HICKORY ENGINEERING, INC.

March 27, 2003

Ms. J. Colleen Henry
Rachel Carson State Office Building
P.O. Box 8466
Harrisburg, PA 17105

Re: Jamestown Municipal Authority
Growing Greener New or Innovative Technology Grant - 351025
Final Report

Dear Ms. Henry,

In accordance with your letter dated December 2, 2002, attached is the final report for the referenced project.

Sincerely,
Hickory Engineering, Inc.,

Joseph P. Pacchoini, P.E

C: Albert G. Drake, JMA Chairman
01-003-09-02

3755 East State Street, Hermitage, PA. 16148
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JAMESTOWN MUNICIPAL AUTHORITY
GROWING GREENER NEW OR INNOVATIVE TECHNOLOGY GRANT
FINAL REPORT

I. Project Summary/Overview

The Jamestown Municipal Authority was awarded a Growing Greener grant for the use of a mixed oxidant generation system and bag filtration for an iron-manganese ground water well treatment system. This treatment system was incorporated into a potable water project that replaced the Authority's complete distribution system, water treatment plant and provided a new 230,000-gallon water standpipe.

II. Water Characteristics and Flows

A. Water Sources: The system uses three ground water wells. The wells are designated as the: Reservoir Well (33 GPM), the South Well (100 GPM) and the New Well (100 GPM). The system is designed to operate with either the South or New well as the primary sources and using the Reservoir Well as needed. The system can operate both the New and South Wells together for a period of not greater than 12 hours every 24 hours.

B. Water Characteristics:

1.

RAW WATER QUALITY, FEBRUARY 2003			
Parameter	South Well	New Well	Reservoir Well
Hardness, mg/l	43.6	54.3	39.3
Langliers Index	+0.14	0.0	+0.15
Iron, mg/l	0.327	0.494	0.120
Sulfur, mg/l	2	4	3
Dissolved Solids, mg/l	290	280	410
pH	8.2	8.0	8.2

2. The average daily water production for 2003 has ranged from 80,000 to 100,000 GPD. The system serves 346 customers (residential, commercial and institutional).

III. Site Description:

A. Ownership and Maintenance – The potable water system is owned by the Jamestown Municipal Authority. It is operated and maintained by the Borough of Jamestown through a lease back agreement. The Borough currently uses a contract operations and maintenance company to operate and maintain the potable water system.

B. Process and Description – Attached is a line schematic of the water treatment plant, the overall site plan and the plan view of the treatment plant. The components of the system and there use are as follows:

1. Raw Water Wells – Three ground water wells are used as the water supply for the service area. The operator daily selects which well or combination of wells will be operated for the day. The system is designed for a maximum daily flow of 144,400 GPD. The projected daily usage is 70,000 to 80,000 GPD. The control system will activate and deactivate the wells based on the water levels in the primary clear well, final clear well or the potable water standpipe.

2. Mixed Oxidant Generation System – A MIOX Sal 80 mixed oxidant generation system produces a mixed oxidant having similar properties to sodium hypochlorite but with better oxidizing capabilities. The mixed oxidant is injected into the raw water flow after the primary flow meter. A secondary feed is provided to allow injection after the final clear well but prior to the distribution system. The mixed oxidant generation system use NaCl (99% pure) to generate the mixed oxidant.

3. Primary Clear well – A 4,000-gallon primary clear well receives the chemically treated raw water. This water is provided with an average detention time of 40 minutes (minimum of 20 minutes) for reaction prior to being pumped to the bag filtration system. Two 100 GPM feed pumps pump the water from the primary clear well through the bag filtration system. Each pump can pump to either or both of the bag filtrations units.

4. Bag Filtration System – Two bag filters are used to remove any particulate matter in the flow stream. Each filter contains four cloth bags that have an opening of 5 to 200 microns depending on which size is installed. The bags are replaced once the filtering system reaches the maximum headloss. If the bags are not changed the control system will sense the

maximum headloss and shut down the treatment system until the operator changes the bags.

5. In-Ground Reservoir – After the bag filtration system the treated water flows to the in-ground 525,000-gallon reservoir. The reservoir is used as a staging area for the final clear well as well as for providing additional system storage. This reservoir can be taken off line for cleaning and maintenance by adjusting the flow control valves to allow the treated water to flow from the bag filtration system to the final clear well.

6. Final Clear well – A 4,000 gallon final clear well receives the treated water either from the in-ground reservoir or the bag filtration system for discharge to the potable water storage tank or the distribution system. The final clear well provides a maximum of 40 minutes and a minimum of 20 minutes of contact time to insure adequate disinfection. The in-ground reservoir also provides contact time for disinfection. Two 100 GPM pumps pump the treated water either the potable water standpipe or the distribution system. The primary flow path for the treated water is from the final clear well to the potable water standpipe then to the distribution system. The two pumps can operate as a lead/lag system, singularly or in parallel (to provide maximum flow to the potable water standpipe).

7. Potable Water Standpipe – A 230,000 gallon standpipe having an operating water height of 98 feet provides the operating pressure for the distribution system as well as a two day supply of water. The standpipe provides a minimum distribution system pressure of 42 PSI at the water treatment plant and a maximum water pressure of 96 PSI in the business district of the Borough. The standpipe is equipped with a pressure transducer to activate and deactivate the final clear well pumping system to maintain the water level in the standpipe.

C. Previous Treatment Problems

1. The previous treatment system was incapable of providing a potable water without being corrosive, without having taste and odor problems, and without periodic bacterial violations.

IV. Innovative Technology Description

A. Mixed Oxidant Generation System – This system was selected as a replacement to gas chlorination due to safety concerns and sodium

hypochlorite due to operational concerns with storage, handling and cost of the liquid. The mixed oxidant generation system utilizes food grade salt having a NaCl purity of at least 99%. The system produces a mixed oxidant solution having a standard chlorine concentration of 1,600% mg/l. The unit uses between 30 and 80 pounds of salt per day (amount varying with the water production). The projected cost for the salt usage on an annual basis is $1,200 to $1,700. The projected annual cost for electric to generate the mixed oxidant is $1,500 to $2,000. The annual cost is dependent on the daily volume of water required. The unknown this March is the failure of the first electrolytic cell. This is the cell that produces the mixed oxidant, in March the unit failed and was shipped back to the manufacturer for review, comment and replacement. It is unknown at this time why the cell failed, however, at $3,000 for a replacement, it is a concern. The mixed oxidant has provided a buffering capability that, to date, has allowed the Borough to operate the treatment system with out the use of soda ash for corrosion control. We acknowledge that the raw water quality has improved, and so may also be providing a natural buffering. However, the previous use of chlorine gas was observed to lower the natural pH of the water accentuating the corrosiveness of the water. In accordance with the PADEP system permit, the Authority is required to analyize the mixed oxidant for the following listed parameters. The PADEP has not set a limit on these parameters.

MIXED OXIDANT – PADEP REQUIRED ANALYSIS			
Month	Chlorite, mg/l	Bromide, mg/l	Bromate, mg/l
Dec., 2002	< 50	< 40	16
January, 2003	<500	<400	<50
February, 2003	<500	<400	<50

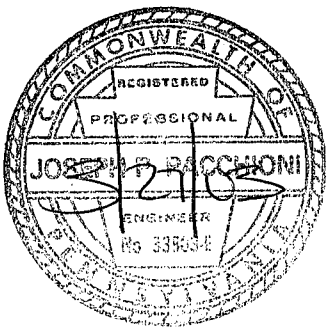
B. Bag Filtration System – The bag filtration system has operated adequately and is fully capable of removing particulate matter from the water. The oxidation of the iron, manganese and sulfur produces a fine brown floc that settles to the bottom of the primary clear well. The bag filters effectively remove this particulate matter from the flow stream. The operations staff is conducting trail runs using various size bags (5 to 200 micron openings) to see which performs best, with best being defined as which removes the particulate matter and lasts the longest time. The bag filtration system provider recommended a five-micron bag. This size was found to be to small plugging quickly. The operations staff is currently using 50-micron bags and is finding that one bag lasts one week. Based on this size the annual cost for the filtration system is $2,100. The price per bag is the same

for the 5 through 200 micron; the savings will be in the length of the time the bag will last before requiring replacement. The advantage to the bag filtration system is that no water is lost backwashing the filtration system. Generally, for a 100 GPM system the backwash water volume would range from 1,000 to 3,000 GPD for the raw water quality. The bag filtration system therefore saves an annual water volume of 365,000 to 1,095,000 GPD. Although saving water, the bag filtration system, using the 50 micron bag, produces 8 bags weekly that need to be disposed.

Submitted by
Hickory Engineering, Inc.,

Joseph P. Pacchioni, P.E.

C: Authority Members
01-003-09-02



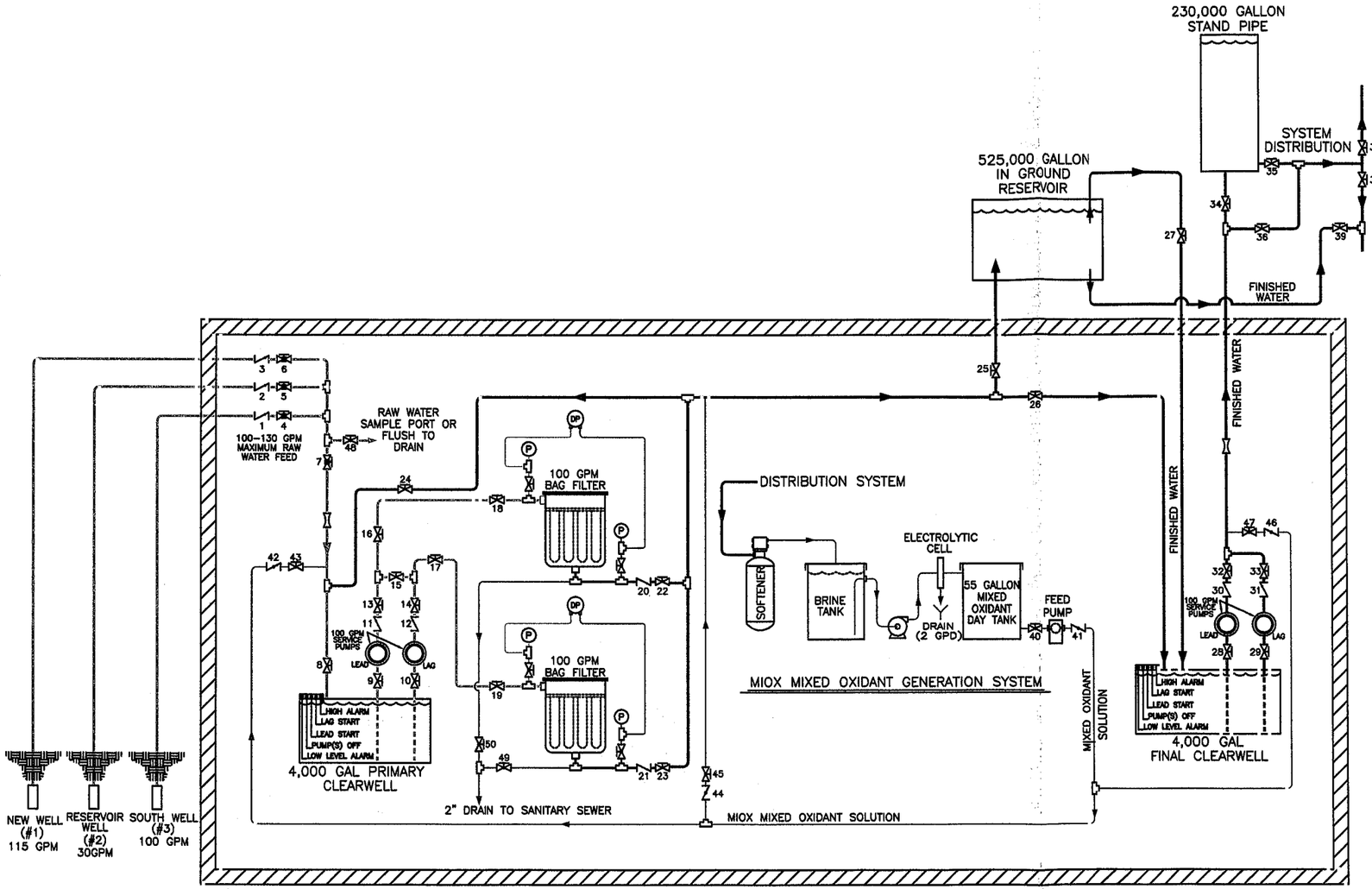
WATER TREATMENT PLANT MODE OF OPERATION

VALVE NUMBER	VALVE TYPE AND SIZE	PRIMARY	SECONDARY
1	CHECK VALVE 4"	OPERATIONAL	OPERATIONAL
2	CHECK VALVE 4"	OPERATIONAL	OPERATIONAL
3	CHECK VALVE 4"	OPERATIONAL	OPERATIONAL
4	PLUG VALVE 4"	*	*
5	PLUG VALVE 4"	*	*
6	PLUG VALVE 4"	*	*
7	PLUG VALVE 4"	NORMALLY OPEN	NORMALLY OPEN
8	BUTTERFLY VALVE 6"	NORMALLY OPEN	NORMALLY CLOSED
9	BUTTERFLY VALVE 6"	NORMALLY OPEN	NORMALLY CLOSED
10	BUTTERFLY VALVE 6"	NORMALLY OPEN	NORMALLY CLOSED
11	CHECK VALVE 6"	OPERATIONAL	OPERATIONAL
12	CHECK VALVE 6"	OPERATIONAL	OPERATIONAL
13	BUTTERFLY VALVE 6"	NORMALLY OPEN	NORMALLY CLOSED
14	BUTTERFLY VALVE 6"	NORMALLY OPEN	NORMALLY CLOSED
15	BUTTERFLY VALVE 6"	NORMALLY CLOSED	NORMALLY CLOSED
16	BUTTERFLY VALVE 6"	NORMALLY OPEN	NORMALLY CLOSED
17	BUTTERFLY VALVE 6"	NORMALLY OPEN	NORMALLY CLOSED
18	BUTTERFLY VALVE 4"	NORMALLY OPEN	NORMALLY CLOSED
19	BUTTERFLY VALVE 4"	NORMALLY OPEN	NORMALLY CLOSED
20	CHECK VALVE 4"	OPERATIONAL	OPERATIONAL
21	CHECK VALVE 4"	OPERATIONAL	OPERATIONAL
22	BUTTERFLY VALVE 4"	NORMALLY OPEN	NORMALLY CLOSED
23	BUTTERFLY VALVE 4"	NORMALLY OPEN	NORMALLY CLOSED
24	BUTTERFLY VALVE 6"	NORMALLY CLOSED	NORMALLY OPEN
25	BUTTERFLY VALVE 6"	NORMALLY OPEN	NORMALLY CLOSED
26	BUTTERFLY VALVE 6"	NORMALLY CLOSED	NORMALLY CLOSED
27	GATE VALVE 12"	NORMALLY OPEN	NORMALLY OPEN
28	BUTTERFLY VALVE 6"	NORMALLY OPEN	NORMALLY OPEN
29	BUTTERFLY VALVE 6"	NORMALLY OPEN	NORMALLY OPEN
30	CHECK VALVE 6"	OPERATIONAL	OPERATIONAL
31	CHECK VALVE 6"	OPERATIONAL	OPERATIONAL
32	BUTTERFLY VALVE 6"	NORMALLY OPEN	NORMALLY OPEN
33	BUTTERFLY VALVE 6"	NORMALLY OPEN	NORMALLY OPEN
34	GATE VALVE 8"	NORMALLY OPEN	NORMALLY OPEN
35	GATE VALVE 12"	NORMALLY OPEN	NORMALLY OPEN
36	GATE VALVE 8"	NORMALLY CLOSED	NORMALLY CLOSED
37	GATE VALVE 8"	NORMALLY OPEN	NORMALLY OPEN
38	GATE VALVE 8"	NORMALLY OPEN	NORMALLY OPEN
39	GATE VALVE 8"	NORMALLY CLOSED	NORMALLY CLOSED
40	BALL VALVE 1"	NORMALLY OPEN	NORMALLY OPEN
41	BALL CHECK VALVE 1"	OPERATIONAL	OPERATIONAL
42	BALL CHECK VALVE 1"	OPERATIONAL	OPERATIONAL
43	BALL VALVE 1"	NORMALLY OPEN	NORMALLY OPEN
44	BALL CHECK VALVE 1"	OPERATIONAL	OPERATIONAL
45	BALL VALVE 1"	NORMALLY CLOSED	NORMALLY CLOSED
46	BALL CHECK VALVE 1"	OPERATIONAL	OPERATIONAL
47	BALL VALVE 1"	NORMALLY CLOSED	NORMALLY CLOSED
48	BALL VALVE 2"	NORMALLY CLOSED	NORMALLY CLOSED
49	BALL VALVE 2"	NORMALLY CLOSED	NORMALLY CLOSED
50	BALL VALVE 2"	NORMALLY CLOSED	NORMALLY CLOSED

PRIMARY MODE – USES COMPLETE TREATMENT SYSTEM.

SECONDARY MODE – ALLOWS PRIMARY CLEAR WELL AND THE BAG FILTERS TO BE OFF LINE FOR MAINTENANCE.

* THE OPERATOR SHALL SELECT THE WELL OR THE COMBINATION OF WELLS TO OPERATE ON A DAILY OR WEEKLY CYCLE. THE OPERATOR MAY SELECT EITHER WELL No. 1 OR 3 OR COMBINATION OF 1 & 2 OR 2 & 3. WELL Nos. 1 & 3 MAY BE OPERATED TOGETHER IN EMERGENCIES, BUT IN NO CASE SHOULD THE WELLS BE OPERATING TOGETHER FOR MORE THAN 12 CONSECUTIVE HOURS.
WHEN OPERATING WELL COMBINATIONS 1 & 2 OR 2 & 3, BOTH BAG FILTERS MUST BE ON LINE. THE OPERATOR IS REQUIRED TO ADJUST VALVE Nos. 15, 16 & 17 ACCORDINGLY.



PROCESS FLOW DIAGRAM

GENERAL KEY	
CHECK VALVE	RAW WATER
BUTTERFLY VALVE	SETTLED WATER
PLUG VALVE	POTABLE WATER
TEE	DRAIN LINE
FLOW METER	MIXED OXIDANT SOLUTION
PRESSURE GAUGE	
DIFFERENTIAL PRESSURE	
BALL VALVE	
BALL CHECK VALVE	

HICKORY ENGINEERING, INC.
3755 E. STATE ST. HERMITAGE, PA. 16148
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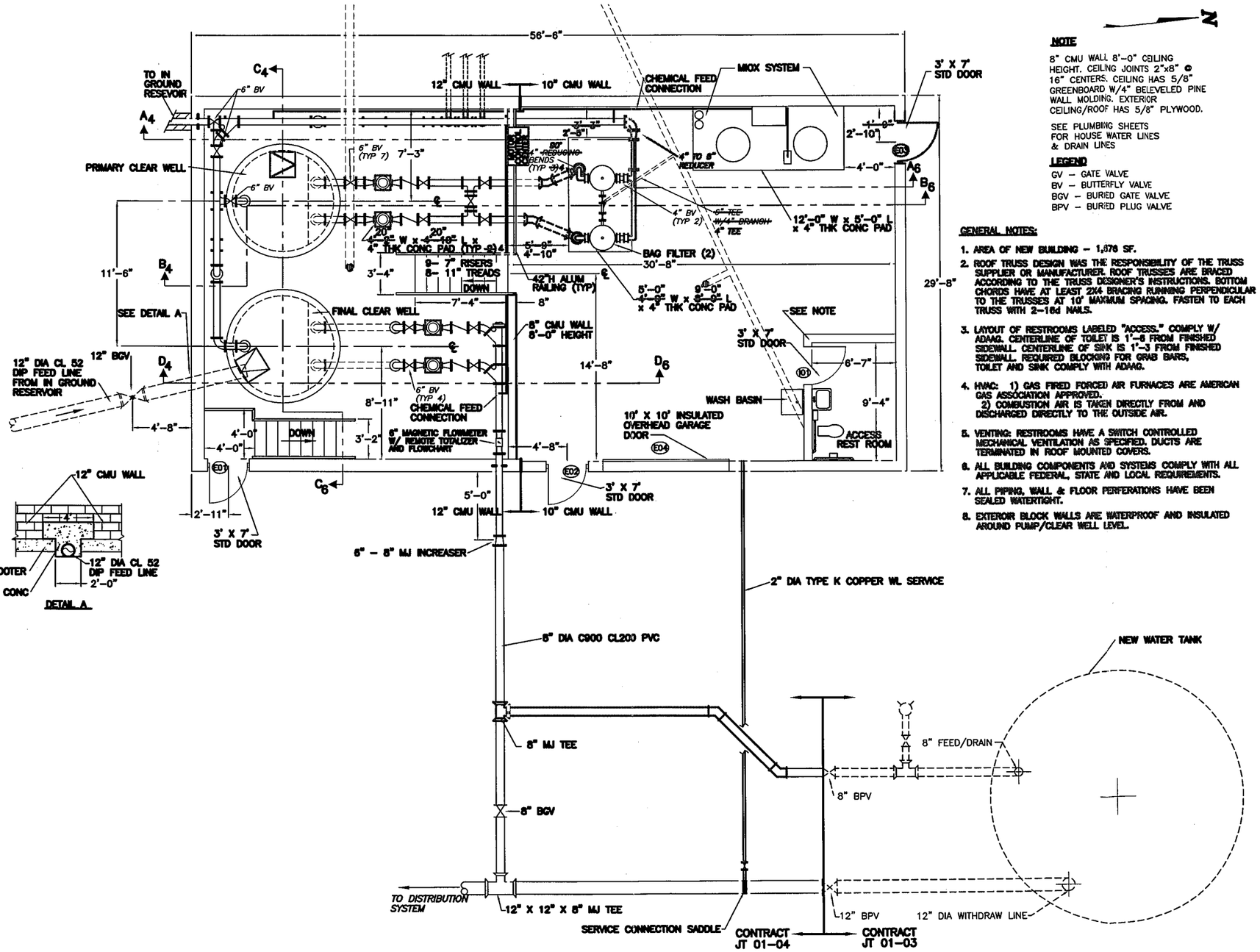
DATE: 01-27-03
DRAWN BY:
CHECKED BY:
APPROVED BY:
FILE: FLOW_DIAGRAM
PLOT @ 1 = 1

NO.	DESCRIPTION	DATE	BY	CHK'D

BOROUGH OF JAMESTOWN MERCER COUNTY, PENNSYLVANIA
JAMESTOWN MUNICIPAL AUTHORITY

WATER TREATMENT PLANT MODE OF OPERATION

SCALES
HOR. NONE
VER. NONE
PROJECT NO. 01-003-09-02
SHEET NO. 1 OF 1



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NOTE

8" CMU WALL 8'-0" CEILING HEIGHT. CEILING JOINTS 2"x8" @ 16" CENTERS. CEILING HAS 5/8" GREENBOARD W/4" BELEVELED PINE WALL MOLDING. EXTERIOR CEILING/ROOF HAS 5/8" PLYWOOD.

SEE PLUMBING SHEETS FOR HOUSE WATER LINES & DRAIN LINES

LEGEND

GV – GATE VALVE
BV – BUTTERFLY VALVE
BGV – BURIED GATE VALVE
BPV – BURIED PLUG VALVE

GENERAL NOTES:

1. AREA OF NEW BUILDING – 1,076 SF.
2. ROOF TRUSS DESIGN WAS THE RESPONSIBILITY OF THE TRUSS SUPPLIER OR MANUFACTURER. ROOF TRUSSES ARE BRACED ACCORDING TO THE TRUSS DESIGNER'S INSTRUCTIONS. BOTTOM CHORDS HAVE AT LEAST 2X4 BRACING RUNNING PERPENDICULAR TO THE TRUSSES AT 10' MAXIMUM SPACING. FASTEN TO EACH TRUSS WITH 2–16d NAILS.
3. LAYOUT OF RESTROOMS LABELED "ACCESS." COMPLY W/ ADAAG. CENTERLINE OF TOILET IS 1'–6 FROM FINISHED SIDEWALL. CENTERLINE OF SINK IS 1'–3 FROM FINISHED SIDEWALL. REQUIRED BLOCKING FOR GRAB BARS, TOILET AND SINK COMPLY WITH ADAAG.
4. HVAC: 1) GAS FIRED FORCED AIR FURNACES ARE AMERICAN GAS ASSOCIATION APPROVED.
   2) COMBUSTION AIR IS TAKEN DIRECTLY FROM AND DISCHARGED DIRECTLY TO THE OUTSIDE AIR.
5. VENTING: RESTROOMS HAVE A SWITCH CONTROLLED MECHANICAL VENTILATION AS SPECIFIED. DUCTS ARE TERMINATED IN ROOF MOUNTED COVERS.
6. ALL BUILDING COMPONENTS AND SYSTEMS COMPLY WITH ALL APPLICABLE FEDERAL, STATE AND LOCAL REQUIREMENTS.
7. ALL PIPING, WALL & FLOOR PERFERATIONS HAVE BEEN SEALED WATERTIGHT.
8. EXTERIOR BLOCK WALLS ARE WATERPROOF AND INSULATED AROUND PUMP/CLEAR WELL LEVEL.

DATE: 03-26-03
DRAWN BY:
CHECKED BY:
APPROVED BY:
FILE: TEMP2
PLOT @ 1 = 1

DESCRIPTION	DATE	BY	CHK'D

REVISIONS NO.

BOROUGH OF JAMESTOWN MERCER COUNTY, PENNSYLVANIA
JAMESTOWN MUNICIPAL AUTHORITY

WATER TREATMENT PLANT CONTRACT No. JT 01-04

WATER TREATMENT PLANT LAYOUT

SCALES	
HOR.	NONE
VER.	NONE
PROJECT NO.	01-003-09-02
SHEET NO.	OF
	1 1

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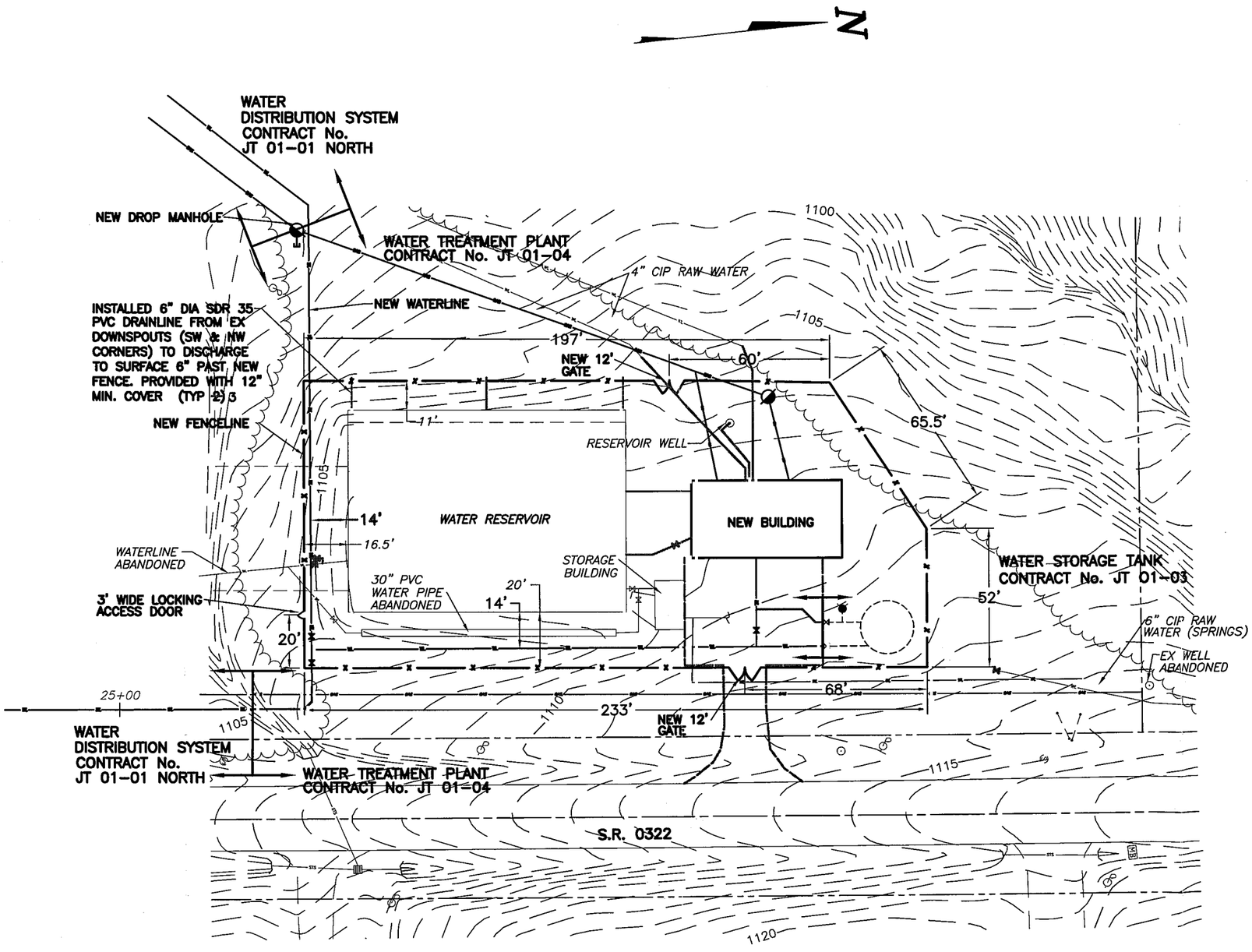

DATE: 03-26-03
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APPROVED BY:
FILE: TEMP
PLOT @ 1 = 1

REV. NO.	DESCRIPTION	DATE	BY	CH'K'D

BOROUGH OF JAMESTOWN MERCER COUNTY, PENNSYLVANIA
JAMESTOWN MUNICIPAL AUTHORITY

WATER TREATMENT PLANT CONTRACT No. JT 01-04

SITE PLAN

SCALES	PROJECT NO.	SHEET NO.	OF
HOR. NONE	01-003-09-02	1	1
VER. NONE			

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