



November 18, 2011

Borough of Naugatuck Public Works Dept.
Mr. James Stewart, P.E., L.S.
258 Rubber Avenue
Naugatuck, CT 06770-4145

**Re: Condition Assessment
Hop Brook Pool, 75 Crown Street, Naugatuck, CT 06770
CHA Project No. 23304.1000.28000**

Dear Mr. Stewart:

CHA is pleased to present this Phase 1 report that documents the condition evaluation of the swimming pool located at 75 Crown Street in the Borough of Naugatuck, Connecticut (Borough). The structural portions of this report are based on a site visit conducted on September 20, 2011 by Brian Bidonde, P.E. of CHA. The reported condition of the plumbing system is based on pressure testing of the pool's water lines, which was completed on November 9, 2011 by Phil Brennan of Savol.

BACKGROUND

The Borough desires to repair the pool structure and pressure test the water lines under the pool for leak detection, and has contacted CHA to perform an evaluation. The evaluation documented the extent and nature of the observed structural deterioration so that appropriate repairs can be designed, and provides findings for the leak testing. The Borough desires a minimum 5 to 7 year lifespan for any recommended repairs.

DESCRIPTION OF THE POOL

The pool is an L-shaped in-ground swimming pool with a water surface area of approximately 4,640 square feet (sq ft). The deep end of the pool is approximately 12'-0" deep, and the shallow end of the pool is approximately 3'-0" deep. A stainless steel gutter system runs around the perimeter of the pool that is believed to be approximately 14 years old. The exact age of the pool structure is unknown.

The pool construction appears to consist of concrete walls and floor that have been covered with layers of shotcrete and several surface patches. The pool's exterior surface finish appears to have been a painted top coat which has severely degraded and is essentially nonexistent. Details regarding the pool construction such as wall and slab thickness, reinforcement, and connection details between the walls and slab are not known because the original construction documents are not available for review.

SCOPE OF EVALUATION

The scope of this evaluation includes the following:

1. Conducting a site visit to assess current structural conditions. The assessment was carried out with visual observations and sounding the concrete walls and floor by hammer-sounding and chain-dragging methods to determine the general extent of delaminated and unsound surfaces.
 - a. No testing or structural calculations were performed to evaluate the structural strength and stability of the pool.
 - b. The original construction documents were not available; therefore details of the pool construction such as wall thickness and reinforcing are not known.
 - c. Photographs taken during the site visit are attached to this report.
2. Pressure testing of lines under the pool to detect any leaks which may be present.
 - a. To detect any possible leaks, all gutter return inlets (124) were plugged and air was added to the line. The team then listened for escaping air and confirmed any leaks by spraying a soap solution on the suspected area. The formation of a soap bubble indicates a leaking section in the plumbing system.
 - b. The process was repeated on the suction side of the plumbing, where the gutter entry point of the plumbing, the main drain entry point of the plumbing, and the vent pipe above the concrete slab where the equipment sits were plugged and air pressure increased.

DISCUSSION OF STRUCTURAL FINDINGS

CHA documented the following findings at the time of the site visit. Refer to the attached Pool Layout for wall designations and the general arrangement of the pool.

1. According to Borough maintenance personnel, the pool is partially drained at the end of each season. The pool is drained to a level that exposes the walls and floor at the shallow areas, but keeps the walls at the deep end partially submerged.
2. Based on a large spall that was observed at the east corner of Wall B, the wall construction appears to consist of a structural layer of concrete covered by a layer of shotcrete with welded wire fabric between the structural concrete and the shotcrete covering. Several layers of cementitious coatings and patches were observed over the shotcrete layer.
3. Unsound concrete was detected in many areas of the pool walls. The unsound concrete consists of cracked concrete, spalling concrete, and delamination of the cementitious layers that were placed over the shotcrete layer. Many of the concrete patches are also unsound. The following is a description of the deterioration observed at each wall.
 - a. Nearly the full length of Wall A is unsound (Photograph 1). Wall A is at the shallow end of the pool.
 - b. Wall B is located at the shallow end of the pool, and is mostly unsound. Large cracks are located at the west end of the wall and a large spall is located at the east corner. The spall has revealed what appears to be a layer of shotcrete and corroding welded wire fabric against what is believed to be the original concrete wall. Several layers of cementitious materials were placed over the shotcrete layer. According to a Borough maintenance employee who has done previous repair work on the pool, a

large portion of this wall was previously patched. The employee believes that the structural integrity of this wall is questionable (Photograph 2).

- c. The western portion of Wall C is at the shallow end of the pool, and is mostly unsound. Two large voids were detected in this wall, and are believed to consist of abandoned light fixtures that were covered with concrete. In one of the voids, what appears to be an electrical cable was observed. According to a Borough maintenance employee who has performed previous repair work on the pool, a large area at the western end of this wall was previously patched. This employee stated to CHA that the patch went through the entire thickness of the wall, and he believes that the integrity of this wall is questionable (Photograph 3).
 - d. The deterioration of Wall D is less severe than Walls A, B, and C, but is still significant. Unsound concrete was detected above the level that the pool is drained to at the end of the season (Photograph 4).
 - e. The unsound concrete at Wall E is located above the level that the pool is drained to at the end of the season. In addition, a circular area approximately 18 inches in diameter of unsound concrete was found at the center of the wall, and is believed to consist of an abandoned light that was covered with concrete (Photograph 5).
 - f. The unsound concrete at Wall F is located above the level that the pool is drained to at the end of the season. This wall also has a circular area of unsound concrete that is believed to consist of an abandoned light fixture that was covered with concrete. The most severe deterioration occurs at the north end of this wall at the corner with Wall B (Photograph 6).
4. The pool floor is covered with layers of patches and cementitious material similar to the walls.
 5. Most of the pool floor between Walls B and C from Wall A to the corner of Walls B and F is unsound (see Figure 1). The unsound concrete consists of cracks, spalls, delaminated layers of cementitious material, and failing patches that are not bonded to the substrate. No spalls were observed to be deep enough to expose a structural layer of concrete that is assumed to exist under the surface layers (Photograph 7).
 6. Several inches of water accumulated at the deep end of the pool which prevented hammer sounding or chain dragging of the floor in this area. However, based on visual observations the floor in this area appeared to be sound.
 7. The concrete stairs at the north and south ends of Wall A are in very poor condition. The concrete is cracking, spalling, and delaminating. A very deep spall was observed in the stair wall at the north end of Wall A (Photograph 8).
 8. According to a Borough Maintenance employee, the pool has significant leakage.
 9. A stainless steel gutter system is located around the perimeter of the pool. The gutter appears to be in good structural condition. However, small, randomly distributed voids were observed between the gutter and the pool wall.

DISCUSSION OF MECHANICAL SYSTEM FINDINGS

1. No leaks were found on the suction side of the plumbing. Air pressure was able to build up and be maintained for 15 minutes.
2. The return side of the plumbing has a pressure leak. The gutter section along the steps of the school side of the pool has a major leak. It appears as though the bottom of the gutter has been cracked.

During the pressure test, the entire area had come away from the top of the pool wall and is leaking. The entire gutter is an open cavity for the return water to reenter the pool.

CONCLUSIONS

The concrete structure of the Hop Brook pool is in very poor condition. The observed deterioration appears to be the result of freeze-thaw damage that has caused the cracking, spalling, and delamination of the various cementitious layers. The majority of the damage is located at the shallow areas of the pool that are fully exposed after draining, because these areas are exposed to the greatest number of freeze-thaw cycles. The areas of the pool that remain submerged after partial draining are exposed to fewer freeze-thaw cycles because of the insulating affect provided by the remaining water, even if it freezes.

Freeze-thaw cycles damage concrete when water in the pores of the concrete freezes and expands, which produces pressure. If this pressure exceeds the tensile strength of the concrete, the walls of the concrete pore will rupture. Repeated freeze-thaw cycles can then cause damage that includes cracking and spalling. Minor freeze-thaw damage can be repaired by removing the damaged surface layers and replacing them with repair mortar. Concrete heavily damaged by freeze-thaw cycles may require removal and replacement.

The damage from freeze-thaw cycles is normally limited by air entraining the concrete by adding an admixture at the time the concrete is mixed. The air entrainment produces many very small bubbles in the hardened concrete, which provide room for the freezing water to expand into. The observed deterioration suggests that the existing concrete may not be air entrained.

The pool's recirculation piping as per the above findings has been compromised in the return pipe lines. It is unknown when the pipes had begun leaking but could potentially have been leaking for several years. This certainly could be contributing to the poor condition of the structural slab as it has most likely created voids in the subgrade material under the pool shell. As with all leaks, surrounding conditions worsen over time.

RECOMMENDATIONS

CHA recommends that additional testing be performed to verify the suitability of the intended repairs that consist of surface patching and full depth repair. CHA recommends that a minimum of two cores should be removed from the pool walls and that one core should be removed from the floor. The cores will provide information regarding the thickness and compressive strength of the concrete, and member thickness and composition. This information will help in the selection of the proper repair materials.

All of the concrete cores should receive a petrographic analysis which will determine the quality and condition of the concrete cores, the chloride concentration, air content, and evidence of physical or chemical deterioration that would adversely affect the intended repairs. This information will help to estimate the lifespan of the intended repairs.

The Phase 2 Report will provide quantities of repair materials, locations for each type of repair, and required repair materials.

CHA also recommends that additional testing be performed on the concrete and subgrade specifically near the area of the leaking identified in order to make a determination of whether to excavate and repair the leaking piping or to explore alternative temporary repair methods. As with the concrete repair recommendation, we will provide details of repair materials and methods required.

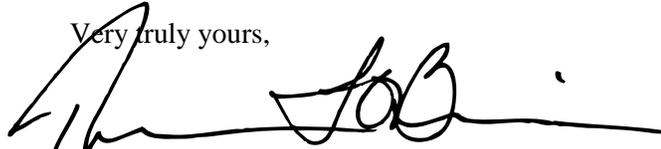


DISCLAIMERS AND QUALIFICATIONS

The opinions and recommendations contained in this report are based upon the information provided by the Town and the conditions readily visible at the time of the inspection. This report does not address any other portions of the structure other than those areas mentioned, nor does it provide any warranty, either expressed or implied, for any portion of the existing structure.

If you have any questions regarding this letter, please feel free to call me at (518) 453-4500.

Very truly yours,

A handwritten signature in black ink, appearing to read 'T. O'Brien', written over a horizontal line.

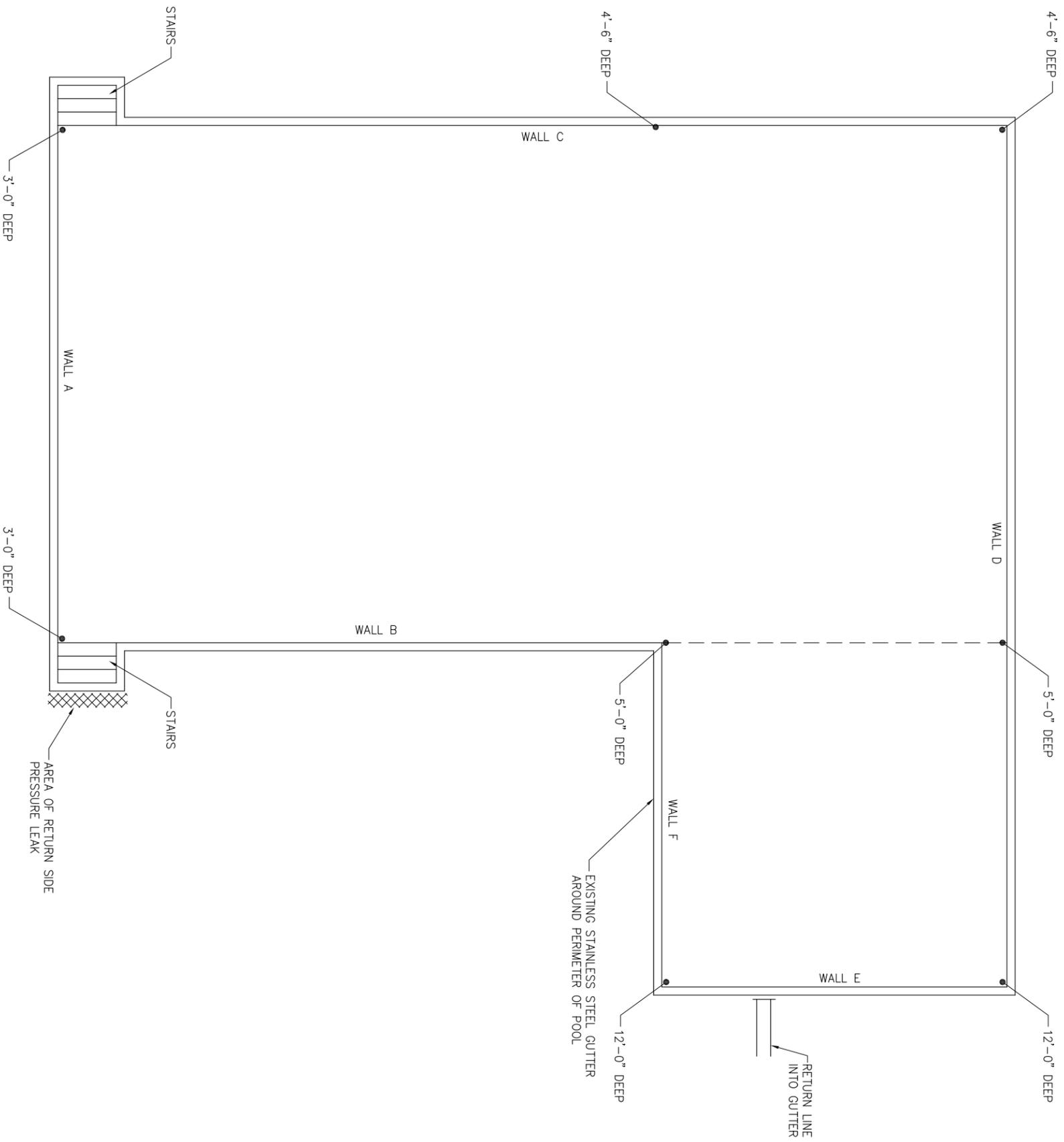
Thomas L. O'Brien, P.E.
Partner

TOB/

Attachments: Pool Layout, Photo Sheets

Cc: D. DeGennaro, CHA
B. Bidonde, CHA
M. Cathone, CHA

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HOP BROOK POOL PLAN

SCALE: NONE



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HOP BROOK POOL
BOROUGH OF NAUGATUCK, CONNECTICUT
POOL PLAN

PROJECT NO.
22304
DATE: 11/18/11
FIGURE 1



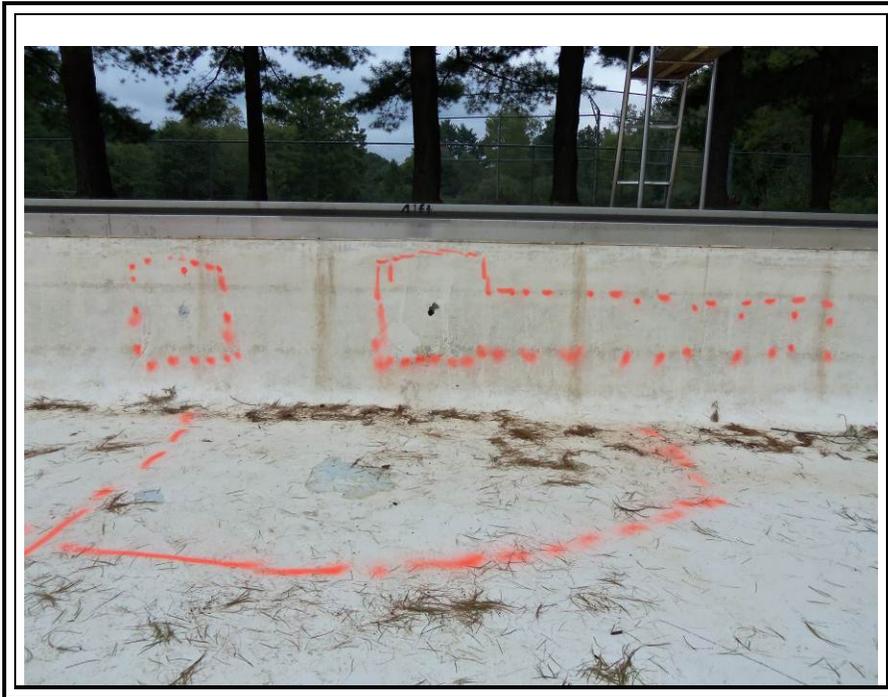
Photograph 1



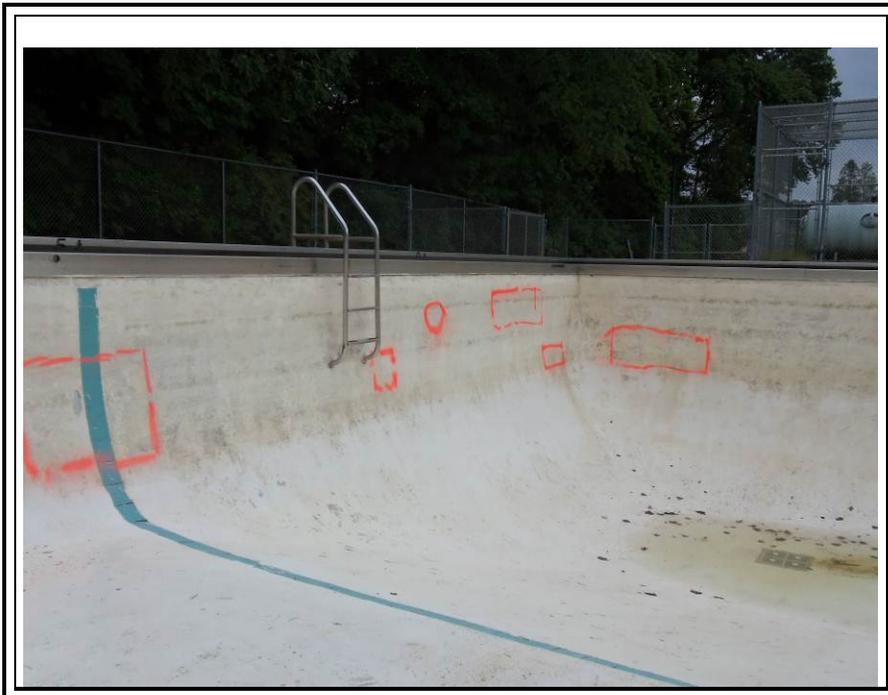
Photograph 2



SITE PHOTOGRAPHS



Photograph 3



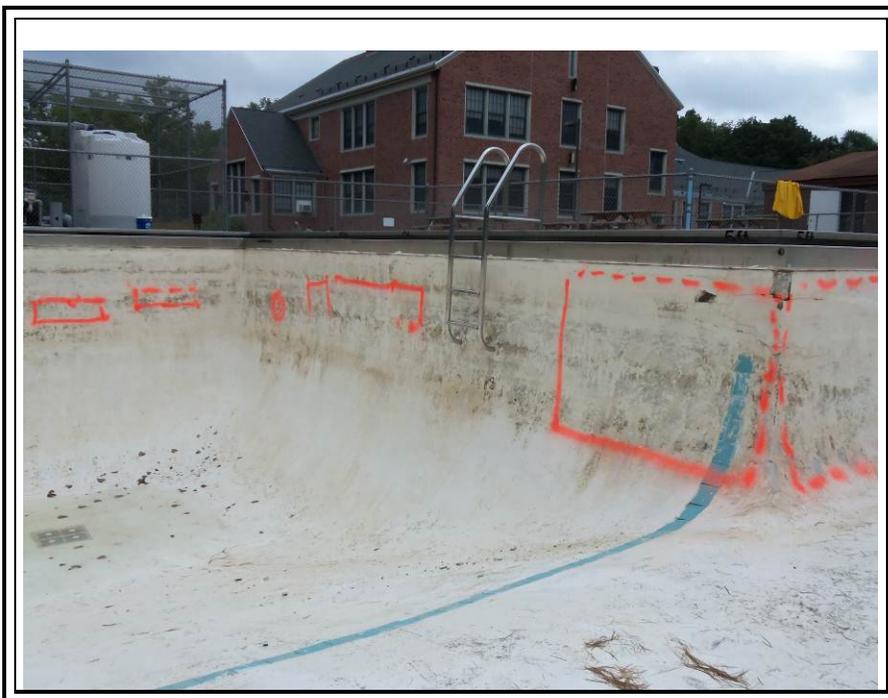
Photograph 4



SITE PHOTOGRAPHS



Photograph 5



Photograph 6



SITE PHOTOGRAPHS



Photograph 7



Photograph 8



SITE PHOTOGRAPHS