STRUCTURAL ENGINEERING ASSOCIATES, INC.

Est. 1909

July 18, 2012

Chad Birdsong
The City of Excelsior Springs Missouri
Public Works Department
103 East Water Street
Excelsior Springs, MO 64024

Re: Hall of Waters North Terrace Well Pump Room

Dear Mr. Birdsong:

At the request of the City of Excelsior Springs, MO, Structural Engineering Associates, Inc. (SEA) performed a structural condition assessment of the existing Hall of Waters North Terrace Well Pump Room, an underground basement-like structure that abuts the north elevation stairways to the historic Hall of Waters (HOW) building. SEA was unable to obtain any record documents on this structure, except what drawings from the 1936 construction indicated as the original (earlier construction) outlines of two above grade spring houses, presumably above this basement in which several mineral springs' wells were present and pumped into the Hall's various mineral waters facilities.

The schematic outline of the pump room foundation walls, columns, etc, can be found in the Appendix section of this report. In performing our field evaluation surveys, SEA coordinated the locations and excavation of four (4) test holes with the City's Public Works Department to determine the depth of the existing soil overburden to the top of the concrete roof slab. SEA also retained MTS Contracting to assist with obtaining a slab core of the reinforced concrete roof slab at Test Hole ##2, so as to determine the slab thickness. The picture below depicts a view from the southeast corner of the HOW north terrace area, noting two of the four test holes (T.H. #1 & T.H. #2) locations above the pump room structure.

Hall of Waters, North Terrace Well Pump Room Test Holes

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In the picture above, Test Holes #3 and #4 were located on the west side of the terrace, adjacent to the HOW north terrace area, and the access ramp leading to Broadway St. respectively. With the assistance of the Public Works Dept. staff, we were able to excavate the soil over the existing roof slab below, and then determine the elevations of both the existing grade at the test holes and the top of concrete roof slab, using an assumed elevation datum of 100.00 from the slab at the bottom of the north terrace stairs. The table below illustrates the elevations of the existing ground at the four test holes, as well as the exposed top of roof slab.

Test Hole	Location	Ground Elevation	Top Roof Slab Elevation
T.H. #1	N.E. Roof Corner	100.7	98.8
T.H. #2	S.W. Roof Corner	99.2	97.8
T.H. #3	S.W. Roof Corner	99.5	98.0
T.H. #4	N.W. Roof Corner	100.5	98.8

The above table indicates that the existing terrace tends to slope from the north to the south, and that the soil overburden ranges from 1.4' to 1.9' on top of the concrete roof slab.

SEA also retained MTS Contracting to assist with obtaining a slab core of the reinforced concrete roof slab at Test Hole ##2, so as to determine the slab thickness (see picture below). The 3" diameter test core at the exposed T.H. #2 location found that the reinforced concrete roof slab thickness was approximately 13" thick in this location, which is fortunate, given the deteriorated condition of the 80+ year-old concrete in this basement structure, and the fact that it is subjected to some two feet of soil overburden.

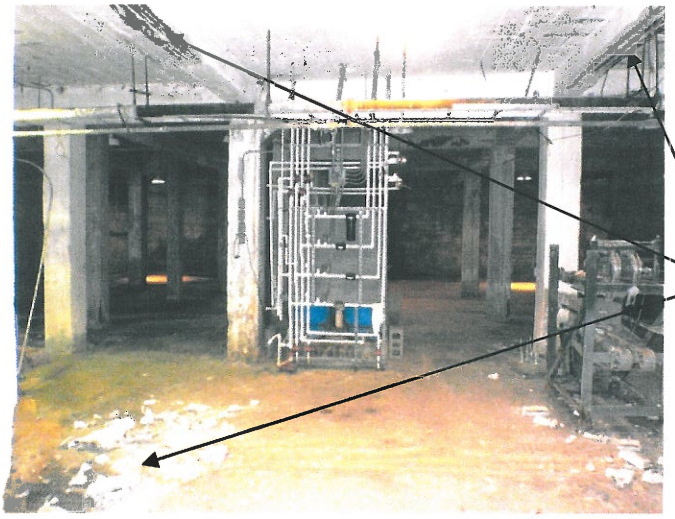
Coring existing roof slab at Test Hole #2

In considering our field survey observations and findings, we were able to look at the existing soil load, which was taken to be a conservative 2' across the roof slab, then add the weight (dead load) of the structural framing, and finally the potential terrace assembly live load condition of 100 psf. These combined loads and measured locations of the interior columns within the basement structure, enabled us to consider temporary shoring concepts for the structure, which constitutes the intended outcome of our services for the City.

SEA contacted HARSCO Infrastructure (formerly Patent Construction Systems) in Kansas City, MO, and organized a field survey with Mr. Kevin Humes, General Superintendent of HARSCO. We looked at the existing concrete framing and discussed best practicable approaches to shoring the existing roof framing from inside the structure. In general, we believe the most cost-effective shoring approach, using the above estimated loading conditions, is to shore the existing beams throughout the roof structure.

Many of the existing concrete beams exhibit significant deterioration from corrosion, and the existing reinforcing steel in these beams have lost section, thus reducing their ability to carry the imposed loads. Further, some of the existing concrete columns should also be repaired, since there are moderate to severe corrosion delaminations at the lower few feet of many of the columns. The two pictures below help to further illustrate these observed structural deficiencies.

Existing column delaminations in Well Pump Room



Concrete beam and slab framing deterioration

These structural (corrosion) delaminations at beams, slab-soffit and columns, make it necessary to either repair the reinforced concrete elements in whole, or erect temporary shoring and bracing to ensure the well pump room does not collapse in part, or whole.

SEA obtained a preliminary proposal to provide a temporary or long term (as the case may be) shoring system from HARSCO Infrastructure, which will consist of 20 kip (20,000 lb. rated) shoring towers to support the distressed reinforced concrete framing beams that support the roof slab of this structure. HARSCO estimates that in designing, erecting and dismantling the proposed shoring system the cost would be approximately $29,000. The monthly rental for the shoring would be approximately $1,202, with the annual rental rate being $15,673.

We requested that HARSCO also give us a purchase option for the shoring system, and that appears to be approximately $37,694. Based on these cost estimates, it might be more advantageous to the City to consider purchasing the shoring, especially if it is to remain in place for more than a year or two.

Also, the shoring will require that a restoration type contractor be secured to provide grouting at the irregular surfaces of the distressed concrete beams, where they will be bearing on the shoring towers and posts. Lastly, we recommend that the same restoration contractor perform partial depth structural concrete repairs to the bottom few feet of the delaminated columns in the well pump house.

These discrete concrete column repairs would entail chipping out the unsound concrete on the 16" square columns, removing (sandblasting) the rebar corrosion and applying an epoxy bonding and corrosion inhibitor product, then forming and pouring new repair concrete around the existing column sections. There are some 20 columns in the structure. The required shoring grouting for bearing seats, and the columns repairs, is estimated to cost $8,000 to $10,000.

In summary, SEA recommends that a temporary shoring system be erected to support the roof framing of this well pump house structure to provide structural stability and life safety. The estimated shoring loads do take into account a potential assembly live load of 100 psf, but even with the new shoring system in place, we do not recommend large assemblies and/or equipment loads above the existing well pump room structure.

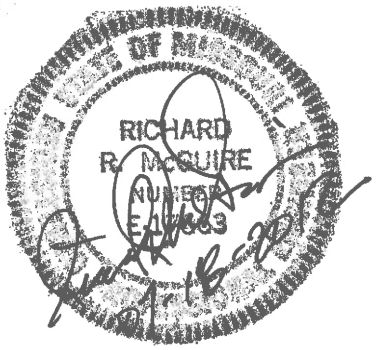
Over time, this structure could be demolished, carefully taking down the roof slab and removing the north and east foundation walls down to a few feet below grade. The construction debris could be retained within the footprint of the foundation walls, while the existing, active mineral spring well head could be retained within a new concrete structure that could be directed to the south, into the Hall of Waters building, if structurally feasible. Such a new well pump house could be on the order of 8' square, or so, then (conceivably) an 8' x 8' precast concrete access tunnel could be constructed. The rest of the demolished well pump house footprint could be backfilled with the demolition rubble and controlled crushed rock fill, with the last few feet being an engineered soil for a new north terrace pocket park and/or garden feature.

SEA is available to discuss these findings and recommendations with the City of Excelsior Springs at your convenience. We believe that the temporary shoring is a life safety issue and that unless the well pump room/basement is to be demolished within a year, or less, the City should go forth with the temporary/long-term shoring measures.

SEA can assist the City in preparing the temporary shoring or demolition construction documents, as well. We greatly appreciate the assistance of the Public Works Department staff during our field surveys and assessments over the last few months. We look forward to our continued engineering support to the City of Excelsior Springs.

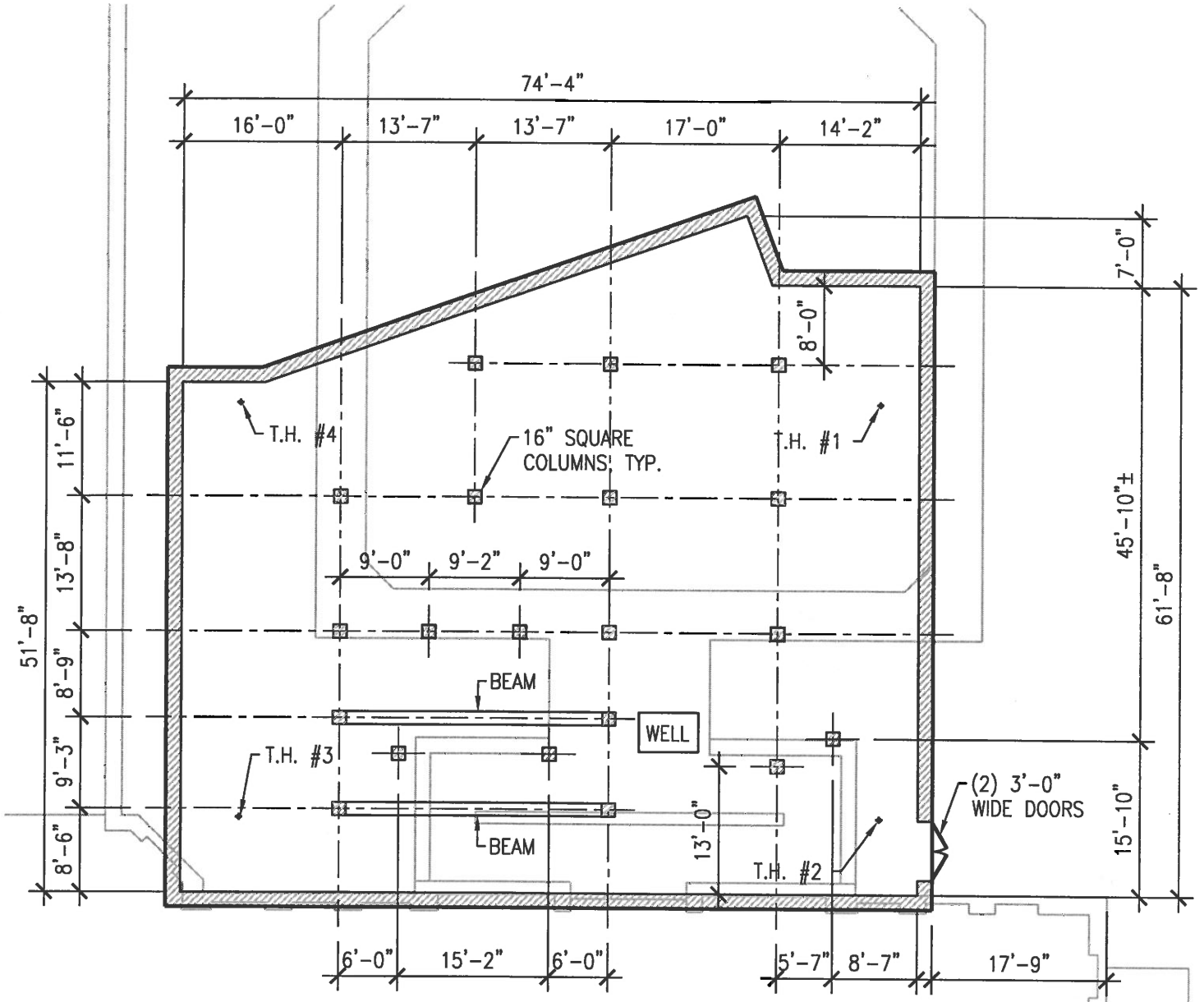
Sincerely,

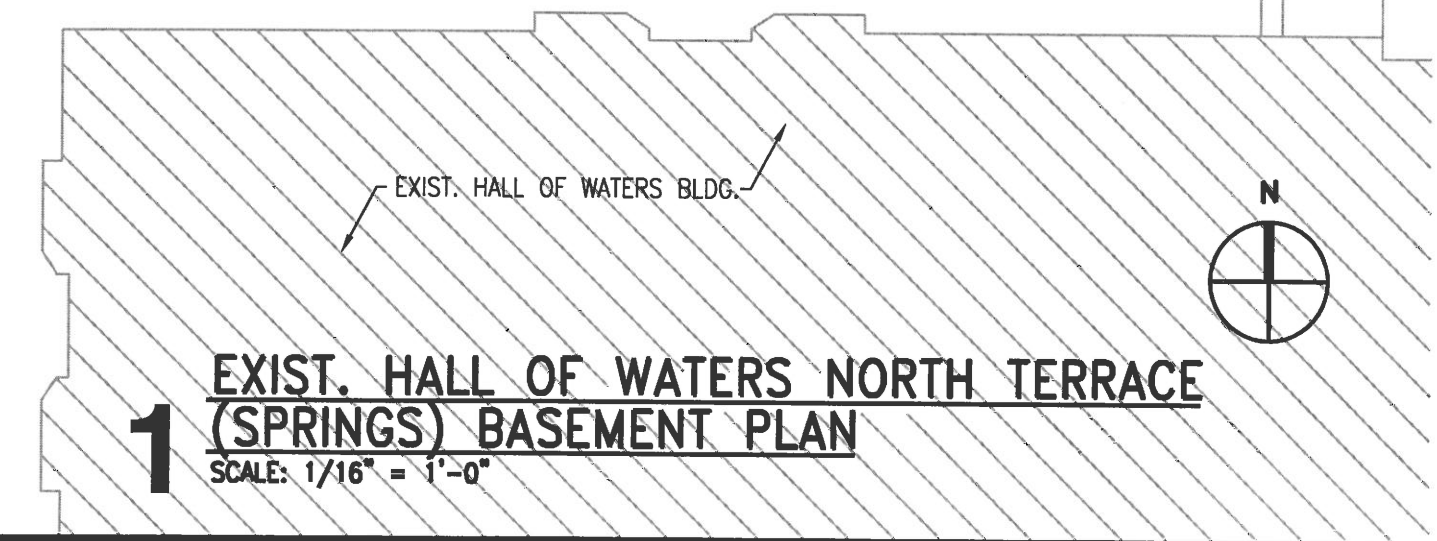
Richard R. McGuire, P.E.
Sr. Project Manager



cc: Kermit Bright, P.E. / SEA
Angie Gaebler, AIA / SRJA

Enclosure: Schematic Plan of Existing Well Pump Room





1 EXIST. HALL OF WATERS NORTH TERRACE (SPRINGS) BASEMENT PLAN

SCALE: 1/16" = 1'-0"

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Hall of Waters North Terrace
(Springs) Basement Condition
Assessment

JOB NO:	2012029.00
DATE:	June 22, 2012
DRAWN BY:	TME
CHECKED BY:	RRM