



STATE OF UTAH - DEPARTMENT OF ADMINISTRATIVE SERVICES

Division of Facilities Construction and Management

DFCM

STANDARD LOW BID PROJECT

March 15, 2010

FIRE SPRINKLER UPGRADE TAYLORSVILLE DEAF CENTER

DIVISION OF SERVICES TO THE DEAF AND HARD OF HEARING TAYLORSVILLE, UTAH

DFCM Project Number 09215230

Protection Consultants, Inc.
1199 South Main Street, Suite 101
Centerville, Utah 84014

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Current copies of the following documents are hereby made part of these contract documents by reference. These documents are available on the DFCM web site at <http://dfcm.utah.gov/StdDocs/index.html> "Standard Documents" – "Reference Documents I" – "Item 6. Supplemental General Conditions" or are available upon request from DFCM:

DFCM Supplemental General Conditions dated July 1, 2009 *

DFCM Supplemental General Conditions dated July 15, 2008

DFCM General Conditions dated May 25, 2005

DFCM Application and Certification for Payment dated May 25, 2005.

*** NOTE: THE NEW SUPPLEMENTAL GENERAL CONDITIONS EFFECTIVE JULY 1, 2009 ADDRESSING HEALTH INSURANCE AND IMMIGRATION ARE REFERENCED AT THE LINK ABOVE.**

The Agreement and General Conditions dated May 25, 2005 have been updated from versions that were formally adopted and in use prior to this date. The changes made to the General Conditions are identified in a document entitled Revisions to General Conditions that is available on DFCM's web site at <http://dfcm.utah.gov>

NOTICE TO CONTRACTORS

Sealed bids will be received by the Division of Facilities Construction and Management (DFCM) for:

FIRE SPRINKLER UPGRADE - TAYLORSVILLE DEAF CENTER
DIVISION OF SERVICES TO THE DEAF AND HARD OF HEARING
TAYLORSVILLE, UTAH
DFCM PROJECT NO: 09215230

Bids will be in accordance with the Contract Documents that will be available at 4:00 PM on Monday, March 15, 2010, and distributed in electronic format only on CDs from DFCM, 4110 State Office Building, Salt Lake City, Utah and on the DFCM web page at <http://dfcm.utah.gov>. For questions regarding this project, please contact Wayne Smith, DFCM, at 801- 550-6536. No others are to be contacted regarding this bidding process. The construction estimate for this project is \$236,000.00.

A **mandatory** pre-bid meeting will be held at 8:00 AM on Wednesday, March 17, 2010 at the Taylorsville Deaf Center, 5709 South 1500 West, Salt Lake City, Utah. All bidders wishing to bid on this project are required to attend this meeting.

Bids will be received until the hour of 3:00 PM on Monday, March 29, 2010 at DFCM, 4110 State Office Building, Salt Lake City, Utah 84114. Bids will be opened and read aloud in the DFCM Conference Room, 4110 State Office Building, Salt Lake City, Utah. NOTE: Bids must be received at 4110 State Office Building by the specified time.

A bid bond in the amount of five percent (5%) of the bid amount, made payable to the Division of Facilities Construction and Management on DFCM's bid bond form, shall accompany the bid.

The Division of Facilities Construction and Management reserves the right to reject any or all bids or to waive any formality or technicality in any bid in the interest of DFCM.

DIVISION OF FACILITIES CONSTRUCTION AND MANAGEMENT
Marla Workman, Contract Coordinator
4110 State Office Building, Salt Lake City, Utah 84114

PROJECT DESCRIPTION

The project consists of installing a fire sprinkler system throughout the building as per drawings and specifications. The facility will remain open for business during construction. Therefore, to minimize conflict with the occupant's work schedule, the work will proceed in phases as outlined in the specifications. No premium time or weekend time is anticipated throughout the project; however, if the contractor wishes to accommodate the occupant's scheduling, two work shifts may be implemented. Work may occur in the building five days per week from 7:00 AM – 10:00 PM.

**PROJECT SCHEDULE**

PROJECT NAME: FIRE SPRINKLER UPGRADE - TAYLORSVILLE DEAF CENTER DIVISION OF SERVICES TO THE DEAF AND HARD OF HEARING TAYLORSVILLE, UTAH				
DFCM PROJECT #: 09215230				
Event	Day	Date	Time	Place
Bidding Documents Available	Monday	March 15, 2010	4:00 PM	DFCM 4110 State Office Bldg SLC, UT and the DFCM web site *
Mandatory Pre-bid Site Meeting	Wednesday	March 17, 2010	8:00 AM	Taylorsville Deaf Center 5709 South 1500 West SLC, UT
Last Day to Submit Questions	Monday	March 22, 2010	5:00 PM	Wayne Smith – DFCM E-mail wfsmith@utah.gov Fax 801-538-3267
Addendum Deadline (exception for bid delays)	Wednesday	March 24, 2010	2:00 PM	DFCM web site *
Prime Contractors Turn In Bid and Bid Bond	Monday	March 29, 2010	3:00 PM	DFCM 4110 State Office Bldg SLC, UT
Sub-contractor List Due	Tuesday	March 30, 2010	3:00 PM	DFCM 4110 State Office Bldg SLC, UT Fax 801-538-3677
Substantial Completion Date	Friday	August 20, 2010		

* **NOTE:** DFCM's web site address is <http://dfcm.utah.gov>



BID FORM

NAME OF BIDDER _____ DATE _____

To the Division of Facilities Construction and Management
4110 State Office Building
Salt Lake City, Utah 84114

The undersigned, responsive to the "Notice to Contractors" and in accordance with the "Instructions to Bidders", in compliance with your invitation for bids for the **FIRE SPRINKLER UPGRADE - TAYLORSVILLE DEAF CENTER - DIVISION OF SERVICES TO THE DEAF AND HARD OF HEARING - TAYLORSVILLE, UTAH - DFCM PROJECT NO: 09215230** and having examined the Contract Documents and the site of the proposed Work and being familiar with all of the conditions surrounding the construction of the proposed Project, including the availability of labor, hereby proposes to furnish all labor, materials and supplies as required for the Work in accordance with the Contract Documents as specified and within the time set forth and at the price stated below. This price is to cover all expenses incurred in performing the Work required under the Contract Documents of which this bid is a part:

I/We acknowledge receipt of the following Addenda: _____

For all work shown on the Drawings and described in the Specifications and Contract Documents, I/we agree to perform for the sum of:

_____ DOLLARS (\$_____)
(In case of discrepancy, written amount shall govern)

I/We guarantee that the Work will be Substantially Complete by **August 20, 2010**, should I/we be the successful bidder, and agree to pay liquidated damages in the amount of **\$200.00** per day for each day after expiration of the Contract Time as stated in Article 3 of the Contractor's Agreement.

This bid shall be good for 45 days after bid opening.

Enclosed is a 5% bid bond, as required, in the sum of _____

The undersigned Contractor's License Number for Utah is _____

Upon receipt of notice of award of this bid, the undersigned agrees to execute the contract within ten (10) days, unless a shorter time is specified in the Contract Documents, and deliver acceptable Performance and Payment bonds in the prescribed form in the amount of 100% of the Contract Sum for faithful performance of the contract.

The Bid Bond attached, in the amount not less than five percent (5%) of the above bid sum, shall become the property of the Division of Facilities Construction and Management as liquidated damages for delay and additional expense caused thereby in the event that the contract is not executed and/or acceptable 100% Performance and Payment bonds are not delivered within the time set forth.

Type of Organization:

(Corporation, Partnership, Individual, etc.)

Any request and information related to Utah Preference Laws:

Respectfully submitted,

Name of Bidder

ADDRESS:

Authorized Signature

INSTRUCTIONS TO BIDDERS

1. Drawings and Specifications, Other Contract Documents

Drawings and Specifications, as well as other available Contract Documents, may be obtained as stated in the Invitation to Bid.

2. Bids

Before submitting a bid, each contractor shall carefully examine the Contract Documents, shall visit the site of the Work; shall fully inform themselves as to all existing conditions and limitations; and shall include in the bid the cost of all items required by the Contract Documents. If the bidder observes that portions of the Contract Documents are at variance with applicable laws, building codes, rules, regulations or contain obvious erroneous or uncoordinated information, the bidder shall promptly notify the DFCM Representative and the necessary changes shall be accomplished by Addendum.

The bid, bearing original signatures, must be typed or handwritten in ink on the Bid Form provided in the procurement documents and submitted in a sealed envelope at the location specified by the Invitation to Bid prior to the deadline for submission of bids.

A bid bond properly signed by a qualified surety, as indicated on the DFCM Bid Bond form provided along with this Instruction to Bidders, in the amount of 5% of the bid, shall accompany the bid submission to DFCM. **THIS BID BOND MUST BE ON THE DFCM BID BOND FORM PROVIDED WITH THIS INSTRUCTION TO BIDDERS IN ORDER TO BE CONSIDERED AN ACCEPTABLE BID** unless only one bid is received by DFCM, or the failure to comply with the bid bond requirements is determined by the Director of DFCM to be nonsubstantial based on the following:

- (a) the bid bond is submitted on a form other than DFCM's required Bid Bond form and the bid bond meets all other requirements including being issued by a surety firm authorized to do business in the State of Utah and be listed in the U.S. Department of the Treasury Circular 570, Companies Holding Certificates of Authority as Acceptable Securities on Federal Bonds and as Acceptable Reinsuring Companies for an amount not less than the amount of the bond to be issued. A co-surety may be utilized to satisfy this requirement; and
- (b) the contractor provides a bid bond properly signed by a qualified surety and on the required DFCM Bid Bond form by the close of business of the next succeeding business day after the DFCM notifies the bidder of the defective bid bond.

3. Contract and Bond

The Contractor's Agreement will be in the form found in the specifications. The Contract Time will be as indicated in the bid. The successful bidder, simultaneously with the execution of the Contract Agreement, will be required to furnish a performance bond and a payment bond, both bearing original signatures, upon the forms provided in the procurement documents. The performance and payment bonds shall be for an amount equal to one hundred percent (100%) of the contract sum and secured from a company that meets the requirements specified in the requisite forms. Any bonding requirements for subcontractors will be specified in the Supplementary General Conditions.

4. Listing of Subcontractors

Listing of Subcontractors shall be as summarized in the “Instructions and Subcontractor’s List Form”, which are included as part of these Contract Documents. The Subcontractors List shall be delivered to DFCM or faxed to DFCM at 801-538-3677 within 24 hours of the bid opening. Requirements for listing additional subcontractors will be listed in the Contract Documents.

DFCM retains the right to audit or take other steps necessary to confirm compliance with requirements for the listing and changing of subcontractors. Any contractor who is found to not be in compliance with these requirements is subject to a debarment hearing and may be debarred from consideration for award of contracts for a period of up to three years.

5. Interpretation of Drawings and Specifications

If any person or entity contemplating submitting a bid is in doubt as to the meaning of any part of the drawings, specifications or other Contract Documents, such person shall submit to the DFCM Project Manager a request for an interpretation thereof. The person or entity submitting the request will be responsible for its prompt delivery. Any interpretation of the proposed documents will be made only by addenda posted on DFCM’s web site at <http://dfcm.utah.gov>. Neither the DFCM nor A/E will be responsible for any other explanations or interpretations of the proposed documents. A/E shall be deemed to refer to the architect or engineer hired by DFCM as the A/E or Consultant for the Project.

6. Addenda

Addenda will be posted on DFCM’s web site at <http://dfcm.utah.gov>. Contractors are responsible for obtaining information contained in each addendum from the web site. Addenda issued prior to the submittal deadline shall become part of the bidding process and must be acknowledged on the bid form. Failure to acknowledge addenda may result in disqualification from bidding.

7. Award of Contract

The Contract will be awarded as soon as possible to the lowest, responsive and responsible bidder, based on the lowest combination of base bid and acceptable prioritized alternates, provided the bid is reasonable, is in the interests of the State of Utah to accept and after applying the Utah Preference Laws in U.C.A. Title 63, Chapter 56. DFCM reserves the right to waive any technicalities or formalities in any bid or in the bidding. Alternates will be accepted on a prioritized basis with Alternate 1 being highest priority, Alternate 2 having second priority, etc.

8. DFCM Contractor Performance Rating

As a contractor completes each DFCM project, DFCM, the architect/engineer and the using agency will evaluate project performance based on the enclosed “DFCM Contractor Performance Rating” form. The ratings issued on this project will not affect this project but may affect the award on future projects.

9. Licensure

The Contractor shall comply with and require all of its subcontractors to comply with the license laws as required by the State of Utah.

10. Permits

In concurrence with the requirements for permitting in the General Conditions, it is the responsibility of the Contractor to obtain the fugitive dust plan requirements from the Utah Division of Air Quality and the SWPPP requirements from the Utah Department of Environmental Quality and submit the completed forms and pay any permit fee that may be required for this specific project. Failure to obtain the required permit may result in work stoppage and/or fines from the regulating authority that will be the sole responsibility of the Contractor. Any delay to the project as a result of any such failure to obtain the permit or noncompliance with the permit shall not be eligible for any extension in the Contract Time.

11. Right to Reject Bids

DFCM reserves the right to reject any or all Bids.

12. Time is of the Essence

Time is of the essence in regard to all the requirements of the Contract Documents.

13. Withdrawal of Bids

Bids may be withdrawn on written request received from bidder prior to the time fixed for opening. Negligence on the part of the bidder in preparing the bid confers no right for the withdrawal of the bid after it has been opened.

14. Product Approvals

Where reference is made to one or more proprietary products in the Contract Documents, but restrictive descriptive materials of one or more manufacturer(s) is referred to in the Contract Documents, the products of other manufacturers will be accepted, provided they equal or exceed the standards set forth in the drawings and specifications and are compatible with the intent and purpose of the design, subject to the written approval of the A/E. Such written approval must occur prior to the deadline established for the last scheduled addenda to be issued. The A/E's written approval will be in an issued addendum. If the descriptive material is not restrictive, the products of other manufacturers specified will be accepted without prior approval provided they are compatible with the intent and purpose of the design as determined by the A/E.

15. Financial Responsibility of Contractors, Subcontractors and Sub-subcontractors

Contractors shall respond promptly to any inquiry in writing by DFCM to any concern of financial responsibility of the contractor, subcontractor or sub-subcontractor.

16. Debarment

By submitting a bid, the Contractor certifies that neither it nor its principals, including project and site managers, have been, or are under consideration for, debarment or suspension, or any action that would exclude such from participation in a construction contract by any governmental department or agency. If the Contractor cannot certify this statement, attach to the bid a detailed written explanation which must be reviewed and approved by DFCM as part of the requirements for award of the Project.

BID BOND

(Title 63, Chapter 56, U. C. A. 1953, as Amended)

KNOW ALL PERSONS BY THESE PRESENTS:

That _____ hereinafter referred to as the "Principal," and _____, a corporation organized and existing under the laws of the State of _____, with its principal office in the City of _____ and authorized to transact business in this State and U. S. Department of the Treasury Listed, (Circular 570, Companies Holding Certificates of Authority as Acceptable Securities on Federal Bonds and as Acceptable Reinsuring Companies); hereinafter referred to as the "Surety," are held and firmly bound unto the STATE OF UTAH, hereinafter referred to as the "Obligee," in the amount of \$ _____ (5% of the accompanying bid), being the sum of this Bond to which payment the Principal and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH that whereas the Principal has submitted to Obligee the accompanying bid incorporated by reference herein, dated as shown, to enter into a contract in writing for the _____ Project.

NOW, THEREFORE, THE CONDITION OF THE ABOVE OBLIGATION IS SUCH, that if the said principal does not execute a contract and give bond to be approved by the Obligee for the faithful performance thereof within ten (10) days after being notified in writing of such contract to the principal, then the sum of the amount stated above will be forfeited to the State of Utah as liquidated damages and not as a penalty; if the said principal shall execute a contract and give bond to be approved by the Obligee for the faithful performance thereof within ten (10) days after being notified in writing of such contract to the Principal, then this obligation shall be null and void. It is expressly understood and agreed that the liability of the Surety for any and all defaults of the Principal hereunder shall be the full penal sum of this Bond. The Surety, for value received, hereby stipulates and agrees that obligations of the Surety under this Bond shall be for a term of sixty (60) days from actual date of the bid opening.

PROVIDED, HOWEVER, that this Bond is executed pursuant to provisions of Title 63, Chapter 56, Utah Code Annotated, 1953, as amended, and all liabilities on this Bond shall be determined in accordance with said provisions to same extent as if it were copied at length herein.

IN WITNESS WHEREOF, the above bounden parties have executed this instrument under their several seals on the date indicated below, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

DATED this _____ day of _____, 20_____.

Principal's name and address (if other than a corporation):

By: _____

Title: _____

Principal's name and address (if a corporation):

By: _____

Title: _____
(Affix Corporate Seal)

Surety's name and address:

By: _____
Attorney-in-Fact (Affix Corporate Seal)

STATE OF _____)
) ss.
COUNTY OF _____)

On this ___ day of _____, 20____, personally appeared before me _____, whose identity is personally known to me or proved to me on the basis of satisfactory evidence, and who, being by me duly sworn, did say that he/she is the Attorney-in-fact of the above-named Surety Company, and that he/she is duly authorized to execute the same and has complied in all respects with the laws of Utah in reference to becoming sole surety upon bonds, undertakings and obligations, and that he/she acknowledged to me that as Attorney-in-fact executed the same.

Subscribed and sworn to before me this _____ day of _____, 20____.
My Commission Expires: _____
Resides at: _____

NOTARY PUBLIC

Agency: _____
Agent: _____
Address: _____
Phone: _____

Approved As To Form: May 25, 2005
By Alan S. Bachman, Asst Attorney General



Division of Facilities Construction and

INSTRUCTIONS AND SUBCONTRACTORS LIST FORM

The three low bidders, as well as all other bidders that desire to be considered, are required by law to submit to DFCM within 24 hours of bid opening a list of **ALL** first-tier subcontractors, including the subcontractor's name, bid amount and other information required by Building Board Rule and as stated in these Contract Documents, based on the following:

DOLLAR AMOUNTS FOR LISTING

PROJECTS UNDER \$500,000: ALL FIRST-TIER SUBS \$20,000 OR OVER MUST BE LISTED
PROJECTS \$500,000 OR MORE: ALL FIRST-TIER SUBS \$35,000 OR OVER MUST BE LISTED

- Any additional subcontractors identified in the bid documents shall also be listed.
- The DFCM Director may not consider any bid submitted by a bidder if the bidder fails to submit a subcontractor list meeting the requirements of State law.
- List subcontractors for base bid as well as the impact on the list that the selection of any alternate may have.
- Bidder may not list more than one subcontractor to perform the same work.
- If there are no subcontractors for the job that are required to be reported by State law (either because there are no subcontractors that will be used on the project or because there are no first-tier subcontractors over the dollar amounts referred to above), then you do not need to submit a sublist. If you do not submit a sublist, it will be deemed to be a representation by you that there are no subcontractors on the job that are required to be reported under State law. At any time, DFCM reserves the right to inquire, for security purposes, as to the identification of the subcontractors at any tier that will be on the worksite.

LICENSURE:

The subcontractor's name, the type of work, the subcontractor's bid amount, and the subcontractor's license number as issued by DOPL, if such license is required under Utah Law, shall be listed. Bidder shall certify that all subcontractors, required to be licensed, are licensed as required by State law. A subcontractor includes a trade contractor or specialty contractor and does not include suppliers who provide only materials, equipment, or supplies to a contractor or subcontractor.

'SPECIAL EXCEPTION':

A bidder may list 'Special Exception' in place of a subcontractor when the bidder intends to obtain a subcontractor to perform the work at a later date because the bidder was unable to obtain a qualified or reasonable bid under the provisions of U.C.A. Section 63A-5-208(4). The bidder shall insert the term 'Special Exception' for that category of work, and shall provide documentation with the subcontractor list describing the bidder's efforts to obtain a bid of a qualified subcontractor at a reasonable cost and why the bidder was unable to obtain a qualified subcontractor bid. The Director must find that the bidder complied in good faith with State law requirements for any 'Special Exception' designation, in order for the bid to be considered. If awarded the contract, the Director shall supervise the bidder's efforts to obtain a qualified subcontractor bid. The amount of the awarded contract may not be adjusted to reflect the actual amount of the subcontractor's bid. Any listing of 'Special Exception' on the sublist form shall also include amount allocated for that work.

GROUNDS FOR DISQUALIFICATION:

The Director may not consider any bid submitted by a bidder if the bidder fails to submit a subcontractor list meeting the requirements of State law. Director may withhold awarding the contract to a particular bidder if one or more of the proposed subcontractors are considered by the Director to be unqualified to do the Work or for

INSTRUCTIONS AND SUBCONTRACTORS LIST FORM
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such other reason in the best interest of the State of Utah. Notwithstanding any other provision in these instructions, if there is a good faith error on the sublist form, at the sole discretion of the Director, the Director may provide notice to the contractor and the contractor shall have 24 hours to submit the correction to the Director. If such correction is submitted timely, then the sublist requirements shall be considered met.

CHANGES OF SUBCONTRACTORS SPECIFICALLY IDENTIFIED ON SUBLIST FORM:

Subsequent to twenty-four hours after the bid opening, the contractor may change its listed subcontractors only after receiving written permission from the Director based on complying with all of the following criteria.

- (1) The contractor has established in writing that the change is in the best interest of the State and that the contractor establishes an appropriate reason for the change, which may include, but not is not limited to, the following reasons: the original subcontractor has failed to perform, or is not qualified or capable of performing, and/or the subcontractor has requested in writing to be released.
- (2) The circumstances related to the request for the change do not indicate any bad faith in the original listing of the subcontractors.
- (3) Any requirement set forth by the Director to ensure that the process used to select a new subcontractor does not give rise to bid shopping.
- (4) Any increase in the cost of the subject subcontractor work is borne by the contractor.
- (5) Any decrease in the cost of the subject subcontractor work shall result in a deductive change order being issued for the contract for such decreased amount.
- (6) The Director will give substantial weight to whether the subcontractor has consented in writing to being removed unless the Contractor establishes that the subcontractor is not qualified for the work.

EXAMPLE:

Example of a list where there are only four subcontractors:

TYPE OF WORK	SUBCONTRACTOR, "SELF" OR "SPECIAL EXCEPTION"	SUBCONTRACTOR BID AMOUNT	CONTRACTOR LICENSE #
ELECTRICAL	ABCD Electric Inc.	\$350,000.00	123456789000
LANDSCAPING	"Self" *	\$300,000.00	123456789000
CONCRETE (ALTERNATE #1)	XYZ Concrete Inc	\$298,000.00	987654321000
MECHANICAL	"Special Exception" (attach documentation)	Fixed at: \$350,000.00	(TO BE PROVIDED AFTER OBTAINING SUBCONTRACTOR)

* Bidders may list "self", but it is not required.

PURSUANT TO STATE LAW - SUBCONTRACTOR BID AMOUNTS CONTAINED IN THIS SUBCONTRACTOR LIST SHALL NOT BE DISCLOSED UNTIL THE CONTRACT HAS BEEN AWARDED.



SUBCONTRACTORS LIST
FAX TO 801-538-3677

PROJECT TITLE: _____

Caution: You must read and comply fully with instructions.

Table with 4 columns: TYPE OF WORK, SUBCONTRACTOR, 'SELF' OR 'SPECIAL EXCEPTION', SUBCONTRACTOR BID AMOUNT, CONT. LICENSE #

We certify that:

- 1. This list includes all subcontractors as required by the instructions, including those related to the base bid as well as any alternates.
2. We have listed 'Self' or 'Special Exception' in accordance with the instructions.
3. All subcontractors are appropriately licensed as required by State law.

FIRM: _____

DATE: _____

SIGNED BY: _____

NOTICE: FAILURE TO SUBMIT THIS FORM, PROPERLY COMPLETED AND SIGNED, AS REQUIRED IN THESE CONTRACT DOCUMENTS, SHALL BE GROUNDS FOR OWNER'S REFUSAL TO ENTER INTO A WRITTEN CONTRACT WITH BIDDER. ACTION MAY BE TAKEN AGAINST BIDDERS BID BOND AS DEEMED APPROPRIATE BY OWNER. ATTACH A SECOND PAGE IF NECESSARY.

CONTRACTOR'S AGREEMENT

FOR:

THIS CONTRACTOR'S AGREEMENT, made and entered into this ____ day of _____, 20__, by and between the DIVISION OF FACILITIES CONSTRUCTION AND MANAGEMENT, hereinafter referred to as "DFCM", and _____, incorporated in the State of _____ and authorized to do business in the State of Utah, hereinafter referred to as "Contractor", whose address is _____.

WITNESSETH: WHEREAS, DFCM intends to have Work performed at _____.

WHEREAS, Contractor agrees to perform the Work for the sum stated herein.

NOW, THEREFORE, DFCM and Contractor for the consideration provided in this Contractor's Agreement, agree as follows:

ARTICLE 1. SCOPE OF WORK. The Work to be performed shall be in accordance with the Contract Documents prepared by _____ and entitled "_____."

The DFCM General Conditions ("General Conditions") dated May 25, 2005 and Supplemental General Conditions dated July 15, 2008 and July 1, 2009 ("also referred to as General Conditions") on file at the office of DFCM and available on the DFCM website, are hereby incorporated by reference as part of this Agreement and are included in the specifications for this Project. All terms used in this Contractor's Agreement shall be as defined in the Contract Documents, and in particular, the General Conditions.

The Contractor Agrees to furnish labor, materials and equipment to complete the Work as required in the Contract Documents which are hereby incorporated by reference. It is understood and agreed by the parties hereto that all Work shall be performed as required in the Contract Documents and shall be subject to inspection and approval of DFCM or its authorized representative. The relationship of the Contractor to the DFCM hereunder is that of an independent Contractor.

ARTICLE 2. CONTRACT SUM. The DFCM agrees to pay and the Contractor agrees to accept in full performance of this Contractor's Agreement, the sum of _____ DOLLARS AND NO CENTS (\$_____.00), which is the base bid, and which sum also includes the cost of a 100% Performance Bond and a 100%

CONTRACTOR'S AGREEMENT
PAGE NO. 2

Payment Bond as well as all insurance requirements of the Contractor. Said bonds have already been posted by the Contractor pursuant to State law. The required proof of insurance certificates have been delivered to DFCM in accordance with the General Conditions before the execution of this Contractor's Agreement.

ARTICLE 3. TIME OF COMPLETION AND DELAY REMEDY. The Work shall be Substantially Complete by _____. Contractor agrees to pay liquidated damages in the amount of \$_____ per day for each day after expiration of the Contract Time until the Contractor achieves Substantial Completion in accordance with the Contract Documents, if Contractor's delay makes the damages applicable. The provision for liquidated damages is: (a) to compensate the DFCM for delay only; (b) is provided for herein because actual damages can not be readily ascertained at the time of execution of this Contractor's Agreement; (c) is not a penalty; and (d) shall not prevent the DFCM from maintaining Claims for other non-delay damages, such as costs to complete or remedy defective Work.

No action shall be maintained by the Contractor, including its or Subcontractor or suppliers at any tier, against the DFCM or State of Utah for damages or other claims due to losses attributable to hindrances or delays from any cause whatsoever, including acts and omissions of the DFCM or its officers, employees or agents, except as expressly provided in the General Conditions. The Contractor may receive a written extension of time, signed by the DFCM, in which to complete the Work under this Contractor's Agreement in accordance with the General Conditions.

ARTICLE 4. CONTRACT DOCUMENTS. The Contract Documents consist of this Contractor's Agreement, the Conditions of the Contract (DFCM General Conditions, Supplementary and other Conditions), the Drawings, Specifications, Addenda and Modifications. The Contract Documents shall also include the bidding documents, including the Invitation to Bid, Instructions to Bidders/ Proposers and the Bid/Proposal, to the extent not in conflict therewith and other documents and oral presentations that are documented as an attachment to the contract.

All such documents are hereby incorporated by reference herein. Any reference in this Contractor's Agreement to certain provisions of the Contract Documents shall in no way be construed as to lessen the importance or applicability of any other provisions of the Contract Documents.

ARTICLE 5. PAYMENT. The DFCM agrees to pay the Contractor from time to time as the Work progresses, but not more than once each month after the date of Notice to Proceed, and only upon Certificate of the A/E for Work performed during the preceding calendar month, ninety-five percent (95%) of the value of the labor performed and ninety-five percent (95%) of the value of materials furnished in place or on the site. The Contractor agrees to furnish to the DFCM invoices for materials purchased and on the site but not installed, for which the Contractor requests payment and agrees to

safeguard and protect such equipment or materials and is responsible for safekeeping thereof and if such be stolen, lost or destroyed, to replace same.

Such evidence of labor performed and materials furnished as the DFCM may reasonably require shall be supplied by the Contractor at the time of request for Certificate of Payment on account. Materials for which payment has been made cannot be removed from the job site without DFCM's written approval. Five percent (5%) of the earned amount shall be retained from each monthly payment. The retainage, including any additional retainage imposed and the release of any retainage, shall be in accordance with UCA 13-8-5 as amended. Contractor shall also comply with the requirements of UCA 13-8-5, including restrictions of retainage regarding subcontractors and the distribution of interest earned on the retention proceeds. The DFCM shall not be responsible for enforcing the Contractor's obligations under State law in fulfilling the retention law requirements with subcontractors at any tier.

ARTICLE 6. INDEBTEDNESS. Before final payment is made, the Contractor must submit evidence satisfactory to the DFCM that all payrolls, materials bills, subcontracts at any tier and outstanding indebtedness in connection with the Work have been properly paid. Final Payment will be made after receipt of said evidence, final acceptance of the Work by the DFCM as well as compliance with the applicable provisions of the General Conditions.

Contractor shall respond immediately to any inquiry in writing by DFCM as to any concern of financial responsibility and DFCM reserves the right to request any waivers, releases or bonds from Contractor in regard to any rights of Subcontractors (including suppliers) at any tier or any third parties prior to any payment by DFCM to Contractor.

ARTICLE 7. ADDITIONAL WORK. It is understood and agreed by the parties hereto that no money will be paid to the Contractor for additional labor or materials furnished unless a new contract in writing or a Modification hereof in accordance with the General Conditions and the Contract Documents for such additional labor or materials has been executed. The DFCM specifically reserves the right to modify or amend this Contractor's Agreement and the total sum due hereunder either by enlarging or restricting the scope of the Work.

ARTICLE 8. INSPECTIONS. The Work shall be inspected for acceptance in accordance with the General Conditions.

ARTICLE 9. DISPUTES. Any dispute, PRE or Claim between the parties shall be subject to the provisions of Article 7 of the General Conditions. DFCM reserves all rights to pursue its rights and remedies as provided in the General Conditions.

ARTICLE 10. TERMINATION, SUSPENSION OR ABANDONMENT. This Contractor's Agreement may be terminated, suspended or abandoned in accordance with the General Conditions.

ARTICLE 11. DFCM'S RIGHT TO WITHHOLD CERTAIN AMOUNT AND MAKE USE THEREOF. The DFCM may withhold from payment to the Contractor such amount as, in DFCM's judgment, may be necessary to pay just claims against the Contractor or Subcontractor at any tier for labor and services rendered and materials furnished in and about the Work. The DFCM may apply such withheld amounts for the payment of such claims in DFCM's discretion. In so doing, the DFCM shall be deemed the agent of Contractor and payment so made by the DFCM shall be considered as payment made under this Contractor's Agreement by the DFCM to the Contractor. DFCM shall not be liable to the Contractor for any such payment made in good faith. Such withholdings and payments may be made without prior approval of the Contractor and may be also be prior to any determination as a result of any dispute, PRE, Claim or litigation.

ARTICLE 12. INDEMNIFICATION. The Contractor shall comply with the indemnification provisions of the General Conditions.

ARTICLE 13. SUCCESSORS AND ASSIGNMENT OF CONTRACT. The DFCM and Contractor, respectively bind themselves, their partners, successors, assigns and legal representatives to the other party to this Agreement, and to partners, successors, assigns and legal representatives of such other party with respect to all covenants, provisions, rights and responsibilities of this Contractor's Agreement. The Contractor shall not assign this Contractor's Agreement without the prior written consent of the DFCM, nor shall the Contractor assign any moneys due or to become due as well as any rights under this Contractor's Agreement, without prior written consent of the DFCM.

ARTICLE 14. RELATIONSHIP OF THE PARTIES. The Contractor accepts the relationship of trust and confidence established by this Contractor's Agreement and covenants with the DFCM to cooperate with the DFCM and A/E and use the Contractor's best skill, efforts and judgment in furthering the interest of the DFCM; to furnish efficient business administration and supervision; to make best efforts to furnish at all times an adequate supply of workers and materials; and to perform the Work in the best and most expeditious and economic manner consistent with the interests of the DFCM.

ARTICLE 15. AUTHORITY TO EXECUTE AND PERFORM AGREEMENT. Contractor and DFCM each represent that the execution of this Contractor's Agreement and the performance thereunder is within their respective duly authorized powers.

ARTICLE 16. ATTORNEY FEES AND COSTS. Except as otherwise provided in the dispute resolution provisions of the General Conditions, the prevailing party shall be entitled to reasonable attorney fees and costs incurred in any action in the District Court and/or appellate body to enforce this Contractor's Agreement or recover damages or any other action as a result of a breach thereof.

PERFORMANCE BOND

(Title 63, Chapter 56, U. C. A. 1953, as Amended)

That _____ hereinafter referred to as the "Principal" and _____, a corporation organized and existing under the laws of the State of _____, with its principal office in the City of _____ and authorized to transact business in this State and U. S. Department of the Treasury Listed (Circular 570, Companies Holding Certificates of Authority as Acceptable Securities on Federal Bonds and as Acceptable Reinsuring Companies); hereinafter referred to as the "Surety," are held and firmly bound unto the State of Utah, hereinafter referred to as the "Obligee," in the amount of _____ DOLLARS (\$) _____ for the payment whereof, the said Principal and Surety bind themselves and their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered into a certain written Contract with the Obligee, dated the _____ day of _____, 20____, to construct _____ in the County of _____, State of Utah, Project No. _____, for the approximate sum of _____ Dollars (\$ _____), which Contract is hereby incorporated by reference herein.

NOW, THEREFORE, the condition of this obligation is such that if the said Principal shall faithfully perform the Contract in accordance with the Contract Documents including, but not limited to, the Plans, Specifications and conditions thereof, the one year performance warranty, and the terms of the Contract as said Contract may be subject to Modifications or changes, then this obligation shall be void; otherwise it shall remain in full force and effect.

No right of action shall accrue on this bond to or for the use of any person or corporation other than the state named herein or the heirs, executors, administrators or successors of the Owner.

The parties agree that the dispute provisions provided in the Contract Documents apply and shall constitute the sole dispute procedures of the parties.

PROVIDED, HOWEVER, that this Bond is executed pursuant to the Provisions of Title 63, Chapter 56, Utah Code Annotated, 1953, as amended, and all liabilities on this Bond shall be determined in accordance with said provisions to the same extent as if it were copied at length herein.

IN WITNESS WHEREOF, the said Principal and Surety have signed and sealed this instrument this _____ day of _____, 20____.

WITNESS OR ATTESTATION:

PRINCIPAL:

By: _____ (Seal)

Title: _____

WITNESS OR ATTESTATION:

SURETY:

By: _____ (Seal)

Attorney-in-Fact

STATE OF _____)
) ss.
COUNTY OF _____)

On this _____ day of _____, 20____, personally appeared before me _____, whose identity is personally known to me or proved to me on the basis of satisfactory evidence, and who, being by me duly sworn, did say that he/she is the Attorney in-fact of the above-named Surety Company and that he/she is duly authorized to execute the same and has complied in all respects with the laws of Utah in reference to becoming sole surety upon bonds, undertakings and obligations, and that he/she acknowledged to me that as Attorney-in-fact executed the same.

Subscribed and sworn to before me this _____ day of _____, 20____.

My commission expires: _____

Resides at: _____

NOTARY PUBLIC

Agency: _____
Agent: _____
Address: _____
Phone: _____

Approved As To Form: May 25, 2005
By Alan S. Bachman, Asst Attorney General

PAYMENT BOND

(Title 63, Chapter 56, U. C. A. 1953, as Amended)

KNOW ALL PERSONS BY THESE PRESENTS:

That _____ hereinafter referred to as the "Principal," and _____, a corporation organized and existing under the laws of the State of _____ authorized to do business in this State and U. S. Department of the Treasury Listed (Circular 570, Companies Holding Certificates of Authority as Acceptable Securities on Federal Bonds and as Acceptable Reinsuring Companies); with its principal office in the City of _____, hereinafter referred to as the "Surety," are held and firmly bound unto the State of Utah hereinafter referred to as the "Obligee," in the amount of _____ Dollars (\$ _____) for the payment whereof, the said Principal and Surety bind themselves and their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered into a certain written Contract with the Obligee, dated the _____ day of _____, 20____, to construct _____ in the County of _____, State of Utah, Project No. _____ for the approximate sum of _____ Dollars (\$ _____), which contract is hereby incorporated by reference herein.

NOW, THEREFORE, the condition of this obligation is such that if the said Principal shall pay all claimants supplying labor or materials to Principal or Principal's Subcontractors in compliance with the provisions of Title 63, Chapter 56, of Utah Code Annotated, 1953, as amended, and in the prosecution of the Work provided for in said Contract, then, this obligation shall be void; otherwise it shall remain in full force and effect.

That said Surety to this Bond, for value received, hereby stipulates and agrees that no changes, extensions of time, alterations or additions to the terms of the Contract or to the Work to be performed thereunder, or the specifications or drawings accompanying same shall in any way affect its obligation on this Bond, and does hereby waive notice of any such changes, extensions of time, alterations or additions to the terms of the Contract or to the Work or to the specifications or drawings and agrees that they shall become part of the Contract Documents.

PROVIDED, HOWEVER, that this Bond is executed pursuant to the provisions of Title 63, Chapter 56, Utah Code Annotated, 1953, as amended, and all liabilities on this Bond shall be determined in accordance with said provisions to the same extent as if it were copied at length herein.

IN WITNESS WHEREOF, the said Principal and Surety have signed and sealed this instrument this _____ day of _____, 20____.

WITNESS OR ATTESTATION:

PRINCIPAL:

By: _____ (Seal)

Title: _____

WITNESS OR ATTESTATION:

SURETY:

By: _____ Attorney-in-Fact (Seal)

STATE OF _____)
) ss.
COUNTY OF _____)

On this _____ day of _____, 20____, personally appeared before me _____, whose identity is personally known to me or proved to me on the basis of satisfactory evidence, and who, being by me duly sworn, did say that he/she is the Attorney-in-fact of the above-named Surety Company, and that he/she is duly authorized to execute the same and has complied in all respects with the laws of Utah in reference to becoming sole surety upon bonds, undertakings and obligations, and that he/she acknowledged to me that as Attorney-in-fact executed the same.

Subscribed and sworn to before me this _____ day of _____, 20____.

My commission expires: _____

Resides at: _____

NOTARY PUBLIC

Agency: _____
Agent: _____
Address: _____
Phone: _____

Approved As To Form: May 25, 2005
By Alan S. Bachman, Asst Attorney General



CERTIFICATE OF SUBSTANTIAL COMPLETION

PROJECT _____ PROJECT NO: _____

AGENCY/INSTITUTION _____

AREA ACCEPTED _____

The Work performed under the subject Contract has been reviewed on this date and found to be Substantially Completed as defined in the General Conditions; including that the construction is sufficiently completed in accordance with the Contract Documents, as modified by any change orders agreed to by the parties, so that the State of Utah can occupy the Project or specified area of the Project for the use for which it is intended.

The DFCM - (Owner) accepts the Project or specified area of the Project as Substantially Complete and will assume full possession of the Project or specified area of the Project at _____ (time) on _____ (date).

The DFCM accepts the Project for occupancy and agrees to assume full responsibility for maintenance and operation, including utilities and insurance, of the Project subject to the itemized responsibilities and/or exceptions noted below:

The Owner acknowledges receipt of the following closeout and transition materials:

- As-built Drawings
- O & M Manuals
- Warranty Documents
- Completion of Training Requirements

A list of items to be completed or corrected (Punch List) is attached hereto. The failure to include an item on it does not alter the responsibility of the Contractor to complete all the Work in accordance with the Contract Documents, including authorized changes thereof. The amount of _____(Twice the value of the punch list work) shall be retained to assure the completion of the punch list work.

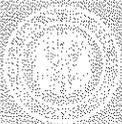
The Contractor shall complete or correct the Work on the list of (Punch List) items appended hereto within _____ calendar days from the above date of issuance of this Certificate. The amount withheld pending completion of the list of items noted and agreed to shall be: \$_____. If the list of items is not completed within the time allotted the Owner has the right to be compensated for the delays and/or complete the work with the help of independent contractor at the expense of the retained project funds. If the retained project funds are insufficient to cover the delay/completion damages, the Owner shall be promptly reimbursed for the balance of the funds needed to compensate the Owner.

_____ by: _____
CONTRACTOR (include name of firm) (Signature) DATE

_____ by: _____
A/E (include name of firm) (Signature) DATE

_____ by: _____
USING INSTITUTION OR AGENCY (Signature) DATE

_____ by: _____
DFCM (Owner) (Signature) DATE

**General Contractor Performance Rating Form**

Project Name:		DFCM Project#	
Contractor: (ABC Construction, John Doe, 111-111-1111)	A/E: (ABC Architects, Jane Doe, 222-222-2222)	Original Contract Amount:	Final Contract Amount:
DFCM Project Manager:		Contract Date:	
Completion Date:		Date of Rating:	

Rating Guideline	QUALITY OF PRODUCT OR SERVICES	COST CONTROL	TIMELINESS OF PERFORMANCE	BUSINESS RELATIONS
5-Exceptional	Contractor has demonstrated an exceptional performance level in any of the above four categories that justifies adding a point to the score. Contractor performance clearly exceeds the performance levels described as "Very Good"			
4-Very Good	Contractor is in compliance with contract requirements and/or delivers quality product/service.	Contractor is effective in managing costs and submits current, accurate, and complete billings	Contractor is effective in meeting milestones and delivery schedule	Response to inquiries, technical/service/administrative issues is effective
3-Satisfactory	Minor inefficiencies/errors have been identified	Contractor is usually effective in managing cost	Contractor is usually effective in meeting milestones and delivery schedules	Response to inquires technical/service/administrative issues is somewhat effective
2-Marginal	Major problems have been encountered	Contractor is having major difficulty managing cost effectively	Contractor is having major difficulty meeting milestones and delivery schedule	Response to inquiries, technical/service/administrative issues is marginally effective
1-Unsatisfactory	Contractor is not in compliance and is jeopardizing achievement of contract objectives	Contractor is unable to manage costs effectively	Contractor delays are jeopardizing performance of contract objectives	Response to inquiries, technical/service/administrative issues is not effective

1. Rate Contractors quality of workmanship, management of sub contractor performance, project cleanliness, organization and safety requirement.	Score
<u>Agency Comments:</u>	
<u>A & E Comments:</u>	
<u>DFCM Project Manager Comments:</u>	

2. Rate Contractor administration of project costs, change orders and financial management of the project budget.	Score
<u>Agency Comments:</u>	
<u>A & E Comments:</u>	
<u>DFCM Project Manager Comments:</u>	

3. Rate Contractor's performance and adherence to Project Schedule, delay procedures and requirements of substantial completion, inspection and punch-list performance.	Score
<u>Agency Comments:</u>	
<u>A & E Comments:</u>	
<u>DFCM Project Manager Comments:</u>	

4. Evaluate performance of contractor management team including project manager, engineer and superintendent also include in the rating team's ability to work well with owner, user agency and consultants.	Score
<u>Agency Comments:</u>	
<u>A & E Comments:</u>	
<u>DFCM Project Manager Comments:</u>	

5. Rate success of Contractor's management plan, completion of the plans mitigation of project risks and performance of value engineering concepts.	Score
<u>Agency Comments:</u>	
<u>A & E Comments:</u>	
<u>DFCM Project Manager Comments:</u>	

Signed by:	Date:	Mean Score
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Additional Comments:



TECHNICAL FIRE PROTECTION SPECIFICATIONS & HYDRAULIC CALCULATIONS

Taylorsville Deaf Center
Fire Sprinkler System Retrofit
Taylorsville, UT
DFCM # 09215230

TECHNICAL FIRE PROTECTION SPECIFICATIONS

1. 017300 - Execution
2. 024119 – Selective Structure Demolition
3. 078413 – Penetration Firestopping
4. 099123 – Interior Painting
5. 210500 – Common Work Results for Fire Suppression
6. 210518 – Escutcheons for Fire Suppression Piping
7. 210548 – Vibration and Seismic Controls for Fire Suppression Piping
8. 211100 – Facility Fire Suppression Water Service Piping
9. 211313 – Wet-Pipe Sprinkler Systems
10. 312000 – Earth Moving

FIRE SPRINKLER HYDRAULIC CALCULATIONS

11. Remote Area #1 – Multipurpose Room
12. Remote Area #2 – Mechanical Penthouse
13. Remote Area #3 – Platform
14. Remote Area #4 – Conference Room
15. Remote Area #5 – Lecture Hall
16. Remote Area #6 – SE Classroom
17. Remote Area #7 – Mechanical Room (Addition)

SECTION 017300 - EXECUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
2. Field engineering and surveying.
3. Installation of the Work.
4. Cutting and patching.
5. Coordination of Owner-installed products.
6. Progress cleaning.
7. Starting and adjusting.
8. Protection of installed construction.
9. Correction of the Work.

- B. Related Sections:

1. Division 02 Section "Selective Structure Demolition" for demolition and removal of selected portions of the building.
2. Division 07 Section "Penetration Firestopping" for patching penetrations in fire-rated construction.

1.3 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.
- B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.4 INFORMATIONAL SUBMITTALS

- A. Cutting and Patching Plan: Submit plan describing procedures at least 5 days prior to the time cutting and patching will be performed. Include the following information:
1. Extent: Describe reason for and extent of each occurrence of cutting and patching.

2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
3. Products: List products to be used for patching and firms or entities that will perform patching work.
4. Dates: Indicate when cutting and patching will be performed.
5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate how long services and systems will be disrupted.

1.5 QUALITY ASSURANCE

- A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
 1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from the Architect before proceeding. Shore, brace, and support structural element during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection
 2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
 3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
 4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
- B. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

1.6 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
 - 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to the Architect for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities and other construction affecting the Work.
 - 1. Before construction, verify the location at points of connection of water-service piping;
 - 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
 - 1. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
 - a. Description of the Work.
 - b. List of detrimental conditions, including substrates.
 - c. List of unacceptable installation tolerances.
 - d. Recommended corrections.
 - 2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
 - 3. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
 - 4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
 - 5. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

- C. Contractor shall be responsible to attend a mandatory pre-bid walk through of the building. If required, an additional pre-bid inspection can be arranged. The contractor shall be responsible to examine all areas and conditions under which fire sprinkler system is to be installed and identify conditions detrimental to proper completion of the work. All unsatisfactory conditions shall be specifically identified in the bid.
- D. Contractor is responsible for making his own job check and any necessary adjustments in the design prior to installation. Make final coordination with existing building elements and adjust design as necessary. Major conflicts shall be brought to the attention of the Project Engineer for resolution

3.2 PREPARATION

- A. Existing Utility Information: Furnish information to local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of the Contractor, submit a request for information to Architect according to requirements in Division 01 Section "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.
- B. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.

3.4 PHASING OF WORK

- A. Building will continue normal operations during installation of the fire sprinkler system. It will be the responsibility of the Contractor to schedule work at least 7 days in advance and submit schedule to Building Coordinator for review and approval.

- B. Work shall be completed in phases with all significant operations completed in one phase before proceeding to the next phase. See drawings for graphical indication of phase boundaries.
- C. Work shall be performed between the hours of 7:00 AM and 10:00 PM. Weekend, holiday and afterhours work will be allowed but is subject to availability of building security and will require prior approval from the building coordinator.
- D. Operations involving the creation of dust, debris or distracting noise shall be scheduled in advance with the building coordinator and shall be performed early in the morning or near the end of the work day
- E. An outdoor equipment staging area will be provided on the east side of the building. Coordinate location with building coordinator. Contractor is responsible for the security of all materials and equipment placed in the staging area. No interior equipment staging area will be provided. Prior to the end of each work shift, the Contractor shall remove all tools, equipment and materials awaiting installation from the building and place in outdoor staging area.
- F. Time is of the essence. All work included in this contract (including inspections and acceptance testing) shall be substantially complete within 90 days or receipt of written notice to proceed.

3.5 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
 - 1. Make vertical work plumb and make horizontal work level.
 - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 - 3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
 - 4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- F. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- G. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with

other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
 2. Allow for building movement, including thermal expansion and contraction.
 3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- H. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- I. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.
- J. Contractor shall provide temporary barriers (cones, tape, barricades, etc.) to visual mark the extent of the work area and to prevent the entry of unauthorized personnel into the work area. All tools, materials, devices and equipment used in the execution of the contract shall be kept inaccessible to building occupants.
- K. Contractor may erect scaffolding or employ motorized lifts for the installation of piping in the Multipurpose room. Prior to erecting scaffolding or placing lifts on floor, however, Contractor shall adequately protect the floor by installing temporary plywood covering on the floor. Placing the wheels of any motorized lift directly on the floor surface is strictly prohibited.

3.6 CUTTING AND PATCHING

- A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Temporary Support: Provide temporary support of work to be cut.
- C. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- D. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching in accordance with requirements of Division 01 Section "Summary."
- E. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.

- F. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 4. Excavating and Backfilling: Comply with requirements in applicable Division 31 Sections where required by cutting and patching operations.
 5. Proceed with patching after construction operations requiring cutting are complete.
- G. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.
1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
 - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
 - b. Restore damaged pipe covering to its original condition.
 3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
 4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
- H. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.7 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
 - 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 - 2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
 - 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
 - a. Utilize containers intended for holding waste materials of type to be stored.
 - 4. Coordinate progress cleaning for joint-use areas where more than one installer has worked.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
 - 1. Remove liquid spills promptly.
 - 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways.
- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.8 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

3.9 CORRECTION OF THE WORK

- A. Repair or remove and replace defective construction. Restore damaged substrates and finishes.
 - 1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.
- B. Restore permanent facilities used during construction to their specified condition.
- C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.
- D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.
- E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 017300

SECTION 024119 - SELECTIVE STRUCTURE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 21 and 28 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Demolition and removal of selected portions of existing fire suppression systems.
 - 2. Salvage of existing items to be reused or recycled.

1.3 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner.
- C. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.
- D. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.

1.5 INFORMATIONAL SUBMITTALS

- A. Proposed Protection Measures: Submit report, including drawings, that indicates the measures proposed for protecting individuals and property for dust control and for noise control. Indicate proposed locations and construction of barriers.
- B. Schedule of Selective Demolition Activities: Indicate the following:
 - 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.

2. Interruption of utility services. Indicate how long utility services will be interrupted.
 3. Coordination for shutoff, capping, and continuation of utility services.
 4. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
- C. Inventory: Submit a list of items to be removed and salvaged and deliver to Owner prior to start of demolition.
- D. Predemolition Photographs or Video: Submit before Work begins.

1.6 FIELD CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- C. Notify Engineer of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
1. Hazardous materials will be removed by Owner before start of the Work.
 2. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
- E. Storage or sale of removed items or materials on-site is not permitted.
- F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
1. Maintain fire-protection facilities in service during selective demolition operations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Review record documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in record documents.
- B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- C. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Engineer.
- D. Survey of Existing Conditions: Record existing conditions by use of measured drawings and/or preconstruction photographs.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
 - 1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
 - 2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 - 3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated to be removed.
 - a. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - b. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - c. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

3.3 PREPARATION

- A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
3. Cover and protect furniture, furnishings, and equipment that have not been removed.

3.4 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.
- B. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, then remove concrete between saw cuts.
- C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.

3.5 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
 1. Do not allow demolished materials to accumulate on-site.
 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
- B. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.6 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 024119

SECTION 078413 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Penetrations in fire-resistance-rated walls.
 - 2. Penetrations in smoke barriers.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Qualification Data: For qualified Installer.
- C. Installer Certificates: From Installer indicating penetration firestopping has been installed in compliance with requirements and manufacturer's written recommendations.
- D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for penetration firestopping.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."
- B. Installer Qualifications: A firm experienced in installing penetration firestopping similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its penetration firestopping products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.
- C. Fire-Test-Response Characteristics: Penetration firestopping shall comply with the following requirements:
 - 1. Penetration firestopping tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.

2. Penetration firestopping is identical to those tested per testing standard referenced in "Penetration Firestopping" Article. Provide rated systems complying with the following requirements:
 - a. Penetration firestopping products bear classification marking of qualified testing and inspecting agency.
 - b. Classification markings on penetration firestopping correspond to designations listed by the following:
 - 1) UL in its "Fire Resistance Directory."
 - 2) FM Global in its "Building Materials Approval Guide."

1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install penetration firestopping when ambient or substrate temperatures are outside limits permitted by penetration firestopping manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.
- B. Install and cure penetration firestopping per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.6 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping is installed according to specified requirements.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping.
- C. Notify Owner's testing agency at least seven days in advance of penetration firestopping installations; confirm dates and times on day preceding each series of installations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. A/D Fire Protection Systems Inc.
 2. Grace Construction Products.
 3. Hilti, Inc.
 4. Johns Manville.
 5. Nelson Firestop Products.
 6. NUCO Inc.
 7. Passive Fire Protection Partners.
 8. RectorSeal Corporation.
 9. Specified Technologies Inc.

10. 3M Fire Protection Products.
11. Tremco, Inc.; Tremco Fire Protection Systems Group.
12. USG Corporation.

2.2 PENETRATION FIRESTOPPING

- A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
- B. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
 1. Fire-resistance-rated walls include fire walls, fire-barrier walls, smoke-barrier walls and fire partitions.
 2. F-Rating: Not less than the fire-resistance rating of constructions penetrated.
- C. Penetrations in Smoke Barriers: Provide penetration firestopping with ratings determined per UL 1479.
 1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at 0.30-inch wg at both ambient and elevated temperatures.
- D. W-Rating: Provide penetration firestopping showing no evidence of water leakage when tested according to UL 1479.
- E. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- F. VOC Content: Provide penetration firestopping that complies with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 1. Architectural Sealants: 250 g/L.
 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 3. Sealant Primers for Porous Substrates: 775 g/L.
- G. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.
 1. Permanent forming/damming/backing materials, including the following:
 - a. Slag-wool-fiber or rock-wool-fiber insulation.
 - b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
 - c. Fire-rated form board.

- d. Fillers for sealants.
2. Temporary forming materials.
3. Substrate primers.
4. Collars.
5. Steel sleeves.

2.3 FILL MATERIALS

- A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.
- B. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.
- C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
- D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized-steel sheet.
- E. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.
- F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.
- G. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.
- H. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.
- I. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
- J. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:
 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and sloped surfaces, unless indicated firestopping limits use of nonsag grade for both opening conditions.

2.4 MIXING

- A. For those products requiring mixing before application, comply with penetration firestopping manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Clean out openings immediately before installing penetration firestopping to comply with manufacturer's written instructions and with the following requirements:
 - 1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping.
 - 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form-release agents from concrete.
- B. Priming: Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Masking Tape: Use masking tape to prevent penetration firestopping from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing firestopping's seal with substrates.

3.3 INSTALLATION

- A. General: Install penetration firestopping to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestopping.

C. Install fill materials for firestopping by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Identify penetration firestopping with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of firestopping edge so labels will be visible to anyone seeking to remove penetrating items or firestopping. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Designation of applicable testing and inspecting agency.
4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

3.5 FIELD QUALITY CONTROL

- A. Owner will engage a qualified testing agency to perform tests and inspections.
- B. Where deficiencies are found or penetration firestopping is damaged or removed because of testing, repair or replace penetration firestopping to comply with requirements.
- C. Proceed with enclosing penetration firestopping with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

- A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping is without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove

damaged or deteriorated penetration firestopping and install new materials to produce systems complying with specified requirements.

3.7 PENETRATION FIRESTOPPING SCHEDULE

- A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHEZ.
- B. Where FM Global-approved systems are indicated, they refer to design numbers listed in FM Global's "Building Materials Approval Guide" under "Wall and Floor Penetration Fire Stops."
- C. Firestopping for Metallic Pipes, Conduit, or Tubing:
 - 1. UL-Classified Systems:.
 - 2. FM Global-Approved Systems.
 - 3. F-Rating: 1 hour or 2 hours .
 - 4. T-Rating: 1 hour or 2 hours
 - 5. W-Rating: No leakage of water at completion of water leakage testing.
 - 6. Type of Fill Materials: As required to achieve rating.

END OF SECTION 078413

SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes surface preparation and the application of paint systems on interior substrates.

1.3 DEFINITIONS

- A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- D. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- E. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- F. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- G. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
- B. Samples for Initial Selection: For each type of topcoat product.
- C. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.
 - 1. Submit Samples on rigid backing, 8 inches square.
 - 2. Step coats on Samples to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.

- D. Product List: For each product indicated, include the following:
1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
 2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.
 3. VOC content.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F
1. Maintain containers in clean condition, free of foreign materials and residue.
 2. Remove rags and waste from storage areas daily.

1.6 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Behr Process Corporation.
 2. Benjamin Moore & Co.
 3. Benjamin Moore & Co. (Canada).
 4. Bennette Paint Manufacturing Company, Inc.
 5. Betonel Ltd.
 6. BLP Mobile Paint Manufacturing.
 7. California Paints.
 8. Cloverdale Paint.
 9. Color Wheel Paints & Coatings.
 10. Columbia Paint & Coatings.
 11. Conco Paints.
 12. Coronado Paint.
 13. Davis Paint Company.
 14. Diamond Vogel Paints.
 15. Dunn-Edwards Corporation.
 16. Durant Performance Coatings.

17. Duron, Inc.
18. Envirocoatings Canada Inc.
19. Euclid Chemical Company.
20. Farrell-Calhoun.
21. Frazee Paint.
22. General Paint.
23. Hallman Lindsay Paints.
24. Hirshfield's, Inc.
25. ICI Paints.
26. ICI Paints (Canada).
27. Insl-x.
28. Kelly-Moore Paints.
29. Kwal Paint.
30. M.A.B. Paints.
31. McCormick Paints.
32. Microblend Technologies Inc.
33. Miller Paint.
34. Mills Paint.
35. PARA Paints.
36. Parex LaHabra Inc.
37. Parker Paint Mfg. Co. Inc.
38. PPG Architectural Finishes, Inc.
39. Pratt & Lambert.
40. Rodda Paint Co.
41. Scott Paint.
42. Sherwin-Williams Company (The).
43. Sico, Inc.
44. Southern Diversified Products, LLC.
45. Smith Paint Products.
46. Vista Paint.
47. Zinsser.

2.2 PAINT, GENERAL

- A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."
- B. Material Compatibility:
 1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- C. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction
- D. Colors: Match existing surfaces to be patched.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Concrete: 12 percent.
 - 2. Masonry (Clay and CMU): 12 percent.
 - 3. Wood: 15 percent.
 - 4. Gypsum Board: 12 percent.
 - 5. Plaster: 12 percent.
- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- D. Plaster Substrates: Verify that plaster is fully cured.
- E. Spray-Textured Ceiling Substrates: Verify that surfaces are dry.
- F. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- G. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

- E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceed that permitted in manufacturer's written instructions.
- F. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- G. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- H. Aluminum Substrates: Remove loose surface oxidation.
- I. Wood Substrates:
 - 1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
 - 2. Sand surfaces that will be exposed to view, and dust off.
 - 3. Prime edges, ends, faces, undersides, and backsides of wood.
 - 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.
- J. Cotton or Canvas Insulation Covering Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 - 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- D. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Paint the following work where exposed in equipment rooms:
 - a. Uninsulated metal piping.
2. Paint the following work where exposed in occupied spaces:
 - a. Uninsulated metal piping.
 - b. Pipe hangers and supports.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 1. Contractor shall touch up and restore painted surfaces damaged by testing.
 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

END OF SECTION 099123

SECTION 210500 - COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 02 and 21 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Piping materials and installation instructions common to most piping systems.
 - 2. Escutcheons.
 - 3. Fire-suppression equipment and piping demolition.
 - 4. Equipment installation requirements common to equipment sections.
 - 5. Painting and finishing.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.4 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

- C. Electrical Characteristics for Fire-Suppression Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.6 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for fire-suppression installations.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Coordinate requirements for access panels and doors for fire-suppression items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 21 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

- A. Refer to individual Division 21 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
 - 2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.4 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Type: With set screw.
 - 1. Finish: Polished chrome-plated.
- D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
 - 1. Finish: Polished chrome-plated.
- E. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.
- F. Split-Plate, Stamped-Steel Type: With exposed-rivet hinge, set screw or spring clips, and chrome-plated finish.
- G. One-Piece, Floor-Plate Type: Cast-iron floor plate.
- H. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

PART 3 - EXECUTION

3.1 FIRE-SUPPRESSION DEMOLITION

- A. Refer to Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.
- B. Disconnect, demolish, and remove fire-suppression systems, equipment, and components indicated to be removed.
 - 1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - 2. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - 3. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - 4. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 21 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.

- J. Select system components with pressure rating equal to or greater than system operating pressure.
- K. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
 - 1. New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
 - c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
 - d. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated finish.
 - e. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
 - 2. Existing Piping: Use the following:
 - a. Chrome-Plated Piping: Split-casting, cast-brass type with chrome-plated finish.
 - b. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
 - c. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
 - d. Bare Piping in Unfinished Service Spaces: Split-casting, cast-brass type with polished chrome-plated finish.
 - e. Bare Piping in Equipment Rooms: Split-casting, cast-brass type.
- L. Sleeves are not required for core-drilled holes.
- M. Permanent sleeves are not required for holes formed by removable PE sleeves.
- N. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
- O. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials.
- P. Verify final equipment locations for roughing-in.
- Q. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.3 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 21 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

- D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- E. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.4 PAINTING

- A. Paint all piping, fittings and couplings to match color of surrounding structure.
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

END OF SECTION 210500

SECTION 210518 - ESCUTCHEONS FOR FIRE-SUPPRESSION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 02, 21 and 28 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Escutcheons.
 - 2. Floor plates.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

- A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.
- C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.
- D. Split-Casting Brass Type: With polished, chrome-plated finish and with concealed hinge and setscrew.
- E. Split-Plate, Stamped-Steel Type: With chrome-plated finish, concealed or exposed-rivet hinge, and spring-clip fasteners.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
 - 1. Escutcheons for New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - b. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
 - c. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
 - d. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
 - e. Bare Piping in Equipment Rooms: One-piece, cast-brass type with polished, chrome-plated finish.
 - 2. Escutcheons for Existing Piping:
 - a. Chrome-Plated Piping: Split-casting brass type with polished, chrome-plated finish.
 - b. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
 - c. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
 - d. Bare Piping in Unfinished Service Spaces: Split-casting brass type with polished, chrome-plated finish.
 - e. Bare Piping in Equipment Rooms: Split-casting brass type with polished, chrome-plated finish.

3.2 FIELD QUALITY CONTROL

- A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 210518

SECTION 210548 - VIBRATION AND SEISMIC CONTROLS FOR FIRE-SUPPRESSION PIPING
AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 02, 21 and 28 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Restraining braces.

1.3 DEFINITIONS

- A. IBC: International Building Code.
- B. ICC-ES: ICC-Evaluation Service.

1.4 PERFORMANCE REQUIREMENTS

- A. Seismic-Restraint Loading:
 - 1. Site Class as Defined in the IBC: A.
 - 2. Assigned Seismic Use Group or Building Category as Defined in the IBC: I.
 - a. Component Importance Factor: 1.5

1.5 SUBMITTALS

- A. Product Data: For the following:
 - 1. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.
 - a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an agency acceptable to authorities having jurisdiction.
 - b. Annotate to indicate application of each product submitted and compliance with requirements.
- B. Delegated-Design Submittal: For vibration isolation and seismic-restraint details indicated to comply with performance requirements and design criteria, including analysis data signed and

sealed by the qualified professional engineer or engineering technician responsible for their preparation.

1. Seismic-Restraint Details:

- a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
- b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
- B. Comply with seismic-restraint requirements in the IBC and NFPA 13 unless requirements in this Section are more stringent.
- C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

2.1 SEISMIC-RESTRAINT DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Amber/Booth Company, Inc.
 2. California Dynamics Corporation.
 3. Cooper B-Line, Inc.; a division of Cooper Industries.
 4. Hilti, Inc.
 5. Kinetics Noise Control.
 6. Loos & Co.; Cableware Division.
 7. Mason Industries.
 8. TOLCO Incorporated; a brand of NIBCO INC.
 9. Unistrut; Tyco International, Ltd.

- B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.
- C. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.
- D. Hanger Rod Stiffener: **Steel tube or steel slotted-support-system sleeve with internally bolted connections** to hanger rod.
- E. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.
- F. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings and matched to type and size of attachment devices used.
- G. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.
- H. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.
- I. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and equipment to receive seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

- A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.

- B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
- C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.3 SEISMIC-RESTRAINT DEVICE INSTALLATION

- A. Equipment Restraints:
 - 1. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
 - 2. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.
- B. Piping Restraints:
 - 1. Comply with requirements in MSS SP-127 and NFPA 13.
 - 2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
 - 3. Brace a change of direction longer than 12 feet.
- C. Install cables so they do not bend across edges of adjacent equipment or building structure.
- D. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.
- E. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
- F. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- G. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
- H. Drilled-in Anchors:
 - 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
 - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 - 3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.

4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in NFPA 13 for piping flexible connections.

END OF SECTION 210548

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes fire-suppression water-service piping and related components outside the building and service entrance piping through wall into the building.
- B. Related Sections:
 - 1. Division 21 Section "Wet-Pipe Sprinkler Systems" for wet-pipe fire-suppression sprinkler systems inside the building.

1.3 SUBMITTALS

- C. Product Data: For each type of product indicated.
- D. Shop Drawings:
- E. Field quality-control reports.

1.4 QUALITY ASSURANCE

- F. Regulatory Requirements:
 - 1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.
 - 2. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.
- G. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- H. Comply with the "Approval Guide," published by FM Global, or UL's "Fire Protection Equipment Directory" for fire-service-main products.
- I. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-suppression water-service piping.

1.5 DELIVERY, STORAGE, AND HANDLING

- J. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:
 - 1. Ensure that valves are dry and internally protected against rust and corrosion.

2. Protect valves against damage to threaded ends and flange faces.
 3. Set valves in best position for handling. Set valves closed to prevent rattling.
- K. During Storage: Use precautions for valves, including fire hydrants, according to the following:
1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
 2. Protect from weather. Store indoors and maintain temperature higher than ambient dew point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.
- L. Handling: Use sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.
- M. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.
- N. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.
- O. Protect flanges, fittings, and specialties from moisture and dirt.
- P. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.
- 1.7 COORDINATION
- Q. Coordinate connection to water main with utility company.

PART 2 - PRODUCTS

2.1 DUCTILE-IRON PIPE AND FITTINGS

- A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end.
- B. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end.
- C. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 1. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- D. Push-on-Joint, Ductile-Iron Fittings: AWWA C153, ductile-iron compact pattern.
 1. Gaskets: AWWA C111, rubber.
- E. Flanges: ASME B16.1, Class 125, cast iron.

2.2 PVC PIPE AND FITTINGS

- A. PVC Pipe: AWWA C900 or UL 1285, Class 150, with bell end with gasket, and with spigot end.
- B. PVC Fittings: AWWA C900 or UL 1285, Class 150, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.

2.3 JOINING MATERIALS

- A. Gaskets for Ferrous Piping and Copper-Alloy Tubing: ASME B16.21, asbestos free.
- B. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series.
- C. Bonding Adhesive for Fiberglass Piping: As recommended by fiberglass piping manufacturer.

2.4 PIPING SPECIALTIES

- A. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.
- B. Tubular-Sleeve Pipe Couplings:
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. Cascade Waterworks Manufacturing.
 - b. Dresser, Inc.; Dresser Piping Specialties.
 - c. Ford Meter Box Company, Inc. (The); Pipe Products Division.
 - d. JCM Industries.
 - e. ROMAC Industries Inc.
 - f. Smith-Blair, Inc.; a Sensus company.
 - g. Viking Johnson.
 - 2. Description: Metal, bolted, sleeve-type, reducing or transition coupling, with center sleeve, gaskets, end rings, and bolt fasteners, and with ends of same sizes as piping to be joined.
 - 3. Standard: AWWA C219.
 - 4. Center-Sleeve Material: Manufacturer's standard.
 - 5. Gasket Material: Natural or synthetic rubber.
 - 6. Pressure Rating: 150 psig minimum.
 - 7. Metal Component Finish: Corrosion-resistant coating or material.

2.5 CURB VALVES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

1. Amcast Industrial Corporation.
 2. Ford Meter Box Company, Inc. (The); Pipe Products Division.
 3. Jones, James Company.
 4. Master Meter, Inc.
 5. McDonald, A. Y. Mfg. Co.
 6. Mueller Co.; Water Products Division.
 7. Red Hed Manufacturing & Supply.
- B. Curb Valves: Comply with AWWA C800 for high-pressure service-line valves. Valve has bronze body, ground-key plug or ball, wide tee head, and inlet and outlet matching service piping material.
- C. Service Boxes for Curb Valves: Similar to AWWA M44 requirements for cast-iron valve boxes. Include cast-iron telescoping top section of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over curb valve and with a barrel approximately 3 inches in diameter.
1. Shutoff Rods: Steel; with tee-handle with one pointed end, stem of length to operate deepest buried valve, and slotted end matching curb valve.

2.6 GATE VALVES

A. AWWA Gate Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. American AVK Company; Valves & Fittings Division.
 - b. American Cast Iron Pipe Company; American Flow Control Division.
 - c. American Cast Iron Pipe Company; Waterous Company Subsidiary.
 - d. American R/D.
 - e. Clow Valve Company; a division of McWane, Inc.
 - f. Crane Co.; Crane Valve Group; Stockham Division.
 - g. East Jordan Iron Works, Inc.
 - h. Kennedy Valve; a division of McWane, Inc.
 - i. M&H Valve Company; a division of McWane, Inc.
 - j. Mueller Co.; Water Products Division.
 - k. NIBCO INC.
 - l. Tyler Pipe; a division of McWane, Inc.; Utilities Division.
 - m. U.S. Pipe.
2. 200-psig, AWWA, Iron, Nonrising-Stem, Resilient-Seated Gate Valves:
 - a. Description: Gray- or ductile-iron body and bonnet; with bronze or gray- or ductile-iron gate, resilient seats, bronze stem, and stem nut.
 - b. Standard: AWWA C509.
 - c. Pressure Rating: 200 psig.
 - d. End Connections: Mechanical or push-on joint.
 - e. Interior Coating: Complying with AWWA C550.

B. UL-Listed or FM-Approved Gate Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. American AVK Company; Valve & Fittings Division.
 - b. American Cast Iron Pipe Company; American Flow Control Division.
 - c. American Cast Iron Pipe Company; Waterous Company Subsidiary.
 - d. Clow Valve Company; a division of McWane, Inc.
 - e. Crane Co.; Crane Valve Group; Jenkins Valves.
 - f. Crane Co.; Crane Valve Group; Stockham Division.
 - g. East Jordan Iron Works, Inc.
 - h. Hammond Valve.
 - i. Kennedy Valve; a division of McWane, Inc.
 - j. M&H Valve Company; a division of McWane, Inc.
 - k. Milwaukee Valve Company.
 - l. Mueller Co.; Water Products Division.
 - m. NIBCO INC.
 - n. Shurjoint Piping Products.
 - o. Troy Valve; a division of Penn-Troy Manufacturing, Inc.
 - p. Tyco Fire & Building Products LP.
 - q. United Brass Works, Inc.
 - r. U.S. Pipe.
 - s. Watts Water Technologies, Inc.
2. 175-psig, UL-Listed or FM-Approved, Iron, Nonrising-Stem Gate Valves:
 - a. Description: Iron body and bonnet, bronze seating material, and inside screw.
 - b. Standards: UL 262 and "Approval Guide," published by FM Global, listing.
 - c. Pressure Rating: 175 psig minimum.
 - d. End Connections: Mechanical or push-on joint.
 - e. Indicator-Post Flange: Include on valves used with indicator posts.

2.7 GATE VALVE ACCESSORIES AND SPECIALTIES

A. Tapping-Sleeve Assemblies:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. American Cast Iron Pipe Company; Waterous Company Subsidiary.
 - b. Clow Valve Company; a division of McWane, Inc.
 - c. East Jordan Iron Works, Inc.
 - d. Flowserve.
 - e. Kennedy Valve; a division of McWane, Inc.
 - f. M&H Valve Company; a division of McWane, Inc.
 - g. Mueller Co.; Water Products Division.
 - h. U.S. Pipe.

2. Description: Sleeve and valve compatible with drilling machine.
3. Standard: MSS SP-60.
4. Tapping Sleeve: Cast-iron, ductile-iron, or stainless-steel, two-piece bolted sleeve with flanged outlet for new branch connection. Sleeve shall match size and type of pipe material being tapped and have recessed flange for branch valve.
5. Valve: AWWA, cast-iron, nonrising-stem, resilient-seated gate valve with one raised-face flange mating tapping-sleeve flange.

B. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over valve and with a barrel approximately 5 inches in diameter.

1. Operating Wrenches: Steel; with tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.

2.8 BACKFLOW PREVENTERS

A. Double-Check, Backflow-Prevention Assemblies:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Ames Fire & Waterworks; a division of Watts Water Technologies, Inc.
 - b. Conbraco Industries, Inc.; Apollo Valves.
 - c. FEBCO; SPX Valves & Controls.
 - d. Flomatic Corporation.
 - e. Watts Water Technologies, Inc.
 - f. Zurn Plumbing Products Group; Wilkins Water Control Products Division.
2. Standard: AWWA C510.
3. Operation: Continuous-pressure applications unless otherwise indicated.
4. Pressure Loss: 5 psig maximum, through middle one-third of flow range.
5. Size: 6 NPS.
6. Design Flow Rate: 750 gpm.
7. Body Material: Stainless steel.
8. End Connections: Grooved for NPS 2-1/2 and larger.
9. Configuration: Designed for horizontal, straight through flow.

B. Backflow Preventer Test Kits:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Conbraco Industries, Inc.; Apollo Valves.
 - b. FEBCO; SPX Valves & Controls.
 - c. Flomatic Corporation.
 - d. Watts Water Technologies, Inc.

- e. Zurn Plumbing Products Group; Wilkins Water Control Products Division.
- 2. Description: Factory calibrated, with gages, fittings, hoses, and carrying case with test-procedure instructions.

2.9 FIRE-DEPARTMENT CONNECTIONS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Elkhart Brass Mfg. Company, Inc.
 - 2. Fire-End & Croker Corporation.
 - 3. Guardian Fire Equipment, Inc.
 - 4. Kidde Fire Fighting.
 - 5. Potter Roemer.
 - 6. Reliable Automatic Sprinkler Co., Inc.
- B. Description: Wall mount, with cast-bronze body, thread inlets according to NFPA 1963 and matching local fire-department hose threads, and threaded bottom outlet. Include lugged caps, gaskets, and chains; lugged swivel connection and drop clapper for each hose-connection inlet; 18-inch high brass sleeve; and round escutcheon plate.
- C. Standard: UL 405.
- D. Inlet Alignment: Inline, horizontal.
- E. Finish Including Sleeve: Polished chrome plated.
- F. Escutcheon Plate Marking: "AUTO SPKR."

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Comply with excavating, trenching, and backfilling requirements in Division 31 Section "Earth Moving."

3.2 PIPING INSTALLATION

- A. Water-Main Connection: Arrange with water utility company for tap of size and in location indicated in water main.
- B. Water-Main Connection: Tap water main according to requirements of water utility company and of size and in location indicated.
- C. Make connections larger than NPS 2 with tapping machine according to the following:
 - 1. Install tapping sleeve and tapping valve according to MSS SP-60.

2. Install tapping sleeve on pipe to be tapped. Position flanged outlet for gate valve.
 3. Use tapping machine compatible with valve and tapping sleeve; cut hole in main. Remove tapping machine and connect water-service piping.
 4. Install gate valve onto tapping sleeve. Comply with MSS SP-60. Install valve with stem pointing up and with valve box.
- D. Comply with NFPA 24 for fire-service-main piping materials and installation.
- E. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.
- F. Install PVC, AWWA pipe according to ASTM F 645 and AWWA M23.
- G. Bury piping with depth of cover at least 12 inches below level of maximum frost penetration, and according to the following:
1. Under Driveways: With at least 36 inches of cover over top.
 2. In Loose Gravelly Soil and Rock: With at least 12 inches of additional cover.
- H. Install piping by tunneling or jacking, or combination of both, under streets and other obstructions that cannot be disturbed.
- I. Extend fire-suppression water-service piping and connect to water-supply source and building fire-suppression water-service piping systems at locations and pipe sizes indicated.
1. Terminate fire-suppression water-service piping at building wall until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building's fire-suppression water-service piping systems when those systems are installed.
- J. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.
- K. Comply with requirements in Division 21 Sections for fire-suppression-water piping inside the building.

3.3 JOINT CONSTRUCTION

- A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure rating same as or higher than systems pressure rating for aboveground applications unless otherwise indicated.
- B. Install flanges, flange adaptors, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
- C. Ream ends of tubes and remove burrs.
- D. Remove scale, slag, dirt, and debris from outside and inside of pipes, tubes, and fittings before assembly.
- E. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.

- F. Ductile-Iron Piping, Grooved Joints: Cut-groove pipe. Assemble joints with grooved-end, ductile-iron-piping couplings, gaskets, lubricant, and bolts.
- G. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with bolts according to ASME B31.9.
- H. PVC Piping Gasketed Joints: Use joining materials according to AWWA C900. Construct joints with elastomeric seals and lubricant according to ASTM D 2774 or ASTM D 3139.
- I. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure.
- J. Do not use flanges or unions for underground piping.

3.4 VALVE INSTALLATION

- A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.
- B. AWWA Valves Other Than Gate Valves: Comply with AWWA C600 and AWWA M44.
- C. UL-Listed or FM-Approved Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast-iron indicator post.
- D. UL-Listed or FM-Approved Valves Other Than Gate Valves: Comply with NFPA 24.
- E. MSS Valves: Install as component of connected piping system.
- F. Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box.

3.5 BACKFLOW PREVENTER INSTALLATION

- A. Install backflow preventers of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department and authorities having jurisdiction.
- B. Do not install backflow preventers that have relief drain in vault or in other spaces subject to flooding.
- C. Do not install bypass piping around backflow preventers.

3.6 FIRE-DEPARTMENT CONNECTION INSTALLATION

- A. Install ball drip valves at each check valve for fire-department connection to mains.

3.7 FIELD QUALITY CONTROL

- A. Use test procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described below.
- B. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.
- C. Hydrostatic Tests: Test at not less than one-and-one-half times the working pressure for two hours.
 - 1. Increase pressure in 50-psig increments and inspect each joint between increments. Hold at test pressure for one hour; decrease to 0 psig. Slowly increase again to test pressure and hold for one more hour. Maximum allowable leakage is 2 quarts per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.
- D. Prepare test and inspection reports.

3.8 IDENTIFICATION

- A. Install continuous underground detectable warning tape during backfilling of trench for underground fire-suppression water-service piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Division 31 Section "Earth Moving."
- B. Permanently attach equipment nameplate or marker indicating plastic fire-suppression water-service piping or fire-suppression water-service piping with electrically insulated fittings, on main electrical meter panel. Comply with requirements for identifying devices in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.9 CLEANING

- A. Clean and disinfect fire-suppression water-service piping as follows:
 - 1. Purge new piping systems and parts of existing systems that have been altered, extended, or repaired before use.
 - 2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.
 - 3. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:
 - a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.

- b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for three hours.
- c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
- d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.

B. Prepare reports of purging and disinfecting activities.

3.10 PIPING SCHEDULE

- A. Underground fire-suppression water-service piping NPS 6 to NPS 12 shall be one of the following:
 1. Grooved-end, ductile-iron pipe; grooved-end, ductile-iron pipe appurtenances; and grooved joints.
 2. Mechanical-joint, ductile-iron pipe; mechanical-joint, ductile- or gray-iron, standard-pattern or ductile-iron, compact-pattern fittings; glands, gaskets, and bolts; and gasketed joints.
 3. Push-on-joint, ductile-iron pipe; push-on-joint, ductile-iron compact-pattern fittings; and gasketed joints.
 4. PVC Class 200] pipe listed for fire-protection service; PVC fittings of same class as pipe; and gasketed joints.

3.11 VALVE SCHEDULE

- A. Underground fire-suppression water-service shutoff valves NPS 3 and larger shall be one of the following:
 1. 200-psig, AWWA, iron, nonrising-stem, resilient-seated gate valves.
 2. 250-psig, AWWA, iron, nonrising-stem, resilient-seated gate valves.
 3. 175-psig, UL-listed or FM-approved, iron, nonrising-stem gate valves.

END OF SECTION 211100

SECTION 211313 - WET-PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Pipes, fittings, and specialties.
 - 2. Fire-protection valves.
 - 3. Fire-department connections.
 - 4. Sprinklers.
 - 5. Alarm devices.
 - 6. Pressure gages.

1.3 DEFINITIONS

- A. Standard-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure of 175 psig maximum.

1.4 SYSTEM DESCRIPTIONS

- A. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply through alarm valve. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. Hose connections are included if indicated.

1.5 PERFORMANCE REQUIREMENTS

- A. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.
- B. Delegated Design: Design sprinkler system(s), including comprehensive engineering analysis by a qualified engineering technician (NICET Level III minimum), using performance requirements and design criteria indicated.
 - 1. Available fire-hydrant flow test records indicate the following conditions:
 - a. Data Obtained From: PCI Flow Test.
 - b. Static Pressure: 88 psi.
 - c. Measured Flow: 950 gpm
 - d. Residual Pressure: 82 psi.

- C. Sprinkler system design shall be approved by authorities having jurisdiction.
 - 1. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
 - 2. Sprinkler Occupancy Hazard Classifications:
 - a. Light Hazard or Ordinary Hazard indicated on drawings.
 - 3. Minimum Density for Automatic-Sprinkler Piping Design:
 - a. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft. area.
 - b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft. area.
 - c. Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm over 1500-sq. ft. area.
 - 4. Maximum Protection Area per Sprinkler:
 - a. Light Hazard Areas: 225 sq. ft.
 - b. Ordinary Hazard Areas: 130 sq. ft. .
 - 5. Total Combined Hose-Stream Demand Requirement: According to NFPA 13 unless otherwise indicated:
 - a. Light-Hazard Occupancies: 100 gpm
 - b. Ordinary-Hazard Occupancies: 250 gpm
- D. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13.

1.6 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For wet-pipe sprinkler systems. Include plans, elevations, sections, details, and attachments to other work.
- C. Delegated-Design Submittal: For sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- D. Coordination Drawings: Sprinkler systems, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Domestic water piping.
 - 2. HVAC ducts.
 - 3. HVAC hydronic piping.
 - 4. Items penetrating finished ceiling include the following:
 - a. Lighting fixtures.
 - b. Air outlets and inlets.
- E. Qualification Data: For qualified Installer.

- F. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.
- G. Welding certificates.
- H. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."
- I. Field quality-control reports.
- J. Operation and Maintenance Data: For sprinkler specialties to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.
- B. Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. NFPA Standards: Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:
 - 1. NFPA 13, "Installation of Sprinkler Systems."
 - 2. NFPA 24, "Installation of Private Fire Service Mains and Their Appurtenances."

1.8 COORDINATION

- A. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

1.9 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes.

2.2 STEEL PIPE AND FITTINGS

- A. Standard Weight, Black Steel Pipe: ASTM A 53/A 53M. Pipe ends may be factory or field formed to match joining method.
- B. Schedule 30, Black Steel Pipe: ASTM A 135; ASTM A 795/A 795M, wrought steel; with wall thickness not less than Schedule 30 and not more than Schedule 40. Pipe ends may be factory or field formed to match joining method.
- C. Schedule 10, Black-Steel Pipe: ASTM A 135 or ASTM A 795/A 795M.
- D. Cast-Iron Flanges: ASME 16.1, Class 125.
- E. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.
- F. Steel Welding Fittings: ASTM A 234/A 234M and ASME B16.9.
- G. Grooved-Joint, Steel-Pipe Appurtenances:
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Anvil International, Inc.
 - b. Corcoran Piping System Co.
 - c. National Fittings, Inc.
 - d. Shurjoint Piping Products.
 - e. Tyco Fire & Building Products LP.
 - f. Victaulic Company.
 - 2. Pressure Rating: 175 psig minimum.
 - 3. Galvanized Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.
 - 4. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213, rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

2.3 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free.

1. Class 125, Cast-Iron Flanges and Class 150, Bronze Flat-Face Flanges: Full-face gaskets.
 2. Class 250, Cast-Iron Flanges and Class 300, Steel Raised-Face Flanges: Ring-type gaskets.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.4 LISTED FIRE-PROTECTION VALVES

A. General Requirements:

1. Valves shall be UL listed or FM approved.
2. Minimum Pressure Rating for Standard-Pressure Piping: 175 psig.

B. Ball Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Anvil International, Inc.
 - b. Victaulic Company.
2. Standard: UL 1091 except with ball instead of disc.
3. Valves NPS 1-1/2 and Smaller: Bronze body with threaded ends.
4. Valves NPS 2 and NPS 2-1/2 : Bronze body with threaded ends or ductile-iron body with grooved ends.
5. Valves NPS 3: Ductile-iron body with grooved ends.

C. Bronze Butterfly Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Fivalco Inc.
 - b. Global Safety Products, Inc.
 - c. Milwaukee Valve Company.
2. Standard: UL 1091.
3. Pressure Rating: 175 psig .
4. Body Material: Bronze.
5. End Connections: Threaded.

D. Iron Butterfly Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Anvil International, Inc.
 - b. Fivalco Inc.
 - c. Global Safety Products, Inc.
 - d. Kennedy Valve; a division of McWane, Inc.
 - e. Milwaukee Valve Company.
 - f. NIBCO INC.
 - g. Pratt, Henry Company.
 - h. Shurjoint Piping Products.
 - i. Tyco Fire & Building Products LP.
 - j. Victaulic Company.
2. Standard: UL 1091.
3. Pressure Rating: 175 psig.
4. Body Material: Cast or ductile iron.
5. End Connections: Grooved.

E. Check Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. AFAC Inc.
 - b. American Cast Iron Pipe Company; Waterous Company Subsidiary.
 - c. Anvil International, Inc.
 - d. Clow Valve Company; a division of McWane, Inc.
 - e. Crane Co.; Crane Valve Group; Crane Valves.
 - f. Crane Co.; Crane Valve Group; Jenkins Valves.
 - g. Crane Co.; Crane Valve Group; Stockham Division.
 - h. Fire-End & Croker Corporation.
 - i. Fire Protection Products, Inc.
 - j. Fivalco Inc.
 - k. Globe Fire Sprinkler Corporation.
 - l. Groeniger & Company.
 - m. Kennedy Valve; a division of McWane, Inc.
 - n. Matco-Norca.
 - o. Metraflex, Inc.
 - p. Milwaukee Valve Company.
 - q. Mueller Co.; Water Products Division.
 - r. NIBCO INC.
 - s. Potter Roemer.
 - t. Reliable Automatic Sprinkler Co., Inc.
 - u. Shurjoint Piping Products.
 - v. Tyco Fire & Building Products LP.
 - w. United Brass Works, Inc.
 - x. Venus Fire Protection Ltd.
 - y. Victaulic Company.

- z. Viking Corporation.
 - aa. Watts Water Technologies, Inc.
2. Standard: UL 312.
 3. Pressure Rating: 250 psig minimum.
 4. Type: Swing check.
 5. Body Material: Cast iron.
 6. End Connections: Flanged or grooved.
- F. Bronze OS&Y Gate Valves:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Stockham Division.
 - c. Milwaukee Valve Company.
 - d. NIBCO INC.
 - e. United Brass Works, Inc.
 2. Standard: UL 262.
 3. Pressure Rating: 175 psig.
 4. Body Material: Bronze.
 5. End Connections: Threaded.
- G. Iron OS&Y Gate Valves:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. American Cast Iron Pipe Company; Waterous Company Subsidiary.
 - b. American Valve, Inc.
 - c. Clow Valve Company; a division of McWane, Inc.
 - d. Crane Co.; Crane Valve Group; Crane Valves.
 - e. Crane Co.; Crane Valve Group; Jenkins Valves.
 - f. Crane Co.; Crane Valve Group; Stockham Division.
 - g. Hammond Valve.
 - h. Milwaukee Valve Company.
 - i. Mueller Co.; Water Products Division.
 - j. NIBCO INC.
 - k. Shurjoint Piping Products.
 - l. Tyco Fire & Building Products LP.
 - m. United Brass Works, Inc.
 - n. Watts Water Technologies, Inc.
 2. Standard: UL 262.
 3. Pressure Rating: 250 psig minimum.
 4. Body Material: Cast or ductile iron.
 5. End Connections: Flanged or grooved.

H. Indicating-Type Butterfly Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Anvil International, Inc.
 - b. Fivalco Inc.
 - c. Global Safety Products, Inc.
 - d. Kennedy Valve; a division of McWane, Inc.
 - e. Milwaukee Valve Company.
 - f. NIBCO INC.
 - g. Shurjoint Piping Products.
 - h. Tyco Fire & Building Products LP.
 - i. Victaulic Company.
2. Standard: UL 1091.
3. Pressure Rating: 175 psig minimum.
4. Valves NPS 2 and Smaller:
 - a. Valve Type: Ball or butterfly.
 - b. Body Material: Bronze.
 - c. End Connections: Threaded.
5. Valves NPS 2-1/2 and Larger:
 - a. Valve Type: Butterfly.
 - b. Body Material: Cast or ductile iron.
 - c. End Connections: Flanged, grooved, or wafer.
6. Valve Operation: Integral electrical, 115-V ac, prewired, single-circuit, supervisory switch and visual indicating device.

2.5 TRIM AND DRAIN VALVES

A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating: 175 psig minimum.

B. Angle Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Fire Protection Products, Inc.
 - b. United Brass Works, Inc.

C. Ball Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Affiliated Distributors.
 - b. Anvil International, Inc.
 - c. Barnett.
 - d. Conbraco Industries, Inc.; Apollo Valves.
 - e. Fire-End & Croker Corporation.
 - f. Fire Protection Products, Inc.
 - g. Flowserve.
 - h. FNW.
 - i. Jomar International, Ltd.
 - j. Kennedy Valve; a division of McWane, Inc.
 - k. Kitz Corporation.
 - l. Legend Valve.
 - m. Metso Automation USA Inc.
 - n. Milwaukee Valve Company.
 - o. NIBCO INC.
 - p. Potter Roemer.
 - q. Red-White Valve Corporation.
 - r. Southern Manufacturing Group.
 - s. Stewart, M. A. and Sons Ltd.
 - t. Tyco Fire & Building Products LP.
 - u. Victaulic Company.
 - v. Watts Water Technologies, Inc.
 - w. <Insert manufacturer's name>.

D. Globe Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Fire Protection Products, Inc.
 - b. United Brass Works, Inc.

E. Plug Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Southern Manufacturing Group.

2.6 SPECIALTY VALVES

A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating:
 - a. Standard-Pressure Piping Specialty Valves: 175 psig minimum.
 - b. High-Pressure Piping Specialty Valves: 250 psig minimum
3. Body Material: Cast or ductile iron.
4. Size: Same as connected piping.
5. End Connections: Flanged or grooved.

B. Automatic (Ball Drip) Drain Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. AFAC Inc.
 - b. Reliable Automatic Sprinkler Co., Inc.
 - c. Tyco Fire & Building Products LP.
2. Standard: UL 1726.
3. Pressure Rating: 175 psig minimum.
4. Type: Automatic draining, ball check.
5. Size: NPS 3/4.
6. End Connections: Threaded.

2.7 FIRE-DEPARTMENT CONNECTIONS

A. Wall mounted, Fire-Department Connection:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. AFAC Inc.
 - b. Elkhart Brass Mfg. Company, Inc.
 - c. GMR International Equipment Corporation.
 - d. Guardian Fire Equipment, Inc.
 - e. Potter Roemer.
2. Standard: UL 405.
3. Type: wall mounting.
4. Pressure Rating: 175 psig minimum.
5. Body Material: Corrosion-resistant metal.
6. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.
7. Caps: Brass, lugged type, with gasket and chain.
8. Escutcheon Plate: Rectangular, brass, wall type.

9. Outlet: With pipe threads.
10. Body Style: Horizontal.
11. Number of Inlets: Two.
12. Outlet Location: Back.
13. Escutcheon Plate Marking: AUTO SPKR
14. Finish: Polished chrome plated.
15. Outlet Size: NPS 4.

2.8 SPRINKLER SPECIALTY PIPE FITTINGS

A. Branch Outlet Fittings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Anvil International, Inc.
 - b. National Fittings, Inc.
 - c. Shurjoint Piping Products.
 - d. Tyco Fire & Building Products LP.
 - e. Victaulic Company.
2. Standard: UL 213.
3. Pressure Rating: 175 psig minimum.
4. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
5. Type: Mechanical-T and -cross fittings.
6. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
7. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
8. Branch Outlets: Grooved, plain-end pipe, or threaded.

B. Flow Detection and Test Assemblies:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. AGF Manufacturing Inc.
 - b. Reliable Automatic Sprinkler Co., Inc.
 - c. Tyco Fire & Building Products LP.
 - d. Victaulic Company.
2. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
3. Pressure Rating: 175 psig minimum.
4. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded.

C. Sprinkler Inspector's Test Fittings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. AGF Manufacturing Inc.
 - b. Triple R Specialty.
 - c. Tyco Fire & Building Products LP.
 - d. Victaulic Company.
 - e. Viking Corporation.
2. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
3. Pressure Rating: 175 psig minimum.
4. Body Material: Cast- or ductile-iron housing with sight glass.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded.

D. Flexible, Sprinkler Hose Fittings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Fivalco Inc.
 - b. FlexHead Industries, Inc.
 - c. Gateway Tubing, Inc.
2. Standard: UL 1474.
3. Type: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.
4. Pressure Rating: 175 psig minimum.
5. Size: Same as connected piping, for sprinkler.

2.9 SPRINKLERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. AFAC Inc.
2. Globe Fire Sprinkler Corporation.
3. Reliable Automatic Sprinkler Co., Inc.
4. Tyco Fire & Building Products LP.
5. Venus Fire Protection Ltd.
6. Victaulic Company.
7. Viking Corporation.

B. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
 2. Pressure Rating for Automatic Sprinklers: 175 psig minimum.
- C. Automatic Sprinklers with Heat-Responsive Element:
1. Nonresidential Applications: UL 199.
 2. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.
- D. Sprinkler Finishes:
1. Chrome plated.
 2. Bronze.
 3. Painted.
- E. Special Coatings:
1. Wax.
 2. Lead.
 3. Corrosion-resistant paint.
- F. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
1. Ceiling Mounting: Chrome-plated steel, two piece, with 1-inch vertical adjustment
 2. Sidewall Mounting: Chrome-plated steel, one piece, flat.
- G. Sprinkler Guards:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Reliable Automatic Sprinkler Co., Inc.
 - b. Tyco Fire & Building Products LP.
 - c. Victaulic Company.
 - d. Viking Corporation.
 2. Standard: UL 199.
 3. Type: Wire cage with fastening device for attaching to sprinkler.
- 2.10 ALARM DEVICES
- A. Alarm-device types shall match piping and equipment connections.
- B. Electrically Operated Alarm Bell:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Fire-Lite Alarms, Inc.; a Honeywell company.
 - b. Notifier; a Honeywell company.
 - c. Potter Electric Signal Company.
 2. Standard: UL 464.
 3. Type: Vibrating, metal alarm bell.
 4. Size: 6-inch minimum diameter.
 5. Finish: Red-enamel factory finish, suitable for outdoor use.
- C. Water-Flow Indicators:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ADT Security Services, Inc.
 - b. McDonnell & Miller; ITT Industries.
 - c. Potter Electric Signal Company.
 - d. System Sensor; a Honeywell company.
 - e. Viking Corporation.
 - f. Watts Industries (Canada) Inc.
 2. Standard: UL 346.
 3. Water-Flow Detector: Electrically supervised.
 4. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
 5. Type: Paddle operated.
 6. Pressure Rating: 250 psig
 7. Design Installation: Horizontal or vertical.
- D. Valve Supervisory Switches:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Fire-Lite Alarms, Inc.; a Honeywell company.
 - b. Kennedy Valve; a division of McWane, Inc.
 - c. Potter Electric Signal Company.
 - d. System Sensor; a Honeywell company.
 2. Standard: UL 346.
 3. Type: Electrically supervised.
 4. Components: Single-pole, double-throw switch with normally closed contacts.
 5. Design: Signals that controlled valve is in other than fully open position.

2.11 PRESSURE GAGES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. AMETEK; U.S. Gauge Division.
 - 2. Ashcroft, Inc.
 - 3. Brecco Corporation.
 - 4. WIKA Instrument Corporation.
- B. Standard: UL 393.
- C. Dial Size: 3-1/2- to 4-1/2-inch diameter.
- D. Pressure Gage Range: 0 to 250 psig.
- E. Water System Piping Gage: Include "WATER" or "AIR/WATER" label on dial face.

2.12 ESCUTCHEONS

- A. General: Manufactured ceiling, floor, and wall escutcheons and floor plates.
- B. One-Piece, Cast-Brass Escutcheons: Polished chrome-plated finish with set-screws.
- C. One-Piece, Deep-Pattern Escutcheons: Deep-drawn, box-shaped brass with chrome-plated finish.
- D. One-Piece, Stamped-Steel Escutcheons: Chrome-plated finish with set-screw or spring clips.
- E. Split-Casting, Cast-Brass Escutcheons: Polished chrome-plated or rough-brass finish with concealed hinge and set-screw.
- F. Split-Plate, Stamped-Steel Escutcheons: Chrome-plated finish with concealed hinge, set-screw or spring clips.
- G. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.
- H. Split-Casting Floor Plates: Cast brass with concealed hinge.

PART 3 - EXECUTION

3.1 SERVICE-ENTRANCE PIPING

- A. Connect sprinkler piping to water-service piping for service entrance to building. Comply with requirements for exterior piping in Division 21 Section "Facility Fire-Suppression Water-Service Piping."

- B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-service piping. Comply with requirements for backflow preventers in Division 21 Section Facility Fire-Suppression Water-Service Piping.]

3.2 PIPING INSTALLATION

- A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.
 - 1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
- B. Piping Standard: Comply with requirements for installation of sprinkler piping in NFPA 13.
- C. Install seismic restraints on piping. Comply with requirements for seismic-restraint device materials and installation in NFPA 13.
- D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- E. Install unions adjacent to each valve in pipes NPS 2 and smaller.
- F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
- G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.
- H. Install sprinkler piping with drains for complete system drainage.
- I. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.
- J. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to and spill over floor drain or to outside building.
- K. Install alarm devices in piping systems.
- L. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13.
- M. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.
- N. Fill sprinkler system piping with water.

3.3 JOINT CONSTRUCTION

- A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.
- B. Install unions adjacent to each valve in pipes NPS 2 and smaller.
- C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
- D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.
- G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- H. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.
 - 1. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.
- I. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.
- J. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.
- K. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.4 VALVE AND SPECIALTIES INSTALLATION

- A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.

- B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.
- C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.
- D. Specialty Valves:
 - 1. General Requirements: Install in vertical position for proper direction of flow, in main supply to system.
 - 2. Alarm Valves: Include bypass check valve and retarding chamber drain-line connection.
 - 3. Deluge Valves: Install in vertical position, in proper direction of flow, and in main supply to deluge system. Install trim sets for drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.

3.5 SPRINKLER INSTALLATION

- A. Install sprinklers in suspended ceilings in center or quarter point of acoustical ceiling panels.
- B. Install dry-type sprinklers with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.

3.6 FIRE-DEPARTMENT CONNECTION INSTALLATION

- A. Install wall-type, fire-department connections.
- B. Install automatic (ball drip) drain valve at low point of piping for fire-department connection.

3.7 ESCUTCHEON INSTALLATION

- A. Install escutcheons for penetrations of walls, ceilings, and floors.
- B. Escutcheons for New Piping:
 - 1. Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.
 - 2. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish.
 - 3. Bare Piping at Ceiling Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish.
 - 4. Bare Piping in Unfinished Service Spaces: One piece, cast brass with polished chrome-plated finish.
 - 5. Bare Piping in Equipment Rooms: One piece, cast brass with chrome-plated finish.
 - 6. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece floor plate.

3.8 IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.
- B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.9 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
 - 3. Energize circuits to electrical equipment and devices.
 - 4. Verify that equipment hose threads are same as local fire-department equipment.
- C. Sprinkler piping system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

3.10 CLEANING

- A. Clean dirt and debris from sprinklers.
- B. Remove and replace sprinklers with paint other than factory finish.

3.11 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain fire sprinkler equipment.

3.12 PIPING SCHEDULE

- A. Piping between Fire-Department Connections and Check Valves: Galvanized, standard-weight steel pipe with grooved ends; grooved-end fittings, grooved-end-pipe couplings; and grooved joints.
- B. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.
- C. Standard-pressure, wet-pipe sprinkler system, NPS 2 and smaller shall be one of the following:
 - 1. Standard-weight or Schedule 30, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.

2. Standard-weight or Schedule 30, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
- D. Standard-pressure, wet-pipe sprinkler system, NPS 2-1/2 to NPS 6, shall be one of the following:
1. Standard-weight or Schedule 30, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
 2. Standard-weight or Schedule 30, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
 3. Standard-weight or Schedule 30, black-steel pipe with roll grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 4. Standard-weight or Schedule 30, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 5. Schedule 10 black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

3.13 SPRINKLER SCHEDULE

- A. Use sprinkler types in subparagraphs below for the following applications:
1. Rooms without Ceilings: Upright sprinklers.
 2. Rooms with Suspended Ceilings: Concealed sprinklers.
 3. Wall Mounting: Sidewall sprinklers.
 4. Spaces Subject to Freezing: Sidewall, dry sprinklers.
- B. Provide sprinkler types in subparagraphs below with finishes indicated.
1. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
 2. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.
 3. Upright, Pendent and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

3.14 PHASING OF WORK

- A. Building will continue normal operations during installation of the fire sprinkler system. It will be the responsibility of the Contractor to schedule work at least 7 days in advance and submit schedule to Building Coordinator for review and approval.
- B. Work shall be completed in phases with all significant operations completed in one phase before proceeding to the next phase. See drawings for graphical indication of phase boundaries.
- C. Work shall be performed between the hours of 7:00 AM and 10:00 PM. Weekend, holiday and afterhours work will be allowed but is subject to availability of building security and will require prior approval from the building coordinator.

- D. Operations involving the creation of dust, debris or distracting noise shall be scheduled in advance with the building coordinator and shall be performed early in the morning or near the end of the work day
- E. An outdoor equipment staging area will be provided on the east side of the building. Coordinate location with building coordinator. Contractor is responsible for the security of all materials and equipment placed in the staging area. No interior equipment staging area will be provided. Prior to the end of each work shift, the Contractor shall remove all tools, equipment and materials awaiting installation from the building and place in outdoor staging area.
- F. Time is of the essence. All work included in this contract (including inspections and acceptance testing) shall be substantially complete within 90 days or receipt of written notice to proceed.

END OF SECTION 211313

SECTION 312000 - EARTH MOVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Excavating and backfilling trenches for utilities and pits for buried utility structures.

1.3 DEFINITIONS

- A. Backfill: Soil material or controlled low-strength material used to fill an excavation.
 - 1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
 - 2. Final Backfill: Backfill placed over initial backfill to fill a trench.
- B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.
- C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.
- D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
- E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.
- F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
- G. Fill: Soil materials used to raise existing grades.
- H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- I. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.
- J. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

- K. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.4 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
 - 2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.
- B. Utility Locator Service: Notify utility locator service for area where Project is located before beginning earth moving operations.
- C. Do not commence earth moving operations until plant-protection measures specified in Division 01 Section "Temporary Tree and Plant Protection" are in place.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.
- B. Protect and maintain erosion and sedimentation controls during earth moving operations.
- C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 DEWATERING

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

3.3 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
 1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.
- B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated.
 1. Clearance: 12 inches each side of pipe or conduit.
- C. Trench Bottoms: Excavate trenches 4 inches deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.
 1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.4 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.5 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
 1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
 2. Surveying locations of underground utilities for Record Documents.
 3. Testing and inspecting underground utilities.
 4. Removing concrete formwork.
 5. Removing trash and debris.
 6. Removing temporary shoring and bracing, and sheeting.
 7. Installing permanent or temporary horizontal bracing on horizontally supported walls.
- B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.6 UTILITY TRENCH BACKFILL

- A. Place backfill on subgrades free of mud, frost, snow, or ice.

- B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- C. Backfill voids with satisfactory soil while removing shoring and bracing.
- D. Controlled Low-Strength Material: Place initial backfill of controlled low-strength material to a height of 12 inches over the pipe or conduit. Coordinate backfilling with utilities testing.
- E. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.7 SOIL FILL

- A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers to required elevations as follows:
 - 1. Under grass and planted areas, use satisfactory soil material.
 - 2. Under walks and pavements, use satisfactory soil material.
 - 3. Under steps and ramps, use engineered fill.
 - 4. Under building slabs, use engineered fill.
 - 5. Under footings and foundations, use engineered fill.
- C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.8 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
 - 1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
 - 2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.9 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

3.10 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
 2. Determine that fill material and maximum lift thickness comply with requirements.
 3. Determine, at the required frequency, that in-place density of compacted fill complies with requirements.

3.11 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.12 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 312000

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 JOB TITLE: REMOTE AREA #1 - MULTIPURPOSE

WATER SUPPLY DATA

SOURCE NODE TAG	STATIC PRESS. (PSI)	RESID. PRESS. (PSI)	FLOW @ (GPM)	AVAIL. PRESS. (PSI)	TOTAL @ DEMAND (GPM)	REQ'D PRESS. (PSI)
A	88.0	82.0	950.0	85.9	535.6	58.5

Required pressure is 27.4 psi (32%) less than available pressure.

AGGREGATE FLOW ANALYSIS:

TOTAL FLOW AT SOURCE	535.6 GPM
TOTAL HOSE STREAM ALLOWANCE AT SOURCE	250.0 GPM
OTHER HOSE STREAM ALLOWANCES	0.0 GPM
TOTAL DISCHARGE FROM ACTIVE SPRINKLERS	285.6 GPM

NODE ANALYSIS DATA

NODE TAG	ELEVATION (FT)	NODE TYPE	PRESSURE (PSI)	DISCHARGE (GPM)	AREA (FT^2)	DENSITY	
						REQ.	ACT.
A	-5.0	SOURCE	58.5	285.6	- - -	- - -	- - -
B	1.0	- - - -	54.2	- - -	- - -	- - -	- - -
C	1.0	- - - -	49.2	- - -	- - -	- - -	- - -
1	12.5	- - - -	44.0	- - -	- - -	- - -	- - -
2	12.5	- - - -	43.6	- - -	- - -	- - -	- - -
3	12.5	- - - -	41.6	- - -	- - -	- - -	- - -
4	12.5	- - - -	38.0	- - -	- - -	- - -	- - -
5	27.5	- - - -	25.0	- - -	- - -	- - -	- - -
6	27.5	- - - -	24.6	- - -	- - -	- - -	- - -
7	27.5	- - - -	24.4	- - -	- - -	- - -	- - -
8	27.5	- - - -	24.4	- - -	- - -	- - -	- - -
101	28.0	K= 5.60	16.9	23.0	108.0	0.150	0.213
102	28.0	K= 5.60	15.3	21.9	108.0	0.150	0.203
103	28.0	K= 5.60	13.7	20.7	108.0	0.150	0.192
104	28.0	K= 5.60	14.7	21.5	108.0	0.150	0.199
105	28.0	K= 5.60	12.5	19.8	108.0	0.150	0.183
106	28.0	K= 5.60	8.8	16.6	108.0	0.150	0.154
107	28.0	K= 5.60	7.8	15.7	104.0	0.150	0.151
108	28.0	K= 5.60	14.6	21.4	108.0	0.150	0.198
109	28.0	K= 5.60	12.4	19.7	108.0	0.150	0.182
110	28.0	K= 5.60	8.7	16.5	108.0	0.150	0.153
111	28.0	K= 5.60	7.8	15.6	104.0	0.150	0.150
112	28.0	K= 5.60	14.6	21.4	108.0	0.150	0.198
113	28.0	K= 5.60	12.3	19.7	108.0	0.150	0.182
114	28.0	K= 5.60	8.7	16.5	108.0	0.150	0.153
115	28.0	K= 5.60	7.8	15.6	104.0	0.150	0.150

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 JOB TITLE: REMOTE AREA #1 - MULTIPURPOSE

PIPE DATA

PIPE TAG	END	ELEV.	NOZ.	PT	DISC.	Q(GPM)	DIA(IN)	LENGTH	PRESS.	
	NODES	(FT)	(K)	(PSI)	(GPM)	VEL(FPS)	HW(C)	(FT)	SUM.	
							FL/FT		(PSI)	
	Pipe: 1					285.6	4.280	PL	60.00	PF 1.7
A		-5.0	SRCE	58.5	(N/A)	6.4	140	FTG	ETG	PE -2.6
B		1.0	0.0	54.2	0.0		0.014	TL	118.00	PV
	Pipe: 2									FIXED PRESSURE LOSS DEVICE
B		1.0	0.0	54.2	0.0		5.0 psi,		285.6 gpm	
C		1.0	0.0	49.2	0.0					
	Pipe: 3					285.6	4.260	PL	11.50	PF 0.2
C		1.0	0.0	49.2	0.0	6.4	120	FTG	----	PE -5.0
1		12.5	0.0	44.0	0.0		0.019	TL	11.50	PV
	Pipe: 4					285.6	4.260	PL	9.00	PF 0.4
1		12.5	0.0	44.0	0.0	6.4	120	FTG	E	PE 0.0
2		12.5	0.0	43.6	0.0		0.019	TL	22.20	PV
	Pipe: 5					285.6	4.260	PL	74.00	PF 1.9
2		12.5	0.0	43.6	0.0	6.4	120	FTG	T	PE 0.0
3		12.5	0.0	41.6	0.0		0.019	TL	100.40	PV
	Pipe: 6					285.6	4.260	PL	106.00	PF 3.6
3		12.5	0.0	41.6	0.0	6.4	120	FTG	6E	PE 0.0
4		12.5	0.0	38.0	0.0		0.019	TL	185.20	PV
	Pipe: 7					285.6	3.260	PL	53.50	PF 6.6
4		12.5	0.0	38.0	0.0	11.0	120	FTG	2ET	PE -6.5
5		27.5	0.0	25.0	0.0		0.071	TL	92.50	PV
	Pipe: 8					219.9	3.260	PL	8.00	PF 0.4
5		27.5	0.0	25.0	0.0	8.5	120	FTG	----	PE 0.0
6		27.5	0.0	24.6	0.0		0.044	TL	8.00	PV
	Pipe: 9					146.4	3.260	PL	8.00	PF 0.2
6		27.5	0.0	24.6	0.0	5.6	120	FTG	----	PE 0.0
7		27.5	0.0	24.4	0.0		0.021	TL	8.00	PV
	Pipe: 10					73.2	3.260	PL	8.00	PF 0.0
7		27.5	0.0	24.4	0.0	2.8	120	FTG	----	PE 0.0
8		27.5	0.0	24.4	0.0		0.006	TL	8.00	PV
	Pipe: 11					65.7	1.408	PL	12.00	PF 7.8
5		27.5	0.0	25.0	0.0	13.5	120	FTG	2T	PE -0.2
101		28.0	5.6	16.9	23.0		0.280	TL	28.00	PV
	Pipe: 12					42.6	1.408	PL	12.50	PF 1.6
101		28.0	5.6	16.9	23.0	8.8	120	FTG	----	PE 0.0
102		28.0	5.6	15.3	21.9		0.126	TL	12.50	PV
	Pipe: 13					20.7	1.080	PL	13.50	PF 1.6
102		28.0	5.6	15.3	21.9	7.3	120	FTG	----	PE 0.0
103		28.0	5.6	13.7	20.7		0.121	TL	13.50	PV

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PIPE TAG	END	ELEV.	NOZ.	PT	DISC.	Q (GPM)	DIA (IN)	LENGTH	PRESS.		
NODES	(FT)	(K)	(PSI)	(GPM)	VEL (FPS)	HW (C)	FL/FT	(FT)	SUM.		
									(PSI)		
	Pipe: 14					73.5	1.408	PL	12.00	PF	9.7
6		27.5	0.0	24.6	0.0	15.1	120	FTG	2T	PE	-0.2
104		28.0	5.6	14.7	21.5		0.345	TL	28.00	PV	
	Pipe: 15					52.0	1.408	PL	12.50	PF	2.3
104		28.0	5.6	14.7	21.5	10.7	120	FTG	----	PE	0.0
105		28.0	5.6	12.5	19.8		0.182	TL	12.50	PV	
	Pipe: 16					32.3	1.080	PL	13.50	PF	3.7
105		28.0	5.6	12.5	19.8	11.3	120	FTG	----	PE	0.0
106		28.0	5.6	8.8	16.6		0.273	TL	13.50	PV	
	Pipe: 17					15.7	1.080	PL	13.00	PF	0.9
106		28.0	5.6	8.8	16.6	5.5	120	FTG	----	PE	0.0
107		28.0	5.6	7.8	15.7		0.072	TL	13.00	PV	
	Pipe: 18					73.3	1.408	PL	12.00	PF	9.6
7		27.5	0.0	24.4	0.0	15.1	120	FTG	2T	PE	-0.2
108		28.0	5.6	14.6	21.4		0.343	TL	28.00	PV	
	Pipe: 19					51.8	1.408	PL	12.50	PF	2.3
108		28.0	5.6	14.6	21.4	10.7	120	FTG	----	PE	0.0
109		28.0	5.6	12.4	19.7		0.181	TL	12.50	PV	
	Pipe: 20					32.1	1.080	PL	13.50	PF	3.7
109		28.0	5.6	12.4	19.7	11.3	120	FTG	----	PE	0.0
110		28.0	5.6	8.7	16.5		0.272	TL	13.50	PV	
	Pipe: 21					15.6	1.080	PL	13.00	PF	0.9
110		28.0	5.6	8.7	16.5	5.5	120	FTG	----	PE	0.0
111		28.0	5.6	7.8	15.6		0.071	TL	13.00	PV	
	Pipe: 22					73.2	1.408	PL	12.00	PF	9.6
8		27.5	0.0	24.4	0.0	15.1	120	FTG	2T	PE	-0.2
112		28.0	5.6	14.6	21.4		0.342	TL	28.00	PV	
	Pipe: 23					51.8	1.408	PL	12.50	PF	2.3
112		28.0	5.6	14.6	21.4	10.7	120	FTG	----	PE	0.0
113		28.0	5.6	12.3	19.7		0.180	TL	12.50	PV	
	Pipe: 24					32.1	1.080	PL	13.50	PF	3.7
113		28.0	5.6	12.3	19.7	11.2	120	FTG	----	PE	0.0
114		28.0	5.6	8.7	16.5		0.271	TL	13.50	PV	
	Pipe: 25					15.6	1.080	PL	13.00	PF	0.9
114		28.0	5.6	8.7	16.5	5.5	120	FTG	----	PE	0.0
115		28.0	5.6	7.8	15.6		0.071	TL	13.00	PV	

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 JOB TITLE: REMOTE AREA #1 - MULTIPURPOSE

NOTES (HASS):

- (1) Calculations were performed by the HASS 8.0 computer program under license no. 50010207 granted by HRS Systems, Inc.
 208 South Public Square
 Petersburg, TN 37144
- (2) The system has been calculated to provide an average imbalance at each node of 0.007 gpm and a maximum imbalance at any node of 0.166 gpm.
- (3) Total pressure at each node is used in balancing the system. Maximum water velocity is 15.1 ft/sec at pipe 14.

(4) PIPE FITTINGS TABLE

Pipe Table Name: ALB.PIP

PAGE: A MATERIAL: S40-TW HWC: 120

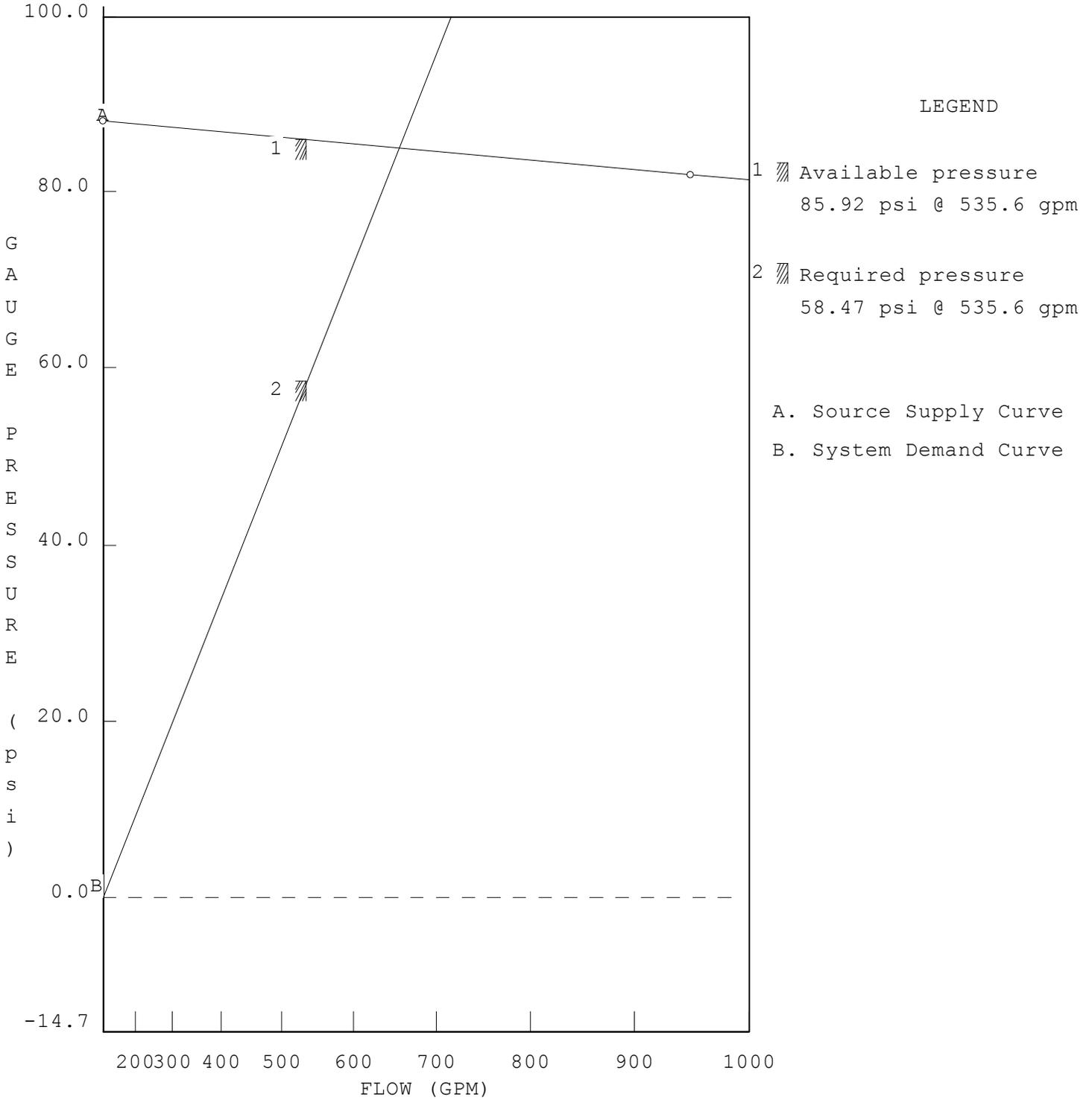
Diameter (in)	Equivalent Fitting Lengths in Feet							
	E	T	L	C	B	G	A	D
	Ell	Tee	LngEl	ChkVl	BfyVl	GatVl	AlmCk	DPVlv
1.080	2.40	6.00	2.40	5.00	6.00	1.00	10.00	10.00
1.408	3.40	8.00	2.30	7.00	6.00	1.00	10.00	10.00
3.260	9.40	20.20	6.70	21.50	13.40	1.40	20.60	13.00
4.260	13.20	26.40	7.90	22.00	12.00	2.60	40.30	13.00

PAGE: D MATERIAL: DIRON HWC: 140

Diameter (in)	Equivalent Fitting Lengths in Feet						
	E	T	L	C	B	G	
	Ell	Tee	LngEl	ChkVl	BfyVl	GatVl	
4.280	18.00	36.00	11.00	39.00	22.00	4.00	

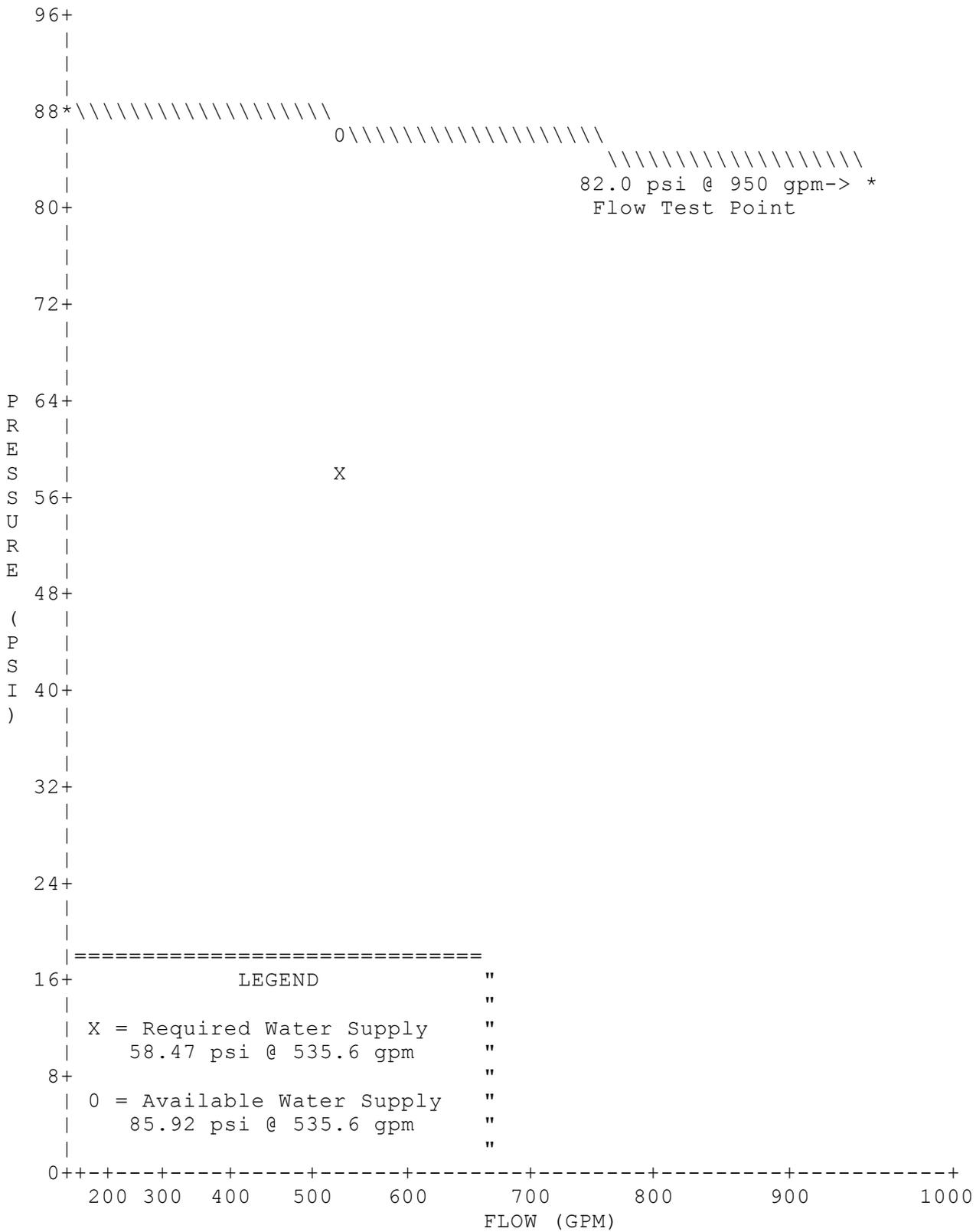
WATER SUPPLY ANALYSIS

Static: 88.00 psi Resid: 82.00 psi Flow: 950.0 gpm



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WATER SUPPLY CURVE



LEGEND

- X = Required Water Supply
58.47 psi @ 535.6 gpm
- 0 = Available Water Supply
85.92 psi @ 535.6 gpm

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 JOB TITLE: REMOTE AREA #2 - MECHANICAL PENTHOUSE

WATER SUPPLY DATA

SOURCE NODE TAG	STATIC PRESS. (PSI)	RESID. PRESS. (PSI)	FLOW @ (GPM)	AVAIL. PRESS. (PSI)	TOTAL @ DEMAND (GPM)	REQ'D PRESS. (PSI)
A	88.0	82.0	950.0	86.6	431.1	61.7

Required pressure is 24.9 psi (29%) less than available pressure.

AGGREGATE FLOW ANALYSIS:

TOTAL FLOW AT SOURCE	431.1 GPM
TOTAL HOSE STREAM ALLOWANCE AT SOURCE	250.0 GPM
OTHER HOSE STREAM ALLOWANCES	0.0 GPM
TOTAL DISCHARGE FROM ACTIVE SPRINKLERS	181.1 GPM

NODE ANALYSIS DATA

NODE TAG	ELEVATION (FT)	NODE TYPE	PRESSURE (PSI)	DISCHARGE (GPM)	AREA (FT^2)	DENSITY	
						REQ.	ACT.
A	-5.0	SOURCE	61.7	181.1	- - -	- - -	- - -
B	1.0	- - - -	58.3	- - -	- - -	- - -	- - -
C	1.0	- - - -	53.3	- - -	- - -	- - -	- - -
1	12.5	- - - -	48.3	- - -	- - -	- - -	- - -
2	12.5	- - - -	48.1	- - -	- - -	- - -	- - -
3	12.5	- - - -	47.2	- - -	- - -	- - -	- - -
4	12.5	- - - -	45.7	- - -	- - -	- - -	- - -
5	27.5	- - - -	36.4	- - -	- - -	- - -	- - -
6	27.5	- - - -	36.1	- - -	- - -	- - -	- - -
7	27.5	- - - -	35.9	- - -	- - -	- - -	- - -
8	27.5	- - - -	35.6	- - -	- - -	- - -	- - -
9	27.5	- - - -	35.3	- - -	- - -	- - -	- - -
10	27.5	- - - -	35.2	- - -	- - -	- - -	- - -
11	28.0	- - - -	31.4	- - -	- - -	- - -	- - -
12	28.0	- - - -	34.6	- - -	- - -	- - -	- - -
201	28.0	K= 5.60	24.1	27.5	130.0	0.200	0.212
202	28.0	K= 5.60	21.6	26.0	130.0	0.200	0.200
203	28.0	K= 5.60	27.8	29.5	130.0	0.200	0.227
204	28.0	K= 5.60	33.9	32.6	130.0	0.200	0.251
205	28.0	K= 5.60	33.8	32.6	130.0	0.200	0.250
206	28.0	K= 5.60	34.5	32.9	130.0	0.200	0.253

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 JOB TITLE: REMOTE AREA #2 - MECHANICAL PENTHOUSE

PIPE DATA

PIPE TAG	END	ELEV.	NOZ.	PT	DISC.	Q(GPM)	DIA(IN)	LENGTH	PRESS.	
	NODES	(FT)	(K)	(PSI)	(GPM)	VEL(FPS)	HW(C)	(FT)	SUM.	
							FL/FT		(PSI)	
	Pipe: 1					181.1	4.280	PL	60.00	PF 0.7
A		-5.0	SRCE	61.7	(N/A)	4.0	140	FTG	ETG	PE -2.6
B		1.0	0.0	58.3	0.0		0.006	TL	118.00	PV
	Pipe: 2									FIXED PRESSURE LOSS DEVICE
B		1.0	0.0	58.3	0.0		5.0 psi,		181.1 gpm	
C		1.0	0.0	53.3	0.0					
	Pipe: 3					181.1	4.260	PL	11.50	PF 0.1
C		1.0	0.0	53.3	0.0	4.1	120	FTG	----	PE -5.0
1		12.5	0.0	48.3	0.0		0.008	TL	11.50	PV
	Pipe: 4					181.1	4.260	PL	9.00	PF 0.2
1		12.5	0.0	48.3	0.0	4.1	120	FTG	E	PE 0.0
2		12.5	0.0	48.1	0.0		0.008	TL	22.20	PV
	Pipe: 5					181.1	4.260	PL	74.00	PF 0.8
2		12.5	0.0	48.1	0.0	4.1	120	FTG	T	PE 0.0
3		12.5	0.0	47.2	0.0		0.008	TL	100.40	PV
	Pipe: 6					181.1	4.260	PL	106.00	PF 1.5
3		12.5	0.0	47.2	0.0	4.1	120	FTG	6E	PE 0.0
4		12.5	0.0	45.7	0.0		0.008	TL	185.20	PV
	Pipe: 7					181.1	3.260	PL	53.50	PF 2.8
4		12.5	0.0	45.7	0.0	7.0	120	FTG	2ET	PE -6.5
5		27.5	0.0	36.4	0.0		0.031	TL	92.50	PV
	Pipe: 8					181.1	3.260	PL	8.00	PF 0.2
5		27.5	0.0	36.4	0.0	7.0	120	FTG	----	PE 0.0
6		27.5	0.0	36.1	0.0		0.031	TL	8.00	PV
	Pipe: 9					181.1	3.260	PL	8.00	PF 0.2
6		27.5	0.0	36.1	0.0	7.0	120	FTG	----	PE 0.0
7		27.5	0.0	35.9	0.0		0.031	TL	8.00	PV
	Pipe: 10					181.1	3.260	PL	8.00	PF 0.2
7		27.5	0.0	35.9	0.0	7.0	120	FTG	----	PE 0.0
8		27.5	0.0	35.6	0.0		0.031	TL	8.00	PV
	Pipe: 11					181.1	3.260	PL	9.50	PF 0.3
8		27.5	0.0	35.6	0.0	7.0	120	FTG	----	PE 0.0
9		27.5	0.0	35.3	0.0		0.031	TL	9.50	PV
	Pipe: 12					98.1	3.260	PL	9.00	PF 0.1
9		27.5	0.0	35.3	0.0	3.8	120	FTG	----	PE 0.0
10		27.5	0.0	35.2	0.0		0.010	TL	9.00	PV
	Pipe: 13					83.1	1.408	PL	0.50	PF 3.7
9		27.5	0.0	35.3	0.0	17.1	120	FTG	T	PE -0.2
11		28.0	0.0	31.4	0.0		0.432	TL	8.50	PV

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 JOB TITLE: REMOTE AREA #2 - MECHANICAL PENTHOUSE

PIPE TAG	END	ELEV.	NOZ.	PT	DISC.	Q(GPM)	DIA(IN)	LENGTH	PRESS.
NODES	(FT)	(K)	(PSI)	(GPM)	VEL(FPS)	HW(C)	(FT)	SUM.	
						FL/FT		(PSI)	
Pipe: 14					98.1	2.635	PL	0.50	PF 0.5
10	27.5	0.0	35.2	0.0	5.8	120	FTG	T	PE -0.2
12	28.0	0.0	34.6	0.0		0.028	TL	17.00	PV
Pipe: 15					53.5	1.080	PL	4.50	PF 7.3
11	28.0	0.0	31.4	0.0	18.7	120	FTG	T	PE 0.0
201	28.0	5.6	24.1	27.5		0.697	TL	10.50	PV
Pipe: 16					26.0	1.080	PL	14.00	PF 2.6
201	28.0	5.6	24.1	27.5	9.1	120	FTG	----	PE 0.0
202	28.0	5.6	21.6	26.0		0.183	TL	14.00	PV
Pipe: 17					29.5	1.080	PL	9.50	PF 3.6
11	28.0	0.0	31.4	0.0	10.3	120	FTG	T	PE 0.0
203	28.0	5.6	27.8	29.5		0.232	TL	15.50	PV
Pipe: 18					65.2	2.104	PL	4.50	PF 0.6
12	28.0	0.0	34.6	0.0	6.0	120	FTG	T	PE 0.0
204	28.0	5.6	33.9	32.6		0.039	TL	15.70	PV
Pipe: 19					32.6	2.104	PL	14.00	PF 0.2
204	28.0	5.6	33.9	32.6	3.0	120	FTG	----	PE 0.0
205	28.0	5.6	33.8	32.6		0.011	TL	14.00	PV
Pipe: 20					32.9	2.635	PL	9.50	PF 0.1
12	28.0	0.0	34.6	0.0	1.9	120	FTG	T	PE 0.0
206	28.0	5.6	34.5	32.9		0.004	TL	26.00	PV

NOTES (HASS):

- (1) Calculations were performed by the HASS 8.0 computer program under license no. 50010207 granted by
 HRS Systems, Inc.
 208 South Public Square
 Petersburg, TN 37144
- (2) The system has been calculated to provide an average imbalance at each node of 0.003 gpm and a maximum imbalance at any node of 0.064 gpm.
- (3) Total pressure at each node is used in balancing the system. Maximum water velocity is 18.7 ft/sec at pipe 15.
- (4) PIPE FITTINGS TABLE

Pipe Table Name: ALB.PIP

DATE: 3/6/2010 G:\DFCM PROJECTS\TAYLORSVILLE SCHOOL FOR THE DEAF\RA2.SDF
 JOB TITLE: REMOTE AREA #2 - MECHANICAL PENTHOUSE

PAGE: A MATERIAL: S40-TW HWC: 120

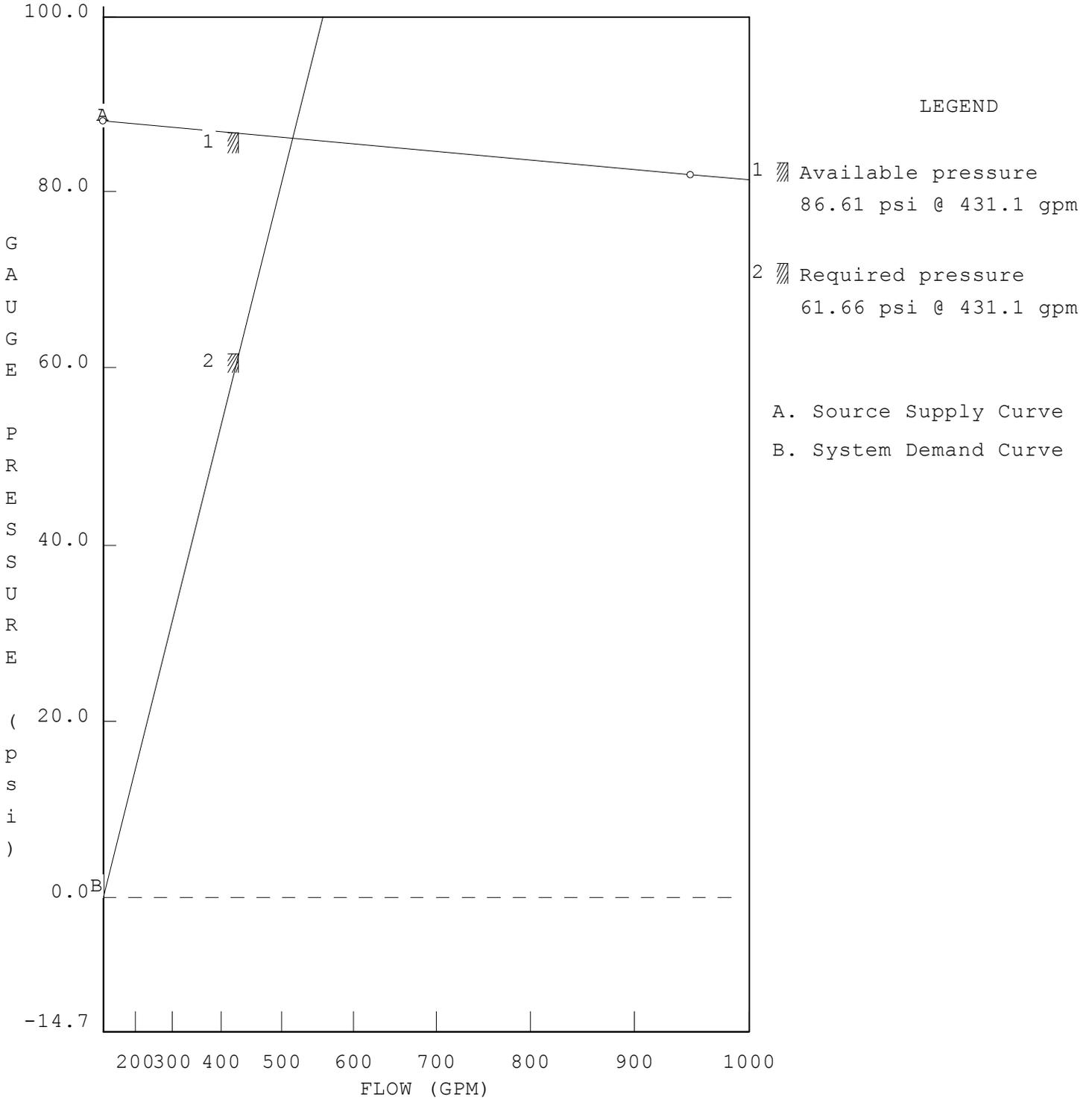
Diameter (in)	Equivalent Fitting Lengths in Feet							
	E	T	L	C	B	G	A	D
	Ell	Tee	LngEl	ChkVl	BfyVl	GatVl	AlmCk	DPVlv
1.080	2.40	6.00	2.40	5.00	6.00	1.00	10.00	10.00
1.408	3.40	8.00	2.30	7.00	6.00	1.00	10.00	10.00
2.104	5.60	11.20	3.40	11.00	6.00	1.00	10.00	10.00
2.635	8.20	16.50	5.50	19.20	9.60	1.40	6.70	14.00
3.260	9.40	20.20	6.70	21.50	13.40	1.40	20.60	13.00
4.260	13.20	26.40	7.90	22.00	12.00	2.60	40.30	13.00

PAGE: D MATERIAL: DIRON HWC: 140

Diameter (in)	Equivalent Fitting Lengths in Feet						
	E	T	L	C	B	G	
	Ell	Tee	LngEl	ChkVl	BfyVl	GatVl	
4.280	18.00	36.00	11.00	39.00	22.00	4.00	

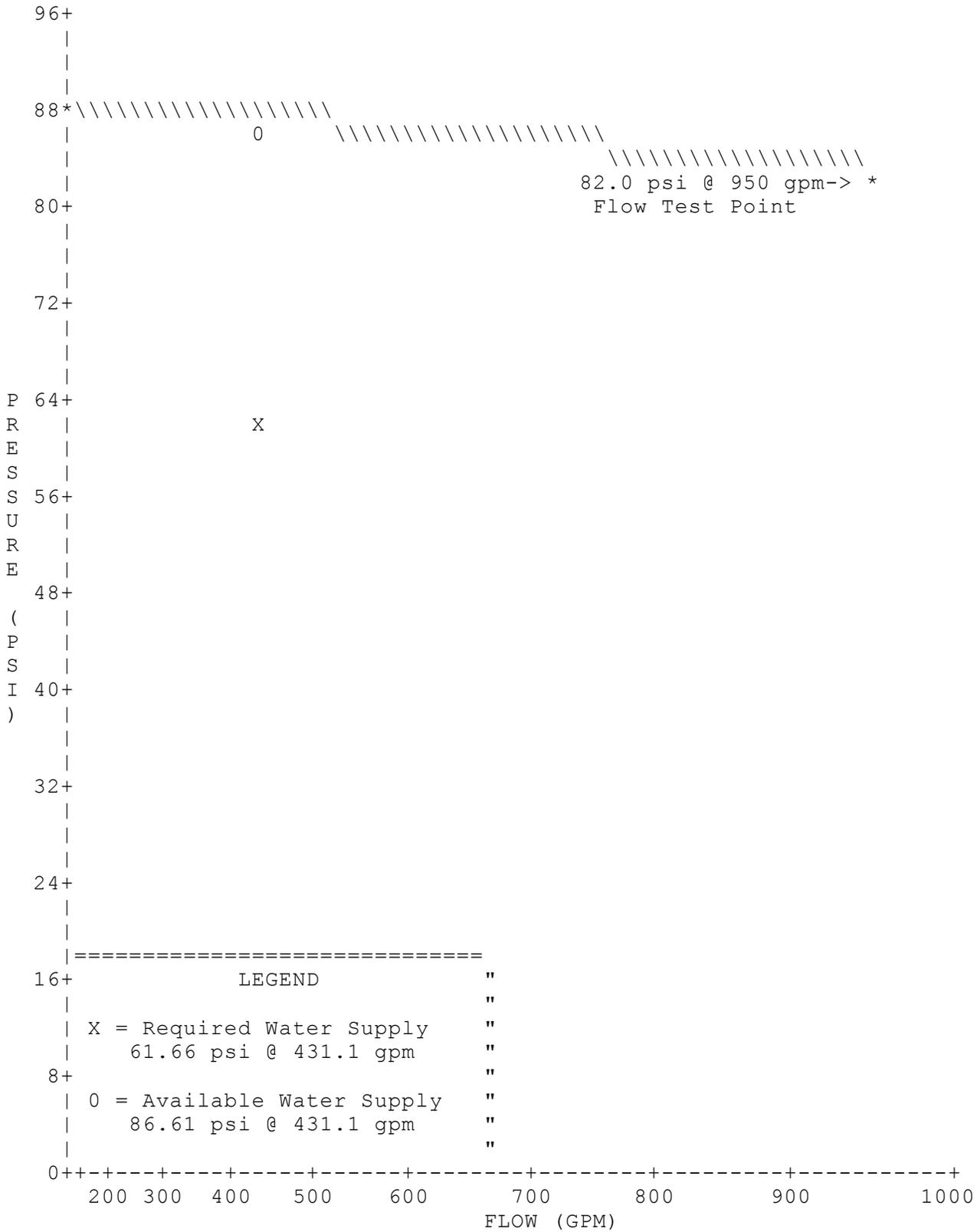
WATER SUPPLY ANALYSIS

Static: 88.00 psi Resid: 82.00 psi Flow: 950.0 gpm



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 JOB TITLE: REMOTE AREA #2 - MECHANICAL PENTHOUSE

WATER SUPPLY CURVE



DATE: 3/6/2010 G:\DFCM PROJECTS\TAYLORSVILLE SCHOOL FOR THE DEAF\RA3.SDF
 JOB TITLE: REMOTE AREA #3 - PLATFORM

WATER SUPPLY DATA

SOURCE NODE TAG	STATIC PRESS. (PSI)	RESID. PRESS. (PSI)	FLOW @ (GPM)	AVAIL. PRESS. (PSI)	TOTAL @ DEMAND (GPM)	REQ'D PRESS. (PSI)
A	88.0	82.0	950.0	86.6	433.6	73.5

Required pressure is 13.0 psi (15%) less than available pressure.

AGGREGATE FLOW ANALYSIS:

TOTAL FLOW AT SOURCE	433.6 GPM
TOTAL HOSE STREAM ALLOWANCE AT SOURCE	250.0 GPM
OTHER HOSE STREAM ALLOWANCES	0.0 GPM
TOTAL DISCHARGE FROM ACTIVE SPRINKLERS	183.6 GPM

NODE ANALYSIS DATA

NODE TAG	ELEVATION (FT)	NODE TYPE	PRESSURE (PSI)	DISCHARGE (GPM)	AREA (FT^2)	DENSITY	
						REQ.	ACT.
						(GPM/FT^2)	(GPM/FT^2)
A	-5.0	SOURCE	73.5	183.6	- - -	- - -	- - -
B	1.0	- - - -	70.2	- - -	- - -	- - -	- - -
C	1.0	- - - -	65.2	- - -	- - -	- - -	- - -
1	12.5	- - - -	60.1	- - -	- - -	- - -	- - -
2	12.5	- - - -	59.9	- - -	- - -	- - -	- - -
3	12.5	- - - -	59.1	- - -	- - -	- - -	- - -
4	12.5	- - - -	57.5	- - -	- - -	- - -	- - -
5	27.5	- - - -	48.1	- - -	- - -	- - -	- - -
6	27.5	- - - -	47.8	- - -	- - -	- - -	- - -
7	27.5	- - - -	47.6	- - -	- - -	- - -	- - -
8	27.5	- - - -	47.3	- - -	- - -	- - -	- - -
9	27.5	- - - -	47.0	- - -	- - -	- - -	- - -
10	27.5	- - - -	46.8	- - -	- - -	- - -	- - -
12	28.0	- - - -	45.0	- - -	- - -	- - -	- - -
206	28.0	- - - -	42.7	- - -	- - -	- - -	- - -
13	28.0	- - - -	42.2	- - -	- - -	- - -	- - -
14	15.0	- - - -	42.9	- - -	- - -	- - -	- - -
15	15.0	- - - -	39.2	- - -	- - -	- - -	- - -
301	15.0	K= 5.60	37.8	34.4	130.0	0.200	0.265
302	15.0	K= 5.60	31.7	31.5	130.0	0.200	0.242
303	15.0	K= 5.60	22.3	26.4	130.0	0.200	0.203
304	15.0	K= 5.60	35.8	33.5	130.0	0.200	0.258
305	15.0	K= 5.60	21.6	26.0	130.0	0.200	0.200
306	15.0	K= 5.60	32.1	31.7	130.0	0.200	0.244

DATE: 3/6/2010 G:\DFCM PROJECTS\TAYLORSVILLE SCHOOL FOR THE DEAF\RA3.SDF
 JOB TITLE: REMOTE AREA #3 - PLATFORM

PIPE DATA

PIPE TAG	END	ELEV.	NOZ.	PT	DISC.	Q (GPM)	DIA (IN)	LENGTH	PRESS.
	NODES	(FT)	(K)	(PSI)	(GPM)	VEL (FPS)	HW (C)	(FT)	SUM.
							FL/FT		(PSI)
Pipe: 1									
A		-5.0	SRCE	73.5	(N/A)	183.6	4.280	PL 60.00	PF 0.7
B		1.0	0.0	70.2	0.0	4.1	140	FTG ETG	PE -2.6
							0.006	TL 118.00	PV
Pipe: 2									
FIXED PRESSURE LOSS DEVICE									
B		1.0	0.0	70.2	0.0	5.0 psi,		183.6 gpm	
C		1.0	0.0	65.2	0.0				
Pipe: 3									
C		1.0	0.0	65.2	0.0	183.6	4.260	PL 11.50	PF 0.1
1		12.5	0.0	60.1	0.0	4.1	120	FTG ----	PE -5.0
							0.009	TL 11.50	PV
Pipe: 4									
1		12.5	0.0	60.1	0.0	183.6	4.260	PL 9.00	PF 0.2
2		12.5	0.0	59.9	0.0	4.1	120	FTG E	PE 0.0
							0.009	TL 22.20	PV
Pipe: 5									
2		12.5	0.0	59.9	0.0	183.6	4.260	PL 74.00	PF 0.9
3		12.5	0.0	59.1	0.0	4.1	120	FTG T	PE 0.0
							0.009	TL 100.40	PV
Pipe: 6									
3		12.5	0.0	59.1	0.0	183.6	4.260	PL 106.00	PF 1.6
4		12.5	0.0	57.5	0.0	4.1	120	FTG 6E	PE 0.0
							0.009	TL 185.20	PV
Pipe: 7									
4		12.5	0.0	57.5	0.0	183.6	3.260	PL 53.50	PF 2.9
5		27.5	0.0	48.1	0.0	7.1	120	FTG 2ET	PE -6.5
							0.031	TL 92.50	PV
Pipe: 8									
5		27.5	0.0	48.1	0.0	183.6	3.260	PL 8.00	PF 0.3
6		27.5	0.0	47.8	0.0	7.1	120	FTG ----	PE 0.0
							0.031	TL 8.00	PV
Pipe: 9									
6		27.5	0.0	47.8	0.0	183.6	3.260	PL 8.00	PF 0.3
7		27.5	0.0	47.6	0.0	7.1	120	FTG ----	PE 0.0
							0.031	TL 8.00	PV
Pipe: 10									
7		27.5	0.0	47.6	0.0	183.6	3.260	PL 8.00	PF 0.3
8		27.5	0.0	47.3	0.0	7.1	120	FTG ----	PE 0.0
							0.031	TL 8.00	PV
Pipe: 11									
8		27.5	0.0	47.3	0.0	183.6	3.260	PL 9.50	PF 0.3
9		27.5	0.0	47.0	0.0	7.1	120	FTG ----	PE 0.0
							0.031	TL 9.50	PV
Pipe: 12									
9		27.5	0.0	47.0	0.0	183.6	3.260	PL 9.00	PF 0.3
10		27.5	0.0	46.8	0.0	7.1	120	FTG ----	PE 0.0
							0.031	TL 9.00	PV
Pipe: 14									
10		27.5	0.0	46.8	0.0	183.6	2.635	PL 0.50	PF 1.5
12		28.0	0.0	45.0	0.0	10.8	120	FTG T	PE -0.2
							0.089	TL 17.00	PV

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 JOB TITLE: REMOTE AREA #3 - PLATFORM

PIPE TAG	END	ELEV.	NOZ.	PT	DISC.	Q(GPM)	DIA(IN)	LENGTH	PRESS.		
NODES	(FT)	(K)	(PSI)	(GPM)	VEL(FPS)	HW(C)	FL/FT	(FT)	SUM.	(PSI)	
Pipe: 20						183.6	2.635	PL	9.50	PF	2.3
12	28.0	0.0	45.0	0.0	10.8	120	FTG	T	PE	0.0	
206	28.0	0.0	42.7	0.0		0.089	TL	26.00	PV		
Pipe: 21						183.6	2.635	PL	6.50	PF	0.6
206	28.0	0.0	42.7	0.0	10.8	120	FTG	----	PE	0.0	
13	28.0	0.0	42.2	0.0		0.089	TL	6.50	PV		
Pipe: 22						183.6	2.104	PL	13.00	PF	4.9
13	28.0	0.0	42.2	0.0	16.9	120	FTG	E	PE	5.6	
14	15.0	0.0	42.9	0.0		0.265	TL	18.60	PV		
Pipe: 23						183.6	2.104	PL	2.50	PF	3.6
14	15.0	0.0	42.9	0.0	16.9	120	FTG	T	PE	0.0	
15	15.0	0.0	39.2	0.0		0.265	TL	13.70	PV		
Pipe: 24						118.4	1.639	PL	3.50	PF	1.4
15	15.0	0.0	39.2	0.0	18.0	120	FTG	----	PE	0.0	
301	15.0	5.6	37.8	34.4		0.397	TL	3.50	PV		
Pipe: 25						83.9	1.408	PL	14.00	PF	6.2
301	15.0	5.6	37.8	34.4	17.3	120	FTG	----	PE	0.0	
302	15.0	5.6	31.7	31.5		0.441	TL	14.00	PV		
Pipe: 26						52.4	1.080	PL	14.00	PF	9.4
302	15.0	5.6	31.7	31.5	18.4	120	FTG	----	PE	0.0	
303	15.0	5.6	22.3	26.4		0.671	TL	14.00	PV		
Pipe: 27						65.2	1.639	PL	12.50	PF	3.4
15	15.0	0.0	39.2	0.0	9.9	120	FTG	ET	PE	0.0	
304	15.0	5.6	35.8	33.5		0.132	TL	26.00	PV		
Pipe: 28						26.0	1.408	PL	14.00	PF	0.7
303	15.0	5.6	22.3	26.4	5.4	120	FTG	----	PE	0.0	
305	15.0	5.6	21.6	26.0		0.050	TL	14.00	PV		
Pipe: 29						31.7	1.080	PL	14.00	PF	3.7
304	15.0	5.6	35.8	33.5	11.1	120	FTG	----	PE	0.0	
306	15.0	5.6	32.1	31.7		0.265	TL	14.00	PV		

NOTES (HASS):

(1) Calculations were performed by the HASS 8.0 computer program under license no. 50010207 granted by
 HRS Systems, Inc.
 208 South Public Square
 Petersburg, TN 37144

(2) The system has been calculated to provide an average imbalance at each node of 0.002 gpm and a maximum imbalance at any node of 0.057 gpm.

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 JOB TITLE: REMOTE AREA #3 - PLATFORM

(3) Total pressure at each node is used in balancing the system.
 Maximum water velocity is 18.4 ft/sec at pipe 26.

(4) PIPE FITTINGS TABLE

Pipe Table Name: ALB.PIP

PAGE: A MATERIAL: S40-TW HWC: 120

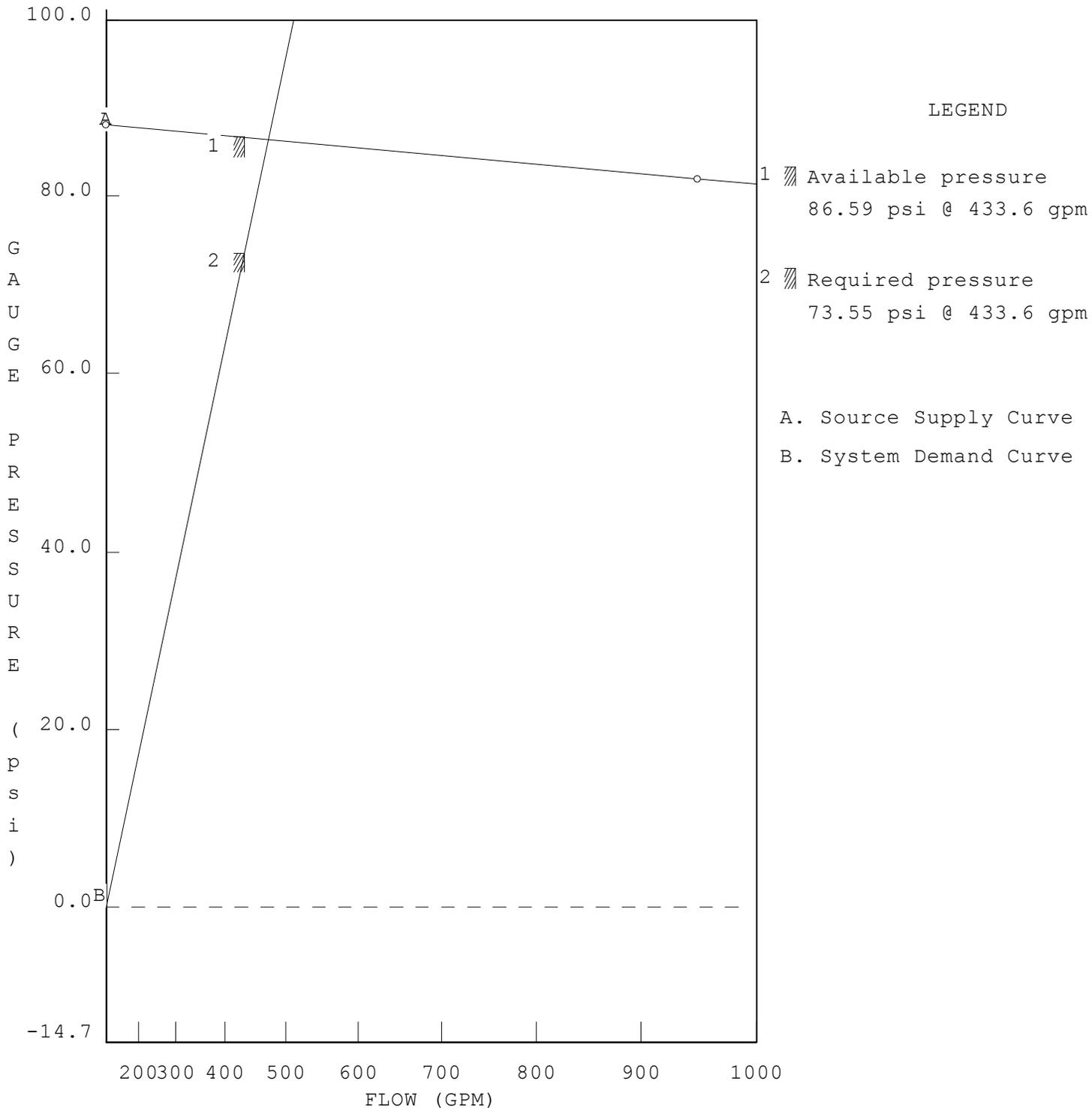
Diameter (in)	Equivalent Fitting Lengths in Feet							
	E	T	L	C	B	G	A	D
	Ell	Tee	LngEl	ChkVl	BfyVl	GatVl	AlmCk	DPVlv
1.080	2.40	6.00	2.40	5.00	6.00	1.00	10.00	10.00
1.408	3.40	8.00	2.30	7.00	6.00	1.00	10.00	10.00
1.639	4.50	9.00	2.30	9.00	6.00	1.00	10.00	10.00
2.104	5.60	11.20	3.40	11.00	6.00	1.00	10.00	10.00
2.635	8.20	16.50	5.50	19.20	9.60	1.40	6.70	14.00
3.260	9.40	20.20	6.70	21.50	13.40	1.40	20.60	13.00
4.260	13.20	26.40	7.90	22.00	12.00	2.60	40.30	13.00

PAGE: D MATERIAL: DIRON HWC: 140

Diameter (in)	Equivalent Fitting Lengths in Feet					
	E	T	L	C	B	G
	Ell	Tee	LngEl	ChkVl	BfyVl	GatVl
4.280	18.00	36.00	11.00	39.00	22.00	4.00

WATER SUPPLY ANALYSIS

Static: 88.00 psi Resid: 82.00 psi Flow: 950.0 gpm



DATE: 3/6/2010 G:\DFCM PROJECTS\TAYLORSVILLE SCHOOL FOR THE DEAF\RA4.SDF
 JOB TITLE: REMOTE AREA #4 - CONFERENCE ROOM

WATER SUPPLY DATA

SOURCE NODE TAG	STATIC PRESS. (PSI)	RESID. PRESS. (PSI)	FLOW @ (GPM)	AVAIL. PRESS. (PSI)	TOTAL @ DEMAND (GPM)	REQ'D PRESS. (PSI)
A	88.0	82.0	950.0	87.6	217.8	36.9

Required pressure is 50.7 psi (58%) less than available pressure.

AGGREGATE FLOW ANALYSIS:

TOTAL FLOW AT SOURCE	217.8 GPM
TOTAL HOSE STREAM ALLOWANCE AT SOURCE	100.0 GPM
OTHER HOSE STREAM ALLOWANCES	0.0 GPM
TOTAL DISCHARGE FROM ACTIVE SPRINKLERS	117.8 GPM

NODE ANALYSIS DATA

NODE TAG	ELEVATION (FT)	NODE TYPE	PRESSURE (PSI)	DISCHARGE (GPM)	AREA (FT^2)	DENSITY	
						REQ.	ACT.
A	-5.0	SOURCE	36.9	117.8	- - -	- - -	- - -
B	1.0	- - - -	33.9	- - -	- - -	- - -	- - -
C	1.0	- - - -	28.9	- - -	- - -	- - -	- - -
1	12.5	- - - -	23.9	- - -	- - -	- - -	- - -
2	12.5	- - - -	23.8	- - -	- - -	- - -	- - -
3	12.5	- - - -	23.4	- - -	- - -	- - -	- - -
19	12.5	- - - -	23.2	- - -	- - -	- - -	- - -
20	12.5	- - - -	23.1	- - -	- - -	- - -	- - -
21	12.5	- - - -	22.5	- - -	- - -	- - -	- - -
22	12.5	- - - -	21.8	- - -	- - -	- - -	- - -
23	12.5	- - - -	21.4	- - -	- - -	- - -	- - -
24	12.5	- - - -	21.0	- - -	- - -	- - -	- - -
25	12.5	- - - -	20.5	- - -	- - -	- - -	- - -
26	12.5	- - - -	23.0	- - -	- - -	- - -	- - -
27	12.5	- - - -	19.8	- - -	- - -	- - -	- - -
28	12.5	- - - -	17.8	- - -	- - -	- - -	- - -
29	12.5	- - - -	15.5	- - -	- - -	- - -	- - -
30	12.5	- - - -	14.0	- - -	- - -	- - -	- - -
31	12.5	- - - -	12.7	- - -	- - -	- - -	- - -
32	12.5	- - - -	9.8	- - -	- - -	- - -	- - -
33	12.5	- - - -	12.1	- - -	- - -	- - -	- - -
401	9.0	K= 5.37	14.5	20.5	144.0	0.100	0.142
402	9.0	K= 5.37	13.2	19.5	144.0	0.100	0.136
403	9.0	K= 5.37	10.2	17.1	144.0	0.100	0.119
404	11.5	K= 5.43	7.0	14.4	144.0	0.100	0.100
405	9.0	K= 5.37	7.6	14.8	144.0	0.100	0.103
406	9.0	K= 5.37	9.0	16.1	144.0	0.100	0.112
407	9.0	K= 5.37	8.2	15.3	144.0	0.100	0.106

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 JOB TITLE: REMOTE AREA #4 - CONFERENCE ROOM

PIPE DATA

PIPE TAG	END	ELEV.	NOZ.	PT	DISC.	Q (GPM)	DIA (IN)	LENGTH	PRESS.
	NODES	(FT)	(K)	(PSI)	(GPM)	VEL (FPS)	HW (C)	(FT)	SUM.
							FL/FT		(PSI)
	Pipe: 1					117.8	4.280	PL 60.00	PF 0.3
A		-5.0	SRCE	36.9	(N/A)	2.6	140	FTG ETG	PE -2.6
B		1.0	0.0	33.9	0.0		0.003	TL 118.00	PV
	Pipe: 2							FIXED PRESSURE LOSS DEVICE	
B		1.0	0.0	33.9	0.0		5.0 psi,	117.7 gpm	
C		1.0	0.0	28.9	0.0				
	Pipe: 3					117.7	4.260	PL 11.50	PF 0.0
C		1.0	0.0	28.9	0.0	2.7	120	FTG ----	PE -5.0
1		12.5	0.0	23.9	0.0		0.004	TL 11.50	PV
	Pipe: 4					117.7	4.260	PL 9.00	PF 0.1
1		12.5	0.0	23.9	0.0	2.7	120	FTG E	PE 0.0
2		12.5	0.0	23.8	0.0		0.004	TL 22.20	PV
	Pipe: 5					117.7	4.260	PL 74.00	PF 0.4
2		12.5	0.0	23.8	0.0	2.7	120	FTG T	PE 0.0
3		12.5	0.0	23.4	0.0		0.004	TL 100.40	PV
	Pipe: 6					117.7	4.260	PL 31.00	PF 0.2
3		12.5	0.0	23.4	0.0	2.7	120	FTG T	PE 0.0
19		12.5	0.0	23.2	0.0		0.004	TL 57.40	PV
	Pipe: 7					77.7	2.635	PL 15.00	PF 0.3
19		12.5	0.0	23.2	0.0	4.6	120	FTG ----	PE 0.0
26		12.5	0.0	23.0	0.0		0.018	TL 15.00	PV
	Pipe: 8					40.0	2.635	PL 8.50	PF 0.1
19		12.5	0.0	23.2	0.0	2.4	120	FTG T	PE 0.0
20		12.5	0.0	23.1	0.0		0.005	TL 25.00	PV
	Pipe: 9					40.0	1.639	PL 10.50	PF 0.6
20		12.5	0.0	23.1	0.0	6.1	120	FTG ----	PE 0.0
21		12.5	0.0	22.5	0.0		0.053	TL 10.50	PV
	Pipe: 10					40.0	1.639	PL 13.00	PF 0.7
21		12.5	0.0	22.5	0.0	6.1	120	FTG ----	PE 0.0
22		12.5	0.0	21.8	0.0		0.053	TL 13.00	PV
	Pipe: 11					40.0	1.639	PL 8.00	PF 0.4
22		12.5	0.0	21.8	0.0	6.1	120	FTG ----	PE 0.0
23		12.5	0.0	21.4	0.0		0.053	TL 8.00	PV
	Pipe: 12					40.0	1.639	PL 7.00	PF 0.4
23		12.5	0.0	21.4	0.0	6.1	120	FTG ----	PE 0.0
24		12.5	0.0	21.0	0.0		0.053	TL 7.00	PV
	Pipe: 13					40.0	1.408	PL 5.00	PF 0.6
24		12.5	0.0	21.0	0.0	8.2	120	FTG ----	PE 0.0
25		12.5	0.0	20.5	0.0		0.112	TL 5.00	PV

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 JOB TITLE: REMOTE AREA #4 - CONFERENCE ROOM

PIPE TAG	END	ELEV.	NOZ.	PT	DISC.	Q (GPM)	DIA (IN)	LENGTH	PRESS.	
NODES	(FT)	(K)	(PSI)	(GPM)	VEL (FPS)	HW (C)	FL/FT	(FT)	SUM.	(PSI)
Pipe: 14					40.0	1.080	PL	10.00	PF	7.5
25	12.5	0.0	20.5	0.0	14.0	120	FTG	ET	PE	1.5
401	9.0	5.4	14.5	20.5		0.407	TL	18.40	PV	
Pipe: 15					19.5	1.080	PL	12.00	PF	1.3
401	9.0	5.4	14.5	20.5	6.8	120	FTG	----	PE	0.0
402	9.0	5.4	13.2	19.5		0.108	TL	12.00	PV	
Pipe: 16					77.7	1.639	PL	8.50	PF	3.2
26	12.5	0.0	23.0	0.0	11.8	120	FTG	T	PE	0.0
27	12.5	0.0	19.8	0.0		0.183	TL	17.50	PV	
Pipe: 17					77.7	1.639	PL	11.00	PF	2.0
27	12.5	0.0	19.8	0.0	11.8	120	FTG	----	PE	0.0
28	12.5	0.0	17.8	0.0		0.183	TL	11.00	PV	
Pipe: 18					77.7	1.639	PL	12.50	PF	2.3
28	12.5	0.0	17.8	0.0	11.8	120	FTG	----	PE	0.0
29	12.5	0.0	15.5	0.0		0.183	TL	12.50	PV	
Pipe: 19					77.7	1.639	PL	8.00	PF	1.5
29	12.5	0.0	15.5	0.0	11.8	120	FTG	----	PE	0.0
30	12.5	0.0	14.0	0.0		0.183	TL	8.00	PV	
Pipe: 20					77.7	1.639	PL	7.00	PF	1.3
30	12.5	0.0	14.0	0.0	11.8	120	FTG	----	PE	0.0
31	12.5	0.0	12.7	0.0		0.183	TL	7.00	PV	
Pipe: 21					46.3	1.408	PL	8.50	PF	2.9
31	12.5	0.0	12.7	0.0	9.5	120	FTG	ET	PE	0.0
32	12.5	0.0	9.8	0.0		0.147	TL	19.90	PV	
Pipe: 22					46.3	1.408	PL	8.00	PF	1.2
32	12.5	0.0	9.8	0.0	9.5	120	FTG	----	PE	1.5
403	9.0	5.4	10.2	17.1		0.147	TL	8.00	PV	
Pipe: 23					29.2	1.080	PL	9.00	PF	2.0
403	9.0	5.4	10.2	17.1	10.2	120	FTG	----	PE	-1.1
404	11.5	5.4	7.0	14.4		0.227	TL	9.00	PV	
Pipe: 24					14.8	1.080	PL	8.00	PF	0.5
404	11.5	5.4	7.0	14.4	5.2	120	FTG	----	PE	1.1
405	9.0	5.4	7.6	14.8		0.065	TL	8.00	PV	
Pipe: 25					31.4	1.408	PL	0.50	PF	0.6
31	12.5	0.0	12.7	0.0	6.5	120	FTG	T	PE	0.0
33	12.5	0.0	12.1	0.0		0.072	TL	8.50	PV	
Pipe: 26					31.4	1.080	PL	15.50	PF	4.7
33	12.5	0.0	12.1	0.0	11.0	120	FTG	E	PE	1.5
406	9.0	5.4	9.0	16.1		0.261	TL	17.90	PV	

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 JOB TITLE: REMOTE AREA #4 - CONFERENCE ROOM

PIPE TAG	Q(GPM)	DIA(IN)	LENGTH	PRESS.
END ELEV. NOZ. PT DISC. VEL(FPS) HW(C) (FT) SUM.				
NODES (FT) (K) (PSI) (GPM) FL/FT (PSI)				
Pipe: 27	15.3	1.080	PL 12.00	PF 0.8
406 9.0 5.4 9.0 16.1 5.4 120 FTG			----	PE 0.0
407 9.0 5.4 8.2 15.3		0.069	TL 12.00	PV

NOTES (HASS):

- (1) Calculations were performed by the HASS 8.0 computer program under license no. 50010207 granted by HRS Systems, Inc. 208 South Public Square Petersburg, TN 37144
- (2) The system has been calculated to provide an average imbalance at each node of 0.005 gpm and a maximum imbalance at any node of 0.118 gpm.
- (3) Total pressure at each node is used in balancing the system. Maximum water velocity is 14.0 ft/sec at pipe 14.

(4) PIPE FITTINGS TABLE

Pipe Table Name: ALB.PIP

PAGE: A MATERIAL: S40-TW HWC: 120

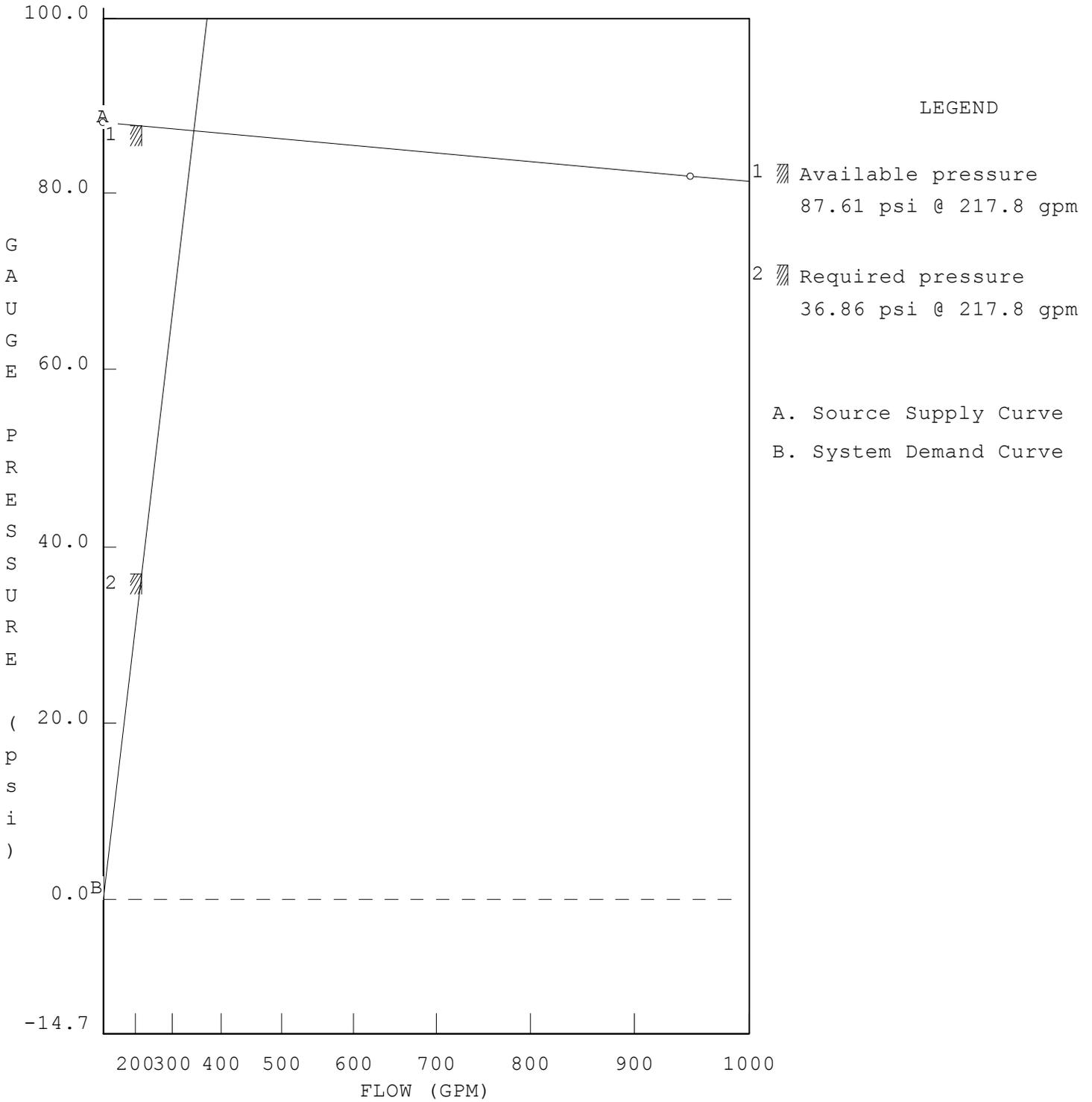
Diameter (in)	Equivalent Fitting Lengths in Feet							
	E	T	L	C	B	G	A	D
	Ell	Tee	LngEl	ChkVl	BfyVl	GatVl	AlmCk	DPVlv
1.080	2.40	6.00	2.40	5.00	6.00	1.00	10.00	10.00
1.408	3.40	8.00	2.30	7.00	6.00	1.00	10.00	10.00
1.639	4.50	9.00	2.30	9.00	6.00	1.00	10.00	10.00
2.635	8.20	16.50	5.50	19.20	9.60	1.40	6.70	14.00
4.260	13.20	26.40	7.90	22.00	12.00	2.60	40.30	13.00

PAGE: D MATERIAL: DIRON HWC: 140

Diameter (in)	Equivalent Fitting Lengths in Feet						
	E	T	L	C	B	G	
	Ell	Tee	LngEl	ChkVl	BfyVl	GatVl	
4.280	18.00	36.00	11.00	39.00	22.00	4.00	

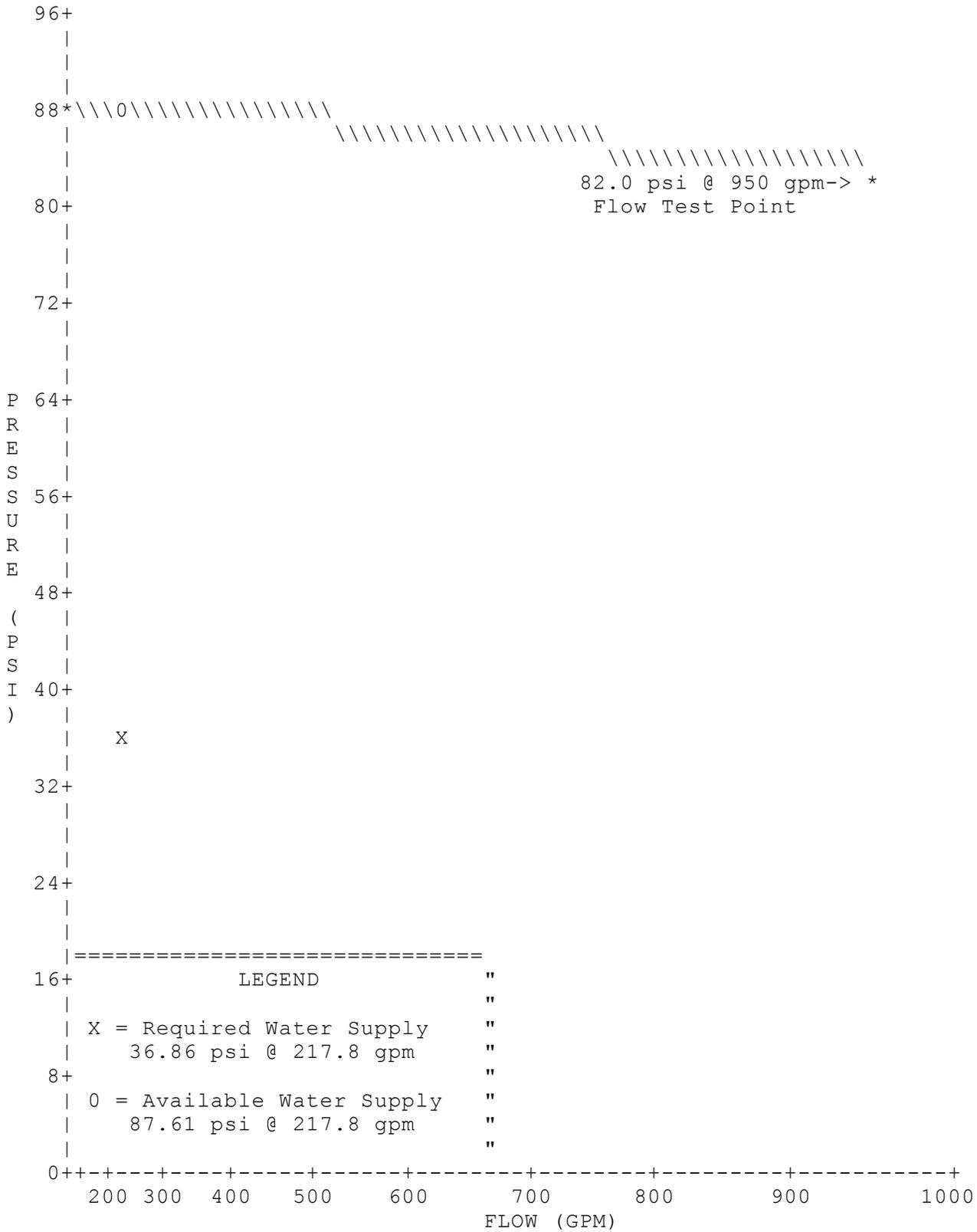
WATER SUPPLY ANALYSIS

Static: 88.00 psi Resid: 82.00 psi Flow: 950.0 gpm



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WATER SUPPLY CURVE



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 JOB TITLE: REMOTE AREA #5 - LECTURE HALL

WATER SUPPLY DATA

SOURCE NODE TAG	STATIC PRESS. (PSI)	RESID. PRESS. (PSI)	FLOW @ (GPM)	AVAIL. PRESS. (PSI)	TOTAL @ DEMAND (GPM)	REQ'D PRESS. (PSI)
A	88.0	82.0	950.0	87.1	331.2	71.0

Required pressure is 16.2 psi (19%) less than available pressure.

AGGREGATE FLOW ANALYSIS:

TOTAL FLOW AT SOURCE	331.2 GPM
TOTAL HOSE STREAM ALLOWANCE AT SOURCE	100.0 GPM
OTHER HOSE STREAM ALLOWANCES	0.0 GPM
TOTAL DISCHARGE FROM ACTIVE SPRINKLERS	231.2 GPM

NODE ANALYSIS DATA

NODE TAG	ELEVATION (FT)	NODE TYPE	PRESSURE (PSI)	DISCHARGE (GPM)	AREA (FT^2)	DENSITY	
						REQ.	ACT.
A	-5.0	SOURCE	71.0	231.2	- - -	- - -	- - -
B	1.0	- - - -	67.2	- - -	- - -	- - -	- - -
C	1.0	- - - -	62.2	- - -	- - -	- - -	- - -
1	12.5	- - - -	57.1	- - -	- - -	- - -	- - -
2	12.5	- - - -	56.8	- - -	- - -	- - -	- - -
3	12.5	- - - -	55.5	- - -	- - -	- - -	- - -
19	12.5	- - - -	54.7	- - -	- - -	- - -	- - -
26	12.5	- - - -	52.7	- - -	- - -	- - -	- - -
34	12.5	- - - -	52.0	- - -	- - -	- - -	- - -
35	12.5	- - - -	44.7	- - -	- - -	- - -	- - -
36	12.5	- - - -	43.6	- - -	- - -	- - -	- - -
37	12.5	- - - -	38.0	- - -	- - -	- - -	- - -
38	12.5	- - - -	39.8	- - -	- - -	- - -	- - -
39	12.5	- - - -	34.6	- - -	- - -	- - -	- - -
40	12.5	- - - -	32.9	- - -	- - -	- - -	- - -
41	12.5	- - - -	44.5	- - -	- - -	- - -	- - -
42	12.5	- - - -	41.9	- - -	- - -	- - -	- - -
43	12.5	- - - -	41.5	- - -	- - -	- - -	- - -
44	12.5	- - - -	39.8	- - -	- - -	- - -	- - -
45	12.5	- - - -	39.6	- - -	- - -	- - -	- - -
46	12.5	- - - -	39.3	- - -	- - -	- - -	- - -
47	12.5	- - - -	39.3	- - -	- - -	- - -	- - -
48	16.5	- - - -	23.3	- - -	- - -	- - -	- - -
49	16.5	- - - -	21.2	- - -	- - -	- - -	- - -
50	16.5	- - - -	20.7	- - -	- - -	- - -	- - -
51	16.5	- - - -	21.3	- - -	- - -	- - -	- - -
52	16.5	- - - -	18.7	- - -	- - -	- - -	- - -
53	16.5	- - - -	13.5	- - -	- - -	- - -	- - -
54	16.5	- - - -	15.8	- - -	- - -	- - -	- - -
55	16.5	- - - -	13.9	- - -	- - -	- - -	- - -
56	16.5	- - - -	9.8	- - -	- - -	- - -	- - -
57	16.5	- - - -	12.1	- - -	- - -	- - -	- - -
58	16.5	- - - -	11.4	- - -	- - -	- - -	- - -

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 JOB TITLE: REMOTE AREA #5 - LECTURE HALL

NODE ANALYSIS DATA

NODE	TAG	ELEVATION (FT)	NODE TYPE	PRESSURE (PSI)	DISCHARGE (GPM)	AREA (FT^2)	DENSITY	
							REQ.	ACT.
							(GPM/FT^2)	(GPM/FT^2)
59		16.5	- - - -	11.3	- - -	- - -	- - -	- - -
60		16.5	- - - -	9.8	- - -	- - -	- - -	- - -
501		15.0	K= 5.42	17.5	22.7	182.0	0.100	0.124
502		15.0	K= 5.42	19.8	24.1	130.0	0.100	0.186
503		15.0	K= 5.42	17.8	22.8	169.0	0.100	0.135
504		15.0	K= 5.42	13.1	19.6	130.0	0.100	0.151
505		15.0	K= 5.42	12.7	19.3	162.5	0.100	0.119
506		15.0	K= 5.42	13.5	19.9	196.0	0.100	0.102
507		15.0	K= 5.42	9.5	16.7	140.0	0.100	0.120
508		15.0	K= 5.42	9.4	16.6	162.5	0.100	0.102
509		15.0	K= 5.42	11.0	18.0	112.0	0.100	0.161
510		15.0	K= 5.42	11.1	18.0	81.0	0.100	0.223
511		15.0	K= 5.42	9.6	16.8	168.0	0.100	0.100
512		15.0	K= 5.42	9.3	16.6	112.0	0.100	0.148
701		12.5	- - - -	40.4	- - -	- - -	- - -	- - -
702		12.5	- - - -	40.2	- - -	- - -	- - -	- - -
703		12.5	- - - -	40.0	- - -	- - -	- - -	- - -
704		12.5	- - - -	40.4	- - -	- - -	- - -	- - -
705		12.5	- - - -	40.3	- - -	- - -	- - -	- - -
706		12.5	- - - -	40.2	- - -	- - -	- - -	- - -

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 JOB TITLE: REMOTE AREA #5 - LECTURE HALL

PIPE DATA

PIPE TAG	END	ELEV.	NOZ.	PT	DISC.	Q (GPM)	DIA (IN)	LENGTH	PRESS.	
	NODES	(FT)	(K)	(PSI)	(GPM)	VEL (FPS)	HW (C)	(FT)	SUM.	
							FL/FT		(PSI)	
	Pipe: 1					231.2	4.280	PL	60.00	PF 1.1
A		-5.0	SRCE	71.0	(N/A)	5.2	140	FTG	ETG	PE -2.6
B		1.0	0.0	67.2	0.0		0.010	TL	118.00	PV
	Pipe: 2									FIXED PRESSURE LOSS DEVICE
B		1.0	0.0	67.2	0.0		5.0 psi,		231.3 gpm	
C		1.0	0.0	62.2	0.0					
	Pipe: 3					231.3	4.260	PL	11.50	PF 0.2
C		1.0	0.0	62.2	0.0	5.2	120	FTG	----	PE -5.0
1		12.5	0.0	57.1	0.0		0.013	TL	11.50	PV
	Pipe: 4					231.3	4.260	PL	9.00	PF 0.3
1		12.5	0.0	57.1	0.0	5.2	120	FTG	E	PE 0.0
2		12.5	0.0	56.8	0.0		0.013	TL	22.20	PV
	Pipe: 5					231.3	4.260	PL	74.00	PF 1.3
2		12.5	0.0	56.8	0.0	5.2	120	FTG	T	PE 0.0
3		12.5	0.0	55.5	0.0		0.013	TL	100.40	PV
	Pipe: 6					231.3	4.260	PL	31.00	PF 0.8
3		12.5	0.0	55.5	0.0	5.2	120	FTG	T	PE 0.0
19		12.5	0.0	54.7	0.0		0.013	TL	57.40	PV
	Pipe: 7					231.3	2.635	PL	15.00	PF 2.0
19		12.5	0.0	54.7	0.0	13.6	120	FTG	----	PE 0.0
26		12.5	0.0	52.7	0.0		0.136	TL	15.00	PV
	Pipe: 8					231.3	2.635	PL	5.00	PF 0.7
26		12.5	0.0	52.7	0.0	13.6	120	FTG	----	PE 0.0
34		12.5	0.0	52.0	0.0		0.136	TL	5.00	PV
	Pipe: 9					115.0	2.104	PL	43.00	PF 7.3
34		12.5	0.0	52.0	0.0	10.6	120	FTG	2ET	PE 0.0
35		12.5	0.0	44.7	0.0		0.112	TL	65.40	PV
	Pipe: 10					67.8	1.639	PL	8.00	PF 1.1
35		12.5	0.0	44.7	0.0	10.3	120	FTG	----	PE 0.0
36		12.5	0.0	43.6	0.0		0.142	TL	8.00	PV
	Pipe: 11					47.2	1.639	PL	70.50	PF 6.8
35		12.5	0.0	44.7	0.0	7.2	120	FTG	E2T	PE 0.0
37		12.5	0.0	38.0	0.0		0.073	TL	93.00	PV
	Pipe: 12					-67.8	1.639	PL	4.00	PF 1.8
37		12.5	0.0	38.0	0.0	10.3	120	FTG	T	PE 0.0
38		12.5	0.0	39.8	0.0		0.142	TL	13.00	PV
	Pipe: 13					36.3	1.639	PL	66.50	PF 3.8
36		12.5	0.0	43.6	0.0	5.5	120	FTG	2T	PE 0.0
38		12.5	0.0	39.8	0.0		0.045	TL	84.50	PV

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 JOB TITLE: REMOTE AREA #5 - LECTURE HALL

PIPE TAG	END	ELEV.	NOZ.	PT	DISC.	Q (GPM)	DIA (IN)	LENGTH	PRESS.	
NODES	(FT)	(K)	(PSI)	(GPM)	VEL (FPS)	HW (C)	FL/FT	(FT)	SUM.	(PSI)
Pipe: 14					31.4	1.639	PL	83.50	PF	3.8
36	12.5	0.0	43.6	0.0	4.8	120	FTG	2E2T	PE	0.0
38	12.5	0.0	39.8	0.0		0.034	TL	110.50	PV	
Pipe: 15					115.0	2.104	PL	7.50	PF	3.3
37	12.5	0.0	38.0	0.0	10.6	120	FTG	2T	PE	0.0
39	12.5	0.0	34.6	0.0		0.112	TL	29.90	PV	
Pipe: 16					115.0	2.104	PL	4.50	PF	1.8
39	12.5	0.0	34.6	0.0	10.6	120	FTG	T	PE	0.0
40	12.5	0.0	32.9	0.0		0.112	TL	15.70	PV	
Pipe: 17					116.2	2.104	PL	49.00	PF	7.5
34	12.5	0.0	52.0	0.0	10.7	120	FTG	ET	PE	0.0
41	12.5	0.0	44.5	0.0		0.114	TL	65.80	PV	
Pipe: 18					72.8	1.639	PL	7.00	PF	2.6
41	12.5	0.0	44.5	0.0	11.1	120	FTG	T	PE	0.0
42	12.5	0.0	41.9	0.0		0.162	TL	16.00	PV	
Pipe: 19					44.1	1.639	PL	7.50	PF	0.5
42	12.5	0.0	41.9	0.0	6.7	120	FTG	----	PE	0.0
43	12.5	0.0	41.5	0.0		0.064	TL	7.50	PV	
Pipe: 20					19.8	1.639	PL	57.50	PF	1.0
43	12.5	0.0	41.5	0.0	3.0	120	FTG	3E	PE	0.0
704	12.5	0.0	40.4	0.0		0.014	TL	71.00	PV	
Pipe: 21					19.8	1.639	PL	8.00	PF	0.1
704	12.5	0.0	40.4	0.0	3.0	120	FTG	----	PE	0.0
705	12.5	0.0	40.3	0.0		0.014	TL	8.00	PV	
Pipe: 22					19.8	1.639	PL	8.00	PF	0.1
705	12.5	0.0	40.3	0.0	3.0	120	FTG	----	PE	0.0
706	12.5	0.0	40.2	0.0		0.014	TL	8.00	PV	
Pipe: 23					19.8	1.639	PL	16.00	PF	0.4
706	12.5	0.0	40.2	0.0	3.0	120	FTG	ET	PE	0.0
44	12.5	0.0	39.8	0.0		0.014	TL	29.50	PV	
Pipe: 24					24.3	1.639	PL	43.50	PF	1.1
43	12.5	0.0	41.5	0.0	3.7	120	FTG	T	PE	0.0
701	12.5	0.0	40.4	0.0		0.021	TL	52.50	PV	
Pipe: 25					24.3	1.639	PL	8.00	PF	0.2
701	12.5	0.0	40.4	0.0	3.7	120	FTG	----	PE	0.0
702	12.5	0.0	40.2	0.0		0.021	TL	8.00	PV	
Pipe: 26					24.3	1.639	PL	8.00	PF	0.2
702	12.5	0.0	40.2	0.0	3.7	120	FTG	----	PE	0.0
703	12.5	0.0	40.0	0.0		0.021	TL	8.00	PV	

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PIPE TAG	END	ELEV.	NOZ.	PT	DISC.	Q (GPM)	DIA (IN)	LENGTH	PRESS.		
NODES	(FT)	(K)	(PSI)	(GPM)	VEL (FPS)	HW (C)	FL/FT	(FT)	SUM.	(PSI)	
	Pipe: 27					24.3	1.639	PL	2.00	PF	0.2
703	12.5	0.0	40.0	0.0	3.7	120	FTG	T	PE	0.0	
44	12.5	0.0	39.8	0.0		0.021	TL	11.00	PV		
	Pipe: 28					28.8	1.639	PL	61.50	PF	2.3
42	12.5	0.0	41.9	0.0	4.4	120	FTG	2T	PE	0.0	
45	12.5	0.0	39.6	0.0		0.029	TL	79.50	PV		
	Pipe: 29					43.4	1.639	PL	62.50	PF	5.3
41	12.5	0.0	44.5	0.0	6.6	120	FTG	E2T	PE	0.0	
47	12.5	0.0	39.3	0.0		0.062	TL	85.00	PV		
	Pipe: 30					44.1	2.104	PL	7.50	PF	0.1
44	12.5	0.0	39.8	0.0	4.1	120	FTG	----	PE	0.0	
45	12.5	0.0	39.6	0.0		0.019	TL	7.50	PV		
	Pipe: 31					72.8	2.104	PL	6.50	PF	0.3
45	12.5	0.0	39.6	0.0	6.7	120	FTG	----	PE	0.0	
46	12.5	0.0	39.3	0.0		0.048	TL	6.50	PV		
	Pipe: 32					72.8	2.104	PL	1.50	PF	0.1
46	12.5	0.0	39.3	0.0	6.7	120	FTG	----	PE	0.0	
47	12.5	0.0	39.3	0.0		0.048	TL	1.50	PV		
	Pipe: 33					116.2	2.104	PL	56.00	PF	6.4
47	12.5	0.0	39.3	0.0	10.7	120	FTG	----	PE	0.0	
40	12.5	0.0	32.9	0.0		0.114	TL	56.00	PV		
	Pipe: 34					231.3	2.635	PL	16.50	PF	7.8
40	12.5	0.0	32.9	0.0	13.6	120	FTG	3ET	PE	-1.7	
48	16.5	0.0	23.3	0.0		0.136	TL	57.60	PV		
	Pipe: 35					46.8	1.408	PL	6.00	PF	2.1
48	16.5	0.0	23.3	0.0	9.6	120	FTG	T	PE	0.0	
49	16.5	0.0	21.2	0.0		0.149	TL	14.00	PV		
	Pipe: 36					22.7	1.080	PL	13.00	PF	4.4
49	16.5	0.0	21.2	0.0	7.9	120	FTG	5ET	PE	0.6	
501	15.0	5.4	17.5	22.7		0.142	TL	31.00	PV		
	Pipe: 37					24.1	1.408	PL	13.00	PF	0.6
49	16.5	0.0	21.2	0.0	5.0	120	FTG	----	PE	0.0	
50	16.5	0.0	20.7	0.0		0.044	TL	13.00	PV		
	Pipe: 38					24.1	1.080	PL	1.00	PF	1.5
50	16.5	0.0	20.7	0.0	8.4	120	FTG	ET	PE	0.6	
502	15.0	5.4	19.8	24.1		0.160	TL	9.40	PV		
	Pipe: 39					184.5	2.104	PL	7.50	PF	2.0
48	16.5	0.0	23.3	0.0	17.0	120	FTG	----	PE	0.0	
51	16.5	0.0	21.3	0.0		0.268	TL	7.50	PV		

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 JOB TITLE: REMOTE AREA #5 - LECTURE HALL

PIPE TAG	END	ELEV.	NOZ.	PT	DISC.	Q (GPM)	DIA (IN)	LENGTH	PRESS.	
NODES	(FT)	(K)	(PSI)	(GPM)	VEL (FPS)	HW (C)	FL/FT	(FT)	SUM.	(PSI)
Pipe: 40					61.8	1.408	PL	2.50	PF	2.6
51	16.5	0.0	21.3	0.0	12.7	120	FTG	T	PE	0.0
52	16.5	0.0	18.7	0.0		0.250	TL	10.50	PV	
Pipe: 41					22.8	1.080	PL	2.50	PF	1.6
52	16.5	0.0	18.7	0.0	8.0	120	FTG	ET	PE	0.6
503	15.0	5.4	17.8	22.8		0.144	TL	10.90	PV	
Pipe: 42					39.0	1.080	PL	13.50	PF	5.2
52	16.5	0.0	18.7	0.0	13.6	120	FTG	----	PE	0.0
53	16.5	0.0	13.5	0.0		0.388	TL	13.50	PV	
Pipe: 43					19.6	1.080	PL	0.50	PF	1.0
53	16.5	0.0	13.5	0.0	6.9	120	FTG	ET	PE	0.6
504	15.0	5.4	13.1	19.6		0.109	TL	8.90	PV	
Pipe: 44					19.3	1.080	PL	13.00	PF	1.4
53	16.5	0.0	13.5	0.0	6.8	120	FTG	----	PE	0.6
505	15.0	5.4	12.7	19.3		0.106	TL	13.00	PV	
Pipe: 45					122.7	1.639	PL	13.00	PF	5.5
51	16.5	0.0	21.3	0.0	18.7	120	FTG	----	PE	0.0
54	16.5	0.0	15.8	0.0		0.424	TL	13.00	PV	
Pipe: 46					53.3	1.408	PL	2.00	PF	1.9
54	16.5	0.0	15.8	0.0	11.0	120	FTG	T	PE	0.0
55	16.5	0.0	13.9	0.0		0.190	TL	10.00	PV	
Pipe: 47					19.9	1.080	PL	0.50	PF	1.0
55	16.5	0.0	13.9	0.0	7.0	120	FTG	ET	PE	0.6
506	15.0	5.4	13.5	19.9		0.112	TL	8.90	PV	
Pipe: 48					33.4	1.080	PL	14.00	PF	4.1
55	16.5	0.0	13.9	0.0	11.7	120	FTG	----	PE	0.0
56	16.5	0.0	9.8	0.0		0.291	TL	14.00	PV	
Pipe: 49					16.7	1.080	PL	3.00	PF	0.9
56	16.5	0.0	9.8	0.0	5.9	120	FTG	ET	PE	0.6
507	15.0	5.4	9.5	16.7		0.081	TL	11.40	PV	
Pipe: 50					16.6	1.080	PL	13.00	PF	1.0
56	16.5	0.0	9.8	0.0	5.8	120	FTG	----	PE	0.6
508	15.0	5.4	9.4	16.6		0.080	TL	13.00	PV	
Pipe: 51					69.4	1.639	PL	20.50	PF	3.7
54	16.5	0.0	15.8	0.0	10.5	120	FTG	E	PE	0.0
57	16.5	0.0	12.1	0.0		0.148	TL	25.00	PV	
Pipe: 52					36.0	1.408	PL	7.50	PF	0.7
57	16.5	0.0	12.1	0.0	7.4	120	FTG	----	PE	0.0
58	16.5	0.0	11.4	0.0		0.092	TL	7.50	PV	

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 JOB TITLE: REMOTE AREA #5 - LECTURE HALL

PIPE TAG	END	ELEV.	NOZ.	PT	DISC.	Q (GPM)	DIA (IN)	LENGTH	PRESS.
NODES	(FT)	(K)	(PSI)	(GPM)	VEL (FPS)	HW (C)	FL/FT	(FT)	SUM.
									(PSI)
Pipe: 53						18.0	1.080	PL 3.00	PF 1.1
58	16.5	0.0	11.4	0.0	6.3	120	FTG	ET	PE 0.6
509	15.0	5.4	11.0	18.0		0.093	TL	11.40	PV
Pipe: 54						18.0	1.408	PL 4.50	PF 0.1
58	16.5	0.0	11.4	0.0	3.7	120	FTG	----	PE 0.0
59	16.5	0.0	11.3	0.0		0.026	TL	4.50	PV
Pipe: 55						18.0	1.080	PL 1.00	PF 0.9
59	16.5	0.0	11.3	0.0	6.3	120	FTG	ET	PE 0.6
510	15.0	5.4	11.1	18.0		0.093	TL	9.40	PV
Pipe: 56						33.4	1.408	PL 7.50	PF 2.3
57	16.5	0.0	12.1	0.0	6.9	120	FTG	4ET	PE 0.0
60	16.5	0.0	9.8	0.0		0.080	TL	29.10	PV
Pipe: 57						16.8	1.080	PL 4.00	PF 0.8
60	16.5	0.0	9.8	0.0	5.9	120	FTG	T	PE 0.6
511	15.0	5.4	9.6	16.8		0.082	TL	10.00	PV
Pipe: 58						16.6	1.080	PL 9.00	PF 1.1
60	16.5	0.0	9.8	0.0	5.8	120	FTG	2E	PE 0.6
512	15.0	5.4	9.3	16.6		0.080	TL	13.80	PV

NOTES (HASS):

- (1) Calculations were performed by the HASS 8.0 computer program under license no. 50010207 granted by
 HRS Systems, Inc.
 208 South Public Square
 Petersburg, TN 37144
- (2) The system has been calculated to provide an average imbalance at each node of 0.003 gpm and a maximum imbalance at any node of 0.131 gpm.
- (3) Total pressure at each node is used in balancing the system. Maximum water velocity is 18.7 ft/sec at pipe 45.
- (4) PIPE FITTINGS TABLE

Pipe Table Name: ALB.PIP

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PAGE: A MATERIAL: S40-TW HWC: 120

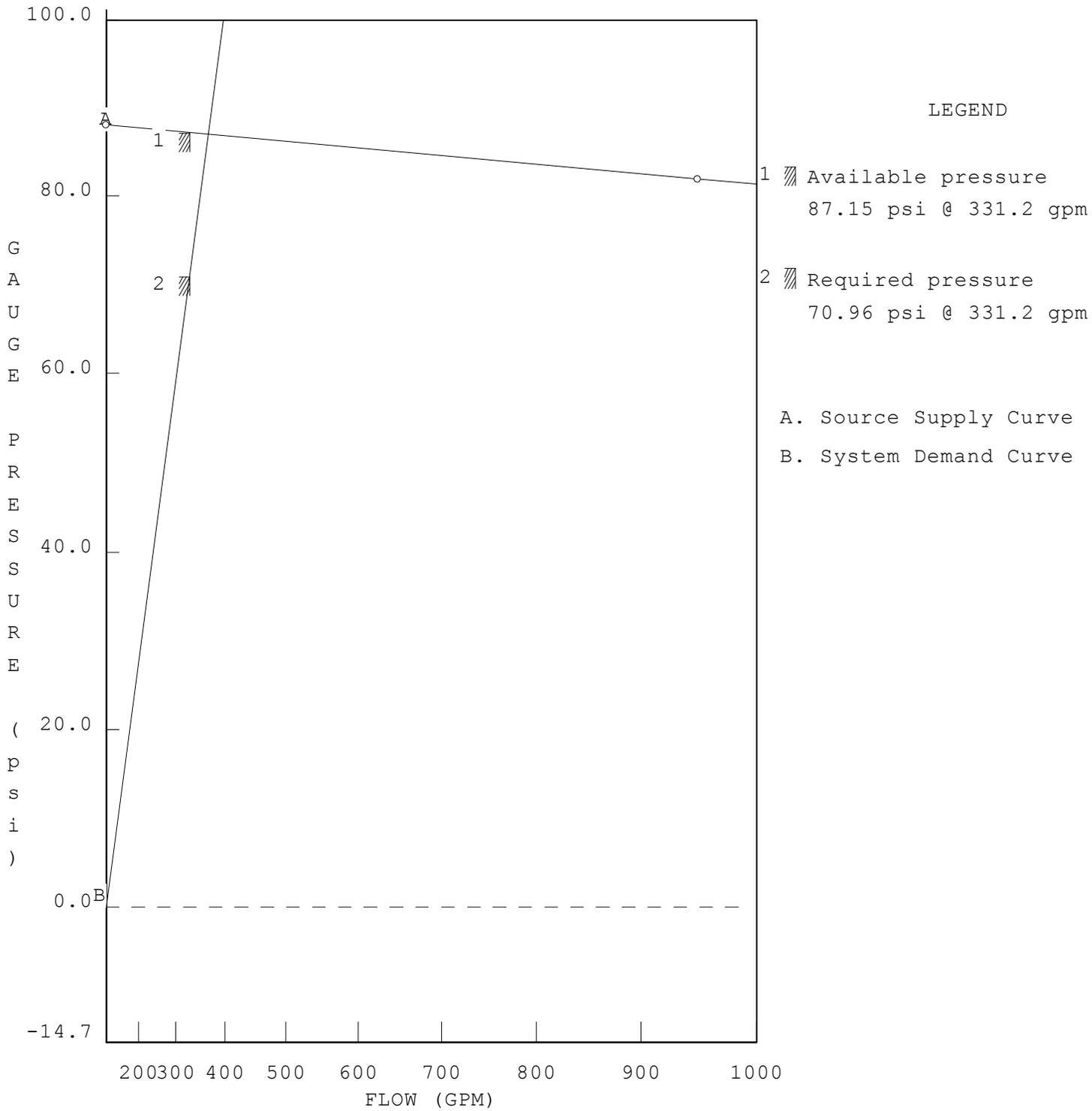
Diameter (in)	Equivalent Fitting Lengths in Feet							
	E	T	L	C	B	G	A	D
	Ell	Tee	LngEl	ChkVl	BfyVl	GatVl	AlmCk	DPVlv
1.080	2.40	6.00	2.40	5.00	6.00	1.00	10.00	10.00
1.408	3.40	8.00	2.30	7.00	6.00	1.00	10.00	10.00
1.639	4.50	9.00	2.30	9.00	6.00	1.00	10.00	10.00
2.104	5.60	11.20	3.40	11.00	6.00	1.00	10.00	10.00
2.635	8.20	16.50	5.50	19.20	9.60	1.40	6.70	14.00
4.260	13.20	26.40	7.90	22.00	12.00	2.60	40.30	13.00

PAGE: D MATERIAL: DIRON HWC: 140

Diameter (in)	Equivalent Fitting Lengths in Feet						
	E	T	L	C	B	G	
	Ell	Tee	LngEl	ChkVl	BfyVl	GatVl	
4.280	18.00	36.00	11.00	39.00	22.00	4.00	

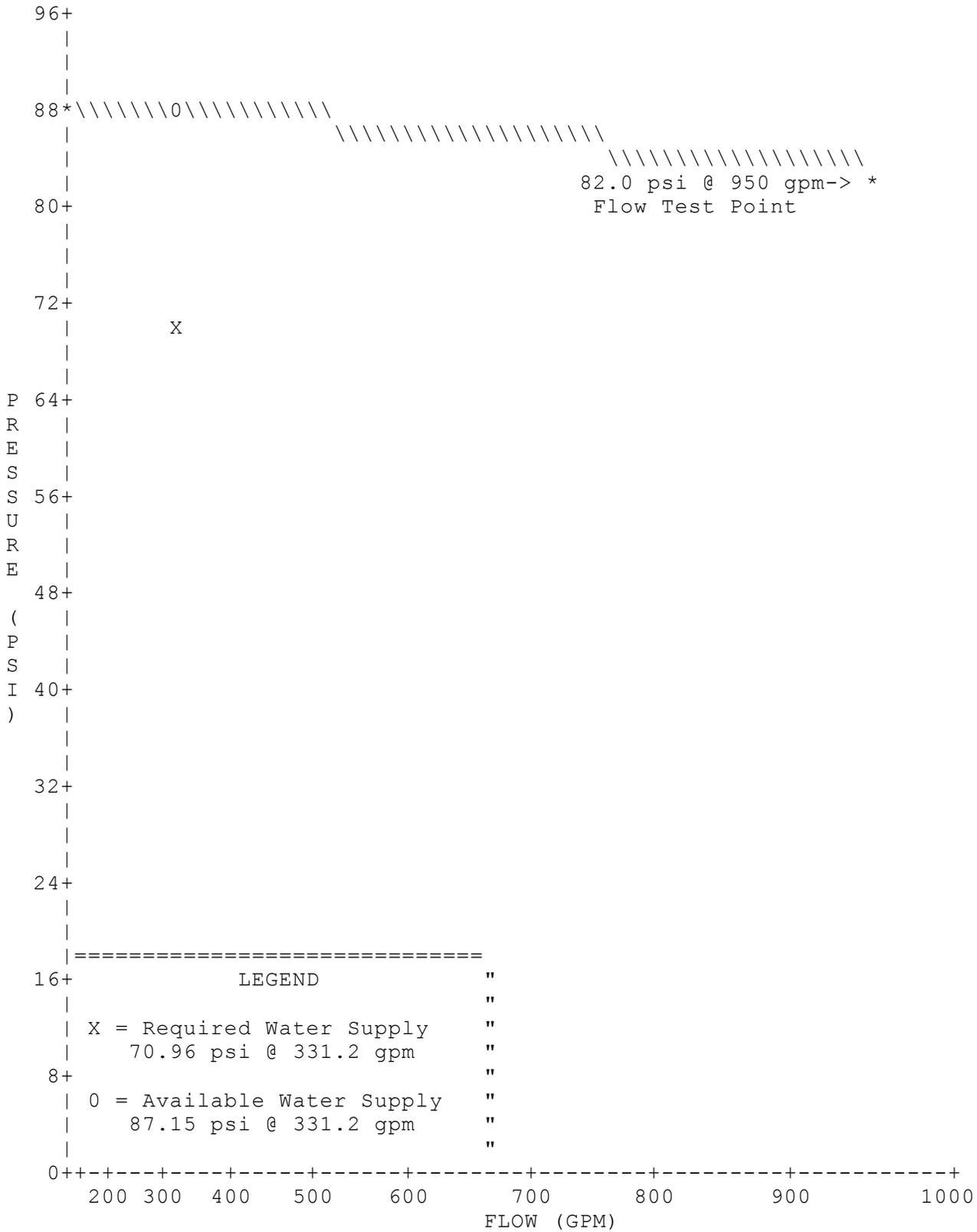
WATER SUPPLY ANALYSIS

Static: 88.00 psi Resid: 82.00 psi Flow: 950.0 gpm



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WATER SUPPLY CURVE



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 JOB TITLE: REMOTE AREA #6 - CLASSROOM

WATER SUPPLY DATA

SOURCE NODE TAG	STATIC PRESS. (PSI)	RESID. PRESS. (PSI)	FLOW @ (GPM)	AVAIL. PRESS. (PSI)	TOTAL @ DEMAND (GPM)	REQ'D PRESS. (PSI)
A	88.0	82.0	950.0	87.4	271.5	56.8

Required pressure is 30.6 psi (35%) less than available pressure.

AGGREGATE FLOW ANALYSIS:

TOTAL FLOW AT SOURCE	271.5 GPM
TOTAL HOSE STREAM ALLOWANCE AT SOURCE	100.0 GPM
OTHER HOSE STREAM ALLOWANCES	0.0 GPM
TOTAL DISCHARGE FROM ACTIVE SPRINKLERS	171.5 GPM

NODE ANALYSIS DATA

NODE TAG	ELEVATION (FT)	NODE TYPE	PRESSURE (PSI)	DISCHARGE (GPM)	AREA (FT^2)	DENSITY	
						REQ.	ACT.
A	-5.0	SOURCE	56.8	171.5	- - -	- - -	- - -
B	1.0	- - - -	53.6	- - -	- - -	- - -	- - -
C	1.0	- - - -	48.6	- - -	- - -	- - -	- - -
1	12.5	- - - -	43.5	- - -	- - -	- - -	- - -
2	12.5	- - - -	43.3	- - -	- - -	- - -	- - -
3	12.5	- - - -	42.6	- - -	- - -	- - -	- - -
19	12.5	- - - -	42.1	- - -	- - -	- - -	- - -
26	12.5	- - - -	41.0	- - -	- - -	- - -	- - -
34	12.5	- - - -	40.6	- - -	- - -	- - -	- - -
35	12.5	- - - -	37.7	- - -	- - -	- - -	- - -
36	12.5	- - - -	37.3	- - -	- - -	- - -	- - -
37	12.5	- - - -	35.1	- - -	- - -	- - -	- - -
38	12.5	- - - -	35.8	- - -	- - -	- - -	- - -
39	12.5	- - - -	33.8	- - -	- - -	- - -	- - -
40	12.5	- - - -	33.1	- - -	- - -	- - -	- - -
41	12.5	- - - -	34.7	- - -	- - -	- - -	- - -
42	12.5	- - - -	32.6	- - -	- - -	- - -	- - -
43	12.5	- - - -	32.2	- - -	- - -	- - -	- - -
44	12.5	- - - -	30.9	- - -	- - -	- - -	- - -
45	12.5	- - - -	30.7	- - -	- - -	- - -	- - -
46	12.5	- - - -	30.5	- - -	- - -	- - -	- - -
47	12.5	- - - -	30.6	- - -	- - -	- - -	- - -
61	12.5	- - - -	16.3	- - -	- - -	- - -	- - -
62	12.5	- - - -	11.8	- - -	- - -	- - -	- - -
63	12.5	- - - -	9.4	- - -	- - -	- - -	- - -
64	12.5	- - - -	14.3	- - -	- - -	- - -	- - -
65	12.5	- - - -	13.8	- - -	- - -	- - -	- - -
601	9.0	K= 5.37	11.1	17.9	143.0	0.100	0.125
602	9.0	K= 5.37	10.1	17.1	143.0	0.100	0.119
603	9.0	K= 5.37	9.1	16.2	143.0	0.100	0.113
604	9.0	K= 5.37	8.2	15.4	143.0	0.100	0.108
605	9.0	K= 5.37	7.9	15.0	143.0	0.100	0.105
606	9.0	K= 5.37	7.1	14.3	143.0	0.100	0.100

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 JOB TITLE: REMOTE AREA #6 - CLASSROOM

NODE ANALYSIS DATA

NODE TAG	ELEVATION (FT)	NODE TYPE	PRESSURE (PSI)	DISCHARGE (GPM)	AREA (FT^2)	DENSITY	
						REQ. (GPM/FT^2)	ACT. (GPM/FT^2)
607	9.0	K= 5.37	13.2	19.5	143.0	0.100	0.136
608	9.0	K= 5.37	12.0	18.6	143.0	0.100	0.130
609	9.0	K= 5.37	12.8	19.2	143.0	0.100	0.134
610	9.0	K= 5.37	11.6	18.3	143.0	0.100	0.128
701	12.5	- - - -	31.3	- - -	- - -	- - -	- - -
702	12.5	- - - -	31.2	- - -	- - -	- - -	- - -
703	12.5	- - - -	31.0	- - -	- - -	- - -	- - -
704	12.5	- - - -	31.4	- - -	- - -	- - -	- - -
705	12.5	- - - -	31.3	- - -	- - -	- - -	- - -
706	12.5	- - - -	31.2	- - -	- - -	- - -	- - -

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 JOB TITLE: REMOTE AREA #6 - CLASSROOM

PIPE DATA

PIPE TAG	END	ELEV.	NOZ.	PT	DISC.	Q(GPM)	DIA(IN)	LENGTH	PRESS.	
NODES	(FT)	(K)	(PSI)	(GPM)	VEL(FPS)	HW(C)	FL/FT	(FT)	SUM.	
									(PSI)	
	Pipe: 1					171.5	4.280	PL	60.00	PF 0.7
A		-5.0	SRCE	56.8	(N/A)	3.8	140	FTG	ETG	PE -2.6
B		1.0	0.0	53.6	0.0		0.006	TL	118.00	PV
	Pipe: 2									FIXED PRESSURE LOSS DEVICE
B		1.0	0.0	53.6	0.0		5.0 psi,		171.5 gpm	
C		1.0	0.0	48.6	0.0					
	Pipe: 3					171.5	4.260	PL	11.50	PF 0.1
C		1.0	0.0	48.6	0.0	3.9	120	FTG	----	PE -5.0
1		12.5	0.0	43.5	0.0		0.008	TL	11.50	PV
	Pipe: 4					171.5	4.260	PL	9.00	PF 0.2
1		12.5	0.0	43.5	0.0	3.9	120	FTG	E	PE 0.0
2		12.5	0.0	43.3	0.0		0.008	TL	22.20	PV
	Pipe: 5					171.5	4.260	PL	74.00	PF 0.8
2		12.5	0.0	43.3	0.0	3.9	120	FTG	T	PE 0.0
3		12.5	0.0	42.6	0.0		0.008	TL	100.40	PV
	Pipe: 6					171.5	4.260	PL	31.00	PF 0.4
3		12.5	0.0	42.6	0.0	3.9	120	FTG	T	PE 0.0
19		12.5	0.0	42.1	0.0		0.008	TL	57.40	PV
	Pipe: 7					171.5	2.635	PL	15.00	PF 1.2
19		12.5	0.0	42.1	0.0	10.1	120	FTG	----	PE 0.0
26		12.5	0.0	41.0	0.0		0.078	TL	15.00	PV
	Pipe: 8					171.5	2.635	PL	5.00	PF 0.4
26		12.5	0.0	41.0	0.0	10.1	120	FTG	----	PE 0.0
34		12.5	0.0	40.6	0.0		0.078	TL	5.00	PV
	Pipe: 9					69.3	2.104	PL	43.00	PF 2.9
34		12.5	0.0	40.6	0.0	6.4	120	FTG	2ET	PE 0.0
35		12.5	0.0	37.7	0.0		0.044	TL	65.40	PV
	Pipe: 10					40.8	1.639	PL	8.00	PF 0.4
35		12.5	0.0	37.7	0.0	6.2	120	FTG	----	PE 0.0
36		12.5	0.0	37.3	0.0		0.055	TL	8.00	PV
	Pipe: 11					28.5	1.639	PL	70.50	PF 2.6
35		12.5	0.0	37.7	0.0	4.3	120	FTG	E2T	PE 0.0
37		12.5	0.0	35.1	0.0		0.028	TL	93.00	PV
	Pipe: 12					-40.8	1.639	PL	4.00	PF 0.7
37		12.5	0.0	35.1	0.0	6.2	120	FTG	T	PE 0.0
38		12.5	0.0	35.8	0.0		0.055	TL	13.00	PV
	Pipe: 13					21.9	1.639	PL	66.50	PF 1.5
36		12.5	0.0	37.3	0.0	3.3	120	FTG	2T	PE 0.0
38		12.5	0.0	35.8	0.0		0.018	TL	84.50	PV

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PIPE TAG	END	ELEV.	NOZ.	PT	DISC.	Q (GPM)	DIA (IN)	LENGTH	PRESS.	
NODES	(FT)	(K)	(PSI)	(GPM)	VEL (FPS)	HW (C)	FL/FT	(FT)	SUM.	(PSI)
Pipe: 14					18.9	1.639	PL	83.50	PF	1.5
36	12.5	0.0	37.3	0.0	2.9	120	FTG	2E2T	PE	0.0
38	12.5	0.0	35.8	0.0		0.013	TL	110.50	PV	
Pipe: 15					69.3	2.104	PL	7.50	PF	1.3
37	12.5	0.0	35.1	0.0	6.4	120	FTG	2T	PE	0.0
39	12.5	0.0	33.8	0.0		0.044	TL	29.90	PV	
Pipe: 16					69.3	2.104	PL	4.50	PF	0.7
39	12.5	0.0	33.8	0.0	6.4	120	FTG	T	PE	0.0
40	12.5	0.0	33.1	0.0		0.044	TL	15.70	PV	
Pipe: 17					102.2	2.104	PL	49.00	PF	5.9
34	12.5	0.0	40.6	0.0	9.4	120	FTG	ET	PE	0.0
41	12.5	0.0	34.7	0.0		0.090	TL	65.80	PV	
Pipe: 18					64.7	1.639	PL	7.00	PF	2.1
41	12.5	0.0	34.7	0.0	9.8	120	FTG	T	PE	0.0
42	12.5	0.0	32.6	0.0		0.130	TL	16.00	PV	
Pipe: 19					39.1	1.639	PL	7.50	PF	0.4
42	12.5	0.0	32.6	0.0	6.0	120	FTG	----	PE	0.0
43	12.5	0.0	32.2	0.0		0.051	TL	7.50	PV	
Pipe: 20					17.6	1.639	PL	57.50	PF	0.8
43	12.5	0.0	32.2	0.0	2.7	120	FTG	3E	PE	0.0
704	12.5	0.0	31.4	0.0		0.012	TL	71.00	PV	
Pipe: 21					17.6	1.639	PL	8.00	PF	0.1
704	12.5	0.0	31.4	0.0	2.7	120	FTG	----	PE	0.0
705	12.5	0.0	31.3	0.0		0.012	TL	8.00	PV	
Pipe: 22					17.6	1.639	PL	8.00	PF	0.1
705	12.5	0.0	31.3	0.0	2.7	120	FTG	----	PE	0.0
706	12.5	0.0	31.2	0.0		0.012	TL	8.00	PV	
Pipe: 23					17.6	1.639	PL	16.00	PF	0.3
706	12.5	0.0	31.2	0.0	2.7	120	FTG	ET	PE	0.0
44	12.5	0.0	30.9	0.0		0.012	TL	29.50	PV	
Pipe: 24					21.6	1.639	PL	43.50	PF	0.9
43	12.5	0.0	32.2	0.0	3.3	120	FTG	T	PE	0.0
701	12.5	0.0	31.3	0.0		0.017	TL	52.50	PV	
Pipe: 25					21.6	1.639	PL	8.00	PF	0.1
701	12.5	0.0	31.3	0.0	3.3	120	FTG	----	PE	0.0
702	12.5	0.0	31.2	0.0		0.017	TL	8.00	PV	
Pipe: 26					21.6	1.639	PL	8.00	PF	0.1
702	12.5	0.0	31.2	0.0	3.3	120	FTG	----	PE	0.0
703	12.5	0.0	31.0	0.0		0.017	TL	8.00	PV	

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 JOB TITLE: REMOTE AREA #6 - CLASSROOM

PIPE TAG	END	ELEV.	NOZ.	PT	DISC.	Q (GPM)	DIA (IN)	LENGTH	PRESS.		
NODES	(FT)	(K)	(PSI)	(GPM)	VEL (FPS)	HW (C)	FL/FT	(FT)	SUM.	(PSI)	
	Pipe: 27					21.6	1.639	PL	2.00	PF	0.2
703	12.5	0.0	31.0	0.0	3.3	120	FTG	T	PE	0.0	
44	12.5	0.0	30.9	0.0		0.017	TL	11.00	PV		
	Pipe: 28					25.6	1.639	PL	61.50	PF	1.9
42	12.5	0.0	32.6	0.0	3.9	120	FTG	2T	PE	0.0	
45	12.5	0.0	30.7	0.0		0.023	TL	79.50	PV		
	Pipe: 29					37.5	1.639	PL	62.50	PF	4.0
41	12.5	0.0	34.7	0.0	5.7	120	FTG	E2T	PE	0.0	
47	12.5	0.0	30.6	0.0		0.047	TL	85.00	PV		
	Pipe: 30					39.1	2.104	PL	7.50	PF	0.1
44	12.5	0.0	30.9	0.0	3.6	120	FTG	----	PE	0.0	
45	12.5	0.0	30.7	0.0		0.015	TL	7.50	PV		
	Pipe: 31					64.7	2.104	PL	6.50	PF	0.3
45	12.5	0.0	30.7	0.0	6.0	120	FTG	----	PE	0.0	
46	12.5	0.0	30.5	0.0		0.038	TL	6.50	PV		
	Pipe: 32					-106.8	2.104	PL	1.50	PF	0.1
46	12.5	0.0	30.5	0.0	9.9	120	FTG	----	PE	0.0	
47	12.5	0.0	30.6	0.0		0.097	TL	1.50	PV		
	Pipe: 33					-69.3	2.104	PL	56.00	PF	2.4
47	12.5	0.0	30.6	0.0	6.4	120	FTG	----	PE	0.0	
40	12.5	0.0	33.1	0.0		0.044	TL	56.00	PV		
	Pipe: 59					171.5	1.639	PL	9.00	PF	14.2
46	12.5	0.0	30.5	0.0	26.1	120	FTG	T	PE	0.0	
61	12.5	0.0	16.3	0.0		0.789	TL	18.00	PV		
	Pipe: 60					95.9	1.639	PL	7.50	PF	4.4
61	12.5	0.0	16.3	0.0	14.6	120	FTG	T	PE	0.0	
62	12.5	0.0	11.8	0.0		0.269	TL	16.50	PV		
	Pipe: 61					60.9	1.408	PL	10.00	PF	2.4
62	12.5	0.0	11.8	0.0	12.6	120	FTG	----	PE	0.0	
63	12.5	0.0	9.4	0.0		0.244	TL	10.00	PV		
	Pipe: 62					75.6	1.639	PL	2.50	PF	2.0
61	12.5	0.0	16.3	0.0	11.5	120	FTG	T	PE	0.0	
64	12.5	0.0	14.3	0.0		0.173	TL	11.50	PV		
	Pipe: 63					37.5	1.639	PL	10.00	PF	0.5
64	12.5	0.0	14.3	0.0	5.7	120	FTG	----	PE	0.0	
65	12.5	0.0	13.8	0.0		0.047	TL	10.00	PV		
	Pipe: 64					35.0	1.080	PL	1.00	PF	2.2
62	12.5	0.0	11.8	0.0	12.3	120	FTG	T	PE	1.5	
601	9.0	5.4	11.1	17.9		0.318	TL	7.00	PV		

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PIPE TAG	Q (GPM)	DIA (IN)	LENGTH	PRESS.
END ELEV. NOZ. PT DISC. VEL (FPS) HW (C) (FT) SUM.				
NODES (FT) (K) (PSI) (GPM) FL/FT (PSI)				
Pipe: 65	17.1	1.080	PL 12.50	PF 1.1
601 9.0 5.4 11.1 17.9 6.0 120 FTG			----	PE 0.0
602 9.0 5.4 10.1 17.1 0.084 TL			12.50	PV
Pipe: 66	31.6	1.080	PL 1.00	PF 1.8
63 12.5 0.0 9.4 0.0 11.1 120 FTG			T	PE 1.5
603 9.0 5.4 9.1 16.2 0.263 TL			7.00	PV
Pipe: 67	15.4	1.080	PL 12.50	PF 0.9
603 9.0 5.4 9.1 16.2 5.4 120 FTG			----	PE 0.0
604 9.0 5.4 8.2 15.4 0.070 TL			12.50	PV
Pipe: 68	29.3	1.080	PL 11.00	PF 3.1
63 12.5 0.0 9.4 0.0 10.3 120 FTG			E	PE 1.5
605 9.0 5.4 7.9 15.0 0.229 TL			13.40	PV
Pipe: 69	14.3	1.080	PL 12.50	PF 0.8
605 9.0 5.4 7.9 15.0 5.0 120 FTG			----	PE 0.0
606 9.0 5.4 7.1 14.3 0.061 TL			12.50	PV
Pipe: 70	38.1	1.080	PL 1.00	PF 2.6
64 12.5 0.0 14.3 0.0 13.3 120 FTG			T	PE 1.5
607 9.0 5.4 13.2 19.5 0.372 TL			7.00	PV
Pipe: 71	18.6	1.080	PL 12.50	PF 1.2
607 9.0 5.4 13.2 19.5 6.5 120 FTG			----	PE 0.0
608 9.0 5.4 12.0 18.6 0.099 TL			12.50	PV
Pipe: 72	37.5	1.080	PL 1.00	PF 2.5
65 12.5 0.0 13.8 0.0 13.1 120 FTG			T	PE 1.5
609 9.0 5.4 12.8 19.2 0.361 TL			7.00	PV
Pipe: 73	18.3	1.080	PL 12.50	PF 1.2
609 9.0 5.4 12.8 19.2 6.4 120 FTG			----	PE 0.0
610 9.0 5.4 11.6 18.3 0.096 TL			12.50	PV

NOTES (HASS):

- (1) Calculations were performed by the HASS 8.0 computer program under license no. 50010207 granted by
 HRS Systems, Inc.
 208 South Public Square
 Petersburg, TN 37144
- (2) The system has been calculated to provide an average imbalance at each node of 0.003 gpm and a maximum imbalance at any node of 0.110 gpm.
- (3) Total pressure at each node is used in balancing the system. Maximum water velocity is 26.1 ft/sec at pipe 59.

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(4) PIPE FITTINGS TABLE

Pipe Table Name: ALB.PIP

PAGE: A MATERIAL: S40-TW HWC: 120

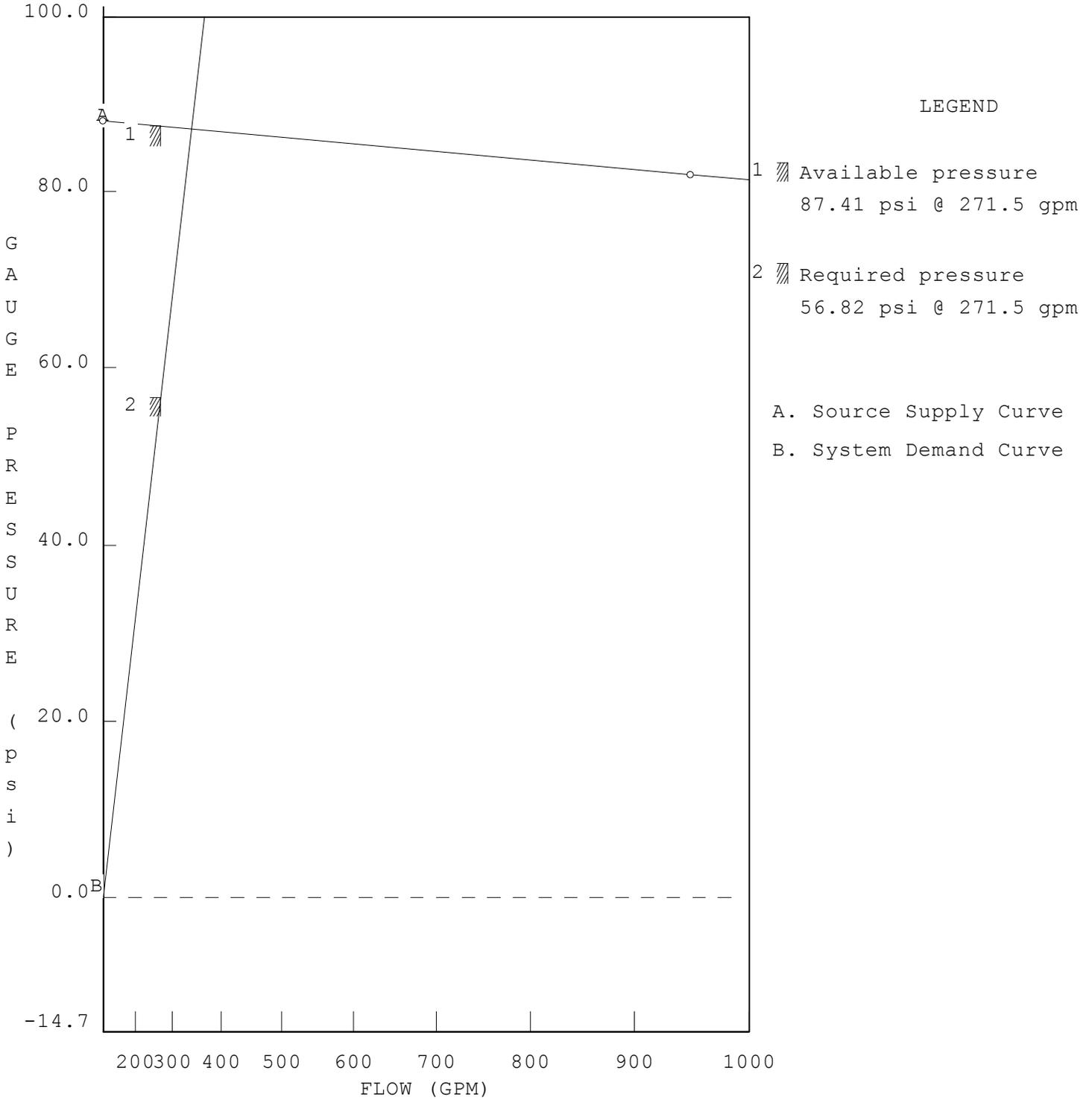
Diameter (in)	Equivalent Fitting Lengths in Feet							
	E	T	L	C	B	G	A	D
	Ell	Tee	LngEl	ChkVl	BfyVl	GatVl	AlmCk	DPVlv
1.080	2.40	6.00	2.40	5.00	6.00	1.00	10.00	10.00
1.408	3.40	8.00	2.30	7.00	6.00	1.00	10.00	10.00
1.639	4.50	9.00	2.30	9.00	6.00	1.00	10.00	10.00
2.104	5.60	11.20	3.40	11.00	6.00	1.00	10.00	10.00
2.635	8.20	16.50	5.50	19.20	9.60	1.40	6.70	14.00
4.260	13.20	26.40	7.90	22.00	12.00	2.60	40.30	13.00

PAGE: D MATERIAL: DIRON HWC: 140

Diameter (in)	Equivalent Fitting Lengths in Feet						
	E	T	L	C	B	G	
	Ell	Tee	LngEl	ChkVl	BfyVl	GatVl	
4.280	18.00	36.00	11.00	39.00	22.00	4.00	

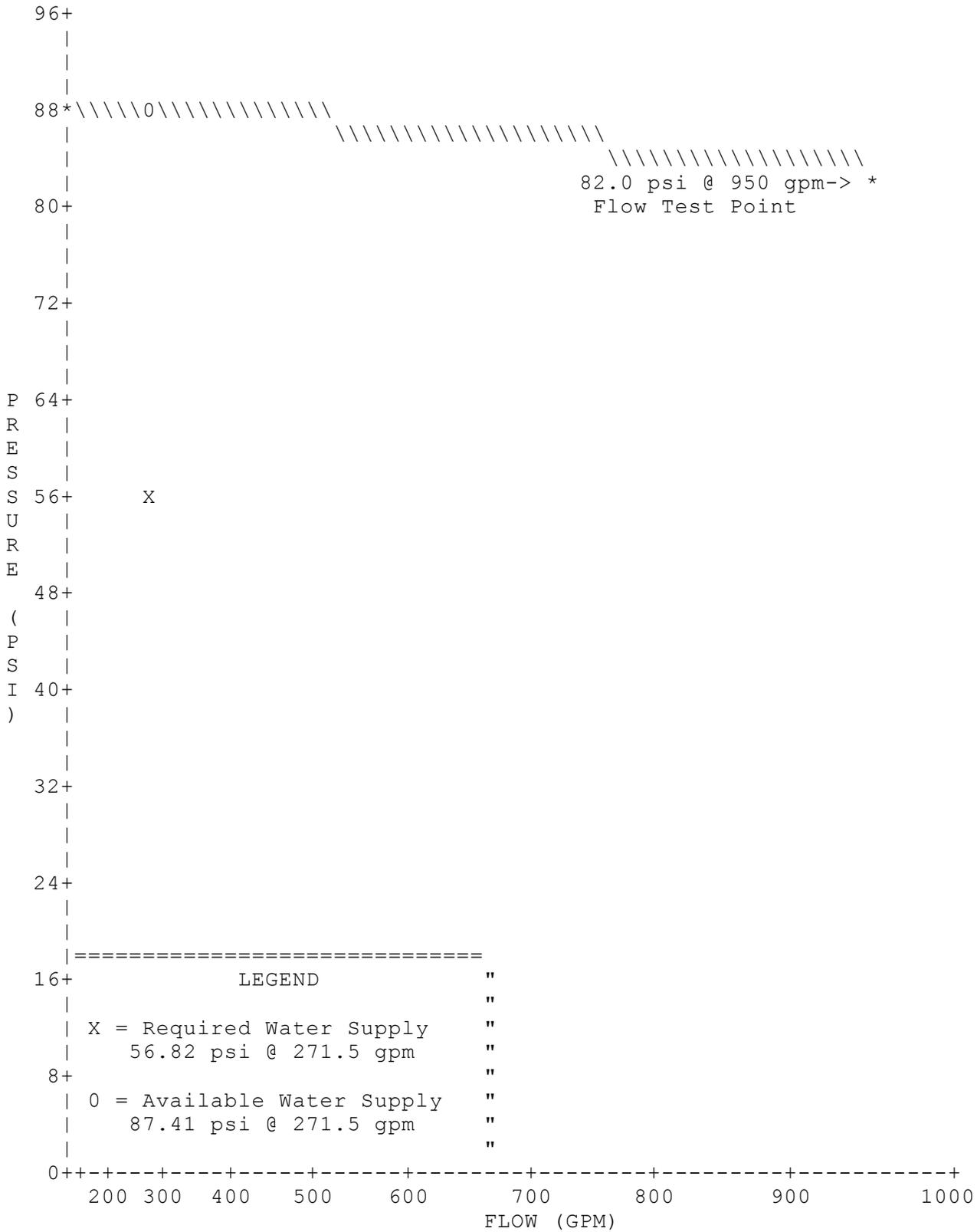
WATER SUPPLY ANALYSIS

Static: 88.00 psi Resid: 82.00 psi Flow: 950.0 gpm



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WATER SUPPLY CURVE



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 JOB TITLE: REMOTE AREA #7 - MECHANICAL ROOM (ADDITION)

WATER SUPPLY DATA

SOURCE NODE TAG	STATIC PRESS. (PSI)	RESID. PRESS. (PSI)	FLOW @ (GPM)	AVAIL. PRESS. (PSI)	TOTAL @ DEMAND (GPM)	REQ'D PRESS. (PSI)
A	88.0	82.0	950.0	86.9	386.2	39.4

Required pressure is 47.5 psi (55%) less than available pressure.

AGGREGATE FLOW ANALYSIS:

TOTAL FLOW AT SOURCE	386.2 GPM
TOTAL HOSE STREAM ALLOWANCE AT SOURCE	250.0 GPM
OTHER HOSE STREAM ALLOWANCES	0.0 GPM
TOTAL DISCHARGE FROM ACTIVE SPRINKLERS	136.2 GPM

NODE ANALYSIS DATA

NODE TAG	ELEVATION (FT)	NODE TYPE	PRESSURE (PSI)	DISCHARGE (GPM)	AREA (FT^2)	DENSITY	
						REQ.	ACT.
A	-5.0	SOURCE	39.4	136.2	- - -	- - -	- - -
B	1.0	- - - -	36.4	- - -	- - -	- - -	- - -
C	1.0	- - - -	31.4	- - -	- - -	- - -	- - -
1	12.5	- - - -	26.3	- - -	- - -	- - -	- - -
2	12.5	- - - -	26.2	- - -	- - -	- - -	- - -
3	12.5	- - - -	25.7	- - -	- - -	- - -	- - -
19	12.5	- - - -	25.5	- - -	- - -	- - -	- - -
26	12.5	- - - -	24.7	- - -	- - -	- - -	- - -
34	12.5	- - - -	24.4	- - -	- - -	- - -	- - -
35	12.5	- - - -	22.7	- - -	- - -	- - -	- - -
36	12.5	- - - -	22.5	- - -	- - -	- - -	- - -
37	12.5	- - - -	21.2	- - -	- - -	- - -	- - -
38	12.5	- - - -	21.6	- - -	- - -	- - -	- - -
39	12.5	- - - -	20.4	- - -	- - -	- - -	- - -
40	12.5	- - - -	20.0	- - -	- - -	- - -	- - -
41	12.5	- - - -	20.3	- - -	- - -	- - -	- - -
42	12.5	- - - -	18.5	- - -	- - -	- - -	- - -
43	12.5	- - - -	17.9	- - -	- - -	- - -	- - -
44	12.5	- - - -	17.7	- - -	- - -	- - -	- - -
45	12.5	- - - -	18.2	- - -	- - -	- - -	- - -
46	12.5	- - - -	18.5	- - -	- - -	- - -	- - -
47	12.5	- - - -	18.6	- - -	- - -	- - -	- - -
701	12.5	K= 5.60	16.8	23.0	112.0	0.200	0.205
702	12.5	K= 5.60	16.8	23.0	112.0	0.200	0.205
703	12.5	K= 5.60	16.9	23.0	112.0	0.200	0.206
704	12.5	K= 5.60	16.0	22.4	112.0	0.200	0.200
705	12.5	K= 5.60	16.0	22.4	112.0	0.200	0.200
706	12.5	K= 5.60	16.1	22.5	112.0	0.200	0.201

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PIPE DATA

PIPE TAG	END	ELEV.	NOZ.	PT	DISC.	Q (GPM)	DIA (IN)	LENGTH	PRESS.
	NODES	(FT)	(K)	(PSI)	(GPM)	VEL (FPS)	HW (C)	(FT)	SUM.
							FL/FT		(PSI)
Pipe: 1									
A		-5.0	SRCE	39.4	(N/A)	136.2	4.280	PL 60.00	PF 0.4
B		1.0	0.0	36.4	0.0	3.0	140	FTG ETG	PE -2.6
							0.004	TL 118.00	PV
Pipe: 2									
FIXED PRESSURE LOSS DEVICE									
B		1.0	0.0	36.4	0.0	5.0	psi,	136.2	gpm
C		1.0	0.0	31.4	0.0				
Pipe: 3									
C		1.0	0.0	31.4	0.0	136.2	4.260	PL 11.50	PF 0.1
1		12.5	0.0	26.3	0.0	3.1	120	FTG ----	PE -5.0
							0.005	TL 11.50	PV
Pipe: 4									
1		12.5	0.0	26.3	0.0	136.2	4.260	PL 9.00	PF 0.1
2		12.5	0.0	26.2	0.0	3.1	120	FTG E	PE 0.0
							0.005	TL 22.20	PV
Pipe: 5									
2		12.5	0.0	26.2	0.0	136.2	4.260	PL 74.00	PF 0.5
3		12.5	0.0	25.7	0.0	3.1	120	FTG T	PE 0.0
							0.005	TL 100.40	PV
Pipe: 6									
3		12.5	0.0	25.7	0.0	136.2	4.260	PL 31.00	PF 0.3
19		12.5	0.0	25.5	0.0	3.1	120	FTG T	PE 0.0
							0.005	TL 57.40	PV
Pipe: 7									
19		12.5	0.0	25.5	0.0	136.2	2.635	PL 15.00	PF 0.8
26		12.5	0.0	24.7	0.0	8.0	120	FTG ----	PE 0.0
							0.051	TL 15.00	PV
Pipe: 8									
26		12.5	0.0	24.7	0.0	136.2	2.635	PL 5.00	PF 0.3
34		12.5	0.0	24.4	0.0	8.0	120	FTG ----	PE 0.0
							0.051	TL 5.00	PV
Pipe: 9									
34		12.5	0.0	24.4	0.0	52.0	2.104	PL 43.00	PF 1.7
35		12.5	0.0	22.7	0.0	4.8	120	FTG 2ET	PE 0.0
							0.026	TL 65.40	PV
Pipe: 10									
35		12.5	0.0	22.7	0.0	30.7	1.639	PL 8.00	PF 0.3
36		12.5	0.0	22.5	0.0	4.7	120	FTG ----	PE 0.0
							0.033	TL 8.00	PV
Pipe: 11									
35		12.5	0.0	22.7	0.0	21.4	1.639	PL 70.50	PF 1.6
37		12.5	0.0	21.2	0.0	3.2	120	FTG E2T	PE 0.0
							0.017	TL 93.00	PV
Pipe: 12									
37		12.5	0.0	21.2	0.0	-30.7	1.639	PL 4.00	PF 0.4
38		12.5	0.0	21.6	0.0	4.7	120	FTG T	PE 0.0
							0.033	TL 13.00	PV
Pipe: 13									
36		12.5	0.0	22.5	0.0	16.4	1.639	PL 66.50	PF 0.9
38		12.5	0.0	21.6	0.0	2.5	120	FTG 2T	PE 0.0
							0.010	TL 84.50	PV

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PIPE TAG	END	ELEV.	NOZ.	PT	DISC.	Q(GPM)	DIA(IN)	LENGTH	PRESS.	
NODES	(FT)	(K)	(PSI)	(GPM)	VEL(FPS)	HW(C)	FL/FT	(FT)	SUM.	(PSI)
Pipe: 14					14.2	1.639	PL	83.50	PF	0.9
36	12.5	0.0	22.5	0.0	2.2	120	FTG	2E2T	PE	0.0
38	12.5	0.0	21.6	0.0		0.008	TL	110.50	PV	
Pipe: 15					52.0	2.104	PL	7.50	PF	0.8
37	12.5	0.0	21.2	0.0	4.8	120	FTG	2T	PE	0.0
39	12.5	0.0	20.4	0.0		0.026	TL	29.90	PV	
Pipe: 16					52.0	2.104	PL	4.50	PF	0.4
39	12.5	0.0	20.4	0.0	4.8	120	FTG	T	PE	0.0
40	12.5	0.0	20.0	0.0		0.026	TL	15.70	PV	
Pipe: 17					84.2	2.104	PL	49.00	PF	4.1
34	12.5	0.0	24.4	0.0	7.8	120	FTG	ET	PE	0.0
41	12.5	0.0	20.3	0.0		0.063	TL	65.80	PV	
Pipe: 18					60.4	1.639	PL	7.00	PF	1.8
41	12.5	0.0	20.3	0.0	9.2	120	FTG	T	PE	0.0
42	12.5	0.0	18.5	0.0		0.115	TL	16.00	PV	
Pipe: 19					50.7	1.639	PL	7.50	PF	0.6
42	12.5	0.0	18.5	0.0	7.7	120	FTG	----	PE	0.0
43	12.5	0.0	17.9	0.0		0.083	TL	7.50	PV	
Pipe: 20					27.1	1.639	PL	57.50	PF	1.8
43	12.5	0.0	17.9	0.0	4.1	120	FTG	3E	PE	0.0
704	12.5	5.6	16.0	22.4		0.026	TL	71.00	PV	
Pipe: 21					4.7	1.639	PL	8.00	PF	0.0
704	12.5	5.6	16.0	22.4	0.7	120	FTG	----	PE	0.0
705	12.5	5.6	16.0	22.4		0.001	TL	8.00	PV	
Pipe: 22					-17.7	1.639	PL	8.00	PF	0.1
705	12.5	5.6	16.0	22.4	2.7	120	FTG	----	PE	0.0
706	12.5	5.6	16.1	22.5		0.012	TL	8.00	PV	
Pipe: 23					-40.2	1.639	PL	16.00	PF	1.6
706	12.5	5.6	16.1	22.5	6.1	120	FTG	ET	PE	0.0
44	12.5	0.0	17.7	0.0		0.054	TL	29.50	PV	
Pipe: 24					23.6	1.639	PL	43.50	PF	1.1
43	12.5	0.0	17.9	0.0	3.6	120	FTG	T	PE	0.0
701	12.5	5.6	16.8	23.0		0.020	TL	52.50	PV	
Pipe: 25					0.7	1.639	PL	8.00	PF	0.0
701	12.5	5.6	16.8	23.0	0.1	120	FTG	----	PE	0.0
702	12.5	5.6	16.8	23.0		0.000	TL	8.00	PV	
Pipe: 26					-22.3	1.639	PL	8.00	PF	0.1
702	12.5	5.6	16.8	23.0	3.4	120	FTG	----	PE	0.0
703	12.5	5.6	16.9	23.0		0.018	TL	8.00	PV	

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PIPE TAG	END	ELEV.	NOZ.	PT	DISC.	Q(GPM)	DIA(IN)	LENGTH	PRESS.		
	NODES	(FT)	(K)	(PSI)	(GPM)	VEL(FPS)	HW(C)	(FT)	SUM.		
							FL/FT		(PSI)		
	Pipe: 27					-45.3	1.639	PL	2.00	PF	0.7
703		12.5	5.6	16.9	23.0	6.9	120	FTG	T	PE	0.0
44		12.5	0.0	17.7	0.0		0.067	TL	11.00	PV	
	Pipe: 28					9.7	1.639	PL	61.50	PF	0.3
42		12.5	0.0	18.5	0.0	1.5	120	FTG	2T	PE	0.0
45		12.5	0.0	18.2	0.0		0.004	TL	79.50	PV	
	Pipe: 29					23.8	1.639	PL	62.50	PF	1.7
41		12.5	0.0	20.3	0.0	3.6	120	FTG	E2T	PE	0.0
47		12.5	0.0	18.6	0.0		0.020	TL	85.00	PV	
	Pipe: 30					-85.5	2.104	PL	7.50	PF	0.5
44		12.5	0.0	17.7	0.0	7.9	120	FTG	----	PE	0.0
45		12.5	0.0	18.2	0.0		0.064	TL	7.50	PV	
	Pipe: 31					-75.8	2.104	PL	6.50	PF	0.3
45		12.5	0.0	18.2	0.0	7.0	120	FTG	----	PE	0.0
46		12.5	0.0	18.5	0.0		0.052	TL	6.50	PV	
	Pipe: 32					-75.8	2.104	PL	1.50	PF	0.1
46		12.5	0.0	18.5	0.0	7.0	120	FTG	----	PE	0.0
47		12.5	0.0	18.6	0.0		0.052	TL	1.50	PV	
	Pipe: 33					-52.0	2.104	PL	56.00	PF	1.4
47		12.5	0.0	18.6	0.0	4.8	120	FTG	----	PE	0.0
40		12.5	0.0	20.0	0.0		0.026	TL	56.00	PV	

NOTES (HASS):

- (1) Calculations were performed by the HASS 8.0 computer program under license no. 50010207 granted by
 HRS Systems, Inc.
 208 South Public Square
 Petersburg, TN 37144
- (2) The system has been calculated to provide an average imbalance at each node of 0.005 gpm and a maximum imbalance at any node of 0.143 gpm.
- (3) Total pressure at each node is used in balancing the system. Maximum water velocity is 9.2 ft/sec at pipe 18.
- (4) PIPE FITTINGS TABLE

Pipe Table Name: ALB.PIP

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 JOB TITLE: REMOTE AREA #7 - MECHANICAL ROOM (ADDITION)

PAGE: A MATERIAL: S40-TW HWC: 120

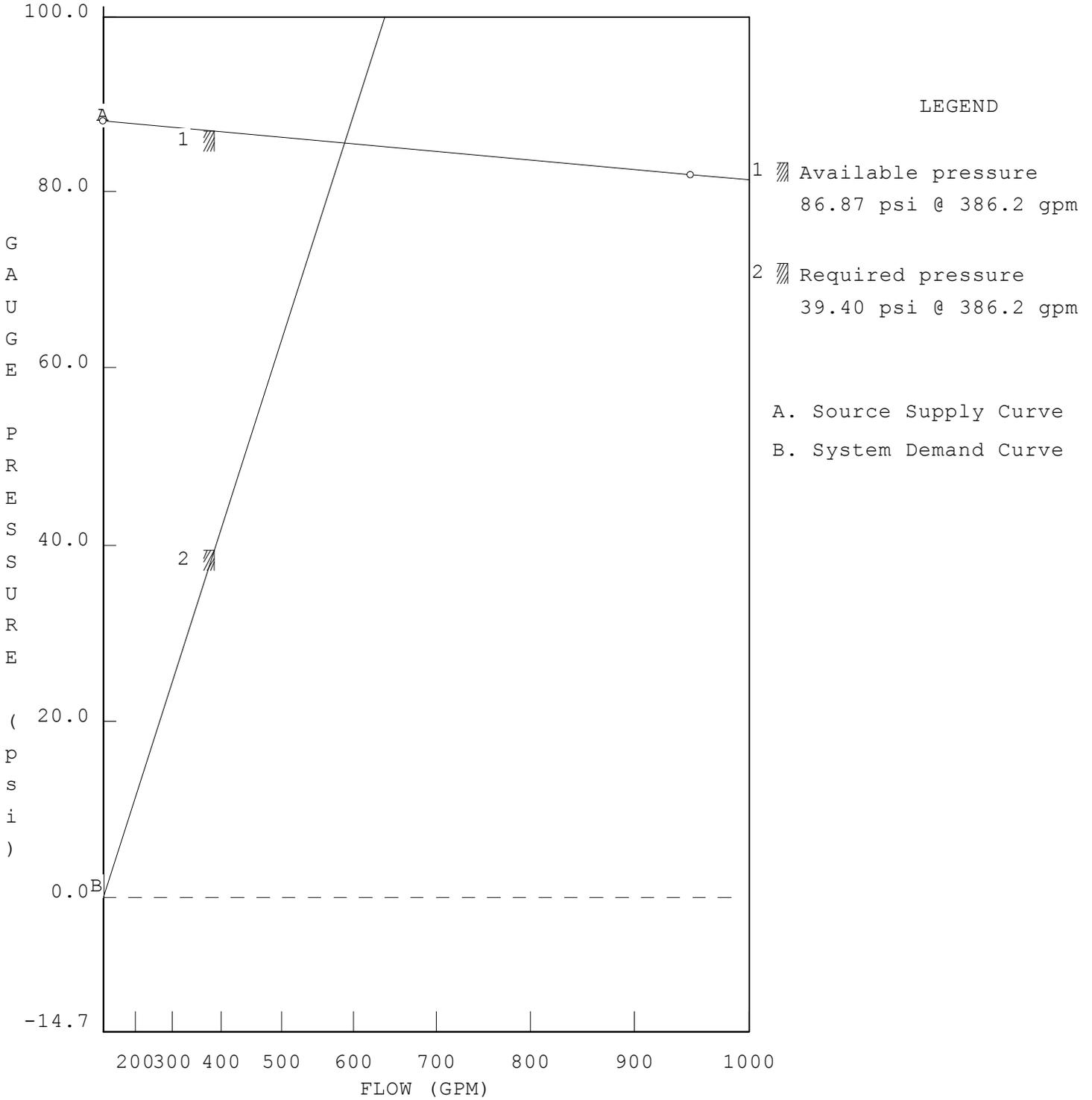
Diameter (in)	Equivalent Fitting Lengths in Feet							
	E	T	L	C	B	G	A	D
	Ell	Tee	LngEl	ChkVl	BfyVl	GatVl	AlmCk	DPVlv
1.639	4.50	9.00	2.30	9.00	6.00	1.00	10.00	10.00
2.104	5.60	11.20	3.40	11.00	6.00	1.00	10.00	10.00
2.635	8.20	16.50	5.50	19.20	9.60	1.40	6.70	14.00
4.260	13.20	26.40	7.90	22.00	12.00	2.60	40.30	13.00

PAGE: D MATERIAL: DIRON HWC: 140

Diameter (in)	Equivalent Fitting Lengths in Feet					
	E	T	L	C	B	G
	Ell	Tee	LngEl	ChkVl	BfyVl	GatVl
4.280	18.00	36.00	11.00	39.00	22.00	4.00

WATER SUPPLY ANALYSIS

Static: 88.00 psi Resid: 82.00 psi Flow: 950.0 gpm



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WATER SUPPLY CURVE

