve handling, use, and disposal of wastes was mentioned several times. There also is a need to understand and predict how much waste and coproducts might be disposed or created over the next 40 years. Seismic concerns were discussed by Phil Goetze on November 15 and by Kyle Murray on November 16.

Disposal of very large volumes of salt was noted as a problem--the volumes could be too great to sell it all. It was suggested that the NMED Solid Waste Bureau create a special “salt landfill” regulation to make it easier to dispose of this excess salt in environmentally safe ways. However, this suggestion appears to conflict with already existing rules at OCD for produced waste disposal. Salt waste disposal options may need expansion; agency collaboration and enough data to evaluate the problem would be a part of the solution.

It was suggested that the state could create an excise tax for disposal on a per-barrel rate that could go to agriculture conservation and research, for example, development of salt-tolerant crops. Production tax credits were also discussed to promote recycling. Collaboration with the National Labs and DOE was mentioned as a way to improve

waste and coproduct research, and to minimize energy use for treatment (including coproduct creation), transportation, and disposal.

A discussion of “carrots and sticks” incentives to enncourage recovery and use of coproducts, and to reduce waste disposal occurred. This included the possibility of subsidies or mandates. Coordinating agricultural groups to buy a quantity of reused or reclaimed treated water was suggested. Knowledge of the existing state of water available in surface and ground supplies is important to this calculation, as is the availability of financing to help create water products and coproducts. Development of renewable portfolio standard scenarios were suggested but it was unclear how that would work. It is clear that our current system of water management in the state does not adequately reflect the costs to replace water when it is running out, but currently only reflects delivery costs. In Israel they started to phase in higher costs as fresh water tables were lowered and fresh water became less available.

POLICY QUESTION #3: WHAT IS THE COST TO PURIFY PRODUCED WATER, AND HOW DO WE MITIGATE THE COST?

First, it is important to clarify that “purification” of produced water can mean many different levels of treatment, to different quality levels, depending on its intended use. Not all uses will entail “putting produced water on the ground”- a key point of concern for the public – but may be consumptive uses with no environmental contact component (e.g., use in industry process feeds or cooling). Along with purification treatment, valuable coproducts may be extracted and wastes will be generated. Balancing the demand for treated waters and coproducts with the costs and financing needed to treat is likely to be done on a localized, and optimized, basis. There is no “one-size-fits-all" scenario, although existing treatment facilities in Pennsylvania were presented as examples of feasible projects.

Janie Chermak discussed broad cost-benefit economic analysis for use and reuse of produced water. Social incentives exist alongside profit incentives, and she presented an overview economic analysis showing that $1-10’s of dollars per barrel value can be derived from economic water research. As such, this leads to the suggestion that incentives should be provided to encourage treatment and reuse, but it is not clear who should pay for those incentives. Subsidies were also suggested to develop water technology including treatment and transport. Readers should note that treating produced water to recover desalinated water shows a very high range of uncertainty in the cost-to-benefit ratio. The importance of secure water supplies was equated to the importance of renewable energy development. An example of using waste flare gas for fueling water plants was presented. These concepts taken as a whole should be integrated into a conceptual model encompassing economics, social costs and benefits, energy use, and the regulatory implications of subsidies or taxes. The model could then test the impacts of energy efficiency in treatment and transport, and the effects of incentives or subsidies. Ultimately, the model could evaluate the true value of water in shortage regions.

According to one commentator, oil and gas companies are buying agricultural land for the water rights. This raised concerns about stewardship, including water extraction, wildlife, weeds, and fire. The person suggested that a tax structure could be used “to keep people on the land”. Soil and Water Conservation districts, partnering with state and federal agencies could help with this concept, while keeping the business environment “friendly to oil and gas.” It was not clear to others at the meeting that current regulations were stopping oil and gas development in this sense. It was noted that commercial sale of fresh water to oil and gas companies is an important source of revenue for many agricultural interests.

Transportation, including pipelines and trucking, is an important component of water supply costs and coproduct supply costs. A model could evaluate the impact of transportation costs on supplying treated water for users. An evaluation of who pays for what services, including treatment and transportation, is essential.

Some successful projects mentioned included the Pacific Rubiales project in Columbia for palm oil irrigation (a non-food crop, used for cow feed), and a "water standard" project in Colorado. The Canadian Oil Sands Innovation Alliance was mentioned as an example of a clearinghouse for technology testing. Technologies that are successful then can be brought into the oil sands region with confidence in their capabilities.

Several ideas were suggested for creating an avenue for economic use of treated produced water:

- *An innovative suggestion was made to evaluate using produced water to help supply the Pecos river compact requirements, or to offset upstream withdrawals. If a quality specification for disposal/discharge to the Pecos was known, then treatment costs could be estimated and supported. For example, this use could replace an $8-12 M Devonian disposal well cost, plus money used to buy out water rights. This magnitude of funding would support the treatment. Negotiation with Texas would be needed to avoid creating other delivery obligations. Follow up on alternative delivery methods was also proposed, to "get credit on the Pecos water compact without actually having to put the water into the river". It was also suggested to revive the 2002 legislative HB 388 to allow a tax credit for cleaning produced water and putting it into the Pecos River.*

- *High-value water users could help solve the cost problem. These users, such as chip makers, may be willing to pay for very clean water. While the cost of treating drinking water is 10 times the treatment costs for produced water, agricultural water is even cheaper. In order to treat for agricultural needs, we must reduce treatment costs by 99%. To turn this around, it was suggested that we use purified produced water for high value processes or uses. From a regulatory standpoint, this is an easier process than treating for agricultural use, because these uses are not discharges to the environment. Industry would set the standards of quality needed for their specific use. An example given was the Palo Verde nuclear plant, which competed for water with the city of Goodyear in Arizona. For comparison, municipal waste water can be argued to be harder to treat than produced water. We have standards for that treatment. A similar development of standards for produced water can be done, to inform regulators and the public.*

- *Produced water use for drilling and hydraulic fracturing operations should be prioritized as a way to preserve fresh water. Selling treated produced water to operators was suggested. Currently, many companies are investigating this*

process, and several operators have invested in their own water-management infrastructure. The state could encourage this, and work to increase recycling of produced water, with the objective of cutting demand for fresh water. However, better data is needed to track both the fresh water offsets as well as the produced water treated and/or reused.

- *Introduce a reduced royalty rate on wells that operators reuse/recycle on a tiered basis: for instance, a 2% reduced royalty rate for an operator that recycles an average of 500,000 bbls/mo, 3% for 1,000,000 bbls/mo, and go up from there to a limit of possibly 4 or 5%. Produced water is already defined in 19.15.2 NMAC in the OCD Rules and Regulations. A 50% reduction on severance tax for 1 year from the 1st date of production for oil production only was also suggested. While tax increases on production were also suggested, royalty or tax reduction were suggested to be better because tax increases could reduce recycling. Economic modeling could help predict the effects of royalty reduction versus tax increases.*

POLICY QUESTION #4: WHAT DO WE DO WITH THE WATER WHEN TREATED?

As in the previous topic, several innovative ideas were presented by observers. Participants were keenly aware of the important need to alleviate stress on regional aquifers, while also encouraging industry and jobs to locate to otherwise arid regions. Key ideas presented include:

- *Clarification or changes to current Aquifer Storage and Recovery rules to allow industries like oil and gas companies or treatment companies to work with public entities (municipalities) to store water in aquifers for later use. This would require close collaboration between OSE, NMED and OCD, and possibly legislator action. Current laws limit ASR to public entities; disposition by use could be a mechanism to allow ASR storage. It was asked (and was not clear) if this mechanism could allow the city to "recover" that water later without obtaining an additional water right.*

- *Good-quality data is needed to quantify how much water should remain under control of the oil and gas industry for their use, and how much should/could be used for other purposes (e.g., quantify the public benefit to using this water). We need to measure how much in-field recycling is occurring and evaluate how much this action reduces consumption of fresh water resources.*

- *Consideration of adequate return flow as well as irrigation efficiency should be included in data evaluations for agricultural use of treated produced water.*

- *Allow low-salinity produced water irrigation where possible.*

- *Requiring, and maximizing, reuse of produced water in the oil field was suggested as a primary method to limit fresh water use. From a public standpoint, this is the first, best use of the water before we treat it for other uses. Regulatory tools such credits, taxes, and rules were all mentioned as incentives for reuse.*

- *Regulatory suggestion: follow the Texas example where salt-water disposal operators can recycle with a 7-day notice.*

- *Work toward a unified state permit application process for PW treatment for use outside of oil field uses: Use a flowchart to show different regulatory requirements for the different regulatory agencies.*

POLICY QUESTION #5: WHAT INFRASTRUCTURE IS NEEDED TO HANDLE, DISPOSE, AND USE THE WATER?

Produced water sources are distributed widely and are typically located far away from potential users. Transportation therefore is a significant cost barrier to use that must be overcome, and that must be economically feasible. There has long been a debate about whether localized treatment and use is more cost effective than centralized treatment – the answer is usually "it depends", though economies of scale almost always result in a loer unit treatment cost for larger facilities (i.e. cost per gallon of water treated). Additional factors are transport costs for treatment waste products to disposal, and for coproducts to users. Economic modeling could help resolve some of these questions, although adequate, good-quality data would be needed to support the models. Use of the "record state surplus" to support infrastructure development was suggested.

An additional factor identified was Human Infrastructure. At the state level, adequate agency staffing is needed to support data collection, management, and regulation of transportation processes. Any proposed legislative/regulatory changes must identify whether additional resources (i.e., staffing, budget, contractor funding, etc.) are necessary for implementation. Technically qualified people are needed in the right positions to best collect and interpret data and information to allow informed decision making. Currently, state agencies cannot compete with industry on salary levels. Funds could be generated from oil and gas to support salaries and staff, however, tax increases could also reduce the incentive to recycle or use produced water. Staff increases and salary improvements could be a future request to the legislature for state regulatory agencies.

Resources – Another concept introduced was that of "regulatory infrastructure". The question posed was "What regulations or policies would need to be addressed to have a water distribution network across the State of New Mexico (sic)?" Considering that

basins boundaries are both a physical and regulated constraint to distribution, this question might be better posed as “inter-basin networks.”

It was noted that the NMED does not issue NPDES permits, and that it would be much easier for industry and others to go to the NMED instead of EPA Region 6 for permit approval. There is concern that at present the NMED does not have adequate staffing or budget to accept primacy for the program.

ADDITIONAL TOPIC #6: STAKEHOLDER ENGAGEMENT AND SOCIAL FACTORS

Engagement with the public and other stakeholders was an important topic throughout the meeting. The concept of “Social license to operate” for engineers was discussed. There was broad agreement that it was essential to live in, or closely involve, communities where produced water use and reuse will occur. The audience agreed that both stakeholders and government needed to be on the side of communities to best address community needs such as water supply.

The assistance of academic researchers was recognized as “very important” and “imperative” to provide unbiased, scientific information and interpretation to stakeholders with respect to treatment and use of produced water. In addition, academics can “bridge the gap” between research and applied science (regulators), including application of new technologies, and development and implementation of appropriate regulations. Stakeholder meetings were thought to be very valuable, but could be more accessible, and should include regulators and industry. Conversations in these types of meetings need to be very inclusive of a wide variety of people in a community. An example given was Singapore, where the “New Water” recycled wastewater concept was actively marketed. In contrast, San Diego ended up with “toilet to tap”, which was poorly accepted initially. Ultimately, indirect and direct potable reuse (IPR and DPR) can teach us lessons. California is doing a good job at this by using demonstration plants to teach, by taking people on tours of the plant and performing surveys before and after the tours. It was noted that approval can go from 20% to 80% in favor of reuse.

Challenges to constructively involving stakeholders include various blocks to outreach. Identifying and reaching the interested parties can be challenging, as is getting them to attend meetings. Careful and appropriate use of media “op-eds” and outreach can be effective, but advertising can be blunted in effect by a crowded market.

Clearly it is hard to address unhappy stakeholders “after the fact”. Technology demonstrations could be used to attract media attention in order to educate the public, while engagement mechanisms could be built into regulatory policy. Use of agency

media outreach could assist with education. The audience was unclear about what media outreach exists now at the various agencies. This lack of knowledge could be reducing stakeholder engagement and attention to important announcements.

A representative from the Utton Transboundary Resources Center at UNM suggested that they could assist with outreach and collaboration in the future. The Center is funded in part by an appropriation from the State of New Mexico. The Center does outreach, for example, for adjudications. In addition, the Nature Conservancy Rio Grande Trust Fund was mentioned as a model for collaborative/alliance use of produced water.

The additional topic of Social Factors arose from the discussion. Social factors include calculating the public welfare benefits of converting a sometimes-controversial waste into a resource; benefits analysis of utilizing a "new" water resource and targeting the uses to achieve the greatest cost-benefit to society; and alleviating concerns of using contaminated wastewater for a resource. Competing water use issues have a strong social component, in that water underpins our economy, our personal health, and the quality of our environment. Concerns regarding climate, water data, analysis, efficiency, and public welfare were raised under multiple topic areas of the meeting.

It was suggested that a white paper could be prepared by forming working groups around the societal benefits and other benefits that would accrue by using produced water as a resource for multiple uses.

Another actionable concept was presented for adoption in New Mexico: forming a program modeled on Colorado's Oil and Gas Conservation Commission program for stakeholder engagement on oil and gas issues called the "Local Government Designee" program. The program was proposed as a joint venture between the OCD and NMED. Such programs require resources – staff, budget, travel budget, contractors, and training dollars, etc.; adopting it without funding adequately could be unsuccessful. The program has helped involve stakeholders while educating them as well.

An important question was submitted that affects all the topics above: "What about Climate?" Climate factors should be incorporated into any proposed analysis of benefits, costs, uses and social factors. Given that aridification is occurring across the state, the benefits of a new water resource could be substantial, albeit transient. We can model future scenarios affected by climate, by incorporating risk and statistical probabilities that give us a picture of likely economic and physical outcomes.

4. SUMMARY SUGGESTIONS TO ACCELERATE PRODUCED WATER REUSE

The 2018 New Mexico Produced Water Conference focused on the policy, regulations, and economic innovations needed to support and accelerate total resource recovery of oil and natural gas produced water in the Permian Basin of southeastern New Mexico. The goal of the conference was to solicit input from regulators, the public, and industry, including oil and gas, water treatment and management, environmental, economic development professionals, and the public about the issues, challenges, and opportunities for enhancing fresh water supplies in New Mexico through reuse and recycling of produced water.

The EPA and State of New Mexico White Paper "Oil and Natural Gas Governance in the State of New Mexico" describes the current regulatory and management framework for produced water in New Mexico. As highlighted in Section 3 of this report, conference participants provided extensive input, suggestions, and recommendations. The topics included changes and coordination of state and federal policies, updates to regulations, innovative technology evaluations, incentives, reductions in disincentives, infrastructure improvements, and stakeholder involvement to help accelerate public acceptance of economically viable opportunities and approaches to enhance fresh water conservation, produced water resource recovery, and produced water beneficial use and reuse.

Noted below is a summary of the major directions identified by the workshop participants to accelerate the innovations, improvements, and changes needed to accelerate 1) preservation of fresh water resources, and 2) total resource recovery of produced water by the oil and gas sector in New Mexico. This summary of stakeholder input offers suggestions and recommendations on improvements that could have the quickest and most valuable impact to achieve these goals.

1. **Collaborative work between all involved entities to preserve fresh water.** *Most participants considered approaches that reduce or eliminate the use of fresh water in the oil and gas sector, encourage produced water treatment, recycling, and resource recovery, and reduce the environmental impactsl from oil and gas development and produced water generation, as positive innovations and directions. A major interest by New Mexico stakeholders is the sustainable stewardship of the state's fresh water, land, and air resources. These stakeholders also recognize the economic benefits of good oil and gas production stewardship in New Mexico, and the need to maintain the vitality of this industry segment for the New Mexico economy. Therefore, coordination and*

cooperation between all government, public, oil and gas, and industrial sectors to address produced water issues should be encouraged.

2. ***Assess options and approaches for reducing disincentives and establishing incentives for produced water reuse, though these incentives must be tied to reduction in the use of fresh water in oil and gas operations.*** *As noted in Section 3, there was discussion of whether using the 'carrot or stick' approach creates the best compliance with natural resource sustainability and environmental stewardship goals. In all cases, the top priorities should be to eliminate disincentives to 1) produced water recycling or 2) increases in the use of fresh water in oil and natural gas development. In many cases, graduated incentives can be effective if established to accelerate innovation and can be decreased over time as familiarity with the economic and environmental benefits of a technology or process become better understood. Examples would include incentives for pilot operations of produced water treatment or reuse to reduce fresh water needs, and incentives that create shared public and industry benefits by creating local economic development opportunities for use of the treated produced water and minerals.*

3. **Develop a produced water resource recovery infrastructure Master Plan through some form of a Public Private Partnership.** *The ability to physically meet the goals of total produced water resource recovery will require the development of treatment and refining facilities for both the produced water and associated salt and mineral coproducts, transportation infrastructure including pipelines, rail lines, and road systems for the treated water and coproducts, siting of industrial and agricultural operations to use the water and the products, and natural gas and power lines to provide the energy for these industrial processes. Therefore, planning and modeling the build-out of these facilities within the next decade is an important undertaking reflecting the rapid rate of development of oil and gas resources in the Permian Basin. This will require industry, oil and gas, and state input to establish accurate planning projections and requirements. Because this type of planning is not within the scope of a single New Mexico departmental jurisdiction, a coordinated state, federal, local, academic, and industry public-private-partnership will likely be required and encouraged. This will provide an understanding of the schedule, timing, location, and investments needed and the associated economic and government service impacts. This Master Plan would provide the blue print for New Mexico on expected needs and benefits of accelerated produced water total resource recovery in New Mexico.*

4. **Standardized produced water treatment and resource recovery technology cost and performance evaluations are needed**. *As noted in the technology session of the conference, several approaches have been implemented successfully to treat and reuse produced water and associated elsewhere in the U.S. But the use of these technologies is not yet widespread and conditions in the Permian Basin are different. For wider use and acceptance, better cost/performance information is needed for a range of scenarios. Finding this data can be costly and time consuming for a vendor or purchaser. Therefore, approaches are needed to accelerate performance testing and verification of produced water treatment and reuse technologies, and to provide the data to industry and the public. A model proposed is the Canadian Oil Sands Innovation Alliance, which is a public private partnership in Alberta that is the clearinghouse for testing and verification of treatment technologies used in the Canadian oil sands. A similar approach in New Mexico could be using the Bureau of Reclamation's Brackish Ground Water National Desalination Research Facility (BGNDRF) in Alamogordo, New Mexico, which is permitted to treat, and has treated, both brackish and produced waters. This federal facility is open to the private, public, and industrial sectors for technology testing and evaluation. Because BGNDRF is in close proximity to the oil and gas regions of SE New Mexico, the facility can provide a practical first step in technology validation, prior to pilot-scale evaluations at oil field sites in New Mexico and West Texas. Using the facility would provide system performance data on local produced waters, helping accelerate technology maturation and implementation. Community colleges in New Mexico also are well positioned to train students for work in treatment and reuse facilities.*

5. **There is a need for proactive Stakeholder Engagement.** *As observed at the Produced Water Conference and highlighted in a December 8, 2018 Washington Post article on the conference[1], there are some stakeholders have expressed concerns about the use of fresh water in oil and gas operations and the health and safety impacts of the use of treated produced water for agricultural or in-stream uses. These types of uses have been demonstrated in other states including Pennsylvania, Texas, and California. Therefore, it will be important to actively engage stakeholders produced water treatment-technology development and make sure that appropriate measures are developed to address stakeholder concerns. This issue will require a major social and educational effort to create and disseminate the best science, knowledge, and understanding of produced*

[1] https://www.washingtonpost.com/national/health-science/a-push-to-make-fracking-waste-water-usable-in-agriculture--and-even-for-drinking/2018/12/07/9a22e496-f803-11e8-8d64-4e79db33382f_story.html?utm_term=.c919922ad210

water resource recovery. Several groups exist at New Mexico's universities to help manage and coordinate this outreach effort including the Water Resources Research Institute at New Mexico State, the Utton Transboundary Resource Center at UNM, The Center for Water and the Environment at UNM, and the Petroleum Recovery Research Center at New Mexico Tech.

6. ***Increase State of New Mexico Energy and Oil Conservation Division Professional Staff.*** *The backlog in the approval of oil and gas related permits, correspondence, and reviews was noted several times during the conference. This is an unsustainable position to be in if the state wishes to promulgate and encourage new approaches to the handling, treatment, and disposition of oil and gas produced water in order to reduce fresh water use. The energy agencies appear to have an approximately 25% vacancy in technical staff, relative to normal staffing levels. Furthermore, the agency has noted difficulty in recruiting and retaining qualified staff because of high compensation packages offered by the oil and gas industry and the high cost of living in southeast New Mexico. This does not include the addition of extra staff needed to support a transition to total resource recovery of produced water and any additional regulatory, permitting, data collection, and analysis tasks related to treatment and reuse. Suggested options to fund the establishment of the appropriate level of staffing included the use of severance and excise tax funds, and use of the current budget surplus to fund human and data infrastructure (e.g. hardware or one-time modeling studies).*

APPENDIX A – CONFERENCE AGENDA

New Mexico Produced Water Conference
"Policy, Regulations & Economics to Support Total Resource Recovery"
Hotel Santa Fe Hacienda & Spa
Santa Fe, New Mexico
November 15-16, 2018

Thursday, November 15, 2018:

12:00 p.m.-1:00 p.m. Exhibitor and Poster Presentation Set Up

12:00 p.m.-1:30 p.m. Conference Registration

1:30 p.m.-1:50 p.m. Opening Remarks & Preview

- **Mr. Ken McQueen, Secretary, New Mexico Energy, Minerals and Natural Resources Department**, Welcome & Introductions**, "**The State Perspective on Produced Water Policy Development"

1:50 p.m.-3:00 p.m. Plenary Session:

The State and Federal Perspective on the Produced Water Disposal and Use Challenges Facing the Oil & Gas Industry in New Mexico

Moderator:

Jeri Sullivan-Graham, Research Professor, Center for Water and the Environment, University of New Mexico, & President, New Mexico Desalination Association

Speakers:

- **Anne Idsal,** Region 6 EPA Administrator, "Region 6 Produced Water Policy"
- **Dave Ross,** Assistant Administrator for the Office of Water, United States Environmental Protection Agency, "The Federal (EPA) Perspective on Produced Water Policy"
- **Tom Blaine,** New Mexico State Engineer "Fresh Water Interplay and Constraints Associated with O&G Produced Water"

3:00 p.m.- 3:15 Break

3:15 p.m.- 5:00 p.m. Current Issues, Policies & Regulations Regarding Produced Water

Moderator:

Bruce Thomson, Professor Emeritus, Civil Engineering Department, University of New Mexico

Speakers:

- **Phil Goetz,** Senior Petroleum Geologist, New Mexico Oil Conservation Division, **"**Challenges of Produced Water Disposal – Geological Constraints on Deep Well Injection, SDW Well Siting & Capacities"
- **Katie Zemlick,** Research Associate, Department of Civil Engineering, University of New Mexico, "Data and Analysis for Produced Water Management in New Mexico"
- **Bill Brancard,** General Counsel, New Mexico Energy, Minerals and Natural Resources Department, "New Mexico Laws & Regulations Regarding Produced Water. Who Owns Produced Water and What are the Regulatory Constraints Regarding its Use"?
- **Janie Chermak**. Professor of Economics, University of New Mexico "Economic Feasibility and Tradeoffs of Recovering Water and/or Commodities from Produced Water"

5:00 p.m. – 7:00 p.m. Reception

Friday, November 16, 2018

7:30 a.m. – 8:00 a.m. Continental Breakfast

8:00 – 10:00 a.m. "The Art of the Possible": Technical & Economic Challenges and Opportunities for Produced Water Recovery, Use & Reuse

Moderator:

Mike Hightower, Research Professor, Civil, Construction and Environmental Engineering, University of New Mexico & V.P., New Mexico Desalination Association

Speakers:

- **James P. Welch**, Director of Business Development, Veolia Water Technologies, & **Dale Cunningham,** P.E. "Produced Water Treatment and Discharge in the Kern River Region of California"
- **Paul Wallace**, Chief Technology Officer, Enviro Water Minerals Company, EWM, "Product Recovery from Desalination Concentrate and Produced Water Opportunities in New Mexico"
- **Martin Hauschild,** President KMX Membrane Technologies, "Vacuum Membrane Distillation of High Salinity Brines and Produced Water"
- **Kevin Thimmesch,** Chief Operating Officer, Eureka Resources LLC, "Disposal to Produced Water to the Susquehanna River and Product Generation from Recovered Salt"
- **Amanda Martin-Brock,** Chief Operating Officer/CCO, Solaris Midstream, "$300M Investment in Water Infrastructure to Capture and Treat Water and the Opportunities for New Mexico"

10:00 a.m. – 10:15 a.m. Break

10:15 a.m. - 12:00 p.m. Infrastructure Build-Out for Multiple Users: Financial/Capital, Engineering, Legal and Market Considerations

Moderator:

Katie Zemlick, Research Associate, Department of Civil Engineering, University of New Mexico

Speakers:

- **Yuliana Porras-Mendoza,** Desalination and Water Purification Research Program Manager, Bureau of Reclamation, "Bureau of Reclamation Research into Produced Water Use and Technology"

- **Bret Moody,** President, First American Bank, “Community Bank and Private Investor Financing”
- **Holly Johnson Churman**, Lead Water/Wastewater Engineer, GHD, “Topic TBD”
- **Bill Hochheiser,** Senior Energy and Environmental Manager, ALL Consulting, Lessons Learned on Produced Water Reuse Permitting”

12:00 p.m. – 1:30 p.m. Lunch

- **Recognitions**
- **Speaker: Randy Hicks,** Principal, R.T. Hicks Consultants, “Past, Present and Future Produced Water Re-use Projects in Lea County NM”

1:30 p.m.– 3:00 p.m. Produced Water Reuse: Why? And How?

Moderator:

Sam Fernald, Director, New Mexico Water Resource Research Institute (WRRI)

Speakers:

- **Kyle Murray,** Hydrogeologist, Oklahoma Geological Survey, The University of Oklahoma, “Topic TBD”

Panel:

- **Brent Van Dyke,** President, National Association of Conservation Districts, New Mexico
- **Ken Rainwater,** Professor. CECE, Texas Tech University, Department of Civil, Environmental, and Construction Engineering
- **Alex Pearl,** Professor of Law: Director, Center for Water Law and Policy, CECE, Texas Tech University
- **Pei Xu**, Associate Professor, Civil Engineering, New Mexico State University, “Modeling Costs for Produced Water Reuse Scenarios”

3:00 p.m. -3:15 p.m. Break

3:15 p.m. -4:30 p.m. Discussion Session – Chatham House Rules (no attribution) Suggested Regulatory and Policy Modifications to Facilitate Improved Water Management in the O&G Industry in New Mexico, "How Do We Make This Happen"

Develop a list of 5 Modifications to existing regulations and policies that would help improve the O&G industry manage its water supply including produced water management challenges in the Permian Basin

Moderator:

Robert Balch, Director, Petroleum Recovery Research Center, New Mexico Tech

John D'Antonio, USACE and Federal Representative, Western States Water Council

4:30 p.m. – **Concluding Remarks: Secretary Ken McQueen**

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APPENDIX C – POLICY SESSION COMMENTS

SESSION NOTES

Thursday session notes:

1. Disposition by use discussion

a. State Engineer (current and former comments) "until the use of water is exhausted" conversation about rights

2. Unified permitting process for reuse (outside oil and gas)-flowchart process or clearinghouse

3. Issue brought up about crossing BLM land with 10,000 mg/L water-new rules and permits.

4. Per OCD legal: only OCD and NMED have assigned responsibilities under WQA. There is a 30-year-old document that assigns/divides authority.

5. What is the Jurisdiction once water is treated? Where does it fall? Work toward a one-agency solution? (author's note: the MOU white paper attempts to address this issue exhaustively).

6. Presenter Katie Zemlick's conclusions about data

7. Presenter Janie Chermak: think about the broader cost-benefit analysis of the water. What are the social incentives that exist alongside profit incentives? $1-10's of dollars per bbl of value can be derived from economic water research. So, what incentives would work, who pays for them?

Friday notes:

1. Ownership of coproducts-- Who owns produced water and coproducts is mostly a contractual issue for companies at this time. Regulatory drivers, business drivers, performance drivers. Presenter Kevin Thimmesch suggests

that producers look at contracts to be sure that they are covered for coproduct sales.

2. Presenter Kevin Thimmesch also suggests subsidies to develop water technology-treatment, transport. Just like renewable energy development-equal importance of water to renewable energy.

3. Use flare gas for cogeneration…for fueling water plants.-how do we improve energy use around treatment/transport and what are regulatory implications?

4. EWM talk- when do the coproducts become severed from the waste stream to become salable products? (they use brackish water in their processes, but this is thinking about PW)

5. How do we promote energy efficiency in treatment and transport? Is this something that should be incentivized or subsidized? They use natural gas and cogenerated electricity at EWM.

6. EWM term used: "distressed feedstock". Idea-specialty greenhouses.

7. Canadian Oil Sands Innovation Alliance-clearinghouse for technologies that can then be brought into sands region for use AFTER testing. (comment from presenter Paul Wallace, ChemX).

8. Presenter Amanda Brock-Solaris-accommodate all stakeholders-what's possible now? Aggregators of water, decentralized scale.

a. Pipeline network is critical. How pay for extra treatment for higher uses? Also pay for network to move the water where it is needed. How pay for moving the coproducts?

b. Pacific Rubiales project in Columbia for palm oil irrigation (non-food crop, used for cow feed?) also water standard project in Colorado. Great art of the possible quote.

9. Comment about MOU: it didn't address midstream companies. How does that affect transfer of jurisdiction and other related issues like ownership?

10. Question-what additional steps or screenings would be needed to treat to EPA DW standards. E.g., radium, surfactants, biocides, and other industrial sourced chemicals that aren't in a typical DW source. Consensus seems to be that the technologies are better than typical surface water conventional treatment tech, with appropriate teaching. Comment from EPA-Lee- the dw regs do pre-presume fresh water but is overall source neutral. What matters is what back end looks like. Public perception is the water can be "guilty by association".

11. Industry scale up creates issues like social structure, employees, housing, community development, etc.

FINAL SESSION - 5 MODIFICATIONS TO EXISTING RULES

1. *How do we define purified produced water?*

Are the right studies are being done for feasibility and study needs? Need samples, need data and actual samples to study/research. Need more and better characterization and toxicity data. Not much at this meeting about what is in the water. Federal drinking water and state water quality and irrigation standards were not. developed for pw as a feedstock. Suggests a review and assessment update of the standards to be sure that they are appropriate for use of treated pw at the surface environment.

-what is the regulatory solution? In NM regulatory framework a start would be a better characterization of the water. One way would be to require disclosure of all that goes down hole. Via FracFocus database and maybe other things outside of stimulation process. At the E&P point. Which agency would do this? OCD most likely. Panel, committee, regulations to ensure we understand the composition of the water that we intend to treat for reuse. Look for potentially toxic components. -there is no dw standard for ethylene glycol, e.g.

Maybe it is more reasonable to test trucks as they get to a plant. Test those trucks.

At disposal point the water is getting tested into the plant, also at going out. Sampling for things impacting the next frac. not for what is being used for beneficial use.

There is sampling but not as robust as for outside reuse in the wider environment. Also, you could sample for lithium and other good constituents that could be.

Whatever you do for produced water, you should do for fresh water, e.g. stormwater. Should be a universal standard. Can't cherry pick waters without looking at broader standards and QA/QC

2. *How do we deal with solid and liquid wastes and product streams?*

Lots of solids would remain. How do you develop markets for those minerals/salts, where put it, store it, etc. What about the energy? When would you go to disposable liquid wastes? For example, limits for subsurface disposal and injectivity and transport. Pit rule, etc. limits.

How much can we practically dispose of over next 40 years? What about seismicity?

What can we do to better handle the waste products?

DOE has WIPP. Could the state work with DOE to dispose of produced water? Other energy factors-use energy recovery devices-capture and reuse of energy to lower costs. RO energy consumption, e.g. Thinks it will be at federal level. Trucking rules improved, DOE could create standards with LANL, Sandia, labs.

State could create an excise tax for disposal that goes to ag, conservation on a per barrel disposed rate. Develop salt tolerant crops, do research, would generate funds for use and research.

"use a stick" is one way to go. Solar and wind were subsidized a few years ago. But you could also put out carrots, or mandates for use. You could

have an ag group buy 20 or 30% of reused water. As a finance person its hard to say that if it rains a lot you are ok. Not being financed. To kick start development when you know you are out of surface water or gw. To get the scale together the govt would create incentives to use tech to get the system kickstarted. Model in 1 cent? Something like an "RPS". Current system doesn't reflect cost when the water runs out. Only reflects current ways of pumping or obtaining water. In Israel they started to phase in higher costs as water got lower and less available.

RPS-how do you address the infrastructure issues with just an RPS? Distributed water may be one way to do this-atmospheric generation or evaporation tech maybe. Renewable portfolio standard. One example of old tech is aqueducts in CA that don't have water to move.

You have to buy 30% of your power from sources.

Jim K. turning wastes into commodities-pushback and concern by industry whether those wastes turned into products have liabilities associated. Regulators can increase certainty – turn waste into a product. Focus of the notion of renewable water. Inherent safety cant be dismissed but if you are going to market these products to Tesla, Facebook, need to increase certainty. Crossed over from wastes to products. Went to a meeting in PA with folks who knew this topic well. How to market the info.

How tackle that from regulatory framework? White paper on jurisdiction and certainty. When does treatment yield what it (a product) not currently is? Move from general counsels at state level to the counsels at companies. Create certainty, define the line when goes from waste to product.

Now we might have an excise tax, but also a regulatory change where we put up gateways, with names before and after.

Production tax and excise tax credits…mike h. industry would be more interested in tax credits for recycling –carrot more than a stick. Not sure which is best. Waste point. Typical most successful waste is McDonalds and Oscar Meyer! How do this.

Soil amendments from WW treatment plants on parks as fertilizer. Public awareness is important somehow. Need to go there.

3. *How much will it cost to purify water, and how do we mitigate the cost?*

Need to make cost competitive with current processes.

Includes energy cost issues. Waste gas, underutilized wind and solar.

Create markets. How value water?

Societal impact of NOT having water going down the stream? Can't go short, need long term supplies in some areas.

Legislators, decisionmakers…Solaris observation—attainable, immediate. Near term beneficial use. Pecos river example. If we knew the spec that NM needed to dispose/discharge to the Pecos, you could quickly back up and say what the cost and method would be, then support the cost. $8-12 M Devonian well cost, plus the amount of money state puts in to buy out water rights, would support the treatment. Need certainty of what's needed from the regulators.

You might be better to offset water that would be taken out of Pecos upstream. Offset purposes. Water swap upstream. Can be challenging if you discharge.

The problem is orders of magnitude. The cost of treating drinking water is 10x less than treatment costs for produced water. Agriculture fresh water supplies are even cheaper. Need a 99% reduction of cost.

Turn this around is if you use purified produced water for high value processes or uses. Regulatory angle-it's an economic consideration, not regulatory. Drinking water standards are set. Use those. If you had high value for e.g. chip manufacturing, industry tells you what they need. Economic not regulatory.

Sell right back to operators. Cut freshwater demand to oil and gas, total recycling. Data is missing on how to track the water. Maybe its circular.

Discussion is similar to muni ww. Muni ww experience was that there were takers for high quality treated water. Eg Palo Verde nuclear plant competed for water with the city of Goodyear in Calif. Muni water can be argued to be harder to treat than PW. We have standards for that. Do parallel development of standards. Regulators can be informed from what went on in muni waste.

(A commentator) cares about environment and economy. The producers are there in Eddy co. more producers are coming. We need to change here in NM, so that everyone doesn't just go over to Texas. Allow the producers to do something. Don't clean to DW standards. Compact delivery-the state bought farms to solve that problem. But that means less ways to further solve the problem. Most of the water in the system is ag water. Wants to incorporate that half the ranchers are bought out. Companies are buying the land. Who will take care of the land-worries about wildlife, weeds, fire. Not usually for a new tax, but likes the idea to keep people on the land. Worked with soil and water conservation district. Partnerships with state and federal agencies. Tweak regulations to be proactive to keep the environment friendly to oil and gas. Do things fast. Don't study to death first.

What OCD regulations are stopping this? (Commentator) is worried about folks taking water off of private land. Locations are too close to houses and the river. OCD needs statutory authority to do this.

4. *What do we do with the water when it is purified?*

Could alleviate stress on regional aquifers. Could enable industries to be there.

One question-what are ASR rules? If an oil company wanted to work with a municipality to agree to add water to temporarily add water to an aquifer

that would help. Could the oil and gas company use the water late if put into storage.

Commentator: there are more questions than answers. ASR laws are limited to public entities only. Could do public/private partnerships. Did some infiltration pilot studies. ASR is a great way to store water and build aquifers. Current laws cover disposition by use. When (a previous State Engineer) was at OSE, he wanted OCD to deal with the water.

Need to quantify how much water should stay within oil and gas for HF and other uses. Outside of that, is the marketable end of the water and could invoke OSE then. Many things could be done. Got it backwards on Pecos-irrigation / drip problem return flow is important. Make farms more efficient. Need return flows to go back into system, but lower water use that accompanies more efficiency cuts return flow and increases consumptive uses.

If we allow water to go back into system, it would make agriculture more efficient. And system would work better.

Public welfare should be considered.

60-day session strategy needs to be figured out asap. For legislators. Renegotiate Texas compact. Don't want to create a delivery obligation for NM, so need to consider where to put it.

How do we keep water here with oil and gas?

White paper. Could form working groups around the paper, how get to next condition. Societal benefits? Other benefits? How do they accrue to multiple uses?

So, how do we get legislators to address water use through compact?

How do we get OSE and OCD to talk and figure out transfers between each other?

5*. What infrastructure is needed to handle, dispose, and use the water?*

PW is distributed widely. Centralized treatment is more cost effective. But it may make more sense to treat locally and avoid transport. How do you distribute and monetize products? And dispose of wastes.

(A commentator) This and previous category. Human infrastructure is important. Proper staffing, funds generated to address increases in demand. Proper people in right positions to best collect and distribute information. OSE, OCD, BLM, all of them. Also need to work together. Not enough regulatory people there to keep up. Industry went up by 4x, can't compete with industry salaries. OCD staff has dropped. This is an ask for the legislators. Come up with an ask for legislative finance committee- governor elect has a paper with proposals. Includes adequate staffing for state agencies. Easy ask for this session. (a commentator) can help facilitate this as a liason.

Regarding a tax for oil and gas for operators. For PW recycling. Thinks a tax would cut recycling. Royalty or tax reduction would be better. E.g. tiered royalty reduction rate for a recycled water. Tier by amount of water recycled. Need an incentive to recycle more. Generates more water for the state.

Therefore the state needs more staff to ensure this…

Different opinions about that.

One fundamental change is needed: the State Environment department doesn't issue NPDES permits. Need this to be in state. Really is a problem to have entities go to Region 6 EPA for approval. Especially is an issue for industrial users.

Transportation. Moving things around. How do we improve transportation? and would these facilitate opportunities for getting water and products to the right place? Use record surplus to pay for this in the same region the money came from.

5. *How do we engage stakeholders?*

Protestors were noted outside the conference.

"Social license to operate" concept for engineers. You need to live in communities where you do the work. Need stakeholders and govt on our side to go to bat for us. Maybe won't be a regulatory part.

A commentator: Academia is imperative to help stakeholders understand what is happening and to inform. Stakeholder meetings could be more accessible, include regulators and industry. E.g. DPR scenario.

Academics are good at science and presenting to other scientists, but usually don't seek limelight to maintain neutrality. - But University parties can be neutral. Bridge gap between regulators (applied science) and pure science researchers.

Need more inclusive conversations.

Singapore handled this well. "New Water" recycled concept actively marketed in Singapore. In contrast, San Diego ended up with "toilet to tap".

IVR and DPR can teach us lessons. California is doing a good job at keeping this up. They take people on tours of the plant. Survey before and after teaching and plant tour. Goes from 20% in favor to 80%. Demonstration plants to teach, explain how it works.

Use of media op education? Hard to address mad stakeholders. Advertising isn't as effective, crowded market.

Do demos, spread to media that way. Engagement mechanisms could be built into regulatory policy.

Martha-academics and outreach is doable, but sometimes it's hard to know who to talk to and how to reach them. Tried to do this on the last PW project. Hard to get folks to come to the meetings when done proactively.

Going forward, need a scrupulous record of being upfront and honest (unlike Flint MI). Trust was compromised and it is hard to recover from that.

Maybe OCD needs a media person.. (note, they have one…)

Utton center- center funded through state of NM. They do outreach, eg for adjudications. Maybe they could help with outreach and collaboration.

COMMENTS RECEIVED AFTER THE SESSION:

1. *Short term relief; Produced water reuse for drilling and frac must be priority to protect fresh water. 50% reduction on severance tax for 1 year from 1st date of production for oil production only. This would encourage oil companies to reuse (produced?) water. State continues to receive revenue.*
2. *Possibly introduce a reduced royalty rate on wells that operators reuse/recycle on a tiered basis: for instance, a 2% reduced royalty rate for an operator that recycles an average of 500,000 bbls/mo, 3% for 1,000,000 bbls/mo, and go up from there to a limit of possibly 4 or 5%. Produced water is already defined in 19.15.2 NMAC in the OCD Rules and Regulations.*
3. *There's a bit of low-salinity produced water irrigation.*
4. *Regulatory suggestion: require reuse in the oil field. May not get to 100% separation from dependence on fresh water, but limit/restrict fresh water use. From a public standpoint, I am going to wonder why treated produced water is good enough for me to use, but not the operators. From reg. standpoint, credits, taxes, rules were all mentioned as incentives for reuse. Start with universal reuse in the oilfield, then move to uses outside of (the) oilfield.*
5. *On the "ownership" of produced water: while under control of the producer, they can determine how to dispose by use. Once comingled with public state waters, it becomes public, not owned. The OSE has a statue that could describe produced water 72-5.27 Artificial Water. "Primarily private and subject beneficial use by the owner or developer therof….provided, (sic) no appropriator can acquire a right excepting by contract….against the owner or developer….to continue such water supply."*
6. *What regulations or policies would need to be addressed to have a network of water distribution across the State of New Mexico (sic)?*
7. *Determine how much in field recycling is occurring and focus on fixing that issue in order to reduce consumption of freshwater resources. This is low hanging fruit when compared wo taking prod. H2O to drinking water, Ag use or other beneficial uses that invoke human consumption.*
8. *Regulatory suggestion: follow TX example where SWD operators can recycle with 7-day notice.*
9. *What about climate?*

10. *What chemicals in PW? Toxicity, state standards, whose develop, source of supply (sic).*
11. *The Nature Conservancy Rio Grande Trust Fund as model for collaborative/alliance for use of produced water.*
12. *Item #1. Time Scale. If it is a benefit, are you then responsible for supplying it? How are you compensated?*
13. *Several comments from one person as follows:*
    a. *Work toward a unified state permit application process for PW treatment for use outside of oil field uses: Use a flowchart to show different regulatory requirements for the different regulatory agencies.*
    b. *Affirm that "Control" of PW as listed in the whitepaper is equivalent to "ownership", where a company that cleans the PW can sell the water or use it for beneficial reuse while complying with all requirements.*
    c. *Can a company that cleans PW and discharges it to GW or surface water get some type of "credit" for the water put back under state control? (tax credit, incentives, etc.).*
    d. *Can a company that cleans PW and works with a NM city needing water use the aquifer storage and recovery act to allow the city to "recover" that water at a later time without obtaining an additional water right? Would like this to be possible.*
    e. *Recommend that you follow up on idea to used treated PW to deliver to Texas and get credit on the Pecos water compact without actually having to put the water into the river.*
    f. *Some oil companies are concerned with liabilities associated with residual amounts of organic/inorganic compounds in treated pw and oil/other residuals in salt sold as a commodity. Can regulatory agencies create standards for these common chemicals/materials found in PW that are not addressed in existing regulations/standards? Is this realistic?*
    g. *Is it feasible or beneficial to try to revive the 2002 legislative HB 388 to allow a tax credit for PW cleaned and put into the Pecos River? If so, can the represented (?) agencies help support this effort?*
    h. *The present whitepaper does not categorize PW as a "waste" product. This should be done as part of the definitions.*
    i. *Salt disposal is a problem--the volumes are too great to sell it all. Can the NMED Solid Waste Bureau create a special "salt landfill" regulation to make it easy to dispose of this excess salt in environmentally safe methods?*

Two commentators submitted comments via email. They are copied here:

1. *"My recommendation for the regulations/policy list is that federal drinking water standards, state water quality standards, and state irrigation standards should all be reviewed and updated with produced water constituents in mind to make sure that they are appropriate in a world in which treated produced water is released to the environment."*
2. *Legislative/Regulatory Changes - We should ensure that any such proposals accomplish the following:*
    a. *Clarifies jurisdiction – Proposed legislative/regulatory changes should contemplate Agency jurisdiction. Knowing that produced water has shared governance between three state agencies (EMNRD, ED, and OSE) as well as the EPA, we need to try to continue to bring clarity. As you know, it took us months to figure out which agency has jurisdiction with the current regulatory landscape.*
    b. *Resources – Any proposed legislative/regulatory should contemplate whether additional resources (i.e., staffing, budget, contractor funding, etc.) are necessary for implementation.*
        i. *For example, there was a discussion about requiring disclosure of all chemicals used for drilling and completions. This would require resources to receive and review the information, make it available to the public, educate the public and industry on the changes, respond to missing or incomplete data, process requests for waivers/extensions, ensure compliance, enforce violations, adjudicate the violations, etc. This suggested regulatory change was in response to the need for scientific data on the components in produced water. While I believe this may be a good solution, I tend to think this is a burdensome and controversial approach. I think a smarter regulatory construct may be to require operators to disclose this information to produced water treatment companies. The companies treating produced water would then need to characterize the incoming water and determine how to make the data publicly available. From an industry perspective, company and individual well data is not traceable. From a government resource perspective, focusing on the treatment facility vs. chemical/well/operator is more manageable since there will always be less treatment facilities than wells. If the goal is ensuring safe renewable water is achieved through treatment – who needs to know the chemical specific data: the treatment facility or the government? I would argue it is the treatment facility. The backstop to such a construct is that state and EPA regulate the treatment facility so we*

can issue/revoke a permit, assure compliance through sampling, etc. We just need smart regulations that are not burdensome to the regulator as well as the industry while ensuring public confidence.

c. *Infrastructure Funding – In addition to taxes and other ideas discussed, private and public partnerships should prepare letters of intent under the new Water Infrastructure Finance and Innovation Act (WIFIA). Letters of intent for the second round of funding will be due in 2019. EPA administers this program and I asked a couple weeks ago if we could have the program contacts come to New Mexico for a WIFIA 101 or offer a webinar – maybe the New Mexico Desal could host in cooperation with the PRRC? The point: we need to get some proposals together ASAP to possibly float to the legislature for support and then to EPA for consideration. The way I see this possibly unfolding is to have a city, county, conservation district, etc. apply for infrastructure funds for pipelines and/or treatment. Note, the former State Engineer, John D'Antonio, is familiar with program and had some ideas. He would be a good resource.*

d. *Stakeholder Engagement – The COGCC has a good program for stakeholder engagement on oil and gas issues called the "Local Government Designee" program that we should adopt in New Mexico. However, it should be a joint venture between the OCD and ED. Again, a reminder that such programs require resources – staff, budget, travel budget, contractors, training dollars, etc. So adopting it without funding adequately would be a terrible outcome. The program has helped involve stakeholders while educating them as well. We can talk further about the pros and cons of the program and I am happy to set up a discussion with the person who started it. If I were in charge, this would be one of the first programs I stood up in the state.*

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