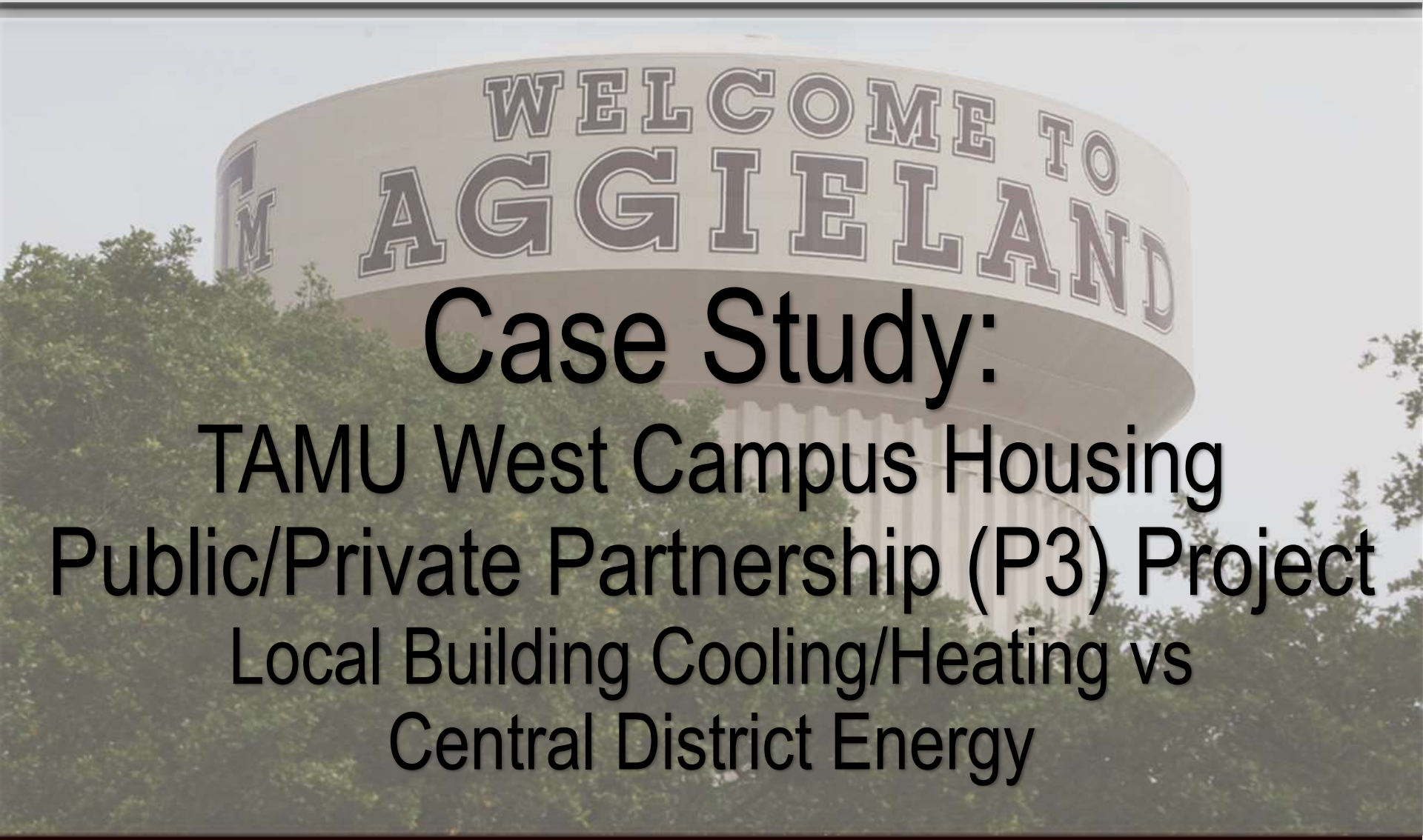
UTILITIES & ENERGY SERVICES
TEXAS A&M UNIVERSITY

INTERNATIONAL DISTRICT ENERGY ASSOCIATION

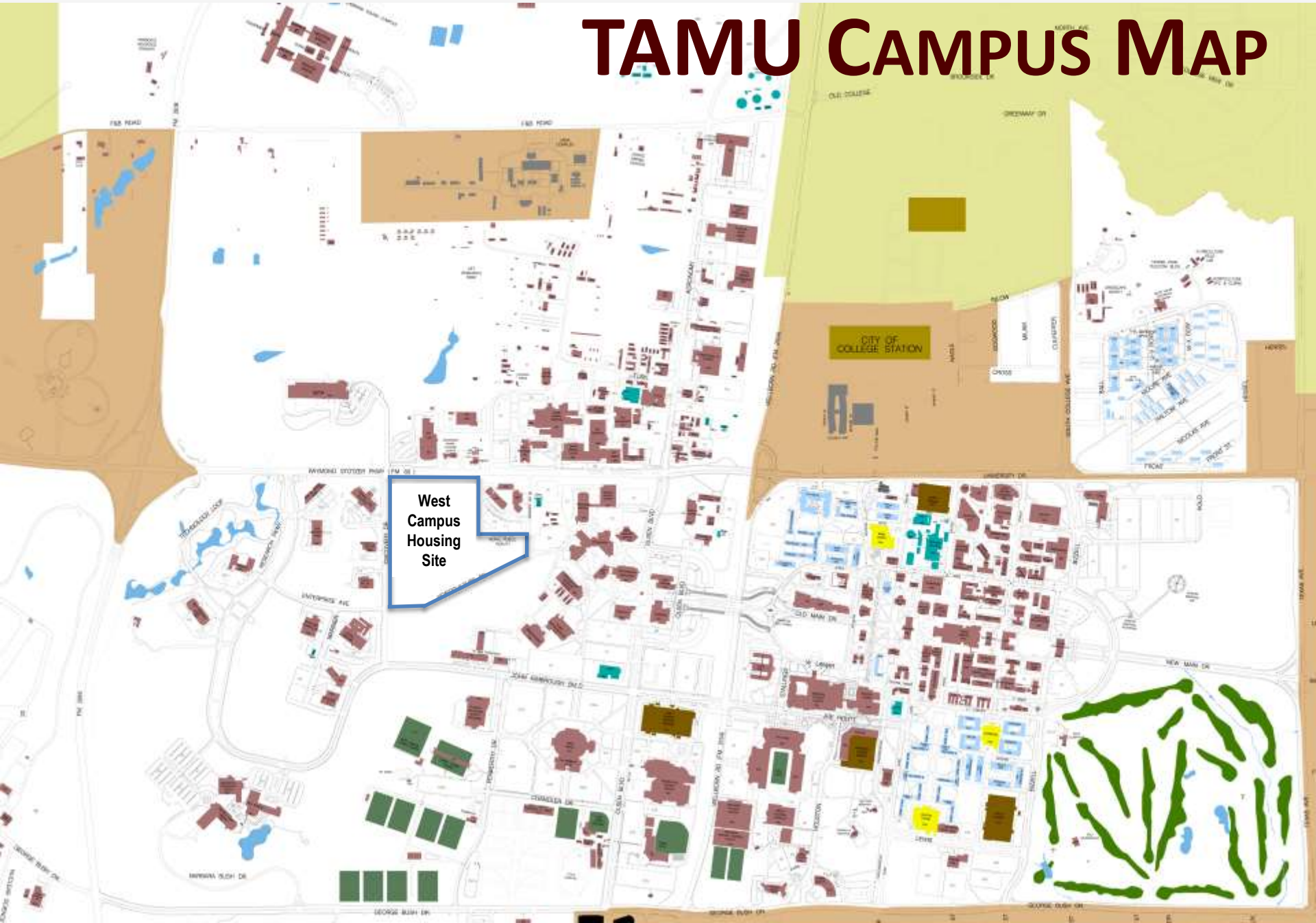


Case Study:

TAMU West Campus Housing Public/Private Partnership (P3) Project

Local Building Cooling/Heating vs Central District Energy

TAMU Campus Map



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ENERGY SERVICES CONTINUUM

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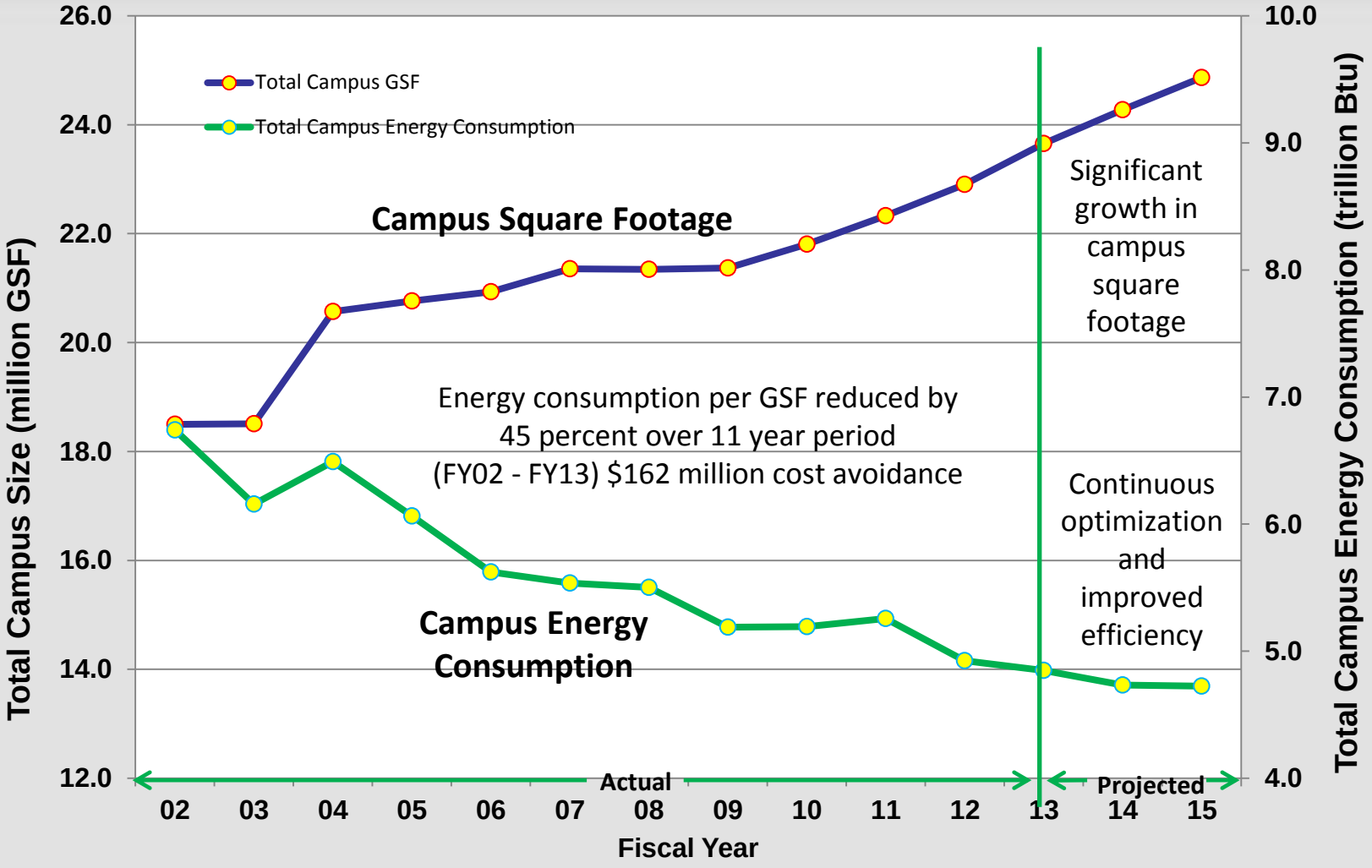
PROCUREMENT	TRANSMISSION	PRODUCTION	DISTRIBUTION	METERING & BILLING	DEMAND-SIDE MANAGEMENT
					
Calculate and nominate campus electricity & NG requirements Specify annual and monthly consumption quantities Review and recommend payment of invoices Serve on TAMU energy procurement and risk management committee	<u>TAMU owns:</u> • Domestic water transmission system <u>Atmos owns:</u> • HP (600 psi) NG transmission system to CHP facility <u>BTU owns:</u> • 138kV electrical transmission system (ERCOT) UES coordinates closely with Atmos, ERCOT, and BTU	<u>Management of:</u> • Four campus utility plants • A&M System Building utility plant • Solid Waste & Recycling Services • 2 wastewater treatment facilities <u>Production of:</u> • Electricity • Chilled water for cooling • Hot water for heating • Domestic cold & hot water • Steam	<u>TAMU owns and operates campus delivery systems:</u> • 12.5kV electrical • Domestic water (hot & cold) • Chilled Water • Heating Hot Water • Steam • Sanitary Sewer • Storm Drainage <u>Atmos owns:</u> • LP & IP natural gas distribution system	2,500 revenue-quality meters in over 500 buildings Manage utility rate model and rate setting Direct customer invoicing and cost recovery • Operating budget • Capital upgrades • Purchased energy Energy management services	First response to ensure customer comfort and environmental control Building automation and HVAC operation Energy stewardship & building system optimization Design review and capital project coordination Customer requests thru AggieWorks Center Capital renewal and upgrade

DIVERGENT ENERGY CHART



SCOPE OF PROJECT

P3 Phase I

- Three 5-story apartment buildings
- 413 apartments with 1,274 private bedrooms
- 533,000 gross square feet
- Each unit includes full kitchen, washer & dryer
- Wood and steel construction w/brick and stucco exterior

- Commence construction - June 2014
- Completion and move-in - August 2015

PROJECT SCOPE

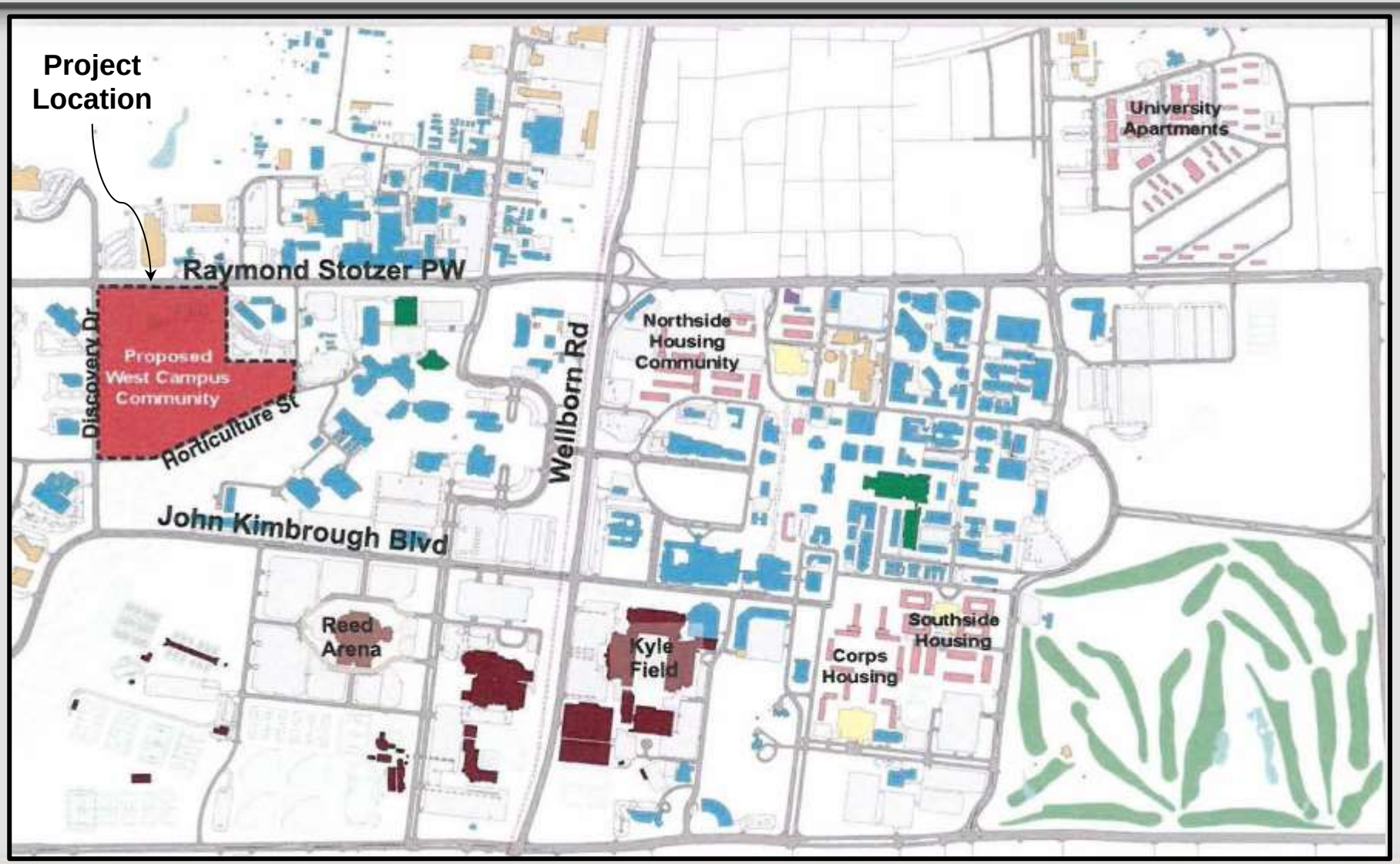
P3 Phase II

- Three 5-story residence halls
- 477 dorm rooms with 1,226 beds
- 365,000 gross square feet
- Amenities include study, lounge and laundry areas
- Steel construction with brick and stucco exterior
- Commence construction - October 2015
- Completion and move-in - August 2016

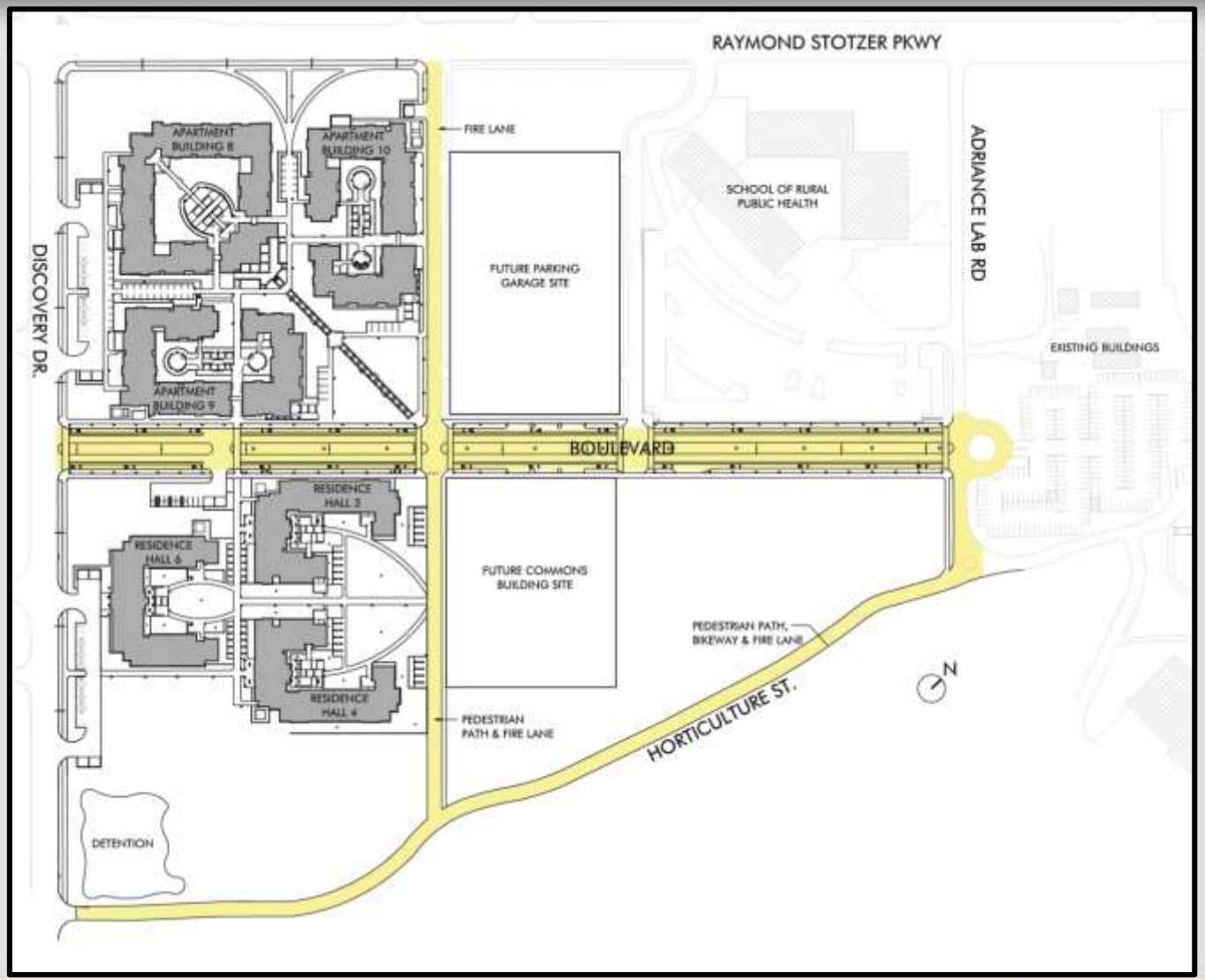
Supporting Facilities (separate projects)

- Commons Building (50-70k GSF) with admin offices, study/computer labs, recreational, dining and retail space
- Parking Garage - 4 or 5-story with1,600 spaces
- Completion with Phase II by August 2016

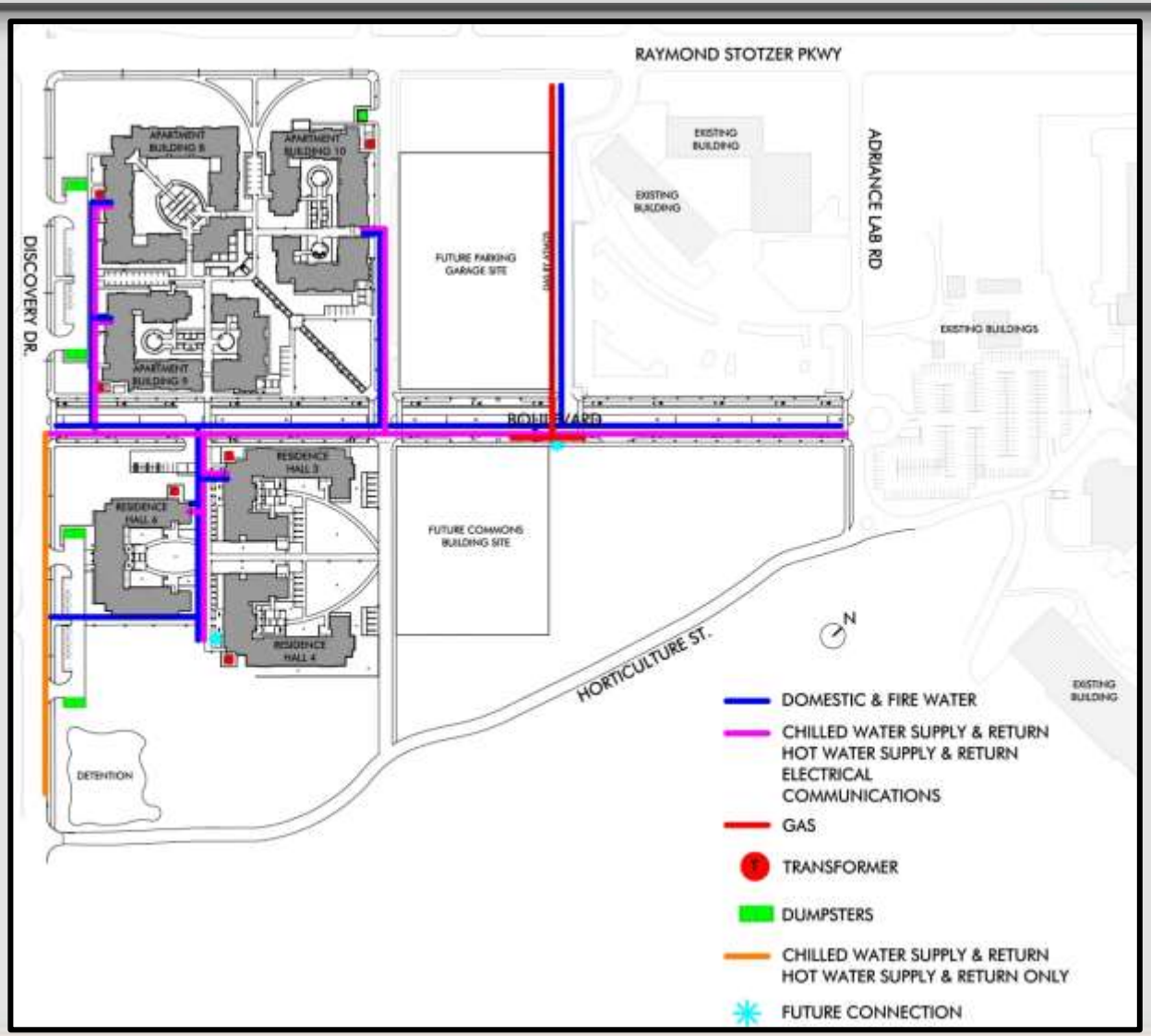
PROJECT SITE LOCATION MAP



ROADWAY CIRCULATION



UTILITY SCHEMATIC



Utility Schematic
Storm Drain & Sanitary Sewer

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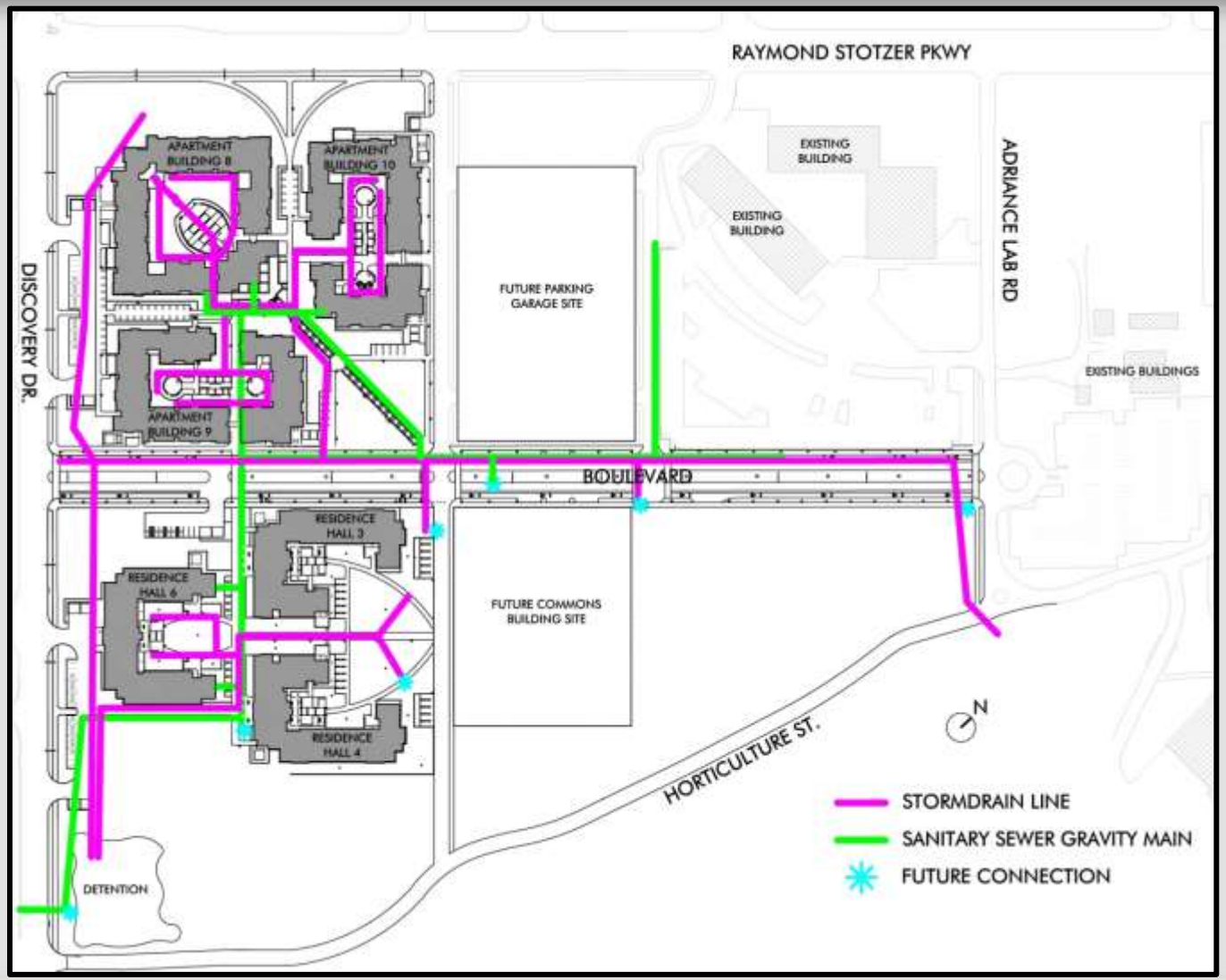

Local vs. Central District Energy Options Considered

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HVAC Options Considered

1) Variable Refrigerant Flow (VRF) Cooling/Heating System
2) Centrally-supplied Chilled Water with Electric Strip Heat
3) Centrally-supplied Chilled Water and Heating Hot Water*

*Option 3 selected due to lowest maintenance and life cycle cost

Domestic Hot Water

Large On-site Electric Heaters with Building DHW Distribution

UTILITY SERVICES

Utility Service to Complex

- Electrical duct bank with redundant 12.47 kV feeds
- 24 inch CHW supply/return lines
- 12 inch HHW supply/return lines
- 12 inch and 16 inch looped domestic water lines
- 14 inch sanitary sewer mains
- 48 inch and 60 inch storm drain mains

Additional Peak Utility Loads

- 5 megawatt electrical power
- 2,500 ton (30 million Btu/hr) cooling
- 500 BHP (17 million Btu/hr) heating
- 250 GPM domestic water

PIPING SYSTEMS

Underground Distribution Piping

- Extra High Molecular Weight Plus (EHMW Plus) High Density Polyethylene (HDPE) (manufactured with PE4710 resin)

Chilled Water and Domestic Water

- Minimum of SDR 17 required
- CHW piping insulated 12 inch and below

Heating Water and Domestic Hot Water

- Minimum of SDR 11 required
- All HHW piping insulated

Sanitary Sewer and Storm Drainage

- Minimum of SDR 26 required (SDR 17 under roadways)

Building Interior Hydronic Piping (CHW and HHW)

- Insulated Copper or Cross-linked Polyethylene (PEX-a) – 2 inch and below
- Insulated Carbon Steel – sizes larger than 2 inch

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