The R9 Ranch was acquired for development as a supplemental water supply resource for the Cities of Hays and Russell as well as other potential regional participants. The water rights on the R9 Ranch are and have always been utilized for irrigation. A review of the existing water rights and irrigation well capacities on the Ranch indicate that the permitted annual quantities and available well yields are viable for development as a long-term municipal water resource.

This memo generally lists the project elements and required infrastructure associated with developing the R9 Ranch as a municipal water supply well field, in addition to general descriptions of essential project features at the preliminary planning level.

Total initial average projected capacity of the R9 Well Field (R9WF) is approximately 4.0 million gallons of water per day (MGD) and is planned to be completed in phases. Further development and future capacity will also be considered to meet additional growth and regional demands. Full development of the Ranch involves installation of 10 to 14 public water supply wells, well houses, power distribution, raw water collection piping, a water storage tank and a high service pump station (HSPS). Figure 1 illustrates a preliminary wellfield layout.

The largest piece of required infrastructure will be a new 65-mile pipeline, which will tie into the existing Hays Smoky Hill River Well Field (SHRWF) pipeline near Schoenchen, KS. The SHRWF is also the area where a pipeline connection will be made to deliver water to the City of Russell raw water collection system.
Construction of the R9WF will be in phases with a 4.0 MGD average daily production capacity utilizing 10 to 14 wells by the third phase. This phased approach and associated infrastructure is described in Table 1 below. Planning and development will consider the entire project, so that infrastructure constructed in early phases will incorporate design features to accommodate the future potential development capacity of later phases.

### Table 1 - Anticipated Required Infrastructure

<table>
<thead>
<tr>
<th>Phase</th>
<th>Yield MGD</th>
<th>Wells Required</th>
<th>Transmission Pipeline</th>
<th>Pump Stations</th>
<th>Storage Tanks</th>
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<th>Civil Improvements</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>2.0</td>
<td>6 - 8</td>
<td>65 Miles</td>
<td>1</td>
<td>1</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>II</td>
<td>1.0</td>
<td>2 - 4</td>
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<td>Yes</td>
<td>Yes</td>
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<td>None</td>
<td>None</td>
<td>Yes</td>
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</tr>
</tbody>
</table>

Phase 1 wells will be constructed in the north and eastern portions of the Ranch where investigations have identified the area as having the highest potential with respect to both water quantity and quality. Phase 2 wells and infrastructure will be constructed in the central area of the Ranch, and Phase 3 will be in the southwest portion.

### Wells

New wells will comply with Kansas Department of Health & Environment (KDHE) Public Water Supply (PWS) regulations. Expected lithology includes unconsolidated sands, gravels, and intermittent clays obtained from the Arkansas River Alluvium and reworked High Plains/Ogallala aquifer.

The concept design for the new public water supply wells at the Ranch anticipates drilling and construction of gravel packed wells completed with 18-inch diameter screen and casing installed concentrically in a 30-inch diameter borehole. Groundwater quality samples obtained from observation wells on the Ranch, and existing irrigation wells indicate the groundwater has potential corrosive characteristics. To protect against corrosion and increase expected well life, wells will be constructed utilizing PVC casing and column pipe as well as stainless steel wire-wrapped screen. A stainless steel submersible pump and motor combination is recommended to reduce required maintenance and increase equipment longevity.

![Photo 2 – Typical well construction diagram](attachment:photo2.png)
Well Houses

The conceptual design for the well houses is a basic concrete structure sized to accommodate the required equipment for operation, maintenance, and control of each well. Concrete well house construction provides the required durability for the sandy environment and isolated conditions found at the Ranch. The well houses will be secured with a lockable metal door and will enclose items such as:

- Motor Control Centers
- Variable Frequency Drives
- Flow meters
- Check valves
- Isolation Valves
- Testing Tees
- Sample ports
- Pressure gages
- Communication Equipment
- Air relief valves
- Supervisory Control and Data Acquisition system (SCADA) controls

Three phase, 480-volt power is required to operate the submersible pumps and motors. A variable frequency drive (VFD) controller will be used to adjust the speed of the pump motors and provide flow control. VFD’s provide many benefits for operation of a well system, including: maximum power efficiency, the ability to control drawdown, increased motor life, and decreased power loading on startup. Ninnescah Electric Cooperative, whose service area covers a substantial portion of the Ranch, has indicated they require VFDs on 35 horsepower and greater motors within their service area.

SCADA

SCADA data will be transmitted to a central location on the Ranch that will then relay the data to the main water treatment plant (WTP) in Hays. Other SCADA requirements, such as door alarms and leak detection, will be examined during the detailed design process.
Typical SCADA controls include:

- Remote Well Start-Stop
- Flow Rate Indications
- Water Level Feedback
- Remote Valve Control
- Storage Tank Levels
- Line Pressure Monitoring

**Power Distribution Network**

The Ranch is located in the service areas of two electrical cooperatives, Ninnescah Electric Cooperative and Victory Electric. Based on discussion with these electric providers, power for the wells will have to be supplied by the respective co-op in the coverage area where the well is physically located. Power lines supplying the wells will likely be installed as overhead lines and will generally follow the same route as the well site access roads.

Construction cost, maintenance, and others factors will be considered prior to finalizing electrical distribution construction parameters. In addition to the power lines, transformers will be required at each well location. Upgrades to the co-op owned substation may be required, dependent on the total electric load at the time of development.

**Access Roads**

Access roads will be required to reach each of the well locations. The access roads will likely be gravel or graded sand construction and must support vehicles for construction and maintenance of the wells, power lines, and pipelines. Road design and construction will be compatible with the intended use as well as the highly dynamic and erodible surface conditions that exist at the Ranch.

**Raw Water Collection System**

The raw water collection system on the Ranch will convey the water from the newly constructed municipal wells to the storage tank. Pipeline sizes depend on the amount of flow required and the resulting pipe hydraulics. The collection system pipes will likely range from 6 to 12-inches in diameter, and be constructed of PVC or ductile iron. Flow velocity, head loss, material cost and expected material lifetime will determine the pipeline materials. Pipelines will likely follow the same alignment as the access roads within the Ranch boundaries to simplify maintenance and access.
Memorandum (cont’d)

September 24, 2015
Page 5

**Raw Water Storage Tank**

The concept design includes an above ground, 1.0 million gallon storage tank for flow control at the Ranch. The tank is anticipated to be constructed of glass-lined bolted steel or pre-cast concrete.

**High Service Pump Station**

It is currently projected that a single pump station will be required. The pump station is expected to have the following features:

- Custom-built station with a prefabricated below grade enclosure with electrical control systems;
- Four pumps in each station (3 duty pumps, one standby);
- A monorail crane for pump installation and removal through hatches placed above each pump;
- Variable frequency drives for each pump;
- Telemetry system to communicate with existing system;
- Back-up power generator/source and appropriate site security measures

![Photo 5 - Example of a High Service Pump Station](image)

**R9WF Monitoring Network**

An existing network of monitoring wells constructed on the Ranch in the mid 1990’s is currently being used to monitor water levels and to collect water quality data. It is anticipated that the existing monitoring network or a potentially expanded monitoring network will be used to facilitate future data collection.

**Raw Water Transmission Pipeline**

The water transmission line for R9WF development is projected to be 20 inches in diameter and approximately 65 miles in length. The use of either ductile iron pipe (DIP) or polyvinylchloride (PVC) pipe for the R9WF pipeline would be acceptable.

A water transmission pipeline will also be required to connect the City of Russell to the system. This pipeline will run from the Schoenchen area to Russell’s Pfeiffer well field, and is projected to be 10 to 12 inches in diameter.
Operation & Maintenance (O&M)

The currently planned operation of the R9WF is based on delivering a constant volume of water to supply a percentage of the base-load water requirements of both Hays and Russell. The percentage of base-load is expected to fluctuate depending on the condition of other available water resources. The total annual quantities produced are expected to increase as demand grows. Supplemental base demand and peaking requirements will be satisfied from other existing water supply sources.

Operation of wells in the R9WF will be rotated based on observed water levels, mechanical considerations, and maintenance requirements. This will ensure that all of the wells are operated regularly to exercise the mechanical equipment.

Final Notes & Discussion

Note that the project elements identified in this memo are general in nature and are intended only as an outline of the required infrastructure anticipated with the development of the R9 Ranch as a municipal water supply well field. Specific project elements will be sized and designed during the engineering phase of the project.

BJM/BJM
R9 Ranch Data Collection

Resource Evaluation

► Water Level Data
  - Quarterly Measurements
  - Examine short and long term trends
  - Better understand aquifer health

[Graph showing water level data with periods of approved and provisional data]
R9 Ranch Data Collection

- Water Level Data
  - Understand Aquifer Underflow
  - Better Estimate Aquifer Recharge
  - Ensure Long-Term Sustainability
  - Provide Data for Groundwater Modeling
R9 Ranch Data Collection

- Water Quality Data
  - Utilize Existing Well Network
  - Baseline Data Collection
  - Full Suite of KDHE Water Quality Parameters
  - Continued Quarterly Sampling of Key Parameters
  - Nitrates, Sulfates, TDS, Chlorides, Hardness

**Observation Well Nitrate Values**

<table>
<thead>
<tr>
<th>Year</th>
<th>Value</th>
</tr>
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<tbody>
<tr>
<td>1995</td>
<td></td>
</tr>
<tr>
<td>1996</td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td>OW-Name</td>
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</table>
R9 Ranch Well Plugging & Erosion Protection

Water Quality & Erosion

► Well Plugging and Abandonment
  - Removed Equipment to Central Site
  - Plugged Wells (coordinated with KDHE)
  - Removed Concrete Pads
  - Completed Required Reports

► Seeding Retired Pivots
  - Native Vegetation
  - Prevents blowing sand
R9 Ranch Well Plugging

- Equipment Removal
  - Full Inventory Completed
  - Column Pipe
  - Pumps
  - Gear Drives
  - Meters
  - Shed Structures
  - Burial of Concrete Pads
  - Site Grading Restoration
R9 Ranch Well Plugging

- Well Plugging and Abandonment
  - Cutoff Casing 3 Feet Below Land Surface
  - Chlorinated Sand to Water Level
  - Concrete Grout to Surface
  - Return to Existing Grade
  - Completed KDHE Reports
R9 Ranch Conceptual Development Summary

- Multiple Phase Approach (3 phases)
- 20” Transmission Line
- High Service Pump Station
- Storage Tank
- Wells, Well Houses & SCADA
- Wellfield Collection Piping
- Monitoring Well Network
- Power Distribution
- Access Roads
## R9 Ranch Conceptual Development

### Phased Development

<table>
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<tr>
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</table>

- **Phase I – 2 MGD**
  - Eastern Half of the Ranch
  - Eastern areas have better water quality
  - Higher producing wells
  - Closer proximity to power network and planned storage tank

- **Phase II – 1 MGD**
  - Moving West/Southwest

- **Phase III – 1 MGD**
  - Southwest portion of Ranch
R9 Ranch Conceptual Development

Legend
- Green circle: Phase I - Proposed Municipal Wells
- Blue circle: Phase II - Proposed Municipal Wells
- Purple circle: Phase III - Proposed Municipal Wells
- Yellow outline: R9 Ranch Property Boundary

Figure 1
Proposed Well Locations & Development Phases
Groundwater Wells

- KDHE construction standards
- 18 Inch Diameter Casing
  - PVC Solid Casing
  - Stainless Steel Wire Wrap Screen
  - Resistance to Corrosion
- 30 Inch Borehole
  - Unconsolidated Sands & Gravels
  - Formation Contact
  - Shallow aquifer conditions
- Stainless steel submersible pump and motor combination
- Adjacent Monitoring Network
Well Houses

► Basic Concrete Structure
  • Resistant to Harsh Environment
  • Remote Conditions and Maintenance

► Houses Include:
  • Motor Control Center
  • Flow Meter
  • Check Valves
  • Isolation Valves
  • Sample Ports
  • Pressure Gages
  • Air Relief
  • SCADA controls
Well Houses – Electrical

- 480 Volt Supply
- Variable Frequency Drive (VFD)
  - Control Drawdown
  - Increased Motor Lifetime
  - Decreased Startup Load
  - Power Efficiency
- Ninnescah Electric Cooperative
  - Supplier for Phase I & II
  - Will require soft start or VFD
R9 Ranch Conceptual Development

SCADA

► Utilize centralized location on the Ranch for relay to WTP

► Typical Control Scheme
  • Remote well start/stop
  • Flow indications
  • Leak detection
  • Water Level Feedback
  • Line Pressure
  • Tanks Levels
R9 Ranch Conceptual Development

Power Distribution

► Ninnescah Electric
  • Phases I & II
► Victory Electric
  • Phase III
► Phase I – Ninnescah Electric
  • Preliminary costs based on OHP at $90K / Mile
  • Cities responsible for initial construction costs
  • Maintenance of secondary power
  • Upgrade to network between substation and HWY 183
  • Future exceedance of 5MW at substation
R9 Ranch Conceptual Development

Raw Water Collection

► Convey water from wells to new storage tank at north end of Ranch

► PVC or Ductile Iron
  • Consideration for maintenance
  • Resistance to Corrosion
  • Flow Velocities
  • Material Costs
  • Follow Access Roads
Access Roads

- Access to each well house
- Power Line Maintenance
- Pipeline Maintenance
- Graded Sand Construction
  - Maintenance Consideration
  - Erosion Control
  - Weather Conditions
R9 Ranch Conceptual Development

Raw Water Storage Tank

- Above Ground Storage
- 1 Million Gallon Capacity
- Provides Flow Buffer
- Glass Lined Bolted Steel
- Pre-Cast Concrete
R9 Ranch Conceptual Development

Water Transmission Line

- Approximately 65 miles from R9 Ranch to SHRWF
- Sized for full build out
  - Single HSP under current design
- PVC or Ductile Iron
R9 Ranch Conceptual Development

Water Transmission Line

► Approximately 65 miles from R9 Ranch to Smoky Hill River Well Field
► Several Preliminary Routes Evaluated
Arkansas River
#1 116.3
#2 121.53
#3 128.94
#5 107.18
#6 124.75
#7 115.36
#11 108.41
#12 127.69
#13 118.71
#14 171.92
#17 125.11
#16 115.12
#18 92.05
#11A 129.05
#8A 127.44

Acknowledgment of the originating agencies would be appreciated in products derived from these data.

Monty Smith, Farm Manager
Imagery Source: USDA NAIP 2014
Maps Are For Visual Aid Only
Boundaries Are Approximate

EXHIBIT 57
Farm #18189
City of Hays/Russell
Edwards County, Kansas

Last Year of Production
Grass
2016
2017