

# Underground Chilled Water Project Approach at Syracuse University for Major Expansion

**Syracuse University**

Campus Planning, Design, and Construction

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# Syracuse University

- Founded in 1870 in Syracuse, NY
- 22,500 students
  - 15,250 undergraduate
  - 7,250 graduate and law students
- District Steam Heating Plant Serving SU Campus, SUNY ESF Campus & Three Hospitals
  - 500,000 PPH, Distribution Length +/-6.5 Miles
- District Cooling Plant Serving SU Campus
  - 6,400 Tons of Cooling, Distribution Length +/-2.5 Miles
- Building Gross Areas
  - 9.4M GSF Total Syracuse Properties (w/o parking garages)
  - 7.4M GSF Total Main Campus
  - 3.0M GSF Cooled by Central Chilled Water Plant & Underground Distribution System



# Project Overview

- Master Planning
- Main Campus Chilled Water Upgrade (Selected Project)
- Carrier Dome & Campus Events Coordination
- Project Phasing
- Specific Project Site Requirements
- Contract – Construction Manager Approach
- Utility Mapping, GPS As-Builts & Site Monitoring
- Lessons Learned

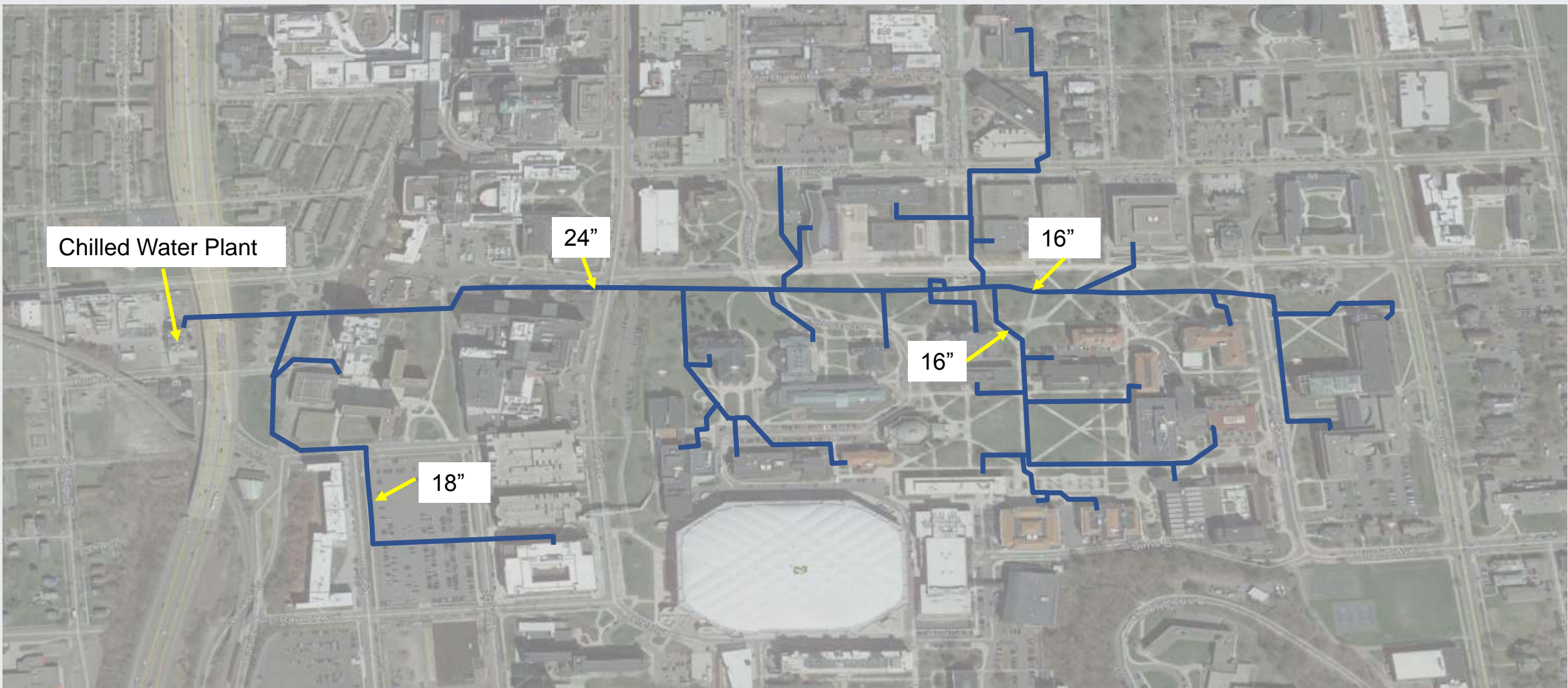
# Master Plan – Chilled Water Loads

- Current: 4,500 Tons
- Future:
  - Arch = 600 Tons
  - NVRC = 270 Tons
  - Hendricks Chapel = 80 Tons
  - Carrier Dome = 3,000 Tons
  - Smith Hall = 100 Tons
  - Machinery Hall = 150 Tons
  - Henry Health Site = 100 Tons
  - Huntington Hall = 130 Tons
  - Ernie Davis = 300 Tons
  - Total: 4,730 Tons
- Future Campus Total: 9,230 Tons

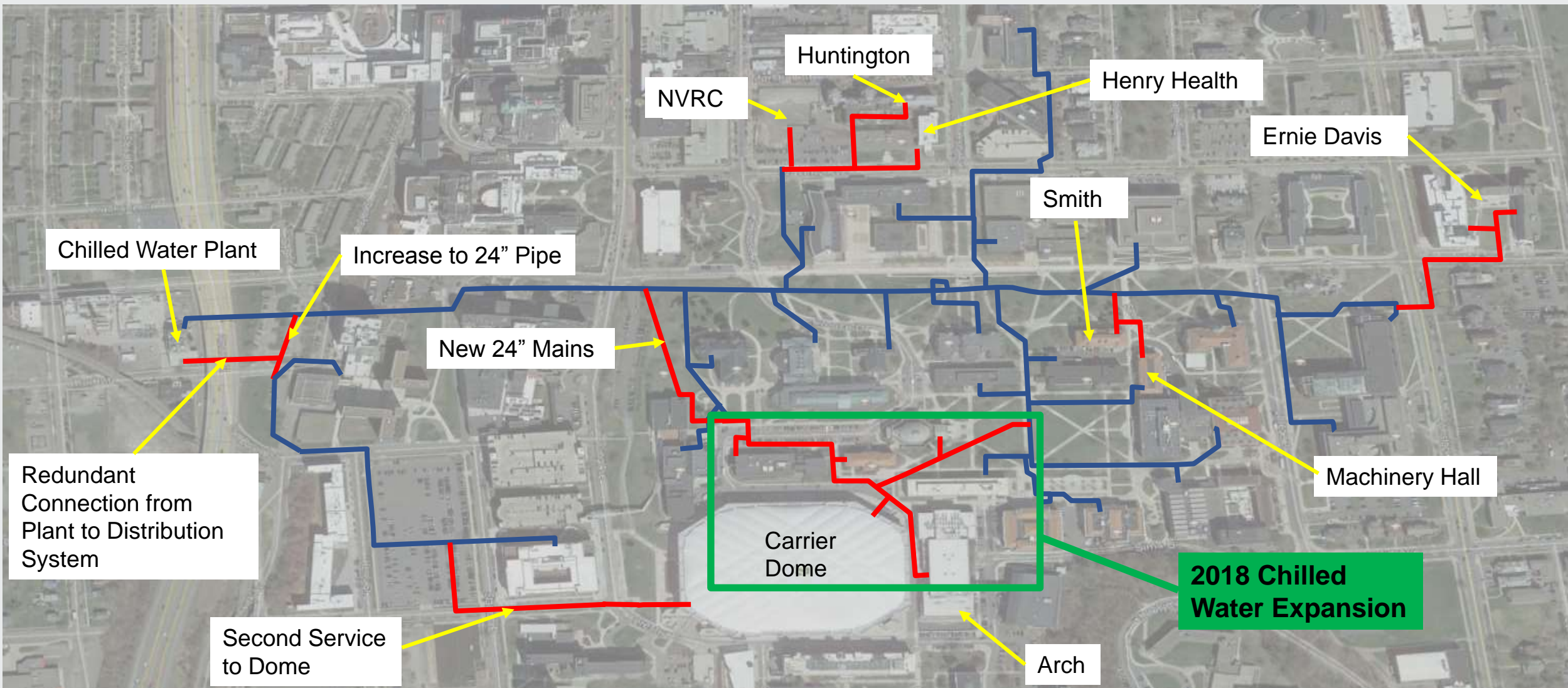




# Existing Underground Chilled Water Distribution System

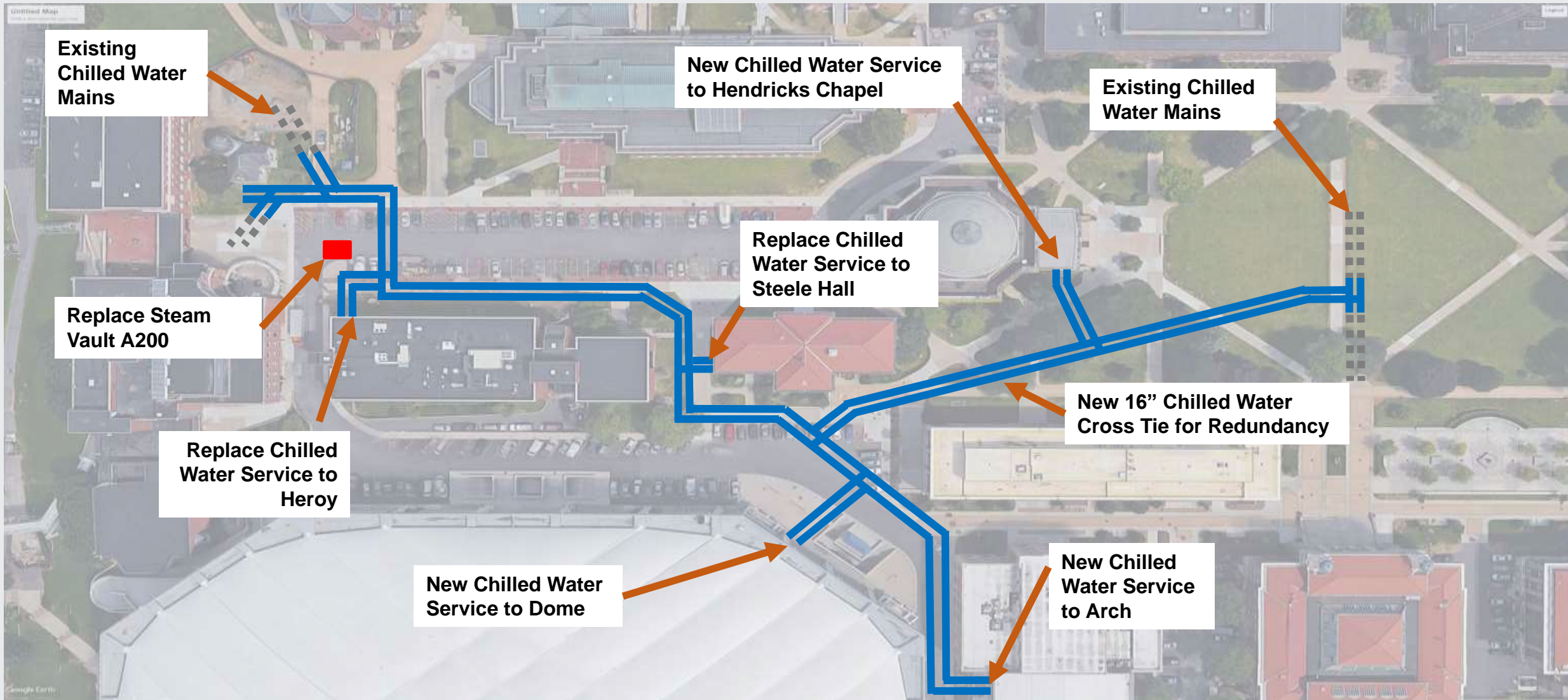


# Chilled Water Distribution Master Plan





# Main Campus Chilled Water Upgrade Project



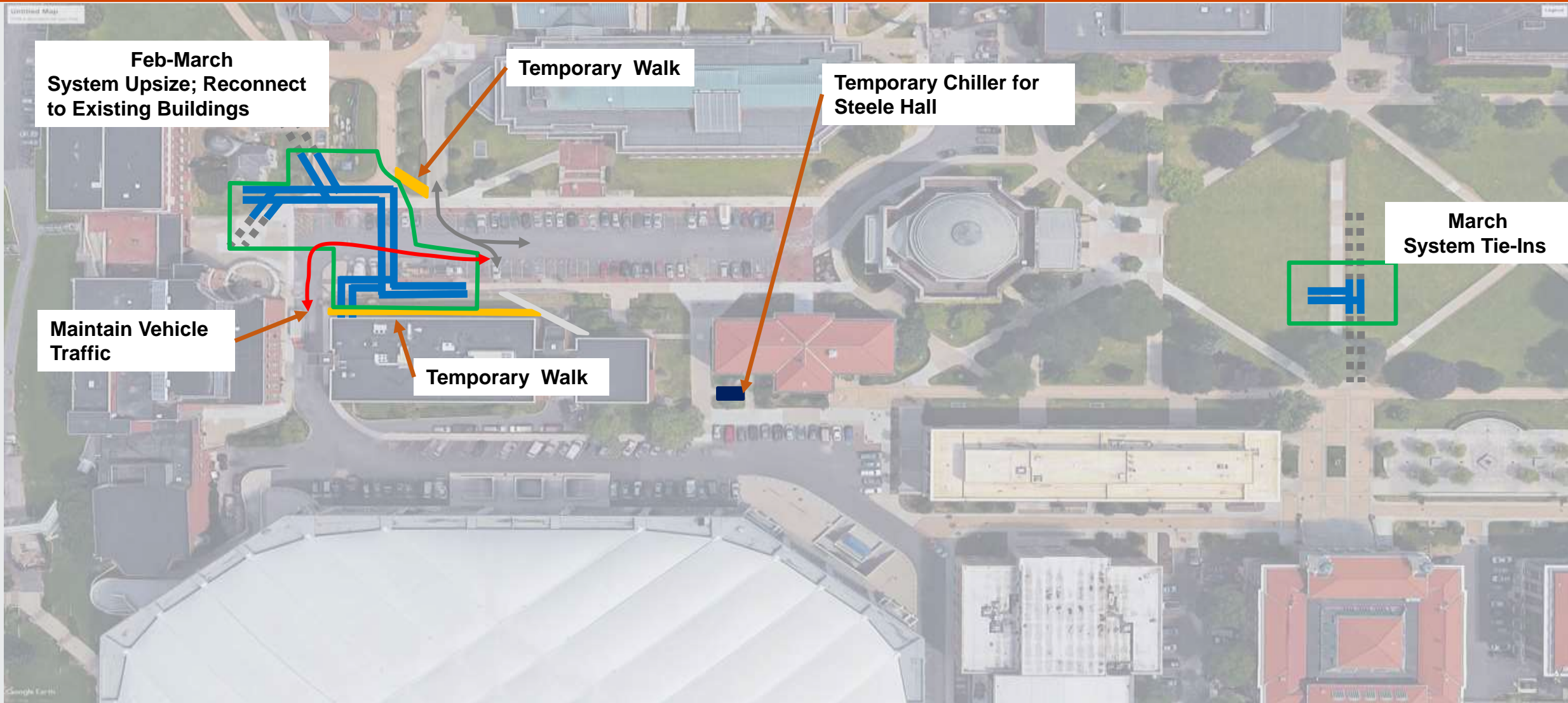


# Carrier Dome and Campus Events





# Phase 1 – Winter 2017/2018



# Phase 1 – Chilled Water Work

- Temporary Chiller to Steele Hall

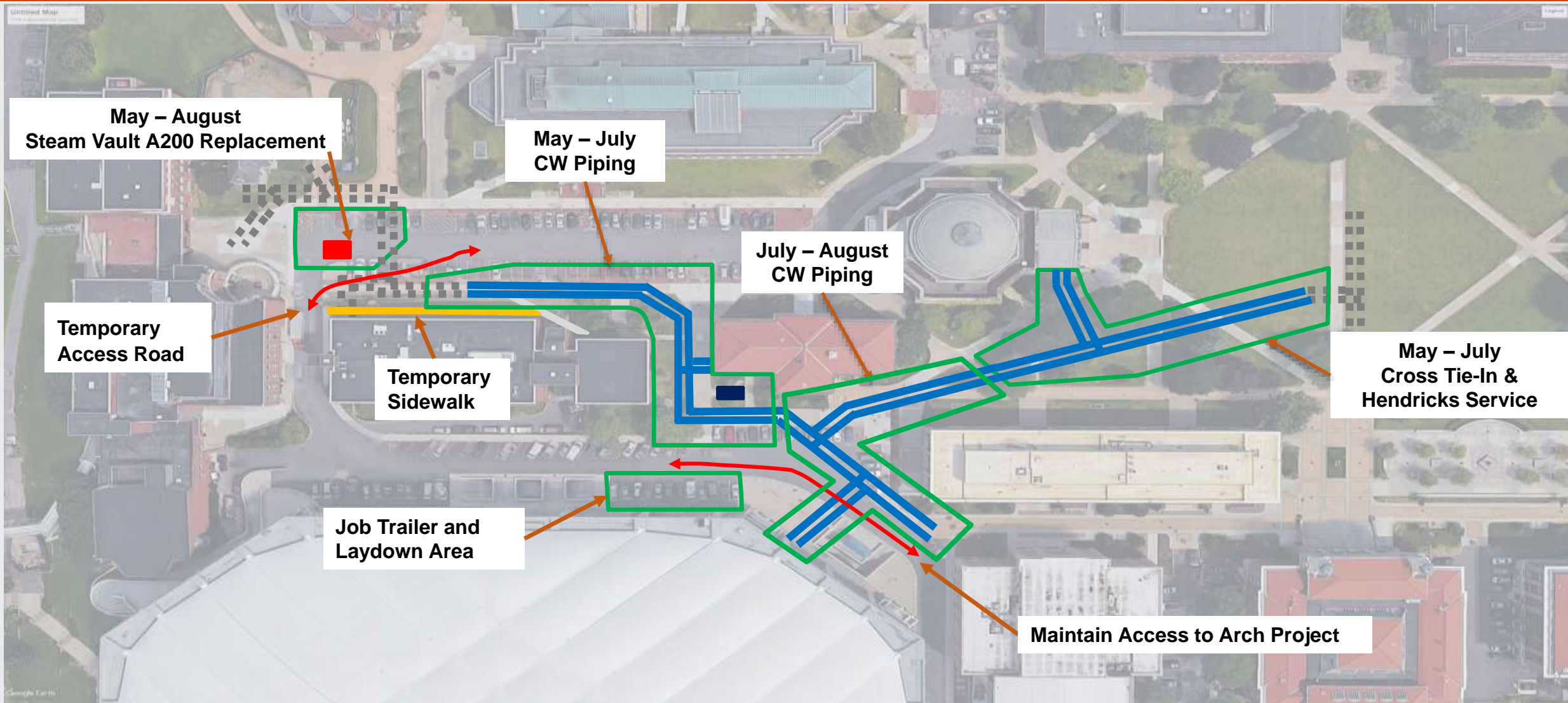


- Scope of Work Necessary to Allow Balance of Project to be Completed with Active Distribution System





# Phase 2 – Summer 2018



# Phase 2 – Chilled Water Work

- 1,450 LF of 4"-24" Ch. Water Mains
  - Included four building services



- Use of Speed Shoring System
  - Low Vibration Area



- Ch. Water Entrance to Carrier Dome
  - 24" Core-Drill into Positive Pressure Building
  - Pedestrian Bridge to Accommodate Tours





# Phase 2 – Steam Work

- Steam Bypass

- Heroy & Falk Domestic Hot Water & Reheat Systems



- Selective Demo of Vault

- No Jackhammering



- New Vault Construction





# Phase 2 – Utility/Water Work

- 200 LF of 8" and 10" Water Main Relocations
  - Temporary HDPE Domestic / Fire Water Service



- 450 LF Primary Electric & Communication Ductbanks





# Phase 2 – Snowmelt/Lighting

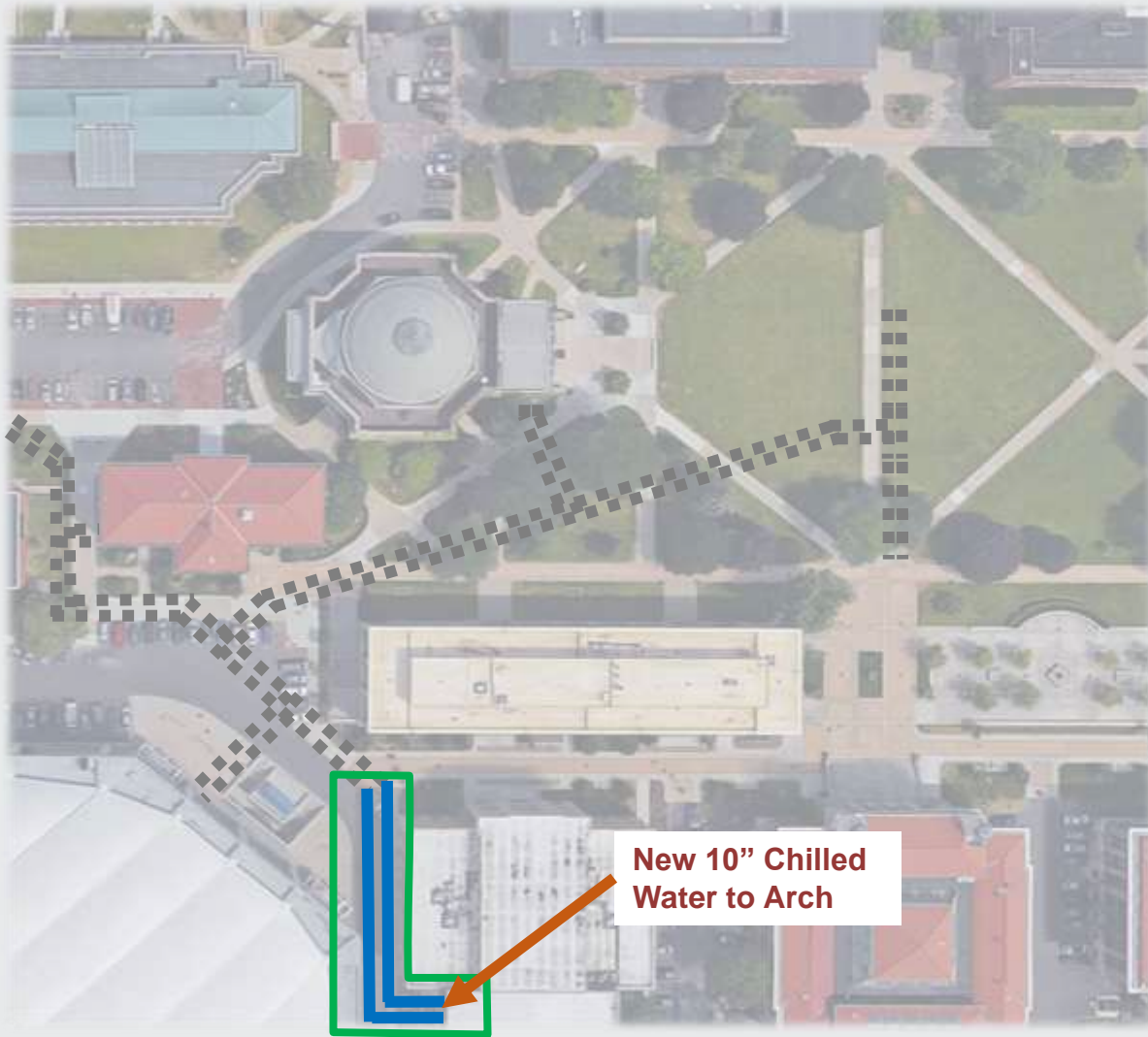
- 4,500 SF Snowmelted Sidewalk  
– Targeted high traffic area



- LED Site Lighting Upgrades for Parking Lot and Pedestrian Walkways



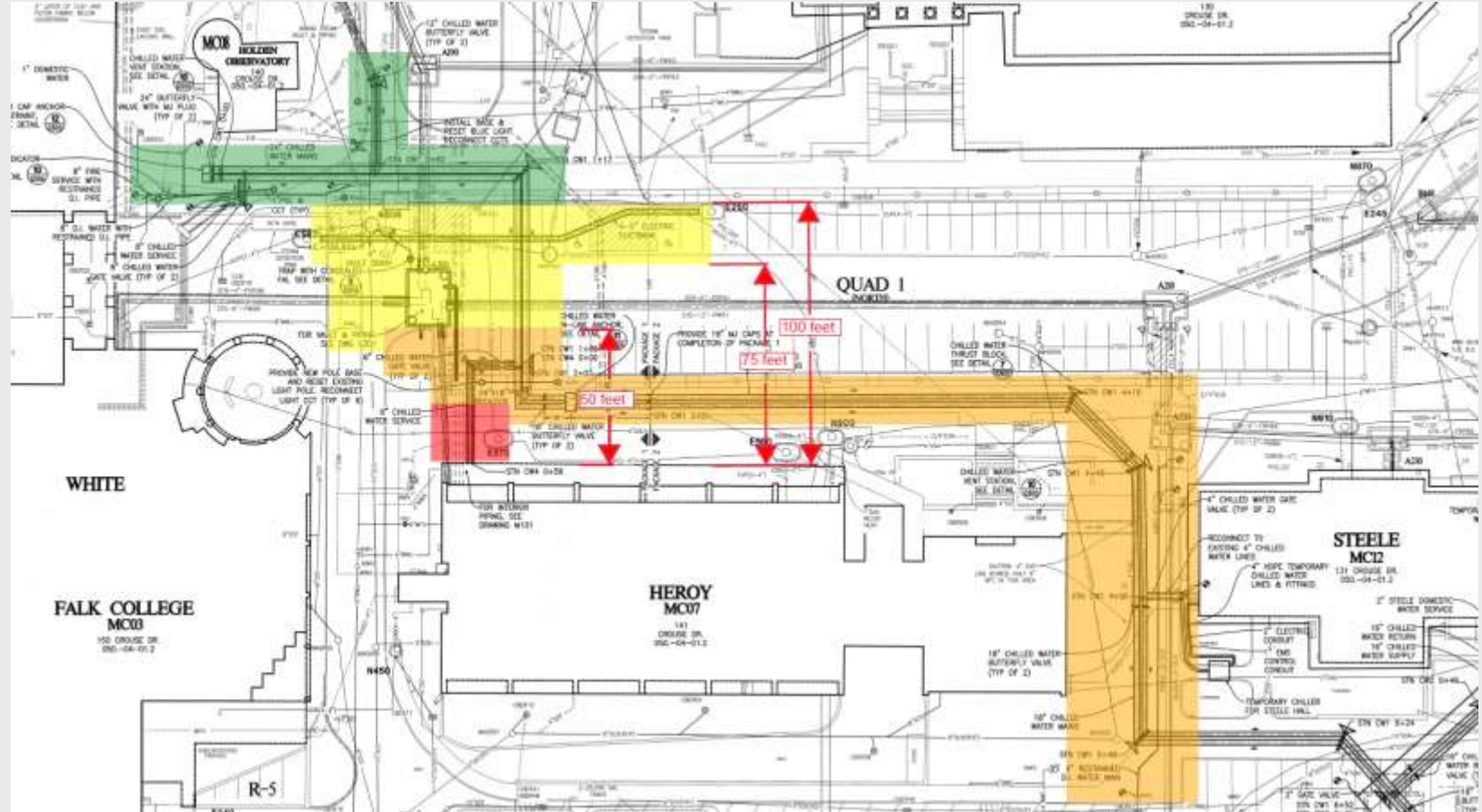
# Phase 3 – Winter/Spring 2019





# Specific Project Site Requirements

- Adjacent Building (Heroy) with Active Electron Microscopes, Mass Spectrometers, Electron Microprobes, etc.
- Developed Plan for Contractor – Allowable Equipment / Techniques
- Modified Plan as Construction Progressed



# Specific Project Site Requirements

- Steam Vault Demolition
  - No Jackhammering
  - Track and Wire Sawcutting Only



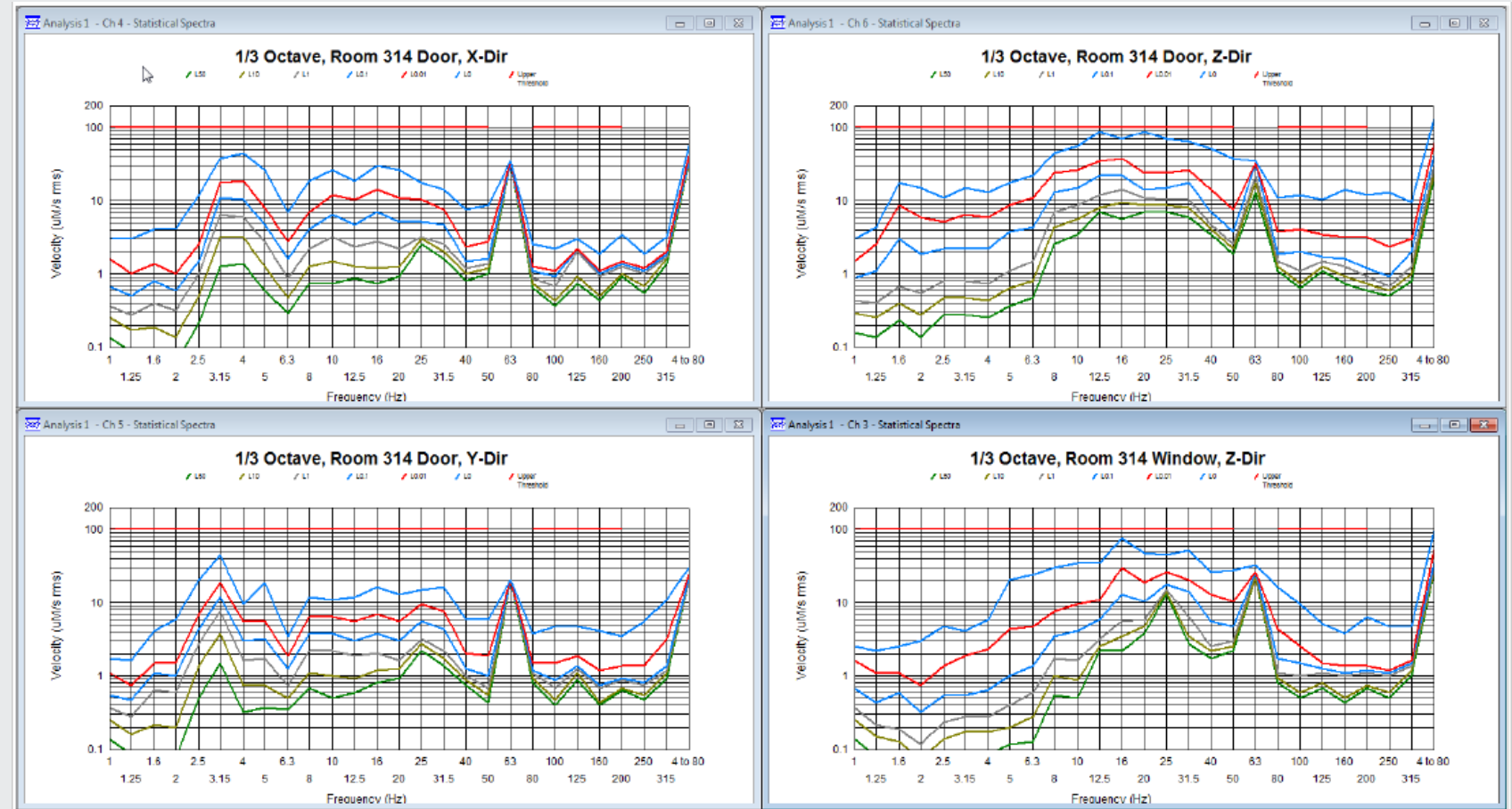
- Backfilling Efforts
  - No plate tampers within 100' of Heroy
  - Utilized #2 stone and jumping-jack





# Specific Project Site Requirements

- Real-Time Vibration Monitoring for Sensitive Lab Equipment
- Sensors (4) Installed in Adjacent Building
- Email / Text Message Alerts
- Reports & Exceedance Logs Every 2 Weeks over 6 Month Period



# Contract – Construction Manager

- Construction Manager At Risk (CMAR)
- CM Selection Process
  - Competitive bids for pre-construction phase services
  - CM's submitted rates for self-performing work
  - CM selected based upon pre-construction bid, self-performing costs and experience
  - All subcontracts were competitive bid by multiple firms (Mechanical, Electrical, Plumbing, Insulation, etc)
- AIA Document A133 Agreement
- Multiple Packages To Meet Project Schedule (Each a GMP Amendment)
  - Phase 1: Utility Work Package
  - Phase 2: Utility Work Package
  - Phase 3: Site Landscaping, Snowmelt, & Site Lighting Package
- Total of 7 Funding Sources, Separate Pay Applications for Each with T&M + Fee
- Total Project Cost: +/- \$4.0MM

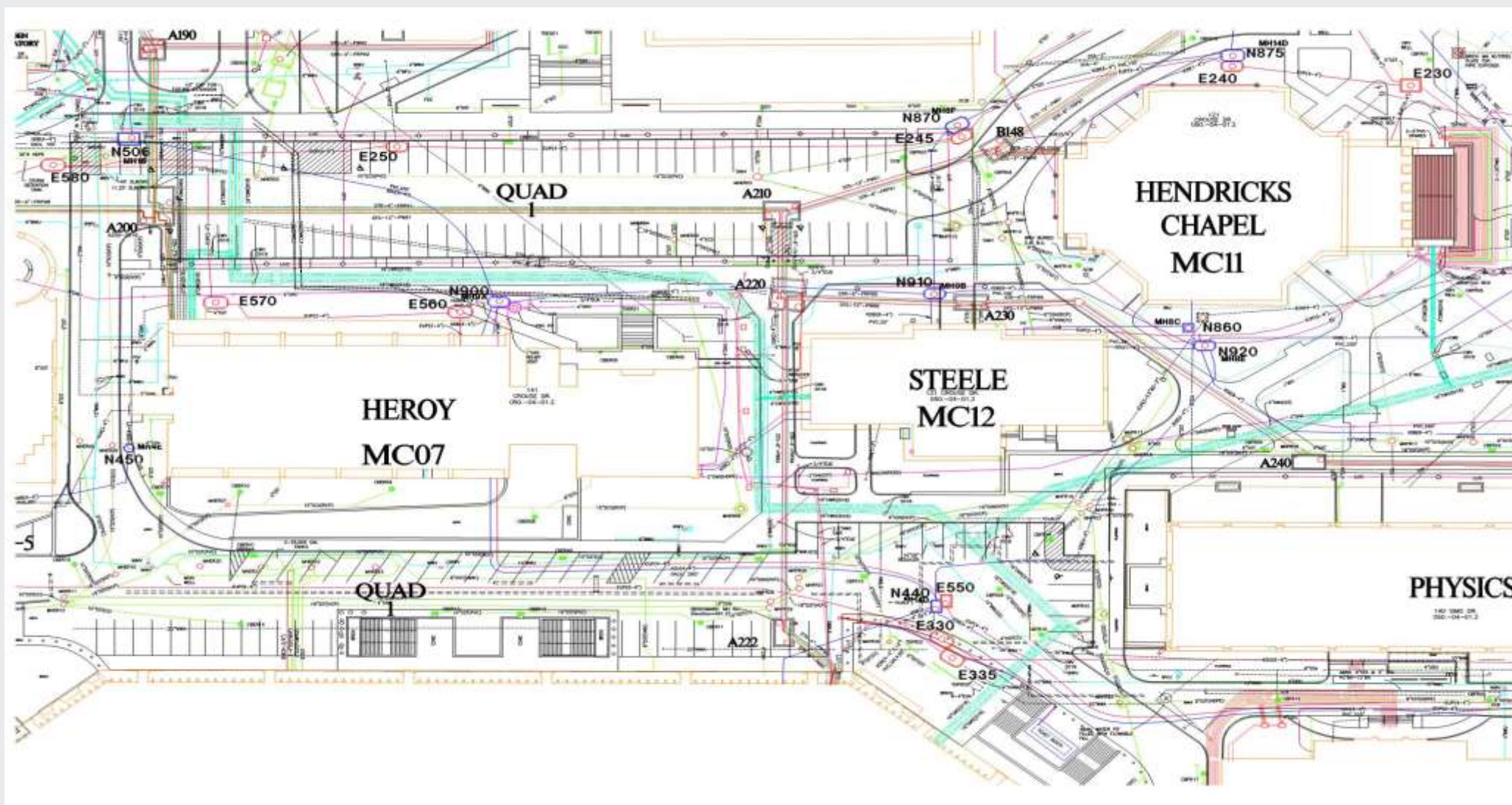


# Utility Mapping, GPS As-Builts, & Site Monitoring

- Current campus site and utility map description
- Leica Equipment
  - Real-Time Kinematic (RTK)
  - CS15 Controller
  - GS14 Receiver
- AutoCad Civil3D & PDF Format
- Student Internship Program
  - State University of New York, ESF Construction Management

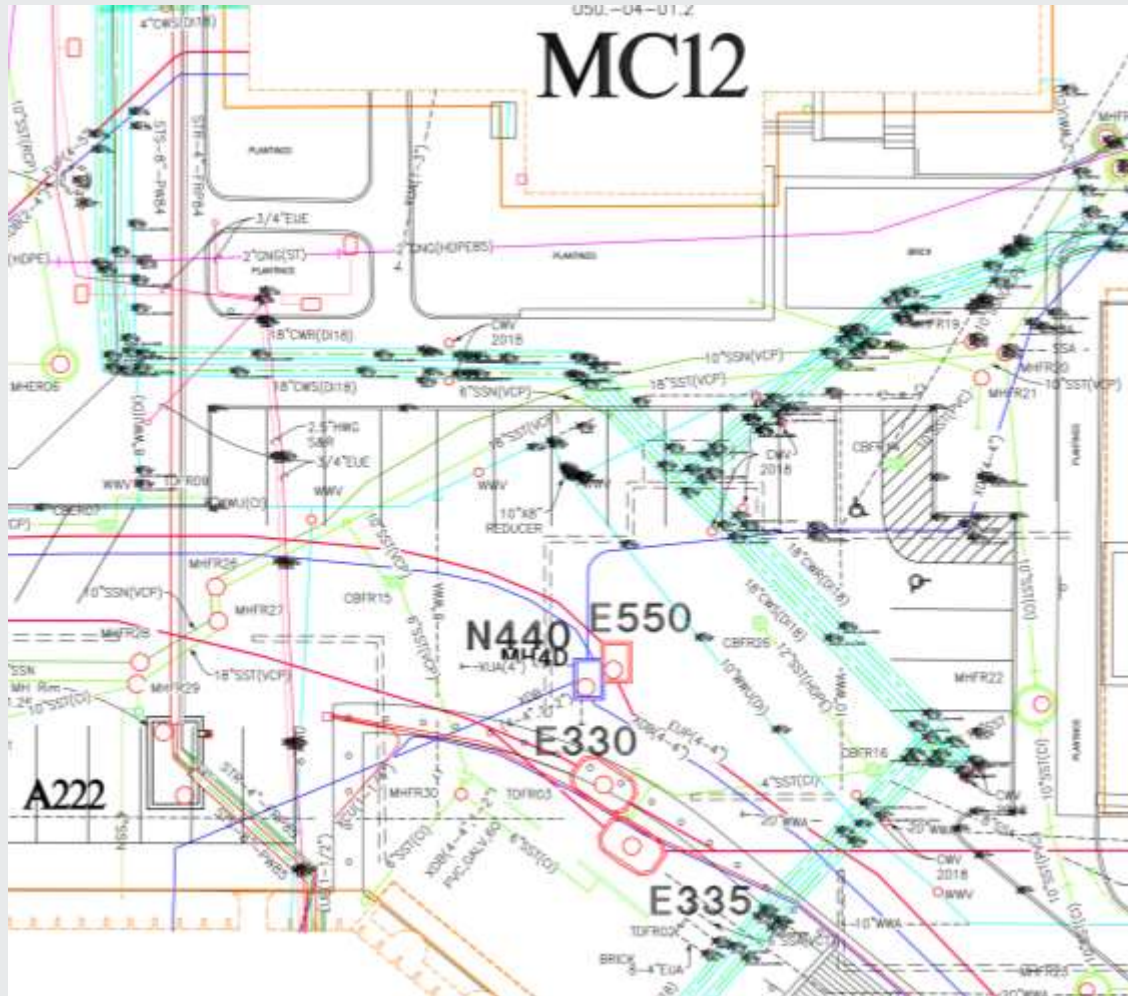


# Campus Site & Utility Map





# GPS As-Built Collection



Points of Project: SU-2018 CW Arch-Dome (Coordinate System: NY C NAD83 12A, Units: fts)

Point Id	Code Description	Code Infor...	Attributes	Date/Time	Northing	Easting	Ortho. Hgt.
✓ 676	CW Top of Pipe		Install Date=2018/Size=16	08/09/2018 15:14:59	1106869.4386	939960.4183	549.0148
✓ 677	CW Top of Pipe		Install Date=2018/Size=16	08/09/2018 15:15:17	1106869.1994	939964.5799	549.1293
✓ 678	CW Valve		Valve Type=Butterfly Valve/Install Date=2018/Size=16	08/09/2018 15:16:19	1106859.9573	939956.1119	548.7817
✓ 679	CW Valve		Valve Type=Butterfly Valve/Install Date=2018/Size=16	08/09/2018 15:16:46	1106862.1157	939953.8786	548.9004
✓ 680	CW Top of Pipe	11.25L	Install Date=2018/Size=16	08/09/2018 15:17:39	1106855.5130	939951.6617	548.8656
✓ 681	CW Top of Pipe	11.25L	Install Date=2018/Size=16	08/09/2018 15:17:59	1106857.2683	939949.7470	549.3411
✓ 682	CW Top of Pipe		Install Date=2018/Size=10	08/11/2018 12:15:18	1106867.4899	939969.2521	551.4556
✓ 683	CW Top of Pipe		Install Date=2018/Size=10	08/11/2018 12:15:55	1106869.3261	939971.3480	551.6274
✓ 684	CW Valve	NUT	Valve Type=Gate Valve/Install Date=2018/Size=10	08/11/2018 12:16:31	1106866.3607	939970.3075	553.5587
✓ 685	CW Valve	NUT	Valve Type=Gate Valve/Install Date=2018/Size=10	08/11/2018 12:16:59	1106868.1407	939972.3778	553.3254
✓ 686	Storm Top Pipe		Size=10	08/11/2018 12:18:15	1106874.0664	939971.9978	559.1610
✓ 687	Steam MH Cover	A200	Install Date=2018	08/15/2018 14:22:32	1107104.8541	939567.3522	567.8704
✓ 688	Steam Rim	A200		08/15/2018 14:22:53	1107106.3593	939567.2889	567.9318
✓ 689	Steam MH Cover	A200	Install Date=2018	08/15/2018 14:23:15	1107094.9384	939555.7682	567.9551
✓ 690	Steam Rim	A200		08/15/2018 14:23:37	1107096.4007	939555.6423	567.9433

## Site Plan Users:

- Dig Safe NY – Utility Locating
- Master Planning
- Campus Site Projects
- Share with Local Municipalities



# Lessons Learned

- Vibration and Backfill Methods
- Temporary Chiller Learning Curve – Controls & Melted PVC Pipe
- Communication: Town Hall Meetings & Utility Outages

2007 Utility Outage Summary  
6/15/08, 09/08

Start/End	Duration	Location	Buildings	Utility Type / Contents	Reason for Outage	Status
4/13 - 6/15/08	~10 weeks	Chilled Water	Isaac	Refrigerator	Installation of chilled water piping	Isaac shut off by a temporary chiller for the duration of the outage
5/16/08	~1-2 hours	Steam	Dome (North Service)	Isaac	Further isolation of Vault A200	Dome south service to remain active (no interruption to domestic hot water)
5/21 thru August	~10 months	Steam	Dome (South Service)	Isaac	Isolate Vault 0200 and isolation bypasses	Outage for duration of summer work. Dome will be fed from north service only
6/18 - 6/22/08	7 days	Steam	Sutton, Ligonier	Refrigerator, Hughes, Plumbing/Drain	Isolate steam bypasses around Vault 0200	Steam shut off 6/18 and will be on 6/22 or later. If required by P&ID
6/18 - 6/22/08	~1-2 days	Steam	Henry, Park, Rogers	Refrigerator	Isolate Vault 0200 and isolation bypasses	Steam shut down to begin at 5:00pm Friday 6/18 and be resumed on Sunday 6/22
6/18 - 6/22/08	~1-2 days	Steam	Baker, John (EST Buildings)	Isaac, Rogers	Remove steam bypasses around Vault 0210, EST impact	
6/30/08	2 days	Hot Water	Henry, Park	Refrigerator	Relocate existing hot water piping east of Henry	Need to coordinate with gas work, replacement in Park, emergency generators, use gas in Park & Henry
6/31/08	2 days	Domestic Water, Fire Water	Hamletts (Domestic & Fire), Isaac (Fire Only), Patient North of Isaac	O'Connor	Establish temp water feed to Hamletts to allow relocation of H <sub>2</sub> O water between Isaac & Henry	
6/15/08 (Saturday)	2 day	Domestic Water, Fire Water	EST, L&P, Ligonier, East side of Hamletts	Orders, Priority of Security Lockdown	Install additional isolation valves in Corridor 4 as	Fire water service to EST will be maintained (fire water outage to 02 area)
6/18 - 6/21/08	~1-2 weeks	Irrigation System	Main Quad - Southwest Corner	Control	Installation of chilled water piping across Quad	
6/18 - 7/13/08	~1-2 weeks	Fire Water	Isaac, Hamletts North of Isaac	Refrigerator	Relocate water distribution piping located between Isaac and Henry	
6/18/08	~1-2 hours	Domestic Water	Isaac	Refrigerator	Relocate temp water feed to Isaac to allow relocation of water main between Isaac & Henry	Outage from approx 6:00AM to 9:00AM
July 14-17 or June 28-30 (TBD)	3 day	Domestic Water, Fire Water	Reviewing w/ DHD, appears to impact Hamletts, South Damage Fire and Shaw Domestic	Numerous	Relocate existing 18" water main isolation valve	City of Syracuse Water Dept reach
Late June (TBD)	~1-2 weeks	Fire Water	Dome South Feed, Hamletts South of Henry	Isaac	Relocate water distribution piping located between Isaac and Henry	
June-July (TBD)	2 day	Electrical, Communication	Isaac	Isaac, P&ID/Control	Modify electrical/communication conduits an entrance to building and replace breakers	Communications can be Quad point of sale hypothesis
Week of 6/23-6/27	~1-2 days	Chilled Water	South Garage	Isaac	Repair water in basement door	
June-July (TBD)	2 day	Chilled Water	Isaac	Refrigerator	Switch building from temp chiller back to plantroom system	
July (TBD)	TBD (~1-2 days)	Domestic Water, Fire Water	Hamletts, Isaac	O'Connor, Refractor	Remove temporary water feeds	
August (TBD)	~1-2 days	Steam	Sutton, Ligonier	Refrigerator, Hughes, Plumbing/Drain	Remove steam bypasses around Vault 0210	
August (TBD)	~1-2 days	Steam	Baker, John (EST Buildings)	Isaac, Rogers	Remove steam bypasses around Vault 0210, EST impact	
August (TBD)	~1-2 days	Steam	Henry, Park	Refrigerator	Remove steam bypasses around Vault A200	
August (TBD)	2 day	Steam	Dome (North Service)	Isaac	Relocate steam to Vault A200 and restore Dome south service	

Utility Outage Scorecard





# Questions?