VILLAGE OF MCFARLAND

Public Works & Utilities Committee

NOTICE OF PUBLIC MEETING

Monday, January 23, 2023 **6:00 PM** **McFarland Municipal Center**
Community Room

AGENDA

You are invited to this meeting through a Zoom webinar. The public may attend in-person or remotely through the webinar or telephone options listed below.

PLEASE CLICK THE LINK BELOW TO JOIN THE ZOOM WEBINAR:
https://us02web.zoom.us/j/87321231583
Or by Telephone: +1 (312) 626-6799
Webinar ID: 873 2123 1583
Press *9 to raise/lower hand. Press *6 to mute/unmute.

1. CALL TO ORDER, ROLL CALL.

2. PUBLIC APPEARANCES.

   a. This is an opportunity for members of the public to address the Public Works and Utilities Committee for items that are not on the agenda. Please remember this is a hybrid meeting conducted in person and through the Zoom online meeting platform. Meeting attendees wishing to address the Committee about items not on the agenda may do so at this time. Zoom attendees should type their name and address in the Question and Answer feature within the Zoom online meeting platform at this time. Members of the public who are present in person and wish to address the Committee should fill out a public comment form and turn into the meeting chairperson. When you are called upon to speak, state your name, address, and provide your comments to the Committee for their consideration. Please adhere to the 3-minute time limit. Additionally, you may send your public comments to public.works@mcfarland.wi.us to be included as part of the meeting.

      Members of the public may also speak during their selected agenda item as they designate on the public comment form or in the Question and Answer feature on Zoom.

3. APPROVAL OF MINUTES.

   a. Motion to approve the minutes of the December 21, 2022 Public Works & Utilities Committee meeting.

4. BUSINESS.

   a. Discussion and action to make a recommendation to the Village Board regarding a Request for Proposal (RFP) for a solar project at Lift Station #2.

   b. Discussion and action to make a recommendation to the Village Board regarding the Water System Needs Assessment

   c. Discussion regarding funding allocation to the utilities fund associated with street projects.

5. SCHEDULE NEXT MEETING DATE.

   a. Monday, February 27, 2023 at 6:00 p.m.

6. ADJOURNMENT.

Any person who has a qualifying disability as defined by the Americans with Disabilities Act that requires the meeting or materials at the meeting to be in an accessible location or format should contact the McFarland Municipal Center at (608)838-3153, 5915 Milwaukee Street, McFarland, Wisconsin, or village.clerk@mcfarland.wi.us by 2:00 p.m. at least 5 business days prior to the meeting so that any necessary arrangements can be made to accommodate each request. If the meeting or request is less than 5 business days from the meeting, requests for accommodations may still be made and reasonable efforts will be made to accommodate each request.

VILLAGE OF MCFARLAND

Public Works & Utilities Committee Minutes

Wednesday, December 21, 2022 - 6:00 PM

1. **CALL TO ORDER, ROLL CALL.**

   Trustee Brandt called the regular meeting of the Public Works & Utilities Committee to order at 6:00 PM in the Community Room of the Municipal Center. This meeting was also held via Zoom webinar.

   Members present: Carolyn Clow, Pauline Boness, Marc Nielsen, Eric Kryzenske, Chris Fredrick, Jerry Adrian, Hilary Brandt

   Members not present:

   Staff Present: Public Works Director Lee Igl, Assistant to the Public Works Director Aimee Irwin, Town & Country staff Brian Berquist and Tim Stieve

2. **PUBLIC APPEARANCES.**

   a. *This is an opportunity for members of the public to address the Public Works & Utilities Committee. Please remember this is a virtual meeting conducted through the Zoom online meeting platform. Zoom meeting attendees wishing to address the Committee may do so using the Question and Answer feature within the Zoom online meeting platform. You may state your name, address, and provide your comments to the Committee for their consideration. Members of the public who are present in person and wish to address the Committee should fill out a public comment form and turn into the meeting chairperson. Members of the public may speak during public appearances or during their selected agenda item as they designate on the public comment form. Please adhere to the 3-minute time limit. Additionally, you may send your public comments to public.works@mcfarland.wi.us to be included as part of the meeting.*

   None.

3. **APPROVAL OF MINUTES.**

   a. *Discussion and action regarding the minutes from the November 28, 2022 Public Works & Utilities Committee meeting.*

   Motion by Trustee Brandt, seconded by Boness, to approve the minutes from the November 28, 2022 Public Works & Utilities Committee meeting. Motion carries 6 - 0 - 0 by acclamation.

4. **BUSINESS.**

   a. *Discussion and action to make a recommendation to the Village Board regarding design approval for water main improvements along Taylor Road and authorize the project for bid.*

   Tim Stieve of Town & Country Engineering presented the design for water main improvements along Taylor Road. Stieve stated that the planned installation would occur in the off street property area owned by the Village and the water main along Taylor road is being planned for trenchless installation.

- Boness asked what trenchless installation means. Stieve explained that trenchless means tunneling without digging up the ground. Trenchless does require a boring pit on either side of the installation. Igl provided an example of TDS installation that has occurred throughout the village.
- Fredrick commented that while trenchless installation typically costs more, savings would be found by not replacing the roadway and off-street property digging. Fredrick asked if the village had HDPE pipes already. Stieve and Berquist stated there are no HDPE pipes for water main. Fredrick asked if the piping would be in casings. Berquist stated this would be without casings. Fredrick asked for the alternate bid, if HDPE pipe is not utilized, what type of pipe would be required. Berquist responded that the type of pipe would be ductile iron with a poly wrap.
- President Clow asked why an alternate was being included. Stieve responded that the alternate bid is to evaluate if the other installation method would be less expensive for both parties. Clow asked what it meant that the village would be switching to HDPE. Berquist stated that it is not the recommendation to switch to HDPE. Igl commented about having the correct equipment on hand to make any necessary repairs to this type of pipe down the road.

Motion by Adrian, seconded by Boness, to recommend approval to the Village Board regarding the design as presented for water main improvements along Taylor Road and further request authorization for the Village Engineer to bid the project. Motion carries 7 - 0 - 0 by acclamation.

b. *Discussion and action to make a recommendation to the Village Board regarding Lift Station #2 design approval and authorize the project for bid.*

Stieve presented and reviewed the Lift Station #2 project design. Due to lead times with the generator, this project may not be constructed and completed until 2024.

- President Clow asked what the building's footprint was. Stieve stated that the building is 46 feet by 33 feet.
- Trustee Brandt asked what the height of the building would be. Berquist responded that it would be similar to the lift station on Holscher Road, including a ten-foot tall garage door which would result in the gutters being at approximately twelve feet with the roof peak at sixteen to eighteen feet.
- President Clow asked if there are any concerns about the functionality of the current lift station until the construction of the new station is complete. Berquist responded that while there are capacity constraints, the station has enough capacity for the Rosewood Fields development. Igl stated that both pumps were rebuilt recently when one of the pumps failed.
- Igl commented that solar installation on the building is also a possibility with this project. Clow asked what solar would look like with this project. Stieve responded that a feasibility study was completed by a consultant with HGA. From this study, the payback would be sixteen to eighteen years. Clow asked if the solar portion would be put out with this bid. Stieve and Berquist stated that the building would be built to be solar ready in anticipation of the solar

installation. Igl stated that based on conversations with HGA it would be recommended to issue a request for proposal (RFP) at a later date once estimated construction completion is known.

- President Clow asked what the lifespan of the building would be. Berquist responded that the lifespan would be 40 to 60 years.
- Fredrick asked about the aesthetics plan. Berquist responded that once the design is approved, the plan is to stake out the building layout and speak with neighbors about what aesthetic they would like to see. Berquist also stated the aesthetics would be an allowance item within the bid package.
- Boness asked about the possibility of the building being shifted to the east. Berquist stated there is still room available to shift the building but it would be dependent on an oak tree as well as the recommendations from discussions with residents.
- Fredrick asked what the payback would be for solar. Igl and Stieve responded that HGA has estimated a payback of sixteen to eighteen years with the initial feasibility study.

Motion by President Clow, seconded by Trustee Brandt, to recommend approval to the Village Board regarding the solar ready Lift Station #2 design as presented and further request authorization for the Village Engineer to bid for the project with the understanding there will be an RFP for a solar project in the future. Motion carries 7 - 0 - 0 by acclamation.

c. _Discussion and action to make a recommendation to the Village Board regarding the 2023 sidewalk replacement bid._

Igl provided an overview regarding the sidewalk replacement project. The project was bid and received one response from Speedway Sand and Gravel Inc. Igl did contact a few concrete companies to inquire why they did not bid on the project. Responses included being locked into a certain timeframe as often the work is fill-in work around other projects.

- President Clow recommended that our bid package includes a flexible scheduling option.
- Fredrick suggested including this with another project in the future.

Motion by President Clow, seconded by Fredrick, to recommend to the Village Board to reject the single bid received from Speedway Sand and Gravel Inc. regarding the 2023 sidewalk replacement project. Motion carries 7 - 0 - 0 by acclamation.

d. _Presentation and discussion regarding the Water System Needs Assessment_

Berquist presented the Water System Needs Assessment and reviewed the summary document enclosed within the packet. Berquist explained there are various approaches that could be taken based on the results compiled. This item will return to the committee for recommendation at a future meeting.

- Trustee Brandt asked when the updated impact fee would start. Berquist explained it would depend on when the committee provides their recommendation along with the completion of the financial review by the auditors to establish the new rate.

- President Clow asked if the population numbers were reviewed by the Community Development Director. Berquist responded that the numbers had been reviewed by the director.
- Boness asked how the impact fees were calculated in the previous study. Berquist stated he would provide this information to the committee at a future meeting.
- President Clow asked about the status of the long-term capital improvement plan for the water utility. Berquist responded that a draft plan is being compiled based on discussions with staff.
- Nielsen commented that the committee used to receive the monthly impact fee report. Nielsen asked if the new fee would price the lot out of the market. Berquist responded that the rate would be established following the auditors' financial review.
- Trustee Brandt asked how the impact fee is charged. Berquist stated the fee is a flat fee per residential unit.

5. SCHEDULE NEXT MEETING DATE.

a. Monday, January 23, 2023 at 6:00 p.m.

6. ADJOURNMENT.

Motion by President Clow, seconded by Fredrick, to adjourn at 7:13 p.m.

Pursuant to law, written notice of this meeting was given to the public and posted on the public bulletin boards in accordance with Open Meetings Law.

Respectfully submitted,
Aimee Irwin
Assistant to the Public Works Director

VILLAGE OF
McFarland

SUMMARY SHEET

MEETING DATE: **Monday, January 23, 2023**

SECTION: **Business**

DEPARTMENT: **Public Works**

CONTACT: **Lee Igl, Streets/Utilities Superintendent, Matt Schuenke, Village Administrator**

AGENDA ITEM: **Discussion and action to make a recommendation to the Village Board regarding a Request for Proposal (RFP) for a solar project at Lift Station #2.**

PREVIOUS ACTION:

ISSUE SUMMARY:
A solar project on the future Lift Station 2 was previously discussed at the December 21, 2022 committee meeting. The committee provided in their recommendation to build the future lift station to be solar ready in anticipation of a solar project following construction. Given the lead times on equipment for the lift station construction, it is recommended to delay the request for proposal process until more accurate completion timeframes are developed. Staff are seeking the committee's recommendation regarding a solar project and utilizing a Request for Proposal (RFP). The draft Request for Proposal (RFP) will be brought to the Village Board when the time is appropriate based on construction timelines.

Enclosed is the solar feasibility study provided by HGA.

FINANCIAL/BUDGET IMPACT:

VILLAGE PLAN REFERENCE:
None.

ORDINANCE REFERENCE:
None.

BOARD, COMMISSION OR COMMITTEE RECOMMENDATION:
Recommended Motion:

Motion, second to recommend approval to the Village Board for the issuance of a Request for Proposal regarding a solar project at the future Lift Station #2.

ATTACHMENTS:
1. McFarland Lift Station Solar PV Feasibility Study 20221202

HGA

SOLAR PV FEASIBILITY STUDY
VILLAGE OF MCFARLAND
LIFT STATION 2

December 2, 2022

HGA

7475 Hubbard Ave, Suite 201
Middleton, WI 53562
608.554.5333
HGA.COM

INTRODUCTION

This study explores the options for adding a solar photovoltaic (PV) system to the Lift Station 2 project for the Village of McFarland. This building replaces the existing lift station building and includes larger pumps, a backup generator and a trailer storage bay. The total area of the new facility is approximately 1,400 ft^2.

In this study we explore system size, utility impact, cost, incentives and payback for the new Lift Station building solar PV system.

Figure 1- Current project site plan showing new floorplan.

New Lift Station 2 Building Energy Consumption

The first step in correctly sizing a Solar PV system for optimum cost benefit is to understand the electric load for the new Lift Station 2 building. Using the utility data for October 2019 through September 2022, we calculated a 3-year average for the existing building and used this to estimate the expected usage at the new building. Since the new lift station will have larger pumps, it has been assumed that the new building will use about twice as much electricity as the existing building. This assumption can be updated if necessary as more information about the new facility becomes available.

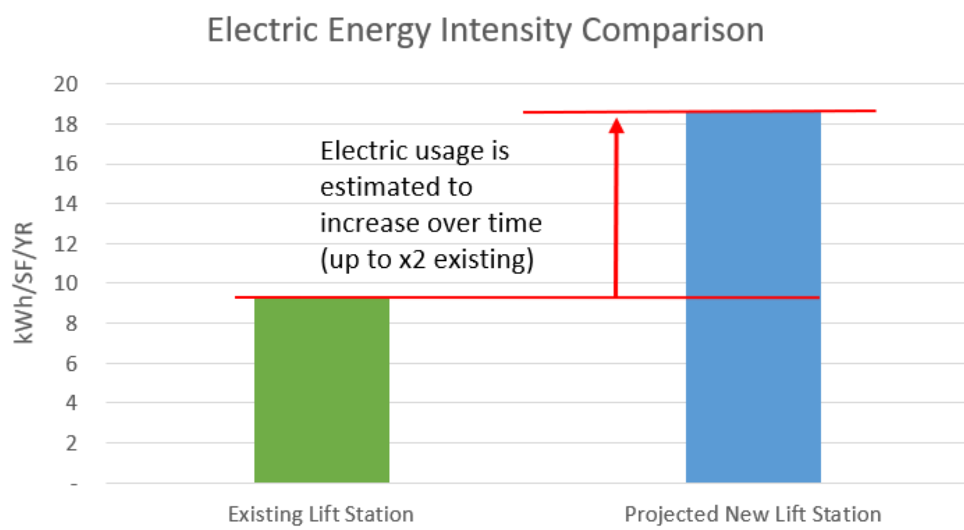


Figure 2- Comparison facility electric energy use intensity

From this data we can project that the electric energy usage intensity of the new Lift Station 2 building will be approximately 19 kWh/SF/year, and 26,000 kWh annually. This projected monthly load profile has been compared to a typical Solar PV production profile (14 kW DC).

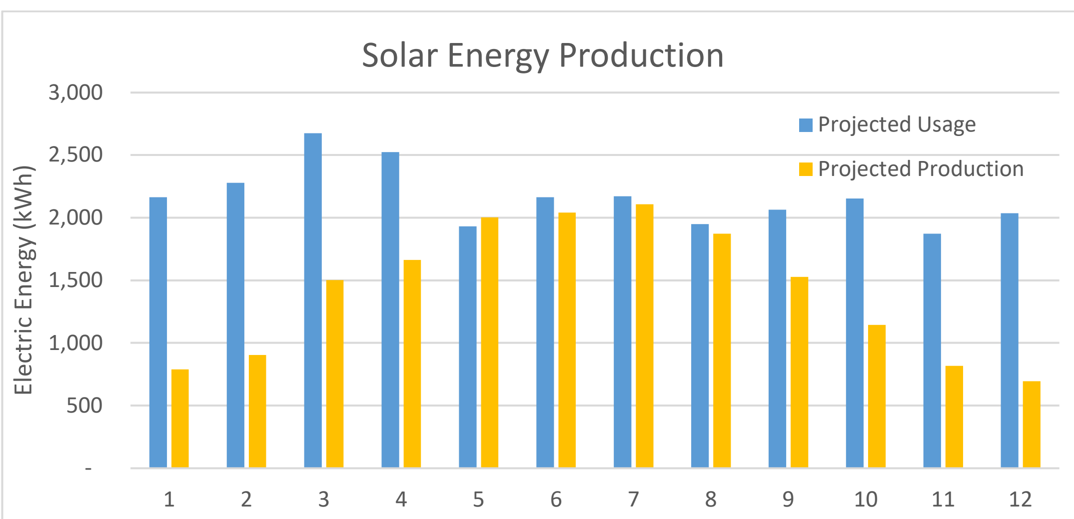


Figure 3- Monthly electric usage vs. monthly solar PV production

Utility Analysis

The Alliant Energy rate schedule that would most likely fit this new building is GS-1(General Service). This rate applies for buildings that will have a measured maximum demand of 75 kW and annual energy usage of less than 250,000 kWh.

For a solar PV system nameplate size of less than 20 kW, the system will be placed on parallel generation rate PgS-3. This rate structure will net meter the energy used and produced on a monthly basis. If there is excess production in any one month, the excess energy shall be credited at a rate of $0.02814/kWh. If in any month there is a credit balance of $100 or less, the amount will be credited to a subsequent bill until a debit balance is reestablished.

Based on General Service electric rate (GS-1) and the parallel generation rate for Solar PV (PgS-1) it will be most cost effective for the system to be sized to produce equal to or less energy than the facility will use in a calendar year. Once the system is over this size the buyback rate from the utility becomes very low.

Our system sizing strategy based on this rate analysis is to size the solar PV system to produce at or under the annual energy consumption of the new building.

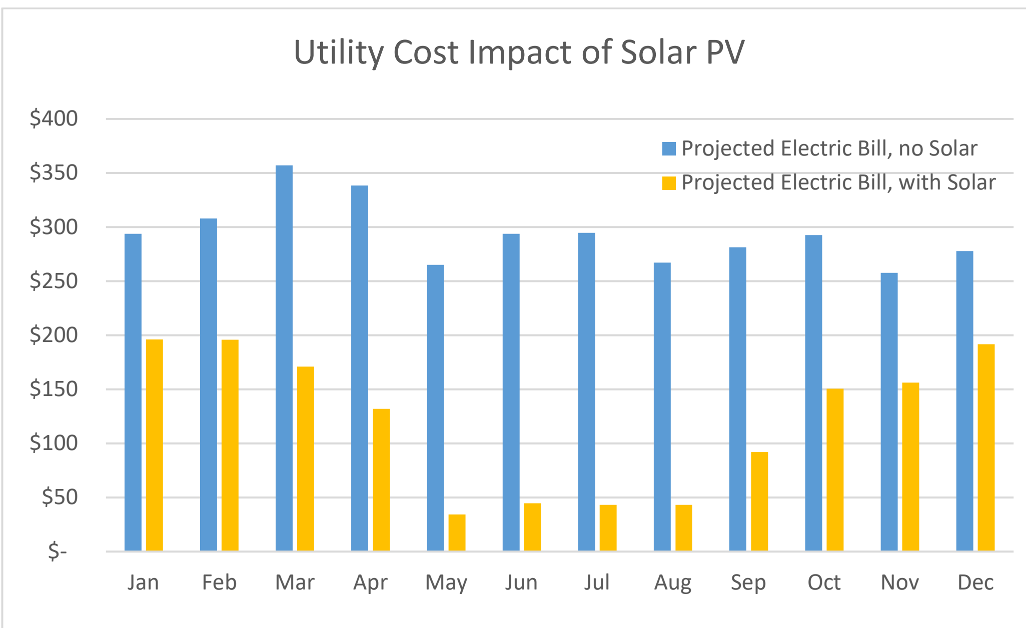


Figure 4- Monthly electric utility bill projection comparison (GS-1 rate assumed here)

The annual utility cost benefit of the 14 kW DC solar PV system is estimated to be approximately $2,000/yr. This will play into the payback analysis shown in the budget section of the report.

Roof Mounted PV System Size

The solar panel layout assumes that the roof for the new building is constructed with a 7° tilt angle, as this allows for a larger array than a flat roof. This assumes that a standing seam metal roof is installed and there is coordination with the project team to achieve this roof pitch.

Any further increases in array size beyond this is not recommended at this time based on parallel generation rate structure and the uncertainty of the new building's electric consumption. The existing lift station used 13,000 kWh, on average over the past 3 years. The new pump station is expected use more electricity than the existing building, but how much more is still uncertain.

The analysis assumes that the panels are not shaded by any surroundings. The site plan shows that the new building will be built close to a tree line, but it was unclear whether the trees will be removed. If the trees are not removed as part the construction process, this analysis may be updated to account for shading.

PV System Tilt Angle	Ground Coverage Ratio	PV System Size	Annual Energy Production
7° tilt angle	1.0	14 kW	17,063 kWh/yr

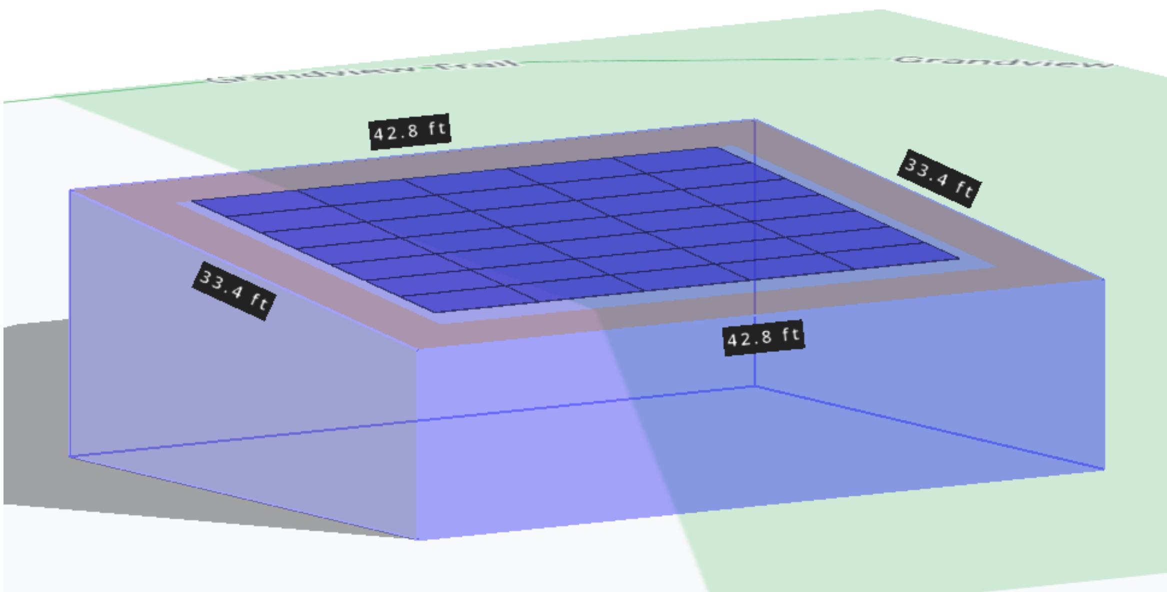


Figure 5- Visual of solar PV basis of design panel layout (14 kW DC)

Basis of design products:

- Heliene 72M 400W Modules (qty 35)
- SolarEdge SE14.4kUS 208 V (qty 1)
- UNIRAC flush mount racking

Figure 6- Sample image of flush mount panel racking on standing seam roof

Utility Incentives for Solar PV

Incentive Program	2022 Dollars Available
Focus on Energy Solar PV	$2,250

These incentive programs will need to be checked for eligibility based on the funding source of the solar PV system.

Solar PV System Budget

Budget Item	Budget
Solar Design, Construction Admin, Commissioning	$8,000
Solar Installation	$34,000
Total Direct Capital Costs	**$42,000**
Possible Incentives	**2022 Programs**
Focus on Energy Solar PV	$2,250
Inflation Reduction Act	TBD*
Net Cost	$39,750
1st Year Annual Utility Value of PV System	$2,000
Life Cycle Cost Payback Period	16 years**

*The Inflation Reduction Act, through the Section 48 Investment Tax Credit, enable non-taxable entities to get a refund for renewable energy systems. Depending on the details of the project, the credit is estimated to be between 6% to 30% of the project cost, lowering the payback range to 11 to 15 years.

**This accounts for inflation, system degradation and O&M costs over the 20 year lifespan of the equipment, and assumes that the property is not subject to any income or property taxes.

Solar PV Coordination with Structural Design

- Solar racking product for basis of design: Unirac SM
- Structural load allowance estimate: 3 psf load allowance, based on standing seam metal roof
- Max PV system height for wind load estimate: 3 inches height
- Roof areas with PV panels planned: all roof areas

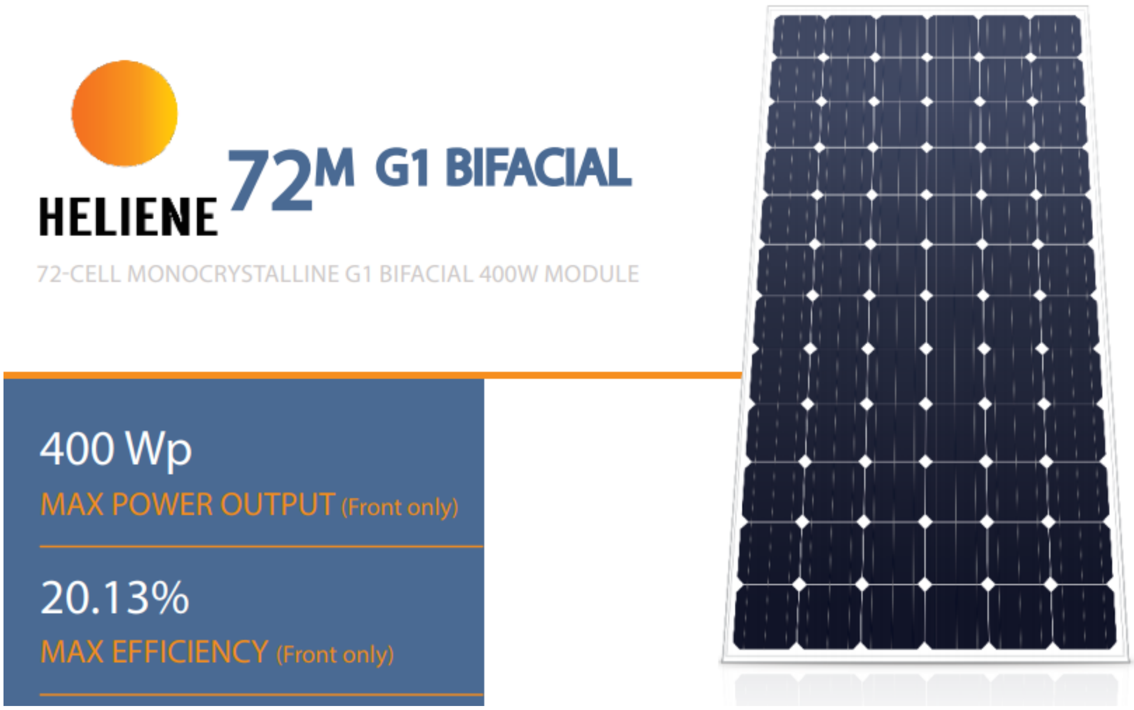
Solar PV Coordination with Electrical Design

- Backup generator electrical design should be coordinated with solar design to ensure they are both electrically isolated at all times
- Solar electric inverter product basis of design: Solaredge SE14.4KUS (qty 1)
- 208V inverter basis of design
- Indoor location for inverter, if possible.
    - Inverter dimensions with safety switch: 30.5” H x 12.5” W x 10.5” D
    - Add 8” clearance for the top of the inverter, and 4” clearance on the other sides per installation instructions.
- Coordinate with utility on location for solar PV disconnect
- 1-line diagram showing PV subpanel and interconnection
- Determine electrical and solar contractor scope of work boundary

APPENDIX A- Basis of Design Solar PV Products

Basis of Design Inverter- Solar EdgeSE14.4K

Basis of Design Panel- Heliene 72M G1 Bifacial



Basis of Design Racking- Unirac SM

VILLAGE OF
McFarland

SUMMARY SHEET

MEETING DATE: **Monday, January 23, 2023**

SECTION: **Business**

DEPARTMENT: **Public Works**

CONTACT: **Lee Igl, Streets/Utilities Superintendent, Matt Schuenke, Village Administrator**

AGENDA ITEM: **Discussion and action to make a recommendation to the Village Board regarding the Water System Needs Assessment**

PREVIOUS ACTION:

The Public Utilities Committee recommended approval to the Village Board regarding a proposal by Town & Country Engineering to conduct a Water System Needs Assessment Study at their January 18, 2022 meeting.

The Village Board approved the proposal by Town & Country Engineering at their January 24, 2022 meeting.

The Public Works & Utilities Committee was presented the Water System Needs Assessment at their December 21, 2022 meeting. No action was taken at this meeting.

ISSUE SUMMARY:

A Water System Needs Assessment Study helps the village identify challenges and deficiencies within the village's water impact fee structure and would be the basis for adopting a revised impact fee ordinance in order to help offset costs associated with continued growth and impacts on the water system. The last assessment was completed by the Village Engineer in 1997 and this current update would follow a similar methodology. Once completed, the Auditor can prepare an update to the impact fees so that these are properly applied to address growth in the future. To reference the 1997 Assessment please click here.

The Village's current water impact fee of $525 is charged for new residential units and was calculated in 1998 to help offset costs of a new water tower on Holscher Road and a network of large diameter mains to connect the tower more efficiently to the water distribution network and provide system looping. Since that time, the village has continued to grow and it has been determined that both a new drinking water well and significant upgrades to the existing wells will be needed in the near future. In addition, construction costs have increased significantly since 1998. Therefore, the Village desires to update its impact fee to represent its currently anticipated future needs and modern construction costs.

It is important to note that using impact fees for financing construction comes with risks that new residential growth will not meet what is projected. Revenue from water rates cannot be used to supplement a lack of residential growth/impact fees. In that case, general funds (tax dollars) would be needed to help pay for the proposed projects.

The Public Facilities Needs Assessment Report is the first step in the process and was presented to the committee at the December 21, 2022 meeting.. Following the report's completion, the Village financial consultant will prepare an impact fee report which will be used to replace the Water Impact Fee.

Enclosed within the packet is the Water Needs Assessment Report as presented at the December 21, 2022 committee meeting. Any blanks within the report are intentional and represent decisions that will need to be made by the committee. Staff are seeking the committee recommendation for the percentage to allocate to future property owners for the impact fee charge. The Village needs to select an impact fee allotment percentage that officials feel reflects the expected future Village growth. The improvements to the wellhouses at #3 and #4 could be reasonably held at 5% given several different population projections. The cost of a new Well 5 could reasonably be assigned anything between 18.5% and 46.4%. Given the risks of the higher allotments, staff suggests 37.8% using the assumed pumping capacity.

FINANCIAL/BUDGET IMPACT:

VILLAGE PLAN REFERENCE:
None.

ORDINANCE REFERENCE:
None.

BOARD, COMMISSION OR COMMITTEE RECOMMENDATION:
Recommended action:

Motion, second to recommend to the Village Board an impact fee allotment of 5% for improvements to both Well 3 and 4 and an allotment of 37.8% for a new Well 5.

ATTACHMENTS:
1. MC Water Needs Assessment Report
2. MC PFNA - January 2023 Summary

PUBLIC FACILITIES NEEDS ASSESSMENT
FOR
MUNICIPAL WATER SYSTEM

Village of McFarland, Wisconsin

December 2022

TOWN & COUNTRY ENGINEERING, INC.
Madison ♦ Rhinelander ♦ Kenosha
6264 Nesbitt Road • Madison, WI 53719 • (608) 273-3350 • tce@tcengineers.net

PUBLIC FACILITIES NEEDS ASSESSMENT
FOR
MUNICIPAL WATER SYSTEM

Village of McFarland, Wisconsin

December 2022

Table of Contents

TABLES

FIGURES

APPENDICES

EXECUTIVE SUMMARY

Report Purpose and Introduction

The purpose of this report is to evaluate the water system facilities for the Village of McFarland and provide recommendations for immediate and future needs. Existing water facilities consist of three water supply wells (Wells 1, 3 and 4), two storage reservoirs, and the distribution system. Some of the existing facilities need improvements to maintain service and reliability. The Village is also currently considering the need for a new well, and the long-range plans for the water utility will impact the sizing and design of the new facilities. This report builds on past studies from 1998, 2012, and 2018 to help the Village guide capital improvement plans and plan for growth. Specific objectives of this report are to evaluate existing deficiencies, determine future needs of the system based on current usage trends and population projections, and identify improvements required to serve future growth areas. This latter objective includes providing the necessary justification to update the Village's existing impact fees for future users, in accordance with Wisconsin Statute 66.0617.

A previous Public Water Facilities Needs Assessment was completed by Town & Country Engineering in 1998 along with a Report of Water Impact Fees by Virchow, Krause & Company. An impact fee of $525 per residential equivalent unit (REU) was established based on the estimated cost for a new water tower, new well, and new water mains to serve as the transmission backbone for these facilities. The Holscher Road water tower was subsequently constructed in 2000 and a network of 10" and 12" water mains has been constructed to connect the new tower to the distribution system and provide looping. Following DNR approval of a 2012 Well Site Investigation report, the Village acquired a new well site in the southeast portion of the Village but new Well 5 has not been constructed yet.

A 2018 study for the East Basin service area evaluated the utility improvements needed to serve the undeveloped areas on the Village's East side out to Door Creek Road. The study recommended the Village closely monitor water usage and prepare for the eventual construction of Well 5. The study also indicated that, depending on how development progresses on the Village's east side, it may be advisable to construct a third water storage reservoir in this area. Since these past studies were completed, the Village has experienced continued growth and development and wishes to pursue construction of Well 5. This report is intended to update previous impact fees based on current usage, planned development, and recent cost estimates.

The 2020 Census population for the Village is 8,991. According to Wisconsin Department of Administration (DOA) projections, the population is expected to grow to 9,895 over the next 20 years. A linear projection using the 1970-2020 census data provides a more aggressive population projection and has been used to estimate the 2040 (20 year) and 2070 (50-year) populations of 11,730 and 15,960, respectively. For the purposes of water system planning, both projections were used, with the linear projection providing a conservatively high estimate of future water demands, particularly for water storage needs past 20 years, and the DOA projection providing the lower end of the range of possible demands in the next 20 years. Planned developments that are expected to occur in the next 5 to 10 years were used to estimate near-term demands for the water system.

Water Supply Improvements

A new well is needed to meet the future water supply needs for the Village of McFarland. The supply from the Village's existing three wells is marginal for meeting existing demands and does not meet the DNR guidelines for source capacity with near term and 20-year projected growth.

Additionally, the Village's existing wellhouses need upgrades to meet current code requirements, extend the life of the structures and equipment, and provide reliable standby power. If any of the wells are permanently removed from service then additional well capacity would be needed for current demands as well as future growth.

Given the size and condition of the existing Well 1 wellhouse, complete replacement of this building would be warranted if the Village intends keep this well for long-term use. Since Well 1 is the oldest and lowest capacity well, the Village has decided it would be more cost-effective to replace the capacity of Well 1 than to upgrade the facilities with a new wellhouse. Well 1 would likely be removed from service the next time major repairs or maintenance are needed at the well. For water supply planning, it is assumed that the new Well 5 will replace the capacity of Well 1, and that Well 1 will be abandoned at some point in the future after Well 5 is in service.

Existing Wells 3 and 4 provide a combined 2,150 gpm of pumping capacity and are a reliable source of high-quality water. These wells need the following improvements for continued long-term use:

- Building addition/modification to provide for two separate chemical rooms at Well 3 and one additional chemical room at Well 4, including new chemical feed pumps, scales and containment.
- Replacement of the existing natural gas engine and right-angle drive at each well with a stationary standby generator and automatic transfer switch to improve standby power reliability.
- Replacement and reconfiguration of electrical equipment within the existing pump rooms.
- Building architectural and HVAC improvements, including air conditioning for the well pump/electrical spaces.
- Replacement of well pump, motor, discharge piping and instrumentation/appurtenances is recommended if a substantial investment is made at the wellhouses.

Village intends to move forward with planning a new Well 5, located in the southeastern area of the village, near the intersection of Holscher Road and Prairie Wood Drive. The well site is two Village-owned parcels off of Prairie Wood Drive near Wiouwash Way. The DNR previously approved the Well Site Investigation Report for this site in 2012 but the approval has lapsed and will need to be renewed.

The well capacity evaluations in Sections 2.6 and 3.4 demonstrate a need for additional source capacity meet future demands, and to replace the capacity of Well 1 if this well is taken out of service. The additional well capacity needed for future growth ranges from 75 gallons per minute (gpm) for the DOA 2040 projection to 185 gpm for near-term development and 378 gpm for the 20-year linear growth projection. The current pumping rate for Well 1 is approximately 536 gpm. The City wishes to install a new well that has similar capacity to Well 3 and 4, which currently pump at 1,024 and 1,129 gpm, respectively. A new 1,000 gpm well would provide adequate source capacity for future growth and replacement of the capacity at Well 1 and would result in a firm well capacity of 2,024 gpm (1,000 gpm + 1,024 gpm). Using the current maximum day demand (MDD) of 178.5 gallons per capita per day, a firm well capacity of 2,024 gpm could serve a population up to 12,246 while still meeting DNR requirements. **A target pumping capacity of 1,000 gpm has been selected by the Village for future planning and design efforts on new Well 5.**

Water Storage Improvements
The Village has adequate storage to meet current needs, but additional storage will be needed as the Village grows. If the Village wishes to have at least an average day of demand in storage, then more storage would be needed as the population reaches approximately 13,710, based on the current average day per capita usage of 74.4 gpcd. As developments move forward in the East Basin area, the Village should continue evaluating options and actively pursue obtaining land for siting of new storage facilities. The 2018 East Basin study identified two potential sites for a new water tower, one located north of Siggelkow Road, near the intersection with Interstate 39, and the second south off Siggelkow Road, approximately 1,400 feet due south of the end of the cul-de-sac at Lee South Court. These sites were selected based on ground elevations, but several other factors will need to be considered in ultimately determining a new site.

Since the need for additional storage is several years in the future, a detailed evaluation and cost estimates for these sites has not been prepared. The only recommended water storage improvements are routine inspection, maintenance, and coating to extending the life of the Village's existing water towers. Recoating of the Burma Road Tower is planned for 2023.

Distribution System Improvements
Past studies in the 1990s identified areas with insufficient fire flows based on distribution system modeling, with recommendations for water main reinforcements and looping. Most of the recommended improvements from that era have been completed by the Village. The Village's current distribution system model was used to evaluate previously identified improvements that have not been completed. Based on this evaluation, the only remaining recommendation is upsizing the 6" water main on Voges Road, east from USH 51 the to the terminal hydrant if more than 1,500 gpm fire flow is needed in this location. The majority of the Village has over 3,000 gpm available fire flow and pressures over 60 psi. No other areas needing immediate improvements for fire flow or pressure were identified, but other system improvements may be desired based on age-related concerns and associated street reconstruction projects.

For future needs, the planned site for new Well 5 is in a developed portion of the Village that is well-looped with the Village's distribution system by a backbone of 12" mains. There is a small section of 8" main on Prairie Wood Drive between Wiouwash Way and Holscher Road that could be upsized to 12" in the future to complete the looping, but this is not an immediate need. Distribution system expansion for future growth and potential new storage locations will be evaluated in the future as those needs become more immediate.

Summary
The following water system improvements are recommended for inclusion in the Village Capital Improvement's Plan:

	Estimated Cost
Construct New Well 5	$3.32 Million
Well 3 Improvements	$1.72 Million
Well 4 Improvements	$1.62 Million

The portion of the new Well 5 capacity is attributed to growth and would be eligible for impact fees. Under Wisconsin Statutes Section 66.0617, the Village has the authority to adopt impact fees to pay for the proportionate share of capital costs for new, expanded, or improved public water facilities needed to serve future growth and land developments.

The following general considerations for impact fees should be noted:

- Impact fees pay for only the portion of new facilities that can be attributed to growth rather than existing deficiencies.
- Impact fees must be used within 8 years of when they are collected, otherwise they must be returned, plus interest, to the property owner.
- Impact fees must be discontinued (or the Public Facilities Needs Assessment updated) after 100% of the capital to be paid by impact fees has been collected.
- The portion of the capital costs paid by impact fees is not included in the Water Utility's rate base and is considered Contributed Plant by the Public Service Commission.
- If growth does not occur, the Water Utility cannot raise water rates to make up for deficiency in funds. Therefore, the Village must carefully evaluate growth that is reasonably expected to occur before assigning impact fees.

Based on the calculations and information presented in this report, the Village has selected xx% as the Impact Fee Percentage for the new well. The cost estimates, development projections, and impact fee percentage from this report will be used by the Village's accountant to update the existing impact fees.

1. INTRODUCTION

1.1 Purpose and Planning Objectives

The purpose of this report is to evaluate the water system facilities for the Village of McFarland and provide recommendations for immediate and future needs. Existing water facilities consist of three water supply wells, two storage reservoirs, and the distribution system. Some of the existing facilities need improvements to maintain service and reliability. The Village is currently evaluating the construction of a new well and the need for additional water storage, and the long-range plans for the water utility will impact the sizing and design of the facilities.

To help the Village guide capital improvement plans, this report evaluates alternatives for upgrading existing facilities and providing additional storage and source capacity when needed. Another objective of this report is to identify any projects or portions of projects that are required to serve future growth areas and provide the necessary justification to establish impact fees for future users, in accordance with Wisconsin Statutes s. 66.0617.

1.2 Planning Area

The Village of McFarland is located within Dane County in south-central Wisconsin, along U.S. Highway 51 and the east shore of Lake Waubesa. The Village is directly southeast of Madison, the County seat. The Village shares borders with the City of Madison to the north; the Town of Dunn to the west, south, and southeast; and the Town of Blooming Grove to the east.

The Village developed its most recent Comprehensive Plan in 2017. The planning area for the Comprehensive Plan included all lands currently within the Village's municipal limits – approximately 4 square miles – and the unincorporated areas within the Village's 1.5-mile extraterritorial jurisdiction. Appendix A contains a map of the Village's jurisdictional boundaries from its Comprehensive Plan, including its municipal boundary and extraterritorial jurisdiction. Within its extraterritorial jurisdiction, the Village may plan, prepare an official map, and review land division proposals.

The planning area covered by this report is the Village of McFarland and the areas immediately adjacent to the Village which may, in the future, be served by the Village's water utility system. A map of the Village's current service area is shown in Figure 1-1. This map, which distinguishes between water main size by color, is provided in Appendix B.

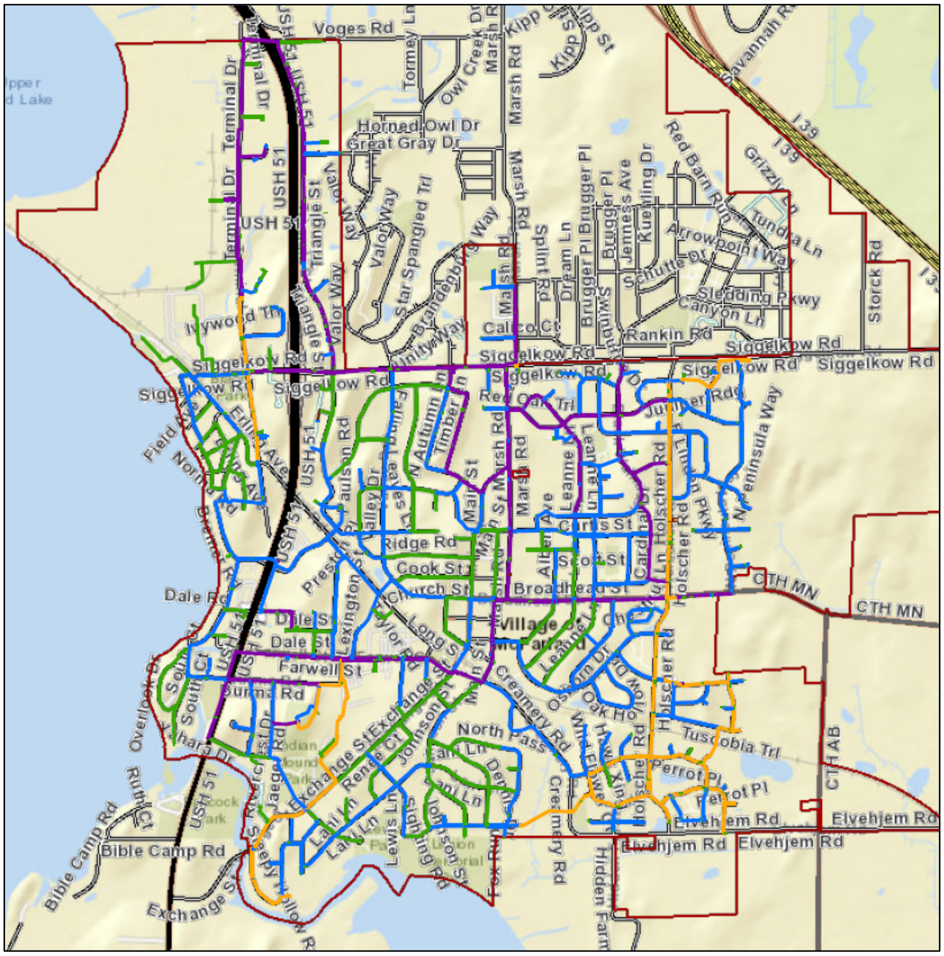


Figure 1-1 Current Village Service Area

1.3 Planning Period

The existing components of the Village's water system and ability to meet current needs are evaluated in Chapter 2. Projections of future needs are made in Chapter 3. Many water system improvements, particularly wells and storage facilities, are designed to last 50 or more years. However, population and land use projections beyond 20 years are inherently inaccurate and based on assumptions for growth and development that may not occur. To balance these two issues, this report uses projections based on a planning period of approximately 20 years as well as projections of growth up to 50 years in the future to provide a range of future water demands. Chapter 4 presents alternatives for water system improvements to meet both current and future needs. Recommendations for future water infrastructure improvements are based on planning projections that will need to be refined as the Village grows or as customer usage changes.

1.4 Population and Existing Land Use

Table 1-1 summarizes the census data and recent population estimates for the Village of McFarland. According to U.S. Census data, the Village's population has increased steadily from 1970 through 2020, with a percent increase of 277%, or a 5.5% annualized growth rate. The Wisconsin Department of Administration estimated that the Village's 2021 population was 9,331.

Table 1-1 Village Population Summary

Year	Census[1]						Estimate[2]
	1970	1980	1990	2000	2010	2020	2021
Population	2,386	3,783	5,232	6,416	7,808	8,991	9,331

For this planning document, the current base population was assumed to be 8,991 based on the 2020 Census. Projected population increases from this baseline figure will be used to estimate future demands in Chapter 4.

According to the Village's 2021 Annual Public Service Commission (PSC) Report, the Village serves 3,291 residential customers, 221 commercial properties, 26 public authority customers, and 58 multifamily residences customers within the municipality.

The existing land use map for the Village is provided in Appendix A, taken from its 2017 Comprehensive Plan. Land use and zoning within the Village is primarily residential; public lands recreation; and transportation, communication, and utilities; and agricultural. The Village also has a significant amount of land which is currently either commercial, industrial, or open land.

1.5 Topography and Geology

The entire Village of McFarland lies within the Yahara River watershed, which generally consists of relatively flat or undulating glacial deposits, including many wetland areas, and drains into the Rock River. The northern and western parts of the Village drain into Lake Waubesa, and the southern and eastern portions of the Village and its extraterritorial jurisdiction drains into Lower Mud Lake, when then flows through the Yahara River onto Lake Kengona and finally the Rock River.

The Village's topography is characteristic of that found in the central and eastern portion of Dane County. The Village's surface geology includes drumlins and other till surfaces, lake plains, and some glacial stream deposits. Elevations in the village generally range from 950 feet above mean sea level (amsl) in the north-central and southwest corners of the Village, down to 850 feet amsl near the Yahara River and Lake Waubesa.

Information on bedrock underlying the Village is based on maps and cross sections developed by the Wisconsin Geological and Natural History Survey and well construction records. The uppermost bedrock in the McFarland area consists of the Sinnipee Group, including the Galena, Decorah, and Platteville Formations, which are dolomite of Paleozoic age within the Ordovician system.

Commented [AB1]: I included this for Dodgeville where they do have karst features but I don't think its relevant/necessary here.

[1] U.S. Census Bureau Data
[2] Wisconsin Department of Administration, Municipal Final Population Estimates, January 2021

The Sinnipee Group is underlain by the Ancell Group, which includes shale and sandstone, and the Prairie du Chien Group, which consists of dolomite with some sandstone and shale. The Prairie du Chien group is underlain by Cambrian bedrock consisting of the Trempealeau, Tunnel City and Elk Mound Groups. The Elk Mound Group consists of units of sandstone and shale including, from oldest to youngest, the Mount Simon, Eau Claire, and Wonewoc Formations. The Mount Simon Formation is made up of coarse to medium-grained sandstone, and gradually transitions upwards to the fine-grained, silty sandstone of the Eau Claire Formation. The upper portion of the Eau Claire Formation contains significant amounts of shale and siltstone, forming an important aquitard, known as the Eau Claire aquitard. The overlying Wonewoc Formation consists of medium- to fine-grained sandstone, forming an important regional aquifer system above the Eau Claire aquitard. The Tunnel City Group overlies the Elk Mound Group and consists of medium to very fine-grained glauconitic sandstone. The Trempealeau Group overlies the Tunnel City Group and consists of the Jordan quartz sandstone and St. Lawrence dolomitic sandstone and siltstone with some thin shale beds.

The Village's existing wells are open to the Prairie du Chien, Trempealeau, Tunnel City and Elk Mound Groups.

1.6 Past Studies

In 1998, Town & Country Engineering performed a Public Facilities Needs Assessment for Public Water Impact Fees on behalf of the Village of McFarland. The purpose of this report was to analyze the Village's water system including water supply and storage needs, the location a new water tower, and future water main construction needs. The report assessed deficiencies in the Village's water system, determined future needs of the system, identified projects required to service future growth areas, and provided the necessary justification to establish impact fees on future users. Recommended distribution system improvements from a 1994 Water System Computer Analysis by Strand Associates, Inc were also evaluated. The 1998 report recommended several water main loop interconnections and water main size increases, construction of a new water storage tank at a site along Holscher Road, and allocation of impact fees on future users. A 1997 Report on Impact Fees by Virchow Krause & Company established impact fees for a new water tower, transmission mains, and a new well. The recommended water storage tank was subsequently constructed in 2000 and is described further in section 2.2.

In 2012, Town & Country Engineering developed a Well Site Investigation Report to evaluate three potential well locations for a future Well 5. All three sites were on the east side of the Village, on properties on the north side of Prairie Wood Drive, east of Holscher Road. The report analyzed past and present uses of the potential well sites; described site characteristics; identified potential contamination sources within a half mile of each site; described wetlands, floodplains, and surface water near the three sites; summarized previous modeling of pertinent groundwater aquifer; and outlined anticipated well construction details such as hole sizing, casing depth, and overall well depth. The report identified the site located northeast of the intersection of Wiouwash Way and Prairie Wood Drive as the primary well site, with the other two sites as backups if the primary site could not be acquired. Following DNR approval of the 2012 well site investigation report, the Village purchased two adjacent parcel off of Prairie Wood Drive for a future Well 5. No well or pumping facilities have been constructed to date on these properties.

In 2018, Town & Country Engineering prepared an East Basin Utility Service Study which, in part, evaluated the Village's existing water utility service capabilities within its East Basin to quantify and plan for the impacts of projected future community growth on this system. The Village's East

Basin generally consists of undeveloped, unserved areas between currently developed areas on the Village's East side out to Door Creek Road. The study recommended the Village closely monitor maximum daily peak water usage on an annual basis, and to prepare for the eventual construction of Well 5 via its long-term capital infrastructure improvement funding and planning. The study also indicated that, depending on how development progresses on the Village's east side, it may be advisable to construct a third water storage reservoir for system redundancy or to maintain system pressures.

Since these past studies were completed, the Village has had continued growth and development and wishes to pursue construction of Well 5. This report is intended to update previous impact fees based on current usage, planned development, and recent cost estimates.

1.7 Regulatory Requirements

When analyzing the overall needs and capacity for a water system, several components need to be taken into consideration, including the average and maximum day water demands, fire flow requirements, past operating data, and standby requirements. It should be recognized that there are no absolute requirements for system capacity. The Wisconsin Administrative Code chapters for Natural Resources (NR) and Public Service Commission (PSC) include specific pressure requirements which must be followed. Recommendations from the Insurance Service Office (ISO), Wisconsin DNR, and the Wisconsin PSC are generally used as guidelines for sound engineering design.

The pertinent requirements set forth in the Wisconsin Administrative Code are as follows:

- Wisconsin Administrative Code s. NR 811.70 requires that "*The minimum and maximum normal static pressure in the distribution system shall be 35 psi and 100 psi, respectively, at ground level. The system shall be designed and operated to maintain a minimum residual pressure of 20 psi at ground level at all points in the distribution system under all conditions of flow. The minimum flow requirement for water mains serving fire hydrants is 500 gpm at 20 psi residual pressure at ground level at all points in the distribution system."*

- Wisconsin Administrative Code s. NR 811.66 requires that *"the maximum variation between high and low levels in storage structures which float on a distribution system may not exceed 30 feet during normal usage. The minimum and maximum pressure in service areas shall be 35 and 100 psi respectively at ground level. In areas where a minimum of 35 psi cannot be maintained, a high pressure zone shall be established in the distribution system by means of booster pumps and related facilities or pressure boosting systems on individual service lines as required in Subchapter XI. The use of individual service line booster pumps shall be limited to the extent possible. In situations where static pressures exceed 100 psi, pressure reducing devices may be required on mains in distribution systems having documented system deficiencies or problems due to high pressure such as main breaks and service line breaks."*

- Wisconsin Administrative Code s. PSC *185.82 states that "Under conditions of normal heavy system demand the residual pressure at the meter outlet shall not be less than 20 psig. For typical residential customers, normal conditions of use shall mean a flow rate of not less than 12 gallons per minute ... This standard shall ordinarily require that the distribution main pressure at the corporation stop connection be at least 35 psig…The maximum pressure at the meter shall not exceed 125 psig. The maximum pressure at the* *meter shall not exceed 100 psig for new systems and, to the extent practical, major additions to existing systems."*

- Wisconsin Administrative Code s. NR 811.62(1) requires that "*A sufficient quantity of water, as determined from engineering studies, shall be maintained in elevated storage when only one pumping unit to the distribution system is available to serve the water system. This shall be at least an average-day supply under normal operating conditions. When more than one distribution pump is available, the storage shall be in accordance with standard engineering practice. Standard engineering practice is based upon an engineering review of existing and future water supply needs including: type of service and population served; average day, maximum day, peak hour and fire flow demands and durations; water source quality, availability and treatment, pump capacities, auxiliary power, storage capacity, water distribution and costs."*

- Wisconsin Administrative Code s. NR 811.26 requires that *"There shall be 2 or more pumping units, with each unit capable of supplying the peak demand. The department may approve exceptions under sub. (2), if additional pumping stations which can meet the peak demand are available or if the department determines that there will be a sufficient volume of storage available between pumping periods to allow for necessary repairs. Depending on the type and size of the water system, a sufficient volume of storage may include elevated storage, ground storage fitted with high-lift pumps and auxiliary power, and pressure tank storage. If only 2 units are provided, each unit shall be capable of supplying the peak demand. If more than 2 units are installed, the total number of units shall have sufficient capacity so that if any one pump is taken out of service, the remaining pumps are capable of supplying the peak demand."*

- Wisconsin Administrative Code s. NR 811.27 requires that "*All municipal pumping stations, pumphouses, and water treatment plants shall have a standby auxiliary power source unless the department determines that there is sufficient pumping capacity with existing auxiliary power located at other water system facilities to provide at least an average day supply of water. Sufficient power shall be provided to operate pumps, treatment systems, chemical addition, control systems, and monitoring equipment. Auxiliary power for chemical addition, treatment, and monitoring equipment is not required if the treatment, chemical addition, control, and monitoring equipment is not necessary to meet the primary drinking water standards in ch. NR 809 or the continuous disinfection requirements of chs. NR 810 and 811."*

- For boosted pressure zones, Wisconsin Administrative Code NR 811.82 states that "*Elevated storage is not required for a boosted pressure zone where the primary pressure zone can provide minimum pressures of 35 psi at street elevation in all areas of the boosted zone. Elevated storage facilities shall be provided for a boosted pressure zone serving more than 50 living units in any of the following situations: (1) If the primary pressure zone cannot maintain pressures of 3 psi or greater at street elevation in all areas served by the booster pumps including situations where emergency power is provided.(2) If the primary pressure zone provides pressures of 3 to 35 psi at street elevation in all areas served by the booster pumps and an emergency power source is not provided for the booster station."*

- For booster pumping stations, Wisconsin Administrative Code s. NR 811.83 requires that *"Emergency power shall be provided if 50 or fewer living units are being served and the* *primary pressure zone cannot maintain positive pressures of 3 psi or greater at street elevation in all areas served by the booster pumps, and sufficient elevated storage is not provided. Emergency power shall be provided if more than 50 living units are being served and the primary pressure zone cannot maintain pressures of 20 psi or greater at street elevation in all areas served by the booster pumps, and sufficient elevated storage is not provided."*

- The DNR's 2018 Guidance for Municipal Drinking Water System Source Capacity Determination states *"The department considers a water system to have adequate source capacity if the maximum daily demand can be met with the largest source out of service while pumping 18 hours per day or less and if the average daily demand can be met with the largest source out of service while pumping 12 hours per day or less. The department considers a water system that relies on only one source to not have adequate source capacity."*

ISO provides evaluations of fire insurance classification for municipalities and establishes the criteria used in the evaluation of a community's fire defenses. ISO calculates recommended fire protection rates for communities based on physical surveys of actual buildings within the community. ISO typically recommends a minimum fire flow of 750 gpm for single family residential areas and 2,500 gpm to 4,500 gpm for commercial areas and areas of high intensity development. ISO calculates the needed fire flow (NFF) for individual buildings based on each building's area, construction, occupancy, and exposure. ISO then uses the fifth highest NFF as the recommended fire protection rate for a community. To get full credit, the water supply must be able to deliver water at 20 psi residual pressure and at the specified rate of flow for a duration of 2 hours for NFF less than 3,000 gpm, for a duration of 3 hours for NFF of 3,000 gpm to 3,500 gpm, and for a duration of 4 hours for NFF in excess of 3,500 gpm. These fire flow capacities must be supplied in excess of the maximum daily pumpage rate, based upon records for the past three years. This fire protection rate makes up about 40% of a community's ISO Public Protection Classification (PPC), which includes other factors such as personnel training, hydrant maintenance, equipment, and historic response time. The PPC is used by insurance companies in setting the property insurance rates for communities.

In May 1995, ISO Commercial Risk Services conducted hydrant flow tests around the Village and developed recommended firefighting capacities at the various test locations, with three locations that required fire flows in excess of 3,000 gpm. Based upon this testing, ISO provided a basic fire flow rating of 3,000 gpm. Appendix C includes documentation of the ISO hydrant flow testing and fire flow rating.

The Village's 1998 Needs Assessment for Public Water Impact Fees and 2018 East Basin Utility Service Study both used a fire flow requirement of 3,000 gpm for a 3-hour duration for analyzing storage needs.

More recent ISO testing and rating was not available at the time of this study, so a fire flow of 3,000 gpm for 3 hours was used for the purposes of this report to evaluate the capacity of the water system. In general, the maximum fire flow normally expected from a public water system does not exceed 3,500 gpm for practical reasons.

2. EXISTING WATER SYSTEM FACILITIES

The Village of McFarland's water system consists of three wells, two storage reservoirs, and the distribution system as described in the following sections. Appendix B contains a map of the existing water system facilities.

2.1 Existing Wells and Pumping Facilities

The Village currently has three existing water production wells, Wells 1, 3 and 4, that discharge directly to the distribution system. (Well 2 was removed from service in 1987 and permanently abandoned in 2000 due to the presence of contaminated groundwater.) Appendix B contains a summary of well construction details and well construction records for the three existing wells.

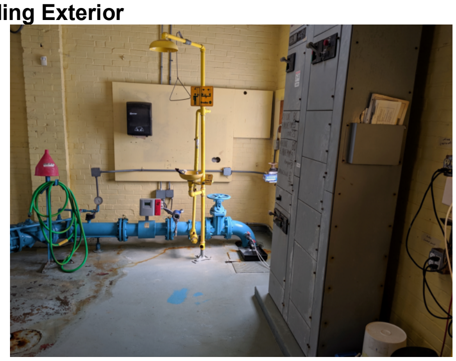
2.1.1 Well 1

Well 1 is located in the south-central part of the Village at 5412 Long Street, on the northwest corner of Long Street and Milwaukee Street, near the E.D. Locke Public Library. Well 1 was originally constructed in 1940, and has a Wisconsin Unique Well Number of BF498. The well has a total depth of 560 feet below ground surface, with a 16-inch outer casing to 145 feet and a 10–inch inner casing to 167 feet and a 10-inch open borehole below the casing.

The current pump is a 6-stage Layne model 10RKHC which is approximately 40 years old. The original pump design was for 500 gpm at 240 feet total dynamic head, and the current pumping rate is approximately 530 gpm. The pump was last pulled for inspection in 2022. The motor is 40 hp and was replaced in 2010 with a maximum efficiency, inverter duty-rated US Motor's RUSI motor.

The wellhouse was constructed in 1940 and is brick building with a flat roof, with approximate building dimensions of 20 ft x 18 ft. The wellhouse has a single room that houses the well pump, discharge piping, chemical feed facilities, and electrical/SCADA equipment. As an auxiliary power source, the wellhouse contains a natural gas internal combustion engine connected to the well pump shaft via a right angle drive. Recommended improvements for Well 1 are described in Section 2.1.5.

Well 1 Building Exterior



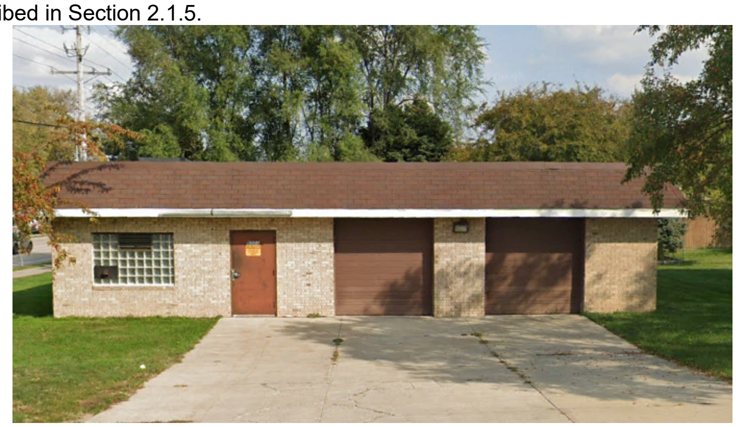
Well 1 Building Interior

2.1.2 Well 3

Well 3 is located in the northern part of the Village at 5001 N. Autumn Lane, on the southeast corner of Siggelkow Road and N. Autumn Lane. Well 3 was originally constructed in 1974 (BF500) with a 20-inch casing to 116 feet and was reconstructed in 1996 (HJ137) with a grouted 14-inch liner casing to 260 feet. The well has and a 17-inch open borehole beneath and a total depth of 700 feet below ground surface.

The well pump is a 12-inch American Turbine 5-stage vertical turbine pump with 125 horsepower electric motor. The pump is set at 230 feet below ground surface, and the current pumping rate is approximately 1,020 gpm. The pump and motor were installed in 1996. The pump was last inspected, repaired, and reset in February 2022.

The wellhouse is of brick-block construction with a mansard roof. The building includes a double garage for maintenance equipment and supply storage. The well pump and discharge piping is housed in room that also contains chemical feed facilities, and electrical/SCADA equipment. As an auxiliary power source, the wellhouse contains natural gas internal combustion engine connected to the well pump shaft via a right angle drive. Recommended improvements for Well 3 are described in Section 2.1.5.



Well 3 Wellhouse Exterior

Well 3 Wellhouse Interior

2.1.3 Well 4

Well 4 is located in the south-eastern part of the Village at 5703 Bird Song Court, within Egner Park between Bird Song Court and Creamery Road. Well 4 was constructed in 1989, and has a Wisconsin Unique Well Identification Number of AC718. Well 4 has a total depth of 800 feet below ground surface, with a 20-inch casing to 130 feet and an 18-inch open borehole beneath that.

The well pump is a MidSouth (Jacuzzi) 11-stage vertical turbine pump, Model 12HCA1, with a 100 hp electric motor. The pump is set at 100 feet below ground surface with 10-inch column pipe. The current pumping rate is approximately 1,130 gpm. The pump was last pulled for inspection in 2020.

The wellhouse is located with a park building that also contains a small garage and covered area containing a picnic bench. The building is of block construction with cedar siding on the exterior. One room houses the well pump, discharge piping, and electrical/SCADA equipment, and a separate room houses the chemical feed facilities. Similar to the other two wells, auxiliary power is provided by a natural-gas engine connected to the well pump shaft via a right angle drive. Recommended improvements for Well 3 are described in Section 2.1.5.

Well 4 Wellhouse Exterior

Well 4 Wellhouse Interior

2.1.4 Chemical Feed Facilities

All of the wells have chemical feed equipment for adding hydrofluorosilicic acid for fluoride dental health protection and sodium hypochlorite for chlorine disinfection. Wisconsin Administrative Code s. NR 811 requires containment for the chemical storage and isolation of the fluoride chemical storage away from controls, electrical contacts and other equipment subject to damage. Separation of fluoride from other chemical storage is also recommended and is required for new installations. At Wells 1 and 3, the chemicals are stored in the same room as the well pump and electrical equipment. Well 4 has a separate chemical room but fluoride and chlorine are stored in the same space. Secondary containment is needed for all of the chemical storage spaces. These non-conforming features are noted in the DNR's 2022 Sanitary Survey (Appendix C), and would need to be addressed if major changes or remodeling to the wellhouses occur or a health hazard is identified.

2.1.5 Recommended Improvements

All three wellhouses need upgrades to meet current code requirements and provide separate spaces for chemical storage and electrical equipment. Room separation and proper ventilation is necessary to eliminate corrosion issues and mitigate safety and health problems that presently exist with having everything in one room. Proper chemical containment and separation of the chemical feed and electrical components would extend the life of electrical equipment and prevent the potential for chemical contact.

In addition to structural improvements, replacement of the existing natural gas-powered engines and right angle drives with stationary generators and automatic transfer switches should be considered for all of the wellhouses. The Village is not able to get replacement parts for the existing equipment and the natural gas supply could be interrupted during storms or major emergencies, making the existing auxiliary power source less reliable than desired.

The Well 1 wellhouse is original to the 1940s and would require substantial improvements to bring the building up to modern day standards for energy efficiency and building construction methods. Additionally, the 20-ft x 18-ft building footprint does not have sufficient space to create a separate chemical feed and electrical rooms. Given these needs, this building is considered insufficient for further capital investment and replacement of the building would be recommended if the Village wanted to upgrade this well. The existing building would be demolished and replaced with a new, expanded structure with four separate rooms: a pump room, two chemical rooms (chlorine and fluoride), and an electrical room. The chemical rooms would include new chemical feed pumps, scales, and containment, as required by Wisconsin Administrative Code s. NR 811. Construction of the new building would include the associated site work and the addition of a stationary generator either interior or exterior to the building.

The Well 3 wellhouse is over 45 years old and needs architectural, HVAC, and electrical upgrades. The building has sufficient space around it for expansion to add on separate chemical rooms, or the existing garage space could be converted. Two new chemical rooms would include new chemical feed pumps, scales and containment for chlorine and fluoride. The pump room could be reconfigured to allow for the replacement of electrical equipment and the provision of adequate clearance. Replacement of the well pump, motor, discharge piping, valves, flowmeter, and instrumentation should also be considered if substantial improvements are planned for the building. In addition, the 2022 Sanitary Survey noted that entry point sample taps after chemical addition are needed and the well vent should be increased to 2" to meet current code requirements.

The Well 4 wellhouse is over 30 years old and needs architectural, HVAC, and electrical upgrades. The building is located within a park but likely has sufficient space around it for an additional chemical room to provide separation of chlorine and fluoride. The new chemical room would include new chemical feed pumps, scales and containment. The pump room could be reconfigured to allow for the replacement of electrical equipment and the provision of adequate clearance. The pump, motor, discharge piping, valves, flowmeter, and instrumentation for Well 4 should be considered for replacement if substantial wellhouse improvements are planned.

2.2 Existing Storage Facilities

The Village has two existing elevated water storage tanks – the Burma Road reservoir and Holscher Road reservoir – as shown on the system map in Appendix B. Both are pedesphere-style painted steel tanks with a characteristic "lollipop"-shaped top and flared conical base.

The Burma Road reservoir is located in the southwest area of the Village within Indian Mound Park, southeast of the intersection of Burma Road and Indian Mounds Drive. The Burma Road Reservoir was constructed in 1975, has a capacity of 500,000 gallons, an overflow elevation of 1,048 feet amsl, and an operating range of approximately 37 feet. The ground surface elevation at the Burma Road reservoir is approximately 957 feet amsl. The tower was last painted (interior and exterior) in 2005 and was last inspected in 2022. Minor repairs were recommended along with cleaning and overcoating of the tank exterior in the near future. This work is planned for 2023.

The Holscher Road reservoir is located in the northeast area of the Village, southeast of the intersection of Siggelkow Road and Holscher Road. The Holscher Road Reservoir was constructed in 2000, has a capacity of 750,000 gallons, an overflow elevation of 1,047 feet amsl, and an operating range of approximately 40 feet. The ground surface elevation at the Holscher Road reservoir is approximately 937 feet amsl. The tower was last inspected in 2022 and minor repairs were recommended along with cleaning and overcoating of the tank exterior in the near future.

Burma Road Reservoir (L) and Holscher Road Reservoir (R)

The maximum service elevation of the existing water storage tanks is approximately 965 feet amsl. The water level in each tank is measured by a pressure-type level sensor connected to the SCADA system to control the wells.

2.3 Supervisory Control and Data Acquisition (SCADA)

In 2018, the Village installed a new SCADA system, which is a networked computer system with associated instrumentation, data storage/processing, and communication devices, that monitors and controls the existing public water system. The SCADA system consists of instrumentation and control panels at the reservoir and well sites, a master control panel, and communication links between the wells, water storage tanks, and the master control panel.

The SCADA system controls the on/off operation of the well pumps, monitors water pressure, and can graph trends of all pumps and water levels. The SCADA system controls operation of the well pumps based on the water levels in the reservoirs. The SCADA system also monitors the operation of all sanitary sewerage lift stations.

2.4 Existing Water Distribution System

Appendix B contains a map of the existing water distribution system. The Village's existing water mains range in size from less than two inches to twelve inches in diameter. Table 2-1 summarizes the approximate quantities of water mains, services, valves in the existing distribution system.

Table 2-1 Summary of Existing Distribution System

Item	Quantity
Water Services	2,234
Fire Hydrants	516
Distribution System Valves	1,322
Water Meters	3,662

Water Mains	Linear Feet
2” Diameter or Smaller	167
4” Diameter	444
6” Diameter	59,870
8” Diameter	99,813
10” Diameter	47,825
12” Diameter	27,503

Past studies have identified areas with insufficient fire flows based on distribution system modeling, with recommendations for water main reinforcements and looping. A 1994 Water System Computer Analysis by Strand Associates, Inc provided recommendations for immediate and intermediate (within 10 years) improvements. The 1998 Public Facilities Needs Assessment also identified the water main network and upsizing needed to connect the new Holscher Road water tower to the existing system and expected future service areas. Most of the recommended improvements have been completed by the Village, as summarized in Appendix D.

Maps of fire flow and pressure from the Village’s existing distribution system model are provided in Appendix D. The majority of the Village has over 3,000 gpm available fire flow and pressures over 60 psi. For the previously identified improvements that have not been completed, modeling was performed to determine potential benefits, as summarized below:

- Replacement of 6” water main on Eighmy Road between Main Street and Marsh Road with a 10” main - Model run shows some fireflow increase, but the existing level of service is not deficient, replacement recommended when the street is reconstructed.
- Replacement of 6” water main on Milwaukee Street from Church Street to Creamery Road. Milwaukee - 6" from Broadhead to Church St remains but the rest was replaced with 10”, Model run shows some fireflow increase, but existing level of service is not deficient, replacement recommended when the street is reconstructed.
- Connection of a new 12” diameter water main loop from Highland Drive through Lewis Park to just west of Sighting Road and replacement of 6” main on Highland Drive and Marsh Wood Road to Lewis Park with 12” to connect to new loop - Model run shows some fireflow increase, but existing level of service is not deficient. Loop is not needed at this time.
- Replacement of 6" water main on east side of USH 51 on Voges Road to hydrant to increase fire flow –Model run shows fireflow increase from 1560 to 2540 gpm with increase to 8" main, Replacement with 8” or larger is recommended if additional fire flow is desired in this location.

The review of existing distribution system did not reveal any other areas needing immediate improvements for fire flow or pressure. Recommendations for future distribution system improvements are provided in Chapter 4.

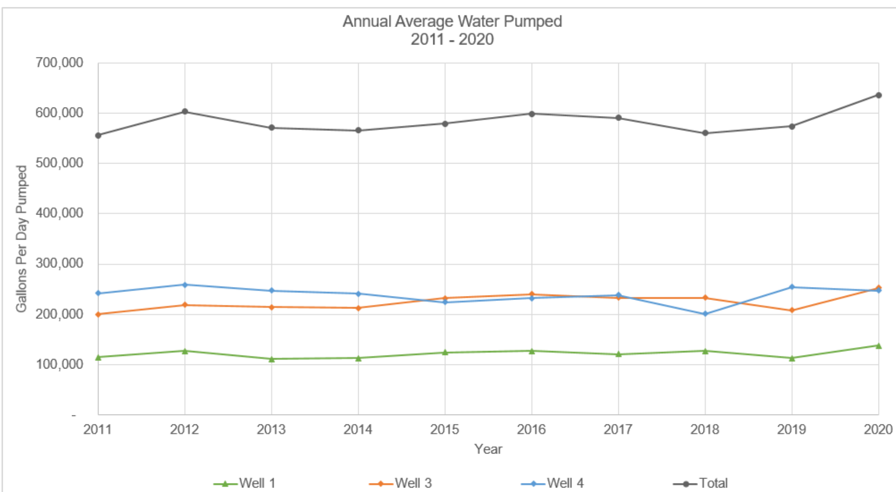
2.5 Water Production and Consumption History

The demands for water in a municipal water system are typically defined using the following terms:

- Average daily demand (ADD) is the total quantity of water pumped over a calendar year divided by 365 days to give an average day.
- The maximum day demand (MDD) is defined as the amount of water pumped during a single day of the year with the highest water usage. The MDD is often expressed as a ratio of MDD to ADD or peaking factor that is applied to the ADD.

- The peak hour demand (PHD) is the maximum volume of water delivered to the system in a single hour, usually the hour of maximum demand that occurs on the maximum day. Demand rates fluctuate throughout the day, generally peaking during the morning and evening hours. The hourly variations in water use vary from municipality to municipality but can be estimated using a typical diurnal demand curve for systems with no records of hourly demands. The PHD is often expressed as a ratio to the MDD using the highest value from the demand curve.

Annual well pumpage for the Village is summarized in the graph below based on data reported to the DNR for high-capacity wells. The annual average pumpage was approximately 592,500 gallons per day based on data from 2016-2020.



Data on water production and usage were taken from the Village's annual reports filed with the Wisconsin PSC. Total water pumped (entering the distribution system) and metered water usage for 2016 through 2021 are summarized in Tables 2-2 and 2-3, respectively. Additional data are provided in Appendix E. The difference between the pumpage and metered usage represents water losses, leakage, and water usage that unaccounted for or unmetered, which is all termed "non-revenue water" by the PSC and is usually expressed as a percentage of the total pumpage. A non-revenue water loss in excess of 15% is considered excessive by PSC guidelines. Between 2016 and 2020, Village's non-revenue water has averaged 14%, with a high of 17% in 2017, and 15% in 2020.

Average water production was 219,508 gallons per day for these 6 years, with the highest annual average of 236,045 gallons per day in 2021. The maximum reported water use days for each year were compared to the average day usage to develop maximum day peaking factors. MDD ranged from 989,000 to 1,754,000 gallons pumped, mainly due to hydrant flushing and water main breaks, with a range of peaking factors from 1.77 to 2.75 for the period of 2016-2021. A statistical analysis was performed on the MDD to ADD pumpage peaking factors using two data sets, the recent data from 2016-2021 and a larger data set from 2010 to 2021, provided in Appendix E. Confidence intervals were calculated for these two data sets to help select an appropriate peaking factor to evaluate future water supply and storage needs. Based on the analysis of data from 2010 to 2021, there is a 95 percent chance in any given year that the actual MDD to ADD peaking factor will be less than or equal to 2.38. Conversely, there is a 5 percent chance the actual peaking factor will exceed 2.38. The 95 percent confidence interval for the smaller data set is 2.48. A MDD:ADD peaking factor of 2.40 was selected for this study to be reasonably conservative in the future projections of maximum day demands.

Table 2-2 also shows the seasonal variation in water production with monthly pumpage. In general, the highest usage is during the summer months, but monthly variations are heavily influenced by events such as water main breaks and flushing hydrants.

Table 2-2 Water Pumpage Summary

	Total Gallons Entering Distribution System (1000 gallons)						
Month	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**Average**
January	16,381	18,054	17,836	16,599	16,566	17,585	17,170
February	18,823	16,362	16,159	15,603	16,200	15,959	16,518
March	16,327	17,472	15,511	16,905	16,845	16,462	16,587
April	20,007	20,871	15,950	15,666	17,345	18,498	18,056
May	19,371	19,546	18,177	18,632	21,497	19,816	19,507
June	20,341	20,931	17,283	17,319	21,398	25,002	20,379
July	21,072	18,330	20,165	21,389	22,827	21,688	20,912
August	18,983	17,230	18,042	19,112	26,148	22,206	20,287
September	16,495	17,714	16,604	17,317	19,697	21,368	18,199
October	17,124	15,932	16,251	16,999	20,659	21,276	18,040
November	16,072	15,811	16,036	16,484	16,353	17,674	16,405
December	17,308	17,641	16,036	17,580	17,612	18,511	17,448
Total	218,304	215,894	204,050	209,605	233,147	236,045	219,508
Average Gallons per Month	18,192	17,991	17,004	17,467	19,429	19,670	18,292
Average Gallons per Day	**598**	**591**	**559**	**574**	**639**	**647**	**601**
DOA Estimated Population	8,044	8,200	8,527	8,700	8,991	9,331	
Avg Gallons per Capita Per Day	**74.4**	**72.1**	**65.6**	**66.0**	**71.4**	**69.3**	**69.7**
Maximum Day Usage	**1,275**	**1,090**	**989**	**1,202**	**1,754**	**1,384**	**1,262**
Max Day Peaking Factor	2.13	1.84	1.77	2.09	2.75	2.14	2.12
Max Gallons per Capita per Day	**159**	**133**	**116**	**138**	**196**	**148**	**148**
Non-Revenue Water Loss % of Supplied	**14%**	**17%**	**14%**	**12%**	**15%**	**12%**	**14%**

Water pumpage and usage per capita for this period was estimated using DOA population estimates and the 2020 Census population, resulting in an average pumpage of 69.7 gallons per capita per day (gpcd) and an average metered usage of 59.8 gpcd. The highest annual average per capita pumping rate – 74.4 gpcd – occurred in 2016, and the highest maximum day per capita pumping rate of 195 gpcd occurred in 2020. Comparison of these rates to those used in a 2018 East Basin study shows that per capita water production and usage has stayed roughly the same.

The 2018 study used a maximum year daily pumping rate of 75.4 gpcd and MDD peaking factor of 2.43 to evaluate future water infrastructure needs. For the purposes of this study, the maximum year daily pumpage of 74.4 gpcd (2016) was used to evaluate current and future needs since the water system must be capable of meeting the greater demands that occurring during dry years. The selected MDD peaking factor of 2.40, described previously, yields a per capita max day demand of 178.5 gpcd. The Village does not have data on hourly demands, so the PHD has been estimated using a standard diurnal curve.

Table 2-3 provides metered water usage by customer class and shows that residential use makes up approximately 75% of the total water usage (83% including multifamily), on average, while commercial use accounts for 13%, and public authority use is 3%. The Village does not have any customers identified as industrial users. Residential water usage has remained fairly constant during the period 2016-2019, while rising in 2020-2021, with usage per metered residential connection ranging from 124 to 137 gallons per meter.

Table 2-3 Water Usage Summary

	Annual Metered Water Usage by Meter Type (1000 gal/yr)						
User Class	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**Average**
Residential	135,886	134,544	133,712	136,341	154,698	156,160	141,890
Number of Meters	2,794	2,864	2,961	3,003	3,083	3,291	2,999
Usage per Meter (gpd)	133	129	124	124	137	130	130
Commercial	23,052	24,034	22,645	23,759	23,163	27,608	24,044
Number of Meters	204	202	200	204	210	221	207
Usage per Meter (gpd)	310	326	310	319	302	342	318
Public Authority	6,458	5,951	4,968	7,065	4,177	4,744	5,561
Number of Meters	21	21	20	21	25	26	22
Usage per Meter (gpd)	843	776	681	922	458	500	696
Multifamily	14,648	14,261	13,422	14,390	15,060	17,640	14,904
Number of Meters	54	54	69	70	56	58	60
Usage per Meter (gpd)	743	724	533	563	737	833	689
Unmetered Sales	7,867	285	1,140	1,980	595	441	2,051
Number of Users	1	1	1	1	17	16	6
Usage per User (gpd)	21,553	781	3,123	5,425	96	76	5,176
Total Yearly Metered Use (1000 gal)	187,911	179,075	175,887	183,535	197,693	206,593	188,449
Number of Users	3,074	3,142	3,251	3,299	3,391	3,612	3,295
Avg Monthly Metered Use (1000 gal)	15,659	14,923	14,657	15,295	16,474	17,216	15,704
Avg Daily Metered Use (1000 gal)	**515**	**491**	**482**	**503**	**542**	**566**	**516**
DOA Estimated Population	8,044	8,200	8,527	8,700	8,991	9,331	

Average Gallons per Capita per Day	**64.0**	**59.8**	**56.5**	**57.8**	**60.2**	**60.7**	**59.8**

During the period of 2016-2021, the top five water users varied from year-to-year, and included such users as a supermarket, laundromat, refrigeration facility, school district, hockey rink, and multi-family apartment complex. None of the top five water users individually constituted more than 2% of total annual water usage. Therefore, there was no need to analyze industrial or large water users separately from the other water users.

2.6 Well Capacity Analysis

There are a number of design guidelines that can be used to evaluate the adequacy of a water supply. When pump maintenance or repair is needed, a well may be out of service for a period of several days to several months, and it is necessary to ensure that water demands can be reliably met even when a well is out of service. According to the Ten States Standards, the total developed groundwater source capacity should equal or exceed the design maximum day demand with the largest producing well out of service. Using this standard, the minimum well capacity for system reliability should be equal to the average (24-hour) pumping rate on the maximum day of pumpage. Also, a minimum of two sources of groundwater should be provided and consideration should be given to locating redundant sources in different aquifers or different locations of an aquifer. Finally, the availability of standby power at supply wells must take into consideration, as emergency conditions are most commonly associated with a loss of electrical power. Wells 1, 3 and 4 currently have natural gas-fueled internal combustion engines connected to right angle gear drives to provide standby power.

The DNR evaluates source capacity by determining whether the maximum daily demand can be met with the largest source out of service while pumping 18 hours per day or less and if the average daily demand can be met with the largest source out of service while pumping 12 hours per day or less. Since the DNR's guidelines are the most conservative, these have been used to evaluate source capacity for the purposes of this report.

Table 2-4 summarizes the total and firm well capacity for the Village. The firm well capacity is defined as the total well capacity with the largest well out of service and is based on the current reported pumping rates from the Village as of August 2022.

Table 2-4 Existing Well Capacity

	Installed Well Pump Capacity	Current Reported Well Pumping Rate	Firm Well Capacity	Percent of Supply (2011-2020 Average)
Well 1	500 gpm	536 gpm	536 gpm	21%
Well 3	1,200 gpm	1,024 gpm	1,024 gpm	39%
Well 4	1,000 gpm	1,129 gpm		40%
Total	2,700 gpm	2,689 gpm	**1,560 gpm**	100%
Pumping Capacity				
24 hours per day	3,888,000	3,872,160	2,246,400	
18 hours per day	2,916,000	2,904,120	1,684,800	
12 hours per day	1,944,000	1,936,080	1,123,200	

The Village's average daily well pumpage from 2016-2021 was 601,390 gallons per day, and the highest value was 646,700 gallons per day in 2021, both of which can easily be met with the existing 12-hour firm well capacity required by the DNR. All but one of the annual maximum days reported from 2016-2021 (989,000 to 1,384,000 gallons pumped) can be met with the current 18-hour firm well capacity. The highest maximum day of water entering the distribution system (1,754,000 gallons pumped in 2020) was just over what can be supplied in 18 hours with the firm well capacity.

Table 2-4 also summarizes the percent of the total water supply for each well based on high-capacity well withdrawal records in Appendix E. Well 4 is the Village's highest production well, supplying 40% of the Village's water over the past 10 years, with Well 3 closely behind at 39%. Well 1 provides the smallest portion at 21% of the total supply.

The required firm well capacity to meet current demands was estimated using the current per capita pumpage for both the average from 2016-2021 and the maximum year, and the 2020 Census population for McFarland (8,991), as shown in Table 2-5. To meet the estimated maximum day demand with 18 hours of pumping, a firm well capacity of 1,486 gpm is required, which is just below the existing firm capacity of 1,560 gpm.

While the existing firm well capacity just meets the DNR requirements based on current demands and pumping rates, additional well capacity would be needed future growth. Using the MDD of 178.5 gpcd, the existing firm well capacity can serve a population up to 9,440 while still meeting DNR requirements. If any of the wells are permanently removed from service then additional well capacity would be needed for current demands as well as future growth.

Table 2-5 Existing Demands and Required Firm Pumping Capacity

Estimated Water Demands	**Current Average (2020)**	**Current Max Year**
Population (2020 Census)	8,991	8,991
Pumpage (gal/capita/day)	69.9	74.4
Average Day Demand (ADD) (gal)	628,400	668,600
MDD:ADD Peaking Factor	2.4	2.4
Maximum Day Demand (MDD) (gal)	1,504,800	1,604,700
Required Firm Pumping Capacity		
ADD Pumping Rate (gpm) (12 hours)	871	929
MDD Pumping Rate (gpm) (18 hours)	**1,393**	**1,486**

2.7 Storage Capacity Analysis

The capacity of water storage facilities such as towers and reservoirs can be divided into the following categories:

- Operating storage is the volume between the "pump on" and lowest "pump off" levels, which fluctuates during normal usage. This volume is not included in the effective storage of the tank because it may not be available depending on the water level.
- Effective storage is the minimum amount of storage normally available for usage, reflecting the capacity left in storage at the low end of the operating range but excluding dead storage.

- Dead storage is the minimum amount of water that must be kept in storage to prevent emptying and low pressure in the distribution system. In general, this is the amount required to maintain a minimum of 20 psi in the distribution system under fire flow conditions.

The Wisconsin Administrative Code requires that water system pressures be maintained above 35 psi under normal operating conditions and at a minimum of 20 psi under emergency conditions, such as during a fire. Given that 1 psi is equal to approximately 2.31 feet of water, the water surface in the storage facility must be approximately 81 feet above the highest elevation area in the service area to maintain 35 psi and at least 46 feet above to maintain 20 psi. These water column heights are based upon static conditions (assuming no head losses due to friction) so actual water column heights would be higher as friction losses are included.

Table 2-6 shows the calculations for effective, operating, and dead storage for the Village's existing water storage facilities. The Village's towers are currently operated with water levels between approximately 1040 to 1045 feet amsl.

Table 2-6 Existing Storage Volumes

Parameter	Burma Reservoir	Holscher Tower
Design Volume (gallons)	500,000	750,000
Height to Overflow (feet above base)	91.0	113.0
Pump On Level (feet above base)	53.5	73.0
Pump Off Level (feet above base)	87.5	109.5
Reservoir Base Elevation (ft amsl)	957.2	933.9
Tower Overflow Elevation (ft amsl)	1048.2	1046.9
Highest HGL Elevation (Pump off) (ft amsl)	1044.7	1043.4
Lowest HGL Elevation (Pump on) (ft amsl)	1041.7	1040.4
Approximate Highest Elevation Served (ft amsl)	965.0	965.0
Approximate HGL Elevation needed to provide 35 psi min to non-boosted areas (ft amsl)	1045.9	1045.9
Approximate HGL Elevation needed to provide 20 psi min to all non-boosted areas (ft amsl)	1011.2	1011.2
Operating Storage (gallons)	**411,000**	**644,700**
Dead Storage (below 20 psi) (gallons)	**1,300**	**35,000**
Effective Storage Volume (gallons)	**409,700**	**609,700**
Effective Storage % of Total Storage	82%	81%
Total Effective Storage Volume (gallons)	**1,019,400**	

While code requires that public water systems be operated within a normal pressure range of 35 psi to 100 psi, it is better practice to operate within a range of 40 psi to 90 psi. This range tends to avoid complaints of pressure being either too low or too high.

Using a minimum desired pressure of 40 psi and the lowest operating levels for the towers, the highest elevation that should be served by the Village's water system without boosted pressure is 960 feet amsl. Based on the highest operating levels, the lowest elevation that can be served without exceeding 90 psi is approximately 836 feet.

Commented [AB2]: How does this compare to elevations of current service area?

Required storage for a municipal water system can be split into the following components:

- Equalizing storage is the amount of water that must be stored for the period where the source pump capacities are less than the peak system demands. It is not necessary to have well pumping rates always exceed demand rates, provided there is enough equalizing storage available to meet demands during peak hour conditions. During off-peak hours or the time when pumping capacity exceeds demand, the wells must meet the instantaneous demand as well as replenish the equalizing storage. Equalizing storage requirements are normally estimated using the "firm" well capacity for the maximum day, and equalizing storage is only necessary only when the firm well capacity is less than the peak hour demand. Calculations for equalizing storage are provided in Appendix E. Required equalizing storage for the existing system is estimated to be approximately 58,200 gallons, assuming a MDD of 1,604,700, a firm well capacity of 1,560 gpm, and a typical diurnal curve for PHD.

- Emergency Reserve is amount of water in storage to accommodate shutdown of sources of supply. Wisconsin Administrative Code s. NR 811 requires at least an average-day supply under normal operating conditions be maintained in elevated storage when only one pumping unit to the distribution system is available to serve the water system. Even when more than one well is available, it is still a good rule of thumb to maintain a reserve equal to the average day demand at a minimum for system reliability. Based on current per capita rates, the current ADD is estimated to be 627,000 gallons on average and 668,600 gallons for a maximum year. Reliable source pumping capacity can be substituted for a portion of the emergency storage. Reliable sources are considered well pumps with automatic transfer to standby power, or manual transfer if it can be done in a reasonable time in accordance with established operating procedures. All three of the Village's wells have standby power.

- Fire reserve is the volume required for fire suppression, based on maintaining a needed fire flow for a given duration of time. A fire flow of 3,000 gpm was used in the 1998 Public Water Facilities Needs Assessment and has been used in this report as the Village's goal for supplying fire flows throughout the water distribution system. Per ISO standards, this rate should be provided for at least 3 hours, which means at least 540,000 gallons of fire reserve is needed. This fire suppression volume should be provided from a reliable source, and elevated storage is generally considered the most reliable type because it will normally always be available to the system if a minimum water level is maintained. When considering fire flow demands, the storage capacity and well pump capacity are interrelated and, to some degree, one can be traded for the other. Where there is excess reliable firm well capacity beyond that needed to cover general emergency purposes, it is reasonable to assume that the excess can offset calculated fire suppression storage needs. There are a range of methods and degrees of conservatism that can be used to balance fire flow volumes against demand components. Methods of analysis may take into consideration the pumping rates to meet the average day demand (least conservative), the maximum day demand, or the maximum hour of the maximum day (most conservative).

The following methods were used to evaluate the required storage capacity for the McFarland water system and provide a range of required storage:

- Method 1: Storage to provide equalizing storage and needed fire flow plus the average demand rate (24-hour) on the maximum day of demand, evaluated using the system well pumping capacity with the largest well out of service (firm well capacity).
- Method 2: Storage to provide equalizing storage and needed fire flow plus the peak hourly demand for the fire duration, evaluated using firm well capacity.
- Method 3: Same as Method 1 but using only those wells that can be operated by standby power facilities.
- Method 4: Same as Method 2 but using only those wells that can be operated by standby power facilities.
- Method 5: Storage to provide the needed fire flow plus the total ADD, evaluated with all wells in service
- Method 6: Storage to provide the needed fire flow plus the total ADD, evaluated with no wells in service

Table 2-7 summarizes the required storage calculated for each of the six methods and based on the current population using 2020 US Census data and per capita rates for a maximum year. Table 2-7 also includes the storage required to hold approximately one day's worth of water for the Village, at a minimum, which has been estimated using the ADD for a max year.

Using these methods, the most conservative storage volume recommended for current needs is 1,208,600 gallons (Method 6), equal to the ADD of 668,600 gallons plus a Fire Reserve of 540,000 gallons, without taking credit for the well capacity. Methods 1 and 3 provides the least conservative volume, with 518,000 gallons of storage recommended. As an absolute minimum, the amount of storage should be equal to the ADD of 668,600 gallons. Using the total effective capacity of 1,019,400 gallons, the Village's current storage tanks are sufficiently sized to meet existing storage needs.

Table 2-7 Existing Storage Needs

	Fire Flow Scenario	**Required Storage (gallons)**
Minimum	Required Storage Equal to Average Day Demand	668,600
Method 1	Max Day + Fire Flow, With Firm Well Capacity	518,000
Method 2	Max Hour + Fire Flow, With Firm Well Capacity	658,400
Method 3	Max Day + Fire Flow, With Firm Well Capacity having Standby Power	518,000
Method 4	Max Hour + Fire Flow, With Firm Well Capacity having Standby Power	658,400
Method 5	Total Pumpage on Average Day + Fire Flow, All wells in service	724,600
Method 6	Total Pumpage on Average Day + Fire Flow, No wells in service	1,208,600
	Existing Effective Storage	**1,019,400**

2.8 Water Quality

Water quality for the Village's three existing wells is routinely monitored for compliance with Federal Safe Drinking Water Act (SDWA) standards, as required by the DNR's monitoring schedule. Compliance monitoring samples are routinely collected and analyzed for coliform bacteria, inorganics (including iron, manganese, lead and copper), nitrates, radioactivity, synthetic organics, disinfection byproducts, and volatile organics and data is available from the DNR's drinking water database. Table 2-8 summarizes water quality data and common contaminants from 2017-2021 for the three wells.

Table 2-8 Water Quality Summary

Parameter	Units	Well 1	Well 3	Well 4
Hardness, Total ($CaCO_3$)	mg/L	381	329	381
Alkalinity, Total	mg/L	331	332	334
pH	SU	7.39	7.53	7.41
Chromium	mg/L	Detected Below MCL	ND	Detected Below MCL
Iron	mg/L	ND	ND	ND
Nitrate (NO_3-N) + Nitrite (NO_2-N)	mg/L	2.93 - 0.84	2.75 – 0.31	3.45 - 2.85
Radium (226 + 228)	pCi/L	Detected Below MCL	Detected Below MCL	Detected Below MCL
Volatile Organics	ug/L	ND*	ND	ND
Atrazine	ug/L	Detected Below MCL	Detected Below MCL	Detected Below MCL
Synthetic Organics	ug/L	ND	ND**	ND

ND = Not Detected
MCL = Maximum Contaminant Level
*Methyl-tert-butyl-ether (MTBE) detected between Limit of Detection and Limit of Quantification.
**Methoxychlor detected below MCL

Commented [AB3]: Should we include PFAS?

A review of data from the past 10 years shows no exceedances of primary drinking water standards at the entry points to the distribution system. Nitrates are often a concern in agricultural areas, but concentrations in McFarland's wells are generally below 3 mg/L with the highest concentrations at Well 4 less than 4 mg/L, compared to the maximum contaminant level (MCL) of 10 mg/L.

Other than chemical addition for chlorination and fluoridation, no treatment is needed at the Village's wells.

2.9 Summary of Identified Needs

Based on the condition of the existing facilities and an evaluation of the well and storage capacity, the following current needs and recommendations have been identified:

Commented [AB4]: Discuss recommendations with Village Staff to get their buy-in/feedback before finalizing, Village does not intend to replace well house at Well 1

- Upgrades to Well 1 – complete building replacement to provide separate chemical and electrical rooms, replacement of electrical equipment, replacement of well discharge piping and instrumentation, new chemical feed pumps, scales and containment, and addition of a standby generator, automatic transfer switch. The Village may consider replacing the capacity of this well rather than constructing a new wellhouse.
- Upgrades to Well 3 – building addition/modification to provide for separate chemical rooms, building architectural/HVAC improvements, replacement of electrical equipment, replacement of well discharge piping and instrumentation, replacement of well pump and motor, new chemical feed pumps, scales and containment. Replacement of the existing natural gas engine and right-angle drive with a stationary standby generator and automatic transfer switch would improve reliability.
- Upgrades to Well 4 – building addition/modification to provide an additional chemical room for flouride, replacement of electrical equipment, replacement of well discharge piping and instrumentation, replacement of well pump and motor, new chemical feed pumps, scales and containment. Replacement of the existing natural gas engine and right-angle drive with a stationary standby generator and automatic transfer switch would improve reliability.

- Continued maintenance of the Burma Road and Holscher Road reservoirs, including routing inspections and recoating/repairs.
- No immediate distribution system improvements are needed for fire flow or pressure, but upsizing of 6" water main on east side of USH 51 on Voges Road to hydrant would provide additional fire flow if desired in this location.
- The existing well capacity is sufficient for current needs as the firm well capacity is able to supply the current ADD with wells operating for less than 12-hours and MDD with wells operating for less than 18-hours. Using the estimated maximum day per capita demand of 178.5 gpcd, the existing firm well capacity can serve a population up to 9,440 while still meeting DNR requirements, so additional capacity will be needed as the Village grows.
- The existing storage is sufficient to supply current ADD, and up to ADD plus fire flow reserve with the wells in service. Existing storage does not meet the most conservative guideline for providing the ADD plus fire flow reserve with the wells out of service, but this is generally not used for storage sizing.

Additional improvements and system additions to meet future growth and capacity needs are addressed in subsequent chapters.

3. FUTURE DESIGN CONDITIONS

3.1 Population Projections

Future population growth for the Village of McFarland was projected using past census data and the Wisconsin DOA population projections and estimates. A graph of the population projections for the Village is provided in Appendix F and Table 3-1 summarizes the projections. The DOA provides projections through 2040, which show the population rising continuously to a population of 9,895 in 2040. A linear projection using the 1970-2020 census data has been used to estimate the 2040 (20 year) and 2070 (50-year) population projections. For the purposes of water system planning, both projections were used, with the linear projection providing a conservatively high estimate of future water demands, particularly for water storage needs past 20 years, and the DOA projection providing the lower end of the range of possible demands in the next 20 years. Projections based on development areas are discussed in Section 3.3.

Table 3-1 Population Projections

	Census	Projection				
	2020	2025	2030	2035	2040	2070
DOA Projection	8991	8,930	9,335	9,635	9,895	
Linear Projection					11,730	15,690

The Village's 2017 Comprehensive Plan, on page 11 of Volume 1: Conditions and Issues, references the DOA projections and states: "The DOA projects that population growth in McFarland will continue through 2040. The projections … suggest a Village population of 9,895 residents by the year 2040 – an increase of about 1,850 residents from 2016. DOA projects that Dane County will have the greatest population growth of any Wisconsin county through 2040. Previous DOA projections were reasonably accurate, having slightly over-projected the County's 2010 population and slightly under-projected the Village's 2010 population."

According to the 2017 Comprehensive Plan, the average number of persons per household was 2.49 in 2015-2016. The DOA projects that the average persons per household in the Village will decline from 2.46 to 2.38 between 2020 and 2040. An estimated 18.9% of Village households have a householder 65 years or older, which indicates a relatively middle-aged resident population. The DOA projects that the number of households in Village of McFarland will increase from 3,226 in 2015 to 4,161 in 2040, an increase of 935 households.

3.2 Future Land Use

The Village's 2017 Comprehensive Plan noted that most of its recent residential development has been a result of easterly growth of the village, driven by its proximity to Madison, excellent highway access, and a reasonable supply of land suitable for development. Future land use for the Village was defined in the Comprehensive Plan's Future Land Use Map**,** provided in Appendix A. The areas on the eastern portions of the Village identified as "Neighborhood" are those which are expected to see the greatest future residential development.

The 2017 Comprehensive Plan also contains projections for future land use demands for the Village. Future residential land use is projected to demand 224 additional acres between 2015 and 2040, while projected land demand for commercial, industrial, and public/institutional land uses is 41, 39, and 157 acres, respectively. Accounting for flexibility in land use planning, the Plan states that projected development would require between 584 and 730 acres of vacant land to accommodate new development through 2040, much of which would be converted from current agricultural use.

The 2018 East Basin Study estimated the acreage of developable property by land use classification within the study boundary, as shown on the map in Appendix F. Among the land use classifications, the study estimated that the East Basin area contains the following developable land: 42.2 acres mixed use, 6.6 acres multiple family residential, 419.9 acres neighborhood, 267.5 acres residential, 5.6 acres two family and townhouse residential. Assuming that all are eventually developed residential, this totals 741 acres of residential area.

3.3 Future Community Growth and Developments

The most likely areas of future growth for the Village of McFarland are in the undeveloped lands on the eastern edge of the Village out to Door Creek Road as described in Section 3.2. Infill development is also expected to occur.

Near term growth, expected within the next 5 to 10 years, was estimated based on developments that are currently in the planning or construction phase, including the following:

- Skaalen Senior Housing – will be completed within 5 years
- Rosewood Fields (Phases 1-3) Phase 1 is done, 2 will be done by end of 2022
- Elvehjem Acres Condos – will be completed within 5 years
- Prairie Pointe Condos – done but not occupied yet
- Waubesa Village Apartments – done but not occupied yet
- Utter Farm – developable in near future

Commented [AB5]: Provide a brief description of location, provide one map showing the location of all of these developments and the other development area, Blooming Grove – April Hills.

Portions of the Town of Blooming Grove border the Village of McFarland, as shown on the Blooming Grove zoning map in Appendix F. The April Hills subdivision just north of Sigglekow Road is a developed area with wells and septic systems that could be served by the McFarland water system or the City of Madison water system in the future. For the purpose of this study, the 151 existing parcels in April Hills were included in the future service area for the McFarland water system.

Growth in the East Basin area was projected by assuming that 75% of the remaining residential land within the East Basin area is developable, with 3.5 households per developable acre. There is no specific timeline associated with the development of this area but it is presumed full build-out will generally occur within 50 years (2070).

Maps of the future growth areas assumed for this report are provided in Appendix F. The potential population growth and water demands associated with these areas are estimated in Table 3-2. Population was estimated using available information for planned residential developments, and assuming 1.5 persons per senior housing unit and 2.38 persons per other households. Water demands were estimated using the per capita rates established in Chapter 3. The near-term development, including April Hills, is estimated to add 1,568 persons to the Village population, resulting in a total population of 10,559. The population projection with full buildout of the East Basin area is 15,389, which is an increase of 6,398 persons over the 2020 Census population of 8,991.

These potential growth areas were used to establish future demands for the water system and develop the impact fee amounts for future development. It is recognized that Village growth may occur outside of these areas and that impact fees would be applied regardless of the location.

Table 3-2 Projected Population and Water Demands Based on Future Development Areas

3.4 Future Water Demands and Pumping Requirements

Future water demands have been estimated using the 2040 DOA population projection and 2040 linear population projection described in Sections 3.1 and the near-term development projection, and 3.2.

Table 3-2 provides the future water demands and required firm capacity for the three projection scenarios. These were estimated using the same methodology, per capita pumping rates, and peaking factors as the current demands in Section 2.5.

Table 3-2 Estimated Future Demands and Required Firm Pumping Capacity

Water Demand	**20-Year DOA Projected Growth (2040)**	**Near Term Development Projected Growth**	**20-Year Linear Growth (2040)**
Population	9,895	10,559	11,730
Usage (gal/capita/day)	74.4	74.4	74.4
Average Day Demand (ADD) (gal)	735,800	785,100	872,200
Maximum Day Demand (MDD) (gal)	1,766,000	1,884,300	2,093,300
Required Firm Pumping Capacity			
ADD Pumping Rate (gpm) (12 hours)	1,022	1,090	1,211
MDD Pumping Rate (gpm) (18 hours)	**1,635**	**1,745**	**1,938**
Additional Pumping Capacity Needed (gpm)	**75**	**185**	**378**

The supply from the Village's three existing wells, with a firm capacity of 1,560 gpm, is not sufficient for the projected demands and additional capacity would be needed. As shown in Table 3-3, additional well capacity needed ranges from 75 gpm for the DOA 2040 projection to 378 gpm for the 20-year linear growth projection.

It should be noted that the DOA 20-year projection represents a population growth of 904 persons over current census numbers while the near-term development and 20-year linear projections represent growth of 1,569 and 2,739 persons, respectively.

3.5 Future Storage Requirements

As described in Section 2.7, the water storage needs for a community can be estimated a number of ways. An average of Method 3 and 4 was used in the 1998 Public Facilities Needs Assessment for determining storage needs. Table 3-3 provides the total recommended storage for future needs based on providing storage equal to the ADD projections, using Method 3 (the storage required to provide equalizing storage and needed fire flow plus the average demand rate (24-hour) on the maximum day of demand), using Method 4 (the storage required to provide equalizing storage and maximum hour demand coinciding with required fire flow), and the average of Method 3 and Method 4. Future storage needs were evaluated using the firm well pumping capacity with wells that can be operated by standby power facilities, which includes all of the Village's existing wells. It was assumed that future well capacity would be added as needed to meet the MDD pumping requirements and that future well capacity would also have standby power.

Table 3-3 Estimated Future Storage Needs

Water Demand	20-Year Projected Growth (2040)	Near Term Development Projected Growth	East Basin Full Buildout Development Projected Growth	50-Year Projected Growth (2070)
Population	9,895	10,559	15,389	
Average Day Demand (ADD) (gal)	735,800	785,100	1,144,200	1,166,600
Maximum Day Demand (MDD) (gal)	1,766,000	1,884,300	2,746,100	2,799,900
Fire Flow (FF) (gal)	540,000	540,000	540,000	540,000
Well Capacity Added to Meet MDD (gpm)	75	185	983	1033
Assumed Firm Well Capacity with Standby Power (gpm)	1,635	1,745	2,543	2,593
Required Storage for ADD (gal)	735,800	785,100	1,144,200	1,166,600
Current Effective Storage	1,019,400	1,019,400	1,019,400	1,019,400
Additional Storage Needed (gal)	None	None	**124,800**	**147,200**
Required Storage (Max Day + FF) (Method 3) (gal)	540,900	527,600	430,100	424,100
Required Storage (Max Hour + FF) (Method 4) (gal)	715,600	727,400	813,100	818,500
Average of Method 3 & Method 4	628,250	627,500	621,600	621,300
Current Effective Storage	1,019,400	1,019,400	1,019,400	1,019,400
Additional Storage Needed (gal)	None	None	None	None

The storage required by the average of Method 3 and Method 4 is generally less than the Village's current total effective storage of its two existing reservoirs. Providing storage equal to the ADD is the more conservative estimate of future storage needs. Using the effective capacity of 1,019,400 gallons, the Village's existing storage tank capacity is adequate to supply the ADD for the 20-year projected growth and near-term development, but too small by 124,800 gallons for the full East Basin buildout projection and too small by 147,200 gallons for the 2070 linear projection.

Based on these estimates, there is no immediate need for additional storage, but additional capacity may be desirable as the ADD approaches 1,019,400, the current effective storage volume. Based on a per capita usage of 74.4 gpcd, this would occur as the population reaches 13,710.

3.6 Future Pressure Requirements

The Village has only one pressure zone currently, with water levels in the two towers at approximately the same Hydraulic Grade Line (HGL). As described in Section 2.7, the existing towers can serve elevations between 836 and 960 feet while maintaining pressures between 40 and 90 psi.

Figure 3-1 shows the areas in the study service area that can be served by the existing hydraulic HGLs based on these contours. Almost the entire area can be served, with a few isolated areas of higher and lower elevation that cannot be served by the existing HGL. Rather than creating additional pressure zones to serve those areas, the areas should not be developed and should be set aside for other uses such as park land or open space. Therefore, no boosted pressure zones are recommended for the existing or future service areas.

Figure 3-1 Service Area for Current Hydraulic Grade Lines

4. WATER SYSTEM IMPROVEMENTS

4.1 Overview

As noted in Section 1.1, the purpose of this Planning Document is to evaluate the water system facilities for the Village of McFarland and provide recommendations for immediate and future needs. The specific needs for the upgrading, replacing, or modifying existing facilities are described in Chapter 2 and are summarized in Section 2.9. Additional supply and storage facilities are required to meet the future demands described in in Chapter 3. This chapter presents the proposed improvements for water supply, storage facilities, and the distribution system.

4.2 Water Supply Improvements

A new well is needed to meet the future water supply needs for the Village of McFarland. The supply from the Village's existing three wells is marginal for meeting existing demands and does not meet the DNR guidelines for source capacity with near term and 20-year projected growth. Additionally, the Village's existing wellhouses need upgrades to meet current code requirements, extend the life of the structures and equipment, and provide reliable standby power. If any of the wells are permanently removed from service then additional well capacity would be needed for current demands as well as future growth.

Given the size and condition of the existing Well 1 wellhouse, a complete replacement of this building would be warranted if the Village intends keep this well for long-term use. Since Well 1 is the oldest and lowest capacity well, the Village has decided it would be more cost-effective to replace the capacity of Well 1 than to upgrade the facilities with a new wellhouse. Well 1 would likely be removed from service the next time major repairs or maintenance are needed at the well. For water supply planning, it is assumed that Well 1 will be abandoned at some point after a new well is constructed.

Existing Wells 3 and 4 provide a combined 2,150 gpm of pumping capacity and are a reliable source of high-quality water. These wells need the following improvements for continued long-term use:

- Building addition/modification to provide for two separate chemical rooms at Well 3 and one additional chemical room at Well 4, including new chemical feed pumps, scales and containment.
- Replacement of the existing natural gas engine and right-angle drive at each well with a stationary standby generator and automatic transfer switch to improve standby power reliability.
- Replacement and reconfiguration of electrical equipment within the existing pump rooms.
- Building architectural and HVAC improvements, including air conditioning for the well pump/electrical spaces.
- Replacement of well pump, motor, discharge piping and instrumentation/appurtenances is recommended if a substantial investment is made at the wellhouses.

The estimated cost of these improvements is provided in Table 4-1:

Table 4-1: Wellhouse Improvements Estimated Capital Costs

Description	Capital Cost
Improvements at Well 3	$1.72 Million
Improvements at Well 4	$1.62 Million

The Village is currently planning for a new Well 5 along Prairie Wood Drive near Wiouwash Way, on a parcel that is currently owned by the Village, as shown on the well site map in Appendix G. The new well site was previously approved by DNR in 2021 (W-2012-0420) but that approval has expired and will need to be renewed with resubmittal of a Well Site Investigation Report. The capacity of the new well will depend on how much firm well capacity the Village wants to provide and pump testing of the new well when constructed. As shown in Table 3-3, required new well capacity ranges from 75 gpm for the DOA 2040 projection to 378 gpm for the 20-year linear growth projection. The current Well 1 capacity of 536 gpm should also be replaced if this well will not be upgraded. For planning purposes, the capacity of Well 5 has been assumed to be 1,000 gpm, making this well comparable in capacity to Wells 3 and 4

A new well would be designed in accordance with WAC Chapter NR 811 and is expected to be of similar depth and construction as Well 4, with the exception of extending the casing through the Eau Claire formation for the new well. The new wellhouse would have a pump room, electrical room, and two chemical feed rooms, with an approximate building footprint of 20 ft by 28 ft. The estimated cost for the new well is summarized in Table 4-2 and details are provided in Appendix H.

Table 4-2: New Well 5 Estimated Capital Costs

Description	Capital Cost
Test Well	$220,200
Well Drilling	$669,000
Well House (and site work/utilities)	$2,428,500
Total Project Cost	**$3,317,700**

These cost estimates were based on unit pricing from similar recent construction projects. The capital costs are intended to be planning level estimates and include costs for the eventual general contractor's scope of services; a contingency of 15% of the projected contractor's cost; and engineering, administration and legal work that will be necessary to plan, design, finance, and manage the project.

The Village also has the possibility of obtaining water from the Madison Water Utility (MWU) in an emergency or disaster scenario if the Village's own water supply is not sufficient. The MWU Southeast Zone 4 is located adjacent to the Village of McFarland, north of Sigglekow Road, as shown on the MWU System Map in Appendix G. MWU Zone 4 is served by Well 31, which was installed recently, and an elevated storage tank on Spaanem Ave, and MWU feels that this zone has adequate capacity for current and near future needs. This zone operates at an HGL of approximately 1046 ft, which is compatible with McFarland's existing water system. The overflow elevations for McFarland's towers are approximately 1047-1048 ft, with normal operation between 1040 and 1044 feet, which is slightly lower than the HGL of MWU Zone 4. A temporary or permanent connection would require significant coordination and cooperation with MWU but could provide additional assurance of adequate water supply to the Village if one or more wells are out of service.

4.3 Water Storage Improvements

The Village has adequate storage to meet current needs, but additional storage will be needed as the Village grows. If the Village wishes to have at least an average day of demand in storage then more storage would be needed as the population reaches approximately 13,710, based on a per capita usage of 74.4 gpcd. As the developments move forward in the East Basin area, the Village should continue evaluating options and actively pursue obtaining land for siting of new storage facilities.

The 2018 East Basin study identified two potential sites for a new water storage reservoir, which are shown in a map provided in Appendix G. The first potential storage site (denoted as #1) is located north of Siggelkow Road, near the intersection with Interstate 39, and the second potential storage site (#2) is south off Siggelkow Road, approximately 1,400 feet due south of the end of the cul-de-sac at Lee South Court.

Since the need for additional storage is several years in the future, a detailed evaluation and cost estimates for these sites has not been prepared. The only recommended water storage improvements are routine inspection, maintenance, and coating to extending the life of the Village's existing water towers. Recoating of the Burma Road Tower is planned for 2023.

4.4 Distribution System Improvements

The selected location for new Well 5 is in a developed portion of the Village, as shown on the maps in Appendix G. The future well would discharge to a 12" water main on Prairie Wood Drive, which is well-looped with the Village's distribution system through a backbone of 12" mains in the southeast portion of the Village and on Holscher Road. There is a small section of 8" main on Prairie Wood Drive between Wiouwash Way and Holscher Road that could be upsized to 12" in the future to complete the looping, but this is not an immediate need. As noted in Section 2.4, no currently developed areas in the Village have been identified as needing immediate improvements for fire flow or pressure. Distribution system expansion for future growth and potential new storage locations will be evaluated in the future as those needs become more immediate.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 New Well Capacity

The Village intends to move forward with planning a new Well 5, to be located at the Village-owned parcel off of Prairie Wood Drive near Wiouwash Way. The DNR previously approved the Well Site Investigation Report for this site in 2012 but the approval has lapsed and will need to be renewed.

The well capacity evaluations in Sections 2.6 and 3.4, demonstrate a need for additional source capacity meet future demands, and to replace the capacity of Well 1 if this well is taken out of service. As shown in Table 3-3, additional well capacity needed for future growth ranges from 75 gpm for the DOA 2040 projection to 185 gpm for the near-term development and 378 gpm for the 20-year linear growth projection. The current pumping rate for Well 1 is approximately 536 gpm. The City wishes to install a new well that has similar capacity to Well 3 and 4, which currently pump at 1024 and 1,129 gpm, respectively. A new 1,000 gpm well would provide adequate source capacity for future growth and replacement of the capacity at Well 1 and would result in a firm well capacity of 2,024 gpm (1,000 gpm + 1,024 gpm). Using the MDD of 178.5 gpcd, a firm well capacity of 2,024 gpm can serve a population up to 12,246 while still meeting DNR requirements. **A target pumping capacity of 1,000 gpm has been selected by the Village for future planning and design efforts on new Well 5.**

5.2 Impact Fee Allocation

The portion of the new well capacity attributed to growth would be eligible for impact fees. Under Wisconsin Statutes Section 66.0617, the Village has the authority to adopt impact fees to pay for the proportionate share of capital costs for new, expanded, or improved public water facilities needed to serve future growth and land developments. In 1998, the Village established impact fees a new water tower, transmission mains, and a new well. The new water storage tank was constructed in 2000 , and this report is intended to update the basis for the impact fee for a new well.

The following general considerations for impact fees should be noted:

- Impact fees pay for only the portion of new facilities that can be attributed to growth rather than existing deficiencies.
- Impact fees must be used within 8 years of when they are collected, otherwise they must be returned, plus interest, to the property owner.
- Impact fees must be discontinued (or the Public Facilities Needs Assessment updated) after 100% of the capital to be paid by impact fees has been collected.
- The portion of the capital costs paid by impact fees is not included in the Water Utility's rate base and is considered Contributed Plant by the Public Service Commission.
- If growth does not occur, the Water Utility cannot raise water rates to make up for deficiency in funds. Therefore, the Village must carefully evaluate growth that is reasonably expected to occur before assigning impact fees.

While the Village does not have any existing deficiency in source capacity, the desire to replace Well 1 in the future factors into the need for a new well. The increment between the source capacity to replace Well 1 and the selected new well capacity is attributed to future growth and is eligible for impact fees. The percentage of the cost that is eligible for impact fees is calculated by using this increment attributed to growth divided by the capacity of the new well:

$$\frac{(1000\text{ gpm} - 536\text{ gpm})}{1000\text{ gpm}} = 46.4\%$$

Alternate Calculation:

The portion of the new well capacity that is attributed to future growth and eligible for impact fees is based on the capacity needed for near term development in Table 3-3, 185 gpm. The percentage of the cost that is eligible for impact fees is calculated by using this increment attributed to growth divided by the capacity of the new well:

$$\frac{185\text{ gpm}}{1000\text{ gpm}} = 18.5\%$$

Based on this calculation, the Village has selected xx% as the Impact Fee Percentage for the new well. A percentage slightly lower than the calculated value was chosen to mitigate the uncertainty associated with future development and the risk of collecting insufficient funds. This impact fee percentage is for the well only, and does not include distribution system improvements beyond the water main to connect the newwell to the system. The cost estimates, development projections, and impact fee percentage from this report will be used by the Village's accountant to update the existing impact fees.

5.3 Other Water System Needs

In addition to the need for more source capacity, the Village's water system has other needs that should be considered for continued maintenance and capital improvement planning, including the following:

- Using the effective capacity of 1,019,400 gallons, the existing Village storage tank capacity is adequate to supply the ADD for the 20-year projected growth and near-term development, but too small by 124,800 gallons for the full East Basin buildout projection and too small by 147,200 gallons for the 2070 linear projection. Based on these estimates, there is no immediate need for additional storage, but additional capacity may be desirable as the ADD approaches 1,019,400, the current effective storage volume. Based on a per capita usage of 74.4 gpcd, this would occur as the population reaches 13,710. Potential locations for a new water storage reservoir include a site north of Siggelkow Road, near the intersection with Interstate 39, and a site south of Siggelkow Road, approximately 1,400 feet due south of the end of the cul-de-sac at Lee South Court.
- The Village's three wellhouses need eventual upgrades to meet current construction standards and code requirements and provide separate spaces for chemical storage and electrical equipment. Given the size and condition of the existing Well 1 wellhouse, a complete replacement of this building would be warranted if the Village intends keep this well for long-term use. Since Well 1 is the oldest and lowest capacity well, the Village has decided it would be more cost-effective to replace the capacity of Well 1 than to upgrade the facilities with a new wellhouse. Well 1 would likely be removed from service the next time major repairs or maintenance are needed at the well. For water supply planning, it is assumed that Well 1 will be abandoned at some point after a new well is constructed.
- Recommended upgrades at Wells 3 and 4 also include separate chemical rooms for chlorine and fluorine with secondary containment for chemicals, HVAC and architectural improvements for the existing pump rooms, electrical equipment replacement and

replacement of the existing natural gas engine and right-angle drive at each well with a stationary standby generator and automatic transfer switch. Replacement of well pump, motor, discharge piping and instrumentation/appurtenances is recommended if a substantial investment is made at the wellhouses

- Continued maintenance of the Burma Road and Holscher Road reservoirs is necessary, including routing inspections and recoating/repairs. Recoating of the Burma Road Tower is planned for 2023.
- No immediate distribution system improvements are needed for fire flow or pressure but upsizing of 6" water main on east side of USH 51 on Voges Road to hydrant would provide additional fire flow if desired in this location.

5.4 Summary

The following water system improvements are recommended for inclusion in the Village Capital Improvement's Plan:

	Estimated Cost
Construct New Well 5	$3.32 Million
Well 3 Improvements	$1.72 Million
Well 4 Improvements	$1.62 Million

Future Growth and Demand Projections

Water Demand	20-Year DOA Projected Growth (2040)	Near Term Development Projected Growth	20-Year Linear Growth (2040)
Population	9,895	10,559	11,730
Usage (gal/capita/day)	74.4	74.4	74.4
Average Day Demand (ADD) (gal)	735,800	785,100	872,200
Maximum Day Demand (MDD) (gal)	1,766,000	1,884,300	2,093,300
Required Firm Pumping Capacity			
ADD Pumping Rate (gpm) (12 hours)	1,022	1,090	1,211
MDD Pumping Rate (gpm) (18 hours)	**1,635**	**1,745**	**1,938**
Existing Firm Pumping Capacity	1,560	1,560	1,560
Additional Pumping Capacity Needed (gpm)	**75**	**185**	**378**

Water Supply Improvements

- Current firm well capacity is marginal for meeting existing demands and additional well capacity is needed to meet future water demands
- Existing wellhouses need upgrades to meet current code requirements, extend the life of the structures and equipment, and provide reliable standby power. The existing structures for Wells 3 and 4 could be modified/upgraded but the Well 1 structure would need complete replacement given its size and condition the intent is to keep this well for long-term use. These improvements will increase reliability, but will not increase pumping capacity.
- Well 1 is the oldest and lowest capacity well, replacement of its capacity (536 gpm) with New Well 5 would be more cost-effective than constructing a new wellhouse
- Proposed Well 5 Capacity is 1,000 gpm to cover the future growth projections and replace the capacity of Well 1, this would be similar to the capacity of Wells 3 and 4.

Estimated Capital Costs

Description	Capital Cost	Potential Impact Fee %
Improvements at Well 3	$1.72 Million	5%
Improvements at Well 4	$1.62 Million	5%
New Well 5	$3.32 Million	37.8%

Impact Fee Considerations:

- Impact Fees pay for the portion of new facilities that can be attributed to growth rather than existing deficiencies and there is a range of what can be justified:
    - Increment between the source capacity to replace Well 1 (536 gpm) and the assumed new well capacity (1,000 gpm) yields an impact fee percentage of 46.4%
    - The new well capacity for near term (185 gpm) or 20-year growth (378 gpm) divided by the assumed new well capacity (1,000 gpm) yields impact fee percentages of 18.5% and 37.8% respectively
- Portion of the capital costs paid by impact fees is <u>not</u> included in the Water Utility's rate base
- If growth does not occur, the Utility cannot raise water rates to make up for deficiency in funds
- Risk increases as impact fee % increases, but reward is smaller user rate increases
- Impact fees cannot be applied for existing facilities (Wells 3 and 4) unless increasing capacity or reliability to support growth

VILLAGE OF
McFarland

SUMMARY SHEET

MEETING DATE: **Monday, January 23, 2023**

SECTION: **Business**

DEPARTMENT: **Public Works**

CONTACT: **Matt Schuenke, Village Administrator, Lee Igl, Streets/Utilities Superintendent**

AGENDA ITEM: **Discussion regarding funding allocation to the utilities fund associated with street projects.**

PREVIOUS ACTION:
Committees have discussed this topic previously over the course of the following meetings (click on the link to view the minutes):

- September 21, 2021
- October 19, 2021
- January 18, 2022
- March 8, 2022
- June 27, 2022
- July 25, 2022

ISSUE SUMMARY:
The practice regarding funding allocation of street projects was previously discussed by committee members. This is the practice of cost distribution between the various Village funds including shares in costs within the utility for road projects where applicable. In the past, the Village Engineer has historically been guided by a 50% ratio of cost allocation between general capital and water project as a guideline for planning improvement costs. This percentage is simply a guide for forecasting and our process to distribute costs can be adjusted accordingly. Following our discussion in July on this very same topic, that assumption was changed to the agreed upon 35% ration and then costs updated as a result. Additionally, the Engineer would continue the practice of reconciling the project costs against the actual work that was conducted.

The following process was proposed and discussed previously:

Summer/Fall (year prior to actual construction): The engineer makes a detailed budget estimate for the anticipated scope (before survey, design, bidding) and takes the street cost and divides up the respective costs for each entity based on the design impact for the project.

Spring (year of construction but prior to award): The engineer opens bids on the final design and goes item-by-item to assign costs.

- Water main, hydrants, and all water related apparatuses get assigned 100% to water.

VILLAGE OF
McFarland

- Paving items (gravel/asphalt/geogrid) are assigned as needed for each entity.
- Curb, sidewalk and various apron repairs related to water apparatuses are assigned on a project-by -project basis along with tie-in areas. The remainder of the items get divided up into their respective entity.

Winter (year of construction but after substantial completion): The Village Clerk asks for a true up of all costs as part of the annual audit process. The engineer again goes item-by-item to assign costs associated with the design impact for each entity.

We are more or less operating this way already, and with the already discussed and agreed to shift in the Capital Improvement Plan process we can continue to discuss further changes. It was requested we revisit these assumption and further again discuss allocating costs to the utility.

FINANCIAL/BUDGET IMPACT:
There are financial implications to shifting percentage applications. Staff will continue to advise that we seek balance in applying allocations as each entity has some responsibility in a project as applicable. Each entity, utilities included should be responsible for a portion of the costs related to the disturbances created via construction projects.

VILLAGE PLAN REFERENCE:
None.

ORDINANCE REFERENCE:
None.

BOARD, COMMISSION OR COMMITTEE RECOMMENDATION:
Presented for discussion. No action needed.

ATTACHMENTS:
None