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Kord Scott
Town of Windham
Selectperson

Monday, August 17, 2020

Subject: Salt Shed Structure- Options to Consider for Rehabilitation and Repairs

Dear Kord,

I am following up with you regarding the Town of Windham salt shed structure at the town garage property along Windham Hill Road. The purpose of my initial involvement in the project was to provide engineering input and comment on the proposed repair of the easterly visibly distressed concrete wall, a concept that included adding buttresses to the outside of the structure along the easterly wall. I sent you a summary of my thoughts regarding the proposed repair on July 20th, 2020. At that time I suggested that we continue with another phase of preliminary design, to work towards developing a few concepts in an attempt to more comprehensively address the project.

The easterly concrete wall is clearly leaning outward at the top (away from the sand which is piled against it) and the wall is also bowing outward, in a shape consistent with the direction away from the sand piles. The concrete wall is cracked in locations consistent with this movement, most notably in the southeasterly corner and on the outside of the wall where the bow is most pronounced. The easterly wall shares the same construction type and geometry as the other two walls. While the other two walls have fared better, primarily because the backfill is higher against them, a permanent repair of the structure should include all the walls.

I have included four drawings (R01-R04) which describe the concepts for reasonable approaches for repairing/stabilizing the wall system. You will want to refer to the drawings as you look at the summary descriptions listed below. I have also included a preliminary opinion of the costs for each of these repairs. The costs listed are approximate and should be used to get a sense of the relative costs between the options presented.

Understanding that it may be desirable or necessary to separate the project into phases, the cost estimates include a provision for a first stage repair of the easterly wall. The cost includes a 25% premium for this section of wall should you decide to do it as a separate project, as it will be less efficient to do the work in phases and in most instances more complicated because of the shed addition on this side. Costs are rounded to $500.00 intervals on this summary page.

Repair Approach R1 - Cast in place concrete gravity retaining walls outside existing walls:

R1 Opinion of cost for Easterly wall only (1 of 3) = $47,500.00
R1 Opinion of cost for all of the walls (3 of 3) = $101,500.00

+ A few benefits of this approach: Simplest of the cast in place concrete systems, no complicated rebar, easy footings, long life and good salt resistance, retains existing space inside bulk storage area.

– A few drawbacks of this approach: Requires one sided concrete forms, more skilled concrete contractor, consumes space within the shed addition, visible change to outside of structure.

Repair Approach R2 - Cast in place concrete cantilever retaining walls inside existing walls:

R2 Opinion of cost for Easterly wall only (1 of 3) = $49,500.00
R2 Opinion of cost for all of the walls (3 of 3) = $105,500.00

+ A few benefits of this approach: No visible change to outside of structure, least amount of excavation, no change to siding, small footprint (only the wall will be visible), shed addition remains useful space.

– A few drawbacks of this approach: Requires one sided concrete forms, highly skilled concrete contractor required due to reinforcement requirements, uses up existing space inside bulk storage area (slightly less sand and salt), footing work more complicated, least resistance of all the approaches to salt exposure because it includes rebar and is adjacent to the salt pile.

Repair Approach R3 - Cast in place concrete cantilever retaining walls outside existing walls:

R3 Opinion of cost for Easterly wall only (1 of 3) = $51,000.00
R3 Opinion of cost for all of the walls (3 of 3) = $108,500.00

+ A few benefits of this approach: Relatively long life and good salt resistance since it is outside existing walls, retains existing space inside bulk storage area.
– A few drawbacks of this approach: Requires one sided concrete forms, highly skilled concrete contractor required due to reinforcement requirements, consumes space within the shed addition, visible change to outside of structure.

Repair Approach R4 - Precast gravity retaining walls outside existing walls:

R4 Opinion of cost for Easterly wall only (1 of 3) = $38,000.00
R4 Opinion of cost for all of the walls (3 of 3) = $81,000.00

+ A few benefits of this approach: Likely to be least expensive of all proposed approaches, retains existing space inside bulk storage area.
– A few drawbacks of this approach: The most flexible structure and as such the walls will lean and move more as time goes by (this approach is by far the least desirable because of this fact), least permanent of the repairs due to movement, consumes most of the space within the shed addition, highly visible change to outside of structure (will be very visible), consumes large space to west of structure where future addition may be planned, further movement of concrete walls will affect and reduce strength of wooden structure.

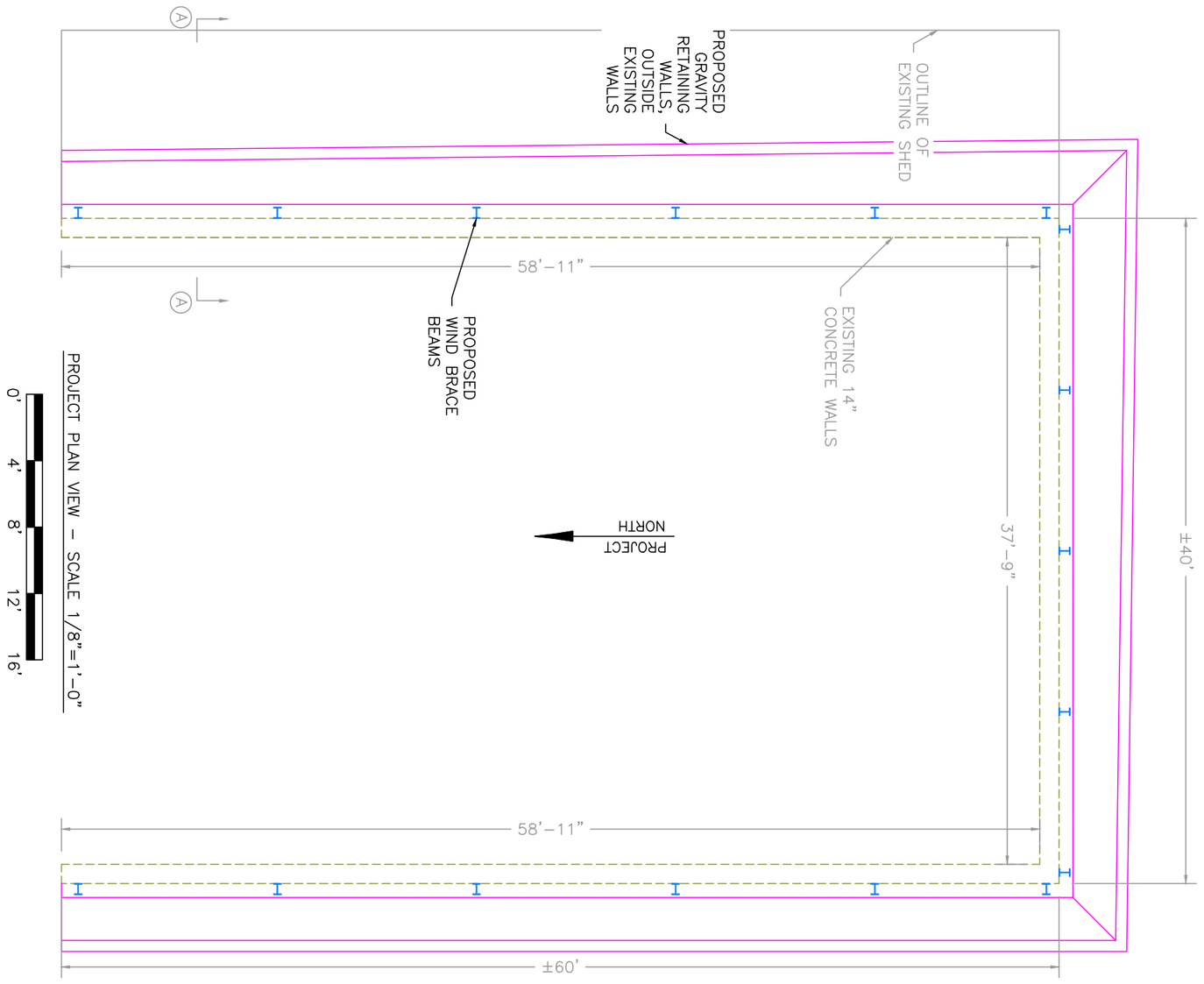
Improvements to structure to increase ability to resolve wind loads:
Relatively absent from the wood frame is a permanent means of resolving wind loads. A permanent means of improving the ability of the structure to resist wind loads is also proposed and shown on the drawings. The improvement includes a series of steel beams bolted vertically to the concrete walls, which extend up to the roof trusses. The beams will be attached to a new framing system at the truss level to provide a means of distributing the wind loads to the new bracing system. It may not be obvious so I will clarify, the system will be connected to the existing concrete walls, so any walls that are not repaired can still move and this movement will damage the wooden structure. The wind bracing system will not aid in strengthening the concrete wall system and as such any walls that are not repaired will still move and continue to damage the wooden structure. The cost for this item is separated into two parts. If only the easterly wall is repaired, and recognizing that this structure is in a very weakened, it is my suggestion that the southerly wall also have the wind bracing system installed. Adding the wind bracing to westerly wall without repairing the westerly wall is likely to cause damage the trusses, hence this should not be done.

Opinion of cost for Easterly and Southerly wall only (2 of 3) = $20,500.00
Opinion of cost for all of the walls (3 of 3) = $25,500.00

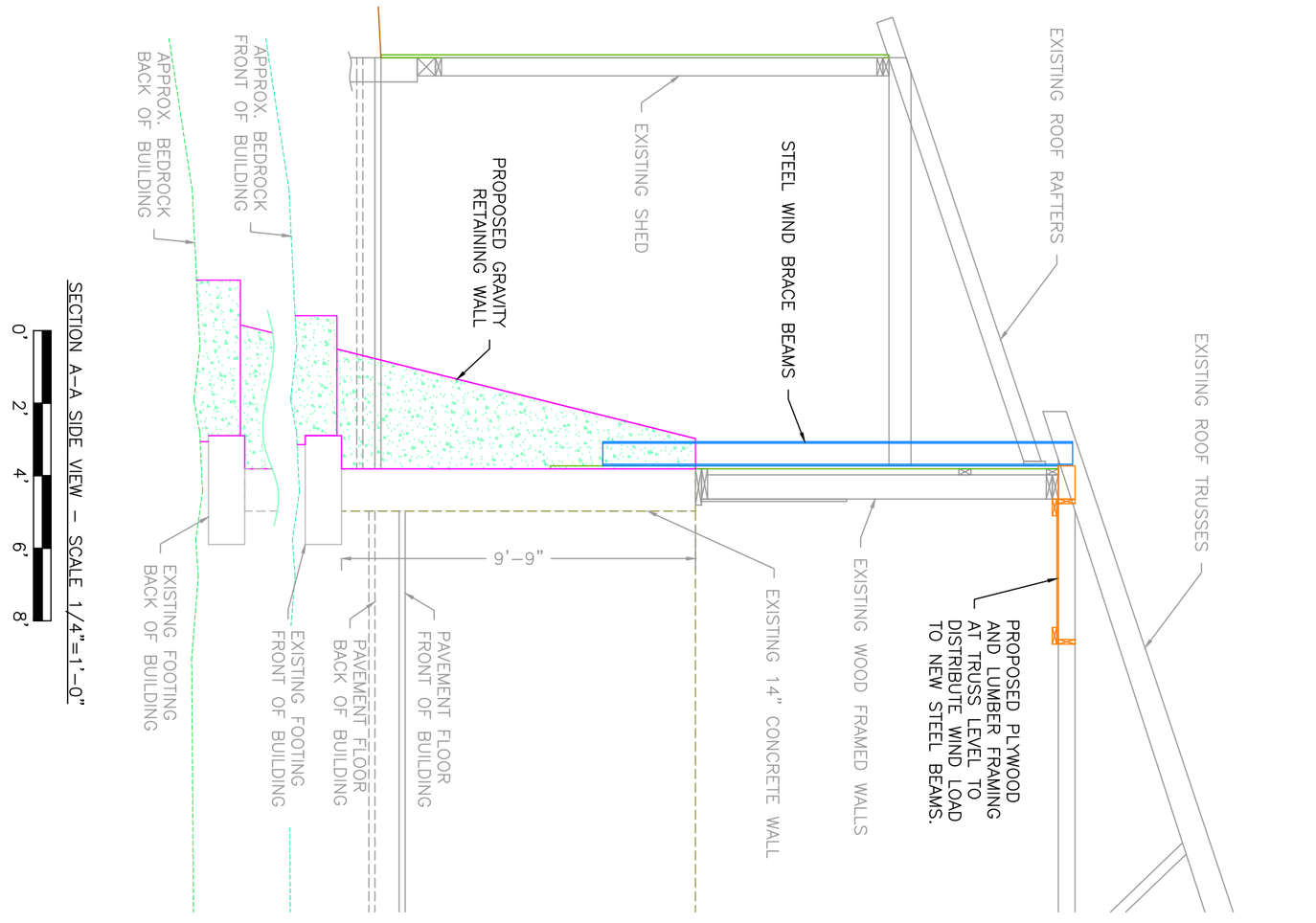
Not included in this discussion of pricing is the relocation of the diesel pump and tank. Not included in this discussion are any improvements to the system to retain the salt or to mitigate movement of the salt to the surrounding area.

Sincerely,

David (Todd) Hindinger, P.E.

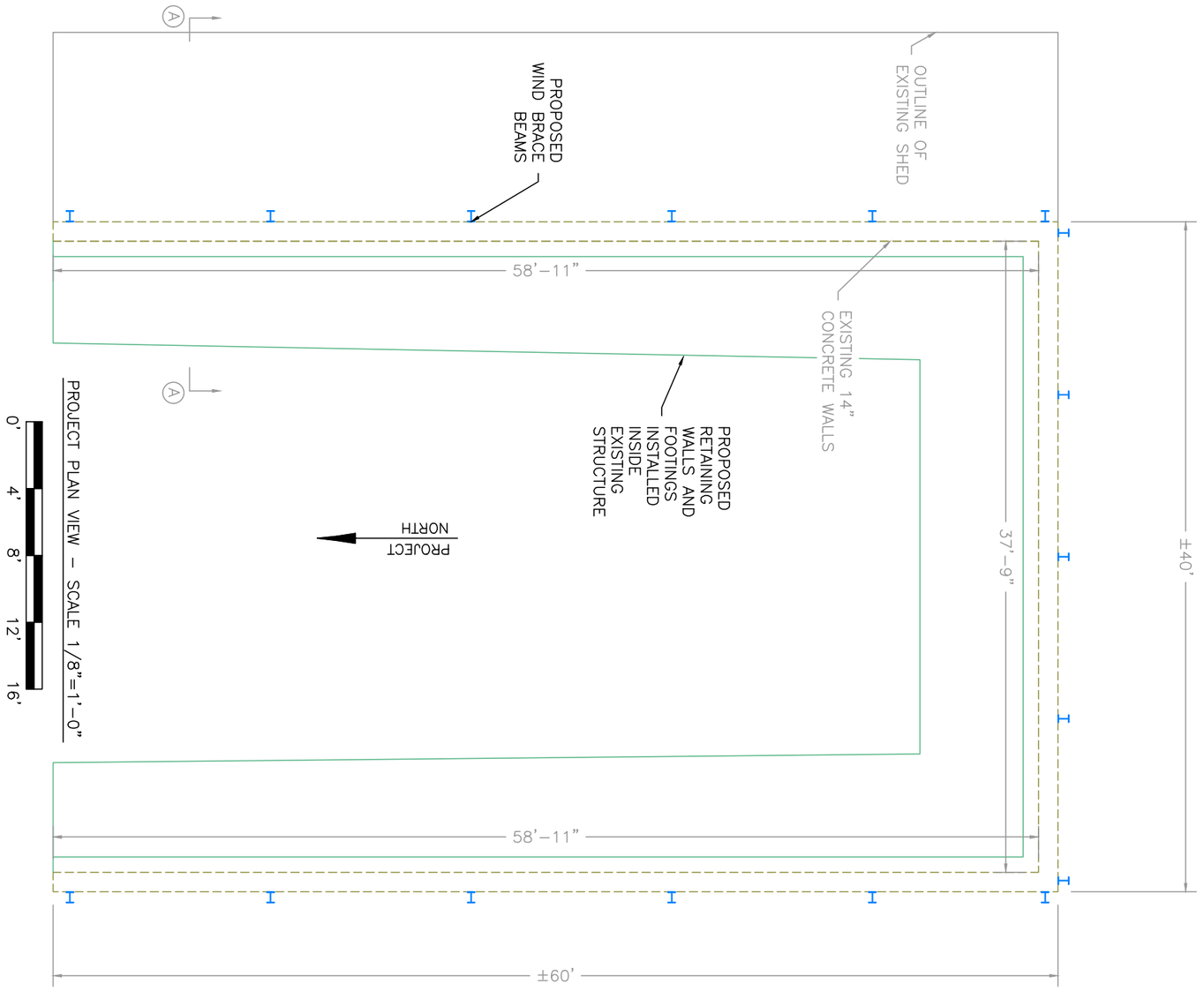


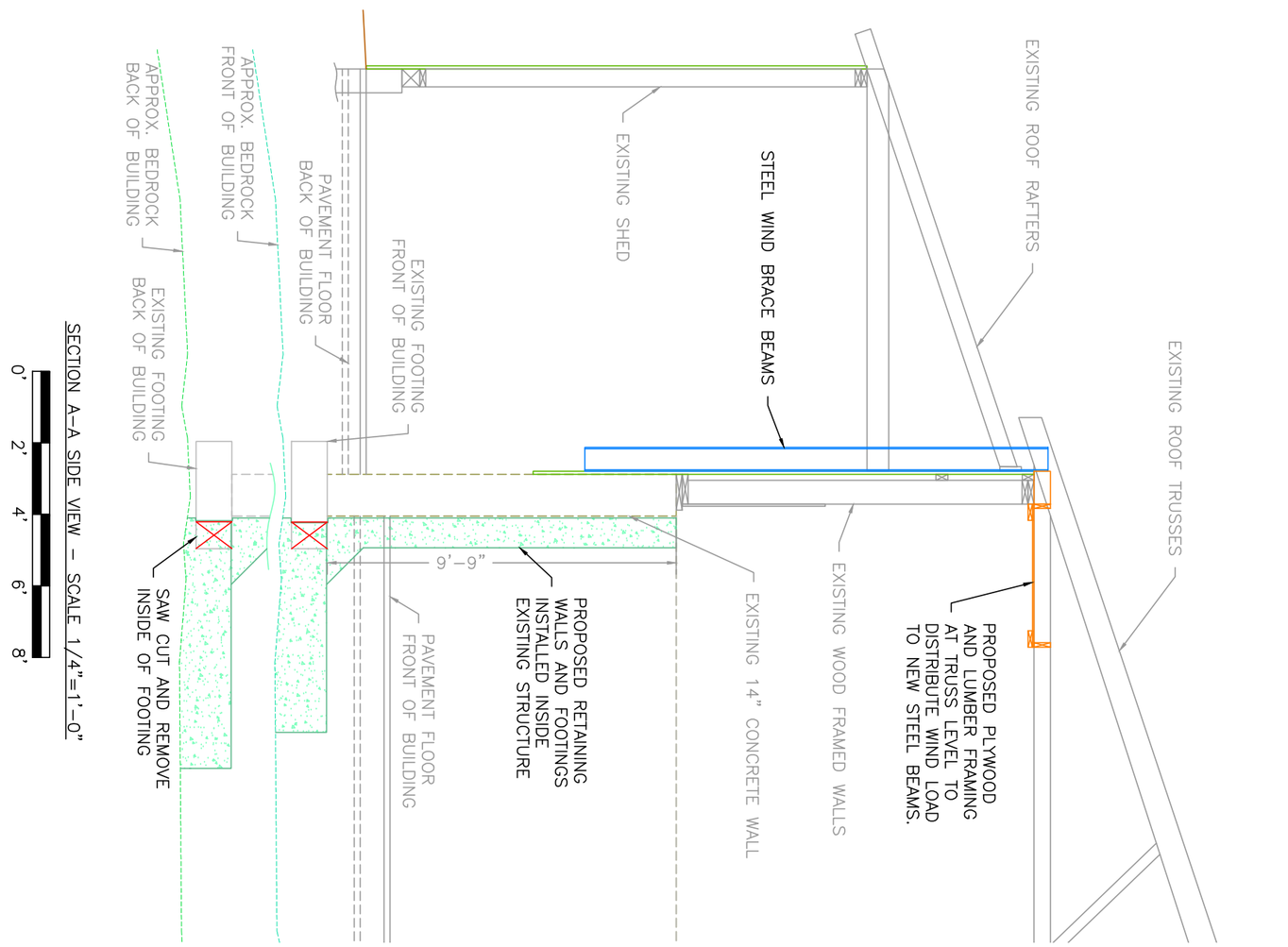
PROJECT PLAN VIEW – SCALE 1/8"=1'–0"



SECTION A–A SIDE VIEW – SCALE 1/4"=1'–0"

DATE: 08-16-2020 DRAWN BY: DTH PROJECT NO.: 2020-28	HERITAGE ENGINEERING	Heritage Engineering, P.C. P.O. Box 255 7290 VT Rte 131 Perkinsville, VT 05151 PH/Fax 802-263-5400 www.heritageengineeringvt.com	WINDHAM SALT SHED REPAIR CONCEPTS WINDHAM HILL ROAD - WINDHAM	FIGURE NO. R01





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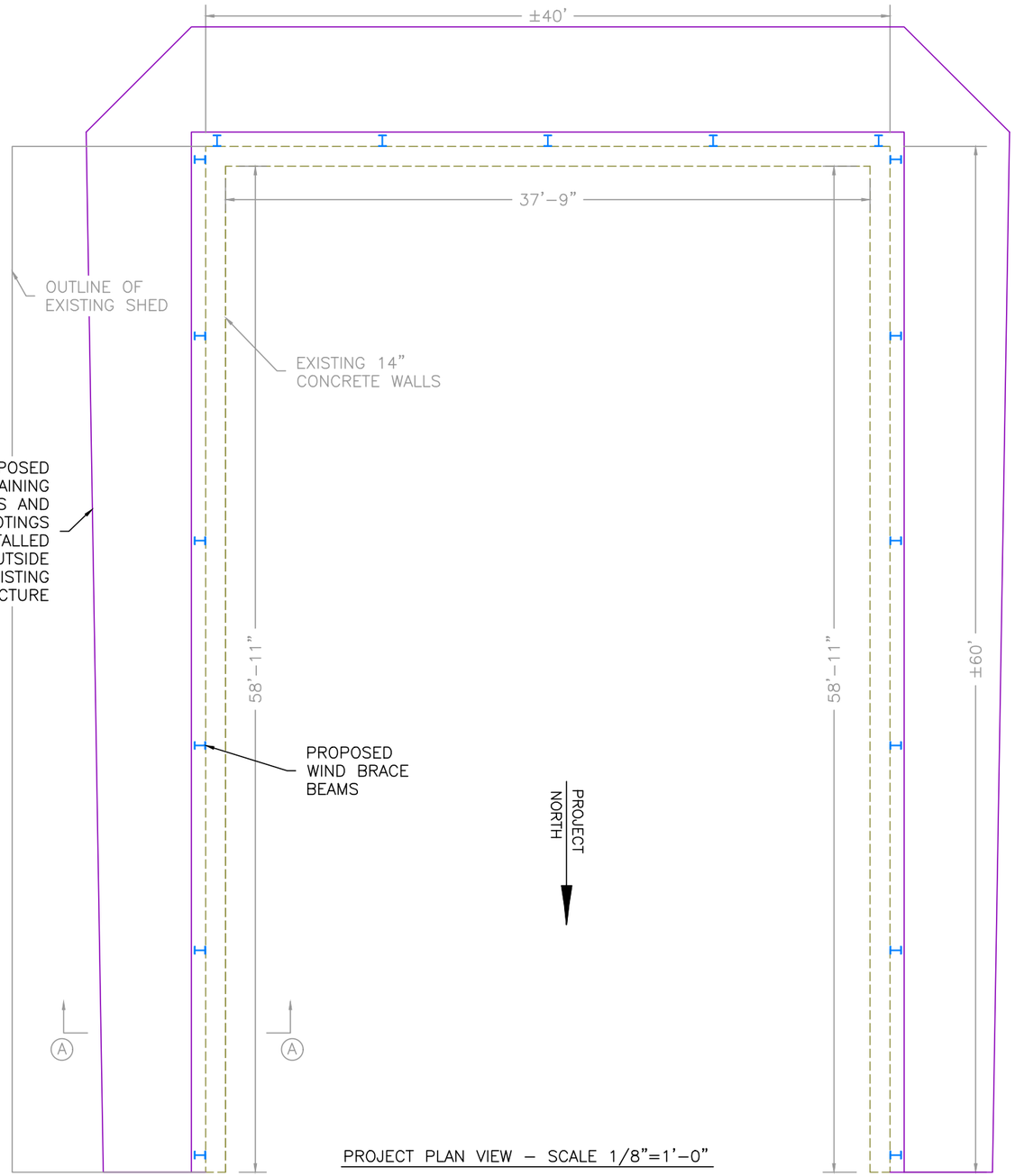
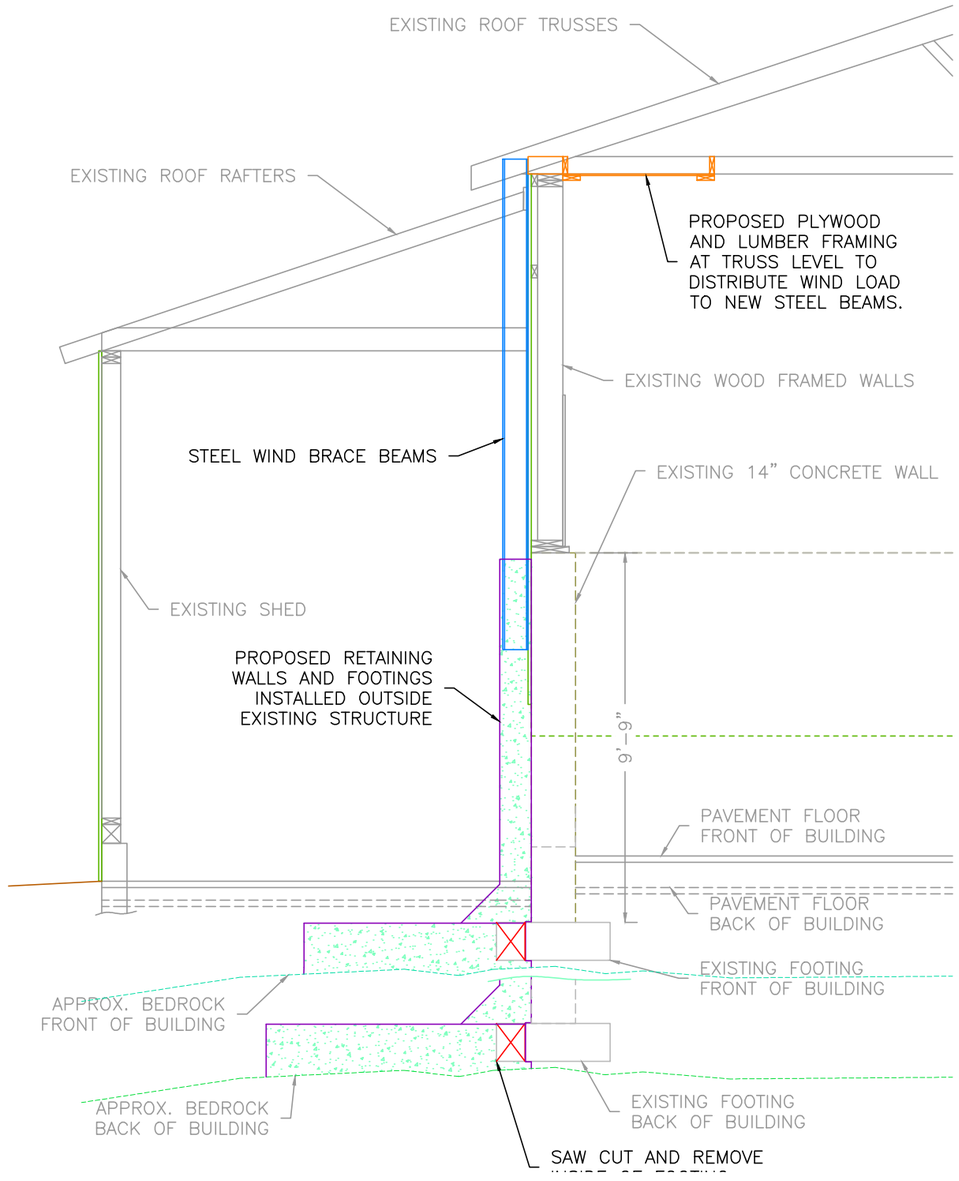


PROJECT PLAN VIEW – SCALE 1/8"=1'–0"

0' 4' 8' 12' 16'



SECTION A–A SIDE VIEW – SCALE 1/4"=1'–0"

0' 2' 4' 6' 8'

FIGURE NO. R03

WINDHAM SALT SHED
REPAIR CONCEPTS
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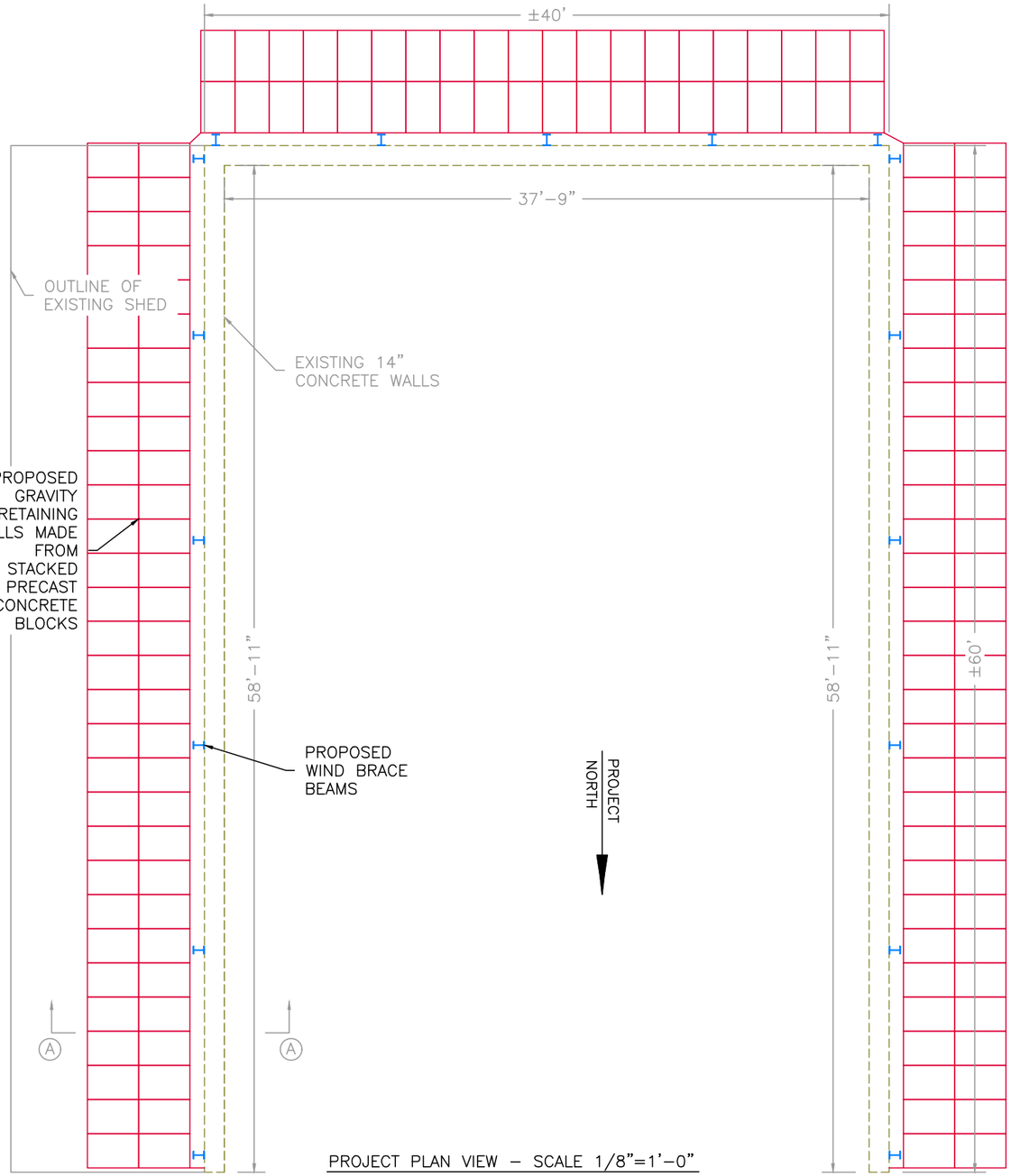
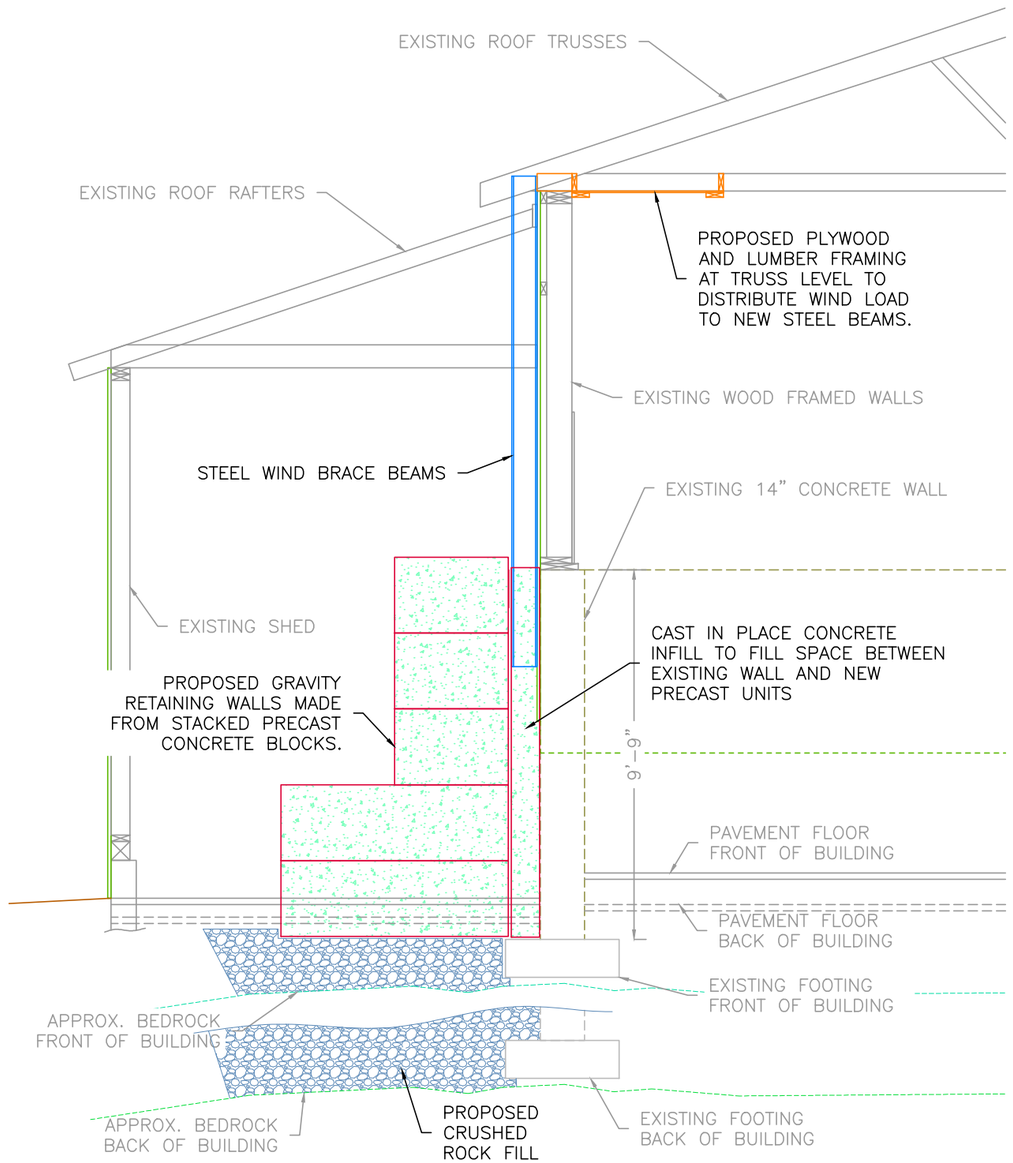


PROJECT PLAN VIEW – SCALE 1/8"=1'–0"

0' 4' 8' 12' 16'



SECTION A–A SIDE VIEW – SCALE 1/4"=1'–0"

0' 2' 4' 6' 8'

FIGURE NO. R04

WINDHAM SALT SHED
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WINDHAM HILL ROAD - WINDHAM

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Salt Shed Rehabilitation Project Planning - Opinion of Approximate Costs		
Repair Approach R1 - Cast in place concrete gravity retaining walls outside existing walls:		
Concrete walls and footings, cast in place		$ 86,400.00
Drill and grout dowels		$ 3,000.00
Flashing/trim/siding		$ 2,000.00
Saw cut and remove pavement		$ 1,500.00
Replace pavement		$ -
Remove, relocate, replace exterior liquid tanks		$ 2,000.00
Remove and replace shed addition far end wall		$ 3,000.00
Excavation, backfill three sides		$ 3,500.00
		$ -
	Sum	$ 101,400.00
Repair approach cost minimum - easterly wall only - 25% premium		$ 47,531.25
Repair approach cost for entire project - Three walls		$ 101,400.00

Repair Approach R2 - Cast in place concrete cantilever retaining walls inside existing walls:		
Concrete walls and footings, cast in place		$ 90,000.00
Sawcut and demo part of footing		$ 2,500.00
Drill and grout dowels		$ 4,000.00
Flashing/trim/siding		$ -
Saw cut and remove pavement		$ 3,000.00
Replace pavement		$ 4,000.00
Remove, relocate, replace exterior liquid tanks		$ -
Remove and replace shed addition far end wall		$ -
Excavation, backfill three sides		$ 2,000.00
		$ -
	Sum	$ 105,500.00
Repair approach cost minimum - Easterly wall only - 25% premium		$ 49,453.13
Repair approach cost for entire project - Three walls		$ 105,500.00

Repair Approach R3 - Cast in place concrete cantilever retaining walls outside existing walls:	
Concrete walls and footings, cast in place	$ 90,000.00
Sawcut and demo part of footing	$ 2,500.00
Drill and grout dowels	$ 4,000.00
Flashing/trim/siding	$ 2,000.00
Saw cut and remove pavement	$ 1,500.00
Replace pavement	$ -
Remove, relocate, replace exterior liquid tanks	$ 2,000.00
Remove and replace shed addition far end wall	$ 3,000.00
Excavation, backfill three sides	$ 3,500.00

		$ -
	Sum	$ 108,500.00
Repair approach cost minimum - easterly wall only - 25% premium		$ 50,859.38
Repair approach cost for entire project - Three walls		$ 108,500.00

Repair Approach R4 - Precast gravity retaining walls outside existing walls:		
Concrete between blocks and existing wall, cast in place		$ 16,000.00
Sawcut and demo part of footing		$ -
Drill and grout dowels		$ 2,000.00
Flashing/trim/siding		$ 2,000.00
Saw cut and remove pavement		$ 1,500.00
Replace pavement		$ -
Concrete blocks 3x2x2 (or 3x3x18)		$ 12,960.00
Concrete blocks 6x2x2 (or 6x3x18)		$ 14,580.00
Trucking to deliver blocks		$ 10,000.00
Crushed rock		$ 2,400.00
Trucking to deliver rock		$ 2,500.00
Remove, relocate, replace exterior liquid tanks		$ 2,000.00
Remove and replace shed addition far end wall		$ 3,000.00
Excavation, backfill three sides		$ 3,500.00
Fastening system at blocks, installation		$ 8,500.00
	Sum	$ 80,940.00
Repair approach cost minimum - easterly wall only - 25% premium		$ 37,940.63
Repair approach cost for entire project - Three walls		$ 80,940.00

Improvements to Structure to increase ability to resolve wind loads	
	Cost Total
Steel Beams, materials and fabrication	9945
Galvanizing of steel beams	1700
Installation of steel beams	2720
Misc Hardware to attach steel beams to walls	1020
Installation of hardware to attach beams	2040
Trucking (galvanizing)	1000
Plywood and framing at trusses, materials	2250
Plywood and framing at trusses, installation	4800
	25475
Improvement cost minimum - Easterly+ Southerly - 25% premium	$ 20,604.78
Improvement cost for entire project - Three walls	$ 25,475.00