

TABLE 10-1: SUMMARY OF WATER SYSTEM EVALUATION

| Water System Pressures | | | | | |
|---|---|-----------------|--|-----------|---|
| Pressure Zone | Pressure Range | | Average Pressure | | Notes |
| | Average Day | Peak Hour | Average Day | Peak Hour | |
| Main Pressure Zone | ~ 30 to 90 psi (day) ~ 35 to 95 psi (night) | ~ 30 to 86 psi | ~54 psi (day) ~59 psi (night) | ~53 psi | ~ 35 psi near Lake Park Road and Midway Road ~ 30-35 psi near Northland Avenue and Richmond Street (near pressure zone boundary) ~ 30-35 psi on 16-inch supply line to Lindbergh Standpipe (has customer services) ~10 psi on Ballard Road to North Reservoir (~50 psi at last customer service) ~ 65-90 psi near the Fox River |
| Ridgeway Pressure Zone | ~ 40 to 70 psi | ~ <40 to 68 psi | ~55 psi | ~50 psi | |
| North Pressure Zone | ~ <35 to 90 psi | ~ <35 to 86 psi | ~65 psi | ~60 psi | ~90 psi on Apple Creek Road |
| Per NR 811, the minimum and maximum normal static pressure in the distribution system shall be 35 psi and 100 psi, respectively. The system pressure shall be maintained at a minimum of 20 psi under emergency conditions. | | | | | |
| Available Fire Flows | | | | | |
| Pressure Zone | Percent of Hydrants Providing Required Fire Flow While Maintaining 20 psi | | Notes | | |
| Main Pressure Zone | 95 percent | | Deficiencies due to small diameter/older main including some 4-inch mains, dead ends. | | |
| Ridgeway Pressure Zone | 94 percent | | Deficiencies due to dead ends at pressure zone boundary, small diameter/older mains. | | |
| North Pressure Zone | 99 percent | | | | |
| Hydraulic Capacity (Headloss/Velocity) | | | | | |
| <ul style="list-style-type: none"> No water mains have higher than recommended velocities or headlosses. | | | | | |
| Guidelines <ul style="list-style-type: none"> AWWA Manual M32 recommends that all pipe velocities should be less than 4 to 6 feet per second (fps) during normal operation. AWWA Manual M32 recommends headlosses in pipes less than 16-inches in diameter should be less than 5 to 7 feet per 1,000 feet of pipe during normal operating conditions. The recommended headloss limit for larger pipes in AWWA Manual M32 is 2 to 3 feet per 1,000 feet of pipe during normal operating conditions. | | | | | |
| Water Age (Water Quality) | | | | | |
| <ul style="list-style-type: none"> Water age in Main Pressure Zone ranges typically from 1-5 days, with water age greater than 5 days at extremities/dead ends. Water age in North Pressure Zone and Ridgeway Pressure zone typically 5 to 8 days, with greater than 8 days at extremities/dead ends. | | | | | |
| <ul style="list-style-type: none"> Chlorine levels measured indicate that chlorine residuals are maintained within the system | | | | | |
| Supply | | | | | |
| <ul style="list-style-type: none"> Adequate reliable supply (22 MGD hydraulic capacity of high lift pumps) to meet existing (14.9 MGD) and projected (17.7 MGD) maximum day demands. Adequate reliable capacity to supply the Ridgeway Pressures Zone and the North Pressure Zone under existing and projected 2040 demand conditions. | | | | | |
| Storage | | | | | |
| <ul style="list-style-type: none"> The Main Pressure Zone had adequate total available effective storage to meet existing and projection demand conditions; however, has a deficiency in operational storage that is projected to grow to approximately 0.43 MG by 2040. The deficiency in operational storage can be offset with excess reliable supply capacity. The Ridgeway Pressure Zone has a storage deficiency of approximately 0.68 MG; however, it can be offset with excess reliable pumping capacity and the ability to transfer water from the North Pressure Zone via 47 Valve Station. The North Pressure Zone has a storage deficiency which is projected to grow to approximately 0.38 MG based on projected 2040 projections. The deficiency can be offset with excess pumping capacity under existing conditions; however, is projected to be slightly deficient (approximately 50,000 gallons) by 2040 with the additional demands and the increase in fire storage requirement (assuming industrial development). | | | | | |
| System Reliability | | | | | |
| <ul style="list-style-type: none"> The raw water lake intake and transmission from the Raw Water Pump Station to the WTP have no redundancy to ensure a reliable supply of water to the WTP. Appleton can maintain water supply provided with auxiliary sources of power in the event of a power emergency or interruption. Appleton has standby power on site at the WTP and the North Booster Station, and a transfer switch at the Lindbergh Booster Station for a portable generator. | | | | | |
| Water Loss Evaluation – Performance Indicators | | | Leak/Break Frequency | | |
| Real Losses: 301 MG/year, 29 gallons per service connection per day Infrastructure Leakage Index (ILI): 1.9 Financial: <ul style="list-style-type: none"> Non-revenue water as percent by volume of water supplied: 17.9% (has ranged from 13.7 percent to 17.9 percent in the past 5 years) Non-revenue water as percent of cost of operating system: 1.2% | | | <ul style="list-style-type: none"> Average number of leaks/breaks per 100 miles per year 22 leaks/breaks per 100 miles per year (10 years) 25 leaks/breaks per 100 miles per year (5 years) Optimized distribution system failure frequency identified in WRF Water Loss Report: ~15 failures per 100 miles per year Aggregate North American failure frequencies identified in WRF Water Loss Report: ~25 failures per 100 miles per year. | | |
| Water Main Reinvestment Level (KANEW Analysis) | | | Water Main Risk Analysis (Risk – Consequence of Failure x Probability of Failure) | | |
| <ul style="list-style-type: none"> The City's water distribution system is an "average aged" water system; approximately 30 percent of the water mains are over 50 years old and approximately 10 percent of the water mains are over 70 years old. Based on the long and short life expectancies in the KANEW analysis, the total recommended replacement lengths in the first 10 years of replacement are approximately 80 miles (21 percent) and 104 miles (28 percent), respectively. Based on the long and short life expectancies in the KANEW analysis, the total replacement lengths over the 20 year period of replacement are approximately 103 miles (27 percent) and 128 miles (34 percent), respectively. | | | | | |
| Note: AWWA Research Foundation developed KANEW software to be used to perform replacement rate analysis for water system based on water main inventory. | | | High POF/COF (red) – Make a plan for replacement in short – term, Moderate/Low POF, High COF (orange) – Monitor and proactively inspect/evaluate alternatives. High POF, Moderate/Low COF (yellow) – Include in proactive replacement plan. Low POF/COF (green) – Normal O&M | | |



TABLE 10-6: SUMMARY DISTRIBUTION SYSTEM IMPROVEMENTS

| Location | Diameter | Length | Description |
|----------|----------|------------|---|
| 1 | 8-inch | 3,300 feet | Replace old 8-inch mains on East Florida Ave and Durkee Street between Capitol Drive and Meade Street. |
| 2 | 8-inch | 2,100 feet | Replace old 6-inch mains on North Appleton Street and West Weiland Avenue between West Marquette Street and North Division Street. |
| 3 | 8-inch | 1,450 feet | Replace old 8-inch mains on North Lawe Street between East Hancock Street and East Wisconsin Avenue. |
| 4 | 8-inch | 750 feet | Replace old 6-inch and 8-inch mains on North Meade Street between East Hancock Street and East Commercial Street. This location was identified in the previous Water System Master Plan as part of Segment H. |
| 5 | 8-inch | 2,200 feet | Replace old 4-inch, 6-inch, and 8-inch mains on North Rankin Street between East Atlantic Street and Nawada Court. This location was identified in the previous Water System Master Plan as part of Segment H. |
| 6 | 8-inch | 6,000 feet | Replace water main new the wastewater plant. A multitude of hydrants currently exist at this location, consider which should be used for fire protection purposes and strengthen water flow to that area with new 8-inch water main. |
| 7 | 8-inch | 2,300 feet | Replace old 4-inch and 6-inch water main on East Lawrence Street, South Oneida Street, and South Durkee Street between East College Avenue and South Appleton Street. |
| 8 | 8-inch | 3,250 feet | Replace old 6-inch water main on North Appleton Street between West Pacific Street and West Franklin Street, West Harris Street between North Appleton Street and North Oneida Street, Franklin Street between North Appleton Street and North Morrison Street, North Oneida Street between East Washington Street and West Packard Street. |
| 9 | 8-inch | 1,200 feet | Replace old 6-inch water main on North Superior Street between West Franklin Street and West Pacific Street. This location was identified in the previous Water System Master Plan as part of Segment D. |
| 10 | 8-inch | 2,600 feet | Replace old 4-inch and 6-inch water main on West Elsie Street between North Mason Street and North Richmond Street. |
| 11 | 8-inch | 700 feet | Replace old 6-inch on South Summit Street between West Prospect Avenue and West Fourth Street. |
| 12 | 8-inch | 700 feet | Replace old 6-inch on South Fairview Street between West Prospect Avenue and West Fourth Street. |
| 13 | 8-inch | 600 feet | Replace old 8-inch on West Fourth Street between South Douglas Street and South Outagamie Street. |
| 14 | 12-inch | 360 feet | New 12-inch water main between West Haskel Street and West Civic Street. |
| 15 | 12-inch | 1,050 feet | Replace old 8-inch on South Lyndale Drive extending south from the intersection with West Leonard Street. |
| 16 | 8-inch | 1,350 feet | Replace old 6-inch on Fairway Court between East Shaw Street and South Lawe Street. |
| 17 | 8-inch | 2,050 feet | Replace old 6-inch on South Walden Avenue between East Fremont Street and East Calumet Street. |
| 18 | 8-inch | 1,250 feet | Replace old 6-inch on South Walden Avenue between East Coolidge Avenue and East Taft Avenue. |
| 19 | 8-inch | 1,250 feet | Replace old 6-inch on South Fountain Avenue between East Coolidge Avenue and East Taft Avenue |
| 20 | 12-inch | 1,200 feet | Replace old 8-inch on West Second Street between South Lilas Drive and South Lynndale. |
| | 8-inch | 900 feet | Replace old 6-inch on South Westhaven Place between West Second Street and West Fourth Street. |

TABLE 11-4: CAPITAL IMPROVEMENT PLAN

| Short-Term Improvements (5 Years) | Estimated Cost | Long-Term Improvements (10-20 Years) | Estimated Cost |
|---|---------------------|--|---------------------|
| 42-inch Raw Water Main to WTP for Reliability (approximately 7,500 feet) ¹ | \$7,500,000 | Transmission Mains for Development (approximately 6.2 miles) | \$4,400,000 |
| Raw Water Intake Main at Raw Water Pump Station ¹ | \$9,000,000 | Water Main Replacement- Year 11: ~3.8 miles ³ | \$2,700,000 |
| | | Water Main Replacement- Year 12: ~3.8 miles ³ | \$2,700,000 |
| Improvements & Modifications to Existing Lake Pump Station & Existing Lake Intake System ¹ | \$3,600,000 | Water Main Replacement- Year 13: ~3.8 miles ³ | \$2,700,000 |
| | | Water Main Replacement- Year 14: ~3.8 miles ³ | \$2,700,000 |
| Water Main Replacement to Address Fire Deficiencies (~ 7 miles, ~1.4 miles annually) ² | \$5,500,000 | Water Main Replacement- Year 15: ~3.8 miles ³ | \$2,700,000 |
| | | Water Main Replacement- Year 16: ~3.8 miles ³ | \$2,700,000 |
| Water Main Replacement - Year 1: ~6.6 miles ³ | \$4,600,000 | Water Main Replacement- Year 17: ~3.8 miles ³ | \$2,700,000 |
| Water Main Replacement - Year 2: ~6.6 miles ³ | \$4,600,000 | Water Main Replacement- Year 18: ~3.8 miles ³ | \$2,700,000 |
| Water Main Replacement - Year 3: ~6.6 miles ³ | \$4,600,000 | Water Main Replacement - Year 19: ~3.8 miles ³ | \$2,700,000 |
| Water Main Replacement - Year 4: ~6.6 miles ³ | \$4,600,000 | Water Main Replacement -Year 20: ~3.8 miles ³ | \$2,700,000 |
| Water Main Replacement - Year 5: 6.6 miles ³ | \$4,600,000 | Demolish Matthias Tower | \$180,000 |
| Subtotal | \$47,900,000 | Subtotal | \$31,580,000 |
| Engineering and Contingencies ⁴ | \$19,160,000 | Engineering and Contingencies ⁴ | \$12,632,000 |
| Total | \$67,060,000 | Total | \$44,212,000 |
| Mid-Term Improvements (5-10 Years) | Estimated Cost | Grand Total | |
| | | \$180,006,000 | |
| Transmission Mains for Development (approximately 6.2 miles) | \$4,400,000 | Footnotes: <ol style="list-style-type: none"> Estimated cost from Appleton Public Works Department, November 2018. Replacement cost provided by Appleton Department of Public Works at \$130 per foot for 8-inch water main, and \$150 per foot for 12-inch water main replacement. Replacement rates based on KANEW analysis with first 5 years lowered to include recommended water main replacements for fire flow deficiencies. Replacement cost provided by Appleton Department of Public Works at \$130 per foot for 8-inch water main Assumed 15 percent for engineering and 25 percent for contingencies. Notes: <ul style="list-style-type: none"> Estimates do not include land purchase, if necessary. The Engineer's Estimate is only an estimate of possible construction costs for budgeting purposes. This estimate is limited to the conditions existing at its issuance and is not a guaranty of actual price or cost. Uncertain market conditions such as, but not limited to: local labor or contractor availability, wages, other work, material market fluctuations, price escalations, force majeure events, and developing bidding conditions, etc. may affect the accuracy of this estimate. AECOM is not responsible for any variance from this estimate or actual prices and conditions obtained. This estimate is an AACE Class 4 Order of Magnitude cost estimate. Estimates are 2019 dollars unless otherwise noted. | |
| Water Main Replacement - Year 6: ~8.0 miles ³ | \$5,500,000 | | |
| Water Main Replacement - Year 7: ~ 8.0 miles ³ | \$5,500,000 | | |
| Water Main Replacement - Year 8: ~8.0 miles ³ | \$5,500,000 | | |
| Water Main Replacement - Year 9: ~8.0 miles ³ | \$5,500,000 | | |
| Water Main Replacement - Year 10: ~8.0 miles ³ | \$5,500,000 | | |
| Potential New South Pressure Zone: | | | |
| New 0.5 MG Spheroid Tower in Potential South Pressure Zone | \$1,200,000 | | |
| New Flow Control Valve from Potential South Pressure Zone to Main Pressure Zone | \$210,000 | | |
| South Pump Station including VFD, 0.2 MG Underground Reservoir, backup generator, SCADA | \$1,500,000 | | |
| Subtotal | \$34,810,000 | | |
| Engineering and Contingencies ⁴ | \$13,924,000 | | |
| Total | \$48,734,000 | | |