

HDR



SEWER PUMP STATIONS
CONDITION ASSESSMENT
TECHNICAL MEMORANDUM

June 28, 2021



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List of Abbreviations

ATS	Automatic Transfer Switch
d	Day
ft	Feet/Foot
gpd	Gallons Per Day
gpm	Gallons Per Minute
HP	Horsepower
HVAC	Heating Ventilation And Air Conditioning
IBC	International Building Code
IMC	International Mechanical Code
kV	Kilovolt
kW	Kilowatt
M	Million
MCC	Motor Control Center
MG	Million Gallons
MGD	Million Gallons Per Day
NFPA	National Fire Protection Association
PLC	Programmable Logic Controller
V	Volt
VFD	Variable Frequency Drive
WWTF	Wastewater Treatment Facility

Section 1. Executive Summary

A condition assessment of the Lehner St. and Mill St. pump stations was performed with the intent of informing the decision to rehabilitate or completely replace each pump station. The decision to rehabilitate or replace is based on each facilities' age, current condition, size, location, operation, and safety risks.

While the pumps themselves are in good condition and the building has been well maintained, the Lehner Street Pump Station was found to have significant deficiencies related to safety and electrical code compliance. Lehner St. Pump Station is in critical need of replacement before failures lead to regulatory non-compliance. It is recommended that an engineering study be undertaken to define the scope of the design of a new pump station including location of a new wet well, pump station type, influent sewer modifications, maintaining operations during construction, and development of an opinion of probable construction cost.

With the pumps and building in a similarly good condition at Mill St., it too has significant deficiencies related to safety and electrical code compliance. While rehabilitation is possible, with the extent of rehabilitation required complete replacement may be more economical. It is recommended that an engineering evaluation be performed to identify and evaluate alternatives for rehabilitation and replacement to determine the most cost effective and constructable approach.

Section 2. Introduction

The Town of Wolfeboro retained the services of HDR to provide a condition assessment of two of the Town's sewer pump stations: Lehner St. and Mill St. A site visit was conducted by HDR on May 6, 2021 with multi-disciplinary engineers for this purpose. This condition assessment will assist in deciding if these facilities are better suited for rehabilitation or complete replacement. The decision to rehabilitate or replace will be based on each facilities' age, current condition, facility size, safety risks and other unique characteristics or challenges. At both facilities, the Town's main concern is to provide a code compliant, safe, and dependable lift station as economically as possible.

One of the main concerns faced at each facility is the annual build-up of fats, oils, and grease, which require collection system staff to enter the wet well at least once a year and sometimes on an emergency basis. Collection system staff clean the buildup out of the wet well using a vacuum truck and high-pressure wash water. The design of these wet wells at the two pump stations make this cleanout difficult, time consuming, and a safety hazard to the Town's collection systems staff.

The pages that follow describe the existing conditions at each of these two pump stations at the time of the site visit. Each pump station is broken down by discipline, and a summary of major findings for each pump station is presented at the end of its section.

Section 3. Lehner St. Pump Station

The Lehner Street Pump Station has significant deficiencies and is in critical need of upgrades before failures lead to compliance issues. The pump station was originally built in 1930's and converted to Gorman-Rupp self-priming pumps in the 1990's. Some ancillary equipment has also been replaced since its original construction.

The pump station consists of an above grade building and a below grade wet wells (one interior to the building and one outside of the building). A plan and profile view of the original pump station is provided in Appendix 1. The pump station is bounded Wolfeboro Oil a Division of Eastern Propane & Oil, Lehner St. and paved entrances/exits to the adjacent shopping plaza. Lehner St. Pump Station can be seen in Figure 3-1 and Figure 3-2.

The existing site where this pump station was built was originally at the edge of the water of Back Bay. Over the years, Back Bay was filled, reclaimed, and the land developed. Previous borings of the site noted the existence of a buried concrete tank, thought to be the Town's sedimentation basin prior to the construction of the WWTF. Groundwater depth at this location is generally the same as the lake and runs approximately 3'-5' below grade elevation.

The red building shown in the background of Figure 3-1 is a Town owned building currently used to store valves, spare parts, and equipment.. This building is old and in poor condition. It is reported that this structure does not have a foundation and is not suitable for restoration. The Town is planning relocate the stored materials to a more appropriate facility and demolish the building to allow more room at the pump station site prior to construction. The red building shown in the background of Figure 3-2 is part of Wolfeboro Oil.

A September 2007 Preliminary Design Report prepared by Wright-Peirce stated that the Lehner St. Pump Station appeared to have exceeded the end of its useful life. The major deficiencies noted included:

- insufficient pump capacity during high flow rain events
- HVAC/ventilation issues
- wet well/bar screen confined space access
- pump bypass line plugging
- interior space limitations
- significant corrosion and moderate structural deterioration
- electrical code concerns and security issues.

While I&I reduction efforts undertaken by the Town have had a significant impact on wet weather flows received and has eliminated pump capacity issues, many of the same deficiencies noted in 2007 remain unresolved.



Figure 3-1 Lehner St. Pump Station with Emergency Generator



Figure 3-2 Lehner St. Pump Station with Emergency Generator

3.1 Process Mechanical

The existing pumps serving this pump station are self-priming pumps manufactured by Gorman-Rupp (Model No. T3A3-B) shown in Figure 3-3. The pumps were last replaced a few years ago and the Town assumes the original design pumping capacity of 320 gpm with one pump running is being achieved. The pumps operate as lead/lag with the lead pump alternating and are connected to a telemetry system to alert the Town to high water levels in the wet well.

The associated valves and piping within the building generally appear in good condition with relatively new coats of paint. Suction and discharge piping are still original piping from 1940's, while some piping was upgraded in 1991. Bypass piping was added in approximately 2008 which allows the wet well to be bypassed during wet well cleaning operations.

The Town has maintained this facility diligently to ensure as much useful life could be obtained as possible. Discussions with the Town and visual inspection revealed the following deficiencies:

- Extremely close working quarters around and between the pumps makes maintenance difficult.
- Safe and adequate access to the wet well areas is not possible with the current wet well and building design.
- Piping within the wet wells are extremely corroded and should be replaced. This includes the discharge forcemain.



Figure 3-3 Lehner St. Raw Wastewater Pumps

3.2 Structural

The original 1940's brick pump station building is showing its age even though the Town has done well maintaining it. The pump station has two wet well structures approximately 16-feet deep. One wet well is exterior to the building (exterior wet well) and one wet well is directly under the building and holds a larger volume (main wet well). The exterior wet well is shown in Figure 3-4. Deficiencies noted in this portion of the structure include:

- Minor abrasion to the concrete with minor loss of paste but with no exposed aggregate at the bottom of the wet well.
- The piping and support members exhibit severe corrosion with loss of section.
- Access ladder has heavy corrosion with loss of section and is not currently safe for access.



Figure 3-4 Lehner St. Exterior Wet Well

The main wet well is shown in Figure 3-5. Deficiencies noted in the main wet well include:

- Minor abrasion to the concrete with minor loss of paste but with no exposed aggregate at the bottom of the wet well.
- The underside of the overhand has two (2) L-shaped spalls with exposed reinforcement having moderate corrosion as shown in Figure 3-6.
- The piping and support members exhibit moderate to severe corrosion with loss of section along with material building up on the valves as shown in Figure 3-7.
- The grating at the bottom of the wet well exhibits severe corrosion.
- The original access ladder has been replaced with a new aluminum ladder.



Figure 3-5 Lehner St. Main Wet Well



Figure 3-6 Exposed Reinforcement in Main Wet Well



Figure 3-7 Corrosion in Main Wet Well

3.3 Architectural

The Lehner Street Pump Station Building consists of a brick structure building built over the concrete wet well. The building is constructed of brick walls with an interior layer of glazed block, concrete floors, plaster ceilings, and a wood frame roof with asphalt shingles. As noted in the structural section, the building appears to be in good condition. No water infiltration was evident or reported. The building layout consists of a single room housing two pumps, electrical equipment and a unit heater. The interior dimensions of this space are approximately 8ft x 10ft. No evident architectural deficiencies were observed during the site visit.

The adjacent red building which is located on the pump station property (Figure 3-1) is constructed of traditional wood framing with wood siding. This building is currently being used for valve and spare parts storage. It is our understanding that this building will be demolished, and the materials currently stored within will be relocated to the new Water and Sewer Department Administration Building being planned at the site of the Wastewater Treatment Facility.

3.4 Mechanical

Lehner Street station is currently served by a unit heater with integral thermostat (Figure 3-8). There was no observation of passive or mechanical ventilation within the pump house. Windows are required to be left open to release excess heat in the summer months which does create a security concern for this pump station.



Figure 3-8 Lehner Street Pump Building Unit Heater

3.5 Electrical

The power for the Lehner Street Pump Station is routed into the building from pole mounted utility transformers next to the building to an automatic transfer switch (ATS) inside. The electrical system consists of the ATS (Figure 3-9), pump controller, pump control panel (Figure 3-10), pump motors, a 25KW diesel stand-by generator (Figure 3-11), and 120 volt power for lights, utility outlets, and controls.

The electrical system exhibited the following deficiencies:

- The wet well is classified as a Class 1 Division 1 space, according to NEC Article 500, and it is not properly sealed off from the electrical equipment. Currently, all the electrical equipment is installed in a Class 1 Division 1 atmosphere, for which it is not properly rated.
- There is not a 3' minimum working space for the electrical equipment and pump motors as required by NEC Article 110.26.
- The ATS and stand-by generator were installed in 1991 and have reached the end of their useful life.

The wet well space not being properly sealed off from the electrical equipment is a significant concern that can lead to failures of the system and regulatory non-compliance. Corrosive gasses will degrade metal in the electrical system including control panels and wiring over time and eventually result in system failures. When failure occurs, the pump station may not operate, and system backups and sanitary sewer overflows may occur causing violations.

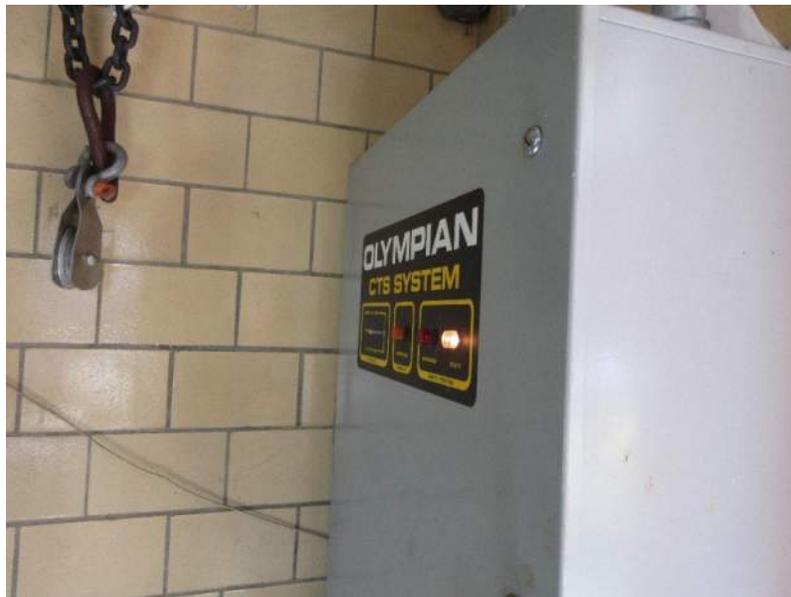


Figure 3-9 Automatic Transfer Switch (ATS)



Figure 3-10 Pump Controller and Pump Control Panel



Figure 3-11 Stand-by Generator

3.6 Major Findings and Conclusions

The major deficiencies found associated with this pump station include the following:

- Lack of ventilation in a hazardous atmosphere.
- Electrical equipment in a hazardous atmosphere for which it is not properly rated.
- Interior space constraints
 - Lack of minimum working space for the electrical equipment
 - Lack of minimum working space for the pumps and motors
- Access for cleaning the existing wet wells is extremely limited and is a safety issue for personnel who perform annual cleaning.
- Moderate to severe corrosion of metals within the wet wells including piping and structural components.
- The ATS and stand-by generator are near the end of their useful life based on age and cost of maintenance.

Given the size of the existing building and the significant deficiencies related to safety and electrical code compliance, it is recommended that this pump station be replaced before a failure occurs that results in non-compliance. It is recommended that an engineering study be undertaken to define the scope of the design of a new pump station including location of a new wet well, pump station type, influent sewer modifications, maintaining operations during construction, and development of an opinion of probable construction cost.

Section 4. Mill St. Pump Station

Mill St. pump station handles most of the flow to the WWTF and its forcemain ties directly into the grit unit inlet piping in the existing Headworks Building. This pump station is generally bounded by Mill St. and paved entrances/exits and parking spaces to the adjacent shopping plaza. The pump station can be seen in Figure 4-1.

The pump station was originally built in the 1940's, and some equipment has been replaced since that time. The red doorway to the right of the main building is an exterior entrance to a portion of the below grade inlet channels. This secondary entrance and wet well expansion were constructed in the early 1970's; hereafter referred to as the '72 wet well.

The pump station building has three levels: main level, pump level, and wet well. The building has several rooms on the main level including a bathroom and a room with access only from the exterior which houses some ventilation equipment. Modifications to the building have been made over time, including the addition of an exterior brick structure housing a fan that ventilates the wet well expansion area.



Figure 4-1 Mill St. Pump Station

A December 2003 evaluation prepared by Woodard & Curran stated that the pump station was in fair condition, although many components had met the end of their useful life. Of the major deficiencies noted, many of them were addressed because of the investigation.

4.1 Process Mechanical

The existing pumps serving this pump station are self-priming pumps manufactured by Gorman-Rupp (Model T6-Super T) shown in Figure 3-3. The pumps were last replaced a few years ago and each pump has a capacity of approximately 1 MGD with one pump running. The pumps operate as lead/lag with the lead pump alternating and are connected to a telemetry system to alert the Town to high water levels in the wet well.

The associated valves and piping within the building generally appear in good condition with relatively new coats of paint. Like Lehner St., some of the original piping remains, while some has since been upgraded. The Town has maintained this facility diligently to ensure as much useful life could be obtained as possible. Discussions with the Town and visual inspection revealed the following deficiencies:

- Safe and adequate access to the wet well areas is important for maintenance and yearly cleaning of the oil and grease build up.
- Pipes within the wet wells are moderately to extremely corroded.



Figure 4-2 Mill St. Pump Station, Pump Level

4.2 Structural

The original pump station is in good condition with no major deficiencies. The only item of note in this building is within the old comminutor room, which currently only houses ventilation equipment. Within this room there is an opening in the floor that was previously open to the incoming sewer line and has since been sealed. The railing surrounding this opening does not meet current OSHA standard due to lack of a toe board.

The main pump wet well is located under the building and is shown in Figure 4-3, and is connected to the '72 wet well by means of a small whole cut in the original wall. Deficiencies noted in the main pump wet well include only minor abrasion to the concrete with minor loss of paste but with no exposed aggregate.



Figure 4-3 Mill St. Wet Well

The '72 wet well located to the west of the original structure is in generally good condition with the following deficiencies noted:

- The influent channels show minor abrasion with loss of concrete paste but no exposed aggregate.

- The west influent channel has a steel structure which is likely the remains of a demolished comminutor (Figure 4-4). This steel is heavily corroded and should be removed in the event it broke loose so as not to damage the pumps.
- The influent channels have bar grating partially covering the opening of the two influent channels. These channels should be fully covered for safety.
- The bottom of the top slab of the wet well has several locations where the reinforcement was placed during construction such that the bars are exposed. These bars exhibit heavy corrosion with loss of section.
- There is minor spalling ($>10 \text{ in}^2$ at each location) near the supports for the ventilation/AC ducting that corroded away.
- The ductwork is currently support by straps screwed into the slab as shown in Figure 4-5.
- The walls of the wet well have random spalls ($>7 \text{ in}^2$) and at the floor wall interface there are areas of efflorescence.
- At the northeast corner of the wet well there is an opening for the ventilation/AC ducting that exhibits rust staining.
- There are two openings in the top slab for hatches providing access to the wet well. Both have a brick layer upon which concrete has been placed to support the hatch. The north hatch framing has moderate laminar corrosion which is causing rust staining along the sides of the opening, as shown in Figure 4-6. The south hatch was added after the original construction of the wet well as evidenced by the exposed reinforcement in the sides of the opening.



Figure 4-4 Mill St. '72 Wet Well Influent Channel



Figure 4-5 Mill St. '72 Wet Well Top Slab

4.3 Architectural

The Mill Street Pump Station Building is of similar construction type as the Lehner Street Station, consisting of brick walls with an interior layer of glazed block, concrete floors, plaster ceilings, and a wood frame roof with asphalt shingles. As noted in the structural section, the building appears to be in good condition with no signs of water infiltration through any of the walls, ceiling, or windows.

The building has three levels: a wet well level, a below grade pump room level, and an at grade level. The at grade level includes an Office / Electrical Room, Bathroom, and Mechanical Room. Access between the pump room and office / electrical room is provided by steel grating stairs with handrails, which appear to be in good condition. There are no walls or doors separating the at grade office / electrical room from the pump room. The mechanical room is separated from the office / electrical room and has separate access via an exterior door. To the left of the door to the office, there is a bronze commemorative plaque from the original construction of the pump station under the Federal Works Agency.

Architecturally, the following deficiencies were observed in the pump station building:

- The railings on the existing steel stairs between the pump room and office do not comply with current OSHA standards.

The '72 Wet Well has a separate concrete access stairwell adjacent to the pump station building. Two access hatches at grade level are located between the pump station building and the access stairwell.

4.4 Mechanical

The Mill Street Pump Station electrical room and dry well is currently ventilated by a push-pull ventilation system. Supply air is provided via an exterior louver intaking outside air to an inline electric duct heater and belt driven supply fan with supply ductwork and wall mounted supply registers. Existing louvers can be seen in Figure 4-6 and the supply fan and inline duct heater can be seen in Figure 4-7.

Exhaust air is removed from the electrical room via interior wall registers through exhaust ductwork to a ceiling hung exhaust fan that exhausts to an exterior wall louver. Exhaust air from the dry well beneath the fan room is removed via exhaust ductwork connected to a floor mounted cabinet exhaust fan and through the same exhaust louver that is used by the electrical room exhaust fan.

The mechanical systems serving the main pump station are generally in good condition with the following deficiencies noted:

- Exhaust air and supply air louvers were observed to be less than the required 10 feet of distance per 2009 IMC Sections 401.4 and 501.2.1.

The '72 Wet Well is currently ventilated via an exhaust fan mounted inside of a brick chase outside of the pump station (Figure 4-6) and exhaust ductwork routed within the wet well (Figure 4-8). The exhaust fan exhausts air to a chimney vent mounted at the roof of the pump station. Make-up air is brought in passively through the access staircase adjacent to the pump station.



Figure 4-6 Exterior Louvers and Wet Well Ventilation Chase



Figure 4-7 Ceiling Mounted Supply Fan with Inline Duct Heater



Figure 4-8 Wet Well Exhaust Ductwork

4.5 Electrical

The power for the Mill Street Pump Station is routed into the building from pole mounted utility transformers next to the building to an old motor control center (MCC) inside. The electrical system consists of the MCC (Figure 4-9), automatic transfer switch (ATS), pump control panel (Figure 4-10), pump motors (Figure 4-11), stand-by generator (Figure 4-12), variable speed drives, and 120 volt power for lights, utility outlets, and controls.

In the 2003 evaluation performed by Woodard & Curran it was noted that the original pumps were provided with two speed motors, but one of the two speed motors had failed and was replaced with a single speed motor. Currently, both motors are single speed motors. It is likely that the remaining two speed motor had failed since the 2003 evaluation.

The operators noted that the stand-by generator recently experienced issues that resulted in repairs to keep it operable. The ATS and standby generator was installed at Mill St. in 1991. Given its current age and maintenance challenges, it is recommended to be replaced.

The '72 wet well has conduits and lights that are explosion proof. The lights were operable, but the conduits and fixtures showed minor signs of corrosion.

The electrical system exhibited the following deficiencies:

- The wet well is classified as a Class 1 Division 1, according to NEC Article 500, and it is not properly sealed off from the electrical equipment. Currently, all the electrical equipment is installed in a Class 1 Division 1 atmosphere, for which it is not properly rated. The only exception to this is the existing lights and conduits in the '72 wet well.
- Much of the original MCC, and pump control panel are not in operation and should be removed.
- The ATS and stand-by generator were installed in 1991 and have reached the end of their useful life.
- Both pump motors are single speed non-inverter rated motors, but they are controlled by VFDs. Running non-inverter rated motors on VFDs could lead to overheating.

As stated above, the wet well space not being properly sealed off from the electrical equipment is a significant concern that can lead to failures of the system and regulatory non-compliance. Corrosive gasses will degrade metal in the electrical system including control panels and wiring over time. When failure occurs, the pump station may not operate, and system backups and sanitary sewer overflows may occur causing violations.



Figure 4-9 Motor Control Center (MCC)



Figure 4-10 Pump Control Panel



Figure 4-11 Pump Motor



Figure 4-12 Stand-by Generator

4.6 Major Findings and Conclusions

The major deficiencies found associated with this pump station include the following:

- Lack of ventilation in a hazardous atmosphere.
- Electrical equipment in a hazardous atmosphere for which it is not properly rated.
- OSHA standards not currently met:
 - At deep opening in HVAC room due to lack of a toeboard.
 - Railings at the steel stairs between the pump room and office do not meet current standards.
- Exhaust air and supply air louvers not adequately separated.
- The pumps and motors appear to be near the end of their useful life.
- The original MCCs, and pump control panel is no longer in use and should be demolished.
- ATS and stand-by generator appear to have reached or exceeded their useful life.
- Single speed non-inverter rated motors are controlled by VFDs.
- Access for cleaning the existing wet wells is extremely limited and is a safety issue for personnel who perform annual cleaning.
- Moderate to severe corrosion of metals within the wet wells including piping and structural components.
- The top slab of the '72 wet well has several areas where the reinforcement is exposed with heavy corrosion and minor loss of section.

Given the significant deficiencies related to safety and electrical code compliance, it is recommended that this pump station be replaced or rehabilitated to meet the Town's goals to provide a code compliant, safe, and dependable lift station. However, with the extent of rehabilitation required, complete replacement may be more economical. It is recommended that an evaluation be performed to identify and evaluate alternatives for rehabilitation and replacement to determine the most cost effective and constructable approach. While Lehner St. and Mill St. share the same significant deficiency related to non-compliance with electrical code, Lehner St. is a higher priority because of the proximity of the wet well connection to the electrical equipment and its smaller size.

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Appendix 1 - Lehner St. Pump Station Original Plan and Profile

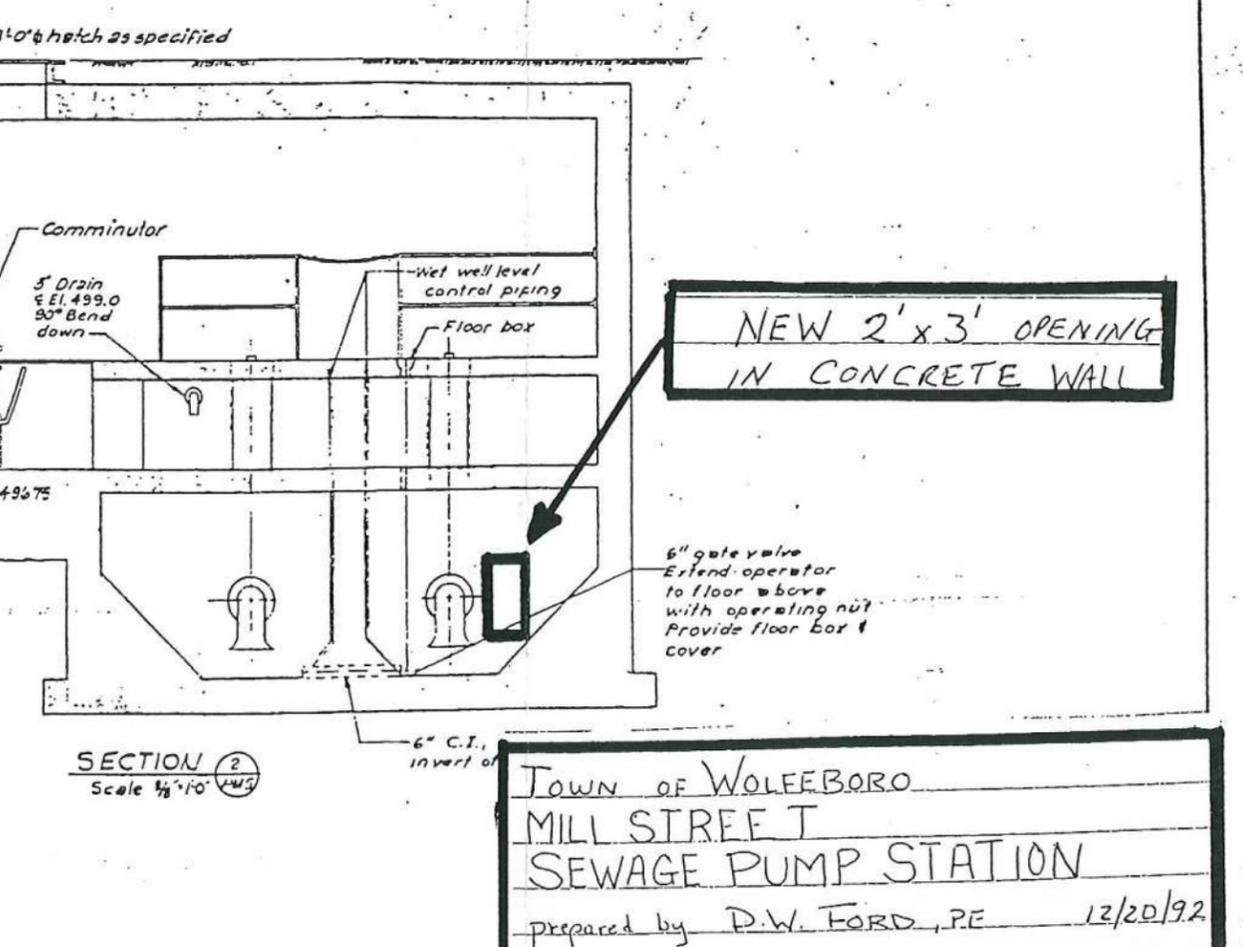
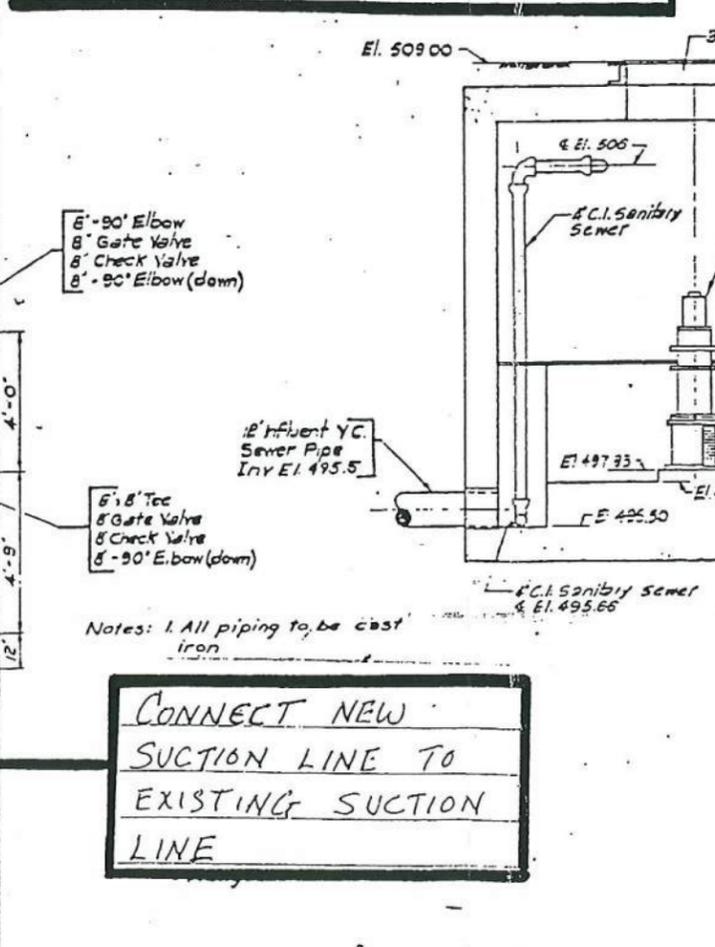
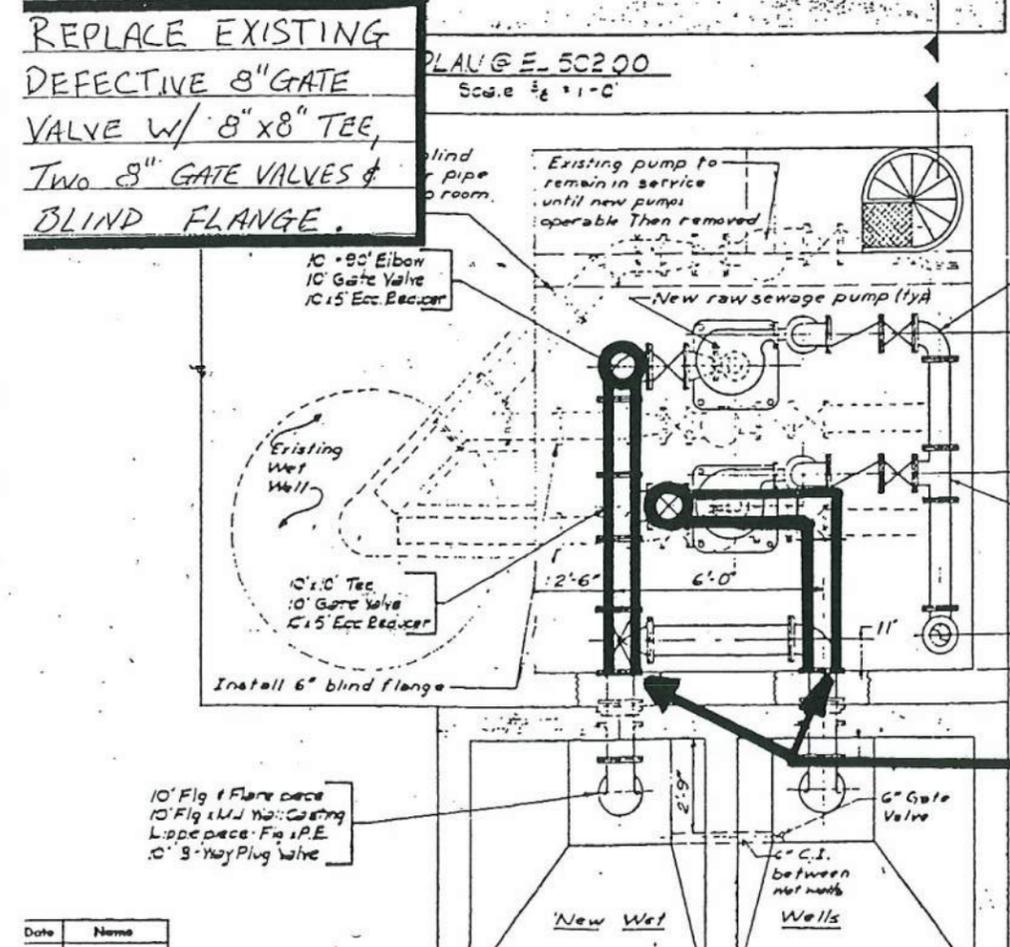
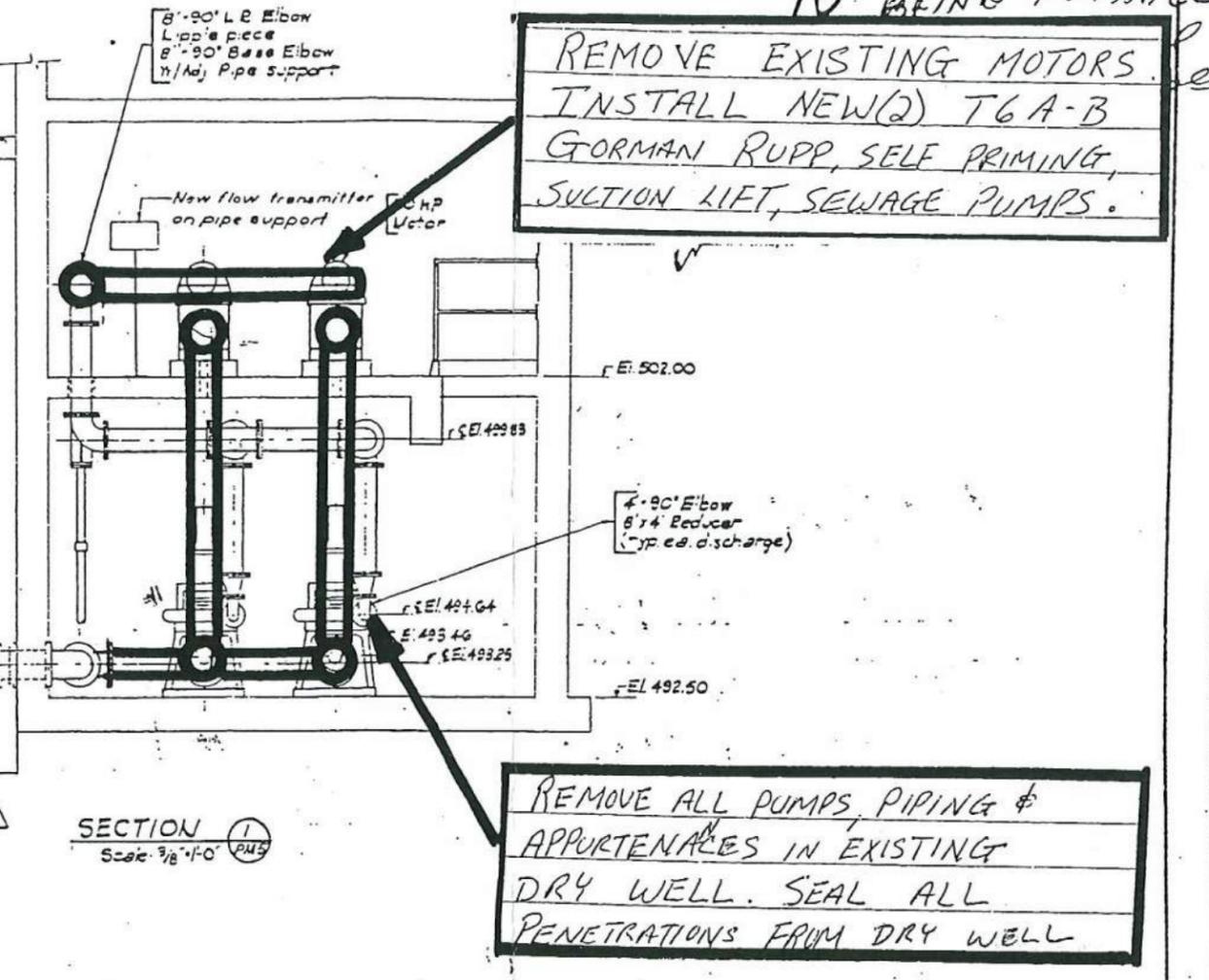
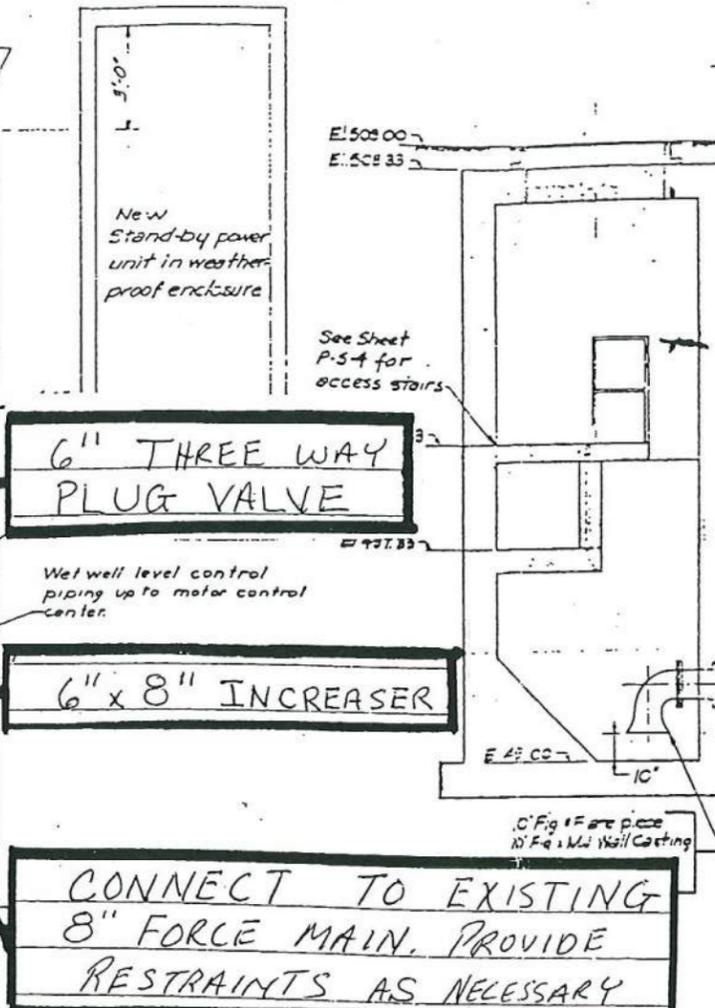
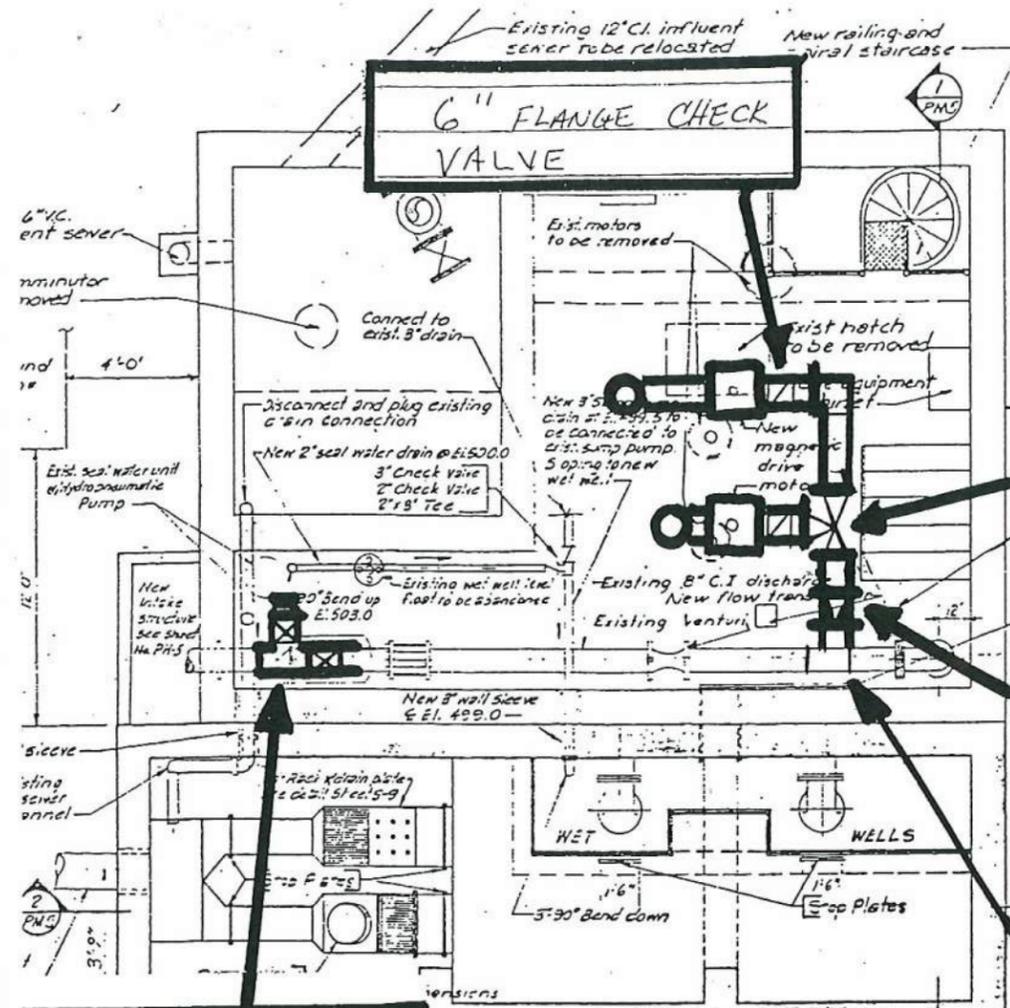
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Appendix 2 - Mill St. Pump Station Sketch Plan and Profile

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Date _____ Name _____

TOWN OF WOLFEBORO
MILL STREET
SEWAGE PUMP STATION
prepared by P.W. FORD, PE 12/20/92

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