

Construction Report

St. Vrain Mill Foundation Stabilization

Prepared for:

St. Vrain Mill Preservation and Historical Foundation
P.O. Box 1282
Mora, NM, 87732

Prepared by:



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Project No. 140571

March 2018

EXECUTIVE SUMMARY

Construction for the St. Vrain Mill Foundation Stabilization project began on January 8, 2018. The scope of work included the following tasks below the northern half of the building: 1) Place permeation (chemical) grout to a depth of 4 feet below the existing foundation bottom. 2) Place compaction grout to a depth of 24 feet below the existing foundation bottom (approx. 20 feet below permeation grout layer).

No significant delays in the construction schedule or work occurred and work was completed on January 23, 2018. Slight delay associated with construction permitting, equipment malfunction, and weather occurred, but did not significantly impact construction duration.

Based on our observation and testing throughout the project, the work was conducted in accordance with the approved plans and specifications. Changes to the original plans and issues addressed during construction are described in this report.

TABLE OF CONTENTS

1.0	INTRODUCTION.....	1
2.0	DESIGN CHANGES	1
3.0	CONSTRUCTION.....	1
3.1	Mobilization and Permitting.....	2
3.2	Permeation Grouting.....	2
3.3	Compaction Grouting.....	2
3.4	Site Protection and Restoration.....	2
4.0	STRUCTURAL OBSERVATIONS AND CONCERNS.....	3
4.1	Movement at Existing Masonry Cracks	3
4.2	Activity at Water Wheel.....	3
5.0	MATERIALS TESTING	3
6.0	RECOMMENDATIONS.....	4
7.0	STANDARD OF CARE	4
8.0	REFERENCES.....	4

LIST OF APPENDICES

- Appendix A Redlined Drawings
- Appendix B Weather Conditions
- Appendix C Construction Photographs
- Appendix D Grout Logs
- Appendix E Materials Testing

1.0 INTRODUCTION

The St. Vrain Mill is a three-story masonry block structure constructed in 1864 in Mora, New Mexico. The structure has a footprint of 50 feet by 41 feet and the masonry wall is approximately 30 inches thick. The north 1/3 of the structure has significant structural distress. Based on our site visit, review of photographs, review of the ATR Institute report (ATR Institute, University of New Mexico, 2003) and the drawings provided by Spears Horn Architects (Spears Horn Architects, 2015), the foundation system is composed of a stone foundation placed in “a shallow trench”.

It is not known for certain when the cracks in the east and west foundation walls developed. However, the timing of the distress is generally understood to have occurred in the late 1800’s or early 1900’s. Refer to the *Stabilization and Foundation Assessment Report: St. Vrain Mill* compiled by Engineering Analytics, Inc. in 2015 for a more complete analysis of the St. Vrain Mill (Engineering Analytics, Inc., 2015).

The construction of the subsurface grout injection occurred in January 2018 for the rehabilitation of the St. Vrain Mill. Construction included the stabilization of the foundation under the building walls and underlying soils with grout injection. This report summarizes the design changes, construction observations, and field testing results for this phase of the project.

2.0 DESIGN CHANGES

Minimal design changes were made during the stabilization of the foundation and underlying soils. All changes that were made are shown on the redlined drawings in Appendix A. In summary, the significant design changes made during construction include:

- The two compaction grout locations furthest south on the outside of the west wall were removed due to overhead hazards at these locations. Loose masonry rock was observed above these two locations making the area unsafe to work in.
- An additional compaction grout location was added to the inside of the building (hole #11) to partially compensate for the removed locations in this general area.

These changes were approved by the Engineer and are not believed to affect the design of the stabilization.

3.0 CONSTRUCTION

The contractor for this project was Hayward Baker, Inc., located in Denver, Colorado. Engineering Analytics, Inc. (EA) provided partial construction oversight throughout the construction phase of the project. Representatives from the St. Vrain Mill Preservation and Historic Foundation (Owner) also provided construction oversight when available. EA also provided construction testing for the compaction grout placed. Construction began January 8, 2018 and was completed in January 23, 2018. The construction progressed on schedule with a

few minor delays. The weather conditions for the site during the construction phase are summarized in Appendix B.

The construction milestones are summarized in the following paragraphs. Construction photographs are presented in Appendix C.

3.1 Mobilization and Permitting

Hayward Baker mobilized to the site in Mora, New Mexico on Monday January 8, 2018. Hayward Baker and the Owner worked to obtain the required permitting, receiving the Business Permit and Building Permit by Wednesday, January 10, 2018.

3.2 Permeation Grouting

Hayward Baker began drilling holes to a depth of approximately 6 feet below the ground surface (4 feet below existing wall foundation) and injecting these holes with permeation (chemical) grout on January 10, 2018. Locations of permeation grout are indicated on the drawings with solid circles and are spaced at 4 feet on center. Permeation grouting was completed on January 12, 2018.

3.3 Compaction Grouting

After permeation grouting was completed, Hayward Baker began drilling through the permeation layer at the locations for compaction grouting. Compaction grouting locations are indicated on the drawings with solid diamonds and are spaced approximately 8 feet on center. The compaction grout holes were first drilled to a depth of 4 feet below the permeation layer, and were injected with grout in a top-down grouting method from approximately 4 feet to 8 feet below the foundation (directly below the permeation layer). At least 12 hours after the top-down grouting was completed, the holes were drilled again but to a depth of 20 feet below the permeation layer. From the depth of 20 feet below the permeation layer, compaction grout was injected in a bottom-up fashion to the previously placed compaction grout at 4 feet below the permeation layer and through the hole drilled in the higher layers of grout. Compaction grout was placed in 1-foot lifts, and advancement to the next lift was dictated by achieving 300 psi, injecting 3 cubic feet of grout material, or having grout material protrude from the hole at the ground surface at the current lift. Typically, 2 or 3 cubic yards of grout were injected into each lift, and the pressure at each lift ranged from 150 to 400 psi.

Grout logs including information documented during construction such as pressure and volume of grout at each lift are presented in Appendix D.

3.4 Site Protection and Restoration

Hayward Baker began construction with general site protection measures and continued these protection measures throughout construction. Disturbed area was minimized when possible, and

all areas of construction that disturbed ground were re-graded to the natural state and cleared of construction debris so that re-seeding could be implemented by the Owner if desired.

4.0 STRUCTURAL OBSERVATIONS AND CONCERNS

During construction some movements and uncommon activities were observed and are noted herein.

4.1 Movement at Existing Masonry Cracks

As indicated in the *Stabilization and Structural Assessment Report*, a large pre-existing crack is present on the east and west walls of the structure. The crack on the east wall is most significant and measures larger than 9 inches wide in some locations between the ground surface and roof of the structure. Prior to construction, the Owner installed a measurement device on the east wall crack to monitor the width of the crack over time. During the foundation stabilization construction, it was observed that the crack widened by approximately $\frac{1}{4}$ to $\frac{1}{2}$ inch on the second story of the building. This movement is most likely due to the addition of pressures below the building foundation. While this does not raise immediate concerns for the structural integrity of the building, continuous monitoring of the crack is advised. It is believed that the foundation has now been stabilized as a result of construction and minimal further movement is anticipated.

A follow up inspection was conducted post construction to determine how far out of plumb the northeast corner is compared to previous survey. At the center of the building on the second story, the most current measurement was recorded at $13\frac{1}{4}$ inches out of plumb, while the measurement from 2017 was $12\frac{3}{4}$ inches. This reveals approximately $\frac{1}{2}$ inch of movement at this location, which is consistent with the measurement gauge. However, measurement at the east window was recorded as $13\frac{3}{4}$ inches out of plumb, and is consistent with the measurement taken in 2017, indicating minimal movement here.

4.2 Activity at Water Wheel

While drilling occurred at the northwest corner of the building and on the outside of the building, activity was observed at the water wheel directly north of the building. While no obvious structural movement was observed, air bubbles and water movement was observed near the water wheel. This movement is assumed to be a result of the drilling occurring within or below the existing water table, therefore fluctuating the standing water near the water wheel. This activity is not anticipated to be a structural concern to the building or the water wheel structure.

5.0 MATERIALS TESTING

Quality assurance testing was conducted on the project as work progressed. Appendix E of this report provides a summary of all testing conducted. The summary includes compressive strength test results for compaction grout at various locations. As the tests indicate, the materials used during construction meet the project requirements unless otherwise noted.

The average compressive strength for the compaction grout was 2,205 psi at 28 days. All grout samples tested at 28 days met or exceeded the required strength of 2,000 psi.

6.0 RECOMMENDATIONS

Stabilization of the foundation and underlying soils which was conducted in January of 2018 is believed to have been a success given that minimal structure movement was recorded and the underlying soils were stabilized with injected grout. However, the completed construction project is only part of the originally recommended improvements in the *Stabilization and Structural Assessment Report* compiled by Engineering Analytics in September of 2015. In addition to foundation and wall stabilization, this report recommended making repairs to the building and water wheel foundation masonry walls, as well as continued monitoring and inspection of the existing structures for movement. Engineering Analytics advises that these recommendations be pursued to complete the structural rehabilitation of the St. Vrain Mill.

It is recommended that movement at the cracks of the building continue to be monitored, recorded and documented. Monitoring should continue regularly until minimal or no movement is observed. Once any movement has decreased, it is recommended that wall repair occur as described in the September 2015 report by Engineering Analytics.

7.0 STANDARD OF CARE

The information contained in this report represents our findings at the time and location as indicated in this report. The methods utilized are in accordance with currently accepted engineering and testing procedures and other than this, no warranty, either expressed or implied, is intended. The conclusions and recommendations submitted in this report represent our best judgment based on the information available. If additional information becomes available, we should be allowed to review that information and modify our conclusions accordingly. This report has been prepared exclusively for our client and we are not responsible for technical interpretations by others.

8.0 REFERENCES

ATR Institute, University of New Mexico. (2003). *St. Vrain Mill, Mora, New Mexico*.

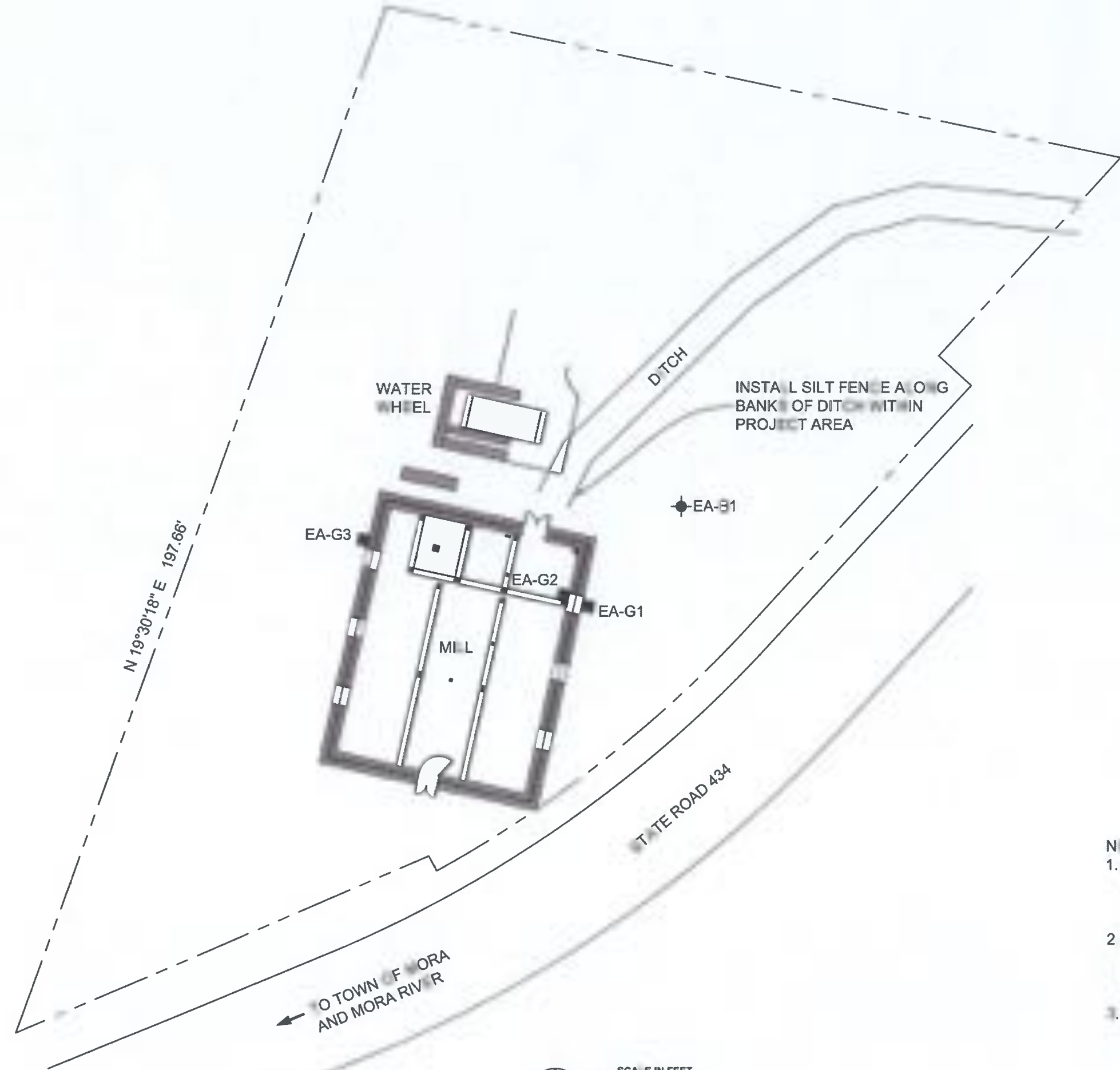
Engineering Analytics, Inc. (2015). *Stabilization and Foundation Assessment Report: St. Vrain Mill*.

Spears Horn Architects. (2015). *Site & Ground Floor Plans*.

APPENDIX A
REDLINED DRAWINGS

T: 140571 St M Sit SWL_5-5-2017.dwg SAVED: 5/25/17 PRINTED: 5/25/17

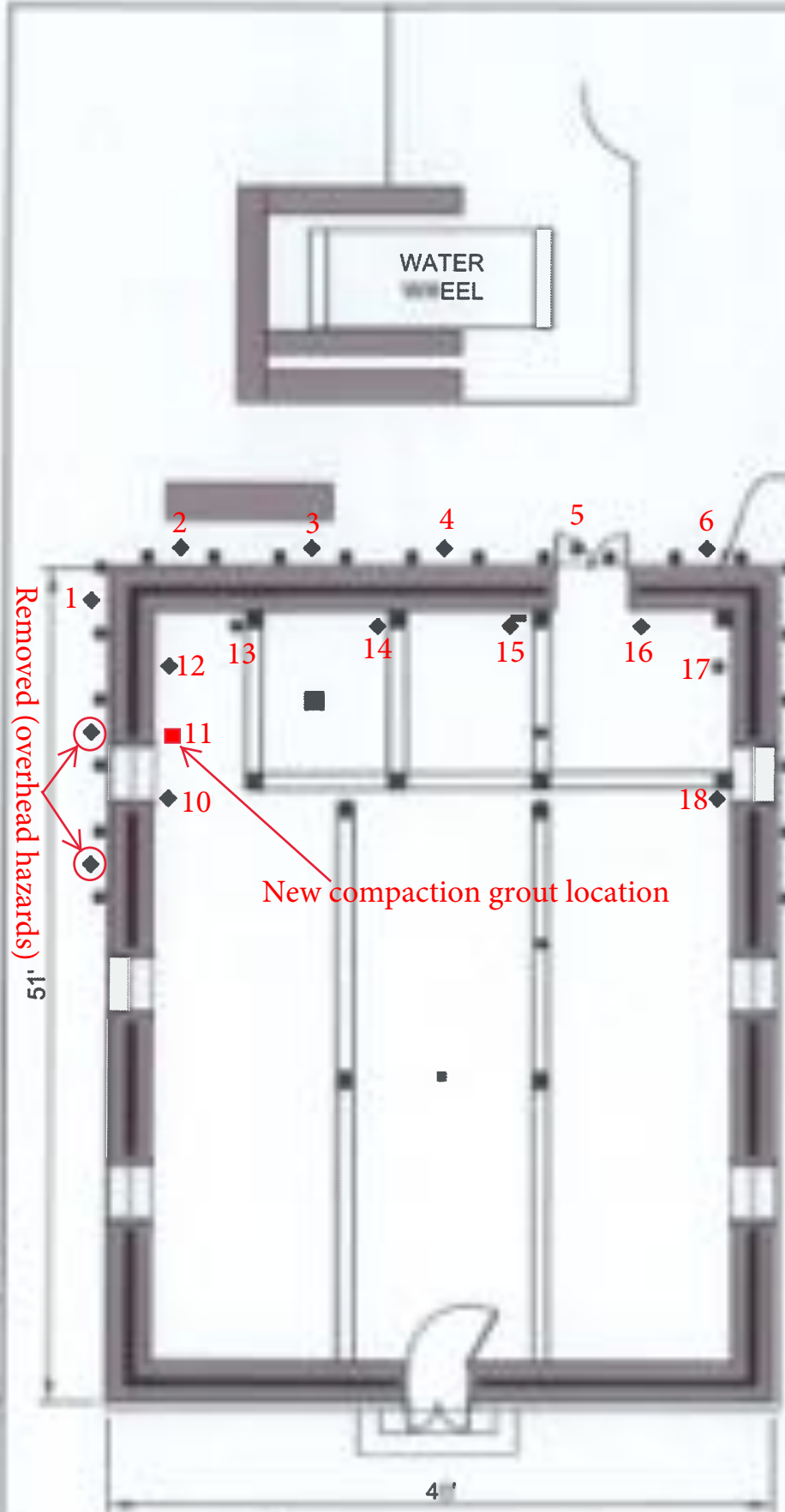
LEND:
 ● EA-B1 BORING LOCATION
 ■ EA-G1 GROUP SAMPLE LOCATION



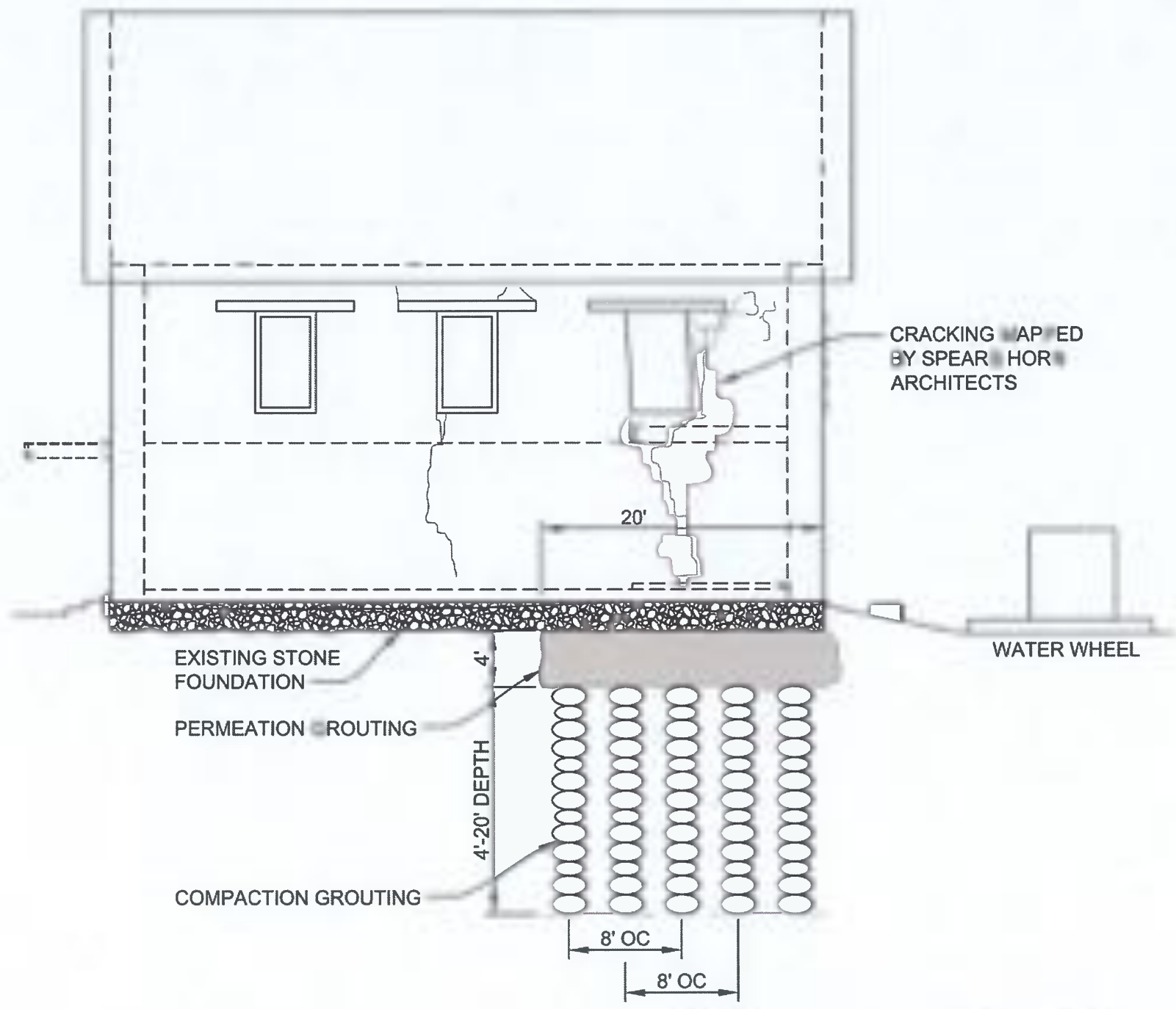
- NOTES:
1. CONTRACTOR SHALL NOT INTRUDE ON THE WETLANDS LOCATED NORTH OF THE ST. VRAIN MILL. SEE EXHIBIT A FOR WETLAND BOUNDARIES
 2. CONTRACTOR SHALL DISPOSE OF ANY CONSTRUCTION DEBRIS OFF SITE (E.G. WASTED ROUT).
 3. ANY AND ALL MATERIALS (E.G. BUILDING STONES, BRICKS, RELIEFS) SHALL BE RETURNED TO THE OWNER.

REVIEWS	
Revision	0
Date	5/25/2017
Designator	ISSUED FOR CONSTRUCTION
Designed by:	JSA
Approved by:	KMS
ST. VRAIN MILL FOUNDATION STABILIZATION	
SITE PLAN	
Project Number	14-71
Date	May 25 2017
Sheet	1 of 1

I:\140571 SL\140571_Site\SM_5-25-2017... SAVED: 5/25/17 P... TIED: 5/26/17



- LEGEND:**
- PERMEATION GROUTING - 0'-4" BELOW LINE WALL
 - ◆ COMPACTION GROUTING - 4'-20" BELOW LINE WALL (ALTERNATING INTERIOR AND EXTERIOR LOCATIONS AS SHOWN)



- NOTES:**
1. CONTRACTOR SHALL NOT ATTEMPT TO REMOVE THE BUILDING USING COMPACTION GROUTING. BUILDING PERFORMANCE SHOULD BE MONITORED DURING ROUTING. GROUTING SHOULD BE STOPPED IF UNACCEPTABLE MOVEMENT IS OBSERVED.
 2. EXISTING TONGUE AND GROOVE FLOOR BOARDS TO BE REMOVED BY OWNER AT INJECTION LOCATIONS. CONTRACTOR TO COORDINATE REMOVAL PRIOR TO ROUTING.
 3. BASE MAP AND MILL PLANS PROVIDED BY SPEAR HORNE ARCHITECTS.

REVISIONS	
Revision	Description
0	5/26/2017 ISSUE OR NOT CTIO

Designed by:	JSA	App. by:	KMS	
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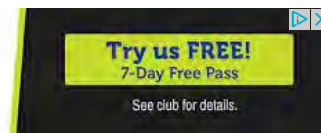
Karen M. Stearns

ST. VRAIN MILL FOUNDATION STABILIZATION

GROUTING PLAN

Project Number:	140571
Date:	May 26, 2017
Sheet:	2 of 2

APPENDIX B
WEATHER CONDITIONS



Las Vegas, NM

Las Vegas Municipal

© 12:29 PM MST on February 05, 2018 (GMT -0700)

Today Forecast

Weather History for KLVS - January, 2018

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	1 Actual: 35° 5° 0.00 in Average: 39° 13° 0.02 in	2 Actual: 42° 6° 0.00 in Average: 40° 14° 0.01 in	3 Actual: 45° 15° 0.00 in Average: 42° 13° 0.00 in	4 Actual: 52° 30° 0.00 in Average: 42° 12° 0.00 in	5 Actual: 57° 19° 0.00 in Average: 45° 17° 0.01 in	6 Actual: 59° 32° 0.00 in Average: 42° 16° 0.01 in
7 Actual: 53° 26° 0.00 in Average: 40° 14° 0.01 in	8 Actual: 60° 21° 0.00 in Average: 43° 14° 0.01 in	9 Actual: 64° 36° 0.00 in Average: 41° 15° 0.01 in	10 Actual: 52° 34° 0.00 in Average: 45° 17° 0.00 in	11 Actual: 44° 21° 0.00 in Average: 46° 19° 0.00 in	12 Actual: 52° 18° 0.00 in Average: 46° 18° 0.02 in	13 Actual: 53° 19° 0.00 in Average: 46° 18° 0.00 in
14 Actual: 53° 24° 0.00 in Average: 46° 19° 0.01 in	15 Actual: 35° 15° MM in Average: 48° 20° 0.01 in	16 Actual: 25° 10° MM in Average: 45° 19° 0.01 in	17 Actual: 48° 10° 0.00 in Average: 45° 19° 0.01 in	18 Actual: 57° 17° 0.00 in Average: 45° 22° 0.03 in	19 Actual: 68° 35° 0.00 in Average: 45° 19° 0.03 in	20 Actual: 60° 30° 0.00 in Average: 43° 19° 0.01 in
21 Actual: 41° 14° 0.00 in Average: 44° 19° 0.00 in	22 Actual: 45° 14° 0.00 in Average: 45° 17° 0.00 in	23 Actual: 44° 12° 0.00 in Average: 48° 19° 0.00 in	24 Actual: 57° 14° 0.00 in Average: 47° 19° 0.00 in	25 Actual: 55° 19° 0.00 in Average: 47° 20° 0.00 in	26 Actual: 48° 19° 0.00 in Average: 47° 20° 0.00 in	27 Actual: 46° 12° 0.00 in Average: 48° 21° 0.02 in
28 Actual: 55° 23° 0.00 in Average: 48° 21° 0.00 in	29 Actual: 57° 16° 0.00 in Average: 47° 20° 0.01 in	30 Actual: 61° 28° 0.00 in Average: 46° 19° 0.00 in	31 Actual: 66° 36° 0.00 in Average: 45° 19° 0.02 in			

Calendar Legend

- Sunny Clear
- Mostly Cloudy
- Partly Cloudy
- Cloudy
- Rain
- Snow
- Hail Flurries
- Thunderstorms
- Hazy Fog
- Sleet
- ? denotes chance of
- Unknown

APPENDIX C
CONSTRUCTION PHOTOGRAPHS



PHOTOGRAPH 1: Mill looking N.W.



PHOTOGRAPH 2: Mill looking S.E.



PHOTOGRAPH 3: West wall cracking



PHOTOGRAPH 4: West wall falling rock

PROJECT: 140571
DATE: MARCH 2018

CONSTRUCTION PHOTOS





PHOTOGRAPH 5: East wall permeation grout locations



PHOTOGRAPH 6: East wall cracking



PHOTOGRAPH 7: East wall cracking



PHOTOGRAPH 8: Skid steer drilling equipment

PROJECT: 140571

DATE: MARCH 2018

CONSTRUCTION PHOTOS





PHOTOGRAPH 9: North wall permeation grouting



PHOTOGRAPH 10: Ditch coming from N.E. of building



PHOTOGRAPH 11: Water wheel N. of building



PHOTOGRAPH 12: Grout mixer and pump



PHOTOGRAPH 13: Grout batch truck



PHOTOGRAPH 14: Drilling at N. wall with mini-excavator



PHOTOGRAPH 15: East wall crack inside building



PHOTOGRAPH 16: Site photo looking S.W.

PROJECT: 140571
DATE: MARCH 2018

CONSTRUCTION PHOTOS





PHOTOGRAPH 17: East wall crack at 2nd story window



PHOTOGRAPH 18: Drilling at N.W. corner (north wall)



PHOTOGRAPH 19: Drilling water at straw bales



PHOTOGRAPH 20: Drilling at N.W. corner (west wall)



PHOTOGRAPH 21: Straw bales to catch surface runoff



PHOTOGRAPH 22: Mixing grout



PHOTOGRAPH 23: Pumping grout at East wall crack



PHOTOGRAPH 24: Pumping grout outside E. wall



PHOTOGRAPH 25: N.W. corner after snow (looking S.E.)



PHOTOGRAPH 26: Drilling inside E. wall



PHOTOGRAPH 27: Drilling inside N. wall



PHOTOGRAPH 28: Drilling full depth outside E. wall

PROJECT: 140571
DATE: MARCH 2018

CONSTRUCTION PHOTOS





PHOTOGRAPH 29: Grout pumping setup inside E. wall



PHOTOGRAPH 30: Removed floor planks inside N. wall



PHOTOGRAPH 31: Movement monitoring gauge at E. wall crack

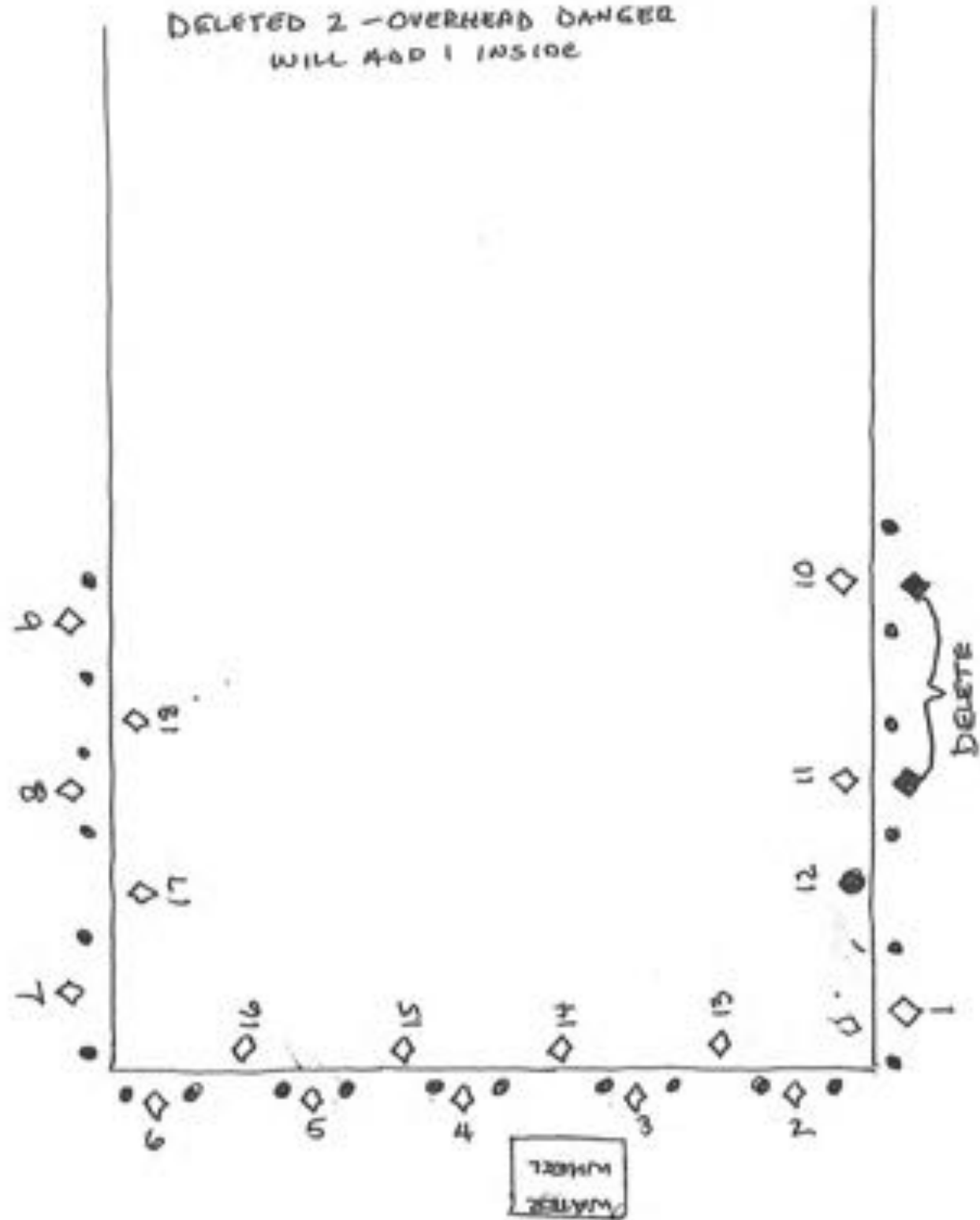
APPENDIX D
GROUT LOGS

ST VRAIN MILL
MORA NEW MEXICO

STARTED 1-8-18
FINISHED 1-23-18

PERMEATION GROUTING	150 GALLONS
COMPACTION GROUTING	833.50 CF 30.85 CY OF GROUT PLACED

DELETED 2 - OVERHEAD DANGER
WILL ADD 1 INSIDE



HAYWARD BAKER

A KELLER COMPANY



COMPACTION GROUT LOG

HBI PROJECT NO.: 600691 PAGE: 1 OF 1
 PROJECT NAME: St Union Mall DATE: 1-12-18
 GROUT POINT NO.: 41 PUMP TYPE: Pu 12
 MAXIMUM DEPTH: Top Drive 8" Full depth 20 PUMP CAPACITY (C.F./STROKE): 1/4
 GROUT TECHNICIAN: Daniel Bala PUMP RATE: 8 Sca

DEPTH (FEET)	TIME		MAXIMUM GRADE PRESSURE (psi)	GROUT QUANTITY		SURFACE HEAVE (IN)	COMMENTS
	START	STOP		STROKES	CU. FT.		
8			200-250	12	3		
7			200-250	12	3		
6			180-200	12	3		
5			140-200	12	3		
20			280-300	12	3		1-13-18
19			280-300	12	3		
18			280-300	12	3		
17			280-300	12	3		
16			280-300	12	3		
15			280-300	12	3		
14			280-300	12	3		
13			280-300	12	3		
12			200-250	12	3		
11			180-200	8	2		lifting Building
10			200-250	8	2		Water coming out
9			200-250	8	2		of hole
8							
7							
6							
5							
4							
3							
2							
1							
TOTALS					45 ⁰⁰		

PUMP QUANTITY THIS PAGE: _____ C.F./C.Y. HAYWARD BAKER SUPERINTENDENT: [Signature]
 COMPLETION TIME: _____ CLIENT'S REPRESENTATIVE: _____

HAYWARD BAKER

A KELLER COMPANY



COMPACTION GROUT LOG

HSE PROJECT NO.: 60621 PAGE: 1 OF 1
 PROJECT NAME: St. Vrain Mill DATE: 1-18-18
 GROUT POINT NO.: #2 PUMP TYPE: Puls
 MAXIMUM DEPTH: TOP DOWN 8" GUL DEPTH PUMP CAPACITY (G.F./STROKE): 1/4
 GROUT TECHNICIAN: Daniel Bala PUMP RATE: 8 S+L

DEPTH (FEET)	TIME		MAXIMUM GAGE PRESSURE (PSI)	GROUT QUANTITY		SURFACE HEAVE (IN)	COMMENTS
	START	STOP		STROKES	CU. FT.		
8			10-240	12	3		
7			10-200	12	3		
6			10-180	8	2		
5			10-170	8	2		Grout Surface
20			350-400	12	3		1-18-18
19			350-400	12	3		
18			350-400	12	3		
17			350-400	12	3		
16			300-350	12	3		
15			300-350	12	3		
14			300-350	12	3		
13			300-340	12	3		
12			300-300	12	3		
11			300-280	12	3		
10			200-200	12	3		
9			200-230	12	3		
TOTALS					46		

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HAYWARD BAKER

A KELLER COMPANY



COMPACTION GROUT LOG

HBI PROJECT NO.: 600681 PAGE 1 OF 1
 PROJECT NAME: STURMILL Mill DATE: 1-15-18
 GROUT POINT NO.: U3 PUMP TYPE: Plute
 MAXIMUM DEPTH: Top Down 8" Full Depth 20" PUMP CAPACITY (C.F./STROKE): 1/4
 GROUT TECHNICIAN: D BATA PUMP RATE: 8 sec.

DEPTH (FEET)	TIME		MAXIMUM GAUGE PRESSURE (psi)	GROUT QUANTITY		SURFACE HEAVE (IN)	COMMENTS
	START	STOP		STROKES	CU. FT.		
8			200-250	12	3		
7			190-200	12	3		
6			180-240	11	3		
5			180-200	8	2		Grout Surficial
20			300-350	12	3		1-19-18
19			280-300	12	3		
18			270-300	12	3		
17			260-300	12	3		
16			250-280	12	3		
15			250-280	12	3		
14			240-280	12	3		
13			230-270	12	3		
12			220-270	12	3		
11			200-230	12	3		
10			150-180	12	3		
9			150-160	8	2		Grout Heaving
TOTALS					46		

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HAYWARD BAKER

A KELLER COMPANY

COMPACTION GROUT LOG



HBI PROJECT NO.: 600681 PAGE: 1 OF 1
 PROJECT NAME: ST URBAN MALL DATE: 1-15-19
 GROUT POINT NO.: #4 PUMP TYPE: P-17
 MAXIMUM DEPTH: DP Point 8'± Full depth 20'± PUMP CAPACITY (G.P./STROKE): 1/4
 GROUT TECHNICIAN: Daniel Bule PUMP RATE: 8 sec

DEPTH (FEET)	TIME		MAXIMUM GAGE PRESSURE (PSI)	GROUT QUANTITY		SURFACE HEAVE (IN)	COMMENTS
	START	STOP		STROKES	CU. FT.		
8			200 - 250	12	3		
7			180 - 200	12	3		
6			180 - 200	12	3		
5			180	1	.25		Grout surface
20			270 - 300	12	3		1-18-19
19			280 - 300	12	3		
18			270 - 300	12	3		
17			280 - 300	12	3		
16			270 - 260	12	3		
15			250 - 260	12	3		
14			200 - 220	12	3		
13			200 - 230	12	3		
12			200 - 210	12	3		
11			180 - 200	12	3		Grout surface
10			150	1	.25		more surface
9							
8							
7							
				TOTAL	39.50		

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 COMPLETION TIME: _____ CLIENT'S REPRESENTATIVE: _____

HAYWARD BAKER

A KELLER COMPANY



COMPACTION GROUT LOG

HBI PROJECT NO: 600681 PAGE: 1 OF 1
 PROJECT NAME: ST UREAN MELL DATE: 1-15-18
 GROUT POINT NO: # 5 PUMP TYPE: Puls
 MAXIMUM DEPTH: TOP AND 8 FT Full Depth 20 FT PUMP CAPACITY (G.F./STROKE): 1/4
 GROUT TECHNICIAN: David Bels PUMP RATE: 8 Sec

DEPTH (FEET)	TIME		MAXIMUM GAGE PRESSURE (PSI)	GROUT QUANTITY		SURFACE HEAVE (IN)	COMMENTS
	START	STOP		STROKES	CU. FT.		
8			180-200	12	3		
7			180-200	12	3		
6			180-200	12	3		
5			200-180	8	2		Ground Heaving
20			280-300	12	3		1-19-18
19			280-300	12	3		
18			280-300	17	3		
17			280-300	12	3		
16			300-320	12	3		
15			200-320	12	3		
14			300-350	12	3		
13			280-300	12	3		
12			280-300	12	3		
11			280-300	8	2		Ground is Heaving
10			250-260	12	3		
9			200-240	12	3		
TOTALS					46		

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 COMPLETION TIME: _____ CLIENT'S REPRESENTATIVE: _____

HAYWARD BAKER

A KELLER COMPANY



COMPACTION GROUT LOG

HBI PROJECT NO: 600681 PAGE: 1 OF 1
 PROJECT NAME: ST VINCENT MILL DATE: 1-12-18
 GROUT POINT NO: 06 PUMP TYPE: PT22
 MAXIMUM DEPTH: TOP DOWN FULL DEPTH PUMP CAPACITY (C.F./STROKE): 1/4
 GROUT TECHNICIAN: D BATA PUMP RATE: 8 SEC

DEPTH (FEET)	TIME		MAXIMUM GAGE PRESSURE (PSI)	GROUT QUANTITY		SURFACE HEAVE (IN)	COMMENTS
	START	STOP		STROKES	CU. FT.		
8			150-160	12	3		
7			150-160	12	3		
6			150-160	12	3		Ground Heaving
5			150-170	8	2		
20			200-250	12	3		
19			200-250	12	3		
18			200-180	12	3		1-18-18
17			250-280	12	3		
16			280-300	12	3		
15			280-300	12	3		
14			280-300	12	3		
13			280-300	12	3		
12			280-300	12	3		
11			260-280	12	3		
10			240-260	12	3		
9			200-220	12	3		
TOTALS					47		

AMOUNT QUANTITY THIS PAGE: _____

C.F. J. C. Y. HAYWARD BAKER SUPERINTENDENT: [Signature]

COMPLETION TIME: _____

CLIENT'S REPRESENTATIVE: _____

HAYWARD BAKER

A KELLER COMPANY



COMPACTION GROUT LOG

NEI PROJECT NO: 600681

PAGE 1 OF 1

PROJECT NAME: ST WAZEN MELL

DATE: 1-15-18

GROUT POINT NO: U 7

PUMP TYPE: Rotz

MAXIMUM DEPTH: Top Down 8' Full Depth 20'

PUMP CAPACITY (C.F./STROKE): 44

GROUT TECHNICIAN: David Gale

PUMP RATE: 8 Sec

DEPTH (FEET)	TIME		MAXIMUM GAGE PRESSURE (psf)	GROUT QUANTITY		SURFACE HEAVE (IN)	COMMENTS
	START	STOP		STROKES	CU. FT.		
8			150-100	12	3		
7			150-100	12	3		
6			150-200	12	3		
5			150-200	12	3		
20			300-40	12	3		1-19-18
19			200-30	12	3		
18			200-20	12	3		
17			150-270	12	3		
16			250-270	12	3		
15			250-170	12	3		
14			150-260	12	3		
13			250-160	12	3		
12			250-250	12	3		
11			200-250	12	3		
10			150-190	12	3		
9			150-200	12	3		
TOTALS					48		

RFY QUANTITY THIS PAGE: _____ C.E. / C. Y. HAYWARD BAKER SUPERINTENDENT: David Gale

COMPLETION TIME: _____ CLIENT'S REPRESENTATIVE: _____

HAYWARD BAKER

A KELLER COMPANY



COMPACTION GROUT LOG

HEI PROJECT NO.: 60681

PAGE 1 OF 1

PROJECT NAME: ST URBAN MALL

DATE: 1-15-18

GROUT POINT NO.: 49

PUMP TYPE: P-12

MAXIMUM DEPTH: Tap Down 3rd Full Depth 20"

PUMP CAPACITY (G.F./STROKE): 44

GROUT TECHNICIAN: Daniel Beale

PUMP RATE: 8 Sec

DEPTH (FEET)	TIME		MAXIMUM GAGE PRESSURE (PSI)	GROUT QUANTITY		SURFACE HEAVE (IN)	COMMENTS
	START	STOP		STROKES	CU. FT.		
8			20-200	12	3		
7			150-200	12	3		
6			150-200	12	3		
5			100-100	12	3		
20			270-160	12	3		1-19-18
19			200-250	12	3		
18			200-270	12	3		
17			200-270	12	3		
16			200-270	12	3		
15			200-250	12	3		
14			200-250	12	3		
13			150-250	12	3		
12			200-240	12	3		
11			150-250	12	3		
10			250-260	12	3		
9			200-260	12	3		
TOTALS					48		

PSI QUANTITY THIS PAGE: _____ C.F. / C.Y. HAYWARD BAKER SUPERINTENDENT: Daniel Beale

COMPLETION TIME: _____ CLIENT'S REPRESENTATIVE: _____

HAYWARD BAKER

A KELLER COMPANY

COMPACTION GROUT LOG



NEI PROJECT NO.: 600681

PAGE 1 OF 1

PROJECT NAME: ST JEROME MALL

DATE: 1-17-18

GROUT POINT NO.: W-10

PUMP TYPE: P-12

MAXIMUM DEPTH: TOP DOWN 8" Full Depth 20"

PUMP CAPACITY (G.F./STROKE): 1/4

GROUT TECHNICIAN: Daniel Bude

PUMP RATE: 8 Sec.

DEPTH (FEET)	TIME		MAXIMUM GAGE PRESSURE (PSI)	GROUT QUANTITY		SURFACE HEAVE (IN)	COMMENTS
	START	STOP		STROKES	CU. FT.		
8			180 - 200	12	3		
7			160 - 180	12	3		
6			140 - 170	12	3		
5			150 - 160	12	3		
20			380 - 400	12	3		1-23-18
19			310 - 350	12	3		
18			270 - 300	12	3		
17			270 - 300	12	3		
16			260 - 280	12	3		
15			260 - 280	12	3		
14			260 - 280	12	3		
13			240 - 270	12	3		
12			240 - 260	12	3		
11			240 - 240	12	3		
10			200 - 220	8	2	.04	off line
9			200 - 220	7	2		
				TOTALS			
						46	

PRINT QUANTITY THIS PAGE: _____ C.R./C.V. HAYWARD BAKER SUPERINTENDENT: [Signature]

COMPLETION TIME: _____ CLIENT'S REPRESENTATIVE: _____

HAYWARD BAKER

A KELLER COMPANY

COMPACTION GROUT LOG



HBI PROJECT NO.: 600681

PAGE 1 OF 1

PROJECT NAME: ST. JEROME MALL

DATE: 1-17-18

GROUT POINT NO.: # 11

PUMP TYPE: Roll

MAXIMUM DEPTH: TOP DOWN 8" Fed DEPTH 20"

PUMP CAPACITY (C.F./STROKE): 1/4

GROUT TECHNICIAN: Daniel Bala

PUMP RATE: 8 sec

DEPTH (FEET)	TIME		MAXIMUM GAGE PRESSURE (PSI)	GROUT QUANTITY		SURFACE HEAVE (IN)	COMMENTS
	START	STOP		STROKES	CU. FT.		
8			200-270	12	3		
7			180-200	12	3		
6			160-190	12	3		
5			160-190	12	3		
20			240-280	12	3		1-23-18
19			250-280	12	3		
18			280-300	12	3		
17			280-300	12	3		
16			280-300	12	3		
15			280-300	12	3		
14			280-300	12	3		
13			280-300	12	3		
12			220-250	12	3		
11			220-250	12	3		
10			200-220	12	3		
9			200-220	12	3		
TOTALS					48		

PAY QUANTITY THIS PAGE: _____ C.F./C.Y. HAYWARD BAKER SUPERINTENDENT: [Signature]
 COMPLETION TIME: _____ CLIENT'S REPRESENTATIVE: _____

HAYWARD BAKER

A KELLER COMPANY



COMPACTION GROUT LOG

NEI PROJECT NO.: 600688

PAGE 1 of 1

PROJECT NAME: ST. URBAN WELL

DATE: 1-17-18

GROUT POINT NO.: N 12

PUMP TYPE: Putz

MAXIMUM DEPTH: TOP ODDS 8 FT Grit DEPTH 20"

PUMP CAPACITY (C.F./STROKE): 74

GROUT TECHNICIAN: Daniel Solt

PUMP RATE: 8 sec

DEPTH (FEET)	TIME		MAXIMUM GAGE PRESSURE (PSI)	GROUT QUANTITY		SURFACE HEAVE (IN)	COMMENTS
	START	STOP		STROKES	CU. FT.		
8			200-150	12	3		
7			180-100	12	3		
6			150-100	12	3		
5			150-100	12	3		
20			200-300	12	3		1-22-18
19			200-200	12	3		
18			200-200	12	3		
17			200-160	12	3		
16			200-200	12	3		
15			200-200	12	3		
14			200-200	12	3		
13			200-200	12	3		
12			260-200	12	3		
11			300-320	12	3		
10			300-350	8	2	.04	lifting building
9			300-400	8	2		

TOTALS

40

HY QUANTITY THIS PAGE: _____

C.F./C.Y. HAYWARD BAKER SUPERINTENDENT: _____

COMPLETION TIME: _____

CLIENT'S REPRESENTATIVE: _____

HAYWARD BAKER

A KELLER COMPANY



COMPACTION GROUT LOG

NEI PROJECT NO.: 600681

PAGE 1 of 1

PROJECT NAME: ST URACON MILL

DATE: 1-17-18

GROUT POINT NO.: B-13

PUMP TYPE: Pump

MAXIMUM DEPTH: TOP Ground 8' Full Depth 20'

PUMP CAPACITY (G.P./STROKE): 1/4

GROUT TECHNICIAN: Daniel Bala

PUMP RATE: 8 Sec

DEPTH (FEET)	TIME		MAXIMUM GAGE PRESSURE (psf)	GROUT QUANTITY		SURFACE HEAVE (IN)	COMMENTS
	START	STOP		STROKES	CU. FT.		
8			250 - 250	12	3		
7			170 - 170	12	3		
6			160 - 170	12	3		
5			160 - 170	12	3		
20			300 - 330	12	3		1-23-18
19			300 - 320	12	3		
18			300 - 330	12	3		
17			300 - 330	12	3		
16			280 - 300	12	3		
15			280 - 300	12	3		
14			280 - 300	12	3		
13			280 - 290	12	3		
12			270 - 290	12	3		
11			270 - 290	12	3		
10			260 - 270	12	3		
9			260 - 270	12	3		
TOTALS					48		

PRY QUANTITY THIS PAGE: _____ C.F. J. C. Y. HAYWARD BAKER SUPERINTENDENT: [Signature]

COMPLETION TIME: _____ CLIENT'S REPRESENTATIVE: _____

HAYWARD BAKER

A KELLER COMPANY



COMPACTION GROUT LOG

HB PROJECT NO.: 60681 PAGE 1 OF 1
 PROJECT NAME: ST URASO MALL DATE: 1-22-18
 GROUT POINT NO.: 4 ME PUMP TYPE: P-12
 MAXIMUM DEPTH: TOP POINT 8' Full DEPTH 26' PUMP CAPACITY (G.F./STROKE): 14
 GROUT TECHNICIAN: Daniel Bulo PUMP RATE: 8 Sec

DEPTH (FEET)	TIME		MAXIMUM GAGE PRESSURE (psf)	GROUT QUANTITY		SURFACE HEAVE (IN)	COMMENTS
	START	STOP		STROKES	CU. FT.		
8			260-220	12	3		
7			180-160	12	3		
6			160-160	12	3		
5			120-180	12	3		
20			350-400	12	3		1-22-18
19			320-400	12	3		
18			350-400	12	3		
17			320-400	12	3		
6			250-400	12	3		
15			280-320	12	3		
14			280-300	12	3		
13			260-280	12	3		
12			260-170	12	3		
11			190-200	12	3		
10			170-200	12	3		
9			200-220	12	3		
				TOTALS			
				48			

PIV QUANTITY THIS PAGE _____ C.F. I.C.V. HAYWARD BAKER SUPERINTENDENT [Signature]
 COMPLETION TIME _____ CLIENT'S REPRESENTATIVE _____

HAYWARD BAKER

A KELLER COMPANY



COMPACTION GROUT LOG

HBI PROJECT NO.: 60601
 PROJECT NAME: ST WADSW MALL
 GROUT POINT NO.: # 15
 MAXIMUM DEPTH: Top down 8" full depth 20'
 GROUT TECHNICIAN: David Rado

PAGE 1 of 1
 DATE: 1-17-18
 PUMP TYPE: P112
 PUMP CAPACITY (G.P./STROKE): 14
 PUMP RATE: 8 GAL

DEPTH (FEET)	TIME		MAXIMUM GAGE PRESSURE (psi)	GROUT QUANTITY		SURFACE HEAVE (IN)	COMMENTS
	START	STOP		STROKES	CU. FT.		
8			200 - 80	12	3		
7			200 - 100	12	3		
6			100 - 200	12	3		
5			200 - 170	12	3		
20			280 - 300	12	3		1-23-18
19			280 - 300	12	3		
18			280 - 300	12	3		
17			280 - 300	12	3		
16			280 - 300	12	3		
15			280 - 300	12	3		
14			280 - 300	12	3		
13			280 - 300	12	3		
12			280 - 300	12	3		
11			280 - 300	12	3		
10			250 - 260	12	3		
9			240 - 150	12	3		
TOTALS					4200		

PAY QUANTITY THIS PAGE: _____ C.F./C.Y. HAYWARD BAKER SUPERINTENDENT: David Rado
 COMPLETION TIME: _____ CLIENT'S REPRESENTATIVE: _____

HAYWARD BAKER

A KELLER COMPANY

COMPACTION GROUT LOG



NBI PROJECT NO: 600681

PAGE 1 OF 1

PROJECT NAME: ST VRAIN MALL

DATE: 1-17-18

GROUT POINT NO: # 16

PUMP TYPE: P-12

MAXIMUM DEPTH: TOP DOWN 8 FT FULL DEPTH 20 FT

PUMP CAPACITY (C.F./STROKE): 74

GROUT TECHNICIAN: Daniel Bule

PUMP RATE: 8 sec

DEPTH (FEET)	TIME		MAXIMUM GAGE PRESSURE (PSI)	GROUT QUANTITY		SURFACE HEAVE (IN)	COMMENTS
	START	STOP		STROKES	CU. FT.		
8			260-300	12	3		
7			180-200	12	3		
6			180-200	12	3		
5			160-170	12	3		
20			400-500	4	1		1-22-18
19			300-400	12	3		
18			270-300	12	3		
17			280-300	12	3		
16			280-300	12	3		
15			280-300	12	3		
14			280-320	12	3		
13			240-260	12	3		
12			200-200	12	3		
11			200-200	12	3		
10			200-240	12	3		
9			180-200	8	2	.68	
TOTALS					45		

PAY QUANTITY THIS PAGE: _____ C.F./C.Y. HAYWARD BAKER SUPERINTENDENT: [Signature]
 COMPLETION TIME: _____ CLIENT'S REPRESENTATIVE: _____

HAYWARD BAKER

A KELLER COMPANY



COMPACTION GROUT LOG

HB PROJECT NO.: 609681 PAGE: 1 OF 1
 PROJECT NAME: 5' UREAN MULL DATE: 1-17-18
 GROUT POINT NO.: # 17 PUMP TYPE: P-12
 MAXIMUM DEPTH: Top 20" 8" Full depth 20" PUMP CAPACITY (C.F./STROKE): 1/4
 GROUT TECHNICIAN: David Rula PUMP RATE: 8.2cc

DEPTH (FEET)	TIME		MAXIMUM GAGE PRESSURE (psi)	GROUT QUANTITY		SURFACE HEAVE (IN)	COMMENTS
	START	STOP		STROKES	CU. FT.		
8			180-200	12	3		
7			180-200	12	3		
6			180-200	11	3		
5			180-200	12	3		
20			40-50	4	1		1-23-18
19			300-350	12	3		
18			500-550	12	3		
17			300-350	12	3		
16			300-350	12	3		
15			300-350	12	3		
14			280-300	12	3		
13			280-300	12	3		
12			280-300	12	3		
11			280-300	12	3		
10			260-280	12	3		
9			260-280	12	3		
TOTALS					46		

PAV QUANTITY THIS PAGE: _____ C.F./C.Y. HAYWARD BAKER SUPERINTENDENT: David Rula
 COMPLETION TIME: _____ CLIENT'S REPRESENTATIVE: _____

HAYWARD BAKER

A KELLER COMPANY



COMPACTION GROUT LOG

NBI PROJECT NO.: 600681 PAGE: 1 OF 1
 PROJECT NAME: ST VRAIN MILL DATE: 1-17-18
 GROUT POINT NO.: #18 PUMP TYPE: PUTZ
 MAXIMUM DEPTH: Tap down 8' full depth 20' PUMP CAPACITY (C.F./STROKE): 1/4
 GROUT TECHNICIAN: D. BALA PUMP RATE: 8 SEC

DEPTH (FEET)	TIME		MAXIMUM GAGE PRESSURE (PSI)	GROUT QUANTITY		SURFACE HEAVE (IN)	COMMENTS
	START	STOP		STROKES	CU. FT.		
8			100-150	12	3		
7			150-190	12	3		
6			100-150	12	3		
5			100-150	8	2		Grout surface
20			40-50	4	1		1-22-18
19			200-300	12	3		
18			210-300	12	3		
17			250-300	12	3		
16			210-300	12	3		
15			260-270	12	3		
14			260-280	12	3		
13			260-280	12	3		
12			240-260	12	3		
11			240-260	12	3		
10			230-240	12	3		
9			230-240	12	3		
				TOTALS	46		

PUMP QUANTITY THIS PAGE: _____ C.F./C.Y. HAYWARD BAKER SUPERINTENDENT: [Signature]
 COMPLETION TIME: _____ CLIENT'S REPRESENTATIVE: _____

APPENDIX E
MATERIALS TESTING

REPORT OF CONCRETE COMPRESSIVE STRENGTH TESTS

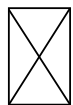


PROJECT: St. Vrain Mill
 JOB NO.: 140571
 PLACEMENT DATE: 1/8/2018 TO 1/23/2018
 CLIENT: St. Vrain Mill Preservation & Historical Fdn
 CONTRACTOR: Hayward Baker

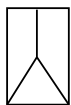
SUPPLIER: Batch Mix
 MIX CODE:
 SPECIFIED STRENGTH: 2,000 psi
 TESTED BY: TLD

	CYLINDER NUMBER	SLUMP (INCH)	AIR (%)	AIR TEMP (°F)	CONCRETE TEMP (°F)	WATER ADDED (GAL)	DATE TESTED	TEST AGE (DAYS)	MAX APPLIED LOAD (LBS)	COMPRESSIVE STRENGTH (PSI)	TYPE OF FAILURE	PLACEMENT LOCATION
HOLE #	3	1-1 A					1/22/18	7	19,570	1,558	3	Hole #3, depth 5' B.G.S., northside immediately below permiation (outside building)
DEPTH	5'	1-1 B	N/A	35	48	-	2/12/18	21	32,960	2,623	3	
TIME	12:30 PM	1-1 C	N/A				2/5/18	28	29,320	2,333	3	
DATE	1/15/2018											
HOLE #	10	2-1 A					2/15/18	28	27,090	2,156	3	Hole #10, depth 7' B.G.S., westside (inside building)
DEPTH	7'		N/A	45	N/A	-						
DATE	1/18/2018											
HOLE #	12	2-2 A					2/15/18	28	25,970	2,067	3	Hole #12, depth 5' B.G.S., westside (inside building)
DEPTH	5'		N/A	45	N/A	-						
DATE	1/18/2018											
HOLE #	16	4-1 A					2/20/18	28	28,470	2,265	3	Hole #16, depth 19' B.G.S., northside (inside building)
DEPTH	19'		N/A	37	N/A	-						
DATE	1/23/2018											

TYPE OF FAILURE



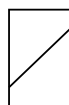
1
CONE



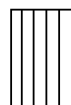
2
SPLIT
CONE



3
SHEAR
CONE



4
SHEAR



5
SPLIT

4-inch Diameter Cylinders Unless Noted Otherwise

All samples prepared and tested in accordance with the following ASTM standards: Sampling C172; Curing C31; Slump C143; Air C231; Temperature C1064; Compression C39

Remarks:

Sampled from end of grout hose