



Surgical Repairs to Temple University Medical Campus' Ailing Steam Distribution System

PRESENTED TO

IDEA Campus Energy 2016

PRESENTED BY

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In association with

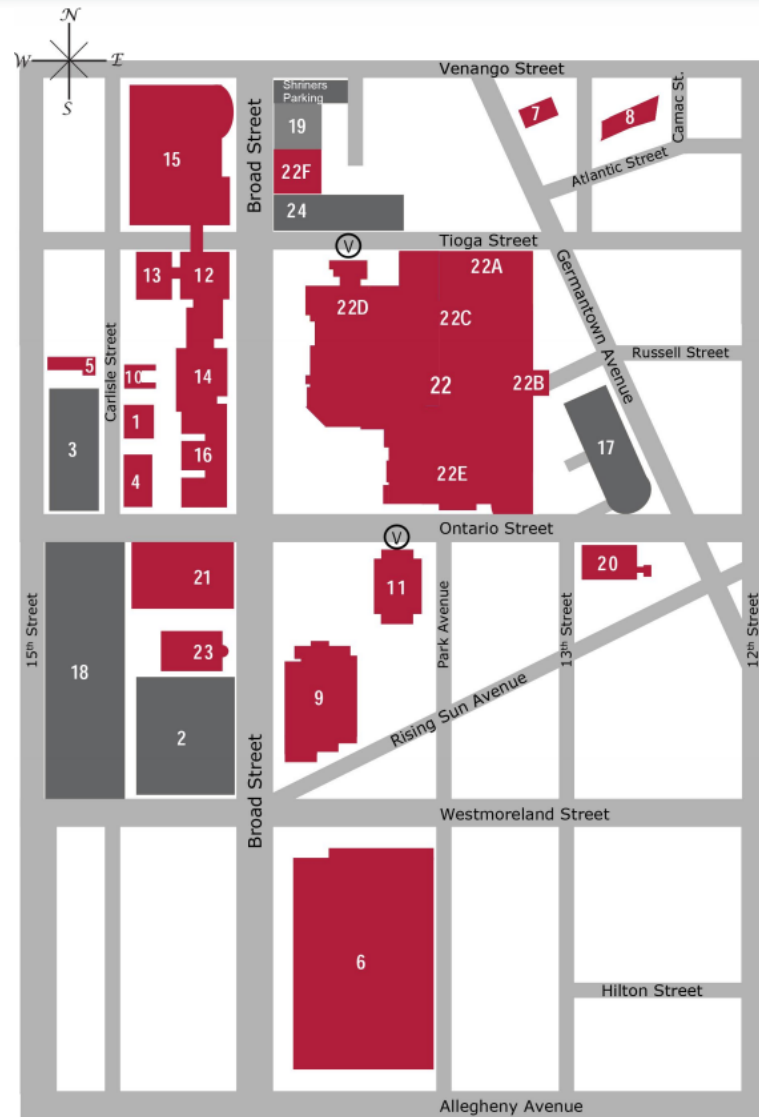
Temple University – Office of Facility Management

Project Background

Temple University Health Science Center (HSC)

Urban North Philadelphia:
27 Buildings, 31 Acres

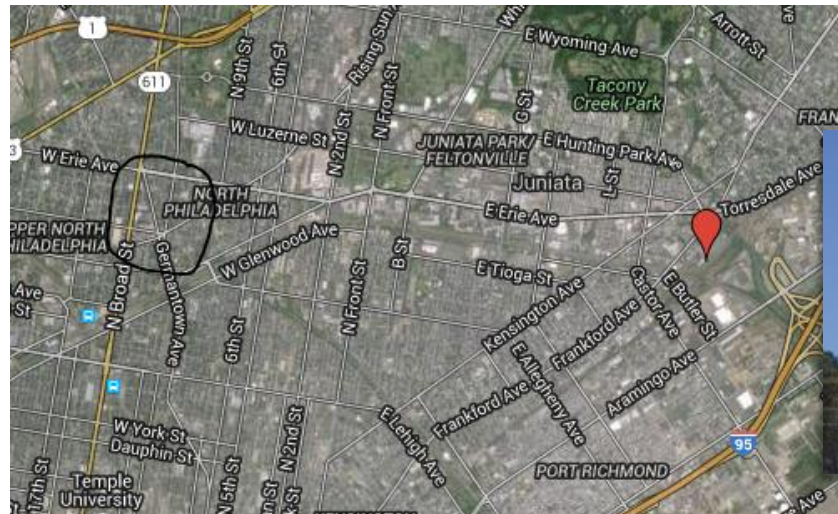
- Hospital
 - Level 1 Trauma Center
 - 721 Beds
 - 84,751 Visits
- Medical School
- Dental School



Project Background

Temple Hospital

- A Level I Trauma Center providing Total Care
- May 2015, a Level 3 event occurred during construction. AMTRAK northeast corridor de-railment



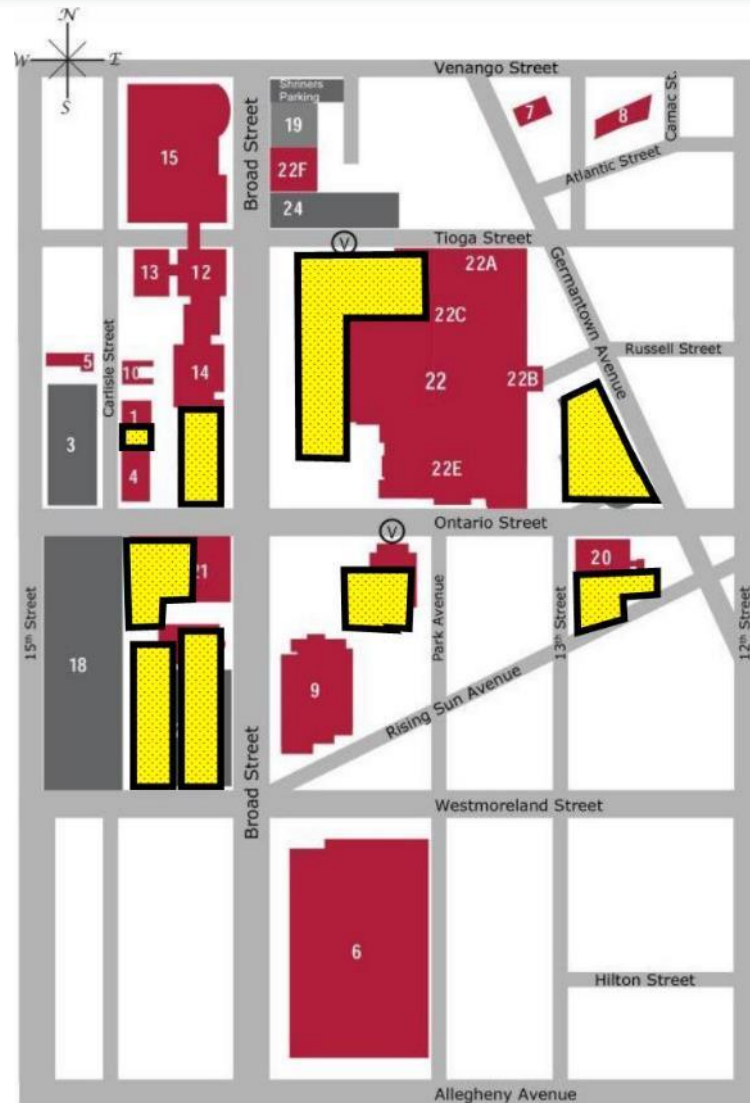
Project Background

HSC Campus Re-Development

- Hospital “Superblock”
- Medical School
- Utility Plant Renewal

2013 Master Plan

- Utility Plant (Capacity Expansion) Renewal
- Addressed All Utilities: Chilled Water, Steam and Electric
- Identified Steam Utility Distribution Renewal



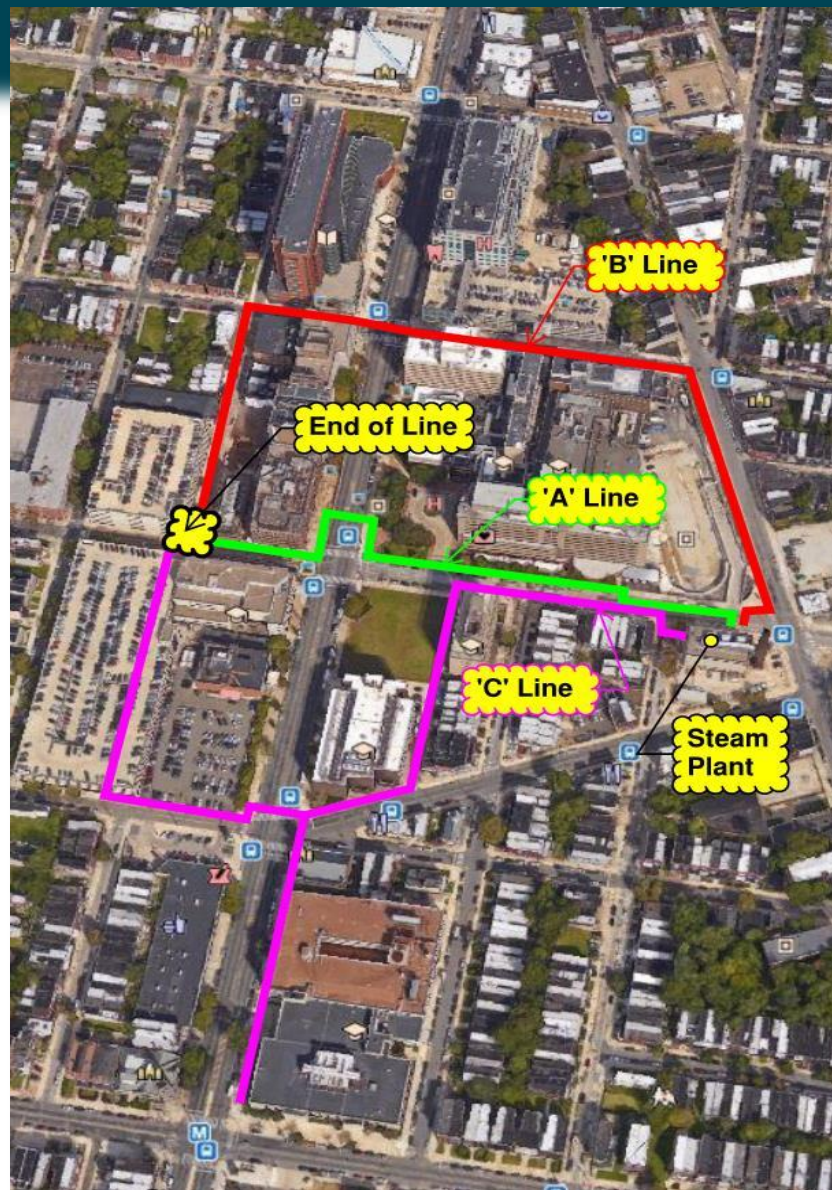
Project Background

Main Distribution Piping

- In Service over 50 years
- Three Service Mains; 'A', 'B' & 'C' Mains
- Single Point of Failure for 'A'-'B' Mains

System Metrics

- 3 Pipe System – Steam (125psi), Low and Hi Pressure Condensate Return
- 21,000+ linear feet of underground piping 2" thru 14"
- Existing Plant Capacity: (3) 60,000 #/hr, Field Erected Water-Tube Boilers (N+1)
- Current Steam Demand = 120,000 #/hr, Future demand requires an additional 50,000 #/hr
- 28 Steam Manholes



Project Background

Leaky Ailing District Heating System

- Safety
- Aesthetics



Project Background

Stakeholders

- Temple University
- Temple Hospital
- Adjacent Neighbors
- Underground Utilities
 - SEPTA (Transit Authority)
 - Philadelphia Gas Works
 - Philadelphia Water
 - PECO (Electric)
 - Verizon, Comcast, etc.(Communications)



Project Goals

Eliminate Steam Leak Hazards

Reduce Service Calls

Enhance Safety, Maintenance and Troubleshooting

Reduce Plant Operating Costs

Increase Steam Quality

Provide Phasing to Accommodate both Fiscal Funding and Constructability

Construction Activities

- Minimize Hospital Access and Utility Disruptions
- Minimize Staging Areas
- Document Existing Underground Utilities



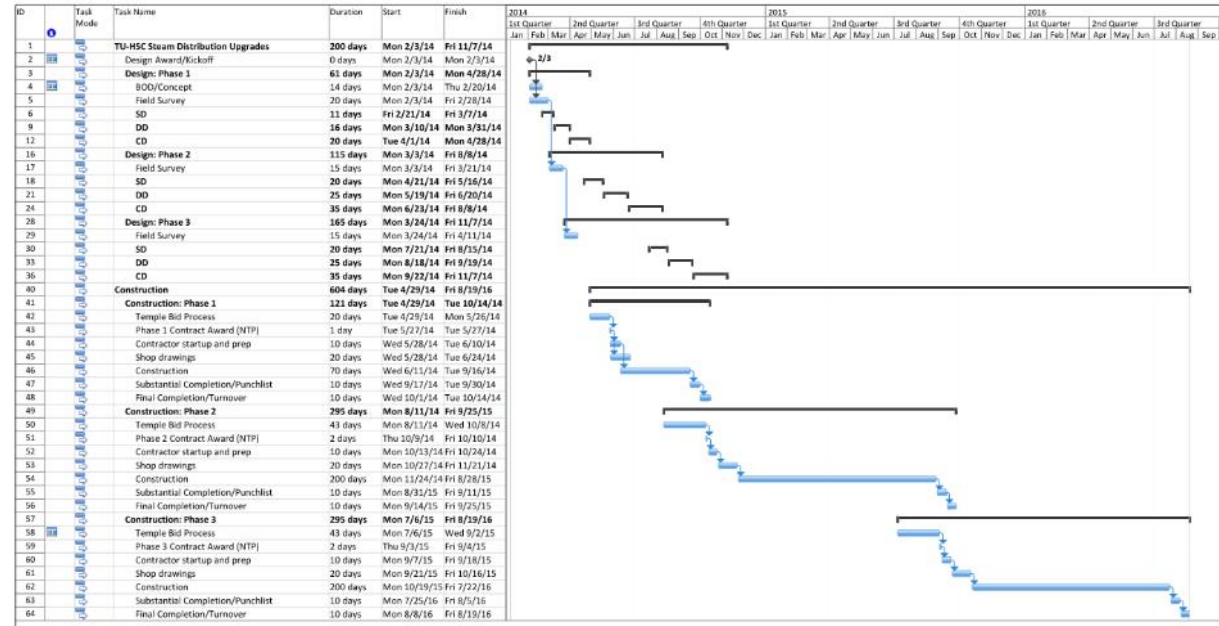
Project Background

Schedule

- Design
- Construction

Budget

- Annual Funding
- Phasing
- Overall Cost



		3 Pipe w/IM 2 Pipe w/o M Above Grade		
		1000 LF	279 LF	
Phase 1	GC Bid			
	Piping			
	Dedicated B' Line	80 LF	LF	80 LF
	UG path along Germantown Ave	600 LF	LF	LF
NIC	Germantown Ave to MH-C20	240 LF	LF	LF
	MH-C20 across Tioga into Tioga Garage	55 LF	LF	LF
	UG - North Tioga St. upstream of MH-C20 and west to Above grade in Tioga Garage	300 LF	LF	265 LF
	Building Service: At Tunnel for Boyer/Shiners from Tioga Garage to NW Broad St. & Tioga MH, including existing Broad St. x-over UG tie	130 LF	LF	LF
NIC	Building Service: Parkinson Pavilion	LF	240 LF	LF
	North Broad St. x-over - Tioga St.	150 LF		
	NW x-over intercept, to Kresge West	160 LF		
	Building Service: Kresge & MRB	LF	105 LF	LF
NIC	Tioga and Carlisle Sts. to Ontario St.	650 LF		
	Building Service: Student Faculty	LF	140 LF	LF
	MH-A6 west x-over Broad St. and south to NW corner of Tioga and Broad St.	200 LF		
	above grade, condensate piping in Ontario West proposed 'C' line x-over on North side of Westmoreland Ave., and UG tie to MH-C10 outside Ontario West	360 LF	LF	10 LF
NIC	A' line extension to from nearby Jones Hall to Broad St.			



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Project Details

Documentation / Assessment

System Analysis

Design

Reliability

Energy Savings

Operational and Serviceability

Future Connections / Flexibility

Construction Staging / Phasing



Project Details

Documentation

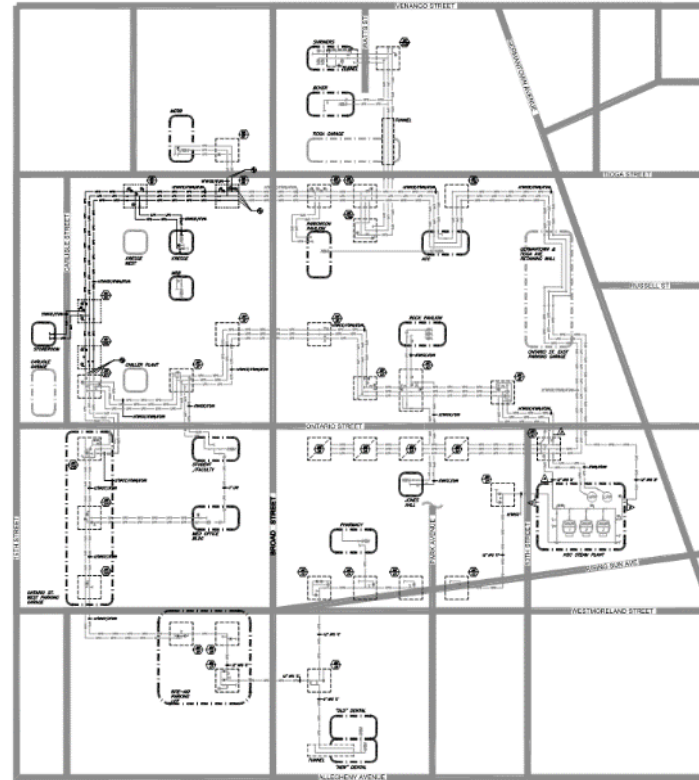
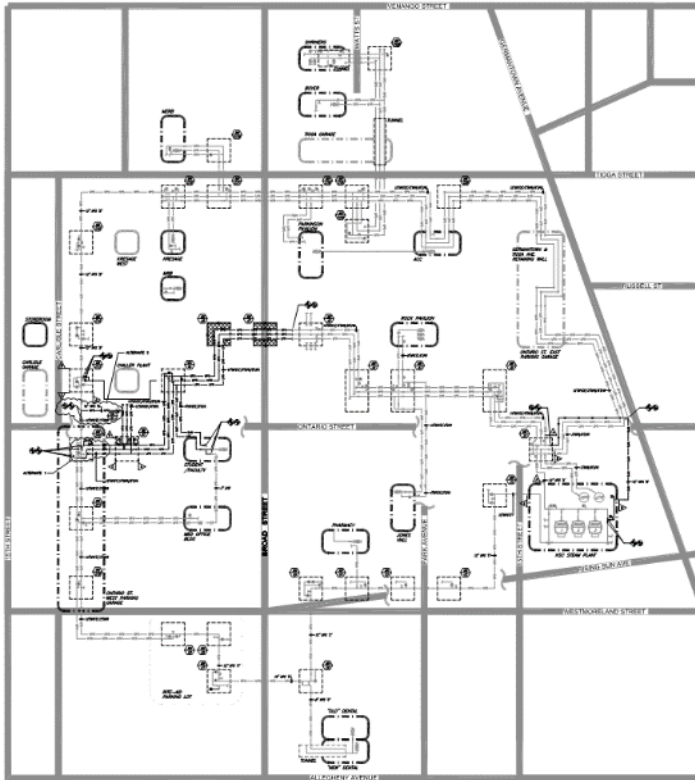
- Survey
 - As-Builts
- Assessment
 - Existing Conditions
 - Material Failures
 - Building Loads and Meter Data



Project Details

System Analysis

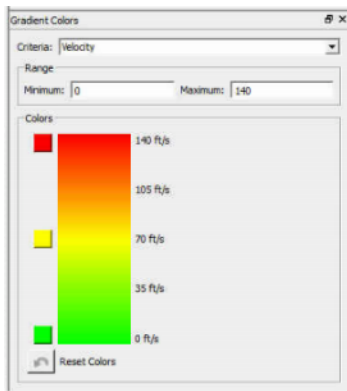
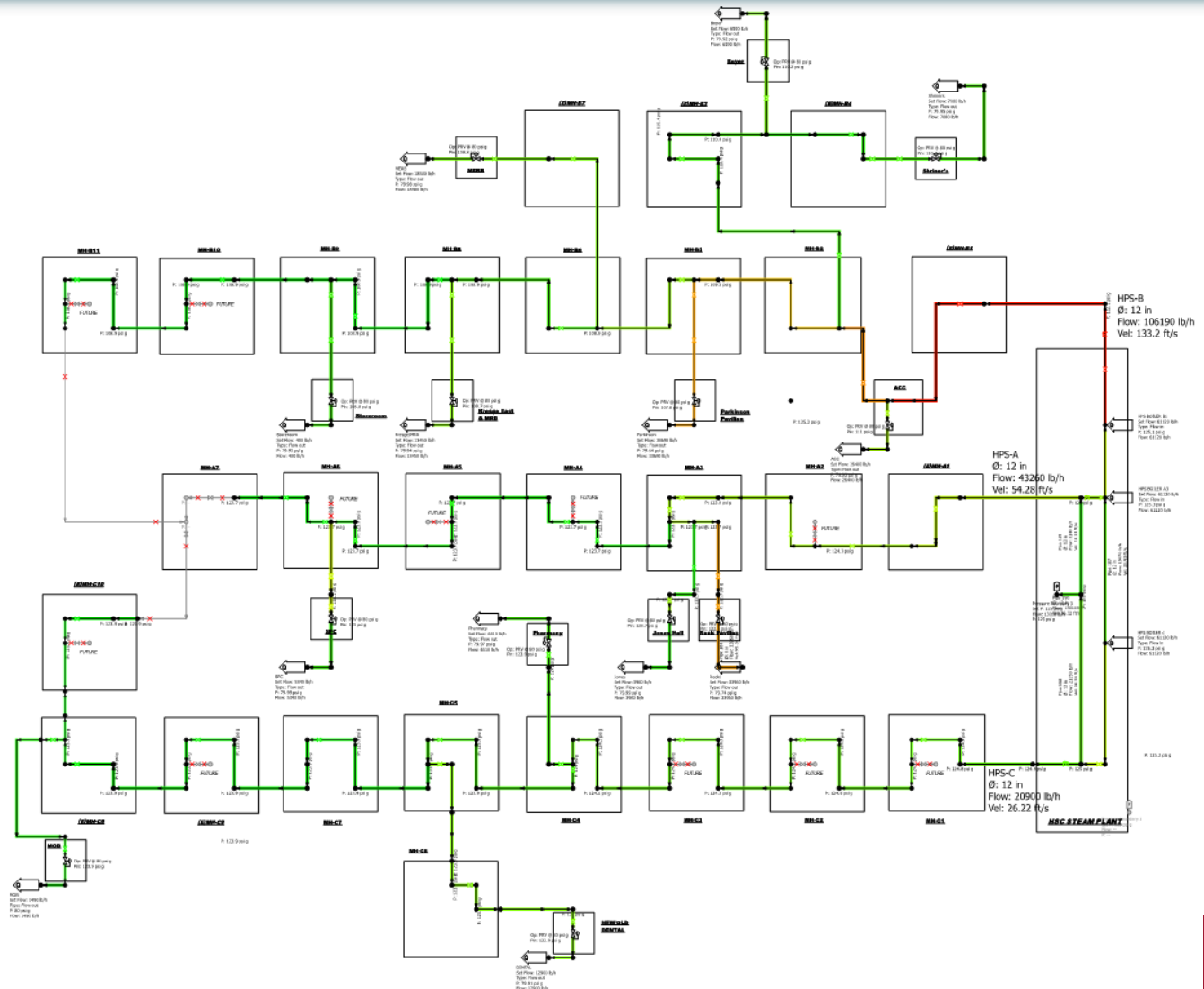
- Flow Requirements
 - Existing Campus
 - Campus Re-Development, Usage and Building Renovations



Project Details

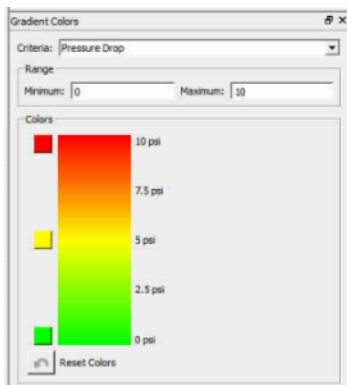
System Analysis

- Velocity
 - Current & Future Cases
 - Outage Scenarios



System Analysis

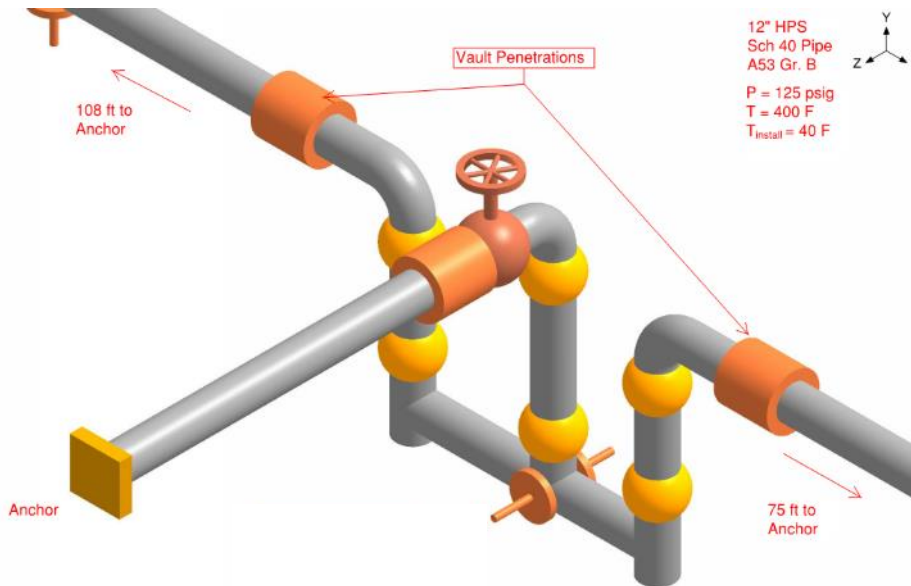
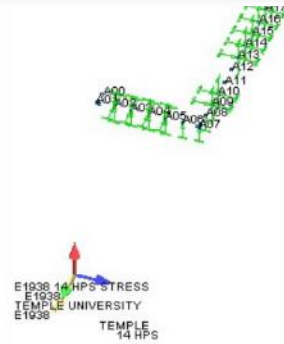
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Project Details

System Analysis

- Stress
 - Buried Distribution
 - Within Structures



02:11 PM TEMPLE UNIVERSITY

AutoPIPE Advanced

RESULT SUMMARY

Maximum sustained stress ratio

Point : A34 N
Stress psi : 2352
Allowable psi : 17100
Ratio : 0.14
Load combination : GR + Max P(1)

Maximum displacement stress ratio

Point : A07 M
Stress psi : 22978
Allowable psi : 25650
Ratio : 0.90
Load combination : Max Range

Maximum hoop stress ratio

Point : A00
Stress psi : 2618
Allowable psi : 17100
Ratio : 0.15
Load combination : Max P(1)

*** The system satisfies ASME B31.1 (2012) code requirements ***
*** for the selected options ***

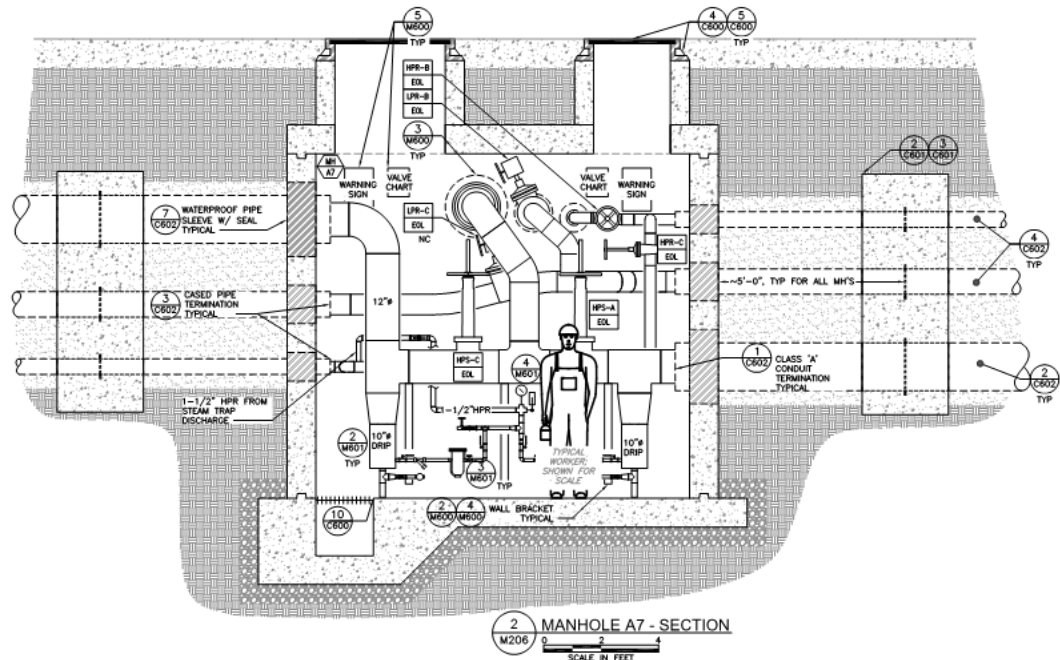
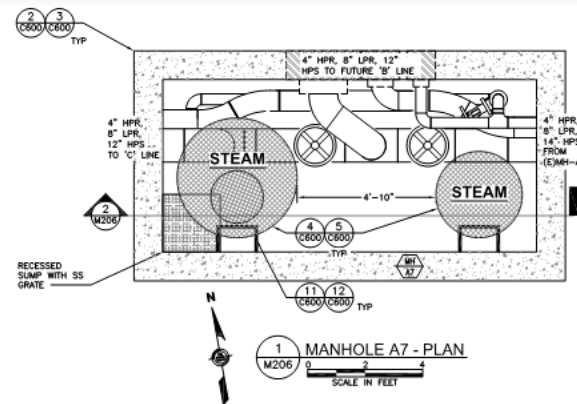


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Project Details

Design

- Distribution Manholes

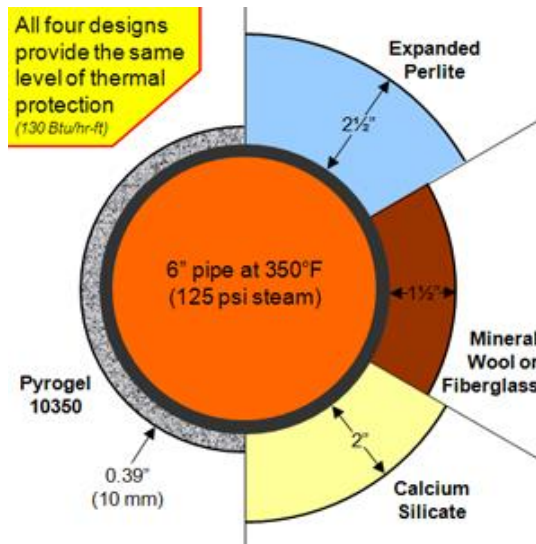
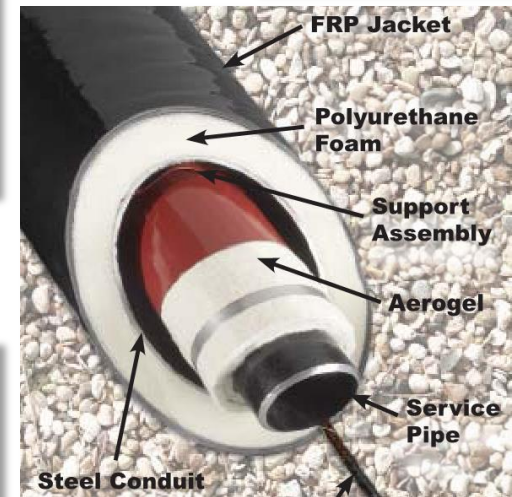


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Project Details

Reliability

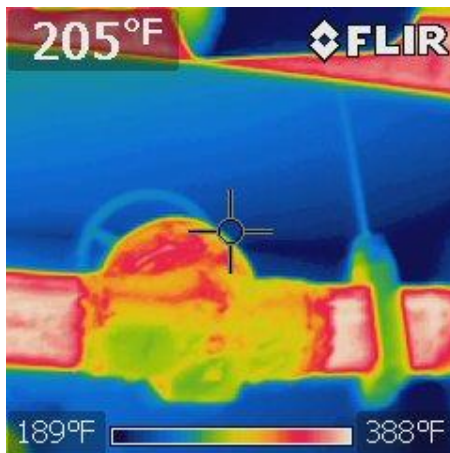
- Quality Materials
- Steam: Class 'A' System
- Condensate: Cased SS304
- “Dryable” Insulation



Project Details

Energy Savings

- Upgrade Components
- Increase Steam Quality
- Insulate Distribution System
- Eliminate Steam Leak/Losses



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Project Details

Energy Savings

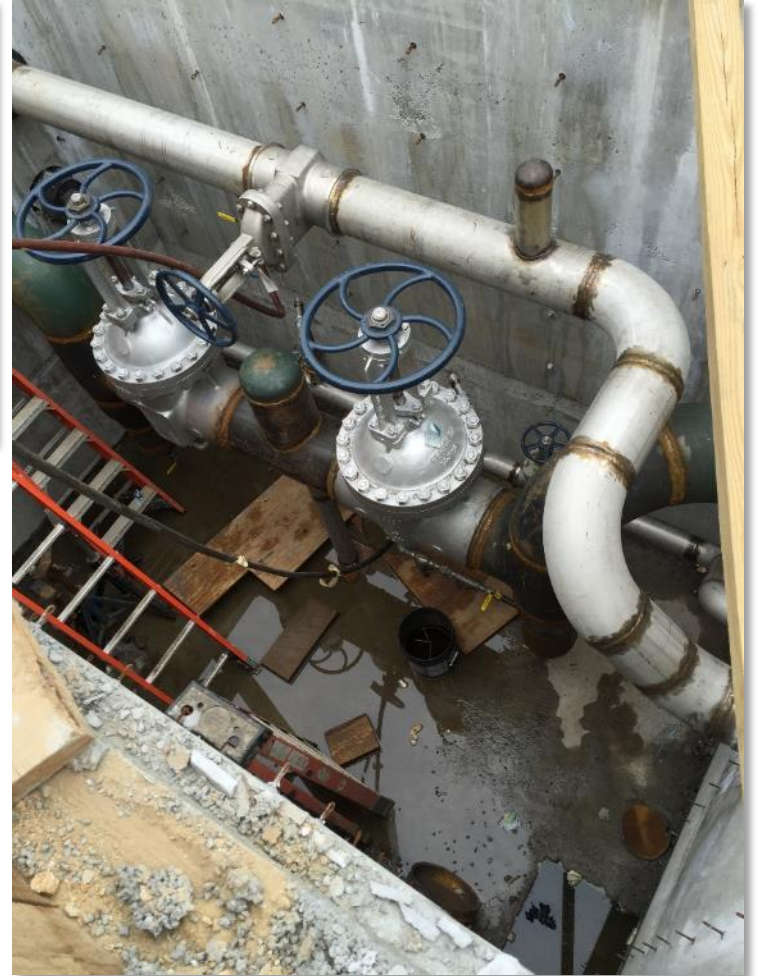
- Steam Plant Operating Costs
 - Steam Consumption
 - Make-up Water Consumption
 - Boiler Chemical Treatment
 - Service Calls



Project Details

Operational and Serviceability

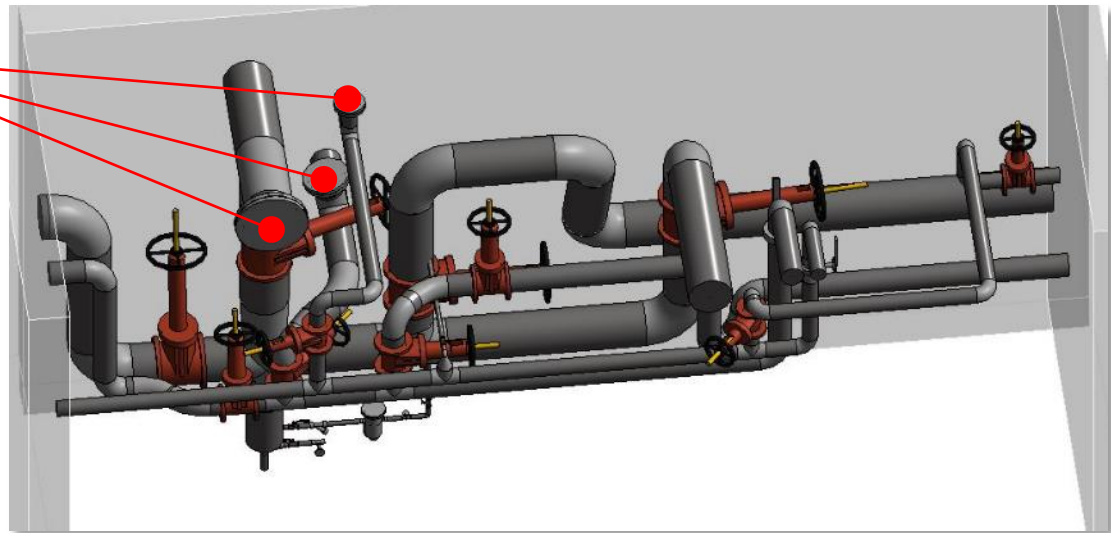
- Manhole Pumping
- Seasonal Changes
- Annual Shut Down
 - Maintenance
 - Testing



Project Details

Future Connections / Flexibility

- Aerial Infrared Annual Survey
- Accommodations for Future Campus Connections



Project Details

Construction Staging



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Project Details



Construction Phasing

- Currently in Phase 3 of 6
- Minimize Hospital Access and Operation Disruption



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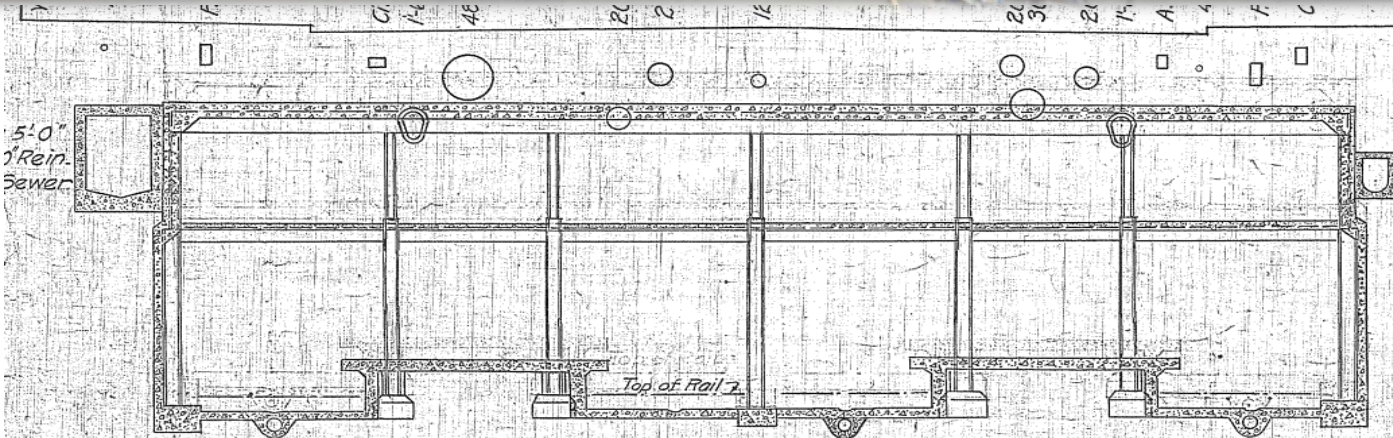
Project Details

Construction Phasing

Coordination with State
Highway Crossing (PA-611)
With Transit Subway Below

Coordination of
Hospital Access
During Construction

Ontario St



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Construction Challenges

Unforeseen Conditions

- Utility Conflicts
 - Chilled Water
 - Telecom
 - Electric
 - Domestic Water
 - City Subway



Q & A

Any Questions?



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