October 24, 2024

Dr. David Wicks & Joe Wolek
Payne Hollow on the Ohio

Subject: **Engineering Recommendations for Payne Hollow on the Ohio**

Rev. 001 **– Per email correspondence with Payne Hollow on the Ohio**

Dear Dr. Wicks & Mr. Wolek,

On October 9, 2024, The Kentucky Steward LLC mobilized to Payne Hollow to visit with its new proactive stewards David and Joe. During the visit, several areas of the property were shown in various conditions most of which involve groundwater issues which has caused and continue to cause soil erosion, soil instability, structural settlement, etc.

It should first be said The Kentucky Steward is aware of the value and prestige of Payne Hollow and considers the property and its structures hallowed ground. Thus, maintaining its character in ways that perhaps Harlan and Anna Hubbard would approve reflects proper stewardship. An act that directly aligns with The Kentucky Steward's mission.

The following encapsulate The Kentucky Steward's engineering recommendations that may be executed in part or in likeness to remedy these prominent issues:

Section 1. Regarding groundwater issues upslope of Harlan Hubbard's Workshop/Studio:

1. **Diverting Groundwater and Surface Runoff**
    a. Surface Swale: Create a small surface drainage swale upslope from the structure to intercept and divert surface runoff. Ensure the swale is graded properly (i.e. ~1-2% slope) to carry water away from the building (studio) and direct it to a safer discharge location (e.g. a natural drainage basin or well-vegetated area). Note: The assumed, or rather, most applicable drainage location is the existing drainage feature discussed in the Section 2 below. ***Rev. 001 – Payne Hollow on the Ohio indicated they will likely pursue Section 1 - 1b/2.***

    b. Subsurface drainage (interceptor drain): Install an interceptor drain along the upslope side of the building, designed to catch groundwater flow. This can be done by trenching down to the water-bearing layer (typically 1-2-ft, but water-bearing layer depth will dictate) and installing perforated pipe (~4-in dia.) wrapped in geotextile filter fabric, backfilled with gravel. The collected groundwater will be diverted downslope away from the building (studio). Note: After heavy or prolonged wet-weather events, remember to regularly check the integrity of the installed system and remedy any defects observed.

        i. Regarding backfill: use clean, well-graded gravel or crushed stone with a size range of ¾" to 1-1/2" for proper drainage. Avoid using fine or silty materials that can clog the system.

ii. With regard to pipe inspection, the following notes may apply:

1. **Visual Inspection**:
    a. Surface Drainage: Inspect the ground surface above and around the interceptor drain for any signs of erosion, pooling, or vegetation die-off, which may indicate clogging or overflow issues.
    b. Drain Line Visibility: Look for exposed sections of the drain, such as damaged geomembrane or pipes, which could signal wear or damage.
    c. Vegetation Growth: If vegetation has overgrown the interceptor drain, clear away roots and debris that may block water flow.
2. **Drain Performance Testing**:
    a. Flood Test: Simulate a rain event by running water into the drain via a hose to ensure water flows freely to the outlet. Observe the flow rate at the outlet to verify it matches expectations for the system.
    b. Check for Leaks: While water flows through the system, monitor for seepage along the drain line that might indicate damage or clogging in sections.
3. **Sediment and Debris Removal**:
    a. Check Inlet for Clogs: Remove accumulated sediment, leaves, or small stones from the drain inlet and any associated catch basins or screens.
    b. Inspect Gravel Layer: Over time, gravel around the drain line may compact or accumulate fine particles that restrict water flow. Check and, if necessary, add or replace gravel to maintain effective drainage.
4. **Pipe and Geotextile Condition**:
    a. Pipe Inspection: Examine accessible drainpipe sections for cracks, dislodged sections, or blockage. Clear any sediment or roots inside the pipe, which may impede flow.
    b. Geomembrane/Geotextile Integrity: Check for tears, holes, or exposed sections of the geotextile fabric. Replace any damaged material to keep the drain line stable and minimize soil infiltration.
5. **Outlet and Discharge Point**:
    a. Observe Outlet Flow: During a rain event or a flood test, confirm water exits the drain outlet without backflow or pooling. This ensures the drainage gradient is working as designed.
    b. Erosion Control: The outlet area may need added stabilization measures, such as rock or additional vegetation, to handle water force and prevent erosion downstream.
6. **Scheduled Routine Maintenance**:
    a. Biannual Inspections: To stay ahead of potential problems, conduct inspections and maintenance at least twice a year, especially after the rainy season or any heavy storms.
    b. Document Changes: Keep a log of each inspection and note any changes or repairs, which will help track the drain's long-term performance and identify recurring issues.

c. Gutter system: It was observed that a gutter run was recently installed on the studio roof. Maintaining the integrity of this gutter during Fall and wet-weather months is critical. Considering it is beneath small-to-large tree canopies, it will likely fill with debris.

2. French Drain Installation

a. Trench Design: Excavate a trench around the perimeter of the back wall where water is pooling. The trench should be at least 18-24 inches wide and deep enough to go at least ~6-inches below the foundation to ensure proper drainage.

i. Materials:

1. Perforated pipe: Use perforated pipe (~4-in dia. PVC or corrugated HDPE) with slotted openings, placed at the bottom of the trench.

2. Gravel Fill: Surround the pipe with washed gravel (~3/4" to 1-1/2"), creating a thick layer that promotes drainage. Place gravel at least 6-inches below perforated pipe for solid drainage, then fill the trench up to 6-inch below the surface with additional gravel. Note: Angular stone locks together better than rounded gravel, providing better drainage and preventing gravel movement.

3. Geotextile/Geomembrane: Line the trench with a non-woven geotextile fabric, typically rated around 4-6oz/yd^2, before placing the pipe and gravel. The fabric should fully encase the gravel and pipe, allowing water to pass while filtering out soil particles. Namely, the fabric will prevent soil particles from clogging the drain system while allowing water to pass through.

a. If considering using a geomembrane: For areas of waterproofing (i.e. around exterior of masonry foundation wall), use a 20-30 mil HDPE geomembrane. For general moisture barriers, a thinner 10-15 mil material is usually sufficient.

4. Outlet for drainage: The French drain must have a safe discharge point. Extend the pipe to a lower area where the water can naturally exit, such as a dry well or nearby drainage feature (i.e. in this instance, the drainage feature at hand may either be the one discussed below that runs below the studio or the smaller one that maintains drainage to the right of the primary drainage feature (when looking up at the studio)).

a. Note: Ensure the perforated pipe is installed with at least a 1% slope (~1/4in per 1-lineal foot) to allow water to flow properly through the system toward the outlet.

3. Masonry Wall Stabilization:

a. I believe you have already "jacked" the first floor of the studio and successfully reset the masonry wall. I am glad you were able to do so in a safe, effective manner. Please do contact me should the masonry wall have issues that resurface.

b. As discussed during the visit, I hope that you were able to effectively waterproof the upslope side of the masonry wall.

Section 2. Regarding groundwater issues downslope of Harlan Hubbard's Workshop/Studio:

To maintain the rustic, homesteader aesthetic while addressing the drainage issue, you can integrate natural materials and time-tested methods that blend into the environment. Below are some recommendations to stabilizing the eroded drainage feature:

1. Clear and Prepare the Drainage Feature

- **Debris Removal**: Clear any debris, vegetation, and loose soil from the drainage feature to expose the natural contours.
    - **Tools**: Use hand tools like a mattock or spade for more control and to prevent over-digging. This maintains the natural form of the channel.
- **Shape the Channel**: If needed, regrade the slopes of the drainage feature to create a consistent, gently sloping V-shaped channel that mimics natural water flow. The slope should be no steeper than **2:1** (horizontal) to reduce further erosion.

2. Install Natural-Looking Stabilization Materials

Gravel Base Layer (Natural Blend of Stone)

- **Gravel Type**: Select natural river stone or fieldstone, ranging from 2-4 inches in diameter. Avoid modern, uniformly cut gravel; instead, use rounded, naturally colored stone (gray, brown, or buff) that fits the local landscape. This maintains an organic, aged look. Specifically, I would consider it to be of Harlan's approach to utilize existing nearby creek rock (perhaps within the area surrounding the oxbows near the Hubbard's spring). Hauling medium-to-large rocks and breaking them with a rock hammer would be resourceful. Obviously, if this approach is performed, be careful to avoid destabilizing and thus adversely reshaping the creek where the rock is sourced.
- **Depth of Gravel**: Spread a layer of 4-6 inches of gravel along the base of the drainage channel. The gravel should extend to the side slopes of the channel to aid water conveyance and soil stabilization.
- **Gravel Placement**: Start placing gravel from the bottom of the channel and work upward, ensuring even distribution. For an organic look, allow some variability in stone sizes, so the appearance feels more natural and less engineered.

Geotextile Fabric

- **Type**: Use a **non-woven geotextile** fabric that is permeable but durable, ideally around 6-8 oz/square yard. This will allow water to filter through while preventing soil migration into the gravel layer.
- **Placement**: Line the bottom of the drainage feature with the fabric, making sure it extends up the sides to about 1-2 feet above the high-water mark of the channel. This fabric should be placed underneath the gravel to reinforce the soil while allowing water to percolate.
- **Overlap**: Ensure there is an overlap of at least 12-18 inches between fabric sections to maintain full coverage and prevent any gaps where soil might infiltrate.
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3. Natural-Looking Erosion Control

Log or Timber Check Dams

To slow water flow and reduce the erosive force, you can install small check dams using natural materials like **logs** or **timber** that blend into the landscape.

- **Material**: Use **6-8 inch diameter logs** cut from naturally fallen trees or reclaimed timber that has an aged, rustic look. Avoid freshly cut wood to prevent an overly "new" appearance.
- **Installation**: Space the logs at **10-12 feet intervals** down the drainage channel, perpendicular to the flow. The logs should be partially buried (about **⅓ of their diameter**) into the side slopes to secure them. Stack additional logs or stones behind the primary log to increase stability.
- **Height**: The check dams should rise **6-12 inches** above the current channel bottom to slow water flow while maintaining the rustic aesthetic.

Stone Riprap (Natural Rock)

If check dams are not suitable for the entire length of the channel, consider placing riprap in targeted areas where water flow is strongest, such as at the mouth of the drainage feature and where it discharges.

- **Rock Size**: Use larger stones, 6-12 inches in diameter, preferably locally sourced from nearby creeks (that maintain abundant stone rather than areas of creek bed with minimal stone coverage) to match the environment. These should be laid out in a natural, non-uniform manner to maintain the rustic look.
- **Placement**: Riprap should be placed only in areas where high-velocity water is likely to cause further erosion. Allow the stones to follow the natural curve of the drainage feature rather than lining the entire length, which would look too modern.

4. Revegetation with Native Plants

Plant Selection

To further stabilize the drainage feature and blend it into the surrounding environment, choose native grasses, sedges, and wildflowers that thrive in moisture-rich soils.

- **Grasses/Sedges**: Plant moisture-loving, native species along the upper edges of the channel. Some species you may consider include the following:
  - **Riverbank Wild Rye (Elymus riparius)** – This cool-season grass thrives in riparian zones and can help stabilize slopes due to its deep roots. It's ideal for handling runoff along the riverbank and in your drainage feature.
  - **Switchgrass (Panicum virgatum)** – A resilient, deep-rooted grass that can stabilize soil effectively, switchgrass is native to Kentucky and suitable for areas with high water flow.
  - **Eastern Red Columbine (Aquilegia canadensis)** – A native perennial that adds both aesthetic appeal and erosion control, it works well in rocky or shaded areas.
  - **Wild Bergamot (Monarda fistulosa)** – This perennial is excellent for promoting pollinator activity while providing soil coverage. It grows well in moderately moist soils, making it ideal for the drainage area once erosion is controlled.
  - **New England Aster (Symphyotrichum novae-angliae)** – A native flowering plant that thrives in moist soils, providing vibrant blooms and stabilizing erosion-prone areas with its extensive root systems.

- **Smooth Sumac (Rhus glabra)** – As a shrub, it helps with slope stabilization and offers a more rustic, natural appearance that blends into the surrounding landscape.
- **OR, Wildflowers**: Incorporate low-growing wildflowers like goldenrod or wild bergamot to provide color and a natural meadow look. Avoid planting directly in the channel, but use them to stabilize the side slopes.

Each of these plants is native to Kentucky and will help stabilize soil without being invasive. Additionally, they promote pollinator activity and maintain the natural, rustic aesthetic that is important for this location. Some of these species have deep root systems that stabilize soil, and all of the choices provide an aesthetically pleasing, natural look.

Planting Layout

- **Spacing**: Space plants 12-18 inches apart for grasses and sedges, and slightly closer for wildflowers (8-12 inches apart).
- **Timing**: Plant during the fall or early spring when water availability is higher, and plants have time to establish before the driest periods.

5. Maintenance and Final Touches

- **Regular Monitoring**: Periodically check the drainage feature for any signs of new erosion or debris buildup, especially after heavy rainfall. Clear away any blockages to maintain flow.
- **Natural Aesthetic**: Leave some natural debris like branches or fallen leaves around the edges to enhance the rustic, homesteader aesthetic without compromising the functionality of the drainage system.

By combining natural materials and methods, you can stabilize the drainage feature while maintaining the historical and rustic charm of Payne Hollow. This approach ensures the structure fits seamlessly into the environment, respecting the environmentally resourceful and stewardly character of the Hubbard's Payne Hollow.

Summary

The engineering recommendations posited herein, I hope, are of use to you and your initiative. Certainly, there is a plethora of other sustainable, environmentally conscious engineering opportunities to pursue in the months/years to come. I have discussed the possibility of a hand-drilled well at Payne Hollow to supplement the natural spring as a viable, reliable water source that would be proximal to the two primary existing Payne Hollow structures. If you are interested in engineering notes regarding a well, please let me know. As The Kentucky Steward LLC promotes the ethical stewardship of Kentucky's environment and culture, and considering your exploits thus far and aspirations of Payne Hollow in the years to come, I can think of no greater ally in this wonderful state.

Thank you,

R. M. True, Managing Director – The Kentucky Steward LLC. | www.thekentuckysteward.com