



PNWS-AWWA 2022 Section Conference

Seismic Resilience without Breaking the Bank

April 29, 2022



Speaker Introductions

Bryan Robinson, PWB



Matt Perkins, Stantec



Agenda

Introduction

PWB Pump Station History

Seismic Design Criteria

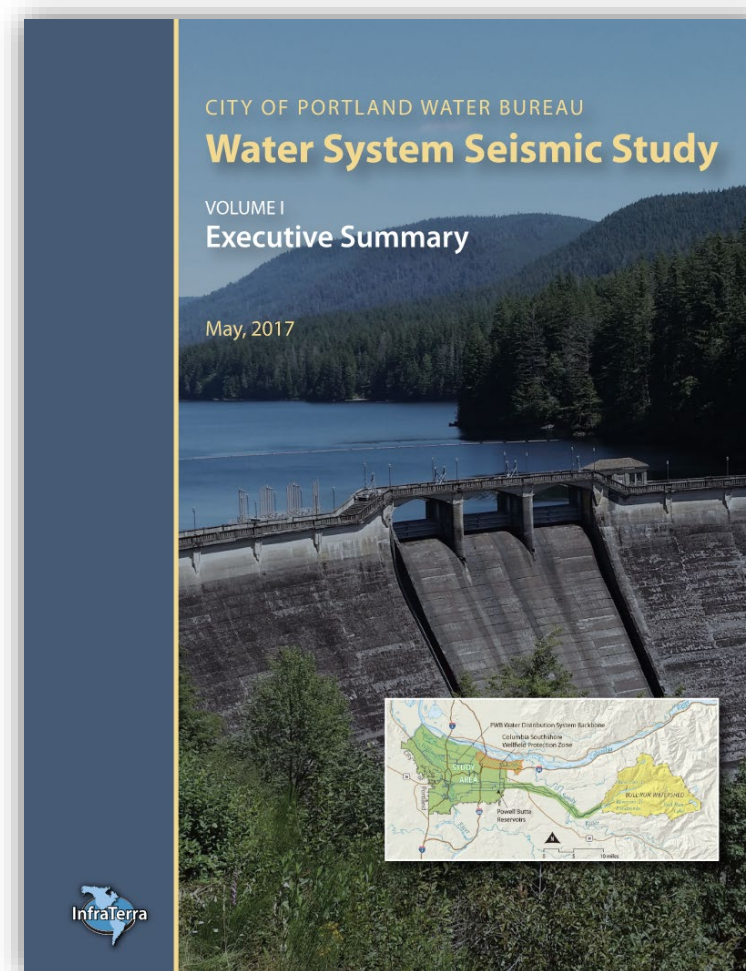
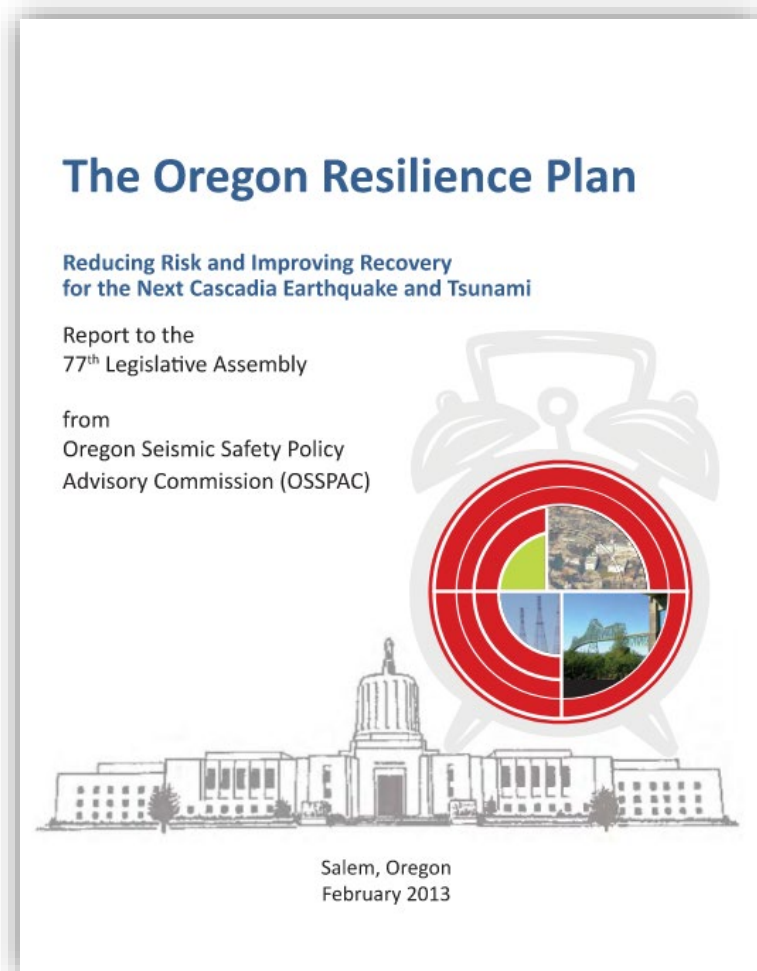
Project Design Phase

Next Steps: Implementation

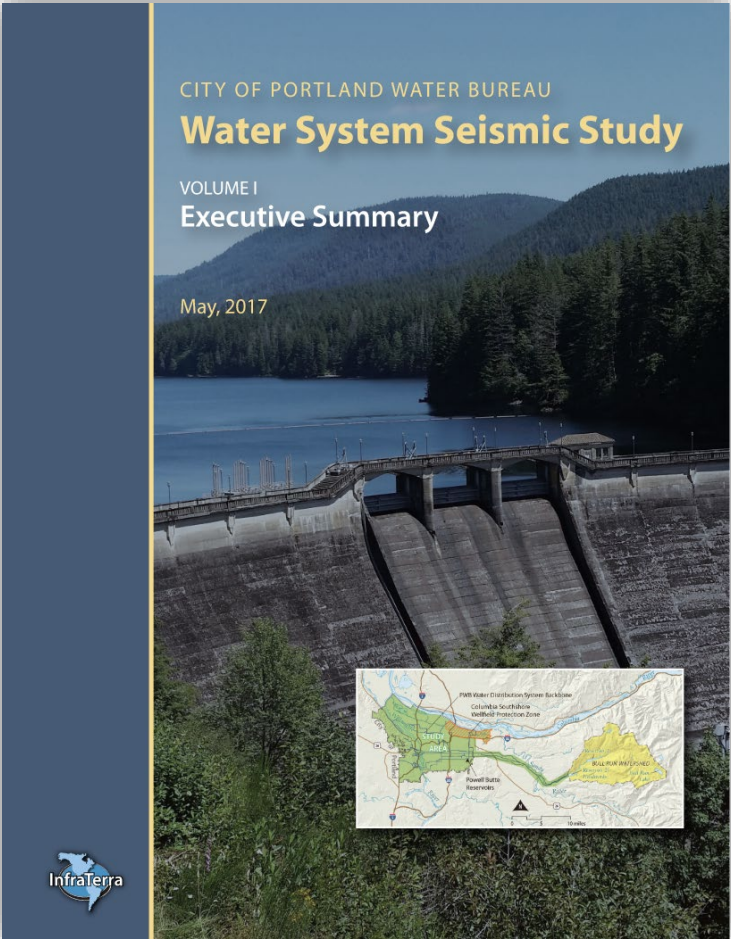
Q&A

Introduction

Problem Identification



Problem Identification

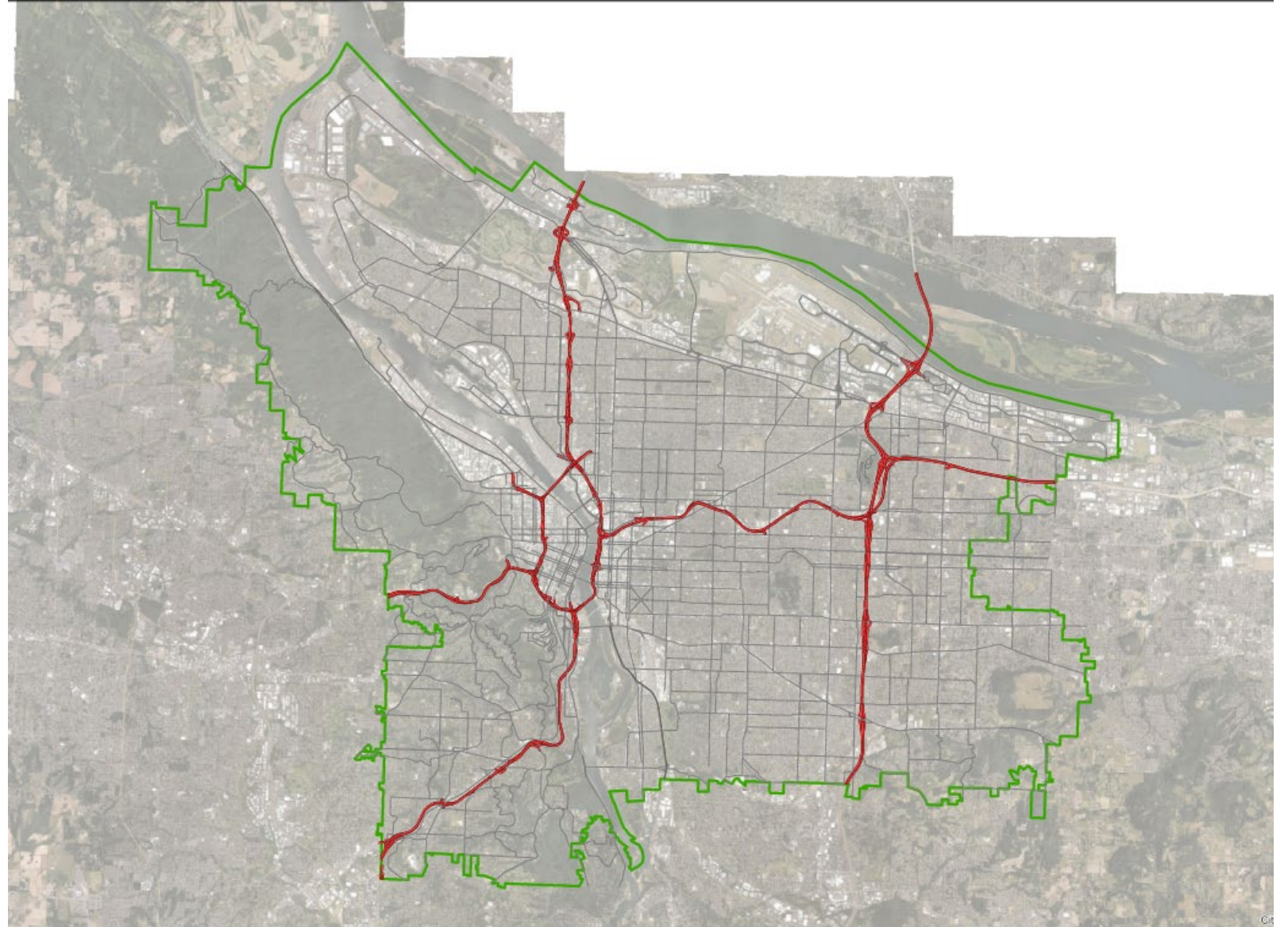


Non-CIP Projects	Develop a program to anchor and restrain all electrical and communication equipment	TBD	High	Equipment damage is most common in an earthquake, and easiest to prevent with a pro-active anchorage program.
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Pump Station History

PWB Pump Stations

- 36 Active Pump Stations throughout the distribution system



PWB Pump Station History

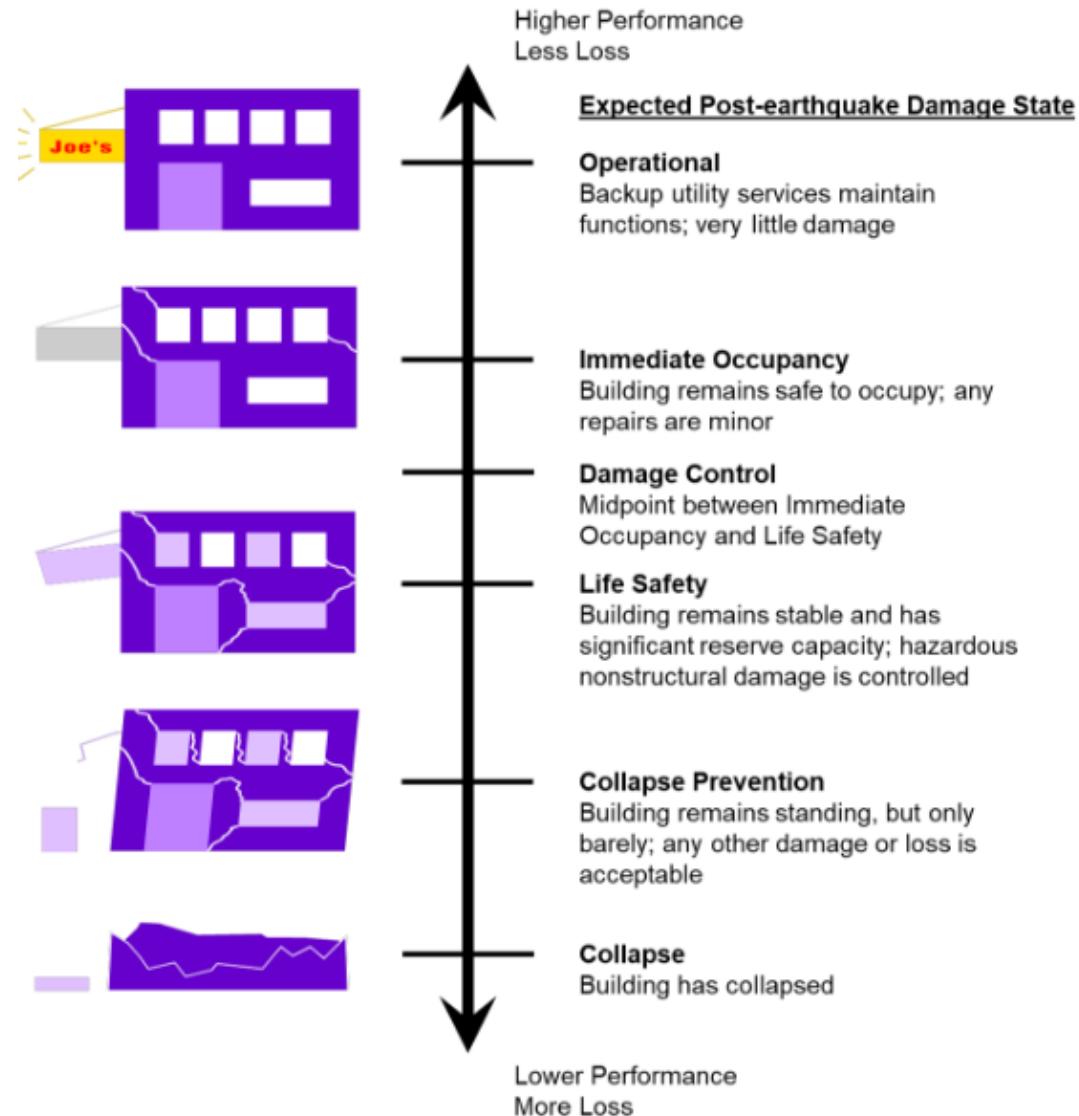


Portland Water Bureau Priority Ranking

Category	Criteria
4	Pump stations constructed or upgraded since 1995.
3	Pump stations where upgrades are scheduled.
2	Pump stations not considered part of the backbone distribution system or supply less than 50 services and are not considered backup stations.
1	Remainder of pump stations.

Seismic Design Criteria

Performance Level



Existing Anchorage Conditions

Anchorage Condition	Technical Description	Practical Description
Anchorage Condition 1	Anchorage exists and adequate records showing the electrical cabinet anchorage meets the demands from the design earthquake using the analytical procedure of ASCE 41 Section 13.4.3.	Cabinet is anchored. Anchorage has been designed by an engineer and adequate records of design and installation are available.
Anchorage Condition 2	Anchorage exists and meets the prescriptive evaluation requirements of ASCE 41-17 Section 13.4.2.	Cabinet is anchored. Anchorage appears to be acceptable based on visual observation by an engineer.
Anchorage Condition 3	Anchorage exists and does not meet the prescriptive evaluation requirements of ASCE 41-17 Section 13.4.2.	Cabinet is anchored. Anchorage does not appear to be acceptable based on visual observation by an engineer.
Anchorage Condition 4	No existing anchorage.	Cabinet is not anchored.




OKAY

???




NOT ACCEPTABLE




Anchorage Installation Instructions













**0000 HIT-EP 2000-A
0000 HIT-EP 2000-B**

Instructions for use
Mode d'emploi
Manual de instrucciones
Instruções de utilização


		
Dry base material	Water-saturated base material	Waterfilled trench to concrete


		
HIT-Z HIT-Z-R	Threaded rod Threaded sleeve	Rebar

					
Uncoated concrete	Coated concrete	Grout-filled CMJ	Hammer drilling	Hollow drill bit	Diamond cutting

			
Temperature of base material	cartridge temperature	Working time	Curing time

Warning



(A), (R)



(B)

ICC ES

ICC ESR 9187
ICC ESR 3963

General instructions:
 1. Read the instructions carefully.
 2. Use only the original Hilti products.
 3. Use only the original Hilti products.
 4. Use only the original Hilti products.
 5. Use only the original Hilti products.
 6. Use only the original Hilti products.

HIT-HY 303A									
		HIT-HY 303A HIS- N				HIT-2			
Relax		Relax		Relax		Relax		Relax	
T ₀	T ₁	C ₀ Rate	C ₁ Rate	C ₀ Rate	C ₁ Rate	C ₀ Rate	C ₁ Rate	C ₀ Rate	C ₁ Rate
10.5	14.23	1.5 h	7 h	—	—	—	—	—	—
4.0	24.32	50 min	4 h	—	—	—	—	—	—
1.5	33.41	25 min	2 h	—	—	—	—	—	—
6.10	42.40	15 min	75 min	15 min	75 min	—	—	—	—
11.20	51.40	7 min	45 min	7 min	45 min	—	—	—	—
21.30	60.40	4 min	30 min	4 min	30 min	—	—	—	—
31.40	67.104	3 min	30 min	3 min	30 min	—	—	—	—

HIT-HY 303B									
		HIT-HY 303B HIS- N				HIT-2			
Relax		Relax		Relax		Relax		Relax	
T ₀	T ₁	C ₀ Rate	C ₁ Rate	C ₀ Rate	C ₁ Rate	C ₀ Rate	C ₁ Rate	C ₀ Rate	C ₁ Rate
10.5	14.23	2 h	25 h	—	—	—	—	—	—
4.0	24.32	2 h	8 h	—	—	—	—	—	—
1.5	33.41	1 h	4 h	—	—	—	—	—	—
6.10	42.50	40 min	2.5 h	40 min	2.5 h	—	—	—	—
11.20	51.50	15 min	1.5 h	15 min	1.5 h	—	—	—	—
21.30	60.50	5 min	1 h	5 min	1 h	—	—	—	—
31.40	67.104	5 min	1 h	5 min	1 h	—	—	—	—

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<p>HIT-Z HAASRT V HVS 1 Geküht Gekühlt</p>		$\frac{d_s}{12 \dots 32 \text{ mm}}$	$\frac{h_w}{27 \text{ mm} \dots 30 \text{ mm}}$ $\frac{h_w}{60 \dots 1000 \text{ mm}}$
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EE-CO
TE-VG

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A

	$\frac{1}{2}$ " $2 \frac{3}{4}$ " - $8 \frac{1}{2}$ " 00...220 mm	HIT-2 	HIT-2® M +	HIT-2® M +
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[illegible][illegible][illegible]

KW 100-2704 / B

Active ingredient: active ingredients for color and anionic inhibitors in concrete and masonry.

SDS 007-2704 / B

Chemical name: 1-hydroxy-2-naphthylphosphonic acid, 1,4-Ethanedithiobis(2-yl), (Diethylenetriamine) Di-



(A) (E)



(B)

<p>Warning:</p> <p>H301 May cause an allergic skin reaction. (A, B)</p> <p>H317 Causes severe eye irritation. (B)</p> <p>H318 Very toxic to aquatic life. (B)</p>	<p>P202 Do not get it on eyes, on skin or on clothing.</p> <p>P273 Avoid contact with water.</p> <p>P280 Wear gloves. (B)</p> <p>P281 Wash face with plenty of soap and water.</p> <p>P282/P283/P284 Wash face, hands and clothing with plenty of soap and water.</p> <p>P301-P312 If swallowed: Rinse mouth. Get medical advice.</p> <p>P303-P312 If on skin or clothing: Wash thoroughly with soap and water.</p> <p>P303-P312 If in eyes: Rinse eyes. Get medical advice.</p>
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Disposal instructions:

Empty packs:

- Leave the inner activated and dispose of the used Gelfix Decontamination system.
- Use Gelfix empty container: 100/100 plastic packaging.
- Part is partially recycled.
- May be disposed of as special waste in accordance with German regulations.
- Use empty material code: 00-00-00 waste identification and transfer to authorized organizations.
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- Use empty material code: 00-00-00 waste identification and transfer to authorized organizations.

Content: 300 g / 11.1 fl. oz. 500 ml / 16.9 fl. oz. **Weight:** 300 g / 10.6 oz. 500 g / 17.6 oz.

Failure to observe these installation instructions, use of non-HAB anchors, poor or questionable workmanship may lead to damage to the building structure and void the warranty.

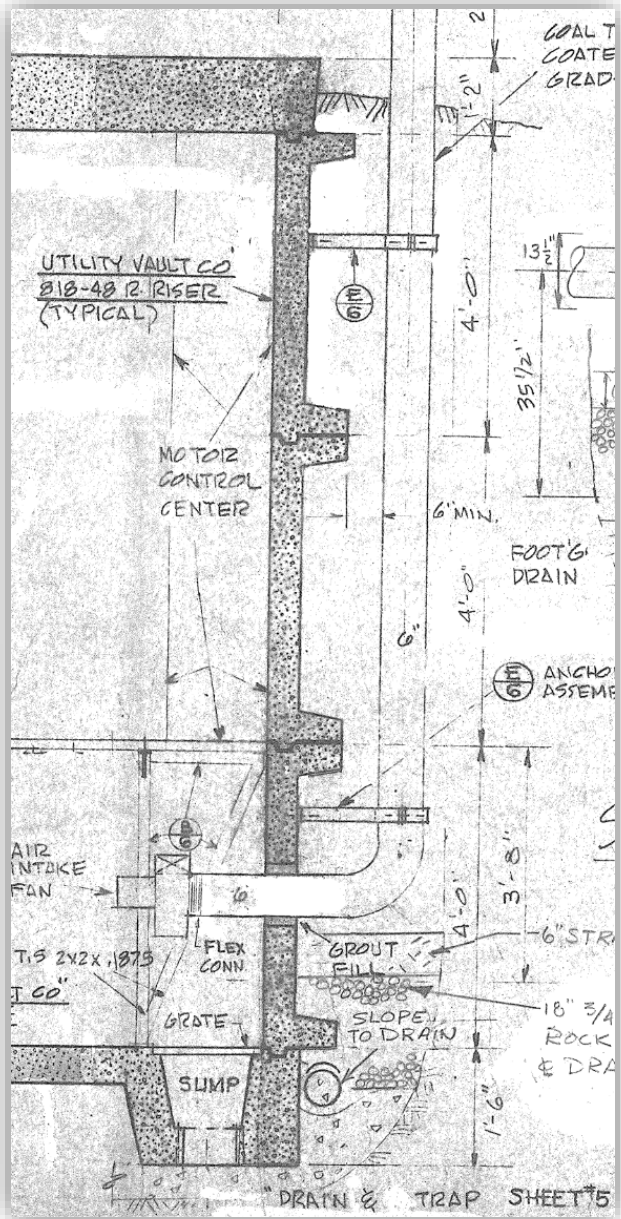
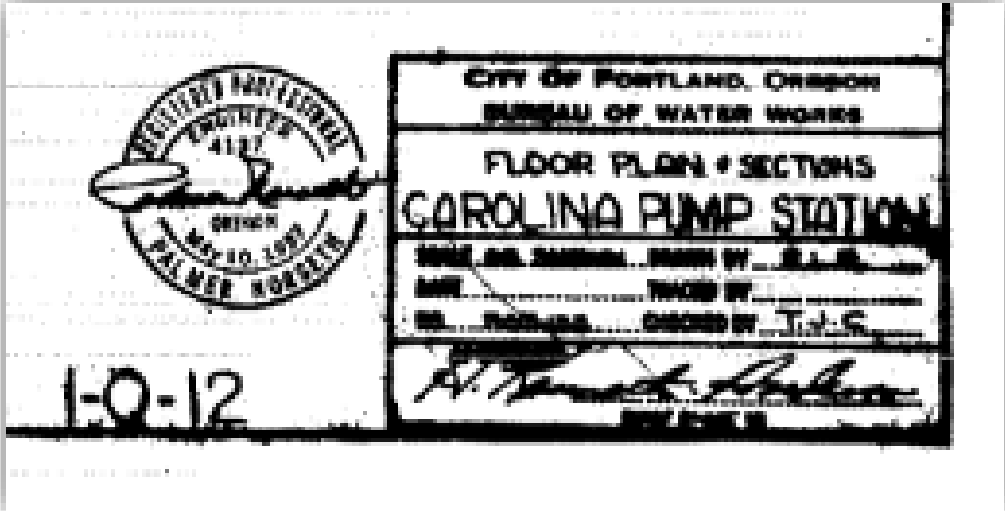
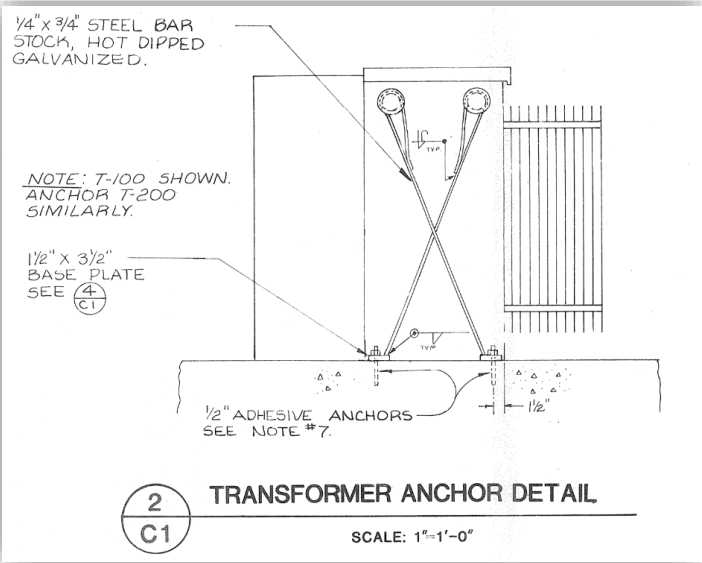
FIGURE 6—MANUFACTURER'S PRINTED INSTALLATION INSTRUCTIONS (MPII) (Continued)

FIGURE 6—MANUFACTURER'S PRINTED INSTALLATION INSTRUCTIONS (MPII) (Continued)

FIGURE 6—MANUFACTURER'S PRINTED INSTALLATION INSTRUCTIONS (MPII)

Project Design Phase

Review of As-Built drawings



Field Investigations

- PWB engineer
- PWB electrical
- Stantec engineer
- Stantec note taker

We Looked on top for anchors



We looked to the side



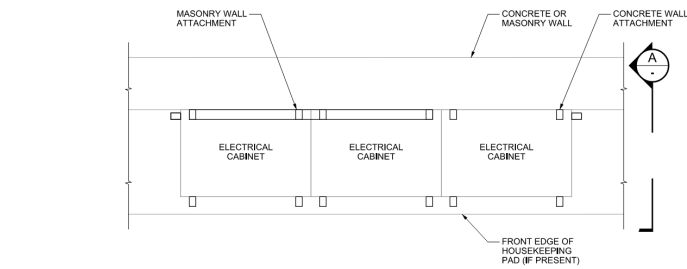
We looked below for anchors



Design Recommendations

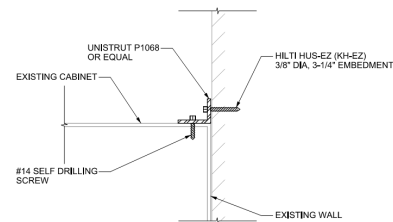
Pump Station	Address	Description	Height (in)	Depth (in)	Width (in)	Anchors Present	Field Notes	NEHRP Site Class, see note below	S _{XS}	Anchorage Condition	PWB Priority	Recommended Attachment Improvements
Calvary		1 (left to right)	91	20	24	none	3" pad available in front of MCCs	E	0.94	4	1	1, 2 (front)
Calvary		2 (left to right)	91	20	20	none	3" pad available in front of MCCs	E	0.94	4	1	1, 2 (front)
Calvary		3 (left to right)	91	20	20	none	3" pad available in front of MCCs	E	0.94	4	1	1, 2 (front)
Calvary		4 (left to right)	91	20	20	none	3" pad available in front of MCCs	E	0.94	4	1	1, 2 (front)
Calvary		5 (left to right)	91	20	24	(4) 1/4"	Wall Mounted	E	0.94	2	1	None

Anchoring Options



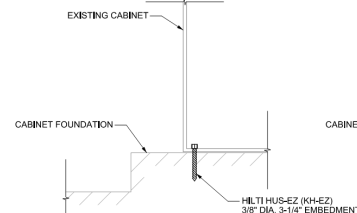
- NOTES:
1. THE NUMBER OF ADJACENT CABINETS VARIES, THE PLAN IS REPRESENTATIVE OF A TYPICAL PUMP STATION.
 2. EACH INDIVIDUAL ELECTRICAL CABINET REQUIRES ATTACHMENT PER DETAIL 1 (CONCRETE WALL BEHIND THE CABINET) OR DETAIL 4 (MASONRY WALL BEHIND THE CABINET) AND EITHER ATTACHMENTS PER DETAIL 2 (FRONT SIDE OF CABINET) OR DETAIL 3.

PLAN
SCALE: 1" = 1'-0"

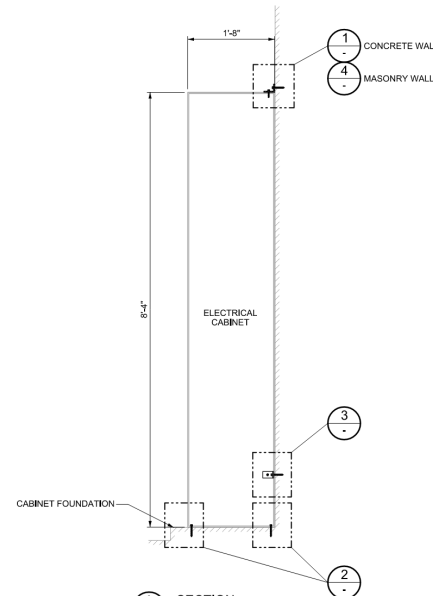


NOTE: THIS ATTACHMENT IS NOT NECESSARY WHERE ANCHORS ARE INSTALLED ON THE BACKSIDE OF THE ELECTRICAL CABINET SIMILAR TO DETAIL 2.

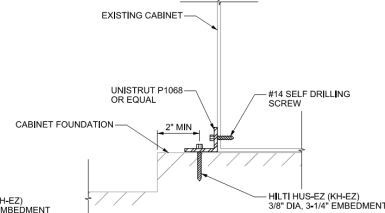
1 TOP DETAIL
SCALE: 3" = 1'-0"



INTERIOR OPTION



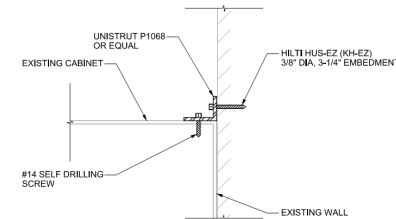
SECTION
SCALE: 1" = 1'-0"



EXTERIOR OPTION

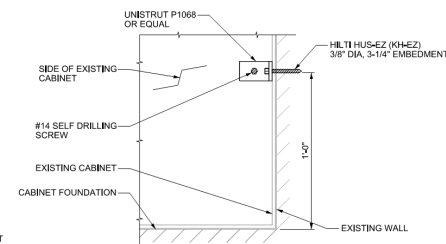
- NOTES:
1. INTERIOR OPTION APPLICABLE WHERE SPACE IS AVAILABLE FOR ANCHOR INSTALLATION.
 2. DETAILS ARE APPLICABLE TO BOTH THE FRONT AND THE BACK OF THE CABINET (WHERE ACCESS IS AVAILABLE).

2 BASE DETAIL
SCALE: 3" = 1'-0"



- NOTES:
1. THIS ATTACHMENT IS NOT NECESSARY WHERE ANCHORS ARE INSTALLED ON THE BACKSIDE OF THE ELECTRICAL CABINET SIMILAR TO DETAIL 2.
 2. INSTALL ANCHORS ONLY IN GROUTED MASONRY CELLS.
 3. CONNECT (GANG) ALL ELECTRICAL CABINETS TOGETHER AT LOCATIONS PER THE CABINET MANUFACTURER.

4 TOP DETAIL
SCALE: 3" = 1'-0"



- NOTE:
1. CLIP SHALL BE WITHIN 12 INCHES OF THE BASE OF ELECTRICAL CABINET.

3 SIDE DETAIL
- SCALE: 3" = 1'-0"



Plot Date: 28-Jul-2020					
	No	Date	Description	Appl	
	Revision				
Survey					



Designed By	Program Mgr
Drawn By	Const Mgr
Checked By	Const Supvr
Project Mgr	Date



TO 02 - Seismic Anchoring Electrical Gear

Electrical Cabinet Anchorage Option 1

ar	SAP Project R
	1/4 Section
	Sheet No S-102 of

Next Steps: Implementation

Implementation Plan

- PWB plans to install during annual PM
- Work is planned to start soon



What else could we have considered?

- Electrical conduits
- Pumps
- Motors
- Piping



Questions?