WALDRON ENGINEERING & CONSTRUCTION, INC
37 INDUSTRIAL DRIVE SUITE G-1 EXETER NH 03833
WALDRON

SourceOne
Capital Area System
Central Plant Feasibility Study

Cost Opinion

SourceOne Energy Solutions

September 17, 2014

Waldron Job Number
175.12.01

Prepared by
Waldron Engineering & Construction, Inc.
Anthony Ciaramitaro, PE

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Capital Area System Central Power Plant
Feasibility Study and Cost Opinion

Introduction

Waldron Engineering & Construction, Inc. (Waldron) was contracted by Source One to develop a schematic design of a boiler/ chiller plant located at the Hartford, CT Capital Area System Power Plant. The project goals were to provide a schematic design of a plant that can supply 30 MMBTU of steam (peak) capacity and 3,600 tons of chilled water (peak) capacity. In addition, a cost opinion was developed for the construction and installation of the equipment and building additions to meet the project goals.

Overall Design Concept

The design concept was to provide N+1 redundancy for the peak steam and chilled water demands. Pump House existing equipment—hot water distribution pumps, chilled water pumps, and steam to water heat exchangers—will be reused. The existing boilers and some auxiliary equipment in the Boiler House will be removed to allow for installation of three new gas fired 15 MMBTU steam boilers and new auxiliary equipment. A new chiller and electrical building will be built on the west side of the Boiler House. The new building will house three 1,800 ton chillers, and the upper level will house the new electrical room. The existing diesel fuel bulk storage tank will be relocated to make room for the new building.

Mechanical Design Concept

Using the N+1 redundancy requirement, two of the three new boilers can provide the peak steam demand of 30 MMBTU. In addition, there is enough turndown in the boiler design to maintain the baseline steam demand of 3 MMBTU. The boiler exhaust flow for the new boilers has been calculated, and it has been determined that the existing stack is acceptable for use. Reference the stack inspection report (Appendix A) for recommended repairs.

The new boilers will be fed by a new deaerator and three feed pumps. The DA will be sized to provide heated feedwater storage for the peak steam demand of the existing steam distribution system with a 15 minute retention period in the event of a loss of condensate or make-up water. The deaerator will be fed with condensate that is collected and pumped from the existing Pump House or make-up from city water if needed. The system was designed with the expectation that nearly 100% of the condensate will be returned to the deaerator because there are no other steam loads between the Boiler House and the steam to hot water heat exchangers in the adjacent Pump House. The deaerator will receive a small stream of pegging steam from the main steam header. Each boiler has a dedicated feed pump that is designed to provide full flow to one boiler with a local recirculation line back to the deaerator. The deaerator has a chemical feed connection that can be piped up by the owner at a later date once water chemistry needs are determined.

The boiler blowdown system is designed to handle a constant flow of 2% of the overall steam production from two 15 MMBTU boilers at peak production. The design concept includes an allowance for a make-up water / continuous blowdown heat exchanger if the plant wants to preheat make-up in

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the future. Note that this heat exchanger is not included in the cost opinion. The intermediate blowdown was sized for a 4" level drop in a single boiler's water level. The continuous blowdown will be mixed with the intermediate blowdown before being directly cooled with city water (as needed) before discharge to sewer.

The chilled water system is designed as a primary/secondary distribution system. The new chilled water pumps act as the constant speed primary pumps, and the existing distribution pumps in the Pump House act as the variable speed secondary pumps. Each 1,800 ton chiller (N+1 redundancy) has a dedicated chilled water pump that will provide a fixed flow to each chiller. The chilled water system will reuse the existing expansion tank in the Boiler House; however the expansion tank will be relocated in that area to make room for the other steam plant equipment. The chilled water system requires a large decoupling line that is needed to allow the primary and secondary systems to operate independently. The chilled water system design concept also includes a new chilled water to cooling water free-cooling heat exchanger. The existing Pump House variable speed secondary pumps will control flow through the free-cooling heat exchanger during the winter and portions of the shoulder season when the chillers are not needed.

The cooling water system for the new chillers is designed as a constant flow system with a headered three pump arrangement for N+1 redundancy. The new cooling water system concept includes six cooling towers. Each chiller requires the capacity of 2.5 cooling towers for cooling water. The sixth cooling tower is reserved to meet the N+1 redundancy requirement. Each cooling water pump is sized to provide 100% of the cooling water flow to a single chiller at full load (1,800 tons). The free-cooling heat exchanger is sized to take the full flow of any single cooling water pump. The system includes a 10" recirculation line to bypass the cooling towers if they are not needed to meet the system design temperatures.

Electrical Design Concept

The two existing electrical feeders to the Boiler House and Pump House cannot accommodate the new electrical loads of the new boiler / chiller plant. A new utility feeder from the utility substation to the project utility disconnect is beyond the scope of the schematic design.

The new utility feeder will connect to the main disconnect switch. The disconnect switch will feed a 5MVA transformer step down transformer from 22.9KV to 4.16KV. The transformer has been sized for the worst case scenario of two chillers and auxiliary equipment running. The transformer feeds the medium voltage switchgear, which provides power to the chillers and low voltage substation. The low voltage substation supplies power to the large motors and the two MCC. All motors 200HP or above are started though soft starters to prevent dips in the system voltage. The MCC's feed all the auxiliary motors and equipment.

The new chiller building is a two story building. The second floor is half enclosed and half open to the elements. The utility disconnect and isolation transformer will be installed outdoors on the second floor of the new chiller building. The new 4160V switchgear, Low voltage substation will be located indoors on the second story of the new chiller building. The switchgear will provide power to the new

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equipment in the Boiler House and chiller building. MCCs, VFDs, and reduced voltage soft-starters will be located in the Boiler House to control the new equipment.

All new foundations and reinforcing steel will be connected to the existing plant ground grid. All equipment and structural steel will also be connected to the ground grid.

Structural Design Concept

Waldron searched for geotech reports in the area local to the existing Boiler House and found soil logs from an AETNA building located in the area. The soil in this report was noted to be very fine sand, silt and clay, stating the following: *"Composed of well-sorted, thin layers of alternating silt and clay, or thick layers of very fine sand and silt, very fine sand commonly occurs at the surface and grades downward into rhythmically bedded silt and clay varves (lake bottom deposits)".*

The soil conditions in this report are unsuitable for large bearing pressures. To stay within the equipment settlement tolerances, the large equipment foundations are expected to require piles. Boilers, large pumps, deaerator, chiller building, and cooling tower foundations are designed with piles. All other equipment is located on existing concrete floors with housekeeping pads.

Stack Inspection

As noted in the stack inspection report (Appendix A) the top 20' of the 122' 9" stack is in need of repair. The design basis assumes that the top of the stack will be removed and rebuilt as part of the boiler/chiller plant project. Minor repairs and cleaning are also required in the lower 102' of the stack. Reference the stack inspection report for more detail. The stack should be repaired before the new boilers are commissioned.

Construction

The construction cost opinion and approach to the execution of the construction are based on schematic design documents and site visits. The design concept of the new boiler/chiller plant presents some unique and expensive challenges to construct the project. Although feasible to construct, the proposed project presents the following construction issues:

- Site congestion
  - The construction site leaves little to no room for stacking of trade labor
  - The construction duration and costs will be higher due to impact on efficiency
  - Performing construction while maintaining access to adjacent parking and loading docks will have an impact on productivity and requires off-shift and weekend work
- Installation of the cooling tower foundations and steel in an active driveway
  - Waldron was directed to include this as weekend work to maintain the active driveway—a new access point to parking would be less expensive
  - Complicates pile installation, steel erection, and incurs equipment standby charges
  - Requires plating and protecting the area during the work week
  - Requires a staged approach to installing and placing pile cap concrete
  - Requires a staged approach to steel erection and equipment setting
  - Requires premium time for labor for all trades working in that area

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- Installation of piles in the existing Boiler House
  - Requires a low-overhead mini-pile rig that limits productivity
- Installation of chiller building
  - Is laid out schematically to be partially on other state property
  - Requires site improvements to fill and modify site drainage to build along the north side of the building
  - Requires work around an existing elevated operational pipe rack that will affect productivity
- Cooling water piping routing
  - The chiller cooling water piping to the cooling towers is large bore and the existing wooden framed brick buildings cannot be relied upon for support
  - A piping utility rack is proposed for this routing along the north side of the existing boiler and pump room buildings
  - This routing requires drainage and site improvements to the area north of the plant
  - This is a difficult area to access with equipment and material without affecting parking

Cost Opinion

The cost opinion was developed using the schematic design drawings and site visits.

Drawing List:

- General Arrangement Drawing
- Elevation Drawing
- Electrical One-line
- Flow Diagrams
- Structural Drawing
- Controls Architecture

Cost Opinion:

Engineering	$	**897,000**
Procurement	$	**6,249,000**
Construction Directs	$	**4,513,000**
Construction Indirects	$	**1,627,000**
Commissioning	$	**155,000**
Training	$	**41,000**
Testing	$	**23,000**
Chimney Repair	$	**262,000**
Construction Permit Allowance	$	**125,000**
TOTAL	$	**13,892,000**

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Cost Opinion Clarifications & Assumptions

- Foundation design concept is based on soil conditions from geotech report of an AETNA building located in the area.
- Cost opinion does not include repairs to any existing building for existing problems unless otherwise noted.
- Cost opinion does not include Owner's contingency.
- All work to be accomplished by union contractors.
- WECI and subcontractors to have free and clear access to the site.
- All work to be accomplished on a "straight" time basis except work at cooling tower area and rigging of major equipment.
- All special insurances and bonds are excluded.
- The identification, removal, and disposal of any hazardous material are excluded.
- Existing systems are of adequate pressure, volume, and size to accommodate the new work.
- All testing and start-up fuels are to be supplied by the Owner.
- All "first fills" of equipment are by the Owner.
- All local, state, and federal permits are excluded. Construction permit allowance is included.
- Connecticut sales & use taxes are excluded.
- Relocation of buried utilities between Pump House and existing utility substation are not included.
- Pricing assumes upgrading / upsizing of fire sprinkler main to new building is not required.
- Pricing assumes a simple, non-addressable fire alarm system wired to existing panel.
- All cooling tower site work, concrete and structural steel is assumed to be weekend work.
- Assumes that some cooling tower piping, insulation, and electrical work will be off shift or weekend work.
- Electrical utility feeder for the new plant is not included.
- Emissions monitoring systems are excluded.
- All electrical branch circuits have been assumed to be installed in rigid metal conduit or intermediate metal conduit.
- Blowdown / make-up water heat exchanger and piping not included.
- The electrical equipment was sized for 350MVA, 50KAIC.
- Cost opinion is based on 2014 current labor and material rates.

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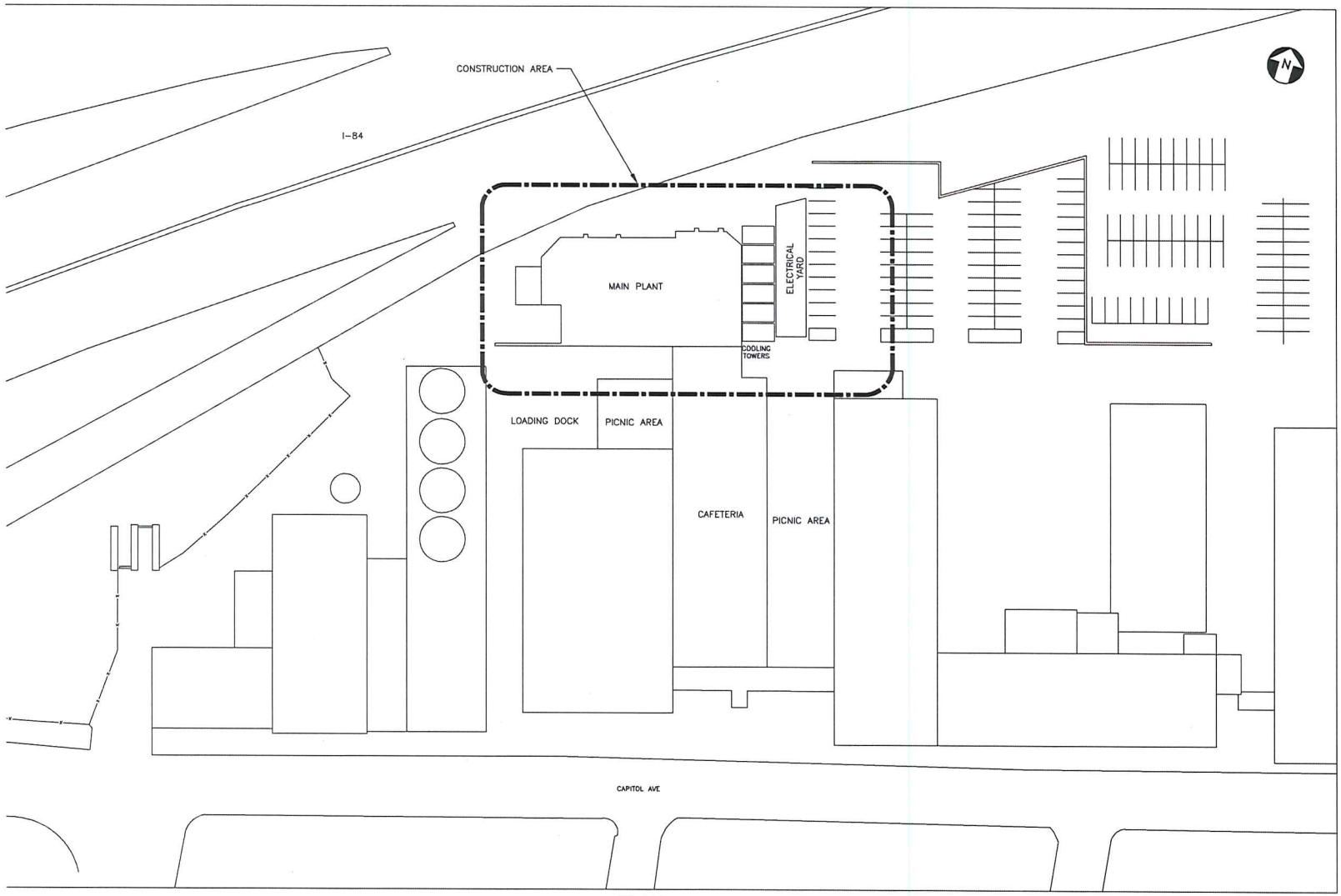

PLAN
N.T.S.
SITE PLAN

NOTES

REV. NO.	REV. BY	DATE	DESCRIPTION	DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY
A	DAG	9/19/14	ISSUED FOR PRICING	CTM		APC	SEG
			NOT FOR CONSTRUCTION				

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	NAME	DATE
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SourceOne Energy Solutions

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NEW YORK, NY 10001

DRAWING TITLE

CAPITAL AREA SYSTEM
CENTRAL PLANT
FEASIBILITY STUDY

SITE PLAN
N+1 OPTION

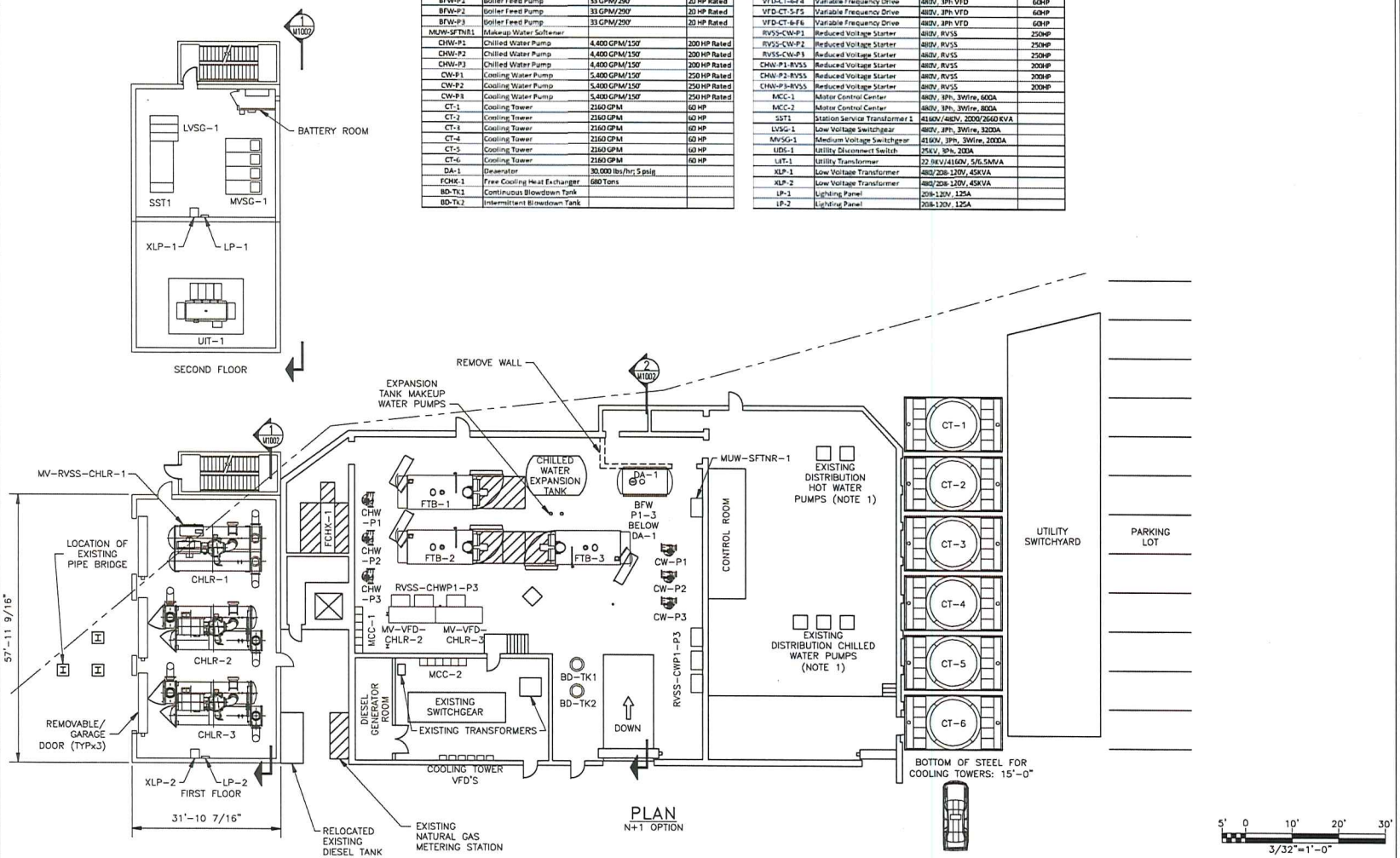
CLIENT DRAWING No.

W.E&C DRAWING No.
175.12-M1000

D

Tag	Description	Capacity	Motor Size
CHLR-1	Electric Chiller	1,800 Tons	1304 HP
CHLR-2	Electric Chiller	1,800 Tons	1304 HP
CHLR-3	Electric Chiller	1,800 Tons	1304 HP
FTB-1	Firetube Boiler	15 MMBTU	20 HP (Fan)
FTB-2	Firetube Boiler	15 MMBTU	20 HP (Fan)
FTB-3	Firetube Boiler	15 MMBTU	20 HP (Fan)
BFW-P1	Boiler Feed Pump	33 GPM/290'	20 HP Rated
BFW-P2	Boiler Feed Pump	33 GPM/290'	20 HP Rated
BFW-P3	Boiler Feed Pump	33 GPM/290'	20 HP Rated
MUW-SFTNR1	Makeup Water Softener		
CHW-P1	Chilled Water Pump	4,400 GPM/150'	200 HP Rated
CHW-P2	Chilled Water Pump	4,400 GPM/150'	200 HP Rated
CHW-P3	Chilled Water Pump	4,400 GPM/150'	200 HP Rated
CW-P1	Cooling Water Pump	5,400 GPM/150'	250 HP Rated
CW-P2	Cooling Water Pump	5,400 GPM/150'	250 HP Rated
CW-P3	Cooling Water Pump	5,400 GPM/150'	250 HP Rated
CT-1	Cooling Tower	2160 GPM	60 HP
CT-2	Cooling Tower	2160 GPM	60 HP
CT-3	Cooling Tower	2160 GPM	60 HP
CT-4	Cooling Tower	2160 GPM	60 HP
CT-5	Cooling Tower	2160 GPM	60 HP
CT-6	Cooling Tower	2160 GPM	60 HP
DA-1	Deaerator	30,000 lbs/hr; 5 psig	
FCHX-1	Free Cooling Heat Exchanger	680 Tons	
BD-TK1	Continuous Blowdown Tank		
BD-TK2	Intermittent Blowdown Tank		

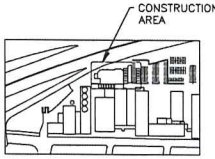
Tag	Description	Capacity	Motor Size
MV-RVSS-CHLR-1	Reduced Voltage Starter	10 GPM	
MV-VFD-CHLR-2	Variable Frequency Drive	4160V, 3Ph, VFD	
MV-VFD-CHLR-3	Variable Frequency Drive	4160V, 3Ph, VFD	
VFD-CT-1-F1	Variable Frequency Drive	480V, 3Ph VFD	60HP
VFD-CT-2-F2	Variable Frequency Drive	480V, 3Ph VFD	60HP
VFD-CT-3-F3	Variable Frequency Drive	480V, 3Ph VFD	60HP
VFD-CT-4-F4	Variable Frequency Drive	480V, 3Ph VFD	60HP
VFD-CT-5-F5	Variable Frequency Drive	480V, 3Ph VFD	60HP
VFD-CT-6-F6	Variable Frequency Drive	480V, 3Ph VFD	60HP
RVSS-CW-P1	Reduced Voltage Starter	480V, RVSS	250HP
RVSS-CW-P2	Reduced Voltage Starter	480V, RVSS	250HP
RVSS-CW-P3	Reduced Voltage Starter	480V, RVSS	250HP
CHW-P1-RVSS	Reduced Voltage Starter	480V, RVSS	200HP
CHW-P2-RVSS	Reduced Voltage Starter	480V, RVSS	200HP
CHW-P3-RVSS	Reduced Voltage Starter	480V, RVSS	200HP
MCC-1	Motor Control Center	480V, 3Ph, 3Wire, 600A	
MCC-2	Motor Control Center	480V, 3Ph, 3Wire, 800A	
SST1	Station Service Transformer 1	4160V/480V, 2000/2660 KVA	
LVSG-1	Low Voltage Switchgear	480V, 3Ph, 3Wire, 3200A	
MVSG-1	Medium Voltage Switchgear	4160V, 3Ph, 3Wire, 2000A	
UDS-1	Utility Disconnect Switch	25kV, 3Ph, 200A	
UIT-1	Utility Transformer	22.9KV/4160V, 5/6.5MVA	
XLP-1	Low Voltage Transformer	480/208-120V, 45KVA	
XLP-2	Low Voltage Transformer	480/208-120V, 45KVA	
LP-1	Lighting Panel	208-120V, 125A	
LP-2	Lighting Panel	208-120V, 125A	



PLAN
N+1 OPTION

5' 0 10' 20' 30'
3/32"=1'-0"

NOTES
1. RE-USE EXISTING CHILLED AND HOT WATER DISTRIBUTION PUMPS IN PUMP ROOM. PUMP LOCATIONS ARE ESTIMATED ON DRAWING AND EXACT LOCATIONS WILL BE VERIFIED.



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DRAWING TITLE
CAPITAL AREA SYSTEM
CENTRAL PLANT
FEASIBILITY STUDY

GENERAL ARRANGEMENT
N+1 OPTION

CLIENT DRAWING No.

W.B&C DRAWING No.
175.12-M1001

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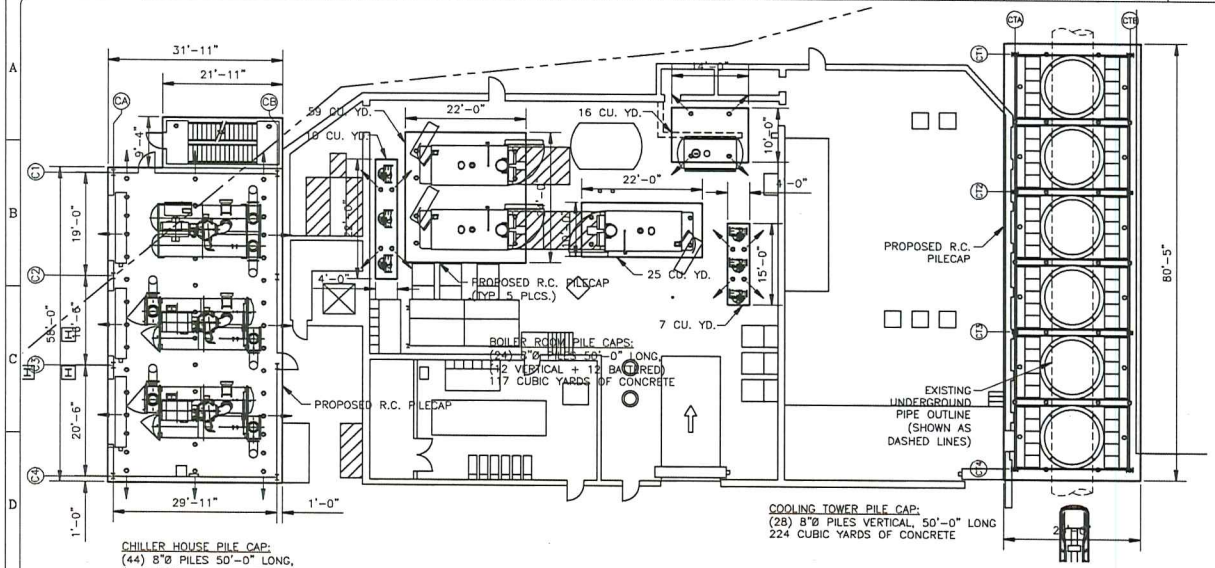
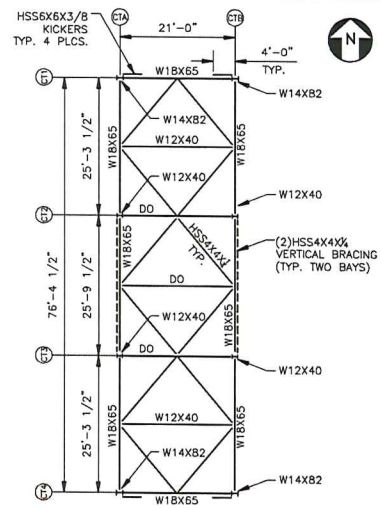
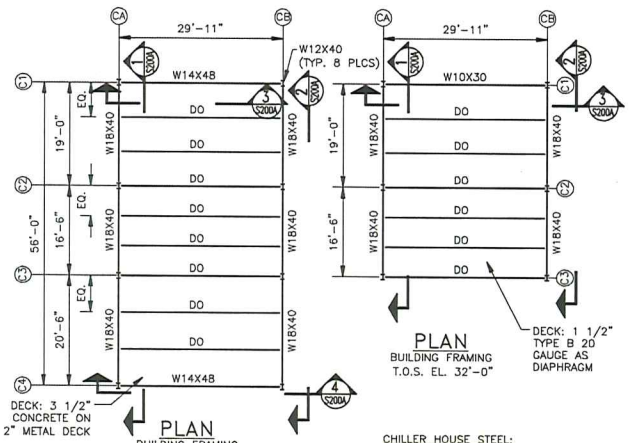


PLAN
PILE & PILE CAP LOCATIONS



PLAN
COOLING TOWER FRAMING
T.O.S. EL. 16'-6"

COOLING TOWER STEEL:
TOTAL STEEL WEIGHT= 31 KIPS



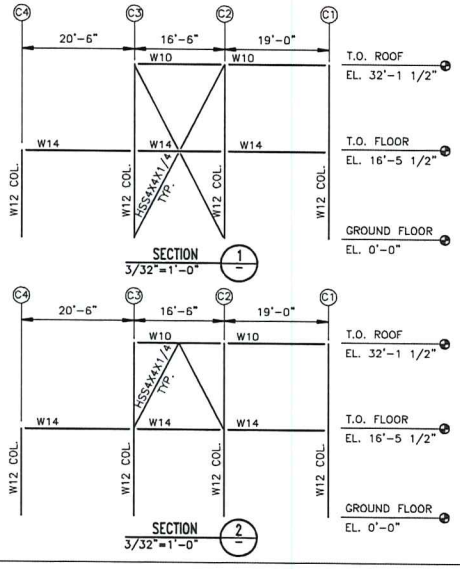
PLAN
BUILDING FRAMING
T.O.S. EL. 16'-0"

PLAN
BUILDING FRAMING
T.O.S. EL. 32'-0"

DECK: 1 1/2" TYPE B 20 GAUGE AS DIAPHRAGM

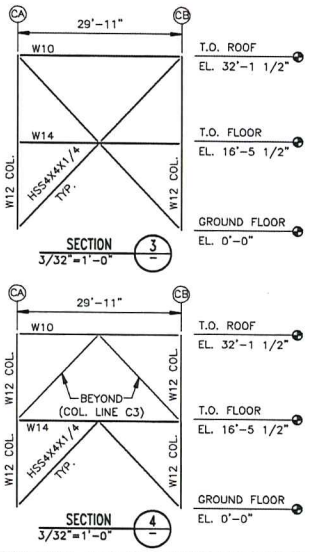
CHILLER HOUSE STEEL:
TOTAL STEEL WEIGHT= 42.6 KIPS

5' 0 10' 20' 30'
3/32"=1'-0"



SECTION 1
3/32"=1'-0"

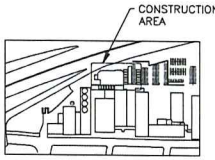
SECTION 2
3/32"=1'-0"



SECTION 3
3/32"=1'-0"

SECTION 4
3/32"=1'-0"

NOTES
1. ALL PILECAPS 36" DEEP, UNLESS OTHERWISE NOTED
2. 4" HOUSEKEEPING PAD UNDER EQUIPMENT AS REQUIRED
3. THIS DRAWING REPRESENTS A "CONCEPTUAL" LEVEL OF DETAIL AND IS SUITABLE FOR PRELIMINARY ESTIMATING PURPOSES ONLY.



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FEASIBILITY STUDY

PILE LOCATIONS
& FRAMING

CLIENT DRAWING No.

W.E&C DRAWING No. 175.12-S200A

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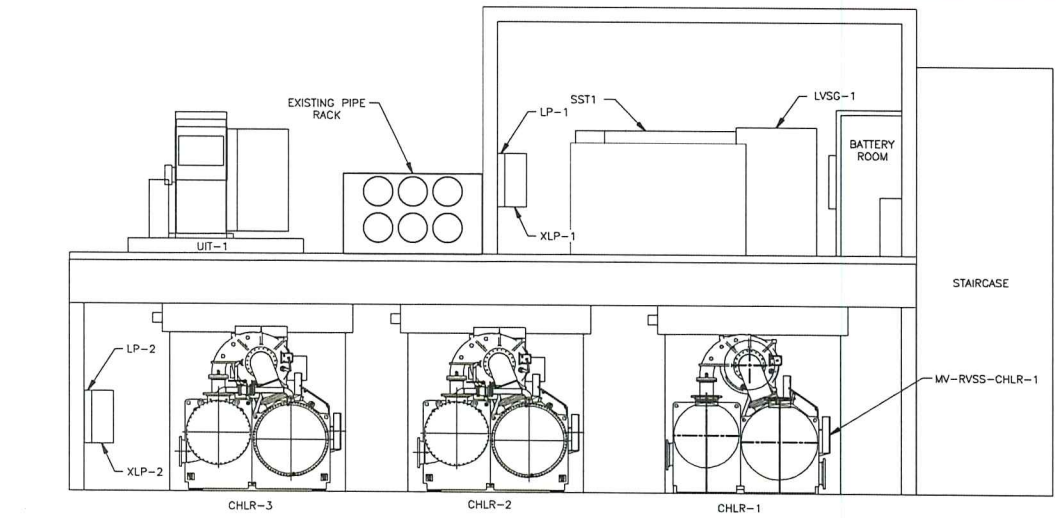
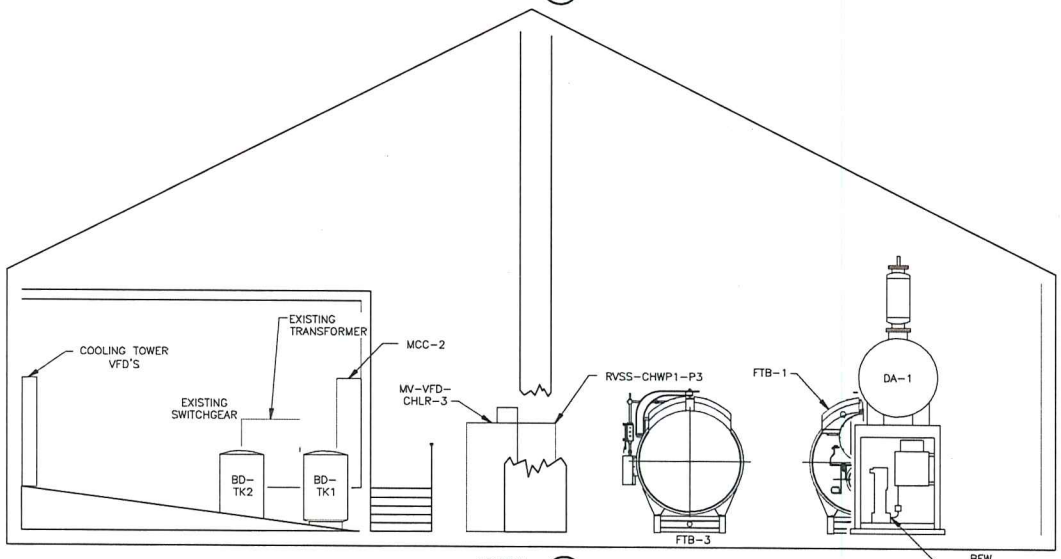


SECTION 1 / M1001

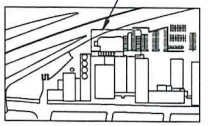


SECTION 2 / M1001

1/4"=1'-0"

NOTES

1. REFER TO M1001 FOR EQUIPMENT LIST.



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FEASIBILITY STUDY

SECTION
N+1 OPTION

CLIENT DRAWING No.

W.E&C DRAWING No. 175.12-M1002

D

CHW-P1, 2, 3
SERVICE: CHILLED WATER PUMP
CAPACITY: 4400 GPM
TDH: 150 FT
HORSEPOWER: 200
ELECTRICAL: 460V/3PH/60Hz

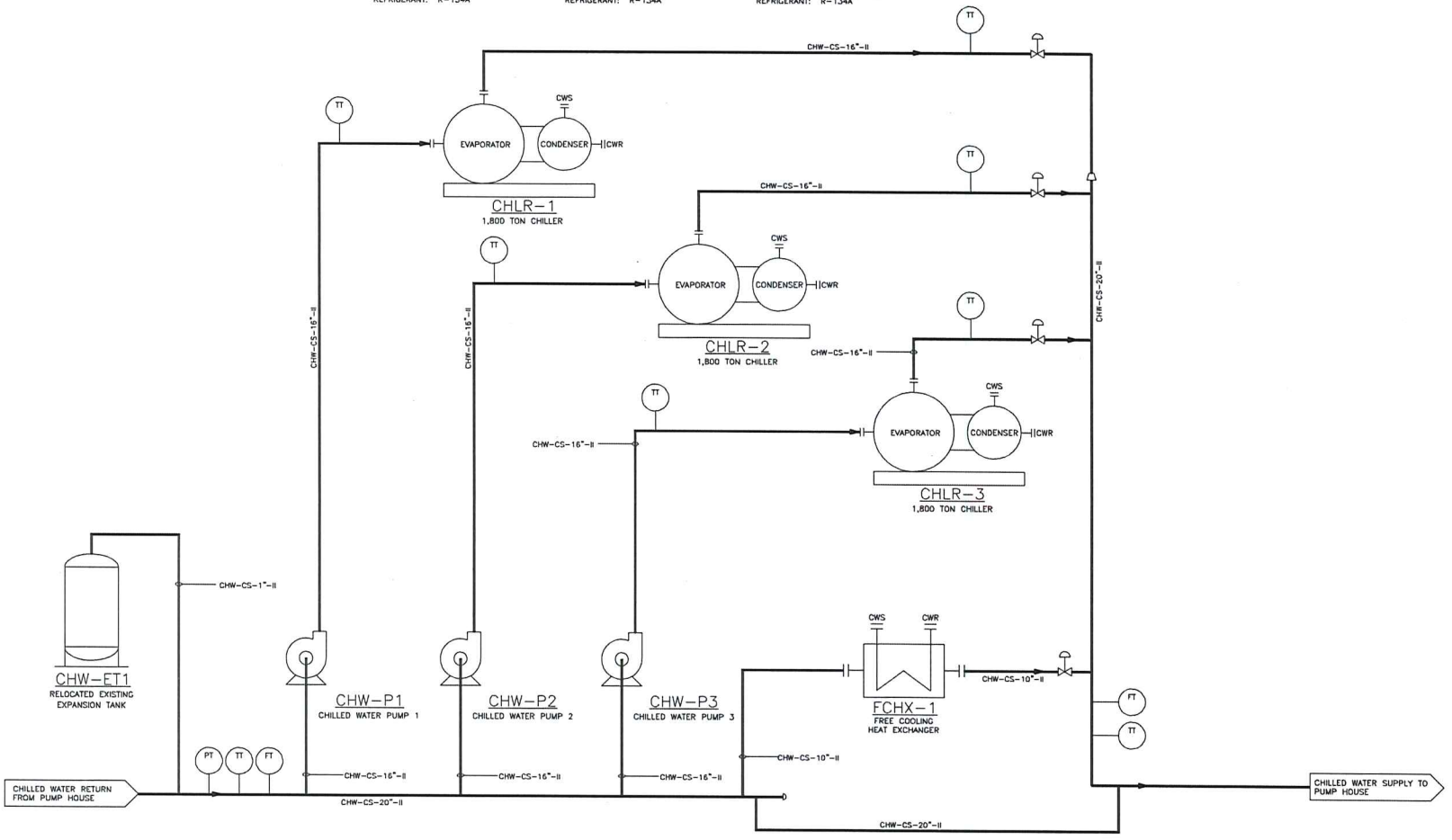
CHW-ET1
SERVICE: CHILLED WATER EXPANSION TANK
CAPACITY: 6,000 GALLONS
PRESSURE RATING: 110.6 PSIG

CHLR-1
SERVICE: ELECTRIC MOTOR DRIVEN CHILLER
CAPACITY: 1800 TONS
FLOW: 4,320 GPM
DELTA T: 10 °F
DELTA P: 18.7 FT
HORSEPOWER: 1,304; RVSS
ELECTRICAL: 4160V/3PH/60Hz
REFRIGERANT: R-134A

CHLR-2
SERVICE: ELECTRIC MOTOR DRIVEN CHILLER
CAPACITY: 1800 TONS
FLOW: 4,320 GPM
DELTA T: 10 °F
DELTA P: 18.7 FT
HORSEPOWER: 1,304; VFD
ELECTRICAL: 4160V/3PH/60Hz
REFRIGERANT: R-134A

CHLR-3
SERVICE: ELECTRIC MOTOR DRIVEN CHILLER
CAPACITY: 1800 TONS
FLOW: 4,320 GPM
DELTA T: 10 °F
DELTA P: 18.7 FT
HORSEPOWER: 1,304; VFD
ELECTRICAL: 4160V/3PH/60Hz
REFRIGERANT: R-134A

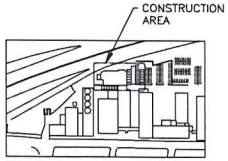
FCHX-1
SERVICE: FREE COOLING HEAT EXCHANGER
CAPACITY: 680 TONS
DELTA T: 10 °F
DELTA P: 8.7 FT



NOTES

INSULATION CLASS SUMMARY

CLASS	TEMP. LIMITS	THICKNESS
I	-20-200	1-1/2"
II	35-99	1-1/2"
III	100-199	1"
IV	200-299	1-1/2"
V	300-399	2-1/2"
H	HEAT TRACE	1"
U	UNINSULATED	



REV. No.	REV. BY	DATE	DESCRIPTION	DRAWN BY	CHECKED BY	APPROVED BY
A	CTM	9/15/14	ISSUED FOR PRICING	SDS	ADC	SDS
			NOT FOR CONSTRUCTION			

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SIGNATURE DATE

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DRAWN BY	CTMankwa	8/29/14

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www.waldron.com

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SourceOne Energy Solutions

7 PENN PLAZA
370 7TH AVE, SUITE 704
NEW YORK, NY 10001

DRAWING TITLE

CAPITAL AREA SYSTEM CENTRAL PLANT FEASIBILITY STUDY

CHILLED WATER FLOW DIAGRAM

CLIENT DRAWING No.

W.E&C DRAWING No. 175.12-FD5A

D

CW-P1, 2, 3
SERVICE: COOLING WATER PUMP
CAPACITY: 5400 GPM
TDH: 150 FT
HORSEPOWER: 250
ELECTRICAL: 460V/3PH/60Hz

CHLR-1
SERVICE: ELECTRIC MOTOR DRIVEN CHILLER
CAPACITY: 1800 TONS
FLOW: 5400 GPM
DELTA T: 9.25 °F
DELTA P: 16.5 FT
HORSEPOWER: 1304; RVSS
ELECTRICAL: 460V/3PH/60Hz

CHLR-2
SERVICE: ELECTRIC MOTOR DRIVEN CHILLER
CAPACITY: 1800 TONS
FLOW: 5400 GPM
DELTA T: 9.25 °F
DELTA P: 16.5 FT
HORSEPOWER: 1304; VFD
ELECTRICAL: 460V/3PH/60Hz

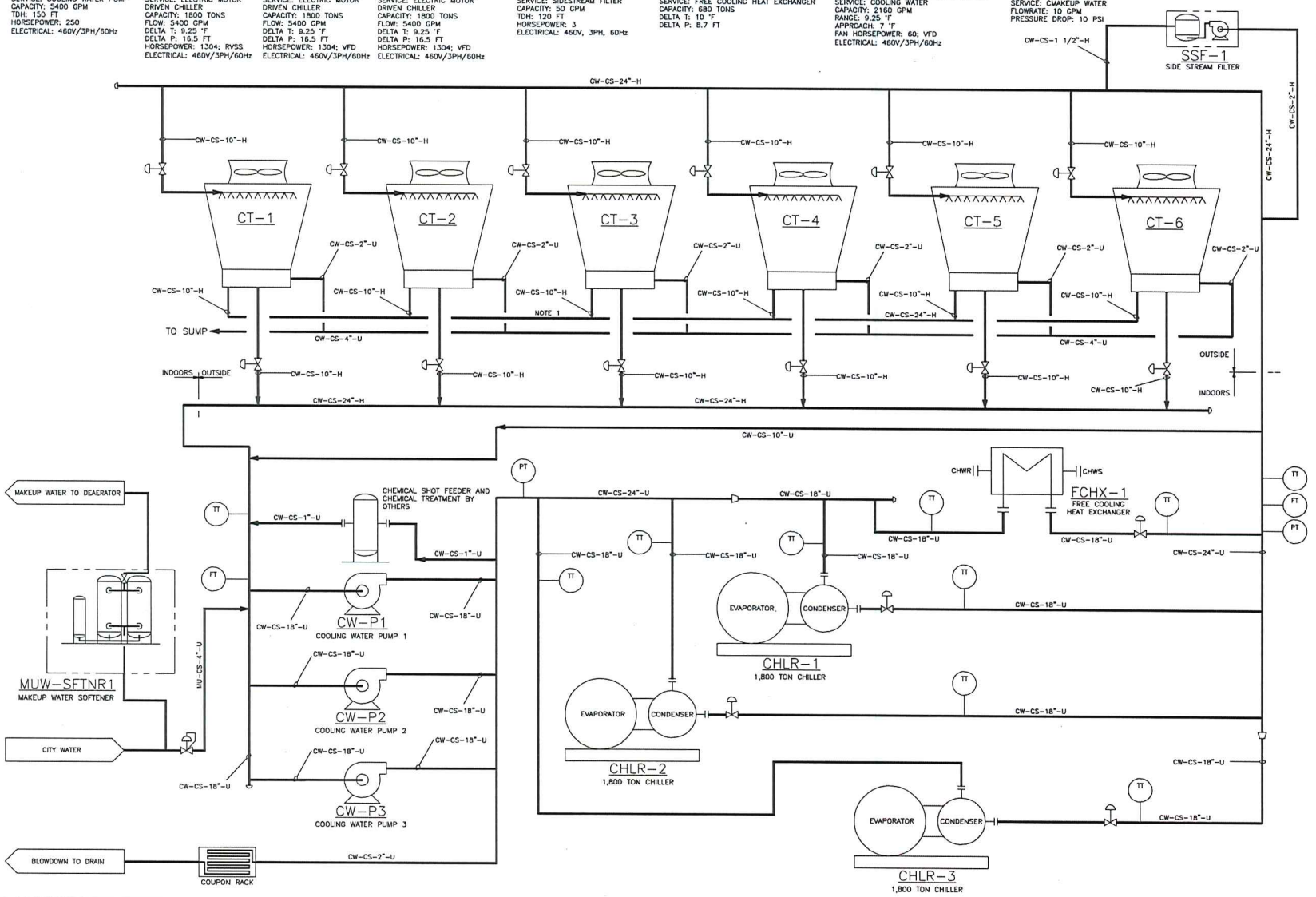
CHLR-3
SERVICE: ELECTRIC MOTOR DRIVEN CHILLER
CAPACITY: 1800 TONS
FLOW: 5400 GPM
DELTA T: 9.25 °F
DELTA P: 16.5 FT
HORSEPOWER: 1304; VFD
ELECTRICAL: 460V/3PH/60Hz

SSF-1
SERVICE: SIDESTREAM FILTER
CAPACITY: 50 GPM
TDH: 120 FT
HORSEPOWER: 3
ELECTRICAL: 460V, 3PH, 60Hz

FCHX-1
SERVICE: FREE COOLING HEAT EXCHANGER
CAPACITY: 680 TONS
DELTA T: 10 °F
DELTA P: 8.7 FT

CT-1, 2, 3, 4, 5, 6
SERVICE: COOLING WATER
CAPACITY: 2160 GPM
RANGE: 9.25 °F
APPROACH: 7 °F
FAN HORSEPOWER: 60; VFD
ELECTRICAL: 460V/3PH/60Hz

MUW-SFTNR1
SERVICE: CMAKEUP WATER
FLOWRATE: 10 GPM
PRESSURE DROP: 10 PSI

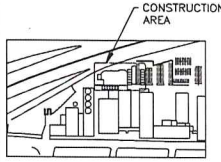


NOTES

INSULATION CLASS SUMMARY

CLASS	TEMP. LIMITS	THICKNESS
I	-20-200	1-1/2"
II	35-99	1-1/2"
III	100-199	1"
IV	200-299	1-1/2"
V	300-399	2-1/2"
H	HEAT TRACE	1"
U	UNINSULATED	

1. THE 24" LINE CONNECTING THE COOLING TOWERS IS AN EQUALIZATION LINE TO KEEP THE FLOWS TO EACH CELL BALANCED.



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DRAWING TITLE

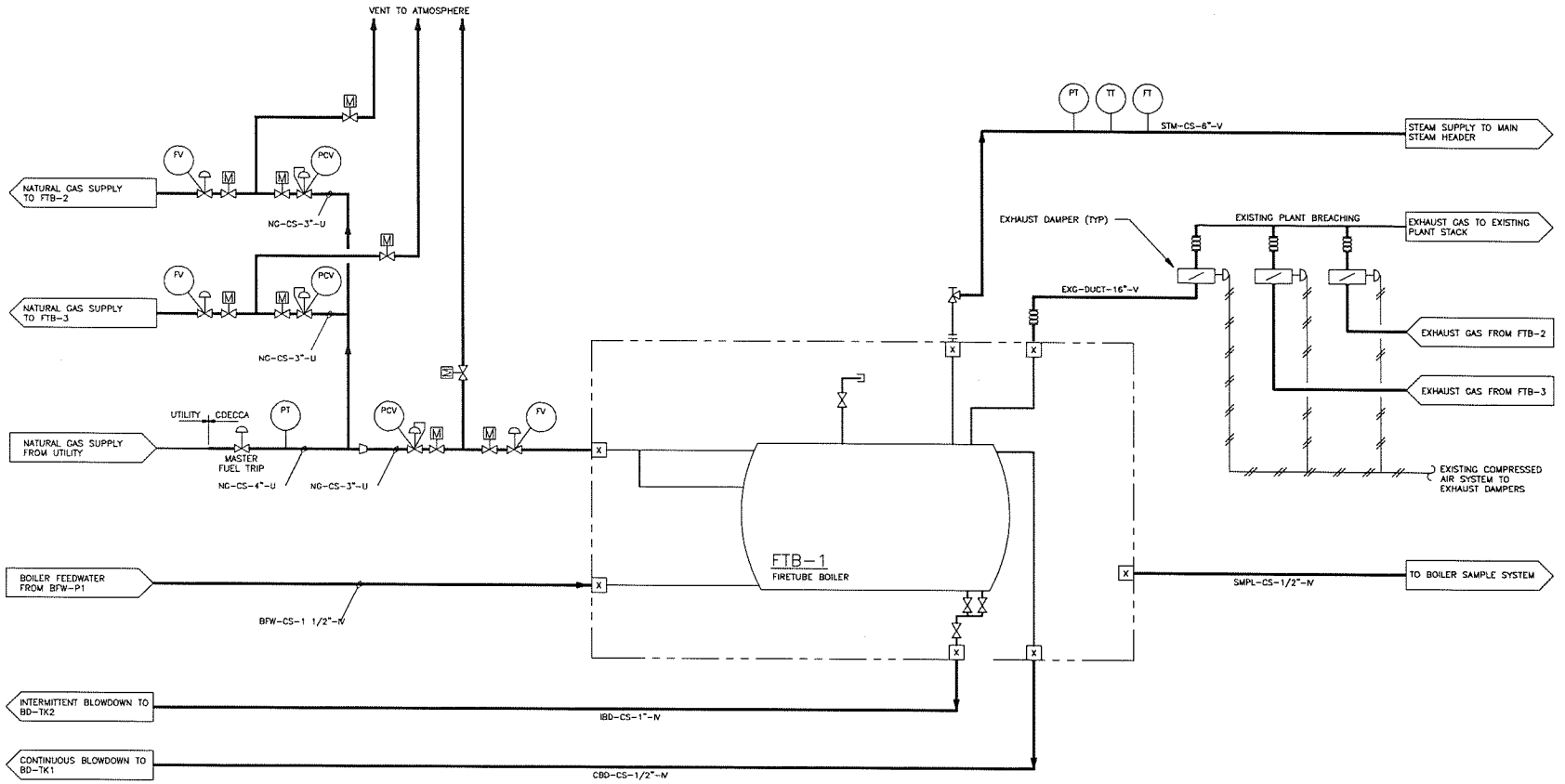
CAPITAL AREA SYSTEM CENTRAL PLANT FEASIBILITY STUDY

COOLING WATER FLOW DIAGRAM

CLIENT DRAWING No.

W.E&C DRAWING No. 175.12-FD6A

D

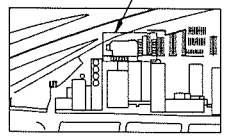


NOTES:

INSULATION CLASS SUMMARY

CLASS	TEMP. LIMITS	THICKNESS
I	-20-200	1-1/2"
II	35-99	1-1/2"
III	100-199	1"
IV	200-299	1-1/2"
V	300-399	2-1/2"
H	HEAT TRACE	1"
U	UNINSULATED	

CONSTRUCTION AREA



REV. No.	REV. BY	DATE	DESCRIPTION	CHECKED BY	PROJECT MANAGER	LEAD ENGINEER
A	CTM	9/15/14	ISSUED FOR PRICING	SEG	APC	SEG
			NOT FOR CONSTRUCTION			

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	NAME	DATE
DRAWN BY	CTMaskwa	8/29/14

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DRAWING TITLE

CAPITAL AREA SYSTEM CENTRAL PLANT FEASIBILITY STUDY

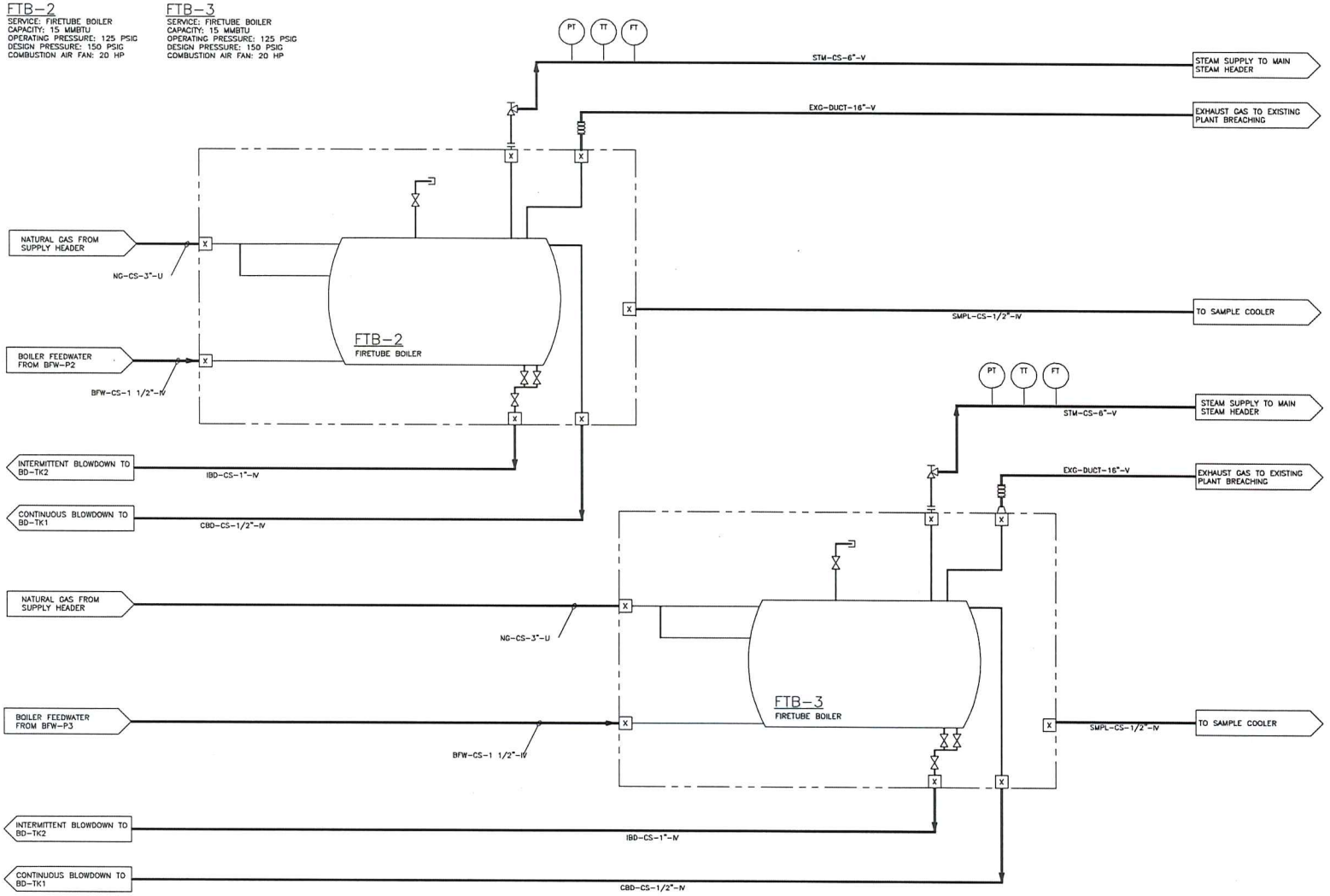
FIRETUBE BOILER #1 FLOW DIAGRAM

CLIENT DRAWING No.

W.E&C DRAWING No. 175.12-FD1A

FTB-2
SERVICE: FIRETUBE BOILER
CAPACITY: 15 MMBTU
OPERATING PRESSURE: 125 PSIG
DESIGN PRESSURE: 150 PSIG
COMBUSTION AIR FAN: 20 HP

FTB-3
SERVICE: FIRETUBE BOILER
CAPACITY: 15 MMBTU
OPERATING PRESSURE: 125 PSIG
DESIGN PRESSURE: 150 PSIG
COMBUSTION AIR FAN: 20 HP



NOTES

INSULATION CLASS SUMMARY

CLASS	TEMP. LIMITS	THICKNESS
I	-20-200	1-1/2"
II	35-99	1-1/2"
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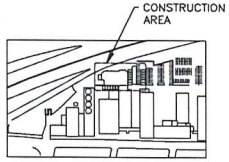
H	HEAT TRACE	1"
U	UNINSULATED	



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			NOT FOR CONSTRUCTION			

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DRAWING TITLE

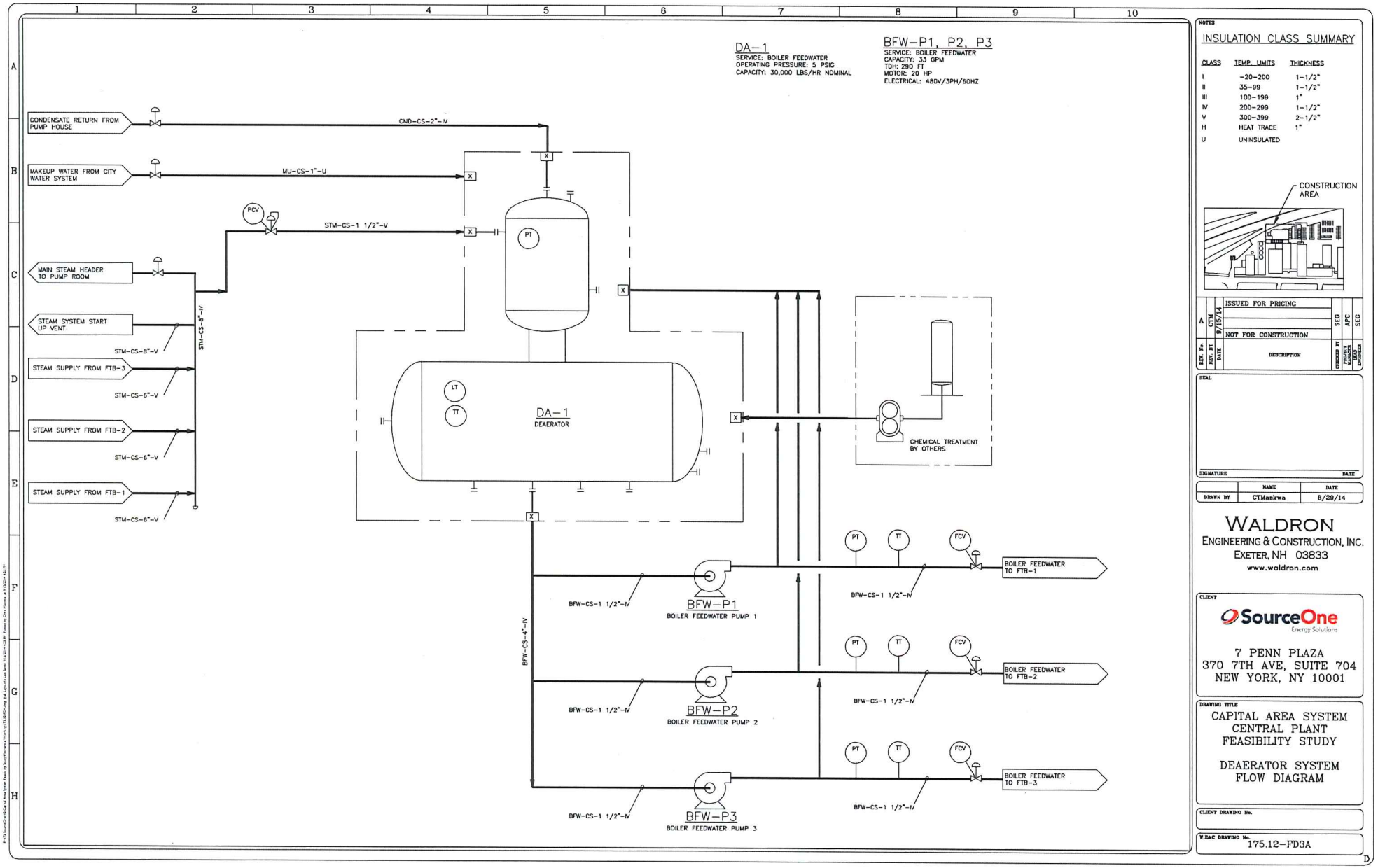
CAPITAL AREA SYSTEM
CENTRAL PLANT
FEASIBILITY STUDY

FIRETUBE BOILERS
#2 AND #3 FLOW DIAGRAM

CLIENT DRAWING No.

W.E&C DRAWING No.
175.12-FD2A

D



NOTES

INSULATION CLASS SUMMARY

CLASS	TEMP. LIMITS	THICKNESS
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V	300-399	2-1/2"
H	HEAT TRACE	1"
U	UNINSULATED	

REV. No	DATE	DESCRIPTION	CHECKED BY	PROJECT MGR.	ENGR.
A	CTM 9/15/14	ISSUED FOR PRICING		SEG	SEG
		NOT FOR CONSTRUCTION		APC	

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	NAME	DATE
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DRAWING TITLE

CAPITAL AREA SYSTEM
CENTRAL PLANT
FEASIBILITY STUDY

DEAERATOR SYSTEM
FLOW DIAGRAM

CLIENT DRAWING No.

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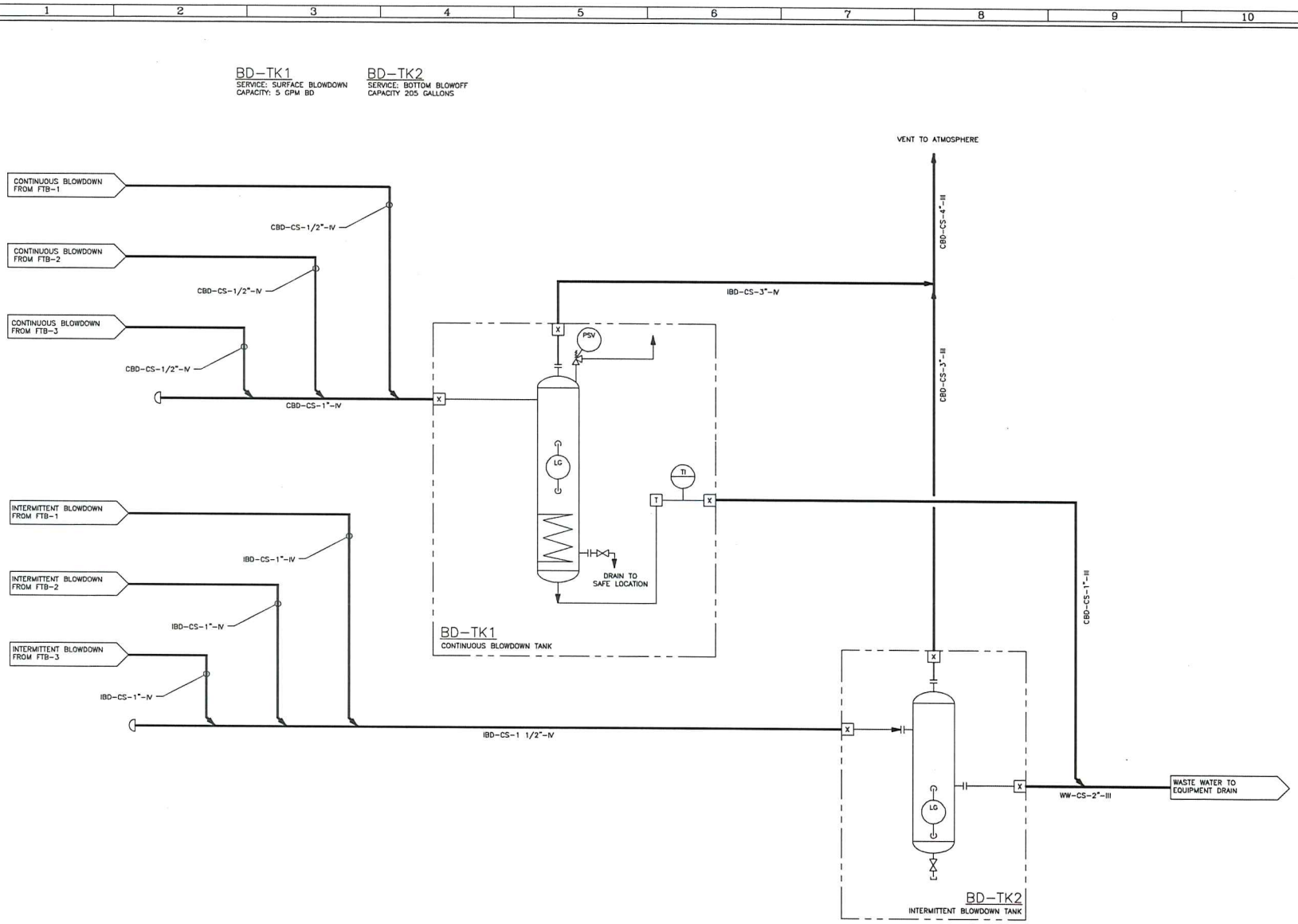
175.12-FD3A

D



NOTES

INSULATION CLASS SUMMARY

CLASS	TEMP. LIMITS	THICKNESS
I	-20-200	1-1/2"
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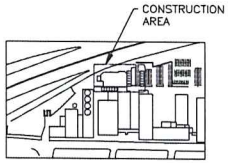

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			NOT FOR CONSTRUCTION			

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	NAME	DATE
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DRAWING TITLE

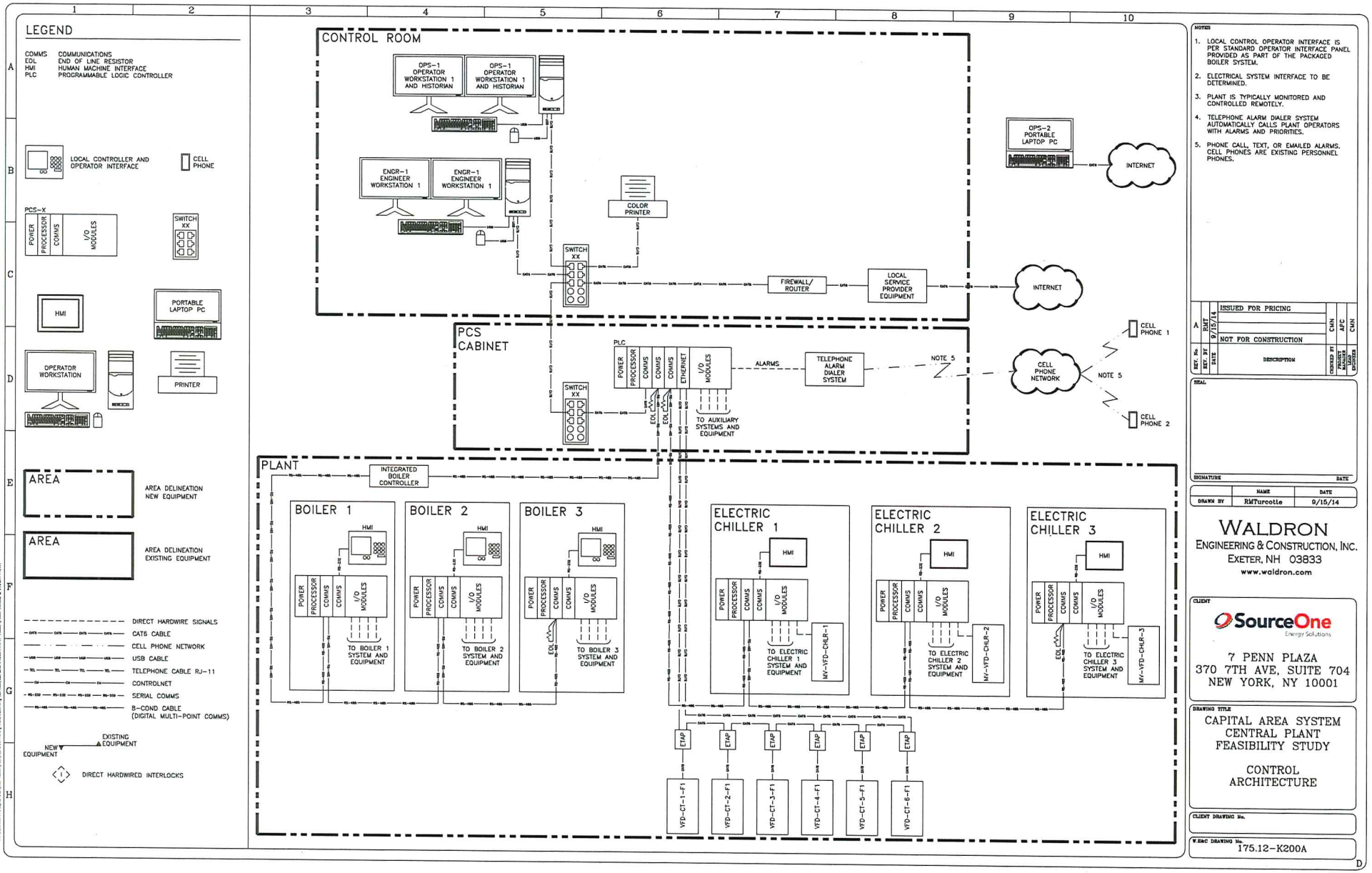
CAPITAL AREA SYSTEM CENTRAL PLANT FEASIBILITY STUDY

BLOWDOWN SYSTEM FLOW DIAGRAM

CLIENT DRAWING No.

W.E&C DRAWING No. 175.12-FD4A

D



NOTES

1. LOCAL CONTROL OPERATOR INTERFACE IS PER STANDARD OPERATOR INTERFACE PANEL PROVIDED AS PART OF THE PACKAGED BOILER SYSTEM.
2. ELECTRICAL SYSTEM INTERFACE TO BE DETERMINED.
3. PLANT IS TYPICALLY MONITORED AND CONTROLLED REMOTELY.
4. TELEPHONE ALARM DIALER SYSTEM AUTOMATICALLY CALLS PLANT OPERATORS WITH ALARMS AND PRIORITIES.
5. PHONE CALL, TEXT, OR EMAILED ALARMS. CELL PHONES ARE EXISTING PERSONNEL PHONES.

REV. No.	REV. BY	DATE	DESCRIPTION	CHECKED BY PROJECT MANAGER	APC	CHN
A	RMT	9/15/14	ISSUED FOR PRICING			
			NOT FOR CONSTRUCTION			

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DRAWING TITLE

CAPITAL AREA SYSTEM
CENTRAL PLANT
FEASIBILITY STUDY

CONTROL
ARCHITECTURE

CLIENT DRAWING No.

W.E&C DRAWING No. 175.12-K200A

D