

APPENDIX 11J**Recommended Table of Contents for O&M Manuals**

The following is a recommended starting table of contents for O&M Manuals for Pumping Stations. Design teams may add or remove sections as needed. The draft O&M manual must be reviewed by SPU Operations during the 90% and Final design circulations.

FACILITY NAME
Project name

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Important: The content of this outline document is not a substitute for specific requirements in the Design Standards and Guidelines, contract documents or other required submittals. It is provided to assist you in developing an Operations and Maintenance manual for review.

Include illustrations, diagrams, and photographs throughout the document wherever possible.

The completed document must be saved in indexed, searchable PDF format and retained by SPU Operations and Maintenance. Manuals for wastewater facilities must also be uploaded to the DWW Facility SharePoint Page.

Preface

General Safety Precautions

This manual identifies known major hazards and associated safety procedures but does not necessarily address every hazard that may be encountered in the course of working at this site. Operators and staff must follow all required and applicable safety procedures, SPU standard procedures, and exercise good judgement.

See [WAC 296-67-021\(1\)c](#). Safety and health considerations.

Provide a list of typical safety precautions for operations and maintenance of equipment (examples follow):

- 1. Locate and lock out all power and water flow when servicing the equipment.
Failure to do so could result in injury or death.*
- 2. Only qualified electrical and mechanical personnel should service this equipment.*
- 3. In an emergency situation, the system may be shut down by pressing the EMERGENCY STOP button.*
- 4. This equipment may start or stop automatically at any time. Disconnect power before servicing any component.*
- 5. Always wear the proper safety equipment when working near energized or moving equipment. Safety equipment includes wearing safety glasses and proper footwear.*
- 6. Replace all guards after servicing or inspecting equipment.*
- 7. etc...*

Personal Safety

Describe known or potential hazards, required specialized safety equipment, PPE, atmospheric monitors, etc.

Lockout/Tagout

Describe potential hazardous energy elements; electrical, mechanical, hydraulic, pneumatic, chemical, thermal, etc. List major equipment that may potentially require a lockout/tagout for service. See OSHA standard for *The Control of Hazardous Energy (Lockout/Tagout)* ([29 CFR 1910.147](#)) for general industry.

Chemical Hazards

List chemicals stored on site, especially those used in the facility process (for example, sodium hypochlorite, etc)

I.0 System/Equipment Overview

Provide a brief narrative of project, purpose, and system/equipment installed or modified as part of the project.

I.1 Systems Overview

A brief functional and physical outline of the facility and its operating context in the system (water or wastewater). Projects that only make modifications to existing facilities must describe the operating context of the complete facility in addition to the project specific modifications.

I.2 Design/Construction Specifications Overview

Brief narrative of key specifications and considerations for design and construction.

*Include significant design criteria in **Appendix A**.* At a minimum, the Basis of Design Plan Sheet must be included in Appendix A.

I.3 Performance Data Overview

Brief narrative describing key performance thresholds and measured data at commissioning for the facility such as: firm and peak pumping rates, odor control treatment rates, ventilation rates, and any other performance based project criteria.

*Include Design/Construction Specifications in **Appendix B**:*

Performance Data and Curves: manufacturer's certified performance data and curves when specified in the Contract; otherwise, manufacturer's catalog performance data and curves.

2.0 Operations

See [WAC 296-67-021 Operating Procedures](#) for recommended content for this section. Include any procedures specific to this facility that may deviate from SPU standard practices or job plans.

✓	
	Initial Startup
	Normal Operations
	Temporary Operations
	Emergency Shutdown
	Emergency Operations
	Normal Shutdown
	Startup following a turnaround
	Consequences of deviation
	Steps to avoid deviation
	Safety & Health Considerations
	Engineering controls
	Administrative controls
	Safety systems
	Operating Procedures

2.1 Operations/Controls Overview

Description of the system and its purpose, how it operates, and any interfaces it may have with other facilities, jurisdictions, or control structures, etc.

A table can provide overall system design criteria, i.e., flow, pressure, temperature, capacity, power requirements, etc.

2.2 Key Contacts

List key contacts for the facility. Where operation of or access to a facility or facility component requires coordination with another agency or property owner, include that contact information (including after-hours information) here. At a minimum, key contacts within SPU (crew chiefs, OCC, etc) must be included here.

2.3 Operating Procedures

Manufacturer's recommended step-by-step procedures for starting, operating, and stopping major process equipment under the normal, emergency, and stand-by modes of operation. Including emergency over-ride, seasonal changeover, etc. At a minimum, the pumping and ventilation systems must be described in this section.

Operating instructions include control narrative overview, equipment configurations for each mode of operation, e.g., valve positions, control settings, intended operating strategies, and break-in procedures.

Include equipment tag numbers, locations, and descriptions throughout so that P&ID drawings and construction drawings may be easily cross-referenced.

2.3.1 Settings

Include operational limits and control set points, etc. where applicable. For example, alarm set points and shutdowns.

2.3.2 Operations Checklist

Include settings, set points, operational ranges, parameters and acceptable values, etc. where applicable. Include sample operating log where applicable.

2.4 Problems and troubleshooting

Include the specified Control Loop descriptions with any modifications required during commissioning. Typical malfunctions, tests, or inspections, and corrective actions or recommendations to correct malfunctions must be included.

For example, system-level troubleshooting tables to guide personnel, via fault tree analysis, in a sequential, step-by-step isolation of a system problem to identify faulty equipment. At a minimum, this section must discuss typical pumping system failures such as: low/no flow, motor starter or drive faults, motor overloads,

Include alarms, panel indicators, etc. where applicable.

Danger / Caution

Call out possible hazards that may cause injury/death (Danger) or damage to equipment (Caution).

Include precautions necessary to prevent exposure, including engineering controls, administrative controls, and personal protective equipment. See [WAC 296-67-021\(1\)c](#).
Safety and health considerations.

3.0 Maintenance

3.1 Maintenance Overview

Overview of major system components (Mechanical and Electrical). Brief narrative of preventive and corrective maintenance and recommended intervals. Include power distribution equipment and backup/emergency electrical systems (uninterruptible power supply, generator) where applicable.

3.2 Maintenance Procedures

Maintenance tasks for equipment that comprises the system. Include diagrams for accessing and removing equipment such as pumps, as required by Section 11.10.1.2 of the Design Standards and Guidelines.

3.2.2 Preventive Maintenance

Manufacturer's recommended steps and schedules for maintaining the equipment.

This should include a recommended schedule that lists the items, how to conduct the PM activities, frequency and other pertinent information.

This schedule must be in one consolidated table and references to other portions of the O&M are to be made if expanded instructions are required for the PM activity.

Maintenance charts include maintenance frequency checklists, maintenance summary, lamp replacement data sheet, equipment data sheets, recommended maintenance and service contacts, etc. Include scheduled intervals (e.g., daily, weekly, monthly, etc.)

Include tolerances or limits established for in-service operations.

3.2.3 Lubrication Information

Manufacturer's recommendations regarding the types of lubricants to be used and lubrication schedule to be followed. (May refer to Mechanical Bill of Materials where applicable)

3.3 Problems and troubleshooting

System-level troubleshooting tables guide maintenance personnel, via fault tree analysis, in a sequential, step-by-step isolation of a system problem to identify faulty equipment. Typical malfunctions, tests, or inspections, and corrective actions or recommendations to correct malfunctions are included.

Include alarms, panel indicators, etc. where applicable.

3.4 Corrective Maintenance

As applicable. Include Lockout/tagout, etc.

Include figures, illustrations and photographs with identifying callouts where applicable.

Danger / Caution

Call out possible hazards that may cause injury/death (Danger) or damage to equipment (Caution).

Include precautions necessary to prevent exposure, including engineering controls, administrative controls, and personal protective equipment. See [WAC 296-67-021\(1\)c](#).
Safety and health considerations.

3.5 Overhaul Procedures

This section may reference the applicable pages of Appendix E for each major piece of process equipment rather than re-stating that information here.

3.5.1 Overhaul instructions

Manufacturer's directions for the disassembly, repair, and reassembly of the equipment, parts and any safety precautions that must be observed while performing the work.

3.5.2 Overhaul parts and materials

Overhaul parts list: manufacturer's recommendations of manufacturer's part numbers and quantity of parts which should be stored and special storage precautions which may be required for a complete overhaul, as well as the generic title, description and manufacturer's part number of each component part of the equipment.

3.5.3 Exploded view or plan and section views

Detailed plan and section views of equipment must be provided when exploded views are not available. All views must have detailed part callouts matching those callouts of the manufacturer's overhaul parts list. Exploded or cut views of equipment must be provided, if available, as a standard item of the manufacturer's information.

3.6 References

Equipment manuals, cut sheets, etc., Manufacturers' literature that provides procedures to operate, maintain, troubleshoot, and repair specific items at the equipment level.

4.0 Mechanical

4.1 Mechanical drawings

For example:

- Area floor plans with system/ equipment tags and physical (room) locations identified.
- Electrical schematics, piping diagrams, and air flow schematics. Provide tag numbers and equipment interconnections
- Valve schedules indicating valve number, location, type, normal position, and description
- CAD drawings, BIM/3D models, illustrations, graphics

4.2 Parts list

4.2.1 Parts list

Recommended spare parts lists for major equipment (pumps, motors, drives, etc). This information may be contained in Appendix E and referenced here.

4.2.2 Manufacturer Reference

All brochures and manuals included be appropriately labeled with the applicable equipment asset name and equipment asset number as it appears in the Contract Documents, and also indicate the Specification Section. Include the names and addresses of the manufacturer, the nearest representative of the manufacturer, and the nearest supplier(s) of the manufacturer's equipment and parts.

This information may be contained in Appendix E and referenced here.

5.0 Electrical

Narrative overview of control strategy, alarm priorities, Wonderware tags for historical trending.

5.1 Electrical Drawings

Circuit diagrams. Include control diagrams for internal and connection wiring and (as applicable) the associated native control program.

For example:

- Control and loop diagrams
- Electrical schematics. Provide asset numbers and equipment interconnections
- CAD drawings, BIM/3D models, illustrations, graphics

5.2 Reference materials

Equipment manuals, cut sheets, etc., Manufacturers' literature that provides procedures to operate, maintain, troubleshoot, and repair specific items at the equipment level. Include the names and addresses of the manufacturer, the nearest representative of the manufacturer, and the nearest supplier(s) of the manufacturer's equipment and parts.

This information may be contained in Appendix E and referenced here.

6.0 Site Features

Description of key site features, especially those that require maintenance or inspection such as drainage systems, retaining walls, fencing, etc. Include load ratings for hatches, covers, or suspended platforms in drivable areas or which may have equipment staged on them. Include parking and crane reach diagrams for crew vehicles as needed.

7.0 Emergency Operation Procedures

Where applicable. This includes operating the station in bypass mode(s) for force main or pump failure and operating with loss of Utility power via a permanent or portable generator.

8.0 Disaster Recovery Procedures

Where applicable. This includes required inspections and procedures for cold starting the facility following a major disaster such as an earthquake, fire, or flood.

Appendix A Significant Design Criteria

Significant design criteria including pertinent calculations used in designing, selecting, or verifying the suitability of the installed equipment.

Appendix B Performance Data and Curves

Performance data and curves: manufacturer's certified performance data and curves when specified in the Contract; otherwise, manufacturer's catalog performance data and curves.

Appendix C Asset Index

Include a copy of the completed Asset Onboarding Worksheet in this Section

Appendix D Reliability Centered Maintenance Analysis

Include the results of the Reliability Centered Maintenance (RCM) analysis for the site, included recommended staffing levels, maintenance intervals, and job plans.

Appendix E Manufacturer's Equipment O&M Information

Include Manufacturer's equipment O&M information submitted as part of the construction contract, including vendor contacts for sales and emergency repair services.

Appendix F Safety Data Sheets

Include safety data sheets (SDS) for any chemicals stored on site.