VERMONT

State of Vermont
Department of Environmental Conservation
Watershed Management Division
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Agency of Natural Resources

LUDLOW WASTEWATER
POST JULY 2023 FLOOD
TREATMENT PLANT ASSESSMENT
WINDSOR COUNTY, VERMONT

NPDES PERMIT NUMBER VT0100145
STATE OF VERMONT PERMIT NUMBER 3-1208

September 13, 2023

This report was prepared based on observations made during the July 18th site visit by Heather Collins, VT DEC, WSMD, WWMP in conjunction with Army Corps of Engineers and US EPA Region 1 representatives.

REPORT LIMITATIONS

This report was prepared from visual observations and operator conversations during the site visit. No testing of equipment or measuring of components was performed.

MAIN PLANT

FACILITY DESCRIPTION

The facility is an extended air facility. Influent flows via gravity through the headworks to a mechanical drum screen, if the drum screen fails, the adjacent bar racks provide primary screening. Influent then flows to the wet well where it is then is pumped by main pump station to parallel oxidation ditches with three anoxic selectors each. After aeration in the oxidation ditches waste flows via gravity to the (3) secondary clarifiers. After the clarifiers treated effluent then flows to the (2) chlorine contact chambers where sodium hypochlorite is injected for disinfection. At the end of the chambers, sodium bisulfite is injected for dichlorination prior to discharge to the Black River. The capacity of the treatment facility is 1.05MGD, but average daily flows are approximately 140,000 GPD in the summer off-season and can exceed 800,000 GPD during the busy ski season. Not all equipment is used during the summer months as flows are low in the summer and increase in winter with ski tourists. One oxidation ditch was in use along with the largest of the three secondary clarifiers and one contact chamber on the day of the inspection.

The headworks, main pump station, and main plant building had recently been upgraded. The facility has near complete redundancy for flows seen throughout most of the year.

The facility is comprised of four buildings.

- The headworks building contains the mechanical drum screen and associated electrical components.
- The recently constructed main pump station building houses the influent pumps, variable frequency drives (VFD's) main control panel, programmable logic controller (PLC) and dehumidifier.
- The Main Plant building contains the motor control center (MCC), chemical storage tanks, chemical feed pumps and associated equipment, laboratory equipment and supplies, mechanical room, maintenance area, staff break room, office heating system and hot water system.
- A garage that houses the plant's lawn mowing equipment and portable pumps with

hoses is located on site.

OBSERVATIONS

The facility site suffered appreciable damage from erosion and scour. Much of the site's asphalt had been destroyed and pieces scattered throughout the property. The majority of the facility's fencing was destroyed. Buried piping and conduits were exposed in several locations. Aside from the plant's potable water service, the operator did not believe any process piping was leaking. A sludge pipe was showing joint deflection but had not yet been tested.

Several electrical conduits were broken or missing. The main electric service drop including automatic transfer switch (ATS) was destroyed. A temporary power service had been installed.

Headworks Building: An appreciable amount scour was observed around the upstream side of the drum screen / headworks building. The below grade structure is deep and constructed of reinforced concrete. Damage appears limited to some siding on the upper, stick-built portion of the building and electric service. The interior was full of silt and debris. The rotary drum screen was submerged in flood waters and was offline due to control/power issues and influent was being bypassed through the bar racks. The external control panel was damaged. The headworks appeared to be operational with a temporary electric service from the main plant building.

Main Pump Station: This building was recently constructed (reportedly complete in 2021) and notably had no significant damage other than scour and debris around the building. Some flood water had made it under the door and leaked into the basement where the influent pumps and sludge pumps are located. The basement high water mark was at approximately 18".
The main pump station was operational and had minimal water intrusion and did not reach pump motors, variable frequency drives (VFD's) or control panel. There was a dehumidifier which was partially submerged but appeared to be operational. The main pumps were operating on the backup level control. There is an error with the level controls communicating with the pumps to pump the influent to the pre-anoxic zone with cascading mixing tanks. The emergency backup controller is being triggered and pumping once levels achieve 63" instead of the normal operational level of 40". One pump is currently operating at a time. This was likely due to a damaged wet well level transducer. Pumps should be assessed for damage from incoming excess silt and debris.

Main Building: Significant scour was observed around the upstream side of the main plant building and exposed the foundation / footer. A horizontal crack at a concrete block grout joint indicated some minor movement / settlement may have occurred. A high-water line was noted approximately 4' above the building finished floor. The motor control center (MCC) including nearly all pump and motor starters, variable frequency drives (VFDs), branch circuit breakers, and electrical conduits were inundated and likely

destroyed. The same is true for the plant's chemical storage tanks, meters, analytical monitors, recorders, laboratory equipment and supplies, chemical feed pumps and associated equipment, mechanical room, maintenance area, staff break room, office heating system and hot water system all of which were submerged. The garage door was damaged by displaced site asphalt.

Generator: Significant scour had undermined the elevated generator platform causing it to lean. The stairs of the generator platform were damaged. The backboard for the electrical components and ATS was damaged and laying on the ground. The generator itself may have been spared from submergence, although the apparent velocity of the water could have caused splashing and water damage and should be evaluated for damage.

Oxidation Ditches: Scour was noted around both oxidation ditches, undermining the shallower ends. The selector tank and oxidation ditches were submerged. Debris and silt were noted in the ditches and tanks. Each ditch contains two electrical motors which drive the aeration rotors and were submerged. The rotary drum motors are blown, and the oxidation ditch was not being aerated. The operator reported they had replacement motors and would likely be installed and in service soon.

Secondary Clarifiers: There are three secondary clarifiers, two of which are nearly at grade level (Clarifier 1 (West), Clarifier 2 (East)) and the third (Clarifier 3) extending 3'-4' above grade. All three operate at the same hydraulic grade. All three are covered. The lower clarifiers were completely submerged. The motor disconnects and mounts were knocked over, several covers were opened. Large sections of displaced asphalt were observed laying on top of the covers. The drives and motors had been submerged. It is probable the clarifiers contain sand, rocks, and pieces of asphalt and should be completely drained prior to attempting to restart the drive motors. Aside from some damage to the covers and submerged drives and motors, the clarifiers are likely suitable for reuse once properly cleared of debris.

The upper clarifier was operational during the site visit. Operational Staff reported said there was a partial blockage between the clarifier and sludge pumps, located in the main pump station. They had a plan to attempt to clear the line. There was significant scour near the upper clarifier exposing its influent pipe. Operational staff had installed a temporary support below the pipe; the line was not showing evidence of leakage.

Chlorine Contact Chambers: The plant has two chlorine contact chambers, one of which is covered by a stick-built built building (covered tank). Both showed evidence of scour around the structures but no apparent damage to the concrete. The exterior contact chamber suffered bent railings, broken conduits, and submergence of the mixers. The covered tank building was missing several pieces of exterior sheeting and broken windows. An appreciable about of silt, grit and debris were conveyed to the chambers. This infill will limit the effectiveness of treatment and will need to be cleaned.

Aerobic Digester: The digester has two compartments, each 38-feet by 12-feet-4-inches with a normal liquid depth of 8-feet. Evidence of scour around the structure was noted but no apparent damage to the concrete.

Upper Garage/Sludge Offloading Station Building: Evidence of scour around the structure was noted but no apparent damage to the structure. Debris and silt were noted on the concrete floor of the structure.

Sludge Storage Tank: The sludge storage tank is a 288,000 gallon precast concrete holding tank that the facility uses in case of emergency. Evidence of scour around the structure was noted but no apparent damage to the structure.

PUMP STATIONS

POND STREET PUMP STATION

FACILITY DESCRIPTION

The facility is a submersible pump station containing 2 pumps that alternate with a concrete wet well and concrete pump pit. The control panel is mounted on grade.

OBSERVATIONS

The pit vent was broken off in the floodwater and silt, rocks and sand were deposited within pit. An appreciable amount of grit and sediment from the upstream collection system was likely conveyed into the pumps. Subsequently, pump performance should be checked for accelerated wear and replaced or reconditioned.

WEST HILL PUMP STATION

FACILITY DESCRIPTION

No flood impact to this pump station due to location

COLLECTION SYSTEM

FACILITY DESCRIPTION

There are eight stream crossings in the collection system; two of the stream crossings are submerged siphons and the other six vary in size from 8” to 15”.

OBSERVATIONS

Overall, the collection system received large amounts of grit/silt/debris. Sections of collection system piping were exposed along Black River. At one section a break in the 15” AC line occurred and was being temporarily bypassed awaiting repair.

RECOMMENDATIONS

IMMEDIATE

- At the current flows, half of the plant needs brought back into service to treat typical flows seen at this time of year.

SHORT TERM

- A permeant electrical service and service entrance will need to be re-established, including new ATS. The elevated generator support structure may require complete demolition and reconstruction. The generator, once accessible in a safe location, should be checked for water intrusion and if present, replaced or rebuilt.

- Evaluate electrical components, wiring and conduits. All may need replacing.

- Complete replacement or professional rehabilitation of all electrical and mechanical equipment and instrumentation below the high-water mark which show evidence of water intrusion. Even equipment quickly brought back into operation may suffer shortened life due to silt and containments in flood waters.

- A significant amount of equipment was impacted, including most of the motor control center (MCC), chlorination & de-chlorination pumps/tanks/feed lines, instrumentation, analytical monitors & recorders, all submerged control panels and generator.

- Pumps which show evidence of water intrusion in bearing grease or oil should be replaced or reconditioned.

- The main plant building’s exposed foundation should be carefully examined for degree of undercut and damage. Lifting and mechanical stabilization of the foundation and / or pressure grouting may be required.

- Undercut portions of oxidation ditches will likely require flowable fill or pressure

grouting to provide a new, firm bearing surface. Grit and debris should be removed from the ditches.

- The site will require replacement of fill materials as well as replacement of multiple conduits and conductors throughout. Overall fine grading and repaving of the entire site will be required. A significant portion of the site fence was damaged or completely destroyed.

- Grit, mud and debris removal from the headworks will be necessary and evaluating the performance of the rotary drum screen.

- The Headworks building also has siding replacement that will be required.

- The lower secondary clarifiers will require new disconnect supports, thorough cleanings, repairs to damaged covers, drive motor replacements and possibly replacement of gear drives. Sludge piping should be checked and debris / clogs if present should be removed.

- The facility will need to drain all treatment tanks to remove silt, sand, and grit.

- A new level transducer or transmitter will likely be required in the main pump station.

- An appreciable amount of grit and sediment from the upstream collection system and headworks inundation was likely conveyed into the plant. Subsequently, main influent pump performance should be checked for accelerated wear.

- Railing, mixers, level measurement transmitters, and siding at the chlorine contact basins will require replacement. Although one tank is conveying flow, sediment and debris will need removed from both tanks.

- The plant will likely require seed sludge to restart biological treatment.

- Jetting and camera inspection of low-lying collection system areas as the collection system received an appreciable about of grit/silt/debris. Camera inspections should be explored to ascertain collection system damages.

- Have Reduced Pressure Zone Backflow Preventers (RPZBP) at the facility inspected and tested to ensure they are properly functioning.

LONG TERM

Long term recommendations to potentially mitigate future flooding impacts include:

- Much of the damage to this facility was the result of scour from swift moving water, *possibly* due to debris built up at the bridge immediately upstream of the facility

causing a redirection of the main channel flow. If the adjacent bridge needs to be replaced, consider providing additional clear span or height to better convey debris and flood waters in a similarly sized storm.

- Due to the low site elevation, the treatment plant has been and will continue to be subjected to repeated flooding during severe events. Conduct a cost and life cycle analysis to determine if relocation is a better option than reconstruction. Elevating the MCC / control panels, motors, and generator. This would require a significant undertaking as an additional building floor, mezzanine or new elevated building would be required.

- A structural analysis of the Main control building should be considered before performing any long term or mitigation repairs are made to ensure the building can support long term use.

- Other protections from lower velocity flood waters include constructing additional wall height to elevate the covers, drives, and disconnects at the lower clarifiers.

- A similar and additional velocity barrier immediately upstream of the chlorine contact tanks, along with utilization of submersible mixers, could also be considered.

- High flows may exceed the working capacity of chemical pumps. Additional pumps should be provided to deliver process and disinfection chemicals during high flows. Larger day tanks and supplies of chemicals on hand may be needed.

- Outfall pipes should have valves or duckbills to prevent river water from backing into plant components.

- Consider portable or fixed pumps to discharge effluent if gravity flow is no longer possible.

PHOTOS

1 – Entrance to Ludlow WWTF Showing Extreme Scour and Asphalt Displacement

2 – Entrance to Ludlow WWTF Showing Extreme Scour and Asphalt Displacement, No. 3 Secondary Clarifier in the Background (Photo courtesy of Aldrich and Elliot, PC)

3 – Left Side: Headworks Building, Right Side Main Control Building. Displaced Asphalt Deposited and Extreme Scour (Photo courtesy of Aldrich and Elliot, PC)

4 – Left Side: Headworks Building, Looking Back Towards Entrance. Extreme Scour and Site Fence Damage (Photo courtesy of Aldrich and Elliot, PC)

5 – Left Side: Headworks Building, Looking Back Towards Entrance. Damage to Exterior of Building and Extreme Scour and Site Fence Damage (Photo courtesy of Aldrich and Elliot, PC)

6 – Interior of Headworks Building

7 – Left Side: Influent Pump Station, Right Side Main Control Building. Displaced Asphalt Deposited, Extreme Scour, and Exposed Conduit and Piping (Photo courtesy of Aldrich and Elliot, PC)

8 – Back of Influent Pump Station, Looking Towards Chlorine Contact Chamber. Note Extreme Scour and Damaged Site Fencing (Photo courtesy of Aldrich and Elliot, PC)

9 – Basement Area of Influent Pump Station Showing High Water Mark at Approximately 18".

10 – Basement Area of Influent Pump Station Showing Influent Pumps, Sludge Pumps and Dehumidifier, High Water Mark at approximately 18".

11 – Left Side: Clarifier No. 1 With Displaced Asphalt Around and on Top of Clarifier. Right Side: Clarifier No. 2. Looking Towards Oxidation Ditches. Note Extreme Scour (Photo courtesy of Aldrich and Elliot, PC)

12 –Clarifier No. 2. In foreground, Clarifier No. 3 in Background. Note Debris and Extreme Scour

13 –Clarifier No. 3. Note Debris and Extreme Scour

14 –East Oxidation Ditch Exterior. Note Debris and Extreme Scour

15 –East Oxidation Ditch Interior. Note Debris

16 –West Oxidation Ditch Exterior. Note Extreme Scour

17 –West Oxidation Ditch Interior. Note Debris

18 –Rotary Drum Motor in West Oxidation Ditch Interior. Note Debris

19 –West Oxidation Ditch Interior. Note Extreme Scour Along Drive and Damaged Fencing Behind Oxidation Ditch

20 –Chlorine Contact Chamber. Note Extreme Scour and Debris (Photo courtesy of Aldrich and Elliot, PC)

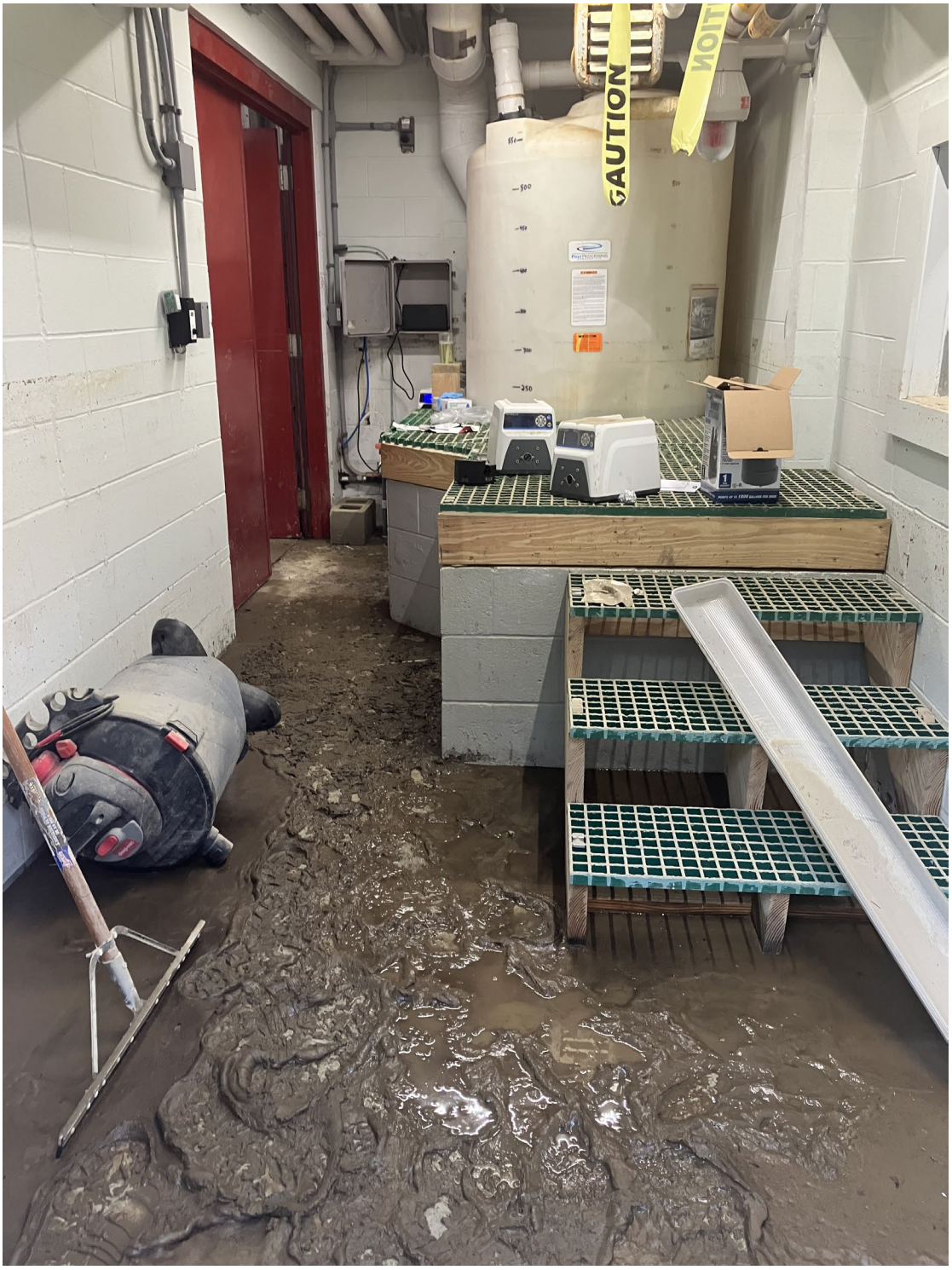
21 –Chlorine Contact Tank Building. (Photo courtesy of Aldrich and Elliot, PC)

22 –Chlorine Contact Tank Building Interior. Note Window Missing on Left Side and Debris

23- Aerobic Digester. Note Extreme Scour and Debris (Photo courtesy of Aldrich and Elliot, PC)

24- Aerobic Digester. Note Exposed Piping and Conduits (Photo courtesy of Aldrich and Elliot, PC)

25- Aerobic Digester. Note Exposed Piping Scour and Debris (Photo courtesy of Aldrich and Elliot, PC)



26- Main Control Building Chlorine Tank. Note High Water Mark at Approximately 4 feet.

27- Main Control Building Bisulfite Tanks. Note High Water Mark at Approximately 4 Feet. (Photo courtesy of Aldrich and Elliot, PC)

28- Main Control Building Office.

29- Main Control Building Maintenance Room.

30- 15" AC Sewer Main Along Black River (Photo courtesy of Chief operator Joe Gaudiana)