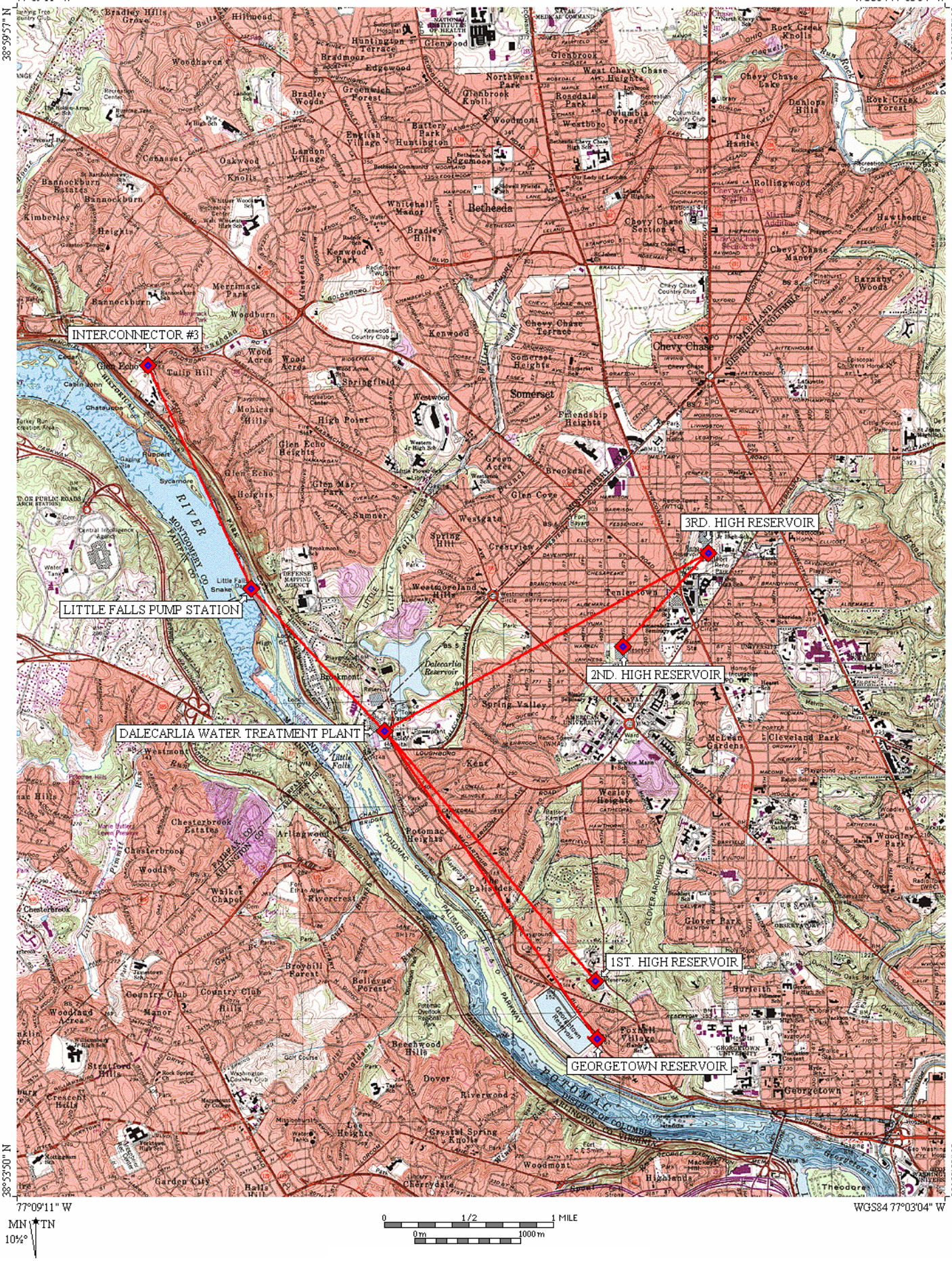

77°09'11" W
WGS84 77°03'04" W
38°59'57" N
38°53'50" N
INTERCONNECTOR #3
LITTLE FALLS PUMP STATION
DALECARLIA WATER TREATMENT PLANT
3RD. HIGH RESERVOIR
2ND. HIGH RESERVOIR
1ST. HIGH RESERVOIR
GEORGETOWN RESERVOIR
POTOMAC RIVER
MONTGOMERY CO
FAIRFAX CO
ARLINGTON CO
DISTRICT OF COLUMBIA
MARYLAND
VIRGINIA
MN
TN
10½°
0
1/2
1 MILE
0m
1000m

GEORGETOWN RESERVOIR

DATE: 3/18/2001

RADIO: METRICOM UTILINET SERIES 2 WANGATE WITH TUNED CAVITY BAND PASS FILTER

SITE NAME: GEORGETOWN RESERVOIR

SITE LAT/LONG: 38-54-39N 77-05-22W

PATH 1: DALECARLIA WATER TREATMENT PLANT

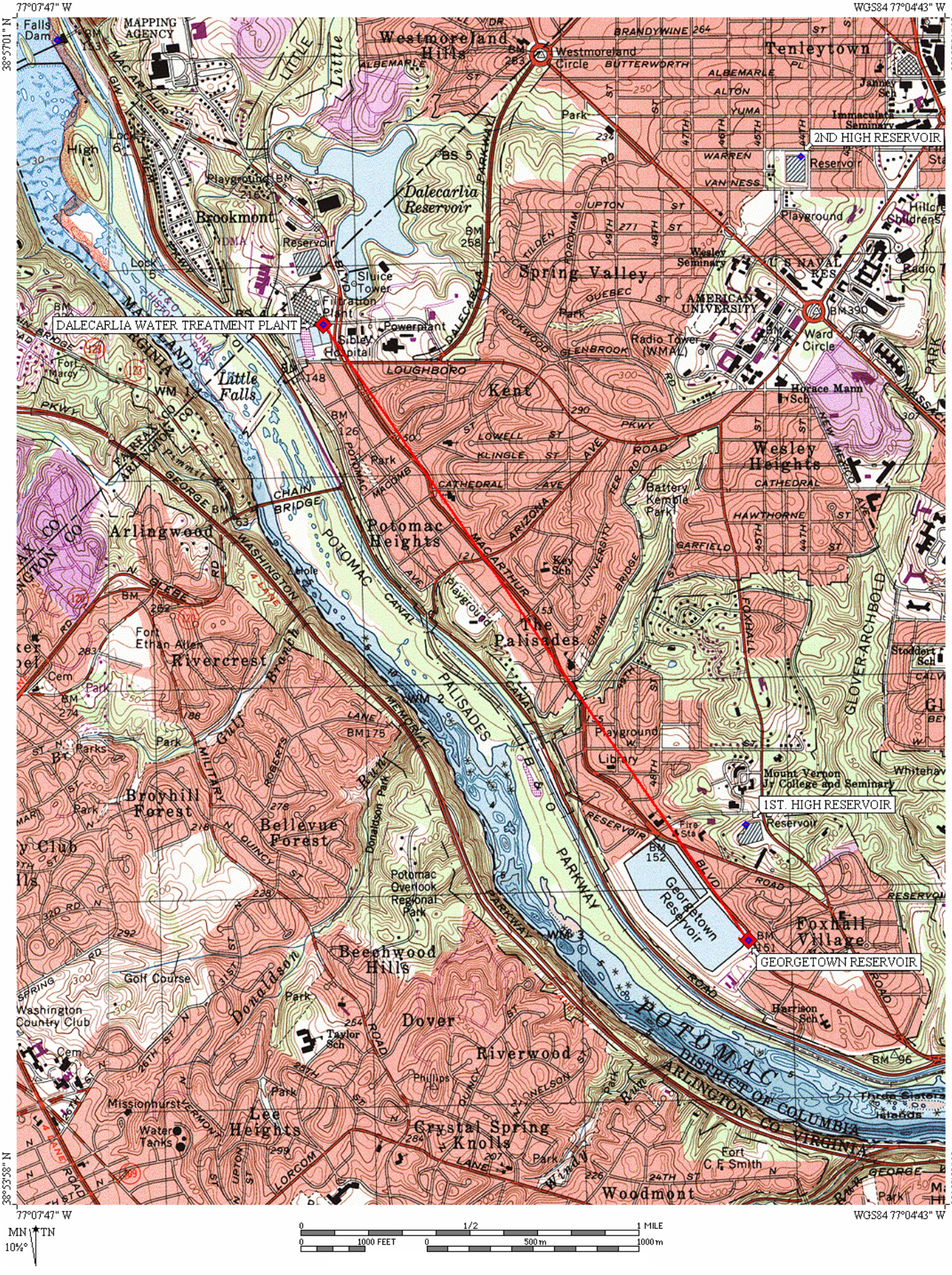
SITE LAT/LONG: 38-56-14N 77-06-46W

CAN ROUTE	TWO WAY	LAST DATA	LAST ACK	SM RSSI	ACK%	TIC%
Y	Y	Y	Y	140	100	100

The Georgetown Reservoir is an open reservoir with a 30 ft. building. The Metricom 900 MHz spread spectrum signal level from this location to the Dalecarlia Water Treatment Plant was recorded at 140 RSSI. The test was conducted utilizing a 5 dB 900 MHz Omni-directional antenna positioned on top of the building. The weather conditions for the test were clear with a temperature of about 50 degrees. It should be noted this survey was conducted during a minimal foliage season therefore a fade margin of 4 to 6 dB was built in to the path analysis to compensate.

RECOMMENDATIONS:

Utilize the Metricom Utilinet Series II Integrated WanGate 900 MHz spread spectrum radio with the mesh networking capability. The Metricom radio is the only radio with the ability to hop through multiple paths allowing for path redundancy and to insure an adequate path to all remote sites. It is recommended that 900 MHz tuned cavity band pass filters be utilized in this application due to expected future cell site transmitter interference. A tuned cavity band pass filter is a device, which can be physically tuned to eliminate interference outside the operating frequency bandwidth of the radio. Install a 10-foot metal pole to the top of the building. Mount a 6 dB yagi directional antenna to the pole with LMR 400 low loss cable


77°07'47" W
WGS84 77°04'43" W
38°57'01" N
38°53'58" N
DALECARLIA WATER TREATMENT PLANT
2ND HIGH RESERVOIR
1ST. HIGH RESERVOIR
GEORGETOWN RESERVOIR
Dalecarlia Reservoir
Brookmont
Spring Valley
Kent
Wesley Heights
Foxhall Village
Georgetown Reservoir
Potomac Heights
Arlingwood
Rivercrest
Palisades
Broyhill Forest
Bellevue Forest
Beechwood Hills
Dover
Riverwood
Lee Heights
Crystal Spring Knolls
Woodmont
Westmoreland Hills
Tenleytown
Mount Vernon Jr College and Seminary
American University
Wesley Seminary
Sibley Hospital
Fort Marcy
Fort Ethan Allen
Fort C.F. Smith
Potomac Overlook Regional Park
Donaldson Run
Little Falls
Chain Bridge
Key Bridge
Georgetown Reservoir
POTOMAC
DISTRICT OF COLUMBIA
ARLINGTON CO. VIRGINIA
MAPPING AGENCY
Falls Dam
Lock 6
Lock 5
Lock 4
Playground
Reservoir
Sluice Tower
Filtration Plant
Powerplant
Radio Tower (WMAL)
Ward Circle
Westmoreland Circle
Battery Kemble Park
Library
Fire Sta
Harrison Sch
Horace Mann Sch
Stoddert Sch
Key Sch
Taylor Sch
Wesley Seminary
Immaculata Seminary
Janney Sch
Hilton Childrens
U.S. NAVAL RES
Radio
Golf Course
Washington Country Club
Missionhurst
Water Tanks
Three Sisters Islands
MAC ARTHUR BLVD
CANAL
PARKWAY
MEMORIAL
GLOVER ARCHBOLD
MASSACHUSETTS AVE
WISCONSIN AVE
NEW MEXICO AVE
CONNECTICUT AVE
FOXHALL
ROCKWOOD PKWY
LOUGHBORO
GLENBROOK
QUEBEC ST
UPTON ST
WARREN
VAN NESS
ALBEMARLE
BRANDYWINE
BUTTERWORTH
YUMA
ALTON
HAWTHORNE
CATHEDRAL
GARFIELD
LOWELL
KLINGLE
ARIZONA
MACOMB
POTOMAC
WASHINGTON
GEORGE
QUINCY
DONALDSON
ROBERTS
MILITARY
GULF BRANCH
LITTLE FALLS BRANCH
MN 10½°
TN
1/2
1 MILE
1000 FEET
0
500m
1000m

1ST. HIGH RESERVOIR

DATE: 3/18/2001

RADIO: METRICOM UTILINET SERIES 2 WANGATE WITH TUNED CAVITY BAND PASS FILTER

SITE NAME: 1ST. HIGH RESERVOIR

SITE LAT/LONG: 38-54-57N 77-05-23W

PATH 1: DALECARLIA WATER TREATMENT PLANT

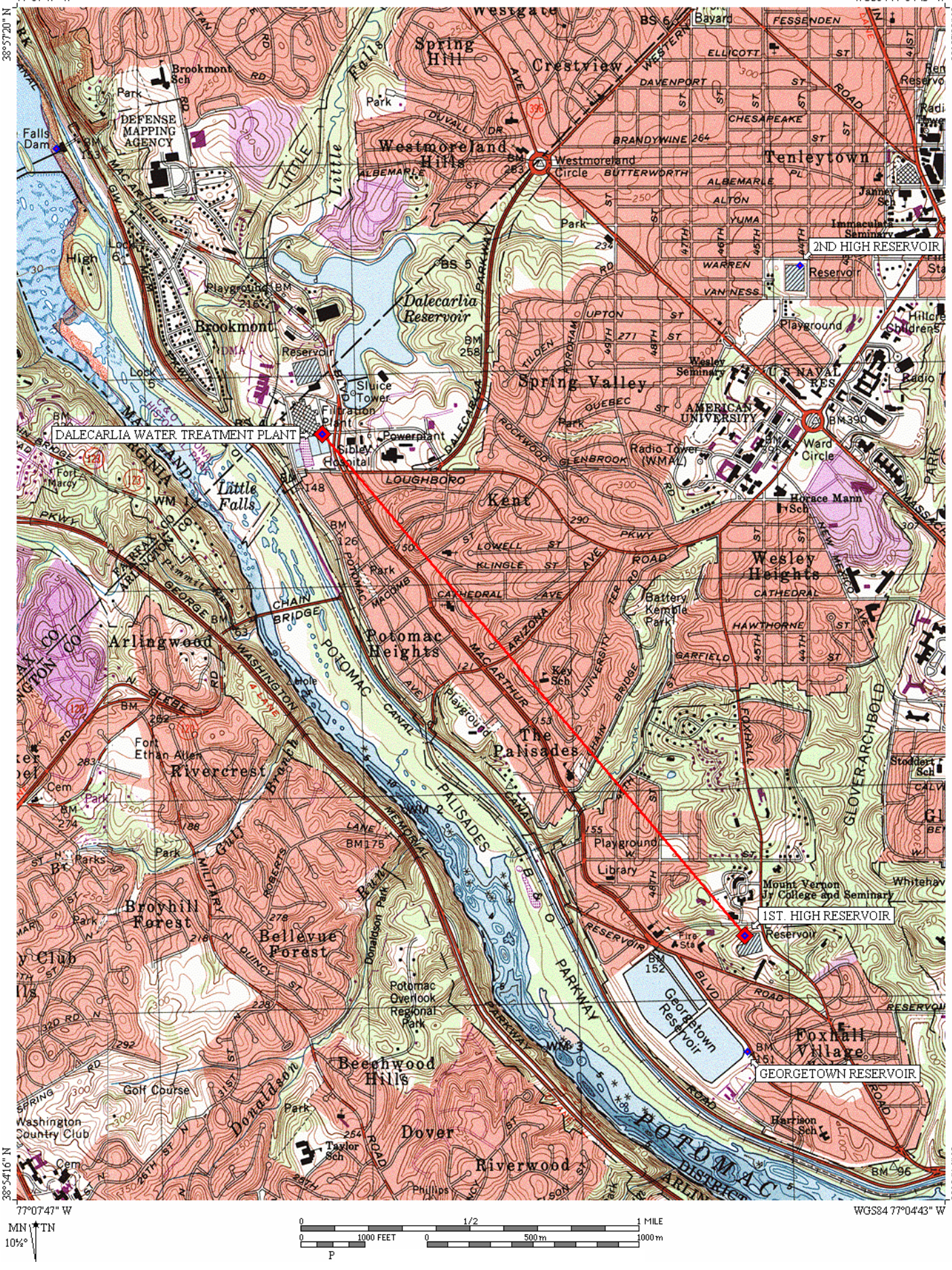
SITE LAT/LONG: 38-56-14N 77-06-46W

CAN ROUTE	TWO WAY	LAST DATA	LAST ACK	SM RSSI	ACK%	TIC%
Y	Y	Y	Y	131	100	100

The 1st. High Reservoir is an underground reservoir with a 10 ft. building. The Metricom 900 MHz spread spectrum signal level from this location to the Dalecarlia Water Treatment Plant was recorded at 131 RSSI. The test was conducted utilizing a 5 dB 900 MHz Omni-directional antenna positioned next to the building. The weather conditions for the test were clear with a temperature of about 50 degrees. It should be noted this survey was conducted during a minimal foliage season therefore a fade margin of 4 to 6 dB was built in to the path analysis to compensate.

RECOMMENDATIONS:

Utilize the Metricom Utilinet 900 MHz spread spectrum radio with the mesh networking capability. The Metricom radio is the only radio with the ability to hop through multiple paths allowing for path redundancy and to insure an adequate path to all remote sites. It is recommended that 900 MHz tuned cavity band pass filters be utilized in this application due to expected future cell site transmitter interference. A tuned cavity band pass filter is a device, which can be physically tuned to eliminate interference outside the operating frequency bandwidth of the radio. Install a 30-foot utility pole next to the building. Mount a 5 ft. metal pole to the utility pole with a 6 dB yagi directional antenna affixed to it with LMR 400 low loss cable.


77°07'47" W
WGS84 77°04'43" W
38°57'20" N
38°54'16" N
DALECARLIA WATER TREATMENT PLANT
2ND HIGH RESERVOIR
1ST. HIGH RESERVOIR
GEORGETOWN RESERVOIR
Dalecarlia Reservoir
Little Falls
Spring Hill
Crestview
Westmoreland Hills
Tenleytown
Brookmont
Spring Valley
Kent
Wesley Heights
Arlingwood
Rivercrest
Rotomac Heights
The Palisades
Foxhall Village
Broyhill Forest
Bellevue Forest
Beechwood Hills
Dover
Riverwood
Georgetown Reservoir
POTOMAC
MN TN
10½°
1 MILE
1000 FEET
500m
1000m

2ND. HIGH RESERVOIR

DATE: 3/18/2001

RADIO: METRICOM UTILINET SERIES 2 WANGATE WITH TUNED CAVITY BAND PASS FILTER

SITE NAME: 2ND. HIGH RESERVOIR

SITE LAT/LONG: 38-56-40N 77-05-12W

PATH 1: 3RD. HIGH RESERVOIR

SITE LAT/LONG: 38-57-09N 77-04-38W

CAN ROUTE	TWO WAY	LAST DATA	LAST ACK	SM RSSI	ACK%	TIC%
Y	Y	Y	Y	150	100	100

The 2nd. High Reservoir is an underground reservoir with a 10 ft. building. The Metricom 900 MHz spread spectrum signal level from this location to the 3rd. High Reservoir was recorded at 150 RSSI. The test was conducted utilizing a 5 dB 900 MHz Omni-directional antenna positioned next to the building. The weather conditions for the test were clear with a temperature of about 50 degrees. It should be noted this survey was conducted during a minimal foliage season therefore a fade margin of 4 to 6 dB was built in to the path analysis to compensate.

RECOMMENDATIONS:

Utilize the Metricom Utilinet 900 MHz spread spectrum radio with the mesh networking capability. The Metricom radio is the only radio with the ability to hop through multiple paths allowing for path redundancy and to insure an adequate path to all remote sites. It is recommended that 900 MHz tuned cavity band pass filters be utilized in this application due to expected future cell site transmitter interference. A tuned cavity band pass filter is a device, which can be physically tuned to eliminate interference outside the operating frequency bandwidth of the radio. Mount a 6 dB yagi directional antenna to the pole with LMR 400 low loss cable.

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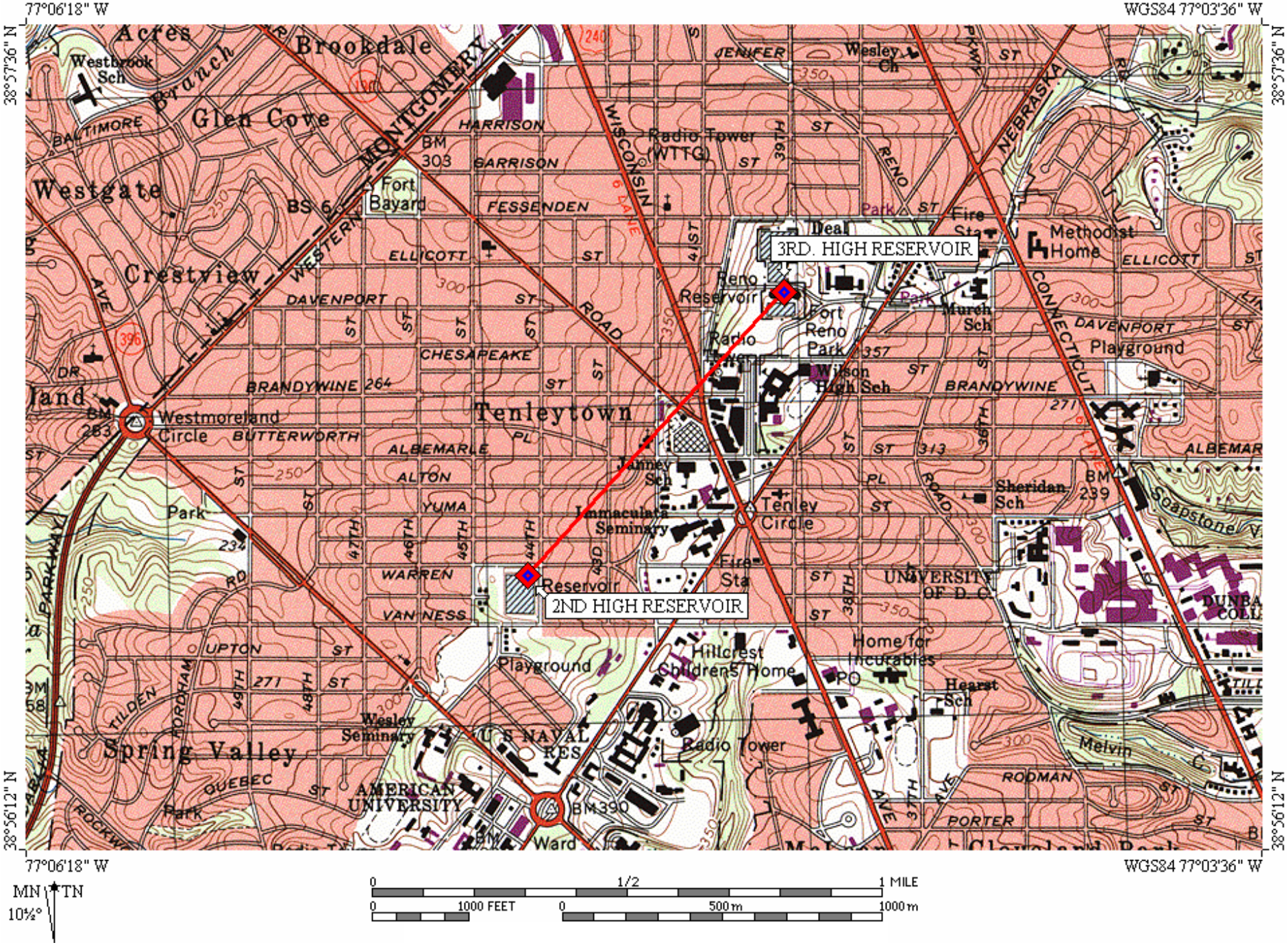


3RD. HIGH RESERVOIR & REPEATER TOWER

DATE: 3/18/2001
RADIO: METRICOM UTILINET SERIES 2 WANGATE WITH TUNED CAVITY BAND PASS FILTER

SITE NAME: 3RD. HIGH RESERVOIR & REPEATER TOWER

SITE LAT/LONG: 38-57-09N 77-04-38W

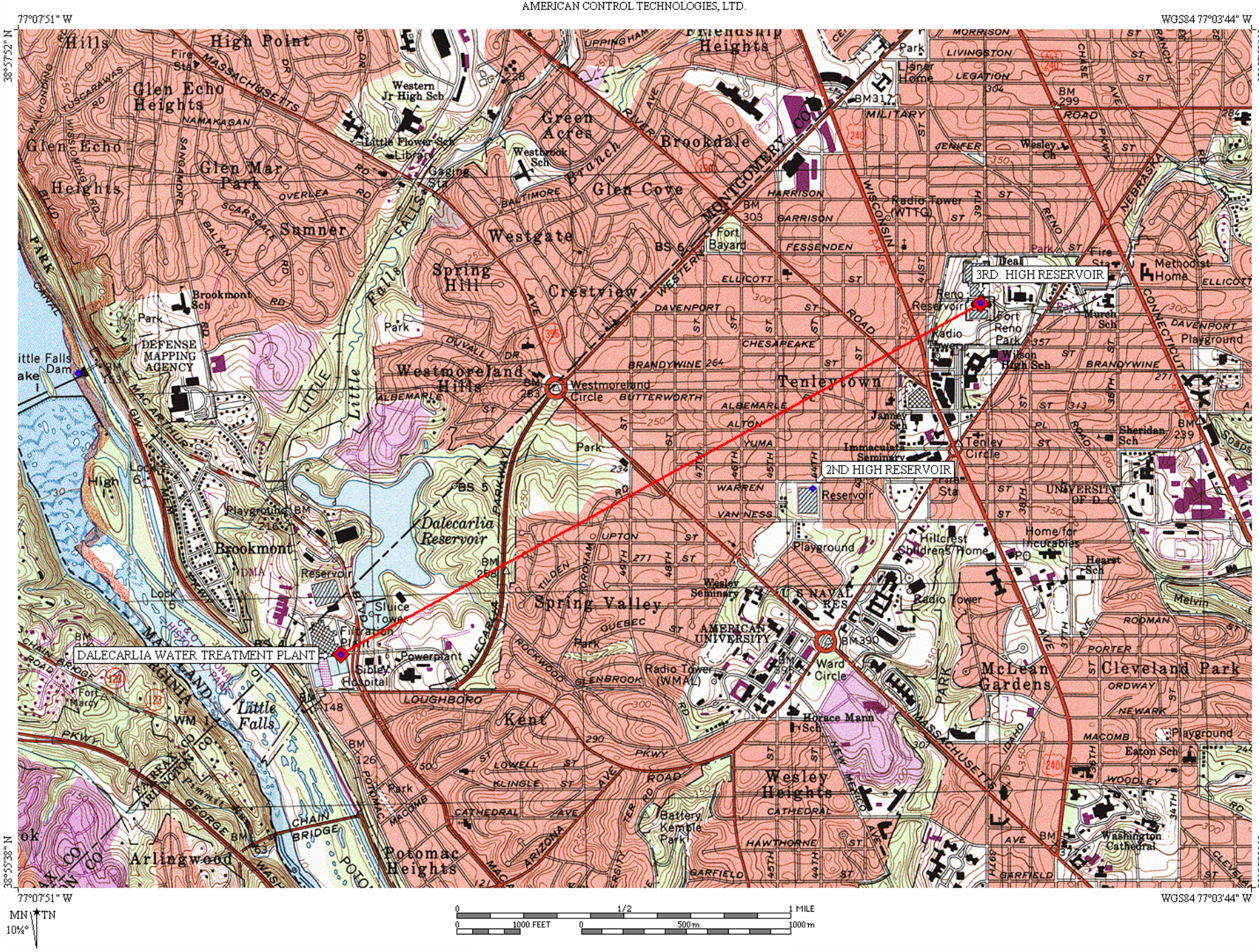
PATH 1: DALECARLIA WATER TREATMENT PLANT

SITE LAT/LONG: 38-56-14N 77-06-46W

CAN ROUTE	TWO WAY	LAST DATA	LAST ACK	SM RSSI	ACK%	TIC%
Y	Y	Y	Y	150	100	100

The 3rd. High Reservoir is an underground reservoir with a 10 ft. building. Located next to the reservoir is a 70 ft. water tower, which is to be used as a repeater location. The Metricom 900 MHz spread spectrum signal level from this repeater location to Dalecarlia Water Treatment Plant was recorded at 150 RSSI. The test was conducted utilizing a 5 dB 900 MHz Omni-directional antenna positioned at the top of the water tower. The weather conditions for the test were clear with a temperature of about 50 degrees. It should be noted this survey was conducted during a minimal foliage season therefore a fade margin of 4 to 6 dB was built in to the path analysis to compensate.

RECOMMENDATIONS:
Utilize the Metricom Utilinet Series II Integrated WanGate 900 MHz spread spectrum radio with the mesh networking capability. The Metricom radio is the only radio with the ability to hop through multiple paths allowing for path redundancy and to insure an adequate path to all remote sites. It is recommended that 900 MHz tuned cavity band pass filters be utilized in this application due to expected future cell site transmitter interference. A tuned cavity band pass filter is a device, which can be physically tuned to eliminate interference outside the operating frequency bandwidth of the radio.
For the repeater install a 10-foot metal pole to the top of the water tower. Mount a 6 dB omni directional antenna to the pole with LMR 400 low loss cable. Mount the Metricom Series II WanGate radio designed for external mounting to the pole.
For the reservoir install a 10-foot metal pole to the building. Mount a 6 dB yagi directional antenna to the pole with LMR 400 low loss cable and directed towards the repeater tower. Locate the Metricom radio inside the building.


77°07'51" W
WGS84 77°03'44" W
38°57'52" N
38°55'38" N
3RD. HIGH RESERVOIR
2ND HIGH RESERVOIR
DALECARLIA WATER TREATMENT PLANT
Dalecarlia Reservoir
Little Falls
Spring Valley
Wesley Heights
Tenleytown
Westmoreland Hills
Brookmont
Glen Echo Heights
Potomac Heights
Arlingwood
Kent
Crestview
Westgate
Brookdale
Glen Cove
Green Acres
Spring Hill
Sumner
Glen Mar Park
McLean Gardens
Cleveland Park
MN TN
10½°
0 1/2 1 MILE
0 1000 FEET 0 500 m 1000 m

LITTLE FALLS PUMP STATION

DATE: 3/18/2001

RADIO: METRICOM UTILINET SERIES 2 WANGATE WITH TUNED CAVITY BAND PASS FILTER

SITE NAME: LITTLE FALLS PUMP STATION

SITE LAT/LONG: 38-56-58N 77-07-39W

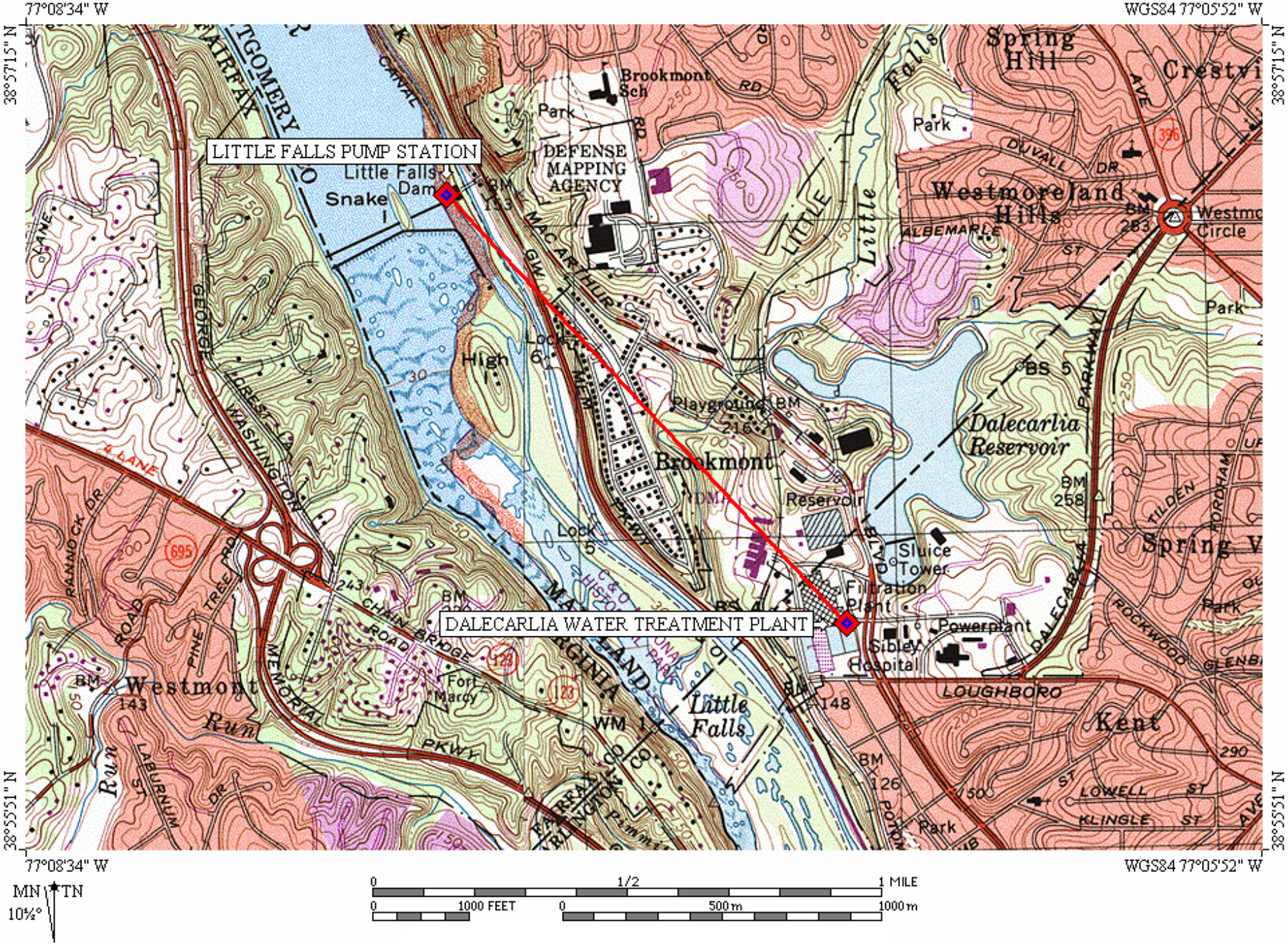
PATH 1: DALECARLIA WATER TREATMENT PLANT

SITE LAT/LONG: 38-56-14N 77-06-46W

CAN ROUTE	TWO WAY	LAST DATA	LAST ACK	SM RSSI	ACK%	TIC%
Y	Y	Y	Y	171	100	100

The Little Falls Pump Station is a 40 ft. concrete building. The Metricom 900 MHz spread spectrum signal level from this location to the Dalecarlia Water Treatment Plant was recorded at 171 RSSI. The test was conducted utilizing a 5 dB 900 MHz Omni-directional antenna positioned on top of the building. The weather conditions for the test were clear with a temperature of about 50 degrees. It should be noted this survey was conducted during a minimal foliage season therefore a fade margin of 4 to 6 dB was built in to the path analysis to compensate.

RECOMMENDATIONS:
Utilize the Metricom Utilinet Series II Integrated WanGate 900 MHz spread spectrum radio with the mesh networking capability. The Metricom radio is the only radio with the ability to hop through multiple paths allowing for path redundancy and to insure an adequate path to all remote sites. It is recommended that 900 MHz tuned cavity band pass filters be utilized in this application due to expected future cell site transmitter interference. A tuned cavity band pass filter is a device, which can be physically tuned to eliminate interference outside the operating frequency bandwidth of the radio. Install a 10-foot metal pole to the top of the building. Mount a 6 dB yagi directional antenna to the pole with LMR 400 low loss cable.


77°08'34" W
WGS84 77°05'52" W
38°57'15" N
38°55'51" N
LITTLE FALLS PUMP STATION
DALECARLIA WATER TREATMENT PLANT
Little Falls Dam
Snake I
DEFENSE MAPPING AGENCY
Brookmont Sch
Park
Brookmont
Dalecarlia Reservoir
Reservoir
Filtration Plant
Sluice Tower
Powerplant
Sibley Hospital
Westmoreland Hills
Spring Hill
Westmont
Fort Marcy
Little Falls
Kent
Playground
Lock 6
Lock 5
High
Westmo Circle
MAC ARTHUR BLVD
MACARTHUR PKWY
CHAIN BRIDGE ROAD
MEMORIAL PKWY
WASHINGTON
GEORGETOWN PIKE
DUVALL DR
ALBEMARLE ST
DALECARLIA PARKWAY
LOUGHBORO
LOWELL ST
KLINGLE ST
ROCKWOOD PKWY
TILDEN
FORDHAM
RANNOCK DR
PINE TREE RD
LABURNUM ST
BM 263
BM 216
BM 258
BM 143
BM 148
BM 126
BS 5
695
123
396
290
MN 10½° TN
0 1/2 1 MILE
0 1000 FEET 0 500 m 1000 m

INTERCONNECTION #3

DATE: 3/18/2001

RADIO: METRICOM UTILINET SERIES 2 WANGATE WITH TUNED CAVITY BAND PASS FILTER

SITE NAME: INTERCONNECTION #3

SITE LAT/LONG: 38-58-07N 77-08-20W

PATH 1: LITTLE FALLS PUMP STATION

SITE LAT/LONG: 38-56-58N 77-07-39W

CAN ROUTE	TWO WAY	LAST DATA	LAST ACK	SM RSSI	ACK%	TIC%
Y	Y	Y	Y	141	100	100

The Interconnection #3 is located in a circle at the intersection of Macarthur Blvd. and Goldsboro Ave. The Metricom 900 MHz spread spectrum signal level from this location to the Little Falls Pump Station was recorded at 141 RSSI. The test was conducted utilizing a 5 dB 900 MHz Omni-directional antenna attached to a 30 ft. pole at the site. The weather conditions for the test were clear with a temperature of about 50 degrees. It should be noted this survey was conducted during a minimal foliage season therefore a fade margin of 4 to 6 dB was built in to the path analysis to compensate.

RECOMMENDATIONS:

Utilize the Metricom Utilinet Series II Integrated WanGate 900 MHz spread spectrum radio with the mesh networking capability. The Metricom radio is the only radio with the ability to hop through multiple paths allowing for path redundancy and to insure an adequate path to all remote sites. It is recommended that 900 MHz tuned cavity band pass filters be utilized in this application due to expected future cell site transmitter interference. A tuned cavity band pass filter is a device, which can be physically tuned to eliminate interference outside the operating frequency bandwidth of the radio. Install a 30-foot utility pole at the site and affix a 10 ft. metal pole to the top of it. Mount a 6 dB yagi directional antenna to the pole with LMR 400 low loss cable.

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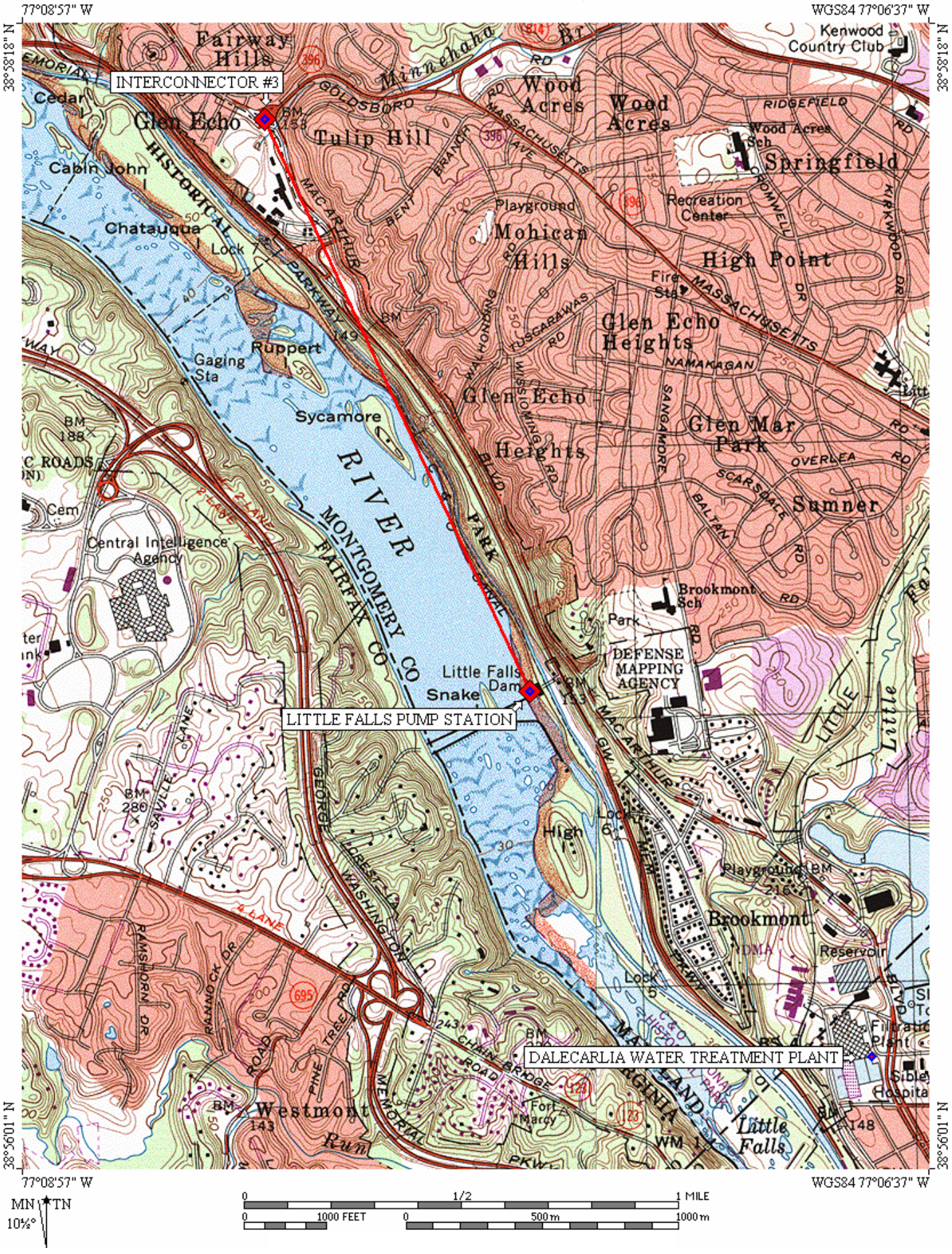

INTERCONNECTION #1

DATE: 3/18/2001

RADIO: METRICOM UTILINET SERIES 2 WANGATE WITH TUNED CAVITY BAND PASS FILTER

SITE NAME: INTERCONNECTOR #1

SITE LAT/LONG: 38-58-57N 77-13-44W

Interconnection #1 is located off of Macarthur Blvd with in Great Falls National Park. A Metricom 900 MHz spread spectrum signal level was not obtained from this location. The test was conducted utilizing a 5 dB 900 MHz Omni-directional antenna attached to a 30 ft. pole. The weather conditions for the test were clear with a temperature of about 50 degrees.

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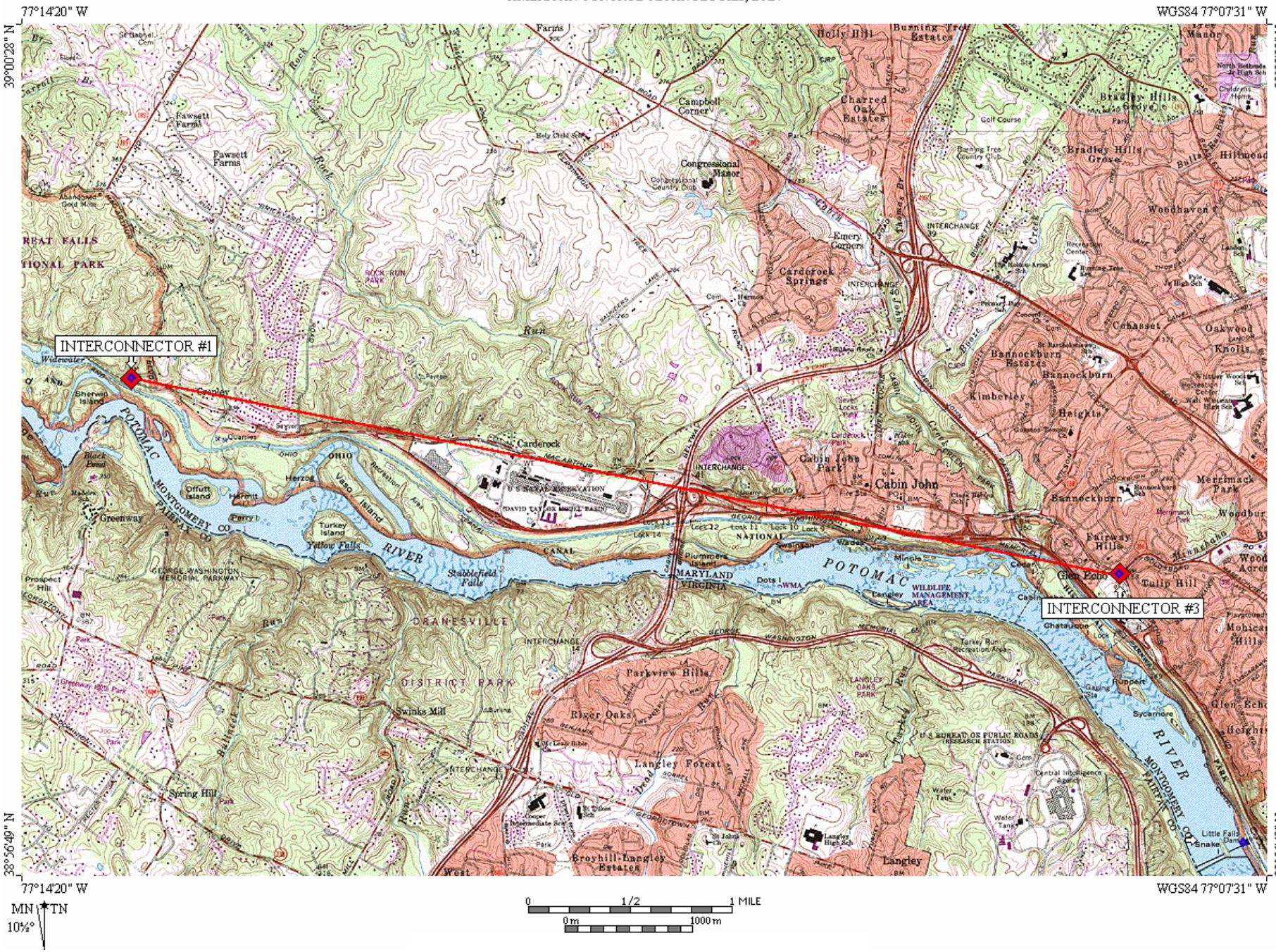


GREAT FALLS INTAKE

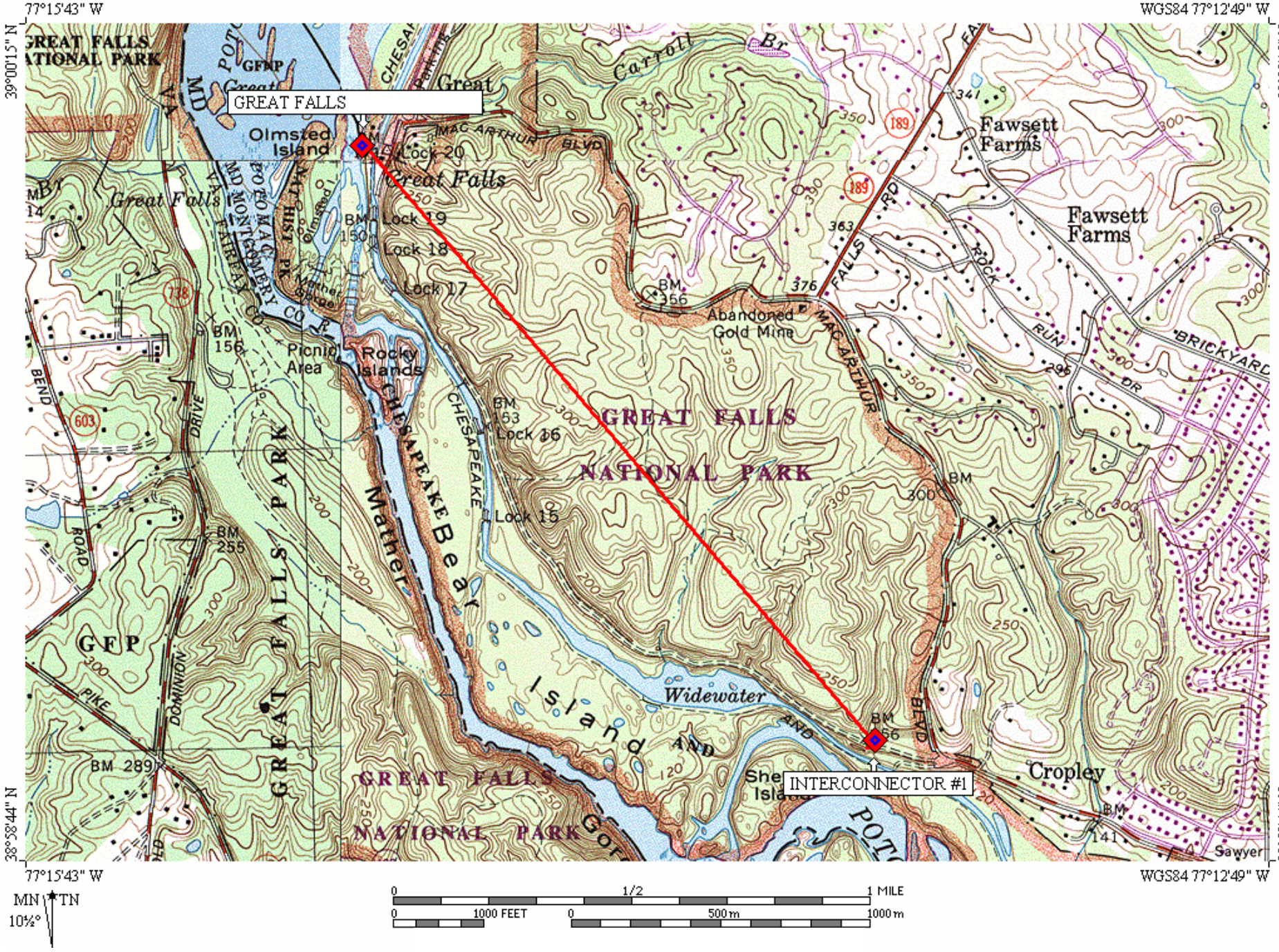
DATE: 3/18/2001

RADIO: METRICOM UTILINET SERIES 2 WANGATE WITH TUNED CAVITY BAND PASS FILTER

SITE NAME: GREAT FALLS INTAKE

SITE LAT/LONG: 39-00-02N 77-14-56W

The Great Falls Intake is located at the northern most end of Great Falls National Park. The Metricom 900 MHz spread spectrum signal level from this location was not obtained. The test was conducted utilizing a 5 dB 900 MHz Omni-directional antenna attached to a 30 ft. pole. The weather conditions for the test were clear with a temperature of about 50 degrees.


77°15'43" W
WGS84 77°12'49" W
39°00'15" N
38°58'44" N
GREAT FALLS
INTERCONNECTOR #1
GREAT FALLS NATIONAL PARK
Olmsted Island
Great Falls
Lock 20
Lock 19
Lock 18
Lock 17
Lock 16
Lock 15
Picnic Area
Rocky Islands
Abandoned Gold Mine
Fawsett Farms
Cropley
Sawyer
Widewater
Island
Chesapeake Bay
Mather Gorge
MAC ARTHUR BLVD
FALLS RD
ROCK RUN
BRICKYARD
POTOMAC
GFP
BM 156
BM 255
BM 289
BM 356
BM 153
BM 300
BM 56
BM 141
MN
TN
10½°
0 1/2 1 MILE
0 1000 FEET 0 500m 1000m

SECTION 13621

MODIFICATIONS TO THE EXISTING
SCADA SYSTEM AT DPS
02/12/03

PART 1 GENERAL

1.1 DESCRIPTION

This section describes the requirements for modifying the existing SCADA system at The Dalecarlia Pump Station (DPS). The DPS is owned and operated by US Army Corps of Engineers, Baltimore District, Washington Aqueduct Division (WA). Work includes furnishing and installing additional hardware, reprogramming (configuring) existing processors in the SCADA at DPS, testing and check-out of the new hardware, and software modifications, services to oversee installation of the new hardware and termination of the wiring within the I/O cabinet and SCADA enclosures.

An Input/Output listing of the points to be added to the existing SCADA Distributed Process Controllers (DPCs) is included in Appendix A to this Section.

The DPC locations are shown on the electrical drawings.

1.2 QUALITY ASSURANCE

Provide hardware and communications software specified in Paragraph 2.1.

Provide software services as specified in Paragraph 3.2, and testing and start-up services from one of the following listed system integrator suppliers.

Bristol Babcock

Tri Jay

Interface Inc.

The Contractor shall provide control system software qualifications if one of the above listed suppliers does not supply the software and services specified. The Contractor shall provide the name of their services suppliers at the time of bid. The Contractor shall not change suppliers from that named unless mutually agreed upon by WA and the Engineer.

The Contractor shall submit the suppliers qualifications within 30-days of the notice to proceed. The supplier shall demonstrate five (5) years experience, all within the last ten (10) years in the development, integration and commissioning of Bristol Babcock systems for the water industry. The integrator shall have procedures in place for standard project methodology for; developing an automation plan, system functional specifications, implementation methods, test plans, integration, testing, staging, installation and startup. The supplier shall demonstrate that their staff has been factory trained by Bristol Babcock. The supplier shall show experience in training of customer staff in the use and long term support of a Bristol Babcock system. The qualifications documentation shall be supported by letters of qualification from Bristol Babcock and

reference list of completed Bristol Babcock projects with reference contacts.

1. The Contractor shall submit the name and qualifications of their supplier for this section of the specifications if not one of the already named suppliers.

2. The supplier shall have completed four Bristol Babcock project over the last five years of similar size and type. Provide description of project. The project description shall include: size, particular Bristol Babcock hardware and software used and any non-Bristol software applications provided.

3. The supplier shall provide a certified financial statement(s) for the past five (5) years. This documentation shall be signed and sealed by a Certified Public Accountant (CPA).

4. Provide list of staff that will be working on the project. Provide staff qualifications that demonstrate their experience with the Bristol Babcock hardware and software.

The DPS SCADA modifications require reconfiguration of existing SCADA modules, which shall be maintained in service at all times. Coordination with WA Process Control personnel is required prior to and during all modification of on-line software. Develop procedures to reload original configuration in the event of malfunction of the software required to implement the new control strategies.

The DPS SCADA modifications require termination of additional I/O in existing SCADA cabinets, which shall be maintained in service at all times. Coordination with WA Process Control personnel is required when terminating I/O in existing enclosures and when connecting new equipment to existing hardware.

Reconfiguration of existing DPCs shall be performed with the Bristol configuration software specifically designed for use with Accol control applications. The reconfiguration wherever possible shall be as close as possible to existing configurations for similar equipment.

Field wiring to the termination shall be fully tested prior to connection of cables to the input/output modules in the DPC.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals having an "FIO" designation are for information only. The following shall be submitted:

SCADA Workstation; G AE

Data composted of catalog cuts, brochures, circulars, specifications, product data, and printed information in sufficient detail and scope to verify compliance with the requirements of the contract documents. Manufacturer's descriptive literature and data sheets indicating relevant features, capacities and identification numbers for the Process Controllers.

Input/Output Components; G AE

A complete itemized listing of equipment and materials proposed for incorporation into the work. Each entry shall include an item number, the quantity of items proposed, and the name of the manufacturer of each item.

SD-02 Shop Drawings

Input/Output Components; G AE

SCADA Workstation; G AE

Detailed dimensioned shop drawings, together with descriptive specifications, wiring schematics for connections between Controllers and other devices, engineering data sheets and catalog cuts showing construction size, arrangement, operating clearances, performance characteristics and capacity of electrical materials, equipment and systems. Each item of equipment proposed shall be a standard catalog product of approved manufacturer, unless otherwise noted.

Detail drawings including a complete list of equipment and material. Detail drawings shall contain complete wiring and schematic diagrams for the equipment furnished, equipment layout, and any other details required to demonstrate that the system has been coordinate and will function properly as a system. Detail drawings shall show dimensions, mounting, and external connection details for the controllers.

SD-08 Manufacturer's Instructions

Software Services; G AE

Written description of the attributes of programming developed for installation in the process controllers, including procedures for modifications, downloading, and programmer operation, if applicable.

Warranty; G WA

The Process Controller system and its components shall be warranty by the control system supplier in writing against defects in materials, workmanship and installation for a period of at least one year following final acceptance of the complete process controller system. The warranty shall cover both parts and labor.

The warranty shall provide (a) a minimum of next-day, on-site service, and (b) replacement of the defective component within one week if repairs cannot be effected within that time. Work under the warranty shall be provided by the control system supplier responsible for the system installation.

SD-09 Manufacturer's Field Reports

Checkout Plan; G AE

Test Report; G AE

Test procedure and reports for physical checkout and field testing. After receipt by the Contractor of written approval of the test procedures, the Contractor shall schedule the tests. The final test procedures report shall be delivered after completion of the tests.

SD-07 Certificates

Installation; G WA

The Contractor shall submit certification that all installers are factory certified to install and test the provided products.

Certification of Compliance; G AE

The Contractor shall submit a Certificate certifying that the process controllers and components have been installed under either the continuous or periodical supervision of the manufacturer's authorized representatives, that they have been tested, adjusted and initially operated in the presence of the manufacturer's authorized representatives and are operating in accordance with the specified requirements to the manufacturer's satisfaction.

SD-10 Operation and Maintenance Data

Operator's Manuals; G WA

Engineer's Manual; G WA

Provide six complete copies of operating instructions outlining the step-by-step procedures required for system startup, operation and shutdown. The instructions shall include layout, wiring and control diagrams of the system as installed. The instructions shall include the manufacturer's name, model number, service manual, parts lists and a brief description of all equipment and their basic operating features.

Six complete copies of maintenance instructions listing routine maintenance procedures, possible breakdowns and repairs and trouble shooting guides.

1.4 DELIVERY, STORAGE AND HANDLING

Packing and Labeling:

Prior to shipment, tag each component to identify its location, and system function. Identification must be prominently displayed on the outside of the package.

Delivery:

Following approval of all equipment by the WA, completion of shop assembly, and shop testing, the Contractor shall have the supplier of the hardware specified in Paragraph 2.1 prepare the cabinets for shipping by wrapping them in heavy-duty polyethylene covers and by packing them in protective crates to protect the equipment from damage, dust, and moisture.

Place dehumidifying agents inside the covers. Skid mount the equipment for transport to final location. Clearly show the packed weights. Instructions for unloading, transporting, storing and handling at the job site shall be attached to the crate.

Pack spare parts in containers bearing labels clearly designating contents and pieces of equipment for which intended.

Receiving: Provide inspection reports and inventory to the WA.

Storage: Do not store the equipment outdoors. Store all equipment in dry permanent shelters, protected against mechanical damage. Repair any damaged equipment at no additional cost to the WA.

PART 2 PRODUCTS

2.1 INPUT/OUTPUT COMPONENTS:

The current I/O list does not indicate a need for the Contractor to provide additional I/O modules. If additional I/O modules are required they will be provided to the Contractor by WA.

2.2 SCADA WORKSTATIONS

Provide three (3) workstations. Provide workstations in the chemical building control room to mimic the existing workstations in the pump station control room. The workstations shall be Dell 360 or equal. The servers shall be provided as a minimum with;

2.4 GHz/512K Cache processor

512 MB DDR400 SDRAM Memory

Standard Keyboard

21-inch Color Monitor

1 - 40 GB Hard Drive

Mouse

2-each 146GB 10K RPM Hard Drive

1-each 18 GB 15K RPM Media Bay Hard Drive

16X DVDROM

64 MB Videocard with DVI and VGA outputs

I/O Ports for all peripherals and network connections

High-performance graphic card w/256MB minimum

19-inch 1901 FP monitor and AS500 sound bar

Windows 2000 Operating System and all SCADA software for monitoring, control and development

Provide all workstations configured and located in the control room console.

2.3 ADDITIONAL SOFTWARE AND HARDWARE

Provide historian software and hardware as specified in specification Sections 13622.

2.4 ELECTRICAL

Provide a complete and fully functional electrical system including all wiring, cables, conduits, junction boxes, terminal boxes, supports required

between instruments and control panels. All electrical equipment required shall comply with the requirements of Division 16 - Electrical.

PART 3 EXECUTION

3.1 INSTALLATION

A. Provide all labor, materials, and equipment to install the additional SCADA equipment as indicated and specified.

3.2 SOFTWARE SERVICES

A. Re-configure the existing control processors to perform the logic specified in 13405A Paragraph 1.2 Control System Description.

B. Configure analog inputs with engineering units, high-high, high, low, and low-low alarms, rate of change limit and alarm deadband.

C. Include trends for all analog inputs.

D. Provide open state and closed stated descriptions for discrete inputs.

E. Classify discrete inputs as events or alarms in a similar manner to the existing discrete inputs.

F. All points, both real and calculated, shall appear on at least two displays: one graphic and one faceplate or table.

G. Provide revisions to twenty (20) existing graphic displays. The revisions shall show all new work. Additional graphics shall be added to provide clarity and to prevent overcrowding of the graphics.

1. Provide screens or revisions to existing screens for; existing water distribution pumps, zone pressure monitoring, sump alarms, sewage ejector alarm, valve position monitoring and remote station monitoring and control.

H. Modify existing display and control logic which monitor and control new or existing equipment. As a minimum, provide additions and modifications to:

1. Inclusion of reverse rotation sensors and high pressure discharge switches for each water distribution pump.

2. Modification of the valve position monitoring to indicate valve open and closed position. Provide graphics to show clear flow paths for distribution pumping to each pressure zone.

3. Provide logic to control and or shutdown pumps on; closed suction valve, high discharge pressure or failure of discharge control valve opening.

4. Add high level alarms to east and west sump pump monitoring.

5. Add alarm to sewage ejector to indicate blockage in the fill line.

6. Add SCADA graphic to depict communications between remote sites and the DPS. Graphic should indicate communication health or loss of communications.

7. Add graphic(s) for Georgetown Reservoir to depict 3 reservoir cells; the cell level and turbidity and the screen run state and alarms.

8. Modify the existing pump station and plant system graphic to depict the new hardware including all workstations, servers and communications lines, switches and routers.

I. Integrate the controls for these loops with the existing loops in the modified DPCs.

J. Include the points added as part of this work in the appropriate summary displays, if appropriate summary displays do not exist, provide an additional summary display for each of the modified DPCs.

K. Assign each alarm point to appropriate group and priority using the same criteria as the existing points within that DPC.

L. Configure alarms and events to write to the historical file and alarm/event history using the same criteria as the existing points within that DPC.

3.3 TESTING REQUIREMENTS

A. Physical checkout and field testing includes the following:

1. Physical Checkout

2. Loop Tests

3. Control Loop Tuning

4. Control Strategy Tests

5. Function Tests

B. Prior to testing submit the following information in the Checkout Plan in accordance with Section 01330 and 13405A.

1. Loop and control strategy checkout schedule arranged by unit process and plant area.

2. Loop checkout procedures including I/O and loop list to be used in tracking checkout progress.

3. Loop tuning procedures to be followed and description of tuning software.

4. Control strategy and display test procedures.

5. Functional test procedures.

C. After testing submit the following test report information in accordance with Section 01330.

1. Completed loop checkout lists.

2. Description of loop checkout problems.

3. Loop tuning documentation.

4. Control strategy test summary and annotated configuration drawings.

5. Functional test problem summary.

D. Perform physical checkout of installed additional SCADA components prior to field testing.

E. Perform field testing to verify the operation of the System. Perform field testing sequentially and organized by plant area and by unit process within each area.

F. Field testing includes loop checkout, loop tuning, control strategy testing, and workstation function testing.

1. Perform field testing on each DPC which is required to be furnished, installed and tested when connected I/O is installed.

G. Test data transfer from SCADA to Historian for the System furnished, installed, and tested.

3.4 PHYSICAL CHECKOUT

A. When additional SCADA components have been put in place and connected to power and to the data highway, checkout the installed SCADA components by performing the following work:

1. Inspect the additional SCADA components to determine that all are present and are not physically damaged.

2. Inspect power and data highway connections for meeting manufacturer's recommended installation.

3. Apply power to the SCADA components and adjust power supplies.

4. Run diagnostics on the SCADA components to determine any malfunctions.

5. Record software programs and files installed, including version number.

B. Checkout cables and wire and conduit after installation to verify termination and identification labels.

3.5 LOOP TESTS

A. Check each loop from the end element to the respective control display. Include instruments, control devices, panels, input/output cards, foreign device gateways and other devices in the loop to ensure proper operation and linkage to workstation displays.

1. Confirm digital input messages, digital output actions, and analog input and output ranges, units of measurements and match to field and panel indicators.

2. Confirm analog input alarm settings.

B. Unless instructed otherwise by the Contracting Officer's Representative (COR), motion check the final control element through panels and through control stations. When not possible to perform a motion check, simulate the motion check through to the final control element location.

C. Document loop checks on an I/O and loop list, and submit to the COR. Include in the I/O and loop checkout list:

1. Loop number.

2. Loop description.

3. Data tested.

4. Comments.

5. Performed by.

6. Witnessed by.

D. Summarize loops found to contain defective or inoperable plant equipment provided by other contractors on separate sheets and submit to the COR.

1. Correct and recheck defective work provided under this Contract.

2. The COR will coordinate correction of defective work provided by other contractors. Perform rechecking.

3. Limit rechecking of defective work provided by other contractors to 10 percent of the total number of loops. Do not perform additional checkout work unless directed by the COR.

3.6 CONTROL LOOP TUNING

A. Tune regulatory control loops to produce stable control. Use a loop tuning software program to document loop performance.

1. For conventional control loop for PI and PID control, use minimum ITAE (Integral of Time and Absolute Error) criteria with overshoot constrained to 10 percent unless otherwise directed by the COR.

2. Utilize averaging control for liquid level and gas pressure in storage vessels unless otherwise directed by the COR.

3. Provide reduced gains or filtering to minimize output activity to electric actuators as directed by the COR.

4. Adjust input scan time or time intervals between controller calculations to produced stable control.

B. Tune cascaded controllers similar to the above with the inner loop tuned first while the outer loop is off or inactive.

C. Derive initial tuning parameters from open loop tests. Make final tuning parameter adjustments based on closed loop tests.

D. Submit loop tuning documentation to the COR.

1. Loop number, description and final tuning parameter values.

2. Graph of open loop tests.

3. Graph of final closed loop response.

4. Signature of tester and data.

5. Signature of COR and date.

6. Problem description if any.

E. Complete loop checkout and problem correction prior to loop tuning. Operate tuned loops for a minimum of 24 hours prior to control strategy testing.

3.7 CONTROL STRATEGY TESTS:

A. Fully test control strategies to ensure specified operation. Include:

1. Sequences.

2. Alternate control modes.

3. Dynamic gain adjustments.

4. Contingency response to device failures, where possible.

5. Display and keyboard interaction.

6. Messages.

B. Prior to use on the process equipment, compare strategies with approved submittals to verify that as-built linkages and logic agree with the documentation. Note and correct discrepancies.

C. Unless directed otherwise by COR, test all logic for process equipment. The COR will direct where it may not be possible to test all logic due to operational constraints.

D. Document strategies tested including problems encountered during strategy tests and submit to the COR. Include:

1. Strategy identification.

2. Tests performed.

3. Logic which could not be tested.

4. Copies of messages, displays and trends which verify operation.

5. Problem description.

6. Signature of tester and date.

E. Annotate changes made during testing on the documentation to reflect final as-built conditions.

3.8 FUNCTIONAL TESTS

A. Fully test workstations and operator functions during the checkout. Include:

1. Process control displays and linkages.

2. User entry functions.

3. Other specified functions for the workstations.

B. Document problems encountered in demonstrations and submit to the COR. Include:

1. Description of function.

2. Signature of tester and data.

3. Signature of COR and date.

4. Problem description.

5. Description of how problem is proposed to be corrected.

6. Date when proposed correction will be made.

7. Proposed date for retesting.

3.9 Certification of Compliance

Provide certificate of compliance from the control systems authorized integrator for this project. The certificate shall summarize the physically installed hardware and software and the associated control algorithms. The certificate shall summarize the system testing. The certificate shall provide WA full access to the system. This document shall be submitted and approved prior to final acceptance of the system.

3.10 MAINTENANCE OF PLANT OPERATIONS

A. Schedule field testing which changes process operating conditions through the WA on a daily basis.

B. Perform no testing which changes process operating conditions without WA concurrence.

3.11 Operations and Maintenance Manuals

3.11.1 Operator's Manuals

Provide operator's manuals for the use and reference of the Plant operators. The manuals shall contain all information required by the operator to perform all necessary duties and functions relevant to the process controller system and modification to the operator interface and data acquisition system. These manuals shall be available in their complete and final form for operator training. The manuals shall contain, but not be limited to, the following:

a. Table of Contents

b. Overall narrative of the system function and operation.

c. Simple pictorial representations of system and process interaction, including block diagrams and references from text.

d. Descriptions of the operator controls and function for the operator interface. All manual panel controls shall be listed and a functional description given for each.

e. Step-by-step procedures for each action to be performed in system operation, including start/stop procedures, controls mode changes, set point controls, emergency procedures, etc. Also, procedures shall be given for software "housekeeping", diagnostics, etc.

f. Glossary of technical terminology used in the Operator's Manual.

The Operator's Manual shall be written assuming a level of technical comprehension equivalent to that of a high school graduate and shall avoid in depth technical description of the system workings.

3.11.2 Engineer's Manual

These manuals shall provide documentation of the system construction and configuration and shall provide instruction to the Plant Engineer for modifications for both system hardware and software, system troubleshooting and component replacement, and backup copies of all system software. The manuals shall contain, but shall not be limited to, the following:

a. Table of Contents.

b. Equipment list of all components of the process controller system, including manufacturer's past numbers.

c. All standard hardware manuals which may accompany the system components.

d. Procedures for system start/stop and reset, system configuration and basic troubleshooting.

e. Pictorial representation for component interaction and function.

f. Narrative description of all system programming, indicating program and sub-program function and organization. A summary listing and description of all global and local program variables shall be included.

g. Listings of the process controller system input/output, data recording and operator interface data base or real time data structure, including memory address numbers if applicable.

h. Listings of all system programming. Listings shall include comments denoting, at a minimum, program execution branches and decision statements, variable definitions, calculation instructions and input/output operations.

i. A program flow chart for system programming, showing the arrangement and interaction of all sub-programs.

j. Tabulation of all equations or formulate used in programming, with sub-program and line number reference.

k. Listing of all sites used for input or output during program execution.

l. Glossary of technical terms used in the Engineer's Manual.

m. Two spare copies of all system programming on the appropriate magnetic media.

n. The Engineer's Manuals shall be written assuming a level of technical comprehension equivalent to that of an experienced electronics technician familiar with computerized process control.

Prior to the initial submittal, within 60 days of contract Notice to Proceed, the Contractor shall arrange a pre-construction conference in the WA office with technical representatives of the Contractor and supplier of software services specified in Paragraph 3.02, and DPS SCADA personnel to discuss overall job concept.

All suppliers either named or submitted as an or-equal to those named shall provide preconstruction documentation two (2) weeks prior to the preconstruction conference. The documentation shall include a project narrative. The project narrative shall describe: project team, design approach, and project plan.

Project Plan should include: a project overview; definition; organization; document plan; change control and test plan. The project overview shall include; work break-down structure, system architecture diagrams, the approach to work, the proposed work schedule indicating milestone and potential meetings, project personal and organization, details of in-house quality assurance organization; details of factory testing, field testing, training programs and a paragraph by paragraph review of the specifications indicating any places where the supplier will provide functional equivalency or not be in compliance and a description of the exception.

Submit the following information for each DPC in accordance with Section 01000; provide all information for DPCs which are required to be modified or furnished, installed, and tested:

Assembly drawings showing equipment layout, overall cabinet dimensions, cabinet clearance dimensions, access doors, power and grounding connection points and all communication (Radio, LAN and telephone) connection points.

I/O termination definition including the I/O point name, description, and hardware address, I/O card, and card termination number, DPC designation, I/O termination cabinet or control panel designation and terminal numbers, and wire numbers for each wired I/O point. Provide this submittal in printed and magnetic media formats. Prepare the files by expanding the I/O database file received from the WA.

Submit control strategy submittals. Include the following information in the submittals:

A narrative of the monitoring and control to be provided.

A detailed control diagram(s) showing database names for all field inputs and outputs and the type and linkage of modules, order of execution and execution frequency. Annotate the diagram(s) with a written description of the function of each module used.

Submittals for displays corresponding with control strategy.

3.12 WA INVOLVEMENT

A. The WA may participate in testing activities at its discretion.

B. Make available for WA's use loops and control strategies which have been verified to operate properly immediately subsequent to conclusion of the test.

C. Recognize and adjust for WA involvement in developing test procedures and schedules.

3.13 WARRANTY AND MAINTENANCE CONTRACT

A. General:

1. Provide warranty for one year following final acceptance. Provide extended warranty in the form of a maintenance contract. Provide warranty and maintenance contract with Supplier for all equipment furnished under this Contract for a period of one year after final acceptance. This maintenance service is to include preventive maintenance, emergency service and replacement of worn or defective parts. Maintenance contract shall be renegotiable and extendable at Owner's option for a period of 4 years.

2. Warranty maintenance shall furnished at Owner's facility.

B. Warranty and Maintenance Requirements

1. Provide all preventive maintenance necessary to maintain equipment in proper operating conditions.

2. Preventive maintenance shall include inspection, testing and calibration, cleaning, lubricating, replacement of worn parts and maintenance service records.

3. Perform all emergency service during regular business hours at no additional cost to the Owner. Supplier shall be on-site at Owner's facility, ready to affect repairs, within 24 hours of notification.

4. Provide all necessary parts or components required to maintain equipment.

5. Maintain an adequate supply of emergency parts of site.

6. All transportation and per diem expenses shall be at no additional cost to the Owner.

-- End of Section --

KEY	ISAFRST	TAG NO.	MOD	TAGDESC	DESC1	DESC2	DEV_TAG	AI	AO	DI	DO	SIG_LEVEL	ONESTATE	ALARM	0_VALUE	SPAN	ENG_UNTS	RTU	CHASSIS	SLOT	POINT	REMARKS
1	P	1001		FINISHED WATER PUMP 1 DISCHARGE PRESSURE		PRESSURE		1				4 TO 20 MA			0	100	PSIG	M7			03	
2	T	1001	A	FINISHED WATER PUMP 1 BEARING TEMPERATURE 1		TEMP		1				4 TO 20 MA			0	200	DEG F	M7			23	
3	T	1001	B	FINISHED WATER PUMP 1 BEARING TEMPERATURE 2		TEMP		1				4 TO 20 MA			0	200	DEG F	M7			24	
4	Z	1001	A	FINISHED WATER PUMP 1 REVERSE ROTATION ALARM		ALARM				1		120 VAC	CLOSED	A				M7			60	
5	P	1002		FINISHED WATER PUMP 2 DISCHARGE PRESSURE		PRESSURE		1				4 TO 20 MA			0	100	PSIG	M8			11	
6	T	1002	A	FINISHED WATER PUMP 2 BEARING TEMPERATURE 1		TEMP		1				4 TO 20 MA			0	200	DEG F	M8			23	
7	T	1002	B	FINISHED WATER PUMP 2 BEARING TEMPERATURE 2		TEMP		1				4 TO 20 MA			0	200	DEG F	M8			24	
8	Z	1002	A	FINISHED WATER PUMP 2 REVERSE ROTATION ALARM		ALARM				1		120 VAC	CLOSED	A				M8			65	
9	P	1003		FINISHED WATER PUMP 3 DISCHARGE PRESSURE		PRESSURE		1				4 TO 20 MA			0	100	PSIG	M9			11	
10	T	1003	A	FINISHED WATER PUMP 3 BEARING TEMPERATURE 1		TEMP		1				4 TO 20 MA			0	200	DEG F	M9			23	
11	T	1003	B	FINISHED WATER PUMP 3 BEARING TEMPERATURE 2		TEMP		1				4 TO 20 MA			0	200	DEG F	M9			24	
12	Z	1003		FINISHED WATER PUMP 3 REVERSE ROTATION ALARM		ALARM				1		120 VAC	CLOSED	A				M9			62	
13	P	1004		FINISHED WATER PUMP 4 DISCHARGE PRESSURE		PRESSURE		1				4 TO 20 MA			0	150	PSIG	M7			06	
14	T	1004	A	FINISHED WATER PUMP 4 BEARING TEMPERATURE 1		TEMP		1				4 TO 20 MA			0	200	DEG F	M7			25	
15	T	1004	B	FINISHED WATER PUMP 4 BEARING TEMPERATURE 2		TEMP		1				4 TO 20 MA			0	200	DEG F	M7			26	
16	Z	1004		FINISHED WATER PUMP 4 REVERSE ROTATION ALARM		ALARM				1		120 VAC	CLOSED	A				M7			61	
17	P	1005		FINISHED WATER PUMP 5 DISCHARGE PRESSURE		PRESSURE		1				4 TO 20 MA			0	150	PSIG	M8			12	
18	T	1005	A	FINISHED WATER PUMP 5 BEARING TEMPERATURE 1		TEMP		1				4 TO 20 MA			0	200	DEG F	M8			25	
19	T	1005	B	FINISHED WATER PUMP 5 BEARING TEMPERATURE 2		TEMP		1				4 TO 20 MA			0	200	DEG F	M8			26	
20	Z	1005		FINISHED WATER PUMP 5 REVERSE ROTATION ALARM		ALARM				1		120 VAC	CLOSED	A				M8			66	
21	P	1006		FINISHED WATER PUMP 6 DISCHARGE PRESSURE		PRESSURE		1				4 TO 20 MA			0	150	PSIG	M9			12	
22	T	1006	A	FINISHED WATER PUMP 6 BEARING TEMPERATURE 1		TEMP		1				4 TO 20 MA			0	200	DEG F	M9			25	
23	T	1006	B	FINISHED WATER PUMP 6 BEARING TEMPERATURE 2		TEMP		1				4 TO 20 MA			0	200	DEG F	M9			26	
24	Z	1006		FINISHED WATER PUMP 6 REVERSE ROTATION ALARM		ALARM				1		120 VAC	CLOSED	A				M9			63	
25	P	1007		FINISHED WATER PUMP 7 DISCHARGE PRESSURE		PRESSURE		1				4 TO 20 MA			0	200	PSIG	M7			09	
26	T	1007	A	FINISHED WATER PUMP 7 BEARING TEMPERATURE 1		TEMP		1				4 TO 20 MA			0	200	DEG F	M7			27	
27	T	1007	B	FINISHED WATER PUMP 7 BEARING TEMPERATURE 2		TEMP		1				4 TO 20 MA			0	200	DEG F	M7			28	
28	Z	1007		FINISHED WATER PUMP 7 REVERSE ROTATION ALARM		ALARM				1		120 VAC	CLOSED	A				M7			62	
29	P	1008		FINISHED WATER PUMP 8 DISCHARGE PRESSURE		PRESSURE		1				4 TO 20 MA			0	200	PSIG	M8			13	
30	T	1008	A	FINISHED WATER PUMP 8 BEARING TEMPERATURE 1		TEMP		1				4 TO 20 MA			0	200	DEG F	M8			27	
31	T	1008	B	FINISHED WATER PUMP 8 BEARING TEMPERATURE 2		TEMP		1				4 TO 20 MA			0	200	DEG F	M8			28	
32	Z	1008		FINISHED WATER PUMP 8 REVERSE ROTATION ALARM		ALARM				1		120 VAC	CLOSED	A				M8			67	
33	P	1009		FINISHED WATER PUMP 9 DISCHARGE PRESSURE		PRESSURE		1				4 TO 20 MA			0	200	PSIG	M9			13	
34	T	1009	A	FINISHED WATER PUMP 9 BEARING TEMPERATURE 1		TEMP		1				4 TO 20 MA			0	200	DEG F	M9			27	
35	T	1009	B	FINISHED WATER PUMP 9 BEARING TEMPERATURE 2		TEMP		1				4 TO 20 MA			0	200	DEG F	M9			28	
36	Z	1009		FINISHED WATER PUMP 9 REVERSE ROTATION ALARM		ALARM				1		120 VAC	CLOSED	A				M9			65	
37	P	1010		FINISHED WATER PUMP 10 DISCHARGE PRESSURE		PRESSURE		1				4 TO 20 MA			0	200	PSIG	M7			12	
38	T	1010	A	FINISHED WATER PUMP 10 BEARING TEMPERATURE 1		TEMP		1				4 TO 20 MA			0	200	DEG F	M7			29	
39	T	1010	B	FINISHED WATER PUMP 10 BEARING TEMPERATURE 2		TEMP		1				4 TO 20 MA			0	200	DEG F	M7			30	
40	Z	1010		FINISHED WATER PUMP 10 REVERSE ROTATION ALARM		ALARM				1		120 VAC	CLOSED	A				M7			63	
41	P	1011		FINISHED WATER PUMP 11 DISCHARGE PRESSURE		PRESSURE		1				4 TO 20 MA			0	200	PSIG	M8			14	
42	T	1011	A	FINISHED WATER PUMP 11 BEARING TEMPERATURE 1		TEMP		1				4 TO 20 MA			0	200	DEG F	M8			29	
43	T	1011	B	FINISHED WATER PUMP 11 BEARING TEMPERATURE 2		TEMP		1				4 TO 20 MA			0	200	DEG F	M8			30	
44	Z	1011		FINISHED WATER PUMP 11 REVERSE ROTATION ALARM		ALARM				1		120 VAC	CLOSED	A				M8			69	
45	P	1012		FINISHED WATER PUMP 12 DISCHARGE PRESSURE		PRESSURE		1				4 TO 20 MA			0	200	PSIG	M9			14	
46	T	1012	A	FINISHED WATER PUMP 12 BEARING TEMPERATURE 1		TEMP		1				4 TO 20 MA			0	200	DEG F	M9			29	
47	T	1012	B	FINISHED WATER PUMP 12 BEARING TEMPERATURE 2		TEMP		1				4 TO 20 MA			0	200	DEG F	M9			30	
48	Z	1012		FINISHED WATER PUMP 12 REVERSE ROTATION ALARM		ALARM				1		120 VAC	CLOSED	A				M9			66	
49	P	1013		FINISHED WATER PUMP 13 DISCHARGE PRESSURE		PRESSURE		1				4 TO 20 MA			0	200	PSIG	M7			21	
50	T	1013	A	FINISHED WATER PUMP 13 BEARING TEMPERATURE 1		TEMP		1				4 TO 20 MA			0	200	DEG F	M7			31	

KEY	ISAFRST	TAG NO.	MOD	TAGDESC	DESC1	DESC2	DEV_TAG	AI	AO	DI	DO	SIG_LEVEL	ONESTATE	ALARM	0_VALUE	SPAN	ENG_UNTS	RTU	CHASSIS	SLOT	POINT	REMARKS
51	T	1013	B	FINISHED WATER PUMP 13 BEARING TEMPERATURE 2		TEMP		1				4 TO 20 MA			0	200	DEG F	M7			32	
52	Z	1013		FINISHED WATER PUMP 13 REVERSE ROTATION ALARM		ALARM				1		120 VAC	CLOSED	A				M7			64	
53	P	1014		FINISHED WATER PUMP 14 DISCHARGE PRESSURE		PRESSURE		1				4 TO 20 MA			0	150	PSIG	M8			15	
54	T	1014	A	FINISHED WATER PUMP 14 BEARING TEMPERATURE 1		TEMP		1				4 TO 20 MA			0	200	DEG F	M8			31	
55	T	1014	B	FINISHED WATER PUMP 14 BEARING TEMPERATURE 2		TEMP		1				4 TO 20 MA			0	200	DEG F	M8			32	
56	Z	1014		FINISHED WATER PUMP 14 REVERSE ROTATION ALARM		ALARM				1		120 VAC	CLOSED	A				M8			70	
57	P	1015		FINISHED WATER PUMP 15 DISCHARGE PRESSURE		PRESSURE		1				4 TO 20 MA			0	200	PSIG	M9			15	
58	T	1015	A	FINISHED WATER PUMP 15 BEARING TEMPERATURE 1		TEMP		1				4 TO 20 MA			0	200	DEG F	M9			31	
59	T	1015	B	FINISHED WATER PUMP 15 BEARING TEMPERATURE 2		TEMP		1				4 TO 20 MA			0	200	DEG F	M9			32	
60	Z	1015		FINISHED WATER PUMP 15 REVERSE ROTATION ALARM		ALARM				1		120 VAC	CLOSED	A				M9			67	
61	P	1021		LOW SERVICE PRESSURE		PRESSURE		1				4 TO 20 MA			0	100	PSIG	M9			19	
62	P	1022	A	1ST HIGH SERVICE PRESSURE		PRESSURE		1				4 TO 20 MA			0	100	PSIG	M9			20	
63	P	1022	B	1ST HIGH SERVICE PRESSURE		PRESSURE		1				4 TO 20 MA			0	150	PSIG	M9			21	
64	P	1022	C	1ST HIGH SERVICE PRESSURE		PRESSURE		1				4 TO 20 MA			0	150	PSIG	M9			22	
65	P	1023		2ND HIGH SERVICE PRESSURE		PRESSURE		1				4 TO 20 MA			0	200	PSIG	M9			33	
66	P	1024	A	3RD HIGH SERVICE PRESSURE		PRESSURE		1				4 TO 20 MA			0	200	PSIG	M9			34	
67	P	1024	B	3RD HIGH SERVICE PRESSURE		PRESSURE		1				4 TO 20 MA			0	200	PSIG	M9			35	
68	P	1025		SERVICE WATER PRESSURE		PRESSURE		1				4 TO 20 MA			0	200	PSIG	M9			36	
69	H	1107	A	FINISHED WATER PUMP 3 SUCTION VALVE	BV-7	OPEN					1	120 VAC						M9			19	
70	H	1107	B	FINISHED WATER PUMP 3 SUCTION VALVE	BV-7	CLOSE					1	120 VAC						M9			20	
71	I	1107		FINISHED WATER PUMP 3 SUCTION VALVE	BV-7	NOT IN REMOTE				1		120 VAC						M9			68	
72	Z	1107	A	FINISHED WATER PUMP 3 SUCTION VALVE	BV-7	OPENED				1		120 VAC						M9			41	
73	Z	1107	B	FINISHED WATER PUMP 3 SUCTION VALVE	BV-7	CLOSED				1		120 VAC						M9			42	
74	H	1108	A	FINISHED WATER PUMP 2 SUCTION VALVE	BV-8	OPEN					1	120 VAC						M8			23	
75	H	1108	B	FINISHED WATER PUMP 2 SUCTION VALVE	BV-8	CLOSE					1	120 VAC						M8			24	
76	I	1108		FINISHED WATER PUMP 2 SUCTION VALVE	BV-8	NOT IN REMOTE				1		120 VAC						M8			72	
77	Z	1108	A	FINISHED WATER PUMP 2 SUCTION VALVE	BV-8	OPENED				1		120 VAC						M8			51	
78	Z	1108	B	FINISHED WATER PUMP 2 SUCTION VALVE	BV-8	CLOSED				1		120 VAC						M8			52	
79	H	1109	A	FINISHED WATER PUMP 1 SUCTION VALVE	BV-9	OPEN					1	120 VAC						M7			40	
80	H	1109	B	FINISHED WATER PUMP 1 SUCTION VALVE	BV-9	CLOSE					1	120 VAC						M7			41	
81	I	1109		FINISHED WATER PUMP 1 SUCTION VALVE	BV-9	NOT IN REMOTE				1		120 VAC						M7			65	
82	Z	1109	A	FINISHED WATER PUMP 1 SUCTION VALVE	BV-9	OPENED				1		120 VAC						M7			19	
83	Z	1109	B	FINISHED WATER PUMP 1 SUCTION VALVE	BV-9	CLOSED				1		120 VAC						M7			20	
84	H	1110	A	FINISHED WATER PUMP 6 SUCTION VALVE	BV-10	OPEN					1	120 VAC						M9			21	
85	H	1110	B	FINISHED WATER PUMP 6 SUCTION VALVE	BV-10	CLOSE					1	120 VAC						M9			22	
86	I	1110		FINISHED WATER PUMP 6 SUCTION VALVE	BV-10	NOT IN REMOTE				1		120 VAC						M9			69	
87	Z	1110	A	FINISHED WATER PUMP 6 SUCTION VALVE	BV-10	OPENED				1		120 VAC						M9			43	
88	Z	1110	B	FINISHED WATER PUMP 6 SUCTION VALVE	BV-10	CLOSED				1		120 VAC						M9			44	
89	H	1111	A	FINISHED WATER PUMP 5 SUCTION VALVE	BV-11	OPEN					1	120 VAC						M8			25	
90	H	1111	B	FINISHED WATER PUMP 5 SUCTION VALVE	BV-11	CLOSE					1	120 VAC						M8			26	
91	I	1111		FINISHED WATER PUMP 5 SUCTION VALVE	BV-11	NOT IN REMOTE				1		120 VAC						M8			73	
92	Z	1111	A	FINISHED WATER PUMP 5 SUCTION VALVE	BV-11	OPENED				1		120 VAC						M8			53	
93	Z	1111	B	FINISHED WATER PUMP 5 SUCTION VALVE	BV-11	CLOSED				1		120 VAC						M8			54	
94	H	1112	A	FINISHED WATER PUMP 4 SUCTION VALVE	BV-12	OPEN					1	120 VAC						M7			42	
95	H	1112	B	FINISHED WATER PUMP 4 SUCTION VALVE	BV-12	CLOSE					1	120 VAC						M7			43	
96	I	1112		FINISHED WATER PUMP 4 SUCTION VALVE	BV-12	NOT IN REMOTE				1		120 VAC						M7			66	
97	Z	1112	A	FINISHED WATER PUMP 4 SUCTION VALVE	BV-12	OPENED				1		120 VAC						M7			21	
98	Z	1112	B	FINISHED WATER PUMP 4 SUCTION VALVE	BV-12	CLOSED				1		120 VAC						M7			22	
99	H	1113	A	FINISHED WATER PUMP 9 SUCTION VALVE	BV-13	OPEN					1	120 VAC						M9			23	
100	H	1113	B	FINISHED WATER PUMP 9 SUCTION VALVE	BV-13	CLOSE					1	120 VAC						M9			24	

KEY	ISAFRST	TAG NO.	MOD	TAGDESC	DESC1	DESC2	DEV_TAG	AI	AO	DI	DO	SIG_LEVEL	ONESTATE	ALARM	0_VALUE	SPAN	ENG_UNTS	RTU	CHASSIS	SLOT	POINT	REMARKS
101	I	1113		FINISHED WATER PUMP 9 SUCTION VALVE	BV-13	NOT IN REMOTE				1		120 VAC						M9			70	
102	Z	1113	A	FINISHED WATER PUMP 9 SUCTION VALVE	BV-13	OPENED				1		120 VAC						M9			45	
103	Z	1113	B	FINISHED WATER PUMP 9 SUCTION VALVE	BV-13	CLOSED				1		120 VAC						M9			46	
104	H	1114	A	FINISHED WATER PUMP 8 SUCTION VALVE	BV-14	OPEN					1	120 VAC						M8			27	
105	H	1114	B	FINISHED WATER PUMP 8 SUCTION VALVE	BV-14	CLOSE					1	120 VAC						M8			28	
106	I	1114		FINISHED WATER PUMP 8 SUCTION VALVE	BV-14	NOT IN REMOTE				1		120 VAC						M8			74	
107	Z	1114	A	FINISHED WATER PUMP 8 SUCTION VALVE	BV-14	OPENED				1		120 VAC						M8			55	
108	Z	1114	B	FINISHED WATER PUMP 8 SUCTION VALVE	BV-14	CLOSED				1		120 VAC						M8			56	
109	H	1115	A	FINISHED WATER PUMP 7 SUCTION VALVE	BV-15	OPEN					1	120 VAC						M7			44	
110	H	1115	B	FINISHED WATER PUMP 7 SUCTION VALVE	BV-15	CLOSE					1	120 VAC						M7			45	
111	I	1115		FINISHED WATER PUMP 7 SUCTION VALVE	BV-15	NOT IN REMOTE				1		120 VAC						M7			67	
112	Z	1115	A	FINISHED WATER PUMP 7 SUCTION VALVE	BV-15	OPENED				1		120 VAC						M7			23	
113	Z	1115	B	FINISHED WATER PUMP 7 SUCTION VALVE	BV-15	CLOSED				1		120 VAC						M7			24	
114	H	1116	A	FINISHED WATER PUMP 12 SUCTION VALVE	BV-16	OPEN					1	120 VAC						M9			25	
115	H	1116	B	FINISHED WATER PUMP 12 SUCTION VALVE	BV-16	CLOSE					1	120 VAC						M9			26	
116	I	1116		FINISHED WATER PUMP 12 SUCTION VALVE	BV-16	NOT IN REMOTE				1		120 VAC						M9			71	
117	Z	1116	A	FINISHED WATER PUMP 12 SUCTION VALVE	BV-16	OPENED				1		120 VAC						M9			47	
118	Z	1116	B	FINISHED WATER PUMP 12 SUCTION VALVE	BV-16	CLOSED				1		120 VAC						M9			48	
119	H	1117	A	FINISHED WATER PUMP 11 SUCTION VALVE	BV-17	OPEN					1	120 VAC						M8			29	
120	H	1117	B	FINISHED WATER PUMP 11 SUCTION VALVE	BV-17	CLOSE					1	120 VAC						M8			30	
121	I	1117		FINISHED WATER PUMP 11 SUCTION VALVE	BV-17	NOT IN REMOTE				1		120 VAC						M8			75	
122	Z	1117	A	FINISHED WATER PUMP 11 SUCTION VALVE	BV-17	OPENED				1		120 VAC						M8			57	
123	Z	1117	B	FINISHED WATER PUMP 11 SUCTION VALVE	BV-17	CLOSED				1		120 VAC						M8			58	
124	H	1118	A	FINISHED WATER PUMP 10 SUCTION VALVE	BV-18	OPEN					1	120 VAC						M7			46	
125	H	1118	B	FINISHED WATER PUMP 10 SUCTION VALVE	BV-18	CLOSE					1	120 VAC						M7			47	
126	I	1118		FINISHED WATER PUMP 10 SUCTION VALVE	BV-18	NOT IN REMOTE				1		120 VAC						M7			68	
127	Z	1118	A	FINISHED WATER PUMP 10 SUCTION VALVE	BV-18	OPENED				1		120 VAC						M7			25	
128	Z	1118	B	FINISHED WATER PUMP 10 SUCTION VALVE	BV-18	CLOSED				1		120 VAC						M7			26	
129	H	1119	A	FINISHED WATER PUMP 15 SUCTION VALVE	BV-19	OPEN					1	120 VAC						M9			27	
130	H	1119	B	FINISHED WATER PUMP 15 SUCTION VALVE	BV-19	CLOSE					1	120 VAC						M9			28	
131	I	1119		FINISHED WATER PUMP 15 SUCTION VALVE	BV-19	NOT IN REMOTE				1		120 VAC						M9			72	
132	Z	1119	A	FINISHED WATER PUMP 15 SUCTION VALVE	BV-19	OPENED				1		120 VAC						M9			49	
133	Z	1119	B	FINISHED WATER PUMP 15 SUCTION VALVE	BV-19	CLOSED				1		120 VAC						M9			50	
134	H	1120	A	FINISHED WATER PUMP 14 SUCTION VALVE	BV-20	OPEN					1	120 VAC						M8			31	
135	H	1120	B	FINISHED WATER PUMP 14 SUCTION VALVE	BV-20	CLOSE					1	120 VAC						M8			32	
136	I	1120		FINISHED WATER PUMP 14 SUCTION VALVE	BV-20	NOT IN REMOTE				1		120 VAC						M8			76	
137	Z	1120	A	FINISHED WATER PUMP 14 SUCTION VALVE	BV-20	OPENED				1		120 VAC						M8			59	
138	Z	1120	B	FINISHED WATER PUMP 14 SUCTION VALVE	BV-20	CLOSED				1		120 VAC						M8			60	
139	H	1121	A	FINISHED WATER PUMP 13 SUCTION VALVE	BV-21	OPEN					1	120 VAC						M7			48	
140	H	1121	B	FINISHED WATER PUMP 13 SUCTION VALVE	BV-21	CLOSE					1	120 VAC						M7			49	
141	I	1121		FINISHED WATER PUMP 13 SUCTION VALVE	BV-21	NOT IN REMOTE				1		120 VAC						M7			69	
142	Z	1121	A	FINISHED WATER PUMP 13 SUCTION VALVE	BV-21	OPENED				1		120 VAC						M7			27	
143	Z	1121	B	FINISHED WATER PUMP 13 SUCTION VALVE	BV-21	CLOSED				1		120 VAC						M7			28	End of Suction valves
144	H	1122	A	FINISHED WATER PUMP 3 CHECK VALVE	PV-22	OPEN					1	120 VAC						M9			49	
145	H	1122	B	FINISHED WATER PUMP 3 CHECK VALVE	PV-22	CLOSE					1	120 VAC						M9			50	
146	I	1122		FINISHED WATER PUMP 3 CHECK VALVE	PV-22	NOT IN REMOTE				1		120 VAC						M9			72	
147	Z	1122	A	FINISHED WATER PUMP 3 CHECK VALVE	PV-22	OPENED				1		120 VAC						M9			03	
148	Z	1122	B	FINISHED WATER PUMP 3 CHECK VALVE	PV-22	CLOSED				1		120 VAC						M9			04	
149	H	1123	A	FINISHED WATER PUMP 2 CHECK VALVE	PV-23	OPEN					1	120 VAC						M8			47	
150	H	1123	B	FINISHED WATER PUMP 2 CHECK VALVE	PV-23	CLOSE					1	120 VAC						M8			48	

KEY	ISAFRST	TAG NO.	MOD	TAGDESC	DESC1	DESC2	DEV_TAG	AI	AO	DI	DO	SIG_LEVEL	ONESTATE	ALARM	0_VALUE	SPAN	ENG_UNTS	RTU	CHASSIS	SLOT	POINT	REMARKS
151	I	1123		FINISHED WATER PUMP 2 CHECK VALVE	PV-23	NOT IN REMOTE				1		120 VAC						M8			77	
152	Z	1123	A	FINISHED WATER PUMP 2 CHECK VALVE	PV-23	OPENED				1		120 VAC						M8			03	
153	Z	1123	B	FINISHED WATER PUMP 2 CHECK VALVE	PV-23	CLOSED				1		120 VAC						M8			04	
154	H	1124	A	FINISHED WATER PUMP 1 CHECK VALVE	PV-24	OPEN					1	120 VAC						M7			49	
155	H	1124	B	FINISHED WATER PUMP 1 CHECK VALVE	PV-24	CLOSE					1	120 VAC						M7			50	
156	I	1124		FINISHED WATER PUMP 1 CHECK VALVE	PV-24	NOT IN REMOTE				1		120 VAC						M7			70	
157	Z	1124	A	FINISHED WATER PUMP 1 CHECK VALVE	PV-24	OPENED				1		120 VAC						M7			03	
158	Z	1124	B	FINISHED WATER PUMP 1 CHECK VALVE	PV-24	CLOSED				1		120 VAC						M7			04	
159	H	1125	A	FINISHED WATER PUMP 6 CHECK VALVE	PV-25	OPEN					1	120 VAC						M9			51	
160	H	1125	B	FINISHED WATER PUMP 6 CHECK VALVE	PV-25	CLOSE					1	120 VAC						M9			52	
161	I	1125		FINISHED WATER PUMP 6 CHECK VALVE	PV-25	NOT IN REMOTE				1		120 VAC						M9			73	
162	Z	1125	A	FINISHED WATER PUMP 6 CHECK VALVE	PV-25	OPENED				1		120 VAC						M9			05	
163	Z	1125	B	FINISHED WATER PUMP 6 CHECK VALVE	PV-25	CLOSED				1		120 VAC						M9			06	
164	H	1126	A	FINISHED WATER PUMP 5 CHECK VALVE	PV-26	OPEN					1	120 VAC						M8			49	
165	H	1126	B	FINISHED WATER PUMP 5 CHECK VALVE	PV-26	CLOSE					1	120 VAC						M8			50	
166	I	1126		FINISHED WATER PUMP 5 CHECK VALVE	PV-26	NOT IN REMOTE				1		120 VAC						M8			78	
167	Z	1126	A	FINISHED WATER PUMP 5 CHECK VALVE	PV-26	OPENED				1		120 VAC						M8			05	
168	Z	1126	B	FINISHED WATER PUMP 5 CHECK VALVE	PV-26	CLOSED				1		120 VAC						M8			06	
169	H	1127	A	FINISHED WATER PUMP 4 CHECK VALVE	PV-27	OPEN					1	120 VAC						M7			51	
170	H	1127	B	FINISHED WATER PUMP 4 CHECK VALVE	PV-27	CLOSE					1	120 VAC						M7			52	
171	I	1127		FINISHED WATER PUMP 4 CHECK VALVE	PV-27	NOT IN REMOTE				1		120 VAC						M7			71	
172	Z	1127	A	FINISHED WATER PUMP 4 CHECK VALVE	PV-27	OPENED				1		120 VAC						M7			07	
173	Z	1127	B	FINISHED WATER PUMP 4 CHECK VALVE	PV-27	CLOSED				1		120 VAC						M7			08	
174	H	1129	A	FINISHED WATER PUMP 8 CHECK VALVE	PV-29	OPEN					1	120 VAC						M8			51	
175	H	1129	B	FINISHED WATER PUMP 8 CHECK VALVE	PV-29	CLOSE					1	120 VAC						M8			52	
176	I	1129		FINISHED WATER PUMP 8 CHECK VALVE	PV-29	NOT IN REMOTE				1		120 VAC						M8			79	
177	Z	1129	A	FINISHED WATER PUMP 8 CHECK VALVE	PV-29	OPENED				1		120 VAC						M8			07	
178	Z	1129	B	FINISHED WATER PUMP 8 CHECK VALVE	PV-29	CLOSED				1		120 VAC						M8			08	
179	H	1131	A	FINISHED WATER PUMP 12 CHECK VALVE	PV-31	OPEN					1	120 VAC						M9			53	
180	H	1131	B	FINISHED WATER PUMP 12 CHECK VALVE	PV-31	CLOSE					1	120 VAC						M9			54	
181	I	1131		FINISHED WATER PUMP 12 CHECK VALVE	PV-31	NOT IN REMOTE				1		120 VAC						M9			74	
182	Z	1131	A	FINISHED WATER PUMP 12 CHECK VALVE	PV-31	OPENED				1		120 VAC						M9			09	
183	Z	1131	B	FINISHED WATER PUMP 12 CHECK VALVE	PV-31	CLOSED				1		120 VAC						M9			10	
184	H	1134	A	FINISHED WATER PUMP 15 CHECK VALVE	PV-34	OPEN					1	120 VAC						M9			55	
185	H	1134	B	FINISHED WATER PUMP 15 CHECK VALVE	PV-34	CLOSE					1	120 VAC						M9			56	
186	I	1134		FINISHED WATER PUMP 15 CHECK VALVE	PV-34	NOT IN REMOTE				1		120 VAC						M9			75	
187	Z	1134	A	FINISHED WATER PUMP 15 CHECK VALVE	PV-34	OPENED				1		120 VAC						M9			11	
188	Z	1134	B	FINISHED WATER PUMP 15 CHECK VALVE	PV-34	CLOSED				1		120 VAC						M9			12	
189	H	1135	A	FINISHED WATER PUMP 14 CHECK VALVE	PV-35	OPEN					1	120 VAC						M8			53	
190	H	1135	B	FINISHED WATER PUMP 14 CHECK VALVE	PV-35	CLOSE					1	120 VAC						M8			54	
191	I	1135		FINISHED WATER PUMP 14 CHECK VALVE	PV-35	NOT IN REMOTE				1		120 VAC						M8			80	
192	Z	1135	A	FINISHED WATER PUMP 14 CHECK VALVE	PV-35	OPENED				1		120 VAC						M8			11	
193	Z	1135	B	FINISHED WATER PUMP 14 CHECK VALVE	PV-35	CLOSED				1		120 VAC						M8			12	End of Check valves
194	H	1141	A	LOW SERVICE SYSTEM ISOLATION VALVE	BV-41	OPEN					1	120 VAC						M7			29	
195	H	1141	B	LOW SERVICE SYSTEM ISOLATION VALVE	BV-41	CLOSE					1	120 VAC						M7			30	
196	I	1141		LOW SERVICE SYSTEM ISOLATION VALVE	BV-41	NOT IN REMOTE				1		120 VAC						M7			72	
197	Z	1141	A	LOW SERVICE SYSTEM ISOLATION VALVE	BV-41	OPENED				1		120 VAC						M7			50	
198	Z	1141	B	LOW SERVICE SYSTEM ISOLATION VALVE	BV-41	CLOSED				1		120 VAC						M7			51	
199	H	1147	A	1ST HIGH SYSTEM ISOLATION VALVE	BV-47	OPEN					1	120 VAC						M7			31	
200	H	1147	B	1ST HIGH SYSTEM ISOLATION VALVE	BV-47	CLOSE					1	120 VAC						M7			32	

KEY	ISAFRST	TAG NO.	MOD	TAGDESC	DESC1	DESC2	DEV_TAG	AI	AO	DI	DO	SIG_LEVEL	ONESTATE	ALARM	0_VALUE	SPAN	ENG_UNTS	RTU	CHASSIS	SLOT	POINT	REMARKS
201	I	1147		1ST HIGH SYSTEM ISOLATION VALVE	BV-47	NOT IN REMOTE				1		120 VAC						M7			73	
202	Z	1147	A	1ST HIGH SYSTEM ISOLATION VALVE	BV-47	OPENED				1		120 VAC						M7			52	
203	Z	1147	B	1ST HIGH SYSTEM ISOLATION VALVE	BV-47	CLOSED				1		120 VAC						M7			53	
204	H	1148	A	1ST HIGH SYSTEM ISOLATION VALVE	BV-48	OPEN					1	120 VAC						M9			31	
205	H	1148	B	1ST HIGH SYSTEM ISOLATION VALVE	BV-48	CLOSE					1	120 VAC						M9			32	
206	I	1148		1ST HIGH SYSTEM ISOLATION VALVE	BV-48	NOT IN REMOTE				1		120 VAC						M9			77	
207	Z	1148	A	1ST HIGH SYSTEM ISOLATION VALVE	BV-48	OPENED				1		120 VAC						M9			53	
208	Z	1148	B	1ST HIGH SYSTEM ISOLATION VALVE	BV-48	CLOSED				1		120 VAC						M9			54	
209	H	1156	A	2ND HIGH SERVICE ISOLATION VALVE	BV-56	OPEN					1	120 VAC						M7			33	
210	H	1156	B	2ND HIGH SERVICE ISOLATION VALVE	BV-56	CLOSE					1	120 VAC						M7			34	
211	I	1156		2ND HIGH SERVICE ISOLATION VALVE	BV-56	NOT IN REMOTE				1		120 VAC						M7			74	
212	Z	1156	A	2ND HIGH SERVICE ISOLATION VALVE	BV-56	OPENED				1		120 VAC						M7			54	
213	Z	1156	B	2ND HIGH SERVICE ISOLATION VALVE	BV-56	CLOSED				1		120 VAC						M7			55	
214	H	1160	A	3RD HIGH SERVICE ISOLATION VALVE	BV-60	OPEN					1	120 VAC						M8			55	
215	H	1160	B	3RD HIGH SERVICE ISOLATION VALVE	BV-60	CLOSE					1	120 VAC						M8			56	
216	I	1160		3RD HIGH SERVICE ISOLATION VALVE	BV-60	NOT IN REMOTE				1		120 VAC						M8			81	
217	Z	1160	A	3RD HIGH SERVICE ISOLATION VALVE	BV-60	OPENED				1		120 VAC						M8			27	
218	Z	1160	B	3RD HIGH SERVICE ISOLATION VALVE	BV-60	CLOSED				1		120 VAC						M8			28	
219	H	1163	A	3RD HIGH SERVICE ISOLATION VALVE	BV-63	OPEN					1	120 VAC						M7			53	
220	H	1163	B	3RD HIGH SERVICE ISOLATION VALVE	BV-63	CLOSE					1	120 VAC						M7			54	
221	I	1163		3RD HIGH SERVICE ISOLATION VALVE	BV-63	NOT IN REMOTE				1		120 VAC						M7			75	
222	Z	1163	A	3RD HIGH SERVICE ISOLATION VALVE	BV-63	OPENED				1		120 VAC						M7			25	
223	Z	1163	B	3RD HIGH SERVICE ISOLATION VALVE	BV-63	CLOSED				1		120 VAC						M7			26	
224	H	1165	A	3RD HIGH SYSTEM ISOLATION VALVE	BV-65	OPEN					1	120 VAC						M7			35	
225	H	1165	B	3RD HIGH SYSTEM ISOLATION VALVE	BV-65	CLOSE					1	120 VAC						M7			36	
226	I	1165		3RD HIGH SYSTEM ISOLATION VALVE	BV-65	NOT IN REMOTE				1		120 VAC						M7			76	
227	Z	1165	A	3RD HIGH SYSTEM ISOLATION VALVE	BV-65	OPENED				1		120 VAC						M7			56	
228	Z	1165	B	3RD HIGH SYSTEM ISOLATION VALVE	BV-65	CLOSED				1		120 VAC						M7			57	
229	H	1166	A	3RD HIGH SYSTEM ISOLATION VALVE	BV-66	OPEN					1	120 VAC						M9			37	
230	H	1166	B	3RD HIGH SYSTEM ISOLATION VALVE	BV-66	CLOSE					1	120 VAC						M9			38	
231	I	1166		3RD HIGH SYSTEM ISOLATION VALVE	BV-66	NOT IN REMOTE				1		120 VAC						M9			78	
232	Z	1166	A	3RD HIGH SYSTEM ISOLATION VALVE	BV-66	OPENED				1		120 VAC						M9			59	
233	Z	1166	B	3RD HIGH SYSTEM ISOLATION VALVE	BV-66	CLOSED				1		120 VAC						M9			60	
234	L	1202	A	EAST SIDE SUMP		HIGH LEVEL				1		120VAC						M7			77	
235	L	1202	B	WEST SIDE SUMP		HIGH LEVEL				1		120 VAC						M7			78	
236	L	1203		SEWER EJECTOR		HIGH LEVEL				1		120 VAC						M7			79	
237																						
238																						

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SECTION 13622

INFORMATION HISTORIAN AND OPERATIONS
04/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced and are referred to in the text by the basic designation only.

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41	(1991; R 1995) Surge Voltages in Low-Voltage AC Power Circuits
IEEE Std 829	(1998) IEEE Standard for Software Test Documentation

1.2 DESCRIPTION

Provide and test the Operations Management System, furnished by a single supplier. Provide equipment, installation, services, and appurtenances required to achieve a complete, integrated, and fully operational system. The system shall include a set of software modules for plant-wide monitoring information archiving and analysis.

The Supplier of this specification shall be responsible for the coordination of all other equipment furnished in this contract with overall control system requirements.

1.3 RELATED WORK

Division 1: General Requirements

1.4 SYSTEM DESCRIPTION

Operations Management System shall consist of computers, operating systems, networks and users historian modules.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Installation; G AE
Wiring; G AE

Detail drawings containing complete wiring, schematic, flow diagrams and any other details required to demonstrate that the

system has been coordinated and will properly function as a unit. Drawings shall include, as appropriate: product specific catalog cuts; a drawing index; a list of symbols; a series of customized drawings showing the historian hardware and wiring installation.

All drawings shall be submitted on 11 x 17-inch sheets. Provide only one control loop per sheet. Loop drawings may be submitted on multiple sheets.

SD-03 Product Data

Data Historian System; G AE

Manufacturer's descriptive and technical literature, performance and installation instructions. Product specific catalog cuts shall be in 8 1/2 x 11 3-ring D binders and 11 x 17 3-ring binders for all documents, indexed to the unique identifiers, and shall consist of data sheets that document compliance with the specification. Where multiple components are shown on a catalog cut, the application specific component shall be marked.

Performance Verification Test (PVT); G AE

The performance verification testprocedure; it shall refer to the actions and expected results to demonstrate that the control system performs in accordance with the sequence of control. A list of the equipment to be used during the testing shall be included. The list shall also include manufacturer's name, model number, equipment function, the date of the latest calibration and the results of the latest calibration.

Factory Test Procedure; G AE

Documentation containing factory test methods and procedures.

SD-06 Test Reports

Factory Test Report; G AE
Testing, Adjusting and Commissioning; G AE
Performance Verification Test(PVT); G AE
Endurance Test; G AE

Test results in report format.

SD-10 Operation and Maintenance Data

Data Historian System; G AE

Six complete copies of operating instructions outlining the step-by-step procedures required for system startup, operation and shutdown. The instructions shall include layout, wiring and control diagrams of the system as installed. The instructions shall include the manufacturer's name, model number, service manual, parts list and a brief description of all equipment and their basic operating features.

Six complete copies of maintenance instructions listing routine maintenance procedures, possible breakdowns and repairs and trouble shooting guides.

Provide within 90 days of Notice to Proceed, product instructions and product manuals identifying all hardware and software to be provided as part of this project.

Provide programming and configuration documentation.

Provide points listing.

Provide User Manuals and Programming Manuals in both hard copy and electronic version prior to Owner training.

1.6 EQUIPMENT REQUIREMENTS

1.6.1 Materials and Equipment

Materials and equipment shall be standard unmodified products of a manufacturer regularly engaged in the manufacturing of such products. Units of the same type of equipment shall be products of a single manufacturer. Items of the same type and purpose shall be identical and supplied by the same manufacturer, unless replaced by a new version approved by the Government.

1.6.2 Nameplates

Each major component of equipment shall have the manufacturer's name and address, and the model and serial number in a conspicuous place. Laminated plastic nameplates shall be provided for equipment devices and panels furnished. Each nameplate shall identify the device, such as pump "P-1" or valve "VLV-402". Labels shall be coordinate with the schedules and the process and instrumentation drawings. Laminated plastic shall be 1/8 inch thick, white with black center core. Nameplates shall be a minimum of 1 by 3 inches with minimum 1/4 inch high engraved block lettering. Nameplates for devices smaller than 1 by 3 inches shall be attached by a nonferrous metal chain. All other nameplates shall be attached to the device with stainless steel screws.

1.7 QUALITY ASSURANCE

The contractor shall submit the manufacturer and their integrators qualifications within 30-days of the notice to proceed. The system manufacturer and integrator shall demonstrate five (5) years experience, all within the last ten (10) years in the development, integration and commissioning of information historian for the water and wastewater industry. The historian shall be a separate application that shall integrate with multiple control system and HMI system manufacturers products. The manufacturer/integrator shall have procedures in place for standard project methodology for; developing a project plan, system functional specifications, implementation methods, test plans, integration, testing, staging, installation and startup. The integrator shall demonstrate that their staff has been factory trained by the historian manufacturer. The integrator shall show experience in training of customer staff in the use and long term support of historian. The qualifications documentation shall be supported by letters of qualification from the manufacturer of historian and reference list of completed projects with reference contacts.

Provide list of staff that will be working on the project.
Provide staff qualifications. The qualifications should show current

factory training on the products that will be used for this project.

Provide project narrative. Narrative shall describe: project team, design approach and major hardware and software that will be used. The reason for selecting a particular hardware and software solution should be explained. The narrative should show a clear understanding of the project needs and objectives.

Substitutions on functions specified will not be allowed. To assure interchangeability of parts, maintenance of quality, and ease of interfacing the various subsystems, strict compliance with the specifications shall be maintained.

The Contractor shall have historian manufacturer coordinate with the controls system supplier to identify any additional communication hardware or software that may be required to complete the system.

Provide historian integration from OSI Software, Omicron, Applied Control Engineering, Davidson & Associate or approved equal.

Upon completion of the start-up, provide competent training personnel for a period of not less than 4 8-hour working days, excluding travel time, for training of personnel in the use, operation and maintenance of the Operations Management System. Training to utilize the submitted operation and maintenance manuals and record copy drawings as reference materials. Training to be for 4 personnel in each class. Each class to be of a four hour duration.

PART 2 PRODUCTS

2.1 DATA HISTORIAN SYSTEM

Provide a data historian that handles the storage and retrieval of numerical, digital and string data, and executes on servers running any of the following operating systems: Microsoft Windows NT, 2000, or XP or later. Historians built around a relational data base shall not be considered.

Provide a snapshot database that stores the current data value for each point being monitored, prior to transferring value to the data archive.

Provide a historical record of values for each point in a point database, including a time-stamped value for all the points in the Point Database. Provide time-stamped values stored in a set of disk files, where each file covers a different, non overlapping time period.

Provide an update manager, which notifies other, related programs and software applications of changes in value in the archive.

Provide a messaging system, which stores and manages status and error messages related to data interfaces and data values.

Provide an SDK and a SQL interface, allowing access to the data archive and the point definition file.

Provide a point database that allows defining all points stored in the archive.

Provide, as a minimum, storage for the following data types:

Digital: Used for points whose value can only be one of several discrete states, such as ON/OFF or Red/Green/Yellow.

Integer 16: Used for points whose values are 15-bit unsigned integers (0 to 32767).

Integer 32: Used for points whose values are 32-bit signed integers (-2147450880 to 2147483647).

Floating Point 16: Used for floating point values, scaled. Provide minimum accuracy of one part in 32767.

Floating Point 32: Used for single-precision floating-point values.

Floating Point 64: Used for double-precision floating-point values.

String: Used to store string data of up to 976 characters.

Blob: Binary large object - Used to store any type of binary data up to 976 bytes.

Timestamp: Used to store values of type Timestamp. Any Time/Date in the Range 1-Jan-1970 to 1-Jan-2038

Provide the ability to set a "typical" value as part of defining each point.

Provide the ability to set a zero value and a span for all numerical points. The zero and span are used to calculate the minimum and maximum values that may be stored in the archive.

Provide the ability to define engineering units for all numerical points.

Provide the ability to select compression on or off for each point. Compression off means that the archive will store all values sent to it. Compression on means that only those data values that have exceeded the limits of change will be saved, resulting in only significant data being saved.

Provide the ability to select archive on or off for each point. Archive off means that the point values will not be added to the data archive.

Provide a step on or off feature, defining whether data is continuous, or sampled. When step is off, values are considered continuous, and the algorithm retrieving data will interpolate values between storage times. When step is on, data is discrete, the values are not interpolated, and the value remains as the last value until a new value is stored.

Provide the ability to limit access to a point based on user name and password.

Provide the ability to configure the number of significant digits displayed for each point value.

Provide the ability to configure a shutdown flag for each point, based on the availability of the interface.

Provide the ability to perform square root extraction on a point value automatically.

Provide the ability to change the time constant of the filter code for smoothing data.

Provide a Network Manager that manages connections between the client applications and the central data storage system.

Provide an audit system to log all system changes, including data, point definition, and system configuration.

Provide Universal Data Server (UDS) or equal.

2.2 DATA INTERFACE

Provide high-speed, fault-tolerant links to real-time data sources by consolidating the operations data from multiple-generation or multiple-vendor control systems into a single, coordinated, information system.

Provide consistent interface, independent of the computer platform or target data source.

Provide fault-tolerant interface that continues collecting data independent of the host computer status. Provide an interface that will hold data for 10 days and automatically transmit the data back to the main computer once the connection has been re-established.

Provide distributed data collection, based on the architecture of the control system.

Provide continuous data collection and buffering during communication failures.

Provide data collection on Microsoft Windows NT, 2000, or XP or later systems.

Provide a unified interface with the following features:

Consistent installation routine independent of the interface.
Configuration parameters with common names independent of the interface.
Orderly startup/shutdown routines.
Messaging.
Indication of bad data and communication failures.
Automatic incorporation of point and device attribute changes.

Provide links to and from the following real-time data sources including, but not limited to:

ABB (ABB Advant, ABB Accuray, ABB Power Systems, Bailey)

Bristol Babcock Inc.

General Electric

OPC DAS (1.0a and 2.0) compliant servers

Rockwell Automation (Allen-Bradley)

Siebe Intelligent Automation (Foxboro, Wonderware)

Schneider Automation (Modicon)

2.3 MANUAL DATA ENTRY

Provide a manual data interface that allows manual entry of values into the data historian.

Provide a manual data entry screen configuration tool, allowing custom development of manual entry screens.

Provide a manual entry screen that allows entering multiple values for multiple points, all with the same time stamp.

Provide a check/verification step allowing one person to enter data, and another to review and accept data.

Provide interface to handheld terminal, including Oyster Terminals, allowing remote data entry and automated transfer to PI.

Provide Manual Logger or equal.

2.4 SPREADSHEET INTERFACE

Provide a link between the data historian and spreadsheet programs running on Microsoft Windows platforms that allow a user running Microsoft Excel or some other spreadsheet program to exchange information directly with the data historian.

Provide the ability to set equations in the spreadsheet to call data from the data historian using standards spreadsheet equations.

Current value

Value at a specific time

Tag attributes

Evenly spaced (sampled) data

Sampled data while a given expression is true

Compressed (archived) data

Compressed data while a given expression is true

Sampled data for a user specified array of timestamps

Data from calculations on tag expressions

Amount of time while a tag expression was true

Totals, minima, maxima, standard deviations, ranges, averages and means for tag

Provide the interface as an Add-In Program, and fully integrate all operations with normal spreadsheet commands in options.

Provide data networked interface via TCP/IP.

Provide an interface that will update data in the spreadsheet in real time.

Provide Datalink.

2.5 PROCESS DATA GRAPHICAL INTERFACE

Provide a real-time graphics package, running under Microsoft Windows, that includes the following capabilities:

Drawing functions for creating process graphics

Values, bars, and trends that update dynamically

Support for viewing data from multiple PI UDS nodes

Access to non-historian data via ODBC

Support for OLE compound documents as both a container and server

Visual Basic for Applications

Provide the ability to switch between view mode and edit mode with an operator action.

Provide the ability to automate graphics using MS Visual Basic to activate alarm scripts, pop-up process displays and flashing alarm indicators.

Provide the ability to save Process graphics as Scalable Vector Graphics (SVG format)

Provide the ability to build displays that track and make readily available critical analyses; to create and organize displays, making it easy to find the source of process issues and to trigger alarms based on process values; and to access and view past process behavior using third-party software including live video. Provide access to ODBC data sources

Provide a program certified by Microsoft to work with other desktop programs.

Provide a real-time graphics package, running under Microsoft Windows including the following features:

Process graphics, pictures, scrolling trend displays, and other built-in active elements.

Built-in drawing tools conforming to the standard look and feel of Windows drawing and painting packages.

An ActiveX control container providing the ability to populate process displays with elements such as 3-D visuals and live video. Link controls to process data, tag names, or descriptions.

Provide Process Book.

2.6 PROCESS ALARM INTERFACE

Provide an alarm handling system that allows users to track notifications caused by process alarms.

Provide the capability to notify specific users about specific alarm conditions depending on the longevity and/or severity of the event depending on the "condition" as well as the "priority" of the event.

Allow viewing alarms from the Windows PC environment using a client application that displays alarm data within the context of the overall alarm structure. Provide detailed information on specific points, and a tool for acknowledging alarms. Present data in a hierarchical tree structure to an unlimited number of Windows clients on- or off-site.

Provide a tree hierarchy displaying the alarm structure of the process or plant.

Provide a table displaying alarms for a particular part or subpart of the process.

Provide a table displaying the alarm history for a specific alarm point.

Provide an update function that notifies controls of the current status of monitored alarms.

Provide Alarmview.

2.7 PROCESS BATCH INTERFACE

Provide a batch interface module that detects and records batch activity, like filter backwash, and allow the user to view process data within the context of a batch activity.

Provide the ability to link points to the batch activity, and to view simultaneously process values related with the batch activity.

Provide the ability to view batch data in the Windows client-environment, including a query dialog allowing MS Access and MS Visual Basic to search the database modules.

Provide a trending capability that displays batch-related data.

Provide an interface allowing display of batch related data in the spreadsheet.

Provide Batchview.

2.8 PROCESS MANAGER

Provide a tool that sorts database contents into useful groups; helps organize real-time data, stores parameters or specifications, and makes them ready for use in programs and displays.

Provide a database that includes the following capabilities:

Adds layered hierarchy and structure to data

Organizes real-time and related data

Archives additions and changes to the relationship of enterprise data over time

Allows users to define properties, aliases, headings, and layers to the data

Saves different versions, allowing reuse of configurations depending on overall plant or process layout or equipment in-service/out-of-service assignments.

Enables users to see how data are organized, as well as how the data and their sources are connected.

Provide Module DB.

2.9 INTERACTIVE ENVIRONMENT

Provide a tool that allows users to create interactive, configurable displays for use with an Internet or intranet portal, including the following:

Server-based maintenance

No software installation required on client computers

Integration with existing intranet environment

No Web development tools necessary to build user displays

Users can maintain views of specific data through Microsoft controls allowing search and display of historical data.

Users data access limited based on security settings

Provide a systems that uses current Internet standards, including Scalable Vector Graphics (SVG) and XML to display and present data in displays, trends and tables.

Provide Interactive Configurable Environment.

2.10 SERVER APPLICATIONS

Provide tools that allow users to automate routine procedures and calculations.

Provide an alarm handling system that allows users to track notifications caused by process alarms.

Provide alarms configurable as a special kind of digital tag with the value as a digital state that gives information about the alarm status of its source tag. Provide digital sets that come with the Data Archive.

Alarm state as either Alarm/No Alarm or the value and the associated alarm state (High high, High, Low, Low low).

The alarm priority (1 to 3) indicating the importance of the alarm.

Alarm Acknowledge/Not Acknowledge status.

Provide an alarm Auto Acknowledge feature.

Provide a missed alarm feature for alarms that are Not Acknowledged by the time an alarm clears, and then comes in again. Provide the ability to hide missed alarms.

Provide the ability to set an alarm start time as either the time of the first Not Acknowledged alarm, or as the time of the most recent alarm event.

Designate Not Acknowledged alarms with a flashing color.

Provide the ability to select specific points for display in the Alarm History feature.

Provide a Batch handling system.

Provide a batch interface module that detects and records batch activity and allow the user to view process data within the context of a batch activity.

Provide the ability to link points to the batch activity, and to view simultaneously process values related with the batch activity.

Provide the ability to view batch data in the Windows client-environment, including a query dialog allowing MS Access and MS Visual Basic to search the database modules.

Provide a trending capability that displays batch-related data.

Provide an interface allowing display of batch related data in the spreadsheet.

Provide the ability to program routine calculations including:

Unit performance
Real-time cost accounting
Real-time yield accounting
Grade-based costing
Batch summary

Steam Tables including a complete set of functions for deriving thermodynamic and transport properties of steam and water, based on the ASME (American Society of Mechanical Engineers) steam tables.

Real-time Statistical Quality Control including numerical methods to monitor the characteristics of a process, making sure the parameters remain within pre-determined boundaries. When an unacceptable deviation from test norms occurs, notify the alarm manager.

Statistical Quality Control Alarms When Real-Time SQC perceives an unacceptable deviation in the process, SQC Alarms alert the appropriate personnel.

Totalizer to establish totals, averages, minimum, and maximum calculation to the time-ordered data entries.

Provide Server Applications.

2.11 REPORTING

Provide a reporting package integrated with the point and process definition configuration.

Provide a report audit trail feature that logs all data and user security changes.

Provide a reporting package that recalculates and regenerates all report data each time the report is run, without saving any calculated or intermediate data. Provide a rigid version auditing system that keeps reports aligned with the process configuration.

Provide a reporting system that allows authorized users to use a browser to access reports resident on a Web site.

Provide report server security that limits user access to specific reporting tasks.

Provide Flex Reports.

2.12 HISTORIAN SERVERS

Provide two (2) servers. Provide an Application Server and an Application Processor Interface Server. The servers shall be equal to Dell Power Edge. The servers shall be provided as a minimum with;

2.4 GHz/512K Cache processor.

2 GB DDR memory.

Standard Keyboard.

Dell 19" 1901 FP Monitor with AS500 Sound Bar.

Mouse.

2-each 146 GB 10K RPM Hard Drive.

1-each 18 GB 15K RPM Media Bay Hard Drive.

Tape Backup.

24X CD-RW/DVD.

1X6 Hot-Pluggable Backplane.

Windows 2003 Server Operating System with 4GB Utility Partition with multiple Client Licenses.

Provide the servers fully configured for the historian.

2.13 FACTORY TESTING

Provide a system shop test during which all software modules are demonstrated and the point database is loaded and verified. Provide test in accordance with IEEE Std 829.

The historian system shall be tested at the factory prior to shipment. Written notification of planned testing shall be given to the Government at least 21 days prior to testing, and in no case shall notice be given until after the Contractor has received written Government approval of the test procedures.

2.13.1 Factory Test Setup

The Contractor shall assemble and integrate the factory test setup as specified to prove that performance of the system satisfies all requirements of this project, including system communications requirements in accordance with the approved test procedures. The factory test shall take place during regular daytime working hours on weekdays. Equipment used shall be the same equipment that is to be delivered to the site. The factory test setup shall include the following:

	Factory Test
Workstation/Server	one of each type
Communications circuits	one of each type and speed to be utilized in the proposed system including bridges, modems, encoder/decoders, transceivers and repeaters.
Surge protection equipment	for power, communications, I/O functions and networks
I/O functions	sufficient to demonstrate the I/O capability and system normal operation
Software	software required for proper operation of the proposed system including application programs and sequences of operation

2.13.2 Factory Test Procedure

Test procedures shall define the tests required to ensure that the system meets technical, operational, and performance requirements. The test procedures shall define location of tests, milestones for the tests, and identify simulation programs, equipment, personnel, facilities, and supplies required. The test procedures shall provide for testing all historian system capabilities and functions specified and shown. The procedures shall cover actual equipment and sequences to be used by the Contractor for the specified project and shall consist of detailed instructions for test setup, execution, and evaluation of test results. The test reports shall document results of the tests. Reports shall be delivered to the Government within 7 days after completion of each test. Surge testing need not be conducted if the Contractor can provide acceptable documented proof that such testing has been satisfactorily demonstrated to the Government with identical surge protection applied. The procedures shall include the following:

	Test Procedure
Equipment	block diagram

Test Procedure	
Hardware and software	descriptions
Commands	operator commands
I/O functions	test database points with failure modes
Passwords	required for each operator access level
Each type of digital and analog point in the test database	description
Test equipment	list
Surge protection	circuit diagrams
Inputs required (I/O point values and status) and corresponding expected results of each set of input values	for each application program
Default values	for the application program inputs not implemented or provided for in the contract documents for the application programs to be tested.

2.13.3 Factory Test Report

Original copies of data produced during the factory test, including results of each demonstration procedure, shall be delivered to the Government at the conclusion of the test, prior to Government approval of the factory test. The report shall be arranged so that commands, responses, and data acquired are correlated to allow logical interpretation of the data.

PART 3 EXECUTION

3.1 POINT CONFIGURATION

Configure the point database using the owner defined point naming configuration.

3.2 INTERFACE CONFIGURATION

Configure Interface to monitor all specified points.

Configure real-time Interface Status Alarm to monitor Interface with each field device and alarm loss of communication.

Demonstrate communication with each point by selecting a snapshot and printing all values for a specific time.

3.3 REPORT CONFIGURATION

Provide 8 reports. The reports shall include; a water quality report that may be submitted to the local regulatory authority, an equipment summary report that provides a summary of equipment runtime and faults, a water production report that provides a summary of all measured system flows, a

report on all insitu water quality measurements, a lab report that allows manual input of lab data and reports that data with real-time plant measurements and an alarm summary report and 2 additional reports to be defined by WA during construction.

3.4 Operation and Maintenance Data

3.4.1 General

Submit preliminary operation and maintenance manuals 60 days prior to on site equipment test performance and furnish complete, as-built, manuals before contract is completed. Two of three complete manuals shall be made up of manufacturer's original documents. Duplicated documents are not acceptable. Inscribe following identification on cover: "OPERATING AND MAINTENANCE MANUAL," and name and location of system, name of Contractor, and contract number. Include names, and addresses, and telephone numbers of local representatives for each item of equipment in system. Include table of contents and assemble to conform to table of contents, with reinforced tab sheets placed before instructions covering subject. Provide legible instruction sheets with large drawings reduced or folded. Update all manuals to include modifications made during installation, checkout, and acceptance include the following:

a. Functional Design Manual: Identify operational requirements for system and explain theory of operation, design philosophy, and specific functions. Provide hardware and software functions, interfaces, and requirements for all system operating modes.

b. Hardware Manual: Furnish hardware manual describing all equipment provided, including:

(1) General description and specifications.

(2) Installation and checkout procedures.

(3) Interface definition including system diagram.

(4) Servicing procedures.

(5) Troubleshooting procedures.

(6) Operating procedures.

2. Software Manual: Describe configuration and testing, starting with system overview and proceeding to detailed description of each software module. Orient to process engineers and describe configuration techniques, examples, and other information necessary to enable proper integration, loading, testing, and application execution. Provide separate sections for each application including:

a. System configuration in hard copy of all software provided, excluding general purpose operating system and utility programs furnished by the manufacturer.

b. Flow diagrams or equivalent documentation in hard copy enabling the logical step-by-step analysis of the configuration.

c. Definitions of terms and functions.

d. Procedures for system generation.

e. Description of algorithms for applications programs.

f. Description of implementation of the applications program, including interfaces with calling and called programs.

g. Data base structure and interface with running programs.

h. Directory of all disk files.

i. Report generator data format, output format, and content.

j. Alarm messages and screen formatting.

k. System access requirements.

l. Color graphic generator data format, output format, and content.

3. Engineer's Manual: This manual, for use by the Engineer and Owner, shall define how the following components are used and how they function with the basic system:

a. Operating system use.

b. All system software including compilers, editors, system utilities, file handlers, and the like.

c. Basic user packages including data base generator, graphics generator, report generator, and general man-machine/operator-process interface.

d. Basic system operation including cold start, warm start, time/date initialization, and backup procedures.

e. System reconfiguration and regeneration procedures.

4. Users Manual: Provide this manual for use by systems Users. These manuals shall be separately bound and shall contain all information required by a system user. Manuals shall be available at the time of the User Training Course and shall be covered as part of course material. Manuals should contain the following information as a minimum:

a. A simple pictorial presentation and description of what system is, what it does, and how this is accomplished. A functional description of all HMI interfaces.

b. A description of each type of data format.

c. A glossary of terms.

e. Separate step-by-step procedure shall be provided for each action to be performed in operating the system. These procedures should include, but not be limited to, the following:

(1) Viewing HMI

(2) Creating reports

(3) Printing screens and reports

3.5 WIRING, CABLE AND CONNECTING HARDWARE

3.5.1 LAN Cables and Connecting Hardware

LAN cables and connecting hardware shall be installed in accordance with Section 16768A.

3.5.2 Power Line Surge Protection

Control panels shall be protected from power line surges. Protection shall meet the requirements of IEEE C62.41. Fuses shall not be used for surge protection.

3.6 FIELD TESTING AND ADJUSTING EQUIPMENT

The Contractor shall provide personnel, equipment, instrumentation, and supplies necessary to perform site testing. The Government will witness the PVT, and written permission shall be obtained from the Government before proceeding with the testing. Original copies of data produced, including results of each test procedure, during PVT shall be turned over to the Government at the conclusion of each phase of testing prior to Government approval of the test. The test procedures shall cover actual equipment and functions specified for the project.

3.6.1 Testing, Adjusting and Commissioning

After successful completion of the factory test as specified, the Contractor will be authorized to proceed with the installation of the system equipment, hardware, and software. Once the installation has been completed, the Contractor shall test, and commission the historian system and shall verify proper operation of hardware and software. Contractor shall calibrate and verify data communications before the system is placed online. The Contractor shall deliver reports and trend of all points showing to the Government that historical information has been collected, stored and retrived correctly. The Contractor shall verify operation of systems in the specified failure modes upon system network failure or loss of power, and verify that systems return to normal upon a resumption of network operation or return of power. The Contractor shall deliver a report describing results of functional tests, diagnostics, and commissioning procedures including written certification to the Government that the installed complete system has been tested, adjusted and commissioned and is ready to begin the PVT. The report shall also include a copy of the approved PVT procedure.

3.6.2 Performance Verification Test (PVT)

The Contractor shall prepare test procedures for the PVT. The test procedure shall describe all tests to be performed and other pertinent information such as specialized test equipment required and the length of the PVT. The test procedures shall explain, in detail, step-by-step actions and the expected results, to demonstrate compliance with all the requirements of the drawings and this specification. The test procedure shall be site specific and based on the inputs and outputs, required calculated points. The Contractor shall demonstrate that the completed historian system complies with the contract requirements. All physical

and functional requirements of the project including communication requirements shall be demonstrated and shown. The Contractor shall demonstrate that the historian operates as required. The PVT as specified shall not be started until after receipt by the Contractor of written permission by the Government, based on the Contractor's written report including certification of successful completion of testing, and commissioning as specified, and upon successful completion of training as specified. Upon successful completion of the PVT, the Contractor shall deliver test reports and other documentation as specified to the Government.

3.6.3 Endurance Test

The Contractor shall use the endurance test to demonstrate the overall system reliability. The endurance test shall be conducted in phases. The endurance test shall not be started until the Government notifies the Contractor in writing that the PVT is satisfactorily completed, training as specified has been completed, outstanding deficiencies have been satisfactorily corrected, and that the Contractor has permission to start the endurance test. The historian endurance test shall be perfomred concurrently with process control test and follow the same criteria.

3.6.3.1 Exclusions

The Contractor will not be held responsible for failures resulting from the following: Outage of the main power supply in excess of the capability of any backup power source, provided that the automatic initiation of all backup sources was accomplished and that automatic shutdown and restart of the control system performed as specified. Failure of a Government furnished communications link, provided that the control system automatically and correctly operates in the stand-alone mode as specified, and that the failure was not due to Contractor furnished equipment, installation, or software. Failure of existing Government owned equipment, provided that the failure was not due to Contractor furnished equipment, installation, or software.

-- End of Section --

SECTION 15201

VALVES
03/02

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN WATER WORKS ASSOCIATION(AWWA)

AWWA C 507	(1994) Rubber-Seated Butterfly Valves

ASTM AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 126	Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
ASTM A 276	Specification for Stainless Steel Bars and Shapes
ASTM A 536	Specification for Ductile Iron Castings

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-25	(1998) Standard Marking System for Valves, Fittings, Flanges and Unions
MSS SP-55	Quality Standard for Steel Castings for Valves, Flanges and Fittings and other Piping Components - Visual Method for Evaluation of Surface Irregularities
MSS SP-58	(1993) Pipe Hangers and Supports - Materials, Design and Manufacture
MSS SP-69	(1996) Pipe Hangers and Supports - Selection and Application
MSS SP-89	(1998) Pipe Hangers and Supports - Fabrication and Installation Practices

1.2 UNIT PRICES

Measurement and payment will be based on completed work performed in accordance with the drawings, specifications and the contract payment schedules.

1.2.1 Payment

Payment for valves and other appurtenances will be made at the respective contract unit price for each item complete in place. Payment will include the furnishing of all testing, plant, labor, and material and incidentals necessary to complete the work, as specified and as shown in contract documents.

1.2.1.1 Connections to Existing Piping

Connections to existing piping systems where new fittings in the existing line are required will be paid for according to the contract prices for such connection. The price will be considered as full compensation for material and labor required for the removal and replacement of the existing pipe as necessary.

1.2.1.2 Connections to Existing Equipment

Connections to existing equipment where new fittings for the existing equipment are required will be paid for according to the contract prices for such connection. The price will be considered as full compensation for material and labor required for the installation of new fittings or the removal and replacement of existing fittings, as necessary.

1.3 SYSTEM DESCRIPTION

This specification covers the requirements for valves and appurtenances located inside.

1.3.1 Design Requirements

Support systems shall be selected and designed in accordance with MSS SP-58, MSS SP-69, and MSS SP-89 within the specified spans and component requirements. The absence of pipe supports and details on the contract drawings does not relieve the Contractor of responsibility for sizing and providing supports throughout facility.

1.3.2 Performance Requirements

The pressure ratings and materials specified represent minimum acceptable standards. The valves shall be suitable for the services specified and intended. Flanges, valves, fittings and appurtenances shall have a pressure rating no less than that required for the system in which they are installed.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings; G AE

Equipment shop drawings and support system detail drawings showing piping systems and appurtenances, such valves and actuators, including a complete list of equipment and materials. As-built

drawings showing pipe anchors and guides, and layout of piping systems relative to other parts of the work including clearances for maintenance and operation. As-built piping and instrumentation diagrams (P&IDs) identifying and labeling equipment, instrumentation, valves, vents, drains, and all other inline devices; if the contract drawings contained P&IDs, the P&IDs found in the contract drawings shall be revised to reflect the constructed process system, as directed by the Contracting Officer.

SD-03 Product Data

Qualifications; G AE

A statement certifying that the Contractor has the specified experience.

Welders and Certification; G AE

Each welder, tacker, and welding operator to be certified by test within the past six months to perform type of work required in conformance with AWS Structural W elding Code.

The names of all qualified welders, their identifying symbols, and the qualifying procedures for each welder including support data such as test procedures used, standards tested to, etc.

Installation Certification; G WA

A signed statement certifying that the installation is satisfactory and in accordance with the contract drawings and specifications and the manufacturer's prescribed procedures and techniques, upon completion of the project and before final acceptance.

Delivery, Storage and Handling; G WA

Material safety data sheets.

Materials and Equipment; G AE

Installation; G AE

The manufacturer's installation recommendations or instructions for each material or procedure to be utilized, including materials preparation.

Valve Schedule; G AE

A list of valve materials, pressure ratings, valve operator's materials, water supply pressure, electrical service, location, source of supply, and reference identification as indicated in the contract drawings. A list of any special tools necessary for each valve type and appurtenances furnished for adjustment, operation, maintenance and disassembly.

SD-06 Test Reports; G AE

Copies of all certified shop and field test reports within 24

hours of the completion of the test.

SD-10 Operation and Maintenance Data; G WA

Six 6 copies each of operation and maintenance manuals in indexed booklet form. Operation manuals shall detail the step-by-step procedures required for specialized startup, operation and shutdown of piping systems, and shall include the manufacturer's name, model number, parts list and brief description of piping equipment such as valves and other appurtenances and their basic operating features. Maintenance manuals shall list routine maintenance procedures and troubleshooting guides for the equipment, and shall include piping layout and valve locations.

1.5 QUALIFICATIONS

1.5.1 Contractor

Contractor shall have successfully completed at least 3 projects of the same scope and size or larger within the last 6 years. Contractor shall demonstrate specific experience in regard to the system installation to be performed and show that the appropriate certified welders are employed.

1.6 GENERAL JOB REQUIREMENTS

Valves and appurtenances shall be as specified and as shown on the drawings, and shall be suitable for the service specified and intended. Valve materials, appurtenances and equipment supplied as part of this contract shall be new and unused except for testing equipment. Components that serve the same function and are the same size shall be identical products of the same manufacturer.

1.6.1 Components

Valves and appurtenances shall be new products of equal material and ratings as the connecting pipe.

1.6.2 Standard Products

Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacturing of the products and shall essentially duplicate items that have been in satisfactory use for at least 5 years prior to bid opening. Nominal sizes for standardized products shall be used. Valves and appurtenances shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site.

1.6.3 Identification and Tagging

Each piece of pipe shall bear the ASTM designation and all other markings required for that designation. Valves shall be marked in accordance with MSS SP-25 and shall bear an identification tag securely attached using stainless steel wire. Identification tags shall be 1.375 inch minimum diameter, made of engraved laminated plastic. Indentations shall be black for reading clarity. The service, valve identification number shown on the Valve Schedule in the contract drawings, the manufacturer's name, and the valve model number shall be displayed.

1.7 DELIVERY, STORAGE AND HANDLING

Materials delivered and placed in storage shall be stored with protection from the weather, excessive humidity variation, excessive temperature variation, dirt, dust and/or other contaminants. Proper protection and care of material before, during and after installation is the Contractor's responsibility. Any material found to be damaged shall be replaced at the Contractor's expense. Materials shall be stored with protection from puncture, dirt, grease, moisture, mechanical abrasions, excessive heat, ultraviolet (UV) radiation damage, or other damage. Valves shall be handled and stored in accordance with the manufacturer's recommendation.

1.8 PROJECT/SITE CONDITIONS

1.8.1 Existing Conditions

The Contractor shall be responsible for the verification of existing piping, penetrations, verifying dimensions and flanged connections (number of bolts and size. Prior to ordering materials, the Contractor shall verify the size, material, joint types, elevation, horizontal location, and pipe service of existing pipes.

1.8.2 Verification of Dimensions

After becoming familiar with all details of the work, the Contractor shall verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

1.9 SEQUENCING AND SCHEDULING

See Specification Section 01520.

1.10 MAINTENANCE

1.10.1 Service

Services for valves shall be provided by a manufacturer's field service engineer who is experienced in the installation, adjustment and operation of the equipment specified. The representative shall inspect the installation, and supervise the adjustment and testing of the valves.

1.10.2 Extra Materials

Concurrent with delivery and installation of the specified valves and appurtenances, spare parts for each different item of material and equipment specified that is recommended by the manufacturer to be replaced any time up to 3 years of service shall be furnished. For each type and size of valve, the following extra materials shall be provided: lubricator, lubricant (with appropriate temperature rating), lubricator/isolating valve. Extra materials shall include 2 of the following spare parts for each type and size of valve: gaskets; O-ring seals; all elastomer parts; stem packing; seat rings and seat ring pulling tool or no less than 20% of spares required for all valves. Spare parts shall be turned over to Washington Aqueduct Maintenance Department.

PART 2 PRODUCTS

2.1 VALVES, MATERIALS AND EQUIPMENT

2.1.1 General Requirements For Valves

Valves shall include operator, actuator, and all other accessories required for a complete operation. Product Data and shop drawings for all valves and accessories shall be submittal for approval. The valves shall be suitable for the specified and intended service. Renewable parts are not to be of a lower quality than those specified. Valve ends shall be compatible with adjacent piping system. An operator shall be sized to operate the associated valve for the full range of pressures and velocities. Valves will open by turning counterclockwise. Operators, actuators, and accessories shall be factory mounted. Detailed Operation and Maintenance Data shall be submittal for approval for all valves and accessories.

2.1.2 Valve Schedule

Requirements relative to this paragraph are shown on the Valve Replacement Schedule and Bid Option Valve Replacement Schedule and located in the contract drawings.

2.2 BUTTERFLY VAVES - METAL SEATED

2.2.1 Valves

Quarter turn, triple-offset metal to metal seated, incorporating "inclined conical" geometry creating a torque seating operation. Provide valves capable of bi-directional zero leakage shut-off at the greater of the test pressure or maximum pressure indicated in the Valve Replacement and Bid Option Valve Replacement schedules designed in accordance with ANSI B16.34 and B31.3. Provide all valve components capable of the maximum output torque of the operating mechanism required to operate the valve against the maximum differential pressure as per the specified class. Resilient seated valves are not acceptable.

2.2.2 Manufacturers

Everest

Adams

Or approved equal

2.2.3 Valve body

Flanged, cast iron or fabricated carbon steel, able to withstand induced pipe loads without distortion and affect on the movement of the disc. Face to face dimensions shall conform to ISO 5752, series 13 for class 150, or special lengths as indicated on the Valve Replacement and Bid Option Valve Replacement Schedules.

2.2.4 Valve disc

Cast Type 316 (CF8M) stainless steel. Attach the disc to the shaft by means of parallel keys. Pins are not acceptable for torque transmission.

2.2.5 Shaft

Provide a one-piece 17-4 PH shaft with a shaft diameter of adequate strength to operate the valve at full rated design conditions. Provide a thrust bearing to absorb thrust in both direction and provide blow-out

protection. Provide a reduced shaft diameter at the actuator connection to pull the weakest point outside the valve and above the packing. Provide the shaft with a surface roughness at the packing area of 0.8 um or smoother.

2.2.6 Seal ring

Provide lamination of Type 316 stainless steel and graphite, (minimum 3 stainless and 2 graphite). Secure the seal ring by means of a retainer to insure no movement or flexing. Locate the seal in the body and fully protected from the flow stream. Retainer bolting on internal rotating parts is not acceptable. To prevent leakage behind the seal ring, provide a static graph oil gasket. Dynamic gaskets are not acceptable.

Provide a minimum of five rings of packing and packing gland with a minimum of four Type 316 stainless steel studs for adjustment and compression of the packing.

Provide solid metal, press fit shaft bearing sealed from the ingress of particulates and contaminants. Provide differential hardness between the shaft and bearing surfaces for non-galling rotation.

2.2.7 Valve Pressure Rating: ANSI Class 150.

Provide flanges and bolting to match to existing flanges as indicated in the Valve Replacement and Bid Option Valve Replacement Schedules.

2.2.8 Cylinder Actuators

Valve manufacturer shall provide water hydraulic cylinders and valves as a complete assembly meeting the requirements of AWWA C 507 and as specified herein.

a. Water source pressure: 90 psi, potable water, 50 to 70 degrees F.

b. Cylinder tubes and heads: Type 316 stainless steel honed to a 20 micro-inch finish.

c. Pistons: Type 316 stainless steel.

d. Rods: 17-4 PH stainless steel.

e. Provide wiper rings to clean the piston rod before it enters the cylinder.

f. Cylinder Seals: Suitable for the service conditions specified.

g. Provide the actuator rigidly attached to the valve drive mechanism and shall not rotate or pivot.

h. Piping: Sch. 40 Type 316L stainless steel pipe and fittings.

i. Isolation Valves: Type 316 stainless steel ball valves with lever operators

For valves BV-41, BV-47, BV-48, BV-56, BV-65 and BV-66 provide electric actuated 4-way valves and piping as indicated.

For valves BV-60 and BV-63 provide new manually operated 4-way valves. 2.2.9 4-way valves provide Type 316L stainless steel ANSI 150 class 4-way valves with NPT connections,teflon seals with manual level operator. Valves to be manufactured by Quality Controls, Inc. to match existing 4-way valves.

2.2.9 Manual Actuators

Provide manually operated valves with self locking gear operator with the actuator mounting bracket pinned to the body and centered by machined register between bracket and body.

2.2.10 4-Way Valve Electric Actuators

Provide electric valve actuators with permanently lubricated self-locking gears. Actuators shall operate on 120V, single phase power and be equipped with SPDT torque and travel switches, handwheel override, mechanical position indicator and NEMA 4X enclosure with epoxy coated aluminum bases and polycarbonate covers. Provide actuators suitable for an Open/Close duty cycle and for mounting to 4 ways as specified herein.

2.2.11 Shop Testing

All shop testing shall be witnessed by the Engineer. The Contractor shall provide a minimum of 30 days notice prior to shop testing.

2.2.11.1 Valve Shop Testing

Provide in accordance with ASME B16.34 and API 598 and provide written and certified test results.

2.2.11.2 Shop Hydrostatic Testing

With the valve open test each valve for a minimum of 30 minutes at 2 times the valve design pressure rating. At this test pressure no leakage shall occur at the exterior of the valve nor shall any part be permanently deformed. Valves not passing the testing shall be retested until passed.

With the valve in the closed position test each valve for a minimum of 20 minutes at 1.5 times the pressure as indicated in the Valve Replacement Schedules, the pressure shall be on the upstream side of the valve and no pressure on the downstream side. Once this test is completed, test the valve with the pressure on the downstream side of the valve and no pressure on the upstream side. There shall be no leakage to the exterior of the valve nor shall any part be permanently deformed.

2.2.11.3 Shop Leakage Testing

With the valve in the closed position leakage test each valve for a minimum of 15 minutes at the pressure as indicated in the Valve Replacement and Bid Option Valve Replacement Schedules. The leakage rate shall be "Zero Leakage" in accordance with ANSI B16.34.

2.2.11.4 Shop Performance Testing

With the valve and the actuator assembled and the valve having passed the hydrostatic and leakage testing specified above, each valve shall be cycled a minimum of three (3) times from the fully closed/seated position at the

pump shutoff head pressure indicated in the Valve Replacement and Bid Option Valve Replacement Schedules and shall operate within the times indicated in the Valve Schedule using 90 psi water pressure. All controls will be fully functional during the testing.

a. Verification of the primary dimensions.

b. Verification of the absence of defects in castings (per MSS SP-55).

c. Verification of the nameplate and marking (per MSS SP-25).

When testing is completed prepare valves for shipment. The external surface of the valves shall be free of grease or oil. The machined surfaces shall be protected with anti corrosive preparation.

2.3 BALL VALVES

Valves: Quarter turn ball valves with resilient seat.

Manufacturers:

KF

Kitz

Jamesbury

Or approved equal.

Working Pressure: 300 psi

Materials:

Body: Type 316 stainless steel

Seat: TFE

Ball: Type 316 stainless steel

Stem: Type 316 stainless steel

Ends: Screwed or flanged

Actuators: Manual: Lever or Handwheel

2.4 COMBINATION AIR RELEASE VALVES

Valves: Singe body, double orifice type with baffled inlet.

Manufacturers:

Golden Anderson

Val-Matic

Crispin

Or approved equal.

Inlet and outlet: Threaded

Valve working pressure: 300 psi

Provide inlet of valve with a manually operated ball valve for isolation, provide ball valves as specified herein.

Materials:

Body: Cast Iron ASTM A 126 Grade B

Float: Type 316 stainless steel

Needle and Seat: BUNA-N

Plug: Type 316 stainless steel

2.5 HYDRAULICALLY OPERATED PUMP CHECK VALVES

Provide pump check valves as specified and as indicated in the Valve Replacement Schedule. Provide either rotary valves manufactured by Golden Anderson or cone valves manufacture by Rodney Hunt or Henry Pratt.

Rubber seated, rubber seated multi piece ball valves and metal seated multi piece ball valves are not acceptable.

Valves shall be designed specifically for the system operating and pump shut-off pressures indicated in the Valve Replacement Schedule

2.5.1 Hydraulically Operated Pump Check Valve-Rotary Type

Manufacturer: Golden Anderson Figure R201-DS

2.5.1.1 Type

Resilient seated trunion mounted rotary valves, designed specifically for pump check valve service.

Rubber seated valves are not acceptable.

Standard ball valves are not acceptable.

Provide valves in accordance with AWWA C 507 except as specified.

2.5.1.2 Body

Ductile Iron ASTM A 536, one piece construction, two piece bodies or bolted bodies are not acceptable.

Pressure Rating: as indicated in the Valve Schedule.

Provide body with integrally cast feet sized to support entire weight of valve and operator when valve is installed in a horizontal pipeline.

Ends: Flanged, Ductile Iron, flat faced, drilled and faced in accordance with ANSI, as indicate din the Valve Schedule.

Cast the following in raised letters on valve body:

Valves size

Manufacturer

Year manufactured

Design working pressure

Provide vent and drain connections with ball valves as specified.

2.5.1.3 Rotor

Ductile Iron ASTM A 536

Provide a valve with a full, unobstructed circular port equal to nominal valve size diameter.

Provide with two (2) integrally cast ductile iron trunions on the axis of the rotation.

Provide seat as specified herein.

2.5.1.4 Body Seats

ASTM A 276 Type 316, stainless steel, fastened to valve body.

Provide drop tight shut-off in from downstream pressure in closed position at rated pressure.

2.5.1.5 Rotor Seat

Provide a hydraulically activated seating arrangement to minimize wear on the rotor seat.

Seat Material: Replaceable UHMW

Provide seat attached to a ductile iron or Type 316, stainless steel seat retainer by means of a Type 316 stainless steel follower ring.

Provide the seat ring/retainer assembly adjustable along tramming downstream using system hydraulic forces. When in the closed position, downstream static pressure shall move the seal/retainer assembly against the body seat. When opening, pump discharge pressure shall move the seat/retainer assembly away from the body seat.

Provide bronze bushing on both the seat retainer and rotor.

Seating load shall be adjustable by the tramming bolts.

2.5.1.6 Bearings

Type 316 Stainless Steel sleeve type, permanently lubricated, provide on top and bottom of rotor trunnions.

Provide bronze bushings.

Provide thrust bearings on top and bottom of rotor trunnions.

2.5.1.7 Shafts

Materials: Type 316 Stainless Steel ASTM A 276.

Rigidly connect shaft to rotor trunnions. Design connection to transmit shaft torque only to the rotor.

Shaft Seals:

Viton "O" rings with a Type 316 stainless steel or bronze cartridge with a minimum of four seal rings.

Seals: Replaceable with valve at pressure rating with rotor either opened or closed.

2.5.1.8 Access Covers

Provide a cover plate on which the operating mechanism is mounted. Provide cover plate for removal of the rotor from the value body through the cover port without removing the valve body from the pipeline.

Provide a separate seat access cover plate permitting inspection, adjustment and replacement of the rotor seat assembly without removing the valve body from the pipeline.

2.5.1.9 Operating Mechanism

Totally enclosed in Ductile Iron ASTM A 536 housing:

Provide a removable, gasketed cover.

Capable of adjustment and repair without removing valve from the pipeline.

Attach the driven mechanism to the valve access cover and rotor shaft. Provide bronze bushings and "O" ring seals where the rotor passes through the mechanism housing.

Type:

Traveling crosshead with link and lever connected to rotor shaft.

1. Lever: Ductile Iron

2. Link: High Strength Steel

3. Cross Head: Aluminum Bronze

The crosshead shall travel along a machined guide tract integrally cast in the mechanism housing. provide grease fittings with Type 316 stainless steel fittings for lubrication.

Design operating mechanism so that first 50 percent of stroke in closing reduces the flow area by 80 percent.

Design to accept valve operator as specified.

2.5.2 Hydraulically Operated Pump Check Valve-Cone Type:

Manufactures: Rodney Hunt or Henry Pratt.

Type:

Metal seated trunion mounted cone valves, designed specifically for pump check valve service.

Provide valves in accordance with AWWA C 507 except as specified.

Body:

Ductile Iron ASTM A 536, one piece construction.

Pressure Rating: as indicated in the Valve Schedule.

Provide Monel seats electrically fused to the valve body waterway and designed for free operation of the plug.

Provide valve body with a full, unobstructed circular port equal to nominal valve size diameter.

Provide body with integrally cast feet sized to support entire weight of valve and operator when valve is installed in a horizontal pipeline.

Ends: Flanged, Ductile Iron, flat faced, drilled and faced in accordance with ANSI, as indicated in the Valve Schedule.

Cast the following in raised letters on valve body:

1. Valves size

2. Manufacturer

3. Year manufactured

4. Design working pressure

Plug (Conical closing elements):

Ductile Iron ASTM A 536

Provide plug with a full, unobstructed circular port equal to nominal valve size diameter.

Provide a fully skirted plug with integrally cast bronze trunnions.

Provide Monel seats as specified herein for the valve body.

Shafts:

Materials:

1. Type 630 stainless steel, 125,000 psi minimum yield strength

2. Pin the shaft to the plug

Shaft Seals: Provide packing of graphite braided teflon with a bronze adjustable packing gland and Type 316 stainless steel bolts

and bronze nuts.

Operating Mechanism:

Totally enclosed in Ductile Iron ASTM A 536 housing:

1. Provide a removable, gasketed cover.

2. Capable of adjustment and repair without removing valve from the pipeline.

3. Attach the drive mechanism to the valve access cover and valve shaft. Provide bronze bushings and "O" ring seals where the shaft passes through the mechanism housing.

Type:

1. Provide an operating mechanism consisting of a threaded lift nut for seating the valve and a rotator attached to the valve shaft for rotation of the plug.

2. Provide an indicator showing position of the plug opening in relation ship to the opening in the valve body.

   a. Guide rods: Type 316 stainless steel.

   b. Cross Head: Bronze ASTM B584.

3. Design to accept valve operator as specified.

2.5.3 Shop Testing

All shop testing shall be witnessed by the Engineer. The Contractor shall provide a minimum of 30 days notice prior to shop testing.

2.5.4 Valve Shop Testing

2.5.4.1 Shop Hydrostatic Testing

With the valve open test each valve for a minimum of 30 minutes at 2 times the valve design pressure rating. At this test pressure no leakage shall occur at the exterior of the valve nor shall any part be permanently deformed. Valves not passing the testing shall be retested until passed.

With the valve in the closed position test each valve for a minimum of 20 minutes at 1.5 times the pump shutoff head pressure as indicated in the Valve Replacement Schedule, the pressure shall be on the upstream side of the valve and no pressure on the downstream side. Once this test is completed, test the valve with the pressure on the downstream side of the valve and no pressure on the upstream side. There shall be no leakage to the exterior of the valve nor shall any part be permanently deformed.

2.5.4.2 Shop Leakage Testing

With the valve in the closed position leakage test each valve for a minimum of 15 minutes at the pump shutoff head pressure as indicated in the Valve Replacement Schedule. The leakage rate shall not exceed 1 fluid ounce/h/in of nominal port diameter to the exterior of the valve nor shall there be any spray or high velocity leakage.

2.5.4.3 Shop Performance Testing

Cycle testing under no flow conditions shall meeting the required number of cycles and testing in accordance with AWWA C507.

2.5.5 Actuators:

Valve manufacturer shall provide water hydraulic cylinders and valves as a complete assembly meeting the requirements of AWWA C 507 and as specified herein.

Water source pressure: 90 psi, potable water, 50 to 70 degrees F.

Cylinder tubes and heads: Type 316 stainless steel honed to a 20 micro-inch finish.

Pistons: Type 316 stainless steel.

Rods: 17-4 PH stainless steel.

Provide wiper rings to clean the piston rod before it enters the cylinder.

Cylinder Seals: Suitable for the service conditions specified.

Provide the actuator rigidly attached to the valve drive mechanism and shall not rotate or pivot.

Piping: SCH 40 Type 316L stainless steel pipe and fittings.

Valves: Type 316 stainless steel ball valves with lever operators.

2.5.6 Control System:

When the pump is started and reaches a set pressure (PSL), the pump check valve opens at a controlled rate. Opening time to be set at factory as indicated in the Valve Replacement Schedule shown on M-2, but adjustable. If pump fails to reach minimum pressure setting or valve fails to begin to open within set time (timer adjustable), de-energize pump motor by timer and AMBER warning light on front of control panel indicates "fault". Provide reset button on panel for resetting controls and permitting return to normal operation. Opening time does not include resetting time.

When stop circuit is energized, pump check valve closes in set time (adjustable). Provide adjustable limit switch to shut down pump when valve is 95 percent closed. If pump motor timer mentioned above de-energizes pump and activates AMBER warning light, due to limit-switch failure or other causes, it will require resetting for normal operation.

In event of pump failure or power failure during normal operation, pump check valve closes at more rapid rate than normal set time and adjustable. Upon power failure pump check valve to close in the rapid closing mode at two different speed as indicated in the Valve Replacement Schedule.

Provide electrical interlocks between pump check valve and pump motor starter to prevent pump from restarting unless the pump check valve is in the closed position.

Provide set of dry contact wired to numbered terminal strip to energize a remote alarm upon system fault.

Provide a manual operation device on control cabinet with AUTOMATIC, OPEN, CLOSE and STOP positions to permit operation of pump check valve.

RED light on front of control lights whenever pump check valve is open or pump is energized.

Provide three limit switches for each control unit, NEMA 6P, adjustable type. Two switches break one circuit and make another at predetermined points near open and closed positions of pump check valve. Arrange third switch so that momentary opening of switch shuts down its associated pump. Provide switches suitable for operation on 110 volts, single phase, 60 Hertz current.

Provide all controls, excluding cylinders and limit switches mounted in a 14 gage, NEMA 4X Type 316 stainless steel cabinet RED (open), GREEN (closed) and AMBER (fault) indicating lights conveniently located on cabinet.

Provide two position four way normal solenoid pilot with manual operator with independently adjustable normal opening and closing speed controls, emergency solenoid with separate adjustable closing speeds, Type 316 stainless steel wye strainer and isolation valve.

Provide limit switches with a visual position indication and a minimum of four sets of SPDT contacts mounted on the valve.

Valves, piping, unions and fittings: Type 316L stainless steel.

Power: 120 volt, 60 Hz.

2.6 BUTTERFLY VALVES - AWWA

Provide AWWA Butterfly valves for BV-7 through BV-21, Bid Options only.

2.6.1 Manufacturers

Rodney Hunt

Henry Pratt

DeZurik

Or approved equal

2.6.2 Valves

Provide valves conforming to AWWA Standard C504 for Rubber Seated Butterfly Valves except as modified herein.

Valves utilizing: Continuous rubber lining on the internal body surfaces and extending over the flanges, or a disk which sits at an angle to the axis of the pipe are acceptable.

Cast or ductile iron thrust or journal bearing surfaces are NOT acceptable.

Class 150A valves except as specified or indicated on the Butterfly Valve

Schedule.

Provide valves conforming to ASTM A126 Class B cast iron or ductile iron for body.

Flanged short body valve.

Provide seats for potable water service of molded new natural rubber or synthetic rubber.

Seat mounted on disc or in body.

Seats offset from shaft and field replaceable for all valves 24-in. and larger.

Seats mounted on disc, mechanically fastened to disc with stainless steel hex head screws. Rubber seat reinforced with stainless steel retaining ring. Seats vulcanized or bonded to the disc not acceptable.

Mating surfaces for valves with seat on disc, Type 316 stainless steel. Mating surface mechanically retained in boy and sealed with O-ring.

Seats mounted on body, clamped or mechanically secured with Type 316 stainless steel fasteners.

Mating surfaces for valve with seat in body, Type 316 stainless steel or plasma applied nickel-chromium material containing 80 percent nickel, 20 percent chrome.

Plated or sprayed on mating surface material not acceptable.

If seat on disc, provide disc of ASTM A126 Class B cast iron or ductile iron. If seat in body, provide disc of ASTM A126 Class B cast iron, ductile iron or 316 stainless steel. Stainless steel edge on cast or ductile-iron discs secured with stainless steel threaded fasteners, heat shrunk on disc, a welded-on overlay, or a plasma applied nickel-chrome material.

Shaft: Type 316 stainless steel. Either one piece extending completely through disc or stub shafts inserted into valve disc stubs.

Shaft seal of the split-V type or O-ring type. Seal replaceable without disassembly of valve.

2.6.3 Operators

Valve manufacturer shall provide water hydraulic cylinders and valves as a complete assembly meeting the requirements of AWWA C 507 and as specified herein.

a. Water source pressure: 90 psi, potable water, 50 to 70 degrees F.

b. Cylinder tubes and heads: Type 316 stainless steel honed to a 20 micro-inch finish.

c. Pistons: Type 316 stainless steel.

d. Rods: 17-4 PH stainless steel.

e. Provide wiper rings to clean the piston rod before it enters the cylinder.

f. Cylinder Seals: Suitable for the service conditions specified.

g. Provide the actuator rigidly attached to the valve drive mechanism and shall not rotate or pivot.

h. Piping: Sch. 40 Type 316L stainless steel pipe and fittings.

i. Isolation Valves: Type 316 stainless steel ball valves with lever operators

For valves BV-7 through BV-21 reuse the existing electric actuated 4-way valves.

2.7 PRESSURE SENSORS FOR PRESSURE INSTRUMENTS:

2.7.1 Pressure Sensor Rings:

Provide sensors that fit inside the bolt circle of 150-lb. ANSI flanges as specified and indicated.

Face to face length of the sensor: Conform to Specification MSS-SP67.

Type flow through design with flexible sleeve around full circumference. The center section shall have a cavity behind the sleeve filled with silicone fluid to transfer pressure to the gauge.

Sleeve: Material suitable for potable water service.

Rigidly support all pressure instruments by a post at least 7/8 in. diameter welded to the isolator. On sensor rings with more than one instrument, provide all connections 1/2-in. NPT as a minimum, 1/4-in. NPT fittings are not acceptable.

The sensor ring shall not have any fill plugs that can be inadvertently removed with the resultant loss of fill fluid.

The sensor shall be liquid filled and permanently vacuum sealed at the factory with a modular seal consisting of a membrane and needle fitting to allow removal and replacement of pressure instruments without compromising the vacuum fill.

Provide the needed fitting with both 1/4-in. NPT(F) threads and 1/2-in. NPT(M) threads.

The pressure isolator shall be capable of operating under pressure with all pressure instruments removed with no loss of fill fluid, without isolating valves.

Attach pressure instruments to the isolator with a hand tightened lock ring.

It shall be possible to remove or attach pressure instruments to the isolator without requiring the use of any tools.

Permanently fill the pressure sensor with high viscosity silicone

instrument oil to damp out surges or pressure spikes without a separate snubber.

Pressure rating: 200 psi minimum for all lines tested at 150 psi or less and 600 psi minimum per lines tested above 150 psi.

Materials: Body and plates: Type 316L stainless steel.

2.8 PRESSURE REDUCING VALVES

2.8.1 Construction:

Pressure reducing valves shall consist of a main valve assembly and a pilot system, completely assembled, tested as a unit and ready for field installation.

Main valve body shall be globe style, constructed of cast iron conforming to ASTM A126 Class B with integral flanges, faced and drilled per ANSI B16.1 Class 250. The valve shall be "full-ported" with a flow area through the valve no less than the area of its nominal pipe size and have an integral bottom pad or feed to permit support directly beneath the body.

The main valve shall operate on the differential piston principle such that the area on the underside of the piston is no less than the pipe area and the area on the upper surface is greater than that of the underside. There shall be no diaphragms or springs in the main valve.

The valve piston shall be fully guided on its outside diameter and all guiding and sealing surface shall be Type 316L stainless steel. To minimize the consequences of throttling, throttling shall be by long, stationary vee-ports located downstream of the seat and not by the seat itself. Sawtooth attachments or other add-on devices are not acceptable.

The valve shall be fully capable of operating in any position without the need of springs and shall not incorporate stems, stem guides or spokes in the waterway. A visual position indicator shall be provided. The main valve shall be serviceable in the line through a single flanged cover which provides easy access to all internal components.

2.8.2 Pressure Reducing Valve for 6" PW

Provide a system of pilots and controls to enable the valve to perform the function listed below. All controls and control piping shall be Type 316L Stainless Steel and suitable for the working pressure.

System shall include a normally open, direct-acting, diaphragm operated, spring loaded Type 316 Stainless steel pressure reducing pilot. Pilot shall be easily field adjustable from near zero to a minimum of 10% above the factory setting. Controls shall include adjustable closing speed control, y-strainer and pilot isolating valves.

The valve shall function to reduce a higher, fluctuating inlet pressure to a lower, steady outlet pressure regardless of variations in demand. Inlet pressure: 140 psi, outless pressure: 95 psi.

2.8.3 Spillage Valve RV-69

Valve manufacturer shall provide water hydraulic cylinders and valves as a complete assembly meeting the requirements of AWWA C 507 and as specified

herein.

a. Water source pressure: 90 psi, potable water, 50 to 70 degrees F.

b. Cylinder tubes and heads: Type 316 stainless steel honed to a 20 micro-inch finish.

c. Pistons: Type 316 stainless steel.

d. Rods: 17-4 PH stainless steel.

e. Provide wiper rings to clean the piston rod before it enters the cylinder.

f. Cylinder Seals: Suitable for the service conditions specified.

g. Provide the actuator rigidly attached to the valve drive mechanism and shall not rotate or pivot.

h. Piping: Sch. 40 Type 316L stainless steel pipe and fittings.

i. Isolation Valves: Type 316 stainless steel ball valves with lever operators

Provide new manually operated 4-way valve. Provide Type 316L stainless steel ANSI 150 class 4-way valves with NPT connections, teflon seals with manual level operator. Valves to be manufactured by Quality Controls, Inc. to match existing 4-way valves. For system operating conditions see M-7 note 3.

2.9 SWING CHECK VALVES

2.9.1 Manufacturers:

Golden Anderson

Valve and Primer Corp

Meuller Co.

Or approved equal

2.9.2 Valves:

Working Pressure: 175 psi

Valve Body:

ASTM A126 Class B cast iron with integral flanges, faced and drilled per ANSI B16.1 Class 125.

Provide full waterway type body with a net flow area not less than the nominal inlet pipe size when swung open a maximum of 25 degrees. When closed, the valve shall seat drop tight.

Provide a replaceable Type 316 stainless steel body seat.

Valve Disc:

ASTM A126 Class B cast iron. Provide disc faced with a renewable resilient seat ring of a material suitable for the service specified and indicated. Provide Type 316 stainless follower ring and hardware.

Disc Arm:

Ductile iron or steel, suspended from and keyed to an austenitic stainless steel shaft located entirely above the waterway and supported at each end by bronze bushings.

Provide shaft to rotate freely without the need for external lubrication.

Provide the shaft sealed where it passes through the body by a stuffing box and adjustable packing. O-ring type shaft seals are not acceptable.

Provide valves with an outside lever and adjustable couterweight to initiate valve closure. Provide final closure dampened by means of a single, side-mounted bronze air-cushion assembly directly mounted to the valve body on machined pads.

Provide an adjustable amount of cushioning without the need for pre-charged air chambers. Commercial air cylinders which pivot and/or are attached with fabricated brackets are not acceptable.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 Protection

Equipment shall be protected from dirt, water, and chemical or mechanical damage.

3.1.2 System Preparation

3.1.2.1 Pipe and Fittings

Valves shall be inspected before installed or buried piping is lowered into the trench. The Contractor shall clean the ends of valves thoroughly, remove foreign matter and dirt from inside of pipes, and keep piping clean during and after laying.

3.1.2.2 Damaged Coatings

The Contractor shall repair damaged coating areas in the field with material equal to the original coating. The Contractor shall not install damaged materials.

3.2 VALVE INSTALLATION

The Contractor shall provide an Installation Certification stating that the valve installation is in accordance with the contract documents and the manufacturers recommendations.

Flanged valve bolt holes shall be installed so as to straddle the vertical centerline of pipe. Flanged faces shall be cleaned prior to inserting the gasket and bolts, and then the nuts shall be tightened progressively and

uniformly. Threaded ends shall have the threads cleaned by wire brushing or swabbing prior to installation.

3.2.1 Valve Orientation

Automatic valves shall be installed in accordance with the manufacturer's instructions and approved drawings.

3.2.2 Butterfly Valves

Orientation of butterfly valves shall take into account changes in pipe direction. Valve shafts shall be oriented so that unbalanced flows caused by pipe direction changes or other disturbances are equally divided to each half of the disc.

3.2.3 Line Size Ball Valves

A line size ball valve and union shall be installed upstream of each solenoid valve, in-line flow switch, or other in-line electrical device, for isolation during maintenance.

3.3 Valve Field Testing

Valves may either be tested while testing pipelines, or as a separate step. It shall be demonstrated that valves open and close smoothly with specified operating pressure on one side and atmospheric pressure on the other, and in both directions for two-way valve applications. The Contractor shall count and record the time or number of turns required to open and close each valve, and account for any discrepancies with manufacturer's data. Air and vacuum relief valves shall be examined as the associated pipe is being filled to verify venting and seating is fully functional. The Contractor shall set, verify, and record set pressures for all relief and regulating valves. Self-contained automatic valves shall be tested at both maximum and minimum operating ranges, and reset upon completion of test to the design value. Automatic valves shall be tested in conjunction with control system testing. The Contractor shall submit the results of the field testing in a Test Report.

-- End of Section --

SECTION 15202

PIPE FITTINGS AND APPURTENANCES
03/02

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36/A 36M	(2000a) Carbon Structural Steel
ASTM A 167	Specification for Stainless and Heat-Resisting Chrominum-Nickel Steel Plate, Sheet, and Strip
ASTM A 181/A 181M	Specification for Carbon Steel Forgings for General Purpose Piping
ASTM A 182/A 182M	Specification for Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service
ASTM A 194/A 194M	(2001) Carbon and Alloy Steel Nuts for Bolts for High-Pressure or High-Temperature Service or Both
ASTM A 307	(2000) Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
ASTM A 312/A 312M	(2000) Seamless and Welded Austenitic Stainless Steel Pipes
ASTM A 403/A 403M	(2000) Wrought Austenitic Stainless Steel Piping Fittings
ASTM A 576	Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality
ASTM A 780	(2000) Repair of Damaged and Uncoated Areas of Hot-Dipped Galvanized Coatings
ASTM D 3308	Specification for PTFE Resin Skived Tape
ASTM F 402	Practice for Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings

AMERICAN WATER WORKS ASSOCIATION(AWWA)

AWWA C104	(1995) Cement-Mortar Lining for

	Ductile-Iron Pipe and Fittings for Water
AWWA C110	(1998) Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (75 mm through 1200 mm), for Water and Other Liquids
AWWA C111	(2000) Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings
AWWA C151	(1996) Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids

ASME INTERNATIONAL (ASME)

ASME B1.20.1	(1983; R 1992) Pipe Threads, General Purpose (Inch)
ASME B16.11	(1996) Forged Fittings, Socket-Welding and Threaded
ASME B16.21	(1992) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.5	(1996; B16.5a) Pipe Flanges and Flanged Fittings NPS 1/2 thru NPS 24
ASME B31.1	(1998) Power Piping
ASME B31.3	(1999) Process Piping
ASME B36.19M	(1985; R 1994) Stainless Steel Pipe

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1910	Occupational Safety and Health Standards

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-25	(1998) Standard Marking System for Valves, Fittings, Flanges and Unions
MSS SP-58	(1993) Pipe Hangers and Supports - Materials, Design and Manufacture
MSS SP-69	(1996) Pipe Hangers and Supports - Selection and Application
MSS SP-89	(1998) Pipe Hangers and Supports - Fabrication and Installation Practices

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 704	Standard System for the Identification of the Hazards of Materials for Emergency Response

1.2 UNIT PRICES

Measurement and payment will be based on completed work performed in accordance with the drawings, specifications and the contract payment schedules. No payment will be made under this section for excavation, trenching, or backfilling. Payment for such work will be made under Section 02316A EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS.

1.2.1 Measurement

The length of pipelines, for which payment will be made, shall be determined by measuring along the centerlines of the various piping systems and sizes as furnished and installed. Pipe shall be measured from the center of fitting to center of fitting and from center of main header to end of pipe. No deduction shall be made for the space occupied by valves or fittings.

1.2.2 Payment

Payment will be made at the price per linear foot listed in the bid form for the various types and sizes of piping, and will be full compensation for all pipes, joints, fittings and specialties, complete in place. Payment for valves and other appurtenances will be made at the respective contract unit price for each item complete in place. Payment will include the furnishing of all testing, plant, labor, and material and incidentals necessary to complete the work, as specified and as shown in contract documents.

1.2.2.1 Connections to Existing Piping

Connections to existing piping systems where new fittings in the existing line are required will be paid for according to the contract prices for such connection. The price will be considered as full compensation for material and labor required for the removal and replacement of the existing pipe as necessary.

1.2.2.2 Connections to Existing Equipment

Connections to existing equipment where new fittings for the existing equipment are required will be paid for according to the contract prices for such connection. The price will be considered as full compensation for material and labor required for the installation of new fittings or the removal and replacement of existing fittings, as necessary.

1.3 SYSTEM DESCRIPTION

This specification covers the requirements for above and below grade liquid process pipe, pipe supports, fittings, equipment and accessories located both inside and outside of treatment plants.

1.3.1 Design Requirements

Support systems shall be selected and designed in accordance with MSS SP-58, MSS SP-69, and MSS SP-89 within the specified spans and component requirements. The absence of pipe supports and details on the contract drawings does not relieve the Contractor of responsibility for sizing and providing supports throughout facility.

1.3.2 Performance Requirements

The pressure ratings and materials specified represent minimum acceptable standards for piping systems. The piping systems shall be suitable for the services specified and intended. Each piping system shall be coordinated to function as a unit. Flanges, valves, fittings and appurtenances shall have a pressure rating no less than that required for the system in which they are installed.

1.3.2.1 Above Grade Piping Systems

Piping systems shall be suitable for design conditions, considering the piping both with and without internal pressure, and installation factors such as insulation, support spans, and ambient temperatures. Consideration shall be given to all operating and service conditions both internal and external to the piping systems.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Pipe and Equipment; G AE

Equipment shop drawings and support system detail drawings showing piping systems and appurtenances, such as mechanical joints, valves, local indicators and hangers, including a complete list of equipment and materials. As-built drawings showing pipe anchors and guides, and layout of piping systems relative to other parts of the work including clearances for maintenance and operation. As-built piping and instrumentation diagrams (P&IDs) identifying and labeling equipment, instrumentation, valves, vents, drains, and all other inline devices; if the contract drawings contained P&IDs, the P&IDs found in the contract drawings shall be revised to reflect the constructed process system, as directed by the Contracting Officer.

SD-03 Product Data

Qualifications; G AE

A statement certifying that the Contractor has the specified experience.

Welders; G AE

The names of all qualified welders, their identifying symbols, and the qualifying procedures for each welder including support data such as test procedures used, standards tested to, etc.

Waste Water Disposal; G WA

The method proposed for disposal of waste water from hydrostatic tests and disinfection, and all required permits, prior to performing hydrostatic tests.

Assistance and Training; G WA

A signed statement certifying that the installation is satisfactory and in accordance with the contract drawings and specifications and the manufacturer's prescribed procedures and techniques, upon completion of the project and before final acceptance.

Delivery, Storage and Handling; G AE

Material safety data sheets.

Materials and Equipment; G AE

Manufacturer's descriptive and technical literature for each piping system, including design recommendations; pressure and temperature ratings; dimensions, type, grade and strength of pipe and fittings; thermal characteristics (coefficient of expansion and thermal conductivity); and chemical resistance to each chemical and chemical mixture in the liquid stream.

1.5 QUALIFICATIONS

1.5.1 Contractor

Contractor shall have successfully completed at least 3 projects of the same scope and size or larger within the last 6 years. Contractor shall demonstrate specific experience in regard to the system installation to be performed.

1.5.2 Welders

The welding of pressure piping systems shall be in accordance with qualifying procedures using performance qualified welders and operators. Welders shall be qualified.

1.6 GENERAL JOB REQUIREMENTS

Piping materials and appurtenances shall be as specified and as shown on the drawings, and shall be suitable for the service intended. Piping materials, appurtenances and equipment supplied as part of this contract shall be new and unused except for testing equipment. Components that serve the same function and are the same size shall be identical products of the same manufacturer. The general materials to be used for the piping systems are indicated by service in the Pipe Schedule in the contract drawings.

1.6.1 Components

Piping equipment and appurtenances shall be new products of equal material and ratings as the connecting pipe.

1.6.2 Standard Products

Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacturing of the products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Nominal sizes for standardized products shall be used. Pipe, valves, fittings and appurtenances shall be supported

by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site.

1.6.3 Identification and Tagging

Each piece of pipe shall bear the ASTM designation and all other markings required for that designation. Valves shall be marked in accordance with MSS SP-25 and shall bear an identification tag securely attached using stainless steel wire. Identification tags shall be 1.375 inch minimum diameter, made of stamped stainless steel. The service, valve identification number shown on the Valve Schedule in the contract drawings, the manufacturer's name, and the valve model number shall be displayed.

1.7 DELIVERY, STORAGE AND HANDLING

Materials delivered and placed in storage shall be stored with protection from the weather, excessive humidity variation, excessive temperature variation, dirt, dust and/or other contaminants. Proper protection and care of material before, during and after installation is the Contractor's responsibility. Any material found to be damaged shall be replaced at the Contractor's expense. During installation, piping shall be capped to keep out dirt and other foreign matter. A material safety data sheet in conformance with 29 CFR 1910 Section 1200(g) shall accompany each chemical delivered for use in pipe installation. At a minimum, this includes all solvents, solvent cements, glues and other materials that may contain hazardous compounds. Handling shall be in accordance with ASTM F 402. Storage facilities shall be classified and marked in accordance with NFPA 704, with classification as indicated in NFPA 49 and NFPA 325-1. Materials shall be stored with protection from puncture, dirt, grease, moisture, mechanical abrasions, excessive heat, ultraviolet (UV) radiation damage, or other damage. Pipe and fittings shall be handled and stored in accordance with the manufacturer's recommendation.

1.8 PROJECT/SITE CONDITIONS

1.8.1 Existing Conditions

The Contractor shall be responsible for the verification of existing piping and penetrations. Prior to ordering materials, the Contractor shall expose all existing pipes which are to be connected to new pipelines. The Contractor shall verify the size, material, joint types, elevation, horizontal location, and pipe service of existing pipes, and inspect size and location of structure penetrations to verify adequacy of wall sleeves, and other openings before installing connecting pipes.

1.8.2 Verification of Dimensions

After becoming familiar with all details of the work, the Contractor shall verify all dimensions including flange sizing and bolt holes, in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

PART 2 PRODUCTS

2.1 MATERIALS (GENERAL)

Materials for various services shall be in accordance with TABLE I. Pipe fittings shall be compatible with the applicable pipe materials.

2.2 DUCTILE IRON PIPING SYSTEM

2.2.1 Ductile Iron Pipe

Ductile iron pipe for pressure service shall have a design and wall thickness conforming to AWWA C151. Ductile iron pipe shall have a double thickness cement lining conforming to AWWA C104.

2.2.2 Ductile Iron Joints

Joints shall have a working pressure rating for liquids equal to the pressure rating of the connected pipe. Dielectric fittings or isolation joints shall be provided between all dissimilar metals.

2.2.2.1 Flanged Joints

Flanged joints shall conform to AWWA C110. Gaskets, bolts and nuts shall be provided with flanged joints in sufficient quantity for the complete assembly of each joint. Gaskets shall be vulcanized synthetic rubber, reclaimed rubber is not acceptable. Flanges shall be ductile iron.

2.2.3 Ductile Iron Fittings

Fittings shall be ductile iron AWWA C110. Fittings shall be cement mortar lined double thickness. Flanges and flanged fittings shall conform to AWWA C110 and shall be rated for 250 psig service. Materials shall be ductile iron. For tie-in to existing flanges, the Contractor shall field check existing flanges for nonstandard bolt hole configurations and shall design as required to assure new pipe and flange mate properly. Bolts and nuts shall be carbon steel conforming to ASTM A 307, Grade B. Bolts shall be provided with washers of the same material as the bolts. Gaskets shall be suitable for potable water service and in accordance with AWWA C111.

2.2.4 Corrosion Control

Ductile iron piping shall be coated with the manufacturer's standard asphaltic coating, approximately 1 mil thick, applied to the outside of pipe and fittings.

2.3 CARBON STEEL PIPING SYSTEM

2.3.1 Steel Pipe

Steel pipe 18-inch diameter and larger: ASTM A139, Grade B, or equal 1/2" wall thickness.

2.3.2 Interior Piping Wall Thickness

Increase as required to limit combined stress (circumferential longitudinal and localized) to 2/3 of the minimum yield of the steel used.

2.3.3 Pipe

Fabricate to sizes, dimensions, and shapes indicated.

Sizes, Pipe, Fittings and Specials: 18 inch and larger: Nominal size to be I.D. or lining.

Seams:

Except for seamless mill type pipe, provide piping fabricated from steel plates rolled into cylinders or sections thereof with longitudinal seams or spiral seams butt welded.

Do not use more than two longitudinal seams in piping 72 in. and smaller in size.

Butt weld girth seams at least 6 ft. apart, except in specials and fittings.

2.3.4 Fittings

Fabricate in accordance with AWWA C208

Provide elbows with a radius of 1-1/2 times nominal diameter, unless otherwise indicated or specified. Provide elbows in accordance to the following:

Bend (degrees)	Number of Pieces
0 to 22-1/2	2
23 to 45	3
46 to 67-1/2	4
68 to 90	5

Provide reinforced tees, laterals, and outlets in accordance with ASME Pressure Vessel Code, Section VIII, Paragraph UG-37. AWWA M-11, Chapter 13.

Provide reducing sections with same shell thicknesses required for larger ends.

Special Sections:

Provide fittings and special sections with ends as indicated and fabricated to shapes, sizes, and dimensions indicated.

Small Branch Connections:

Provide branch connections 2-1/2 in. and smaller fabricated with welding fittings with threaded outlets.

Provide branch connections 3 in. through 12 in. fabricated with pipe nipples or with welding fittings.

Provide pipe nipples and welding fittings welded to pipe shell and reinforced to meet working and test pressure requirements.

Provide seamless pipe nipples of Schedule 40 black steel pipe in accordance with ASTM A53 unless otherwise specified.

Provide threaded and welded outlets as indicated.

Provide small branch connections located so as not to interfere with joints, supports, or other details.

Provide fittings shop fabricated from previously hydrostatically tested straight pipe with magnetic particle non-destructive testing of all welds that were not previously tested in the straight pipe.

2.3.5 Field Joints

Type as indicated:

Location and type of joint may be modified to provide for lining, coating and flexibility in field assembly as approved by the Engineer.

Provide pipe end preparation and tolerances in accordance with AWWA C200 Section 3.6.

FLANGES:

Provide in accordance with AWWA C207, 125 or 300 lb to match existing piping and/or valves.

Provide flanged end pipe fitted with slip-on flanges. Provide longitudinal or spiral welds ground flush to accommodate type of flanges provided.

Provide bolts and bolt-studs in accordance with ASTM A307 and ANSI B1.1 with hexagonal or square heads, coarse thread fit, threaded full length with ends chamfered or rounded.

Project bolt ends 1/4 in. beyond surface of nuts.

Provide hexagonal nuts with dimensions in accordance with ANSI B18.2 and coarse threads in accordance with ANSI B1.1.

Provide face and finish flanges flat to a plane surface.

Provide flanges attached normal to axis of pipe for alignment.

Provide flanges tested, after welding to pipe, for true plane and reface, to bring them within specified tolerances.

Gaskets:

Provide full face ring-type flange gaskets made from 1/8-in. thick compressed material suitable for potable water.

2.3.6 Welded Joints

Welds:

Sound and free from embedded scale or slag, with tensile strength of weld not less than that of thinner of connected sections. Welds to be watertight.

Field welding of epoxy lined pipe is not acceptable.

Field welds of interior piping: Butt welds.

Outside back-up bar may be used.

Field welds of buried piping: Bell and spigot lap welds with single weld inside or outside.

Provide field welds, in accordance with AWWA C206.

2.3.7 Lining and Coating

Epoxy Lining:

Epoxy-phenolic lining shop applied over grit blast cleaned surface, near white per SSPC-SP10.

Minimum of two coats providing a total dry film thickness of at least 12 mils of liquid epoxy in accordance with AWWA C210 or fusion bonded epoxy in accordance with AWWA C213.

Applied per manufacturer's written instruction.

Exposed exterior surfaces of pipe within the building: Commercial blast (SSPC-SP6) and paint with one shop coat of universal primer compatible with field painting Section 09941.

2.4 STAINLESS STEEL PIPING SYSTEM

2.4.1 Austenitic Piping

2.4.1.1 Stainless Steel Pipe

Stainless steel pipe intended for general corrosive service shall meet the requirements of ASTM A 312/A 312M, seamless TP316L, Schedule 40 in accordance with Pipe Schedule with dimensions conforming to ASME B36.19M.

2.4.1.2 Stainless Steel Joints

Stainless steel piping shall be joined by threaded couplings, socket welded fittings or flanges. Dielectric fittings or isolation joints shall be provided between all dissimilar metals.

2.4.1.3 Stainless Steel Threaded Fittings

Threaded fittings shall be austenitic stainless steel, Grade TP316L, conforming to ASME B16.11, and threaded in accordance with ASME B1.20.1. Polytetrafluoroethylene (PTFE) pipe-thread tape conforming to ASTM D 3308 shall be used for lubricant/sealant.

2.4.1.4 Stainless Steel Welding Fittings

Welding fittings shall be socket-welding. Welding fittings shall be forged austenitic stainless steel, ASTM A 403/A 403M Grade TP316L, socket-welding fittings, conforming to ASME B16.11.

2.4.1.5 Stainless Steel Flanged Fittings

The internal diameter bores of flanges and flanged fittings shall be the same as that of the associated pipe. The flanges shall be socket welding or threaded type. Flanges and flanged fittings shall be forged austenitic stainless steel, ASTM A 182/A 182M Grade TP316L, Class 150, drilled to ASME B16.5 with a flat face. For tie-in to existing flanges, the Contractor shall field check existing flanges for non-standard bolt hole configurations and shall design as required to assure new pipe and flange mate properly. Bolting shall be Type 316 Stainless Steel. Bolts shall be

provided with washers of the same material as the bolts. Gaskets shall meet the requirements of ASME B16.5. Nonmetallic gaskets shall conform to ASME B16.21 and be a maximum 1/8 inch thick chloroprene rubber, durometer hardness No.80, full face type for use with flat face flanges.

2.5 ISOLATION JOINTS AND COUPLINGS

2.5.1 Dielectric Fittings

Dielectric fittings shall be provided between threaded ferrous and nonferrous metallic pipe, fittings and valves. Dielectric fittings shall prevent metal-to-metal contact of dissimilar metallic piping elements and shall be suitable for the required working pressure, temperature and corrosive application.

2.5.2 Isolation Joints

Isolation joints shall be provided between nonthreaded ferrous and nonferrous metallic pipe fittings and valves. Isolation joints shall consist of an isolation gasket of the dielectric type, isolation washers and isolation sleeves for flange bolts. Isolation gaskets shall be full faced with an outside diameter equal to the flange outside diameter. Bolt isolation sleeves shall be full length. Units shall be of a shape to prevent metal-to-metal contact of dissimilar metallic piping elements.

2.6 PIPE SUPPORTS AND PENETRATIONS

Auxiliary steel shall be provided by the Contractor where the support of piping systems and equipment is required between building structural elements. Light gauge and structural steel shapes shall conform to the requirements of ASTM A 36/A 36M. The Contractor shall have the option to use pre-engineered support systems of electrogalvanized steel products. However, a mixture of support system manufacturers products is not permitted. Where auxiliary steel is indicated as stainless steel, the Contractor shall provide TP304 stainless steel conforming to ASTM A 167, No. 1 Finish.

2.6.1 Pipe Supports

Pipe supports shall conform to the requirements of MSS SP-58, MSS SP-69, and MSS SP-89. Where pipe supports contact bare piping or in-line devices, provide supports of compatible material so that neither shall have a deteriorating action on the other.

2.6.1.1 Beam Clamps

For upper attachments on structural steel, the Contractor shall provide beam clamps of ASTM A 36/A 36M carbon steel or ASTM A 181/A 181M forged steel and MSS SP-58 Types 19 through 23, 25 or 27 through 30. Holes drilled in structural steel for hanger support rods will not be permitted. Clamps shall be provided with hardened steel cup-point set screws and lock-nuts for anchoring in place. Clamp size selection shall only be based on the support of the required load.

2.6.1.2 Riser Clamps

Vertical runs of piping shall be supported at each floor, or closer where required, with ASTM A 36/A 36M carbon steel clamps bolted around pipes and attached to the building construction.

2.6.1.3 Brackets

Where piping is run adjacent to walls or steel columns, the Contractor shall provide welded ASTM A 36/A 36M steel brackets, pre-punched with a minimum of two fastener holes.

2.6.1.4 Offset Pipe Clamp

Where pipes are indicated as offset from wall surfaces, a double-leg design two-piece pipe clamp shall be supplied by the Contractor.

2.6.1.5 Racks

Multiple pipe racks or trapeze hangers shall be fabricated from ASTM A 36/A 36M steel, and designed to suit the conditions at the points of installation. Pipes shall be kept in their relative positions to each other by the use of clamps or clips. Pipelines subject to thermal expansion must be free to slide or roll.

2.6.1.6 Hangers

Hangers shall be fabricated of ASTM A 36/A 36M carbon steel. All hangers shall be of a uniform type and material for a given pipe run and application. Coated or plated hangers shall be used to isolate steel hangers from dissimilar metal tube or pipe. Hangers for pipe sizes 2.5 inches or larger shall incorporate a means of vertical adjustment after erection while supporting the load. For piping systems with liquid temperatures up to 122 degrees F the following shall be used: MSS SP-58 Types 1,3 through 12, Types 24 and 26 with overhead support, or Types 35 through 38 with support from below.

2.6.1.7 Hanger Rods

Hanger rods shall be carbon steel conforming to ASTM A 576. The diameter of the rods for piping system support shall conform to ASME B31.1.

2.7 Couplings

Type: Bolted, split-sleeve type consisting of four basic components; one piece housing, gaskets assembly, bolts and nuts, and end rings as required for restraint.

Provide split-sleeve with a double arch cross section closing around pipe ends that are smooth for expansion or contraction requirements or pipe ends with end rings affixed for pipe end restraint requirements. As the coupling housing closes, it confines the elastomeric gasket beneath the arches of the sleeve to create the radial seal. The axial seal is effected at the closure plates as the bolts pull the coupling housing snug around the pipe.

Provide sealing members comprised of two "O" ring gaskets and an elastomer sealing pad bonded to the integral sealing plate. Provide design that does not require internal pressure to effect the seal.

Provide couplings designed for the type, size, and working pressure of the piping system as indicated in the Process Piping Schedule and specified.

Materials:

Split-sleeve: Carbon Steel and Ductile Iron Pipelines: ASTM A-36 Carbon Steel.

Gaskets: Elastomers in accordance with ASTM D-2000, suitable for use with potable water.

Bolts and Nuts: Stainless steel bolts and nuts shall be conforming to ASTM A-276 T-304, minimum tensile strength 120,000 psi.

End Rings: Provide end rings of the same material as the coupling housing. Fixed x Fixed (FxF) type couplings: Provide a fully restrained pipe joint. Provide one end ring welded to each of the pipe ends fitting beneath the coupling and protected by the coupling. Follow manufacturer's written recommendations and instructions for size and welding detail required to attach the end rings.

Protective Coating: Prior to installation, couplings shall be coated on the I.D. and O.D. in accordance with Section 09900.

Installation of couplings shall be in accordance with manufacturer's recommendation.

The coupling housing shall be assembled pulling the closure plates together with the bolts tightened to assure snug coupling housing contact with the pipe OD. Follow the manufacturer's recommendation regarding the installation and tightening of the bolts.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 Protection

Pipe and equipment openings shall be closed with caps or plugs during installation. Equipment shall be protected from dirt, water, and chemical or mechanical damage.

3.1.2 System Preparation

3.1.2.1 Pipe and Fittings

Pipe and fittings shall be inspected before exposed piping is installed or buried piping is lowered into the trench. The Contractor shall clean the ends of pipes thoroughly, remove foreign matter and dirt from inside of pipes, and keep piping clean during and after laying.

3.1.2.2 Damaged Coatings

The Contractor shall repair damaged coating areas in the field with material equal to the original coating, except for damaged glass-lined pipe which shall be promptly removed from the site. The Contractor shall not install damaged piping materials. Field repair of damaged and uncoated areas of galvanized piping shall conform to ASTM A 780.

3.1.2.3 Field Fabrication

The Contractor shall notify the Contracting Officer at least 2 weeks prior to the field fabrication of pipe or fittings and at least 3 days prior to the start of any surface preparation or coating application work. Welding electrodes shall be provided in accordance with Table 4.1 of AWS D1.1 as required for the applicable base metals and welding process. Fabrication of fittings shall be performed in accordance with the manufacturer's instructions.

3.2 EXPOSED PIPING INSTALLATION

Exposed piping shall be run as straight as practical along the alignment shown on the contract drawings and with a minimum of joints. Piping and appurtenances shall be installed in conformance with reviewed shop drawings, manufacturer's instructions and ASME B31.3. Piping shall be installed without springing or forcing the pipe.

3.2.1 Anchors and Fasteners

Impact expansion (hammer and explosive charge drive-type) anchors and fastener systems are not acceptable. Lead shields, plastic or fiber inserts, and drilled-in plastic sleeve/nail drive systems are also not acceptable.

3.2.1.1 Drilled-In Expansion Anchors and Fasteners

Anchors shall be designed to accept both machine bolts and/or threaded rods. Such anchors shall consist of an expansion shield and expander nut contained inside the shield. The expander nut shall be fabricated and designed to climb the bolt or rod thread and simultaneously expand the shield as soon as the threaded item, while being tightened, reaches, and bears against the shield bottom. The shield body shall consist of four legs, the inside of each shall be tapered toward shield bottom (or nut end). The end of one leg shall be elongated and turned across shield bottom. The outer surface of shield body shall be ribbed for grip-action. The expander nut shall be of square design with sides tapered inward from bottom to top. The anchor materials of construction shall be TP316 stainless steel 43,541 psi minimum tensile strength. Fasteners shall be machine bolts for use with above anchors; nuts and washers shall conform to ASTM A 194/A 194M. The anchor length, diameter, and embedment depth shall meet the manufacturer's requirements for the maximum allowable working load of the application. The anchor length, diameter, and embedment depth shall meet the manufacturer's requirements for the maximum allowable working load of the application.

3.2.1.2 Drilled-In Adhesive Anchors

Drilled-in adhesive anchors shall not be used for overhead applications. The anchors shall be composed of an anchor rod assembly and an anchor rod adhesive cartridge. The anchor rod assembly shall be a chamfered and threaded stud rod of TP316 stainless steel with a nut and washer of TP316 stainless steel. The anchor length, diameter, and embedment depth shall meet the manufacturer's requirements for the maximum allowable working load of the application. The adhesive cartridge shall be a sealed capsule containing premeasured amounts of resin, quartz sand aggregate, and a hardener contained in a separate vial within the capsule. The capsule ingredients shall be activated by the insertion procedure of the anchor rod assembly.

3.2.2 Piping Expansion and Contraction Provisions

The piping shall be installed to allow for thermal expansion and contraction resulting from the difference between installation and operating temperatures. Design for installation of plastic pipe exposed to ambient conditions or in which the temperature variation of the contents is substantial shall have provisions for movement due to thermal expansion and contraction documented to be in accordance with PPI AW-32 TR21. Anchors shall be installed as shown in the contract drawings to withstand expansion thrust loads and to direct and control thermal expansion. An intermediate pipe guide shall be installed for every pipe at each metal channel framing support not carrying an anchor or alignment guide. Where pipe expansion joints are required, pipe alignment guides shall be installed adjacent to the expansion device and within four pipe diameters. Expansion devices shall be installed in accordance with the manufacturer's instructions.

3.2.3 Piping Flexibility Provisions

Thrust protection shall be provided as required. Flexible couplings and expansion joints shall be installed at connections to equipment, and where shown on the contract drawings. Additional pipe anchors and flexible couplings beyond those shown on the contract drawings, shall be provided to facilitate piping installation, in accordance with reviewed shop drawings.

3.2.4 Couplings, Adapters and Service Saddles

Pipes shall be thoroughly cleaned of oil, scale, rust, and dirt in order to provide a clean seat for gaskets. Gaskets shall be wiped clean prior to installation. Flexible couplings and flanged coupling adapter gaskets shall be lubricated with the manufacturer's standard lubricant before installation on the pipe ends. Couplings, service saddles, and anchor studs shall be installed in accordance with manufacturer's instructions. Bolts shall be tightened progressively, drawing up bolts on opposite sides a little at a time until all bolts have a uniform tightness. Torque-limiting wrenches shall be used to tighten bolts.

3.2.5 Pipe Flanges

Pipe flanges shall be set level, plumb, and aligned. Flanged fittings shall be installed true and perpendicular to the axis of the pipe. The bolt holes shall be concentric to the centerline of the pipe and shall straddle the vertical centerline of the pipe.

3.2.6 Valve Locations

Valves shall be located in accordance with the contract drawings where actuators are shown. Where actuators are not shown, valves shall be located and oriented to permit easy access to the valve operator, and to avoid interferences.

3.2.7 Pipe Tap Connections

Taps to pipe barrels are unacceptable. Taps to ductile iron piping shall be made only with a service saddle or at a tapping boss of a fitting, valve body, or equipment casting. Taps to steel piping shall be made only with a welded threadolet connection.

3.3 CONNECTING DISSIMILAR PIPE

Flexible transition couplings, dielectric fittings and isolation joints shall be installed in accordance with the manufacturer's instructions.

3.4 WASTE WATER DISPOSAL

The water used for testing, cleaning, flushing and/or disinfection shall be disposed of in accordance with all applicable regulations. Disposal is solely the responsibility of the Contractor. The method proposed for disposal of waste water shall be provided to, and approved by, the Contracting Officer prior to performing any testing, cleaning, flushing and disinfection activities.

-- End of Section --

SECTION 15500

HVAC SYSTEM CLEANING
02/03

PART 1 GENERAL

1.1 DESCRIPTION

This section defines the requirements necessary to render the Dalecarlia Pumping Station HVAC system components clean, and to verify the cleanliness through inspection and/or testing in accordance with items specified herein and applicable NADCA Standards.

The Contractor shall be responsible for the removal of visible surface contaminants and deposits from within the HVAC system in strict accordance with these specifications and following the Site Evaluation and Preparations Report and the HVAC System Component Inspection.

The HVAC system includes any interior surface of the facility's air distribution system for conditioned spaces and/or occupied zones. This includes the entire heating, air-conditioning and ventilation system from the points where the air enters the system to the points where the air is discharged from the system. The return air grilles, return air ducts to the air handling unit (AHU), the interior surfaces of the AHU, mixing box, coil compartment, condensate drain pans, humidifiers and dehumidifiers, supply air ducts, fans, fan housing, fan blades, air wash systems, spray eliminators, turning vanes, filters, filter housings, reheat coils, and supply diffusers are all considered part of the HVAC system. The HVAC system may also include other components such as dedicated exhaust and ventilation components and make-up air systems.

1.2 QUALIFICATIONS OF THE HVAC SYSTEM CLEANING CONTRACTOR

1.2.1 Membership

The HVAC system cleaning contractor shall be a certified member of the National Air Duct Cleaners Association (NADCA), or shall maintain membership in a nationally recognized non-profit industry organization dedicated to the cleaning of HVAC systems.

1.2.2 Certification

The HVAC system cleaning contractor shall have a minimum of one (1) Air System Cleaning Specialist (ASCS) certified by NADCA on a full time basis, or shall have staff certified by a nationally recognized certification program and organization dedicated to the cleaning of HVAC systems.

1.2.3 Supervisor Qualifications

A person certified as an ASCS by NADCA, or maintaining an equivalent certification by a nationally recognized program and organization, shall be responsible for the total work herein specified.

1.2.4 Experience

The HVAC system cleaning contractor shall submit records of experience in

the field of HVAC system cleaning as requested by WA.

1.2.5 Equipment, Materials and Labor

The HVAC system cleaning contractor shall possess and furnish all necessary equipment, materials and labor to adequately perform the specified services.

The contractor shall assure that its employees have received safety equipment training, medical surveillance programs, individual health protection measures, and manufacturer's product and material safety data sheets (MSDS) as required for the work by the U.S. Occupational Safety and Health Administration, and as described by this specification. For work performed in countries outside of the U.S.A., contractors should comply with applicable national safety codes and standards.

The contractor shall maintain a copy of all current MSDS documentation and safety certifications at the site at all times, as well as comply with all other site documentation requirements of applicable OSHA programs and this specification.

1.2.6 Licensing

The HVAC system cleaning contractor shall provide proof of maintaining the proper license(s), if any, as required to do work in this state. Contractor shall comply with all Federal, state and local rules, regulations, and licensing requirements.

1.3 APPLICABLE STANDARDS AND PUBLICATIONS

The following current standards and publications of the issues currently in effect form a part of this specification to the extent indicated by any reference thereto:

National Air Duct Cleaners Association (NADCA): "ACR-2002, Assessment, Cleaning & Restoration of HVAC Systems," 2001.

National Air Duct Cleaners Association (NADCA): "Understanding Microbial Contamination in HVAC Systems," 1996.

National Air Duct Cleaners Association (NADCA): "Introduction to HVAC System Cleaning Services," 2002.

National Air Duct Cleaners Association (NADCA): "Introduction to HVAC System Cleaning Services," 2002.

National Air Duct Cleaners Association (NADCA): Standard 05 "Requirements for the Installation of Service Openings in HVAC Systems," 1997.

Underwriters' Laboratories (UL): UL Standard 181.

American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE): Standard 62-89, "Ventilation for Acceptable Indoor Air Quality".

Environmental Protection Agency (EPA): "Building Air Quality," December 1991.

Sheet Metal and Air Conditioning Contractors' National Association (SMACNA): "HVAC Duct Construction Standards - Metal and Flexible," 1985.

North American Insulation Manufacturers Association (NAIMA): "Cleaning Fibrous Glass Insulated Air Duct Systems," 1993.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEEDURES:

SD-01 Preconstruction Submittals

Certifications; G WA

Certification that the HVAC system cleaning contractor has a minimum of one (1) Air System Cleaning Specialist (ASCS) certified by NADCA on a full time basis, or has staff certified by a nationally recognized certification program and organization dedicated to the cleaning of HVAC systems.

Documentation and references of experience in the field of HVAC system cleaning.

All Material Safety Data Sheets (MSDS) for all chemical products proposed to be used in the cleaning process.

SD-09 Manufacturer's Field Reports

Site Evaluation and Preparations; G WA

Contractor shall conduct a site evaluation, and establish a specific, coordinated plan which details how each area of the building will be protected during the various phases of the project

HVAC System Component Inspection; G WA

Prior to the commencement of any cleaning work, the HVAC system cleaning contractor shall perform a visual inspection of the HVAC system to determine appropriate methods, tools, and equipment required to satisfactorily complete this project. The cleanliness inspection should include air handling units and representative areas of the HVAC system components and ductwork. In HVAC systems that include multiple air handling units, a representative sample of the units should be inspected.

The cleanliness inspection shall be conducted without negatively impacting the indoor environment through excessive disruption of settled dust, microbial amplification or other debris. In cases where contamination is suspected, and/or in sensitive environments where even small amounts of contaminant may be of concern, environmental engineering control measures should be implemented

Damaged system components found during the inspection shall be documented and brought to the attention of WA.

Post-project Report; G WA

At the conclusion of the project, the Contractor shall provide a report indicating the following:

Success of the cleaning project, as verified through visual inspection and/or gravimetric analysis.

Areas of the system found to be damaged and/or in need of repair.

1.5 STANDARDS

1.5.1 NADCA Standards

The HVAC system cleaning contractor shall perform the services specified here in accordance with the current published standards of the National Air Duct Cleaners Association (NADCA). All terms in this specification shall have their meaning defined as stated in the NADCA Standards. NADCA Standards must be followed with no modifications or deviations being allowed.

1.6 DOCUMENTS

1.6.1 Mechanical Drawings

The HVAC system drawings shall be made available to the HVAC system cleaning contractor. (Reference COE WA Dwgs. 40.11-2.1-153 through 40.11-2.1-163)Attached.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 GENERAL

3.1.1 Containment

Debris removed during cleaning shall be collected and precautions must be taken to ensure that Debris is not otherwise dispersed outside the HVAC system during the cleaning process.

3.1.2 Particulate Collection

Where the Particulate Collection Equipment is exhausting inside the building, HEPA filtration with 99.97% collection efficiency for 0.3-micron size (or greater) particles shall be used. When the Particulate Collection Equipment is exhausting outside the building, Mechanical Cleaning operations shall be undertaken only with Particulate Collection Equipment in place, including adequate filtration to contain Debris removed from the HVAC system. When the Particulate Collection Equipment is exhausting outside the building, precautions shall be taken to locate the equipment down wind and away from all air intakes and other points of entry into the building.

3.1.3 Controlling Odors

Measures shall be employed to control odors and/or mist vapors during the cleaning process.

3.1.4 Component Cleaning

Cleaning methods shall be employed such that all HVAC system components must be Visibly Clean as defined in applicable standards (see NADCA Standards). Upon completion, all components must be returned to those settings recorded just prior to cleaning operations.

3.1.5 Air-Volume Control Devices

Dampers and any air-directional mechanical devices inside the HVAC system must have their position marked prior to cleaning and, upon completion, must be restored to their marked position.

3.1.6 Service Openings

The contractor shall utilize service openings, as required for proper cleaning, at various points of the HVAC system for physical and mechanical entry, and inspection.

1. Contractor shall utilize the existing service openings already installed in the HVAC system where possible.

2. Other openings shall be created where needed and they must be created so they can be sealed in accordance with industry codes and standards.

3. Closures must not significantly hinder, restrict, or alter the airflow within the system.

4. Closures must be properly insulated to prevent heat loss/gain or condensation on surfaces within the system.

5. Openings must not compromise the structural integrity of the system.

6. Construction techniques used in the creation of openings should conform to requirements of applicable building and fire codes, and applicable NFPA, SMACNA and NADCA Standards.

7. Cutting service openings into flexible duct is not permitted. Flexible duct shall be disconnected at the ends as needed for proper cleaning and inspection.

8. Rigid fiber glass duct systems shall be resealed in accordance with NAIMA recommended practices. Only closure techniques that comply with UL Standard 181 or UL Standard 181a are suitable for fiber glass duct system closures.

9. All service openings capable of being re-opened for future inspection or remediation shall be clearly marked and shall have their location reported to WA in project report documents.

3.1.7 Ceiling Sections (tile)

The contractor may remove and reinstall ceiling sections to gain access to HVAC systems during the cleaning process.

3.1.8 Air distribution devices (registers, grilles & diffusers)

The contractor shall clean all air distribution devices.

3.1.9 Air handling units, terminal units (VAV, Dual duct boxes, etc.) , blowers and exhaust fans

The contractor shall insure that supply, return, and exhaust fans and blowers are thoroughly cleaned. Areas to be cleaned include blowers, fan housings, plenums (except ceiling supply and return plenums), scrolls, blades, or vanes, shafts, baffles, dampers and drive assemblies. All visible surface contamination deposits shall be removed in accordance with NADCA Standards. Contractor shall:

1. Clean all air handling units (AHU) internal surfaces, components and condensate collectors and drains.

2. Assure that a suitable operative drainage system is in place prior to beginning wash down procedures.

3. Clean all coils and related components, including evaporator fins.

3.1.10 Duct Systems

Contractor shall:

1. Create service openings in the system as necessary in order to accommodate cleaning of otherwise inaccessible areas.

2. Mechanically clean all duct systems to remove all visible contaminants, such that the systems are capable of passing Cleaning Verification Tests (see NADCA Standards).

3.2 HEALTH AND SAFETY

3.2.1 Safety Standards

Cleaning contractors shall comply with applicable federal, state, and local requirements for protecting the safety of the contractor's employees, building occupants, and the environment. In particular, all applicable standards of the Occupational Safety and Health Administration (OSHA) shall be followed when working in accordance with this specification.

3.2.2 Occupant Safety

No processes or materials shall be employed in such a manner that they will introduce additional hazards into occupied spaces.

3.2.3 Disposal of Debris

All Debris removed from the HVAC System shall be disposed of in accordance with applicable federal, state and local requirements.

3.3 MECHANICAL CLEANING METHODOLOGY

3.3.1 Source Removal Cleaning Methods

The HVAC system shall be cleaned using Source Removal mechanical cleaning

methods designed to extract contaminants from within the HVAC system and safely remove contaminants from the facility. It is the contractor's responsibility to select Source Removal methods that will render the HVAC system Visibly Clean and capable of passing cleaning verification methods (See applicable NADCA Standards) and other specified tests, in accordance with all general requirements. No cleaning method, or combination of methods, shall be used which could potentially damage components of the HVAC system or negatively alter the integrity of the system.

1. All methods used shall incorporate the use of vacuum collection devices that are operated continuously during cleaning. A vacuum device shall be connected to the downstream end of the section being cleaned through a predetermined opening. The vacuum collection device must be of sufficient power to render all areas being cleaned under negative pressure, such that containment of debris and the protection of the indoor environment are assured.

2. All vacuum devices exhausting air inside the building shall be equipped with HEPA filters (minimum efficiency), including hand-held vacuums and wet-vacuums.

3. All vacuum devices exhausting air outside the facility shall be equipped with Particulate Collection including adequate filtration to contain Debris removed from the HVAC system. Such devices shall exhaust in a manner that will not allow contaminants to re-enter the facility. Release of debris outdoors must not violate any outdoor environmental standards, codes or regulations.

4. All methods require mechanical agitation devices to dislodge debris adhered to interior HVAC system surfaces, such that debris may be safely conveyed to vacuum collection devices. Acceptable methods will include those, which will not potentially damage the integrity of the ductwork, nor damage porous surface materials such as liners inside the ductwork or system components.

3.3.2 Methods of Cleaning Fibrous Glass Insulated Components

Fibrous glass thermal or acoustical insulation elements present in any equipment or ductwork shall be thoroughly cleaned with HEPA vacuuming equipment, while the HVAC system is under constant negative pressure, and not permitted to get wet in accordance with applicable NADCA and NAIMA standards and recommendations.

Cleaning methods used shall not cause damage to fibrous glass components and will render the system capable of passing Cleaning Verification Tests (see NADCA Standards).

3.3.3 Damaged Fibrous Glass Material

Evidence of damage: If there is any evidence of damage, deterioration, delaminating, friable material, mold or fungus growth, or moisture such that fibrous glass materials cannot be restored by cleaning or resurfacing with an acceptable insulation repair coating, they shall be identified for replacement.

Replacement: When requested or specified, Contractor must be capable of remediating exposed damaged insulation in air handlers and/or ductwork requiring replacement.

Replacement material: In the event fiber glass materials must be replaced, all materials shall conform to applicable industry codes and standards, including those of UL and SMACNA.
Text

3.3.4 Cleaning of Coils

Any cleaning method may be used which will render the Coil Visibly Clean and capable of passing Coil Cleaning Verification (see applicable NADCA Standards). Coil drain pans shall be subject to Non-Porous Surfaces Cleaning Verification. The drain for the condensate drain pan shall be operational. Cleaning methods shall not cause any appreciable damage to, displacement of, inhibit heat transfer, or erosion of the coil surface or fins, and shall conform to coil manufacturer recommendations when available. Coils shall be thoroughly rinsed with clean water to remove any latent residues.

3.3.5 Biocidal Agents and Coatings

Biocidal agents shall only be applied if active fungal growth is reasonably suspected, or where unacceptable levels of fungal contamination have been verified through testing.

Application of any biocidal agents used to control the growth of fungal or bacteriological contaminants shall be performed after the removal of surface deposits and debris.

When used, chemical biocides and coatings shall be applied in strict accordance with manufacturer recommendations and EPA registration listing.

Biocidal coatings shall be applied according to manufacturer's instructions. Coatings shall be sprayed directly onto interior ductwork surfaces, rather than "fogged" downstream onto surfaces. A continuous film must be achieved on the surface to be treated by the coating application. Application of any biocidal coatings shall be in strict accordance with manufacturer's minimum mileage surface application rate standards for effectiveness.

3.4 CLEANLINESS VERIFICATION

3.4.1 General

Verification of HVAC System cleanliness, to be included in the Post-Project Report will be determined after mechanical cleaning and before the application of any treatment or introduction of any treatment-related substance to the HVAC system, including biocidal agents and coatings.

3.4.2 Visual Inspection

The HVAC system shall be inspected visually to ensure that no visible contaminants are present.

1. If no contaminants are evident through visual inspection, the HVAC system shall be considered clean; however, WA reserves the right to further verify system cleanliness through Surface Comparison Testing or the NADCA vacuum test specified in the NADCA standards. NADCA vacuum test analysis should be performed by a qualified third party experienced in testing of this nature at no additional costs to WA.