CONTRACT PROVISIONS and SPECIFICATIONS

2026 Waste Storage Facility - Burmaster Construction
Project #WA1206-140-11

SMALL PUBLIC WORKS PROJECT
SKAGIT COUNTY PUBLIC WORKS

Must be an approved contractor on the Municipal Research and Services Center (MRSC) Roster in order to Bid this project: http://www.mrscrosters.org

2026 Waste Storage Facility - Burmaster Construction Project #WA1206-140-11

This Contract is for the construction of a livestock waste storage facility for one (1) landowner in Skagit County.

Schedule: TBD from date of Notice to Proceed.

Measurement & Payment: Each item will be per the bid proposal.

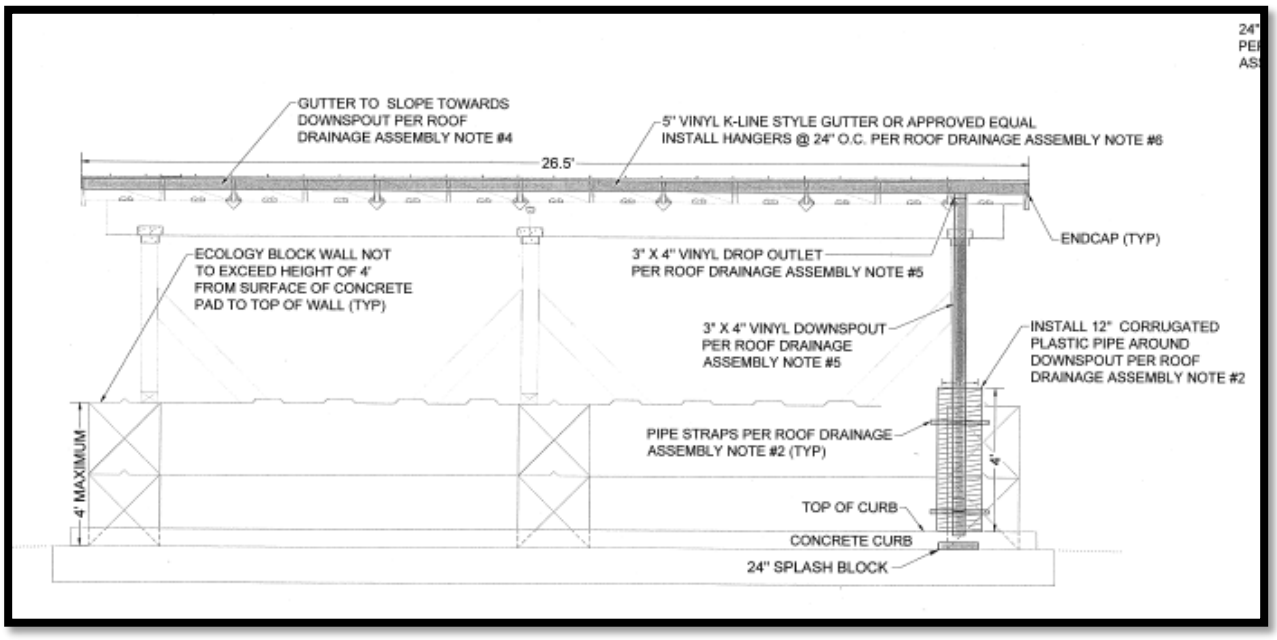

Image: Waste Storage Facility design drawing made with Ecology blocks. Structure is built on a concrete pad and includes a roof and drainage infrastructure.

WASHINGTON STATE DEPARTMENT OF HEALTH

CLEAN WATER PROGRAM

SPECIFICATIONS INSERT

This project has been funded wholly or in part by the United States Environmental Protection Agency under assistance agreement PC-01J89801 to the Washington State Department of Health. The contents of this document do not necessarily reflect the views and policies of the Environmental Protection Agency, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

GENERAL INFORMATION
AND
CONTRACT PROVISIONS

These general provisions are hereby a part of the conditions agreed to by the Contractor upon Bid. Skagit County Public Works is guided by Title 39 RCW, and utilizes the *2025 Standard Specifications for Road, Bridge, and Municipal Construction*, where applicable.

GENERAL INFORMATION

PROJECT TITLE: 2026 Waste Storage Facility - Burmaster Construction

DESCRIPTION OF WORK: Skagit County is interested in obtaining the services of a contractor to construct a livestock waste storage facility on one (1) property in Skagit County. The waste storage facility is a three (3) walled structure made of ecology blocks. The structure includes one (1) dividing wall to create two (2) bays. The structure has a concrete floor. The structure has a roof with runoff structures, designed according to Natural Resource Conservation Service (NRCS) standards. The designed structure has an interior space of two hundred (200) square feet.

Work shall take place at the following property:

Sally Burmaster, Owner
23086 Bassett Road
Sedro-Woolley, WA 98284

BID DUE DATE AND TIME: Wednesday, April 22, 2026, at 3:00 p.m., or soon thereafter

ENGINEER'S ESTIMATE: $28,000 - $33,000

NOTICE TO PROCEED: Contractor shall not commence work until notice to proceed has been given by Skagit County; this occurs after the Contract has been executed by Skagit County Board of Commissioners.

QUESTIONS AND ANSWERS: All technical questions and requests for interpretation shall be in writing and submitted by email with the subject line reading, "Waste Storage Facility - Burmaster," no later than **4:00 p.m. on Friday, April 10, 2026**, to Leanne Ingman, Natural Resources Technician, leannei@co.skagit.wa.us. Questions will not be accepted after Friday, April 10, 2026

ADDENDA: If Skagit County issues addenda to this project, bidders must acknowledge receipt of all addenda on the revised bid proposal. It is the Bidder's responsibility to ensure that the bidder has received all addenda, although Skagit County will make reasonable effort to provide addenda to all plan holders. Addenda will be forwarded to Contractors on the Plan Holder list via email, and will be posted online at www.skagitcounty.net/rfp. Failure to sign the acknowledgement of addenda on the revised proposal packet may result in rejection of the bid.

All addenda, if needed, will be posted online for this work **by 4:00 p.m. on Wednesday April 15 2026**. All addenda shall become part of the bid package. If further addenda are required to be issued, after Wednesday, April 15, 2026, the bid opening may be postponed. Contractors on the plan holder list will be notified of postponement via phone and email. A postponement notice will also be posted online at www.skagitcounty.net/rfp.

MANDATORY BIDDER RESPONSIBILITY CRITERIA: Before award, the bidder must meet the following bidder responsibility criteria to be considered a responsible bidder. The bidder may be required by Skagit County to submit documentation demonstrating compliance with the criteria.

The bidder must:

1. Have a current certificate of registration as a contractor in compliance with Title 18.27 RCW, which must have been in effect at the time of bid submittal;
2. Have a current Washington Unified Business Identifier (UBI) number;
3. Have Industrial Insurance (workers' compensation) coverage for the bidder's employees working in Washington, as required in Title 51 RCW;
4. Have a Washington Employment Security Department number (ESD), as required in Title 50 RCW, **(and, if lowest responsive and responsible bidder, provide documentation in the form of a letter or statement from ESD within 24 hours of submitting bid)**;
5. Have a Washington Department of Revenue state excise tax registration number, as required in Title 82 RCW;
6. Not be disqualified from bidding on any public works contract under Title 39.06.010 RCW or Title 39.12.065(3) RCW and;
7. Not be excluded or suspended from bidding on any public works contract under federal laws.

TITLE VI: Skagit County, in accordance with the provisions of Title VI of the Civil Rights Act of 1964 (78 Stat. 252,42 U.S.C. 2000d to 2000d-4) and the Regulations, hereby notifies all bidders that will affirmatively ensure that any contract entered into pursuant to this advertisement, disadvantaged business enterprises will be afforded full and fair opportunity to submit bids in response to this invitation and will not be discriminated against on the grounds of race, color, or national origin in consideration for an award

For questions regarding Skagit County's Title VI Program, you may contact the Public Works Department's Title VI Coordinator, Michael See, at (360) 416-1400.

EXAMINATION OF BID AND CONTRACT DOCUMENTS, SITE, AND SITE CONDITIONS: The Bidder shall carefully examine the Bid Documents as defined in Section 1-01.3 of the *2025 Standard Specifications for Road, Bridge, and Municipal Construction*.

Submittal of a Bid shall be conclusive evidence that the Bidder has made these examinations and understands all requirements for the performance of the completed Work. The Bidder further warrants, agrees, and acknowledges by submitting a Bid that it:

1. Has taken steps reasonably necessary to ascertain the nature and location of the Work;
2. Has investigated and satisfied itself as to the general and local conditions, which can affect the Work or its cost, including but not limited to:

a. Conditions bearing upon acquisition, transportation, disposal, handling, and storage of materials;
b. The availability of labor, materials, water, electric power, and roads;
c. Uncertainties of weather, river stages, tides, or similar physical conditions at the site;
d. The conformation and condition of the ground;
e. The character of equipment and facilities needed preliminary to and during Work performance; and
f. The site biological hazards and associated physical hazards.

3. Has satisfied itself as to the character, quality, and quantity of surface and subsurface materials or obstacles to be encountered insofar as this information is reasonably ascertainable from an inspection of the Work site (including material sites) as well as from the Bid Documents and other information made a part of this Contract; and
4. Has satisfied itself as to the adequacy of time allowed for the completion of the physical Work on the Contract.

Any failure of the Bidder to take the actions described and acknowledged in this clause shall not relieve the Bidder from responsibility for estimating properly the difficulty and cost of successfully performing the Work, or from proceeding to successfully perform the Work without additional expense to the Contracting Agency.

The Bidder agrees that the Contracting Agency shall not be liable to it on any claim for additional payment or additional time or any claim whatsoever if the claim directly or indirectly results from the Bidder's failure to investigate and familiarize itself sufficiently with the conditions under which the Contract is to be performed.

The Bidder shall be familiar and comply with all Federal, State, tribal, and local laws, ordinances, and regulations which might affect those engaged in the Work. The Contracting Agency will not consider any plea of misunderstanding or ignorance of such requirements.

BID PRICE: Bid prices shall reflect what the Bidder anticipates the cost of completing the Work to be, including methods, materials, labor, and equipment. Except as the Contract may provide, the Bidder shall receive no payment for any costs that exceed those in the Bid prices.

The Contractor shall bear all cost for such insurance as provided in Section 1-07.10. No Claim shall be allowed because of any ambiguity in the Contract if:
1. The Bidder discovers an ambiguity but fails to notify the Contracting Agency, or
2. The Bidder failed to discover a patent ambiguity that would be discovered by a reasonably prudent contractor in preparing its Bid.

Any prospective Bidder desiring an explanation or interpretation of the Bid Documents, shall request the explanation or interpretation in writing by close of business on the Thursday preceding the bid opening to allow a written reply to reach all prospective Bidders before the submission of their Bids. Oral explanations, interpretations, or instructions given by anyone before the Award of a Contract will not be binding on the Contracting Agency.

Any information given a prospective Bidder concerning any of the Bid Documents will be furnished to all prospective Bidders as an Addendum if that information is deemed by the Contracting Agency to be necessary in submitting Bids or if the Contracting Agency concludes that the lack of the information would be prejudicial to other prospective Bidders.

BID PROCEDURES AND CONDITIONS

PROPOSAL FORMS: At the request of a bidder, the Contracting Agency will provide a proposal form for any project on which the bidder is eligible to bid.

The proposal form will identify the project, list estimated quantities, units of measurement, the items of work, and the materials to be furnished at the unit bid prices. The bidder shall complete spaces on the proposal form that call for information such as: unit prices; extensions; total bid amount; signatures; date; retail sales taxes; the bidder's name, address, telephone number, and signature.

PREPARATION OF PROPOSAL: The Contracting Agency will accept only those Proposals properly executed on forms it provides.

All prices shall be in legible figures (not words) written in ink or typed. The Proposal shall include:

1. A unit price for each item (omitting digits more than four (4) places to the right of the decimal point)
2. An extension for each unit price (omitting digits more than two (2) places to the right of the decimal point)
3. The total Contract price (the sum of all extensions)

BID PRICE: The bidder shall submit the completed Bid Proposal as part of the bid. The bid shall include everything necessary for the prosecution and completion of the Contract including, but not limited to, furnishing all material, labor, equipment, and Subcontractors, and other facilities and all management, superintendent's labor and service as outlined in the Provisions, except as may be provided otherwise in the Contract documents. In the event of a discrepancy between the unit price and the total price, the unit price will govern and Skagit County will correct total price accordingly.

SIGNATURES: Bids shall be signed by one of the legally authorized officers of said corporation. If awarded the contract, the Contract shall also be so executed. If a Bid Proposal or Contract is signed by an agent, the agent shall provide satisfactory evidence of authority to sign as legal representative of Bidder, upon request of Skagit County. An authorized partner of a co-partnership may sign the contract, subject to the approval of the attorney, who may at his discretion, require each and every member of the co-partnership to sign the contract.

DELIVERY OF PROPOSAL: Sealed bids will be received by the Board of Skagit County Commissioners. Bids must be received no later than **3:00 p.m. on Wednesday, April 22, 2026,** according to the SKAGIT COUNTY COMMISSIONERS' Reception Desk clock. All bid envelopes must be plainly marked on the outside, "Sealed Bid: Waste Storage Facility - Burmaster," and delivered to the address below.

Hand-deliver or Mail Proposal to:
Skagit County Commissioners
1800 Continental Place, Suite 100
Mount Vernon, WA 98273

It is the Contractor's responsibility to allow enough time for delivery to occur before the designated time. Quotations delivered to locations other than as indicated above or received after the designated time will not be accepted. Incomplete proposals cannot be considered. Oral, telephonic, telegraphic, electronic, or faxed proposals will not be accepted.

Skagit County reserves the right to reject any or all bids, waive informalities, and make the award in the best interest of Skagit County. Quotation results and questions pertaining to this project can be obtained by calling Leanne Ingman, Natural Resources Technician at (360) 416-1450.

Bids remain confidential and no information about bids is released until the public information of the bids is otherwise available.

The Contracting Agency will not open or consider any Proposal when the Proposal or Bid deposit is received after the time specified for receipt of Proposals or received in a location other than that specified for receipt of Proposals unless an emergency or unanticipated event interrupts normal work processes of the Contracting Agency so that Proposals cannot be received.

If an emergency or unanticipated event interrupts normal work processes of the Contracting Agency so that Proposals cannot be received at the office designated for receipt of bids as specified above the time specified for receipt of the Proposal will be deemed to be extended to the same time of day specified in the solicitation on the first work day on which the normal work processes of the Contracting Agency resume.

BID BOND DEPOSIT/GUARANTY: Pursuant to Title 36.32.250 RCW, no bid will be considered unless accompanied by a surety company bid bond, Cashier's or certified check payable to the order of Skagit County for a sum not less than five percent (5%) of the estimated bid amount. Should the successful bidder fail to enter into such contract, the bid bond will be forfeited to Skagit County.

Any proposal bond shall be on a form acceptable to the Contracting Agency and shall be signed by the Bidder and the Surety. A proposal bond shall not be conditioned in any way to modify the minimum five percent (5%) required. The Surety shall: (1) be registered with the Washington State Insurance Commissioner, and (2) appear on the current Authorized Insurance List in the State of Washington published by the Office of the Insurance Commissioner.

The failure to furnish a Bid deposit of a minimum of five percent (5%) with the Bid or as a physical supplement to the electronic Proposal Form shall make the Bid nonresponsive and shall cause the Bid to be rejected by the Contracting Agency.

NON-COLLUSION: Submittal and signature of the non-collusion certificate confirms the bid is genuine and not a sham or collusive, and not made in the interest of any person not named, and that the Contractor has not induced or solicited others to submit a sham offer, or to refrain from proposing.

CONSIDERATION OF BIDS: After opening and reading proposals, the Contracting Agency will check them for correctness of extensions of the prices per unit and the total price. If a discrepancy exists between the price per unit and the extended amount of any bid item, the

price per unit will control. The total of extensions, corrected where necessary, will be used by the Contracting Agency for Award purposes and to fix the amount of the Contract Bond.

The right is reserved by the Contracting Agency to waive informalities in the bidding, accept a Proposal of the lowest responsible Bidder, reject any or all Bids, republish the call for Bids, revise or cancel the Work, or require the Work to be done in another way, if the best interest of the Contracting Agency is served.

A Bidder who wishes to claim error after the Bids have been opened and read as required by Title 47.28.090 RCW shall promptly notify the Contracting Agency that an error occurred. The Bidder shall submit a notarized affidavit or declaration under penalty of perjury signed by the Bidder and accompanied by the work sheets used in the preparation of the Bid, requesting relief from the responsibilities of Award. The affidavit or declaration shall describe the specific error(s) and certify that the work sheets are the ones used in preparing the Bid.

The affidavit or declaration shall be submitted no later than 4:30 p.m. on the first business day after Bid opening or the claim will not be considered. The Contracting Agency will review the affidavit or declaration and the certified work sheets to determine the validity of the claimed error and if the error is of the kind for which the law allows relief from forfeiture of the Bid deposit. If the Contracting Agency concurs in the claim of error and determines that the error is of the kind which allows relief from forfeiture, the Bidder will be relieved of responsibility and the Bid deposit of the Bidder will be returned. If the Contracting Agency does not concur in the error or determines that the error is not the kind for which the law allows relief, the Contracting Agency may Award the Contract and if the Bidder refuses to execute the Contract, the Bidder's Bid deposit shall be forfeited as required by Title 47.28.100 RCW. Title 39.04.107 RCW applies, thereafter.

NON-RESPONSIVE BIDS: Any bid that does not comply with these instructions, is not signed, supplements or deviates from the specifications herein, or is incomplete, may be declared non-responsive by Skagit County and not further considered.

PROTESTS: Protests will be in accordance with all RCWs, as applicable.

AWARD OF CONTRACT

CONDITION OF AWARD: It is the intent of Skagit County to award a contract to the lowest responsive and responsible bidder. The Board of Skagit County Commissioners reserves the right to reject any or all bids for cause, and to waive minor irregularities in the bidding.

AWARD OF CONTRACT: Normally, Contract Award or Bid rejection will occur within forty-five (45) calendar days after Bid opening. If the lowest responsible Bidder and the Contracting Agency agree, this deadline may be extended. If they cannot agree on an extension by the 45-calendar day deadline, the Contracting Agency reserves the right to Award the Contract to the next lowest responsible Bidder or reject all Bids. The Contracting Agency will notify the successful Bidder of the Contract Award in writing.

ACCEPTANCE OF AWARD: If awarded, the Contractor is deemed to have agreed to all Addenda, Bid Instruction to bidders, General and Contract Provisions, Scope of Work, Specifications, Contract, and all other related documents.

COORDINATION OF DOCUMENTS: Any inconsistency in the parts of the Contract shall be resolved by following this order of precedence (e.g., 1 presiding over 2, 3, 4, 5, 6, and 7; 2 presiding over 3, 4, 5, 6, and 7; and so forth):

1. Addenda,
2. Proposal Form,
3. Special Provisions,
4. Contract Plans,
5. Amendments to the Standard Specifications,
6. Standard Specifications, and
7. Standard Plans.

On the Contract Plans, Working Drawings, and Standard Plans, figured dimensions shall take precedence over scaled dimensions.

This order of precedence shall not apply when Work is required by one part of the Contract but omitted from another part or parts of the Contract. The Work required in one part must be furnished even if not mentioned in other parts of the Contract.

Whenever reference is made in these Specifications or the Special Provisions to codes, rules, specifications, and standards, the reference shall be construed to mean the code, rule, specification, or standard that is in effect on the Bid advertisement date, unless otherwise stated or as required by law.

If any part of the Contract requires Work that does not include a description for how the Work is to be performed, the Work shall be performed in accordance with standard trade practice(s). For purposes of the Contract, a standard trade practice is one having such regularity of observance in the trade as to justify an expectation that it will be observed by the Contractor in doing the Work.

In case of any ambiguity or dispute over interpreting the Contract, the Engineer's decision will be final as provided in *2025 WSDOT Standard Specifications for Road, Bridge, and Municipal Construction* Section 1-05.1.

CONTRACT

EXECUTION OF CONTRACT: Successful bidder is allowed a maximum of **ten (10) calendar days** after the award date to return the signed contract, contract bond, all required insurance certifications, and any other required documentation as specified in this document.

Until the Contracting Agency executes a Contract, no Proposal shall bind the Contracting Agency nor shall any Work begin within the project limits or within Contracting Agency-furnished sites. The Contractor shall bear all risks for any Work begun outside such areas and for any materials ordered before the Contract is executed by the Contracting Agency.

If the Bidder experiences circumstances beyond their control that prevents return of the Contract documents within ten (10) calendar days after the Award date, the Contracting Agency may grant up to a maximum of ten (10) additional calendar days for return of the documents, provided the Contracting Agency deems the circumstances warrant it.

CONTRACT DOCUMENTS: The Addenda, Bid Proposal, General and Contract Provisions and Specifications, and Contract, shall be a part of and constitute the Contract entered into by Skagit County and successful Bidder. In the event there is discrepancy between any of the foregoing contract documents, the above order of documents governs so that the former prevails over the latter.

CONTRACT BOND: Pursuant to Title 39.08 RCW, the successful Bidder shall provide an executed contract bond for the full contract amount. This contract bond shall:

1. Be on a Contracting Agency-furnished form;
2. Be signed by an approved Surety (or Sureties) that:
   a. Is registered with the Washington State Insurance Commissioner, and
   b. Appears on the current Authorized Insurance List in the State of Washington published by the Office of the Insurance Commissioner,
3. Be conditioned upon the faithful performance of the contract by the Contractor within the prescribed time;
4. Guarantee that the Surety shall indemnify, defend, and protect the Contracting Agency against any claim of direct or indirect loss resulting from the failure:
   a. Of the Contractor (or any of the employees, subcontractors, or lower tier subcontractors of the Contractor) to faithfully perform the contract, or
   b. Of the Contractor (or the subcontractors or lower tier subcontractors of the Contractor) to pay all laborers, mechanics, subcontractors, lower tier subcontractors, material or any other person who provides supplies or provisions for carrying out the work;

The Contracting Agency may require Sureties or Surety companies on the Contract Bond to appear and qualify themselves. Whenever the Contracting Agency deems the Surety or Sureties to be inadequate, it may, upon written demand, require the Contractor to furnish additional Surety to cover any remaining work. Until the added Surety is furnished, payments on the Contract will stop.

RETAINAGE: Pursuant to Title 60.28 RCW, a sum of five percent (5%) of the monies earned by the Contractor will be retained from progress estimates. Such retainage shall be used as a trust fund for the protection and payment (1) to the State with respect to taxes imposed pursuant to Title 82 RCW, and (2) the claims of any person arising under the Contract.

Monies retained under the provisions of Title 60.28 RCW shall, at the option of the Contractor, be:

1. Retained in a fund by the Contracting Agency; or
2. Deposited by the Contracting Agency in an escrow (interest-bearing) account in a bank, mutual saving bank, or savings and loan association (interest on monies so retained shall be paid to the Contractor). Deposits are to be in the name of the Contracting Agency and are not to be allowed to be withdrawn without the Contracting Agency's written authorization. The Contracting Agency will issue a check representing the sum of the monies reserved, payable to the bank or trust company. Such check shall be converted into bonds and securities chosen by the Contractor as the interest accrues.

At the time the Contract is executed the Contractor shall designate the option desired. The Contractor in choosing option (2) agrees to assume full responsibility to pay all costs that may accrue from escrow services, brokerage charges or both, and further agrees to assume all risks

in connection with the investment of the retained percentages in securities. The Contracting Agency may also, at its option, accept a bond in lieu of retainage.

Release of the retainage will be made sixty (60) days following the Completion Date (pursuant to Title 39.12 RCW, and Title 60.28 RCW) provided the following conditions are met:

1. On Contracts totaling more than $35,000, a release has been obtained from the Washington State Department of Revenue.
2. Affidavits of Wages Paid for the Contractor and all Subcontractors are on file with the Contracting Agency (Title 39.12.040 RCW).
3. A certificate of Payment of Contributions Penalties and Interest on Public Works Contract is received from the Washington State Employment Security Department.
4. Washington State Department of Labor and Industries (in accordance with Section 1-07.10) shows the Contractor is current with payments of industrial insurance and medical aid premiums.
5. All claims, as provided by law, filed against the retainage have been resolved. In the event claims are filed and provided the conditions of 1, 2, 3, and 4 are met, the Contractor will be paid such retained percentage less an amount sufficient to pay any such claims together with a sum determined by the Contracting Agency sufficient to pay the cost of foreclosing on claims and to cover attorney's fees.

INSURANCE: Contractor shall comply with the following conditions and procure and keep in force during the term of this Agreement, at Contractor's own cost and expense, the following policies of insurance with companies authorized to do business in the State of Washington, which are rated at least "A" or better and with a numerical rating of no less than seven (7), by A.M. Best Company and which are acceptable to the County.

1. Commercial General Liability Insurance on an occurrence basis in an amount not less than $1,000,000 per occurrence and at least $1,000,000 in the annual aggregate, including but not limited to: premises/operations (including off-site operations), blanket contractual liability and broad form property damage.
2. Business Automobile Liability Insurance in an amount not less than $1,000,000 per occurrence, extending to any automobile.
3. Workers' Compensation Insurance as required by Washington law and Employer's Liability Insurance (Stop Gap) with limits not less than $1,000,000 per occurrence. If the County authorizes sublet work, the Contractor shall require each Subcontractor to provide Workers' Compensation Insurance for its employees, unless the Contractor covers such employees.

The above liability policies shall contain a provision that the policy shall not be canceled or materially changed without thirty (30) days prior written notice to the County. No cancellation provision in any insurance policy shall be construed in derogation of the continuous duty of the Contractor to furnish the required insurance during the term of this Agreement.

Upon written request by the County, the insurer or his/her agent will furnish, prior to or during any Work being performed, a copy of any policy cited above, certified to be a true and complete copy of the original.

ADDITIONAL INSURED: Prior to the Contractor performing any Work, Contractor shall provide the County with a Certificate of Insurance acceptable to the County Attorney evidencing the above-required insurance and naming Skagit County, its officers, employees and agents as

Additional Insureds on the Commercial General Liability Insurance policy and the Business Automobile Liability Insurance policy with respect to the operations performed and services provided under this Agreement and that such insurance shall apply as primary insurance on behalf of such Additional Insureds. Skagit County shall be named as an Additional Insured by endorsement using ISO Form CG 2010 or equivalent. Receipt by the County of any certificate showing less coverage than required is not a waiver of the Contractor's obligations to fulfill the requirement.

The Certificate must name the County as additional insured, and state: Skagit County, its elected officials, officers and employees are named as additional insured.

The insurance policies required in this Contract are to contain and be endorsed to contain the following provisions:

With respect to all Liability Policies:

Skagit County its officers, officials, employees, and agents and volunteers are named as additional insured's as respects liability arising out of activities performed by or on behalf of the Contractor in connection with this Contract.

The Contractor's insurance coverage shall be primary insurance as respects Skagit County, its officers, officials, employees, agents, volunteers and consultants. Any insurance and/or self-insurance maintained by Skagit County, its officers, officials, employees, agents and consultants shall not contribute with the Contractor's insurance or benefit the Contractor in any way.

An additional insureds endorsement template can be provided by Skagit County, upon request.

PUBLIC WORKS PROJECT – PREVAILING WAGE: Pursuant to Title 39.12 RCW, if awarded the project, the Contractor and each Subcontractor shall complete or have on file with the County a current "Statement of Intent to Pay Prevailing Wages" before payment will be made for work performed. An "Affidavit of Wages Paid" shall be required at the end of the project, before final payment is authorized. These forms are available from Washington State Department of Labor & Industries and can be filed electronically at http://www.lni.wa.gov/TradesLicensing/PrevWage.

The State of Washington prevailing wage rates applicable for this public works project, which is located in Skagit County, may be found at the following website address of the Department of Labor and Industries: https://fortress.wa.gov/lni/wagelookup/prvWagelookup.aspx.
Any materials purchased will be used in public work type projects as defined in RCW 39.12, and therefore, subject to state prevailing wage rates as set forth by the Washington Department of Labor and Industries. Bidders are advised to consider this charge when computing bids.

LICENSES AND PERMITS: Contractor shall procure all licenses, pay all charges, fees and taxes, and give all notices necessary and incidental to the due and lawful prosecution of the work. Contractors awarded a County Contract are responsible for compliance with Washington State Business License regulations.

A Land Disturbance Activity permit will have to be submitted for the concrete curtain, with a SWPP submitted by the Contractor.

CHANGES/AMENDMENTS: Skagit County reserves the right to add or delete work, items, agencies, or locations from this contract, subject to appropriate adjustments to the Contract price. Added items, agencies, or locations will be related to those on contract, and additions or deletions will be by mutual agreement, with prices consistent with the original bid price margins, and evidenced by an amendment to the Contract. The execution of an amendment shall constitute a waiver of Claims by the Contractor arising out of the Work to be performed or deleted pursuant to the amendment, except as specifically described in the amendment. General reservations of rights will be deemed waived and void.

FAILURE TO EXECUTE CONTRACT: Upon failure to return the performance and payment bonds, insurance certifications, and any other required documentation as specified in this document with the signed contract, as required, Skagit County may then award the contract to the second lowest responsive and responsible Bidder, or reject all remaining bids.

RETURN OF BID BOND/GUARANTY: Proposal bonds and deposits will be held until the Contract has been properly executed pursuant to Title 36.32.250 RCW. When the Contract has been properly executed, all remaining bonds or deposits, except those subject to forfeiture, will be returned.

LEGAL RELATIONS AND RESPONSIBILITIES TO THE PUBLIC

COMPLIANCE WITH LAWS: Contractor shall comply with all applicable federal, state, tribal and local laws, rules, and regulations affecting its performance and hold Skagit County harmless against any claims arising from the violation thereof. No extension of time or additional payment will be made for loss of time or disruption of work caused by any actions against the Contractor for any of the above reasons.

APPLICATION OF SALES TAX: The work on this contract is to be performed upon lands whose ownership obligates the Contractor to pay State sales tax. Department of Revenue Rule 171 applies to this project. This work is not exempt from Sales Tax. The contractor shall include appropriate sales tax as shown on the Bid Proposal. The Contracting Agency will not adjust its payment if the Contractor bases a bid on a misunderstood tax liability.

DEFENSE & INDEMNITY AGREEMENT: The Contractor agrees to defend, indemnify and save harmless the County, its appointed and elective officers and employees, from and against all loss or expense, including but not limited to judgments, settlements, attorney's fees and costs by reason of any and all claims and demands upon the County, its elected or appointed officials or employees for damages because of personal or bodily injury, including death at any time resulting therefrom, sustained by any person or persons and on account of damage to property including loss of use thereof, whether such injury to persons or damage to property is due to the negligence of the Contractor, its subcontractors, its elected officers, employees or their agents, except only such injury or damage as shall have been occasioned by the sole negligence of the County, its appointed or elected officials or employees. It is further provided that no liability shall attach to the County by reason of entering into this contract, except as expressly provided herein.

HOLD HARMLESS: The Contractor shall hold Skagit County and its officers, agents and employees harmless from all costs, claims or liabilities of any nature including attorneys; fees, costs and expenses for or on account of injuries or damages sustained by any persons or property resulting from the negligent activities or omissions of the Contractor, its agents or

employees pursuant to the Contract, or on account of any unpaid wages or other remuneration for services; and if a suit as described above be filed, the Contractor shall appear and defend the same at its own cost and expense, and if judgment be rendered or settlement made requiring payment by Skagit County, the Contractor shall pay the same.

TERMINATION FOR PUBLIC CONVENIENCE: The County may terminate the contract in whole or in part whenever the County determines, in its sole discretion that such termination is in the best interests of the County. Whenever the contract is terminated in accordance with this paragraph, the Contractor shall be entitled to payment for actual work performed at unit contract prices for completed items of work. An equitable adjustment in the contract price for partially completed items of work will be made, but such adjustment shall not include provision for loss of anticipated profit on deleted or uncompleted work. Termination of this contract by the County at any time during the term, whether for default or convenience, shall not constitute a breach of contract by the County. If sufficient funds are not appropriated or allocated for payment under this contract for any future fiscal period, the County will not be obligated to make payments for services or amounts incurred after the end of the current fiscal period. No penalty or expense shall accrue to the County in the event this provision applies.

PAYMENT

INVOICES: The Contractor shall be paid, upon submission of a proper invoice for payment request, the prices stipulated in the Contract for services performed (less deductions, if any), in accordance with all payment and retainage instructions herein. All accounts are paid according to Title 39.76 RCW. Submitted Payment Requests must contain the following minimum information:

- Contract number;
- Item number, quantity, and description as appropriate;
- Unit and extended prices.
- Approved Intent of Wages Paid with WA Department of Labor and Industries

Payments are to be submitted no more than monthly, but not less than quarterly.

Mail Payment Requests to:
Skagit County Public Works
ATTN: Leanne Ingman, Natural Resources Technician
1800 Continental Place
Mount Vernon, WA 98273-5625

Payment will be made to the Contractor upon completion of all work and after final inspection and acceptance of the work by the Owner's Representative.

APPENDIX A

WA State Prevailing Wages

State of Washington
Department of Labor & Industries
Prevailing Wage Section - Telephone 360-902-5335
PO Box 44540, Olympia, WA 98504-4540

Washington State Prevailing Wage
The PREVAILING WAGES listed here include both the hourly wage rate and the hourly rate of fringe benefits. On public works projects, worker's wage and benefit rates must add to not less than this total. A brief description of overtime calculation requirements are provided on the Benefit Code Key.

Journey Level Prevailing Wage Rates for the Effective Date: 4/22/2026

Skagit County

Trade	Job Classification	Wage	Holiday	Overtime	Note
Asbestos Abatement Workers	Journey Level	$67.39	**5D**	**1H**	
Boilermakers	Journey Level	$80.89	**5N**	**1C**	
Brick Mason	Journey Level	$76.07	**7E**	**1N**	
Brick Mason	Pointer-Caulker-Cleaner	$76.07	**7E**	**1N**	
Building Service Employees	Janitor	$17.13		**1**	
Building Service Employees	Shampooer	$17.13		**1**	
Building Service Employees	Waxer	$17.13		**1**	

Building Service Employees	Window Cleaner	$17.13		**1**	
Cabinet Makers (In Shop)	Journey Level	$18.85		**1**	
Carpenters	Acoustical Worker	$83.21	**15J**	**11U**	
Carpenters	Bridge Dock and Wharf Carpenter	$84.81	**15J**	**11U**	**9L**
Carpenters	Floor Layer & Floor Finisher	$83.21	**15J**	**11U**	
Carpenters	General Carpenter	$83.21	**15J**	**11U**	
Carpenters	Scaffold Erector	$83.21	**15J**	**11U**	
Cement Masons	Application of all Composition Mastic	$81.87	**15J**	**4U**	
Cement Masons	Application of all Epoxy Material	$81.36	**15J**	**4U**	
Cement Masons	Application of all Plastic Material	$81.87	**15J**	**4U**	
Cement Masons	Application of Sealing Compound	$81.36	**15J**	**4U**	
Cement Masons	Application of Underlayment	$81.87	**15J**	**4U**	
Cement Masons	Building General	$81.36	**15J**	**4U**	
Cement Masons	Composition or Kalman Floors	$81.87	**15J**	**4U**	

Cement Masons	Concrete Paving	$81.36	**15J**	**4U**
Cement Masons	Curb & Gutter Machine	$81.87	**15J**	**4U**
Cement Masons	Curb & Gutter, Sidewalks	$81.36	**15J**	**4U**
Cement Masons	Curing Concrete	$81.36	**15J**	**4U**
Cement Masons	Finish Colored Concrete	$81.87	**15J**	**4U**
Cement Masons	Floor Grinding	$81.87	**15J**	**4U**
Cement Masons	Floor Grinding/Polisher	$81.36	**15J**	**4U**
Cement Masons	Green Concrete Saw, self-powered	$81.87	**15J**	**4U**
Cement Masons	Grouting of all Plates	$81.36	**15J**	**4U**
Cement Masons	Grouting of all Tilt-up Panels	$81.36	**15J**	**4U**
Cement Masons	Gunite Nozzleman	$81.87	**15J**	**4U**
Cement Masons	Hand Powered Grinder	$81.87	**15J**	**4U**
Cement Masons	Journey Level	$81.36	**15J**	**4U**
Cement Masons	Patching Concrete	$81.36	**15J**	**4U**
Cement Masons	Pneumatic Power Tools	$81.87	**15J**	**4U**
Cement Masons	Power Chipping & Brushing	$81.87	**15J**	**4U**

Cement Masons	Sand Blasting Architectural Finish	$81.87	**15J**	**4U**	
Cement Masons	Screed & Rodding Machine	$81.87	**15J**	**4U**	
Cement Masons	Spackling or Skim Coat Concrete	$81.36	**15J**	**4U**	
Cement Masons	Troweling Machine Operator	$81.87	**15J**	**4U**	
Cement Masons	Troweling Machine Operator on Colored Slabs	$81.87	**15J**	**4U**	
Cement Masons	Tunnel Workers	$81.87	**15J**	**4U**	
Divers & Tenders	Bell/Vehicle/Submersible Operator (not under pressure)	$144.72	**15J**	**11T**	**9I**
Divers & Tenders	Dive Supervisor	$146.22	**15J**	**11T**	**9I**
Divers & Tenders	Diver	$144.72	**15J**	**11T**	**9I**
Divers & Tenders	Diver Tender	$91.05	**15J**	**11T**	**9I**
Divers & Tenders	Hyperbaric Worker - Compressed Air Worker 0-30.00 PSI	$114.73	**15J**	**11U**	
Divers & Tenders	Hyperbaric Worker - Compressed Air Worker 30.01-44.00 PSI	$124.28	**15J**	**11U**	

Divers & Tenders	Hyperbaric Worker - Compressed Air Worker 44.01 - 54.00 PSI	$133.82	**15J**	**11U**	
Divers & Tenders	Hyperbaric Worker - Compressed Air Worker 54.01 - 60.00 PSI	$143.37	**15J**	**11U**	
Divers & Tenders	Hyperbaric Worker - Compressed Air Worker 60.01 - 64.00 PSI	$152.91	**15J**	**11U**	
Divers & Tenders	Hyperbaric Worker - Compressed Air Worker 64.01 - 68.00 PSI	$162.46	**15J**	**11U**	
Divers & Tenders	Hyperbaric Worker - Compressed Air Worker 68.01 - 70.00 PSI	$172.00	**15J**	**11U**	
Divers & Tenders	Hyperbaric Worker - Compressed Air Worker 70.01 - 72.00 PSI	$181.55	**15J**	**11U**	
Divers & Tenders	Hyperbaric Worker - Compressed Air Worker 72.01 - 74.00 PSI	$191.09	**15J**	**11U**	
Divers & Tenders	Lead Diver (Dive Master)	$105.51	**15J**	**11T**	**9I**
Divers & Tenders	Manifold Operator (Life Support Technician)	$96.05	**15J**	**11U**	**9I**
Divers & Tenders	Remote Operated Vehicle Operator/Technician	$91.05	**15J**	**11T**	**9I**

Divers & Tenders	Remote Operated Vehicle Operator/Technician	$91.05	**15J**	**11U**	**9I**
Divers & Tenders	Remote Operated Vehicle Tender	$84.75	**15J**	**11T**	**9I**
Divers & Tenders	Stand-by Diver	$100.51	**15J**	**11T**	**9I**
Dredge Workers	Assistant Engineer	$89.47	**5D**	**3F**	
Dredge Workers	Assistant Mate (Deckhand)	$88.78	**5D**	**3F**	
Dredge Workers	Boatmen	$89.47	**5D**	**3F**	
Dredge Workers	Engineer Welder	$91.20	**5D**	**3F**	
Dredge Workers	Leverman, Hydraulic	$93.03	**5D**	**3F**	
Dredge Workers	Mates	$89.47	**5D**	**3F**	
Dredge Workers	Oiler	$88.78	**5D**	**3F**	
Drywall Applicator	Journey Level	$81.71	**15O**	**11S**	
Drywall Tapers	Journey Level	$81.71	**15O**	**11S**	
Electrical Fixture Maintenance Workers	Journey Level	$21.48		**1**	
Electricians - Inside	Cable Splicer	$100.52	**7H**	**1E**	
Electricians - Inside	Construction Stock Person	$48.08	**7H**	**1D**	

Electricians - Inside	Journey Level	$94.06	**7H**	**1E**	
Electricians - Motor Shop	Craftsman	$17.13		**1**	
Electricians - Motor Shop	Journey Level	$17.13		**1**	
Electricians - Powerline Construction	Cable Splicer	$107.31	**5A**	**4D**	
Electricians - Powerline Construction	Certified Line Welder	$98.45	**5A**	**4D**	
Electricians - Powerline Construction	Groundperson	$61.75	**5A**	**4D**	
Electricians - Powerline Construction	Heavy Line Equipment Operator	$98.45	**5A**	**4D**	
Electricians - Powerline Construction	Journey Level Lineperson	$98.45	**5A**	**4D**	
Electricians - Powerline Construction	Line Equipment Operator	$84.18	**5A**	**4D**	
Electricians - Powerline Construction	Meter Installer	$61.75	**5A**	**4D**	**8W**
Electricians - Powerline Construction	Pole Sprayer	$98.45	**5A**	**4D**	
Electricians - Powerline Construction	Powderperson	$72.81	**5A**	**4D**	
Electronic Technicians	Electronic Technicians Journey Level	$62.05	**5B**	**1B**	

Elevator Constructors	Mechanic	$119.17	**7D**	**4A**	
Elevator Constructors	Mechanic In Charge	$128.95	**7D**	**4A**	
Fabricated Precast Concrete Products	Journey Level	$17.13		**1**	
Fabricated Precast Concrete Products	Journey Level - In-Factory Work Only	$17.13		**1**	
Fence Erectors	Fence Erector	$57.66	**15J**	**11P**	**8Y**
Fence Erectors	Fence Laborer	$57.66	**15J**	**11P**	**8Y**
Flaggers	Journey Level	$57.66	**15J**	**11P**	**8Y**
Glaziers	Journey Level	$85.16	**7L**	**1Y**	
Heat & Frost Insulators And Asbestos Workers	Journey Level	$96.42	**15H**	**11C**	
Heating Equipment Mechanics	Mechanic	$103.56	**7F**	**1E**	
Hod Carriers & Mason Tenders	Journey Level	$71.09	**15J**	**11P**	**8Y**
Industrial Power Vacuum Cleaner	Journey Level	$17.13		**1**	
Inland Boatmen	Boat Operator	$71.28	**5B**	**1K**	
Inland Boatmen	Cook	$69.70	**5B**	**1K**	
Inland Boatmen	Deckhand	$70.00	**5B**	**1K**	

Inland Boatmen	Deckhand Engineer	$69.55	**5B**	**1K**
Inland Boatmen	Launch Operator	$71.23	**5B**	**1K**
Inland Boatmen	Mate	$89.12	**5B**	**1K**
Inspection/Cleaning/Sealing Of Sewer & Water Systems By Remote Control	Cleaner Operator	$54.56	**15M**	**11O**
Inspection/Cleaning/Sealing Of Sewer & Water Systems By Remote Control	Foamer Operator	$54.56	**15M**	**11O**
Inspection/Cleaning/Sealing Of Sewer & Water Systems By Remote Control	Grout Truck Operator	$54.56	**15M**	**11O**
Inspection/Cleaning/Sealing Of Sewer & Water Systems By Remote Control	Head Operator	$52.40	**15M**	**11O**
Inspection/Cleaning/Sealing Of Sewer & Water Systems By Remote Control	Technician	$45.97	**15M**	**11O**
Inspection/Cleaning/Sealing Of Sewer & Water Systems By Remote Control	TV Truck Operator	$49.20	**15M**	**11O**
Insulation Applicators	Journey Level	$83.21	**15J**	**11U**
Ironworkers	Journeyman	$94.82	**15K**	**11N**

Laborers	Air, Gas Or Electric Vibrating Screed	$67.39	**15J**	**11P**	**8Y**
Laborers	Airtrac Drill Operator	$69.37	**15J**	**11P**	**8Y**
Laborers	Ballast Regular Machine	$67.39	**15J**	**11P**	**8Y**
Laborers	Batch Weighman	$57.66	**15J**	**11P**	**8Y**
Laborers	Brick Pavers	$67.39	**15J**	**11P**	**8Y**
Laborers	Brush Cutter	$67.39	**15J**	**11P**	**8Y**
Laborers	Brush Hog Feeder	$67.39	**15J**	**11P**	**8Y**
Laborers	Burner	$67.39	**15J**	**11P**	**8Y**
Laborers	Caisson Worker	$69.37	**15J**	**11P**	**8Y**
Laborers	Carpenter Tender	$67.39	**15J**	**11P**	**8Y**
Laborers	Cement Dumper-paving	$69.37	**15J**	**11P**	**8Y**
Laborers	Cement Finisher Tender	$67.39	**15J**	**11P**	**8Y**
Laborers	Change House Or Dry Shack	$67.39	**15J**	**11P**	**8Y**
Laborers	Chipping Gun (30 Lbs. And Over)	$68.56	**15J**	**11P**	**8Y**
Laborers	Chipping Gun (Under 30 Lbs.)	$67.39	**15J**	**11P**	**8Y**
Laborers	Choker Setter	$67.39	**15J**	**11P**	**8Y**

Laborers	Chuck Tender	$67.39	**15J**	**11P**	**8Y**
Laborers	Clary Power Spreader	$68.56	**15J**	**11P**	**8Y**
Laborers	Clean-up Laborer	$67.39	**15J**	**11P**	**8Y**
Laborers	Concrete Dumper/Chute Operator	$69.37	**15J**	**11P**	**8Y**
Laborers	Concrete Form Stripper	$67.39	**15J**	**11P**	**8Y**
Laborers	Concrete Placement Crew	$69.37	**15J**	**11P**	**8Y**
Laborers	Concrete Saw Operator/Core Driller	$68.56	**15J**	**11P**	**8Y**
Laborers	Crusher Feeder	$57.66	**15J**	**11P**	**8Y**
Laborers	Curing Laborer	$67.39	**15J**	**11P**	**8Y**
Laborers	Demolition: Wrecking & Moving (Incl. Charred Material)	$67.39	**15J**	**11P**	**8Y**
Laborers	Ditch Digger	$67.39	**15J**	**11P**	**8Y**
Laborers	Diver	$69.37	**15J**	**11P**	**8Y**
Laborers	Drill Operator (Hydraulic, Diamond)	$68.56	**15J**	**11P**	**8Y**
Laborers	Dry Stack Walls	$67.39	**15J**	**11P**	**8Y**
Laborers	Dump Person	$67.39	**15J**	**11P**	**8Y**

Laborers	Epoxy Technician	$67.39	**15J**	**11P**	**8Y**
Laborers	Erosion Control Worker	$67.39	**15J**	**11P**	**8Y**
Laborers	Faller & Bucker Chain Saw	$68.56	**15J**	**11P**	**8Y**
Laborers	Fine Graders	$67.39	**15J**	**11P**	**8Y**
Laborers	Firewatch	$57.66	**15J**	**11P**	**8Y**
Laborers	Form Setter	$69.37	**15J**	**11P**	**8Y**
Laborers	Gabian Basket Builders	$67.39	**15J**	**11P**	**8Y**
Laborers	General Laborer	$67.39	**15J**	**11P**	**8Y**
Laborers	Grade Checker & Transit Person	$71.09	**15J**	**11P**	**8Y**
Laborers	Grinders	$67.39	**15J**	**11P**	**8Y**
Laborers	Grout Machine Tender	$67.39	**15J**	**11P**	**8Y**
Laborers	Groutmen (Pressure) Including Post Tension Beams	$68.56	**15J**	**11P**	**8Y**
Laborers	Guardrail Erector	$67.39	**15J**	**11P**	**8Y**
Laborers	Hazardous Waste Worker (Level A)	$69.37	**15J**	**11P**	**8Y**
Laborers	Hazardous Waste Worker (Level B)	$68.56	**15J**	**11P**	**8Y**

Laborers	Hazardous Waste Worker (Level C)	$67.39	**15J**	**11P**	**8Y**
Laborers	High Scaler	$69.37	**15J**	**11P**	**8Y**
Laborers	Jackhammer	$68.56	**15J**	**11P**	**8Y**
Laborers	Laserbeam Operator	$68.56	**15J**	**11P**	**8Y**
Laborers	Maintenance Person	$67.39	**15J**	**11P**	**8Y**
Laborers	Manhole Builder-Mudman	$68.56	**15J**	**11P**	**8Y**
Laborers	Material Yard Person	$67.39	**15J**	**11P**	**8Y**
Laborers	Mold Abatement Worker	$67.39	**15J**	**11P**	**8Y**
Laborers	Motorman-Dinky Locomotive	$71.19	**15J**	**11P**	**8Y**
Laborers	nozzleman (concrete pump, green cutter when using combination of high pressure air & water on concrete & rock, sandblast, gunite, shotcrete, water blaster, vacuum blaster)	$71.09	**15J**	**11P**	**8Y**
Laborers	Pavement Breaker	$68.56	**15J**	**11P**	**8Y**
Laborers	Pilot Car	$57.66	**15J**	**11P**	**8Y**
Laborers	Pipe Layer (Lead)	$71.09	**15J**	**11P**	**8Y**

Laborers	Pipe Layer/Tailor	$68.56	**15J**	**11P**	**8Y**
Laborers	Pipe Pot Tender	$68.56	**15J**	**11P**	**8Y**
Laborers	Pipe Reliner	$68.56	**15J**	**11P**	**8Y**
Laborers	Pipe Wrapper	$68.56	**15J**	**11P**	**8Y**
Laborers	Pot Tender	$67.39	**15J**	**11P**	**8Y**
Laborers	Powderman	$69.37	**15J**	**11P**	**8Y**
Laborers	Powderman's Helper	$67.39	**15J**	**11P**	**8Y**
Laborers	Power Jacks	$68.56	**15J**	**11P**	**8Y**
Laborers	Power Washer	$67.39	**15J**	**11P**	**8Y**
Laborers	Railroad Spike Puller - Power	$68.56	**15J**	**11P**	**8Y**
Laborers	Raker - Asphalt	$71.09	**15J**	**11P**	**8Y**
Laborers	Re-timberman	$69.37	**15J**	**11P**	**8Y**
Laborers	Remote Equipment Operator	$68.56	**15J**	**11P**	**8Y**
Laborers	Rigger/Signal Person	$68.56	**15J**	**11P**	**8Y**
Laborers	Rip Rap Person	$67.39	**15J**	**11P**	**8Y**
Laborers	Rivet Buster	$68.56	**15J**	**11P**	**8Y**

Laborers	Rodder	$69.37	**15J**	**11P**	**8Y**
Laborers	Scaffold Erector	$67.39	**15J**	**11P**	**8Y**
Laborers	Scale Person	$67.39	**15J**	**11P**	**8Y**
Laborers	Sloper (Over 20")	$68.56	**15J**	**11P**	**8Y**
Laborers	Sloper Sprayer	$67.39	**15J**	**11P**	**8Y**
Laborers	Spreader (Concrete)	$69.37	**15J**	**11P**	**8Y**
Laborers	Stake Hopper	$67.39	**15J**	**11P**	**8Y**
Laborers	Stock Piler	$67.39	**15J**	**11P**	**8Y**
Laborers	Swinging Stage/Boatswain Chair	$57.66	**15J**	**11P**	**8Y**
Laborers	Tamper & Similar Electric, Air & Gas Operated Tools	$68.56	**15J**	**11P**	**8Y**
Laborers	Tamper (Multiple & Self-propelled)	$68.56	**15J**	**11P**	**8Y**
Laborers	Timber Person - Sewer (Lagger, Shorer & Cribber)	$68.56	**15J**	**11P**	**8Y**
Laborers	Toolroom Person (at Jobsite)	$67.39	**15J**	**11P**	**8Y**
Laborers	Topper	$67.39	**15J**	**11P**	**8Y**
Laborers	Track Laborer	$67.39	**15J**	**11P**	**8Y**

Laborers	Track Liner (Power)	$68.56	**15J**	**11P**	**8Y**
Laborers	Traffic Control Laborer	$61.41	**15J**	**11P**	**9C**
Laborers	Traffic Control Supervisor	$64.86	**15J**	**11P**	**9C**
Laborers	Truck Mounted Attenuator	$61.41	**15J**	**11P**	**9C**
Laborers	Truck Spotter	$67.39	**15J**	**11P**	**8Y**
Laborers	Tugger Operator	$68.56	**15J**	**11P**	**8Y**
Laborers	Tunnel Work-Compressed Air Worker 0-30 psi	$225.32	**15J**	**11P**	**9B**
Laborers	Tunnel Work-Compressed Air Worker 30.01-44.00 psi	$230.35	**15J**	**11P**	**9B**
Laborers	Tunnel Work-Compressed Air Worker 44.01-54.00 psi	$234.03	**15J**	**11P**	**9B**
Laborers	Tunnel Work-Compressed Air Worker 54.01-60.00 psi	$239.73	**15J**	**11P**	**9B**
Laborers	Tunnel Work-Compressed Air Worker 60.01-64.00 psi	$241.85	**15J**	**11P**	**9B**
Laborers	Tunnel Work-Compressed Air Worker 64.01-68.00 psi	$246.95	**15J**	**11P**	**9B**

Laborers	Tunnel Work-Compressed Air Worker 68.01-70.00 psi	$248.85	**15J**	**11P**	**9B**
Laborers	Tunnel Work-Compressed Air Worker 70.01-72.00 psi	$250.85	**15J**	**11P**	**9B**
Laborers	Tunnel Work-Compressed Air Worker 72.01-74.00 psi	$252.85	**15J**	**11P**	**9B**
Laborers	Tunnel Work-Guage and Lock Tender	$71.19	**15J**	**11P**	**8Y**
Laborers	Tunnel Work-Miner	$71.19	**15J**	**11P**	**8Y**
Laborers	Vibrator	$69.37	**15J**	**11P**	**8Y**
Laborers	Vinyl Seamer	$67.39	**15J**	**11P**	**8Y**
Laborers	Watchman	$52.73	**15J**	**11P**	**8Y**
Laborers	Welder	$68.56	**15J**	**11P**	**8Y**
Laborers	Well Point Laborer	$68.56	**15J**	**11P**	**8Y**
Laborers	Window Washer/Cleaner	$52.73	**15J**	**11P**	**8Y**
Laborers - Underground Sewer & Water	General Laborer & Topman	$67.39	**15J**	**11P**	**8Y**
Laborers - Underground Sewer & Water	Pipe Layer	$68.56	**15J**	**11P**	**8Y**

Landscape Construction	Landscape Construction/Landscaping Or Planting Laborers	$52.73	**15J**	**11P**	**8Y**
Landscape Construction	Landscape Operator	$89.10	**15J**	**11G**	**8X**
Landscape Maintenance	Groundskeeper	$17.13		**1**	
Lathers	Journey Level	$81.71	**15O**	**11S**	
Marble Setters	Journey Level	$76.07	**7E**	**1N**	
Metal Fabrication (In Shop)	Fitter	$17.13		**1**	
Metal Fabrication (In Shop)	Laborer	$17.13		**1**	
Metal Fabrication (In Shop)	Machine Operator	$17.13		**1**	
Metal Fabrication (In Shop)	Painter	$17.13		**1**	
Metal Fabrication (In Shop)	Welder	$17.13		**1**	
Millwright	Journey Level	$80.28	**15J**	**4C**	
Modular Buildings	Journey Level	$17.13		**1**	
Painters	Journey Level	$57.46	**6Z**	**11J**	
Pile Driver	Crew Tender	$80.50	**15J**	**11U**	**9L**
Pile Driver	Journey Level	$84.81	**15J**	**11U**	
Plasterers	Journey Level	$78.60	**7Q**	**1R**	

Plasterers	Nozzleman	$82.70	**7Q**	**1R**	
Playground & Park Equipment Installers	Journey Level	$17.13		**1**	
Plumbers & Pipefitters	Journey Level	$95.37	**5A**	**1G**	
Power Equipment Operators	Asphalt Plant Operators	$90.58	**15J**	**11G**	**8X**
Power Equipment Operators	Assistant Engineer	$85.17	**15J**	**11G**	**8X**
Power Equipment Operators	Barrier Machine (zipper)	$89.78	**15J**	**11G**	**8X**
Power Equipment Operators	Batch Plant Operator: concrete	$89.78	**15J**	**11G**	**8X**
Power Equipment Operators	Boat Operator	$92.08	**7A**	**11H**	**8X**
Power Equipment Operators	Bobcat	$85.17	**15J**	**11G**	**8X**
Power Equipment Operators	Brokk - Remote Demolition Equipment	$85.17	**15J**	**11G**	**8X**
Power Equipment Operators	Brooms	$85.17	**15J**	**11G**	**8X**
Power Equipment Operators	Bump Cutter	$89.78	**15J**	**11G**	**8X**
Power Equipment Operators	Cableways	$90.58	**15J**	**11G**	**8X**

Power Equipment Operators	Chipper	$89.78	**15J**	**11G**	**8X**
Power Equipment Operators	Compressor	$85.17	**15J**	**11G**	**8X**
Power Equipment Operators	Concrete Finish Machine - Laser Screed	$85.17	**15J**	**11G**	**8X**
Power Equipment Operators	Concrete Pump - Mounted Or Trailer High Pressure Line Pump, Pump High Pressure	$89.10	**15J**	**11G**	**8X**
Power Equipment Operators	Concrete Pump: Truck Mount With Boom Attachment Over 42 M	$90.58	**15J**	**11G**	**8X**
Power Equipment Operators	Concrete Pump: Truck Mount With Boom Attachment Up To 42m	$89.78	**15J**	**11G**	**8X**
Power Equipment Operators	Conveyors	$89.10	**15J**	**11G**	**8X**
Power Equipment Operators	Cranes Friction: 200 tons and over	$94.85	**7A**	**11H**	**8X**
Power Equipment Operators	Cranes, A-frame: 10 tons and under	$86.60	**7A**	**11H**	**8X**
Power Equipment Operators	Cranes: 100 tons through 199 tons, or 150' of boom (including jib with attachments)	$92.98	**7A**	**11H**	**8X**

Power Equipment Operators	Cranes: 20 tons through 44 tons with attachments	$91.25	**7A**	**11H**	**8X**
Power Equipment Operators	Cranes: 200 tons- 299 tons, or 250' of boom including jib with attachments	$93.95	**7A**	**11H**	**8X**
Power Equipment Operators	Cranes: 300 tons and over or 300' of boom including jib with attachments	$94.85	**7A**	**11H**	**8X**
Power Equipment Operators	Cranes: 45 tons through 99 tons, under 150' of boom(including jib with attachments)	$92.08	**7A**	**11H**	**8X**
Power Equipment Operators	Cranes: Friction cranes through 199 tons	$93.95	**7A**	**11H**	**8X**
Power Equipment Operators	Cranes: through 19 tons with attachments, a-frame over 10 tons	$90.55	**7A**	**11H**	**8X**
Power Equipment Operators	Crusher	$89.78	**15J**	**11G**	**8X**
Power Equipment Operators	Deck Engineer/Deck Winches (power)	$89.78	**15J**	**11G**	**8X**
Power Equipment Operators	Derricks, On Building Work	$92.08	**7A**	**11H**	**8X**
Power Equipment Operators	Dozers D-9 & Under	$89.10	**15J**	**11G**	**8X**

Power Equipment Operators	Drill Oilers: Auger Type, Truck Or Crane Mount	$89.10	**15J**	**11G**	**8X**
Power Equipment Operators	Drilling Machine	$91.52	**15J**	**11G**	**8X**
Power Equipment Operators	Elevator and man-lift: permanent and shaft type	$85.17	**15J**	**11G**	**8X**
Power Equipment Operators	Finishing Machine, Bidwell And Gamaco & Similar Equipment	$89.78	**15J**	**11G**	**8X**
Power Equipment Operators	Forklift: 3000 lbs and over with attachments	$89.10	**15J**	**11G**	**8X**
Power Equipment Operators	Forklifts: under 3000 lbs. with attachments	$85.17	**15J**	**11G**	**8X**
Power Equipment Operators	Grade Engineer: Using Blue Prints, Cut Sheets, Etc	$89.78	**15J**	**11G**	**8X**
Power Equipment Operators	Gradechecker/Stakeman	$85.17	**15J**	**11G**	**8X**
Power Equipment Operators	Guardrail Punch	$89.78	**15J**	**11G**	**8X**
Power Equipment Operators	Hard Tail End Dump Articulating Off- Road Equipment 45 Yards. & Over	$90.58	**15J**	**11G**	**8X**
Power Equipment Operators	Hard Tail End Dump Articulating Off-road	$89.78	**15J**	**11G**	**8X**

	Equipment Under 45 Yards				
Power Equipment Operators	Horizontal/Directional Drill Locator	$89.10	**15J**	**11G**	**8X**
Power Equipment Operators	Horizontal/Directional Drill Operator	$89.78	**15J**	**11G**	**8X**
Power Equipment Operators	Hydralifts/Boom Trucks Over 10 Tons	$90.55	**7A**	**11H**	**8X**
Power Equipment Operators	Hydralifts/boom trucks: 10 tons and under	$86.60	**7A**	**11H**	**8X**
Power Equipment Operators	Leverman	$92.45	**15J**	**11G**	**8X**
Power Equipment Operators	Loader, Overhead, 6 Yards. But Not Including 8 Yards	$90.58	**15J**	**11G**	**8X**
Power Equipment Operators	Loaders, Overhead Under 6 Yards	$89.78	**15J**	**11G**	**8X**
Power Equipment Operators	Loaders, Plant Feed	$89.78	**15J**	**11G**	**8X**
Power Equipment Operators	Loaders: Elevating Type Belt	$89.10	**15J**	**11G**	**8X**
Power Equipment Operators	Locomotives, All	$89.78	**15J**	**11G**	**8X**
Power Equipment Operators	Material Transfer Device	$89.78	**15J**	**11G**	**8X**
Power Equipment Operators	Mechanics: All (Leadmen - $0.50 per hour over	$91.52	**15J**	**11G**	**8X**

	mechanic)				
Power Equipment Operators	Motor Patrol Graders	$90.58	**15J**	**11G**	**8X**
Power Equipment Operators	Mucking Machine, Mole, Tunnel Drill, Boring, Road Header And/or Shield	$90.58	**15J**	**11G**	**8X**
Power Equipment Operators	Oil Distributors, Blower Distribution & Mulch Seeding Operator	$85.17	**15J**	**11G**	**8X**
Power Equipment Operators	Outside Hoists (Elevators and Manlifts), Air Tuggers, Strato	$89.10	**15J**	**11G**	**8X**
Power Equipment Operators	Overhead, bridge type Crane: 20 tons through 44 tons	$91.25	**7A**	**11H**	**8X**
Power Equipment Operators	Overhead, bridge type: 100 tons and over	$92.98	**7A**	**11H**	**8X**
Power Equipment Operators	Overhead, bridge type: 45 tons through 99 tons	$92.08	**7A**	**11H**	**8X**
Power Equipment Operators	Pavement Breaker	$85.17	**15J**	**11G**	**8X**
Power Equipment Operators	Pile Driver (other Than Crane Mount)	$89.78	**15J**	**11G**	**8X**
Power Equipment Operators	Plant Oiler - Asphalt, Crusher	$89.10	**15J**	**11G**	**8X**

Power Equipment Operators	Posthole Digger, Mechanical	$85.17	**15J**	**11G**	**8X**
Power Equipment Operators	Power Plant	$85.17	**15J**	**11G**	**8X**
Power Equipment Operators	Pumps - Water	$85.17	**15J**	**11G**	**8X**
Power Equipment Operators	Quad 9, Hd 41, D10 And Over	$90.58	**15J**	**11G**	**8X**
Power Equipment Operators	Quick Tower: no cab, under 100 feet in height base to boom	$89.78	**15J**	**11G**	**8X**
Power Equipment Operators	Remote Control Operator On Rubber Tired Earth Moving Equipment	$90.58	**15J**	**11G**	**8X**
Power Equipment Operators	Rigger and Bellman	$86.60	**7A**	**11H**	**8X**
Power Equipment Operators	Rigger/Signal Person, Bellman(Certified)	$90.55	**7A**	**11H**	**8X**
Power Equipment Operators	Rollagon	$90.58	**15J**	**11G**	**8X**
Power Equipment Operators	Roller, Other Than Plant Mix	$85.17	**15J**	**11G**	**8X**
Power Equipment Operators	Roller, Plant Mix Or Multi-lift Materials	$89.10	**15J**	**11G**	**8X**
Power Equipment Operators	Roto-mill, Roto-grinder	$89.78	**15J**	**11G**	**8X**

Power Equipment Operators	Saws - Concrete	$89.10	**15J**	**11G**	**8X**
Power Equipment Operators	Scraper, Self Propelled Under 45 Yards	$89.78	**15J**	**11G**	**8X**
Power Equipment Operators	Scrapers - Concrete & Carry All	$89.10	**15J**	**11G**	**8X**
Power Equipment Operators	Scrapers, Self-propelled: 45 Yards And Over	$90.58	**15J**	**11G**	**8X**
Power Equipment Operators	Service Engineers: Equipment	$89.10	**15J**	**11G**	**8X**
Power Equipment Operators	Shotcrete/Gunite Equipment	$85.17	**15J**	**11G**	**8X**
Power Equipment Operators	Shovel, Excavator, Backhoe, Tractors Under 15 Metric Tons	$89.10	**15J**	**11G**	**8X**
Power Equipment Operators	Shovel, Excavator, Backhoe: Over 30 Metric Tons To 50 Metric Tons	$90.58	**15J**	**11G**	**8X**
Power Equipment Operators	Shovel, Excavator, Backhoes, Tractors: 15 To 30 Metric Tons	$89.78	**15J**	**11G**	**8X**
Power Equipment Operators	Shovel, Excavator, Backhoes: Over 50 Metric Tons To 90 Metric Tons	$91.52	**15J**	**11G**	**8X**

Power Equipment Operators	Shovel, Excavator, Backhoes: Over 90 Metric Tons	$92.45	**15J**	**11G**	**8X**
Power Equipment Operators	Slipform Pavers	$90.58	**15J**	**11G**	**8X**
Power Equipment Operators	Spreader, Topsider & Screedman	$90.58	**15J**	**11G**	**8X**
Power Equipment Operators	Subgrader Trimmer	$89.78	**15J**	**11G**	**8X**
Power Equipment Operators	Tower Bucket Elevators	$89.10	**15J**	**11G**	**8X**
Power Equipment Operators	Tower Crane: over 175' through 250' in height, base to boom	$93.95	**7A**	**11H**	**8X**
Power Equipment Operators	Tower crane: up to 175' in height base to boom	$92.98	**7A**	**11H**	**8X**
Power Equipment Operators	Tower Cranes: over 250' in height from base to boom	$94.85	**7A**	**11H**	**8X**
Power Equipment Operators	Transporters, All Track Or Truck Type	$90.58	**15J**	**11G**	**8X**
Power Equipment Operators	Trenching Machines	$89.10	**15J**	**11G**	**8X**
Power Equipment Operators	Truck Crane Oiler/Driver: 100 tons and over	$91.25	**7A**	**11H**	**8X**
Power Equipment Operators	Truck crane oiler/driver: under 100 tons	$90.55	**7A**	**11H**	**8X**

Power Equipment Operators	Truck Mount Portable Conveyor	$89.78	**15J**	**11G**	**8X**
Power Equipment Operators	Vac Truck (Vactor Guzzler, Hydro Excavator)	$89.78	**15J**	**11G**	**8X**
Power Equipment Operators	Welder	$90.58	**15J**	**11G**	**8X**
Power Equipment Operators	Wheel Tractors, Farmall Type	$85.17	**15J**	**11G**	**8X**
Power Equipment Operators	Yo Yo Pay Dozer	$89.78	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Asphalt Plant Operators	$90.58	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Assistant Engineer	$85.17	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Barrier Machine (zipper)	$89.78	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Batch Plant Operator, Concrete	$89.78	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Boat Operator	$92.08	**7A**	**11H**	**8X**
Power Equipment Operators- Underground	Bobcat	$85.17	**15J**	**11G**	**8X**

Sewer & Water					
Power Equipment Operators- Underground Sewer & Water	Brokk - Remote Demolition Equipment	$85.17	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Brooms	$85.17	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Bump Cutter	$89.78	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Cableways	$90.58	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Chipper	$89.78	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Compressor	$85.17	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Concrete Finish Machine - Laser Screed	$85.17	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Concrete Pump - Mounted Or Trailer High Pressure Line Pump, Pump High Pressure	$89.10	**15J**	**11G**	**8X**

Power Equipment Operators- Underground Sewer & Water	Concrete Pump: Truck Mount With Boom Attachment Over 42 M	$90.58	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Concrete Pump: Truck Mount With Boom Attachment Up To 42m	$89.78	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Conveyors	$89.10	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Cranes Friction: 200 tons and over	$94.85	**7A**	**11H**	**8X**
Power Equipment Operators- Underground Sewer & Water	Cranes, A-frame: 10 tons and under	$86.60	**7A**	**11H**	**8X**
Power Equipment Operators- Underground Sewer & Water	Cranes: 100 tons through 199 tons, or 150' of boom (including jib with attachments)	$92.98	**7A**	**11H**	**8X**
Power Equipment Operators- Underground Sewer & Water	Cranes: 20 tons through 44 tons with attachments	$91.25	**7A**	**11H**	**8X**
Power Equipment Operators- Underground Sewer & Water	Cranes: 200 tons- 299 tons, or 250' of boom including jib with attachments	$93.95	**7A**	**11H**	**8X**
Power Equipment Operators- Underground	Cranes: 300 tons and over or 300' of boom including	$94.85	**7A**	**11H**	**8X**

Sewer & Water	jib with attachments				
Power Equipment Operators- Underground Sewer & Water	Cranes: 45 tons through 99 tons, under 150' of boom(including jib with attachments)	$92.08	**7A**	**11H**	**8X**
Power Equipment Operators- Underground Sewer & Water	Cranes: Friction cranes through 199 tons	$93.95	**7A**	**11H**	**8X**
Power Equipment Operators- Underground Sewer & Water	Cranes: through 19 tons with attachments, a-frame over 10 tons	$90.55	**7A**	**11H**	**8X**
Power Equipment Operators- Underground Sewer & Water	Crusher	$89.78	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Deck Engineer/Deck Winches (power)	$89.78	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Derricks, On Building Work	$92.08	**7A**	**11H**	**8X**
Power Equipment Operators- Underground Sewer & Water	Dozers D-9 & Under	$89.10	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Drill Oilers: Auger Type, Truck Or Crane Mount	$89.10	**15J**	**11G**	**8X**

Power Equipment Operators- Underground Sewer & Water	Drilling Machine	$91.52	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Elevator and man-lift: permanent and shaft type	$85.17	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Finishing Machine, Bidwell And Gamaco & Similar Equipment	$89.78	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Forklift: 3000 lbs and over with attachments	$89.10	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Forklifts: under 3000 lbs. with attachments	$85.17	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Grade Engineer: Using Blue Prints, Cut Sheets, Etc	$89.78	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Gradechecker/Stakeman	$85.17	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Guardrail Punch	$89.78	**15J**	**11G**	**8X**

Power Equipment Operators- Underground Sewer & Water	Hard Tail End Dump Articulating Off- Road Equipment 45 Yards. & Over	$90.58	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Hard Tail End Dump Articulating Off-road Equipment Under 45 Yards	$89.78	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Horizontal/Directional Drill Locator	$89.10	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Horizontal/Directional Drill Operator	$89.78	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Hydralifts/boom trucks: 10 tons and under	$86.60	**7A**	**11H**	**8X**
Power Equipment Operators- Underground Sewer & Water	Hydralifts/boom trucks: over 10 tons	$90.55	**7A**	**11H**	**8X**
Power Equipment Operators- Underground Sewer & Water	Leverman	$92.45	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Loader, Overhead, 6 Yards. But Not Including 8 Yards	$90.58	**15J**	**11G**	**8X**

Power Equipment Operators- Underground Sewer & Water	Loaders, Overhead Under 6 Yards	$89.78	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Loaders, Plant Feed	$89.78	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Loaders: Elevating Type Belt	$89.10	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Locomotives, All	$89.78	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Material Transfer Device	$89.78	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Mechanics: All (Leadmen - $0.50 per hour over mechanic)	$91.52	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Motor Patrol Graders	$90.58	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Mucking Machine, Mole, Tunnel Drill, Boring, Road Header And/or Shield	$90.58	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Oil Distributors, Blower Distribution & Mulch Seeding Operator	$85.17	**15J**	**11G**	**8X**

Power Equipment Operators- Underground Sewer & Water	Outside Hoists (Elevators and Manlifts), Air Tuggers, Strato	$89.10	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Overhead, bridge type Crane: 20 tons through 44 tons	$91.25	**7A**	**11H**	**8X**
Power Equipment Operators- Underground Sewer & Water	Overhead, bridge type: 100 tons and over	$92.98	**7A**	**11H**	**8X**
Power Equipment Operators- Underground Sewer & Water	Overhead, bridge type: 45 tons through 99 tons	$92.08	**7A**	**11H**	**8X**
Power Equipment Operators- Underground Sewer & Water	Pavement Breaker	$85.17	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Pile Driver (other Than Crane Mount)	$89.78	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Plant Oiler - Asphalt, Crusher	$89.10	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Posthole Digger, Mechanical	$85.17	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Power Plant	$85.17	**15J**	**11G**	**8X**

Power Equipment Operators- Underground Sewer & Water	Pumps - Water	$85.17	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Quad 9, Hd 41, D10 And Over	$90.58	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Quick Tower: no cab, under 100 feet in height base to boom	$89.78	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Remote Control Operator On Rubber Tired Earth Moving Equipment	$90.58	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Rigger and Bellman	$86.60	**7A**	**11H**	**8X**
Power Equipment Operators- Underground Sewer & Water	Rigger/Signal Person, Bellman(Certified)	$90.55	**7A**	**11H**	**8X**
Power Equipment Operators- Underground Sewer & Water	Rollagon	$90.58	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Roller, Other Than Plant Mix	$85.17	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Roller, Plant Mix Or Multi-lift Materials	$89.10	**15J**	**11G**	**8X**

Power Equipment Operators- Underground Sewer & Water	Roto-mill, Roto-grinder	$89.78	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Saws - Concrete	$89.10	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Scraper, Self Propelled Under 45 Yards	$89.78	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Scrapers - Concrete & Carry All	$89.10	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Scrapers, Self-propelled: 45 Yards And Over	$90.58	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Shotcrete/Gunite Equipment	$85.17	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Shovel, Excavator, Backhoe, Tractors Under 15 Metric Tons	$89.10	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Shovel, Excavator, Backhoe: Over 30 Metric Tons To 50 Metric Tons	$90.58	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Shovel, Excavator, Backhoes, Tractors: 15 To 30 Metric Tons	$89.78	**15J**	**11G**	**8X**

Power Equipment Operators- Underground Sewer & Water	Shovel, Excavator, Backhoes: Over 50 Metric Tons To 90 Metric Tons	$91.52	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Shovel, Excavator, Backhoes: Over 90 Metric Tons	$92.45	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Slipform Pavers	$90.58	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Spreader, Topsider & Screedman	$90.58	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Subgrader Trimmer	$89.78	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Tower Bucket Elevators	$89.10	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Tower Crane: over 175' through 250' in height, base to boom	$93.95	**7A**	**11H**	**8X**
Power Equipment Operators- Underground Sewer & Water	Tower crane: up to 175' in height base to boom	$92.98	**7A**	**11H**	**8X**
Power Equipment Operators- Underground Sewer & Water	Tower Cranes: over 250' in height from base to boom	$94.85	**7A**	**11H**	**8X**

Power Equipment Operators- Underground Sewer & Water	Transporters, All Track Or Truck Type	$90.58	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Trenching Machines	$89.10	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Truck Crane Oiler/Driver: 100 tons and over	$91.25	**7A**	**11H**	**8X**
Power Equipment Operators- Underground Sewer & Water	Truck crane oiler/driver: under 100 tons	$90.55	**7A**	**11H**	**8X**
Power Equipment Operators- Underground Sewer & Water	Truck Mount Portable Conveyor	$89.78	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Vac Truck (Vactor Guzzler, Hydro Excavator)	$89.78	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Welder	$90.58	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Wheel Tractors, Farmall Type	$85.17	**15J**	**11G**	**8X**
Power Equipment Operators- Underground Sewer & Water	Yo Yo Pay Dozer	$89.78	**15J**	**11G**	**8X**

Power Line Clearance Tree Trimmers	Journey Level In Charge	$69.62	**5A**	**4A**
Power Line Clearance Tree Trimmers	Spray Person	$65.89	**5A**	**4A**
Power Line Clearance Tree Trimmers	Tree Equipment Operator	$69.62	**5A**	**4A**
Power Line Clearance Tree Trimmers	Tree Trimmer	$62.19	**5A**	**4A**
Power Line Clearance Tree Trimmers	Tree Trimmer Groundperson	$45.93	**5A**	**4A**
Refrigeration & Air Conditioning Mechanics	Journey Level	$100.71	**5A**	**1G**
Residential Brick Mason	Journey Level	$32.30		**1**
Residential Carpenters	Journey Level	$40.89		**1**
Residential Cement Masons	Journey Level	$20.67		**1**
Residential Drywall Applicators	Journey Level	$51.52	**15J**	**4C**
Residential Drywall Tapers	Journey Level	$40.92		**1**
Residential Electricians	Journey Level	$48.59	**7F**	**1D**
Residential Glaziers	Journey Level	$58.75	**7L**	**1H**
Residential Insulation Applicators	Journey Level	$32.93		**1**

Residential Laborers	Journey Level	$23.64		**1**
Residential Marble Setters	Journey Level	$32.30		**1**
Residential Painters	Journey Level	$30.66		**1**
Residential Plumbers & Pipefitters	Journey Level	$57.55	**5A**	**1G**
Residential Refrigeration & Air Conditioning Mechanics	Journey Level	$107.92	**7F**	**1E**
Residential Sheet Metal Workers	Journey Level	$24.60		**1**
Residential Soft Floor Layers	Journey Level	$36.37		**1**
Residential Sprinkler Fitters (Fire Protection)	Journey Level	$37.16		**1**
Residential Stone Masons	Journey Level	$32.30		**1**
Residential Terrazzo Workers	Journey Level	$32.30		**1**
Residential Terrazzo/Tile Finishers	Journey Level	$35.85		**1**
Residential Tile Setters	Journey Level	$32.30		**1**
Roofers	Journey Level	$70.70	**5A**	**3H**
Roofers	Using Irritable Bituminous Materials	$74.15	**5A**	**3H**

Sheet Metal Workers	Journey Level (Field or Shop)	$103.56	**7F**	**1E**
Shipbuilding & Ship Repair	New Construction Boilermaker	$61.07	**7X**	**4J**
Shipbuilding & Ship Repair	New Construction Carpenter	$51.85	**7X**	**4J**
Shipbuilding & Ship Repair	New Construction Crane Operator	$44.29	**7V**	**1**
Shipbuilding & Ship Repair	New Construction Electrician	$61.12	**7X**	**4J**
Shipbuilding & Ship Repair	New Construction Heat & Frost Insulator	$96.42	**15H**	**11C**
Shipbuilding & Ship Repair	New Construction Laborer	$60.73	**7X**	**4J**
Shipbuilding & Ship Repair	New Construction Machinist	$60.93	**7X**	**4J**
Shipbuilding & Ship Repair	New Construction Operating Engineer	$44.29	**7V**	**1**
Shipbuilding & Ship Repair	New Construction Painter	$60.93	**7X**	**4J**
Shipbuilding & Ship Repair	New Construction Pipefitter	$61.21	**7X**	**4J**
Shipbuilding & Ship Repair	New Construction Rigger	$61.07	**7X**	**4J**
Shipbuilding & Ship Repair	New Construction Sheet Metal	$60.94	**7X**	**4J**

Shipbuilding & Ship Repair	New Construction Shipwright	$51.85	**7X**	**4J**
Shipbuilding & Ship Repair	New Construction Warehouse/Teamster	$44.29	**7V**	**1**
Shipbuilding & Ship Repair	New Construction Welder / Burner	$61.07	**7X**	**4J**
Shipbuilding & Ship Repair	Ship Repair Boilermaker	$61.07	**7X**	**4J**
Shipbuilding & Ship Repair	Ship Repair Carpenter	$51.85	**7X**	**4J**
Shipbuilding & Ship Repair	Ship Repair Crane Operator	$45.06	**7Y**	**4K**
Shipbuilding & Ship Repair	Ship Repair Electrician	$61.12	**7X**	**4J**
Shipbuilding & Ship Repair	Ship Repair Heat & Frost Insulator	$96.42	**15H**	**11C**
Shipbuilding & Ship Repair	Ship Repair Laborer	$60.73	**7X**	**4J**
Shipbuilding & Ship Repair	Ship Repair Machinist	$60.93	**7X**	**4J**
Shipbuilding & Ship Repair	Ship Repair Operating Engineer	$45.06	**7Y**	**4K**
Shipbuilding & Ship Repair	Ship Repair Painter	$60.93	**7X**	**4J**
Shipbuilding & Ship Repair	Ship Repair Pipefitter	$61.21	**7X**	**4J**
Shipbuilding & Ship Repair	Ship Repair Rigger	$61.07	**7X**	**4J**
Shipbuilding & Ship Repair	Ship Repair Sheet Metal	$60.94	**7X**	**4J**

Shipbuilding & Ship Repair	Ship Repair Shipwright	$51.85	**7X**	**4J**	
Shipbuilding & Ship Repair	Ship Repair Warehouse / Teamster	$45.06	**7Y**	**4K**	
Sign Makers & Installers (Electrical)	Journey Level	$17.13		**1**	
Sign Makers & Installers (Non-Electrical)	Journey Level	$17.13		**1**	
Soft Floor Layers	Journey Level	$63.29	**15J**	**4C**	
Solar Controls For Windows	Journey Level	$17.13		**1**	
Sprinkler Fitters (Fire Protection)	Journey Level	$104.44	**5C**	**1X**	
Stage Rigging Mechanics (Non Structural)	Journey Level	$17.13		**1**	
Stone Masons	Journey Level	$76.07	**7E**	**1N**	
Street And Parking Lot Sweeper Workers	Journey Level	$17.13		**1**	
Surveyors	Assistant Construction Site Surveyor	$90.55	**7A**	**11H**	**8X**
Surveyors	Chainman	$86.60	**7A**	**11H**	**8X**
Surveyors	Construction Site Surveyor	$92.08	**7A**	**11H**	**8X**
Surveyors	Drone Operator (when used in conjunction with	$86.60	**7A**	**11H**	**8X**

	survey work only)				
Surveyors	Ground Penetrating Radar Operator	$86.60	**7A**	**11H**	**8X**
Telecommunication Technicians	Telecom Technician Journey Level	$62.05	**5B**	**1B**	
Telephone Line Construction - Outside	Cable Splicer	$42.62	**5A**	**2B**	
Telephone Line Construction - Outside	Hole Digger/Ground Person	$27.97	**5A**	**2B**	
Telephone Line Construction - Outside	Telephone Equipment Operator (Light)	$35.60	**5A**	**2B**	
Telephone Line Construction - Outside	Telephone Lineperson	$40.28	**5A**	**2B**	
Terrazzo Workers	Journey Level	$70.61	**7E**	**1N**	
Tile Setters	Journey Level	$68.61	**7E**	**1N**	
Tile, Marble & Terrazzo Finishers	Finisher	$59.44	**7E**	**1N**	
Traffic Control Stripers	All cleanup required in connection with traffic control stripers work (Group 1)	$95.41	**15L**	**1K**	
Traffic Control Stripers	Handling, painting and installing of all car stops, stop signs and any other type sign (Group 2)	$62.69	**15L**	**1K**	

Traffic Control Stripers	Installation of guard rail and posts and similar protective devices (Group 2)	$62.69	**15L**	**1K**
Traffic Control Stripers	Installation of parking gates, ticket spitters and other mechanical and automatic control devices (Group 2)	$62.69	**15L**	**1K**
Traffic Control Stripers	Installation of plastic metal or composition button, or lines used instead of paint (Group 1)	$95.41	**15L**	**1K**
Traffic Control Stripers	Line removal; chemical sand and hydro-blast, paint and button (Group 1)	$95.41	**15L**	**1K**
Traffic Control Stripers	Manufacturing and installation of all car stops and control devices and similar traffic regulators (Group 2)	$62.69	**15L**	**1K**
Traffic Control Stripers	Manufacturing, painting, stenciling, servicing, repairing, placing and removal of traffic safety and control devices/barricades (Group 2)	$62.69	**15L**	**1K**

Traffic Control Stripers	Painting and installing lines, arrows, bumpers, curbs, etc., on parking lots, air fields, highways, game courts (Group 1)	$95.41	**15L**	**1K**	
Traffic Control Stripers	Preparation and maintenance of all surfaces (Group 1)	$95.41	**15L**	**1K**	
Traffic Control Stripers	Seal coating, slurry coating and other surface protection (Group 2)	$62.69	**15L**	**1K**	
Truck Drivers	Asphalt Mix Over 16 Yards	$82.20	**15J**	**11M**	**8L**
Truck Drivers	Asphalt Mix To 16 Yards	$81.36	**15J**	**11M**	**8L**
Truck Drivers	Dump Truck	$81.36	**15J**	**11M**	**8L**
Truck Drivers	Dump Truck & Trailer	$82.20	**15J**	**11M**	**8L**
Truck Drivers	Other Trucks	$82.20	**15J**	**11M**	**8L**
Truck Drivers - Ready Mix	Transit Mix	$82.20	**15J**	**11M**	**8L**
Well Drillers & Irrigation Pump Installers	Irrigation Pump Installer	$17.13		**1**	
Well Drillers & Irrigation Pump Installers	Oiler	$17.13		**1**	
Well Drillers & Irrigation Pump Installers	Well Driller	$17.13		**1**	

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Overtime Codes

Overtime calculations are based on the hourly rate actually paid to the worker. On public works projects, the hourly rate must be not less than the prevailing rate of wage minus the hourly rate of the cost of fringe benefits actually provided for the worker.

1. ALL HOURS WORKED IN EXCESS OF EIGHT (8) HOURS PER DAY OR FORTY (40) HOURS PER WEEK SHALL BE PAID AT ONE AND ONE-HALF TIMES THE HOURLY RATE OF WAGE.

B. All hours worked on Saturdays shall be paid at one and one-half times the hourly rate of wage. All hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

C. The first two (2) hours after eight (8) regular hours Monday through Friday and the first ten (10) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. All other overtime hours and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

D. The first two (2) hours before or after a five-eight (8) hour workweek day or a four-ten (10) hour workweek day and the first eight (8) hours worked the next day after either workweek shall be paid at one and one-half times the hourly rate of wage. All additional hours worked and all worked on Sundays and holidays shall be paid at double the hourly rate of wage.

E. The first two (2) hours after eight (8) regular hours Monday through Friday and the first eight (8) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. All other hours worked Monday through Saturday, and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

F. The first two (2) hours after eight (8) regular hours Monday through Friday and the first ten (10) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. All other overtime hours worked, except Labor Day, shall be paid at double the hourly rate of wage. All hours worked on Labor Day shall be paid at three times the hourly rate of wage.

G. The first ten (10) hours worked on Saturdays and the first ten (10) hours worked on a fifth calendar weekday in a four-ten hour schedule, shall be paid at one and one-half times the hourly rate of wage. All hours worked in excess of ten (10) hours per day Monday through Saturday and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

H. All hours worked on Saturdays (except makeup days if work is lost due to inclement weather conditions or equipment breakdown) shall be paid at one and one-half times the hourly rate of wage. All hours worked Monday through Saturday over twelve (12) hours and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

I. All hours worked on Sundays and holidays shall also be paid at double the hourly rate of wage.

J. The first two (2) hours after eight (8) regular hours Monday through Friday and the first ten (10) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. All hours worked over ten (10) hours Monday through Saturday, Sundays and holidays shall be paid at double the hourly rate of wage.

K. All hours worked on Saturdays and Sundays shall be paid at one and one-half times the hourly rate of wage. All hours worked on holidays shall be paid at double the hourly rate of wage.

M. All hours worked on Saturdays (except makeup days if work is lost due to inclement weather conditions) shall be paid at one and one-half times the hourly rate of wage. All hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

Overtime Codes Continued

1. N. All hours worked on Saturdays (except makeup days) shall be paid at one and one-half times the hourly rate of wage. All hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

O. The first ten (10) hours worked on Saturday shall be paid at one and one-half times the hourly rate of wage. All hours worked on Sundays, holidays and after twelve (12) hours, Monday through Friday and after ten (10) hours on Saturday shall be paid at double the hourly rate of wage.

P. All hours worked on Saturdays (except makeup days if circumstances warrant) and Sundays shall be paid at one and one-half times the hourly rate of wage. All hours worked on holidays shall be paid at double the hourly rate of wage.

Q. The first two (2) hours after eight (8) regular hours Monday through Friday and up to ten (10) hours worked on Saturdays shall be paid at one and one-half times the hourly rate of wage. All hours worked in excess of ten (10) hours per day Monday through Saturday and all hours worked on Sundays and holidays (except Christmas day) shall be paid at double the hourly rate of wage. All hours worked on Christmas day shall be paid at two and one-half times the hourly rate of wage.

R. All hours worked on Sundays and holidays shall be paid at two times the hourly rate of wage.

U. All hours worked on Saturdays shall be paid at one and one-half times the hourly rate of wage. All hours worked on Sundays and holidays (except Labor Day) shall be paid at two times the hourly rate of wage. All hours worked on Labor Day shall be paid at three times the hourly rate of wage.

V. All hours worked on Sundays and holidays (except Thanksgiving Day and Christmas day) shall be paid at one and one-half times the hourly rate of wage. All hours worked on Thanksgiving Day and Christmas day shall be paid at double the hourly rate of wage.

X. The first four (4) hours after eight (8) regular hours Monday through Friday and the first twelve (12) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. All hours worked over twelve (12) hours Monday through Saturday, Sundays and holidays shall be paid at double the hourly rate of wage. When holiday falls on Saturday or Sunday, the day before Saturday, Friday, and the day after Sunday, Monday, shall be considered the holiday and all work performed shall be paid at double the hourly rate of wage.

Y. All hours worked outside the hours of 5:00 am and 5:00 pm (or such other hours as may be agreed upon by any employer and the employee) and all hours worked in excess of eight (8) hours per day (10 hours per day for a 4 x 10 workweek) and on Saturdays and holidays (except labor day) shall be paid at one and one-half times the hourly rate of wage. (except for employees who are absent from work without prior approval on a scheduled workday during the workweek shall be paid at the straight-time rate until they have worked 8 hours in a day (10 in a 4 x 10 workweek) or 40 hours during that workweek.) All hours worked Monday through Saturday over twelve (12) hours and all hours worked on Sundays and Labor Day shall be paid at double the hourly rate of wage.

Z. All hours worked on Saturdays and Sundays shall be paid at one and one-half times the hourly rate of wage. All hours worked on holidays shall be paid the straight time rate of pay in addition to holiday pay.

Overtime Codes Continued

2. ALL HOURS WORKED IN EXCESS OF EIGHT (8) HOURS PER DAY OR FORTY (40) HOURS PER WEEK SHALL BE PAID AT ONE AND ONE-HALF TIMES THE HOURLY RATE OF WAGE.

   B. All hours worked on holidays shall be paid at one and one-half times the hourly rate of wage.

   F. The first eight (8) hours worked on holidays shall be paid at the straight hourly rate of wage in addition to the holiday pay. All hours worked in excess of eight (8) hours on holidays shall be paid at double the hourly rate of wage.

   M. This code appears to be missing. All hours worked on Saturdays, Sundays and holidays shall be paid at double the hourly rate of wage.

   R. All hours worked on Sundays and holidays and all hours worked over sixty (60) in one week shall be paid at double the hourly rate of wage.

   U. All hours worked on Saturdays shall be paid at one and one-half times the hourly rate of wage. All hours worked over 12 hours in a day or on Sundays and holidays shall be paid at double the hourly rate of wage.

3. ALL HOURS WORKED IN EXCESS OF EIGHT (8) HOURS PER DAY OR FORTY (40) HOURS PER WEEK SHALL BE PAID AT ONE AND ONE-HALF TIMES THE HOURLY RATE OF WAGE.

   F. All hours worked on Saturday shall be paid at one and one-half times the hourly rate of wage. All hours worked on Sunday shall be paid at two times the hourly rate of wage. All hours worked on paid holidays shall be paid at two and one-half times the hourly rate of wage including holiday pay.

   H. All work performed on Sundays between March 16th and October 14th and all Holidays shall be compensated for at two (2) times the regular rate of pay. Work performed on Sundays between October 15th and March 15th shall be compensated at one and one half (1-1/2) times the regular rate of pay.

   J. All hours worked between the hours of 10:00 pm and 5:00 am, Monday through Friday, and all hours worked on Saturdays shall be paid at a one and one-half times the hourly rate of wage. All hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

   K. Work performed in excess of eight (8) hours of straight time per day, or ten (10) hours of straight time per day when four ten (10) hour shifts are established, or forty (40) hours of straight time per week, Monday through Friday, or outside the normal 5 am to 6pm shift, and all work on Saturdays shall be paid at one and one-half times the hourly rate of wage. All work performed after 6:00 pm Saturday to 5:00 am Monday and Holidays, and all hours worked in excess of twelve (12) hours in a single shift shall be paid at double the hourly rate of wage.

   After an employee has worked eight (8) hours at an applicable overtime rate, all additional hours shall be at the applicable overtime rate until such time as the employee has had a break of eight (8) hours or more. When an employee returns to work without at least eight (8) hours time off since their previous shift, all such time shall be a continuation of shift and paid at the applicable overtime rate until he/she shall have the eight (8) hours rest period.

Overtime Codes Continued

4. ALL HOURS WORKED IN EXCESS OF EIGHT (8) HOURS PER DAY OR FORTY (40) HOURS PER WEEK SHALL BE PAID AT ONE AND ONE-HALF TIMES THE HOURLY RATE OF WAGE.

A. All hours worked in excess of eight (8) hours per day or forty (40) hours per week shall be paid at double the hourly rate of wage. All hours worked on Saturdays, Sundays and holidays shall be paid at double the hourly rate of wage

C. On Monday through Friday, the first four (4) hours of overtime after eight (8) hours of straight time work shall be paid at one and one half (1-1/2) times the straight time rate of pay, unless a four (4) day ten (10) hour workweek has been established. On a four (4) day ten (10) hour workweek scheduled Monday through Thursday, or Tuesday through Friday, the first two (2) hours of overtime after ten (10) hours of straight time work shall be paid at one and one half (1-1/2) times the straight time rate of pay. On Saturday, the first twelve (12) hours of work shall be paid at one and one half (1-1/2) times the straight time rate of pay, except that if the job is down on Monday through Friday due to weather conditions or other conditions outside the control of the employer, the first ten (10) hours on Saturday may be worked at the straight time rate of pay. All hours worked over twelve (12) hours in a day and all hours worked on Sunday and Holidays shall be paid at two (2) times the straight time rate of pay.

D. All hours worked in excess of eight (8) hours per day or forty (40) hours per week shall be paid at double the hourly rate of wage. All hours worked on Saturday, Sundays and holidays shall be paid at double the hourly rate of pay. Rates include all members of the assigned crew.

EXCEPTION:
On all multipole structures and steel transmission lines, switching stations, regulating, capacitor stations, generating plants, industrial plants, associated installations and substations, except those substations whose primary function is to feed a distribution system, will be paid overtime under the following rates:

The first two (2) hours after eight (8) regular hours Monday through Friday of overtime on a regular workday, shall be paid at one and one-half times the hourly rate of wage. All hours in excess of ten (10) hours will be at two (2) times the hourly rate of wage. The first eight (8) hours worked on Saturday will be paid at one and one-half (1-1/2) times the hourly rate of wage. All hours worked in excess of eight (8) hours on Saturday, and all hours worked on Sundays and holidays will be at the double the hourly rate of wage.

All overtime eligible hours performed on the above described work that is energized, shall be paid at the double the hourly rate of wage.

E. The first two (2) hours after eight (8) regular hours Monday through Friday and the first eight (8) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. All other hours worked Monday through Saturday, and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

On a four-day, ten-hour weekly schedule, either Monday thru Thursday or Tuesday thru Friday schedule, all hours worked after ten shall be paid at double the hourly rate of wage. The Monday or Friday not utilized in the normal four-day, ten hour work week, and Saturday shall be paid at one and one half (1½) times the regular shift rate for the first eight (8) hours. All other hours worked Monday through Saturday, and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

G. All hours worked on Saturdays shall be paid at one and one-half times the hourly rate of wage. All hours worked Monday through Saturday over twelve (12) hours and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

I. The First eight (8) hours worked on Saturdays shall be paid at one and one-half times the hourly rate of wage. All hours worked in excess of eight (8) per day on Saturdays shall be paid at double the hourly rate of wage. All hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

Overtime Codes Continued

4. J. The first eight (8) hours worked on a Saturday shall be paid at one and one-half times the hourly rate of wage. All hours worked in excess of eight (8) hours on a Saturday shall be paid at double the hourly rate of wage. All hours worked over twelve (12) in a day, and all hours worked on Sundays and Holidays shall be paid at double the hourly rate of wage.

K. All hours worked on a Saturday shall be paid at one and one-half times the hourly rate of wage, so long as Saturday is the sixth consecutive day worked. All hours worked over twelve (12) in a day Monday through Saturday, and all hours worked on Sundays and Holidays shall be paid at double the hourly rate of wage.

L. The first twelve (12) hours worked on a Saturday shall be paid at one and one-half times the hourly rate of wage. All hours worked on a Saturday in excess of twelve (12) hours shall be paid at double the hourly rate of pay. All hours worked over twelve (12) in a day Monday through Friday, and all hours worked on Sundays shall be paid at double the hourly rate of wage. All hours worked on a holiday shall be paid at one and one-half times the hourly rate of wage, except that all hours worked on Labor Day shall be paid at double the hourly rate of pay.

S. On a four (4) day ten (10) hour workweek scheduled Monday through Thursday, or Tuesday through Friday, work performed in excess of (10) hours shall be paid at one and one half (1-1/2) times the hourly rate of pay. On Monday through Friday, work performed outside the normal work hours of 6:00 a.m. and 6:00 p.m. shall be paid at one and one-half (1-1/2) times the straight time rate, (except for special shifts or multiple shift operations).

All hours worked on Saturdays shall be paid at one and one-half times the hourly rate of wage. All work performed on Sundays and holidays shall be paid at double the hourly rate of wage. When an employee returns to work without at least eight (8) hours time off since their previous shift, all such time shall be a continuation of shift and paid at the applicable overtime rate until such time as the employee has had a break of eight (8) hours.

Multiple Shift Operations: When the first shift of a multiple shift (a two or three shift) operation is started at the basic straight time rate or at a specific overtime rate, all shifts of that day's operation shall be completed at that rate. Special Shifts: The Special Shift Premium is the basic hourly rate of pay plus $2.00 an hour. When due to conditions beyond the control of the employer or when an owner (not acting as the contractor), a government agency or the contract specifications require more than four (4) hours of a special shift can only be performed outside the normal 6am to 6pm shift then the special shift premium will be applied to the basic straight time for the entire shift. When an employee works on a special shift, they shall be paid the special shift premium for each hour worked unless they are in overtime or double-time status. (For example, the special shift premium does not waive the overtime requirements for work performed on Saturday or Sunday).

U. The first four (4) hours after eight (8) regular hours Monday through Friday and the first twelve (12) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. (Except on makeup days if work is lost due to inclement weather, then the first eight (8) hours on Saturday may be paid the regular rate.) All hours worked over twelve (12) hours Monday through Saturday, and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

Overtime Codes Continued

4. X. All hours worked on Saturdays shall be paid at one and one-half times the hourly rate of wage. All hours worked on Sundays and holidays shall be paid at double the hourly rate of wage. Work performed outside the normal shift of 6 am to 6pm shall be paid at one and one-half the straight time rate, (except for special shifts or three shift operations). All work performed on Sundays and holidays shall be paid at double the hourly rate of wage. Shifts may be established when considered necessary by the Employer.

The Employer may establish shifts consisting of eight (8) or ten (10) hours of work (subject to WAC 296-127-022), that shall constitute a normal forty (40) hour work week. The Employer can change from a 5-eight to a 4-ten hour schedule or back to the other. All hours of work on these shifts shall be paid for at the straight time hourly rate. Work performed in excess of eight hours (or ten hours per day (subject to WAC 296-127-022) shall be paid at one and one-half the straight time rate.

When due to conditions beyond the control of the Employer, or when contract specifications require that work can only be performed outside the regular day shift, then by mutual agreement a special shift may be worked at the straight time rate, eight (8) hours work for eight (8) hours pay. The starting time shall be arranged to fit such conditions of work.

When an employee returns to work without at a break of eight (8) hours since their previous shift, all such time shall be a continuation of shift and paid at the applicable overtime rate until such time as the employee has had a break of eight (8) hours.

Overtime Codes Continued

11. ALL HOURS WORKED IN EXCESS OF EIGHT (8) HOURS PER DAY OR FORTY (40) HOURS PER WEEK SHALL BE PAID AT ONE AND ONE-HALF TIMES THE HOURLY RATE OF WAGE.

B After an employee has worked eight (8) hours, all additional hours worked shall be paid at the applicable overtime rate until such time as the employee has had a break of eight (8) hours or more.

C The first two (2) hours after eight (8) regular hours Monday through Friday and the first eight (8) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. All other overtime hours worked, except Labor Day, and all hours on Sunday shall be paid at double the hourly rate of wage. All hours worked on Labor Day shall be paid at three times the hourly rate of wage. All non-overtime and non-holiday hours worked between 4:00 pm and 5:00 am, Monday through Friday, shall be paid at a premium rate of 15% over the hourly rate of wage.

D. All hours worked on Saturdays and holidays shall be paid at one and one-half times the hourly rate of wage. All hours worked on Sundays shall be paid at double the hourly rate of wage.

After an employee has worked eight (8) hours, all additional hours worked shall be paid at the applicable overtime rate until such time as the employee has had a break of eight (8) hours or more.

E. The first two (2) hours after eight (8) regular hours Monday through Friday, the first ten (10) hours on Saturday, and the first ten (10) hours worked on Holidays shall be paid at one and one-half times the hourly rate of wage. All hours worked over ten (10) hours Monday through Saturday, and Sundays shall be paid at double the hourly rate of wage.

After an employee has worked eight (8) hours, all additional hours worked shall be paid at the applicable overtime rate until such time as the employee has had a break of eight (8) hours or more.

Overtime Codes Continued

11. F. The first two (2) hours after eight (8) regular hours Monday through Friday and the first eight (8) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. All other hours worked Monday through Saturday, and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

On a four-day, ten-hour weekly schedule, either Monday thru Thursday or Tuesday thru Friday schedule, all hours worked after ten shall be paid at double the hourly rate of wage. The Monday or Friday not utilized in the normal four-day, ten hour work week, and Saturday shall be paid at one-half times the hourly rate of wage for the first eight (8) hours. All other hours worked Monday through Saturday, and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

G. Work performed in excess of eight (8) hours of straight time per day, or ten (10) hours of straight time per day when four ten (10) hour shifts are established, or forty (40) hours of straight time per week, Monday through Friday, or outside the normal 5 am to 6pm shift, and all work on Saturdays shall be paid at one and one-half times the hourly rate of wage.

All work performed after 6:00 pm Saturday to 5:00 am Monday and Holidays, and all hours worked in excess of twelve (12) hours in a single shift shall be paid at double the hourly rate of wage.

After an employee has worked eight (8) hours at an applicable overtime rate, all additional hours shall be at the applicable overtime rate until such time as the employee has had a break of nine (9) hours or more. When an employee returns to work without at least nine (9) hours time off since their previous shift, all such time shall be a continuation of shift and paid at the applicable overtime rate until he/she shall have the nine (9) hours rest period.

H. Work performed in excess of eight (8) hours of straight time per day, or ten (10) hours of straight time per day when four ten (10) hour shifts are established, or forty (40) hours of straight time per week, Monday through Friday, or outside the normal 5 am to 6pm shift, and all work on Saturdays shall be paid at one and one-half times the hourly rate of wage.

All work performed after 6:00 pm Saturday to 5:00 am Monday and Holidays, and all hours worked in excess of twelve (12) hours in a single shift shall be paid at double the hourly rate of wage.

After an employee has worked eight (8) hours at an applicable overtime rate, all additional hours shall be at the applicable overtime rate until such time as the employee has had a break of ten (10) hours or more. When an employee returns to work without at least ten (10) hours time off since their previous shift, all such time shall be a continuation of shift and paid at the applicable overtime rate until he/she shall have the ten (10) hours rest period.

J. All hours worked on holidays shall be paid at double the hourly rate of wage.

K. On Monday through Friday hours worked outside 4:00 am and 5:00 pm, and the first two (2) hours after eight (8) hours worked shall be paid at one and one-half times the hourly rate. All hours worked over 10 hours per day Monday through Friday, and all hours worked on Saturdays, Sundays, and Holidays worked shall be paid at double the hourly rate of wage.

L. An employee working outside 5:00 am and 5:00 pm shall receive an additional two dollar ($2.00) per hour for all hours worked that shift. All hours worked on holidays shall be paid at one and one-half times the hourly rate of wage. All hours worked on holidays shall be paid at one and one-half times the hourly rate of wage.

Overtime Codes Continued

11. M. On Monday through Friday, the first four (4) hours of overtime after eight (8) hours of straight time work shall be paid at one and one half (1-1/2) times the straight time rate of pay, unless a four (4) day ten (10) hour workweek has been established. On a four (4) day ten (10) hour workweek scheduled Monday through Thursday, or Tuesday through Friday, the first two (2) hours of overtime after ten (10) hours of straight time work shall be paid at one and one half (1-1/2) times the straight time rate of pay.

Work performed outside the normal work hours of 5:00 a.m. and 6:00 p.m. shall be paid at one and one-half (1-1/2) times the straight time rate, (except for special shifts or multiple shift operations). When the first shift of a multiple shift (a two or three shift) operation is started at the basic straight time rate or at a specific overtime rate, all shifts of that day's operation shall be completed at that rate. When due to conditions beyond the control of the Employer or when contract specifications require that work can only be performed outside the regular day shift of 5:00 am to 6:00 pm, then a special shift may be worked at the straight time rate, plus the shift pay premium when applicable. The starting time of work will be arranged to fit such conditions of work. Such shift shall consist of eight (8) hours work for eight (8) hours pay or ten (10) hours work for ten (10) hours pay for four ten shifts.

On Saturday, the first twelve (12) hours of work shall be paid at one and one half (1-1/2) times the straight time rate of pay. All work performed after 6:00 pm Saturday to 5:00 am Monday, all work performed over twelve (12) hours, and all work performed on holidays shall be paid at double the straight time rate of pay.

Shift Pay Premium: In an addition to any overtime already required, all hours worked between the hours of 6:00 pm and 5:00 am shall receive an additional two dollars ($2.00) per hour.

N. All work performed over twelve hours in a shift and all work performed on Sundays and Holidays shall be paid at double the straight time rate.

Any time worked over eight (8) hours on Saturday shall be paid double the straight time rate, except employees assigned to work six 10-hour shifts per week shall be paid double the straight time rate for any time worked on Saturday over 10 hours.

O. All work performed on Saturdays, Sundays, and Holidays shall be paid at one and one half (1-1/2) times the straight time rate of pay.

Overtime Codes Continued

11. P. Work performed in excess of ten (10) hours of straight time per day when four ten (10) hour shifts are established and all work on Saturdays, except for make-up days shall be paid at time and one-half (1 ½) the straight time rate.

Work performed outside the normal work hours of 5:00 a.m. and 6:00 p.m. shall be paid at one and one-half (1-1/2) times the straight time rate, (except for special shifts or multiple shift operations). When the first shift of multiple shift (a two or three shift) operation is started at the basic straight time rate or at a specific overtime rate, all shifts of that day's operation shall be completed at that rate. When due to conditions beyond the control of the Employer or when contract specifications require that work can only be performed outside the regular day shift of 5:00 a.m. to 6:00 p.m., then a special shift may be worked at the straight time rate, plus the shift pay premium when applicable. The starting time of work will be arranged to fit such conditions of work. Such shifts shall consist of eight (8) hours work for eight (8) hours pay or ten (10) hours work for ten (10) hours pay for four ten-hour shifts.

In the event the job is down due to weather conditions, then Saturday may, be worked as a voluntary make-up day at the straight time rate. However, Saturday shall not be utilized as a make-up day when a holiday falls on Friday. All work performed on Sundays and holidays and work in excess of twelve (12) hours per day shall be paid at double (2x) the straight time rate of pay.

After an employee has worked eight (8) hours at an applicable overtime rate, all additional hours shall be at the applicable overtime rate until such time as the employee has had a break of eight (8) hours.

When an employee returns to work without a break of eight (8) hours since their previous shift, all such time shall be a continuation of shift and paid at the applicable overtime rate until such time as the employee has had a break of eight (8) hours.

Q. All hours worked between the hours of 6:00 pm and 6:00 am, Monday through Saturday, shall be paid at a premium rate of 35% over the hourly rate of wage. Work performed on Sundays shall be paid at double time. All hours worked on holidays shall be paid at double the hourly rate of wage.

R On Monday through Saturday hours worked outside 6:00 am and 7:00 pm, and all hours after eight (8) hours worked shall be paid at one and one-half times the hourly rate. All hours worked on Sundays and Holidays shall be paid at double the hourly rate of wage.

When a holiday falls on a Saturday, the Friday before shall be the observed holiday. When a holiday falls on a Sunday, the following Monday shall be the observed holiday.

S. The first ten (10) hours worked on Saturdays shall be paid at one and one-half times the hourly rate of wage. In the event the job is down due to weather conditions, or other conditions beyond the control of the Employer, then Saturday may be worked at the straight time rate, for the first eight (8) hours, or the first ten (10) hours when a four day ten hour workweek has been established.

All hours worked Monday through Saturday over twelve (12) hours and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

When an employee returns to work without a break of eight (8) hours since their previous shift, all such time shall be a continuation of shift and paid at the applicable overtime rate until such time as the employee has had a break of eight (8) hours.

Overtime Codes Continued

11. T. On Monday through Friday, the first four (4) hours of overtime after eight (8) hours of straight time work shall be paid at one and one half (1-1/2) times the straight time rate of pay, unless a four (4) day ten (10) hour workweek has been established. On a four (4) day ten (10) hour workweek scheduled Monday through Thursday, or Tuesday through Friday, the first two (2) hours of overtime after ten (10) hours of straight time work shall be paid at one and one half (1-1/2) times the straight time rate of pay.

On Saturday, the first twelve (12) hours of work shall be paid at one and one half (1-1/2) times the straight time rate of pay, except that if the job is down on Monday through Friday due to weather conditions or other conditions outside the control of the employer, the first ten (10) hours on Saturday may be worked at the straight time rate of pay.

All hours worked over twelve (12) hours in a day and all hours worked on Sunday and Holidays shall be paid at two (2) times the straight time rate of pay.

U. On Monday through Friday, the first four (4) hours of overtime after eight (8) hours of straight time work shall be paid at one and one half (1-1/2) times the straight time rate of pay, unless a four (4) day ten (10) hour workweek has been established. On a four (4) day ten (10) hour workweek scheduled Monday through Thursday, or Tuesday through Friday, the first two (2) hours of overtime after ten (10) hours of straight time work shall be paid at one and one half (1-1/2) times the straight time rate of pay.

On Saturday, the first twelve (12) hours of work shall be paid at one and one half (1-1/2) times the straight time rate of pay, except that if the job is down on Monday through Friday due to weather conditions or other conditions outside the control of the employer, the first ten (10) hours on Saturday may be worked at the straight time rate of pay.

All hours worked over twelve (12) hours in a day and all hours worked on Sunday and Holidays shall be paid at two (2) times the straight time rate of pay.

If, due to conditions beyond the control of the Employer or when contract specifications require that work can only be performed outside the regular day shift, then a Special Shift may be worked, Monday through Friday, at the straight-time rate. The starting time of work for the Special Shift will be arranged to fit such conditions of work. Such Special Shift shall consist of eight (8) hours of work for eight (8) hours of pay or ten (10) hours of work for ten(10) hours of pay on a four-ten workday schedule.

V. All hours worked on Saturdays and Sundays (except make-up days due to conditions beyond the control of the employer) shall be paid at one and one-half times the hourly rate of wage. All hours worked on holidays shall be paid at double the hourly rate of wage.

W. Work performed in excess of eight (8) hours of straight time per day, or ten (10) hours of straight time per day when four ten (10) hour shifts are established, or forty (40) hours of straight time per week, Monday through Friday, or outside the normal 6 am to 6pm shift, and all work on Saturdays shall be paid at one and one-half times the hourly rate of wage. All work performed on Sundays and Holidays shall be paid at double the hourly rate of wage.

After an employee has worked eight (8) hours at an applicable overtime rate, all additional hours shall be at the applicable overtime rate until such time as the employee has had a break of eight (8) hours or more.

When an employee returns to work without at least eight (8) hours time off since their previous shift, all such time shall be a continuation of shift and paid at the applicable overtime rate until he/she shall have the eight (8) hours rest period.

Holiday Codes

5. A. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday after Thanksgiving Day, and Christmas Day (7).

B. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday after Thanksgiving Day, the day before Christmas, and Christmas Day (8).

C. Holidays: New Year's Day, Presidents' Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, And Christmas Day (8).

D. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday and Saturday after Thanksgiving Day, And Christmas Day (8).

H. Holidays: New Year's Day, Memorial Day, Independence Day, Thanksgiving Day, the Day after Thanksgiving Day, And Christmas (6).

I. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, and Christmas Day (6).

K. Holidays: New Year's Day, Presidents' Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday After Thanksgiving Day, The Day Before Christmas, And Christmas Day (9).

L. Holidays: New Year's Day, Martin Luther King Jr. Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday after Thanksgiving Day, And Christmas Day (8).

N. Holidays: New Year's Day, Presidents' Day, Memorial Day, Independence Day, Labor Day, Veterans' Day, Thanksgiving Day, The Friday After Thanksgiving Day, And Christmas Day (9).

P. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday And Saturday After Thanksgiving Day, The Day Before Christmas, And Christmas Day (9). If A Holiday Falls On Sunday, The Following Monday Shall Be Considered As A Holiday.

Q. Paid Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, and Christmas Day (6).

R. Paid Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Day After Thanksgiving Day, One-Half Day Before Christmas Day, And Christmas Day. (7 1/2).

S. Paid Holidays: New Year's Day, Presidents' Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, And Christmas Day (7).

Z. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Veterans Day, Thanksgiving Day, the Friday after Thanksgiving Day, And Christmas Day (8).

Holiday Codes Continued

6. G. Paid Holidays: New Year's Day, Martin Luther King Jr. Day, Presidents' Day, Memorial Day, Independence Day, Labor Day, Veterans' Day, Thanksgiving Day, the Friday after Thanksgiving Day, Christmas Day, and Christmas Eve Day (11).

H. Paid Holidays: New Year's Day, New Year's Eve Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday After Thanksgiving Day, Christmas Day, The Day After Christmas, And A Floating Holiday (10).

T. Paid Holidays: New Year's Day, Presidents' Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, The Friday After Thanksgiving Day, The Last Working Day Before Christmas Day, And Christmas Day (9).

Z. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday after Thanksgiving Day, And Christmas Day (7). If a holiday falls on Saturday, the preceding Friday shall be considered as the holiday. If a holiday falls on Sunday, the following Monday shall be considered as the holiday.

Holiday Codes Continued

7. A. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday and Saturday after Thanksgiving Day, And Christmas Day (8). Any Holiday Which Falls On A Sunday Shall Be Observed As A Holiday On The Following Monday. If any of the listed holidays falls on a Saturday, the preceding Friday shall be a regular work day.

B. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday and Saturday after Thanksgiving Day, And Christmas Day (8). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

C. Holidays: New Year's Day, Martin Luther King Jr. Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, And Christmas Day (8). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

D. Paid Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Veteran's Day, Thanksgiving Day, the Friday after Thanksgiving Day, And Christmas Day (8). Unpaid Holidays: President's Day. Any paid holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any paid holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

E. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, And Christmas Day (7). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

F. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, the last working day before Christmas day and Christmas day (8). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

Holiday Codes Continued

7. G. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, and Christmas Day (6). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday.

H. Holidays: New Year's Day, Martin Luther King Jr. Day, Independence Day, Memorial Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, the Last Working Day before Christmas Day and Christmas Day (9). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

I. Holidays: New Year's Day, President's Day, Independence Day, Memorial Day, Labor Day, Thanksgiving Day, The Friday After Thanksgiving Day, The Day Before Christmas Day And Christmas Day (9). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

J. Holidays: New Year's Day, Independence Day, Memorial Day, Labor Day, Thanksgiving Day and Christmas Day (6). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

K. Holidays: New Year's Day, Memorial Day, Independence Day, Thanksgiving Day, the Friday and Saturday after Thanksgiving Day, And Christmas Day (8). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

L. Holidays: New Year's Day, Memorial Day, Labor Day, Independence Day, Thanksgiving Day, the Last Work Day before Christmas Day, And Christmas Day (7). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

N. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, And Christmas Day (7). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. When Christmas falls on a Saturday, the preceding Friday shall be observed as a holiday.

P. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday after Thanksgiving Day, And Christmas Day (7). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday.

Q. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, the Last Working Day before Christmas Day and Christmas Day (8). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. If any of the listed holidays falls on a Saturday, the preceding Friday shall be a regular work day.

S. Paid Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday after Thanksgiving Day, Christmas Day, the Day after Christmas, and A Floating Holiday (9). If any of the listed holidays falls on a Sunday, the day observed by the Nation shall be considered a holiday and compensated accordingly.

V. Holidays: New Year's Day, President's Birthday, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, Christmas Day, the day before or after Christmas, and the day before or after New Year's Day. If any of the above listed holidays falls on a Sunday, the day observed by the Nation shall be considered a holiday and compensated accordingly.

W. Holidays: New Year's Day, Day After New Year's, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, Christmas Eve Day, Christmas Day, the day after Christmas, the day before New Year's Day, and a Floating Holiday.

Holiday Codes Continued

7. X. Holidays: New Year's Day, Day before or after New Year's Day, Presidents' Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, Christmas Day, and the day before or after Christmas day. If a holiday falls on a Saturday or on a Friday that is the normal day off, then the holiday will be taken on the last normal workday. If the holiday falls on a Monday that is the normal day off or on a Sunday, then the holiday will be taken on the next normal workday.

Y. Holidays: New Year's Day, Presidents' Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, and Christmas Day. (8) If the holiday falls on a Sunday, then the day observed by the federal government shall be considered a holiday and compensated accordingly.

Z. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday and Saturday after Thanksgiving Day, Christmas Eve, and Christmas Day (9). Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday. Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday.

Holiday Codes Continued

15. G. New Year's Day, Washington's Birthday, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, The Friday After Thanksgiving Day, the last scheduled workday before Christmas, and Christmas Day (9). If any of the listed holidays falls on a Sunday, the day observed by the Nation shall be considered a holiday and compensated accordingly.

H. Holidays: New Year's Day, Martin Luther King Jr. Day, Independence Day, Memorial Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, the Last Working Day before Christmas Day and Christmas Day (9). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

I. Holidays: New Year's Day, President's Day, Independence Day, Memorial Day, Labor Day, Thanksgiving Day, The Friday After Thanksgiving Day, The Day Before Christmas Day And Christmas Day (9). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

J. Holidays: New Year's Day, Martin Luther King Jr. Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday and Saturday after Thanksgiving Day, and Christmas Day (9). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. If any of the listed holidays falls on a Saturday, the preceding Friday shall be a regular work day.

K. Holidays: New Year's Day, Memorial Day, Independence Day, Thanksgiving Day, the Friday and Saturday after Thanksgiving Day, And Christmas Day (8). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

L. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Veteran's Day, Thanksgiving Day, the Friday after Thanksgiving Day, and Christmas Day (8). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. If any of the listed holidays falls on a Saturday, the preceding Friday shall be a regular work day.

M. Holidays: New Year's Day, Martin Luther King Jr. Day, Independence Day, Memorial Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, Christmas Eve Day and Christmas Day (9). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. If any of the listed holidays falls on a Saturday, the preceding Friday shall be a regular work day.

Holiday Codes Continued

15. N. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Veteran's Day, Thanksgiving Day, the Friday after Thanksgiving Day, and Christmas Day (8). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday.

O. Holidays: New Year's Day, Martin Luther King Jr. Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday and Saturday after Thanksgiving Day, the day before Christmas day, and Christmas Day (10). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday.

P. Holidays: New Year's Day, Memorial Day, Labor Day, Independence Day, Thanksgiving Day, the Friday after Thanksgiving Day, Christmas Eve Day, And Christmas Day (8). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

Note Codes

8. D. Workers working with supplied air on hazmat projects receive an additional $1.00 per hour.

L. Workers on hazmat projects receive additional hourly premiums as follows -Level A: $0.75, Level B: $0.50, And Level C: $0.25.

M. Workers on hazmat projects receive additional hourly premiums as follows: Levels A & B: $1.00, Levels C & D: $0.50.

N. Workers on hazmat projects receive additional hourly premiums as follows -Level A: $1.00, Level B: $0.75, Level C: $0.50, And Level D: $0.25.

S. Effective August 31, 2012 – A Traffic Control Supervisor shall be present on the project whenever flagging or spotting or other traffic control labor is being utilized. Flaggers and Spotters shall be posted where shown on approved Traffic Control Plans or where directed by the Engineer. All flaggers and spotters shall possess a current flagging card issued by the State of Washington, Oregon, Montana, or Idaho. This classification is only effective on or after August 31, 2012.

T. Effective August 31, 2012 – A Traffic Control Laborer performs the setup, maintenance and removal of all temporary traffic control devices and construction signs necessary to control vehicular, bicycle, and pedestrian traffic during construction operations. Flaggers and Spotters shall be posted where shown on approved Traffic Control Plans or where directed by the Engineer. All flaggers and spotters shall possess a current flagging card issued by the State of Washington, Oregon, Montana, or Idaho. This classification is only effective on or after August 31, 2012.

U. Workers on hazmat projects receive additional hourly premiums as follows – Class A Suit: $2.00, Class B Suit: $1.50, And Class C Suit: $1.00. Workers performing underground work receive an additional $0.40 per hour for any and all work performed underground, including operating, servicing and repairing of equipment. The premium for underground work shall be paid for the entire shift worked. Workers who work suspended by a rope or cable receive an additional $0.50 per hour. The premium for work suspended shall be paid for the entire shift worked. Workers who do "pioneer" work (break open a cut, build road, etc.) more than one hundred fifty (150) feet above grade elevation receive an additional $0.50 per hour.

Note Codes Continued

8. V. In addition to the hourly wage and fringe benefits, the following depth and enclosure premiums shall be paid. The premiums are to be calculated for the maximum depth and distance into an enclosure that a diver reaches in a day. The premiums are to be paid one time for the day and are not used in calculating overtime pay.

Depth premiums apply to depths of fifty feet or more. Over 50' to 100' - $2.00 per foot for each foot over 50 feet. Over 101' to 150' - $3.00 per foot for each foot over 101 feet. Over 151' to 220' - $4.00 per foot for each foot over 220 feet. Over 221' - $5.00 per foot for each foot over 221 feet.

Enclosure premiums apply when divers enter enclosures (such as pipes or tunnels) where there is no vertical ascent and is measured by the distance travelled from the entrance. 25’ to 300’ - $1.00 per foot from entrance. 300’ to 600’ - $1.50 per foot beginning at 300’. Over 600’ - $2.00 per foot beginning at 600’.

W. Meter Installers work on single phase 120/240V self-contained residential meters. The Lineman/Groundmen rates would apply to meters not fitting this description.

X. Workers on hazmat projects receive additional hourly premiums as follows - Class A Suit: $2.00, Class B Suit: $1.50, Class C Suit: $1.00, and Class D Suit: $0.50. Special Shift Premium: Basic hourly rate plus $2.00 per hour.

When due to conditions beyond the control of the Employer or when an owner (not acting as the contractor), a government agency or the contract specifications requires that work can only be performed outside the normal 5 am to 6pm shift, then the special shift premium will be applied to the basic hourly rate. When an employee works on a special shift, they shall be paid a special shift premium for each hour worked unless they are in OT or Double-time status. (For example, the special shift premium does not waive the overtime requirements for work performed on Saturday or Sunday.)

Y. Tide Work: When employees are called out between the hours of 6:00 p.m. and 6:00 a.m. to work on tide work (work located in the tide plane) all time worked shall be at one and one-half times the hourly rate of pay.

Swinging Stage/Boatswains Chair: Employees working on a swinging state or boatswains chair or under conditions that require them to be tied off to allow their hands to be free shall receive seventy-five cents ($0.75) per hour above the classification rate.

Z. Workers working with supplied air on hazmat projects receive an additional $1.00 per hour.

Special Shift Premium: Basic hourly rate plus $2.00 per hour. When due to conditions beyond the control of the Employer or when an owner (not acting as a contractor), a government agency or the contract specifications require that more than (4) hours of a special shift can only be performed outside the normal 6 am to 6pm shift, then the special shift premium will be applied to the basic straight time for the entire shift. When an employee works on a special shift, they will be paid a special shift premium for each hour worked unless they are in overtime or double-time status. (For example, the special shift premium does not waive the overtime requirements for work performed on Saturday or Sunday.)

Note Codes Continued

9. A. Workers working with supplied air on hazmat projects receive an additional $1.00 per hour.

Special Shift Premium: Basic hourly rate plus $2.00 per hour. When due to conditions beyond the control of the Employer or when an owner (not acting as the contractor), a government agency or the contract specifications require that more than four (4) hours of a special shift can only be performed outside the normal 6 am to 6pm shift, then the special shift premium will be applied to the basic straight time for the entire shift. When an employee works on a special shift, they shall be paid a special shift premium for each hour worked unless they are in overtime or double-time status. (For example, the special shift premium does not waive the overtime requirements for work performed on Saturday or Sunday.)

Certified Crane Operator Premium: Crane operators requiring certifications shall be paid $0.50 per hour above their classification rate.

Boom Pay Premium: All cranes including tower shall be paid as follows based on boom length:

(A) – 130’ to 199’ – $0.50 per hour over their classification rate.
(B) – 200’ to 299’ – $0.80 per hour over their classification rate.
(C) – 300’ and over – $1.00 per hour over their classification rate.

B. The highest pressure registered on the gauge for an accumulated time of more than fifteen (15) minutes during the shift shall be used in determining the scale paid.

Tide Work: When employees are called out between the hours of 6:00 p.m. and 6:00 a.m. to work on tide work (work located in the tide plane) all time worked shall be at one and one-half times the hourly rate of pay. Swinging Stage/Boatswains Chair: Employees working on a swinging stage or boatswains chair or under conditions that require them to be tied off to allow their hands to be free shall receive seventy-five cents ($0.75) per hour above the classification rate.

C. Tide Work: When employees are called out between the hours of 6:00 p.m. and 6:00 a.m. to work on tide work (work located in the tide plane) all time worked shall be at one and one-half times the hourly rate of pay. Swinging Stage/Boatswains Chair: Employees working on a swinging stage or boatswains chair or under conditions that require them to be tied off to allow their hands to be free shall receive seventy-five cents ($0.75) per hour above the classification rate.

Effective August 31, 2012 – A Traffic Control Supervisor shall be present on the project whenever flagging or spotting or other traffic control labor is being utilized. A Traffic Control Laborer performs the setup, maintenance and removal of all temporary traffic control devices and construction signs necessary to control vehicular, bicycle, and pedestrian traffic during construction operations. Flaggers and Spotters shall be posted where shown on approved Traffic Control Plans or where directed by the Engineer. All flaggers and spotters shall possess a current flagging card issued by the State of Washington, Oregon, Montana, or Idaho. These classifications are only effective on or after August 31, 2012.

D. Industrial Painter wages are required for painting within industrial facilities such as treatment plants, pipelines, towers, dams, bridges, power generation facilities and manufacturing facilities such as chemical plants, etc., or anywhere abrasive blasting is necessary to prepare surfaces, or hazardous materials encapsulation is required.

E. Heavy Construction includes construction, repair, alteration or additions to the production, fabrication or manufacturing portions of industrial or manufacturing plants, hydroelectric or nuclear power plants and atomic reactor construction. Workers on hazmat projects receive additional hourly premiums as follows -Level A: $1.00, Level B: $0.75, Level C: $0.50, And Level D: $0.25.

Note Codes Continued

9. F. Industrial Painter wages are required for painting within industrial facilities such as treatment plants, pipelines, towers, dams, power generation facilities and manufacturing facilities such as chemical plants, etc., or anywhere abrasive blasting is necessary to prepare surfaces, or hazardous materials encapsulation is required.

H. One (1) person crew shall consist of a Party Chief. (Total Station or similar one (1) person survey system). Two (2) person survey party shall consist of a least a Party Chief and a Chain Person. Three (3) person survey party shall consist of at least a Party Chief, an Instrument Person, and a Chain Person.

I. In addition to the hourly wage and fringe benefits, the following depth and enclosure premiums shall be paid. The premiums are to be calculated for the maximum depth and distance into an enclosure that a diver reaches in a day. The premiums are to be paid one time for the day and are not used in calculating overtime pay.

Depth premiums apply to depths of fifty feet or more. Over 50' to 100' - $2.00 per foot for each foot over 50 feet. Over 101' to 150' - $3.00 per foot for each foot over 101 feet. Over 151' to 220' - $4.00 per foot for each foot over 220 feet. Over 221' - $5.00 per foot for each foot over 221 feet.

Enclosure premiums apply when divers enter enclosures (such as pipes or tunnels) where there is no vertical ascent and is measured by the distance travelled from the entrance. 25’ to 300’ - $1.00 per foot from entrance. 300’ to 600’ - $1.50 per foot beginning at 300’. Over 600’ - $2.00 per foot beginning at 600’.

Employees may be required to perform any combination of work within the Diving team/crew, (with the exception of dive Supervisor) provided they are paid at the highest rate at which he/she has worked for the shift.

L. Workers on hazmat projects receive additional hourly premiums as follows -Level A: $0.75, Level B: $0.50, And Level C: $0.25.

Tide Work: When employees are called out between the hours of 6:00 p.m. and 6:00 a.m. to work on tide work (work located in the tide plane) all time worked shall be at one and one-half times the hourly rate of pay.

Swinging Stage/Boatswains Chair: Employees working on a swinging stage or boatswains chair or under conditions that require them to be tied off to allow their hands to be free shall receive seventy-five cents ($0.75) per hour above the classification rate.

M. Certified Crane Operator Premium: Crane operators requiring certifications shall be paid $1.50 per hour above their classification rate.

Workers on hazmat projects receive additional hourly premiums as follows - Class A Suit: $2.00, Class B Suit: $1.50, Class C Suit: $1.00, and Class D Suit: $0.50.

Special Shift Premium: Basic hourly rate plus $2.00 per hour. When due to conditions beyond the control of the Employer or when an owner (not acting as the contractor), a government agency or the contract specifications requires that work can only be performed outside the normal 6 am to 6pm shift, then the special shift premium will be applied to the basic hourly rate. When an employee works on a special shift, they shall be paid a special shift premium for each hour worked unless they are in OT or Double-time status. (For example, the special shift premium does not waive the overtime requirements for work performed on Saturday or Sunday.)

APPENDIX B

Contract, Contract Bond, and Supporting Documents

CONSTRUCTION CONTRACT AGREEMENT

THIS AGREEMENT, effective upon the date of mutual execution, is made and entered into between Skagit County, Washington, and _____, hereinafter called the Contractor.

WITNESSETH:
That in consideration of the terms and conditions contained herein and attached and made a part of this agreement, the parties hereto covenant and agree as follows:

I. The Contractor shall do all work and furnish all tools, materials, equipment, and transportation required for the construction of _____ in accordance with and as described in the attached plans and specifications and the Washington State Department of Transportation *Standard Specifications for Road, Bridge, and Municipal Construction M 41-10 2025 edition*, which are by this reference incorporated herein and made a part hereof, and shall perform any changes to the work in accord with the Contract Documents.

II. The Contractor shall provide and bear the expense of all equipment, work, and labor of any sort whatsoever that may be required for the transfer of materials and for constructing and completing the work provided for in this contract and every part thereof and shall guarantee said materials and work for a period of one year after substantial completion of this contract, except as may be modified by the plans, specifications and/or contract documents.

III. Skagit County, Washington, hereby promises and agrees with the Contractor to retain and does retain the Contractor to provide the materials and to do and cause to be done the above-described work and to complete and finish the same according to the attached plans and specifications and the terms and conditions herein contained, and hereby contracts to pay for the same according to the attached specifications and the schedule of prices bid and hereto attached, at the time and in the manner and upon the conditions provided for in this contract.

IV. The Contractor for himself/herself, and for his/her heirs, executors, administrators, successors, and assigns, does hereby agree to full performance of all covenants required of the Contractor in the contract.

V. It is further provided that no liability shall attach to Skagit County by reason of entering into this contract, except as provided herein.

IN WITNESS WHEREOF the Contractor has executed this instrument on the day and year first below written, and the Authorized Official has caused this instrument to be executed by and in the name of Skagit County the day and year first above written.

CONTRACTOR

Signature _____ Mailing Address:

Printed _____

Title _____

Date _____ Telephone No. (___) ____-____

DATED this _____ day of _____, 2026.

BOARD OF COUNTY COMMISSIONERS
SKAGIT COUNTY, WASHINGTON

_____
Ron Wesen, Chair

_____
Peter Browning, Commissioner

_____
Joe Burns, Commissioner

Attest:

_____
Clerk of the Board

For contracts under $5,000:
Authorization per Resolution R20030146

_____
County Administrator

Recommended:

_____
Department Head

Approved as to form:

_____
Civil Deputy Prosecuting Attorney

Approved as to indemnification:

_____
Risk Manager

Approved as to budget:

_____
Budget & Finance Director

CONTRACT BOND

KNOW ALL MEN BY THESE PRESENTS, that Skagit County, a Municipal Corporation of Washington, has awarded
_____ of
_____, as Principal, and _____as Surety, are jointly and severally held and bound unto the County of Skagit in the penal sum of _____ ($_____), dollars, for the payment of which we jointly and severely bind ourselves, our heirs, executors, administrators, and assigns, and successors and assigns, firmly by these presents.

THE CONDITION of this bond is such that whereas, on the _____ day of _____ A.D., 2026, the said Principal, herein, executed a certain contract with the County of Skagit by the items, conditions and provisions of which contract the said _____, Principal, herein agree to furnish all material and do certain work, to wit: That _____ will undertake and complete the

2026 Waste Storage Facility - Burmaster Construction

according to the maps, plans and specifications made a part of said contract, which contract as so executed, is hereunto attached, is now referred to and by reference is incorporated herein and made a part hereof as fully for all purposes as if here set forth at length. The bond shall cover all approved change orders as if they were in the original contract.

NOW, THEREFORE, if the Principal herein shall faithfully and truly observe and comply with the terms, conditions and provisions of said contract in all respects and shall well and truly and fully do and perform all matters and things by _____ (principal) undertaken to be performed under said contract, upon the terms proposed therein, and within the time prescribed therein, and until the same is accepted, and shall pay all laborers, mechanics, subcontractors and material men, and all persons who shall supply such contractor or subcontractor with provisions and supplies for the carrying on of such work, and shall in all respects faithfully perform said contract according to law, then this obligation to be void, otherwise to remain in full force and effect.

WITNESS our hands this _____ day of _____, 2026.

_____

_____

_____

(Principal)

_____

_____

_____

Attorney-in-Fact, Surety

_____

Name and Address
Local Office of Agent

APPROVED AS TO FORM
RICH WEYRICH
Skagit County Prosecuting Attorney

APPROVED AS TO FORM
BONNIE BEDDALL
Skagit County Risk Manager

BY: _____
Approving Authority

DATE: _____, 2026

_____
SURETY BOND NUMBER

_____
CONTRACT NUMBER

_____

_____

DECLARATION OF OPTION FOR MANAGEMENT OF STATUTORY RETAINED PERCENTAGE

Note: This form must be submitted at the time the Contractor executes the contract. Contractor shall designate the option desired by checking the appropriate space.

Monies reserved under provisions of **Chapter 60.28 RCW**, at the option of the Contractor, shall be:

☐ 1. I hereby elect to have the retained percentage of this contract held in a fund by Skagit County in a non-interest bearing account.

☐ 2. I hereby elect to have Skagit County deposit the retained percentage of this contract in an interest bearing account, not subject to withdrawal until after final acceptance of the work.

I hereby further agree to open the interest-bearing account in a qualified financial institution. I further agree to provide instructions to the bank to provide Skagit County Public Works with a monthly account statement to the attention of the Project Manager. Prior to Skagit County depositing any funds into the account, the CONTRACTOR shall obtain a letter from the financial institution on their letterhead stating the account number and bank address and confirming they will not release any funds until authorized in writing by Skagit County.

☐ 3. I hereby elect to have Skagit County invest the retained percentage of this contract from time to time as such retained percentage accrues.

I hereby designate _____ as the repository for the escrow of said funds.

I hereby further agree to be fully responsible for payment of all costs or fees incurred as a result of placing said retained percentage in escrow and investing it as authorized by statute.

Skagit County shall not be liable in any way for any costs or fees in connection therewith. Prior to Skagit County investing any funds in an escrow account, the CONTRACTOR shall obtain an escrow agreement from the repository stating their acceptance of the account, the account number and a statement that they will not release any funds until authorized in writing by Skagit County. Additionally, Skagit County Public Works will require a monthly statement from the bank for the escrow account.

☐ 4. I hereby elect to obtain a Retainage Bond acceptable to Skagit County, and agree to provide the original bond to the County. I acknowledge that no retainage will be held by Skagit County from the CONTRACTOR when Skagit County has received an acceptable bond.

The Contractor in choosing option (2) or (3) agrees to assume full responsibility to pay all costs which may accrue from escrow services, brokerage charges or both, and further agrees to assume all risks in connection with the investment of the retained percentages in securities.

_____	_____
Company Name	Date
_____	_____
Authorized Signature	Title
_____	_____
Print Name	Phone Number

Prevailing Wage Acknowledgement
Please Return With Construction Contract
To Skagit County Public Works

Mail or fax to: **Skagit County Public Works**
1800 Continental Place
Mount Vernon, WA 98273
360-416-1400
360-416-1405 (fax)
Attn: Leanne Ingman

We, _____ the undersigned vendor acknowledge receipt of the Washington State Prevailing Wage scales for the Public Works Contract covering:

2026 Waste Storage Facility – Burmaster Construction

Dated: _____

Signed by: _____
(Name & Title)

Attention Sole Proprietors, Partners & Officer/Owners

- Sole owners of their own businesses who perform the actual work themselves are not required to pay themselves the prevailing wage rates.
- Partners in a partnership who own at least 30% of a company are likewise not required to pay themselves prevailing wage rates.
- The President, Vice President, and Treasurer of a corporation are not required to pay themselves prevailing wage, as long as each owns at least 30% of the corporations.

These companies are not exempt from the remaining requirements of the statute, including the filing of Intent and Affidavit forms. Any worker who owns less than 30% of the company is not exempt and must be paid the prevailing wage rate. WAC 296-127-026.

APPENDIX C

Proposal Forms

Proposal
For
Bidding Purposes

2026 Waste Storage Facility - Burmaster Construction
Project #WA1206-140-6

SKAGIT COUNTY PUBLIC WORKS

Must be an approved contractor on the Municipal Research and Services Center (MRSC) Roster in order to Bid this project: http://www.mrscrosters.org

---

SKAGIT COUNTY
Public Works Department
1800 Continental Place
Mount Vernon, WA 98273

BID PROPOSAL

2026 Waste Storage Facility - Burmaster Construction

Skagit County, Washington

2026

**** ENTIRE PROPOSAL TO BE RETURNED AS YOUR BID PACKAGE ****

MUST BE AN APPROVED CONTRACTOR ON THE MUNICIPAL RESEARCH AND SERVICES CENTER (MRSC) ROSTER IN ORDER TO BID THIS PROJECT:
http://www.mrscrosters.org

All bid envelopes must be plainly marked on the outside, **"Sealed Bid: Waste Storage Facility - Burmaster."**

BID DUE DATE AND TIME: **Wednesday, April 22, 2026 at 3:00 p.m.**

Late and/or incomplete bids will not be considered. Oral, telephonic, telegraphic, electronic, or faxed proposals will not be accepted.

Sealed Bids will be accepted at the following location by one of the following delivery methods:

Bids May be Hand-Delivered or Mailed to:

Skagit County Commissioners Office
Attn: Reception Desk
1800 Continental Place
Mount Vernon, WA 98273

FAILURE TO SIGN OR COMPLETE ALL INFORMATION ON THE FORMS PROVIDED CAN RESULT IN REJECTION OF THE PROPOSAL AS NON-RESPONSIVE

CONDITION OF AWARD:
It is the intent of Skagit County to award a contract to the low responsive and responsible bidder. All terms and conditions listed in the Contract Provisions and Specifications apply to this condition.

MANDATORY BIDDER CRITERIA:
Before award, the bidder must meet the following bidder responsibility criteria to be considered a responsible bidder. The bidder may be required by Skagit County to submit documentation demonstrating compliance with the criteria. The bidder must:

1. Have a current certificate of registration as a contractor in compliance with chapter 18.27 RCW, which must have been in effect at the time of bid submittal.
2. Have a current Washington Unified Business Identifier (UBI) number.
3. Have Industrial Insurance (workers' compensation) coverage for the bidder's employees working in Washington, as required in Title 51 RCW. Not applicable to sole proprietors if the owner performs work himself/herself.
4. Have a Washington Employment Security Department number (ESD), as required in Title 50 RCW **(and, if the lowest responsive and responsible bidder, provide documentation from ESD in the form of a letter or statement within 24 hours of submitting bid)**;
5. Have a Washington Department of Revenue state excise tax registration number, as required in Title 82 RCW;
6. Not be disqualified from bidding on any public works contract under RCW 39.06.010 or 39.12.065(3) and;
7. Not be excluded or suspended from bidding on any public works contract under federal laws.

SCHEDULE:
Contractor shall not commence work until notice to proceed has been given by Skagit County; this occurs after the Contract has been executed by Skagit County Board of County Commissioners.

PAYMENT:
Invoices can be submitted after work is performed. Payment is made when the Contractor has filed his/her "Intent to Pay Prevailing Wages" with the Washington State Department of Labor and Industries. Final payment is made when the Contractor has filed his/her "Affidavit of Paying Prevailing Wages".

FAILURE TO SIGN OR COMPLETE ALL INFORMATION ON THE FORMS PROVIDED CAN RESULT IN REJECTION OF THE PROPOSAL AS NON-RESPONSIVE

This certifies that the undersigned has examined the entire bid proposal and contract provisions and specifications for the:

2026 Waste Storage Facility – Burmaster Construction

and the contract governing the work embraced in this project, and the method by which payment will be made for said work, is understood. The undersigned hereby proposes to undertake and complete the work, or as much thereof as can be completed with the money available in accordance with the said description of work and contract, and the following schedule of rates and prices. Bidder acknowledges all requirements and signed all certificates contained herein. Bidder agrees to pay labor not less than the prevailing rates of wages in accordance with the requirements of the special provisions for this project.

2026 Waste Storage Facility – Burmaster Construction					
Item	**Description**	**Qty.**	**Unit**	**Unit Price**	**Total Cost**
1	Mobilization	1	LS	$	$
2	Surveying road setback	1	LS	$	$
3	Site Preparation (grading, staging, fill, etc.)	1	LS	$	$
4	Two (2) bay ecology block waste storage facility (labor, equipment, materials)	1	LS	$	$
				Subtotal:	$
				Sales Tax (8.6%):	$
				Total:	$

Please use ink, print legibly, and initial and date any changes, erasures, or cross-outs. All unit prices, when relevant, are mandatory and shall control.

FAILURE TO SIGN OR COMPLETE ALL INFORMATION ON THE FORMS PROVIDED CAN RESULT IN REJECTION OF THE PROPOSAL AS NON-RESPONSIVE

PROPOSAL – Signature Page

The bidder is hereby advised that by signature of this proposal he/she is deemed to have acknowledged all requirements and signed all certificates contained herein.

The undersigned hereby agrees to pay labor not less than the prevailing rates of wages in accordance with the requirements of the special provisions for this project.

A proposal guaranty in an amount, which is equal to five percent (5%) of the estimated bid amount, based upon the approximate estimate of above prices and in the form as indicated below is attached hereto:

☐ CASHIER'S CHECK In the amount of $_____ Dollars

☐ CERTIFIED CHECK (Payable to Skagit County) In the amount of $_____ Dollars

☐ PROPOSAL BOND In the amount of five percent (5%) of the total estimated contract amount.

If addendums have been issued:
Receipt is hereby acknowledged of Addendum(s) No.(s)_____

S I G N

Signature of Authorized Official(s):

_____

_____

Firm Name: _____

Address: _____

_____

Phone No. _____

State of Washington Contractor's License No._____

UBI No._____ Employment Security Department No._____

Note:

(1) This proposal form is not transferable and any alteration of the firm's name entered hereon without prior permission from the Skagit County will be cause for considering the proposal irregular and subsequent rejection of the bid.

(2) Please refer to Section 1-02.6 of the Standard Specifications, "Preparation of Proposal", or "Article 4" of the Instruction to Bidders for building construction jobs.

FAILURE TO SIGN OR COMPLETE ALL INFORMATION ON THE FORMS PROVIDED CAN RESULT IN REJECTION OF THE PROPOSAL AS NON-RESPONSIVE

NON-COLLUSION DECLARATION

I, by signing the proposal on page 5, hereby declare, under penalty of perjury under the laws of the United States that the following statements are true and correct:

1. That the undersigned person(s), firm, association or corporation has (have) not, either directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken any action in restraint of free competitive bidding in connection with the project for which this proposal is submitted.

2. That by signing the signature page of this proposal, I am deemed to have signed and have agreed to the provisions of this declaration.

NOTICE TO ALL BIDDERS

To report bid rigging activities call:

1-800-424-9071

The U.S. Department of Transportation (USDOT) operates the above toll free 'hotline' Monday through Friday, 8:00 a.m. to 5:00 p.m., Eastern Standard Time. Anyone with knowledge of possible bid rigging, bidder collusion, or other fraudulent activities should use the 'hotline' to report such activities.

The 'hotline' is part of USDOT's continuing effort to identify and investigate highway construction fraud and abuse and is operated under the direction of the USDOT Inspector General. All information will be treated confidentially and caller anonymity will be respected.

MUST ACCOMPANY EACH BID

FAILURE TO SIGN OR COMPLETE ALL INFORMATION ON THE FORMS PROVIDED CAN RESULT IN REJECTION OF THE PROPOSAL AS NON-RESPONSIVE

NON-DISBARMENT CERTIFICATION

Are you on Comptroller General's list of Ineligible Contractors or list of parties excluded from Federal procurement or non-procurement programs? ☐ NO ☐ YES

Company Name: _____

Type of Business ☐ Corporation ☐ Partnership (general) ☐ Partnership (limited)
☐ Sole Proprietorship ☐ Limited Liability Company

FID #: _____

Company Address: _____

The County/State/Zip: _____

Phone:_____ Fax:_____

E-Mail: _____

Print Name of Signatory:_____

Print Title of Signatory:_____

MUST ACCOMPANY EACH BID

FAILURE TO SIGN OR COMPLETE ALL INFORMATION ON THE FORMS PROVIDED CAN RESULT IN REJECTION OF THE PROPOSAL AS NON-RESPONSIVE

IN LIEU OF A CASHIER'S OR CERTIFIED CHECK, YOU MAY SUBMIT THE ENCLOSED PROPOSAL BOND FORM WITH YOUR PROPOSAL

USE OF OTHER FORMS MAY SUBJECT YOUR BID TO REJECTION

PROPOSAL BOND

KNOW ALL MEN BY THESE PRESENTS, That we, _____ _____of _____ as principal, and the _____ a corporation duly organized under the laws of the State of _____, and authorized to do business in the State of Washington, as surety, are held and firmly bound unto Skagit County in the full and penal sum of five (5) percent of the total amount of the bid proposal of said principal for the work hereinafter described for the payment of which, well and truly to be made, we bind our heirs, executors, administrators and assigns, and successors and assigns, firmly by these presents.

The condition of this bond is such, that whereas the principal herein is herewith submitting his or its sealed proposal for the following construction, to wit:

2026 Waste Storage Facility - Burmaster Construction

said bid and proposal, by reference thereto, being made a part hereof.

NOW THEREFORE, If the said proposal bid by said principal be accepted, and the contract be awarded to said principal, and if said principal shall duly make and enter into and execute said contract and shall furnish bond as required by Skagit County within a period of ten (10) days from and after said award, exclusive of the day of such award, then this obligation shall be null and void, otherwise it shall remain and be in full force and effect.

IN TESTIMONY WHEREOF, The principal and surety have caused these presents to be signed and sealed this _____ day of _____, 2026.

_____
(Principal)

_____ _____
(Surety) (Attorney-in-fact)

Certification of Compliance with Wage Payment Statutes

The bidder hereby certifies that, within the three-year period immediately preceding the bid solicitation date on Wednesday, March 18, 2026, the bidder is not a "willful" violator, as defined in RCW 49.48.082, of any provision of chapters 49.46, 49.48, or 49.52 RCW, as determined by a final and binding citation and notice of assessment issued by the Department of Labor and Industries or through a civil judgment entered by a court of limited or general jurisdiction.

I certify under penalty of perjury under the laws of the State of Washington that the foregoing is true and correct.

_____
Bidder's Business Name

_____
Signature of Authorized Official*

_____
Printed Name

_____
Title

_____ _____ _____
Date City State

Check One:

Sole Proprietorship ☐ Partnership ☐ Joint Venture ☐ Corporation ☐

State of Incorporation, or if not a corporation, State where business entity was formed:

_____

If a co-partnership, give firm name under which business is transacted:

_____

** If a corporation, proposal must be executed in the corporate name by the president or vice-president (or any other corporate officer accompanied by evidence of authority to sign). If a co-partnership, proposal must be executed by a partner.*

APPENDIX D

Agricultural Best Management Practice Guidelines for WA State

PUGET SOUND
National Estuary Program

SHELLFISH BEDS

Washington State Department of Health
National Estuary Program Shellfish Strategic Initiative

Agricultural Best Management Practice Guidelines

Washington State Department of HEALTH

DOH 334-492 March 2023

Contents

Publication Information

This document provides agricultural best management practices (ag BMPs) eligibility and implementation guidance to Washington State Department of Health (DOH) National Estuary Program (NEP) Shellfish Strategic Initiative (SSI) grant subrecipients. It updates the Agricultural Best Management Practice Guidelines we published in November 2018, and strategically borrows from and aligns with the state Department of Ecology's funding guidelines for ag BMPs. We will update it as needed.

Technical Contact Information

Lea Shields
National Estuary Program Environmental Planner
Office of Environmental Health and Safety
Washington State Department of Health
Lea.shields@doh.wa.gov
360-819-2908

Administrative Contact Information

Megan Schell
National Estuary Program Contract Manager
Office of Environmental Health and Safety
Washington State Department of Health
megan.schell@doh.wa.gov
360-236-3307

Laura Heinse
National Estuary Program Contract Manager
Office of Environmental Health and Safety
Washington State Department of Health
laura.heinse@doh.wa.gov
360-236-3301

Jill Stewart
National Estuary Program Contract Manager
Office of Environmental Health and Safety
Washington State Department of Health
jill.stewart@doh.wa.gov
360-236-3337

Background

When not managed properly, animal manure and chemical fertilizer from agricultural land uses can allow fecal bacteria and nutrient water pollution to enter ditches, streams, rivers, lakes, and marine waters. Fecal bacteria from animal manure can contain pathogens. Too much fecal bacteria measured in surface waters and marine waters can lead to limits and advisories on human contact, recreational activities, and shellfish harvesting.

Agricultural best management practices (ag BMPs) are tools farmers can use to reduce soil and nutrient runoff, protect riparian areas, and manage animals and animal waste in ways that minimize or prevent water pollution.

Overview

Throughout this document, “we” and “us” refer to Department of Health National Estuary Program (DOH NEP) and “you” refers to the subrecipient unless otherwise stated.

Purpose

We will contract with subrecipients to use our DOH NEP Shellfish Strategic Initiative (SSI) ag BMP funds (DOH ag BMP funds) in approved project areas. Projects will promote, plan, and install eligible ag BMPs that help control fecal bacteria and nutrient pollution sources and improve and protect the filtering and habitat functions of riparian areas. Ag BMPs installed and maintained in eligible project areas may significantly reduce the potential for livestock and manure to negatively affect water quality flowing to Puget Sound shellfish growing areas.

Subrecipients will encourage landowners to access our ag BMP funds to help implement eligible practices to correct identified fecal bacteria pollution sources. You will provide technical assistance to help landowners locate, design, construct, and install eligible ag BMPs according to applicable U.S. Environmental Protection Agency (EPA) grant terms and conditions, DOH guidelines and requirements, and U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) specifications.

When using our ag BMP funds, you will inform participants of eligibility requirements and perform administrative tasks necessary for landowner cost-share reimbursement, administrative cost reimbursement, and grant reporting. Administrative tasks include working with us to complete project pre-approval and federal Section 106 cultural resource review requirements before any ground-disturbing work takes place related to BMP implementation.

Subrecipients may combine ag BMP funds with other grant funds to implement multiple BMPs on the same property. Examples of other funding sources may include Washington State Conservation Commission, Department of Ecology (Ecology), and NRCS. You should work with us to clarify when using multiple grant funding sources for BMPs on the same property.

You may contract with or use other organizations to complete ag BMP implementation tasks. However, you remain responsible for project oversight and for ensuring that required tasks are completed. We will reimburse you directly for eligible and approved ag BMP installation costs and eligible administrative costs. You are responsible for reimbursing landowners, contractors, or sub-subrecipients (subawardees of DOH subrecipients) for eligible ag BMP project and administrative costs before requesting reimbursement from DOH.

Need assistance? Contact the National Estuary Program (page 3) for contract requirements, best management practice eligibility, technical questions, and payment requests for pre-approved BMP projects. We will review and authorize payment requests and distribute reimbursements.

For contracts with subawardees, communications with us should follow the appropriate privity of contract relationships.

General funding eligibility, approval, and implementation requirements

To be eligible for DOH ag BMP fund cost reimbursement, ag BMPs must:

- Be based primarily on water quality improvement purposes and not on agricultural production needs. Ag BMPs should provide a public benefit by correcting riparian area damage; conditions where livestock and manure contribute to fecal bacteria, sediment, and nutrient pollution to surface water flowing to commercial shellfish growing areas; or both.
- Comply with the requirements in this document and the NRCS Field Office Technical Guide (FOTG) for Washington State construction specifications or equivalent construction standards. If NRCS specifications aren't available, a licensed engineer must design the structural design of the proposed BMP. To avoid implementing ineligible projects or practices, you should follow the steps in this document's "Project Implementation Steps" section.
- Receive documented project pre-approval from us.
- Comply with all applicable local codes and requirements: State Environmental Policy Act (SEPA), permits, Critical Areas Ordinances, and any others as needed. You are responsible for ensuring any local requirements are fulfilled.

To be eligible for DOH ag BMP fund cost reimbursement, properties must:

- Be in a project area included in the subrecipient contract Statement of Work. You should be able to clearly demonstrate—using a combination of topographic maps, aerial imagery, flow lines, or seasonal or preferential pathways—that runoff from the property affects shellfish growing areas downstream.
- Be implemented on a property where the owner or operator has a manure management plan in place or be part of the development of a manure management plan.
- Have a signed landowner agreement in place before BMP implementation.
- See "Project implementation steps" section for more details.

General DOH ag BMP fund reimbursement rates:

- For all eligible practices described in these guidelines, we will reimburse up to 100% of installation costs (within associated cost caps). We may grant exceptions for project estimates that exceed cost caps on a case-by-case basis. Subrecipient must provide adequate justification for the increased cost of the project. Plan to allow additional time for review and pre-approval if the project budget exceeds stated cost caps.
- Practices not described in these guidelines may also be eligible for reimbursement up to 100%. You must provide adequate justification for benefit to water quality and shellfish growing areas downstream during the pre-approval process. Requesting pre-approval for BMPs not listed in this document may add additional time for approval.
- Proposals that include appropriate riparian buffers or address multiple pollution sources on water courses on the properties in the project area in support water quality and salmon recovery will be prioritized for funding.

Project implementation steps

Planning and pre-approval

In approved project areas, subrecipients will:

1. Promote use of DOH ag BMP funds to help implement eligible ag BMPs to address identified sources of fecal bacteria and nutrient pollution to surface water.
2. Meet with landowners to assess project sites and evaluate the need for ag BMPs.
3. Identify potential qualifying ag BMP projects in project areas and work with landowners to develop site-specific plans locating and designing eligible BMPs to NRCS specifications.
4. Work with us to complete the DOH pre-approval process. To request project pre-approval:
    a. Submit a completed "Project Pre-approval Form" with requested attachments. The Project Pre-approval Form will include a recommended suite of BMPs, estimated project costs, and a description of existing site conditions or expected water quality benefit to shellfish growing areas. See Appendix I for Pre-approval Process detail.
    b. We will review the submitted materials and provide written notice to the subrecipient about project funding eligibility and pre-approval status.

Cultural Resources Review

When you receive project pre-approval from us, you will:

5. Work with us to complete the required Section 106 Cultural Resource Review process. See Appendix II for Section 106 Cultural Resource Review process detail.
6. Receive our confirmation that Cultural Resources Review is complete before any ground disturbance activity takes place related to ag BMP project implementation. **Note that Cultural Resources Review must be completed through DOH and not prior to pre-approval or independent from our process. Costs incurred before Cultural Resources Review is complete are not eligible for reimbursement.**

Landowner agreement

Before installing eligible BMPs, you will:

7. Secure a signed landowner agreement between the property owner and the subrecipient.
    a. The agreement must allow you to inspect the BMP(s) and may provide for you and the landowner to arrange public and educational tours. The landowner will agree to maintain the installed BMPs for at least 10 years or the lifespan of the practice (defined by NRCS), whichever is longer.

Technical assistance to implement approved BMPs

After securing a signed landowner agreement, you will:

8. Provide technical assistance to landowners to construct and install pre-approved ag BMP projects according to NRCS specifications.
    a. As necessary, coordinate with other technical service providers to obtain engineering design or construction plans to properly locate, design, construct, and install eligible and DOH pre-approved ag BMP projects. Pre-project installation work should include taking "before" pictures to capture site conditions prior to project installation.

        i. Take before and after pictures from the same location to show context and site condition before and after ag BMP installation. When submitted to us as part of cost share reimbursement request, you should label pictures to clearly identify cost-shared work.
    b. Conduct site visits during the BMP construction and installation period to ensure BMP implementation meets NRCS standards.
    c. Before submitting a cost share reimbursement request to us, conduct a final site visit to ensure BMPs were implemented properly. Your post-installation site visit should include taking pictures of completely installed and functional BMPs.
    d. Conduct follow up site visits to ensure proper operation and maintenance of NEP SSI supported ag BMPs. As needed or requested, you will report to us findings of follow-up visits you did to assess operation and maintenance status of BMPs.

Administrative tasks for grant reporting and cost share reimbursement request

Throughout project planning, pre-approval, implementation, and follow up you will:

9. Collect BMP project information and maintain project records to support timely and accurate grant reporting and cost share reimbursement requests.
    a. Gather and maintain project information (including photos) necessary to document and track BMP project pre-approval, implementation, costs, follow up, and reimbursement requests.
10. Provide administrative assistance to participants to meet recordkeeping and reporting requirements for cost share reimbursement.
11. Ensure accuracy of data and records submitted for grant reporting and payment requests.
12. When ag BMP installation is complete, submit required forms to the contract manager and ag BMP technical lead to approve deliverable of ag BMP, including ag BMP project management checklist, post-installation form (documenting certification of implementation, “after” photos,” and actual installation costs).
13. Within 90 days of confirming that the approved ag BMP was installed to NRCS specifications and is operational, submit to us a request for BMP cost share reimbursement using the process in *SSI Subrecipient Grant Funding Guidance*. Submit an invoice package as a stand-alone payment request (not to be combined with other contract work) for review and approval.

Eligible Best Management Practices

This section describes eligibility requirements and specific practices that qualify to be considered for DOH ag BMP fund cost share reimbursement. You may work with participants to install a combination of eligible BMPs on a single property.

Riparian Buffers and associated practices

DOH ag BMP funds can be used to implement riparian buffer projects that help protect water quality and improve riparian area productivity and functions. Eligible riparian buffer project work can include riparian planting, livestock exclusion fencing, and off stream watering (may include well construction and livestock stream crossing) practices.

See Appendix III for detail supporting EPA’s Riparian Buffer Programmatic Condition and tools to help determine stream class, appropriate buffer width, and process for submitting a deviation request.

Figure 1: EPA Riparian Buffer Programmatic Condition

Riparian buffer restoration projects in agricultural areas shall be consistent with the interim riparian buffer recommendations provided to EPA and the Natural Resource Conservation Service by National Marine Fisheries Service letters of January 30, 2013, (stamp received date - February 4, 2013) and April 9, 2013 (stamp received date - April 16, 2013), or the October 28, 2013, guidance. Grantees shall confirm in writing projects' consistency with the recommendations referenced above.

When developing project proposals, grantees also should consider the extent to which proposals include appropriate riparian buffers or otherwise address pollution sources on other water courses on the properties in the project area to support water quality and salmon recovery.

Deviations can only be obtained through an exception approved by EPA. In order for EPA to evaluate a request for an exception, the grantee must submit the scientific rationale demonstrating adequacy of buffers for supporting water quality and salmon recovery. The request must summarize tribal input on the scientific rationale or other relevant issues.

The scientific rationale could be developed from sources such as site-specific assessment data, salmon recovery plans, Total Maximum Daily Loads (TMDLs) and the state nonpoint plan. EPA will confer with the National Oceanic and Atmospheric Administration (NOAA) and the Washington Department of Ecology and provide the opportunity for affected tribes to consult with EPA before making a final decision on a deviation request."[1]

Additional eligibility requirements:

- Riparian buffer widths must be measured starting from the ordinary high-water mark.
- When establishing riparian buffer projects in forested areas, the buffer width must be consistent with the EPA Riparian Buffer Programmatic Condition (Figure 1) and Washington State Forest Practices Rules.
- Subrecipient must obtain any necessary permits and will verify compliance with all applicable codes and regulations, including county Critical Area Ordinances, county Shoreline Rules, and other state and local regulations.
- To be eligible for funding, the minimum riparian buffer width on each side of surface water must be consistent with the EPA Riparian Buffer Programmatic Condition.
    - If a project's site conditions, such as existing infrastructure, make it difficult to adhere to the EPA Riparian Buffer Condition, you can request a deviation from minimum NMFS buffer-width requirements. EPA must approve the deviation request.
    - You must work with us to pursue EPA review of a riparian buffer deviation request. A buffer deviation request must provide adequate justification as to why the minimum buffer requirement cannot be met. Deviations have been granted for existing structures within the minimum buffer width requirements. Please reach

out to your contract manager or ag BMP technical lead for more information on the deviation request process.

Riparian Planting

Riparian buffer projects eligible for cost share reimbursement may be planted only with native trees and shrubs. Grass filter strips by themselves are not sufficient to satisfy this requirement.

- Prior to implementation, the subrecipient must develop site-specific plans for riparian buffer projects. Your plan must include plant locations and species; and you must base it on an assessment of native plant associations and community types.

Livestock Exclusion Fencing

DOH ag BMP funds may be used to install qualifying and pre-approved fencing to permanently exclude livestock from a waterway and riparian planting. To qualify for cost reimbursement, fencing must be part of a riparian buffer planting project, provide a minimum setback from the ordinary high-water mark consistent with the EPA Riparian Buffer Condition, and be built according to NRCS specifications.

- Cross fencing is not eligible for ag BMP cost-share funding.

Off stream watering

When included in an eligible riparian buffer project that installs qualifying livestock exclusion fencing, off-stream water facilities (including well construction) are conditionally eligible for DOH ag BMP fund financial assistance.

Financial assistance limits (cost caps) for watering facilities are based on the continuous linear distance of riparian exclusion per landowner. See Table 1 below for limits.

Table 1. Financial assistance limits for off-stream watering projects

Miles of Livestock Riparian Exclusion	Financial Assistance Limit for water facility (per project)
< ½ mile	100% of total eligible cost or $8,000 (whichever is less)
> ½ mile and < 1 mile	100% of total eligible cost or $12,000 (whichever is less)
> 1 mile and < 1.5 miles	100% of total eligible cost or $16,000 (whichever is less)
> 1.5 miles and < 2 miles	100% of total eligible cost or $24,000 (whichever is less)
> 2 miles and < 2.5 miles	100% of total eligible cost or $32,000 (whichever is less)
> 2.5 miles	100% of total eligible cost or $40,000 (whichever is less)

Other requirements for off-stream watering project funding:

- The riparian buffer project must include permanent and continuous fencing compliant with NRCS specifications that displaces an established watering area in the riparian area.

- Livestock fencing excludes livestock from waters of the state according to EPA's Riparian Buffer Programmatic Condition.
- The project will address an existing surface water quality problem(s) and establish an improved watering area at a location far enough from waterways to prevent a pollution risk to surface water.
    - Ag BMP funds may not be used to rebuild watering facilities where the primary purpose is to repair existing infrastructure.
- For off-stream watering BMP projects using surface water as a source, the participant must own a legal right to surface water withdrawal for the purpose of livestock watering.
- Subrecipient will ensure that water supplied is for livestock use only.
- If land use is changed from livestock management to residential, commercial, or industrial development during the landowner/subrecipient agreement period, the grant recipient must repay DOH immediately for all financial assistance we issued for the off-stream watering facility project.
    - Facilities must serve no greater number of livestock than historically range that parcel of property. The amount of water that livestock consume due to the funded off-stream watering facility should not exceed the amount consumed if they drink directly from the stream.
        - Pumps, pipes, and water troughs, as needed, are eligible.
        - All components of solar powered pumps are project eligible.
        - Electrical or mechanical power provisions are eligible only if existing infrastructure is available and can be used at a minimal cost.
- Off-stream water facilities for fewer than 20 Animal Units (see WAC 173-224-030 for definition of animal unit) may be eligible for ag BMP cost share reimbursement. However, related well construction is not eligible for cost share reimbursement when the project serves fewer than 20 animal units.
- Heavy-use area protection at watering facilities is eligible as part of the watering facility if necessary and approved. The cost of heavy-use area protection related to a watering facility is part of the cost of the off-stream watering facility BMP and is included in the funding limitations listed in Table 1.

Well construction

For wells to be eligible for ag BMP funding as part of an off-stream watering facility, the participant property must have at least 20 animal units. The funding caps related to off-stream watering facilities (Table 1) include the cost for well drilling. A cost analysis for wells must be completed according to the following criteria:

- The participant must consider gravity feeding or pumping from existing surface water (if participant owns a legal right to surface water withdrawal for the purpose of livestock watering) and groundwater sources and water hauling as first choices. If these alternatives are not feasible, the participant may consider newly dug or drilled wells.
- DOH ag BMP funds will not reimburse recipients for costs related to unsuccessful well drilling.
- Wells eligible for DOH ag BMP funds must be either less costly or demonstrably more cost-effective (based on analysis of hydraulic flow, sediment clogging, freezing).
- The selected practice must follow a site-specific farm plan (or more focused plan involving livestock exclusion and off-stream water provisions).

Livestock Crossing

- Structures built to provide livestock access across a stream are conditionally eligible for DOH ag BMP fund cost reimbursement. To be eligible, the stream crossing must be part of a riparian buffer project with livestock excluded from stream access and buffer widths that meet EPA's Riparian Buffer Programmatic Condition.
- A stream crossing bridge eligible for cost reimbursement must be used only by livestock and be no more than 6 feet wide. If a landowner wants to construct a crossing wider than 6 feet, we may consider prorating the cost-share eligibility based on the 6-foot width. For example, the total cost of a 10-foot-wide bridge would be 60% eligible for cost reimbursement. Subrecipients must get preapproval from us to cost share bridges more than 6 feet wide.

Waste management

Select waste management BMPs are eligible for DOH ag BMP funds. They include waste storage or composting facilities designed and constructed to NRCS or equivalent engineering standards, to address sources of livestock- and manure-related nonpoint surface water pollution. A participant may install a combination of waste management BMPs when appropriate and necessary to address the threat to water quality.

Eligible waste management (storage or composting) BMPs must be engineered to NRCS or equivalent engineering standards and include a permanent roof, a concrete floor, and gutters or other appropriate structures to manage roof runoff.

DOH ag BMP funds for waste management practices apply only to projects that will correct an identified fecal bacteria-related water quality problem. They may not be used where the primary purpose is to repair existing structures.

BMPs for waste management are eligible for reimbursement with the combined total package of waste management BMPs eligible for up to a maximum reimbursement (cost cap) of $32,000 per landowner. The "total package of waste management BMPs" is defined to include:

- A waste storage or a composting structure with impervious concrete floor.
- A permanent roof.
- Gutters.
- Other roof runoff structure such as downspouts and underground outlets.

Funding eligibility conditions for waste management BMPs include:

- A professional engineer must design and stamp waste storage and composting facilities.
- The recipient must obtain any required building permits.
- The owner or operator must have a manure management plan in place to protect water quality.
- Eligible waste management BMPs must be designed, built, and located so that the management area does not present a risk of polluting surface water.

Waste storage facility or Composting facility

- Waste storage or composting facilities, roofs and covers, and roof runoff structures must be designed and constructed according to NRCS standards, located in compliance with all local codes, compliant with NMFS buffers, and sited to optimize water quality protection.

Roof runoff structure

- As a stand-alone BMP, roof runoff structures for existing buildings are eligible on a case-by-case basis. To be eligible, roof runoff structures on existing buildings must demonstrate a water quality benefit.

Heavy Use Area Protection

Heavy-use area protection must prevent manure contaminated mud and polluted runoff at feeding, watering, and waste management facilities. The design and construction must meet NRCS standards.

- Heavy use area protection is eligible for cost reimbursement up to a maximum of $10,700 per landowner.
- Concrete and other cement-based materials, rock aggregate, and other appropriate materials may be eligible for funding when included in an eligible heavy use area protection BMP designed and constructed to NRCS standards.
- A participant must use a waste management facility and protect adjacent waterways with appropriate riparian buffers to be eligible for cost share to implement heavy use area protection (see Waste storage facility or Composting facility above).
    - Building permanent feed lots where livestock will be confined continuously throughout the year is not eligible for heavy use area protection funding.
    - Heavy use area protection is eligible only to protect critical areas directly surrounding feeding, watering, and manure storage locations.

Fencing that creates temporary animal confinement to support relocation of livestock feeding areas that threaten water quality or to prevent the use of pasture/rangeland in winter months is eligible. Fencing to create permanent confinement areas is not eligible. Fencing must be limited to areas directly surrounding feeding stations and may include a connected pasture area. This type of fencing is eligible up to a maximum of $10,700 per landowner, in addition to the heavy use protection area.

Reimbursement requests

Ag BMP Installation Cost Reimbursement

For a project to be eligible for reimbursement, we require the subrecipient to receive DOH pre-approval for each proposed ag BMP project and meet all other eligibility requirements outlined in this guidance document. Ag BMP installations that do not adhere to these funding guidelines or are not installed as pre-approved may not be eligible for reimbursement. Once pre-approved, we will keep on file:

- Pre-approval form and email documenting DOH pre-approval and geographic eligibility.
- Pre-installation photos.
- EZ-1 form and final determination letter documenting completion of Section 106 requirements.

The subrecipient should ensure that thorough and accurate records of materials, labor, and other expenses are kept during the installation process. Expenses lacking proper documentation may not be eligible for reimbursement.

Ag BMPs should be implemented and fully operational before a subrecipient submits a reimbursement request to us. After successful implementation of BMP(s), subrecipients will submit to their contract manager and ag BMP technical lead all documentation required to approve the deliverable. This includes:

- Ag BMP project management checklist.
- Post-installation reporting form (including post-installation photos, certification of implementation, and actual costs).
- Signed landowner agreement (CD form).

If the landowner chooses not to complete the full project according to guidelines, the subrecipient will seek to recoup any funds previously reimbursed. For projects with multiple ag BMPs that must be implemented in stages, we may allow cost reimbursement for individual BMPs completed in an early stage as part of a larger, multi-stage project. To consider reimbursement for partially completed projects, we require a written agreement. We will consider reimbursement for partially completed projects on a case-by-case basis.

In-kind contributions are eligible as match (if needed). In-kind contributions include interlocal costs, donated or loaned real or personal property, volunteer services, and employee services donated by a third party.

Interlocal costs are in-kind contributions made to the project by a governmental entity other than the recipient according to a valid written agreement, which details the work to be accomplished, the goods to be provided, and the value thereof. If deemed necessary, in-kind match documentation must be submitted with the reimbursement requests.

Payment Request Package

You must submit all the pre-approval and post-installation documentation described above before we will process reimbursement requests. Refer to the SSI Subrecipient Grant Funding Guidance for the reimbursement request process.

Appendix I

Project Pre-Approval Process

DOH technical staff must review and pre-approve ag BMP projects proposed for DOH ag BMP funding to ensure eligibility for cost reimbursement. To request pre-approval, subrecipient must

provide DOH with enough information for technical staff to assess the project scope and confirm eligibility for DOH ag BMP funds.

Subrecipients will submit a completed Project Pre-approval Form to DOH describing:

- Existing site features and conditions.
- Project site location in relation to affected and eligible shellfish growing area clearly showing how runoff from the property impacts growing area(s) downstream.
- Existing water quality problem to be corrected and how the proposed BMP(s) will help address the problem.
- Ag BMP(s) proposed for addressing water quality problem.
- Estimated costs of proposed BMPs.
- Any other information to support project eligibility (e.g. applicable NRCS practice name and number, status of a manure management plan, presence of existing livestock exclusion fencing, etc.).
- Map or maps sufficient to allow reviewers to understand project area property location relative to affected shellfish growing area. Map(s) should include:
    - aerial photo(s) with labeled project site details such as topography lines, surface water flow, existing site features (i.e. waterways, buildings, fencing), and ag BMPs proposed for funding through DOH NEP. Include other site photos or explanation as necessary.

Depending on what BMPs are proposed, DOH can most efficiently complete project review if supplied with complete information supporting eligibility. For example:

- A project proposes a composting facility (waste management BMP in guidelines) with gutters and an associated improved heavy use area to address an identified water quality problem.
    - Funding guidelines note that a manure management plan is required for a waste management and a heavy use area protection BMP to be eligible for funding.
- The project proposal description should include a statement confirming the proposed BMP(s) is/are part of a manure management plan.
- Also helpful is for the project form to acknowledge the BMP(s) will be constructed to NRCS standards and to note the NRCS practice name(s) and practice number(s). By proactively stating in the pre-approval request that eligibility components are in place, it saves some back and forth with DOH asking subrecipient to confirm. The application should clearly explain the water quality problem in need of correction for a reviewer who has not visited the site. Additional maps or photos with hand-drawn lines showing flow pathways by which contaminated runoff enters surface waters and downstream shellfish growing areas are especially helpful for project areas without obvious watercourses on site.

Appendix II

Section 106 Cultural Resources Review Requirements and Process

These requirements are outlined in Section 106 of the National Historic Preservation Act. The process requires agencies to consider effects of their actions on historic properties and ensure preservation values are factored into planning and decisions. Section 106 requires consultation about projects with the State Historic Preservation Officer, Indian Tribes, and other interested

parties. See more information about the Section 106 Cultural Resources review process at the Washington State Department of Archaeology and Historic Preservation (DAHP) website (https://dahp.wa.gov/project-review/section-106).

DOH staff work with subrecipients to conduct required cultural resources review. The cultural resources review process follows steps with DAHP and tribes to determine if a project site has the potential of disturbing or significantly impacting cultural or historic resources. Activities associated with cultural and historic resources site assessments for proposed projects are eligible for DOH ag BMP fund cost reimbursement.

After receiving project pre-approval from DOH, a subrecipient will submit a completed EZ-1 form to DOH to begin the Section 106 Cultural Resource review process. DOH NEP subrecipients **must** go through DOH to complete this process.

- Subrecipients are responsible for submitting an accurate and complete EZ-1 form to DOH and for complying with project specific requirements for cultural resource protection as directed by DOH Cultural and Environmental Program Specialist.
    - Subrecipient will email a completed EZ-1 form to Scott Kugel at scott.kugel@doh.wa.gov for DOH review and processing. Please cc: your DOH NEP contract manager and the technical staff for ag BMP projects.
    - Subrecipients should include a copy of the Project Pre-approval Form in the email.

Throughout the cultural resources review process, a DOH Cultural and Environmental Program Specialist will communicate with subrecipients and DOH NEP staff to facilitate completion of cultural resources review requirements. General steps in the cultural resources review process include:

- Preliminary Determination.
- Request for Concurrence with Preliminary Determination.
    - Letters to DAHP and to consulting tribes.
    - Includes a 30-day consultation period.
- Archaeological survey (in cases of adverse effect, or potential adverse effect).
- Final Determination.

A subrecipient should not pursue any ground disturbing activity related to a DOH ag BMP funded project until subrecipient receives a Final Determination letter from DOH.

- Ground-disturbing activities that occur prior to a cultural resources review *are not eligible expenses.*
- An Inadvertent Discovery Plan (IDP) is required at the project site at all times.

Appendix III

List of Subrecipient Forms

Please refer to the ag BMP page in the NEP subrecipient resources SharePoint for current versions of these forms and templates:

- Flowchart for ag BMP installations cultural review
- Ag BMP pre-approval form
- Ag BMP post-installation reporting form
- Ag BMP project management checklist (including list of supporting documentation and required forms)
- SSI Subrecipient Grant Funding Guidance (Policies and Processes page)

Appendix IV

Riparian Buffer Guidance

DOH ag BMP funds can be used to implement riparian buffer projects that meet EPA's Riparian Buffer Programmatic Condition (included verbatim in the text box below). The EPA condition requires that riparian buffer projects in agricultural areas be consistent with interim riparian buffer recommendations provided by National Marine Fisheries Service (NMFS) letters of January 30, 2013, and April 9, 2013, or October 28, 2013, guidance. These buffer width recommendations are referred to as "NMFS buffers."

Appendix III provides:

- EPA Riparian Buffer Programmatic Condition and copies of the NMFS letters and guidance referred to in the condition:
  - January 30, 2013, letter;
  - April 9, 2013, letter; and,
  - October 28, 2013, guidance
- Additional sources to help subrecipients determine minimum buffer width appropriate to for the water body to be protected.
- Information about requesting a deviation from NMFS buffers.

EPA Riparian Buffer Programmatic Condition

> Riparian buffer restoration projects in agricultural areas shall be consistent with the interim riparian buffer recommendations provided to EPA and the Natural Resource Conservation Service by National Marine Fisheries Service letters of January 30, 2013 (stamp received date - February 4, 2013) and April 9, 2013 (stamp received date – April 16, 2013), or the October 28, 2013, guidance. Grantees shall confirm in writing projects' consistency with the recommendations referenced above.
>
> When developing project proposals, grantees also should consider the extent to which proposals include appropriate riparian buffers or otherwise address pollution sources on other water courses on the properties in the project area to support water quality and salmon recovery.
>
> Deviations can only be obtained through an exception approved by EPA. In order for EPA to evaluate a request for an exception, the grantee must submit the scientific rationale demonstrating adequacy of buffers for supporting water quality and salmon recovery. The request must summarize tribal input on the scientific rationale or other relevant issues.
>
> The scientific rationale could be developed from sources such as site-specific assessment data, salmon recovery plans, Total Maximum Daily Loads (TMDLs) and the state nonpoint plan. EPA will confer with the National Oceanic and Atmospheric Administration (NOAA) and the Washington Department of Ecology and provide the opportunity for affected tribes to consult with EPA before making a final decision on a deviation request."[1]

[1] Always refer to your contract for most current Terms and Conditions

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northwest Region
7600 Sand Point Way N.E., Bldg. 1
Seattle, WA 98115

January 30, 2013

Ms. Roylene Rides-at-the Door
USDA Natural Resources Conservation Service
316 W. Boone Avenue, Suite 450
Spokane, Washington 99201-2348

Mr. Dennis McLerran, Regional Administrator
EPA - Region 10
1200 6th Ave., Suite 900
Seattle, Washington 98101

Dear Ms. Rides-at-the-Door and Mr. McLerran:

Our three agencies have been in very active discussions on opportunities to restore the health of our streams and nearshore areas as part and parcel of our collective effort to address the Treaty rights issues associated with the continuing loss of habitat productivity of importance to salmon and steelhead populations and other fishery resources in the Pacific Northwest. In particular, we have been examining the adequacy of our current approaches to describing those riparian buffers in lower elevation landscapes that may be necessary to protect and restore important aquatic functions.

NOAA Fisheries has recently reviewed the current scientific information associated with this topic in order to assist us in identifying approaches that might help protect aquatic functions important to fishery resources. In this context, I am writing to recommend that you use on an interim basis the enclosed matrix of riparian buffers in programs EPA or the NRCS support or fund. I would also couple this with our request to join with us and others to refine the matrix based on best available science over the coming months. For your information, I have enclosed a brief synopsis of existing scientific information about the relationship between riparian buffers and aquatic stream functions important to Pacific salmonids in the low elevation agricultural landscapes of western Washington which I believe will help provide some meaningful background for our recommendation.

Several factors provide context for our recommendation. Numerous populations of salmon and steelhead in the Pacific Northwest are at risk of extinction and as a consequence, federally-reserved treaty rights to harvest these fish are also at risk. Degradation and loss of freshwater and estuary habitat are significant factors in the decline of these populations. Salmon habitat ranges from the forested areas of the upper elevations to the lower-elevation floodplains to the estuarine and near-shore habitats of Puget Sound. All of these areas provide vital functions in

the system as whole, particularly the lower-elevation and estuarine areas that are the focus of my recommendation. There are many ongoing efforts to rebuild Puget Sound salmon, including those of numerous state and federal agencies, tribal and local governments and the private sector. I am providing the enclosed matrix as NOAA Fisheries' recommendation for minimum riparian buffers in lower-elevation agricultural landscapes. Our technical guidance is intended to help shape recovery and rebuilding efforts effectively and to offer our technical advice on what aquatic functions fish need.

In some cases, our recommendations are framed in terms of ranges of buffer widths rather than point estimates, and expressed as probabilities of achieving desired outcomes. Local conditions and local circumstances matter, and may affect the choice of the riparian buffer most effective at achieving salmon recovery. Nevertheless, the scientific information does support conclusions about the probability of differing buffer ranges to provide a range of aquatic functions that are essential for water quality and salmon needs, as depicted in the enclosures. We are ready to work with project proponents, landowners, agencies, departments and tribes to provide technical advice and find solutions that will support salmon recovery.

The enclosed matrix has its origins in the Washington Agriculture, Fish and Water process (AFW), which occurred from 1999 to 2003 and included participation by state and federal agencies, tribal governments and diverse agricultural interests. One of the efforts undertaken in the AFW process was to identify riparian buffers for agricultural landscapes that provide adequate salmon habitat and are implementable. Several options were developed by the AFW caucuses. For the sake of clarity, the enclosed matrix displays the proposal developed by the federal caucus at the request of the AFW Executive Committee, Option 3. It was presented to the Executive Committee by NOAA Fisheries, along with several caveats which still hold true today: 1) there is a technical basis for the buffer table, supported by the refereed literature and other references; 2) it represents a coarse-scale classification; and 3) the goal of the matrix is to meet state and federal water quality standards and improve salmon habitat. NOAA Fisheries explained the numbers are within an advisable range, and stated there is flexibility to implement more complex approaches when looking at specific sites, so long as water quality protection and salmon habitat function are equivalent or better than that provided by our recommendations.

This history is relevant today as our view of the buffer table is unchanged. We supported its use in 2002, and we still support its use in 2012 as a guide for establishing interim minimum buffers for programs to promote good water quality and aquatic conditions important to salmon and other aquatic life. While the table identifies buffers as narrow as 35 feet for limited situations, in most settings buffers will need to be significantly wider than this to meet salmon habitat needs. We recommend protecting wider buffers where they exist and creating wider buffers where it is practicable and where local watershed conditions warrant. Further, we are convinced that any strategy to meaningfully increase the agricultural landscape's contribution to salmon recovery, as well as any strategy to sufficiently protect water quality, should contain a robust riparian restoration program.

If you have any further questions about this letter, please feel free to call me directly or Mr. Steve Landino, the director of our Washington State Habitat Office.

Sincerely,

William W. Stelle, Jr.
Regional Administrator

Enclosures

cc: Puget Sound Federal Caucus Agencies
Northwest Indian Fisheries Commission
Washington State Dept. of Ecology
Washington State Department of Fish and Wildlife
Washington State Department of Natural Resources
Washington State Department of Agriculture
Washington State Department of Health
Washington State Conservation Commission
Washington Recreation and Conservation Office
Puget Sound Partnership

Interim Riparian Buffer Recommendations for Streams in Puget Sound Agricultural Landscapes
November 2012
(Originally proposed as federal Option 3 for the
Agriculture Fish and Water (AFW) Process, March 2002)

Channel Type	Habitat Functions	Composition	Buffer Width	Comments
Class I Constructed ditches; small non-fish bearing streams	Water quality protection; shade; sediment filtration	Grasses, trees or shrubs; may only need woody vegetation on one side of channel	As wide as necessary to meet water quality standards; can be determined by NRCS Field Office Technical Guide (FOTG)	Channels constructed for purpose of draining farmland. If dredged, dredging should occur when fish are absent or at lowest densities
Class II Fish bearing streams; natural and modified natural watercourses that are incised and cannot move	Water quality; LWD for cover, complexity; litter fall; shade	Site potential vegetation; trees where they will grow	2/3 Site potential tree height; 50 ft. minimum to 180 ft. maximum	Portions of natural watercourses that can no longer migrate laterally
Class III Fish bearing; natural unconfined channels	Same as above, but structural LWD essential	Same as above	3/4 Site potential tree height	Highly desirable to buffer entire channel migration zone (CMZ)
Class IV fish bearing streams confined by dikes or other hardened man-made feature	Water quality; complex cover; litter fall; shade	Trees and shrubs	Face of levee, from top of dike to Ordinary High Water (OHW) mark	
Class V Fish bearing intertidal and estuarine streams and channels	Water quality; food inputs; habitat complexity	Site potential vegetation (salt-tolerant sedges, shrubs, trees)	35-75 ft.; varies according to adjacent land use	

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northwest Region
7600 Sand Point Way N.E., Bldg. 1
Seattle, WA 98115

April 9, 2013

Ms. Roylene Rides-at-the-Door
Washington State Conservationist
USDA - Natural Resources Conservation Service
316 W. Boone Avenue, Suite 450
Spokane, Washington 99201-2348

Mr. Dennis McLerran, Regional Administrator
U.S. Environmental Protection Agency – Region 10
1200 Sixth Avenue, Suite 900
Seattle, Washington 98101

Dear Ms. Rides-at-the-Door and Mr. McLerran:

I am writing to convey my support for slight modifications to the riparian matrix that I distributed on January 30 of this year. As Natural Resources Conservation Service (NRCS) staff developed guidance for implementing riparian restoration actions consistent with the matrix, they discovered that internal agency issues prevented the use of a 100-year soil site index upon which the matrix is predicated. It is my understanding that the NRCS is required to use soils data that are available on line, and that only 50-year soil site index data are so available. Fortunately, NRCS and NMFS staff crafted a workaround that requires only minor modifications to the matrix while enabling the use of 50-year soil site index data.

Buffers for two of the channel types on the matrix were to be set at minimums equal to either two-thirds or three-fourths of a 100-year-old site potential tree. Using the same fractions of a 50-year site index potential tree height, at least where site potential trees are conifers, would result in much narrower buffers. However, a review of conifer growth rates across a range of western Washington soil types suggests that modifying the matrix to set minimums at three-fourths and 100 percent of a 50-year old site potential tree height, respectively, would yield nearly identical minimum buffer widths as those in the original matrix. I support this modification as a practical accommodation to on-the-ground implementation.

In addition, I understand there are concerns that the matrix is too vague regarding type 1 channels. The intent is that type 1 channels not contribute to water quality problems downstream. Reference to the Field Office Technical Guide is intended to convey that the necessary width and composition of buffers on type 1 channels will vary depending on the adjacent land use and geomorphic setting.

To implement the recommendations in the matrix, when surface waters are present, water quality must be identified as a resource concern and appropriate combinations of best management practices (BMPs)[1] must be applied to ensure the associated farm operation will comply with water quality standards. For example, where pathogens are of concern, there is no support in the literature for buffers narrower than 35 feet. Therefore, we expect that type 1 channels on lands occupied by livestock or where manure is being applied will be treated with a combination of BMPs that will result in a buffer width of 35 feet or greater, e.g., a 15-foot wide hedgerow and a 20-foot or wider filter strip.

Lastly, I agree that channel type 4, leveed channels, should be removed from the list, as these features are managed according to Corps of Engineers' requirements.

I look forward to working with each of you in applying our shared authorities and responsibilities to dramatically improve habitat and water quality in the Puget Sound basin. If you have any further questions about this letter, please feel free either to call me directly or to contact Mr. Steve Landino, the director of our Washington State Habitat Office.

Sincerely,

William W. Stelle, Jr.
Regional Administrator

cc: Washington State Dept. of Ecology
Washington State Conservation Commission
Mike Grayum, Northwest Indian Fisheries Commission
Thomas Eaton, Environmental Protection Agency
Linda Anderson Carnahan, Environmental Protection Agency
Sherre Copeland, Natural Resources Conservation Service

[1] BMPs may include conservation practices found in the Field Office Technical Guide applied in manner that results in compliance with water quality standards.

Interim Riparian Buffer Recommendations for Streams in Puget Sound Agricultural Landscapes (Originally proposed as federal Option 3 for the Agriculture Fish and Water (AFW) Process, March 2002)

Guidance

October 28, 2013 Final

NMFS Channel Type[i]	Channel Types	Habitat Functions/Composition	Buffer – Minimum Default Width[ii]
Class I Constructed ditches; fishless streams.	1. Constructed Ditches, Intermittent Streams and Ephemeral Streams that are not identified as being accessed and were historically not accessed by anadromous or ESA listed fish species 2. Perennial waters that are not identified as being accessed and were historically not accessed by anadromous or ESA listed fish species	Water quality protection; shade; sediment filtration	1. 35′ 2. 50′
Class II Fish bearing, modified natural channel, entrenched or spring fed watercourses that do not move	Modified or highly entrenched perennial, intermittent and ephemeral waters that are identified as being accessed or were historically accessed by anadromous or ESA listed fish species	Water quality, large wood debris (LWD) for cover, complexity and shade	100′ supporting site assessment recommended to increase buffer width
Class III Fish bearing	Unconfined perennial, intermittent and ephemeral waters that are identified as being accessed or were historically accessed by anadromous or ESA listed fish species	Water quality, large wood debris (LWD) for cover, complexity and shade	100′ supporting site assessment recommended to increase buffer width
Class IV. Diked, permanently fixed[iii]	N/A	N/A	N/A
Class V [iv] Fish bearing, intertidal/estuary	Perennial, intermittent and ephemeral waters that are identified as being accessed or were historically accessed by anadromous or ESA listed fish species in intertidal and estuarine streams and channels	Site potential vegetation (salt water) sedges, shrubs, etc.	35′ – 75′ Supporting site assessment of adjacent land use recommended to increase buffer protections needed to meet all applicable water quality standards.

[I] Fish presence based on Washington's Integrated Fish Distribution database. Fish presence includes all classes of presence of anadromous or ESA listed fish. Where no fish distribution data is available, fish presence must be determined by contacting local WDFW or Tribal biologist.

[ii] Buffer widths are required minimums, however, if a landowner believes that the buffers called for by the table significantly interfere with his/her ability to reasonably use their property, there is a process to identify alternative buffers that are smaller. Please see FAQs for more information.

[iii] Generally, buffer vegetation is required between the watercourse and dike, based upon the criteria of the corresponding channel type. However, levee vegetation requirements are subject to U.S. Army Corps of Engineers (Corps) guidance which can be found in Engineering Technical Letter No. 1110-2-571, "Engineering and Design: Guidelines for Landscape Planting and Vegetation Management at Levees, Floodwalls, Embankment Dams, and Appurtenant Structures", as well as in the USACE Levee Owner's Manual for Non-Federal Flood Control Works.

[iv] Estuarine channels are defined as stream channels having direct, daily tidal influence such that the vegetation is adapted to saltwater or intertidal conditions.

Resources to help determine and document stream class and associated NMFS buffer minimum:

- Fish distribution
  - For fish distribution (presence) information, consult Statewide Washington Integrated Fish Distribution | Statewide Washington Integrated Fish Distribution | Washington State Geospatial Open Data Portal
- Riparian Buffer Width Map - Washington State Department of Ecology
  - ArcGIS - WAECY - Riparian Buffer Width Map
  - Website notes the buffer width information is based on the 2013 Distribution of Anadromous and ESA listed fish species, and the most recent published flowlines from the National Hydrography Dataset (NHD). Anadromous and ESA listed fish distribution data was compiled by the Northwest Indian Fish Commission (NWIFC) and the Washington Department of Fish and Wildlife (WDFW).
- Water quality and flow information - Washington State Department of Ecology Water Quality Atlas
  - Water Quality Atlas - Map
  - The Water Quality Atlas is a web-based map application developed to search for and access Washington State water quality information. Data includes water quality standards, assessment categories, TMDL information, reach codes, and flow information.

When proposing a riparian buffer project for DOH ag BMP funding, subrecipients must demonstrate to DOH how the project meets the EPA riparian buffer condition. Submitted materials should include:

- Site map(s)
  - Map(s) should include aerial photo(s) that label existing conditions and proposed buffer (width, length, composition).
- Project background
  - Identify the project's channel type and associated NMFS buffer minimum
  - Describe land use and site conditions
  - Identify habitat and water quality functions improved by proposed buffer

If a project proposes to establish riparian buffers narrower than NMFS recommendations, the subrecipient must prepare a scientific exemption request and seek EPA approval through DOH. The request to deviate from NMFS buffer minimums must include a scientific rationale demonstrating that proposed buffers adequately support water quality and salmon recovery.

If requesting a deviation from NMFS buffer minimum widths, scientific rationale supporting a deviation should include site map and project background information described above, as well as:

- How the proposed buffer is adequate to support water quality and salmon recovery.
- Salmonid presence or use, water quality conditions, and the applicable habitat functions of the project's channel type
- Summarize tribal input on the scientific rationale or other relevant issues

The scientific rationale may include information from the Integrated Fish Distribution portal, Riparian Buffer Width Map, or Water Quality Atlas sources listed as "Resources to help determine and document stream class and associated NMFS buffer minimum" in this Appendix. Other sources could be site-specific assessment data, salmon recovery plans, Total Maximum Daily Loads (TMDLs) and Washington's Water Quality Management Plan to Control Nonpoint Sources of Pollution.

If physical infrastructure on a property interferes with a riparian buffer project's ability to meet the relevant NMFS minimum buffer width, the subrecipient may seek to implement a buffer that is narrower at the

location of the interfering infrastructure but that otherwise meets NMFS buffer requirements. Subrecipients seeking a deviation due to property infrastructure constraints should submit site map, project background, and scientific rationale information described in this Appendix to DOH to be considered on a case-by-case basis. EPA must approve a deviation request before the project can be considered for DOH ag BMP funding.

APPENDIX E

NRCS Guidelines

United States Department of Agriculture

Conservation Practice Overview

September 2020

Composting Facility (Code 317)

A structure or device to contain and facilitate an aerobic microbial ecosystem for the decomposition of manure, other organic material, or both, into a final product sufficiently stable for storage, onfarm use, and application to land as a soil amendment.

Practice Information

A composting facility is designed to produce an amendment that adds organic matter and beneficial organisms to the soil, provides slow-release plant-available nutrients, and improves soil health. This amendment can be applied to the land or marketed to the public.

Organic solid wastes to be composted derive primarily from agricultural production or processing. The compost can be reused in the operation, utilized for crop production, improve soil health, or marketed to the public.

Composting is accomplished by mixing a carbon material with a nitrogen-rich material in a manner that encourages the growth of aerobic bacteria. Bins, windrows, or in-vessel structures, such as a rotary drum, can be used.

Design information for this practice includes site location, design sizing, storage period, and safety/biosecurity features. It may also include fabricated structure criteria.

This practice has a minimum expected life of 15 years. Operation requirements for the facility depend on the type of facility chosen by the producer. For every system, the temperature and moisture content of the compost will be monitored frequently. Bin or windrow compost must be turned at least once during the composting process. The operation and maintenance plan includes provisions for proper utilization of residual material. Routine maintenance is needed to ensure the facility operates as designed.

Common Associated Practices

NRCS Conservation Practice Standard (CPS) Composting Facility (Code 317) is commonly applied with NRCS CPSs Roofs and Covers (Code 367), Roof Runoff Structure (Code 558), Heavy Use Area Protection (Code 561), Waste Storage Facility (Code 313), and Waste Transfer (Code 634). Utilization of composted material will be handled in accordance with NRCS CPS Nutrient Management (Code 590). If animal mortality is to be composted, use NRCS CPS Animal Mortality Facility (Code 316). If animal manure solids are just being stored without managing for composting, use NRCS CPS Waste Storage Facility (Code 313).

For further information, contact your local NRCS field office.

Natural Resources Conservation Service

CONSERVATION PRACTICE STANDARD

ROOFS AND COVERS

CODE 367

(no)

DEFINITION

A rigid, semirigid, or flexible manufactured membrane, composite material, or roof structure placed over a waste management facility, agrichemical handling facility, or an on-farm secondary containment facility.

PURPOSE

Use this practice to accomplish one or more of the following purposes–

- Protect clean water by excluding precipitation from potential contaminants.
- Improve waste management and utilization to protect nearby surface water quality.
- Reduce emissions of ammonia, odorous sulfur compounds, greenhouse gases, volatile organic compounds, and particulate matter to improve air quality.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies where—

- Precipitation should be excluded from the following areas: animal feeding and management areas, on-farm secondary containment facilities, facilities for waste storage, animal mortality, composting, waste transfer or waste treatment, and agrichemical handling.
- Biotreatment of emissions using a porous cover on a wastewater storage facility is needed to improve air quality, limit odors, and moderate the net effect of greenhouse gas emissions.
- A cover is needed to exclude precipitation from a waste management facility. Auxiliary elements of the cover will also capture and manage biogas emissions, improve air quality, limit odors, and reduce the net effect of greenhouse gas emissions.
- Biogas capture for energy production is a component of an existing or planned waste management system. Biogas capture and utilization will also improve air quality, limit odors, and reduce the net effect of greenhouse gas emissions.

This practice does not apply to NRCS Conservation Practice Standard (CPS) High Tunnel System (Code 325).

CRITERIA

General Criteria Applicable to All Purposes

Laws and Regulations

Plan, design, and construct the roof and covers to meet all Federal, State, Tribal, and local laws and regulations.

All necessary local, state, and federal permits shall be obtained by the producer or their designee. Construction specifications and/or drawings will specify that NRCS be provided copies of all required permits prior to construction. A Concentrated Animal Feeding Operations Permit may be required for the facility from the North Dakota Department of Environmental Quality (ND DEQ). Excavation or embankment work within or near streams and wetlands may require a permit from the U.S. Army Corps of Engineers in accordance with Section 404 of the Clean Water Act (Bismarck Regulatory Office). Projects that disturb more than 1 acre are required to develop a Stormwater Pollution Prevention Plan and submit it along with a Notice of Intent to the ND Department of Environmental Quality. Projects within the ordinary high-water mark of navigable lakes and streams require a Sovereign Lands Permit from the ND Department of Water Resources. Ensure that proposed embankments and/or overall site gradings involving fill do not increase the Base Flood (100-year recurrence interval) Elevation within Special Flood Hazard Areas (SFHA) by more than the allowable as defined by the local County Floodplain Administrator. Obtain a floodplain development permit through the local County Floodplain Administrator and the ND Department of Water Resources Floodplain Management Regulatory Program as necessary.

In addressing the National Environmental Policy Act (NEPA) for conservation practices within or near wetlands, sequencing must be conducted as per Executive Order 11990 included in Section G. Wetlands of the NRCS-CPA-052. Sequencing must include avoiding impacts if feasible. If avoidance is not feasible, a determination will be made using the North Dakota Minimal Effect Evaluation Worksheet. If the effects are determined to be minimal, the determination will be included in the NRCS-CPA-052. If the determination is not minimal, either wetland mitigation credits must be purchased from an approved mitigation bank or completed on site, on the basis of an HGM evaluation of lost wetland function. Implementation of the conservation practice(s) impacting the wetland(s) may begin upon obtaining either the letter of approved sale from the mitigation bank or all signatures on the wetland mitigation plan and agreement.

In cases where a 367 Roof Structure is being used for relocation or expansion if there is a significant increase animal numbers or a change in livestock type, consult the State Resource Conservationist to determine if a NRCS-CPA-052 will be adequate for addressing NEPA.

Materials
Select the type, thickness and material properties of the roof or cover and any supporting members after accounting for all loads and stresses due to operational, environmental, and climatic conditions.

Design
Design roofs and covers to withstand all anticipated loads in accordance with the requirements in Title 210, National Engineering Manual, Part 536, “Structural Design” (210-NEM-536) including all anticipated loads in the structural design for facility components that serve as part of the foundation or support for a roof or cover. See the sections below, on Additional Criteria for Rigid and Semi-rigid Roofs and Covers, and Additional Criteria for Flexible Covers.

Refer to NRCS CPS Waste Storage Facility (Code 313) or NRCS CPS Agrichemical Handling Facility (Code 309) for structural design criteria of the foundations associated with these respective practices. Account for all items that will influence the performance of the roof or cover, including strength, durability, serviceability, material properties and construction quality in the current editions of the following material references, as well as other references as appropriate as noted in Title 210, National Engineering Manual, Part 536, “Structural Design” (210-NEM-536):

- Steel. Manual of Steel Construction, AISC, American Institute of Steel Construction.
- Timber. National Design Specifications for Wood Construction, American Wood Council.
- Concrete Appropriate ACI Standard (see 210-NEM-536), American Concrete Institute.

- HDPE/LLDPE Geomembrane. HDPE and LLDPE Geomembrane Installation Specification, International Association of Geosynthetic Installers.

Access
Provide suitable access for normal operation and maintenance of a facility which is enclosed as the result of a roof or cover.

Venting
For an enclosed roof structure located over animals, manure storage, or petroleum product storage, provide ridge or end vent openings of at least 2 inches per 10-foot-width of building. This prevents buildup of moisture and gases in the attic area.

For enclosed buildings, provide mechanical (exhaust fans) or natural (adequate openings) ventilation in order to maintain a safe working environment when human entry is intended. Refer to American Society of Agricultural and Biological Engineers' (ASABE's) document, *ASABE S607, Ventilating Manure Storages to Reduce Entry Risk* for design standards.

Safety
Provide safety features, including fences and warning signs, as appropriate, to prevent undue hazards from biogases and drowning. Refer to ASABE's document, *ASAE EP470.1, Manure Storage Safety* for guidance.

Design covers and grating over openings such that livestock and humans cannot accidentally displace them and fall into the facility.

Include provisions in the design to prevent the unintentional conveyance of biogas to any facilities connected to the installed roof or cover.

Confined spaces where human entry may occur shall be designed and operated in compliance with the provisions contained in ASABE EP470, Manure Storage Safety.

Additional Criteria for Rigid and Semirigid Roofs and Covers -
Confinement Barns

These facilities are defined as roof structures that are used to feed livestock in a confined building where they do not have access to open lots November through July. Confinement barns in the Upper Midwest are typically termed "Bedded Pack Barns", where a minimum manure pack depth of 24 inches. "Compost Barns", when the manure pack will be regularly tilled for aeration to optimize composting on the floor, and "Slatted Floor Barns" has a concrete deep pit below the concrete slatted pen surface.

Confinement Barns are considered to be a Conservation Practice when one of the following conditions apply:

1. **To replace and/or expand feedlots located above shallow glacial drift aquifers that have been rated by the ND Department of Environmental Quality as highly or moderately vulnerable to surface contaminants. Aquifer extents and up to date vulnerability ratings are available at https://gishubdata-ndgov.hub.arcgis.com/datasets/ndgishub-drastic/explore. All outdoor lots will be abandoned except for sick pens and working facilities.**
2. **To replace all, or portions of, outdoor feedlots when an economic analysis supports a confinement barn as being the most cost-effective long-term alternative to bring the current or future expanded operation into compliance with water quality standards. The planning engineer will work with the producer to document their rationale and decisions utilizing the ND Economic Analysis Tool Open Lot vs Confinement Barn, available at:** Engineering Planning Guides - North Dakota | Natural Resources Conservation Service (usda.gov) **If outdoor lots are to be utilized in conjunction with a confinement barn then the runoff from the lots**

will need to be addressed with a 313 Waste Storage Facility or 635 Vegetated Treatment Area.

The extent of the confinement barn for the purpose of this standard includes the roof and all of the structural components that support the roof. These components may include piers, columns, footings, pilings, walls, beams, connections, and other items.

1. **Floors of confinement barns located over highly or moderately vulnerable shallow glacial drift aquifers the finished subgrade elevation, must be constructed entirely of concrete or a hardened soil- cement surface. Soil cement floor shall be constructed with one of the following secondary containment structures: A clay liner designed in accordance with Appendix 10D of the Agricultural Waste Management Field Handbook (AWMFH). The liner shall also meet any additional requirements defined in CPS Pond Sealing or Lining – Compacted Soil (520).**
2. **A synthetic liner designed in accordance with CPS Pond Sealing or Lining – Geomembrane or Geosynthetic Clay Liner (521).**

Design of floors, interior waste stacking walls, and other related facilities will be through the Waste Storage Facility Practice Standard (313).

A minimum of 270 days storage will be provided for bedding material and the solid portion of manure, within the roofed structure and/or other storage facilities designed under the Waste Storage Facility Practice Standard (313). The methodology presented in SD NRCS Tech Note SD2011-1, "Beef and Dairy Bedded Pack Barn Planning and Design" will be utilized for computing storage requirements.

Design rigid and semirigid roofs and covers to withstand all anticipated loads including, but not limited to, internal and external loads, uplift pressure, concentrated surface and impact loads and load combinations in compliance with this standard. Design roofs, covers and associated support systems to resist all applicable loads including wind, snow, and seismic loads as specified in the current version of American Society of Civil Engineers (ASCE), Standard ASCE 7, *Minimum Design Loads for Buildings and Other Structures*. In lieu of compliance with ASCE 7, use the applicable provisions of the current International Building Code (IBC) to develop design loads and load combinations.

Design covers intended for vehicle, equipment and/or livestock traffic to withstand anticipated dead and live loads. The minimum live load design values for covers are contained in ASABE ASAE EP378.4, *Floor and Suspended Loads on Agricultural Structures Due to Use*, and ASAE EP393.3, *Manure Storages*. For tank wagons having more than a 2,000-gallon capacity, use the actual axle load for design.

Follow criteria outlined in NRCS CPS Roof Runoff Structure (Code 558) for structural practices to collect, control and convey roof runoff away from the contaminated area. Divert any outside surface water from entering the roofed area.

Treated Wood
Use preservative-treated wood when wood members are exposed to animal waste or elements that deteriorate wood. Preservative-treated wood must meet the applicable American Wood Protection Association (AWPA) Standards or have an evaluation service report (ESR) prepared by an organization recognized by the International Code Council (ICC). Treated wood in contact with animal wastes or as critical components that are difficult to replace, should meet AWPA UC4B or equivalent for heavy-duty ground contact.

Aluminum fasteners, connectors, or cladding must not be used in direct contact with treated wood unless specifically allowed by the preservative manufacturer. Use hot-dipped galvanized or stainless steel bolts, washers, nuts, nails, and other hardware which meet American Society for Testing and Materials (ASTM) specifications A153 for fasteners and ASTM A653 coating designation G185 for sheet metal connectors, or ASTM A240 for Type 304 or 316 stainless steel, except as noted below. Fasteners and connectors of

other materials may be used if specifically allowed by the preservative manufacturer. All fasteners, connectors, and any other metal in contact with Alkaline Copper Quaternary (ACQ), micronized copper quaternary (MCQ), Copper Azole (CA), Micronized Copper Azole (MCA), or Dispersed Copper Azole (µCA-C) treated wood shall be stainless steel if the conditions for AWPA Use Category UC4B apply, if in direct contact with manure, or if constant, repetitive, or where long periods of wet conditions may occur. All fasteners, connectors, and any other metal in contact with wood treated with Ammoniacal Copper Zinc Arsenate (ACZA) or any other preservative containing ammonia must be stainless steel.

Repair
Allow use of sectional replacement repair for rigid or semirigid roof and cover material.

Additional Criteria for Flexible Covers -
For fabrication of flexible membrane inflated and floating covers, use only membrane materials which have been certified by the manufacturer as suitable for the intended application.

Design flexible membrane cover systems to resist snow, wind, and wind uplift loads as appropriate. **A wind speed of 90 mph (3-second gust) shall be used for uplift analysis unless weather data indicates otherwise for a 50-year recurrence interval.**

Design floating covers to fluctuate with rising and falling liquid levels to properly manage the waste storage facility.

Include floatation materials on floating membrane covers as necessary for proper cover performance, and operation and maintenance tasks.

Design impermeable floating covers with a biogas collection, transfer, and control system to provide protection for the cover and convey biogas to a flare, release, or control point.

Design biogas handling systems with the capacity to handle the large range in gas production that can occur as a result of changing ambient temperatures and substrate conditions.

Design inflated**(supported by forced air from mechanical means)** covers to be—

- Equipped with a warning system to notify operator of blower failure for mechanically forced air systems.
- Provided with a support system to limit cover collapse.

Use table 1 to select the minimum thickness for flexible geomembrane cover materials.

Table 1. Flexible geomembrane cover materials.

Type for	**Minimum Thickness Criteria**	
Purpose	***Contain Biogas***	***Divert Clean Water***
HDPE	40 mil	30 mil
LLDPE	40 mil	30 mil
LLDPE-R	36 mil	24 mil
PVC	40 mil	30 mil
EPDM	45 mil	45 mil
FPP	40 mil	30 mil
FPP-R	36 mil	23 mil
PE-R	NR	23 mil

1 mil = 1/1000 of an inch

HDPE – High Density Polyethylene Geomembrane

LLDPE – Linear Low Density Polyethylene Geomembrane

LLDPE-R – Reinforced Linear Low Density Polyethylene Geomembrane,

PVC – Polyvinyl Chloride Geomembrane

EPDM – Ethylene Propylene Diene Terpolymer Geomembrane

FPP – Flexible Polypropylene Geomembrane

FPP-R – Reinforced Flexible Polypropylene Geomembrane PE-R – Reinforced, Slit –Film, Woven Polyethylene Geomembrane

NR – Not Recommended

Repair.
Use only flexible cover material which is readily repairable. Repair may be made by solvent, adhesive, thermoplastic welding, or other methods according to manufacturer's recommendation.

Additional Criteria for Biogas Control/Utilization-

Biogas Emissions
The cover system will provide for bio-reduction and treated release of gaseous emissions, contain and manage release of gaseous emissions, or capture and control or utilization of biogas, as appropriate.

- Permeable Cover for Bio-reduction and Treated Release. Select a cover fabricated of a permeable composite membrane designed to promote biological treatment of gaseous emissions which pass through the membrane for treated release to the atmosphere.
- Impermeable Cover for Precipitation Exclusion and Biogas Capture. Design the impermeable cover system on the stored manure and organic wastes with auxiliary elements to manage any biogas produced by capturing biogas emissions and transferring biogas to the point of discharge without mixing with air. For storage cover systems which collect biogas, provide for the safe handling, transfer, and flaring or utilization of the biogas.

Equipment and material exposed to biogas must be resistant to corrosion and suitable for use within a potentially explosive environment. Materials, controls, motors and their installation must conform to the National Electrical Code (NEC). Motors must be rated explosion proof and properly sealed.

Design aboveground pipe for biogas transfer with fittings for expansion and contraction effects.

Use steel or plastic materials for aboveground biogas transfer pipe intended for pressurized biogas systems. Steel pipe must meet the requirements of American Water Works Association (AWWA) Specification C-200, or ASTM A53; or AWWA C-220 or ASTM A312 for stainless steel. Plastic pipe must be HDPE meeting AWWA Specification C-906 or ASTM D-3350. PVC is only acceptable for aboveground biogas transfer when pipe meets ASTM D2241 or D1785, is ultraviolet light inhibited and pipe material is modified for high impact strength.

Perforated pipe and other components under the facility cover shall be designed to exclude floating debris and waste residue and shall have a service life consistent with the expected cover life, but not less than 10 years.

Anchorage. Design the cover anchorage system to withstand internal gas pressures, corrosive environment, wind loads, air tightness (as necessary), and other forces as appropriate to the cover system.

Pressure. For covers associated with biogas production, include provisions for fail safe pressure relief when interior pressures exceed design operating pressures. Do not exceed manufacturer's recommended maximum pressure.

Precipitation. Design features to direct precipitation on impermeable covers to collection points for removal by pumping or by controlled release to suitable grassed or otherwise stabilized areas for discharge or infiltration.

Biogas Capture
Design the cover materials and all appurtenances such as weights and floats, to capture and convey biogas to the gas collection system. Provide for the following:

1. Air Exclusion - Design the cover system and appurtenances, including perimeter soil slopes above the water line, for in-ground liquid waste storage, to exclude the entrance of air under all operating conditions.
2. Gas Collection, Control, and Utilization - The collection, control, and utilization of biogas must meet appropriate criteria in NRCS CPS Anaerobic Digester (Code 366). **Specifically:**
    - **Appropriate fire protection equipment and biogas leak detection sensors and/or ventilation shall be provided where biogas leakage would enter confined areas intended for human entry.**
    - **Open flares shall be located a minimum distance of 95 feet from the biogas source. Flares shall have a minimum height of 10 feet and shall be grounded or otherwise protected to minimize the chance of lightning strike damage.**
    - **A flame trap assembly (flame arrester and thermal valve) device shall be installed in the biogas line between the cover/structure and sources of ignition or as recommended by the flame arrester manufacturer.**
    - **The location of underground gas lines shall be marked with signs to prevent accidental disturbance or rupture. Mark exposed pipe to indicate whether gas line or other.**

Biogas Safety
As a minimum for all roofs and covers that contain or control biogas, post the following warning signs:

- “Warning Flammable Gas.”
- “No Smoking.”
- And when human entry is possible: “Do Not Enter – Hazardous Gases.”

Where biogas is captured, design the gas collection, transfer and control/utilization system in accordance with standard engineering practice for safely handling a flammable gas including safety criteria noted in NRCS CPS Anaerobic Digester (Code 366).

CONSIDERATIONS

Consider an increased level of designed treatment for sites with high priority areas for source water protection or that are upstream of community drinking water withdrawal sites. Also consider increased levels of treatment in watersheds where water quality impairments for nutrients or pathogens have been shown to have impacted the designated use of downstream waterbodies.

To further improve water quality, consider eliminating or reducing feedlot areas when placing livestock under roof.

Screening with vegetative plantings, landforms, or other measures may be implemented for aesthetic purposes.

Maintain storage capacity and functionality of covered liquid waste storage by minimizing solids accumulation. Consider the use of manure management practices such as solid/liquid separation, NRCS CPS Waste Separation (Code 632).

On USDA certified organic and transitioning-organic operations, all wood treatments should comply with the National Organic Program (NOP) regulations.

For organic applications, consider using special construction material such as qualifying lumber as documented by an evaluation service recognized by the International Code Council (ICC). Other application considerations may also need to be made to address organic issues.

For areas where energy production is an option, consider adding energy recovery or production to the gas handling system. Energy recovery or production can offset air emissions from fossil fuel combustion.

Consider storage of biogas when installing flexible covers over waste storage facilities or waste treatment lagoons to attenuate gas supply for end use or treated release.

Waste facility covers which capture biogas may change nutrient volatilization of the stored manure. Consider the effect this may have on the nutrient management plan.

Waste facility covers which capture biogas may increase the odor nuisance during agitation, pump out, and land application. Consider the effect these activities may have on the surrounding areas and waste management options.

PLANS AND SPECIFICATIONS

Prepare plans and specifications that describe the requirements for applying this practice to meet its intended purpose.

As a minimum, the plans and specifications will provide the following:

- Include information about the location and sequence of the phases of construction.
- Specify layout and location of agricultural waste storage and handling facility, or agrichemical handling facility.
- Include roof or cover footprint, any waste collection points and all planned access features.
- Grading plan showing excavation and fill. Include appropriate drainage features and revegetation plan as needed.
- Materials and structural details of the roof or cover including all necessary appurtenances as appropriate for the complete system.
- For flexible geomembrane cover systems with biogas utilization, include a listing of associated biogas collection and transfer equipment, and necessary appurtenances.
- Specify that the manufacturer or installer of the geomembrane cover system must certify the installation of the cover. Require the same manufacturer or installer to provide the project owner with maintenance instructions for the cover material.
- Biosecurity measures during installation.
- Warning and safety signage placement.

OPERATION AND MAINTENANCE

Prepare an operation and maintenance (O&M) plan and review the plan with the landowner or operator responsible for the application of this practice. Provide specific instructions for proper operation and maintenance of each component of this practice and detail the level of inspection and repairs needed to maintain the effectiveness and useful life of the practice.

- For covers fabricated of a permeable composite membrane designed to promote biological treatment of gaseous emissions, maintain the cover media for the life of the practice to ensure proper biofilter operation.
- Address biosecurity concerns in all aspects of operation and maintenance.
- For enclosed waste facilities, exercise caution and care during cover removal or access. If opening of the cover is required for facility management, include provisions to prevent exposure of workers to hazardous gases.

- If personnel are or may be required to enter an enclosed waste facility, include safety provisions recommended by the National Institute for Occupational Safety and Health (NIOSH) for working in confined spaces including, but not limited to, using a positive-pressure self-contained breathing apparatus, safety line, and standby personnel.
- Develop an emergency action plan for covered systems associated with biogas production. Include instructions as to limits of cover performance and emergency procedures if control equipment fails. Provide contact(s) and phone numbers of person(s) to contact for the event of an emergency.

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Natural Resources Conservation Service

CONSERVATION PRACTICE STANDARD

ROOF RUNOFF STRUCTURE

CODE 558

(no)

DEFINITION

A structure or system of structures to collect, control, and convey precipitation runoff from a roof.

PURPOSE

This practice may be applied to achieve one or more of the following purposes:

- Protect surface water quality by excluding roof runoff from contaminated areas
- Prevent erosion from roof runoff
- Increase infiltration of roof runoff
- Capture roof runoff for onfarm use

CONDITIONS WHERE PRACTICE APPLIES

Where roof runoff from precipitation needs to be—

- Diverted away from a contaminated area.
- Collected and conveyed to a stable outlet or infiltration area.
- Collected and captured for other uses such as evaporative cooling systems, livestock water, or irrigation.

CRITERIA

General Criteria Applicable to All Purposes

Plan, design, and construct the roof runoff structure to comply with all Federal, State, and local laws and regulations. Notify landowner and/or contractor of their responsibility to locate all buried utilities in the project area, including drainage tile and other structural measures. The landowner is also required to obtain all necessary permits for project installation prior to construction.

Evaluate the condition of the existing roof structure prior to installation of a gutter. Install new fascia boards as needed to support gutters and downspouts for the practice life span. Mount gutters on plumb fascia boards. If the building does not have a fascia board, mount to the rafter ends, adding any necessary appurtenances to ensure the gutters are securely attached and positioned to collect runoff from the roof.

Ensure that the gutter support system will withstand the anticipated loading from precipitation including loads from snow and ice, where applicable. Where snow and ice are expected, install roof gutters below the projection of the roof line. If this is not possible with the existing roof, install rigid supports or wraparound straps. If structural supports are missing or insufficient, design the required supports for the gutter.

Protect the downspouts, laterals, and cross-pipe pipelines from damage by livestock or equipment with heavy-walled pipe, fencing, or other protective measures to exclude livestock and equipment.

Gutter design capacity
To exclude roof runoff from manure contamination, design roof runoff structures to convey the peak flow from a 25-year, 5-minute rainfall event. (Refer to NRCS National Engineering Handbook (Title 210), Part 651, Agricultural Waste Management Field Handbook, Chapter 10, Appendix 10B.)

For other applications, design roof runoff structures to convey the peak flow from a 10-year, 5-minute rainfall event.

Downspout
Design downspouts, collector pipes, lateral downspouts, or cross-pipes with a capacity that equals or exceeds the designed roof gutter flow rate. If downspouts drain directly onto the ground, use an elbow and energy dissipation device at the outlet to provide erosion protection and direct water away from the foundation of the structure by ensuring that ground slopes away from the building.

Ground gutter
If roof gutters are not feasible, ground gutters may be used in some instances. Ground gutters may not be practical for livestock housing where the purpose is to exclude roof runoff from contaminated areas.

Use ground gutters only on buildings with eaves that extend 12 inches or more horizontally from the building. Where runoff from the roof eave drops onto the ground surface, provide a gutter with the same capacity as required for roof gutters. Ground gutters must convey runoff away from the building to a stable outlet without erosion.

Ground gutters can be rock-lined channels, rock-filled trenches with subsurface drains, or concrete channels.

Outlet
Roof runoff can empty into a subsurface drain, underground outlet, a storage tank, a dry well, or onto an energy dissipation device as described above in section “Downspout.”

Size outlets to handle the design flow from the gutter system. Provide accessible cleanouts for subsurface drains, underground outlets, and storage tanks that are used as outlets.

Use NRCS Conservation Practice Standard (CPS) Subsurface Drain (Code 606) to design subsurface drains if necessary to dewater ground gutters or infiltration ditches.

Use NRCS CPS Underground Outlet (Code 620) to design underground outlets to convey roof runoff to a stable outlet. In cold climates, ensure underground outlets are deep enough to avoid freezing or include a method to bypass the outlet without damage to the downspout.

Materials
Roof gutters and downspouts may be made of aluminum, galvanized steel, plastic, or wood. Aluminum gutters must have a minimum nominal thickness of 0.027 inches. Aluminum downspouts of 3 inches by 4 inches must have a minimum nominal thickness of 0.019 inches. Aluminum downspouts larger than 3 inches by 4 inches must have a minimum nominal thickness of 0.024 inches. Galvanized steel gutters and downspouts must be a minimum of 28 gauge. Plastics must contain ultraviolet stabilizers. Wood gutters must be made of rot-resistant wood free of knots.

To prevent corrosion, avoid contact between components of dissimilar metals.

To improve infiltration for rock-filled trenches and dry wells, use poorly graded gravel.

Where traffic, climatic, or other conditions necessitate the use of reinforced concrete for channels, pads, and slabs, refer to NRCS National Engineering Manual (NEM) (Title 210), Part 536, Section 536.20, “Design Criteria for Reinforced Concrete,” for design and installation of reinforced concrete.

Where nonreinforced concrete is acceptable, refer to NRCS 210-NEM-536, Section 536.22, “Design Criteria for Concrete Slabs-on-Ground,” for design and installation of nonreinforced concrete.

Additional Criteria to Increase Infiltration

Increase runoff infiltration by directing flow to existing vegetation or infiltration features (e.g., lawns, mass planting areas, existing natural areas, infiltration trenches, dry wells, rain gardens, or natural areas). Ensure these areas have the capacity to infiltrate the runoff without flowing directly to surface or ground water, causing excessive erosion, or adversely affecting the desired plant species.

Additional Criteria to Capture Water for Other Uses

Roof runoff can be contaminated with environmental pollutants that have settled on the roof between runoff events. This may make the captured runoff unsuitable for uses such as drinking water for livestock without treatment. The operator is responsible for ensuring that the quality of the runoff is suitable for the intended purpose.

If runoff water is to be stored, determine the tank size based on the planned use of the captured water. Select tank materials that have adequate strength and durability to hold water for the intended purpose and length of time required. Use materials that will not degrade the quality of the stored water for its intended use. Include a drain to allow maintenance of the tank and to protect from damage from freezing.

Install the storage tank on a firm, level foundation that will not settle differentially. Examples of suitable foundation materials are bedrock, concrete, compacted gravel, and stable well-compacted soils. Where necessary, prepare the foundation by removal and disposal of materials that are not adequate to support the design loads. Anchor or brace aboveground tanks as needed to prevent overturning or sliding by wind and animals.

Use NRCS design procedures or manufacturer’s guidelines to ensure that buried tanks will withstand all earth and vehicle loads anticipated for the site.

Include provisions for access to the tank for maintenance and repairs. However, ensure that access points will limit unintended or unauthorized access.

Design tanks connected directly to gutters and downspouts to bypass runoff events that exceed the design capacity of the tank. Include provisions to convey overflows to a stable outlet without excessive erosion.

CONSIDERATIONS

Gutter size can be decreased by increasing the number of downspouts. When designing a gutter and downspout system consider the balance between gutter size and the spacing and sizing of downspouts to optimize the design.

If roof runoff will be used for livestock drinking water, the runoff should be treated before being consumed by livestock. This might include bypassing the first flush of runoff which often contains the majority of pollutants. Depending on the use of the runoff, additional actions may be necessary, such as settling and filtration to remove suspended particles and treatment of pathogens with ultraviolet light or chlorination. See International Code Council, CSA/ICC 805-2018, “Rainwater Harvesting Systems,” for information on water quality treatment options for different end uses of the collected water.

Discharging roof runoff outlets near wells and sinkholes or directly into drainage ditches, streams, or ponds can be a point source of pollution. Consider the use of vegetative filter areas, such as raingardens, at outlets to minimize the pollution potential from roof runoff.

Consider the use of wraparound straps in lieu of rigid supports on steep roofs where the outer edge of the gutter cannot be placed below the projected roof line.

On roofs subject to snow and ice slides, consider additional supports even if the gutter is installed below the projected roof line.

PLANS AND SPECIFICATIONS

Provide plans and specifications that describe the requirements for applying this practice to achieve its intended purpose. As a minimum, include—

- A plan view showing the layout of gutters, downspouts, and outlets.
- Details of gutter installation, including necessary cross sections and slope of gutters.
- Details on the protection of downspouts from damage.
- Details on outlets, storage tanks, or infiltration areas as appropriate.
- Any other site-specific detail drawings necessary for the installation of the practice.
- Requirements for stabilization of any areas disturbed by the installation of the practice.
- Construction specifications describing the installation of the practice, materials, and quantities.

OPERATION AND MAINTENANCE

Prepare an operation and maintenance plan and review it with the operator. Describe the actions that must be taken to ensure that the facility functions properly for its design life. As a minimum, include—

- A schedule for regularly checking the gutters and downspouts for removal of any accumulated debris, damage from weather events, livestock, and equipment. Additional checks should be made after significant weather events (rain, snow, ice, extended cold periods, or high winds).
- Ensuring that the outlets are freely operating and not causing erosion.
- Ensuring roof runoff structures are clean, operating properly, and overflows are not causing erosion.
- Promptly repairing or replacing any damaged components.

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UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

CONSTRUCTION SPECIFICATION

CS-42: "CONCRETE FOR MINOR STRUCTURES"

42.1 SCOPE

The work shall consist of furnishing, forming, placing, finishing, and curing Portland cement concrete as required to build the structures described in the drawings. These structures are low and moderate hazard structures, where the quantity of concrete is generally 75 cubic yards or less and the location allows economical maintenance or replacement.

42.2 MATERIALS

Aggregates shall conform to the requirements of Material Specification 201, Concrete Aggregates, unless otherwise specified. The grading of coarse aggregates shall be as specified in the drawings.

Portland cement shall conform to the requirements of Material Specification 202, Portland Cement, for the specified type indicated in the drawings.

Fly ash shall conform to the requirements of Material Specification 203, Supplementary Cementitious Materials.

Air-entraining admixtures shall conform to the requirements of Material Specification 204, Chemical Admixtures for Concrete. If air-entraining cement is used, any additional air-entraining admixture shall be of the same type as that in the cement.

Water reducing and/or retarding admixtures shall conform to the requirements of Material Specification 204, Chemical Admixtures for Concrete.

Curing compound shall conform to the requirements of Material Specification 205, Concrete Curing Compound.

Preformed expansion joint filler shall conform to the requirements of Material Specification 206, Preformed Expansion Joint Filler.

Waterstops shall conform to the requirements of Material Specifications 207, Nonmetallic Waterstops, and 208, Metal Waterstops according to waterstops depicted in the drawings.

Water used in mixing and curing concrete shall be clean and free from injurious amounts of oil, salt, acid, alkali, organic matter, or other deleterious substances.

42.3 CLASS OF CONCRETE

Concrete for structure concrete shall be classified as follows:

Class of concrete	Maximum net water content (gal/bag)	Minimum cement content (bags/yd^3)
3000M	6	5.5
4000M	6	6

42.4 AIR CONTENT AND CONSISTENCY

Unless otherwise specified on the drawings, the slump shall be 3 to 5 inches. If air entrainment is specified, the air content, by volume, shall be 4 to 7 percent of the volume of the concrete. When specified, directed, or approved by NRCS, a water-reducing, set-retarding, or other admixture shall be used. High range, water reducing agents (superplasticizers) may be used to increase workability, reduce water content, and control concrete temperature in hot weather. The maximum slump after adding high range water reducing agents shall be 7.5 inches.

42.5 CONCRETE MIX DESIGN

The proportions of the aggregates shall be such as to produce a concrete mixture that works readily into the corners and angles of the forms and around reinforcement when consolidated but does not segregate or exude free water during consolidation.

Fly ash may be used as a partial substitution for portland cement in an amount of no more than 25 percent (by weight) of the cement in the concrete mix, unless otherwise specified.

The maximum water to cement ratio shall be 0.5 unless otherwise specified. When more than one cementitious material is used, the maximum water to cementitious materials ratio shall be 0.5 unless otherwise specified.

Before the concrete is placed, the contractor/landowner shall furnish NRCS, for approval, a statement of the materials and mix proportions (including admixtures, if any) intended for use. The statement shall include evidence satisfactory to NRCS that the materials and proportions will produce concrete conforming to this specification. The materials and proportions so stated shall constitute the "job mix." After a job mix has been approved, neither the source, character, or grading of the aggregates nor the type or brand of cement or admixture shall be changed without prior notice to NRCS. If such changes are necessary, no concrete containing such new or altered material shall be placed until NRCS has approved a revised job mix.

42.6 INSPECTION AND TESTING

NRCS shall have free entry to the plant and equipment furnishing concrete under the contract. Proper facilities shall be provided for NRCS to inspect materials, equipment, and processes and to obtain samples of the concrete. All tests and inspections will be conducted so as not to interfere unnecessarily with manufacture and delivery of the concrete.

42.7 HANDLING AND MEASUREMENT OF MATERIAL

Materials shall be stockpiled and batched by methods that prevent segregation or contamination of aggregates and ensure accurate proportioning of the ingredients of the mix. Except as otherwise provided on the drawings, cement and aggregates shall be measured as follows:

- Cement shall be measured by weight or in bags of 94 pounds each. When cement is measured in bags, no fraction of a bag shall be used unless weighed.

- Aggregates shall be measured by weight. Mix proportions shall be based on saturated, surface-dry weight. The batch weight of each aggregate shall be the required saturated, surface-dry weight plus the weight of surface moisture it contains.

- Water shall be measured, by volume or by weight, to an accuracy within 1 percent of the total quantity of water required for the batch.

- Admixtures shall be measured within a limit of accuracy of 3 percent.

42.8 MIXERS AND MIXING

Concrete shall be uniform and thoroughly mixed when delivered to the work site. Variations in slump of more than 1 inch within a batch are considered evidence of inadequate mixing and shall be corrected by increasing mixing time or other acceptable alternative.

For stationary mixers, the mixing time after all cement and aggregates are in the mixer drum shall be not less than 1.5 minutes. When concrete is mixed in a truck mixer, the number of revolutions of the drum or blades at mixing speed shall be not less than 70 nor more than l00.

Unless otherwise specified, volumetric batching and continuous mixing at the construction site are permitted. To produce concrete meeting the specified proportioning and uniformity requirements, the batching and mixing equipment shall conform to the requirements of ASTM Specification C 685 and shall be demonstrated by tests with the job mix before the concrete is placed. Concrete made by this method shall be produced, inspected, and certified in conformance with sections 6, 7, 8, 13, and 14 of ASTM Specification C 685.

No mixing water in excess of the amount called for by the job mix shall be added to the concrete during mixing or hauling or after arrival at the delivery point.

42.9 FORMS

Forms shall be of wood, plywood, steel, or other approved material and shall be mortar tight. The forms and associated falsework shall be substantial and unyielding and shall be constructed so that the finished concrete will conform to the specified dimensions and contours. Form surfaces shall be smooth and free from holes, dents, sags, or other irregularities. Forms shall be coated with a non-staining form release agent before being set into place.

Metal ties or anchorages within the forms shall be equipped with cones, she-bolts or other devices that permit their removal to a depth of at least 1 inch without injury to the concrete. Ties designed to break off below the surface of the concrete shall not be used without cones.

All edges that will be exposed to view when the structure is completed shall be chamfered, unless finished with molding tools as shown on the drawings.

42.10 PREPARATION OF FORMS AND SUBGRADE

Prior to placement of concrete, the forms and subgrade shall be free of chips, sawdust, debris, water, ice, snow, extraneous oil, mortar, or other harmful substances or coatings and the temperature of all surfaces to be in contact with the new concrete shall be not be less than 40 degrees Fahrenheit. Any oil on the reinforcing steel or other surfaces required to be bonded to the concrete shall be removed. Rock surfaces shall be cleaned by air-water cutting, wet sandblasting, or wire brush scrubbing, as necessary, and shall be wetted immediately before placement of concrete. The earth surface shall be firm and damp. Placement of concrete on mud, dried earth, or uncompacted fill or frozen subgrade is not permitted.

Items to be embedded in the concrete shall be positioned accurately and anchored firmly.

Weepholes in walls or slabs shall be formed with nonferrous material.

42.11 CONVEYING

Concrete shall be delivered to the site and discharged into the forms within l-1/2 hours after the introduction of the cement to the aggregates. In hot weather or under conditions contributing to quick stiffening of the concrete, the time between the introduction of the cement to the aggregates and discharge shall not exceed 45 minutes.

NRCS may allow a longer time, provided the setting time of the concrete is increased a corresponding amount by the addition of an approved set-retarding admixture. In any case, concrete shall be conveyed from the mixer to the forms as rapidly as practicable by methods that prevent segregation of the aggregates and assure no loss of mortar occurs.

42.12 PLACING

Concrete shall not be placed until the subgrade, forms, steel reinforcement, and embedded items have been inspected and approved. No concrete shall be placed except in the presence of NRCS. The contractor/landowner shall give reasonable notice to NRCS each time concrete is to be placed. Such notice shall provide sufficient time for NRCS to inspect the subgrade, forms, steel reinforcement, and other preparations for compliance with the specifications. Other preparations include, but are not limited to, the concrete mixing plant; delivery equipment system; placing, finishing,

and curing equipment and system; schedule of work; workforce; and heating or cooling facilities, if applicable. Deficiencies are to be corrected before concrete is delivered for placing.

The concrete shall be deposited as closely as possible to its final position in the forms. It shall be worked into the corners and angles of the forms and around all reinforcement and embedded items in a manner to prevent segregation of aggregates or excessive laitance. Formed concrete shall be placed in horizontal layers not more than 20 inches thick. Concrete shall not be dropped more than 5 feet vertically unless suitable equipment is used to prevent segregation. When high range water reducing agents are used, the concrete shall not be allowed to drop more than 10 feet. Hoppers and chutes, pipes, or "elephant trunks" shall be used as necessary to prevent segregation and the splashing of mortar on the forms and reinforcing steel above the layer being placed.

Immediately after the concrete is placed in the forms, it shall be consolidated by spading, hand tamping, or vibration as necessary to ensure a smooth surface and dense concrete. Each layer shall be consolidated to ensure monolithic bond with the preceding layer. If the surface of a layer of concrete in place sets to the degree that it will not flow and merge with the succeeding layer when spaded or vibrated, the contractor/landowner shall discontinue placing concrete and shall make a construction joint according to the procedures specified on the drawings.

If placing is discontinued when an incomplete horizontal layer is in place, the unfinished end of the layer shall be formed by a vertical bulkhead.

42.13 CONSTRUCTION JOINTS

Construction joints shall be made at the locations shown on the drawings. If construction joints are needed that are not shown on the drawings, they shall be placed in locations approved by NRCS.

Where a feather edge would be produced at a construction joint, as in the top surface of a sloping wall, an insert form shall be used so that the resulting edge thickness on either side of the joint is not less than 6 inches.

In walls and columns, as each lift is completed, the top surface shall be immediately and carefully protected from any condition that might adversely affect the hardening of the concrete.

Steel tying and form construction adjacent to concrete in place shall not be started until the concrete has cured at least 12 hours. Before new concrete is deposited on or against concrete that has hardened, the forms shall be retightened. New concrete shall not be placed until the hardened concrete has cured at least 12 hours.

The surface of construction joints shall be cleaned of all unsatisfactory concrete, laitance, coatings, or debris by washing and scrubbing with a wire brush or wire broom or by other means approved by NRCS. The surface shall be kept moist for at least 1 hour before the new concrete is placed.

42.14 EXPANSION AND CONTRACTION JOINTS

Expansion and contraction joints shall be made only at locations shown on the drawings.

Exposed concrete edges at expansion and contraction joints shall be carefully tooled or chamfered, and the joints shall be free of mortar and concrete. Joint filler shall be left exposed for its full length with clean and true edges.

Preformed expansion joint filler shall be held firmly in the correct position as the concrete is placed.

When open joints are specified, they shall be constructed by the insertion and subsequent removal of a wooden strip, metal plate, or other suitable template in such a manner that the corners of the concrete are not chipped or broken. The edges of open joints shall be finished with an edging tool before the joint strips are removed.

42.15 WATERSTOPS

Waterstops shall be held firmly in the correct position as the concrete is placed. Joints in metal waterstops shall be soldered, brazed, or welded. Joints in rubber or plastic waterstops shall be cemented, welded, or vulcanized as recommended by the manufacturer.

42.16 REMOVAL OF FORMS

Forms shall not be removed without NRCS approval. Forms shall be removed in such a way as to prevent damage to the concrete. Supports shall be removed in a manner that permits the concrete to take the stresses of its own weight uniformly and gradually.

42.17 FINISHING FORMED SURFACES

Immediately after the forms are removed:

a. All fins and irregular projections shall be removed from exposed surfaces.
b. The holes produced on all surfaces by the removal of form ties, cone-bolts, and she-bolts shall be cleaned, wetted, and filled with a dry-pack mortar. The mortar will consist of one-part Portland cement, three parts sand that will pass a No. 16 sieve, and just sufficient water to produce a consistency such that the filling is at the point of becoming rubbery when the material is solidly packed.

42.18 FINISHING UNFORMED SURFACES

All exposed surfaces of the concrete shall be accurately screeded to grade and then float finished, unless specified otherwise.

Excessive floating or troweling of surfaces while the concrete is soft is not permitted.

Adding dry cement or water to the surface of the screeded concrete to expedite finishing is not allowed.

Joints and edges on unformed surfaces that will be exposed to view shall be chamfered or finished with molding tools.

42.19 CURING

Concrete shall be prevented from drying for a curing period of at least 7 days after it is placed. Exposed surfaces shall be kept continuously moist for the entire period, or until curing compound is applied as specified below. Moisture shall be maintained by sprinkling, flooding, or fog spraying, or by covering with continuously moistened canvas, cloth mats, straw, sand, or other approved material. Wood forms left in place during the curing period shall be kept continuously wet. A formed surface shall be thoroughly wetted immediately after forms are removed and shall be kept wet until patching and repairs are completed. Water or covering shall be applied in such a way that the concrete surface is not eroded or otherwise damaged.

Concrete, except at construction joints, may be coated with the approved curing compound instead of continued application of moisture, except as otherwise specified on the drawings. The compound shall be sprayed on the moist concrete surface as soon as free water has disappeared, but it shall not be applied to any surface until patching, repairs, and finishing of that surface are completed. The compound shall be applied at a uniform rate of not less than 1 gallon per 175 square feet of surface and shall form a continuous adherent membrane over the entire surface. Curing compound shall be thoroughly mixed before applying and continuously agitated during application. Curing compound shall not be applied to a surface requiring bond to subsequently placed concrete, such as construction joints, shear plates, reinforcing steel, and other embedded items. If the membrane is damaged during the curing period, the damaged area shall be resprayed at the rate of application specified above. Any surface covered by the membrane shall not be trafficked unless protected from wear.

42.20 REMOVAL AND REPLACEMENT OR REPAIR

When concrete is honeycombed, damaged, or otherwise defective, the contractor/landowner shall remove and replace the structure or structural member containing the defective concrete or, where feasible, correct or repair the defective parts. NRCS determines the required extent of removal, replacement, or repair. Before starting repair work, the contractor/landowner shall obtain NRCS' approval of the plan for repairs. The contractor/landowner shall perform all repair work in the presence of NRCS.

42.21 CONCRETING IN COLD WEATHER

Concrete shall not be mixed nor placed when the daily minimum atmospheric temperature is less than 40 degrees Fahrenheit unless facilities are provided to prevent the concrete from freezing. The use of accelerators or antifreeze compounds is not allowed.

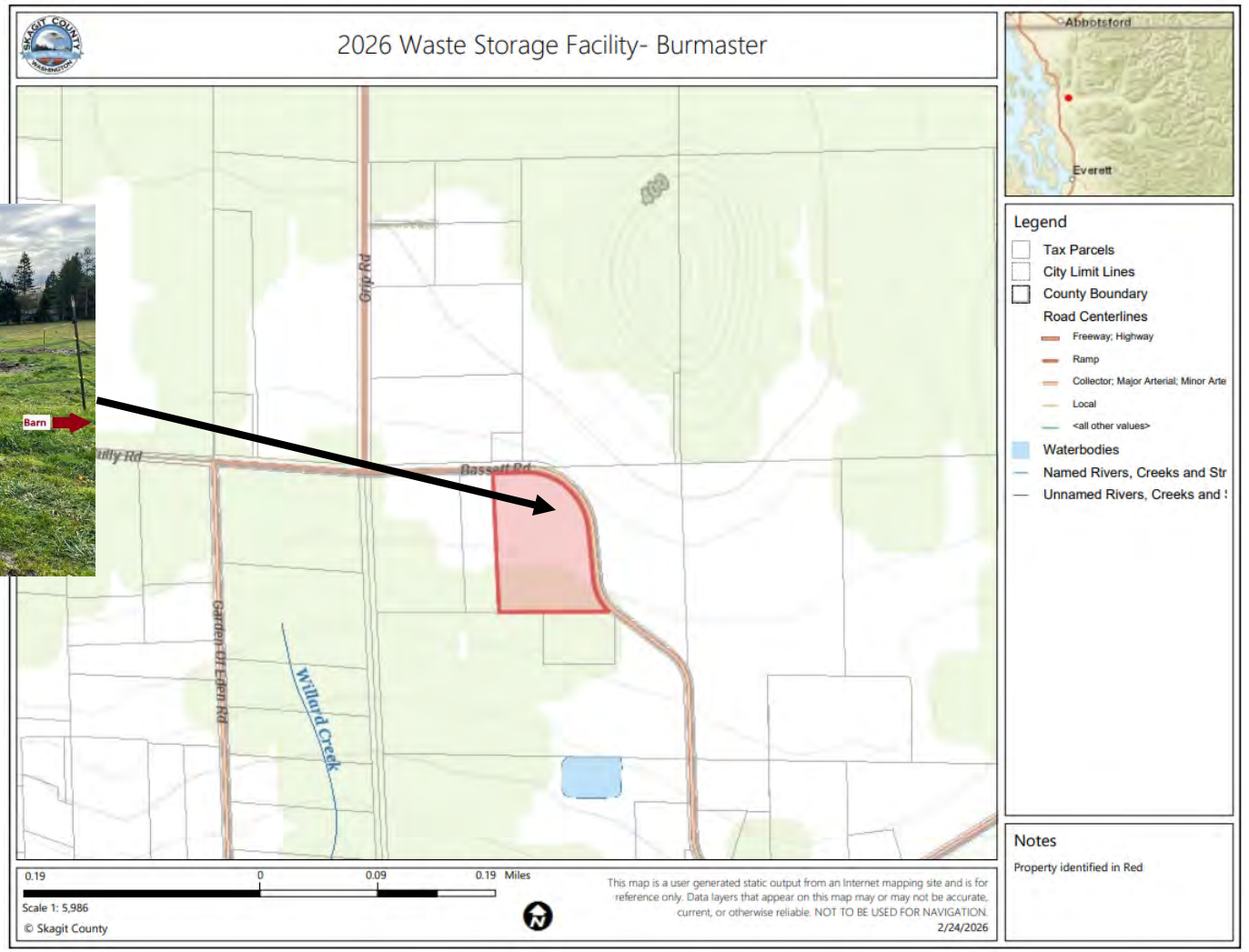
42.22 CONCRETING IN HOT WEATHER

The contractor/landowner shall apply effective means to maintain the temperature of the concrete below 90 degrees Fahrenheit during mixing, conveying, and placing.

APPENDIX F

Vicinity Map and Plans

Map 1 Sally A Burmaster site map, 23086 Bassett Road, Sedro Woolley, WA 982



Burmaster Site Map

Legend

- Tax Parcels
- Shellfish Commercial Growing
- Shellfish Recreational Beaches
- Skagit Wetlands
- City Limit Lines
- County Boundary
- Waterbodies

Notes

Property identified in RED.
Manure Storage identified with PURPLE STAR
Road Setback in YELLOW
Drainage identified with BLUE dotted

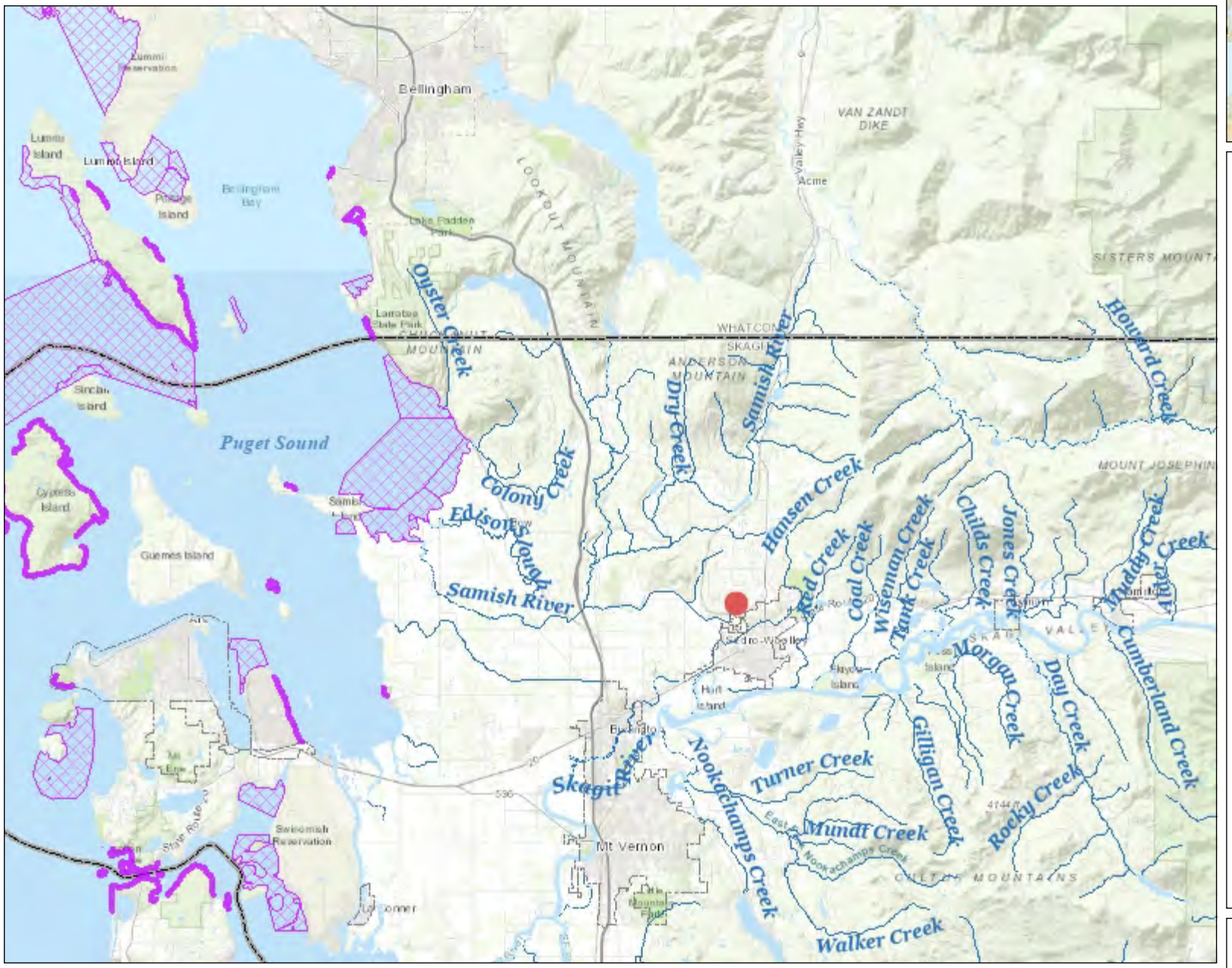
0.05 0 0.02 0.05 Miles

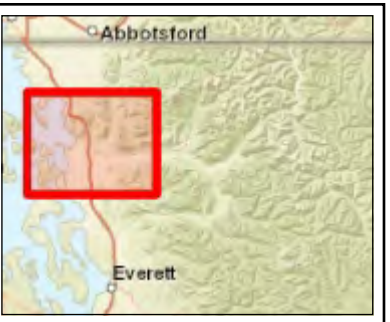
Scale 1: 1,496

This map is a user generated static output from an Internet mapping site and is for reference only. Data layers that appear on this map may or may not be accurate, current, or otherwise reliable. NOT TO BE USED FOR NAVIGATION.

11/3/2025

Burmaster related to shellfish growing area





Legend

- Shellfish Commercial Growing
- Shellfish Recreational Beaches
- City Limit Lines
- County Boundary
- Waterbodies
- Named Rivers, Creeks and Str

Notes

Property identified with red dot.

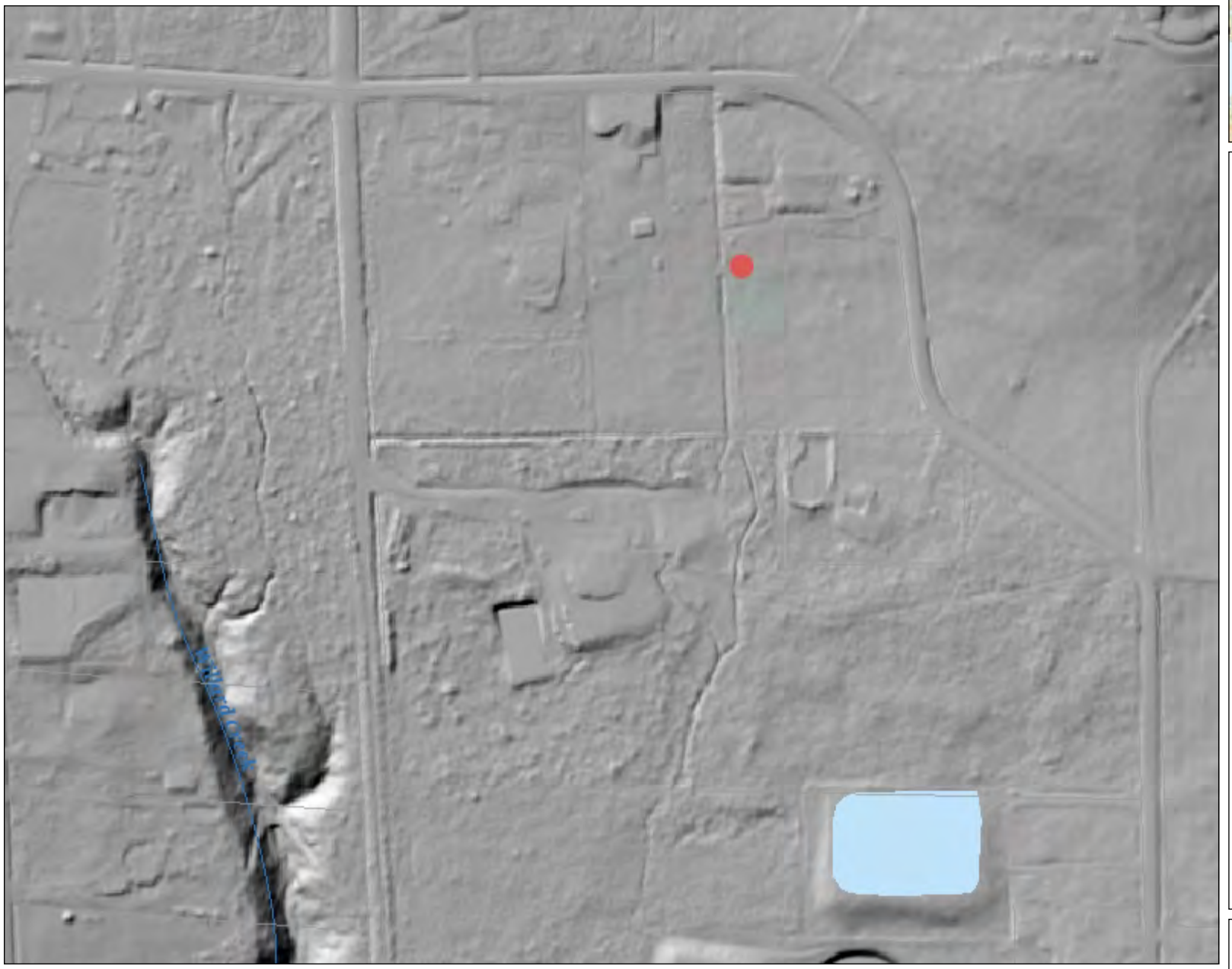
8.99 0 4.49 8.99 Miles

Scale 1: 284,666

This map is a user generated static output from an Internet mapping site and is for reference only. Data layers that appear on this map may or may not be accurate, current, or otherwise reliable. NOT TO BE USED FOR NAVIGATION.

11/3/2025

Burmaster Lidar



Legend

- Tax Parcels
- Shellfish Commercial Growing
- Shellfish Recreational Beaches
- City Limit Lines
- County Boundary
- Waterbodies
- Named Rivers, Creeks and Str
- Hillshade -LIDAR 2016
- Hillshade - LIDAR
  - 0
  - 1
  - 2
  - 3
  - 4
  - 5
  - 6
  - 7
  - 8
  - 9
  - 10
  - 11
  - 12
  - 13
  - 14
  - 15
  - 16

Notes

Property identified in RED.

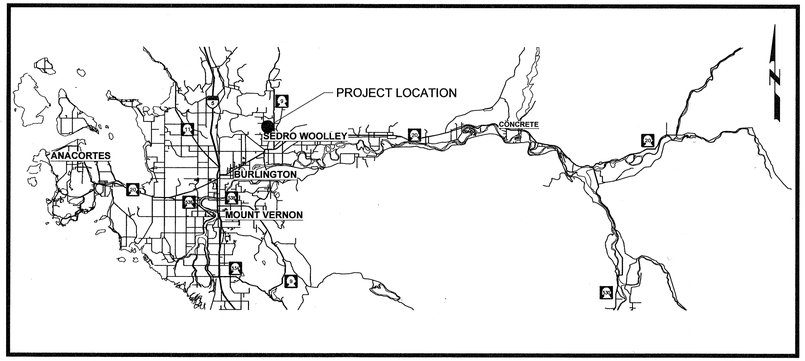
0.09 0 0.05 0.09 Miles

Scale 1: 2,993

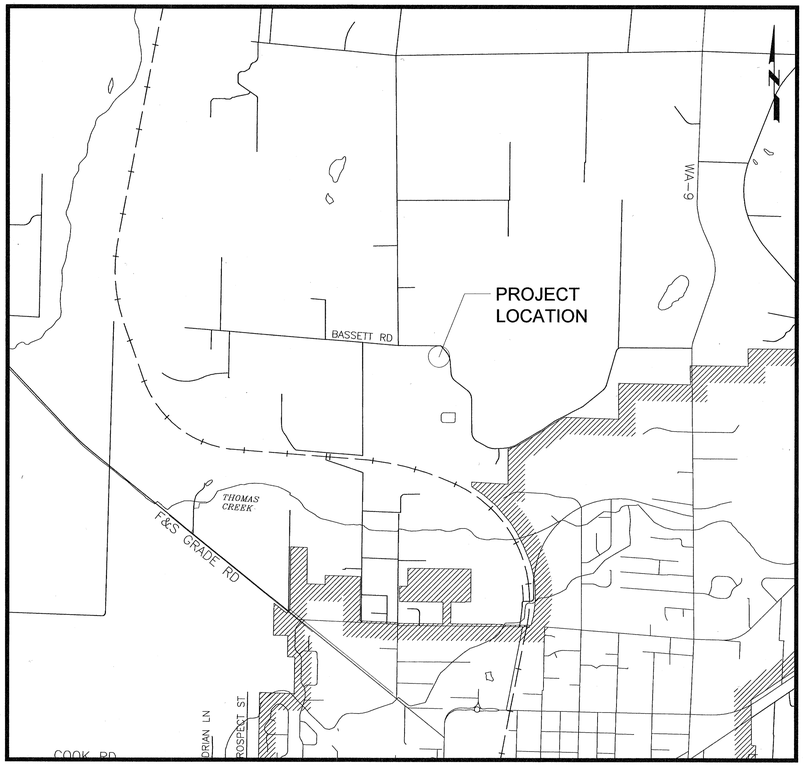
This map is a user generated static output from an Internet mapping site and is for reference only. Data layers that appear on this map may or may not be accurate, current, or otherwise reliable. NOT TO BE USED FOR NAVIGATION.

11/3/2025

BURMASTER WSF ROOF DRAINAGE



VICINITY MAP NTS



SITE MAP NTS

ABBREVIATIONS:

APPROX	APPROXIMATE
ASPH	ASPHALT
AVE	AVENUE
BLDG	BUILDING
BLVD	BOULEVARD
CAT	CATEGORY
CB	CATCH BASIN
CIP	CAST IRON PIPE
CFS	CUBIC FEET PER SECOND
CL & ℄	CENTERLINE
CP	CONTROL POINT
CMP	CORRUGATED METAL PIPE
CPP	CORRUGATED PLASTIC PIPE
CPCP	CORRUGATED POLYETHYLENE CULVERT PIPE
CPSSP	CORRUGATED POLYETHYLENE STORM SEWER PIPE
CSBC	CRUSHED SURFACING BASE COURSE
CSP	CORRUGATED STEEL PIPE
CULV	CULVERT
CY	CUBIC YARD
DEG	DEGREE
DIA	DIAMETER
DWG	DRAWING
E	EAST/EASTING
EL & ELEV	ELEVATION
EST	ESTIMATED
EX	EXISTING
FGR	FACE OF GUARDRAIL
FT & '	FEET
GALV	GALVANIZED
GND	GROUND
HUA	HEAVY USE AREA
IN & "	INCHES
INV	INVERT
LF	LINEAR FEET
LT	LEFT
MAX	MAXIMUM
MIN	MINIMUM
MIC	MONUMENT IN CASE
MON	MONUMENT
MP	MILE POST
MUTCD	MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES
N	NORTH/NORTHING
NRCS	NATURAL RESOURCES CONSERVATION SERVICE
NTS	NOT TO SCALE
PCMS	PORTABLE CHANGEABLE MESSGE SIGN
PERF	PERFORATED PIPE
PI	POINT OF INTERSECTION
R	RADIUS
RD	ROAD
R/W & ROW	RIGHT OF WAY
RT	RIGHT
S	SOUTH
SEC	SECTION
SF	SQUARE FOOT
SHLD	SHOULDER
SPEC	SPECIFICATIONS
ST	STREET
STA	STATION
TYP	TYPICAL
UG	UNDERGROUND
USDA	UNITED STATES DEPARTMENT OF AGRICULTURE
W	WEST
WSDOT	WASHINGTON STATE DEPARTMENT OF TRANSPORTATION
W.M.	WILLAMETTE MERIDIAN
WSF	WASTE STORAGE FACILITY

SKAGIT COUNTY OFFICIALS

BOARD OF COMMISSIONERS
- RON WESEN, CHAIR
- JOE BURNS, COMMISSIONER
- PETER BROWNING, COMISSIONER

APPROVED FOR CONSTRUCTION

THOMAS M. WELLER, P.E. COUNTY ENGINEER — 02/17/2026 DATE

SHEETLIST TABLE	
SHEET NUMBER	SHEET TITLE
1	COVER SHEET
2	SITE PLAN
3	ROOF DRAINAGE PLAN

LEGEND

- CPP - PLAN VIEW
- CPP - ELEVATION VIEW
- DESIGN BY OTHERS
- DESIGN LINES - ROOF DRAINAGE
- SITE PLAN - FENCE LINE
- FINISHED GRADE
- GUTTER AND DOWNSPOUT ASSEMBLY

SURVEY NOTES:

HORIZONTAL DATUM: NAD83 WASHINGTON STATE PLANE NORTH ZONE
VERTICAL DATUM: NAVD88

811 Know what's **below** **Call** before you dig.
Determina lo que está **bajo tierra** **Llama** antes de excavar.

SKAGIT COUNTY PUBLIC WORKS
1800 CONTINENTAL PLACE
MOUNT VERNON, WA 98273-5625
(360) 416-1400

NO.	REVISIONS	DATE

ENGINEER OF RECORD — THOMAS M. WELLER — 02/17/26

PROJECT NO.: WA1205-140-6
FED. AID NO.: N/A
DESIGNED BY: RMM
CHECKED BY: TMW
DRAWN BY: RMM
APPROVED BY: TMW

PROJECT LOCATED NEAR:
SEDRO WOOLLEY, WA 98284
SEC 13, T35N, R4E

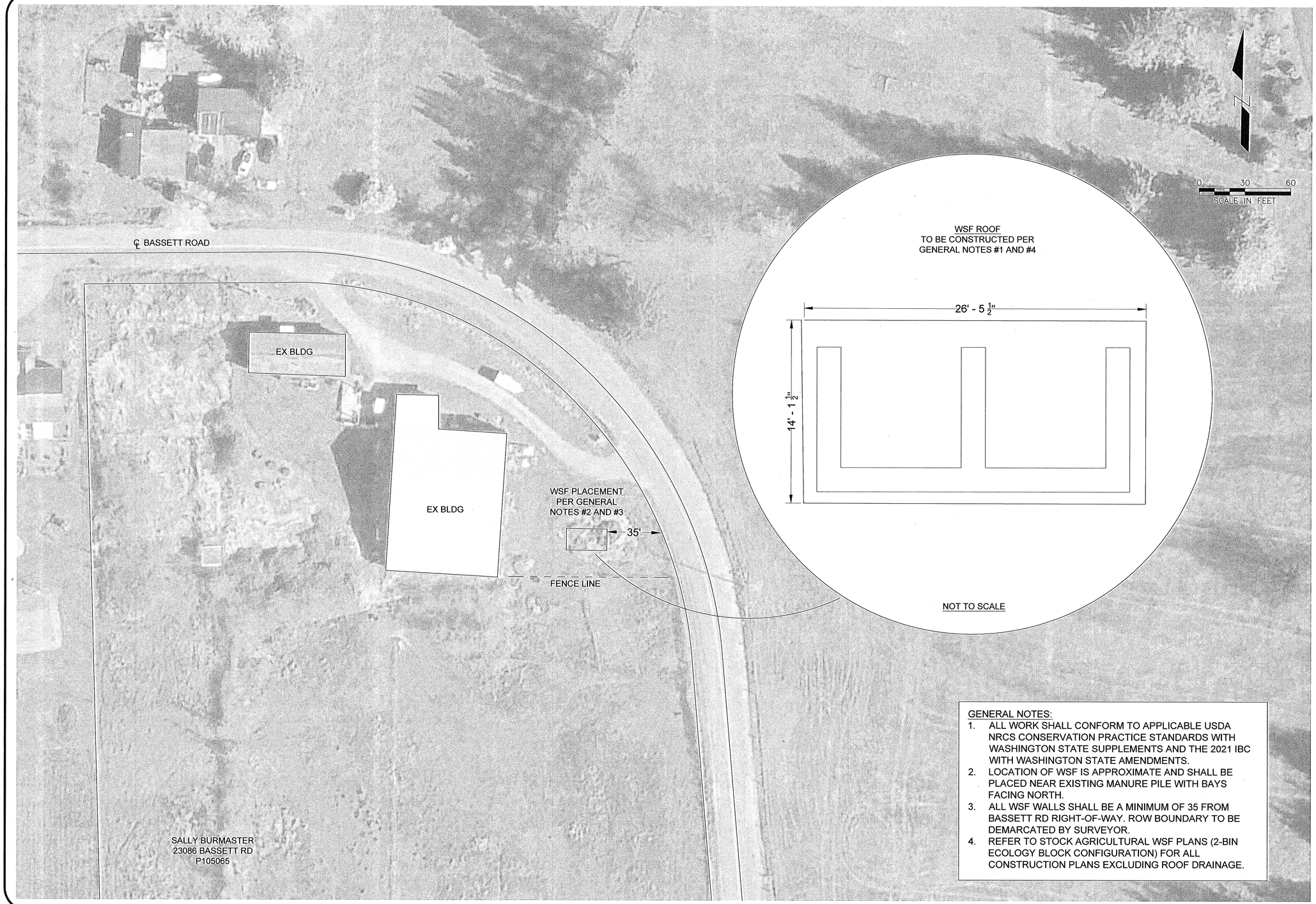
BURMASTER WSF ROOF DRAINAGE

COVER SHEET

1 INCH SCALE BAR
ADJUST SCALE ACCORDINGLY

SHEET 1 OF 3

RENEEM - April 10, 2025 - 10:22 AM - \\ADMNTMV2\PWUSERS\RENEEM\DOCUMENTS\MY PROJECTS\MANURE BINS\GROESBECK\1-COVER SHEET.DWG



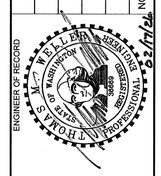
GENERAL NOTES:

1. ALL WORK SHALL CONFORM TO APPLICABLE USDA NRCS CONSERVATION PRACTICE STANDARDS WITH WASHINGTON STATE SUPPLEMENTS AND THE 2021 IBC WITH WASHINGTON STATE AMENDMENTS.
2. LOCATION OF WSF IS APPROXIMATE AND SHALL BE PLACED NEAR EXISTING MANURE PILE WITH BAYS FACING NORTH.
3. ALL WSF WALLS SHALL BE A MINIMUM OF 35 FROM BASSETT RD RIGHT-OF-WAY. ROW BOUNDARY TO BE DEMARCATED BY SURVEYOR.
4. REFER TO STOCK AGRICULTURAL WSF PLANS (2-BIN ECOLOGY BLOCK CONFIGURATION) FOR ALL CONSTRUCTION PLANS EXCLUDING ROOF DRAINAGE.

SKAGIT COUNTY
PUBLIC WORKS
1800 CONTINENTAL PLACE
MOUNT VERNON, WA 98273-5625
(360) 416-1400

NO.	REVISIONS	DATE

ENGINEER OF RECORD



PROJECT NO.: WA1208-140-8
FED. AID NO.: N/A
DESIGNED BY: RMM | DRAWN BY: RMM
CHECKED BY: TMW | APPROVED BY: TMW

PROJECT LOCATED NEAR:
SEDRO WOOLLEY, WA 98284
SEC 13, T35N, R4E

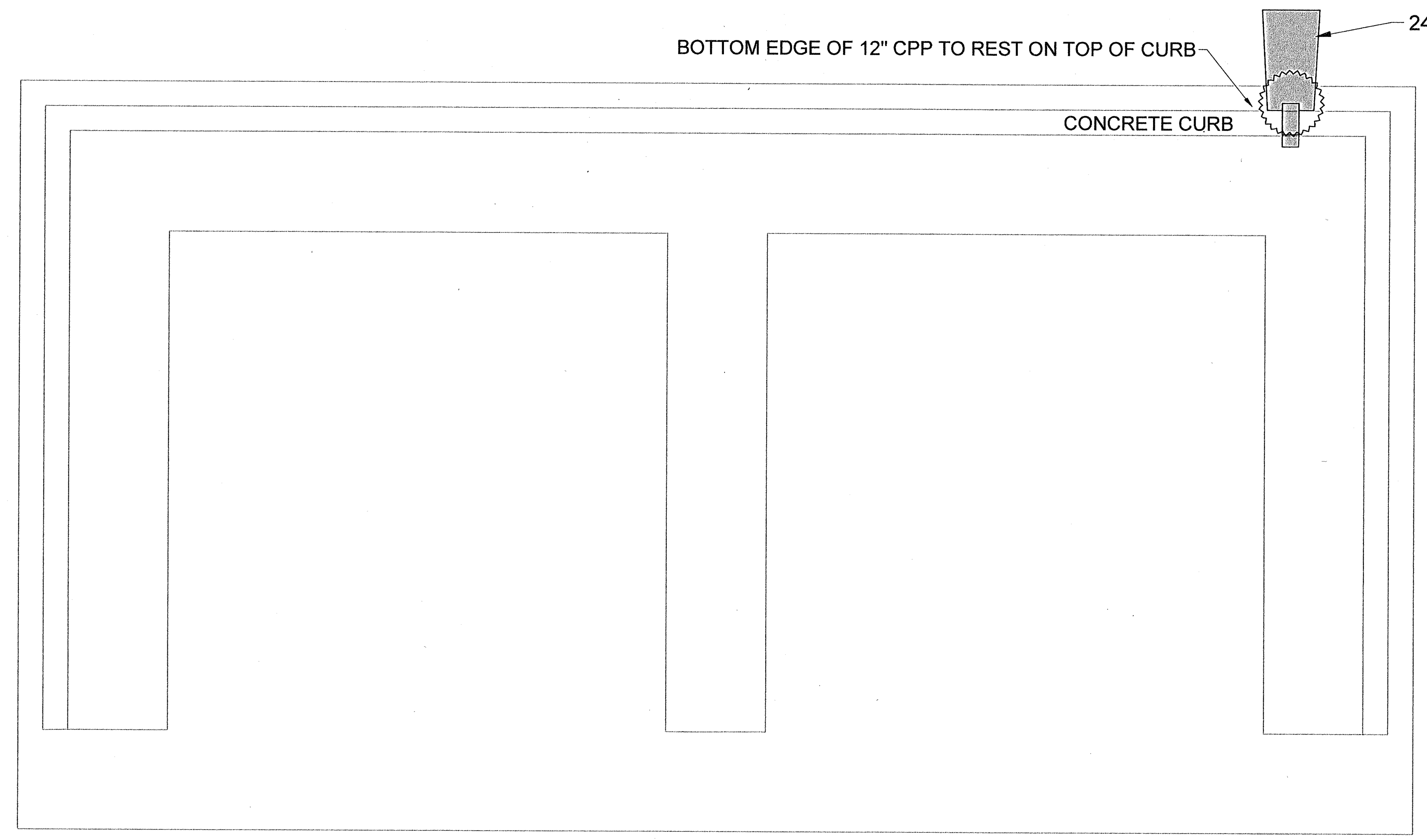
BURMASTER WSF
ROOF DRAINAGE

SITE PLAN

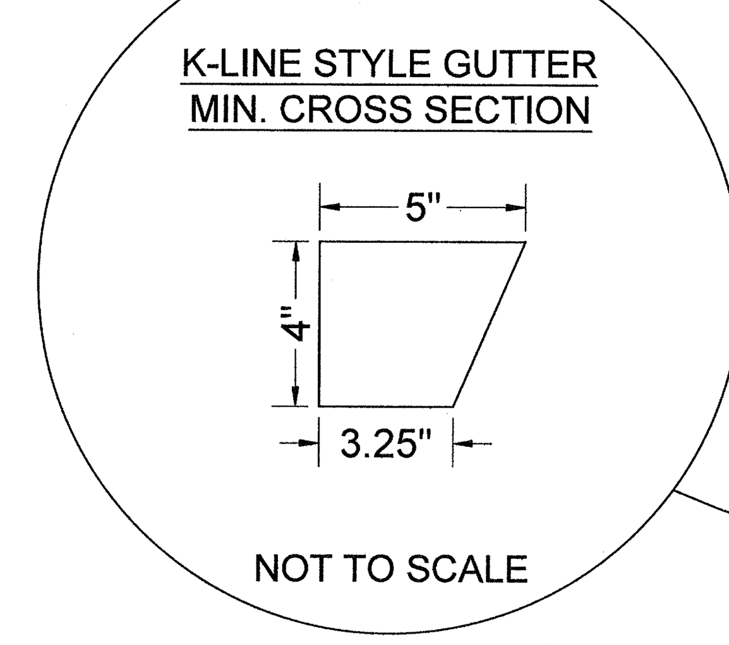
1 INCH SCALE BAR
ADJUST SCALE ACCORDINGLY

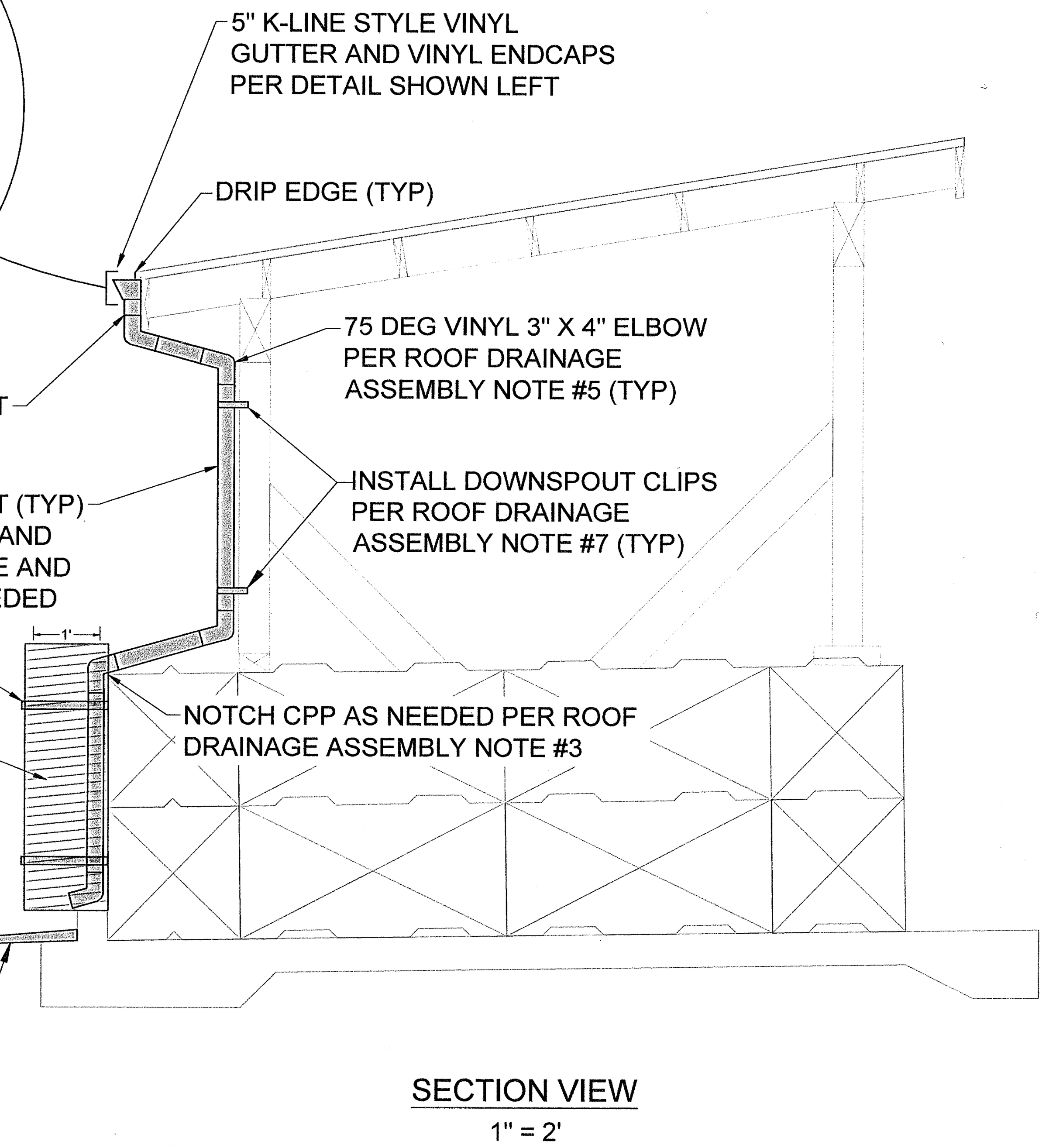
SHEET
2 OF **3**

RENEEM - April 10, 2025 - 11:11 AM - \\ADMNTMV2\PW\USERS\RENEEM\DOCUMENTS\MY PROJECTS\MANURE BINS\GROESBECK\2-SITE PLAN.DWG

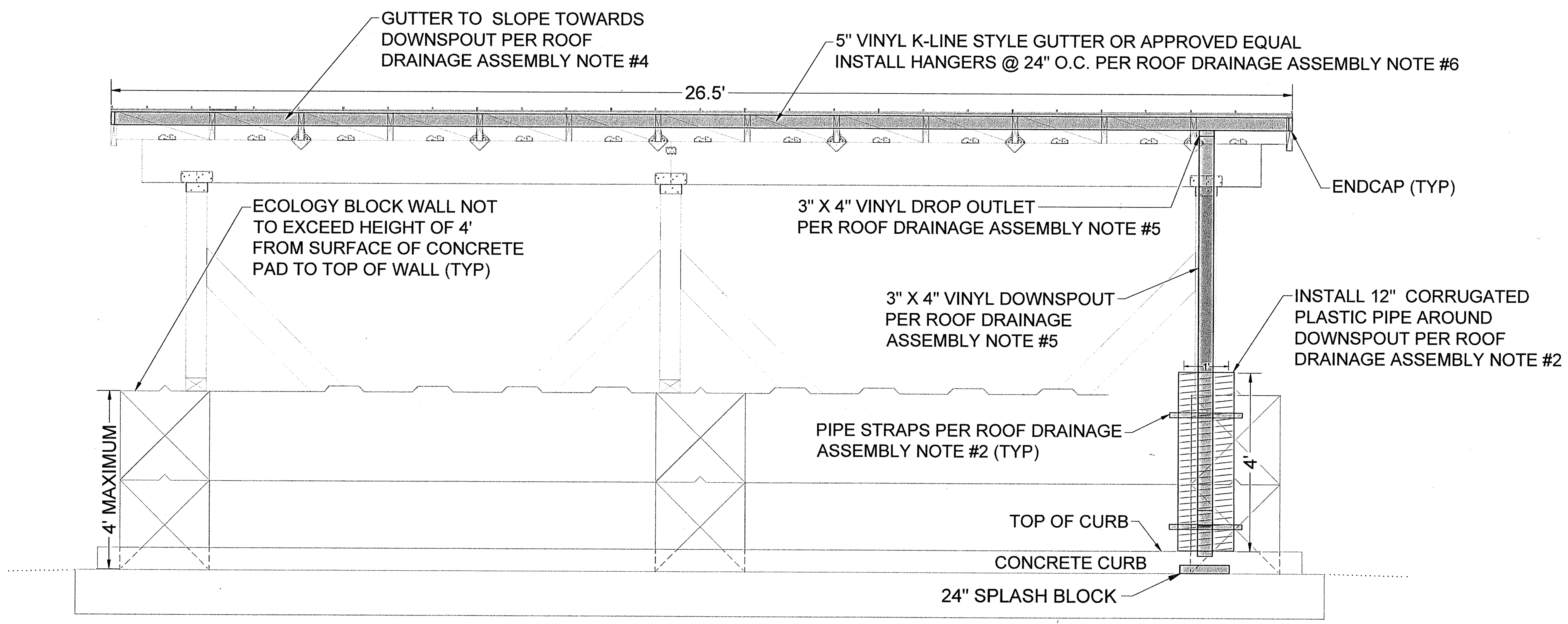


PLAN VIEW - FOUNDATION
1" = 2'





SECTION VIEW
1" = 2'



SOUTH ELEVATION
1" = 2'

ROOF DRAINAGE ASSEMBLY NOTES:

1. ROOF DRAINS AND HARDWARE SHALL BE INSTALLED IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.
2. INSTALL 12" CPP (OR APPROVED EQUAL) AROUND LOWEST 4FT-SECTION OF DOWNSPOUT FOR PROTECTION FROM ANIMALS. BOTTOM OF CPP MAY REST ON TOP OF CONCRETE CURB. ATTACH CPP TO ECOLOGY BLOCKS USING MIN. OF TWO PIPE STRAPS.
3. NOTCH TOP SECTION OF CPP FOR DOWNSPOUT PASS THROUGH AS NEEDED.
4. GUTTER MUST HAVE A MINIMUM $\frac{1}{4}$" PER 10' OF SLOPE TOWARDS DOWNSPOUT.
5. DROP OUTLET, ELBOWS AND DOWNSPOUTS MUST BE 3" X 4" VINYL OR APPROVED EQUAL.
6. GUTTER HANGERS SHALL BE SPACED AT MAXIMUM 24" O.C.
7. DOWNSPOUT SUPPORT CLIPS MUST HAVE MAXIMUM SPACING OF 60" O.C. AND MAXIMUM SPACING OF 6" BETWEEN ANGLE JOINTS AND BRACKETS.
8. ABUT 24" LONG CONCRETE SPLASH BLOCK TO BOTTOM OF CONCRETE CURB AND INSTALL ACCORDING TO MANUFACTURER'S DIRECTIONS.

SKAGIT COUNTY PUBLIC WORKS
1800 CONTINENTAL PLACE
MOUNT VERNON, WA 98273-5625
(360) 416-1400

NO.	REVISIONS	DATE

ENGINEER OF RECORD

BURMASTER WSF
ROOF DRAINAGE

PROJECT NO.: WA1206-140-6
FED. AID NO.: N/A
DESIGNED BY: RMM
DRAWN BY: RMM
CHECKED BY: TMW
APPROVED BY: TMW

PROJECT LOCATED NEAR:
SEDRO WOOLLEY, WA 98284
SEC 13, T35N, R4E

ROOF DRAINAGE PLAN

1 INCH SCALE BAR
ADJUST SCALE ACCORDINGLY

STRUCTURAL SHEETS:

S1 GENERAL NOTES
S2 CIP BIN OPTION – FOUNDATION AND ROOF PLAN
S3 CIP BIN OPTION – ELEVATIONS AND SECTIONS
S4 CIP BIN OPTION – WALL AND FOUNDATION DETAILS
S5 ECOLOGY BLOCK OPTION – FOUNDATION AND ROOF PLAN
S6 ECOLOGY BLOCK OPTION – ELEVATION AND SECTIONS
S7 ECOLOGY BLOCK OPTION – WALL AND FOUNDATION DETAILS
S8 GENERAL DETAILS – ROOF FRAMING
S9 GENERAL DETAILS – POST BRACING DETAILS

GENERAL STRUCTURAL NOTES:

1. THESE NOTES ARE GENERAL IN NATURE AND ARE INTENDED TO SET MINIMUM STANDARDS FOR CONSTRUCTION. THE CONTRACTOR SHALL BE COMPLETELY FAMILIAR WITH THE CONTRACT DOCUMENTS AND HAVE A COPY OF THEM ON SITE AT ALL TIMES.

2. FOR ANY PORTION OF THE CONSTRUCTION WHICH THE CONTRACTOR IS UNABLE TO ASCERTAIN THE REQUIRED CONSTRUCTION OR WHERE CONFLICTS EXIST, IT IS THE CONTRACTOR'S RESPONSIBILITY TO REQUEST ADDITIONAL INFORMATION (RFIs) AND/OR CLARIFICATIONS BEFORE CONSTRUCTION.

3. ALL WORK SHALL BE IN STRICT CONFORMANCE WITH THE 2021 INTERNATIONAL BUILDING CODE (IBC) WITH WASHINGTON STATE AMENDMENTS AS WELL AS APPLICABLE UNITED STATES DEPARTMENT OF AGRICULTURE NATIONAL RESOURCE CONSERVATION SERVICE (NRCS) STANDARDS WITH WASHINGTON STATE SUPPLEMENTS. ALL BUILDING ELEMENTS AND COMPONENTS NOT SPECIFICALLY DETAILED IN THESE STRUCTURAL CONSTRUCTION DOCUMENTS SHALL BE FABRICATED AND CONSTRUCTED IN ACCORDANCE WITH THE MINIMUM STANDARDS CONTAINED IN THE IBC.

4. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS AND ELEVATIONS BEFORE CONSTRUCTION. THE ENGINEER SHALL BE NOTIFIED OF ANY DISCREPANCIES OR INCONSISTENCIES.

5. THE CONTRACT STRUCTURAL DRAWINGS REPRESENT THE FINISHED STRUCTURE. METHODS, PROCEDURES, AND SEQUENCE OF CONSTRUCTION ARE THE RESPONSIBILITY OF THE CONTRACTOR. THE CONTRACTOR SHALL TAKE ALL NECESSARY PRECAUTIONS TO MAINTAIN AND ENSURE THE INTEGRITY OF THE STRUCTURE AT ALL STAGES OF CONSTRUCTION.

6. CONSTRUCTION LOADS SHALL NOT EXCEED THE DESIGN LIVE LOAD FOR THE STRUCTURE. PROVIDE SHORING AND/OR BRACING WHERE LOADS EXCEED DESIGN CAPACITY AND WHERE STRUCTURES HAVE NOT ATTAINED DESIGN STRENGTH.

7. CLADDING, WATERPROOFING, AND ARCHITECTURAL FEATURES ARE OUTSIDE THE STRUCTURAL SCOPE OF WORK. ANY DEPICTION OF SUCH FEATURES ON THE STRUCTURAL DRAWINGS ARE NOT INTENDED TO BE USED FOR CONSTRUCTION. REPRESENTATION OF SUCH FEATURES ON THESE DRAWINGS MAY OR MAY NOT BE ACCURATE.

DESIGN LOADS: PER 2021 IBC & NRCS WITH WASHINGTON AMENDMENTS

1603.1.1 – FLOOR LOADS:

LIVE LOAD	250 PSF DISTRIBUTED, 8,000 LB CONCENTRATED
RETAINING WALL SURCHARGE	250 PSF (VERTICAL, BEHIND WALL)

1603.1.2 – ROOF LOADS:

DEAD LOAD	12 PSF
LIVE LOAD	SEE SNOW LOADS

1603.1.3 – SNOW LOADS:

GROUND SNOW LOAD, Pg	40 PSF
FLAT-ROOF SNOW LOAD, Pf	30 PSF
SNOW EXPOSURE FACTOR, Ce	1.1
SNOW LOAD IMPORTANCE FACTOR, Is	0.8, CATEGORY I
THERMAL FACTOR, Ct	1.2
FROST DEPTH	12 INCHES

1603.1.4 – WIND DESIGN CRITERIA:

BASIC DESIGN WIND SPEED, V	100 MPH
RISK CATEGORY	I
WIND EXPOSURE	EXPOSURE D
TOPOGRAPHIC EFFECTS, K_{zt}	1.5
COMPONENTS & CLADDING: DESIGN WIND PRESSURES (+/–)	
ROOF ELEMENTS (Atrib = 9 ft^2)	77.93 PSF (1.0W), 46.76 PSF (0.6W) & –114.72 PSF (1.0W), –68.83 PSF (0.6W)

1603.1.5 – EARTHQUAKE DESIGN CRITERIA:

RISK CATEGORY	I
SEISMIC IMPORTANCE FACTOR, I_E	1.00
SPECTRAL ACCELERATION, S_s	1.500 g
SPECTRAL ACCELERATION, S_1	0.600 g
SITE CLASS	D (DEFAULT)
SPECTRAL RESPONSE COEFFICIENT, S_{DS}	1.3 g
SPECTRAL RESPONSE COEFFICIENT, S_{D1}	0.800 g
SEISMIC DESIGN CATEGORY	CATEGORY D
SEISMIC FORCE RESISTING SYSTEM(S)	CANTILEVERED COLUMN SYSTEM – TIMBER FRAMES
RESPONSE MODIFICATION FACTORS(S), R	1.5
SEISMIC RESPONSE COEFFICIENTS(S), C_S	0.8

PROJECT APPLICABILITY NOTES:
THE SUBJECT WASTE STORAGE FACILITY STANDARD STRUCTURAL DESIGN AS DETAILED HEREIN SHALL ONLY BE CONSTRUCTED IN REGIONS WITHIN SKAGIT, WHATCOM, WHIDBEY ISLAND AND SAN JUAN ISLANDS CONSERVATION DISTRICTS WHERE ALL OF THE DESIGN CRITERIA OUTLINED ABOVE AND IN THE DESIGN CRITERIA MEMORANDUM PREPARED BY PSE ARE MET. THE STRUCTURAL DESIGN SHALL NOT BE IMPLEMENTED IN ANY LOCATION WHERE THE LIVE, SNOW, WIND, OR SEISMIC LOAD CRITERIA SUMMARIZED ABOVE ARE EXCEEDED.

THE STRUCTURAL DESIGN PRESENTED HEREIN IS A STANDARD DESIGN THAT MAY REQUIRE ADAPTATION FOR A SPECIFIC USE OR SITE. ANY DESIGN ADAPTATIONS SHALL BE REVIEWED AND APPROVED BY A PROFESSIONAL ENGINEER LICENSED IN THE STATE OF WASHINGTON.

PSE IS NOT RESPONSIBLE FOR THE REGULATION OR OVERSIGHT OF DESIGN IMPLEMENTATION.

CONCRETE:

1. ALL CONCRETE SHALL BE HARD ROCK CONCRETE MEETING REQUIREMENTS OF ACI–301, "SPECIFICATIONS FOR STRUCTURAL CONCRETE FOR BUILDINGS". MIX PROPORTIONS SHALL BE PER ACI–301, METHOD 2 OR THE ALTERNATE PROCEDURE.

2. STRUCTURAL CONCRETE SHALL ATTAIN THE FOLLOWING MINIMUM COMPRESSIVE STRENGTH AT 28 DAYS:

TYPE	f'c	SLUMP	w/c	AIR
ALL CONCRETE	4,000 psi	1–4"	0.45	6%

3. SPECIAL INSPECTION IS NOT REQUIRED. SEE EXCEPTIONS TO SPECIAL INSPECTION INCLUDED IN IBC SECTION 1705.3. 4,000 psi COMPRESSIVE STRENGTH IS SPECIFIED FOR WEATHERING PROTECTION. STRUCTURAL DESIGN OF CONCRETE BASED ON 2,500 psi COMPRESSIVE STRENGTH.

4. ALL CONCRETE EXPOSED TO WEATHER SHALL CONTAIN 6% (±) 1% AIR ENTRAINMENT BY VOLUME. AIR ENTRAINMENT SHALL BE IN CONFORMANCE WITH ASTM C260.

5. COLD WEATHER PLACEMENT SHALL CONFORM TO ACI–306. HOT WEATHER PLACEMENT SHALL CONFORM TO ACI–305. MECHANICALLY VIBRATE ALL FORMED CONCRETE. DO NOT OVER–VIBRATE. PLACE CONCRETE MONOLITHICALLY BETWEEN CONSTRUCTION OR CONTROL JOINTS. PROTECT ALL CONCRETE FROM PREMATURE DRYING.

6. CHAMFER ALL EXTERIOR CORNERS 1/2" UNLESS SHOWN OTHERWISE.

7. SLUMP LIMITS MAY BE INCREASED BY ADDITION OF ADMIXTURES PROVIDED THAT THE WATER/CEMENT RATIO OF THE ORIGINAL MIX DESIGN IS NOT EXCEEDED. WATER REDUCING ADMIXTURE SHALL BE IN CONFORMANCE WITH ASTM494, USED IN CONFORMANCE WITH MANUFACTURER'S INSTRUCTIONS. SUBMIT ADMIXTURES TO ENGINEER FOR REVIEW PRIOR TO CONSTRUCTION.

8. CEMENT SHALL BE TYPE I OR II IN CONFORMANCE WITH ASTM C150. AGGREGATES SHALL BE IN CONFORMANCE WITH ASTM C33 AND USE CRUSHED (NOT ROUND) GRAVEL OR STONE. COARSE AGGREGATES SHALL NOT EXCEED 3/4". WATER SHALL BE CLEAN AND POTABLE.

9. REINFORCING STEEL SHALL CONFORM TO ASTM A615, GRADE 60. GRADE 40 MAY BE USED FOR #3 AND SMALLER TIES AND STIRRUPS. DETAIL AND PLACE ACCORDING TO ACI MANUAL SP–66. BENDS SHALL BE MADE AROUND A PIN HAVING A DIAMETER NOT LESS THAN SIX TIMES THE MINIMUM THICKNESS OF THE BAR. REBENDING OR STRAIGHTENING OF REINFORCING OR BENDING OF REINFORCING STEEL CAST INTO CONCRETE IS NOT ALLOWED.

10. UNLESS OTHERWISE NOTED, MINIMUM COVER SHALL BE 1 1/2" FOR #5 AND SMALLER BARS, 2" FOR #6 AND LARGER BARS AND 3" WHEN POURED AGAINST EARTH. SUPPORT REINFORCEMENT WITH APPROVED CHAIRS, SPACERS, OR TIES.

11. UNLESS OTHERWISE NOTED, PROVIDE MINIMUM 48 BAR DIAMETERS AT SPLICES. NO MORE THAN 50% OF REINFORCING SHALL BE SPLICED AT ANY LOCATION. UNLESS OTHERWISE NOTED, BEND ALL HORIZONTAL REINFORCING A MINIMUM OF 2'–0" AT CORNERS AND WALL/FOOTING INTERSECTIONS WITH MIN. EMBEDMENT BEYOND INTERFACE PER DEVELOPMENT LENGTH SPECIFIED IN ACI 318.

12. FORMWORK SHALL BE IN ACCORDANCE WITH ACI–347 "GUIDE TO FORMWORK FOR CONCRETE". FORMS SHALL BE DESIGNED BY THE CONTRACTOR. BRACING SHALL BE PROVIDED AS REQUIRED OR UNTIL THE CONCRETE HAS REACHED ITS SPECIFIED 28–DAY STRENGTH. ALL SHORING SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR. FORMWORK, SUPPORTS, AND SHORING SHALL PROVIDE FINISHED CONCRETE SURFACES AT ALL FACES: LEVEL, PLUMB, AND TRUE TO DIMENSIONS AND ELEVATIONS SHOWN IN THE DRAWINGS.

FOUNDATIONS:

1. SOIL CHARACTERISTICS HAVE BEEN ASSUMED PER THE 2021 IBC WITH WASHINGTON AMENDMENTS SECTION 1806 PRESUMPTIVE LOAD–BEARING VALUES OF SOILS CONSISTENT WITH CLAY, SANDY CLAY, SILTY CLAY, CLAYEY SILT, SILT AND SANDY SILT (CL, ML, MH AND CH) SOIL TYPES. THE CONTRACTOR SHALL VERIFY THE PRESUMED SOIL TYPES PRIOR TO CONSTRUCTION AND NOTIFY THE ENGINEER AND ARCHITECT OF NON–CONFORMING IN–SITU CONDITIONS IF PRESENT BEFORE PROCEEDING.

2. ALL FOUNDATIONS TO BEAR ON UNDISTURBED NATIVE MATERIAL, OR GRANULAR COMPACTED FILL.

3. SOIL DESIGN CRITERIA, PER 2021 IBC SECTION 1806:
   3.1. SOIL BEARING – 1,500 PSF
   3.2. ⅓ INCREASE ALLOWED FOR SHORT TERM LOADS
   3.3. SOIL PROFILE – D
   3.4. FRICTION COEFFICIENT – 0.35 (GRANULAR COMPACTED SUBGRADE)

4. ALL EXCAVATIONS SHALL BE PROPERLY BACKFILLED. DO NOT PLACE BACKFILL BEHIND RETAINING WALLS UNTIL THE CONCRETE WALL HAS ATTAINED THE 80% DESIGN STRENGTH. WHERE A SLAB ON GRADE IS USED TO RESTRAIN THE BOTTOM OF A RETAINING WALL, DO NOT PLACE BACKFILL BEHIND THE WALL UNTIL THE SLAB(S) HAVE BEEN CAST AND ATTAINED FULL DESIGN STRENGTH.

POST–INSTALLED CONCRETE ANCHORS:

1. ADHESIVE:
   1.1. ADHESIVE ANCHORS SHALL BE INSTALLED BY QUALIFIED PERSONNEL TRAINED TO INSTALL ADHESIVE ANCHORS IN ACCORDANCE WITH THE CONTRACT DOCUMENTS AND WITH STRICT ADHERENCE TO THE PROVISIONS WITHIN THE MANUFACTURER'S PRINTED INSTALLATION INSTRUCTIONS.
   1.2. AT THE TIME OF ANCHOR INSTALLATION, IN ACCORDANCE WITH ACI 318–19 SECTION 17.1.2, ADHESIVE ANCHORS SHALL BE INSTALLED IN CONCRETE HAVING A MINIMUM AGE OF 21 DAYS.

2. MECHANICAL:
   2.1. 2.1. MECHANICAL ANCHORS SHALL BE INSTALLED BY QUALIFIED PERSONNEL TRAINED TO INSTALL MECHANICAL ANCHORS IN ACCORDANCE WITH THE CONTRACT DOCUMENTS AND WITH STRICT ADHERENCE TO THE PROVISIONS WITHIN THE MANUFACTURER'S PRINTED INSTALLATION INSTRUCTIONS.

SOLID SAWN LUMBER:

1. UNLESS NOTED OTHERWISE, STRUCTURAL LUMBER SHALL BE DOUGLAS FIR OR HEM FIR CONFORMING TO WWPA GRADING RULES.

2. MINIMUM GRADES ARE, EXCEPT AS NOTED OTHERWISE:
   STRUCTURAL JOISTS & PLANKS – #2
   BEAMS & STRINGERS – #2
   POSTS & TIMBERS – #1

3. NOTCHING IS NOT PERMITTED IN JOISTS, RAFTERS, BEAMS, LINTELS, COLUMNS, TRUSSES, AND BRACING MEMBERS UNLESS NOTED OTHERWISE.

4. ALL LUMBER IN CONTACT WITH CONCRETE SHALL BE PRESSURE TREATED OR SUFFICIENTLY TREATED FOR EXTERIOR EXPOSURE. OWNER SHALL ROUTINELY OBSERVE MATERIAL CONDITIONS, AND MAINTAIN AS NEEDED. WHEN MATERIAL DETERIORATION OCCURS, MEMBERS SHOULD BE REPLACED.

5. PRESSURE TREATED LUMBER SHALL CONFORM TO THE AWPA AND SHALL BEAR THE QUALITY MARK OF AN ACCREDITED ALSC INSPECTION AGENCY. MINIMUM TREATING STANDARDS (RETENTION LBS./CU. FT) SHALL BE AS FOLLOWS:

APPLICATION	ACQ/ACZA	CA–B
ABOVE GROUND	0.25	0.10
GROUND CONTACT	0.40	0.21
FRESH WATER IMMERSION	0.40	0.21
IN GROUND (STRUCTURAL)	0.60	0.31
SILL PLATES	0.25	0.10

6. TREAT ALL CUT ENDS OF TREATED WOOD FOR EXTERIOR EXPOSURE.

7. NAILING SHALL BE IN CONFORMANCE WITH THE 2021 IBC AS AMENDED WITH WASHINGTON AMENDMENTS UNLESS NOTED OTHERWISE. FASTENERS FOR PRESERVATIVE–TREATED WOOD SHALL BE OF HOT–DIPPED ZINC–COATED GALVANIZED STEEL, STAINLESS STEEL, SILICON BRONZE OR COPPER. THE COATING WEIGHTS FOR ZINC–COATED FASTENERS SHALL BE IN ACCORDANCE WITH ASTM A–153. 5/8–INCH DIAMETER STEEL ANCHOR BOLTS & LARGER NEED NOT BE GALVANIZED, UNLESS NOTED OTHERWISE.

8. USE STANDARD WASHERS FOR ALL BOLT HEADS AND NUTS IN CONTACT WITH WOOD.

PREMANUFACTURED CONNECTION HARDWARE:

1. CONNECTION HARDWARE IS BY THE SIMPSON COMPANY OF SAN LEANDRO, CA. ALL STEEL CONNECTORS SHALL BE GALVANIZED OR BY SOME METHOD MADE CORROSION RESISTANT, UNLESS OTHERWISE INDICATED.

2. PROVIDE BOLTED OR NAILED CONNECTIONS FOR THE MAXIMUM CAPACITY UNLESS NOTED OTHERWISE.

3. CONNECTORS IN CONTACT WITH PRESSURE TREATED WOOD SHALL BE EITHER POST HOT–DIP GALVANIZED OR STAINLESS STEEL. FASTENERS SHALL BE OF THE SAME MATERIAL OR PROTECTIVE COATING AS THE CONNECTORS, DO NOT MIX DIFFERING METALS IN THE SAME CONNECTION.

4. ALL HARDWARE SHALL BE INSTALLED PER MANUFACTURER'S INSTRUCTIONS AND RECOMMENDATIONS, UNLESS NOTED OTHERWISE.

SHEATHING:

1. WOOD STRUCTURAL PANELS SHALL BE APA RATED EXPOSURE 1 PLYWOOD, AND COVERED IN DOC PS 1 AND PS 2, UNLESS NOTED OTHERWISE.

2. MINIMUM PANEL THICKNESS SHALL BE $^{15}/_{32}$", OR AS INDICATED IN THESE PLANS. PARTICLEBOARD IS NOT PERMITTED.

3. MINIMUM NAILING IS 8d@6" AT PANEL EDGES AND 8d@12" IN THE FIELD. ALL NAILS SHALL BE COMMON OR GALVANIZED BOX NAILS. BLOCKING IS REQUIRED WHERE NOTED ON THE PLANS.

NOTE REGARDING BIN OPTIONS:
THE FOLLOWING DESIGN INCLUDES OPTIONS FOR CAST–IN–PLACE (CIP) BIN CONSTRUCTION AND ECOLOGY BLOCK BIN CONSTRUCTION. WHERE CIP BINS ARE BEING USED, SHEETS S1–S4 AND S8–S9 ARE APPLICABLE. WHERE ECOLOGY BLOCK BINS ARE BEING USED, SHEETS S1 AND S5–S9 ARE APPLICABLE. IT IS NOT PERMITTED TO INTERMIX CIP WALLS AND ECOLOGY BLOCK WALLS IN THE DESIGN.

AT OWNER/CONTRACTOR'S OPTION, THESE PLANS MAY BE USED FOR THE CONSTRUCTION OF EITHER A 2–BIN, 3–BIN, OR 4–BIN CONFIGURATION. OTHER CONFIGURATIONS ARE NOT INCLUDED AS PART OF THIS DESIGN.

NOTICE
0 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

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02/09/2024

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STOCK AGRICULTURAL WSF

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PROJECT SITE:
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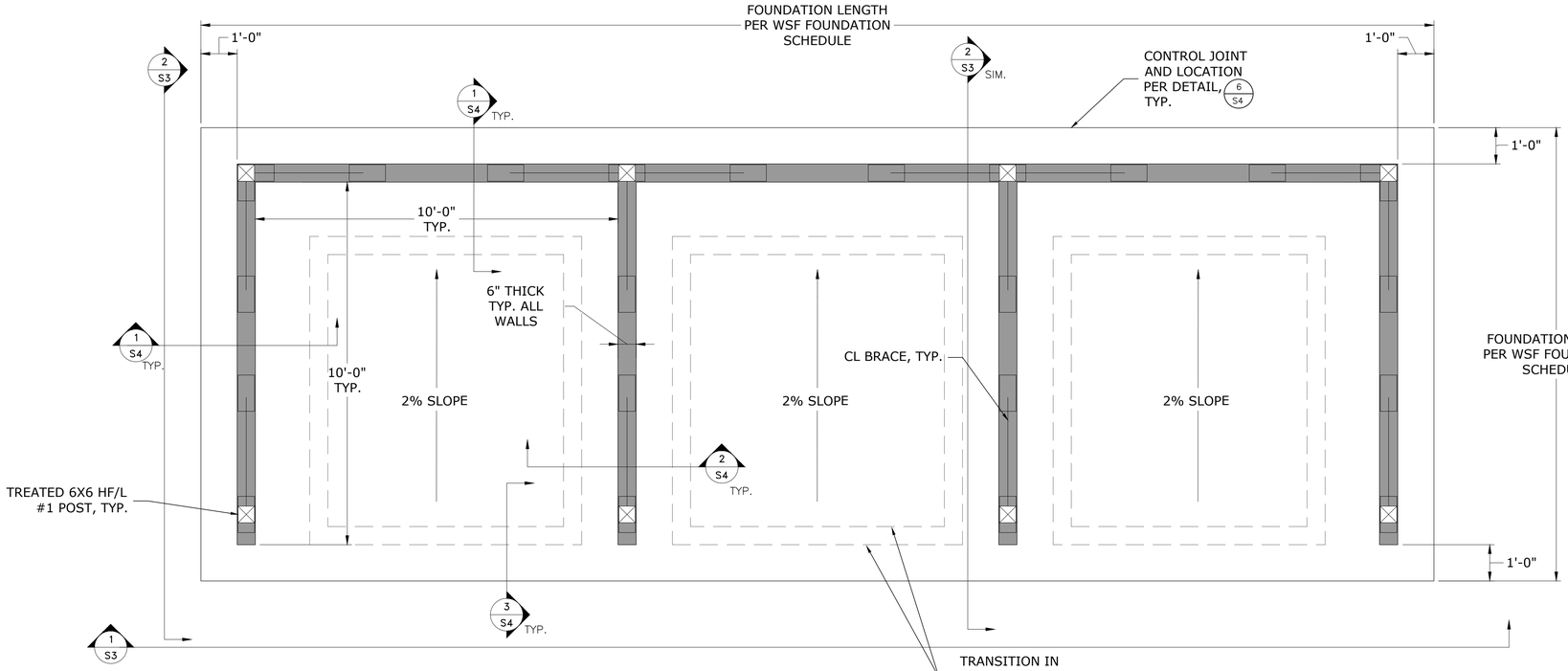
WHATCOM CONSERVATION DISTRICT
WHIDBEY ISLAND CONSERVATION DISTRICT
SAN JUAN ISLANDS CONSERVATION DISTRICT

SHEET CONTENT
GENERAL NOTES

JOB No. 2302-0069
DRAWN RLKC
CHECKED NRW
DATE 2/9/24
REVISIONS
SHEET S1 OF 9



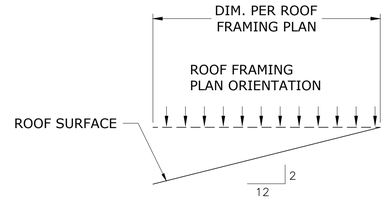
WALL/ FOUNDATION PLAN

1/2" = 1'-0"

DETAIL NOTE:
CONTROL JOINT AND LOCATION PER DETAIL, 6 S4 TYP.

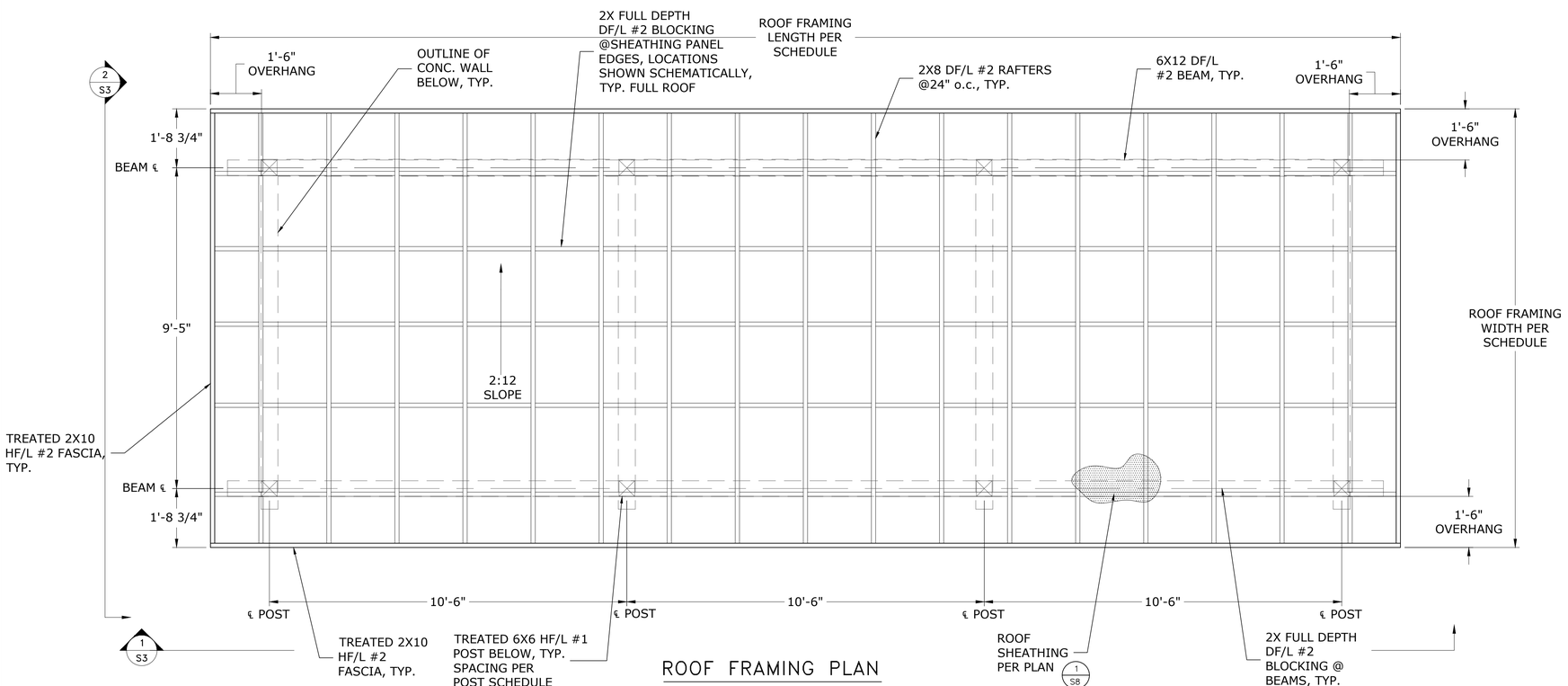
CIP WSF FOUNDATION SCHEDULE		
CIP BIN CONFIGURATION	TOTAL FOUNDATION LENGTH	TOTAL FOUNDATION WIDTH
CIP 2-BIN	23'-6"	12'-6"
CIP 3-BIN	34'-0"	12'-6"
CIP 4-BIN	44'-6"	12'-6"

SHEET NOTES:
1. CONTRACTOR/OWNER'S OPTION TO USE 2-BIN, 3-BIN OR 4-BIN CONFIGURATION.
2. TREAT ALL CUT ENDS OF TREATED LUMBER FOR EXTERIOR EXPOSURE.
3. GUTTERS, DRIP EDGE, AND FLASHING BY OTHERS. NOT SHOWN FOR CLARITY.



ROOF FRAMING PLAN ORIENTATION

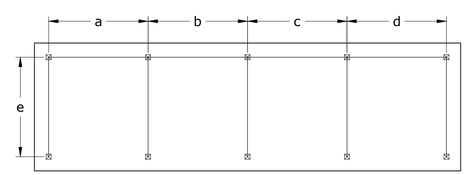
NOTE: DIMENSIONS TAKEN AS HORIZONTAL PROJECTIONS BASED ON ANGLE OF ROOF SURFACE



ROOF FRAMING PLAN

1/2" = 1'-0"

CIP ROOF FRAMING SCHEDULE		
CIP BIN CONFIGURATION	ROOF PLAN LENGTH	ROOF PLAN WIDTH
CIP 2-BIN	24'-5"1/2	12'-7"3/4
CIP 3-BIN	34'-11"1/2	12'-7"3/4
CIP 4-BIN	45'-5"1/2	12'-7"3/4



POST SPACING GEOMETRY

NTS

CIP POST SPACING SCHEDULE			
	CIP 2-BIN	CIP 3-BIN	CIP 4-BIN
a	10'-6"	10'-6"	10'-6"
b	10'-6"	10'-6"	10'-6"
c	-	10'-6"	10'-6"
d	-	-	10'-6"
e	9'-5"	9'-5"	9'-5"

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SHEET CONTENT
CIP BIN OPTION - FOUNDATION AND ROOF PLAN

JOB No. 2302-0069

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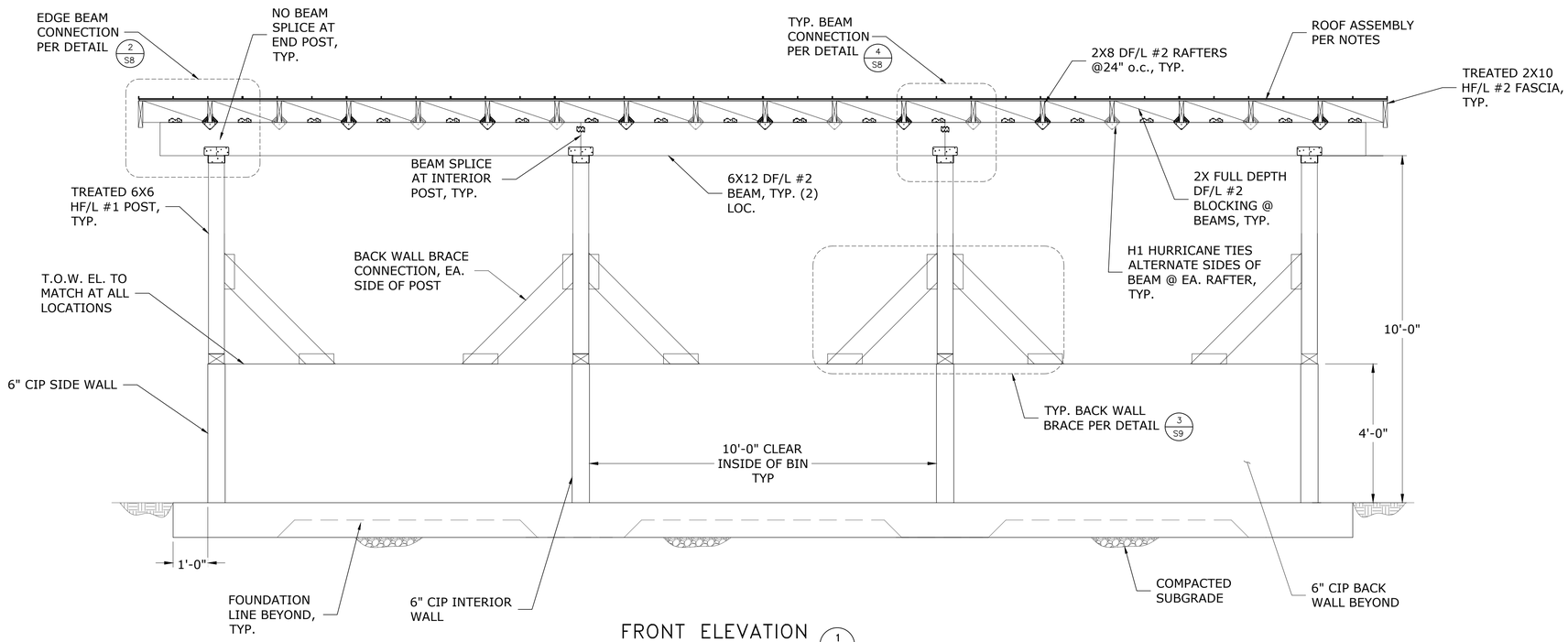
DATE 2/9/24

REVISIONS

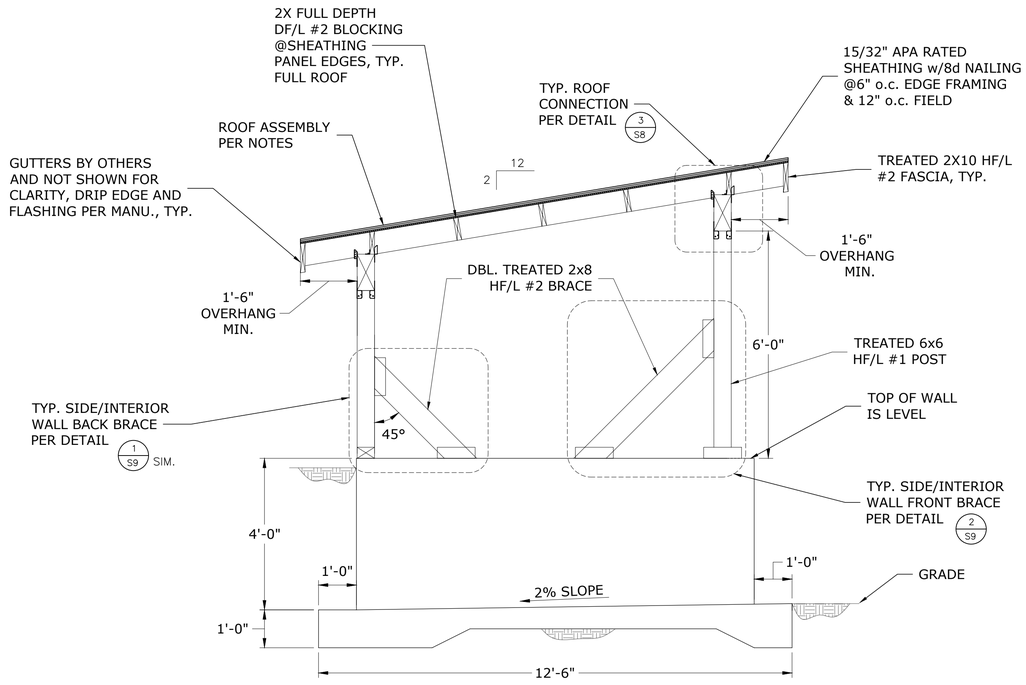
SHEET S2 OF 9

158



FRONT ELEVATION 1/S3

1/2" = 1'-0"



WALL SECTION 2/S3

1/2" = 1'-0"

ROOF ASSEMBLY NOTES:

- ROOF ASSEMBLIES, UNDERLAYMENT, AND ATTACHMENT SHALL BE IN CONFORMANCE WITH CHAPTER 15 OF THE 2021 IBC WITH WASHINGTON AMMENDMENTS.
- ROOF ASSEMBLIES SHALL BE CAPABLE OF RESISTING THE DESIGN LOADS SUMMARIZED ON SHEET S1.
- CONTRACTOR/OWNER OPTION TO USE METAL ROOF PANELS OF COMPOSITE (SYNTHETIC) SHINGLES. UNDERLAYMENT, INSTALLATION, AND ATTACHMENT SHALL BE PER MANUFACTURE INSTALLATION INSTRUCTIONS

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SHEET CONTENT
CIP BIN OPTION - ELEVATIONS AND SECTIONS

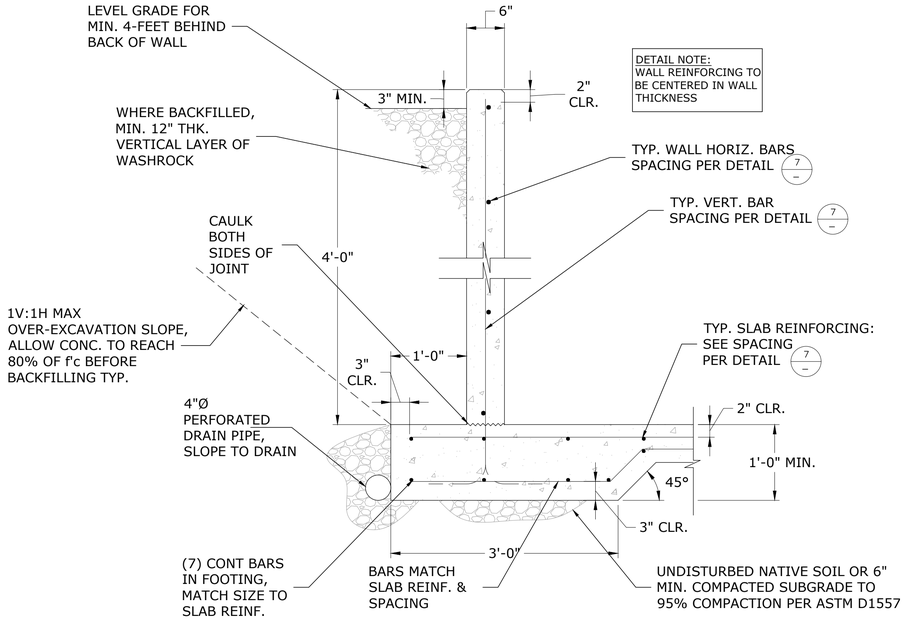
JOB No. 2302-0069

DRAWN	CHECKED
RLKC	NRW

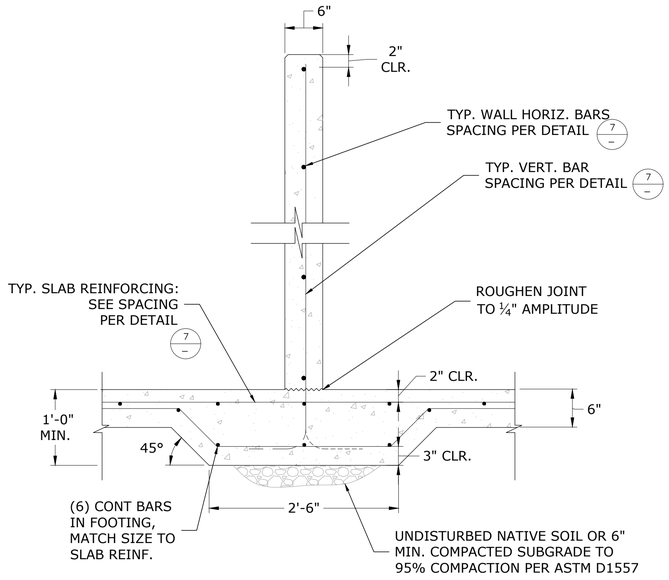
DATE 2/9/24

REVISIONS

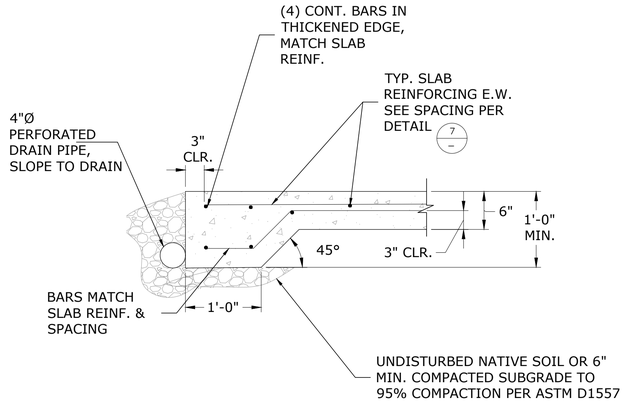
SHEET S3 OF 9



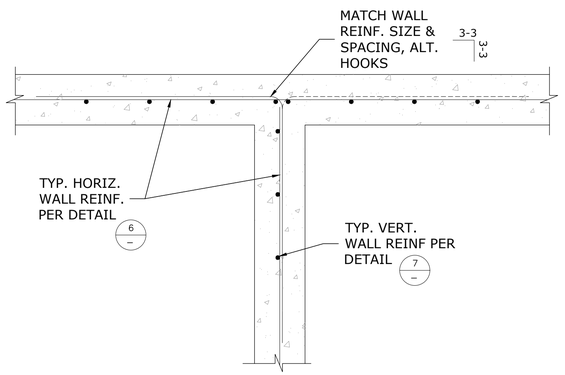
TYP. EXTERIOR CONC. WALL DETAIL 1/S4
1" = 1'–0"



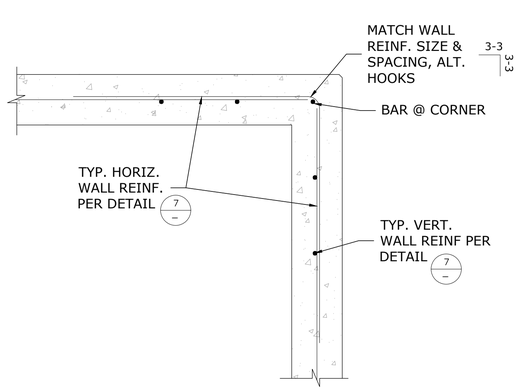
TYP. INTERIOR CONC. WALL DETAIL 2/S4
1" = 1'–0"



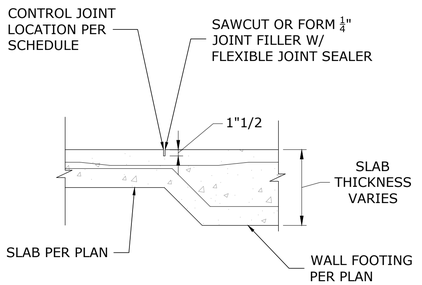
FRONT OF SLAB THICKENED EDGE DETAIL 3/S4
1" = 1'–0"



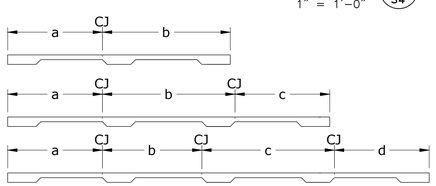
CONC. WALL INTERSECTION DETAIL 4/S4
1" = 1'–0"



CONC. WALL CORNER DETAIL 5/S4
1" = 1'–0"



SLAB CONTROL JOINT DETAIL 6/S4
1" = 1'–0"



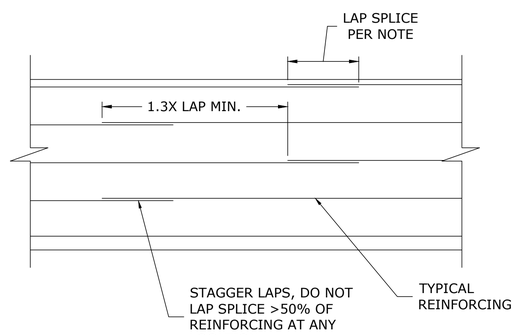
FOUNDATION CONTROL JOINT ELEVATION
NTS

CIP CONTROL JOINT LOCATION SCHEDULE			
	CIP 2-BIN	CIP 3-BIN	CIP 4-BIN
a	10'-0"	10'-0"	10'-0"
b	13'-6"	14'-0"	10'-6"
c	-	10'-0"	14'-0"
d	-	-	10'-0"

VERT. WALL REINF.	
#4 BARS @18" O.C.	#5 BARS @18" O.C.
HORZ. WALL REINF.	
#4 BARS @10" O.C.	#5 BARS @16" O.C.

SLAB REINF.	
#4 BARS @12" O.C.	#5 BARS @16" O.C.

TYPICAL REINFORCING SCHEDULE 7/S4
N.T.S



GENERAL LAP SPLICE DETAIL 8/S4
NTS

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STOCK AGRICULTURAL WSF

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SHEET CONTENT
CIP BIN OPTION - WALL AND FOUNDATION DETAILS

JOB No. 2302-0069
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DATE 2/9/24
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SHEET S4 OF 9

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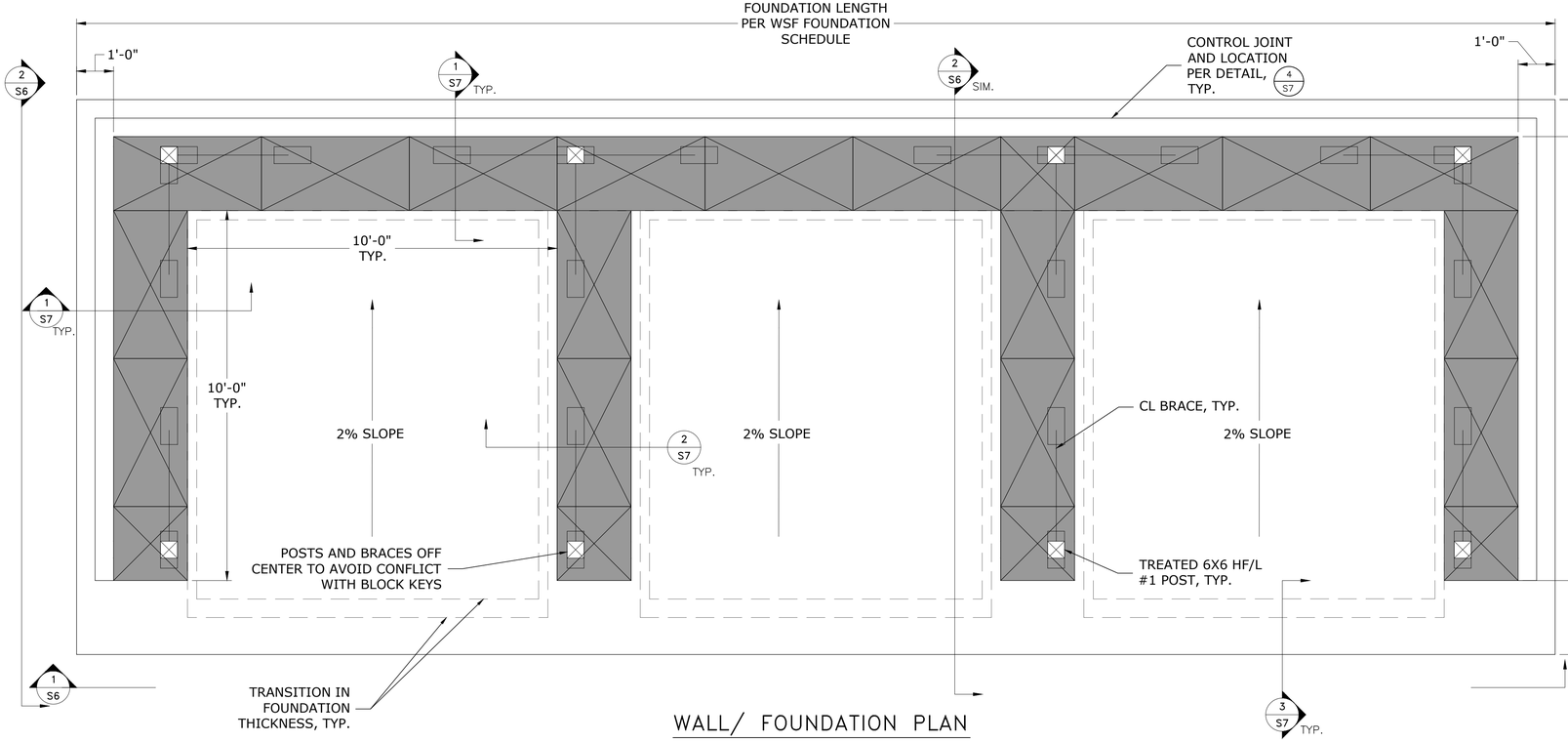


WALL/ FOUNDATION PLAN

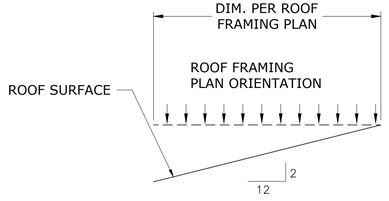
1/2" = 1'-0"

NOTE:
CONTRACTOR MAY USE A COMBINATION OF HALF BLOCKS (2'X2'X2') AND FULL BLOCKS (4'X2'X2') TO ACHIEVE THE BIN GEOMETRY SHOWN

DETAIL NOTE:
CONTROL JOINT AND LOCATION PER DETAIL, 4 S7 TYP.

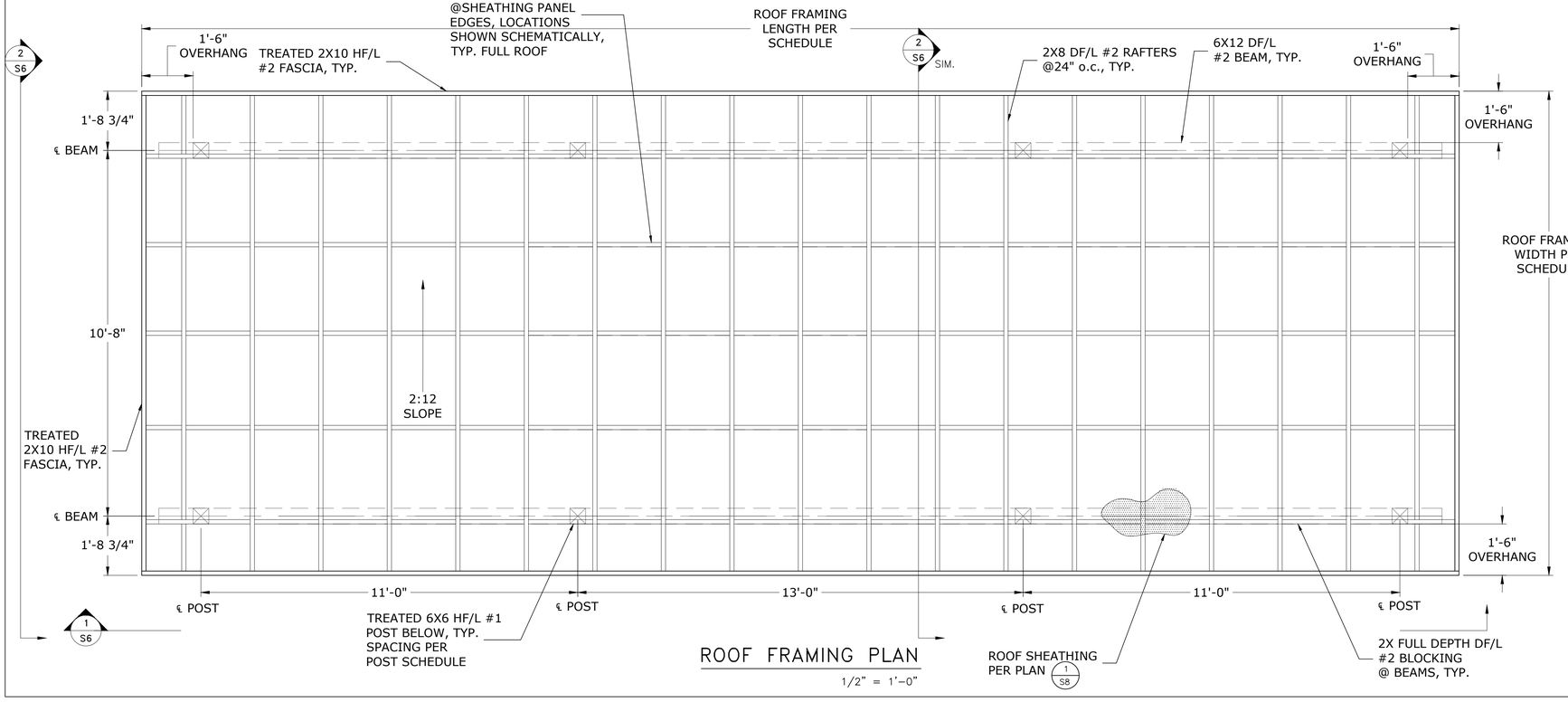
ECOLOGY BLOCK WSF FOUNDATION SCHEDULE		
ECOLOGY BLOCK BIN CONFIGURATION	TOTAL FOUNDATION LENGTH	TOTAL FOUNDATION WIDTH
EB 2-BIN	28'-0"	15'-0"
EB 3-BIN	40'-0"	15'-0"
EB 4-BIN	52'-0"	15'-0"

SHEET NOTES:
1. CONTRACTOR/OWNER'S OPTION TO USE 2-BIN, 3-BIN OR 4-BIN CONFIGURATION.
2. TREAT ALL CUT ENDS OF TREATED LUMBER FOR EXTERIOR EXPOSURE.
3. GUTTERS, DRIP EDGE, AND FLASHING BY OTHERS. NOT SHOWN FOR CLARITY.



ROOF FRAMING PLAN ORIENTATION

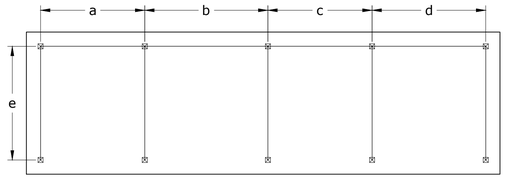
NOTE: DIMENSIONS TAKEN AS HORIZONTAL PROJECTIONS BASED ON ANGLE OF ROOF SURFACE



ROOF FRAMING PLAN

1/2" = 1'-0"

ECOLOGY BLOCK ROOF FRAMING SCHEDULE		
ECOLOGY BLOCK BIN CONFIGURATION	ROOF PLAN LENGTH	ROOF PLAN WIDTH
EB 2-BIN	26'-5"1/2	14'-1"1/2
EB 3-BIN	38'-5"1/2	14'-1"1/2
EB 4-BIN	50'-5"1/2	14'-1"1/2



POST SPACING GEOMETRY

NTS

NOTE:
POST SPACING IS NOT UNIFORM ON ECOLOGY BLOCK OPTION TO AVOID CONFLICT WITH BLOCK KEYS

ECOLOGY BLOCK POST SPACING SCHEDULE			
	EB 2-BIN	EB 3-BIN	EB 4-BIN
a	11'-0"	11'-0"	11'-0"
b	12'-0"	13'-0"	13'-0"
c	-	11'-0"	11'-0"
d	-	-	12'-0"
e	10'-8"	10'-8"	10'-8"

NOTICE
0 1
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SHEET CONTENT
ECOLOGY BLOCK OPTION - FOUNDATION AND ROOF PLAN

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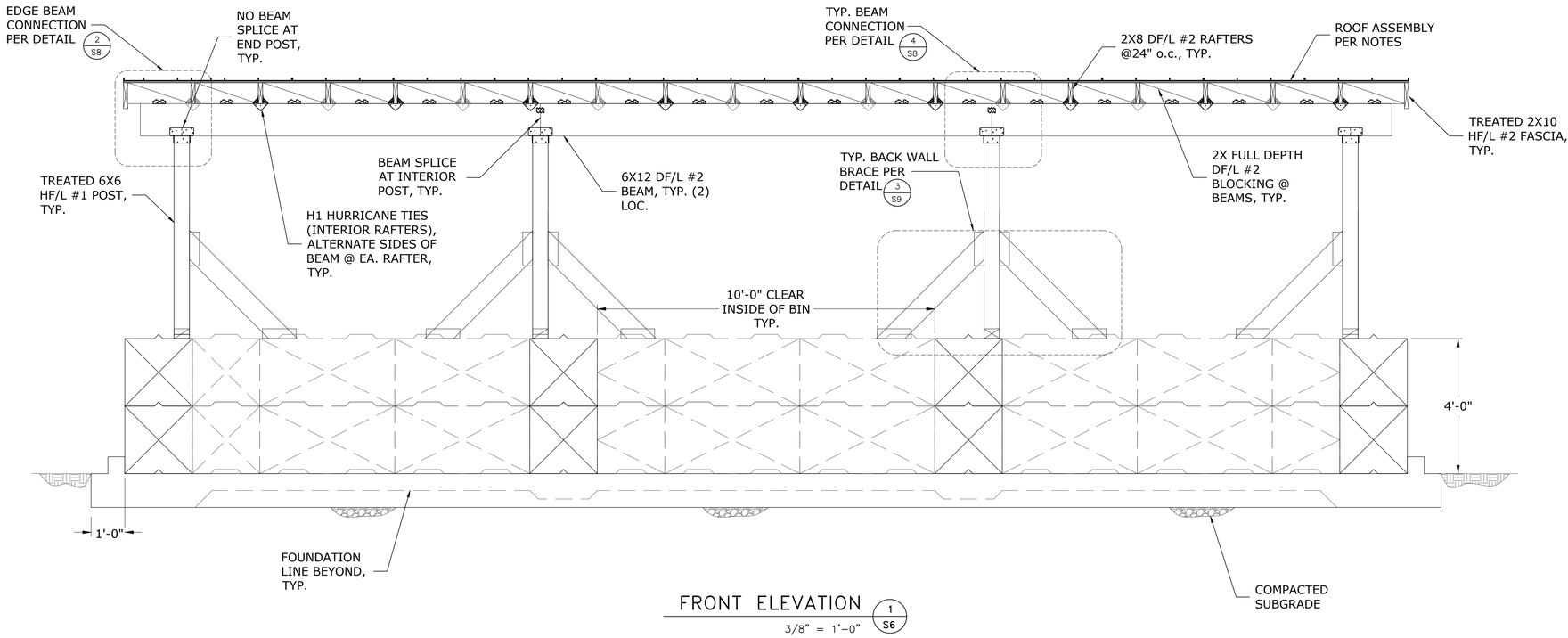
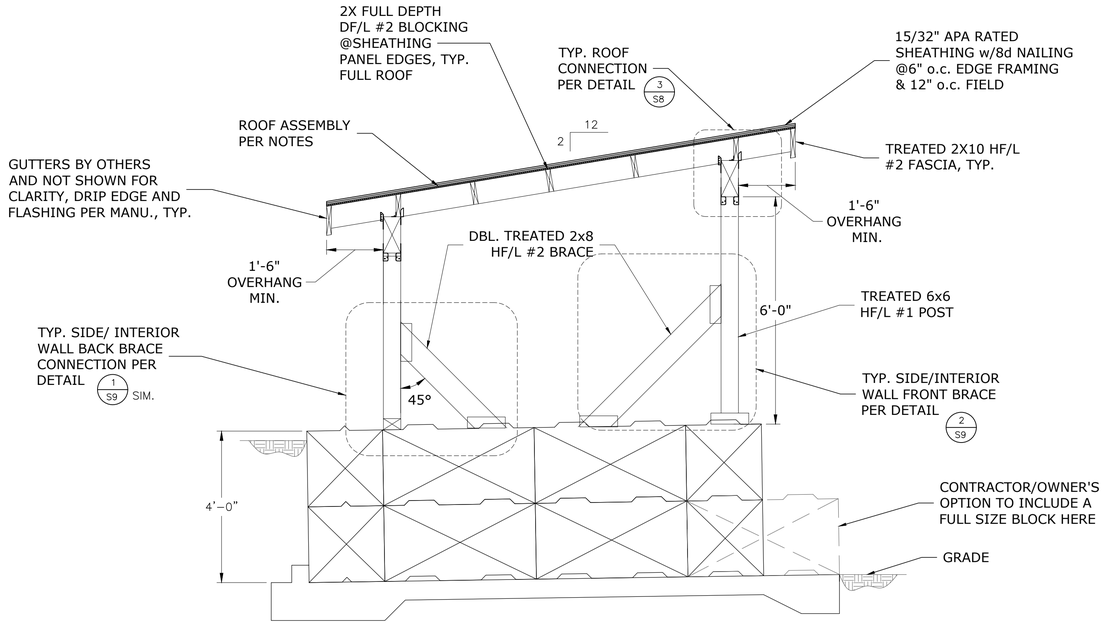
REVISIONS

SHEET S5 OF 9

161



FRONT ELEVATION 1/S6
3/8" = 1'-0"



SECTION 2/S6
3/8" = 1'-0"

ROOF ASSEMBLY NOTES:
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ECOLOGY BLOCK OPTION - ELEVATION AND SECTIONS

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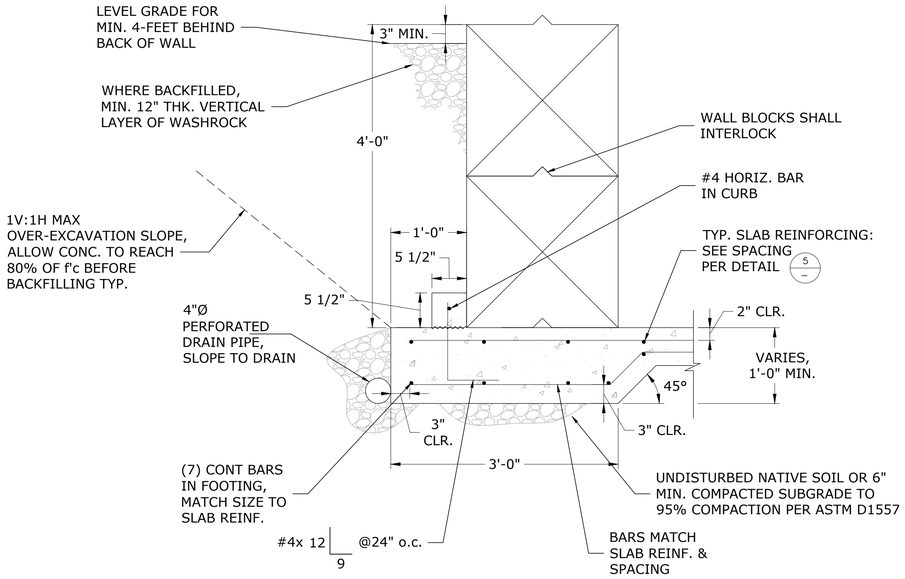
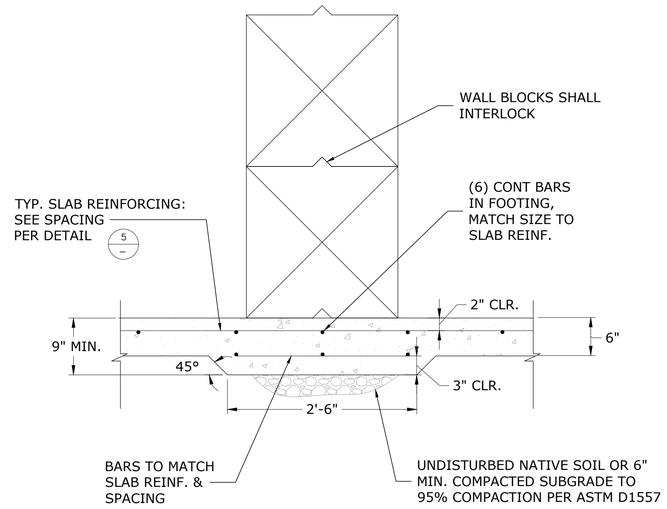


TYP. EXTERIOR ECO BLOCK WALL FOOTING DETAIL 1/S7
1" = 1'–0"



TYP. INTERIOR ECO BLOCK WALL FOOTING DETAIL 2/S7
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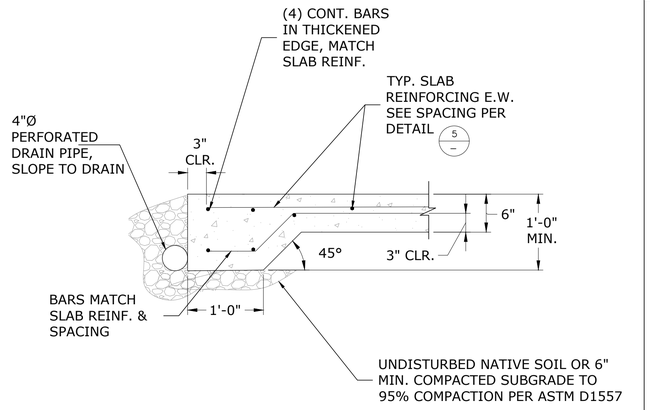
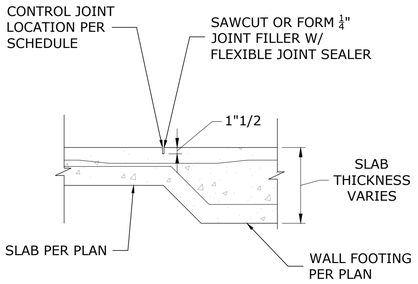
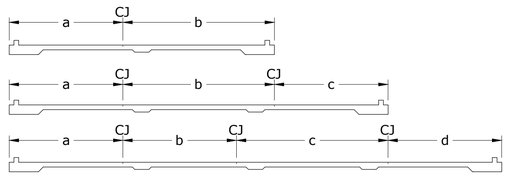


FRONT OF SLAB THICKENED EDGE DETAIL 3/S7
1" = 1'–0"



SLAB CONTROL JOINT DETAIL 4/S7
1" = 1'–0"

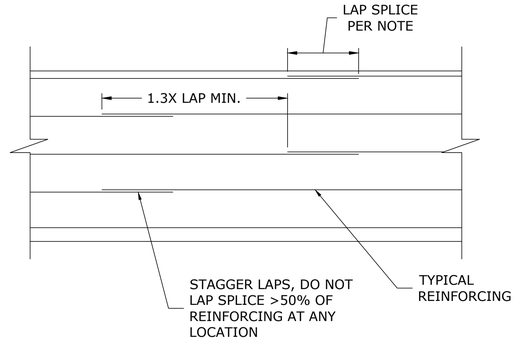


FOUNDATION CONTROL JOINT ELEVATION
NTS

ECOLOGY BLOCK CONTROL JOINT LOCATION SCHEDULE			
	EB 2-BIN	EB 3-BIN	EB 4-BIN
a	12'-0"	12'-0"	12'-0"
b	16'-0"	16'-0"	12'-0"
c	-	12'-0"	16'-0"
d	-	-	12'-0"

SLAB REINF.	
#4 BARS @12" O.C.	#5 BARS @16" O.C.

TYPICAL REINFORCING SCHEDULE 5/S7
N.T.S



GENERAL LAP SPLICE DETAIL 8/S7
NTS

WILLIAM JOHN STANBRO
STATE OF WASHINGTON
48224
STRUCTURAL ENGINEER
PROFESSIONAL ENGINEER
03/09/2024

PSE
PETERSON STRUCTURAL ENGINEERS
708 Broadway, Suite 110
Tacoma, WA 98402
(253)830 - 2140

STOCK AGRICULTURAL WSF

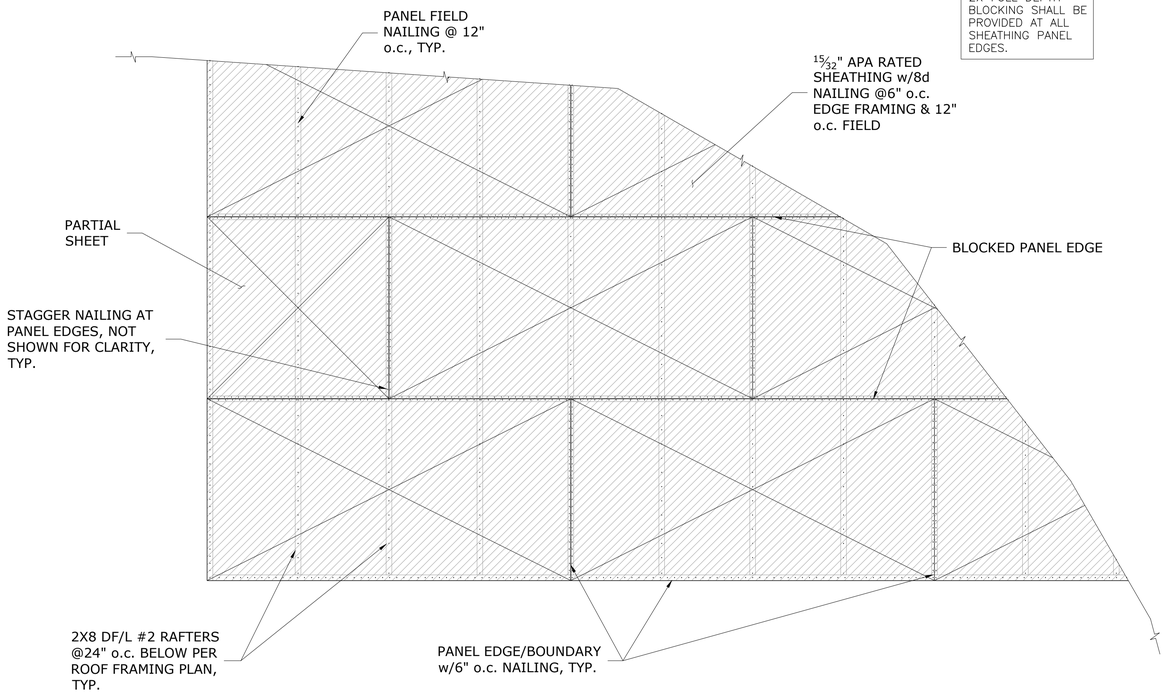
CLIENT INFO:
SKAGIT CONSERVATION DISTRICT
2021 E. COLLEGE WAY, SUITE 203
MOUNT VERNON, WA 98273

PROJECT SITE:
SKAGIT CONSERVATION DISTRICT
WHATCOM CONSERVATION DISTRICT
WHIDBEY ISLAND CONSERVATION DISTRICT
SAN JUAN ISLANDS CONSERVATION DISTRICT

SHEET CONTENT
ECOLOGY BLOCK OPTION - WALL AND FOUNDATION DETAILS

JOB No. 2302-0069
DRAWN RLKC CHECKED NRW
DATE 2/9/24
REVISIONS

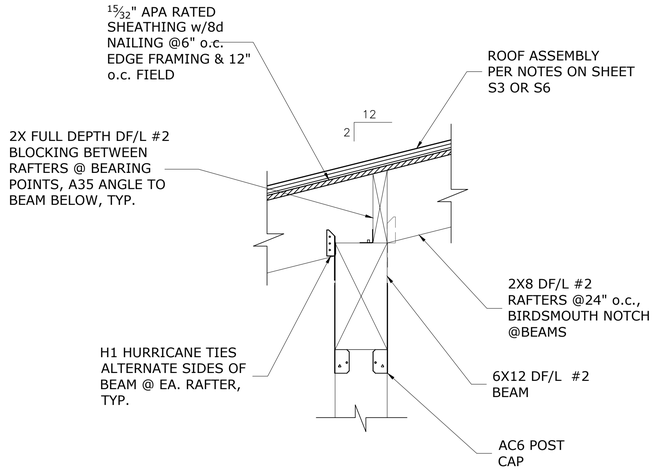
SHEET S7 OF 9



DETAIL NOTES:
2X FULL DEPTH BLOCKING SHALL BE PROVIDED AT ALL SHEATHING PANEL EDGES.

ROOF SHEATHING PLAN (1 / S8)

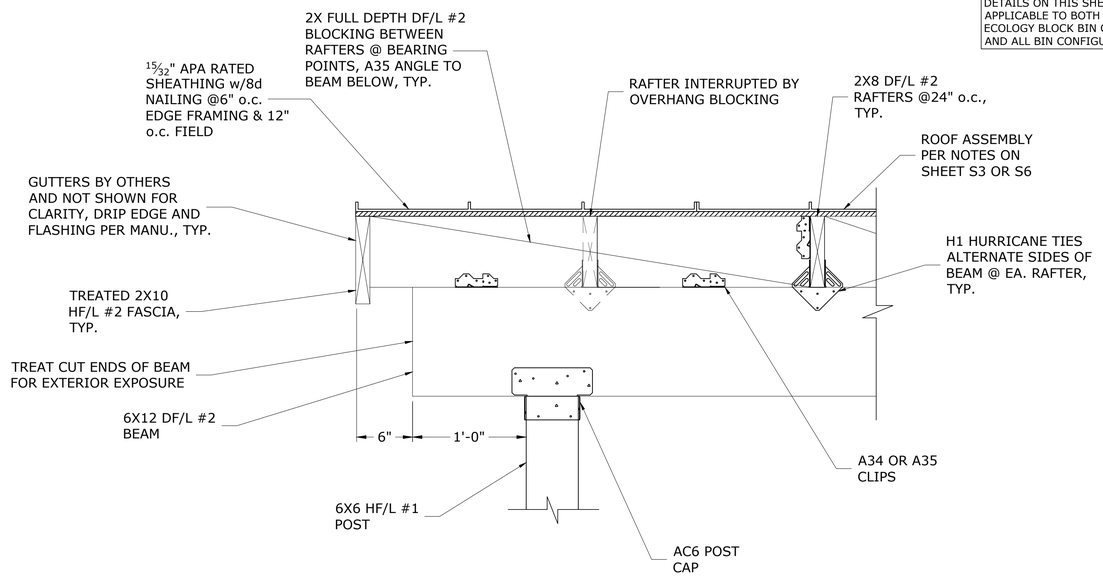
NTS



TYP. POST–BEAM CONNECTION (3 / S8)

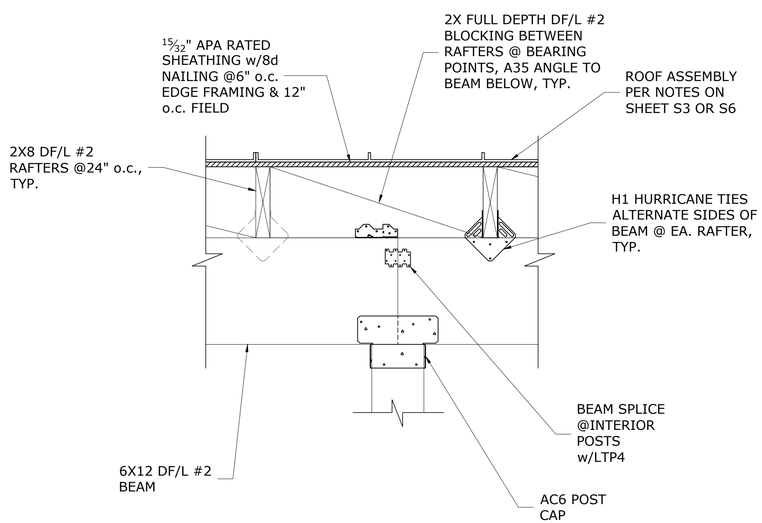
1"1/2 = 1'–0"

SHEET NOTE
DETAILS ON THIS SHEET ARE APPLICABLE TO BOTH CIP BIN AND ECOLOGY BLOCK BIN OPTIONS AND ALL BIN CONFIGURATIONS



TYP. EDGE–POST BEAM CONNECTION (2 / S8)

1"1/2 = 1'–0"



INTERIOR POST–BEAM CONNECTION (4 / S8)

1"1/2 = 1'–0"

NOTICE
0 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

WILLIAM JOHN STANDRIDGE — STATE OF WASHINGTON — 48224 — STRUCTURAL ENGINEER — PROFESSIONAL ENGINEER
03/07/2024

PSE
PETERSON STRUCTURAL ENGINEERS
708 Broadway, Suite 110
Tacoma, WA 98402
(253)830 - 2140

STOCK AGRICULTURAL WSF

CLIENT INFO:
SKAGIT CONSERVATION DISTRICT
2021 E. COLLEGE WAY, SUITE 203
MOUNT VERNON, WA 98273

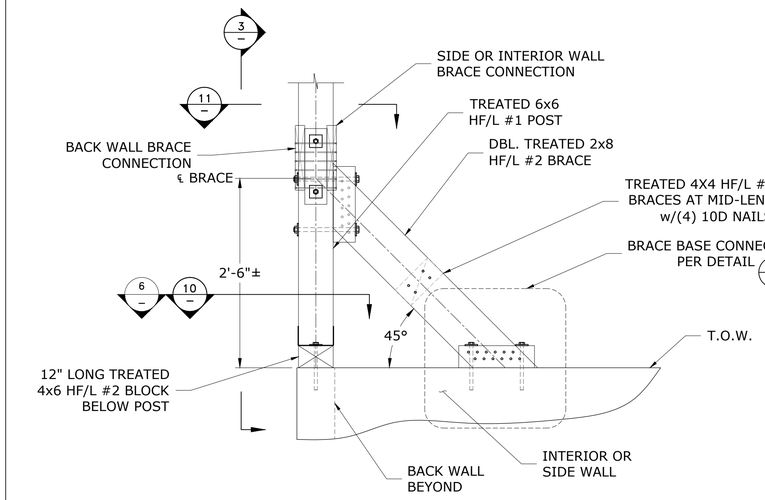
PROJECT SITE:
SKAGIT CONSERVATION DISTRICT
WHATCOM CONSERVATION DISTRICT
WHIDBEY ISLAND CONSERVATION DISTRICT
SAN JUAN ISLANDS CONSERVATION DISTRICT

SHEET CONTENT
GENERAL DETAILS - ROOF FRAMING

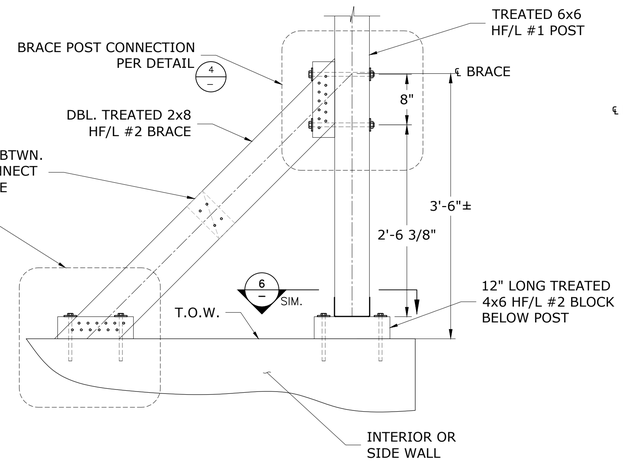
JOB No. 2302-0069
DRAWN RLKC
CHECKED NRW
DATE 2/9/24
REVISIONS

SHEET S8 OF 9

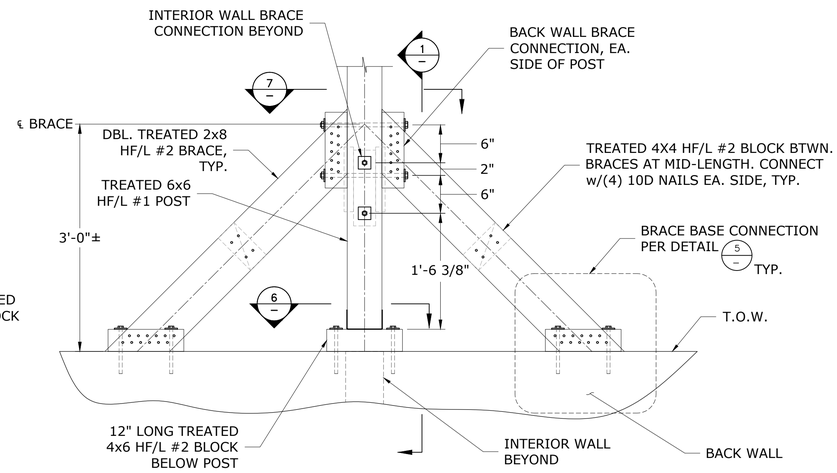
NOTICE
0 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE



BACK BRACE SIDE ELEVATION (1/S9)
1" = 1'-0"



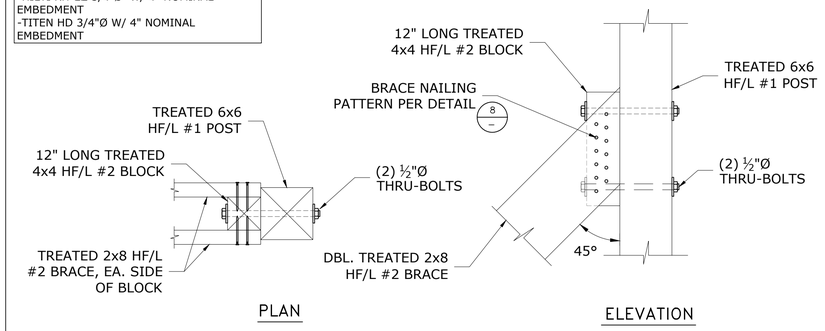
FRONT BRACE ELEVATION (2/S9)
1" = 1'-0"



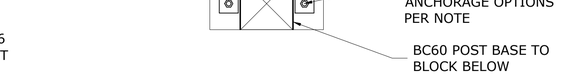
BACK BRACE REAR ELEVATION (3/S9)
1" = 1'-0"

BRACE AND COLUMN ANCHORAGE OPTIONS:
EPOXY:
-HILTI HIT-RE 500 V3 3/4"Ø THREADED ROD ASTM F1554 GR36/A36 W/ 6" EMBEDMENT
-SIMPSON SET 3G 3/4"Ø THREADED ROD ASTM F1554 GR36 W/ 6" EMBEDMENT
-DEWALT PURE110+ 3/4"Ø THREADED ROD ASTM F1554 GR36/A36 W/ 6" EMBEDMENT

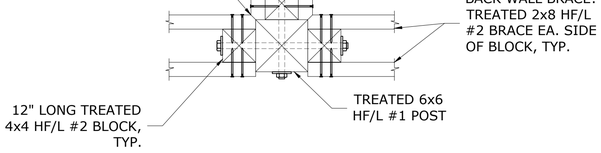
MECHANICAL:
-DEWALT SCREW-BOLT+ 3/4"Ø W/ 4.25" NOMINAL EMBEDMENT
-HILTI KH-EZ 3/4"Ø W/ 4" NOMINAL EMBEDMENT
-TITEN HD 3/4"Ø W/ 4" NOMINAL EMBEDMENT

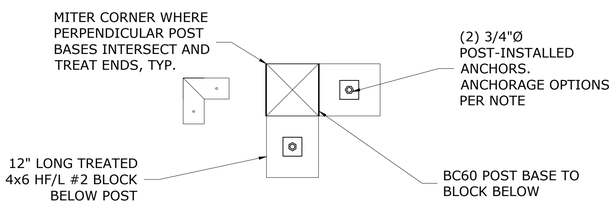


TYP. BRACE POST CONNECTION DETAIL (4/S9)
1 1/2" = 1'-0"



TYP. POST BASE CONNECTION DETAIL (6/S9)
1 1/2" = 1'-0"

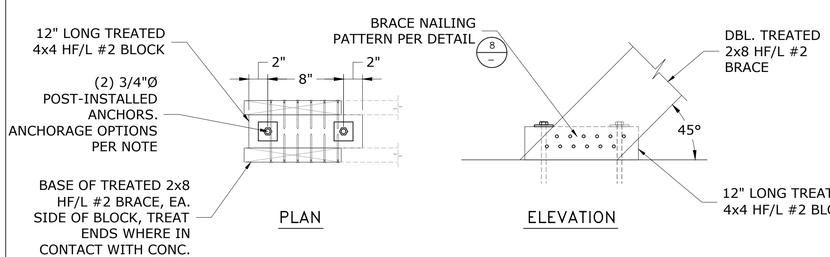




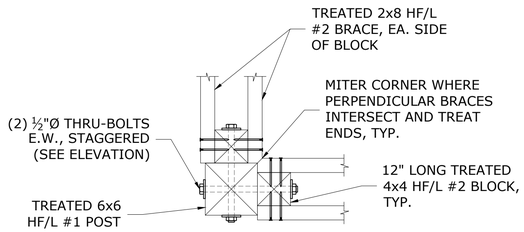
CORNER POST BASE CONNECTION DETAIL (10/S9)
1 1/2" = 1'-0"

BACK MIDDLE POST DETAIL (7/S9)
1 1/2" = 1'-0"

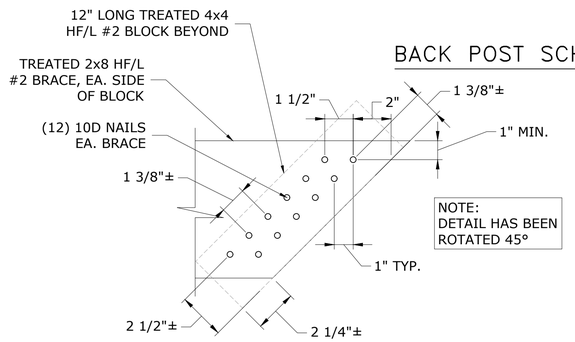
SHEET NOTE
DETAILS ON THIS SHEET ARE APPLICABLE TO BOTH CIP BIN AND ECOLOGY BLOCK BIN OPTIONS AND ALL BIN CONFIGURATIONS



TYP. BRACE BASE CONNECTION DETAIL (5/S9)
1 1/2" = 1'-0"



BACK CORNER POST DETAIL (11/S9)
1 1/2" = 1'-0"



BACK POST SCHEMATIC ISOMETRIC (9/S9)
1/2" = 1'-0"

TYP. BRACE NAILING PATTERN (8/S9)
3" = 1'-0"

WILLIAM JOHN STANBRO
STATE OF WASHINGTON
48224
STRUCTURAL ENGINEER
PROFESSIONAL ENGINEER
03/07/2024

PSE
PETERSON STRUCTURAL ENGINEERS
708 Broadway, Suite 110
Tacoma, WA 98402
(253)830-2140

STOCK AGRICULTURAL WSF

CLIENT INFO:
SKAGIT CONSERVATION DISTRICT
2021 E. COLLEGE WAY, SUITE 203
MOUNT VERNON, WA 98273

PROJECT SITE:
SKAGIT CONSERVATION DISTRICT
WHATCOM CONSERVATION DISTRICT
WHIDBEY ISLAND CONSERVATION DISTRICT
SAN JUAN ISLANDS CONSERVATION DISTRICT

SHEET CONTENT
GENERAL DETAILS - POST BRACING

JOB No. 2302-0069
DRAWN RLKC
CHECKED NRW
DATE 2/9/24
REVISIONS

SHEET S9 OF 9

PETERSON STRUCTURAL ENGINEERS

Tacoma Office
708 Broadway
Suite 110
Tacoma, WA 98402
253.830.2140

February 9, 2024

Emmett Wild
Skagit Conservation District
2021 E. College Way Suite 203
Mount Vernon, WA 98273
360.428.4313

Project #: 2302-0069

RE: **Stock Agricultural Waste Storage Facility – Design Criteria Memorandum**

To Whom it May Concern -

The following memorandum has been generated by Peterson Structural Engineers (PSE) to summarize the structural design criteria and loading considered for the 10-Foot Bin Waste Storage Facility (WSF) Stock Structure Standard Design. The following memorandum, in conjunction with the provided structural drawings and structural design calculations (dated February 9, 2024 and collectively referred to as the "design documents"), may be used by Skagit, Whatcom, Whidbey Island, and San Juan Island Conservation Districts to determine project design applicability in the subject counties.

The subject WSF structural design as detailed in the structural drawings shall only be constructed in regions where all of the criteria outlined herein are met. The structural design shall not be implemented where any of the criteria outlined herein are not met, unless otherwise reviewed and approved by a Professional Engineer licensed in Washington State. The structural design is a standard design that may require adaptation for a specific use or site. Any design alterations or deviations from the design documents shall be reviewed and approved by a Professional Engineer licensed in Washington State.

Appended to this memorandum are design criteria references as provided by the Skagit, Whatcom, Whidbey Island, and San Juan Island Counties as well as excerpts from the American Society of Civil Engineers Standard 7-16 (ASCE 7-16), *Minimum Design Loads for Buildings and Other Structures*. The provided excerpts may be used as an aid in determining project design applicability in the subject counties.

General Standards

All work shall be in strict conformance with the 2021 International Building Code (2021 IBC) as amended by the State of Washington as well as the applicable United States Department of Agriculture (USDA) National Resources Conservation Service (NRCS) Standards. The subject WSF structural design is only applicable under the 2021 IBC and is not permitted for use under future code adoption cycles without written approval by PSE. Following future building code adoption, PSE may be consulted to review, update, and reissue the design for use.

The subject WSF structural design is considered a Risk Category I structure per the 2021 IBC and ASCE 7-16. Per Section C1.5.1 of ASCE 7-16, "Risk Category I structures generally encompass buildings and structures that normally are unoccupied and that would result in negligible risk to the public should they fail." Uses and occupancies of the structure which conform to higher Risk Categories are not permitted.

Location

The subject WSF structural design shall only be applicable to regions within Skagit, Whatcom, Whidbey Island, and San Juan Island Counties in Washington State where in conformance with the criteria outlined herein.

Bin Types

Per the structural drawings, the owner/contractor are provided the following options for bin construction:

- Reinforced Concrete Walls
    - Height: 4’-0”
    - Thickness: 0’-6”
    - Reinforcing: See structural drawings
- Precast Ecology Block Walls
    - Height: 4’-0”
    - Block geometry:
        - Width: 2’-0”
        - Height: 2’-0”
        - Length: 4’-0” (full block) and 2’-0” (half block). Block types shall be as noted in the structural drawings.

General Requirements

Per the structural drawings, the owner/contractor are provided the option of using a 2-bin, 3-bin, or 4-bin configuration. This subject design is not applicable to layouts or bin configurations other than those detailed in the structural drawings. Summarized below are the primary geometric requirements for the structure:

- Internal bin size: 10’-0” x 10’-0” clear
- Retained exterior backfill height: Up to 3” below the top of wall
- Front beam soffit elevation (vertical entry clearance): 10’-0” above top of slab (6’-0” above top of wall)
- Roof slope: 2V:12H (approximately = 9.46°)
- Slab slope: 2% to back wall
- Foundation thickness:
    - At footing edges: 1’-0” minimum
    - Interior slab region: 0’-6” minimum
- Geometry: See structural drawings

Maintenance of Structure

Portions of the structure will be exposed to weather, contact with stored waste, and other conditions that promote material deterioration. The owner should routinely observe material conditions and perform maintenance as needed to ensure structural soundness. When material deterioration occurs, owner shall repair or replace impacted members. Furthermore, structural damages that result from storage operations or machinery should be reviewed by a Professional Engineer licensed in the State of Washington to determine repairs. Alternatively, the member may be replaced in kind and connected as detailed in the design documents. The owner or contractor is responsible for any shoring required to support the structure during member placement.

Live Loads

The subject WSF structural design shall only be applicable to the following live loads:

- Floor Distributed Load: Shall not exceed 250psf
- Flood Concentrated Load: Shall not exceed 8,000lb
- Retaining Wall Vertical Surcharge Load: Shall not exceed 250psf

Snow Loads

The subject WSF structural design shall only be applicable to regions that meet the following snow load criteria:

- Ground Snow Loads: Shall not exceed 40.0-psf
- Flat Roof Snow Loads: Shall not exceed 30.0-psf

Wind Loads

The subject WSF structural design shall only be applicable to regions that meet the following wind load criteria:

- Wind Exposure: Exposures B through D are acceptable
- Basic Wind Speed per ASCE 7-16: Shall not exceed 100-mph
- Topographic Factor: K_{zt} shall not exceed 1.5

Seismic Loads

The subject WSF structural design shall only be applicable to regions that meet the following seismic load criteria:

- Site Class: Class A through D are permitted. Structural design has assumed Site Class D. Design is not valid for Site Class E and Site Class F.
- Mapped Short Spectral Response, $S_S \leq 1.50g$
- Mapped Spectral Response at 1-second, $S_1 \leq 0.60g$
- Design Short Spectral Response, $S_{DS} \leq 1.30g$
- Design Spectral Response at 1-second, $S_{D1} \leq 0.8$
- Seismic Response Coefficient, $C_S \leq 0.80$

For more information on site-specific loading, refer to ASCE 7-16 and ATC Hazard Maps[1].

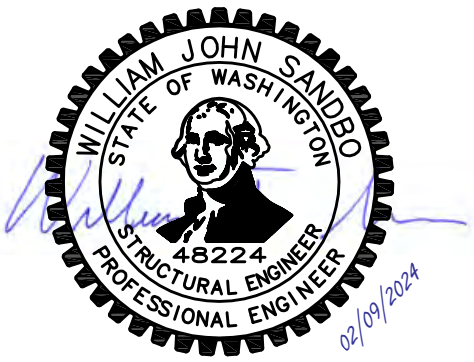
The design criteria outlined herein may not capture all load scenarios across the applicable regions. PSE is not responsible for the regulation or oversight of design implementation and construction for the subject WSF design. Applicability of the subject WSF structural design shall be regulated by the Conservation Districts in strict conformance with the provided design documents.

Site civil, architectural (including waterproofing and flashing), and any other nonstructural elements are outside of PSE's scope of work. All construction shall be in strict conformance with the 2021 IBC and USDA NRCS standards.

[1] https://hazards.atcouncil.org/

Please don't hesitate to contact us if you have any questions.

Sincerely,



Bill Sandbo, PE, SE, LEED AP
Principal
Peterson Structural Engineers, Inc.

Sent via email to Emmett Wild on 2/9/2024 <emmett@skagitcd.org>

Appendix Table of Contents

Appendix A - County Provided Design Criteria

Skagit County

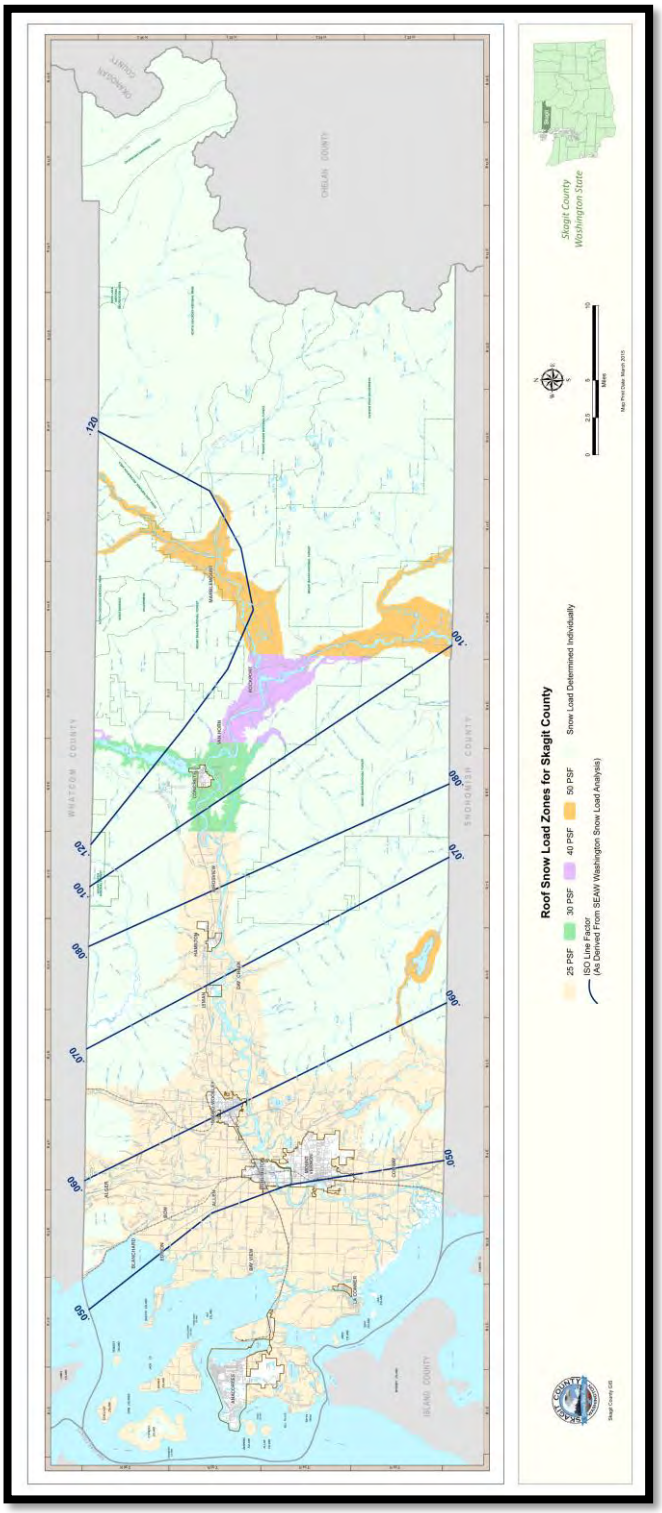


Figure 1: Skagit Roof Snow Load Map - URL: https://www.skagitcounty.net/Maps/iMap/?mapid=8fe801e1318643c9bfef288efb64c85f

Whatcom County

SNOW LOAD REVISION

Whatcom County	Approx. Average Elevation	Revised Ground Snow Load	Revised Roof Snow Load
Acme	310	22	25
Bellingham	100	15	25
Blaine	45	16	25
Deming	210	24	25
Diablo	910	100	100
Ferndale	60	20	25
Glacier	900	74	74
Lawrence	145	24	25
Lynden	103	24	25
Maple Falls	643	77	77
Mt. Baker Ski Area	4200	588	588
Newhalem	510	129	129
Nooksack	84	24	25
Sumas	36	24	25
Wickersham	310	28	28
Kendall	460		50
Paradise	460		50
Pt. Roberts	120		25

Essential facilities, Group A and other applicable occupancies, will require engineering.

Any proposal can challenge the above design load with engineer or architect stamped and signed calculations and criteria.

Buildings where the roof snow load exceeds 70 PSF will require engineering.

Recommendations are valid for the recognized central area of each regional designation. Building Services reserves the right to adjust the roof snow load based on building location and/or criteria per the currently adopted version of the IBC and/or the Snow Load Analysis for Washington.

Seismic Design Category D1.

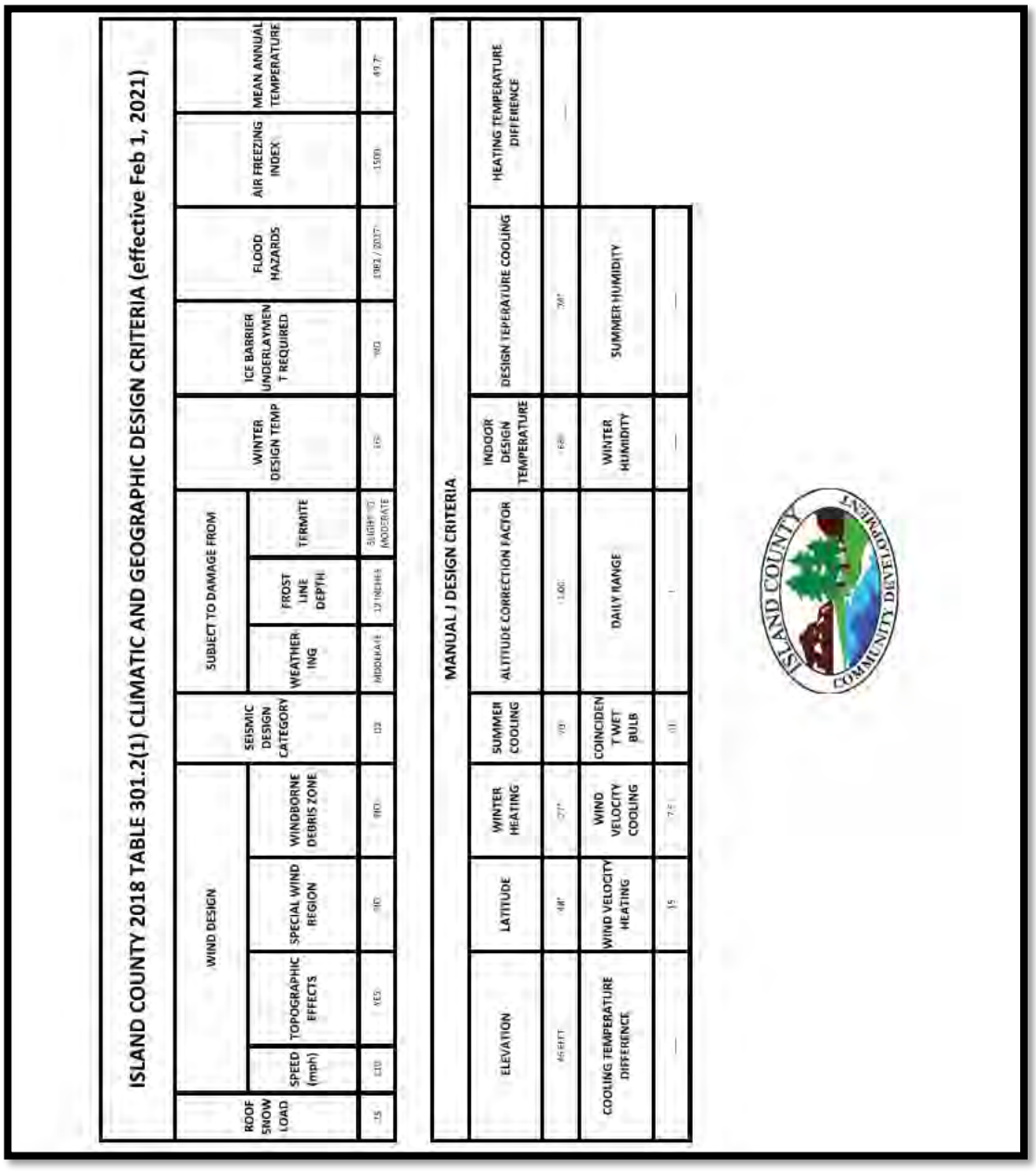
Basic wind speed – 85 MPH (verify exposure rating with Building Services Division.)
Tax Parcel Number required.

Residential Permit Application Packet
Form PL4-72-001A

Page 12 of 19

Figure 2: Whatcom County Climatic and Geographic Design Criteria - URL: https://www.whatcomcounty.us/542/Snow-Loads

Island County



ISLAND COUNTY 2018 TABLE 301.2(1) CLIMATIC AND GEOGRAPHIC DESIGN CRITERIA (effective Feb 1, 2021)

ROOF SNOW LOAD	WIND DESIGN: SPEED (mph)	WIND DESIGN: TOPOGRAPHIC EFFECTS	WIND DESIGN: SPECIAL WIND REGION	WIND DESIGN: WINDBORNE DEBRIS ZONE	SEISMIC DESIGN CATEGORY	SUBJECT TO DAMAGE FROM: WEATHERING	SUBJECT TO DAMAGE FROM: FROST LINE DEPTH	SUBJECT TO DAMAGE FROM: TERMITE	WINTER DESIGN TEMP	ICE BARRIER UNDERLAYMENT REQUIRED	FLOOD HAZARDS	AIR FREEZING INDEX	MEAN ANNUAL TEMPERATURE
25	110	YES	NO	NO	D2	MODERATE	12"NEHRS	SLIGHT TO MODERATE	15°	NO	1982 / 2017	1500	49.7°

MANUAL J DESIGN CRITERIA

ELEVATION	LATITUDE	WINTER HEATING	SUMMER COOLING	ALTITUDE CORRECTION FACTOR	INDOOR DESIGN TEMPERATURE	DESIGN TEMPERATURE COOLING	HEATING TEMPERATURE DIFFERENCE
46 FT	48°	27°	70	1.00	68	76°	—

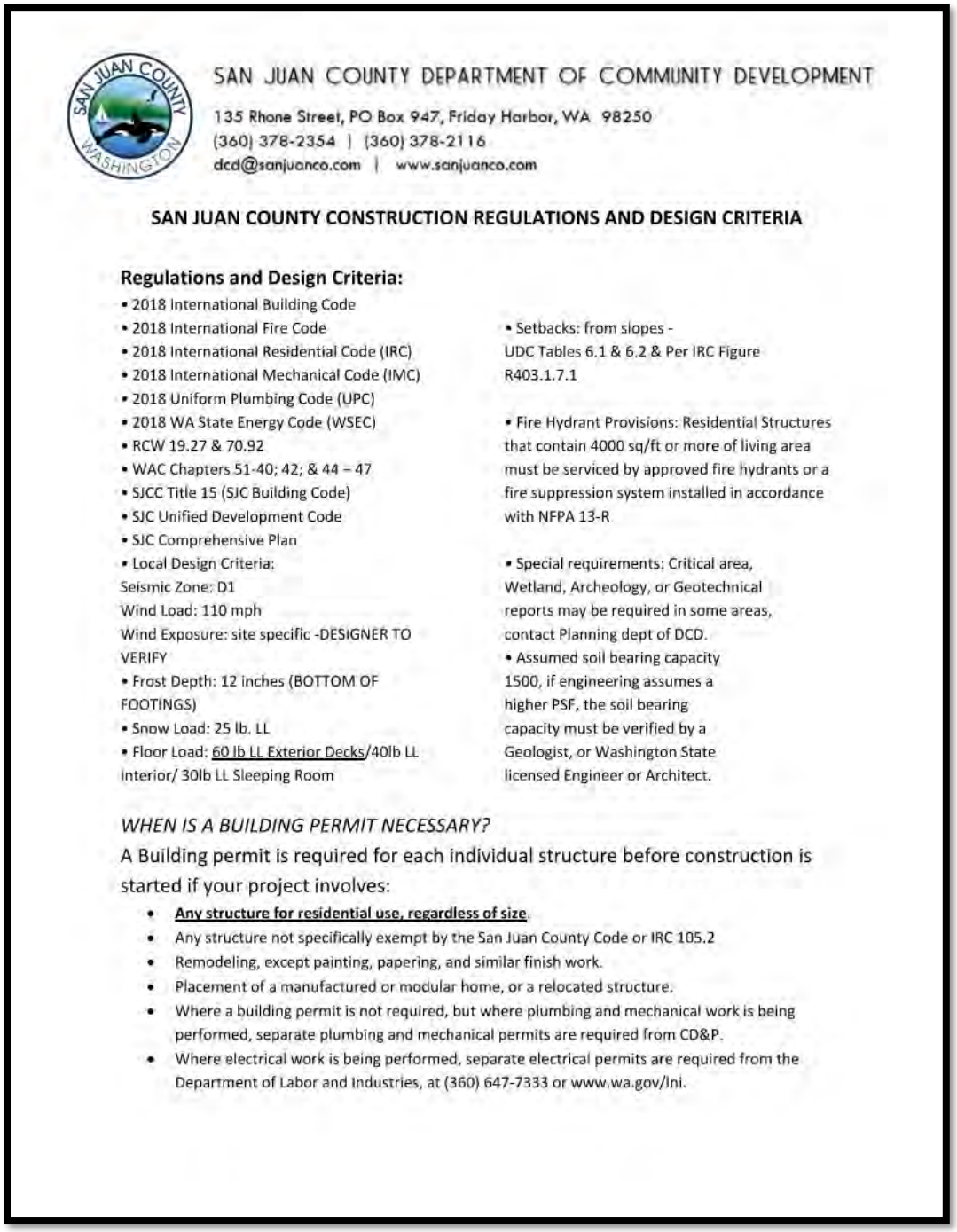
COOLING TEMPERATURE DIFFERENCE	WIND VELOCITY HEATING	WIND VELOCITY COOLING	COINCIDENT WET BULB	DAILY RANGE	WINTER HUMIDITY	SUMMER HUMIDITY
—	15	7.5	61	L	—	—

Figure 3: Island County 2018 Table 301.2(1) Climatic and Geographic Design Criteria – URL: https://www.islandcountywa.gov/547/Building-Codes

Figure notes:

1. Design criteria shown above is for the 2018 IBC and ASCE 7-16. Some design criteria may be updated under the 2021 IBC. PSE recommends contacting the local Building Department for more information.
2. Wind loads generated per the 2021 IBC and ASCE 7-16 are based on the basic wind speed. Ultimate wind speed as listed above is applicable to the 2021 International Residential Code (IRC). Subject design is based on the 2021 IBC/ASCE 7-16 design criteria and loads.

San Juan Island County



SAN JUAN COUNTY DEPARTMENT OF COMMUNITY DEVELOPMENT

135 Rhone Street, PO Box 947, Friday Harbor, WA 98250
(360) 378-2354 | (360) 378-2116
dcd@sanjuanco.com | www.sanjuanco.com

SAN JUAN COUNTY CONSTRUCTION REGULATIONS AND DESIGN CRITERIA

Regulations and Design Criteria:

- 2018 International Building Code
- 2018 International Fire Code
- 2018 International Residential Code (IRC)
- 2018 International Mechanical Code (IMC)
- 2018 Uniform Plumbing Code (UPC)
- 2018 WA State Energy Code (WSEC)
- RCW 19.27 & 70.92
- WAC Chapters 51-40; 42; & 44 – 47
- SJCC Title 15 (SJC Building Code)
- SJC Unified Development Code
- SJC Comprehensive Plan
- Local Design Criteria:

Seismic Zone: D1
Wind Load: 110 mph
Wind Exposure: site specific -DESIGNER TO VERIFY

- Frost Depth: 12 inches (BOTTOM OF FOOTINGS)
- Snow Load: 25 lb. LL
- Floor Load: 60 lb LL Exterior Decks/40lb LL Interior/ 30lb LL Sleeping Room
- Setbacks: from slopes - UDC Tables 6.1 & 6.2 & Per IRC Figure R403.1.7.1
- Fire Hydrant Provisions: Residential Structures that contain 4000 sq/ft or more of living area must be serviced by approved fire hydrants or a fire suppression system installed in accordance with NFPA 13-R
- Special requirements: Critical area, Wetland, Archeology, or Geotechnical reports may be required in some areas, contact Planning dept of DCD.
- Assumed soil bearing capacity 1500, if engineering assumes a higher PSF, the soil bearing capacity must be verified by a Geologist, or Washington State licensed Engineer or Architect.

WHEN IS A BUILDING PERMIT NECESSARY?

A Building permit is required for each individual structure before construction is started if your project involves:

- **Any structure for residential use, regardless of size**.
- Any structure not specifically exempt by the San Juan County Code or IRC 105.2
- Remodeling, except painting, papering, and similar finish work.
- Placement of a manufactured or modular home, or a relocated structure.
- Where a building permit is not required, but where plumbing and mechanical work is being performed, separate plumbing and mechanical permits are required from CD&P.
- Where electrical work is being performed, separate electrical permits are required from the Department of Labor and Industries, at (360) 647-7333 or www.wa.gov/lni.

Figure 4: San Juan County Construction Regulations and Design Criteria - URL: https://www.sanjuancountywa.gov/DocumentCenter/View/11661/Construction-Regulations--Local-Design-Criteria---PDF?bidId=

Figure note: Wind loads generated per the 2021 IBC and ASCE 7-16 are based on the basic wind speed. Ultimate wind speed as listed above is applicable to the 2018 International Residential Code (IRC). Subject design is based on the 2021 IBC/ASCE 7-16 design criteria and loads.

Appendix B – ASCE 7-16 Design Criteria Excerpts

Wind Speed Map

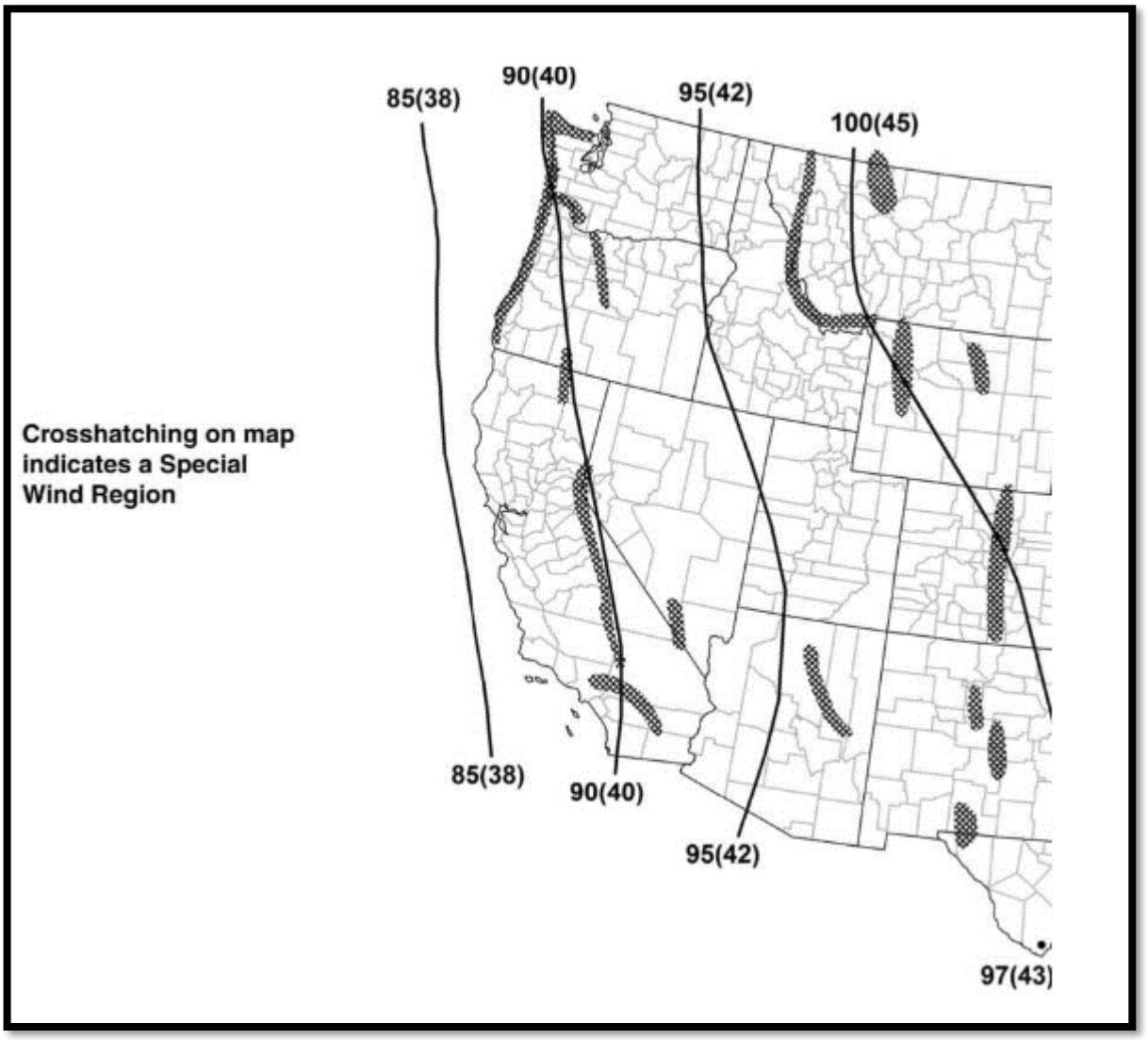


Figure 5: Basic Wind Speed Map for Risk Category I Buildings and Other Structures, Excerpt from Figure 26.5-1A of ASCE 7-16.

Ground Snow Loads

Table 1: Ground Snow Loads for Selected Locations in Washington, Excerpt from Table 7.2-5 of ASCE 7-16.

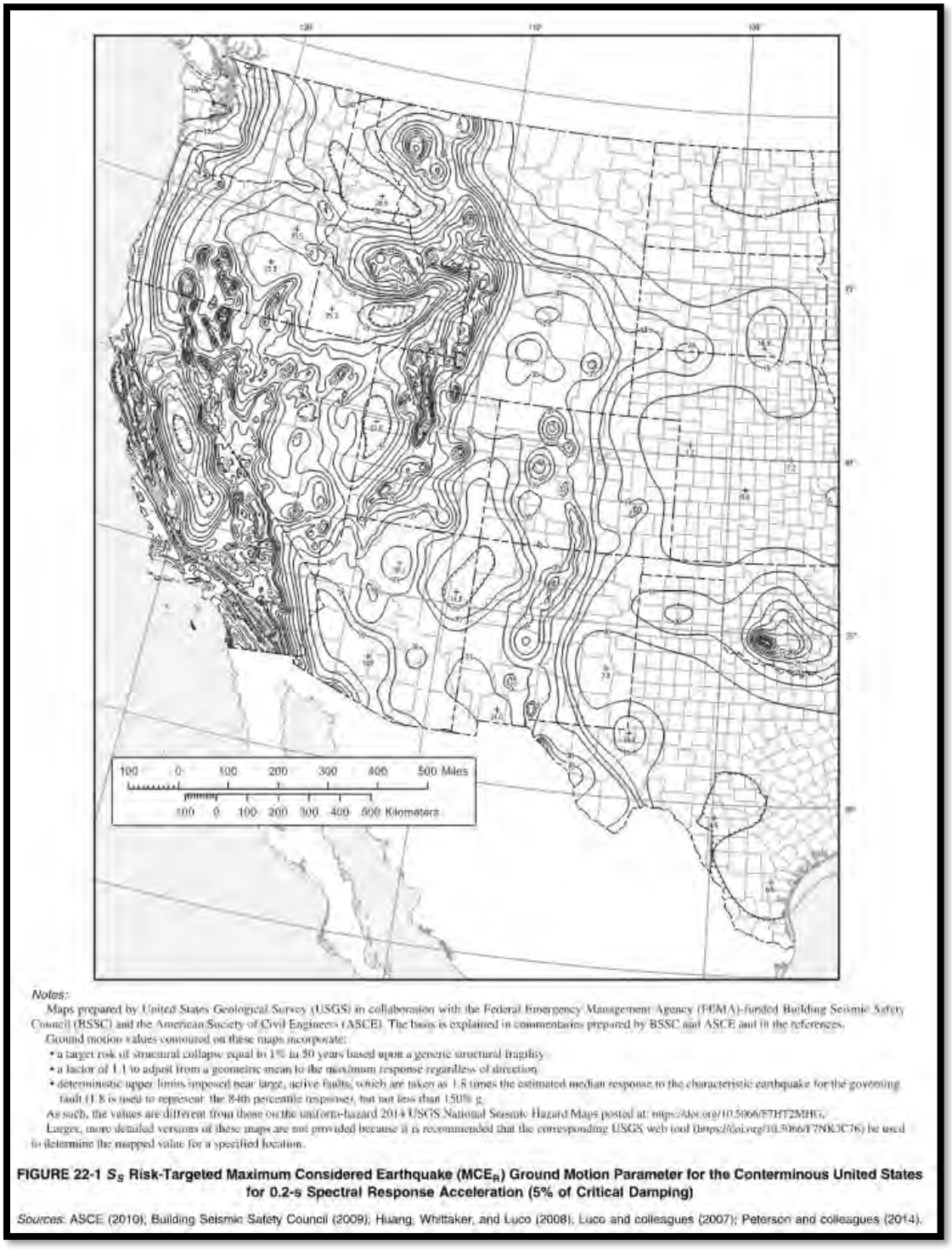
Table 7.2-5 Ground Snow Loads for Selected Locations in Washington

City/Town	County	Ground Snow Load (lb/ft^2)	Elevation (ft)
Arlington	Snohomish	17	120
Auburn	King	20	85
Bainbridge Island	Kitsap	15	100
Bellevue	King	20	100
Bellingham	Watcom	15	100
Bonney Lake	Pierce	18	40
Bothell	King	20	90
Bremerton	Kitsap	15	100
Burien	King	16	325
Covington	King	20	85
Crystal Mt.	Pierce	438	4,380
Des Moines	King	18	370
Edmonds	Snohomish	20	350
Ellensburg	Kittitas	34	1,540
Everett	Snohomish	15	110
Federal Way	King	20	85
Issaquah	King	20	100
Kenmore	King	20	90
Kennewick	Benton	15	400
Kent	King	20	50
Kirkland	King	20	180
Lacey	Thurston	15	200
Lake Stevens	Snohomish	15	250
Lakewood	Pierce	15	235
Longview	Cowlitz	18	21
Lynnwood	Snohomish	22	435
Maple Valley	King	23	440
Marysville	Snohomish	16	20
Mercer Island	King	16	320
Mt. Baker	Whatcom	588	4,200
Mt. Spokane	Spokane	151	5,800
Mt. Vernon	Skagit	15	180
Oak Harbor	Island	17	120
Olympia	Thurston	15	130
Pasco	Franklin	15	383
Pullman	Whitman	30	2,400
Puyallup	Pierce	18	40
Redmond	King	20	120
Renton	King	20	15
Richland	Benton	15	359
Sammamish	King	28	520
SeaTac	King	22	440
Seattle	King	20	350
Shoreline	King	22	450
Snoqualmie Pass	Kittitas	433	3,000
Spokane	Spokane	39	2,000
Spokane Valley	Spokane	39	2,000
Stevens Pass	Chelan	400	4,060
Tacoma	Pierce	21	380
Tukwila	King	16	325
Univ. Place	Pierce	20	400
Vancouver	Clark	20	150
Walla Walla	Walla Walla	18	1,000
Wenatchee	Chelan	22	780
White Pass	Yakima	244	4,720
Yakima	Yakima	19	1,066

Note: To convert lb/ft^2 to kN/m^2, multiply by 0.0479. To convert feet to meters, multiply by 0.3048.

1. Statutory requirements of the Authority Having Jurisdiction are not included in this state ground snow load table.
2. For locations where there is substantial change in altitude over the jurisdiction, the load applies at and below the cited elevation, with a tolerance of 100 ft (30 m).
3. For other locations in Washington, see Structural Engineers Association of Washington (1995). "Snow Load Analysis for Washington," Seattle, WA, www.seaw.org, for ground snow load values.

Seismic Ground Motions



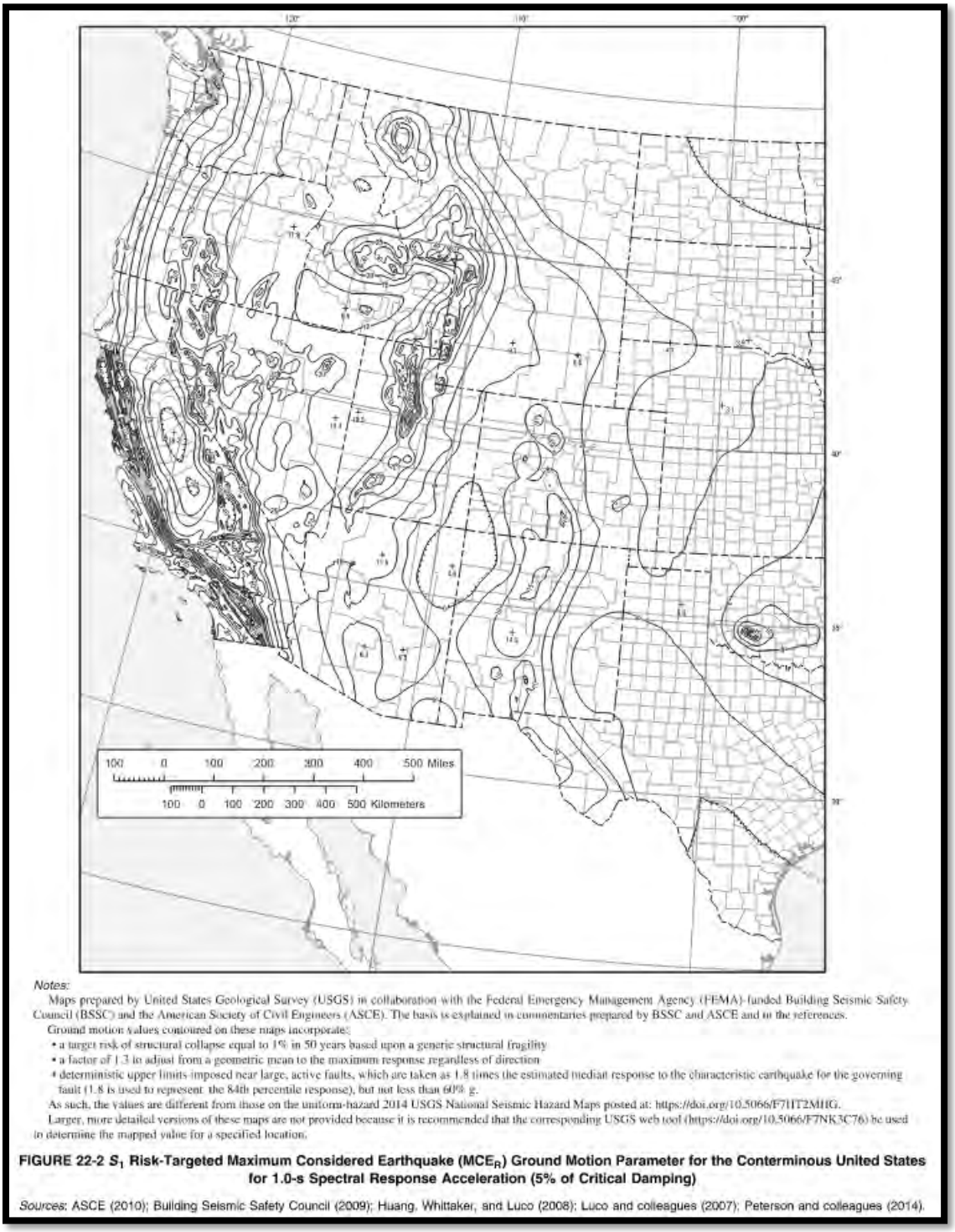
Notes:
Maps prepared by United States Geological Survey (USGS) in collaboration with the Federal Emergency Management Agency (FEMA)-funded Building Seismic Safety Council (BSSC) and the American Society of Civil Engineers (ASCE). The basis is explained in commentaries prepared by BSSC and ASCE and in the references.
Ground motion values contoured on these maps incorporate:
- a target risk of structural collapse equal to 1% in 50 years based upon a generic structural fragility
- a factor of 1.1 to adjust from a geometric mean to the maximum response regardless of direction
- deterministic upper limits imposed near large, active faults, which are taken as 1.8 times the estimated median response to the characteristic earthquake for the governing fault (1.8 is used to represent the 84th percentile response), but not less than 150% g.

As such, the values are different from those on the uniform-hazard 2014 USGS National Seismic Hazard Maps posted at: https://doi.org/10.5066/F7HT2MHG.
Larger, more detailed versions of these maps are not provided because it is recommended that the corresponding USGS web tool (https://doi.org/10.5066/F7NK3C76) be used to determine the mapped value for a specified location.

FIGURE 22-1 S_S Risk-Targeted Maximum Considered Earthquake (MCE_R) Ground Motion Parameter for the Conterminous United States for 0.2-s Spectral Response Acceleration (5% of Critical Damping)

Sources: ASCE (2010); Building Seismic Safety Council (2009); Huang, Whittaker, and Luco (2008); Luco and colleagues (2007); Peterson and colleagues (2014).

Figure 6: S_S Risk Targeted Maximum Considered Earthquake (MCE_R) Ground Motion Parameter from the Conterminous United States for 0.2-s Spectral Response Acceleration (5% of Critical Damping), Excerpt from Figure 22-1 of ASCE 7-16



Notes:

Maps prepared by United States Geological Survey (USGS) in collaboration with the Federal Emergency Management Agency (FEMA)-funded Building Seismic Safety Council (BSSC) and the American Society of Civil Engineers (ASCE). The basis is explained in commentaries prepared by BSSC and ASCE and in the references.

Ground motion values contoured on these maps incorporate:

- a target risk of structural collapse equal to 1% in 50 years based upon a generic structural fragility
- a factor of 1.3 to adjust from a geometric mean to the maximum response regardless of direction
- deterministic upper limits imposed near large, active faults, which are taken as 1.8 times the estimated median response to the characteristic earthquake for the governing fault (1.8 is used to represent the 84th percentile response), but not less than 60% g.

As such, the values are different from those on the uniform-hazard 2014 USGS National Seismic Hazard Maps posted at: https://doi.org/10.5066/F7HT2MHG.

Larger, more detailed versions of these maps are not provided because it is recommended that the corresponding USGS web tool (https://doi.org/10.5066/F7NK3C76) be used to determine the mapped value for a specified location.

FIGURE 22-2 S_1 Risk-Targeted Maximum Considered Earthquake (MCE_R) Ground Motion Parameter for the Conterminous United States for 1.0-s Spectral Response Acceleration (5% of Critical Damping)

Sources: ASCE (2010); Building Seismic Safety Council (2009); Huang, Whittaker, and Luco (2008); Luco and colleagues (2007); Peterson and colleagues (2014).

Figure 7: S_1 Risk-Targeted Maximum Considered Earthquake (MCE_R) Ground Motion Parameters for the Conterminous United States for 1.0-s Spectral Response Acceleration (5% of Critical Damping), Excerpt from Figure 22-2 of ASCE 7-16.

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Structural Design Calculations

Stock Agricultural WSF
Whatcom County, Skagit County, Whidbey Island, and San Juan Island, WA

Client Information
Emmett Wild
Skagit Conservation District
2021 E. College Way Suite 203
Mount Vernon, WA 98273
(360) 899-8761

Project Site
Whatcom County
Skagit County
Whidbey Island
San Juan Island

Prepared By
Peterson Structural Engineers
February 9, 2024
Project No. 2302-0069

Endorsement

Scope

To provide structural calculations for a stock structure standard design waste storage facility (WSF) to be implemented at various locations within Whatcom County, Skagit County, Whidbey Island, and San Juan Island, WA. Elements under review include the foundation, retaining walls, and roof framing. Any other elements not specifically referenced in these calculations are outside the purview of these calculations and are designed by others.

References

1. 2021 International Building Code with Washington Amendments (IBC)
2. United States Department of Agriculture National Resources Conservation Service, Conservation Practice Standard (NRCS CPS)
3. United States Department of Agriculture National Resource Conservation Service, National Engineering Manual with Washington State Supplements (NRCS NEM)
4. ASCE/SEI 7-16, Minimum Design Loads for Buildings and Other Structures, American Society of Civil Engineers (ASCE)
5. 2019 Building Code Requirements for Structural Concrete, ACI 318-19, and Commentary (ACI)
6. 2018 National Design Specification for Wood Construction, ANSI/AWC (NDS)
7. 2015 Special Design Provisions for Wind and Seismic ANSI/AWC (SDPWS)
8. ATC Hazards Website, https://hazards.atcouncil.org/, (ATC)
9. Design Criteria as Provided by Whatcom County, Skagit County, Whidbey Island, and San Juan Island.

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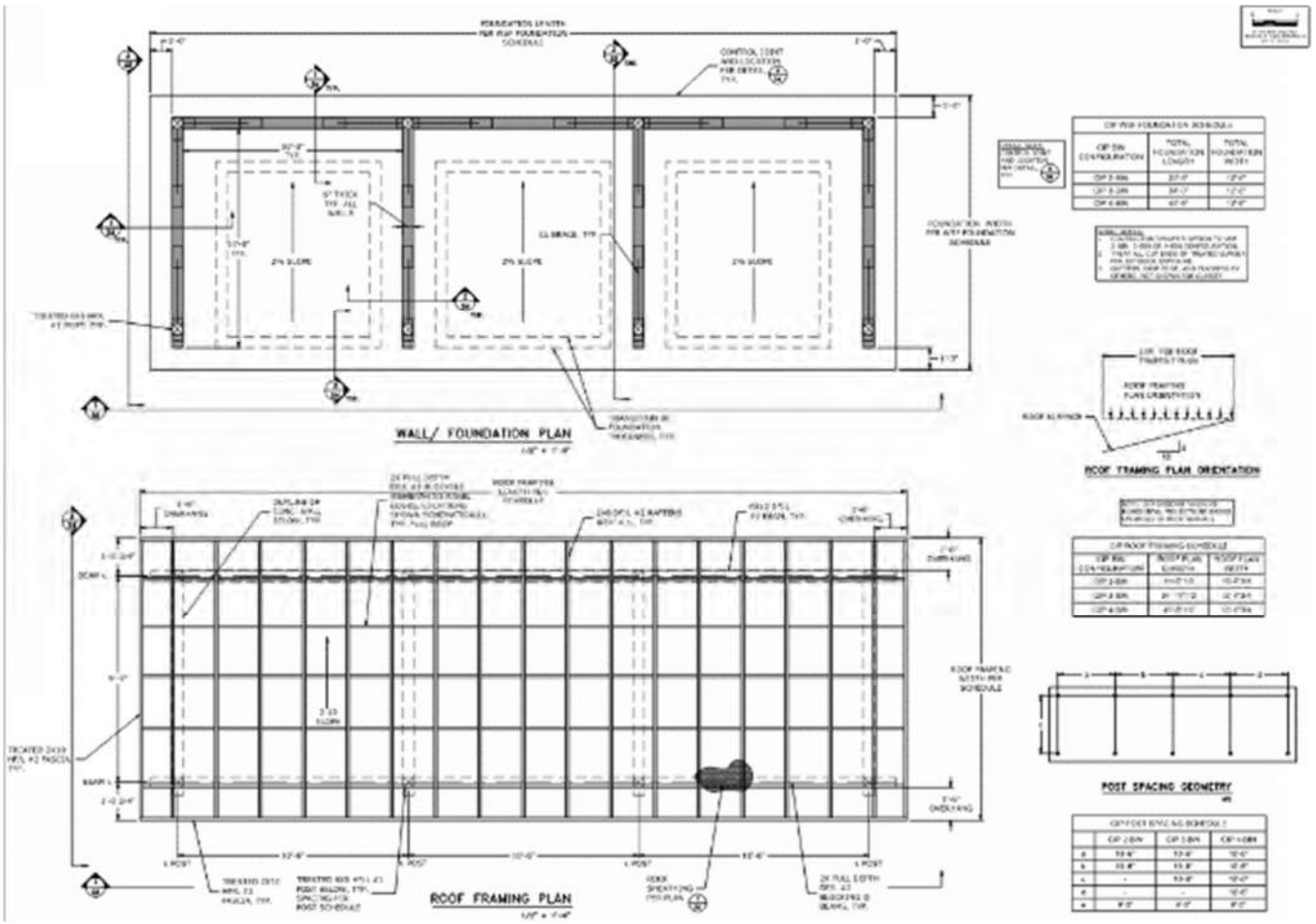
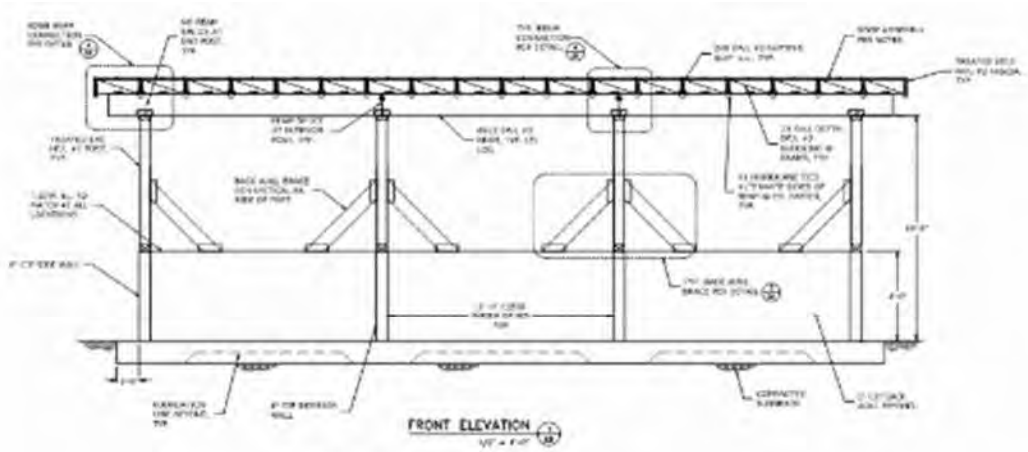
Drawings


WALL/ FOUNDATION PLAN
ROOF FRAMING PLAN
ROOF FRAMING PLAN ORIENTATION
POST SPACING GEOMETRY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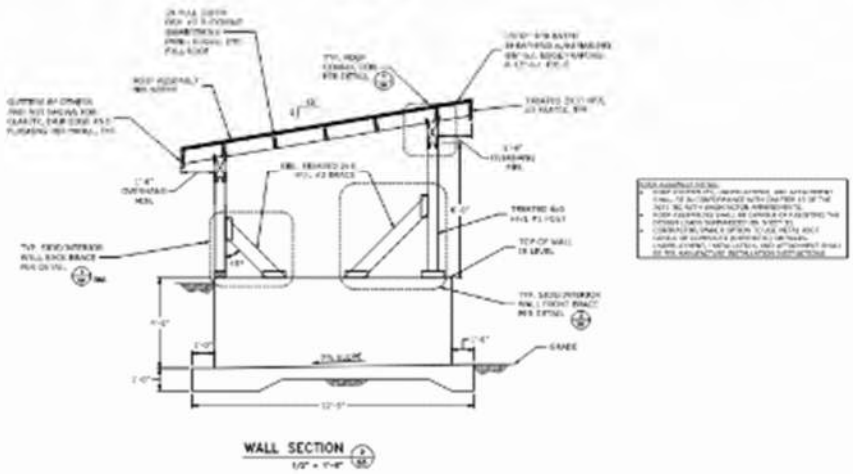
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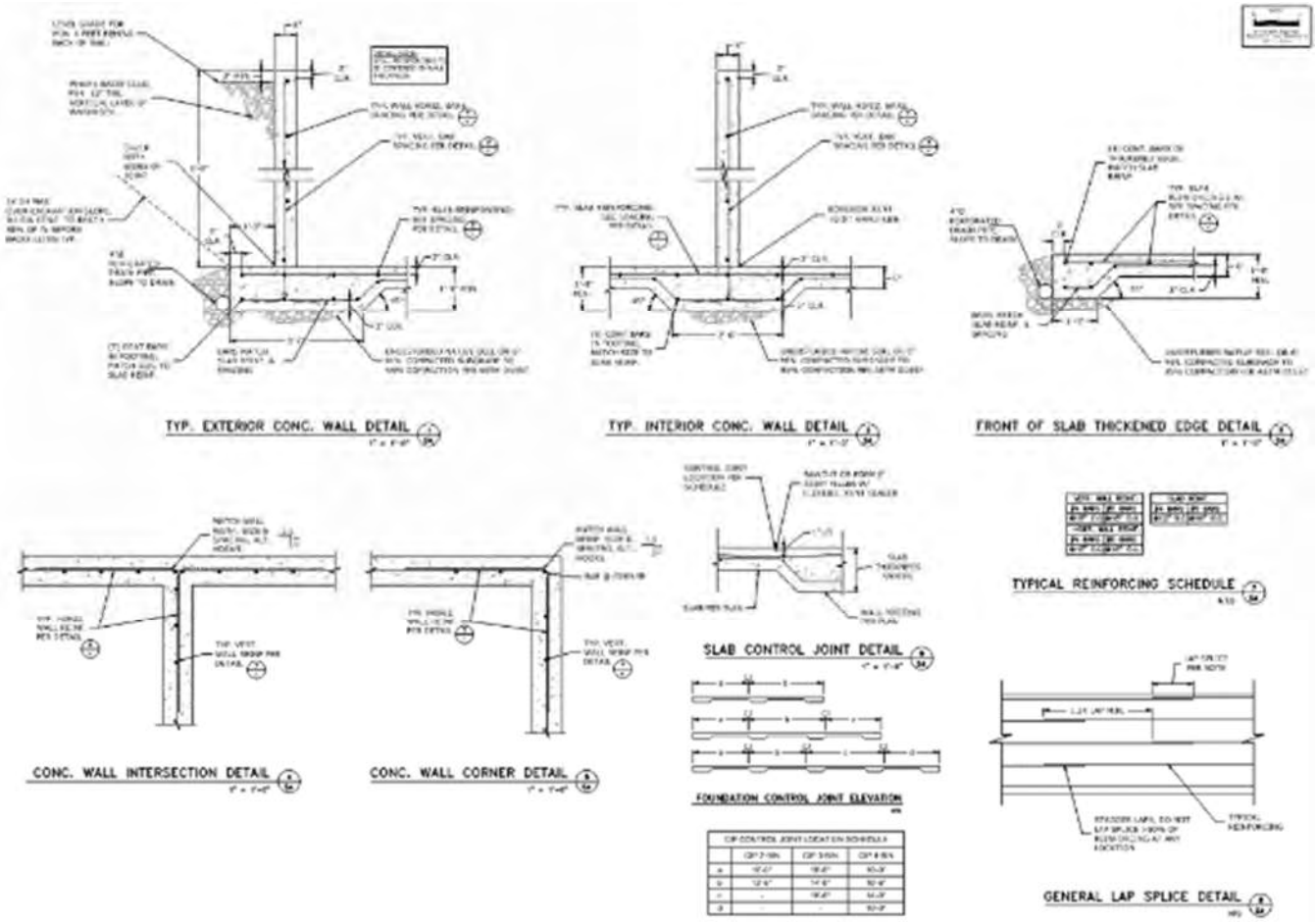
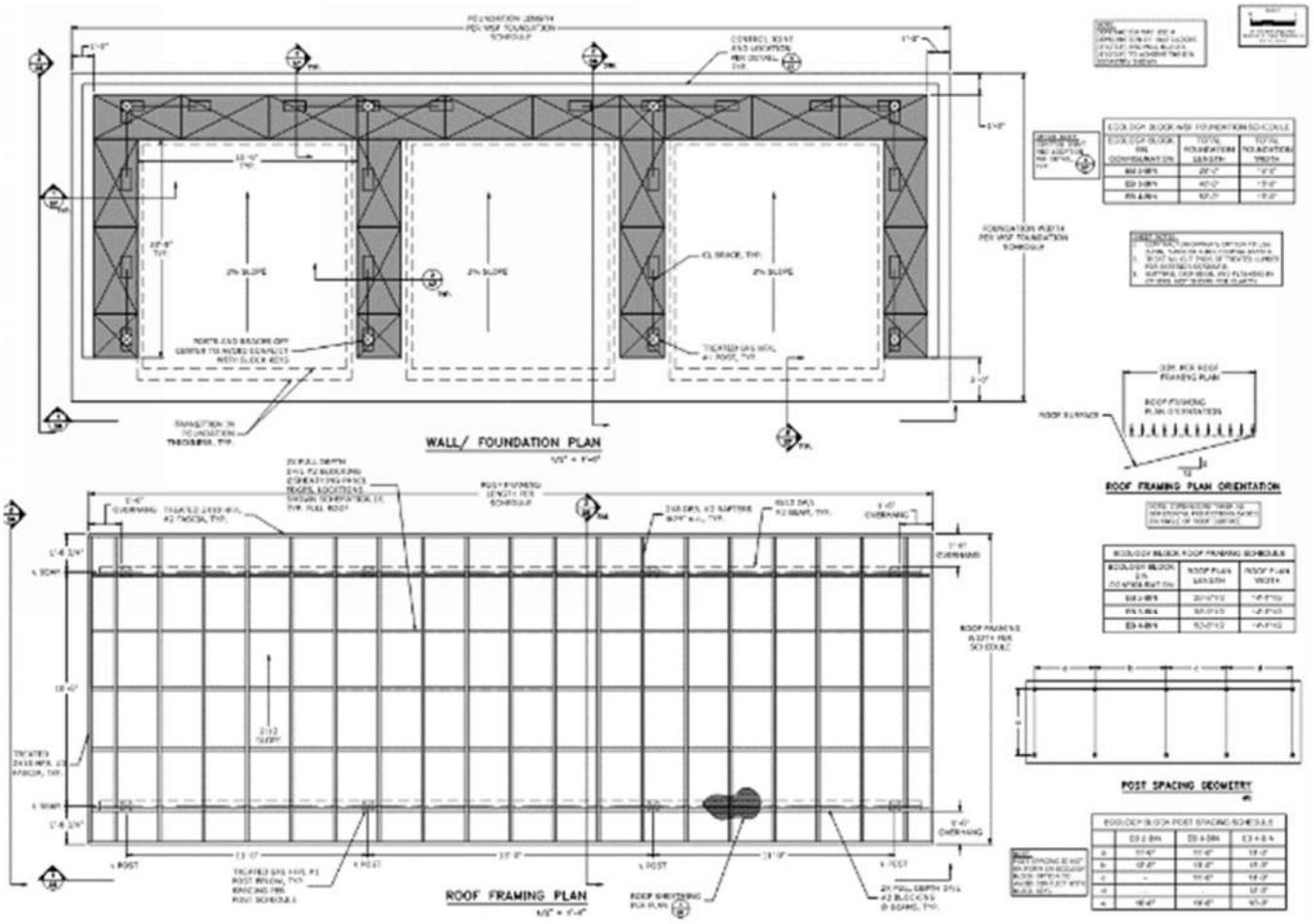
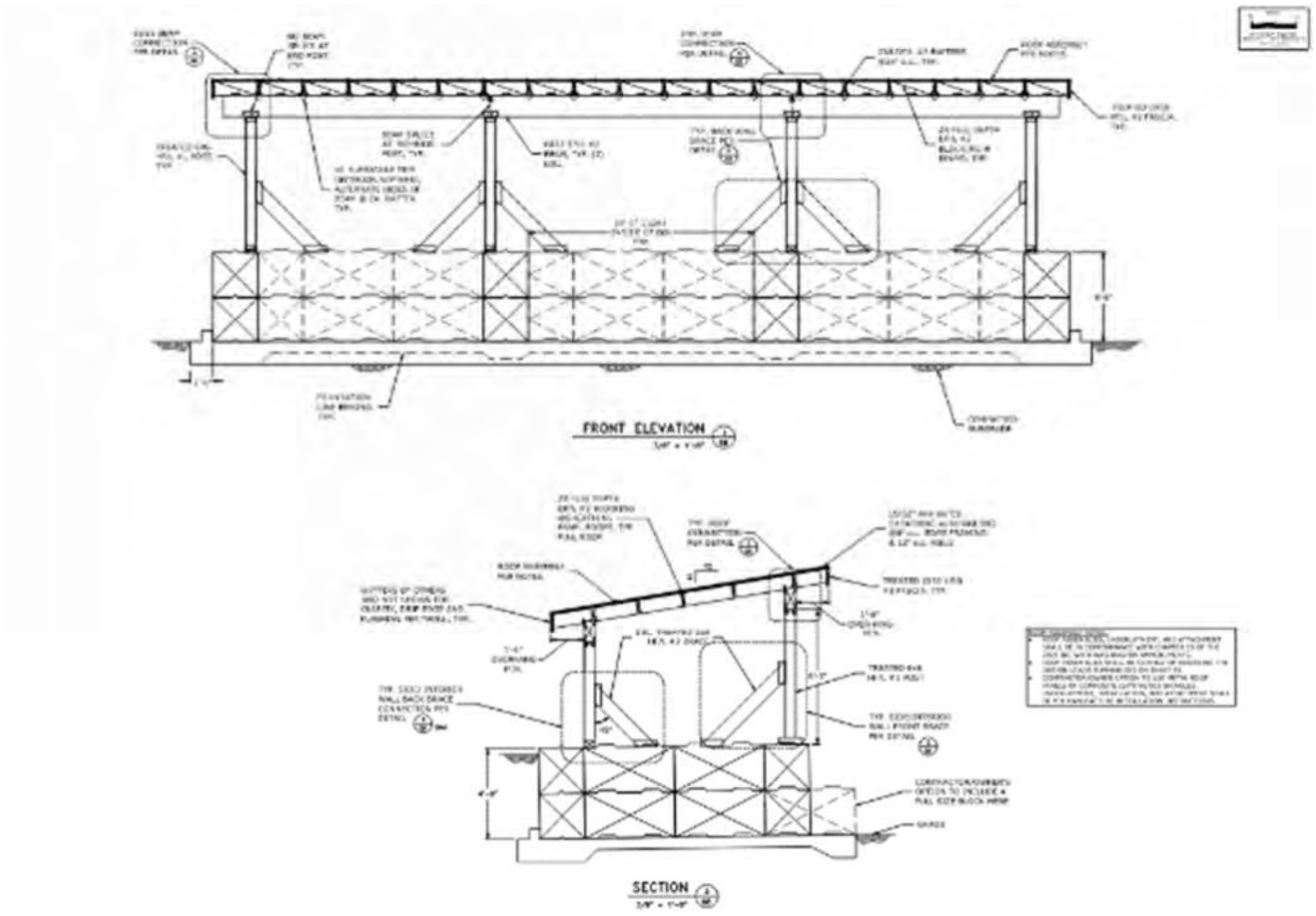
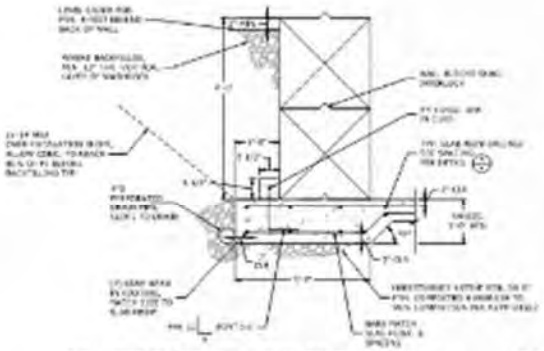

TYP. EXTERIOR CONC. WALL DETAIL
TYP. INTERIOR CONC. WALL DETAIL
FRONT OF SLAB THICKENED EDGE DETAIL
TYPICAL REINFORCING SCHEDULE
SLAB CONTROL JOINT DETAIL
FOUNDATION CONTROL JOINT ELEVATION
CONC. WALL INTERSECTION DETAIL
CONC. WALL CORNER DETAIL
GENERAL LAP SPLICE DETAIL


WALL/ FOUNDATION PLAN
ROOF FRAMING PLAN
ROOF FRAMING PLAN ORIENTATION
POST SPACING GEOMETRY


FRONT ELEVATION
SECTION



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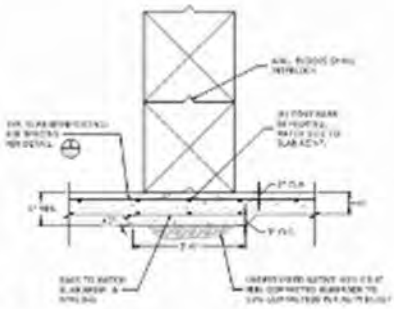

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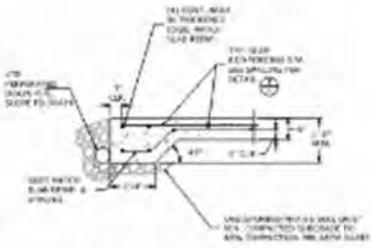
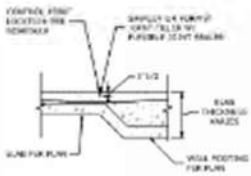


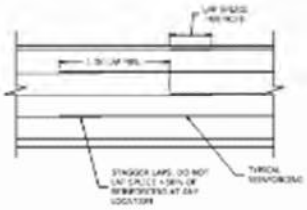
FRONT OF SLAB THICKENED EDGE DETAIL



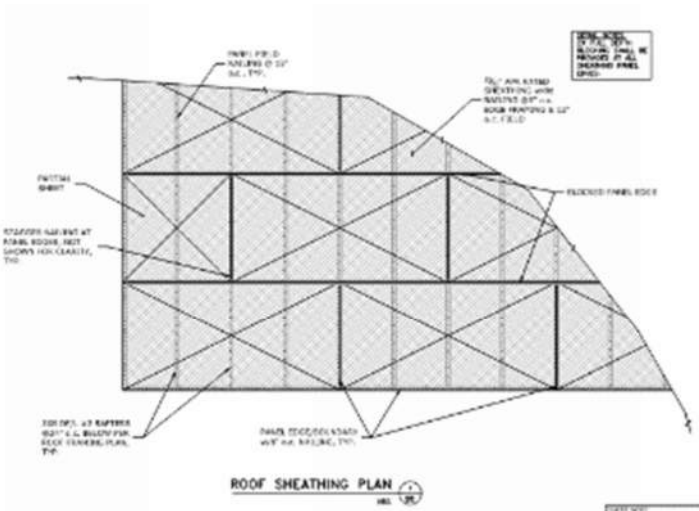
SLAB CONTROL JOINT DETAIL

FOUNDATION CONTROL JOINT ELEVATION

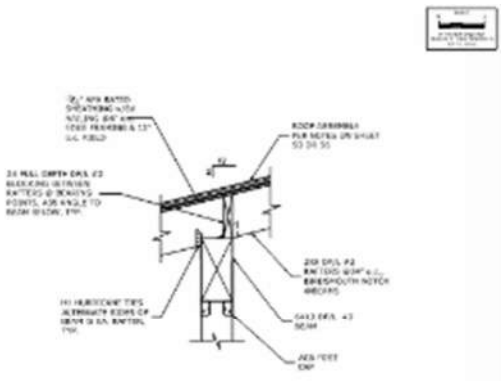
TYPICAL REINFORCING SCHEDULE



GENERAL LAP SPLICE DETAIL



ROOF SHEATHING PLAN



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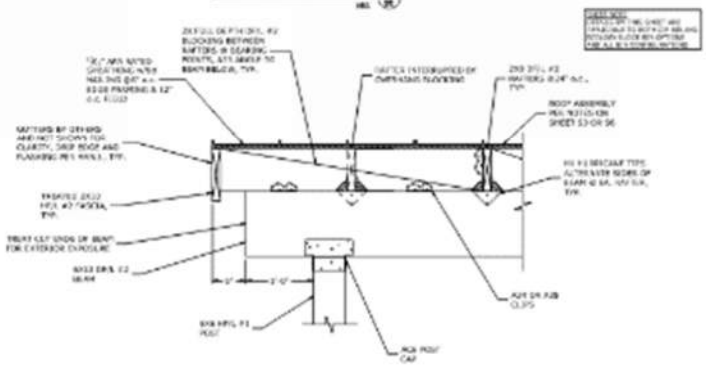

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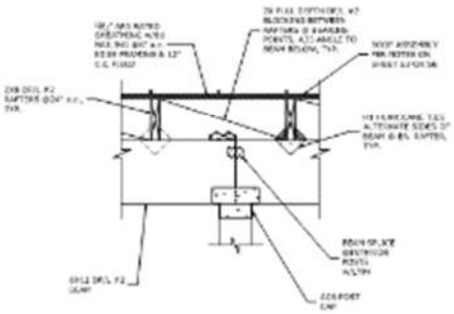
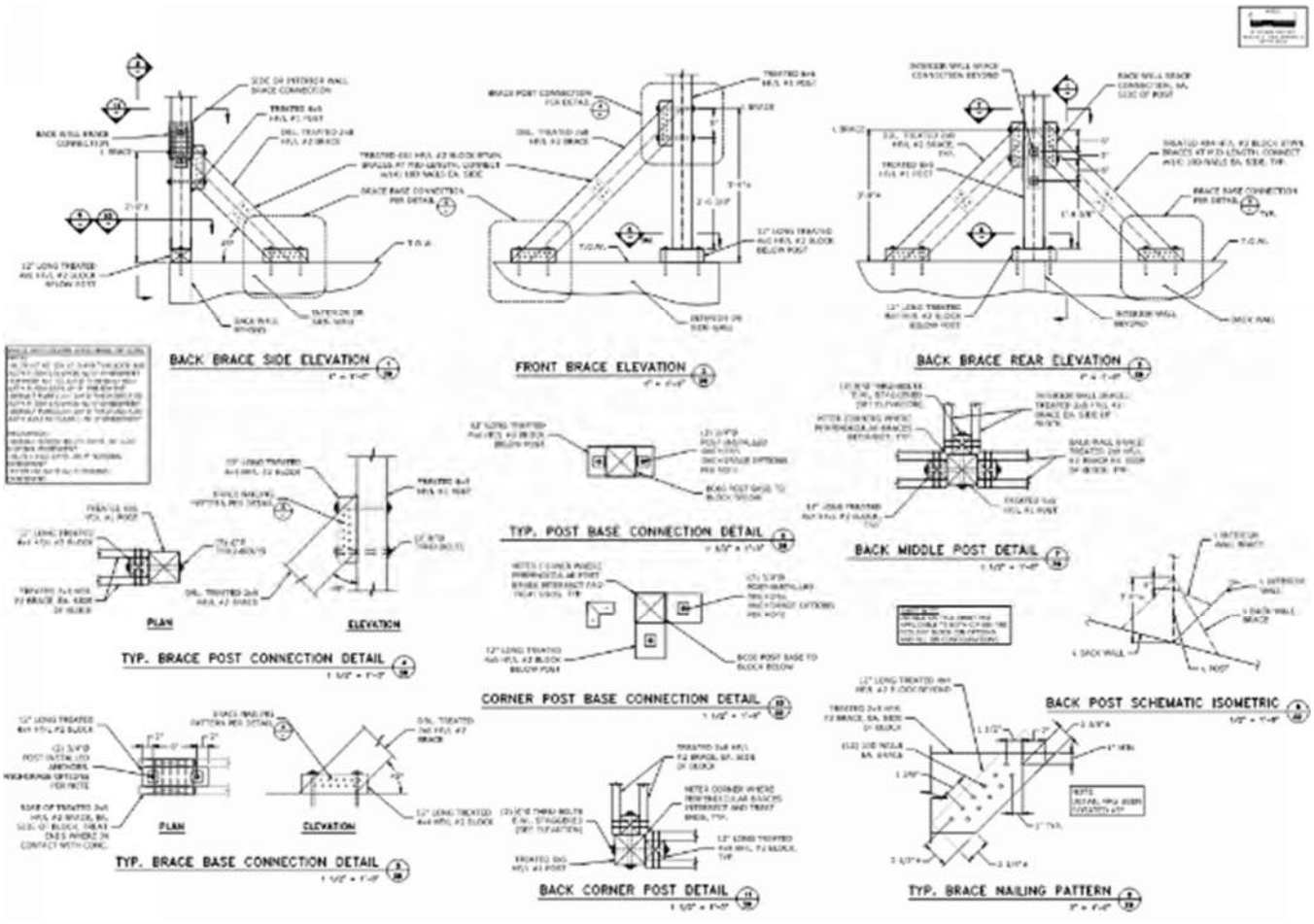


INTERIOR POST-BEAM CONNECTION



Note: sketches are schematic.

Design Criteria

Risk Category I

Importance Factors — Per ASCE 7-16, Table 1.5-2

Snow, $I_S = 0.8$

Seismic, $I_E = 1.00$

Geometry

Retaining Wall Height = 4’-0”

Eave Height = 10’-0” max (6’-0” above top of retaining wall)

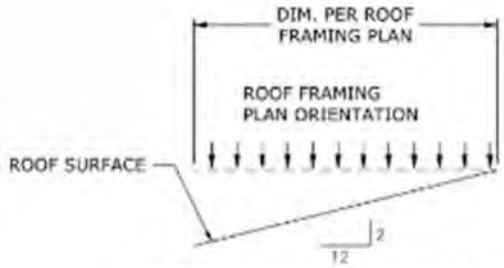
Foundation:

CIP WSF FOUNDATION SCHEDULE		
CIP BIN CONFIGURATION	TOTAL FOUNDATION LENGTH	TOTAL FOUNDATION WIDTH
CIP 2-BIN	23'-6"	12'-6"
CIP 3-BIN	34'-0"	12'-6"
CIP 4-BIN	44'-6"	12'-6"

ECOLOGY BLOCK WSF FOUNDATION SCHEDULE		
ECOLOGY BLOCK BIN CONFIGURATION	TOTAL FOUNDATION LENGTH	TOTAL FOUNDATION WIDTH
EB 2-BIN	28'-0"	15'-0"
EB 3-BIN	40'-0"	15'-0"
EB 4-BIN	52'-0"	15'-0"

Roof Framing:

Note: Roof dimensions taken as horizontal projections based on angle of roof surface



ROOF FRAMING PLAN ORIENTATION

CIP ROOF FRAMING SCHEDULE		
CIP BIN CONFIGURATION	ROOF PLAN LENGTH	ROOF PLAN WIDTH
CIP 2-BIN	24'-5"1/2	12'-7"3/4
CIP 3-BIN	34'-11"1/2	12'-7"3/4
CIP 4-BIN	45'-5"1/2	12'-7"3/4

ECOLOGY BLOCK ROOF FRAMING SCHEDULE		
ECOLOGY BLOCK BIN CONFIGURATION	ROOF PLAN LENGTH	ROOF PLAN WIDTH
EB 2-BIN	26'-5"1/2	14'-1"1/2
EB 3-BIN	38'-5"1/2	14'-1"1/2
EB 4-BIN	50'-5"1/2	14'-1"1/2

Deflection Criteria

Deflection criteria is per IBC Table 1604.3. The most stringent deflection between the span ratio and total deflection shown below shall be used.

	L or L_r	**S & W**	**D + L**
Roof Members	L/360 in	L/360 in	L/240 in

Gravity Loading

Dead Load

Roof Dead Load;	q_{DLr} = 12 psf;	
Exterior Conc. Wall Dead Load;	q_{DLew} = 100 psf;	Concrete wall in elevation
Partition Wall Dead load;	q_{DLpw} = 100 psf;	Concrete wall in elevation

See Soil Design Values for stored waste loads.

Live Load

Roof Live Load (area);	q_{LLr} = 20 psf;	per IBC Table 1607.1
Roof Live Load (concentrated);	P_{LLr} = 300 lb;	per IBC Table 1607.1
Floor Vehicle Live Load (area);	q_{LLf} = 250 psf;	per IBC Table 1607.1
Floor Vehicle Live Load (concentrated);	P_{LLr} = 8,000 lb;	per IBC Table 1607.1

Backfill Surcharge Load → See retaining wall design

Snow Load

Snow Importance Factor;	I_s = 0.8;	per ASCE Table 1.5-2
Snow Exposure Factor;	C_e = 1.1; cat. C, sheltered	conservative per ASCE Table 7.3-1
Snow Thermal Factor;	C_t = 1.20; unheated	per ASCE Table 7.3-2
Snow Slope Factor;	C_{sl} = 1.0;	per ASCE 7.4.1 – 7.4.4, & Figure 7.4-1
Minimum Roof Snow Load;	P_{min} = (25 psf) × I_s = 20 psf;	per ASCE Section 7.3.4
Ground Snow Load;	p_g = 40.0 psf;	maximum in considered regions
Balanced Snow Load;	p_B = 29.6psf;	See following page for balanced snow loads.

ASCE 7-16 Chapter 7 - SNOW LOADS

FLAT ROOF SNOW LOAD

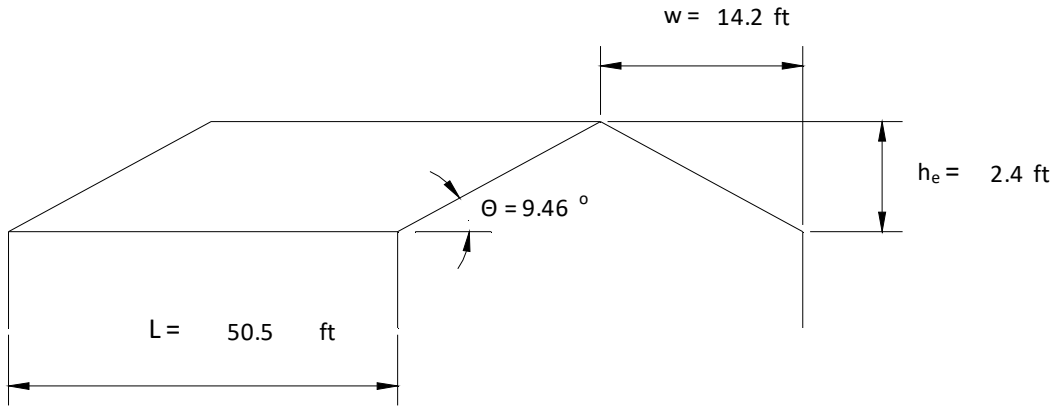
Flat-roof snow load, p_f =	$0.7C_eC_tI_sp_g$		Eq. 7.3-1
Exposure factor, C_e =	1.10		Table 7.3-1
Thermal factor, C_t =	1.20		Table 7.3-2
Flat-roof snow load, p_f =	29.57	psf	
Min p_f (ASCE 7) =	16.00	psf	
Calculated p_f =	29.57	psf	

SLOPE ROOF SNOW LOAD

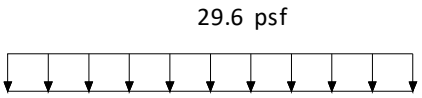
p_s =	C_sp_f		Eq. 7.4-1
Design p_f =	29.57	psf	
Slope Θ =	9.46	°	
C_t =	1.20		
Slope factor C_s =	1.00		7.4-1, 7.4.2, 7.4.3 Figure 7-2a, 7-2b and 7-2c
Calculated p_s =	29.57	psf	
p_{sBD} =	25.00	psf	Building Dept. Minimum

PARTIAL LOADING
UNBALANCED SNOW LOADS

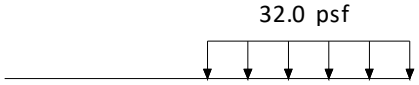
Balanced and Unbalanced Snow Load for Hip and Gable Roof (Fig. 7-5)



BALANCED



UNBALANCED W ≤ 20 ft



Note: Per ASCE 7-16 Section 12.7.2, snow loads do not need to be included in the effective seismic weight since flat roof snow loads < 30psf.

Note: Structure geometry is shown for 1 example configuration. Snow loads are the same for the other design configurations included as well.

Soil Design Values (Assumed)

Backfill Soil Active Lateral Pressure;	γ_{ab} = 45 psf/ft;	per IBC Table 1610.1, NRCS CPS Code 313
Infill Waste Active Lateral Pressure;	γ_{ai} = 60 psf/ft;	Conservative, accounts for stored waste

Coefficient of Sliding Friction; μ_s = 0.35;
per IBC Table 1806.2, NRCS CPS Code 313, Assumes GW/GP prepped subgrade

Allowable Soil Bearing; $P_{b,a}$ = 1,500 psf; per IBC Table 1806.2, NRCS CPS Code 313

Wind Loading

Wind Exposure C		
Basic Wind Speed;	V = 100; mph	Per ASCE 7
Topographic Factor,	K_{zt} = 1.5;	Conservative
Ground Elevation;	0ft	Conservative
Component and Cladding Trib. Area;	Typical: 9ft^2	Conservative
	Roof Beams: 31.5ft^2	Controlling trib. area

See following pages for wind load generation.

Roof Loads

Main Wind Force Resisting System (MWFRS) Loading

MWFRS is defined as an assembly of structural elements assigned to provide support and stability to the overall system.

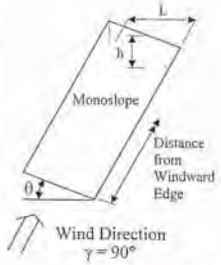
ASCE 7-16 Chapter 27: Wind Forces on Monoslope Free Roofs - Directional Method

Per ASCE 7-16 §27.3.2

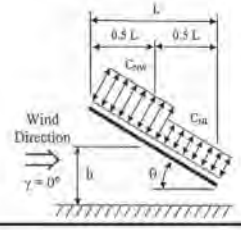
Risk Category	I		
Basic wind speed (3 sec gust), V =	100	MPH	OK
Exposure	C		
Roof Angle, θ =	9.46	°	OK
Mean Roof Height, h =	10.9	ft	
Horizontal Dimension of Roof, L=	14.2	ft	
h/L=	0.91		OK
Exposure Coefficient, K_z =	0.85		Section 26.10.1
Topographic Factor, K_{zt} =	1.50		Section 26.8.2
Wind Directionality Factor, K_d =	0.85		Section 26.6
Ground Elevation Factor, K_e =	1.00		Section 26.9
Velocity Pressure, q_h =	27.74	psf	$0.00256K_zK_{zt}K_dK_eV^2$ (Eqn. 26.10-1)
Gust-Effect Factor, G =	0.85		Section 26.11
Net Design Pressure, P_N =	q_hGC_N		Eqn. 27.3-2

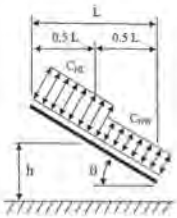
Net Pressure Coefficients, C_N for γ = 90°

Horz. Distance from Windward Edge	Load Case	Clear Wind Flow		Obstr. Wind Flow	
		C_N	P_N (psf)	C_N	P_N (psf)
<h	A	-0.8	-18.9	-1.2	-28.3
	B	0.8	18.9	0.5	11.8
>h, ≤2h	A	-0.6	-14.1	-0.9	-21.2
	B	0.5	11.8	0.5	11.8
>2h	A	-0.3	-7.1	-0.6	-14.1
	B	0.3	7.1	0.3	7.1



Note: For monoslope roofs with θ less than 5°, C_N values shown apply for cases where γ=0° and 0.05≤ h/L ≤ 0.25. See Fig 27.3-4 for other h/L values.





Wind Direction
γ = 180°

Notation

L = Horizontal dimension of roof, measured in the along-wind direction, ft.
h = Mean roof height, ft.
γ = Direction of wind, degrees.
θ = Angle of plane of roof from horizontal, degrees.

Net Pressure Coefficients, C_N

Roof Angle (Deg.)	Load Case	Wind Direction, γ = 0°				Wind Direction, γ = 180°			
		Clear Wind Flow		Obstr. Wind Flow		Clear Wind Flow		Obstr. Wind Flow	
		C_{NW}	C_{NL}	C_{NW}	C_{NL}	C_{NW}	C_{NL}	C_{NW}	C_{NL}
9.46	A	-0.7	-1.1	-1.0	-1.5	1.0	1.5	0.0	-1.2
	B	-1.5	0.0	-1.8	-0.7	1.7	0.4	0.9	-0.3

Net Design Pressures (psf)

Roof Angle (Deg.)	Load Case	Wind Direction, γ = 0°				Wind Direction, γ = 180°			
		Clear Wind Flow		Obstr. Wind Flow		Clear Wind Flow		Obstr. Wind Flow	
		P_{NW}	P_{NL}	P_{NW}	P_{NL}	P_{NW}	P_{NL}	P_{NW}	P_{NL}
9.46	A	-16.0	-25.4	-24.2	-35.4	23.7	36.0	-1.0	-27.7
	B	-36.1	0.0	-42.6	-17.6	39.0	8.9	21.3	-7.1

Notes (ASCE 7-16):

1. C_{NW} and C_{NL} denote net pressures (contributions from top and bottom surfaces) for windward and leeward half of roof surfaces, respectively.
2. Clear wind flow denotes relatively unobstructed wind flow with blockage less than or equal to 50%. Obstructed wind flow denotes objects below roof inhibiting wind flow (> 50% blockage).
3. For values of θ between 7.5° and 45°, linear interpolation is permitted. For values of θ less than 7.5°, use load coefficients for 0°.
4. Plus and minus signs signify pressures acting toward and away from the top roof surface, respectively.
5. All load cases shown for each roof angle shall be investigated.
6. Figures per ASCE 7-16

Components & Cladding (C&C) Loading

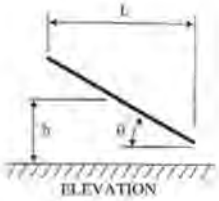
Components and Cladding wind loads shall be used for structural items that are not a part of the MWFRS. Roof rafters, sheathing, roof joists, wall studs, wall headers, and their connection to the structure shall be designed for C&C loading.

Typical C&C

ASCE 7-16 Chapter 30: Wind Forces on Monoslope Free Roofs - Components and Cladding

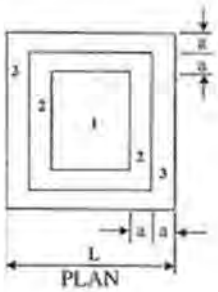
Per ASCE 7-16 §30.7

Risk Category	I		
Basic wind speed (3 sec gust), V =	100	MPH	
Exposure	C		
Roof Angle, θ =	9.46	°	OK
Mean Roof Height, h =	10.90	ft	
Horizontal Dimension of Roof, L=	14.2	ft	
h/L=	0.91		OK
Exposure Coefficient, K_z =	0.85		Section 26.10.1
Topographic Factor, K_{zt} =	1.50		Section 26.8.2
Wind Directionality Factor, K_d =	0.85		Section 26.6
Ground Elevation Factor, K_e =	1.00		Section 26.9
Velocity Pressure, q_h =	27.74	psf	$0.00256K_zK_{zt}K_dK_eV^2$ (Eqn. 26.10-1)
Gust-Effect Factor, G =	0.85		Section 26.11
Net Design Pressure, P_N =	q_hGC_N		Eqn. 30.7-1
a =	3	ft	Per Fig. 30.7-1, a = 10% of least horiz. Dimension or 0.4h, whichever is smaller but not less than 4% of least horizontal dimension or 3ft.
Effective Wind Area (EWA) =	9	ft^2	
Min. C&C Preesure =	16	psf	§30.2.2



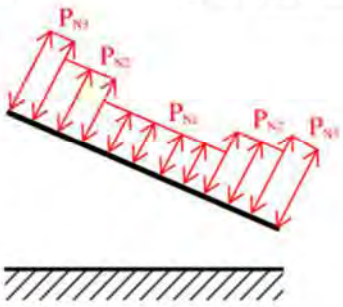
Net Pressure Coefficients - Figure 30.7-1 (0.25 ≤ h ≤ 1.0, θ ≤ 45°)

Net Pressure Coefficients, C_N					
Effective Wind Area (ft^2)			≤a^2	>a^2,≤4.0a^2	>4a^2
Clear Wind Flow	Zone 3	Towards	3.30	2.48	1.65
		Away	-4.10	-2.31	-1.53
	Zone 2	Towards	2.48	2.48	1.65
		Away	-2.31	-2.31	-1.53
	Zone 1	Towards	1.65	1.65	1.65
		Away	-1.53	-1.53	-1.53
Obstructed Wind Flow	Zone 3	Towards	1.81	1.36	0.90
		Away	-4.86	-2.76	-1.80
	Zone 2	Towards	1.36	1.36	0.90
		Away	-2.76	-2.76	-1.80
	Zone 1	Towards	0.90	0.90	0.90
		Away	-1.80	-1.80	-1.80



Net C&C Wind Pressures for Select Effective Wind Area → EWA = 9 sq. ft. <a^2

			C_N	P_N (psf)
Clear Wind Flow	Zone 3	Towards	3.30	77.93
		Away	-4.10	-96.58
	Zone 2	Towards	2.48	58.45
		Away	-2.31	-54.45
	Zone 1	Towards	1.65	38.96
		Away	-1.53	-36.10
Obstructed Wind Flow	Zone 3	Towards	1.81	42.66
		Away	-4.86	-114.72
	Zone 2	Towards	1.36	32.00
		Away	-2.76	-65.01
	Zone 1	Towards	0.90	21.33
		Away	-1.80	-42.56



Notes (ASCE 7-16):

1. C_N denotes net pressures (contributions from top and bottom surfaces).
2. Clear wind flow denotes relatively unobstructed wind flow with blockage less than or equal to 50%. Obstructed wind flow denotes objects below roof inhibiting wind flow (> 50% blockage).
3. For values of θ other than those shown in Figure 30.7-1, linear interpolation is permitted.
4. Plus and minus signs signify pressures acting toward and away from the top roof surface, respectively.
5. All load cases shown for each roof angle shall be investigated.
6. Figures per ASCE 7-16

The above wind loads are applicable to all C&C members other than the beams.

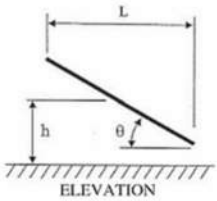
Beam C&C Loads

The following component and cladding loads are applicable to only the roof beams.

ASCE 7-16 Chapter 30: Wind Forces on Monoslope Free Roofs - Components and Cladding

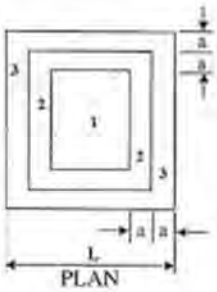
Per ASCE 7-16 §30.7

Risk Category	I		
Basic wind speed (3 sec gust), V =	100	MPH	
Exposure	C		
Roof Angle, θ =	9.46	°	OK
Mean Roof Height, h =	10.90	ft	
Horizontal Dimension of Roof, L=	14.2	ft	
h/L=	0.91		OK
Exposure Coefficient, K_z =	0.85		Section 26.10.1
Topographic Factor, K_{zt} =	1.50		Section 26.8.2
Wind Directionality Factor, K_d =	0.85		Section 26.6
Ground Elevation Factor, K_e =	1.00		Section 26.9
Velocity Pressure, q_h =	27.74	psf	$0.00256K_zK_{zt}K_dK_eV^2$ (Eqn. 26.10-1)
Gust-Effect Factor, G =	0.85		Section 26.11
Net Design Pressure, P_N =	q_hGC_N		Eqn. 30.7-1
a =	3	ft	Per Fig. 30.7-1, a = 10% of least horiz. Dimension or 0.4h, whichever
Effective Wind Area (EWA) =	31.5	ft^2	is smaller but not less than 4% of least horizontal dimension or 3ft.
Min. C&C Preesure =	16	psf	§30.2.2



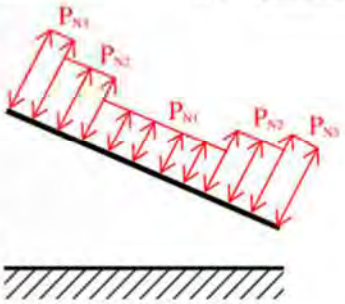
Net Pressure Coefficients - Figure 30.7-1 (0.25 ≤ h ≤ 1.0, θ ≤ 45°)

Net Pressure Coefficients, C_N					
Effective Wind Area (ft^2)			≤a²	>a²,≤4.0a²	>4a²
Clear Wind Flow	Zone 3	Towards	3.30	2.48	1.65
		Away	-4.10	-2.31	-1.53
	Zone 2	Towards	2.48	2.48	1.65
		Away	-2.31	-2.31	-1.53
	Zone 1	Towards	1.65	1.65	1.65
		Away	-1.53	-1.53	-1.53
Obstructed Wind Flow	Zone 3	Towards	1.81	1.36	0.90
		Away	-4.86	-2.76	-1.80
	Zone 2	Towards	1.36	1.36	0.90
		Away	-2.76	-2.76	-1.80
	Zone 1	Towards	0.90	0.90	0.90
		Away	-1.80	-1.80	-1.80



Net C&C Wind Pressures for Select Effective Wind Area → EWA = 31.5 sq. ft. >a^2,≤4.0a^2

			C_N	P_N (psf)
Clear Wind Flow	Zone 3	Towards	2.48	58.45
		Away	-2.31	-54.45
	Zone 2	Towards	2.48	58.45
		Away	-2.31	-54.45
	Zone 1	Towards	1.65	38.96
		Away	-1.53	-36.10
Obstructed Wind Flow	Zone 3	Towards	1.36	32.00
		Away	-2.76	-65.01
	Zone 2	Towards	1.36	32.00
		Away	-2.76	-65.01
	Zone 1	Towards	0.90	21.33
		Away	-1.80	-42.56



Notes (ASCE 7-16):

1. C_N denotes net pressures (contributions from top and bottom surfaces).
2. Clear wind flow denotes relatively unobstructed wind flow with blockage less than or equal to 50%. Obstructed wind flow denotes objects below roof inhibiting wind flow (> 50% blockage).
3. For values of θ other than those shown in Figure 30.7-1, linear interpolation is permitted.
4. Plus and minus signs signify pressures acting toward and away from the top roof surface, respectively.
5. All load cases shown for each roof angle shall be investigated.
6. Figures per ASCE 7-16

Seismic Loading

Seismic Importance Factor;	I_e = 1.0;	per ASCE 7 Table 1.5-2
Soil Class D – Default		assumed
Seismic Design Category D		per ASCE 7 Table 11.6-1 and 11.6-2
Spectral Response (short);	S_s = 1.50; g	per ASCE 7 Figure 22-1
Spectral Response (1s);	S_1 = 0.600; g	per ASCE 7 Figure 22-2
Spectral Acceleration (short);	S_{DS} = 1.3; g	See following pages
Spectral Acceleration (1s);	S_{D1} = 0.800; g	See following pages

Seismic Force Resisting System: Cantilevered Column Systems Detailed to Conform to the Requirements for Timber Frames

Seismic Response Coefficient;	C_s = 0.8;	See following pages
Vertical Seismic Coefficient;	$0.2 \times S_{DS}$ =0.16	

Building Code Information		
Risk Category =	I	
S_s =	1.500	Fig. 22-1, 22-3,& 22-5 to 22-8
S_1 =	0.600	Fig. 22-2, 22-4, & 22-5 to 22-8
Long Transition Period, T_L =	16	Fig. 22-14 to 22-17
Soil Site Class =	D (default)	See Section 11.4.4 for mininmum Fa

Design Spectral Acceleration Parameters - ASCE 7-16 Chapter 11		
Short-Period Site Coefficient, F_a =	1.2	Tbl. 11.4-1, min. of 1.2 per 11.4.4
Long-Period Site Coefficient, F_v =	1.7	Table 11.4-2
S_{MS} =	1.800	$S_{MS} = F_a \cdot S_S$, Eq. 11.4-1
S_{M1} =	1.020	$S_{M1} = F_v \cdot S_1$, Eq. 11.4-2
S_{DS} =	1.200	$S_{DS} = 2/3 \cdot S_{MS}$, Eq. 11.4-3
S_{D1} =	0.680	$S_{D1} = 2/3 \cdot S_{M1}$, Eq. 11.4-4
T_s =	0.567	$T_s = S_{D1}/S_{DS}$, Sect. 11.4.6

Seismic Design Category - ASCE 7-16 Chapter 11		
Seismic Design Category for S_{DS} =	D	Table 11.6-1
Seismic Design Category for S_{D1} =	D	Table 11.6-2
Seismic Design Category =	D	Most critical of the cases above

Exception 2 of section 11.4.8 is applicable

Seismic Base Shear - Building Structures - ASCE 7-16 Chapter 12		
Importance Factor, I_e =	1.00	Table 1.5-2
Structure Height, h_n =	12.90	ft
Seismic Force Resisting System =	G. Timber frames	
Response Modification Coef., R =	1.5	Table. 12.2-1
Overstrength Factor, Ω_o =	1.5	Table. 12.2-1
Deflection Amplification Fact., C_d =	1.5	Table 12.2-1
Building Height Limit =	35	Table 12.2-1

Building Height Okay for Seismic Force Resisting System

Fundamental Period		
Actual Calc'd Period, T_c =		from analysis (calculated if blank)
Period Coefficient, C_T =	0.020	Table 12.8-2
Period Exponent, x =	0.75	Table. 12.8-2
Approximate Period, T_a =	0.14	sec., $T_a = C_T \cdot h_n^x$, Eq. 12.8-7
Upper Limit Coefficient, C_u =	1.40	Table. 12.8-1
Max Period, T_{max} =	0.19	sec., $T_{max} = C_u \cdot T_a$, Section 12.8.2
Fundamental Period, T =	0.14	sec.

Horizontal Component - Seismic Design Coefficients		
C_s =	0.800	Cs = SDS/(R/Ie), Eqn. 12.8-2 per 11.4.8 Exception 2
$C_{s,max}$ =	3.330	Cs,max = SD1/(T·R/Ie), Eq. 12.8-3
$C_{s,min}$ =	0.200	Cs,min = 0.5·S1/(R/Ie), Eq. 12.8-6

Seismic Coefficients		
Base Shear Coeff., $C_{s,design}$ =	0.800	g's $E_h = C_s W$
Vert. Seismic Coeff., $0.2 \cdot S_{DS}$ =	0.240	g's $E_v = 0.2 S_{DS} W$

Gravity Design

Design Result Summary (Controlling Actions Shown)

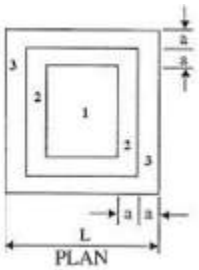
Member	Utilization
Roof Sheathing	DCR = 0.75
Rafters	DCR = 0.86
Girder Beams	DCR = 0.87
Slab on Grade	FS = 11.59

Note: By inspection, there is a reserve capacity in the gravity force resisting system to resist 30psf design snow loads (calculations included considered 29.6psf)

Roof Design

Demands:

- Dead = 8-12psf
- Live = 20psf
- Snow = 29.6psf
- Wind:
  - MWFRS:
    - Applicable to elements not considered components and cladding.
    - Controlling Downward = 42.66psf
    - Controlling Uplift = 21.33psf
  - C&C:
    - Applicable to roof sheathing, and rafters
      - Controlling Downward: Clear Wind Flow
        - Zone 1 = 38.96psf
        - Zone 2 = 58.45psf
        - Zone 3 = 77.93psf
      - Controlling Uplift: Obstructed Wind Flow
        - Zone 1 = 21.33psf
        - Zone 2 =32.00sf
        - Zone 3 = 42.66psf
    - Applicable to roof girder beams
      - Controlling Downward: Clear Wind Flow
        - Zone 1 = 38.96psf
        - Zone 2 = 58.45psf
        - Zone 3 = 58.45psf
      - Controlling Uplift: Obstructed Wind Flow
        - Zone 1 = 21.33psf
        - Zone 2 =32.00psf
        - Zone 3 = 32.00psf



Sheathing

Evaluate the roof sheathing for out-of-plane load effects.
Try 15/32 sheathing with 32/16 span rating.
Sheathing spans 24" (rafter spacing)
Demands:

- Dead = 1.6psf (sheathing weight)
- Live = 20psf
- Snow = 29.6psf
- Wind: C&C
  - Down = 77.93psf
  - Up = -114.72psf
- By inspection, $0.6D+0.6W_{UP}$ controls
- Demand, P = 0.6*(1.6) + 0.6*(-114.72)psf = 69.79psf (up)

Capacity:

- Nominal out-of-plane capacity, P_n = 155psf (SDPWS Table 3.2.2)
- ASD reduction factor, Ω = 1.67
- ΩP_n = 92.81psf > P ✓

15/32 APA rated sheathing with 32/16 span rating is adequate (DCR = 0.29)

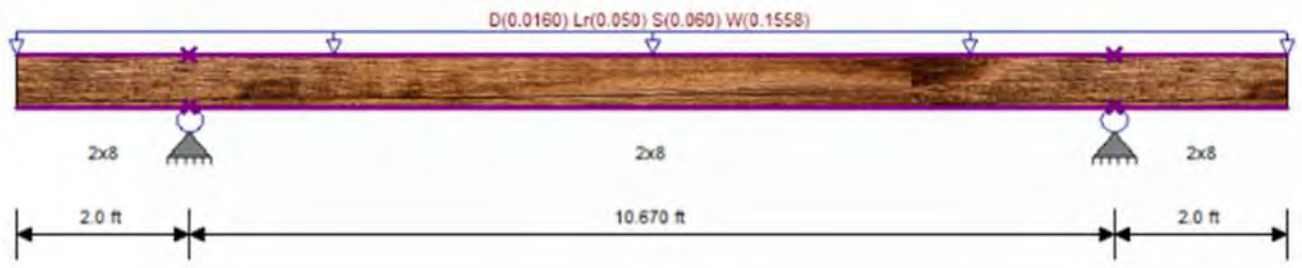
Rafters: 2x8 DF/L #2 @24" o.c.

Spans:

- Span 1 ≈ 2' (cantilever end)
- Span 2 ≈ 10.67' (interior)
- Span 3 ≈ 2' (cantilever end)

Spacing = 2'-0" o.c.
Demands:

- Dead = 8psf
- Live = 20psf
- Snow = 29.6psf
  - Note, additional partial snow load cases were considered per ASCE 7 section 7.5.1 and are included in the Enercalc calculations appended to this report.
- Wind (Zone 3) = 77.93psf (downward)



Per Enercalc (see appendix) 2x8 DF/L #2 @24" o.c. rafters are adequate (DCR = 0.86)

Girder Beams: 6x12 DF/L #2

By inspection, the front beam line controls since it has the greatest tributary width.

Spans:

- Span 1 = 2'-0" (cantilever overhang)
- Span 2 ≈ 13'-0" (largest span in Ecology Block)

Demands:

- Tributary Width ≈ 8'-0"
- Dead = 12psf
- Live = 20psf
- Snow = 29.6psf
- Wind (Zone 2&3) = 32.00psf (downward)

Per Enercalc (see appendix) 6x12 DF/L #2 beams are adequate (DCR = 0.87)

Slab on Grade Design

Evaluate the slab on grade for vehicular concentrated loads.

Concrete compressive strength, f'_c = 2,500psi

Assumed soil modulus of subgrade reaction = 50pci (conservative)

Per Enercalc (see appendix) a 12" thick slab on grade is adequate (FS = 11.59)

Lateral Design

Design Result Summary (Controlling Actions Shown)

Member	Utilization
Post	DCR = 0.72
Corner Post Anchorage	Varies (All DCR <1.0, see design)
Brace	DCR = 0.7
Wall Sill Plate	DCR = 0.43
Wall Sill Plate Anchorage	Varies (All DCR <1.0, see design)
Retaining Wall	Varies (All DCR <1.0, see design)

Assumptions:

- The primary lateral force resisting system are the braced cantilevered posts supporting the roof framing.
- Evaluate the structure for horizontal seismic load effects in the two orthogonal principal directions: transverse and longitudinal (per ASCE 7, Section 12.14.4.2.1).
- In the transverse direction, the diaphragm will have flexible behavior.
- In the longitudinal direction, the diaphragm will behave as a cantilever/3-sided diaphragm and is idealized as rigid in the analysis.
- Because there are not vertical elements of the lateral force resisting system on both sides in the longitudinal direction (i.e. cantilever/3-sided diaphragm), a redundancy factor of 1.3 is used per ASCE 7 Section 12.3.4.2.
- Flat roof snow load is less than 30 psf (see snow load generation). As such, roof snow loads do not need to be considered in the effective seismic weight of the structure per Section 12.7.2 of ASCE 7-16.

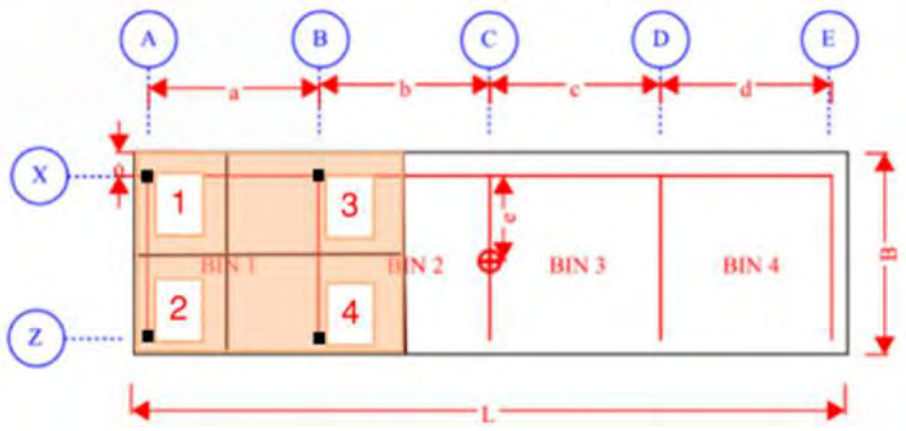
Load Generation

Generate gravity and lateral seismic demands for each post. By inspection, seismic demands control over wind. By inspection, the ecology block option will control over the CIP option because the thicker walls result in greater tributary widths. Also, by inspection, the 3 or 4-bin option will control because of the staggering of columns. For example, Bin 2 has the largest width to accommodate the offset post base from the interlocking notch in the middle of the ecology block. Thus, the posts on the ecology block layout are furthest apart and support a larger tributary area and load which will govern the post design.

Gravity Demands

Post Mark	Description	Trib Area (ft^2)	Dead (kip)	Live Roof (kip)	Snow (kip)
1	Side Back	41.25	0.495	0.825	1.221
2	Side Front	41.25	0.495	0.825	1.221
3	Interior Back	90	1.08	1.8	2.664
4	Interior Front	90	1.08	1.8	2.664

Note: Tributary areas are approximate.



Geometry

	2-Bin	3-Bin	4-Bin	units
o	1.5	1.5	1.5	ft
B	15	15	15	ft
L	27	39	51	ft
a	11	11	11	ft
b	12	13	13	ft
c	0	11	11	ft
d	0	0	12	ft
e	6.75	6.75	6.75	ft

Example Calculations: Post Mark 1

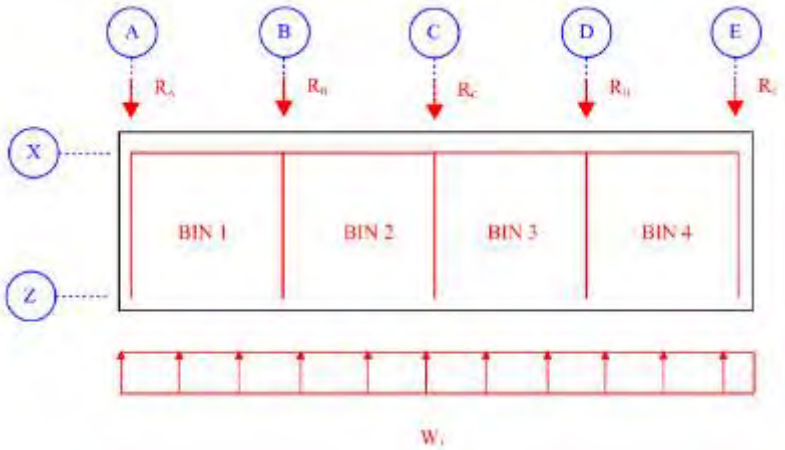
- Tributary Width, W = 5.5’ (estimated from CAD, all posts support gravity loads)
- Tributary Length, L = 7.5’ (estimated from CAD, all posts support gravity loads)
- Tributary Area, A = W*L = 41.25ft^2
- Dead Load = D*A = 12psf*41.25ft^2= 0.495kip
- Live Roof = L_r*A = 20psf*41.25ft^2= 0.825kip
- Snow Load = S*A = 29.6psf*41.25ft^2= 1.221kip

Seismic Demands

Inputs

Roof Dead	12	psf
ρC_S	1.04	-
Bin Width	10	ft
Bin Length	10	ft
Wall Thickness	2	ft
Overhang, o	1.5	ft

Case 1 – Transverse Seismic Loading



Diaphragm Forces

	2-Bin	3-Bin	4-Bin	units
W_1	187	187	187	plf
R_A	1310	1310	1310	lb
R_B	2153	2246	2246	lb
R_C	1310	2246	2246	lb
R_D	0	1310	2153	lb
R_E	0	0	1404	lb
Max Diaphragm Shear	**144**	**150**	**150**	**plf**

Example Calculations: R_A

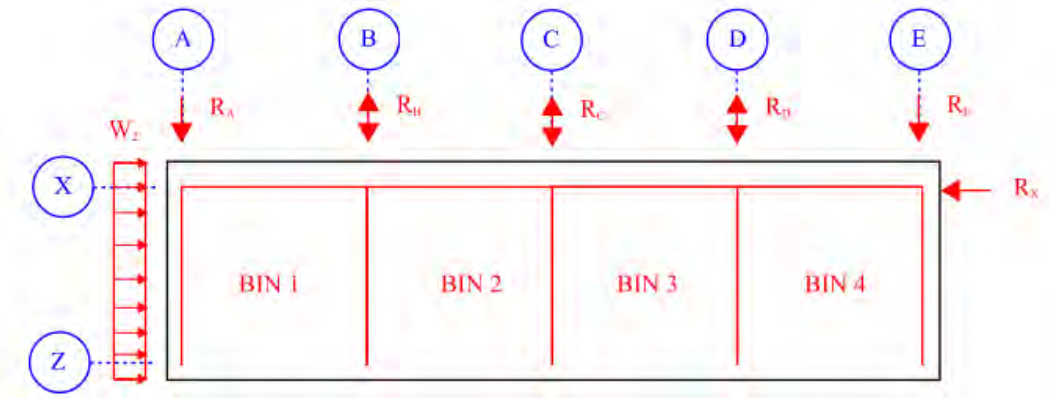
- Transverse seismic loading, $W_1 = DL*\rho C_s*B = 12psf*1.04*15ft = 187plf$
- Force along line $R_A = W_1*((a)+o) = 187plf*((11ft)+1.5ft) = 1{,}310lbs$

Transverse Seismic Load Imposed on Braces and Posts per reactions R_A through R_E

Reactions	2-Bin	3-Bin	4-Bin	units
R_{AX}	655	655	655	lb
R_{AZ}	655	655	655	lb
R_{BX}	1076	1123	1123	lb
R_{BZ}	1076	1123	1123	lb
R_{CX}	655	1123	1123	lb
R_{CZ}	655	1123	1123	lb
R_{DX}	0	655	1076	lb
R_{DZ}	0	655	1076	lb
R_{EX}	0	0	702	lb
R_{EZ}	0	0	702	lb
Controlling Back Post/Brace Demand	**1076**	**1123**	**1123**	**lb**
Controlling Front Post/Brace Demand	**1076**	**1123**	**1123**	**lb**

Case 2 – Transverse Seismic Loading

Note: Reactions A-E are calculated assuming cantilever diaphragm behavior. These braces are responsible for resisting torsional effects. Demands along interior brace lines are expected to effectively cancel out within each bin zone due to positive and negative contributions from each adjacent bin zone (slight differences in bin geometry produce a non-zero reaction value). Exterior brace lines develop the reactions required to resist the torsional demands within the subject bin zone.



Diaphragm Forces

	2-Bin	3-Bin	4-Bin	units
W_2	306	437	568	plf
W_2/No. Bins	153	146	142	plf
R_A	87	83	81	lb
R_B	0	0	0	lb
R_C	87	0	0	lb
R_D	0	83	0	lb
R_E	0	0	81	lb
R_X	4128	5897	7666	lb
Max Diaphragm Shear	**168**	**168**	**168**	**plf**

Reactions	2-Bin	3-Bin	4-Bin	units
R_{AX}	52	50	49	lb
R_{AZ}	52	50	49	lb
R_{BX}	4	8	8	lb
R_{BZ}	4	8	8	lb
R_{CX}	47	-8	-8	lb
R_{CZ}	47	-8	-8	lb
R_{DX}	0	50	4	lb
R_{DZ}	0	50	4	lb
R_{EX}	0	0	45	lb
R_{EZ}	0	0	45	lb
R_{XA}	1264	1217	1193	lb
R_{XB}	1264	1217	1193	lb
R_{XC}	1264	1217	1193	lb
R_{XD}	1264	1217	1193	lb
R_{XE}	1264	1217	1193	lb
Controlling Back Post/Brace Demand	**1264**	**1217**	**1193**	**lb**
Controlling Front Post/Brace Demand	**52**	**50**	**49**	**lb**

Demand Summary

Controlling Back Longitudinal Demand	**1264**	**lb**
Controlling Back Transverse Demand	**1123**	**lb**
Controlling Front Demand	**1123**	**lb**

Interior Back Post and Longitudinal Brace

Maximum height above wall = 4’-3”
Intermediate bracing at 3’-0” above base

Gravity Demands:

- Dead = 1.08 kip
- Live Roof = 1.8 kip
- Snow = 2.664 kip

Lateral Demands:

- Seismic = 1.264kip

Per RISA (see appendix) P.T. 6x6 HF/L #1 posts are adequate (DCR = 0.41)
Per RISA (see appendix) DBL P.T. 2x6 HF/L #2 braces are adequate (DCR = 0.48)

Interior Back Post and Transverse Brace

Maximum height above wall = 4'-3"
Intermediate bracing at 2'-6" above base

Gravity Demands:

- Dead = 1.08 kip
- Live Roof = 1.8 kip
- Snow = 2.664 kip

Lateral Demands:

- Seismic = 1.123kip

Per RISA (see appendix) P.T. 6x6 HF/L #1 posts are adequate (DCR = 0.46)
Per RISA (see appendix) DBL P.T. 2x6 HF/L #2 braces are adequate (DCR = 0.36)

Interior Front Post and Transverse Brace

Maximum height above wall = 6'-0"
Intermediate bracing at 3'-6" above base

Gravity Demands:

- Dead = 1.08 kip
- Live Roof = 1.8 kip
- Snow = 2.664 kip

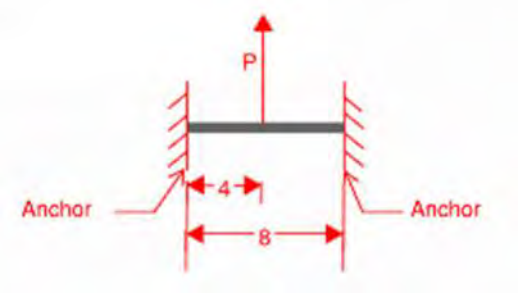
Lateral Demands:

- Seismic = 1.123kip

Per RISA (see appendix) P.T. 6x6 HF/L #1 posts are adequate (DCR = 0.72) - Governs
Per RISA (see appendix) DBL P.T. 2x6 HF/L #2 braces are adequate (DCR = 0.7) - Governs

Sill Plate Design

Evaluate the sill plate for the maximum tension reaction from the brace.
Total Double Brace Axial Load = 2.72kip (1.0E)
Vertical component of demand per RISA output, P = 1,930lb



Per Enercalc (see appendix) a P.T. 4x4 HF/L #2 sill plate in weak axis bending is adequate (DCR = 0.43)

Knee Brace Nailing Design

Evaluate the Nailing on the brace to sill plate connection for the maximum axial force in the brace. Per RISA Front Post brace RISA model, the maximum brace reaction for a single Brace Axial Load in Single Shear= 1.36 kip (1.0E). See Appendix A for brace demand forces.

American Wood Council Connection Results – Capacity for (12) 10D Nails = 2.09 kip
(12) 10D Nails on each Brace/ Sill Plate Connection is adequate (DCR = 0.65)

Design Method	Load & Resistance Factor Design (LRFD)
Connection Type	Lateral loading
Fastener Type	Nail
Loading Scenario	Single Shear
	Submit Initial Values

Main Member Type	Hem-Fir
Main Member Thickness	3.5 in.
Side Member Type	Hem-Fir
Side Member Thickness	1.5 in.
Nail Type	Box
Nail Size	10d (D = 0.128 in.; L = 3 in.)
Time Effect Factor	= 1.0
Wet Service Factor	C_M = 1.0
End Grain Factor	C_eg = 1.0
Temperature Factor	C_t = 1.0
Diaphragm Factor	C_di = 1.0

Calculate Connection Capacity

Connection Yield Mode Descriptions | Limits of Use

Diaphragm Factor Help | Load Duration Factor Help | Technical Help

Show Printable View

Connection Yield Modes

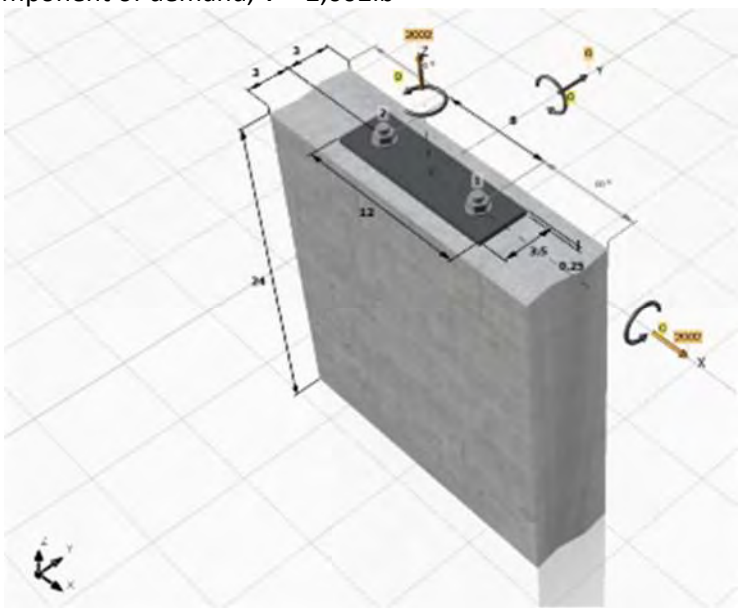
Im	660 lbs.
Is	660 lbs.
II	273 lbs.
IIIm	242 lbs.
IIIs	242 lbs.
IV	174 lbs.

Adjusted LRFD Capacity	174 lbs.

Sill Plate Anchorage Design

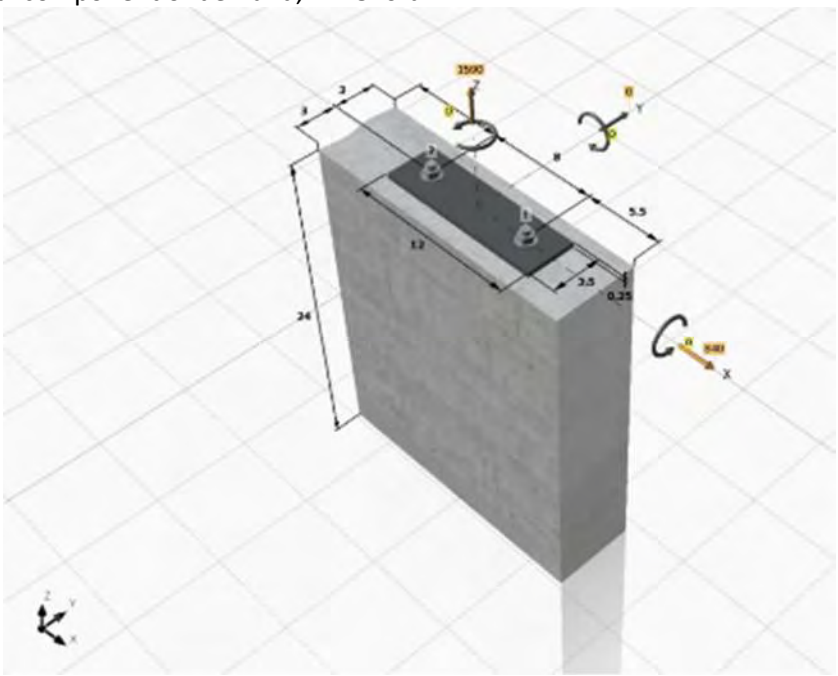
Case 1:

Evaluate the sill plate anchorage for the lateral and vertical reaction from the brace.
Demands per RISA output for load combination [$(0.9-0.2S_{DS})D+\Omega_0E$]
Vertical component of demand, P = 2,002lb
Horizontal component of demand, V = 2,002lb



Case 2

Evaluate the sill plate anchorage for the lateral and vertical reaction at the base of the front post.
Edge condition – Anchor is 5.5" from front of wall
Demands per RISA output for load combination [$(0.9-0.2S_{DS})D+\Omega_0E$]
Vertical component of demand, P = 1590lb
Horizontal component of demand, V = 840lb



Provide anchorage designs compatible with either hot dipped galvanized threaded rods or 304/316SS threaded rods. By inspection, HDG Gr 36 threaded rods will control.

Provide anchorage designs for the following epoxy options:

- Hilti HIT-RE 500 V3
- Simpson SET-3G
- Dewalt Pure 110+

Provide anchorage designs for the following mechanical options:

- Hilti KH-EZ
- Titen HD
- Dewalt Screw Bolt+

Per Dewalt Design Assist Anchorage Software and Simpson Anchorage Software, the following anchors are adequate to resist tension loads

BRACE AND COLUMN ANCHORAGE OPTIONS:
EPOXY:
-HILTI HIT-RE 500 V3 3/4"Ø THREADED ROD ASTM F1554 GR36/A36 W/ 6" EMBEDMENT
-SIMPSON SET 3G 3/4"Ø THREADED ROD ASTM F1554 GR36 W/ 6" EMBEDMENT
-DEWALT PURE110+ 3/4"Ø THREADED ROD ASTM F1554 GR36/A36 W/ 6" EMBEDMENT

MECHANICAL:
-DEWALT SCREW-BOLT+ 3/4"Ø W/ 4.25" NOMINAL EMBEDMENT
-HILTI KH-EZ 3/4"Ø W/ 4" NOMINAL EMBEDMENT
-TITEN HD 3/4"Ø W/ 4" NOMINAL EMBEDMENT

Retaining Wall Design

CIP Wall Properties:

- Wall Thickness = 6”
- Wall Height = 4’-0” (max)
- Retained backfill height = Wall height - 3”
- Retained infill height = Wall Height
- Concrete Compressive Strength, f'_c = 2,500psi
- Reinforcing Info:
  - Vertical Reinforcing = #5@16” o.c. OR #4 @ 12” o.c.
  - Horizontal Reinforcing = #5@16” o.c. OR #4 @ 10” o.c.
  - Reinforcing Yield, f_y = 60,000psi

Footing Properties:

- Footing Thickness = 12”
- Footing width = Enercalc calculation considers the whole footing width, including the tapered portion. Note that the analysis is inherently conservative as it idealizes the wall as a cantilevered condition, though it is also supported on the side by the back wall. Further, the soil backfill is tapered to the front of the bins, so average demands are less than approximated by Enercalc.
- Reinforcing Info:
  - Rebars size and spacing match slab reinforcing

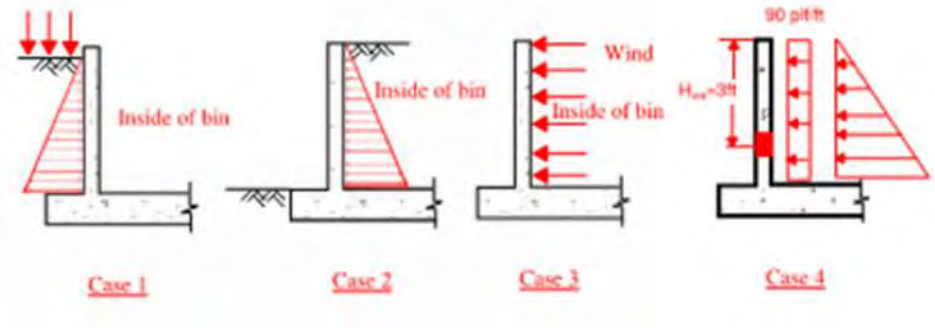
Ecology Block Properties:

- Ecology Block Wall Thickness = 2’-0”
- Ecology Block Wall Height = 2’-0” (max)
- Retained backfill height = Wall height - 3”
- Retained infill height = Wall Height

Surcharge Loads: NRCS does not prescribe surcharge design loads for agricultural storage structures. As such, this design conservatively assumes the following: For wall strength checks: Design for a 250psf surcharge load. Note that this is conservative and is representative of if a heavy vehicle load was placed behind a portion of the wall. The intent of this check is to evaluate the strength of the wall for high localized demands as a result of heavy vehicular loads.

Design Cases:

- Case 1 (Wall Design): Backfill + Surcharge with Empty Bin – **Governs Design by Inspection**
- Case 2 (Wall Design): Infill without Backfill
- Case 3 (Wall Design): Wind on an Empty Bin Without Backfill
- Case 4 (Beam Design): Back Wall Horizontally Spanning



Case 1: Backfill + Surcharge with Empty Bin

Demands:

- Active Backfill = 45psf/ft
- Backfill Surcharge = 250psf

Per Enercalc (See Appendix), the 6" retaining wall is adequate with #5 Verts. @16" o.c. and #5 Horiz. Bars @16" o.c. OR with #4 Verts. @12" o.c. and #4 Horiz. Bars @10" o.c.

Case 2: Infill Without Backfill

Demands:

- Active Infill = 60psf/ft

Only active infill considered in case. By inspection, case 1 governs the design.

Case 3: Wind with Empty Bin Without Backfill

Demands:

- Wind = 54.43 psf (see bin wall wind load generation)

Only wind loads considered in case. By inspection, case 1 governs the design.

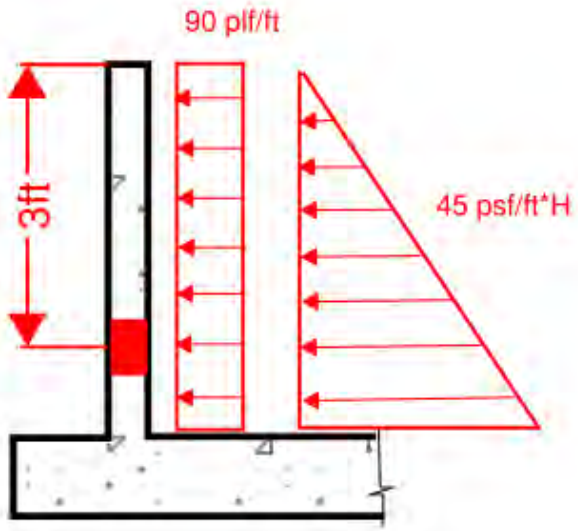
Case 4: Back Wall Horizontally Spanning

Idealize the back wall as horizontally spanning. Is assumed as a simple support beam supported at the interior and side walls. Analysis assumes the lowest 12" of the wall is effectively fixed by the footing below rather than horizontally spanning. Evaluate the region directly above as horizontally spanning. Note that the analysis is inherently conservative.

Demands:

- By inspection, stem demands for Case 1 controls.
- Active Pressure Demands:
  - Active Pressure, p_a = 45psf/ft
  - Average Depth H_1 = 3 ft
  - Uniform Load = p_a * H_1 = 135 plf/ft
  - In Enercalc, consider active pressures as dead loads since they have the same load factor

- Backfill Surcharge = 250psf
  - Soil Density = 12 pcf
  - Surcharge pressure width H_2 = 250psf /125pcf = 2 ft of additional surcharge
  - Uniform Load = p_a * H_2 = 90 plf/ft
  - In Enercalc, consider surcharge pressures as a live load

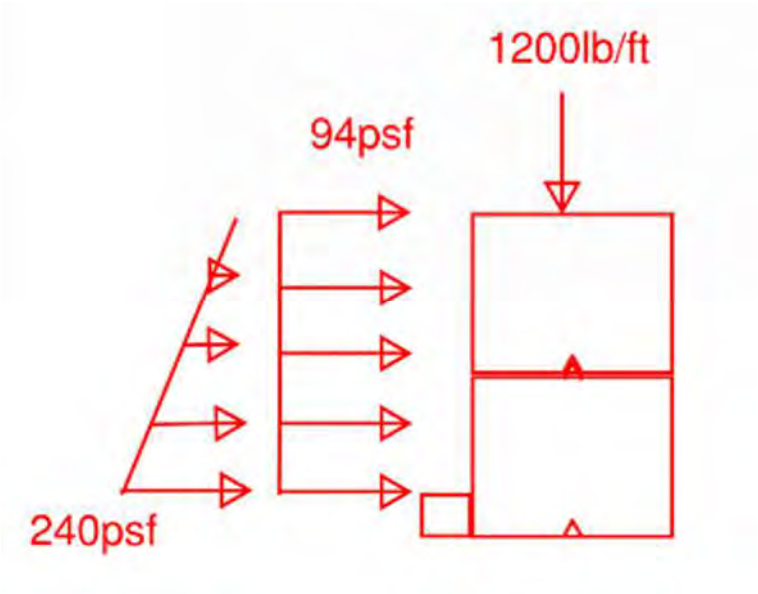


By inspection, case 1 governs the design.

Ecology Block Overturning and Sliding Check

Backfill Surcharge	250	psf
Soil Density	120	pcf
Active Soil Pressure	45	psf/ft
Surcharge OT Load Height Above Wall	2.08	ft
Surcharge OT Load at Top of Wall	93.75	psf
Surcharge OT Load at Bot of Wall	304.69	psf
Triangular OT Load at Bot of Wall	240	psf
Backfill Height	3.25	ft
OT Moment	752.58	lb*ft/ft
Conc Density	150	pcf
Ecology Block width	2	ft
Ecology Block height	4	ft
Ecology Block Wt.	1200	lb/ft
Resist Moment	1200	lb*ft/ft
Overturning Safety Factor	1.59	

coeff. Friction	0.7	
Sliding Resistance	840	lb/ft
Sliding Force	542.34	lb/ft
Sliding Safety Factor	1.55	



Multiple Simple Beam

Project File: Roof Girder and Rafter 2302-0069.ec6

LIC# : KW-06014167, Build:20.23.08.01 PETERSON STRUCTURAL ENGINEERS (c) ENERCALC INC 1983-2023

Description : 2x8 Rafter DF/L #2 @ 24" o.c.

Wood Beam Design : 2x8 Rafter DF/L #2

Calculations per NDS 2018, IBC 2021, ASCE 7-16

BEAM Size : **2x8, Sawn, Fully Braced**
Using Allowable Stress Design with ASCE 7-16 Load Combinations, Major Axis Bending
Wood Species : Douglas Fir-Larch Wood Grade : No.2

Fb - Tension	900.0 psi	Fc - Prll	1,350.0 psi	Fv	180.0 psi	Ebend- xx	1,600.0 ksi	Density	31.210 pcf
Fb - Compr	900.0 psi	Fc - Perp	625.0 psi	Ft	575.0 psi	Eminbend - xx	580.0 ksi		

Wood Beam Design : 2x8 Rafter DF/L #2

Calculations per NDS 2018, IBC 2021, ASCE 7-16

BEAM Size : **2x8, Sawn, Fully Braced**
Using Allowable Stress Design with ASCE 7-16 Load Combinations, Major Axis Bending
Wood Species : Douglas Fir-Larch Wood Grade : No.2

Fb - Tension	900.0 psi	Fc - Prll	1,350.0 psi	Fv	180.0 psi	Ebend- xx	1,600.0 ksi	Density	31.210 pcf
Fb - Compr	900.0 psi	Fc - Perp	625.0 psi	Ft	575.0 psi	Eminbend - xx	580.0 ksi		

Applied Loads

Beam self weight calculated and added to loads
Unif Load: D = 0.0080, Lr = 0.0250, S = 0.030, W = 0.07790 k/ft, Trib= 2.0 ft

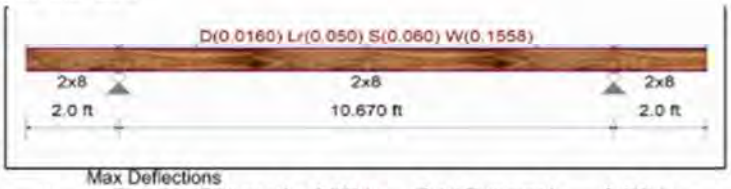
Design Summary

Max fb/Fb Ratio = 0.863 : 1
fb : Actual : 1,490.75 psi at 5.335 ft in Span # 2
Fb : Allowable : 1,728.00 psi
Load Comb : +D+0.750S+0.450W

Max fv/FvRatio = 0.341 : 1
fv : Actual : 98.21 psi at 10.670 ft in Span # 2
Fv : Allowable : 288.00 psi
Load Comb : +D+0.750S+0.450W

Max Reactions (k)

	D	Lr	L	S	W	E	H
Left Support	0.13	0.37		0.44	1.14		
Right Support	0.13	0.37		0.44	1.14		



Max Deflections

Transient Downward	0.501 in	Total Downward	0.429 in
Ratio	255 <0	Ratio	298
	LC: W Only		LC: +D+0.750S+0.450W
Transient Upward	-0.275 in	Total Upward	-0.236 in
Ratio	174 <0	Ratio	202
	LC: W Only		LC: +D+0.750S+0.450W

Description : 6x12 Roof Girder DF/L #2

Wood Beam Design : Roof Girder DF/L #2

Calculations per NDS 2018, IBC 2021, ASCE 7-16

BEAM Size : **6x12, Sawn, Defined Brace Spacing, 1st at ft and spaced at 2.0 ft**
Using Allowable Stress Design with ASCE 7-16 Load Combinations, Major Axis Bending

Wood Species :	Douglas Fir-Larch				Wood Grade :	No.2			
Fb - Tension	875.0 psi	Fc - Prll	600.0 psi	Fv	170.0 psi	Ebend- xx	1,300.0 ksi	Density	31.210 pcf
Fb - Compr	875.0 psi	Fc - Perp	625.0 psi	Ft	425.0 psi	Eminbend - xx	470.0 ksi		

Wood Beam Design : Roof Girder DF/L #2

Calculations per NDS 2018, IBC 2021, ASCE 7-16

BEAM Size : **6x12, Sawn, Defined Brace Spacing, 1st at ft and spaced at 2.0 ft**
Using Allowable Stress Design with ASCE 7-16 Load Combinations, Major Axis Bending

Wood Species :	Douglas Fir-Larch				Wood Grade :	No.2			
Fb - Tension	875.0 psi	Fc - Prll	600.0 psi	Fv	170.0 psi	Ebend- xx	1,300.0 ksi	Density	31.210 pcf
Fb - Compr	875.0 psi	Fc - Perp	625.0 psi	Ft	425.0 psi	Eminbend - xx	470.0 ksi		

Applied Loads

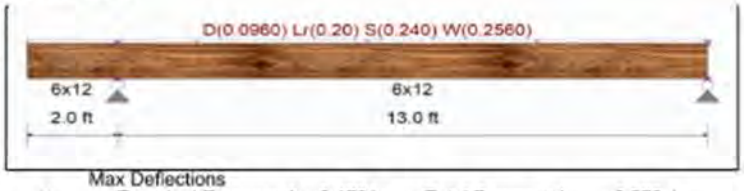
Beam self weight calculated and added to loads
Unif Load: D = 0.0120, Lr = 0.0250, S = 0.030, W = 0.0320 k/ft, Trib= 8.0 ft

Design Summary

Max fb/Fb Ratio = **0.867** : 1
fb : Actual : 697.05 psi at 6.630 ft in Span # 2
Fb : Allowable : 803.60 psi
Load Comb : +D+S

Max fv/FvRatio = **0.305** : 1
fv : Actual : 47.64 psi at 2.000 ft in Span # 1
Fv : Allowable : 156.40 psi
Load Comb : +D+S

Max Reactions (k)	D	Lr	L	S	W	E	H
Left Support	0.95	1.73		2.08	2.22		
Right Support	0.70	1.27		1.52	1.62		



Max Deflections

Transient Downward	0.173 in	Total Downward	0.273 in
Ratio	904	Ratio	571
	LC: W Only		LC: +D+0.750S+0.450W
Transient Upward	-0.080 in	Total Upward	-0.126 in
Ratio	600	Ratio	378
	LC: W Only		LC: +D+0.750S+0.450W

DESCRIPTION: Slab on Grade

Code References

Calculations per IBC 2021, ASCE 7-16
Load Combinations Used : ASCE 7-16

Analytical Values

d - Slab Thickness	6.0 in	Ks - Soil Modulus of Subgrade Reac	50.0 pci
FS - Req'd Factor of Safety	5.0 : 1	Ec - Concrete Elastic Modulus	2,850.0 ksi
		f'c - Concrete Compressive Strength	2.50 ksi
		μ - Poisson's Ratio	0.150
		Min. Adjacent Load Distance	48.012 in

Analysis Formulas

Pn = 1.72 [(Ks R1 / Ec) 10,000 + 3.6] Fr d²

Ks = Soil modulus of subgrade reaction
R1 = 50% plate average dimension = sqrt(PlWid * PlLer
Ec = Concrete elastic modulus
Fr - Concrete modulus of rupture = 7.5 * sqrt(f'c)
d - Slab Thickness

Min Adjacent Column Distance = 1.5 * ([Ec d^3 / (12 * (1- u^2) Ks] ^ 1

Ec = Concrete elastic modulus
d - Slab Thickness
u - Poisson's ratio
Ks = Soil modulus of subgrade reaction

Load & Capacity Table

Load ID	Plate (in) Wid	Len	R1 (in)	Applied Concentrated Load on Plate - (kip) D	Lr	L	S	W	E	Governing Ld Comb	Pu (kip)	Pn (kip)	Check
Point Load	4.50	4.50	2.25			8.00				L Only	8.0	92.8	Pass, FS=11.59 >= 5

Node Coordinates

	Label	X [ft]	Y [ft]	Z [ft]	Detach From Diaphragm
1	N1	0	0	0	
2	N2	0	4.22	0	
3	N3	0	3	0	
4	N4	3	0	0	

Wood Section Sets

	Label	Shape	Type	Design List	Material	Design Rule	Area [in²]	Iyy [in⁴]	Izz [in⁴]	J [in⁴]
1	Post	6X6	Column	Rectangular	HF/L #1	Typical	30.25	76.26	76.26	128.87
2	Brace	6X6	Column	Rectangular	HF/L #2	Typical	30.25	76.26	76.26	128.87
3	Brace Alt	2X6	Column	Rectangular	HF/L #2	Typical	8.25	1.55	20.8	5.12

Member Primary Data

	Label	I Node	J Node	Section/Shape	Type	Design List	Material	Design Rule
1	M1	N1	N2	Post	Column	Rectangular	HF/L #1	Typical
2	M2	N3	N4	Brace Alt	Column	Rectangular	HF/L #2	Typical
3	M3	N3	N4	Brace Alt	Column	Rectangular	HF/L #2	Typical

Node Loads and Enforced Displacements (BLC 1 : Dead)

	Node Label	L, D, M	Direction	Magnitude [(k, k-ft), (in, rad), (k*s²/ft, k*s²*ft)]
1	N2	L	Y	-1.08

Node Loads and Enforced Displacements (BLC 2 : Live Roof)

	Node Label	L, D, M	Direction	Magnitude [(k, k-ft), (in, rad), (k*s²/ft, k*s²*ft)]
1	N2	L	Y	-1.8

Node Loads and Enforced Displacements (BLC 3 : Snow)

	Node Label	L, D, M	Direction	Magnitude [(k, k-ft), (in, rad), (k*s²/ft, k*s²*ft)]
1	N2	L	Y	-2.66

Node Loads and Enforced Displacements (BLC 4 : Seismic Horiz)

	Node Label	L, D, M	Direction	Magnitude [(k, k-ft), (in, rad), (k*s²/ft, k*s²*ft)]
1	N2	L	X	1.26

Load Combinations

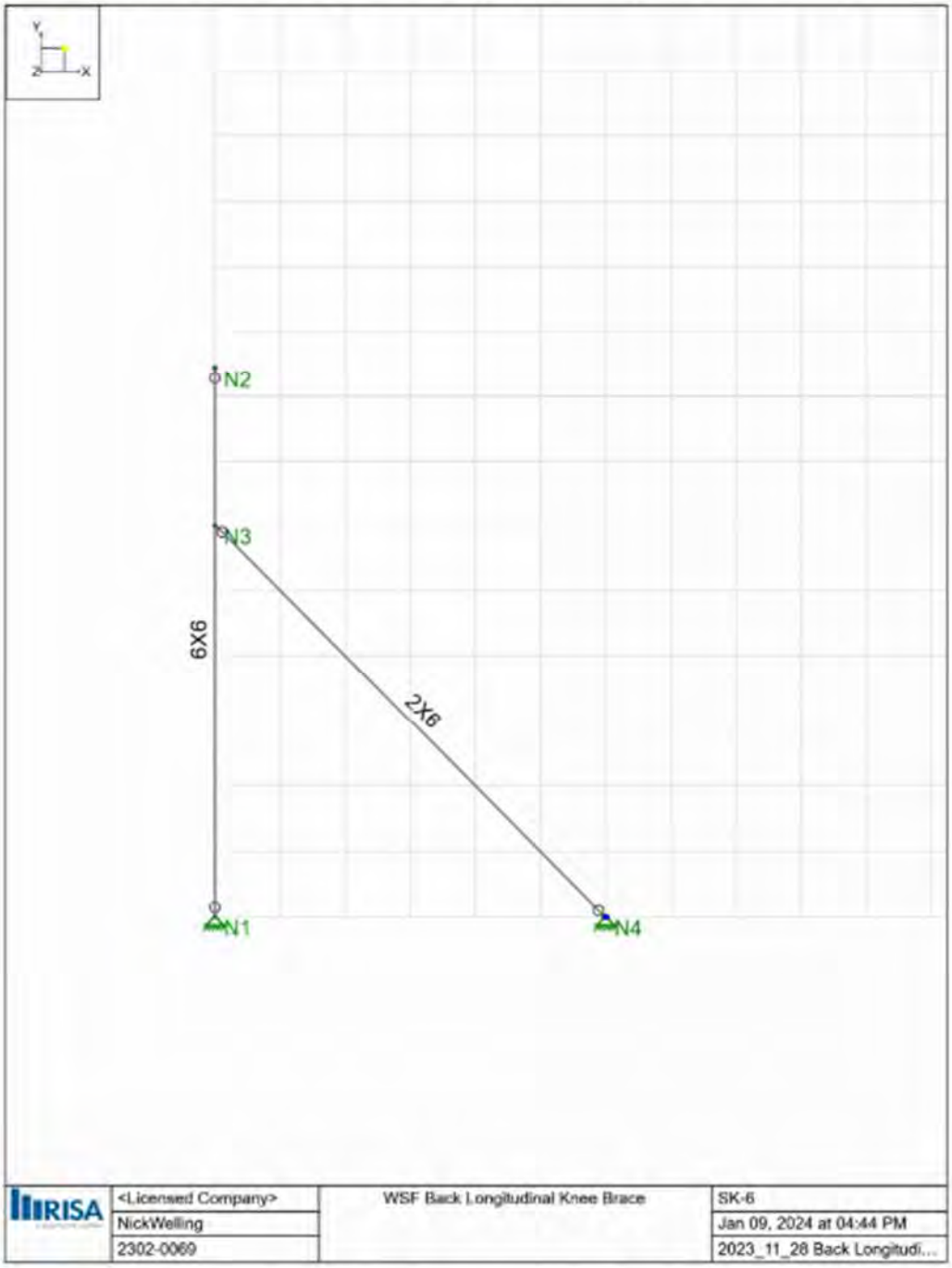
	Description	Solve	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor
1	D	Yes	DL	1	NL	1				
2	D+Lr	Yes	DL	1	RLL	1				
3	D+S	Yes	DL	1	SL	1				
4	D+0.7Ev+0.7Eh	Yes	DL	1	Sds*DL	0.17	EL	0.7		
5	D+0.7Ev-0.7Eh	Yes	DL	1	Sds*DL	0.17	EL	-0.7		
6	D+0.7Ev+(0.7OmEh)	Yes	DL	1	Sds*DL	0.17	Om*EL	0.7		
7	D+0.7Ev-(0.7OmEh)	Yes	DL	1	Sds*DL	0.17	Om*EL	-0.7		
8	D+0.525Ev+0.525Eh+0.1S	Yes	DL	1	Sds*DL	0.13	EL	0.53	SL	0.1
9	D+0.525Ev-0.525Eh+0.1S	Yes	DL	1	Sds*DL	0.13	EL	-0.53	SL	0.1
10	D+0.525Ev+0.525(OmEh)+0.1S	Yes	DL	1	Sds*DL	0.13	Om*EL	0.53	SL	0.1
11	D+0.525Ev-0.525(OmEh)+0.1S	Yes	DL	1	Sds*DL	0.13	Om*EL	-0.53	SL	0.1
12	0.6D-0.7Ev+0.7Eh	Yes	DL	0.6	Sds*DL	-0.17	EL	0.7		
13	0.6D-0.7Ev-0.7Eh	Yes	DL	0.6	Sds*DL	-0.17	EL	-0.7		
14	0.6D-0.7Ev+0.7(OmEh)	Yes	DL	0.6	Sds*DL	-0.17	Om*EL	0.7		
15	0.6D-0.7Ev-0.7(OmEh)	Yes	DL	0.6	Sds*DL	-0.17	Om*EL	-0.7		

Envelope Node Reactions

	Node Label		X [k]	LC	Y [k]	LC	Z [k]	LC	MX [k-ft]	LC	MY [k-ft]	LC	MZ [k-ft]	LC
0	N3	max	0	13	0	13	0	13	0	13	0	13	0	13
1		min	0	1	0	1	0	1	0	1	0	1	0	1
2	N4	max	1.24	5	1.24	4	0	13	0	13	0	13	0	13
3		min	-1.24	4	-1.24	13	0	1	0	1	0	1	0	1
4	N1	max	0.36	4	3.74	3	0	13	0	13	0	13	0	13
5		min	-0.36	5	-0.81	12	0	1	0	1	0	1	0	1
6	Totals:	max	0.88	5	3.74	3	0	13						
7		min	-0.88	4	0.43	12	0	1						

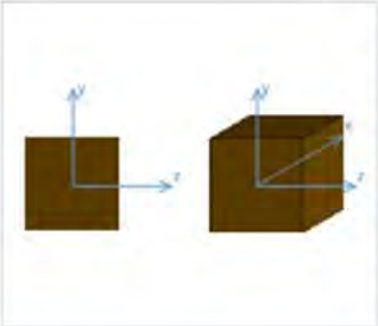
Envelope Node Reactions - Overstrength or Capacity Limit

	Node Label		X [k]	LC	Y [k]	LC	Z [k]	LC	MX [k-ft]	LC	MY [k-ft]	LC	MZ [k-ft]	LC
0	N3	max	0	15*	0	15*	0	15*	0	15*	0	15*	0	15*
1		min	0	6*	0	6*	0	6*	0	6*	0	6*	0	6*
2	N4	max	1.87	15*	1.87	14*	0	15*	0	15*	0	15*	0	15*
3		min	-1.87	6*	-1.87	7*	0	6*	0	6*	0	6*	0	6*
4	N1	max	0.54	6*	3.16	7*	0	15*	0	15*	0	15*	0	15*
5		min	-0.54	7*	-1.44	14*	0	6*	0	6*	0	6*	0	6*
6	Totals:	max	1.33	15*	1.51	10*	0	15*						
7		min	-1.33	6*	0.43	15*	0	6*						



Detail Report: M1

Load Combination: Envelope **Code check:** 0.405 (LC 12)



Input Data

Shape:	6X6 (nominal)	**I Node:**	N1
Member Type:	Column	**J Node:**	N2
Length (ft):	4.22	**I Release:**	Fixed
Material Type:	Wood	**J Release:**	Fixed
Design Rule:	Typical	**I Offset:**	N/A
Internal Sections:	97	**J Offset:**	N/A
Design Code:	AWC NDS-18 / SDPWS-15 ASD	**T/C Only:**	Both Way

Material Properties

Material:	HF/L #1	**Grade:**	No.1	**Nu:**	0.3
Type:	Solid Sawn	**Cm:**	Yes	**Alpha ($1e^{-6}F^{-1}$):**	0.3
Database:	Visually Graded	**Ci:**	Yes	**Density (k/ft^3):**	0.04
Species:	Hem-Fir	**Emod:**	1		

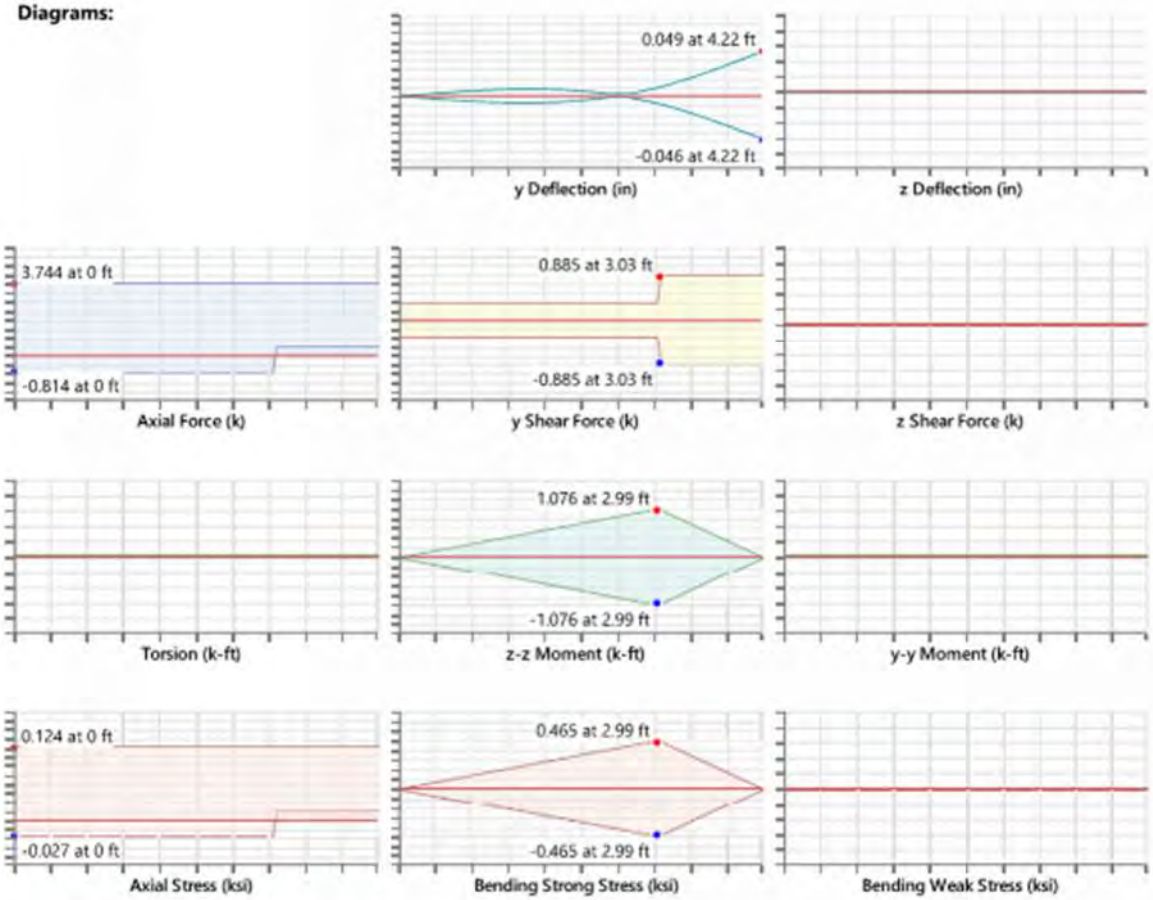
Shape Properties

F_b (ksi):	0.98	**E (ksi):**	1300	**b (actual) (in):**	5.5
F_t (ksi):	0.65	**Emod:**	1	**d (actual) (in):**	5.5
F_v (ksi):	0.14	**COV_E (Table F1):**	0.25		
F_c (ksi):	0.85	**E_{min} (ksi):**	474.9		

Design Properties

le2 (ft):	4.22	**y sway:**	No	**C_{fu}:**	1
le1 (ft):	4.22	**z sway:**	No	**C_P:**	0.93
le-bend top:	Lbyy	**C_D:**	1.6	**Max Defl Ratio:**	L/1041
le-bend bot (ft):	4.22	**R_B:**	3.03	**Max Defl Location:**	4.22
K_{y-y}:	1	**C_L:**	1	**Span:**	N/A
K_{z-z}:	1	**C_r:**	1		

Diagrams:

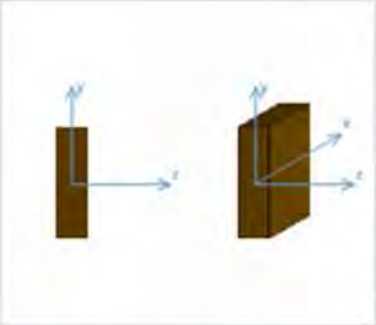


AWC NDS-18 / SDPWS-15 ASD Code Check

Limit State	Gov. LC	Required	Available	Unity Check	Result
Applied Loading - Bending/Axial	12	-	-	-	-
Applied Loading - Shear + Torsion	5	-	-	-	-
Axial Compression Analysis	-	0 ksi	0.92 ksi	-	-
Axial Tension Analysis	-	-0.03 ksi	0.83 ksi	-	-
Flexural Analysis, Fb1'	-	0.47 ksi	1.25 ksi	-	-
Flexural Analysis, Fb2'	-	0 ksi	1.25 ksi	-	-
Bending & Axial Compression Analysis	-	-	-	0.37	PASS
Bending & Axial Tension Analysis	-	-	-	0.41	PASS
Shear Analysis	-	0.04 ksi	0.18 ksi	0.24	PASS

Detail Report: M2

Load Combination: Envelope **Code check:** 0.477 (LC 4)



Input Data

Shape:	2X6 (nominal)	**I Node:**	N3
Member Type:	Column	**J Node:**	N4
Length (ft):	4.24	**I Release:**	BenPIN
Material Type:	Wood	**J Release:**	Fixed
Design Rule:	Typical	**I Offset:**	N/A
Internal Sections:	97	**J Offset:**	N/A
Design Code:	AWC NDS-18 / SDPWS-15 ASD	**T/C Only:**	Both Way

Material Properties

Material:	HF/L #2	**Grade:**	No.2	**Nu:**	0.3
Type:	Solid Sawn	**Cm:**	Yes	**Alpha ($1e^{-5}F^{-1}$):**	0.3
Database:	Visually Graded	**Ct:**	Yes	**Density (k/ft^3):**	0.04
Species:	Hem-Fir	**Emod:**	1		

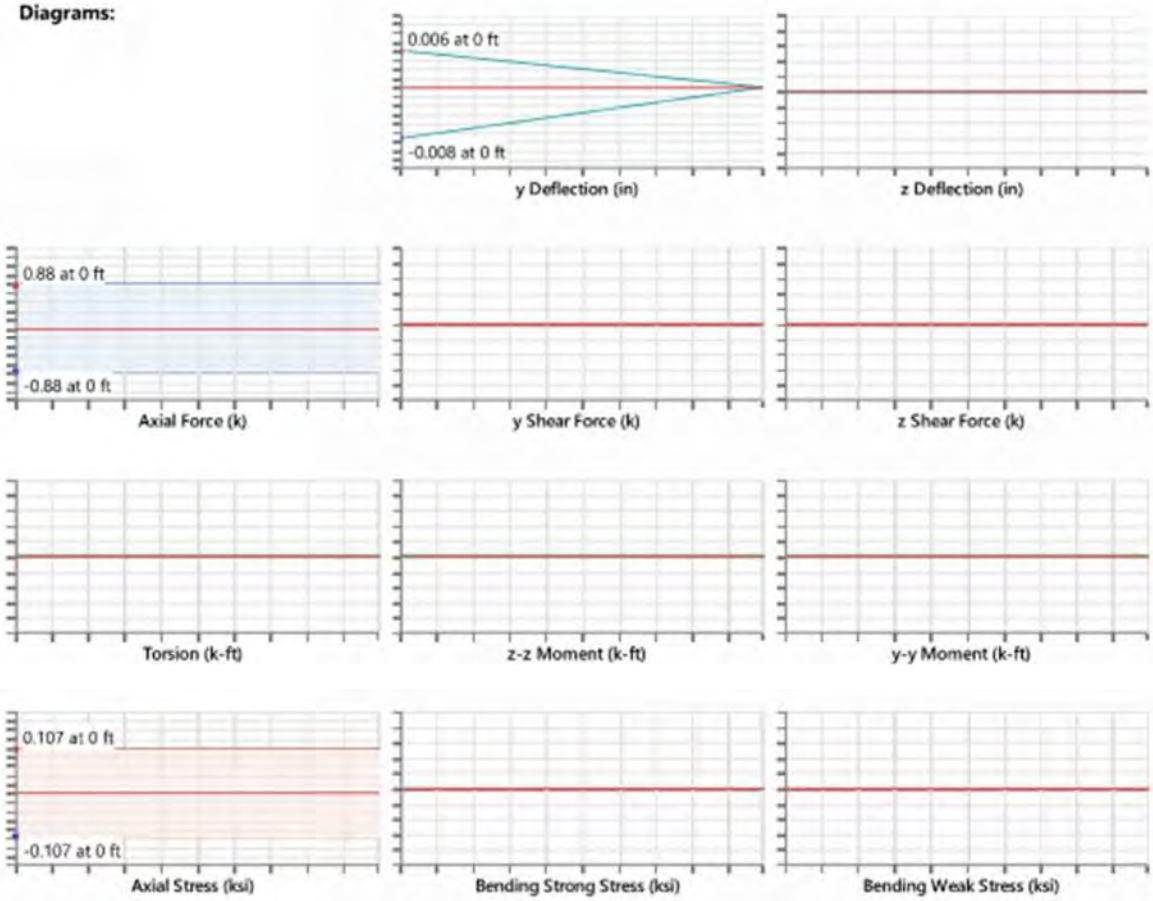
Shape Properties

F_b (ksi):	0.85	**E (ksi):**	1300	**b (actual) (in):**	1.5
F_t (ksi):	0.52	**Emod:**	1	**d (actual) (in):**	5.5
F_v (ksi):	0.15	**COV_E (Table F1):**	0.25		
F_c (ksi):	1.3	**E_{min} (ksi):**	474.9		

Design Properties

le2 (ft):	4.24	**y sway:**	No	**C_{fu}:**	1
le1 (ft):	4.24	**z sway:**	No	**C_P:**	0.15
le-bend top:	Lbyy	**C_D:**	1.6	**Max Defl Ratio:**	L/10000
le-bend bot (ft):	4.24	**R_B:**	11.16	**Max Defl Location:**	0
K_{y-y}:	1	**C_L:**	0.96	**Span:**	N/A
K_{z-z}:	1	**C_r:**	1		

Diagrams:

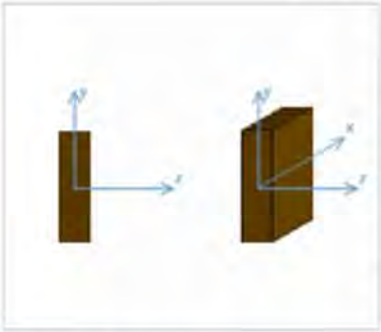


AWC NDS-18 / SDPWS-15 ASD Code Check

Limit State	Gov. LC	Required	Available	Unity Check	Result
Applied Loading - Bending/Axial	4	-	-	-	-
Applied Loading - Shear + Torsion	13	-	-	-	-
Axial Compression Analysis	-	0.11 ksi	0.22 ksi	-	-
Axial Tension Analysis	-	0 ksi	0.87 ksi	-	-
Flexural Analysis, Fb1'	-	0 ksi	1.36 ksi	-	-
Flexural Analysis, Fb2'	-	0 ksi	1.41 ksi	-	-
Bending & Axial Compression Analysis	-	-	-	0.48	PASS
Bending & Axial Tension Analysis	-	-	-	0	PASS
Shear Analysis	-	0 ksi	0.19 ksi	0	PASS

Detail Report: M3

Load Combination: Envelope **Code check:** 0.477 (LC 4)



Input Data

Shape:	2X6 (nominal)	**I Node:**	N3
Member Type:	Column	**J Node:**	N4
Length (ft):	4.24	**I Release:**	BenPIN
Material Type:	Wood	**J Release:**	Fixed
Design Rule:	Typical	**I Offset:**	N/A
Internal Sections:	97	**J Offset:**	N/A
Design Code:	AWC NDS-18 / SDPWS-15 ASD	**T/C Only:**	Both Way

Material Properties

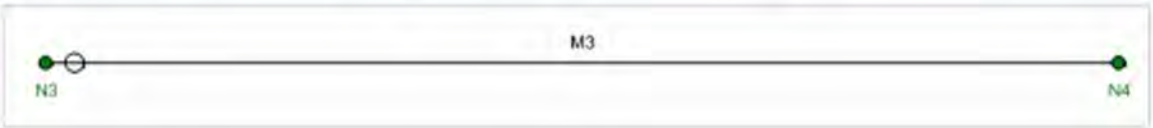
Material:	HF/L #2	**Grade:**	No.2	**Nu:**	0.3
Type:	Solid Sawn	**Cm:**	Yes	**Alpha ($1e^{-6}F^{-1}$):**	0.3
Database:	Visually Graded	**Ci:**	Yes	**Density (k/ft^3):**	0.04
Species:	Hem-Fir	**Emod:**	1		

Shape Properties

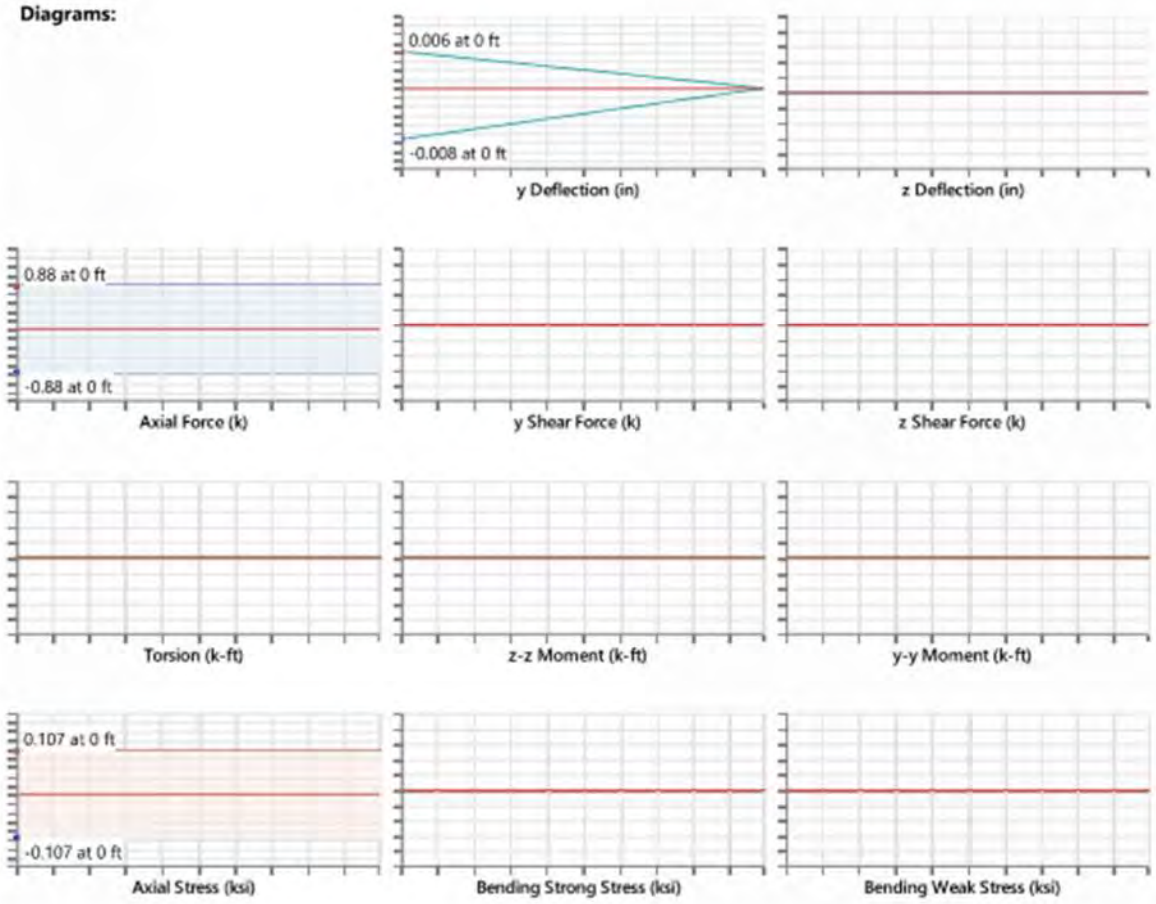
F_b (ksi):	0.85	**E (ksi):**	1300	**b (actual) (in):**	1.5
F_t (ksi):	0.52	**Emod:**	1	**d (actual) (in):**	5.5
F_v (ksi):	0.15	**COV_E (Table F1):**	0.25		
F_c (ksi):	1.3	**E_{min} (ksi):**	474.9		

Design Properties

le2 (ft):	4.24	**y sway:**	No	**C_{fu}:**	1
le1 (ft):	4.24	**z sway:**	No	**C_P:**	0.15
le-bend top:	Lbyy	**C_D:**	1.6	**Max Defl Ratio:**	L/10000
le-bend bot (ft):	4.24	**R_B:**	11.16	**Max Defl Location:**	0
K_{y-y}:	1	**C_L:**	0.96	**Span:**	N/A
K_{z-z}:	1	**C_t:**	1		



Diagrams:



AWC NDS-18 / SDPWS-15 ASD Code Check

Limit State	Gov. LC	Required	Available	Unity Check	Result
Applied Loading - Bending/Axial	4	-	-	-	-
Applied Loading - Shear + Torsion	13	-	-	-	-
Axial Compression Analysis	-	0.11 ksi	0.22 ksi	-	-
Axial Tension Analysis	-	0 ksi	0.87 ksi	-	-
Flexural Analysis, Fb1'	-	0 ksi	1.36 ksi	-	-
Flexural Analysis, Fb2'	-	0 ksi	1.41 ksi	-	-
Bending & Axial Compression Analysis	-	-	-	0.48	PASS
Bending & Axial Tension Analysis	-	-	-	0	PASS
Shear Analysis	-	0 ksi	0.19 ksi	0	PASS

Node Coordinates

	Label	X [ft]	Y [ft]	Z [ft]	Detach From Diaphragm
1	N1	0	0	0	
2	N2	0	4.22	0	
3	N3	0	2.5	0	
4	N4	2.5	0	0	

Wood Section Sets

	Label	Shape	Type	Design List	Material	Design Rule	Area [in²]	Iyy [in⁴]	Izz [in⁴]	J [in⁴]
1	Post	6X6	Column	Rectangular	HF/L #1	Typical	30.25	76.26	76.26	128.87
2	Brace	6X6	Column	Rectangular	HF/L #2	Typical	30.25	76.26	76.26	128.87
3	Brace Alt	2X6	Column	Rectangular	HF/L #2	Typical	8.25	1.55	20.8	5.12

Member Primary Data

	Label	I Node	J Node	Section/Shape	Type	Design List	Material	Design Rule
1	M1	N1	N2	Post	Column	Rectangular	HF/L #1	Typical
2	M2	N3	N4	Brace Alt	Column	Rectangular	HF/L #2	Typical
3	M3	N3	N4	Brace Alt	Column	Rectangular	HF/L #2	Typical

Node Loads and Enforced Displacements (BLC 1 : Dead)

	Node Label	L, D, M	Direction	Magnitude [(k, k-ft), (in, rad), (k*s²/ft, k*s²*ft)]
1	N2	L	Y	-1.08

Node Loads and Enforced Displacements (BLC 2 : Live Roof)

	Node Label	L, D, M	Direction	Magnitude [(k, k-ft), (in, rad), (k*s²/ft, k*s²*ft)]
1	N2	L	Y	-1.8

Node Loads and Enforced Displacements (BLC 3 : Snow)

	Node Label	L, D, M	Direction	Magnitude [(k, k-ft), (in, rad), (k*s²/ft, k*s²*ft)]
1	N2	L	Y	-2.66

Node Loads and Enforced Displacements (BLC 4 : Seismic Horiz)

	Node Label	L, D, M	Direction	Magnitude [(k, k-ft), (in, rad), (k*s²/ft, k*s²*ft)]
1	N2	L	X	1.12

Load Combinations

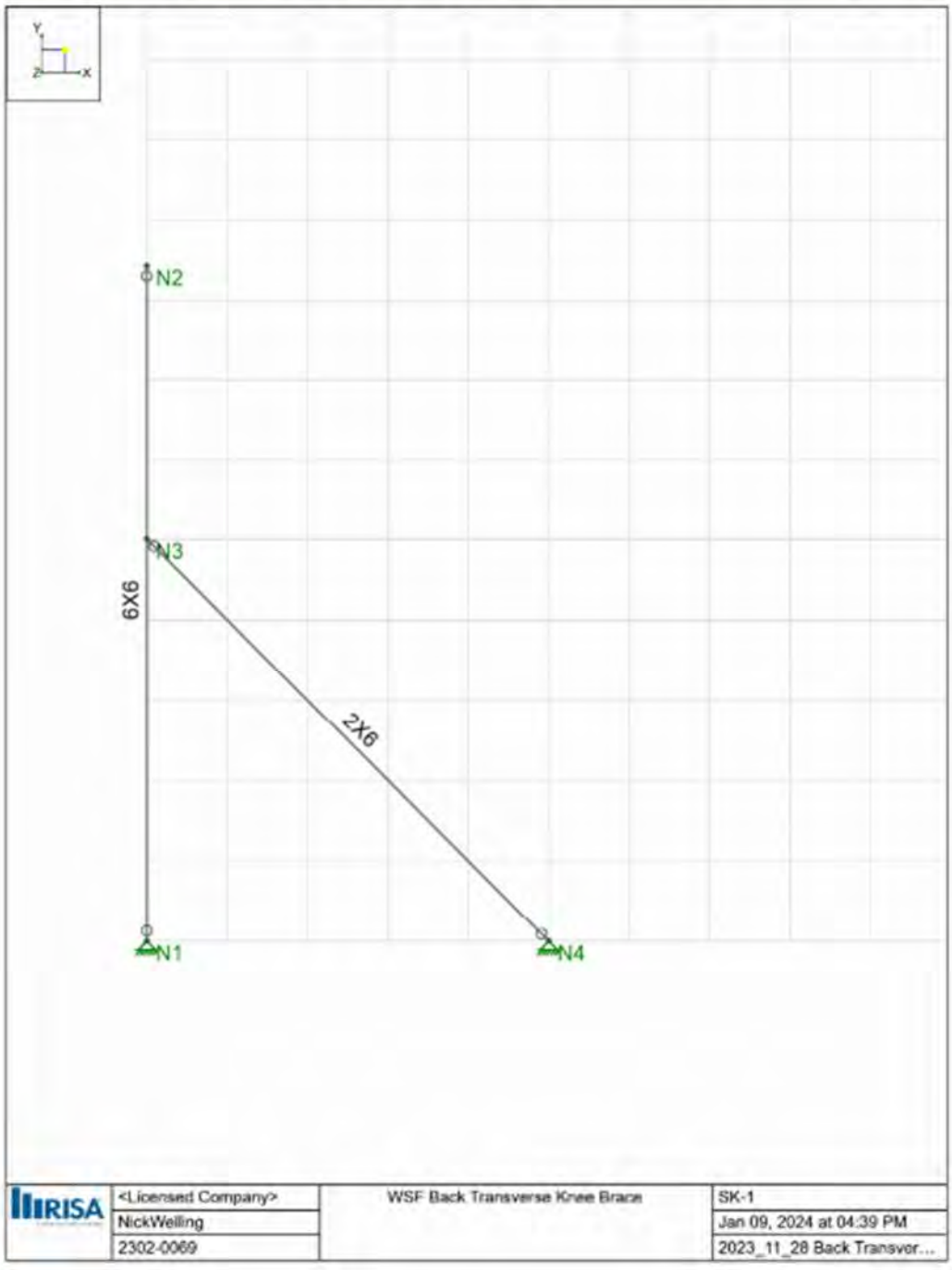
	Description	Solve	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor
1	D	Yes	DL	1	NL	1				
2	D+Lr	Yes	DL	1	RLL	1				
3	D+S	Yes	DL	1	SL	1				
4	D+0.7Ev+0.7Eh	Yes	DL	1	Sds*DL	0.17	EL	0.7		
5	D+0.7Ev-0.7Eh	Yes	DL	1	Sds*DL	0.17	EL	-0.7		
6	D+0.7Ev+(0.7OmEh)	Yes	DL	1	Sds*DL	0.17	Om*EL	0.7		
7	D+0.7Ev-(0.7OmEh)	Yes	DL	1	Sds*DL	0.17	Om*EL	-0.7		
8	D+0.525Ev+0.525Eh+0.1S	Yes	DL	1	Sds*DL	0.13	EL	0.53	SL	0.1
9	D+0.525Ev-0.525Eh+0.1S	Yes	DL	1	Sds*DL	0.13	EL	-0.53	SL	0.1
10	D+0.525Ev+0.525(OmEh)+0.1S	Yes	DL	1	Sds*DL	0.13	Om*EL	0.53	SL	0.1
11	D+0.525Ev-0.525(OmEh)+0.1S	Yes	DL	1	Sds*DL	0.13	Om*EL	-0.53	SL	0.1
12	0.6D-0.7Ev+0.7Eh	Yes	DL	0.6	Sds*DL	-0.17	EL	0.7		
13	0.6D-0.7Ev-0.7Eh	Yes	DL	0.6	Sds*DL	-0.17	EL	-0.7		
14	0.6D-0.7Ev+0.7(OmEh)	Yes	DL	0.6	Sds*DL	-0.17	Om*EL	0.7		
15	0.6D-0.7Ev-0.7(OmEh)	Yes	DL	0.6	Sds*DL	-0.17	Om*EL	-0.7		

Envelope Node Reactions

	Node Label		X [k]	LC	Y [k]	LC	Z [k]	LC	MX [k-ft]	LC	MY [k-ft]	LC	MZ [k-ft]	LC
0	N4	max	1.33	13	1.33	12	0	13	0	13	LOCKED		0	13
1		min	-1.33	4	-1.33	5	0	1	0	1	LOCKED		0	1
2	N1	max	0.54	12	3.74	3	0	13	0	13	0	13	0	13
3		min	-0.54	5	-0.9	12	0	1	0	1	0	1	0	1
4	N3	max	NC		NC		NC		LOCKED		NC		NC	
5		min	NC		NC		NC		LOCKED		NC		NC	
6	Totals:	max	0.79	13	3.74	3	0	13						
7		min	-0.79	4	0.43	13	0	1						

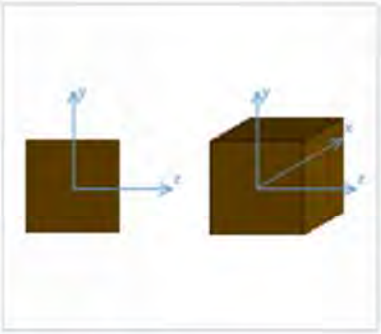
Envelope Node Reactions - Overstrength or Capacity Limit

	Node Label		X [k]	LC	Y [k]	LC	Z [k]	LC	MX [k-ft]	LC	MY [k-ft]	LC	MZ [k-ft]	LC
0	N4	max	1.99	15*	1.99	6*	0	15*	0	15*	LOCKED		0	15*
1		min	-1.99	14*	-1.99	15*	0	6*	0	6*	LOCKED		0	6*
2	N1	max	0.81	14*	3.29	7*	0	15*	0	15*	0	15*	0	15*
3		min	-0.81	7*	-1.56	14*	0	6*	0	6*	0	6*	0	6*
4	N3	max	NC		NC		NC		LOCKED		NC		NC	
5		min	NC		NC		NC		LOCKED		NC		NC	
6	Totals:	max	1.18	15*	1.51	11*	0	15*						
7		min	-1.18	6*	0.43	15*	0	6*						



Detail Report: M1

Load Combination: Envelope **Code check:** 0.497 (LC 12)



Input Data

Shape:	6X6 (nominal)	**I Node:**	N1
Member Type:	Column	**J Node:**	N2
Length (ft):	4.22	**I Release:**	Fixed
Material Type:	Wood	**J Release:**	Fixed
Design Rule:	Typical	**I Offset:**	N/A
Internal Sections:	97	**J Offset:**	N/A
Design Code:	AWC NDS-18 / SDPWS-15 ASD	**T/C Only:**	Both Way

Material Properties

Material:	HF/L #1	**Grade:**	No.1	**Nu:**	0.3
Type:	Solid Sawn	**Cm:**	Yes	**Alpha ($1e^{-6}F^{-1}$):**	0.3
Database:	Visually Graded	**Ci:**	Yes	**Density (k/ft^3):**	0.04
Species:	Hem-Fir	**Emod:**	1		

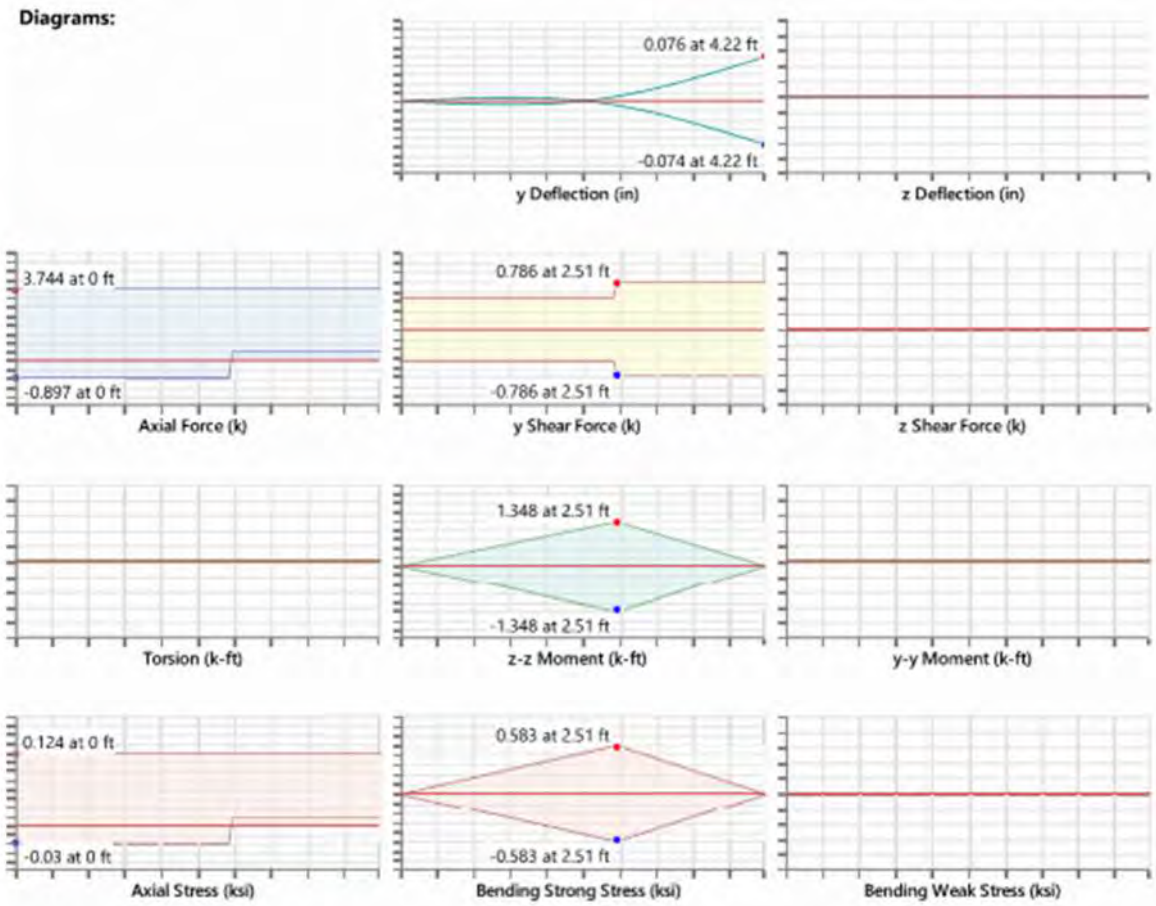
Shape Properties

F_b (ksi):	0.98	**E (ksi):**	1300	**b (actual) (in):**	5.5
F_t (ksi):	0.65	**Emod:**	1	**d (actual) (in):**	5.5
F_v (ksi):	0.14	**COV_E (Table F1):**	0.25		
F_c (ksi):	0.85	**E_{min} (ksi):**	474.9		

Design Properties

le2 (ft):	4.22	**y sway:**	No	**C_{fu}:**	1
le1 (ft):	4.22	**z sway:**	No	**C_P:**	0.93
le-bend top:	I.byy	**C_D:**	1.6	**Max Defl Ratio:**	I/664
le-bend bot (ft):	4.22	**R_B:**	3.03	**Max Defl Location:**	4.22
K_{y-y}:	1	**C_L:**	1	**Span:**	N/A
K_{z-z}:	1	**C_c:**	1		

Diagrams:

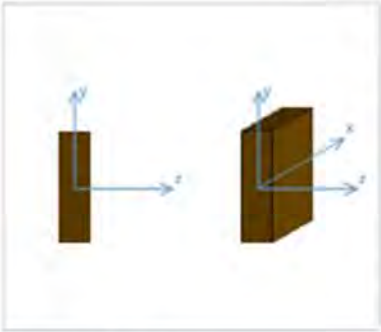


AWC NDS-18 / SDPWS-15 ASD Code Check

Limit State	Gov. LC	Required	Available	Unity Check	Result
Applied Loading - Bending/Axial	12	-	-	-	-
Applied Loading - Shear + Torsion	12	-	-	-	-
Axial Compression Analysis	-	0 ksi	0.92 ksi	-	-
Axial Tension Analysis	-	-0.03 ksi	0.83 ksi	-	-
Flexural Analysis, Fb1*	-	0.58 ksi	1.25 ksi	-	-
Flexural Analysis, Fb2*	-	0 ksi	1.25 ksi	-	-
Bending & Axial Compression Analysis	-	-	-	0.46	PASS
Bending & Axial Tension Analysis	-	-	-	0.5	PASS
Shear Analysis	-	0.04 ksi	0.18 ksi	0.22	PASS

Detail Report: M2

Load Combination: Envelope **Code check:** 0.360 (LC 12)



Input Data

Shape:	2X6 (nominal)	**I Node:**	N3
Member Type:	Column	**J Node:**	N4
Length (ft):	3.54	**I Release:**	BenPIN
Material Type:	Wood	**J Release:**	Fixed
Design Rule:	Typical	**I Offset:**	N/A
Internal Sections:	97	**J Offset:**	N/A
Design Code:	AWC NDS-18 / SDPWS-15 ASD	**T/C Only:**	Both Way

Material Properties

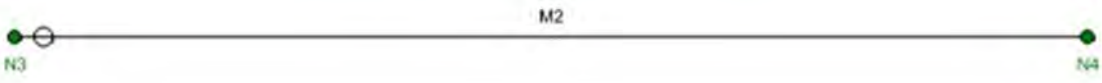
Material:	HF/L #2	**Grade:**	No.2	**Nu:**	0.3
Type:	Solid Sawn	**Cm:**	Yes	**Alpha ($1e^{-6}F^{-1}$):**	0.3
Database:	Visually Graded	**Ci:**	Yes	**Density (k/ft^3):**	0.04
Species:	Hem-Fir	**Emod:**	1		

Shape Properties

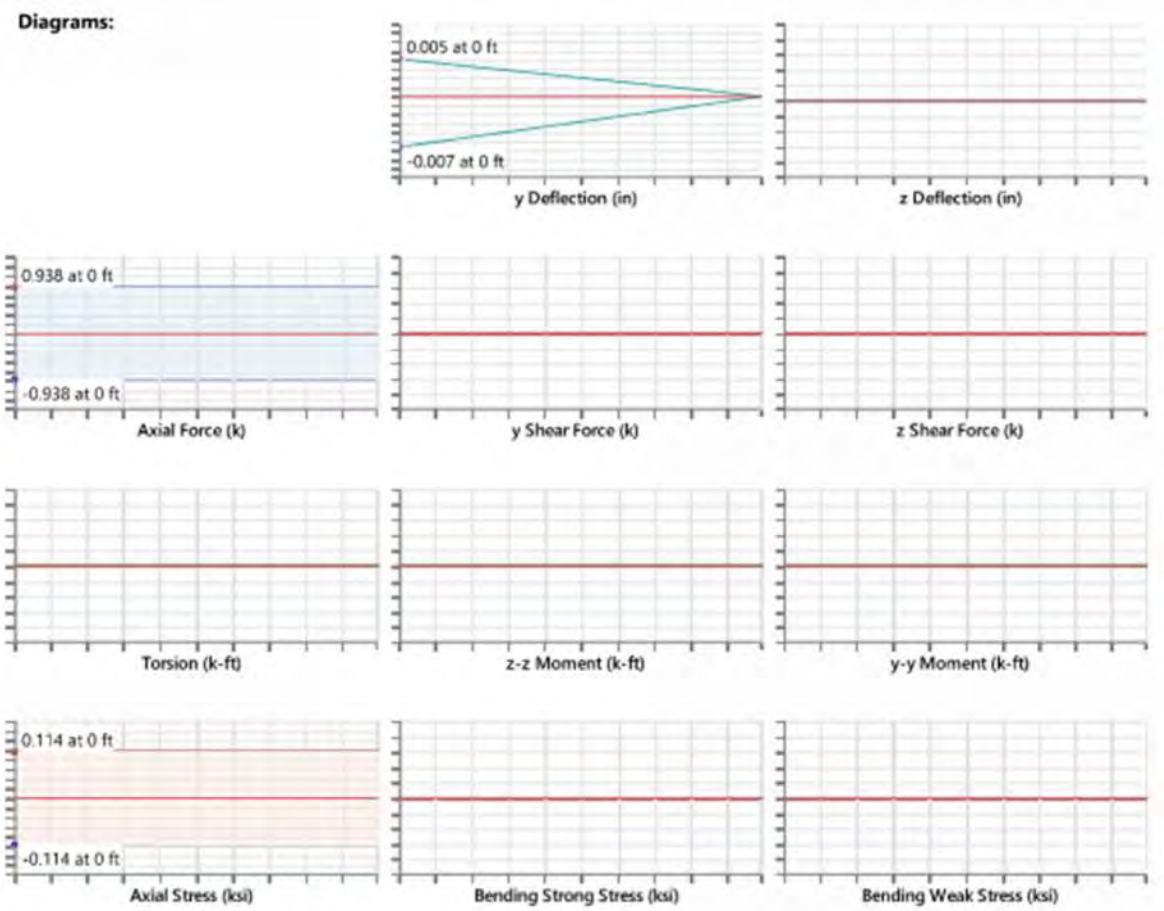
F_b (ksi):	0.85	**E (ksi):**	1300	**b (actual) (in):**	1.5
F_t (ksi):	0.52	**Emod:**	1	**d (actual) (in):**	5.5
F_v (ksi):	0.15	**COV_E (Table F1):**	0.25		
F_c (ksi):	1.3	**E_{min} (ksi):**	474.9		

Design Properties

le2 (ft):	3.54	**y sway:**	No	**C_{fu}:**	1
le1 (ft):	3.54	**z sway:**	No	**C_P:**	0.22
le-bend top:	Lbyy	**C_D:**	1.6	**Max Defl Ratio:**	L/10000
le-bend bot (ft):	3.54	**R_B:**	10.18	**Max Defl Location:**	0
K_{y-y}:	1	**C_L:**	0.97	**Span:**	N/A
K_{z-z}:	1	**C_r:**	1		



Diagrams:

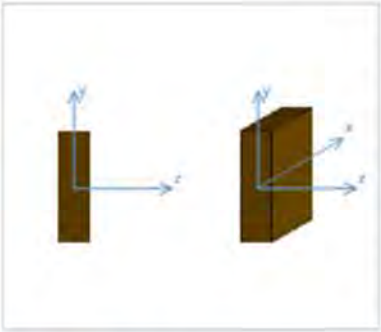


AWC NDS-18 / SDPWS-15 ASD Code Check

Limit State	Gov. LC	Required	Available	Unity Check	Result
Applied Loading - Bending/Axial	12	-	-	-	-
Applied Loading - Shear + Torsion	4	-	-	-	-
Axial Compression Analysis	-	0.11 ksi	0.32 ksi	-	-
Axial Tension Analysis	-	0 ksi	0.87 ksi	-	-
Flexural Analysis, Fb1'	-	0 ksi	1.37 ksi	-	-
Flexural Analysis, Fb2'	-	0 ksi	1.41 ksi	-	-
Bending & Axial Compression Analysis	-	-	-	0.36	PASS
Bending & Axial Tension Analysis	-	-	-	0	PASS
Shear Analysis	-	0 ksi	0.19 ksi	0	PASS

Detail Report: M3

Load Combination: Envelope **Code check:** 0.360 (LC 12)



Input Data

Shape:	2X6 (nominal)	**I Node:**	N3
Member Type:	Column	**J Node:**	N4
Length (ft):	3.54	**I Release:**	BenPIN
Material Type:	Wood	**J Release:**	Fixed
Design Rule:	Typical	**I Offset:**	N/A
Internal Sections:	97	**J Offset:**	N/A
Design Code:	AWC NDS-18 / SDPWS-15 ASD	**T/C Only:**	Both Way

Material Properties

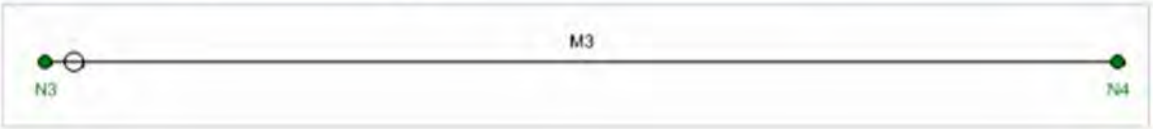
Material:	HF/L #2	**Grade:**	No.2	**Nu:**	0.3
Type:	Solid Sawn	**Cm:**	Yes	**Alpha ($1e^{-6}F^{-1}$):**	0.3
Database:	Visually Graded	**Ci:**	Yes	**Density (k/ft^3):**	0.04
Species:	Hem-Fir	**Emod:**	1		

Shape Properties

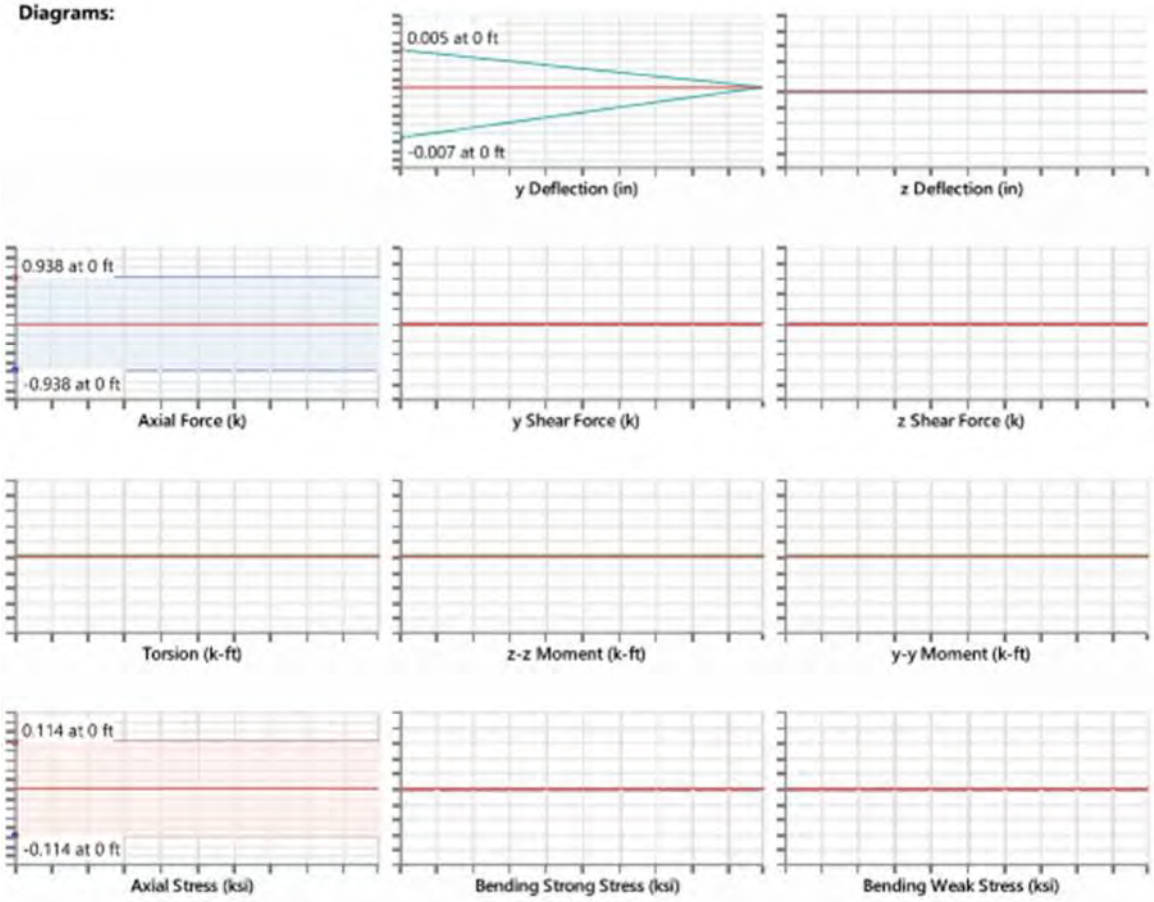
F_b (ksi):	0.85	**E (ksi):**	1300	**b (actual) (in):**	1.5
F_t (ksi):	0.52	**Emod:**	1	**d (actual) (in):**	5.5
F_v (ksi):	0.15	**COV_E (Table F1):**	0.25		
F_c (ksi):	1.3	**E_{min} (ksi):**	474.9		

Design Properties

le2 (ft):	3.54	**y sway:**	No	**C_{fu}:**	1
le1 (ft):	3.54	**z sway:**	No	**C_P:**	0.22
le-bend top:	Lbyy	**C_D:**	1.6	**Max Defl Ratio:**	L/10000
le-bend bot (ft):	3.54	**R_B:**	10.18	**Max Defl Location:**	0
K_{y-y}:	1	**C_L:**	0.97	**Span:**	N/A
K_{z-z}:	1	**C_r:**	1		



Diagrams:



AWC NDS-18 / SDPWS-15 ASD Code Check

Limit State	Gov. LC	Required	Available	Unity Check	Result
Applied Loading - Bending/Axial	12	-	-	-	-
Applied Loading - Shear + Torsion	4	-	-	-	-
Axial Compression Analysis	-	0.11 ksi	0.32 ksi	-	-
Axial Tension Analysis	-	0 ksi	0.87 ksi	-	-
Flexural Analysis, Fb1'	-	0 ksi	1.37 ksi	-	-
Flexural Analysis, Fb2'	-	0 ksi	1.41 ksi	-	-
Bending & Axial Compression Analysis	-	-	-	0.36	PASS
Bending & Axial Tension Analysis	-	-	-	0	PASS
Shear Analysis	-	0 ksi	0.19 ksi	0	PASS

Node Coordinates

	Label	X [ft]	Y [ft]	Z [ft]	Detach From Diaphragm
1	N1	0	0	0	
2	N2	0	6	0	
3	N3	0	3.5	0	
4	N4	3.5	0	0	

Wood Section Sets

	Label	Shape	Type	Design List	Material	Design Rule	Area [in²]	Iyy [in⁴]	Izz [in⁴]	J [in⁴]
1	Post	6X6	Column	Rectangular	HF/L #1	Typical	30.25	76.26	76.26	128.87
2	Brace	6X6	Column	Rectangular	HF/L #2	Typical	30.25	76.26	76.26	128.87
3	Brace Alt	2X6	Column	Rectangular	HF/L #2	Typical	8.25	1.55	20.8	5.12

Member Primary Data

	Label	I Node	J Node	Section/Shape	Type	Design List	Material	Design Rule
1	M1	N1	N2	Post	Column	Rectangular	HF/L #1	Typical
2	M2	N3	N4	Brace Alt	Column	Rectangular	HF/L #2	Typical
3	M3	N3	N4	Brace Alt	Column	Rectangular	HF/L #2	Typical

Node Loads and Enforced Displacements (BLC 1 : Dead)

	Node Label	L, D, M	Direction	Magnitude [(k, k-ft), (in, rad), (k*s²/ft, k*s²*ft)]
1	N2	L	Y	-1.08

Node Loads and Enforced Displacements (BLC 2 : Live Roof)

	Node Label	L, D, M	Direction	Magnitude [(k, k-ft), (in, rad), (k*s²/ft, k*s²*ft)]
1	N2	L	Y	-1.8

Node Loads and Enforced Displacements (BLC 3 : Snow)

	Node Label	L, D, M	Direction	Magnitude [(k, k-ft), (in, rad), (k*s²/ft, k*s²*ft)]
1	N2	L	Y	-2.66

Node Loads and Enforced Displacements (BLC 4 : Seismic Horiz)

	Node Label	L, D, M	Direction	Magnitude [(k, k-ft), (in, rad), (k*s²/ft, k*s²*ft)]
1	N2	L	X	1.12

Load Combinations

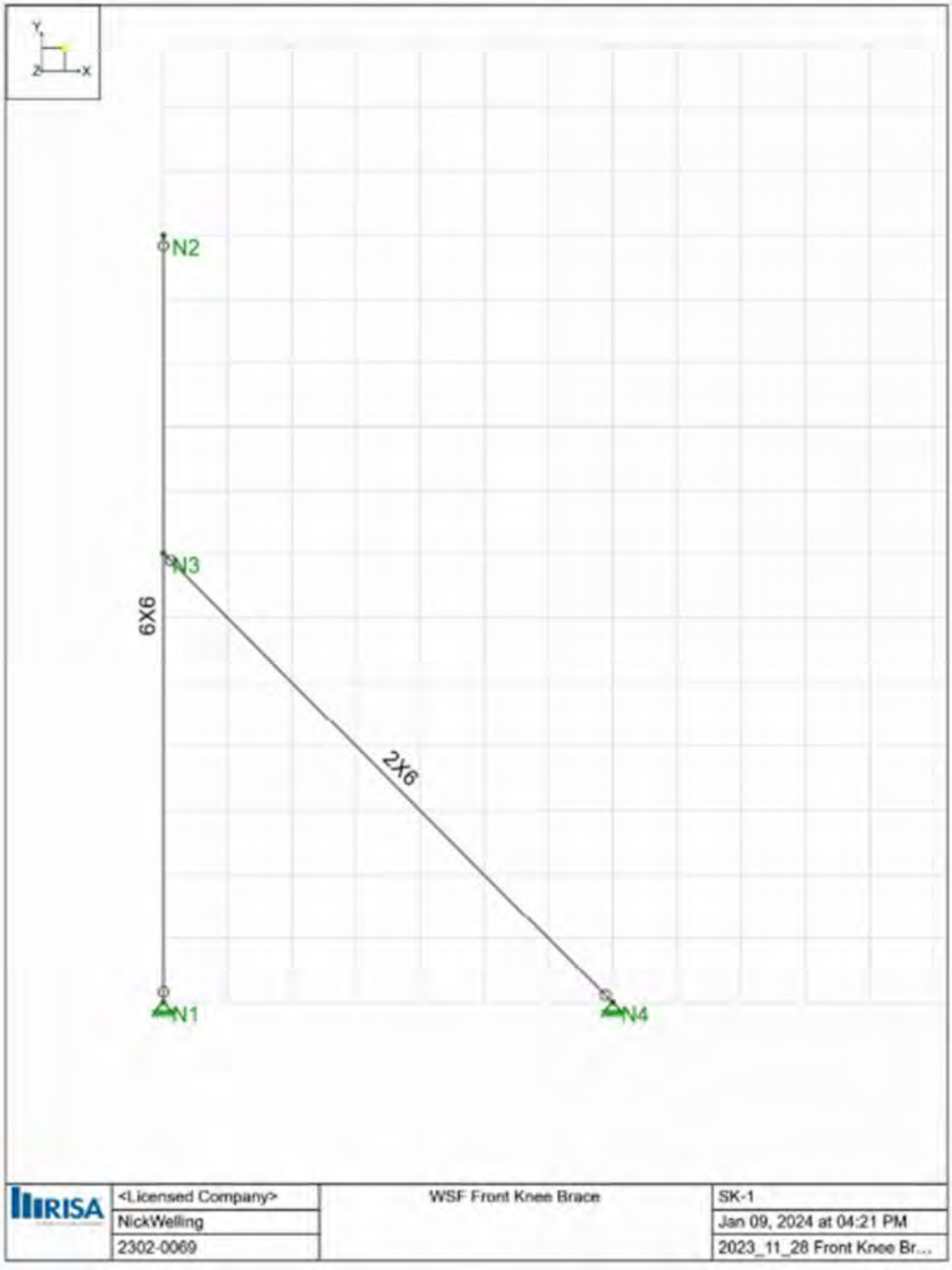
	Description	Solve	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor
1	D	Yes	DL	1	NL	1				
2	D+Lr	Yes	DL	1	RLL	1				
3	D+S	Yes	DL	1	SL	1				
4	D+0.7Ev+0.7Eh	Yes	DL	1	Sds*DL	0.17	EL	0.7		
5	D+0.7Ev-0.7Eh	Yes	DL	1	Sds*DL	0.17	EL	-0.7		
6	D+0.7Ev+(0.7OmEh)	Yes	DL	1	Sds*DL	0.17	Om*EL	0.7		
7	D+0.7Ev-(0.7OmEh)	Yes	DL	1	Sds*DL	0.17	Om*EL	-0.7		
8	D+0.525Ev+0.525Eh+0.1S	Yes	DL	1	Sds*DL	0.13	EL	0.53	SL	0.1
9	D+0.525Ev-0.525Eh+0.1S	Yes	DL	1	Sds*DL	0.13	EL	-0.53	SL	0.1
10	D+0.525Ev+0.525(OmEh)+0.1S	Yes	DL	1	Sds*DL	0.13	Om*EL	0.53	SL	0.1
11	D+0.525Ev-0.525(OmEh)+0.1S	Yes	DL	1	Sds*DL	0.13	Om*EL	-0.53	SL	0.1
12	0.6D-0.7Ev+0.7Eh	Yes	DL	0.6	Sds*DL	-0.17	EL	0.7		
13	0.6D-0.7Ev-0.7Eh	Yes	DL	0.6	Sds*DL	-0.17	EL	-0.7		
14	0.6D-0.7Ev+0.7(OmEh)	Yes	DL	0.6	Sds*DL	-0.17	Om*EL	0.7		
15	0.6D-0.7Ev-0.7(OmEh)	Yes	DL	0.6	Sds*DL	-0.17	Om*EL	-0.7		

Envelope Node Reactions

	Node Label		X [k]	LC	Y [k]	LC	Z [k]	LC	MX [k-ft]	LC	MY [k-ft]	LC	MZ [k-ft]	LC
0	N4	max	1.35	13	1.35	12	0	13	0	13	LOCKED		0	13
1		min	-1.35	4	-1.35	13	0	1	0	1	LOCKED		0	1
2	N1	max	0.56	12	3.74	3	0	13	0	13	0	13	0	13
3		min	-0.56	13	-0.92	12	0	1	0	1	0	1	0	1
4	N3	max	NC		NC		NC		LOCKED		NC		NC	
5		min	NC		NC		NC		LOCKED		NC		NC	
6	Totals:	max	0.79	5	3.74	3	0	13						
7		min	-0.79	4	0.43	12	0	1						

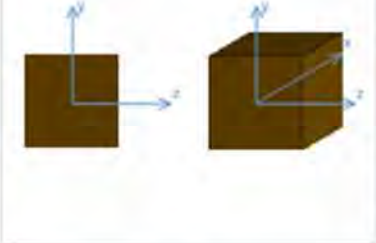
Envelope Node Reactions - Overstrength or Capacity Limit

	Node Label		X [k]	LC	Y [k]	LC	Z [k]	LC	MX [k-ft]	LC	MY [k-ft]	LC	MZ [k-ft]	LC
0	N4	max	2.02	7*	2.02	14*	0	15*	0	15*	LOCKED		0	15*
1		min	-2.02	14*	-2.02	7*	0	6*	0	6*	LOCKED		0	6*
2	N1	max	0.84	6*	3.32	7*	0	15*	0	15*	0	15*	0	15*
3		min	-0.84	7*	-1.59	14*	0	6*	0	6*	0	6*	0	6*
4	N3	max	NC		NC		NC		LOCKED		NC		NC	
5		min	NC		NC		NC		LOCKED		NC		NC	
6	Totals:	max	1.18	7*	1.51	11*	0	15*						
7		min	-1.18	14*	0.43	14*	0	6*						



Detail Report: M1

Load Combination: Envelope **Code check:** 0.718 (LC 12)



Input Data

Shape:	6X6 (nominal)	**I Node:**	N1
Member Type:	Column	**J Node:**	N2
Length (ft):	6	**I Release:**	Fixed
Material Type:	Wood	**J Release:**	Fixed
Design Rule:	Typical	**I Offset:**	N/A
Internal Sections:	97	**J Offset:**	N/A
Design Code:	AWC NDS-18 / SDPWS-15 ASD	**T/C Only:**	Both Way

Material Properties

Material:	HF/L #1	**Grade:**	No.1	**Nu:**	0.3
Type:	Solid Sawn	**Cm:**	Yes	**Alpha ($1e^{-6}F^{-1}$):**	0.3
Database:	Visually Graded	**Ci:**	Yes	**Density (k/ft^3):**	0.04
Species:	Hem-Fir	**Emod:**	1		

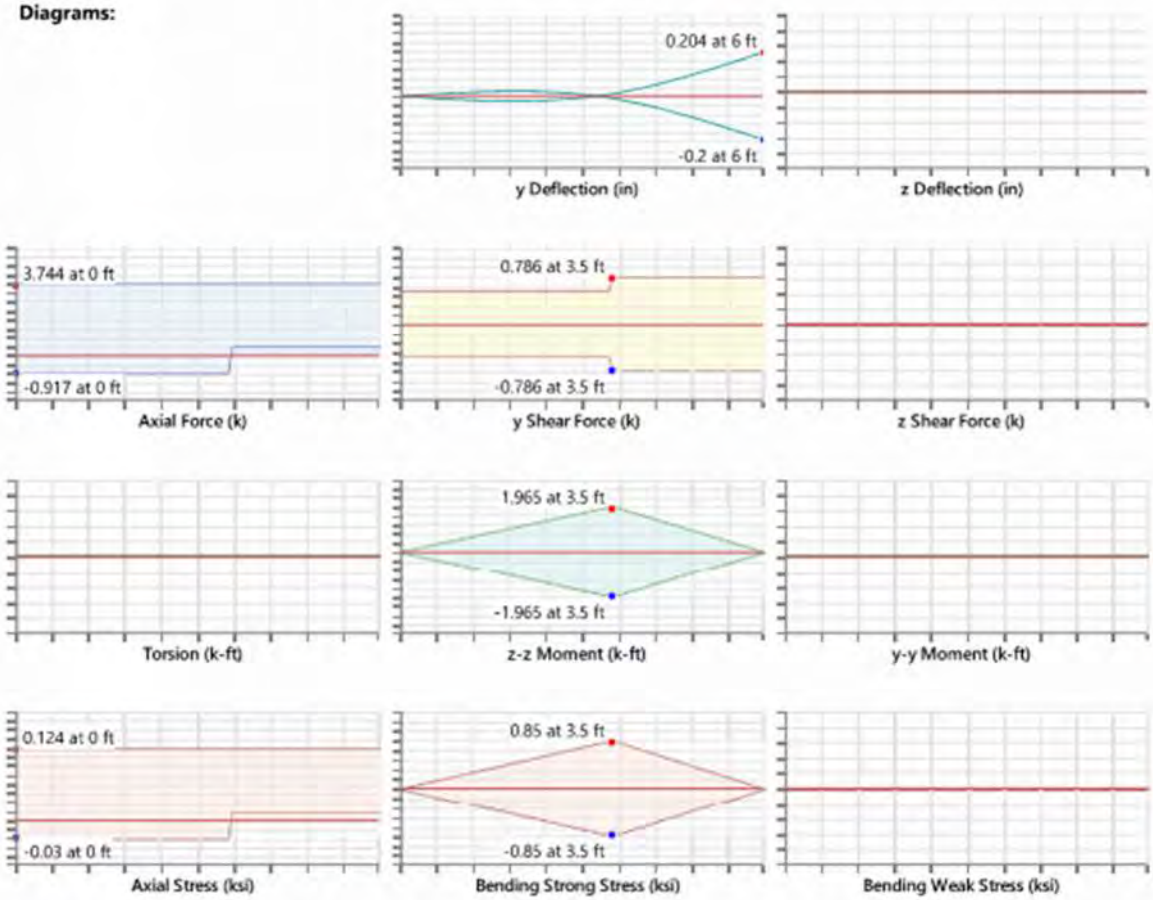
Shape Properties

F_b (ksi):	0.98	**E (ksi):**	1300	**b (actual) (in):**	5.5
F_t (ksi):	0.65	**Emod:**	1	**d (actual) (in):**	5.5
F_v (ksi):	0.14	**COV_E (Table F1):**	0.25		
F_c (ksi):	0.85	**E_{min} (ksi):**	474.9		

Design Properties

le2 (ft):	6	**y sway:**	No	**C_{fu}:**	1
le1 (ft):	3.5	**z sway:**	No	**C_P:**	0.84
le-bend top:	Lbyy	**C_D:**	1.6	**Max Defl Ratio:**	L/353
le-bend bot (ft):	6	**R_B:**	3.62	**Max Defl Location:**	6
K_{y-y}:	1	**C_L:**	1	**Span:**	N/A
K_{z-z}:	1	**C_r:**	1		

Diagrams:

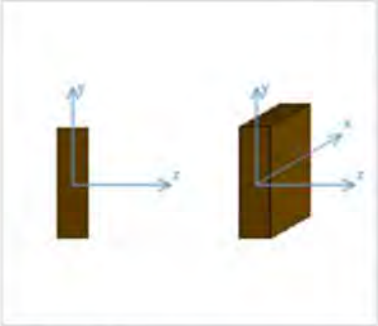


AWC NDS-18 / SDPWS-15 ASD Code Check

Limit State	Gov. LC	Required	Available	Unity Check	Result
Applied Loading - Bending/Axial	12	-	-	-	-
Applied Loading - Shear + Torsion	5	-	-	-	-
Axial Compression Analysis	-	0 ksi	0.83 ksi	-	-
Axial Tension Analysis	-	-0.03 ksi	0.83 ksi	-	-
Flexural Analysis, Fb1'	-	0.85 ksi	1.25 ksi	-	-
Flexural Analysis, Fb2'	-	0 ksi	1.25 ksi	-	-
Bending & Axial Compression Analysis	-	-	-	0.68	PASS
Bending & Axial Tension Analysis	-	-	-	0.72	PASS
Shear Analysis	-	0.04 ksi	0.18 ksi	0.22	PASS

Detail Report: M2

Load Combination: Envelope **Code check:** 0.696 (LC 12)



Input Data

Shape:	2X6 (nominal)	**I Node:**	N3
Member Type:	Column	**J Node:**	N4
Length (ft):	4.95	**I Release:**	BenPIN
Material Type:	Wood	**J Release:**	Fixed
Design Rule:	Typical	**I Offset:**	N/A
Internal Sections:	97	**J Offset:**	N/A
Design Code:	AWC NDS-18 / SDPWS-15 ASD	**T/C Only:**	Both Way

Material Properties

Material:	HF/L #2	**Grade:**	No.2	**Nu:**	0.3
Type:	Solid Sawn	**Cm:**	Yes	**Alpha ($1e^{-6}F^{-1}$):**	0.3
Database:	Visually Graded	**Ci:**	Yes	**Density (k/ft^3):**	0.04
Species:	Hem-Fir	**Emod:**	1		

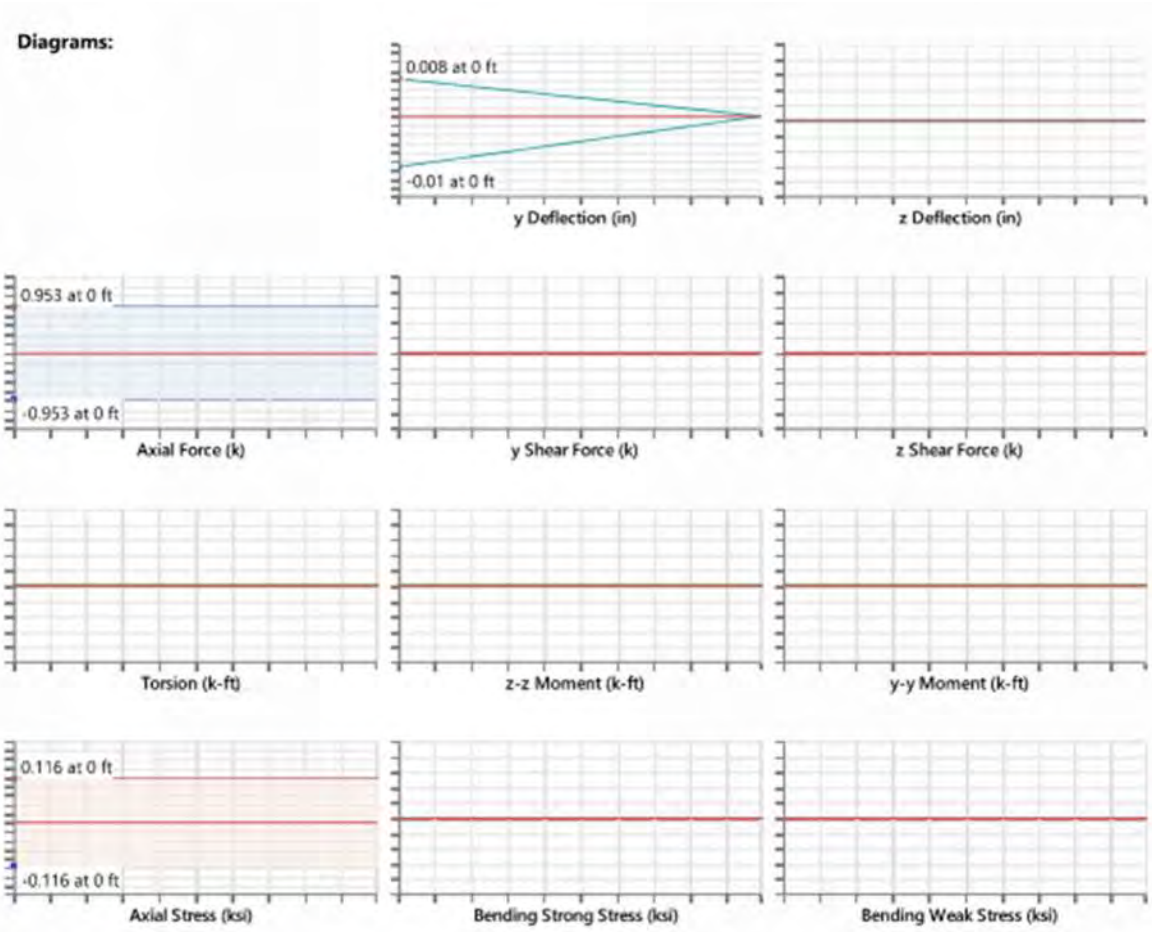
Shape Properties

F_b (ksi):	0.85	**E (ksi):**	1300	**b (actual) (in):**	1.5
F_t (ksi):	0.52	**Emod:**	1	**d (actual) (in):**	5.5
F_v (ksi):	0.15	**COV_E (Table F1):**	0.25		
F_c (ksi):	1.3	**E_{min} (ksi):**	474.9		

Design Properties

le2 (ft):	4.95	**y sway:**	No	**C_{fu}:**	1
le1 (ft):	4.95	**z sway:**	No	**C_F:**	0.11
le-bend top:	Lbyy	**C_D:**	1.6	**Max Defl Ratio:**	L/10000
le-bend bot (ft):	4.95	**R_B:**	12.05	**Max Defl Location:**	0
K_{y-y}:	1	**C_L:**	0.95	**Span:**	N/A
K_{z-z}:	1	**C_r:**	1		

Diagrams:

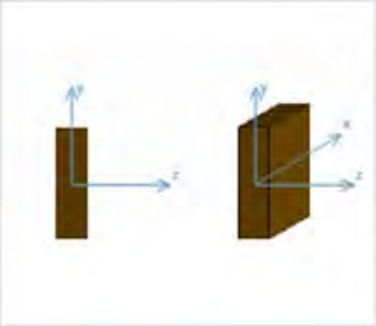


AWC NDS-18 / SDPWS-15 ASD Code Check

Limit State	Gov. LC	Required	Available	Unity Check	Result
Applied Loading - Bending/Axial	12	-	-	-	-
Applied Loading - Shear + Torsion	13	-	-	-	-
Axial Compression Analysis	-	0.12 ksi	0.17 ksi	-	-
Axial Tension Analysis	-	0 ksi	0.87 ksi	-	-
Flexural Analysis, Fb1'	-	0 ksi	1.35 ksi	-	-
Flexural Analysis, Fb2'	-	0 ksi	1.41 ksi	-	-
Bending & Axial Compression Analysis	-	-	-	0.7	PASS
Bending & Axial Tension Analysis	-	-	-	0	PASS
Shear Analysis	-	0 ksi	0.19 ksi	0	PASS

Detail Report: M3

Load Combination: Envelope **Code check:** 0.696 (LC 12)



Input Data

Shape:	2X6 (nominal)	**I Node:**	N3
Member Type:	Column	**J Node:**	N4
Length (ft):	4.95	**I Release:**	BenPIN
Material Type:	Wood	**J Release:**	Fixed
Design Rule:	Typical	**I Offset:**	N/A
Internal Sections:	97	**J Offset:**	N/A
Design Code:	AWC NDS-18 / SDPWS-15 ASD	**T/C Only:**	Both Way

Material Properties

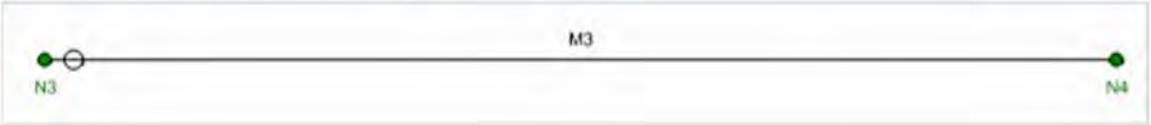
Material:	HF/L #2	**Grade:**	No.2	**Nu:**	0.3
Type:	Solid Sawn	**Cm:**	Yes	**Alpha ($1e^{-6}F^{-1}$):**	0.3
Database:	Visually Graded	**Ci:**	Yes	**Density (k/ft^3):**	0.04
Species:	Hem-Fir	**Emod:**	1		

Shape Properties

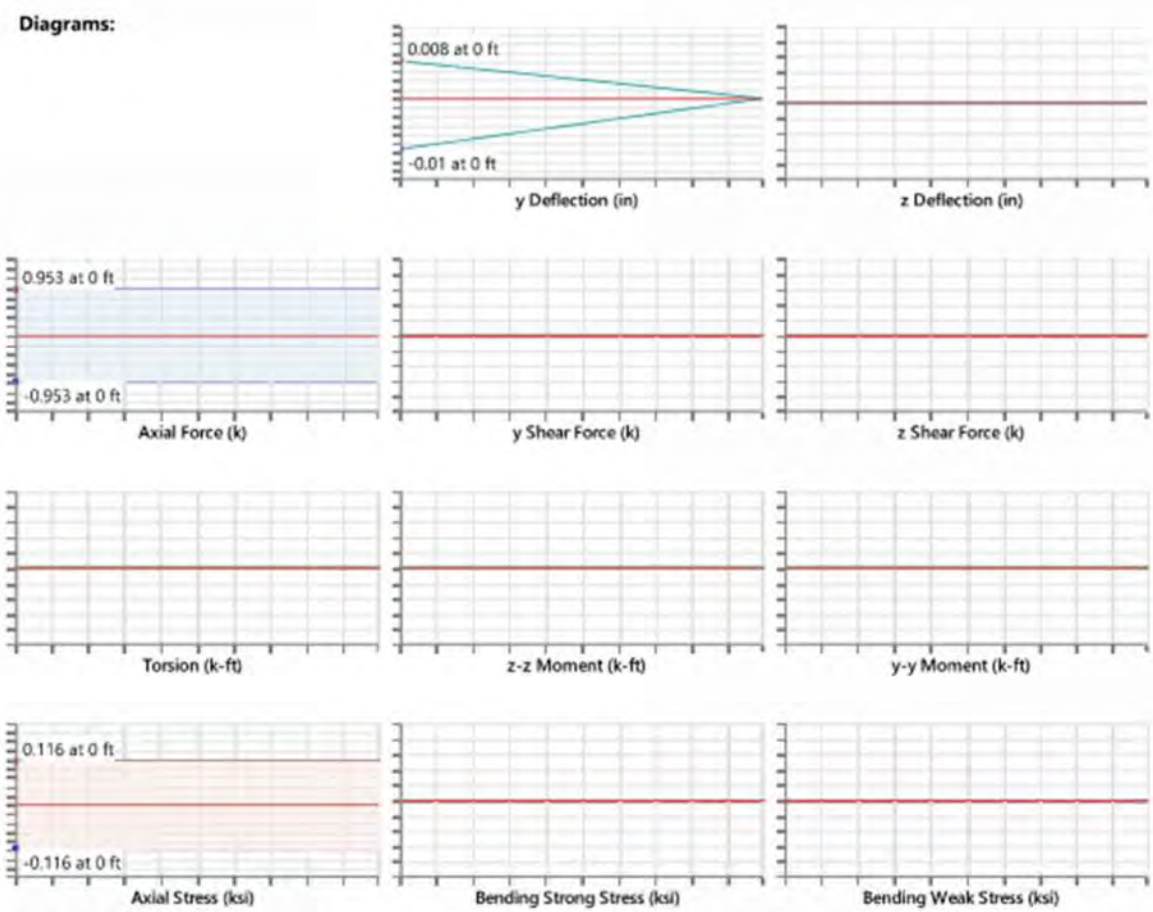
F_b (ksi):	0.85	**E (ksi):**	1300	**b (actual) (in):**	1.5
F_t (ksi):	0.52	**Emod:**	1	**d (actual) (in):**	5.5
F_v (ksi):	0.15	**COV_E (Table F1):**	0.25		
F_c (ksi):	1.3	**E_{min} (ksi):**	474.9		

Design Properties

le2 (ft):	4.95	**y sway:**	No	**C_{fu}:**	1
le1 (ft):	4.95	**z sway:**	No	**C_P:**	0.11
le-bend top:	Lbyy	**C_D:**	1.6	**Max Defl Ratio:**	L/10000
le-bend bot (ft):	4.95	**R_B:**	12.05	**Max Defl Location:**	0
K_{y-y}:	1	**C_L:**	0.95	**Span:**	N/A
K_{z-z}:	1	**C_r:**	1		



Diagrams:



AWC NDS-18 / SDPWS-15 ASD Code Check

Limit State	Gov. LC	Required	Available	Unity Check	Result
Applied Loading - Bending/Axial	12	-	-	-	-
Applied Loading - Shear + Torsion	13	-	-	-	-
Axial Compression Analysis	-	0.12 ksi	0.17 ksi	-	-
Axial Tension Analysis	-	0 ksi	0.87 ksi	-	-
Flexural Analysis, Fb1'	-	0 ksi	1.35 ksi	-	-
Flexural Analysis, Fb2'	-	0 ksi	1.41 ksi	-	-
Bending & Axial Compression Analysis	-	-	-	0.7	PASS
Bending & Axial Tension Analysis	-	-	-	0	PASS
Shear Analysis	-	0 ksi	0.19 ksi	0	PASS

Wood Beam Project File: Sill Plate.ec6

LIC# : KW-06014167, Build:20.23.08.01 PETERSON STRUCTURAL ENGINEERS (c) ENERCALC INC 1983-2023

DESCRIPTION: Sill Plate Weak Axis Bending

Vertical Reactions Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	0.967	0.963
Max Upward from Load Cases	0.967	0.963
E Only * 0.70	0.677	0.674
E Only * 0.5250	0.507	0.506
E Only	0.967	0.963

DESCRIPTION: Sill Plate Weak Axis Bending

CODE REFERENCES

Calculations per NDS 2018, IBC 2021, ASCE 7-16
Load Combination Set : IBC 2021

Material Properties

Analysis Method : Allowable Stress Design
Load Combination : IBC 2021

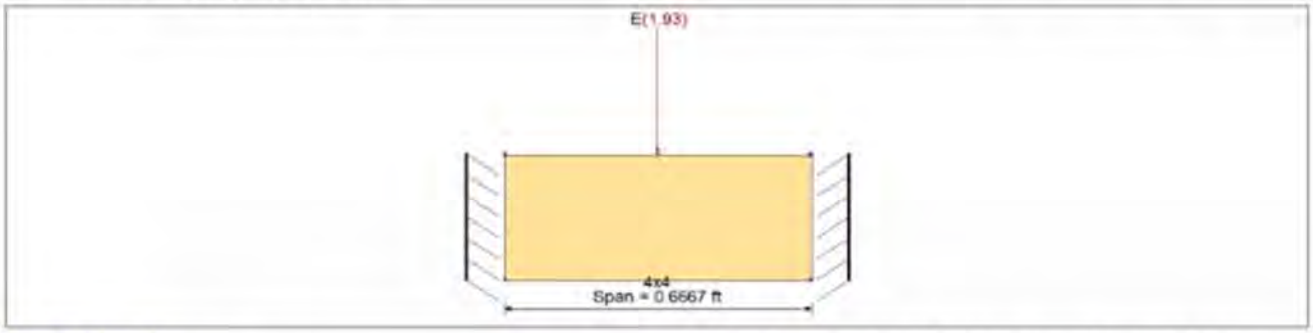
Wood Species : Hem-Fir
Wood Grade : No.2

Beam Bracing : Completely Unbraced

Fb +	850.0 psi
Fb -	850.0 psi
Fc - Prll	1,300.0 psi
Fc - Perp	405.0 psi
Fv	150.0 psi
Ft	525.0 psi

E : Modulus of Elasticity

Ebend- xx	1,300.0 ksi
Eminbend - xx	470.0 ksi
Density	26.840 pcf



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight NOT internally calculated and added
Point Load : E = 1.930 k @ 0.3330 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.116 : 1	Maximum Shear Stress Ratio	=	0.431 : 1
Section used for this span		4x4	Section used for this span		4x4
fb: Actual	=	189.27 psi	fv: Actual	=	82.84 psi
F'b	=	1,632.00 psi	F'v	=	192.00 psi
Load Combination		E Only * 0.70	Load Combination		E Only * 0.70
Location of maximum on span	=	0.000 ft	Location of maximum on span	=	0.000 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0 in	Ratio =	0 <120 n/a
Max Upward Transient Deflection	0 in	Ratio =	0 <120 n/a
Max Downward Total Deflection	0.000 in	Ratio =	34291 >=120 Span: 1 : E Only * 0.70
Max Upward Total Deflection	0 in	Ratio =	0 <120 n/a

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	CD	CM	C_t	CLx	C_F	Cfu	C_i	C_r	Moment Values M	fb	F'b	Shear Values V	fv	F'v
														0.0	0.00	0.0	0.0
Length = 0.6667 ft	1			0.90	1.00	1.00	1.00	1.500	1.00	0.80	1.00			918.0	0.00	0.0	108.0
E Only * 0.70					1.00	1.00	1.00	1.500	1.00	0.80	1.00			0.0	0.00	0.0	0.0
Length = 0.6667 ft	1	0.116	0.431	1.60	1.00	1.00	1.00	1.500	1.00	0.80	1.00	0.11	189.3	1,632.0	0.68	82.8	192.0
E Only * 0.5250					1.00	1.00	1.00	1.500	1.00	0.80	1.00			0.0	0.00	0.0	0.0
Length = 0.6667 ft	1	0.087	0.324	1.60	1.00	1.00	1.00	1.500	1.00	0.80	1.00	0.08	142.0	1,632.0	0.51	62.1	192.0

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
E Only	1	0.0003	0.333		0.0000	0.000

DESCRIPTION: Retaining Wall - Case 1 UPDATE (Wall Design): Backfill+Surcharge with Empty Tank

Code Reference:

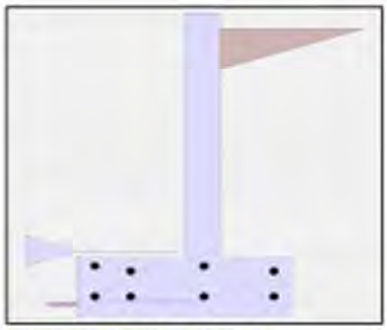
Calculations per IBC 2021 1807.3, ASCE 7-16

Criteria

Retained Height	=	3.75 ft
Wall height above soil	=	0.25 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	0.00 in
Water table above bottom of footing	=	0.0 ft

Soil Data

Allow Soil Bearing	=	1,500.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	45.0 psf/ft
	=	
Passive Pressure	=	200.0 psf/ft
Soil Density, Heel	=	125.00 pcf
Soil Density, Toe	=	125.00 pcf
Footing||Soil Friction	=	0.400
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	250.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0
NOT Used for Sliding & Overturning		

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Wind (W) (Service Level)
Wind on Exposed Stem (Strength Level)	=	0.0 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Spread Footing
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Axial Load Applied to Stem

Axial Dead Load	=	0.0 lbs
Axial Live Load	=	0.0 lbs
Axial Load Eccentricity	=	0.0 in

DESCRIPTION: Retaining Wall - Case 1 UPDATE (Wall Design): Backfill+Surcharge with Empty Tank

Design Summary

Wall Stability Ratios

Overturning	=	1.65	OK
Slab Resists All Sliding !			
Global Stability	=	1.65	
Total Bearing Load	=	1,469 lbs	
...resultant ecc.	=	8.38 in	
Eccentricity outside middle third			
Soil Pressure @ Toe	=	1,221 psf	OK
Soil Pressure @ Heel	=	0 psf	OK
Allowable	=	1,500 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	1,710 psf	
ACI Factored @ Heel	=	0 psf	
Footing Shear @ Toe	=	9.7 psi	OK
Footing Shear @ Heel	=	10.6 psi	OK
Allowable	=	75.0 psi	

Sliding Calcs

Lateral Sliding Force	=	935.2 lbs

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing

Load Factors

Building Code	
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.600
Seismic, E	1.000

Stem Construction

		Bottom		
		Stem OK		
Design Height Above Ftg	ft =	0.00		
Wall Material Above "Ht"	=	Concrete		
Design Method	=	SD	SD	SD
Thickness	=	6.00		
Rebar Size	=	# 5		
Rebar Spacing	=	16.00		
Rebar Placed at	=	3.3 in		
Design Data				
fb/FB + fa/Fa	=	**0.519**		
Total Force @ Section				
Service Level	lbs =			
Strength Level	lbs =	1,046.3		
Moment....Actual				
Service Level	ft-# =			
Strength Level	ft-# =	1,645.3		
Moment.....Allowable	=	3,165.6		
Shear.....Actual				
Service Level	psi =			
Strength Level	psi =	26.4		
Shear.....Allowable	psi =	54.1		
Anet (Masonry)	in2 =			
Wall Weight	psf =	75.0		
Rebar Depth 'd'	in =	3.30		

Masonry Data

f'm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
Equiv. Solid Thick.	=	
Masonry Block Type	=	
Masonry Design Method	=	ASD

Concrete Data

f'c	psi =	2,500.0
Fy	psi =	60,000.0

DESCRIPTION: Retaining Wall - Case 1 UPDATE (Wall Design): Backfill+Surcharge with Empty Tank

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.1226 in2/ft		
0.0018bh : 0.0018(12)(6) :	0.1296 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.1296 in2/ft	#4@ 18.52 in	#4@ 37.04 in
Provided Area :	0.2325 in2/ft	#5@ 28.70 in	#5@ 57.41 in
Maximum Area :	0.447 in2/ft	#6@ 40.74 in	#6@ 81.48 in

Footing Data

Toe Width	=	1.50 ft
Heel Width	=	1.50
Total Footing Width	=	3.00
Footing Thickness	=	12.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft

f'c = 2,500 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 3.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel	
Factored Pressure	=	1,710	0 psf	
Mu' : Upward	=	1,523	8 ft-#	
Mu' : Downward	=	203	571 ft-#	
Mu: Design	=	1,321 OK	563 ft-#	OK
phiMn	=	11,610	11,610 ft-#	
Actual 1-Way Shear	=	9.69	10.63 psi	
Allow 1-Way Shear	=	75.00	75.00 psi	
Toe Reinforcing	=	# 5 @ 12.00 in		
Heel Reinforcing	=	# 5 @ 12.00 in		
Key Reinforcing	=	None Spec'd		
Footing Torsion, Tu	=	0.00 ft-lbs		
Footing Allow. Torsion, phi Tu	=	0.00 ft-lbs		

If torsion exceeds allowable, provide supplemental design for footing torsion.

Other Acceptable Sizes & Spacings

Toe: #4@ 9.25 in, #5@ 14.35 in, #6@ 20.37 in, #7@ 27.77 in, #8@ 36.57 in, #9@ 46.29 in, #10@ 58.79 in

Heel: #4@ 9.25 in, #5@ 14.35 in, #6@ 20.37 in, #7@ 27.77 in, #8@ 36.57 in, #9@ 46.29 in, #10@ 58.79 in

Key: No key defined

Min footing T&S reinf Area 0.78 in2
Min footing T&S reinf Area per foot 0.26 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 9.26 in	#4@ 18.52 in
#5@ 14.35 in	#5@ 28.70 in
#6@ 20.37 in	#6@ 40.74 in

DESCRIPTION: Retaining Wall - Case 1 UPDATE (Wall Design): Backfill+Surcharge with Empty Tank

Summary of Overturning & Resisting Forces & Moments

Item		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#		.....RESISTING..... Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)		507.7	1.58	803.8	Soil Over HL (ab. water tbl)	468.8	2.50	1,171.9
HL Act Pres (be water tbl)					Soil Over HL (bel. water tbl)		2.50	1,171.9
Hydrostatic Force					Water Table			
Buoyant Force	=				Sloped Soil Over Heel	=		
Surcharge over Heel	=	427.5	2.38	1,015.3	Surcharge Over Heel	= 250.0	2.50	625.0
Surcharge Over Toe	=				Adjacent Footing Load	=		
Adjacent Footing Load	=				Axial Dead Load on Stem	=		
Added Lateral Load	=				* Axial Live Load on Stem	=		
Load @ Stem Above Soil	=				Soil Over Toe	=		
	=				Surcharge Over Toe	=		
					Stem Weight(s)	= 300.0	1.75	525.0
					Earth @ Stem Transitions	=		
					Footing Weight	= 450.0	1.50	675.0
					Key Weight	=		
					Vert. Component	=		
Total	=	935.2	**O.T.M.** =	1,819.1	**Total =**	1,468.8 lbs	**R.M.=**	2,996.9

Resisting/Overturning Ratio = **1.65**
Vertical Loads used for Soil Pressure = 1,468.8 lbs

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Overturning Resistance.

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	100.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.113	in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

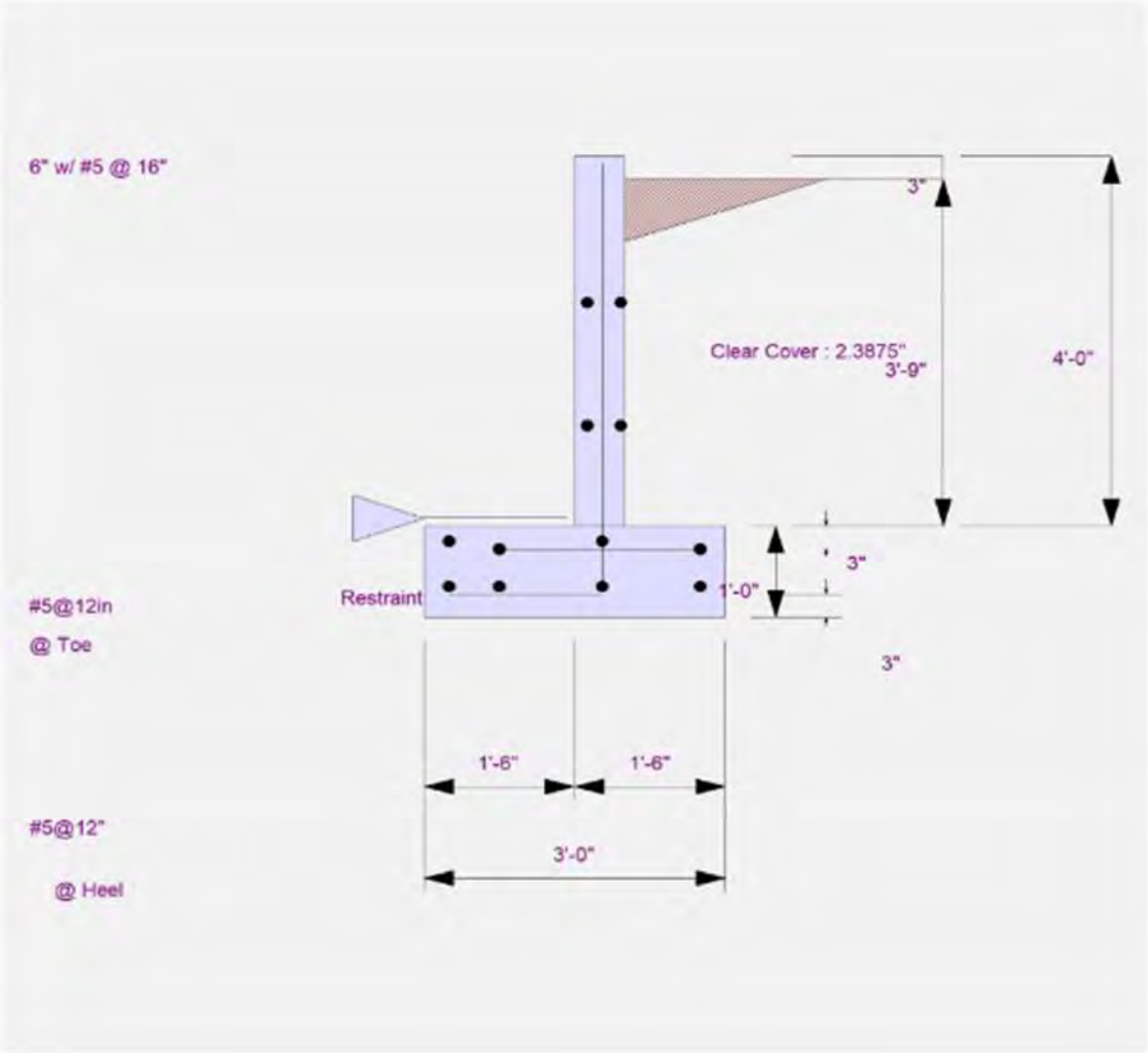
Cantilevered Retaining Wall Project File: Cantilevered Wall.ec6
LIC# : KW-06014167, Build:20.23.08.01 PETERSON STRUCTURAL ENGINEERS (c) ENERCALC INC 1983-2023
DESCRIPTION: Retaining Wall - Case 1 UPDATE (Wall Design): Backfill+Surcharge with Empty Tank

Rebar Lap & Embedment Lengths Information

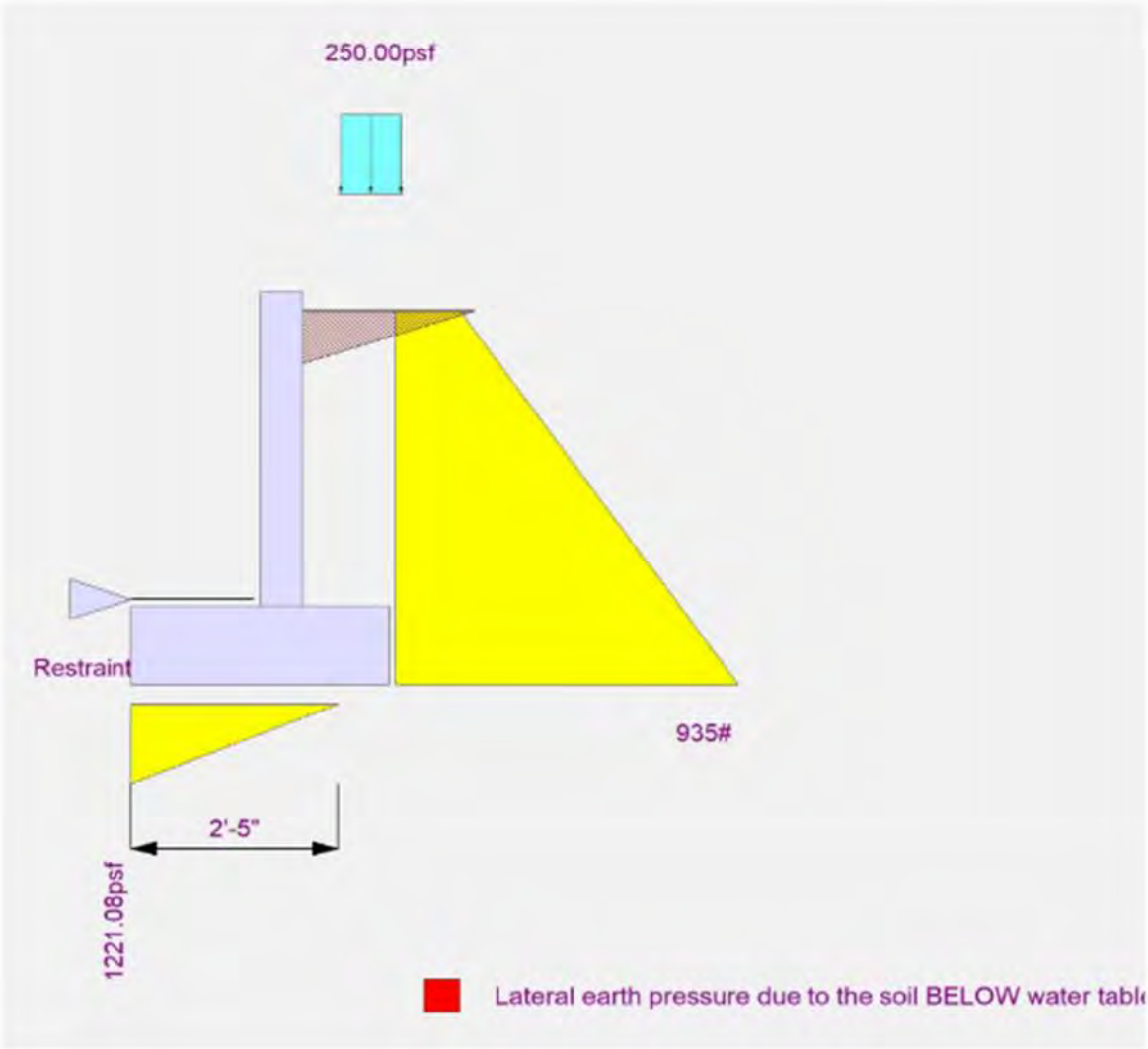
Stem Design Segment: Bottom
Stem Design Height: 0.00 ft above top of footing

Lap Splice length for #5 bar specified in this stem design segment (25.4.2.4a) =	23.40 in
Development length for #5 bar specified in this stem design segment =	18.00 in
Hooked embedment length into footing for #5 bar specified in this stem design segment =	10.50 in
As Provided =	0.2325 in2/ft
As Required =	0.1320 in2/ft

DESCRIPTION: Retaining Wall - Case 1 UPDATE (Wall Design): Backfill+Surcharge with Empty Tank



DESCRIPTION: Retaining Wall - Case 1 UPDATE (Wall Design): Backfill+Surcharge with Empty Tank



Appendix B – Anchorage Calculations

Dewalt Design Assist Anchorage Design Software

DEWALT DESIGN ASSIST 1.7.0.0 Page 1

2024_01_26 Post Anchorage 2302-0069

1/26/2024

1.Project Information

Company:	
Project Engineer:	- -
Address:	- - - Oregon 97201
Phone:	M: - P: -
Email:	rachelle.child@psengineers.com
Project Name:	Untitled
Project Address:	Untitled
Notes:	

2.Selected Anchor Information

Selected Anchor :	Pure110+
Brand:	DEWALT
Material:	3/4" Ø Threaded Rod ASTM F1554 GR36/A36
Embedment:	h_{ef} 6.00 in h_{nom} 6 in
Approval:	ICC-ES ESR-3298
Issued/Revision:	Jul.2023 -
Drill method:	Hammer Drilled

3.Design Principles

Design Method:	ACI 318-19
Load Combinations:	Section 5.3 User Defined Loads

4.Base Material Information

Concrete:								
Type:	Cracked		Normal Weight Concrete					
Strength	2500	psi						
Reinforcement:								
Edge Reinforcement	None or < #4 Rebar							
Spacing	Tension	No (Condition B)		Shear	No (Condition B)			
Controls Breakout	Tension	False		Shear	False			
Base Plate:								
Sizing	Thickness	0.25	in	Length	3.5	in	Width 12	in
Standoff	None			Height	0	in		
Strength	36000	psi						
Profile:	None							
Hole Condition:	Dry Hole							
Max. Service Temperature:	Long Term: 110	°F		Short Term: 130	°F			

Input data and results must be checked for agreement with the existing conditions, the standards and guidelines and must be checked for plausibility

5.Geometric Conditions

h_{slab}	24	in	h_{min}	7.750	in
Edge Cx-	∞	in	c_{min}	1.750	in
Edge Cx+	5.5	in	c_{ac}	8.772	in
Edge Cy-	3	in	s_{min}	3.750	in
Edge Cy+	3	in			

6.Summary Results

Tension Loading

Design Proof	Demand(lb)	Capacity(lb)	Utilization	Status	Critical
Steel Strength:	795.00	14551.00	0.055	OK	
Concrete Breakout Strength:	1590.00	3156.00	0.504	OK	Controls
Bond Strength	1590.00	3629.00	0.438	OK	

Shear Loading

Design Proof	Demand(lb)	Capacity(lb)	Utilization	Status	Critical
Steel Strength	420.00	7566.00	0.056	OK	
Concrete Breakout Strength:	840.00	1723.00	0.488	OK	Controls
Pryout Strength	840.00	6798.00	0.124	OK	

Input data and results must be checked for agreement with the existing conditions, the standards and guidelines and must be checked for plausibility

7.Warnings and Remarks

ANCHOR DESIGN CRITERIA IS SATISFIED

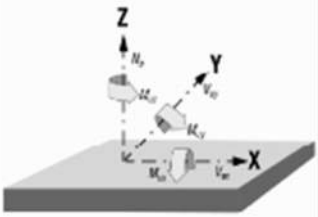
- The results of the calculations carried out by means of the DDA Software are based essentially on the data you put in. Therefore, you bear the sole responsibility for the absence of errors, the completeness and the relevance of the data to be put in by you. Moreover, you bear sole responsibility for having the results of the calculation checked and cleared by an design professional/engineer, particularly with regard to compliance with applicable standards, norms and permits, prior to using them for your specific project. The DDA Software serves only as an aid to interpret standards, norms and permits without any guarantee as to the absence of errors, the correctness and the relevance of the results or suitability for a specific application.

8.Load Condition

Design Loads / Actions

Nu	1590	lb	Vux	840	lb	Vuy	0	lb
Muz	0	in-lb	Mux	0	in-lb	Muy	0	in-lb

Consider Load Reversal X Direction 100% Y Direction 100%



Input data and results must be checked for agreement with the existing conditions, the standards and guidelines and must be checked for plausibility

DEWALT

2024_01_26 Knee Brace Anchorage 2302-0069

1/26/2024

1.Project Information

Company:	
Project Engineer:	- -
Address:	- - - Oregon 97201
Phone:	M: - P: -
Email:	rachelle.child@psengineers.com
Project Name:	Untitled
Project Address:	Untitled
Notes:	

2.Selected Anchor Information

Selected Anchor :	Pure110+
Brand:	DEWALT
Material:	3/4" Ø Threaded Rod ASTM F1554 GR36/A36
Embedment:	h_{ef} 6.00 in h_{nom} 6 in
Approval:	ICC-ES ESR-3298
Issued/Revision:	Jul.2023 -
Drill method:	Hammer Drilled

3.Design Principles

Design Method:	ACI 318-19
Load Combinations:	Section 5.3 User Defined Loads

4.Base Material Information

Concrete:								
Type:	Cracked		Normal Weight Concrete					
Strength	2500	psi						
Reinforcement:								
Edge Reinforcement	None or < #4 Rebar							
Spacing	Tension	No (Condition B)		Shear	No (Condition B)			
Controls Breakout	Tension	False		Shear	False			
Base Plate:								
Sizing	Thickness	0.25	in	Length	3.5	in	Width 12	in
Standoff	None			Height	0	in		
Strength	36000	psi						
Profile:	None							
Hole Condition:	Dry Hole							
Max. Service Temperature:	Long Term: 110	°F		Short Term: 130	°F			

Input data and results must be checked for agreement with the existing conditions, the standards and guidelines and must be checked for plausibility

5.Geometric Conditions

h_{slab}	24	in	h_{min}	7.750	in
Edge Cx-	∞	in	c_{min}	1.750	in
Edge Cx+	∞	in	c_{ac}	8.772	in
Edge Cy-	3	in	s_{min}	3.750	in
Edge Cy+	3	in			

6.Summary Results

Tension Loading

Design Proof	Demand(lb)	Capacity(lb)	Utilization	Status	Critical
Steel Strength:	1001.00	14551.00	0.069	OK	
Concrete Breakout Strength:	2002.00	3128.00	0.640	OK	Controls
Bond Strength	2002.00	4206.00	0.476	OK	

Shear Loading

Design Proof	Demand(lb)	Capacity(lb)	Utilization	Status	Critical
Steel Strength	1001.00	7566.00	0.132	OK	
Concrete Breakout Strength:	2002.00	6183.00	0.324	OK	Controls
Pryout Strength	2002.00	6737.00	0.297	OK	

7.Warnings and Remarks

ANCHOR DESIGN CRITERIA IS SATISFIED

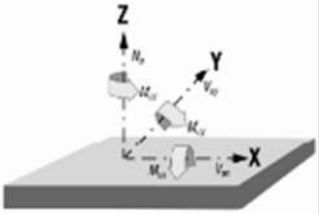
- The results of the calculations carried out by means of the DDA Software are based essentially on the data you put in. Therefore, you bear the sole responsibility for the absence of errors, the completeness and the relevance of the data to be put in by you. Moreover, you bear sole responsibility for having the results of the calculation checked and cleared by an design professional engineer, particularly with regard to compliance with applicable standards, norms and permits, prior to using them for your specific project. The DDA Software serves only as an aid to interpret standards, norms and permits without any guarantee as to the absence of errors, the correctness and the relevance of the results or suitability for a specific application.

8.Load Condition

Design Loads / Actions

Nu	2002	lb	Vux	2002	lb	Vuy	0	lb
Muz	0	in-lb	Mux	0	in-lb	Muy	0	in-lb

Consider Load Reversal X Direction 100% Y Direction 100%



Input data and results must be checked for agreement with the existing conditions, the standards and guidelines and must be checked for plausibility!

DEWALT

2024_01_26 Post Anchorage 2302-0069

1/26/2024

1.Project Information

Company:	
Project Engineer:	- -
Address:	- - - Oregon 97201
Phone:	M: - P: -
Email:	rachelle.child@psengineers.com
Project Name:	Untitled
Project Address:	Untitled
Notes:	

2.Selected Anchor Information

Selected Anchor :	HIT-RE 500 V3
Brand:	Hilti®
Material:	3/4" Ø Threaded Rod ASTM F1554 GR36/A36
Embedment:	h_{ef} 6.00 in h_{nom} 6 in
Approval:	ICC-ES ESR-3814
Issued/Revision:	Jan.2023 Mar.2023
Drill method:	Hammer Drilled

3.Design Principles

Design Method:	ACI 318-19
Load Combinations:	Section 5.3 User Defined Loads

4.Base Material Information

Concrete:								
Type:	Cracked		Normal Weight Concrete					
Strength	2500	psi						
Reinforcement:								
Edge Reinforcement	None or < #4 Rebar							
Spacing	Tension	No (Condition B)		Shear	No (Condition B)			
Controls Breakout	Tension	False		Shear	False			
Base Plate:								
Sizing	Thickness	0.25	in	Length	3.5	in	Width 12	in
Standoff	None			Height	0	in		
Strength	36000	psi						
Profile:	None							
Hole Condition:	Dry Hole							
Max. Service Temperature:	Long Term: 110	°F		Short Term: 130	°F			

5.Geometric Conditions

h_{slab}	24	in	h_{min}	7.750	in
Edge Cx-	∞	in	c_{min}	1.750	in
Edge Cx+	5.5	in	c_{ac}	8.772	in
Edge Cy-	3	in	s_{min}	3.750	in
Edge Cy+	3	in			

6.Summary Results

Tension Loading

Design Proof	Demand(lb)	Capacity(lb)	Utilization	Status	Critical
Steel Strength:	795.00	14551.00	0.055	OK	
Concrete Breakout Strength:	1590.00	3156.00	0.504	OK	
Bond Strength	1590.00	2977.00	0.534	OK	Controls

Shear Loading

Design Proof	Demand(lb)	Capacity(lb)	Utilization	Status	Critical
Steel Strength	420.00	7566.00	0.056	OK	
Concrete Breakout Strength:	840.00	1723.00	0.488	OK	Controls
Pryout Strength	840.00	6412.00	0.131	OK	

7.Warnings and Remarks

ANCHOR DESIGN CRITERIA IS SATISFIED

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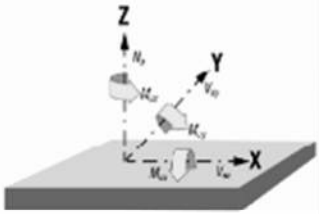
8.Load Condition

Design Loads / Actions

Nu	1590	lb	Vux	840	lb	Vuy	0	lb
Muz	0	in-lb	Mux	0	in-lb	Muy	0	in-lb

Consider Load Reversal X Direction 100% Y Direction 100%



DEWALT

2024_01_26 Knee Brace Anchorage 2302-0069

1/26/2024

1.Project Information

Company:
Project Engineer: - -
Address: - - - Oregon 97201
Phone: M: - P: -
Email: rachelle.child@psengineers.com
Project Name: Untitled
Project Address: Untitled
Notes:

2.Selected Anchor Information

Selected Anchor : HIT-RE 500 V3
Brand: Hilti®
Material: 3/4" Ø Threaded Rod ASTM F1554 GR36/A36
Embedment: h_{ef} 6.00 in h_{nom} 6 in
Approval: ICC-ES ESR-3814
Issued/Revision: Jan,2023 Mar,2023
Drill method: Hammer Drilled

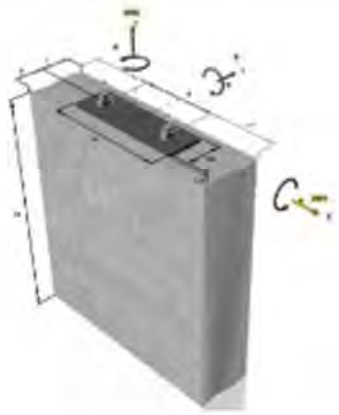
3.Design Principles

Design Method: ACI 318-19
Load Combinations: Section 5.3 User Defined Loads

4.Base Material Information

Concrete:
Type: Cracked Normal Weight Concrete
Strength 2500 psi
Reinforcement:
Edge Reinforcement None or < #4 Rebar
Spacing Tension No (Condition B) Shear No (Condition B)
Controls Breakout Tension False Shear False
Base Plate:
Sizing Thickness 0.25 in Length 3.5 in Width 12 in
Standoff None Height 0 in
Strength 36000 psi
Profile: None
Hole Condition: Dry Hole
Max. Service Temperature: Long Term: 110 °F Short Term: 130 °F

5.Geometric Conditions



h_{slab}	24	in	h_{min}	7.750	in
Edge Cx-	∞	in	c_{min}	1.750	in
Edge Cx+	∞	in	c_{ac}	8.772	in
Edge Cy-	3	in	s_{min}	3.750	in
Edge Cy+	3	in			

6.Summary Results

Tension Loading

Design Proof	Demand(lb)	Capacity(lb)	Utilization	Status	Critical
Steel Strength:	1001.00	14551.00	0.069	OK	
Concrete Breakout Strength:	2002.00	3128.00	0.640	OK	Controls
Bond Strength	2002.00	3591.00	0.558	OK	

Shear Loading

Design Proof	Demand(lb)	Capacity(lb)	Utilization	Status	Critical
Steel Strength	1001.00	7566.00	0.132	OK	
Concrete Breakout Strength:	2002.00	6183.00	0.324	OK	Controls
Pryout Strength	2002.00	6737.00	0.297	OK	

7.Warnings and Remarks

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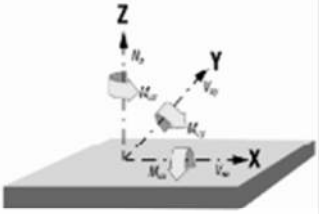
8.Load Condition

Design Loads / Actions

Nu	2002	lb	Vux	2002	lb	Vuy	0	lb
Muz	0	in-lb	Mux	0	in-lb	Muy	0	in-lb

Consider Load Reversal X Direction 100% Y Direction 100%



1.Project Information

Company:	
Project Engineer:	- -
Address:	- - - Oregon 97201
Phone:	M: - P: -
Email:	rachelle.child@psengineers.com
Project Name:	Untitled
Project Address:	Untitled
Notes:	

2.Selected Anchor Information

Selected Anchor :	KH-EZ
Brand:	Hilti®
Material:	3/4" Ø Medium Carbon Steel
Embedment:	h_{ef} 2.92 in h_{nom} 4 in
Approval:	ICC-ES ESR-3027
Issued/Revision:	Dec,2021 Apr,2022
Drill method:	Hammer Drilled

3.Design Principles

Design Method:	ACI 318-19
Load Combinations:	Section 5.3 User Defined Loads

4.Base Material Information

Concrete:								
Type:	Cracked	Normal Weight Concrete						
Strength	2500	psi						
Reinforcement:								
Edge Reinforcement	None or < #4 Rebar							
Spacing	Tension	No (Condition B)	Shear	No (Condition B)				
Controls Breakout	Tension	False	Shear	False				
Base Plate:								
Sizing	Thickness	0.25	in	Length	3.5	in	Width	12 in
Standoff	None			Height	0	in		
Strength	36000	psi						
Profile:	None							

5.Geometric Conditions

h_{slab}	24	in	h_{min}	6.000	in
Edge Cx-	∞	in	e_{min}	1.750	in
Edge Cx+	5.5	in	c_{ac}	4.410	in
Edge Cy-	3	in	s_{min}	3.000	in
Edge Cy+	3	in			

6.Summary Results

Tension Loading

Design Proof	Demand(lb)	Capacity(lb)	Utilization	Status	Critical
Steel Strength:	795.00	20810.00	0.038	OK	
Concrete Breakout Strength:	1590.00	3271.00	0.486	OK	Controls

Shear Loading

Design Proof	Demand(lb)	Capacity(lb)	Utilization	Status	Critical
Steel Strength	420.00	9996.00	0.042	OK	
Concrete Breakout Strength:	840.00	1523.00	0.551	OK	Controls
Pryout Strength	840.00	7046.00	0.119	OK	

7.Warnings and Remarks

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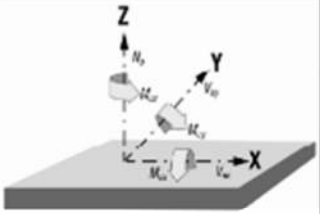
8.Load Condition

Design Loads / Actions

Nu	1590	lb	Vux	840	lb	Vuy	0	lb
Muz	0	in-lb	Mux	0	in-lb	Muy	0	in-lb

Consider Load Reversal X Direction 100% Y Direction 100%



Input data and results must be checked for agreement with the existing conditions, the standards and guidelines and must be checked for plausibility.

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DEWALT

2024_01_26 Knee Brace Anchorage 2302-0069

1/26/2024

1.Project Information

Company:
Project Engineer: - -
Address: - - - Oregon 97201
Phone: M: - P: -
Email: rachelle.child@psengineers.com
Project Name: Untitled
Project Address: Untitled
Notes:

2.Selected Anchor Information

Selected Anchor : KH-EZ
Brand: Hilti®
Material: 3/4" Ø Medium Carbon Steel

Embedment: h_{ef} 2.92 in h_{nom} 4 in
Approval: ICC-ES ESR-3027
Issued/Revision: Dec,2021 Apr,2022
Drill method: Hammer Drilled

3.Design Principles

Design Method: ACI 318-19
Load Combinations: Section 5.3 User Defined Loads

4.Base Material Information

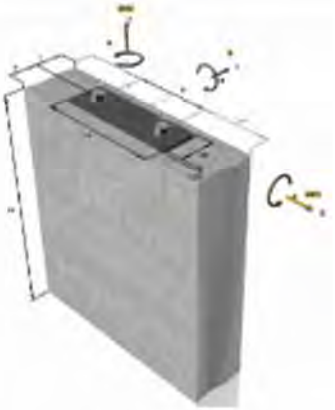
Concrete:
Type: Cracked Normal Weight Concrete
Strength 2500 psi

Reinforcement:
Edge Reinforcement None or < #4 Rebar
Spacing Tension No (Condition B) Shear No (Condition B)
Controls Breakout Tension False Shear False

Base Plate:
Sizing Thickness 0.25 in Length 3.5 in Width 12 in
Standoff None Height 0 in
Strength 36000 psi

Profile: None

5.Geometric Conditions



h_{slab}	24	in	h_{min}	6.000	in
Edge Cx-	∞	in	c_{min}	1.750	in
Edge Cx+	∞	in	c_{ac}	4.410	in
Edge Cy-	3	in	s_{min}	3.000	in
Edge Cy+	3	in			

6.Summary Results

Tension Loading

Design Proof	Demand(lb)	Capacity(lb)	Utilization	Status	Critical
Steel Strength:	1001.00	20810.00	0.048	OK	
Concrete Breakout Strength:	2002.00	3271.00	0.612	OK	Controls

Shear Loading

Design Proof	Demand(lb)	Capacity(lb)	Utilization	Status	Critical
Steel Strength	1001.00	9996.00	0.100	OK	
Concrete Breakout Strength:	2002.00	5466.00	0.366	OK	Controls
Pryout Strength	2002.00	7046.00	0.284	OK	

7.Warnings and Remarks

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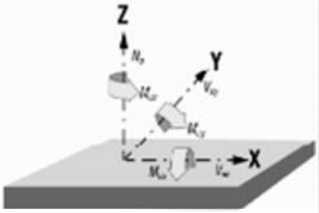
8.Load Condition

Design Loads / Actions

Nu	2002	lb	Vux	2002	lb	Vuy	0	lb
Muz	0	in-lb	Mux	0	in-lb	Muy	0	in-lb

Consider Load Reversal X Direction 100% Y Direction 100%



Input data and results must be checked for agreement with the existing conditions, the standards and guidelines and must be checked for plausibility

1.Project Information

Company:	
Project Engineer:	- -
Address:	- - - Oregon 97201
Phone:	M: - P: -
Email:	rachelle.child@psengineers.com
Project Name:	Untitled
Project Address:	Untitled
Notes:	

2.Selected Anchor Information

Selected Anchor :	Screw-Bolt+
Brand:	DEWALT
Material:	3/4" Ø
Embedment:	h_{ef} 2.92 in h_{nom} 4 in
Approval:	ICC-ES ESR-3889
Issued/Revision:	Nov,2023 -
Drill method:	Hammer Drilled

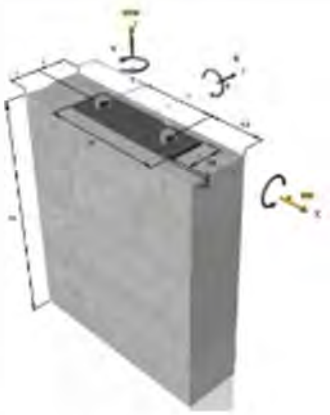
3.Design Principles

Design Method:	ACI 318-19	
Load Combinations:	Section 5.3	User Defined Loads

4.Base Material Information

Concrete:								
Type:	Cracked		Normal Weight Concrete					
Strength	2500	psi						
Reinforcement:								
Edge Reinforcement	None or < #4 Rebar							
Spacing	Tension	No (Condition B)		Shear	No (Condition B)			
Controls Breakout	Tension	False		Shear	False			
Base Plate:								
Sizing	Thickness	0.25	in	Length	3.5	in	Width 12	in
Standoff	None			Height	0	in		
Strength	36000	psi						
Profile:	None							

5.Geometric Conditions



h_{slab}	24	in	h_{min}	6.000	in
Edge Cx-	∞	in	c_{min}	1.750	in
Edge Cx+	5.5	in	c_{ac}	10.900	in
Edge Cy-	3	in	s_{min}	3.000	in
Edge Cy+	3	in			

6.Summary Results

Tension Loading

Design Proof	Demand(lb)	Capacity(lb)	Utilization	Status	Critical
Steel Strength:	795.00	24807.00	0.032	OK	
Concrete Breakout Strength:	1590.00	3271.00	0.486	OK	

Shear Loading

Design Proof	Demand(lb)	Capacity(lb)	Utilization	Status	Critical
Steel Strength	420.00	11556.00	0.036	OK	
Concrete Breakout Strength:	840.00	1540.00	0.546	OK	
Pryout Strength	840.00	7046.00	0.119	OK	

Input data and results must be checked for agreement with the existing conditions, the standards and guidelines and must be checked for plausibility

7.Warnings and Remarks

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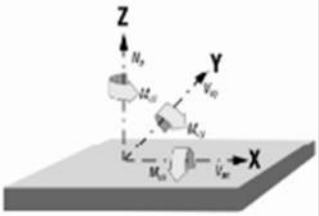
8.Load Condition

Design Loads / Actions

Nu	1590	lb	Vux	840	lb	Vuy	0	lb
Muz	0	in-lb	Mux	0	in-lb	Muy	0	in-lb

Consider Load Reversal X Direction 100% Y Direction 100%



Input data and results must be checked for agreement with the existing conditions, the standards and guidelines and must be checked for plausibility!

DEWALT

2024_01_26 Knee Brace Anchorage 2302-0069

1/26/2024

1.Project Information

Company:	
Project Engineer:	- -
Address:	- - - Oregon 97201
Phone:	M: - P: -
Email:	rachelle.child@psengineers.com
Project Name:	Untitled
Project Address:	Untitled
Notes:	

2.Selected Anchor Information

Selected Anchor :	Screw-Bolt+
Brand:	DEWALT
Material:	3/4" Ø
Embedment:	h_{ef} 2.92 in h_{nom} 4 in
Approval:	ICC-ES ESR-3889
Issued/Revision:	Nov,2023 -
Drill method:	Hammer Drilled

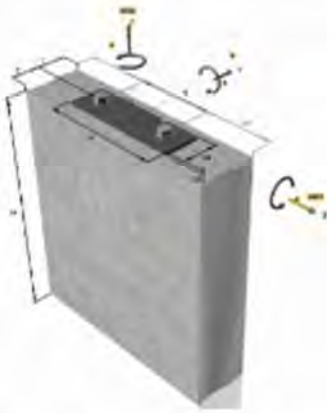
3.Design Principles

Design Method:	ACI 318-19
Load Combinations:	Section 5.3 User Defined Loads

4.Base Material Information

Concrete:								
Type:	Cracked		Normal Weight Concrete					
Strength	2500	psi						
Reinforcement:								
Edge Reinforcement	None or < #4 Rebar							
Spacing	Tension	No (Condition B)		Shear	No (Condition B)			
Controls Breakout	Tension	False		Shear	False			
Base Plate:								
Sizing	Thickness	0.25	in	Length	3.5	in	Width 12	in
Standoff	None			Height	0	in		
Strength	36000	psi						
Profile:	None							

5.Geometric Conditions



h_{slab}	24	in	h_{min}	6.000	in
Edge Cx-	∞	in	c_{min}	1.750	in
Edge Cx+	∞	in	c_{ac}	10.900	in
Edge Cy-	3	in	s_{min}	3.000	in
Edge Cy+	3	in			

6.Summary Results

Tension Loading

Design Proof	Demand(lb)	Capacity(lb)	Utilization	Status	Critical
Steel Strength:	1001.00	24807.00	0.040	OK	
Concrete Breakout Strength:	2002.00	3271.00	0.612	OK	

Shear Loading

Design Proof	Demand(lb)	Capacity(lb)	Utilization	Status	Critical
Steel Strength	1001.00	11556.00	0.087	OK	
Concrete Breakout Strength:	2002.00	5525.00	0.362	OK	
Pryout Strength	2002.00	7046.00	0.284	OK	

Input data and results must be checked for agreement with the existing conditions, the standards and guidelines and must be checked for plausibility!

7.Warnings and Remarks

ANCHOR DESIGN CRITERIA IS SATISFIED

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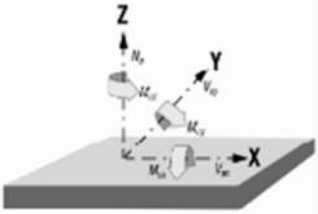
8.Load Condition

Design Loads / Actions

Nu	2002	lb	Vux	2002	lb	Vuy	0	lb
Muz	0	in-lb	Mux	0	in-lb	Muy	0	in-lb

Consider Load Reversal X Direction 100% Y Direction 100%



Simpson Strong Tie Anchorage Design Software

SIMPSON StrongTie

Anchor Designer™ Software
Version 3.1.2209.3

Company:		Date:	9/8/2022
Engineer:		Page:	1/6
Project:			
Address:			
Phone:			
E-mail:			

1.Project information

Customer company:
Customer contact name:
Customer e-mail:
Comment:

Project description:
Location:
Fastening description:

2. Input Data & Anchor Parameters

General
Design method:ACI 318-19
Units: Imperial units

Anchor Information:
Anchor type: Bonded anchor
Material: F1554 Grade 36
Diameter (inch): 0.750
Effective Embedment depth, h_{ef} (inch): 6.000
Code report: ICC-ES ESR-4057
Anchor category: -
Anchor ductility: Yes
h_{min} (inch): 7.75
c_{ac} (inch): 8.77
C_{min} (inch): 1.75
S_{min} (inch): 3.00

Base Material
Concrete: Normal-weight
Concrete thickness, h (inch): 48.00
State: Uncracked
Compressive strength, f'_c (psi): 2500
$\Psi_{c,V}$: 1.4
Reinforcement condition: Supplementary reinforcement not present
Supplemental edge reinforcement: No
Reinforcement provided at corners: No
Ignore concrete breakout in tension: No
Ignore concrete breakout in shear: No
Hole condition: Dry concrete
Inspection: Continuous
Temperature range, Short/Long: 150/110°F
Ignore 6do requirement: Not applicable
Build-up grout pad: No

Base Plate
Length x Width x Thickness (inch): 3.50 x 12.00 x 0.25

Recommended Anchor
Anchor Name: SET-3G - SET-3G w/ 3/4"Ø F1554 Gr. 36
Code Report: ICC-ES ESR-4057

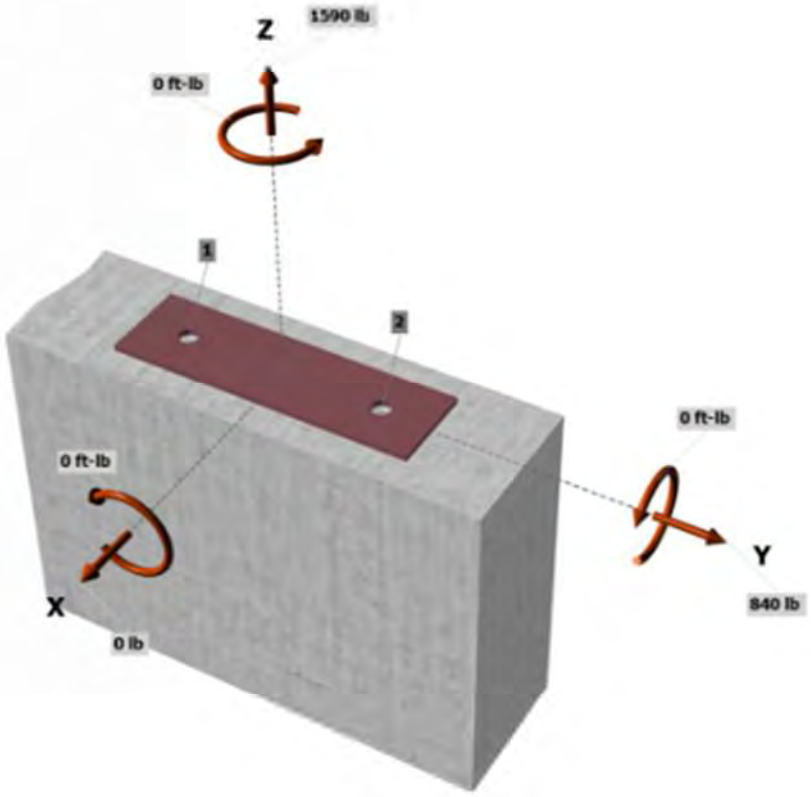
Company:		Date:	9/8/2022
Engineer:		Page:	2/6
Project:			
Address:			
Phone:			
E-mail:			

Load and Geometry
Load factor source: ACI 318 Section 5.3
Load combination: not set
Seismic design: No
Anchors subjected to sustained tension: No
Apply entire shear load at front row: No
Anchors only resisting wind and/or seismic loads: No

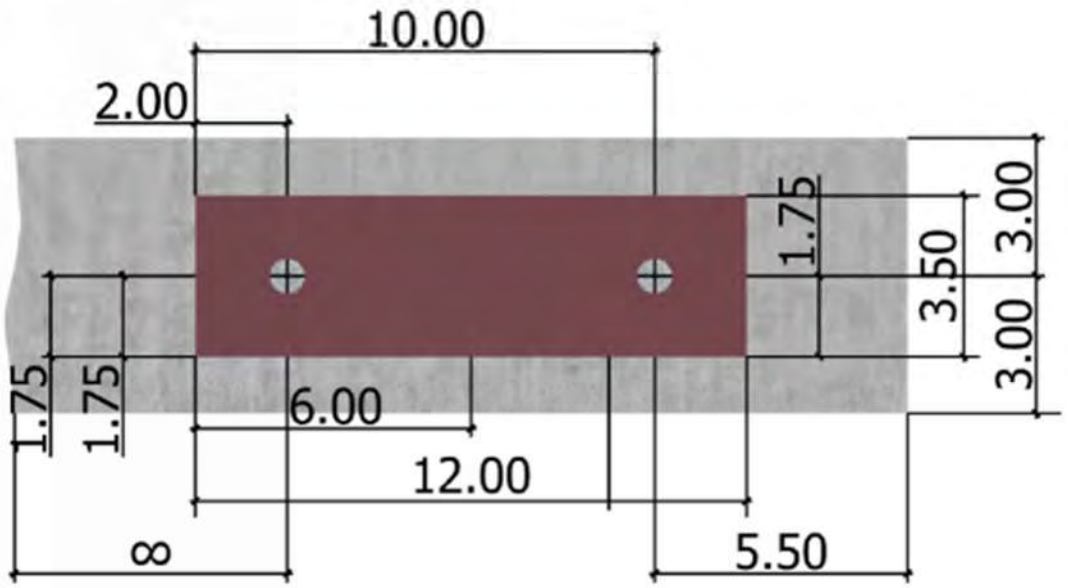
Strength level loads:

N_{ua} [lb]: 1590
V_{uax} [lb]: 0
V_{uay} [lb]: 840
M_{ux} [ft-lb]: 0
M_{uy} [ft-lb]: 0
M_{uz} [ft-lb]: 0

<Figure 1>



<Figure 2>

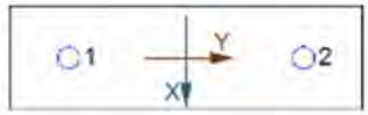


3. Resulting Anchor Forces

Anchor	Tension load, N_{ua} (lb)	Shear load x, V_{uax} (lb)	Shear load y, V_{uay} (lb)	Shear load combined, $\sqrt{(V_{uax})^2+(V_{uay})^2}$ (lb)
1	795.0	0.0	420.0	420.0
2	795.0	0.0	420.0	420.0
Sum	1590.0	0.0	840.0	840.0

Maximum concrete compression strain (‰): 0.00
Maximum concrete compression stress (psi): 0
Resultant tension force (lb): 1590
Resultant compression force (lb): 0
Eccentricity of resultant tension forces in x-axis, e'_{Nx} (inch): 0.00
Eccentricity of resultant tension forces in y-axis, e'_{Ny} (inch): 0.00
Eccentricity of resultant shear forces in x-axis, e'_{Vx} (inch): 0.00
Eccentricity of resultant shear forces in y-axis, e'_{Vy} (inch): 0.00

<Figure 3>



4. Steel Strength of Anchor in Tension (Sec. 17.6.1)

N_{sa} (lb)	ϕ	ϕN_{sa} (lb)
19370	0.75	14528

5. Concrete Breakout Strength of Anchor in Tension (Sec. 17.6.2)

$N_b = k_c \lambda_a \sqrt{f'_c} h_{ef}^{1.5}$ (Eq. 17.6.2.2.1)

k_c	λ_a	f'_c (psi)	h_{ef} (in)	N_b (lb)
24.0	1.00	2500	3.667	8425

$\phi N_{cbg} = \phi (A_{Nc} / A_{Nco}) \Psi_{ec,N} \Psi_{ed,N} \Psi_{c,N} \Psi_{cp,N} N_b$ (Sec. 17.5.1.2 & Eq. 17.6.2.1a)

A_{Nc} (in²)	A_{Nco} (in²)	$c_{a,min}$ (in)	$\Psi_{ec,N}$	$\Psi_{ed,N}$	$\Psi_{c,N}$	$\Psi_{cp,N}$	N_b (lb)	ϕ	ϕN_{cbg} (lb)
114.00	121.00	3.00	1.000	0.864	1.00	1.000	8425	0.65	4456

6. Adhesive Strength of Anchor in Tension (Sec. 17.6.5)

$\tau_{k,cr} = \tau_{k,cr} f_{short-term} K_{sat} (f'_c / 2,500)^n$

$\tau_{k,cr}$ (psi)	$f_{short-term}$	K_{sat}	f'_c (psi)	n	$\tau_{k,cr}$ (psi)
2064	1.00	1.00	2500	0.35	2064

$N_{ba} = \lambda_a \tau_{cr} \pi d_a h_{ef}$ (Eq. 17.6.5.2.1)

λ_a	τ_{cr} (psi)	d_a (in)	h_{ef} (in)	N_{ba} (lb)
1.00	2064	0.75	6.000	29179

$\phi N_{ag} = \phi (A_{Na} / A_{Na0}) \Psi_{ec,Na} \Psi_{ed,Na} \Psi_{cp,Na} N_{ba}$ (Sec. 17.5.1.2 & Eq. 17.6.5.1b)

A_{Na} (in²)	A_{Na0} (in²)	c_{Na} (in)	$c_{a,min}$ (in)	$\Psi_{ec,Na}$	$\Psi_{ed,Na}$	$\Psi_{cp,Na}$	N_{ba} (lb)	ϕ	ϕN_{ag} (lb)
142.64	422.18	10.27	3.00	1.000	0.788	1.000	29179	0.65	5047

8. Steel Strength of Anchor in Shear (Sec. 17.7.1)

V_{sa} (lb)	ϕ_{grout}	ϕ	$\phi_{grout}\phi V_{sa}$ (lb)
11625	1.0	0.65	7556

9. Concrete Breakout Strength of Anchor in Shear (Sec. 17.7.2)

Shear perpendicular to edge in y-direction:

$V_{by} = \min[7(l_e / d_a)^{0.2}\sqrt{d_a}\lambda_a\sqrt{f'_c}c_{a1}^{1.5};\ 9\lambda_a\sqrt{f'_c}c_{a1}^{1.5}]$ (Eq. 17.7.2.2.1a & Eq. 17.7.2.2.1b)

l_e (in)	d_a (in)	λ_a	f'_c (psi)	c_{a1} (in)	V_{by} (lb)
6.00	0.750	1.00	2500	13.50	22321

$\phi V_{cby} = \phi(A_{Vc} / A_{Vco})\Psi_{ed,V}\Psi_{c,V}\Psi_{h,V}V_{by}$ (Sec. 17.5.1.2 & Eq. 17.7.2.1a)

A_{Vc} (in²)	A_{Vco} (in²)	$\Psi_{ed,V}$	$\Psi_{c,V}$	$\Psi_{h,V}$	V_{by} (lb)	ϕ	ϕV_{cby} (lb)
121.50	820.13	0.744	1.400	1.000	22321	0.70	2413

Shear parallel to edge in x-direction:

$V_{bx} = \min[7(l_e / d_a)^{0.2}\sqrt{d_a}\lambda_a\sqrt{f'_c}c_{a1}^{1.5};\ 9\lambda_a\sqrt{f'_c}c_{a1}^{1.5}]$ (Eq. 17.7.2.2.1a & Eq. 17.7.2.2.1b)

l_e (in)	d_a (in)	λ_a	f'_c (psi)	c_{a1} (in)	V_{bx} (lb)
6.00	0.750	1.00	2500	3.00	2338

$\phi V_{cbgx} = \phi(2)(A_{Vc} / A_{Vco})\Psi_{ec,V}\Psi_{ed,V}\Psi_{c,V}\Psi_{h,V}V_{bx}$ (Sec. 17.5.1.2, 17.7.2.1(c) & Eq. 17.7.2.1b)

A_{Vc} (in²)	A_{Vco} (in²)	$\Psi_{ec,V}$	$\Psi_{ed,V}$	$\Psi_{c,V}$	$\Psi_{h,V}$	V_{bx} (lb)	ϕ	ϕV_{cbgx} (lb)
76.50	40.50	1.000	1.000	1.400	1.000	2338	0.70	8657

10. Concrete Pryout Strength of Anchor in Shear (Sec. 17.7.3)

$\phi V_{cpg} = \phi\min[k_{cp}N_{ag};\ k_{cp}N_{cbg}] = \phi\min[k_{cp}(A_{Na} / A_{Nao})\Psi_{ec,Na}\Psi_{ed,Na}\Psi_{cp,Na}N_{ba};\ k_{cp}(A_{Na} / A_{Nao})\Psi_{ec,N}\Psi_{ed,N}\Psi_{c,N}\Psi_{cp,N}N_b]$ (Sec. 17.5.1.2 & Eq. 17.7.3.1b)

k_{cp}	A_{Na} (in²)	A_{Nao} (in²)	$\Psi_{ec,Na}$	$\Psi_{ed,Na}$	$\Psi_{cp,Na}$	N_{ba} (lb)	N_a (lb)
2.0	142.64	422.18	0.788	1.000	1.000	29179	7765

A_{Nc} (in²)	A_{Nco} (in²)	$\Psi_{ec,N}$	$\Psi_{ed,N}$	$\Psi_{c,N}$	$\Psi_{cp,N}$	N_b (lb)	N_{cb} (lb)	ϕ
114.00	121.00	1.000	0.864	1.000	1.000	8425	6855	0.70

ϕV_{cpg} (lb)
9598

11. Results

Interaction of Tensile and Shear Forces (Sec. 17.8)

Tension	Factored Load, N_{ua} (lb)	Design Strength, ϕN_n (lb)	Ratio	Status
Steel	795	14528	0.05	Pass
Concrete breakout	**1590**	**4456**	**0.36**	**Pass (Governs)**
Adhesive	1590	5047	0.32	Pass

Shear	Factored Load, V_{ua} (lb)	Design Strength, ϕV_n (lb)	Ratio	Status
Steel	420	7556	0.06	Pass
T Concrete breakout y+	**840**	**2413**	**0.35**	**Pass (Governs)**

|| Concrete breakout x-	**840**	**8657**	**0.10**	**Pass (Governs)**
Pryout	840	9598	0.09	Pass

Interaction check	$N_{ua}/\phi N_n$	$V_{ua}/\phi V_n$	Combined Ratio	Permissible	Status
Sec. 17.8.1	0.36	0.00	35.7%	1.0	Pass

SET-3G w/ 3/4"Ø F1554 Gr. 36 with hef = 6.000 inch meets the selected design criteria.

12. Warnings

- Designer must exercise own judgement to determine if this design is suitable.
- Refer to manufacturer's product literature for hole cleaning and installation instructions.

SIMPSON StrongTie

Anchor Designer™ Software
Version 3.1.2209.3

Company:		Date:	9/8/2022
Engineer:		Page:	1/6
Project:			
Address:			
Phone:			
E-mail:			

1 Project information

Customer company:
Customer contact name:
Customer e-mail:
Comment:

Project description:
Location:
Fastening description:

2. Input Data & Anchor Parameters

General
Design method: ACI 318-19
Units: Imperial units

Anchor Information:
Anchor type: Bonded anchor
Material: F1554 Grade 36
Diameter (inch): 0.750
Effective Embedment depth, h_{ef} (inch): 6.000
Code report: ICC-ES ESR-4057
Anchor category: -
Anchor ductility: Yes
h_{min} (inch): 7.75
c_{ac} (inch): 8.77
C_{min} (inch): 1.75
S_{min} (inch): 3.00

Base Material
Concrete: Normal-weight
Concrete thickness, h (inch): 48.00
State: Uncracked
Compressive strength, f'_c (psi): 2500
$\Psi_{c,V}$: 1.4
Reinforcement condition: Supplementary reinforcement not present
Supplemental edge reinforcement: No
Reinforcement provided at corners: No
Ignore concrete breakout in tension: No
Ignore concrete breakout in shear: No
Hole condition: Dry concrete
Inspection: Continuous
Temperature range, Short/Long: 150/110°F
Ignore 6do requirement: Not applicable
Build-up grout pad: No

Base Plate
Length x Width x Thickness (inch): 3.50 x 12.00 x 0.25

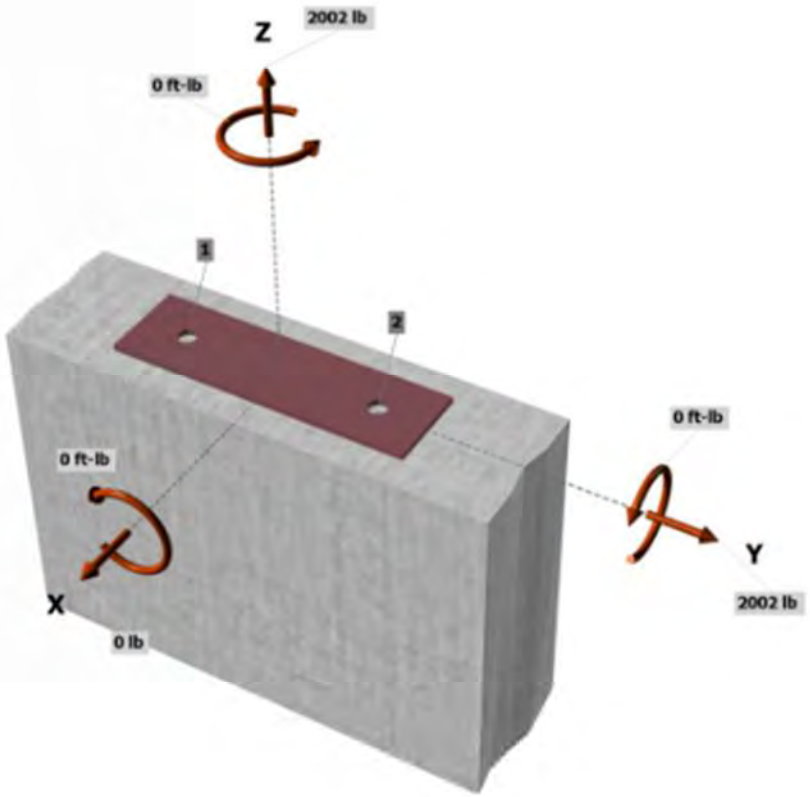
Recommended Anchor
Anchor Name: SET-3G - SET-3G w/ 3/4"Ø F1554 Gr. 36
Code Report: ICC-ES ESR-4057

Load and Geometry
Load factor source: ACI 318 Section 5.3
Load combination: not set
Seismic design: No
Anchors subjected to sustained tension: No
Apply entire shear load at front row: No
Anchors only resisting wind and/or seismic loads: No

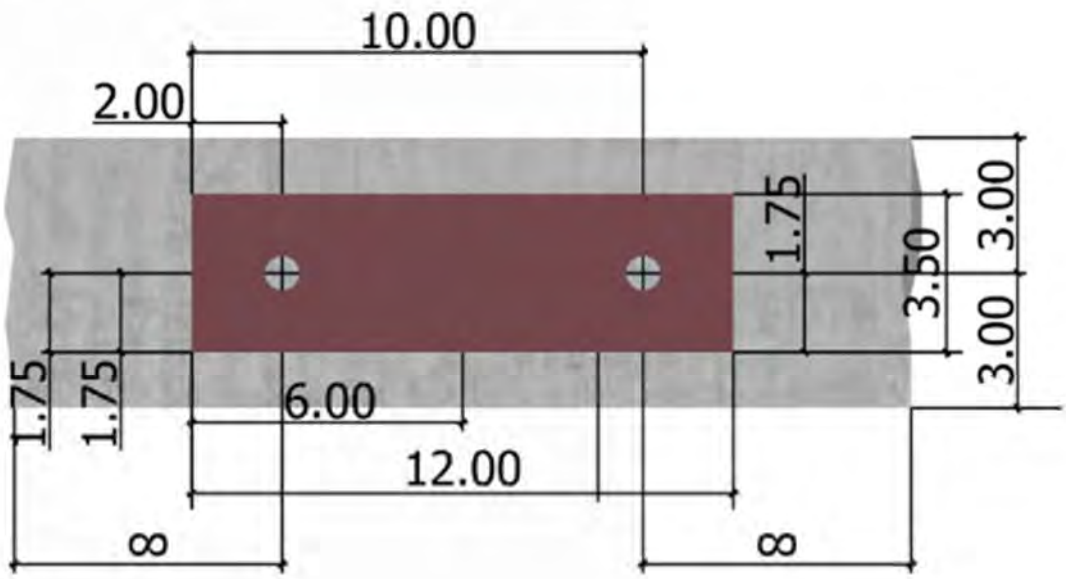
Strength level loads:

N_{ua} [lb]: 2002
V_{uax} [lb]: 0
V_{uay} [lb]: 2002
M_{ux} [ft-lb]: 0
M_{uy} [ft-lb]: 0
M_{uz} [ft-lb]: 0

<Figure 1>



<Figure 2>



3. Resulting Anchor Forces

Anchor	Tension load, N_{ua} (lb)	Shear load x, V_{uax} (lb)	Shear load y, V_{uay} (lb)	Shear load combined, $\sqrt{(V_{uax})^2+(V_{uay})^2}$ (lb)
1	1001.0	0.0	1001.0	1001.0
2	1001.0	0.0	1001.0	1001.0
Sum	2002.0	0.0	2002.0	2002.0

Maximum concrete compression strain (‰): 0.00
Maximum concrete compression stress (psi): 0
Resultant tension force (lb): 2002
Resultant compression force (lb): 0
Eccentricity of resultant tension forces in x-axis, e'_{Nx} (inch): 0.00
Eccentricity of resultant tension forces in y-axis, e'_{Ny} (inch): 0.00
Eccentricity of resultant shear forces in x-axis, e'_{Vx} (inch): 0.00
Eccentricity of resultant shear forces in y-axis, e'_{Vy} (inch): 0.00

<Figure 3>

4. Steel Strength of Anchor in Tension (Sec. 17.6.1)

N_{sa} (lb)	ϕ	ϕN_{sa} (lb)
19370	0.75	14528

5. Concrete Breakout Strength of Anchor in Tension (Sec. 17.6.2)

$N_b = k_c \lambda_a \sqrt{f'_c} h_{ef}^{1.5}$ (Eq. 17.6.2.2.1)

k_c	λ_a	f'_c (psi)	h_{ef} (in)	N_b (lb)
24.0	1.00	2500	6.000	17636

$\phi N_{cbg} = \phi (A_{Nc} / A_{Nco}) \Psi_{ec,N} \Psi_{ed,N} \Psi_{c,N} \Psi_{cp,N} N_b$ (Sec. 17.5.1.2 & Eq. 17.6.2.1a)

A_{Nc} (in²)	A_{Nco} (in²)	$c_{a,min}$ (in)	$\Psi_{ec,N}$	$\Psi_{ed,N}$	$\Psi_{c,N}$	$\Psi_{cp,N}$	N_b (lb)	ϕ	ϕN_{cbg} (lb)
156.00	324.00	3.00	1.000	0.800	1.00	1.000	17636	0.65	4416

6. Adhesive Strength of Anchor in Tension (Sec. 17.6.5)

$\tau_{k,cr} = \tau_{k,cr} f_{short-term} K_{sat} (f'_c / 2,500)^n$

$\tau_{k,cr}$ (psi)	$f_{short-term}$	K_{sat}	f'_c (psi)	n	$\tau_{k,cr}$ (psi)
2064	1.00	1.00	2500	0.35	2064

$N_{ba} = \lambda_a \tau_{cr} \pi d_a h_{ef}$ (Eq. 17.6.5.2.1)

λ_a	τ_{cr} (psi)	d_a (in)	h_{ef} (in)	N_{ba} (lb)
1.00	2064	0.75	6.000	29179

$\phi N_{ag} = \phi (A_{Na} / A_{Na0}) \Psi_{ec,Na} \Psi_{ed,Na} \Psi_{cp,Na} N_{ba}$ (Sec. 17.5.1.2 & Eq. 17.6.5.1b)

A_{Na} (in²)	A_{Na0} (in²)	c_{Na} (in)	$c_{a,min}$ (in)	$\Psi_{ec,Na}$	$\Psi_{ed,Na}$	$\Psi_{cp,Na}$	N_{ba}(lb)	ϕ	ϕN_{ag} (lb)
171.28	422.18	10.27	3.00	1.000	0.788	1.000	29179	0.65	6060

8. Steel Strength of Anchor in Shear (Sec. 17.7.1)

V_{sa} (lb)	ϕ_{grout}	ϕ	$\phi_{grout}\phi V_{sa}$ (lb)
11625	1.0	0.65	7556

9. Concrete Breakout Strength of Anchor in Shear (Sec. 17.7.2)

Shear parallel to edge in x-direction:

$V_{by} = \min[7(l_e / d_a)^{0.2}\sqrt{d_a}\lambda_a\sqrt{f'_c}c_{a1}^{1.5};\ 9\lambda_a\sqrt{f'_c}c_{a1}^{1.5}]$ (Eq. 17.7.2.2.1a & Eq. 17.7.2.2.1b)

l_e (in)	d_a (in)	λ_a	f'_c (psi)	c_{a1} (in)	V_{by} (lb)
6.00	0.750	1.00	2500	3.00	2338

$\phi V_{cbgv} = \phi\,(2)(A_{Vc} / A_{Vco})\Psi_{ec,V}\Psi_{ed,V}\Psi_{c,V}\Psi_{h,V}V_{by}$ (Sec. 17.5.1.2, 17.7.2.1(c) & Eq. 17.7.2.1b)

A_{Vc} (in²)	A_{Vco} (in²)	$\Psi_{ec,V}$	$\Psi_{ed,V}$	$\Psi_{c,V}$	$\Psi_{h,V}$	V_{by} (lb)	ϕ	ϕV_{cbgv} (lb)
76.50	40.50	1.000	1.000	1.400	1.000	2338	0.70	8657

10. Concrete Pryout Strength of Anchor in Shear (Sec. 17.7.3)

$\phi V_{cpg} = \phi \min[k_{cp}N_{ag};\ k_{cp}N_{cbg}] = \phi \min[k_{cp}(A_{Na} / A_{Nao})\Psi_{ec,Na}\Psi_{ed,Na}\Psi_{cp,Na}N_{ba};\ k_{cp}(A_{Nc} / A_{Nco})\Psi_{ec,N}\Psi_{ed,N}\Psi_{c,N}\Psi_{cp,N}N_b]$ (Sec. 17.5.1.2 & Eq. 17.7.3.1b)

k_{cp}	A_{Na} (in²)	A_{Nao} (in²)	$\Psi_{ec,Na}$	$\Psi_{ed,Na}$	$\Psi_{cp,Na}$	N_{ba} (lb)	N_b (lb)
2.0	171.28	422.18	0.788	1.000	1.000	29179	9324

A_{Nc} (in²)	A_{Nco} (in²)	$\Psi_{ec,N}$	$\Psi_{ed,N}$	$\Psi_{c,N}$	$\Psi_{cp,N}$	N_b (lb)	N_{cb} (lb)	ϕ
156.00	324.00	1.000	0.800	1.000	1.000	17636	6793	0.70

ϕV_{cpg} (lb)
9511

11. Results

Interaction of Tensile and Shear Forces (Sec. 17.8)

Tension	Factored Load, N_{ua} (lb)	Design Strength, ϕN_n (lb)	Ratio	Status
Steel	1001	14528	0.07	Pass
Concrete breakout	**2002**	**4416**	**0.45**	**Pass (Governs)**
Adhesive	2002	6060	0.33	Pass

Shear	Factored Load, V_{ua} (lb)	Design Strength, ϕV_n (lb)	Ratio	Status
Steel	1001	7556	0.13	Pass
|| Concrete breakout x-	**2002**	**8657**	**0.23**	**Pass (Governs)**
Pryout	2002	9511	0.21	Pass

Interaction check	$N_{ua}/\phi N_n$	$V_{ua}/\phi V_n$	Combined Ratio	Permissible	Status
Sec. 17.8.1	0.45	0.00	45.3%	1.0	Pass

SET-3G w/ 3/4"Ø F1554 Gr. 36 with hef = 6.000 inch meets the selected design criteria.

12. Warnings

- Designer must exercise own judgement to determine if this design is suitable.

- Refer to manufacturer's product literature for hole cleaning and installation instructions.

SIMPSON StrongTie

Anchor Designer™ Software
Version 3.1.2209.3

Company:		Date:	9/8/2022
Engineer:		Page:	1/5
Project:			
Address:			
Phone:			
E-mail:			

1.Project information

Customer company:
Customer contact name:
Customer e-mail:
Comment:

Project description:
Location:
Fastening description:

2. Input Data & Anchor Parameters

General
Design method:ACI 318-19
Units: Imperial units

Anchor Information:
Anchor type: Concrete screw
Material: Carbon Steel
Diameter (inch): 0.750
Nominal Embedment depth (inch): 4.000
Effective Embedment depth, h_{ef} (inch): 2.940
Code report: ICC-ES ESR-2713
Anchor category: 1
Anchor ductility: No
h_{min} (inch): 6.00
c_{ac} (inch): 6.00
C_{min} (inch): 1.75
S_{min} (inch): 2.75

Base Material
Concrete: Normal-weight
Concrete thickness, h (inch): 48.00
State: Uncracked
Compressive strength, f'_c (psi): 2500
$\Psi_{c,V}$: 1.4
Reinforcement condition: Supplementary reinforcement not present
Supplemental edge reinforcement: No
Reinforcement provided at corners: No
Ignore concrete breakout in tension: No
Ignore concrete breakout in shear: No
Ignore 6do requirement: Not applicable
Build-up grout pad: No

Base Plate
Length x Width x Thickness (inch): 3.50 x 12.00 x 0.25

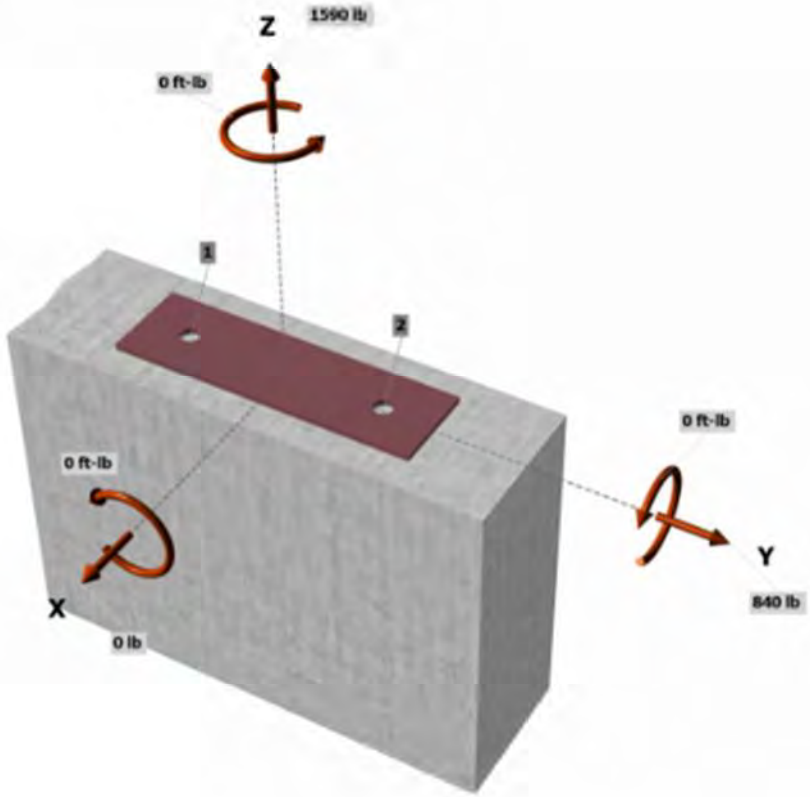
Recommended Anchor
Anchor Name: Titen HD® - 3/4"Ø Titen HD, hnom:4" (102mm)
Code Report: ICC-ES ESR-2713

Load and Geometry
Load factor source: ACI 318 Section 5.3
Load combination: not set
Seismic design: No
Anchors subjected to sustained tension: Not applicable
Apply entire shear load at front row: No
Anchors only resisting wind and/or seismic loads: No

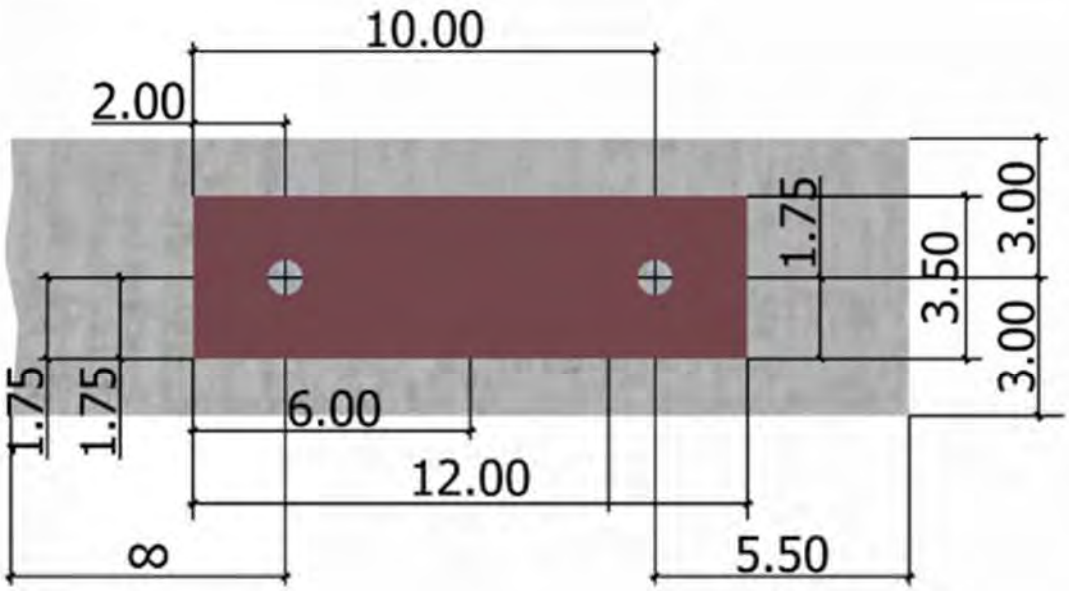
Strength level loads:

N_{ua} [lb]: 1590
V_{uax} [lb]: 0
V_{uay} [lb]: 840
M_{ua} [ft-lb]: 0
M_{ux} [ft-lb]: 0
M_{uy} [ft-lb]: 0

<Figure 1>



<Figure 2>



3. Resulting Anchor Forces

Anchor	Tension load, N_{ua} (lb)	Shear load x, V_{uax} (lb)	Shear load y, V_{uay} (lb)	Shear load combined, $\sqrt{(V_{uax})^2+(V_{uay})^2}$ (lb)
1	795.0	0.0	420.0	420.0
2	795.0	0.0	420.0	420.0
Sum	1590.0	0.0	840.0	840.0

Maximum concrete compression strain (‰): 0.00
Maximum concrete compression stress (psi): 0
Resultant tension force (lb): 1590
Resultant compression force (lb): 0
Eccentricity of resultant tension forces in x-axis, e'_{Nx} (inch): 0.00
Eccentricity of resultant tension forces in y-axis, e'_{Ny} (inch): 0.00
Eccentricity of resultant shear forces in x-axis, e'_{Vx} (inch): 0.00
Eccentricity of resultant shear forces in y-axis, e'_{Vy} (inch): 0.00

<Figure 3>

4. Steel Strength of Anchor in Tension (Sec. 17.6.1)

N_{sa} (lb)	ϕ	ϕN_{sa} (lb)
45540	0.65	29601

5. Concrete Breakout Strength of Anchor in Tension (Sec. 17.6.2)

$N_b = k_c \lambda_a \sqrt{f'_c} h_{ef}^{1.5}$ (Eq. 17.6.2.2.1)

k_c	λ_a	f'_c (psi)	h_{ef} (in)	N_b (lb)
27.0	1.00	2500	2.940	6805

$\phi N_{cbg} = \phi (A_{Nc} / A_{Nco}) \Psi'_{ec,N} \Psi'_{ed,N} \Psi'_{c,N} \Psi'_{cp,N} N_b$ (Sec. 17.5.1.2 & Eq. 17.6.2.1a)

A_{Nc} (in²)	A_{Nco} (in²)	$c_{a,min}$ (in)	$\Psi'_{ec,N}$	$\Psi'_{ed,N}$	$\Psi'_{c,N}$	$\Psi'_{cp,N}$	N_b (lb)	ϕ	ϕN_{cbg} (lb)
100.92	77.79	3.00	1.000	0.904	1.00	0.735	6805	0.65	3813

8. Steel Strength of Anchor in Shear (Sec. 17.7.1)

V_{sa} (lb)	ϕ_{grout}	ϕ	$\phi_{grout}\phi V_{sa}$ (lb)
14950	1.0	0.60	8970

9. Concrete Breakout Strength of Anchor in Shear (Sec. 17.7.2)

Shear perpendicular to edge in y-direction:

$V_{by} = \min[7(l_e / d_a)^{0.2} \sqrt{d_a} \lambda_a \sqrt{f'_c} c_{a1}^{1.5}; 9 \lambda_a \sqrt{f'_c} c_{a1}^{1.5}]$ (Eq. 17.7.2.2.1a & Eq. 17.7.2.2.1b)

l_e (in)	d_a (in)	λ_a	f'_c (psi)	c_{a1} (in)	V_{by} (lb)
2.94	0.750	1.00	2500	13.50	19759

$\phi V_{cby} = \phi (A_{Vc} / A_{Vco}) \Psi'_{ed,V} \Psi'_{c,V} \Psi'_{h,V} V_{by}$ (Sec. 17.5.1.2 & Eq. 17.7.2.1a)

A_{Vc} (in²)	A_{Vco} (in²)	$\Psi'_{ed,V}$	$\Psi'_{c,V}$	$\Psi'_{h,V}$	V_{by} (lb)	ϕ	ϕV_{cby} (lb)
121.50	820.13	0.744	1.400	1.000	19759	0.70	2136

Shear parallel to edge in x-direction:

$V_{bx} = \min[7(l_e / d_a)^{0.2} \sqrt{d_a} \lambda_a \sqrt{f'_c} c_{a1}^{1.5}; 9 \lambda_a \sqrt{f'_c} c_{a1}^{1.5}]$ (Eq. 17.7.2.2.1a & Eq. 17.7.2.2.1b)

l_e (in)	d_a (in)	λ_a	f'_c (psi)	c_{a1} (in)	V_{by} (lb)
2.94	0.750	1.00	2500	3.00	2070

$\phi V_{cbgv} = \phi\,(2)(A_{Vc}\,/\,A_{Vco})\Psi_{ec,V}\Psi_{ed,V}\Psi_{c,V}\Psi_{h,V}V_{by}$ (Sec. 17.5.1.2, 17.7.2.1(c) & Eq. 17.7.2.1b)

A_{Vc} (in²)	A_{Vco} (in²)	$\Psi_{ec,V}$	$\Psi_{ed,V}$	$\Psi_{c,V}$	$\Psi_{h,V}$	V_{by} (lb)	ϕ	ϕV_{cbgv} (lb)
76.50	40.50	1.000	1.000	1.400	1.000	2070	0.70	7663

10. Concrete Pryout Strength of Anchor in Shear (Sec. 17.7.3)

$\phi V_{cpg} = \phi k_{cp} N_{cbg} = \phi k_{cp}(A_{Nc}\,/\,A_{Nco})\Psi_{ec,N}\Psi_{ed,N}\Psi_{c,N}\Psi_{cp,N}N_b$ (Sec. 17.5.1.2 & Eq. 17.7.3.1b)

k_{cp}	A_{Nc} (in²)	A_{Nco} (in²)	$\Psi_{ec,N}$	$\Psi_{ed,N}$	$\Psi_{c,N}$	$\Psi_{cp,N}$	N_b (lb)	ϕ	ϕV_{cpg} (lb)
2.0	100.92	77.79	1.000	0.904	1.000	0.735	6805	0.70	8213

11. Results

Interaction of Tensile and Shear Forces (Sec. R17.8)

Tension	Factored Load, N_{ua} (lb)	Design Strength, ϕN_n (lb)	Ratio	Status
Steel	795	29601	0.03	Pass
Concrete breakout	**1590**	**3813**	**0.42**	**Pass (Governs)**

Shear	Factored Load, V_{ua} (lb)	Design Strength, ϕV_n (lb)	Ratio	Status
Steel	420	8970	0.05	Pass
T Concrete breakout y+	**840**	**2136**	**0.39**	**Pass (Governs)**
|| Concrete breakout x-	**840**	**7663**	**0.11**	**Pass (Governs)**
Pryout	840	8213	0.10	Pass

Interaction check	$(N_{ua}/\phi N_{na})^{5/3}$	$(V_{ua}/\phi V_{na})^{5/3}$	Combined Ratio	Permissible	Status
Sec. R17.8	0.23	0.21	44.4%	1.0	Pass

3/4"Ø Titen HD, hnom:4" (102mm) meets the selected design criteria.

12. Warnings

- Designer must exercise own judgement to determine if this design is suitable.

- Refer to manufacturer's product literature for hole cleaning and installation instructions.

SIMPSON Strong-Tie

Anchor Designer™ Software
Version 3.1.2209.3

Company:		Date:	9/8/2022
Engineer:		Page:	1/5
Project:			
Address:			
Phone:			
E-mail:			

1.Project information

Customer company:
Customer contact name:
Customer e-mail:
Comment:

Project description:
Location:
Fastening description:

2. Input Data & Anchor Parameters

General
Design method:ACI 318-19
Units: Imperial units

Anchor Information:
Anchor type: Concrete screw
Material: Carbon Steel
Diameter (inch): 0.750
Nominal Embedment depth (inch): 4.000
Effective Embedment depth, h_{ef} (inch): 2.940
Code report: ICC-ES ESR-2713
Anchor category: 1
Anchor ductility: No
h_{min} (inch): 6.00
c_{ac} (inch): 6.00
C_{min} (inch): 1.75
S_{min} (inch): 2.75

Base Material
Concrete: Normal-weight
Concrete thickness, h (inch): 48.00
State: Uncracked
Compressive strength, f'_c (psi): 2500
$\Psi_{c,V}$: 1.4
Reinforcement condition: Supplementary reinforcement not present
Supplemental edge reinforcement: No
Reinforcement provided at corners: No
Ignore concrete breakout in tension: No
Ignore concrete breakout in shear: No
Ignore 6do requirement: Not applicable
Build-up grout pad: No

Base Plate
Length x Width x Thickness (inch): 3.50 x 12.00 x 0.25

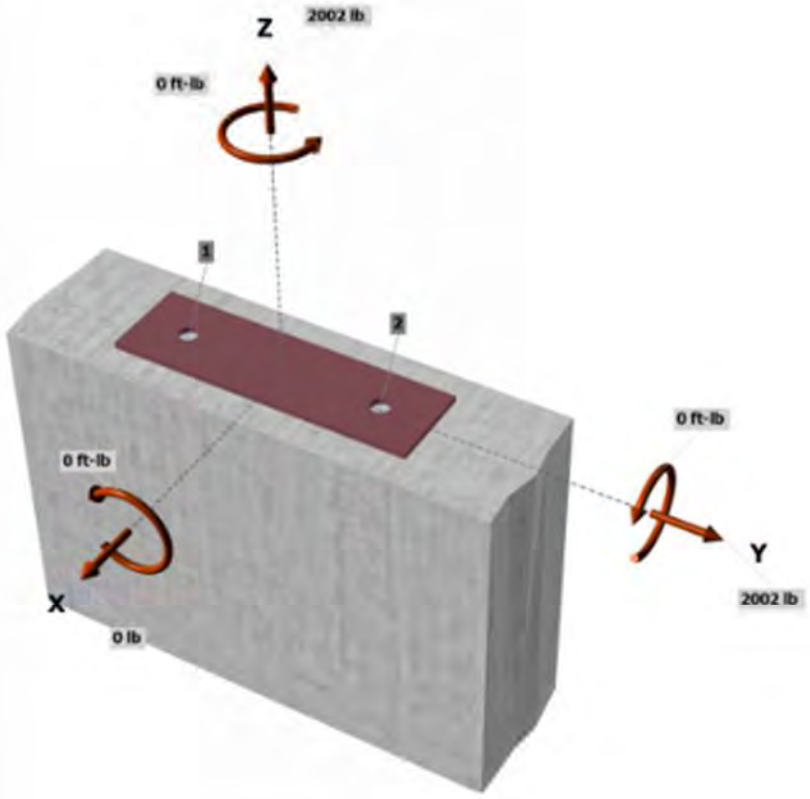
Recommended Anchor
Anchor Name: Titen HD® - 3/4"Ø Titen HD, hnom:4" (102mm)
Code Report: ICC-ES ESR-2713

Load and Geometry
Load factor source: ACI 318 Section 5.3
Load combination: not set
Seismic design: No
Anchors subjected to sustained tension: Not applicable
Apply entire shear load at front row: No
Anchors only resisting wind and/or seismic loads: No

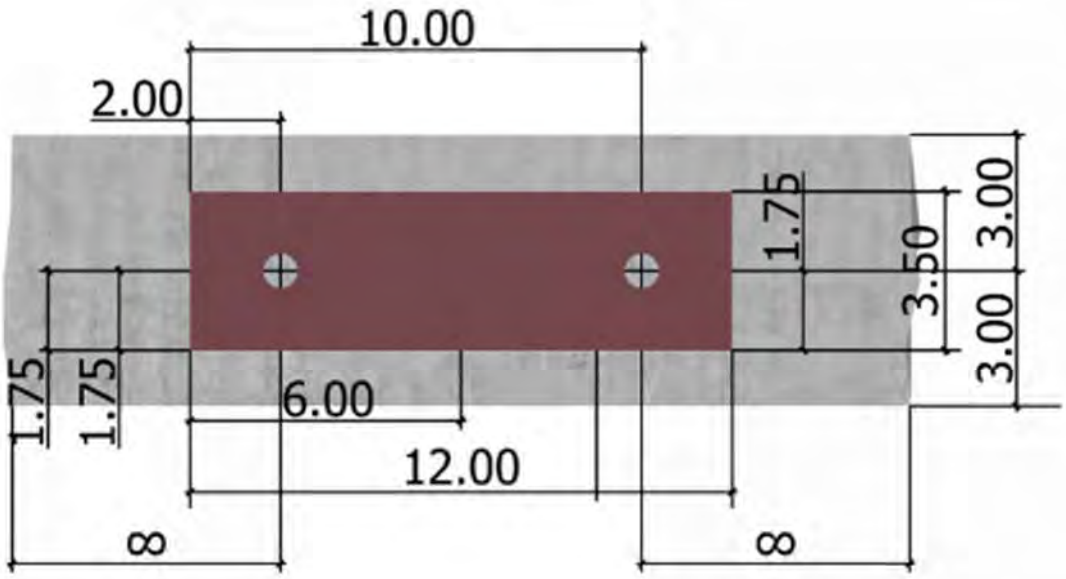
Strength level loads:

N_{ua} [lb]: 2002
V_{uax} [lb]: 0
V_{uay} [lb]: 2002
M_{ux} [ft-lb]: 0
M_{uy} [ft-lb]: 0
M_{uz} [ft-lb]: 0

<Figure 1>



<Figure 2>

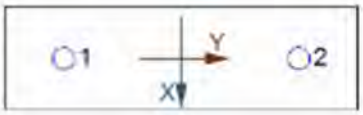


3. Resulting Anchor Forces

Anchor	Tension load, N_{ua} (lb)	Shear load x, V_{uax} (lb)	Shear load y, V_{uay} (lb)	Shear load combined, $\sqrt{(V_{uax})^2+(V_{uay})^2}$ (lb)
1	1001.0	0.0	1001.0	1001.0
2	1001.0	0.0	1001.0	1001.0
Sum	2002.0	0.0	2002.0	2002.0

Maximum concrete compression strain (‰): 0.00
Maximum concrete compression stress (psi): 0
Resultant tension force (lb): 2002
Resultant compression force (lb): 0
Eccentricity of resultant tension forces in x-axis, e'_{Nx} (inch): 0.00
Eccentricity of resultant tension forces in y-axis, e'_{Ny} (inch): 0.00
Eccentricity of resultant shear forces in x-axis, e'_{Vx} (inch): 0.00
Eccentricity of resultant shear forces in y-axis, e'_{Vy} (inch): 0.00

<Figure 3>



4. Steel Strength of Anchor in Tension (Sec. 17.6.1)

N_{sa} (lb)	ϕ	ϕN_{sa} (lb)
45540	0.65	29601

5. Concrete Breakout Strength of Anchor in Tension (Sec. 17.6.2)

$N_b = k_c \lambda_a \sqrt{f'_c} h_{ef}^{1.5}$ (Eq. 17.6.2.2.1)

k_c	λ_a	f'_c (psi)	h_{ef} (in)	N_b (lb)
27.0	1.00	2500	2.940	6805

$\phi N_{cbg} = \phi (A_{Nc} / A_{Nco}) \Psi_{ec,N} \Psi_{ed,N} \Psi_{c,N} \Psi_{cp,N} N_b$ (Sec. 17.5.1.2 & Eq. 17.6.2.1a)

A_{Nc} (in²)	A_{Nco} (in²)	$c_{a,min}$ (in)	$\Psi_{ec,N}$	$\Psi_{ed,N}$	$\Psi_{c,N}$	$\Psi_{cp,N}$	N_b (lb)	ϕ	ϕN_{cbg} (lb)
100.92	77.79	3.00	1.000	0.904	1.00	0.735	6805	0.65	3813

8. Steel Strength of Anchor in Shear (Sec. 17.7.1)

V_{sa} (lb)	ϕ_{grout}	ϕ	$\phi_{grout}\phi V_{sa}$ (lb)
14950	1.0	0.60	8970

9. Concrete Breakout Strength of Anchor in Shear (Sec. 17.7.2)

Shear parallel to edge in x-direction:

$V_{by} = \min[7(l_e / d_a)^{0.2} \sqrt{d_a} \lambda_a \sqrt{f'_c} c_{a1}^{1.5}; 9 \lambda_a \sqrt{f'_c} c_{a1}^{1.5}]$ (Eq. 17.7.2.2.1a & Eq. 17.7.2.2.1b)

l_e (in)	d_a (in)	λ_a	f'_c (psi)	c_{a1} (in)	V_{by} (lb)
2.94	0.750	1.00	2500	3.00	2070

$\phi V_{cbgy} = \phi (2)(A_{Vc} / A_{Vco}) \Psi_{ec,V} \Psi_{ed,V} \Psi_{c,V} \Psi_{h,V} V_{by}$ (Sec. 17.5.1.2, 17.7.2.1(c) & Eq. 17.7.2.1b)

A_{Vc} (in²)	A_{Vco} (in²)	$\Psi_{ec,V}$	$\Psi_{ed,V}$	$\Psi_{c,V}$	$\Psi_{h,V}$	V_{by} (lb)	ϕ	ϕV_{cbgy} (lb)
76.50	40.50	1.000	1.000	1.400	1.000	2070	0.70	7663

10. Concrete Pryout Strength of Anchor in Shear (Sec. 17.7.3)

$\phi V_{cpg} = \phi K_{cp} N_{cbg} = \phi K_{cp} (A_{Nc} / A_{Nco}) \Psi_{ec,N} \Psi_{ed,N} \Psi_{c,N} \Psi_{cp,N} N_b$ (Sec. 17.5.1.2 & Eq. 17.7.3.1b)

k_{cp}	A_{Nc} (in²)	A_{Nco} (in²)	$\Psi_{ec,N}$	$\Psi_{ed,N}$	$\Psi_{c,N}$	$\Psi_{cp,N}$	N_b (lb)	ϕ	ϕV_{cpg} (lb)
2.0	100.92	77.79	1.000	0.904	1.000	0.735	6805	0.70	8213

11. Results

Interaction of Tensile and Shear Forces (Sec. 17.8)

Tension	Factored Load, N_{ua} (lb)	Design Strength, ϕN_n (lb)	Ratio	Status
Steel	1001	29601	0.03	Pass
Concrete breakout	**2002**	**3813**	**0.53**	**Pass (Governs)**

Shear	Factored Load, V_{ua} (lb)	Design Strength, ϕV_n (lb)	Ratio	Status
Steel	1001	8970	0.11	Pass
|| Concrete breakout x-	**2002**	**7663**	**0.26**	**Pass (Governs)**
Pryout	2002	8213	0.24	Pass

Interaction check	$N_{ua}/\phi N_n$	$V_{ua}/\phi V_n$	Combined Ratio	Permissible	Status
Sec. 17.8.1	0.53	0.00	52.5%	1.0	Pass

3/4"Ø Titen HD, hnom:4" (102mm) meets the selected design criteria.

12. Warnings

- Designer must exercise own judgement to determine if this design is suitable.

- Refer to manufacturer's product literature for hole cleaning and installation instructions.