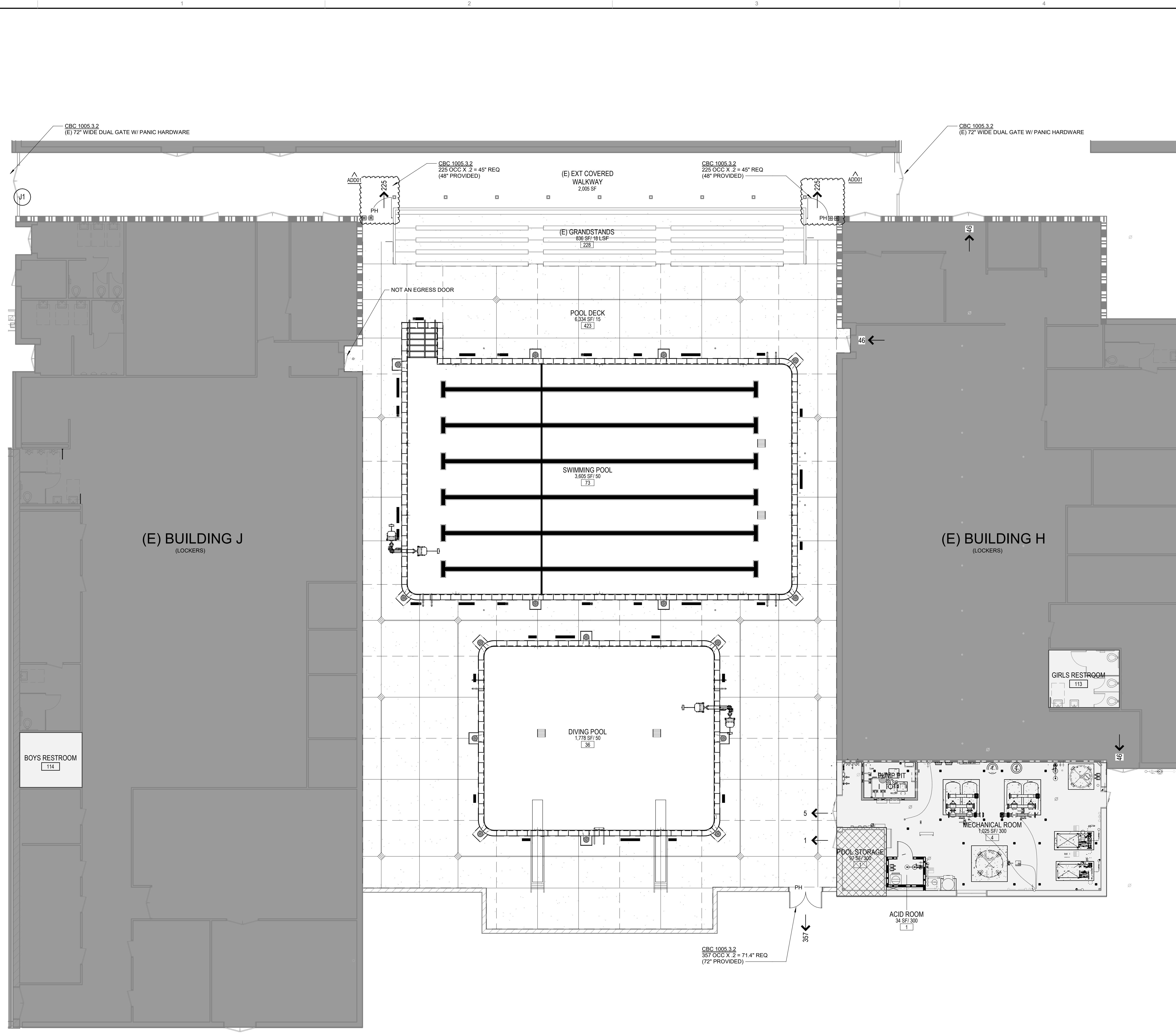


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EXISTING POOL AREA ANALYSIS

- GOVERNING CODE: 2022 CALIFORNIA BUILDING CODE
- OCCUPANCY TYPE: (CBC CHAPTER 3) EXISTING GROUP E OCCUPANCY (BUILDING H & J)
EXISTING GROUP A-5 OCCUPANCY (EXTERIOR POOL AREA)
- (E) CONSTRUCTION TYPE: (CBC CHAPTER 6)

BUILDING H	TYPE V-A (NON-SPRINKLERED)
BUILDING J	TYPE V-A (NON-SPRINKLERED)
POOL	N/A

NOTE: (E) SPRINKLERS EXISTS ONLY AT BUILDING H MECHANICAL ROOM
- (E) BUILDING AREA:

	GROUP E	GROUP A-5	GROUP S
BUILDING H	9,069 SF		1,380 SF
BUILDING J	8,270 SF		
POOL		11,654 SF	
- (E) BUILDING HEIGHT:

BUILDING H	17'-10"
BUILDING J	17'-5"
POOL	N/A
- (E) OCCUPANT LOAD: (CBC CHAPTER 10)

BUILDING H	6,872 SF/ 50 = 138 OCCUPANTS
BUILDING J	1,398 SF/ 300 = 5 OCCUPANTS (MECH + POOL STORAGE)
POOL	781 OCCUPANTS

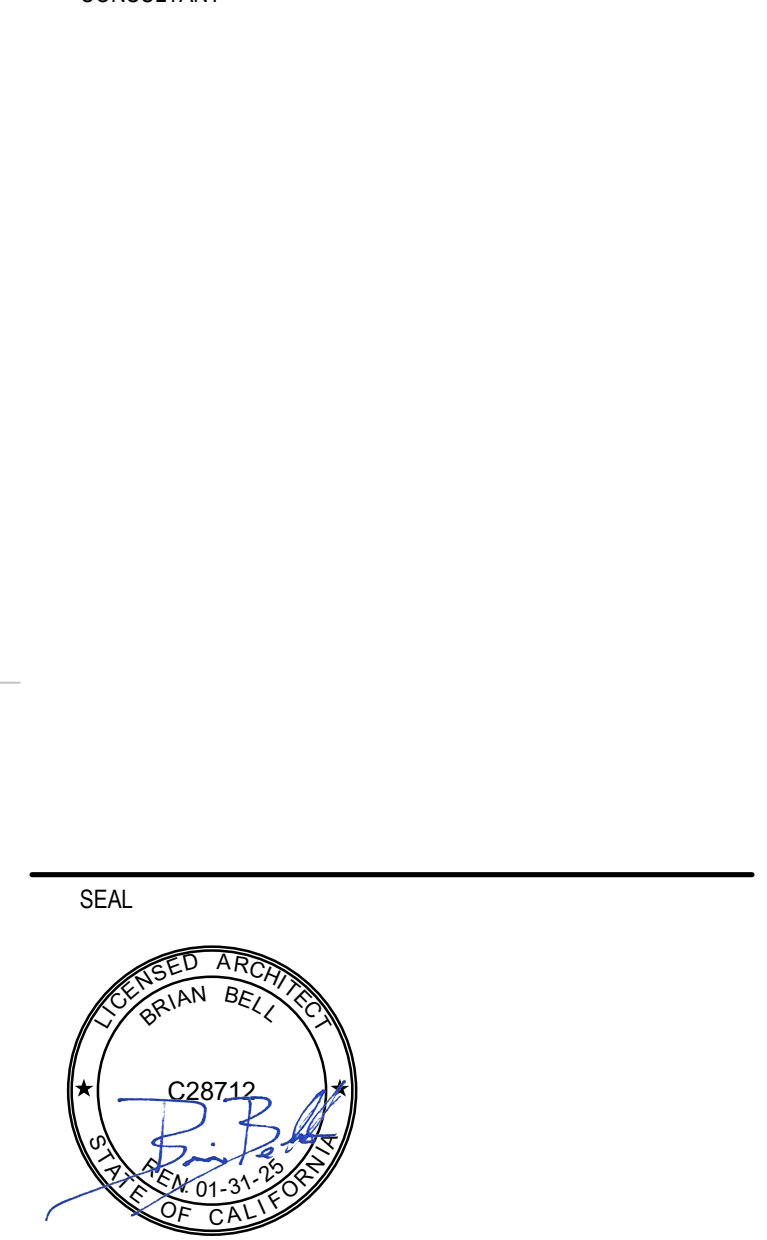
NOTE: SCOPE OF WORK DOES NOT CHANGE EXISTING SF, OCCUPANCY LOAD, AND OCCUPANCY GROUP

LEGEND

Name	ROOM USE
150 SF/ 20	SQUARE FOOTAGE / OCCUPANT FACTOR
7	OCCUPANT LOAD
→ 0	EXIT AND NUMBER OF OCCUPANTS USING EXIT
0 ▶	EXIT ACCESS AND NUMBER OF OCCUPANTS USING EXIT ACCESS
[White Box]	(E) A-5 OCCUPANCY WITH SCOPE OF WORK
[Light Grey Box]	(E) S OCCUPANCY WITH SCOPE OF WORK
[Dark Grey Box]	(E) E OCCUPANCY WITH NO SCOPE OF WORK
[Cross-hatched Box]	(E) S OCCUPANCY WITH NO SCOPE OF WORK
PH	PANIC HARDWARE
[Thick Line]	(E) WOOD STUD FRAMED WALLS
[Dashed Line]	(E) 2-HR FIRE SEPARATED WOOD STUD FRAMED WALLS
[Thin Dashed Line]	(E) 1-HR FIRE SEPARATED "MODULAR" SYSTEM PARTITION
[Thick Dashed Line]	1-HR SHAFT FIRE BARRIER



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PROJECT
**JOHN F KENNEDY HIGH SCHOOL
SWIMMING POOL UPGRADE**

6715 GLORIA DR
SACRAMENTO, CA 95831

CLIENT
SACRAMENTO CITY UNIFIED SCHOOL DISTRICT

ISSUED

MARK	DATE	DESCRIPTION
ADD01	5/10/2024	ADD 01

MANAGEMENT
LIONAKIS PROJECT NO: 0223264
CLIENT PROJECT NO:
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TITLE
**LIFE SAFETY FLOOR
PLAN - POOL**

SHEET
GL111

1 LIFE SAFETY FLOOR PLAN - POOL
SCALE 1/8" = 1'-0"

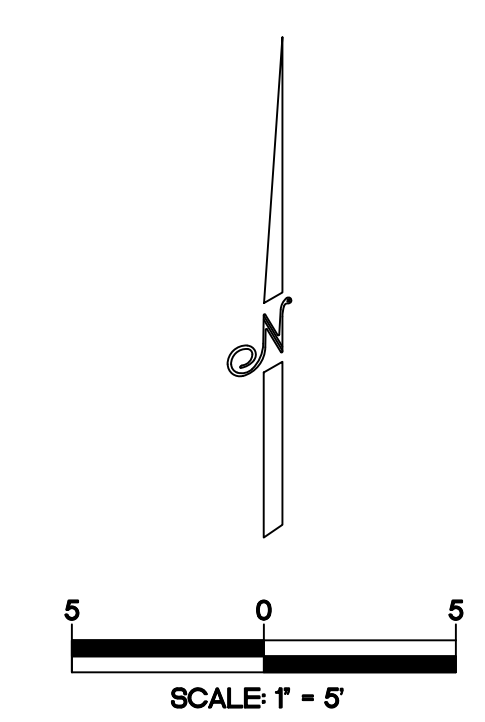
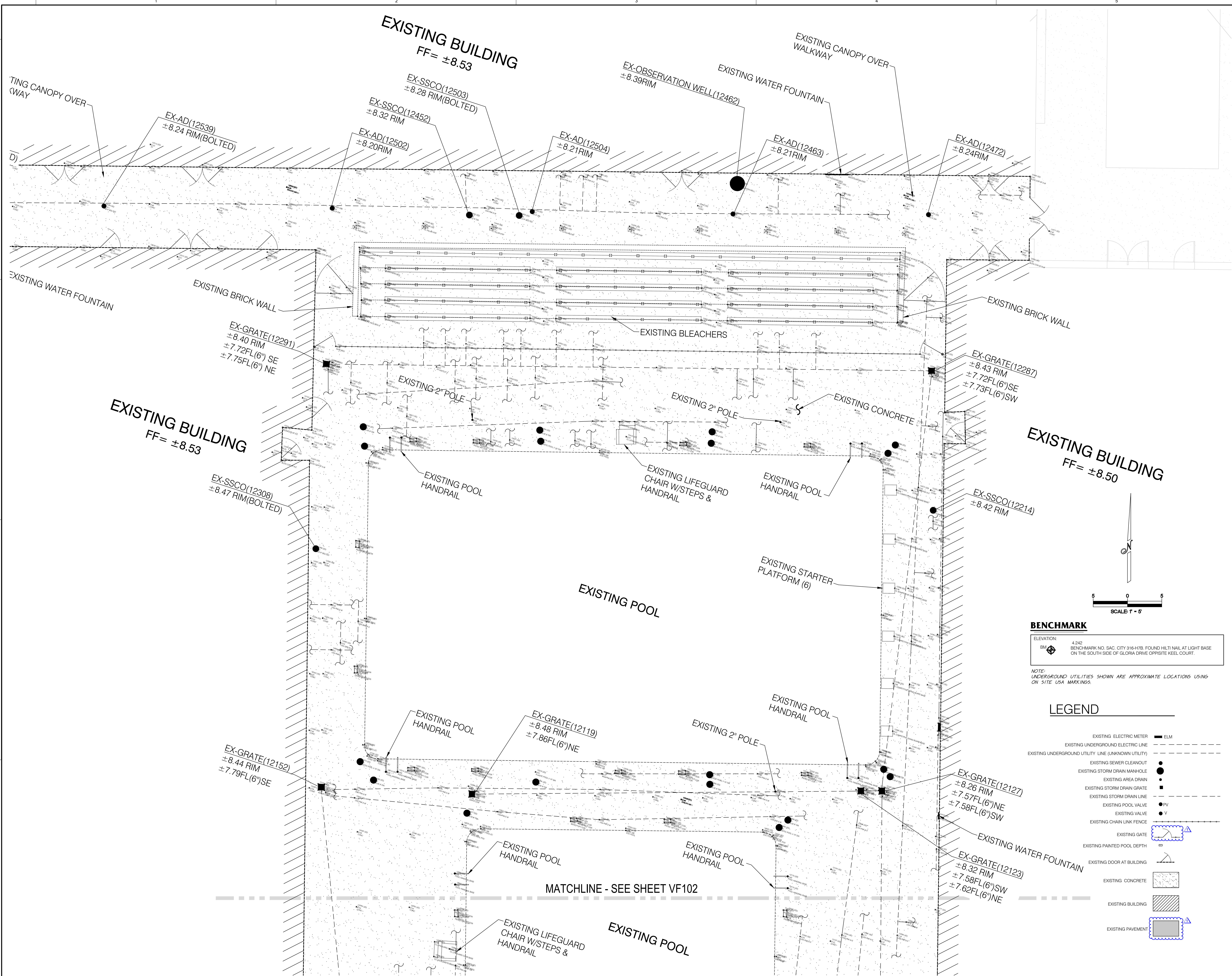
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BENCHMARK

ELEVATION: 4.242
 BM: BENCHMARK NO. SAC. CITY 316-H78. FOUND HILT NAIL AT LIGHT BASE ON THE SOUTH SIDE OF GLORIA DRIVE OPPOSITE KEEL COURT.

NOTE: UNDERGROUND UTILITIES SHOWN ARE APPROXIMATE LOCATIONS USING ON SITE USA MARKINGS.

LEGEND

EXISTING ELECTRIC METER	ELM
EXISTING UNDERGROUND ELECTRIC LINE	---
EXISTING UNDERGROUND UTILITY LINE (UNKNOWN UTILITY)	---
EXISTING SEWER CLEANOUT	●
EXISTING STORM DRAIN MANHOLE	●
EXISTING AREA DRAIN	●
EXISTING STORM DRAIN GRATE	■
EXISTING STORM DRAIN LINE	---
EXISTING POOL VALVE	● PV
EXISTING VALVE	● V
EXISTING CHAIN LINK FENCE	---
EXISTING GATE	---
EXISTING PAINTED POOL DEPTH	---
EXISTING DOOR AT BUILDING	---
EXISTING CONCRETE	▨
EXISTING BUILDING	▨
EXISTING PAVEMENT	▨

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 P 916.558.1900
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 EL DORADO HILLS, CA 95762 | (916) 985-1870

SEAL

PROJECT
JOHN F. KENNEDY HIGH SCHOOL SWIMMING POOL UPGRADE

6715 GLORIA DRIVE
 SACRAMENTO, CA 95831

CLIENT
 SACRAMENTO CITY UNIFIED SCHOOL DISTRICT

ISSUED

MARK	DATE	DESCRIPTION
1	5/10/2024	ADD 01

MANAGEMENT

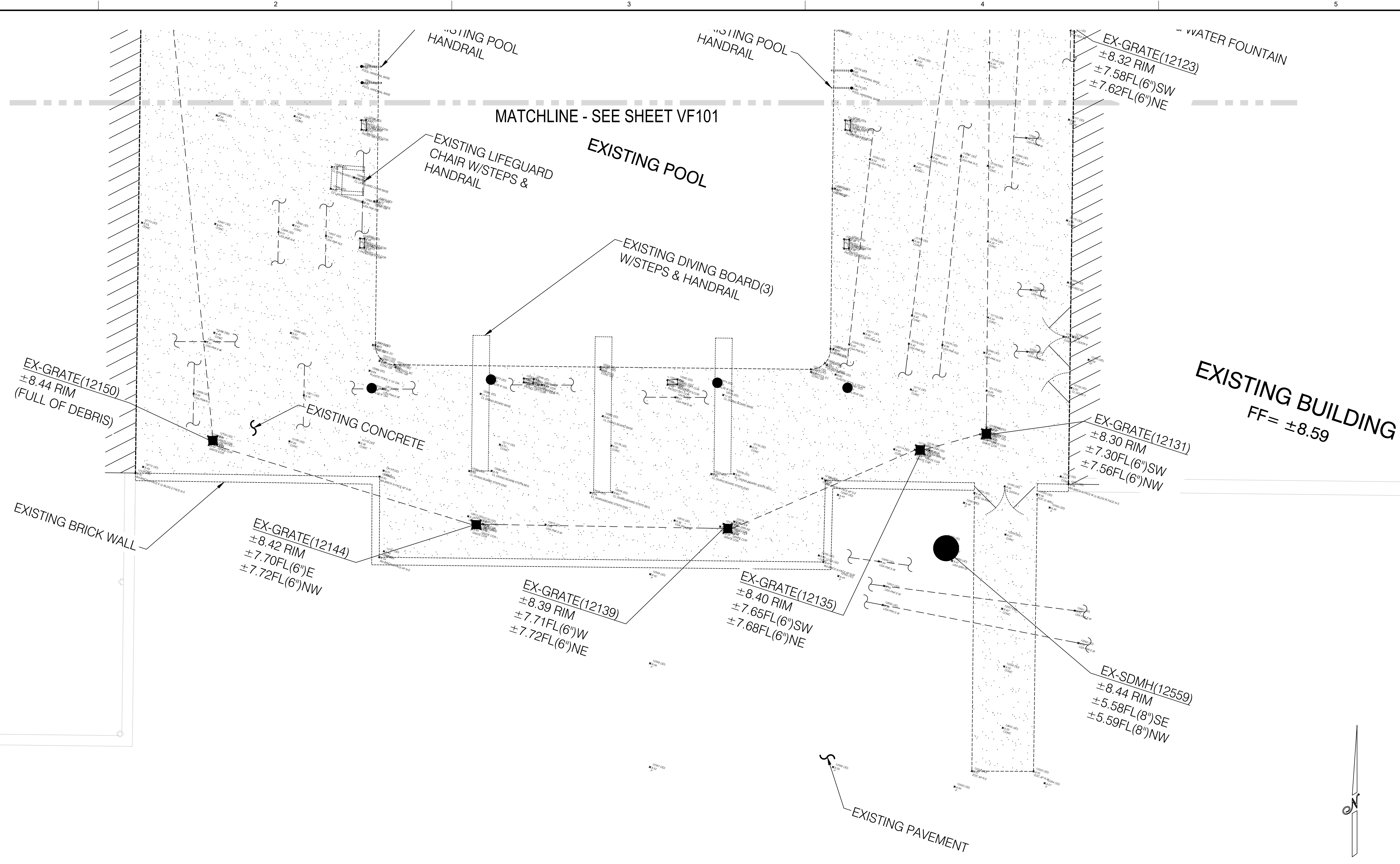
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AGENCY

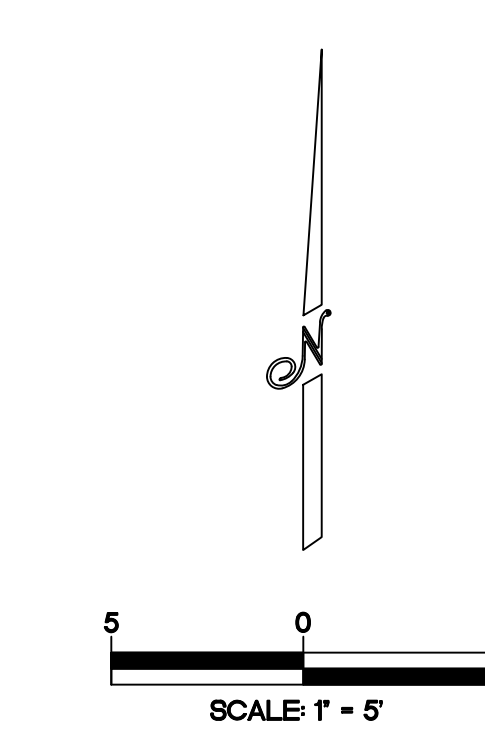
TITLE
TOPOGRAPHIC SURVEY

SHEET
VF101

1
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EXISTING BUILDING
FF= ±8.59



BENCHMARK
 ELEVATION: 4.242
 BM BENCHMARK NO. SAC. CITY 316-H78. FOUND HILTI NAIL AT LIGHT BASE ON THE SOUTH SIDE OF GLORIA DRIVE OPPOSITE KEEL COURT.

NOTE:
 UNDERGROUND UTILITIES SHOWN ARE APPROXIMATE LOCATIONS USING ON SITE USA MARKINGS.

LEGEND

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- EXISTING UNDERGROUND ELECTRIC LINE
- EXISTING UNDERGROUND UTILITY LINE (UNKNOWN UTILITY)
- EXISTING SEWER CLEANOUT
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- EXISTING POOL VALVE
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- EXISTING PAVEMENT

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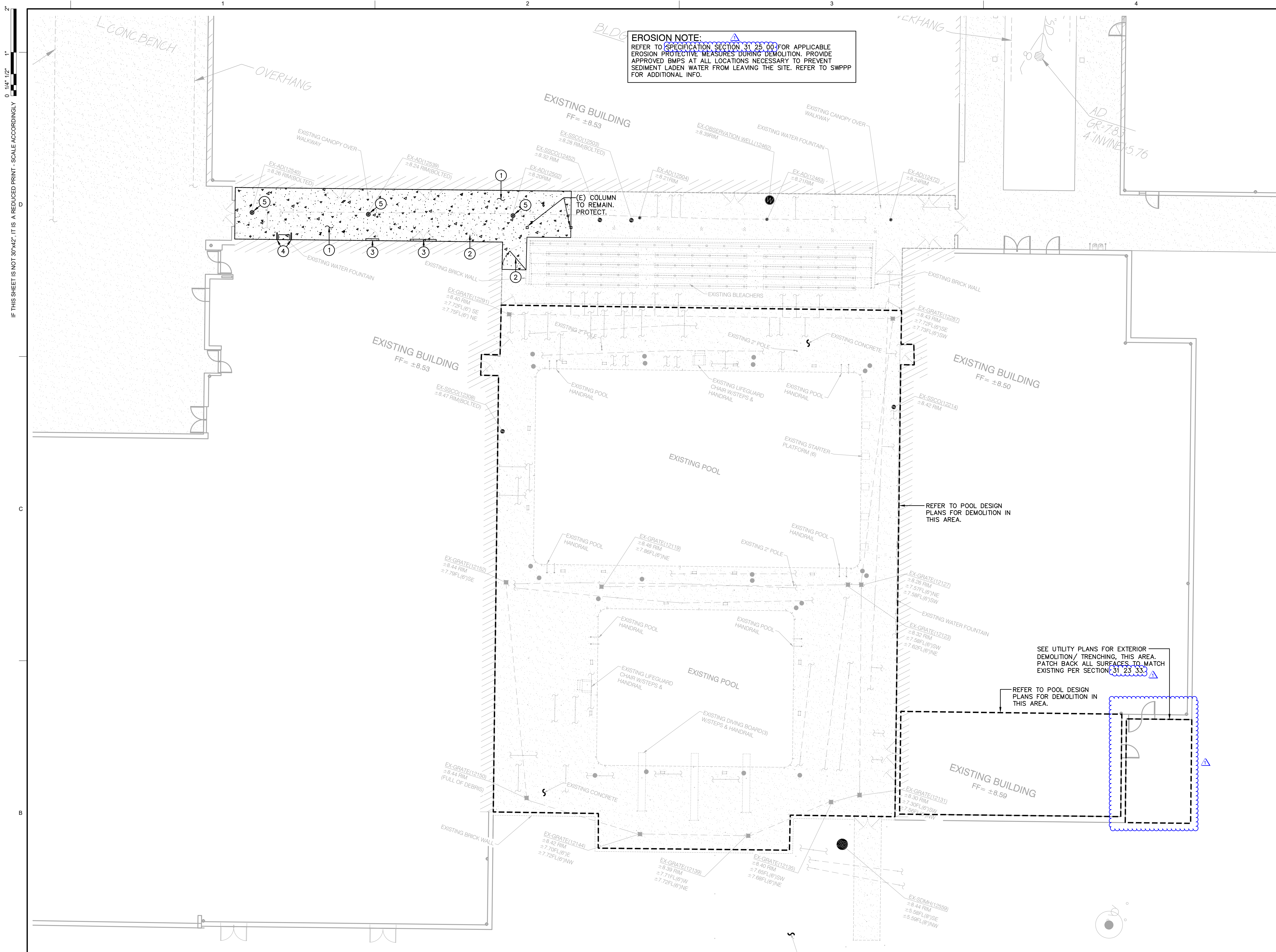
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AGENCY

TITLE
TOPOGRAPHIC SURVEY

SHEET

VF102



- ### DEMOLITION GENERAL NOTES
- IN THE EVENT THAT ANY UNUSUAL CONDITIONS NOT COVERED BY THE GEOTECHNICAL INVESTIGATION REPORT OR ARE ENCOUNTERED DURING GRADING OPERATIONS THE GEOTECHNICAL ENGINEER AND THE ENGINEER SHALL BE IMMEDIATELY NOTIFIED FOR DIRECTIONS.
 - NO BURNING OR BLASTING SHALL BE PERMITTED.
 - ADDITIONAL DEMOLITION INFORMATION MAY BE SHOWN ON THE GRADING, DRAINAGE, AND UTILITY PLANS, AND THOSE PLANS PREPARED BY OTHER DISCIPLINES FOR THIS PROJECT.
 - ALL DEMOLISHED ITEMS SHALL BE DISPOSED OF OFFSITE AT A SUITABLE, LEGAL, DUMP SITE OR OTHER FACILITY.
 - ALL DISPOSED OF MATERIALS SHALL BE RECYCLED IF POSSIBLE.
 - THE TYPES, LOCATIONS, SIZES AND/OR DEPTHS OF EXISTING UNDERGROUND UTILITIES AS SHOWN IN THESE PLANS WERE OBTAINED FROM SOURCES OF VARYING RELIABILITY. THE CONTRACTOR IS CAUTIONED THAT ONLY ACTUAL EXCAVATION WILL REVEAL THE TYPES, EXTENT, SIZES, LOCATIONS, AND DEPTHS OF SUCH UNDERGROUND UTILITIES. A REASONABLE EFFORT HAS BEEN MADE TO LOCATE AND DELINEATE ALL KNOWN UNDERGROUND UTILITIES. HOWEVER, WARREN CONSULTING ENGINEERS CAN ASSUME NO RESPONSIBILITY FOR THE COMPLETENESS OR ACCURACY OF ITS DELINEATION OF SUCH UNDERGROUND UTILITIES, NOR FOR THE EXISTENCE OF OTHER BURIED OBJECTS OR UTILITIES WHICH MAY BE ENCOUNTERED BUT WHICH ARE NOT SHOWN ON THESE DRAWINGS. THE CONTRACTOR OR ANY SUBCONTRACTOR FOR THIS CONTRACT SHALL NOTIFY THE DISTRICT TWO (2) WORKING DAYS IN ADVANCE OF PERFORMING ANY EXCAVATION WORK IN ORDER TO VERIFY TO THE GREATEST EXTENT POSSIBLE THE EXISTING UTILITY LINES, CONFLICTS AND PROPOSED UTILITY CONNECTION POINTS.
 - THE SCHOOL DISTRICT SHALL HAVE SALVAGE RIGHTS TO ANY DEMOLISHED ITEMS SHOWN HEREON. THE CONTRACTOR SHALL GIVE THE DISTRICT NOTICE 7 DAYS PRIOR TO THE START OF DEMOLITION. THE DISTRICT SHALL MOVE ANY RETAINED ITEMS OUT OF THE CONTRACTORS WORK AREA, UNLESS ANOTHER ARRANGEMENT IS MADE WITH THE CONTRACTOR. ANY REMAINING ITEMS BECOME THE PROPERTY OF THE CONTRACTOR AND SHALL BE REMOVED FROM THE SITE. ANY ITEMS NOT SHOWN FOR REMOVAL SHALL REMAIN AND SHALL BE PROTECTED FROM DAMAGE DURING CONSTRUCTION TO A REASONABLE EXTENT.
 - EXISTING UTILITY STRUCTURES IN AREAS OF NEW PAVING SHALL BE REMOVED AND REINSTALLED AT NEW GRADE UNLESS SPECIFICALLY NOTED OTHERWISE.
 - ITEMS OUTSIDE THE LIMITS OF DEMOLITION SHALL REMAIN AND BE PROTECTED FROM DAMAGE DURING CONSTRUCTION.
 - CONTRACTOR SHALL COMPLY WITH CHAPTER 33 OF THE 2022 CFC, "FIRE SAFETY DURING CONSTRUCTION AND DEMOLITION" AT ALL TIMES DURING CONSTRUCTION.
 - CONTRACTOR SHALL HIRE A UTILITY LOCATING COMPANY AND SHALL SCAN THE ENTIRE AREA WITHIN THE LIMITS OF NEW WORK. ALL UTILITIES LOCATED SHALL BE MARKED AND PROTECTED DURING THE LIMITING OPERATIONS AS WELL AS ANY EXCAVATING TASKS. ANY LOCATED UTILITY DAMAGED WITHIN THE LIMITS OF WORK WILL BE THE RESPONSIBILITY OF THE CONTRACTOR TO REPAIR.
 - ALL DEMOLITION SHALL BE APPROPRIATELY SUPPORTED AND REINFORCED DURING REMOVAL TO PREVENT INJURY FROM FALLING, PROJECTILE, OR OTHERWISE MOVING DEBRIS OR OTHER DELETERIOUS MATERIAL. ON-SITE SAFETY WITHIN THE LIMITS OF WORK IS THE CONTRACTORS SOLE RESPONSIBILITY.

- ### DEMOLITION NOTES
- AND/OR LEGEND
- REMOVE EXISTING CONCRETE PAVING AND BASE AGGREGATES (IF EXIST), WHERE SAWCUTS ARE NECESSARY, THEY SHALL BE A NEAT STRAIGHT LINE. CUT SHALL BE MADE AT NEAREST EXISTING JOINT TO LOCATION SHOWN.
 - REMOVE EXISTING LARGE MAINTENANCE GATE. SEE ARCHITECTURAL PLANS FOR NEW GATE.
 - REMOVE EXISTING METAL THRESHOLD. SEE GRADING PLANS FOR NEW FLATWORK. SEE ARCHITECTURAL PLANS FOR NEW THRESHOLD.
 - REMOVE EXISTING DRINKING FOUNTAIN HANDRAILS. SALVAGE AND RE-INSTALL ON NEW CONCRETE FLATWORK.
 - REMOVE EXISTING FLOOR DRAIN. PROTECT EXISTING PIPING SYSTEMS.

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 2025 Ninth Street
 Sacramento, CA 95818
 P 916.558.1900
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PROJECT
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 SWIMMING POOL UPGRADE**

6715 GLORIA DRIVE
 SACRAMENTO, CA 95831

CLIENT
 SACRAMENTO CITY UNIFIED SCHOOL DISTRICT

ISSUED

MARK	DATE	DESCRIPTION
1	5/10/2024	ADD 01

MANAGEMENT

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 CLIENT PROJECT NO: N/A
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AGENCY

TITLE
**SURFACE DEMOLITION
 PLAN**

SHEET
CD101

1 SURFACE DEMOLITION PLAN

SCALE 1" = 10'-0"

EXISTING UTILITIES AND LOCATING
 VARIOUS UTILITIES EXIST BENEATH THE PROPOSED IMPROVEMENTS. CONTRACTOR SHALL ACQUIRE UNDERGROUND LOCATOR TO LOCATE ALL UTILITIES IN ACCORDANCE WITH EARTHWORK SECTION 31 0000. APPROXIMATE LOCATIONS HAVE BEEN SHOWN ON THESE PLANS FROM RECORD SOURCES BUT FIELD CONDITIONS MAY VARY. CELLULAR CONDUITS REQUIRE EXTREME CAUTION WHEN WORKING AROUND. SHALLOW UTILITIES, MAY REQUIRE ADDITIONAL WORK AS OUTLINED IN THESE PLANS AND SPECIFICATIONS TO AVOID DAMAGE TO UTILITIES. CONTACT ARCHITECT IMMEDIATELY IF FOUND UTILITIES CONFLICT WITH NEW WORK.

UTILITY VERIFICATION NOTE
 PRIOR TO THE START OF CONSTRUCTION, VERIFY AND POTHOLE ALL UTILITY POINTS OF CONNECTION FOR LOCATION, DEPTH, AND SIZE. IF CONFLICT IS FOUND, CONTACT THE ENGINEER IMMEDIATELY FOR DIRECTION.

CONCRETE SAWCUT NOTE
 SAWCUTS AND SUBSEQUENT PATCH BACK OF CONCRETE WALKS, SHALL BE TO THE EXISTING CONCRETE JOINT BEYOND NEAREST THE LOCATION OF DEMOLITION AS SHOWN. A REASONABLE EFFORT HAS BEEN MADE TO LOCATE, SHOW AND COORDINATE WITH EXISTING JOINTS, HOWEVER IF FIELD CONDITIONS ARE OTHERWISE, IT IS UNDERSTOOD TO REMOVE AND PATCH BACK TO THE NEAREST JOINTS BEYOND DEMOLITION.

IRRIGATION DEMOLITION
 WITHIN LANDSCAPE AREAS TO BE DEMOLISHED THERE MAY BE EXISTING IRRIGATION LINES NOT SHOWN ON THIS PLAN. CONTRACTOR SHALL REMOVE LATERAL LINE AND HEADS ENCOUNTERED, PROVIDED THAT THE MAIN LINES AND CONTROL WIRES ONLY IF ROUTING IS KNOWN AND REMOVAL WILL NOT DEACTIVATE AN IRRIGATION SYSTEM INTENDED TO REMAIN. IF CONFLICT IS FOUND, CONTACT THE ENGINEER FOR DIRECTION.

WHEN IRRIGATION LINES ENTERING NEW WORK ARE CUT TEMPORARILY FOR CONSTRUCTION, EVEN IF THEY ARE TO BE RE-CONNECTED TO AT SOME POINT DURING CONSTRUCTION, SHALL BE CAPPED TO ALLOW UPSTREAM HEADS IN THAT SYSTEM ZONE TO OPERATE. CAPS SHALL BE REMOVED IF A RE-CONNECTION IS PLANNED.

CAL-GREEN - Waste Diversion

5.408.1 Construction waste management. Recycle and/or salvage for reuse a minimum of 65 percent of the nonhazardous construction and demolition waste in accordance with Section 5.408.1.1, 5.408.1.2 or 5.408.1.3, or meet a local construction and demolition waste management ordinance, whichever is more stringent.

5.408.1.1 Construction waste management plan. Where a local jurisdiction does not have a construction and demolition waste management ordinance that is more stringent, submit a construction waste management plan that:

- Contractor shall identify the construction and demolition waste materials to be diverted from disposal, to comply with 65% criteria listed above, by efficient usage, recycling, reuse on the project or salvage for future use or sale.
- Contractor shall determine if construction and demolition waste materials will be sorted on-site (source-separated) or bulk mixed (single stream). Either method is the responsibility of the contractor.
- Contractor shall identify diversion facilities where construction and demolition waste material collected will be taken. Transport to such facilities is contractor's responsibility.
- Contractor shall record and provide record of the amount of construction and demolition waste materials diverted shall be calculated by weight or volume, but not by both.

5.408.1.2 Waste management company. Utilize a waste management company that can provide verifiable documentation that the percentage of construction and demolition waste material diverted from the landfill complies with this section.

Contractor shall make the determination if the construction and demolition waste material will be diverted by a waste management company. Contractor shall make any and all arrangements with waste management company for pickup of materials.

Exceptions to Sections 5.408.1.1 and 5.408.1.2:

- Excavated soil and land-clearing debris.
- Alternate waste reduction methods developed by working with local agencies if diversion or recycle facilities capable of compliance with this item do not exist.
- Demolition waste meeting local ordinance or calculated in consideration of local recycling facilities and markets.

5.408.1.3 Waste stream reduction alternative. The combined weight of new construction disposal that does not exceed two pounds per square foot of building area may be deemed to meet the 65 percent minimum requirement as approved by the enforcing agency.

CAL-GREEN - Waste Diversion Documentation Required (Ref Calgreen 5.408.1.4)
 Contractor shall prepare and provide documentation to the enforcing agency which demonstrates compliance with Calgreen Sections 5.408.1.1 through 5.408.1.3. The waste management plan shall be updated as necessary and shall be accessible during construction for examination by the enforcing agency.

Notes:

- Sample forms found in "A Guide to the California Green Building Standards Code (Nongovernmental)" located at <http://www.tbc.ca.gov/Home/CALGreen.aspx> may be used to assist in documenting compliance with the waste management plan.
- Mixed construction and demolition debris (C&D) processors can be located at the California Department of Resources Recycling and Recovery (CalRecycle).

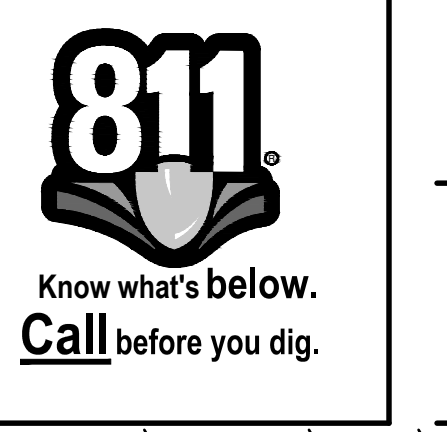
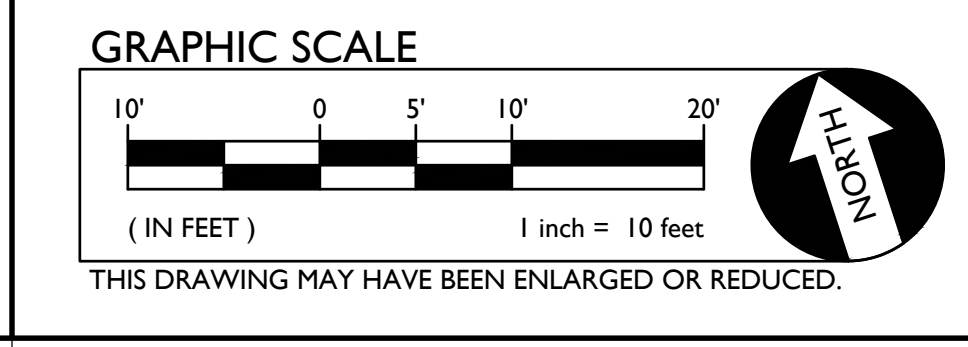
CAL-GREEN - Excavated Soil & Land Clearing

5.408.3 Excavated soil and land clearing debris. 100 percent of trees, stumps, rocks and associated vegetation and soils resulting primarily from land clearing shall be reused or recycled. For a phased project, such material may be stockpiled on site until the storage site is developed.

Exception: Reuse, either on-or off-site, of vegetation or soil contaminated by disease or pest infestation.

Notes:

- If contamination by disease or pest infestation is suspected, contact the County Agricultural Commissioner and follow its direction for recycling or disposal of the material. (www.cdffa.ca.gov/ExecCountyCounty_contacts.html)
- For a map of known pest and/or disease quarantine zones, consult with the California Department of Food and Agriculture. (www.cdffa.ca.gov)



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DOOR SCHEDULE																		
DOOR NO	LOCATION	FIRE RATING (MINS)	HDW GP	DOORS								FRAMES						COMMENTS
				TYPE	WIDTH	LEAF 2 TYPE	WIDTH	MATL	HEIGHT	FINISH	GL	TYPE	MATL	FINISH	GL	HEAD	JAMB	
106A	MECHANICAL ROOM	45	(none)	DF1	3'-0"			HM	7'-0"	PT					9/A-532	9/A-532		DOOR AND FRAME SHALL BE CORROSION RESISTANT

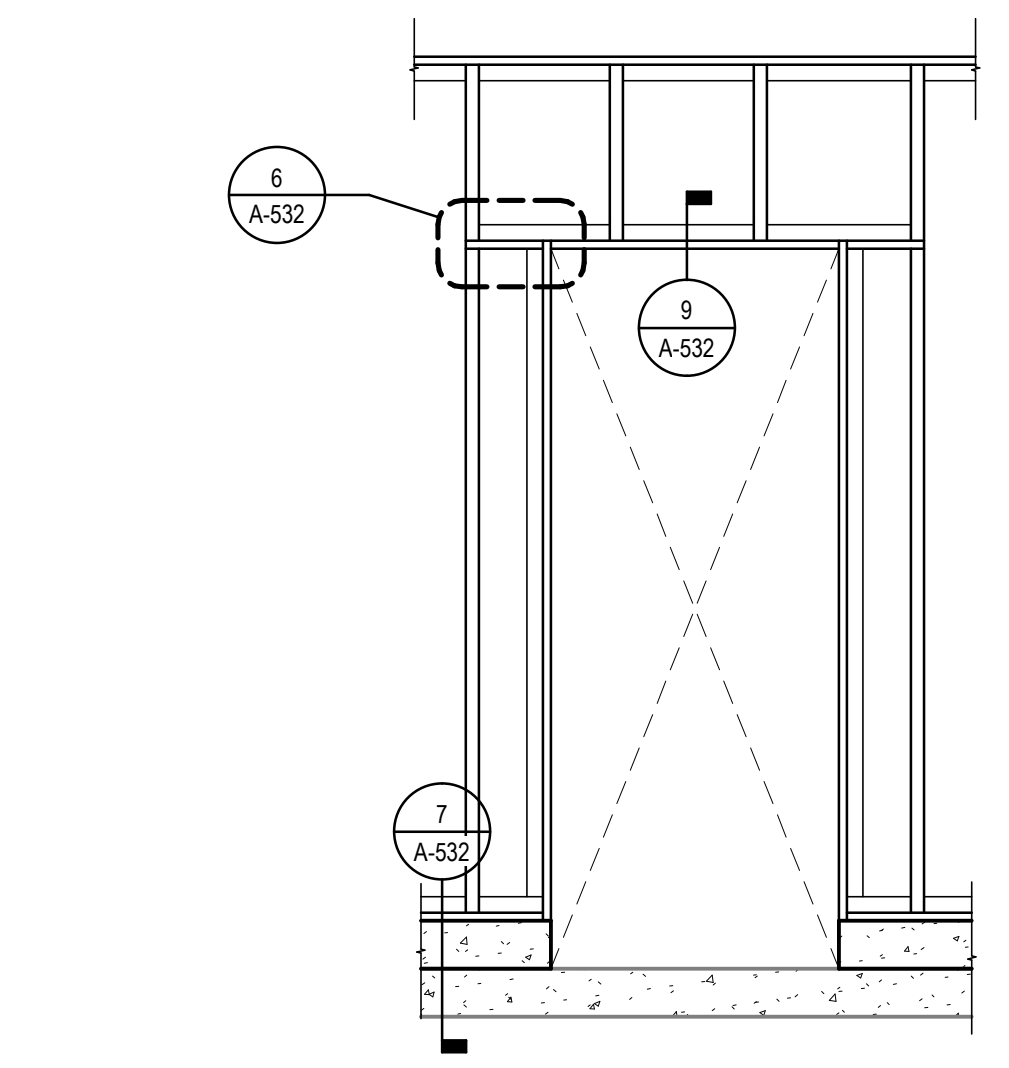
DOOR SCHEDULE GENERAL NOTES

- GENERAL DOOR SHEET NOTES ARE TYPICAL UNLESS NOTED OTHERWISE.
- FLOORS OR LANDINGS ON EACH SIDE OF EXIT DOORS SHALL NOT EXCEED 1/2" FROM THE TOP OF THE DOOR THRESHOLD TO THE FLOOR OR LANDING SURFACE ON EITHER SIDE OF THE DOOR ASSEMBLY.
- EXITS AND EXIT ACCESS DOORS SHALL BE MARKED BY AN APPROVED EXIT SIGN READILY VISIBLE FROM ANY DIRECTION OF TRAVEL.
- THE FORCE FOR PUSHING OR PULLING OPEN INTERIOR SWINGING EGRESS DOORS, OTHER THAN FIRE DOORS, SHALL NOT EXCEED 5 POUNDS. FOR OTHER SWINGING DOORS, AS WELL AS SLIDING AND FOLDING DOORS, THE DOOR LATCH SHALL RELEASE WHEN SUBJECTED TO A 15 POUND MAXIMUM FORCE.
- LATCHING AND LOCKING DOORS THAT ARE HAND ACTIVATED AND WHICH ARE IN THE PATH OF TRAVEL SHALL BE OPERABLE WITH A SINGLE EFFORT BY LEVER TYPE HARDWARE, PANIC BARS, PUSH-PULL ACTIVATING BARS OR OTHER HARDWARE DESIGNED TO PROVIDE PASSAGE WITHOUT REQUIRING THE ABILITY TO GRASP, PINCH OR TWIST THE OPENING HARDWARE.
- THE BOTTOM 10" OF ALL DOORS EXCEPT AUTOMATIC AND SLIDING DOORS SHALL HAVE A SMOOTH UNINTERRUPTED SURFACE TO ALLOW THE DOOR TO BE OPENED BY A WHEELCHAIR FOOTREST WITHOUT CREATING A TRAP OR HAZARDOUS CONDITION. WHERE NARROW FRAME DOORS ARE USED, A 10" HIGH SMOOTH PANEL SHALL BE INSTALLED ON THE PUSH SIDE OF THE DOOR, WHICH WILL ALLOW THE DOOR TO BE OPENED BY A WHEELCHAIR FOOTREST WITHOUT CREATING A TRAP OR HAZARDOUS CONDITION.
- RATED DOORS SHALL BE POSITIVE LATCHING AND SELF CLOSING.
- FIRE RATED DOORS AND GLASS SHALL HAVE AN APPROVED LABEL OR LISTING MARK INDICATING THE FIRE PROTECTION RATING WHICH IS PERMANENTLY AFFIXED AT THE FACTORY WHERE FABRICATION AND ASSEMBLY OCCUR.
- DOOR AND FRAME ASSEMBLY DIMENSIONS SHALL BE FIELD VERIFIED PRIOR TO FABRICATION AND INSTALLATION.
- COORDINATE OVERALL DOOR FRAME DEPTHS WITH WALL TYPES.
- FOR DOOR HARDWARE GROUPS, SEE PROJECT SPECIFICATIONS.

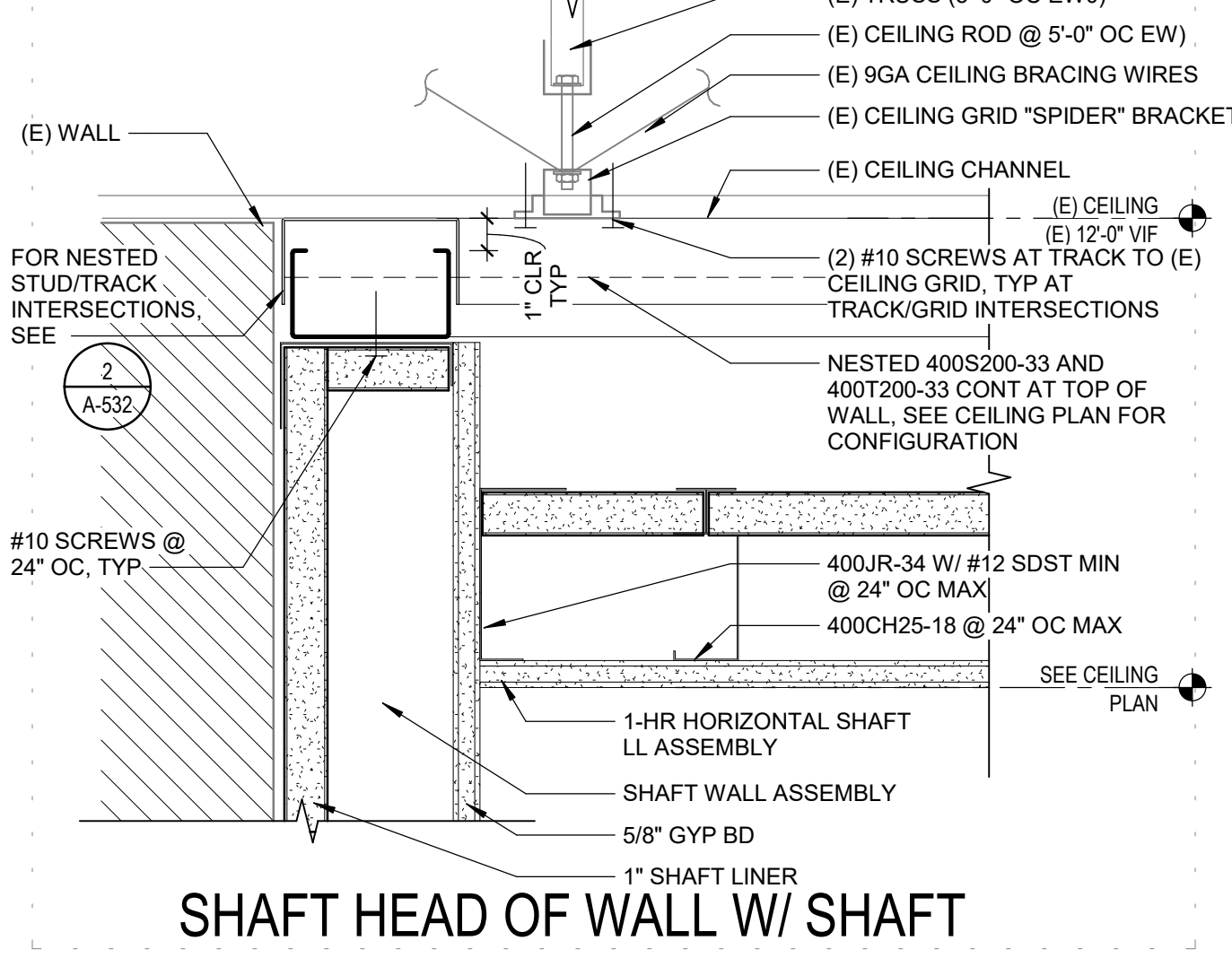


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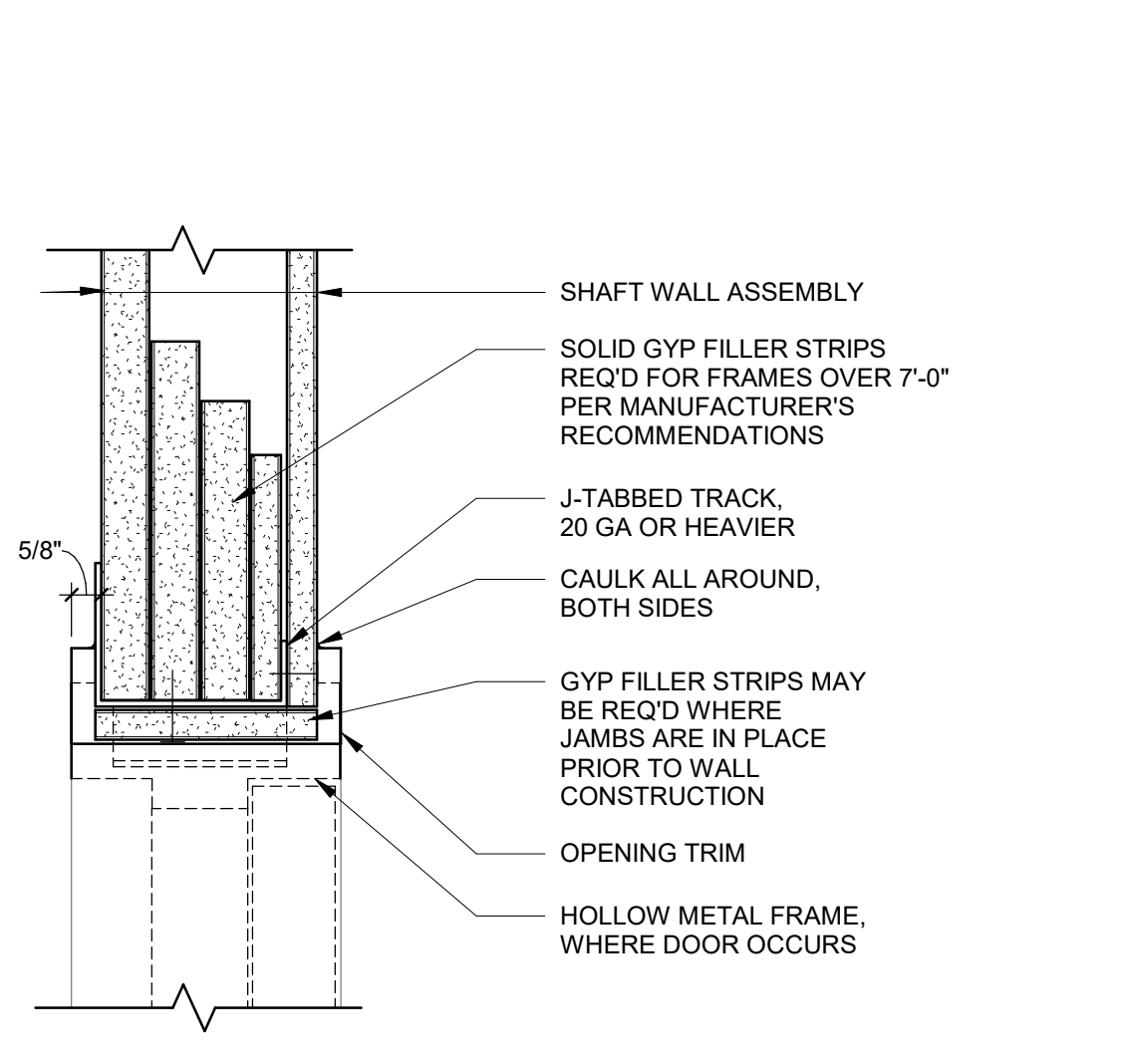
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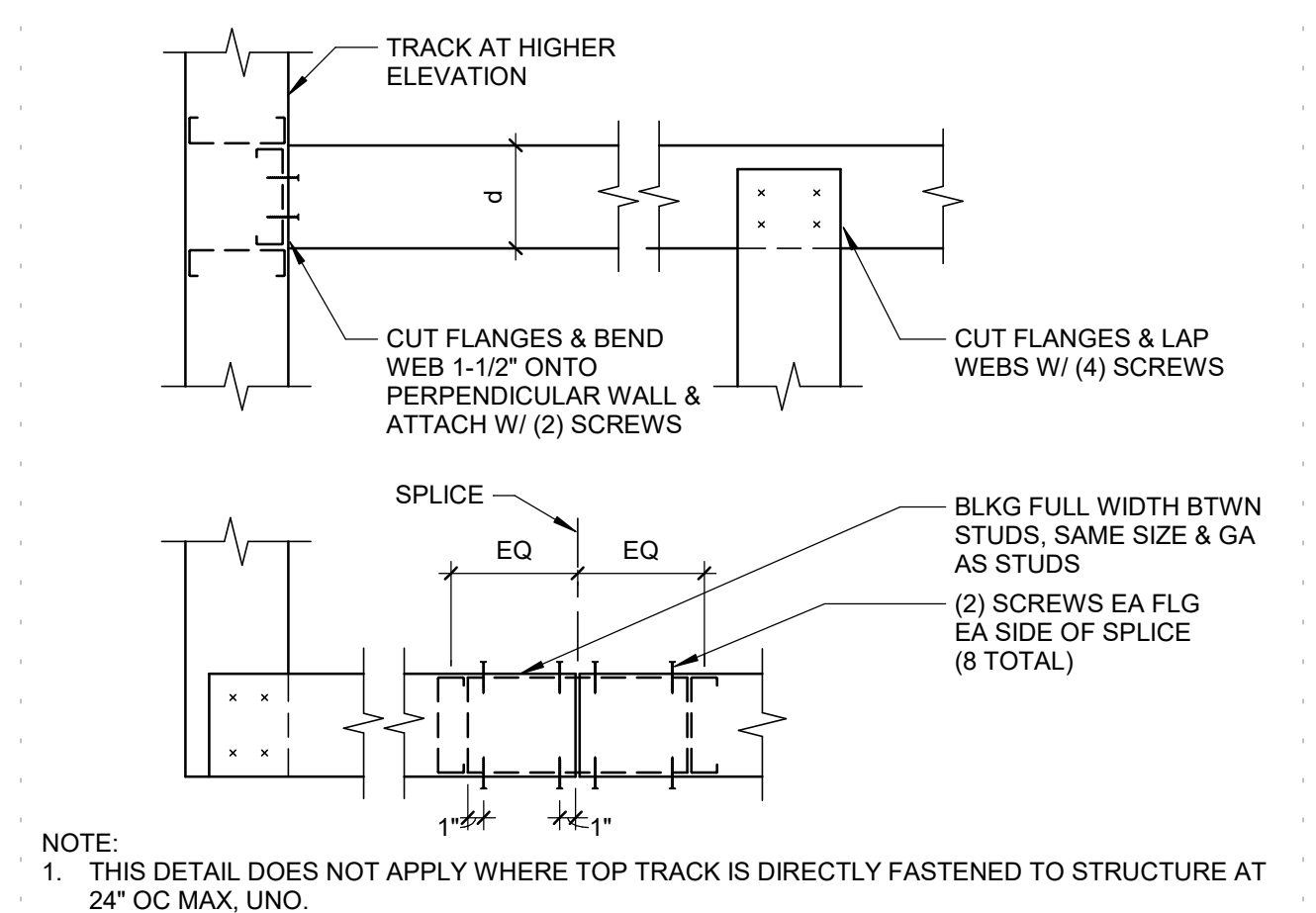
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1/2" = 1'-0"



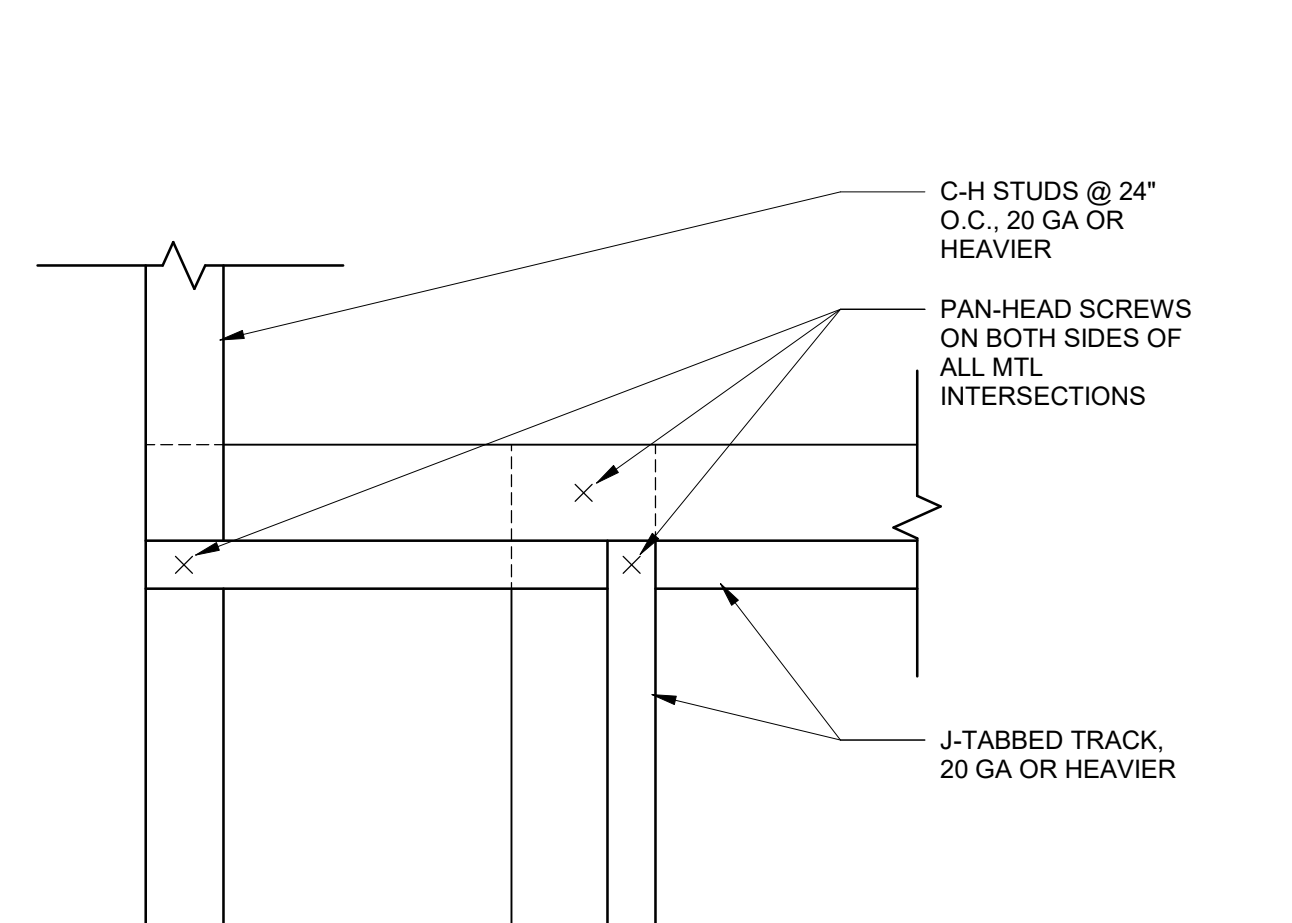
5 SHAFT WALL - HEAD (JAMB SIM)
3" = 1'-0"



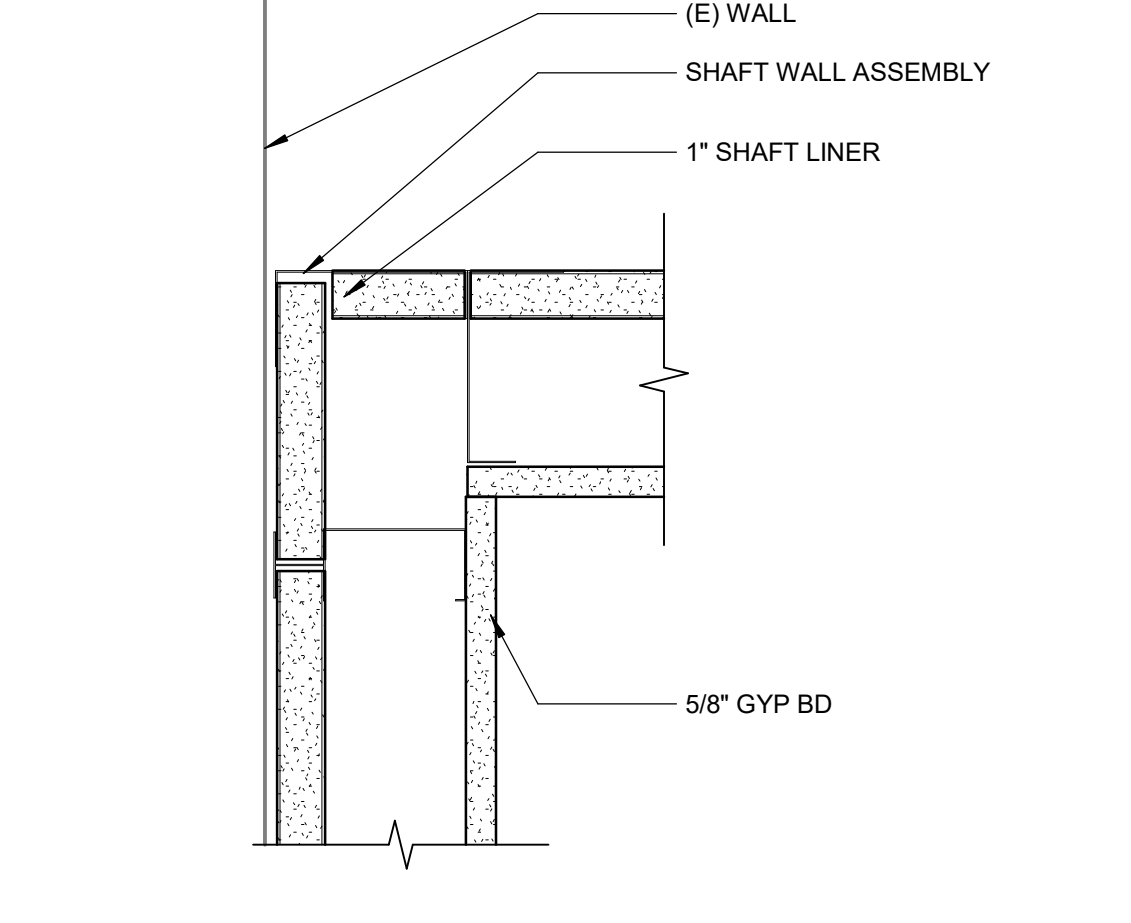
9 SHAFT WALL - HEAD (JAMB SIM)
3" = 1'-0"



2 TYP STEEL TOP TRACK FRAMING AT CORNERS, INTERSECTIONS, AND SPLICES
SCALE: NTS



6 OPNG INSIDE CRNR (SHAFT WALL)
3" = 1'-0"



10 SHAFT WALL - CORNER FRAMING - PLAN
3" = 1'-0"

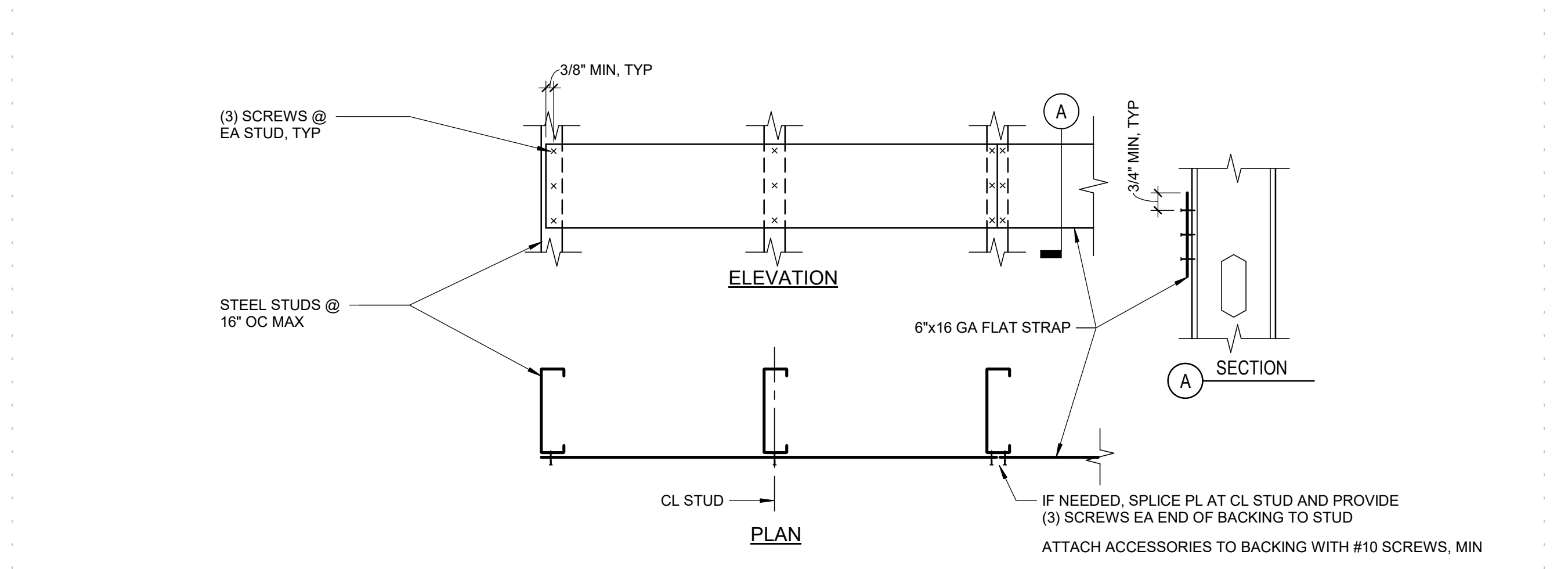
LEGEND

- (E) = EXISTING
ADO = AUTOMATIC DOOR OPERATOR
ADC = AUTOMATIC DOOR CLOSER
CR = CARD READER
EL = ELECTRIC LOCK
HDW GP = HARDWARE GROUP
HO = HOLD OPEN
PH = PANIC HARDWARE
V = VINYL STRIPS
- MATERIAL**
ALUM = ALUMINUM
DHM = DETENTION HOLLOW METAL
CR = CARD READER
HM = HOLLOW METAL
SST = STAINLESS STEEL
WD = WOOD
- FINISH**
ANOD = ANODIZED
FRP = FIBER REINFORCED PLASTIC
PLAM = PLASTIC LAMINATE
PT = PAINT
ST = STAIN
- GLASS LEGEND:**
GL = GLASS
LG = LEADED GLASS
RG = RATED GLASS
SG = SPANDREL GLASS
TG = TEMPERED GLASS
- GLASS LEGEND NOTES:**
1. SEE SPECS FOR GLASS TYPES NOTED

COLD-FORMED STEEL SHAFT WALL

- SHAFT WALL ASSEMBLY SHALL BE DESIGNED TO UL 415
- THE DESIGN, INSTALLATION AND CONSTRUCTION OF COLD-FORMED STEEL SHAFT WALL FRAMING SHALL COMPLY WITH THE REQUIREMENTS OF FIRE-RESISTANCE RATED ASSEMBLIES INDICATED IN THE UNITED STATES GYPSUM (USG) SYSTEM FOLDER SA926.
- PRODUCTS SHALL BE MANUFACTURED BY OR FOR THE UNITED STATES GYPSUM COMPANY AND COMPLY WITH ICC AER-09036.
- STEEL MEMBERS SHALL COMPLY WITH ASTM C645.
- ALL STEEL SHAFT WALL MEMBERS SHALL HAVE THE MINIMUM EFFECTIVE STRUCTURAL SECTION PROPERTIES AS GIVEN IN TABLES BELOW.
- J-RUNNERS AND JAMB STRUT SHALL BE ASTM A653 SS GRADE 33 FOR 24GA. MINIMUM THICKNESS AND ASTM A653 SS GRADE 40 FOR 20GA MINIMUM THICKNESS.
- C-H AND E STUDS SHALL BE MANUFACTURED FROM COLD ROLL-FORMED LIGHT GAUGE STEEL CONFORMING TO ASTM A653 SS GRADE 33 FOR 25GA THICKNESS AND ASTM A653 SS GRADE 40 FOR 20GA MINIMUM THICKNESS.
- PROVIDE FIRESTOPPING SEALANT AT ALL JOINTS AND PENETRATIONS AT RATED WALL. FIRE SEALANT RATINGS TO MATCH WALL RATING MINIMUM.

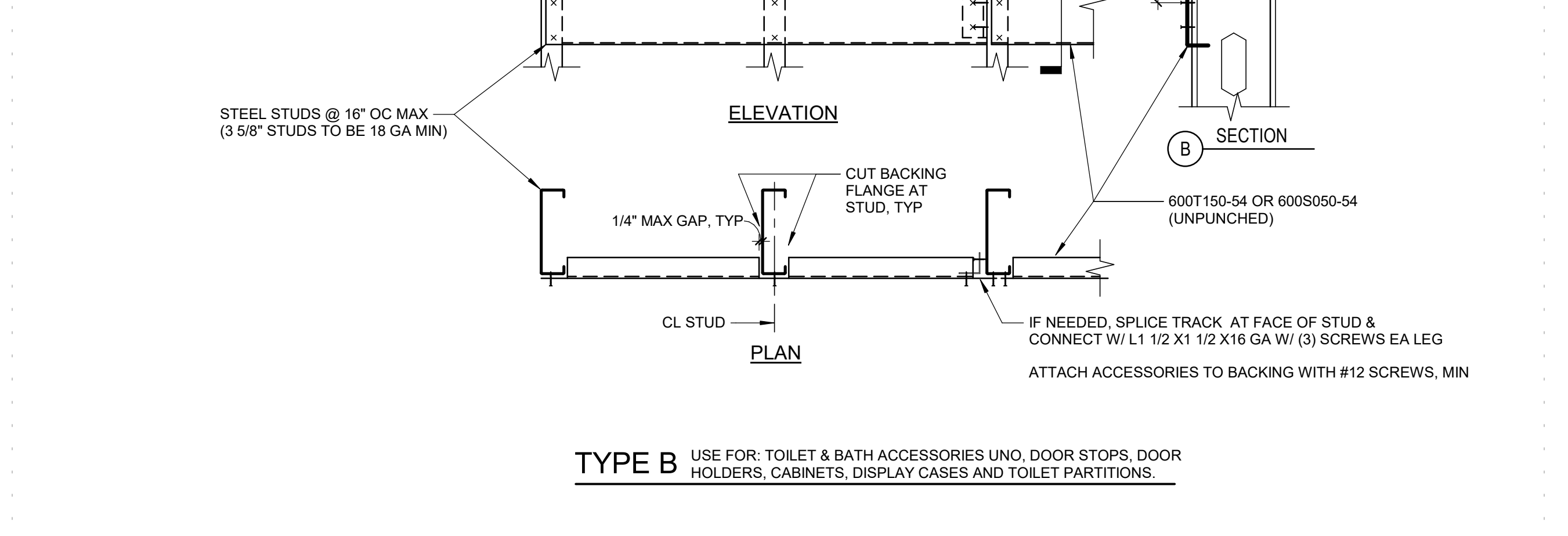
COMPONENT	SHAFT WALL COMPONENT SECTION PROPERTIES						
	USG PRODUCT IDENTIFICATION	MEMBER DEPTH, d (in)	FLANGE WIDTH b (in)	MILS	REF GA	EFFECTIVE AREA A (in ²)	EFFECTIVE S _x (in ³)
C-H STUDS	212CH-18	2 1/2	1 1/2	18	25	0.1524	0.129
	212CH-34	2 1/2	1 1/2	34	20	0.2910	0.239
	400CH-18	4	1 1/2	18	25	0.1798	0.383
	400CH-34	4	1 1/2	34	20	0.3433	0.730
	600CH-34	6	1 1/2	34	20	0.4227	1.988
DOUBLE E-STUDS	600ES-18	6	2	18	25	0.3962	2.004
	600ES-34	6	2	34	20	0.6364	3.400
J-RUNNER	212JR-23	2 1/2	1 & 2	23	24	0.1346	0.117
	212JR-34	2 1/2	1 & 2	34	20	0.2039	0.192
	400JR-23	4	1 & 2	23	24	0.1705	0.351
	400JR-34	4	1 & 2	34	20	0.2577	0.574
	600JR-23	6	1 & 2	23	24	0.2183	0.937
	600JR-34	6	1 & 2	34	20	0.3295	1.523
JAMB STRUT	400JS-34	4	1 & 3	34	20	0.2290	0.917
	600JS-34	6	1 & 3	34	20	0.3654	1.673



8 TYP STEEL STUD WALL BACKING PLATE
SCALE: NTS



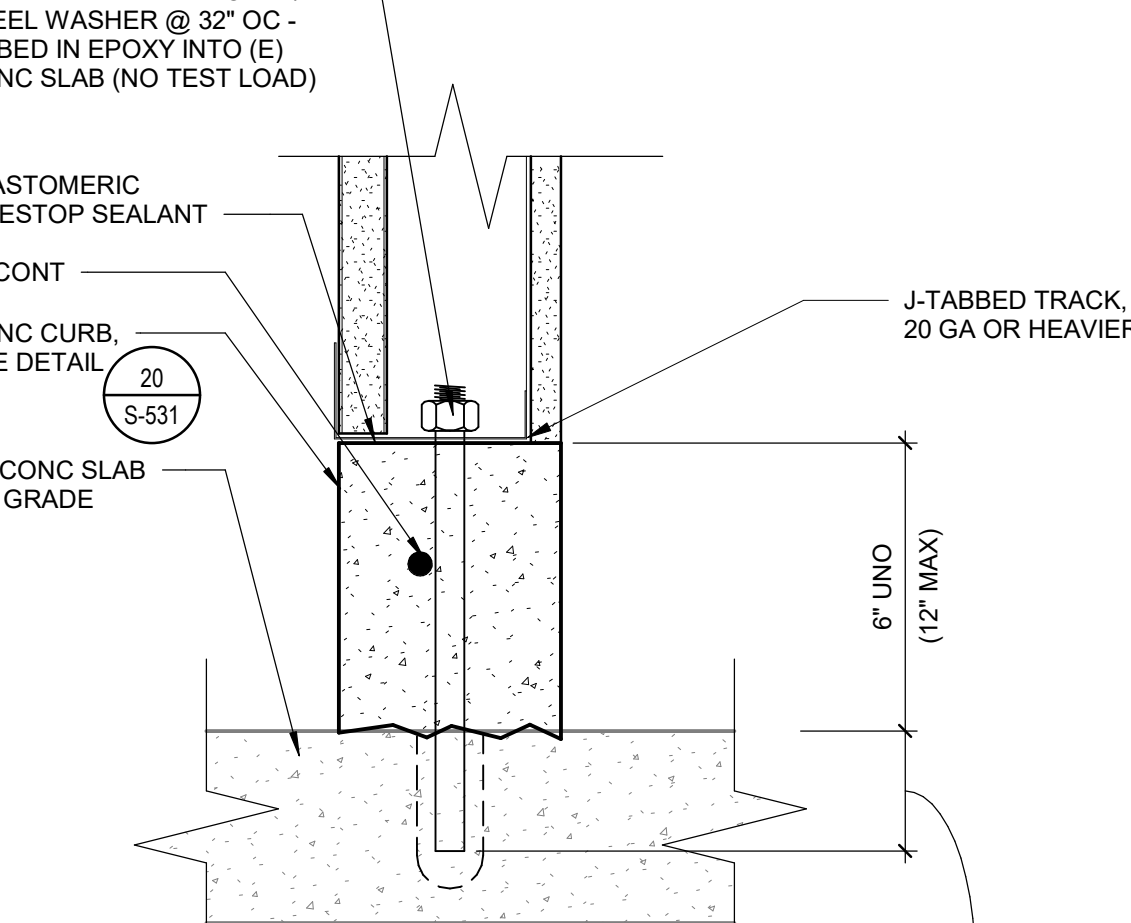
16 URINAL PARTITION ATTACHMENT
3" = 1'-0"



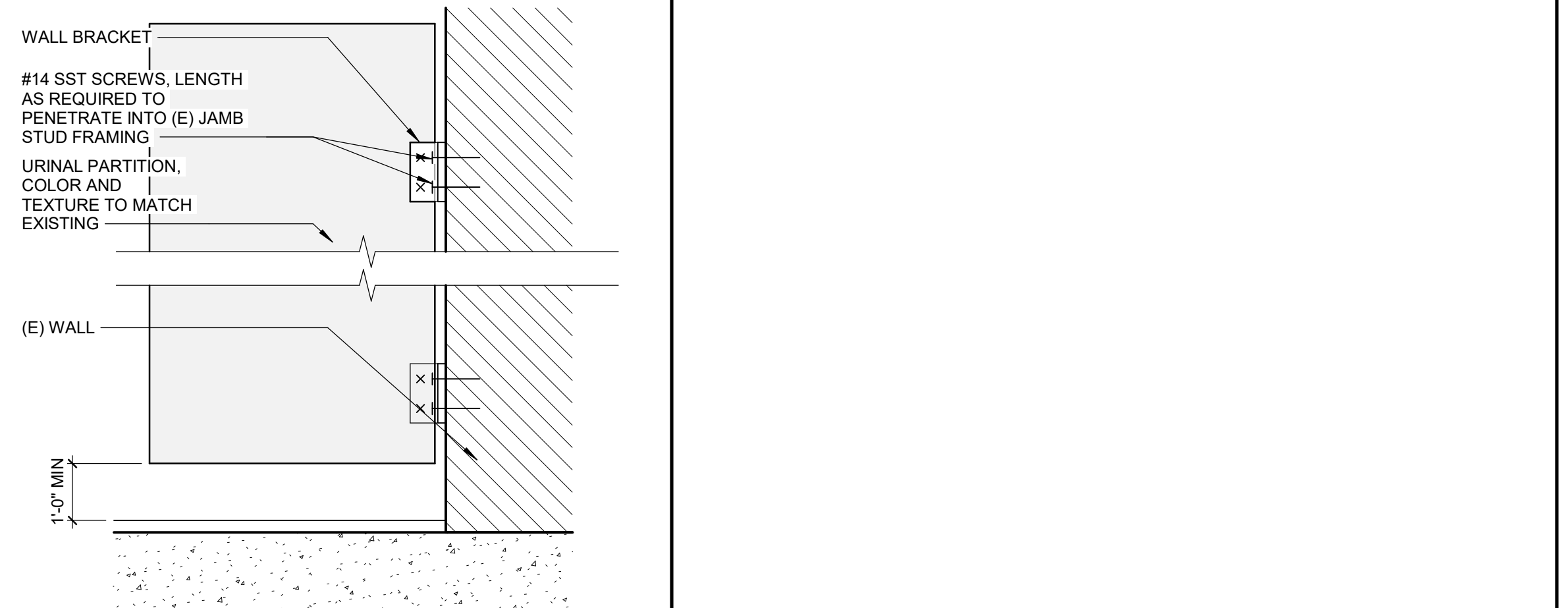
7 SHAFT WALL SILL
3" = 1'-0"

- NOTES:**
- DO NOT CUT OR NOTCH STUDS TO INSTALL BACKING.
 - BACKING CONT ONE PIECE OVER (3) STUDS MIN. DO NOT CUT OR NOTCH BACKING EXCEPT AS SHOWN.
 - VERIFY LENGTH, HEIGHT, QUANTITY & LOCATION OF BACKING WITH ARCHITECTURAL DETAILS AND ACCESSORY MANUFACTURER.
 - EXTEND BACKING TO FIRST STUD PAST END OF ATTACHED ACCESSORY.
 - DEEPER BACKING MAY BE USED. ADD (1) SCREW AT EA CORN FOR EA 2" INCREASE IN DEPTH.
 - SEE "COLD FORMED STEEL FRAMING" NOTES FOR SCREW SIZES. UNO. USE LOW-PROFILE SCREW HEADS FOR BACKING TO STUD CONNECTION.

8 TYP STEEL STUD WALL BACKING PLATE
SCALE: NTS

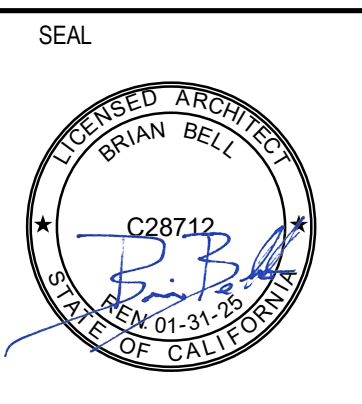


9 SHAFT WALL - HEAD (JAMB SIM)
3" = 1'-0"



16 URINAL PARTITION ATTACHMENT
3" = 1'-0"

16 URINAL PARTITION ATTACHMENT
3" = 1'-0"



PROJECT
JOHN F KENNEDY HIGH SCHOOL SWIMMING POOL UPGRADE

6715 GLORIA DR
SACRAMENTO, CA 95831

CLIENT
SACRAMENTO CITY UNIFIED SCHOOL DISTRICT

MARK	DATE	DESCRIPTION
ADD01	5/10/2024	ADD 01

MANAGEMENT
LIONAKIS PROJECT NO: 023264
CLIENT PROJECT NO:
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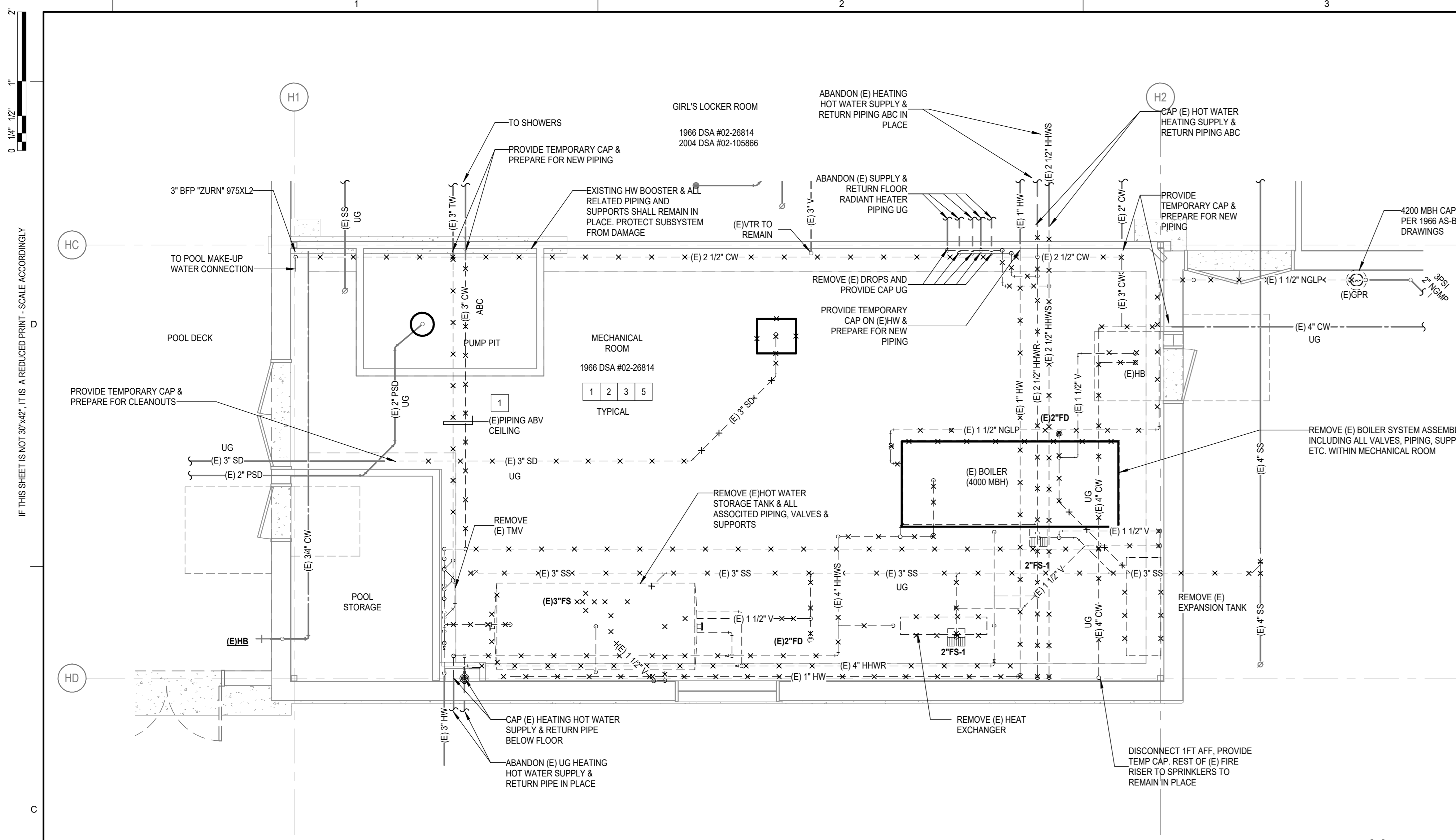
DETAILS

SHEET
A-532

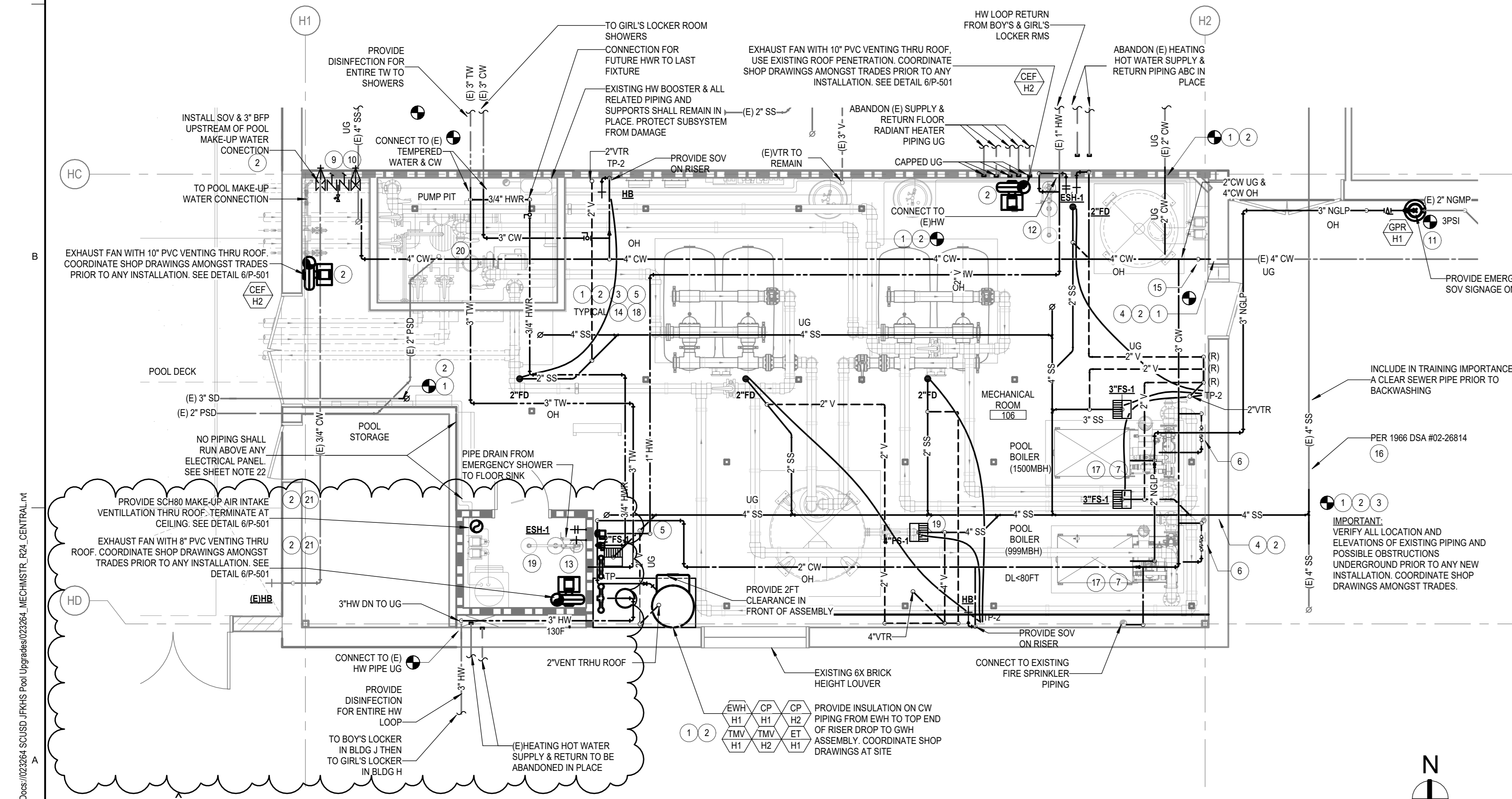
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5/26/2024 1:12:33 PM



1 ENLARGED PLUMBING DEMO PLAN - POOL MECHANICAL ROOM
 P-411 SCALE: 1/4" = 1'-0"



2 PLUMBING FLOOR PLAN
 P-411 SCALE: 1/4" = 1'-0"

PLUMBING DEMO KEY NOTES:

- VERIFY EXACT SIZE AND LOCATION OF EXISTING PIPE. REFLECT VERIFIED INFORMATION ON SHOP DRAWINGS FOR COORDINATION AMONGST TRADES PRIOR TO ANY PIPE INSTALLATION. REFLECT ON AS-BUILT DRAWING IF DIFFERENT FROM HEREWITH.
- VERIFY EXACT LOCATION OF ALL BUILDING COMPONENTS THAT MAY OBSTRUCT PATH OF NEW PIPING WELL AHEAD OF INSTALLATION. REFLECT VERIFIED INFORMATION ON SHOP DRAWINGS AND COORDINATE AMONGST TRADES PRIOR TO ANY PIPE INSTALLATION. REROUTE PIPING IF REQUIRED. REFLECT ON AS-BUILT DRAWINGS IF DIFFERENT FROM HEREWITH.
- ENSURE ALL CONDITIONS AFFECTING WORK, SUCH AS VERIFICATION OF TIE-IN ELEVATION TO EXISTING BY OTHERS, ARE WELL COORDINATED AMONGST TRADES PRIOR TO ANY INSTALLATION OR FABRICATION WORK. ADJUST PIPE ROUTE IF NEEDED. REFLECT ON AS-BUILT'S IF DIFFERENT FROM HEREWITH.
- UNLESS NOTED OTHERWISE, REMOVE ALL EXISTING UNUSED MECHANICAL AND PLUMBING PIPING WITHIN MECHANICAL ROOM. COORDINATE ALL DEMO WORK AMONGST TRADES AND WITH SCHOOL DISTRICT PRIOR TO DEMO WORK.

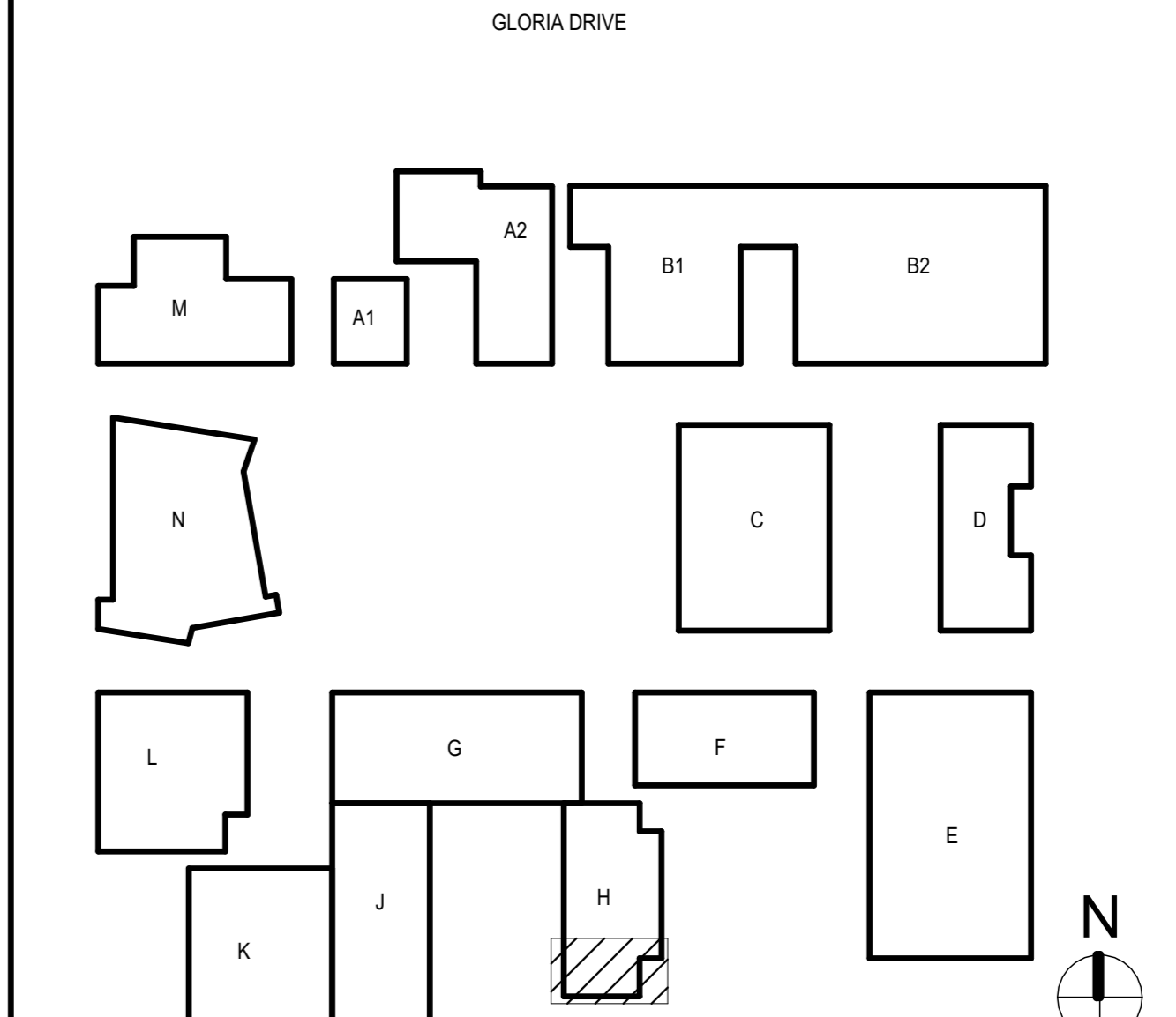
PLUMBING SHEET NOTES:

- ALL WORK FOR THE REMOVAL OF HAZARDOUS MATERIALS SHALL BE FULLY COORDINATED BETWEEN THE CONTRACTOR AND THE OWNER. THE ARCHITECT AND ENGINEERS THAT HAVE CREATED THE DRAWINGS AND SPECIFICATIONS FOR THIS PROJECT ARE NOT RESPONSIBLE FOR SPECIFYING REQUIREMENTS FOR, OR CONSTRUCTION OBSERVATION OF, HAZARDOUS MATERIAL REMOVAL. THE OWNER SHALL PROVIDE SEPARATE DOCUMENTS REQUIRED FOR HAZARDOUS MATERIAL REMOVAL AND SEPARATE CONSTRUCTION OBSERVATION OF HAZARDOUS MATERIAL REMOVAL. CONTACT OWNER FOR MORE INFORMATION.
- ANY MATERIAL REQUIRED FOR WORK NOT READILY AVAILABLE FOR PURCHASE SHALL HAVE LEAD TIME INDICATED ON THE BID AND ON THE SUBMITTALS. SUCCESSFUL PROCUREMENT OF ALL MATERIALS REQUIRED FOR THE COMPLETION OF WORK SHALL BE ASCERTAINED BY CONTRACTOR PRIOR TO SCHEDULING OF WORK.
- ALL FINISH FLOOR ELEVATIONS (FF) BASED FROM CIVIL GRADING DRAWINGS. PLEASE REFER TO CIVIL DRAWINGS FOR MORE INFORMATION. SEF VALUES ARE ALL BASED FROM FINISH FLOOR ELEVATION INSIDE BUILDING. COORDINATE EXACT ELEVATIONS THRU SHOP DRAWINGS AND AT SITE.
- EXISTING PLUMBING LAYOUT ARE BASED FROM AVAILABLE RECORD DRAWINGS OF UNKNOWN ACCURACY. ACTUAL CONDITIONS MAY BE DIFFERENT ESPECIALLY FOR THOSE WITHIN CONCEALED SPACES AND/OR UNDERGROUND. CONTRACTOR SHALL INVESTIGATE EXISTING PIPE ROUTE, ELEVATION, SIZE AND CONDITION. VISUAL OBSERVATION, PROBING, TAPPING, AND/OR UNDERGROUND INSPECTIONS NECESSARY TO COMPLETE WORK, WELL AHEAD OF NEW PIPE INSTALLATION. SCHEDULE WORK ACCORDINGLY TO PROVIDE ENOUGH TIME TO FIND SOLUTIONS SHOULD VERIFIED INFORMATION BE DIFFERENT FROM HEREWITH. REFLECT ALL FINDINGS ON SHOP DRAWINGS FOR COORDINATION AMONGST TRADES, AND ON AS-BUILT DRAWINGS.
- SEE EXISTING AS-BUILT DRAWINGS FOR CONTINUATION OF EXISTING PLUMBING UTILITIES OUTSIDE OF THIS PROJECT'S SCOPE FOR REFERENCE.
- FOR CONNECTIONS TO EXISTING PIPE FOUND SMALLER THAN WHAT IS SHOWN ON PLANS, FIELD VERIFY TO LOCATE CLOSEST LARGEST PIPE UPSTREAM FOR SUPPLY PIPING. FOR DRAIN PIPING, FIELD VERIFY TO LOCATE CLOSEST LARGEST PIPE OF SUFFICIENT DEPTH DOWNSTREAM. REFLECT ON SHOP DRAWINGS FOR COORDINATION AMONGST TRADES.
- PROVIDE TEMPORARY UTILITIES TO ALL FIXTURES & EQUIPMENT TO REMAIN IN SERVICE DURING CONSTRUCTION PERIOD.
- COORDINATE CONSTRUCTION WORK AND SCHEDULE OF WORK WITH SCHOOL DISTRICT. CONTRACTOR SHALL INCLUDE IN BID MEANS AND METHODS REQUIRED FOR THE WORK INCLUDING ANY REQUIRED SERVICE SHUT DOWNS, TEMPORARY LINES, ROAD CLOSURES, SPECIAL INSPECTIONS, ETC. TO ACCOMPLISH SCOPE. SCHEDULING OF WORK SHALL BE AMICABLE BETWEEN OWNER AND CONTRACTOR.
- CONTRACTOR SHALL FOLLOW GENERAL PIPE ROUTE AND VALVE LOCATIONS, AND GENERAL ORDER OF SYSTEM COMPONENTS SHOWN ON PLANS. ADJUST PIPE ELEVATIONS OR ROUTING TO AVOID STRUCTURAL COMPONENTS & OTHER BUILDING COMPONENTS WHEN POSSIBLE. IF NECESSARY & ONCE AMICABLE BETWEEN TRADES, COORDINATE ALL SHOP DRAWINGS AMONGST TRADES PRIOR TO ANY PIPE FABRICATION OR INSTALLATION.
- CONTRACTOR SHALL PREPARE AND MAINTAIN AS-BUILT DRAWINGS OF ALL PLUMBING SYSTEMS AS INSTALLED AT THE JOB SITE. DRAWN BY CONTRACTOR OVER THE DESIGN PLANS. THEY SHALL BE READILY AVAILABLE TO VIEW & INSPECT UPON REQUEST BY PROJECT INSPECTOR, ENGINEER OR OWNER. AS-BUILT'S SHALL CLEARLY SHOW CHANGES, REVISIONS, CLARIFICATIONS & SUBSTITUTIONS INSTALLED IN THE PROJECT INCLUDING BUT NOT LIMITED TO EXACT PIPE ROUTE ESPECIALLY THOSE CONCEALED AND/OR UNDERGROUND. UNDERGROUND PIPE ELEVATIONS, PIPE SIZES, DIMENSIONS FROM WALL/SIGRID LINES OF ANY REROUTED PIPE, RFI/CDD/ASI TAG AS REFERENCE TO WHERE CHANGES OCCURRED FROM IF ANY, AND ANY INFORMATION THAT MAY CLARIFY HOW SYSTEMS & COMPONENTS HAD BEEN INSTALLED OR HOW IT DIFFERS FROM ORIGINAL DESIGN PLANS. REFERENCE TO AN RFI/CDD/ASI ALONE SHALL NOT CONSTITUTE COMPLETE AS-BUILT DRAWINGS. AS-BUILT DRAWINGS SHALL BE IN HARD COPY AND DIGITAL (PDF) FORMAT. AS-BUILT'S AND QUALITY OF SUCH ARE CRITICAL REQUIREMENTS FOR MAINTENANCE UPKEEP AND FORWARD USE AS BASIS FOR POSSIBLE FUTURE CONSTRUCTION IMPROVEMENTS. FUTURE DESIGNER/CONTRACTOR WOULD RELY ON CONTRACTOR SHALL PROVIDE "AS-BUILT" TAG AND CONTRACTOR INFORMATION ON ALL AS-BUILT SHEETS.
- CONNECT WASTE, VENT & COLD WATER LINES TO ALL NEW FIXTURES. SEE FIXTURE SCHEDULE FOR BRANCH AND FIXTURE OUTLET/INLET CONNECTION SIZES.
- HORIZONTAL DRAINAGE PIPING SHALL BE RUN IN PRACTICAL ALIGNMENT AND A UNIFORM SLOPE OF NOT LESS THAN 2% TOWARD THE POINT OF DISPOSAL UNLESS IMPRACTICAL. DUE TO BUILDING'S STRUCTURAL FEATURES, OR IF CONNECTING TO EXISTING PIPE AT ITS EXISTING UPSTREAM/DOWNSTREAM DEPTH IS IMPOSSIBLE WITHOUT SLOPING LESS THAN 2% IN SUCH CONDITIONS, PIPE CAN BE SLOPED AT NO LESS THAN 1%. COORDINATE SHOP DRAWINGS AMONGST TRADES PRIOR TO FABRICATION AND INSTALLATION THEN REFLECT ALL CHANGES ON THE AS-BUILT DRAWINGS.
- COORDINATE ALL CONNECTION POINTS AMONGST TRADES AT SITE PRIOR TO FABRICATION OR INSTALLATION.
- UNLESS INSIDE UTILITY ROOMS, ALL OVERHEAD PIPING INSIDE ROOM WITH AN EXPOSED CEILING SHALL HAVE THE PIPING INSTALLED AS HIGH AS POSSIBLE. FULLY COORDINATE AMONGST TRADES.
- ALL PUMPED CONDENSATE DRAIN LINES (PCD) SHALL SLOPE AND DISCHARGE DOWN TO A GRAVITY CD BY A MINIMUM OF 6" TO AVOID BACKFLOW TO MECH UNIT.
- TRAPS ON A GAS CONNECTION SHALL BE INSTALLED AS ILLUSTRATED ON CPC FIGURE 1212.9 OF THE 2022 CPC. INCOMING GAS FLOW SHALL ALWAYS COME FROM THE TOP TO ALLOW SEDIMENTS SETTLE IN DOWN IN THE TRAP. A TEST BEFORE TRAP SHALL SERVE AS THE BRANCH CONNECTING TO THE APPLIANCE.
- ALL VALVES ABOVE CEILING, ACCESSIBLE THRU ACCESS PANELS WITH AN OPENING OF NO MORE THAN 14"x14", SHALL BE WITHIN ARMS REACH FROM THE ACCESS PANEL OPENING.
- PRIME AND PAINT ALL EXPOSED PIPING TO MATCH ARCHITECTURAL FINISH. KEEP PAINT OFF OF TAGS AND MARKS IDENTIFYING SYSTEM, SIZE, MODEL OR OTHER IMPORTANT INFORMATION.
- PROTECT ALL INSTALLED DRAINS, DRAIN STRAINERS, EQUIPMENT COMPONENTS, FIXTURES ESPECIALLY THOSE WITH STAINLESS STEEL SURFACES FROM DAMAGE. PLUMBING SYSTEM SHALL BE CLEAN, UNDAMAGED, WORKING AND IN NEW CONDITION UP TO HAND OFF TO OWNER. SEE SPECIFICATIONS FOR MORE INFORMATION ON CLOSING DCC.
- NO EXPOSED PIPING SHALL BE LEFT TO RUST OR SUBJECTED TO CONDITIONS DETRIMENTAL TO THE PIPE WITHOUT PROVIDING PROTECTION, TEMPORARY OR OTHERWISE, SUITABLE FOR THE TYPE OF PIPE BEING PROTECTED.
- CLOSELY COORDINATE PENETRATIONS THRU STRUCTURAL MEMBERS AMONGST TRADES AT THE SITE THRU SHOP DRAWINGS PRIOR TO CONSTRUCTION. PENETRATION THRU CONCRETE FOUNDATION SHALL BE PROPERLY SLEEVED WHEN REQUIRED. COORDINATE DROPPING FOOTING IF REQUIRED. ALL NOTCHES AND HOLES SHALL BE NEATLY BORED. SEE STRUCTURAL DRAWINGS FOR MORE INFORMATION.
- THERE SHALL BE NO PIPING WITHIN ELECTRICAL EQUIPMENT'S DEDICATED SPACE. ELECTRICAL EQUIPMENT SUCH AS PANEL BOARDS, SWITCHBOARDS AND MOTOR CONTROL CENTERS LOCATED IN ELECTRICAL ROOMS MUST HAVE EXCLUSIVE DEDICATED SPACE FROM THE FLOOR AND FORWARD 12" ABOVE THE EQUIPMENT. THE WIDTH AND DEPTH OF THE EQUIPMENT. COORDINATE SHOP DRAWINGS AMONGST TRADES LOCATING ALL ELECTRICAL EQUIPMENT PRIOR TO ANY PIPE INSTALLATION. THERE SHALL ALSO BE NO PIPING ABOVE THE DEDICATED SPACE UNLESS PROTECTION IS PROVIDED FOR EQUIPMENT SHOULD THE PIPING LEAK OR BREAK.
- CONTRACTOR TO AVOID GRABBING ELECTRICAL HARDWARES SUCH AS TELEPHONES TO AVAILABLE WATER LINES, WHEN POSSIBLE TO AVOID METALLIC TASTE IN WATER FROM DRINKING FOUNTAINS.

PLUMBING KEY NOTES:

- VERIFY EXACT SIZE AND LOCATION OF EXISTING PIPE. REFLECT VERIFIED INFORMATION ON SHOP DRAWINGS FOR COORDINATION AMONGST TRADES PRIOR TO ANY PIPE INSTALLATION. REFLECT ON AS-BUILT DRAWING IF DIFFERENT FROM HEREWITH.
- VERIFY EXACT LOCATION OF ALL BUILDING COMPONENTS THAT MAY OBSTRUCT PATH OF NEW PIPING WELL AHEAD OF INSTALLATION. REFLECT VERIFIED INFORMATION ON SHOP DRAWINGS AND COORDINATE AMONGST TRADES PRIOR TO ANY PIPE INSTALLATION. REROUTE PIPING IF REQUIRED. REFLECT ON AS-BUILT DRAWINGS IF DIFFERENT FROM HEREWITH.
- ENSURE ALL CONDITIONS AFFECTING WORK, SUCH AS VERIFICATION OF TIE-IN ELEVATION TO EXISTING BY OTHERS, ARE WELL COORDINATED AMONGST TRADES PRIOR TO ANY INSTALLATION OR FABRICATION WORK. ADJUST PIPE ROUTE IF NEEDED. REFLECT ON AS-BUILT'S IF DIFFERENT FROM HEREWITH.
- SEE STRUCTURAL DRAWINGS FOR PROVISIONS ON & REQUIREMENTS WHEN RUNNING PIPE THROUGH, BELOW OR IN CLOSE PROXIMITY TO STRUCTURAL COMPONENTS. COORDINATE ALL SHOP DRAWINGS AMONGST TRADES PRIOR TO ANY INSTALLATION.
- ALL PLUMBING COMPONENTS SHALL RUN NEATLY ON WALL OR AS CLOSE AS POSSIBLE TO EQUIPMENT SERVED. NO COMPONENT SHALL PROTRUDE OUT ENCROROACHING PERSONNEL PATH OF TRAVEL NOR WITHIN ANY AREA RESERVED FOR SERVICE CLEARANCE OF OTHER UNITS WITHIN ROOM. COORDINATE ALL SHOP DRAWINGS PRIOR TO ANY INSTALLATION.
- CW MAKE-UP WATER FOR POOL BOILERS. PROVIDE SOV, BFP-2 & PRV NO HIGHER THAN 3FT FROM FF. SET PRV TO 15PSI. SEE BOILER INSTALLATION INSTRUCTIONS FOR MORE INFORMATION. PROVIDE AIR GAP AND DRAIN LINE TO NEAREST APPROVED RECEPTOR.
- CONNECT GAS PIPE TO POOL BOILER. PROVIDE SOV & DIRT LEG. SEE BOILER INSTALLATION INSTRUCTIONS FOR MORE INFORMATION.
- MAKE-UP WATER FOR POOL SYSTEM. PROVIDE SOV ON RISER ABOUT 400' ABOVE FLOOR.
- BFP-1 WILKINS 375. PROVIDE AIR GAP FITTING AND DRAIN TO PIT. REFER TO POOL DRAWINGS FOR EXACT LOCATION.
- INSTALL GAS REGULATOR 3FT MINIMUM AWAY FROM IGNITION SOURCES. TYP.
- PROVIDE TMV & SOV TO ESH-EV. TMV ACCESSORY SHALL BE FROM SAME MANUFACTURER AS THE EMERGENCY SHOWER-EYEWASH COMBO. SEE POOL DRAWINGS FOR EMERGENCY SHOWER-EYEWASH COMBO MODEL NUMBER.
- THE TMV & SOV FOR EMERGENCY EYEWASH IN ACD ROOM SHALL BE INSTALLED IN ADJACENT ROOM AWAY FROM BEING SUBJECTED TO ACD FUMES. TMV ACCESSORY SHALL BE FROM SAME MANUFACTURER AS THE EMERGENCY SHOWER-EYEWASH COMBO. SEE POOL DRAWINGS FOR EMERGENCY SHOWER-EYEWASH COMBO MODEL NUMBER.
- ANY METALLIC PLUMBING PIPING OR METALLIC SUPPORT COMPONENTS FOR PLUMBING PIPING SHALL BE COATED WITH TNEC SERIES COATING TO RESIST CORROSION. PREPARE SURFACE OF METAL PRIOR TO APPLYING PRIME COAT, STRIKE COAT AND FINISH COAT. EXACT COATING AND PROCEDURES SHALL BE PER MANUFACTURER RECOMMENDATIONS.
- PROVIDE BLDG SHUT OFF VALVE 3FT AFF. ALL FIXTURES INCLUDING HOSE BIBBS AND TRAP PRIMERS IN BUILDING SHALL BE CONNECTED DOWNSTREAM OF THIS SHUT OFF VALVE. 10 VALVE AS MAIN SHUT OFF VALVE FOR BUILDING.
- CLEAN AND FLUSH ALL EXISTING SEWER LINES DOWNSTREAM OF NEW FIXTURES TO THE 6" MAIN SS LINE.
- PROVIDE INTAKE AND EXHAUST VENT. INSTALL PER BOILER INSTALLATION INSTRUCTIONS AND DETAIL 4IP-501
- INSTALL PIPING BELOW STEEL FRAME. SEE STRUCTURAL DRAWINGS AND DETAILS FOR MORE INFORMATION. LOCATE PIPING WITHIN 1.5FT HORIZONTALLY FROM FRAMES. COORDINATE SHOP DRAWINGS AMONGST TRADES PRIOR TO ANY INSTALLATION.
- PROVIDE LABEL TO LIMIT DISCHARGE FLOW TO NO MORE THAN 50GPM. INCLUDE IN TRAINING IMPORTANCE OF HAVING A CLEAN SEWER SYSTEM DURING BACKWASH.
- PROVIDE NEW SUMP PUMP ZOLLER 55 115V-1PH-37AMP. PROVIDE NEW BACKWATER VALVE & SOV. CONNECT TO EXISTING PIPE.
- INCLUDE IN TRAINING IMPORTANCE OF PROPER HANDLING OF ACIDS & OTHER CHEMICALS. IMPORTANCE OF MAINTENANCE OF ALL COMPONENTS, & IMPORTANCE OF REPORTING OF ACID-CHEMICAL LEAKS ONCE OBSERVED. EXHAUST VENTING HAVE BEEN SIZED TO BE ABOVE MINIMUM CODE REQUIREMENTS, HOWEVER ITS EFFECTIVITY TO RESIST ABOVE NORMAL CONCENTRATION OF CHEMICALS IS NOT LIMITLESS. FUMES FROM LEAKING ACID, OR ACID SPLASH SHOULD BE PROPERLY & IMMEDIATELY ADDRESSED TO AVOID CREATION AND/OR EXACERBATION OF AN ENVIRONMENT DETRIMENTAL TO PEOPLE'S HEALTH, OR TO BUILDING COMPONENTS WITHIN THE CHEMICAL ROOM, OR IN CLOSE PROXIMITY TO THE CHEMICAL ROOMS.

KEYPLAN

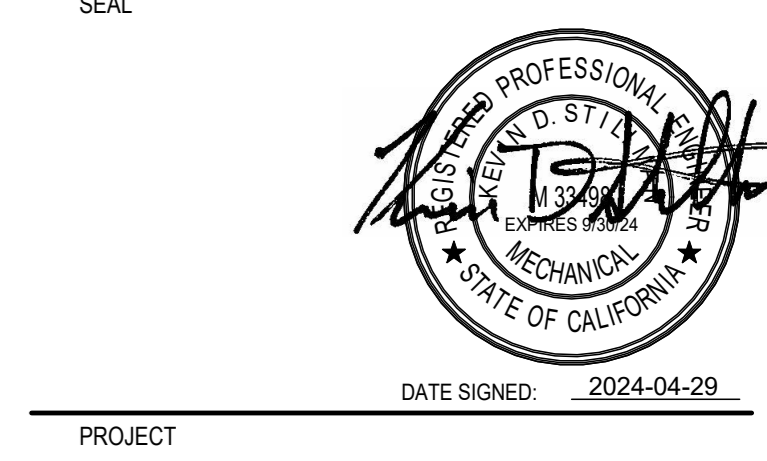


LIONAKIS
 2025 Ninth Street
 Sacramento, CA 95818
 P 916.558.1900
 www.lionakis.com

CONSULTANT

capital engineering
 RANCHO COVINA, CA 91710
 MB - JV 232142.00
 PM - DESIGN TEAM PROJECT NO.

FOR REVIEW ONLY / NOT FOR CONSTRUCTION
 THE CONSTRUCTION DOCUMENTS HAVE NOT BEEN APPROVED BY THE ENFORCEMENT AGENCY AND ARE NOT COMPLETE OR READY FOR CONSTRUCTION. ELEMENTS, MEMBERS, SYSTEMS AND ASSOCIATED DETAILS AND SPECIFICATIONS MAY NOT BE SHOWN OR FULLY DEVELOPED. FOR BIDDING ESTIMATING PURPOSES, UTILIZE ADDITIONAL MATERIALS AND QUANTITIES TO ACCOUNT FOR THOSE ITEMS NOT SHOWN OR FULLY DEVELOPED.



PROJECT
JOHN F KENNEDY HIGH SCHOOL SWIMMING POOL UPGRADE

6715 GLORIA DR
 SACRAMENTO, CA 95831

CLIENT
 SACRAMENTO CITY UNIFIED SCHOOL DISTRICT

MARK	DATE	DESCRIPTION
ADD01	05/13/2024	ADDENDUM 01

MANAGEMENT	LIONAKIS PROJECT NO.	023284
CLIENT PROJECT NO.	LIONAKIS PROJECT NO.	LIONAKIS 2017

TITLE
ENLARGED PLUMBING DEMO & CONSTRUCTION PLAN

SHEET
P-411

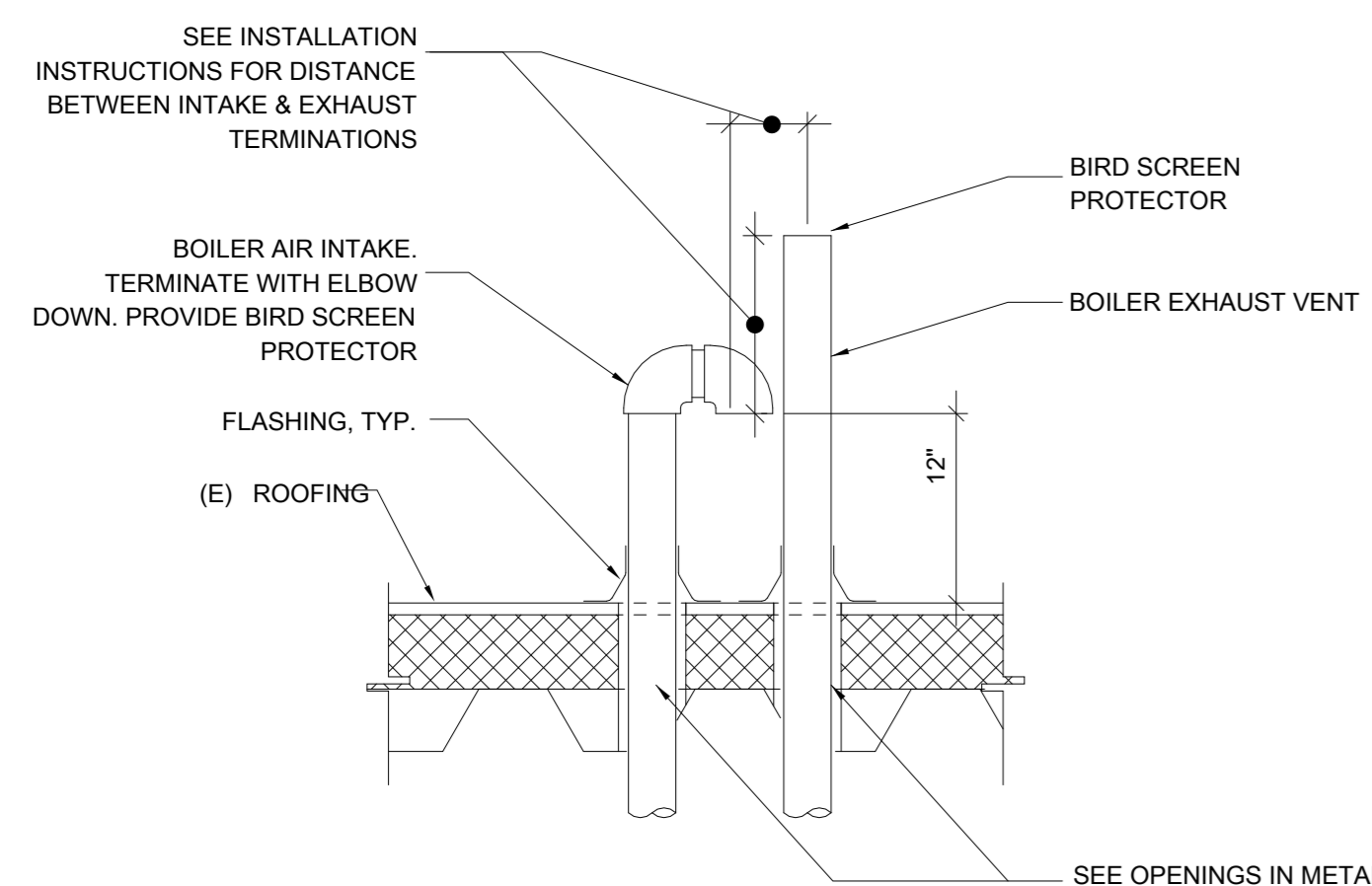
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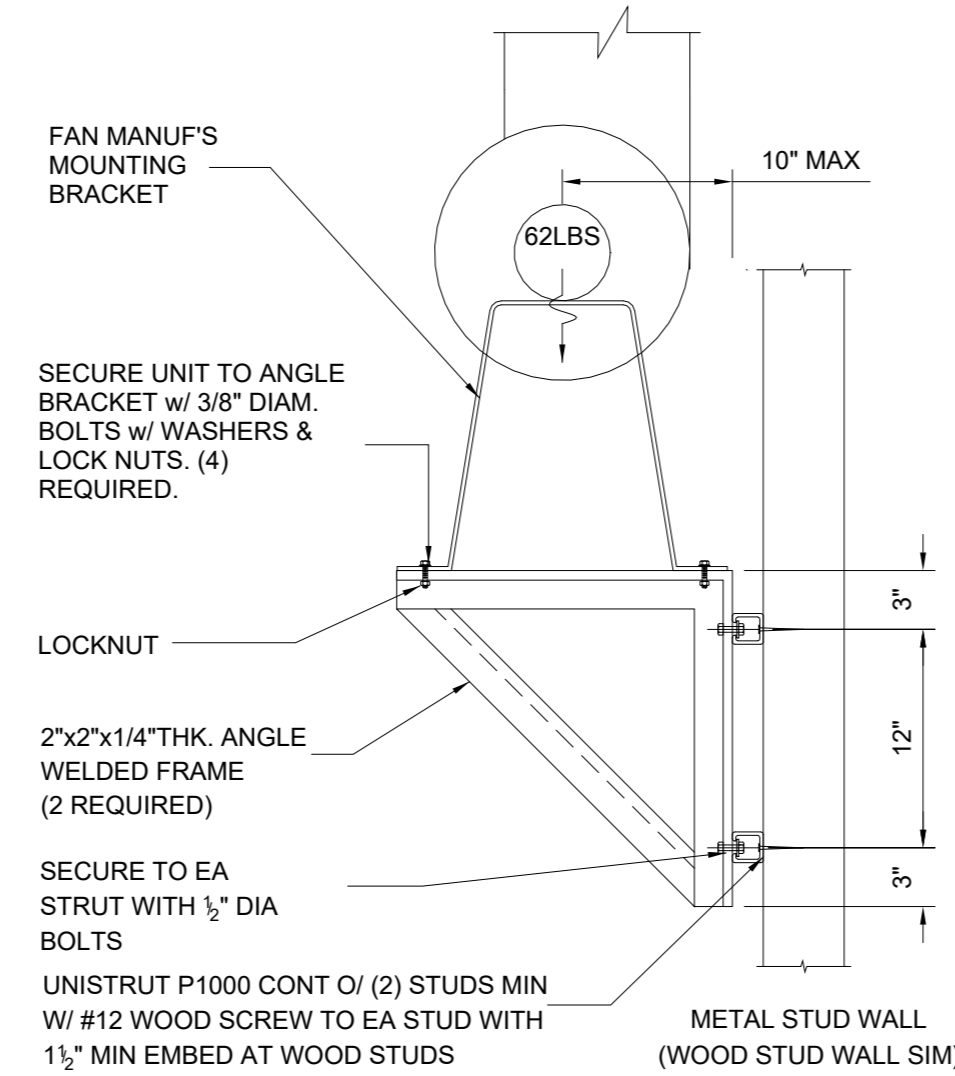
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BOILER INTAKE/FLUE THRU ROOF

SCALE: NONE

4
P-501



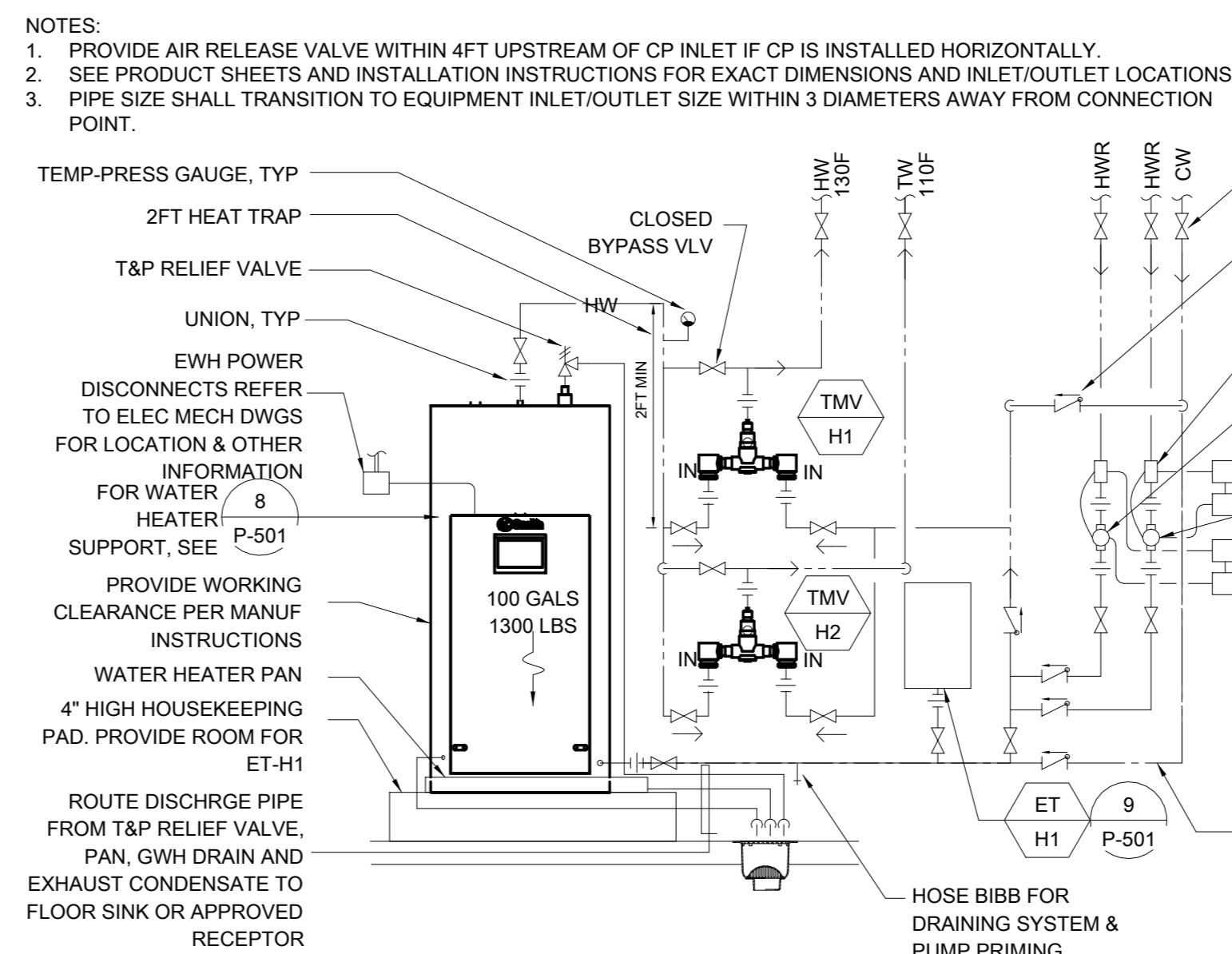
CHEM EXHAUST FAN MOUNTING

SCALE: NONE

3
P-501

ELECTRIC WATER HEATER

SCALE: NONE



SWIMMING POOL DATA

SURFACE AREA	=	3,375 SQ. FT.
PERIMETER	=	236 FT.
DEPTHS	=	3'-0" TO 8'-0"
VOLUME	=	146,715 GAL.
6 HR TURNOVER	=	407 GPM

DIVING POOL DATA

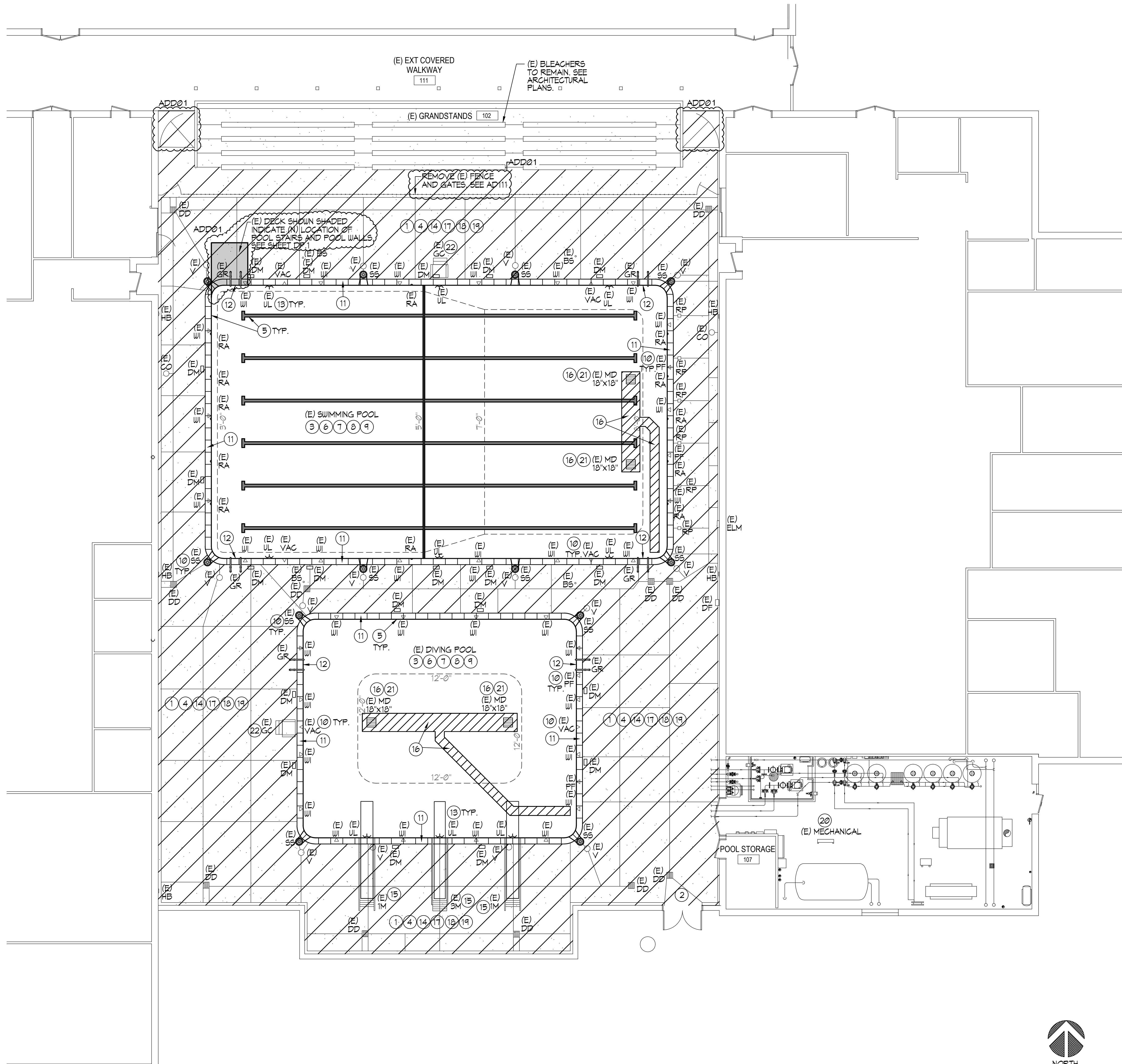
SURFACE AREA	=	1,616 SQ. FT.
PERIMETER	=	159 FT.
DEPTHS	=	12'-0"
VOLUME	=	145,052 GAL.
6 HR TURNOVER	=	403 GPM

LEGEND

MD	=	MAIN DRAIN	DD	=	DECK DRAIN
SS	=	SURFACE SKIMMER	CO	=	CLEAN-OUT
DM	=	DEPTH MARKER	V	=	VALVE
GR	=	GRABRAIL	HB	=	HOSE BIB
WI	=	WALL INLET	ELM	=	ELECTRIC METER
RA	=	ROPE ANCHOR	(E)	=	EXISTING
UL	=	UNDERWATER LIGHT			
RP	=	RACING PLATFORM		=	LIMITS OF POOL DECK REMOVAL
1M	=	ONE METER DIVE STAND		=	LIMITS OF POOL FLOOR REMOVAL AS NOTED ON PLANS
3M	=	THREE METER DIVE STAND			
VAC	=	VACUUM			
PF	=	POOL FILL			

DEMOLITION/CONSTRUCTION NOTES

- 1 THE CONTRACTOR SHALL COORDINATE DEMOLITION WITH OTHER TRADES AND SHALL PROTECT ALL EXISTING WORK, BUILDINGS, UTILITIES, ETC. TO REMAIN AS REQUIRED FOR RENOVATION OF SWIMMING POOL.
- 2 COORDINATE INGRESS/EGRESS AND HAUL ROUTES WITH THE OWNER PRIOR TO START OF WORK.
- 3 POOL PLAN VIEWS AND SECTIONS ARE SHOWN FOR CONTRACTOR INFORMATION AND ASSISTANCE. THE CONTRACTOR IS RESPONSIBLE FOR INDIVIDUAL SQUARE FOOTAGE TAKE-OFFS AND ESTIMATIONS WITH REGARD TO DEMOLITION, PREPARATION, AS WELL AS MEANS AND METHODS OF CONSTRUCTION. CONTRACTOR SHALL VISIT THE SITE AS REQUIRED TO ACCOMPLISH THE WORK, AND TO BECOME FAMILIAR WITH SCOPE AND SERVICES OF WORK REQUIRED.
- 4 COORDINATE PROPOSED CONTRACTOR STAGING AREA WITH THE OWNER PRIOR TO CONSTRUCTION. PROVIDE TEMPORARY PHONE, TOILET(S), FENCING, GATES, ETC. AS REQUIRED.
- 5 REMOVE EXISTING WATERLINE TILE, SWIMMING POOL LANE LINES AND END WALL TARGET TILE, POOL COPING AND PLASTER FINISHES DOWN TO ORIGINAL SOUND CONCRETE/SHOTCRETE. ANY CRACKS SHALL BE CHIPPED OUT TO A MINIMUM TO 3/4"x3/4" AND THEN FILLED FLUSH WITH NON-SHRINK GROUT. ALL EXPOSED REBAR, RUST SPOTS, ETC. SHALL BE EXPOSED, BUSHED DOWN 1/2" BELOW FINISH SURFACE, ZINC COATED AND FILLED FLUSH WITH NON-SHRINK GROUT. OTHER IMPERFECTIONS IN THE POOL SHELL SHALL BE REPAIRED PRIOR TO INSTALLING A NEW WHITE PLASTER FINISH.
- 6 THE CONTRACTOR SHALL INSURE THAT ALL SURFACES ARE PREPARED TO RECEIVE PLASTER FINISH. WEATHER CONDITIONS SHALL BECOME A CRITICAL PART OF WORK AND SHALL BE TAKEN INTO CONSIDERATION AT THE TIME OF PLASTER APPLICATION.
- 7 THE CONTRACTOR SHALL PROVIDE A SUFFICIENT NUMBER OF WORKERS TO ENSURE THAT THE ENTIRE POOL CAN BE PLASTERED IN A SINGLE DAY OR SHALL PROVIDE CONTINUAL MISTING OF PLASTERED SURFACES TO INSURE THAT PLASTER IS NOT EXPOSED TO THE AIR FOR A PERIOD OF TIME WHICH WOULD CAUSE DAMAGE IN ANY WAY.
- 8 PROVIDE NEW TILE AND PLASTER FINISHES PER PLANS. REPLACE ANY DAMAGED OR LOST POOL FITTINGS AND GRATES LOST DURING DEMOLITION/CONSTRUCTION AS REQUIRED.
- 9 THE OWNER SHALL IDENTIFY THE POOL FILL WATER SOURCE FROM CLOSEST FIRE HYDRANT AND SHALL PAY FOR THE WATER TO FILL THE POOL. THE CONTRACTOR IS RESPONSIBLE FOR FIRE HOSE, HOSES, FILLING AND PROTECTION OF PLASTER SURFACES. FILL SOURCE SHALL BE BLOW-OFF INITIALLY TO PROVIDE A CLEAN DOMESTIC WATER SOURCE. THE CONTRACTOR SHALL PROVIDE CONTINUOUS FILL UNTIL THE WATER IS AT OPERATIONAL LEVEL. THE CONTRACTOR SHALL BE RESPONSIBLE FOR CLEANING AND BALANCING OF THE POOL WATER FOR A PERIOD OF NOT LESS THAN SEVEN (7) DAYS AFTER PLASTER. THE CONTRACTOR SHALL COORDINATE HIS EFFORTS WITH OWNERS STAFF TO PROVIDE INSTRUCTION AND TRAINING IN PROPER OPERATION OF POOL IN CONJUNCTION WITH NEW PLASTER SURFACES.
- 10 REMOVE EXISTING SURFACE SKIMMERS AND REPLACE WITH NEW PER PLANS. REMOVE EXISTING VACUUM FITTINGS AND FILL PENETRATIONS WITH HIGH STRENGTH GROUT FLUSH WITH WALL IN PREPARATION FOR NEW WHITE PLASTER FINISH.
- 11 PROVIDE NEW POOL COPING TO MATCH NEW DECKING, COLOR/FINISH.
- 12 REMOVE AND REPLACE ALL EXISTING GRABRAIL STEPS. ONCE STEPS ARE REMOVED ALL RUST SPOTS SHALL BE EXPOSED, BUSHED DOWN 1/2" BELOW FINISHED SURFACE, ZINC COATED AND FILLED FLUSH WITH NON-SHRINK GROUT. THEN NEW CYCLOCAC STEPS SHALL BE INSTALLED FLUSH WITH NON-SHRINK GROUT.
- 13 REMOVE AND REPLACE EXISTING POOL UNDERWATER LIGHTS AND MOUNTING RINGS AS NEEDED WITH NEW LED PER PLANS. PULL NEW CORDS THROUGH NEW CONDUITS TO NEW JUNCTION BOXES. FIELD VERIFY CORP LENGTHS PRIOR TO ORDERING. SEE UNDERWATER LIGHT PLAN, FIELD VERIFY ALL CONDITIONS.
- 14 REMOVE EXISTING DECK EQUIPMENT AS REQUIRED PRIOR TO DEMOLITION. PROVIDE NEW DECK EQUIPMENT AND ANCHORS AND BOND TO NEW DECKING. CONTRACTOR TO FIELD VERIFY AND DOCUMENT LOCATION OF DECK EQUIPMENT ANCHORS AND INSTALL NEW ANCHORS PER NEW LAYOUT PLAN.
- 15 REMOVE EXISTING ONE (1) 3M DIVE STAND AND BOARD COMPLETELY. REMOVE EXISTING TWO (2) 1M DIVE STANDS AND BOARDS COMPLETELY AND INSTALL NEW TWO (2) 1M DIVE STANDS AND BOARDS PER PLANS.
- 16 THE CONTRACTOR SHALL SAWCUT AND REMOVE POOL FLOOR AS REQUIRED TO INSTALL NEW SWIMMING POOL AND DIVING POOL 18" X 18" MAIN DRAINS, SUMPS, FRAMES, GRATES AND PIPING. THE CONTRACTOR SHALL PROVIDE VG&A CERTIFICATION TO THE OWNER AND HEALTH DEPARTMENT.
- 17 REFER TO SHEET SP-112 FOR NEW DECK LAYOUT PLAN IN COORDINATION WITH CONTRACTOR FIELD LAYOUT AND EXISTING INFORMATIONAL PLANS. ALL NEW CONCRETE SHALL BE 4,000 PSI MINIMUM AT 28 DAYS.
- 18 CONTRACTOR IS TO PHOTOGRAPH AND DOCUMENT ON A PLAN ANY AND ALL EXISTING DAMAGED ITEMS/SURFACES FINISHES IN AND IMMEDIATELY AROUND THE WORK AREA AND ALONG ALL WORK PATHS FROM STAGING AREA PRIOR TO THE START OF WORK. CONTRACTOR IS TO SITE WALK ALL EXISTING DAMAGED AREAS WITH THE OWNER AND PROVIDE A COPY OF THE PHOTOGRAPHS AND DOCUMENTATION BEFORE WORK BEGINS. FAILURE TO PROVIDE THIS INFORMATION REPRESENTS ACCEPTANCE BY THE CONTRACTOR THAT ALL EXISTING SURROUNDING FINISHES (CONCRETE, AG PAVING, FLOORING, ETC.) AND ALL GATES, DOORS, PATHWAYS, ETC. ARE UNDAMAGED AND IN CLEAN AND FUNCTIONING CONDITION, AND CONTRACTOR ACCEPTS THE RESPONSIBILITY TO MAINTAIN AND CORRECT ANY DAMAGE LATER FOUND BY THE OWNER DURING CONSTRUCTION PERIOD IN THESE AREAS AT NO EXPENSE TO THE OWNER.
- 19 REMOVE EXISTING POOL DECKS AND POOL COPING AS SHOWN. NEW SUBGRADES ARE TO BE SCARIFIED A MIN OF 2" AND COMPACTED TO 10% PER ASTM D1557. THE CONTRACTOR SHALL COORDINATE AND PROTECT ALL ADJACENT WORK, BUILDINGS, ETC. TO REMAIN. COORDINATE DECK ELEVATIONS WITH EXISTING. MAXIMUM DECK SLOPE IN ANY DIRECTION SHALL BE 1.0% MAXIMUM. THE CONTRACTOR SHALL BE RESPONSIBLE FOR COMPLETE DEMOLITION, REMOVAL AND LEGAL DISPOSAL OF ALL EXISTING CONCRETE POOL DECKING SHOWN HATCHED ON THE PLANS, REGARDLESS OF THICKNESS, REINFORCING AND DECK SUBGRADE CONDITIONS. POOL DECK SUBGRADE SHALL BE BROUGHT INTO CONFORMANCE WITH NEW DECK DESIGN INCLUDING THICKNESS AND TYPE OF MATERIALS IN CONFORMANCE WITH SOILS REPORT AND/OR DETAILS HEREON. THE CONTRACTOR SHALL BE RESPONSIBLE FOR REMOVAL OR IMPORTING SUBGRADE MATERIAL AND COMPACTION TO PROVIDE THE REQUIRED POOL DECK GRADES FOR NEW POOL DECKING PER PLANS AND SPECIFICATIONS.
- 20 REMOVE AND REPLACE EXISTING SWIMMING POOL MECHANICAL EQUIPMENT AS SHOWN ON SHEET SP-411 AND SP-412.
- 21 CARE IS TO BE TAKEN DURING POOL DRAIN DOWN TO RELIEVE ANY HYDROSTATIC PRESSURE THROUGH EXISTING HYDROSTATIC RELIEF VALVES AND DRAINING THE POOL SLOWLY. CONTRACTOR IS RESPONSIBLE FOR DEWATERING THROUGHOUT CONSTRUCTION.
- 22 REMOVE EXISTING LIFE GUARD CHAIR.



SWIMMING POOL / DIVING POOL DEMOLITION PLAN

1/8"=1'-0"

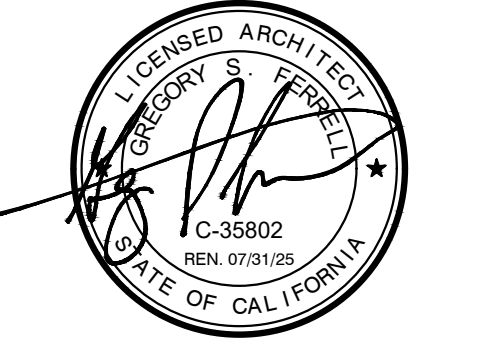
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Sacramento CA 95818
P 916.558.1900
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SEAL



PROJECT
**JOHN F KENNEDY HIGH SCHOOL
SWIMMING POOL UPGRADE**

6715 GLORIA DR
SACRAMENTO, CA 95831

CLIENT
SACRAMENTO CITY UNIFIED SCHOOL DISTRICT

MARK	DATE	DESCRIPTION
ADD01	5/10/2024	ADD 01

MANAGEMENT	700007
LIONAKIS PROJECT NO.	700007
CLIENT PROJECT NO.	700.00.007
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TITLE
**SWIMMING POOL / DIVING
POOL DEMOLITION PLAN**

SHEET
SP-111

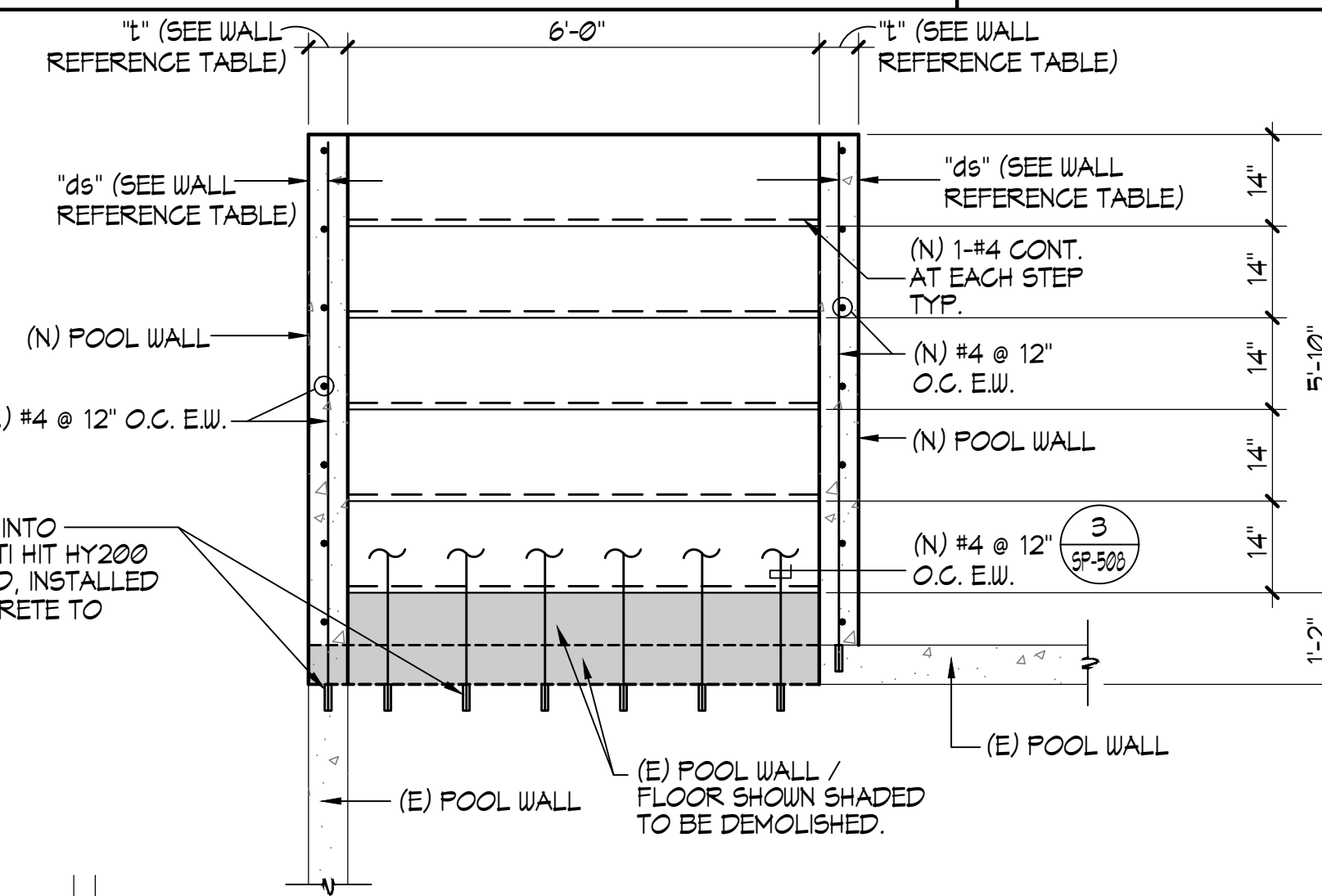
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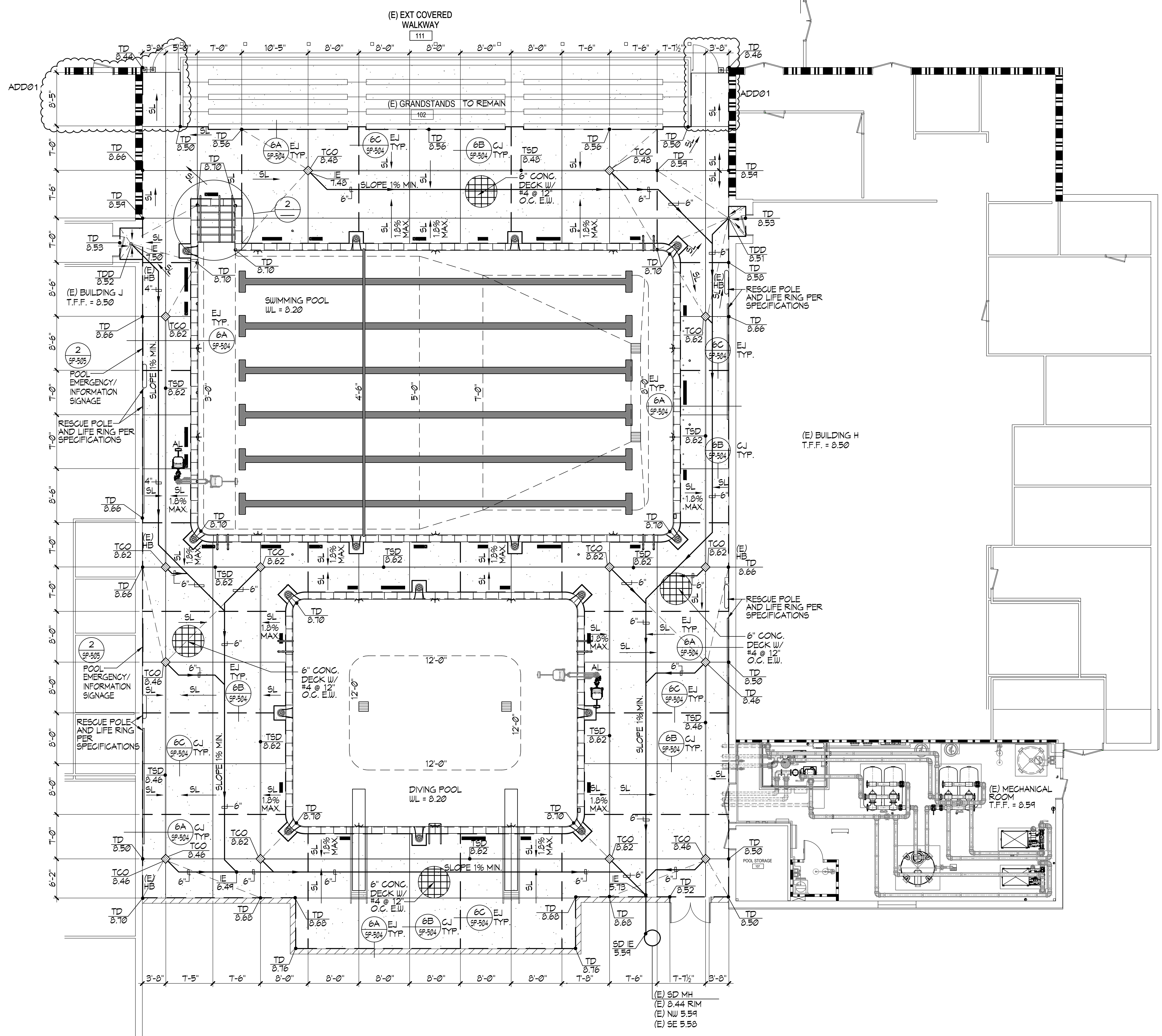
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2 STAIRS REINFORCEMENT PLAN
1/8"=1'-0"

WALL REINFORCEMENT TABLE						
WATER DEPTH	"t"	"ds"	RADIUS	VERTICAL REINF.	HORIZONTAL REINF.	TRANSITION TO FLOOR REINF. BEYOND END RADIUS
0'-0" TO 3'-0"	6"	3"	6" TO 12"	#4 @ 12" O.C.	#4 @ 12" O.C.	24"

NOTE:
SEE 1, SP-501 FOR CONCRETE AND SHOTCRETE NOTES.



1 SWIMMING POOL / DIVING POOL DECK PLAN
1/8"=1'-0"

SWIMMING POOL DATA

SURFACE AREA	=	3,417 SQ. FT.
PERIMETER	=	250 FT.
DEPTHS	=	3'-0" TO 8'-0"
VOLUME	=	146,715 GAL.
6 HR. TURNOVER	=	407 GPM

DIVING POOL DATA

SURFACE AREA	=	1,616 SQ. FT.
PERIMETER	=	159 FT.
DEPTHS	=	12'-0"
VOLUME	=	145,052 GAL.
6 HR. TURNOVER	=	403 GPM

LEGEND

- EJ — = EXPANSION JOINT
- CJ — = CONTROL JOINT
- TSD — = TOP OF SLOT DRAIN
- TCO = TOP OF CLEAN-OUT
- AL = ACCESSIBLE LIFT
- TDD = TOP OF DECK DRAIN
- HB = HOSE BIBB
- V.I.F. = VERIFY IN FIELD
- SL = SLOPE DIRECTION
- WL = WATERLEVEL
- TFF = TOP OF FINISHED FLOOR
- TD = TOP OF DECK
- I.E. = INVERT ELEVATION
- P.O.C. = POINT OF CONNECTION
- SD = STORM DRAIN
- (E) = EXISTING
- (N) = NEW

- NOTES:**
- COORDINATE SIGNAGE PLACEMENT AND COLOR SCHEME WITH OWNER PRIOR TO INSTALLATION.
 - DECKS SHALL HAVE 1% MIN. SLOPE AND 1.0% MAX. SLOPE TO DRAINS.
 - ALL POOL DECKING SHALL BE NON-SLIP AND NON-ABRASIVE MEDIUM BROOM FINISH WITH NATURAL GRAY CONCRETE UNLESS OTHERWISE NOTED.
 - REFER TO ARCHITECTURAL PLANS FOR LOCATIONS AND QUANTITY OF REQUIRED EXITS, DRINKING FOUNTAINS, AND SANITARY FIXTURES.
 - THE POOL CANNOT BE WITHOUT AN APPROVED POOL ENCLOSURE AT ANY TIME, INCLUDING DURING CONSTRUCTION AND INSTALLATION OF THE NEW POOL ENCLOSURE.

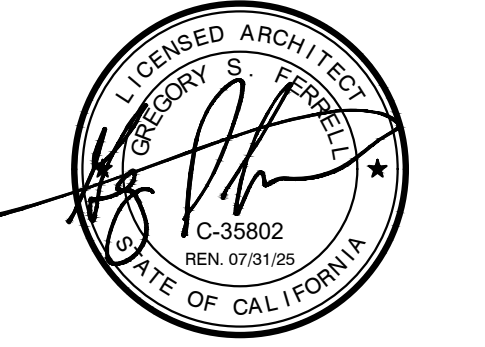
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P 916.558.1900
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PROJECT
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SWIMMING POOL UPGRADE**

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TITLE
**SWIMMING POOL /
DIVING POOL DECK
PLAN**

SHEET

SP-112

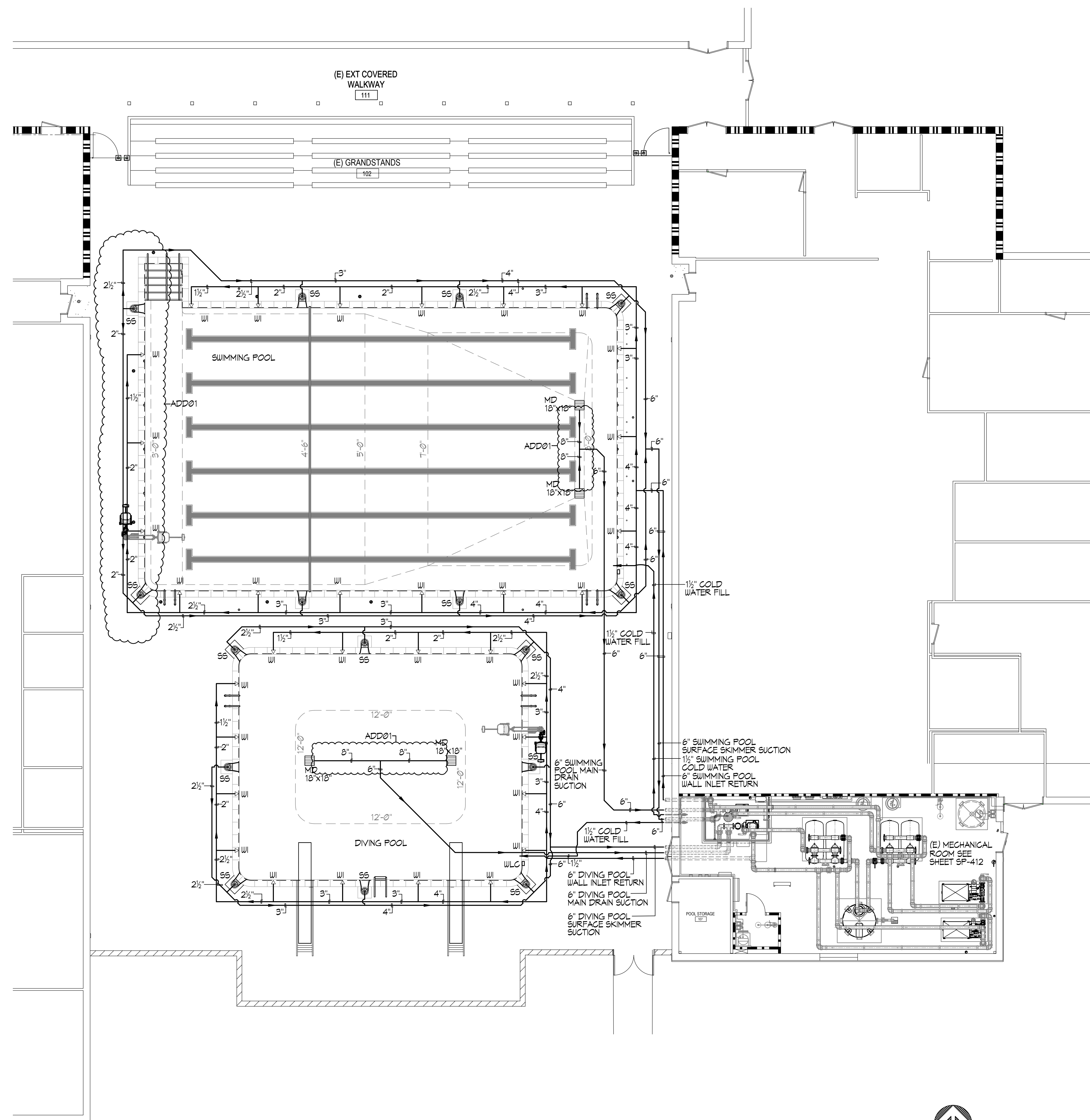
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SWIMMING POOL DATA

SURFACE AREA	=	3,417 SQ. FT.
PERIMETER	=	250 FT.
DEPTHS	=	3'-0" TO 8'-0"
VOLUME	=	146,715 GAL.
6 HR TURNOVER	=	407 GPM

DIVING POOL DATA

SURFACE AREA	=	1,616 SQ. FT.
PERIMETER	=	159 FT.
DEPTHS	=	12'-0"
VOLUME	=	143,052 GAL.
6 HR TURNOVER	=	403 GPM

LEGEND

MD	=	MAIN DRAIN	
SS	=	SURFACE SKIMMER	
WLC	=	WATER LEVEL CONTROLLER	
WI	=	WALL INLET	

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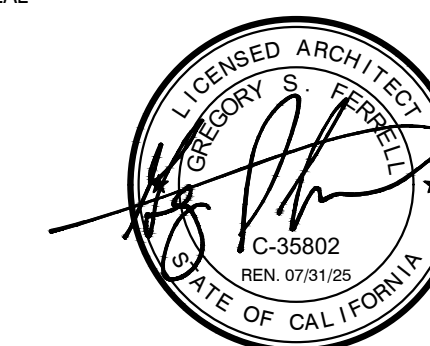
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SWIMMING POOL UPGRADE**

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TITLE
**SWIMMING POOL /
DIVING POOL PIPING
PLAN**

SHEET

SP-115

SWIMMING POOL / DIVING POOL PIPING PLAN

1/8"=1'-0"

1

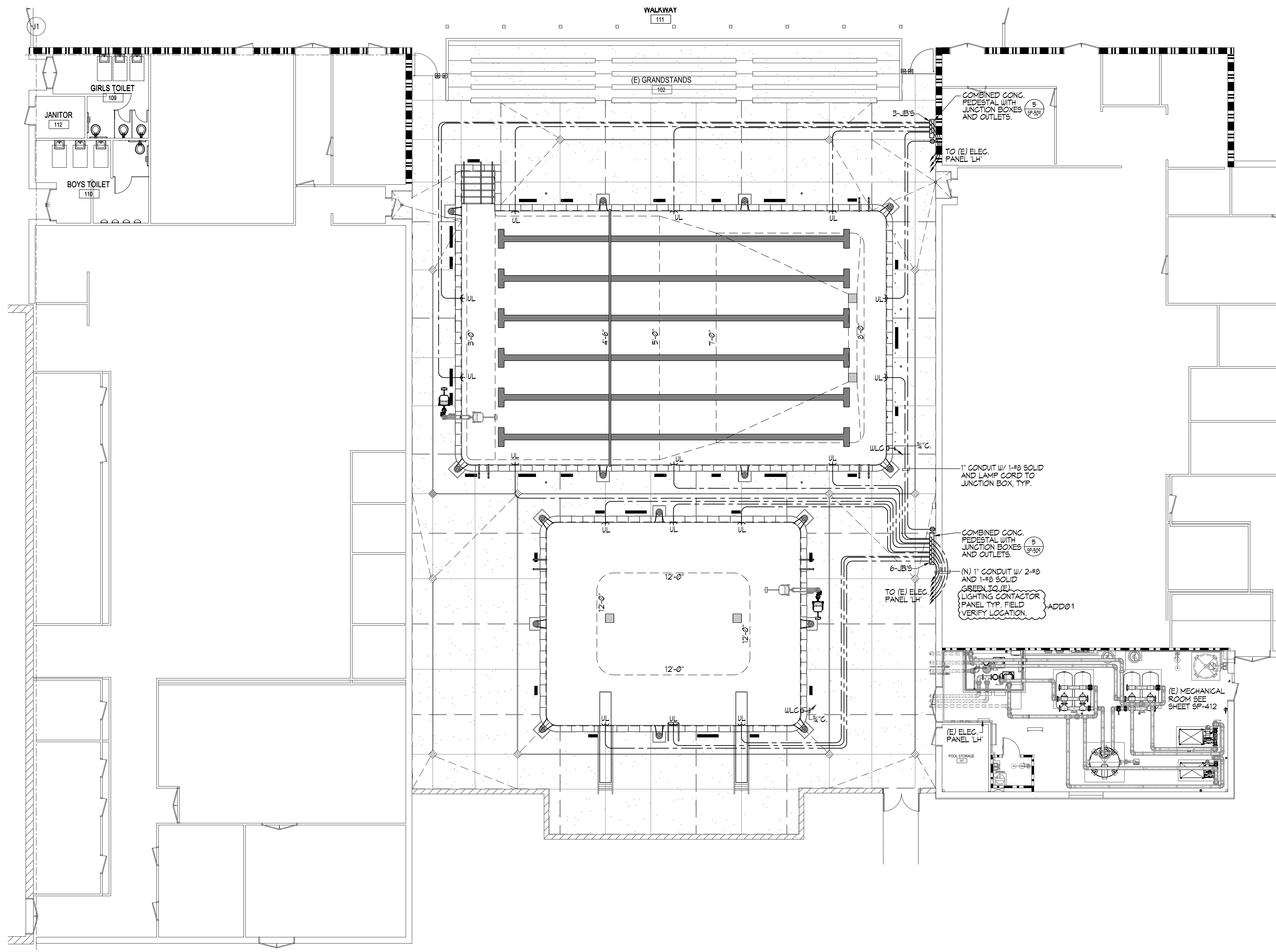
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LEGEND

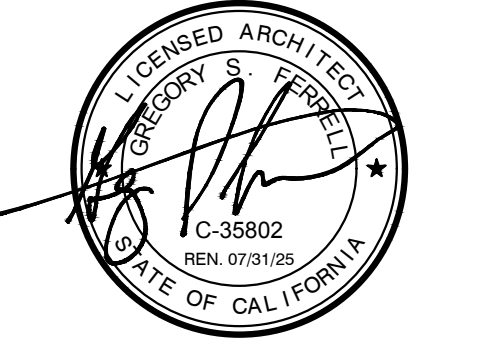
- UL = UNDERWATER LIGHT
- JB = JUNCTION BOX
- WLC = WATER LEVEL CONTROLLER
- (E) = EXISTING
- (N) = NEW

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TITLE
SWIMMING POOL /
DIVING POOL
UNDERWATER LIGHT
PLAN

SHEET
SP-116

SWIMMING POOL UNDERWATER LIGHT PLAN

1/8"=1'-0"

0.14" = 1'-0"

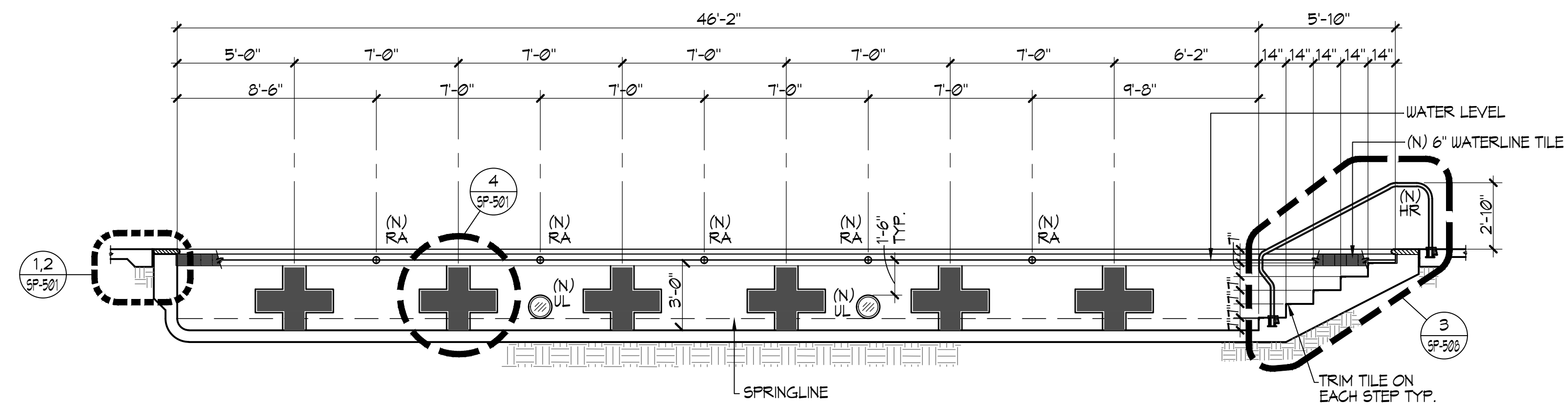
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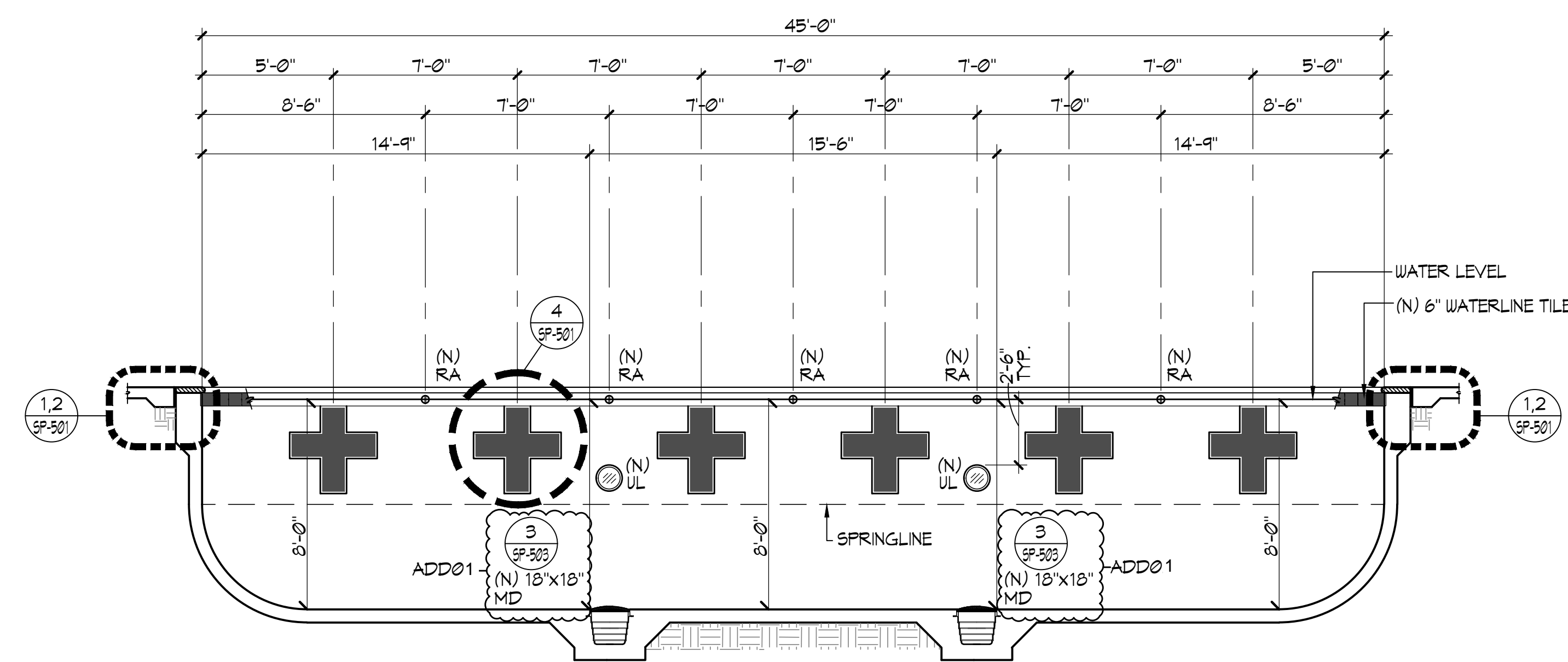
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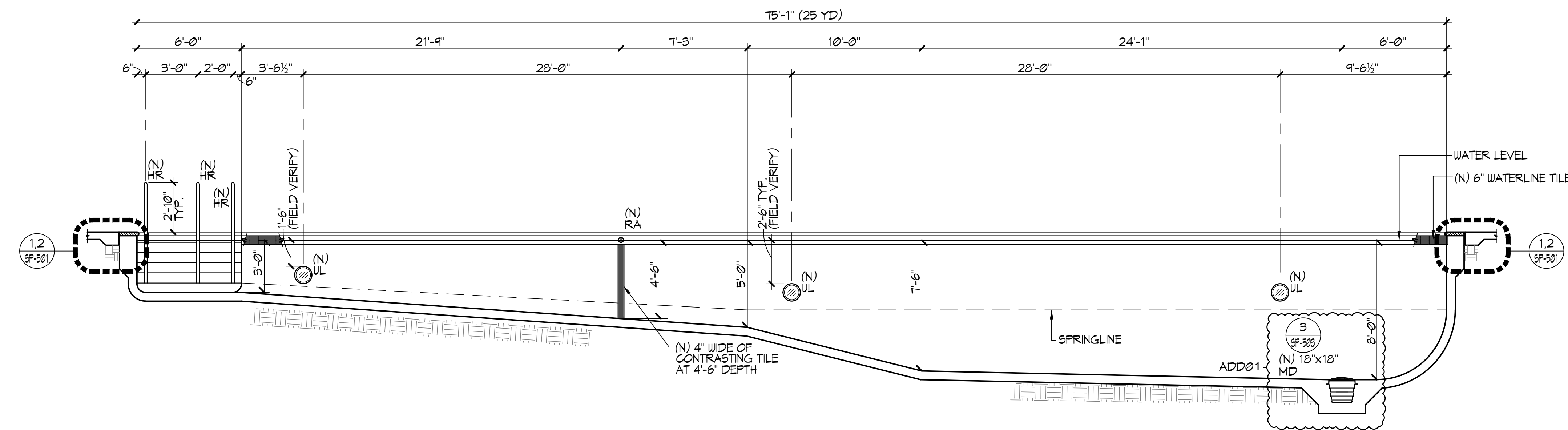
A

SWIMMING POOL SECTION 1/4" = 1'-0"



B

SWIMMING POOL SECTION 1/4" = 1'-0"



C

SWIMMING POOL SECTION 1/4" = 1'-0"

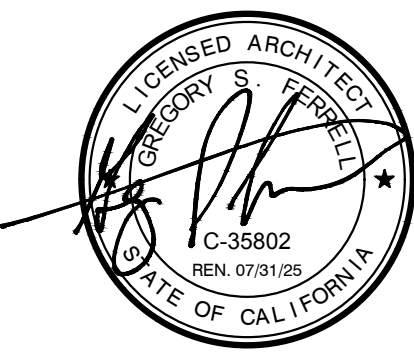
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TITLE
SWIMMING POOL
SECTIONS

SHEET
SP-311

0.14" = 1'-0"

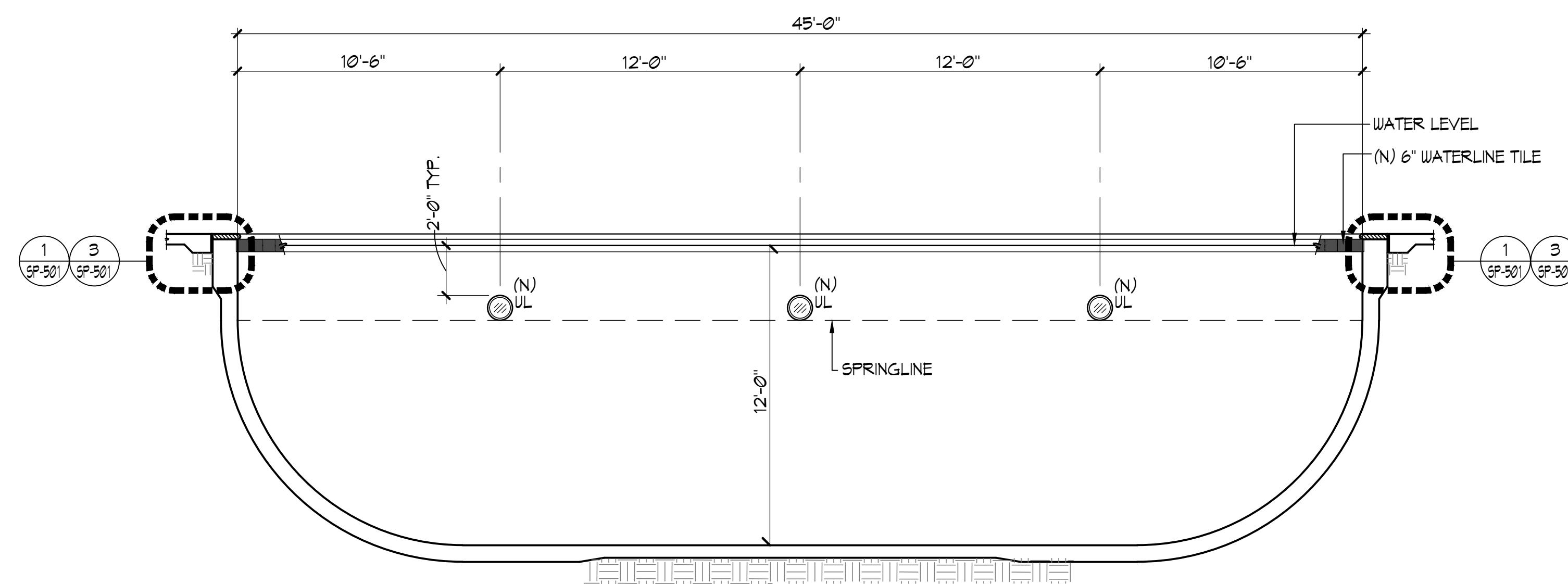
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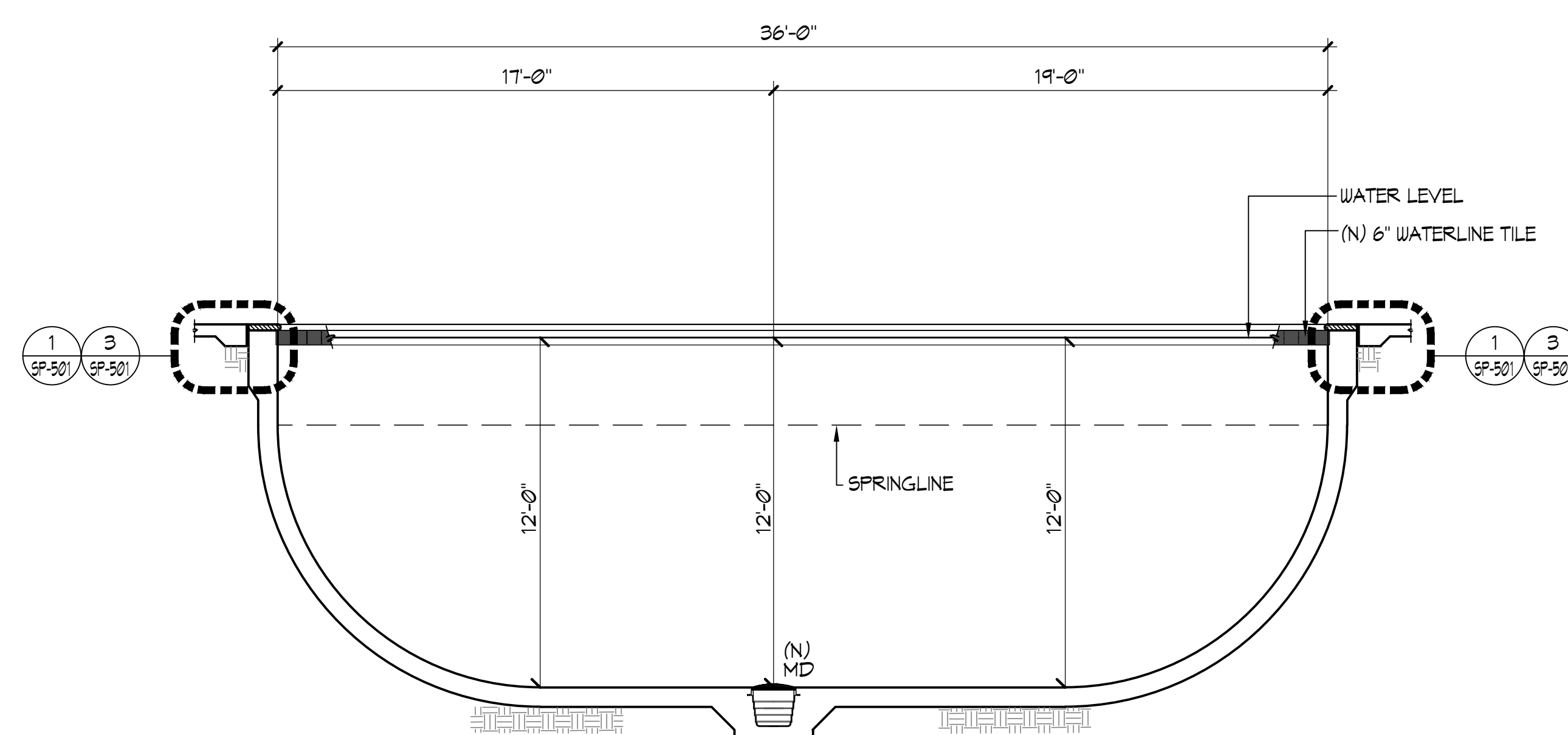
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DIVING POOL SECTION

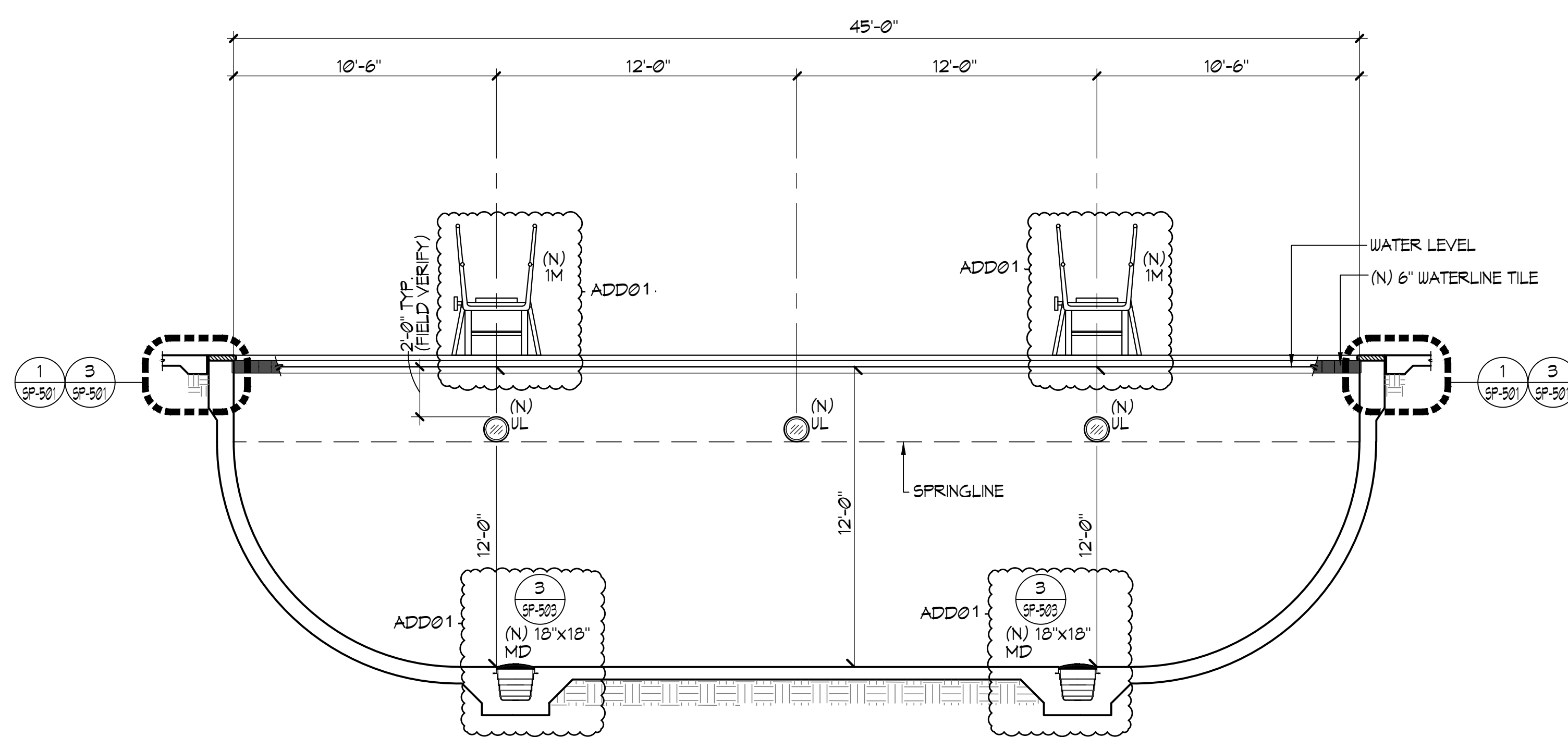
1/4" = 1'-0"



B

DIVING POOL SECTION

1/4" = 1'-0"



C

DIVING POOL SECTION

1/4" = 1'-0"

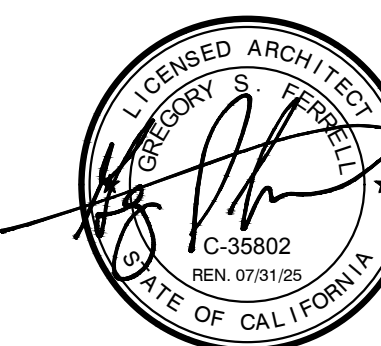
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TITLE
DIVING POOL
SECTIONS

SHEET
SP-312

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Balancing Air Systems:
 - a. Constant-volume air systems.
 - b. Dual-duct systems.
 - 2. Balancing Domestic Water Piping Systems.

1.02 RELATED REQUIREMENTS

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

1.03 REFERENCES AND STANDARDS

- A. Associated Air Balance Council (AABC)
 - 1. National Standards for Total System Balance, latest edition.
- B. National Environmental Balancing Bureau (NEBB)
 - 1. Procedural Standards for Testing and Balancing of Environmental Systems, latest edition.

1.04 DEFINITIONS

- A. The intent of this Section is to use the standards pertaining to the TAB specialist engaged to perform the Work of this Contract, with additional requirements specified in this Section. Contract requirements take precedence over corresponding AABC or NEBB standards requirements. Differences in terminology between the Specifications and the specified TAB organization standards do not relieve the TAB entity engaged to perform the Work of this Contract of responsibility from completing the Work as described in the Specifications.
- B. Similar Terms: The following table is provided for clarification only:

<u>Similar Terms</u>		
Contract Term	AABC Term	NEBB Term
TAB Specialist	TAB Agency	NEBB Certified Firm
TAB Standard	National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems	Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems
TAB Field Supervisor	Test and Balance Engineer	Test and Balance Supervisor

- C. AABC: Associated Air Balance Council.
- D. NEBB: National Environmental Balancing Bureau.
- E. TAB: Testing, adjusting, and balancing.
- F. TAB Organization: Body governing practices of TAB Specialists.
- G. TAB Specialist: An entity engaged to perform TAB Work.

1.05 ACTION SUBMITTALS

- A. For additional requirements, refer to Section 23 00 50, Basic HVAC Materials and Methods.
- B. LEED Submittals:

1.06 INFORMATIONAL SUBMITTALS

- A. For additional requirements, refer to Section 23 00 50, Basic HVAC Materials and Methods.
- B. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
 - 1. Provide list of similar projects completed by proposed TAB field supervisor.
 - 2. Provide copy of completed TAB report, approved by mechanical engineer of record for a completed project with similar system types and of similar complexity.
- C. Contract Documents Examination Report: Within 30 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.
 - 1. Submit examinations report with qualifications data.
- D. Strategies and Procedures Plan: Within 60 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.

- E. Interim Reports. Submit interim reports as specified in Part 3. Include list of system conditions requiring correction and problems not identified in Contract Documents examination report.
- F. Certified TAB reports.
 - 1. Provide three printed copies of final TAB report. Provide one electronic file copy in PDF format.
- G. Sample report forms.
- H. Instrument calibration reports, to include the following:
 - 1. Instrument type and make.
 - 2. Serial number.
 - 3. Application.
 - 4. Dates of use.
 - 5. Dates of calibration.
 - a. Instruments to be used for testing and balancing shall have been calibrated within a period of one year, or less if so recommended by instrument manufacturer and be checked for accuracy prior to start of work.

1.07 CLOSEOUT SUBMITTALS

- A. For additional requirements, refer to Section 23 00 50, Basic HVAC Materials and Methods.
- B. Certified TAB reports, for inclusion in Operation and Maintenance Manual.

1.08 QUALITY ASSURANCE

- A. Independent TAB Specialist Qualifications: Engage a TAB entity certified by AABC or NEBB.
 - 1. The certification shall be maintained for the entire duration of TAB work for this Project. If TAB specialist loses certification during this period, the Contractor shall immediately notify the Architect and submit another TAB specialist for approval. All work specified in this Section and in other related Sections performed by the TAB specialist shall be invalidated if the TAB specialist loses certification, and shall be performed by an approved successor.
- B. To secure approval for the proposed TAB specialist, submit information certifying that the TAB specialist is either a first tier subcontractor engaged and paid by the Contractor, or is engaged and paid directly by the Owner. TAB specialist shall not be affiliated with any other entity participating in Work of this Contract, including design, furnishing equipment, or construction. In addition, submit evidence of the following:
 - 1. TAB Field Supervisor: Full-time employee of the TAB specialist and certified by AABC or NEBB.
 - a. TAB field supervisor shall have minimum 10 years supervisory experience in TAB work.
 - 2. TAB Technician: Full-time employee of the TAB specialist and who is certified by AABC or NEBB as a TAB technician.
 - a. TAB technician shall have minimum 4 years TAB field experience.

- C. TAB Specialist engaged to perform TAB work in this Project shall be a business limited to and specializing in TAB work, or in TAB work and Commissioning.
- D. TAB specialist engaged to perform TAB work shall not also perform commissioning activities on this Project.
- E. Certified TAB field supervisor or certified TAB technician shall be present at the Project site at all times when TAB work is performed.
 - 1. TAB specialist shall maintain at the Project site a minimum ratio of one certified field supervisor or technician for each non-certified employee at times when TAB work is being performed.
- F. Contractor shall notify Architect in writing within three days of receiving direction resulting in reduction of test and balance scope or other deviations from Contract Documents. Deviations from the TAB plan shall be approved in writing by the mechanical engineer of record for the Project.
- G. TAB Standard:
 - 1. Perform TAB work in accordance with the requirements of the standard under which the TAB agencies' qualifications are approved unless Specifications contain different or more stringent requirements:
 - a. AABC National Standards for Total System Balance, or
 - b. NEBB Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems.
 - 2. All recommendations and suggested practices contained in the TAB standard are mandatory. Use provisions of the TAB standard, including checklists and report forms, to the extent to which they are applicable to this Project.
 - 3. Testing, adjusting, balancing procedures, and reporting required for this Project, and not covered by the TAB standard applicable to the TAB specialist engaged to perform the Work of this Contract, shall be submitted for approval by the design engineer.
- H. TAB Conference: Meet with Architect and mechanical engineer on approval of the TAB strategies and procedures plan to develop a mutual understanding of the project requirements. Require the participation of the TAB field supervisor. Provide seven days' advance notice of scheduled meeting time and location. TAB conference shall take place at location selected by Architect offices of Capital.
 - 1. Agenda Items:
 - a. The Contract Documents examination report.
 - b. The TAB plan.
 - c. Coordination and cooperation of trades and subcontractors.
 - d. Coordination of documentation and communication flow, including protocol for resolution tracking and documentation.
 - 2. The requirement for TAB conference may be waived at the discretion of the mechanical engineer of record for the Project.
- I. Certify TAB field data reports and perform the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
 2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.
- J. TAB Report Forms: Use standard TAB specialist's forms approved by Architect .
- K. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."
- 1.09 PROJECT CONDITIONS
- A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.
- 1.10 WARRANTY
- A. Provide workmanship and performance warranty applicable to TAB specialist engaged to perform Work of this Contract:
1. AABC Performance Guarantee.
 2. NEBB Quality Assurance Program.
- B. Refer to Division 01 Specifications for additional requirements.
- 1.11 COORDINATION
- A. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.
- B. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.
- C. Coordinate TAB work with work of other trades.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Contract Documents Examination Report:
1. TAB specialist shall review Contract Documents, including plans and specifications. Provide report listing conditions that would prevent the system(s) from operating in accordance with the sequence of operations specified, or would prevent accurate testing and balancing:
 - a. Identify each condition requiring correction using equipment designation shown on Drawings. Provide room number, nearest building grid line intersection, or other information necessary to identify location of condition requiring correction.
 - b. Proposed corrective action necessary for proper system operation.

- B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine equipment performance data including fan and pump curves.
 - 1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
- F. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- G. Examine test reports specified in individual system and equipment Sections.
- H. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- I. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.
- J. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.
- K. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- L. Examine system pumps to ensure absence of entrained air in the suction piping.
- M. Examine operating safety interlocks and controls on HVAC equipment.
- N. Report conditions requiring correction discovered before and during performance of TAB procedures.
- O. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.02 PREPARATION

- A. Prepare a TAB plan that includes strategies and step-by-step procedures. TAB plan shall be specific to Project and include the following:
 - 1. General description of each air system and sequence(s) of operation.
 - 2. Complete list of measurements to be performed.

3. Complete list of measurement procedures. Specify types of instruments to be utilized and method of instrument application.
 4. Qualifications of personnel assigned to Project.
 5. Single-line CAD drawings reflecting all test locations (terminal units, grilles, diffusers, traverse locations, etc).
 6. Air terminal correction factors for the following:
 - a. Air terminal configuration.
 - b. Flow direction (supply or return/exhaust).
 - c. Effective area of each size and type of air terminal.
 - d. Air density.
- B. Complete system-readiness checks and prepare reports. Verify the following:
1. Permanent electrical-power wiring is complete.
 2. Automatic temperature-control systems are operational.
 3. Equipment and duct access doors are securely closed.
 4. Balance, smoke, and fire dampers are open.
 5. Isolating and balancing valves are open and control valves are operational.
 6. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
 7. Windows and doors can be closed so indicated conditions for system operations can be met.

3.03 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and in this Section.
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
 2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 23 80 00 Heating, Ventilating, and Air Conditioning."
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.04 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

- B. Test each system to verify building or space operating pressure, including all stages of economizer cycle. Maximum building pressure shall not exceed 0.03 inches of pressure.
- C. Except as specifically indicated in this Specification, Pitot tube traverses shall be made of each duct to measure airflow. Pitot tubes, associated instruments, traverses, and techniques shall conform to ASHRAE Handbook, HVAC Applications, and ASHRAE Handbook, HVAC Systems and Equipment.
 - 1. Use state-of-the-art instrumentation approved by TAB specialists governing agency..
 - 2. Where ducts' design velocity and air quantity are both less than 1000 fpm/CFM, air quantity may be determined by measurements at terminals served.
- D. Test holes shall be placed in straight duct, as far as possible downstream from elbow, bends, take-offs, and other turbulence-generating devices.
- E. For variable-air-volume systems, develop a plan to simulate diversity.
- F. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- G. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
- H. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- I. Verify that motor starters are equipped with properly sized thermal protection.
- J. Check dampers for proper position to achieve desired airflow path.
- K. Check for airflow blockages.
- L. Check condensate drains for proper connections and functioning.
- M. Check for proper sealing of air-handling-unit components.
- N. Verify that air duct system is sealed as specified in Section 23 80 00 "Heating, Ventilating, and Air Conditioning."
- O. Provide for adjustments or modifications to fan and motor sheaves, belts, damper linkages, and other components as required to achieve specified air balance at no additional cost to Owner.
- P. Automatically operated dampers shall be adjusted to operate as indicated in Contract Documents. Controls shall be checked for proper calibration.

3.05 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
 - 1. Measure total airflow.
 - a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow. Alternative

methods shall be examined for determining total CFM, i.e., Pitot-tube traversing of branch ducts, coil or filter velocity profiles, prior to utilizing airflow values at terminal outlets and inlets.

2. Measure fan static pressures as follows to determine actual static pressure:
 - a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
 - b. Measure static pressure directly at the fan outlet.
 - c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
 - d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
 3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
 - a. Report the cleanliness status of filters and the time static pressures are measured.
 4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
 5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
 6. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
 7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.
- B. Check operation of relief air dampers. Measure total relief air quantity at each stage of normal, economizer, power exhaust, or power exhaust economizer operation, as applicable to installed equipment. Adjust relief air dampers to provide 100 percent relief in economizer mode. Ensure that relief dampers close completely upon unit shutdown.
- C. Check operation of outside air dampers. Measure total outside air quantity at each stage of normal, economizer, power exhaust, or power exhaust economizer operation, as applicable to installed equipment. Adjust outside air dampers to provide 100 percent outside air in economizer mode. Ensure that outside air dampers close completely upon unit shutdown.
- D. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
1. Measure airflow of submain and branch ducts.
 - a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
 3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.
- E. Measure air outlets and inlets without making adjustments.
1. Measure terminal outlets using a direct-reading digital backflow compensating hood. Use outlet manufacturer's written instructions and calculating factors only when direct-reading hood cannot be used due to physical obstruction or other limiting factors. Final report shall indicate where values listed have not been obtained by direct measurement.
- F. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.
1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents, if included.
 2. Adjust patterns of adjustable outlets for proper distribution without drafts. Terminal air velocity at five feet above finished floor shall not exceed 50 feet per minute in occupied air conditioned spaces.
- G. Do not overpressurize ducts.

3.06 PROCEDURES FOR MOTORS

- A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
1. Manufacturer's name, model number, and serial number.
 2. Motor horsepower rating.
 3. Motor rpm.
 4. Efficiency rating.
 5. Nameplate and measured voltage, each phase.
 6. Nameplate and measured amperage, each phase.
 7. Starter manufacturer's name, model number, size, type, and thermal-protection-element rating.
 - a. Starter strip heater size, type, and rating.
- B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.07 PROCEDURES FOR CONDENSING UNITS

- A. Verify proper rotation of fans.
- B. Measure entering- and leaving-air temperatures.
- C. Record compressor data.

3.08 PROCEDURES FOR HEAT-TRANSFER COILS

- A. Measure, adjust, and record the following data for each electric heating coil:
1. Nameplate data.
 2. Airflow.
 3. Entering- and leaving-air temperature at full load.
 4. Voltage and amperage input of each phase at full load and at each incremental stage.
 5. Calculated kilowatt at full load.
 6. Fuse or circuit-breaker rating for overload protection.
- B. Measure, adjust, and record the following data for each refrigerant coil:
1. Dry-bulb temperature of entering and leaving air.
 2. Wet-bulb temperature of entering and leaving air.
 3. Airflow.
 4. Air pressure drop.

3.09 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS

- A. Perform a preconstruction inspection of existing equipment that is to remain and be reused.
1. Measure and record the operating speed, airflow, and static pressure of each fan.
 2. Measure motor voltage and amperage. Compare the values to motor nameplate information.
 3. Check the condition of filters.
 4. Check the condition of coils.
 5. Check the operation of the drain pan and condensate-drain trap.
 6. Check bearings and other lubricated parts for proper lubrication.
 7. Report on the operating condition of the equipment and the results of the measurements taken. Report conditions requiring correction.
- B. Before performing testing and balancing of existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment has been cleaned and refurbished. Verify the following:
1. New filters are installed.
 2. Coils are clean and fins combed.
 3. Drain pans are clean.
 4. Fans are clean.
 5. Bearings and other parts are properly lubricated.
 6. Conditions requiring correction noted in the preconstruction report are corrected.
- C. Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work.
1. Compare the indicated airflow of the renovated work to the measured fan airflows, and determine the new fan speed and the face velocity of filters and coils.
 2. Verify that the indicated airflows of the renovated work result in filter and coil face velocities and fan speeds that are within the acceptable limits defined by equipment manufacturer.

3. If calculations increase or decrease the air flow rates and water flow rates by more than 5 percent, make equipment adjustments to achieve the calculated rates. If increase or decrease is 5 percent or less, equipment adjustments are not required.
4. Balance each air outlet.

3.10 GENERAL PROCEDURES FOR PLUMBING SYSTEMS

- A. Measure pressure drop across each backflow preventer assembly at design flows.
- B. Measure water flow at pumps. Use the following procedures except for positive-displacement pumps:
 1. Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
 - a. If impeller sizes must be adjusted to achieve pump performance, obtain approval from Architect Owner Construction Manager and comply with requirements in Section 22 50 00 "Plumbing Equipment Section 22 11 23 "Domestic Water Pumps."
 2. Check system resistance. With all valves open, read pressure differential across the pump and mark pump manufacturer's head-capacity curve. Adjust pump discharge valve until indicated water flow is achieved.
 - a. Monitor motor performance during procedures and do not operate motors in overload conditions.
 3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.
 4. Report flow rates that are not within range given in article, Tolerances.
- C. Set calibrated balancing valves, if installed, at calculated presettings.
- D. Measure flow at all stations and adjust, where necessary, to obtain first balance.
 1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.
- E. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than indicated flow.
- F. Adjust balancing stations to within specified tolerances of indicated flow rate as follows:
 1. Determine the balancing station with the highest percentage over indicated flow.
 2. Adjust each station in turn, beginning with the station with the highest percentage over indicated flow and proceeding to the station with the lowest percentage over indicated flow.
 3. Record settings and mark balancing devices.

- G. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures including outdoor-air temperature.
- H. Measure the differential-pressure-control-valve settings existing at the conclusion of balancing.
- I. Check settings and operation of each safety valve. Record settings.

3.11 TOLERANCES

- A. Set HVAC system's air flow rates and water flow rates within the following tolerances:
 - 1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus 10 percent and minus 0 percent.
 - 2. Air Outlets and Inlets: Plus 5 percent and minus 5 percent.
 - 3. Multiple outlets within single room: Plus 5 percent and minus 0 percent for total airflow within room. Tolerance for individual outlets within a single room having multiple outlets shall be as for "Air Outlets and Inlets."
- B. Set plumbing systems water flow rates within plus or minus 10 percent.

3.12 REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.
- B. Interim Reports: Prepare periodic lists of conditions requiring correction and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.13 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
 - 1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing field supervisor. Report shall be co-signed by the Contractor, attesting that he has reviewed the report, and the report has been found to be complete and accurate.
 - 2. The certification sheet shall be followed by sheet(s) listing items for which balancing objectives could not be achieved. Provide explanation for failure to achieve balancing objectives for each item listed.
 - 3. Include a list of instruments used for procedures, along with proof of calibration.
- B. Final Report Contents: In addition to certified field-report data, include the following:
 - 1. Pump curves.
 - 2. Fan curves.
 - 3. Manufacturers' test data.

4. Field test reports prepared by system and equipment installers.
 5. Other information relative to equipment performance; do not include Shop Drawings and product data.
- C. General Report Data: In addition to form titles and entries, include the following data:
1. Title page.
 2. Name and address of the TAB specialist.
 3. Project name.
 4. Project location.
 5. Project Performance Guaranty
 6. Architect's name and address.
 7. Engineer's name and address.
 8. Contractor's name and address.
 9. Report date.
 10. Signature of TAB supervisor who certifies the report.
 11. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
 12. Summary of contents including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.
 13. Nomenclature sheets for each item of equipment.
 14. Data for terminal units, including manufacturer's name, type, size, and fittings.
 15. Test conditions for fans and pump performance forms including the following:
 - a. Settings for outdoor-, return-, and exhaust-air dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet- and dry-bulb conditions.
 - d. Face and bypass damper settings at coils.
 - e. Fan drive settings including settings and percentage of maximum pitch diameter.
 - f. Inlet vane settings for variable-air-volume systems.
 - g. Settings for supply-air, static-pressure controller.
 - h. Other system operating conditions that affect performance.
- D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
1. Quantities of outdoor, supply, return, and exhaust airflows.
 2. Duct, outlet, and inlet sizes.
 3. Pipe and valve sizes and locations.
 4. Terminal units.
 5. Balancing stations.
 6. Position of balancing devices.
- E. Air distribution outlets and inlets shall be shown on keyed plans with designation for each outlet and inlet matching designation used in Contract Documents and TAB test reports. Room numbers shall be included in keyed plans and test reports. Where multiple outlets and inlets are installed within a

single room, a designation shall be assigned and listed for each outlet and inlet in addition to room number.

F. Test Reports – General:

1. All test reports containing air or liquid flow data shall record flow values prior to system adjustment in addition to required data listed for each test report.

G. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:

1. Unit Data:

- a. Unit identification.
- b. Location.
- c. Make and type.
- d. Model number and unit size.
- e. Manufacturer's serial number.
- f. Unit arrangement and class.
- g. Discharge arrangement.
- h. Sheave make, size in inches, and bore.
- i. Center-to-center dimensions of sheave, and amount of adjustments in inches.
- j. Number, make, and size of belts.
- k. Number, type, and size of filters.

2. Motor Data:

- a. Motor make, and frame type and size.
- b. Horsepower and rpm.
- c. Volts, phase, and hertz.
- d. Full-load amperage and service factor.
- e. Sheave make, size in inches, and bore.
- f. Center-to-center dimensions of sheave, and amount of adjustments in inches.

3. Test Data (Indicated and Actual Values):

- a. Total air flow rate in cfm.
- b. Total system static pressure in inches wg.
- c. Fan rpm.
- d. Discharge static pressure in inches wg.
- e. Filter static-pressure differential in inches wg.
- f. Preheat-coil static-pressure differential in inches wg.
- g. Cooling-coil static-pressure differential in inches wg.
- h. Heating-coil static-pressure differential in inches wg.
- i. Outdoor airflow in cfm.
- j. Return airflow in cfm.
- k. Relief airflow in cfm.
- l. Outdoor-air damper position, normal and economizer, power exhaust, or power exhaust economizer modes, as applicable to installed equipment.
- m. Return-air damper position.
- n. Relief-air damper position, normal and economizer, power exhaust, or power exhaust economizer modes, as applicable to installed equipment.
- o. Vortex damper position.

- H. Electric-Coil Test Reports: For electric furnaces, duct coils, and electric coils installed in central-station air-handling units, include the following:
1. Unit Data:
 - a. System identification.
 - b. Location.
 - c. Coil identification.
 - d. Capacity in Btu/h.
 - e. Number of stages.
 - f. Connected volts, phase, and hertz.
 - g. Rated amperage.
 - h. Air flow rate in cfm.
 - i. Face area in sq. ft.
 - j. Minimum face velocity in fpm.
 2. Test Data (Indicated and Actual Values):
 - a. Heat output in Btu/h.
 - b. Air flow rate in cfm.
 - c. Air velocity in fpm.
 - d. Entering-air temperature in deg F.
 - e. Leaving-air temperature in deg F.
 - f. Voltage at each connection.
 - g. Amperage for each phase.
- I. Fan Test Reports: For supply, return, and exhaust fans, include the following:
1. Fan Data:
 - a. System identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and size.
 - e. Manufacturer's serial number.
 - f. Arrangement and class.
 - g. Sheave make, size in inches, and bore.
 - h. Center-to-center dimensions of sheave, and amount of adjustments in inches.
 2. Motor Data:
 - a. Motor make, and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in inches, and bore.
 - f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
 - g. Number, make, and size of belts.
 3. Test Data (Indicated and Actual Values):
 - a. Total airflow rate in cfm.
 - b. Total system static pressure in inches wg.
 - c. Fan rpm.

- d. Discharge static pressure in inches wg.
 - e. Suction static pressure in inches wg.
- J. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
- 1. Report Data:
 - a. System and air-handling-unit number.
 - b. Location and zone.
 - c. Traverse air temperature in deg F.
 - d. Duct static pressure in inches wg.
 - e. Duct size in inches.
 - f. Duct area in sq. ft.
 - g. Indicated air flow rate in cfm.
 - h. Indicated velocity in fpm.
 - i. Actual air flow rate in cfm.
 - j. Actual average velocity in fpm.
 - k. Barometric pressure in psig.
- K. Air-Terminal-Device Reports:
- 1. Unit Data:
 - a. System and air-handling unit identification.
 - b. Location and zone.
 - c. Apparatus used for test.
 - d. Area served.
 - e. Make.
 - f. Number from system diagram.
 - g. Type and model number.
 - h. Size.
 - i. Effective area in sq. ft.
 - 2. Test Data (Indicated and Actual Values):
 - a. Air flow rate in cfm.
 - b. Air velocity in fpm.
 - c. Preliminary air flow rate as needed in cfm.
 - d. Preliminary velocity as needed in fpm.
 - e. Final air flow rate in cfm.
 - f. Final velocity in fpm.
 - g. Space temperature in deg F.
- L. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:
- 1. Unit Data:
 - a. Unit identification.
 - b. Location.
 - c. Service.
 - d. Make and size.

- e. Model number and serial number.
 - f. Water flow rate in gpm.
 - g. Water pressure differential in feet of head or psig.
 - h. Required net positive suction head in feet of head or psig.
 - i. Pump rpm.
 - j. Impeller diameter in inches.
 - k. Motor make and frame size.
 - l. Motor horsepower and rpm.
 - m. Voltage at each connection.
 - n. Amperage for each phase.
 - o. Full-load amperage and service factor.
 - p. Seal type.
2. Test Data (Indicated and Actual Values):
- a. Static head in feet of head or psig.
 - b. Pump shutoff pressure in feet of head or psig.
 - c. Actual impeller size in inches.
 - d. Full-open flow rate in gpm.
 - e. Full-open pressure in feet of head or psig.
 - f. Final discharge pressure in feet of head or psig.
 - g. Final suction pressure in feet of head or psig.
 - h. Final total pressure in feet of head or psig.
 - i. Final water flow rate in gpm.
 - j. Voltage at each connection.
 - k. Amperage for each phase.

M. Instrument Calibration Reports:

1. Report Data:
- a. Instrument type and make.
 - b. Serial number.
 - c. Application.
 - d. Dates of use.
 - e. Dates of calibration.

3.14 INSPECTIONS

A. Initial Inspection:

1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
2. Check the following for each system:
 - a. Measure airflow of at least 10 percent of air outlets.
 - b. Measure water flow of at least 5 percent of terminals.
 - c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
 - d. Verify that balancing devices are marked with final balance position.
 - e. Note deviations from the Contract Documents in the final report.

- B. Final Inspection:
1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Architect .
 2. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Architect .
 3. Architect shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
 4. If rechecks yield measurements that differ from the measurements documented in the final report by more than 10 percent, the measurements shall be noted as "FAILED."
 5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.
- C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:
1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
 2. If the second final inspection also fails, Owner may contact the TAB specialists' governing organization for remedial action by the governing organization under the workmanship and performance warranty. See article, Warranty.
 3. If remedial action is not provided by the TAB specialists' governing organization in a timely manner, Owner may contract the services of another TAB specialist to complete the TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB specialists' final payment.
- D. Prepare test and inspection reports.

3.15 ADDITIONAL TESTS

- A. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION

SECTION 23 80 00

HEATING, VENTILATING AND AIR CONDITIONING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Fans.
 - 2. Relief and intake vents.
 - 3. Louvers.
 - 4. Air inlets and outlets.
 - 5. Dampers.
 - 6. Insulation.

1.02 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Section 23 00 50, Basic HVAC Materials and Methods.
- C. Section 23 05 93, Testing, Adjusting, and Balancing for HVAC.
- D. Section 23 09 23, Direct Digital Control (DDC) System for HVAC.

1.03 ACTION SUBMITTALS

- A. For additional requirements, refer to Section 23 00 50, Basic HVAC Materials and Methods.
- B. Product Data: Submit manufacturer's technical product data, including rated capacities of selected model clearly indicated, dimensions, weight, corner or mounting point weights, furnished specialties and accessories; and installation and start-up instructions. Product data shall include applicable product listings and standards. Refer to Section 23 00 50, Basic HVAC Material and Methods for additional requirements.
 - 1. Upon approval of submittal, provide manufacturer's installation and operating instructions to the Project inspector for the following:
 - a. Fire dampers, smoke dampers, and combination smoke-fire dampers.
- C. Engineering Data: Submit fan curves and sound power level data for each fan unit. Data shall be at the scheduled capacity. Data shall include the name of the rating agency or independent laboratory.

1.04 INFORMATIONAL SUBMITTALS

- A. For additional requirements, refer to Section 23 00 50, Basic HVAC Materials and Methods.
- B. Record of pre-installation meeting.

- C. Coordinated Layouts: Submit coordinated layouts. For requirements refer to article, Coordinated Layouts, in this Section.

1.05 CLOSEOUT SUBMITTALS

- A. For additional requirements, refer to Section 23 00 50, Basic HVAC Materials and Methods.
- B. Maintenance Data: Submit maintenance data and parts list for each piece of equipment, control, and accessory; including "trouble-shooting guide," in Operation and Maintenance Manual.
- C. Record Drawings: Submit Record Drawings of installed ductwork, duct accessories, and outlets and inlets in accordance with requirements of Division 01.

1.06 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Belts: One set(s) for each belt-driven unit.
 - 2. Provide one complete set(s) of filters for each filter bank.

1.07 COORDINATED LAYOUT

- A. Coordinated layouts are required to amplify, expand and coordinate the information contained in the Contract Documents.
- B. Provide minimum 1/4 inch equals one foot scaled coordinated layout drawings showing plan and pertinent section or elevation views of piping, ductwork, equipment, accessories, and electrical systems. Drawings shall be reproducible and work of each trade represented shall be fully coordinated with structure, other disciplines, and finished surfaces. Drawings shall be presented on a single size sheet. Coordinated layout drawings shall have title block, key plan, north arrow and sufficient grid lines to provide cross-reference to design Drawings.
 - 1. Provide a stamp or title block on each drawing with locations for signatures from all contractors involved, including but not limited to the General, HVAC, Plumbing, Fire Protection, and Electrical contractors. Include statement for signature that the contractor has reviewed the coordinated layout drawings in detail and has coordinated the work of his trade.
 - 2. Show on drawings the intended elevation of all ductwork in accordance with the following example:

B.O.D. = 9'-0"
OFFSET UP 6"
B.O.D. = 9'-6"
 - 3. Highlight, encircle or otherwise indicate deviations from the Contract Documents on the coordinated layouts. Architect will not be responsible for identifying deviations from the original Contract Documents.
- C. Since scale of contract drawings is small and all offsets and fittings are not shown, Contractor shall make allowances in bid for additional coordination time, detailing, fittings, offsets, hangers and the

like to achieve a fully coordinated installation. If changes in duct size are required, equivalent area shall be maintained and the aspect ratio shall not be in excess of 2 to 1 unless approved by the engineer. Drawings shall be submitted for review prior to fabrication and installation. Drawings may be submitted in packages representing at least one quarter of the building ductwork.

- D. Check routing on all ductwork before fabricating. Report any discrepancies to Architect. No extra cost will be allowed for failure to conform to above.

1.08 QUALITY ASSURANCE

A. Design Criteria:

1. All equipment and accessories to be the product of a manufacturer regularly engaged in its manufacture. All gas-fired equipment shall be UL, ETL or CSA listed.
2. Supply all equipment and accessories in accordance with requirements of applicable national, state and local codes.
3. All items of a given type shall be products of the same manufacturer.
4. Scheduled equipment performance is minimum capacity required.
5. Scheduled electrical capacity shall be considered as maximum available.
6. Scheduled gas BTU input shall be considered as maximum available.

1.09 FIELD CONDITIONS

- A. Interruption of Existing Services: Do not interrupt services to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary services according to requirements indicated:
 1. Notify Architect no fewer than two days in advance of proposed interruption of services.
 2. Do not interrupt services without Architect's written permission.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Insulation products, including insulation, insulation facings, jackets, adhesives, sealants and coatings shall not contain polybrominated diphenyl ethers (PBDEs) in penta, octa, or deca formulations in amounts greater than 0.1 percent (by mass).

2.02 GAS FIRED EQUIPMENT

- A. All gas-fired equipment shall be listed for use as a gas appliance.
- B. All units shall comply with the emissions requirements of the Air Quality Management District (AQMD) in which they are to be installed.

2.03 COOLING COIL

- A. Provide direct expansion encased cooling coil.

1. Install encased coil to operate properly in vertical or horizontal position as required. Construct coil with aluminum plate fins mechanically bonded in non-ferrous tubing with all joints brazed ultrasonically. Coil shall have factory-installed refrigerant metering device, refrigerant line fittings which permit mechanical connections, and condensate pan with primary and auxiliary drain connections.
2. Construct casings of galvanized steel, bonderize, insulate, and finish with baked enamel.

2.04 FANS

- A. All fans shall be Air Moving and Control Association Inc. (AMCA) labeled.
- B. Provide self-aligning, enclosed ball bearings, accessible for lubrication unless specified otherwise.
- C. Provide variable speed switch for all direct drive fans.
- D. Roof Mounted:
 1. Direct or V-belt Drive: Provide one-piece heavy-duty ventilator housings, one piece heavy gauge spun aluminum construction, with weatherproof assembly and integral weather shield. Mount ventilators on curbs furnished by the fan manufacturer. Install with fan assembly level.
 2. Fan wheels shall be centrifugal design, statically and dynamically balanced. Tip speed, rpm and motor horsepower shall not exceed listing in manufacturer's catalog for unit specified.
 3. Fans shall have integral factory formed base and one piece spinning without welding. Housings shall be provided with wiring channel and are to be of the direct discharge design. Motor and fan assembly shall be on vibration isolating mounts. Fans shall have capacity, speeds and motor sizes as shown.
 4. Provide the following accessories:
 - a. Gravity backdraft dampers.
 - b. Aluminum bird screen with a minimum of 85 percent free area.
 - c. Adjustable motor pulley.
 - d. Laboratory fume hood exhaust fans shall be Keysite coated.
 - e. Provide grease collection tray for kitchen exhaust fans.
 - f. Provide ventilated roof curb for kitchen exhaust fans where exhaust duct is mounted within rated shaft.
 - g. Provide hinge kit for kitchen hood exhaust fans.
- E. In-Line Propeller Fans:
 1. Heavy-duty propeller type with belt or direct drive as specified. Blades shall be individually mounted to wheel.
 2. Provide sloped roof or flat roof type roof cap, or wall cap to suit the location indicated on the Drawings.
- F. In-Line Centrifugal Fans:
 1. Centrifugal fan with airfoil blades, aluminum or steel housing, externally mounted belt-drive motor, external lube tubes, integral support brackets.
 2. Provide sloped roof or flat roof type roof cap, or wall cap to suit the location indicated on the Drawings.

G. Ceiling Mounted Fans:

1. Acoustic lined cabinet, built-in back draft damper, vibration isolated fan and motor, variable speed switch.
2. Provide sloped roof or flat roof type roof cap, or wall cap to suit the location indicated on the Drawings.

H. Fan Drives:

1. Drive Design: The design horsepower rating of each drive shall be at least 1.5 times, single belt drives 2 times, the nameplate rating of the motor with proper allowances for sheave diameters, speed ratio, arcs of contact and belt length.
2. Provide variable speed drives, Dayco, Browning, Woods, or equal. Allow for replacement of fan and motor drives and belts as required to suit the balance requirements of the project.
3. Select variable speed drives to allow an increase or decrease of minimum of ten percent of design fan speed.

I. Motors:

1. Motors of 25 HP and less shall have adjustable pitch sheaves; sheaves on motors above 25 HP may be non-adjustable. Change, at no extra cost to Owner, the non-adjustable sheaves to obtain desired air quantities.
2. For single-phase fan motors sized larger than 1/12 hp and smaller than 1 hp, refer to Article, Electric Motors, in Section 23 00 50, Basic HVAC Materials and Methods.

J. Sheaves: Sheaves shall be cast or fabricated, bored to size or bushed with fully split tapered bushings to fit properly on the shafts. All sheaves shall be secured with keys and set screws.

K. Belts:

1. All belts shall be furnished in matched sets.
2. Belts shall be within 1 degree 30 minutes of true alignment in all cases.

L. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:

1. Greenheck Fan Corporation.
2. Loren Cook Company.
3. PennBarry.
4. American Coolair Corporation.

M. Fly Fan (Air Curtain)

1. Manufacturer's standard, high velocity, non-recirculating type. Units for kitchens or food storage shall comply with NSF 37.
2. Casing: Sheet metal or polycarbonate plastic. Provide internal or external vibration isolation to effectively prevent transmission of vibration and noise from units to building structure. Units shall completely house all parts and have manufacturer's standard finish coating.

3. Fans: Ruggedly constructed, statically and dynamically balanced. Noise level shall not exceed 77 dBA measured at 5 feet distance.
 4. Air Discharge Outlet Nozzle: Cover full width of door opening. Fan discharge ducts, plenum, flow control vanes and nozzles shall provide a uniform distribution of air over entire length of door. Provide adjustable volume and directional control.
 5. Heating Coil: Provide electric heating coil. Maximum discharge air temperature shall be 120 degrees F.
 6. Controls: Provide on-off door operated switch. The "on-off" switch circuit shall close to start fan motors when door starts to open and open when the door reaches closed position. A local disconnect switch for each fan motor shall be provided and shall be mounted to be accessible without use of ladder.
 7. Motors: Provide heavy-duty totally enclosed fan motor, sealed ball bearings, resilient mounting, automatic thermal overload switch, UL listed. Provide weather protection for motor and electrical equipment.
 8. Available Manufacturers: Subject to compliance with requirements, manufacturers offering air doors / fly fans which may be incorporated in the work include the following, or equal:
 - a. Mars Air Products; Mars Air Door Division.
 - b. Berner International.
 - c. Fantech.
- N. Owner Training: Manufacturer shall provide one on-site 1-hour training session for Owners' maintenance personnel.

2.05 RELIEF AND INTAKE VENTS

- A. Galvanized steel housing with 1/2 inch mesh screen, counterbalanced backdraft damper and matching prefabricated curb. Omit backdraft damper on intake vents. Provide pitched roof curb for relief vents, and install with backdraft damper level.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 1. Greenheck Fan Corporation.
 2. Lauren Cook Company.
 3. PennBarry.
 4. American Coolair Corporation.

2.06 LOUVERS

- A. Louvers shall be minimum 16 gauge steel with Bonderite and Epon gray primer and 1/2 inch square mesh, 16 gauge galvanized steel screen on the inside. Louvers shall be Airolite #609, Arrow United Industries, or equal, with 4 inch louver depth.

2.07 AIR INLETS AND OUTLETS

- A. Except as otherwise indicated, provide manufacturer's standard inlets and outlets where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.

- B. Ceiling, wall or floor Compatibility: Provide inlets and outlets with border styles that are compatible with adjacent ceiling, wall or floor systems, and that are specifically manufactured to fit into ceiling, wall or floor module with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling systems that will contain each type of air outlet and inlet.
- C. Refer to Schedule on Mechanical Drawings for details of inlets and outlets to be used.

2.08 DAMPERS

- A. Backdraft Dampers: Ruskin CBD2, counterbalanced, Nailer Industries, or equal.
- B. Manual Air and Balance Dampers: Provide dampers of single blade type or multi-blade type constructed in accordance with SMACNA, "HVAC Duct Construction Standards," except as noted herein.
 - 1. Rectangular Ductwork:
 - a. Single damper blades may be used in ducts up to 10 inches in height. Dampers shall be 16 gauge minimum. Provide self-locking regulators, equal to Ventlok 641. Provide end bearings equal to Ventlok 607 at each damper. Provide continuous solid 3/8 inch square shafts.
 - b. Multiple blade dampers shall be equal to Ruskin CD35 Standard Control Damper. Maximum width for multiple damper blades for use in rectangular duct shall not exceed 6 inches.
 - c. Where duct velocity may be expected to exceed 1500 fpm, provide Ruskin CD-50, or equal, low leakage dampers with airfoil blades.
 - 2. Round Ductwork:
 - a. Single damper blades may be used in ducts up to 12 inches in diameter. Provide multiple blade opposed blade dampers, with connected linkage, for ductwork larger than 12 inches in diameter.
 - b. Damper blades for round ductwork shall be 20 gauge steel for ducts up to 12 inches diameter and 16 gauge steel for dampers larger than 12 inches diameter. Provide self-locking regulators, equal to Ventlok 641, Durodyne, or equal for operation of dampers. Provide end bearings equal to Ventlok 607 and provide continuous solid 3/8 inch square shafts.
 - 3. Where ductwork is externally insulated, provide self-locking regulators equal to Ventlok 644, Durodyne, or equal for rectangular ductwork, and Ventlok 637, Durodyne, or equal for round ducts.
- C. Fire Dampers and Combination Fire/Smoke Dampers:
 - 1. Fire dampers and combination fire/smoke dampers shall be listed and approved by the California State Fire Marshal. Installation shall conform to the manufacturer's UL approved installation instructions.
 - a. Fire dampers shall be UL 555 classified and labeled as dynamic fire dampers approved for wall and floor installation. They shall ship from the manufacturer as an assembly with a minimum 20-gauge factory installed sleeve. Sleeve length shall suit the requirements of the wall construction. Each dynamic fire damper/sleeve assembly shall ship complete with factory "roll formed" one-piece angles with pre-punched holes for easy installation. Dynamic fire dampers for vertical installation must consist of a single section on sizes up to 33" x 36" and a single section on sizes up to 24" x 24" for horizontal installation. 1-1/2 hour dynamic fire

- dampers shall be Ruskin DIBD20, Pottorff, or equal. 3 hour dynamic fire dampers shall be Ruskin DIBD230, Pottorff, or equal.
- b. Fire dampers for high pressure/velocity systems where velocities exceed 2000 fpm and/or 4" w.g. pressure fire damper shall be Ruskin FD60, Pottorff, or equal.
 - c. Fire dampers for ceiling installation shall be UL 555C classified and labeled as ceiling dampers. They shall be provided with a thermal insulating blanket to fit the inlet or outlet condition if required by the application. Ceiling dampers shall be Ruskin CFD 2, 3, 4 or 5. Ceiling dampers for ceilings constructed of wood shall have UL tested in design L501 and shall be Ruskin CFD7, Pottorff, or equal.
 - d. Combination fire/smoke dampers. Dampers shall be UL classified and labeled as Leakage Class I Smoke Dampers in accordance with the latest version of UL 555S. Dampers shall be warranted to be free from defects in material and workmanship for a period of 5 years after date of shipment. Damper/actuator assembly shall be tested to full open and full close at minimum 2000 fpm 250° F heated air and 4" w.g. with airflow in both directions. (Specified select: 250° / 350°, 2000 fpm/3000 fpm). Each damper shall be equipped with "controlled closure" quick detect heat actuated release device to prevent duct and HVAC component damage resulting from instantaneous damper closure. Release device shall be EFL type and shall allow reset from outside the sleeve after moderate temperature exposure. (Replacement type fusible links not acceptable.)
 - e. Two position combination fire smoke dampers shall be equipped with one or more factory installed, direct coupled, 120 volt, single phase, electric actuator for energize open – fail close operation. Dampers with multiple actuators shall be factory wired with single point connection at the EFL heat release device for connection to power. Damper actuator shall include minimum one-year energized hold open (no cycles) and spring return (fail) close reliability. Damper/actuator shall include minimum 20,000 full open-full close cycle performances.
 - f. Modulating combination fire smoke dampers shall be equipped with one or more factory installed contact for modulating signal connection. Damper/actuator shall include minimum 100,000 full open-full close cycle performances with spring return (fail) close on loss of power.
 - g. Round combination fire smoke dampers up to 24" diameter shall be true round type with minimum 20 gauge galvanized steel designed for lowest pressure drop and noise performance. Bearings shall be stainless steel sleeve turning in an extruded hole in the frame. Blade seals shall be silicone edge designed to withstand 450° F and galvanized steel mechanically locked in to the blade edge (adhesive type seals are not acceptable). Each damper shall be equipped with a factory-installed sleeve of 17 inches minimum length and factory "roll formed" one-piece angles with pre-punched holes. Dampers shall be Ruskin FSDR25, Pottorff, or equal.
 - h. Round (larger than 24" diameter) or rectangular combination fire smoke dampers shall include roll-formed structural hat channel frame, reinforced at the corners, formed from a single piece of minimum 16 gauge equivalent thickness formed from single piece galvanized steel. Bearings shall be stainless steel turning in an extruded hole in the frame. Blade edge seals shall be silicone rubber designed to withstand 450° F and galvanized steel mechanically locked in to the blade edge (adhesive type seals are not acceptable). Each damper shall be equipped with a factory-installed sleeve of 17" minimum length and factory "roll formed" one-piece angles with pre-punched holes for easy installation. Dampers shall be Ruskin FSD60, Pottorff, or equal.
 - i. 3-hour rated combination fire smoke dampers shall be Ruskin model FSD60-3, Pottorff, or equal.

- j. All FSD60 type dampers shall be AMCA licensed and shall bear the AMCA Seal for Air Performance. AMCA certified testing shall verify pressure drop does not exceed .03" w.g. at a face velocity of 1,000 fpm on a 24" x 24" damper.
- k. Wall type fire/smoke damper:
 - 1) Combination fire/smoke dampers for use in the wall of exit corridors shall be classified and labeled as Leakage Class II Smoke Dampers in accordance with the latest version of UL 555S. Dampers shall meet the requirements for combination fire/smoke dampers in paragraph 3 above except AMCA certified testing shall verify pressure drop does not exceed .07" w.g. at a face velocity of 1,000 fpm on a 24" x 24" damper and blades shall be single skin galvanized steel 10 gauge minimum with 3 longitudinal grooves for reinforcement. Dampers shall be Ruskin FSD36, Pottorff, or equal.
 - 2) Front access combination fire/smoke dampers shall meet all the requirements for combination fire/smoke dampers in paragraph 3 above except pressure drop requirement. In addition the dampers shall be constructed so that actuators and all accessories are accessible from the grille side. Actuators and accessories shall be housed within an integral cabinet on the side of the damper frame and shall not be installed in the air stream in front of the damper. The damper sleeve shall be minimum 14" and flanged to accept a steel framed grille. The sleeve shall be covered with fire resistant material. Dampers shall be Ruskin FSD60FA, Pottorff, or equal.
- l. Ceiling type fire/smoke damper for tunnel type corridor construction: Combination fire/smoke dampers for use in the corridor ceiling of tunnel type corridor construction shall be UL classified and labeled as Corridor Damper. Dampers shall meet the requirements of paragraph 4a above except pressure drop testing does not require AMCA certification. Dampers shall be Ruskin FSD36C, Pottorff, or equal.
- m. Fusible links shall have temperature rating approximately 50° F above normal maximum operating temperature of the heat producing appliance.
 - 1) If project requires re-openable fire/smoke dampers, provide Ruskin 165 ° F / 350° F TS150, NCA or equal. The TS150 firestat replaces the EFL and allows the damper to be re-opened from remote location up to 350 ° F. TS150 shall include full open and full closed damper position contacts for interface with remote position indication panel.
 - 2) Each fire/smoke damper shall be equipped with "controlled closure" quick detect heat actuated release device to prevent duct and HVAC component damage. Release device shall allow easy reset after moderate temperature rise outside the sleeve. Heat release device shall be the Ruskin EFL, NCA or equal.
 - 3) Unless the system is using a validation control system, each fire/smoke damper shall be equipped with a control panel including blade position indicator lights and a key operated switch. The panel cover shall be oversized for flush mount into the wall or ceiling and shall have a brushed look. Control panel shall be Ruskin MCP2, Pottorff, or equal.
- 2. All actuators used for smoke dampers or combination fire/smoke dampers shall have a cycle time requirement of not more than every twelve months and shall be rated for continuous "On" duty and shall be provided with internal spring return. Actuators shall be equipped with pilot light, remote key test switch, end switch and circuitry to activate pilot light on remote key (test) switch located in corridor ceiling adjacent to damper. Electric motors shall be Invensys MA-250, MA-253, Honeywell H2000, or equal.

- D. Where required to suit the size of damper required, provide manufacturers standard UL Classified mullions, arranged to support multiple dampers. Assembly shall be of minimum 16 gauge galvanized steel, complete with all accessory caps and framing members required for installation.

2.09 INSULATION MATERIALS

A. General:

1. Insulation products, including insulation, insulation facings, jackets, adhesives, sealants and coatings shall not contain polybrominated diphenyl ethers (PBDEs) in penta, octa, or deca formulations in amounts greater than 0.1 percent (by mass).
2. Products shall not contain asbestos, lead, mercury, or mercury compounds.
3. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
4. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
5. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
6. Test insulation, jackets and lap-seal adhesives as a composite product and confirm flame spread of not more than 25 and a smoke developed rating of not more than 50 when tested in accordance with UL723 or ASTM E84.
7. Adhesives and sealants shall comply with testing and product requirements of South Coast Air Quality Management District, Rule 1168.

B. Insulation Materials:

C. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - a. Design Polymerics.
 - b. Foster Brand; H. B. Fuller Construction Products.
 - c. Knauf Insulation.
2. Water-Vapor Permeance: Comply with ASTM E96/E96M or ASTM F1249.
3. Service Temperature Range: 0 to plus 180 deg F.
4. Color: White.

D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below-ambient services.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - a. Design Polymerics.
 - b. Childers Brand; H. B. Fuller Construction Products.
 - c. Foster Brand; H. B. Fuller Construction Products.
2. Water-Vapor Permeance: Comply with ASTM E96/E96M or ASTM F1249.
3. Service Temperature Range: Minus 50 to plus 220 deg F.
4. Color: White.

- E. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following, or equal:
 - a. Design Polymerics.
 - b. Childers Brand; H. B. Fuller Construction Products.
 - c. Foster Brand; H. B. Fuller Construction Products.
 - d. Knauf Insulation.
 - 2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
 - 3. Service Temperature Range: 0 to plus 180 deg F.
 - 4. Color: White.

2.10 TEMPERATURE CONTROL SYSTEM

- A. Refer to Section 23 09 23, Direct Digital Control System for HVAC.

PART 3 - EXECUTION

3.01 ROOF MOUNTED EQUIPMENT INSTALLATION

- A. Mount and anchor equipment in strict compliance with Drawings details. Alternate anchorage methods will not be considered for roof mounted equipment.
- B. Examine rough-in for roof mounted equipment to verify actual locations of piping and duct connections prior to final equipment installation.
- C. Verify that piping to be installed adjacent to roof mounted equipment allows service and maintenance.
- D. Verify that gas piping will be installed with sufficient clearance for burner removal and service.
- E. Install ducts to termination at top of roof curb and install heavy duty rubber gaskets on supply and return openings and on full perimeter of curb, or as required for an airtight installation, prior to setting unit on curb.
- F. Cover roof inside each roof mounted air conditioning unit, heat pump unit, and heating and ventilating unit roof curb with 2 inch thick, 3 pound density fiberglass insulation board.
- G. Connect supply and return air ducts to horizontal discharge roof mounted equipment with flexible duct connectors. Provide G 90 galvanized steel weather hood over flexible connections exposed to the weather. Weather hood minimum gauge shall be per PART 2 article, Ductwork, Table A.
- H. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.

3.02 FAN INSTALLATION

- A. Ceiling Mounted Fans: Mount variable speed switch within fan housing. Mark final balance point on variable speed switch.

- B. Provide access doors for fans or motors mounted in ductwork.
- C. Mount all fans as detailed on Drawings and in compliance with CBC standards.
- D. Fan motors mounted in air-stream to be totally enclosed.
- E. Completely line supply, return or exhaust fan cabinets with 1 inch thick, 3/4 pound density acoustic insulation securely cemented in place.
- F. Roof fans shall be mounted level.
- G. Provide heavy-duty rubber gasket between exhaust fan mounting flange and roof curb, or as required for an airtight installation.
- H. Label fume hood fans with sign "CAUTION - HAZARDOUS EXHAUST."

3.03 RELIEF VENT INSTALLATION

- A. Install relief vents to provide a level mounting for backdraft damper.

3.04 AIR INLETS AND OUTLETS INSTALLATION

- A. Provide all air inlets and outlets with gaskets and install so that there will be no streaking of the walls or ceilings due to leakage. Duct connection to outlet on exposed duct shall be full size of outer perimeter of outlet flange.
- B. Unless otherwise indicated on Drawings, provide rectangular galvanized steel plenum on top of each diffuser and ceiling return for connection to ductwork. Line plenum with internal insulation as indicated for lined ductwork. Size plenum to allow full opening into air terminal. Plenum sheet metal gauge shall be equal to gauge for rectangular equivalent of the branch duct serving the air inlet or outlet.
- C. Ceiling-mounted air inlets, outlets, or other services installed in T-Bar type ceiling systems shall be positively attached to the ceiling suspension main runners or to cross runners with the same carrying capacity as the main runners.
 - 1. Air inlets, outlets, or other services weighing not more than 56 pounds shall have two No. 12 gauge hangers connected from the terminal or service to the structure above. These wires may be slack.
 - 2. Support air inlets, outlets, or other services weighing more than 56 pounds directly from the structure above by approved hangers. Provide 4 taut 12 gauge wires each, attached to the fixture and to the structure above. The 4 taut 12 gauge wires, including their attachment to the structure above must be capable of supporting 4 times the weight of the unit.
 - 3. Secure air inlets and outlets to main runners of ceiling suspension system with two No. 8 sheet metal screws at opposing corners.
- D. Furnish all air inlets and outlets with a baked prime coat unless otherwise noted. Provide off-white baked enamel finish on ceiling-mounted air inlets and outlets. Paint exposed mounting screws to match the material being secured.

- E. Air inlets and outlets shall match all qualities of these specified including appearance, throw, noise level, adjustability, etc.

3.05 DAMPER INSTALLATION

- A. All dampers automatically controlled by damper motors are specified under "Temperature Control System" except those specified with items of equipment.
- B. Provide opposed blade manual air dampers at each branch duct connection and at locations indicated on the drawings and where necessary to control air flow for balancing system. Provide an opposed blade balancing damper in each zone supply duct. Provide an access panel or Ventlok flush type damper regulator on ceiling or wall for each concealed damper.
- C. Install fusible link fire dampers full size of duct at points where shown or required.
- D. Provide 18 inch x 12 inch minimum hinged access doors in ductwork and furring for easy access to each fire damper; insulated access doors in insulated ducts. Label access doors with 1/2 inch high red letters.
 - 1. Provide Ventlok Series 100, Durodyne, or equal access doors with hardware for convenient access to all automatic dampers and other components of the system, insulated type in insulated ducts. Provide Ventlok #202 for light duty up to 2 inch thick doors, #260 heavy-duty up to 2 inch thick doors and #310 heavy-duty for greater than 2 inch thick doors. Provide #260 hinges on all hinged and personnel access doors; include gasketing.

3.06 PIPING INSTALLATION

- A. General:
 - 1. All piping shall be concealed unless shown or otherwise directed. Allow sufficient space for ceiling panel removal.
 - 2. Installation of piping shall be made with appropriate fittings. Bending of piping will not be accepted.
 - 3. Install piping to permit application of insulation and to allow valve servicing.
 - 4. Where piping or conduit is left exposed within a room, the same shall be run true to plumb, horizontal, or intended planes. Where possible, uniform margins are to be maintained between parallel lines and/or adjacent wall, floor, or ceiling surfaces.
 - 5. Horizontal runs of pipes and conduits suspended from ceilings shall provide for a maximum headroom clearance. The clearance shall not be less than 6'-6" without written approval from the Architect.
 - 6. Close ends of pipe immediately after installation. Leave closure in place until removal is necessary for completion of installation.
 - 7. Use reducing fittings; bushings shall not be allowed. Use eccentric reducing fittings wherever necessary to provide free drainage of lines and passage of air.
 - 8. Verify final equipment and fixture locations for roughing-in.
 - 9. Where piping is installed in walls within one inch of the face of stud, provide a 16 gauge sheet metal shield plate on the face of the stud. The shield plate shall extend a minimum of 1-1/2 inches beyond the outside diameter of the pipe.
 - 10. Each piping system shall be thoroughly flushed and proved clean before connection to equipment.

11. Install exposed polished or enameled connections with special care showing no tool marks or threads at fittings.
12. Service Markers: Mark the location of each plugged or capped pipe with a 4 inch round by 30 inch long concrete marker, set flush with finish grade. Provide 2-1/2 inch diameter engraved brass plate as part of monument marker.
13. Pipe the discharge of each relief valve, air vent, backflow preventer, and similar device to floor sink or drain.

B. Sleeves:

1. Install Adjus-to-Crete, Pipeline Seal and Insulator, or equal, pipe sleeves of sufficient size to allow for free motion of pipe, 24 gauge galvanized steel. The space between pipe and sleeves through floor slabs on ground, through outside walls above or below grade, through roof, and other locations as directed shall be caulked with oakum and mastic and made watertight. The space between pipe and sleeve and between sleeve and slab or wall shall be sealed watertight.
2. At Contractor's option, Link-Seal, Metraflex Metraseal, or equal, casing seals may be used in lieu of caulking. Wrap pipes through slabs on grade with 1 inch thick fiberglass insulation to completely isolate the pipe from the concrete.

C. Floor, Wall, and Ceiling Plates:

1. Fit all pipes with or without insulation passing through walls, floors, or ceilings, and all hanger rods penetrating finished ceilings with chrome-plated or stainless escutcheon plates.

D. Firestopping:

1. Pack the annular space between pipe sleeves and pipes penetrating floors and walls with UL listed fire stop, and sealed at the ends. All pipe penetrations shall be UL listed, Hilti, 3M Pro-Set, or equal.
 - a. Install fire caulking behind mechanical services installed within fire rated walls, to maintain continuous rating of wall construction.
2. Provide SpecSeal Systems UL fire rated sleeve/coupling penetrators for each pipe penetration or fixture opening passing through floors, walls, partitions or floor/ceiling assemblies. All Penetrators shall comply with UL Fire Resistance Directory (Latest Edition), and in accordance with CBC requirements.
3. Sleeve penetrators shall have a built in anchor ring for waterproofing and anchoring into concrete pours or use the special fit cored hole penetrator for cored holes.
4. Copper and steel piping shall have SpecSeal, or equal, plugs on both sides of the penetrator to reduce noise and to provide waterproofing.
5. Firestopping systems to be installed in strict accordance with manufacturer's instructions.
6. Alternate firestopping systems are acceptable if approved equal. However, any deviation from the above specification requires the Contractor to be responsible for determining the suitability of the proposed products and their intended use, and the Contractor shall assume all risks and liabilities whatsoever in connection therewith.

E. Flashing:

1. The work of this section shall include furnishing, layout, sizing, and coordination of penetrations required for the mechanical work.
2. Refer to Division 07 specifications and Drawings details as applicable.
3. Flashing for penetrations of metal or membrane roof for pipes shall be coordinated with the roofing manufacturer and roofing installer for the specific roofing type.
 - a. Furnish and install flashing and counterflashing in strict conformance with the requirements of the roofing manufacturer. Submit shop drawing details for review prior to installation.
 - b. Furnish and install counterflashing above each flashing required. Provide Stoneman, or equal, vandalproof top and flashing combination. Elmdor/Stoneman Model 1540.
4. Furnish and install flashing and counterflashing in strict conformance with the requirements of the roofing manufacturer. Submit shop drawing details for review prior to installation.

3.07 PIPE JOINTS AND CONNECTIONS

A. General:

1. Cutting: Cut pipe and tubing square, remove rough edges or burrs. Bevel plain ends of steel pipe.
2. Remove scale, slag, dirt and debris from inside and outside of pipe before assembly.
3. Boss or saddle type fittings or mechanically extracted tube joints will not be allowed.

B. Flexible Connections:

1. Furnish and install Thermo Tech., Inc. F/J/R, Metraflex, or equal, flexible couplings with limiter bolts on piping connections to all equipment mounted on anti-vibration bases, except fan coil units under 2000 cfm, on each connection to each base mounted pump and where shown. Couplings shall be suitable for pressure and type of service.
2. Anchor piping securely on the system side of each flexible connection.

3.08 HANGER AND SUPPORT INSTALLATION

- #### A. General: Support ductwork, equipment and piping so that it is firmly held in place by approved iron hangers and supports, and special hangers. Hanger and support components shall support weight of ductwork, equipment and pipe, fluid, and pipe insulation based on spacing between supports with minimum factor of safety of five based on ultimate strength of material used. Do not exceed manufacturer's load rating. Pipe attachments or hangers, of same size as pipe or tubing on which used, or nearest available. Rigidly fasten hose faucets, fixture stops, compressed air outlets, and similar items to the building construction. The Architect shall approve hanger material before installation. Where building structural members do not match piping and ductwork support spacing, provide "bridging" support members firmly attached to building structural members in a fashion approved by the structural engineer.

1. Materials, design, and type numbers for support of piping per Manufacturers' Standardization Society (MSS), Standard Practice (SP)-58.
 - a. Provide copper-plated or felt-lined hangers for use on uninsulated copper tubing.
2. Materials and design for ductwork support shall be per SMACNA "HVAC Duct Construction Standards, Metal and Flexible."

- B. Hanger components shall be provided by one manufacturer: B-Line, Grinnell, Unistrut, Badger, or equal.
- C. Riser clamps: B-line model B3373, or equal.
- D. Rubber Neoprene Pipe Isolators:
1. Pipe isolators shall comprise an internal rubber or neoprene material that isolates pipe from hanger and structure. Install at all piping located in acoustical walls. Refer to Architectural Drawings for location of acoustical walls.
 2. Isolation material shall be either a rubber or neoprene material that prevents contact between the pipe and the structure. The rubber shall have between a 45 to 55 durometer rating and a minimum thickness of 1/2 inch.
 3. Manufacturers:
 - a. Vertical runs: Acousto-Plumb or equal.
 - b. Horizontal runs: B-Line, Vibraclamp; Acousto-Plumb or equal.
- E. Pipe Hanger and Support Placement and Spacing:
1. Provide a support or hanger close to each change of direction of pipe either horizontal or vertical and as near as possible to concentrated loads.
 2. Vertical piping hanger and support spacing: Provide riser clamps for piping, above each floor, in contact with the floor. Provide support at joints, branches, and horizontal offsets. Provide additional support for vertical piping, spaced at or within the following maximum limits:

<u>Pipe Diameter</u>	<u>Steel Threaded or Welded (Note 3)</u>	<u>Copper Brazed or Soldered (Notes 3, 4)</u>	<u>CPVC & PVC (Note 2)</u>
1/2 - 1"	12 ft.	Each Floor, Not to Exceed 10 ft.	Base and Each Floor (Note 1)
1-1/4 - 2"	12 ft.	Each Floor, Not to Exceed 10 ft.	Base and Each Floor (Note 1)
2-1/2 - 3"	12 ft.	Each Floor, Not to Exceed 10 ft.	Base and Each Floor (Note 1)
Over 4"	12 ft.	Each Floor, Not to Exceed 10 ft.	Base and Each Floor (Note 1)

- a. Note 1: Provide mid-story guides.
- b. Note 2: For PVC piping, provide for expansion every 30 feet per IAPMO installation standard. For CPVC piping, provide for expansion per IAPMO installation standard.
- c. Note 3: Spacing of hangers and supports for piping assembled with mechanical joints shall be in accordance with standards acceptable to authorities having jurisdiction.
- d. Note 4: Includes refrigerant piping, including vapor and hot gas pipes.

3. Horizontal piping, hanger and support spacing: Locate hangers and supports at each change of direction, within one foot of elbow, and spaced at or within following maximum limits:

<u>Pipe Diameter</u>	<u>Steel Threaded or Welded (Note 2)</u>	<u>Copper Brazed or Soldered (Notes 2, 3)</u>	<u>CPVC & PVC (Note 1)</u>
1/2 - 1"	6 ft.	5 ft.	3 ft.
1-1/4 - 2"	7 ft.	6 ft.	4 ft.
2-1/2 - 3"	10 ft.	10 ft.	4 ft.
Over 4"	10 ft.	10 ft.	4 ft.

- a. Note 1: For PVC piping, provide for expansion every 30 feet per IAPMO installation standard. For CPVC piping, provide for expansion per IAPMO installation standard.
 - b. Note 2: Spacing of hangers and supports for piping assembled with mechanical joints shall be in accordance with standards acceptable to authorities having jurisdiction.
 - c. Note 3: Includes refrigerant piping, including vapor and hot gas pipes.
4. Suspended Piping:
- a. Individually suspended piping: B-Line B3690 J-Hanger or B3100 Clevis, complete with threaded rod, or equal. All hangers on supply and return piping handling heating hot water or steam shall have a swing connector at point of support.

<u>Pipe Size</u>	<u>Rod Size Diameter</u>
2" and Smaller	3/8"
2-1/2" to 3-1/2"	1/2"
4" to 5"	5/8"
6"	3/4"

- b. Suspend rods from concrete inserts with removable nuts where suspended from concrete decks. Power actuated inserts will not be allowed.
 - c. Trapeze Suspension: B-Line, or equal, 1-5/8 inch width channel in accordance with manufacturers' published load ratings. No deflection to exceed 1/180 of a span.
 - d. Trapeze Supporting Rods: Shall have a safety factor of five; securely anchor to building structure.
 - e. Pipe Clamps and Straps: B-Line B2000, B2400, or equal. Where used for seismic support systems, provide B-Line B2400 series, or equal, pipe straps.
5. Provide support for piping through roof, arranged to anchor piping solidly in place at the roof penetration.

F. Piping Support to Structure:

1. Wood Structure: Provide and install wood blocking as required to suit structure. Provide lag screws or through bolts with length to suit requirements, and with size (diameter) to match the size of hanger rods required.
 - a. Do not install Lag screws in tension without written review and acceptance by Structural Engineer.

Side Beam Angle Clip	B-Line B3062--MSS Type 34
Side Beam Angle Clip	B-Line B3060
Ceiling Flange	B-Line B3199

- b. Blocking for support of piping shall be not less than 2 inch thick for piping up to 2 inch size. Provide 3 inch blocking for piping up through 5 inch size, and 4 inch blocking for larger piping. Provide support for blocking in accordance with Structural Engineers requirements.
- c. Where lag screws are used, length of screw shall be 1/2 inch less than the wood blocking. Pre-drill starter holes for each lag screw.

3.09 INSULATION AND FIELD-APPLIED JACKET INSTALLATION

A. General:

1. The term "piping" used herein includes pipe, air separators, valves, strainers and fittings.
2. Clean thoroughly, test and have approved, all piping and equipment before installing insulation and/or covering.
3. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping, ductwork, and equipment.
4. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment as specified in insulation system schedules.
5. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
6. Install insulation with longitudinal seams at top and bottom of horizontal runs.
7. Install multiple layers of insulation with longitudinal and end seams staggered.
8. Keep insulation materials dry during application and finishing.
9. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
10. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
11. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.
12. For piping, ductwork, and equipment, with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.

13. Repair all damage to existing pipe, duct and equipment insulation whether or not caused during the work of this contract, to match existing adjacent insulation for thickness and finish, but conforming to flame spread and smoke ratings specified above.
14. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - a. Install insulation continuously through hangers and around anchor attachments.
 - b. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - c. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - d. Cover inserts with jacket material matching adjacent insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

3.10 TEMPERATURE CONTROL SYSTEM INSTALLATION

- A. Provide thermostats where indicated on drawings. All wiring shall be in conduit. Provide all relays, transformers and the like to render the control system complete and fully operable. All control conduit to be rigid steel type.

3.11 EQUIPMENT START-UP

- A. Initial start-up of the systems and pumps shall be under the direct supervision of the Contractor.
- B. Equipment start-up shall not be performed until the piping systems have been flushed and treated and the initial water flow balance has been completed.
- C. It shall be the responsibility of the Contractor to assemble and supervise a start-up team consisting of controls contractor, start-up technician, and test and balance contractor; all to work in concert to assure that the systems are started, balanced, and operate in accordance with the design.
- D. After start-up is complete, instruct the Owner's personnel in the operation and maintenance of the systems. Obtain from the Owner's representative a signed memo certifying that instruction has been received.
- E. For additional requirements, refer to article, Check, Test and Start Requirements, in Section 23 00 50, Basic HVAC Materials and Methods.

3.12 TESTING AND BALANCING

- A. For testing and balancing requirements, refer to Section 23 05 93, Testing and Balancing for HVAC.

3.13 CLEANING AND PROTECTION

- A. As each duct section is installed, clean interior of ductwork of dust and debris. Clean external surfaces of foreign substances that might cause corrosive deterioration of metal or where ductwork is to be painted.

- B. Temporary Closure: At ends of ducts that are not connected to equipment or air distribution devices at time of ductwork installation, provide temporary closure of polyethylene film or other covering that will prevent entrance of dust and debris until connections are to be completed.
- C. As each internally lined duct section is installed, check internal lining for small cuts, tears, or abrasions. Repair all damage with fire retardant adhesive.

3.14 EQUIPMENT MOUNTING

- A. Mount and anchor equipment in strict compliance with Drawings details. Alternate anchorage methods will not be considered for roof mounted equipment.

END OF SECTION