

1 IRON AND MANGANESE TREATMENT SYSTEM AT WELL 7

1.1 WELL 7 BACKGROUND

Section 3 recommended that well head treatment was the most cost effective means to remove iron and manganese from Well 7 and that pyrolusite is the preferred filtration media. This Section presents alternatives for how iron and manganese removal could be provided at Well 7.

Well 7 is located in a residential setting on the southeast quadrant of the intersection of Schlingen Avenue and N. Sherman Avenue, just north of Shabazz High School. The well, which is housed within a masonry block/brick building (Figure 5-1), has an average flow rate of 2,100 gallons per minute (gpm) and a depth of 737 feet. The facilities include a first floor and a basement. The first floor is comprised of a single room, including a work station, chemical feed equipment, electrical equipment and the well pump motor (Figure 5-2). The basement houses a bathroom, HVAC system, booster pump and the booster pump discharge. Discharge from the well pump is conveyed to an above-grade 135,000 gallon reservoir. From the reservoir, one constant speed 150 HP booster pump conveys water directly to the distribution system. Chlorine and fluoride (hydrofluosilicic acid) are added to the well discharge prior upstream of the reservoir. The well is operated continuously at its rated capacity with all existing pumps using constant speed drives.



Figure 5-1: Well 7 Front View



Figure 5-2: Well Pump for Well 7

1.2 FACILITY CONDITION ASSESSMENT AND RECOMMENDATIONS

Well 7 is the oldest of the east side wells. There have been a number of facility assessments, studies, and site visits completed in an effort to assess the condition of the water supply, treatment, and distribution facilities and offer recommendations for improvements. A comprehensive facility condition assessment of water supply, treatment, and distribution facilities was conducted in 2005 as part of the MWU's Infrastructure Management Plan (IMP), dated November 2005. Appendix H presents additional details about Well 7 and its condition.

The following conclusions are made about the existing condition of the Well 7 facility which will guide future improvements:

- The facility is old and its relative condition reflects the structural, electrical, and control systems are nearing the end of their useful life.
- Several components of the system do not meet existing WDNR requirements.
- If the facility were to be expanded to include treatment for iron and manganese removal, the existing pumping and storage facilities would need to be replaced as well.

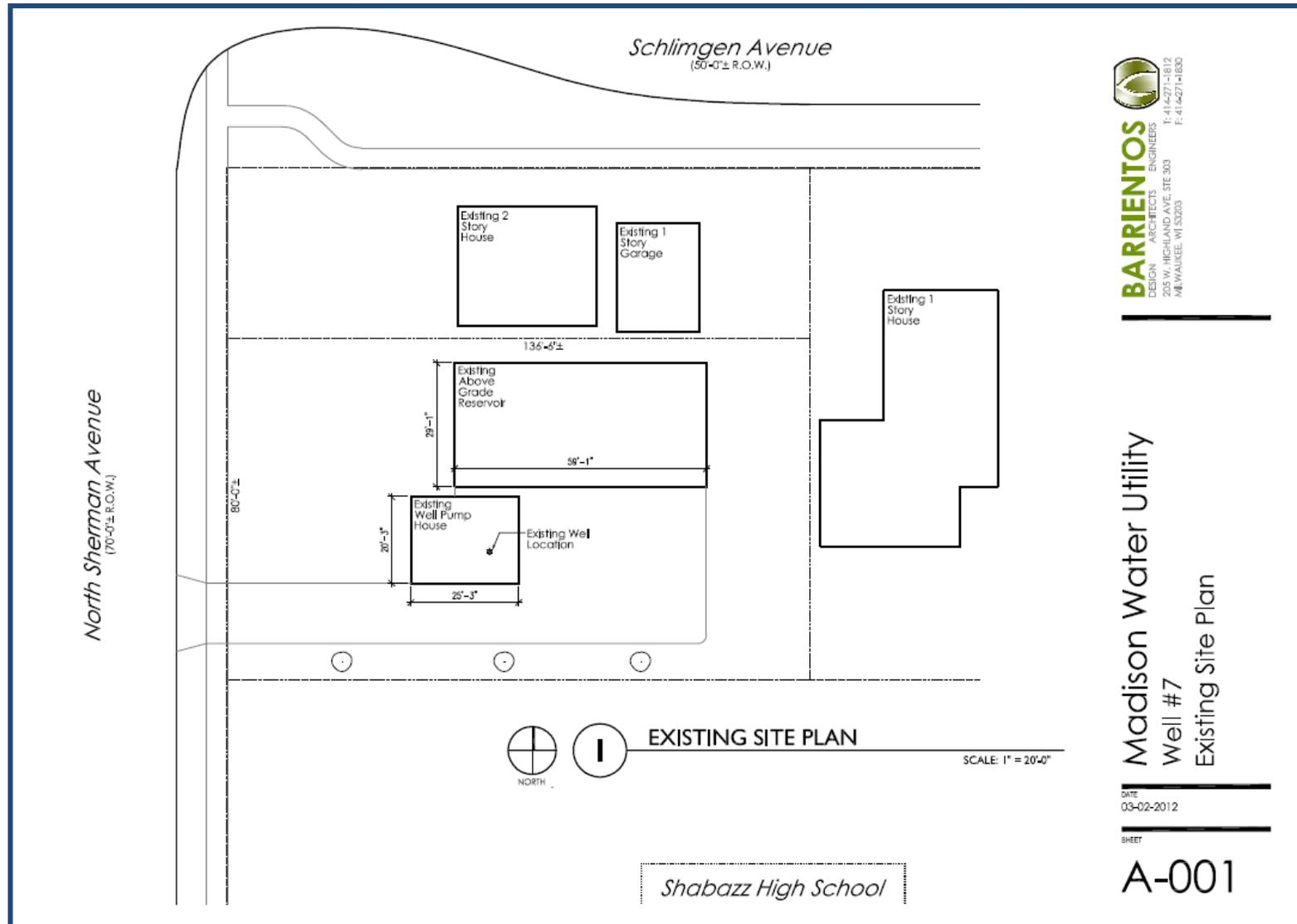
1.3 RECOMMENDED TREATMENT

The recommended treatment at UW 7 is chlorine oxidation of the raw water to precipitate iron and manganese, followed by pyrolusite media filtration to capture and remove iron and manganese. The UWs 7 & 8 Pilot Study demonstrated that with this treatment system, MWU's treatment goals could be met. The study further states that maintenance of a free chlorine residual following filtration would maintain an oxidized media state and result in optimal filter performance and filter run times in excess of 24 to 30 hours. Filtration rates of 12 gpm/ft² would result in a relatively small building footprint. Such a system, while providing effective treatment for UWs 7 and 8, would also be similar to the iron and manganese treatment system that the MWU already operates at UW 29. Appendix H presents additional treatment information including design criteria and process flow schematic.

1.4 SITE ANALYSIS FOR NEW TREATMENT SYSTEM

1.4.1 Description of Existing Site

The current site for UW 7 sits on an 80 foot by 136.5 foot property consisting of reservoir and well structures built in 1938. It is located adjacent to two residential properties (Figure 5-3). A Madison Public Junior High and High School is located immediately to the south. The existing facilities occupy approximately 2,200 ft² of the area. The site slopes slightly towards the adjacent school and teacher parking lot, but it is generally flat. Along this southern border is shared fencing and mature trees. The existing well pump is approximately 30 feet from the same southern border and approximately 61.5 feet from the west property line. Access to the site is from N. Sherman Avenue by a driveway entrance that runs along the edge of the southern part of the property.



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Madison Water Utility
 Well #7
 Existing Site Plan

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Figure 5-3: Existing Well 7 Site Plan

Proposed layouts need to take into consideration the fixed location for the well based on its current orientation on the site. Additionally, the current location of the pump house's south face will serve as a limit for the proposed building. This will ensure space is adequate within the existing site for a driveway on the south of the building. The buildable area of the existing property, not including the driveway, is approximately 3,480 ft².

1.5 SITE REQUIREMENTS, CONSTRAINTS AND OPPORTUNITIES

UW 7 has certain site requirements and constraints (e.g., standards and codes) that must be considered when planning for onsite upgrades or new construction. Requirements will include City of Madison and MWU building and zoning codes and WDNR regulations. Upgrades or expansion will need to also consider site constraints. Site constraints are physical limitations to consider based on analysis of the existing site, the existing structures, the community's needs/desires and client preferences, such as the desire to preserve existing trees on the site. However, each site also presents opportunities to add value. The following summarizes requirements, constraints, and opportunities for UW 7.

1.5.1 Requirements

- MWU desires to build a new 410,000+ gallon above grade reservoir on site. Typical water depth for a Unit Well reservoir is 20 foot.
- The reservoir would need approximately 2,740 ft² of site area for the desired capacity.
- Current water quality goals require a facility of approximately 2,500 ft² to house necessary pumping, treatment and filtration technologies.
- Madison Zoning Code identifies the site as zoned R3 WP-07. Setbacks according to this code classification are as follows:
 - Front: 25'-0".
 - Rear: 35'-0".
 - Sides: 6'-0" typical; plus 1.5" for each foot of wall within 18'-0" of the property line beyond 40'.
- The WDNR requires buried reservoirs to extend no more than 6 foot in the ground.
- The WDNR would like well casing to extend up to the well pump.

1.5.2 Constraints

- Existing property boundary does not allow desired reservoir capacity of 410,000+ gallons, limits proposed facilities design layout, and limits land available for additional landscaping to assimilate the industrial building into the residential neighborhood.
- Keeping with the size of the surrounding neighborhood structures, a new Pump House should be kept under 20'-0" tall and the new reservoir should be kept under 28'-0" tall.
- The existing driveway footprint will remain for operations, maintenance and as a barrier.
- Trees and fencing at the south end of the property boundary are preferred to remain intact.

1.5.3 Opportunities

- Purchase of adjacent property for additional space to meet ideal reservoir capacity, additional space for improved design layout and provide room for future additions.
- Demolition of the existing 1938 buildings will allow for a modern building façade that assimilates to the neighborhood.

1.6 PROPOSED LAYOUT ON EXISTING SITE

The buildable area of the existing property at 3,480 ft² would allow approximately 2,275 ft² and 1,200 ft² for the pump house and reservoir, respectively. Figure 5-4 shows a proposed site plan where the new treatment facilities and reservoir are kept within the existing property limits.

Keeping the new facilities on the MWU existing property has the following constraints:

- There is little room for operation and maintenance of the facilities. Crane access is required to remove pumps through a roof hatch and adequate space is required for chemical delivery and handling.
- The reservoir footprint would only allow for capacity of around 300,000 gallons at a water height of 32 foot, which corresponds to a building height of roughly 30ft.
- The reservoir would have to be taller than preferred and no space would be available for maintenance operations or to make the site aesthetically pleasing to the surrounding neighborhood.
- It would be very challenging and costly to build these relatively large facilities so close to existing homes.
- Such an arrangement allows no room for expansion.
- The site would look over-built in the context of the existing community.

This option has the advantage of not requiring acquisition of additional property or the relocation of the adjacent resident.

1.7 PROPOSED LAYOUT ON AN EXPANDED SITE

Figure 5-5 shows a conceptual UW 7 layout on an expanded site. The opportunity to purchase adjacent property to the north would extend the existing boundary, adding approximately 5,460 ft². An extended property boundary allows for a new 410,000 gallon above grade reservoir approximately 48 foot by 59 foot (at a 22.5ft water height). Adjacent to the new reservoir, sharing a common wall is the new well pump house at approximately 40 foot by 61 foot with a separate Chemical Room, further accommodating comfortable spacing needs inside the pump house. Spacing in front of the proposed buildings facilitates landscaping potential for assimilating the industrial building to the residential community. Lastly, additional area of approximately 1,200 ft² provides for future additions to accommodate more than the maximum 500,000 gallon reservoir capacity desired.

This proposed layout would allow for adequate capacity of the reservoir, comfortable space for maintenance needs of the new pump house, better landscaping, lower roof elevations, and leave space for future additions. Overall, such an option allows for a facility that would fit better in the

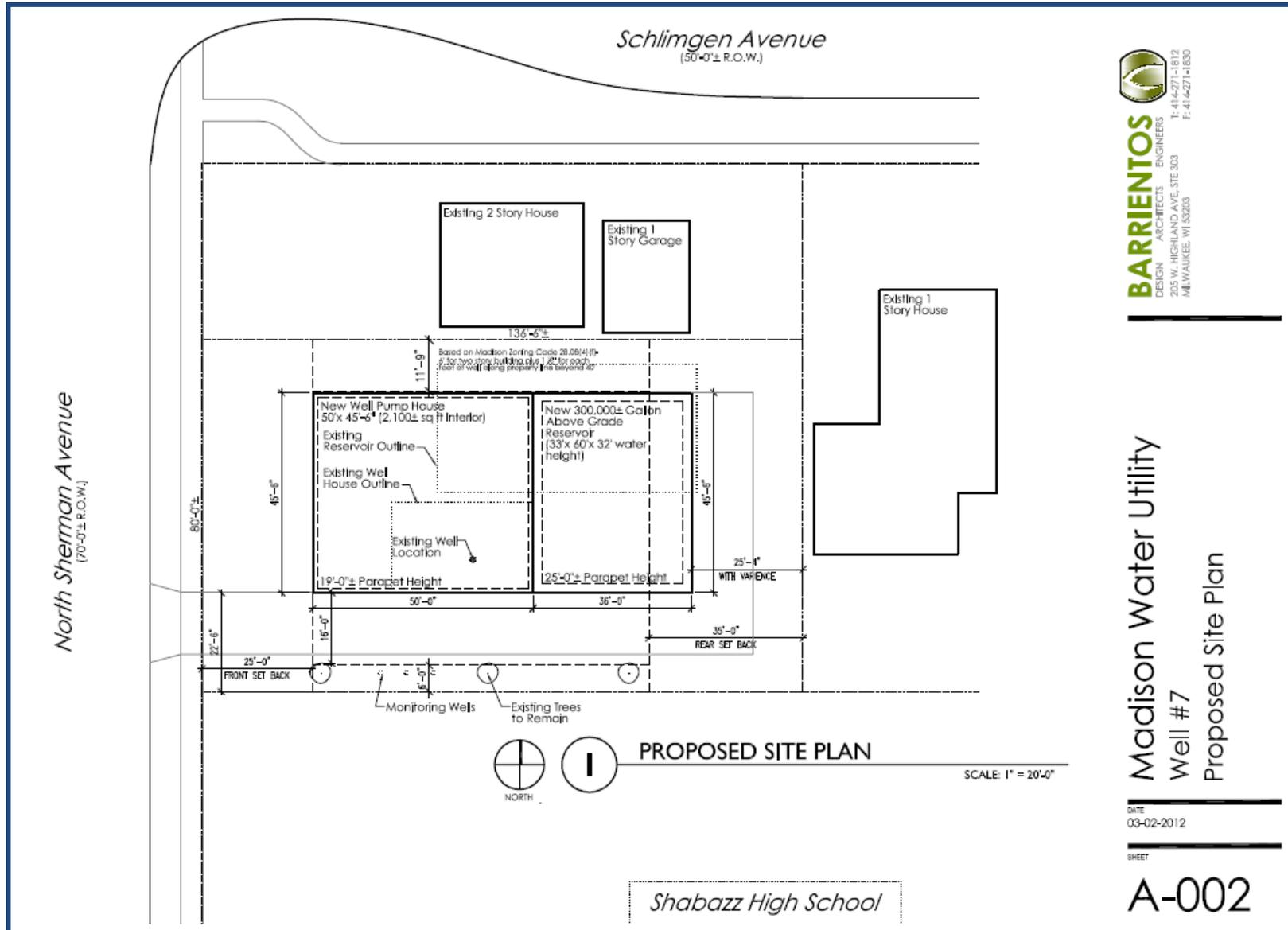
neighborhood's existing architectural context and would allow the MWU better access for maintenance and flexibility for future expansion.

1.8 EVALUATION AND RECOMMENDATION

A Citizen's Advisory Panel was formed to help develop and assess each alternative. The CAP met several times in the winter and spring of 2012. A final recommendation will be made through subsequent CAP activities, the involvement of the Alder, and additional MWU staff evaluations.

1.9 ESTIMATED COST

The cost of a new and expanded Well 7 will depend on the final selected alternative. The cost of Option 2 is estimated to be \$6 million based on the recent construction of a new reservoir and treatment system at Well 29.



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Figure 5-4: Proposed Site Plan Unit Well 7 within Existing Site

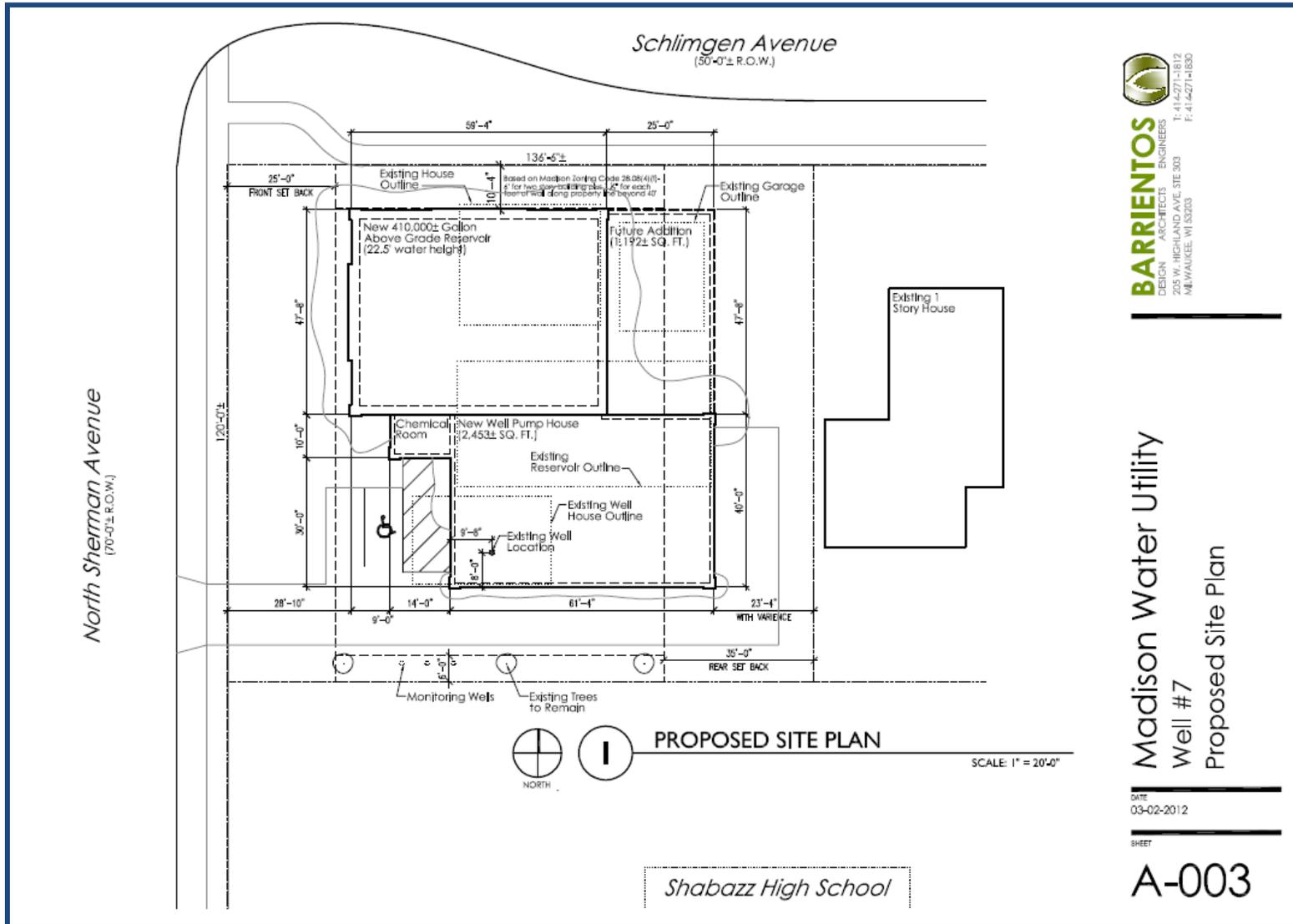


Figure 5-5: Proposed Site Plan Unit Well 7 with Expanded Site