

## PREVENTATIVE MAINTENANCE

### GENERAL OVERVIEW

The Brewer Water Pollution Control Facility represents a complex system of equipment, piping, valves, instrumentation and electrical systems with many moving mechanical parts. Periodically, components of this equipment will fail and require repair or replacement. The rate and frequency of such failures can be minimized by establishing a preventative maintenance program at the facility. Data from well-maintained treatment plants shows that the costs and efforts of such a program will pay dividends to the City in the long run by extending the useful life of the treatment plant. An inadequate maintenance program can cause major process failures that can result in effluent quality deterioration and discharge license violations. The City and the plant operators can be held liable for water quality violations that could have been prevented had the treatment system been properly maintained.

### MANUFACTURER'S RECOMMENDATIONS

Each unit process in the plant has equipment that has an Operations and Maintenance manual provided by the equipment's manufacturer. The plant operators should become familiar with these manuals and refer to them often in developing a preventative maintenance program or in repairing equipment as it fails. Guidelines presented in this manual are general in nature and are not intended to supercede the recommendations of the manufacturers of the equipment. The plant operators are encouraged to review each manual and to maintain all manuals on file at the plant.

### ELEMENTS OF PREVENTATIVE MAINTENANCE

An effective preventative maintenance program should consist of the following elements:

- Operation and Maintenance manuals for each piece of equipment.
- Equipment cards for each piece of equipment that contains detailed technical information about the equipment. An example of a typical equipment card is shown in Appendix J.
- Preventative maintenance cards that list the required scope and frequency of routine lubrication and maintenance requirements

needed for each equipment component. A sample of a typical card is shown in Appendix J.

- An annual maintenance schedule for the plant that is broken down week-by-week to show required preventative maintenance tasks to be performed. This schedule is essentially a combination of the individual preventative maintenance cards. It tells the operators what tasks must be performed each week of the month.
- Repair cards that list the date, scope, and details of all work done on plant systems. An example of a repair card is shown in Appendix F.
- A well organized filing system where all equipment cards, preventative maintenance cards, repair cards, and operations manuals are kept updated for future reference. The system should be so well organized that any wastewater treatment professional that has no knowledge of the facility could quickly review the files and immediately be brought up to-date on the mechanical status and needs of the plant.
- Frequent daily inspections and observations of all plant processes and equipment during both the morning and afternoon walkaround period to allow the operators to be aware of the equipment's status at all times. The frequent review of the equipment also allows the operators to identify potential equipment problems long before they become major problems that result in equipment failures.
- Sufficient tools at the plant to make routine repairs of all equipment.
- An adequate inventory of spare parts.
- Keep all warranty information provided for all equipment organized and readily available for when servicing is required.

### TYPICAL PREVENTATIVE MAINTENANCE TASKS

On the following pages of this manual, typical preventative maintenance tasks are listed for each piece of equipment as summarized in Table 19. These lists are intended to be used as initial guidelines by the operators and are not

intended to supercede or replace the specific Operations and Maintenance manuals for each piece of equipment as provided by their manufacturer. This data represents a starting point for the development of a preventative maintenance card system.

TABLE 19:

TYPICAL MAINTENANCE REQUIREMENTS

| <u>PROCESS EQUIPMENT</u>         | <u>FREQUENCY</u> | <u>TASK</u>  |
|----------------------------------|------------------|--|
| <u>Smith and Loveless</u>        | As needed        | Adjust pressure switches                                   |
| <u>Pump Stations</u>             | As needed        | Clean check valves   |
|                                  | As needed        | Have wet well grease removed                               |
|                                  | Monthly          | Remove and clean electrodes                                |
|                                  | Monthly          | Remove and clean water bowls                               |
|                                  | Monthly          | Exercise all alarms  |
|                                  | Monthly          | Exercise discharge plug valve                              |
|                                  | Quarterly        | Oil ventilation motor bearing                              |
|                                  | Semi-annually    | Close louvers in winter                                    |
|                                  | Semi-annually    | Open louvers in summer                                     |
|                                  | Semi-annually    | Check vacuum system for leaks                              |
|                                  | Annually         | Lubricate pump bearings                                    |
|                                  | Annually         | Replace mechanical seals                                   |
|                                  | Annually         | Check float assembly                                       |
| <u>Rt. 15 Gorman-Rupp</u>        | As needed        | Clean transducer and stilling tube                         |
| <u>Pump Station</u>              | As needed        | Clean check valves   |
|                                  | As needed        | Have wet well grease removed                               |
|                                  | Weekly           | Inspect pump bearings                                      |
|                                  | Monthly          | Clean and adjust V-belts                                   |
|                                  | Monthly          | Exercise all alarms  |
|                                  | Monthly          | Exercise discharge plug valve                              |
|                                  | Quarterly        | Lubricate air release valve                                |
|                                  | Semi-annually    | Clean air release valve plunger rod                        |
|                                  | Semi-annually    | Inspect front and rear impeller clearance                  |
|                                  | Annually         | Inspect pump and driver alignment                          |
|                                  | Annually         | Inspect shaft deflection                                   |
|                                  | Annually         | Inspect and lubricate bearings                             |
|                                  | Annually         | Inspect bearing housing                                    |
|                                  | Annually         | Inspect piping   |
|                                  | Annually         | Inspect and lubricate seals                                |
| <u>Hardy Street Paco Pump</u>    | As needed        | Have wet well grease removed                               |
| <u>Station</u>                   | As needed        | Clean check valves   |
|                                  | Monthly          | Exercise discharge plug valve                              |
|                                  | Monthly          | Exercise all alarms  |
|                                  | Monthly          | Exercise sump pump   |
|                                  | Quarterly        | Lubricate pump and motor bearings                          |
|                                  | Semi-annually    | Inspect and clean pump                                     |
| <u>Whitewater Influent Pumps</u> | Monthly          | Clean grease fittings and wipe down work                   |
| <u>#1, #2, #3</u>                | Monthly          | Check amp readings (start up and run) and record results   |
| <u>(Paco)</u>                    | Monthly          | Check temperature readings – 15 min. and 30 min. run time. |

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|--|---------------|--|
|  | Monthly       | Record results   |
|  | Monthly       | Check all electrical connections   |
|  | Quarterly     | Check all switches for operation   |
|  | Annually      | Lubricate pump and motor bearings and bearing frame                        |
|  |               | Clean and inspect the pump   |
| <u>Grit Blowers #1, #2, #3</u><br>(Sutorbuilt) | As needed     | Replace filters  |
|  | Monthly       | Clean grease fitting and wipe down work                                    |
|  | Monthly       | Check amp readings (start up and run), record results                      |
|  | Monthly       | Check temperature readings - 15 min. and 30 min. run.                      |
|  |               | Record results   |
|  | Monthly       | Check all electrical connections   |
|  | Monthly       | Check all switches for operation   |
|  | Monthly       | Inspect blower for working fan, overheating, noise, working keypad lights. |
|  | Monthly       | Lubricate drive bearings and drive end                                     |
|  | Quarterly     | Change gear box oil  |
| <u>Grit Screw Conveyor</u><br>(Schloss)        | As needed     | Hose off discharge chute   |
|  | Daily         | Visual inspection  |
|  | Weekly        | Lubricate screw conveyor wall bearing                                      |
|  | Weekly        | Lubricate hanger bearings  |
|  | Monthly       | Check oil level and breather in reducer                                    |
|  | Monthly       | Clean grease fittings and wipe down work                                   |
|  | Monthly       | Check amp readings (start up and run) and record results                   |
|  | Monthly       | Check temperature readings – 15 min. and 30 min. run time.                 |
|  |               | Record results   |
|  | Monthly       | Check all electrical connections   |
|  | Monthly       | Check all switches for operation   |
|  | Monthly       | Inspect internal and external bearings                                     |
|  | Monthly       | Inspect flight edge thickness  |
|  | Monthly       | Inspect coupling bolts, nuts, and hole                                     |
|  | Monthly       | Inspect seals, bearing , flange and cover bolts                            |
|  | Monthly       | Inspect gasketed joints  |
|  | Monthly       | Lubricate roller bearings  |
|  | Monthly       | Check v-belt / chain tension   |
|  | Monthly       | Check for loose bolts and fasteners  |
|  | Semi-annually | Lubricate reducer seals  |
|  | Semi-annually | Check for wear on screw conveyor flights                                   |
|  | Annually      | Lubricate motor bearings   |
|  | Every 5 years | Overhaul reducers  |
| <u>Grit Pumps #1, #2</u><br>(Wemco)            | Weekly        | Check oil lubricated ball bearings – fill as needed.                       |
|  | Monthly       | Clean grease fittings and wipe down work                                   |
|  | Monthly       | Check amp readings (start up and run) and record results                   |
|  | Monthly       | Check temperature readings – 15 min. and 30 min. run time.                 |
|  |               | Record results   |
|  | Monthly       | Check all electrical connections   |
|  | Monthly       | Check all switches for operation   |
|  | Quarterly     | Grease bearings  |
|  | Annually      | Inspect and clean pumps  |
| <u>Grit classifier #1, #2</u><br>(Wemco)       | As needed     | Replace liners   |
|  | Monthly       | Inspect wearing shoes  |
|  | Annually      | Inspect lower bearing  |

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| <u>Grit screw conveyor</u> | Monthly  | Clean grease fittings and wipe down work                                     |
|                            | Monthly  | Check amp readings (start up and run) and record results                     |
|                            | Monthly  | Check temperature readings – 15 min. and 30 min. run time.<br>Record results |
|                            | Monthly  | Check all electrical connections   |
|                            | Monthly  | Check all switches for operation   |
|                            | Quarterly                                      | Lubricate motor  |
|                            | Quarterly                                      | Clean motor  |
|                            | Quarterly                                      | Apply bolt dressing  |
|                            | Quarterly                                      | Lubricate all bearings   |
|                            | <u>Influent Parshall Flumes and Flowmeters</u> | Monthly  |
|                            | Annually                                       | Have checked and calibrated  |

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| <u>Primary Clarifier #1, #2,#3</u><br>(Envirex) | Weekly  | Check oil level   |
|   | Monthly   | Clean motors  |
|   | Monthly   | Check inside of control panel and switch gear for moisture – change desiccants as needed                                |
|   | Monthly   | Check temperature readings – 15 min and 30 min run, record results  |
|   | Monthly   | Check motor amps (start up and run), record results   |
|   | Monthly   | Wipe up all oil and grease on motors and reducers   |
|   | Monthly   | Clean control panels and switch gear with industrial spray cleaner  |
|   | Monthly   | Inspect panels for rust – wire brush and paint as needed  |
|   | Monthly   | Lubricate all fittings  |
|   | Monthly   | Clean grease fittings and wipe down work  |
|   | Monthly   | Check all electrical connections  |
|   | Monthly   | Check all switches for operation  |
|   | Monthly   | Grease pivoting skimmer fittings  |
|   | Monthly   | Clean worm gear section of main drive air vent.   |
|   | Monthly   | Check worm gear bearings.   |
|   | Monthly   | Lubricate worm gear bearings  |
|   | Monthly   | Check worm gear oil for condensation. Flush as needed.  |
|   | Monthly   | Check gap setting on torque overload switch.  |
|   | Monthly   | Check condensate drain line on main drive final turntable.  |
|   | Monthly   | Check condition of oil on final turntable of main drive.  |
|   | Monthly   | Grease bore in driven shear pin sprocket.   |
|   | Monthly   | Check driven shear pin sprocket – check retaining washer, check for loose setscrews or loose key, check teeth for wear. |
|   | Monthly   | Inspect bridge, tighten any loose fittings. Note condition of walkways and handrails                                    |
|   | Monthly   | Check oil levels in motor primary reducer.  |
|   | Monthly   | Check coupling alignment, and mounting bolt torque in motor primary reducer.  |
|   | Monthly   | Clean grease fittings and wipe down work.   |
|   | Semi-annually   | Clean and inspect skimmer-tighten loose connections, adjust for proper submergence, replace lost or worn parts.         |
|   | Semi-annually   | Remove driven shear pin, rotate to expose shear faces.  |
| Semi-annually                                   | Check motor primary reducer coupling teeth for wear.  |   |
| Semi-annually                                   | Inspect scum baffle, weirs, scum beach. Clean off slime and sludge. Tighten any loose bolted connections. |   |
| Semi-annually                                   | Check corner sweeps for proper clearance.   |   |
| Semi-annually                                   | Check shear pin limit switch.   |   |
| Semi-annually                                   | Check sweep arm pivots for looseness, rebush if needed.   |   |
| Semi-annually                                   | Replace bent or broken scraper blades as needed. Test upon restart.                                       |   |
| Semi-annually                                   | Hose off equipment  |   |
| Semi-annually                                   | Grease all fittings   |   |

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|  | Semi-annually | Bring oil to proper levels.  |
|  | Semi-annually | Change drive oil   |
| <u>Selector Tank Mixer #1, #2</u><br>(Aqua-Aerobics) | Monthly       | Clean out the motor  |
|  | Monthly       | Grease all bearings  |
|  | Monthly       | Apply bolt dressings to the two drive bolts  |
|  | Monthly       | Clean grease fittings and wipe down work   |
|  | Monthly       | Check amp readings (start up and run), record results  |
|  | Monthly       | Check temperature readings, 15 min. and 30 min. run, record results                          |
|  | Monthly       | Check all electrical connections   |
|  | Monthly       | Check all switches for operation   |
|  | Monthly       | Inspect guide cable anchors  |
|  | Monthly       | Check gear oil level   |
|  | Semi-annually | Lubricate motor bearings   |
|  | Annually      | Change gear drive oil  |
|  | Annually      | Remove rags from shaft   |
| <u>Aerators</u><br>(Eimco)                           | As needed     | Change oil   |
|  | As needed     | Remove debris  |
|  | As needed     | Grease seals   |
|  | Monthly       | Clean grease fittings and wipe down work   |
|  | Monthly       | Check amp readings for start up and run  |
|  | Monthly       | Check all electrical connections   |
|  | Monthly       | Check all switches for operation   |
|  | Monthly       | Clean dust and dirt off VFD's  |
|  | Monthly       | Inspect VFD's for proper operations: working fan, overheating, noise, working keypad lights. |
|  | Monthly       | Check VFD's electrical connections   |
|  | Monthly       | Check VFD's switches for operation   |
|  | Monthly       | Clean dust, dirt, sludge off motors  |
|  | Monthly       | Check inside of control panels and switchgear for moisture – change desiccants as needed.    |
|  | Monthly       | Check motor running temperature and record results   |
|  | Monthly       | Check motor amps (start up and run) and record results                                       |
|  | Monthly       | Wipe up all oil and grease on motors and reducers.   |
|  | Monthly       | Clean control panels and switchgear with industrial spray cleaner.                           |
|  | Monthly       | Lubricate motor bearings   |
|  | Monthly       | Inspect and lubricate flexible coupling  |
|  | Monthly       | Lubricate lower gear unit bearing  |
|  | Monthly       | Check oil levels   |
|  | Monthly       | Inspect panels for rust – wire brush and paint as needed.                                    |
|  | Monthly       | Check for loose bolts and nuts on motor/reducer assembly                                     |
|  | Monthly       | Check motor/reducer alignment  |
|  | Semi-annually | Drain and clean aeration basin   |
|  | Semi-annually | Check aerator mounting platform for alignment  |
|  | Annually      | Change oil in motor and gearbox  |
|  | Annually      | Remove rags from shaft   |
| <u>Final Clarifiers</u><br>(Envirex)                 | Weekly        | Check oil level  |
|  | Monthly       | Clean motors   |
|  | Monthly       | Check inside of control panels and switch gear for moisture, change desiccants as needed     |
|  | Monthly       | Check amp readings (start-up and run), record results  |
|  | Monthly       | Check temperature readings – 15 min and 30 min run, record                                   |

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|  | Monthly       | results.  |
|  | Monthly       | Wipe up all oil and grease on motors and reducers   |
|  |               | Clean control panels and switch gear with industrial spray cleaner  |
|  | Monthly       | Inspect panels for rust – wire brush and paint when needed.   |
|  | Monthly       | Lubricate all fittings  |
|  | Monthly       | Clean grease fittings and wipe down work.   |
|  | Monthly       | Check all electrical connections  |
|  | Monthly       | Check all switches for operation  |
|  | Monthly       | Clean worm gear section of main drive air vent  |
|  | Monthly       | Check worm gear bearings  |
|  | Monthly       | Lubricate worm gear bearings  |
|  | Monthly       | Check worm gear oil for condensation, flush as needed   |
|  | Monthly       | Check gap setting on torque overload switch.  |
|  | Monthly       | Check condensate drain line on main drive final turntable.  |
|  | Monthly       | Check condition of oil on final turntable of main drive.  |
|  | Monthly       | Grease bore in driven shear pin sprocket.   |
|  | Monthly       | Check driven shear pin sprocket teeth for wear.   |
|  | Monthly       | Inspect driven shear pin sprocket – check retaining washer, check for loose setscrews or loose key, check teeth for wear. |
|  | Monthly       | Inspect bridge, tighten any loose fittings. Note condition of walkways and handrails.                                     |
|  | Monthly       | Check oil levels in motor primary reducer.  |
|  | Monthly       | Check chain alignment and mounting bolt torque in motor primary reducer.  |
|  | Monthly       | Check all fittings of pivoted type surface skimmer.   |
|  | Semi-annually | Clean and inspect surface skimmer – tighten loose connections, adjust for proper submergence, replace parts as needed.    |
|  | Semi-annually | Remove drive shear pin, rotate to expose shear faces.   |
|  | Semi-annually | Check motor primary coupling teeth for wear.  |
|  | Semi-annually | Inspect scum baffle, weirs, and scum beach. Clean off slime and sludge. Tighten any loose bolted connections.             |
|  | Semi-annually | Check shear pin limit switch.   |
|  | Semi-annually | Inspect corner sweep for proper clearance. Tighten any loose bolted connections.  |
|  | Semi-annually | Check sweep arm pivots for looseness, rebush if necessary.  |
|  | Semi-annually | Replace bent or broken scraper blades as needed. Test upon restart.   |
|  | Semi-annually | Hose off equipment.   |
|  | Semi-annually | Grease all fittings.  |
|  | Semi-annually | Bring oil to proper levels  |
|  | Semi-annually | Change drive oil  |
| <u>Hypochlorite Feed #1, #2, #3</u>            | As needed     | Clean piping and valves   |
| <u>RAS Hypochlorite Feed #1, #2</u>            | As needed     | Clean piping and valves   |
| <u>Effluent Parshall Flumes and Flowmeters</u> | Monthly       | Check water level versus meter reading  |
|  | Annually      | Have checked and calibrated   |
| <u>Scum Pump (Wemco)</u>                       | Monthly       | Clean grease fittings and wipe down work  |
|  | Monthly       | Check amp readings (start up and run) and record results  |



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|   | Monthly  | Check temperature readings – 15 min. and 30 min. run time.<br>Record results  |
|   | Monthly  | Check all electrical connections  |
|   | Monthly  | Check all switches for operation  |
|   | Monthly  | Clean motors  |
|   | Monthly  | Check inside of control panels and switchgear for moisture –<br>change desiccants as needed.  |
|   | Monthly  | Wipe up all oil and grease on motors and reducers   |
|   | Monthly  | Clean control panels and switchgear with industrial spray<br>cleaner.   |
|   | Monthly  | Inspect panels for rust – wire brush and paint as needed.   |
|   | Monthly  | Check operation of pump and control panel   |
|   | Quarterly  | Lubricate pump bearings   |
|   | Quarterly  | Inspect and clean pump  |
|   | Annually   | Clean and lubricate access hatch cover  |
| <u>Submersible Scum Pump<br/>#1, #2<br/>(Flyght)</u>      | Semi-annually<br>Semi-annually<br>Three years  | Pull pump and inspect<br>Check oil condition<br>Service pump in shop  |
| <u>Scum Tank Mixer #1, #2<br/>(Flyght)</u>                | Semi-annually<br>Semi-annually<br>Semi-annually<br>Annually<br>Annually<br>Three years | Check oil level and condition<br>Check starter for damage<br>Check cable condition<br>Check propeller condition<br>Check overall system integrity<br>Service mixer in shop  |
| <u>Samplers<br/>(ISCO)</u>                                | As needed<br>As needed<br>As needed<br>As needed                                       | Clean and inspect o-rings<br>Inspect and clean chamber<br>Inspect and clean conductive path of bottle – full sensor<br>Clean sampler bottle   |
| <u>Primary Sludge Pumps<br/>#1, #2, #3, #4<br/>(Paco)</u> | Monthly<br>Monthly<br>Monthly<br>Monthly<br>Monthly<br>Quarterly<br>Semi-annually      | Clean grease fittings and wipe down work<br>Check amp readings (start up and run) and record results<br>Check temperature readings – 15 min. and 30 min. run time.<br>Record results<br>Check all electrical connections<br>Check all switches for operation<br>Lubricate pump and motor bearings and bearing frame<br>Inspect and clean pump |
| <u>RAS Pumps<br/>#1, #2, #3, #4, #5<br/>(Paco)</u>        | Monthly<br>Monthly<br>Monthly<br>Monthly<br>Monthly<br>Quarterly<br>Semi-annually      | Clean grease fittings and wipe down work<br>Check amp readings (start up and run) and record results<br>Check temperature readings – 15 min. and 30 min. run time.<br>Record results<br>Check all electrical connections<br>Check all switches for operation<br>Lubricate pump and motor bearings and bearing frame<br>Inspect and clean pump |
| <u>WAS Pumps #1, #2, #3<br/>(Paco)</u>                    | Monthly<br>Monthly<br>Monthly<br>Monthly<br>Monthly                                    | Clean grease fittings and wipe down work<br>Check amp readings (start up and run) and record results<br>Check temperature readings – 15 min. and 30 min. run time.<br>Record results<br>Check all electrical connections<br>Check all switches for operation  |

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|   | Quarterly<br>Semi-annually<br>Annually  | Lubricate pump and motor bearings and bearing frame<br>Inspect and clean pump<br>Change reducer oil |
| <u>Gravity Thickeners #1, #2</u><br>(Envirex)     | Weekly  | Check oil level   |
|   | Monthly   | Clean motors  |
|   | Monthly   | Check inside of control panels and switch gear for moisture, change desiccants as needed            |
|   | Monthly   | Check amp readings (start-up and run), record results   |
|   | Monthly   | Check temperature readings – 15 min and 30 min run, record results.                                 |
|   | Monthly   | Wipe up all oil and grease on motors and reducers   |
|   | Monthly   | Clean control panels and switch gear with industrial spray cleaner                                  |
|   | Monthly   | Inspect panels for rust – wire brush and paint when needed.   |
|   | Monthly   | Lubricate all fittings  |
|   | Monthly   | Clean grease fittings and wipe down work.   |
|   | Monthly   | Check all electrical connections  |
|   | Monthly   | Check all switches for operation  |
|   | Monthly   | Clean worm gear section of main drive air vent  |
|   | Monthly   | Check worm gear bearings  |
|   | Monthly   | Lubricate worm gear bearings  |
|   | Monthly   | Check worm gear oil for condensation, flush as needed   |
|   | Monthly   | Check gap setting on torque overload switch.  |
|   | Monthly   | Check condensate drain line on main drive final turntable.  |
|   | Monthly   | Check condition of oil on final turntable of main drive.  |
|   | Monthly   | Grease bore in driven shear pin sprocket.   |
| Monthly   | Check driven shear pin sprocket teeth for wear.   |   |
| Monthly   | Inspect driven shear pin sprocket – check retaining washer, check for loose setscrews or loose key, check teeth for wear. |   |
| Monthly   | Inspect bridge, tighten any loose fittings. Note condition of walkways and handrails.                                     |   |
| Monthly   | Check oil levels in motor primary reducer.  |   |
| Monthly   | Check chain alignment and mounting bolt torque in motor primary reducer.  |   |
| Monthly   | Check all fittings of pivoted type surface skimmer.   |   |
| Semi-annually                                     | Clean and inspect surface skimmer – tighten loose connections, adjust for proper submergence, replace parts as needed.    |   |
| Semi-annually                                     | Remove drive shear pin, rotate to expose shear faces.   |   |
| Semi-annually                                     | Check motor primary coupling teeth for wear.  |   |
| Semi-annually                                     | Inspect scum baffle, weirs, and scum beach. Clean off slime and sludge. Tighten any loose bolted connections.             |   |
| Semi-annually                                     | Check shear pin limit switch.   |   |
| Semi-annually                                     | Inspect corner sweep for proper clearance. Tighten any loose bolted connections.  |   |
| Semi-annually                                     | Check sweep arm pivots for looseness, rebush if necessary.  |   |
| Semi-annually                                     | Replace bent or broken scraper blades as needed. Test upon restart.   |   |
| Semi-annually                                     | Hose off equipment.   |   |
| Semi-annually                                     | Grease all fittings.  |   |
| Semi-annually                                     | Bring oil to proper levels  |   |
| Semi-annually                                     | Change drive oil  |   |
| <u>Dissolved Air Flotation Unit</u><br>(Sterling) | Monthly   | Clean grease fittings and wipe down work  |
|   | Monthly   | Check amp readings (start up and run) and record results  |

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|                                 | Monthly       | Check temperature readings – 15 min. and 30 min. run time.<br>Record results                           |
|                                 | Monthly       | Check all electrical connections   |
|                                 | Monthly       | Check all switches for operation   |
|                                 | Monthly       | Top flights - lubricate shear pin sprocket hub   |
|                                 | Monthly       | Top flights – oil drive chain  |
|                                 | Monthly       | Lubricate skim collected drive chain   |
|                                 | Semi-annually | Change oil in drive unit   |
|                                 | Semi-annually | Inspect walkways for corrosion   |
| <u>Dissolved Air Floatation</u> | As needed     | Lubricate skimmer roller chain   |
| <u>Unit Level Regulating</u>    | Daily         | Lubricate foot shaft and head shaft bearings   |
| <u>System</u>                   | Monthly       | Check amp readings (start up and run) and record results   |
|                                 | Monthly       | Check temperature readings – 15 min. and 30 min. run time.<br>Record results                           |
|                                 | Monthly       | Check all electrical connections   |
|                                 | Monthly       | Check all switches for operation   |
|                                 | Monthly       | Inspect interior of mercury level switches for oxidation of mercury, bare wires and loose connections. |
| <u>Polyblend #1, #2, #3</u>     | Monthly       | Check amp readings (start up and run) and record results   |
| (Stranco)                       | Monthly       | Check temperature readings – 15 min. and 30 min. run time.<br>Record results                           |
|                                 | Monthly       | Check all electrical connections   |
|                                 | Monthly       | Check all switches for operation   |
|                                 | Monthly       | Inspect and clean flowmeter  |
|                                 | Monthly       | Clean and inspect solenoid valve and valve strainer  |
|                                 | Monthly       | Cycle solenoid valve on and off.   |
| <u>Thickened Primary Sludge</u> | Weekly        | Check connecting rods and pins   |
| <u>Plunger Pump #1, #2, #3</u>  | Weekly        | Check sight feed oiler   |
| (Komline-Sanderson)             | Weekly        | Inspect air chamber charge   |
|                                 | Weekly        | Inspect packings   |
|                                 | Weekly        | Hose off pump and flush  |
|                                 | Monthly       | Clean grease fittings and wipe down work   |
|                                 | Monthly       | Check amp readings (start up and run) and record results   |
|                                 | Monthly       | Check temperature readings – 15 min. and 30 min. run time.<br>Record results                           |
|                                 | Monthly       | Check all electrical connections   |
|                                 | Monthly       | Check all switches for operation   |
|                                 | Monthly       | Clean motor openings   |
|                                 | Monthly       | Inspect ball valves and seats  |
|                                 | Monthly       | Check condition of motor/reducer coupling  |
|                                 | Monthly       | Check plunger side wall wear.  |
|                                 | Monthly       | Check for leakage  |
|                                 | Monthly       | Check motor bearings for lubrication   |
|                                 | Monthly       | Check eccentric flange tightness of set screws   |
|                                 | Monthly       | Check eccentric center position over pistons   |
|                                 | Monthly       | Check reducer oil level  |
|                                 | Monthly       | Check alignment of magnetic stroke counters  |
|                                 | Quarterly     | Check valve chamber covers   |
|                                 | Quarterly     | Grease motor bearings  |
|                                 | Annually      | Change oil   |
| <u>Thickened WAS Plunger</u>    | Weekly        | Check connecting rods and pins   |
| <u>Pump #1, #2, #3</u>          | Weekly        | Check sight feed oiler   |

|  |               |  |
|--|---------------|--|
| (Komline-Sanderson)                                    | Weekly        | Inspect air chamber charge   |
|  | Weekly        | Inspect packings   |
|  | Weekly        | Hose off pump and flush  |
|  | Monthly       | Clean grease fittings and wipe down work   |
|  | Monthly       | Check amp readings (start up and run) and record results                         |
|  | Monthly       | Check temperature readings – 15 min. and 30 min. run time.<br>Record results     |
|  | Monthly       | Check all electrical connections   |
|  | Monthly       | Check all switches for operation   |
|  | Monthly       | Inspect ball valves and seats  |
|  | Monthly       | Check condition of motor/reducer coupling  |
|  | Monthly       | Check plunger side wall wear.  |
|  | Monthly       | Check for leakage  |
|  | Monthly       | Check motor bearings for lubrication   |
|  | Monthly       | Check eccentric flange tightness of set screws                                   |
|  | Monthly       | Check eccentric center position over pistons                                     |
|  | Monthly       | Check reducer oil level  |
|  | Monthly       | Check alignment of magnetic stroke counters                                      |
|  | Quarterly     | Check valve chamber covers   |
|  | Quarterly     | Grease motor bearings  |
|  | Annually      | Change oil   |
| <u>Magnetic Sludge Flowmeters</u><br>(Fischer-Porter)  | Annually      | Have meter checked and calibrated  |
| <u>Sludge In-line Grinders #1, #2</u><br>(JWC)         | Monthly       | Clean grease fittings and wipe down work   |
|  | Monthly       | Check amp readings (start up and run) and record results                         |
|  | Monthly       | Check temperature readings – 15 min. and 30 min. run time.<br>Record results     |
|  | Monthly       | Check all electrical connections   |
|  | Monthly       | Check all switches for operation   |
|  | Monthly       | Clean motors   |
|  | Monthly       | Check control panels and switch gear for moisture – change desiccants as needed. |
|  | Monthly       | Wipe up all oil and grease on motors and reducers                                |
|  | Monthly       | Clean control panels and switch gear with industrial spray cleaner               |
|  | Monthly       | Inspect panels for rust – wire brush and paint as needed                         |
|  | Quarterly     | Inspect inside of controller for moisture and dust                               |
|  | Semi-annually | Check cutter stack for tightness   |
|  | Semi-annually | Inspect for fluid leakage under top plate  |
|  | Annually      | Inspect and tighten fasteners.   |
|  | Annually      | Inspect motor starter contacts for pitting                                       |
|  | Annually      | Inspect bearing and seal assembly  |
|  | Annually      | Inspect top and bottom seals   |
|  | Annually      | Grease all gears and shafts  |
| <u>Sludge Blend Mixer #1, #2</u><br>(Lightnin)         | Semi-annually | Lubricate bearings   |
|  | Semi-annually | Analyze gear chamber grease  |
| <u>Belt Filter Press #1, #2</u><br>(Komline-Sanderson) | As needed     | Replace tracking sensors   |
|  | Weekly        | Grease drum bearings   |
|  | Weekly        | Lubricate roller bearings  |
|  | Weekly        | Lubricate alignment shafts   |
|  | Weekly        | Lubricate drive gears  |

|  |               |   |
|--|---------------|---|
|  | Monthly       | Clean grease fittings and wipe down work  |
|  | Monthly       | Check amp readings (start up and run) and record results                                    |
|  | Monthly       | Check temperature readings – 15 min. and 30 min. run time.<br>Record results                |
|  | Monthly       | Check all electrical connections  |
|  | Monthly       | Check all switches for operation  |
|  | Monthly       | Inspect roll and drum alignment, set screws and fasteners.                                  |
|  | Monthly       | Clean belt wash spray nozzles.  |
|  | Monthly       | Check oil level and quality in main drive gear reducer, replace as needed                   |
|  | Monthly       | Check take-up actuator cylinder breather vents for foreign matter, clean as needed.         |
|  | Monthly       | Check belt tracking sensors, clean or grease as needed                                      |
|  | Semi-annually | Lubricate pressure belt motor bearings  |
|  | Semi-annually | Check wedge zone side seals for wear, replace as needed                                     |
|  | Semi-annually | Check drainage grid supports for wear, rotate all supports as needed                        |
|  | Semi-annually | Check discharge scraper blades for wear, reverse or replace as needed                       |
|  | Semi-annually | Check gravity side seals, feed distribution box seals, and washbox seals, replace as needed |
|  | Semi-annually | Wash and inspect filter belts.  |
|  | Semi-annually | Check plows for wear and sharp edges, replace as needed.                                    |
|  | Semi-annually | Replace main control panel moisture inhibitor.  |
|  | Semi-annually | Check washwater spray nozzle pattern, replace as needed.                                    |
|  | Annually      | Change drive oil  |
|  | Bi-annually   | Change oil in pressure belt reducer   |
|  | Every 5 years | Regrease main drive motor   |
| <u>Belt Filter Press Washwater Pump</u><br>(Ingersol-Rand) | As needed     | Inspect and change seals  |
|  | Monthly       | Clean grease fittings and wipe down work  |
|  | Monthly       | Check amp readings (start up and run) and record results                                    |
|  | Monthly       | Check temperature readings – 15 min. and 30 min. run time.<br>Record results                |
|  | Monthly       | Check all electrical connections  |
|  | Monthly       | Check all switches for operation  |
|  | Semi-annually | Lubricate pump bearings   |
|  | Semi-annually | Inspect and clean pump  |
| <u>Process Water Pumps #1, #2</u><br>(Paco)                | Monthly       | Clean grease fittings and wipe down work  |
|  | Monthly       | Check amp readings (start up and run) and record results                                    |
|  | Monthly       | Check temperature readings – 15 min. and 30 min. run time.                                  |

|   |           |  |
|---|-----------|--|
|   | Monthly   | Record results   |
|   | Monthly   | Check all electrical connections                                   |
|   | Quarterly | Check all switches for operation                                   |
|   |           | Grease bearings  |
| <u>Sump Pumps</u>                                     | Weekly    | Exercise float switch  |
|   | Monthly   | Clean grease fittings and wipe down work                           |
|   | Monthly   | Check amp readings (start up and run) and record results           |
|   | Monthly   | Check temperature readings – 15 min. and 30 min. run time.         |
|   |           | Record results   |
|   | Monthly   | Check all electrical connections                                   |
|   | Monthly   | Check all switches for operation                                   |
|   | Quarterly | Grease bearings  |
| <u>Myers Portable Pump</u>                            | Annually  | Change oil in engine   |
|   | Annually  | Service air cleaner cartridge                                      |
|   | Annually  | Clean cooling system   |
|   | Annually  | Replace or clean spark plug  |
|   | Annually  | Change pump seal cavity oil  |
| <u>Hypochlorite Booster Pumps #1, #2, #3 (Goulds)</u> | Monthly   | Clean grease fittings and wipe down work                           |
|   | Monthly   | Check amp readings (start up and run) and record results           |
|   | Monthly   | Check temperature readings – 15 min. and 30 min. run time.         |
|   |           | Record results   |
|   | Monthly   | Check all electrical connections                                   |
|   | Monthly   | Check all switches for operation                                   |
|   | Monthly   | Inspect for working fan, overheating, noise, key pad light working |
|   | Monthly   | Lubricate pump bearings  |
|   | Annually  | Flush out system at end of chlorination season                     |
|   | Monthly   | Inspect and clean pump   |
| <u>Influent Flow Recorder</u>                         | Monthly   | Inspect paper roll and ink ribbon                                  |
| <u>Influent Refrigerated Municipal Sampler (ISCO)</u> | Monthly   | Clean inside and outside   |
|   | Annually  | Clean refrigerator condenser coils                                 |
| <u>Portable Samplers</u>                              | Monthly   | Clean grease fittings and wipe down work                           |
|   | Monthly   | Check amp readings (start up and run) and record results           |
|   | Monthly   | Check temperature readings – 15 min. and 30 min. run time.         |
|   |           | Record results   |
|   | Monthly   | Check all electrical connections                                   |
|   | Monthly   | Check all switches for operation                                   |
|   | Monthly   | Clean sampler inside and out.                                      |
|   | Monthly   | Inspect and clean tubing   |
|   | Monthly   | Inspect and clean suction line                                     |
|   | Monthly   | Inspect desiccant  |
|   | Monthly   | Inspect control box  |
|   | Monthly   | Check battery  |
| <u>Boiler Room Air Compressor (Quincy)</u>            | Daily     | Inspect oil levels and pressure                                    |
|   | Daily     | Drain moisture accumulation  |
|   | Weekly    | Inspect and clean cooling surface                                  |
|   | Weekly    | Operate safety valves  |

|  |               |   |
|--|---------------|---|
|  | Weekly        | Inspect filters   |
|  | Monthly       | Check belt tension  |
|  | Monthly       | Check pulley and pulley clamp screws or set screws                        |
|  | Monthly       | Inspect oil for contamination. Change is needed.                          |
|  | Monthly       | Clean grease fittings and wipe down work                                  |
|  | Monthly       | Check amp readings (start up and run), record results                     |
|  | Monthly       | Check temperature readings – 15 min. and 30 min. run time, record results |
|  | Monthly       | Check all electrical connections  |
|  | Monthly       | Check all switches for operation  |
|  | Quarterly     | Change oil and filter   |
|  | Semi-annually | Inspect compressor valves for leakage or carbon buildup                   |
|  | Annually      | Inspect pressure switch   |
|  | Annually      | Inspect contact points in motor starter                                   |
|  | Annually      | Lubricate motor or engine   |
| <u>HVAC Air Compressor</u><br>(Quincy)       | Daily         | Inspect oil levels and pressure   |
|  | Daily         | Drain moisture accumulation   |
|  | Weekly        | Inspect and clean cooling surface   |
|  | Weekly        | Operate safety valves   |
|  | Weekly        | Inspect filters   |
|  | Monthly       | Check belt tension  |
|  | Monthly       | Check pulley and pulley clamp screws or set screws                        |
|  | Monthly       | Inspect oil for contamination. Change is needed.                          |
|  | Monthly       | Clean grease fittings and wipe down work                                  |
|  | Monthly       | Check amp readings (start up and run), record results                     |
|  | Monthly       | Check temperature readings – 15 min. and 30 min. run time, record results |
|  | Monthly       | Check all electrical connections  |
|  | Monthly       | Check all switches for operation  |
|  | Quarterly     | Change oil and filter   |
|  | Semi-annually | Inspect compressor valves for leakage or carbon buildup                   |
|  | Annually      | Inspect pressure switch   |
|  | Annually      | Inspect contact points in motor starter                                   |
|  | Annually      | Lubricate motor or engine   |
| <u>Bubbler Air Compressor</u><br>(Speedaire) | Daily         | Inspect oil levels and pressure   |
|  | Daily         | Drain moisture accumulation   |
|  | Weekly        | Inspect and clean cooling surface   |
|  | Weekly        | Operate safety valves   |
|  | Weekly        | Inspect filters   |
|  | Monthly       | Check belt tension  |
|  | Monthly       | Check pulley and pulley clamp screws or set screws                        |
|  | Monthly       | Inspect oil for contamination. Change is needed.                          |
|  | Monthly       | Clean grease fittings and wipe down work                                  |
|  | Monthly       | Check amp readings (start up and run), record results                     |
|  | Monthly       | Check temperature readings – 15 min. and 30 min. run time, record results |
|  | Monthly       | Check all electrical connections  |
|  | Monthly       | Check all switches for operation  |
|  | Quarterly     | Change oil and filter   |
|  | Semi-annually | Inspect compressor valves for leakage or carbon buildup                   |
|  | Annually      | Inspect pressure switch   |
|  | Annually      | Inspect contact points in motor starter                                   |
|  | Annually      | Lubricate motor or engine   |

|   |   |   |
|---|---|---|
| <u>Sludge Press Air Compressor #1, #2</u><br>(Quincy) | Daily                                   | Inspect oil levels and pressure   |
|   | Daily                                   | Drain moisture accumulation   |
|   | Weekly                                  | Inspect and clean cooling surface   |
|   | Weekly                                  | Operate safety valves   |
|   | Weekly                                  | Inspect filters   |
|   | Monthly                                 | Check belt tension  |
|   | Monthly                                 | Check pulley and pulley clamp screws or set screws  |
|   | Monthly                                 | Inspect oil for contamination. Change is needed.  |
|   | Monthly                                 | Clean grease fittings and wipe down work  |
|   | Monthly                                 | Check amp readings (start up and run), record results                                     |
|   | Monthly                                 | Check temperature readings – 15 min. and 30 min. run time, record results                 |
|   | Monthly                                 | Check all electrical connections  |
|   | Monthly                                 | Check all switches for operation  |
|   | Quarterly                               | Change oil and filter   |
|   | Semi-annually                           | Inspect compressor valves for leakage or carbon buildup                                   |
| Annually  | Inspect pressure switch                 |   |
| Annually  | Inspect contact points in motor starter |   |
| Annually  | Lubricate motor or engine               |   |
| <u>Fuel Tank</u>                                      | Monthly                                 | Check for leakage of fuel   |
|   | Monthly                                 | Check all fuel lines  |
|   | Monthly                                 | Check gauge for operation   |
| <u>Roof Weather Monitoring System</u>                 | Monthly                                 | Inspect level   |
|   | Monthly                                 | Inspect recorder for proper reading   |
|   | Monthly                                 | Inspect general condition   |
| <u>Boiler</u> (WeilMcLane)                            | Annually                                | Have inspected and maintained   |
| <u>Hoist</u><br>(Electolift)                          | Semi-annually                           | Drain and refill hoist gear case  |
|   | Semi-annually                           | Lubricate exposed teeth on geared trolley wheels  |
|   | Semi-annually                           | Lubricate sheave bearings in upper block, equalizer, and bottom block                     |
|   | Semi-annually                           | Apply a small amount of oil to the shaft bearings of the upper limit switch               |
|   | Semi-annually                           | Check wire rope for kinks, abrasion, stretch, corrosion, or broken wire strands.          |
|   | Semi-annually                           | Remove, clean, inspect and adjust motor brake disc plate and linings.                     |
|   | Semi-annually                           | Inspect contacts of control contactors.   |
|   | Annually                                | Check all wiring for evidence of damage and check security of all electrical connections. |
|   | Annually                                | Inspect hook for cracks.  |
|   | Annually                                | Inspect safety latch and test its operation   |
| <u>Chart recorders</u> (Fisher Porter)                | Annually                                | Have calibrated   |
| <u>Emergency Generators</u>                           | Weekly                                  | Operate at full load for 30 minutes   |
|   | Bi-monthly                              | Check oil levels  |
|   | Bi-monthly                              | Check coolant levels  |
|   | Bi-monthly                              | Check block heaters   |
|   | Quarterly                               | Check battery water   |



|   |               |  |
|---|---------------|--|
|   | Semi-annually | Flush radiator   |
|   | Annually      | Change oil and filter  |
|   | Annually      | Check battery chargers   |
|   | Annually      | Check drives   |
| <u>All Slide Gates and Sluice Gates</u> | Monthly       | Operate gate through full range of motion. Note any maintenance required.. |
|   | Quarterly     | Grease and wipe off fittings   |
|   | Semi-annually | Clean and grease stems   |
| <u>Butterfly Valves</u>                 | Monthly       | Check all flanges for tightness  |
|   | Monthly       | Cycles all valves over full range  |
|   | Semi-annually | Lubricate valve operators  |
| <u>Plug Valves</u>                      | Monthly       | Cycle all valves over full range   |
|   | Monthly       | Check all flanges for tightness  |
|   | Semi-annually | Lubricate valve operators  |
| <u>Exhaust Fans</u>                     | Quarterly     | Check all parts and clean  |
| <u>Laboratory Equipment</u>             | Annually      | Have serviced and calibrated   |
| <u>Alarm System</u>                     | Daily         | Test annunciator system  |
|   | Monthly       | Test autodialer  |

### LUBRICATION SUPPLIES

The plant's numerous unit processes and equipment have many lubrication and grease needs. The manufacturer's operating manual for each piece of equipment should be checked to determine the proper type of lubricant to use on all equipment. An account with a local lubrication company should be opened to ensure that lubricants are readily available as needed. Table 20 lists some of the typical types of lubricants needed to operate the facility:

TABLE 20:

TYPICAL LUBRICANT INVENTORY

| TYPE OF LUBRICANT        | LOCATION OF USE  |
|--------------------------|--|
| 10W-40                   | Grit blowers gear box oil  |
| 80-90W                   | Chemical pump lube oil   |
|                          | Primary thickened sludge pumps piston lube oil   |
| Alvania EP-2             | Grit blowers bearing grease  |
|                          | Grit pump bearing grease   |
|                          | Belt filter press roller bearing grease, drive gear grease, and motor bearing grease         |
|                          | Aerator seal grease and motor bearing grease (lithium based)                                 |
| DTE 30W Heavy Medium Oil | Belt Filter Press compressor lube oil  |
|                          | Boiler compressor oil  |
|                          |  |
| Hydraulic Oil            | Hydraulic Muffin Monster Grinder   |
| Mobilgear SHC 629        | Winter final clarifiers #3, #4 lube oil for main gear case, main gear drive and gear reducer |
| Mobilgear SHC 630        | Primary clarifier #3 oil   |
|                          | Summer final clarifiers #3, #4 lube oil for main gear case, main gear drive and gear reducer |
|                          | Belt filter press drive gear   |
| Mobilux EP2              | Influent grinder grease  |
|                          | Selector mixer motor bearing grease  |
|                          | Final clarifier #3, #4 grease  |
|                          | Sludge blend mixer bearing grease  |
|                          | Lime feed bearing grease   |
| Molyube 630              | Mechanical aerators main gear case oil   |
| Molyube 690              | Belt press conveyor gear case oil  |
|                          | Classifier oil   |
| Molyube 814              | Grit pumps ball bearing oil  |
|                          | Primary clarifiers #1, #2 oil  |
|                          | Primary and final scum pumps motor/gear lube oil   |
|                          | Primary sludge pump lube oil   |
|                          | RAS pump lube oil  |
|                          | WAS pump lube oil  |
|                          | WAS pump bearing grease  |
|                          | TAS pumps gear case oil  |
|                          | TAS pumps piston lube oil  |
|                          | Gravity thickener main gear case and gear reducer lube oil                                   |

|                        |  |
|------------------------|--|
|                        | DAF recirculating pump oil                                   |
|                        | DAF skimmer drive chain oil                                  |
|                        | DAF top scraper gear case lube oil                           |
|                        | Primary thickened sludge pumps gear box oil                  |
|                        | Polymer mixer gear oil                                       |
|                        | Belt Press washwater booster pump oil                        |
|                        | Lime feed oil  |
|                        | Boiler compressor lube oil                                   |
| Motor oil              | Generator  |
| Tribol Moluballoy      | Primary clarifier #1, #2 grease                              |
|                        | Gravity Thickener bearing grease                             |
|                        | DAF skimmer motor grease                                     |
|                        | DAF recirculation pump motor grease                          |
|                        | Belt press washwater pump bearings                           |
|                        | Process water pump and motor bearing grease                  |
|                        | Wet well submersible pump bearings                           |
|                        | Boiler compressor grease                                     |
| Moluballoy 814-814-690 | Final clarifier #1, #2 oil                                   |
| Moluballoy 860         | Primary scum pump motor and bearing grease                   |
|                        | Final clarifiers #1, #2 grease                               |
|                        | RAS pumps bearing grease                                     |
|                        | TAS pump bearing grease                                      |
|                        | Thickened primary sludge pumps (KS) bearing grease and motor |
| White lithium grease   | Grit screw chain   |