Executive Summary

LUSK MASTER PLAN
LEVEL I STUDY
FOR THE
WYOMING WATER DEVELOPMENT COMMISSION
AND THE TOWN OF LUSK
September 1, 2014

PREPARED BY:

AVI PROFESSIONAL CORPORATION

IN ASSOCIATION WITH

TST OF DENVER, INC.

HINCKLEY CONSULTING

HINCKLEY CONSULTING
LUSK MASTER PLAN
LEVEL I STUDY
EXECUTIVE SUMMARY

• ENGINEER’S AND GEOLOGIST’S CERTIFICATE •

We hereby certify that we have prepared or directly supervised the preparation of these reports and that we are duly registered professionals in the State of Wyoming.

Bruce H. Perryman, P.E., P.L.S.
Wyoming P.E. and P.L.S. No. 5488

Bern Hinckley, P.G
Wyoming P.G. No. 2457
LUSK MASTER PLAN

LEVEL I STUDY

• ENGINEER’S AND GEOLOGIST’S CERTIFICATE •

We hereby certify that we have prepared or directly supervised the preparation of these reports and that we are duly registered professionals in the State of Wyoming.

Glendon W. Berrett, P.E.
Wyoming P.E.10713
REPORT SUMMARY BY TASK

INTRODUCTION

The Wyoming Water Development Commission selected the consulting team of AVI Professional Corporation (AVI), TST Inc. of Denver and Hinckley Consulting (HC) to develop a water supply master plan for the Town of Lusk in Niobrara County. AVI was the prime contractor providing management oversight, project coordination, and surveying services. AVI was also responsible for the following tasks: meetings, review of existing information, evaluation of system operations, water demand and population forecasts, water system financing/rate study, prioritization of recommendations, cost estimates, and final report preparation. TST was the lead in system inventory, evaluation, and mapping including the system hydraulic model, and developing the GIS system. HC was responsible for water rights, water source analysis, pump tests, video well logs, and system pump evaluation. HC also provided water quality information. All three firms coordinated with development of cost estimates, recommendations and preparation of the final report.

TASK 1. MEETINGS

A scoping meeting was held in Lusk on August 20, 2013 to discuss the study goals and schedule. Additional meetings were held as necessary during the study.

AVI Survey Crew was on site in Lusk September 23rd through the 26th 2013 to record topographic observations of water system components.

On February 19, 2014 representatives of TST and AVI met with the Town utility staff to present the results of TST’s GIS development, introduce ArcExplorer software, and provide training in the use of a Trimble Handheld GPS.

Bern Hinckley of Hinckley Consulting was on site the first two weeks of May 2014 to evaluate three of Lusk’s existing production wells (#1, #8 and #9) and to video log Well No. 3 (abandoned). DC Drilling provided services.

A final meeting to present the Draft Report was held on August 13, 2014.

TASK 2. REVIEW OF EXISTING INFORMATION

Prior to initiating technical work on the Lusk Master Plan Study, the AVI Consulting Team compiled existing information including Town records scanned during the Scoping Meeting, three previous WWDO Lusk reports, two Wyoming Legislative reports (for appropriation information relating to WWDO construction projects, the most recent EPA Sanitary Survey, and the Lusk Area Groundwater Level I Study prepared for WWDO by Hinckley Consulting.
TASK 3. INVENTORY, EVALUATE AND MAP EXISTING WATER SYSTEM

The Town of Lusk water system serves a population of approximately 1,567 residents (2010 Census) through 846 taps including 705 residential, 134 commercial, and 7 other including the Wyoming Women’s Center.

The potable water system is currently supplied by four wells designated Well No. 1, No. 8, No. 9, and No. 10 producing from the Arickaree formation. Water is chlorinated at each well head prior to introduction into the transmission/distribution system. An additional well provides irrigation water to the Municipal Golf Course but is not used for potable purposes.

The Town has three storage tanks with a total capacity of 1.6 million gallons, approximately 10,400 feet of 14” asbestos concrete transmission line from the wells east of Town and about 1,400 feet of 10” PVC from Well No. 1 to the two older storage tanks. The distribution system main lines are a mix of cast iron, ductile iron, and PVC from 4” to 12” diameter. Line information is described in detail in the GIS deliverable.

As part of this task, a schedule was developed for replacing components requiring repair or replacement now and in the next 20 years. The only system bottlenecks identified were flow restrictions created by undersized lines.

The AVI Survey Department collected geographic data for all major and most system components including valves, meters, and hydrants for incorporation into the GIS digital database. Data were also used to update water system maps.

TASK 4. WATER SOURCE DATA COLLECTION

Hinckley Consulting conducted a comprehensive evaluation of the Town's active and abandoned production wells including review of Town records, permits, aquifer tests, and video logs. The results of this evaluation are too lengthy and detailed to accurately summarize here. For general information, the municipal water source for the Town of Lusk is a series of groundwater wells developed in the Arikaree Formation in and just east of the town. There are ten municipal-supply wells of record for the Town of Lusk, although only four are presently in service.

Most of these wells have been abandoned or are otherwise out of service. The currently active wells are Nos. 1, 8, 9, and 10. During the summer, these wells are pumped in a regular rotation, with more than one well added as necessary to maintain deliveries and target storage levels. During the winter, the rotation is reduced to an approximately daily alternation between Well Nos. 1 and 8, the two most productive wells.

The water source component of the Lusk municipal water system is in generally good order. The installed capacity and water rights are sufficient to meet present and projected future
needs. Multiple wells provide redundancy to maintain supplies in case of individual well failure. With few exceptions, water quality meets all applicable standards. Thus, the focus of this investigation was to establish baseline conditions for future reference, to identify potential problems going forward, and to look for opportunities for improvement. Issues of interest include:

1. Documentation of the history and current status of the Arikaree Aquifer, the Lusk municipal wells, and the installed pumping equipment provides information to guide future groundwater development and a benchmark with which to assess future changes.

2. The most productive active well is No. 1, yet little was known about the completion of this well; the below-ground vault at the wellhead increases opportunities for wellhead contamination and poses safety issues for Town staff accessing the vault.

3. The uranium and radioactivity levels in all of the active wells approach, or occasionally exceed, EPA Primary Drinking Water standards.

4. Sand production has been a problem for the eastern wells (Nos. 7, 8, 9, and 10) in the past but is currently not a major concern.

5. The Town would like to reduce its vulnerability to a transmission-line disruption cutting off the supply from the eastern wells by evaluating additional “in-town” well alternatives.

**TASK 5. WATER QUALITY**

Although originating as surface water, groundwater recharge picks up minerals as it move through the subsurface. Of the constituents for which laboratory analyses were located for this report, the only concentrations occasionally in excess of EPA standards are for gross alpha (a general measure of radioactivity) and uranium (a toxic metal, in addition to being a source of radioactivity.)

Exceedances of the gross alpha standard consist of one of the three available analyses for Well No. 1, and one of the six available analyses for Well No. 9. Uranium exceedances consist of one of the five available analyses for well No. 8, two of the six available analyses for Well No. 9, and two of the five available analyses for Well No. 10.

As of June 2014, the intermittent nature and small magnitude of these exceedances has forestalled EPA regulation of the Lusk water system. The Town is on a somewhat more frequent sampling schedule than would be the case were all analyses within the standards, as a longer-term record, perhaps revealing seasonal or long-term fluctuations, is developed (this speaks to our recommendation for an upgraded water quality recording system.) Also, since groundwater from the three eastern wells is comingled before delivery to users, there is opportunity to take advantage of water-quality blending to stay consistently within standards.
TASK 6. REVIEW OF WATER RIGHTS

The Wyoming State Engineer’s Office lists the Town of Lusk as owner of multiple wells, however total of five active production wells are currently in use. Four wells, Nos. 1, 8, 9, and 10 are used as a municipal supply; the fifth irrigates the golf course. Well No. 7 has been taken off-line due to low production and issues with sand infiltration, but is still an active permit. All wells are permitted for municipal use except the golf course well which is permitted for miscellaneous use.

### Table 6.1

<table>
<thead>
<tr>
<th>Permit No.</th>
<th>Priority Date</th>
<th>Well Name</th>
<th>Permit Status</th>
<th>Location ¼ ¼ Sec-T-R</th>
<th>Permitted Yield (gpm)</th>
<th>Well Depth (ft.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2850G</td>
<td>7/30/54</td>
<td>Lusk #1 Well</td>
<td>Adjudicated</td>
<td>NENW 7-32-63</td>
<td>350</td>
<td>132</td>
</tr>
<tr>
<td>P762070W</td>
<td>1/26/88</td>
<td>Lusk #1 Well</td>
<td>Adjudicated</td>
<td>NENW 7-32-63</td>
<td>550</td>
<td>132</td>
</tr>
<tr>
<td>P590020W</td>
<td>7/31/81</td>
<td>Lusk #7 Well</td>
<td>Adjudicated</td>
<td>NWWN 15-32-63</td>
<td>400</td>
<td>460</td>
</tr>
<tr>
<td>P762090W</td>
<td>1/26/88</td>
<td>Lusk #7 Well</td>
<td>Adjudicated</td>
<td>NWWN 15-32-63</td>
<td>350</td>
<td>460</td>
</tr>
<tr>
<td>P590030W</td>
<td>1/26/88</td>
<td>Lusk #8 Well</td>
<td>Adjudicated</td>
<td>NWNE 15-32-63</td>
<td>800</td>
<td>484</td>
</tr>
<tr>
<td>P782540W</td>
<td>10/13/88</td>
<td>Lusk #8 Well</td>
<td>Adjudicated</td>
<td>NWNE 15-32-63</td>
<td>100</td>
<td>484</td>
</tr>
<tr>
<td>P1913430W</td>
<td>9/10/08*</td>
<td>Lusk #9 Well</td>
<td>Adjudicated</td>
<td>NWWN 14-32-63</td>
<td>450</td>
<td>460</td>
</tr>
<tr>
<td>P1913440W</td>
<td>9/10/08</td>
<td>Lusk #10 Well</td>
<td>Complete, Not Adjudicated</td>
<td>NENE 15-32-63</td>
<td>400</td>
<td>579</td>
</tr>
<tr>
<td>P678900W</td>
<td>7/11/84</td>
<td>Golf Course Well</td>
<td>Adjudicated</td>
<td>SWSE 12-32-63</td>
<td>15</td>
<td>170</td>
</tr>
</tbody>
</table>

TASK 7. EVALUATION OF SYSTEM OPERATIONS

In general, the Lusk Utility Staff does an excellent job of maintaining and operating the water system given the budgetary limitations common to small municipalities with a limited customer base. The consulting team identified a few areas where changes in operations would result in a benefit achieved through cost savings, convenience, enhancement of system reliability, or protection of water quality.

**PRIMARY PRIORITIES**

Backup Emergency Power. The existing supply wells provide reasonable system redundancy should the system experience one or more wells going offline. Well No. 1 has sufficient production capacity to get the Town through a short-term interruption of
supply from the wells east of town, especially if the storage tanks were at operational levels and consumers cooperated by limiting water consumption. However, the worst case scenario could be a simultaneous major break in the east transmission line and a power failure taking Well No. 1 offline. A reasonable operational safeguard would be an emergency backup generator with the correct well house wiring to allow operation of the well.

**Fluctuation Of Storage Tank Levels.** As is common in Wyoming public water systems, Lusk endeavors to keep all three storage tanks at or close to maximum capacity. This practice can lead to limited turnover in storage tanks which in turn may contribute to stagnation, thermostratification (water layering by temperature within the tanks), and possibly formation of disinfection by products (DBP). DBPs are a function of reaction between disinfection media (chlorination) and organic matter in the water, not usually a problem in systems based on groundwater where organic matter is not present. However, tank fluctuation is suggested. It is our recommendation that operational controls be adjusted to promote greater fluctuation in tank levels and promote mixing without compromising adequate storage volume to meet peak demands and emergency storage requirements.

**SECONDARY PRIORITIES**

**Use of SCADA System.** The Town has in place an excellent functional Supervisory Control and Data Acquisition (SCADA) system. However, our observation is that the system is mostly supervisory control and is not currently creating records over time. We recommend an update to the existing SCADA system to allow Town to save data in Excel or other spreadsheet format. This would enable staff to export tank levels, production flows, and other data into spreadsheets that will allow valuable analysis and evaluation of demand patterns, identify changes in production over time. The ability to track trends allows early identification of system symptoms – declining well production may indicate pump problems or leaking drop pipes, drastic increase in use/tank drawdown could be the result of a major line break.

**Repair Of Telemetry To Flow Meter At No. 10 Well.** During evaluation of the Town’s production wells, it was observed that the flow meter at Well No. 9 is not functioning correctly nor was the telemetry from the flow meter at Well No. 10. This compromises the ability to monitor and maintain well activity. We recommend repair or replacement.

**Exercising Valves, Hydrant Testing, Flushing Dead-End Lines.** The Town should develop a schedule for exercising line valves, testing fire hydrants, and flushing dead-end lines in the north part of the system. Exercising valves and testing hydrants increase the reliability of these components and reduce the potential for failure during operation.
Hydrant testing is especially important when lines are replaced or upsized. Records of testing should be retained to provide a good data base for future system hydraulic modeling. Flushing dead-end lines diminishes the potential for water quality issues due to stagnation. The schedule and procedures suggested could be contained in a system operating manual.

System Operating Manual. The Consulting Team found the Town’s utility staff to be exceptionally well informed about system operations and maintenance. Such institutional knowledge is invaluable and should be preserved for the benefit of future employees. As time allows, the recordation of this information in a system operating manual – a three ring binder would suffice – will prove to be of significant importance when the inevitable happens and existing staff retire or move on to other positions.

Tracking Water Quality Data. The Consulting Team experienced some difficulty collating and analyzing the Town’s water quality data. Given that the wells occasionally exceed the Maximum Contaminant Level (MCL) for radionuclides, there is benefit to developing a systematic method for tracking water quality information as test results become available. A simple Excel spreadsheet or other equivalent software would allow identification and recordation of water quality trends.

Storage Tank Maintenance. As described in Task 3, the Town’s treated water storage consists of three steel storage tanks. Industry standards recommend that potable water storage tanks should be inspected and cleaned every three to four years, so all of Lusk’s tanks are due.

Acquire Easement from Department Of Corrections. In 1982, the Town of Lusk conveyed through a Quitclaim deed a parcel of approximately 70 acres to the Wyoming Department of Corrections (DOC), at that time the Board of Charities and Reform. The Quitclaim Deed has no provisions for Lusk to retain ownership of the Well No. 1 site, waterline easement or access road. There is no accommodation for future utilities such as a new well offset to Well No. 1. We recommend that Lusk negotiate with the DOC to obtain permanent easements.

Complete Adjudication Process For Well No. 10. According to the most recent information available from the Wyoming State Engineer’s Office, all of Lusk’s wells are adjudicated except for No. 10. The Town should determine what is necessary to complete the process.

Move Chlorination To Single Point For East Wells. Lusk could reduce operating costs and expense of replacing chlorination units by treating all wells at the Well No. 7 well house. The Town should consider this option when or if chlorination units at east side wells require replacement. Town staff indicated no interest in moving units at this time.
TASK 8.  POPULATION GROWTH AND WATER DEMAND PROJECTIONS

The population information in Table 8.1 below was obtained from the Economic Analysis Division of the Wyoming Department of Administration and Information (EAD/DAI).

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Census Town of Lusk</td>
<td>1,504</td>
<td>1,447</td>
<td>1,567</td>
<td>1,634</td>
<td>1,678</td>
<td>1,697</td>
<td>1,710</td>
</tr>
<tr>
<td>Census Niobrara County</td>
<td>2,499</td>
<td>2,407</td>
<td>2,484</td>
<td>2,590</td>
<td>2,660</td>
<td>2,690</td>
<td>2,710</td>
</tr>
</tbody>
</table>

Note that EAD/DAI derives population projections by increasing verifiable census numbers using a linear regression formula. While no “official” numbers are available past 2030 from EAD/DAI, the regression analysis yielded an estimated population for the Town of Lusk in 2035 of 1,724 and 1,737 by 2040. We determined the existing system is adequate to meet both present and future demand including adjacent service areas and projected population increases.

TASK 9.  WATER SYSTEM FINANCING

This section of the report addresses two issues. First, the existing Lusk water system financing was examined to determine if income from water rates, tap fees, and other revenues are supporting system expenses. This analysis includes current operating expenses and sinking fund accounts to accommodate emergency repairs to the system as well as replacement of key components over time.

Second, a determination was made of the water rates and fees necessary to make the system self-supporting under several scenarios of recommended system improvements and funding sources. AVI prepared a project financing model for all alternatives evaluated during the study regardless of the financial feasibility of the option.

As presently operated, system revenues are in most years sufficient to cover operating expenses unless a major capital expenditure is required. The Town has a general purpose sinking fund that is not specifically earmarked for emergency repairs or long-term component replacement over the 20 year planning window.

Lusk’s residential base water rate is $17.45 per month as a minimum charge for first 10,000 gallons per month, plus $0.750 per 1,000 gallons over the minimum amount of 10,000 gallons. Based on AVI’s review of system financial records, we identified a base rate of $25.24 as the minimum necessary to cover existing (2014) fixed costs. To fund identified priority improvements, the total rate must be increased to between $47.69 and $58.18 depending on
the funding source and loan conditions. We recommended a gradual base rate increase to $40.00 per month for residential users.

**TASK 10. CREATION OF A GEOGRAPHIC INFORMATION SYSTEM (GIS)**

The Geographic Information System (GIS) for Lusk’s water system was compiled from field survey locations of all of the Town’s water infrastructure assets as completed by the AVI Survey Department with assistance from Town staff. TST used the survey locates to create a new system map within an AutoCAD based hydraulic modeling software (WaterCAD) as discussed in Task 3. The hydraulic model mapping of the assets was then transferred from the model into a GIS (ESRI ArcGIS) platform. The ArcGIS platform allowed the captured water system locations and associated data to be displayed with background aerial imagery, parcels, and other data. Along with the development of the GIS, the AVI – TST team provided training to the Town’s staff on a free GIS viewer (ArcGIS Explorer). Training was also provided on the Town’s Trimble GPS to enable staff to collect locations and information on additional assets and import new data into the platform.

**DEVELOPMENT PROCESS**

The foundation of the GIS platform is a detailed field survey in which each asset such as fire hydrants, valves, tanks, and other components of Lusk’s water system were located. Survey locations were captured by survey grade GPS on a Wyoming State Plane East (Feet) projection, NAD 1983 datum, with elevations being NAVD88. These survey locates were then transferred to TST, who attempted to fit the Town’s existing AutoCAD mapping to the survey data. It was quickly obvious that the existing mapping was merely a schematic representation of the system and not spatially accurate. With this discovery, each asset was then individually created within the hydraulic model. Pipe alignments were created by tying to the locations of the valves, hydrants, tanks, etc., with size information matching the original schematic map. The preliminary CAD map update was then sent to Town staff for review and comment in order to finalize the layout of the system.

**TASK 11. PRIORITIZATION OF RECOMMENDATIONS**

Refer to Task 7 above for prioritization of non-structural/operational recommendations.

**STRUCTURAL IMPROVEMENTS – PRIMARY PRIORITIES**

Using the inventory in Task 3 and also input from Town utility staff, the following structural improvements were identified and are listed below in the approximate order of priority. More information can be found in the complete report narrative and tables for Task 9 Water System Financing.
Replacement Of Undersized Lines And Looping. The Hydraulic Model constructed by TST as described in Task 3 Inventory, Evaluate and Map existing system identified over 33,000 LF of 4” line recommended for replacement. The presence of undersized lines in corrosive soils results in frequent leaks or line breaks, thus increasing maintenance expenses and operational costs as well as creating the potential for contamination of the system at the point of the leak or break. The hydraulic model identified 51 hydrants with flows of less than 500 gpm and an additional 63 hydrants with flows below 1500 gpm primarily due to undersized lines.

Well No. 1 Underground Vault. The well head, controls, and chlorination unit for Well No. 1 are located in a pit with locking steel cover. The Occupational Health and Safety Administration (OSHA) would classify this pit as a confined space posing a hazard to Town employees entering the vault for maintenance or repairs (Reference Code of Federal Regulations CFR 29-1910.146.)

Lusk is at some risk of liability if an employee is injured or dies entering a confined space, but more importantly, preemptive steps should be taken to prevent an accident from occurring. Confined spaces may be entered if an attendant is present and a retrieval mechanism is in place in case the employee is overcome and unable to exit the space. The best solution is to extend the well head so that controls and the chlorination unit can be placed in an above-ground well house or construct a new well. Due to the danger posed by the well vault, remediation is a high priority.

Rehabilitation Of Well No. 1. Well No. 1 is the oldest of the Town’s four active production wells. As noted in Task 4 Water Source Data Collection, there is a significant accumulation of sediment in the bottom of the well. The perforated casing has some encrustation that interferes with the efficiency of the well. Rehabilitation would consist of removal of the sediment and a mechanical and/or chemical treatment to remove the scale from the perforated section of the well casing.

Inspect And Clean Storage Tanks. The American Water Works Association and the EPA recommend that municipal water storage tanks be inspected and cleaned on a regular basis, usually every three to four years. Various firms conduct such work without the necessity of draining the tanks and cost is very reasonable. Cleaning and inspection allows the Town to address maintenance issues before any serious damage can occur, thus avoiding excessive repair costs in the future.

Well And Pump Maintenance. As described in Section 9 Water System Financing, we recommend that the Town establish a sinking account to provide a source of funds for short-term emergency repairs.
Replacement Of Old/Aging Hydrants. As funds become available, the Town should prioritize replacement of older hydrants found to be leaking, broken, or inoperable.

STRUCTURAL IMPROVEMENTS – SECONDARY PRIORITIES

Additional Production Well – Replace Well No. 1. Lusk now has, with its four production wells, sufficient capacity to meet present and future demand. However, redundancy in public water systems is always desirable. Well No. 1 may be nearing the end of its life span. We recommend the Town consider an offset well to replace No. 1. This would be a new well designed according to public water system standards including an above-ground well house.

Additional Production Well – Well No. 3 Site. Well No. 3 was abandoned due to incorrect completion and interconnection with the Niobrara River. A new properly designed well at this site is likely to be a good producer and has the advantages of proximity to the existing transmission line from the east wells to the storage tanks.

Routine Replacement Of Water Lines And Valves. The hydraulic model identified over 30,000 feet of undersized or dead end lines recommended for replacement. We recommend the Town establish a dedicated account to address replacement.

TASK 12. COST ESTIMATES

Cost opinions prepared for a Level I Master Plan Reconnaissance study are intended to allow an “apples to apples” comparison of various system upgrades or improvements recommended by the Consulting Team. These estimates are intentionally very conservative and accurate enough to form the basis of most funding applications. However, we assumed that cost information would be used primarily by the Town to plan for future system improvements by comparing relative costs and determining priorities for available funding.