



City of Louisville

Internal Decarbonization Plan

HOWARD BERRY WATER TREATMENT PLANT DECARBONIZATION AUDIT REPORT

7000 MARSHALL ROAD
LOUISVILLE, COLORADO
AUGUST 18, 2023



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Date	Version History
5/12/2023	Version 1 - Issued for City Review and Input
8/18/2023	Version 2 - Issued to City

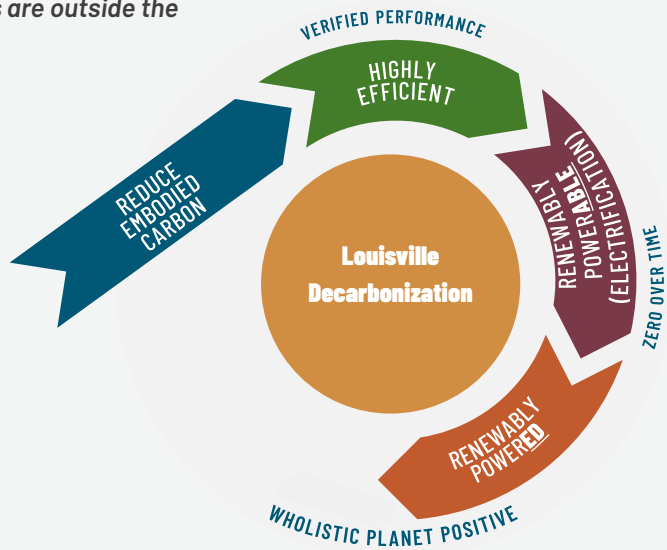
Background

In August of 2019, City Council passed Resolution 25, Series 2019, which set clean energy and carbon emission reduction goals for the municipality and larger community. This resolution sets goals to meet all of Louisville’s municipal electric needs with 100% carbon-free sources by 2025, and to reduce core municipal greenhouse gas emissions annually below the 2016 baseline through 2025. The City of Louisville has demonstrated its commitment toward creating a healthy and sustainable environment for its residents, evident through Resolution 25-2019 (Setting Clean Energy and Carbon Emission Reduction Goals), as well as their Sustainability Action Plan (adopted in October 6, 2020). In support of these goals, McKinstry was contracted to identify a strategic roadmap for electrification and decarbonization of all City buildings, fleet, equipment and operations* by 2030, and recommend an alternative target if appropriate.

This is an interim report, providing initial directions, findings, as well as a draft set of detailed decarbonization approaches for the Howard Berry Water Treatment Plant.

*Process water treatment energy, process wastewater energy, and street lighting/signals are outside the scope of this study.

There are many possible pathways for decarbonizing Louisville. With guidance from City staff, this report focuses on identification of strategies that provide the highest value, most fiscally responsible path forward to achieve Louisville’s decarbonization goals.



Decarbonization Recommendation

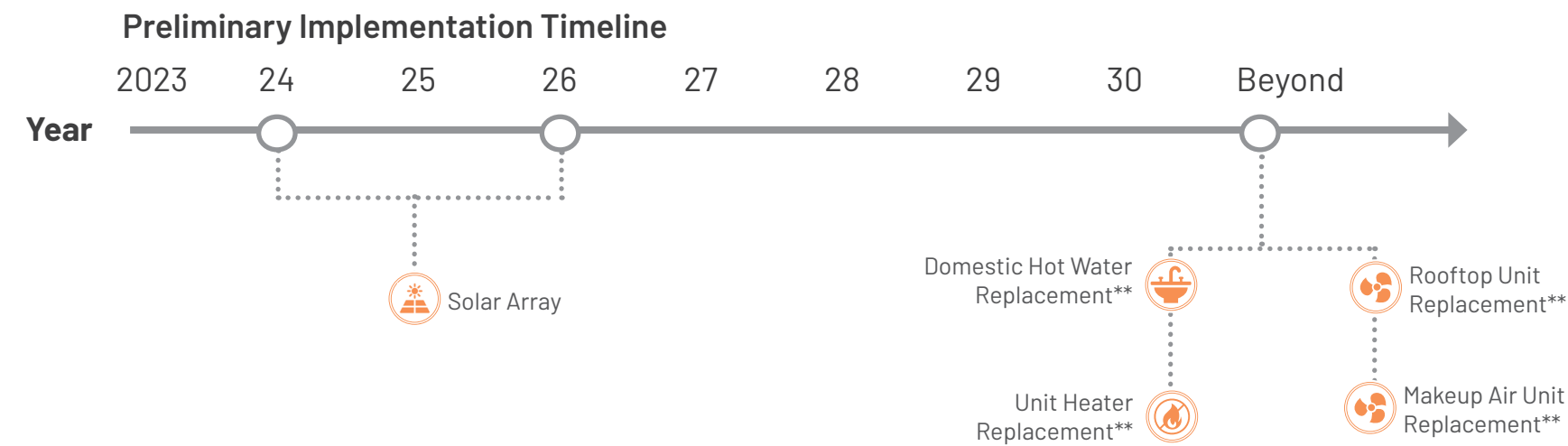
The table below outlines the findings of the study and highlights the opportunity towards a viable and cost-effective path towards carbon neutrality. The total cost is the total amount of money that will need to be allocated for budgetary purposes. The net cost is the total construction costs minus the replacement costs that would’ve been spent to replace the existing units with like-for-like fossil fuel units. The net cost represents the true cost of this decarbonization effort. All information included in this table is explained in greater detail in this report. **These are “all-in costs” and represent the total cost of construction. They are also Rough Order of Magnitude (ROM) numbers, with a +/-20% range.** See “Construction Pricing Context” section for more detail.

	Scenario	Life Cycle Carbon Reduced	Life Cycle Carbon % Reduction	Total First Cost	Net First Cost Over Business as Usual Cost
	Full Electrification	1,000 tons	100%	\$650k	\$250k
	Renewables	N/A	N/A	\$750k*	N/A
	EV Charging	N/A	N/A	N/A	N/A

*Renewable costs do not account for funding from the Inflation Reduction Act (IRA).

Implementation

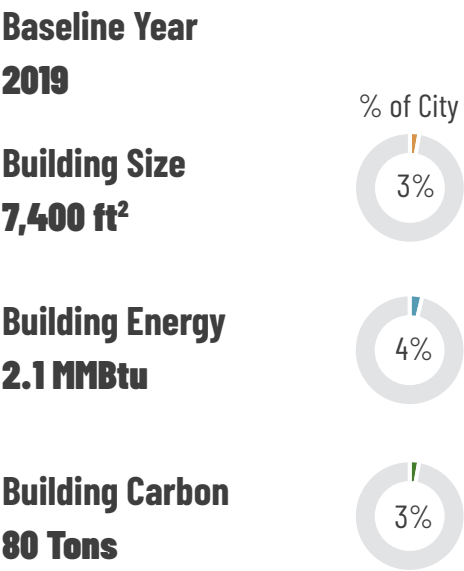
A preliminary implementation timeline is shown below, based on the 2023 Capital Improvement Plan (CIP).



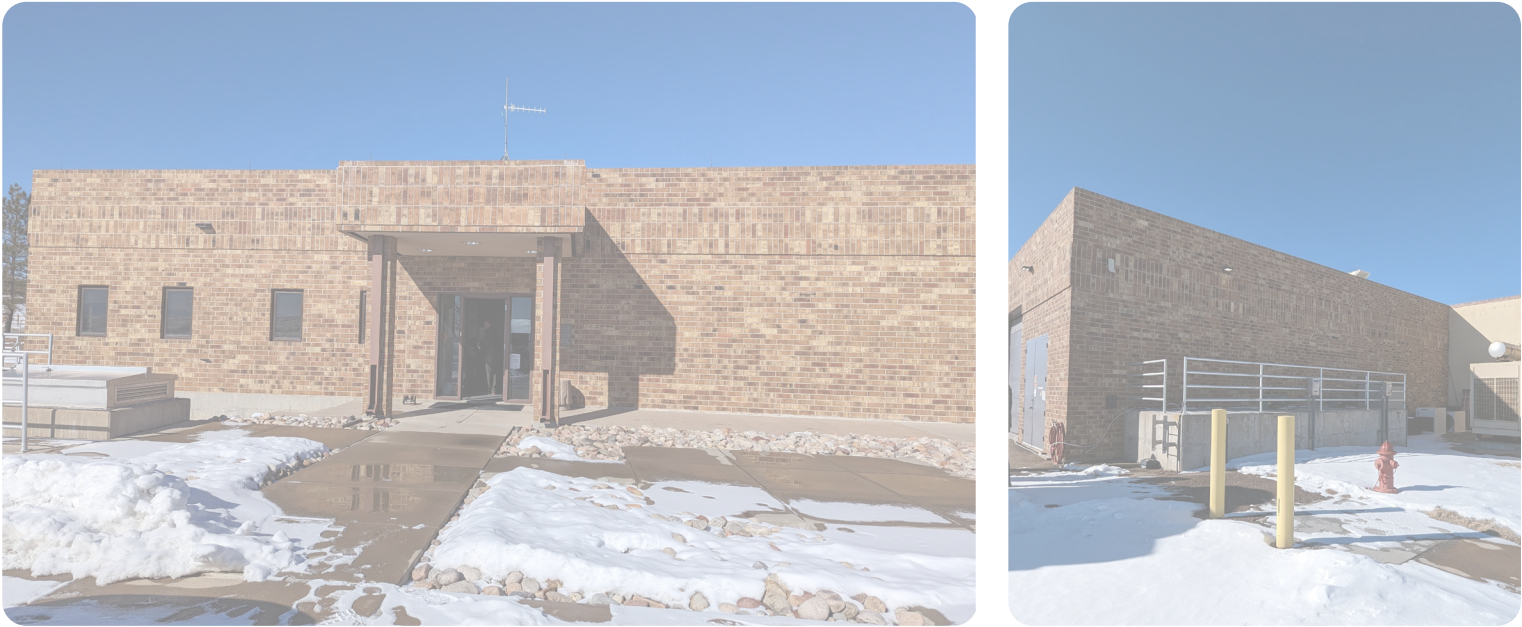
**Existing equipment was installed in 2015-2018. Replace at end-of-life.

Baseline | Building Use & Energy and Carbon Analysis

Baseline Building Use

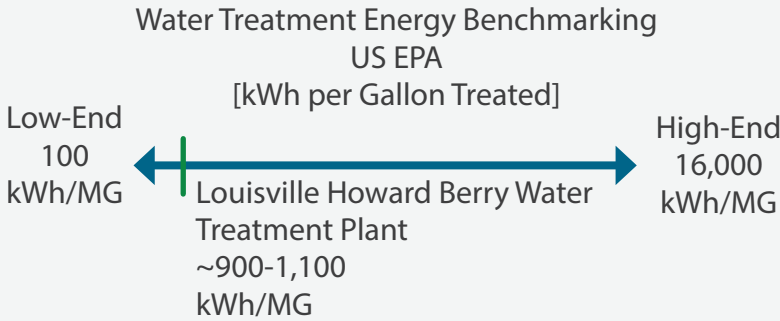


- Building Information
- Peaking and backup water treatment plant for Louisville.
 - Consists of 2 small support buildings.
 - The Administration and Dewatering Building have gas use. Other buildings utilize electric freeze protection.
 - Located at southern border of the city.
 - Not open to public.
- Recent Renovations and Energy Improvements
- To be determined.



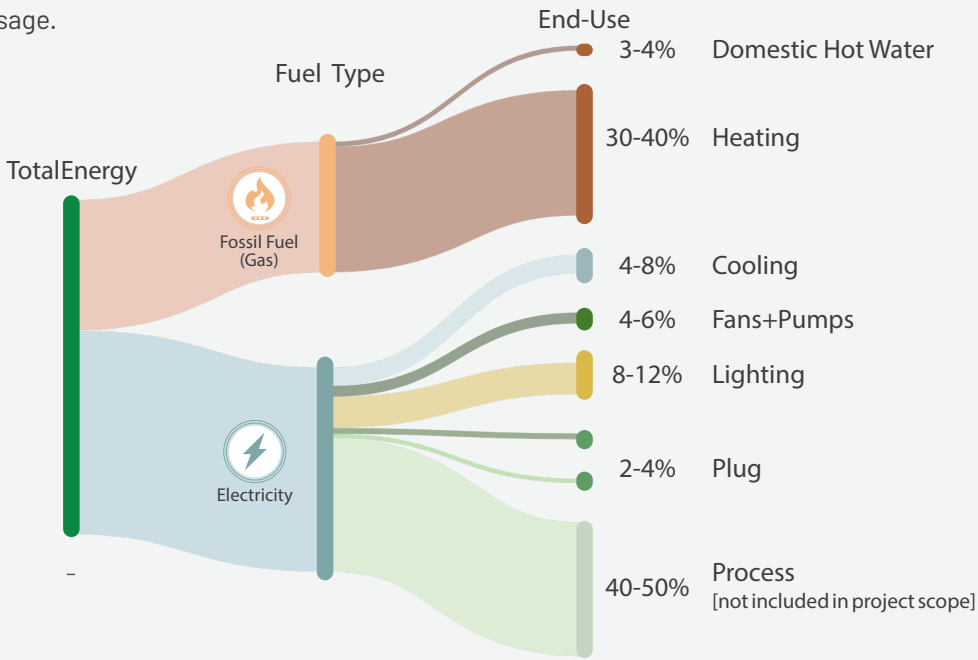
Baseline Energy Use

The Howard Berry Water Treatment Plant performs well when compared to the expected ranges of energy use for water treatment plants per the Energy Efficiency in Water and Wastewater Facilities report by the US Environmental Protection Agency (EPA). Note that performance for water/wastewater treatment plants can vary significantly by the specific treatment processes of each plant.



Baseline Energy End-Use

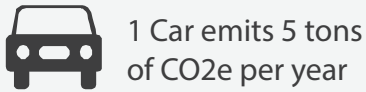
Energy end-use estimates are based on most recent available 2018 Commercial Building Energy Consumption Survey (CBECS) benchmarking data and site audit information. Pumping energy data for the site was provided but did not align with utility bill usage.



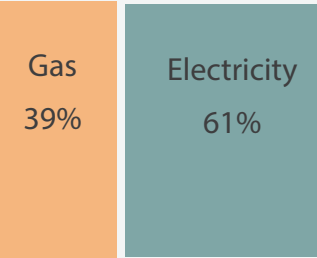
Baseline Carbon Use

The City of Louisville participates in programs to offset their existing electrical consumption with renewable sources. **Therefore, for the purposes of this study the total carbon emissions at Louisville will be solely driven by on-site fossil fuel combustion and emissions associated with electric consumption will be zero.**

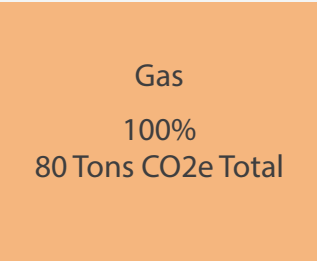
The amount of electric consumption offset needed for zero carbon will be addressed in future phases of this study, and will be evaluated at the portfolio level. The offset will be a function of post-decarbonization electrical consumption considering carbon and load reduction measures, on-site renewable energy provided, and the grid emissions of Xcel Energy and zero-carbon utility subscription programs.



Baseline Energy

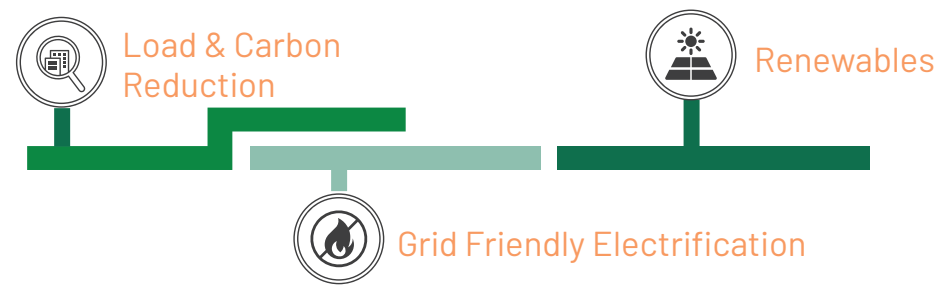


Baseline Carbon



Decarbonization Process

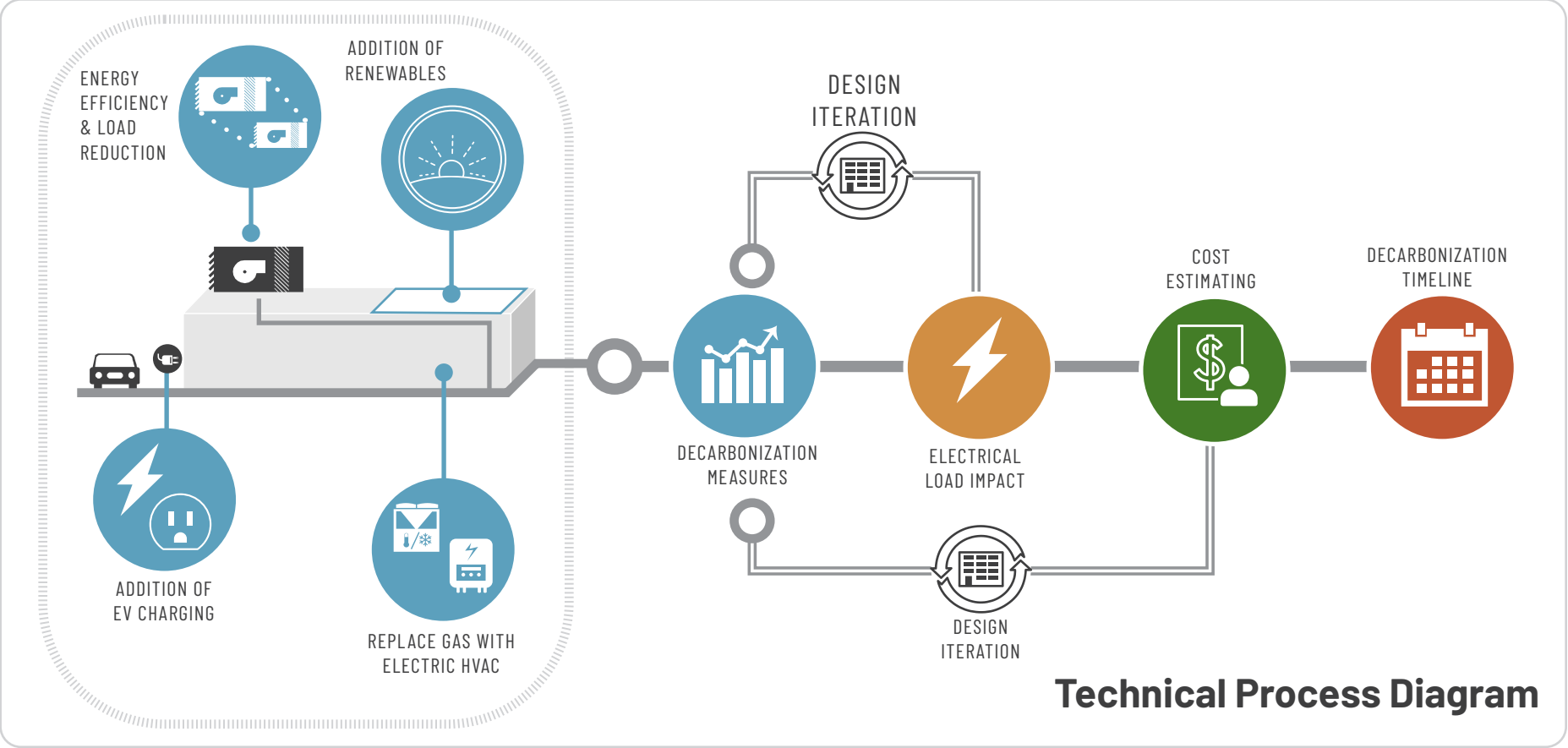
There are a host of measures to employ on the path of decarbonization, ranging from time-tested traditional energy efficiency measures to the more aggressive electrification measures. The key to decarbonization is finding the right balance between measures, as indicated by the graphic below. With this approach, Louisville will find the most cost-effective path to full decarbonization.



The decarbonization solution starts by identifying measures at the building, and continues with design iteration to arrive at the final timeline, as seen in the Technical Process Diagram.

Load & Carbon Reduction

The recent shift towards decarbonization still operates on the core foundation of reducing building’s overall energy use. Measures can have two functions: reducing annual energy/carbon consumption and reducing peak building demand load. These measures are often incentivized by Xcel and may have shorter paybacks. **Note that a large portion of the electrical load at the site is associated with treatment processes, which are outside the scope of this study.**

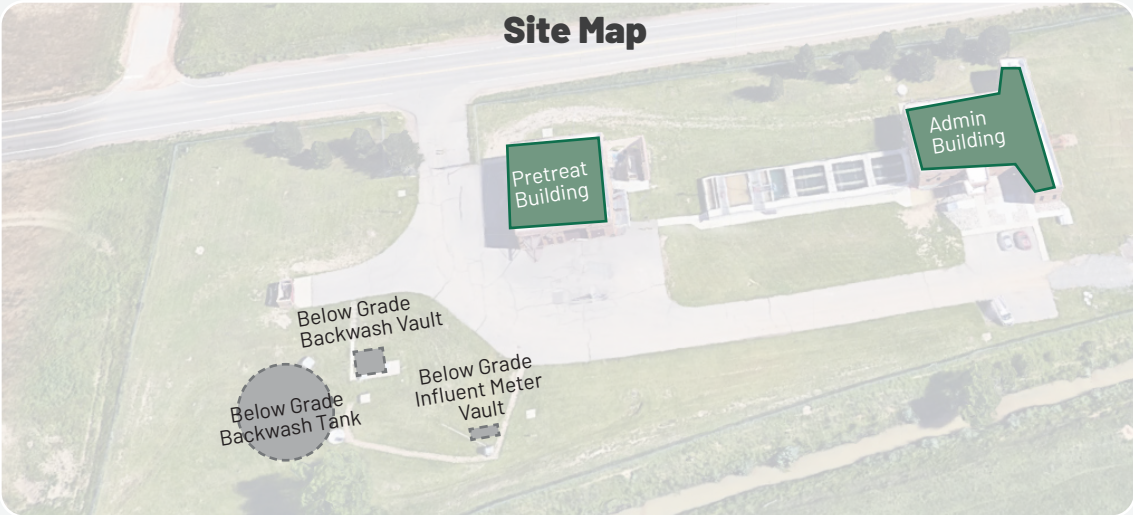


Load	Carbon	Measure	Description
■	■	ENVELOPE AIR SEALING	Buildings are often remarkably leaky – the wall/parapet junction being a frequent culprit. Ensuring a building is tight and ventilated right is an effective efficiency measure that also has durability benefits (condensation often occurs at air leakage points) and improves air quality (mold reduction and limiting outside air infiltration during wildfire events).
□	■	LIGHTING CONTROLS/VACANCY SENSORS	LED light replacements typically are the most cost effective way for saving electricity in the lighting arena, but adding lighting controls (which turn off lights with vacancy and vary based on available daylight) provide additional savings and better user experience (avoiding over-lighting).
■	■	LED LIGHTS	Complete the LED light upgrade that has already been started by the building maintenance group. Most of the building lighting has already been upgraded to LED but there is still about 5% of the light fixtures that could be upgraded. LED light replacement typically are the most cost effective way for saving electricity.

Decarbonization Measures | Mechanical Electrification

Proposed Electrification

The Howard Berry Water Treatment Plant facility has 2 buildings that contain gas-fired equipment: the Pretreatment building and the Admin building, shown in green on the site map below.



AIRSIDE

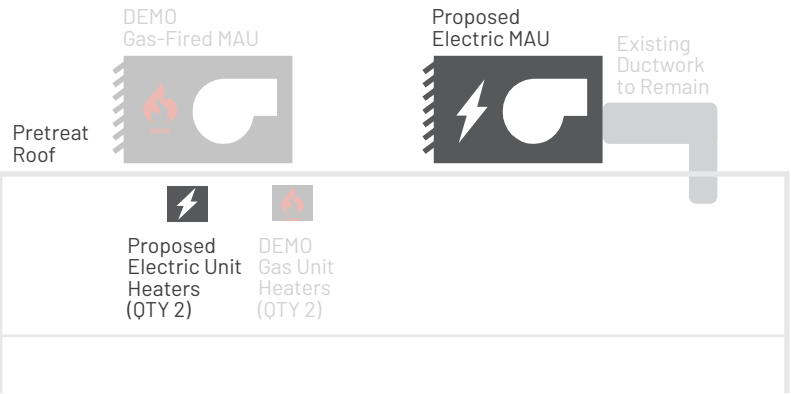
A gas-fired makeup air unit (MAU) provides ventilation to the Pretreatment Building. Additionally, 2 gas-fired unit heaters provide freeze protection. The purpose of these heaters is to avoid freezing temperatures for protection to the buildings and equipment, and not to provide full space heating. Typically these units run significantly less than space conditioning units. To fully electrify, the gas-fired MAU will be replaced with an electric MAU and the gas unit heaters will be replaced with electric unit heaters.

In the Admin building, HVAC is supplied via a packaged gas/refrigerant rooftop unit (RTU), which provides cooling via packaged refrigerant and heating via gas-fired burner. The decarbonized system will replace the RTU with a heat pump based RTU with electric resistance backup heat. Backup heat is utilized to supplement heat pump capacity when temperatures drop below the heat pump operating range. This is typically a small amount of time in the year and has minor energy impacts (described in results section).

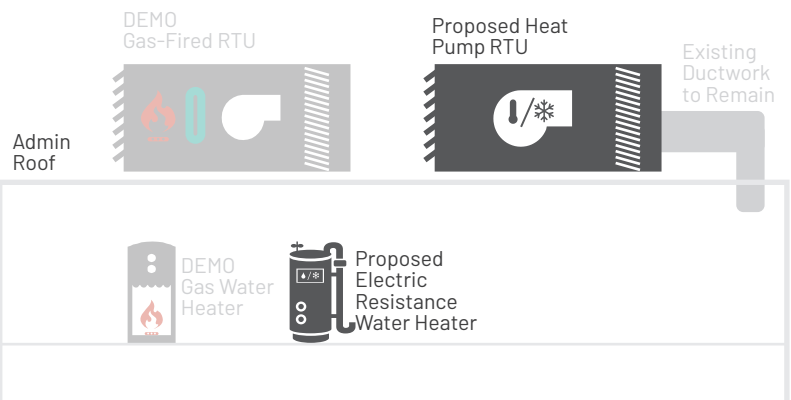
DOMESTIC HOT WATER

Domestic hot water (DHW) in the Pretreatment building is currently served by an electric resistance water heater, to remain as is. DHW in the Admin building is currently served by a gas-fired water heater, to be replaced with a new electric resistance water heater. A heat pump water heater was considered, but is not cost-effective since the domestic hot water load in this building is small.

Pretreatment Bldg Diagram



Admin Bldg Diagram



All Electric vs Hybrid Systems

Based on the sizes of the mechanical equipment and the load profile of the building, there is no need for a Hybrid option for the Howard Berry Water Treatment plant. All of the proposed electrification measures are within the available capacity of the existing electrical service and would not require an electrical service upgrade.

Beneficial Electrification

Electrification of mechanical systems provides value beyond energy and carbon savings. This includes, but is not limited to:

- Enhanced ventilation control (outside-air supply, CO₂ Control, etc.) with a new RTU
- Improved thermal comfort with right-sized RTU and updated controls
- Improved resiliency of newer units

Decarbonization Measures | Renewables & Electric Vehicle Chargers

Renewables

At the Howard Berry Water Treatment Plant (HBWTP), Louisville could install two solar arrays on the northwest and southwest corners of the site that would total to a ~200 kW-DC fixed-tilt ground mount solar PV system.

Renewable energy plays the important role of offsetting remaining carbon emissions after building load reductions and electrification are complete. This can be handled through a variety of avenues – behind-the-meter systems, Community Solar Gardens, and utility subscriptions. Since City of Louisville already offsets its current electricity with renewable utility subscriptions, we focused on customer-owned, behind-the-meter systems that would provide more value to the City of Louisville.

When evaluating this site, the following factors were considered:

AVAILABLE SPACE & RACKING MODALITY

Solar systems benefit from economies of scale – generally, the larger the system, the cheaper it is per kW. The first constraint on system size is the available space on the property. Since ground mounts are typically the least expensive racking modality, we evaluate this first. Water Treatment Plants are constructed with many buried water lines that reduces the land available for ground mounted solar. We

were able to locate 238.7kWdc of potential ground mounted arrays at this facility. Special considerations were taken in the placement of arrays due to their proximity to existing underground infrastructure and undulation of terrain.

SIMPLE PAYBACK

Payback is an easy way to determine the value of a solar system. Solar PV systems last around 25-30 years. McKinstry typically only recommends systems that – including Inflation Reduction Act credits, utility incentives, and/or other funding sources – will pay back within the system lifetime. At this stage of evaluation, simple payback is used. However, if the project advances, more detailed cash flows and paybacks can be calculated.

INTERCONNECTION METHOD & INCENTIVES

Due to size and value of utility savings, the HBWTP array would interconnect behind the utility meter and would qualify for Xcel’s Solar*Rewards C&I Tier 1. These arrays were not considered for Community Solar since those gardens must typically be much larger (500kW-AC+) to make financial sense. Additionally, this solar project would be eligible for the Inflation Reduction Act incentives, giving 25-30% of the solar cost back to City of Louisville depending on the chosen financing mechanism.

Further savings can be generated by transitioning from Utility Rate Secondary General (SG) to Utility Rate Secondary Photovoltaic Time of Use (SPVTOU).

ON-SITE VERSUS GRID PURCHASE

Some of the benefits of on-site solar vs renewables purchased from the grid are listed below.

- Avoid solar sprawl at scale - avoiding offsetting of impacts to rural areas
- Avoid electrical energy loss due to transmitting power over long distances
- Dispersed approach is typically grid beneficial, especially when on-site renewables are a small percentage of the total usage of building – most solar on this building would be self used
- Enable future resiliency through addition of batteries and storage
- Demonstrate decarbonization to local Louisville community
- Avoid electrical energy loss due to transmitting power over long distances
- Dispersed approach is typically grid beneficial, especially when on-site renewables are a small percentage of the total usage of building – most solar on this building would be self used

Electric Vehicle (EV) Chargers

EV FLEET CONVERSION

No fleet vehicles are currently stored at this site.

CHARGING INFRASTRUCTURE

EV charging is not recommended at this site since there are no fleet vehicles and there is limited public visitation.

Emergency chargers at the Howard Berry Water Treatment plant may be a viable option for emergency back-up charging based on electrical capacity. Depending on City preference, this could be evaluated further during the next stage of design.

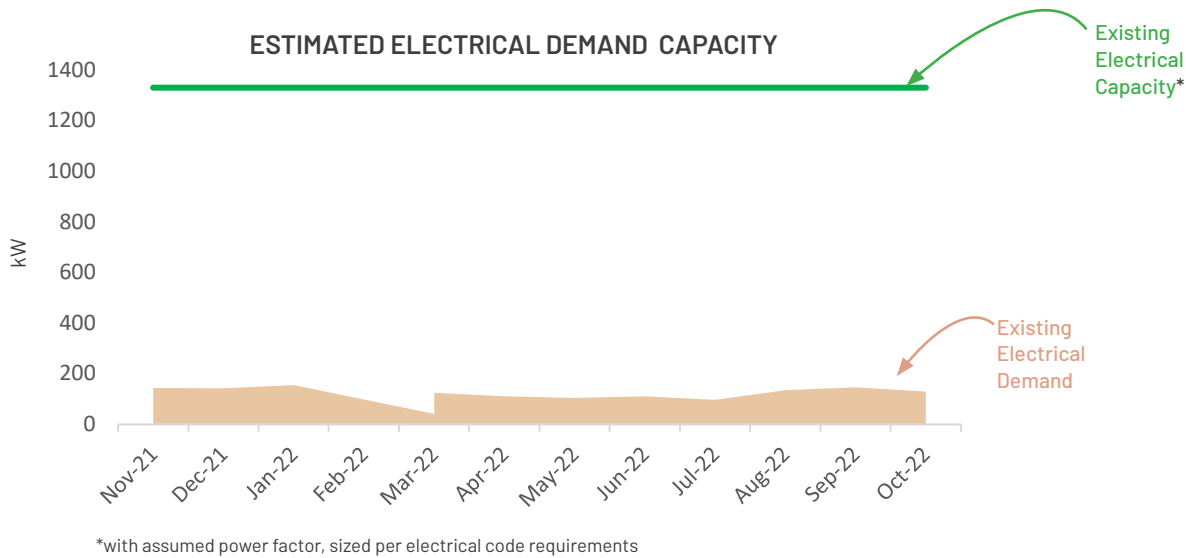


Decarbonization Measures | Electrical and Structural Impacts

Electrical Impacts

The existing service to the Howard Berry Water Treatment Plant is 480 Volts (V), 3 phase. There are some inconsistencies in the ratings of this equipment in the documentation provided, however photos and documents suggest the service is rated at 2500 Amps (A).

Utility data was analyzed for the date range 11/2021 – 10/2022. This data shows the existing annual maximum demand of the Howard Berry Water Treatment Plant is 155.1kW. Remaining service capacity available for electrification projects (building HVAC or EV) is approximately 2209A, equating to approximately 1,475kW of additional equipment.



Observed peak demand occurred in Winter. It should be noted that future changes in building occupancy or consumption patterns from the date range where data was provided may impact the service demand and available capacity for electrification.

Electrically, there is sufficient service and generator capacity (assuming a generator size of 450kW) to support the proposed HVAC electrification. The Administration building and Pretreatment building electrification efforts were priced separately, to allow the projects to be prioritized based on cost if desired.

ADMINISTRATION BUILDING ELECTRIFICATION

Consists of replacing the existing gas fired Roof Top Unit with a new packaged air source heat pump with 100% electric backup heat, as well as the replacement of the existing gas fired water heater with an electric heat pump water heater. This scope is achievable within the constraints of the electrical distribution system.

PRETREATMENT BUILDING ELECTRIFICATION

Consists of replacing the existing gas fired MAU with electric MAU and replacing existing gas fired unit heaters with electric resistance unit heaters. This scope requires a distribution upgrade (feeder and panel) to increase the capacity available at the pretreatment building.

Structural Impacts

ADMINISTRATION BUILDING

Rooftop RTU replacement is not anticipated to trigger a structural upgrade to underlying truss framing below the roof level. Replacement RTU to be configured with curb adapter and fastened to existing mechanical curb. Existing supply and return openings to be maintained.

The existing roof framing consists of bar joist or open web steel trusses supported by CMU bearing walls. Corrugated metal deck is configured and spans perpendicular to underlying truss framing. The existing supply and return openings under the unit are trimmed out and supported with secondary steel angle framing.

PRETREATMENT BUILDING

Rooftop MAU replacements is not anticipated to trigger a structural upgrade to underlying truss framing below the roof level. Replacement RTU to be configured with curb adapter and fastened to existing mechanical curb. Existing supply and return openings to be maintained.

The existing roof framing consists of bar joist or open web steel trusses supported by CMU bearing walls or girder truss framing spanning between structural steel columns. Corrugated metal deck is configured and spans perpendicular to underlying truss framing. The existing supply and return opening under the unit are trimmed out and supported with secondary steel angle framing.

Decarbonization Measures | Proposed Electrification

Electrification



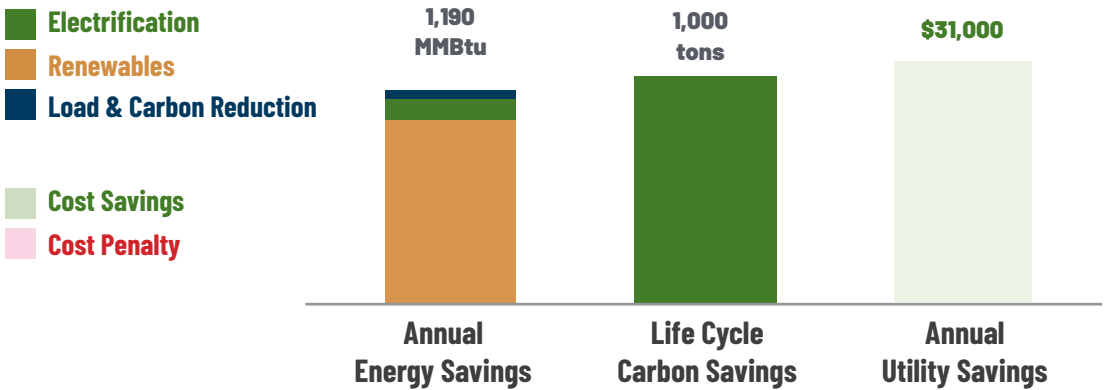
FULL ELECTRIFICATION – Full electrification at the Howard Berry Water Treatment Plant, including all-electric RTUs, MAUs, electric resistance unit heaters and domestic water heaters. EV charging costs are not included in this option. **This option does not require an electrical service upgrade.**

	Load & Carbon Reduction	Grid Friendly Electrification	Renewables
	Envelope Air Sealing Lighting Controls LED Upgrades	Electrification Full	On-Site Ground Mount PV
Total Cost	\$10k	\$650k	\$750k*
Base Cost	N/A	\$400k	N/A
Net Cost of Electrification	N/A	\$250k	N/A

*Renewable costs do not account for funding from the Inflation Reduction Act (IRA).

Proposed Annual Measure Savings

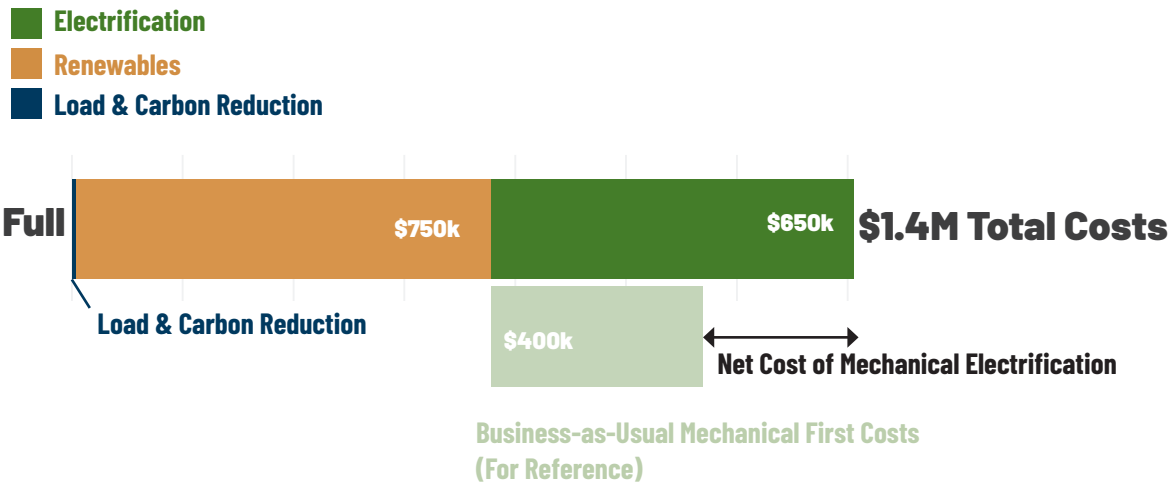
Energy, carbon, and utility cost savings for the full electrification project are shown here. Note that the majority of the energy and utility savings come from the renewable PV system and all of the carbon savings comes from the electrification measures.



Proposed Total Measure Costs

Proposed measure costs are shown below, including any structural and electrical upgrades needed for each option. They are also Rough Order of Magnitude (ROM) numbers, with a +/- 20% range.

The total cost is the total amount that will need to be allocated for budgetary purposes. The net cost represents the total cost minus the replacement cost that would've been spent to replace the existing units with like-for-like fossil fuel units.



Decarbonization Measures | Construction Pricing Context & Constructibility

Construction Pricing Context

The MEP scope narratives described in previous sections and included in the appendices were used by McKinstry’s construction division to provide Rough Order of Magnitude (ROM) pricing. This early ROM budgeting process sought to be reasonable but conservative wherever possible. **Typically for ROM-level pricing a range of +/- 20% is applied to the total construction and start up costs.** This range can be reduced, and the pricing further refined, via a deeper understanding of existing building conditions and detailed design. Note this does not account for escalation, which is addressed separately. This pricing represents the total construction and startup cost to Louisville, including:

- General contractor markup
- Design fees
- Engineering energy analysis
- Controls
- Equipment startup, commissioning, testing, and balancing
- Placeholders for miscellaneous trades (e.g. carpentry).
- Allowances specific to each building for construction conditions (e.g. crane time)

All construction costs are in 2023 dollars unless noted otherwise.

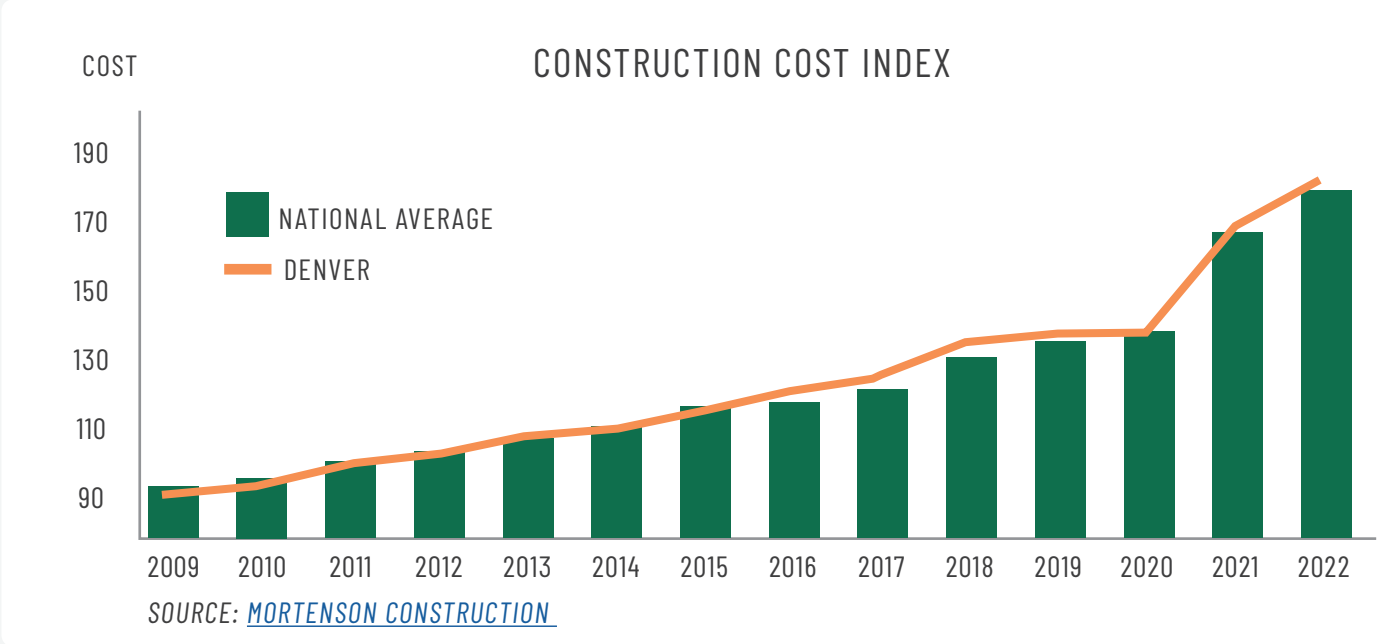
Using These Construction Costs

Throughout this report, differentiation is made between “total construction costs” and “net cost over business-as-usual fossil fuel systems”The distinction between the two is:

- Total costs: these are the total construction costs. This is the total amount of money that will need to be allocated for budgetary purposes.
- Net Cost: these are the total construction costs minus the replacement costs that would’ve been spent to replace the existing units with like-for-like fossil fuel units. These numbers represent the true cost of this decarbonization effort.

Note the numbers in the 2023 City Budget are budget numbers, and do not represent all costs for replacing the existing units. As such, they should not be used when determining the costs of decarbonization. In addition, the cost estimates in this report assume miscellaneous equipment (e.g. expansion tanks, domestic hot water storage tanks) need to be replaced. This assumption should be validated in detailed design, and could result in the total construction cost being lower if equipment can be reused.

As shown in the graph by the Mortenson, construction costs have been steadily rising since 2009. However, costs rose drastically from 2020 to 2022 (approximately 35%) due to global supply chain issues and unforeseen consequences of the COVID-19 pandemic.



Constructibility

Recent upheavals in the global supply chain and labor workforce have caused uncertainty in the construction market. Our construction teams are seeing the following trends as of March, 2023:

ELECTRICAL LEAD TIMES:

- Most commodity items, such as conduit, wire, fittings, etc. are readily available.
- Lead times for Switchboards are being quoted 50-80 weeks. Panel-boards can be 20-40 weeks depending on complexity.

MECHANICAL LEAD TIMES:

- Equipment needs to be ordered earlier in detailed design process to accommodate long lead times. Requires additional coordination earlier in design.

In order to combat these lead time challenges, design teams may need to be flexible with their specifications and the products/manufacturers they are selecting.

LABOR MARKET:

While we are seeing a general relaxing of labor shortages in other markets around the country, the contractor and labor shortages continue to persist in the Denver market.

Next Steps | Implementation

Implementation

A preliminary implementation timeline is shown below, based on the 2023 Capital Improvement Plan (CIP). Given the CIP replacement schedule, the Wastewater Treatment Plant will likely implement measures beyond 2030, at equipment end of life. The summary below is the implementation recommendation based on age of equipment as well as additional thoughts on emerging technologies and sequence of upgrades.

AIRSIDE

- As the Admin RTU reaches end of life, replace with all-electric heat pump alternatives. These replacements can be made over time as they will not trigger electrical or structural upgrades.
- As the Pretreatment MAU reaches end of life, replace with all-electric alternative. These replacements can be made over time as they will not trigger electrical or structural upgrades.

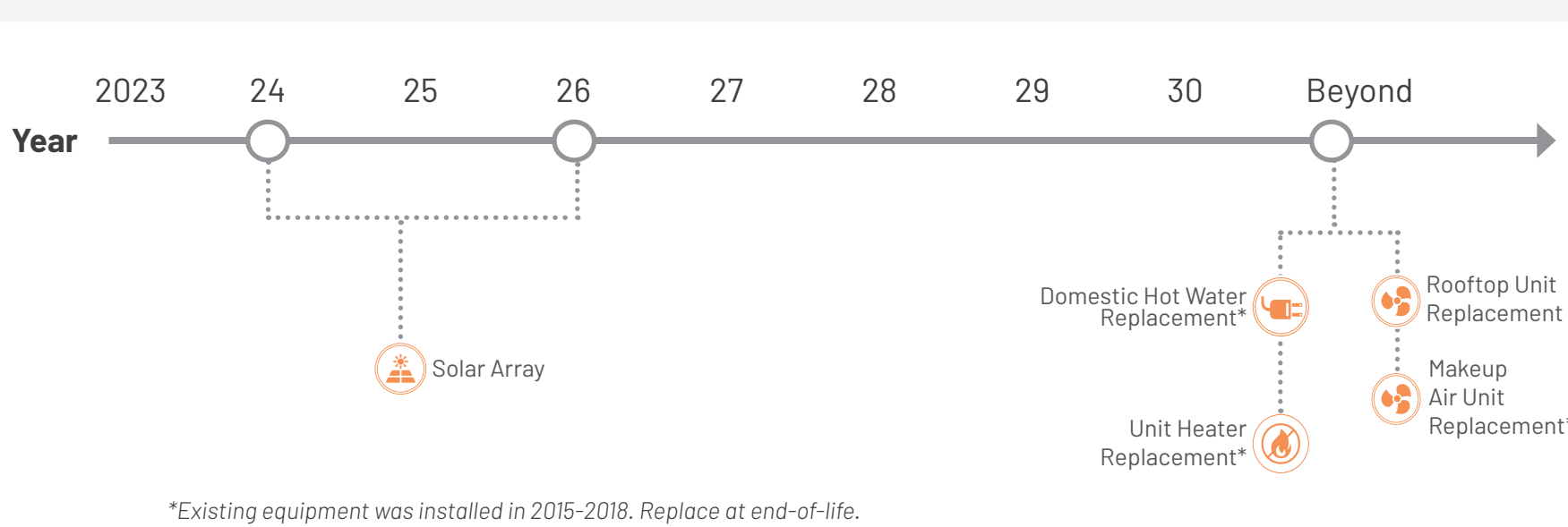
UNIT HEATERS

- As unit heaters reach end of life, replace with electric resistance options. These replacements can be made over time as they will not trigger electrical or structural upgrades.

RENEWABLES

- Install 200 kW ground-mounted PV system. (NW Array - 65 kWdc) (SW Array - 135 kWdc)

Preliminary Implementation Timeline





Appendix

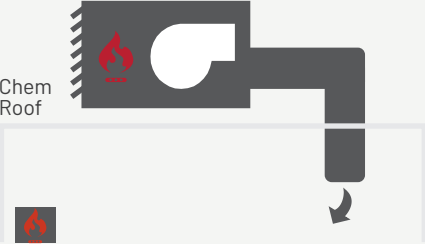
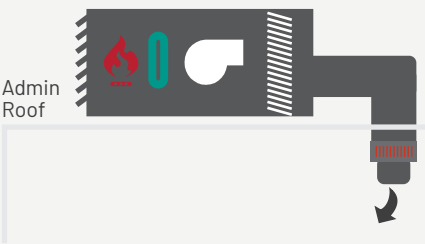
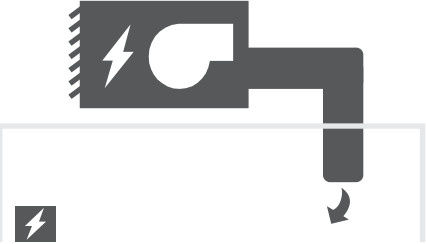
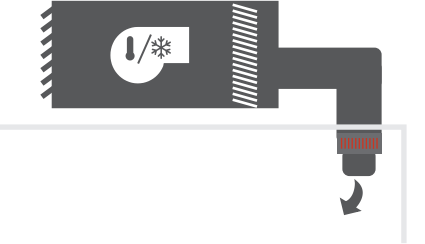
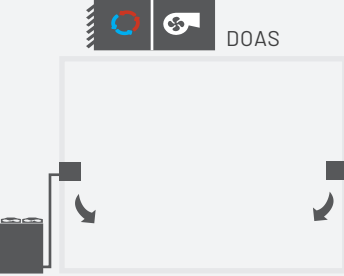
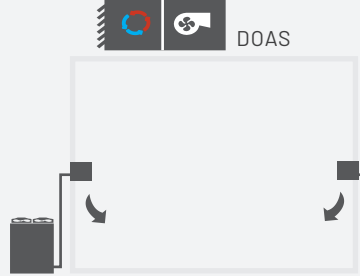
1. Mechanical System Matrix Options
2. Mechanical Decarbonization Scoping
3. Electrical Decarbonization Scoping
4. Structural Scoping
5. Electric Vehicle Charging Narrative
6. Renewables Scoping
7. Cost Estimating



Appendix

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6. Renewables Scoping
7. Cost Estimating

HVAC System Options Matrix: Howard Berry Water Treatment Plant

	Existing System: PRE-TREAT BLDG	Existing System: ADMIN BLDG	Recommendation: PRE-TREAT BLDG	Recommendation: ADMIN BLDG	High Performance Alternate: PRE-T	High Performance Alternate: ADMIN
General	Gas-Fired Makeup Air Unit & Gas Unit Heaters	Gas Rooftop Unit	Electric Makeup Air Unit & Electric Unit Heaters	Rooftop Heat Pump	DOAS with ACVRF throughout - full system replacement	DOAS with ACVRF throughout - full system replacement
						
Plant Equipment	None	None	None	None	Air-cooled VRF condenser farm located on roof	Air-cooled VRF condenser farm located on roof
	-	-	-	-	See Above	See Above
Water Heating	-	Gas Water Heater	-	Heat Pump Water Heater	-	Heat Pump Water Heater
Extent of Retrofit	-	-	Minimal Maintain existing ductwork, piping, and downstream equipment.	Minimal Maintain existing ductwork, piping, and downstream equipment.	Extensive. Remove existing VAV boxes and electric reheat coils. Reuse existing medium pressure ductwork for ventilation air.	Extensive. Remove existing VAV boxes and electric reheat coils. Reuse existing medium pressure ductwork for ventilation air.
Electrical Impacts	-	-	Minor Recommended measures fit within the existing electrical service.	Minor Recommended measures fit within the existing electrical service.	Minor Recommended measures fit within the existing electrical service.	Minor Recommended measures fit within the existing electrical service.
Limiting Factor	-	-	None	None	Cost Prohibitive Building is too small.	Cost Prohibitive Building is too small.
Verdict	-	-	Proceed w/ Detailed Scoping	Proceed w/ Detailed Scoping	Fast Fail	Fast Fail



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SWTP – Mechanical Scope Narratives

Chemical Building – Full Electrification

Demo Scope of Work:

- Includes removal and disposal of (1) indirect gas-fired make-up air unit, and (2) gas-fired unit heaters.
 - Assume cut, cap and make safe gas piping for each, MAU, and GUH
 - Includes demo of existing GUH flue ducts

New Scope of Work:

- Includes (1) new 130kW electric MAU.
 - Assumes existing ductwork and any sound attenuation to remain and be reused.
- Includes (1) new 60kW and (1) new 20kW EUHs.

Admin Building – Full Electrification

- Includes removal and disposal of (1) gas fired RTU with DX cooling.
 - Assume cut, cap, and make safe gas piping for each RTU.
- Includes removal and disposal of (1) gas-fired domestic water heater, (1) recirc pump, (1) expansion tank, and associated DHW piping.
 - Includes removal of existing flue and patch and seal of roof
 - Assumes flue is accessible for demo, excludes demo/reinstalling of any shaft walls.
 - Assumes cut, cap and make safe gas piping from gas DWH.
- New Scope of Work:
- Includes (1) new 4-ton air sourced heat pump RTU.
 - Includes new refrigerant piping.
 - Assumes existing ductwork and any sound attenuation to remain and be reused.
 - Assumes any condensate off RTUs may drain to existing roof receptors.
- Includes (1) new 120-gal heat pump water heater, (1) recirc pump, (1) expansion tank, and associated DHW piping.
 - Includes seismic support.

Mechanical General Inclusions, Clarifications, & Exclusions

- Includes allowance for crane/rigging
- Includes allowance for permits
- Includes allowance for carpentry
- Carrying Seattle labor rates
- Pricing in today's dollars
- Excludes temp HVAC and plumbing



- Excludes overtime work
- Excludes parking
- Excludes any new sound attenuation scope. Assumes ductwork and existing sound attenuation to remain.
- Excludes duct smoke detectors and wiring
- Excludes any heat tracing
- Excludes good faith survey
- Excludes demolishing gas distribution lines/piping back to meter
- Excludes condensate drain piping to roof drains. Assumes piping directly down onto roof.

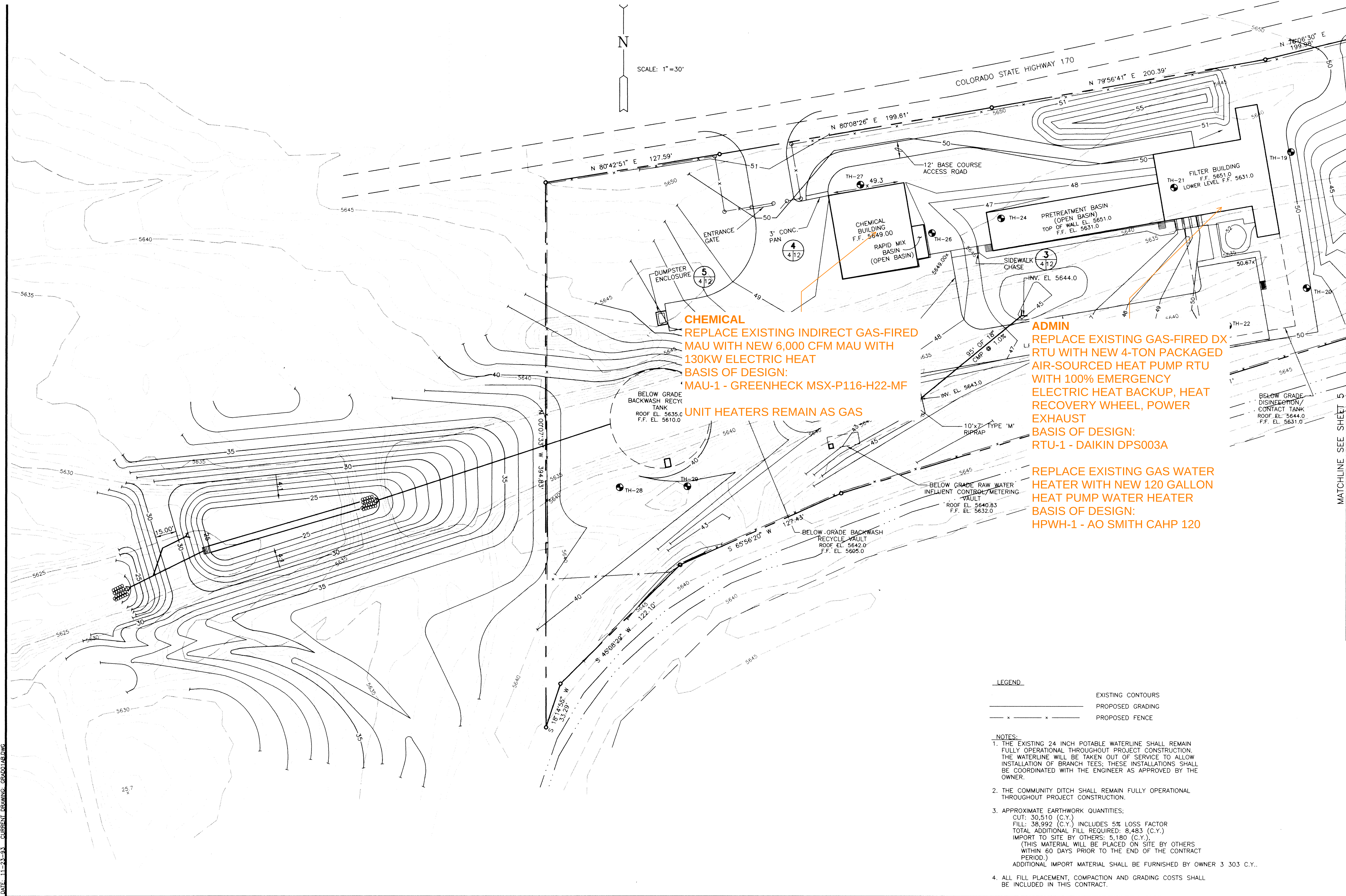
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JOB NO.
0058.051.05

SHEET
4 OF 103

LOUISVILLE HOWARD BERRY WATER TREATMENT PLANT - MECHANICAL PRICING DOCUMENT
OPTION 2 - UTILIZING THE EXISTING ELECTRICAL SERVICE



CHEMICAL
REPLACE EXISTING INDIRECT GAS-FIRED
MAU WITH NEW 6,000 CFM MAU WITH
130KW ELECTRIC HEAT
BASIS OF DESIGN:
MAU-1 - GREENHECK MSX-P116-H22-MF

UNIT HEATERS REMAIN AS GAS

ADMIN
REPLACE EXISTING GAS-FIRED DX
RTU WITH NEW 4-TON PACKAGED
AIR-SOURCED HEAT PUMP RTU
WITH 100% EMERGENCY
ELECTRIC HEAT BACKUP, HEAT
RECOVERY WHEEL, POWER
EXHAUST
BASIS OF DESIGN:
RTU-1 - DAIKIN DPS003A

REPLACE EXISTING GAS WATER
HEATER WITH NEW 120 GALLON
HEAT PUMP WATER HEATER
BASIS OF DESIGN:
HPWH-1 - AO SMITH CAHP 120

- LEGEND**
- EXISTING CONTOURS
 - PROPOSED GRADING
 - PROPOSED FENCE
- NOTES:**
- THE EXISTING 24 INCH POTABLE WATERLINE SHALL REMAIN FULLY OPERATIONAL THROUGHOUT PROJECT CONSTRUCTION. THE WATERLINE WILL BE TAKEN OUT OF SERVICE TO ALLOW INSTALLATION OF BRANCH TEES; THESE INSTALLATIONS SHALL BE COORDINATED WITH THE ENGINEER AS APPROVED BY THE OWNER.
 - THE COMMUNITY DITCH SHALL REMAIN FULLY OPERATIONAL THROUGHOUT PROJECT CONSTRUCTION.
 - APPROXIMATE EARTHWORK QUANTITIES:
CUT: 30,510 (C.Y.)
FILL: 38,992 (C.Y.) INCLUDES 5% LOSS FACTOR
TOTAL ADDITIONAL FILL REQUIRED: 8,483 (C.Y.)
IMPORT TO SITE BY OTHERS: 5,180 (C.Y.)
(THIS MATERIAL WILL BE PLACED ON SITE BY OTHERS WITHIN 60 DAYS PRIOR TO THE END OF THE CONTRACT PERIOD.)
ADDITIONAL IMPORT MATERIAL SHALL BE FURNISHED BY OWNER 3 303 C.Y..
 - ALL FILL PLACEMENT, COMPACTION AND GRADING COSTS SHALL BE INCLUDED IN THIS CONTRACT.

REVISIONS

NO.	DATE	BY
1	6/92	AMENDMENT

CITY OF LOUISVILLE, COLORADO

SOUTH WATER TREATMENT FACILITY

SITE GRADING PLAN AND SOIL BORING LOGS

DATE: JAN. 1992

DESIGNED BY: TJB

DRAWN BY: FY

CHECKED BY: MCK

JOB NO.

0058.051.05

SHEET

4 OF 103

ROCKY MOUNTAIN CONSULTANTS

8301 EAST PRENTICE AVENUE, SUITE 101

ENGLEWOOD, COLORADO 80111

(303) 741-6000

RMC



Appendix

1. Mechanical System Matrix Options
2. Mechanical Decarbonization Scoping
3. Electrical Decarbonization Scoping
4. Structural Scoping
5. Electric Vehicle Charging Narrative
6. Renewables Scoping
7. Cost Estimating

HBWTP – Electrical Scope Narratives

Full Electrification – Admin Building

- General:
 - Replacement of existing gas-fired dx RTU with new packaged air-sourced heat pump RTU with 100% emergency electric heat backup, heat recovery wheel, power exhaust
 - Replacement of existing gas water heater with new 120-gallon heat pump water heater.
- 30 Day Metering: Required for 400A Panel “PP4A”. Refer to drawings PDF page 13 of 19 (1992 drawing set sheet 94 of 103) for panel locations.
- Electrical Demo:
 - Demolish circuit powering existing RTU-1 (24A/480V/3 phase) wiring. Believed served from panel PP4A circuits 31, 33, 35 25A circuit breaker. Evaluate existing conduit for reuse.
 - Demolish circuit powering existing GWH-1 (120V single phase) wiring and conduit. Believed served from panel PP2B but not clearly identified on panel schedule.
- Electrical New Work:
 - Within panel PP4A, replace now spare (circuits 31, 33, 35, 25A) circuit breaker with new 35A/3P circuit breaker.
 - Install new 4#8, 1#10G branch circuit to location of new RTU air source heat pump located on roof (replacement for demolished RTU). Reuse existing conduit if in acceptable condition.
 - Within panel PP4A, consolidate 2 of existing lighting circuits onto a single circuit to free up circuit 16. It is assumed that some LED upgrades have been performed, reducing the interior and exterior lighting load sufficiently to allow consolidation. The exact circuiting will be verified during the design phase.
 - Install new 2P 50A circuit breaker in circuit 16, 18 (480V) to supply new single-phase transformer (see below). Run 2#8, 1#10G to transformer.
 - Install new single phase 15kVA 480:208V power transformer on elevated equipment platform above panel (or at other field confirmed location)
 - Install new 80A enclosed circuit breaker or fused disconnect (may be integral to transformer). Install 1”-2#4, 1#8G (80A) secondary wiring from transformer to this OCPD. Perform N-G bond.
 - Install new 1”-2#4, 1#8G (80A) branch circuit to location of new HPWH-1 heat pump water heater (replacement for demolished gas water heater).

Full Electrification – Pre-Treatment Building

- General: Replacement of gas MAU with MAU with electric heat and gas unit heaters with electric unit heaters. Requires electrical upgrades, including:
 - Replacement of existing 225A feeder to admin building with a new 400A feeder
 - Replacement of existing 400A MLO PP4C section 1 with new 400A MCB panel (to comply with NEC requirements for disconnecting means).
- 30 Day Metering: Required for 400A Panel PP4C (section 1 & 2). Refer to drawings for location.
- Electrical Demo:



- Demolish existing 250A/3P circuit breaker in existing Siemens series 6 switchboard MDP. (Admin building). Refer new work one-line sketch on drawing sheet E-104.
- Demolish existing 250A feeder from MDP (Admin building) to PP4C section 1 (Pre-Treatment building). Retain existing 4" (per drawings) conduit for reuse.
- Demolish existing PP4C Section 1. Retain conduit and wire of existing circuits for reuse.
- Demolish circuit powering existing MAU and conduit. Believed served from panel PP4C.
- Demolish circuit powering existing Reznor GUH1 and conduit. Believed served from panel PP2D.
- Demolish circuit powering existing Reznor GUH2 and conduit. Believed served from panel PP2D.
- Electrical New Work:
 - Distribution Upgrade:
 - Install new 400A circuit breaker in existing Siemens series 6 switchboard MDP. Refer new work one-line sketch on drawing sheet E-104.
 - Install new 400A MCB distribution panelboard PP4C Section 1. Refer drawing sheet "96 of 103" for location and new work one-line sketch on drawing sheet E-104. Panel shall contain:
 - (1) 40A/3P
 - (8) 20A/3P
 - (3) 20A/1P
 - (2) spare 3P breakers, assorted sizes.
 - Feed through lugs
 - 1x 175A/3P sub feed breaker (if not possible within the lineup, this may be taken as a feeder tap from the sub-feed lugs.
 - Install 400/4 feeder from MDP to new 400A MCB distribution panelboard PP4C Section 1 in existing 4" conduit.
 - Install new 400/4 feeder from New PP4C Section 1 to existing PP4C section 2 (adjacent)
 - MAU & Electric Unit Heater Feeders
 - Install new 2"-4#2/0, 1#6G branch circuit from PP4C section 1 175A circuit breaker to location of new MAU located on roof (replacement for demolished MAU).
 - Within panel PP4C Section 2 replace existing spare circuit breaker with new 100A/3P circuit breaker. Install new 1 1/2"-3#2, 1#8G branch circuit to location of new electric unit heater EUH-1 (replacement for demolished gas unit heater).
 - Within panel PP4C Section 2 replace existing spare circuit breaker with new 35A/3P circuit breaker. Install new 3/4"-3#8, 1#10G branch circuit to location of new electric unit heater EUH-1 (replacement for demolished gas unit heater). Reuse existing conduit if in acceptable condition.

Electrical Exclusions

- Applicable sales, use and B&O tax
- Performance and Payment Bonds
- Utility company charges.
- Refurbishing existing lighting (cleaning, re-lamping, re-trimming, repair, restoration).



- Roof and building envelope penetrations, waterproofing.
- Moving, placing and (re)-calibrating owner equipment.
- Mechanical and plumbing control devices, including wiring, conduit, and components.
- Correcting existing code violations
- Hidden conditions.
- Removing, re-installing and replacing ceiling tiles.
- Opening and repairing walls and ceilings for electrical work.
- Patching and painting.
- Access panels.
- Temporary power and lighting
- Handling hazardous material including but not limited to asbestos, lead and PCB's.
- Overtime and shift premiums.
- Work stoppages, hindrances, multiple trim passes and out-of-sequence installation.
- Electrical engineering, calculations, drawings, peer review services.
- Structural and Seismic Engineering
- Material cost escalation.
- Plywood and specialty backing.
- Low voltage systems (telecom, CCTV, access control, audio visual, etc.).
- Any work not specifically included in this proposal.
- No thermostat relocations are included

CITY OF LOUISVILLE, COLORADO

SOUTH WATER TREATMENT FACILITY

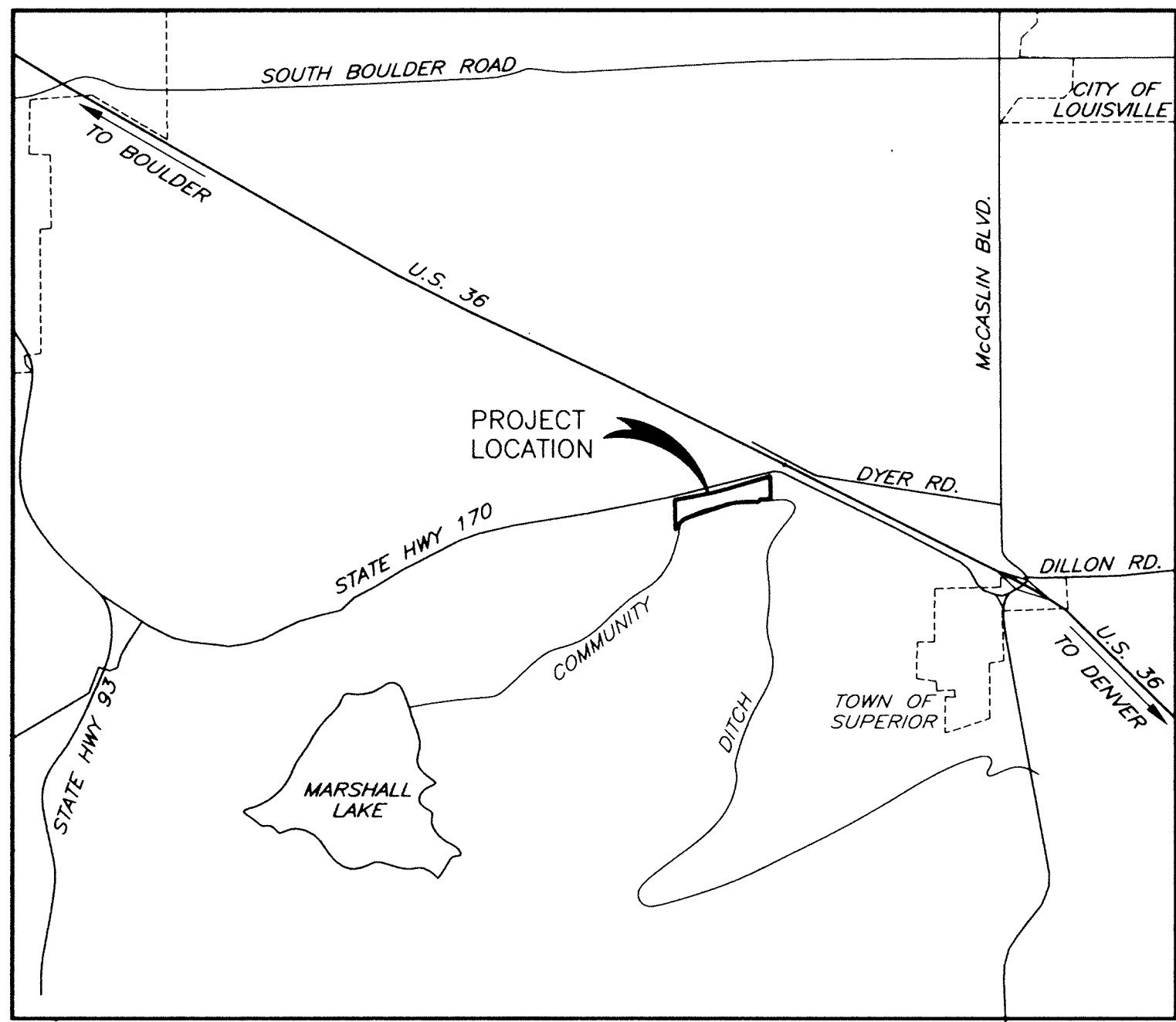
CITY OF LOUISVILLE, COLORADO

749 MAIN STREET

LOUISVILLE, COLORADO 80027

PHONE: (303) 666-6565

SHEET INDEX



VICINITY MAP

NO SCALE

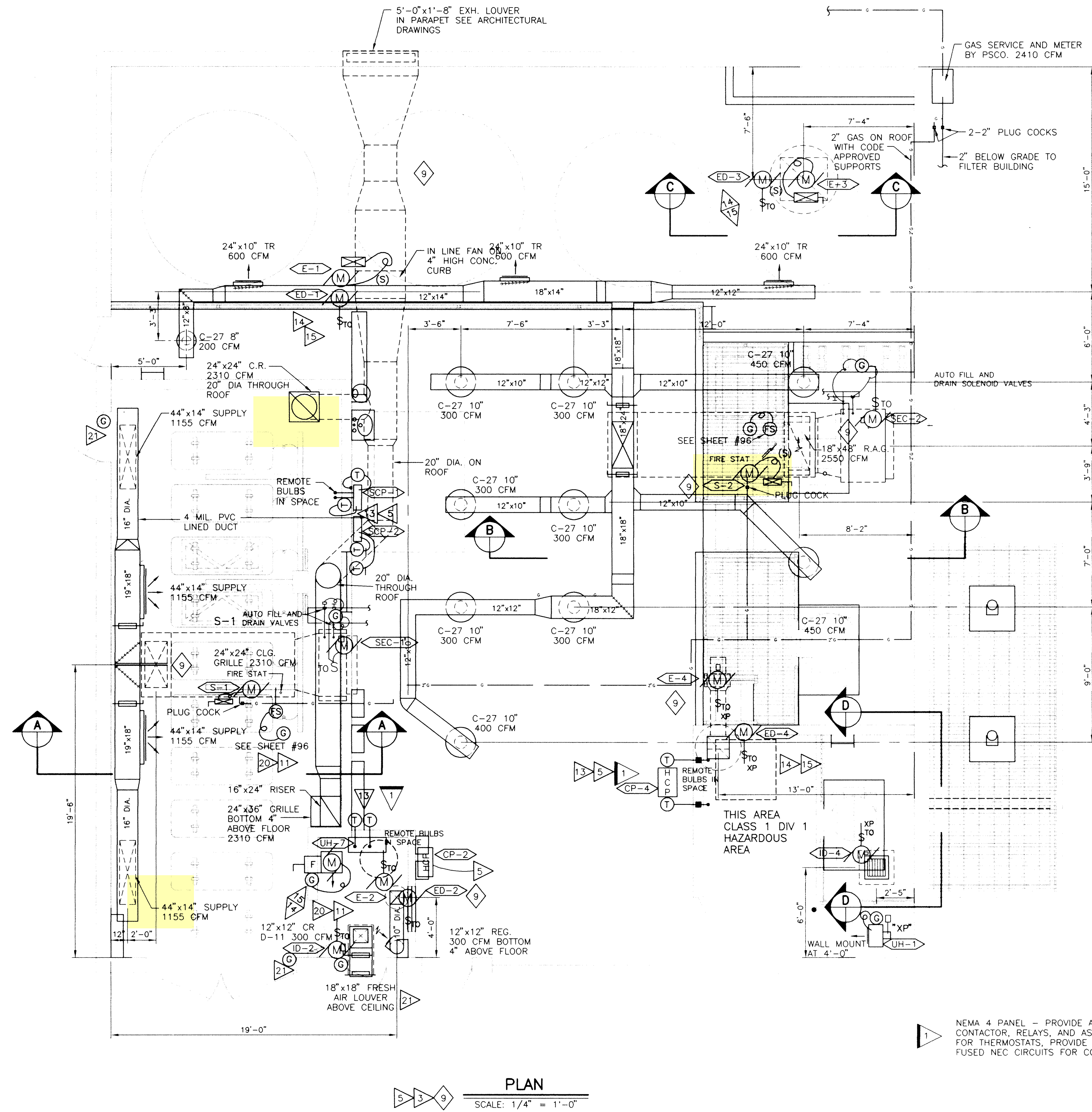
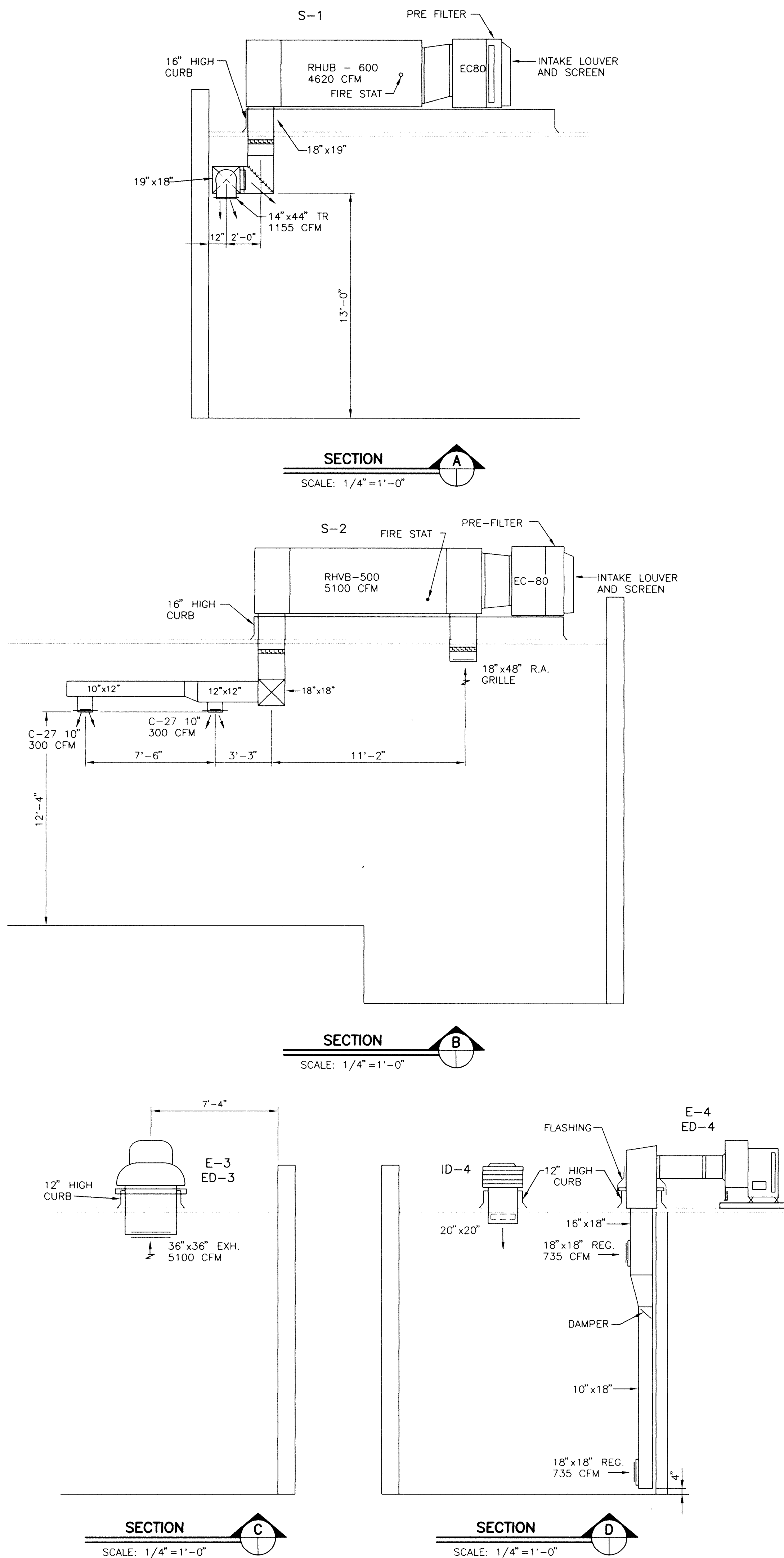
1	COVER SHEET	54	FILTER BUILDING PIPE CHASE COVER PLAN AND DETAILS
2	HYDRAULIC GRADIENT SCHEMATIC	55	FILTER BUILDING LOWER LEVEL BRIDGE CRANE AND DETAILS
3	SITE GEOMETRIC CONTROL	56	FILTER BUILDING UPPER LEVEL FLOOR STRUCTURAL PLAN
4	SITE GRADING PLAN AND SOIL BORING LOGS	57	FILTER BUILDING STRUCTURAL DETAILS
5	SITE GRADING PLAN AND SOIL BORING LOGS	58	FILTER BUILDING UPPER LEVEL FLOOR PENETRATION PLAN
6	SITE PIPING PLAN	59	FILTER BUILDING ROOF FRAMING PLAN AND DETAILS
7	SITE PIPING PLAN	60	FILTER BUILDING STRUCTURAL DETAILS
8	SITE PIPING PLAN	61	DISINFECTION/CONTACT TANK FLOOR PLAN
9	SITE PIPING DETAILS	62	DISINFECTION/CONTACT TANK STRUCTURAL FLOOR PLAN & DETAILS
10	SITE PIPING DETAILS	63	DISINFECTION/CONTACT TANK WALL REINFORCING PLAN & DETAILS
11	SITE LANDSCAPING PLAN	64	DISINFECTION/CONTACT TANK STRUCTURAL ROOF PLAN & DETAILS
12	SITE DETAILS	65	BACKWASH RECYCLE TANK AND VAULT PLANS AND SECTION
13	INFLUENT CONTROL AND METERING VAULT PLAN AND SECTIONS	66	BACKWASH RECYCLE VAULT SECTIONS
14	INFLUENT CONTROL AND METERING VAULT STRUCTURAL PLAN AND SECTIONS	67	BACKWASH RECYCLE TANK STRUCTURAL FLOOR PLAN AND DETAILS
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33	PRETREATMENT BASIN UPPER STRUCTURAL PLAN AND DETAILS	86	ELECTRICAL EQUIPMENT SCHEDULE
34	FILTER BUILDING EXTERIOR ELEVATIONS	87	ELECTRICAL EQUIPMENT SCHEDULE
35	FILTER BUILDING UPPER LEVEL FLOOR PLAN	88	ELECTRICAL EQUIPMENT SCHEDULE
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37	FILTER BUILDING LOWER LEVEL SECTION	90	POWER DISTRIBUTION ONE LINE DIAGRAM
38	LOWER LEVEL FILTER BACKWASH AND SURFACE WASH PUMPS AND PIPING	91	MOTOR CONTROL CENTER ONE LINE DIAGRAM
39	LOWER LEVEL HIGH ZONE BOOSTER PUMPS AND PIPING	92	SITE ELECTRICAL PLAN
40	LOWER LEVEL HIGH ZONE, BACKWASH INFLUENT AND PRETREATED WATER PIPING SECTIONS	93	FILTER BUILDING UPPER LEVEL LIGHTING AND RECEPTACLE PLAN
41	LOWER LEVEL AIR BLOWERS AND PIPING SECTIONS	94	FILTER BUILDING UPPER LEVEL ELECTRICAL PROCESS AND LIGHTING PLAN
42	LOWER LEVEL PIPE CHASE PLAN AND SECTIONS	95	FILTER BUILDING LOWER LEVEL ELECTRICAL PROCESS & LIGHTING PLAN
43	FILTER PIPE GALLERY SCHEMATIC AND SECTIONS	96	CHEMICAL FEED BUILDING ELECTRICAL PROCESS AND LIGHTING PLAN
44	FILTER PIPE GALLERY SECTION AND WALL PENETRATIONS	97	INFLUENT METERING/CONTROL VAULT, PRETREATMENT BASIN AND BACKWASH RECYCLE VAULT ELECTRICAL PLANS
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52	FILTER BUILDING LOWER LEVEL STRUCTURAL FLOOR PLAN		
53	FILTER BUILDING STRUCTURAL DETAILS		

AS-BUILTS

NOTE TO OWNER:
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AS-BUILT DATE: NOVEMBER 1993

RMC ROCKY MOUNTAIN CONSULTANTS, INC.
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ENGLEWOOD, COLORADO 80111 (303) 741-6000
JOB NUMBER: 0058.051.05 SHEET 1 OF 103

DATE: 11-23-93 CURRENT DRAWING: HVAC04B.DWG



1 NEMA 4 PANEL - PROVIDE AND INSTALL CONTACTOR, RELAYS, AND ASSOCIATED WIRING FOR THERMOSTATS, PROVIDE TRANSFORMER AND FUSED NEC CIRCUITS FOR CONTROL POWER

ROCKY MOUNTAIN CONSULTANTS
8301 EAST PRENTICE AVENUE, SUITE 101
ENGLEWOOD, COLORADO 80111
(303) 741-6000

RMC

REVISIONS	DATE	BY
1	6/92	AMENDMENT

CITY OF LOUISVILLE, COLORADO
SOUTH WATER TREATMENT FACILITY
CHEMICAL FEED BUILDING HVAC AND ELECTRICAL

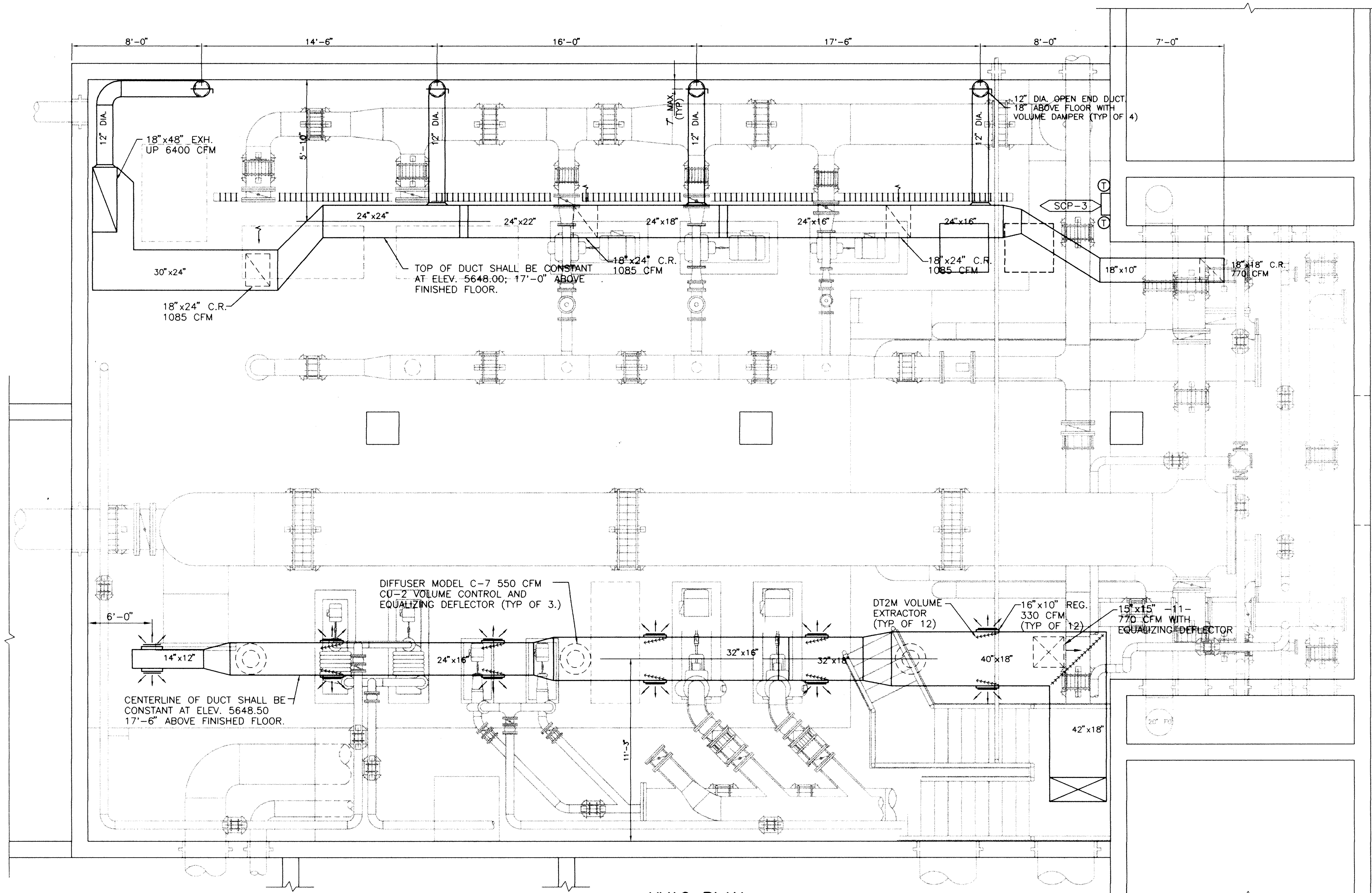
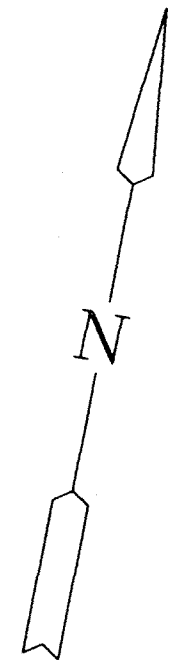
DATE: JAN. 1992
DESIGNED BY: B.M./J.G.P.
DRAWN BY: E.V.
CHECKED BY: M.C.K.

JOB NO.
0058.051.09

SHEET
82 OF 103



DATE: 11-23-93 CURRENT DRAWING: HVAC03AB.DWG



HVAC PLAN

SCALE: 1/4"=1'-0"

HVAC EQUIPMENT SCHEDULE

PLAN NO.	AREA SERVED	MANUFACTURER MODEL NO.	CFM	S.P. "WC. @ 5000 FT.	H.P. OR KVA	ELECTRICAL CHARACTERISTIC		BTU INPUT	EVAPORATIVE COOLER NO.	INTERLOCK WITH	REMARKS
						VOLTS	PHASE				
S-1	CHLORINE STORAGE	HASTINGS RHUB 600	4620	.5"	2HP 2SPD	480	3	600,000	EC 80	SCP-1,E-1,ED-1	FIRE STAT WITH UNIT 900/1800 RPM
SEC-1	CHLORINE STORAGE	-	-	-	1/6 HP	120	1	-	-	SCP-1,S-1,E-1,ED-1	-
SCP-1	CHLORINE STORAGE	-	-	-	120	1	1	-	-	S-1,E-1,ED-1	NEMA 4 PANEL WITH PILOTS, TRANSFORMER, RELAYS, TWO WCRT-100 (120V) WITH REMOTE BULB
S-2	CHEMICAL STORAGE	HASTINGS RHVB 500	5100	.75"	2HP 2SPD	480	3	500,000	EC 80	SCP-2,E-3,ED-3	FIRE STAT WITH UNIT
SEC-2	CHEMICAL STORAGE	-	-	-	1/6 HP	120	1	-	-	SCP-2,S-2,E-3,ED-3	-
SCP-2	CHEMICAL STORAGE	-	-	-	120	1	1	-	-	S-2,E-3,ED-3	NEMA 4 PANEL WITH PILOTS, TRANSFORMER, RELAYS, TWO WCRT-100 (120V)
S-3	FILTER BUILDING LOWER LEVEL	HASTINGS SBD 215	6400	.75"	3HP	480	3	575,000	EC120	SCP-3,E-6,ED-6	FIRE STAT WITH UNIT
SEC-3	FILTER BUILDING LOWER LEVEL	-	-	-	1/6 HP	120	1	-	-	SCP-3,S-3,E-6,ED-6	-
SCP-3	FILTER BUILDING LOWER LEVEL	-	-	-	120	1	1	-	-	S-3,E-6,ED-6	NEMA 4 PANEL WITH PILOTS, TRANSFORMER, RELAYS, TWO WCRT-100 (120V)
S-4	FILTER BUILDING UPPER LEVEL	LENNOX (TWINNED)	-	-	3/4 HP	208	1	200,000	-	SID-4	FIRE STAT WITH UNIT, THERMOSTAT RTC, INTERFACE TO ROOF MOUNT CONDENSOR
SID-4	FILTER BUILDING UPPER LEVEL	PENNHOUSE	-	-	1/10 HP	120	1	-	-	S-4	-
SCP-4	FILTER BUILDING UPPER LEVEL	-	-	-	-	-	-	-	-	-	-
E-1	CHLORINE STORAGE ROOM (EXHAUST)	PENN VENT REX-278	4620	1.5"	3HP 2SPD	480	3	-	-	SCP-1,S-1,ED-1	FAN SHALL HAVE COATING FOR USE IN CHLORINE ATMOSPHERE, INTERLOCK TO MANUAL DOOR AND WALL SWITCHES FOR HIGH SPEED, WCRT-100 (120V) AND REMOTE BULB, PROVIDE CONTROL RELAYS NEMA 4X PANEL
ED-1	CHLORINE STORAGE ROOM	-	-	-	1/10 HP	120	1	-	-	SCP-1,S-1,E-1	-
E-2	CHLORINE CONTROL ROOM (EXHAUST)	PENN VENT FMX9RL	300	.37"	1/10 HP	120	1	-	-	ED-2,ID-2	FAN SHALL HAVE COATING FOR USE IN CHLORINE ATMOSPHERE, INTERLOCK TO MANUAL DOOR AND WALL SWITCHES, WCRT-100 (120V) AND REMOTE BULB, PROVIDE CONTROL RELAYS (4X,JBOX)
ED-2	CHLORINE CONTROL ROOM	-	-	-	1/10 HP	120	1	-	-	E-2,ID-2	-
ID-2	CHLORINE CONTROL ROOM	-	-	-	1/10 HP	120	1	-	-	E-2,ED-2	-
E-3	CHEMICAL BUILDING (EXHAUST)	PENN VENT QB-36	5100	.5"	2HP 2SPD	480	3	-	-	SCP-2,S-2,ED-3	-
ED-3	CHEMICAL BUILDING	-	-	-	1/10 HP	120	1	-	-	SCP-2,S-2,E-3	-
E-4	POTASSIUM/CARBON ROOM (EXHAUST)	NEW YORK BLOWER 155	1470	.375"	1/3 HP	120	1	-	-	ED-4,ID-4	EXPLOSION PROOF RATED, PROVIDE NEMA 4 CONTROL PANEL, RELAYS, ETC. MOUNTED OUTSIDE OF SPACE, WCRT-100 (120V) AND REMOTE BULB
ED-4	POTASSIUM/CARBON ROOM	-	-	-	1/10 HP	120	1	-	-	E-4,ID-4	EXPLOSION PROOF RATED
ID-4	POTASSIUM/CARBON ROOM	-	-	-	1/10 HP	120	1	-	-	E-4,ED-4	EXPLOSION PROOF RATED
E-5	FILTER BUILDING ELECTRICAL ROOM (EXHAUST)	PENN VENT LB-24	1530	.375"	1/3 HP	120	1	-	-	ED-5,ID-5	PROVIDE CONTROL RELAY AND TRANSFORMER, NEMA 4, J-BOX, WCRT-100 (120V)
ED-5	FILTER BUILDING ELECTRICAL ROOM	-	-	-	1/10 HP	120	1	-	-	E-5,ID-5	-
ID-5	FILTER BUILDING ELECTRICAL ROOM	-	-	-	1/10 HP	120	1	-	-	E-5,ED-5	-
E-6	FILTER BUILDING LOWER LEVEL (EXHAUST)	PENN VENT KB-420	6400	.75"	2 HP	480	3	-	-	SCP-3,S-3,ED-6	-
ED-6	FILTER BUILDING LOWER LEVEL	-	-	-	1/10 HP	120	1	-	-	SCP-3,S-3,E-6	-
E-7	FILTER BUILDING WOMENS LAVATORY (EXHAUST)	PENN VENT Z-6	95	.25"	130 WATTS	120	1	-	-	-	10FR ROOF CAP 1050 RPM
E-8	FILTER BUILDING MENS LAVATORY (EXHAUST)	PENN VENT Z-6	95	.25"	130 WATTS	120	1	-	-	-	10FR ROOF CAP 1050 RPM
E-9	FILTER BUILDING FILTER ROOM (EXHAUST)	PENN VENT CB-18	2700	.25"	1/3HP 2SPD	120	1	-	-	ED-9,ID-9	PROVIDE CONTROL RELAY AND TRANSFORMER, NEMA 4,J-BOX,WCRT-100 (120V)
ED-9	FILTER BUILDING FILTER ROOM	-	-	-	1/10 HP	120	1	-	-	E-9,ID-9	-
ID-9	FILTER BUILDING FILTER ROOM	-	-	-	1/10 HP	120	1	-	-	E-9,ED-9	-
E-10	INFLUENT METERING/CONTROL VAULT (SUPPLY)	PENN SX 105V	815	.25"	1/8 HP	120	1	-	-	-	-
E-11	BACKWASH RECYCLE PUMP VAULT (SUPPLY)	PENN SX 105G	1570	.50"	1/2 HP	120	1	-	-	-	-
ID-10	FILTER BUILDING LABORATORY	-	-	-	1/10 HP	120	1	-	-	-	-
UH-1	POTASSIUM/CARBON ROOM	CHROMOLOX FTPE-3(268710)	-	-	3 KVA	480	1	-	-	-	PROVIDE CONTROL RELAY AND TRANSFORMER PANEL NEMA 4 MOUNTED OUTSIDE OF SPACE, FOR BOTH HEATING AND COOLING WCRT-100 (120V) AND REMOTE BULB
UH-2	FILTER BUILDING FILTER ROOM	CHROMOLOX LUH-05-43OCR(336321)	-	-	5 KVA	480	3	17,100	-	UH-3,4,5	PROVIDE CONTROL RELAY AND TRANSFORMER PANEL NEMA 4 FOR BOTH HEATING AND COOLING, WCRT-100 (120V)
UH-3	FILTER BUILDING FILTER ROOM	CHROMOLOX LUH-05-43	-	-	5 KVA	480	3	17,100	-	UH-2,4,5	-
UH-4	FILTER BUILDING FILTER ROOM	CHROMOLOX LUH-05-43	-	-	5 KVA	480	3	17,100	-	UH-2,3,5	-
UH-5	FILTER BUILDING FILTER ROOM	CHROMOLOX LUH-05-43	-	-	5 KVA	480	3	17,100	-	UH-2,3,4	-
UH-6	FILTER BUILDING ELECTRICAL ROOM	CHROMOLOX LUH-05-43	-	-	5 KVA	480	3	17,100	-	-	PROVIDE CONTROL RELAY AND TRANSFORMER PANEL NEMA 4 FOR BOTH HEATING AND COOLING, WCRT-100 (120V)
UH-7	CHLORINE CONTROL ROOM	CHROMOLOX LUH-02-81	-	-	3 KVA	208	1	8,900	-	-	PROVIDE CONTROL RELAY AND TRANSFORMER PANEL NEMA 4 FOR BOTH HEATING AND COOLING, WCRT-100 (120V) AND REMOTE BULB
UH-8	INFLUENT METERING/CONTROL VAULT	CHROMOLOX LUH-02-81	-	-	3 KVA	208	1	8,900	-	-	PROVIDE CONTROL RELAY AND TRANSFORMER PANEL NEMA 4 FOR BOTH HEATING AND COOLING, WCRT-100 (120V)
UH-9	BACKWASH RECYCLE PUMP VAULT	CHROMOLOX LUH-02-81	-	-	3 KVA	208	1	8,900	-	UH-10	PROVIDE CONTROL RELAY AND TRANSFORMER PANEL NEMA 4 FOR BOTH HEATING AND COOLING, WCRT-100 (120V)
UH-10	BACKWASH RECYCLE PUMP VAULT	CHROMOLOX LUH-02-81	-	-	3 KVA	208	1	8,900	-	UH-9	PROVIDE CONTROL RELAY AND TRANSFORMER PANEL NEMA 4 FOR BOTH HEATING AND COOLING, WCRT-100 (120V)
SB1M	SEDIMENTATION BASIN IMMERSION HEATER	CHROMOLOX PTH-101	-	-	1.0 KVA	120	1	-	-	-	PROVIDE CONTROL RELAY AND "FREEZE PROTECT" THERMOSTAT NEMA 4, J-BOX

DATE: 4-3-92 CURRENT DRAWING: ELS004E.DWG

ELECTRICAL EQUIPMENT SCHEDULE		SEE ALL RELATED ELECTRICAL PLANS, SITE PLAN, MOTOR CONTROL CENTER O.L.D., PANEL SCHEDULES, ONE LINE POWER DIAGRAM (O.L.D.) AND DETAILS WITH FLAGNOTES.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
SYMBOL/TAG IDENTIFICATION	EQUIPMENT DESCRIPTION	HORSEPOWER	CALCULATED AT 1.4 NEC RUNNING AMPS PER RULE "CONTINUOUS LOAD"	VOLTS	PHASE	AMPS INDICATED BY NEC	PANEL OR MCC		STARTER		INTERLOCK WITH	SAFETY SWITCH	POWER CONDUIT/WIRE				CONTROL CONDUIT/WIRE				INSTRUMENT CONDUIT/WIRE				DRAWING REF. SH. NO.	REMARKS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
							PANEL PREFIX	PANEL DESIGNATION	CIRCUIT NUMBER	SWITCH(S)/FUSE(F) BREAKER/AMPS[CB]			CONDUIT SIZE	CONDUIT TYPE	WIRE SIZE	EQUIPMENT GROUND SIZE	CONDUIT SIZE	CONDUIT TYPE	WIRE SIZE	EQUIPMENT GROUND SIZE																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
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	NOTE: WIRE TO AND CONNECT EACH DEVICE WITH ASSOCIATED CONTROLS AND INSTRUMENTATION WIRE, CONDUIT JUNCTION BOXES, FITTINGS, STARTERS, DISCONNECT SWITCHES AND ACCESSORIES ARE TO BE FURNISHED, INSTALLED, CONNECTED AND TESTED. PROVIDE CONDUIT SHOP DRAWINGS PER SPECIFICATIONS. * - SYMBOL INDICATES PHASE 1 COMPONENTS		FWE		FWE		FWE		FWE		FWE		FWE		FWE		FWE		FWE		FWE		FWE																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
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FESP-1		FILTER #1 - FILTER EFFLUENT SAMPLE PUMP	1/15	0.01	120	1	0.10	PP2	F	31	[20/1]	XL	10A																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											

REVISIONS	
NO.	DATE BY
1	AMENDMENT 6/92

CITY OF LOUISVILLE, COLORADO

SOUTH WATER TREATMENT FACILITY

ELECTRICAL EQUIPMENT SCHEDULE

ROCKY MOUNTAIN CONSULTANTS

8301 EAST PRENTICE AVENUE, SUITE 101

ENGLEWOOD, COLORADO 80111

(303) 741-6000

DATE: JAN. 1992

DESIGNED BY: MCK

DRAWN BY: FV

CHECKED BY: MCK

JOB NO. 0058.051.05

SHEET 103

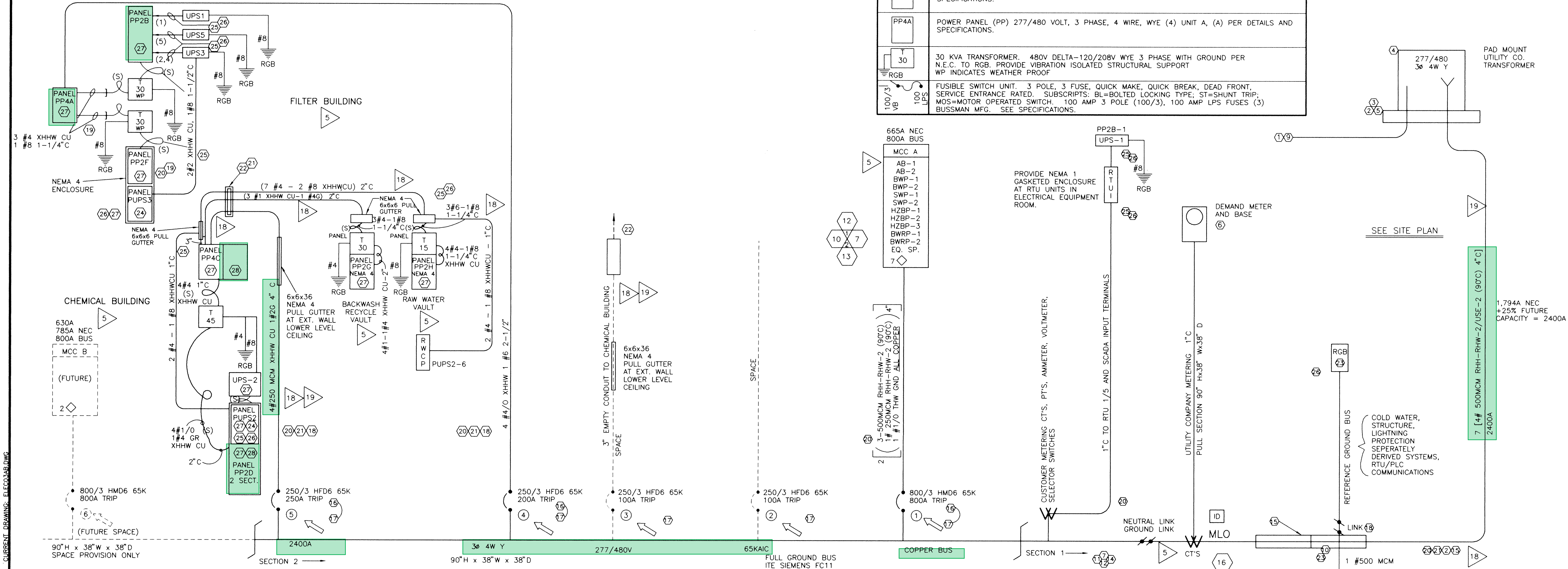
ONE LINE DIAGRAM ELECTRICAL NOTES

- 1 SERVING ELECTRIC POWER UTILITY COMPANY WILL BE PUBLIC SERVICE COMPANY OF COLORADO (PSCO). PAD MOUNTED TRANSFORMER FURNISHED AND INSTALLED BY PSCO. COORDINATE ALL ASPECTS OF SERVICE WITH MR. TOM KIRKPATRICK.
- 2 277/480 VOLT, 3 PHASE, 4 WIRE, WYE ELECTRIC SERVICE WILL BE FURNISHED AND INSTALLED BY ELECTRIC CONTRACTOR. SEE NOTES 8, 13, 19, 21.
- 3 TERMINATION OF ALL PRIMARY AND SECONDARY CONDUCTORS AT PAD MOUNTED TRANSFORMER BY PSCO AND COORDINATED BY THE ELECTRICAL CONTRACTOR.
- 4 ELECTRICAL CONTRACTOR SHALL COORDINATE ALL DIMENSIONAL AND CONSTRUCTION CRITERIA FOR THE TRANSFORMER PAD FOR THE GENERAL CONTRACTOR. OBTAIN PSCO SHOP DRAWINGS AND LAYOUT. INFORMATION SHALL INCLUDE REINFORCEMENT STEEL DETAILS, PRIMARY AND SECONDARY PAD WINDOW DIMENSIONS AND LAYOUT, TRANSFORMER ANCHORAGE DETAILS AND LOCATION DIMENSIONS, TRANSFORMER DIMENSIONS AND WEIGHT DATA, STUB LOCATIONS OF PRIMARY AND SECONDARY CONDUITS, LOCATION OF PAD ON SITE.
- 5 THE GENERAL CONTRACTOR SHALL CONSTRUCT THE TRANSFORMER PAD ON SITE, PER THE CRITERIA PROVIDED BY PSCO THROUGH THE ELECTRICAL CONTRACTOR.
- 6 ELECTRICAL CONTRACTOR SHALL OBTAIN METERING CRITERIA AND REQUIREMENTS FROM PSCO. CT COILS AND MOUNTING HARDWARE SHALL BE PROVIDED BY PSCO. PSCO SHALL INSTALL METER ALONG WITH METERING EQUIPMENT IN TRANSFORMER.
- 7 SHIP SWITCH GEAR FROM MANUFACTURER'S LOCATION TO SITE ON C3 x 4.1 ALIGNMENT CHANNEL IRONS SECURELY BOLTED TO SWITCH GEAR BASE. SHIP MCC TO SITE SIMILARLY.
- SEAL ALL OPENINGS AND BOTTOM WITH 3/4" THICK WOOD SHIPPING CLOSURES AT SHIPPING SPLITS.
- 8 PROVIDE SUITABLE TEMPORARY BRACING AND SUPPORTS FOR SHEET METAL BUSSING AND STRUCTURES FOR SHIPMENT WITHOUT DAMAGE FROM HAULING. PROVIDE TOP LIFT RIGGING SUPPORTS AT SHIPPING SPLITS. WRAP FOR WEATHER AND DUST RESISTANT SHIPPING AND STORAGE.
- 9 SECONDARY SERVICE ENTRANCE CONDUITS ENTER PULL SECTION AT FRONT OF MDC. CONSTRUCT CONDUIT ENTRY PANEL SUITABLE SIZED FOR CONDUITS ENTERING FROM CT ENCLOSURE. PROVIDE SUITABLE STRUT SUPPORTS FOR CONDUCTOR SUPPORT AND LASHING WITHIN CT COMPARTMENT. SUPPORT ALL CABLE FOR BRACING IN THE EVENT OF FAULT CONDITION. PROVIDE DIELECTRIC PLASTIC BARRIERS BETWEEN STRUTS AND CABLES. PLUG CONDUITS WITH DUX SEAL AT EACH END AFTER CONDUCTOR INSTALLATION. CROUSE HINDS "ES".
- 10 PROVIDE 2 - 4" GRC/CR CONDUIT STUBS, OUT OF THE PRIMARY WINDOW OF THE TRANSFORMER PAD, FOR PRIMARY SERVICE ENTRANCE CABLES. PROVIDE GRC COUPLING WITH FLUSH PLUGS AND #9 STEEL GALVANIZED PULL WIRES AT EACH ENTRANCE, TAG AND STAKE.
- 11 PROVIDE FULL GROUND AND NEUTRAL BUS IN MDP AND MCC. PROVIDE BUS LINK BOLTED JUMPERS AT EACH.
- 12 MDP SHALL CARRY U.L. LABEL AND SHALL BE SUITABLE PER N.E.C. AND NEMA FOR USE AS "SERVICE ENTRANCE EQUIPMENT". NEMA 1 GASKETED.
- 13 ALL ELECTRICAL SWITCH GEAR, PANEL BOARDS, MOTOR CONTROL CENTERS AND OTHER FACTORY ASSEMBLED SHEET METAL ENCLOSURES SHALL BE FINISHED ANSI-61 GREY. FACTORY PAINTED AND FINISHED PER THE SPECIFICATIONS IN COLOR SELECTED BY THE ENGINEER. INTERIORS SHALL BE ANSI-70 WHITE. PROVIDE VINYL EDGE GUARDS AT ALL INTERIOR SHEET METAL EDGES.

- 13 MDC BUS ASSEMBLY SHALL BE 2400 AMP, 277/480 VOLT, 3 PHASE, 4 WIRE, BRACED FOR 65,000 AMPS I.C.. PROVIDE LASHING SUPPORTS MANUFACTURED INTO MCC AND MDP FOR ALL WIRING.
- 14 PROVIDE VOLTMETER AMMETER WITH 3 PHASE AND OFF SELECTOR SWITCHES. CT'S AND PT'S AT THE MDP. PROVIDE WESTINGHOUSE IQ DATA PLUS EQUIPMENT. IQ DATA PLUS II, OR ITC "DMP". PROVIDE RS232 PORT AND CABLE CONNECT TO SCADA SYSTEM AT RTU-1.
- 15 ROUTE SECONDARY SERVICE ENTRANCE CONDUITS FROM GRADE IN CR-GRC, SUPPORT CONDUITS FROM BUILDING VIA GALVANIZED UNISTRUT. ENTER MDP THROUGH FLOOR VIA GRC/CR NIPPLES. PROVIDE PULL BOX AT CEILING OF LOWER LEVEL WITH SEAL PROVISIONS, PER UTILITY COMPANY.
- 16 TEST ALL APPARATUS, CABLES, SWITCH GEAR AND GROUNDING SYSTEMS PER SPECIFICATIONS.
- 17 IS MAIN DISCONNECT SWITCH. PROVIDE 5"x7" LAMACOID SIGN. SHOW REQUIRED FUSE AND TYPE.
- 18 COORDINATE CONDUIT ENTRY LOCATIONS WITH STRUCTURAL ASPECTS OF AREA WALLS AS APPROVED BY THE ENGINEER. ALL CONDUIT EXITING BUILDING FOR THE FIRST 10' SHALL BE PVC BONDED 40 MIL COATED GALVANIZED RIGID CONDUIT.
- 19 ALL CONDUITS TO LOWER LEVEL AND GALLERY SHALL ROUTE DOWN WALLS TO AVOID CONFLICTS WITH ALL MECHANICAL EQUIPMENT IN LOWER AREAS.
- 20 CLEAR ALL ACCESS PANELS. CONDUITS SHALL NOT PENETRATE OR CONFLICT WITH SWITCH GEAR STRUCTURE.
- 21 SEAL OFF ALL CONDUITS CROUSE-HINDS TYPE "ES" FITTING & DUX SEAL TO PREVENT THE TRANSMISSION OF LIQUIDS AND GASES FROM ENVIRONMENT TO ENVIRONMENT.
- 22 CONCRETE STRUCTURAL - H20 SITE PULLBOX NEC SIZED 25% SPARE CAPACITY FLUSH IN GRADE WITH SUMP GRATE, PULL IRONS, LIFT LIDS AND GRAVEL SUMP. SEE SITE PLAN.
- 23 REFERENCE GROUND BUS SHALL PROVIDE A SINGLE COMMON GROUNDING POINT AT THE SERVICE ENTRANCE LOCATION FOR ALL INTER-RELATED GROUNDING PER NEC ARTICLE 250 AND NFPA78, ALL OTHER GROUNDING SHALL EMANATE FROM THIS LOCATION AND SHALL BE CONNECTED PER ALL APPLICABLE NATIONAL, STATE AND LOCAL CODES. THIS PROJECT WILL BE PROVIDED WITH A MASTER LABEL PER NFPA78, PER THE SPECIFICATIONS. SEE LIGHTNING GROUNDING NOTES.
- 24 MOUNT UPS PANEL INSIDE NEMA ENCLOSURE ON ALL GLASS INSULATORS FROM BACK PANEL. PROVIDE PANEL WITH ISOLATED NEUTRAL AND ISOLATED GROUND BUSES. PANEL SHALL BE CONNECTED SINGLE PHASE/2 WIRE (ONE PHASE AND ONE NEUTRAL BUS).
- 25 PROVIDE DIELECTRIC COUPLING AND EXTERNALLY BONDED GROUND JUMPER.
- 26 ALL UPS SYSTEM GROUNDS SHALL BE SEPERATE AND DISTINCT FROM ALL OTHER SYSTEM GROUNDS AND SHALL BE IDENTIFIED GREEN WITH A YELLOW TRACER. BOND ALL UPS GROUNDS AT THE RGB.
- 27 ALL PANELS SHALL BE U.L. LABELED SEE DETAIL SHEET FOR PANEL ENCLOSURE DETAIL.
- 28 2 SECTION PANEL PROVIDE SUBFEED LUGS, CONDUCTOR JUMPERS AND OVERSIZE NEMA GASKETED ENCLOSURE. 2-30 POLE SECTIONS.
- 29 MOUNT TRANSFORMER ABOVE PANEL ON CHANNEL IRON WELDED SUPPORT FROM FLOOR AND WALL.

ELECTRICAL LEGEND

MARK	IDENTIFICATION
MLO	INDICATES MAIN LUGS ONLY AT MAIN BUS
DMP	CIRCUIT BREAKER, SERVICE ENTRANCE RATED 65 KAIC
RGB	COVER MOUNTED DIGITAL MONITORING PANEL PER SPECIFICATIONS
3	REFERENCE GROUND BUS PER SPECIFICATIONS
UPS	INDICATES MAIN SWITCH #3 OF 6 PER N.E.C.
LINK	UNINTERRUPTABLE POWER SUPPLY PER SPECIFICATIONS 27
4	BUS LINK FOR ISOLATION OF GROUND OR NEUTRAL BUS. LOCATE AT ACCESS PANEL FOR GFI TESTING. PROVIDE PERMANENT TAG IDENTIFICATION.
4	INDICATES ONE LINE DIAGRAM NOTE #4 - SEE NOTE SCHEDULE
4	GENERAL PURPOSE SUPPORT - SEE DETAIL
4/0	4/0 THW GREEN CU BOND COUNTERPOISE FOR GROUNDING
3/4" x 10'	3/4" x 10' LG. COPPERWELD GROUND ROD, EXOTHERMIC WELDED CONNECTION
INDICATES MAIN DISCONNECT SWITCH WITH IDENTIFICATION LABEL PER SPECIFICATIONS	
BWV FDI	VARIABLE FREQUENCY DRIVE CONTROLLER
PTorCT	INSTRUMENT TRANSFORMER PT: POTENTIAL CT: CURRENT
UPS	UNINTERRUPTABLE "CLEAN" POWER SUPPLY. SEE SPECIFICATIONS
45	TRANSFORMER, DRY TYPE NUMBER INDICATES KVA SIZE (45)
TC	TEMPERATURE CONTROLS EQUIPMENT CABINET - EFPC EXHAUST FAN CONTROL PANEL
IMCP	INSTRUMENTATION CONTROLS TERMINATION CABINET
120/208V 3Ø 4W	SURFACE PANEL, 120/208V 3Ø 4W. SEE TYPICAL PANEL ELEVATION
277/480V 3Ø 4W	SURFACE PANEL, 277/480V 3Ø 4W. SEE TYPICAL PANEL ELEVATION
MCC	MOTOR CONTROL CENTER (MCC) 460V 3Ø
277/480V 3Ø 3xW FUSIBLE SWITCHES AND BREAKER 3Ø 4W SECTION	
HEFCP	HEATING, EXHAUST FAN, SHUTTER AND DAMPER CONTROLS J-BOX NEMA 4 MOUNT THERMOSTATS TO CABINET, PROVIDE "XL" RELAYS, TERMINAL STRIPS PILOT LIGHTS AND HOA SWITCHES IN CABINET HOFFMAN - 24"H x 24"W x 6"D
HCP	HOFFMAN NEMA 4 J-BOX WITH HINGED COVER, MOUNT THERMOSTAT TO BOX, PROVIDE TERMINAL STRIPS FOR LINE AND CONTROL WIRING, SUB PANEL 12"x12"x4"
EQ	EQUIPMENT LABEL PER SPEC'S, VOLTAGE, FEEDER SOURCE, FEEDER FUSE SIZE
2	INDICATES FLAG NOTE #2 - SEE FLAG NOTE SCHEDULE
4	INDICATES LIGHTNING GROUNDING NOTE #1 - SEE LIGHTNING GROUNDING SCHEDULE
CT'S	CURRENT TRANSFORMERS FOR METERING. PROVIDED BY UTILITY COMPANY, INSTALLED BY CONTRACTOR.
PP2B	UTILITY COMPANY REVENUE AND DEMAND METER AND BASE. PROVIDE SUPPORT AND ANCHORAGE FOR METER BASE. CONNECT TO CURRENT TRANSFORMER ENCLOSURE VIA 1" CONDUIT PER UTILITY COMPANY REQUIREMENTS. PROVIDE PROJECTILE RESISTANT COVER AND ENCLOSURE APPROVED BY UTILITY COMPANY.
PP4A	POWER PANEL (PP) 120/208 VOLT, 3 PHASE, 4 WIRE, WYE (2) UNIT B, (B) PER DETAILS AND SPECIFICATIONS.
PP4A	POWER PANEL (PP) 277/480 VOLT, 3 PHASE, 4 WIRE, WYE (4) UNIT A, (A) PER DETAILS AND SPECIFICATIONS.
30	30 KVA TRANSFORMER. 480V DELTA-120/208V WYE 3 PHASE WITH GROUND PER N.E.C. TO RGB. PROVIDE VIBRATION ISOLATED STRUCTURAL SUPPORT WP INDICATES WEATHER PROOF
100/3	FUSIBLE SWITCH UNIT. 3 POLE, 3 FUSE, QUICK MAKE, QUICK BREAK, DEAD FRONT, SERVICE ENTRANCE RATED. SUBSCRIPTS: BL=BOLTED LOCKING TYPE; ST=SHUNT TRIP; MOS=MOTOR OPERATED SWITCH. 100 AMP 3 POLE (100/3), 100 AMP LPS FUSES (3) BUSSMAN MFG. SEE SPECIFICATIONS.



ELECTRICAL POWER DISTRIBUTION ONE LINE DIAGRAM (O-L-D)

- FLAG NOTES:
- 1 REFER TO THE ELECTRICAL EQUIPMENT SCHEDULES FOR ALL RELEVANT LOAD DATA ASSOCIATED WITH THIS PROJECT.
- 2 REFER TO THE MCC ONE LINE DIAGRAM FOR THIS UNIT.

ROCKY MOUNTAIN CONSULTANTS
8301 EAST PRENTICE AVENUE, SUITE 101
ENGLEWOOD, COLORADO 80111
(303) 741-6000

RMC

NO	DATE	BY
1	6/92	AMENDMENT

CITY OF LOUISVILLE, COLORADO
SOUTH WATER TREATMENT FACILITY
ELECTRICAL POWER DISTRIBUTION ONE LINE DIAGRAM AND NOTES

DATE: JAN. 1992
DESIGNED BY: GAP
DRAWN BY: FV
CHECKED BY: MCK
JOB NO.
0058.051.05
SHEET
90 OF 103

120/208 Voltage		Panel		Exist. 'PP2D' (Sec 1)		Surface		Mountings	
3 Phase, 4 Wire		A/C		10000 @ 240V		125A MCB		Mains	
NEMA 1 Enclosure Rating		Panel Equipped with Feed Through Lugs		100%		Neutral Rating		No Isolated Ground Bar	
Description	Load (kW)	BKR	CKT #	PH.	CKT #	BKR	Load (kW)	Description	
PPCMPPCF	1.40	20/1	1	A	2	20/1	1.20	ALMSCR-1 (ALMP-1)	
PPCCTP	1.90	30/1	3	B	4	20/1	1.20	ALMSCR-2 (ALMP-2)	
PPCP	0.50	20/1	5	C	6	20/1	1.20	PMSCR-1 (PMP-1)	
FCDCFCCTPFTPSV	1.10	20/1	7	A	8	20/1	1.20	PMSCR-2 (PMP-2)	
FCMFCE	1.50	20/1	9	B	10	20/1	1.50	SAWSACE	
CIMPSCR-1 (CIMP-1)	1.20	20/1	11	C	12	20/1	1.10	SADC/SACTP/SATPS-1	
CIMPSCR-2 (CIMP-2)	1.20	20/1	13	A	14	20/1	0.50	CHLRCHSV-PFCHSV-BW	
GD	1.20	20/3	15	B	16	20/1	0.50	CHLD-1/CHLDS-1	
.	.	//	17	C	18	20/1	0.50	CHLD-1/CHLDS-2	
UHL-7	3.00	20/2	21	B	22	20/1	0.80	ED-1/E-2/ED-2	
.	.	//	23	C	24	20/1	0.90	E-4	
EHW	3.00	30/1	25	A	26	20/1	0.10	RMHLP	
Space	.	.	27	B	28	.	.	Space	
SB1IM(Heater)	1.50	20/1	29	C	30	20/1	1.00	CSCP/SASLCP	
Receptacle	1.8	kW	AT	100	% Demand =	1.80	kW		
Misc.	19.30	kW	AT	100	% Demand =	19.30	kW		
Motor	17.30	kW	AT	100	% Demand =	17.30	kW		
Largest Motor	3.00	kW	AT	125	% Demand =	3.75	kW		
Total Demand = 42.15 kWAT 100 % PF= 42.2 kVA									
Feeder Size 42.2 kVA DIVIDED BY VLL x SQRT(3) = 117.0 AMPS									
0% SPARE CAPACITY = 0.0 AMPS									
117.0 AMPS TOTAL									

120/208 Voltage		Panel		Exist. 'PP2J'		Surface		Mountings	
3 Phase, 4 Wire		A/C		10000 @ 240V		125A MCB		Mains	
NEMA 1 Enclosure Rating		Panel Equipped with Feed Through Lugs		100%		Neutral Rating		No Isolated Ground Bar	
Description	Load (kW)	BKR	CKT #	PH.	CKT #	BKR	Load (kW)	Description	
SPARE	20/1	1	A	2	20/1	SPARE			
WATER HEATER	8.00	50/2	3	B	4	20/1	SPARE		
.	//	5	C	6	20/1	SPARE			
GENERATOR	10.82	125/2	7	A	8	20/1	SPARE		
.	//	9	B	10	20/1	SPARE			
CHLORINE DIOXIDE	0.18	20/1	11	C	12	20/1	0.10	HYDROGEN MONITOR	
SPARE	20/1	13	A	14	20/1	SPARE			
SPARE	20/1	15	B	16	20/1	SPARE			
SIGMA PUMP #1	0.25	20/1	17	C	18	20/1	0.25	SIGMA PUMP #2	
SPARE	20/1	19	A	20	20/1	SPARE			
SPARE	20/1	21	B	22	20/1	SPARE			
SPARE	20/1	23	C	24	20/1	SPARE			
SPARE	20/1	25	A	26	20/1	SPARE			
SPARE	20/1	27	B	28	20/1	SPARE			
SPARE	20/1	29	C	30	20/1	SPARE			
Receptacle	0.18	kW	AT	100	% Demand =	0.18	kW		
Misc.	18.92	kW	AT	100	% Demand =	18.92	kW		
Motor	0.25	kW	AT	100	% Demand =	0.25	kW		
Largest Motor	0.25	kW	AT	125	% Demand =	0.31	kW		
Total Demand = 19.66 kWAT 90 % PF= 21.8 kVA									
Feeder Size 21.8 kVA DIVIDED BY VLL x SQRT(3) = 60.6 AMPS									
0% SPARE CAPACITY = 0.0 AMPS									
60.6 AMPS TOTAL									

120/208 Voltage		Panel		Exist. 'PP2D' (Sec 2)		Surface		Mountings	
3 Phase, 4 Wire		A/C		10000 @ 240V		125A MCB		Mains	
NEMA 1 Enclosure Rating		Panel is Subfed from Exist. 'PP2D' (Sec 1)		100%		Neutral Rating		No Isolated Ground Bar	
Description	Load (kW)	BKR	CKT #	PH.	CKT #	BKR	Load (kW)	Description	
Roofs	1.80	20/1	31	A	32	20/1	.	SPARE	
LT1/PTLT/CT/TLT/TCST1/CST	0.50	20/1	33	B	34	20/1	0.20	SEC1/SCP1/SEC2/SCP2	
FGA	1.70	25/1	35	C	36	20/1	.	SPARE	
Intrusion Alarms FGIA	0.10	20/1	37	A	38	20/1	.	SPARE	
SPARE	20/1	39	B	40	20/1	.	.	SPARE	
SPARE	50/2	41	C	42	20/1	.	.	SPARE	
.	//	43	A	44	20/1	.	.	SPARE	
SPARE	20/1	45	B	46	20/1	.	.	SPARE	
SPARE	20/1	47	C	48	20/1	.	.	SPARE	
SPARE	20/1	49	A	50	20/1	.	.	SPARE	
SPARE	20/1	51	B	52	20/1	.	.	SPARE	
SPARE	20/1	53	C	54	20/1	.	.	SPARE	
Space	.	55	A	56	/1	.	.	Space	
Space	.	57	B	58	50/2	.	7.50	UPS-2	
Space	.	59	C	60	/2	.	.	.	
Receptacle	1.8	kW	AT	100	% Demand =	1.80	kW		
Misc.	8.10	kW	AT	100	% Demand =	8.10	kW		
Motor	0.20	kW	AT	100	% Demand =	0.20	kW		
Largest Motor	1.70	kW	AT	125	% Demand =	2.13	kW		
Total Demand = 12.23 kWAT 100 % PF= 12.2 kVA									
Feeder Size 12.2 kVA DIVIDED BY VLL x SQRT(3) = 33.9 AMPS									

277/480 Voltage		Panel		Exist. 'PP4C' (Sec 1)		Surface		Mountings	
3 Phase, 4 Wire		A/C		14000 @ 480V		250A MLO		Mains	
NEMA 1 Enclosure Rating		Panel Equipped with Feed Through Lugs		100%		Neutral Rating		No Isolated Ground Bar	
Description	Load (kW)	BKR	CKT #	PH.	CKT #	BKR	Load (kW)	Description	
Rapid Mx1 (RMJVF1)	9.00	20/3	1	A	2	20/1	4.10	Lighting 8LD, SL	
.	.	//	3	B	4	20/1	3.62	Lighting 4PB, BL	
.	.	//	5	C	6	20/3	15.00	Panel PP2H	
Rapid Mx2 (RMJVF2)	9.00	20/3	7	A	8	//	.	.	
.	.	//	9	B	10	//	.	.	
.	.	//	11	C	12	40/3	30.00	Panel 'PP2G'	
Hoist (CHH)	2.70	20/3	13	A	14	//	.	.	
.	.	//	15	B	16	//	.	.	
.	.	//	17	C	18	20/3	.	.	
Supply (S-1)	2.70	20/3	19	A	20	//	.	.	
.	.	//	21	B	22	//	.	.	
.	.	//	23	C	24	20/1	.	.	
Fan (E-1)	3.90	20/3	25	A	26	20/3	6.30	GWSP	
.	.	//	27	B	28	//	.	.	
.	.	//	29	C	30	//	.	.	
Lighting	7.72	kW	AT	125	% Demand =	9.65	kW		
Receptacle	0.18	kW	AT	100	% Demand =	0.18	kW		
Misc.	87.82	kW	AT	100	% Demand =	87.82	kW		
Motor	37.16	kW	AT	100	% Demand =	37.16	kW		
Largest Motor	9.00	kW	AT	125	% Demand =	11.25	kW		
Total Demand = 146.06 kWAT 90 % PF= 162.3 kVA									
Feeder Size 162.3 kVA DIVIDED BY VLL x SQRT(3) = 195.2 AMPS									
0% SPARE CAPACITY = 0.0 AMPS									
195.2 AMPS TOTAL									

277/480 Voltage		Panel		Exist. 'PP4C' (Sec 2)		Surface		Mountings	
3 Phase, 4 Wire		A/C		14000 @ 480V		250A MLO		Mains	
NEMA 1 Enclosure Rating		Panel is Subfed from Exist. 'PP4C' (Sec 1)		100%		Neutral Rating		No Isolated Ground Bar	
Description	Load (kW)	BKR	CKT #	PH.	CKT #	BKR	Load (kW)	Description	
Supply (S-2)	2.70	20/3	31	A	32	60/3	15.00	Panel 'PP2D'	
.	.	//	33	B	34	//	.	.	
.	.	//	35	C	36	//	.	.	
Fan (E-3)	2.70	20/3	37	A	38	20/1	.	SPARE	
.	.	//	39	B	40	20/2	3.60	Heater (UH-1)	
.	.	//	41	C	42	//	.	.	
FLVFD-1A	6.48	20/3	43	A	44	20/3	.	SPARE	
.	.	//	45	B	46	//	.	.	
.	.	//	47	C	48	//	.	.	
FLVFD-1B	6.48	20/3	49	A	50	20/3	.	SPARE	
.	.	//	51	B	52	//	.	.	
.	.	//	53	C	54	//	.	.	
PANEL 'PP2J'	18.60	90/3	55	A	56	20/1	.	SPARE	
.	.	//	57	B	58	20/1	.	SPARE	
.	.	//	59	C	60	20/1	.	SPARE	
Receptacle	0.18	kW	AT	100	% Demand =	0.18	kW		
Misc.	36.52	kW	AT	100	% Demand =	36.52	kW		
Motor	12.38	kW	AT	100	% Demand =	12.38	kW		
Largest Motor	6.48	kW	AT	125	% Demand =	8.10	kW		
Total Demand = 57.18 kWAT 90 % PF= 63.5 kVA									
Feeder Size 63.5 kVA DIVIDED BY VLL x SQRT(3) = 76.4 AMPS									

- FLAG NOTES - THIS SHEET ONLY
- 1

PERFORM 30 DAY AMMETER TEST PER REQUIREMENTS THIS SHEET AND NEC.
- 2

VERIFY SPACE AVAILABLE IN PANEL PRIOR TO BID.
- 3

INTERLOCKED SUCH THAT ONLY ONE RUNS AT ANYTIME, CONTROL BY OTHERS NOT SHOWN ON DRAWINGS.
- 4

DRIVES SUPPLIED WITH BLOWER, INSTALLED AND CONNECTED BY ELECTRICAL CONTRACTOR. CONTRACTOR TO COORDINATE CONTROLS AND RELATED CONNECTIONS - PROVIDE AS REQUIRED.

FEEDER SCHEDULE - EXISTING	
(KEY)	DESCRIPTION
1E	7 RUNS [(4 #500 MCM RHH-RHW-2/USE-2) 4"C.]
2E	(4 #250 MCM XHHW CU & #2 CU GRD) 4"C.
3E	(4 #4 XHHW CU & #4 CU GRD) 1"C.
4E	(4 #1/0 XHHW CU & #4 CU GRD) 2"C.
5E	(#4 CU GRD)
6E	(4 #1/0 XHHW CU & #4 CU GRD) 2"C.

FEEDER SCHEDULE - NEW	
(KEY)	DESCRIPTION
1N	(3 #2 CU THWN & #8 CU GRD) 1 1/2"C.
2N	(4 #1/0 CU THWN & #6 CU GRD) 2"C.
3N	(#6 CU GRD) 1/2"C.
4N	(4 #1/0 CU THWN & #6 CU GRD) 2"C.

- 30-DAY AMMETER TEST REQUIREMENTS
- A.

ELECTRICAL CONTRACTOR SHALL HIRE A QUALIFIED THIRD PARTY TESTING AGENCY THAT SPECIALIZES IN ASSOCIATED WORK SUCH AS ERS (ELECTRICAL RELIABILITY SERVICES) TO PERFORM 30-DAY AMMETER TESTS IN ACCORDANCE WITH NEC 220.87. RECORDINGS SHALL BE STORED ELECTRONICALLY AND REPORTED TO THE ENGINEER ELECTRONICALLY IN A FORMAT COMPATIBLE WITH MICROSOFT EXCEL. ELECTRICIAN SHALL PROVIDE ENGINEER WITH THE ACTUAL MAXIMUM DEMAND VALUES (PER NEC 220.87) FOR EACH FEEDER, IN ADDITION TO THE ELECTRONIC DATA, AMMETER TESTS SHALL BE PERFORMED ON ALL THREE PHASES FOR THE FEEDERS INDICATED ON THE DRAWINGS.
- B.

RECORDINGS SHALL BE COORDINATED WITH OWNER TO MINIMIZE RECORDING DURING PERIODS OF WHEN THE FACILITY IS NOT OPERATING UNDER "TYPICAL" CONDITIONS.
- C.

RECORDINGS SHALL BE EMAILED TO ENGINEER (PROVIDE ONE ".XLS" FILE PER RECORDING) AND INCLUDE A SUMMARY INDICATING ALL INFORMATION OUTLINED BELOW FOR EACH AMMETER TEST CALLED FOR ON THE DRAWINGS:

1.

FEEDER (EQUIPMENT FED FROM/TO):

2.

SIZE AND TYPE OF OCPD'S AT EACH END OF FEEDER:

3.

PHASE CONDUCTOR SIZE AND INSULATION TYPE:

4.

NEUTRAL CONDUCTOR SIZE AND INSULATION TYPE:

5.

GROUND SIZE AND INSULATION TYPE:

6.

CONDUIT SIZE AND TYPE:

7.

NUMBER OF PARALLEL RUNS:

8.

DATE TIME TEST BEGAN AND ENDED:

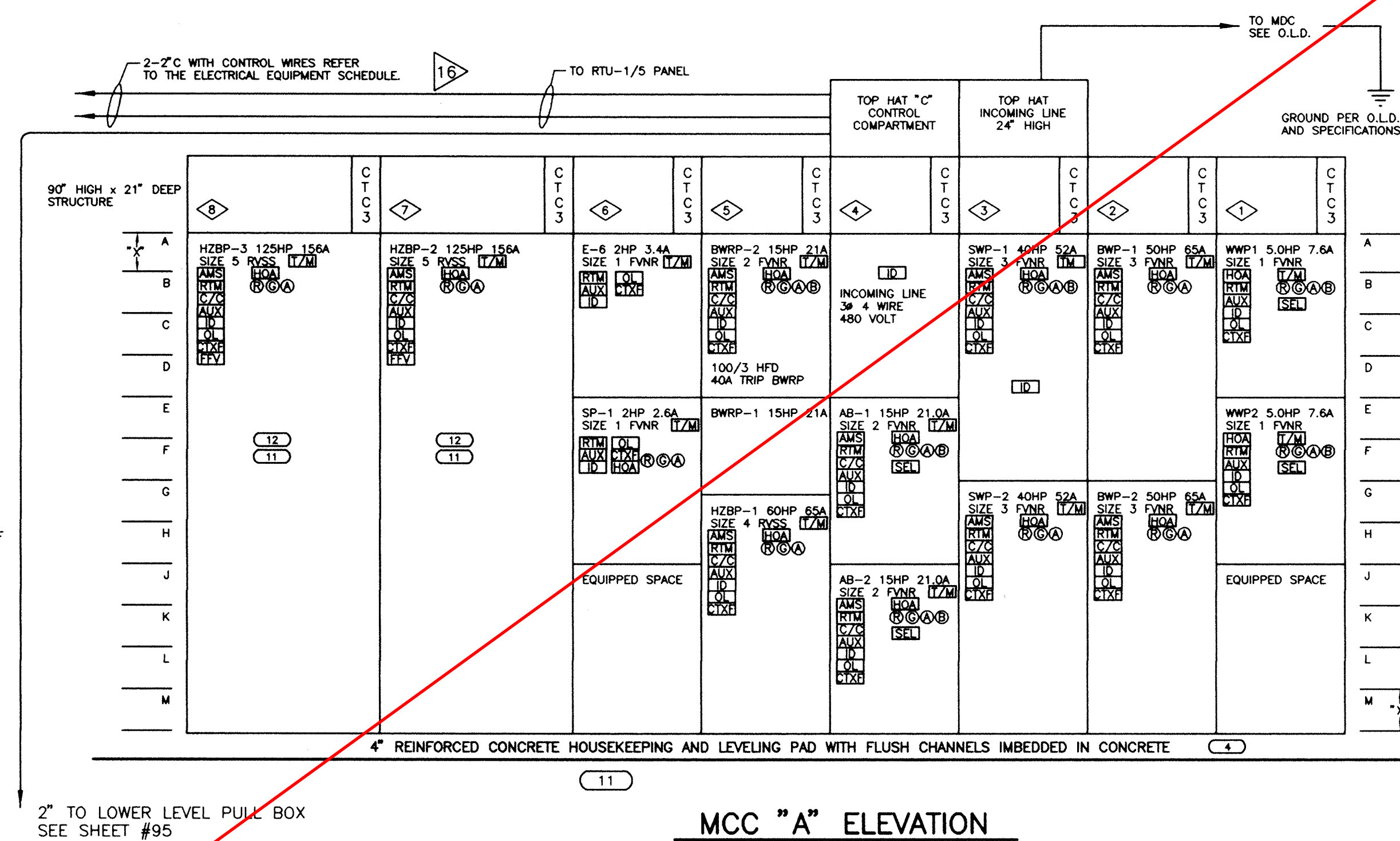
9.

ELECTRICAL LEGEND

MARK	IDENTIFICATION
	MOTOR DISCONNECT SWITCH HORSE POWER RATED 600V HEAVY DUTY NEMA 4X, MOUNTED ON STRUCTURAL SUPPORT AT MOTOR
	FULL VOLTAGE, NON REVERSING STARTER. FOOT NOTES AT STARTER: 2SPD = 2 SPEED MS=MULTISPEED, RV=REVERSING, SEE SPECIFICATIONS (FVNR)
	REDUCED VOLTAGE SOLID STATE STARTER. SEE SPECIFICATIONS. (RVSS)
	MCC SPACE AND SECTION IDENTIFICATION. NUMERAL IDENTIFIES VERTICAL SECTION NUMBER. ALPHA IDENTIFIES UNITS WITHIN SECTION FOR SECTION A THROUGH M EXCLUDING I. A-M = 72"
	FUSIBLE DISCONNECT SWITCH UNIT. 200 AMP, 3 POLE. 200 AMP BUSSMAN LPS FUSE. SEE SPECIFICATIONS
	MOULDED CASE CIRCUIT BREAKER C SERIES HMCP (REFERENCE WESTINGHOUSE) COORDINATE TRIP SELECTION WITH RUNNING CHARACTERISTICS OF MOTOR TO BE USED WITH THE ENGINEER.
	LIQUID TIGHT FLEXIBLE CONDUIT CONNECTION. WIRE MESH, GRIP TYPE, SUPPORT CONNECTORS
	CORD FLEXIBLE CONDUCTOR CONNECTION. WIRE MESH, GRIP TYPE, SUPPORT CONNECTORS
	MOTOR
	ELECTRICAL EQUIPMENT TAG SYMBOL. SEE ELECTRICAL EQUIPMENT SCHEDULE (EES)
	STARTER SIZE NOTATION
	MCC SPACE ALLOCATION WITHIN VERTICAL UNIT
	25 AMP FUSETRON FUSE. BUSSMAN MFG.
	30 AMP, 3 POLE SWITCH DESIGNATION
	ELECTRICAL EQUIPMENT SCHEDULE
	ONE LINE DIAGRAM
	HAND, OFF, AUTOMATIC SWITCH, LEGEND PLATE
	OVERLOAD PROTECTION MODULE PER SPECIFICATIONS
	PLASTIC LAMINATED 2 COLOR ENGRAVED IDENTIFICATION LABEL.
	MOTOR CONTROL CENTER NOTES, NOTE NUMBER REFERENCE.
	AMMETER, LEGEND PLATE, OFF SWITCH
	CYCLE COUNTER LEGEND PLATE
	RUNNING TIME METER, LEGEND PLATE
	TIME MARK BRAND #269 MOTOR PROTECTION RELAY. PROVIDE GROMMETED WINDOW IN STARTER DOOR OVER LED UNITS.
	RED PILOT LIGHT, OFF LEGEND PLATE
	GREEN PILOT LIGHT, ON LEGEND PLATE
	AMBER PILOT LIGHT, AUTO LEGEND PLATE
	BLUE PILOT LIGHT, INDICATES 2 MOTORS INTERLOCKED ALTERNATELY. THIS UNIT RUNS NEXT LEGEND
	TOP COMPARTMENT MOUNTED TRACK TYPE TERMINAL STRIPS-3 UNITS FOR CONTROL WIRE CONNECTIONS PER SPECIFICATIONS. INTERLOCKING, BARRIER TYPE, TUBULAR SCREW TYPE, PER CONTROL SYSTEM SUPPLIER DRAWINGS. PROVIDE QUANTITY AND AMPACITY WITH 25% SPARE TERMINALS. PROVIDE LEGEND PLATES WITH NUMBERED MARKERS.
	CONTROL CIRCUIT TRANSFORMER WITH INTEGRAL FUSE HOLDER AND BUSSMAN KTK FUSES. PER SPECIFICATIONS AND NEC REQUIREMENTS. EXTRA CAPACITY UNIT VERIFY CAPACITY WITH CONTROL EQUIPMENT SUPPLIER AND ENGINEER.
	FORCED AIR FILTERED VENTILATION UNIT AT RVSS STARTERS. ALL VENTILATION OPENINGS IN THIS STARTER WRAPPER AND CAVITY SHALL BE FILTERED.
	NEC SIZED TOP HAT TERMINAL BOX ABOVE MCC FOR CONDUIT AND WIRE CONNECTION. PROVIDE BUSHINGS, BONDING AND MOUNT TO MCC BOND.
	CONTROL CONDUIT AND WIRING TO MCC VIA CODE SIZED TOP HAT BOX, NIPPLE AND BUSH TO TOP MCC WIREWAY. PROVIDE 3 RACK MOUNT TERMINAL STRIP UNIT AT EACH TOP HAT SIMILAR TO CTC3 UNITS WITHIN MCC AT FRNT SIDE OF TOP HAT.
	ELEC. INTERLOCK OF 2 MOTORS. MOTORS SHALL RUN ALTERNATELY OR AS SELECTED BY SWITCH
	2 POSITION RUN SELECTOR SWITCH AT UNITS WHICH ARE INTERLOCKED TO RUN ALTERNATELY. INTERLOCK WITH BLUE PILOT LIGHTS ON RESPECTIVE STARTERS.
	CONTROL WIRING CONNECTIONS AT MOTOR CONTROL CENTER TERMINAL CONTROL CONNECTION RACK PER SUPPLIER SHOP DRAWING SUBMITTALS.
	AUXILIARY CONTACTS PER SPECIFICATIONS.

MOTOR CONTROL CENTER NOTES

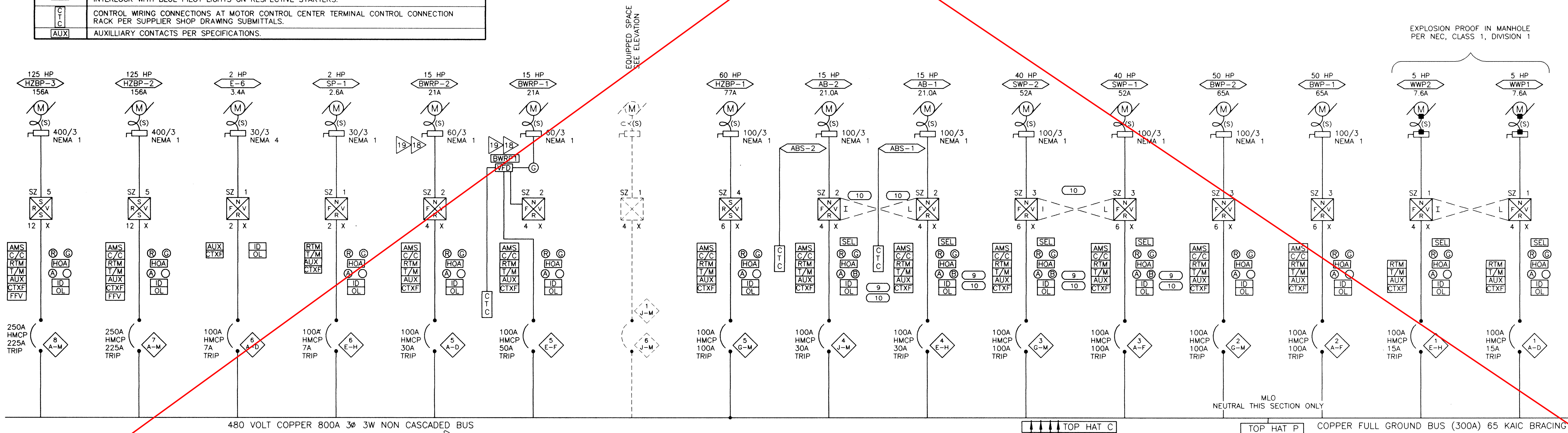
- MODULAR MOTOR CONTROL CENTER 480 VOLT, 3 PHASE 4 WIRE U.L. LABLE, NEMA 1, GASKETED ENCLOSURE, ANSI-70 WHITE INTERIORS. BUSES BRACED FOR 65 KAIC. GASKETED BOTTOM COVERS. PAN WRAPPER ENCLOSING A THREE RACK MASTER CONTROL TERMINAL RACK. PROVIDE STANDARD CRIMP SPADE BARRIRED NEMA TYPE PULL APART TERMINAL BOARD AS REQUIRED BY CONTROL SYSTEM SUPPLIER.
- ALL MCC TERMINALS SHALL BE OF RING/SPADE TYPE COMPRESSION TERMINALS.
- MCC MANUFACTURER SHALL COORDINATE WIRING OF MCC UNITS WITH CONTROLS SUPPLIER THROUGH SHOP DRAWINGS AND SHALL PROVIDE SUFFICIENT CONDUCTOR FOR CT INSTALLATION OF MOTOR PROTECTION RELAY EQUIPMENT.
- COORDINATE BOTTOM CONDUIT ENTRY LOCATIONS WITH STRUCTURAL ASPECTS OF AREA FLOORS AS APPROVED BY THE ENGINEER.
PROVIDE TOP HAT TYPE PULL COMPARTMENTS FOR CONDUIT ENTRIES AS REQUIRED.
ALL CONDUITS TO LOWER LEVEL PUMP VAULT SHALL ROUTE BELOW STRUCTURAL FLOOR AND AVOID CONFLICTS WITH EQUIPMENT IN SLAB, AS APPROVED BY THE ENGINEER.
- PROVIDE AMMETERS WITH SELECTOR SWITCHES, CT'S AND ASSOCIATED WIRING AT EACH STARTER UNIT. SELECTOR SWITCHES SHALL HAVE "OFF" POSITION. SYMBOL: [AMS]
- PROVIDE RUNNING TIME METERS AT EACH STARTER UNIT. SYMBOL: [RTM]
- MCC MANUFACTURER SHALL PROVIDE MOUNTING PROVISION OF MPR RELAYS. PROVIDE TIME MARK #269 PROTECTION RELAYS ASSOCIATED CT COILS AND WIRING AT EACH STARTER. PROVIDE GASKETED WINDOW AT EACH RELAY FOR FULL VIEW OF INDICATOR IN MCC DOORS. SYMBOL: [T/M]
- PROVIDE HOA SWITCHES, SYMBOL: [HOA], AT EACH STARTER WITH RED RUNNING LIGHTS (R), GREEN OFF LIGHTS (G), AMBER AUTO LIGHTS (A). PROVIDE BLUE LIGHTS (B) TO INDICATE UNIT SELECTED TO RUN.
- PROVIDE AUTOALTERNATOR FOR INTERLOCKED OPERATION. PROVIDE BLUE LIGHTS TO INDICATE UNIT WHICH WILL RUN NEXT. PROVIDE GASKETED WINDOW OVER INDICATOR LAMPS.
- INTERLOCK MOTORS ELECTRICALLY. ONLY ONE MOTOR SHALL RUN AT ANY TIME AS DETERMINED BY AUTO ALTERNATOR.
- VERIFY CUBICAL WIDTH OF ALL MCC SECTIONS. NOTIFY ENGINEER OF EXACT SECTION WIDTH'S AND DEPTH'S REQUIRED BY ALL BIDDING SUPPLIERS PRIOR TO BID DATE.
- STARTERS SHALL BE DESIGNED AND MANUFACTURED TO PROVIDE GROUND FAULT PROTECTION. INSTALL CURRENT TRANSFORMERS AND WIRING TO EACH SWITCH CUBICLE. PROVIDE LED INDICATOR TO SHOW "GFI TRIP".



MCC "A" ELEVATION

NOT TO SCALE
SEE UPPER LEVEL ELECTRICAL PROCESS PLAN
SEE NOTES 1 THROUGH 12

PROVIDE CONDUIT SLEEVES TO LOWER LEVEL EQUIPMENT AREA AS REQUIRED SEE ELECTRICAL EQUIPMENT SCHEDULE (EES).

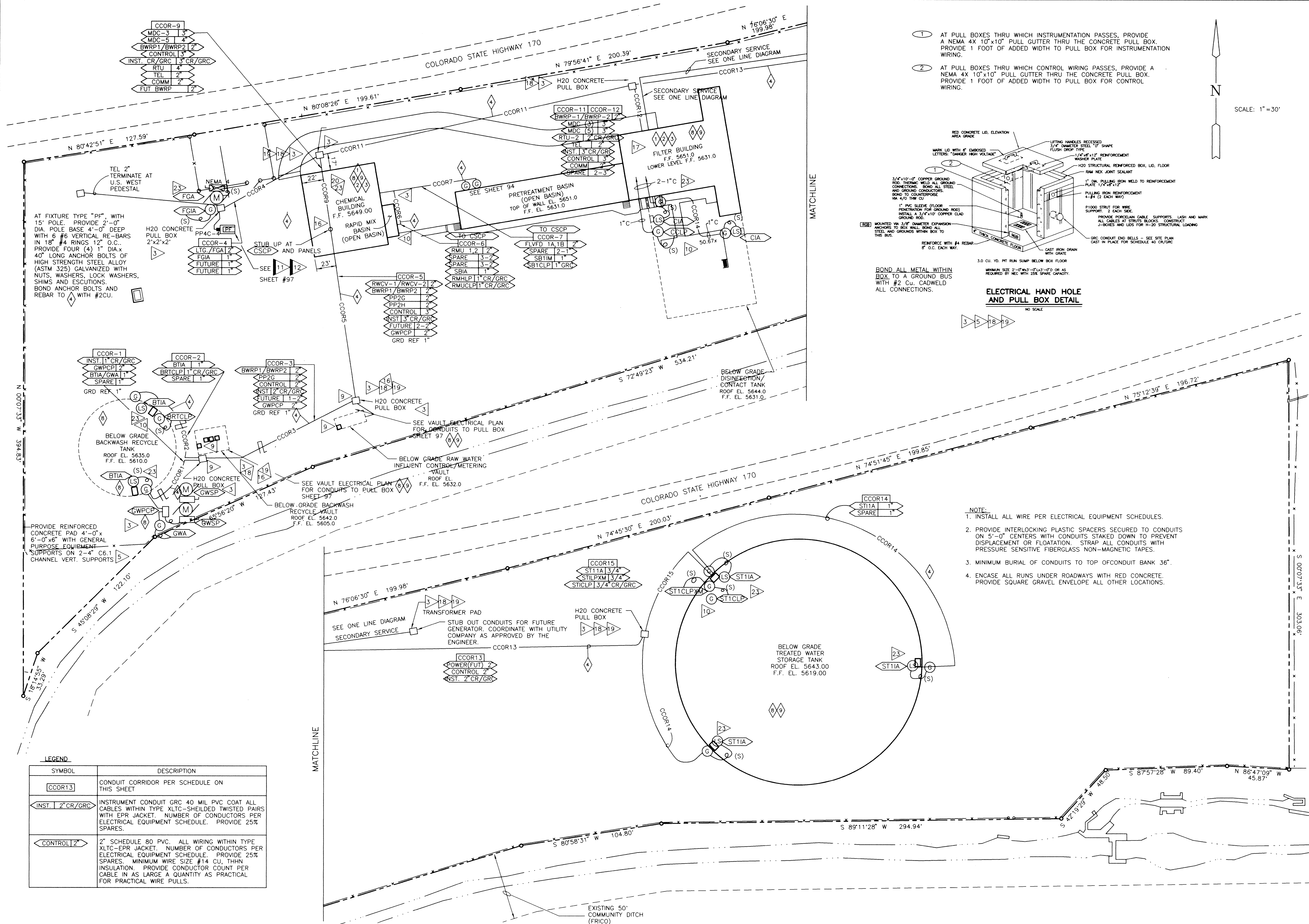


MOTOR CONTROL CENTER
TOTAL CONNECTED AMPS:
SUM OF ALL MOTORS RUNNING
PLUS 1.4X LARGEST MOTOR.

RTU ENCLOSURE
IN FILTER BUILDING
ELECTRICAL EQUIPMENT
ROOM

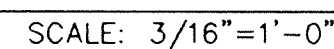
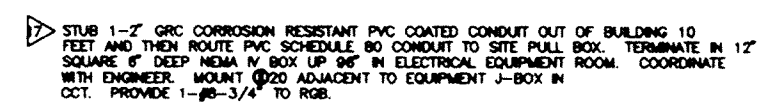
ELECTRICAL MOTOR CONTROL CENTER "A" ONE LINE DIAGRAM (O-L-D)

1 2 3 5 6 7 8 12

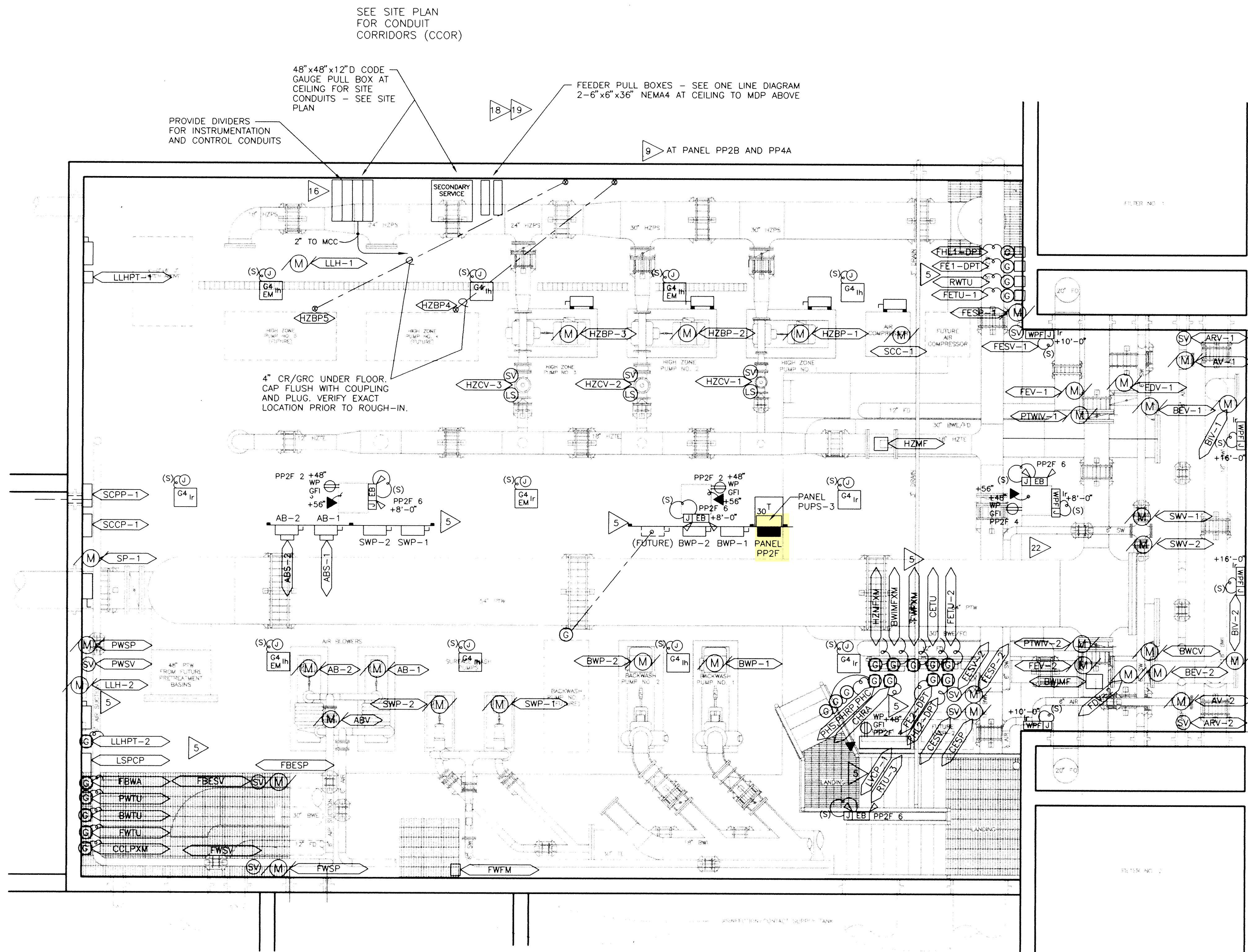
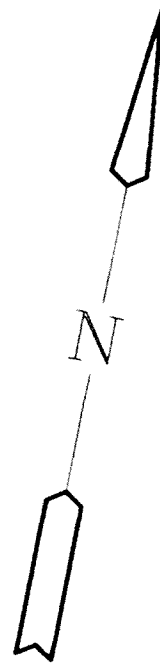


WIRE MOLD RACEWAY SCHEDULE	CATALOG NO.
RACEWAY BASE	G4000B
RACEWAY COVER	G4000C
RACEWAY DIVIDER	G4000D
WALL BOX CONNECTOR	G4014A
INTERNAL CORNER	G40177C
DIVIDER CLIP	G4001D
COUPLING	G4001
SINGLE GANG DEVICE PLATE	G4007C-1
BLANK END	G4010B
CABLE OUTLET	G4046F
ACCESS PLATE CONDUIT	G4046FF
COMBINATION RECEPT/BUSH PLATE	G4046J

- 1 FIRELITE DETECTOR CONTROL AND POWER PANEL, U/L LABELED, SYSTEM 500. WIRE TO ANNUNCIATE UNAUTHORIZED ENTRY AND SMOKE HAZARD AND MECHANICAL VENTILATING FAILURE AS RECOMMENDED BY MANUFACTURER.
- 2 FIRE LITE #2400 SMOKE DETECTOR WIRED TO ANNUNCIATE TO RTU UNIT THROUGH SYSTEM 500 PANEL SEE
- 3 DUCT SMOKE DETECTOR, FIRELITE #DH23/RCM/ACA 120V. WIRE TO CONTROL FURNACE UNIT UNDER ALARM CONDITIONS AND ANNUNCIATE TO RTU UNIT.
- 4 8"x8"x4" J BOX AT BAR JOIST FOR ALARM SYSTEM WIRING. PROVIDE TERMINAL STRIPS AND MARKERS.
- 5 NEMA 12 GASKETED PANEL FOR RTU-1, RTU-5, INPUT/OUTPUT RACKS.
- 6 SLEEVE FLOOR FOR FUTURE HIGH ZONE BOOSTER PUMPS. VERIFY EXACT LOCATION PRIOR TO ROUGH-IN WITH ENGINEER.
- 7 CONNECT PREWIRED PUMP UNIT CABLES AND SUPPORT CABLES VIA 1/2" STRAIN RELIEF STRIP FITTINGS WITH KELLUMS SEAL FITTINGS AT EACH END.
- 8 MOUNT DISCONNECT SWITCHES FROM GENERAL PURPOSE SUPPORTS AT WALL FOR WASTEWATER LIFT PUMPS. WMP1 WMP2
- 9 WIRE TO AND CONNECT FOUR FLOAT SWITCHES AND SEAL SENSOR SWITCHES VIA 1/2" STRAIN RELIEF STRIP FITTINGS WITH KELLUMS SEAL STRAIN RELIEF STRIP TYPES AND COMPRESSION SEAL FITTINGS AT EACH END.
- 10 CONNECT FLOAT CONTROLS AND SEAL SENSORS TO MCC UNIT.
- 11 PROVIDE SEAFFOS FOR EXPLOSIVE LOCATIONS PER NEC, CLASS 1, DIVISION 1.

[illegible]

DATE: 11-23-93 CURRENT DRAWING: ELEC00248.DWG



PROCESS PLAN

SCALE: 1/4" = 1'-0"

1 2 3 5

6 18 19

NOTE:
ALL Sfr FIXTURES CIRCUIT #PP4A - 14 VIA "LVP"
ALL Sfr FIXTURES CIRCUIT #PP4A - 16 VIA "LVP"

CITY OF LOUISVILLE, COLORADO
SOUTH WATER TREATMENT FACILITY
FILTER BUILDING LOWER LEVEL ELECTRICAL PROCESS AND LIGHTING PLAN

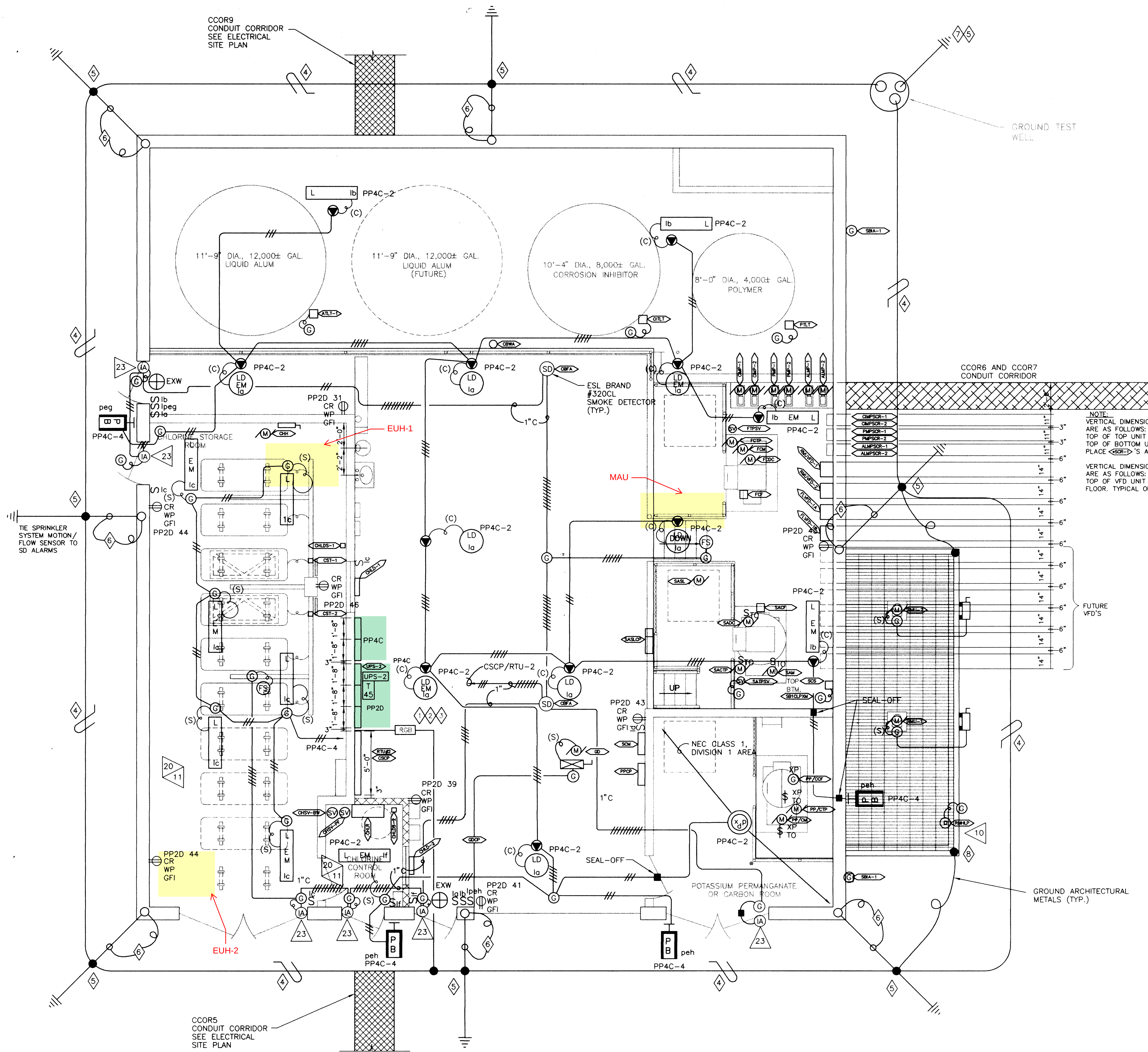
DATE: JAN. 1992
DESIGNED BY: GPM/MK
DRAWN BY: FV
CHECKED BY: MCK

JOB NO.
0058.051.05
SHEET
95 OF 103

REVISIONS

NO. DATE BY

RMCC
ROCKY MOUNTAIN CONSULTANTS
8301 EAST PRENTICE AVENUE, SUITE 101
ENGLEWOOD, COLORADO 80111
(303) 741-6000



ELECTRICAL PROCESS PLAN

SCALE: 1/4" = 1'-0"

LIGHTNING PROTECTION NOTES:

1. PROVIDE AND INSTALL A COMPLETE LIGHTNING PROTECTION SYSTEM PER THE SPECIFICATIONS, AND LIGHTNING PROTECTION HARDWARE MANUFACTURER'S RECOMMENDATIONS, AND IN ACCORDANCE WITH ALL APPLICABLE ARTICLES OF THE NFPA, UBC, AND NEC. THE INSTALLATION SHALL BE ACCOMPLISHED BY LICENSED JOURNEYMAN ELECTRICIANS UNDER THE SUPERVISION OF A STATE OF COLORADO MASTER ELECTRICIAN. ALL WORK SHALL BE INSPECTED JOINTLY BY THE LOCAL INSPECTION AUTHORITY, THE ENGINEER, THE LIGHTNING PROTECTION MANUFACTURER, AND THE LABELING AGENT BEFORE ANY PORTION OF THE SYSTEM MAY BE COVERED. THE ELECTRICAL CONTRACTOR SHALL ENSURE THAT ALL INSPECTION RECORDS ARE SIGNED OFF BY ALL RESPONSIBLE PARTIES FOR PROPER LABELING OF THE BUILDING AS A SYSTEM. NO PORTION OF THE BUILDING STRUCTURE SHALL BE UTILIZED AS A GROUNDING PATH FOR THE LIGHTNING PROTECTION SYSTEM.
2. PROVIDE BUILDING REFERENCE GROUND BUS, 1/4" COPPER PLATE 6" WIDE 12" LONG, MOUNT FROM 3/8" EXPANSION BOLTS, ON ALL GLASS BUS INSULATORS WITH 3/8" BOLTS AND FULL HARDWARE SETS. BOLT AT ALL WIRE CONNECTIONS WITH PHOSPHOR BRONZE, DURUM OR STAINLESS STEEL BOLTS, TORQUED TO MANUFACTURER'S SPECIFICATIONS. PROVIDE BURROU STYLE TOLA LUGS FOR #2 AND LARGER CABLES. PROVIDE TYPE KC2262 TRANSFORMER GROUND CONNECTORS FOR WIRES SMALLER THAN #2. LABEL ALL WIRING AS TO SOURCE AT REFERENCE GROUND BUS WITH EMBOSSED PLASTIC TAGS SECURED TO CABLES VIA TYRAP CABLE TIES. LASH ALL CONDUCTORS PER NEC. BOND ALL CONDUCTORS TO THEIR RESPECTIVE METALLIC CONDUITS VIA T&E #3000 STYLE BOND HUBS. PROVIDE TAB #3000 STYLE BOND CLAMP AT THE POINT OF ENTRY OF THE BUILDING POTABLE DOMESTIC WATER SERVICE. BOND THE WATER SERVICE TO THE REFERENCE GROUND BUS. BOND THE BUILDING ELECTRICAL SERVICE FROM THE REFERENCE GROUND BUS. BOND ALL SEPARATELY DERIVED SYSTEMS TO THE REFERENCE GROUND BUS. SIZE ALL GROUND CONDUCTORS RELATIVE TO THE BUILDING ELECTRICAL SYSTEM PER THE NEC, ARTICLE #250.
3. PROVIDE AND INSTALL LIGHTNING PROTECTION GROUNDING AS DIRECTED BY THE LIGHTNING PROTECTION LABELING AGENCY (LPA), CONSISTENT WITH THE SPECIFICATIONS AT ALL ROOF MOUNTED HEATING AND VENTILATING APPARATUS. PROVIDE ROOF PENETRATIONS FOR ALL LIGHTNING PROTECTION CONDUCTORS SIMILAR TO THAT PROVIDED FOR CONDUIT ROOF PENETRATIONS.
4. PERIMETER GROUND COUNTERPOISE, 4/0 TWH GREEN STANDARD COPPER, 24" BELOW GRADE, 24" FROM FOUNDATION. ISOLATE THIS CONDUCTOR FROM ALL PROCESS PIPING SYSTEMS. PROVIDE 6" WIDE WARNING TAPE 12" ABOVE ALL WIRING AND 12" BELOW GRADE.
5. 3/4" x 10' COPPER CLAD GROUND ROD EXOTHERMICALLY WELDED TO THE COUNTERPOISE SYSTEM. ENAMEL AND SEAL ALL WELDS. PROVIDE MARKER STAKES AT ALL GROUND RODS.
6. 1/0 BRAID COPPER LIGHTNING PROTECTION CABLE TO ROOF VIA CONCEALED 1" PVC CONDUIT. ISOLATE THIS CONDUCTOR FROM BOTH THE STRUCTURE AND ALL PROCESS PIPING SYSTEMS. INSTALL THIS CONDUCTOR IN ACCORDANCE WITH THE SPECIFICATIONS FOR THE LIGHTNING PROTECTION SYSTEM AND PROVIDE INSPECTION SERVICES AS WILL BE REQUIRED TO PROVIDE LABELING BY THE LIGHTNING PROTECTION SYSTEM SUPPLIER AND THE LOCAL CODE ENFORCEMENT AUTHORITY. LEAVE SUFFICIENT TAIL WIRE AT THE TOP OF THE BUILDING STRUCTURE FOR THE ATTACHMENT OF FURTHER LIGHTNING PROTECTION SYSTEM APPARATUS. BOND THE DOWN CONDUCTORS AT THE BUILDING COUNTERPOISE SYSTEM WITH EXOTHERMIC WELDS, AND PROVIDE FOR INSPECTION BY LIGHTNING PROTECTION SYSTEM LABEL SUPPLIER. ENAMEL AND SEAL ALL EXOTHERMIC WELDS WITH GE BRAND GYPTAL PAINT OR 3M SCOTCH COAT AND SCOTCH #2200 EASY SEAL PADS.
7. PROVIDE AND INSTALL GROUND TEST AND INSPECTION WELL. JUNCTION BOX SHALL BE SUITABLE FOR H-20 STRUCTURAL LOADING PER J-BOX DETAIL. INSTALL AND CONNECT PER SPECIFICATIONS AND LIGHTNING PROTECTION SYSTEM SUPPLIER DIRECTIONS.
8. CONNECT LIGHTNING GROUNDING CONDUCTOR TO ARCHITECTURAL OR EXPOSED METALS AT ALL LOCATIONS PER NEPA 78.
9. CONNECT ALL LIGHTNING GROUNDING CONDUCTOR TO ALL ROOF MOUNTED HEATING AND VENTILATING APPARATUS.

NOTE:
VERTICAL DIMENSIONS FOR SCR'S
ARE AS FOLLOWS:
TOP OF TOP UNIT 4'-6" ABOVE FLR.
TOP OF BOTTOM UNIT 3'-0" ABOVE FLR.
PLACE <SCR>'S ABOVE <SCR>'S.

VERTICAL DIMENSIONS FOR VFD'S
ARE AS FOLLOWS:
TOP OF VFD UNIT 6'-0" ABOVE
FLOOR, TYPICAL OF ALL UNITS.

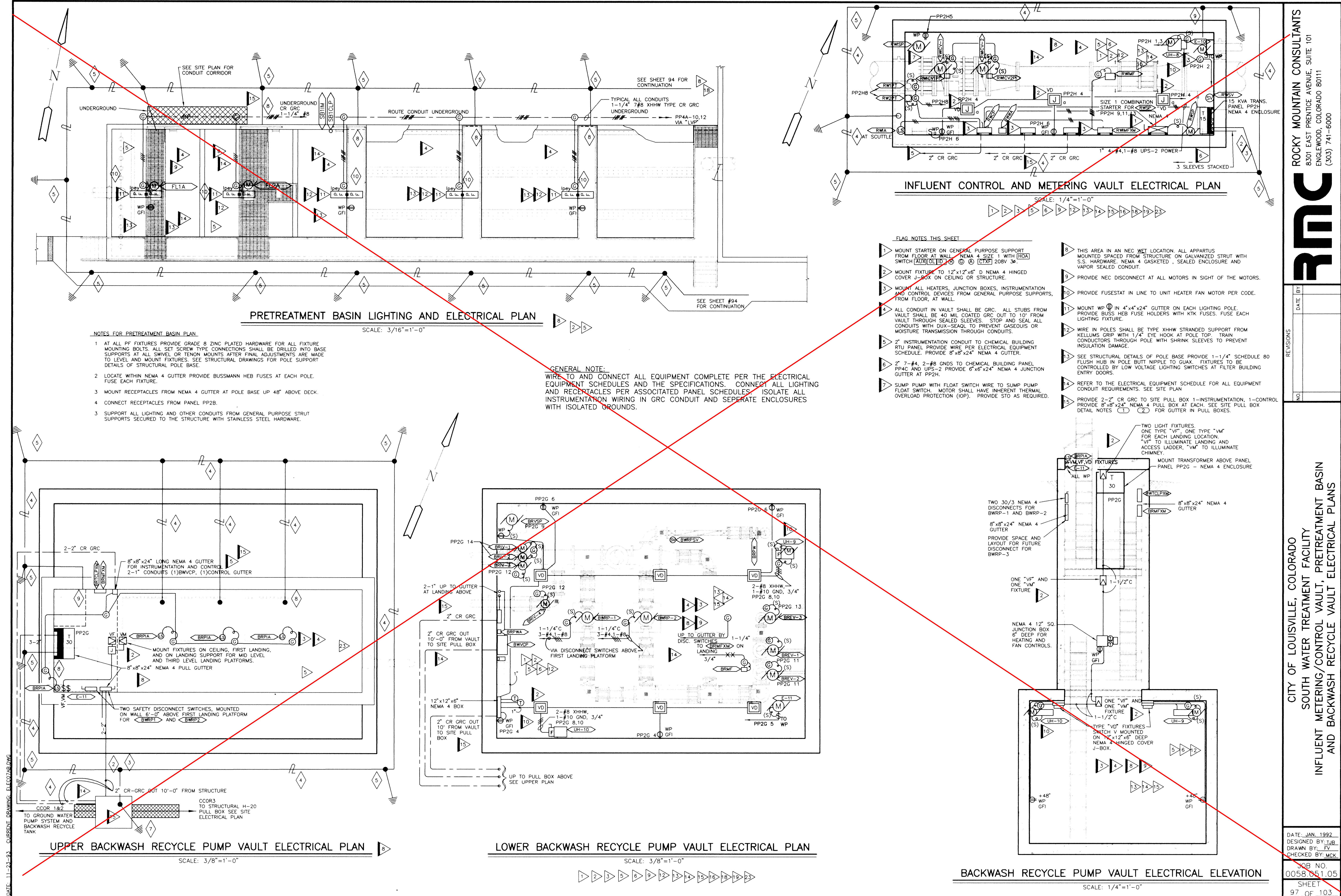
ROCKY MOUNTAIN CONSULTANTS
8301 EAST PRENTICE AVENUE, SUITE 101
ENGLEWOOD, COLORADO 80111
(303) 741-6000

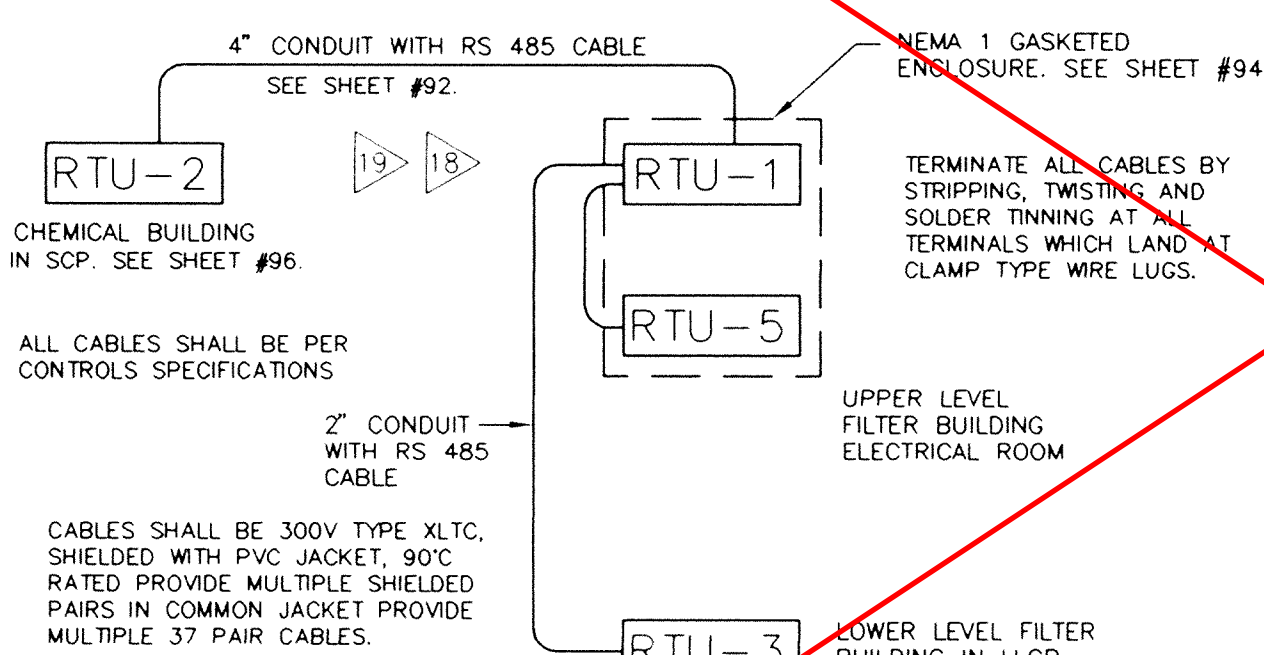
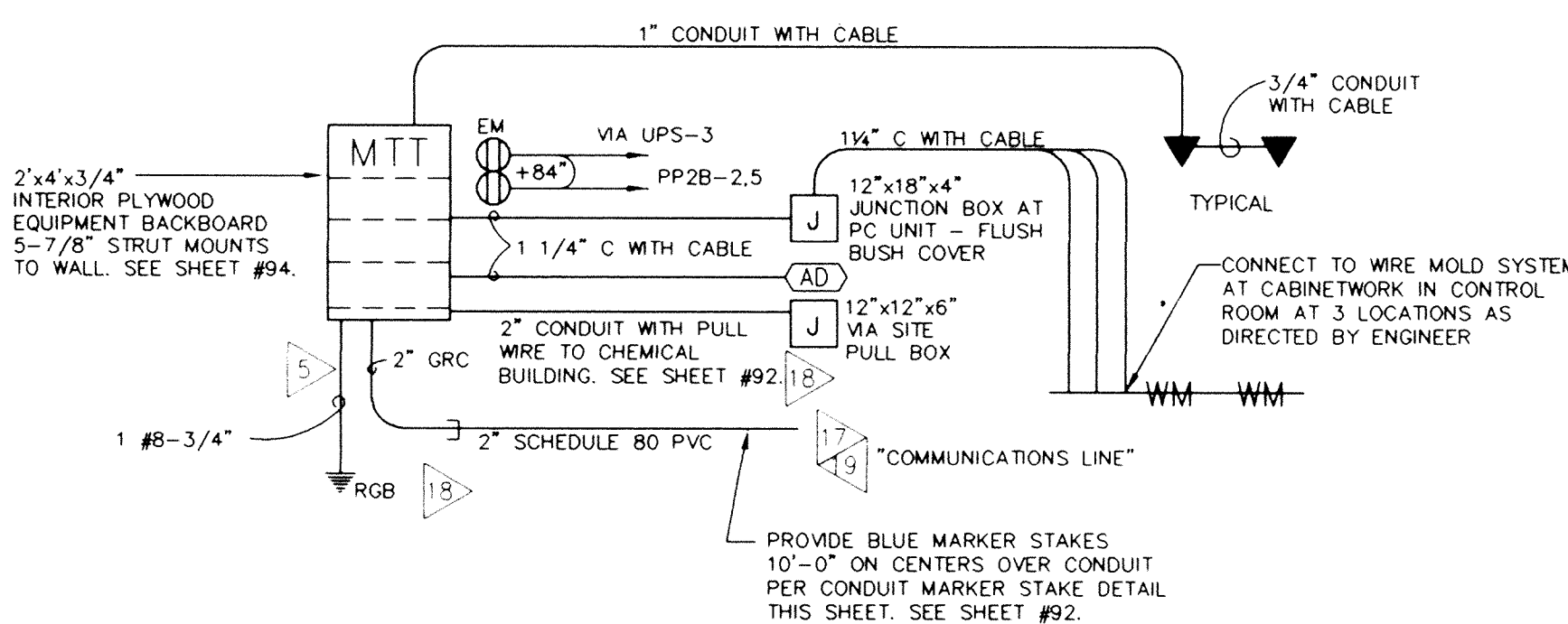
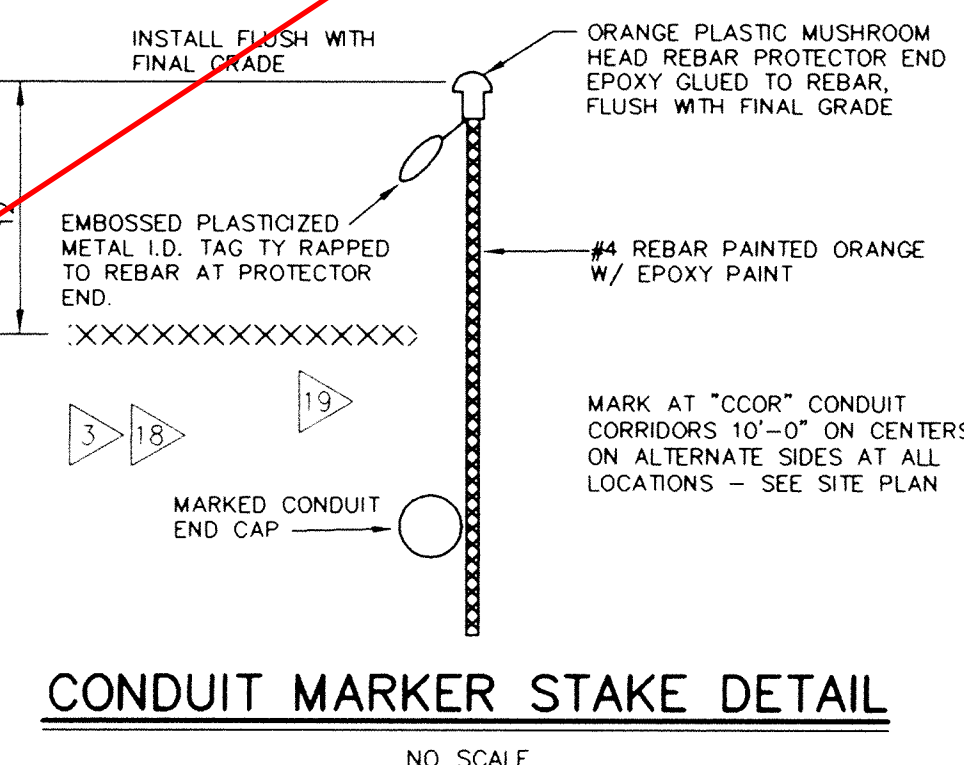
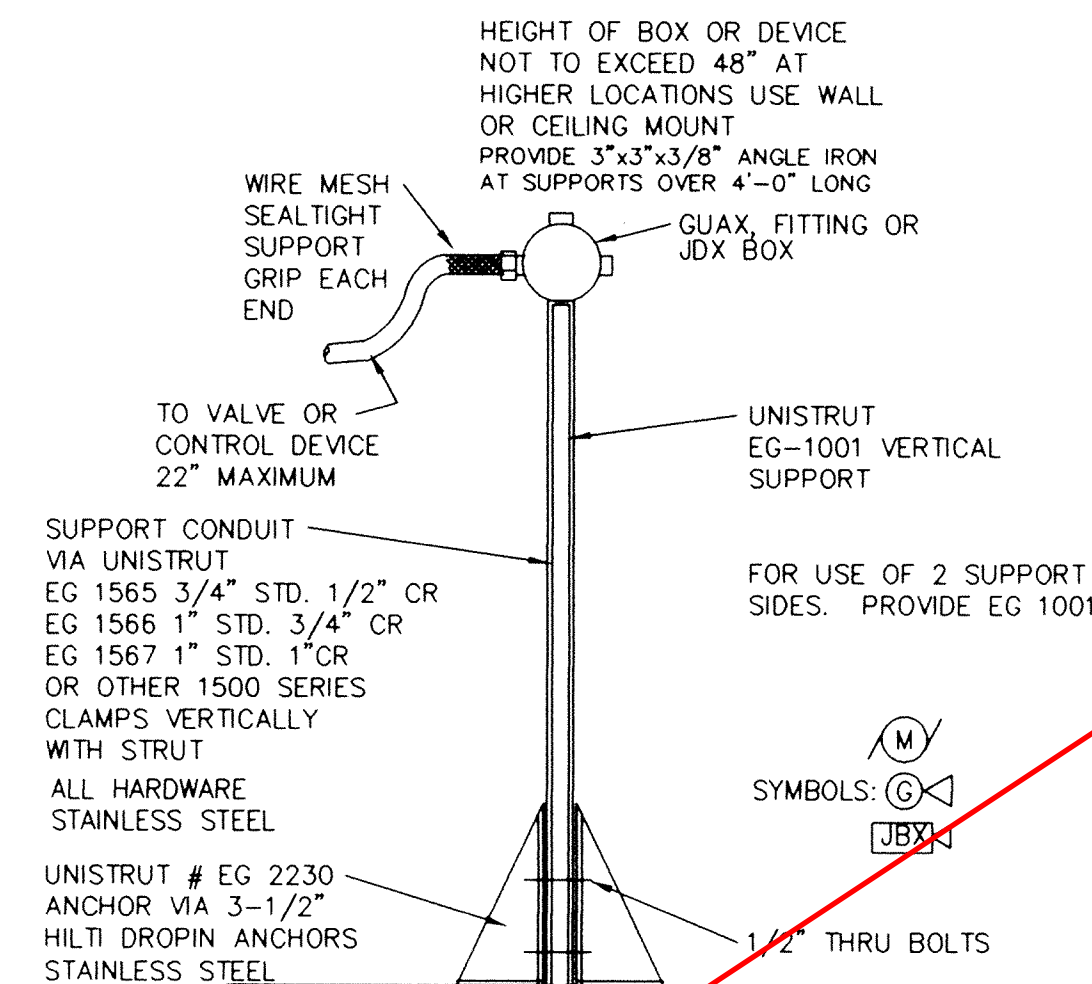
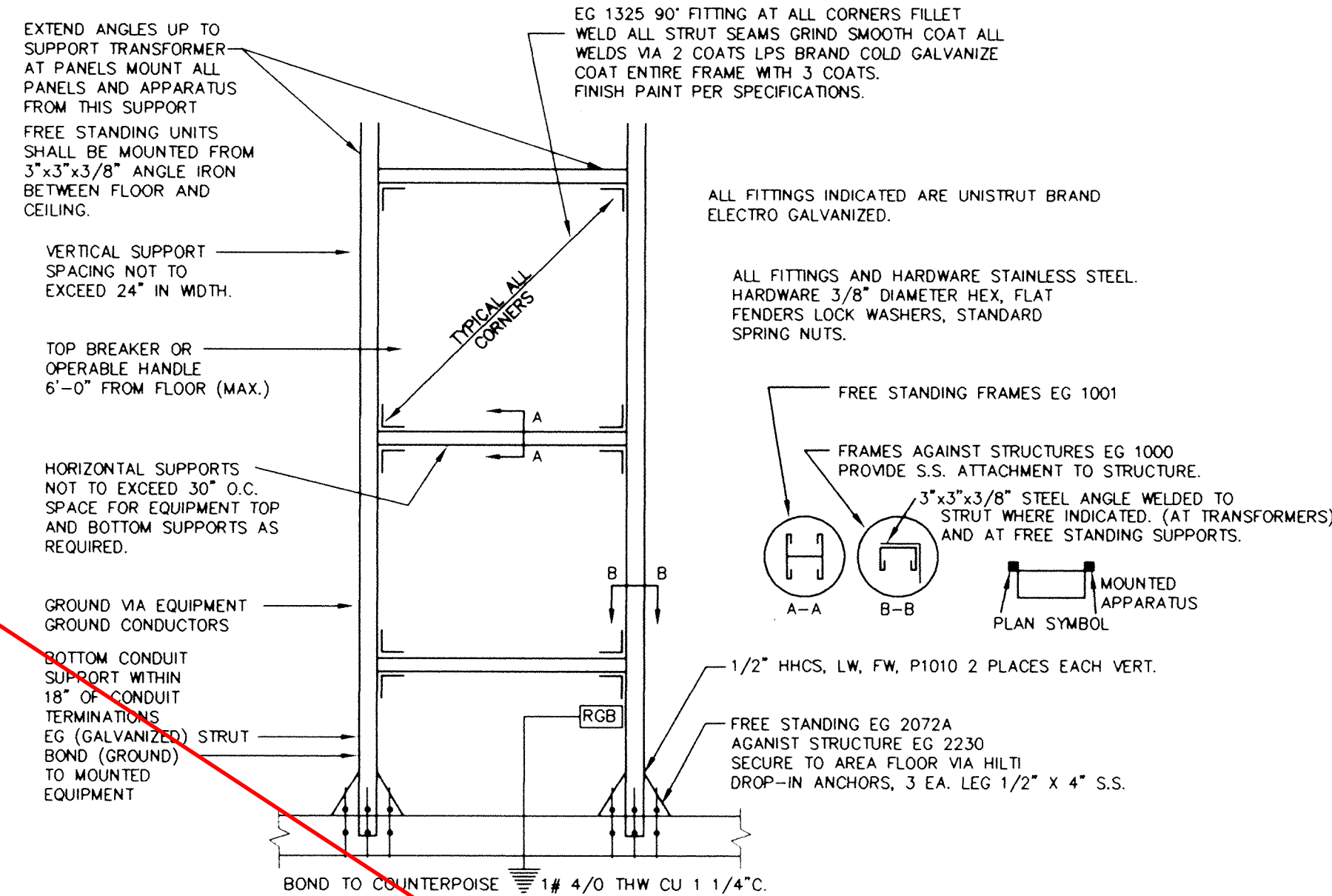
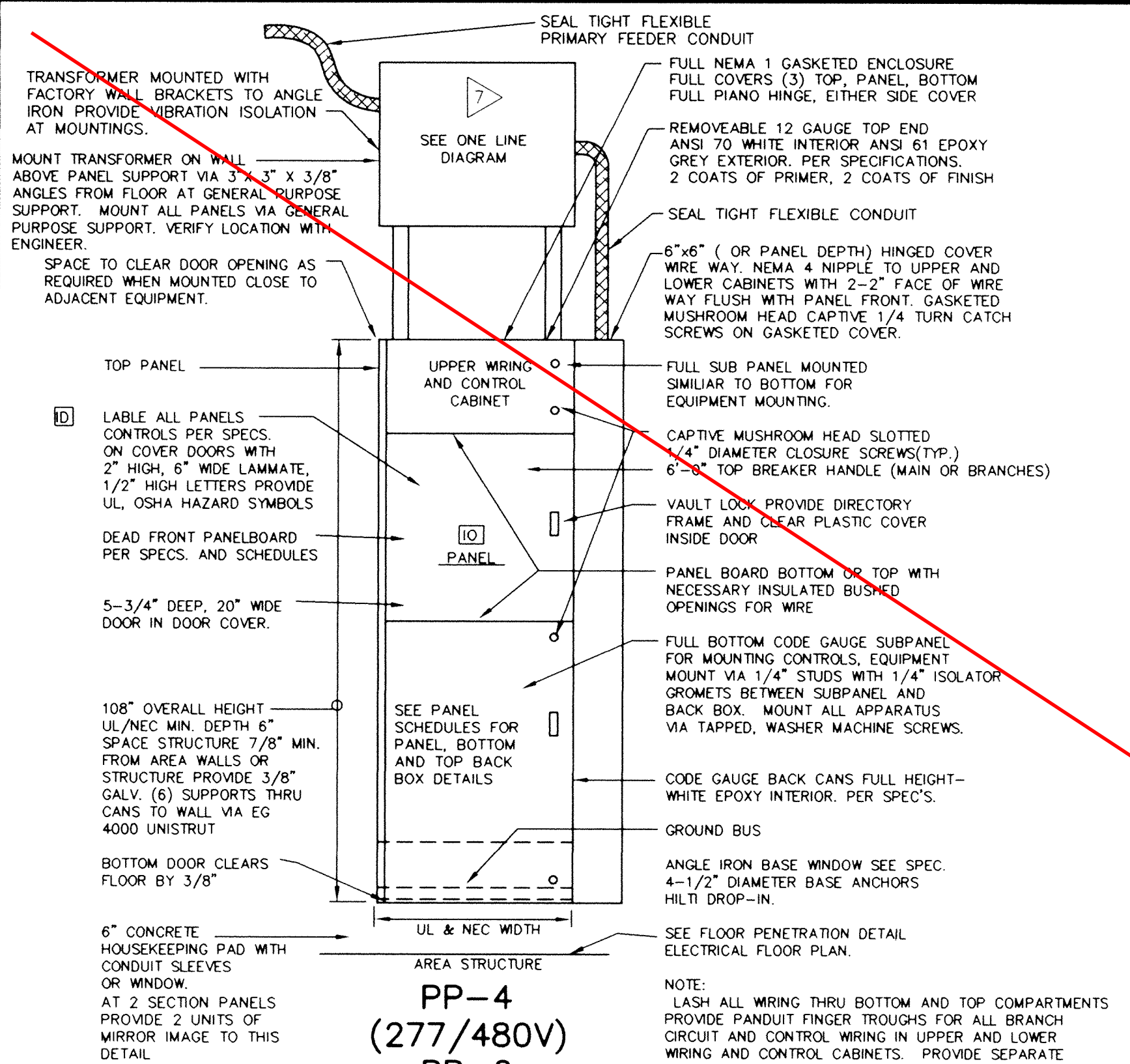
RMC

NO.	REVISIONS	DATE	BY
1	AMENDMENT	6/92	
2	REVISED PANEL LOC.	10/92	

CITY OF LOUISVILLE, COLORADO
SOUTH WATER TREATMENT FACILITY
CHEMICAL FEED BUILDING ELECTRICAL PROCESS AND LIGHTING PLAN

DATE: JAN. 1992
DESIGNED BY: GAP
DRAWN BY: FV
CHECKED BY: MCK
JOB NO.
0058.051.05
SHEET
96 OF 103

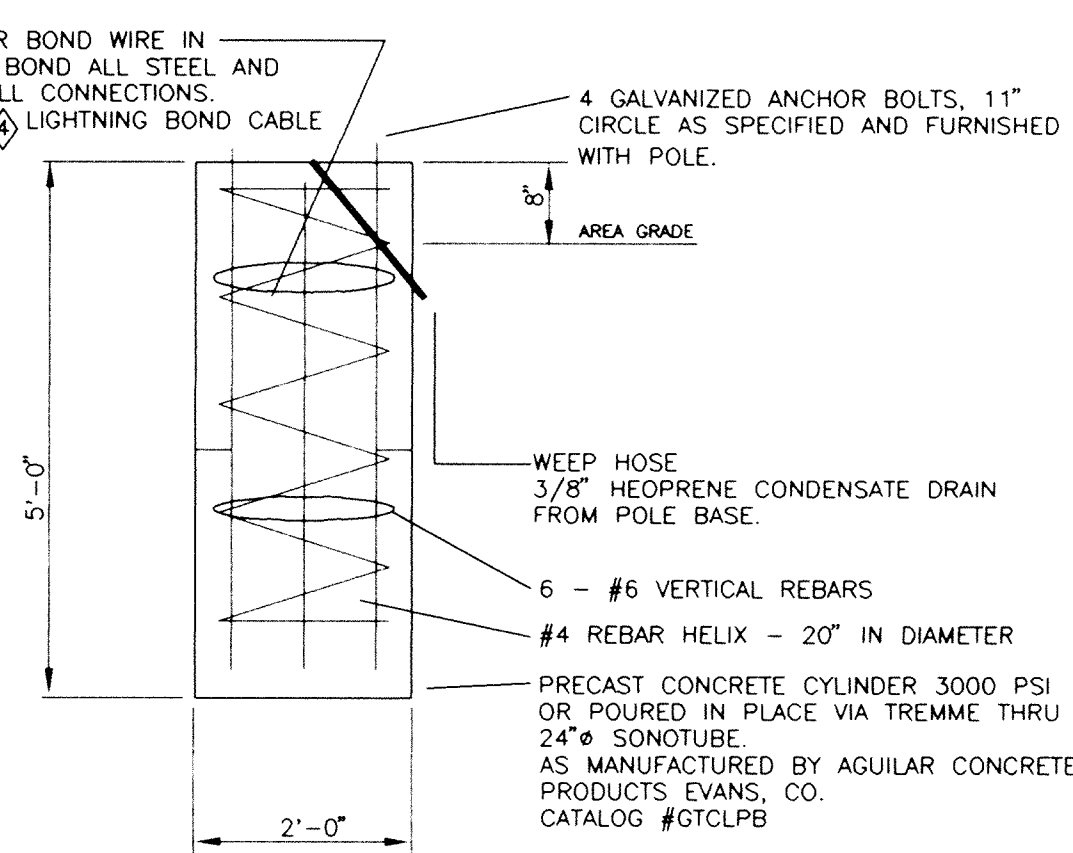




NOTES:

1. AT ALL POLES PROVIDE 4"x4"x8" NEMA 4 PULLBOX NIPPLED TO FLUSH HUG IN POLE. FUSE EACH POLE WITH BUSSMAN HEB FUSE HOLDER AND KTK FUSE AT POLE BASE.
2. ALL CONDUITS STUBBED OUT 5'-0" FROM BASE IN CR/GRC
3. SUPPORT ALL CONDUCTORS UP POLES VIA KELLUMS GRIP FROM 1/4" RING AT POLE TOP.
4. LIGHTING POLES AT BASIN: SPAULDING SOST-2" TENNON, 5" SQUARE 7 GAUGE HAND HOLE, BASE COVER AND (SPECIAL) SOCKET/TUBE STRUCTURAL BASE PER DETAILS. 15'-SOST-607-0L-1.25N 1 1/4" FLUSH HUB OPPOSITE HAND HOLE, 1/2" NC WELDED GROUND NUT OPPOSITE HAND HOLE.
5. GALVANIZED HARDWARE AT POLE BASE DOUBLE NUT, FLAT AND LOCK WASHERS AND HORSESHOE SHIMS.
6. ALL POLE CONDUCTORS TYPE XHHW-Cu STRANDED.
7. SUPPORT ALL CONDUCTORS UP POLES VIA KELLUMS GRIP FROM 1/4" RING AT POLE TOP.

CONCRETE POLE BASE DETAIL



ELECTRICAL FLAG NOTES:

1. MOUNTING HEIGHT OF DEVICES: RECEPTACLES: +48", SWITCHES: +54", TELEPHONES: +66", THERMOSTATS, MISC. CONTROL DEVICES: +60", CABINETS: +72".
2. MOUNT ALL RECEPTACLES ON FACE MASONRY OR CONCRETE WALLS IN DEEP MALLEABLE STEEL BOXES. PROVIDE CORROSION RESISTANT DEVICE WEATHERPROOF DEVICE COVER AND GASKET.
3. STOP ALL CONDUITS INSTALLED FROM FLOOR AT PANELS, DEVICES, CABINETS, OR APPARATUS WITH PERMAGUM RESINOID SEALANT (DUXSEAL). PROVIDE "C" CONDULET AT ALL LOCATIONS BELOW ELEVATED TERMINATIONS. LOCATE CONDULET AS THE FIRST FITTING ABOVE THE AREA GRADE OR FLOOR ELEVATION, FROM FLUSH GRC COUPLING.
4. ALL EXPOSED ELECTRICAL CONDUIT IN THIS PROJECT AREA SHALL BE COATED GALVANIZED RIGID STEEL, EPOXY PAINTED COATED. ALL ASSOCIATED FITTINGS BOXES, HANGERS AND SUPPORT HARDWARE SHALL BE SIMILARLY CORROSION PROOFED.
5. MOUNT ALL BOXES, OUTLETS, CABINETS, PANELS, STARTERS, CONTROL CABINETS, TRANSFORMERS, AND OTHER APPARATUS FROM AN INDEPENDENTLY SUPPORTED SYSTEM OF GALVANIZED STRUT. THE STRUT SHALL AFFORD A MEANS OF SUPPORT AS WELL AS DRIP DRAIN AND AIR FLOW SPACE TO MAINTAIN ALL EQUIPMENT IN AS DRY A STATE AS POSSIBLE. SEE GENERAL PURPOSE SUPPORT DETAIL ON THESE PLANS FOR ALL APPARATUS SUPPORTS.
6. SUPPORT FLOURESCENT LIGHTING FIXTURES FROM 1-5/8" 12 GAUGE STRUT SYSTEM WITH COMPLETE ACCESSORIES NOT LIMITED TO: SWIVEL CUSHION BALL ALIGNER FIXTURE HANGER OF MALLEABLE STEEL, SPRING NUTS, BUSHINGS, SWIVEL SUPPORT HANGERS, YOKE, SUPPORT HANGERS, DROP RODS, CROSS SUPPORTS OF STRUT ON BUILDING STRUCTURE, BEAM CLAMPS, END CAPS, GAUX BOX. PROVIDE 18" SEALTIGHT AT FEED POINTS TO ALLOW FLEX POINT. ALL STRUT HARDWARE SHALL BE STAINLESS STEEL. MINIMUM WIRE SIZE SHALL BE #12 THHN. INSTALL A #12 GROUND THRU THE ENTIRE RACEWAY SYSTEM AND BOND ALL COMPONENTS. ALL WIRING LUGS AND CONNECTORS SHALL BE PER SPECIFICATIONS. ALL HARDWARE AND STRUTS FINISH PAINTED PER SPECIFICATIONS.

7. 30 KVA 480 VOLT-120/208 VOLT 3Ø, 4 WIRE "WYE" TRANSFORMER, TYPE ETP 115" TEMPERATURE RISE, TOTALLY ENCLOSED, VENTILATED, WITH FLEXIBLE LEADS, BOTTOM TERMINAL COMPARTMENT. WESTINGHOUSE #Y48M 28T 30N WITH ALL BRACKETS STYLE 600A679G02. PROVIDE 3/8" x 2" x 4" STEEL ANGLE LINTELS AT 2 LOCATIONS ON MASONRY WALL. PREDRILL LINTELS AND INSTALL 1/2" GALVANIZED SUPPORT BOLTS. THE ELECTRICAL CONTRACTOR SHALL SUPERVISE THE INSTALLATION AND COORDINATION OF 4 #4 VERTICAL REINFORCING BARS AT THE AREA OF THE TRANSFORMER SUPPORT, FULL HEIGHT OF WALL ELEMENTS. MASONRY UNITS SHALL HAVE VOIDS CONCRETE FILLED AT RISING #4 BAR LOCATIONS. ISOLATE ALL TRANSFORMER MOUNTING POINTS FROM STRUCTURE AND MOUNT WITH WAFFLE TYPE VIBRATION ISOLATOR PADS. CONNECT TRANSFORMER VIA SEALTIGHT CONDUIT. PROVIDE SEAL TYPE LOCK NUTS AND "O" RING AT CONNECTORS. BOND AS A SEPARATELY DERIVED SYSTEM PER NEC AT "RGT" 26-5/8"H x 25-1/8"W x 12-3/4"D 422 LBS.
8. WIRE SWITCH TO OVERRIDE THE OPERATION OF THE PHOTOCELL TO TURN LIGHTS OFF.
9. STUB 3-1", 1-2" GRC, PVC COATED CONDUITS OUT 10 FEET 36" BELOW GRADE. CAP AND STAKE AT ENDS. STUB FOUR (4) 1" CONDUITS TO ACCESSABLE CEILING AND CAP, MARK SPARE, INDICATE SOURCE.
10. MOUNT LEVEL PROBE AT EDGE OF HATCH WAY OR FLOOR SLEEVE WIRE VIA 1" DECK ELL AND GAUX FROM UPPER AREA FLOOR VIA NIPPLES. WIRE LEVEL TRANSMITTER SIMILARLY.
11. ALL CONDUIT AND WIRING IN CHLORINE AREAS SHALL BE PVC COATED GRC, SUPPORT WITHIN 8" OF EVERY TERMINATION. SEAL OFF ALL CONDUIT ENTRIES TO THIS ROOM VIA SLEEVES, CAULKED INSIDE, OUTSIDE WITH METHODS DESCRIBED IN SPECIFICATIONS. PROVIDE ESCUTIONS. SEAL OFF ALL CONDUITS.
12. SUPPORT ALL LIGHTING AND HEATING APPARATUS FROM THE BUILDING STRUCTURE. TOGGLE SUPPORTS SHALL NOT BE USED. ALL SUPPORTS SHALL BE STAINLESS STEEL WITH FULL HARDWARE SETS, 3/8" DIAMETER SUPPORT EVERY FIXTURE AT 2 LOCATIONS. FROM STRUCTURE. NO ELECTRICAL APPARATUS SHALL DERIVE SUPPORT FROM GYPSUM BOARD MATERIALS. PROVIDE STRUCTURAL SPANS BEHIND GYPSUM SURFACES WITH STRUT SYSTEMS AS NECESSARY AND SECURE TO STUD STRUCTURE. FINISH PAINT ALL HANGERS. PER SPECIFICATIONS.

13. INSTALL AND CONNECT "XL" CONTROL RELAYS FOR EXHAUST FANS AND DAMPERS AND SHUTTERS. PROVIDE 1 RELAY FOR EACH FAN, SHUTTER OR DAMPER. PROVIDE 120 VOLT CLASS 1 CONTROL POWER AND NEMA 4 H.C. 24" x 18" x 8" J-BOX FOR FAN, INTERLOCK DAMPERS AND SHUTTERS. INSTALL START AND STOP PUSH BUTTONS AND RED "ON" PILOT LIGHT.
14. WIRE TO AND CONNECT AIR INTAKE DAMPER, INTERLOCK WITH EXHAUST DAMPER AT ASSOCIATED EXHAUST FAN. SEE FLAG NOTE 13.
15. WIRE TO AND CONNECT SUPPLY DAMPER. SEE FLAG NOTE 13.
16. ROUTE 1 CONDUIT FOR CONTROL WIRING AND ONE CONDUIT FOR INSTRUMENTATION WIRING FROM THIS LOCATION TO THE RTU ENCLOSURE. PROVIDE WIRE IN CONDUITS PER ELECTRICAL EQUIPMENT SCHEDULE AND TERMINATE PER MANUFACTURER SHOP DRAWINGS.
17. STUB 1-2" GRC CORROSION RESISTANT PVC COATED CONDUIT OUT OF BUILDING 10 FEET AND THEN ROUTE PVC SCHEDULE 80 CONDUIT TO SITE PULL BOX. TERMINATE IN 12" SQUARE 6" DEEP NEMA IV BOX UP 96" IN ELECTRICAL EQUIPMENT ROOM. COORDINATE WITH ENGINEER. MOUNT 20 ADJACENT TO EQUIPMENT J-BOX IN CCT. PROVIDE 1-#8-3/4" TO RGT.
18. STUB ALL CONDUITS FROM EQUIPMENT TO A POINT OUTSIDE STRUCTURE OR PULL BOX WITH GRC, PVC COATED CORROSION RESISTANT CONDUIT. MINIMUM CONDUIT LENGTH OF 10 FEET SHALL BE STUBBED FROM PULL BOX, APPARATUS OR STRUCTURE.

19. PROVIDE 1x8 #NA-708 "ELECTRICAL LINE" WARNING TAPE 6" WIDE 12" BELOW GRADE AND 12" ABOVE CONDUIT, ABOVE ALL BELOW GRADE CONDUITS, OUTSIDE STRUCTURES. PROVIDE "SQUEEZE" GRAVEL FILL MINIMUM OF 6" SURROUNDING ALL BELOW GRADE CONDUITS. PROVIDE PVC MESH SAFETY FENCE OVER ALL MULTIPLE CONDUIT RUNS. PROVIDE MARKER TAPE TIED ON 4" CENTERS. INSTALL BARRIER FENCE WITHIN BACKFILL LIFTS 12" BELOW FINAL GRADE.
20. SEAL ALL CONDUIT PENETRATIONS TO CHLORINE, AMMONIA AND CARBON HANDLING OR PROCESSING AREAS WITH RTV SEALANT AND ESCUTIONS. PROVIDE SEAL-OFF FITTINGS IN ALL CONDUITS ENTERING, LEAVING OR CROSSING THE SPACE. ALL CONDUIT IN CHLORINE HANDLING AREAS SHALL BE GRC/CR. ALL BOXES, FITTINGS AND APPARATUS BE OF HEAVY DUTY CAST MALLEABLE STEEL, PVC COATED PVC. ALL SUPPORTS SHALL BE PVC COATED OR BE FIELD COATED WITH 3 COATS OF CARLON BRAND PVC SPRAY COATING. ALL HARDWARE IN CHLORINE AREAS SHALL BE STAINLESS STEEL.
21. FURNISH, INSTALL AND WIRE MICRO SWITCH BRAND PROXIMITY DOOR SWITCH TO RUN EXHAUST FAN WHEN DOOR IS OPEN.
22. PROVIDE 2 TYPE L AND 2 TYPE L2EM FIXTURES IN PIPE GALLERY. SEE UPPER LEVEL LIGHTING PLAN FOR SWITCHING CONTROL. SEE FLAG NOTE 15 AND 16 AND 17.
23. FURNISH, INSTALL AND WIRE MAGNETIC TYPE MICRO BRAND PROXIMITY SWITCH CONTACT AT ALL EXTERIOR DOORS. LOOP IN SERIES FOR INTRUSION ALARM. WIRE VIA KELLUMS BRAND POLYTUFF II RACEWAY AND FITTINGS FROM GAUX DOOR HEAD.

PANEL: PP4A
LOCATION: FILTER BUILDING UPPER LEVEL
TYPE: 277/480V
DIMENSION: 20"Wx5"D
WT:

LOAD DESCRIPTION	PHASE & CIRCUIT NUMBER	AMPS/ POLES	AMPS/ H.P.	GROUND SIZE	WATTS L1	WATTS L2	WATTS L3	SEE NOTE/S
HOIST - ERH	1 A 20/3	3.4/2.0	12	900	—	—	—	
FILTER LGT - G2A	2 A 20/1	12	4130	—	—	—	—	
HOIST - ERH	3 B 20/3	3.4/2.0	—	900	—	—	—	
TOILET UTIL. ELEC. HALL LGT.	4 B 20/1	12	—	4110	—	—	—	
HOIST - ERH	5 C 20/3	3.4/2.0	—	900	—	—	—	
OFFICE PERS./LAB LGT.	6 C 20/1	12	—	3510	—	—	—	
COMPRESSOR - SCC1	7 A 20/3	4.8/3.0	12	1300	—	—	—	
EXTERIOR LGT.	8 A 20/1	12	3630	—	—	—	—	
COMPRESSOR - SCC1	9 B 20/3	4.8/3.0	12	1300	—	—	—	
EXTERIOR POLE LIGHT	10 B 20/1	12	2275	—	—	—	—	
COMPRESSOR - SCC1	11 C 20/3	4.8/3.0	12	1300	—	—	—	
EXTERIOR POLE LIGHT	12 C 20/1	12	—	2275	—	—	—	
HOIST - LLH1	13 A 20/3	3.4/2.0	12	900	—	—	—	
SPR	14 A 20/1	—	—	—	—	—	—	
HOIST - LLH1	15 B 20/3	3.4/2.0	—	900	—	—	—	
SPR	16 B 20/1	—	—	—	—	—	—	
HOIST - LLH1	17 C 20/3	3.4/2.0	—	900	—	—	—	
SPR	18 C 20/1	—	—	—	—	—	—	
HOIST - LLH2	19 A 20/3	3.4/2.0	12	4000	—	—	—	
SPR	20 A 20/1	—	—	—	—	—	—	
HOIST - LLH2	21 B 20/3	3.4/2.0	—	4000	—	—	—	
SPR	22 B 20/1	—	—	—	—	—	—	
HOIST - LLH2	23 C 20/3	3.4/2.0	—	4000	—	—	—	
SPR	24 C 20/1	—	—	—	—	—	—	
SUPPLY - S-3	25 A 20/3	4.8/3.0	12	900	—	—	—	
SPR	26 A 20/3	—	—	—	—	—	—	
SUPPLY - S-3	27 B 20/3	4.8/3.0	—	900	—	—	—	
SPR	28 B 20/3	—	—	—	—	—	—	
SUPPLY - S-3	29 C 20/3	4.8/3.0	—	900	—	—	—	
SPR	30 C 20/3	—	—	—	—	—	—	
HEATERS - UH-2,3	31 A 20/3	12	12	3333	—	—	—	
PP2F	32 A 40/3	—	—	—	—	—	—	
HEATERS - UH-2,3	33 B 20/3	12	—	3333	—	—	—	
PP2F	34 B 40/3	—	—	—	—	—	—	
HEATERS - UH-2,3	35 C 20/3	12	—	3333	—	—	—	
PP2F	36 C 40/3	—	—	—	—	—	—	
HEATERS - UH-4,5	37 A 20/3	12	12	3333	—	—	—	
HEATER - UH-6	38 A 20/3	6	—	1666	—	—	—	
HEATERS - UH-4,5	39 B 20/3	12	—	3333	—	—	—	
HEATER - UH-6	40 B 20/3	6	—	1666	—	—	—	
HEATERS - UH-4,5	41 C 20/3	12	—	3333	—	—	—	
HEATER - UH-6	42 C 20/3	6	—	1666	—	—	—	

WATTS BY PHASE TOTAL								
PHASE TOTAL AMPS								
DEMAND BY PHASE								
DEMAND BY PHASE @ 125%								
DEMAND BY PHASE								

FEEDER	CONDUIT	NO. & SIZE WIRE	WIRE TYPE	GROUND SIZE	FROM	FEEDING O.C. PROT.
	2 1/4"	4-4/0	XHHW	6	MDC (4)	250/3

LOCATION: FILTER BUILDING UPPER LEVEL
I-T-E CDP-7

BOX SELECTION (SURF)	PANEL	BOTTOM	TOP
A/C	MAIN	18K	10K
MAIN BREAKER SIZE	277/480	3 PHASE	4 WIRE
VOLTAGE			

PANEL: PP2F
LOCATION: LOWER LEVEL FILTER BUILDING
TYPE: 120/208V
DIMENSION: 20"Wx5"D
WT:

LOAD DESCRIPTION	PHASE & CIRCUIT NUMBER	AMPS/ POLES	AMPS/ H.P.	GROUND SIZE	WATTS L1	WATTS L2	WATTS L3	SEE NOTE/S
PTWV-1/BIV-1	1 A 20/1	2 AT 1/4	12	1500	—	—	—	
BEV-1/ARV-1	2 A 20/1	2 AT 1/4	12	700	—	—	—	
AV-1/SWV-1	3 B 20/1	2 AT 1/4	12	—	—	—	—	
PTWV-2/BIV-2	4 B 20/1	2 AT 1/4	12	—	—	—	—	
FCC-1/F1CLPXM	5 C 20/1	2 AT 1/4	12	1500	—	—	—	
BEV-2/ARV-2	6 C 20/1	2 AT 1/4	12	500	—	—	—	
FCC-2/F2CLPXM	7 A 20/1	2 AT 1/4	12	—	—	—	—	
AV-2/SWV-2	8 B 20/1	2 AT 1/4	12	—	—	—	—	
ABV/FWFXM	9 C 20/1	2 AT 1/4	12	900	—	—	—	
LVCP-1	10 A 20/1	2 AT 1/4	12	500	—	—	—	
CCLPXM	11 B 20/1	2 AT 1/4	12	500	—	—	—	
FE1-DPT/EHL1-DPT	12 C 20/1	12	—	120	—	—	—	
FE2-DPT/EHL2-DPT	13 A 20/1	12	—	120	—	—	—	
BWMFXM/HZMFxm	14 B 20/1	12	—	120	—	—	—	
FBWA/PWSP/FWSV	15 C 20/1	12	—	120	—	—	—	
CESP/FBESP/CEV/FBESV	16 A 20/1	12	—	120	—	—	—	
FWSP/LSPCP/FWSV	17 B 20/1	12	—	120	—	—	—	
FESP-1/FESP-2	18 C 20/1	12	—	120	—	—	—	
SPR	19 A 20/1	12	—	—	—	—	—	
SPR	20 A 20/1	12	—	—	—	—	—	
SPR	21 B 20/1	12	—	—	—	—	—	
SPR	22 B 20/1	12	—	—	—	—	—	
SPR	23 C 20/1	12	—	—	—	—	—	
SPR	24 C 20/1	12	—	—	—	—	—	
SPR	25 A 20/1	12	—	—	—	—	—	
SPR	26 A 20/1	12	—	—	—	—	—	
SPR	27 B 20/1	12	—	—	—	—	—	
SPR	28 B 20/1	12	—	—	—	—	—	
SPR	29 C 20/1	12	—	—	—	—	—	
SPR	30 C 20/1	12	—	—	—	—	—	
SPR	31 A 20/1	12	—	—	—	—	—	
SPR	32 A 20/1	12	—	—	—	—	—	
SPR	33 B 20/1	12	—	—	—	—	—	
SPR	34 B 20/1	12	—	—	—	—	—	
SPR	35 C 20/1	12	—	—	—	—	—	
SPR	36 C 20/1	12	—	—	—	—	—	
SPR	37 A 20/1	12	—	—	—	—	—	
SPR	38 A 20/1	12	—	—	—	—	—	
SPR	39 B 20/1	12	—	—	—	—	—	
SPR	40 B 20/1	12	—	—	—	—	—	
SPR	41 C 20/1	12	—	—	—	—	—	
SPR	42 C 20/1	12	—	—	—	—	—	

WATTS BY PHASE TOTAL								
PHASE TOTAL AMPS								
DEMAND BY PHASE								
DEMAND BY PHASE @ 100%								
DEMAND BY PHASE @ 125%								
DEMAND BY PHASE								

FEEDER	CONDUIT	NO. & SIZE WIRE	WIRE TYPE	GROUND SIZE	FROM	FEEDING O.C. PROT.
	1 1/4"	4-#2	XHHW	#8	PP4A	40/3

LOCATION: LOWER LEVEL FILTER BUILDING
I-T-E CDP-7

BOX SELECTION (SURF)	PANEL	NEMA 4 ENCLOSURE	TOP
A/C	MAIN	18K	10K
MAIN BREAKER SIZE	90A	TYPE	10K
VOLTAGE	120	208	3 PHASE

PANEL: PP3C
LOCATION: BACKWASH RECYCLE VAULT
TYPE: 120/208V
DIMENSION: 42"Hx30"Wx14"D
WT:

LOAD DESCRIPTION	PHASE & CIRCUIT NUMBER	AMPS/ POLES	AMPS/ H.P.	GROUND SIZE	WATTS L1	WATTS L2	WATTS L3	SEE NOTE/S
3-VOL, 3-VF, 3-VM FIXTURES	1 A 20/1	12	1125	—	—	—	—	
WP GFI AT PANEL	2 A 20/1	12	750	—	—	—	—	
WP GFI AT LADDERS	3 B 20/1	12	—	—	—	—	—	
FAN - E-11	4 B 20/1	12	—	750	—	—	—	
WP GFI AT VAULT	5 C 20/1	12	—	1400	—	—	—	
CONTROL CCT - BWKPSV	6 C 20/1	12	—	750	—	—	—	
HEATERS - UH-9,10	7 A 20/1	12	100	—	—	—	—	
SUMP PUMP - BRVSP	8 A 40/2	28.8/	12	3000	—	—	—	
HEATERS - UH-9,10	9 B 20/1	9.8/1/2	12	1200	—	—	—	
VALVES - BREV-1,2	10 B 40/2	28.8/	12	3000	—	—	—	
VALVES - BREV-3,4	11 C 20/1	2/5.8/1/2	12	—	—	—	—	
VALVE - BREV-3	12 C 20/1	2/5.8/1/2	12	—	—	—	—	
VALVES - BRV-1,2	13 A 20/1	12	700	—	—	—	—	
TRANSMITTER - BRWFXM	14 A 20/1	12	1500	—	—	—	—	
TRANSMITTER - BRWFXM	15 B 20/1	1/	12	100	—	—	—	
TRANSMITTER - BRWFXM	16 B 20/1	1/	12	100	—	—	—	
SPR	17 C 20/1	1/	12	100	—	—	—	
SPR	18 C 20/1	1/	12	100	—	—	—	
SPR	19 C 20/1	1/	12	100	—	—	—	
SPR	20 C 20/1	1/	12	100	—	—	—	
SPR	21 C 20/1	1/	12	100	—	—	—	
SPR	22 C 20/1	1/	12	100	—	—	—	
SPR	23 C 20/1	1/	12	100	—	—	—	
SPR	24 C 20/1	1/	12	100	—	—	—	
WATTS BY PHASE TOTAL								
PHASE TOTAL AMPS								
DEMAND BY PHASE								
DEMAND BY PHASE @ 100%								
DEMAND BY PHASE @ 125%								
DEMAND BY PHASE								

FEEDER	CONDUIT	NO. & SIZE WIRE	WIRE TYPE	GROUND SIZE	FROM	FEEDING O.C. PROT.
	2"STGR/PVC	4#1 CU	XHHW	#4	PP4C	40/3

LOCATION: IN BACKWASH RECYCLE VAULT
I-T-E CDP-7

BOX SELECTION (SURF)	PANEL	NEMA 4 ENCLOSURE	TOP
A/C	MAIN	14K	10K
MAIN BREAKER SIZE	90/3	TYPE	3100
VOLTAGE	480V	PRIMARY	3 PHASE

AT ALL PANELS:
ALL BREAKERS BELOW 72" IN OVERALL HEIGHT, ABOVE FLOOR.
MINIMUM CLEAR WORKING SPACE IN FRONT OF PANEL 42".
PROVIDE STRUCTURAL STEEL SUPPORT FROM FLOOR AT
WALL WITH STRUT GENERAL PURPOSE SUPPORT PER DETAIL.

NOTES:
ITA: PROVIDE HANDLE LOCK TO PREVENT BREAKER SHUT OFF
HVAR: BREAKER RATED FOR HEATING/VENTILATION/CONDENSORS
NIT: LOAD WATTS NOT INCLUDED IN PANEL LOAD CALCULATION

PANEL: PP2H
LOCATION: INFLUENT CONTROL AND METERING VAULT
TYPE: 120/208V
DIMENSION: 42"Hx30"Wx14"D
WT:

LOAD DESCRIPTION	PHASE & CIRCUIT NUMBER	AMPS/ POLES	AMPS/ H.P.	GROUND SIZE	WATTS L1	WATTS L2	WATTS L3	SEE NOTE/S
UNIT HEATER - UH-8	1 A 20/2	14.4/	12	1500	—	—	—	
FAN - E-10	2 A 20/1	5.8/1/2	12	700	—	—	—	
UNIT HEATER - UH-8	3 B 20/2	14.4/	12	1500	—	—	—	
LIGHTING	4 B 20/1	12	—	1500	—	—	—	
SUMP PUMP - RWSP	5 C 20/1	5.8/1/2	12	—	—	—	—	
RECEPTACLES	6 C 20/1	12	—	1000	—	—	—	
TRANSMITTER - RWMFxm	7 A 20/1	12	240	—	—	—	—	
TRANSMITTERS - RW1PT,RW2PT	8 A 20/1	12	100	—	—	—	—	
SAMPLE PUMP - RWSP	9 B 20/1	7.8/2.0	12	—	—	—	—	
RWWA	10 B 20/1	12	—	10	—	—	—	
SAMPLE PUMP - RWSP	11 C 20/3	7.8/2.0	12	—	—	—	—	
SAMPLE PUMP - RWSP	12 C 20/1	7.8/2.0	12	900	—	—	—	
RWCP/RWSV	13 A 20/3	7.8/2.0	12	900	—	—	—	
SPR	14 A 20/1	NA	—	100	—	—	—	
SPC	15 B 20/1	NA	—	SPR	—	—	—	
SPC	16 B 20/1	NA	—	SPR	—	—	—	
SPC	17 C 20/1	NA	—	SPR	—	—	—	
SPC	18 C 20/1	NA	—	SPR	—	—	—	
WATTS BY PHASE TOTAL								
PHASE TOTAL AMPS								
DEMAND BY PHASE								
DEMAND BY PHASE @ 125%								
DEMAND BY PHASE								

FEEDER	CONDUIT	NO. & SIZE WIRE	WIRE TYPE	GROUND SIZE	FROM	FEEDING O.C. PROT.
	1 1/4"	4-#4CU	XHHW	#8 CU	PP4C	20/3

ELECTRICAL LEGEND

MARK	IDENTIFICATION
	CAST HUBBED BOX VAPOR TIGHT, GASKETED "X" BODY SEAL OFF
	UNISTRUT SUPPORT SEE DETAIL
	FLEXIBLE SEAL TIGHT CONDUIT WITH WIRE MESH SUPPORT GRIP CONNECTORS
	CONDUIT BELOW FLOOR CR/GRC-PVC-80 AS INDICATED
	CONDUIT IN WALL CONCEALED, ON WALL OR CEILING EXPOSED OR CONCEALED
	CEILING OUTLET WITH FIXTURE TYPE "A".
	WALL BRACKET OUTLET WITH FIXTURE TYPE "B".
	CONCRETE RING OCTAGON BOX WITH STUD TYPE COVER FOR FLUSH CONCRETE CONSTRUCTION
	JUNCTION BOX, SURFACE OR CONCEALED, ACCESSIBLE SIZED PER NEC WITH 25% SPARE
	SWITCH 20A, 2 SUBSCRIPT INDICATES 2 POLE, 4 SUBSCRIPT INDICATES 4 WAY.
	SWITCH, 3-WAY-S3M 20A. 480 VOLT 3 POLE RATED TOGGLE SWITCH SUBSCRIPT M
	SWITCH, PILOT LIGHT, 120 VOLT PILOT LIGHT, NEON WITH LEGEND PLATE
	SWITCH, THERMAL OVERLOAD, ALLEN-BRADLEY #600-TCB-7 FOR 120V, #600-TCA-7 FOR 230V, #600-TAX-4 OR #600-TCX-4 W/ APPROPRIATE HEATERS
	SUBSCRIPT K INDICATES STANDARD KEY TYPE
	SWITCH WIRED TO OVERRIDE PHOTO ELEC. CELL ON EXT. LIGHTING CIRCUITS
	TELEPHONE OUTLET 4 1/8" SQ 2 1/2" D SINGLE GANG BOX W/TELEPHONE PLATE 1" CONDUIT STUB
	CONDUIT RUN CONCEALED BY STRUCTURE OR FILL
	CONDUIT TURNING UP
	CONDUIT TURNING DOWN
	DUPLEX RECEPTACLE, GROUND FAULT FEED THROUGH TYPE P&S #1591 FD BOX WP COVER
	THERMOSTAT
	MOTOR SEE EQUIPMENT OR PLAN FOR DETAILS
	FLAG, NOTE SEE FLAG NOTE SCHEDULE #19
	3/4" CR/GRC WITH 14 GA. CU. SHIELDED TWISTED PAIR 4-20MA SIGNAL - 3 #14 XLTC-(STP)
	PHOTO-ELECTRIC CELL-AT PARAPET 3/4" CONDULET, 3/4"x1/2" R.E.B. 1/2" UNION, ORIENT NORTH. JACK, FLASH AND SEAL PENETRATION IN ROOF. (SEE FIX. SCH.)
	DOUBLE DUPLEX TRANSIENT-VOLTAGE VOLTAGE SUPPRESSOR, HUBBELL #53525 BLUE DEVICE AND PLATE, LIGHT AND ALARM, PROVIDE HUBBELL #SPJ-26 PLATES, MOUNT DEVICES IN 4 1/8" SQ X 2 1/4" D BOXES WITH APPROPRIATE SQUARE CUT DEEP DEVICE RINGS. VERIFY MOUNTING LOCATION AND HEIGHT WITH ENGINEER PRIOR TO ROUGH IN.
	GALVANIZED RIGID CONDUIT, STEEL
	CORROSION RESISTANT (40 MIL PVC COATED GRC CONDUIT) 40 MIL PVC COATED FITTING FURNISHED WITH EQUIPMENT, INTEGRAL TO MANUFACTURED EQUIPMENT (IME)
	FURNISHED BY OTHERS
	SUITABLE FOR USE AS SERVICE ENTRANCE EQUIPMENT (LABELED U.L.)
	FUTURE
	NEMA 12 N III R (NEMA 3 R) N IV (NEMA FOUR) NATIONAL ELECTRICAL CODE
	REFERENCE GROUND BUS SEE DETAIL
	SPECIAL PURPOSE 277 VOLT NEMA 115R OUTLET WITH CORD, CAP AND POWER HOOK
	WEATHERPROOF
	SPACE
	SPARE
	LOCATE AT
	NOT APPLICABLE
	ELECTRICAL CONTRACTOR
	LOWER CASE SUBSCRIPT INDICATES SWITCHING CONTROL
	20A. IP HORSEPOWER RATED MOTOR TOGGLE DISCONNECT SWITCH IN FD CAST BOX
	DOOR SWITCH IN MULLION W/BACK BOX RUN WIRE IN ENT CONDUIT IN MULLION
	ONE LINE DIAGRAM
	FULL VOLTAGE, NON REVERSING STARTER
	STARTER, FBO, INTEGRAL TO MANUFACTURED EQUIPMENT, WITH DISCONNECT SWITCH
	PROBE - LEVEL INDICATING HLP HIGH LEVEL PROBE CONNECT TO RTU 3/4"C/STP
	LEVEL PROBE AND STILLING WELL CONNECTED TO RTU 3/4"C/STP
	LIMIT SWITCH
	SOLENOID VALVE
	HAND-OFF AUTOMATIC SWITCH WITH PILOT LIGHTS RED(RUN) AMBER(AUTO) GREEN(OFF)
	MAGNETIC STARTER AT MOTOR, CONTRACTOR AT HEATERS OR LIGHTING.
	COMBINATION STARTER WITH MCP DISCONNECT SWITCH NEMA 4
	FULL VOLTAGE, NON REVERSING STARTER
	DISCONNECT SWITCH
	PILOT LIGHTS NEMA 12 RED(R) "ON" LEGEND AMBER(A) AUTO LEGEND GREEN(G) OFF LEGEND
	BLUE PILOT LIGHT "THIS UNIT RUNS NEXT" LEGEND (SEL) SELECTOR SWITCH
	CYCLE COUNTER
	AMMETER, VOLT METER, SELECTOR SWITCH OFF, 0A, 0B, 0C, N 0AB, 0BC, 0CA
	GENERAL PURPOSE SUPPORT - SEE DETAIL
	4/0 THW GREEN CU BOND COUNTERPOISE FOR GROUNDING, SEE GROUNDING SCH. AND SPECS.
	3/4" x 10' LG. COPPERWELD GROUND ROD, EXOTHERMIC WELDED CONNECTION
	REFERENCE GROUND BUS 6" H x 12" L x 3/8" COPPER - SEE DETAIL
	INSTALL FROM STRUCTURE ON UNISTRUT WITH DOUBLE 3/8" ALL GLASS INSULATORS
	INSTRUMENT TRANSFORMER PT: POTENTIAL CT: CURRENT
	METER-REVENUE-DEMAND BY UTILITY CO. BASE FURNISHED & MOUNTED BY E.C.
	TRANSFORMER, DRY TYPE NUMBER INDICATES KVA SIZE (50)
	INSTRUMENTATION CONTROLS TERMINATION CABINET
	SURFACE PANEL, 120/208V 30 4W. SEE TYPICAL PANEL ELEVATION AND
	SURFACE PANEL, 277/480V 30 4W. SEE TYPICAL PANEL ELEVATION AND
	MOTOR CONTROL CENTER (MCC) 460V 30
	DISTRIBUTION PANEL 277/480V 30 3xw FUSIBLE SWITCHES AND BREAKER 30 4W SECTION
	HEATING, EXHAUST FAN, SHUTTER AND DAMPER CONTROLS J-BOX NEMA 4 MOUNT THERMOSTATS TO CABINET, PROVIDE "XL" RELAYS, TERMINAL STRIPS PILOT LIGHTS AND HOA SWITCHES IN CABINET HOFFMAN - 24"H x 24"W x 6"D
	HOFFMAN NEMA 4 J-BOX WITH HINGED COVER, MOUNT THERMOSTAT TO BOX, PROVIDE TERMINAL STRIPS FOR LINE AND CONTROL WIRING, SUB PANEL 12"x

ALARM DEVICES LEGEND

MARK	IDENTIFICATION
(SD)	SMOKE DETECTOR - FIRE LITE #2400
(S)	DUCT DETECTOR - FIRE LITE #DH23/RCM50/ACA
500	FIRE/SMOKE DETECTION CONTROL PANEL U.L. APPROVED 8 ZONE EXTERNAL ANNUCIATOR PANEL WIRE TO AND CONNECT TO RTU TO ANNUCIATE ALARM PER ALL LOCAL CODES AND U.L. REQUIREMENTS.
(IA) (P) (C)	INTRUSION ALARM MICRO BRAND PROXIMITY SWITCH IN DOOR MULLION WIRE TO GUAX IN KELLUMS POLYTUFF II LIQUID TIGHT CONDUIT
(LS) (C)	HATCH LIMIT ALARM SWITCH AND CONNECTION BOX. WIRE TO AND CONNECT SET AND ADJUST LIMIT SWITCH. FURNISH AND INSTALL BRACKETS.

LIGHTING	FIXTURE	SCHEDULE
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ROCKY MOUNTAIN CONSULTANTS
8301 EAST PRENTICE AVENUE, SUITE 101
ENGLEWOOD, COLORADO 80111
(303) 741-6000

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CITY OF LOUISVILLE, COLORADO
SOUTH WATER TREATMENT FACILITY
ELECTRICAL LEGEND AND LIGHTING FIXTURE SCHEDULE

DATE: JAN. 1992
DESIGNED BY: GA
DRAWN BY: FV
CHECKED BY: MC

JOB NO.
0058.051.0

SHEET
100 OF 103



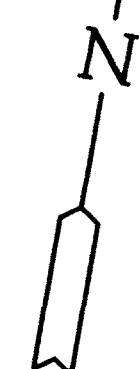
Appendix

1. Mechanical System Matrix Options
2. Mechanical Decarbonization Scoping
3. Electrical Decarbonization Scoping
4. Structural Scoping
5. Electric Vehicle Charging Narrative
6. Renewables Scoping
7. Cost Estimating

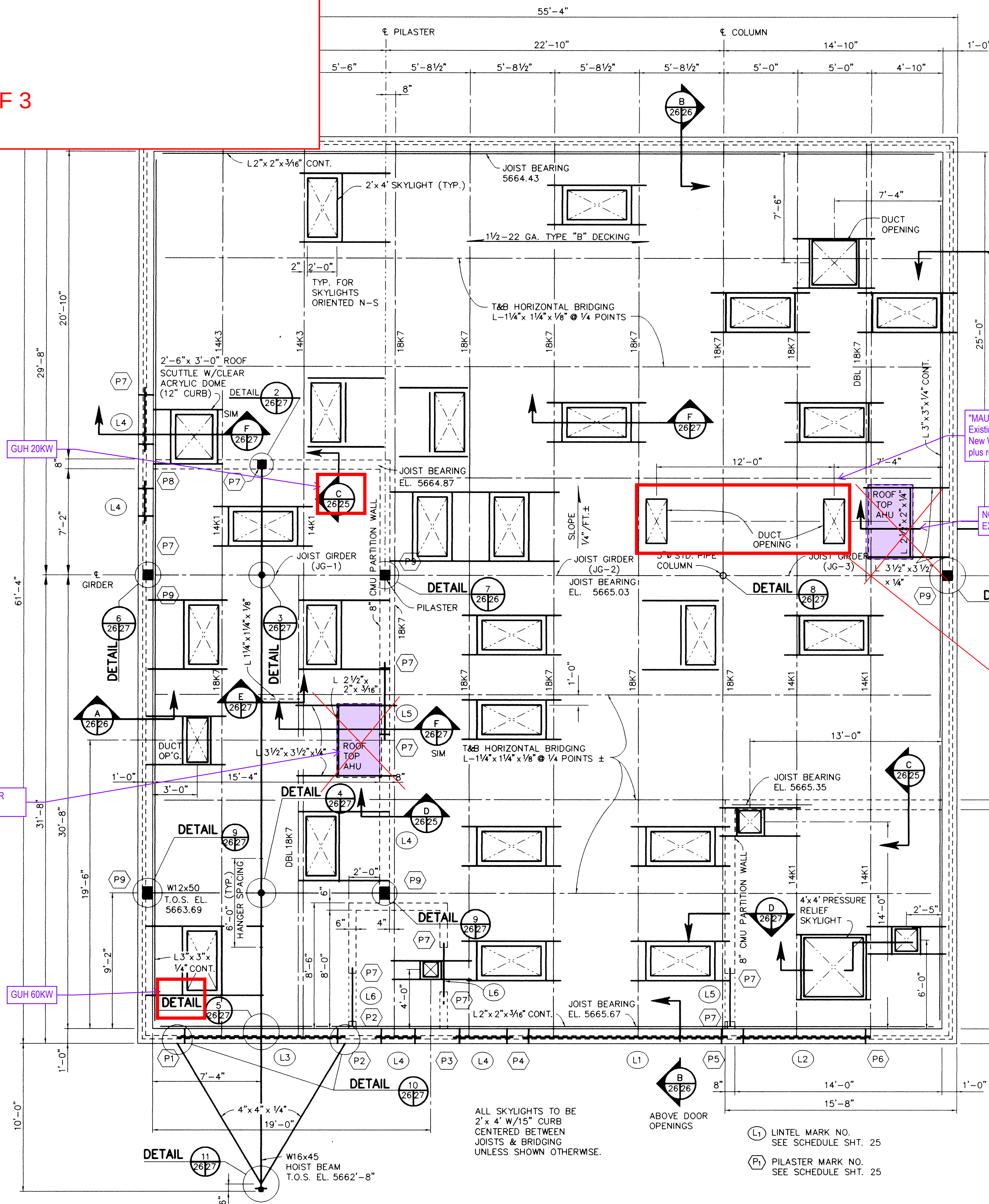
STRUCTURAL MARKUP FOR
HOWARD BERRY WATER PLANT

3-15-24

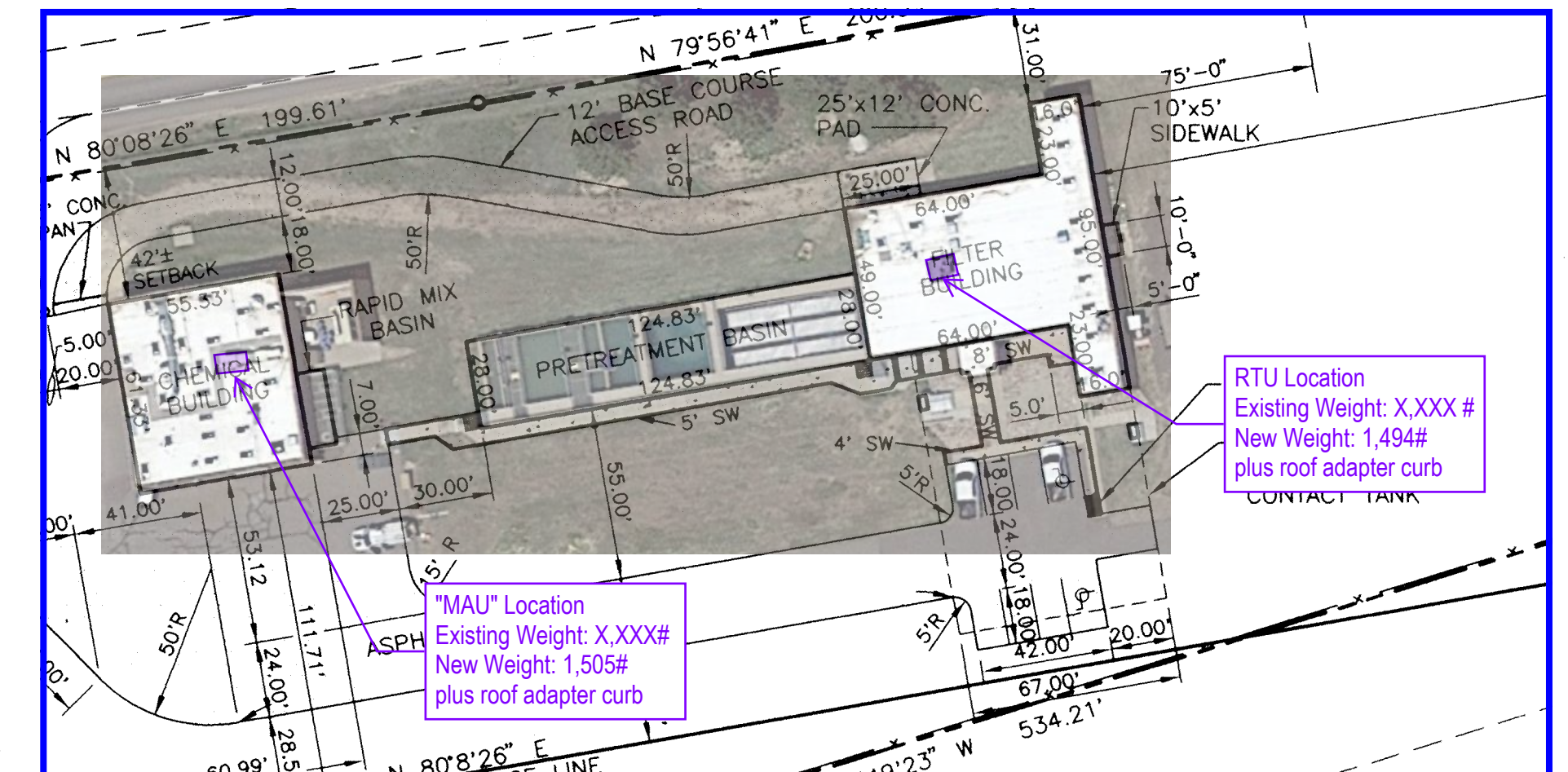
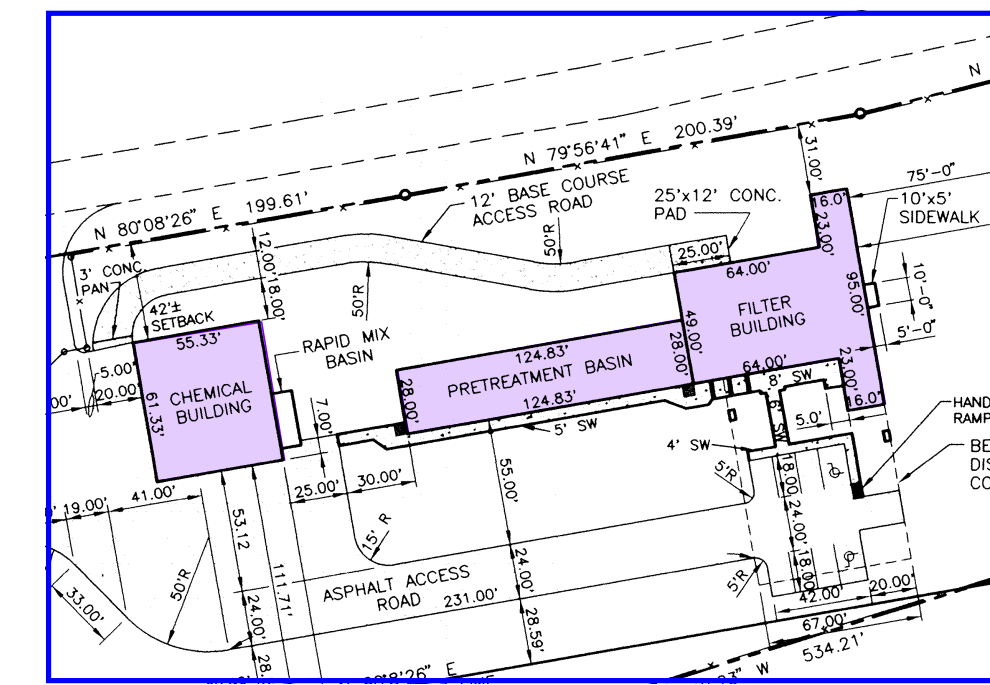
SHT: 1 OF 3



LSWCRF DWG 11-30-93
1=4



STRUCTURAL ROOF PLAN
Scale: 1/4" = 1'-0"



EXISTING FRAMING OK
MAINTAIN EXISTING
OPENINGS
NO STRUCT UPGRADE
TO UNDERLYING BAR
JOIST REQ'D

NEW MAU WITH
ADAPTER CURB
MAX WT = 1800# WITH
ADAPTER CURB

STRUCTURAL NOTES:
1. REPLACEMENT ROOFTOP UNITS CONFIGURED WITH LG ADAPTER
CURB.

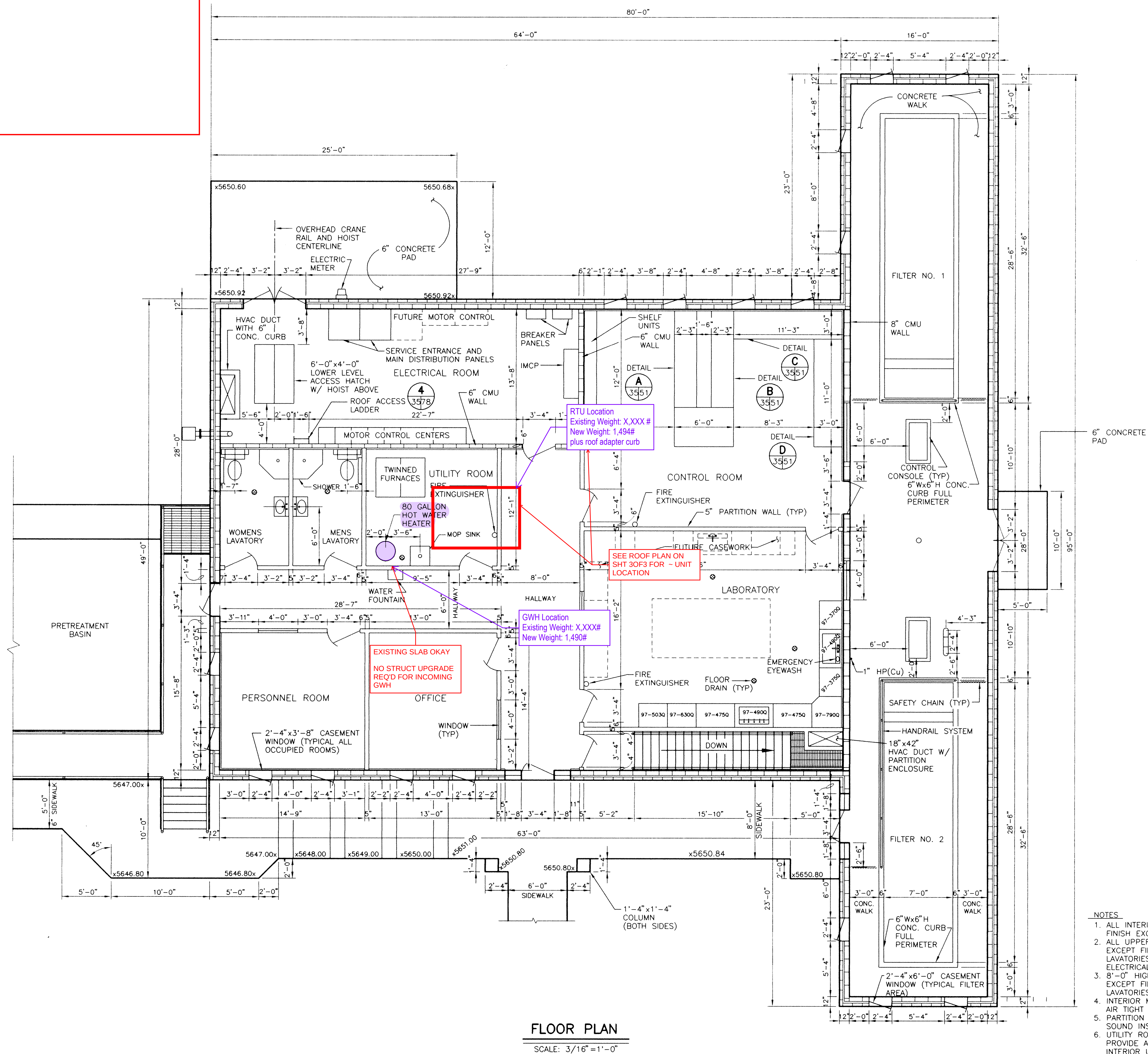
NO STRUCT UPGRADE
REQ'D FOR
REPLACEMENT MECH
EQUIPMENT

MEPS Coordination Matrix - South Treatment Plant													
Existing General (from nameplates/dwgs)													
BUILDING	Heating Type (Conditioned vs Freeze Protection)	UNIT	MAKE	Tonnage	Model #	Serial #	Year	Natural Gas Input (Btu/hr)	Calculated Equivalent kW (@34.12 Btu/kWh, 80% eff)	New Electrical (Elec. Only w/ Wheel, Resistance Backup)		Structural	
										Make	Model	Existing Weight (lbs)	New Weight (lbs)
ADMIN BLDG	Conditioned	RTU	CARRIER	4	48LCE007A3MGA0SC0	0518P89282	2018	125,000	29.3	DAIKIN	DP5003A	587	1,494
ADMIN BLDG	Conditioned	GWU	SANBLASTER		SBS10070NE300	1412M001826	2014	75,100	17.6	AO SMITH	CAHP 120	1,490	1,490
PRE TREATMENT	Freeze Protection	MAU	CAPTIVE AIR		A2-18T-4500-300-G15		2015	600,000	140.7	Greenheck	R45-41216422-AM		1,505
PRE TREATMENT	Freeze Protection	GUH	NORTEK		UDAS-250	8583062008547		250,000	58.6	Reznor	EGHB-60-AKPE		
PRE TREATMENT	Freeze Protection	GUH	NORTEK		UDAS-75	BRC3062019659		75,000	17.6	Reznor	EGHB-20-AKPE		

STRUCTURAL MARKUP FOR
HOWARD BERRY WATER PLANT

3-15-24

SHT: 2 OF 3



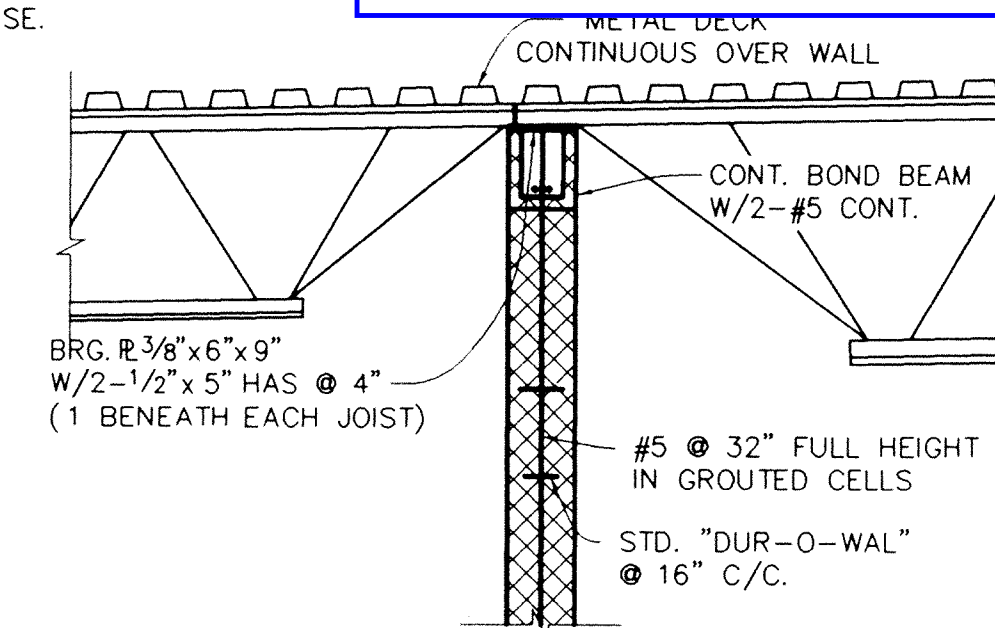
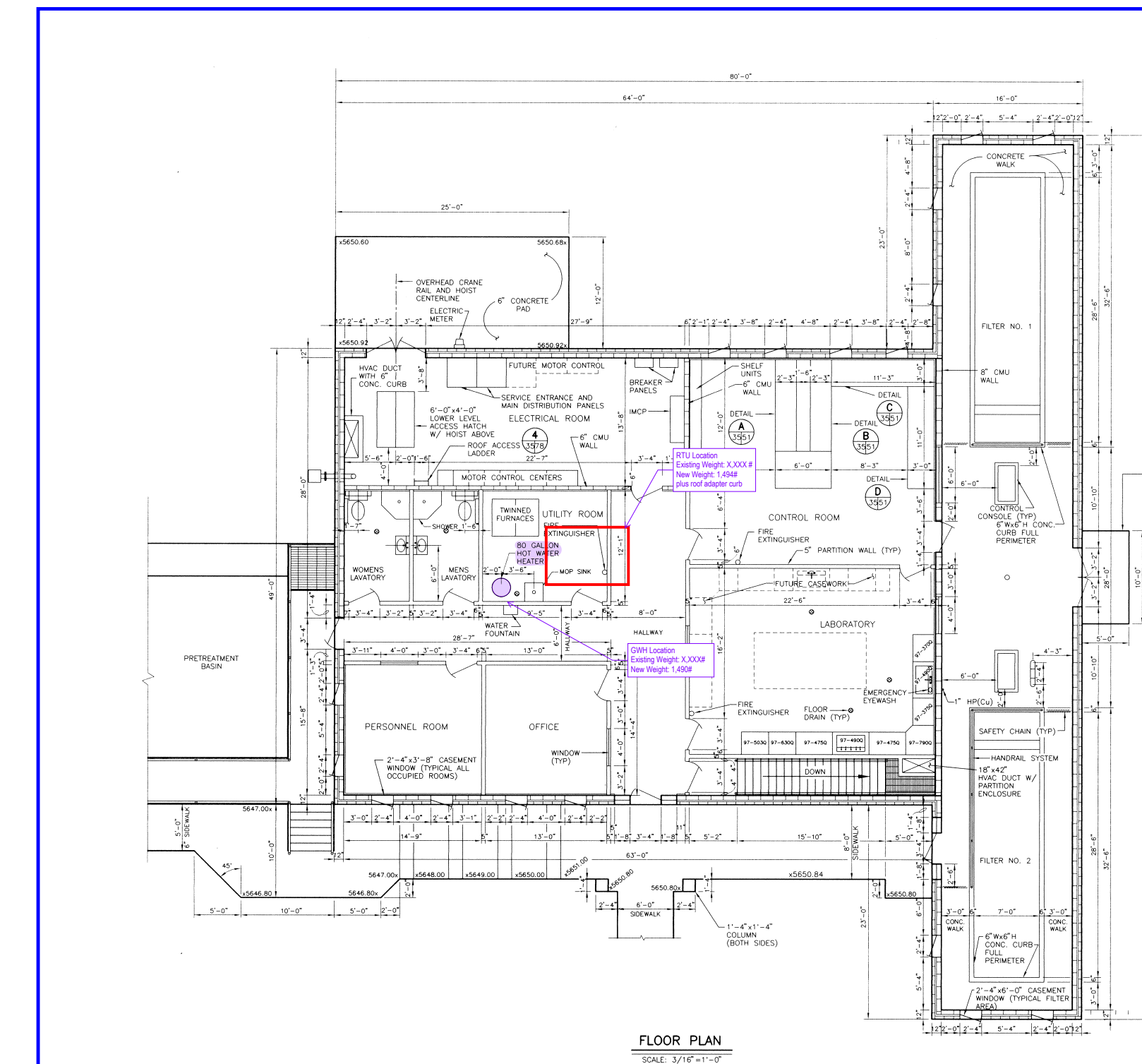
FLOOR PLAN

SCALE: 3/16" = 1'-0"

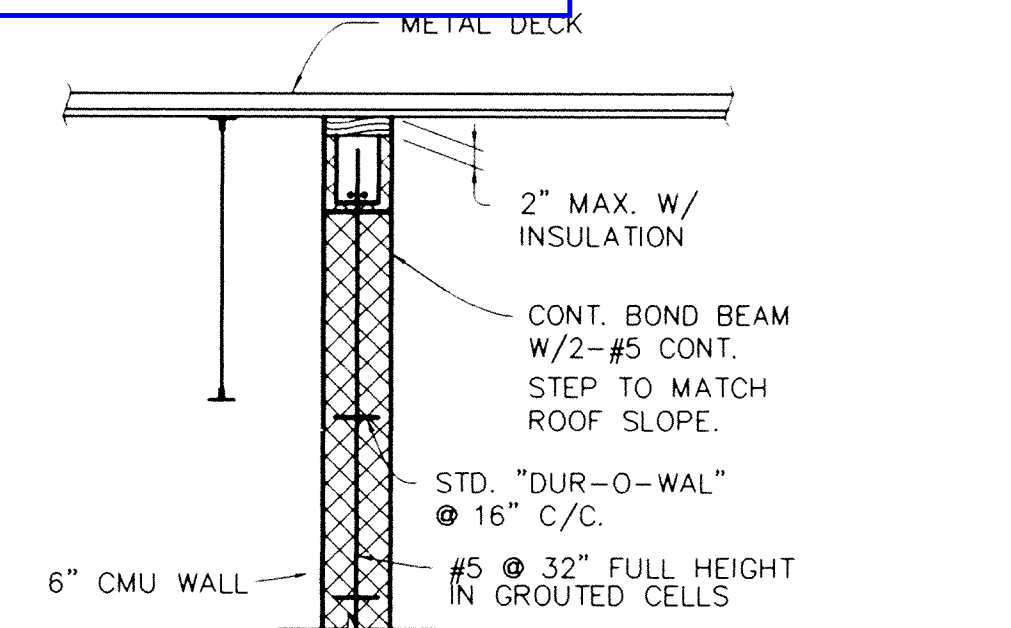
NOTES

1. ALL INTERIOR MASONRY WALLS SHALL HAVE GYPSUM BOARD FINISH EXCEPT FILTER AREA, ELECTRICAL ROOM AND STAIRWELL.
2. ALL UPPER LEVEL FLOORS SHALL HAVE RESILIENT FLOORING EXCEPT FILTER AREA, LAVATORIES AND ELECTRICAL ROOM. LAVATORIES SHALL HAVE TILE FLOORS. FILTER AREA AND ELECTRICAL ROOM SHALL HAVE PAINTED FLOORS.
3. 8'-0" HIGH SUSPENDED CEILING SHALL BE PROVIDED THROUGHOUT EXCEPT FILTER AREA, ELECTRICAL ROOM, UTILITY ROOM AND LAVATORIES. LAVATORIES SHALL HAVE GREEN BOARD CEILING.
4. INTERIOR MASONRY WALLS SHALL BE FULL HEIGHT; PROVIDE AIR TIGHT SEAL AT ROOF DECK.
5. PARTITION WALL BETWEEN STAIRWELL AND LABORATORY SHALL BE SOUND INSULATED WITH R-11 BATT INSULATION.
6. UTILITY ROOM SHALL HAVE FULL HEIGHT PARTITION WALLS. PROVIDE AIR TIGHT SEAL AT ROOF DECK AND PENETRATIONS. INTERIOR UTILITY ROOM WALLS SHALL BE GREEN BOARD.
7. INTERIOR DIMENSIONS ARE TO MASONRY.
8. LAVATORIES SHALL HAVE CEMENT BACKER BOARD FOR 4'-0" HIGH WALL TILE INSTALLATION.

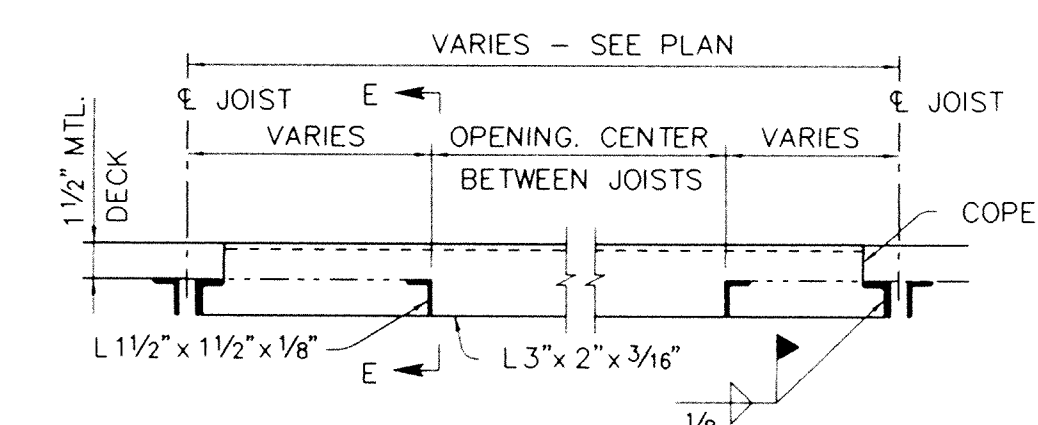
SHT: 3 OF 3



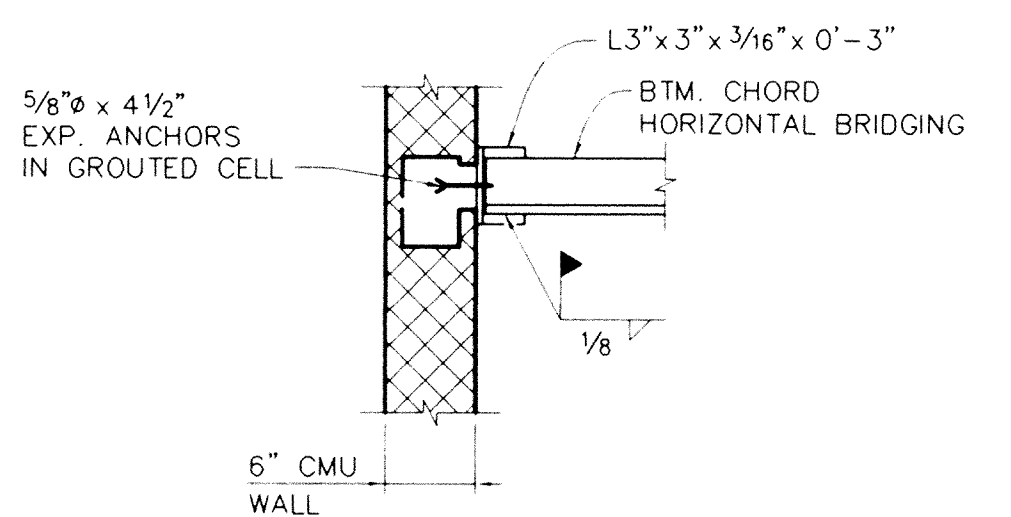
SECTION C
SCALE: 3/4"=1'-0" 5959



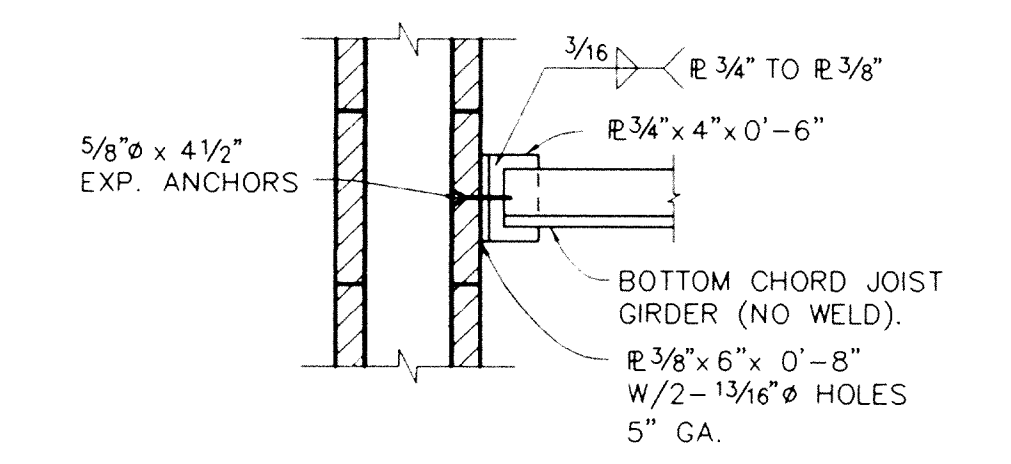
SECTION 
SCALE: 3/4"=1' 0" 595



TYPICAL FRAMING PLAN FOR OPENINGS
THROUGH ROOF DECK



HORIZONTAL BRIDGING BOTTOM
CHORD SUPPORT
SCALE: 1" = 1'-0"



JOIST GIRDER BOTTOM
CHORD SUPPORT
TYP. AT (P1) AND (P2)

SEE SHEET 63
FOR GENERAL NOTES



Appendix

1. Mechanical System Matrix Options
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City of Louisville Howard Berry Water Treatment Plant Electric Vehicle Charging Narrative

Electric Vehicle Charging Narrative

Electric Vehicle Charging Narrative

Fleet & Electric Vehicle Charging

As part of the decarbonization study, the fleet vehicles were analyzed for replacement with electric vehicle (EV) equivalents. In addition, building electrical capacities were reviewed to determine if they have enough capacity to charge the fleet vehicles and if any electrical upgrades may be needed to the buildings.

EV Fleet Conversion

Based on current technology, transitioning from internal combustion engine (ICE) vehicles to EVs can substantially lower overall carbon emissions. A caveat to consider in assessing the environmental impact of EVs is the variation of electricity generation sources in each area. The state of Colorado relies mainly on coal and natural gas. However, the share of these fuel sources as a percentage of total generation is decreasing. Alternative energy sources such as wind and solar are increasing rapidly. By using additional onsite renewable energy sources and phasing in vehicle replacement it will be possible for Louisville's fleet to be entirely carbon free.

In the current vehicle market mainly light duty vehicles are being produced. The battery technology is still being developed for heavy-duty vehicles. The market is rapidly changing so over the course of the next 5 years, new innovation should allow heavy duty vehicles to be carbon free through either advanced battery technology or other yet to be determined technology.

EVs typically have a higher initial capital cost to purchase or lease when compared to ICE vehicles, EVs can cost less in the long-term due to lower fuel costs, different maintenance requirements, and longer vehicle lives. Therefore, it is important to consider the entire lifespan of a vehicle when investing in fleet vehicles. There are also limiting factors of EVs to consider, such as range and power needs of certain fleet vehicles, as well as the near-constant changes in the electric vehicle and infrastructure technology.

Charging Infrastructure

When planning for EV charging infrastructure, it is recommended to proactively plan for the number of charging stations needed by installing more electrical equipment (e.g. transformers and conduits) than is needed for the initial purchase of EVs. It is more cost effective to install excess electrical equipment during the initial installation than having to add electrical wires each time additional stations are required. This electrical equipment installation does not include purchasing all the charging stations that can fit with that equipment, but instead having the electrical capacity to purchase charging stations to meet future capacity needs without additional construction. The city has already thought about this and this report is the result of that forward thinking.

While there are three levels of EV charging infrastructure currently available, Level 2 charging is currently the most prevalent among them and requires electrical infrastructure upgrades to extend 240 volt AC service to locations where the EVs would charge. It charges at over twice the rate of level 1, adding 12 to 80 miles of range per hour charging. Level 3 charges are also becoming more common and can add from 80 to 500 miles of range per hour. Level 3 charging typically requires a 480 volt AC service. The level 2 and 3 chargers with the increased rate of charging can justify the costs to serve the needs of fleet management in a timely manner. Costs per unit can vary within these ranges depending on the installation and labor costs, warranties for equipment, and operation and maintenance costs for the equipment. Level 2 chargers provide good value for infrastructure investment when factoring in cost and time required to charge when compared to Level 3 chargers. Level 3 chargers can make sense when high use vehicles need quick recharging, though these chargers will cost more to install and incur a higher charging cost than level 2 chargers.

Electric Vehicle Charging Narrative

For the public chargers the City may want to consider charging a some type of fee for usage. Many charging stations charge a usage fee at some dollar per kWh of charging. This can help offset the peak demand that may be incurred by the city. Another option is to charge an idle fee. This type of fee encourages people not to leave their vehicle plugged in for long period of times once the vehicle has reached full charge.

Another consideration for charging infrastructure is the daily charging schedule. Most of the buildings reviewed for this study are on a secondary general rate schedule. This rate schedule does not have time of use rates for electrical consumption or peak demand. This means depending on when and how many vehicles charge relative to the buildings peak demand, it may increase the demand charges the city pays. Xcel Energy does offer a EV charging rate plan that incentivize the intentional reduction of electricity use during peak energy demand periods, such as during hot summer days. This rate plane does require a separate service for just the charging stations. Planning for fleet recharging during off-peak periods can add up to thousands of dollars in savings.

Battery capacity

Battery technology is changing rapidly, resulting in increased charge capacity and lower operating cost per mile. Many manufactures now offer eight year/100,000 mile warranties on their EV batteries (generally covering defects and workmanship), and some offers an eight year/100,000 mile warranty on battery capacity. Auto manufacturer warranties and charge capacity have generally reduced consumer concern about battery life and range. As a result, the analysis of total ownership cost does not account for the cost of EV battery replacement, assuming that municipal vehicles will be retired at the warranty expiration.

Howard Berry Water Treatment Plant Site

The Howard Berry Water Treatment Plant has no fleet vehicles currently stored at that location. However, because this site is relatively remote the City would like to have the ability charge vehicles at this location in an emergency situation.

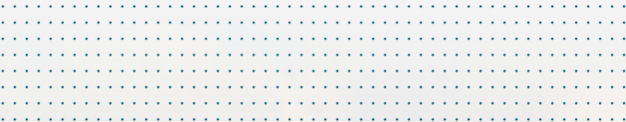
We recommend installing 2 level 3 chargers and upgrading the electrical infrastructure to support them. The two level 3 chargers will enable the city to rapidly recharge vehicles if necessary and unavailable at the vehicles typical charging location. Table XX below shows the number of recommended chargers.

Existing Public charging stations	Existing Public Charger Level	Quantity of New Level 2 Public Charger	Quantity of New Level 3 Public Charger	Quantity of New Level 2 Fleet Charger	Quantity of New Level 3 fleet Charger
0	N/A	0	0	0	2



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City of Louisville Decarbonization Study

Louisville Howard Berry Water
Treatment Plant

RENEWABLES SUPPORTING ANALYSIS

LOUISVILLE, CO

AUGUST 18, 2023

Together Building a Thriving Planet



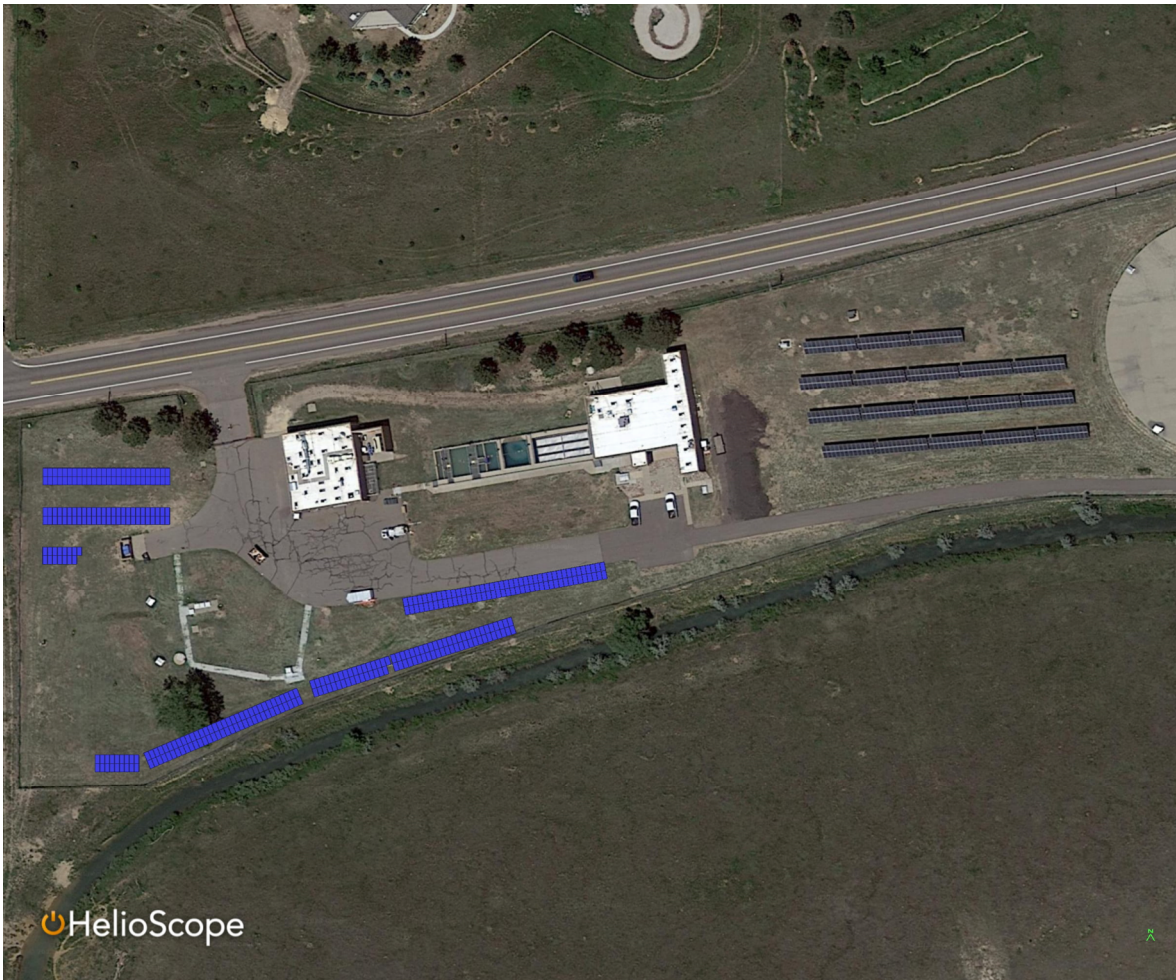
Louisville Howard Berry Water Treatment Plant

The Louisville Howard Berry Water Treatment Plant is a great candidate for a fixed-tilt ground mount solar PV system. South and East of the main building have area available for solar expansion.

1. Proposed Solar PV System Overview

Below is a high-level summary of the proposed system specifications. Please note, specific equipment manufacturers and models may change depending on availability and market conditions at the time of construction.

SITE NAME	SITE ADDRESS	SIZE (KW-DC)	SIZE (KW-AC)	SYSTEM TYPE	YEAR 1 PRODUCTION (kWh)
Howard Berry Water Treatment Plant	7000 Marshall Rd, Louisville, CO 80027	202	160	Fixed-tilt ground mount	335,400



Louisville Howard Berry Water Treatment Plant

LOUISVILLE HOWARD BERRY WATER TREATMENT PLANT EQUIPMENT AND QUANTITY SUMMARY

QUANTITY	EQUIPMENT DESCRIPTION
374	JA Solar, JAM72D30-540 (540W) – Bifacial Mono PERC Half Cell Double Glass Modules
2	CPS SCA50KTL-DO/US-480 - Inverters
1	CPS SCA60KTL-DO/US-480 - Inverters
1	30° Fixed-Tilt Ground Mount Racking System
1	AlsoEnergy Data Acquisition System (DAS) Package – PLCS400
1	Electrical Balance of Systems Package

AlsoEnergy Data Acquisition System (DAS) includes the equipment/functionality listed below.

- NEMA 4 Enclosure and Data Logger
- Cellular modem
- CT Based Revenue Grade Meter
- Inverter Direct Monitoring
- 5-year service plan
- A Meteorological Station consisting of the following:
 - Cell Temp Sensor
 - Pyranometer
- Publicly accessible web-based dashboard functionality

The Electrical Balance of Systems Package includes all components to create an electrically complete ground mounted solar PV installation. This includes grounding materials, wiring, conduit, MCT, panelboards/combiners, switchgear, fuses, and disconnects. For the purposes of this decarbonization study, this scope may be split between the electrical and solar PV pricing. More details provided in Section 4.

2. Production Modeling

Array layouts and system production are modeled in Helioscope, an industry-standard design and energy modeling software package with 3-dimensional modeling capabilities. Through Helioscope, we can incorporate site-specific characteristics of buildings and shade producing obstructions to determine their impacts upon system layout and production. McKinstry further applies our knowledge of codes and regulations, industry best practices, and professional judgment to ensure that designs are code-compliant and strike a balance across customer preferences, production, constructability, and price concerns.

Helioscope provides robust PV system output modeling capabilities. We use these in conjunction with Typical Meteorological Year (TMY) weather datasets, real-world equipment specifications, proprietary 3rd-party-engineered dust and snow soiling models, and professional judgment to determine a system's annual kWh production. For City of Louisville, we are using the TMY, DENVER INTL AP, NSRDB (tmy3,I) weather data set and soiling conditions from the DNV-GL NOAA Lafayette station. Full Helioscope report below.

Louisville Howard Berry Water Treatment Plant



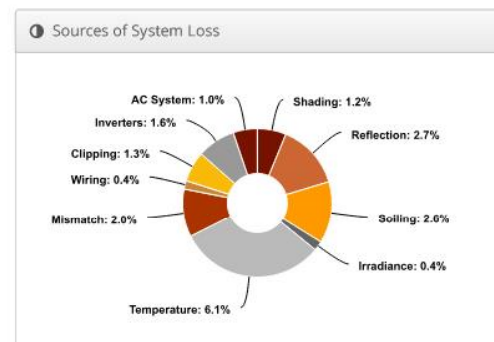
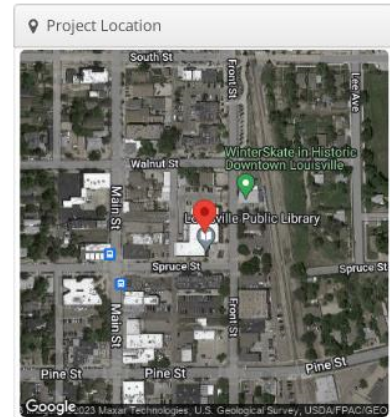
Annual Production Report produced by Mountain Bryan H

Cohort 2 - SWTP_site max City of Louisville, 951 Spruce St, Louisville, CO 80027

Report

Project Name	City of Louisville
Project Address	951 Spruce St, Louisville, CO 80027
Prepared By	Mountain Bryan H bryan.h@mckinstry.com

System Metrics	
Design	Cohort 2 - SWTP_site max
Module DC Nameplate	202.0 kW
Inverter AC Nameplate	160.0 kW Load Ratio: 1.26
Annual Production	335.4 MWh
Performance Ratio	83.4%
kWh/kWp	1,660.5
Weather Dataset	TMY, DENVER INTL AP, NSRDB (tmy3, I)
Simulator Version	0b20365465-f9de7709be-37a695226a-28e7c7d839



Louisville Howard Berry Water Treatment Plant



Annual Production Report produced by Mountain Bryan H

⚡ Annual Production			
	Description	Output	% Delta
Irradiance (kWh/m²)	Annual Global Horizontal Irradiance	1,670.2	
	POA Irradiance	1,991.8	19.3%
	Shaded Irradiance	1,967.9	-1.2%
	Irradiance after Reflection	1,915.0	-2.7%
	Irradiance after Soiling	1,865.4	-2.6%
	Total Collector Irradiance	1,865.4	0.0%
Energy (kWh)	Nameplate	381,489.4	
	Output at Irradiance Levels	379,991.3	-0.4%
	Output at Cell Temperature Derate	356,988.4	-6.1%
	Output After Mismatch	349,802.1	-2.0%
	Optimal DC Output	348,574.2	-0.4%
	Constrained DC Output	344,201.4	-1.3%
	Inverter Output	338,751.7	-1.6%
	Energy to Grid	335,364.1	-1.0%
Temperature Metrics			
	Avg. Operating Ambient Temp		15.0 °C
	Avg. Operating Cell Temp		29.7 °C
Simulation Metrics			
		Operating Hours	4513
		Solved Hours	4513

☁ Condition Set											
Description	Ground 30 deg										
Weather Dataset	TMY, DENVER INTL AP, NSRDB (tmy3, I)										
Solar Angle Location	Project Lat/Lng										
Transposition Model	Perez Model										
Temperature Model	Diffusion Model										
Temperature Model Parameters	Rack Type	U _{const}				U _{wind}					
	Fixed Tilt	20				0					
	Flush Mount	15				0					
	East-West	29				0					
	Carport	29				0					
Soiling (%)	J	F	M	A	M	J	J	A	S	O	N D
	5	5	5	4	2	0	1	1	1	1	4 6
Irradiation Variance	3.5%										
Cell Temperature Spread	3° C										
Module Binning Range	0% to 2.5%										
AC System Derate	1.00%										
Trackers	Maximum Angle					Backtracking					
	30°					Disabled					
Module Characterizations	Module				Uploaded By		Characterization				
	JAM72D30-540/MB (JA Solar)				HelioScope		Spec Sheet Characterization, PAN				
Component Characterizations	Device				Uploaded By		Characterization				
	CPS SCA50KTL-DO/480 (Chint)				HelioScope		Spec Sheet				
	CPS SCA60KTL-DO/480 (Chint)				HelioScope		Spec Sheet				

📦 Components		
Component	Name	Count
Inverters	CPS SCA50KTL-DO/480 (Chint)	2 (100.0 kW)
Inverters	CPS SCA60KTL-DO/480 (Chint)	1 (60.0 kW)
Strings	10 AWG (Copper)	22 (2,747.1 ft)
Module	JA Solar, JAM72D30-540/MB (540W)	374 (202.0 kW)

🔌 Wiring Zones			
Description	Combiner Poles	String Size	Stringing Strategy
Wiring Zone	-	17-17	Along Racking
Wiring Zone 2	-	17-17	Along Racking
Wiring Zone 3	-	17-17	Along Racking

🏠 Field Segments									
Description	Racking	Orientation	Tilt	Azimuth	Intrarow Spacing	Frame Size	Frames	Modules	Power
Field Segment 1 (copy 5)	Fixed Tilt	Portrait (Vertical)	30°	169.53775°	14.4 ft	2x1	42	84	45.4 kW
Field Segment 1 (copy 7)	Fixed Tilt	Portrait (Vertical)	30°	170°	14.4 ft	2x34			0
Field Segment 1 (copy 8)	Fixed Tilt	Portrait (Vertical)	30°	162.63907°	14.4 ft	2x26	1	52	28.1 kW
Field Segment 1 (copy 9)	Fixed Tilt	Portrait (Vertical)	30°	157.10013°	14.4 ft	2x34	1	68	36.7 kW
Field Segment 6	Fixed Tilt	Portrait (Vertical)	30°	180°	17.3 ft	2x1	60	119	64.3 kW
Field Segment 6 (copy)	Fixed Tilt	Portrait (Vertical)	30°	180°	17.3 ft	2x9	1	18	9.72 kW
Field Segment 1 (copy 10)	Fixed Tilt	Portrait (Vertical)	30°	162.63907°	14.4 ft	2x17	1	33	17.8 kW

Louisville Howard Berry Water Treatment Plant

3. Annual Utility Savings and Value of Solar Energy

To analyze utility bill savings, we utilize Energy Toolbase, an industry-standard bill modeling software package. Energy Toolbase estimates bill savings based upon a site's electric load characteristics, PV system production (imported from Helioscope or other sources), and local utility tariffs and net metering policies. Xcel Energy tariffs and Net Metering tariff adjustments used in this analysis are:

- Secondary General (SG)
- Secondary Photovoltaic Time-of-Use (SPVTOU)
- Net Metering Service (Schedule NM)

To properly calculate the annual utility savings associated with the solar PV, we need to analyze the building load after all electrification and carbon reduction measures are implemented. As noted in the Summary Report, there is one bundle of measures – Bundle 1 post Electrification. A modeled usage profile was created from the Waste Water Treatment Plant interval data. This scenario provides a 63% consumption offset.

OPTION 1 - GROUND MOUNT ONLY ESTIMATE WITH SPVTOU RATE SWITCH

SCENARIO	ANNUAL SAVINGS	ENERGY SAVINGS	DEMAND SAVINGS
Bundle 1	\$37,136	\$16,168	\$21,029

To qualify for a rate switch to SPVTOU, the facilities meter must have a minimum 30% load factor for the trailing 12 months and a maximum service load rating of 500kW. This site's service load is under 500kW. 2019 Average Load factor was 31%. Bundle 1 is projected to have an increased load factor totaling 38% prior to PV installation. We have projected that this site will qualify for the SPVTOU rate class.

4. System Price and Financial Results

There are two main avenues City of Louisville can choose to finance these projects – cash purchase or tax-exempt lease purchase (TELP). As a tax-exempt entity, City of Louisville is eligible for direct pay in Year 1 at Energy Investment Tax Credit (ITC) rates. These rates are 30% for cash purchase and 25.5% for TELP.

At this early feasibility study stage of a portfolio, we focus on simple payback to get a high-level look at the project economics. Our simple payback calculation is based on Year 1 solar production, Year 1 annual utility savings, and the Solar*Rewards C&I incentive program. Should any of these projects move into the next stage of development, McKinstry would develop more detailed proformas and cash flows to include items like solar degradation, Operations & Maintenance, discount rates, and more.

McKinstry aims to recommend solar systems that will pay back in the at least the system lifetime, 30 years for a ground mount system. In all funding scenarios, this system would pay back well within the solar lifetime and under 15 years.

Louisville Howard Berry Water Treatment Plant

OPTION 1 - GROUND MOUNT ONLY

BUNDLE 1	SYSTEM PRICE	ANNUAL SAVINGS	UTILITY INCENTIVE	SIMPLE PAYBACK (YRS)
Cash Purchase or Tax-Exempt Lease Purchase (TELP)	\$750,000	\$37,136	\$12,543	15.2
TELP with IRA	\$558,750			11.35
Cash Purchase with IRA	\$525,000			10.66

Please note that there is no proposed service upgrade for this site. The full PV scope from the Point of Interconnection, to the Solar Disconnect, Solar Meter, AC Combiner, Inverters to Modules is included in the pricing below. Additionally, pricing below assumes Louisville moves forward with a system at the Sid Copeland Water Treatment Plant and the Wastewater Treatment Plant; there are cost efficiencies in material, installation, and construction management scopes using a portfolio approach.

Another metric that may be useful as the City of Louisville considers the best way to decarbonize is levelized cost of electricity (LCOE). This is defined as capital cost divided by the estimated system lifetime production with units of \$/kWh. It can help the City of Louisville compare the value of owning onsite solar versus subscribing to renewable utility programs like Renewable Connect and Windsource. The table below shows LCOE with and without the Solar*Rewards C&I incentive.

BUNDLE 1	LCOE - NO UTILITY INCENTIVES (\$/KWH)	LCOE - W/ UTILITY INCENTIVES (\$/KWH)
Cash Purchase or Tax-Exempt Lease Purchase (TELP)	\$0.075	\$0.048
TELP with IRA	\$0.056	\$0.029
Cash Purchase with IRA	\$0.052	\$0.026

5. Future Considerations and Next Steps

Should Louisville decide to move forward with the Howard Berry Water Treatment Plant ground mount system, next steps would involve a geotechnical study, utility locates, land survey, racking and electrical bid sets, an interconnection application to Xcel, a subcontractor RFP to get final pricing, and any other due diligence items necessary to de-risk the project and ready it for implementation.

Louisville Howard Berry Water Treatment Plant

6. Assumptions, Inclusions, and Exclusions

- Codes and Utility Standards:
 - NEC 2020
 - IBC 2018
 - IFC 2018
 - Xcel Energy Blue Book (7/31/2022 Version)
 - Xcel Energy DG Tech Manual (10/28/2021 Version)
- Tax-exempt
- Prevailing wage
- The full PV scope from the Point of Interconnection, to the Solar Disconnect, Solar Meter, AC Combiner, Inverters to Modules
- Pricing assumes a portfolio approach; Louisville will move forward with a solar PV system at both the Sid Copeland Water Treatment Plant and Wastewater Treatment Plant.
- Pricing includes payment & performance bond
- Terms & Conditions listed in the Xcel Energy Interconnection Agreement
- Current labor rates
- Modeling:
 - TMY, DENVER INTL AP, NSRDB (tmy3,l) weather file
 - 1.5% production gain for ground mounts with bifacial modules
 - Soiling data from DNV-GL
- Design Loads
 - Wind speed:
 - Risk Category II: 145mph
 - Exposure: C
 - Ground snow load: 30 psf
 - Risk Category II: 1.0 importance factor
- No interconnection upgrade costs
- No grounding transformers
- Major equipment warranties
 - Modules – 12 year Product
 - Modules – 30 year Power Output
 - Inverters – 10 years
 - DAS – 5 years
 - AC Combiners – 5 years
- No extended warranties
- No ongoing DAS Costs
 - Any ongoing fees beyond year 5 are excluded (both Cell Service and Data Subscription Monitoring fees).
- No backup generation
- Favorable soil conditions. No hard drilling or special footers/foundations required.
- No hazardous soils or materials (asbestos, PFAS, etc.). Should monitoring, mitigation, abatement, and/or disposal be required, Louisville would be responsible for this additional scope.
- Xcel Energy Solar*Rewards C&I Incentives:
 - Tier 1: <250kWac = \$0.04/kWh for 20 years



Appendix

1. Mechanical System Matrix Options
2. Mechanical Decarbonization Scoping
3. Electrical Decarbonization Scoping
4. Structural Scoping
5. Electric Vehicle Charging Narrative
6. Renewables Scoping
7. Cost Estimating

HBWTP Cost Estimates

Three sets of numbers are listed below:

1. Cost Delta of Decarbonization – These are the total construction costs minus the replacement costs that would've been spent to replace the existing units with like-for-like fossil fuel units. These numbers represent the true cost of this decarbonization effort.
2. Total Decarbonization Construction Costs – These are the total amounts of money that will need to be allocated for budgetary purposes. The delta between the above numbers and the below numbers represents the cost of decarbonization.
3. Baseline Costs - These are the costs that would be spent to replace the existing gas-based systems with like-for-like gas units.

All numbers are “all-in costs”, including all GC markups, permitting, etc. They are also Rough Order of Magnitude (ROM) numbers, with a +/-20% range. See the “Construction Pricing Context” section in the report body for more detail. All costs associated with the solar PV systems (including the electrical infrastructure to support these systems) are included in the Renewables costs as outlined in a separate section of the Appendix.

Cost Delta of Decarbonization

DECARBONIZATION DELTA COSTS: SWTP

	Total Cost
Full Electrification	\$ 249,000

Total Decarbonization Construction Costs

FULL ELECTRIFICATION: SWTP CHEM BUILDING

Scope	Total Cost
HVAC Rooftop Units and Ductwork	\$ 123,000
HVAC Piping	\$ 74,000
Domestic Water Heating and Piping	\$ -
Electrical	\$ 165,000
GC all-in Total (design, CM, bonds, etc.)	\$ 361,000



FULL ELECTRIFICATION: SWTP ADMIN BUILDING

Scope	Total Cost
HVAC Rooftop Units and Ductwork	\$ 61,000
HVAC Piping	\$ 86,000
Domestic Water Heating and Piping	\$ 92,000
Electrical	\$ 56,000
GC all-in Total (design, CM, bonds, etc.)	\$ 294,000

Baseline Costs

GAS LIKE-FOR-LIKE REPLACEMENT COSTS: SWTP

	Total Cost
South Water Plant	\$ 406,000