3.18 Utility Water System

A. Potable water is used at the treatment plant for making chlorine solution, pump seal water, flushing water, yard hydrants and wall hydrants. The water from the water supplier is discharged to an atmospheric sump through a control valve. An air gap is provided to prevent backsiphonage. The water from the sump is pressurized by two (2) horizontal, close-coupled centrifugal pumps.

B. A control panel has been provided for the operation of the two (2) pumps. The controls are designed for one (1) pump to operate continuously as the lead pump with the second pump called if the pressure drops below a certain set point. If the pressure were to continue to drop below a second set point, an alarm would be sounded. Unfortunately, the control panel is not functional and parts are not available. Presently, one pump is put in the 'hand' position and let to run continuously. If a pump failure occurred, the failure would not be annunciated and the second would not be automatically started. As a result, the disinfection system would not be in operation and this condition could exist for up to twenty (20) hours before being detected. It is recommended that a completely new control system be installed.

C. The seals on both pumps are leaking and the pumps have been rebuilt several times. It is recommended that either before or during the replacement of the control panel that both pumps be replaced.

D. The treatment plant does not have a utility water system with wall and yard hydrants throughout the plant site that would provide flushing or housekeeping water at each treatment unit. In addition, the treatment plant receives a bill for potable water of approximately $1200.00 each month. It is recommended that a utility water system that uses filtered treatment plant effluent water be designed and installed.

3.19 Chlorination System

A. The chlorination system consists of the following items:

- One (1) one-ton cylinder with tank mounted vacuum regulator.
- Two (2) 100 lb. cylinders with tank-mounted vacuum regulators.
- One (1) automatic gas valve with a 100 ppd Rotometer.
- One (1) 100 ppd manually controlled rate valve.
- One (1) 100 ppd ejector with a potable water supply for vacuum production and chlorine solution.
- Scales for each cylinder with low weight alarms.
- Automatic switchover from the ton cylinder to the 100 lb. Cylinder when the ton cylinder is out of chlorine.

B. All regulators are new and the automatic gas valve has recently been serviced.

C. The one (1) ton cylinder was located out of doors for at least fifteen (15) years and operated satisfactorily. For some reason, the plant personnel were advised or directed to install the ton cylinder in the Control Building. The cylinder is presently located in an unsafe area that is not designed to house a hazardous gas. If a leak were to occur, the entire Control Building could fill with chlorine gas and a significant amount of damage to equipment would occur and to personnel if they were in the Building at the time a leak occurred. It is recommended that the one (1) ton cylinder be relocated outdoors immediately.

3.20 Sludge Removal

A. Sludge from the Secondary Clarifiers is removed continuously via telescopic valves and returned to the headend of the treatment plant. The telescopic valves are hard to operate and need some maintenance work. Unfortunately, this cannot be accomplished until the influent valves to the clarifiers have been replaced so each tank could be isolated and partially drained.

B. Sludge from the Primary Clarifiers, which is a combination of Primary and Secondary sludge, is removed from each clarifier via telescopic valves and discharged to a sludge pit attached to the side of each clarifier. Scum from the sludge skimmer is also discharged to the pit. A mixer is located in each pit to blend the sludge and scum. The mixer motors have recently been replaced and all equipment is operating satisfactorily.

3.21 Primary Clarifier Sludge Pumps

A. The original duplex piston pumps have been removed. One (1) suction-lift, self-priming type centrifugal pump with a sludge grinder in the suction piping has been installed. A second pump with valves and fittings are in the Control Building but not installed. It is recommended that the pump and piping be installed as soon as possible.

B. The Primary Clarifier Sludge Pumps pump sludge from the Primary Clarifier Sludge Pits to the Anaerobic Digesters. Presently, there is no meter located in the discharge piping to measure and totalize the amount of sludge wasted. It is recommended that a magnetic flowmeter be installed.

3.22 Anaerobic Digesters

A. In 1985, major rehabilitation of the digesters was completed that included the following:

- Removal and replacement of both floating covers.
- Draining and cleaning of each tank.
- Installation of gas recirculation equipment.
- Installation of new gas collection equipment.
- Replacement of heater controls

B. Shortly after the digesters were cleaned, the Automatic Filter Screen and Grit Chamber were placed into operation. Considering this, it is felt that the tanks would not have a significant accumulation of grit and rags that would rob the tanks of useful volume, and, as a result, cleaning of the tanks at present should not be required.

C. The digester boiler is original equipment. It is reported that the water tubes have been replaced several times, some of the sludge tubes are in poor condition and some of the appurtenant equipment located on the boiler need to be replaced. It is recommended that the boiler be replaced.

D. The gas recirculation system is not operable and hasn't been used for several years. It is recommended that the equipment be inspected by the manufacturer's representative to determine whether it is cost effective to repair or replace the unit.

E. The rollers for the covers are in poor condition and should be replaced.

F. Some of the gas handling equipment such as drip traps, moisture and sediment accumulators and pressure/vacuum relief valves have been removed. These items should be purchased and installed.

G. Maintenance work is required on the gas manometer and gas flowmeter system.

3.23 Digested Sludge Transfer

Digested sludge is transferred from the digesters to a Sludge Well at the Control Building. Transfer of the sludge is controlled by a bubbler level system in the well and an air-operated plug valve in the transfer pipe. The equipment has operated relatively trouble free for several years and no recommendation for repair or replacement is made at this time.

3.24 Centrifuge Loading Pumps

A. Two (2) progressive cavity pumps with mechanical variable speed drives are located in the basement of the Control Building. The pumps withdrawal sludge from the sludge well and pump the sludge to the centrifuge. The centrifuge control panel controls the operation of the pumps. Both pumps and drives are in good operating condition and no action recommended to be taken.

B. No flowmeter exists in the discharge piping to the centrifuge. It is recommended that a 4" magmeter be installed to indicate and totalize the amount of sludge processed.

3.25 Centrifuge

A. The centrifuge is relatively new and in good working condition. Operation of the centrifuge is usually required only one (I) or two (2) days per week and a sludge cake of approximately 24% is usually obtained.

B. Sludge cake from the centrifuge is discharged to a screw conveyor that was installed with the centrifuge. The screw conveyor conveys the sludge a short horizontal and vertical distance to a horizontal flat belt conveyor, which in turn discharges to an inclined troughing belt conveyor for disposal of the sludge to a 20 cubic yard container located outside the Control Building. Both belt conveyors are original equipment and significant portions of the frames are corroded. In addition, the drive systems, belt tensioners and some rollers need replacement. It is recommended that both conveyors be removed and replaced with a single conveyor.

3.26 Polymer System

The polymer makeup system is completely manual. The operator drains a known amount of emulsion polymer into a container and then empties the container into a tank with a mixer that is located in the upper level of the Control Building. A known amount of water is manually added to the tank through a meter and mixed for several minutes to obtain a uniform and thinner emulsion. When the operator notices that the polymer storage tank located in the basement of the Control Building is low, the drain valve for the mix tank on the upper level is opened and the tank drains by gravity to the storage tank below. The operator repeats this process up to thirty (30) times a day! It is recommended that an automatic makeup and blending system be installed.

3.27 Diesel Powered Generator

A 200 kw, 240 volt, 3 phase diesel-powered generator with an automatic transfer switch is located in the basement of the Control Building. The generator is exercised usually every other Friday for 30 to 45 minutes under load. The generator powers everything in the plant with the exception of the Automatic Filter Screen, Grit Chamber and Secondary Trickling Filter pumps. The generator and transfer switch are original equipment. The generator is reported to be in good operating condition. However, intermittent problems have been encountered with the transfer switch. Considering the age of the transfer switch, it is recommended to be replaced.

4.0 Sewage Pumping Stations

4.1 General

The following eighteen (18) pumping stations are located in the Bristol Township Authority's sewage collection system:

- Croydon Acres
- Croydon Manor
- Croydon Park
- Bristol Park
- State Road
- College Park
- Delhaas
- FDR
- Silver Lake

- Margo Gardens
- Beaver Dam Road
- Palmer Avenue
- Radcliffe Street
- Atkins Avenue
- Keystone Park
- Hartel Street
- Delaware Avenue
- I-95 Pump Station

The Croydon Acres and FDR stations were constructed and in service prior to the construction of the Authority's collection system and treatment plant. These stations conveyed the wastewater to the Township of Falls treatment plant located at Newportville and Ford Roads. When the Authority's system was constructed, the discharge from these two (2) stations was routed to discharge to the Authority's system.

The Croydon Manor, Croydon Park, Silver Lake, Palmer Avenue, Radcliffe Street, College Park and Margo Gardens stations were constructed with the original system. As the original collection system was extended to serve development, the remaining pump stations were installed by Developers and dedicated to the Authority. The last pump station constructed was the I-95 station.

The Croydon Manor, Croydon Park, FDR, Croydon Acres, Silver Lake, Palmer Avenue and Delaware Avenue stations are of the concrete and masonry wet well and dry well design. Bristol Park, State Road, Delhaas, Margo Gardens, Beaver Dam Road, Keystone Park and Hartel Street are of the pre-engineered metal dry well and round concrete wet well type.

The College Park and Radcliffe Street stations were originally of the pre-engineered air ejector type station with the equipment installed in a metal well. Because of the inherent operating problems with these types of stations, each station was converted to a self-priming, suction lift station by installing the pumps, valves and controls in a concrete pit adjacent to the metal well and converting the well into a wet well.

The Atkins Avenue station is a pre-engineered, air ejector type station with a metal well. The I-95 station is a vacuum primed, suction lift station with the pumps, controls and valves installed in a small fiberglass enclosure mounted atop a six (6') foot diameter concrete wet well.

Appendix C provides detailed information about each pump station.

4.2 Condition of Pump Stations

From a mechanical and electrical standpoint, all the stations have been reasonably well maintained. All stations can handle peak wet weather flows and no overflows have been reported to occur. Over the years, the majority of the pumps in the original pump station have been replaced in kind. It is noted that the bubbler based control panels installed in several of the original pump stations have parts that are no longer available. It is recommended that these panels be either upgraded or replaced in the next few years. It is reported that the control panels are presently functioning well.

4.3 Alarm System

Each of the eighteen (18) stations has a high level float located in the wet well. When a high level condition occurs, the float switch closes and sends a signal via a dedicated pair of telephone lines to a Main Alarm Panel located at the treatment plant. During non-working hours, an alarm dialer will be activated to contact personnel to respond to the alarm condition.

The alarm system was installed twenty-six years ago and still remains functional with a reasonable amount of maintenance. However, when funds become available in the future, it is recommended that the system be replaced with equipment employing current technology.

4.4 Recommended Actions

In addition to the miscellaneous maintenance that is ongoing at each pump station, the following major items of work are recommended:

A. Palmer Avenue Pump Station

1. The last 12" X 8" wye in the elevated discharge manifold has developed a leak and a temporary gasket type patch was installed several months ago. It is imperative that the fitting be replaced as soon as possible. The Palmer Avenue Pump Station discharges wastewater from the northern portion of the collection system directly to the Lower Bucks Joint Municipal Authority's (LBJMA) treatment plant. Unfortunately, the forcemain is long and has a submerged discharge at the treatment plant. Careful planning and coordination will be required for this repair/replacement.

2. Representatives of LBJMA have indicated that their Authority will be proposing to charge Bristol Township for treatment at their plant on the basis of measured flow and not on the basis of the number of connections. Considering this, it is recommended that, if possible, a magnetic flowmeter be installed in the forcemain at the same time the wye fitting is being replaced.

B. Silver Lake Pump Station

1. A portion of the flow from the pump station is diverted to the Bristol Borough collection system for treatment at the Borough's plant. The remaining flow is conveyed to the Authority's treatment plant. Billing from the Borough is based on metered flow. The accuracy of the existing Doppler meter that replaced the original magnetic flowmeter is questionable. As a result, a new magnetic flowmeter and discharge valve are recommended to be installed.

2. In 1976, the Authority entered into a thirty (30) year agreement, which provided for the Township to have 0.5 MGD of capacity at the Borough's plant. Both parties have expressed a willingness to extend the Agreement and negotiations are underway for a new Agreement. Since recent monthly flows have periodically slightly exceeded the 3.0 rated capacity of the treatment plant,

consideration should be given to purchasing additional capacity in the future from the Borough. Several large developments are being proposed that are tributary to the Authority's treatment plant and it is questionable whether capacity will be available at the Authority's treatment plant. The cost to purchase additional capacity can be recovered by increasing the tapping fee.

3. A PLC Controller was recently installed to function in conjunction with the existing control panel. However, no operator interface was installed to allow the Authority personnel to change set points. It is recommended that the interface be installed in the near future.

C. I-95 Pump Station

This station is the least expensive type of pump station that a Developer could have been permitted to install. It has been a constant maintenance nightmare to the Township personnel and after hour callouts are becoming more frequent. It is recommended that the vacuum prime, suction lift type station be abandoned and a submersible type station be installed. The existing wet well would be used to house the pumps. Water service or lighting has not been provided at the site.

Consideration may be given to establishing a separate district for the area serviced by the station and enacting a surcharge to recover the replacement costs.

D. Atkins Avenue Station

This air ejector type station also has required a significant amount of maintenance since its installation. During a recent visit to the station, it was noticed that the influent flow to the station was approaching the station's capacity of 50 gpm.

The station has a small service area but one with a high groundwater table. A subsequent video inspection of a portion of the system revealed two (2) sources of significant infiltration. It is recommended that these leaks be repaired as soon as possible.

After the leaks have been repaired, the reserve capacity of the station should be evaluated. Even if it is determined that sufficient reserve capacity exists, funds should be budgeted for upgrading the station controls.

5.0 Gravity Sewer System

As shown in Figure 1, the Authority has an extensive gravity collection system. The majority of the system was installed in 1962 – 1963 using vitrified clay pipe (VCP). Pipe sizes range from 8" in diameter to the 36" influent trunk sewer to the treatment plant. In 1990, the specification for the sewer main material was changed from VCP to SDR18 PVC or Class 52 ductile iron pipe. It is noted that the comprehensive sewer map shown in Figure 1 has not been updated since 1991 to show extensions to the sewer system. It is recommended that the sewer map be revised to indicate recent extensions to the system.

The overall system is in good condition considering its age. Unfortunately, the collection system exhibits I/I problems during rain events. The portion of the system that is tributary to the treatment plant is not significant enough to exceed conveyance capacities in the collection and pumping station systems or create operating problems at the treatment plant.

However, both the Bucks County Water and Sewer Authority and the Lower Bucks Joint Municipal Authority have imposed connection bans to those portions of the collection system that are tributary to their systems due to high peak flows during rain events.

Because of insufficient funding, manpower and equipment, Bristol Township has never implemented a significant and continuous I/I abatement program. For the most part, maintenance of the collection system has been on a reactive basis instead of proactive.

The only major equipment item the Authority has for maintenance of the collection system is a high pressure jet washer. However, the last three times a washer was purchased it was used equipment sold by other Sewer Authorities. Needless to say, the equipment required constant maintenance and was often unreliable.

Reduction of I/I will be important if the Township is to proceed with some of the proposed developments. In order to implement an effective I/I reduction program, there must be proper equipment and staffing available. It is recommended that a new high pressure jet washer, a lateral camera and sewer main video inspection equipment be purchased.

6.0 Staffing

In order to maintain reliable operation at the treatment plant and pump station, properly maintain the collection system and implement an I/I reduction program, it is recommended that, as a minimum, the following staff be in place:

Position	No. of Employees
Superintendent	1
Plant Operators	2
Mechanics	2
Mechanic Helper	1
Sewer System Crew	3

7.0 Estimated Costs

The estimated present day costs to implement the recommended actions are as follows:

7.1 Treatment Plant

A. Maintenance	
• Preparation of O&M Manual	$ 20,000
B. Replace Influent Sampler	6,000
C. Wet Well	
• Install Influent Flowmeter	3,000
• Repair/Replace Sluice Gate	5,000
• Install pH Meter/Recorder	6,000
D. Influent Pumps	
• Replace Suction and Discharge Valves	30,000
• Replace Pump Control Panel	15,000
• Service Electro-Magnetic Clutches and Controls	4,000
E. Filter Screen and Grit Chamber	
• Service Filter Screen	15,000
• Service Grit Screw	2,000
F. Primary Clarifiers	
• Replace Collector Drives	80,000
• Replace Bridges	20,000
• Repairs to Submerged Mechanism	2,000
• Raise Scum Troughs	1,000
G. Distribution Box	
• Replace Electric Actuators	12,000
• Miscellaneous Repairs to Sluice Gates	2,000
H. Secondary Trickling Filter Pumps	
• Replace Transducers	2,000
• Install Alarms	3,000

I. Secondary Clarifiers

• Replace Influent Valves	40,000
• Install Scum Collection Equipment	25,000
• Replace Collector Drives	80,000
• Replace Bridges	20,000
• Repairs to Submerged Mechanism	2,000

J. Chlorine Contact Tanks

• Install Mixer	6,000
• Clean and Install Protective Coating	15,000

K. Recirculation Pump Station

• Replace Pumps and Motors	28,000
• Install VFDs and Controller	8,000

L. Utility Water System

• Replace Pumps	6,000
• Replace Control Panel	6,000
• Install Non-Potable Water Utility System	40,000

M. Sludge Removal

• Maintenance on Telescopic Valves	2,000

N. Primary Clarifier Sludge Pumps

• Install Second Pump and Piping	3,000
• Install Flowmeter	7,000

O. Anaerobic Digesters

• Replace Boiler	40,000
• Repair/Replace Gas Recirculation System	40,000
• Replace Cover Rollers	15,000
• Replace or Repair Gas Collection and Safety Equipment	50,000
• Clean Interior Piping and Replace Defective Valves	20,000

P. Centrifuge Loading Pumps

• Install Flowmeter	5,000

Q. Centrifuge

- Replace Belt Conveyors 35,000

R. Polymer System

- Install Labor Saving Automatic Feed System 25,000

S. Generator

- Replace 800 Amp Transfer Switch 30,000

Total $ 776,000

7.2 Pump Stations

A. Control Panels

- Modify Control Panels to Various Pump Stations ($3000/YR for 5 Years) $ 15,000

B. Palmer Avenue P.S.

- Replace Defective Wye 20,000
- Install Flowmeter 8,000

C. Silver Lake P.S.

- Replace Meter and Valve 10,000
- Install Operator Interface 600

D. I-95 P.S.

- Replace with Submersible Pumps and Valve Chamber and Provide Water Service and Lighting 90,000

E. Atkins Avenue P.S.

- Repair Leaks in Collection System 6,000
- Upgrade Controls and Equipment 10,000

Total $ 159,600

7.3 Gravity Sewer System

• Purchase High Pressure Jetter	$ 85,000
• Update Sewer Map	5,000
• Purchase Lateral Camera	7,000
• Purchase Sewer Main Video Inspection Equipment	100,000
• Allocate a Minimum of $50,000/Yr for I/I Repairs for next Four (4) Years and $10,000 this Year	210,000
Total	$ 407,000
Total Estimated Installed Costs	$1,342,600
10% Contingency	134,260
Subtotal	$1,476,860
Engineering, Legal And Administration	$ 153,140
Total	$1,630,000

8.0 Recommended Five (5) Year Capital Improvement Plan

The following is the recommended plan for implementing the recommended actions and estimated costs discussed in the previous sections of the Report. The highest priority is given to reducing the possibility of pollution incidence, NPDES Permit exceptions or significant reduction in system reliability. Also considered is work related to reducing I/I in the system so that proposed projects can proceed without delay. The Authority's fiscal year runs from April 1 to March 31.

8.1 Fiscal Year 06-07

• Replace Defective Wye and Install Meter in Palmer Avenue P.S.	$ 28,000
• Replace Meter and Valve and Install Operator Interface at Silver Lake P.S.	10,600
• Repair Sewer Main Leaks in Atkins Ave.	6,000
• Update Sewer Map	5,000
• Upgrade Pump Station Controls	3,000
• Purchase High Pressure Jetter	85,000
• Purchase Lateral Camera	7,000
• I/I Repairs	10,000
• Replace Influent Pump Control Panel	15,000
• Install Chlorine Mixer	6,000
• Install Second Primary Sludge Pump	3,000
• Service Grit Screw	2,000
• Raise Scum Troughs	1,000
Total	$ 181,600
10% Contingency	18,160
Engineering, Legal & Administration	20,345
Total for Fiscal Year 06-07	$ 220,105

8.2 Fiscal Year 07-08

• Preparation of O&M Manual	$ 20,000
• Replace Influent Sampler	6,000
• Service Electro-Magnetic Clutches and Controls	4,000
• Service Filter Screen	15,000
• Repairs to Primary Clarifier Submerged Mechanisms	2,000
• Replace Transducers for Secondary Trickling Filter Pumps and Install Alarms	5,000
• Replace Utility Water Pumps	6,000
• Replace Utility Water Pump Control Panel	6,000
• Install Automatic Polymer Feed System	25,000
• I/I Repairs	50,000
• Purchase Sewer Main Video Inspection Equipment	100,000
• Upgrade Pump Station Controls	3,000
• Upgrade Controls at Atkins Avenue P.S.	10,000
• Replace Influent Valves to Secondary Clarifiers	40,000
• Install Scum Collection Equipment for Secondary Clarifiers	25,000
• Install Influent pH Meter/Recorder	6,000
Total	$ 323,000
10% Contingency	32,300
Engineering, Legal & Administration	38,915
Total for Fiscal Year 07-08	$ 394,215

8.3 Fiscal Year 08-09

• I/I Repairs	$ 50,000
• Upgrade Pump Station Controls	3,000
• Replace Suction and Discharge Valves for Influent Pumps	30,000
• Repair/Replace Wet Well Sluice Gate	5,000
• Replace Electric Actuator on Trickling Filter Distribution Box Sluice Gates and Miscellaneous Repairs to Gates	14,000
• Replace Primary Clarifier Collector Drives and Bridges	100,000
• Replace I-95 Pump Station	90,000
• Install Primary Sludge Pump Flow Meter	7,000
• Replace or Repair Digester Gas Collection and Safety Equipment	50,000
• Replace Digester Cover Rollers	15,000
• Replace Sludge Cake Conveyors	35,000
• Install Flowmeter for Centrifuge Loading Pumps	5,000
Total	$ 404,000
10%Contingency	40,400
Engineering, Legal & Administration	45,260
Total for Fiscal Year 08-09	$ 489,660

8.4 Fiscal Year 09-10

• I/I Repairs	$ 50,000
• Upgrade Pump Station Controls	3,000
• Install Influent Flowmeter at Treatment Plant	3,000
• Replace Secondary Clarifier Collector Drives and Bridges And Repairs to Submerged Mechanism	102,000
• Maintenance to Secondary Clarifier Telescopic Valves	2,000
• Clean and Install Protective in Contact Tanks	15,000
• Clean Interior Piping and Replace Defective Valves	20,000
Total	$ 195,000
10% Contingency	19,500
Engineering, Legal & Administration	21,845
Total for Fiscal Year 09-10	$ 236,345

8.5 Fiscal Year 10-11

• I/I Repairs	$ 50,000
• Upgrade Pump Station Controls	3,000
• Replace Generator Automatic Transfer Switch	30,000
• Replace Digester Boiler	40,000
• Repair/Replace Digester Gas Recirculation System	40,000
• Install Non-Potable Water Utility Water System	40,000
• Replace Recirculation Pumps and Install VFD and Controller	36,000
Total	$ 239,000
10% Contingency	23,900
Engineering, Legal & Administration	26,775
Total for Fiscal Year 10-11	$ 289,675