MEMO

To:	City of Lake Quivira Attn: Angela Gupta 10 Crescent Boulevard Lake Quivira, KS 66217
From:	Brent Johnson, PE Brian Fairchild, PE, CFM Ethan Price, EIT
RE:	5535 Renner Road Sediment Analysis & Field Walkthrough
Date:	May 15, 2023
Project #:	023-00917
Phase:	200
Task:	001

Intro

Olsson performed a desktop analysis and field walkthrough of the recently acquired property located at 5535 Renner Road to assess the potential contribution of sediment from this area to Lake Quivira. The field walkthrough consisted of identifying signs of significant stream erosion such as streambanks with bare vegetations, head cuts (large elevation drops in the stream bottom), areas along the overbank of bare vegetation, etc. The desktop analysis consisted of comparing Light Detention and Ranging (lidar) elevation data obtained from Johnson County from the years 2012 and 2020. The elevation data was compared by analyzing the difference between 2020 lidar surface from the 2012 lidar surface and determining areas that have increased or decreased in elevation along the stream or in the immediate surrounding areas within that time period.

Background

The property at 5535 Renner Road is a 39.2-acre parcel located north of Johnson Drive on the east side of Renner Road. The parcel itself has remained undeveloped, despite the development of surrounding properties throughout the years. The watershed that flows through the parcel from the south and east has remained relatively unchanged for the past 20 years, with only a few additional houses being built around 2004 to the east. The soil types are predominantly silts, clays, and loams, falling into the hydrologic soil group D. As a result, soils in the area are prone to generate a relatively high amount of runoff in response to rainfall. The parcel is heavily vegetated with trees, shrubs, and other plants.

Field Walkthrough & Desktop Analysis

Olsson assembled a photo log and location map which identifies areas of moderate to significant stream erosion, as noted during the field walkthrough performed on April 18, 2023. A photo log and location map are included with this memo, which is referenced in the following description.

Signs of streambank erosion were present intermittently within the property. In general, the severity of stream bank erosion seems to increase the further you go downstream, as illustrated by photos 3, 7, 11, and 17. These photos show exposed roots and non-vegetated banks, which is typically a sign that erosion has occurred from development of the area upstream. The most significant impacted stream bank is shown in photo location 17, where the approximately 20-foot-tall streambank has exposed roots throughout. At the south end of the parcel, the outlet for the detention basin to the south shows a significant drop in elevation or head cut (photo location 4). A head cut is when erosion occurs at the bottom of the stream and appears as a sudden drop or “step” in the channel bottom. These features are a sign of instability and typically move from downstream to upstream until they hit a non-erodible surface (such as a rock ledge or roadway culvert) that stops their progression.

The desktop analysis compared the 2020 lidar surface with the 2012 lidar surface, which identifies areas that have changed in elevation over the past 8 years. This is useful since it identifies more recent erosion, which is a better use of resources to address, since it is less likely to have reached a stable equilibrium (e.g., it is still occurring today and has not yet stabilized). This analysis identified that the most consistent erosion has occurred behind the houses west of Legler Street/Mohawk Street. This outcome is typical given the increased runoff that is often generated from rooftop drainage. Increased runoff can contribute to higher velocities and typically picks up sediment as it runs overland to a stream. Addressing erosion caused by this mechanism is more difficult to address at it sources due to its spatial distribution over wide areas.

Erosion was also identified along the primary stream corridor, ranging from 0.5 feet to about 6 feet. The headcut identified at photo location 4 was corroborated with the desktop analysis, which indicates that this headcut has been worsening over the past 8 years. Additionally, the scour/erosion identified at photo locations 13, 14, and 16 were also identified in the desktop analysis. These could potentially be good locations to consider sediment mitigation measures, such as streambank stabilization or grade control structures, which will slow or prevent these types of erosion.

It is worth nothing that the field walkthrough identified eroded banks that approach 20 feet tall, yet the desktop analysis showed a maximum of around 6 feet in the same area. This likely because 6 feet has eroded in the past 8 years, from 2012 to 2020, and the remaining erosion occurred prior to 2012.

Conceptual Recommendations

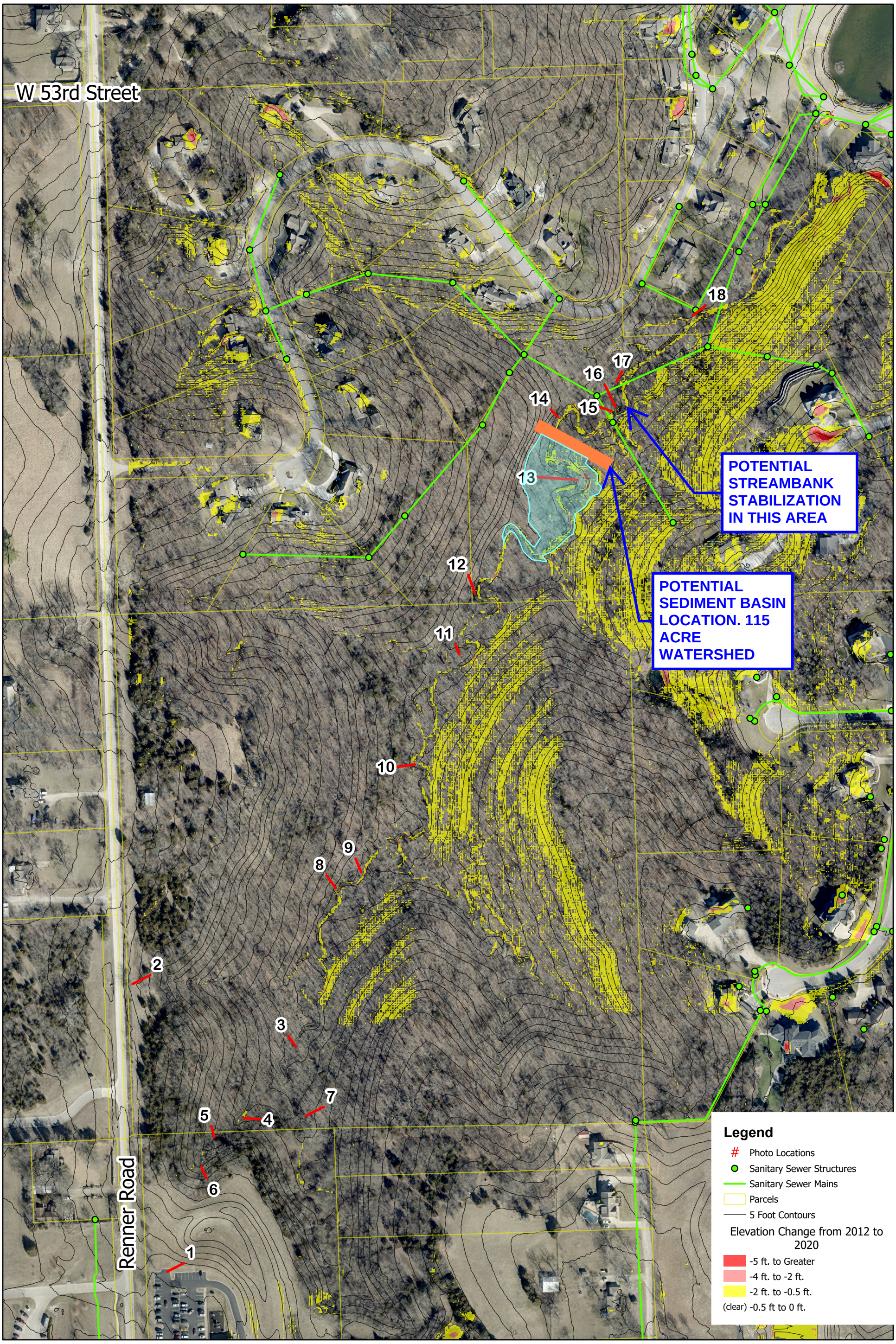
The included photo location map shows concept level recommendations that would mitigate the amount of sediment being delivered to Lake Quivira, based on the findings from the desktop analysis and field walkthrough. A temporary sediment basin behind the property at 445 Navajo Lane West Street would capture sediment from the upstream watershed and provide a short and convenient access point from Navajo Lane West Street for maintenance. Should this option be pursued, a hydrologic and hydraulic analysis would be required to ensure that the sediment basin does not increase flood risk to the surrounding properties. The size of the basin would also need to be engineered to ensure that the basin does not fill with sediment too rapidly, creating overly burdensome maintenance. Maintenance will be required to clean out the basin on a regular basis.

Streambank stabilization measures could be implemented near photo locations 13 (only if a sedimentation basin is not built), 14, and 16 to address the most severe streambank erosion that was identified in both the field walkthrough and the desktop analysis. There are generally two categories of effective streambank stabilization: hard stabilization and soft stabilization. Hard stabilization usually consists of placement of riprap to armor the bank from future erosion, and is typically more costly, but more reliable. Soft stabilization consists of mechanisms that increase vegetation or encourage the banks to “fill back in” naturally over time. This type of stabilization is usually less expensive and is typically considered more environmentally friendly, however is generally less reliable as it depends on the manipulation of natural processes, which are inherently more unpredictable.

As mentioned earlier, a grade control structure could also be installed at photo location 4, which would help prevent the loss of sediment from the stream bottom (i.e., the headcut) from worsening and moving upstream. A grade control structure for this application typically involves digging a trench and filling it with riprap immediately upstream of the existing head cut and functions by preventing the headcut from

continuing its progression upstream. However, given that the headcut erosion is relatively minor in volume compared to the streambanks, it may not be worth the cost of addressing the issue. Furthermore, it is in a different location than the previous two proposed conceptual improvements, hence a contractor would have to clear additional vegetation to reach it.

Please don't hesitate to reach out with any questions or comments regarding the findings of this memo. Olsson would be happy to schedule a follow-up meeting to discuss the next steps regarding concept level recommendations, if desired.



olsson

Lake Quivira
Erosion Analysis Site Visit
Photo Locations and Desktop Analysis

0 500 1,000 Feet

1 Inch =225 Feet

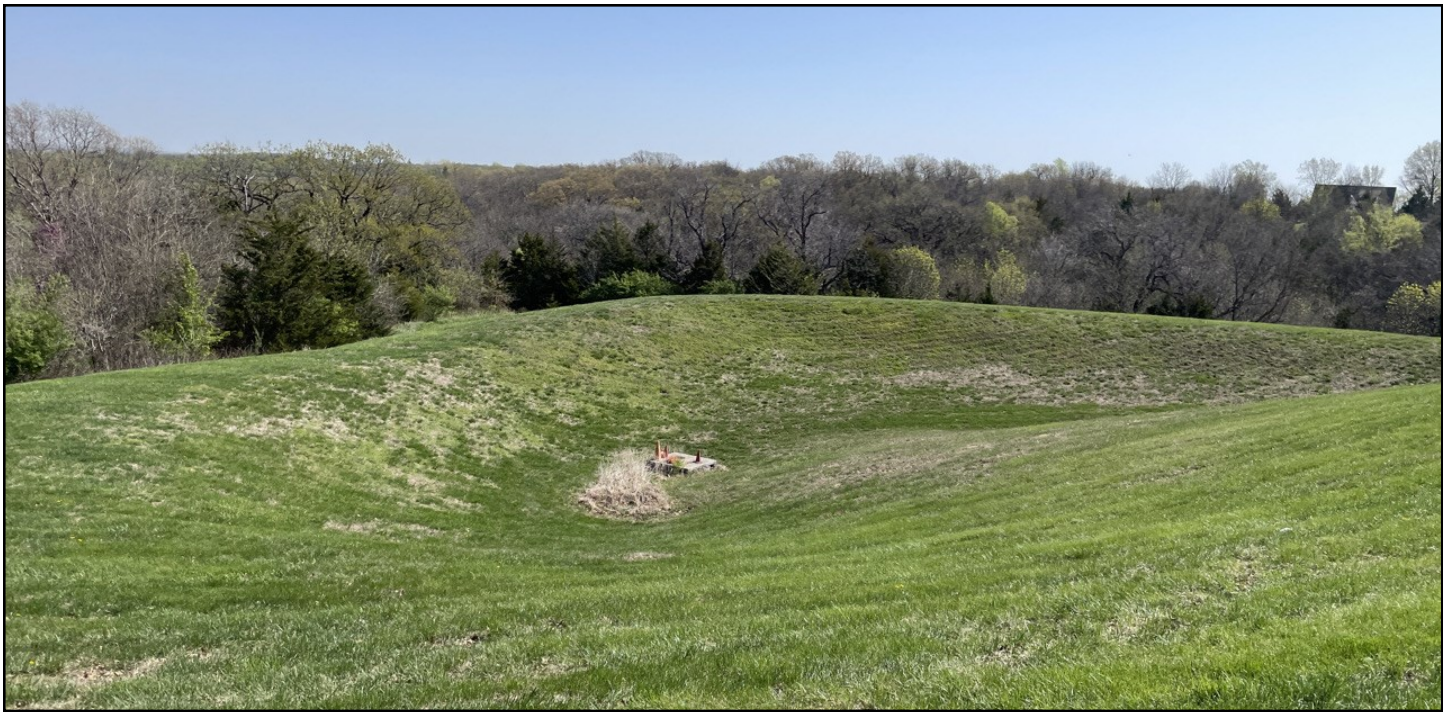


Photo No.	1	Photo Dir.	Northeast

Description: Detention basin south of the 5535 Renner Road property.

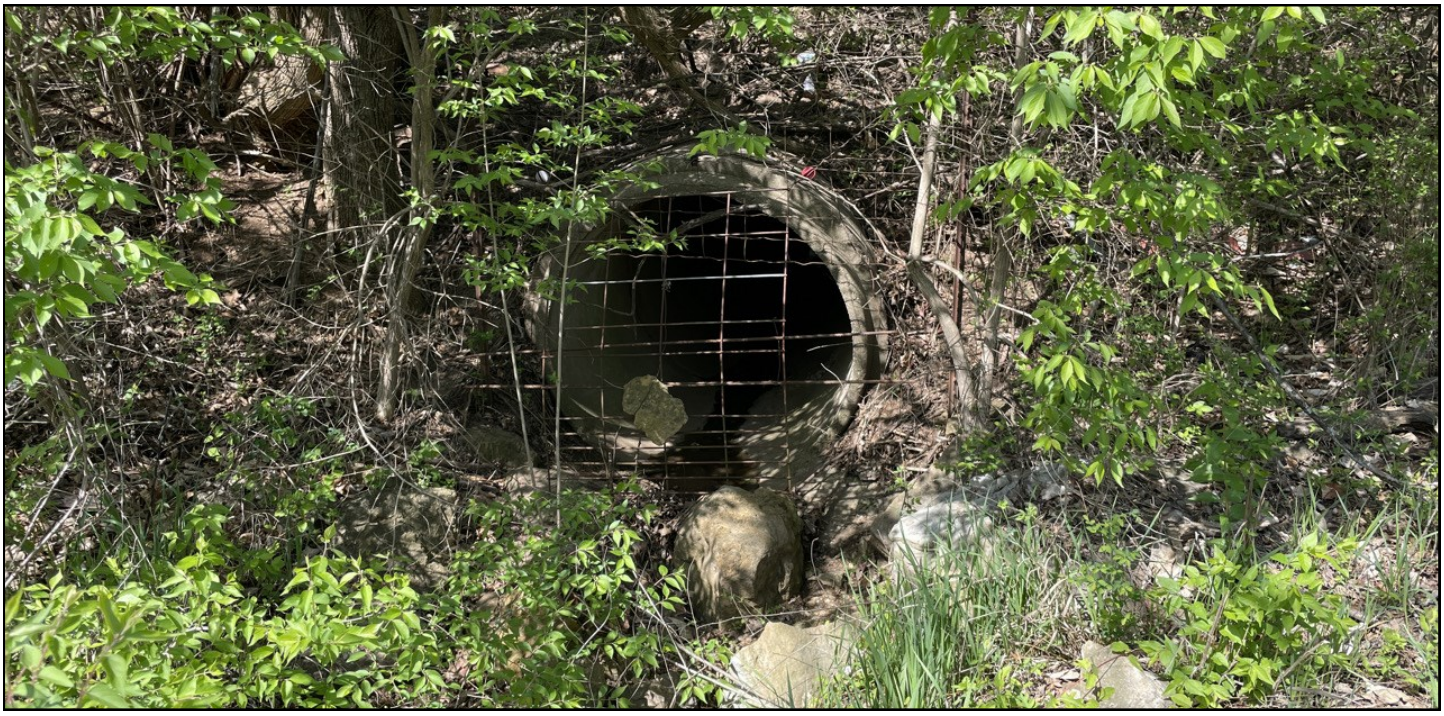


Photo No.	2	Photo Dir.	West

Description: Downstream end of storm sewer pipe under Renner road. Drains onto property.

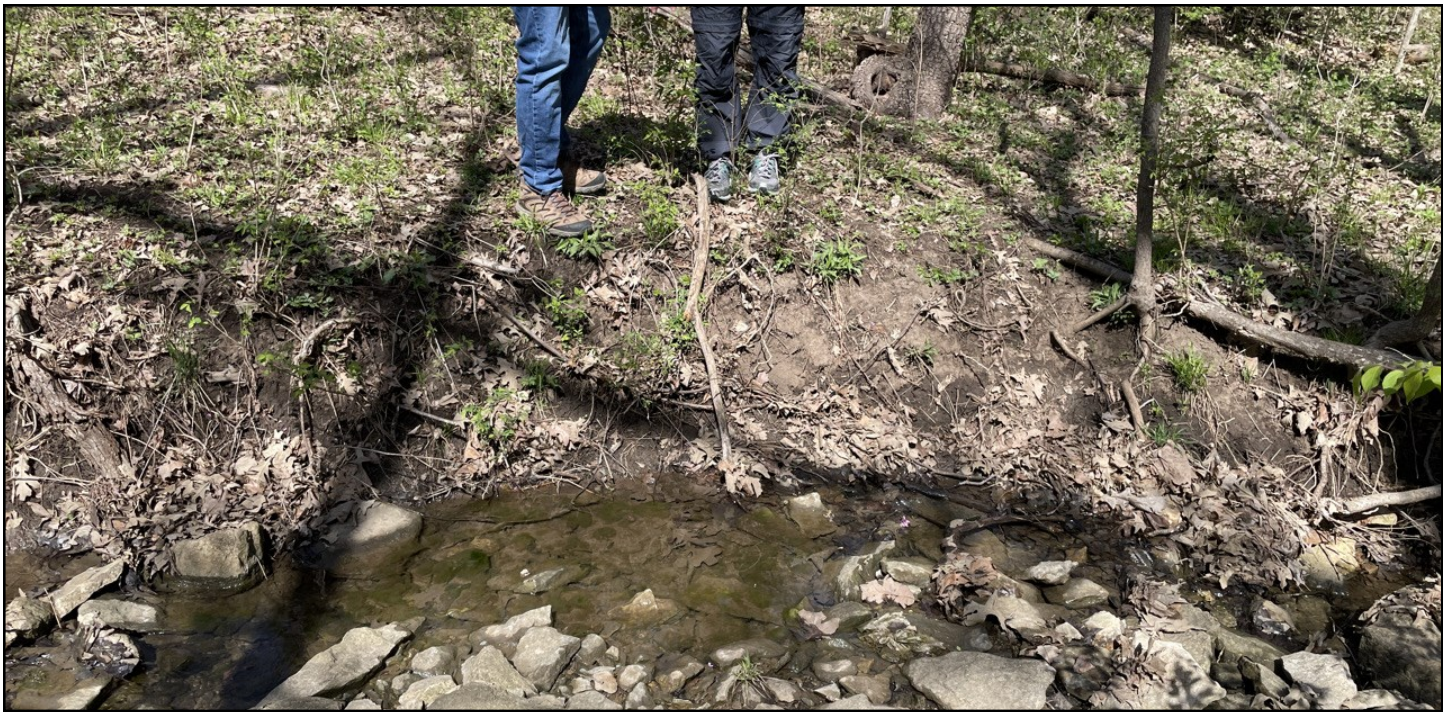


Photo No.	3	Photo Dir.	West

Description: Minor bank erosion present along west bank. Stream bank is approximately 3 feet tall.

Photo No.	4	Photo Dir.	Southwest

Description: Head cut present at upstream end of property. Tree with exposed roots and minor bank erosion present.

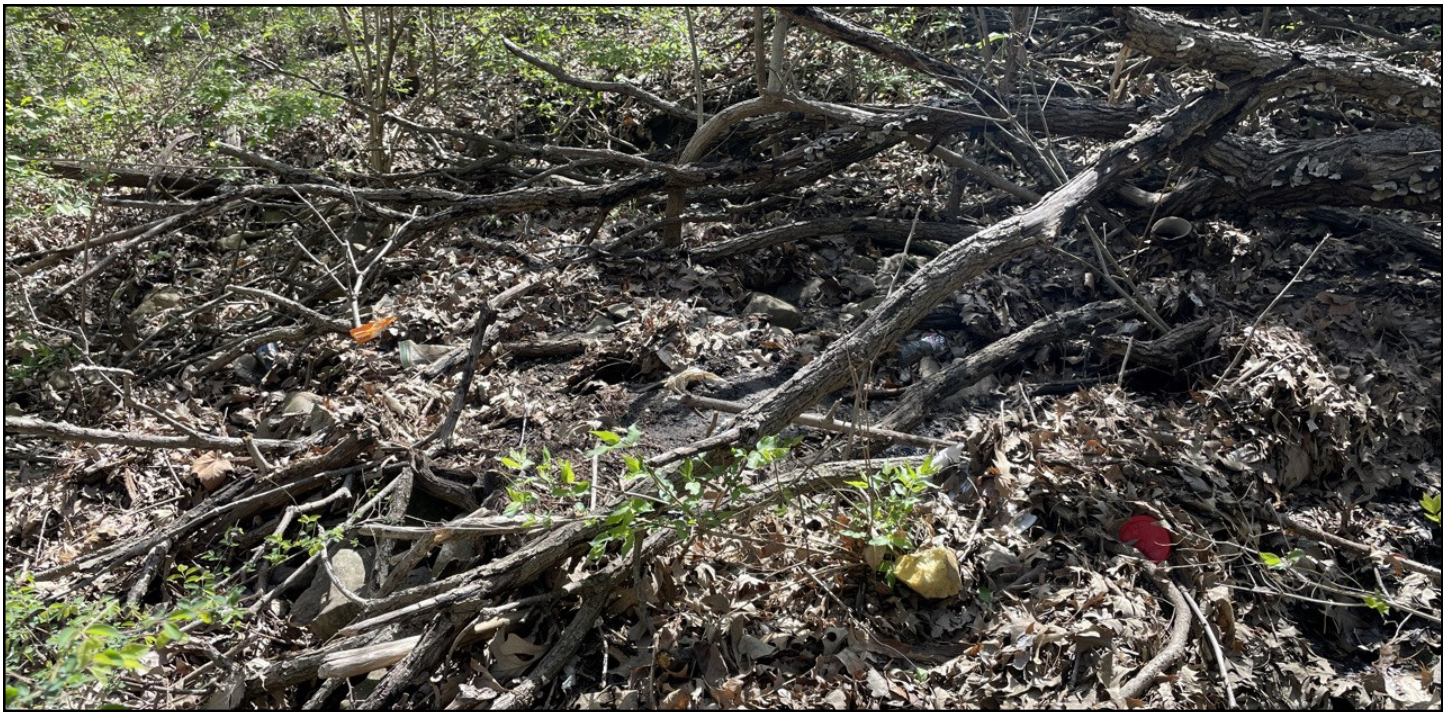


Photo No.	5	Photo Dir.	N/A

Description: 21.2 — Accumulated trash is present along the stream throughout upstream end of the property.

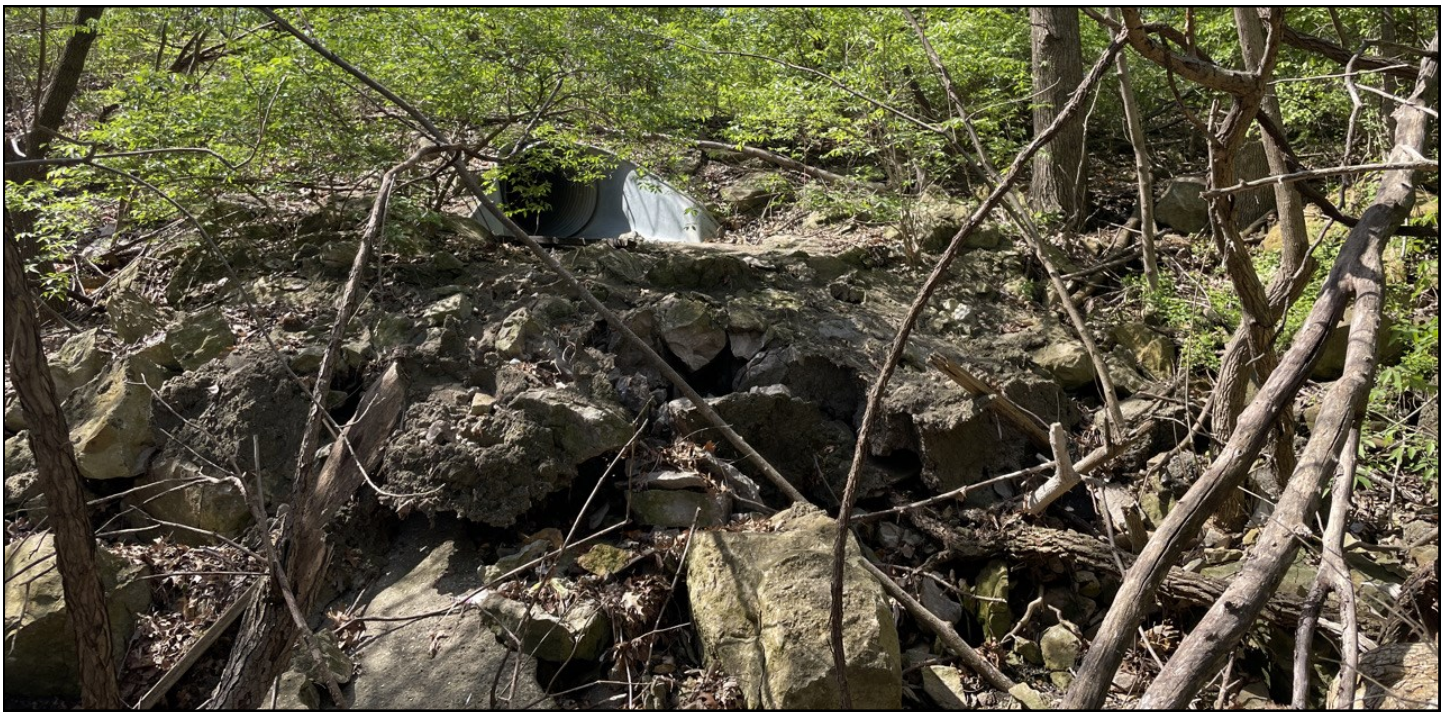


Photo No.	6	Photo Dir.	Southwest

Description: Outlet for detention basin to the south of the property. Major erosion is present around the pipe outfall and grouted riprap is starting to undercut and fail.

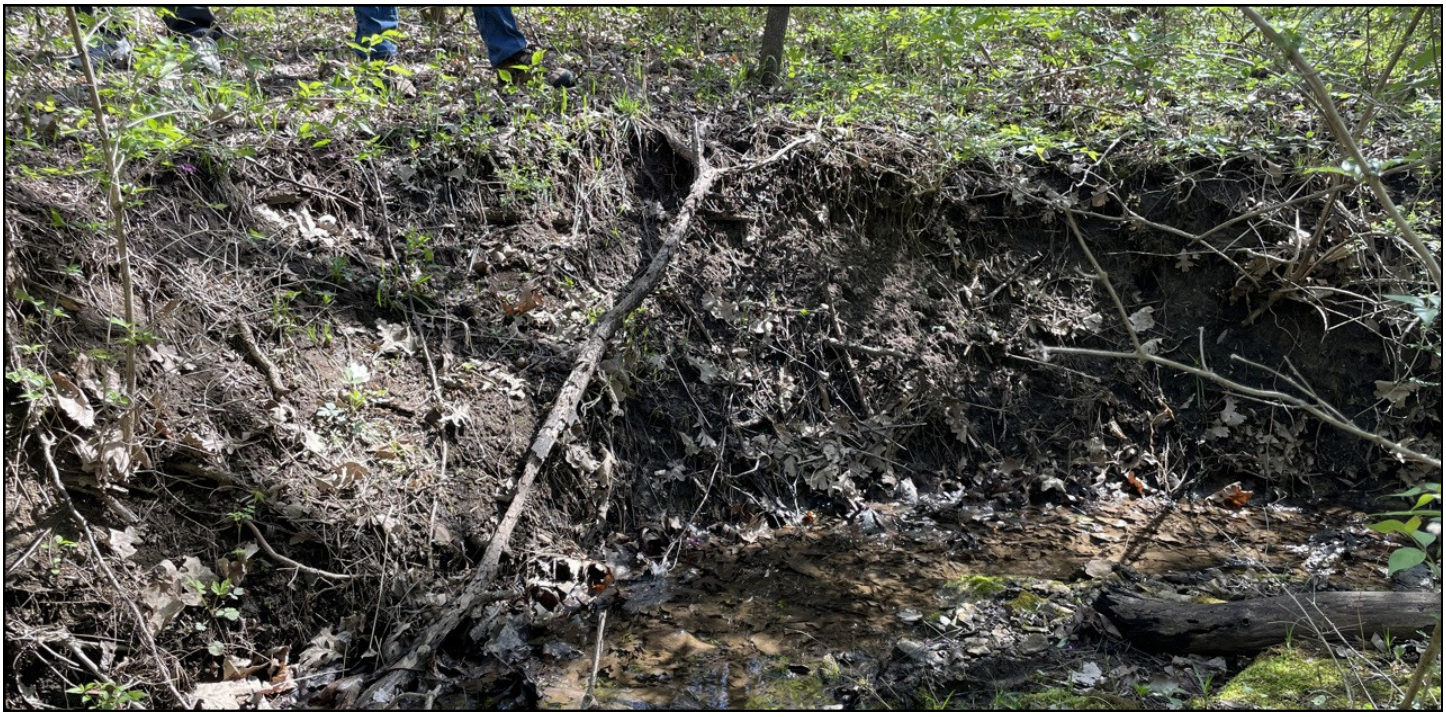


Photo No.	7	Photo Dir.	East

Description: Bank erosion present along east bank. Stream bank is approximately 4 feet tall.

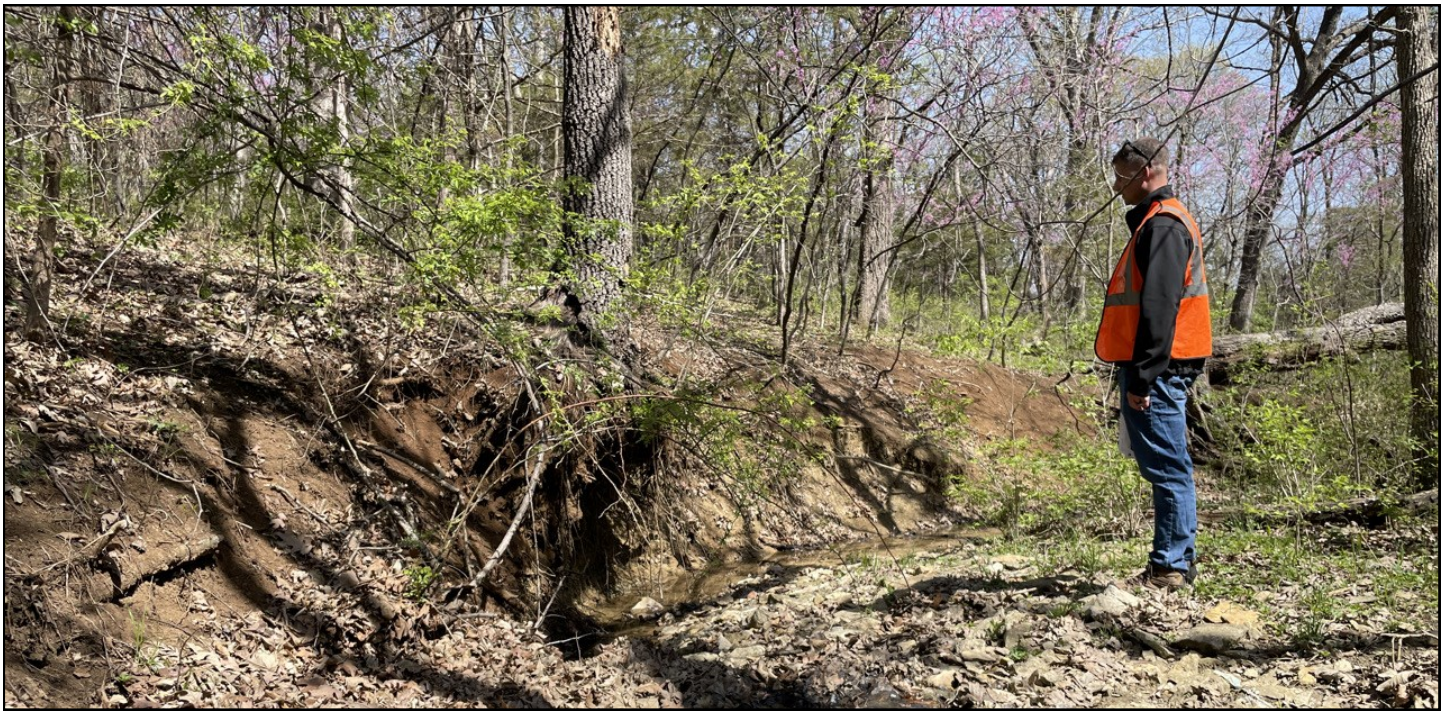


Photo No.	8	Photo Dir.	North

Description: Bank erosion present along outside bend of west bank. Exposed tree roots and loose dirt. Stream bank is approximately 4-5 feet tall.

Photo No.	9	Photo Dir.	South

Description: Bank erosion present along east bank with exposed tree roots. Stream bank is approximately 4-5 feet tall.

Photo No.	10	Photo Dir.	North

Description: Minor scour pool present with stream bank erosion along the east bank. Stream bank is approximately 3 feet tall. Stream bank erosion along west bank present approximately 25 feet downstream of pool. Bank erosion appears fairly new.

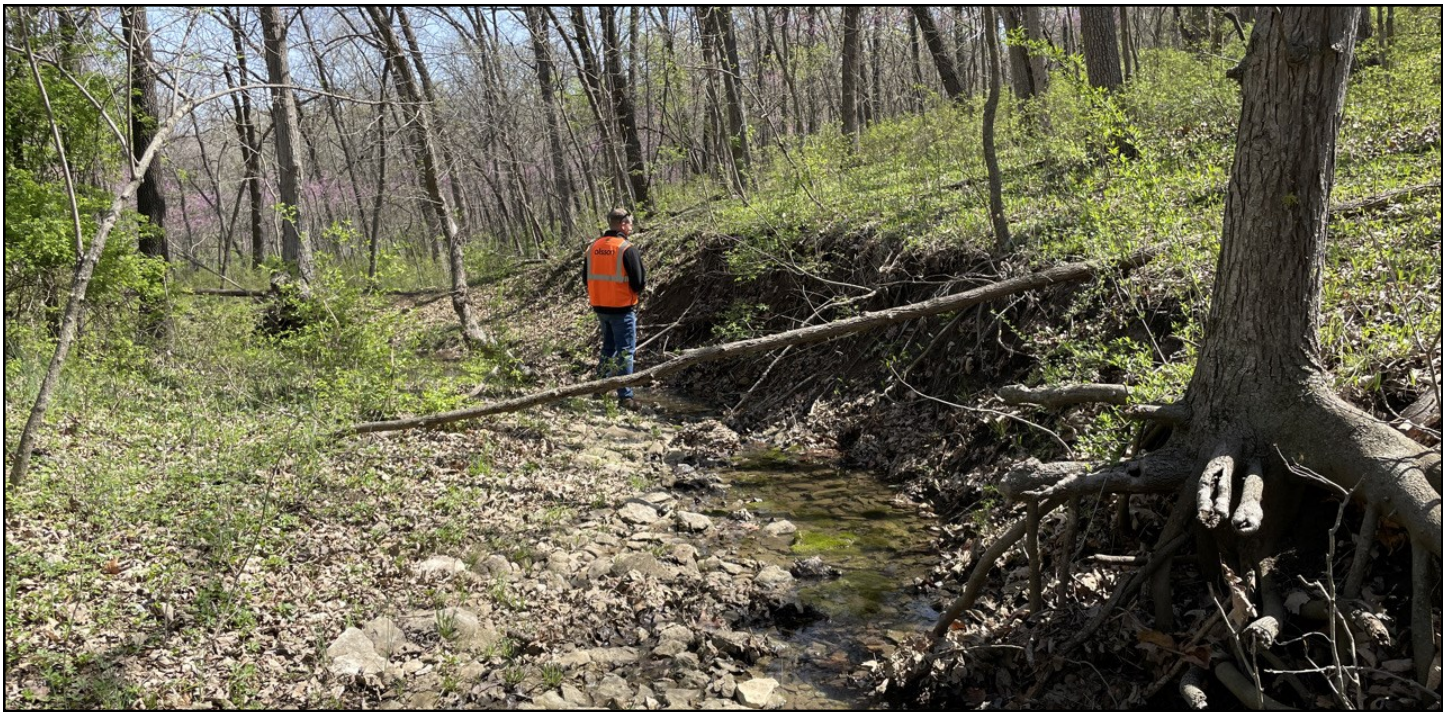


Photo No.	11	Photo Dir.	Northeast

Description: Bank erosion present along east bank with exposed tree roots. Stream bank is approximately 5 feet tall.

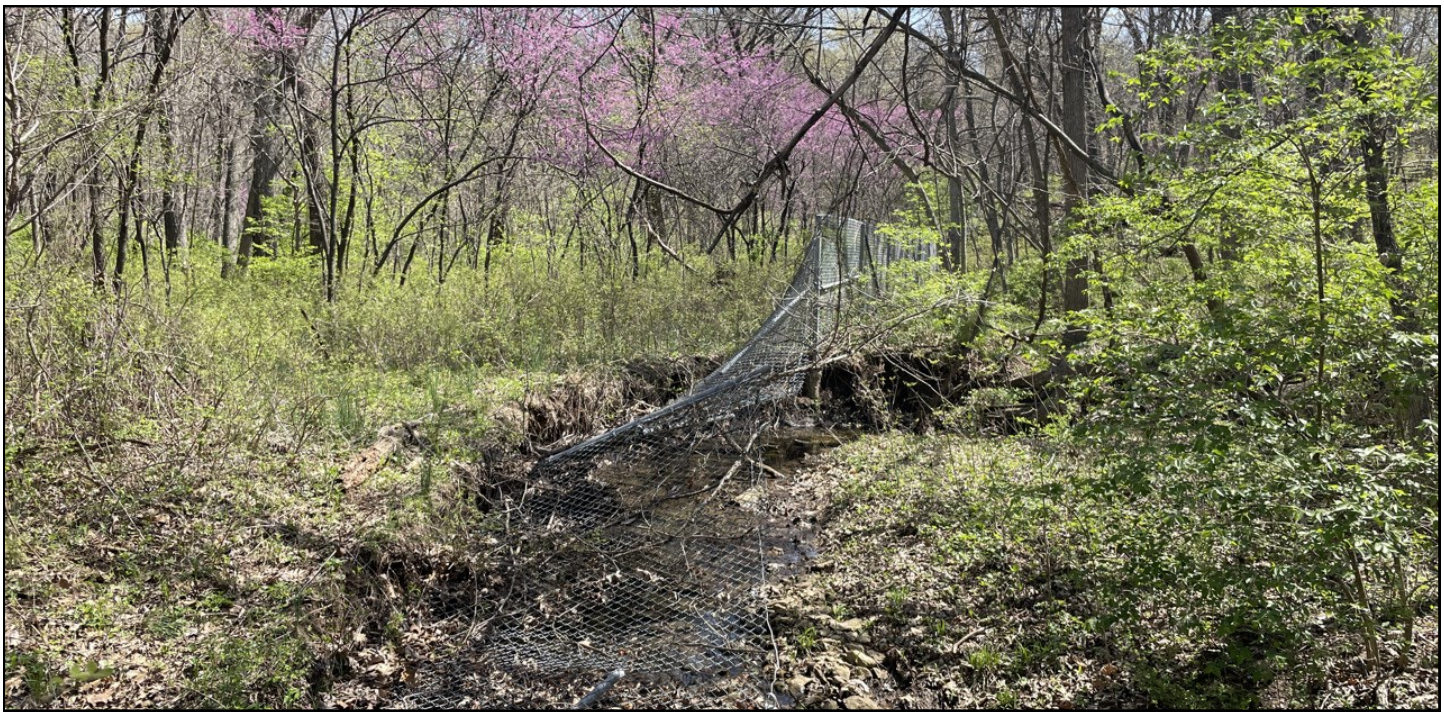


Photo No.	12	Photo Dir.	N/A

Description: Chain link fence along property line has fallen into stream due to erosion. Stream bank is approximately 2-3 feet tall.

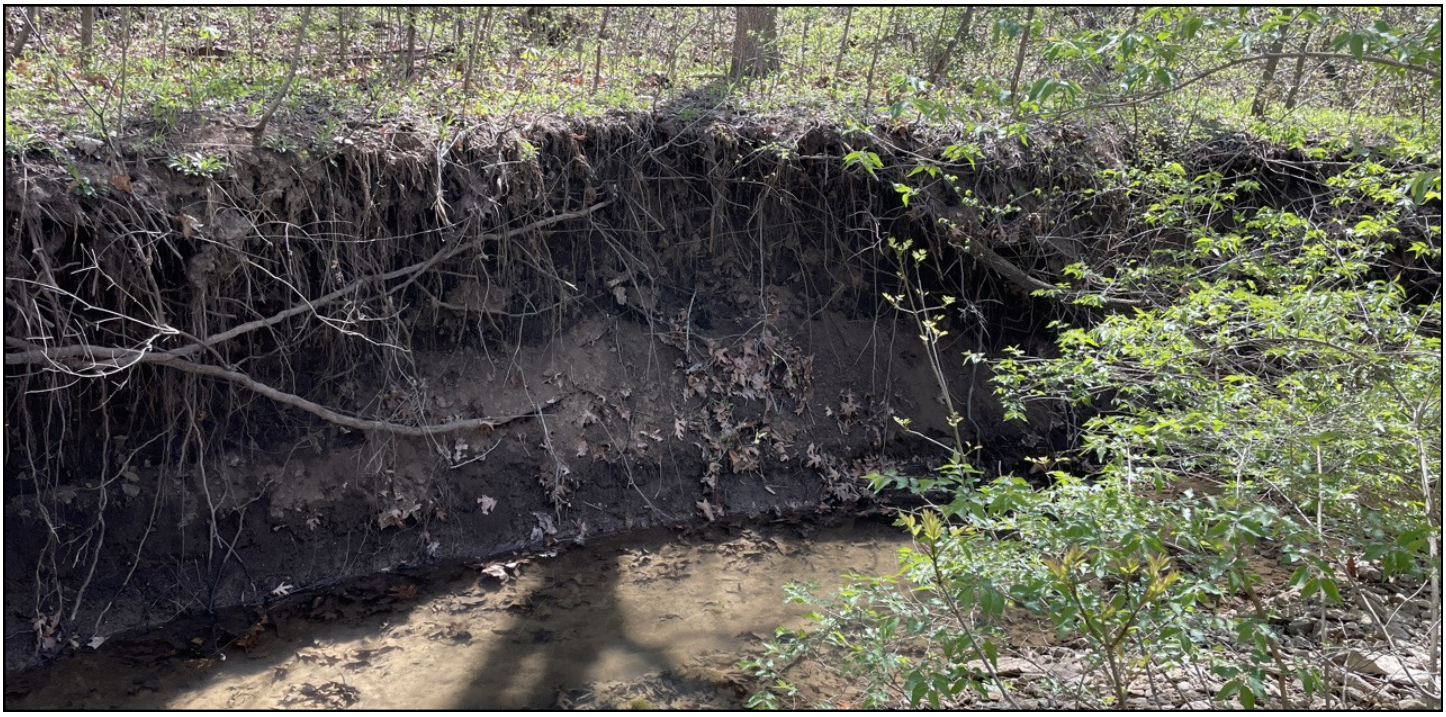


Photo No.	13	Photo Dir.	Southeast

Description: Bank erosion present along east bank with many exposed roots. Stream bank is approximately 6-7 feet tall.

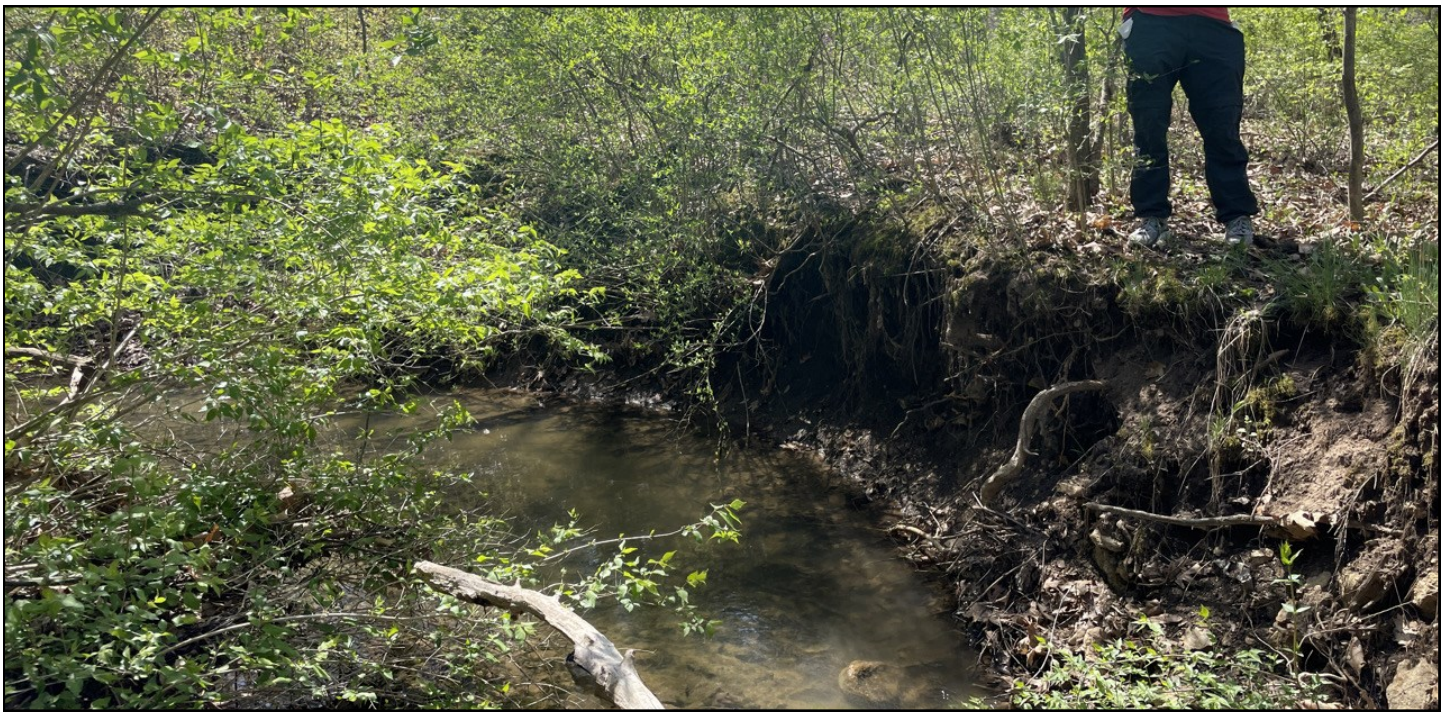


Photo No.	14	Photo Dir.	Southwest

Description: Bank erosion present along west bank with exposed roots. Stream bank is approximately 4-5 feet tall.

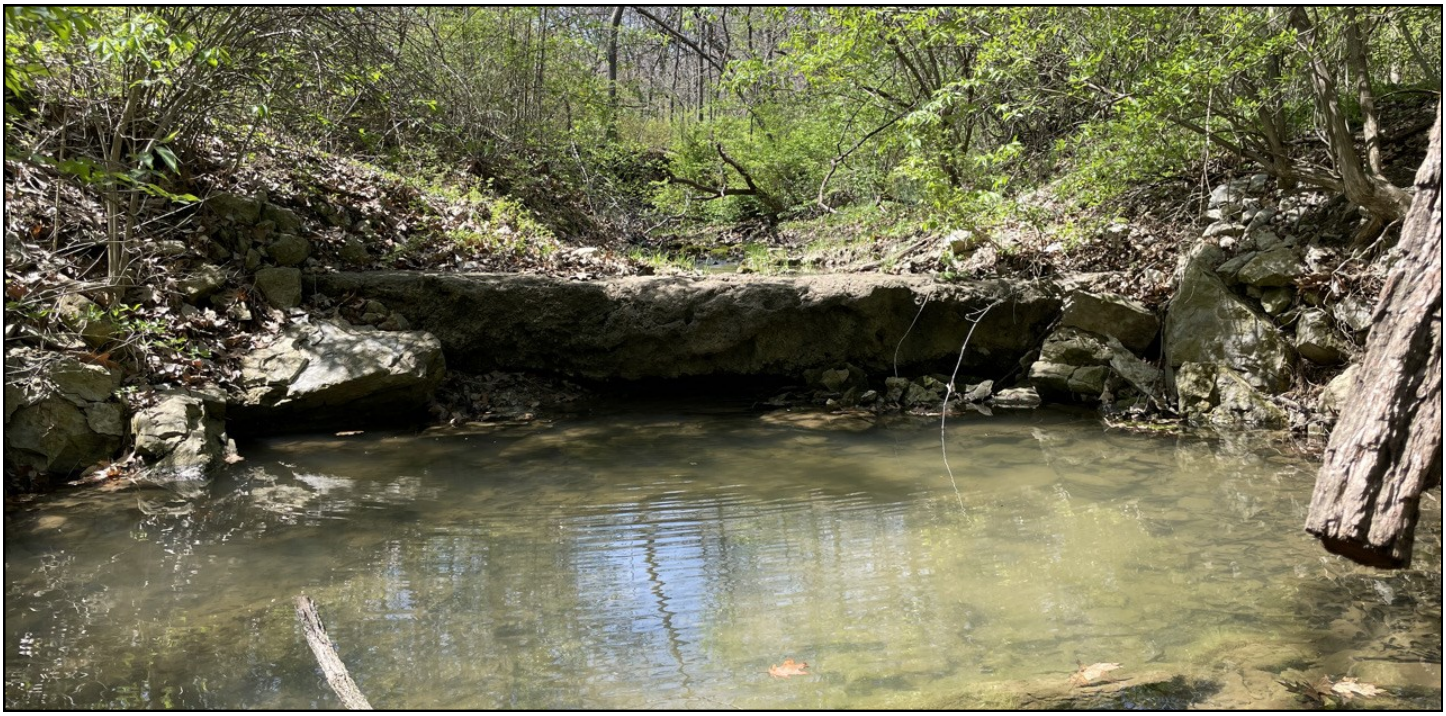


Photo No.	15	Photo Dir.	Southwest

Description: Sanitary sewer pipe encasement crossing the stream. Water is undercutting on the upstream side of the encasement and flowing downstream.

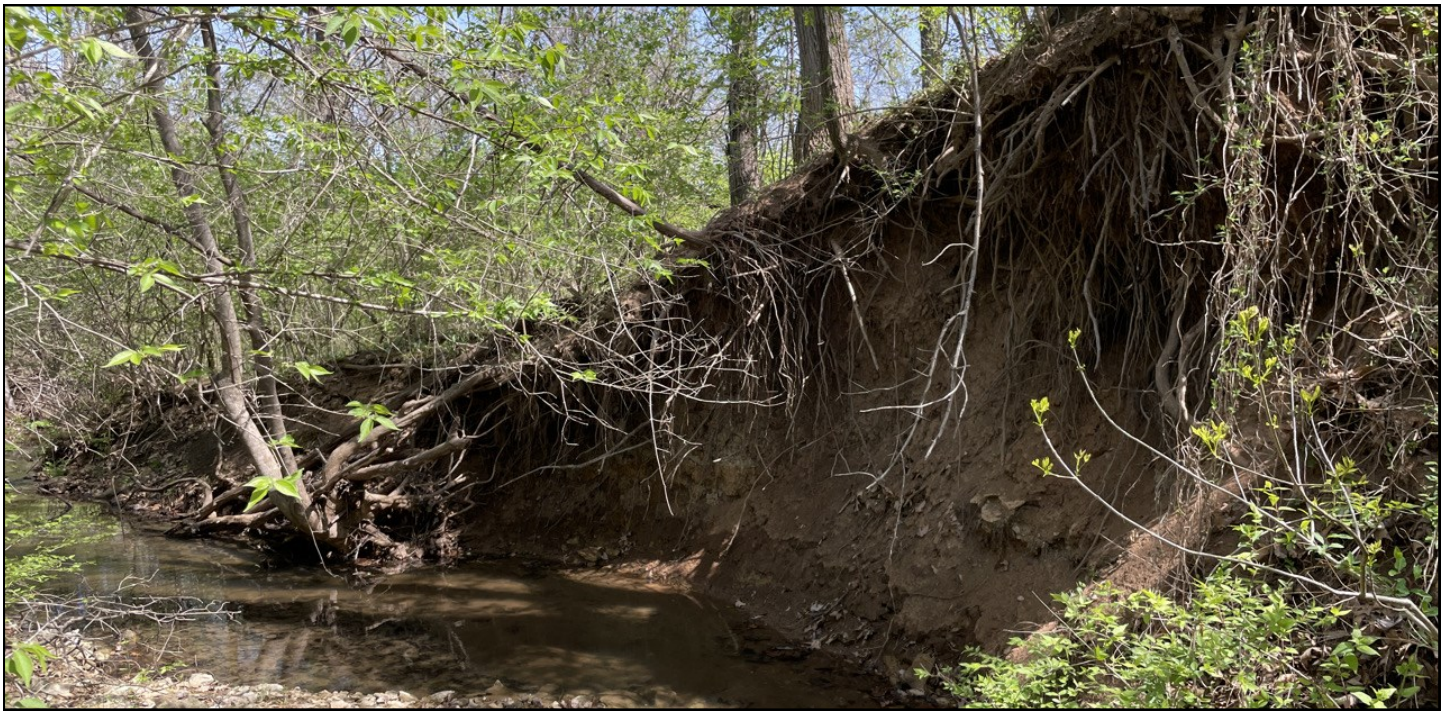


Photo No.	16	Photo Dir.	Northeast

Description: Significant bank erosion present along east bank with many exposed roots. Located just downstream of sanitary sewer crossing. Stream bank is approximately 20 feet tall.

Photo No.	17	Photo Dir.	Northeast

Description: Second sanitary sewer pipe encasement crossing.

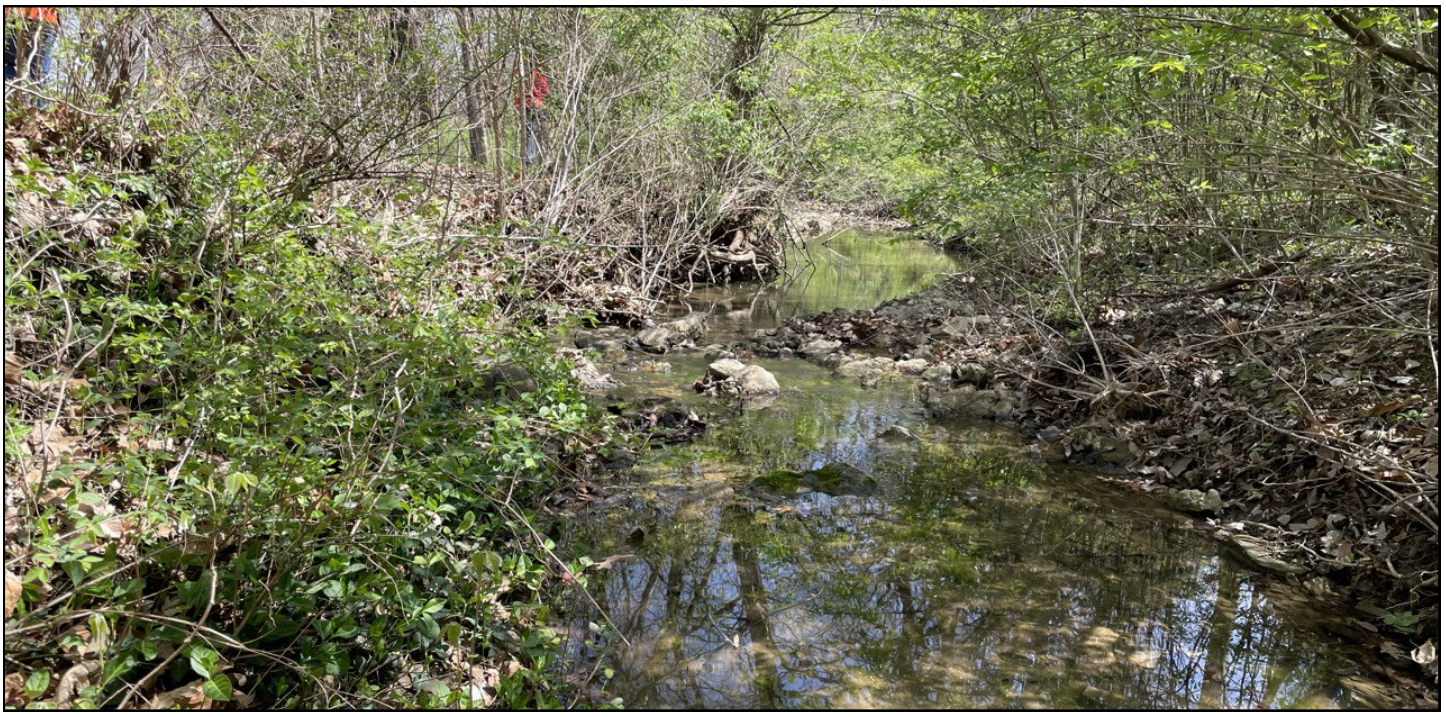


Photo No.	18	Photo Dir.	Northeast

Description: Minimal amounts of stream bank erosion on the downstream end of the stream, as it begins to run between residential properties.