

CITY COUNCIL CONFERENCE MINUTES

December 5, 2017

The City Council of the City of Norman, Cleveland County, State of Oklahoma, met in a conference at 5:35 p.m. in the Municipal Building Conference Room on the 5th day of December, 2017, and notice and agenda of the meeting were posted at the Municipal Building at 201 West Gray and the Norman Public Library at 225 North Webster 48 hours prior to the beginning of the meeting.

PRESENT: Councilmembers Allison, Bierman, Castleberry, Clark*, Hickman, Holman, Karjala, Wilson, Mayor Miller

ABSENT: None

*Councilmember Clark arrived at 6:10 p.m.

Item 1, being:

DISCUSSION REGARDING HORIZONTAL DRILLING FOR PUBLIC WATER SUPPLY WATER WELLS.

Mr. Michael Graves, Garver Engineering (Garver), said the objective of tonight's discussion is to provide Council with a recap of the feasibility study recently completed by Garver that reviews alternative drilling methods in an attempt to access isolated water of higher quality and potentially increase yields from the reservoir of water being tapped into through a horizontal fashion as opposed to a traditional vertical well installation. He said Garver is building upon accessing additional groundwater as outlined in the Strategic Water Supply Plan (SWSP). Garver is taking a step by step approach to the execution of this project and validating the feasibility of those steps before moving forward.

Mr. Ken Komiske, Director of Utilities, said in 2014 the City completed the SWSP that reviewed water supply needs over the next 50 years. The long term goals were to augment Lake Thunderbird, expand the Water Treatment Plant, and complete wellhead treatment of existing wells while the short term goal was to expand water wells. He said other short term options included expanding the groundwater supply system and treating the new supply for arsenic and Chromium 6 at a centralized facility. Over the past few months the City has been testing sites for new wells and reviewing alternatives to installing vertical wells by testing the installation of horizontal wells, which has the potential to access three to four times the volume of water.

Ms. Mary Elizabeth Mock, Garver Project Manager, said the Garber-Wellington Aquifer (aquifer) is unique in that it has a variety of mudstone and sandstone layers. The sandstone layers have water flowing through them that will make a productive well whereas the mudstone layers are a retardant for water flow. The deeper you drill into the aquifer, the more arsenic and other contaminants you run into so it is important to try to target a thicker layer of sandstone for higher production while limiting the arsenic and other contaminates. She said the City can optimize the water quality by targeting a specific layer from a quality and quantity perspective.

Ms. Mock said horizontal wells were developed by the oil and gas industry and has proven to be a technology that could be used for water wells. She said the City would drill 250 feet in four zones of the aquifer that have been tested for high quality and high production of water. The horizontal wells provide potential benefits for the City because one horizontal well can potentially yield as much water as three or four vertical wells. Horizontal drilling will also target specific zones that have a higher quality of water with low concentration of arsenic or other contaminants. Ultimately, this will result in reducing costs on wells. Ms. Mock said the drill site locations include three potential well sites that optimize areas of the aquifer shown to have higher or deeper sand thicknesses as well as lower arsenic concentrations. She said only one site would currently be utilized to develop a horizontal well.

Phase I is the Feasibility Study being discussed tonight, which includes locating promising drill sites, estimating horizontal well yield through modeling, creating conceptual well designs and cost estimates, and analyzing risks involved. She said future phases include Phase II, field assessment; Phase III, performing advanced hydraulic modeling; Phase IV, design and bidding; and Phase V, construction services.

A desktop model was used to evaluate potential range of yields and the model has several inputs that include aquifer characteristics, specific site properties, and well bore properties. The aquifer characteristics are broad based and consist of the sandstone layers, mudstone layers and location. The model estimates a range of yields based on horizontal versus vertical ratio, i.e., if a vertical, single vertical well produces 1 gallon per minute (gpm), by comparison a horizontal well will produce 1.3 gallons or up to 11.6 gpm. An average of the various ranges equals an anticipated horizontal range of 3 to 8 times that of a vertical well production.

Ms. Mock highlighted conceptual cost estimates as follows:

Well Type	Anticipated Yield (gpm)	Total Cost	Unit Cost (gpm)
Vertical	200	\$ 767,000	\$3,600
Horizontal	800	\$2,150,000	\$2,700
	1400	\$2,277,000	\$1,700

Ms. Mock said it is important to remember that a horizontal well will provide yields of 3 to 8 times the yields associated with typical City of Norman well, so the cost estimates are basically breakeven points. She said conceptual cost estimates were completed using vertical cost information provided by the City of Norman and horizontal well installation costs developed in coordination with horizontal well drillers. She said it is anticipated that the capital costs of a single horizontal well will be approximately three times the cost of a traditional well. While, the initial costs are expected to be higher for the horizontal well, a larger anticipated yield indicates that cost per gpm may be reduced by 25% or more for the horizontal well.

Ms. Mock said there are always risks associated with well construction and application of new technologies for new applications and seven risk factors and mitigation strategies were identified as follows:

RISK	MITIGATION STRATEGY
Borehole collapse	Adopt best practices
Insufficient removal of cuttings	Adopt best practices
Drilling fluid invading well zone	Continuous air lifting in laterals
Miss target zone	Site investigation (250' lateral)
Production water quality	Test hole analysis (angled drilling)
Significant vertical anisotropy	Test hole analysis (angled drilling)
Regulatory challenges	Discussion with agencies (ongoing)

Ms. Mock said Phase I evaluations have produced favorable results with both the potential yield and cost benefits of horizontal wells and effective risk mitigation. The first five risks are low level, the sixth and seventh risks are moderate level, and the last risk is very low level.

Councilmember Wilson asked how the sites were identified and Ms. Mock said site criteria involved sand thickness, adjacent well water quality, and property within City limits. Councilmember Wilson asked how large the property would need to be and Mr. Komiske said 300 feet by 300 feet; however, these are conceptual sites at this time.

Councilmember Hickman asked if Garver has taken into consideration the spacing from any oil and gas wells in the area that may have perforated the formation that Garver is recommending the City extract water from. Has Garver eliminated the possibility of contaminants from the oil and gas wells in the water supply? Mr. Komiske said municipal wells have to be at least 300 feet deep and drilling below 300 feet eliminates the chance of interfering with domestic or oil and gas wells. He said there is a lot of mudstone between the layers acting as a natural protection from penetration of contaminants and the City will test the water quality as the phases move forward to ensure the water is not contaminated.

Councilmember Hickman asked what type of drilling fluids will be used and Ms. Mock said potable water and air are the two drilling fluids used.

Councilmember Allison asked if other States are using horizontal drilling for water and Mr. Graves said there are not a number of applications that are full scale, but there are applications going through this similar process in Texas. There have been some industrial applications in Arizona and the Tinker Air Force Base area for industrial water use. Councilmember Allison asked if there are vendors available that will do this type of drilling and Mr. Graves said yes, Garver employs contractors that will do this.

Chairman Hickman asked Ms. Mock to explain what anisotropy is and Ms. Mock said it is the flow path of the aquifer and understanding the flow path helps to determine the yield based on vertical or horizontal drilling.

Councilmember Karjala asked about the timeline of each phase and Ms. Mock said at least six months to complete Phase II and perhaps longer for the remaining phases. Mr. Komiske said Phase II approval will be on Council's agenda in January 2018. Ms. Mock said Phase II consists of testing three sites and if the first site is productive then site two and three will not be needed.

Ms. Mock said it is recommended the project proceed to Phase II which will include field work evaluations and completion of the following major tasks:

- Test Hole Site Verification
- Primary Test Hole Drilling and Geographical Logging Surveys
- Groundwater Sample Collections and Water Quality Testing
- Identification of Test Zone
- Geophysical Investigations
- Secondary Test Hole Drilling, Geophysical Logging, and Water Quality Testing
- Estimation of Well Production
- Cost Analysis Update
- Phase II Recommendation
- Technical Memorandum

Mr. Steve Lewis, City Manager, asked Mr. Graves to explain what type of grant funding may be available for this project and Mr. Graves said there are opportunities when doing something innovative, such as producing more water at a lower cost, to obtain smart water grants through the Bureau of Water Reclamation as well as innovation grants from the federal government and Oklahoma Water Resources Board. He said a Grants Administrator is preparing a compilation of funding opportunities and defining what those funding application requirements will be so that can be communicated to City Staff.

Mr. Graves said during each phase, Garver will continue to present a registry of risks and mitigations and if the risks become too much to bear, Garver will back out because Garver does not want to be associated with a risky project any more than the City does.

Items submitted for the record

1. PowerPoint presentation entitled, "Horizontal Water Well Feasibility Study," dated December 5, 2017
2. Norman Horizontal Well Feasibility Study, Phase 1 Technical Memorandum, Norman Utilities Authority, prepared by Garver Engineering

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The meeting was adjourned at 6:30 p.m.

ATTEST:

City Clerk

Mayor