ADDENDUM NO. 1

TO: PLANS AND SPECIFICATIONS FOR STATE OF MISSOURI

New Premium Campsites
Watkins Woolen Mill State Park and State Historic Site
Project No. X2220-01

Bid Opening Date: 1:30 PM, Thursday, May 29, 2025 (Changed)

Bidders are hereby informed that the construction Plans and/or Specifications are modified as follows:

SPECIFICATION CHANGES:

1. Section 011000 – Summary of Work

    a. As stated in part 1.8 Owner-Furnished Products, the Owner will provide the shower house, Tuff Shed, fire rings, picnic tables, lantern hangers and campsite post markers. All items will be installed by the contractor except for the Tuff Shed and picnic tables.

DRAWING CHANGES/CLARIFICATIONS:

1. Sheet G-000 – access gate area added to location map.

2. Sheet L-404, detail 1 Prefabricated Shower House Plan – an MEP is not required; however, all required venting, electrical and plumbing work must be performed by licensed professionals provided by the contractor.

3. Sheet L-501, detail 03 – as the note states, this detail only applies to locations where the sidewalk abuts the parking lot, which is the shower house. It does not apply to campsite pads.

4. Sheet C-001, General Note #13 – Permits should be up to date. Any additional permits that should arise shall be the responsibility of the contractor.

5. Sheet C-501, revise reference to match line C113. This should refer to C-502.

6. Sheet C-502, revise reference to match line C112. This should refer to C-501.

7. Sheet C-522, straw wattles shall be a minimum 9-inches in diameter.

8. Sheet C-601, Phase III notes – delete “sod right-of-way.” Disturbed areas will be seeded. Refer to specifications.

GENERAL COMMENTS:

1. RESPONSE TO QUESTIONS:
    a) There is a reference made to obtaining permits from Platte County. The project is in Clay County.
    b) Topsoil is to be stockpiled and re-used on site. Excess topsoil and other soils are to be removed from the site
    c) The NPDES Land Disturbance Permit is provided in the Appendix of the Specifications

d) State Parks will perform necessary Bat Surveys prior to tree removal.

e) Question: The IPS DR-11 water line drawings include notes about installing bends. If we use a roll, will it be necessary to cut the pipe and install a bend instead of making a long sweep with no fittings?
Response: Long sweeps are acceptable on the service lines if there are not additional crossings or conflicts presented. If a conflict is present, bends shall be installed. Water main shall be constructed as shown on the plans.

f) Question: Please list the size of the water main we tie into on 162nd Street. *Response: 10" Public Water Main along 162nd Street.*

g) Question: Will the tie in at 162nd require a tapping sleeve and valve? It is not shown.
Response: Tapping sleeves and valves required, see connection details per Sheet C-521.

h) Question: Please provide more information about the Rigid Lip shown on Sheet C-518 and the detail on Sheet C-523
Response: See note for Level Spreader Detail – "Rigid Lip 6"x6" Cast in Place Concrete Strip". Per sheet C-518, shall be 46 LF.

i) Question: For the water, is it OK to propose SDR-21, Class 200?
Response: Yes, SDR-21.

j) Question: On the sewer, should I price SDR-35 or SDR-26?
Response: Price SDR-26.

k) Question: Who pays the power company for extending service to the proposed control panel locations?
Response: The Contractor, who will be reimbursed by the State of Missouri.

l) Sheet C-102 refers to MSP Lagoon Sanitary Plans.
Response: See attached for plans of existing lagoon.

m) Soil Boring B-02 is the only one that reports Lean Clay (low plasticity). Is it expected that we import 12" of lean clay under all roadways and concrete pads?
Response: Refer to Geotech report and specification Section 012200 Unit Prices. Items B, C, D and E are options provided for remediation of high plastic clays and other select areas.

n) Question: Please list the contact information for the local power company. I think the drawings may need updated.
Response: Contact information shown on E-201 is correct. Phone for Joshua Meyer is 816-629-2843. Phone number for Jacob Bishop is 816-903-7374.

o) Question: Are there CAD files for the site grading available?
Response: Contract Chad Potter or Ashley Shmalberg from Vireo to request access to the shared files. Chad@bevireo.com or Ashley@bevireo.com.

2. The Pre-Bid Meeting was held on May 7, 2025 at 10:00 AM.
3. Please contact Paul Girouard, Contract Specialist, at 573-751-4797 or Paul.girouard@oa.mo.gov for questions about bidding procedures, MBE\WBE\SDVE Goals, and other submittal requirements.
4. The deadline for technical questions is March 22, 2025 at 12:00 PM.

5. Changes to, or clarification of, the bid documents are only made as issued in the addenda.
6. Chad Potter will be out of the office May 26-30. Please route addendum questions to Ashley Shmalberg. Email address Ashley@bevireo.com.
7. All correspondence with respect to this project must include the State of Missouri project number as indicated above.
8. Current Plan holders list available online at https://www.oafmdcplanroom.com/projects/2792/plans/X2220-01-new-premium-campsites
9. Prospective Bidders contact American Document Solutions, 1400 Forum Blvd Suite 1C, Columbia MO 65201, 573-446-7768 to order official plans and specifications.
10. **All bids shall be submitted on the bid form without additional terms and conditions, modifications, or stipulations. Each space on the bid form shall be properly filled including a bid amount for each alternate. Failure to do so will result in rejection of the bid.**
11. **MBE/WBE/SDVE participation requirements can be found in DIVISION 00. The MBE/WBE/SDVE participation goals are 10%/10%/3%, respectively. Only certified firms as of the bid opening date can be used to satisfy the MBE/WBE/SDVE participation goals for this project. If a bidder is unable to meet a participation goal, a Good Faith Effort Determination Form must be completed. Failure to complete this process will result in rejection of the bid.**

ATTACHMENTS:

1. Attendance Sheet
2. Modular Unit Plan
3. Watkins Mill State Park & Historic Site Upgrade Wastewater Treatment System Plans
4. Sheet G-000

May 9, 2025

END OF ADDENDUM NO. 1

Kansas City | Omaha

www.BeVireo.com

Vireo

A planning and design firm where being **fresh, healthy, and vigorous** is more than an ideology; it's how everyday decisions are made.

Sign In

Please Print Clearly

Name	Organization	Address	City	State, Zip	Phone	E-mail
Daniel Tottleben	Vazquez CC	3303 Gillham	KC	MO	816-812-3430	dant@vazquezcc.com
Justin Shreve	Herner Construction	5810 N. 22nd St	St. Joseph	MO	816-232-4551	justin@hernerconstruction.com
T.J Fears	Indidge 1 LLC	3811 N cobbler R	Independence	MO	816-310-9166	Indidge1@gmail.com
John Anderson	Scott gann Const.	3929 Pear Street	St. Joseph	MO	816-383-3805	janderson@scottgannconst.com
Jim Kunce	DSP P&D	Lewis & Clark St			816-308-1002	jim.kunce@dspmail.com
Mike Beckett	DSP-Watkins Mill	26000 R-HOLM Lawson MO 64062	—	—	816-615-9265	Michael.beckett@dspmo.com
Cody Theis	Lexeco	5037 S. 4th St Leavenworth, KS 66048			913-727-1234	cody@lexeco.com
Darrell Erwin	SDI	Blue Springs		Mo	660-924-3307	Darrell@shedigsit.com
Stan Schultz	Better By Design	900 west Hwy Brookfield MO		MO	573-776-8736	sschultz@betterbydesignllc.com
Austin Pounds	Apex Earthworks Solutions	11625 Johnson Cemetery Rd	Ashland	MO 65010	573 808 5495	apex.earthwork@gmail.com
JIM ALLER	ALLER'S LLC	2095 Kingfisher Rd	Hiawatha,	KS 66434	785-741-3000	JIM@ALLERSLLC.COM
Joe Sigler	Flowmaster Construction	4303 E Liberty	Mexico	MO 65265	573-581-9132	joe@flowmasterconstruction.com
DAN O'DONNELL	METRO ASPHALT, INC.	3811 N. COBBLER ROAD	INDEPENDENCE	MO. 64058	816 836-7400 office 816 564-4134 CELL	dodonnell@metroasphalt.net

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Sign In

Please Print Clearly

Name	Organization	Address	City	State, Zip	Phone	E-mail
Brian Paxton	Vazquez CC	3303 Gillham	KCMO	64109	816-284-2625	brianp@vazquezcc.com
David Madden	"	"	"	"	816-225-4576	DavidMA@Vazquezcc.com
Doug Ronk	Frontier Services	5817 NW 90th St	Riverside	KS 66703	913 461-3805	dronk@frontierservices.net
Ben Williams	Frontier Services	1807 Elsea Smith	Indep Mo	MO	8166054490	
David Ackley	BRIS	110 NW Parkway	Riverside	MO	816.400.2316	DAVID.ACKLEY@BROWNANDROOT.COM
Chris Head	Superior Electrical Constrnd	12780E US Hwy 40	Independence	MO 64055	816-719-2740	SEC@SUPERIOR-ELECT.COM
Matt Lincoln	Better By Design LLC	900 W Helm St	Brookfield	MO 64628	660-412-5411	m.lincoln@betterbydesignllc.com
Charles Saunders	BRIS	2400 Bluff Creek Columbia	Columbia	Mo 65205	573-721 3564	Charles.Saunders@BrownandRoot.com
Dustin Hagens	SES Construction	8305 Nichols St	Fulton	MO 65251	(209) 620-0825	DUSTIN@SESCONSTRUCTION.COM
Steven Brockman	FMDC/OA		Warrensburg	MO	5736194395	steven.brockman@oa.mo.gov
Ashley Shmalberg	Vireo		KCMO	64106	816-777-3009	ashleye bevireo.com
Chad Potter	VIREO					Chad@BeVireo.com
Andy Carroll	FMDC					Andy.Carroll@oa.mo.gov

Missouri Public Service Commission
Manufactured Housing & Modular Units Program

Application for Modular Unit Plan Approvals

Transmittal Number (PSC Office)	Check Number	Check Amount
375500759	103534	$150

INSTRUCTIONS

Submit the completed application, plans, & fees to your Third Party to forward to: Manufactured Housing & Modular Units Program P.O. Box 360, Jefferson City, MO 65102 or 200 Madison St., 5th Fl., Jefferson City, MO 65101	**Plan Approval Fees (non-refundable): $150 per model** Make all checks and money orders payable to: **Missouri Director of Revenue**	**How to reach us:** **Phone:** 800-819-3180 **Fax:** 573-522-2509 **Web Page:** www.psc.mo.gov

MANUFACTURER INFORMATION

Must use the actual facility name & address where the model will be produced.

MISSOURI PUBLIC SERVICE COMMISSION
APPROVED
11/19/2024
MANUFACTURED HOUSING

Registration Number:	Modular 12-000476	Registration Expiration Date:	11/06/2024
Manufacturer's Name:	CXT, Inc.		
Contact Name:	Ali Cairns	Email Address:	acairns@lbfoster.com
Mailing Address:	901 N.Highway 77	Physical Location:	901 N.Highway 77
City/State/Zip:	Hillsboro/ TX/ 76645		
Phone Number:	(800)334-6946	Fax Number:	509-928-8270

THIRD PARTY INSPECTION AGENCY INFORMATION

NOTE: A letter from the authorized representative approving models listed below must be attached to this Plan Approval Form.

RECEIVED
NOV 12 REC'D
MANUFACTURED HOUSING DEPARTMENT

Third Party Agency:	ICC-NTA		
Contact Name:	Chris Pfleegor	Email Address:	cpfleegor@icc-nta.org
Mailing Address:	305 N Oakland Ave.		
City/State/Zip:	Nappanee, IN 46550		
Phone Number:	(574) 773-7975	Fax Number:	(574) 773-2732

DEALER OR CONSUMER INFORMATION

Attach additional sheets if necessary.

Dealer or Consumer Name:	Missouri State Parks	Dealer Registration #:	
Physical Address:	1659 E. Elm St., P.O. Box 176	Dealer Email Address:	
City/State/Zip:	Jefferson City, MO 65102-0176	Phone Number:	Shanea Frederick 816-579-5564

MODEL INFORMATION

Please list the models to be approved below.

NOTE: Plans are approved for a period of one year and must be renewed each year until production of the model has ceased.

Please indicate ✓ New Model	Model Revision	Model Renewal	Model Name	Model Destination- **COMPLETE ADDRESS REQUIRED** (Street Address, City, State & Zip Code)	Seismic Design Category
X			Rainier RN-125	16600 MO-45, Weston, MO 64098	E

New models constructed **after March 30, 2018**, shall be constructed to the criteria set forth in the 2015 International Building Code, the 2015 International Plumbing Code, the 2015 International Mechanical Code, the 2015 International Residential Code, 2015 International Fuel Gas Code, and the 2014 National Electric Code NFPA. Current models approved **prior to March 30, 2018**, are good until October 1, 2018.

According to the Public Service Commission's Rules 4CSR 240-123.010(I) governing modular units, modular units must be completed structures and must be tagged with a code compliance seal before being shipped and sold in the State of Missouri. Questions, please contact us at the above phone number.

SIGNATURE

Authorized Company Official

Title	Date
Senior Project Manager	10/24/24

NTA® ICC INTERNATIONAL CODE COUNCIL®

TESTING • INSPECTION • ENGINEERING

305 N. OAKLAND AVE. • P.O. BOX 490 • NAPPANEE, IN 46550 • P: 574.773.7975 • F: 574.773.2732 • ICC-NTA.ORG

October 31, 2024

Missouri Public Service Commission
Manufactured Housing Department
200 Madison St. Suite 530
Jefferson City, MO 65101

Attn: David Freeman

CXT Inc-Hillsboro, TX
Model: Rainier RN-125-MO

Dear Mr. Freeman,

Attached is (1) copy of the above referenced project. This project has been reviewed and found to be in compliance with the applicable codes and regulations for the State of Missouri as evidenced by the NTA approval stamp on each page.

If you should have any questions, please feel free to contact me at your convenience.

Sincerely,

Chris Pfleegor

Chris Pfleegor
Account Manager
ICC NTA, LLC

MISSOURI
PUBLIC SERVICE
COMMISSION
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11/19/2024
MANUFACTURED
HOUSING

Missouri Public Service Commission
Manufactured Housing & Modular Unit Program
Plan Review Form

To be completed by the Third Party Agency.

We, the Third Party Agency, have reviewed and approved plans from:

Manufacturer Name	CXT, Inc.
Project Name	Rainier
Job Number	RN-126
Number of Units	1
Location of Project (Exact Location Required)	16600 MO-45, Weston, MO 64098

This unit meets or exceeds the:

- 2015 International Building Code (IBC)
- 2015 International Residential Code (IRC)
- 2015 International Plumbing
- 2015 International Mechanical Code
- 2015 International Fuel Gas Code
- 2014 National Electric Code (NFPA)

MISSOURI
PUBLIC SERVICE
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HOUSING

Seismic Design Category (Please specify) E

An on-line inspection for compliance will be completed for the above units.

Third Party Name	ICC-NTA		
Address	305 N Oakland Ave. Nappanee, IN 46550		
Phone	(574) 773-7975 ext 321	Fax	(574) 773-2732
Contact Email Address:	cpfleegor@icc-nta.org		
Representative Name:	Chris Pfleegor	Representative Title	Admin.

Please send the complete plan approval submission to:
(See Plan Approval Checklist for Submission Guidelines)

Mailing Address:

Missouri Public Service Commission
Manufactured Housing & Modular Unit Program
P.O. Box 360
Jefferson City, MO 65102

Phone: 800-819-3180
Fax: 573-522-2509

Street Address:

Missouri Public Service Commission
Manufactured Housing & Modular Unit Program
200 Madison Street, Suite 500
Jefferson City, MO 65101

Web Address: www.psc.mo.gov

This form must accompany the plan approval form as well as any other required documentation and fees.

ICC NTA

To: Manufactured Housing & Modul MANUFACTHOU

Check Number: 0000103534

Date: 11/06/2024

Invoice Number	Date	Description	Amount	Discount	Paid Amount
10/31/24 A	10/31/2024	fee Rainier RN-125-MO	$150.00	$0.00	$150.00

RECEIVED

NOV 0 8 2024

MO PUBLIC SERVICE COMMISSION
MAIL ROOM

TOTALS:	$150.00	$0.00	$150.00

THIS CHECK HAS A COLORED BACKGROUND AND CONTAINS MULTIPLE SECURITY FEATURES - SEE BACK FOR DETAILS

NTA® ICC INTERNATIONAL CODE COUNCIL®

JPMorgan Chase Bank, N.A.
Chicago, IL

0000103534
2-1/710

DATE	AMOUNT
Nov 6, 2024	$150.00

One Hundred Fifty Dollars And 00 Cents

Pay to the Order of: Manufactured Housing & Modular Units Program
200 Madison St 5th Floor
Jefferson City, MO 65101

HEAT SENSITIVE RUB AREA TO VERIFY

⑈0000103534⑈ ⑆071000013⑆ 518923153⑈

MARINE PACKAGE

RAINIER

NOTES

1. BUILDING IS DESIGNED TO COMPLY WITH THE 2018 INTERNATIONAL BUILDING CODE (IBC).

2. DESIGN COMPLIES WITH THE PROVISIONS OF THE 2018 IBC FOR THE FOLLOWING LOADS:
   GROUND SNOW LOAD = 250 PSF
   ROOF SNOW LOAD = 210 PSF
   FLOOR LOAD = 400 PSF
   IBC DESIGN SPECTRAL RESPONSE S_S = 1.057, S_1 = 1.057
   SITE CLASS: D
   RISK CATEGORY: II
   SEISMIC DESIGN CATEGORY: E
   BEARING WALL SYSTEM: R = 4.0
   A5 – INTERMEDIATE PRECAST SHEARWALLS
   WIND – V_{ULT} = 150 MPH
   WIND – V_{ASD} = 116 MPH
   WIND EXPOSURE C
   OCCUPANT LOAD: 3
   ***BUILDING IS NOT TO BE PLACED IN A LOCATION WHERE LOADS EXCEED THE VALUES PROVIDED ABOVE

3. CONSTRUCTION TYPE: V–B
   OCCUPANCY: U
   EXTERIOR WALLS: 1–HR RATED PER IBC TABLE 721.1(2), ITEM 4–1.1
   MINIMUM FIRE SEPARATION DISTANCE: 10' PER IBC TABLE 705.8
   MAXIMUM UNPROTECTED OPENING AREA: 12.36% (WALL W8)

4. CONCRETE STRENGTH f'ci = 2500 PSI INITIAL f'c = 5000 PSI
   FINAL AIR ENTRAINMENT 6% ± 1 1/2% IN PLASTIC CONCRETE.
   REINFORCING STEEL: ASTM A615 #3 GRADE 40, #4 AND LARGER GRADE 60 Fy=60 KSI MINIMUM LAP 18" AT SPLICES. TIE BARS WITH DOUBLE ANNEALED 16 GA IRON WIRE. REINFORCING TO BE PLACED IN CENTER OF PANEL UNO. ALL WELDED WIRE FABRIC (W.W.F.): ASTM A1064 GRADE 80, 4x4xW6.7xW6.7, Fy=80 KSI (OR EQUIVALENT), SMOOTH WIRE, MIN. LAP 2 SQUARES.

5. EMBEDDED ITEMS IDENTIFIED ON DRAWINGS (i.e. PS–2, R301) REFER TO CXT STANDARD EMBEDMENT CATALOG.

6. REFER TO SEPARATE CXT INCORPORATED SPECIFICATIONS COVERING DESIGN, MATERIALS, PRODUCTION, AND INSTALLATION CRITERIA FOR SPECIFIC STYLE OF BUILDING.

7. BACK OF PANELS TO HAVE SMOOTH TROWEL FINISH U.N.O. ALL SURFACES TO BE TEXTURED ARE NOTED ON PANEL DWG'S

8. ALL REBAR BENDS ARE TO HAVE A MINIMUM RADIUS OF 6x BAR DIAMETER.

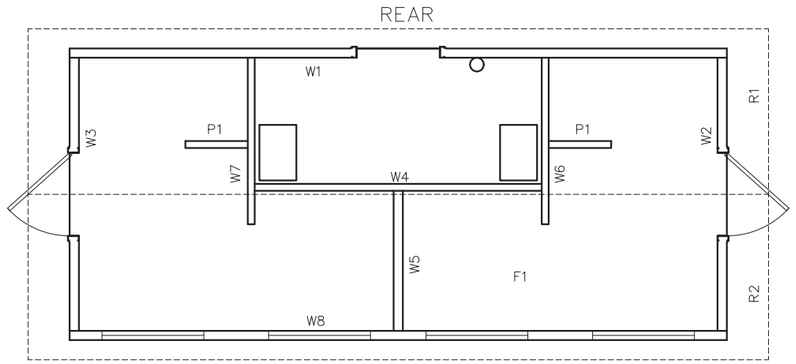
9. INSTALLATION TO MEET APPLICABLE LOCAL, STATE & FEDERAL CODES, BY OTHERS.

10. ADEQUATE PLUMBING FACILITIES MUST BE PROVIDED IN ACCORDANCE WITH THE 2018 IBC (NOT BY CXT)

MANUFACTURED BY:
CXT INC. (TX)
901 N. HIGHWAY 77
HILLSBORO, TX 76645

SITE ADDRESS:
WESTON BEND STATE PARK
16600 MO–45
WESTON, MO 64098

PANEL MARK NO. KEY PLAN



APPLICABLE CODES

2018 INTERNATIONAL BUILDING CODE
2018 INTERNATIONAL PLUMBING CODE
2017 NATIONAL ELECTRIC CODE
2018 INTERNATIONAL MECHANICAL CODE
2018 INTERNATIONAL ENERGY CONSERVATION CODE (2013 ASHRAE 90.1)
2009 ANSI A117.1

SPECIAL CONDITIONS AND/OR LIMITATIONS

ACCESSIBILITY TO THIS BUILDING, INCLUDING PARKING, IS TO BY PROVIDED BY OTHER AND CONSTRUCTED IN ACCORDANCE WITH ALL LOCAL BUILDING CODES

INDEX OF DRAWINGS

APPROVED BY
NTA
10/31/2024
Approval of this document does not authorize or approve any deviation or deviations from the requirements of applicable State Laws.

MISSOURI
PUBLIC SERVICE
COMMISSION
APPROVED
11/19/2024
MANUFACTURED
HOUSING

STATE OF MISSOURI
WILLIAM
RICHARD HEIDEN III
NUMBER
PE-2002010219
PROFESSIONAL ENGINEER
October 27, 2024

LBFoster®
CXT® Products

6701 E Flamingo Ave Bldg 300 Nampa, ID 83687
901 N. Highway 77 Hillsboro, TX 76645
362 Waverly Road Williamstown, WV 26187

PROJECT TITLE
RANIER
BUILDING NUMBER RN–125

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CXT Incorporated

REV.	DESCRIPTION	APPROVAL	DATE

SCALE	NTS	DATE	10–10–24
DRAWN	G.OGG	FILE NO.	RN–125
CHECKED	N.PENNER	PLOT	NTS

COVER SHEET

DWG NO.	SHEET	REV.
RN–01	1 / 25	0

CASTING TOLERANCES:

OVERALL LENGTH OR WIDTH
10 FT OR UNDER = ± 1/8"
10 TO 20 FT = +1/8", –3/16"
20 TO 40 FT = ±1/4"

EDGE REINFORCEMENT TO BE NO MORE THAN 4" FROM FORM

TOTAL THICKNESS = –1/8, +1/4

VARIATION FROM SQUARE = ±1/8 PER 6 FT OF DIAGONAL

LOCAL SMOOTHNESS = 1/4" IN 10 FT

SWEEP = ±1/4"

POSITION OF TENDONS = ±1/4"

POSITION OF BLOCKOUTS = ±1/4"

SIZE OF BLOCKOUTS = ±1/4"

POSITION OF EMBEDS = ±1/4"

TIPPING AND FLUSHNESS OF PLATES = +1/16, –1/4
BOWING = LENGTH/360
END SQUARENESS = ±1/8"

MISSOURI STATE TAGS, APPROVAL, & PE DRAWINGS (ECC ONLY) REQUIRED

WALL TEXTURE: BARNWOOD
WALL COLOR: GEORGIA BRICK

ROOF TEXTURE: RIBBED METAL
ROOF COLOR: CHARCOAL GRAY

TRIM PAINT: DTM ALKYD ENAMEL SW 7005 PURE WHITE

SEALER: STANDARD
MARINE PACKAGE: STAINLESS STEEL EMBEDS & HINGES REQUIRED

APPROVED BY
NTA
10/31/2024
Approval of this document does not authorize or approve any deviation or deviations from the requirements of applicable State Laws.

MISSOURI
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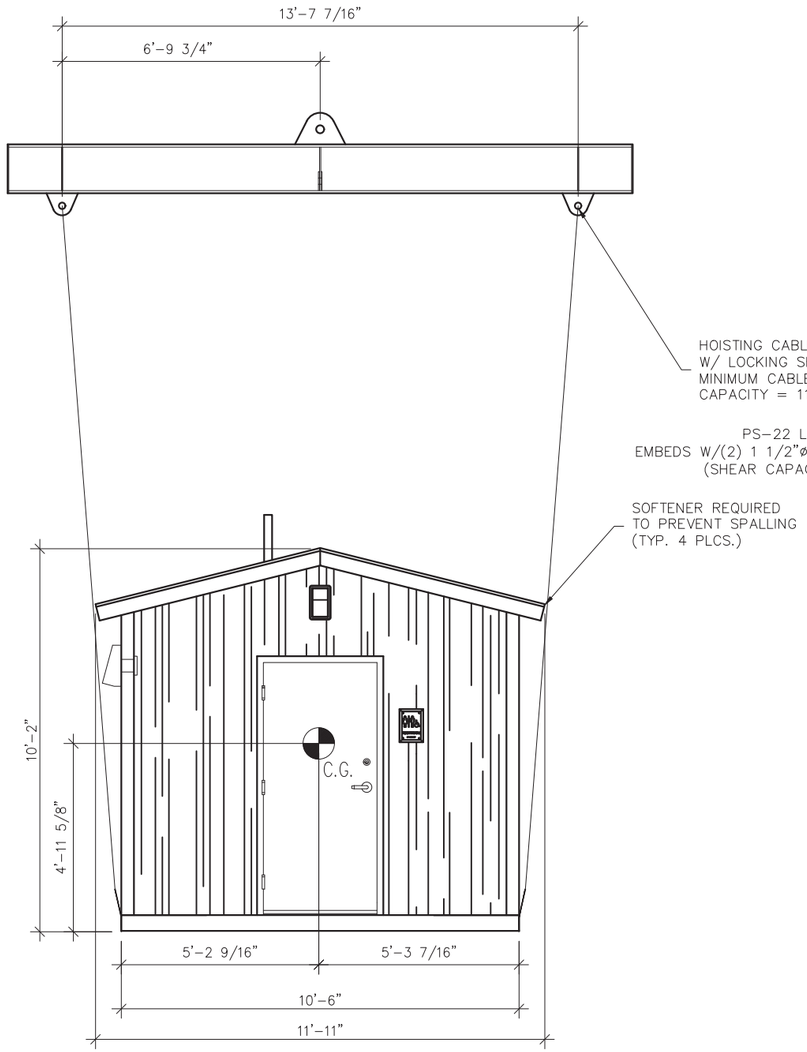
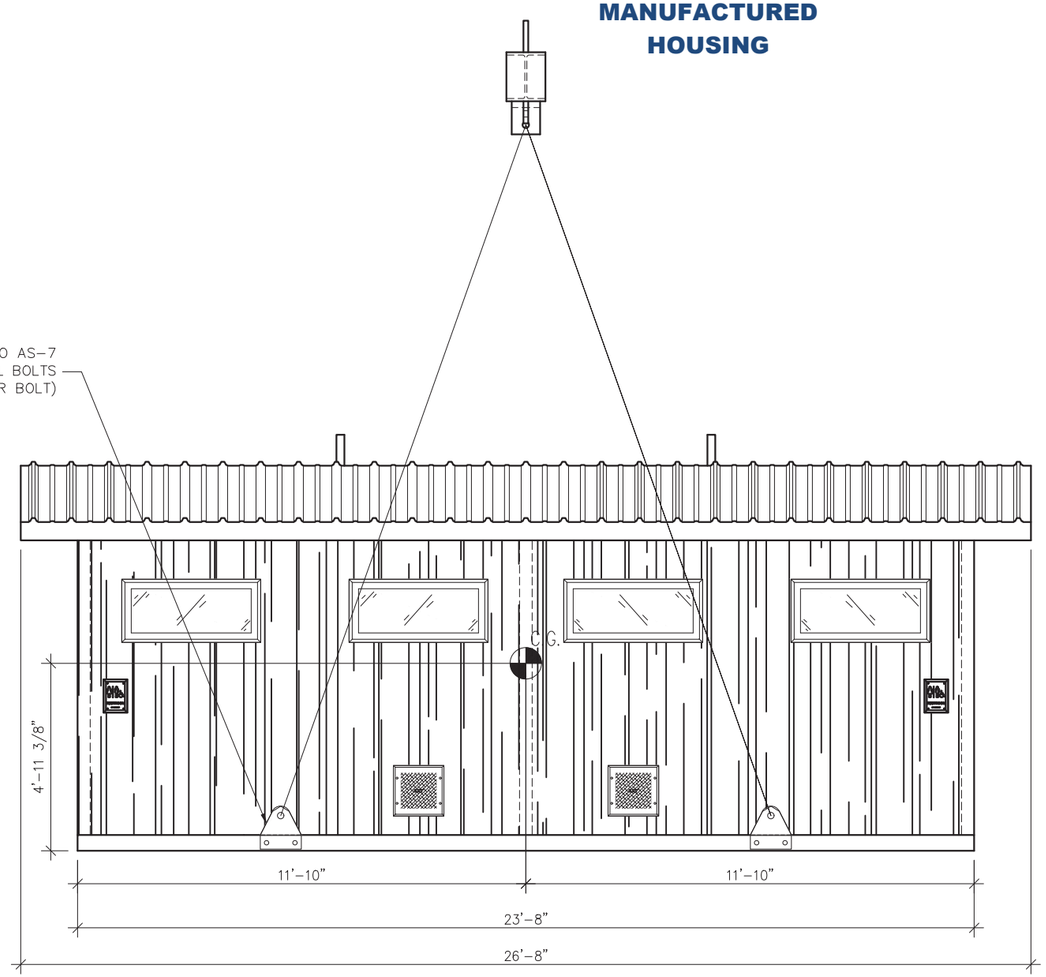
APPROVED
11/19/2024
MANUFACTURED
HOUSING



LEFT SIDE ELEVATION



FRONT ELEVATION

SHIPPING WEIGHTS AND DIMENSIONS			
WEIGHT	LENGTH	WIDTH	HEIGHT
68,800	26'-8"	11'-11"	10'-2"

STATE OF MISSOURI
WILLIAM
RICHARD HEIDEN III
NUMBER
PE-2002010219
PROFESSIONAL ENGINEER
October 27, 2024

LBFoster®
CXT® Products

6701 E Flamingo Ave Bldg 300 Nampa, ID 83687
901 N. Highway 77 Hillsboro, TX 76645
362 Waverly Road Williamstown, WV 26187

PROJECT TITLE
RANIER
BUILDING NUMBER RN-125

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CXT Incorporated

REV.	DESCRIPTION	APPROVAL	DATE

SCALE	1/4" = 1'-0"	DATE	10-10-24
DRAWN	G.OGG	FILE NO.	RN-125
CHECKED	N.PENNER	PLOT	48

RIGGING DETAIL

DWG NO.	SHEET	REV.
RN-02	2 / 25	0

DOOR SCHEDULE

	TYPE	FRAME	DOOR SIZE	MATERIAL	DOOR TYPE	LATCH	LOCK
A	SINGLE	3/0 x 6/8 x 3-3/4"	3/0 x 6/8 x 1-3/4"	GALVANIZED	LH REVERSE	PRIVACY	DEADBOLT THUMBTURN
	GLAZING	HINGES	KICK PLATE	STOP	SWEEP	THRESHOLD	VENTILATION
	N/A	SS SPRING HINGE 4-1/2" x 4 1/2"	N/A	WALL	3'	3' x 4" x 1/4"	LOUVER
B	TYPE	FRAME	DOOR SIZE	MATERIAL	DOOR TYPE	LATCH	LOCK
	SINGLE	3/0 x 6/8 x 3-3/4"	3/0 x 6/8 x 1-3/4"	GALVANIZED	RH REVERSE	PRIVACY	DEADBOLT THUMBTURN
	GLAZING	HINGES	KICK PLATE	STOP	SWEEP	THRESHOLD	VENTILATION
	N/A	SS SPRING HINGE 4-1/2" x 4 1/2"	N/A	WALL	3'	3' x 4" x 1/4"	LOUVER
C	TYPE	FRAME	DOOR SIZE	MATERIAL	DOOR TYPE	LATCH	LOCK
	SINGLE	3/0 x 6/8 x 3-3/4"	3/0 x 6/8 x 1-3/4"	GALVANIZED	RH REVERSE	PASSAGE	DEADBOLT THUMBTURN
	GLAZING	HINGES	KICK PLATE	STOP	SWEEP	THRESHOLD	VENTILATION
	N/A	SS SPRING HINGE 4-1/2" x 4 1/2"	N/A	WALL	3'	3' x 4" x 1/4"	N/A

WINDOW & VENT SCHEDULE

SYMBOL	DESCRIPTION
A	MS-2 EMBED*
B	MS-6 EMBED
C	DOOR LOUVER

LEXAN SELF-IGNITION > 1000, SMOKE DENSITY < 75, CLASS CC1.
*FOR CLARITY SEE SHEET RN-04 FOR MS-2 LOCATION

1. ALL EXTERIOR DOORS AND WINDOWS TO BE LISTED AND LABELED AS COMPLIANT WITH AAMA/WDMA/CSA101/I.S.2/A440 OR TESTED PER ASTM E330.
2. DOOR HARDWARE SHALL NOT REQUIRE TIGHT PINCHING OR TWISTING OF THE WRIST OR SPECIAL KNOWLEDGE TO OPERATE.
3. UNLATCHING OF ANY DOOR SHALL NOT REQUIRE MORE THAN ONE OPERATION,

LIGHTING AND VENTILATION REQUIREMENTS

	RESTROOM	CHASE
AREA	85.63 SQ FT	46.50 SQ FT
REQUIRED VENTILATION	3.43 SQ FT	1.86 SQ FT
PROVIDED VENTILATION	20.87 SQ FT	20.00 SQ FT
REQUIRED NATURAL LIGHTING	6.85 SQ FT	3.72 SQ FT
PROVIDED NATURAL LIGHTING	7.38 SQ FT ***	0.00 SQ FT ***

***ARTIFICAL LIGHTING PROVIDED TO MEET REQUIRED FOOT CANDLES.

MARINE PACKAGE

APPROVED BY NTA 10/31/2024

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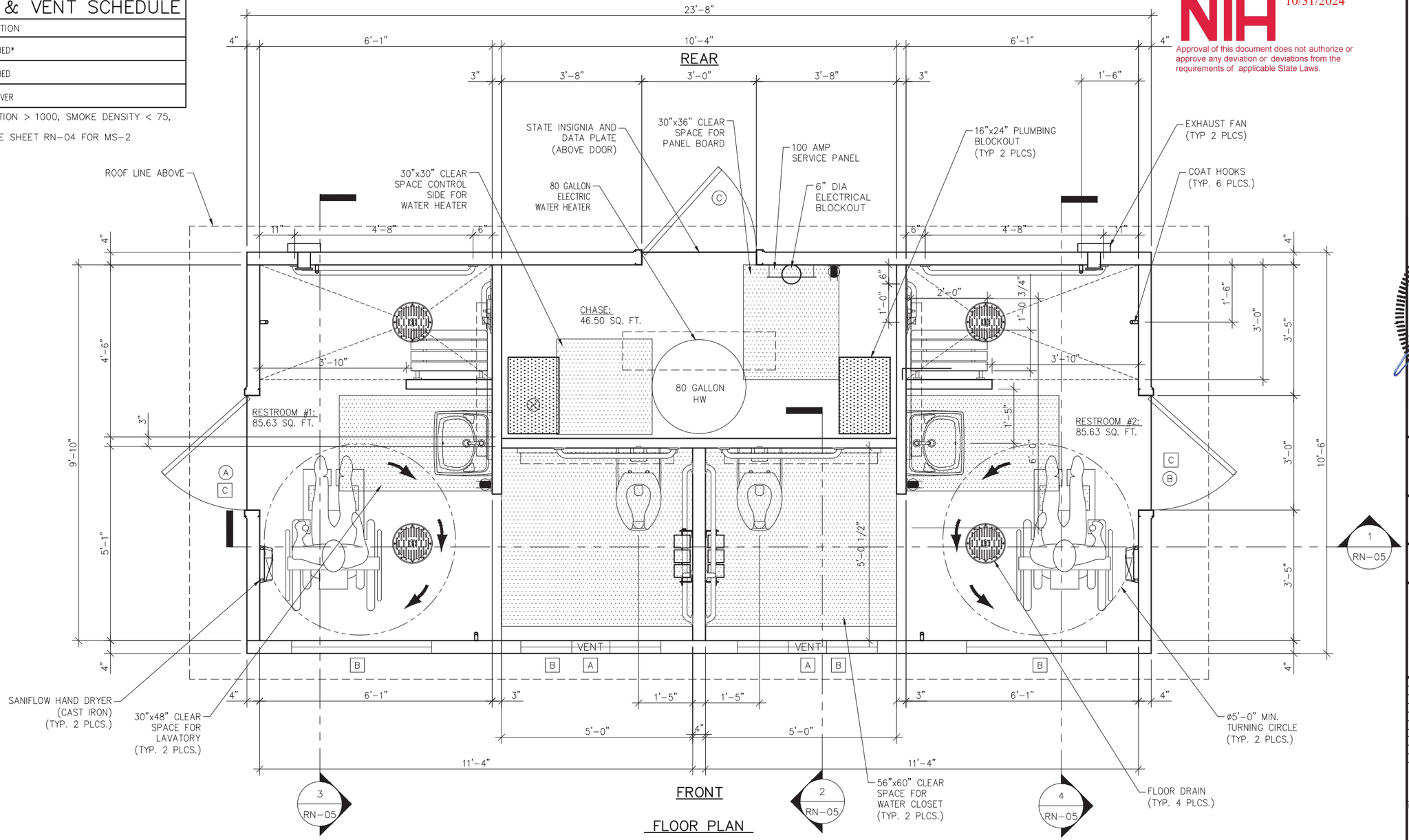

FRONT

FLOOR PLAN

MISSOURI PUBLIC SERVICE COMMISSION
APPROVED
11/19/2024
MANUFACTURED HOUSING

STATE OF MISSOURI
WILLIAM RICHARD HEIDEN III
NUMBER PE-2002010219
PROFESSIONAL ENGINEER
October 27, 2024

LB Foster CXT® Products

6701 E Flamingo Ave Bldg 300 Nampa, ID 83687
901 N. Highway 77 Hillsboro, TX 76645
362 Waverly Road Williamstown, WV 26187

PROJECT TITLE
RANIER
BUILDING NUMBER RN-125

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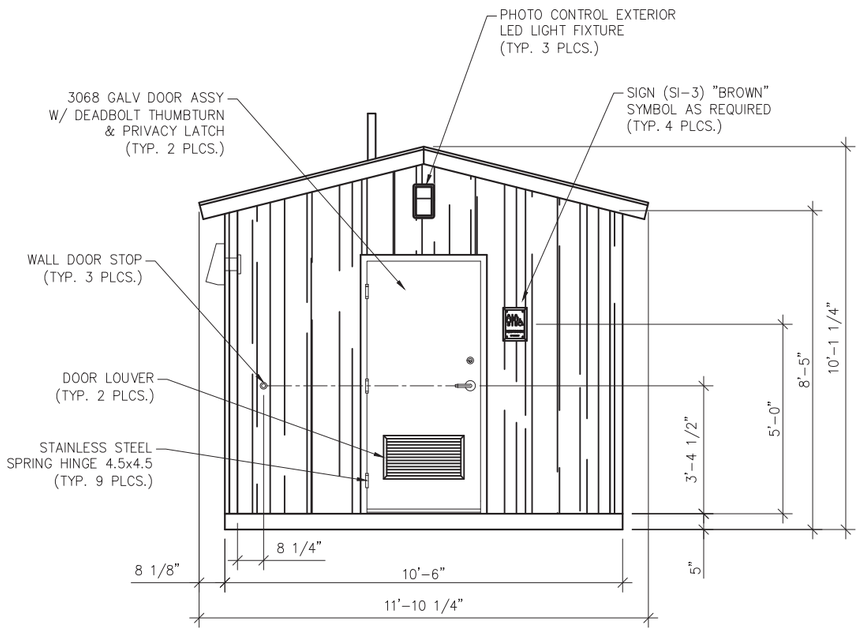
CXT Incorporated

REV.	DESCRIPTION	APPROVAL	DATE
SCALE	1/4" = 1'-0"	DATE	10-10-24
DRAWN	G.OGG	FILE NO.	RN-125
CHECKED	N.PENNER	PLOT	48

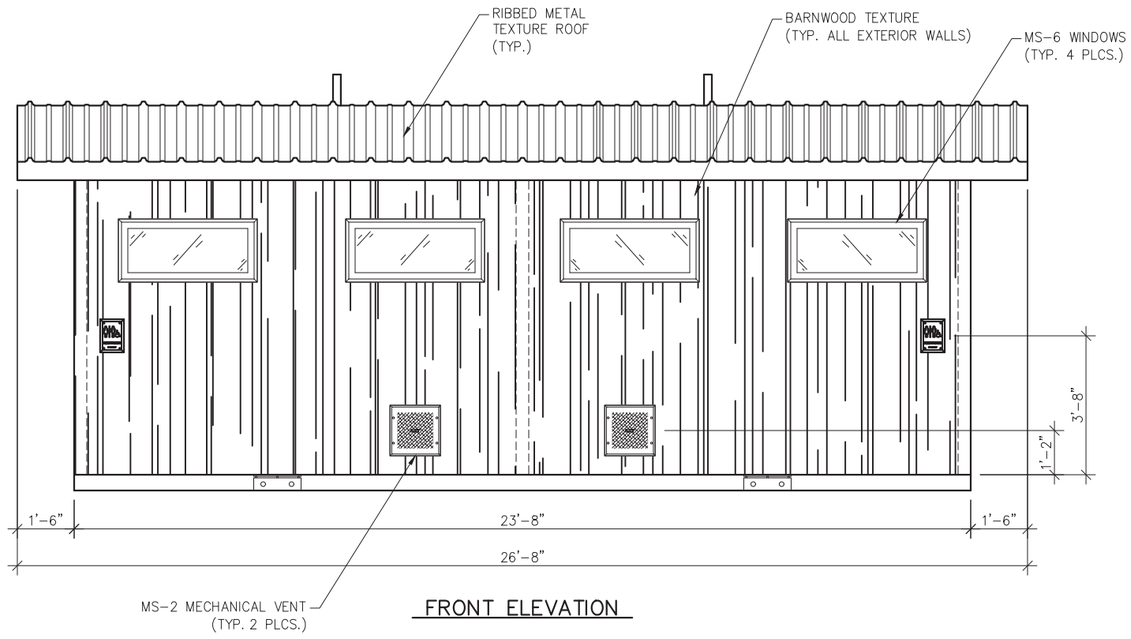
FLOOR PLAN

DWG NO.	SHEET	REV.
RN-03	3 / 25	0

MARINE PACKAGE



LEFT SIDE ELEVATION



FRONT ELEVATION

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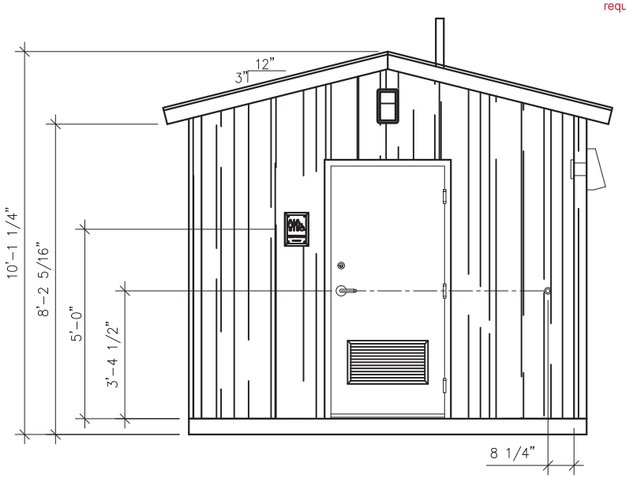
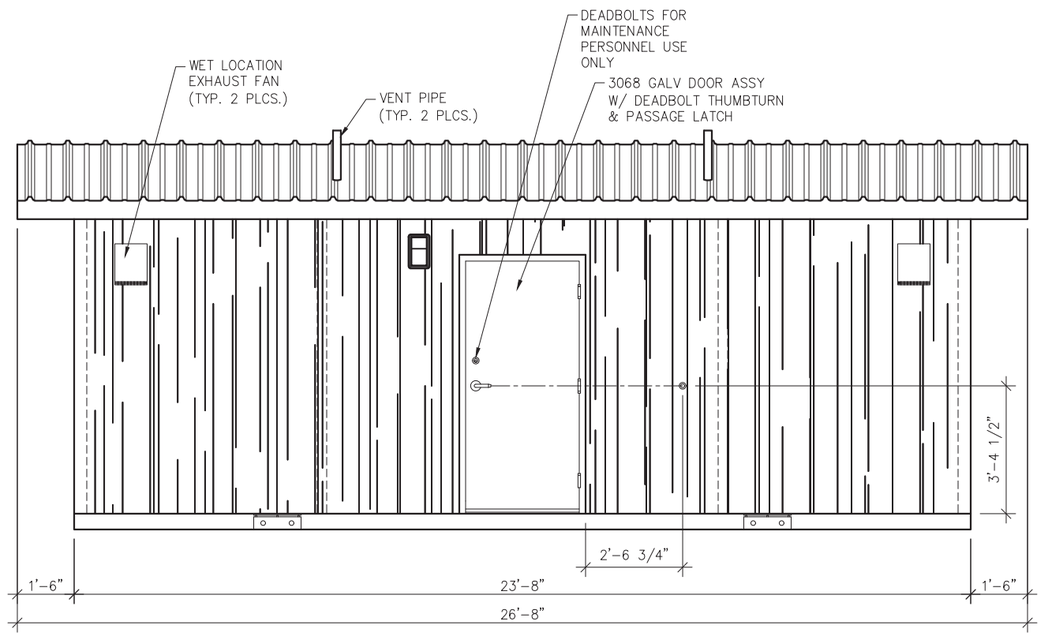


RIGHT SIDE ELEVATION

MISSOURI
PUBLIC SERVICE
COMMISSION
APPROVED
11/19/2024
MANUFACTURED
HOUSING



BACK ELEVATION

MATERIALS LIST	
ITEM	QTY
3068 PRIVACY LATCH DOOR ASSY	2
SS SPRING HINGE 4.5x4.5	9
WALL DOOR STOP	3
SI-3 "BROWN"	4
3068 PASSAGE LATCH DOOR ASSY	1
MS-2	2
MS-6	4
DOOR LOUVER	2

CU. FT. GROSS CU. FT. W.W.F.
APPROXIMATE WEIGHT

STATE OF MISSOURI
WILLIAM
RICHARD HEIDEN III
NUMBER
PE-2002010219
PROFESSIONAL ENGINEER
October 27, 2024

LBFoster®
CXT® Products

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BUILDING NUMBER RN-125

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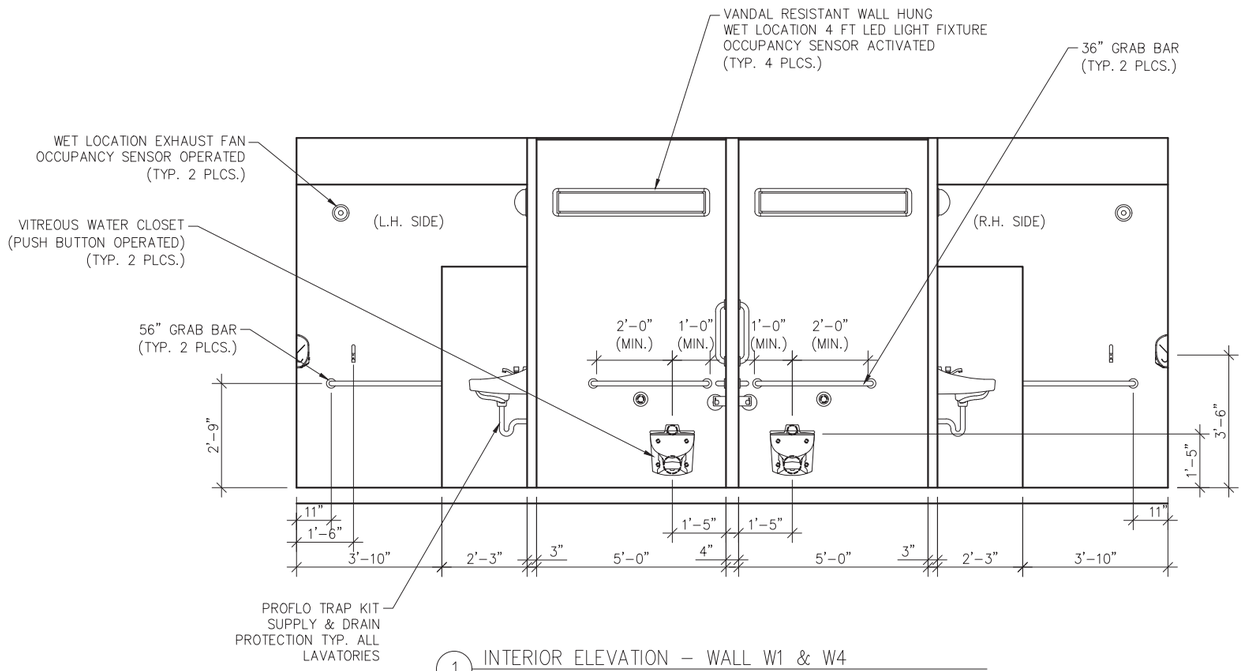
SCALE	1/4" = 1'-0"	DATE	10-10-24
DRAWN	G.OGG	FILE NO.	RN-125
CHECKED	N.PENNER	PLOT	48

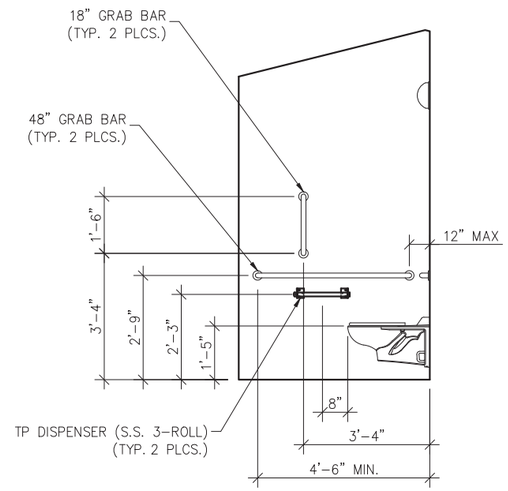
BUILDING ELEVATIONS

DWG NO.	SHEET	REV.
RN-04	4 / 25	0

MARINE PACKAGE



1 INTERIOR ELEVATION – WALL W1 & W4



2 INTERIOR ELEVATION – WALL W5

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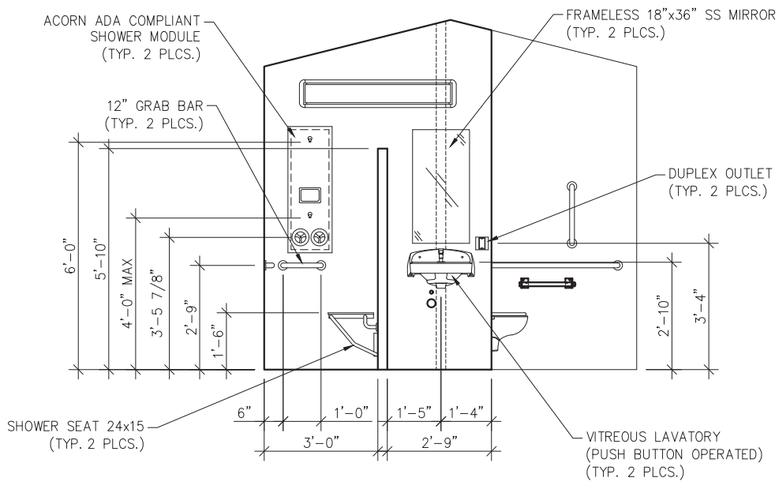


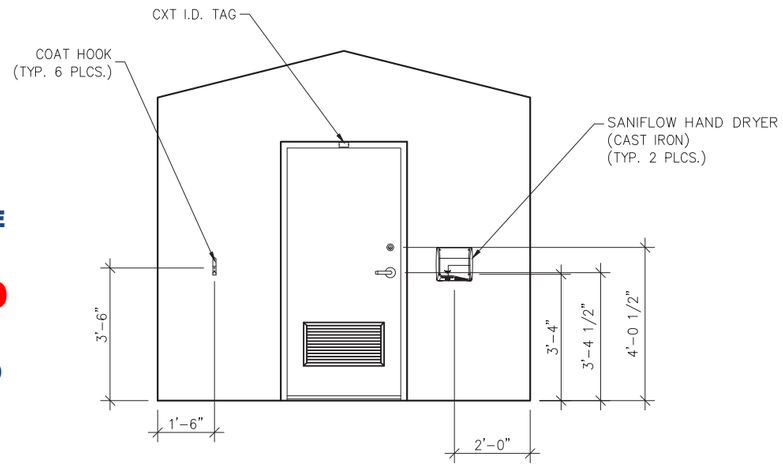
3 INTERIOR ELEVATION – WALL W5 & W6 & W7

MISSOURI PUBLIC SERVICE COMMISSION

APPROVED

11/19/2024

MANUFACTURED HOUSING



4 INTERIOR ELEVATION – WALL W2 & W3

MATERIALS LIST	
ITEM	QTY
TP DISPENSER	2
TP ROLLS	6
48" GRAB BAR	2
36" GRAB BAR	2
18" GRAB BAR	2
COAT HOOK	6
CXT I.D. TAG	1
12" GRAB BAR	2
56" GRAB BAR	2
SHOWER SEAT 24x15	2
FRAMELESS 18"x36" S.S. MIRROR	2

CU. FT. (GROSS) CU. FT. W.W.F.
APPROXIMATE WEIGHT

STATE OF MISSOURI
WILLIAM RICHARD HEIDEN III
NUMBER PE-2002010219
PROFESSIONAL ENGINEER
October 27, 2024

LB Foster CXT® Products

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901 N. Highway 77 Hillsboro, TX 76645
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BUILDING NUMBER RN-125

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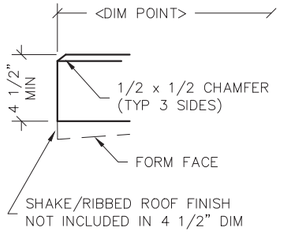
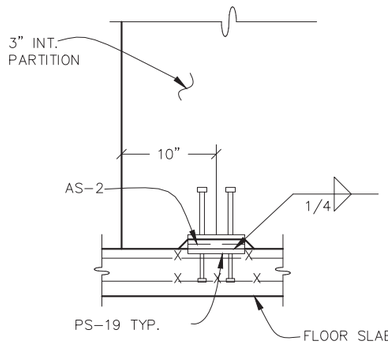
DRAWN	G.OGG	FILE NO.	RN-125
CHECKED	N.PENNER	PLOT	48

INTERIOR ELEVATIONS

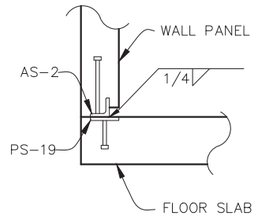
DWG NO.	SHEET	REV.
RN-05	5 / 25	0



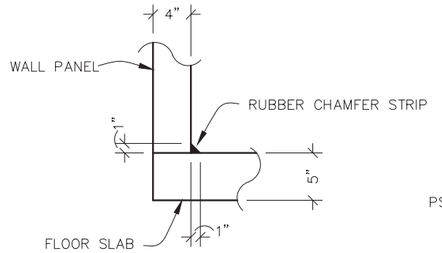
1 TYPICAL ROOF SLAB EDGE



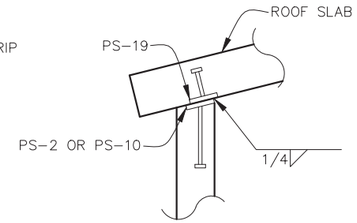
2 INT. PARTITION BASE CONNECTION



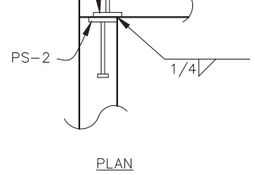
3 TYP. WALL TO FLOOR SLAB WELDED CONNECTION



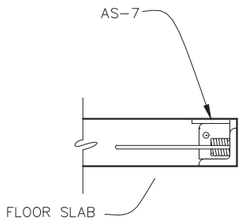
4 TYP. WALL TO FLOOR SLAB JOINT DETAIL



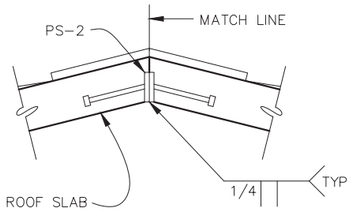
5 TYP. WALL TO ROOF SLAB WELDED CONNECTION



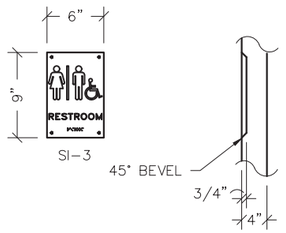
6 TYP. WALL TO WALL PANEL WELDED CONNECTION



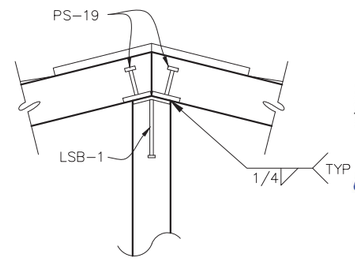
7 FLOOR LIFT PLATE DETAIL



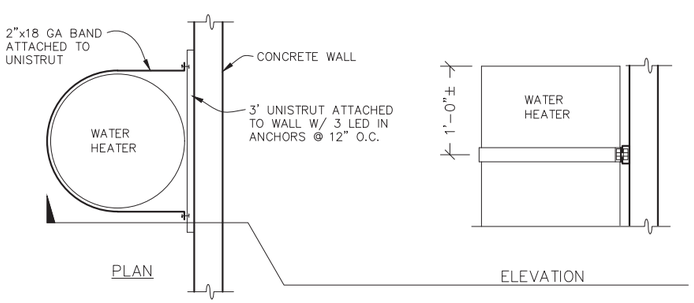
8 ROOF PEAK WELDMENT DETAIL



14 SIGN SI-3 DETAIL



10 ROOF PEAK TO INTERIOR WALL CONNECTION



11 FLOOR MOUNTED WATER HEATER RESTRAINT

APPROVED BY NTA 10/31/2024

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MISSOURI PUBLIC SERVICE COMMISSION
APPROVED
11/19/2024
MANUFACTURED HOUSING

STATE OF MISSOURI
WILLIAM RICHARD HEIDEN III
NUMBER PE-2002010219
PROFESSIONAL ENGINEER
October 27, 2024

LBFoster CXT® Products

6701 E Flamingo Ave Bldg 300 Nampa, ID 83687
901 N. Highway 77 Hillsboro, TX 76645
362 Waverly Road Williamstown, WV 26187

PROJECT TITLE
RANIER
BUILDING NUMBER RN-125

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CXT Incorporated

REV.	DESCRIPTION	APPROVAL	DATE
SCALE	3/4" = 1'-0"	DATE	10-10-24
DRAWN	G.GGG	FILE NO.	RN-125
CHECKED	N.PENNER	PLOT	16

CASTING DETAILS

DWG NO.	SHEET	REV.
RN-06	6 / 25	0

MARINE PACKAGE

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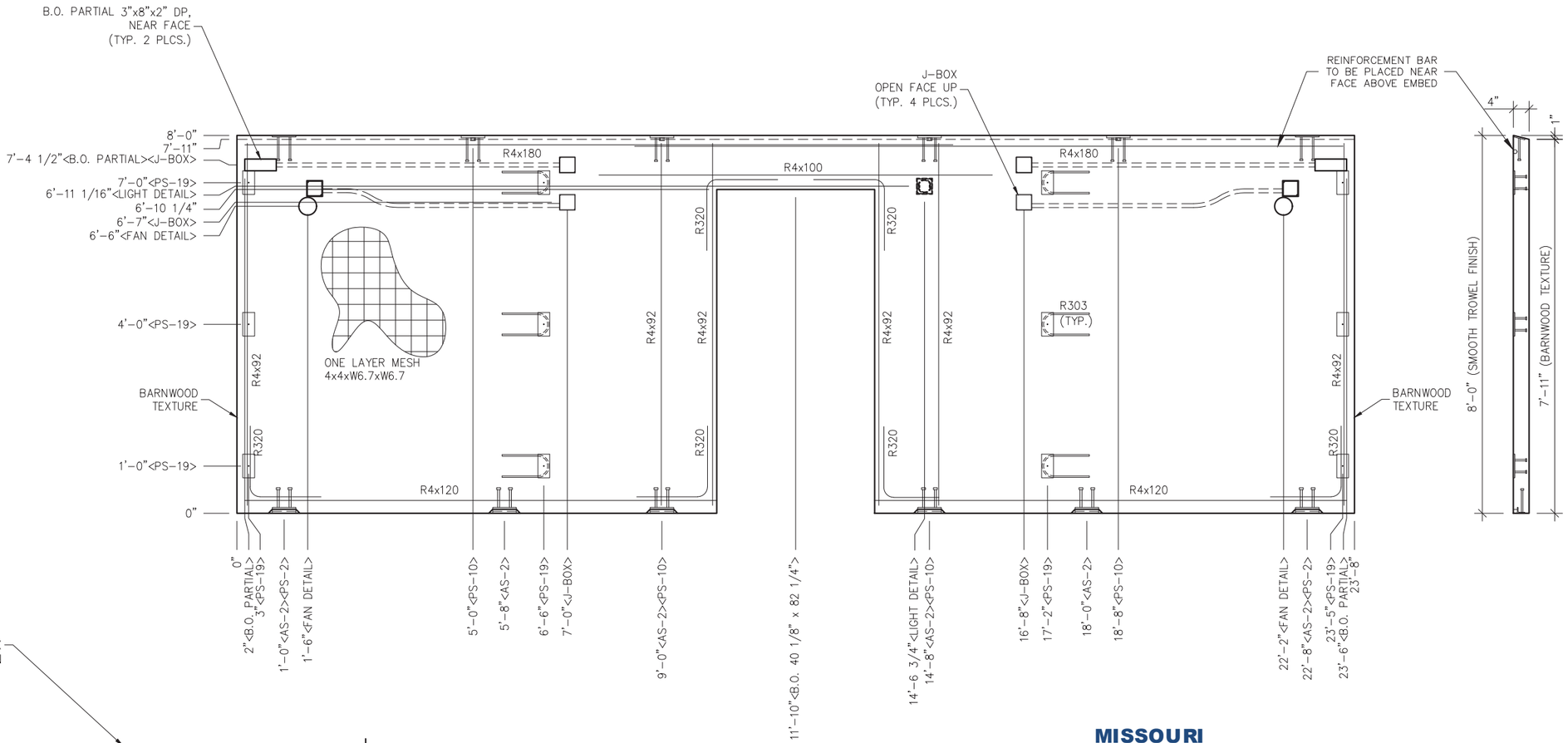
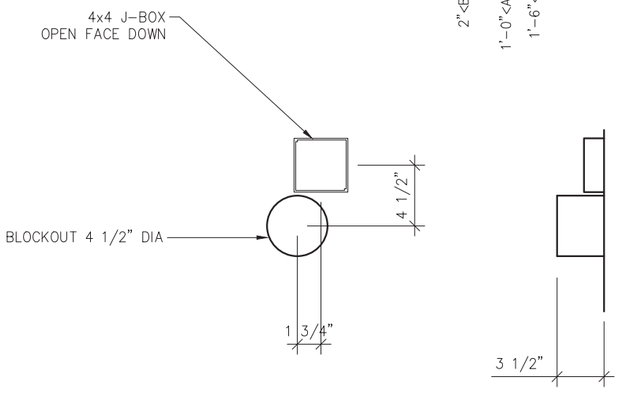
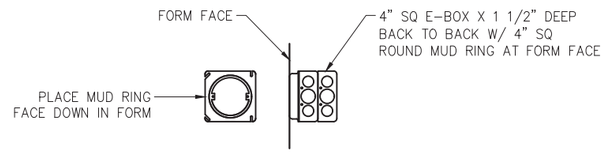




FAN DETAIL
RVF4XL



LIGHT DETAIL

MISSOURI PUBLIC SERVICE COMMISSION
APPROVED
11/19/2024
MANUFACTURED HOUSING

NOTES:

1. ALL REINFORCEMENT BARS TO BE CENTERED IN PANEL UNO.

EMBEDDED MATERIALS	
ITEM	QTY
PS-19 SS	12
AS-2 SS	6
PS-10 SS	4
PS-2 SS	2
R4x92	6
R4x120	2
R4x100	1
R320	6
4x4 J-BOX	6
B.O. 4-1/2" DIA	2
B.O. 40 1/8" x 82 1/4"	1
R303	6
R4x180	2
B.O. PARTIAL 3"x8"x2" DP	2
4x4 E-BOX	2
ROUND MUD RING	1
MARINE PACKAGE	

CU. FT. CONC. | LBS. FT. W.W.F.
66
APPROXIMATE WEIGHT
8,263

STATE OF MISSOURI
WILLIAM RICHARD HEIDEN III
NUMBER PE-2002010219
PROFESSIONAL ENGINEER
October 27, 2024

LBFoster CXT® Products

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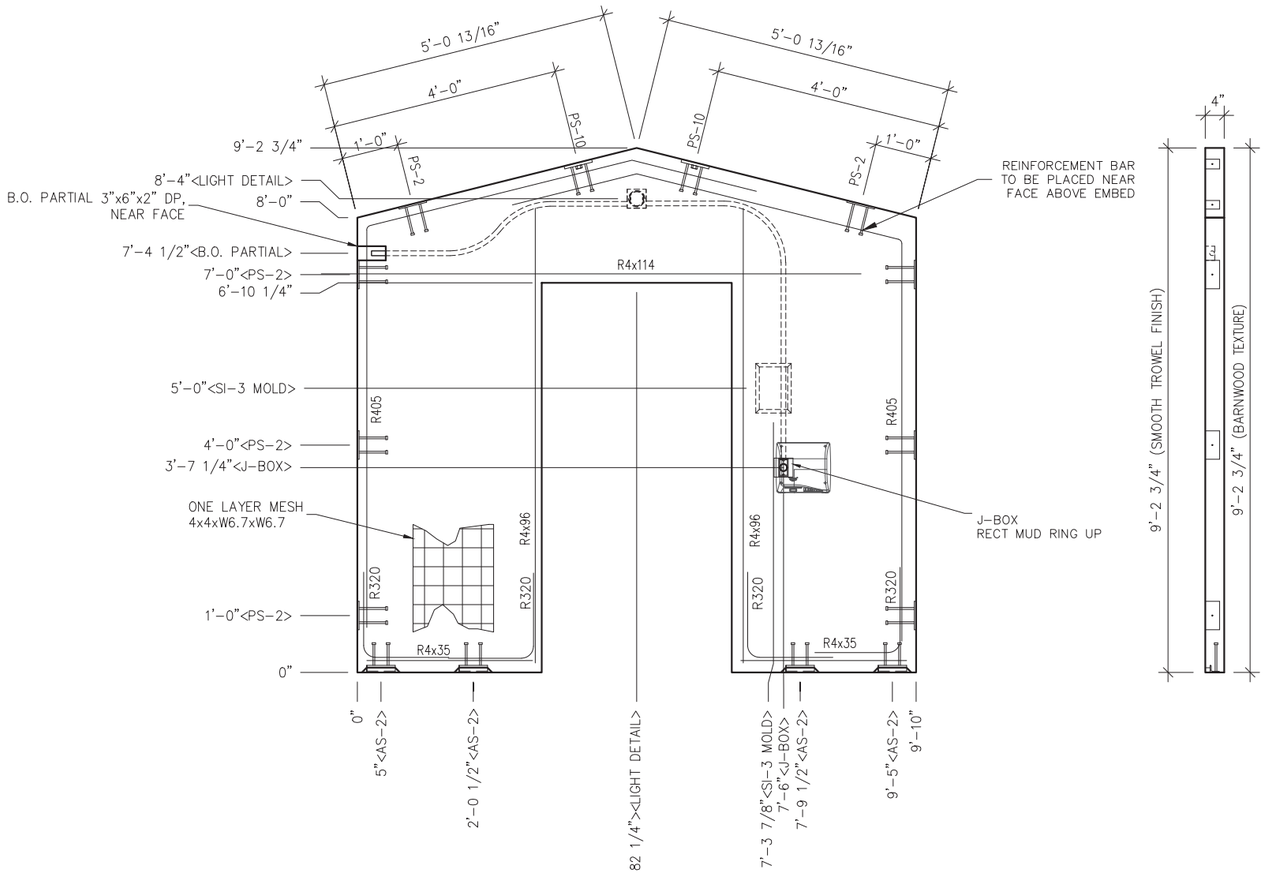
CXT Incorporated

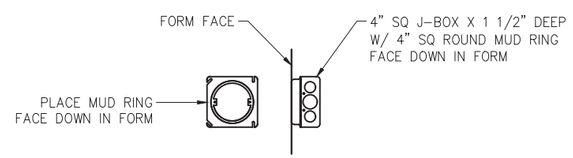
REV.	DESCRIPTION	APPROVAL	DATE
SCALE	3/8" = 1'-0"	DATE	10-10-24
DRAWN	G.OGG	FILE NO.	RN-125
CHECKED	N.PENNER	PLOT	32

WALL PANEL MARK W1

DWG NO.	SHEET	REV.
RN-07	7 / 25	0

MARINE PACKAGE





LIGHT DETAIL

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MISSOURI PUBLIC SERVICE COMMISSION
APPROVED
11/19/2024
MANUFACTURED HOUSING

NOTES:

1. ALL REINFORCEMENT BARS TO BE CENTERED IN PANEL UNO.

EMBEDDED MATERIALS	
ITEM	QTY
AS-2 SS	4
PS-2 SS	8
PS-10 SS	2
R4x114	1
R405	2
R4x35	2
R4x96	2
SI-3 MOLD	1
B.O. 40 1/8" x 82 1/4"	1
4x4 J-BOX	2
ROUND MUD RING	1
B.O. PARTIAL 3"x6"x2" DP	1
RECT. MUD RING	1
R320	4
MARINE PACKAGE	

CU. FT. CONC. | LBS. FT. W.W.F.
APPROXIMATE WEIGHT
3,086

STATE OF MISSOURI
WILLIAM RICHARD HEIDEN III
NUMBER PE-2002010219
PROFESSIONAL ENGINEER
October 27, 2024

LBFoster®
CXT® Products

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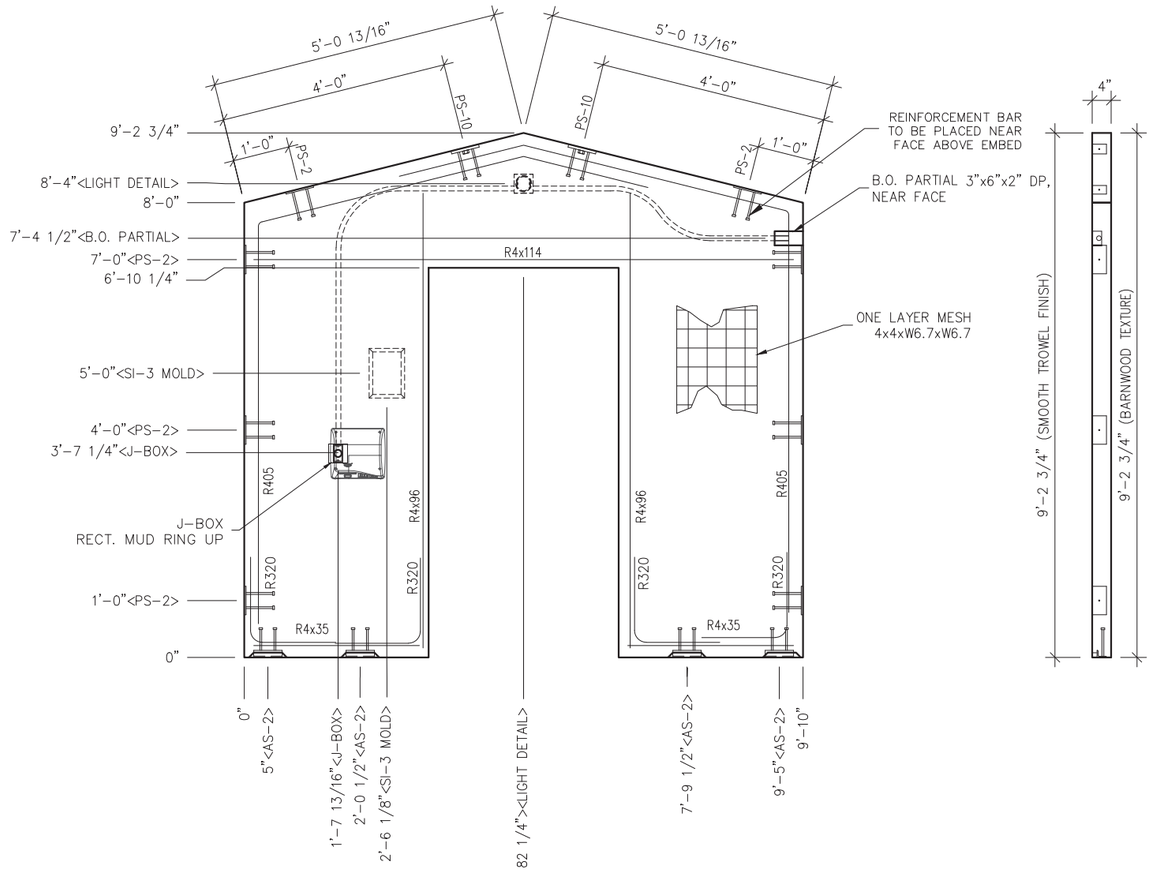
DRAWN	G.OGG	FILE NO.	RN-125
CHECKED	N.PENNER	PLOT	32

WALL PANEL
MARK W2

DWG NO.	SHEET	REV.
RN-08	8 / 25	0

MARINE PACKAGE



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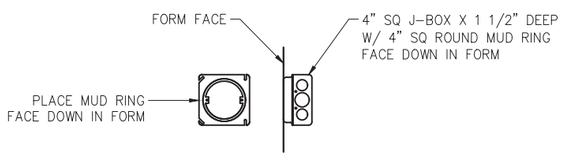

LIGHT DETAIL

MISSOURI PUBLIC SERVICE COMMISSION

APPROVED

11/19/2024

MANUFACTURED HOUSING

NOTES:

1. ALL REINFORCEMENT BARS TO BE CENTERED IN PANEL UNO.

EMBEDDED MATERIALS	
ITEM	QTY
AS-2 SS	4
PS-2 SS	8
PS-10 SS	2
R4x114	1
R405	2
R4x35	2
R4x96	2
SI-3 MOLD	1
B.O. 40 1/8" x 82 1/4"	1
4x4 J-BOX	2
ROUND MUD RING	1
B.O. PARTIAL 3"x6"x2" DP	1
RECT. MUD RING	1
R320	4
MARINE PACKAGE	

CU. FT. CONC. 3,086 LB. FT. W.W.F.

APPROXIMATE WEIGHT

STATE OF MISSOURI
WILLIAM RICHARD HEIDEN III
NUMBER PE-2002010219
PROFESSIONAL ENGINEER

October 27, 2024

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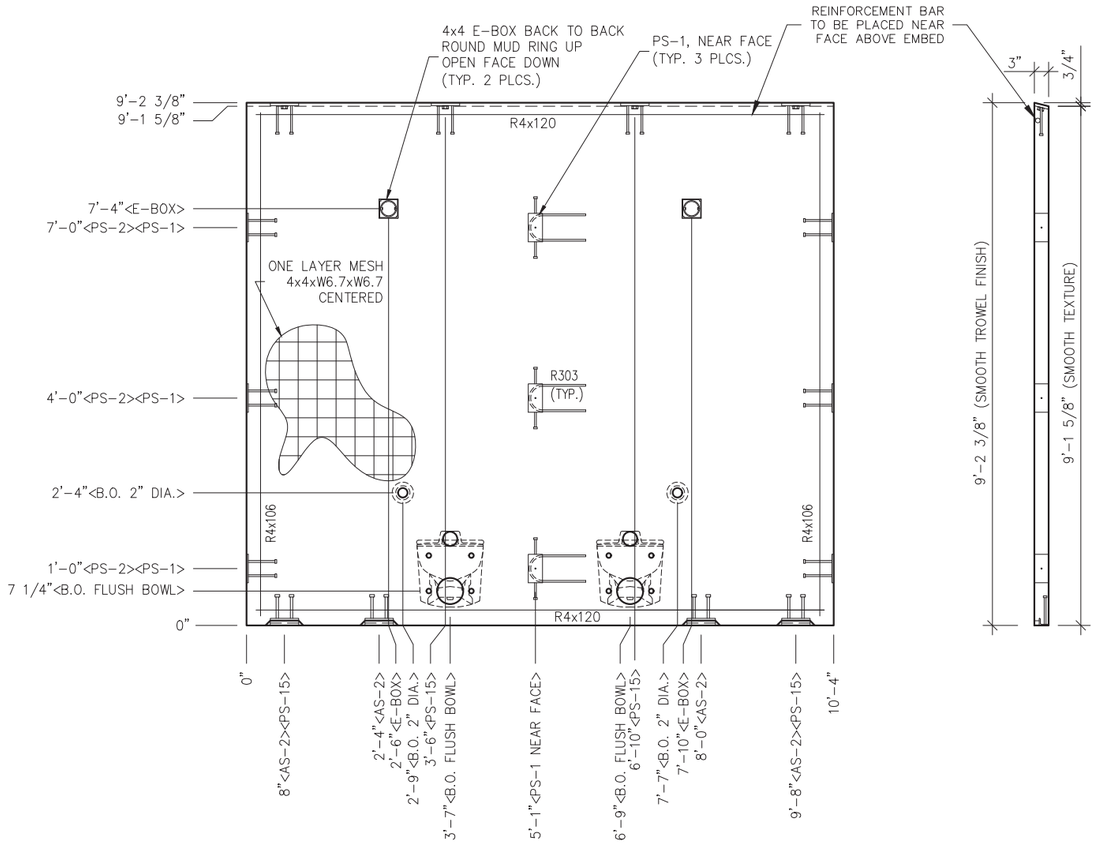
CHECKED	N.PENNER	PLOT	32

WALL PANEL
MARK W3

DWG NO.	SHEET	REV.
RN-09	9 / 25	0

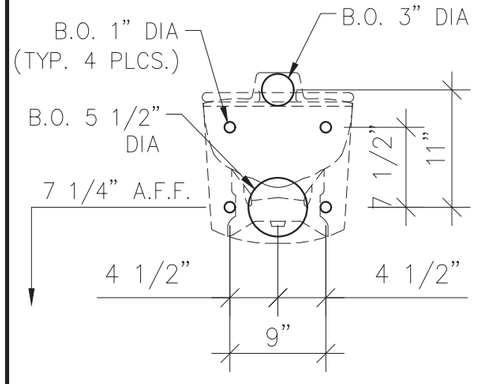
MARINE PACKAGE



BLOCKOUT DETAIL

FLUSH VALVE BOWL DETAIL

AMERICAN STANDARD 0356.421



MISSOURI PUBLIC SERVICE COMMISSION

APPROVED

11/19/2024

MANUFACTURED HOUSING

NOTES:

1. ALL REINFORCEMENT BARS TO BE CENTERED IN PANEL UNO.

APPROVED BY NTA 10/31/2024

Approval of this document does not authorize or approve any deviation or deviations from the requirements of applicable State Laws.

EMBEDDED MATERIALS	
ITEM	QTY
PS-1 SS	3
AS-2 SS	4
PS-15 SS	4
PS-2 SS	6
R4x106	2
R4x120	2
R303	3
4x4 E-BOX	4
ROUND MUD RING	2
B.O. FLUSH BOWL	2
B.O. 2" DIA	2
MARINE PACKAGE	

CU. FT. CONC. | LBS. FT. W.W.F.

APPROXIMATE WEIGHT: 3,549

STATE OF MISSOURI
WILLIAM RICHARD HEIDEN III
NUMBER PE-2002010219
PROFESSIONAL ENGINEER
October 27, 2024

LBFoster CXT® Products

6701 E Flamingo Ave Bldg 300 Nampa, ID 83687
901 N. Highway 77 Hillsboro, TX 76645
362 Waverly Road Williamstown, WV 26187

PROJECT TITLE
RANIER
BUILDING NUMBER RN-125

NOTICE

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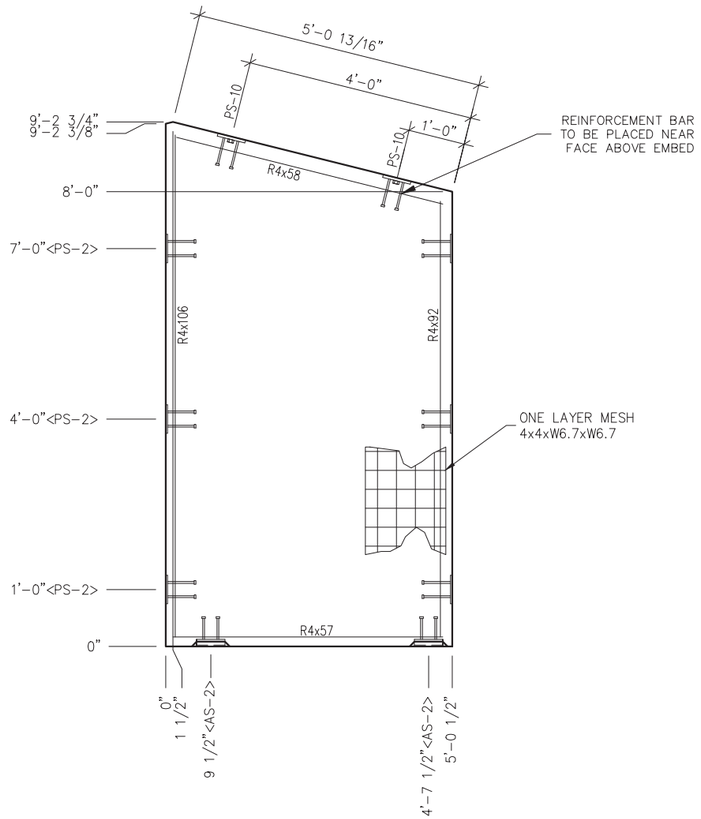
CXT Incorporated

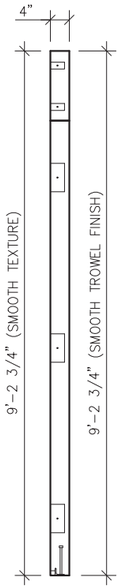
REV.	DESCRIPTION	APPROVAL	DATE
SCALE	3/8" = 1'-0"	DATE	10-10-24
DRAWN	G.OGG	FILE NO.	RN-125
CHECKED	N.PENNER	PLOT	32

WALL PANEL
MARK W4

DWG NO.	SHEET	REV.
RN-10	10 / 25	0

MARINE PACKAGE





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MISSOURI PUBLIC SERVICE COMMISSION
APPROVED
11/19/2024
MANUFACTURED HOUSING

NOTES:

1. ALL REINFORCEMENT BARS TO BE CENTERED IN PANEL UNO.

EMBEDDED MATERIALS	
ITEM	QTY
PS-2 SS	6
PS-10 SS	2
AS-2 SS	2
R4x58	1
R4x92	1
R4x106	1
R4x57	1
MARINE PACKAGE	

CU. FT. CONC. | LBS. FT. W.W.F.
APPROXIMATE WEIGHT
2,194

STATE OF MISSOURI
WILLIAM RICHARD HEIDEN III
NUMBER PE-2002010219
PROFESSIONAL ENGINEER
October 27, 2024

LBFoster® CXT® Products

6701 E Flamingo Ave Bldg 300 Nampa, ID 83687
901 N. Highway 77 Hillsboro, TX 76645
362 Waverly Road Williamstown, WV 26187

PROJECT TITLE
RANIER
BUILDING NUMBER RN-125

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CXT Incorporated

REV.	DESCRIPTION	APPROVAL	DATE

SCALE	3/8" = 1'-0"	DATE	10-10-24
DRAWN	G.GGG	FILE NO.	RN-125
CHECKED	N.PENNER	PLOT	32

WALL PANEL
MARK W5

DWG NO.	SHEET	REV.
RN-11	11 / 25	0

MARINE PACKAGE

APPROVED BY
NTA
10/31/2024
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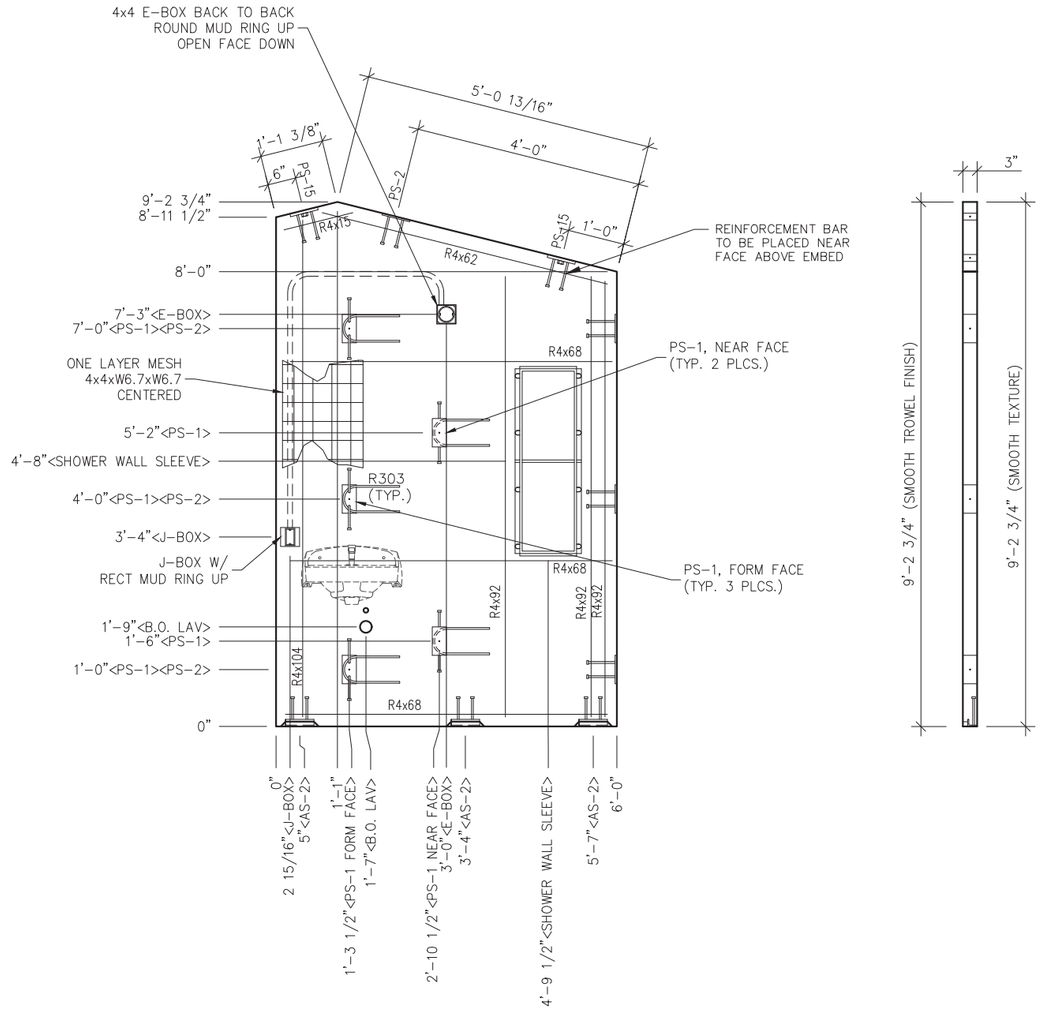

EMBEDDED MATERIALS	
ITEM	QTY
PS-2 SS	4
PS-15 SS	2
R4x62	1
R4x15	1
PS-1 SS	5
R4x68	3
AS-2 SS	3
R4x92	3
R4x104	1
R303	5
4x4 J-BOX	1
4x4 E-BOX	2
ROUND MUD RING	1
RECT MUD RING	1
SHOWER WALL SLEEVE	1
B.O. LAV	1
MARINE PACKAGE	

CU. FT. CONC. | LBS. FT. W.W.F.
APPROXIMATE WEIGHT
1,860

STATE OF MISSOURI
WILLIAM RICHARD HEIDEN III
NUMBER PE-2002010219
PROFESSIONAL ENGINEER
October 27, 2024

LBFoster
CXT® Products

6701 E Flamingo Ave Bldg 300 Nampa, ID 83687
901 N. Highway 77 Hillsboro, TX 76645
362 Waverly Road Williamstown, WV 26187

PROJECT TITLE
RANIER
BUILDING NUMBER RN-125

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CXT Incorporated

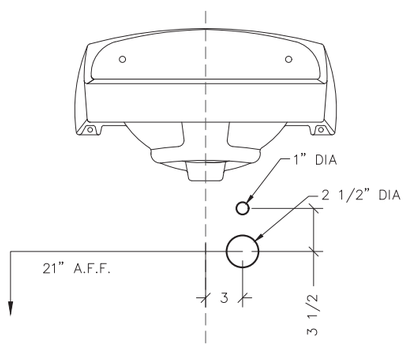
REV.	DESCRIPTION	APPROVAL	DATE
SCALE	3/8" = 1'-0"	DATE	10-10-24
DRAWN	G.OGG	FILE NO.	RN-125
CHECKED	N.PENNER	PLOT	32

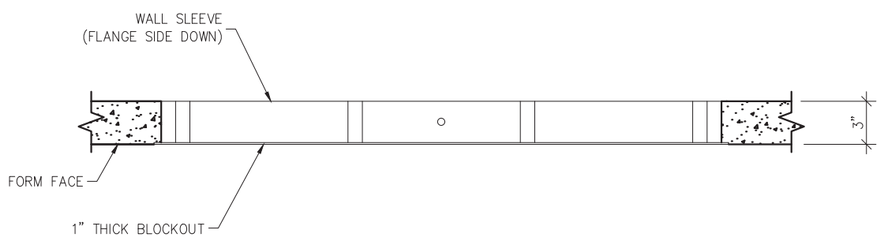
WALL PANEL
MARK W6

DWG NO.	SHEET	REV.
RN-12	12/25	0

BLOCKOUT DETAIL

LAVATORY DETAIL
AMERICAN STANDARD 0356.421





WALL SLEEVE BLOCKOUT DETAIL

MISSOURI
PUBLIC SERVICE
COMMISSION
APPROVED
11/19/2024
MANUFACTURED
HOUSING

NOTES:

1. ALL REINFORCEMENT BARS TO BE CENTERED IN PANEL UNO.

MARINE PACKAGE

APPROVED BY
NTA 10/31/2024
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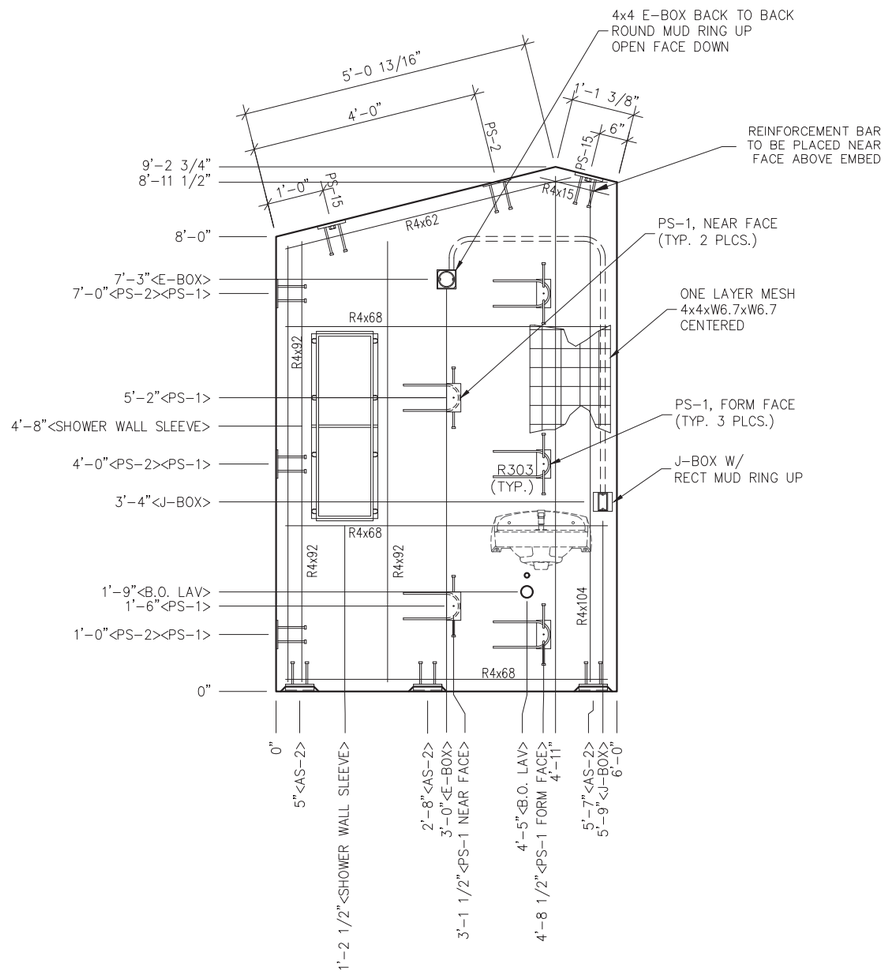

EMBEDDED MATERIALS	
ITEM	QTY
PS-2 SS	4
PS-15 SS	2
R4x62	1
R4x15	1
PS-1 SS	5
R4x68	3
AS-2 SS	3
R4x92	3
R4x104	1
R303	5
4x4 J-BOX	1
4x4 E-BOX	2
ROUND MUD RING	1
RECT MUD RING	1
SHOWER WALL SLEEVE	1
B.O. LAV	1
MARINE PACKAGE	

CU. FT. CONC. | LBS. FT. W.W.F.
APPROXIMATE WEIGHT
1,860

STATE OF MISSOURI
WILLIAM RICHARD HEIDEN III
NUMBER PE-2002010219
PROFESSIONAL ENGINEER
October 27, 2024

LBFoster CXT® Products

6701 E Flamingo Ave Bldg 300 Nampa, ID 83687
901 N. Highway 77 Hillsboro, TX 76645
362 Waverly Road Williamstown, WV 26187

PROJECT TITLE
RANIER
BUILDING NUMBER RN-125

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CXT Incorporated

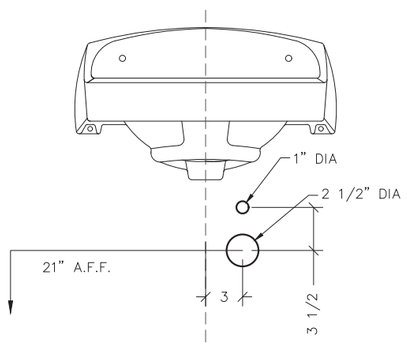
REV.	DESCRIPTION	APPROVAL	DATE
SCALE	3/8" = 1'-0"	DATE	10-10-24
DRAWN	G.OGG	FILE NO.	RN-125
CHECKED	N.PENNER	PLOT	32

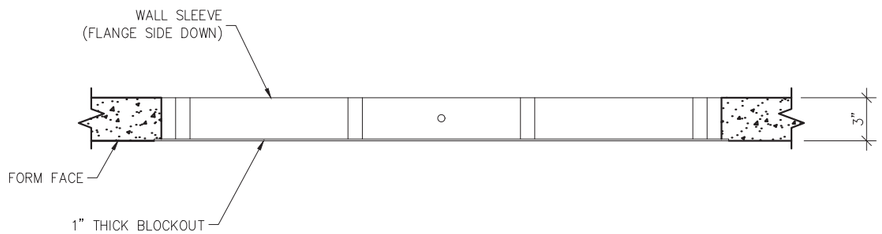
WALL PANEL
MARK W7

DWG NO.	SHEET	REV.
RN-13	13 / 25	0

BLOCKOUT DETAIL

LAVATORY DETAIL
AMERICAN STANDARD 0356.421





WALL SLEEVE BLOCKOUT DETAIL

MISSOURI
PUBLIC SERVICE
COMMISSION
APPROVED
11/19/2024
MANUFACTURED
HOUSING

NOTES:

1. ALL REINFORCEMENT BARS TO BE CENTERED IN PANEL UNO.

MARINE PACKAGE

APPROVED BY
NTA
10/31/2024
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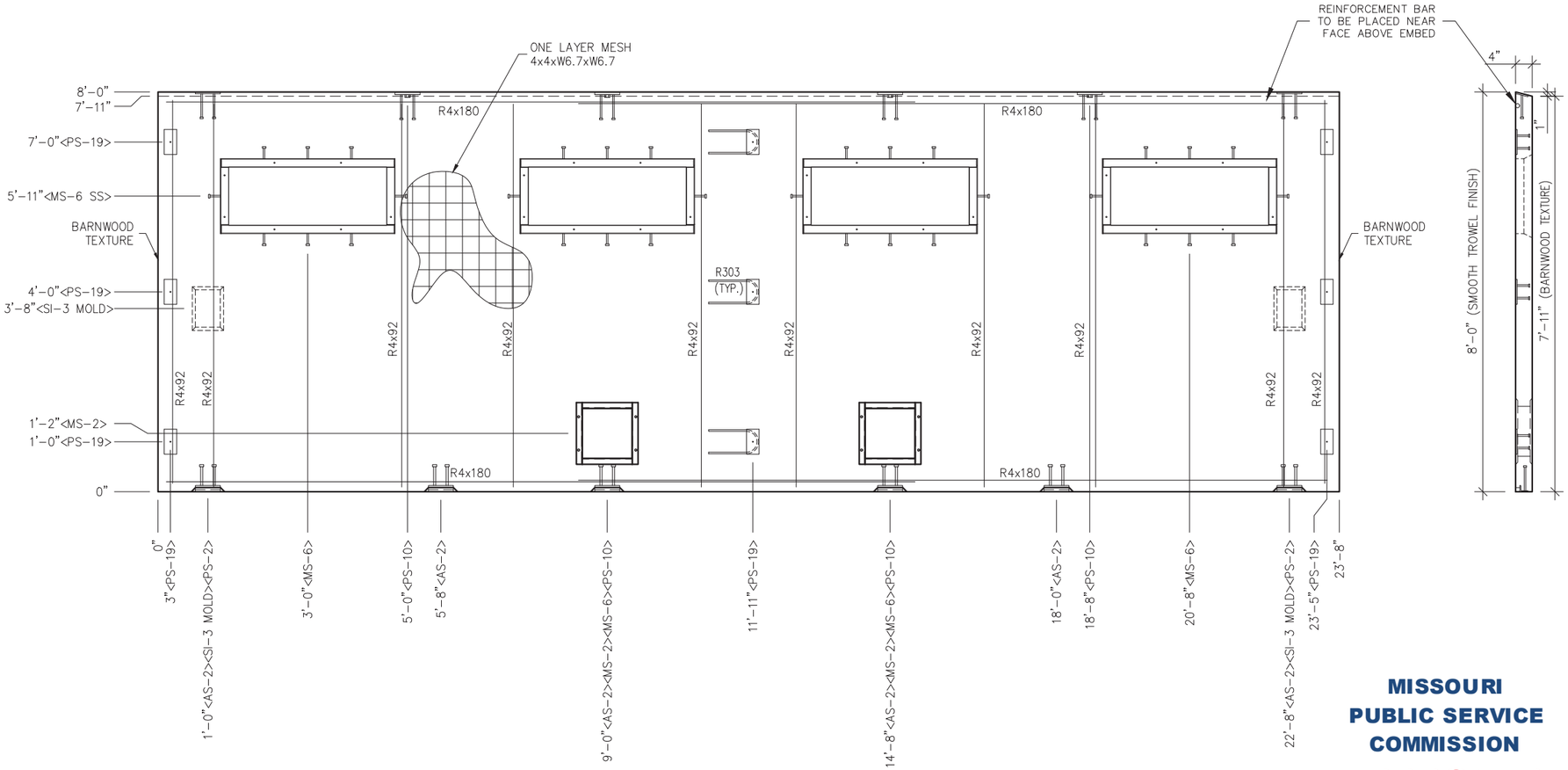

MISSOURI
PUBLIC SERVICE
COMMISSION
APPROVED
11/19/2024
MANUFACTURED
HOUSING

NOTES:

1. ALL REINFORCEMENT BARS TO BE CENTERED IN PANEL UNO.

EMBEDDED MATERIALS	
ITEM	QTY
PS-19 SS	9
AS-2 SS	6
PS-10 SS	4
PS-2 SS	2
R4x92	10
R303	3
MS-2	2
MS-6 SS	4
R4x180	4
SI-3 MOLD	2

MARINE PACKAGE

CU. FT. CONC. | LBS. FT. W.W.F.
APPROXIMATE WEIGHT
8,579

STATE OF MISSOURI
WILLIAM
RICHARD HEIDEN III
NUMBER
PE-2002010219
PROFESSIONAL ENGINEER
October 27, 2024

LBFoster
CXT® Products

6701 E Flamingo Ave Bldg 300 Nampa, ID 83687
901 N. Highway 77 Hillsboro, TX 76645
362 Waverly Road Williamstown, WV 26187

PROJECT TITLE
RANIER
BUILDING NUMBER RN-125

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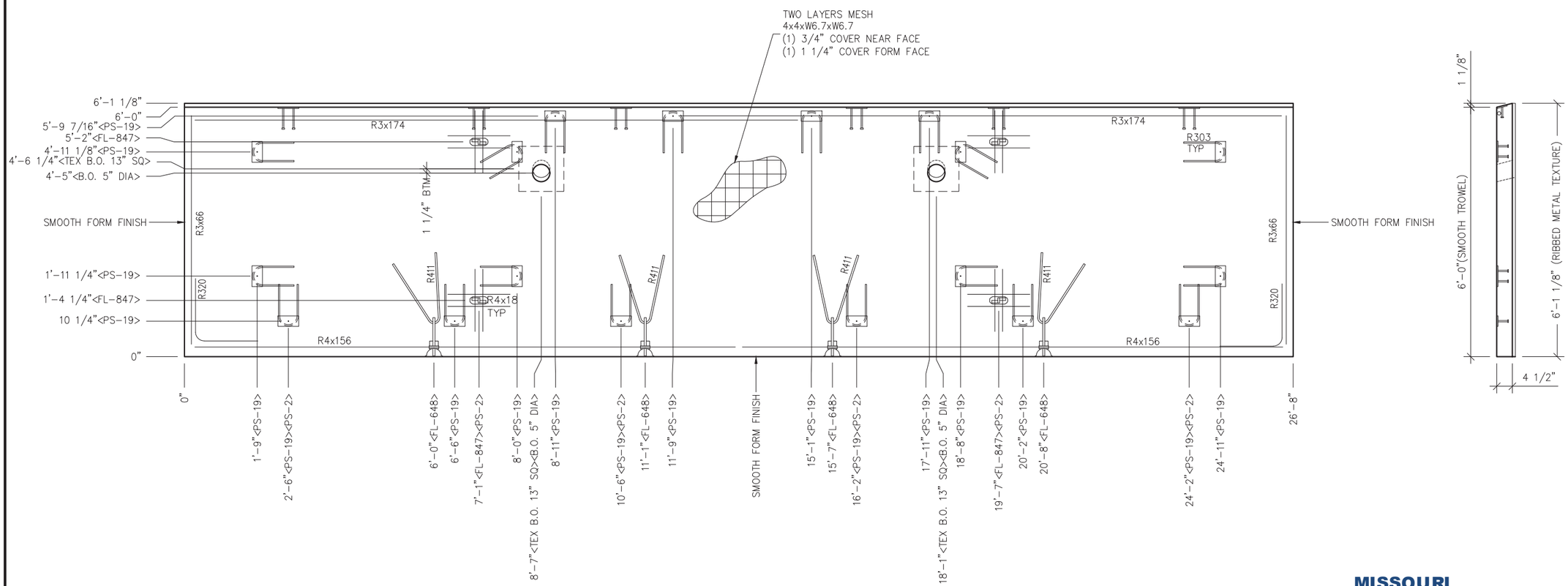
CXT Incorporated

REV.	DESCRIPTION	APPROVAL	DATE
SCALE	3/8" = 1'-0"	DATE	10-10-24
DRAWN	G.OGG	FILE NO.	RN-125
CHECKED	N.PENNER	PLOT	32

WALL PANEL
MARK W8

DWG NO.	SHEET	REV.
RN-14	14 / 25	0

MARINE PACKAGE



EMBEDDED MATERIALS	
ITEM	QTY
PS-19 SS	18
PS-2 SS	6
R303	18
B.O. 5" DIA	2
FL-648	4
R411	4
FL-847	4
R4x18	16
TEX B.O. 13" SQ	2
R3x66	4
R320	4
R4x156	2
R3x174	4
MARINE PARKAGE	

CU. FT. [illegible] LBS. FT. W.W.F.
[illegible] 25
APPROXIMATE WEIGHT
9,565

STATE OF MISSOURI
WILLIAM RICHARD HEIDEN III
NUMBER PE-2002010219
PROFESSIONAL ENGINEER
October 27, 2024

LBFoster®
CXT® Products

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901 N. Highway 77 Hillsboro, TX 76645
362 Waverly Road Williamstown, WV 26187

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RANIER
BUILDING NUMBER RN-125

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CXT Incorporated

REV.	DESCRIPTION	APPROVAL	DATE
SCALE	3/8" = 1'-0"	DATE	10-10-24
DRAWN	G.OGG	FILE NO.	RN-125
CHECKED	N.PENNER	PLOT	32

ROOF SLAB
MARK R1

DWG NO.	SHEET	REV.
RN-15	15 / 25	0

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10/31/2024
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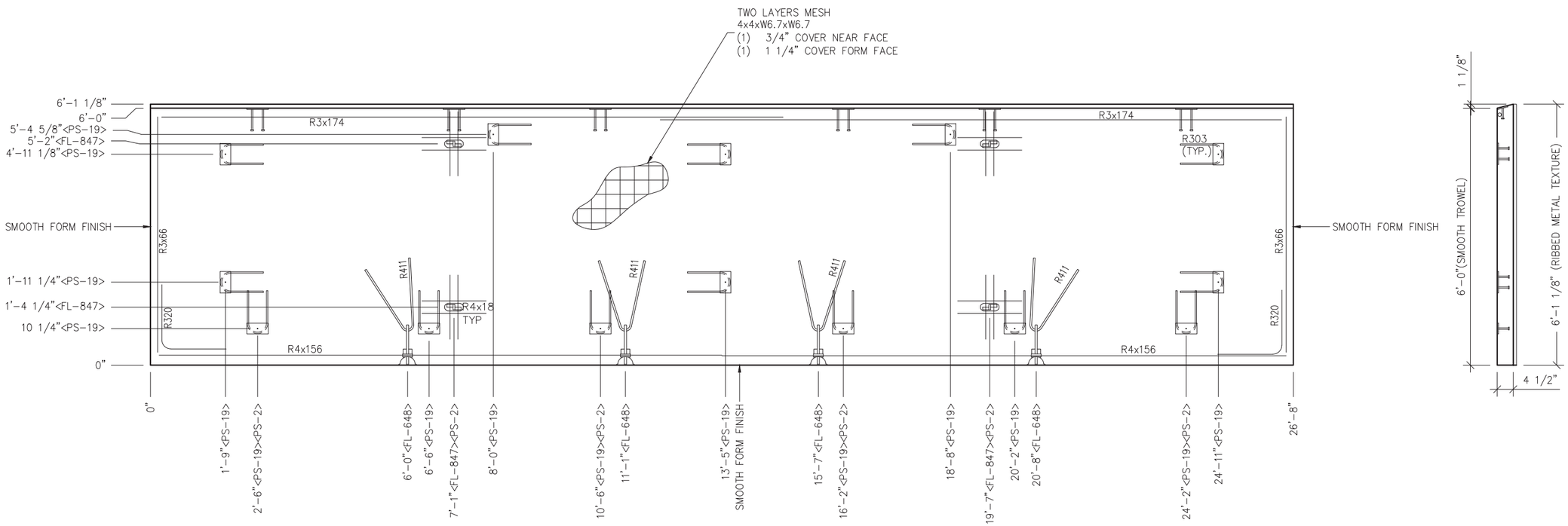
MISSOURI
PUBLIC SERVICE
COMMISSION
APPROVED
11/19/2024
MANUFACTURED
HOUSING

NOTES:

1. EXCEPT R303, R411, R4x156 & R4x18, BARS TO BE PLACED IN PAIRS, ONE EACH FACE OF PANEL W/ 3/4" CLR NEAR FACE & 1 1/4" CLR FORM FACE
2. PLACE BARS R4x18 ACCORDING TO MF'R INSTRUCTIONS.
3. ALL OTHER BARS TO BE CENTERED IN PANEL.

MARINE PACKAGE



EMBEDDED MATERIALS	
ITEM	QTY
PS-19 SS	14
PS-2 SS	6
R303	14
R3x174	4
FL-648	4
R411	4
FL-847	4
R4x18	16
R4x156	2
R3x66	4
R320	4
MARINE PACKAGE	

CU. FT. [illegible] LBS. FT. W.W.F.
[illegible] 25
APPROXIMATE WEIGHT
9,581

STATE OF MISSOURI
WILLIAM RICHARD HEIDEN III
NUMBER PE-2002010219
PROFESSIONAL ENGINEER
October 27, 2024

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MISSOURI PUBLIC SERVICE COMMISSION
APPROVED
11/19/2024
MANUFACTURED HOUSING

NOTES:
1. EXCEPT R303, R411, R4x156 & R4x18, BARS TO BE PLACED IN PAIRS, ONE EACH FACE OF PANEL W/ 3/4" CLR NEAR FACE & 1 1/4" CLR FORM FACE
2. PLACE BARS R4x18 ACCORDING TO MF'R INSTRUCTIONS.
3. ALL OTHER BARS TO BE CENTERED IN PANEL.

LBFoster® CXT® Products

6701 E Flamingo Ave Bldg 300 Nampa, ID 83687
901 N. Highway 77 Hillsboro, TX 76645
362 Waverly Road Williamstown, WV 26187

PROJECT TITLE
RANIER
BUILDING NUMBER RN-125

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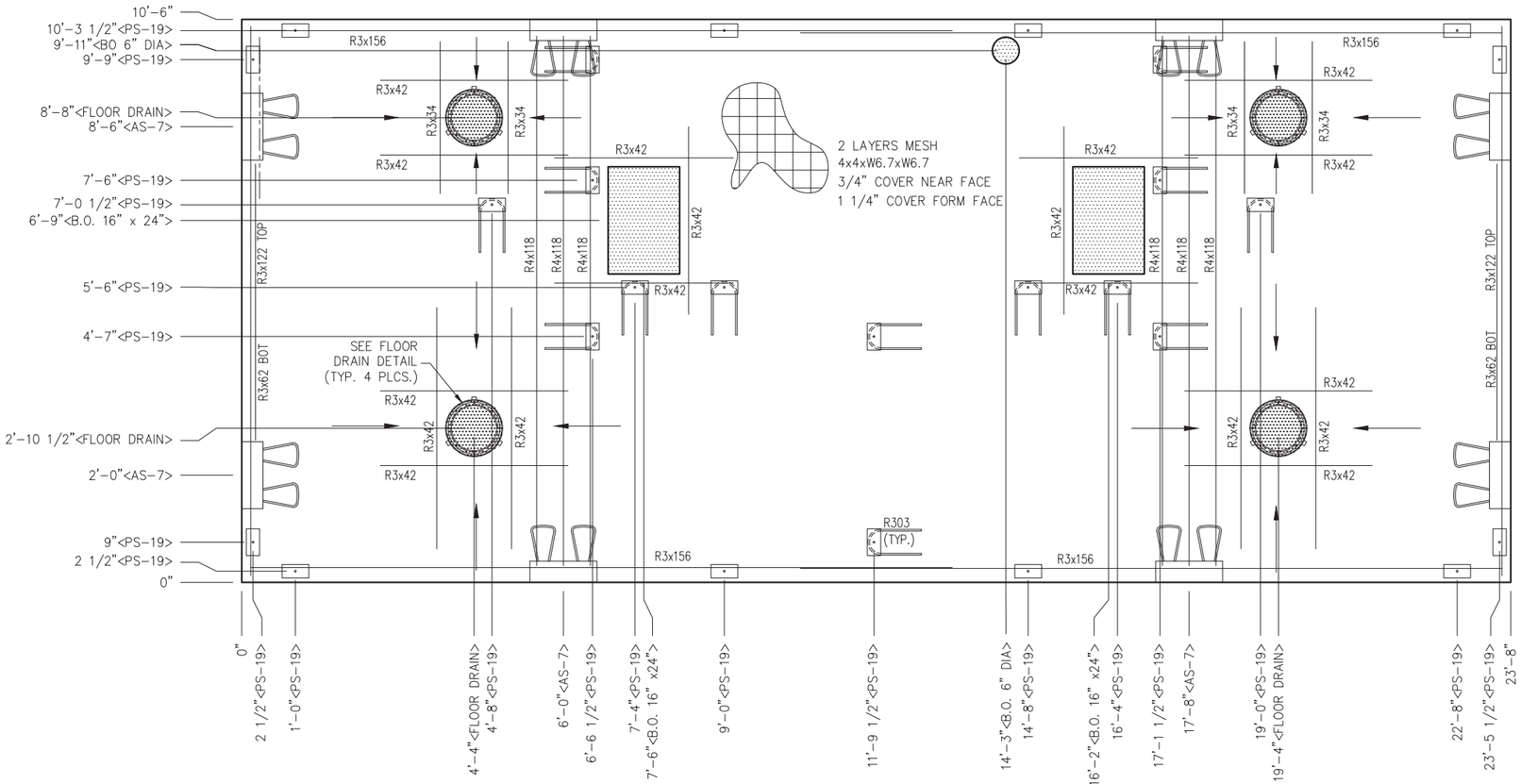
CXT Incorporated

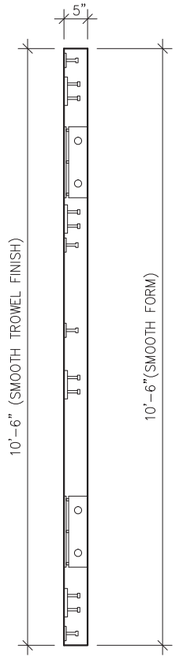
REV.	DESCRIPTION	APPROVAL	DATE
SCALE	3/8"= 1'-0"	DATE	10-10-24
DRAWN	G.OGG	FILE NO.	RN-125
CHECKED	N.PENNER	PLOT	32

ROOF SLAB
MARK R2

DWG NO.	SHEET	REV.
RN-16	16/25	0

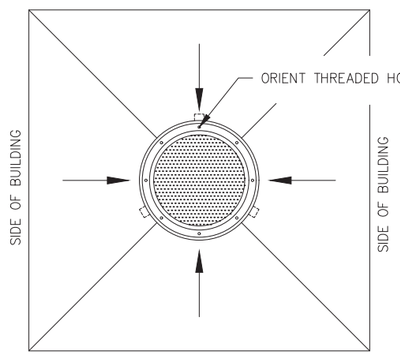
MARINE PACKAGE

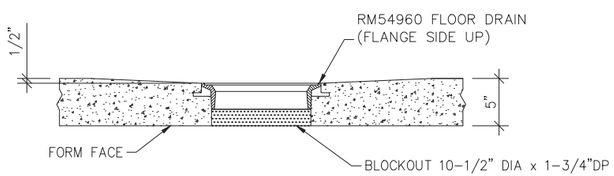




EMBEDDED MATERIALS	
ITEM	QTY
AS-7	8
PS-19 SS	26
R303	14
R3x42	36
R3x62	2
R3x122	2
R3x156	8
R4x118	6
B.O. 16"x24"	2
B.O. 6" DIA	1
FLOOR DRAIN	4
R3x34	8
MARINE PACKAGE	

CU. FT. CONC. [illegible] LBS. FT. W.W.F.
[illegible] 107
APPROXIMATE WEIGHT
15,186





FLOOR DRAIN BLOCK-OUT DETAIL

APPROVED BY
NTA
10/31/2024
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MISSOURI PUBLIC SERVICE COMMISSION
APPROVED
11/19/2024
MANUFACTURED HOUSING

NOTES:
1. SLOPE 1/4" TO FLOOR DRAIN BLOCKOUTS AS INDICATED BY ARROWS.
2. EXCEPT R3x62, R3x122 & R4x118, REINFORCING BARS TO BE PLACED IN PAIRS, ONE EACH FACE OF PANEL W/ 3/4" CLR NEAR FACE & 1 1/4" CLR FORM FACE.
3. R4x118 TO BE PLACED ACCORDING TO MF'R INSTRUCTIONS.
4. ALL OTHER BARS TO BE CENTERED IN PANEL.

STATE OF MISSOURI
WILLIAM RICHARD HEIDEN III
NUMBER PE-2002010219
PROFESSIONAL ENGINEER
October 27, 2024

LBFoster
CXT® Products

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362 Waverly Road Williamstown, WV 26187

PROJECT TITLE
RANIER
BUILDING NUMBER RN-125

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CXT Incorporated

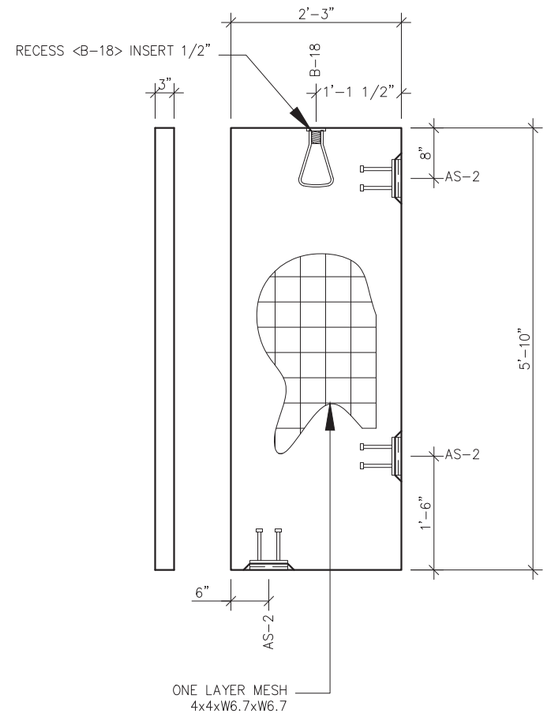
REV.	DESCRIPTION	APPROVAL	DATE

SCALE	3/8"" = 1'-0"	DATE	10-10-24
DRAWN	G.OGG	FILE NO.	RN-125
CHECKED	N.PENNER	PLOT	32

FLOOR SLAB
MARK F1

DWG NO.	SHEET	REV.
RN-17	17 / 25	0

MARINE PACKAGE



MARK P1 – (2 REQUIRED)

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10/31/2024
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MISSOURI
PUBLIC SERVICE
COMMISSION
APPROVED
11/19/2024
MANUFACTURED
HOUSING

NOTES:

1. ALL REINFORCEMENT BARS TO BE CENTERED IN PANEL UNO.
2. RECESS B-18 INSERTS 1/2", GROUT CLOSED AT FINAL ASSEMBLY.
3. CUP STONE ALL EDGES.

EMBEDDED MATERIALS	
ITEM	QTY
AS-2 SS	3
B-18	1
MARINE PACKAGE	

CU. FT. CONC. | LBS. FT. W.W.F.
10 | 1
APPROXIMATE WEIGHT
492

STATE OF MISSOURI
WILLIAM
RICHARD HEIDEN III
NUMBER
PE-2002010219
PROFESSIONAL ENGINEER
October 27, 2024

LBFoster®
CXT® Products

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CXT Incorporated

REV.	DESCRIPTION	APPROVAL	DATE
SCALE	1/2" = 1'-0"	DATE	10-10-24
DRAWN	G.OGG	FILE NO.	RN-125
CHECKED	N.PENNER	PLOT	24

INTERIOR PARTITION
MARK P1

DWG NO.	SHEET	REV.
RN-18	18 / 25	0

APPROVED BY
NTA
10/31/2024
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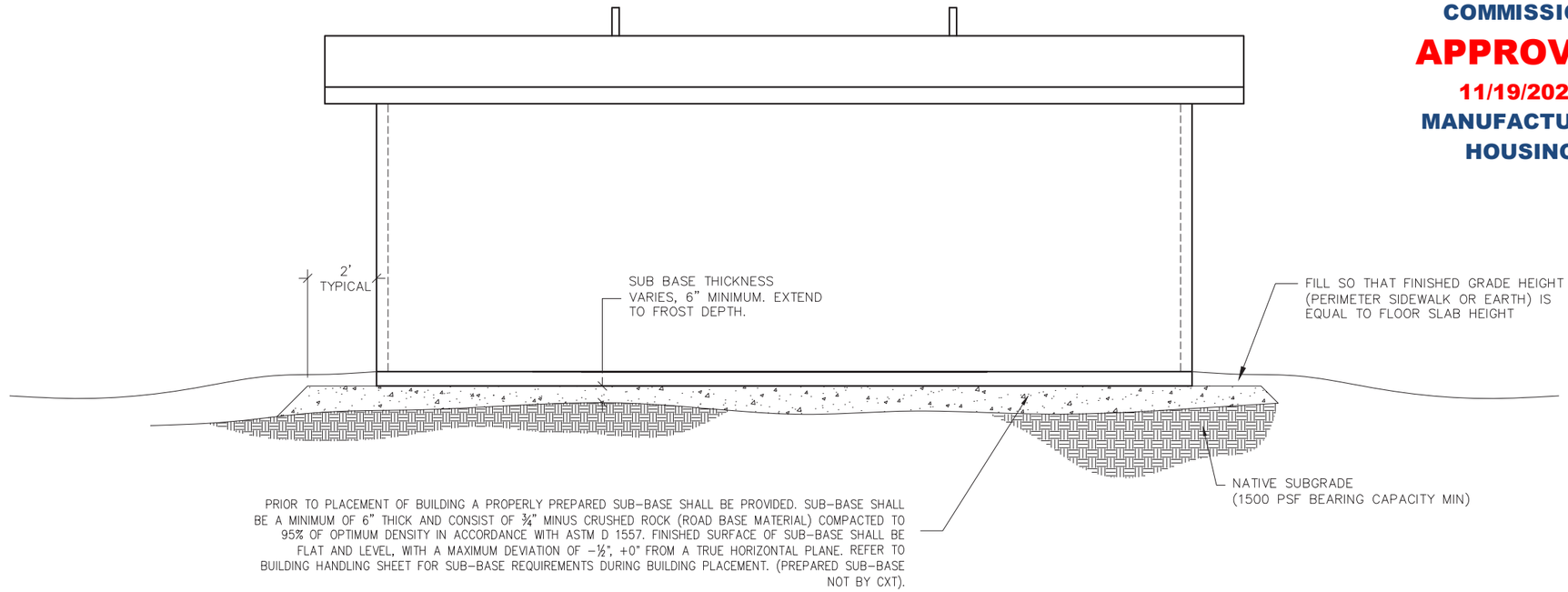
NOTE:

THIS FACTORY ASSEMBLED BUILDING, AS CONSTRUCTED, PROVIDES A RIGID BOX TYPE STRUCTURAL SYSTEM. VERTICAL LOADS ARE TRANSFERRED PRIMARILY THROUGH BEARING WALLS TO THE STRUCTURAL SLAB FLOOR OF THE BUILDING. THE VERTICAL LOADS ARE THEN DISTRIBUTED THROUGH THE REINFORCED CONCRETE FLOOR TO THE PREPARED GRANULAR, NON-FROST SUSCEPTIBLE (NFS) SUB-BASE WHICH DISTRIBUTES THE VERTICAL LOADS IN RELATIVELY UNIFORM FASHION TO THE NATIVE SUB-GRADE. AS WITH MOST CONSTRUCTION, THIS DOES REQUIRE THE NATIVE SUB-GRADE TO BE STRIPPED OF VEGETATION AND TOP SOIL PRIOR TO PLACEMENT OF THE PREPARED GRANULAR SUB-BASE. DUE TO THE INHERENT STIFFNESS OF THE BUILDING, IT WILL REMAIN SAFE AND STRUCTURALLY SOUND IN THE UNLIKELY EVENT OF FREEZING ACTION BELOW THE BUILDING REGARDLESS OF NATURAL FREEZE/ THAW CYCLES ANTICIPATED TO BE ENCOUNTERED IN THE STATE OF MISSOURI.

LATERAL LOADS ARE TRANSFERRED TO THE GROUND THROUGH FRICTIONAL RESISTANCE WITHOUT SLIDING OR SHIFTING BETWEEN THE BUILDING FLOOR SLAB AND THE PREPARED SOIL AND GRAVEL SUB-BASE ON WHICH THE BUILDING RESTS. SEISMIC ANALYSES ARE BASED ON LOADS DETERMINED IN ACCORDANCE WITH THE INTERNATIONAL BUILDING CODE USING PARAMETERS, WHICH MEET OR EXCEED THE CODE PRESCRIBED REQUIREMENTS FOR THIS INSTALLATION.

THIS BUILDING AS DESIGNED, RESTING ON A PROPERLY PREPARED GRANULAR SUB-BASE WILL BE SAFE AND STRUCTURALLY SOUND FOR VERTICAL AND LATERAL LOADS AS DISCUSSED ABOVE. A FULL DEPTH FOUNDATION WALL AT THE BUILDING PERIMETER AND AN ANCHORAGE SYSTEM, TYPICAL FOR OTHER TYPES OF BUILDING CONSTRUCTION, ARE NOT REQUIRED FOR THIS BUILDING.

THE "FOUNDATION" FOR THIS STRUCTURE IS ESSENTIALLY THE COMBINATION OF THE COMPACTED SUB-BASE MATERIAL AND THE BUILDING'S REINFORCED SLAB. THE COMBINATION OF THE COMPACTED SUB-BASE MATERIAL AND THE BUILDING'S REINFORCED SLAB NEED TO BE AT LEAST 12" THICK AND THE COMPACTED SUB-BASE MATERIAL SHALL EXTEND BELOW THE LOCAL FROST DEPTH



PRIOR TO PLACEMENT OF BUILDING A PROPERLY PREPARED SUB-BASE SHALL BE PROVIDED. SUB-BASE SHALL BE A MINIMUM OF 6" THICK AND CONSIST OF ¾" MINUS CRUSHED ROCK (ROAD BASE MATERIAL) COMPACTED TO 95% OF OPTIMUM DENSITY IN ACCORDANCE WITH ASTM D 1557. FINISHED SURFACE OF SUB-BASE SHALL BE FLAT AND LEVEL, WITH A MAXIMUM DEVIATION OF -½", +0" FROM A TRUE HORIZONTAL PLANE. REFER TO BUILDING HANDLING SHEET FOR SUB-BASE REQUIREMENTS DURING BUILDING PLACEMENT. (PREPARED SUB-BASE NOT BY CXT).

MISSOURI
PUBLIC SERVICE
COMMISSION
APPROVED
11/19/2024
MANUFACTURED
HOUSING

STATE OF MISSOURI
WILLIAM
RICHARD HEIDEN III
NUMBER
PE-2002010219
PROFESSIONAL ENGINEER
October 27, 2024

LBFoster®
CXT® Products

6701 E Flamingo Ave Bldg 300 Nampa, ID 83687
901 N. Highway 77 Hillsboro, TX 76645
362 Waverly Road Williamstown, WV 26187

PROJECT TITLE
RANIER
BUILDING NUMBER RN-125

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CXT Incorporated

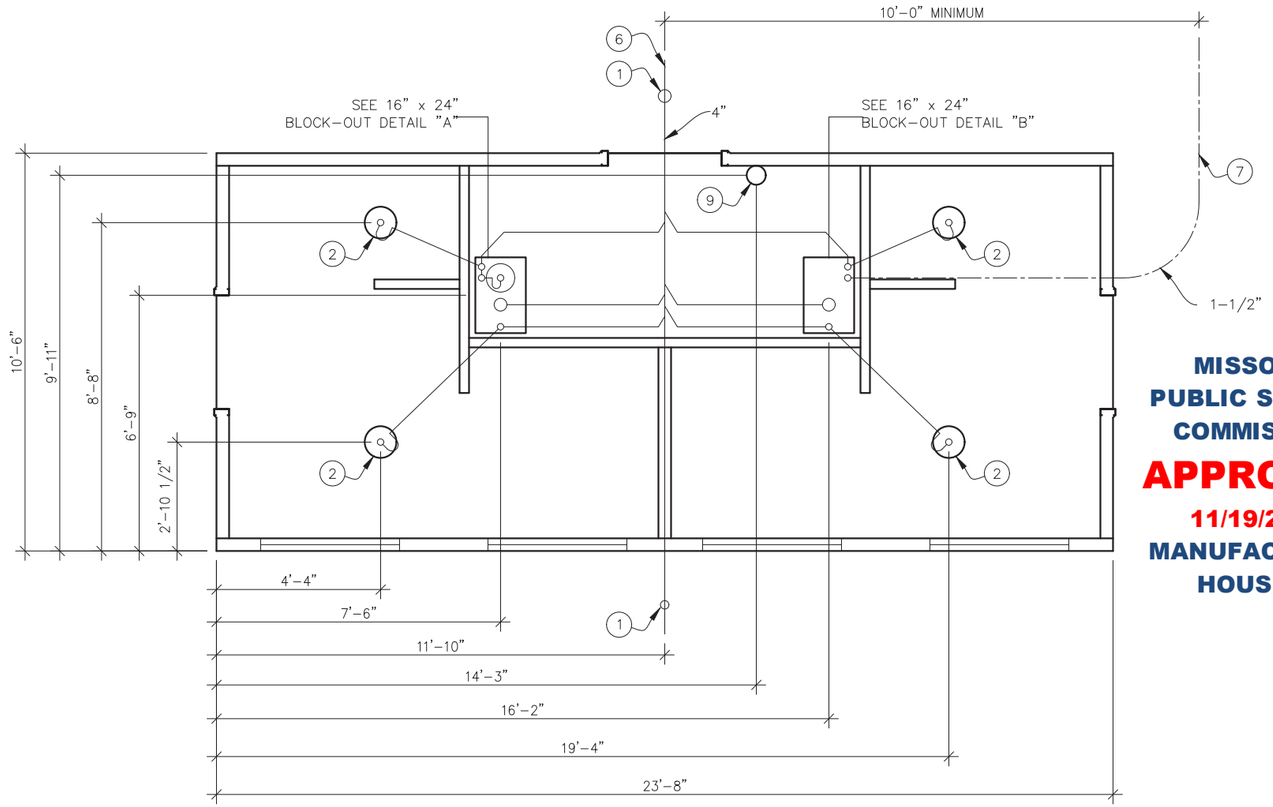
REV.	DESCRIPTION	APPROVAL	DATE

SCALE	NTS	DATE	10-10-24
DRAWN	G.OGG	FILE NO.	RN-125
CHECKED	N.PENNER	PLOT	48

FOUNDATION DETAIL

DWG NO.	SHEET	REV.
RN-19	19 / 25	0

ALL PIPING INDICATED ON
THIS SHEET IS NOT BY CXT



FLOOR DRAIN BLOCK-OUTS & BELOW FLOOR PIPING

1/4"=1'-0"

MISSOURI PUBLIC SERVICE COMMISSION

APPROVED

11/19/2024

MANUFACTURED HOUSING

BELOW FLOOR PIPING – KEY NOTES

1. 4" CLEAN OUT TO GRADE.
2. 2" FLOOR DRAIN. FIELD INSTALLED 2" TRAP SEAL SYSTEM IF REQUIRED BY AUTHORITY HAVING JURISDICTION. (10" DIA. BLOCK-OUT)
3. 2" VENT PIPES EXTENDED 12" ABOVE FINISHED FLOOR LEVEL, PROVIDE TEST PLUG. (16"x24" BLOCK-OUT)
4. 4" WASTE PIPE EXTENDED 12" ABOVE FINISHED FLOOR LEVEL, PROVIDE TEST PLUG. (16"x24" BLOCK-OUT)
5. 1 1/2" TYPE 'K' OR 'L' ANNEALED "SOFT" COPPER WATER SERVICE EXTENDED 12" ABOVE FINISHED FLOOR LEVEL, PROVIDE CAP AT END. (16"x24" BLOCK-OUT)
6. 30" MIN. BURY, PROVIDE TRACER TAPE.
7. MIN. BURY PER LOCAL REQUIREMENTS TO PROTECT FROM FREEZING AND DAMAGE.
8. 2" FLOOR DRAIN. FIELD INSTALLED 2" TRAP SEAL SYSTEM IF REQUIRED BY AUTHORITY HAVING JURISDICTION. (16"x24" BLOCK-OUT)
9. ELECTRICAL STUB UP, (6" DIA. BLOCK-OUT)

PIPING LEGEND

BELOW FLOOR WASTE PIPING SCH 40 PVC ASTM D2665 TYPE DWV

1 1/2" WATER SERVICE ANNEALED "SOFT" COPPER ASTM B88, TYPE 'K' OR 'L'

APPROVED BY NTA 10/31/2024

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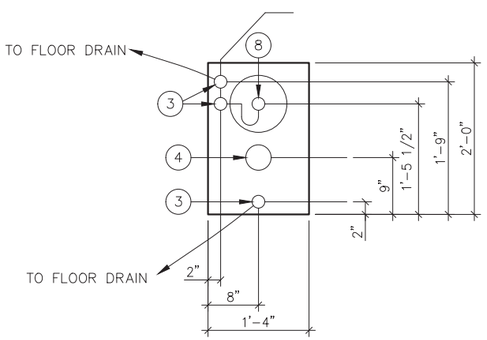
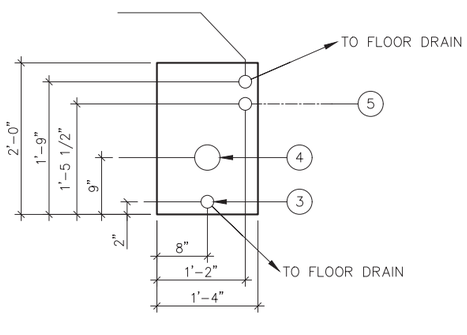


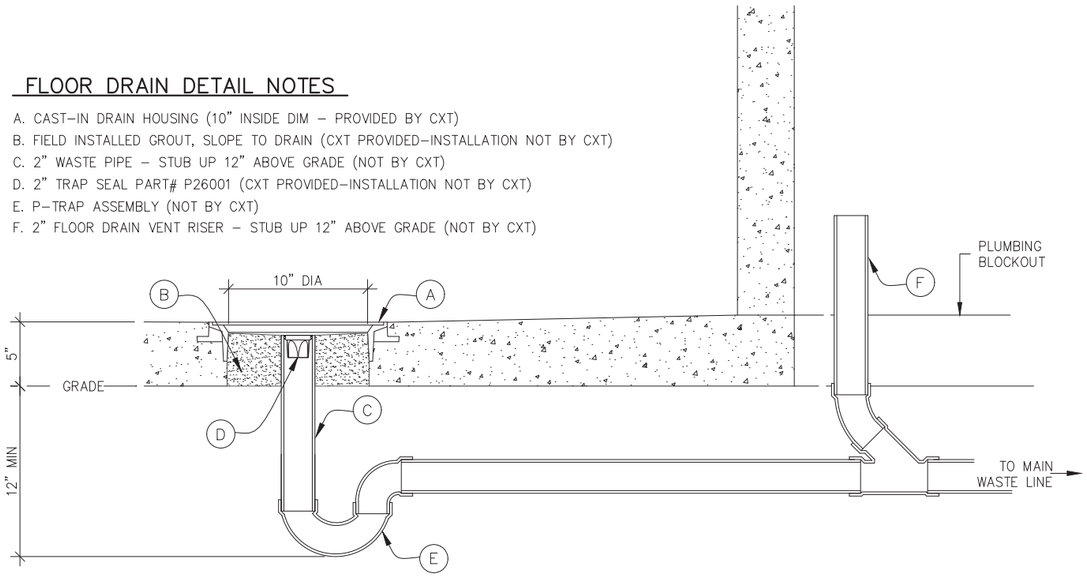
16" x 24" BLOCK-OUT DETAIL "A'



16" x 24" BLOCK-OUT DETAIL "B'

FLOOR DRAIN DETAIL NOTES

A. CAST-IN DRAIN HOUSING (10" INSIDE DIM – PROVIDED BY CXT)
B. FIELD INSTALLED GROUT, SLOPE TO DRAIN (CXT PROVIDED-INSTALLATION NOT BY CXT)
C. 2" WASTE PIPE – STUB UP 12" ABOVE GRADE (NOT BY CXT)
D. 2" TRAP SEAL PART# P26001 (CXT PROVIDED-INSTALLATION NOT BY CXT)
E. P-TRAP ASSEMBLY (NOT BY CXT)
F. 2" FLOOR DRAIN VENT RISER – STUB UP 12" ABOVE GRADE (NOT BY CXT)



FLOOR DRAIN DETAIL

STATE OF MISSOURI
WILLIAM RICHARD HEIDEN III
NUMBER PE-2002010219
PROFESSIONAL ENGINEER
October 27, 2024

LB Foster
CXT® Products

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901 N. Highway 77 Hillsboro, TX 76645
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RANIER
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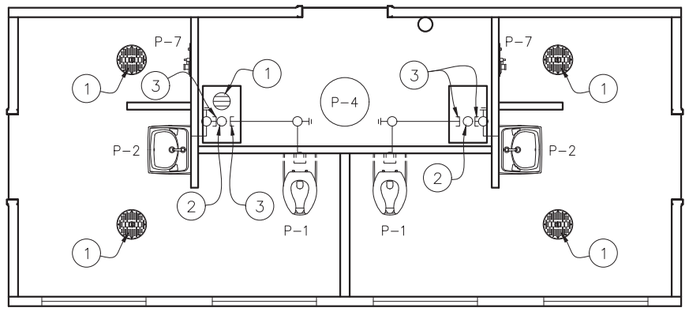
CXT Incorporated

REV.	DESCRIPTION	APPROVAL	DATE
SCALE	1/4" = 1'-0"	DATE	10-10-24
DRAWN	G.OGG	FILE NO.	RN-125
CHECKED	N.PENNER	PLOT	48

FLOOR DRAIN LOCATIONS AND BELOW FLOOR PIPING

DWG NO.	SHEET	REV.
RN-20	20 / 25	0



WASTE PIPE PLAN

1/4"=1'-0"

WASTE PIPING – KEY NOTES

1. 2" FLOOR DRAIN, FIELD INSTALLED (NOT BY CXT)
2. 4" WASTE THROUGH FLOOR, FIELD INSTALLED (NOT BY CXT)
3. PROVIDE TEST PLUG IN END OF WASTE PIPE. CONTINUATION OF PIPING IS FIELD INSTALLED & NOT BY CXT.

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10/31/2024
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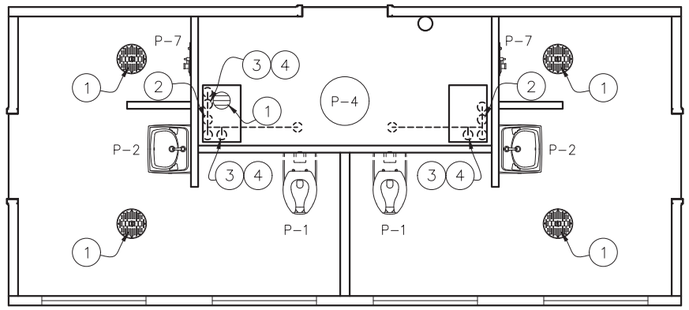


VENT PIPE PLAN

1/4"=1'-0"

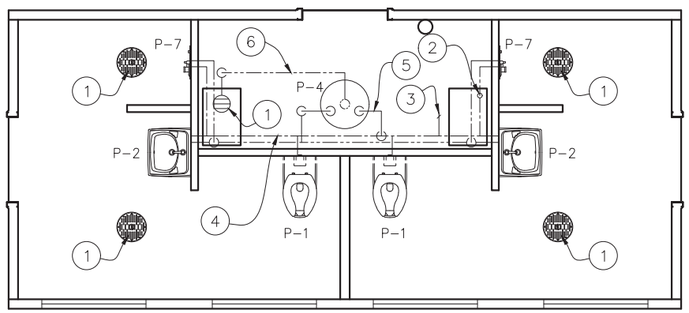
VENT PIPING – KEY NOTES

1. 2" FLOOR DRAIN, FIELD INSTALLED (NOT BY CXT)
2. 3" VENT THROUGH ROOF.
3. 2" VENT WITH TEST PLUG. FIELD INSTALLED
4. 2" VENT PIPING FROM FLOOR DRAINS. (NOT BY CXT)

PIPING LEGEND

—·—·—·—	COLD WATER; COPPER. ASTM B88, TYPE 'K' OR 'L'
—··—··—··	HOT WATER; COPPER, ASTM B88, TYPE 'K' OR 'L'
----------	VENT PIPING; SCH 40 PVC, ASTM D2665, TYPE DWV
————	WASTE PIPE; SCH 40 PVC, ASTM D2665, TYPE DWV
.....	FIELD PIPING; (NOT BY CXT)

SPECIAL NOTES:
1. TOTAL FIXTURE COUNT : (7)
2. FLOWING PRESSURE: 45 PSI MIN, 80 PSI MAX
3. APPROXIMATE DEVELOPED PIPE LENGTH = 35'-0"
4. INSULATE PIPING WITH 1" (R3.6)
5. PER-MOLDED PIPE INSULATION WITH ASJ



WATER PIPE PLAN

1/4"=1'-0"

WATER PIPING – KEY NOTES

1. 2" FLOOR DRAIN, FIELD INSTALLED (NOT BY CXT)
2. FIELD INSTALLED 1 1/2" WATER SUPPLY WITH SHUT-OFF VALVE NEAR FLOOR. (NOT BY CXT)
3. 3/4" HOSE BIBB WITH VACUUM BREAKER AND WHEEL HANDLE
4. WATER PIPING ALONG WALL, SEE DIAGRAM ON RN-22
5. 3/4" CW TO WATER HEATER, SEE HOT WATER PIPING RISER DIAGRAM.
6. 3/4" RELIEF VALVE DISCHARGE PIPING TO FLOOR DRAIN.

MISSOURI
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STATE OF MISSOURI
WILLIAM
RICHARD HEIDEN III
NUMBER
PE-2002010219
PROFESSIONAL ENGINEER
October 27, 2024

LBFoster
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BUILDING NUMBER RN-125

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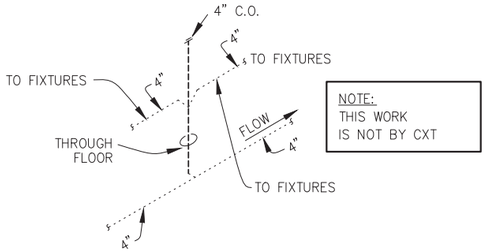
REV.	DESCRIPTION	APPROVAL	DATE

SCALE	3/16" = 1'-0"	DATE	10-10-24
DRAWN	G.OGG	FILE NO.	RN-125
CHECKED	N.PENNER	PLOT	64

WATER, WASTE & VENT PIPING PLANS & NOTES

DWG NO.	SHEET	REV.
RN-21	21/25	0



NOTE:
THIS WORK
IS NOT BY CXT

DETAIL OF FIELD INSTALLED WASTE CONNECTION

NTS

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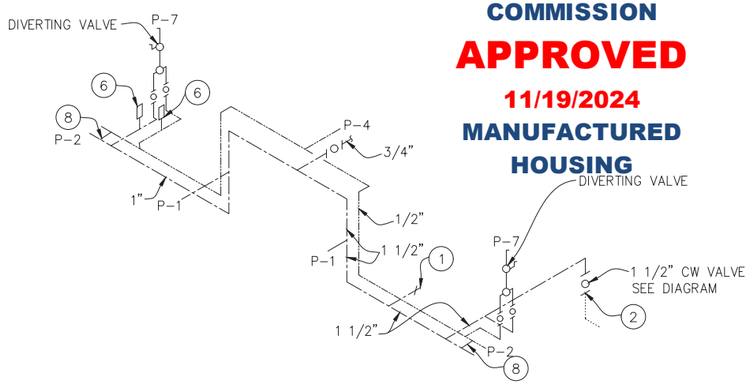
MISSOURI PUBLIC SERVICE COMMISSION

APPROVED

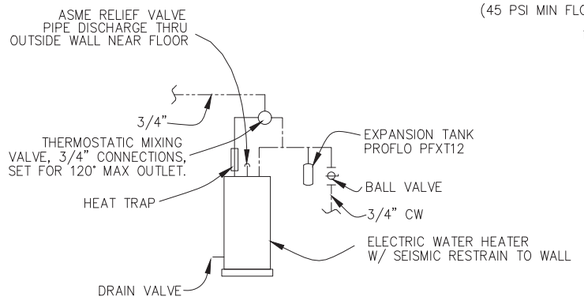
11/19/2024

MANUFACTURED HOUSING



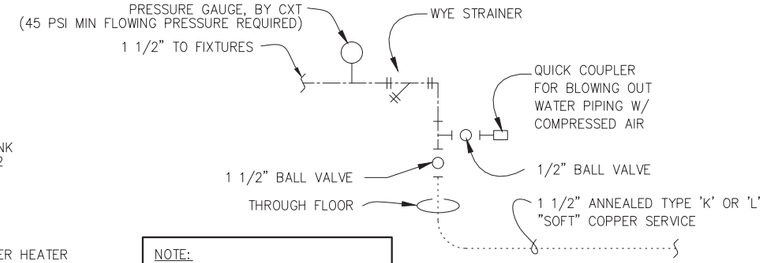
WATER PIPING RISER DIAGRAM

NTS



HOT WATER HEATER RISER DIAGRAM

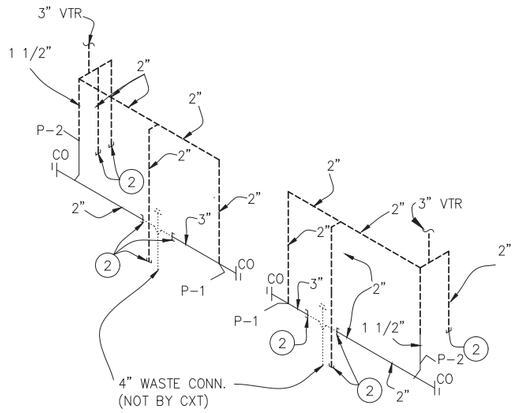
NTS



NOTE:
THIS PIPING IS FIELD
INSTALLED & NOT BY CXT

WATER SERVICE DETAIL

NTS



WASTE & VENT RISER DIAGRAM

NTS

PIPING LEGEND

- COLD WATER; COPPER. ASTM B88, TYPE 'K' OR 'L'
- HOT WATER; COPPER, ASTM B88, TYPE 'K' OR 'L'
- VENT PIPING; SCH 40 PVC, ASTM D2665, TYPE DWV
- WASTE PIPE; SCH 40 PVC, ASTM D2665, TYPE DWV
- FIELD PIPING; (NOT BY CXT)
- WYE STRAINER

KEY NOTES

1. 3/4" HOSE BIBB WITH VACUUM BREAKER & WHEEL HANDEL.
2. TO THIS POINT BY CXT.
3. N/A
4. 1/2" AIR QUICK CONNECTION W/ BALL VALVE FOR BLOWING OUT WATER PIPING.
5. 2" TRAP SEAL IF REQUIRED BY JURISDICTION HAVING AUTHORITY.
6. ASSE 1010 WATER HAMMER ARRESTOR SIOUX CHIEF HYDRA-RESTOR #654-C OR EQUAL.
7. ELECTRIC WATER HEATER. SEE DIAGRAM
8. ASSE 1070 WATER TEMPERATURE LIMITING DEVICE.
9. PROVIDE SHUT-OFF VALVES ON COLD AND HOT WATER SUPPLY FOR EACH FIXTURE.

SYM	DESCRIPTION	MANUFACTURER	CXT PART NUMBER	FLUSH VALVE/FAUCET	SUPPLIES	QTY	HW	CW	WASTE	VENT	SUPPLIES / NOTES
P1	WATER CLOSET (PUSH BUTTON)	AMERICAN STANDARD	2634.101 (W.C.) 5905.100 (W.C. SEAT)	SLOAN "ROYAL" #952-1.6 L-3 W=4"	SLOAN HY33A	2	–	1-1/4"	3"	2"	1. OFFSET FLUSH VALVE TAILPIECE PER ADA, RIGHT OR LEFT HAND, AS REQUIRED. 2. MOUNT RIM AT 17" ABOVE FLOOR. 3. USE CLOSET GASKET JG13534 AND Z1203 FINISH KIT
P2	LAVATORY (PUSH BUTTON)	AMERICAN STANDARD	0356.421 (LAV)	SYMMONS SLS-7000		2	1/2"	1/2"	1-1/2"	1-1/2"	1. 1/2X15 COMP ANG LAV BSCR1915AC 2. 3 PC COVER SET PF202WH.
P3											
P4	WATER HEATER	AO SMITH DURA-POWER	DEN 80 – 5.5KW – 5.5KW – 240V			1	3/4"	3/4"	–	–	1. ST-5 EXP.TANK 2. 80 GALLON, ELECTRIC, DUAL ELEMENT 2-5500W EACH), SIMULTANEOUS.
P5											
P6	FLOOR DRAIN	TRAVIS	54960-CXT (QTY 4)			4	–	–	2"	2"	1. 2" TRAP SEAL PART# P26001
		SIOUX CHIEF (CHASE)	840-2A (QTY 1)			1					
P7	ADA SHOWER	ACORN	ACORN ADA (PL84890) M1741-E706-1-8DIV			2	1/2"	1/2"			1. ACCESSORIES: TSM # 895 , TSM #730-PHI SEAT

STATE OF MISSOURI
WILLIAM RICHARD HEIDEN III
NUMBER PE-2002010219
PROFESSIONAL ENGINEER

October 27, 2024

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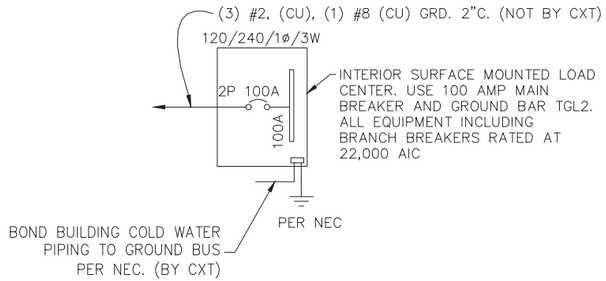
SCALE	NTS	DATE	10-10-24
DRAWN	G.OGG	FILE NO.	RN-125
CHECKED	N.PENNER	PLOT	64

PLUMBING SCHEDULE, DIAGRAMS & NOTES

DWG NO.	SHEET	REV.
RN-22	22 / 25	0



ONE–LINE POWER DIAGRAM

NTS

PANEL SCHEDULE

AMP 100 — PANEL — TOTAL CONNECTED VA LOAD 14,169

SURFACE MOUNT — 120/240V, 1P, 3W — TOTAL CALCULATED VA LOAD 17,500

CIRCUIT NO.	DESCRIPTION	OCP	TYPE	LOAD (VA)	LOAD (A)	PH.	CIRCUIT NO.	DESCRIPTION	OCP	TYPE	LOAD (VA)	LOAD (A)
1	RECEPTACLE ROOM #1	1P/20A	R	180	1.5	A	2	RECEPTACLE ROOM #2	1P/20A	R	180	1.5
3	LIGHTS AND FAN ROOM #1	1P/20A*	N	141	1.2	B	4	LIGHTS AND FAN ROOM #2	1P/20A*	N	141	1.2
5	EXTERIOR LIGHTS	1P/20A	C	42	0.4	A	6	LIGHTS - CHASE	1P/20A	N	25	0.2
7	WATER HEATER	2P/60A	C	5,500	45.8	B	8	RECEPTACLE - CHASE	1P/20A	R	180	1.5
9			C	5,500	45.8	A	10	HAND DRYER ROOM #1	1P/20A*	L	1,140	9.5
11	HAND DRYER ROOM #2	1P/20A*	L	1,140	9.5	B	12					
13						A	14					
15						B	16					
17						A	18					
19						B	20					

NOTE: MAXIMUM ALLOWABLE AIC IS 22K AMPS, PANEL MODIFICATIONS WILL BE REQUIRED (NOT BY CXT) IF TRANSFORMER CAPACITY EXCEEDS 175 KVA.

*PROVIDE LOCKOUT BREAKER (LO) CONFORMING TO NEC 110.25

LOAD	CONNECTED	CALCULATED
(C)ONTINUOUS	11,042 x1.25	13,803 VA
(R)EC (1ST 10KVA)	540 x1.00	540 VA
(N)ON-CONTINUOUS	307 x1.00	307 VA
(L)ARGEST MOTOR	2,280 x1.25	2,850 VA
TOTAL LOAD	14,169	17,500 VA
		72.9 AMPS

GENERAL ELECTRICAL NOTES

1. RECESSED JUNCTION BOXES FOR SINGLE DEVICES SHALL HAVE SINGLE GANG MUD RINGS CAST IN CONCRETE WALLS.
2. ALL RECEPTACLES SHALL BE GFCI PROTECTED BY CIRCUIT BREAKERS OR BY OTHER GFCI RECEPTACLES
3. ALL CONDUIT SHALL BE 3/4" MINIMUM, EXPOSED CONDUIT SHALL BE EMT, RECESSED SHALL BE PVC.
4. INSTALL ALL WIRING IN CONDUIT OR RELATED ENCLOSURES.
5. ALL ELECTRICAL INSTALLATIONS SHALL MEET THE 2017 NATIONAL ELECTRICAL CODE.
6. MINIMUM WIRE SIZE SHALL BE #12 AWG COPPER, THHN INSULATION UNLESS NOTED OTHERWISE.
7. ROUTE ALL CONDUIT IN UTILITY ROOM AT CEILING OR FACE OF WALLS.
8. ELECTRICAL DRAWINGS ARE DIAGRAMMATIC IN NATURE AND MAY NOT SHOW EXACT LOCATIONS OF DEVICES, REFER TO WALL PANEL AND OTHER DRAWINGS FOR EXACT LOCATIONS OF J–BOXES, ETC.
9. PROVIDE WATER HEATER WITH A 100 AMP DISCONNECT, AND A DEDICATED TWO POLE 60 AMP CIRCUIT. INSTALL WITH #6 COPPER AWG
10. CIRCUIT BREAKER LOCKOUTS REQUIRED FOR EACH HAND DRYER AND EXHAUST FAN.

APPROVED BY NTA 10/31/2024

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MISSOURI PUBLIC SERVICE COMMISSION

APPROVED

11/19/2024

MANUFACTURED HOUSING

EXHAUST FAN SCHEDULE							
SYM	MFR	MODEL #	CFM	VOLTS	AMPS	WATTS	NTS.
EF–1	FANTECH	RVF–4XL	154	120	0.79	91	1

NOTES:

1. FANS LISTED FOR WET LOCATION, CONTROL VIA MOTION SENSOR. LOCATE OPEN FACE E–BOX ON EXTERIOR SIDE OF PANEL.

LIGHTING FIXTURE SCHEDULE			
FIXTURE NUMBER	VOLTAGE	WATTS	DESCRIPTION
A	120	25	**LUMINAIRE VPF84 INTERIOR LIGHT FIXTURE, VPF8–4FT–NODIM–25W–40K–MV–CLP–WHT–WL–20CC** SURFACE MOUNTED, LED LAMP 4 FT, WRAP AROUND LENS, LOW TEMPERATURE DRIVER, BUILT IN OCCUPANCY SENSOR ACTIVATED W/ ADDITIONAL OCCUPANCY SENSOR FOR FAN CONTROL
B	120	14	**SWOOP YWP610 LED EXTERIOR LIGHT, YWP610–14W HP–3500K–120–CP–BRZ–CAB/PC** EXTERIOR, VANDAL RESISTANT, WALL MOUNTED, 14 WATT, CLEAR PRISMATIC LENS, BUILT IN PHOTOELECTRIC CONTROL
C	120	25	**LUMINAIRE VPF84 INTERIOR LIGHT FIXTURE, VPF8–4FT–NODIM–25W–40K–MV–CLP–WHT–WL** SURFACE MOUNTED, LED LAMP 4 FT, WRAP AROUND LENS, LOW TEMPERATURE DRIVER, SWITCH ACTIVATED

NOTE : THE SOURCE OF EFFICACY OF EXTERIOR LIGHTING IS TO BE A MINIMUM OF 45 LUMENS PER WATT.

STATE OF MISSOURI
WILLIAM RICHARD HEIDEN III
NUMBER PE-2002010219
PROFESSIONAL ENGINEER

October 27, 2024

LBFoster CXT® Products

6701 E Flamingo Ave Bldg 300 Nampa, ID 83687
901 N. Highway 77 Hillsboro, TX 76645
362 Waverly Road Williamstown, WV 26187

PROJECT TITLE

RANIER

BUILDING NUMBER RN–125

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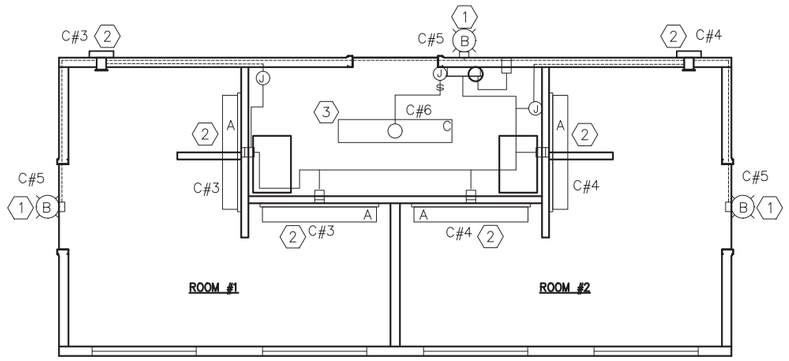
CXT Incorporated

REV.	DESCRIPTION	APPROVAL	DATE

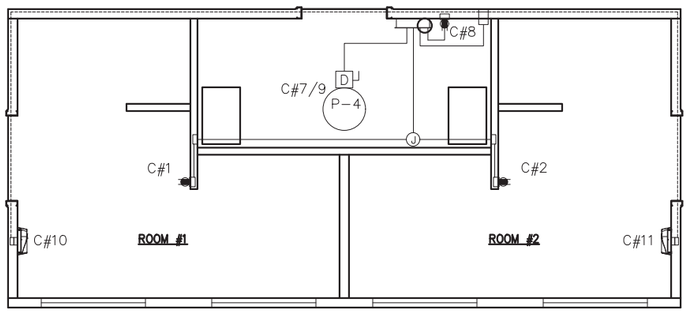
SCALE	NTS	DATE	10–10–24
DRAWN	G.OGG	FILE NO.	RN–125
CHECKED	N.PENNER	PLOT	64

ELECTRICAL NOTES & SCHEDULES

DWG NO.	SHEET	REV.
RN–23	23 / 25	0



LIGHTING PLAN



RECEPTACLE, HAND DRYER, & WATER HEATER PLAN

ELECTRICAL - KEY NOTES

1. EXTERIOR LIGHT FIXTURES TO BE CONTROLLED BY PHOTOCELL BUILT INTO FIXTURE. ROUTE WIRING IN CONCEALED CONDUIT.
2. MOTION CONTROLLED RESTROOM LIGHTS AND EXHAUST FANS.
3. CHASE LIGHTS SWITCH OPERATED.

SYMBOLS

- GFCI RECEPTACLE
- ON / OFF SWITCH
- JUNCTION BOX
- RECESSED JUNCTION BOX
- ELECTRICAL PANEL
- WALL MOUNTED LED FIXTURE
- CEILING MOUNTED LED FIXTURE
- EXTERIOR LIGHT FIXTURE
- EXHAUST FAN
- WATER HEATER
- SAFETY DISCONNECT
- C#XX — CIRCUIT NUMBER
- ---------- — CONCEALED CONDUIT
- HAND DRYER

APPROVED BY NTA 10/31/2024

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MISSOURI PUBLIC SERVICE COMMISSION
APPROVED
11/19/2024
MANUFACTURED HOUSING

STATE OF MISSOURI
WILLIAM RICHARD HEIDEN III
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REV.	DESCRIPTION	APPROVAL	DATE

SCALE	3/16" = 1'-0"	DATE	10-10-24
DRAWN	G.OGG	FILE NO.	RN-125
CHECKED	N.PENNER	PLOT	64

ELECTRICAL PLAN, LEGEND & NOTES

DWG NO.	SHEET	REV.
RN-24	24 / 25	0

WALL PANEL W1

EMBEDDED MATERIALS

ITEM	QTY
PS-19 SS	12
AS-2 SS	6
PS-10 SS	4
PS-2 SS	2
R4x92	6
R4x120	2
R4x100	1
R320	6
4x4 J-BOX	6
B.O. 4-1/2" DIA	2
B.O. 40 1/8" x 82 1/4"	1
R303	6
R4x180	2
B.O. PARTIAL 3"x8"x2" DP	2
4x4 E-BOX	2
ROUND MUD RING	1
MARINE PACKAGE	

CU. FT. CONC.	SQ. FT. W.W.F.
55.1 (2.04)	166

APPROXIMATE WEIGHT
8,263

WALL PANEL W2

EMBEDDED MATERIALS

ITEM	QTY
AS-2 SS	4
PS-2 SS	8
PS-10 SS	2
R4x114	1
R405	2
R4x35	2
R4x96	2
SI-3 MOLD	1
B.O. 40 1/8" x 82 1/4"	1
4x4 J-BOX	2
ROUND MUD RING	1
B.O. PARTIAL 3"x6"x2" DP	1
RECT. MUD RING	1
R320	4
MARINE PACKAGE	

CU. FT. CONC.	SQ. FT. W.W.F.
20.6 (0.76)	62

APPROXIMATE WEIGHT
3,086

WALL PANEL W3

EMBEDDED MATERIALS

ITEM	QTY
AS-2 SS	4
PS-2 SS	8
PS-10 SS	2
R4x114	1
R405	2
R4x35	2
R4x96	2
SI-3 MOLD	1
B.O. 40 1/8" x 82 1/4"	1
4x4 J-BOX	2
ROUND MUD RING	1
B.O. PARTIAL 3"x6"x2" DP	1
RECT. MUD RING	1
R320	4
MARINE PACKAGE	

CU. FT. CONC.	SQ. FT. W.W.F.
20.6 (0.76)	62

APPROXIMATE WEIGHT
3,086

WALL PANEL W4

EMBEDDED MATERIALS

ITEM	QTY
PS-1 SS	3
AS-2 SS	4
PS-15 SS	4
PS-2 SS	6
R4x106	2
R4x120	2
R303	3
4x4 E-BOX	4
ROUND MUD RING	2
B.O. FLUSH BOWL	2
B.O. 2" DIA	2
MARINE PACKAGE	

CU. FT. CONC.	SQ. FT. W.W.F.
23.7 (0.88)	95

APPROXIMATE WEIGHT
3,549

WALL PANEL W5

EMBEDDED MATERIALS

ITEM	QTY
PS-2 SS	6
PS-10 SS	2
AS-2 SS	2
R4x58	1
R4x92	1
R4x106	1
R4x57	1
MARINE PACKAGE	

CU. FT. CONC.	SQ. FT. W.W.F.
14.6 (0.54)	44

APPROXIMATE WEIGHT
2,194

WALL PANEL W6

EMBEDDED MATERIALS

ITEM	QTY
PS-2 SS	4
PS-15 SS	2
R4x62	1
R4x15	1
PS-1 SS	5
R4x68	3
AS-2 SS	3
R4x92	3
R4x104	1
R303	5
4x4 J-BOX	1
4x4 E-BOX	2
ROUND MUD RING	1
RECT MUD RING	1
SHOWER WALL SLEEVE	1
B.O. LAV	1
MARINE PACKAGE	

CU. FT. CONC.	SQ. FT. W.W.F.
12.4 (0.46)	52

APPROXIMATE WEIGHT
1,860

WALL PANEL W7

EMBEDDED MATERIALS

ITEM	QTY
PS-2 SS	4
PS-15 SS	2
R4x62	1
R4x15	1
PS-1 SS	5
R4x68	3
AS-2 SS	3
R4x92	3
R4x104	1
R303	5
4x4 J-BOX	1
4x4 E-BOX	2
ROUND MUD RING	1
RECT MUD RING	1
SHOWER WALL SLEEVE	1
B.O. LAV	1
MARINE PACKAGE	

CU. FT. CONC.	SQ. FT. W.W.F.
12.4 (0.46)	52

APPROXIMATE WEIGHT
1,860

WALL PANEL W8

EMBEDDED MATERIALS

ITEM	QTY
PS-19 SS	9
AS-2 SS	6
PS-10 SS	4
PS-2 SS	2
R4x92	10
R303	3
MS-2	2
MS-6 SS	4
R4x180	4
SI-3 MOLD	2
MARINE PACKAGE	

CU. FT. CONC.	SQ. FT. W.W.F.
57.2 (2.12)	189

APPROXIMATE WEIGHT
8,579

ROOF SLAB R1

EMBEDDED MATERIALS

ITEM	QTY
PS-19 SS	18
PS-2 SS	6
R303	18
B.O. 5" DIA	2
FL-648	4
R411	4
FL-847	4
R4x18	16
TEX B.O. 13" SQ	2
R3x66	4
R320	4
R4x156	2
R3x174	4
MARINE PARKAGE	

CU. FT. CONC.	SQ. FT. W.W.F.
63.8 (2.36)	325

APPROXIMATE WEIGHT
9,565

ROOF SLAB R2

EMBEDDED MATERIALS

ITEM	QTY
PS-19 SS	14
PS-2 SS	6
R303	14
R3x174	4
FL-648	4
R411	4
FL-847	4
R4x18	16
R4x156	2
R3x66	4
R320	4
MARINE PACKAGE	

CU. FT. CONC.	SQ. FT. W.W.F.
63.9 (2.37)	325

APPROXIMATE WEIGHT
9,581

FLOOR SLAB F1

EMBEDDED MATERIALS

ITEM	QTY
AS-7	8
PS-19 SS	26
R303	14
R3x42	36
R3x62	2
R3x122	2
R3x156	8
R4x118	6
B.O. 16"x24"	2
B.O. 6" DIA	1
FLOOR DRAIN	4
R3x34	8
MARINE PACKAGE	

CU. FT. CONC.	SQ. FT. W.W.F.
101.2 (3.75)	497

APPROXIMATE WEIGHT
15,186

INTERIOR PARTITION P1

EMBEDDED MATERIALS

ITEM	QTY
AS-2 SS	3
B-18	1
MARINE PACKAGE	

CU. FT. CONC.	SQ. FT. W.W.F.
3.3 (0.12)	13

APPROXIMATE WEIGHT
492

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NTA
10/31/2024

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MISSOURI
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11/19/2024
MANUFACTURED
HOUSING

STATE OF MISSOURI
WILLIAM
RICHARD HEIDEN III
NUMBER
PE-2002010219
PROFESSIONAL ENGINEER
October 27, 2024

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CXT® Products

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PROJECT TITLE
RANIER
BUILDING NUMBER RN-125

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CXT Incorporated

REV.	DESCRIPTION	APPROVAL	DATE

SCALE	NTS	DATE	10-10-24
DRAWN	G.OGG	FILE NO.	RN-125
CHECKED	N.PENNER	PLOT	--

EMBEDDED MATERIALS

DWG NO.	SHEET	REV.
RN-25	25 / 25	0

COM*check* Software Version COMcheckWeb
Interior Lighting Compliance Certificate

Project Information

Energy Code:	90.1 (2016) Standard
Project Title:	RAINIER RN-125
Project Type:	New Construction

Construction Site: Owner/Agent: Designer/Contractor:

Allowed Interior Lighting Power

A Area Category	B Floor Area (ft2)	C Allowed Watts / ft2	D Allowed Watts
1-CHASE (Workshop)	47	0.90	42
2-RESTROOM (Office)	202	0.79	160
		Total Allowed Watts =	202

Proposed Interior Lighting Power

A Fixture ID : Description / Lamp / Wattage Per Lamp / Ballast	B Lamps/ Fixture	C # of Fixture	D Fixture Watt.	E (C X D)
1-CHASE (Workshop)				
LED: C: LUMINAIRE: Other:	2	1	25	25
2-RESTROOM (Office)				
LED: A: LUMINAIRE: Other:	2	4	25	100
			Total Proposed Watts =	125

Interior Lighting PASSES: Design 38% better than code

Interior Lighting Compliance Statement

Compliance Statement: The proposed interior lighting design represented in this document is consistent with the building plans, specifications, and other calculations submitted with this permit application. The proposed interior lighting systems have been designed to meet the 90.1 (2016) Standard requirements in COM*check* Version COMcheckWeb and to comply with any applicable mandatory requirements listed in the Inspection Checklist.

Name - Title Signature Date

APPROVED BY NTA 10/31/2024

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STATE OF MISSOURI
WILLIAM RICHARD HEIDEN III
NUMBER PE-2002010219
PROFESSIONAL ENGINEER

October 27, 2024

MISSOURI PUBLIC SERVICE COMMISSION
APPROVED
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COM*check* Software Version COMcheckWeb
Exterior Lighting Compliance Certificate

APPROVED BY NTA 10/31/2024

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Project Information

Energy Code:	90.1 (2016) Standard
Project Title:	RAINIER RN-125
Project Type:	New Construction
Exterior Lighting Zone	3 (Other (LZ3))

Construction Site: Owner/Agent: Designer/Contractor:

Allowed Exterior Lighting Power

A Area/Surface Category	B Quantity	C Allowed Watts /	D Tradable Wattage	E Allowed Watts (B X C)
DOORS (Pedestrian and vehicular entrances and exits)	9 ft of door	21	Yes	189
			Total Tradable Watts (a) =	189
			Total Allowed Watts =	189
			Total Allowed Supplemental Watts (b) =	500

(a) Wattage tradeoffs are only allowed between tradable areas/surfaces.
(b) A supplemental allowance equal to 500 watts may be applied toward compliance of both non-tradable and tradable areas/surfaces.

Proposed Exterior Lighting Power

A Fixture ID : Description / Lamp / Wattage Per Lamp / Ballast	B Lamps/ Fixture	C # of Fixture	D Fixture Watt.	E (C X D)
DOORS (Pedestrian and vehicular entrances and exits, 9 ft of door width): Tradable Wattage				
LED: B: SWOOP: Other:	1	3	14	42
			Total Tradable Proposed Watts =	42

Exterior Lighting PASSES: Design 94% better than code

Exterior Lighting Compliance Statement

Compliance Statement: The proposed exterior lighting design represented in this document is consistent with the building plans, specifications, and other calculations submitted with this permit application. The proposed exterior lighting systems have been designed to meet the 90.1 (2016) Standard requirements in COM*check* Version COMcheckWeb and to comply with any applicable mandatory requirements listed in the Inspection Checklist.

Name - Title | Signature | Date

STATE OF MISSOURI
WILLIAM RICHARD HEIDEN III
NUMBER PE-2002010219
PROFESSIONAL ENGINEER

October 27, 2024

MISSOURI PUBLIC SERVICE COMMISSION
APPROVED
11/19/2024
MANUFACTURED HOUSING

COM*check* Software Version COMcheckWeb

Inspection Checklist

Energy Code: 90.1 (2016) Standard

Requirements: 0.0% were addressed directly in the COM*check* software

Text in the "Comments/Assumptions" column is provided by the user in the COMcheck Requirements screen. For each requirement, the user certifies that a code requirement will be met and how that is documented, or that an exception is being claimed. Where compliance is itemized in a separate table, a reference to that table is provided.

Section # & Req.ID	Plan Review	Complies?	Comments/Assumptions
4.2.2, 8.4.1.1, 8.4.1.2, 8.7 [PR6][2]	Plans, specifications, and/or calculations provide all information with which compliance can be determined for the electrical systems and equipment and document where exceptions are claimed. Feeder connectors sized in accordance with approved plans and branch circuits sized for maximum drop of 3%.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	
4.2.2, 9.4.3, 9.7 [PR4][1]	Plans, specifications, and/or calculations provide all information with which compliance can be determined for the interior lighting and electrical systems and equipment and document where exceptions to the standard are claimed. Information provided should include interior lighting power calculations, wattage of bulbs and ballasts, transformers and control devices.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	
9.7 [PR8][1]	Plans, specifications, and/or calculations provide all information with which compliance can be determined for the exterior lighting and electrical systems and equipment and document where exceptions to the standard are claimed. Information provided should include exterior lighting power calculations, wattage of bulbs and ballasts, transformers and control devices.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	

Additional Comments/Assumptions:

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MISSOURI PUBLIC SERVICE COMMISSION

APPROVED

11/19/2024

MANUFACTURED HOUSING

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)

Section # & Req.ID	Rough-In Electrical Inspection	Complies?	Comments/Assumptions
8.4.2 [EL10][2]	At least 50% of all 125 volt 15- and 20-Amp receptacles are controlled by an automatic control device.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	
8.4.3 [EL11][2]	New buildings have electrical energy use measurement devices installed. Where tenant spaces exist, each tenant is monitored separately. In buildings with a digital control system the energy use is transmitted to to control system and displayed graphically.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	
9.4.1.1 [EL1][2]	Automatic control requirements prescribed in Table 9.6.1, for the appropriate space type, are installed. Mandatory lighting controls (labeled as 'REQ') and optional choice controls (labeled as 'ADD1' and 'ADD2') are implemented.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	
9.4.1.1 [EL2][2]	Independent lighting controls installed per approved lighting plans and all manual controls readily accessible and visible to occupants.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	
9.4.1.1f [EL13][1]	Daylight areas under skylights and roof monitors that have more than 150 W combined input power for general lighting are controlled by photocontrols.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	
9.4.1.4 [EL3][2]	Automatic lighting controls for exterior lighting installed.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	
9.4.1.3 [EL4][1]	Separate lighting control devices for specific uses installed per approved lighting plans.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	
9.6.2 [EL8][1]	Additional interior lighting power allowed for special functions per the approved lighting plans and is automatically controlled and separated from general lighting.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	

Additional Comments/Assumptions:

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)

Section # & Req.ID	Final Inspection	Complies?	Comments/Assumptions
8.7.1 [FI16][3]	Furnished as-built drawings for electric power systems within 30 days of system acceptance.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	
8.7.2 [FI17][3]	Furnished O&M instructions for systems and equipment to the building owner or designated representative.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	
9.2.2.3 [FI18][1]	Interior installed lamp and fixture lighting power is consistent with what is shown on the approved lighting plans, demonstrating proposed watts are less than or equal to allowed watts.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	*See the Interior Lighting fixture schedule for values.*
9.4.2 [FI19][1]	Exterior lighting power is consistent with what is shown on the approved lighting plans, demonstrating proposed watts are less than or equal to allowed watts.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	*See the Exterior Lighting fixture schedule for values.*
9.4.4 [FI20][1]	At least 75% of all permanently installed lighting fixtures in dwelling units have >= 55 lm/W efficacy or a >= 45 lm/W total luminaire efficacy.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	

Additional Comments/Assumptions:

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HOUSING

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)

CXT Inc. (Precast Division)

Calculations
RAINIER RN-125
Structural Analysis

Design Loads
400 psf Live Floor Load
250 psf Ground Snow Load
Wind Speed – 150 mph Exp. C
Seismic Design Category: E

Design Standards
2018 International Building Code
ASCE 7-16/ ACI 318-14

UL-752 Bullet Resistance
Classification: Level IV
Report #: 2012-647

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THIS REPORT CONTAINS 33 PAGES, INCLUDING THIS COVER AND THE TABLE OF CONTENTS. ANY ADDITIONS TO, ALTERATIONS OF, OR UNAUTHORIZED USE OF EXCERPTS FROM THIS REPORT ARE EXPRESSLY FORBIDDEN.

STATE OF MISSOURI
WILLIAM
RICHARD HEIDEN III
NUMBER
PE-2002010219
PROFESSIONAL ENGINEER

October 27, 2024

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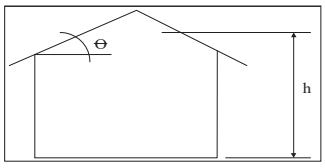
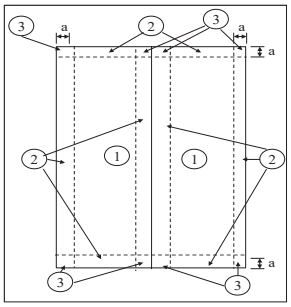
October 27, 2024

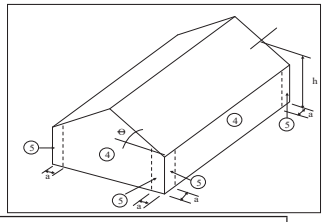
Main Wind Force Resisting System Loads (ASCE 7-16)

RAINIER RN-125		
Category	II	IBC TABLE 1604.5: Risk Category of Buildings and Other Structures.
Exposure	C	See § 26.7.3: Exposure Categories, General.
Velocity	150 mph	See Figure 26.5-1A thru 26.5-2D: Basic Wind Speed (3 second Gust)
h.wind	7.96 ft	Windward wall height
h.lee	7.96 ft	Leeward wall height
W.building	10.5 ft	Width of the building
L.building	23.67 ft	Length of the building
H.building	9.69 ft	Height of the building (to the ridge). Enter 0 if unknown.
Roof Rise	3	Roof pitch (per foot)
ϑ	14.04 deg	Roof Angle
Kd	0.85	Wind directionality factor. 0.85 when using load combinations, 1.0 otherwise.
K_1	0.00	
K_2	0.00	
K_3	0.00	See Figure 26.8-1: Multipliers for Obtaining Topographical Factor Kzt





Kzt	1	Topographic factor
h	8.824 ft	Mean roof height
n_a	8.50	Natural frequency
Flexibility	Rigid	Building flexibility
α	9.5	Terrain factor
z_g	900 ft	Terrain factor



Velocity Pressure Exposure Coefficient		
K(z)	0.849	at windward eave

Velocity Pressure (27.3.2)	
q_z	41.56 psf

Gable	Type of Roof - Gable or Hip?

Partially Enclosed if the building meets both of the following conditions:
1. Total area of openings in one wall exceeds area of openings in the balance of the building by more than 10%.
2 Total area of openings in one wall exceeds 4 sq. ft. or 1% of area of that wall and the total area of openings in the balance of the building does not exceed 20% of the area in the balance of the building.

Zone	Opening Area	Gross Area	Agi	Aoi	Condition 1	Condition 2	Condition 3	Condition 4	Type:
Windward sidewall	0 sq ft	188.4 sq ft	622.2 sq ft	0 sq ft	0.00	0.00	0.00	0.00	Enclosed
Windward endwall	0 sq ft	92.7 sq ft	717.9 sq ft	0 sq ft	0.00	0.00	0.00	0.00	Enclosed
Leeward sidewall	0 sq ft	188.4 sq ft	622.2 sq ft	0 sq ft	0.00	0.00	0.00	0.00	Enclosed
Leeward endwall	0 sq ft	92.7 sq ft	717.9 sq ft	0 sq ft	0.00	0.00	0.00	0.00	Enclosed
Roof	0 sq ft	248.5 sq ft	562.1 sq ft	0 sq ft	0.00	0.00	0.00	0.00	Enclosed

Enclosed

Gust Factor - (26.9)	
G =	0.85

External Pressure Coefficients				
C_{po}	0.8	See 27.3.3 Roof Overhangs		
Cp	0.8	Windward wall (Use with qz) Fig. 27.3-1		
	-0.500	Leeward wall (wind normal to ridge) (Use with qh)	L/B =	0.44
	-0.287	Leeward wall (wind parallel to ridge) (Use with qh)	L/B =	2.25
	-0.7	Sidewalls (Use with qh) Fig. 27.4-1		

Internal Pressures:	
Negative:	-7.48 psf
Positive:	7.48 psf

	Pos. Windward	Neg. Windward	Leeward
Roof Pressure Coefficients (Fig 27.3-1) Normal to Ridge when Theta >= 10degrees	-0.180	-0.953	-0.581

Roof Pressures Wind Perpendicular to Ridge w/ ϑ >= 10 deg	
w/ Negative Internal	1.12 psf
w/ Positive Internal	-41.14 psf

*WORST CASE LOADING

	0 to h/2	h/2 to h	h to 2h	> 2h
Roof Pressure Coefficients (Fig 27.3-1) Normal to Ridge when Theta < 10 deg.	-1.17	-0.76	-0.64	-0.57
Roof Pressure Coefficients (Fig 27.3-1) PARALLEL to Ridge	-0.90	-0.90	-0.50	-0.30

Wall Pressures:	w/ Negative	w/ Positive Internal
Windward	35.74 psf	20.78 psf
Leeward (wind normal)	-16.00 psf	-25.14 psf
Leeward (wind parallel)	-16.00 psf	-17.63 psf
Side Wall	-17.25 psf	-32.21 psf

Additional Overhang Pressure:	28.26 psf

Roof Pressures: Wind Parallel to ridge for all roof slopes:	
Location	w/ Positive Internal
0 to h/2	-39.28 psf
h/2 to h	-39.28 psf
h to 2h	-25.14 psf
Over 2h	-18.08 psf

Roof Pressures: Wind Perpendicular to ridge for ϑ < 10 deg:	
Location	w/ Positive Internal
0 to h/2	0.00 psf
h/2 to h	0.00 psf
h to 2h	0.00 psf
Over 2h	0.00 psf

Wind Speed:	**150 mph**	Roof Slope:	**3.00 : 12**	**COMPONENTS & CLADDING**	
Exposure:	**C**	Mean Roof Height:	**8.82 ft**		
	Effective Area				
Zone	10.0 sq ft		100.0 sq ft		500.0 sq ft	
1	-38.21 psf	19.98 psf	-34.05 psf	11.67 psf	-34.05 psf	11.67 psf
2	-71.45 psf	19.98 psf	-50.67 psf	11.67 psf	-50.67 psf	11.67 psf
2oh	-91.44 psf	-	-91.44 psf	-	-91.44 psf	-
3	-108.86 psf	19.98 psf	-83.92 psf	11.67 psf	-83.92 psf	11.67 psf
3oh	-153.78 psf	-	-103.90 psf	-	-103.90 psf	-
4	-46.52 psf	40.76 psf	-38.21 psf	33.70 psf	-34.05 psf	28.29 psf
5	-58.99 psf	40.76 psf	-46.52 psf	33.70 psf	-34.05 psf	28.29 psf
a:	**3.00 ft**					

Higher pressures at the ridge line only applies to roof pitches > 7 degrees

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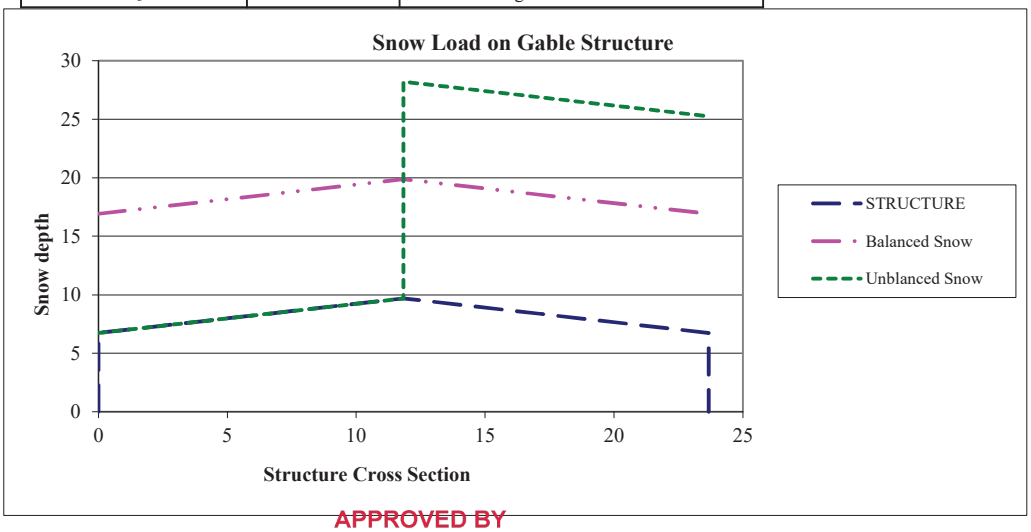
ASCE 7-16 SNOW LOAD CALCULATION

Category	II	IBC TABLE 1604.5: Risk Category of Buildings and Other Structures.
Exposure	C	See § 26.7.3: Exposure Categories, General.
Pg	250 psf	See ASCE Figure 7.2-1: Ground Snow Load
W.building	10.5 ft	Length of the building
L.building	23.67 ft	Width of the building
H.building	9.69 ft	Height of the building (to the ridge). Enter 0 if unknown.
Roof Rise (per foot)	3	Roof pitch
ϑ	14.04 deg	Roof Angle

ASCE Table 7.3-2 - Thermal Condition:	C_t
All structures except as indicated below:	1.0
Structures kept just above freezing and others with cold, ventilated roofs in which the thermal resistance (R-value) between the ventilated space and the heated space exceeds 25*h (deg*sq ft/BTU).	1.1
Unheated and open air structures	1.2
Structures intentionally kept below freezing	1.3
Continuously heated greenhouses with a roof having a thermal resistance value (R-value) less than 2.0*h (deg*sq ft/BTU).	0.85

C_t	1.2	(Choose from table above)
Is	1	ASCE Table 1.5-2
Surface	Unobstructed	ASCE § 7.4
Roof type	Gable	
Hor. Eave to Ridge Distance - windward	5.25 ft	
Roof Exposure	Partially exposed	ASCE Table 7.3-1
C_e	1	ASCE Table 7.3-1
Cs	1	Slope Factor from Figure 7.4-1
Low Sloped?:	Yes	ASCE § 7.3.4
P_f	210.00 psf	Flat Roof Snow Load
P_s	210.00 psf	Sloped Roof Snow Load
Use unbalanced?	Yes	ASCE § 7.6.1
$P_{windward}$	0.00 psf	ASCE § 7.6.1
$P_{leeward\_1}$	250.00 psf	ASCE § 7.6.1
$P_{leeward\_2}$	250.00 psf	ASCE § 7.6.1
Distance from Ridge to Edge of $P_{leeward1}$ loading	5.3 ft	ASCE Figure 7.6-2

γ	30.00 pcf	Snow density	Eq. 7.7-1 of ASCE 7
S	4	Run per rise of 1	ASCE § 7.1
h_d	10.19 ft	Height of drifting snow on leeward side	
h_b	7.00 ft	Height of balanced snow	



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Seismic Loads (ASCE 7-16)

RAINIER RN-125				
Category	II	IBC TABLE 1604.5: Risk Category of Buildings and Other Structures.		
Ss	1.057 g	Max. Earthquake Ground Motion of 0.2 sec Spectral Response Acceleration	*ASCE Figure 22-1*	
S_1	1.057 g	Max. Earthquake Ground Motion of 1.0 sec Spectral Response Acceleration	*ASCE Figure 22-2*	
Site Class	D (Default)	Site classification (Use D if unknown unless jurisdiction, or geotechnical data determines Site Class E or F.)	*ASCE 20.1*	
T_L	16.0 sec	Long Period Transition Period	*ASCE Figure 22-14*	
Seismic Force Resisting System	A.5	Intermediate precast shear walls	*ASCE Table 12.2-1*	
R	4.00	Response Modification Factor		
Ω_0	2.5	System Over strength Factor		
C_t	0.02	Approximate period parameter	ASCE Table 12.8-2	
x	0.75	Approximate period parameter	ASCE Table 12.8-2	
hn	9.03 ft	Height in feet from base to highest level of structure		

				Value 1*	Value 2*	
F_a	1.2	Interpolated Value	*ASCE Table 11.4-1*	1.1	1	*=Used for interpolation ***1.2 used per ASCE 11.4-2
F_v	1.7	Interpolated Value	*ASCE Table 11.4-2*	1.7	1.7	

$S_{MS} = Fa * S_S$	1.268 g	Adjusted MCE Spectral Response Acceleration at short periods	*ASCE 11.4-1*
$S_{M1} = F_v * S_1$	1.797 g	Adjusted MCE Spectral Response Acceleration at 1 sec period (MCE = Maximum considered earthquake)	*ASCE 11.4-2*

$S_{DS} = 2/3\ Sm_s$	0.846 g	Design Spectral Acceleration Parameters	*ASCE 11.4-3*
$S_{D1} = 2/3\ Sm_1$	1.198 g	Design Spectral Acceleration Parameters	*ASCE 11.4-4*

I_E	1	Importance Factor	*ASCE Table 1.5-2*

Seismic Design Category		E
Based on S_{DS}	D	Table 11.6-1
Based on S_{D1}	E	Table 11.6-2

Geotechnical Investigation Report Required? **Yes per ASCE 11.8.2 and 11.8.3, IBC 1803**

EQUIVALENT LATERAL FORCE PROCEDURE		
$T_a = C_t * hn^x$	0.10 sec	Approximate fundamental period *ASCE 12.8-7*
$T_s = S_{D1}/S_{DS}$	1.42 sec	
T	0.10 sec	Fundamental period of the structure (can be taken as Ta per ASCE 12.8.2)
$C_s = S_{DS}/(R/I)$	0.211	*ASCE 12.8-2*
$C_{s.min}$	0.132	*ASCE 12.8-5 & 12.8-6*
$C_{s.max}$	2.874	*ASCE 12.8-3 & 12.8-4*
C_s	0.211	
k	1.000	*ASCE 12.8.3*
W	81.14 kip	
$V = C_s * W$	42.88 kip	*ASCE 12.8-1* *Shear **with** snow load*
M_o =	381.8 k-ft	*Overturning Moment **with** snow load*
$V = C_s * W$	35.83 kip	*Shear **without** snow load*
M_o =	317.3 k-ft	*Overturning Moment **without** snow load*

WITH SNOW LOAD

Level	Story Height	h_i or h_x	P_f (flat roof snow load)	w_i	$w_i * h_i^k$	*12.8-12* C_{vx}	*12.8-11;11.7* F_x	V_x (Story shear)	M_x	*12.10-1* F_{px} (diaphragm force)
Roof	8.82 ft	9.03 ft	210 psf	49.22 kip	444.6 k-ft	0.985	42.25 kip	42.25 kip	0.0 k-ft	16.65 kip
Walls	0.00 ft	0.00 ft								
Floor	0.21 ft	0.21 ft		31.92 kip	6.6 k-ft	0.015	0.63 kip	42.88 kip	372.8 k-ft	10.80 kip
Base	0 ft	0.00 ft	W=	81.14 kip	451.3 k-ft			M_o =	381.8 k-ft	

WITHOUT SNOW LOAD

Level	Story Height	h_i or h_x	P_f (flat roof snow load)	w_i	$w_i * h_i^k$	*12.8-12* C_{vx}	*12.8-11;11.7* F_x	V_x (Story shear)	M_x	*12.10-1* F_{px} (diaphragm force)
Roof	8.82 ft	9.03 ft	0 psf	35.88 kip	324.1 k-ft	0.980	35.11 kip	35.11 kip	0.0 k-ft	12.13 kip
Walls	0.00 ft	0.00 ft								
Floor	0.21 ft	0.21 ft		31.92 kip	6.6 k-ft	0.020	0.72 kip	35.83 kip	309.8 k-ft	10.80 kip
Base	0 ft	0.00 ft	W=	67.79 kip	330.7 k-ft			Mo =	317.3 k-ft	

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Center of Mass & Rigidity

RAINIER RN-125

				X	Y
	Upper Left = 0,0		Lower Right	320	143
Wall	X Relative Stiffness	Y Relative Stiffness	Shear Force lbs	Shear Force plf	Dist to CoRx dx (IN)	Dist to CoRy dy (IN)
W1	0.00%	41.05%	4,272	181	0.006	64.104
W2	22.33%	0.00%	2,323	236	140.000	3.056
W3	22.33%	0.00%	2,323	236	140.000	3.056
W4	0.00%	12.11%	1,260	122	0.000	6.604
W5	19.53%	0.00%	2,032	400	0.000	25.396
W6	17.91%	0.00%	1,863	311	63.500	24.763
W7	17.91%	0.00%	1,863	311	63.500	24.763
W8	0.00%	46.84%	4,874	206	0.002	57.896
P1-1	0.00%	0.00%	-	-	78.500	24.604
P1-2	0.00%	0.00%	-	-	78.500	24.604

			Left Edge	Top Edge	Right Edge	Bottom Edge	Snow/Live	Center of Gravity		Live	Live
Slab	Thickness	Weight	X	Y	X	Y	(psf)	X	Y	w snow	w/o snow
R1	4.5	9565	0	0	320	71.5	210	160.0	35.8	16238	9565
R2	4.5	9581	0	71.5	320	143	210	160.0	107.3	16254	9581
F1	5	15186	18	8.5	302	134.5	400	160.0	71.5	15186	0
Totals		33461						160.0	71.1		

Torsional Eccentricity		Wgt	Wgt		wgt	wgt
ex	ey	(w snow)	(w/o snow)		(w snow)	(w/o snow)
0.00	3.49	81,140	67,793	roof	49,223	35,877
Center of Gravity				floor	31,917	
X	Y					
160.0	71.1					
Center of Rigidty						
X	Y					
160.0	74.6					

	Wall Overturning Checks Using Weight of Adjacent Walls Force Transferred by Connections Between Walls					
	Anchorage Required to Resist Overturning From Design Moment	Toward Lower Right Anchor Resistance		Toward Upper Left Anchor Resistance		Overturning status using just connection to adjacent walls
Wall	(kip-ft)	Moment (kip-ft)	check	Moment (kip-ft)	check	
W1	-24.98	302.82	OK	281.44	OK	None Required
W2	31.67	45.16	OK	41.96	OK	None Required
W3	31.67	45.16	OK	41.96	OK	None Required
W4	7.99	48.25	OK	69.12	OK	None Required
W5	38.40	23.35	Need More	23.35	Need More	TRY BASE ANCHORS
W6	33.70	40.81	OK	37.34	OK	None Required
W7	33.70	33.06	Need More	45.09	OK	TRY BASE ANCHORS
W8	-14.37	246.45	OK	246.45	OK	None Required
P1-1	-0.87	0.00	OK	6.89	OK	None Required
P1-2	-0.87	6.89	OK	0.00	OK	None Required

Overturning resistance considers only the weight of the wall, the weight of the roof supported by the wall, and connection to adjacent walls. Roof weight supported by other walls has not been considered. Connection to adjacent walls is taken as the connection capacity, not to exceed that portion of the adjacent wall weight that can be reasonably attributed to the connection.

	Wall Overturning Checks Using Base Anchors Only Must investigate ONLY if connection to adjacent walls is insufficient						
	Design Moment (kip-ft)	Toward Lower Right Anchor Resistance Moment (kip-ft)	check	Toward Upper Left Anchor Resistance Moment (kip-ft)	check	Combined Loading Unity Check	Required Tension Capacity per Base Anchor (lb)
Wall							
W1	-24.98	187.46	OK	187.46	OK	OK	(4316)
W2	31.67	57.54	OK	57.54	OK	OK	(523)
W3	31.67	57.54	OK	57.54	OK	OK	(523)
W4	7.99	60.40	OK	60.40	OK	OK	(1948)
W5	38.40	16.59	Try Both	15.37	Try Both	OK	3225
W6	33.70	23.95	Try Both	26.56	Try Both	OK	(389)
W7	33.70	23.95	Try Both	26.56	Try Both	OK	75
W8	-14.37	187.46	OK	187.46	OK	OK	(3674)
P1-1	-0.87	6.07	OK	1.73	OK	OK	(499)
P1-2	-0.87	1.73	OK	6.07	OK	OK	(499)

	Wall Overturning Checks Using Base Anchors and Connection to Adjacent Walls Must investigate ONLY if both base anchor alone and adjacent walls alone are insufficient					
	Base Anchor Shear Required	Base Anchor Tension Available	Available Overturning Resistance (kip-ft) From Base Anchors		Overturning Unity Check of Base Anchors	
Wall	(% Capacity)	(% Capacity)	Lower Right	Upper Left	Lower Right	Upper Left
W1	0.0%	100.0%	490.28	468.89	OK	OK
W2	0.0%	100.0%	102.71	99.50	OK	OK
W3	0.0%	100.0%	102.71	99.50	OK	OK
W4	0.0%	100.0%	108.65	129.53	OK	OK
W5	0.0%	100.0%	39.93	38.72	OK	OK
W6	0.0%	100.0%	64.76	63.90	OK	OK
W7	0.0%	100.0%	57.01	71.65	OK	OK
W8	0.0%	100.0%	433.91	433.91	OK	OK
P1-1	0.0%	100.0%	6.07	8.62	OK	OK
P1-2	0.0%	100.0%	8.62	6.07	OK	OK

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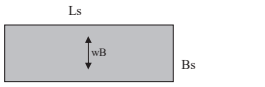
ID: **RAINIER RN-125**

DESIGN OF ROOF PANELS MARK R1

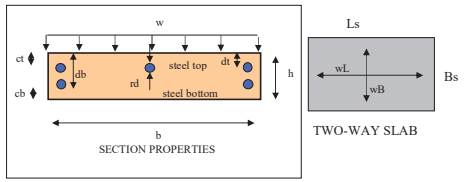
Notes:



Material Properties

f ' c	5000 psi	
Steel Reinforcement	Plain WWF Grade 80	
Fy	80000 psi	
Lightweight?	No	
C_d (Concrete density)	150 pcf	O.K.
E (Steel)	29000000 psi	
E (Concrete)	4286826 psi	*ACI 8.5.1*
n (modular ratio)	6.76	*ACI 14.0*

fr (rupture modulus)	530.3 psi	*ACI 9.5.2.3*
Ig = (b*h^3)/12	91.125 in^4	
Ag = (b*h)	54 in^4	
Yt = h/2	2.25 in^4	
Mcr	21.48	*ACI 9.5.2.3*
Beta_1	0.8	*ACI 10.2.7.3*
delta_initial	180	
delta_longterm	480	
B	8.830	
kd	0.776 in	
Icr	11.45 in^4	
c	0 in	
a	0.32 in	



Geometric Properties

Ls (overall length of slab)	26.67 ft		
Bs (overall width of slab)	6.09 ft		
Design will be performed as :	**Two-way slab**		
tfr (roof finish thickness)	0.375 in		
b (section width)	12 in		*(typically 12 inches)*
h (section thickness)	4.5 in		
ct (cover top)	1 1/4 in		
cb (cover bottom)	3/4 in		
rd (assumed reinf. diameter)	0.319 in		*(if centered enter 0)*
dt (effective depth top)	1.4095 in		
db (effective depth bottom)	3.431 in		
oh1 (overhang length and qty for Bs)	8.5 in	1	*{qty of overhangs in Bs direction}*
oh2 (overhang length and qty for ls)	18 in	2	*{qty of overhangs in ls direction}*
Cs (% of DL used for Seismic)	0.211		*{from seismic analysis}*
NBs (qty of walls in Bs direction)	2		*{walls that support one or more roof panels in the short direction}*
Nls (qty of walls in ls direction)	4		*{walls that support one or more roof panels in the long direction}*

bottom mesh

$\rho_{provided}$ (reinforcement ratio provided)		0.0049
top mesh	ω =	0.0784 psi
$\rho_{provided}$ (reinforcement ratio provided)		0.0119
both layers	ω =	0.1904 psi
$\rho_{provided}$ (reinforcement ratio provided)		0.0138
	ω =	0.2208 psi

Reinforcement Limits

ρ_t (maximum tensile reinforcement)	0.0166	*ACI 10.3.3*
ρ_{temp} (min. temperature reinforcement)	0.0014	*ACI 7.12.2*
ρ_{min} (minimum tensile reinforcement)	0.0027	*ACI 10.5.1*
ρ_{trial} (trial reinforcement ratio bottom)	0.0033	
ρ_{trial} (trial reinforcement ratio top)	0.0033	

	Wire Mesh (Top)	
	Wire Size	W6.7
Trial As' req'd	spacing	4 in
	Mesh Area	**0.20 in^2** = **As'**

	Wire Mesh (Bottom)	
	Wire Size	W6.7
Trial Ast required	spacing	4 in
0.136 in^2	Mesh Area	**0.20 in^2** = **As**

Loading

Design Loads	
Pressure on Slab	**w**
D (Dead load))	60.938 psf
S (Snow Load)	210 psf
L (Live Load)	0 psf
Lr (Live Roof Load)	30 psf
W (Wind Load)	108.86 psf
E (Earthquake Load)	12.88 psf

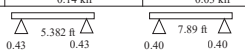
Sustained Loading	
Pressure on slab	**W**
D (Dead load)	60.938 psf
S (Snow Load)	210 psf
Lr (Live Roof Load)	30 psf

Factored Design Loads		Pressure on Section	Pressure on Section
Factored Loading per ACI equation indicated	Factored Pressure on Slab **W**	**wB** = W*(L^4 / B^4 + L^4)*be	**wL** = W*(B^4 / B^4 + L^4)*be
ACI eq. 9-3	496.213 psf	0.41 klf	0.09 klf

Unfactored Design Loads	Pressure on Section	Pressure on Section
Unfactored Pressure on Slab **W**	**wB** = W*(L^4 / B^4 + L^4)*be	**wL** = W*(B^4 / B^4 + L^4)*be
300.0825 psf	0.25 klf	0.05 klf

B (Span in the short direction) = Bs-1(oh1)	5.382 ft
L (Span in the long direction) = Ls-2(oh2)	7.89 ft

Factored Sustained Loads		Pressure on Section	Pressure on Section
Factored Loading per ACI equation indicated	Factored Pressure on Slab **W**	**wB** = W*(L^4 / B^4 + L^4)*be	**wL** = W*(B^4 / B^4 + L^4)*be
ASCE7-05 eq CC1b	165.938 psf	0.14 klf	0.03 klf



SUMMARY

Use 1 Layer of Wire Mesh on Top	W6.7 x W6.7 x 4 x 4
Use 1 Layer of Wire Mesh on Bottom	W6.7 x W6.7 x 4 x 4

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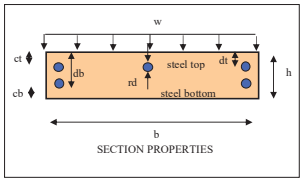
ID: RAINIER RN-125

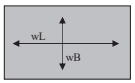
DESIGN OF ROOF PANELS MARK R1

Notes:

ONE-WAY SLAB



SECTION PROPERTIES



TWO-WAY SLAB

Material Properties

f' c	5000 psi	
Steel Reinforcement	Plain WWF Grade 80	
Fy	80000 psi	
Lightweight?	No	
C_d (Concrete density)	150 pcf	O.K.
E (Steel)	29000000 psi	
E (Concrete)	4286826 psi	*ACI 8.5.1*
n (modular ratio)	6.76	*ACI 14.0*

Geometric Properties

Ls (overall length of slab)	26.67 ft		
Bs (overall width of slab)	6.09 ft		
Design will be performed as :	**Two-way slab**		
tfr (roof finish thickness)	0.375 in		
b (section width)	12 in		*(typically 12 inches)*
h (section thickness)	4.5 in		
ct (cover top)	1 1/4 in		
cb (cover bottom)	3/4 in		
rd (assumed reinf. diameter)	0.319 in		*(if centered enter 0)*
dt (effective depth top)	1.4095 in		
db (effective depth bottom)	3.431 in		
oh1 (overhang length and qty for Bs)	8.5 in	1	*{qty of overhangs in Bs direction}*
oh2 (overhang length and qty for ls)	18 in	2	*{qty of overhangs in ls direction}*
Cs (% of DL used for Seismic)	0.211		*{from seismic analysis}*
NBs (qty of walls in Bs direction)	2		*{walls that support one or more roof panels in the short direction}*
Nls (qty of walls in ls direction)	4		*{walls that support one or more roof panels in the long direction}*

fr (rupture modulus)	530.3 psi	*ACI 9.5.2.3*
Ig = (b*h^3)/12	91.125 in^4	
Ag = (b*h)	54 in^4	
Yt = h/2	2.25 in^4	
Mcr	21.48	*ACI 9.5.2.3*
Beta_1	0.8	*ACI 10.2.7.3*
delta_initial	180	
delta_longterm	480	
B	8.830	
kd	0.776 in	
I.cr	11.45 in^4	
c	0 in	
a	0.32 in	

bottom mesh		
$\rho_{provided}$ (reinforcement ratio provided)		0.0049
top mesh	ω =	0.0784 psi
$\rho_{provided}$ (reinforcement ratio provided)		0.0119
both layers	ω =	0.1904 psi
$\rho_{provided}$ (reinforcement ratio provided)		0.0138
	ω =	0.2208 psi

Flexure

Flexural Moments for Bs	Mu	Tensile Strain	Check ACI 14.8.2.3	ϕb	ϕMn trial = ϕf'cbd^2ω(1-0.59ω)	ΔM = Mu - ϕM	ϕMn =	Check ϕMn > Mu	% allowed
Mpos (positive Moment) = (wB*B^2) / 8	1.48 kip-ft	0.036	Tension	0.9	3.96 kip-ft		3.96 kip-ft	O.K.	37.37%

		Structural Plain Concrete per ACI 22.5				
	Mu	S Elastic Section Modulus	ϕb	ϕMn = ϕ5*(f'c*S)^0.5	Check ϕMn > Mu	% allowed
Mneg (negative Moment) = (wB*oh1^2) / 2	0.103 kip-ft	0.023 ft^3	0.55	0.941 kip-ft	O.K.	10.93%
Mneg (negative Moment) = (wB*oh2^2) / 2	0.103 kip-ft	0.023 ft^3	0.55	0.941 kip-ft	O.K.	10.93%

Flexural Moments for ls	Mu	Tensile Strain	Check ACI 14.8.2.3	ϕb	ϕMn trial = ϕf'cbd^2ω(1-0.59ω)	ΔM = Mu - ϕM	ϕMn =	Check ϕMn > Mu	% allowed
Mpos (positive Moment) = (wL*L^2) / 8	0.700 kip-ft	0.036	Tension	0.9	3.96 kip-ft		3.96 kip-ft	O.K.	17.69%

		Structural Plain Concrete per ACI 22.5				
	Mu	S Elastic Section Modulus	ϕb	ϕMn = ϕ5*(f'c*S)^0.5	Check ϕMn > Mu	% allowed
Mneg (negative Moment) = (wL*oh1^2) / 2	0.10125	0.023 ft^3	0.55	0.941 kip-ft	O.K.	10.76%
Mneg (negative Moment) = (wL*oh2^2) / 2	0.10125	0.023 ft^3	0.55	0.941 kip-ft	O.K.	10.76%

Shear

Maximum Shear for Bs	Vu	ϕv per ACI 9.3.2.3	Vc per ACI 11.3.1.1	ϕVc	Check ϕVc > Vu	% allowed
Vu = wB (B/2)	1.10 kip	0.85	5.82 kip	4.95 kip	O.K.	22.29%
			per ACI 22.8			
Vu for side overhang 1 = wB*oh1	0.29 kip	0.55	2.98 kip	1.64 kip	O.K.	17.71%
Vu for side overhang 1 = wB*oh1	0.29 kip	0.55	2.98 kip	1.64 kip	O.K.	17.71%

Shear for Ls	Vu	ϕv per ACI 9.3.2.3	Vc per ACI 11.3.1.1	ϕVc	Check ϕVc > Vu	% allowed
Vu = wL (L/2)	0.12 kip	0.85	5.82 kip	4.95 kip	O.K.	2.39%
			per ACI 22.8			
Vu for end overhang 2 = wL*oh2	0.05 kip	0.55	2.98 kip	1.64 kip	O.K.	2.74%
Vu for end overhang 2 = wL*oh2	0.05 kip	0.55	2.98 kip	1.64 kip	O.K.	2.74%

Span type:	K	Sustained Load Duration	Epsilon
Simple span	1	6 months	1.2

Deflection

	Service Loads													
Span	Mserv	M.sus	I.eff.serv	I.eff.sustained	Immediate Deflection Δi	ρ_{comp}	λ	Long-Term Deflection Δlt	Δ total long-term deflection (Δi + Δlt)	Δ allow (immediate)	Δ allow (long term)	Check short term deflection	Check total long term deflection	% allowed - short term	% allowed - total long term
B	1.48 kip-ft	0.507 kip-ft	91.13 in^4	91.13 in^4	0.007 in	0.0049	0.9639	0.007 in	0.013 in	0.3588 in	0.1345 in	O.K.	O.K.	1.89%	4.85%
L	0.7 kip-ft	0.233 kip-ft	91.13 in^4	91.13 in^4	0.000 in	0.0049	0.9639	0.007 in	0.013 in	0.5260 in	0.1973 in	O.K.	O.K.	0.00%	3.31%

APPROVED BY

NTA 10/31/2024

Approval of this document does not authorize or approve any deviation or deviations from the requirements of applicable State Laws.

MISSOURI PUBLIC SERVICE COMMISSION

APPROVED

11/19/2024

MANUFACTURED HOUSING

CXT, Inc. (Precast Div.)

Rainier RN-125

ID: **RAINIER RN-125**

DESIGN OF ROOF PANELS MARK R2

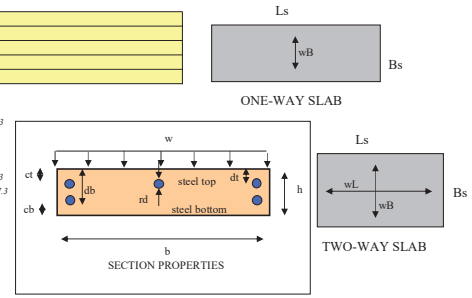
Notes:

Material Properties

f ' c	5000 psi	
Steel Reinforcement	Plain WWF Grade 80	
Fy	80000 psi	
Lightweight?	No	
C_d (Concrete density)	150 pcf	O.K.
E (Steel)	29000000 psi	
E (Concrete)	4286826 psi	*ACI 8.5.1*
n (modular ratio)	6.76	*ACI 14.0*

Geometric Properties

Ls (overall length of slab)	26.67 ft		
Bs (overall width of slab)	6.09 ft		
Design will be performed as :	**One-way slab**		
tfr (roof finish thickness)	0.375 in		
b (section width)	12 in		*(typically 12 inches)*
h (section thickness)	4.5 in		
et (cover top)	1 1/4 in		
cb (cover bottom)	3/4 in		
rd (assumed reinf. diameter)	0.319 in		*(if centered enter 0)*
dt (effective depth top)	1.4095 in		
db (effective depth bottom)	3.431 in		
oh1 (overhang length and qty for Bs)	8.5 in	1	*{qty of overhangs in Bs direction}*
oh2 (overhang length and qty for ls)	18 in	2	*{qty of overhangs in ls direction}*
Cs (% of DL used for Seismic)	0.211		*{from seismic analysis}*
NBs (qty of walls in Bs direction)	1		*{walls that support one or more roof panels in the short direction}*
Nls (qty of walls in ls direction)	3		*{walls that support one or more roof panels in the long direction}*



fr (rupture modulus)	530.3 psi	*ACI 9.5.2.3*
Ig = (b*h^3)/12	91.125 in^4	
Ag = (b*h)	54 in^4	
Yt = h/2	2.25 in^4	
Mcr	21.48	*ACI 9.5.2.3*
Beta_1	0.8	*ACI 10.2.7.3*
delta_initial	180	
delta_longterm	480	
B	8.830	
kd	0.776 in	
Icr	11.45 in^4	
c	0 in	
a	0.32 in	

bottom mesh

$\rho_{provided}$ (reinforcement ratio provided)		0.0049
top mesh	ω =	0.0784 psi
$\rho_{provided}$ (reinforcement ratio provided)		0.0119
both layers	ω =	0.1904 psi
$\rho_{provided}$ (reinforcement ratio provided)		0.0138
	ω =	0.2208 psi

Reinforcement Limits

ρ_t (maximum tensile reinforcement)	0.0166	*ACI 10.3.3*
ρ_{temp} (min. temperature reinforcement)	0.0014	*ACI 7.12.2*
ρ_{min} (minimum tensile reinforcement)	0.0027	*ACI 10.5.1*
ρ_{trial} (trial reinforcement ratio bottom)	0.0033	
ρ_{trial} (trial reinforcement ratio top)	0.0033	

Wire Mesh (Top)			
	Wire Size	W6.7	
Trial As' req'd	spacing	4 in	
	Mesh Area	**0.20 in^2**	**= As'**

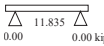
Wire Mesh (Bottom)			
	Wire Size	W6.7	
Trial Ast required	spacing	4 in	
0.136 in^2	Mesh Area	**0.20 in^2**	**= As**

Loading

Design Loads	
Pressure on Slab	**w**
D (Dead load))	60.938 psf
S (Snow Load)	210 psf
L (Live Load)	0 psf
Lr (Live Roof Load)	30 psf
W (Wind Load)	108.86 psf
E (Earthquake Load)	12.88 psf

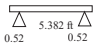
Sustained Loading	
Pressure on slab	**W**
D (Dead load)	60.938 psf
S (Snow Load)	210 psf
Lr (Live Roof Load)	30 psf

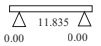
Factored Design Loads		Pressure on Section	Pressure on Section
Factored Loading per ACI equation indicated	Factored Pressure on Slab **W**	**wB** = W*(L^4 / B^4 + L^4)*be	**wL** = W*(B^4 / B^4 + L^4)*be
ACI eq. 9-3	496.213 psf	0.5 klf	0 klf



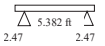
B (Span in the short direction) = Bs-1(oh1)	5.382 ft
L (Span in the long direction) = Ls-2(oh2)	11.835 ft

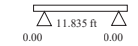
Factored Sustained Loads		Pressure on Section	Pressure on Section
Factored Loading per ACI equation indicated	Factored Pressure on Slab **W**	**wB** = W*(L^4 / B^4 + L^4)*be	**wL** = W*(B^4 / B^4 + L^4)*be
ASCE7-05 eq CC1b	165.938 psf	0.17 klf	0 klf





Unfactored Design Loads	Pressure on Section	Pressure on Section
Unfactored Pressure on Slab **W**	**wB** = W*(L^4 / B^4 + L^4)*be	**wL** = W*(B^4 / B^4 + L^4)*be
300.0825 psf	0.81 klf	0 klf





SUMMARY

Use 1 Layer of Wire Mesh on Top	W6.7 x W6.7 x 4 x 4
Use 1 Layer of Wire Mesh on Bottom	W6.7 x W6.7 x 4 x 4

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NTA
10/31/2024
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MISSOURI
PUBLIC SERVICE
COMMISSION
APPROVED
11/19/2024
MANUFACTURED
HOUSING

ID: RAINIER RN-125

DESIGN OF ROOF PANELS MARK R2

Notes:

Material Properties

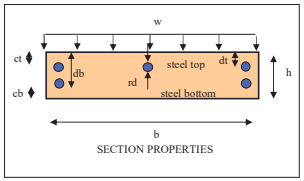
f' c	5000 psi	
Steel Reinforcement	Plain WWF Grade 80	
Fy	80000 psi	
Lightweight?	No	
C_d (Concrete density)	150 pcf	O.K.
E (Steel)	29000000 psi	
E (Concrete)	4286826 psi	*ACI 8.5.1*
n (modular ratio)	6.76	*ACI 14.0*

Geometric Properties

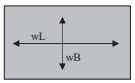
Ls (overall length of slab)	26.67 ft		
Bs (overall width of slab)	6.09 ft		
Design will be performed as :	**One-way slab**		
tfr (roof finish thickness)	0.375 in		
b (section width)	12 in		*(typically 12 inches)*
h (section thickness)	4.5 in		
ct (cover top)	1 1/4 in		
cb (cover bottom)	3/4 in		
rd (assumed reinf. diameter)	0.319 in		*(if centered enter 0)*
dt (effective depth top)	1.4095 in		
db (effective depth bottom)	3.431 in		
oh1 (overhang length and qty for Bs)	8.5 in	1	*{qty of overhangs in Bs direction}*
oh2 (overhang length and qty for ls)	18 in	2	*{qty of overhangs in ls direction}*
Cs (% of DL used for Seismic)	0.211		*{from seismic analysis}*
NBs (qty of walls in Bs direction)	1		*{walls that support one or more roof panels in the short direction}*
Nls (qty of walls in ls direction)	3		*{walls that support one or more roof panels in the long direction}*

ONE-WAY SLAB

fr (rupture modulus)	530.3 psi	*ACI 9.5.2.3*
Ig = (b*h^3)/12	91.125 in^4	
Ag = (b*h)	54 in^4	
Yt = h/2	2.25 in^4	
Mcr	21.48	*ACI 9.5.2.3*
Beta_1	0.8	*ACI 10.2.7.3*
delta_initial	180	
delta_longterm	480	
B	8.830	
kd	0.776 in	
I.cr	11.45 in^4	
c	0 in	
a	0.32 in	



SECTION PROPERTIES



TWO-WAY SLAB

bottom mesh		
$\rho_{provided}$ (reinforcement ratio provided)		0.0049
top mesh	ω =	0.0784 psi
$\rho_{provided}$ (reinforcement ratio provided)		0.0119
both layers	ω =	0.1904 psi
$\rho_{provided}$ (reinforcement ratio provided)		0.0138
	ω =	0.2208 psi

Flexure

One-way slab	Mu	Tensile Strain	Check ACI 14.8.2.3	ϕb	ϕMn trial = ϕf'cbd^2ω(1-0.59ω)	ΔM = Mu - ϕM	ϕMn =	Check ϕMn > Mu	% allowed
Mpos (positive Moment) = (wB*B^2) / 8	1.81 kip-ft	0.036	Tension	0.9	3.96 kip-ft		3.96 kip-ft	O.K.	45.71%

		Structural Plain Concrete per ACI 22.5				
	Mu	S Elastic Section Modulus	ϕb	ϕMn = ϕ5*(f'c*S)^0.5	Check ϕMn > Mu	% allowed
Mneg (negative Moment) = (wB*oh1^2) / 2	0.125 kip-ft	0.023 ft^3	0.55	0.941 kip-ft	O.K.	13.33%
Mneg (negative Moment) = (wB*oh2^2) / 2	0.125 kip-ft	0.023 ft^3	0.55	0.941 kip-ft	O.K.	13.33%

	Mu	Tensile Strain	Check ACI 14.8.2.3	ϕb	ϕMn trial = ϕf'cbd^2ω(1-0.59ω)	ΔM = Mu - ϕM	ϕMn =	Check ϕMn > Mu	% allowed
Mpos (positive Moment) = (wL*L^2) / 8	0.000 kip-ft	0.036	Tension	0.9	3.96 kip-ft		3.96 kip-ft	O.K.	0.00%

		Structural Plain Concrete per ACI 22.5				
	Mu	S Elastic Section Modulus	ϕb	ϕMn = ϕ5*(f'c*S)^0.5	Check ϕMn > Mu	% allowed
Mneg (negative Moment) = (wL*oh1^2) / 2	0	0.023 ft^3	0.55	0.941 kip-ft	O.K.	0.00%
Mneg (negative Moment) = (wL*oh2^2) / 2	0	0.023 ft^3	0.55	0.941 kip-ft	O.K.	0.00%

Shear

One-way slab	Vu	ϕv per ACI 9.3.2.3	Vc per ACI 11.3.1.1	ϕVc	Check ϕVc > Vu	% allowed
Vu = wB (B/2)	1.35 kip	0.85	5.82 kip	4.95 kip	O.K.	27.18%
			per ACI 22.8			
Vu for side overhang 1 = wB*oh1	0.35 kip	0.55	2.98 kip	1.64 kip	O.K.	21.60%
Vu for side overhang 1 = wB*oh1	0.35 kip	0.55	2.98 kip	1.64 kip	O.K.	21.60%

Shear for Ls	Vu	ϕv per ACI 9.3.2.3	Vc per ACI 11.3.1.1	ϕVc	Check ϕVc > Vu	% allowed
Vu = wL (L/2)	0.00 kip	0.85	5.82 kip	4.95 kip	O.K.	0.00%
			per ACI 22.8			
Vu for end overhang 2 = wL*oh2	0.00 kip	0.55	2.98 kip	1.64 kip	O.K.	0.00%
Vu for end overhang 2 = wL*oh2	0.00 kip	0.55	2.98 kip	1.64 kip	O.K.	0.00%

Span type:	K	Sustained Load Duration	Epsilon
Simple span	1	6 months	1.2

Deflection

	Service Loads													
Span	Mserv	M.sus	I.eff.serv	I.eff.sustained	Immediate Deflection Δi	ρ_{comp}	λ	Long-Term Deflection Δlt	Δ total long-term deflection (Δi + Δlt)	Δ allow (immediate)	Δ allow (long term)	Check short term deflection	Check total long term deflection	% allowed - short term	% allowed - total long term
B	1.81 kip-ft	0.615 kip-ft	88.50 in^4	91.13 in^4	0.008 in	0.0049	0.9639	0.008 in	0.016 in	0.3588 in	0.1345 in	O.K.	O.K.	2.29%	5.88%
L	0 kip-ft	0 kip-ft	0.00 in^4	0.00 in^4	0.000 in	0.0049	0.9639	0.008 in	0.016 in	0.7890 in	0.2959 in	O.K.	O.K.	0.00%	2.68%

ID:	RAINIER RN-125
	DESIGN OF WALL MARKED W1

Notes

ACI's Alternate Design of Slender Walls	ACI 14.8
Assumptions from this methodology:	
Wall panel shall be simply supported, axially loaded, and subject to out-of-plane uniform lateral loading where maximum moments and deflections occur at mid-height of the wall.	ACI 14.8.2.1
The cross section is constant over the height of the wall panel.	ACI 14.8.2.2
The wall cross sections shall be tension controlled.	ACI 14.8.2.3
Phi*Mn >= Mcr	ACI 14.8.2.4
Concentrated gravity loads are distributed over the wall length	ACI 14.8.2.5
The vertical stress Pu/Ag at mid-height shall not exceed 0.06*f'c	ACI 14.8.2.6

Material Properties		
f'c	5000 psi	
Steel Reinforcement	Plain WWF Grade 80	
Fy wire mesh	80000 psi	
Fy rebar	60000 pcf	
Lightweight?	No	
Concrete density	150 pcf	O.K.
E (Steel)	29000000 psi	
E (Concrete)	4290000 psi	ACI 8.5.1
n (modular ratio)	6.76	

Shear Parameters		
Phi.v	0.85	ACI 9.3.2.3
Vc	3.394 kip	ACI 11.3.1.1 & 11.2.1.2
Phi*Vc	2.885 kip	ACI 11.1.1

Minimum Wall Reinforcement Requirements		
roe.min.vert	0.0012	ACI 14.3.2
roe.min.hor	0.002	ACI 14.3.3
Max Vertical spacing	18 in	ACI 14.3.5
Max Horizontal spacing	18 in	ACI 14.3.5

Geometric Properties	
X Corridinate	18
Y Corridinate	10.5
Direction of Wall	X
Center of gravity X	160.006
Center of gravity Y	10.500
Wall Weight	8263.000 lbs.
Central wall?	Yes
Wall that supports 2 roof panels?	No
lop (length of opening on wall)	0 ft
H (height of wall)	95.5 in
Lh (length of wall)	23.667 ft
Analyisis will be performed as :	One-way slab
b (section width)	12 in
h (section thickness)	4 in
ct (cover top)	1.708 in
cb (cover bottom)	1.708 in
rd (assumed reinf. diameter)	0.292 in
dt (effective depth top)	2 in
db (effective depth bottom)	2 in
Cs (% of DL used for Seismic)	0.196
Eccentricity - Axial Load	1 in
Is wall Split	No

Loading			
Axial Design Loads (pressure from roof)		**Lateral Design Loads (pressure on wall)**	
D (Dead load) + Ww (Wall weight)	110.94 psf	Dead Load (DL.lat)	0 psf
S (Snow Load)	210 psf	Snow Load (SL.lat)	0 psf
L (Live Load)	0 psf	Live Load (LL.lat)	0 psf
Lr (Live Roof Load)	30 psf	Live Roof Load (LLr.lat)	0 psf
W (Wind Load)	108.86 psf	Wind Load (WL.lat)	58.99 psf
E (Earthquake Load)	12.88 psf	Earthquake Load (EL.lat)	9.78 psf

Wire Mesh	
Wire Size	W6.7
spacing	4 in
Mesh Area	0.20 in^2 = As

Factored Axially Applied Loads	
Factored Loading per ACI	ACI eq. 9-3
Factored Pressure on Roof Wr	496.213

Axial Pressure on Section	
PuB	1.71 kip

Assumption check	
Pu/Ag	35.625 psi
0.06*f'c	300 psi
Check ACI 14.8.2.6	O.K.

Unfactored Axially Applied Loads	
Unfactored Pressure on Roof uWr	300.0825 psf

Axial Pressure on Section	
PB	1.13 kip

Shear	
Factored Loading per ACI	ACI eq. 9-3
Vu = wuB*(Bw-2db) / 2	0
Phi*Vc/2	1.44
Check Shear ACI 11.5.5.1	O.K.

Factored Laterally Applied Loads	
Factored Loading per ACI	*ACI eq. 9-4*
Factored Pressure on Wall Ww	94.38 psf

Lateral Pressure on Section	
Lw = W*(L^4 / H^4 + L^4)	0 klf
Hw = W*(L^4 / H^4 + L^4)	0.09 klf

Unfactored Laterally Applied Loads	
Unfactored Pressure on Wall uWw	58.99 psf

Lateral Pressure on Section	
Lw = W*(L^4 / H^4 + L^4)	0 klf
Hw = W*(L^4 / H^4 + L^4)	0.06 klf

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Deflection	ACI 14.8.4
Service Loads	
Axial	1.13 kip
Lateral	0 klf
Allowed service deflection	0.64 in
Msa	0.565 kip-in
M	0.567 kip-in
Ds	0.002 in
Check deflection	O.K.

Allowable Capacity	
Ig = (b*h^3)/12	64 in^4
Ag = (b*h)	48 in^2
Yt = h/2	2
fr (rupture modulus)	530.330 psi
Mcr	16.971 kip-in
Beta_1	0.8
Trial Ast req'd	0.079 in^2
B	8.836162648
kd	0.569 in
I.cr	3.52 in^4
e_c	0.003
e_s	0.005
a	0.33483 psi
c	0.419 in
Ase	0.22 in^2
Icrdeflection	4.19 in^4
Ie	64.00 in^4
delta	150
r_t (maximum tensile reinforcement)	0.0166
r_{temp} (min. temperature reinforcement)	0.0014
r_{min} (minimum tensile reinforcement)	0.0027
r_{trial} (trial reinforcement ratio bottom)	0.0033
$\rho_{provided}$ (reinforcement ratio provided)	0.0080

Flexure		
Assumption check		
Span	Hw	Lw
net Tensile Strain	0.011	0.011
Check ACI 14.8.2.3	Tension	Tension
Mua	0.781 kip-ft	

ACI eq. (14-6)		
Mu	0.890 kip-ft	0.000 kip-ft

ACI 9.3.2		
fb	0.9	0.9
fMn trial = ϕAsFy(dt - a/2)	2.210 kip-ft	2.210 kip-ft
DM =Mpos - ϕM	0.000 kip-ft	0.000 kip-ft
As Add'l req'd	0.00 in^2	0.00 in^2
Additional reinf req'd	0.00 in^2	0.00 in^2
Add'l bar size:	3	3
qty req'd	0	0
or spacing of:	0	0
As add'l =	0.000 kip-ft	0.000 kip-ft
Ast = As + As add'l	0.20 in^2	0.20 in^2
fMn = ϕAsFy(db - a/2)	2.209 kip-ft	2.209 kip-ft
Check ϕMn > Mu	O.K.	O.K.
% allowed	40.29%	0.00%

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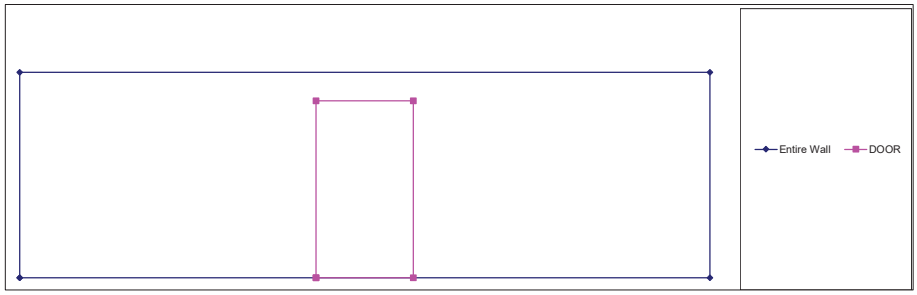

REINFORCEMENT AT OPENINGS

Loading	
Pu (factorized load from roof)	0.41 klf
Ww (weight of panel per sq ft)	0.05 ksf

Material Properties	
db (effective depth bottom)	2 in
a (block of strain)	0.33483 psi
	a=As * fy / (0.85 * f'c *b)

Factorized Moment

Opening	Horizontal Location	Vertical Location	L length of opening	H height above opening	(-) Weight of Opening (LBS)	Pw total factorized panel load	wu total factorized load	**Mu** (wu*L^2)/12
DOOR	10.16 ft	0 ft	3.34 ft	1.1 ft	1145.34	0.06 klf	0.47 klf	0.44 kip-ft

Flexure

Opening	ϕb	As req'd	Bar size	qty req'd:	**ϕMn** = ϕAsFy(db - a/2)	Check ϕMn > Mu
DOOR	0.9	0.009 in^2	No. 3	1	5.73 kip-ft	O.K.

CONNECTIONS

			Full Resistance Value Overturning				
Base Anchors			Lateral	Base Anchors		Wall-Wall Connection	
Quantity in Shear	Maximum R - Distance	Maximum L - Distance	Shear kip	Moment + kip - ft	Moment - kip - ft	Moment + kip - ft	Moment - kip - ft
6	272	272	73.254	187.46	187.46	302.82	281.44

Total Tension	Base Anchors					
21.846	Dist	Tension (kip)	Shear	L - Dist	Moment +	Moment -
Base Anchor 1	12 in	3.64	12.21	272 in	0.161 kip*ft	82.529 kip*ft
Base Anchor 2	68 in	3.64	12.21	216 in	5.158 kip*ft	52.045 kip*ft
Base Anchor 3	108 in	3.64	12.21	176 in	13.011 kip*ft	34.554 kip*ft
Base Anchor 4	176 in	3.64	12.21	108 in	34.554 kip*ft	13.011 kip*ft
Base Anchor 5	216 in	3.64	12.21	68 in	52.045 kip*ft	5.158 kip*ft
Base Anchor 6	272 in	3.64	12.21	12 in	82.529 kip*ft	0.161 kip*ft

	Wall Connections									
	Quantity of Anchors	Capacity of each Anchor	Countering Dead Load from Adjoining Wall	% of wall to use	Adjoining Wall	Dist (inches)	L - Dist	Allowable Force	Overturning Moment Resistance (kip-ft) Up Left	Overturning Moment Resistance (kip-ft) Low Right
Wall Connection 1	3	***2.703***	8.624	50.00%	W3	2	282.000	8.109	1.352	190.562
Wall Connection 2	3	***2.703***	3.224	26.04%	W7	78.5	205.500	3.224	21.092	55.215
Wall Connection 3	3	***2.703***	5.245	42.36%	W6	205.5	78.500	5.245	89.816	34.309
Wall Connection 4	3	***2.703***	8.624	50.00%	W2	282	2.000	8.109	190.562	1.352

Wall Shear Checks

Shear Connections at Base			Wall Shear Capacity			Required Shear Capacity (lb) per Base Connector		
Design Force (lb)	Capacity (lb)	Reserve Capacity	Design (PLF)	Resistance (PLF)	check			Reserve Capacity
12863	73254	60391	451	16163	OK	2144	(60391)	OK

RIGIDITY

	CALCULATED VALUES	79%	Final	15.16315906

	Pier Label	Length (inches)	Height (inches)	Fixed Top? (Y/N)	Useable? (Y/N)	Stiffness (k) (1000 kip / IN)	Deflection (in / 1000 kip)
DOOR	Entire Wall	284	95.5	Y	Y	19.105	0.052
	A'	284	82.3	Y	Y	22.379	0.045
	A	121.92	82.3	Y	Y	8.574	0.117
	B	122	82.3	Y	Y	8.581	0.117
	0	0	0		N	0.000	0.000
	0	0	0		N	0.000	0.000
	0	0	0		N	0.000	0.000

	Combine Logic					
	First Segment	Second Segment	Re-Name	Combine/Subtract	Method	Combined
DOOR	Entire Wall	A'	A'a	-	Deflection	0.008
	A	B	AB	+	Stiffness	17.155
	A'a	AB	Final	+	Deflection	0.066
	0	0	0			0.000
	0	0	0			0.000
	0	0	0			0.000

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ID:	RAINIER RN-125
	DESIGN OF WALL MARKED W2

Notes

ACI's Alternate Design of Slender Walls	ACI 14.8
Assumptions from this methodology:	
Wall panel shall be simply supported, axially loaded, and subject to out-of-plane uniform lateral loading where maximum moments and deflections occur at mid-height of the wall.	ACI 14.8.2.1
The cross section is constant over the height of the wall panel.	ACI 14.8.2.2
The wall cross sections shall be tension controlled.	ACI 14.8.2.3
Phi*Mn >= Mcr	ACI 14.8.2.4
Concentrated gravity loads are distributed over the wall length	ACI 14.8.2.5
The vertical stress Pu/Ag at mid-height shall not exceed 0.06*f'c	ACI 14.8.2.6

Material Properties

f'c	5000 psi	
Steel Reinforcement	Plain WWF Grade 80	
Fy wire mesh	80000 psi	
Fy rebar	60000 pcf	
Lightweight?	No	
Concrete density	150 pcf	O.K.
E (Steel)	29000000 psi	
E (Concrete)	4290000 psi	ACI 8.5.1
n (modular ratio)	6.76	

Shear Parameters

Phi.v	0.85	ACI 9.3.2.3
Vc	3.394 kip	ACI 11.3.1.1 & 11.2.1.2
Phi*Vc	2.885 kip	ACI 11.1.1

Minimum Wall Reinforcement Requirements

roe.min.vert	0.0012	ACI 14.3.2
roe.min.hor	0.002	ACI 14.3.3
Max Vertical spacing	18 in	ACI 14.3.5
Max Horizontal spacing	18 in	ACI 14.3.5

Geometric Properties

X Corridinate	300
Y Corridinate	12.5
Direction of Wall	Y
Center of gravity X	300.000
Center of gravity Y	71.547
Wall Weight	3086.000 lbs.
Central wall?	Yes
Wall that supports 2 roof panels?	Yes
lop (length of opening on wall)	0 ft
H (height of wall)	103.37 in
Lh (length of wall)	9.833 ft
Analyisis will be performed as :	Two-way slab
b (section width)	12 in
h (section thickness)	4 in
ct (cover top)	1.708 in
cb (cover bottom)	1.708 in
rd (assumed reinf. diameter)	0.292 in
dt (effective depth top)	2 in
db (effective depth bottom)	2 in
Cs (% of DL used for Seismic)	0.196
Eccentricity - Axial Load	1 in
Is wall Split	No

Loading

Axial Design Loads (pressure from roof)		Lateral Design Loads (pressure on wall)	
D (Dead load) + Ww (Wall weight)	110.94 psf	Dead Load (DL.lat)	0 psf
S (Snow Load)	210 psf	Snow Load (SL.lat)	0 psf
L (Live Load)	0 psf	Live Load (LL.lat)	0 psf
Lr (Live Roof Load)	30 psf	Live Roof Load (LLr.lat)	0 psf
W (Wind Load)	108.86 psf	Wind Load (WL.lat)	58.99 psf
E (Earthquake Load)	12.88 psf	Earthquake Load (EL.lat)	9.78 psf

Wire Mesh	
Wire Size	W6.7
spacing	4 in
Mesh Area	0.20 in^2 = As

Factored Axially Applied Loads

Factored Loading per ACI	ACI eq. 9-3
Factored Pressure on Roof Wr	496.213

Axial Pressure on Section	
PuB	2.16 kip

Assumption check	
Pu/Ag	45.000 psi
0.06*f'c	300 psi
Check ACI 14.8.2.6	O.K.

Unfactored Axially Applied Loads

Unfactored Pressure on Roof uWr	300.0825 psf

Axial Pressure on Section	
PB	1.39 kip

Factored Laterally Applied Loads

Factored Loading per ACI	ACI eq. 9-4
Factored Pressure on Wall Ww	94.38 psf

Lateral Pressure on Section	
Lw = W*(L^4 / L^4 + H^4)	0.03 klf
Hw = W*(H^4 / H^4 + L^4)	0.06 klf

Unfactored Laterally Applied Loads

Unfactored Pressure on Wall uWw	58.99 psf

Lateral Pressure on Section	
Lw = W*(L^4 / L^4 + H^4)	0.02 klf
Hw = W*(H^4 / H^4 + L^4)	0.04 klf

Shear

Factored Loading per ACI	ACI eq. 9-3
Vu = wuB*(Bw-2db) / 2	0.09
Phi*Vc/2	1.44
Check Shear ACI 11.5.5.1	O.K.

Deflection ACI 14.8.4

Service Loads	
Axial	1.39 kip
Lateral	0.02 klf
Allowed service deflection	0.69 in
Msa	2.921 kip-in
M	2.938 kip-in
Ds	0.012 in
Check deflection	O.K.

Allowable Capacity

Ig = (b*h^3)/12	64 in^4
Ag = (b*h)	48 in^2
Yt = h/2	2
fr (rupture modulus)	530.330 psi
Mcr	16.971 kip-in
Beta_1	0.8
Trial Ast req'd	0.079 in^2
B	8.836162648
kd	0.569 in
I.cr	3.52 in^4
e_c	0.003
e_s	0.005
a	0.33483 psi
c	0.419 in
Ase	0.23 in^2
Icrdeflection	4.36 in^4
Ie	64.00 in^4
delta	150
r_t (maximum tensile reinforcement)	0.0166
r_{temp} (min. temperature reinforcement)	0.0014
r_{min} (minimum tensile reinforcement)	0.0027
r_{trial} (trial reinforcement ratio bottom)	0.0033
$\rho_{provided}$ (reinforcement ratio provided)	0.0080

Flexure

Assumption check		
Span	Hw	Lw
net Tensile Strain	0.011	0.011
Check ACI 14.8.2.3	Tension	Tension
Mua	0.650 kip-ft	

ACI eq. (14-6)		
Mu	0.780 kip-ft	0.360 kip-ft

ACI 9.3.2		
fb	0.9	0.9
fMn trial = ϕAsFy(dt - a/2)	2.210 kip-ft	2.210 kip-ft
DM =Mpos - ϕM	0.000 kip-ft	0.000 kip-ft
As Add'l req'd	0.00 in^2	0.00 in^2
Additional reinf req'd	0.00 in^2	0.00 in^2
Add'l bar size:	3	3
qty req'd	0	0
or spacing of:	0	0
As add'l =	0.000 kip-ft	0.000 kip-ft
Ast = As + As add'l	0.20 in^2	0.20 in^2
fMn = ϕAsFy(db - a/2)	2.209 kip-ft	2.209 kip-ft
Check ϕMn > Mu	O.K.	O.K.
% allowed	35.31%	16.30%

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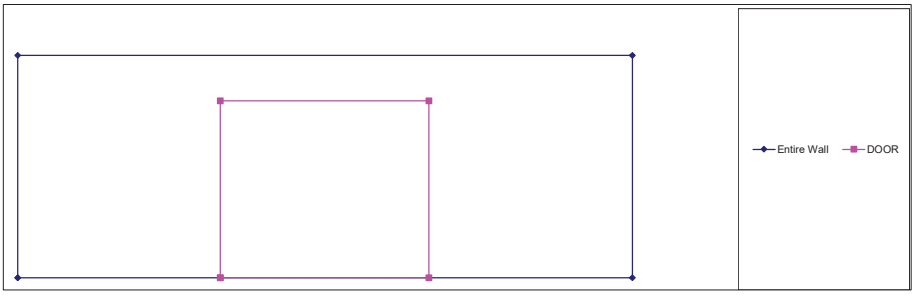

REINFORCEMENT AT OPENINGS

Loading	
Pu (factorized load from roof)	0.41 klf
Ww (weight of panel per sq ft)	0.05 ksf

Material Properties	
db (effective depth bottom)	2 in
a (block of strain)	0.33483 psi
	a=As * fy / (0.85 * f'c *b)

Factorized Moment

Opening	Horizontal Location	Vertical Location	L length of opening	H height above opening	(-) Weight of Opening (LBS)	Pw total factorized panel load	wu total factorized load	**Mu** (wu*L^2)/12
DOOR	3.24 ft	0 ft	3.34 ft	1.76 ft	1144.65	0.09 klf	0.5 klf	0.46 kip-ft

Flexure

Opening	ϕb	As req'd	Bar size	qty req'd:	**ϕMn** = ϕAsFy(db - a/2)	Check ϕMn > Mu
DOOR	0.9	0.005 in^2	No. 3	1	9.67 kip-ft	O.K.

CONNECTIONS

			Full Resistance Value Overturning				
Base Anchors			Lateral	Base Anchors		Wall-Wall Connection	
Quantity in Shear	Maximum R - Distance	Maximum L - Distance	Shear kip	Moment + kip - ft	Moment - kip - ft	Moment + kip - ft	Moment - kip - ft
4	113	113	35.030	57.54	57.54	45.16	41.96

Total Tension	Base Anchors					
14.162	Dist	Tension (kip)	Shear	L - Dist	Moment +	Moment -
Base Anchor 1	5 in	3.44	5.31	113 in	0.063 kip*ft	32.393 kip*ft
Base Anchor 2	24.5 in	3.64	12.21	93.5 in	1.612 kip*ft	23.474 kip*ft
Base Anchor 3	93.5 in	3.64	12.21	24.5 in	23.474 kip*ft	1.612 kip*ft
Base Anchor 4	113 in	3.44	5.31	5 in	32.393 kip*ft	0.063 kip*ft

	Wall Connections									
	Quantity of Anchors	Capacity of each Anchor	Countering Dead Load from Adjoining Wall	% of wall to use	Adjoining Wall	Dist (inches)	L - Dist	Allowable Force	Overturning Moment Resistance (kip-ft) Up Left	Low Right
Wall Connection 1	3	*1.531*	4.267	14.17%	W1	0	118.000	4.267	0.000	41.961
Wall Connection 2	3	*1.531*	7.713	25.35%	W8	118	0.000	4.593	45.165	0.000

Wall Shear Checks

Shear Connections at Base			Wall Shear Capacity			Required Shear Capacity (lb) per Base Connector		
Design Force (lb)	Capacity (lb)	Reserve Capacity	Design (PLF)	Resistance (PLF)	check		Reserve Capacity	
6624	35030	28406	591	7688	OK	1656	(28406)	OK

RIGIDITY

	CALCULATED VALUES	38%	Final	2.287854839

	Pier Label	Length (inches)	Height (inches)	Fixed Top? (Y/N)	Useable? (Y/N)	Stiffness (k) (1000 kip / IN)	Deflection (in / 1000 kip)
DOOR	Entire Wall	118	103.37	Y	Y	6.060	0.165
	A'	118	82.25	Y	Y	8.231	0.121
	A	38.88	82.25	Y	Y	1.265	0.791
	B	39.04	82.25	Y	Y	1.276	0.784

	Combine Logic					
	First Segment	Second Segment	Re-Name	Combine/Subtract	Method	Combined
DOOR	Entire Wall	A'	A'a	-	Deflection	0.044
	A	B	AB	+	Stiffness	2.541
	A'a	AB	Final	+	Deflection	0.437

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ID:	RAINIER RN-125
	DESIGN OF WALL MARKED W3

Notes

ACI's Alternate Design of Slender Walls	ACI 14.8
Assumptions from this methodology:	
Wall panel shall be simply supported, axially loaded, and subject to out-of-plane uniform lateral loading where maximum moments and deflections occur at mid-height of the wall.	ACI 14.8.2.1
The cross section is constant over the height of the wall panel.	ACI 14.8.2.2
The wall cross sections shall be tension controlled.	ACI 14.8.2.3
Phi*Mn >= Mcr	ACI 14.8.2.4
Concentrated gravity loads are distributed over the wall length	ACI 14.8.2.5
The vertical stress Pu/Ag at mid-height shall not exceed 0.06*f'c	ACI 14.8.2.6

Material Properties

f'c	5000 psi	
Steel Reinforcement	Plain WWF Grade 80	
Fy wire mesh	80000 psi	
Fy rebar	60000 pcf	
Lightweight?	No	
Concrete density	150 pcf	O.K.
E (Steel)	29000000 psi	
E (Concrete)	4290000 psi	ACI 8.5.1
n (modular ratio)	6.76	

Shear Parameters

Phi.v	0.85	ACI 9.3.2.3
Vc	3.394 kip	ACI 11.3.1.1 & 11.2.1.2
Phi*Vc	2.885 kip	ACI 11.1.1

Minimum Wall Reinforcement Requirements

roe.min.vert	0.0012	ACI 14.3.2
roe.min.hor	0.002	ACI 14.3.3
Max Vertical spacing	18 in	ACI 14.3.5
Max Horizontal spacing	18 in	ACI 14.3.5

Geometric Properties

X Corridinate	20
Y Corridinate	12.5
Direction of Wall	Y
Center of gravity X	20.000
Center of gravity Y	71.547
Wall Weight	3086.000 lbs.
Central wall?	Yes
Wall that supports 2 roof panels?	Yes
lop (length of opening on wall)	0 ft
H (height of wall)	103.37 in
Lh (length of wall)	9.833 ft
Analyisis will be performed as :	Two-way slab
b (section width)	12 in
h (section thickness)	4 in
ct (cover top)	1.708 in
cb (cover bottom)	1.708 in
rd (assumed reinf. diameter)	0.292 in
dt (effective depth top)	2 in
db (effective depth bottom)	2 in
Cs (% of DL used for Seismic)	0.196
Eccentricity - Axial Load	1 in
Is wall Split	No

Loading

Axial Design Loads (pressure from roof)		Lateral Design Loads (pressure on wall)	
D (Dead load) + Ww (Wall weight)	110.94 psf	Dead Load (DL.lat)	0 psf
S (Snow Load)	210 psf	Snow Load (SL.lat)	0 psf
L (Live Load)	0 psf	Live Load (LL.lat)	0 psf
Lr (Live Roof Load)	30 psf	Live Roof Load (LLr.lat)	0 psf
W (Wind Load)	108.86 psf	Wind Load (WL.lat)	58.99 psf
E (Earthquake Load)	12.88 psf	Earthquake Load (EL.lat)	9.78 psf

Wire Mesh	
Wire Size	W6.7
spacing	4 in
Mesh Area	0.20 in^2 = As

Factored Axially Applied Loads

Factored Loading per ACI	ACI eq. 9-3
Factored Pressure on Roof Wr	496.213

Axial Pressure on Section	
PuB	2.16 kip

Assumption check	
Pu/Ag	45.000 psi
0.06*f'c	300 psi
Check ACI 14.8.2.6	O.K.

Unfactored Axially Applied Loads

Unfactored Pressure on Roof uWr	300.0825 psf

Axial Pressure on Section	
PB	1.39 kip

Factored Laterally Applied Loads

Factored Loading per ACI	ACI eq. 9-4
Factored Pressure on Wall Ww	94.38 psf

Lateral Pressure on Section	
Lw = W*(L^4 / L^4 + H^4)	0.03 klf
Hw = W*(H^4 / H^4 + L^4)	0.06 klf

Unfactored Laterally Applied Loads

Unfactored Pressure on Wall uWw	58.99 psf

Lateral Pressure on Section	
Lw = W*(L^4 / L^4 + H^4)	0.02 klf
Hw = W*(H^4 / H^4 + L^4)	0.04 klf

Shear

Factored Loading per ACI	ACI eq. 9-3
Vu = wuB*(Bw-2db) / 2	0.09
Phi*Vc/2	1.44
Check Shear ACI 11.5.5.1	O.K.

Deflection ACI 14.8.4

Service Loads	
Axial	1.39 kip
Lateral	0.02 klf
Allowed service deflection	0.69 in
Msa	2.921 kip-in
M	2.938 kip-in
Ds	0.012 in
Check deflection	O.K.

Allowable Capacity

Ig = (b*h^3)/12	64 in^4
Ag = (b*h)	48 in^2
Yt = h/2	2
fr (rupture modulus)	530.330 psi
Mcr	16.971 kip-in
Beta_1	0.8
Trial Ast req'd	0.079 in^2
B	8.836162648
kd	0.569 in
I.cr	3.52 in^4
e_c	0.003
e_s	0.005
a	0.33483 psi
c	0.419 in
Ase	0.23 in^2
Icrdeflection	4.36 in^4
Ie	64.00 in^4
delta	150
r_t (maximum tensile reinforcement)	0.0166
r_{temp} (min. temperature reinforcement)	0.0014
r_{min} (minimum tensile reinforcement)	0.0027
r_{trial} (trial reinforcement ratio bottom)	0.0033
$\rho_{provided}$ (reinforcement ratio provided)	0.0080

Flexure

Assumption check		
Span	Hw	Lw
net Tensile Strain	0.011	0.011
Check ACI 14.8.2.3	Tension	Tension
Mua	0.650 kip-ft	

ACI eq. (14-6)		
Mu	0.780 kip-ft	0.360 kip-ft

ACI 9.3.2		
fb	0.9	0.9
fMn trial = ϕAsFy(dt - a/2)	2.210 kip-ft	2.210 kip-ft
DM =Mpos - ϕM	0.000 kip-ft	0.000 kip-ft
As Add'l req'd	0.00 in^2	0.00 in^2
Additional reinf req'd	0.00 in^2	0.00 in^2
Add'l bar size:	3	3
qty req'd	0	0
or spacing of:	0	0
As add'l =	0.000 kip-ft	0.000 kip-ft
Ast = As + As add'l	0.20 in^2	0.20 in^2
fMn = ϕAsFy(db - a/2)	2.209 kip-ft	2.209 kip-ft
Check ϕMn > Mu	O.K.	O.K.
% allowed	35.31%	16.30%

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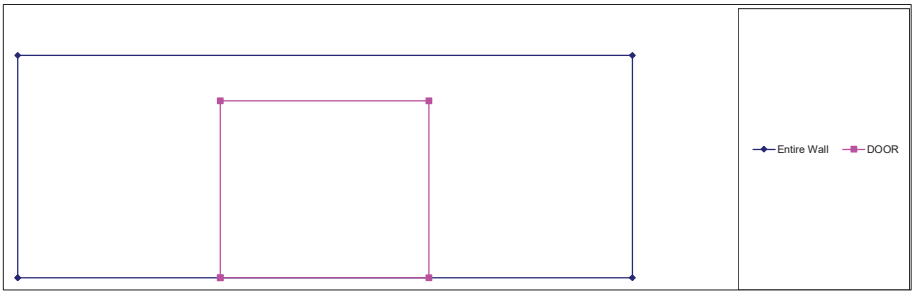

REINFORCEMENT AT OPENINGS

Loading	
Pu (factorized load from roof)	0.41 klf
Ww (weight of panel per sq ft)	0.05 ksf

Material Properties	
db (effective depth bottom)	2 in
a (block of strain)	0.33483 psi
	a=As * fy / (0.85 * f'c *b)

Factorized Moment

Opening	Horizontal Location	Vertical Location	L length of opening	H height above opening	(-) Weight of Opening (LBS)	Pw total factorized panel load	wu total factorized load	**Mu** (wu*L^2)/12
DOOR	3.24 ft	0 ft	3.34 ft	1.76 ft	1144.65	0.09 klf	0.5 klf	0.46 kip-ft

Flexure

Opening	ϕb	As req'd	Bar size	qty req'd:	**ϕMn** = ϕAsFy(db - a/2)	Check ϕMn > Mu
DOOR	0.9	0.005 in^2	No. 3	1	9.67 kip-ft	O.K.

CONNECTIONS

			Full Resistance Value Overturning				
Base Anchors			Lateral	Base Anchors		Wall-Wall Connection	
Quantity in Shear	Maximum R - Distance	Maximum L - Distance	Shear kip	Moment + kip - ft	Moment - kip - ft	Moment + kip - ft	Moment - kip - ft
4	113	113	35.030	57.54	57.54	45.16	41.96

Total Tension	Base Anchors					
14.162	Dist	Tension (kip)	Shear	L - Dist	Moment +	Moment -
Base Anchor 1	5 in	3.44	5.31	113 in	0.063 kip*ft	32.393 kip*ft
Base Anchor 2	24.5 in	3.64	12.21	93.5 in	1.612 kip*ft	23.474 kip*ft
Base Anchor 3	93.5 in	3.64	12.21	24.5 in	23.474 kip*ft	1.612 kip*ft
Base Anchor 4	113 in	3.44	5.31	5 in	32.393 kip*ft	0.063 kip*ft

	Wall Connections									
	Quantity of Anchors	Capacity of each Anchor	Countering Dead Load from Adjoining Wall	% of wall to use	Adjoining Wall	Dist (inches)	L - Dist	Allowable Force	Overturning Moment Resistance (kip-ft) Up Left	Low Right
Wall Connection 1	3	*1.531*	4.267	14.17%	W1	0	118.000	4.267	0.000	41.961
Wall Connection 2	3	*1.531*	7.713	25.35%	W8	118	0.000	4.593	45.165	0.000

Wall Shear Checks

Shear Connections at Base			Wall Shear Capacity			Required Shear Capacity (lb) per Base Connector		
Design Force (lb)	Capacity (lb)	Reserve Capacity	Design (PLF)	Resistance (PLF)	check		(28406)	Reserve Capacity OK
6624	35030	28406	591	7688	OK	1656		

RIGIDITY

	CALCULATED VALUES	38%	Final	2.287854839

	Pier Label	Length (inches)	Height (inches)	Fixed Top? (Y/N)	Useable? (Y/N)	Stiffness (k) (1000 kip / IN)	Deflection (in / 1000 kip)
DOOR	Entire Wall	118	103.37	Y	Y	6.060	0.165
	A'	118	82.25	Y	Y	8.231	0.121
	A	38.88	82.25	Y	Y	1.265	0.791
	B	39.04	82.25	Y	Y	1.276	0.784

	Combine Logic					
	First Segment	Second Segment	Re-Name	Combine/Subtract	Method	Combined
DOOR	Entire Wall	A'	A'a	-	Deflection	0.044
	A	B	AB	+	Stiffness	2.541
	A'a	AB	Final	+	Deflection	0.437

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ID:	RAINIER RN-125
	DESIGN OF WALL MARKED W4

Notes

ACI's Alternate Design of Slender Walls	ACI 14.8
Assumptions from this methodology:	
Wall panel shall be simply supported, axially loaded, and subject to out-of-plane uniform lateral loading where maximum moments and deflections occur at mid-height of the wall.	ACI 14.8.2.1
The cross section is constant over the height of the wall panel.	ACI 14.8.2.2
The wall cross sections shall be tension controlled.	ACI 14.8.2.3
Phi*Mn >= Mcr	ACI 14.8.2.4
Concentrated gravity loads are distributed over the wall length	ACI 14.8.2.5
The vertical stress Pu/Ag at mid-height shall not exceed 0.06*f'c	ACI 14.8.2.6

Material Properties

f'c	5000 psi	
Steel Reinforcement	Plain WWF Grade 80	
Fy wire mesh	80000 psi	
Fy rebar	60000 pcf	
Lightweight?	No	
Concrete density	150 pcf	O.K.
E (Steel)	29000000 psi	
E (Concrete)	4290000 psi	ACI 8.5.1
n (modular ratio)	6.76	

Shear Parameters

Phi.v	0.85	ACI 9.3.2.3
Vc	2.546 kip	ACI 11.3.1.1 & 11.2.1.2
Phi*Vc	2.164 kip	ACI 11.1.1

Minimum Wall Reinforcement Requirements

roe.min.vert	0.0012	ACI 14.3.2
roe.min.hor	0.002	ACI 14.3.3
Max Vertical spacing	18 in	ACI 14.3.5
Max Horizontal spacing	18 in	ACI 14.3.5

Geometric Properties

X Corridinate	98
Y Corridinate	68
Direction of Wall	X
Center of gravity X	160.000
Center of gravity Y	68.000
Wall Weight	3549.000 lbs.
Central wall?	Yes
Wall that supports 2 roof panels?	No
lop (length of opening on wall)	0 ft
H (height of wall)	109.87 in
Lh (length of wall)	10.333 ft
Analyisis will be performed as :	Two-way slab
b (section width)	12 in
h (section thickness)	3 in
ct (cover top)	1.208 in
cb (cover bottom)	1.208 in
rd (assumed reinf. diameter)	0.292 in
dt (effective depth top)	1.5 in
db (effective depth bottom)	1.5 in
Cs (% of DL used for Seismic)	0.196
Eccentricity - Axial Load	1 in
Is wall Split	No

Loading

Axial Design Loads (pressure from roof)		Lateral Design Loads (pressure on wall)	
D (Dead load) + Ww (Wall weight)	98.44 psf	Dead Load (DL.lat)	0 psf
S (Snow Load)	210 psf	Snow Load (SL.lat)	0 psf
L (Live Load)	0 psf	Live Load (LL.lat)	0 psf
Lr (Live Roof Load)	30 psf	Live Roof Load (LLr.lat)	0 psf
W (Wind Load)	108.86 psf	Wind Load (WL.lat)	58.99 psf
E (Earthquake Load)	12.88 psf	Earthquake Load (EL.lat)	7.34 psf

Wire Mesh	
Wire Size	W6.7
spacing	4 in
Mesh Area	0.20 in^2 = As

Factored Axially Applied Loads

Factored Loading per ACI	ACI eq. 9-3
Factored Pressure on Roof Wr	496.213

Axial Pressure on Section	
PuB	1.7 kip

Assumption check	
Pu/Ag	47.222 psi
0.06*f'c	300 psi
Check ACI 14.8.2.6	O.K.

Unfactored Axially Applied Loads

Unfactored Pressure on Roof uWr	300.0825 psf

Axial Pressure on Section	
PB	1.13 kip

Factored Laterally Applied Loads

Factored Loading per ACI	ACI eq. 9-4
Factored Pressure on Wall Ww	94.38 psf

Lateral Pressure on Section	
Lw = W*(L^4 / L^4 + H^4)	0.04 klf
Hw = W*(H^4 / H^4 + L^4)	0.06 klf

Unfactored Laterally Applied Loads

Unfactored Pressure on Wall uWw	58.99 psf

Lateral Pressure on Section	
Lw = W*(L^4 / L^4 + H^4)	0.02 klf
Hw = W*(H^4 / H^4 + L^4)	0.04 klf

Shear

Factored Loading per ACI	ACI eq. 9-3
Vu = wuB*(Bw-2db) / 2	0.15
Phi*Vc/2	1.08
Check Shear ACI 11.5.5.1	O.K.

Deflection ACI 14.8.4

Service Loads	
Axial	1.13 kip
Lateral	0.02 klf
Allowed service deflection	0.73 in
Msa	3.080 kip-in
M	3.118 kip-in
Ds	0.034 in
Check deflection	O.K.

Allowable Capacity

Ig = (b*h^3)/12	27 in^4
Ag = (b*h)	36 in^2
Yt = h/2	1.5
fr (rupture modulus)	530.330 psi
Mcr	9.546 kip-in
Beta_1	0.8
Trial Ast req'd	0.059 in^2
B	8.836162648
kd	0.480 in
I.cr	1.86 in^4
e_c	0.003
e_s	0.005
a	0.33483 psi
c	0.419 in
Ase	0.22 in^2
Icrdeflection	2.21 in^4
Ie	27.00 in^4
delta	150
r_t (maximum tensile reinforcement)	0.0166
r_{temp} (min. temperature reinforcement)	0.0014
r_{min} (minimum tensile reinforcement)	0.0027
r_{trial} (trial reinforcement ratio bottom)	0.0033
$\rho_{provided}$ (reinforcement ratio provided)	0.0110

Flexure

Assumption check		
Span	Hw	Lw
net Tensile Strain	0.008	0.008
Check ACI 14.8.2.3	Tension	Tension
Mua	0.701 kip-ft	

ACI eq. (14-6)		
Mu	1.000 kip-ft	0.530 kip-ft

ACI 9.3.2		
fb	0.9	0.9
fMn trial = ϕAsFy(dt - a/2)	1.610 kip-ft	1.610 kip-ft
DM =Mpos - ϕM	0.000 kip-ft	0.000 kip-ft
As Add'l req'd	0.00 in^2	0.00 in^2
Additional reinf req'd	0.00 in^2	0.00 in^2
Add'l bar size:	3	3
qty req'd	0	0
or spacing of:	0	0
As add'l =	0.000 kip-ft	0.000 kip-ft
Ast = As + As add'l	0.20 in^2	0.20 in^2
fMn = ϕAsFy(db - a/2)	1.606 kip-ft	1.606 kip-ft
Check ϕMn > Mu	O.K.	O.K.
% allowed	62.27%	33.00%

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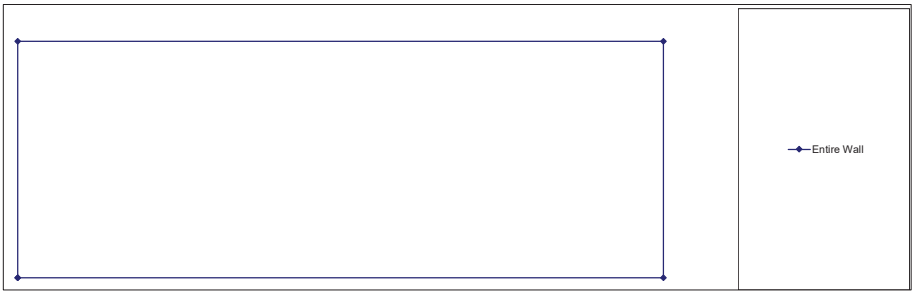

REINFORCEMENT AT OPENINGS

Loading	
Pu (factorized load from roof)	0.41 klf
Ww (weight of panel per sq ft)	0.04 ksf

Material Properties	
db (effective depth bottom)	1.5 in
a (block of strain)	0.33483 psi
	a=As * fy / (0.85 * f'c *b)

Factorized Moment

Opening	Horizontal Location	Vertical Location	L length of opening	H height above opening	(-) Weight of Opening (LBS)	Pw total factorized panel load	wu total factorized load	**Mu** (wu*L^2)/12

Flexure

Opening	ϕb	As req'd	Bar size	qty req'd:	**ϕMn** = ϕAsFy(db - a/2)	Check ϕMn > Mu

CONNECTIONS

			Full Resistance Value Overturning				
Base Anchors			Lateral	Base Anchors		Wall-Wall Connection	
Quantity in Shear	Maximum R - Distance	Maximum L - Distance	Shear kip	Moment + kip - ft	Moment - kip - ft	Moment + kip - ft	Moment - kip - ft
4	116	116	40.946	60.40	60.40	48.25	69.12

Total Tension	Base Anchors					
14.334	Dist	Tension (kip)	Shear	L - Dist	Moment +	Moment -
Base Anchor 1	8 in	***3.53***	***8.26***	116 in	0.162 kip*ft	34.085 kip*ft
Base Anchor 2	28 in	3.64	12.21	96 in	2.051 kip*ft	24.106 kip*ft
Base Anchor 3	96 in	3.64	12.21	28 in	24.106 kip*ft	2.051 kip*ft
Base Anchor 4	116 in	***3.53***	***8.26***	8 in	34.085 kip*ft	0.162 kip*ft

	Wall Connections									
	Quantity of Anchors	Capacity of each Anchor	Countering Dead Load from Adjoining Wall	% of wall to use	Adjoining Wall	Dist (inches)	L - Dist	Allowable Force	Overturning Moment Resistance (kip-ft) Up Left	Overturning Moment Resistance (kip-ft) Low Right
Wall Connection 1	3	***1.531***	4.385	35.42%	W7	0	124.000	4.385	0.000	45.311
Wall Connection 2	3	***2.703***	4.609	50.00%	W5	62	62.000	4.609	23.813	23.813
Wall Connection 3	3	***1.531***	2.364	19.10%	W6	124	0.000	2.364	24.432	0.000

Wall Shear Checks

Shear Connections at Base			Wall Shear Capacity			Required Shear Capacity (lb) per Base Connector		
Design Force (lb)	Capacity (lb)	Reserve Capacity	Design (PLF)	Resistance (PLF)	check			Reserve Capacity
4088	40946	36858	305	15274	OK	1022	(36858)	OK

RIGIDITY

CALCULATED VALUES	100%	Final	4.472584522

Pier Label	Length (inches)	Height (inches)	Fixed Top? (Y/N)	Useable? (Y/N)	Stiffness (k) (1000 kip / IN)	Deflection (in / 1000 kip)
Entire Wall	124	109.87	Y	Y	4.473	0.224

Combine Logic					
First Segment	Second Segment	Re-Name	Combine/Subtract	Method	Combined
Entire Wall	0	Final			4.473

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ID:	RAINIER RN-125
	DESIGN OF WALL MARKED W5

Notes

ACI's Alternate Design of Slender Walls	ACI 14.8
Assumptions from this methodology:	
Wall panel shall be simply supported, axially loaded, and subject to out-of-plane uniform lateral loading where maximum moments and deflections occur at mid-height of the wall.	ACI 14.8.2.1
The cross section is constant over the height of the wall panel.	ACI 14.8.2.2
The wall cross sections shall be tension controlled.	ACI 14.8.2.3
Phi*Mn >= Mcr	ACI 14.8.2.4
Concentrated gravity loads are distributed over the wall length	ACI 14.8.2.5
The vertical stress Pu/Ag at mid-height shall not exceed 0.06*f'c	ACI 14.8.2.6

Material Properties

f'c	5000 psi	
Steel Reinforcement	Plain WWF Grade 80	
Fy wire mesh	80000 psi	
Fy rebar	60000 pcf	
Lightweight?	No	
Concrete density	150 pcf	O.K.
E (Steel)	29000000 psi	
E (Concrete)	4290000 psi	ACI 8.5.1
n (modular ratio)	6.76	

Shear Parameters

Phi.v	0.85	ACI 9.3.2.3
Vc	3.394 kip	ACI 11.3.1.1 & 11.2.1.2
Phi*Vc	2.885 kip	ACI 11.1.1

Minimum Wall Reinforcement Requirements

roe.min.vert	0.0012	ACI 14.3.2
roe.min.hor	0.002	ACI 14.3.3
Max Vertical spacing	18 in	ACI 14.3.5
Max Horizontal spacing	18 in	ACI 14.3.5

Loading

Axial Design Loads (pressure from roof)		Lateral Design Loads (pressure on wall)	
D (Dead load) + Ww (Wall weight)	110.94 psf	Dead Load (DL.lat)	0 psf
S (Snow Load)	210 psf	Snow Load (SL.lat)	0 psf
L (Live Load)	0 psf	Live Load (LL.lat)	0 psf
Lr (Live Roof Load)	30 psf	Live Roof Load (LLr.lat)	0 psf
W (Wind Load)	108.86 psf	Wind Load (WL.lat)	58.99 psf
E (Earthquake Load)	12.88 psf	Earthquake Load (EL.lat)	9.78 psf

Factored Axially Applied Loads

Factored Loading per ACI	ACI eq. 9-3
Factored Pressure on Roof Wr	496.213

Axial Pressure on Section	
PuB	2.24 kip

Assumption check	
Pu/Ag	46.667 psi
0.06*f'c	300 psi
Check ACI 14.8.2.6	O.K.

Unfactored Axially Applied Loads

Unfactored Pressure on Roof uWr	300.0825 psf

Axial Pressure on Section	
PB	1.48 kip

Shear

Factored Loading per ACI	ACI eq. 9-3
Vu = wuB*(Bw-2db) / 2	0.04
Phi*Vc/2	1.44
Check Shear ACI 11.5.5.1	O.K.

Allowable Capacity

Ig = (b*h^3)/12	64 in^4
Ag = (b*h)	48 in^2
Yt = h/2	2
fr (rupture modulus)	530.330 psi
Mcr	16.971 kip-in
Beta_1	0.8
Trial Ast req'd	0.079 in^2
B	8.836162648
kd	0.569 in
I.cr	3.52 in^4
e_c	0.003
e_s	0.005
a	0.33483 psi
c	0.419 in
Ase	0.23 in^2
Icrdeflection	4.36 in^4
Ie	64.00 in^4
delta	150
r_t (maximum tensile reinforcement)	0.0166
r_{temp} (min. temperature reinforcement)	0.0014
r_{min} (minimum tensile reinforcement)	0.0027
r_{trial} (trial reinforcement ratio bottom)	0.0033
$\rho_{provided}$ (reinforcement ratio provided)	0.0080

Geometric Properties

X Corridinate	160
Y Corridinate	69.5
Direction of Wall	Y
Center of gravity X	160.000
Center of gravity Y	100.000
Wall Weight	2194.000 lbs.
Central wall?	Yes
Wall that supports 2 roof panels?	Yes
lop (length of opening on wall)	0 ft
H (height of wall)	103.6 in
Lh (length of wall)	5.083 ft
Analyisis will be performed as :	Two-way slab
b (section width)	12 in
h (section thickness)	4 in
ct (cover top)	1.708 in
cb (cover bottom)	1.708 in
rd (assumed reinf. diameter)	0.292 in
dt (effective depth top)	2 in
db (effective depth bottom)	2 in
Cs (% of DL used for Seismic)	0.196
Eccentricity - Axial Load	1 in
Is wall Split	No

Wire Mesh	
Wire Size	W6.7
spacing	4 in
Mesh Area	0.20 in^2 = As

Factored Laterally Applied Loads

Factored Loading per ACI	ACI eq. 9-4
Factored Pressure on Wall Ww	94.38 psf

Lateral Pressure on Section	
Lw = W*(L^4 / L^4 + H^4)	0.08 klf
Hw = W*(H^4 / H^4 + L^4)	0.01 klf

Unfactored Laterally Applied Loads

Unfactored Pressure on Wall uWw	58.99 psf

Lateral Pressure on Section	
Lw = W*(L^4 / L^4 + H^4)	0.05 klf
Hw = W*(H^4 / H^4 + L^4)	0.01 klf

Deflection ACI 14.8.4

Service Loads	
Axial	1.48 kip
Lateral	0.05 klf
Allowed service deflection	0.69 in
Msa	6.330 kip-in
M	6.368 kip-in
Ds	0.026 in
Check deflection	O.K.

Flexure

Assumption check		
Span	Hw	Lw
net Tensile Strain	0.011	0.011
Check ACI 14.8.2.3	Tension	Tension
Mua	0.183 kip-ft	

ACI eq. (14-6)		
Mu	0.220 kip-ft	0.260 kip-ft

ACI 9.3.2		
fb	0.9	0.9
fMn trial = ϕAsFy(dt - a/2)	2.210 kip-ft	2.210 kip-ft
DM =Mpos - ϕM	0.000 kip-ft	0.000 kip-ft
As Add'l req'd	0.00 in^2	0.00 in^2
Additional reinf req'd	0.00 in^2	0.00 in^2
Add'l bar size:	3	3
qty req'd	0	0
or spacing of:	0	0
As add'l =	0.000 kip-ft	0.000 kip-ft
Ast = As + As add'l	0.20 in^2	0.20 in^2
fMn = ϕAsFy(db - a/2)	2.209 kip-ft	2.209 kip-ft
Check ϕMn > Mu	O.K.	O.K.
% allowed	9.96%	11.77%

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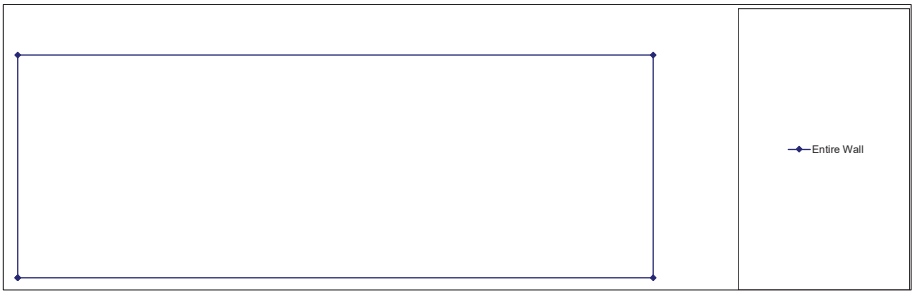

REINFORCEMENT AT OPENINGS

Loading	
Pu (factorized load from roof)	0.41 klf
Ww (weight of panel per sq ft)	0.05 ksf

Material Properties	
db (effective depth bottom)	2 in
a (block of strain)	0.33483 psi
	a=As * fy / (0.85 * f'c *b)

Factorized Moment

Opening	Horizontal Location	Vertical Location	L length of opening	H height above opening	(-) Weight of Opening (LBS)	Pw total factorized panel load	wu total factorized load	**Mu** (wu*L^2)/12

Flexure

Opening	ϕb	As req'd	Bar size	qty req'd:	**ϕMn** = ϕAsFy(db - a/2)	Check ϕMn > Mu

CONNECTIONS

Base Anchors			Full Resistance Value Overturning				
			Lateral	Base Anchors		Wall-Wall Connection	
Quantity in Shear	Maximum R - Distance	Maximum L - Distance	Shear kip	Moment + kip - ft	Moment - kip - ft	Moment + kip - ft	Moment - kip - ft
2	56	51	15.543	16.59	15.37	23.35	23.35

Total Tension	Base Anchors					
7.024	Dist	Tension (kip)	Shear	L - Dist	Moment +	Moment -
Base Anchor 1	10 in	***3.58***	***10.24***	51 in	0.533 kip*ft	15.232 kip*ft
Base Anchor 2	56 in	3.44	5.31	5 in	16.053 kip*ft	0.141 kip*ft

	Wall Connections									
	Quantity of Anchors	Capacity of each Anchor	Countering Dead Load from Adjoining Wall	% of wall to use	Adjoining Wall	Dist (inches)	L - Dist	Allowable Force	Overturning Moment Resistance (kip-ft) Up Left	Overturning Moment Resistance (kip-ft) Low Right
Wall Connection 1	3	***1.531***	8.942	50.00%	W4	0	61.000	4.593	0.000	23.348
Wall Connection 2	3	***1.531***	14.998	49.30%	W8	61	0.000	4.593	23.348	0.000

Wall Shear Checks

Shear Connections at Base			Wall Shear Capacity			Required Shear Capacity (lb) per Base Connector		
Design Force (lb)	Capacity (lb)	Reserve Capacity	Design (PLF)	Resistance (PLF)	check			Reserve Capacity
5660	15543	9883	999	20365	OK	2830	(9883)	OK

RIGIDITY

CALCULATED VALUES	100%	Final	2.001224238

Pier Label	Length (inches)	Height (inches)	Fixed Top? (Y/N)	Useable? (Y/N)	Stiffness (k) (1000 kip / IN)	Deflection (in / 1000 kip)
Entire Wall	61	103.6	Y	Y	2.001	0.500

Combine Logic					
First Segment	Second Segment	Re-Name	Combine/Subtract	Method	Combined
Entire Wall	0	Final			2.001

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ID:	RAINIER RN-125
	DESIGN OF WALL MARKED W6

Notes

ACI's Alternate Design of Slender Walls	ACI 14.8
Assumptions from this methodology:	
Wall panel shall be simply supported, axially loaded, and subject to out-of-plane uniform lateral loading where maximum moments and deflections occur at mid-height of the wall.	ACI 14.8.2.1
The cross section is constant over the height of the wall panel.	ACI 14.8.2.2
The wall cross sections shall be tension controlled.	ACI 14.8.2.3
Phi*Mn >= Mcr	ACI 14.8.2.4
Concentrated gravity loads are distributed over the wall length	ACI 14.8.2.5
The vertical stress Pu/Ag at mid-height shall not exceed 0.06*f'c	ACI 14.8.2.6

Material Properties

f'c	5000 psi	
Steel Reinforcement	Plain WWF Grade 80	
Fy wire mesh	80000 psi	
Fy rebar	60000 pcf	
Lightweight?	No	
Concrete density	150 pcf	O.K.
E (Steel)	29000000 psi	
E (Concrete)	4290000 psi	ACI 8.5.1
n (modular ratio)	6.76	

Shear Parameters

Phi.v	0.85	ACI 9.3.2.3
Vc	2.546 kip	ACI 11.3.1.1 & 11.2.1.2
Phi*Vc	2.164 kip	ACI 11.1.1

Minimum Wall Reinforcement Requirements

roe.min.vert	0.0012	ACI 14.3.2
roe.min.hor	0.002	ACI 14.3.3
Max Vertical spacing	18 in	ACI 14.3.5
Max Horizontal spacing	18 in	ACI 14.3.5

Loading

Axial Design Loads (pressure from roof)		Lateral Design Loads (pressure on wall)	
D (Dead load) + Ww (Wall weight)	98.44 psf	Dead Load (DL.lat)	0 psf
S (Snow Load)	210 psf	Snow Load (SL.lat)	0 psf
L (Live Load)	0 psf	Live Load (LL.lat)	0 psf
Lr (Live Roof Load)	30 psf	Live Roof Load (LLr.lat)	0 psf
W (Wind Load)	108.86 psf	Wind Load (WL.lat)	58.99 psf
E (Earthquake Load)	12.88 psf	Earthquake Load (EL.lat)	7.34 psf

Factored Axially Applied Loads

Factored Loading per ACI	ACI eq. 9-3
Factored Pressure on Roof Wr	496.213

Axial Pressure on Section	
PuB	2.16 kip

Assumption check	
Pu/Ag	60.000 psi
0.06*f'c	300 psi
Check ACI 14.8.2.6	O.K.

Unfactored Axially Applied Loads

Unfactored Pressure on Roof uWr	300.0825 psf

Axial Pressure on Section	
PB	1.39 kip

Shear

Factored Loading per ACI	ACI eq. 9-3
Vu = wuB*(Bw-2db) / 2	0.12
Phi*Vc/2	1.08
Check Shear ACI 11.5.5.1	O.K.

Allowable Capacity

Ig = (b*h^3)/12	27 in^4
Ag = (b*h)	36 in^2
Yt = h/2	1.5
fr (rupture modulus)	530.330 psi
Mcr	9.546 kip-in
Beta_1	0.8
Trial Ast req'd	0.059 in^2
B	8.836162648
kd	0.480 in
I.cr	1.86 in^4
e_c	0.003
e_s	0.005
a	0.33483 psi
c	0.419 in
Ase	0.23 in^2
Icrdeflection	2.29 in^4
Ie	27.00 in^4
delta	150
r_t (maximum tensile reinforcement)	0.0166
r_{temp} (min. temperature reinforcement)	0.0014
r_{min} (minimum tensile reinforcement)	0.0027
r_{trial} (trial reinforcement ratio bottom)	0.0033
$\rho_{provided}$ (reinforcement ratio provided)	0.0110

Geometric Properties

X Corridinate	223.5
Y Corridinate	12.5
Direction of Wall	Y
Center of gravity X	223.500
Center of gravity Y	49.840
Wall Weight	1860.000 lbs.
Central wall?	Yes
Wall that supports 2 roof panels?	Yes
lop (length of opening on wall)	0 ft
H (height of wall)	104.36 in
Lh (length of wall)	6.000 ft
Analyisis will be performed as :	Two-way slab
b (section width)	12 in
h (section thickness)	3 in
ct (cover top)	1.208 in
cb (cover bottom)	1.208 in
rd (assumed reinf. diameter)	0.292 in
dt (effective depth top)	1.5 in
db (effective depth bottom)	1.5 in
Cs (% of DL used for Seismic)	0.196
Eccentricity - Axial Load	1 in
Is wall Split	No

Wire Mesh	
Wire Size	W6.7
spacing	4 in
Mesh Area	0.20 in^2 = As

Factored Laterally Applied Loads

Factored Loading per ACI	ACI eq. 9-4
Factored Pressure on Wall Ww	94.38 psf

Lateral Pressure on Section	
Lw = W*(L^4 / L^4 + H^4)	0.08 klf
Hw = W*(H^4 / H^4 + L^4)	0.02 klf

Unfactored Laterally Applied Loads

Unfactored Pressure on Wall uWw	58.99 psf

Lateral Pressure on Section	
Lw = W*(L^4 / L^4 + H^4)	0.05 klf
Hw = W*(H^4 / H^4 + L^4)	0.01 klf

Deflection ACI 14.8.4

Service Loads	
Axial	1.39 kip
Lateral	0.05 klf
Allowed service deflection	0.70 in
Msa	6.367 kip-in
M	6.455 kip-in
Ds	0.063 in
Check deflection	O.K.

Flexure

Assumption check		
Span	Hw	Lw
net Tensile Strain	0.008	0.008
Check ACI 14.8.2.3	Tension	Tension
Mua	0.280 kip-ft	

ACI eq. (14-6)		
Mu	0.420 kip-ft	0.360 kip-ft

ACI 9.3.2		
fb	0.9	0.9
fMn trial = ϕAsFy(dt - a/2)	1.610 kip-ft	1.610 kip-ft
DM =Mpos - ϕM	0.000 kip-ft	0.000 kip-ft
As Add'l req'd	0.00 in^2	0.00 in^2
Additional reinf req'd	0.00 in^2	0.00 in^2
Add'l bar size:	3	3
qty req'd	0	0
or spacing of:	0	0
As add'l =	0.000 kip-ft	0.000 kip-ft
Ast = As + As add'l	0.20 in^2	0.20 in^2
fMn = ϕAsFy(db - a/2)	1.606 kip-ft	1.606 kip-ft
Check ϕMn > Mu	O.K.	O.K.
% allowed	26.15%	22.42%

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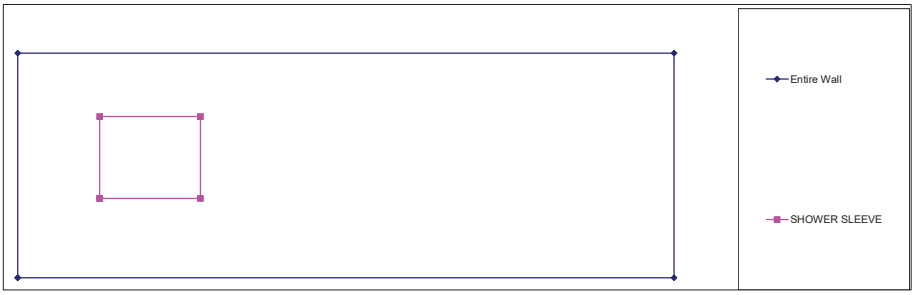

REINFORCEMENT AT OPENINGS

Loading	
Pu (factorized load from roof)	0.41 klf
Ww (weight of panel per sq ft)	0.04 ksf

Material Properties	
db (effective depth bottom)	1.5 in
a (block of strain)	0.33483 psi
	a=As * fy / (0.85 * f'c *b)

Factorized Moment

Opening	Horizontal Location	Vertical Location	L length of opening	H height above opening	(-) Weight of Opening (LBS)	Pw total factorized panel load	wu total factorized load	**Mu** (wu*L^2)/12
SHOWER SLEEVE	0.75 ft	3.08 ft	0.92 ft	2.45 ft	109.25	0.1 klf	0.51 klf	0.04 kip-ft

Flexure

Opening	ϕb	As req'd	Bar size	qty req'd:	**ϕMn** = ϕAsFy(db - a/2)	Check ϕMn > Mu
SHOWER SLEEVE	0.9	0 in^2	No. 3	0	0 kip-ft	O.K.

CONNECTIONS

			Full Resistance Value Overturning				
Base Anchors			Lateral	Base Anchors		Wall-Wall Connection	
Quantity in Shear	Maximum R - Distance	Maximum L - Distance	Shear	Moment +	Moment -	Moment +	Moment -
			kip	kip - ft	kip - ft	kip - ft	kip - ft
3	67	67	22.821	23.95	26.56	40.81	37.34

Total Tension	Base Anchors					
10.521	Dist	Tension (kip)	Shear	L - Dist	Moment +	Moment -
Base Anchor 1	5 in	3.44	5.31	67 in	0.107 kip*ft	19.207 kip*ft
Base Anchor 2	32 in	3.64	12.21	40 in	4.637 kip*ft	7.246 kip*ft
Base Anchor 3	67 in	3.44	5.31	5 in	19.207 kip*ft	0.107 kip*ft

	Wall Connections									
	Quantity of Anchors	Capacity of each Anchor	Countering Dead Load from Adjoining Wall	% of wall to use	Adjoining Wall	Dist (inches)	L - Dist	Allowable Force	Overturning Moment Resistance (kip-ft)	
									Up Left	Low Right
Wall Connection 1	3	*1.531*	10.787	35.83%	W1	0	72.000	4.593	0.000	27.558
Wall Connection 2	2	*2.703*	3.961	100.00%	P1-1	61	11.000	3.961	20.135	3.631
Wall Connection 3	3	*2.703*	4.471	25.00%	W4	55.5	16.500	4.471	20.677	6.147

Wall Shear Checks

Shear Connections at Base			Wall Shear Capacity			Required Shear Capacity (lb) per Base Connector		
Design Force (lb)	Capacity (lb)	Reserve Capacity	Design (PLF)	Resistance (PLF)	check			Reserve Capacity
5150	22821	17671	776	13814	OK	1717	(17671)	OK

RIGIDITY

	CALCULATED VALUES	90%	Final	1.834990701

	Pier Label	Length (inches)	Height (inches)	Fixed Top? (Y/N)	Useable? (Y/N)	Stiffness (k) (1000 kip / IN)	Deflection (in / 1000 kip)
SHOWER SLEEVE	Entire Wall	72	104.36	Y	Y	2.029	0.493
	A'	72	38	Y	Y	8.669	0.115
	A	9	38	Y	Y	0.171	5.862
	B	51.96	38	Y	Y	5.802	0.172

	Combine Logic					
	First Segment	Second Segment	Re-Name	Combine/Subtract	Method	Combined
SHOWER	Entire Wall	A'	A'a	-	Deflection	0.378
	A	B	AB	+	Stiffness	5.973
	A'a	AB	Final	+	Deflection	0.545

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ID:	RAINIER RN-125
	DESIGN OF WALL MARKED W7

Notes

ACI's Alternate Design of Slender Walls	ACI 14.8
Assumptions from this methodology:	
Wall panel shall be simply supported, axially loaded, and subject to out-of-plane uniform lateral loading where maximum moments and deflections occur at mid-height of the wall.	ACI 14.8.2.1
The cross section is constant over the height of the wall panel.	ACI 14.8.2.2
The wall cross sections shall be tension controlled.	ACI 14.8.2.3
Phi*Mn >= Mcr	ACI 14.8.2.4
Concentrated gravity loads are distributed over the wall length	ACI 14.8.2.5
The vertical stress Pu/Ag at mid-height shall not exceed 0.06*f'c	ACI 14.8.2.6

Material Properties

f'c	5000 psi	
Steel Reinforcement	Plain WWF Grade 80	
Fy wire mesh	80000 psi	
Fy rebar	60000 pcf	
Lightweight?	No	
Concrete density	150 pcf	O.K.
E (Steel)	29000000 psi	
E (Concrete)	4290000 psi	ACI 8.5.1
n (modular ratio)	6.76	

Shear Parameters

Phi.v	0.85	ACI 9.3.2.3
Vc	2.546 kip	ACI 11.3.1.1 & 11.2.1.2
Phi*Vc	2.164 kip	ACI 11.1.1

Minimum Wall Reinforcement Requirements

roe.min.vert	0.0012	ACI 14.3.2
roe.min.hor	0.002	ACI 14.3.3
Max Vertical spacing	18 in	ACI 14.3.5
Max Horizontal spacing	18 in	ACI 14.3.5

Geometric Properties

X Corridinate	96.5
Y Corridinate	12.5
Direction of Wall	Y
Center of gravity X	96.500
Center of gravity Y	49.840
Wall Weight	1860.000 lbs.
Central wall?	Yes
Wall that supports 2 roof panels?	Yes
lop (length of opening on wall)	0 ft
H (height of wall)	104.36 in
Lh (length of wall)	6.000 ft
Analyisis will be performed as :	Two-way slab
b (section width)	12 in
h (section thickness)	3 in
ct (cover top)	1.208 in
cb (cover bottom)	1.208 in
rd (assumed reinf. diameter)	0.292 in
dt (effective depth top)	1.5 in
db (effective depth bottom)	1.5 in
Cs (% of DL used for Seismic)	0.196
Eccentricity - Axial Load	1 in
Is wall Split	No

Loading

Axial Design Loads (pressure from roof)		Lateral Design Loads (pressure on wall)	
D (Dead load) + Ww (Wall weight)	98.44 psf	Dead Load (DL.lat)	0 psf
S (Snow Load)	210 psf	Snow Load (SL.lat)	0 psf
L (Live Load)	0 psf	Live Load (LL.lat)	0 psf
Lr (Live Roof Load)	30 psf	Live Roof Load (LLr.lat)	0 psf
W (Wind Load)	108.86 psf	Wind Load (WL.lat)	58.99 psf
E (Earthquake Load)	12.88 psf	Earthquake Load (EL.lat)	7.34 psf

Wire Mesh	
Wire Size	W6.7
spacing	4 in
Mesh Area	0.20 in^2 = As

Factored Axially Applied Loads

Factored Loading per ACI	ACI eq. 9-3
Factored Pressure on Roof Wr	496.213

Axial Pressure on Section	
PuB	2.16 kip

Assumption check	
Pu/Ag	60.000 psi
0.06*f'c	300 psi
Check ACI 14.8.2.6	O.K.

Unfactored Axially Applied Loads

Unfactored Pressure on Roof uWr	300.0825 psf

Axial Pressure on Section	
PB	1.39 kip

Factored Laterally Applied Loads

Factored Loading per ACI	*ACI eq. 9-4*
Factored Pressure on Wall Ww	94.38 psf

Lateral Pressure on Section	
Lw = W*(L^4 / L^4 + H^4)	0.08 klf
Hw = W*(H^4 / H^4 + L^4)	0.02 klf

Unfactored Laterally Applied Loads

Unfactored Pressure on Wall uWw	58.99 psf

Lateral Pressure on Section	
Lw = W*(L^4 / L^4 + H^4)	0.05 klf
Hw = W*(H^4 / H^4 + L^4)	0.01 klf

Shear

Factored Loading per ACI	ACI eq. 9-3
Vu = wuB*(Bw-2db) / 2	0.12
Phi*Vc/2	1.08
Check Shear ACI 11.5.5.1	O.K.

Deflection *ACI 14.8.4*

Service Loads	
Axial	1.39 kip
Lateral	0.05 klf
Allowed service deflection	0.70 in
Msa	6.367 kip-in
M	6.455 kip-in
Ds	0.063 in
Check deflection	O.K.

Allowable Capacity

Ig = (b*h^3)/12	27 in^4
Ag = (b*h)	36 in^2
Yt = h/2	1.5
fr (rupture modulus)	530.330 psi
Mcr	9.546 kip-in
Beta_1	0.8
Trial Ast req'd	0.059 in^2
B	8.836162648
kd	0.480 in
I.cr	1.86 in^4
e_c	0.003
e_s	0.005
a	0.33483 psi
c	0.419 in
Ase	0.23 in^2
Icrdeflection	2.29 in^4
Ie	27.00 in^4
delta	150
r_t (maximum tensile reinforcement)	0.0166
r_{temp} (min. temperature reinforcement)	0.0014
r_{min} (minimum tensile reinforcement)	0.0027
r_{trial} (trial reinforcement ratio bottom)	0.0033
$\rho_{provided}$ (reinforcement ratio provided)	0.0110

Flexure

Assumption check		
Span	Hw	Lw
net Tensile Strain	0.008	0.008
Check ACI 14.8.2.3	Tension	Tension
Mua	0.280 kip-ft	

ACI eq. (14-6)		
Mu	0.420 kip-ft	0.360 kip-ft

ACI 9.3.2		
fb	0.9	0.9
fMn trial = ϕAsFy(dt - a/2)	1.610 kip-ft	1.610 kip-ft
DM =Mpos - ϕM	0.000 kip-ft	0.000 kip-ft
As Add'l req'd	0.00 in^2	0.00 in^2
Additional reinf req'd	0.00 in^2	0.00 in^2
Add'l bar size:	3	3
qty req'd	0	0
or spacing of:	0	0
As add'l =	0.000 kip-ft	0.000 kip-ft
Ast = As + As add'l	0.20 in^2	0.20 in^2
fMn = ϕAsFy(db - a/2)	1.606 kip-ft	1.606 kip-ft
Check ϕMn > Mu	O.K.	O.K.
% allowed	26.15%	22.42%

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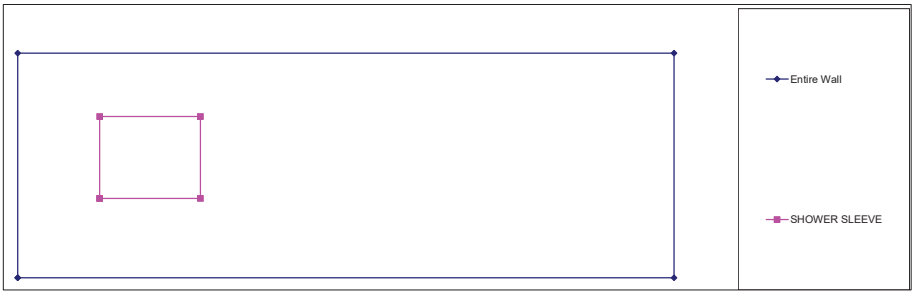

REINFORCEMENT AT OPENINGS

Loading	
Pu (factorized load from roof)	0.41 klf
Ww (weight of panel per sq ft)	0.04 ksf

Material Properties	
db (effective depth bottom)	1.5 in
a (block of strain)	0.33483 psi
	a=As * fy / (0.85 * f'c *b)

Factorized Moment

Opening	Horizontal Location	Vertical Location	L length of opening	H height above opening	(-) Weight of Opening (LBS)	Pw total factorized panel load	wu total factorized load	**Mu** (wu*L^2)/12
SHOWER SLEEVE	0.75 ft	3.08 ft	0.92 ft	2.45 ft	109.25	0.1 klf	0.51 klf	0.04 kip-ft

Flexure

Opening	ϕb	As req'd	Bar size	qty req'd:	**ϕMn** = ϕAsFy(db - a/2)	Check ϕMn > Mu
SHOWER SLEEVE	0.9	0 in^2	No. 3	0	0 kip-ft	O.K.

CONNECTIONS

			Full Resistance Value Overturning				
Base Anchors			Lateral	Base Anchors		Wall-Wall Connection	
Quantity in Shear	Maximum R - Distance	Maximum L - Distance	Shear kip	Moment + kip - ft	Moment - kip - ft	Moment + kip - ft	Moment - kip - ft
3	67	67	22.821	23.95	26.56	33.06	45.09

Total Tension	Base Anchors					
10.521	Dist	Tension (kip)	Shear	L - Dist	Moment +	Moment -
Base Anchor 1	5 in	3.44	5.31	67 in	0.107 kip*ft	19.207 kip*ft
Base Anchor 2	32 in	3.64	12.21	40 in	4.637 kip*ft	7.246 kip*ft
Base Anchor 3	67 in	3.44	5.31	5 in	19.207 kip*ft	0.107 kip*ft

	Wall Connections									
	Quantity of Anchors	Capacity of each Anchor	Countering Dead Load from Adjoining Wall	% of wall to use	Adjoining Wall	Dist (inches)	L - Dist	Allowable Force	Overturning Moment Resistance (kip-ft) Up Left	Low Right
Wall Connection 1	3	*1.531*	10.787	35.83%	W1	0	72.000	4.593	0.000	27.558
Wall Connection 2	2	*2.703*	3.961	100.00%	P1-2	37.5	34.500	3.961	12.378	11.388
Wall Connection 3	3	*2.703*	4.471	25.00%	W4	55.5	16.500	4.471	20.677	6.147

Wall Shear Checks

Shear Connections at Base			Wall Shear Capacity			Required Shear Capacity (lb) per Base Connector		
Design Force (lb)	Capacity (lb)	Reserve Capacity	Design (PLF)	Resistance (PLF)	check			Reserve Capacity
5150	22821	17671	776	13814	OK	1717	(17671)	OK

RIGIDITY

	CALCULATED VALUES	90%	Final	1.834990701

	Pier Label	Length (inches)	Height (inches)	Fixed Top? (Y/N)	Useable? (Y/N)	Stiffness (k) (1000 kip / IN)	Deflection (in / 1000 kip)
SHOWER SLEEVE	Entire Wall	72	104.36	Y	Y	2.029	0.493
	A'	72	38	Y	Y	8.669	0.115
	A	9	38	Y	Y	0.171	5.862
	B	51.96	38	Y	Y	5.802	0.172

	Combine Logic					
	First Segment	Second Segment	Re-Name	Combine/Subtract	Method	Combined
SHOWER	Entire Wall	A'	A'a	-	Deflection	0.378
	A	B	AB	+	Stiffness	5.973
	A'a	AB	Final	+	Deflection	0.545

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MANUFACTURED HOUSING

ID:	RAINIER RN-125
	DESIGN OF WALL MARKED W8

Notes

Material Properties

f'c	5000 psi	
Steel Reinforcement	Plain WWF Grade 80	
Fy wire mesh	80000 psi	
Fy rebar	60000 pcf	
Lightweight?	No	
Concrete density	150 pcf	O.K.
E (Steel)	29000000 psi	
E (Concrete)	4290000 psi	ACI 8.5.1
n (modular ratio)	6.76	

Shear Parameters

Phi.v	0.85	ACI 9.3.2.3
Vc	3.394 kip	ACI 11.3.1.1 & 11.2.1.2
Phi*Vc	2.885 kip	ACI 11.1.1

Minimum Wall Reinforcement Requirements

roe.min.vert	0.0012	ACI 14.3.2
roe.min.hor	0.002	ACI 14.3.3
Max Vertical spacing	18 in	ACI 14.3.5
Max Horizontal spacing	18 in	ACI 14.3.5

Loading

Axial Design Loads (pressure from roof)		Lateral Design Loads (pressure on wall)	
D (Dead load) + Ww (Wall weight)	110.94 psf	Dead Load (DL.lat)	0 psf
S (Snow Load)	210 psf	Snow Load (SL.lat)	0 psf
L (Live Load)	0 psf	Live Load (LL.lat)	0 psf
Lr (Live Roof Load)	30 psf	Live Roof Load (LLr.lat)	0 psf
W (Wind Load)	108.86 psf	Wind Load (WL.lat)	58.99 psf
E (Earthquake Load)	12.88 psf	Earthquake Load (EL.lat)	9.78 psf

Factored Axially Applied Loads

Factored Loading per ACI	ACI eq. 9-3
Factored Pressure on Roof Wr	496.213

Axial Pressure on Section

PuB	2.2 kip

Assumption check

Pu/Ag	45.833 psi
0.06*f'c	300 psi
Check ACI 14.8.2.6	O.K.

Unfactored Axially Applied Loads

Unfactored Pressure on Roof uWr	300.0825 psf

Axial Pressure on Section

PB	1.43 kip

Shear

Factored Loading per ACI	ACI eq. 9-3
Vu = wu8*(Bw-2db) / 2	0
Phi*Vc/2	1.44
Check Shear ACI 11.5.5.1	O.K.

Allowable Capacity

Ig = (b*h^3)/12	64 in^4
Ag = (b*h)	48 in^2
Yt = h/2	2
fr (rupture modulus)	530.330 psi
Mcr	16.971 kip-in
Beta_1	0.8
Trial Ast req'd	0.079 in^2
B	8.836162648
kd	0.569 in
I.cr	3.52 in^4
ε_c	0.003
ε_s	0.005
a	0.33483 psi
c	0.419 in
Ase	0.23 in^2
Icrdeflection	4.35 in^4
Ie	64.00 in^4
delta	150
r_t (maximum tensile reinforcement)	0.0166
r_{temp} (min. temperature reinforcement)	0.0014
r_{min} (minimum tensile reinforcement)	0.0027
r_{actual} (trial reinforcement ratio bottom)	0.0033
$\rho_{provided}$ (reinforcement ratio provided)	0.0080

ACI's Alternate Design of Slender Walls ACI 14.8

Assumptions from this methodology:

Wall panel shall be simply supported, axially loaded, and subject to out-of-plane uniform lateral loading where maximum moments and deflections occur at mid-height of the wall.	ACI 14.8.2.1
The cross section is constant over the height of the wall panel.	ACI 14.8.2.2
The wall cross sections shall be tension controlled.	ACI 14.8.2.3
Phi*Mn >= Mcr	ACI 14.8.2.4
Concentrated gravity loads are distributed over the wall length	ACI 14.8.2.5
The vertical stress Pu/Ag at mid-height shall not exceed 0.06*f'c	ACI 14.8.2.6

Geometric Properties

X Corridinate	18
Y Corridinate	132.5
Direction of Wall	X
Center of gravity X	159.998
Center of gravity Y	132.500
Wall Weight	8579.000 lbs.
Central wall?	Yes
Wall that supports 2 roof panels?	No
lop (length of opening on wall)	0 ft
H (height of wall)	95.5 in
Lh (length of wall)	23.667 ft
Analysis will be performed as :	One-way slab
b (section width)	12 in
h (section thickness)	4 in
ct (cover top)	1.708 in
cb (cover bottom)	1.708 in
rd (assumed reinf. diameter)	0.292 in
dt (effective depth top)	2 in
db (effective depth bottom)	2 in
Cs (% of DL used for Seismic)	0.196
Eccentricity - Axial Load	1 in
Is wall Split	No

Wire Mesh	
Wire Size	W6.7
spacing	4 in
Mesh Area	0.20 in^2 = As

Factored Laterally Applied Loads

Factored Loading per ACI	ACI eq. 9-4
Factored Pressure on Wall Ww	94.38 psf

Lateral Pressure on Section

Lw = W*(L^4 / H^4 + L^4)	0 klf
Hw = W*(L^4 / H^4 + L^4)	0.09 klf

Unfactored Laterally Applied Loads

Unfactored Pressure on Wall uWw	58.99 psf

Lateral Pressure on Section

Lw = W*(L^4 / H^4 + L^4)	0 klf
Hw = W*(L^4 / H^4 + L^4)	0.06 klf

Deflection ACI 14.8.4

Service Loads	
Axial	1.43 kip
Lateral	0 klf
Allowed service deflection	0.64 in
Msa	0.715 kip-in
M	0.719 kip-in
Ds	0.002 in
Check deflection	O.K.

Flexure

Assumption check		
Span	Hw	Lw
net Tensile Strain	0.011	0.011
Check ACI 14.8.2.3	Tension	Tension
Mua	0.802 kip-ft	

ACI eq. (14-6)		
Mu	0.940 kip-ft	0.000 kip-ft

ACI 9.3.2		
fh	0.9	0.9
fMn trial = ϕAsFy(dt - a/2)	2.210 kip-ft	2.210 kip-ft
DM =Mpos - ϕM	0.000 kip-ft	0.000 kip-ft
As Add'l req'd	0.00 in^2	0.00 in^2
Additional reinf req'd	0.00 in^2	0.00 in^2
Add'l bar size:	3	3
qty req'd	0	0
or spacing of:	0	0
As add'l =	0.000 kip-ft	0.000 kip-ft
Ast = As + As add'l	0.20 in^2	0.20 in^2
fMn = ϕAsFy(db - a/2)	2.209 kip-ft	2.209 kip-ft
Check ϕMn > Mu	O.K.	O.K.
% allowed	42.55%	0.00%

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MISSOURI PUBLIC SERVICE COMMISSION
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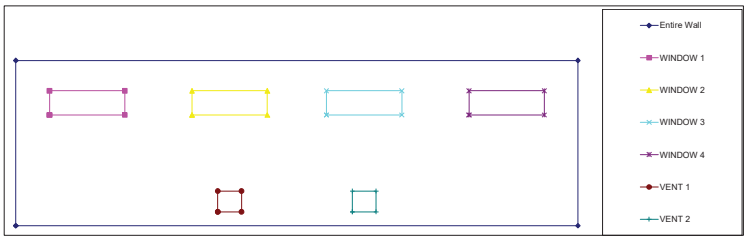
MANUFACTURED HOUSING



REINFORCEMENT AT OPENINGS

Loading	
Pu (factorized load from roof)	0.41 klf
Ww (weight of panel per sq ft)	0.05 ksf

Material Properties	
db (effective depth bottom)	2 in
a (block of strain)	0.33483 psi
	a=As * fy / (0.85 * f'c *b)

Factorized Moment

Opening	Horizontal Location	Vertical Location	L length of opening	H height above opening	(-) Weight of Opening (LBS)	Pw total factorized panel load	wu total factorized load	Mu (wu*L^2)/12
WINDOW 1	1.42 ft	5.33 ft	3.17 ft	1.46 ft	185.18	0.07 klf	0.48 klf	0.4 kip-ft
WINDOW 2	7.42 ft	5.33 ft	3.17 ft	1.46 ft	185.18	0.07 klf	0.48 klf	0.4 kip-ft
WINDOW 3	13.08 ft	5.33 ft	3.17 ft	1.46 ft	185.18	0.07 klf	0.48 klf	0.4 kip-ft
WINDOW 4	19.08 ft	5.33 ft	3.17 ft	1.46 ft	185.18	0.07 klf	0.48 klf	0.4 kip-ft
VENT 1	8.5 ft	0.67 ft	1 ft	6.29 ft	49.92	0.31 klf	0.72 klf	0.06 kip-ft
VENT 2	14.17 ft	0.67 ft	1 ft	6.29 ft	49.92	0.31 klf	0.72 klf	0.06 kip-ft

Flexure

Opening	ϕb	As req'd	Bar size	qty req'd:	ϕMn = ϕAsfy(db - a/2)	Check ϕMn > Mu
WINDOW 1	0.9	0.006 in^2	No. 3	1	7.88 kip-ft	O.K.
WINDOW 2	0.9	0.006 in^2	No. 3	1	7.88 kip-ft	O.K.
WINDOW 3	0.9	0.006 in^2	No. 3	1	7.88 kip-ft	O.K.
WINDOW 4	0.9	0.006 in^2	No. 3	1	7.88 kip-ft	O.K.
VENT 1	0.9	0 in^2	No. 3	0	0 kip-ft	O.K.
VENT 2	0.9	0 in^2	No. 3	0	0 kip-ft	O.K.

CONNECTIONS

			Full Resistance Value				
				Overturning			
Base Anchors			Lateral	Base Anchors		Wall-Wall Connection	
Quantity in Shear	Maximum R - Distance	Maximum L - Distance	Shear kip	Moment + kip - ft	Moment - kip - ft	Moment + kip - ft	Moment - kip - ft
6	272	272	73.254	187.46	187.46	246.45	246.45

Total Tension	Base Anchors					
21.846	Dist	Tension (kip)	Shear	L - Dist	Moment +	Moment -
Base Anchor 1	12 in	3.64	12.21	272 in	0.161 kip*ft	82.529 kip*ft
Base Anchor 2	68 in	3.64	12.21	216 in	5.158 kip*ft	52.045 kip*ft
Base Anchor 3	108 in	3.64	12.21	176 in	13.011 kip*ft	34.554 kip*ft
Base Anchor 4	176 in	3.64	12.21	108 in	34.554 kip*ft	13.011 kip*ft
Base Anchor 5	216 in	3.64	12.21	68 in	52.045 kip*ft	5.158 kip*ft
Base Anchor 6	272 in	3.64	12.21	12 in	82.529 kip*ft	0.161 kip*ft

	Wall Connections								
	Quantity of Anchors	Capacity of each Anchor	Countering Dead Load from Adjoining Wall	% of wall to use	Adjoining Wall	Dist (inches)	L - Dist	Allowable Force	Overturning Moment Resistance (kip-ft) Up Left / Low Right
Wall Connection 1	3	*2.703*	8.624	50.00%	W3	2	282.000	8.109	1.352 / 190.562
Wall Connection 2	3	*2.703*	4.609	50.00%	W5	142	142.000	4.609	54.540 / 54.540
Wall Connection 3	3	*2.703*	8.624	50.00%	W2	282	2.000	8.109	190.562 / 1.352

Wall Shear Checks

Shear Connections at Base			Wall Shear Capacity			Required Shear Capacity (lb) per Base Connector		
Design Force (lb)	Capacity (lb)	Reserve Capacity	Design (PLF)	Resistance (PLF)	check			Reserve Capacity
14451	73254	58803	515	18439	OK	2409	(58803)	OK

RIGIDITY

	CALCULATED VALUES	91%	Final	17.29892936

	Pier Label	Length (inches)	Height (inches)	Fixed Top? (Y/N)	Useable? (Y/N)	Stiffness (k) (1000 kip / IN)	Deflection (in / 1000 kip)
	Entire Wall	284	95.5	Y	Y	19.105	0.052
WINDOW 1	A'	284	14.02	Y	Y	134.936	0.007
	A	17.04	14.02	Y	Y	6.611	0.151
	B	228.92	14.02	Y	Y	108.718	0.009
WINDOW 2	B'	284	14.02	Y	Y	134.936	0.007
	C	89.04	14.02	Y	Y	41.992	0.024
	D	156.92	14.02	Y	Y	74.419	0.013
WINDOW 3	C'	284	14.02	Y	Y	134.936	0.007
	E	156.96	14.02	Y	Y	74.438	0.013
	F	89	14.02	Y	Y	41.973	0.024
WINDOW 4	D'	284	14.02	Y	Y	134.936	0.007
	G	228.96	14.02	Y	Y	108.737	0.009
	H	17	14.02	Y	Y	6.590	0.152
VENT 1	E'	284	11.98	Y	Y	157.947	0.006
	I	102	11.98	Y	Y	56.501	0.018
	J	170	11.98	Y	Y	94.446	0.011
VENT 2	F'	284	11.98	Y	Y	157.947	0.006
	L	170.04	11.98	Y	Y	94.468	0.011
	M	101.96	11.98	Y	Y	56.479	0.018

	Combine Logic					
	First Segment	Second Segment	Re-Name	Combine/Subtract	Method	Combined
WINDOW 1	Entire Wall	A'	A'a	-	Deflection	0.045
	A	B	AB	+	Stiffness	115.329
	A'a	AB	A'b	+	Deflection	0.054
WINDOW 2	A'b	B'	B'a	-	Deflection	0.046
	C	D	CD	+	Stiffness	116.412
	B'a	CD	B'b	+	Deflection	0.055
WINDOW 3	B'b	C'	C'a	-	Deflection	0.047
	E	F	EF	+	Stiffness	116.412
	C'a	EF	C'b	+	Deflection	0.056
WINDOW 4	C'b	D'	D'a	-	Deflection	0.049
	G	H	GH	+	Stiffness	115.327
	D'a	GH	D'b	+	Deflection	0.057
VENT 1	D'b	E'	E'a	-	Deflection	0.051
	I	J	IJ	+	Stiffness	150.947
	E'a	IJ	E'b	+	Deflection	0.058
VENT 2	E'b	F'	F'a	-	Deflection	0.051
	L	M	LM	+	Stiffness	150.947
	F'a	LM	Final	+	Deflection	0.058

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ID:	RAINIER RN-125
	DESIGN OF WALL MARKED P1-1

Notes

ACI's Alternate Design of Slender Walls	ACI 14.8
Assumptions from this methodology:	
Wall panel shall be simply supported, axially loaded, and subject to out-of-plane uniform lateral loading where maximum moments and deflections occur at mid-height of the wall.	ACI 14.8.2.1
The cross section is constant over the height of the wall panel.	ACI 14.8.2.2
The wall cross sections shall be tension controlled.	ACI 14.8.2.3
Phi*Mn >= Mcr	ACI 14.8.2.4
Concentrated gravity loads are distributed over the wall length	ACI 14.8.2.5
The vertical stress Pu/Ag at mid-height shall not exceed 0.06*f'c	ACI 14.8.2.6

Material Properties

f'c	5000 psi	
Steel Reinforcement	Plain WWF Grade 80	
Fy wire mesh	80000 psi	
Fy rebar	60000 pcf	
Lightweight?	No	
Concrete density	150 pcf	O.K.
E (Steel)	29000000 psi	
E (Concrete)	4290000 psi	ACI 8.5.1
n (modular ratio)	6.76	

Shear Parameters

Phi.v	0.85	ACI 9.3.2.3
Vc	2.546 kip	ACI 11.3.1.1 & 11.2.1.2
Phi*Vc	2.164 kip	ACI 11.1.1

Minimum Wall Reinforcement Requirements

roe.min.vert	0.0012	ACI 14.3.2
roe.min.hor	0.002	ACI 14.3.3
Max Vertical spacing	18 in	ACI 14.3.5
Max Horizontal spacing	18 in	ACI 14.3.5

Loading

Axial Design Loads (pressure from roof)		Lateral Design Loads (pressure on wall)	
D (Dead load) + Ww (Wall weight)	98.44 psf	Dead Load (DL.lat)	0 psf
S (Snow Load)	210 psf	Snow Load (SL.lat)	0 psf
L (Live Load)	0 psf	Live Load (LL.lat)	0 psf
Lr (Live Roof Load)	30 psf	Live Roof Load (LLr.lat)	0 psf
W (Wind Load)	108.86 psf	Wind Load (WL.lat)	58.99 psf
E (Earthquake Load)	12.88 psf	Earthquake Load (EL.lat)	7.34 psf

Factored Axially Applied Loads

Factored Loading per ACI	ACI eq. 9-3
Factored Pressure on Roof Wr	496.213

Axial Pressure on Section	
PuB	0.15 kip

Assumption check	
Pu/Ag	4.167 psi
0.06*f'c	300 psi
Check ACI 14.8.2.6	O.K.

Unfactored Axially Applied Loads

Unfactored Pressure on Roof uWr	300.0825 psf

Axial Pressure on Section	
PB	0.15 kip

Shear

Factored Loading per ACI	ACI eq. 9-3
Vu = wuB*(Bw-2db) / 2	-0.03
Phi*Vc/2	1.08
Check Shear ACI 11.5.5.1	O.K.

Allowable Capacity

Ig = (b*h^3)/12	27 in^4
Ag = (b*h)	36 in^2
Yt = h/2	1.5
fr (rupture modulus)	530.330 psi
Mcr	9.546 kip-in
Beta_1	0.8
Trial Ast req'd	0.059 in^2
B	8.836162648
kd	0.480 in
I.cr	1.86 in^4
e_c	0.003
e_s	0.005
a	0.33483 psi
c	0.419 in
Ase	0.2 in^2
Icrdeflection	2.04 in^4
Ie	27.00 in^4
delta	150
r_t (maximum tensile reinforcement)	0.0166
r_{temp} (min. temperature reinforcement)	0.0014
r_{min} (minimum tensile reinforcement)	0.0027
r_{trial} (trial reinforcement ratio bottom)	0.0033
$\rho_{provided}$ (reinforcement ratio provided)	0.0110

Geometric Properties

X Corridinate	225
Y Corridinate	50
Direction of Wall	X
Center of gravity X	238.500
Center of gravity Y	50.000
Wall Weight	492.000 lbs.
Central wall?	No
Wall that supports 2 roof panels?	No
lop (length of opening on wall)	0 ft
H (height of wall)	70 in
Lh (length of wall)	2.250 ft
Analyisis will be performed as :	One-way slab
b (section width)	12 in
h (section thickness)	3 in
ct (cover top)	1.208 in
cb (cover bottom)	1.208 in
rd (assumed reinf. diameter)	0.292 in
dt (effective depth top)	1.5 in
db (effective depth bottom)	1.5 in
Cs (% of DL used for Seismic)	0.196
Eccentricity - Axial Load	1 in
Is wall Split	No

Wire Mesh	
Wire Size	W6.7
spacing	4 in
Mesh Area	0.20 in^2 = As

Factored Laterally Applied Loads

Factored Loading per ACI	ACI eq. 9-4
Factored Pressure on Wall Ww	94.38 psf

Lateral Pressure on Section	
Lw = W*(L^4 / L^4 + H^4)	0.09 klf
Hw = W*(H^4 / H^4 + L^4)	0 klf

Unfactored Laterally Applied Loads

Unfactored Pressure on Wall uWw	58.99 psf

Lateral Pressure on Section	
Lw = W*(L^4 / L^4 + H^4)	0.06 klf
Hw = W*(H^4 / H^4 + L^4)	0 klf

Deflection ACI 14.8.4

Service Loads	
Axial	0.15 kip
Lateral	0.06 klf
Allowed service deflection	0.47 in
Msa	3.138 kip-in
M	3.140 kip-in
Ds	0.014 in
Check deflection	O.K.

Flexure

Assumption check		
Span	Hw	Lw
net Tensile Strain	0.008	0.008
Check ACI 14.8.2.3	Tension	Tension
Mua	0.006 kip-ft	

ACI eq. (14-6)		
Mu	0.010 kip-ft	0.060 kip-ft

ACI 9.3.2		
fb	0.9	0.9
fMn trial = ϕAsFy(dt - a/2)	1.610 kip-ft	1.610 kip-ft
DM =Mpos - ϕM	0.000 kip-ft	0.000 kip-ft
As Add'l req'd	0.00 in^2	0.00 in^2
Additional reinf req`d	0.00 in^2	0.00 in^2
Add'l bar size:	3	3
qty req`d	0	0
or spacing of:	0	0
As add'l =	0.000 kip-ft	0.000 kip-ft
Ast = As + As add'l	0.20 in^2	0.20 in^2
fMn = ϕAsFy(db - a/2)	1.606 kip-ft	1.606 kip-ft
Check ϕMn > Mu	O.K.	O.K.
% allowed	0.62%	3.74%

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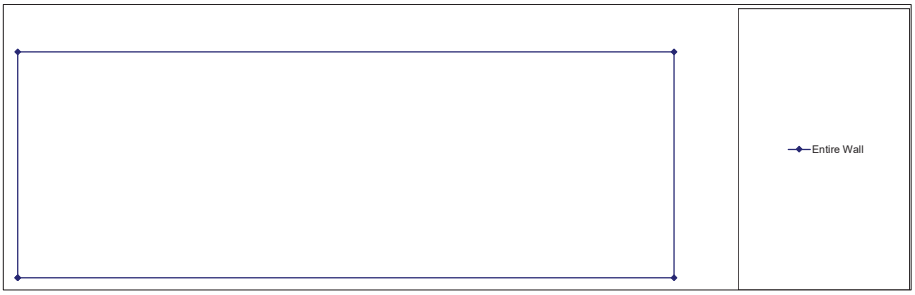

REINFORCEMENT AT OPENINGS

Loading	
Pu (factorized load from roof)	0.41 klf
Ww (weight of panel per sq ft)	0.04 ksf

Material Properties	
db (effective depth bottom)	1.5 in
a (block of strain)	0.33483 psi
	a=As * fy / (0.85 * f'c *b)

Factorized Moment

Opening	Horizontal Location	Vertical Location	L length of opening	H height above opening	(-) Weight of Opening (LBS)	Pw total factorized panel load	wu total factorized load	**Mu** (wu*L^2)/12

Flexure

Opening	ϕb	As req'd	Bar size	qty req'd:	**ϕMn** = ϕAsFy(db - a/2)	Check ϕMn > Mu

CONNECTIONS

			Full Resistance Value Overturning				
Base Anchors			Lateral	Base Anchors		Wall-Wall Connection	
Quantity in Shear	Maximum R - Distance	Maximum L - Distance	Shear kip	Moment + kip - ft	Moment - kip - ft	Moment + kip - ft	Moment - kip - ft
1	21	6	6.292	6.07	1.73	0.00	6.89

Total Tension	Base Anchors					
3.469	Dist	Tension (kip)	Shear	L - Dist	Moment +	Moment -
Base Anchor 1	21 in	***3.47***	***6.29***	6 in	6.071 kip*ft	1.735 kip*ft

	Wall Connections									
	Quantity of Anchors	Capacity of each Anchor	Countering Dead Load from Adjoining Wall	% of wall to use	Adjoining Wall	Dist (inches)	L - Dist	Allowable Force	Overturning Moment Resistance (kip-ft) Up Left	Low Right
Wall Connection 1	2	***1.531***	4.772	38.54%	W6	0	27.000	3.062	0.000	6.890

Wall Shear Checks

Shear Connections at Base			Wall Shear Capacity			Required Shear Capacity (lb) per Base Connector		
Design Force (lb)	Capacity (lb)	Reserve Capacity	Design (PLF)	Resistance (PLF)	check			Reserve Capacity
130	6292	6162	0	15274	OK	130	(6162)	OK

RIGIDITY

CALCULATED VALUES	100%	Final	0

Pier Label	Length (inches)	Height (inches)	Fixed Top? (Y/N)	Useable? (Y/N)	Stiffness (k) (1000 kip / IN)	Deflection (in / 1000 kip)
Entire Wall	27	70	N	Y	0.194	5.166

Combine Logic					
First Segment	Second Segment	Re-Name	Combine/Subtract	Method	Combined
Entire Wall	0	Final			0.194

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ID:	RAINIER RN-125
	DESIGN OF WALL MARKED P1-2

Notes

ACI's Alternate Design of Slender Walls	ACI 14.8
Assumptions from this methodology:	
Wall panel shall be simply supported, axially loaded, and subject to out-of-plane uniform lateral loading where maximum moments and deflections occur at mid-height of the wall.	ACI 14.8.2.1
The cross section is constant over the height of the wall panel.	ACI 14.8.2.2
The wall cross sections shall be tension controlled.	ACI 14.8.2.3
Phi*Mn >= Mcr	ACI 14.8.2.4
Concentrated gravity loads are distributed over the wall length	ACI 14.8.2.5
The vertical stress Pu/Ag at mid-height shall not exceed 0.06*f'c	ACI 14.8.2.6

Material Properties

f'c	5000 psi	
Steel Reinforcement	Plain WWF Grade 80	
Fy wire mesh	80000 psi	
Fy rebar	60000 pcf	
Lightweight?	No	
Concrete density	150 pcf	O.K.
E (Steel)	29000000 psi	
E (Concrete)	4290000 psi	ACI 8.5.1
n (modular ratio)	6.76	

Shear Parameters

Phi.v	0.85	ACI 9.3.2.3
Vc	2.546 kip	ACI 11.3.1.1 & 11.2.1.2
Phi*Vc	2.164 kip	ACI 11.1.1

Minimum Wall Reinforcement Requirements

roe.min.vert	0.0012	ACI 14.3.2
roe.min.hor	0.002	ACI 14.3.3
Max Vertical spacing	18 in	ACI 14.3.5
Max Horizontal spacing	18 in	ACI 14.3.5

Loading

Axial Design Loads (pressure from roof)		Lateral Design Loads (pressure on wall)	
D (Dead load) + Ww (Wall weight)	98.44 psf	Dead Load (DL.lat)	0 psf
S (Snow Load)	210 psf	Snow Load (SL.lat)	0 psf
L (Live Load)	0 psf	Live Load (LL.lat)	0 psf
Lr (Live Roof Load)	30 psf	Live Roof Load (LLr.lat)	0 psf
W (Wind Load)	108.86 psf	Wind Load (WL.lat)	58.99 psf
E (Earthquake Load)	12.88 psf	Earthquake Load (EL.lat)	7.34 psf

Factored Axially Applied Loads

Factored Loading per ACI	ACI eq. 9-3
Factored Pressure on Roof Wr	496.213

Axial Pressure on Section	
PuB	0.15 kip

Assumption check	
Pu/Ag	4.167 psi
0.06*f'c	300 psi
Check ACI 14.8.2.6	O.K.

Unfactored Axially Applied Loads

Unfactored Pressure on Roof uWr	300.0825 psf

Axial Pressure on Section	
PB	0.15 kip

Shear

Factored Loading per ACI	ACI eq. 9-3
Vu = wuB*(Bw-2db) / 2	-0.03
Phi*Vc/2	1.08
Check Shear ACI 11.5.5.1	O.K.

Allowable Capacity

Ig = (b*h^3)/12	27 in^4
Ag = (b*h)	36 in^2
Yt = h/2	1.5
fr (rupture modulus)	530.330 psi
Mcr	9.546 kip-in
Beta_1	0.8
Trial Ast req'd	0.059 in^2
B	8.836162648
kd	0.480 in
I.cr	1.86 in^4
e_c	0.003
e_s	0.005
a	0.33483 psi
c	0.419 in
Ase	0.2 in^2
Icrdeflection	2.04 in^4
Ie	27.00 in^4
delta	150
r_t (maximum tensile reinforcement)	0.0166
r_{temp} (min. temperature reinforcement)	0.0014
r_{min} (minimum tensile reinforcement)	0.0027
r_{trial} (trial reinforcement ratio bottom)	0.0033
$\rho_{provided}$ (reinforcement ratio provided)	0.0110

Geometric Properties

X Corridinate	68
Y Corridinate	50
Direction of Wall	X
Center of gravity X	81.500
Center of gravity Y	50.000
Wall Weight	492.000 lbs.
Central wall?	No
Wall that supports 2 roof panels?	No
lop (length of opening on wall)	0 ft
H (height of wall)	70 in
Lh (length of wall)	2.250 ft
Analyisis will be performed as :	One-way slab
b (section width)	12 in
h (section thickness)	3 in
ct (cover top)	1.208 in
cb (cover bottom)	1.208 in
rd (assumed reinf. diameter)	0.292 in
dt (effective depth top)	1.5 in
db (effective depth bottom)	1.5 in
Cs (% of DL used for Seismic)	0.196
Eccentricity - Axial Load	1 in
Is wall Split	No

Wire Mesh	
Wire Size	W6.7
spacing	4 in
Mesh Area	0.20 in^2 = As

Factored Laterally Applied Loads

Factored Loading per ACI	ACI eq. 9-4
Factored Pressure on Wall Ww	94.38 psf

Lateral Pressure on Section	
Lw = W*(L^4 / L^4 + H^4)	0.09 klf
Hw = W*(H^4 / H^4 + L^4)	0 klf

Unfactored Laterally Applied Loads

Unfactored Pressure on Wall uWw	58.99 psf

Lateral Pressure on Section	
Lw = W*(L^4 / L^4 + H^4)	0.06 klf
Hw = W*(H^4 / H^4 + L^4)	0 klf

Deflection ACI 14.8.4

Service Loads	
Axial	0.15 kip
Lateral	0.06 klf
Allowed service deflection	0.47 in
Msa	3.138 kip-in
M	3.140 kip-in
Ds	0.014 in
Check deflection	O.K.

Flexure

Assumption check		
Span	Hw	Lw
net Tensile Strain	0.008	0.008
Check ACI 14.8.2.3	Tension	Tension
Mua	0.006 kip-ft	

ACI eq. (14-6)		
Mu	0.010 kip-ft	0.060 kip-ft

ACI 9.3.2		
fb	0.9	0.9
fMn trial = ϕAsFy(dt - a/2)	1.610 kip-ft	1.610 kip-ft
DM =Mpos - ϕM	0.000 kip-ft	0.000 kip-ft
As Add'l req'd	0.00 in^2	0.00 in^2
Additional reinf req'd	0.00 in^2	0.00 in^2
Add'l bar size:	3	3
qty req'd	0	0
or spacing of:	0	0
As add'l =	0.000 kip-ft	0.000 kip-ft
Ast = As + As add'l	0.20 in^2	0.20 in^2
fMn = ϕAsFy(db - a/2)	1.606 kip-ft	1.606 kip-ft
Check ϕMn > Mu	O.K.	O.K.
% allowed	0.62%	3.74%

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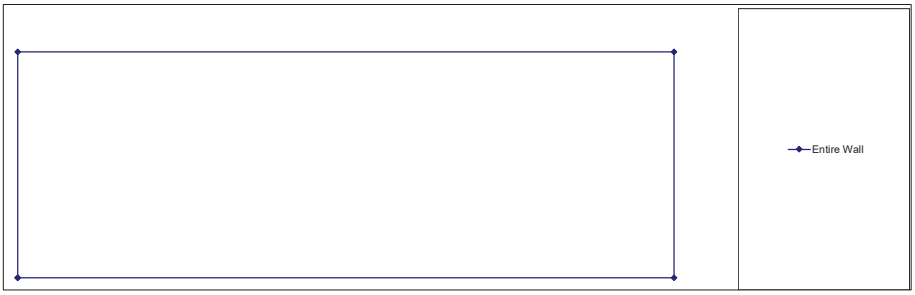

REINFORCEMENT AT OPENINGS

Loading	
Pu (factorized load from roof)	0.41 klf
Ww (weight of panel per sq ft)	0.04 ksf

Material Properties	
db (effective depth bottom)	1.5 in
a (block of strain)	0.33483 psi
	a=As * fy / (0.85 * f'c *b)

Factorized Moment

Opening	Horizontal Location	Vertical Location	L length of opening	H height above opening	(-) Weight of Opening (LBS)	Pw total factorized panel load	wu total factorized load	**Mu** (wu*L^2)/12

Flexure

Opening	ϕb	As req'd	Bar size	qty req'd:	**ϕMn** = ϕAsFy(db - a/2)	Check ϕMn > Mu

CONNECTIONS

			Full Resistance Value Overturning				
Base Anchors			Lateral	Base Anchors		Wall-Wall Connection	
Quantity in Shear	Maximum R - Distance	Maximum L - Distance	Shear kip	Moment + kip - ft	Moment - kip - ft	Moment + kip - ft	Moment - kip - ft
1	6	21	6.292	1.73	6.07	6.89	0.00

Total Tension	Base Anchors					
3.469	Dist	Tension (kip)	Shear	L - Dist	Moment +	Moment -
Base Anchor 1	6 in	***3.47***	***6.29***	21 in	1.735 kip*ft	6.071 kip*ft

	Wall Connections									
	Quantity of Anchors	Capacity of each Anchor	Countering Dead Load from Adjoining Wall	% of wall to use	Adjoining Wall	Dist (inches)	L - Dist	Allowable Force	Overturning Moment Resistance (kip-ft) Up Left	Low Right
Wall Connection 1	2	***1.531***	4.772	38.54%	W7	27	0.000	3.062	6.890	0.000

Wall Shear Checks

Shear Connections at Base			Wall Shear Capacity			Required Shear Capacity (lb) per Base Connector		
Design Force (lb)	Capacity (lb)	Reserve Capacity	Design (PLF)	Resistance (PLF)	check			Reserve Capacity
130	6292	6162	0	15274	OK	130	(6162)	OK

RIGIDITY

CALCULATED VALUES	100%	Final	0

Pier Label	Length (inches)	Height (inches)	Fixed Top? (Y/N)	Useable? (Y/N)	Stiffness (k) (1000 kip / IN)	Deflection (in / 1000 kip)
Entire Wall	27	70	N	Y	0.194	5.166

Combine Logic					
First Segment	Second Segment	Re-Name	Combine/Subtract	Method	Combined
Entire Wall	0	Final			0.194

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ID: **RAINIER RN-125**

DESIGN OF FLOOR PANEL F1

Material Properties

f ' c	5000 psi	
Steel Reinforcement	Plain WWF Grade 80	
Fy	80000 psi	
Lightweight?	No	
C_d (Concrete density)	150 pcf	O.K.
E (Steel)	29000000 psi	
E (Concrete)	4286826 psi	*ACI 8.5.1*
n (modular ratio)	6.76	*ACI 14.0*

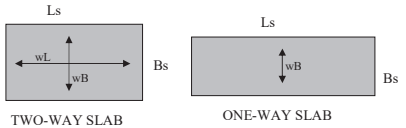
Geometric Properties

Ls (overall length of slab)	23.67 ft		
Bs (overall width of slab)	10.5 ft		
Design will be performed as :	**Two-way slab**		
tfr (floor finish thickness)	0 in		
b (section width)	12 in		*(typically 12 inches)*
h (section thickness)	5 in		
ct (cover top)	3/4 in		
cb (cover bottom)	1 1/4 in		
rd (assumed reinf. diameter)	0.319 in		*(if centered enter 0)*
l (length of slab for deflection)	40.577 in		
dt (effective depth top)	0.910 in		
db (effective depth bottom)	3.431 in		
oh1 (overhang length and qty for Bs)	0 in	0	*{qty of overhangs in Bs direction}*
oh2 (overhang length and qty for Ls)	0 in	0	*{qty of overhangs in ls direction}*
Cs (% of DL used for Seismic)	0.211		*{from seismic analysis}*
NsL (Num. of supports along Ls)	8		*{either walls of vaults or enter "8" if no vault}*
NsB (Num. of supports along Bs)	4		*{either walls of vaults or enter "4" if no vault}*

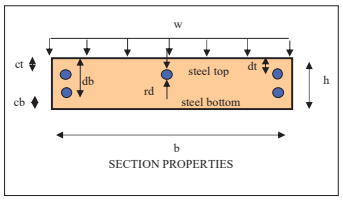
Reinforcement Limits

ρ_t (maximum tensile reinforcement)	0.0166	*ACI 10.3.3*
ρ_{temp} (min. temperature reinforcement)	0.0014	*ACI 7.12.2*
ρ_{min} (minimum tensile reinforcement)	0.0027	*ACI 10.5.1*
ρ_{trial} (trial reinforcement ratio bottom)	0.0033	
ρ_{trial} (trial reinforcement ratio top)	0.0033	

Notes:



fr (rupture modulus)	530.3 psi	*ACI 9.5.2.3*
Ig = (b*h^3)/12	125 in^4	
Ag = (b*h)	60 in^4	
Yt = h/2	2.5 in^4	
Mcr	26.51650429	*ACI 9.5.2.3*
Beta_1	0.8	*ACI 10.2.7.3*
delta_initial	180	
delta_longterm	480	
B	8.830	
kd	0.355 in	
I.cr	0.60 in^4	
c	0 in	
a	0.32 in	



$\rho_{provided}$ (reinforcement ratio provided)	0.0049	
ω =	0.0781	
$\rho_{provided}$ (reinforcement ratio provided)	0.0154	
ω =	0.2469	
$\rho_{provided}$ (reinforcement ratio provided)	0.0041	
ω =	0.0655	
$\rho_{provided}$ (reinforcement ratio provided)	0.0118	
ω =	0.1893	

	Wire Mesh (Top)		
	Wire Size	W6.7	
Trial As' req'd	spacing	4 in	
0.14 in^2	Mesh Area	**0.20 in^2**	**= As'**

	Wire Mesh (Bottom)		
	Wire Size	W6.7	
Trial Ast required	spacing	4 in	
0.136 in^2	Mesh Area	**0.20 in^2**	**= As**

Loading

Design Loads	
Pressure on Slab	**w**
D (Dead load))	62.5 psf
S (Snow Load)	0 psf
L (Live Load)	0 psf
LF (Live Floor Load)	400 psf
W (Wind Load)	0 psf
E (Earthquake Load)	13.21 psf

Sustained Loading	
Pressure on slab	**W**
D (Dead load)	62.5 psf
S (Snow Load)	0 psf
Lr (Live Floor Load)	400 psf

Factored Design Loads		Pressure on Section	Pressure on Section
Factored Loading per ACI equation indicated	Factored Pressure on Slab **W**	**wB** = W*(L^4 / B^4 + L^4)*be	**wL** = W*(B^4 / B^4 + L^4)*be
ACI eq. 9-3	715 psf	0.33 klf	0.38 klf

3.500 ft — 0.58 0.58 kip

3.38 ft — 0.64 0.64 kip

B (Span in the short direction) = (Bs/NsB-1) - 0(oh1)	3.500 ft
L (Span in the long direction) = (Ls/NsL-1) - 0(oh2)	3.38 ft

Factored Sustained Loads		Pressure on Section	Pressure on Section
Factored Loading per ACI equation indicated	Factored Pressure on Slab **W**	**wB** = W*(L^4 / B^4 + L^4)*be	**wL** = W*(B^4 / B^4 + L^4)*be
ASCE7-05 eq CC1a	462.5 psf	0.215 klf	0.247 klf

3.500 ft — 0.38 0.38

3.38 ft — 0.42 0.42

Unfactored Design Loads		Pressure on Section	Pressure on Section
Factored Pressure on Slab **W**		**wB** = W*(L^4 / B^4 + L^4)*be	**wL** = W*(B^4 / B^4 + L^4)*be
400 psf		0.19 klf	0.21 klf

3.500 — 0.33 0.33

3.38 ft — 0.36 0.36

Eficiency can be enhanced if Ast is diminished

SUMMARY

Use 1 Layer of Wire Mesh on Top W6.7 x W6.7 x 4 x 4

Use 1 Layer of Wire Mesh on Bottom W6.7 x W6.7 x 4 x 4

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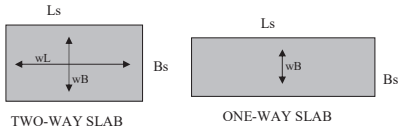
ID: **RAINIER RN-125**

DESIGN OF FLOOR PANEL F1

Notes:



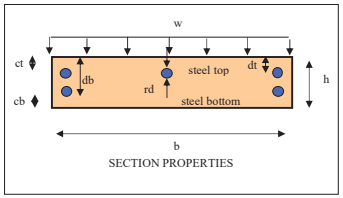
Material Properties

f ' c	5000 psi		
Steel Reinforcement	Plain WWF Grade 80		
Fy	80000 psi		
Lightweight?	No		
C_d (Concrete density)	150 pcf	O.K.	
E (Steel)	29000000 psi		
E (Concrete)	4286826 psi	*ACI 8.5.1*	
n (modular ratio)	6.76	*ACI 14.0*	

Geometric Properties

Ls (overall length of slab)	23.67 ft		
Bs (overall width of slab)	10.5 ft		
Design will be performed as :	**Two-way slab**		
tfr (floor finish thickness)	0 in		
b (section width)	12 in	*(typically 12 inches)*	
h (section thickness)	5 in		
ct (cover top)	3/4 in		
cb (cover bottom)	1 1/4 in		
rd (assumed reinf. diameter)	0.319 in	*(if centered enter 0)*	
l (length of slab for deflection)	40.577 in		
dt (effective depth top)	0.910 in		
db (effective depth bottom)	3.431 in		
oh1 (overhang length and qty for Bs)	0 in	0	*{qty of overhangs in Bs direction}*
oh2 (overhang length and qty for Ls)	0 in	0	*{qty of overhangs in ls direction}*
Cs (% of DL used for Seismic)	0.211	*{from seismic analysis}*	
NsL (Num. of supports along Ls)	8	*{either walls of vaults or enter "8" if no vault}*	
NsB (Num. of supports along Bs)	4	*{either walls of vaults or enter "4" if no vault}*	

fr (rupture modulus)	530.3 psi	*ACI 9.5.2.3*
Ig = (b*h^3)/12	125 in^4	
Ag = (b*h)	60 in^4	
Yt = h/2	2.5 in^4	
Mcr	26.51650429	*ACI 9.5.2.3*
Beta_1	0.8	*ACI 10.2.7.3*
delta_initial	180	
delta_longterm	480	
B	8.830	
kd	0.355 in	
I.cr	0.60 in^4	
c	0 in	
a	0.32 in	



SECTION PROPERTIES

$\rho_{provided}$ (reinforcement ratio provided)	0.0049
ω =	0.0781
$\rho_{provided}$ (reinforcement ratio provided)	0.0154
ω =	0.2469
$\rho_{provided}$ (reinforcement ratio provided)	0.0041
ω =	0.0655
$\rho_{provided}$ (reinforcement ratio provided)	0.0118
ω =	0.1893

Flexure

	Flexural Moments for Bs	Mu	Tensile Strain	Check ACI 14.8.2.3	ϕb	ϕMn trial = ϕf'cbd^2ω(1-0.59ω)	ΔM = Mu - ϕM	**ϕMn** =	Check ϕMn > Mu	% allowed
**	Mpos (positive Moment) = (wB*B^2)*0.08	0.32 kip-ft	0.036	Tension	0.9	3.95 kip-ft		3.95 kip-ft	O.K.	8.19%
**	Mneg (negative Moment) = (wB*B^2)*0.1	0.40 kip-ft	0.036	Tension	0.9	4.74 kip-ft		4.74 kip-ft	O.K.	8.53%

***continuous beam moment coefficients used*

Structural Plain Concrete per ACI 22.5

	Mu	S Elastic Section Modulus	ϕb	**ϕMn** = ϕ5*(f'c*S)^0.5	Check ϕMn > Mu	% allowed
Moh1 (Moment at oh1) = 0	0.00 kip-ft	0.029 ft^3	0.55	1.046 kip-ft	O.K.	0.00%

	Flexural Moments for Ls	Mu	Tensile Strain	Check ACI 14.8.2.3	ϕb	ϕMn trial = ϕf'cbd^2ω(1-0.59ω)	ΔM = Mu - ϕM	**ϕMn** =	Check ϕMn > Mu	% allowed
**	Mpos (positive Moment) = (wL*L^2)*0.078	0.34 kip-ft	0.036	Tension	0.9	3.95 kip-ft		3.95 kip-ft	O.K.	8.57%
**	Mneg (negative Moment) = (wB*B^2)*0.106	0.40 kip-ft	0.036	Tension	0.9	4.74 kip-ft		4.74 kip-ft	O.K.	8.43%

***continuous beam moment coefficients used*

Structural Plain Concrete per ACI 22.5

	Mu	S Elastic Section Modulus	ϕb	**ϕMn** = ϕ5*(f'c*S)^0.5	Check ϕMn > Mu	% allowed
Moh1 (Moment at oh1) = 0	0.00 kip-ft	0.029 ft^3	0.55	1.046 kip-ft	O.K.	0.00%

Shear

	Maximum Shear for Bs	Vu	ϕv per ACI 9.3.2.3	Vc per ACI 11.3.1.1	**ϕVc**	Check ϕVc > Vu	% allowed
**	VuB = wB * B * 0.6	0.69 kip	0.85	5.82 kip	4.95 kip	O.K.	14.00%
				per ACI 22.8			
**	Voh1 = 0	0.00 kip	0.55	2.98 kip	1.64 kip	O.K.	0.00%

***continuous beam shear coefficients used*

	Shear for Ls	Vu	ϕv per ACI 9.3.2.3	Vc per ACI 11.3.1.1	**ϕVc**	Check ϕVc > Vu	% allowed
**	VuL = wL * L * 0.605633802816901	0.51 kip	0.85	5.82 kip	4.95 kip	O.K.	10.22%
				per ACI 22.8			
**	Voh2 = 0	0.00 kip	0.55	2.98 kip	1.64 kip	O.K.	0.00%

***continuous beam shear coefficients used*

Deflection

Span type:	K	Sustained Load Duration	Epsilon
Simple span	1	6 months	1.2

	Service Loads													
Span	Mserv	M.sus	I.eff.serv	I.eff.sustained	**Immediate Deflection Δi**	ρ_{comp}	λ	Long-Term Deflection Δl-t	**Δ total long-term deflection (Δi + Δl-t)**	Δ allow (immediate)	Δ allow (long term)	Check short term deflection	Check long term deflection	% allowed - short term	% allowed - long term
B	0.32 kip-ft	0.33 kip-ft	125.00 in	125.00 in	0.001 in	0.0049	0.9646	0.001 in	0.003 in	0.2333 in	0.0875 in	O.K.	O.K.	0.58%	1.49%
L	0.34 kip-ft	0.35 kip-ft	125.00 in	125.00 in	0.001 in	0.0049	0.9646	0.001 in	0.003 in	0.2253 in	0.0845 in	O.K.	O.K.	0.60%	1.55%

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MANUFACTURED HOUSING

ID: **RAINIER RN-125**

Geometric properties	
Bs (width of roof panel)	11.92 ft
Ls (Length of roof panel)	26.67 ft
Ar Area of Roof	317.78 ft^2
H (height of building)	9.69 ft
Lb (length of building)	23.67 ft
Wb (width of building)	10.5 ft
Ab (Area of building)	248.54 ft^2
Nv (quantity of vaults)	0
Avl (Area of Vault Lips)	0.00 ft^2
Av (Area of Vault)	0.00 ft^2
Vh (Vault height)	0 ft
Cab (Closed Area of building)	237.22 ft^2
Hw (depth of floodwater)	1 ft

Loading	
Wv (weight of vault)**	0 lb
Wtr (roof panel weight)	19146 lb
Ww (total walls panel weight)	33461 lb
Fw (floor panel weight)	15186 lb
We (estimated weight of building)	67793 lb
Wev (estimated weight of building w/ vault)	67793 lb
PSFr (roof snow load)	210 psf
PSFf (Floor Live Load)	400 psf
Pmax (Maximum allowable pressure)	1500 psf
Fupmw (MWFRS Uplift Force)	38.41 psf
WLlat (MWFRS lateral wind pressure)	51.74 psf
γw (specific weight of water)	62.4 pcf

**Weight of vault is not considered in sliding resistance

μ (sliding factor)	0.40	**FS** (factor of safety required)	1.00

CHECK SLIDING RESISTANCE

Shear	**.7*Vseismic** (from seismic analysis with snow)	12007.0 lb
	.7*Vseismic (from seismic analysis without snow)	10032.0 lb
	Vwind = WLlat * max(Wb,Lb)*H	11867.8 lb

* Load adjustment per IBC 1605.3 load combinations.

Sliding Resistance with Snow	Pslide = u*(.6*We+.75*PSFr*Ar)	Pslide =	36290.32 lb			
					Fsreqd	
Factor of Safety	FSwind = Pslide / Vwind	FSwind =	3.1	≥	1.0	O.K.
	FSseismic = Pslide / Vseismic	Fseismic =	3.0	≥	1.0	O.K.
Sliding Resistance with No Snow	Pslide = u*.6*We	Pslide =	16270.32 lb			
					Fsreqd	
Factor of Safety	FSwind = Pslide / Vwind	Fswind =	1.4	≥	1.0	O.K.
	FSseismic = Pslide / Vseismic	Fseismic =	1.6	≥	1.0	O.K.

CHECK OVERTURNING RESISTANCE

Shear	.7*Otseismic (from seismic analysis with snow)	106.892 kip-ft
	.7*Otseismic (from seismic analysis without snow)	88.834 kip-ft
	Otwind = (WLlat*Lb*H^2 / 2) + (Fupmw*Lb*Wb^2 / 2)	107.618 kip-ft

* Load adjustment per IBC 1605.3 load combinations.

Overturning Resistance with Snow	Otrsnow = (.6*We+.75*PSFr*Ar)*(Wb/2)	Otrsnow =	221.560 kip-ft			
					Fsreqd	
Factor of Safety	FSwind = Otrsnow / Otwind	FSwind =	2.06	≥	1.0	O.K.
	FSseismic = Otrsnow / Vseismic	Fseismic =	2.07	≥	1.0	O.K.
Overturning Resistance with No Snow	Otr = .6*We*Wb/2	Otr	213.548 kip-ft			
					Fsreqd	
Factor of Safety	FSwind = Otr / Vwind	Fswind =	1.98	≥	1.0	O.K.
	FSseismic = Otr / Vseismic	Fseismic =	2.40	≥	1.0	O.K.

CHECK BEARING PRESSURE CONDITION

Net Pressure	Pnet = (Wev + PSFr*Ar + PSFf*Af) / Ab	941.27 psf

Allowable	Pmax ≥ Pnet	1500 psf ≥ 941.27 psf	O.K.

By observation, if the building is placed on a properly prepared well drained granular sub-base, the design is sufficient for lateral and vertical loads.

CHECK BUOYANCY FORCE CONDITION

Buoyant Force	Fb = γw*Av*Hw+γw*Cab*(Hw-Vh)	**Fb =**	14802.67 lb			
Factor of Safety	FSb = We / Fb	**FSb =**	4.58	≥	1.00	O.K.

The weight of the building exceeds the buoyant force due to hydrostatic pressure acting on the horizontal surface of the vault, therefore, the design is sufficient against buoyancy.

Floor Design Information:

1) The referenced building is made of flood damage resistant 5000 psi reinforced concrete.
2) The vault system, if existing, is designed to minimize infiltration into system and can be considered water tight to a height of 17"
3) Flood Ventilation is available at threshold level and flood ventilation exceeding 1" per sq. ft. of floor area is provided no more than 12" A.F.F.

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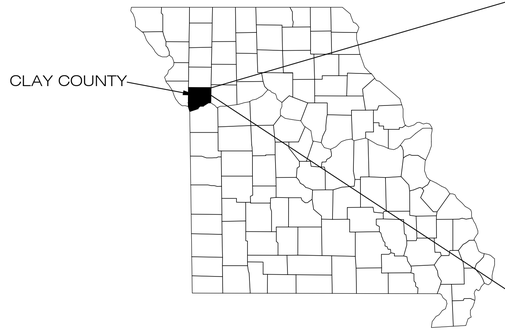
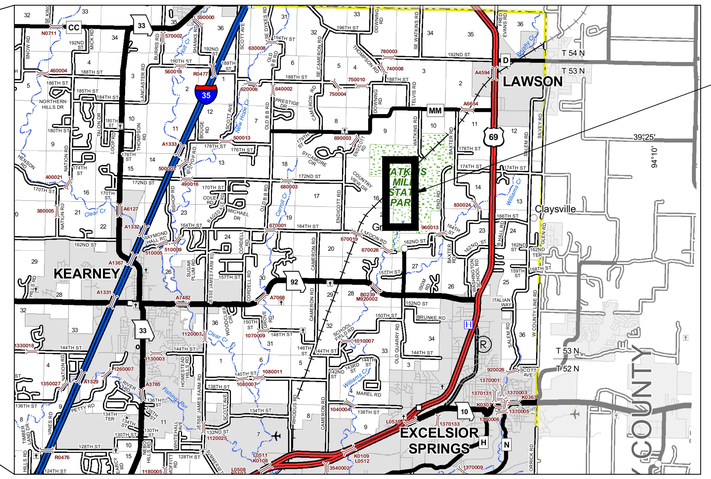
MISSOURI CERTIFICATE OF AUTHORITY: 000143

Watkins Mill State Park & Historic Site
Upgrade Wastewater Treatment System
Lawson, Missouri





CLAY COUNTY, MISSOURI

OWNER: STATE OF MISSOURI
ERIC GREITENS,
GOVERNOR

DEPARTMENT OF
NATURAL RESOURCES

PROJECT
MANAGEMENT: OFFICE OF ADMINISTRATION
DIVISION OF FACILITIES MANAGEMENT,
DESIGN AND CONSTRUCTION

DESIGNER: SHAFER, KLINE & WARREN, INC.
3200 PENN TERRACE, SUITE 100
COLUMBIA, MO 65202
(573) 442-4537

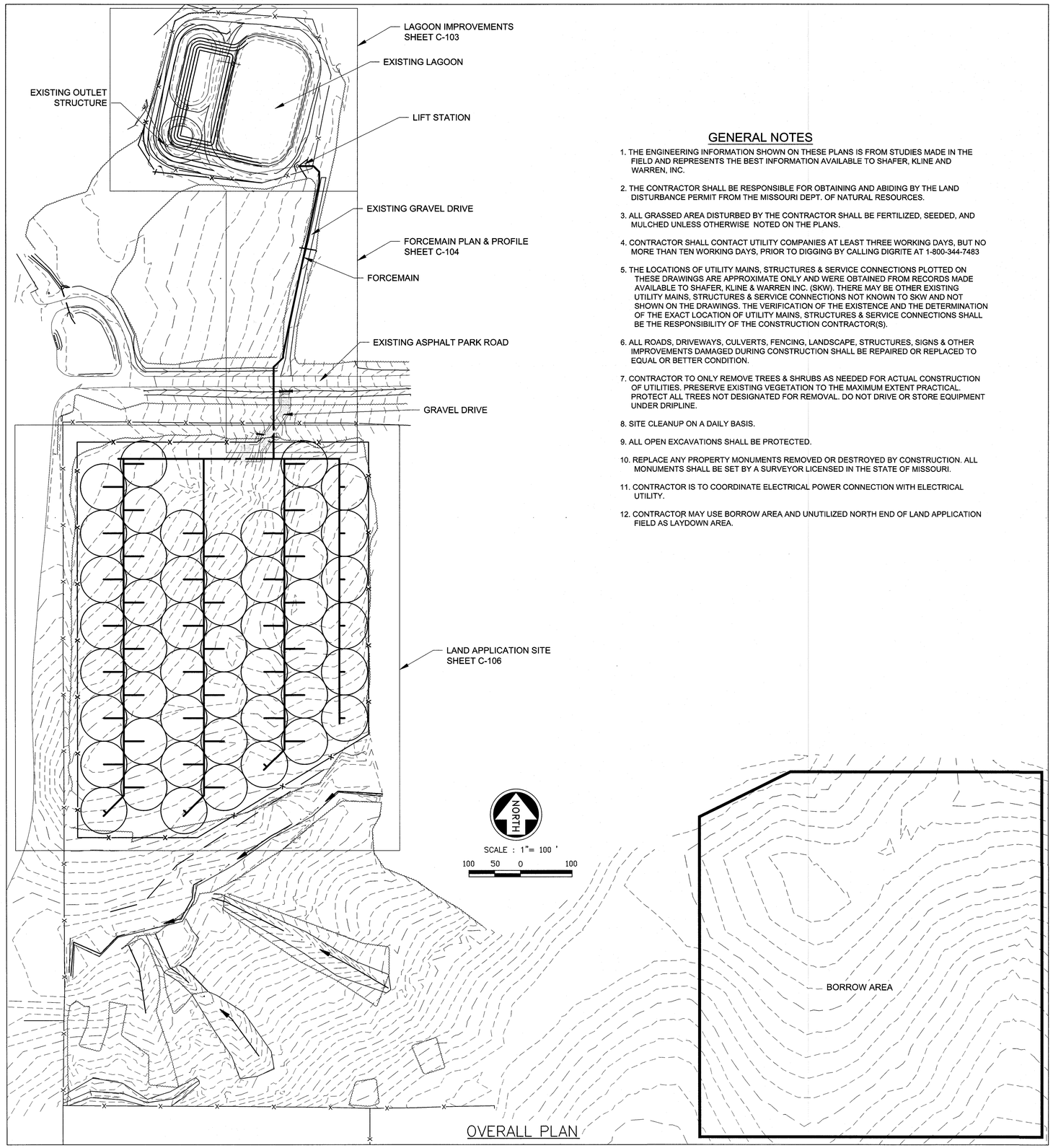
PROJECT NUMBER: X 1410-01

SITE NUMBER: 4118
FACILITY NUMBER: 51577
ISSUE DATE: 4-3-2017

SHEET NUMBER:

G-001

1 OF 16 SHEETS
April 3, 2017



OVERALL PLAN

GENERAL NOTES

1. THE ENGINEERING INFORMATION SHOWN ON THESE PLANS IS FROM STUDIES MADE IN THE FIELD AND REPRESENTS THE BEST INFORMATION AVAILABLE TO SHAFER, KLINE AND WARREN, INC.
2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING AND ABIDING BY THE LAND DISTURBANCE PERMIT FROM THE MISSOURI DEPT. OF NATURAL RESOURCES.
3. ALL GRASSED AREA DISTURBED BY THE CONTRACTOR SHALL BE FERTILIZED, SEEDED, AND MULCHED UNLESS OTHERWISE NOTED ON THE PLANS.
4. CONTRACTOR SHALL CONTACT UTILITY COMPANIES AT LEAST THREE WORKING DAYS, BUT NO MORE THAN TEN WORKING DAYS, PRIOR TO DIGGING BY CALLING DIGRITE AT 1-800-344-7483
5. THE LOCATIONS OF UTILITY MAINS, STRUCTURES & SERVICE CONNECTIONS PLOTTED ON THESE DRAWINGS ARE APPROXIMATE ONLY AND WERE OBTAINED FROM RECORDS MADE AVAILABLE TO SHAFER, KLINE & WARREN INC. (SKW). THERE MAY BE OTHER EXISTING UTILITY MAINS, STRUCTURES & SERVICE CONNECTIONS NOT KNOWN TO SKW AND NOT SHOWN ON THE DRAWINGS. THE VERIFICATION OF THE EXISTENCE AND THE DETERMINATION OF THE EXACT LOCATION OF UTILITY MAINS, STRUCTURES & SERVICE CONNECTIONS SHALL BE THE RESPONSIBILITY OF THE CONSTRUCTION CONTRACTOR(S).
6. ALL ROADS, DRIVEWAYS, CULVERTS, FENCING, LANDSCAPE, STRUCTURES, SIGNS & OTHER IMPROVEMENTS DAMAGED DURING CONSTRUCTION SHALL BE REPAIRED OR REPLACED TO EQUAL OR BETTER CONDITION.
7. CONTRACTOR TO ONLY REMOVE TREES & SHRUBS AS NEEDED FOR ACTUAL CONSTRUCTION OF UTILITIES. PRESERVE EXISTING VEGETATION TO THE MAXIMUM EXTENT PRACTICAL. PROTECT ALL TREES NOT DESIGNATED FOR REMOVAL. DO NOT DRIVE OR STORE EQUIPMENT UNDER DRIPLINE.
8. SITE CLEANUP ON A DAILY BASIS.
9. ALL OPEN EXCAVATIONS SHALL BE PROTECTED.
10. REPLACE ANY PROPERTY MONUMENTS REMOVED OR DESTROYED BY CONSTRUCTION. ALL MONUMENTS SHALL BE SET BY A SURVEYOR LICENSED IN THE STATE OF MISSOURI.
11. CONTRACTOR IS TO COORDINATE ELECTRICAL POWER CONNECTION WITH ELECTRICAL UTILITY.
12. CONTRACTOR MAY USE BORROW AREA AND UNUTILIZED NORTH END OF LAND APPLICATION FIELD AS LAYDOWN AREA.

SHEET INDEX

BID ITEMS

Item	Description	Units	Est. Qty
	LAGOON CONSTRUCTION		
1	Sludge Removal - 3-cell lagoon	LS	1
2	Lagoon Earthwork, complete including compaction	LS	1
3	Lagoon Liner, installed complete including compaction	CY	1,750
4	Lagoon Fencing, installed complete, including relocated and additional lengths	LF	417
5	Effluent Structure Modifications, installed complete with internal and lagoon piping	LS	1
6	6" SDR 26 PVC Gravity Outfall Line, installed complete	LF	84
7	8" SDR 26 PVC Gravity Sewer Line, installed complete	LF	260
8	4-ft Diameter Standard Manhole, installed complete	EA	1
9	Silt Fence, installed complete	LF	592
10	Clearing and Grubbing, including removal of obsolete materials	LS	1
11	Rip Rap at Lagoon	SY	280
	LAND APPLICATION SYSTEM		
12	Electric Service Line Extension to Pump Station, installed complete	LS	1
13	Pump Station, installed complete, incl. DIP, fittings, valves, meter, gauge, drain li	LS	1
14	6" SDR 26 PVC Forcemain, complete installed with tracer wire & fittings	LF	557
15	6" Yellowmine PVC Directional Bore	LF	40
16	4" SDR 21 PVC Pipe, complete installed with tracer wire and fittings	LF	156
17	3" SDR 21 PVC Pipe, complete installed with tracer wire and fittings	LF	914
18	2" SDR 21 PVC Pipe, complete installed with tracer wire and fittings	LF	927
19	1.5" SDR 21 PVC Pipe, complete installed with tracer wire and fittings	LF	450
20	1" SDR 21 PVC Pipe, complete installed with tracer wire on lateral and fittings	LF	2,120
21	Sprinkler Assembly, complete installed	EA	48
22	1" Line Termination System, complete installed	EA	4
23	4" Line Termination System, complete installed	EA	1
24	Land Application Field Fencing, installed complete	LF	2,519
25	12 ft Gate, installed complete	EA	1
26	24" CMP Culvert, complete installed with two Flared End Sections	LF	18
27	18" CMP Culvert, complete installed with one Flared End Section	LF	30
28	Gravel Drive and Turnaround, complete installed, including clearing	SY	500
	SEPTIC SYSTEM		
29	Sludge Removal - Residence	LS	1
30	Lagoon Earthwork, complete including compaction	LS	1
31	4" SDR 35 PVC Service Line, installed complete including connections	LF	190
32	Septic Tank, installed complete including connections	LS	1
33	Electric Service Line Extension for Dosing Tank, installed complete	LS	1
34	Dosing Tank, installed complete including connections, pump and controls	LS	1
35	Distribution Field and Header, installed complete	LS	1
36	Curtain Drain, installed complete	LF	160
37	Clearing and Grubbing, including removal & abandonment of obsolete materials	LS	1
	MISCELLANEOUS CONSTRUCTION		
38	Mobilization/Demobilization	LS	1
39	Maintenance and Compliance with SWPPP	LS	1
40	Site Restoration, Fertilize, Seed and Mulch	LS	1
41	Construction Staking	LS	1

NOTE:
QUANTITIES ARE NOT GUARANTEED AND ARE PROVIDED FOR ESTIMATING PURPOSES ONLY. BIDDER TO VERIFY QUANTITIES IN PREPARATION OF BID.

IN KANSAS 1-800-344-7233 DIG-SAFE

IN MISSOURI 1-800-344-7483 DIG-RITE

STATE OF MISSOURI
ERIC GREITENS, GOVERNOR

STATE OF MISSOURI
ELKE B. BOYD
NUMBER PE-2005022092
PROFESSIONAL ENGINEER
4/3/2017

SHAFER, KLINE & WARREN, INC.
107 Butler Street; Macon, MO 63552-1628
660/385-6441 FAX: 660/385-6614
OFFICE LOCATIONS: Lenexa, KS; Tulsa, OK; North Kansas City, MO; Moline, IL; Columbia, MO; Houston, TX
CIVIL ENGINEERS ELECTRICAL ENGINEERS MECHANICAL ENGINEERS STRUCTURAL ENGINEERS LANDSCAPE ARCHITECTS LAND SURVEYORS LAND PLANNERS
MISSOURI CERTIFICATE OF AUTHORITY: 000143

OFFICE OF ADMINISTRATIO
DIVISION OF FACILITIES MANAGEMENT, DESIGN AND CONSTRUCTIO

DEPARTMENT OF NATURAL RESOURCES

PROJECT TITLE
WATKINS MILL STATE PARK & HISTORIC SITE
UPGRADE WASTEWATER TREATMENT SYSTEM

WATKINS MILL STATE PARK & HISTORIC SITE

PROJECT # X 1410-01
SITE # 4118
FACILITY # 51577

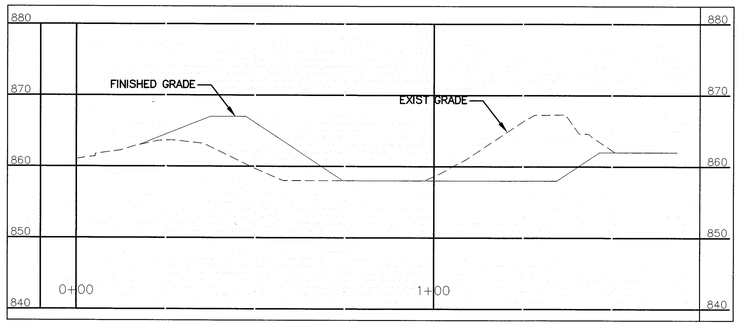
REVISION:
DATE:
REVISION:
DATE:
REVISION:
DATE:
ISSUE DATE: 4/3/2017

CAD DWG FILE: C-101.dwg
DRAWN BY: JWR
CHECKED BY: DES
DESIGNED BY: EBB

SHEET TITLE:
OVERALL PLAN

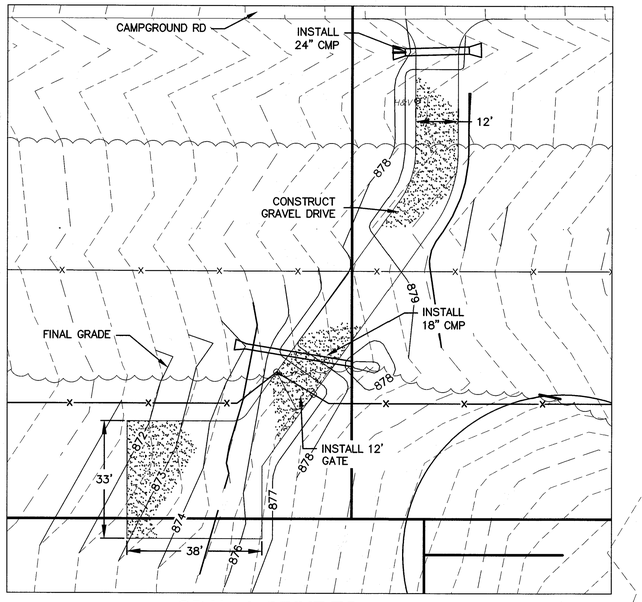
SHEET NUMBER:
C-101

2 OF 16 SHEETS
4/3/2017



LAGOON SECTION A-A

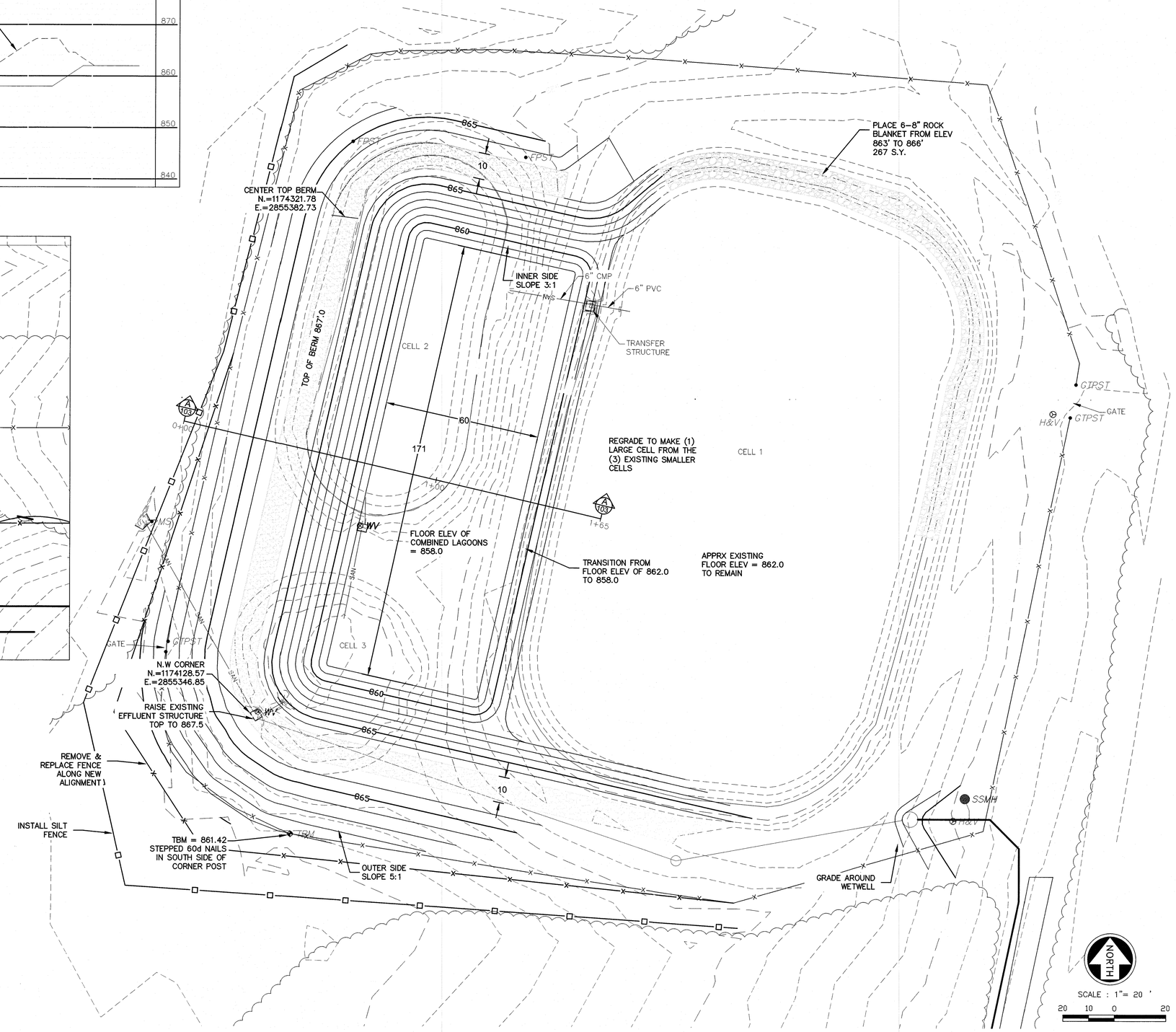
SCALE: VERT: 1"= 10'
HORZ: 1"= 20'



GRAVEL DRIVE TO LAND APPLICATION

SCALE: 1"= 20'

NOTE: IF BORROW SITE IS UTILIZED, ANY TOPSOIL SHALL BE STOCKPILED AND RETURNED TO THE TOP OF THE DISTURBED AREA AT THE END OF WORK AT THE BORROW SITE. GRADE SITE TO DRAIN AND SEED PER SPECIFICATIONS



ESTIMATED EARTHWORK QUANTITIES
CUT = 2318 CY
FILL = 2418 CY

*ASSUMES NO SHRINKAGE

SCALE : 1"= 20 '

20 10 0 20

STATE OF MISSOURI
ERIC GREITENS,
GOVERNOR

STATE OF MISSOURI
ELKE B. BOYD
NUMBER PE-2005022082
PROFESSIONAL ENGINEER
04/03/2017

SHAFER, KLINE & WARREN, INC.
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Tulsa, OK
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CIVIL ENGINEERS ELECTRICAL ENGINEERS MECHANICAL ENGINEERS STRUCTURAL ENGINEERS LANDSCAPE ARCHITECTS LAND SURVEYORS LAND PLANNERS
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DEPARTMENT OF NATURAL RESOURCES

PROJECT TITLE
WATKINS MILL STATE PARK & HISTORIC SITE
UPGRADE WASTEWATER TREATMENT SYSTEM

WATKINS MILL STATE PARK & HISTORIC SITE

PROJECT # X 1410-01
SITE # 4118
FACILITY # 51577

REVISION:
DATE:
REVISION:
DATE:
REVISION:
DATE:
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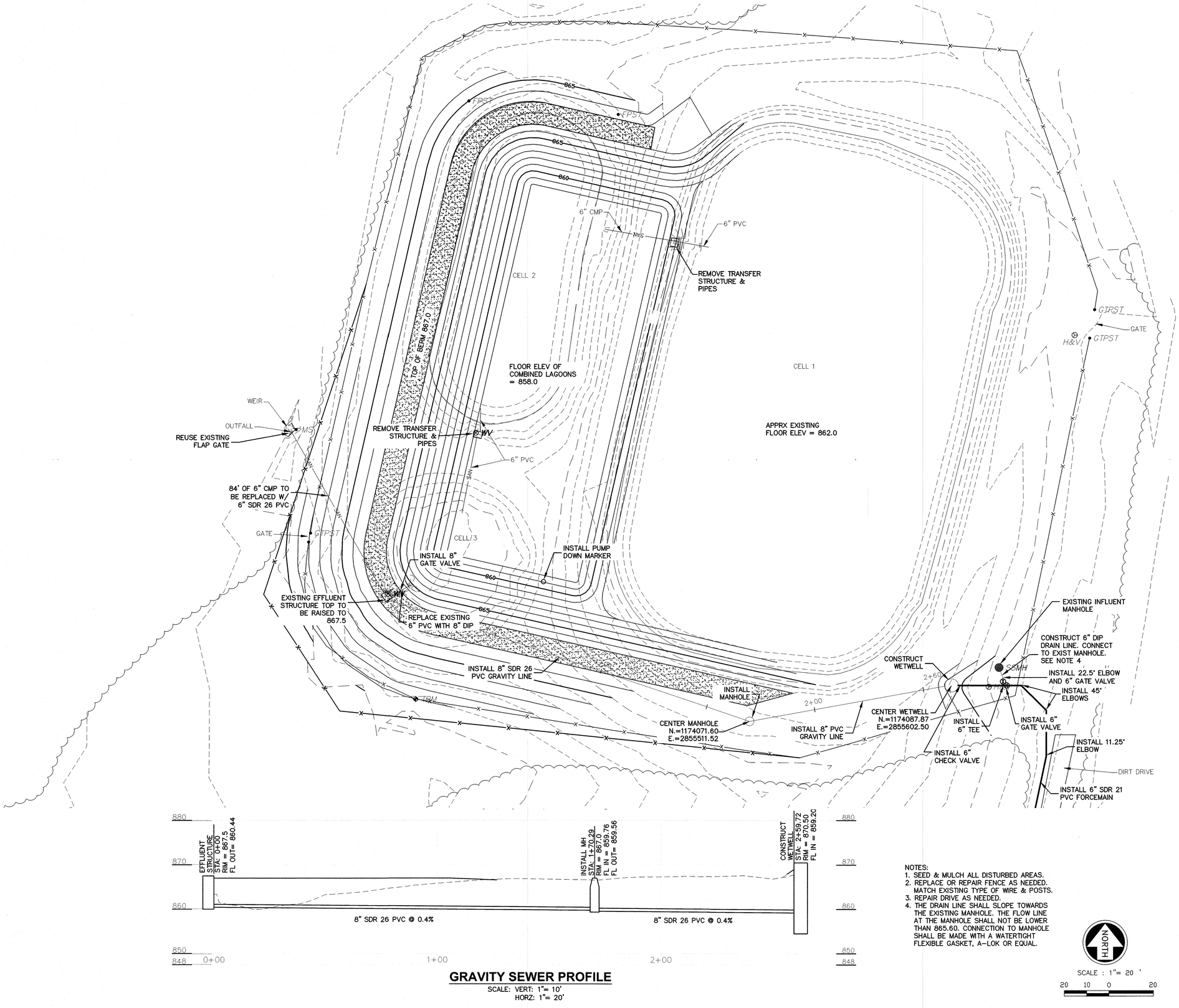
CAD DWG FILE: C-102.dwg
DRAWN BY: JWR
CHECKED BY: DES
DESIGNED BY: EBB

SHEET TITLE:
GRADING PLAN

SHEET NUMBER:
C-102

3 OF 16 SHEETS
4/3/2017



GRAVITY SEWER PROFILE

SCALE: VERT: 1"= 10'
HORZ: 1"= 20'

NOTES:
1. SEED & MULCH ALL DISTURBED AREAS.
2. REPLACE OR REPAIR FENCE AS NEEDED. MATCH EXISTING TYPE OF WIRE & POSTS.
3. REPAIR DRIVE AS NEEDED.
4. THE DRAIN LINE SHALL SLOPE TOWARDS THE EXISTING MANHOLE. THE FLOW LINE AT THE MANHOLE SHALL NOT BE LOWER THAN 865.60. CONNECTION TO MANHOLE SHALL BE MADE WITH A WATERTIGHT FLEXIBLE GASKET, A-LOK OR EQUAL.

NORTH

SCALE : 1"= 20 '

20 10 0 20

STATE OF MISSOURI
ERIC GREITENS, GOVERNOR

STATE OF MISSOURI
BLKE B. BOYD
NUMBER PE-2005022082
PROFESSIONAL ENGINEER
04/03/2017

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REVISION:
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DATE:
REVISION:
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ISSUE DATE: 4/3/2017

CAD DWG FILE: C-103.dwg
DRAWN BY: JWR
CHECKED BY: DES
DESIGNED BY: EBB

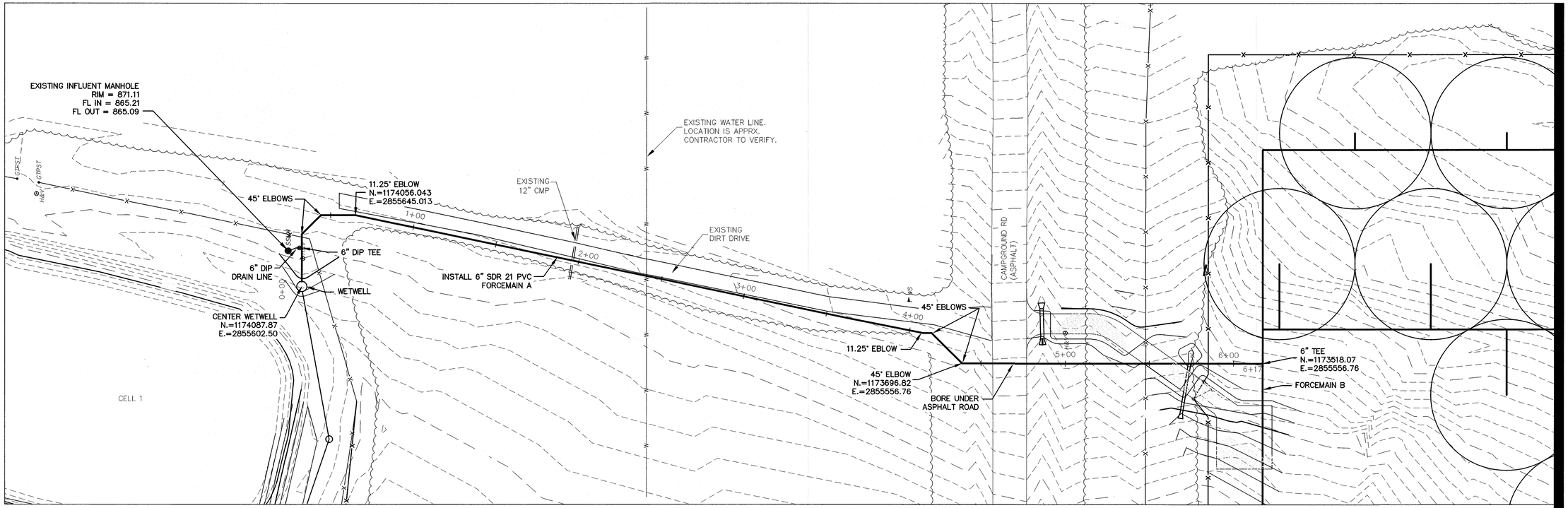
SHEET TITLE:

LAGOON SITE PLAN

SHEET NUMBER:

C-103

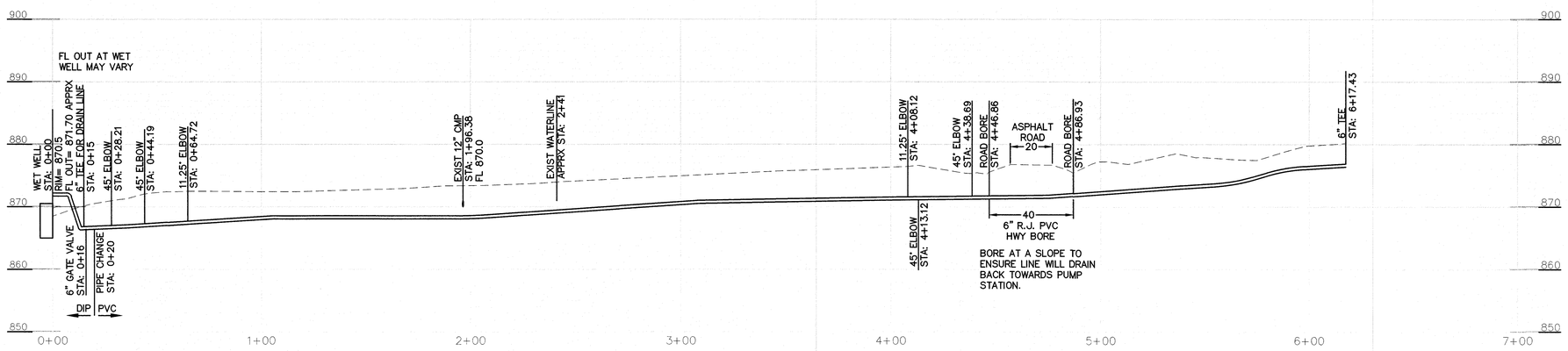
4 OF 16 SHEETS
4/3/2017



NORTH

SCALE : 1"= 20 '

20 10 0 20



FORCEMAIN A PROFILE

SCALE: VERT: 1"= 10'
HORIZ: 1"= 30'

NOTES:
1. FORCEMAIN SHALL HAVE A MINIMUM OF 42" OF COVER.
2. ALL PIPING IS TO BE SDR 21 PVC UNLESS OTHERWISE NOTED.
3. THE 6" TEE FOR THE DRAIN LINE SHALL BE LOCATED AT THE LOW POINT OF THE FORCEMAIN TO ALLOW DRAINAGE.
4. MINIMUM OF 18" VERTICAL SEPARATION BETWEEN FORCEMAIN AND WATERLINE.

STATE OF MISSOURI
ERIC GREITENS,
GOVERNOR

STATE OF MISSOURI
ELKE B. BOYD
NUMBER
PE-2005022082
PROFESSIONAL ENGINEER
04/03/2017

SHAFER, KLINE & WARREN, INC.
107 Butler Street, Macon, MO 63552-1628
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WATKINS MILL STATE PARK
& HISTORIC SITE

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FACILITY # 51577

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DATE:
REVISION:
DATE:
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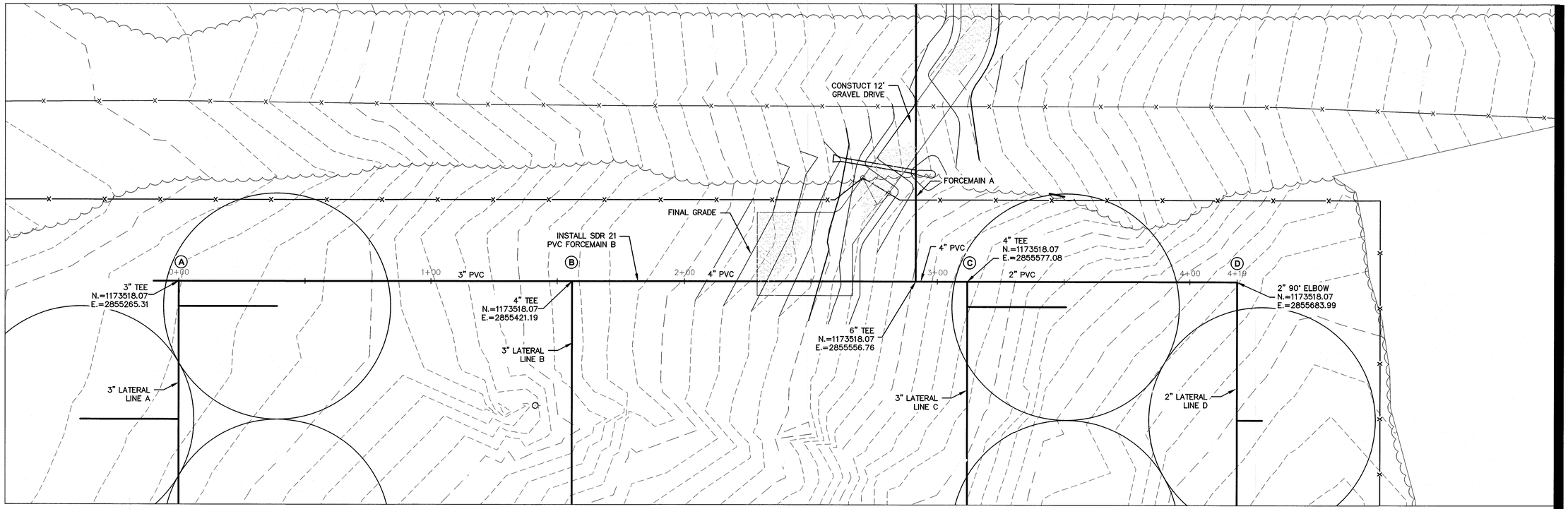
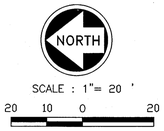
CAD DWG FILE: C-104.dwg
DRAWN BY: JWR
CHECKED BY: DES
DESIGNED BY: EBB

SHEET TITLE:
FORCEMAIN A
PLAN & PROFILE

SHEET NUMBER:
C-104

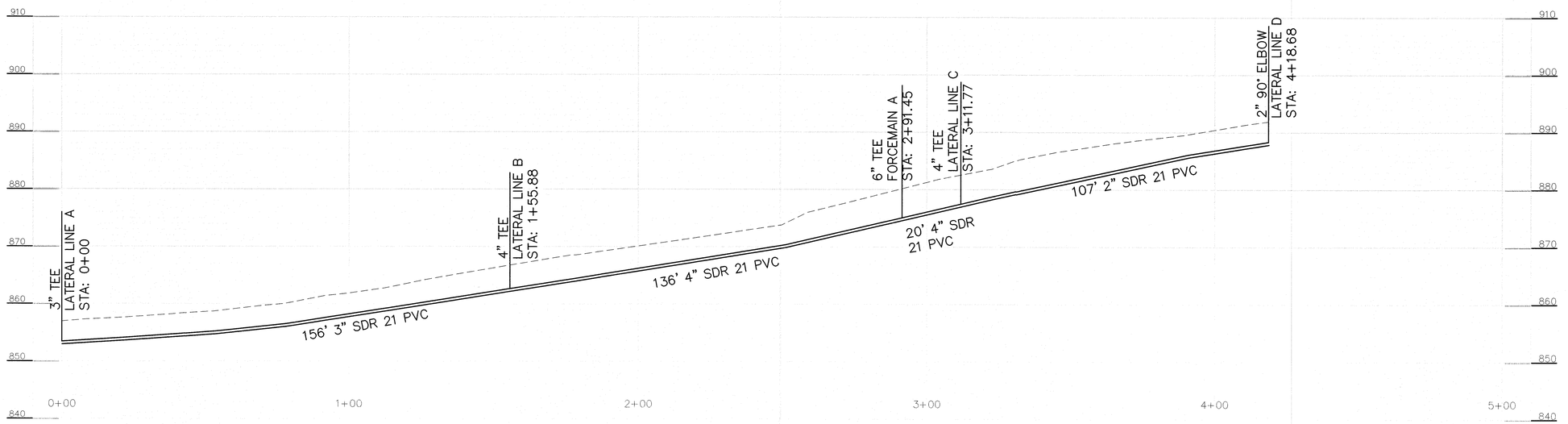
5 OF 16 SHEETS
4/3/2017





SCALE : 1"= 20 '

20 10 0 20



FORCEMAIN B PROFILE

SCALE: VERT: 1"= 10'
HORIZ: 1"= 20'

NOTES:
1. FORCEMAIN SHALL HAVE A MINIMUM OF 42" OF COVER.
2. ALL PIPING IS TO BE SDR 21 PVC UNLESS OTHERWISE NOTED.

STATE OF MISSOURI
ERIC GREITENS, GOVERNOR

STATE OF MISSOURI
ELKE B. BOYD
NUMBER PE-2005022093
PROFESSIONAL ENGINEER

4/13/2017

SHAFER, KLINE & WARREN, INC.
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MISSOURI CERTIFICATE OF AUTHORITY: 000143

OFFICE OF ADMINISTRATIC
DIVISION OF FACILITIES MANAGEMENT,
DESIGN AND CONSTRUCTIC

DEPARTMENT OF NATURAL RESOURCES

PROJECT TITLE
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UPGRADE WASTEWATER TREATMENT SYSTEM

WATKINS MILL STATE PARK & HISTORIC SITE

PROJECT # X 1410-01
SITE # 4118
FACILITY # 51577

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DATE:
REVISION:
DATE:
ISSUE DATE: 4/3/2017

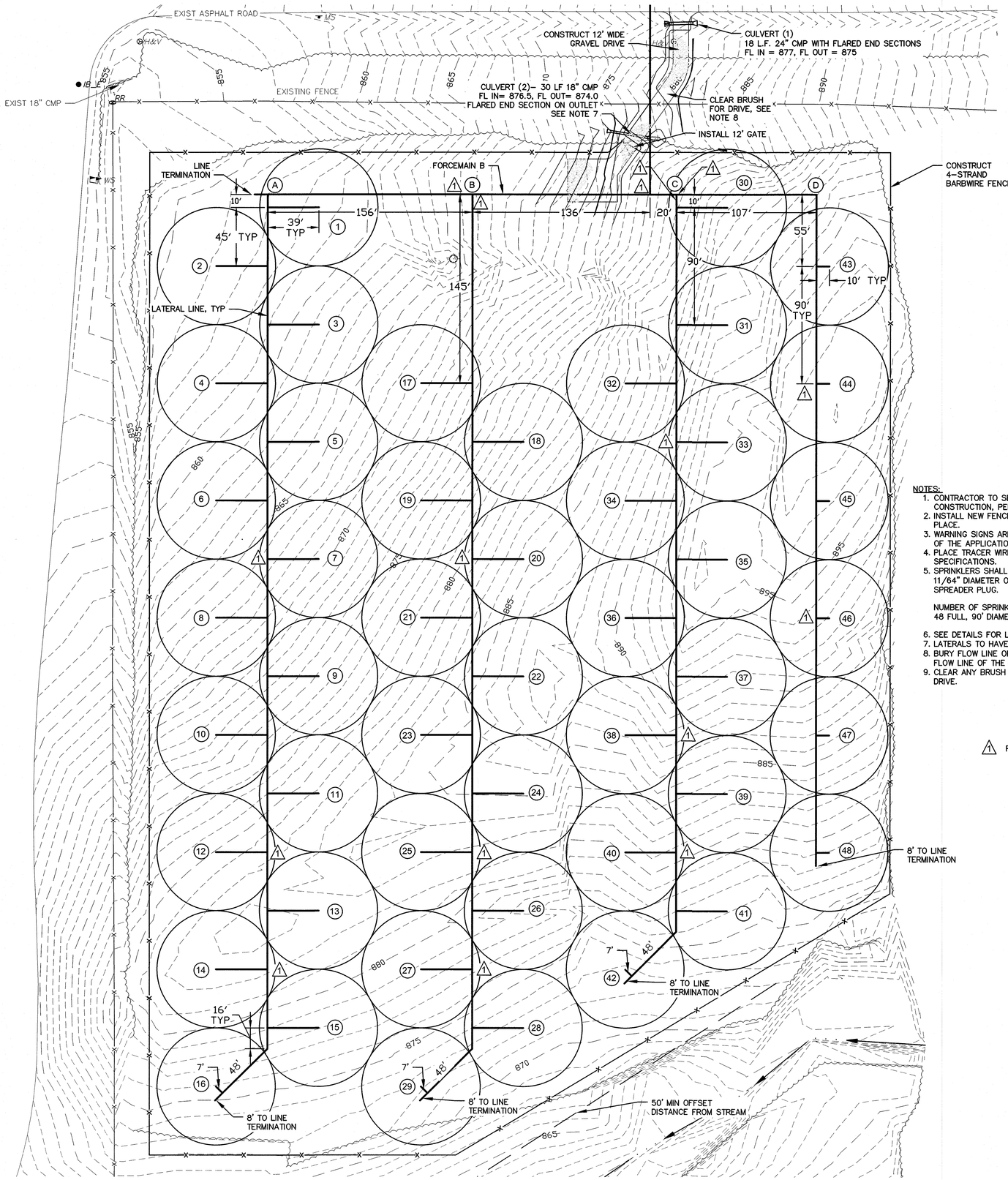
CAD DWG FILE: C-105.dwg
DRAWN BY: JWR
CHECKED BY: DES
DESIGNED BY: EBB

SHEET TITLE:
FORCEMAIN B PLAN & PROFILE

SHEET NUMBER:
C-105

6 OF 16 SHEETS
4/3/2017

Line Segment	Main Line Size (in)	Main Line Length (ft)	Sprinkler Line Size (in)	Sprinkler Line Length (ft)
FM A: PS to FM B	6.0	617.4	---	---
FM B: FM A to Lat B	4.0	135.6	---	---
FM B: Lat B to Lat A	3.0	156.0	---	---
Lat A to Termination	3.0	8.0	---	---
Lat A: FM B to A1	3.0	10.0	1.0	39.0
A1 to A2	3.0	45.0	1.0	39.0
A2 to A3	3.0	45.0	1.0	39.0
A3 to A4	3.0	45.0	1.0	39.0
A4 to A5	3.0	45.0	1.0	39.0
A5 to A6	3.0	45.0	1.0	39.0
A6 to A7	3.0	45.0	1.0	39.0
A7 to A8	2.0	45.0	1.0	39.0
A8 to A9	2.0	45.0	1.0	39.0
A9 to A10	2.0	45.0	1.0	39.0
A10 to A11	2.0	45.0	1.0	39.0
A11 to A12	2.0	45.0	1.0	39.0
A12 to A13	1.5	45.0	1.0	39.0
A13 to A14	1.5	45.0	1.0	39.0
A14 to A15	1.0	45.0	1.0	39.0
A15 to A16	1.0	16.0	1.0	48.0
A16 to Termination	---	---	1.0	8.0
Lat B: FM B to B17	3.0	145.0	1.0	39.0
B17 to B18	3.0	45.0	1.0	39.0
B18 to B19	3.0	45.0	1.0	39.0
B19 to B20	3.0	45.0	1.0	39.0
B20 to B21	2.0	45.0	1.0	39.0
B21 to B22	2.0	45.0	1.0	39.0
B22 to B23	2.0	45.0	1.0	39.0
B23 to B24	2.0	45.0	1.0	39.0
B24 to B25	2.0	45.0	1.0	39.0
B25 to B26	1.5	45.0	1.0	39.0
B26 to B27	1.5	45.0	1.0	39.0
B27 to B28	1.0	45.0	1.0	39.0
B28 to B29	1.0	16.0	1.0	48.0
B29 to Termination	---	---	1.0	8.0
FM B: FM A to Lat C	4.0	20.0	---	---
Lat C: FM B to C30	3.0	10.0	1.0	39.0
C30 to C31	3.0	90.0	1.0	39.0
C31 to C32	3.0	45.0	1.0	39.0
C32 to C33	3.0	45.0	1.0	39.0
C33 to C34	2.0	45.0	1.0	39.0
C34 to C35	2.0	45.0	1.0	39.0
C35 to C36	2.0	45.0	1.0	39.0
C36 to C37	2.0	45.0	1.0	39.0
C37 to C38	2.0	45.0	1.0	39.0
C38 to C39	1.5	45.0	1.0	39.0
C39 to C40	1.5	45.0	1.0	39.0
C40 to C41	1.0	45.0	1.0	39.0
C41 to C42	1.0	16.0	1.0	48.0
C42 to Termination	---	---	1.0	8.0
FM B: Lat C to Lat D	2.0	107.0	---	---
Lat D: FM B to D43	2.0	55.0	1.0	10.0
D43 to D44	2.0	90.0	1.0	10.0
D44 to D45	1.5	90.0	1.0	10.0
D45 to D46	1.5	90.0	1.0	10.0
D46 to D47	1.0	90.0	1.0	10.0
D47 to D48	1.0	90.0	1.0	10.0
D48 to Termination	1.0	8.0	---	---



NOTES:
1. CONTRACTOR TO SEED AND MULCH ALL DISTURBED AREAS AFTER CONSTRUCTION, PER SPECIFICATIONS.
2. INSTALL NEW FENCE AS SHOWN. EXISTING FENCE TO BE ABANDONED IN PLACE.
3. WARNING SIGNS ARE TO BE PLACED AT 200' INTERVALS ON ALL SIDES OF THE APPLICATION AREA ON NEW FENCE. SEE FENCE DETAILS.
4. PLACE TRACER WIRE OVER FORCEMAINS & LATERALS PER SPECIFICATIONS.
5. SPRINKLERS SHALL BE RAINBIRD MODEL 30WH (SBN-3V) OR EQUAL: 11/64" DIAMETER ORIFICE, 4.3 GPM AT 25 PSI BRASS IMPACT WITH SPREADER PLUG.

   NUMBER OF SPRINKLERS:
   48 FULL, 90' DIAMETER PATTERN
6. SEE DETAILS FOR LINE TERMINATION.
7. LATERALS TO HAVE MINIMUM OF 36" OF COVER.
8. BURY FLOW LINE OF CULVERT 2, ON INLET SIDE, 6" (ELEV= 876.5). FLOW LINE OF THE DITCH AT INLET OF CULVERT SHALL BE 877.0.
9. CLEAR ANY BRUSH LESS THAN 18" IN DIAMETER 20' FROM EACH SIDE OF DRIVE.

1 PIPE CHANGE

NORTH

SCALE : 1"= 40 '

40 20 0 40

STATE OF MISSOURI
ERIC GREITENS, GOVERNOR

BLKE B BOYD
NUMBER PE-2005022682
PROFESSIONAL ENGINEER
04/03/2017

SHAFER, KLINE & WARREN, INC.
107 Butler Street, Macon, MO 63552-1628
660/385-6441 FAX: 660/385-6614
OFFICE LOCATIONS: Macon, MO; Columbia, MO; Houston, TX; Lenexa, KS; Tulsa, OK; North Kansas City, MO
CIVIL ENGINEERS ELECTRICAL ENGINEERS MECHANICAL ENGINEERS STRUCTURAL ENGINEERS LANDSCAPE ARCHITECTS LAND SURVEYORS LAND PLANNERS
MISSOURI CERTIFICATE OF AUTHORITY: 000143

OFFICE OF ADMINISTRATIO
DIVISION OF FACILITIES MANAGEMENT, DESIGN AND CONSTRUCTIO

DEPARTMENT OF NATURAL RESOURCES

PROJECT TITLE
WATKINS MILL STATE PARK & HISTORIC SITE
UPGRADE WASTEWATER TREATMENT SYSTEM

WATKINS MILL STATE PARK & HISTORIC SITE

PROJECT # X 1410-01
SITE # 4118
FACILITY # 51577

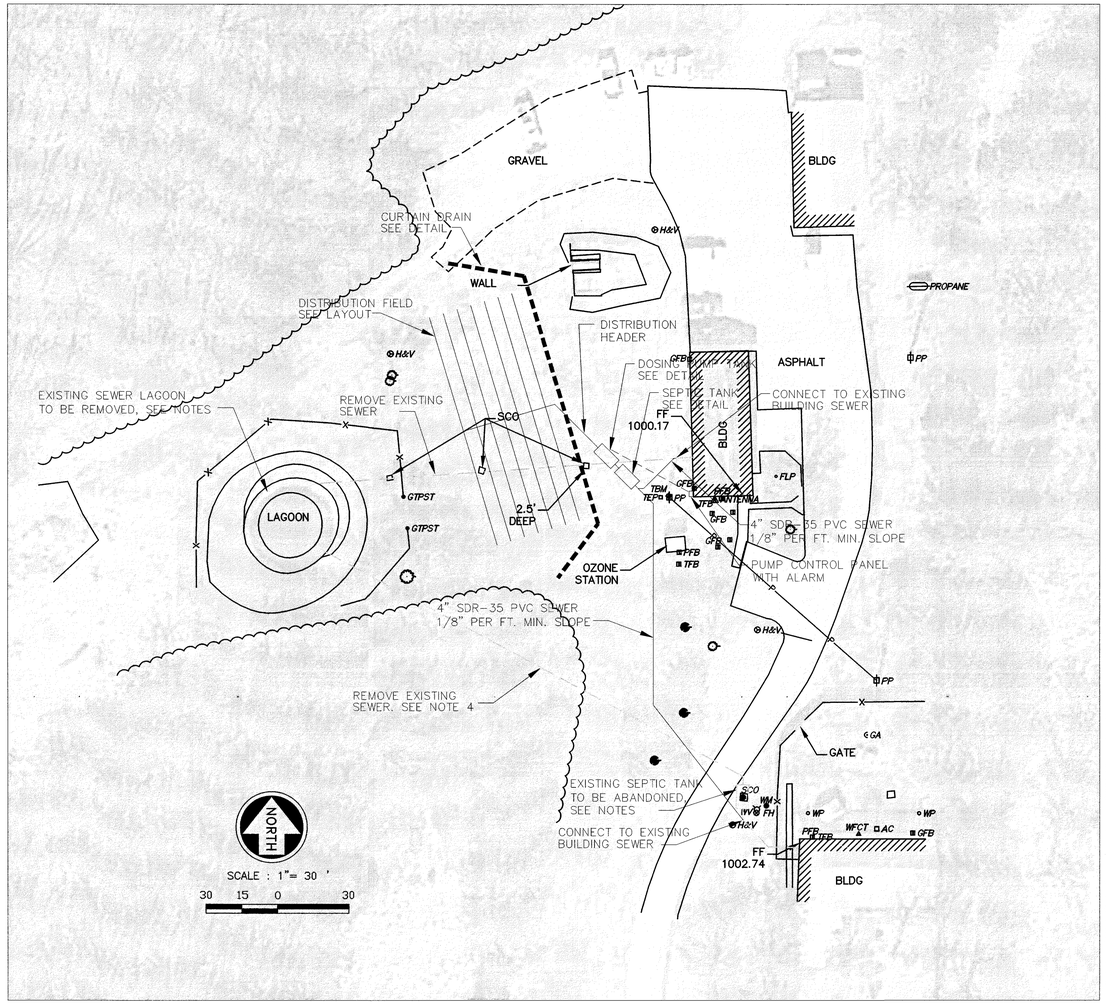
REVISION:
DATE:
REVISION:
DATE:
REVISION:
DATE:
ISSUE DATE: 4/3/2017

CAD DWG FILE: C-106.dwg
DRAWN BY: JWR
CHECKED BY: DES
DESIGNED BY: EBB

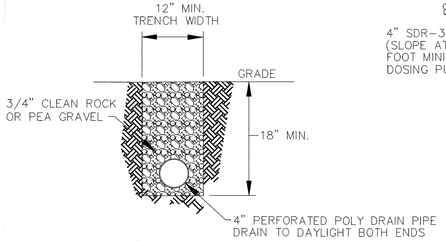
SHEET TITLE:
LAND APPLICATION SITE PLAN

SHEET NUMBER:
C-106

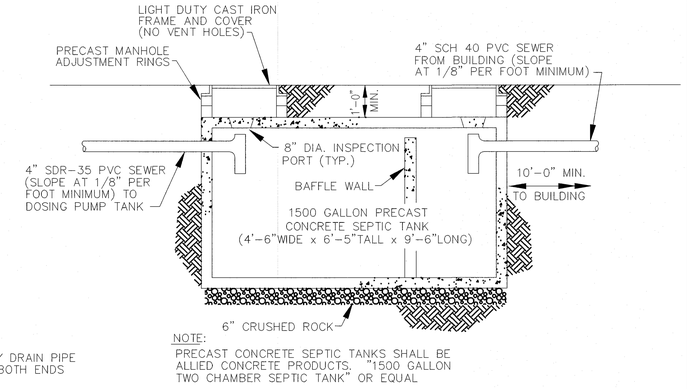
7 OF 16 SHEETS
4/3/2017



SEPTIC SYSTEM SITE PLAN

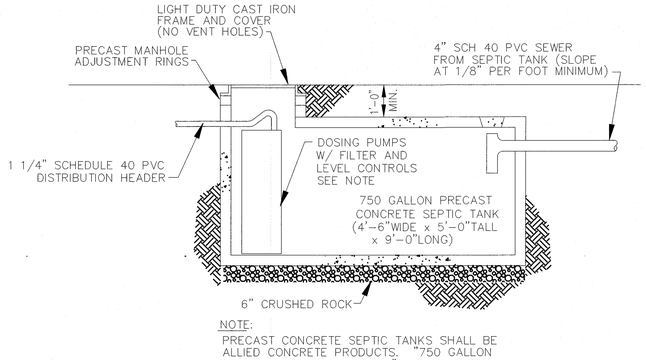


CURTAIN DRAIN DETAIL
NOT TO SCALE



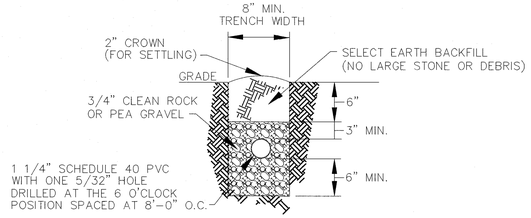
NOTE:
PRECAST CONCRETE SEPTIC TANKS SHALL BE ALLIED CONCRETE PRODUCTS, "1500 GALLON TWO CHAMBER SEPTIC TANK" OR EQUAL

SEPTIC TANK DETAIL
NOT TO SCALE



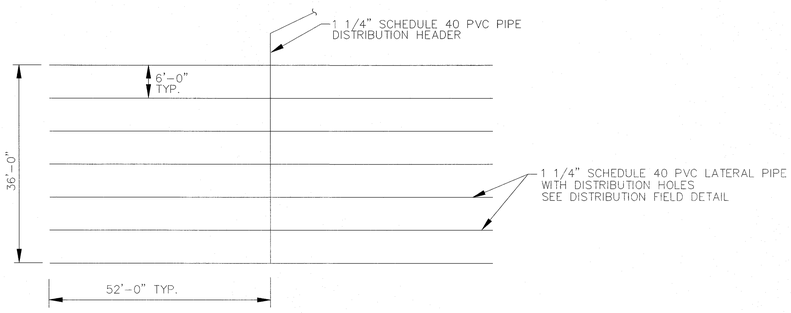
NOTE:
PRECAST CONCRETE SEPTIC TANKS SHALL BE ALLIED CONCRETE PRODUCTS, "750 GALLON ONE CHAMBER SEPTIC TANK" OR EQUAL

DOSING PUMP TANK DETAIL
NOT TO SCALE



NOTES:
1. RAKE BOTTOM AND SIDES IF SMEARING HAS OCCURRED WHILE EXCAVATING.

DISTRIBUTION FIELD DETAIL
NOT TO SCALE



DISTRIBUTION FIELD LAYOUT
NOT TO SCALE

NOTES:

1. THE EXISTING SEWER LAGOON SHALL BE DECOMMISSIONED AND REMOVED AFTER THE PROPOSED SEPTIC SYSTEM IS APPROVED AND IN SERVICE. LAGOON LIQUID AND SLUDGE SHALL BE REMOVED AND HAULED BY A LICENSED SEPTIC HAULING CONTRACTOR. EXISTING FENCING SHALL BE REMOVED AND PIPING SHALL BE REMOVED TO BELOW GRADE AND THE REMAINDER ABANDONED IN PLACE. THE LAGOON SHALL BE FILLED IN AND GRADED TO MATCH THE SURROUNDING AREA. ALL DISTURBED AREAS SHALL BE SEEDED AND MULCHED.
2. THE EXISTING SEPTIC TANK LOCATED AT THE HOME SHALL BE DECOMMISSIONED AFTER THE PROPOSED SEPTIC SYSTEM IS APPROVED AND IN SERVICE. LIQUID AND SLUDGE SHALL BE REMOVED AND HAULED BY A LICENSED SEPTIC HAULING CONTRACTOR. THE TOP SHALL BE REMOVED, A DRAINAGE HOLE PLACED IN THE BOTTOM OF THE TANK, AND THE TANK FILLED WITH COMPACTED SOIL TO MATCH THE SURROUNDING AREA. ALL DISTURBED AREAS SHALL BE SEEDED AND MULCHED.
3. SEWER DOSING PUMP SHALL BE AN ENGINEERED DEMAND DOSED PUMP PACKAGE AND SHALL INCLUDE PUMPS, FILTER, FLOAT SWITCHES ASSEMBLY, DISCHARGE ASSEMBLY, AND PUMP CONTROL PANEL WITH HIGH WATER ALARM. PUMP PACKAGE SHALL BE "BIOTUBE VAULT PVU57-1819" WITH TWO "PF5005" 50 GPM PUMPS AND "DAX2 ROSA" PANEL MANUFACTURED BY ORENCO SYSTEMS, INC. OR APPROVED EQUAL.
4. EXISTING SEWER IN WOODED AREA MAY BE ABANDONED BY PLUGGING EACH END OF PIPE AT THE EDGE OF TIMBER.

DESIGN NOTES:

3 BEDROOM HOME
150 GALLONS PER BEDROOM PER DAY
MAXIMUM TOTAL FLOW PER DAY= 450 GALLONS

SHOP BUILDING
30 GALLONS PER USER, 5 USERS
MAXIMUM TOTAL FLOW PER DAY= 150 GALLONS

COMBINED HOUSE AND SHOP TOTAL FLOW PER DAY= 600 GALLONS

ONE 1500 GALLON SEPTIC TANK= 1500 GALLONS
600 GALLONS PER DAY= 2.5 DAYS = 60 HOURS MINIMUM DETENTION TIME

INDICATION OF HIGH WATER TABLE AT 16" DEPTH
CONVENTIONAL LEACHFIELD NOT APPROPRIATE, USE SHALLOW PRESSURE DOSED SYSTEM

SOIL LOADING RATE= .15 GALLONS PER DAY/ PER SQ. FT. AT 23 INCHES
600 GALLONS/.15 GALLONS= 4000 SQ. FT. OF DISTRIBUTION FIELD
DISTRIBUTION FIELD =100' LONG x 40' WIDE

STATE OF MISSOURI
ERIC GREITENS, GOVERNOR

BLKE B. BOYD
NUMBER PE-2005022092
PROFESSIONAL ENGINEER
4/3/2017

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MISSOURI CERTIFICATE OF AUTHORITY: 000043

OFFICE OF ADMINISTRATION
DIVISION OF FACILITIES MANAGEMENT, DESIGN AND CONSTRUCTION

DEPARTMENT OF NATURAL RESOURCES

PROJECT TITLE
WATKINS MILL STATE PARK & HISTORIC SITE
UPGRADE WASTEWATER TREATMENT SYSTEM

WATKINS MILL STATE PARK & HISTORIC SITE

PROJECT # X 1410-01
SITE # 4118
FACILITY # 51577

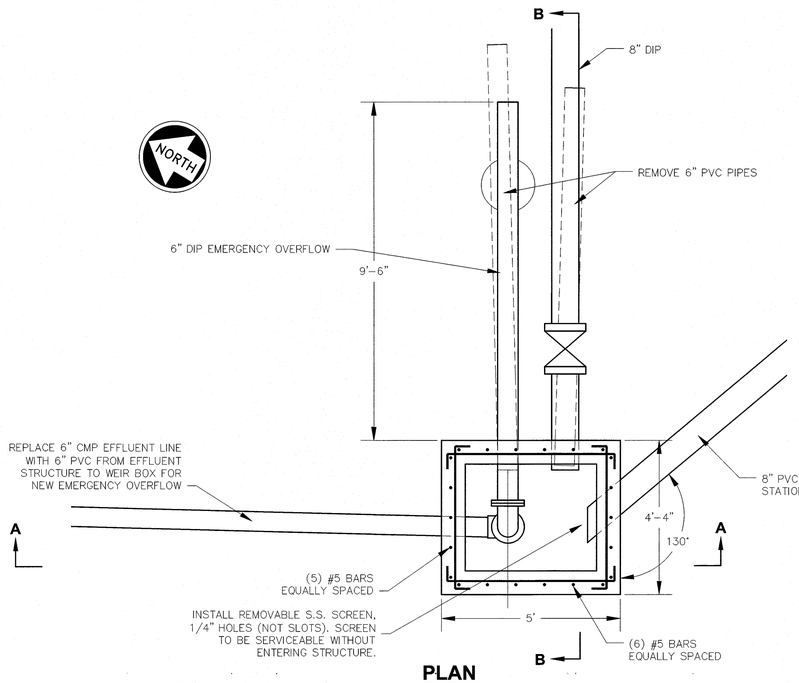
REVISION:
DATE:
REVISION:
DATE:
REVISION:
DATE:
ISSUE DATE: 4/3/2017

CAD DWG FILE: SEPTIC DRAWING.dwg
DRAWN BY: DAB
CHECKED BY: DES
DESIGNED BY: EBB

SHEET TITLE:
SEPTIC SYSTEM

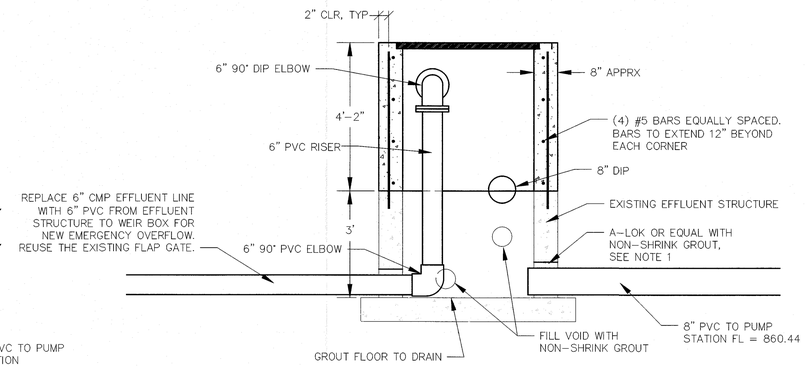
SHEET NUMBER:
C-107

8 OF 16 SHEETS
4/3/2017



PLAN

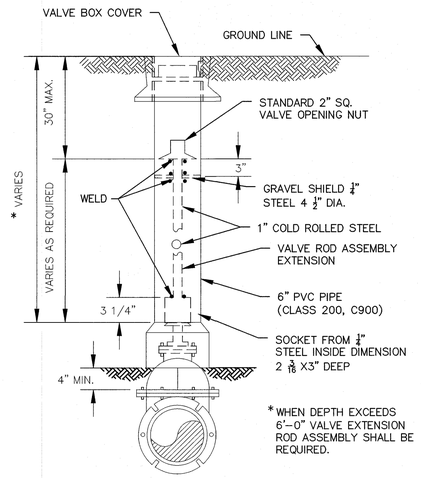
SCALE: 1/2"=1'



SECTION A-A

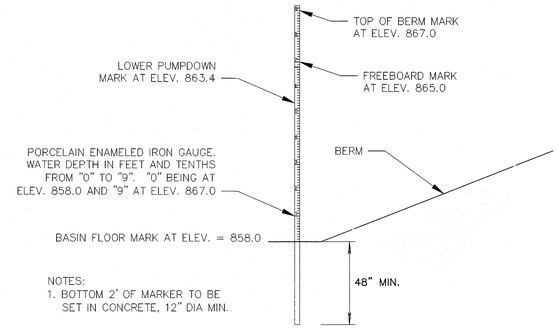
SCALE: 1/2"=1'

NOTES:
1. INSTALL A-LOK OR EQUAL PER MANUFACTURER'S RECOMMENDATIONS.



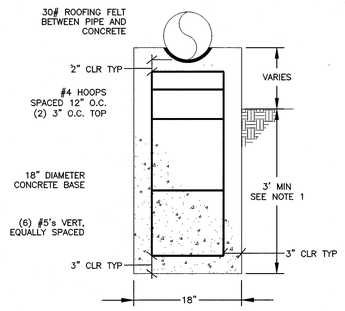
VALVE BOX & OPERATING NUT EXTENSION

SCALE: N.T.S.



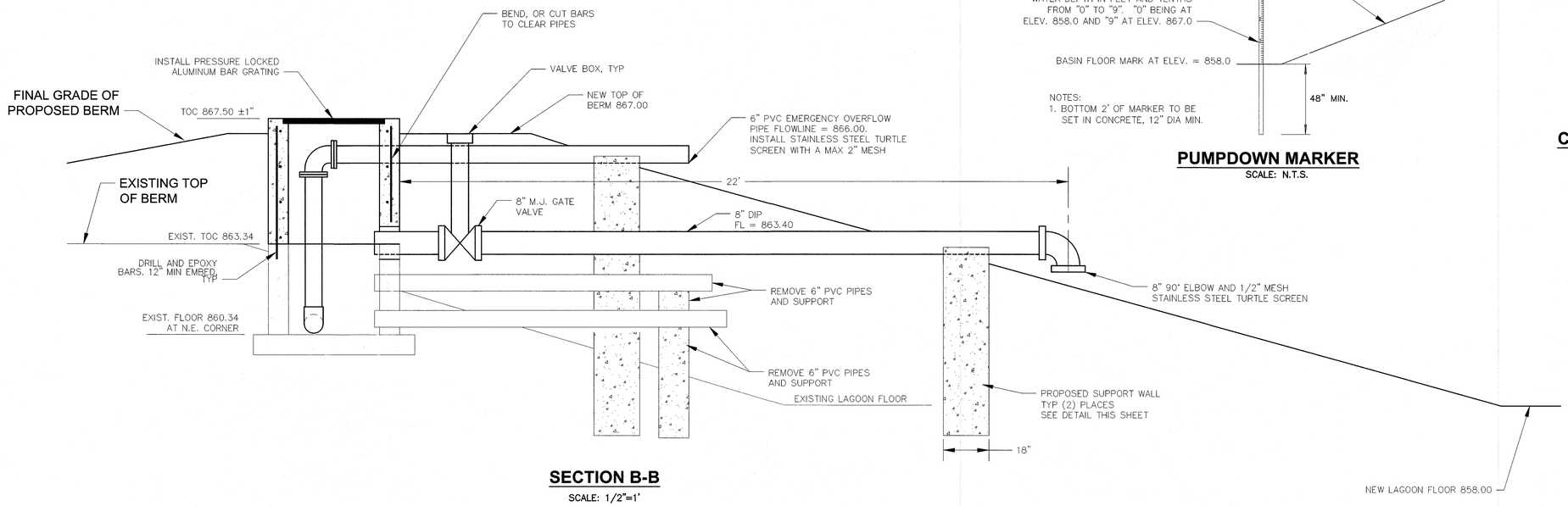
PUMPDOWN MARKER

SCALE: N.T.S.



CONCRETE SUPPORT DETAIL

SCALE: N.T.S.



SECTION B-B

SCALE: 1/2"=1'

STATE OF MISSOURI
ERIC GREITENS, GOVERNOR

STATE OF MISSOURI
BLKE B. BOYD
NUMBER PE-2005022082
PROFESSIONAL ENGINEER
6/05/2017

SHAFER, KLINE & WARREN, INC.
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Houston, TX
Lenexa, KS
Tulsa, OK
North Kansas City, MO
CIVIL ENGINEERS ELECTRICAL ENGINEERS MECHANICAL ENGINEERS STRUCTURAL ENGINEERS LANDSCAPE ARCHITECTS LAND SURVEYORS LAND PLANNERS
MISSOURI CERTIFICATE OF AUTHORITY: 000643

OFFICE OF ADMINISTRATIO
DIVISION OF FACILITIES MANAGEMENT, DESIGN AND CONSTRUCTIO

DEPARTMENT OF NATURAL RESOURCES

PROJECT TITLE
WATKINS MILL STATE PARK & HISTORIC SITE
UPGRADE WASTEWATER TREATMENT SYSTEM

WATKINS MILL STATE PARK & HISTORIC SITE

PROJECT # X 1410-01
SITE # 4118
FACILITY # 51577

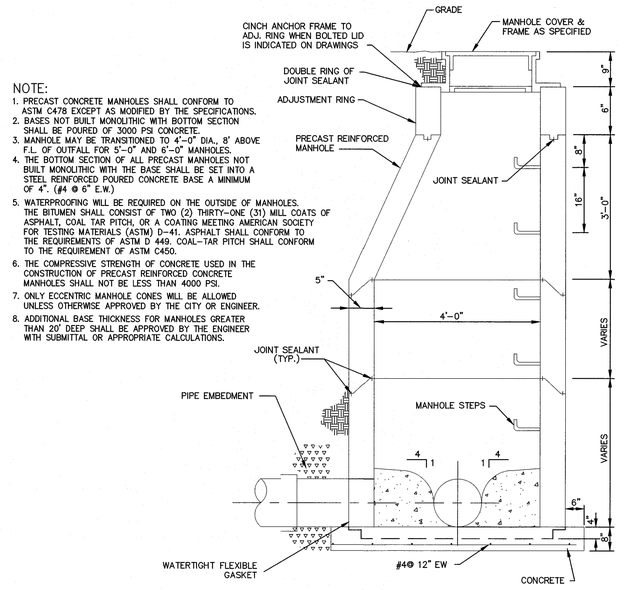
REVISION: 1 REMOVED PIPE 1
DATE: 09-30-15
REVISION: 2 REVISED MARKER
DATE: 9-30-15
REVISION:
DATE:
ISSUE DATE: 4/3/2017

CAD DWG FILE: 130512 EFFL STRUC.d
DRAWN BY: JWR
CHECKED BY: DES
DESIGNED BY: EBB

SHEET TITLE:
EFFLUENT STRUCTURE DETAILS

SHEET NUMBER:
C-108

9 OF 16 SHEETS
4/3/2017

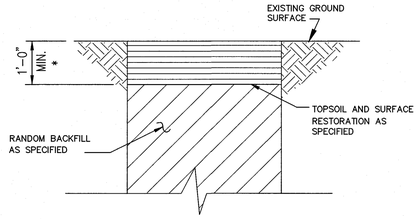


NOTE:

1. PRECAST CONCRETE MANHOLES SHALL CONFORM TO ASTM C478 EXCEPT AS MODIFIED BY THE SPECIFICATIONS.
2. BASES NOT BUILT MONOLITHIC WITH BOTTOM SECTION SHALL BE POURED OF 3000 PS CONCRETE.
3. MANHOLE MAY BE TRANSITIONED TO 4'-0" DIA., 8' ABOVE F.L. OF OUTFALL FOR 5'-0" AND 6'-0" MANHOLES.
4. THE BOTTOM SECTION OF ALL PRECAST MANHOLES NOT BUILT MONOLITHIC WITH THE BASE SHALL BE SET INTO A STEEL REINFORCED POURED CONCRETE BASE A MINIMUM OF 4". (#4 @ 6" E.W.)
5. WATERPROOFING WILL BE REQUIRED ON THE OUTSIDE OF MANHOLES. THE BITUMEN SHALL CONSIST OF TWO (2) THIRTY-ONE (31) MILL COATS OF ASPHALT, COAL TAR PITCH, OR A COATING MEETING AMERICAN SOCIETY FOR TESTING MATERIALS (ASTM) D-41. ASPHALT SHALL CONFORM TO THE REQUIREMENTS OF ASTM D 449. COAL-TAR PITCH SHALL CONFORM TO THE REQUIREMENT OF ASTM C450.
6. THE COMPRESSIVE STRENGTH OF CONCRETE USED IN THE CONSTRUCTION OF PRECAST REINFORCED CONCRETE MANHOLES SHALL NOT BE LESS THAN 4000 PSI.
7. ONLY ECCENTRIC MANHOLE CONES WILL BE ALLOWED UNLESS OTHERWISE APPROVED BY THE CITY OR ENGINEER.
8. ADDITIONAL BASE THICKNESS FOR MANHOLES GREATER THAN 20' DEEP SHALL BE APPROVED BY THE ENGINEER WITH SUBMITTAL OR APPROPRIATE CALCULATIONS.

4'-0" I.D. STANDARD PRECAST MANHOLE

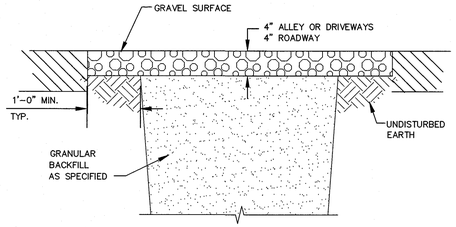
SCALE: N.T.S.



* 2'-0" MINIMUM IN ESTABLISHED GARDENS

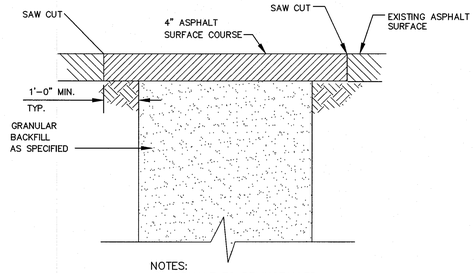
NON-PAVED AND NON-GRAVELED SURFACE AREA

N.T.S.



GRAVEL SURFACED AREA

N.T.S.



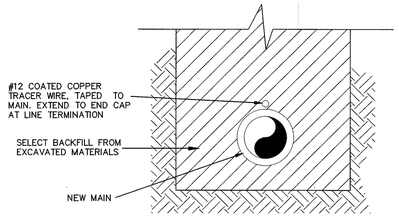
NOTES:
1) ASPHALT TO BE INSTALLED IN 2" LIFTS.

ASPHALT DRIVEWAYS

N.T.S.

TYPICAL TRENCH BACKFILL & SURFACE RESTORATION DETAILS

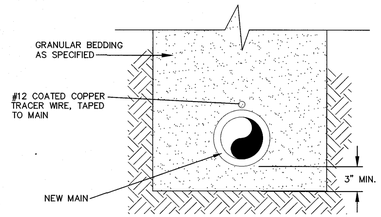
SCALE: N.T.S.



EXCAVATE AND REPLACE SOFT OR UNSUITABLE TRENCH BOTTOM AND REPLACE WITH GRANULAR EMBEDMENT MATERIAL OR GRANULAR BACKFILL MATERIAL, AS REQUIRED BY THE EARTHWORK SPECIFICATIONS.

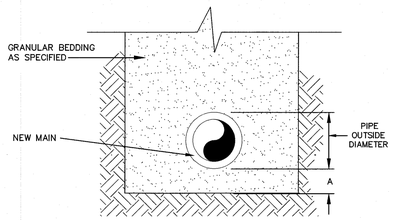
NON-PAVED AND NON-GRAVELED SURFACE AREA (FORCEMAIN)

N.T.S.



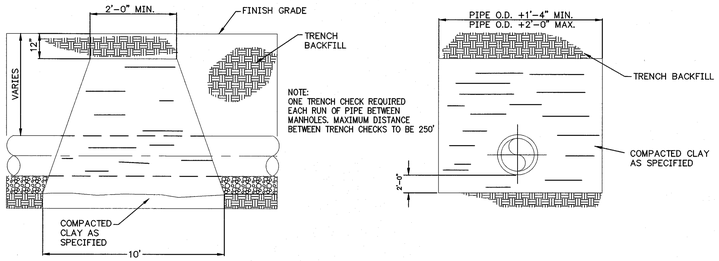
IN DRIVING SURFACES (FORCEMAIN)

N.T.S.



GRAVITY SEWER (ALL SURFACES)

N.T.S.

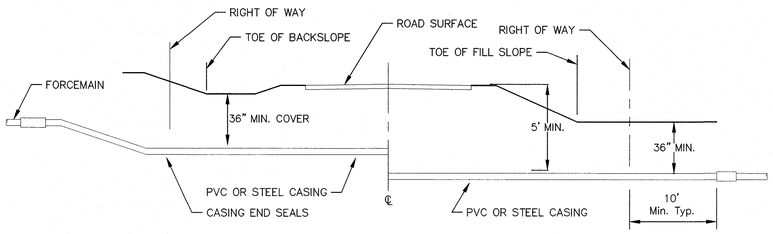


TRENCH CHECK

SCALE: N.T.S.

NOTE:

1. FOR ALL PIPELINES GREATER THAN 2", MINIMUM CASING LENGTH SHALL BE FROM RIGHT-OF-WAY TO RIGHT-OF-WAY OR AS SHOWN ON DRAWINGS.
2. ALL ROAD CROSSINGS SHALL BE BORED OR OPEN CUT, AS INDICATED ON THE PLANS.
3. USE STANDARD FITTINGS TO MAINTAIN MINIMUM COVER.
4. CARRIER PIPE TO BE "YELOMINE" RESTRAINED JOINT, OR APPROVED EQUAL.
5. ROAD BEDS TO BE COMPACTED TO 95% STANDARD PROCTOR DENSITY IF APPLICABLE.



CUT SECTION FILL SECTION

ROAD CROSSING

SCALE: N.T.S.

TYPICAL PIPE INSTALLATION/BEDDING DETAILS

SCALE: N.T.S.

NOTES: PIPE INSTALLATION/BEDDING (FORCEMAIN)

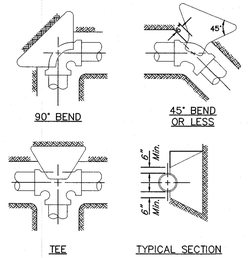
1. FORCEMAIN SHALL BE BURIED TO A MINIMUM DEPTH OF 42" AND LATERALS 36" TO THE TOP OF THE LINE
2. PVC PIPE SHALL BE SLIP JOINT SDR21 AND SHALL MEET REQUIREMENTS OF ASTM 2241. JOINTS SHALL BE 20' IN LENGTH UNLESS PREAPPROVED BY THE ENGINEER
3. ALL CHANGES IN THE MAIN LINE DIRECTION GREATER THAN 11.25° SHALL BE ACCOMPLISHED USING STANDARD FITTINGS
5. TRACER WIRE SHALL BE TYPE UF #12 SOLID CONDUCTOR
6. TRACER WIRE SHALL BE INSTALLED WITH THE FORCEMAINS AND LATERAL LINES

PIPE SIZE (INCHES)	TRENCH WIDTH: MIN. TRENCH WIDTH IN EARTH (INCHES)	MAX. TRENCH WIDTH IN EARTH (INCHES)	MIN. TRENCH WIDTH IN ROCK (INCHES)
< 4	20	26	20
4 – 6	24	30	24
8	26	32	24
10	30	34	24
12	32	36	26

NOTE:
WHEN ANY TRENCH IS AT EDGE OF PAVEMENT, BACKFILL TRENCH WITH COMPACTED ROLL STONE BASE ROCK, AFTER BEDDING.

NOTE:
FOR GRAVITY SEWERS, GRANULAR BEDDING TYPICALLY TO EXTEND 6" ABOVE SEWER MAIN, AND FOR TRENCH DEPTHS OF 17' OR GREATER, GRANULAR BEDDING TO EXTEND 24" ABOVE SEWER MAIN.

INSIDE PIPE DIAMETER	DIMENSION "A": EARTH EXCAVATION	ROCK EXCAVATION
4"	4"	7"
6"	4"	7"
8"	4"	7"
12"	6"	9"
18"	6"	9"
24"	9"	12"
36"	12"	15"



THRUST BLOCK AREA TABLE

PIPE SIZE	24"	20"	18"	16"	14"	12"	10"	8"	6"	4" & UNDER
90° BEND	40	30	25	20		12	8	5	3	1
45° BEND	24	16	14	12		7	5	3	1 1/2	1
22 1/2° BEND	12	8	7	5 1/2		3 1/2	2 1/2	1 1/2	1	1
11 1/4° BEND	6	4	3 1/2	3		2	1 1/2	1	1	1
TEE	30	22	18	14		8	6	3 1/2	2	1

*TABLE GIVES REQUIRED AREA OF BEARING IN SQUARE FEET BETWEEN CONCRETE AND UNDISTURBED TRENCH WALL.

NOTE:
1. THRUST BLOCKS SHALL BE POURED CONCRETE.
2. THRUST BLOCKS SHALL BE PLACED AT EVERY FITTING.

TYPICAL CONCRETE THRUST BLOCKS

SCALE: N.T.S.

STATE OF MISSOURI
ERIC GREITENS, GOVERNOR

STATE OF MISSOURI ELKE B. BOYD NUMBER PE-2005022002 PROFESSIONAL ENGINEER
4/5/2017

SHAFER, KLINE & WARREN, INC.
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660/385-6441 FAX: 660/385-6614
OFFICE LOCATIONS: Lenexa, KS; Tulsa, OK; Columbia, MO; North Kansas City, MO; Houston, TX
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MISSOURI CERTIFICATE OF AUTHORITY: 000143

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WATKINS MILL STATE PARK & HISTORIC SITE
UPGRADE WASTEWATER TREATMENT SYSTEM

WATKINS MILL STATE PARK & HISTORIC SITE

PROJECT # X 1410-01
SITE # 4118
FACILITY # 51577

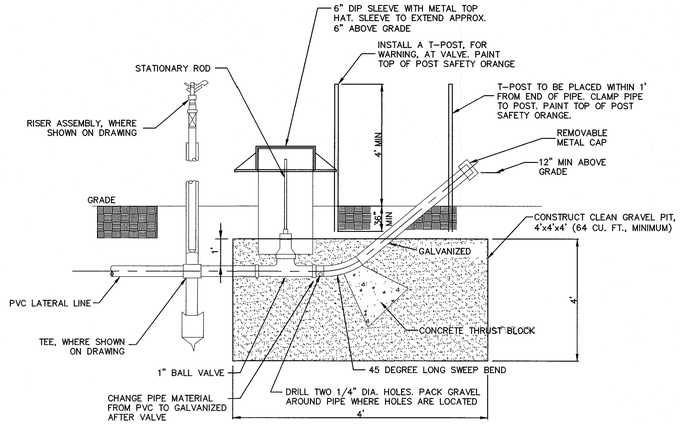
REVISION: 1 TEXT CORRECTION
DATE: 09-30-15
REVISION:
DATE:
REVISION:
DATE:
ISSUE DATE: 4/3/2017

CAD DWG FILE: 130512 DETAILS.dwg
DRAWN BY: JWR
CHECKED BY: DES
DESIGNED BY: EBB

SHEET TITLE:
PIPING DETAILS

SHEET NUMBER:
C-109

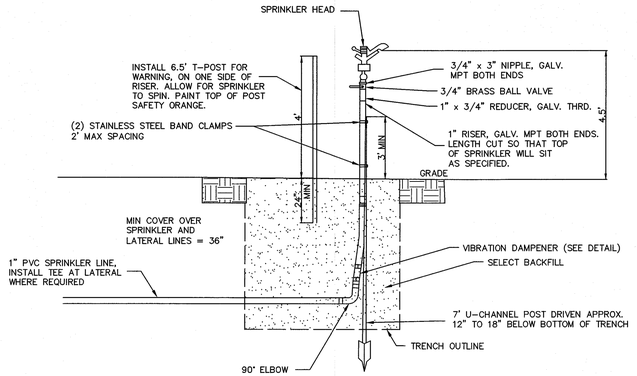
10 OF 16 SHEETS
4/3/2017



NOTES:
1. INSTALL WHERE SHOWN ON DRAWING.
2. PIT WIDTH = 4'.
3. MATCH PIPE DIAMETER, VALVES & FITTINGS TO CONNECTING LINE.

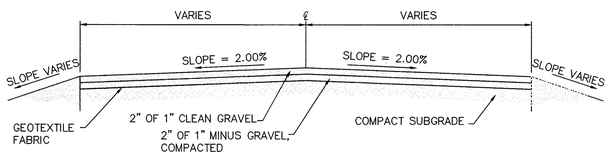
LINE TERMINATION-SPRINKLER SYSTEM

SCALE: N.T.S.



SPRINKLER ASSEMBLY DETAIL

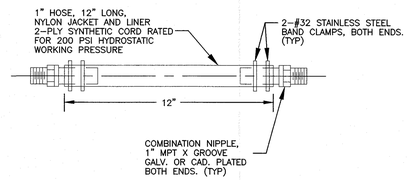
SCALE: N.T.S.



NOTE:
1. 3" MINUS, AND 1" MINUS SURFACING WILL BE COMPACTED BY NOT LESS THAN THREE COMPLETE COVERAGE'S WITH A 5 TON ROLLER. ROLLING SHALL BE CONTINUED UNTIL THERE IS NO VISIBLE EVIDENCE OF FUTURE CONSOLIDATION. CONTRACTOR SHOULD PROOF ROLL THE AGGREGATE BASE WITH A LOADED DUMP TRUCK TO VERIFY WHEEL TRACKING OF NOT MORE THAN ONE INCH.

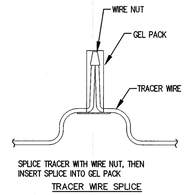
GRAVEL DRIVE SECTION

SCALE: N.T.S.



VIBRATION DAMPENER-SPRINKLER SYSTEM

SCALE: N.T.S.



TRACER WIRE SPLICE

TRACER WIRE DETAILS

SCALE: N.T.S.

STATE OF MISSOURI
ERIC GREITENS, GOVERNOR

STATE OF MISSOURI
ELKE B. BOYD
NUMBER PE-2010022382
PROFESSIONAL ENGINEER
5/5/2017

SHAFER, KLINE & WARREN, INC.
107 Butler Street, Macon, MO 63552-1628
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North Kansas City, MO
CIVIL ENGINEERS ELECTRICAL ENGINEERS MECHANICAL ENGINEERS STRUCTURAL ENGINEERS LANDSCAPE ARCHITECTS LAND SURVEYORS
MISSOURI CERTIFICATE OF AUTHORITY: 000043

OFFICE OF ADMINISTRATIO
DIVISION OF FACILITIES MANAGEMENT, DESIGN AND CONSTRUCTIO

DEPARTMENT OF NATURAL RESOURCES

PROJECT TITLE
WATKINS MILL STATE PARK & HISTORIC SITE
UPGRADE WASTEWATER TREATMENT SYSTEM

WATKINS MILL STATE PARK & HISTORIC SITE

PROJECT # X 1410-01
SITE # 4118
FACILITY # 51577

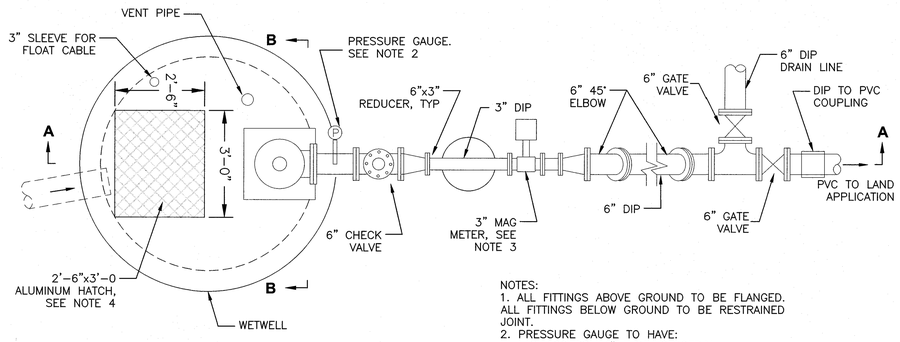
REVISION:
DATE:
REVISION:
DATE:
REVISION:
DATE:
ISSUE DATE: 4/3/2017

CAD DWG FILE: 130512 DETAILS.dwg
DRAWN BY: JWR
CHECKED BY: DES
DESIGNED BY: EBB

SHEET TITLE:
LAND APPLICATION DETAILS

SHEET NUMBER:
C-110

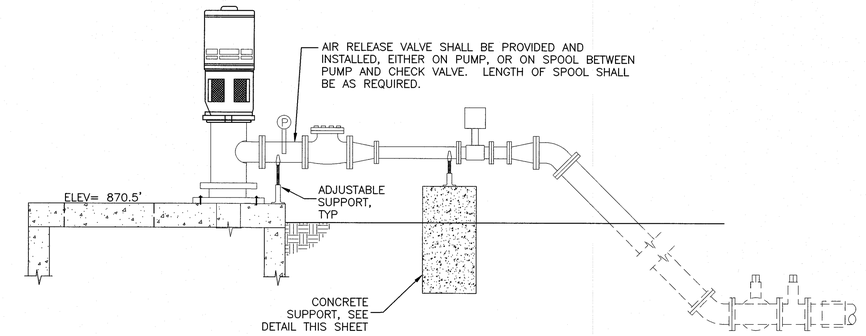
11 OF 16 SHEETS
4/3/2017



WET WELL PLAN

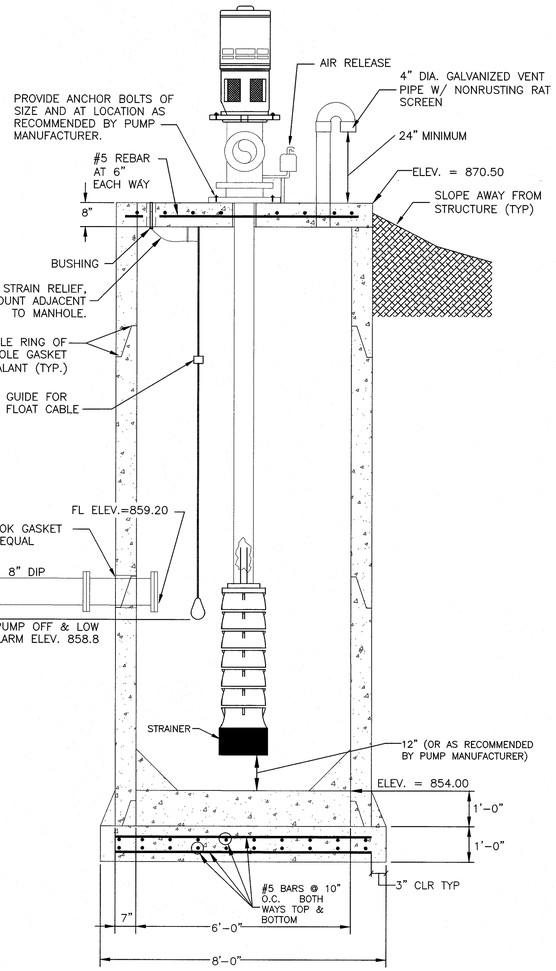
SCALE: 1/2"=1'

NOTES:
1. ALL FITTINGS ABOVE GROUND TO BE FLANGED. ALL FITTINGS BELOW GROUND TO BE RESTRAINED JOINT.
2. PRESSURE GAUGE TO HAVE:
   0-100 PSI, 4" FACE, GLYCERIN FILLED, ISOLATION VALVE, 1/2" GALV. PIPE
3. INSTALLATION OF METER PER MANUFACTURER'S RECOMMENDATIONS. LENGTH OF RUNS OF PIPE BEFORE AND AFTER METER SHALL BE PER METER MANUFACTURER'S RECOMMENDATIONS.
4. ACCESS HATCH TO BE ALUMINUM CHECKER PLATE, 3/16" THICK. ALUMINUM ANGLE FRAME TO BE 1 1/2"x1 1/2"x1/4" CONTINUOUS WITH 1/2"x4" ANCHORS AT 24" O.C. IT SHALL BE A POSITIVE LOCK OPEN COVER.
5. INSTALL VALVE BOXES AND OPERATING NUT EXTENSION PER DETAIL, SHEET C-108



SECTION A-A

SCALE: 1/2"=1'



WET WELL SECTION B-B

SCALE: 1/2"=1'

WET WELL NOTES:

1. THE CONTRACTOR SHALL ADJUST THE ELEVATION OF THE SUMP TO SATISFY THE REQUIREMENTS OF THE PUMP MANUFACTURER.

2. THE CONTRACTOR MAY ADJUST THE SUMP ONLY AFTER RECEIVING APPROVAL FROM THE ENGINEER.

3. THE NUMBER OF PUMP BOWLS MAY VARY BY MANUFACTURER.

4. CONTRACTOR SHALL PROVIDE SUPPORT FOR THE PUMP AND SHAFT AS RECOMMENDED BY THE MANUFACTURER.

5. ALL EXPOSED STEEL AND CONDUIT TO BE HOT DIPPED GALVANIZED.

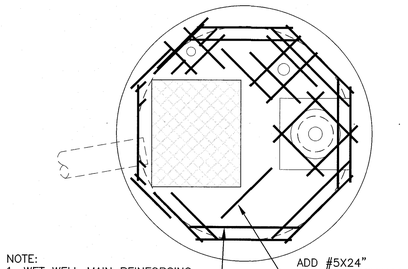
6. MAINTAIN REQUIRED DISTANCE FROM METER TO FITTINGS BY MANUFACTURER.

7. CONTROL FLOAT SHALL BE ADJUSTABLE OR REPLACEABLE WITHOUT ENTERING THE WET WELL.

8. PROVIDE SUFFICIENT CABLE TO ALLOW DISCONNECTION WITHOUT ENTERING INTERIOR OF LIFT STATION.

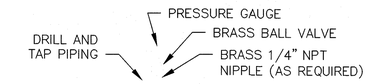
NOTE:
1. ALL INTERIOR FITTINGS TO BE FLANGED. ALL EXTERIOR FITTINGS TO BE RESTRAINED JOINT.

VERTICAL TURBINE PUMP STATION	
DESCRIPTION	PUMP STATION
PUMP CAPACITY	206 GPM
TOTAL DYNAMIC HEAD	115 FT
MIN. FLOW LINE IN AT P.S.	859.2 FT
APPROX. CONTROL SETTING	6 HRS
RISING PUMP NO. 1 "ON"	MANUAL W/ TIMER
TOP ELEV. OF PUMP STATION	870.5 FT
INSIDE DIAMETER OF PUMP STATION	6 FT



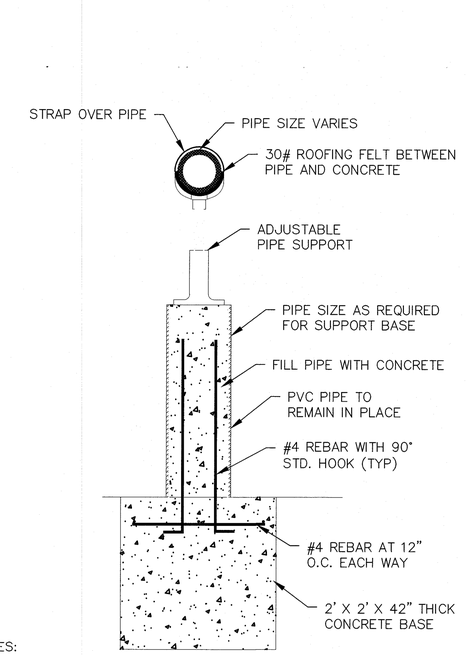
TOP SLAB PLAN

SCALE: 1/2"=1'



PRESSURE GAUGE INSTALLATION

NOT TO SCALE



NOTES:

1. BASE NOT NEEDED IF CONSTRUCTED IN A BUILDING OR A VAULT WITH A CONCRETE FLOOR.

2. CONCRETE SUPPORT SHALL BEAR ON UNDISTURBED SOIL IF POSSIBLE. OTHERWISE IT SHALL BEAR ON THOROUGHLY COMPACTED SOIL.

3. CONTRACTOR TO VERIFY HEIGHT OF SUPPORT.

CONCRETE SUPPORT DETAIL

NOT TO SCALE

STATE OF MISSOURI
ERIC GREITENS, GOVERNOR

STATE OF MISSOURI ELKE B. BOYD NUMBER PE-2005022081 PROFESSIONAL ENGINEER
6/13/2017

SHAFER, KLINE & WARREN, INC.
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CIVIL ENGINEERS ELECTRICAL ENGINEERS MECHANICAL ENGINEERS STRUCTURAL ENGINEERS LANDSCAPE ARCHITECTS LAND SURVEYORS LAND PLANNERS
MISSOURI CERTIFICATE OF AUTHORITY: 000143

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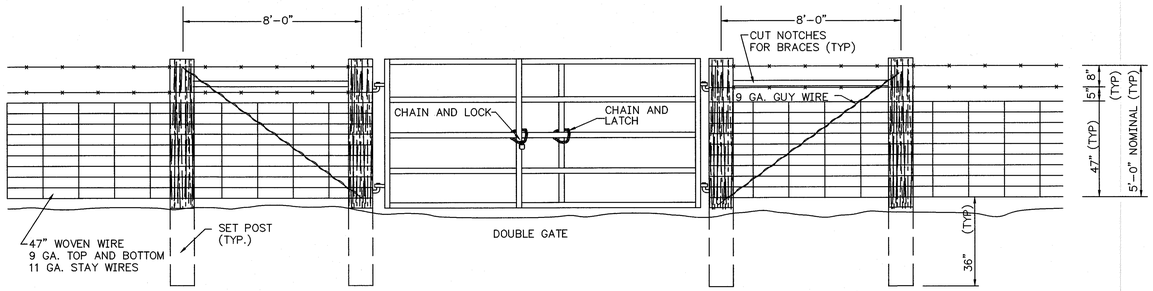
CAD DWG FILE: 130512 DETAILS.dwg
DRAWN BY: JWR
CHECKED BY: DES
DESIGNED BY: EBB

SHEET TITLE:
PUMP STATION DETAILS

SHEET NUMBER:
C-111

12 OF 16 SHEETS
4/3/2017



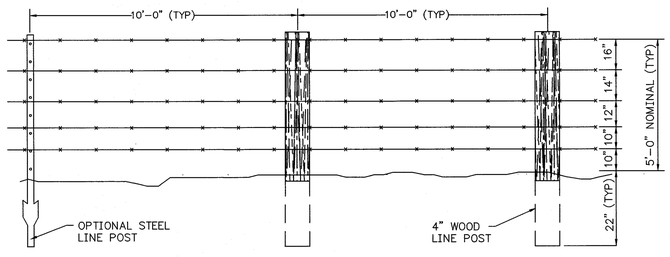
GATE & BRACING DETAIL

SCALE: N.T.S.

WOVEN WIRE FENCE SHOWN
(BARB WIRE FENCE SIMILAR)

FENCE NOTES:

1.) ALL FENCING MATERIALS SHALL BE WITHIN THE REQUIREMENTS OF THIS PLAN SHEET.
2.) FENCING IS TO BE WOVEN WIRE AROUND LAGOON. FENCING IS TO BE 5 STRAND GALVANIZED, 4 POINT BARBED WIRE AROUND APPLICATION AREA.
3.) ALL SET POSTS SHALL BE 8" MINIMUM DIAMETER WOOD POSTS SET IN A 18" MINIMUM DIAMETER HOLE, BACKFILLED WITH SUITABLE MATERIAL THOROUGHLY TAMPED. POST MATERIAL SHOULD BE THAT WHICH IS READILY AVAILABLE AND TREATED TO RESIST ROT AND TERMITES.
4.) SINGLE GATES SHALL BE REQUIRED FOR ENTRANCES UP TO 12' WIDE. DOUBLE GATES SHALL BE REQUIRED FOR ENTRANCES OVER 12' WIDE. GATES SHALL BE HEAVY TUBULAR STEEL, WELDED CONSTRUCTION AND PAINTED.
5.) STEEL LINE POSTS SHALL BE OF AN APPROVED "I" SECTION, STUDDED, AND WITH AN ANCHOR PLATE. MINIMUM LENGTH SHALL BE 7'.
6.) STAPLES SHALL BE SCREW SHANK TYPE OR EQUIVALENT, 1 1/4" MINIMUM LENGTH, GALVANIZED.
7.) STRETCH WIRE ON OUTSIDE OF POST ON CORNERS AND CURVES.
8.) FOR BRACE WIRES, USE 2 LOOPS OF GALVANIZED WIRE TWISTED TIGHT WITH A SHORT STICK OR BOARD. LEAVE IN PLACE FOR FUTURE TIGHTENING.
9.) AT ALL END POSTS, EACH WIRE IS TO WRAPPED AROUND THE POST, TIED TO ITSELF AND STAPLED.
10.) ALL WOOD CORNER, END, PULL AND APPROACH POSTS SHALL BE NOTCHED TO SUPPORT ENDS OF WOOD BRACES. BRACES SHALL BE TOENAILED TO THE POSTS WITH 2-10D NAILS IN EACH END OF THE BRACE. BRACES SHALL BE 4" DIAMETER MINIMUM.
11.) THE ALIGNMENT LAYOUTS SHOWN ARE TYPICAL, BUT ARE NOT REPRESENTATIVE OF ALL SITUATIONS THAT MAY OCCUR. CONSTRUCTION MAY BE VARIED AS REQUIRED TO MEET FIELD CONDITIONS AND/OR AS DIRECTED BY THE ENGINEER.



LINE POST & FENCE DETAIL (5 STRAND BARB WIRE)

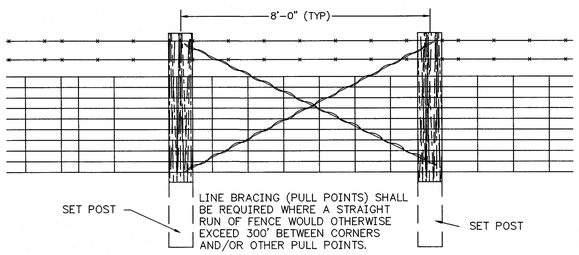
SCALE: N.T.S.

OTHER DETAILS SHOWN ARE FOR WOVEN WIRE FENCE (4 STRAND BARB WIRE FENCE SIMILAR)

WIRE SPLICING DETAIL
(BARBED AND SMOOTH)

WIRE SPLICING DETAIL

SCALE: N.T.S.

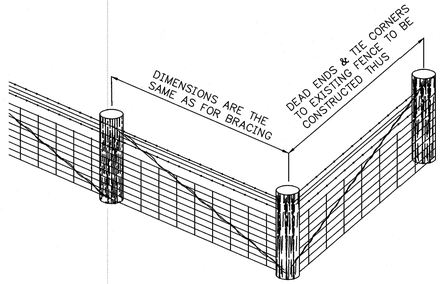


NOTE: DIMENSIONS ARE SAME AS BRACING DETAIL.

LINE BRACING DETAIL

SCALE: N.T.S.

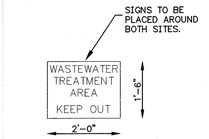
WOVEN WIRE FENCE SHOWN
(BARB WIRE FENCE SIMILAR)



TYPICAL CORNER

SCALE: N.T.S.

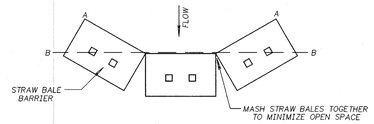
WOVEN WIRE FENCE SHOWN
(BARB WIRE FENCE SIMILAR)



WARNING SIGN DETAIL

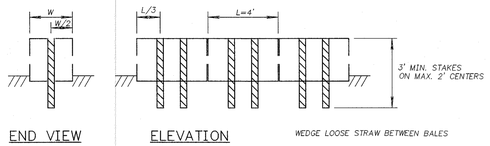
SCALE: N.T.S.

1. WARNING SIGN TO BE PLACED ON EACH GATE AND AT 200' INTERVALS ALONG THE FENCES. SIGNS SHALL FACE OUTWARD.
2. WHITE BACKGROUND.
3. RED BLOCK LETTERS – 2 1/2" HIGH.
4. SIGNS TO BE 1/16" THICK STEEL.
5. FASTEN SIGN TO GATES USING GALVANIZED 1/4" U-BOLTS.
6. FASTEN TO FENCE AT POSTS USING 1/4" GALVANIZED LAG BOLTS AND WASHERS.
7. FASTEN TO STEEL POSTS USING 1/4" GALVANIZED U-BOLTS.



TOP VIEW

NOTE:
POINTS "A" SHOULD BE HIGHER THAN POINTS "B" TO INSURE FLOW THROUGH OR OVER BARRIER, NOT AROUND IT.

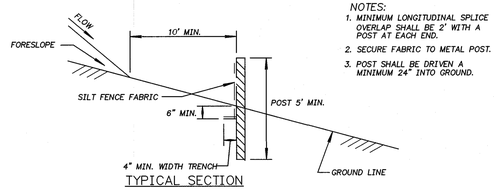


END VIEW ELEVATION

WEDGE LOOSE STRAW BETWEEN BALES

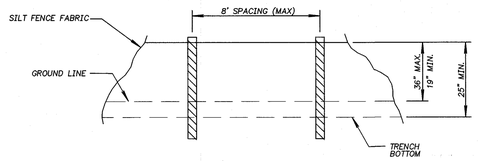
TEMPORARY STRAW BALE DITCH CHECK

SCALE: N.T.S.



TYPICAL SECTION

NOTES:
1. MINIMUM LONGITUDINAL SPLICE OVERLAP SHALL BE 2' WITH A POST AT EACH END.
2. SECURE FABRIC TO METAL POST.
3. POST SHALL BE DRIVEN A MINIMUM 24" INTO GROUND.



SILT FENCE DETAIL

SCALE: N.T.S.

STATE OF MISSOURI
ERIC GREITENS, GOVERNOR

STATE OF MISSOURI
ELKE B. BOYD
NUMBER PE-2009012082
PROFESSIONAL ENGINEER
4/3/2017

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MISSOURI CERTIFICATE OF AUTHORITY: 000143

OFFICE OF ADMINISTRATIO
DIVISION OF FACILITIES MANAGEMENT, DESIGN AND CONSTRUCTIO

DEPARTMENT OF NATURAL RESOURCES

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UPGRADE WASTEWATER TREATMENT SYSTEM

WATKINS MILL STATE PARK & HISTORIC SITE

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SITE # 4118
FACILITY # 51577

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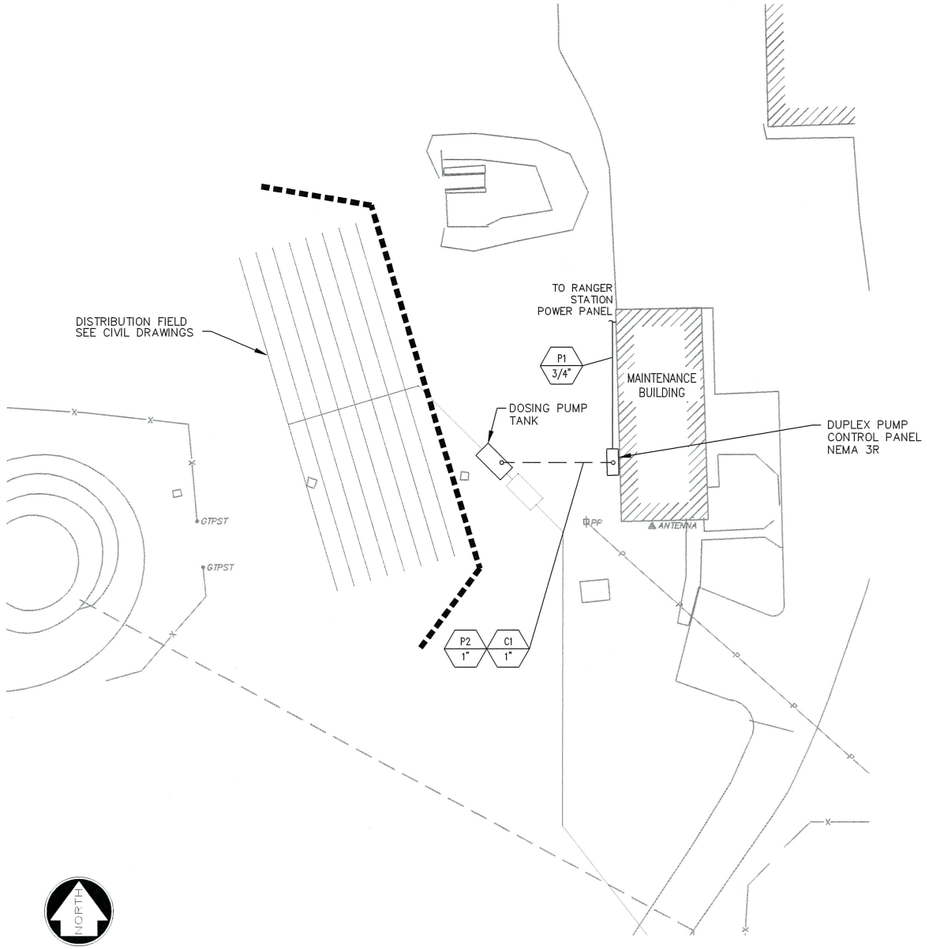
CAD DWG FILE: 130512 DETAILS.dwg
DRAWN BY: JWR
CHECKED BY: DES
DESIGNED BY: EBB

SHEET TITLE:
FENCE DETAILS

SHEET NUMBER:
C-112

13 OF 16 SHEETS
4/3/2017



RANGER STATION ELECTRICAL SITE PLAN

CONDUIT NUMBER	FROM	TO	VOLTAGE (V)	# PHASES	WIRE SIZE, CONDUIT	WIRE INSULATION TYPE	CONDUIT TYPE
P1	BREAKER IN STATION POWER PANEL	CONTROL PANEL	240	1	3–#10, #10 GND, 3/4"	THHW/THWN	RGS
P2	CONTROL PANEL	EXTERNAL SPLICE BOX	240	1	(2) 3–#10, #10 GND, 1"	THHW/THWN	PVC & RGS
N/A	EXTERNAL SPLICE BOX	PUMP 1	240	1	SUBMERSIBLE CABLE FURNISHED WITH PUMP	SOW	N/A
N/A	EXTERNAL SPLICE BOX	PUMP 2	240	1	SUBMERSIBLE CABLE FURNISHED WITH PUMP	SOW	N/A
C1	CONTROL PANEL	EXTERNAL SPLICE BOX	DC	N/A	1"	THHW/THWN	PVC & RGS
N/A	EXTERNAL SPLICE BOX	FLOAT SWITCH	DC	N/A	SUBMERSIBLE CABLE FURNISHED WITH PUMP	SOW	N/A

CONDUIT SCHEDULE

GENERAL NOTES:

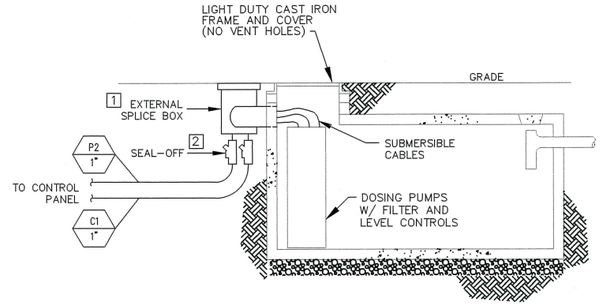
1. BURIED POWER CONDUITS SHALL BE SCHEDULE 40 PVC INSTALLED AT 36" MINIMUM BELOW GRADE OR AS INDICATED ON PLAN. TRANSITION TO RIGID GALVANIZED STEEL (RGS) AT 90° ELBOW BELOW GRADE. RGS CONDUIT TO BE COATED WITH BITUMASTIC COAL TAR EPOXY.
2. CONDUIT ROUTING AREA IS APPROXIMATE. FINAL ROUTING DECISIONS ARE BY CONTRACTOR AND OWNER'S REPRESENTATIVE.

SYMBOL NOTES:

[1] PROVIDE EXTERNAL SPLICE BOX FOR TRANSITION INTO DOSING PUMP TANK. ORENCO SBEX1–4–P, OR EQUALIVENT.

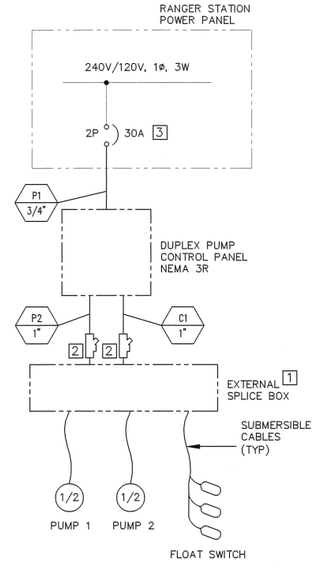
[2] PROVIDE SEAL–OFF AS REQUIRED BY NEC. ORENCO SBCS100, OR EQUALIVENT.

[3] ADD BREAKER TO EXISTING PANEL.



DOSING PUMP TANK DETAIL

NOT TO SCALE



POWER ONE-LINE

IN KANSAS 1–800–344–7233 DIG–SAFE

IN MISSOURI 1–800–344–7483 DIG–RITE

STATE OF MISSOURI
ERIC GREITENS, GOVERNOR

STATE OF MISSOURI
ADAM C. FERGUSON
NUMBER PE–2017000294
PROFESSIONAL ENGINEER
ADAM C. FERGUSON
PE–2017000294
4/3/17

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MISSOURI CERTIFICATE OF AUTHORITY: 000143

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PROJECT # X 1410-01
SITE # 4118
FACILITY # 51577

REVISION:
DATE:
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DATE:
REVISION: 0
DATE: 04/3/17
ISSUE DATE: 4/3/2017

CAD DWG FILE: 130512-010-E-100.dwg
DRAWN BY: DM
CHECKED BY: ACF
DESIGNED BY: HJS

SHEET TITLE:
RANGER STATION

SHEET NUMBER:
E-100

14 OF 16 SHEETS
4/3/2017

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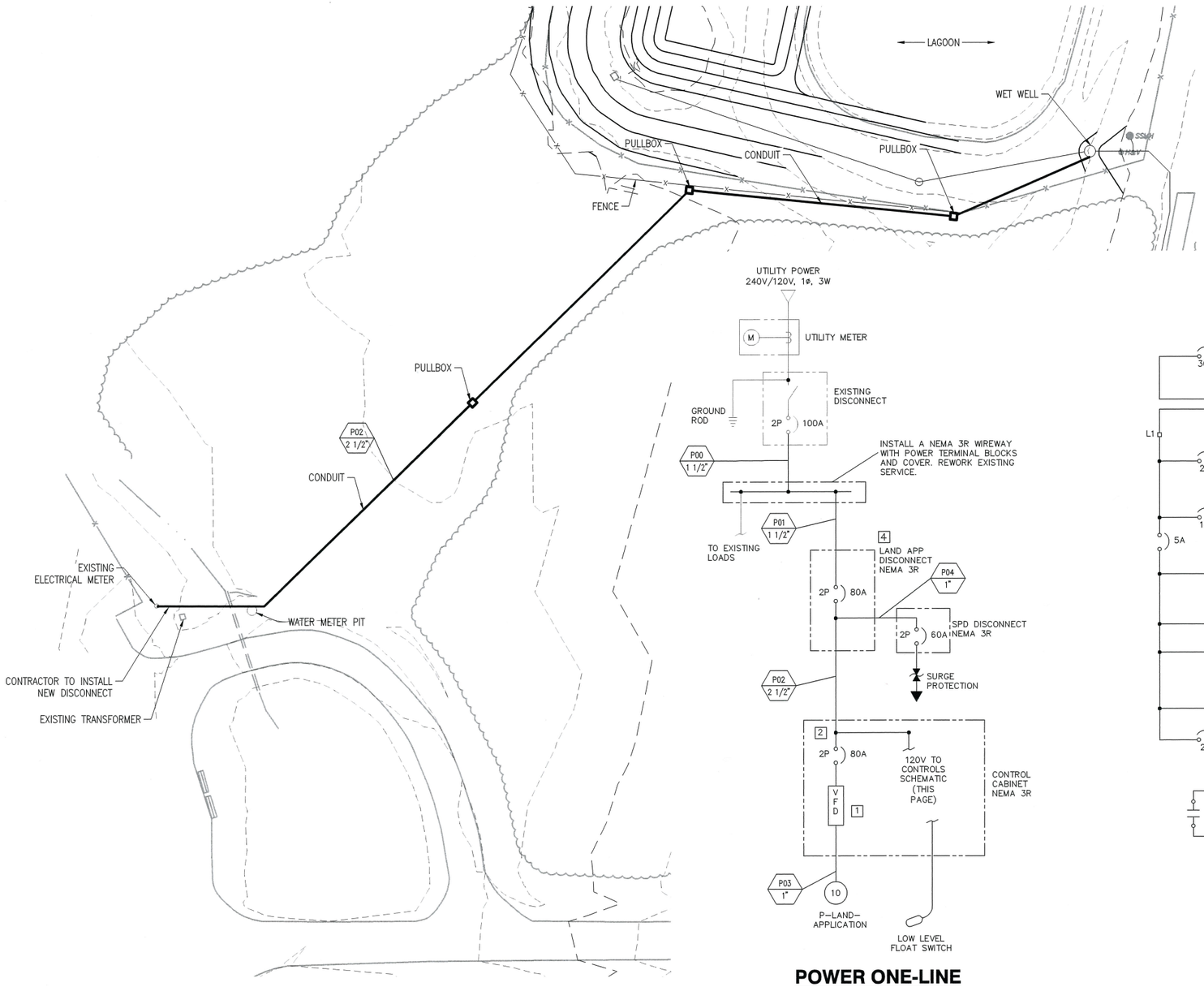
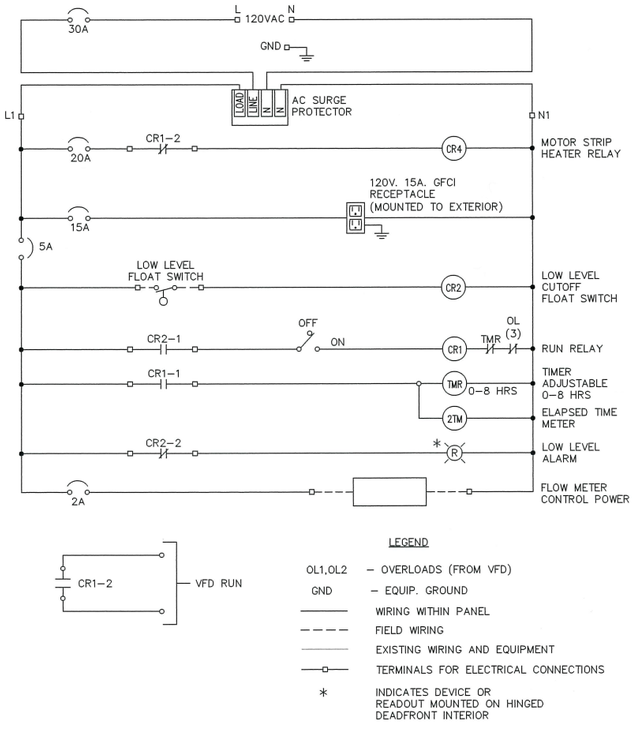


ELECTRICAL SITE PLAN

POWER ONE-LINE



CONTROLS SCHEMATIC

CONDUIT NUMBER	FROM	TO	VOLTAGE (V)	# PHASES	WIRE SIZE, CONDUIT	WIRE INSULATION TYPE	CONDUIT TYPE
P00	EXISTING MAIN DISCONNECT	WIREWAY	240	1	3-#3, #8 GND, 1 1/2"	THHW/THWN	RGS
P01	WIREWAY	LAND APP DISCONNECT	240	1	3-#3, #8 GND, 1 1/2"	THHW/THWN	PVC & RGS
P02	LAND APP DISCONNECT	CONTROL CABINET	240	1	3-#4/0, #1 GND, 2 1/2"	THHW/THWN	PVC & RGS
P03	CONTROL CABINET	P-LAND-APPLICATION	240	1	3-#10, #10 GND, 1"	THHW/THWN	RGS
P04	LAND APP DISCONNECT	SURGE PROTECTION DEVICE	240	1	#4	THHW/THWN	RGS
P05	CONTROL CABINET	MAG METER PANEL	120VAC	1	2-#14AWG, #14GND, 3/4"	THHW/THWN	RGS
C01	MAG METER PANEL	MAG METER SENSOR	DC	N/A	PROVIDE BY METER MFG	-	RGS & FLEX

CONDUIT SCHEDULE

GENERAL NOTES:

1. BURIED POWER CONDUITS SHALL BE SCHEDULE 40 PVC INSTALLED AT 36" MINIMUM BELOW GRADE OR AS INDICATED ON PLAN. TRANSITION TO RIGID GALVANIZED STEEL (RGS) AT 90° ELBOW BELOW GRADE. RGS CONDUIT TO BE COATED WITH BITUMASTIC COAL TAR EPOXY.
2. CONDUIT ROUTING AREA IS APPROXIMATE. FINAL ROUTING DECISIONS ARE BY CONTRACTOR AND OWNER'S REPRESENTATIVE.
3. SEE CIVIL PACKAGE FOR OVERALL SITE PLAN.

SYMBOL NOTES:

[1] VFD WILL TAKE 1ø INPUT AND DELIVER 3ø OUTPUT TO P-LAND-APPLICATION. VFD SHALL BE RATED FOR 1ø TO 3ø CONVERSION AND SIZE SHALL BE DERATED FOR TWICE (2x) THE FLA AND HP OF THE MOTOR OR PER MANUFACTURER GUIDANCE, WHICHEVER IS GREATER. APPROPRIATE DC BUS FILTERING MUST BE INCLUDED.

[2] USE TERMINAL BLOCKS IN CONTROL CABINET TO FEED 240V TO VFD AND 120V TO CONTROL CIRCUITRY.

[3] ALL GROUND RODS SHALL BE 3/4" X 10' COPPER BOND. GROUND WIRE SHALL BE CAD WELD BONDED TO ROD.

[4] INSTALL NEW NEMA 3R DISCONNECT FOR FEEDER. WIREWAY WITH POWER DISTRIBUTION BLOCKS TO BE USED TO FEED NEW DISCONNECT AND EXISTING LOADS. INTERCEPT EXISTING CONDUIT AND WIRE.

STATE OF MISSOURI
ERIC GREITENS,
GOVERNOR

STATE OF MISSOURI
ADAM C. FERGUSON
NUMBER PE-2017000294
PROFESSIONAL ENGINEER
ADAM C. FERGUSON PE-2017000294
4/3/17

SHAFER, KLINE & WARREN, INC.
107 Butler Street, Macon, MO 63552-1628
660/385-6441 FAX: 660/385-6614
OFFICE LOCATIONS: Macon, MO Columbia, MO Houston, TX
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CIVIL ENGINEERS ELECTRICAL ENGINEERS MECHANICAL ENGINEERS STRUCTURAL ENGINEERS LANDSCAPE ARCHITECTS LAND SURVEYORS LAND PLANNERS
MISSOURI CERTIFICATE OF AUTHORITY#: 000143

OFFICE OF ADMINISTRATION
DIVISION OF FACILITIES MANAGEMENT,
DESIGN AND CONSTRUCTION

DEPARTMENT OF
NATURAL RESOURCES

PROJECT TITLE
WATKINS MILL STATE PARK & HISTORIC SITE
UPGRADE WASTEWATER TREATMENT SYSTEM

WATKINS MILL STATE PARK & HISTORIC SITE

PROJECT # X 1410-01
SITE # 4118
FACILITY # 51577

REVISION:
DATE:
REVISION:
DATE:
REVISION: 0
DATE: 4/3/2017
ISSUE DATE: 4/3/2017

CAD DWG FILE: 130512-010-E-101.dwg
DRAWN BY: DM
CHECKED BY: ACF
DESIGNED BY: HJS

SHEET TITLE:
ELECTRICAL PLAN, ONE-LINE, SCHEMATIC

SHEET NUMBER:
E-101

15 OF 16 SHEETS
4/3/2017

IN KANSAS 1-800-344-7233 DIG-SAFE
IN MISSOURI 1-800-344-7483 DIG-RITE

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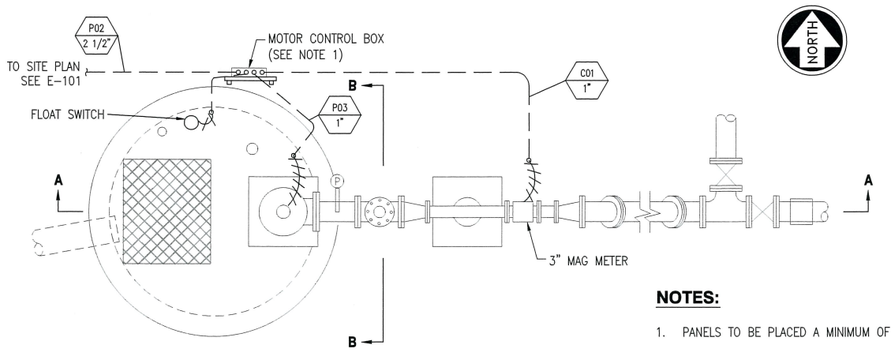
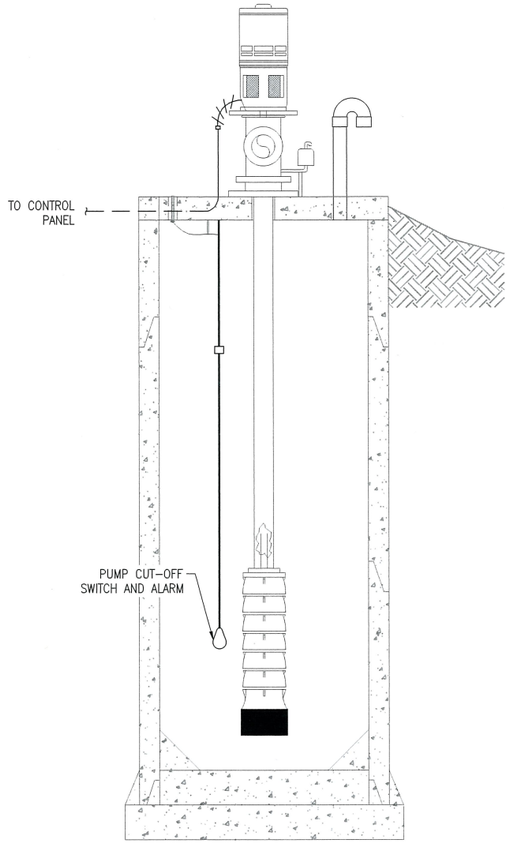


WET WELL PLAN

SCALE: ½"=1'-0"

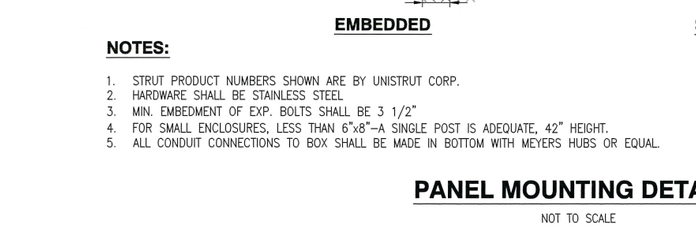
NOTES:

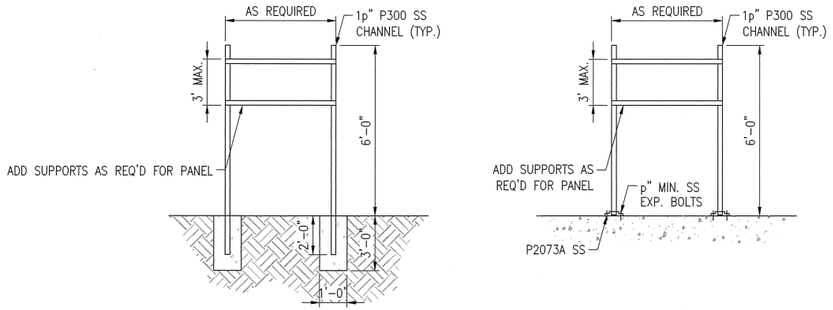
1. PANELS TO BE PLACED A MINIMUM OF 10' AWAY FROM VENTS.



WET WELL SECTION B-B

SCALE: ½"=1'-0"





EMBEDDED

SURFACE MOUNT

NOTES:

1. STRUT PRODUCT NUMBERS SHOWN ARE BY UNISTRUT CORP.
2. HARDWARE SHALL BE STAINLESS STEEL
3. MIN. EMBEDMENT OF EXP. BOLTS SHALL BE 3 1/2"
4. FOR SMALL ENCLOSURES, LESS THAN 6"x8"-A SINGLE POST IS ADEQUATE, 42" HEIGHT.
5. ALL CONDUIT CONNECTIONS TO BOX SHALL BE MADE IN BOTTOM WITH MEYERS HUBS OR EQUAL.

PANEL MOUNTING DETAILS

NOT TO SCALE

IN KANSAS 1-800-344-7233 DIG-SAFE

IN MISSOURI 1-800-344-7483 DIG-RITE

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STATE OF MISSOURI
ERIC GREITENS,
GOVERNOR

STATE OF MISSOURI
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NUMBER PE-2017000294
PROFESSIONAL ENGINEER
ADAM C. FERGUSON PE-2017000294 4/3/17

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WETWELL PLAN

SHEET NUMBER:
E-102

16 OF 16 SHEETS
4/3/2017

NEW PREMIUM CAMPSITES
WATKINS WOOLEN MILL STATE HISTORIC SITE

MISSOURI STATE PARKS NORTH REGION

BID DOCUMENTS

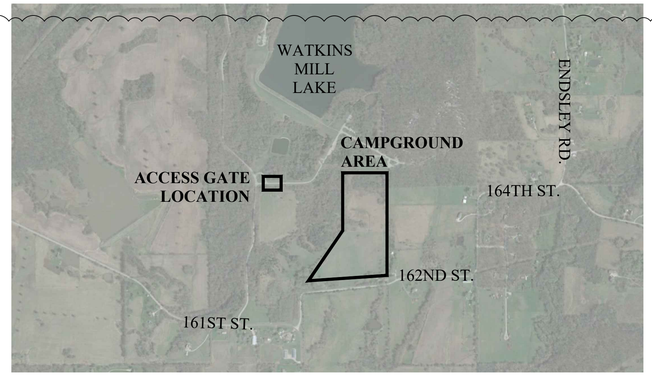
OWNER: STATE OF MISSOURI
MICHAEL L. PARSON, GOVERNOR

DEPARTMENT OF NATURAL RESOURCES, MISSOURI STATE PARKS

PROJECT MANAGEMENT: OFFICE OF ADMINISTRATION
DIVISION OF FACILITIES MANAGEMENT,
DESIGN AND CONSTRUCTION

PROJECT NUMBER: X2220-01

WATKINS WOOLEN MILL STATE HISTORIC SITE
26600 Park Road N.
Lawson, MO 64062
SITE NUMBER: 5126 ASSET NUMBER: 7815126063



LANDSCAPE ARCHITECT:
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SHEET INDEX:

SHEET NUMBER:
G-000
1 OF 56 SHEETS
March 19, 2025