

**SHAKER LANDING
PUMP STATION O & M MANUAL
VOLUME I
OPERATIONAL AND MAINTENANCE
NARRATIVE**

LANDING ROAD



**ROUTE 4A SEWER EXTENSION PROJECT
ENFIELD, NEW HAMPSHIRE
GRAFTON COUNTY
NHDES CWSRF PROJECT NUMBER CS-330167-04
USDA RURAL DEVELOPMENT PROJECT**

**DECEMBER 7, 2018
(Project No. 10068-05)**

Prepared by

**Pathways Consulting, LLC
Project No. 10068-05**

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CHAPTER 1 – INTRODUCTION

1.1 PURPOSE OF MANUAL

This Operation and Maintenance (O&M) Manual is written specifically for the Town of Enfield (Town) Shaker Landing Pump Station located just off Landing Road in Enfield, New Hampshire. In this document the O&M Manual will be referred to as the manual, and the Shaker Landing Pump Station as the pump station. The purpose of this manual is to provide the Town Public Works Department personnel with information related to the design, equipment specification, operation, and maintenance of the pump station and related equipment systems.

The manual will facilitate the efficient operation of the pump station in compliance with the Town Municipal Sewer Ordinance, the New Hampshire Department of Environmental Services (NHDES) Code of Administrative Rules section Env-Wq 700 *Standards of Design and Construction for Sewerage and Wastewater Treatment Facilities*, and other applicable Environmental Protection Agency (EPA) requirements.

1.2 USE AND UPDATING INFORMATION FOR THIS MANUAL

The manual has been formatted to provide ready access to key information related to the pump station basis of design, the specific equipment design specifications and details, equipment supplier's recommended operation and maintenance procedures, monitoring and control systems, and other information related to safety, emergency response, and recordkeeping. The format complies with and generally follows the NHDES *Pump Station O and M Manual Review Checklist* and the requirements of NHDES Env-Wq 705.10 *Sewage Pumping Station Operation and Maintenance Manual*.

The manual is intended to be utilized by trained Town wastewater operators and maintenance personnel. It is recommended that these technical personnel read particular sections related to the operation of the pump station in detail, and become generally familiar with the information contained in the appendices and other reference sections. Where appropriate reduced size copies of design and construction documents are provided for reference, and photographs are included to identify specific equipment systems. This manual is not intended to replace installation, operation, maintenance, or troubleshooting guides provided specifically by equipment manufacturers or suppliers. This information is provided in the Appendices in Volume II and should be consulted by Town personnel.

This manual is intended to be a working document that allows amendment and modifications when equipment or operating parameters change. For this reason the manual is presented in a three-ring binder format to allow easy insertion of revised pages or other required information. The document is presented in three volumes with the first volume being the core operational and maintenance narrative; and the second volume containing reference materials such as drawings, specifications, forms, and product submittals; and the third volume containing manufacturer supplied operating and maintenance materials.

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1.3 ABBREVIATIONS

The following abbreviations are used throughout this manual:

1Ø,3Ø	Single Phase Power, Three Phase Power
ADF	Average Daily Flow
CFM	Cubic Feet Per Minute, AR
EPA or USEPA	United States Environmental Protection Agency
FPS	Feet Per Second
GPH	Gallons Per Day
GPM	Gallons Per Minute
HP	Horsepower
I/I	Infiltration or Inflow
kW	Kilowatts of Power
LF	Linear Feet
NHDES	New Hampshire Department of Environmental Services
NPDES	National Pollutant Discharge Elimination System
PHF	Peak Hourly Flow or Peak Flow
SSO	Sanitary Sewer Overflow
SS	Stainless Steel
TDH	Total Dynamic Head
V	Volts

1.4 BASIS OF DESIGN SUMMARY

Table 1-1 summarizes the basis of design and construction for the pump station and associated equipment systems. The individual systems are described further in following sections of this manual.

Pump Station General Information			
Site and System ID	Shaker Landing Pump Station		
Location	Landing Road, Enfield, New Hampshire		
Site Operator	Town of Enfield Public Works Department		
Number of Connections	6 buildings, 3 units each, 3 bedrooms per unit (present) No planned future interconnections		
Average Daily Flow Rate	8,100 gallons per day		
Average Daily Flow Rate	5.6 gallons per minute (based on 24 hour operation)		
Design Peaking Factor	6.0		
Design Inflow Rate	34 gallons per minute		
Design Pump Flow Rate	120 gallons per minute (each pump in duplex system)		
Type of Operation	Continuous		
Pump Station and Related Equipment			
Description	Size/Capacity	Quantity	Year Constructed
Wet Well Pump Station	8'-0" x 6'-0" x 10'-4" deep precast concrete with removable aluminum inlet basket, mechanical ventilation, SS access hatch	1	2018
Solids Handling	EBARA Model 80DLMFU62.2	2	2018

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Submersible Pumps, rail mounted with break away discharge flange	120 gpm at 29 feet TDH 3-inch discharge Impeller 7.40" 3 HP, 1800 RPM, 230V 3		
Valve Vault	8'-0" x 6'-0" x 8'-0" deep precast concrete, mechanical ventilation, SS access hatch	1	2018
Valve Vault Sump Pump	Myers Model MS33T10, 1-1/2-inch discharge; Max. 25 gpm at 14 feet TDH 1/3 HP, 115V, 1	1	2018
Valve Vault Flow Meter	Foxboro Model 9300A 4-inch magnetic flowmeter rated for 55 to 1100 gpm flow range, output to pump station control enclosure	1	2018
Pump Controller	MPE Inc. Model SC100 Station Controller	1	2018
SCADA/Telemetry	No SCADA system installed; Local alarm light and horn and a Sensaphone Moel 1400 telephone installed.	1	2018
Emergency Generator	Generac QT Series, 25kW, propane fired, with transfer switch	1	2018
Gravity Sewers	8-inch SDR 35 PVC, with manholes	240 LF	2018
Force Main	4-inch SDR21 PVC, IPS	300 LF	2018

Table 1-1: Basis of Design Summary

1.5 PROJECT DESCRIPTION

Shaker Landing is a residential condominium development located off of Route 4A and accessed by Landing Road. It is located directly on the south central shore of Mascoma Lake with a total lake frontage of about 700 feet. Shaker Landing consists of six three-unit condominium buildings that was served by an existing gravity sewer collection system and pump station. As part of this project, the Shaker Landing pump station was replaced with a system having upgraded capacity, emergency power backup, and updated monitoring and controls. A short extension of 8-inch diameter gravity sewer was connected at the former pump station location and routed to the new pump station wet well. A duplex pumping system transfers sewage from the development via a 4-inch force main to a connection point on the adjacent, existing municipal gravity sewer system. This existing gravity sewer system discharges into a Town-owned pump station located on N.H. Route 4A.

The system includes the following major components:

- Existing four-inch building connections, gravity collection sewer, and manholes providing collection of sanitary sewage flow from the six building locations;

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- A new eight-inch gravity collection sewer, and manholes transferring flow from the former pump station location to the new Shaker Landing Pump Station;
- A pump station located at the northeast corner of the Shaker Landing complex consisting of a control and electrical enclosure, an emergency generator and fuel tank, a duplex pump wet well structure, and a valve vault; and
- A four-inch force main that ties into the existing municipal gravity sewer collection system within the development.

Where it was feasible, the design utilized portions of existing gravity sewers within the Shaker Landing complex, tying these into the new sanitary sewer collection extensions to the new pump station and force main system. The existing on-site septic tanks, pump station, and force main were removed from service and abandoned in place after cleaning by filling with flowable fill.

The project is funded by the NHDES Clean Water State Revolving Loan Fund (CWSRF), USDA Rural Development loans and grants, and other funding agreements approved by the Town of Enfield. The NHDES CWSRF project identification number is CS-330167-04. The Town rebid this portion of the project in November 2017 and ultimately awarded the construction contract to Conkley Enterprises, Inc. Conkley Enterprises began construction in November 2017 with the project substantial completion in early 2018.

1.6 SITE LOCATION MAPS

The following figures are attached at the end of this chapter and portray the project on an overall USGS location plan and aerial photographs:

- Figure 1 USGS Location Map
- Figure 2 Shaker Landing Pump Station and Sewer Connection Plan

1.7 SERVICE AREA DESCRIPTIONS

The Shaker Landing pump station is intended to serve the existing 6 condominium buildings including a total of 18 units located within the Shaker Landing complex. Part of the existing and all of the new gravity collection system serving these buildings is shown on plan Sheet 11 in Appendix 2. The location of existing building service lines, existing and new sanitary manholes, and other structures is included on those plan sheets. The profile for the new gravity sewer is also shown on Sheet 11 included in Appendix 2. All current service connections are residential use.

At this time there are no other service areas connected into the gravity sewer collection system or force main. The existing site is fully developed and it is not anticipated that there will be any future increase in service connections. The force main plan and profile is shown on Sheet 11 in in Appendix 2.

1.8 DESIGN CRITERIA

The pump station was designed to provide transfer of sanitary sewage from the Shaker Landing complex. Currently this consists of 18 units in 6 buildings, with the current site

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fully built out. Table 1-2 summarizes the design flow rates from the Shaker Landing complex and the design of the pump station. Unit flows are taken from recommended flow rates contained in the NHDES Env-Wq 700 as modified by historic site water usage metering. The pump flow rate is set at approximately three times the anticipated peak flow rate to allow standard cycling of pump and to achieve minimum flow velocities in force main for scouring.

Total Units	Flow Rate Per Unit	Total Flow Rate	Comment
18	450 gpd each	8,100 gpd	Average Daily Flow – Design
-----	-----	5.6 gpm	Based on ADF Current, 24 hrs/day
-----	-----	34 gpm	Peak Flow Rate Current, 6.0 peaking factor
-----	-----	120 gpm	Pump Flow Design Rate, each pump

Table 1-2: Pump Station Design Flow

Table 1-3 summarizes the design of the pump station wet well and the operation of the duplex pump system. The station is designed to run with one pump on line at a time, and to alternate pumps every required pumping cycle to subject each unit to approximately the same wear rate. The maximum design operating level of the wet well is to the bottom of the inlet gravity sewer line. If the level continues to rise above this, sewage will back up into the collection system. This is not anticipated to occur since the pumping station is equipped with an emergency generator and an automatic transfer switch that will maintain operation of the station during power outages. The generator system uses propane fuel supplied from a 1,000 gallon aboveground propane tank. At peak power output a full tank will allow about eight days of operation, and at 50% power output a full tank will provide almost 14 days of operation.

Wet Well Elevation	Wet Well Volume	Operating Mode	Comment
748.33	Empty	Pump Station Off Line	
749.33	247 gallons +/-	All Pumps Off – Override Controls	Low Water Alarm
750.33	539 gallons +/-	Normal Lead Pump Shutoff	Pump Off Setpoint
751.33	876 gallons +/-	Lead Pump On	Lead Pump On Setpoint
752.33	1,235 gallons +/-	Lag Pump On	Lag Pump On Setpoint High Level Alarm
753.33	1,594 gallons +/-	Wet Well Max. Operating Level	To Inlet Invert Elevation
758.66	3,508 gallons +/-	Wet Well Full	To Bottom of Cover Overflow Immanent

Table 1-3: Wet Well Design

The design operating point of the installed sewage pumps is 120 gallons per minute at 29.0 feet Total Dynamic Head (TDH). There is about 337 gallons of volume between the lead pump start depth and the lead pump stop depth. At the rated flow rate this will facilitate pump down in about 3 to 5 minutes at peak inlet flow. Typically the flow will be less during off peak hours and pump down will take less time. During peak flow hours the pump is designed to operate about 50% of the time, between three and four cycles per peak hour. It is important to maintain frequent emptying of the tank to minimize the potential for odor buildup since there is no odor control system installed.

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The US EPA design guidelines for force mains recommends an operating velocity of six to nine feet per second. The NHDES Env-Wq 700 requires a minimum force main velocity of two feet per second to maintain scouring velocities, and a minimum diameter of four inches for the amount of units connected. Other design documents recommend a minimum flow velocity of three feet per second, with a maximum velocity of 10 fps. Above this velocity the friction loss in the piping contributes to significantly higher power costs to pump the sewage.

The force main from the pump station to the discharge manhole located along Landing Road is four-inch diameter, ductile iron pipe size (DIPS), SDR-21 wall thickness with an operating pressure rating of 200 psig. The force main has been sized for the current connected flow. This is summarized in Table 1-4.

Description	Total Units	Maximum Flow Rate	Calculated Velocity
Current Shaker Landing Complex – 6 Buildings	18	120 gpm	2.7 fps
EPA Recommended Velocity Range	-----	266 to 400 gpm	6.0 to 9.0 fps
Minimum Required Velocity for Scour	-----	89 to 133 gpm	2.0 to 3.0 fps
Maximum Design Velocity, Pressure Loss	-----	444 gpm	10.0 fps

Table 1-4: Force Main Design Velocities

1.9 CHAIN OF COMMAND STRUCTURE

The Shaker Landing pump station and force main is a municipally owned and operated system, managed and operated by the Town of Enfield Public Works Department. The normal chain of command and contact information is summarized below.

Owner: Town of Enfield, New Hampshire
Town Offices
23 Main Street, Enfield, New Hampshire 03748
Ryan Aylesworth, Town Manager
(603) 632-5026 ext. 5405

Manager: Town of Enfield, New Hampshire
Department of Public Works
74 Lockehaven Road, Enfield, New Hampshire 03748
Jim Taylor, Director of Public Works
(603) 632-4605

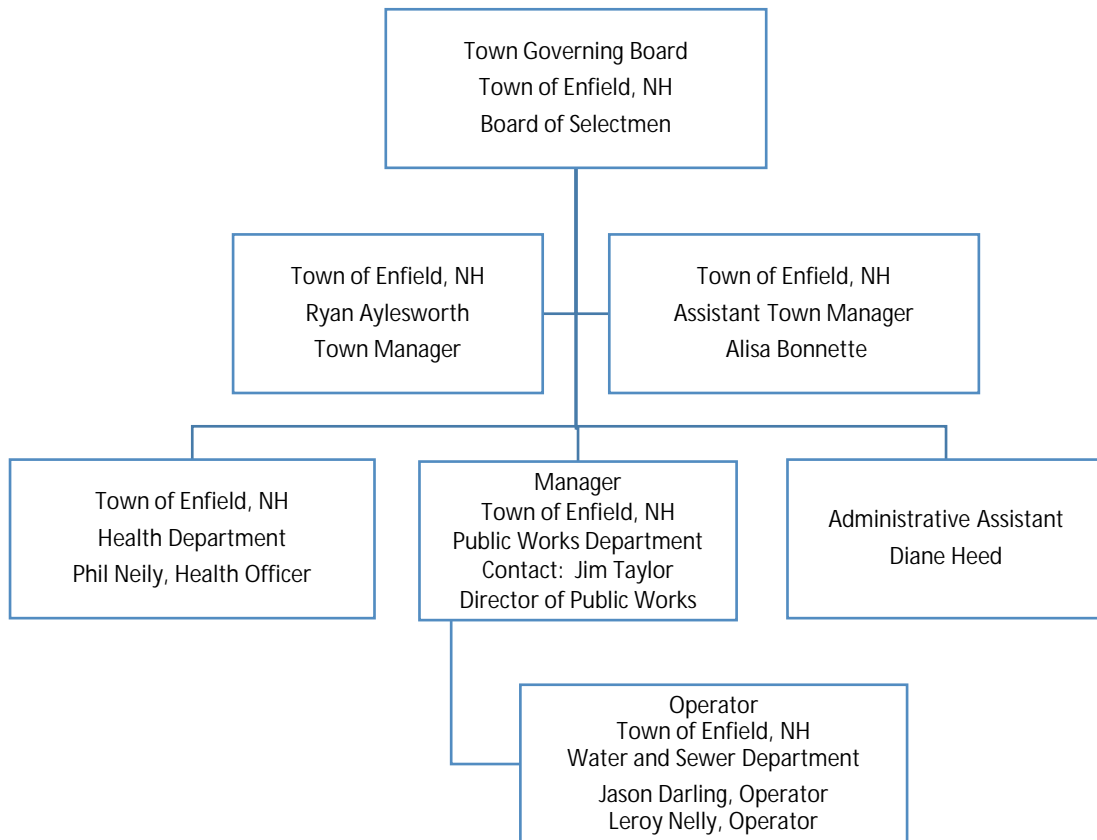
Operator: Town of Enfield, New Hampshire
Water and Sewer Department
74 Lockehaven Road, Enfield, New Hampshire 03748
Jason Darling, Certified Operator
Leroy Neily, Certified Operator
(603) 632-4002 Extension 5421

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Public Health: Town of Enfield, New Hampshire
Health Department
74 Lockehaven Road, Enfield, New Hampshire 03748
Philip Neily, Health Officer
(603) 632-4343

Refer to the attached organizational chart for a visual representation of the chain of command.



1.10 OWNER/MANAGER RESPONSIBILITIES

The Town of Enfield Board of Selectmen, operating through the Town Manager and the Director of Public Works is responsible for the following:

- Preparing and enforcing municipal ordinances related to sanitary sewage collection and disposal;
- Establishing an annual operating and maintenance budget that is adequate to properly operate the sanitary sewage systems;
- Developing a capital improvements and/or equipment replacement fund that provides for future equipment replacement, upgrade, or expansion;
- Establishing and collecting a connection fee and user rate fee to fund the annual budget requirements;

- Identifying staffing needs, preparing job descriptions, and hiring qualified and/or certified operators and maintenance workers;
- Providing operator and maintenance personnel training in equipment maintenance and operation, in personal safety, in compliance with NHDES regulations, in record keeping, and in safe work practices;
- Providing opportunities for regulatory or outside organizational training to facilitate required personal development hours for continued operator certification;
- Developing safe work practices and standard operating procedures to guide personnel in specific work tasks or methods;
- Maintaining the facilities and related equipment to provide a good and safe operating environment in compliance with Federal and State requirements;
- Providing personnel review and feedback and implementing a professional development and comprehensive salary administration and benefits program;
- Providing the required equipment, tools, administrative support, and other resources required to maintain efficient and effective operation and maintenance of the equipment systems;
- Facilitating communication between the Town and the community at large regarding system operation, ordinances, annual or monthly reporting, planned improvements, and budget and user fees;
- Functioning as the liaison between Federal and State regulatory agencies for compliance monitoring, permitting, and required reporting;
- Maintaining system operating and maintenance records in a readily accessible and up-to-date format as required by NHDES regulation or good business practice;
- Responding to changing environmental regulations, community utility needs, or availability of new or improving technology by implement appropriate managerial or supervisory methods; and
- Reviewing this O&M manual and the referenced procedures on at least an annual basis for completeness, and commissioning the revision or amendment of its content as required.

1.11 OPERATOR RESPONSIBILITIES

The Town maintains certified operators, maintenance personnel, and other administrative or support personnel to allow for the continued operation and maintenance of the sewage systems in compliance with applicable NHDES regulations and in response to the needs of the Town of Enfield connected users. Its operating and maintenance staff are responsible for the following:

- Following established and proper operational and maintenance means and methods for various required work tasks;
- Seeking training or instruction in new work procedures, safety, or equipment operation to stay current with the requirements of the job and any required certifications;
- Observing all safety protocols to maintain personal safety while on the job and to avoid impacts to public health or the environment;
- Collecting and transmitting required operating data in an accurate and timely fashion for compliance monitoring or reporting;

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- Contributing to financial accountability within the Water and Sewer Department by managing project work and expenditures within budget, providing copies of all subcontracted work or supplies invoices for payment, and following other established Town accounting protocol;
- Providing operation and maintenance during normal operational periods, providing response to emergency conditions to address issues as quickly as possible and avoid public health or environmental impact, and completing communication with Town supervisory personnel as situations require it;
- Completing system preventative maintenance, routine inspections, and monitoring of equipment condition and readiness;
- Coordinating the ordering with Town supervisory personnel of expendable supplies, spare parts, safety equipment, treatment chemicals, or generator fuel on an ongoing basis;
- Maintaining good housekeeping practices to keep all facilities and equipment in a clean, safe, and properly functioning condition; and
- Providing other operational or maintenance functions that may be required by the Town supervisory personnel.

1.12 ENGINEER AND CONSTRUCTION CONTRACTOR RESPONSIBILITIES

The design, permitting, and construction administration engineer for this project is:

Pathways Consulting, LLC
240 Mechanic Street, Suite 100
Lebanon, New Hampshire 03766
(603) 448-2200
Rodrick Finley, P.E., Director of Engineering Services
Jeffrey Durrell, Construction Engineer

The contractor for this project is:

Conkley Enterprises, LLC
146 Goose Pond Road
Canaan, New Hampshire 03741
(603) 632-5005
Art Conkley, President

Typical practice for the Construction Contractor and the Engineer is to provide a complete, operational system in substantial conformance to the system specifications and design and in compliance with applicable State regulations. Specific requirements contained within the Construction Contract Documents for Engineer and Construction Contractor are as follows:

The Engineer is responsible for:

- Observation of construction activities and providing construction contract administration assistance to the Town;

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- Assisting the Town in the initial permitting to allow NHDES approval of the design, funding agency signoff, and NHDES and NHDOT approval to construct;
- Completing a Substantial Completion review of the project, issuing a final punch list of items to be addressed by the contractor or Owner, and providing field assistance during equipment testing, startup and initial operation;
- Providing the Owner record drawings prepared from field notes, Contractor redlines, and submittal information;
- Assisting the Owner in any required documentation to the NHDES or the funding agencies involved in the project; and
- Preparing an O&M Manual for use by the project Owner, Manager, and Operator.

The Construction Contractor is responsible for:

- Providing a complete, operable system that is in substantial conformance to the approved Contract Documents;
- Providing final site restoration after construction work is complete;
- Providing a manufacturer's representative to provide one day of field testing, initial startup, and initial training of the Town operators for installed equipment, systems, and controls;
- Providing copies of all equipment and material submittals to the Engineer for transmittal to the Owner with the contract administration files;
- Providing manufacturer's operation and maintenance manuals, equipment cutsheets, and other factory information to assist in the preparation of the final O&M manual and to provide the Owner with required equipment specifications, manufacturer contacts, and design data;
- Providing Engineer with a set of redline construction drawings and specifications documenting record information related to installation, location, or any documented changes to the approved contract documents; and
- Guaranteeing the project construction against faulty materials or workmanship, or other supplied equipment defects for the period of one year from the date of Substantial Completion.