OPERATIONS AND MAINTENANCE MANUAL

FOR

PRIMROSE CREEK SUBDIVISION

WASTEWATER TREATMENT FACILITY

CLEBURNE COUNTY, ARKANSAS

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SECTION 1

INTRODUCTION

1.0 PURPOSE OF MANUAL

The purpose of this operation and maintenance manual is to give the Primrose Creek Subdivision wastewater system personnel the proper understanding, technique and references necessary to efficiently operate their facilities.

1.1 OPERATION AND MAINTENANCE RESPONSIBLILITY

To ensure efficient and economical wastewater treatment system operation, the responsibilities of both the operational personnel and the system's management must be clearly defined. The problem confronting each group must be fully understood by both parties. This section is used to outline the scope of responsibility for both parties. The effective operation of the facilities will depend on a coordinated effort of the three organizational levels, management by River Ranch Properties, LLC and later by the Primrose Creek Subdivision Property Owner Association, supervision by the wastewater facility Superintendent and by the operating personnel.

1.1.1 MANAGEMENT'S RESPONSIBILITY

It is the responsibility of the management (River Ranch Properties, LLC/Primrose Creek Subdivision POA) to provide the operating personnel and give them the authority to operate the facility in the necessary manner. The management's responsibility should include the following:

1. Ensure that operational personnel are paid a salary commensurate with their level of responsibility.
2. Provide operational personnel with job security.

3. Provide operational personnel with sufficient funds to properly operate and maintain the wastewater system.

4. Maintain operator training program.

5. Establish and enforce sewer ordinances and inform the personnel of significant changes.

6. Make periodic inspection of treatment systems to discuss mutual problems with the operational personnel and to observe operational practices.

7. Create an atmosphere that will make operational personnel feel that they can bring special problems to management's attention.

8. Maintain good public relations.

9. Prepare budgets and reports.

10. Plan for future facility needs.

11. Review treatment system operational and management records to ensure federal, state and local standards are being met.

1.1.2 SUPERINTENDENT'S REPSONSIBILITIES

2. Establish staff requirements, prepare job description, develop organizational charts and assign personnel.

3. Establish on-the-job training of operators and provide for school training on a routine basis for operators, staff and himself.

4. Motivate personnel to achieve maximum efficiency of operation.

5. Make employees aware of the importance of proper facility performance.

6. Maintain close supervision of the treatment facility to ensure proper operation and develop standard operating procedures.

7. Supervise the preparation of records and reports to be sure they are accurate and that federal, state and local standards are being met.
8. Comply with OSHA regulations.
9. Recommend employee salaries and advancement to the management.
10. Keep management well informed concerning facility conditions and anticipated future requirements.
11. Be familiar with facility in every detail and plan for future needs.
12. Be able to activate and carry out the emergency operating and response plans. Designate and train another person to serve in your place when you are not available.
13. Become a member of trade association and maintain a library of books and periodicals pertaining to facility operation and maintenance. Make such library readily available to all employees.

1.1.3 OPERATIONAL PERSONNEL RESPONSIBILITY

1. Have knowledge of the operation of each treatment unit and the means of evaluating the unit's performance.
2. Learn the operation of the units in order that changing flow and load conditions do not "upset" the treatment process, thus maintaining maximum efficiency at all times.
3. Engage in all the required safety practices as pertain to the operation and maintenance of the facility's units.
4. Keep the superintendent informed as to the need for extensive maintenance or overloaded treatment units.

5. Maintain the treatment facility's site in a well-kept condition.

6. Keep good control records of all phases of operation and maintenance.

7. Obtain state certification and work toward higher classifications.

8. Learn all you can about the wastewater system; attend training schools when possible.

9. Make accurate reports and records of facility operations as necessary to operate the facility and comply with regulations.

10. Develop a favorable relationship with the public.

11. Be able to carry out your part in the emergency operating and response plan.

12. Use the technical literature available in the system library.

13. Develop a friendly and cooperative working relationship with other members of the wastewater treatment team.

1.2 TYPE OF TREATMENT FACILITY

The Primrose Creek Subdivision sewage treatment facility is of the aerated facultative lagoon type with a design flow of 21,250 GPD, processing domestic sewage. The effluent is land applied to 2 acres of land with pine trees and fescue grass. The removal rates for the effluent meets the requirements set forth by ADEQ in the State Water Land application Permit 4059-W. The lagoons are to be monitored and periodically dredged of bottom material when necessary. The dredged material shall be taken to a facility and disposed of in accordance with federal and state regulations. A copy of the State Permit can be found in Appendix "A."

1.2.1 SEWAGE COLLECTION SYSTEM

The collection systems consists of gravity sewer lines, force main, manholes, and pump station located in the subdivision. The sewer lines, running throughout the collection area, provide a sewage flow path from one portion of the collection area to another. The pump station is provided at a low point in the collection system where gravity flow of the wastewater is collected and then pumped to the treatment facility.

1.2.2 WASTEWATER TREATMENT FACILITY

The treatment facility consists of the following components:

1. Influent Flow Measuring Device
2. Aerated Facultative Lagoons
3. Air Blower System
4. Submersible Life Station

1.2.3 PHYSICAL TREATMENT

Raw sewage flows by gravity and force main to the first lagoon. Initial settling occurs in the primary lagoon. Biological treatment is accomplished via the aerated facultative process carried out in the aerated lagoons. Air is supplied to the aerators by the blowers. The treated effluent is pumped to land applications lines within the pine tree grove. The aerated lagoons are periodically dredged to maintain design volume.

SECTION 2

PERMITS AND STANDARDS

2.0 GENERAL PERMIT PROVISIONS

The Primrose Creek Subdivision wastewater treatment facility will operate under the authority of the State Water Land Application permit.

The Arkansas State Permit is issued by the Arkansas Department of Environmental Quality. A copy of this permit is provided in appendix "A" of this manual.

2.1.1 SPECIAL REPORTING REQUIREMENTS

Anytime the facility effluent does not meet the permit requirements, a special report shall be sent to ADEQ within five (5) days of the violation. The facility cannot bypass inadequately treated waste to any surface. The facility cannot at any time discharge into any watercourse. The effluent shall not contain floating solids.

2.1.2 REPORTING PROCEDURES FOR SPILLS

Wastewater spill could occur by untreated or partially treated swage being accidentally discharged into a receiving water (namely the Little Red River). In the event a spill occurs, the responsible authority must immediately notify in the writing ADEQ. Such reports must be made within five (5) days of the spill. The report should include:

1. The nature of the spill and it's effect on the receiving water.
2. The cause of the spill.
3. The steps taken by operational personnel to reduce or control the spill.
4. Anticipated duration of the spill or the duration and amount of the spill if the spill has been discontinued.

5. Anticipated recurrence period and steps taken to prevent recurrence.

6. All downstream users should be promptly notified.

The report should be forwarded to the following address:

Arkansas Department of Environmental Quality
Water division
8001 National Drive
P.O. Box 8913
Little Rock, Arkansas 72219

It is advisable that all operating personnel are informed of the reporting requirements concerning spills. A sample wall poster (Figure 2-1) is developed to assist operational personnel in reporting any emergency. It is advised that the wall poster be displayed in a prominent location.

EMERGENCY REPORTING

IN CASE OF SPILLS OF RAW OR INADEQUATELY TREATED WASTEWATER, CALL THE ARKANSAS DEPARTMENT OF ENVIRONMENTAL QUALITY (ADEQ): PHONE 501-682-0651 AND GIVE AS MUCH AS POSSIBLE OF THE FOLLOWING INFORMATION:

NAME OF FACILITY:_____

TIME/DATE SPILL STARTED:_____

SPILL VOLUME AND COMPOSITION_____

CONDITIONS SURROUNDING SPILL:_____

ABATEMENT ACTIONS:_____

ASSISTANCE REQUIRED:_____

RECEIVING STREAM AFFECTED:_____

THE ADEQ WILL ACCEPT COLLECT CALLS IF YOU INFORM THE OPERATOR YOU WISH TO REPORT A SPILL.

FIGURE 2-1

SAMPLE WALL POSTER FOR EMERGENCY SPILLS

SECTION 3

DETAILED OPERATION AND CONTROLS OF WASTEWATER TREATMENT FACILITIES

3.0 GENERAL

This section of the Operation and Maintenance Manual deals with the operation and controls for the various wastewater treatment facilities whose functions were briefly described in Section 1.

3.0.1 BASIC O & M PROCEDURE

All operating personnel should learn the basic O & M Procedure and make these routine procedures. The procedures apply throughout the system and include the following:

1. An efficient and odor free operation of the facilities requires good housekeeping.
2. Test results are the perimeters by which the facility is run effectively. Test performance should be conducted on a timely and scheduled basis and the results analyzed. Understanding of such results in terms of process performance is the key to early detection of possible problems.
3. Preventive maintenance should be a part of personnel's daily schedule. Such maintenance includes lubrication and cleaning, etc.
4. All control structures and open passages which come in contact with raw sewage should be cleaned on a regular basis.
5. All operating personnel should constantly be on alert for strange noises or signs of reduced performance in the equipment of the process. Early detection of trouble may eliminate costly repairs or process shut-down.

6. Operating personnel should be thoroughly familiar with the O&M Manual so as to identify problems and provide solutions.

3.0.2 SUBSECTIONS

The contents of this section are divided into subsections dealing with the various units of the wastewater treatment system. The corresponding subsections are listed below for easy reference.

Subsection Number and Title

3.1 Sanitary Sewer System

3.2 Aerated Lagoons

3.3 Air Blower System

3.4 Submersible Lift Stations

3.1 SANITARY SEWER SYSTEM

3.1.1 PURPOSE

The raw sewage is collected and transported to the treatment facility by a network of the subdivision sewer lines.

3.1.2 EQUIPMENT

The sewer system consists of house service lines, laterals, sewer main, interceptor and manholes located in various part of the service area.

3.1.3 RELATIONSHIP TO ADJACENT UNTIS

The sewer mains tie the various areas of the system together. The interceptors provide a sewage flow path from one portion of the collection system to another. A pump station is provided in the collection system to pump wastewater to the treatment facility. Force

mains are used to transport the collected wastewater at the pump station to the treatment facility and pump treated effluent from the treatment facility to the land application area.

3.1.4 OPERATIONS

3.1.4.1 NORMAL OPERATIONS

Wastewater is collected by sanitary sewer lines and transported through a series of pipes to a pump station within the collection system. The pump station pumps the wastewater and discharges it into the treatment facility.

Manholes allow access to the sewer lines for inspection and maintenance. These are 4' diameter cylinders extended from the surface to the level of the effluent pipe invert, and are located at breaks in slope, at directional changes, and where two or more sewers come together.

A standard manhole has little change in elevation (0.1' minimum) between entering and exiting sewer lines. Drop manholes on the other hand, are installed whenever there is a change in elevation of the effluent line. Access to the influent sewer line is provided at it's normal elevation for cleaning and inspection.

3.1.4.2 EMERGENCY OPERATION

Collapsed pipe, sewage flow back-ups, sewage outflow conditions are considered emergency situations in a sewage system. Such situations can occur through a lack of preventive maintenance or through factors beyond the control of the maintenance crew. When emergency situations occur they should receive top priority.

Emergency crews should be equipped with all items required to make minor repairs and provide the necessary degree of safety to all the operations. All of the components in a

sewer collection system are subject to breakdown or failure which results in interruption of service requiring maintenance of the emergency classification.

Such malfunctions can usually be traced to one of the following causes: stoppages, structural failure, or overloading.

1. Stoppage: This is probably the most common maintenance problem encountered. An obstruction in the pipe can be the result of foreign objects such as rocks, roots, rags and sticks: materials such as grease, settled solids, sand and gravel; or by bad joints or a broken pipe. In most cases, such problems can be resolved by utilizing flexible steel rods.

2. Structural Failure: Structural failures causing stoppage are usually the result of some unforeseen force acting adversely on the pipe, resulting in broken pipe, cave-ins or washouts. This type of trouble is usually more serious than an ordinary stoppage. The repair of a sewer damaged as a result of a structural failure frequently requires extensive excavation to uncover the line to repair or replace the broken or damaged pipe. In some cases, it is necessary to reroute or bypass the sewage load in order to effect the repair. Pumps can be utilized to pump the sewage around the section to be repaired but should not be used if other methods are available. Pumping, once started, is a continuous problem on a job and can be extremely costly.

3. Overloading: Overloading of a sewer line generally occurs as a result of insufficient capacity in the line to handle the loads imposed by the existing conditions. If the sewer functions with a minimum of trouble during dry weather but overflows during periods of wet weather, the trouble is probably

due to excessive infiltration. This type of problem is extremely difficult to locate and correct. If houses are flooded by an overloaded sewer during periods of wet weather, sewage can be pumped to bypass the problem area as a temporary solution to the problem. The infiltration point must be located and that portion of the sewer line must be replaced.

When a sewer overflows during dry weather, the first step is a thorough cleaning of the line. If the overflow is cause by a partial stoppage as a result of foreign materials in the line, cleaning will eliminate the problem. However, a permanent solution should be found immediately.

3.1.5 CONTROLS

The diameter of the sewer line and it's slope determines it's flow capacity. Sewer lines are generally designed to handle maximum flow. Normally, the lines flow partially full due to variation in sewer flow and the allowance made for increased volume resulting from future population growth in the area.

3.1.6 COMMON OPERATION PROBLEMS

3.1.6.1 SEWER LINES

Problem: Sewer Capacity reduced due to:

A. Accumulation on the pipe walls.
B. Obstruction caused by deposition of grease or various materials and solids on the pipe.
C. Root growth in the line.

Solutions: A sewer ball is an effective means of removing most deposits from sewer lines. The ball is inserted in the upstream manhole and restrained to allow water

pressure to build up. It is then allowed to pass slowly down the line, sweeping any loose material ahead of it.

Ridges on the ball act as a squeegee to remove accumulated slime and grease from the walls. The ball must permit large quantities of water to pass so that the system does not flood. At the same time, the speed of the ball must be adequately restrained so that loose material will be flushed ahead of the ball and not block the pipe.

Greater accumulations can be removed by a special bucket with a cable attached to both ends. The bucket is pulled down the line until the operator feels that it is full. It is then pulled backward, removed and emptied. A bucker does not work well on the pipes which are out of line, or in which differential settling has occurred.

Complete stoppages and roots are removed by a rodding machine. Flexible metal rods, rotated by a motor on the surface, turn various cleaning devices inserted into the lines in the direction of the flow. Debris is removed by the mechanical action of the cleaners and flushing by the sewage. Situations in which pipes have collapsed will require excavation and major repair procedures to restore proper sewage flow.

Problem: Settlement in a sewer line causing sections of the line to shift or joint damage resulting in groundwater infiltration. Groundwater entering into the line might carry sand and/or rocks with it resulting in solids accumulation.

Solution: Settled lines should be realigned and stabilized promptly.

Problem: Sewer manhole covers might be damaged or lost. Open manholes are extremely dangerous.

Solution: If the covers cannot be repaired they should be replaced immediately. If the covering is damaged, the ring should be repaired or replaced.

Problem: Each pipe entering the manhole is jointed to the manhole wall. These pipes may have settled or shifted causing cracks. Sewage will leak out and groundwater may infiltrate due to such cracks.

Solution: Repair the joints or replace the pipe as needed.

Problem: Manhole walls have cracks or holes.

Solution: Patch the walls. Proper cement or mortar mixture should be used for such patching work. For larger holes use cement and brick. The patch should be covered with chemically resistant patching compound to prevent chemical corrosion. If damage to the walls is extensive, the entire manhole should be replaced.

Problem: Manhole steps weakened or shows excessive deterioration.

Solution: Damaged or missing steps can cause serious accidents. Replace steps immediately after the problem is discovered.

Problem: Solids or debris build-up in the manhole bottom.

Solution: Develop a regular manhole cleaning program. Manholes in each section of the sewer system should be cleaned when that section of sewer line is cleaned. The debris removed should be disposed of in sanitary landfills to prevent odor problems or rodent attraction.

Problem: Hydrogen sulfide build-up in manholes.

Solution: Hydrogen sulfide gas is a major problem in manholes (especially drop manholes) because of the mixing action of the sewage. This gas can be explosive or lethal in high concentrations. At low concentrations, the gas can be detected by it's strong "rotten egg" odor. Whenever personnel are working near or in a manhole, the unit should be ventilated continuously with a fresh air blower. The hydrogen sulfide

build-up can be prevented by adding chlorine, nitrates, iron salts, or zinc salts to the sewage. Also, a thorough sewer and manhole cleaning program will prevent gas build-up.

Problem: Rodent activity in manholes.

Solution: Cracked or settled pipes or manhole walls may allow rats to burrow into the earth surrounding the manhole and as result cause damage by allowing infiltration of water or pipe blockage by solid build-up. Damaged pipes or joints should be repaired as soon as discovered to prevent rats from causing further damage.

Problem: Groundwater infiltration in the system.

Solution: Groundwater infiltration can be caused by loose connections between pipe and joints, ineffective installations or house service connections or a structurally unsound manhole. Although some infiltration is inevitable, large quantities can cause a serious overload of the plant facility. The source of infiltration can be determined by methodical analysis of the sewer system including flow measurement and running a close circuit TV camera through the lines in question. Once the source is known, chemical grout may be applied to prevent further infiltration. In sever problem areas, the entire line may have to be replaced.

3.1.7 MAINTENANCE

Proper and timely maintenance of a sanitary sewer system is the safest and most efficient way of using the public funds allocated to the controlling entity. Maintenance helps to prevent public health hazards and inconvenience caused by interruptions in sewer service, and will also extend the service life of the lines. Regular maintenance minimizes the possibility of damage to private property by

sewer stoppage, and also the legal responsibility of the sewer authority for such damage. Maintenance crews should work on a regular schedule, covering the entire system, with greatest attention to the oldest sections and known trouble areas.

A cleaning schedule based on the flow, the slope of the sewer lines, and the nature of the waste carried should be developed. Sewer lines on a steep slope or carrying large flow will have adequate velocities with little or no deposits. Low discharge lines on a small slope will have greater accumulations and require more frequent cleaning. A schedule calling for a thorough cleaning, at least annually, could be adopted initially, and then modified as experience shows necessary.

Sewers should be inspected on a regular basis to determine necessary repairs and the general physical condition of the sewer lines. Inspections can be accomplished as a separate operation, or at the same time as other sewer work. The frequency of inspection will depend on the rate of accumulation in the different sections of the sanitary sewer system.

After inspection, repair crews should re-lay collapsed pipes, raise and lower manholes and repair structural failures in sewers, culverts, manholes and appurtenant structures as necessary. Repair equipment would include digging and pipe laying tools, cement, sand, pipe, oakum, scaffolding and necessary leveling equipment.

As a compliment to cleaning, chemicals can be used to inhibit root growth, to reduce slimes and sulfide generation, and to protect against rodent and insect infestation. In most cases, proper maintenance will eliminate the need for chemical application. Care should be taken when using chemicals, however, because careless use of chemicals

can adversely affect downstream units, and reduce the efficiency of the wastewater facility.

Maintenance crews should be equipped with hydraulic flushing devices with scraping devices and with a rodding machine. In addition, an air compressor to operate pneumatic tools and a pump to bypass incoming sewage may be necessary.

A program of regular inspection, repair and maintenance work should be adopted and carried out routinely. This will reduce the number of customer complaints, reduce operational costs and increase overall efficiency of the system.

3.2 AERATED LAGOONS

3.2.1 PURPOSE

The lagoons are provided to treat the raw sewage sufficiently to enable the effluent to be applied to the land application site at minimum quality land application requirements, as permitted by the State Water Land Application Permit.

3.2.2 AERATION SYSTEM

The lagoons contain static tube aerators which provide required amounts of oxygen to the lagoon and acts as a mixing device. Air is supplied by a blower located in the Blower Building. The air passes through the tubing and the diffusion equipment which creates tiny air bubbles to aerate the wastewater effectively. Openings in the bottom of the tube allow wastewater to enter the bottom and pass up through the tube and the aerator acts as an airlift pump, mixing the wastewater in the lagoon.

3.2.3 OPERATION

3.2.3.1 INITIAL START UP

Before placing the aerated lagoon into normal operation, check the following:

1. All aeration equipment for proper installation in accordance with manufacturer's recommendations.
2. The tube aerators have been securely anchored and properly fastened to the air distribution pipe.
3. All air distribution piping and tubing for leaks and secure installation.
4. Follow the following procedure to fill the ponds initially.

a. Fill lagoons with fresh water from a river or municipal system, if available. (Spring and early Summer is the best time to startup to avoid low temperature and possible freezing).

b. Begin the addition of wastewater.

c. Keep pH above 7.5.

d. Check D.O. daily.

e. If started during warm weather:

1e. Algal blooms usually will appear from 7 to 14 days.

2e. A good biological community will be established in about 60 days. Color will be a definite green as contrasted with blue or yellow-green.

3.2.3.2 NORMAL OPERATION

During normal operation, all wastewater will flow into and through the aerated lagoons. The settleable solids in the wastewater will begin to settle to the bottom of the first pond and this process will continue throughout the lagoon system. The later ponds allow additional detention time for settlement of solids and for aerobic treatment of the wastewater. The final pond's effluent should be a relatively clear liquid low in suspended solids and relatively high in dissolved oxygen. The lagoons

will require dredging periodically to maintain the design depth of the ponds. The dredged material shall be hauled to a proper landfill in accordance with State and Federal Regulations.

The following is a brief description to help familiarize the operator with the biological process:

In an aerated lagoon, sufficient oxygen is supplied to mix the contents and to allow for suitable growth of aerobic organisms. These organisms are the means by which treatment of the sewage is accomplished. Upon contact with the sewage, these organisms adsorb organic matter present (assimilate this matter into their systems) and form additional organisms. Since the organisms upon which the process depends are aerobic in nature, there must be present in the lagoons a sufficient quantity of oxygen in the solution (called dissolved oxygen or D.O.) to maintain life.

Aerobic organisms use this oxygen much the same way as human beings use oxygen in their life cycle. The longer the organisms remain in contact with sewage the greater the amount of organic matter is removed. The time period (called detention time) therefore is important in determining the amount of treatment which will occur. A certain amount of solids, both organic and inorganic, settles to the bottom of the lagoon and undergoes anaerobic decomposition (also called digestion). Therefore, the lagoon is both an aeration basin and a settling basin as well as an anaerobic digester.

The static tube aerator combines many desirable elements of aeration that are especially suited for aerated lagoons such as (1) excellent oxygen transfer, (2)

maximum mixing from bottom up, (3) non-clog design, (4) uniform mixing throughout the basin, (5) easily accepts changes in air flow and water level. Air is introduced through the orifice located inside the vertical tube. The tube contains diffuser membranes appropriately located within the tube to diffuse (break up) the upward moving large air bubbles and thereby cause oxygen transfer to the liquid. The upward action of air bubbles through the tube also serves as an air lift pump circulating large volume of liquid and creating large mixing zones of influence. Air is continuously introduced through these aerators to maintain the designed level of dissolved oxygen and a complete mixing. It is important to note that most of the oxygen transfer will take place from the surface aeration. However, the aerators must be operated continuously to provide enough mixing to distribute the influent and settleable solids throughout the pond.

3.2.3.3 EMERGENCY OPERATION

During emergency operations, the water level in the lagoon can be partially lowered for repair of piping, tubing, or aerators. Flow need not and cannot be bypassed as the lagoon system will give partial treatment to the wastewater even during emergency operations.

Both the first pond and the second pond can be used as temporary holding and treatment ponds for the duration of repairs.

3.2.4 CONTROLS

3.2.4.1 ELECTRICAL CONTROLS

There are no electrical controls associated with the operation of the aerated lagoons.

3.2.4.2 OPERATIONAL PROBLEMS

The major operational problems which may occur are the breakdown of a blower or a power outage. Two 5 hp blowers are provided in the blower enclosure. Sufficient oxygen can be provided by one of the blowers leaving one as a standby to be used if the other blower is inoperable. During a power outage, the lagoons will act as storage basins for the flow until power is restored. Other operational problems include air leak in the distribution piping. These problems should be remedied as soon as possible to assure optimal operation of the lagoons.

3.2.4.3 MAINTENANCE

Since the tube aerators have no moving parts, maintenance is minimal. There are no maintenance items for these units. The following maintenance goal is provided as a guideline.

1. The facility effluent should meet the State Water Permit or other regulatory permit levels for BOD and SS for the system.
2. Maintain a minimum of 2 mg/l DO throughout the pond at heaviest loading periods.
3. The ponds should have a deep green sparkling color which indicates high pH and DO.
4. The surface water should be turbulent with no dead spots. Visually inspect aeration pattern for "dead spots" or line ruptures. Repair if necessary to maintain even distribution of air. Measure DO at several points in the ponds weekly to maintain even distribution.
5. A good pond has no weeds growing in the water nor tall weeds on the bank.

6. Dikes are well seeded above the water line with grasses and kept mowed. This prevents soil erosion and insect problems.
7. Inlet and outlet structures are clean. No floating debris, caked scum, or other trash that might produce odors or be unsightly.
8. A good pond operation includes a schedule for getting things done. An available facility record shows weather data and basic test results such as pH, DO, BOD, and SS.

3.3 AIR BLOWER SYSTEM

3.3.1 PURPOSE

The air blowers, located in the Blower Enclosure, produce low pressure compressed air for use by the aerated lagoons diffuser system.

3.3.2 EQUIPMENT

There are two 5 hp blowers, located in the Blower Enclosure and which are connected via air lines to the static tube aerator in the aerated lagoons. The rest of the system is made up of valves and piping, intake filters, silencers and discharge silencers each handling the discharge from one blower unit.

3.3.3 RELATIONSHIP TO ADJACENT UNITS

The air blowers force air through the air lines and eventually to the air diffuser systems of the aerated lagoons.

3.3.4 OPERATION

3.3.4.1 INITIAL START UP

Before placing the blowers into operation, various checks of the equipment must be made. All mounting and anchoring bolts and belts should be checked to see that they

have been properly tightened. The blower and drive motor should be checked for proper drive alignment. The V-belt should be tensioned to the manufacturer's limits. The blower should be properly lubricated according to the manufacturer's instructions. WARNING: The blower units are shipped without lubricating oil. Do not operate before lubricating. The oil fill plugs are located on top of the gear case. Using locally available automatic transmission fluid, fill the oil pan. After the unit has been started the load should be applied gradually. The first few minutes of operation are the most critical in so far as potential problems are concerned so all equipment should be observed closely for excessive heat, noise or vibration during this period. Speeds, pressure, temperatures, vacuums and other operation conditions should be checked to ensure that specific limits are not exceeded. The units should be checked for proper operation and the air piping should be checked for leaks at the various fittings and connections. Any operational problems with any of the equipment should be investigated immediately and remedied before any further operation of the equipment.

3.3.4.2 NORMAL OPERATION

Under normal operation, the blowers are controlled by manual on/off switches and are designed for 24 hours continuous service. At any one time one of the blowers must be operating. The operator should establish a routine operation procedure such that both blowers are used the same amount of time.

3.3.4.3 EMERGENCY OPERATION

If one of the blowers has to be taken out of service for maintenance or repair, the other blower will stay in operation. The appropriate valves should be closed. The unit should

be put back into operation as soon as possible. Any repair work should be done only by trained personnel.

It is preferable that the blower be unloaded before shutdown. If the unit is to be shut down for an extended period of time it is desirable to take some step to prevent rust from forming inside the casing. Condensation, gas vapors can close up internal clearances and cause the unit to bind. Injection of oil or other rust retardant will help to prevent this problem.

3.3.5 OPERATIONAL PROBLEMS

The main problem associated with the blower concerns clogging of the air filters. A clogged filter reduces the amount of air that is delivered to the lagoons which in return reduces the facility's treatment efficiency. The filters should be cleaned frequently to prevent clogging.

Air leaks in the piping system will also result in excessive working of the compressor. Whenever a leak is suspected, it should be investigated quickly and repaired if necessary. Leaks may be detected by brushing soapy water on suspected areas.

3.3.6 MAINTENANCE

Once started up, positive placement blowers should not stand idle for more than one or two days. If blowers are shut down for any reason they should be turned over at least once every two days. If it is not possible to turn over the unit with the motor, turn the unit by hand. The two lobes within the unit have very close tolerances and are made of cast iron. If the blowers are not run for any length of time these lobes will rust and could cause major damage. If a unit is shut down for any long period of time, piping should be disconnected and lobes sprayed with a fine mist of oil to thoroughly coat the

lobes with a thin film of oil. Seal off the inlet and outlet. Turn the lobes by hand once a week. Input the gears to ensure they are adequately greased or oiled.

3.3.7 TROUBLESHOOTING

No matter how well equipment is designed and manufactured, there may be times when servicing will be required due to normal wear., the need for readjustment, and various external causes. Whenever equipment needs attention, the operator or repairman should be able to locate the cause and correct the trouble quickly. The following Trouble Shooting Chart will assist the mechanic in those respects.

1. Problem: Knocking

Possible Causes	Solution
Unit out of time	Retime
Distortion due to improper mounting or pipe strains	Check mounting alignment and relieve pipe strains.
Excessive pressure differential	Reduce to manufacturers recommended pressure. Examine relief valve, reset if necessary.
Worn gears	Replace timing gears.
Worn bearings	New bearings.
Worn bearing cartridge	Replace cartridges.

2. Problem: Excessive blower temperature

Possible Causes	Solution
Too much oil in the gear case or drive cover	Reduce oil level.
Too low operating speed	Increase actual blower speed.
Clogged filter or muffler	Remove cause of obstruction.

Excessive pressure differential	Reduce pressure differential across the blower.
Worn impeller clearances	Restore clearances.

3. Problem: Impeller end or tip drag

Possible Causes	Solution
Insufficient assembled clearances	Correct clearances.
Case of frame distortion	Check mounting and pipe strain.
Excessive operating pressure	Remove cause.
Excessive operating temperature	Remove cause.

4. Problem: Lack of volume

Possible Causes	Solution
Slipping belts	Tighten belts.
Worn clearances	Re-establish proper clearances

5. Problem: Excessive bearing or gear wear

Possible Causes	Solution
Improper lubrication	Correct oil level. Replace dirty oil.

6. Problem: Loss of oil

Possible Causes	Solution
Headplate, gear case drive cover vents plugged	Clean vents.
Worn seal	Replace seals.

3.4 SUBMERSIBLE PUMP STATION

3.4.1 PURPOSE

The pump station is provided to transfer all the incoming wastewater from the contributing collection system to a higher elevation at the treatment facility. The pump station structure provides a covered, enclosed area for the wet well and submersible pumps. The sewer pump and force main is provided to pump and convey the wastewater flow from the wet well to the treatment facility.

3.4.2 EQUIPMENT

The pump station contains two submersible non-clog pumps with integral motors; valves, internal piping, central control panel with circuit breakers; motor starters and automatic pumping level controllers, and internal wiring. The pump station has pumps of equal capacity.

The control panel located on the control stand contains circuit breaker switches, "Hand-Off-Automatic" selector switches, alternator selector switch and all other necessary switches.

3.4.3 RELATIONSHIP TO ADJACENT UNITS

Wastewater from the contributing collection system flows by gravity to the pump station wet well. The wastewater is then pumped through force main directly to the treatment facility.

3.4.4 OPERATION

3.4.4.1 INITIAL START UP

Pump and motor: Before placing the pumps into operation make the following checks:

1. All mounting and anchoring bolts should be checked for proper tightening.

2. All equipment should be checked for proper leveling and alignment.
3. All of the equipment should be checked for proper lubrication in accordance with manufacturer's instructions.
4. Wet well should be free of construction debris.

Before starting the pumps, the first time when new or after maintenance, be sure that the wet well level is above the pump impeller. Normally, the operator will start up the system by setting all control switches to automatic; however, for testing and maintenance purposes other settings may be selected. After such start up, check to see if all equipment is functioning properly and that the control system operates the pumps at the correct rate and proper schedule. A factory representative should be present to supervise the Initial Pumping System Start Up.

Any operational problems with any of the equipment, such as excessive vibrations, noise, heat, or lubricant leakage should be investigated immediately and remedied before any further operation of the equipment.

3.4.4.2 NORMAL OPERATION

The pumps are normally operated automatically in conjunction with the float switches. The pumping sequence of the pumps, (i.e., the "lead-lag" arrangement) is automatically alternated at the end of each pumping cycle. Normally, both pumps will never run together as each is capable of handling the entire system flow on its own. As the liquid level in the wet well rises, the float switches are activated. When the wet well liquid level rises to the LEAD PUMP ON setting, the drive motor for the lead pump starts and the liquid in the well is pumped down to the lowest water level (OFF for both pumps). When the level is sensed, the lead pump shuts off. If the rate of

inflow into the wet well is greater than the capacity of the lead pump, the liquid level will reach the LAG PUMP ON level, at which time the drive motor of the lag pump is also started so that both pumps operate together in parallel to lower the level in the wet well. When OFF level is reached, both pumps will shut off. The alarm is activated during a power failure or when high or low liquid levels exist in the wet well.

During normal operation, the pumps run alternately so that during one cycle one pump will run and during the next cycle the other pump will run. This tends to equalize the wear on the pumps and motors. Pump selection is controlled by an alternator relay. The alternator relay is also equipped with a manual selector switch to select automatic alternation of the pumps or to select either pump as the lead pump.

Liquid discharged from the pump is directed into the force main through the discharge piping. This consists of check valves, gate valves and the necessary elbows and fittings to make the connections. The check valves prevent reverse liquid flow through the pumps. The discharge gate valves control the discharge lines from either or both pumps.

3.4.4.3 EMERGENCY OPERATION

Should a power failure occur, the sewage level will rise in the wet well and back up through the system. An alarm light and horn will sound. The cause of power failure should be investigated immediately and given top priority for repair.

If one of the pumps breaks down, that unit should be taken out of service and repaired as soon as possible by qualified personnel. During repair of the pump, the discharge valve for the pump should be closed. After the necessary repairs are completed, the pumping system (including all valves and control settings) should be returned to the

normal operation mode. It should be noted that normal operation can be maintained even though a single pump is out of service. During repair of the pump, the second pump should be operated as the "lead" pump on each pumping cycle by the proper setting on the "Lead Pump Selector Switch."

High water level in the wet well is an emergency condition that may occur. However, such an emergency situation is not anticipated under normal conditions while both pumps are working. If high water level in the wet well occurs when one or both of the units are out of service, a portable pump may be used to pump sewage directly out of the wet well to the force main through a quick disconnect installed on the force main. After the high water level has been corrected, a complete investigation should be made to determine the cause of the high water level. For example, a malfunction of the automatic controls; an improper liquid level setting adjustment; or mechanical equipment problem may have caused the situation. Only qualified personnel should make any necessary repairs or adjustments.

3.4.5 CONTROLS

3.4.5.1 FLOW CONTROLS

The wastewater flow to the pump station wet well is controlled by gravity.

Each pump is provided with a discharge shutoff valve and a discharge check valve. The discharge shutoff valves will normally be open. The check valves operate automatically and are open when the pump is operating and closed to prevent the backflow of sewage when the pump is off.

3.4.5.2 ELECTRICAL CONTROLS

The electrical controls for the sewage pumps and motors are mounted on the control panel located on the control stand.

Each pump is provided with a "Hand-Off-Auto" selector switch. The "Auto" position of the switches provide for automatic operation of the units and "Hand" and "Off" positions are provided for manual starting and stopping of the units. The switches will normally be in the "Auto" position to provide for automatic operation of the units as controlled by the level control system. If a pump is manually controlled, care should be taken so that the pump does not continue pumping after the liquid level in the wet well has been lowered below the bottom of the suction lines. Operation of the pump for a long period of time in a dry condition may cause damage to the pump or drive motor.

An automatic alternator is provided for the pumps to alternate the operation (i.e., the "lead-lag" arrangement) of the pumps at the end of the pumping cycle. By alternating the "lead-lag" arrangement, wear on the units will be approximately equal. A manual switch is provided on the control panel to select automatic alternation of the pumps to select either pump as the lead pump. Normally, the manual switch would be in the automatic alternation position. Conditions in which a specific pump would be selected as the lead pump are when one pump is out of service; one pump has less total running time; or when one pump has a higher pumping efficiency than the other.

3.4.5.3 OPERATIONAL PROBLEMS

A list of pump operation problems which includes most of the causes of failure or reduced efficiency resulting from mechanical equipment problems is given below.

Electrical malfunctions should be inspected by a trained electrician and corrected as necessary. Manufacturer's O&M Manual gives a detailed troubleshooting guide for easy reference.

LIST OF OPERATION PROBLEMS

A. PUMP WILL NOT START

Causes:

1. Breakers tripped
    a. Switch contacts corroded or shortened.
    b. Motor shorted or burned out.
    c. Contacts of the controls dirty and arcing.
    d. Breakers or thermal units too warm.
    e. Wiring short-circuited.
    f. Shaft binding or sticking by reason of rubbing impeller or clogging of pump.

B. REDUCED RATE OF DISCHARGE

Causes:

1. Mixture of air in the wastewater.
2. Speed of motor too low.
3. Defective motor.
4. Impeller clogged.
5. Discharge line clogged.
6. Valves partially or entirely closed.
7. Check valves stuck or clogged.

8. Incorrect impeller adjustment.

9. Impeller damaged.

10. Loss of suction during pumping caused by:

    a. Pump pulling air into bowl.

    b. Ineffective seal.

C. HIGH POWER REQUIREMENTS

Causes:

1. Clogged pump.

2. Pump shaft bent.

3. Rotating elements binding.

4. Impeller rubbing.

D. NOISY PUMP

Causes:

1. Inlet clogged.

2. Inlet not submerged.

3. Pump not lubricated properly.

4. Worn impeller.

5. Foundation insecure.

Should any problem develop in a pump, it should be taken out of service immediately for repairs. Only qualified personnel should make any necessary repairs.

The switch system in the wet well could be a source of operational problems. Grease and other solids may collect on it, causing improper operation of the pumps. The floats

should be inspected regularly for excessive accumulations of grease and solids and cleaned as necessary to ensure proper operation of the system.

Grease and scum should not be allowed to accumulate on the wet well walls. Large accumulations will eventually break loose in large pieces and disrupt operations by clogging the pumps or clogging the pipes. The walls should be inspected once a week and cleaned as necessary. Caustic soda and a stiff bristle brush with a handle of adequate length can be used to do the necessary cleaning.

Major problems with the automatic pump control system, causing improper pump operation, should be investigated and corrected as soon as possible by a trained electrician or a manufacturer's representative.

3.5.6 MAINTENANCE

The pump station should be checked daily to see that each pump is starting., pumping, and stopping properly. The wet wells have steep hoppers to minimize solids accumulation, however, the inside walls and corners should be washed down as necessary. The top slab should also be kept clean. Once each month, all valves should be operated to be sure they are serviceable. Any defects in the pumping system should be repaired as soon as they are observed.

For maintenance of the pumps and motors and associated controls, see the following preventive maintenance schedule and troubleshooting. The pumps can be removed for inspection or repair by lifting them with a hand wench.

PREVENTIVE MAINTENANCE SCHEDULE

UNTI NAME

UNIT NO.

	FREQUENCY					
	D	W	M	S	A	OTHER
Inspection:						
1. Check pumps and level controls System for proper operation.		X				
2. Check pumps for overheating, excessive noise, vibration, or other indication of trouble.		X				
3. Inspect check valves for proper operation and seat wear.					X	
4. Check impeller and impeller casing And remove any deposits or scaling.					X	
5. Clean and check motor control.						As Needed
6. Check and lubricate pump seal & bearing.			X			
Cleaning:						
1. Clean the wet well walls to prevent excessive accumulations of grease or scum on the walls.		X				
Lubricant:						
1. Lithium base grease.						As needed

Note: For more detailed information see manufacturer's O&M Manual.

D-Daily W-Weekly M-Monthly S-Semi-Annually A-Annually

TROBULESHOOTING

1. Indicator: Black or odorous septic wastewater.

Possible Causes	Solution
Improper operation of lift station	Repair lift station.
Flat grades in collection system	Flushing program to maintain correct velocities.

2. Indicator: Intermittent flow or surging.

Possible Causes	Solution
Improper wet well sensor adjustments	Adjust level sensors.
Hydraulic capacity of station is exceeded	Install surge tank.
Illegal connections to the system	Remove and prevent illegal connections.

3. Indicator: Intermittent flow or surging during heavy rainfall.

Possible Causes	Solution
Flooded streets and water entering through manholes	Seal manholes and repair cracks in manhole structures.
Broken lines	Repair broken lines.

4. Indicator: Pump not running.

Possible Causes	Solution
Defective control circuit	Replace defective part.
Defective motor	Replace motor.

5. Indicator: Pump not running, circuit breaker will not reset.

Possible Causes	Solution
Clogged pump or closed valve	Remove obstruction.

6. Indicator: Pump is running, reduce discharge.

Possible Causes	Solution
Pump air-bound	Remove obstruction.
Clogged impeller	Remove obstruction.
Wearing rings	Replace worn rings.

7. Indicator: Clogged pump or pump suction line.

Possible Causes	Solution
Grease accumulations	Frequent cleaning of wet well or removal of grease by dewatering the well, and scraping the bottom.

8. Indicator: Rising power consumption per gallon.

Possible Causes	Solution
Clogged pump	Remove obstruction in pump.

9. Indicator: Improper liquid levels.

Possible Causes	Solution
Fouling in float controls	Clean float switch assembly.

10. Indicator: Excessive wear or damage to pumps.

Possible Causes	Solution
Sand accumulations in wet well	Remove sand from wet well.
Grease accumulations in wet well	Clean wet well (see 7 solution).

SECTION 4

RECORDS

4.0 GENERAL

Good record-keeping is an essential element in efficient and effective operation of a treatment facility. Complete and accurate records are an important control tool as well as a good guide for management in decision making. Such informative records can be used as a guide in making necessary changes to an existing facility. It can also serve as a documental proof of operation, methods and results, and can justify required improvements if need be.

Among other records that might be necessary because of facility type, age, and other unique conditions, the following records should be maintained:

1. Records of operation.
2. Records of operating costs.
3. Maintenance records.
4. Records of emergency conditions.
5. Personnel records.

All records should be neat, accurate, and in a format that can be easily understood. Records should be well kept to avoid loss or damage. Entry into the record book should be made promptly at the time the data is collected or occurrence observed. The Superintendent is responsible for good data entry, proper filing and upkeeping of the records.

4.1 RECORDS OF OPERATION

4.1.1 DAILY OPERATION LOG

A daily operator's log should be filled out consistently on a daily basis. A sample of such a log is shown in Figure 4-1. Copies of the daily logs should be kept in the operation building at all times. Accumulated copies of daily logs provides the personnel with a continuous summary of factors that might affect the operational process and effluent quality and should serve as a guide to the preparation of monthly reports and performance evaluation. Important entries to be made on the log are as follows:

1. Duty personnel (Name and Title).
2. Date of entry.
3. Normal maintenance and operational duties. This should include normal daily, weekly or monthly duties performed on the recording day, such as meter readings, replacement of recorder charts, etc.
4. Visitors of the facility, purpose of the visit and accomplishments.
5. Complaints received, purpose of complaint, time of complaint, remedial action taken, name and address of complaintant.
6. Emergencies, accidents or injuries and unusual conditions.
7. Power consumption.
8. Influent and effluent wastewater quality.
9. Weather conditions.

DAILY OPERATOR'S LOG

PRIMROSE CREEK SUBDIVISION

DATE: _____ TIME: _____

PERSON ON DUTY: _____

WEATHER CONDITIONS: _____

WASTEWATER FLOW:

INFLUENT (RAW): _____GPD EFFLUENT: _____GPD

1. ROUTINE OPERATIONAL AND MAINTENANCE DUTIES PERFORMED

_____

2. COMPLAINTS RECEIVED

NAME: _____ ADDRESS: _____

SUBJECT _____

3. FACILITY VISITORS	TIME	PURPOSE	COMMENT
_____	_____	_____	_____
_____	_____	_____	_____

4. ACCIDENTS OR INJURIES	CAUSE	ACTION TAKEN
_____	_____	_____

5. UNUSUAL CONDITIONS	CAUSE	ACTION TAKEN
_____	_____	_____
_____	_____	_____

6. POWER CONSUMPTION TOTAL: _____KWH

FIGURE 4-1

DAILY OPERATOR'S LOG

4.2 ANNUAL REPORT RECORDS

At the end of each calendar year, the superintendent should prepare an annual report for the treatment system. The report should include the cost of operating the system for that year, the additions or changes to the system during that year, and an evaluation of the treatment provided at the treatment facility to include averages of test results and the percentage of time the facility effluent met the requirements established by the state agencies. The monthly cost reports and facility operation reports will be valuable tools for preparing the annual report.

4.2.1 REPORTING PROCEDURES FOR SPILLS OR NON-COMPLIANCE

Section 2 of this manual gives reporting methods for spills or non-compliance.

4.3 RECORDS OF OPERATING COSTS

Cost information is very important to the owner for the funding of the operation and maintenance of the wastewater facilities. The superintendent should maintain a monthly report of operating costs and forward such reports to the responsible officials. The superintendent should collect and keep relevant cost data to support the reports. Records should include administrative, supplies, equipment, utilities, and other costs incurred through normal facility operation.

4.3.1 COLLECTION SYSTEM COSTS

The breakdown of wages, power, equipment purchases, replacement or repair, chemicals and miscellaneous costs are necessary data for the cost analysis of the collection system. Wages should include the actual salaries of the people involved, plus fringe benefits. Fringe benefits may include such things as vacation time, sick leave, insurance, etc. A record of the wages should be kept for each individual involved in the system operation.

This would even include part-time help that might only be available during summer periods, such as students, as well as other personnel who may from time to time find themselves involved in system operations.

Power costs should include all power necessary to operate all of the equipment. Included under the power costs may be costs of electricity, gasoline, diesel, etc. This information is usually available from monthly statements received by the Official System Authorities for the utilities costs.

Equipment repair or replacement cost records is also necessary. When items or equipment are purchased, a record of the purchase prices should be maintained and summarized on a monthly basis. Likewise with equipment repairs, the cost related to each repair, including the wages, should be recorded.

Chemical costs, if any, will also include those chemicals needed for maintenance of the collection system or any other uses.

Finally, there should be a general cost item which relates to things such as cement, mortar, or other miscellaneous repair items, screws, nuts, bolts, lumber, etc. It may be necessary to update this form to include other items should they become significant expenses.

4.3.2 PLANT AND PUMP STATION COSTS

The total monthly flow, labor, utilities, chemicals, equipment purchases and replacement and miscellaneous items are necessary data for the cost analysis for the facilities operation.

Labor costs should include cost of the operation of the facilities as well as the cost for maintaining the facilities. Administration costs should include all salaries of people involved, plus fringe benefits.

Utility costs will include all electricity necessary to operate the electrical equipment. Also included under utilities will be costs for fuel, water service, telephone service, etc.

Equipment purchases or replacement costs recording is self-explanatory. When items of equipment are purchased, a record of the purchase prices should be maintained and summarized on a monthly basis. Likewise, with equipment repairs, the cost relating to this repair including wages of employees who are not involved on a routine facilities basis should be recorded.

Material costs should include laboratory costs, cleaning supplies costs, and the cost of various maintenance material. Laboratory costs include samples sent out for testing that cannot be done at the facility. Cleaning supplies cost should include any cost of material used for cleaning such as cleaning compounds, mops, sponges, etc. Maintenance material cost includes all expenditures for items used for maintenance which should include tools, paint, and miscellaneous repair items such as screws, nuts, bolts, etc.

In order to permit a comparison of present day cost with cost that will occur in the future, it is a good idea to relate each cost subdivision of the flow through the treatment facility. In other words, determine the cost of each one of these items per gallons of treated sewage flow. This can be compared by year in order to analyze the rising or falling costs. Cost information is extremely important and the maintenance of accurate cost records cannot be stressed too greatly. Each year when it is necessary for the Official System

Authority to arrive at a budget allowance for it's various operations, the Authority will insist upon a good set of records on which to base it's allocation of funds.

4.4 MAINTENANCE REOCRDS

Maintenance is a vital part of the treatment process to guarantee performance and efficiency. Accurate and consistent record keeping keeps operators informed when essential services were last performed. This aids personnel in determining when future services will be required and assists in maintaining a properly scheduled program. Records should show costs and maintenance intensity of each piece of equipment. This should act as an overall comparative tool for all equipment against performance, breakdowns cost of repairs and man-hour requirements.

4.5 RECORD OF EMERGENCY CONDITIONS

A record of emergency conditions affecting the treatment facilities operation should be maintained. The emergency conditions record book should consist of a standard three-ring notebook equipped with prepared log sheets. The record book should be kept in a file and easily accessible. A sample emergency condition report form is shown in Figure 4-2. An emergency conditions record need not be maintained daily. Only when a condition exists that affects the treatment process should the superintendent fill out a log sheet. Such conditions could be fires, explosions, floods, equipment failures and power failures. Data to be recorded includes the date and time of the occurrence, a description of what happened, corrective action taken, probable reasons for the emergency condition, and preventive measures that can be taken to minimize the chance of recurrence. For natural disasters which cannot be prevented from recurring, the procedures followed in dealing with them can be reviewed to develop more effective action plans.

PRIMROSE CREEK SUBDIVISION TREATMENT FACILITY

EMERGENCY CONDITIONS REPORT

1. Date: _____ Time: _____

2. Weather conditions: _____

_____

3. Description of emergency condition: _____

_____

4. Effect of emergency condition (Damages, Injuries, etc.): _____

_____

_____

5. Corrective action taken: _____

_____

6. Cause of emergency condition: _____

_____

_____

7. Preventive measures to minimize the chance of recurrence: _____

_____

_____

_____

_____

Operator's Signature

Figure 4-2

4.6 PERSONNEL RECORDS

The superintendent should keep a personal ledger for the facility operating staff. The ledger should provide the following information as a minimum for each employee.

1. Date employed, position and pay rate.
2. Dates and rates of salary adjustments.
3. Dates of promotion and/or termination.
4. Work schedule.
5. Holidays, vacation, sick leave.
6. Educational background.
7. Training programs completed.
8. Short courses and special classes attended.
9. Licenses obtained and in progress.

SECTION 5

PREVENTIVE MAINTENANCE

5.0 GENERAL

The operating performance of a wastewater treatment facility is very dependant on quality and timeliness of its mechanical maintenance. A proper maintenance schedule ensures that each piece of equipment operates at maximum efficiency and eliminates sudden equipment breakdown which could cause serious problems for the entire treatment facility.

This section of the manual is designed to help the operating personnel set up and maintain a good and efficient maintenance program. Instructions on inspection and services are based on experience and recommendations of skilled engineers and operators as well as manufacturer's equipment maintenance guide. Modification of these instructions might be necessary to reflect local conditions and operational methods. Such schedule changes should be based on experience and judgment of the personnel, equipment manufacturers and prevailing local conditions.

5.1 EQUIPMENT RECORD

This is an organized system of procedures designed to help personnel provide economical and effective maintenance for treatment facility equipment. The system assists operators in detecting and remedying on a routine basis, minor problems that might result in major ones if not corrected promptly.

5.1.1 EQUIPMENT NUMBERING SYSTEM

A five-digit system should be set up by personnel and used to number all equipment. The first number should represent the section that discusses the equipment. The next two

digits should indicate the subsection in the identified section. The last two digits should differentiate the equipment from all others discussed in the same subsection.

5.1.2 EQUIPMENT CATALOG

A file card system should be set up by the personnel to include a file card for each piece of equipment containing all information regarding that piece of equipment.

A preventive maintenance file should be set up by the Superintendent using equipment service records cards as a guide. The equipment service card should contain spaces for the person performing the scheduled maintenance to fill in the date the maintenance was performed, his remarks and signature.

The schedules supplied in this manual should be used to prepare work schedules on a daily basis. Each day, the personnel will do the scheduled daily work. One day each week (for example, Wednesday) should be set aside for weekly work. Therefore, each Wednesday, the personnel will list the daily maintenance and the weekly maintenance. Likewise, certain days should be set up for monthly, semi-annual and annual maintenance tasks. The following is a suggested schedule:

Maintenance	Day
Daily	Every day
Weekly	Every Wednesday
Monthly	1st Tuesday of the month
Semi-annual	Last Thursday of March & September
Annual	Last Thursday of June

The personnel must remember the importance of ensuring that all necessary parts, materials, and, if required, outside help is available when the maintenance is scheduled, be it preventive or corrective.

5.2 PLANNING AND SCHEDULING

Since a wastewater facility is run every day of the year, there is always flow variation. Maintenance schedules should therefore be planned in such a way to eliminate idle time or peakload periods. Operations should be monitored continuously to determine required maintenance that needs to be made. In case of emergency breakdown of equipment immediate action should be taken to bring the equipment back to full and efficient operation.

5.2.1 PREVENTIVE MAINTENANCE SCHEDULES

This manual provides preventive maintenance schedules for each major piece of equipment in the system that will assist the Superintendent in planning and scheduling of his maintenance workload. These preventive maintenance schedule procedures can be easily used and will provide the personnel with a complete maintenance program if used accurately.

5.2.2 WORK ORDER SYSTEM

Routine and non-routine maintenance tasks involved with facility operation are most easily accomplished by the work order system. This system aids the personnel in identifying the work to be done, the priority of the job, and other special information (such as parts needed and tools required) pertinent to the equipment or job.

Work orders will record when the work was initiated and when the job was completed. Numbers should be allocated to work orders to aid retrieval and accountability. Records

of those work orders help personnel estimate future non-routine or corrective maintenance. Example of a work order form is given in Figure 5-1. this form is useful in the initiation of preventive or corrective work, type of work done, who did the job, duration of work and time of completion.

During the daily inspections the need for non-routine maintenance might arise for a particular piece of equipment or structure. All non-routine work should be taken care of as soon as possible. Work backlog arises when there is not enough manpower or materials necessary to take care of maintenance work promptly. In this case, the backlog requires an important planning schedule to clear up the unperformed maintenance. Priorities should be given to maintenance items in the backlog (with respect to the critical nature of required maintenance) to clear them up in the most efficient and systematic way without endangering the treatment process.

Parts orders should be placed immediately whenever material shortage exists and maintenance performed in the order of importance to the treatment process.

5.3 STOREROOM AND INVENTORY SYSTEM

Spare parts inventory should be developed and maintained. The exact amount and type of spare parts and supplies inventory necessary for proper operation and maintenance of the facility should be determined through careful evaluation and experience. Inventory checklists should be designed to maintain records of parts, materials and equipment received and issued and to determine when inventory levels are running low. Purchase orders should be place promptly for low level stocks. Economic consideration should be given to inventory levels to prevent overstocking or understocking of items which can be

PRIMROSE CREEK WASTEWATER FACILITY

MAINTENANCE WORK ORDER

NO._____

DATE:_____

WORK TO BE PERFORMED:

_____

_____

_____

LOCATION:_____

_____

PRIORITY: _____ REQUESTED BY: _____

LABOR $: _____ MATERIAL $: _____ PHONE: _____

ESTIMATE ESTIMATE

RECORD HOURS OF LABOR, TRAVEL TIME AND EQUIPMENT TIME USED

MATERIALS USED					LABOR, TRUCK & EQUIPMENT TIME			
SIZE	ITEM	QUAN.	ITEM PRICE	TOTAL	NAME	HOURS	RATE	TOTAL

REMARKS:_____

_____

WORK COMPLETED BY _____

WORK ACCEPTED BY _____

FIGURE 5-1

very costly. Periodic inspections should be conducted to evaluate and update needed inventory levels.

5.3.1 STOREROOM INVENTORY SYSTEM

Inventory for most items should be kept in stock to insure that a minimum number of each type of part is available at all times. Periodic check (at least semi-annually) should be made and orders placed for items with low inventory level. Maintenance records should be reviewed annually to determine the right level of inventory necessary to operate and maintain the facility at minimum cost without loss to efficiency.

The role of each spare part in the overall system should be evaluated and the critical nature of each part determined. The spare parts for the pumping equipment and other major units of the facility should be considered critical items, and should always be on hand when needed. A sample storeroom inventory card is shown in Figure 5-2.

5.3.2 SPARE PARTS LIST

A recommended spare parts list with manufacturer's instructions should be kept on hand for normal schedule maintenance and repair of equipment.

5.3.3 PURCHASE ORDERS

Purchase order forms should be filled out in duplicate whenever ordering equipment, supplies, etc... A copy should be sent for the ordering purposes while the duplicate copy should be kept in purchase-orders reference file.

This reference file will help the Superintendent keep control of expenditures. He can then tabulate the cost of material through these order forms. A sample purchase order form is shown in Figure 5-3.

STOREROOM INVENTORY CARD ITEM NO. _____

ITEM DESCRIPTION _____ AISLE NO. _____

BIN NO. _____

QUANTITY MAXIMUM _____ MINMUM _____

REORDER _____

INVENTORY INFORMATION

QUANTITY USED OR STOCKED	DATE	SIGNED	QUANTITY ON HAND	USAGE OR SUPPLY INFORMATION USAGE – WORK ORDER NO. SUPPLY – PURCHASE PRDER NO.

FIGURE 5-2

PURCHASE ORDER FORM

TO _____

_____

_____

SHIP TO: _____

_____

_____

PURCHASE ORDER NO. _____

WORK ORDER NO. _____

DATE INITIATED: _____

DATE REQUIRED: _____

SHIP VIA: _____

F.O.B. _____

TERMS: _____

_____

_____

_____

IMPORTANT

OUR PURCHASE ORDER NUMBER MUST

APPEAR ON INVOICES, PACKAGES AND

CORRESPONDENCE.

QUANTITY	STOCK NUMBER/DESCRIPTION	PRICE	PER	TOTAL
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

APPROVED BY _____ DATE _____

SHEET ____ OF _____

FIGURE 5-3

The purchase order forms should be used for checking the goods received. Discrepancies between purchase order and actual shipment should be noted accordingly and remedial action taken.

5.4 MAINTENANCE PERSONNEL

The facility personnel have the responsibility of performing the daily maintenance schedule and monitoring equipment performance.

Such maintenance should be limited in scope, and will include lubrication, cleaning and replacement of damaged parts. Qualified contractors should be hired periodically to perform special maintenance such as mechanical, electrical and instrumentation calibration work.

5.5 MAINTENANCE COSTS AND BUDGETS

Cost estimate and budget development should be done through subdivision of maintenance operation into three major categories. These categories are:

1) preventive maintenance done without interruption of operation,

2) corrective maintenance performed on out-of-service equipment, and

3) repair maintenance handled by contractors.

An accurate cost record is very important for the preparation of these three categories of maintenance cost and budget listed above. To ensure a high degree of accuracy in the cost control process, sufficient cost information should be maintained.

5.6 HOUSEKEEPING

Housekeeping duties include all miscellaneous duties necessary for good keeping of the treatment facility and it's surroundings. This will include general cleanings, ground maintenance, painting of structures and buildings, janitorial duties and general yard work.

The Superintendent should make sure that all tools and supplies need for adequate housekeeping are furnished and safely kept.

The superintendent should draw up a schedule for certain duties that require daily or periodic maintenance. Housekeeping maintenance could be handled by in-house personnel or could be given to an outside contractor.

5.7 LUBRICATION

As a vital part of the preventive maintenance program, use proper lubricants only and comply strictly to manufacturer's or established lubrication schedules. Manufacturers normally supply equipment lubricant recommendations with purchased equipment, however, when such recommendations are not available, a substitute could be determined using Table 5-1, 5-2 and 5-3. The information on these tables is derived from the "Interchangeability Lube chart" – Plant Engineering Magazine, August 22, 1968, page 63.

For example, if a heavy inhibited hydraulic and general purpose oil is called for, by referring to Table 5-1, this oil has a SSU (Saybolt Seconds Universal) rating of 630-770 at 100 degrees F. It is then possible to determine the correct SAE number by referring to Table 5-2. Here the SSU rating in the range of 630-770 is 700. Then by moving across Table 5-2 to the SAE Viscosity number column, it can be seen that the lubricant should be a No. 40.

Table 5-3 is provided as a cross-reference lubricants chart. It may be used with the above discussed tables to determine a proper lubricant for a certain application. For example, if an application called for a light gear oil, the personnel would look on Table 5-1 to

TABLE 5-1

LUBRICATION CHART

LUBRICANT TYPE & VISCOSITY, S.S.U. @ 100F

1.	Light Inhibited Hydraulic & Gen. Purpose	135-165
2.	Med. Inhibited Hydraulic & Gen. Purpose	194-236
3.	Med. Heavy Inhibited Hydraulic & Gen. Purpose	284-346
4.	Heavy Inhibited Hydraulic & Gen. Purpose	630-770
5.	High-Pressure (Anti-Wear) Hydraulic Oil	135-165
6.	High-Pressure (Anti-Wear) Hydraulic Oil	194-236
7.	High-Pressure (Anti-Wear) Hydraulic Oil	284-346
8.	Fire-Resistant Hyd. Fluid-Synthetic	
9.	Fire-Resistant Hyd. Fluid/Water-Glycol	
10.	Fire-Resistant Hyd. Fluid/Water-Oil Emulsion	
11.	Very Light Spindle Oil (Over 6000 rpm)	29-35
12.	Light Spindle Oil (3600-6000 rpm)	54-66
13.	Spindle Oil (Up to 3600 rpm)	95-115
14.	Light Weight Oil	135-165
15.	Medium Weight Oil	248-346
16.	Heavy Weight Oil	900-1100
17.	Light Gear Oil	630-770
18.	Medium Gear Oil	900-1100
19.	Heavy Gear Oil	1935-2365
20.	Light Extreme-Pressure Gear Oil	283-347
21.	Heavy Extreme-Pressure Gear Oil	1350-1650
22.	Cling-Type Gear Shield (Open Gears)	900-1100
23.	Gen. Purpose E.P. Lithium Base Grease	NLGI 2
24.	Molybdenum Disulfide E.P. Grease	

TABLE 5-2

LUBRICANT CHART

Designations Based on ASTM & ASLE Recommendations (Saybolt Seconds Universal 100F + 10%)	Saybolt Seconds Universal 210F (Approx.)	AGMA Grade No. (Approx.)	SAE Viscosity No. (Approx.)	SAE Gear Lubricant No. (Approx.)
32	--------	----------	----------	----------
60	--------	----------	----------	----------
105	--------	----------	----------	----------
150	40	----------	10W	75
215	43	1	10	----------
315	50	2	20	80
465	60	3	30	----------
700	75	4	40	90
1000	95	5	50	----------
1500	110	6	60	----------
2150	130	7	70	140
3150	140	8	----------	----------

TABLE 5-3

INTERCHANGEABLE LUBRICANTS LIST

Chevron Oil Co. (Standard Oil of California)	Gulf Oil Corp.	Mobile Oil Co.
1. Chevron OC Turbine Oil 9	Gulf Harmony 44	ETNA 24
2. Chevron OC Turbine Oil 11	Gulf Harmony 47	ETNA 25
3. Chevron OC Turbine Oil 15	Gulf Harmony 53	ETNA 26
4. Chevron OC Turbine Oil 24	Gulf Harmony 69	DTE Oil Ext. Heavy
5. Chevron EP Hyd. Oil 9	Gulf Harmony 43AW	DTE 24
6. Chevron EP Hyd. Oil 11	Gulf Harmony 48AW	DTE 25
7. Chevron EP Hyd. Oil 15	Gulf Harmony 54AW	DTE 26
8. Chevron FT Fluid	-------	---------
9. ----------	Gulf FR Fluid G Series	---------
10. ----------	Gulf FR Fluid	Nyvac 20
11. ----------	-------	Velocity Oil No. 3
12. Chevron Machine Oil 5	Gulfspin 35	Velocity Oil No. 6
13. Chevron Machine Oil 7	Gulfspin 41	Velocity Oil No. 10
14. ----------	Gulf Harmony 43AW	Vactra Oil No. 1
15. Chevron Vistac Oil 15W	Gulfway 52	Vactra Oil No. 2
16. Chevron Vistac Oil 33W	Gulfway 75	Vactra Oil No. 4
17. Chevron Machine Oil 26	Gulf Harmony 76	Compound BB
18. Chevron Machine Oil 36	Gulf Harmony 97	Compound CC
19. Chevron Machine Oil 70	Gulf Harmony 121	600 W Cylinder Oil
20. Chevron Gear Compound 60	E.P. Lubricant 55	Compound AA
21. Chevron Gear Compound 120	E.P. Lubricant S120	Compound DD
22. Chev. Pinion Grease Ms	Lubcoat No. 1	Dorcia No. 20
23. Chev. Duralith Grease EP-2	Gulf Crown Grease No. 2	Mobilux Grease No. 2
24. RPM Moly Grease 2	-------	----------

Shell Oil Co.	Sinclair Refining Co.	Texaco, Inc.
1. Tellus 27	Duro Oil 150	Rando Oil A
2. Tellus 29	Duro Oil 200	Rando Oil B
3. Tellus 33	Duro Oil 300	Rando Oil C
4. Tellus 69	Duro Oil 600	Rando Oil F
5. Tellus 927	Duro AW 16	Rando Oil HD-A
6. Tellus 929	Duro AW 21	Rando Oil HD-B
7. Tellus 933	Duro AW 31	Rando Oil HD-C
8. -------	----------	----------
9. -------	----------	Hydraulic Safety Fluid 200
10. IRUS Fluid 902	Duro FR-HD	Fire Resistant Hydra Fluid
11. -------	----------	----------

(Table 5-3 cont. next page)

TABLE 5-3 CONT.

INTERCHANGEABLE LUBRICANTS LIST

Shell Oil Co.	Sinclair Refining Co.	Texaco, Inc.
12. Tellus 15	Cadet Oil "D"	Spintex Oil 60
13. Tellus 23	Cadet Oil "B"	Spintex Oil 100
14. Tonna 27	Truslide 150	Cleartex 140
15. Tonna 33	Truslide 300	Way Lubricant D
16. Tonna 72	Truslide 900	Way Lubricant G
17. Vitrea 69	Rubilene Oil Heavy	Regal Oil F-R&O
18. Vitrea 69	Opaline Gear Lub BX	Regal Oil G-R&O
19. Vitrea 78	Opaline Gear Lub CX	Pinnacle Cylinder Oil
20. Macoma 33	Pennant E.P. 1	Meropa Lubricant 1
21. Macoma 73	Pennant E.P. 3	Meropa Lubricant 3
22. Cardium D	Jet Lube No. 8	Crater 1
23. Alvania EP 2	Litholine Industrial 2 EP	Multifak EP 2
24. Lithall MDS	Litholine EP-Moly	Molytex Grease 2

determine the general reference number, which is No. 17 for a light gear oil. Assuming that the facility was using Texaco products, No. 17 on Table 5-3 corresponds to Texaco Regal Oil F (R&O inhibited). The table may also be used to determine which oil to use when an oil of a different manufacturer is specified. For example, if the manufacturer specified Shell Tellus 69 oil or equal and the facility was using Mobile Oil products, the equivalent lubricant may be determined by locating the No. 4 lubricant under the Mobile Oil heading which is Mobile DTE Oil Extra Heavy.

In most cases, it is possible to consolidate to one or two greases. Ordinarily, a general purpose, lithium based, extreme pressure grease may be used for all but special applications. It is also recommended that a local oil company be consulted for a recommendation on total facility lubrication. Generally, they will be happy to establish this complete lubrication program in exchange for the privilege of selling the lubricants.

5.8 SPECIAL TOOLS AND EQUIPMENT

Tools are an important part of a complete system maintenance program. They should be kept in good condition and used only for the purpose for which they are intended. The Superintendent should conduct inspections of all tools and replace any tools which are found to be worn out or broken.

Safekeeping of tools is important for tool protection, as well as for accident prevention. Tools should be stored away in safe areas when not in use. All tools should be returned to their designated storage area immediately after use and clean-up. The following is a list of recommended hand tools and maintenance equipment:

1. Roller Tool Cabinet
2. All Purpose Tool Box

3. Combination Wrench Set, 5/6" through 1 ¼"

4. 3/8" sq. Drive Socket Wrench Set, 3/8" through ¾", 12 pt. sockets with ratchet, ext. bars, hinge handle and speed handle

5. ¾" sq. drive socket wrench set, 7/8" through 2 3/8", 12 pt. sockets with ratchet, ext. bars, hinge handle and bar handle

6. Hex key set

7. Light duty puller, 3-way

8. Punch and chisel set

9. Adjustable wrenches - 8" nom. length, 15" nom. length, 20" nom. length

10. Straight pipe - 1 – 10", 2 – 24", 1 – 36"

11. Pipe cutters, 1/8" through 4"

12. Pipe threaders, exposed ratchet, drop head, ½" through 2"

13. Pipe vise - bench yoke type capacity, 1/8" through 4"

14. Tube cutter set

15. Bars - wracking bar, 36" length, pinch point crow bar, 60" length

16. Hammers - ripping claw 16 oz., ball peen 16 oz., hand drilling 2 lb., double face striking 4 lb., double face striking 8 lb., soft face 8 oz.

17. Aluminum level, 24" length

18. Hack saw, adjustable frame

19. Hack saw blades, pack of 10 blades – 18 T Blade, 24 T Blade

20. Files – 12" mill B-cut, 12" mill S-cut, 8" slim taper, 10" half round machinist B-cut, 10" half round machinist S-cut, 10" round machinist B-cut, 12" half round wood rasp B-cut

21. Tape rule, ½" blade, 10'

22. Screwdrivers (rubber grip) – 8" sq. blade std. tip, 12" sq. blade std. tip, 10" light blade cabinet tip, stubbly sq. blade, 6" Phillips head, 8" Phillips head

23. All purpose snips, duckbill pattern, 12 ¾" length

24. Combination square

25. Screw extractor set

26. Pliers – needle nose side cutting, thin nose slip joint, general utility, power track, lineman's side cutting, vise grip with quick release

27. Propane torch kit in carry-all case

28. Bench vise with replaceable hardened steel jaws and swivel base, 5" jaw width

29. Power bit set (wood), spade type, ¼" shank

30. Masonry drill set, carbide tipped, ¼", 5/16", 3/8", ½"

31. High speed drill set in metal stand

32. Reversible ½" H.D. end handle drill

33. 8" H.D. ball-bearing bench grinder, single phase

34. Vacuum cleaner with 1 ½" wet and dry H.D. attachments

35. Squeegee, rubber blade, 24" with aluminum handle

36. Mop pail, 19 qt. capacity

5.9 MAJOR EQUIPMENT INFORMATION

Preventive maintenance as provided in Section 3 is meant to be a guide for the personnel to perform limited maintenance such as inspections, parts replacement and lubrication of equipment and should not be used as a complete instruction for the maintenance system.

Manufacturer's instruction manuals should be used to supplement this information. A yearly review of schedules should be conducted and changes made where necessary.

5.10 WARRANTY PROVISIONS

Most facility equipment comes with a one year manufacturer's guarantee period. The manufacturer or contractor has the responsibility to repair, correct or replace any warranted equipment that fails to perform according to the terms and conditions of the contract. It is important to know that any major alteration to the equipment or lack of compliance to manufacturer's recommended maintenance schedule might relieve the contractor or manufacturer of his repair obligations. Equipment should be properly maintained even while under warranty to prolong the service life.

5.11 CONTRACT MAINTENANCE

Special repair and maintenance should be handled by qualified professionals. Unauthorized personnel should not try to perform repairs. Electricians, plumbers, mechanics and contractors should be contacted for repairs in their respective areas whenever the need arises. The treatment facilities will be serviced more effectively and efficiently through a contract with outside contractors to perform repair duties. A competitive yearly bid process should be used to select the best and most economical contract.

5.12 GENERAL NOTE ON MAINTENANCE

This section is aimed at achieving the optimum maintenance program for the Primrose Creek Treatment Facility and System. The Superintendent should therefore strive for the implementation of these maintenance requirements. However, in the event of an insufficient maintenance budget and/or personnel the Superintendent should tailor the

requirement to maximize the available resources. Priority should be given to maintenance necessary for employees safety and equipment life.

SECTION 6

EMERGENCY OPERATION AND RESPONSE PROGRAM

6.0 OBJECTIVE OF PROGRAM

This section is aimed at helping operating personnel develop a program to cope with emergency conditions that might arise from natural disasters, civil disorder, strikes and equipment failure. Such a program should be designed to:

1. Eliminate or reduce serious effects resulting from emergency situations that might arise in the treatment facility.
2. Instruct personnel on how to respond to emergencies.
3. Provide inventories of available emergency equipment and instruct personnel on where to get assistance in case of emergencies.

In this section, potential emergencies will be evaluated and response actions recommended. The highly flexible facility process flow pattern together with personnel training should minimize problems due to emergency situations.

6.1 VULNERABILITY ANALYSIS

Listed below are possible emergencies that might arise in the treatment facility system. Contingency plans should be aimed at covering as many emergencies as foreseeable. These emergencies include:

1. Equipment break-down
2. Fire

3. Flood

4. Windstorm

5. Power Failure

6. Personnel Injury

7. Discharges

8. Explosions

6.1.1 EQUIPMENT BREAK-DOWNS

Equipment break-downs could be greatly minimized by proper maintenance program and periodic inspection of equipment and operations. Under certain circumstances, early warning might be detected before equipment break-down. However, there is an exception to this rule; equipment might suddenly break down without warning due to unforeseeable reasons like clogging or pump. Personnel should therefore be ready for sudden equipment failure even under a perfect maintenance program.

Some equipment is furnished with warning devices such as lights or alarms to warn the personnel of the failure. For failures that are not instantly identifiable, the personnel's daily inspection of the equipment will detect the malfunction.

In case of sudden break-down of equipment, the electrical circuit should be checked first. If the reason for such a malfunction is not from the circuit system, a thorough check of the unit should be conducted. If there is still power supply to the effected unit, it should be shut off before dismantling the unit.

It is important that a good spare parts inventory be maintained. This will make repairs possible in a shorter time.

6.1.2 FIRE

Should fire occur in the treatment facilities, personnel should determine whether or not they can handle the fire and also notify the Fire Department for help in all cases. Adequate control measures should be taken to ensure that fire does not spread to the immediate surrounding of the treatment facilities. Highly flammable materials like fuel and explosives should be immediately moved to a safe area provided the safety of the personnel is not jeopardized by doing so. Personnel should try to put out large scale fires alone. Serious fires should be handled by the Fire Department. However, if the fire is small enough to be handled with a fire extinguisher, personnel should act timely and swiftly to put it out. Water, sand, dirt, etc... should be used where necessary to combat the fire. Adequate precautionary measures should be taken by all personnel not to inhale excessive smoke. As soon as the fire is extinguished, personnel should water down ashes and remains until the air is free of smoke.

After the fire is out, extent of damage should be assessed by the Superintendent. In case of major fire, the Arkansas Department of Environmental Quality should be promptly notified of the nature and extent of damage.

The best temporary treatment procedure should be used until complete repair to the facility is done and the facility restored back to it's normal efficiency level.

The Superintendent should investigate the cause of the fire and take necessary steps to prevent reoccurrence of similar mishaps. If the fire was caused by ignition of flammable materials, different arrangements need to be made to eliminate its fire hazards. In the event that fire was caused at an electrical connection or meter, the wiring system needs to be checked and proper corrective measures taken.

6.1.3 FLOOD

The treatment facility is located above expected flood level. However, if flooding should occur, safety measures should be taken to reduce possibility of damage to the facility. The major damage due to flooding would be erosion of the pond levee, damage to fencing, damage to mechanical equipment in the facility and pumping system, minor yard erosion and road damage. It should be a regular practice to monitor closely the National Weather Service forecasts. Any flood possibility should be immediately communicated to all facility personnel. If a strong probability of flooding is forecasted, sandbag barriers should be immediately built around the facilities.

The facility should be brought back to normal operations as soon as flood waters start to recede. This should done through clean up of the facilities and washing out of all debris that might clog the equipment. If the treatment facility becomes susceptible to frequent flooding, an adequate emergency program should be drawn up to minimize flood impact. Experience of successful measures taken in previous floods should play an important role in designing a program to prevent or minimize flood damage in the future. The Superintendent is charged with obtaining information about all previous flooding vital to the design of an effective defense program against future flood damages. Preventive measures should focus on permanent embankments where flood waters first gained access to the facilities, pumping equipment and necessary tools and damming materials. Also, it is advisable to consider possible means of diverting the flood waters away from the facilities.

6.1.4 WINDSTORM

Damage from a windstorm will most likely be limited to fallen vertically supported objects like fences, power poles, tress, etc…, and damage done to the treatment facilities by these objects.

Since a windstorm is an act of nature, there is nothing the personnel can do to prevent it. However, the Superintendent should maintain communication with the State and/or National Weather Service closest to Heber Springs to learn at the earliest possible time of an impending windstorm.

If report of a possible windstorm is received, personnel should be vigilant and take necessary precautionary measures. Protective measures should be taken by securing all outside facilities that might be damaged by the storm. All building windows should be opened if a tornado is forecast for the vicinity.

If power lines are blown down by the windstorm, electric power supply to the facility might be disrupted. The electric company should be notified of such disruption for immediate repairs. The damage to the facilities should be assessed by the Superintendent as soon as the windstorm stops.

The Superintendent should notify the Arkansas Department of Environmental Quality of the nature and extent of damage. Adequate steps should be taken to clean up the facilities and return the facility to full operation.

6.1.5 POWER FAILURE

The treatment facility is almost entirely powered by electricity. Power failure will result in the instant stoppage of pumping and aeration equipment. However, the pond can store incoming flow for an extended period of time without causing and permit violation. The

treatment process is such that the effluent quality will not be seriously affected by a short time of power loss.

Reason for power failure should be immediately investigated. If failure was caused for conditions outside the facility, the operator should wait for the restoration of power. The power company should be promptly notified of power loss. The effect of power loss to the treatment facilities should be explained to the power company authorities and first priority consideration should be requested for power restoration.

If the failure is the result of internal problems, the electrical circuits should be checked immediately. If a circuit was overloaded, the breaker should be reset to restore power supply. If wiring problems caused the failure, a qualified electrician should be brought in to repair the system. It is good practice to have the electrical system checked annually to guard against electrical problems.

6.1.6 PERSONNEL INJURY

Procedures for handling injuries should be developed and personnel adequately trained to carry them out. Sufficient warning signs should be installed at hazardous arrears of the facilities.

If any of the personnel is injured, the extent of the injury should be determined and assistance requested immediately if necessary. Minor injuries like scratches, cuts and minor burns should be immediately treated from first aid supplies. Serious injuries should be referred to a qualified physician.

All personnel should be well trained on the first aid procedures. Protective inoculation against infectious bacteria like tetanus and typhoid should be given to all employees on a regular basis.

6.1.7 DISCHARGE INTO SEWERS

Industrial discharge, oil or gasoline spills from filling stations and trucks are the major sources of accidental spills into the sewage collection system.

Any party responsible for a spill should report such an incident to the facility Superintendent. All personnel that witness the occurrence of a spill should notify the superintendent promptly of the source, nature and volume of the spill entering the collection system. Also, the public should be encouraged to report source and nature of a spill at all times. Once a spill is reported, the Superintendent should have lab tests conducted and use the results to determine the effects on facility influent. He should also determine the cause and volume of the spill, report the occurrence to the appropriate agencies. The fire department should be notified if oil, gasoline, or any flammable material is involved. The Superintendent should also inform parties responsible for the spill to take immediate action to stop further discharge and start clean-up operations without delays.

If spilled material settles and flows on top of the wastewater, the flow can be skimmed off and taken away for disposal. It is the duty of the responsible party to carry out the clean-up operation, however the Superintendent should have the facility personnel assist where possible in the clean-up process.

6.2 METHODS TO REDUCE SYSTEM VULNERABILITY

Subsection 6.1 has dealt with steps to be taken to minimize the impact of most emergencies to the treatment facilities. An optimum preventive maintenance and testing program will reduce vulnerability of the system. It is recommended that the employees be

trained in emergency procedures and emergency operations exercises be conducted periodically.

6.3 EMERGENCY EQUIPMENT INVENTORY

Personnel should be aware of emergencies that could occur in the course of daily operations and maintenance routine. Materials and equipment to cope with such emergencies should in stock at all times or should be easily accessible through mutual aid agreements when needed. Parts that are not easily available should always be in stock even if such parts are very rarely used.

A comprehensive emergency inventory list of material and equipment should be compiled, identifying locations of the emergency items. Such a list should be placed at a highly visible location. The Superintendent should review and update the list as necessary. A sample of emergency inventory equipment sheet is shown in Figure 6-1.

Reject materials might prove helpful during emergency repair process. It is therefore good practice to neatly store away materials like spare shingles, pipe sections, old steel beams and plates, bolts, screws, nails, scrap lumber, etc.. for possible use during emergency repair process.

Other materials to consider in preparing for emergencies include routine hand tools, special tools, weight lifting equipment, etc... The Superintendent should also consider which pieces of heavy mechanized equipment might be required for each emergency. For example, backhoes and bulldozers would be useful for fighting floods and grass or forest fires.

EMERGENCY EQUIPMENT AND MATERIAL INVENTORY SHEET

Description of Emergency Equip.	Location of Equipment	Name and Phone of Responsible Party	Terms of Agreement

Figure 6-1

The Superintendent should also make arrangements for external help to augment the capabilities of his personnel. If the manpower available to tackle any particular emergency is insufficient, the Superintendent should be able to obtain additional labor force on short notice.

6.4 INDUSTRIAL WASTE INVENTORY/MONITORING SYSTEM

No industrial wastes are or will be discharged to the Primrose Creek Treatment Facility.

6.5 PRESERVING TREATMENT SYSTEM RECORDS

Even though strong efforts should be made to keep records in a convenient place, it is equally important that these records be preserved in case of an emergency. As a safeguard, duplicate records should be made and kept at different locations. The Superintendent should formulate record preservation systems with the personnel.

6.6 COORDINATING INSTRUCTIONS FOR LOCAL POWER AND FIRE DEPARTMENTS

The treatment facility Superintendent should develop the emergency response program with the involvement of the Cleburne County Sheriff's Department and fire departments of Heber Springs. He should discuss with members of each department, areas of participation and required assistance during emergencies. The responsibilities of the departments are as follows:

Police: The Cleburne County Sheriff's Department maintain a 24-hour personnel and communication system. Therefore, they will have a critical role to play during any emergency, particularly when the treatment facility is unattended.

It should be requested that regular police patrols be established to the treatment facility, especially during hours of darkness. The police department should also notify the

Superintendent of any event that might concern the treatment facility such as street spill, etc.. All emergency activities should be coordinated with the County Sheriff.

Fire: The fire department should be requested to make periodic inspections of the wastewater treatment facility and equipment, and to make recommendations. These recommendations should concern fire preventions, gas handling, on-site protection equipment and preparation for use by the City of Heber Springs Fire Department.

All staff members should pass a first aid course and be familiar with the best route to the Hospital Emergency Room.

The Fire Chief should be consulting during emergencies and he should notify the Superintendent of any fire or fire hazard that could endanger the wastewater treatment facility.

6.7 PERSONNEL RESPONSIBLITIES

The facility operator on duty, or the designated off-duty operator, shall notify the Superintendent of any emergency. He shall also request police or fire aid, if required. He shall also take any immediate action necessary to meet the emergency, prevent further damage and ensure the continued operation of the facility.

The Superintendent shall be responsible for obtaining additional assistance, as may be required, from other local departments, state agencies and private organizations. Because the operating staff of the wastewater treatment facility is small, outside help will usually be required during an emergency. The Superintendent will direct the activities of all personnel reacting to the emergency.

If the Superintendent is not available, his responsibilities will be executed by the Senior Operator.

Facility Operators will work under the Superintendent to direct the activities of assisting personnel to relieve the emergency and maintain the proper function of the wastewater treatment facility.

Each member of the wastewater treatment facility and collection system staff should be provided with a billfold size Emergency Response Card. This card should have the telephone numbers of the Superintendent, Fire Department, Cleburne County Sheriff's Office and Sewer Facility Chairman. The Superintendent and operators should also have the telephone numbers of the State Police, the Arkansas Department of Environmental Quality and local staff members.

The card should give the location of the main Emergency Response Center and alternate location. The card should also provide specific instructions for each person, if possible.

6.8 EMERGENCY RESPONSE CENTER

In case of an emergency, all necessary personnel and equipment will meet at a designated location. If, for any reason, the designated location is not accessible, an alternate meeting location should also be designated.

During duty hours, it is the responsibility of the operator to notify the Superintendent of the emergency and take immediate corrective action. If the Superintendent is not available, the Senior Operator shall be notified.

During hours the facility is unattended, a duty schedule shall be prepared to ensure that a qualified person is available at a known location at all times. This schedule should be available for the Cleburne County Sheriff's Office and Superintendent. This person will be on call for problems that may occur at the wastewater treatment facility and shall start emergency operations when necessary.

6.9 AUXILIARY PERSONNEL REQUIREMENTS

Situations might arise when the treatment facility might not have enough personnel for daily operation or to handle an emergency. Auxiliary personnel from volunteers or through a mutual aid agreement to serve as back-up for regular employees should therefore be trained by the Superintendent. The Superintendent should have on hand the addresses and telephone numbers of all auxiliary personnel so that they can be easily reached when needed.

SECTION 7

SAFETY

7.0 GENERAL

The major danger inherent with wastewater treatment facilities is due to health hazards posed by noxious gases and various types of bacteria that might result from the treatment process. It is very important that all persons involved with the operation of the facility be knowledgeable is the safety practices to avoid such dangers.

The following factors are possible causes of injury in the treatment facility:

1. Personnel negligence
2. Faulty design or equipment
3. Improper operation
4. Equipment overload or breakdown
5. Inadequately trained employees.

The management and operational personnel should strive for injury prevention at all times using good judgment and adhering strictly to the recommended safety practices required by the Occupational Safety and Health Administration (OSHA). In case of an injury, the employee must report it immediately to the Superintendent. A suggested form for reporting injury is included here as Figure 7-1. Once an injury report is made, it is the responsibility of the Superintendent to investigate the cause and institute a method of prevention. He should follow up all other procedures required by management and insurance.

REPORT OF INJURY

Employee_____ Employee Number _____

Date & Time of Injury_____20__, A.M.____, P.M.____

Nature of

Injury_____

_____

_____

Cause of Injury (Improper work procedure, failure to use protective equipment, machine or tool failures, etc..) _____

_____

_____

Witnesses: 1: _____

2: _____

Recommendations to prevent a repetition of the accident _____

_____

_____

Reported by: _____

Reviewer's Remarks: _____

_____

_____

Reviewed by: _____

Figure 7-1

An overall knowledge of safety practices is important. Every employee should complete a standard Red Cross First Aid Curse. A list of several good reference books have been provided at the end of this section. These references should be made a part of the facility library; each employee should be familiar with their contents.

Operators should request that they be provided additional safety equipment or tools that they believe would be desirable.

7.1 SAFE PRACTICES

The following safety practices and recommendations are required by OSHA. These should be observed where applicable.

7.1.1 SEWERS AND WET WELLS

Sewer manholes, pump wet wells and similar below grade structures can be dangerous. Frequently the air does not contain enough oxygen to support life and carbon monoxide may be present. Other toxic gases and chemicals may be in the sewage; dumping gasoline and oil into sewers is a common occurrence. There are several basic rules that should be followed if a man is to enter a sewer manhole or other below grade structure.

1. Use a forced air blower to ventilate the structure both before entering and while inside the structure. Be sure the exhaust from engines does not enter the blower intake.

2. Use a gas detector to insure toxic gases are not present and that adequate oxygen is present.

3. The man entering the structure should have a safety harness and a safety rope; at least two (2) man should be above the opening to pull the man out with the safety rope if necessary.

4. Do not trust manhole steps or permanent ladders. It is better to use a portable ladder stored elsewhere.

5. Do not smoke or use sparking tools.

6. If any symptoms of illness, such as headaches, dizziness or nausea are noted, leave the structure at once.

7. Do not enter any structure if a portable pump is operating inside.

7.1.2 FIRE AND EXPLOSION

Many of the common materials found around a typical wastewater treatment facility are flammable and under some conditions may explode. Many of the products of decomposing sewage are also flammable and explosive. In addition, materials with these characteristics may have been dumped into the sanitary sewerage system. Therefore, it is recommended that flammable materials not be stored at the facility, that waste materials and debris not be allowed to accumulate and that smoking and open flames be restricted. Oils, lubricants and solvents should be present only in as small a quantity as practical. Cleaning rags should be kept in a sealed metal container, and only as many as necessary. Hydrogen, methane, hydrogen sulfide and other gases are flammable and possibly explosive. They can be found in the natural decomposition of sewage. Some of the gases are heavy and lay in low areas, others are light and rise to the top. Keep open flames, sparking tools, electric motors and smoking materials out of sewers, headworks and pumping system.

If gasoline, oil or other flammable materials are observed entering the facility, the pumping system and headworks power should be disconnected to prevent an explosion

and to hold the material out of the main treatment units. The fire department should be called to remove the flammable material.

Keep the fire extinguisher charged and make sure everyone knows the location. Do not use water on electrical fires or flammable liquids. A clean well maintained facility is the best defense against fires.

7.1.3 HEALTH HAZARDS

Sewage by it's nature contains the organic source of a great many diseases. The disease organism can be acquired through direct contact with the wastewater or by inhaling the fine spray from the wastewater. Even the completely treated wastewater may still contain some of the organisms.

There are two basic protective measures to follow; prevent disease entry into the body and destroy those organisms that do enter the body.

1. Prevent Entry - Avoid body contact with the wastewater. Keep the body as clean as possible. Wash face and hands frequently, especially if body contact may have occurred. Use gloves, boots and face mask when possible.

Do not connect water hoses to wastewater equipment or allow them to enter wastewater basins. There is always the possibility of back-siphonage through the water hose into the water distribution system. Water from the various water outlets in the facility area should be tested regularly for bacteria content to be sure the water is safe for human consumption.

2. Internal Defense – It is important that the facility staff members be in good health. They should not work within the facility area when their body resistance is low due to colds, infections or similar disorders. Each staff member should have a physical

examination at least every two years and should be immunized as recommended by his doctor.

The Primrose Creek Association should furnish working uniforms for the facility employees. These work uniforms should be washed in a commercial laundry, not washed with other family clothes.

The following rules should be observed by all facility personnel:

1. Do not put hand or fingers in the mouth, nose or eyes while working. Fingernails should be cut short always.
2. Hands should be thoroughly washed before eating, smoking or leaving work.
3. Rubber gloves should be used whenever possible by operating personnel.

Cuts, abrasions and any type of skin injury should be treated immediately. Also, cuts and scratches should be treated immediately with 2% tincture of iodine solution and a doctor should be called for all major injuries.

7.1.4 ELECTRICAL EQUIPMENT HAZARDS

This wastewater treatment facility is an electric powered system with a fair amount of electrical equipment. Operators should not handle electrical equipment except under the close supervision of competent electrical technicians.

While working with electrical equipment, the following rules should be followed as a safety measure:

1. Allow only authorized people to work on electrical equipment and repairs.
2. Keep wires from becoming a tripping hazard.
3. Keep rubber mats on the ground in front of electrical panels; keep edges trimmed so that they do not become a tripping hazard.

4. Keep all electrical controls accessible and well marked.

5. Do not ground yourself in water or on pipes or drains. Avoid them when working near any electricity.

6. Work in pairs around electrical equipment.

7. Never use metal ladders around electrical equipment.

8. Place "Man on Line" signs and lock the switches when working on electrical equipment which another person can turn on.

9. Handle breaker wires as though they were live wires.

10. Ground all electrical tools.

11. When there is a question about any electrical hazard, ask before you expose yourself to it.

12. When working around electrical equipment, as with any other hazardous work, keep your mind on the hazards at all times.

13. Do not use any part of your body to test a circuit.

7.1.5 MECHANICAL EQUIPMENT HAZARDS

There are many pieces of moving mechanical equipment. Most of this equipment is also heavy and some are near deep liquid basins or wetwells. The guards around moving parts must be in place at all times, even when testing and checking. The following general rules should be followed:

1. Before lubricating or working on any machine, it is imperative that the power switch be turned to OFF and that the control panel master disconnect be pulled to OFF.

2. Do not lift or hold equipment by your physical strength. Always use jacks or hoists. Do not assume that these lifting devices will hold. Stand well away and place wooden blocks under the machine.

3. Follow the manufacturer's instructions on repair procedures.

4. When working near deep water or on high places, use a safety harness with a short roped tied to a sturdy support.

5. Use gloves, safety shoes, hard hats, goggles, and other protective clothing as appropriate.

6. Many machines develop sharp edges after a period of use or repair; these edges and irregularities should be files smooth.

7. Equipment supports, hangers and stairways should be regularly inspected for loose bolts and rust. Repairs should be made immediately.

7.2 SAFETY EQUIPMENT

In previous sections of this chapter, the need for certain pieces of safety equipment has been discussed. This equipment will need to be furnished by the Primrose Creek Association and the individual user. An introductory list is given below. Additional equipment may be added as the need is presented.

1. Safety Helms to provide head protection from falling or flying objects and from limited electric shock.

2. Ear Protectors required in areas of high noise levels.

3. Goggles where there is a reasonable probability of eye injury that can be prevented.

4. Protective Creams protect the skin from oils, greases, paints and dust.

5. Gloves to prevent injuries while handling pipe, tools, chemicals, solvents, and similar materials.

6. Boots with metal foot guards required for working around air equipment, manholes, and other heavy equipment.

7. Oxygen Deficiency Indicator required for testing for low oxygen levels in enclosed areas.

8. Portable Air Blower used for ventilating manholes and other subterraneous structures before entering.

9. Hose Mask used in atmospheres immediately hazardous to life or health. A standby man is required to be present with the proper rescue equipment in case of respiratory failure.

10. Chlorine Canister Masks required to be present where there is handling of chlorine. This mask is used in protection against chlorine gas leaks, but must be used in atmospheres containing sufficient oxygen.

11. Safety Harness required where individuals are exposed to hazardous atmospheres.

7.3 SAFETY REFERENCES

MOP No. 1 – Safety in Wastewater Works.

MOP No. 7 – Sewer Maintenance, Chapter 9.

MOP No. 11 – Operation of Wastewater Treatment Plants, Chapter 31.

MOP No. 18 – Simplified Laboratory Procedures for Wastewater Examination, Section I.

Manual of Wastewater Operations, Texas Water Utilities Association, Chapter 35.

Fisher Safety Manual, Fisher Scientific Company.

Handbook of Occupational Safety and Health Standards for Water Utilities, American Water works Association.

Safety in the Operation and Maintenance of Wastewater Treatment Works, U.S. Environmental Protection Agency.

MOP is the Water Pollution Control Federation Manual of Practice

To obtain these books write:

Water Pollution Control Federation

2626 Pennsylvania Ave., N.W.

Washington, DC 20037