



July 16, 2024

The OAKS of N. Londonderry Township
HOA Board
1200 E. Main Street, Suite 2
Palmyra, PA 17078

Project: Summary of Field Oversight/Documentation Services
Removal/Replacement of SWM Piping
SWM Basin behind Hickory Street within the OAKS HOA
N. Londonderry Township, Lebanon County, Pennsylvania

Dear Oaks HOA Board,

The ALW Group, LLC (ALW) has prepared summary letter report documenting field oversight in support of the replacement of damaged SWM piping at the above-referenced site. The following paragraphs outline background information pertaining to the project, outline of the scope of services, and the findings/results of the SWM removal and replacement work performed by Starnier Excavating LLC (herein referenced as “Contractor”). Our services were provided in general accordance with the executed ALW Proposal, dated January 22, 2024.

PROJECT LOCATION/BACKGROUND

The Oaks residential development is situated in the Palmyra area of Lebanon County, Pennsylvania. There are approximately 150+ residential dwellings comprising The Oaks. Specifically, the development is situated in North Londonderry Township, along the southern side of Route 422.

In January of 2024, the Oaks HOA contracted ALW to visit an area of concern (AOC) associated with a stormwater management (SWM) basin situated behind homes along Hickory Street. Our site visit included members of the HOA and a representative of the Contractor. The SWM basin collects runoff from several areas along Hickory Street. Stormwater conveyed to this basin is eventually carried and discharged to a nearby wooded area of lower elevation. The basin includes a release structure (15-inch opening) and a 24-inch PVC outlet pipe which carries storm water out of the basin. The historic AOC encompasses the outlet structure and underground piping, where numerous sinkholes and/or settlement features have occurred.

At the time of the site visit, the HOA provided two hand-drawn sketches associated with past repairs in the AOC. In summary, our site visit revealed the following key observations and findings:



- A soil collapse or closed depression had formed immediately behind the outlet structure located on the downgradient side of the basin. The area of the depression measured roughly 10 feet by four feet and was situated above the outlet pipe or adjacent to it.
- Observation of the inside of the below-grade outlet/discharge pipe from the basin to outflow head wall revealed a significantly irregular pipe shape. The PVC piping appeared to have been “egg-shaped” with multiple “high” and “low” spots throughout the run of pipe. Of particular concern, we observed numerous areas of separation at joints in the piping and cracking in the pipe (many of the cracks appeared to penetrate completely through the pipe). In its current condition, water flowing through the pipe is escaping via cracks/openings resulting in excessive water concentration into the surrounding subgrade.
- A rock outcrop is present along a slope just northeast of the headwall on the downgradient side of the embankment. Closer examination of the rock outcrop revealed limestone rock that was highly weathered, thinly bedded and containing a considerable amount of fractures. The rock is consistent with the mapped geology and is highly problematic in this geographic setting.
- Through our discussions with the HOA, we understand that there is a history of sinkhole development throughout The Oaks footprint and in the Hickory Street basin itself. The Oaks HOA provided several hand-made notes and sketches which indicate that there have been at least 4 past occurrences of soil collapse/sinkhole type features in the general AOC. A contractor(s) was engaged in the past to perform a variety of restoration activities. It appears that some of those activities included replacing some portions of the existing buried storm water outflow piping and outlet structure. In addition, concrete collars and/or cradle type pads/mats may have also been constructed beneath sections of the pipe alignment and/or structure. Details relative to the actual restoration of the sinkhole openings are not available.

As a result of our findings and observations, it was recommended that the existing SWM pipe alignment be removed and replaced with new water-tight 24-inch pipe. In addition, we suggested that during the pipe removal, ALW provide oversight and recommendations relative to the observed subgrade conditions (i.e. any exposed openings, depressions, past repairs).

SCOPE OF SERVICES

The overall purpose of this exercise was to return the SWM outflow pipe to a properly functioning condition in general conformance with stormwater management regulations within the Commonwealth of Pennsylvania, including the preparation of a stabilized subgrade supporting the pipe alignment. In addition, the primary work activities would allow for the detailed documentation and mitigation against additional subsidence in the immediate area of the newly placed SWM pipe. The following paragraphs provide an outline of our scope of services for the work related to the AOC.



ALW coordinated with the contractor (hired by the HOA) to provide oversight of critical steps/stages during the excavation and removal of the existing SWM piping. The Contractor began excavation and removal of the existing SWM alignment on July 8, 2024 and completed replacement and restoration activities on July 10, 2024.

During the excavation and removal process, ALW provided observation along the sidewalls and bottom of the excavation. The following paragraphs detail the significant observations and activities performed on each day.

July 8, 2024

Beginning on July 8, 2024, the Contractor began with the excavation and removal of approximately 50 percent of the overall length of SWM pipe or about 30 feet of horizontal removal. The excavation and existing pipe removal work was initiated behind the outlet structure and proceeded through the embankment to the outflow side.

Within the initial 10 to 15 feet of excavation and pipe removal on July 8, 2024, the following significant observations were made:

- The first section of 24-inch pipe behind the outlet structure included a poured-in-place concrete anti-seepage collar.
- The section of pipe between the outlet structure and anti-seep collar was resting on a thin (about two-inches thick) poured, reinforced concrete pad.
- The concrete pad was poured over top of several feet of placed boulder-sized rocks which were stacked.
- The concrete pad was poured over top of several feet of placed boulder-sized rocks which were stacked. The stacked rocks appeared to be stable but did not include finer or smaller aggregate; therefore, leaving numerous void spaces between the rocks. The poured concrete pad and underlying placed boulders appear to be part of past repair efforts.
- The concrete pad ended at about the anti-seep collar location (approximately 15-20 feet behind the outlet structure). Beyond this point, the subgrade beneath the pipe included a soil-rock mixture. The subgrade soil and rock immediately beneath the existing pipe was wet throughout this area. The next section of pipe (beyond the anti-seep collar) was obviously damaged and cracked at several locations. The damaged pipe was noted in the immediate area of underlying saturated soils.
- The concrete pad ended at about the anti-seep collar location. Beyond this point, the subgrade beneath the pipe included a soil-rock mixture. The subgrade soil and rock immediately beneath the existing pipe was wet throughout this area. The next section of pipe (beyond the anti-seep collar) was obviously damaged and cracked at several locations. The damaged pipe was noted to be in the immediate area of underlying saturated soils.



- Along the sidewall (western side), a previous “rock filter” type repair was encountered. The rock filter was noted just a few feet beneath the existing ground surface and extended beneath the pipe invert elevation. The rock filter consisted of several geotextile fabrics and various sized aggregate including some cobble and boulder sized material.

Photograph Nos. 1 through 8 (attached with this summary report) provide additional detail relative to the above-described conditions.

Based on our initial observations during the excavation and demolition activities, ALW directed the Contractor to remove the anti-seep collar and a portion of the degraded concrete pad along with soft, loose and/or wet soil materials beneath the bottom of the pipe beyond the concrete pad. The excavation of these materials also extended along the sidewalls in order to remove additional loose materials and slope back the excavation. The excavation extended about 5 feet beneath the bottom of the existing pipe elevation. At this point, the Contractor began to encounter what appeared to be stable soil conditions and some competent bedrock surfaces. The visible bedrock surfaces did not reveal any obvious openings/fractures.

In summary, the excavated and removed pipe, rock and soft/wet soils on this date appeared to encompass the majority of past repairs and the most recently observed sinkhole/subsidence. Some of the past repairs were observed to continue laterally away from the pipe location (into the sidewall) and deeper into the subsurface (beneath the remainder of the concrete pad)

Upon completion of these activities, ALW updated the HOA as to the observed conditions. In collaboration with the Contractor, it was determined that additional effort to remove the entirety of past repair work in the various horizontal and vertical dimensions would entail an extensive effort and would not be practical considering that much of the remaining past repair work was beyond any areas directing supporting the new pipe.

As such, we recommended that the excavations performed on this date be backfilled prior to continuation of the remaining 50 percent of the pipe excavation/removal. Excavations were subsequently backfilled with a flowable fill mixture of low-strength sand, cement and water. Approximately 40 cubic yards of 125-150 psi flowable fill was placed within the excavations on this date. The backfilled zone was subjected to a vibrator during placement and was terminated about 6 inches to 1 foot beneath the new pipe invert elevation. Upon completion of the flowable fill placement, the area was allowed to rest or cure before returning the site to continue work activities on July 9, 2024.

See attached Photograph Nos. 8 through 10 for additional detail/information.



July 9, 2024

Upon arrival, the flowable fill appeared stable and unyielding. No discernible areas of settlement in the flowable fill or surrounding exposed soil subgrade were noted. The contractor proceeded with excavation and removal of the remaining 30 feet or thereabout of existing pipe.

Throughout the removal and excavation process, the subgrade conditions along the bottom and sidewalls were observed and probed for any anomalies. No instability, soft/wet conditions or conditions potentially indicative of sinkholes were observed. The soils generally appeared to consist of natural silt and clay soils. Utilizing a vibratory plate attachment, the Contractor compacted the existing subgrade and sidewalls along and beneath the pipe section. In addition, the plate compactor was applied throughout the backfilled zone from the previous day.

The sidewalls were appropriately shaped and/or benched, where necessary, in preparation for the placement of new pipe.

On July 9, 2024, the Contractor placed approximately 60 feet of new 24-inch, N12 pipe (PVC) between the outlet structure and end wall. The pipe was bedded in about 6 to 12 inches of compacted modified 2A stone. Lime or stone dust was also applied over top of the aggregate. Small quantities of flowable fill were also placed along the pipe sidewall within the immediate AOC area that was excavated and backfilled on July 8, 2024. The additional flowable fill placement along the sidewalls was to provide for further reinforcement and stabilization.

The pipe placement included Mar-Mac water tight banding/seals at the joints. The slope of the new pipe was checked by the Contractor and deemed appropriate to provide adequate conveyance of stormwater from high to low elevations.

See attached Photograph Nos. 11 through 19.

July 10, 2024

On this date, the contractor backfilled the remaining portion of the excavation and pipe trench with soil backfill. Backfill placement was performed in lifts and compacted using the vibratory plate and the track-mounted excavation equipment.

After completion of the backfill activities, the disturbed area was finished using a thin layer of topsoil, seeded and stabilized.

See attached Photograph Nos. 18 through 22.



SUMMARY

The significant or key findings of the removal/replacement work performed by the Contractor on July 8 through July 10, 2024 for the areas described within this report, are as follows:

1. During the excavation and removal of the former SWM pipe alignment, multiple prior repairs were encountered. The observed repairs are considered varied in terms of their extent and composition. Based on our observations, it is difficult to discern/determine the extent of such repairs and repair objectives. It is our opinion that, at least the majority of the past repairs were undertaken in an effort to stabilize the ground surface and support the buried SWM pipe.
2. There was clear and obvious damage to the former SWM pipe. The damaged section of pipe was located in the immediate vicinity of multiple past repairs and coincided with the edge of an encountered buried concrete pad. Wet/soft conditions were noted immediately underlying the section of pipe that was damaged and along the edge of the concrete pad. It is difficult to determine what caused the damaged pipe and whether the leaking pipe was the root source for the eventual sinkholes/ground subsidence beneath and around the SWM pipe. Regardless, the leaking pipe certainly would have contributed to the ongoing weakened subsurface conditions over a period of time the eventually lead to additional failure(s).
3. Soft, wet and otherwise unstable soil and rock was removed beneath the immediate AOC to an extent that was determined to be practical for the project. Multiple past repairs (i.e. reinforced concrete and large boulders) appear to be extensive throughout this area and complete removal of these materials (to allow comprehensive observation of the natural underlying conditions) was deemed impractical and costly. The immediate area(s) underlying/supporting the new pipe construction was the focus for the improvement activities. These immediate areas underlying the new pipe were stabilized and are expected to provide adequate support to the new pipe alignment.
4. The new pipe placement included upgraded water-tight seals which will act to mitigate against future leakage at pipe joints.
5. It should be noted that the AOC and the general project site area are located within a known “Karst” setting and an area considered prone to sinkhole development. The results of the work performed can not be considered a guarantee against sinkhole development within this area in the future. Furthermore, there can be no warranty with respect to the adequacy of prior repair work (provided by others) and portions thereof that remain. The Contractor and Consultant have provided services with a standard of care and performance considered within generally-accepted industry practices and standards for this geographic setting.
6. We recommend that the HOA or designated representative perform periodic inspection of this SWM basin and similar areas throughout the development. Such inspection should also be performed immediately following intense or extreme storm events. Such observations may provide for the early detection of unusual conditions or conditions leading to eventual ground failures.



ALW GROUP, LLC *Construction Inspections · Environmental Services · Geotechnical Consulting · Subsurface Exploration*

CLOSING

We appreciate the opportunity to be of continued assistance to the HOA on this project. Should you have any questions, please feel free to contact the undersigned.

Respectfully submitted,

ALW GROUP, LLC

Scott A. Summers, PG
Managing Principal
Licensed Professional Geologist – Commonwealth of PA

Attachments: Site Photographs (1 through 22)



SITE PHOTOGRAPHS



**Photograph No. 1 – View across the SWM basin and the outlet structure at AOC.
Photograph facing north**



Outlet Structure
Is About Here



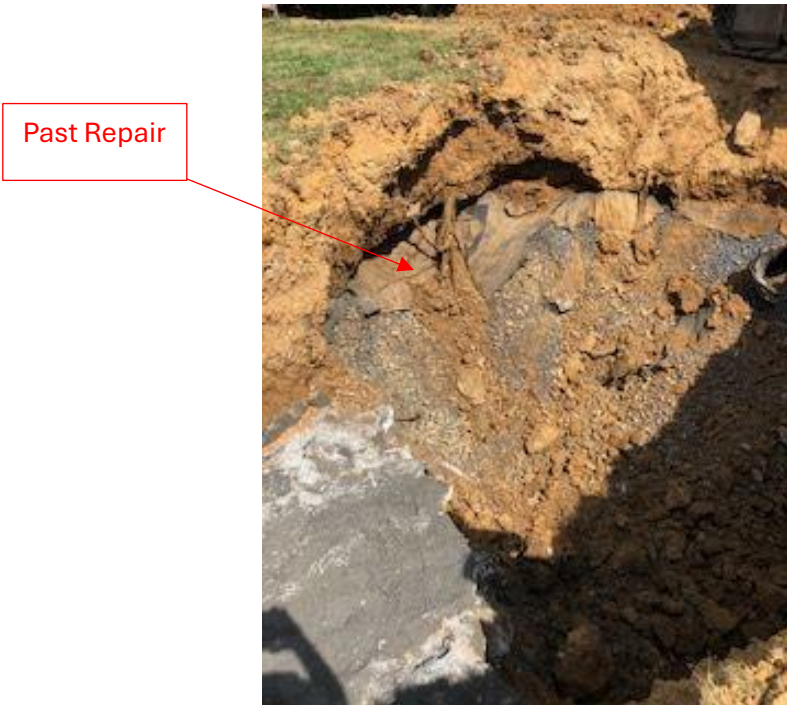
Photograph No. 2 – View of the initial excavation exposing the existing pipe and anti-seep collar. The edge of the section of the pipe sitting over the concrete pad is noted with arrow.



Leaky section of Pipe

Edge of Concrete Pad

Photograph No. 3 – Additional view of exposed pipe facing northwest. Arrow notes the section of pipe that was obviously damaged and leaking.



Past Repair

Photograph No. 4 – View of excavation after removal of pipe, anti-seep collar and portion of damaged concrete pad. Note past repair along sidewall and extending beneath pipe.



Photograph No. 5 – View behind outlet structure after pipe, anti-seep collar and portion of pad was removed. Note the void space and large rock beneath the edge of the concrete pad.



Photograph No. 6 – View of excavation as cleanup of soft/wet subgrade continued.



Stacked Rock Boulders
Beneath Pad

Past Repairs

Apparent Top of
Bedrock Here



Photograph No. 7 – Additional view behind outlet structure. Note stacked rocks beneath past concrete pad repair and separate past sidewall repair (rock filter).



Photograph No. 8 – Additional view of first section of pipe removal and excavation of past repair and AOC areas. The area designated with RED represents a approximate picture of the area to be backfilled using low-strength cement flowable fill.



Photograph No. 9 – View of Photograph No. 8 area after backfilling with flowable fill.



Photograph No. 10 – Additional view of flowable fill on July 8, 2024, facing north.



Photograph No. 11 – Photograph on July 9, 2024 after flowable fill placement of July 8, 2024



Photograph No. 12 – View of flowable fill along eastern sidewall, facing south



Photograph No. 13 – Flowable fill placement along western sidewall and past repair area, facing southwest.



Photograph No. 14 – View of evidence of past repairs and materials used, along sidewall



Photograph No. 15 – Remaining alignment after completion of existing pipe removal and subgrade preparation on July 9, 2024. Photo facing end wall.



Photograph No. 16 – Contractor compacting subgrade



Photograph No. 17 – New 24-inch pipe after placement



Photograph No. 18 – Additional flowable fill and backfilling placement around new pipe



Photograph No. 19 – Grading/backfill activities near the outlet structure



Photograph No. 20 – Completed backfilling/restoration at end wall on July 10, 2024



Photograph No. 21 – View of restoration across top of berm, facing west



Photograph No. 22 – View from basin of restoration of ground surface facing north