

North Railroad Ditch

Stormwater from the “Third Street Roadway and Drainage” section discussed earlier in this report outlets into the ditch on the north side of the old railroad tracks. This north railroad ditch begins at MO-133 and drains west toward Bertha Street. Additional runoff is collected from adjacent roadways over this stretch before passing under Bertha Street through a 24” CMP culvert. Over the years, sediment deposited along the flat ditch has created pockets of ponding water.



Figure 10: Bridged sidewalk near Bertha St. culvert leading to old MFA building

In addition to the water ponding issue, the culvert configuration at Bertha Street is very inefficient. East of the roadway, the ditch flow passes under an old bridge sidewalk immediately in front of the 24" CMP under Bertha Street. An 18" CMP also outlets runoff from the north at this point. West of the roadway, one 24" CMP outlets to the west while a second 24" CMP outlets from the north directly into the side of the 24" Bertha Street culvert. The conversion of these perpendicular culverts has created scour holes on both side of Bertha Street.



Figure 11: Perpendicular culverts intersecting at Bertha Street

South Railroad Ditch

Much like the north railroad ditch, the south railroad ditch parallels the old railroad track beginning at MO-133 and draining west. One difference is that the south ditch between MO-133 and Bertha Street is very wide and unchannelized. Without well-defined channelized flow, the south ditch ponds water and stays saturated during a large portion of the year. City maintenance crews struggle to mow and maintain the south ditch as a result.

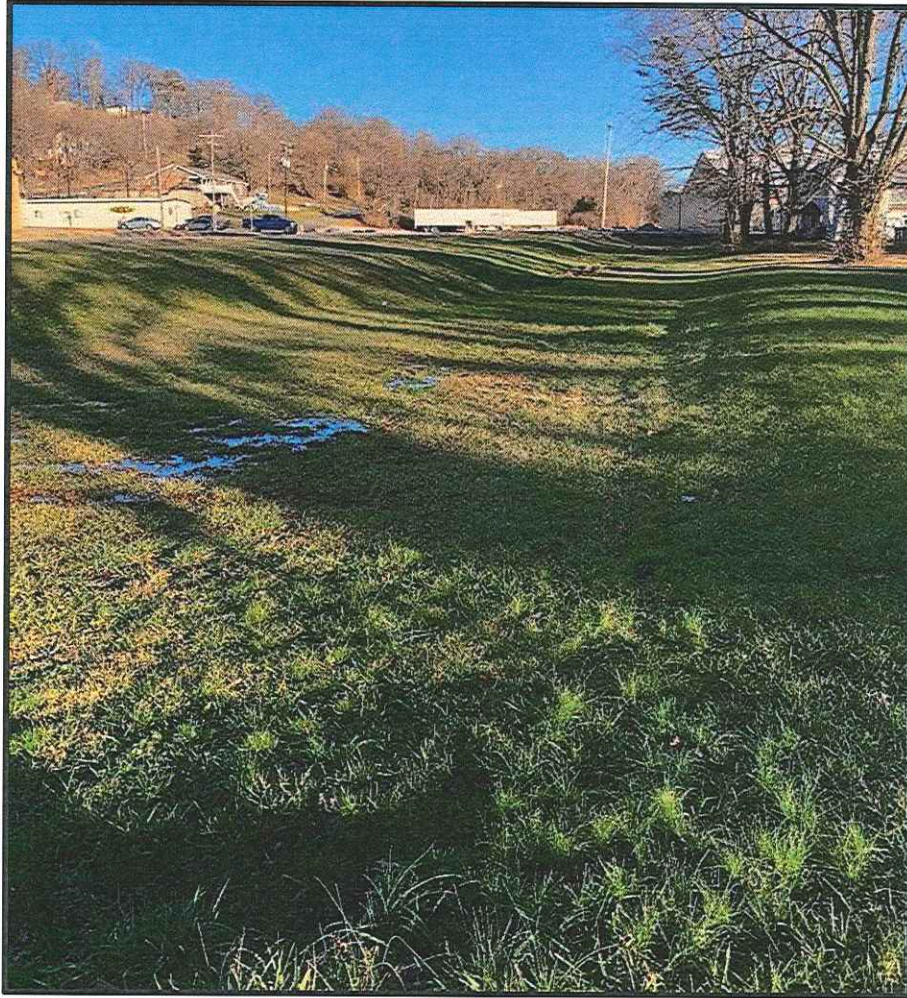


Figure 12: Wide, flat ditch between MO-133 and Bertha Street

Another area of concern in this location is the culvert under MO-133 at the head of the south railroad ditch. The 15" CMP is meant to capture runoff from the east side of MO-133 and discharge it west; however, the culvert frequently clogs and backs up water onto MO-133. The City has reported the issue to MoDOT but the issue still persists.

Nathan Street Road Embankment

Nathan Street is located on the northeast end of Meta and serves as a connection between Rose Street and MO-133. At the sump location, roadside ditches along the north side of Nathan Street pass through a 24" CMP and are discharged into a larger ditch along the south side of Nathan Street that ultimately leads east toward MO-133. No capacity issues have been reported at this location; however, the road embankment above the culvert outlet has begun to erode. The south roadway embankment is relatively steep and thick brush lines the channel bank between the outlet ditch and Nathan Street. On the day of the site visit leaves covered most of the erosion but further investigation revealed approximately a 1 ft drop off the south shoulder of Nathan Street above the outlet end of the 24" culvert.



Figure 13: Nathan Street roadway embankment between Rose St. and MO-133

Roadway Study Alternatives

Three alternatives were evaluated at each location as part of this study. Each location was evaluated based on the levels of deterioration, the impacts to surrounding properties, and the potential improvement costs. An in-depth discussion of each location is continued below. Detailed cost estimates have been included in Appendix E with this report. The estimates provided are based on field investigations and measurements made in the field or from publicly available data.

Third Street Drainage

- **Alternative A: Do Nothing** \$0.00
The first alternative to do nothing is not acceptable. If the issues around the intersection of Third Street and MO-133 are ignored, the flooding damage will continue to occur at City Hall. In addition, if the retaining wall along MO-133 is left to further deteriorate, the roadway embankment could become unstable and become unsafe for traffic loading.
- **Alternative B: Storm Sewer Only** \$107,216.70
The second alternative consists of constructing a continuous, enclosed pipe network to carry stormwater from the north side of Third Street to the outlet location into the north railroad ditch. Sump inlets will also be added in the low area adjacent to City Hall to help minimize ponding water.
- **Alternative C: Storm Sewer and Retaining Wall**..... \$159,381.64
The third alternative also consists of constructing a continuous, enclosed pipe network between Third Street and the north railroad ditch. In addition, the existing retaining wall adjacent to the roadway will be replaced with either a cast-in-place or block retaining wall in order to properly stabilize the roadway embankment.

Fourth Street Culvert

- **Alternative A: Do Nothing** \$0.00
The first alternative to do nothing is not acceptable. If the issues at Fourth Street are ignored, the clogging issues will continue to occur and require more frequent attention from City Maintenance crews.
- **Alternative B: Culvert Replacement** \$23,239.66
The second alternative consists of replacing the existing 15" CMP culvert under Fourth Street with a larger 24" culvert. The larger diameter pipe would increase the capacity of the crossing and reduce the frequency of clogging. Standard precast concrete end sections would be provided with this option and the adjacent roadside ditches would be graded to appropriately tie into the new culvert flowline.
- **Alternative C: Culvert Replacement with Safety Ends** \$24,479.11
The third alternative also consists of replacing the existing 15" CMP culvert under Fourth Street with a larger 24" culvert. In addition to the required ditch grading and pavement replacement across Fourth Street, safety slope end sections would be utilized on each end of the culvert. Safety slope end sections not only help reduce the risk of vehicle roll-overs where sharp drop-offs are present, but they also hold up better to traffic loading.

Cherry Street Culvert

- **Alternative A: Do Nothing** \$0.00
The first alternative to do nothing is not acceptable. If the issues at Cherry Street are ignored, the clogging issues will continue to occur and require more frequent attention from City Maintenance crews.
- **Alternative B: Cleanout** \$8,676.14
The second alternative consist of contracting services to cleanout the existing culverts. The existing culverts appear to have significant clogs between the two visible ends of the pipe. City maintenance crews do not possess the necessary equipment to properly cleanout the existing culverts; therefore, the work would need to be contracted out to a third-party contractor. This alternative is a short-term solution because the culvert sizes and configurations will ultimately need to be cleaned out again in the future.
- **Alternative C: Culvert Replacement** \$24,476.62
The third alternative consists of replacing the two existing culverts with one larger 24" culvert. Using curved pipes and changing pipe diameters at blind connections are typically avoided in modern storm sewer construction. In addition, current design standards commonly specify that storm sewer pipes for transportation project be no less than 15" diameter to reduce the risk of clogging. In addition to addressing the clogging issues at this location, replacing the two existing culverts on Cherry Street would eliminate these non-standard design issues and upgrade the infrastructure in this location to meet current design standards.

Sixth Street Drainage

- **Alternative A: Do Nothing** \$0.00
The first alternative to do nothing is not acceptable. Allowing stormwater to surface discharge across Pine Street can not only lead to increased erosion along the embankment but also increased pavement deterioration due to freeze/thaw cycles.
- **Alternative B: Ditch Grading** \$8,180.38
The second alternative includes regrading the roadside ditch along the south side of Sixth Street between Pine Street and the low water crossing on Sixth Street. By redefining the ditch along the roadway, more runoff will be effectively routed to the nearby stream instead of ponding in the adjacent lot.
- **Alternative C: Ditch Grading and Storm Sewer** \$35,999.78
The third alternative also consists of regrading the ditch along the south side of Sixth Street while also adding a new culvert under Pine Street. A junction structure will need to be added on the southwest corner of the intersection in order to lower the crossroad culvert enough to provide sufficient cover over the pipe. A rock blanket will be provided at the end of the culvert to prevent scour from forming below the flared end section.

Second Street Culvert

- **Alternative A: Do Nothing** \$0.00
The first alternative to do nothing is not acceptable. If the issue at Second Street is ignored, the clogging problem will continue to occur and require more frequent attention from City Maintenance crews.
- **Alternative B: Cleanout** \$4,957.80
The second alternative consist of contracting services to cleanout the existing culverts. The City maintenance crews do not possess the necessary equipment to properly cleanout the existing culvert; therefore, the work would need to be contracted out to a third-party contractor. This

alternative is a short-term solution because the existing culvert will inevitably need to be cleaned out again in the future.

- **Alternative C: Culvert Replacement\$28,726.71**
The third alternative consists of replacing the existing 18" culvert with a larger 24" culvert. Conventional precast concrete end sections will be included and the adjacent roadside ditches will be regraded to match the flowline of the new culvert.

Schriefer Street Drainage

- **Alternative A: Do Nothing \$0.00**
The first alternative to do nothing is not acceptable. Without a ditch along Schriefer Street to direct runoff to the adjacent storm sewer systems, runoff from the empty lot will continue to cause problems to the nearby commercial buildings.
- **Alternative B: Ditch Grading and Storm Sewer to Existing\$25,376.48**
The second alternative consists of grading a ditch along the north side of Schriefer Street to direct stormwater to either the existing ditch along Locust Street or existing pipe network near Bertha Street. The existing pipes near Bertha Street begin on the south side of Schriefer Street; therefore, one pipe will need to be added to convey water under Schriefer Street in a controlled manner.
- **Alternative C: Ditch Grading and Storm Sewer to Bertha St.\$38,886.46**
The third alternative also consists of grading a ditch along the north side of Schriefer Street but also includes upgrading the existing pipes near Bertha Street to create one continuous pipe network through the construction limits.

North Railroad Ditch

- **Alternative A: Do Nothing \$0.00**
The first alternative to do nothing is not acceptable. If the issues along the north railroad ditch are ignored, the scour occurring near Bertha Street will continue to worsen and the ponding issues along the ditch will continue to be a maintenance challenge for City crews.
- **Alternative B: Culvert Replacement\$56,791.54**
The second alternative consists of replacing the culvert under Bertha Street and constructing junction structures on each side of the intersection. The structures will more effectively connect flows from the adjacent pipes along Bertha Street and eliminate the scour concerns at the pipe junctions. In addition, the existing bridge sidewalk will be removed and replaced with standard concrete sidewalk and ramps that meet current ADA standards.
- **Alternative C: Culvert Replacement and Ditch Grading.....\$65,963.44**
The third alternative includes all the storm sewer upgrades and sidewalk improvements highlighted in Alternative B and additionally includes regrading the north railroad ditch from MO-133 to Bertha Street. Regrading the north railroad ditch will help smooth out the existing sediment deposits and scour holes to help provide a continuous slope to the west and minimize ponding water along the ditch.

South Railroad Ditch

- **Alternative A: Do Nothing** \$0.00
The first alternative to do nothing is not acceptable. If the issues along the south railroad ditch are ignored, the ponding will continue to create maintenance issue for City crews and the clogging issues could lead to further hazards to motorists traveling MO-133.
- **Alternative B: Ditch Grading** \$23,673.46
The second alternative consist of constructing a rock-lined, low-flow channel along the south railroad ditch between MO-133 and Bertha Street. The low-flow channel will provide a more concentrated path for the average rainfall flows to travel to help minimize ponding. During larger rainfall events, the wider footprint of the south railroad ditch will be utilized to provide increased capacity.
- **Alternative C: Ditch Grading and Culvert Replacement**..... \$45,894.83
The third alternative also consists of constructing a rock-lined, low-flow channel along the south railroad ditch between MO-133 and Bertha Street. Additionally, it includes replacing the existing 15" CMP under MO-133. The culvert will be replaced with a larger 24" RCP with precast concrete flared end sections to increase capacity and reduce the risk of water backing up onto MO-133.

Nathan Street Road Embankment

- **Alternative A: Do Nothing** \$0.00
The first alternative to do nothing is not acceptable. If the erosion issues are ignored, the roadway embankment could worsen and potentially jeopardize the stability of Nathan Street.
- **Alternative B: Slope Stabilization**..... \$9,345.44
The second alternative consists of stabilizing the existing roadway embankment with a rock blanket to prevent further erosion above the crossroad culvert.
- **Alternative C: Culvert Extension** \$13,386.04
The third alternative consists of extending the existing 24" CMP further south and regrading the roadway embankment with a flatter slope. The flatter slope will provide a more stable road embankment and be less prone to future erosion.

Recommendations

For this report, it is recommended that the City take action at the study locations when funding becomes available. Below is a priority list of recommended improvements that should be pursued based on the amount of available funding, stormwater capacity issues, maintenance problems, and/or roadside safety concerns.

Project Priority List:

1. Third Street Roadway and Drainage – Alternative C: Storm Sewer and Retaining Wall
2. Fourth Street Culvert – Alternative B: Culvert Replacement
3. Cherry Street Culvert – Alternative C: Culvert Replacement
4. Sixth Street Drainage – Alternative C: Ditch Grading and Storm Sewer
5. Second Street Culvert – Alternative B: Cleanout
6. Schriefer Street Drainage – Alternative B: Ditch Grading and Storm Sewer to Existing
7. North Railroad Ditch – Alternative B: Culvert Replacement
8. South Railroad Ditch – Alternative B: Ditch Grading
9. Nathan Street Road Embankment – Alternative B: Slope Stabilization

The total combined cost of the recommended alternatives is \$364,132.60. The CDBG fundable amounts for engineering services do not cover all anticipated engineering services and associated fees that include full topographic and boundary survey, hydraulic modeling, engineering design, and detailed construction plans and documents for a complete design of these storm sewer projects. The additional fees associated with engineering services not covered by CDBG are also listed throughout Appendix E.

If additional funding becomes available, the City should consider amending the above priority list with the following changes:

- 5b. Second Street Culvert – Alternative C: Culvert Replacement
- 6b. Schriefer Street Drainage – Alternative C: Ditch Grading and Storm Sewer to Bertha St.
- 7b. North Railroad Ditch – Alternative C: Culvert Replacement and Ditch Grading
- 8b. South Railroad Ditch – Alternative C: Ditch Grading and Culvert Replacement
- 9b. Nathan Street Road Embankment – Alternative C: Culvert Extension

Appendices

[Appendix A: Vicinity Map](#)

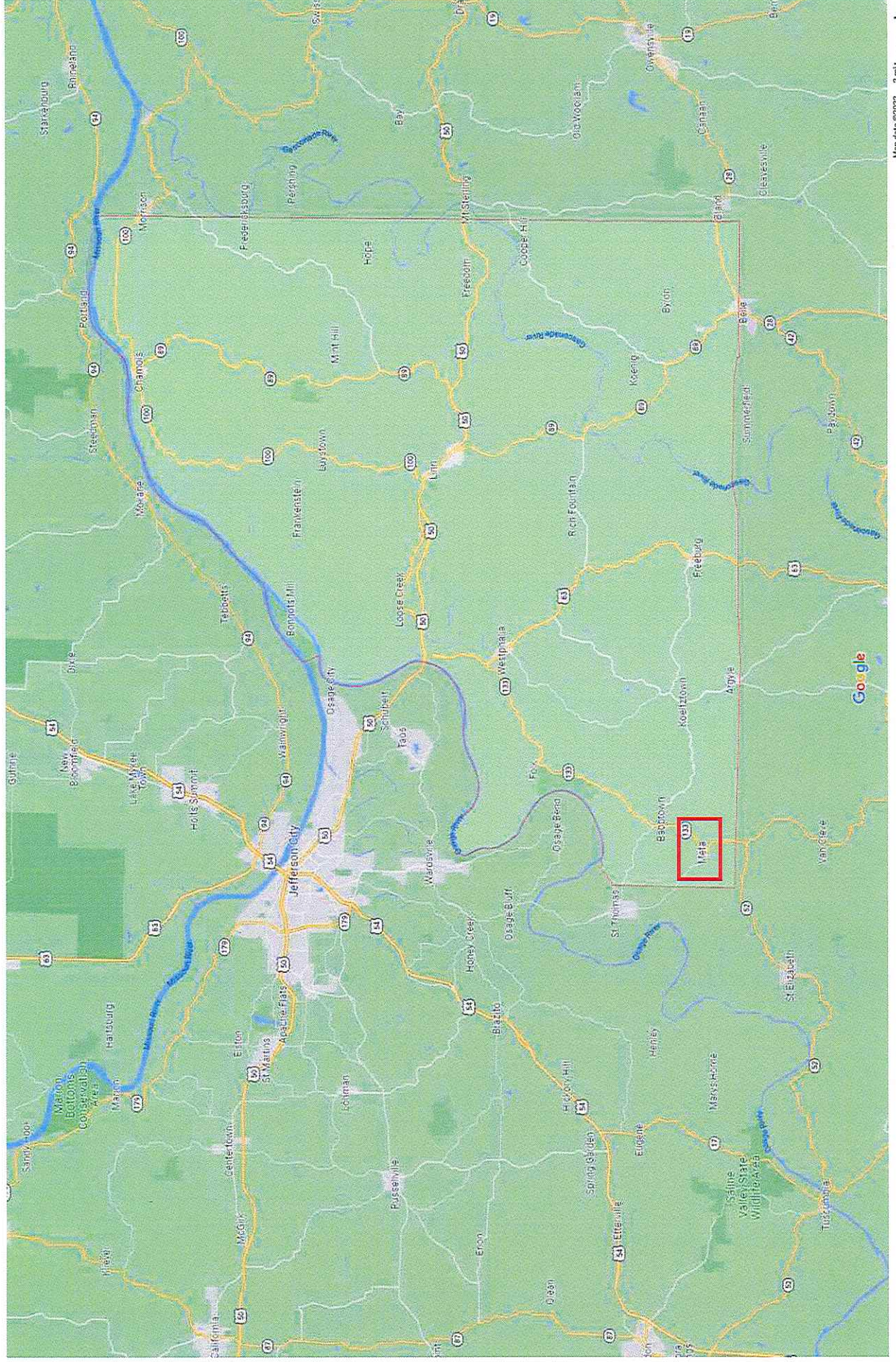
[Appendix B: Location Map](#)

[Appendix C: Topo Map](#)

[Appendix D: Project Exhibits](#)

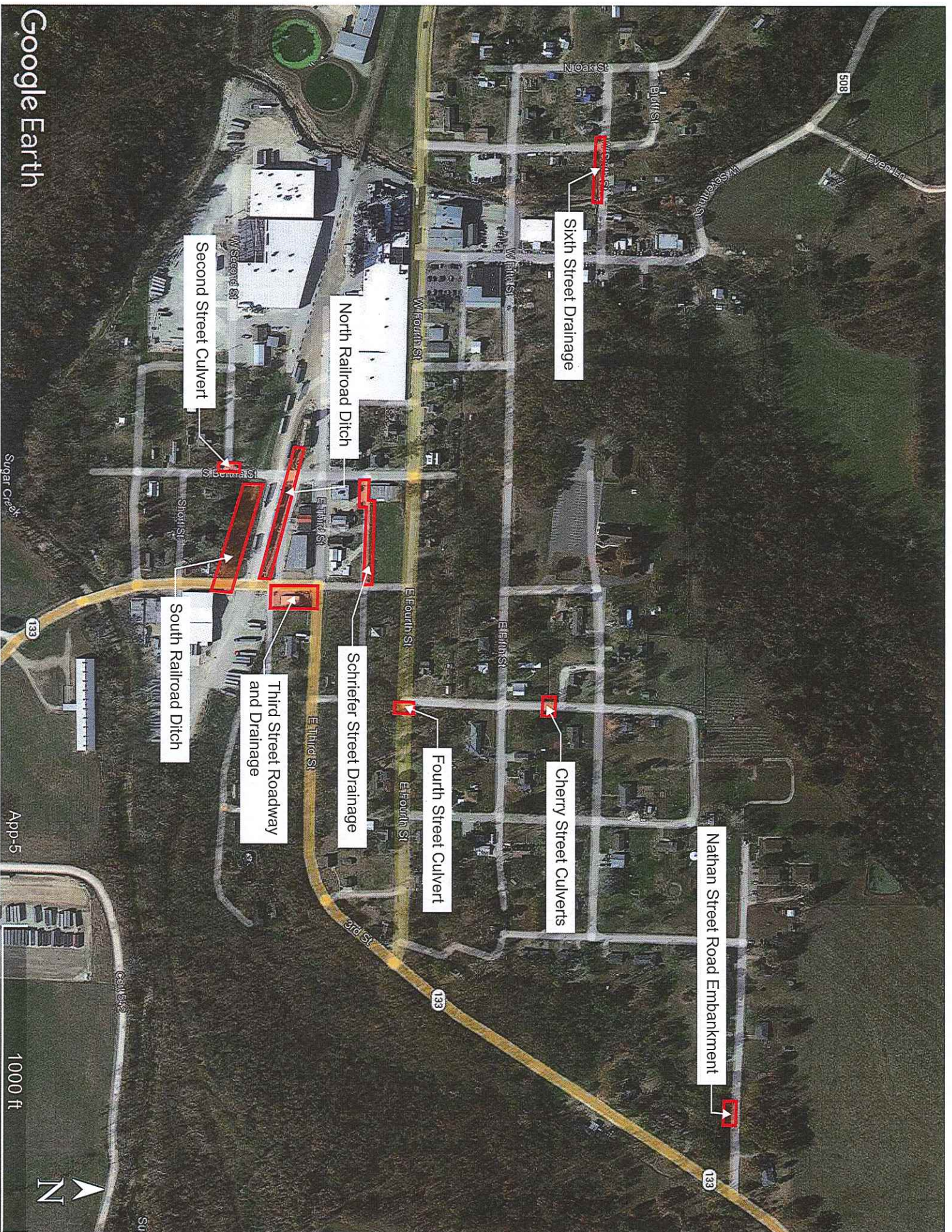
[Appendix E: Cost Estimates](#)

Appendix A: Vicinity Map



Map data ©2022 2 mi

Appendix B: Location Map



508

Evening

W. Belmont St

Birch St

Oak St

Sixth Street Drainage

W Fourth St

North Railroad Ditch

Second Street Culvert

W Second St

St. Bernard St

South Railroad Ditch

St. Peter St

Third Street Roadway and Drainage

Schriefer Street Drainage

Fourth Street Culvert

E Fourth St

E Third St

Cherry Street Culverts

Nathan Street Road Embankment

133

133

133

133

133

App-5

1000 ft



Google Earth

Appendix C: Topo Map

USGS Topo Map

