Appendix B – 2009 Water System Master Plan

FINAL DRAFT

WATER SYSTEM MASTER PLAN
CITY OF WAYNE, NEBRASKA

November 2000

KM-000627

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I. SUMMARY OF FINDINGS AND RECOMMENDATIONS

A. Findings

Major findings of the water system master study are as follows:

1. The water system has been well maintained over the years and the system operator is very knowledgeable and experienced in system operations and maintenance.

2. The majority of the water system provides adequate pressures and fire flows to its customers. There are a few specific areas, however, where the existing water distribution mains cannot support fire flow conditions that are required.

3. The existing well field has sufficient capacity by Health and Human Services Department and industry standards. Well field capacity improvements will be necessary prior to the Year 2020 to meet projected demands.

4. The existing finished water storage provides approximately 73 percent of the recommended storage to meet projected demands within the study period. A new 300,000 gallon elevated storage tank is recommended later within the study period.

B. Recommendations

1. A phased recommended construction plan is being proposed to establish system priorities and more equally level financial requirements.

2. The phased plan is prioritized in four segments. Phase 1 recommended improvements have a more immediate need (prior to Year 2005) while Phase 2 improvements can be deferred, but are desirable prior to the Year 2010. Phase 3 improvements should be implemented prior to the Year 2015 and lastly, Phase 4 improvements should be implemented as planned development occurs and prior to Year 2020.

3. A Source Water Assessment Program (SWAP) has been implemented to identify potential contamination sources and risks to the City's well field. The SWAP should be reviewed on an annual basis to ensure the City of Wayne maintains an excellent water quality.

4. The following Table 1 summarizes recommended phased system improvements:

Table 1
Summary of Recommended Water System Improvements

Phase 1 (2001-2005)	
• Water Distribution Mains-Fire Protection	$219,000
• Transmission Main Relocation	$200,000
• Chemical Feed Systems	$30,000
Total Phase 1	**$449,000**
Phase 2 (2005-2010)	
• Redundant Transmission Main	$2,485,000
• Water Main - Country Club Road	$205,000
Total Phase 2	**$2,690,000**
Phase 3 (2010-2015)	
• Elevated Water Tank	$705,000
• Distribution Mains on Country Club Road	$326,000
Total Phase 3	**$1,031,000**
Phase 4 (2015-2020)	
• Well field Improvements	$250,000
• Water Distribution Mains for Looping and Future for Looping and Future Service Areas	$1,096,000
Total Phase 4	**$1,346,000**
Total Recommended Water System Improvements	**$5,516,000**

5. The total recommended improvements over the 20 Year period are approximately $5.5 million. The most probable funding alternatives include general obligation or revenue bonds, USDA-RD grants and loans, Water State Revolving Loan Fund and/or special assessments. Any combination of these funding mechanisms can be utilized.

II. INTRODUCTION

A. Purpose

The purpose of this study and report is to review and evaluate alternatives for accommodating the needs of the City of Wayne's public water supply system and provide recommendations relative to the supply and distribution systems including water storage. Recommendations for water system improvements will meet Wayne's projected water needs for a 20-year planning period through the year 2020.

B. Scope of Services

This report will project water demands, review service to the study area, provide estimates of probable costs and review financial considerations. Kirkham Michael contracted in April 2000 to complete a Water Master Study and Report. The specific scope of work for this study is as follows:

Project Management

1. *Initial Kick-Off Meeting*

A meeting will be scheduled before project work begins to encourage the City of Wayne staff input and to provide for the exchange of ideas and information relative to the evaluation and study. The objective of this meeting is to develop a clear understanding of the project scope of services, design criteria and expectations, obtain background information and refine the project schedule.

2. *Data Collection and Background Research*

The KM team will obtain the following information:

- Obtain City plans and specifications, aerial photographs, U.S.G.S. maps, floodplain information, water operations records and data, water and wastewater system maps, Insurance Service Office reports and other pertinent records.
- Photograph the key components of the study area.
- Obtain and review existing customer and metered water use records.
- Determine critical elevations within the existing and future service area.
- Copies of any water distribution main failure studies, maps, or reports.
- Obtain financial information regarding capital improvements.
- Obtain and review planning studies and maps regarding projected population and growth areas.
- Interview key administration and water system operating personnel.
- Review pump and supply well control strategy, i.e., what controls pumping capacities, levels and pressures in the system.
- Review the operational processes to determine normal practices, methods, and emergency procedures.
- Copies of any available geotechnical data and reports.
- Copies of any hydrogeology well supply reports or studies.

3. *Periodic Review Meetings*

Periodic review meetings will be established with the City to discuss the status and progress of the project. The meetings will be scheduled at the 30% and 90% complete study milestones to review progress and status of the project.

4. *On-going Project Communications and Correspondence*

KM will maintain frequent communications with City staff and other interested parties as the project dictates. Project documentation and correspondence will be produced as necessary and filed for the record.

5. *Maintain Project Schedule*

The study is to be completed in accordance with the schedule established for the project. KM will report on the status of the project schedule at two-week intervals; and at appropriate intermediate intervals as needed.

6. *Submittals*

   a. Preliminary Draft Water Master Study

   b. Final Water Study Report

Distribution System Analysis

- From the existing maps, develop the computer model(s) on Cybernet computer modeling program. A copy of the model data files will be delivered to the City.
- Calibrate the model by field measurements for pressure and fire hydrant flow tests. Field testing for calibration purposes will be provided by City staff, if necessary. The consultant team will review all existing data in order to verify the assumptions to be used for pipe roughness coefficients in the model.
- Define boundaries of water service planning area taking into account future population, growth patterns, and water demands.
- Determine the peak day water demand for the design year. The design year will be arrived at by mutual discussion between the KM team and the City, however, is usually 20 years in the future. Factors to be considered include lawn irrigation, population, future land use considerations, industry demands and operating policies.
- In addition to normal domestic water uses, fire flow demands will be simulated on the computer to determine distribution pipe losses and pumping capacities. The ISO Report will be utilized to review needed fire flow for high-value buildings or districts.
- Identify alternate improvements and model their impact. During this sub-task, considerable judgement must be exercised to balance overall distribution pipe capacity with pump operating characteristics. These issues will be coordinated with City staff.

- Make comparative cost estimates for the various alternatives in order to screen and define the solutions in the next task.
- Identify undersized distribution and transmission mains. Subsequent analysis will be performed with proposed improvements for replacing undersized mains.
- Water main failure history will also be analyzed to determine trends and system deficiencies.
- Determine the need for and capacities of stand-by power generation or drive units for existing pumps.
- Various computer analysis of the distribution system will be conducted under average and peak flow conditions. The trials will simulate fire demands on the system at several key locations throughout the City. These may include schools, downtown areas, industries, rest homes , hotels, apartments, and office buildings, as well as residential areas. Factors that can be varied are:
    - system demands
    - time of day during peak pumping season
    - fire flow requirements
    - roughness coefficients of pipe
    - size of pipe in future pipe network
- Based upon the findings in the above sub-task, the most cost effective solutions will be evaluated. Alternatives will consider variances in size of pumps, pipe and storage capacity.
- A file of all computer trials will be maintained for reference and a single copy catalog will be provided to the City.

Water Quality, Supply and Treatment

- Meet with NHHS staff to review existing raw water quality and discuss water quality requirements, especially in regard to the Federal Safe Drinking Water Act Amendment recently adopted by Congress.
- Evaluate the existing north well fields and determine location for alternate or additional sources of supply, if necessary, for the planning period. Analyze available water quality data from each well and review well performance.

Consideration will be given to all alternates including well field treatment consolidation.

- Evaluate peak day demands and recommend treatment processes and expansions for meeting future demands. Of special importance is the cost effectiveness of various treatment alternatives. All factors will be considered including water quality, operation and maintenance expenses, capital costs, and treatment alternative impacts.

Water Storage and Pumpage Requirements

- Determine the need for additional storage to meet peak day demand and evaluate the storage requirements for needed fire flow on the total system. Review site locations for future storage facilities to ensure compatibility with existing distribution system hydraulics and future requirements.
- Evaluate and make recommendations on the capacity of any future booster pump stations that may be necessary to establish additional pressure zones.

Develop Construction Stages

- Recommend the most cost-effective solution, prioritize and divide the water improvement projects into phases, if necessary, to meet the funding capabilities of the City. Each phase shall meet certain goals and be a separate and operable addition to the overall master plan.
- Identify financial methods for construction, operation, maintenance, and management of the water system.
- Report on possible funding assistance from State or Federal agencies, by grants, loans, etc.
- Summarize the recommended plans and the financial options for the water system for review by City staff.

Prepare Opinions of Probable Construction Costs

- Evaluate the cost of viable alternatives from the standpoint of initial capital and operations and maintenance cost items included will be construction, land, easements, legal, engineering, and financing. Fuel, power, maintenance, equipment, replacement and labor will be evaluated for each alternative.

- Index the opinions of probable costs for future inflation considerations.
- Review the costs and alternatives with the City staff.

Prepare Final Report

Following the completion of the preceding tasks, the team will prepare the report for the water system which will summarize our findings, conclusions and recommendations. We will include design parameters, costs, priorities, proposed layouts, updated distribution map and financial data. Supplemental information pertinent to the study will be included in the appendix. This information may include calculations, correspondence, meeting summaries, cost estimates, data and test reports. Preliminary and final drafts will be submitted for review and 20 final report copies will be furnished for your use.

City's Responsibility

The City will be responsible for the following tasks:

1. Designate City Project Manager for direct liaison with KM study team.
2. Supply all maps, drawings, records, and other available data pertinent to the project.
3. Make necessary policy and budgetary decisions to enable timely completion of the work.
4. Coordinate, arrange, and conduct meetings with representatives of the affected property owners and agencies, as required to complete the work.
5. Provide City plans and specifications, aerial photographs, floodplain information, water distribution system maps, Insurance Service Office reports and other pertinent records.
6. Provide existing customer and metered water use records.
7. Copies of any water distribution main failure studies, maps or reports.
8. Provide financial information regarding capital improvements.
9. Comprehensive planning documents regarding projected growth areas and population forecasts.

10. Copies of any available geotechnical data and reports.
11. Copies of any available hydrogeological reports or studies.
12. Provide any testing required including water quality testing.

III. STUDY AREA

The study area consists of all area within the Wayne city limits and the future land use plan, as referenced within the adopted Comprehensive Plan. Wayne is located in the northeastern segment of the State and is the County Seat of Wayne County. Wayne is approximately 35 miles north and east of Norfolk. The City has primary access to Nebraska Highway Nos. 15 and 35. The 1990 Census population was 5,142. The terrain within the study area is gently sloping and is at U.S.G.S elevations ranging from 1430 to 1520. The soils within this area are characterized by the Moody classification. These soils are generally deep, well-drained and are nearly level. These types of soils are normally found on broad divides and uplands. The soil types are generally a combination of loam and silt. Moody soils have a high available water capacity and moderately slow permeability. The organic content is moderate and natural fertility is high. These soils are well suited to dryland and irrigation farming and normally reflect slopes of 2-7 percent. The southern sector of the City is influenced somewhat by the South Logan Creek, which is the major drainage tributary for the City.

The planning period for the proposed improvements of this report is a 20-year period through the year 2020. A design period of approximately 20 years is normal for these types of water utility improvements.

IV. WATER REQUIREMENTS

A. Population

The City of Wayne's population has generally increased over the last 50 years with the exception of a slight decline over the last two decades. The U.S. Census population history is depicted within Table 2 for the decades of 1940 through 1990.

Table 2
Historic and Projected Population

YEAR	POPULATION
1940	2,719
1950	3,595
1960	4,217
1970	5,379
1980	5,240
1990	5,142
2000	6,700*
2010	7,400*
2020	8,200*

*Population projections including Wayne State College.

Although Table 2 historical population (1940-1990) is based upon the United States Census data, it is estimated by Wayne State College and City staff that the estimated current city population is approximately 6,700. If the total (City and College) population is projected to increase approximately one percent annually, the following would result:

Year 2010 - 7,400

Year 2020 - 8,200

These projections are utilized for the purposes of this study.

B. Water Demands

The rate of water use varies over a wide range during different periods of the year and during different hours of the day. Several characteristic demands are recognized as being critical in the design and operation of a water system. In this report demand rates are expressed in gallons per day (gpd) or million gallons per day (mgd) which, in the case of daily use, indicates the total amount of water pumped in a 24 hour period.

The average daily use is equal to the total annual pumpage divided by the number of days in the year. The principal significance of the average daily use is in estimating maximum daily use or maximum hourly demands. The average daily use is also utilized in estimating revenues and operating costs, such as for power or chemicals since these items are determined primarily by the total annual use and not by daily or hourly rates.

Maximum daily use is the maximum quantity pumped in any day during the year. The maximum daily use is the critical factor in the design of certain elements of the water system. The principal items affected by the maximum daily use are:

1. Aquifer capacity;
2. Raw water supply facilities;
3. Storage capacity requirements;

Raw water supply facilities should be adequate to supply the maximum daily use in a 20-hour period and equal or exceed the design average day demand with the largest producing well out of service.

Water use consisting of the City's well pumpage for the years 1997 through 1999 were reviewed. The highest demand year was 1997, with a total annual pumpage of 326,826,000 gallons or an average day demand of approximately 895,000 gallons per day. Based upon pumpage records, the maximum day of record for the three year period was approximately 2,217,200 gallons per day on July 28, 1998. Based upon these actual data, current water demands are presented in Table 3, as follows:

Table 3
Historic Water Demands
1997 - 1999

	1997	1998	1999
Annual Water Pumpage (mg)	326.8	317.8	297.7
Average Day - Pumpage (gpd)	895,340	870,680	815,610
Per Capita Demand (gpcd)	174*	169*	122
Maximum (mg)	1.69	2.22	1.80
Ratio - Peak Day/Ave. Day	1.9	2.5	2.2
Annual Water Sales (mg)	249.9	239.4	260.0
Unaccounted for Water (percent)	23.5	24.7	12.7

mg = million gallons

gpd = gallons per day

gpcd - gallons per capita per day

* Per Capita Demand values shown may be higher than actual as 1990 population data apparently did not include Wayne State College students.

The three year data (1997 - 1999) generally represents information that would be typical for a Nebraska community. Maximum day information indicates a peak day to average day ratio range of 1.9 to 2.5. The ratio of the maximum day to the average day is normal, indicating an absence of excessive water use.

Unaccounted for water which is the difference between water pumped and metered water is important to monitor. When unaccounted for water is above 20 - 25 percent, surveys or investigations should be completed. This is water that is typically attributed to hydrant usage and maintenance, unmetered usage, water distribution leaks and inaccurate meter registration. The unaccounted for water indicated in Table 3 ranges from 12.7 to 24.7 percent. The average for the three year period is 20.3 percent. This amount usually is considered marginal unless a substantial portion can be documented or estimated as unmetered. The City staff should monitor unaccounted water on an annual basis.

C. Future Requirements

The current per capita water demands are utilized concurrently with the projected population in the design year 2020 to determine the future average day and maximum day water demands. Per capita water demands may actually decrease through the future years, due to on-going development and use of water saving plumbing fixtures and appliances as well as continuing pressure for water conservation. These decreases are difficult to accurately predict at this time, and therefore, it is prudent to use the current per capita demands for the improvement design.

These future water demands are shown in Table 4, as follows:

Table 4
Population and Water Demand

Year	Population	A.D.D. (gpd)	M.D.D. (gpd)
2000	6,700	895,000	2,200,000
2010	7,400	984,200	2,460,500
2020	8,200	1,090,600	2,726,500

A.D.D.- Average Day Demand (gallons per day)

M.D.D. - Maximum Day Demand (gallons per day)

These projected future water demands are used as the basis of the sizing and design of the proposed improvements. The 2000 water demands represent the peaks for the past three years (1997-1999) and should be a conservative approach or represent continued drought conditions. The per capita average day demand was projected at 133 gallons/day and the maximum day demand was projected at 2.5 times the average day demand.

V. DESIGN STANDARDS

All design criteria, materials and equipment discussed in this report and included in the final project design shall meet the requirements of State and Federal laws and regulations, including:

A. Nebraska Department of Health Regulations Governing Public Water Supply Systems - 179 NAC2

B. Great Lakes Upper Mississippi River Board of State Health and Environmental Managers (Ten State Standards) Recommended Standards for Water Works

VI. EXISTING FACILITIES

The existing water system is generally shown on Figure 1. The community's first public water system was probably installed in the 1890's.

A. Source Wells

The Wayne water source consists of six active water production wells. The wells pump directly into the distribution system. Fluoride is added at the wells. Two wells (Nos. 4 and 5) are located within the northern sector of the City limits. Two wells (Nos. 6 and 7) are located within or near the golf course. The primary production wells (Nos. 9 and 10) are located approximately six miles northwest of the City. These two wells pump 93-95 percent of the annual total pumpage into the water distribution system. Construction data and operating characteristics of the six wells is displayed in Table 5, as follows:

Table 5
Well Construction and Operations Data

Data	Well No. 4	Well No. 5	Well No. 6	Well No. 7	Well No. 9	Well No. 10
Year Constructed/New Pump Installed	1999	1964	1970	1970	1988	1990
Depth, ft.	105	125	185	103	253	262
Casing Size, Inches	12	12	12	12	16	16
Screen Size, Inches	n/a	n/a	12	12	16	16
Screen Length, ft.	n/a	n/a	20	20		81
Pump, hp	50	n/a	60	50	125	125
Pump Discharge Pressure, psi	60	62	50	90		
Pumping Capacity, gpm	330	475	600	500	700	1000
Pump Column Diameter, Inches	6	6	6	6	8	8
Static Water Level, ft.	95	82	137	47	114	145
Pumping Level, ft.	105	87	138	62	135	155

n/a = not available

The wells are radio controlled by the water tank levels within the two existing storage tanks. The system is served with one pressure district with no booster pumps.

None of the water wells have emergency power capabilities. Electricity is provided by the Northeast Nebraska Public Power District. The City does have portable generators that can be utilized during an extended power outage.

B. Water Quality

A review was completed of all water quality analysis that was provided and on record at the State Department of Health and Human Services. These tests were for inorganic chemicals such as arsenic and nitrates, synthetic organic chemicals such as pesticides and volatile organic compounds. Also, additional water quality testing was conducted within the study. Wayne's water quality meets the State and Federal Safe Drinking Water Act requirements. Nitrates are higher within the City's wells, such as Number 6, and range

consistently in the range of 8 - 9 mg/l, which is near the Federal standard Maximum Contaminant Level (MCL) of 10.0 mg/l. However, the primary wells (Nos. 9 and 10) are in the range of 2 - 3 mg/l, resulting in a blend within the distribution system, which is well within the Federal limits. The City is also within the lead and copper action levels that are causing concern to many Nebraska communities. The water quality from the two primary production wells (Nos. 9 and 10) is significantly better than the other four wells. As previously mentioned, these two wells produce the majority of source water (93-95 percent). Even though, the water quality within the other four wells (Nos. 4 - 7) generally meets State and Federal standards, the aesthetic parameters are not as desirable. These four wells are much higher in hardness and total dissolved solids. These water quality parameters can impart objectionable tastes and odors to the water and results in drinking water that is not aesthetically acceptable. In addition, Well Nos. 5, 6, and 7 all show nitrate levels that are high. Well No. 5 nitrate levels are above the mcl of 10.0. This discussion emphasizes the importance of the north well field (Numbers 9 and 10) and its substantial impact to the City's overall quality and quality of water provided to the community. A Source Water Assessment Program (SWAP) has been implemented. The SWAP should be reviewed on an annual basis. The following table summarizes the water quality data:

Table 6
Water Quality Data

	Well No. 4	Well No. 5	Well No. 6	Well No. 7	Well No. 9	Well No. 10	Distribution System (Light Plant)
Test Date	n/a	11/24/99	5/25/00	4/29/00	5/25/00	n/a	5/25/00
Sodium	n/a	17	42.3	n/a	16.3	n/a	17.4
Calcium	n/a	n/a	153	n/a	105	n/a	112
Magnesium	n/a	n/a	35.7	n/a	22.5	n/a	23.2
PH (unit)	n/a	7.6	7.85	n/a	7.95	n/a	7.92
Nitrates	n/a	12	9.0	8.8	3.0	n/a	2.8
Sulfates	n/a	115	155	n/a	92	n/a	109
Conductivity (mmhos/cm)	n/a	0.719	1.065	n/a	0.674	n/a	0.716
Total Dissolved Solids	n/a	n/a	692	n/a	438	n/a	465
Hardness (gn/gallons)	n/a	20.2	31.0	n/a	20.8	n/a	22.0
Iron	n/a	0.01	N.D.	n/a	N.D.	n/a	N.D.
Manganese	n/a	n/a	N.D.	n/a	N.D.	n/a	N.D.
Chloride	n/a	2.2	30	n/a	2	n/a	2

1) All concentrations are in parts per million unless otherwise noted

2) N.D. = Not Detected.

3) n/a = not available

C. Water Mains

The public water mains within the City range generally from 2 inches to 12 inches in diameter. There is also a 16-inch diameter transmission main from the north well field located approximately six miles north of the City. The majority of these distributions mains are of cast iron or ductile iron materials, with some newer PVC extensions. Many of the sand cast iron mains were probably constructed in the era from 1940-1960. Several mains are dead-end, which can cause a reduction in water quality and fire flow protection. City staff indicates there are 17 dead end locations. The frequency and quantity of water main

breaks do not appear to be a problem. The City is 100 percent metered. Meters have remote readers. Many meters are over 10 years old and should be replaced.

The fire hydrants and distribution valves are maintained by the City water staff. There are approximately 262 hydrants in the system. The hydrants are generally flushed every fall. Valves are reported to be exercised once every three years. Some system valves are probably inadequate and some fire hydrants lack appropriate hydrant branch valves.

The existing distribution system serves the basic domestic water service needs of most of the users. The normal operating system pressures range from 36 psi to 91 psi.

The majority of the system has adequate water mains to provide the needed fire flow. There are a few areas including some of the residential areas between 8th and 12th Streets, from Douglas to Walnut and also in the Central Business District (CBD), that have undersized water mains that do not provide the needed fire flow. Many of these mains are probably 4-inch unlined cast iron pipe installed during the 1930-1940 era.

The Insurance Services Office periodically conducts a review and classification of a community's fire suppression system which includes evaluations of the water system, fire department and fire communications. This was last conducted in Wayne in 1985 and resulted in an overall classification of 6 (on a scale of 1-10 with one being the best rating). A major factor in the evaluation was the level of available hydrant fire flows in specific areas of the City. The Insurance Service Offices 1985 Hydrant Flow Data Summary is included in Appendix "B".

The fire flow capabilities of Wayne's water system have improved considerably, as evidenced by the computer model, since the ISO study was conducted. An improved rating should result from the next ISO study. It may be appropriate for City officials to request an ISO evaluation at this time.

The community has a strong 40-member volunteer fire department with the following major equipment capabilities:

1 - 1976 Ford aerial ladder truck
1 - 1976 GMC tanker truck
1 - 1980 Chevrolet first response truck
1 - 1985 Chevrolet tanker truck
1 - 1986 GMC pumper truck
1 - 1987 Chevrolet Suburban command car
1 - 1991 Ford van carrier
1 - 1992 INC pumper truck
1 - 1999 Ford equipment truck

D. Water Storage

The City is served by one 500,000 gallon elevated storage tank and one 750,000 gallon standpipe. The elevated, hydropillar style tank is located in the northeastern part of the City near the industrial park. The standpipe is located at the northwest fringe of the City. Although the standpipe is located on higher elevations, a substantial percent of its height is not usable for hydraulic purposes. The effective or usable storage volume for the water system is 808,000 gallons, which includes the 500,000 gallon elevated tank and the top 38 feet of the standpipe (308,000 gallons).

VII. DESIGN CRITERIA AND EVALUATION OF EXISTING FACILITIES

A. Source Wells

Groundwater supply sources shall be capable of supplying the maximum day demand or the average day demand with the largest well out of service. For the design year 2020, the maximum day is projected to be 2,726,500 gpd (1893 gpm) and the average day is projected to be 1,090,600 gpd (757 gpm).

Existing system rated well capacity is approximately 3600 gpm. The firm capacity with the largest well out of service is approximately 2600 gpm. The well field capacity is

therefore, adequate to meet projected demands through 2020, assuming all existing well capacity is maintained.

The EPA has published drafts of the proposal Groundwater Rule. The Final Rule will probably be issued later this year and effective by 2003. Most communities within Nebraska will probably be affected by the Groundwater Rule.

With the proposed groundwater disinfection rule, the City may need to plan for the addition of chemical feed equipment at the wells. In order to provide the necessary contact time for the chlorine, prior to any service connections, Wells 4 and 5 will probably need to be abandoned/decommissioned. Well No. 6 has already been decommissioned and No. 7 is used for irrigation purposes only.

Well Nos. 9 and 10 have a total capacity of 1,700 gpm and a firm capacity with the largest well out of service of 700 gpm. These capacities are minimal when compared to 2020 projected demands of 757 gpm firm capacity and 1,893 gpm of total required capacity. The north well field capacity will need to be increased in the future. This can be accomplished by adding one new production well with similar capacity. It may be possible to increase well No. 9 capacity by installing a new large pump or adding stages to the existing well pump.

The City has provided separate chemical rooms at the wells and these rooms can be utilized for the chlorination equipment. The addition of liquid form chlorine (sodium hypochlorite) is recommended. The chemical can be fed into the transmission main from drums by chemical metering pumps. Equipment to monitor chlorine residuals is also recommended.

The required contact time was computed at 1,800 gpm in the 16-inch transmission main. At 15°C with a 1.0 mg/l chlorine residual, approximately 90 minutes are required. This equates to approximately 15,500 ft. (3 mi.) from the point of chlorine application. Therefore, a minimum of 3 miles should be maintained without any individual service lines

B. Water Storage

Effective storage shall be provided in an amount equal to the average day demand or as required to provide fire protection in systems that provide fire flow.

Based upon average day demand water use, the amount of storage to be provided is approximately 1,090,600 gallons. Based on existing effective storage of 808,000 gallons, an additional 300,000 gallons is recommended (utilizing standard tank size) prior to the year 2020.

C. Water Mains

The water mains should be sized to provide the needed fire flow to each respective location. Generally, a minimum main size of 6 inch diameter is required to provide minimum fire flows and is the recommended minimum diameter by Ten State Standards. If undersized mains are utilized, excessive velocities and headlosses will prevent adequate available fire flow. Therefore, it is generally recommended that a minimum diameter of 6 inch be utilized for all water main replacements or extensions to new service areas. Also, mains should be connected in loops whenever possible to provide circulation, better water quality and increased fire flow protection.

The water main system in Wayne generally provides adequate domestic flow to most areas of the City. Some main improvements are recommended, however and are discussed in the following sections of this report.

VIII. WATER SYSTEM ANALYSIS

The existing water system was computer modeled using the Cybernet Program. The program was first calibrated to ensure the computer model performed within generally acceptable tolerances of actual field measured conditions. The calibration was completed and the computer results matched the field pressures with good correlation. Significant changes have occurred in the water distribution system since the 1985 ISO report was completed, including construction of the 500,000 gallon elevated storage tank. A system was formulated to approximate the water system that existed at the time of the ISO report. Results from modeling of this system were compared to the results of the ISO study. Some minor variations between the flows available in ISO field tests and the

computer model were observed; however, the two generally matched with good correlation. It is important to note that the ISO available flow only represents the amount of flow available at the time of the test under the physical conditions during the test. These ISO hydrant field tests were conducted in June 1985. The following Table 7 documents the computer values with actual field pressures. The results shown in Table 7 represent system performance with the existing mains, wells and storage tanks. It should be emphasized that the values represented in the table are only instantaneous or short term and would not represent the capabilities for a two hour fire flow duration, for instance. Also, two existing systems were modeled. The first system (AFFM1) represents the system before 1985, when the ISO field testing was done. The second system (AFFM2) represents the system after 1990 when the 500,000 gallon elevated tank was installed and is more representative of the City's existing distribution system.

Table 7
Needed and Available Fire Flows
Existing Water System

Map Reference	Location	NFF	AFF1	AFFM1	AFFM2
30	10th and Lincoln Street	1,000	n/a	630	680
40	13th and Lincoln Street	2,000	5,000	1,400	3,350
45	10th and Nebraska Street	2,000	750	1,300	1,500
52	North End of Walnut St. Near College	3,000	n/a	460	500
83	5th and Windon Street	1,000	n/a	1,450	3,500+
95	Sherman and Grainland Street	1,000	n/a	1,650	2,900
98	1st and Birch Street	1,000	1,600	1,670	1,900
102	2nd and Main Street	2,500	1,300	1,520	3,500+
113	5th and Wayside Lane	2,500	1,400	1,420	3,500+
115	7th and Pine Heights Road	1,700	1,200	1,420	3,500+
130	9th and Main Street	2,000	1,400	1,450	3,500+
135	6th and Lincoln Street	2,500	n/a	1,570	2,900
145	Sunset Dr. and Westwood Rd.	1,000	n/a	850	990
169	4th and Sherman Street	2,250	1,500	1,500	3,500+

175	7th and Oak Drive	3,000	3,700	3,200	3,500+
178	7th St. West of Donner Pass	1,000	n/a	1,400	1,500
195	1st and Logan Street	2,500	1,600	1,500	3,500+
200	Fairground Ave. & Windon St.	3,500	1,100	1,500	3,300
222	Providence Rd. at 12th St.	1,000	n/a	1,400	3,500+
230	Claycomb Rd. & Brooke Dr.	1,000	n/a	1,350	3,200
255	7th & Thorman Street	1,000	n/a	1,400	3,500+
273	Main St. at Country Club Rd.	3,000	n/a	1,200	2,750
284	Main St. at Golf Course North Limit	3,000	n/a	1,200	2,650
287	Country Club Rd. North of Claycomb Rd.	2,000	n/a	1,200	3,500
289	Country Club & Centennial Rd.	2,000	n/a	1,300	3,500+
298	14th & Centennial Road	3,000	n/a	1,360	3,500+
311	East City Limits	2,000	n/a	1,400	3,500+

NFF - Needed Fire Flow

AFFI - Available Fire Flow from 1985 Insurance Service Office Report

AFFM-1 - Available Fire Flow Model Pre-1985 System

AFFM-2 - Available Fire Flow Model - Existing System

Refer to Figure 1 to locate map references

3500+ indicates fire flow availability exceeds 3,500 gpm

Following analysis of the existing system, various "improved" systems were modeled to provide the NFF to each area in Table 7 which did not meet the Needed Fire Flow. Various water main improvements were analyzed to recommend a program of improvements to economically deliver the required fire flows, at the required pressure, at each location.

The flowrates available at the critical locations with the recommended improvements are shown in Table 8.

Table 8
Available Flowrate at 20 psi
with Recommended Improvements

Map Reference	Location	NFF	AFFMIMP
30	10th and Lincoln Street	1,000	2,910
40	13th and Lincoln Street	2,000	3,500+
45	10th and Nebraska Street	2,000	3,500+
52	North End of Walnut St. Near College	3,000	3,500+
83	5th and Windon Street	1,000	3,500+
95	Sherman and Grainland Street	1,000	2,930
98	1st and Birch Street	1,000	1,910
102	2nd and Main Street	2,500	3,500+
113	5th and Wayside Lane	2,500	3,500+
115	7th and Pine Heights Road	1,700	3,500+
130	9th and Main Street	2,000	3,500+
135	6th and Lincoln Street	2,500	2,980
145	Sunset Dr. and Westwood Rd.	1,000	1,000
169	4th and Sherman Street	2,250	3,500+
175	7th and Oak Drive	3,000	3,500+
178	7th St. West of Donner Pass	1,00	1,530
195	1st and Logan Street	2,500	3,500+
200	Fairground Ave. & Windon St.	3,500	3,360
222	Providence Rd. at 12th St.	1,000	3,500+
230	Claycomb Rd. & Brooke Dr.	1,000	3,260

255	7th & Thorman Street	1,000	3,500+
273	Main St. at Country Club Rd.	3,000	3,500+
284	Main St. at Golf Course North Limit	3,000	3,420
287	Country Club Rd. North of Claycomb Rd.	2,000	3,500+
289	Country Club & Centennial Rd.	2,000	3,500+
298	14th & Centennial Road	3,000	3,500+
311	East City Limits	2,000	3,500+

NFF - Needed fire flow

AFFMIMP - Available fire flow model, with recommended improvements

Flowrates in gallons per minute

Fire flows simulated with the recommended water main improvements

IX. RECOMMENDED IMPROVEMENTS AND ESTIMATES OF PROBABLE COST

A. Water Main Improvements

In order to provide better operating pressures and provide the recommended fire flows to the critical areas as identified in Table 8, some water main improvements are recommended. These recommended water main improvements are shown in Table 9 and are depicted graphically within Figure 1.

Additionally, several water main improvements are recommended to loop existing deadend mains and to serve future development areas and recommended storage improvements. These improvements are shown in Table 10 and also within Figure 1.

City staff have indicated that some water mains within the system may be subject to internal corrosion and also some water main breaks. Many of these mains were probably unlined cast iron mains installed within the 1930-1994 era. Also, there is some concern with the 4-inch cast iron mains within the Central Business District (CBD). We have recommended new mains to provide the needed fire flow to the CBD; however, a program of replacing 4-inch mains with 6-inch mains on a periodic basis is good industry practice. Mains that can be identified with structural deficiencies (main breaks) and are an internal corrosion concern should be replaced as they are programmed.

A portion of the existing 16-inch transmission main from the north well field will need to be relocated in the future. The Nebraska Department of Roads has two Highway No. 15 projects programmed for the immediate Wayne area. The Highway No. 35 South Project (0.5 miles) is programmed for 2004. It is not anticipated that substantial utility relocation will be necessary for this project. However, the second project (Wayne North) begins at 14th Street and terminates at Dog Creek north of the Golf Course. The project includes grading, excavation and shifting of the roadway to the west, requiring the relocation of the 16-inch water transmission main. The project will absorb costs of the transmission main relocation within the City limits. It is estimated that approximately 0.5 miles of relocation is beyond the City limits and will need to be financed 100 percent by the City. The project is currently programmed for 2005.

The City also wants to provide an additional 16-inch water transmission main from the north well field for a redundant, reliable source of water supply to the City. This is important as the north well field is the primary long term source of quality water for the City. An alignment within the country road right-of-way one mile west of Highway No. 15 is recommended for this new transmission main. The transmission main should be connected to future 12-inch mains at Country Club Road and west of the current water storage standpipe site. This new transmission main is depicted schematically on Figure 1. The main will be 16-inch diameter and approximately 33,800 feet long and should be constructed prior to the Nebraska Highway No. 15 Project.

Table 9
Recommended Water Main Improvements-Fire Flow Requirements

No.	Description	Size (inches)	Length (ft.)
1	10th Street from Sherman Street to Main Street	6	1,600
2	12th Street from Pearl Street to Main Street	6	400
3	Drive West of Walnut Street from 14th to 12th Street	10	550
4	5th Street from Pearl Street to Logan Street	6	800
5	3rd Street from Lincoln Street to Main Street	6	800
6	2nd Street from Lincoln Street to Main Street	6	800

Table 10
Recommended Water Main Improvements-Looping and Future Service Areas

No.	Description	Size (inches)	Length (ft.)
1	Centennial Road, 14th Street to North Limit	12	4,200
2	2,000 ft. North of Country Club Road	12	4,300
3	Claycomb Road, Brooke Drive to Country Club	8	650
4	County Road West of Fairgrounds	12	7,700
5	From Standpipe West to County Road	12	2,200
6	7th Street, from Dead-end West to County Road	8	900
7	Grainland from Maple to County Road	8	2,200
8	Country Club Road, from Well 6 West to County Road	12	3,800
9	Grainland from Sherman to Pearl Street	8	1,100
10	From 7th Street South to Dead-end on Nathan Drive	8	600

B. Storage Improvements

A new elevated water storage tank is recommended as previously discussed. The new tank should be sized to bring the system's effective storage to 1,100,000 gallons.

Sites on Country Club Road, whether at the east or west City limits, would be good sites with topographical advantages. The site to the east would require a taller tank making it less cost-effective. The recommended site is near the existing standpipe. Construction of a new 300,000 gallon elevated tank is recommended in the vicinity of the existing standpipe. An overflow elevation of 1642.42 (USGS) to match the existing tank overflow is recommended at the tank site. A minimum site size of 150 ft. X 150 ft. should be provided for the new elevated storage tank.

A larger elevated tank (600,000 gallons) should also be evaluated or alternately bid. If the larger tank was constructed, the existing standpipe could be demolished.

C. Well Improvements

As mentioned previously, Year 2020 projected demands will require additional well capacity. It may be possible to increase capacity of Well No. 9 by replacing the pump or adding additional stages. If not, a new well will be required. The City has an option for additional well field land. The option should be maintained or the City should purchase the property. Also, emergency power capabilities should be provided.

D. SCADA System

The City has initiated a program to replace the existing controls for the wastewater lift stations. The system being utilized is a programmable logic controller (PLC) system called Sensaphone. The system utilizes telephone communications and radio communications across a range of frequencies to link sites at the wastewater treatment plant, lift stations, and operating personnel sites. The system is relatively inexpensive and can be expanded to encompass all of the lift stations, as well as the water wells and water storage facilities.

Continued use of this system as new facilities are constructed is recommended, as well as incorporation of existing utility facilities into this system, to provide a practical effective water and wastewater control system.

E. Chemical Feed Systems

Chemical feed systems are recommended at Well Nos. 9 and 10, pending issuance of the proposed Groundwater Rule. The systems will be designed to feed liquid chlorine directly into the transmission main at the well houses.

F. Estimates of Probable Cost

1. Water Mains

The following estimates of probable costs are provided for the recommended water mains. The first table represents those water mains recommended to increase fire flow protection while those within Table 12 relate to looping dead-end mains and also future development requirements.

Table 11
Estimates of Probable Costs - Recommended Water Mains-Fire Flow Improvements

No.	Description	Diameter (in.)	Length (ft.)	Unit Cost	Cost
1	10th Street from Sherman Street to Main Street	6	1,600	$32	$51,200
2	12th Street from Pearl Street to Main Street	6	400	$32	$12,800
3	Drive West of Walnut Street from 14th to 12th Street	10	550	$42	$23,100
4	5th Street from Pearl Street to Logan Street	6	800	$32	$25,600
5	3rd Street from Lincoln Street to Main Street	6	800	$32	$25,600
6	2nd Street from Lincoln Street to Main Street	6	800	$32	$25,600
				Contingencies	$24,600
				Opinion of Probable Construction Cost	$188,500
				Engineering	$30,500
				Total Estimated Project Costs	$219,000

Table 12
Estimates of Probable Costs
- Recommended Water Main Improvements-Looping and Future Service Areas

No.	Description	Diameter (in.)	Length (ft.)	Unit Cost	Cost
1	Centennial Road, 14th Street to North Limit	12	4,200	$42	$176,400
2	2,000 Ft. North of Country Club Road Westerly from Centennial Road	12	4,300	$42	$180,600
3	Claycomb Road, Brooke Drive to Country Club Road	8	650	$35	$22,750
4	County Road West of Fairgrounds from Grainland Road to Fairacres Road	12	3,850	$42	$169,400
4a.	County Road West of the Fairgrounds from Fairacres Road to County Club Road	12	3,850	$42	$169,400
5	From existing Standpipe West to County Road on Fairacres Road extended	12	2,200	$42	$92,400
6	7th Street, from Dead-end West to County Road	8	900	$35	$31,500
7	Grainland Road from Maple Street to County Road	8	2,200	$35	$77,000
8	Country Club Road, from Well No. 6 West to County Road	12	3,800	$42	$159,600
9	Grainland Road from Sherman to Pearl Streets	8	1,100	$35	$38,500
10	From 7th Street South to Dead-end on Nathan Drive	8	600	$35	$21,000
11	Pearl Street extended from Clark Street to South End of Highway 15	6	1,200	$32	$38,400
12	2nd Street extended West of Blaine Street	6	250	$32	$8,000
13	Birch Street from 2nd Avenue to 3rd Avenue	6	600	$32	$19,200
14	Sunset Drive at Fairacres Road	6	150	$32	$4,800
15	Sherman Street to Meadow Lane	6	650	$32	$20,800
16	Sherman Street at Westwood Road	6	150	$32	$4,800
17	Tomar Drive, 6th Street to 7th Street	6	350	$32	$11,200
				Contingencies	$184,650
				Opinion of Probable Construction Cost	$1,430,400
				Engineering	$212,000
				Total Estimated Costs	$1,642,400

Note:

Costs for 12-inch mains assume construction prior to development.

Table 13
North Well Field Redundant Transmission Main
and Transmission Main Relocation

Description	Diameter (in.)	Length (ft.)	Unit Cost	Cost
Redundant Water Transmission Main	16	33,800	$56	$1,892,800
Relocation of Transmission Main	16	2,640	$56	$147,840
			Contingencies	$304,360
			Opinion of Probable Construction Cost	$2,345,000
			Engineering	$340,000
			Total Estimated Costs	$2,685,000

2. Elevated Water Storage Tank (Locate near existing standpipe)

- New 300,000 gallon pedestal style elevated storage tank = $550,000
- Sitework = $ 12,000
- Electrical and Controls at Tank = $ 10,000
- Cathodic Protection = $ 7,000
- Contingencies (15%) = $ 73,000
- Legal and bonding expense = $ 5,000
- Geo-Technical Investigation & Testing = $ 8,000
- Engineering = $ 40,000

Total Opinion of Probable Cost $705,000

3. Chemical Feed Systems

- Feed equipment (2) = $20,000
- Contingencies (15%) = $ 4,000
- Engineering = $ 6,000

Total Opinion of Probable Cost $30,000

4. Well Improvements

- New Well and Transmission Piping = $250,000

5. Total Project Improvements

The total opinion of probable costs for the recommended improvements are as follows:

• Water Mains-Fire Flow Improvements	$ 219,000
• Water Mains-Looping and Future Service Areas	$1,627,000
• Redundant Transmission Main & Transmission Main Relocation	$2,685,000
• Elevated Storage Tank	$ 705,000
• Chemical Feed Systems	$ 30,000
• Well Improvements	$ 250,000
Total Opinion of Probable Project Cost	$5,516,000

G. Construction Staging

The total recommended water system improvement for the 20 year study period is $5,516,000. We recommend dividing the improvements into four phases for financial implementation purposes. Phase 1 improvements have an immediate need. Phase 2 improvements are desirable, but can be deferred until Year 2010. Phase 3 recommendations should be constructed prior to Year 2015 and finally, Phase 4 improvements should be completed as future development occurs prior to Year 2020.

New water mains for fire flow improvement purposes are included in the first phase since these improvements will have an immediate impact on the existing system where fire flows are less than recommended. Also included in the first phase is the relocation of a portion of the transmission main, since the Highway No. 15 project is programmed for Year 2005.

The 16-inch redundant transmission main and a portion of the future 12-inch mains are recommended in the second phase. The future mains should be associated with future development of the specific areas.

Construction of the new elevated tank is recommended for the third phase to be constructed by 2010. The exact size and location of the elevated tank can be determined at that time.

The remaining improvements, which include a new well, looping of deadend mains and addition of mains to serve development areas west, north, and east of the City are shown in the final phase. The new well or capacity upgrading of Well No. 9 is also included within the last phase. Timing of these improvements is dependant on the progress of new developments and available budget for looping mains.

The phasing of the improvements with associated costs is shown below:

Phase 1 (2001-2005)	
• Water Distribution Mains-Fire Protection	$219,000
• Transmission Main Relocation	$200,000
• Chemical Feed Systems	$30,000
Total Phase 1	**$449,000**
Phase 2 (2005-2010)	
• Redundant Transmission Main	$2,485,000
• Water Main - Country Club Road	$205,000
Total Phase 2	**$2,690,000**
Phase 3 (2010-2015)	
• Elevated Water Tank	$705,000
• Distribution Mains on Country Club Road	$326,000
Total Phase 3	**$1,031,000**
Phase 4 (2015-2020)	
• Well field Improvements	$250,000

• Water Distribution Mains for Looping and Future for Looping and Future Service Areas	$1,096,000
Total Phase 4	**$1,346,000**
Total Recommended Water System Improvements	**$5,516,000**

X. FINANCIAL CONSIDERATIONS

A. Introduction

The water system improvements to be financed are approximately $5,516,000. Several methods of financing are available, including:

- Revenue Bonds
- General Obligation Bonds
- Community Development Block Grants (CDBG)
- Rural Economic Community Development (RECD) Loans
- Special Assessment Districts
- Drinking Water State Revolving Loan Fund (SRF)

Combinations of these funding sources are also possible. A description of each of these funding methods follows.

B. Revenue Bonds

Revenue bonds may be issued by utilities or jurisdictions that provide services for which revenues are collected. Debt service on the revenue bond issue is paid from the net revenues of the utility. One requirement of revenue bonds is that the total revenues of the utility must exceed the amount of the bond issue by an excess amount referred to as "coverage". This coverage is typically as much as 30% of the annual debt service payments in order to make the bonds attractive to buyers. In projects such as this with large expenditures and debt service requirements, the revenue bond requirement for 30% to 50% coverage often is a hardship to the owner which makes other forms of financing more attractive. Revenue bonds are currently sold at interest rates of 5-6% for 15-20 year terms, depending on market conditions.

C. General Obligation Bonds

General obligation bonds may be issued for this type of improvement. General obligation bonds are repaid from tax levies against properties in the jurisdiction. It is becoming more popular to retire general obligation bonds with utility revenues. General obligation bonds do not require coverage or excess revenues to be accrued, as the bonds are secured by the taxable value of the government agency. General obligation bonds are currently sold at interest rates of 5-6% for 15-20 year terms, depending on market conditions.

D. Community Development Block Grants (CDBG)

Community Development Block Grants are available through the Nebraska Department of Economic Development for this type of project. The maximum grant that is available to the City for this type of improvement is $250,000. Grant applications are ranked on the basis of need, impact to low and moderate income persons, and the feasibility of the project. Pre-applications for water or wastewater projects can be submitted at any time to the Nebraska Water Wastewater Advisory Committee. Their review will normally take 30-60 days. To reach the maximum grant payment, the grantee must provide a local matching payment equal to 50% of the grant amount. A copy of this report should be submitted with the pre-application to the committee for funding consideration. The community's low to moderate income level is 41.25 percent in accordance with the 1990 census.

E. Rural Economic Community Development (RECD) Loans/Grants

Low interest loans and/or grants are available from the federal agency RECD (formerly Farmers Home Administration-FmHA). The loans are available for a term of 40 years at a lower interest rate than is normally available to a city on the open market. However, funds are limited and are allocated based on need and the City's overall financial conditions.

There are many program requirements attached to this type of funding which should be considered before committing to using this financing option. RECD grants are also available; however, these grant funds are very limited. Wayne's Current (1990 Census) Median Household Income is $20,224 which is the best category for funding purposes.

F. Special Assessment Districts

Special Assessment Districts can be created by the City Council to provide improvements such as public water mains. The cost of said improvements would be totally or partially assessed to benefitted properties.

G. Drinking Water State Revolving Fund (SRF)

The 1996 Amendments to the Federal Safe Drinking Act included a State Revolving Loan Fund which generally provides financial assistance to public water supply systems. The primary funding is in the form of a loan, however some portion of the loan can be "forgiven" if the community qualifies. A maximum of 50 percent "loan forgiveness" is possible based upon the communities median household income. With a Median Household Income of $20,224, it may be desirable to pursue SRF funding as well as USDA-RD.

H. Other Financial Considerations

The City's current water rate ordinance was effective in November 1999. Water rates are a combination of a service charge based upon meter size and a volumetric charge of $1.00 per thousand gallons (Gross). The rate is the same for all users. Rates are double for outside - city customers. There are approximately 1,480 residential customers and approximately 235 commercial customers.

It will be necessary for the City to review the existing rate schedule if the proposed water system improvements are implemented. Water rates will probably need to be increased to support the debt service for the improvements. A detailed rate study was not within the scope of services for this study. However, several funding agencies require the customers to fund an annual rate of 1.375 percent times the median household income. This would result in an average residential monthly bill of approximately $23.17 per month.

APPENDIX A

RECENT WATER QUALITY ANALYSIS

REPORT NUMBER
00-147-2002

REPORT DATE
05/25/00

REPORT TO:

CITY OF WAYNE
TIM PICKINPAUGH
P.O. BOX 8 306 PEARL ST
WAYNE NE 68787-1903

Midwest Laboratories, Inc.℠

13611 "B" Street • Omaha, Nebraska 68144-3693 • (402) 334-7770 • FAX (402) 334-9121

JUN 0 1 2000

IDENTIFICATION:

WATER ANALYSIS

COPY TO:

KMA ROUTING

	Orig	Copy	Encl	Initial
Pres.	☒	☐	☐	
VP Eng.	☐	☒	☐	
VP Adm.	☐	☐	☐	
VP OMA	☐	☒	☐	DLC
	☐	☒	☐	
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	

DOMESTIC WATER ANALYSIS

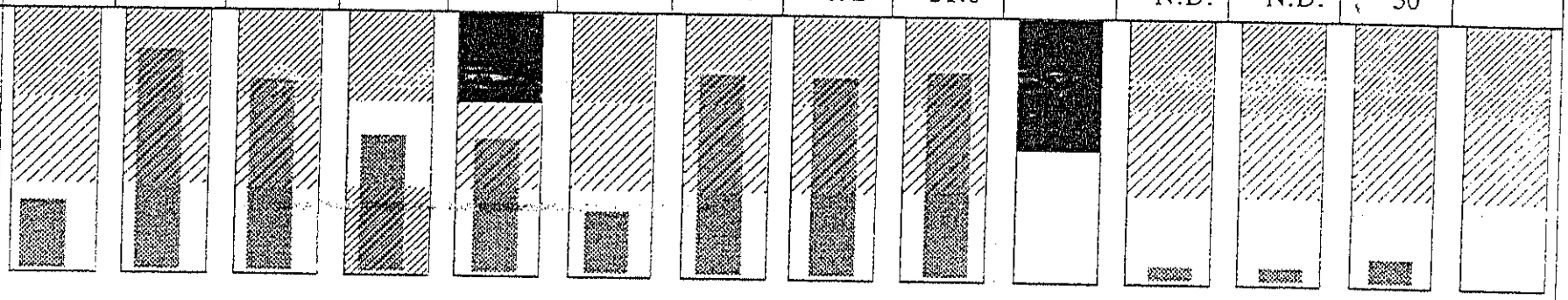
SAMPLE IDENTIFICATION: WELL #6

LABORATORY NUMBER: 547368

CATEGORY	SODIUM Na ppm	CALCIUM Ca ppm	MAGNESIUM Mg ppm	pH	NITRATE NITROGEN NO_3-N ppm	SULFATE SO_4 ppm	CONDUCTIVITY mmhos/cm	TOTAL DISSOLVED SOLIDS (TDS) ppm	HARDNESS gr/gallon	TOTAL COLIFORM cfu/100 ml	IRON Fe ppm	MANGANESE Mn ppm	CHLORIDE Cl ppm	COPPER Cu ppm
LEVEL FOUND	42.3	153	35.7	7.85	9.0	155	1.065	692	31.0		N.D.	N.D.	30	

GRAPHIC

PROBLEMS LIKELY
POTENTIAL PROBLEMS
NO APPARENT PROBLEMS
LEVEL EXCEEDS EPA LIMITS



CATEGORY	SODIUM	CALCIUM	MAGNESIUM	pH	NITRATE-N	SULFATE	CONDUCTIVITY	TDS	HARDNESS	COLIFORM	IRON	MANGANESE	CHLORIDE	COPPER
LEVEL FOUND	42.3	153	35.7	7.85	9.0	155	1.065	692	31.0		N.D.	N.D.	30	
CAUTION LEVEL	100	80	30	6.5/9.0	10	400	0.75	500	20		0.3	0.50	200	
CATEGORY	SODIUM	CALCIUM	MAGNESIUM	pH	NITRATE-N	SULFATE	CONDUCTIVITY	TDS	HARDNESS	COLIFORM	IRON	MANGANESE	CHLORIDE	COPPER
PROBLEM AREAS		****	****				****	****	****					

ADDITIONAL PARAMETERS

CATEGORY	Fluoride					
LEVEL FOUND	1.0					

COMMENTS:

Signed _____
Midwest Laboratories, Inc.

Rev. 3/98

REPORT NUMBER
00-147-2003

REPORT DATE
05/25/00

Midwest Laboratories, Inc.℠

136[illegible] • (402) 334-7770 • FAX (402) 334-9121

REPORT TO:

CITY OF WAYNE
TIM PICKINPAUGH
P.O. BOX 8 306 PEARL ST
WAYNE NE 68787-1903

IDENTIFICATION:

COPY TO:

WATER ANALYSIS

DOMESTIC WATER ANALYSIS

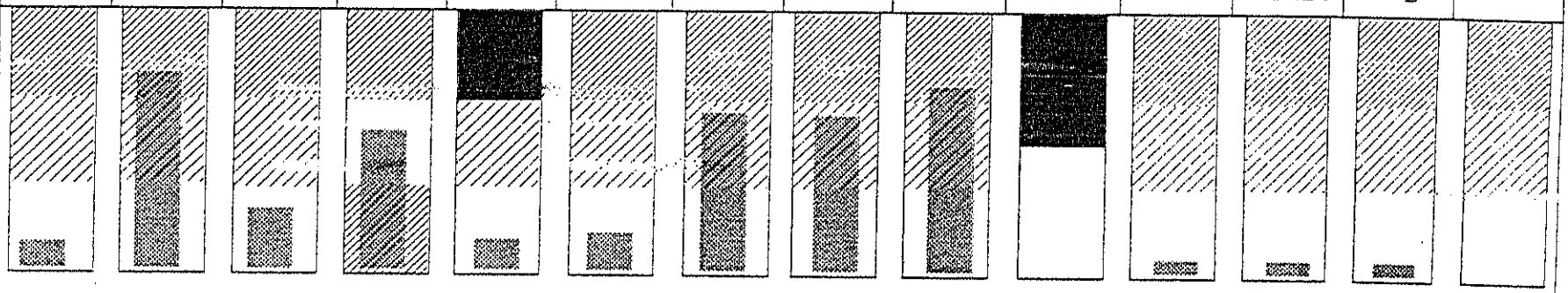
SAMPLE IDENTIFICATION: WELL #9

LABORATORY NUMBER: 547369

CATEGORY	SODIUM Na ppm	CALCIUM Ca ppm	MAGNESIUM Mg ppm	pH	NITRATE NITROGEN NO_3-N ppm	SULFATE SO_4 ppm	CONDUCTIVITY mmhos/cm	TOTAL DISSOLVED SOLIDS (TDS) ppm	HARDNESS gr/gallon	TOTAL COLIFORM cfu/100 ml	IRON Fe ppm	MANGANESE Mn ppm	CHLORIDE Cl ppm	COPPER Cu ppm
LEVEL FOUND	16.3	105	22.5	7.95	3.0	92	0.674	438	20.8		N.D.	N.D.	2	

GRAPHIC

PROBLEMS LIKELY
POTENTIAL PROBLEMS
NO APPARENT PROBLEMS
LEVEL EXCEEDS EPA LIMITS



CATEGORY	SODIUM	CALCIUM	MAGNESIUM	pH	NITRATE-N	SULFATE	CONDUCTIVITY	TDS	HARDNESS	COLIFORM	IRON	MANGANESE	CHLORIDE	COPPER
LEVEL FOUND	16.3	105	22.5	7.95	3.0	92	0.674	438	20.8		N.D.	N.D.	2	
CAUTION LEVEL	100	80	30	6.5/9.0	10	400	0.75	500	20		0.3	0.50	200	
CATEGORY	SODIUM	CALCIUM	MAGNESIUM	pH	NITRATE-N	SULFATE	CONDUCTIVITY	TDS	HARDNESS	COLIFORM	IRON	MANGANESE	CHLORIDE	COPPER
PROBLEM AREAS		****							****					

ADDITIONAL PARAMETERS

CATEGORY	Fluoride					
LEVEL FOUND	0.2					

COMMENTS:

Signed [signature]
Midwest Laboratories, Inc.

Rev. 3/99

REPORT NUMBER
00-147-2005

REPORT DATE

05/25/00

Midwest Laboratories, Inc.℠

13611 "B" Street • Omaha, Nebr. 68144-3693 • (402) 334-7770 • FAX (402) 334-9121

REPORT TO:

CITY OF WAYNE
TIM PICKINPAUGH
P.O. BOX 8 306 PEARL ST
WAYNE NE 68787-1903

IDENTIFICATION:

COPY TO:

WATER ANALYSIS

DOMESTIC WATER ANALYSIS

SAMPLE IDENTIFICATION: LIGHT PLANT

LABORATORY NUMBER: 547370

CATEGORY	SODIUM Na ppm	CALCIUM Ca ppm	MAGNESIUM Mg ppm	pH	NITRATE NITROGEN NO_3-N ppm	SULFATE SO_4 ppm	CONDUCTIVITY mmhos/cm	TOTAL DISSOLVED SOLIDS (TDS) ppm	HARDNESS gr/gal/pn	TOTAL COLIFORM cfu/100 ml	IRON Fe ppm	MANGANESE Mn ppm	CHLORIDE Cl ppm	COPPER Cu ppm
LEVEL FOUND	17.4	112	23.2	7.92	2.8	109	0.716	465	22.0		N.D.	N.D.	2	

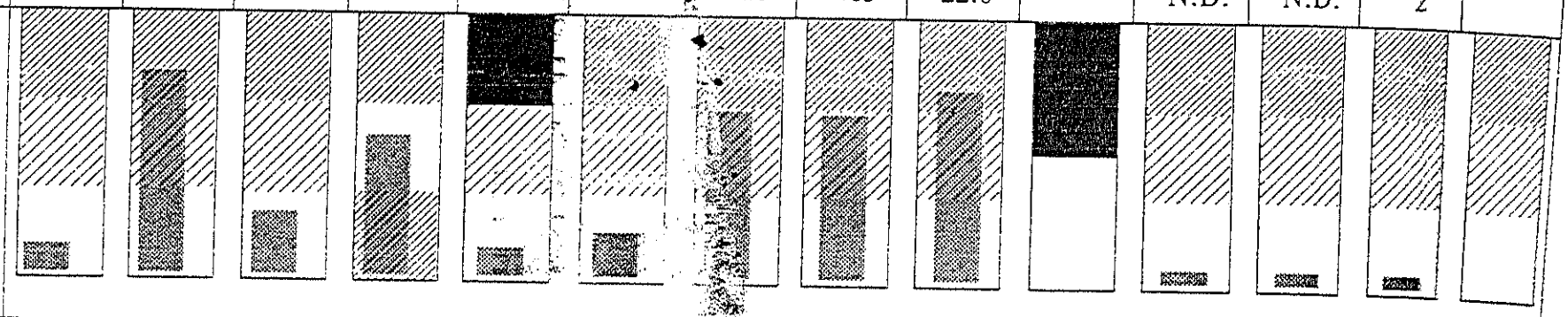
GRAPHIC

PROBLEMS LIKELY

POTENTIAL PROBLEMS

NO APPARENT PROBLEMS

LEVEL EXCEEDS EPA LIMITS



CATEGORY	SODIUM	CALCIUM	MAGNESIUM	pH	NITRATE-N	SULFATE	CONDUCTIVITY	TDS	HARDNESS	COLIFORM	IRON	MANGANESE	CHLORIDE	COPPER
LEVEL FOUND	17.4	112	23.2	7.92	2.8	109	0.716	465	22.0		N.D.	N.D.	2	
CAUTION LEVEL	100	80	30	6.5/9.0	10	400	0.75	500	20		0.3	0.50	200	
CATEGORY	SODIUM	CALCIUM	MAGNESIUM	pH	NITRATE-N	SULFATE	CONDUCTIVITY	TDS	HARDNESS	COLIFORM	IRON	MANGANESE	CHLORIDE	COPPER
PROBLEM AREAS		****							****					

ADDITIONAL PARAMETERS

CATEGORY	Fluoride
LEVEL FOUND	1.0

COMMENTS:

Signed

Midwest Laboratories, Inc.

Rev 335

U.S. EPA WATER QUALITY GUIDELINES FOR HUMAN CONSUMPTION

Sodium (Na)	Less than 20 ppm: No adverse effects	20-80 ppm: Persons on restricted sodium diets should consult a physician concerning use.	More than 80 ppm: Should be used sparingly by persons on low-sodium diets.
Calcium (Ca)	Less than 80 ppm: No adverse effects	80-150 ppm: Hard water problems such as scale formation can be expected.	More than 150 ppm: May be associated with high levels of sulfate (see sulfate below). Extreme hardness is undesirable for household use.
Magnesium (Mg)	Less than 30 ppm: No adverse effects	30-80 ppm: Contributes to hardness when associated with high calcium levels.	More than 80 ppm: When associated with high sulfate, is likely to have a laxative effect (magnesium sulfate is Epsom Salts).
pH	Less than 6.5: Corrosive to metal	6.5-8.5: No adverse effects	Higher than 8.5: Possible bitter taste, and germicidal activity of chlorine is reduced, corrosive to pipes.
Nitrate Nitrogen (NO_3-N)	Less than 2 ppm: No adverse effects	2-10 ppm: No acute toxicity. Could have some negative health effects in young children.	More than 10 ppm: Increasing probability of health effect in children under 6 months of age due to reduced oxygen carrying capacity of the blood.
Sulfate (SO_4)	Less than 250 ppm: No adverse effects	250-500 ppm: Likely to have a laxative effect, especially when first introduced. Diarrhea may or may not persist.	More than 500 ppm: Strongly laxative.
Conductivity	Less than 0.30: Extremely pure water can be corrosive to metal.	0.30-1.50: No adverse effects	Greater than 1.50: High levels of dissolved solids (see below).
Total Dissolved Solids (TDS)	Less than 200 ppm: No adverse health or nutritional effects. May be corrosive if extremely pure.	200-1000 ppm: No adverse effects	More than 1000 ppm: Increasingly adverse effects, especially diarrhea. Water loses esthetic effect.
Hardness	Less than 6 gr/gal: No adverse effects (17.1 mg/L CaCO3 = (1 gr/gal)	6-12 gr/gal: Some scale may form in pipes and water heaters. Softening may be desirable.	More than 12 gr/gal: Scale will form rapidly and laundry will not come clean. Softening for household use is desirable.
Purity	Negative: No coliform bacteria present in 100 mL of water.		Positive: Water is contaminated with coliform (sewage) bacteria. Disease transmission is possible if unpurified water is used.
Iron (Fe)	Less than 0.3 ppm: No adverse effects	0.3-1.0 ppm: Some staining will occur	More than 1.0 ppm: Iron oxide (rust) will cause extensive staining and will precipitate out, forming a red sludge. Taste will be bitter.
Manganese (Mn)	Less than 0.05 ppm: No adverse effects	0.05-0.50 ppm: May cause black or brown staining of pipes, sinks, and laundry.	More than 0.50 ppm: Besides the staining effect, will cause a metallic taste.
Chloride (Cl)	Less than 200 ppm: No adverse effects	200-500 ppm: Increasingly salty taste.	More than 500 ppm: Very salty taste.

N.D. = Not Detected

Jeff City

1

Sample
11-24-99
Wayne

Well #6

ANALYSIS

	CITY WELL #5	CITY WELL #6
pH	7.6	7.7
CONDUCTIVITY, µmho	719	1005
'M'-ALKALINITY, as $CaCO_3$, mg/L	258	338
TOTAL HARDNESS, as $CaCO_3$, mg/L	345	478
CALCIUM HARD., as $CaCO_3$, mg/L	257	348
MAGNESIUM HARD. as $CaCO_3$, mg/L	88	130
IRON, as Fe, mg/L	0.01	<0.01
COPPER, as Cu, mg/L	<0.01	<0.01
ZINC, as Zn, mg/L	0.01	<0.01
SODIUM, as Na, mg/L	17	34
POTASSIUM, as K, mg/L	6.2	7.4
TOT. INORG. PHOSPHATE, mg/L	0.8	0.6
CHLORIDE, as Cl, mg/L	2.2	19
SULFATE, as SO_4, mg/L	115	164
NITRATE, as NO_3, mg/L	12	35
ORTHO-PHOSPHATE, as PO_4, mg/L	<0.5	<0.5
SILICA, as SiO_2, mg/L	31	31

WELL # 9

- REPORTED - FEB 25 '88 P4:13
- RECEIVED - FEB 25 '88 A8:47

COMPLETE INFORMATION BELOW:

WATER CHEMISTRY

STATE LAB NO. 158-1428

DATE COLLECTED 2 (Mo.) 24 (Day) 88 (Yr) 1400 (Hour)

SAMPLE COLLECTED BY LAYNE WESTERN Co

SAMPLE LOCATION PIZ #2 WAYNE NE.

PROPERTY LEGAL DESCRIPTION: COUNTY

QUARTER SECTION TOWNSHIP N S RANGE E W

NAME AND ADDRESS OF PERSON TO RECEIVE EXTRA REPORT:

PLEASE PRINT COMPLETE ADDRESS
THIS LAB REPORT IS TO BE MAILED TO:

LAYNE WESTERN Co
P.O. BOX 11067
OMAHA NE 68111
ATT. Greg ZEKOFF

STATE OF NEBRASKA DEPARTMENT OF HEALTH LABORATORIES
3701 SOUTH 14TH, LINCOLN, NE 68502

CHECK TESTS REQUESTED

- ☐ ALL TESTS BELOW
- ☐ pH
- ☐ CALCIUM mg/l
- ☐ MANGANESE mg/l
- ☐ CHLORIDE mg/l
- ☒ NITRATE-N 2.5 mg/l
- ☐ FLUORIDE mg/l
- ☐ SODIUM mg/l
- ☐ IRON mg/l
- ☐ SULFATE mg/l
- ☐ TOTAL ALKALINITY mg/l as $CaCO_3$
- ☐ TOTAL HARDNESS mg/l as $CaCO_3$
- ☐ TOTAL DISSOLVED SOLIDS mg/l

NOT TESTED BECAUSE OF: ☐ DAMAGE
☐ INSUFFICIENT AMOUNT ☐ IMPROPER CONTAINER

TESTS BY: CS

FOR DEPARTMENTAL USE ONLY

FOR ACCOUNTING USE ONLY:

FEB 1988 RECEIVED Layne Western Inc. Omaha, NE 68111

- REPORTED - MAR -3 '88 P3:48
- RECEIVED - FEB 25 '88 A8:47

COMPLETE INFORMATION BELOW:

WATER CHEMISTRY

STATE LAB NO. 15 1453

DATE COLLECTED 2 (Mo.) 24 (Day) 88 (Yr) 1400 (Hour)

SAMPLE COLLECTED BY LAYNE WESTERN

SAMPLE LOCATION PIZ #2 WAYNE NE

PROPERTY LEGAL DESCRIPTION: COUNTY

QUARTER SECTION TOWNSHIP N S RANGE E W

NAME AND ADDRESS OF PERSON TO RECEIVE EXTRA REPORT:

PLEASE PRINT COMPLETE ADDRESS
THIS LAB REPORT IS TO BE MAILED TO:

LAYNE WESTERN Co
P.O. BOX
OMAHA NE, 68111
ATT Greg ZEKOFF

STATE OF NEBRASKA DEPARTMENT OF HEALTH LABORATORIES
3701 SOUTH 14TH, LINCOLN, NE 68502

CHECK TESTS REQUESTED

- ☒ ALL TESTS BELOW
- ☐ pH 7.8
- ☐ CALCIUM 114 mg/l
- ☐ MANGANESE 0.1 mg/l
- ☐ CHLORIDE 12 mg/l
- ☐ NITRATE-N 2.6 mg/l
- ☐ FLUORIDE 0.28 mg/l
- ☐ SODIUM 17 mg/l
- ☐ IRON 1.1 mg/l
- ☐ SULFATE 94 mg/l
- ☐ TOTAL ALKALINITY 284 mg/l as $CaCO_3$
- ☐ TOTAL HARDNESS 336 mg/l as $CaCO_3$
- ☐ TOTAL DISSOLVED SOLIDS 318 mg/l

NOT TESTED BECAUSE OF: ☐ DAMAGE
☐ INSUFFICIENT AMOUNT ☐ IMPROPER CONTAINER

TESTS BY:

FOR DEPARTMENTAL USE ONLY:
13 parameters

FOR ACCOUNTING USE ONLY:

'88 MAR -3 P3:48 - REPORTED - '88 FEB 25 A8:47 - RECEIVED -

COMPLETE INFORMATION BELOW:

WATER CHEMISTRY

STATE LAB NO. 15 1450

DATE COLLECTED 2 23 88 1800 (Mo.) (Day) (Yr) (Hour)

SAMPLE COLLECTED BY LAYNE WESTERN Co

SAMPLE LOCATION PIZ #1 WAYNE, NE

PROPERTY LEGAL DESCRIPTION: COUNTY

QUARTER SECTION TOWNSHIP N S RANGE E W

NAME AND ADDRESS OF PERSON TO RECEIVE EXTRA REPORT:

PLEASE PRINT COMPLETE ADDRESS
THIS LAB REPORT IS TO BE MAILED TO:

LAYNE WESTERN Co.
P.O. BOX 11067
OMAHA NE 68111
ATT. Greg Zecoff

STATE OF NEBRASKA DEPARTMENT OF HEALTH LABORATORIES
3701 SOUTH 14TH, LINCOLN, NE 68502

CHECK TESTS REQUESTED

- ☒ ALL TESTS BELOW
- ☐ CALCIUM 191 mg/l
- ☐ CHLORIDE 42 mg/l
- ☐ FLUORIDE 0.32 mg/l
- ☐ IRON 0.5 mg/l
- ☐ TOTAL ALKALINITY 288 mg/l as $CaCO_3$
- ☐ TOTAL HARDNESS 396 mg/l as $CaCO_3$
- ☐ TOTAL DISSOLVED SOLIDS 1006 mg/l
- ☐ pH 7.6
- ☐ MANGANESE 0.3 mg
- ☐ NITRATE-N 4.4 mg/l
- ☐ SODIUM 43 mg/l
- ☐ SULFATE 300 mg/l

Sample contained excessive amoun

NOT TESTED BECAUSE OF: ☐ DAMAGE foriegn ☐ INSUFFICIENT AMOUNT ☐ IMPROPER CONTAINER Materi

TESTS BY: CK JW GNH CC

FOR DEPARTMENTAL USE ONLY: 13 parameter

FOR ACCOUNTING USE ONLY:

'88 FEB 25 P4:13 - REPORTED - '88 FEB 25 A8:47 - RECEIVED -

COMPLETE INFORMATION BELOW:

WATER CHEMISTRY

STATE LAB NO. 158-1429

DATE COLLECTED 2 23 88 1800 (Mo.) (Day) (Yr) (Hour)

SAMPLE COLLECTED BY LAYNE WESTERN

SAMPLE LOCATION PIZ #1 WAYNE NE

PROPERTY LEGAL DESCRIPTION: COUNTY

QUARTER SECTION TOWNSHIP N S RANGE E W

NAME AND ADDRESS OF PERSON TO RECEIVE EXTRA REPORT:

PLEASE PRINT COMPLETE ADDRESS
THIS LAB REPORT IS TO BE MAILED TO:

LAYNE WESTERN Co
P.O. BOX 11067
OMAHA NE 68111
ATT Greg Zecoff

STATE OF NEBRASKA DEPARTMENT OF HEALTH LABORATORIES
3701 SOUTH 14TH, LINCOLN, NE 68502

CHECK TESTS REQUESTED

- ☐ ALL TESTS BELOW
- ☐ CALCIUM mg/l
- ☐ CHLORIDE mg/l
- ☐ FLUORIDE mg/l
- ☐ IRON mg/l
- ☐ TOTAL ALKALINITY mg/l as $CaCO_3$
- ☐ TOTAL HARDNESS mg/l as $CaCO_3$
- ☐ TOTAL DISSOLVED SOLIDS mg/l
- ☐ pH
- ☐ MANGANESE mg
- ☒ NITRATE-N 5.3 mg/l
- ☐ SODIUM mg/l
- ☐ SULFATE mg/l

NOT TESTED BECAUSE OF: ☐ DAMAGE ☐ INSUFFICIENT AMOUNT ☐ IMPROPER CONTAINER

TESTS BY: CK

FOR DEPARTMENTAL USE ONLY:

FOR ACCOUNTING USE ONLY:

FEB 1988 RECEIVED Layne Western Inc

COMPLETE INFORMATION BELOW:

WATER CHEMISTRY

STATE LAB NO. 158-2055

DATE COLLECTED 3 (Mo.) 13 (Day) 88 (Yr) 1645 (Hour)

SAMPLE COLLECTED BY Layne Western Co

SAMPLE LOCATION Wayne NE Supply well

PROPERTY LEGAL DESCRIPTION: COUNTY _____

QUARTER _____ SECTION _____ TOWNSHIP _____ N S RANGE _____ E W

NAME AND ADDRESS OF PERSON TO RECEIVE EXTRA REPORT

PLEASE PRINT COMPLETE ADDRESS
THIS LAB REPORT IS TO BE MAILED TO:

Layne Western Co
P.O. Box 11067
Omaha NE, 68111
ATT Greg Zekoff

STATE OF NEBRASKA DEPARTMENT OF HEALTH LABORATORIES
3701 SOUTH 14TH, LINCOLN, NE 68502

CHECK TESTS REQUESTED

- ☐ ALL TESTS BELOW
- ☐ CALCIUM _____ mg/l
- ☐ CHLORIDE _____ mg/l
- ☐ FLUORIDE _____ mg/l
- ☐ IRON _____ mg/l
- ☐ pH _____
- ☐ MANGANESE _____ mg/l
- ☒ NITRATE-N 2.1 mg/l
- ☐ SODIUM _____ mg/l
- ☐ SULFATE _____ mg/l
- ☐ TOTAL ALKALINITY _____ mg/l as $CaCO_3$
- ☐ TOTAL HARDNESS _____ mg/l as $CaCO_3$
- ☐ TOTAL DISSOLVED SOLIDS _____ mg/l

NOT TESTED BECAUSE OF: ☐ DAMAGE ☐ INSUFFICIENT AMOUNT ☐ IMPROPER CONTAINER

TESTS BY: CC

FOR DEPARTMENTAL USE ONLY:

FOR ACCOUNTING USE ONLY:

REPORTED MAR 14 88
RECEIVED MAR 17 88

COMPLETE INFORMATION BELOW:

WATER CHEMISTRY

STATE LAB NO. 158-2056

DATE COLLECTED 3 (Mo.) 13 (Day) 88 (Yr) 1645 (Hour)

SAMPLE COLLECTED BY Layne Western Co

SAMPLE LOCATION Wayne NE, Supply well

PROPERTY LEGAL DESCRIPTION: COUNTY _____

QUARTER _____ SECTION _____ TOWNSHIP _____ N S RANGE _____ E W

NAME AND ADDRESS OF PERSON TO RECEIVE EXTRA REPORT:

PLEASE PRINT COMPLETE ADDRESS
THIS LAB REPORT IS TO BE MAILED TO:

Layne Western Co
P.O Box 11067
Omaha NE 68111
ATT Greg Zekoff

STATE OF NEBRASKA DEPARTMENT OF HEALTH LABORATORIES
3701 SOUTH 14TH, LINCOLN, NE 68502

CHECK TESTS REQUESTED

- ☒ ALL TESTS BELOW
- ☐ CALCIUM 99 mg/l
- ☐ CHLORIDE 8 mg/l
- ☐ FLUORIDE 0.24 mg/l
- ☐ IRON <0.1 mg/l
- ☐ pH 7.4
- ☐ MANGANESE <0.1 mg/l
- ☐ NITRATE-N 2.0 mg/l
- ☐ SODIUM 15 mg/l
- ☐ SULFATE 41 mg/l
- ☐ TOTAL ALKALINITY 276 mg/l as $CaCO_3$
- ☐ TOTAL HARDNESS 332 mg/l as $CaCO_3$
- ☐ TOTAL DISSOLVED SOLIDS 416 mg/l

NOT TESTED BECAUSE OF: ☐ DAMAGE ☐ INSUFFICIENT AMOUNT ☐ IMPROPER CONTAINER

TESTS BY: CC, DW

FOR DEPARTMENTAL USE ONLY:
13 parameter

FOR ACCOUNTING USE ONLY:

REPORTED MAR 21 88
RECEIVED MAR 18 88

Well #9

COMPLETE INFORMATION BELOW:

WATER CHEMISTRY

STATE LAB NO. 15 1454

DATE COLLECTED 2 23 88 1800 (Mo.) (Day) (Yr) (Hour)

SAMPLE COLLECTED BY LAYNE WESTERN Co

SAMPLE LOCATION PIZ. #1 WAYNE, NE

PROPERTY LEGAL DESCRIPTION: COUNTY

QUARTER SECTION TOWNSHIP N S RANGE E W

NAME AND ADDRESS OF PERSON TO RECEIVE EXTRA REPORT:

PLEASE PRINT COMPLETE ADDRESS
THIS LAB REPORT IS TO BE MAILED TO:

LAYNE WESTERN Co
P.O. BOX 11067
OMAHA NE 68111
ATT. Greg Zecoff

STATE OF NEBRASKA DEPARTMENT OF HEALTH LABORATORIES
3701 SOUTH 14TH, LINCOLN, NE 68502

- REPORTED - MAR -3 '88 P3:48
- RECEIVED - FEB 25 '88 A8:47

CHECK TESTS REQUESTED

- ☒ ALL TESTS BELOW
- ☐ CALCIUM 141 mg/l
- ☐ CHLORIDE 42 mg/l
- ☐ FLUORIDE 0.32 mg/l
- ☐ IRON 0.5 mg/l
- ☐ TOTAL ALKALINITY 284 mg/l as $CaCO_3$
- ☐ TOTAL HARDNESS 396 mg/l as $CaCO_3$
- ☐ TOTAL DISSOLVED SOLIDS 1006 mg/l
- ☐ pH 7.6
- ☐ MANGANESE 0.3 mg/l
- ☐ NITRATE-N 4.4 mg/l
- ☐ SODIUM 43 mg/l
- ☐ SULFATE 300 mg/l

Sample contained excessive amount

NOT TESTED BECAUSE OF: ☐ DAMAGE foriegn
☐ INSUFFICIENT AMOUNT ☐ IMPROPER CONTAINER Materia

TESTS BY: CS SW GNH CC

FOR DEPARTMENTAL USE ONLY:

13 parameter

FOR ACCOUNTING USE ONLY:

COMPLETE INFORMATION BELOW:

WATER CHEMISTRY

STATE LAB NO. 158-1429

DATE COLLECTED 2 23 88 1800 (Mo.) (Day) (Yr) (Hour)

SAMPLE COLLECTED BY LAYNE WESTERN

SAMPLE LOCATION PIZ #1 WAYNE NE

PROPERTY LEGAL DESCRIPTION: COUNTY

QUARTER SECTION TOWNSHIP N S RANGE E W

NAME AND ADDRESS OF PERSON TO RECEIVE EXTRA REPORT:

PLEASE PRINT COMPLETE ADDRESS
THIS LAB REPORT IS TO BE MAILED TO:

LAYNE WESTERN Co
P.O. BOX 11067
OMAHA NE 68111
ATT Greg Zecoff

STATE OF NEBRASKA DEPARTMENT OF HEALTH LABORATORIES
3701 SOUTH 14TH, LINCOLN, NE 68502

- REPORTED - FEB 25 '88 P4:13
- RECEIVED - FEB 25 '88 8:47

CHECK TESTS REQUESTED

- ☐ ALL TESTS BELOW
- ☐ CALCIUM ____ mg/l
- ☐ CHLORIDE ____ mg/l
- ☐ FLUORIDE ____ mg/l
- ☐ IRON ____ mg/l
- ☐ TOTAL ALKALINITY ____ mg/l as $CaCO_3$
- ☐ TOTAL HARDNESS ____ mg/l as $CaCO_3$
- ☐ TOTAL DISSOLVED SOLIDS ____ mg/l
- ☐ pH ____
- ☐ MANGANESE ____ mg/l
- ☒ NITRATE-N 5.3 mg/l
- ☐ SODIUM ____ mg/l
- ☐ SULFATE ____ mg/l

NOT TESTED BECAUSE OF: ☐ DAMAGE
☐ INSUFFICIENT AMOUNT ☐ IMPROPER CONTAINER

TESTS BY: CS

FOR DEPARTMENTAL USE ONLY:

FOR ACCOUNTING USE ONLY:

RECEIVED FEB 1988 Layne Western Inc. Omaha NE 68111

Next

COMPLETE INFORMATION BELOW:

WATER CHEMISTRY

STATE LAB NO. 158-1428

DATE COLLECTED 2 (Mo.) 24 (Day) 88 (Yr) 1400 (Hour)

SAMPLE COLLECTED BY Layne Western Co

SAMPLE LOCATION PIZ #2 Wayne NE.

PROPERTY LEGAL DESCRIPTION: COUNTY

QUARTER SECTION TOWNSHIP N S RANGE E W

NAME AND ADDRESS OF PERSON TO RECEIVE EXTRA REPORT:

PLEASE PRINT COMPLETE ADDRESS
THIS LAB REPORT IS TO BE MAILED TO:

Layne Western Co
P. O. Box 11067
Omaha NE 68111
Att. Greg Zekoff

STATE OF NEBRASKA DEPARTMENT OF HEALTH LABORATORIES
3701 SOUTH 14TH, LINCOLN, NE 68502

CHECK TESTS REQUESTED

- ☐ ALL TESTS BELOW
- ☐ CALCIUM ____ mg/l
- ☐ CHLORIDE ____ mg/l
- ☐ FLUORIDE ____ mg/l
- ☐ IRON ____ mg/l
- ☐ pH ____
- ☐ MANGANESE ____ mg/l
- ☒ NITRATE-N 2.5 mg/l
- ☐ SODIUM ____ mg/l
- ☐ SULFATE ____ mg/l
- ☐ TOTAL ALKALINITY ____ mg/l as $CaCO_3$
- ☐ TOTAL HARDNESS ____ mg/l as $CaCO_3$
- ☐ TOTAL DISSOLVED SOLIDS ____ mg/l

NOT TESTED BECAUSE OF: ☐ DAMAGE ☐ INSUFFICIENT AMOUNT ☐ IMPROPER CONTAINER

TESTS BY: CS

FOR DEPARTMENTAL USE ONLY:

FOR ACCOUNTING USE ONLY:

RECEIVED - FEB 25 '88 A8:47 - REPORTED - FEB 25 '88 P4:13

RECEIVED FEB 1988 Layne Western Inc. Omaha, NE 68111

COMPLETE INFORMATION BELOW:

WATER CHEMISTRY

STATE LAB NO. 15 1453

DATE COLLECTED 2 (Mo.) 24 (Day) 88 (Yr) 1400 (Hour)

SAMPLE COLLECTED BY Layne Western

SAMPLE LOCATION PIZ #2 Wayne NE

PROPERTY LEGAL DESCRIPTION: COUNTY

QUARTER SECTION TOWNSHIP N S RANGE E W

NAME AND ADDRESS OF PERSON TO RECEIVE EXTRA REPORT:

PLEASE PRINT COMPLETE ADDRESS
THIS LAB REPORT IS TO BE MAILED TO:

Layne Western Co
P.O. Box
Omaha NE, 68111
Att Greg Zekoff

STATE OF NEBRASKA DEPARTMENT OF HEALTH LABORATORIES
3701 SOUTH 14TH, LINCOLN, NE 68502

CHECK TESTS REQUESTED

- ☒ ALL TESTS BELOW
- ☐ CALCIUM 114 mg/l
- ☐ CHLORIDE 12 mg/l
- ☐ FLUORIDE 0.28 mg/l
- ☐ IRON 1.1 mg/l
- ☐ pH 7.8
- ☐ MANGANESE 0.1 mg/l
- ☐ NITRATE-N 2.6 mg/l
- ☐ SODIUM 17 mg/l
- ☐ SULFATE 7 mg/l
- ☐ TOTAL ALKALINITY 284 mg/l as $CaCO_3$
- ☐ TOTAL HARDNESS 336 mg/l as $CaCO_3$
- ☐ TOTAL DISSOLVED SOLIDS 318 mg/l

NOT TESTED BECAUSE OF: ☐ DAMAGE ☐ INSUFFICIENT AMOUNT ☐ IMPROPER CONTAINER

TESTS BY: CS DW

FOR DEPARTMENTAL USE ONLY: 13 parameters

FOR ACCOUNTING USE ONLY:

RECEIVED - FEB 25 '88 A8:47 - REPORTED - MAR -3 '88 P3:48

UNIVERSITY OF IOWA - HYGIENIC LABORATORY

Well #9

Analytical Report for Sample Number 8852748

Iowa City Laboratory
Oakdale Hall
Iowa City, IA 52242
(319) 335-4500

Des Moines Branch
900 East Grand
H.A. Wallace Building
Des Moines, IA 50319
(515) 281-5371

Date Received: 03/16/88 Date of Report: 03/28/88

Submitter: CITY OF WAYNE NE.
Address: 306 PEARL STREET
City: WAYNE, IA 68787

Sample Location: WAYNE NE. Sample Description: WATER
Date Collected: 03/13/88 16:48:00 Client Reference:
Collected By: M MARSHALL

Comments

PROJECT #88-1,PUMPING HOSE,WELL #9.
PUMPED 24HRS @ 55 GPM. TEMP=-7.2 SAMPLE FREE OF TURBIDITY.
REPORT TO MERT MARSHALL.

--- Listing of Analyses Performed and Results ---

TEST	CONCENTRATION		METHOD USED	ANALYST
pH VALUE (LAB)	7.4	pH UNITS	EPA 150.1	SMM
SPEC. CONDUCTANCE	630	uMHOS @ 25 C	EPA 120.1	SMM
PHEN. ALKALINITY	NONE	MG/L AS CaCO3	EPA 310.1	SMM
TOTAL ALKALINITY	255	MG/L AS CaCO3	EPA 310.1	SMM
TOTAL HARDNESS	318	MG/L AS CaCO3	EPA 130.2	ML
TOTAL HARDNESS	18.6	GRAINS/GALLON	EPA 130.2	ML
SILICA	34	MG/L	EPA 370.1	SMM
TOTAL SOLIDS	390	MG/L @103 C	EPA 160.3	SMM
DISSOLVED SOLIDS	390	MG/L @180 C	EPA 160.1	SMM
CALCIUM	96	MG/L	EPA 215.2	SR
MAGNESIUM	19	MG/L	EPA 200.7	SR
MANGANESE	<0.02	MG/L	EPA 200.7	SR
POTASSIUM	5.2	MG/L	EPA 258.1	ML
SODIUM	14	MG/L	EPA 273.1	ML
BICARBONATE	311	MG/L	S.M. 403	SMM
CARBONATE	NONE	MG/L	S.M. 403	SMM
CHLORIDE	1.5	MG/L	EPA 325.3	SMM

PPM - Parts/Million MG/L - Milligrams/Liter MG/KG - Milligrams/Kilogram
PPB - Parts/Billion uG/L - Micrograms/Liter uG/KG - Micrograms/Kilogram
< - Less than > - Greater than pCi/L - pico Curies/Liter

UNIVERSITY OF IOWA - HYGIENIC LABORATORY

Analytical Report for Sample Number 8852748

TEST	CONCENTRATION		METHOD USED	ANALYST
FLUORIDE	0.25	MG/L	USGS 14327	RLP
NO2+NO3 AS NITRATE	8.9	MG/L	EPA 353.2	JAC
SULFATE	80	MG/L	EPA 275.4	SMM
LANGELIER INDEX	-0.05	UNITS	S.M. 203	ML
STABILITY INDEX	7.5	UNITS	S.M. 203	ML
AQUAPOISE PH	7.45	UNITS	S.M. 203	ML
SOLUBLE IRON	0.05	MG/L	EPA 200.7	SR
TOTAL IRON	0.05	MG/L	EPA 200.7	SR

Verified:

PPM - Parts/Million MG/L - Milligrams/Liter MG/KG - Milligrams/Kilogram
PPB - Parts/Billion uG/L - Micrograms/Liter uG/KG - Micrograms/Kilogram
(- Less than) - Greater than pCi/L - pico Curies/Liter

APPENDIX B

INSURANCE SERVICES OFFICE, INC.

1985 CLASSIFICATION DETAILS

INSURANCE SERVICES OFFICE, INC.
111 NORTH CANAL STREET SUITE 950 CHICAGO, ILLINOIS 60606-7270 (312) 930-0070 (800) 444-4554 FAX: (312) 930-0017

March 10, 2000

Harold Reynolds, Water Superintendent
City of Wayne
P.O.Box 8
Wayne, NE 68787

Dear Mr.Reynolds:

We are enclosing a copy of the Classification Details in response to a recent request. These details cover the items which are reviewed in our Fire Suppression Rating Schedule, and which are of importance in determining your fire insurance classification.

These Classification Details were developed using the information obtained during our 1985 survey, and consider that conditions in your city have remained the same.

They refer only to the fire insurance classification of your city and are not for property loss prevention or life safety purposes.

The city classification applies to properties with a needed fire flow of 3500 gpm or less. The private and public protection at properties with larger needed fire flows are individually evaluated, and may vary from the city classification.

We are also enclosing a copy of the hydrant flows from the 1985 survey.

Please contact us if you have any questions concerning the enclosed material.

Sincerely,

Michael Ramirez

Michael Ramirez
Community Classification Services Analyst

INSURANCE SERVICES OFFICE, INC.

HYDRANT FLOW DATA SUMMARY

Community Wayne State NE Witnessed by Insurance Services Office, Inc. Date June,1985

TEST NO.	TYPE DIST.*	TEST LOCATION	SERVICE	FLOW-GPM				PRESSURE PSI		FLOW AT 20 PSI		REMARKS
				INDIVIDUAL HYDRANTS			TOTAL	STATIC	RESID	NEEDED **	AVAIL.	MAIN SIZE
1	Comm	2nd & Main	Direct	940			940	78	44	2500	1300	
2	"	Abt. E 1st & Logan	"	1540			1540	77	22	3500	1600	
3	"	W.4th & Sherman	"	1440			1440	56	22	2250	1500	
4	Res.	1ST Ave & Birch	"	1010			1010	66	46	1000	1600	
5	Comm	W.7th Hyd W.of High School	"	1800			1800	50	42	3000	3700	
6	"	W.13th & Lincoln	"	2320			2320	57	48	2000	5000	
7	"	9th & Main	"	810			810	59	44	2000	1400	
8	"	E.10th & Nebraska	"	440			440	70	52	2000	750	
9	"	Schreiner & JCW Lewis Dr	"	1140			1140	56	19	2500	1100	
10	"	E.7th & Pine Heights Rd	"	830			830	80	48	1750	1200	
11	"	E.6th & Wayside Lane	"	1060			1060	78	45	2500	1400	
12	"	Wayne Ind Site East Hyd	"	1380			1380	90	23	AS	1400	Outside City
13	Comm	Fairground Ave & Windom	"	950			950	78	36	4000	1100	
13a	Res	" "	"	950			950	78	36	1000	1100	

THE ABOVE LISTED NEEDED FIRE FLOWS ARE FOR PROPERTY INSURANCE PREMIUM CALCULATION PURPOSES ONLY AND ARE NOT INTENDED TO PREDICT THE MAXIMUM AMOUNT OF WATER REQUIRED FOR A LARGE SCALE FIRE CONDITION. THE AVAILABLE FLOWS ONLY INDICATE THE CONDITIONS THAT EXISTED AT THE TIME AND AT THE LOCATION WHERE TESTS WERE WITNESSED.

*Comm = Commercial; Res = Residential + Limited by available hydrants ++ Limited by supply works

**Needed is the rate of flow for a specific duration for a full credit condition. Needed fire flows greater than 3,500 gpm are not considered in determining the classification of the city when using the Fire Suppression Rating Schedule.

INSURANCE SERVICES OFFICE, INC.

111 N. CANAL STREET SUITE 950 CHICAGO, ILLINOIS 60606-7270 (312) 930-0070 (800) 444-4554 FAX: (312) 930-0017

CLASSIFICATION DETAILS

Municipality: Wayne	State: NE	Population:	5,240
Date Surveyed: June 01, 1985	Total Credit: 47.42	Class:	6

RECEIVING AND HANDLING FIRE ALARMS

This section of the Fire Suppression Rating Schedule reviews the facilities provided for the general public to report fires, and for the operator on duty at the communication center to dispatch fire department companies to the fires.

	Credit	
	Actual	Maximum
1. Credit for Telephone Service (Item 414)		
This item reviews the facilities provided for the public to report fires, including the listing of fire and business numbers in the telephone directory.	1.00	2.00
2. Credit for Operators (Item 422)		
This item reviews the number of operators on-duty at the communication center to handle fire calls.	2.70	3.00
3. Credit for Dispatch Circuits (Item 432)		
This item reviews the dispatch circuit facilities used to transmit alarms to fire department members.	3.00	5.00
4. Total Credit for Receiving and Handling Fire Alarms:	6.70	10.00

CLASSIFICATION DETAILS

Municipality: Wayne	State: NE	Population:	5,240
Date Surveyed: June 01, 1985	Total Credit: 47.42	Class:	6

FIRE DEPARTMENT

This section of the Fire Suppression Rating Schedule reviews the engine and ladder-service companies, equipment carried, response to fires, training and available fire fighters.

	Credit	
	Actual	Maximum
1. Credit for Engine Companies (Item 513)		
This item reviews the number of engine companies and the hose equipment carried.	4.56	10.00
2. Credit for Reserve Pumpers (Item 523)		
This item reviews the number of reserve pumpers, their pump capacity and the hose equipment carried	0.21	1.00
3. Credit for Pump Capacity (Item 532)		
This item reviews the total available pump capacity.	3.61	5.00
4. Credit for Ladder-Service Companies (Item 549)		
This item reviews the number of ladder and service companies and the equipment carried.	3.15	5.00
5. Credit for Reserve Ladder-Service Companies (Item 553)		
This item reviews the number of reserve ladder and service trucks, and the equipment carried.	0.21	1.00

CLASSIFICATION DETAILS

Municipality: Wayne	State: NE	Population:	5,240
Date Surveyed: June 01, 1985	Total Credit: 47.42	Class:	6

FIRE DEPARTMENT
(continued

	Credit	
	Actual	Maximum
6. Credit for Distribution (Item 561)		
This item reviews the percent of the built-upon area of the city which has an adequately-equipped, responding first-due engine company within 1.5 miles and an adequately-equipped, responding ladder-service company within 2.5 miles.	1.99	4.00
7. Credit for Company Personnel (Item 571)		
This item reviews the average number of equivalent fire fighters and company officers on duty with existing companies.	5.12	15.00+
8. Credit for Training (Item 581)		
This item reviews the training facilities and their use.	0.94	9.00
9. Total Credit for Fire Department:	19.79	50.00+

+ This indicates that credit for manning is open-ended, with no maximum credit for this item.

CLASSIFICATION DETAILS

Municipality: Wayne	State: NE	Population:	5,240
Date Surveyed: June 01, 1985	Total Credit: 47.42	Class:	6

WATER SUPPLY

This section of the Fire Suppression Rating Schedule reviews the water supply system that is available for fire suppression in the city.

	Credit	
	Actual	Maximum
1. Credit for the Water System (Item 616)		
This item reviews the supply works, the main capacity and hydrant distribution.	23.22	35.00
2. Credit for Hydrants (Item 621)		
This item reviews the type of hydrants, and method of installation.	1.22	2.00
3. Credit for Inspection and Condition of Hydrants (Item 631)		
This item reviews the frequency of inspections of hydrants and their condition	1.58	3.00
4. Total Credit for Water Supply:	26.02	40.00

Grading Sheet For: Wayne, NE

Public Protection Class: 6 Surveyed: June 01, 1985

Feature		Credit Assigned	Maximum Credit
Receiving and Handling Fire Alarms		6.70%	10.00%
Fire Department		19.79%	50.00%
Water Supply		26.02%	40.00%
*Divergence		5.09%	
	Total Credit	47.42%	100.00%

The Public Protection Class is based on the total percentage credit as follows:

Class	%
1	90.00 or more
2	80.00 to 89.99
3	70.00 to 79.99
4	60.00 to 69.99
5	50.00 to 59.99
6	40.00 to 49.99
7	30.00 to 39.99
8	20.00 to 29.99
9	10.00 to 19.99
10	0 to 9.99

*Divergence is a reduction in credit to reflect a difference in the relative credits for Fire Department and Water Supply.

*The above Classification has been developed for fire insurance rating purposes only.