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FINAL REPORT

EAST MOUNTAIN STORMWATER AND DRAINAGE STUDY

Submitted to: City of Scranton
Lackawanna Co., PA

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January 9, 2024

Herbert, Rowland & Grubic, Inc.
Engineering | Planning | Infrastructure Solutions

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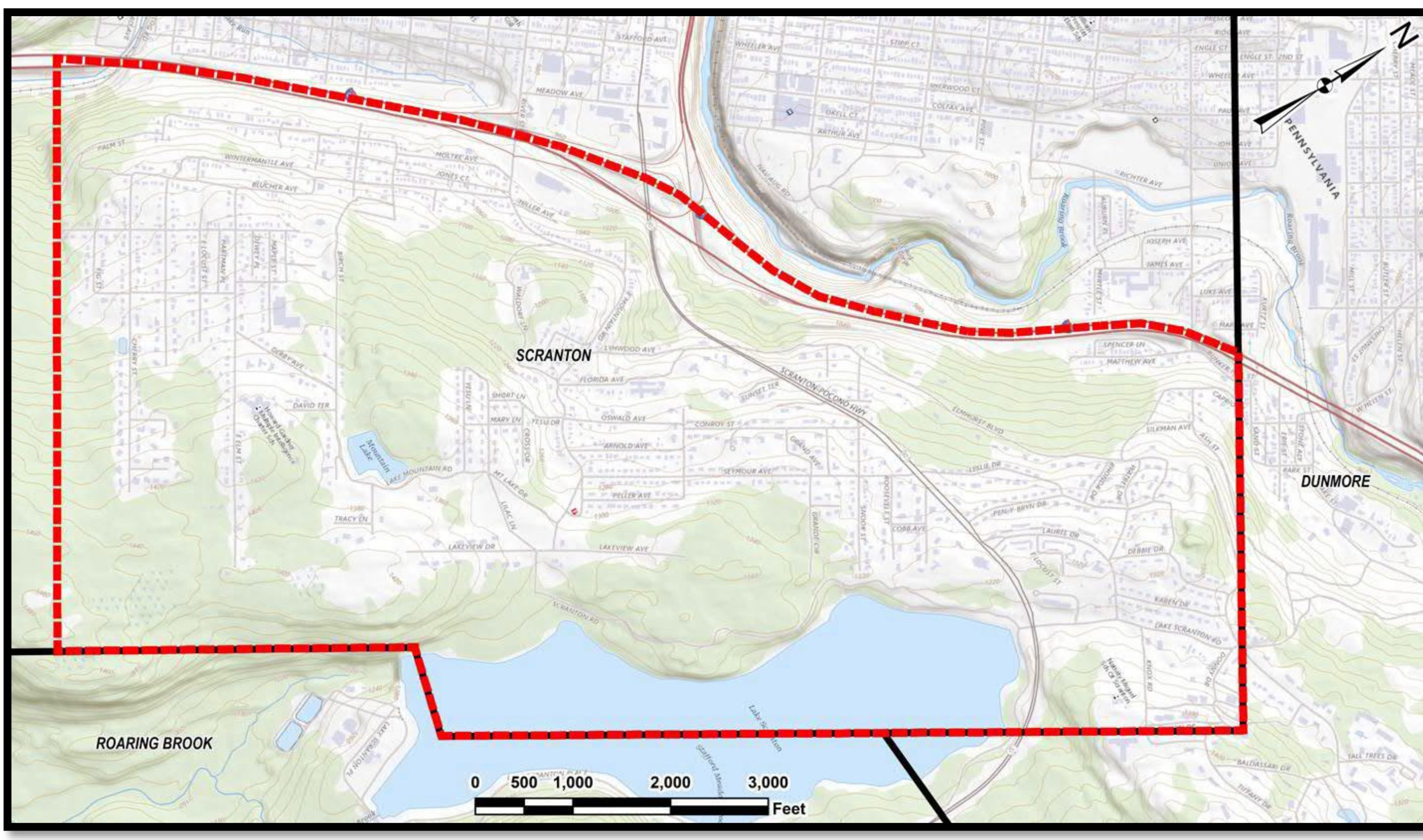
SECTION 1: INTRODUCTION

On June 9, 2022 the City of Scranton (City) released a Request for Qualification for the East Mountain Stormwater and Drainage Study. On July 1, 2022, Herbert, Rowland & Grubic, Inc (HRG) submitted a proposal to the City to provide those professional services. Subsequently, the City revised the scope of the proposed study to include seven (7) drainage issues in the area. HRG was awarded the project on August 29, 2022.

SECTION 1.1 – STUDY AREA

The East Mountain neighborhood is a primarily residential area which is bound by Interstate 81 to the West, Fig Street to the South, Dunmore Borough to the North and Roaring Brook Township to the East (See Figure 1.1.1).

Figure 1.1.1: East Mountain - Scranton



SECTION 1.2 – AREAS OF CONCERN

The Areas of Concern were provided to HRG by City Engineer, Tom Reilly, Jr. PE. and were reviewed during a follow-up phone conversation. These included the following drainage issues:

- **Cherry Street Drainage and Stormwater Management Issues**
  Existing drainage systems on Cherry, Rollins and Froude streets are inadequate for the current drainage patterns. The conveyance systems are undersized, and the stormwater basin does not receive the amount of flow to properly manage the stormwater during certain rainfall events.

- **Blucher and Wintermantle Avenue Drainage Problems**
  Runoff from Blucher and Wintermantle Avenues is flowing unregulated down the East Elm Street right-of-way towards Interstate Route 81.

- **Mountain Lake Creek**
  The conveyance system for Mountain Lake Creek has been significantly impacted by development from the upstream limits of the Marine Corps League Museum, northwest to the drainage system on the eastern side of Route I-81 northbound.

- **Roaring Brook Tributary**
  Recent drainage improvements on Mountain Lake Road may have had an impact upon the drainage area. In addition, the stormwater from the Linwood Nursing and Rehabilitation Center is not currently controlled and has been causing drainage issues.

- **Snook Street Area (3 sites)**
  Three sites of localized drainage issues have been identified in the area of Snook Street. These include drainage issues at the end of Grande Circle, Seymour Avenue between Batluck and Snook Street, and the Snook Street right of way on the northern side of State Route 307 (Moosic Street).

Following HRG's initial review of drainage issues in East Mountain the following additional sites were added to the Stormwater and Drainage Study:

- **Abandoned Railroad Grade**
  This abandoned railroad grade, located between Moltke Avenue and Route 81, creates a barrier to stormwater runoff flowing downhill from East Mountain towards Route 81.

- **Florida Avenue**
  Ponded water has been a longtime problem along a low-lying section of Florida Avenue. In addition, there was a report by the residents of 101 Florida Avenue about flood water flowing down the hill behind their home.

- **East Mountain Road**
  Just uphill of Yesu Lane, on the southwestern side of East Mountain Road are a row of seven (7) homes which have been experiencing flooding from stormwater runoff.

- **Beech Street & Wintermantle Avenue**
  Along the northern side of Beech Street, just north of Wintermantle Avenue is an open drainage swale which is located immediately adjacent to the edge of pavement. Stormwater runoff from Blucher Avenue and the woodlands to the southeast drain into this swale. Flooding and icing conditions from this drainage system pose a danger to vehicles traveling down the hill from Blucher Avenue.

SECTION 1.3 – PUBLIC COMMENTS

Section 1.3.1 - City Staff

On October 21, 2022, an in-person meeting was held with City Staff and Management to discuss the scope and goals of the East Mountain Stormwater and Drainage Study. Site specific drainage problems were discussed, and possible mitigation measures were identified.

Section 1.3.2 – Stakeholders Committee

On November 16, 2022 an online meeting was held with the East Mountain Stakeholders Committee to discuss the Drainage Study and the upcoming Public Meeting. The Committee included HRG Staff, City Staff, Scranton Fire Department, Howard Gardner School and Local Resident, Marie Schumacher.

Section 1.3.3 – 1st Public Meeting

A Public Meeting was held on November 30, 2022 at the Howard Gardner Multiple Intelligence Charter School in East Mountain. This meeting was well attended with over 75 members of the public present. A summary of the meeting was also featured on two local news broadcasts and in the newspaper. During this meeting, representatives from HRG outlined the scope and goals of the ongoing study and solicited comments from the public regarding drainage issues in East Mountain.

Section 1.3.4 – Website Reporting

As part of the East Mountain Stormwater and Drainage Study, the City of Scranton created an online site where members of the public could submit their "Flood and Stormwater Issues".

(https://scrantonpa.viewpointcloud.com/categories/1072/record-types/6525).

At the November 30, 2022 Public Meeting which was held at the Howard Gardner Multiple Intelligence Charter School, HRG and the City announced this online reporting service and encouraged the public to submit their information for inclusion in the Study. To date, twenty-six (26) submissions have been made to this site to express concern about local flooding and drainage issues. Narratives describing the problems were accompanied by sketches, photographs and videos.

The location of each site has been identified in HRG's Geographic Information System (GIS) mapping of the community and labeled accordingly. Public comments and documentation were reviewed for each submission so that this information could be included in the Stormwater and Drainage Study. Four of the sites fall outside of East Mountain, so they were not included in the Study.

A summary of these comments have been included in Appendix A of this report.

Section 1.3.5 – Personal Interviews

During the course of the Drainage Study, personal interviews were carried out with numerous East Mountain residents whom we met in the field or at the Public Meetings. Many of them provided first-had accounts of the flooding throughout the area.

Section 1.3.6 – 2nd Public Meeting

A second Public Meeting was held on October 25, 2023 at the Howard Gardner Multiple Intelligence Charter School in East Mountain. Once again, the meeting was well attended with over 50 members of the public present. The meeting was featured on two local news broadcasts and in the newspaper. During this meeting, representatives from HRG outlined the process used for the study, our findings, recommendations, and preliminary Mitigation Plans.

Section 1.3.7 – PennDOT Field Meeting

On November 7, 2023 a field meeting was held with representatives from PennDOT and their engineers from AECOM to discuss the proposed drainage improvements and how they might impact the future improvements plans for Route 81. HRG representatives walked the abandoned railroad grade with PennDOT and discussed the plan to add stormwater culverts along the rail bed. PennDOT asked that we be sure to tie the drainage from the new culverts into their drainage system for Route 81.

SECTION 2: DRAINAGE BASIN

SECTION 2.1 – WATERSHED CHARACTERISTICS

In general, East Mountain drains in a northwestern direction with Lake Scranton at the top of the mountain and Interstate Route 81 at the bottom. The Study Area is divided between two drainage areas, the southern portion of the community drains to Stafford Meadow Brook, and the northern side drains to Roaring Brook. Stafford Meadow Brook is classified as a High Quality (HQ), Cold Water Fishes (CWF) water which supports Natural Trout Reproduction. Roaring Brook is classified as a Cold Water Fishes (CWF) water which also supports Natural Trout Reproduction. Both of these waterways have been classified as Impaired, Non-Attaining Waterways due to Pathogens from Urban Runoff and Storm Sewers. They are both tributaries of the Lackawanna River in the Susquehanna Watershed. East Mountain can be further divided into drainage sub-basins as shown in Figure 2.1.1.

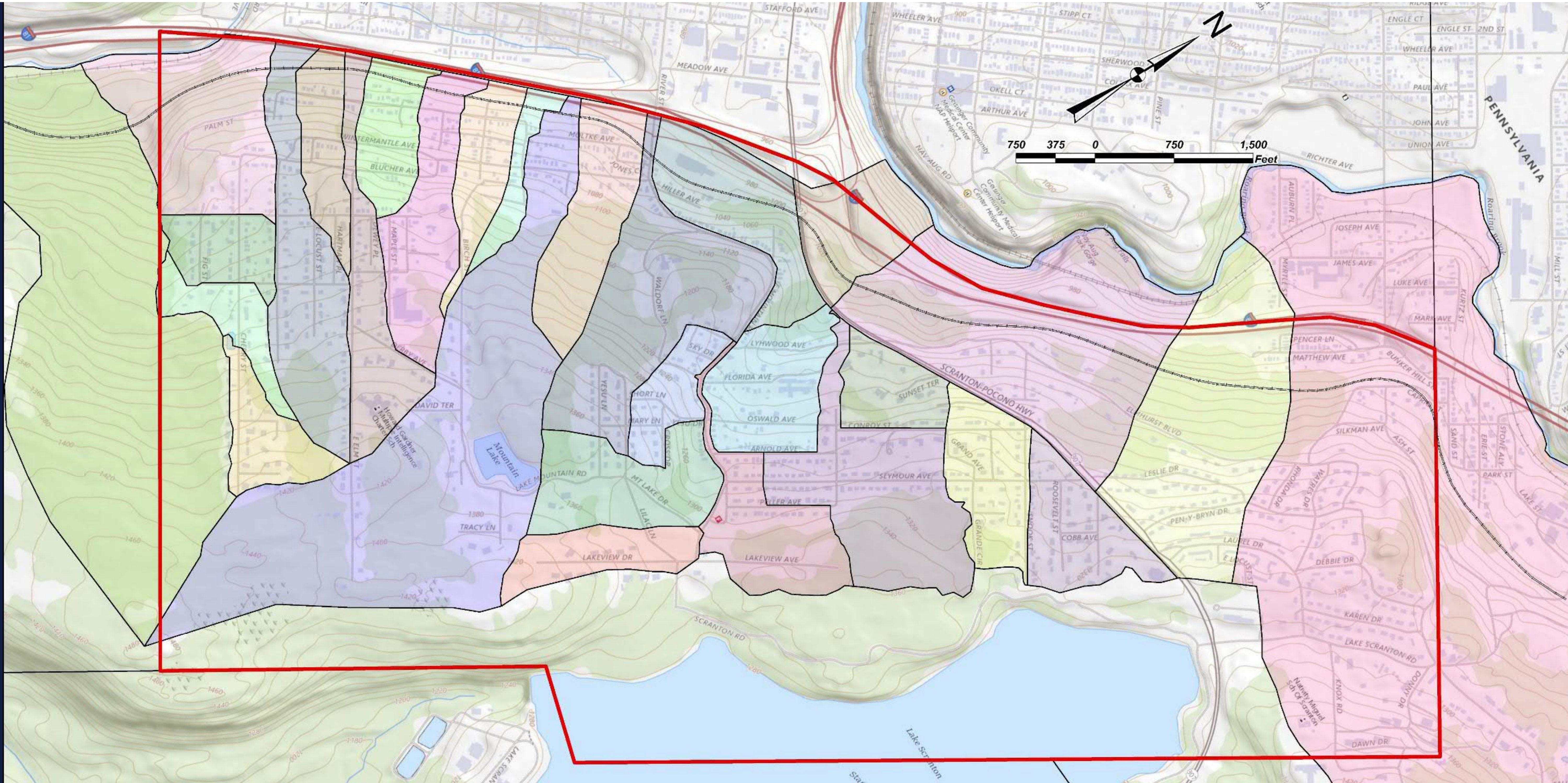
SECTION 2.2 – EXISTING DEVELOPMENT

Much of the East Mountain was developed in a grid pattern similar to the city blocks close to the city center. However, the direction of the roads on East Mountain were adjusted slightly to better match the mountain's slopes. Streets run in a northwest to southeast direction perpendicular to the slopes, while avenues run from southwest to northeast parallel to the slope. In many areas, the roadway grid is interrupted by steep slopes and/or rock outcrops which prevented the roadway from continuing. However, once conditions improve, the roadway system continued. Therefore, roads such as East Locust Street have several sections which have been built, separated by undeveloped sections of right of way.

Development on East Mountain is predominately single-family residential on ¼ to ½ acre lots. A few larger buildings in the area include schools, churches and a nursing home. Due to steep slopes and excessive rock outcrops, approximately 50% of the area is undeveloped.

SECTION 2.3 – EXISTING STORMWATER MANAGEMENT

Much like the road system, the drainage systems on East Mountain are broken up and incomplete. In many places, existing drainage systems reach a dead end at the bottom of a hill, and the water is just dumped into the undeveloped right of way with no consideration for stability or downhill development. This uncontrolled runoff often leads to flooding problems downhill. Similarly, minor changes in stormwater runoff patterns near the top of the mountain may result in significant changes in flow at the bottom of the mountain.



DRAINAGE BASINS

EAST MOUNTAIN STORMWATER AND DRAINAGE STUDY

HRG

SECTION 3: DRAINAGE IMPROVEMENT PROJECTS

SECTION 3.1 – ABANDONED RAILROAD GRADE

Section 3.1.1 – Description of the Drainage Problem

Long before the development of East Mountain or the creation of Route 81, a railroad line ran along the bottom of the hillside. On the 1891 USGS Map of Scranton, this rail line was identified as the Erie and Wyoming Valley Railroad. Although the railroad has been abandoned, the grade and some tracks remain. Located between Moltke Avenue and Route 81, the grade where the tracks were once located creates a barrier to stormwater runoff flowing downhill from East Mountain. There is only one culvert under the railroad tracks to allow a stream (now known as Mountain Lake Creek) to flow underneath. Since the area uphill of the tracks was undeveloped, it appears that no other consideration was made for stormwater runoff.

However, the residential development on East Mountain has created additional stormwater runoff which flows down the hillside. Although a drainage system was developed to intercept stormwater flow coming down onto Route 81, no consideration was given to the railroad grade. Concentrated stormwater flow being discharged at the end of the streets flows unregulated across the rail grade towards the highway. In most places, the stormwater has eroded ditches across the elevated rail bed. Below the rail grade, much of the water is captured by the Route 81 drainage system. However, during large storm events the water crossing the rail grade often evades the highway drainage inlets and flows onto the roadway creating dangerous conditions (See Photos in Section 3.4.5).

Section 3.1.2 – Proposed Drainage Improvements

Concentrated stormwater runoff is discharged from the end of each of the East Mountain roadways that run perpendicular to the slope of the hillside. This includes Alder Street; Willow Street; Birch Street; Beech Street; Maple Street; East Elm Street; East Locust Street; and Brook Street. In order to control the flow of this runoff and direct it into the Route 81 drainage system, individual culverts are needed at each location (See Figure 3.4.1). Stabilized swales will also be required draining into the culverts, and then to direct flow from the culverts into the Route 81 drainage system. Discharge of these systems will need to be coordinated with PennDOT during the final design process. HRG conducted a preliminary site walk with PennDOT going through the initial findings, with the anticipation of ongoing coordination through the next phase of design. The existing bypass drainage system will be utilized to safely convey stormwater through the PennDOT ROW.

Appendix B of this report contains the Preliminary Drainage Improvement Plans developed by HRG for this project. The preliminary drainage calculations which were used to develop the preliminary plans have been included in Appendix D of this report.

Section 3.1.3 – Final Design and Permitting Requirements

Upon the abandonment of the Erie and Wyoming Valley Railroad grade, the rail property was sold to a private party. Based upon our preliminary research, it appears that this property is currently owned by F&L Realty, Inc. of 400 Mill Street, Dunmore, PA 18512. Any work on this property will require authorization from the property owner. Permanent drainage easements are recommended for construction of each proposed culvert, and for future maintenance.

PennDOT Right of Way mapping for Route 81 has been requested from their engineering consultant, AECOM but no information has been received to date. It is assumed that some of the drainage improvements may extend south into this Right of Way, so authorization may also be required from PennDOT.

Once the required drainage easements have been obtained, additional Civil Survey and Engineering will be required to complete the design for construction. A PA-1 Call inquiry should be submitted to locate all utilities around the work areas. If underground utilities are located within the proposed limits of disturbance, additional Subsurface Utility Engineering (SUE) may be necessary to determine the precise location and depth of the pipes. Survey should be completed to create topographic mapping around the proposed improvements and identify existing features in the area.

Additional drainage calculations will be required to assure that all new drainage features are stable and sized appropriately. Soil erosion control measures, standard notes and details, and construction specifications will be required for final designs.

The proposed culvert below Alder Street will be a replacement for the existing Mountain Lake Creek culvert which has failed. Since this is a natural, perennial stream it may be regulated under PADEP Chapter 105 Regulations. Therefore, we recommend that permits for this culvert replacement be included with the PADEP Permit application for the other improvements outlined in Section 3.4 of this report. Depending upon the work needed to tie the new culverts into the Route 81 drainage system, there may be disturbance within the PennDOT right of way which would require a Highway Occupancy Permit (HOP).

Section 3.1.4 – Preliminary Cost Estimate

Based upon our preliminary design, we estimate that completion of the construction required to mitigate this drainage problem will cost approximate $300,000. Our Preliminary Design – Engineer's Project Cost Opinion has been included in Appendix C of this report.

Section 3.1.5 – Abandoned Railroad Grade Site Photographs

Photo 3.1.1 TV News coverage of flooding on Route 81 which was caused by runoff from East Mountain.

Photo 3.1.2 Stormwater runoff from East Mountain has eroded ditches through the abandoned railroad grade which is located between Moltke Avenue and Route 81.

Section 3.1.5 – Abandoned Railroad Grade Site Photographs

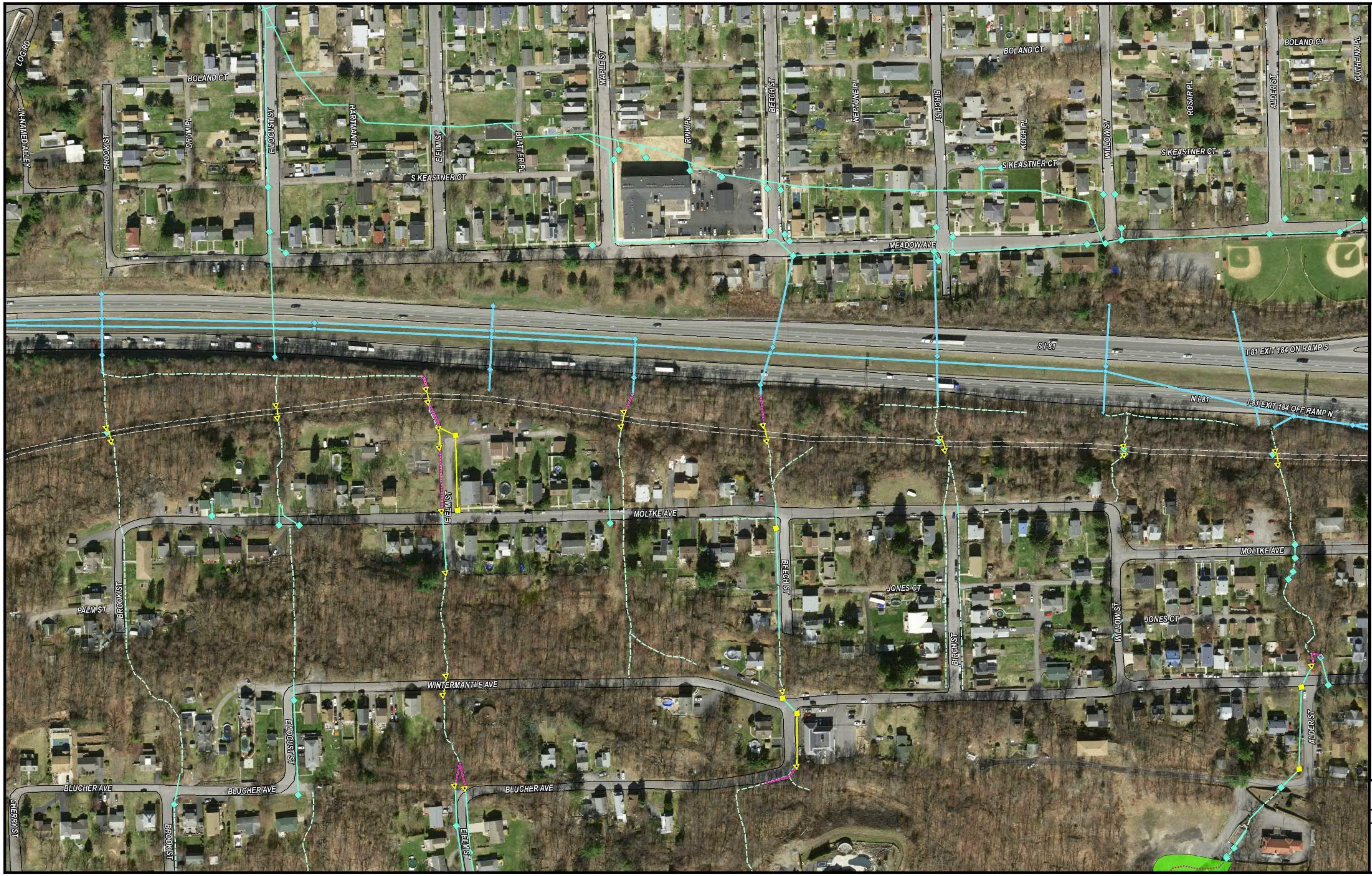
Photo 3.1.3 This abandoned railroad grade dates back to pre-1891 when it was the route of the Erie and Wyoming Valley Railroad.

Photo 3.1.4 Concentrated flow of stormwater runoff from East Mountain has eroded ditches across the railroad grade.

Section 3.1.5 – Abandoned Railroad Grade Site Photographs

Photo 3.1.5 The unregulated flow of stormwater runoff flows directly towards Route 81 where it has cause dangerous flooding in the past.

Photo 3.1.6 Lack of maintenance of PennDOT drainage structures has also been responsible for flooding on the highway.



PROPOSED DRAINAGE IMPROVEMENTS ABANDONED RAIL GRADE (CONCEPTUAL)

East Mountain Stormwater and Drainage Study

City of Scranton
Lackawanna Co., PA

N

100 50 0 100 200 Feet

MAP LEGEND:

EXISTING STORM SEWERS

- STORM SEWER STRUCTURES
- STORM SEWER PIPES
- STORMWATER SWALES

PROPOSED IMPROVEMENTS

- INLET
- MANHOLE
- HEADWALL
- STORM SEWER
- UNDER DRAIN
- DRAINAGE SWALE
- INSTALL CURB
- DRAINAGE SWALE
- FRENCH DRAIN
- STORMWATER BASIN
- PAVE APRON AROUND EX. INLET

- Contours based upon 2019 PASDA LiDar
- Property Lines base upon Lckawanna County GIS Parcel Mapping
- 2021 PEMA Aerial Imagery

Mapping derived from data provided by PASDA, Lackawanna County GIS, and City of Scranton GIS and GPS field locations by HRG.

10/9/2023	PM: GW	GIS: GW	QA: SS	004441.0436

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SECTION 3.2 – CHERRY STREET

Section 3.2.1 – Description of the Drainage Problem

Cherry Street is a residential area on the southwestern side of East Mountain. The roadway slopes to the northwest towards Route 81, and there is a stone shoulder on either side of the cartway (See Photos in Section 3.3.5). Homes on the top of the hill were built in the early 1990's as part of the Mountain Laurel Estates Subdivision. As part of that subdivision, a stormwater management system was installed along Cherry Street, in the area of Mountain Laurel Drive. This drainage system included a stormwater detention basin and a series of eight roadside catch basins which are connected by a network of pipes (See Figure 3.2.1).

However, the existing drainage system is not efficiently collecting stormwater runoff and conveying it to the stormwater basin as designed. Much of the runoff is bypassing the inlets and flowing down Cherry Street past the basin towards Rollin Avenue where it is causing roadway and residential flooding. Field analysis by HRG concluded that since the stormwater inlets were placed within the stone shoulder rather than on the edge of the cartway, stormwater runoff is currently draining into the stones rather than flowing into the inlets. The water then flows down the hill until it hits an obstruction, such as a driveway crossing, which deflects the water back into the roadway. This cycle continues down the roadway and past the stormwater basin, until it reaches a low point in the roadway where it ponds.

Section 3.2.2 – Proposed Drainage Improvements

Based upon our evaluation of this drainage system, HRG feels that the original drainage design is sufficient to manage the runoff from the Mountain Laurel Estates Subdivision. However, the implementation of that design has created the drainage problems along Cherry Street. It appears that field modifications of the current system may correct the drainage problems. The objective is to drain runoff into the catch basins, rather than into the stone shoulder. This can be accomplished by paving the area from the edge of the existing pavement down to, and around each inlet. Bituminous curbing can be added to the downhill side of these paved areas to direct runoff into the inlets (See Figure 3.2.2). Each inlet should be opened up and existing debris and silt should be removed. In some cases, it may be necessary to lower the grate elevation to facilitate better drainage flow, but it appears that the current drainage structures should be sufficient once the drainage flow has been corrected.

Appendix B of this report contains the Preliminary Drainage Improvement Plans developed by HRG for this project.

Section 3.2.3 – Final Design and Permitting Requirements

Based upon our preliminary analysis of this drainage problem, additional engineering design can be kept to a minimum. A PA-1 Call inquiry should be submitted to locate all utilities around the work areas. A Civil Survey should be completed to record spot elevations around each inlet, and identify existing features in the areas (i.e. mailboxes, landscaping, etc.). Pavement dimensions, standard notes and details, and construction specifications will be required for final designs. Due to the minimal area of disturbance, no permits from outside agencies are anticipated.

Section 3.2.4 – Preliminary Cost Estimate

Based upon our preliminary design, we estimate that completion of the construction required to mitigate this drainage problem will cost approximate $43,000. Our Preliminary Design – Engineer's Project Cost Opinion has been included in Appendix C of this report.

CHERRY STREET

- *Existing drainage system not collecting stormwater runoff.*
- *Water not getting into existing stormwater basin.*
- *Water continues to flow down Cherry Street past basin and creates problems at Fig Street.*

HRG

Section 3.2.5 – Cherry Street Site Photographs

<u>Photo 3.2.1</u> View looking down Cherry Street from just below the intersection with Ridgewood Avenue

<u>Photo 3.2.2</u> View of the existing stormwater detention basin which was built as part of the Mountain Laurel Estates Subdivision.

Section 3.2.5 – Cherry Street Site Photographs

Photo 3.2.3 Existing discharge pipe from the drainage system along Cherry Street into the detention basin. It appears that only a fraction of the runoff from this street makes it into this basin.

Photo 3.2.4 Existing stone shoulders on both sides of Cherry Street have created a drainage problem along the roadway by keeping runoff from entering the inlets.

Section 3.2.5 – Cherry Street Site Photographs

Photo 3.2.5 It appears that roadway runoff drains into the stones along the roadway shoulder and is then unable to drain into the inlets.

Photo 3.2.6 Stormwater inlets were placed on the back side of the stone shoulder rather than along the paved cartway

Section 3.2.5 – Cherry Street Site Photographs

Photo 3.2.7 To correct the current drainage problems along Cherry Street, we recommend adding a paved apron from the cartway to the inlets.

Photo 3.2.8 Additional Civil Survey of the project area is needed to identify existing features which may be impacted by the improvements.

Section 3.2.5 – Cherry Street Site Photographs

Photo 3.2.9 The water then flows through the stone shoulder until it hits an obstruction, such as a driveway crossing, which deflects the water back into the roadway.

Photo 3.2.10 Each inlet should be opened up and existing debris and silt should be removed.

PROPOSED DRAINAGE IMPROVEMENTS CHERRY STREET (CONCEPTUAL)

East Mountain Stormwater and Drainage Study

City of Scranton
Lackawanna Co., PA

N

50 25 0 50 100 Feet

MAP LEGEND:

EXISTING STORM SEWERS

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- STORM SEWER PIPES
- STORMWATER SWALES

PROPOSED IMPROVEMENTS

- INLET
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- PUBLIC COMMENTS RECEIVED

- Contours based upon 2019 PASDA LiDar
- Property Lines base upon Lckawanna County GIS Parcel Mapping
- 2021 PEMA Aerial Imagery

Mapping derived from data provided by PASDA, Lackawanna County GIS, and City of Scranton GIS and GPS field locations by HRG.

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SECTION 3.3 – WINTERMANTLE AVENUE & EAST ELM STREET

Section 3.3.1 – Description of the Drainage Problem

Stormwater from East Elm Street has been creating problems for East Mountain residents. Beginning at a high point to the southeast of the Howard Gardner Multiple Intelligence Charter School, stormwater runoff flows in a northwestern direction down East Elm Street until the road ends at Blucher Avenue. There is an existing drainage system of roadside inlets and pipes which runs along East Elm from the intersection of Derby Avenue down to Blucher (See Figure 3.3.1).

At the end of this section of East Elm, the water discharges from the storm pipes onto an undeveloped section of the road right-of-way, where it continues to drain overland down the hillside. There is no stabilization, or defined storm swale at these discharge points. Further downhill, the flow of stormwater has eroded a swale which runs down the slope. Approximately 250 feet further downhill, the runoff hits the crossroad of Wintermantle Avenue. Due to volume and reoccurring blockage of the culvert, this storm water often overtops the cartway.

The runoff continues flowing to the northwest until it come to the continuation of East Elm Street, where the water flows into an existing stone inlet and down a pipe which runs along the roadway. After crossing under Moltke Avenue, it discharges into a roadside swale which flows towards the abandoned railroad grade and Route 81.

Drainage issues throughout this stormwater system appear to be caused by inefficient transitions between pipes and open swales, lack of maintenance of drainageways, and insufficient capacity (See Photos in Section 3.3.5). Beginning at the intersection with Derby Avenue, stormwater flow from the upstream drainage swales is not being captured by the storm sewer because there are no headwalls at the top of the pipe system. Runoff overwhelms these inlets and flows down East Elm Street. The excess flow down the roadway exceeds the capacity of the downhill inlets and the drainage problem continues to compound as it runs down the hill. The lack of a well-defined, stable channel below Wintermantle Avenue causes the culvert to become clogged with debris. In addition, the open channel below Moltke Avenue has not been maintained, so its capacity has been significantly diminished.

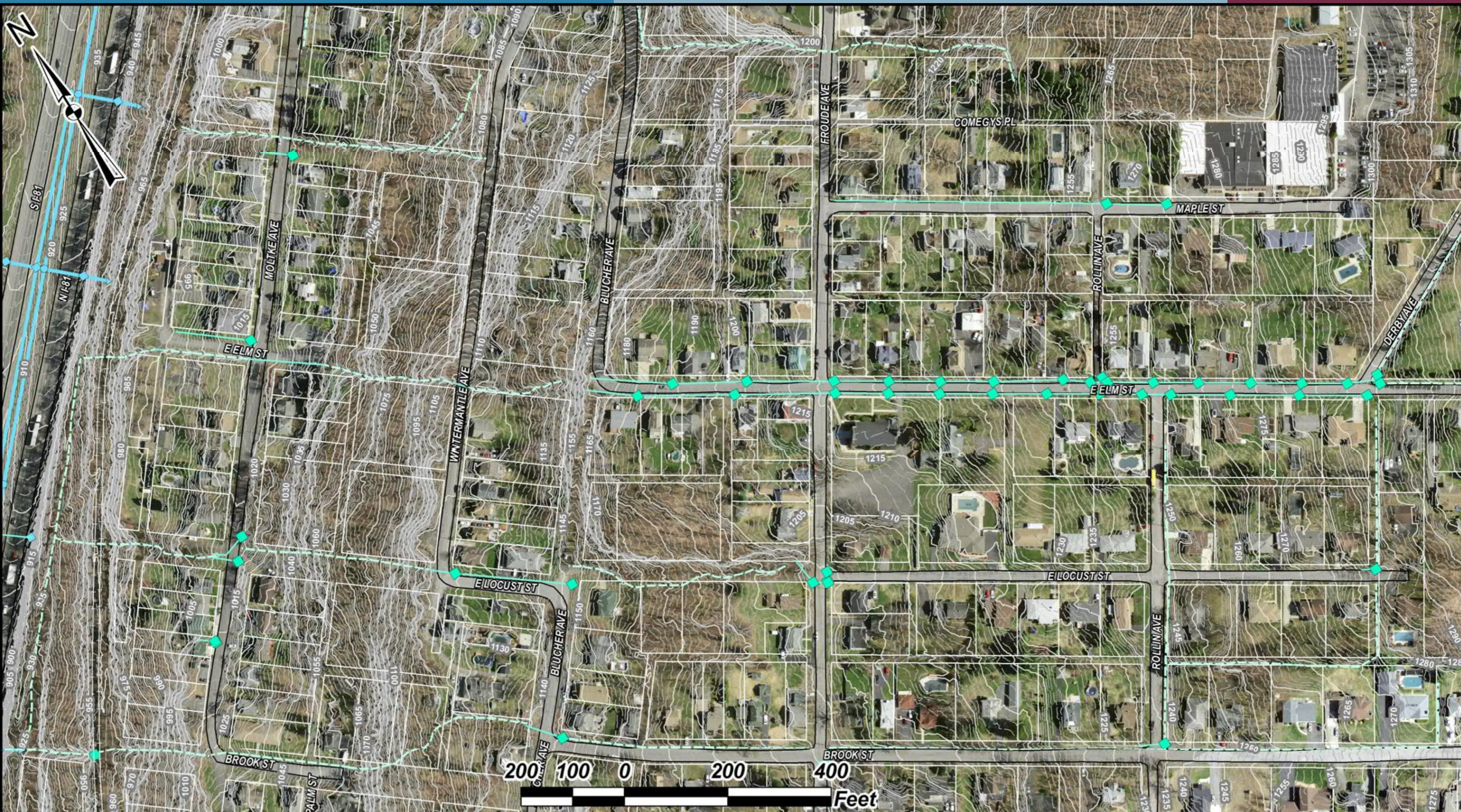
Section 3.3.2 – Proposed Drainage Improvements

To more efficiently transmit stormwater down the East Elm Avenue corridor, several upgrades must be made to the existing stormwater management system (See Figure 3.3.2). New headwalls are needed at the intersection of East Elm and Derby to properly transition stormwater runoff from the upstream swales into the East Elm drainage system. The upstream swales should also be cleared of excess stone which has reduced the capacity of those conveyance structures.

Below the intersection of Blucher Avenue, outlet stabilization and defined channels should be created below the two storm drain discharges. Downstream, the existing channel should be cleared and stabilized to improve flow down to the Wintermantle culvert. The existing culvert under Wintermantle should be upgraded with headwalls and a larger pipe.

The existing stone inlet at the top of lower East Elm Street should be retrofitted with a trash rack for both safety and debris protection. Below Moltke Avenue, the East Elm Street drainage swale should be cleared and stabilized all the way down to the proposed culvert under the abandoned railroad grade. The existing storm drain on the northern side of East Elm Street should also be replaced since the current corrugated metal pipe has failed.

WINTERMANTLE AVENUE & EAST ELM STREET



- *Drainage from intersection of E. Elm and Derby is not getting into the existing E. Elm drainage system*
- *Water over-topping Wintermantle Ave.*
- *Swale along bottom of E Elm is eroded and in poor condition.*
- *Runoff eroding abandoned rail grade*

PROPOSED DRAINAGE IMPROVEMENTS WINTERMANTLE AVE & EAST ELM STREET (CONCEPTUAL)

East Mountain Stormwater and Drainage Study

City of Scranton
Lackawanna Co., PA

N

50 25 0 50 100 Feet

MAP LEGEND:

EXISTING STORM SEWERS
- STORM SEWER STRUCTURES
- STORM SEWER PIPES
- STORMWATER SWALES

PROPOSED IMPROVEMENTS
- INLET
- MANHOLE
- HEADWALL
- STORM SEWER
- UNDER DRAIN
- DRAINAGE SWALE
- INSTALL CURB
- DRAINAGE SWALE
- FRENCH DRAIN
- STORMWATER BASIN
- PAVE APRON AROUND EX. INLET

- Contours based upon 2019 PASDA LiDar
- Property Lines base upon Lckewanna County GIS Parcel Mapping
- 2021 PEMA Aerial Imagery

Mapping derived from data provided by PASDA, Lackawanna County GIS, and City of Scranton GIS and GPS field locations by HRG.

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Section 3.3.3 – Final Design and Permitting Requirements

Building upon our preliminary drainage improvement plans, additional Civil Survey and Engineering will be required to complete the design for construction. A PA-1 Call inquiry should be submitted to locate all utilities around the work areas. If underground utilities are located within the proposed limits of disturbance, additional Subsurface Utility Engineering (SUE) may be necessary to determine the precise location and depth of the pipes. Survey should be completed to create topographic mapping around the proposed improvements, and identify existing features in the area (i.e. mailboxes, landscaping, etc.).

Additional drainage calculations will be required to assure that all new drainage features are stable and sized appropriately. Soil erosion control measures, standard notes and details, and construction specifications will be required for final designs. Due to the minimal area of disturbance and the fact that this is a non-jurisdictional waterway, no permits from outside agencies are anticipated.

Appendix B of this report contains the Preliminary Drainage Improvement Plans developed by HRG for this project.

Section 3.3.4 – Preliminary Cost Estimate

Based upon our preliminary design, we estimate that completion of the construction required to mitigate this drainage problem will cost approximate $205,000. Our Preliminary Design – Engineer's Project Cost Opinion has been included in Appendix C of this report.

Section 3.3.5 – Wintermantle Avenue & East Elm Street Site Photographs

<u>Photo 3.3.1</u> View looking uphill at the intersection of East Elm and Derby where stormwater runoff has been over topping the storm sewer inlets.

<u>Photo 3.3.2</u> Excess rock within the East Elm Street drainage swale has significantly reduced its capacity which causes the swale to regularly overflow.

Section 3.3.5 – Wintermantle Avenue & East Elm Street Site Photographs

Photo 3.3.3 The lack of a headwall at the inlets at Derby Avenue allows runoff to bypass the storm drains and run down East Elm Street.

Photo 3.3.4 The East Elm storm sewer currently discharges overland below Blucher Avenue. A stabilized channel is recommended for this discharge.

Section 3.3.5 – Wintermantle Avenue & East Elm Street Site Photographs

Photo 3.3.5 The culvert under Wintermantle Avenue is currently undersized and lacks proper headwalls. It is also prone to clogging by debris.

Photo 3.3.6 This stone inlet at the top of the lower section of East Elm Street requires a track rack for safety and protection from debris.

Section 3.3.5 – Wintermantle Avenue & East Elm Street Site Photographs

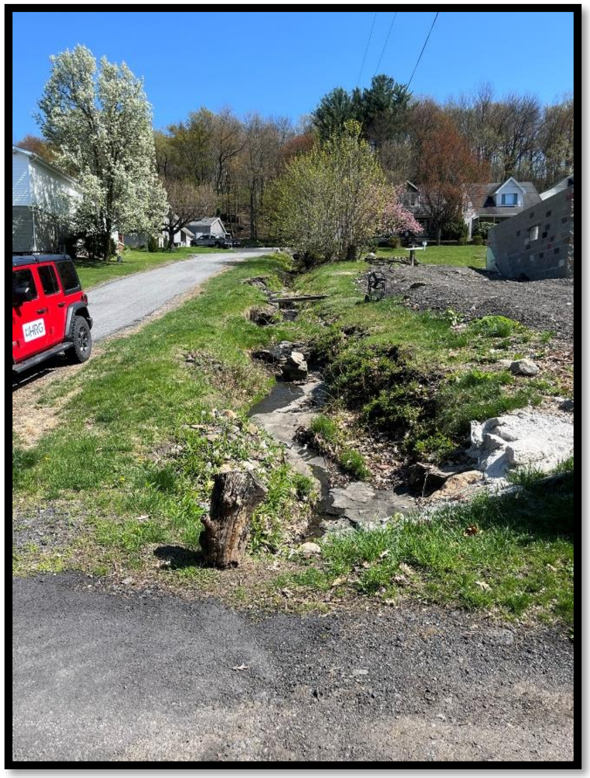


Photo 3.3.7 The drainage swale along East Elm Street, below Moltke Avenue is overgrown and clogged with debris.

Photo 3.3.8 Stabilization is also needed in the channel flowing downhill from the end of East Elm Street.

Section 3.3.5 – Wintermantle Avenue & East Elm Street Site Photographs

Photo 3.3.9 The existing storm drain on the northern side of East Elm Street should also be replaced since the current corrugated metal pipe has failed.

Photo 3.3.10 At the bottom of the hill, the uncontrolled runoff from the East Elm Drainage System has undermined the abandoned railroad tracks which run parallel to Route 81.

SECTION 3.4 – MOUNTAIN LAKE CREEK

Section 3.4.1 – Description of the Drainage Problem

With a drainage area of approximately 155 acres, Mountain Lake Creek is the only natural stream within the study area. A tributary of Stafford Meadow Brook, it begins as the discharge of Mountain Lake, a 4-acre man-made impoundment located in the central section of East Mountain. From the dam outlet, the stream runs approximately 2,300 feet through a wooded area north of Birch Street until it flows onto the grounds of the Marine Corps League Museum (See Figure 3.1.1). At the Museum, the stream is diverted into a system of stone culverts which were constructed in 1936 by the Works Progress Administration (WPA) as part of President Franklin D. Roosevelt's New Deal Plan. Memorialized at the top of the stone arch in the front of the museum, this water feature was named Hopkins Falls. (See Photos in Section 3.4.5)

Increased flow volumes of this stream, due to development within the drainage area, has reach a point where it often exceeds the capacity of the culverts at the Museum. Further downstream, Mountain Lake Creek passes through a series of culverts and surface channels as it flows downhill towards Route 81. Inefficiencies and a lack of maintenance throughout this lower portion of the drainageway has resulted in flooding and damage to the public roads and residential properties.

At the bottom of the hill, where the stream originally passed under the railroad grade, the railroad culvert has become completely silted in causing the water to pond on the eastern side of the tracts. Once the level of this ponding reaches the top of the railroad grade, it overtops the tracks and flows uncontrolled downhill towards Route 81.

Section 3.4.2 – Proposed Drainage Improvements

Due to the historical significance of the stonework at the Marine Corps League Museum, HRG recommends working to limit the maximum flow rates entering the culverts, rather than removing or replacing them with larger culvert pipes. This could be accomplished by creating a stormwater detention basin where excess stormwater flow could be stored and released at a controlled rate. It is believed that there may be sufficient room along the edge of the existing gravel parking lot to build a basin, but final drainage calculations will be required to determine the size and discharge rates of this basin. Maintenance and clearing of the existing culverts are also recommended to increase their capacity.

Even with these proposed improvements, it is likely that the existing conveyance system will not be capable of containing the runoff from a 100-year storm. Therefore, relief from PADEP requirements may be needed to preserve the existing stonework at the Museum. If that relief is not granted, the existing drainage system through the Museum property will have to be improved to convey a larger volume of flow.

Below the museum, additional drainage improvements are recommended to reduce downstream flooding and damage (See Figure 3.4.2). New roadside inlets are needed along Alder Street, and the discharges below Wintermantle Avenue need to be stabilized and a swale should be established in this area. The failed railroad culvert will be replaced under the construction outlined in Section 3.1.3. None of these improvements will increase the volume of flow travelling downhill to the Route 81 drainage system. Therefore, the existing PennDOT drainage system should not be impacted.

Appendix B of this report contains the Preliminary Drainage Improvement Plans developed by HRG for this project.

Section 3.4.3 – Final Design and Permitting Requirements

Building upon our preliminary drainage improvement plans, additional Civil Survey and Engineering will be required to complete the design for construction. A PA-1 Call inquiry should be submitted to locate all utilities around the work areas. If underground utilities are located within the proposed limits of disturbance, additional Subsurface Utility Engineering (SUE) may be necessary to determine the precise location and depth of the pipes. Survey should be completed to create topographic mapping around the proposed improvements, and identify existing features in the area (i.e. mailboxes, landscaping, etc.).

Additional drainage calculations will be required to assure that all new drainage features are stable and sized appropriately. Soil erosion control measures, standard notes and details, and construction specifications will be required for final designs.

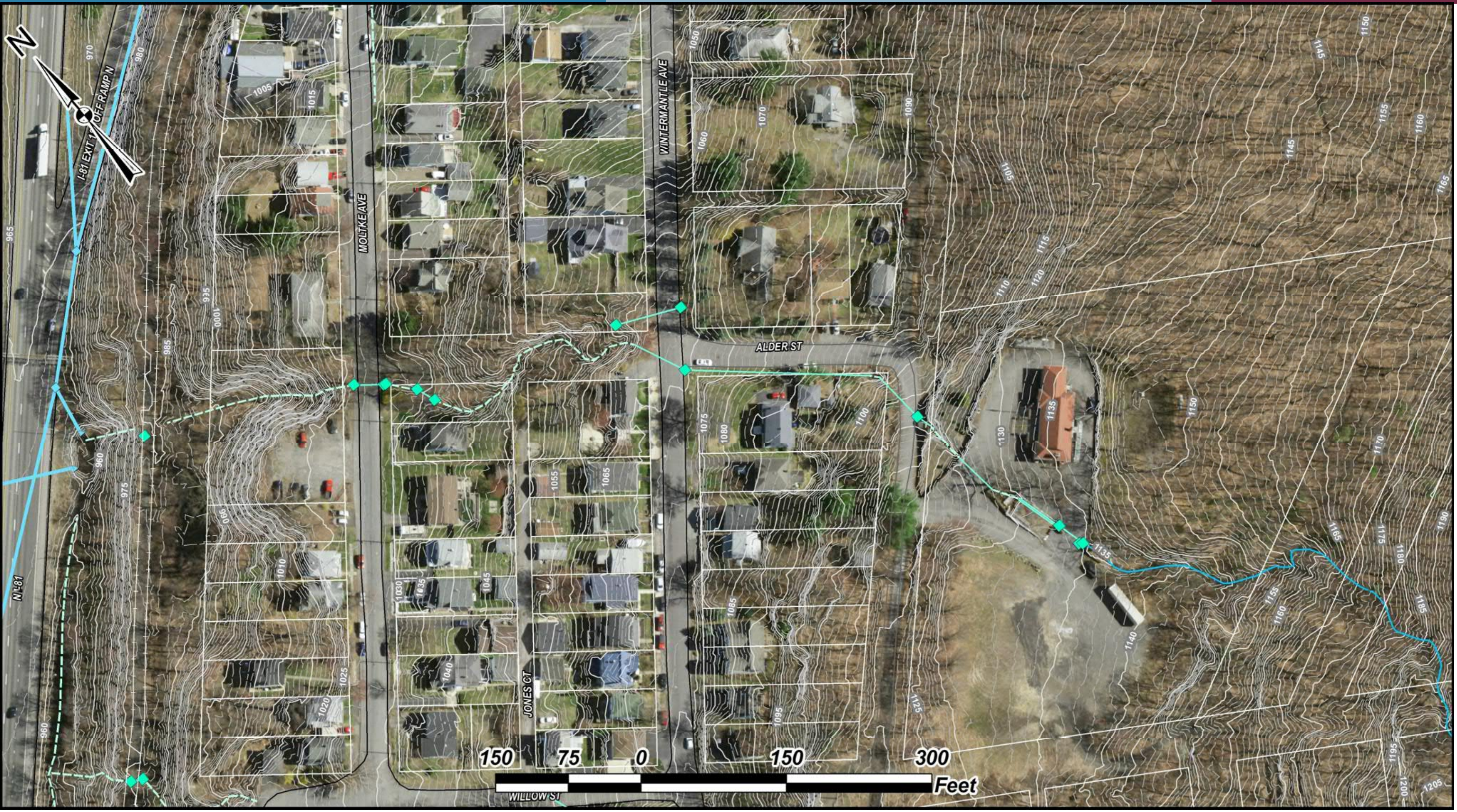
Since Mountain Lake Creek is a natural, perennial stream it is regulated under PADEP Chapter 105 Regulations. Therefore, any disturbance within the channel of this stream will require permitting by the PADEP. Since the Mountain Lake Creek railroad culvert is the only regulated crossing of the abandoned railroad grade, we recommend including that work in the PADEP Permit package. The proposed basin can be constructed adjacent to the stream so that it provides a bypass for excess flow during storms. By not putting this basin "inline" with the stream channel, a PADEP Dam Permit may not be required. A pre-application field meeting with the PADEP is highly recommended to discuss regulatory and permitting requirements.

In addition, if the earthwork required for the proposed stormwater detention basin exceeds one (1) acre, a National Pollutant Discharge Elimination System (NPDES) permit would be needed for this project.

Section 3.4.4 – Preliminary Cost Estimate

Based upon our preliminary design, we estimate that completion of the construction required to mitigate this drainage problem will cost approximate $434,000. Our Preliminary Design – Engineer's Project Cost Opinion has been included in Appendix C of this report.

MOUNTAIN LAKE CREEK



- ➢ *Storm flows are overwhelming the drainage system at the Marine Corps League Museum.*
- ➢ *Inlets are missing along Alder Street.*
- ➢ *Uncontrolled discharge below Wintermantle Ave.*
- ➢ *Flooding and eroding abandoned rail grade*

HRG

Section 3.4.5 – Mountain Lake Creek Site Photographs

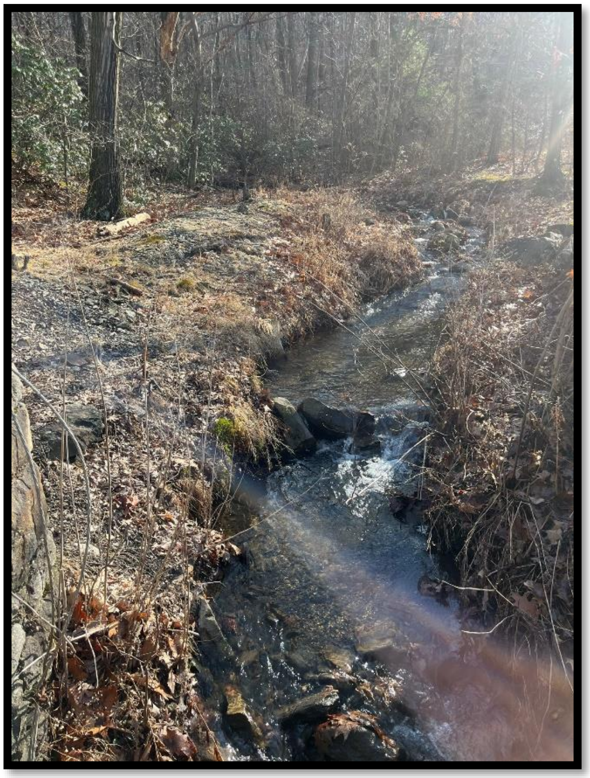


Photo 3.4.1 View of Mountain Lake Creek as it flows towards the Marine Corps League Museum.

Photo 3.4.2 Stone culvert at the Marine Corps League Museum which was built in 1936 by the Works Progress Administration.

Section 3.4.5 – Mountain Lake Creek Site Photographs

Photo 3.4.3 Stonework at the Marine Corps League Museum which was built in 1936 by the Works Progress Administration.

Photo 3.4.4 View looking up Alder Street towards the Marine Corps League Museum. Two stormwater inlets will be replaced along this section of the road.

Section 3.4.5 – Mountain Lake Creek Site Photographs

Photo 3.4.5 The culvert discharge below Wintermantle Avenue needs to be improved with stabilization and a better defined channel.

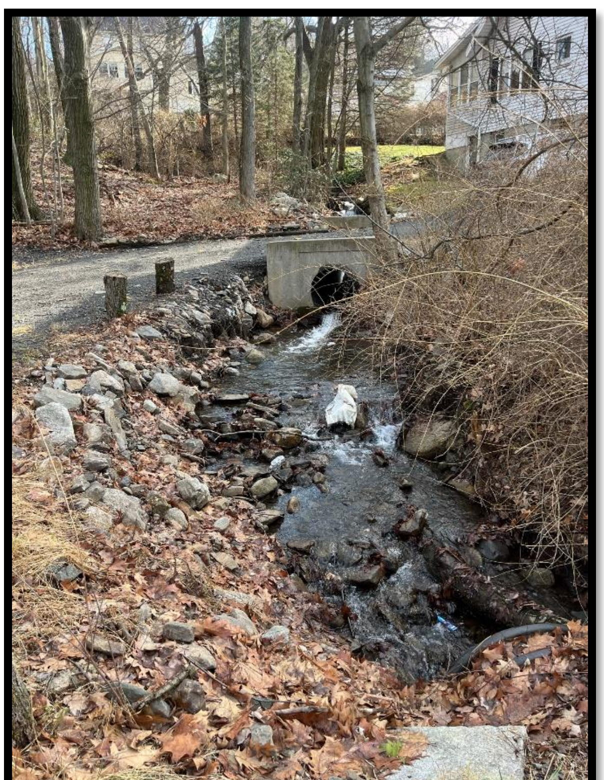


Photo 3.4.6 Further downstream, Mountain Lake Creek passes through this driveway culvert.

Section 3.4.5 – Mountain Lake Creek Site Photographs

Photo 3.4.7 The channel below Moltke Avenue should be cleared of debris to improve flow.

Photo 3.4.8 The culvert under the railroad has failed and water now ponds above the rail line until it reaches a level where is over-tops the grade.

PROPOSED DRAINAGE IMPROVEMENTS MOUNTAIN LAKE CREEK (CONCEPTUAL)
East Mountain Stormwater and Drainage Study
City of Scranton
Lackawanna Co., PA
N
50 25 0 50 100
Feet
MAP LEGEND:
EXISTING STORM SEWERS
- STORM SEWER STRUCTURES
- STORM SEWER PIPES
- STORMWATER SWALES
PROPOSED IMPROVEMENTS
- INLET
- MANHOLE
- HEADWALL
- STORM SEWER
- UNDER DRAIN
- DRAINAGE SWALE
- INSTALL CURB
- DRAINAGE SWALE
- FRENCH DRAIN
- STORMWATER BASIN
- PAVE APRON AROUND EX. INLET
- Contours based upon 2019 PASDA LiDar
- Property Lines base upon Lckawanna County GIS Parcel Mapping
- 2021 PEMA Aerial Imagery
Mapping derived from data provided by PASDA, Lackawanna County GIS, and City of Scranton GIS and GPS field locations by HRG.
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ESTABLISH SWALES
INSTALL NEW INLETS
CREATE A REGIONAL STORMWATER BASIN
REPLACE FAILING RR CULVERT
I-81 EXIT 184 OFF RAMP N
WINTERMANTLE AVE
ALDER ST
MOLTKE AVE
JONES CT
WILLOW ST

SECTION 3.5 – BEECH STREET & WINTERMANTLE AVENUE

Section 3.5.1- Description of the Drainage Problem

Along the northern side of Beech Street, just north of Wintermantle Avenue is an open drainage swale which is located immediately adjacent to the edge of pavement for the cartway (See Photos in Section 3.5.5). Stormwater runoff from Blucher Avenue and the woodlands to the southeast drain into this swale. Flooding and icing conditions from this drainage system pose a danger to vehicles traveling down the hill from Blucher Avenue. This hazard is of even a greater concern because the building on this corner houses the Discovery Montessori School. (See Figure 3.5.1)

Section 3.5.2 – Proposed Drainage Improvements

Based upon our evaluation of this drainage system, HRG feels that the existing drainage swale can be excavated out, and a new stormwater drainage pipe can be installed. A headwall should be installed at the beginning of the pipe to assure efficient drainage of the upstream runoff. A stormwater inlet should be added at the corner of Beech and Wintermantle to keep water out of the intersection. Installation of a guiderail adjacent to the roadway should be included to provide a safety buffer between the roadway and the school building. In addition, a stable drainage channel should be added below the discharge on the western side of Wintermantle Avenue.

Appendix B of this report contains the Preliminary Drainage Improvement Plans developed by HRG for this project.

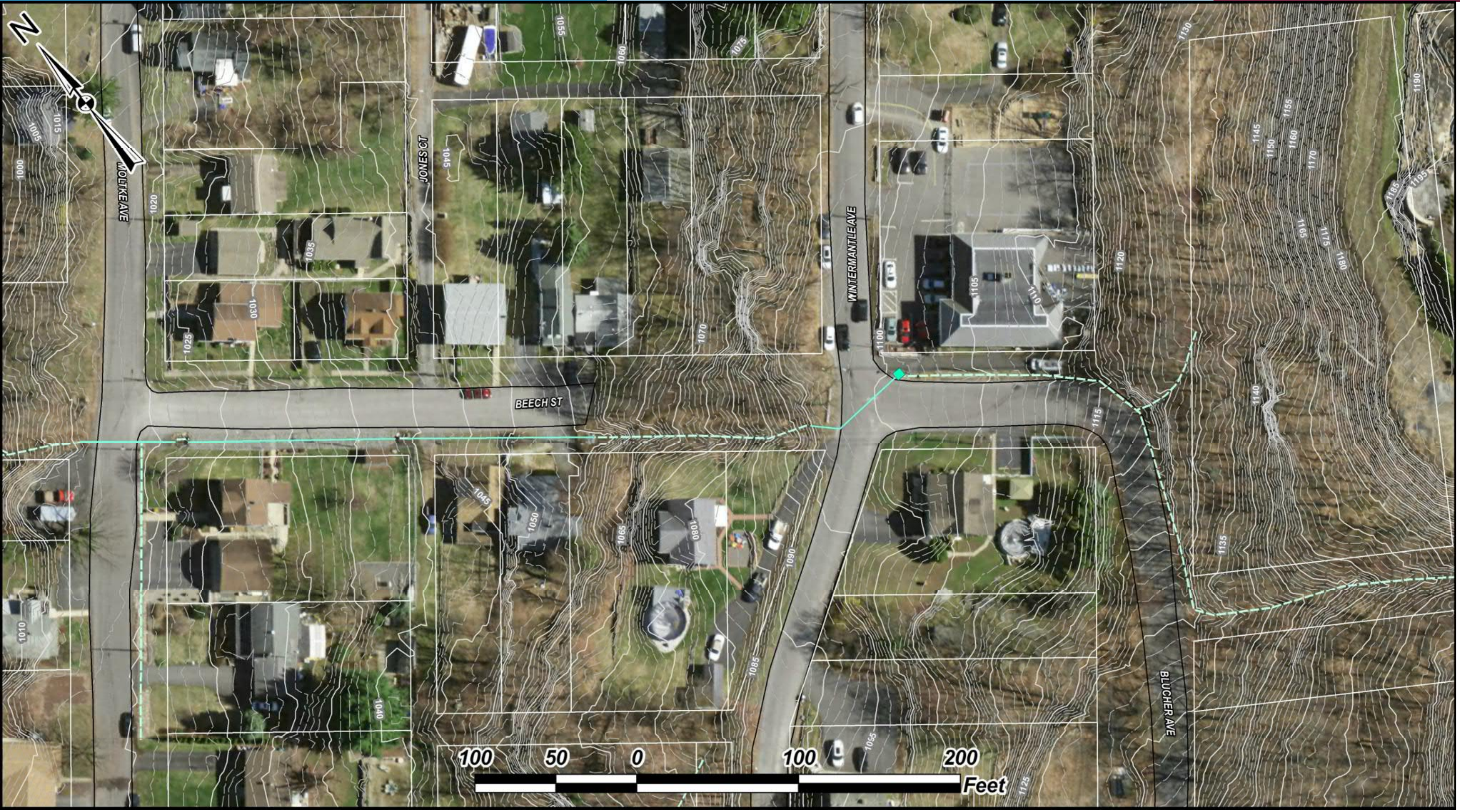
Section 3.5.3 – Final Design and Permitting Requirements

Based upon our preliminary analysis of this drainage problem, additional engineering design can be kept to a minimum. A PA-1 Call inquiry should be submitted to locate all utilities around the work areas. If underground utilities are located within the proposed limits of disturbance, additional Subsurface Utility Engineering (SUE) may be necessary to determine the precise location and depth of the pipes. A Civil Survey should be completed to record spot elevations around each inlet, and identify existing features in the areas (i.e. mailboxes, landscaping, etc.). Pipe dimensions, standard notes and details, and construction specifications will be required for final designs. Additional drainage calculations will be required to assure that all new drainage features are stable and sized appropriately. Due to the minimal area of disturbance, no permits from outside agencies are anticipated.

Section 3.5.4 – Preliminary Cost Estimate

Based upon our preliminary design, we estimate that completion of the construction required to mitigate this drainage problem will cost approximate $45,000. Our Preliminary Design – Engineer’s Project Cost Opinion has been included in Appendix C of this report.

BEECH STREET & WINTERMANTLE AVENUE



- *Roadway Hazard* *(Ice & Flooding)*
- *Residential Flooding*
- *School Safety*

HRG

Section 3.5.5 – Beech Street & Wintermantle Avenue Site Photographs

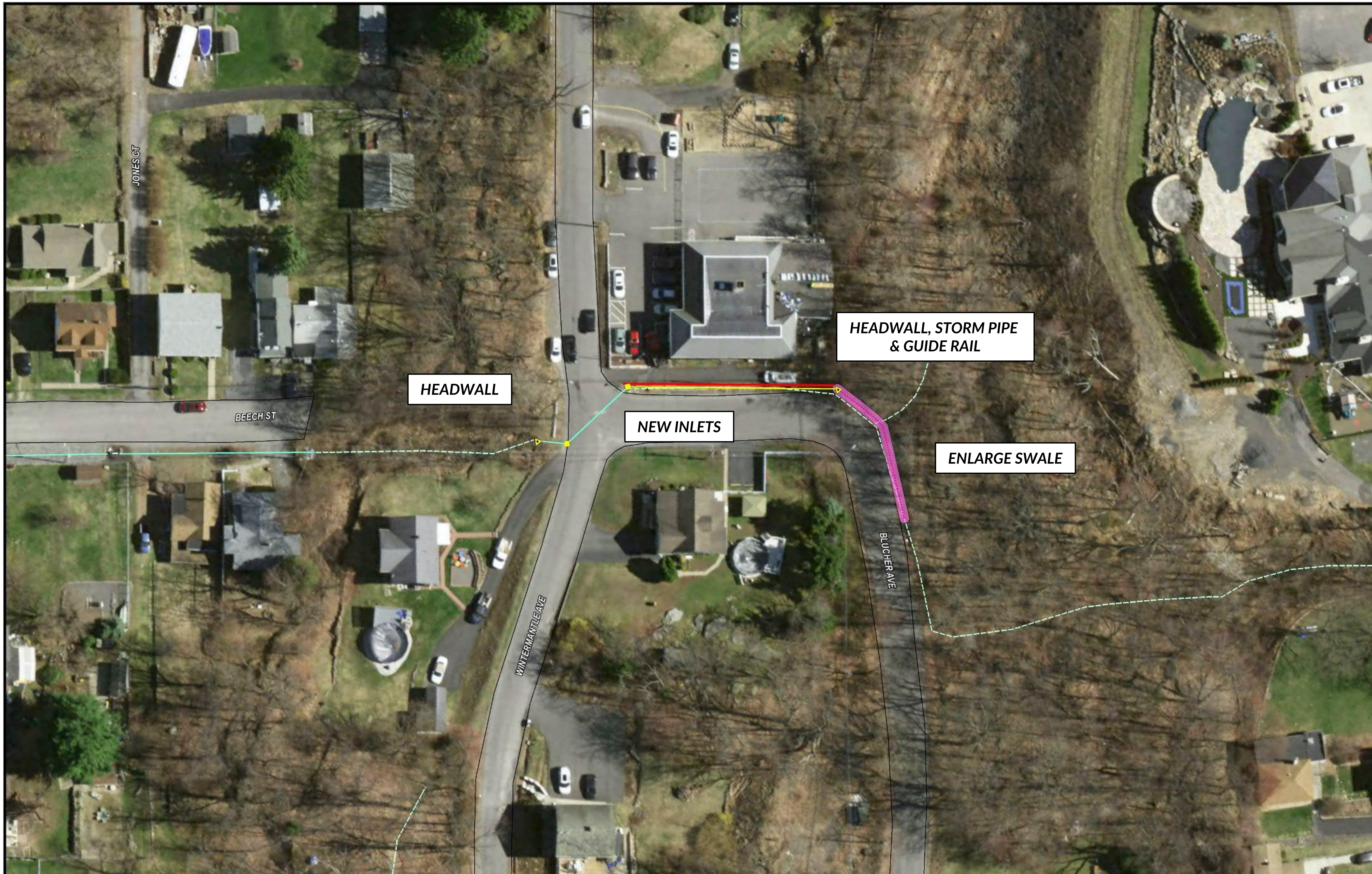
<u>Photo 3.5.1</u> View looking up Beech Street from Wintermantle Avenue at the existing drainage ditch adjacent to the Discovery Montessori School.

<u>Photo 3.5.2</u> View looking down Beech Street from Blucher Avenue. Flooding and icing conditions pose a hazard to vehicles coming down the hill.

Section 3.5.5 – Beech Street & Wintermantle Avenue Site Photographs

Photo 3.5.3 This drainage swale along Blucher Avenue should be excavated and stabilized to better handle stormwater runoff.

Photo 3.5.4 The existing discharge below Wintermantle Avenue should also be stabilized.



PROPOSED DRAINAGE IMPROVEMENTS BEECH STREET & WINTERMANTLE AVENUE (CONCEPTUAL)

East Mountain Stormwater and Drainage Study

City of Scranton
Lackawanna Co., PA

MAP LEGEND:

EXISTING STORM SEWERS

- STORM SEWER STRUCTURES
- STORM SEWER PIPES
- STORMWATER SWALES

PROPOSED IMPROVEMENTS

- INLET
- MANHOLE
- HEADWALL
- STORM SEWER
- UNDER DRAIN
- DRAINAGE SWALE
- INSTALL CURB
- DRAINAGE SWALE
- FRENCH DRAIN
- STORMWATER BASIN
- PAVE APRON AROUND EX. INLET
- NEW CURBS AND PAVEMENT

- Contours based upon 2019 PASDA LiDar
- Property Lines base upon Lckawanna County GIS Parcel Mapping
- 2021 PEMA Aerial Imagery

Mapping derived from data provided by PASDA, Lackawanna County GIS, and City of Scranton GIS and GPS field locations by HRG.

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SECTION 3.6 – EAST MOUNTAIN ROAD

Section 3.6.1- Description of the Drainage Problem

East Mountain Road is a main throughfare which runs through the middle of East Mountain community. Just uphill of Yesu Lane, on the southwestern side of East Mountain Road are a row of seven (7) homes which have been experiencing flooding from stormwater runoff. Based upon a field evaluation of this area, it appears that the flooding is being caused by a combination of stormwater surface runoff and groundwater seepage coming from adjacent properties. The topography of the area sends runoff from three sides into this residential area (See Figure 3.6.1). This includes a 7-acre tract of city-owned land at the intersection of East Mountain and Mountain Lake Roads.

Previously, drainage flowing into the back yards of these homes was collected in a storm drain and discharged into the existing drainage system along East Mountain Road (See Photos in Section 3.6.5). However, based upon flooding photos and videos provided by the homeowners, it appears that this backyard system has failed. Photos of water discharging from a yard grate in the middle of the drainage system indicates that a pipe in the lower portion of the system has collapsed, causing residential flooding.

Section 3.6.2 – Proposed Drainage Improvements

Based upon our evaluation of this drainage problem, HRG feels that the entire drainage system should be replaced behind these homes. Since a majority of the water flowing onto these properties is from a City-owned property, it is appropriate for the City to replace the storm sewer. A new 24" HDPE pipe with lawn grate inlets has been proposed along the same general route that the current system follows. A new headwall will be built to assure that upstream water flows into the system, and the discharge into the East Mountain Road system will be rebuilt. (See Figure 3.6.2).

Appendix B of this report contains the Preliminary Drainage Improvement Plans developed by HRG for this project.

Section 3.6.3 – Final Design and Permitting Requirements

Since the proposed new drainage system will be built on privately owned property, Drainage Easements will be required across each of the eight (8) residential lots for the construction of the system and future maintenance. Once the required drainage easements have been obtained, additional Civil Survey and Engineering will be required to complete the design for construction. A PA-1 Call inquiry should be submitted to locate all utilities around the limits of disturbance. A Civil Survey should be completed to record spot elevations around the proposed improvements, and identify existing features in the areas (i.e. structures, landscaping, etc.). Pipe dimensions, standard notes and details, and construction specifications will be required for final designs. Additional drainage calculations will be required to assure that all new drainage features are stable and sized appropriately. Due to the minimal area of disturbance, no permits from outside agencies are anticipated.

Section 3.6.4 – Preliminary Cost Estimate

Based upon our preliminary design, we estimate that completion of the construction required to mitigate this drainage problem will cost approximate $129,000. Our Preliminary Design – Engineer's Project Cost Opinion has been included in Appendix C of this report.

EAST MOUNTAIN ROAD

- *Residential Flooding*
- *Runoff from new Mountain Lake Road Culvert?*
- *Submitted photos of pipe discharge in rear yard.*
- *Ties into Mountain Lake Road drainage system*

Section 3.6.5 – East Mountain Road Site Photographs

Photo 3.6.1 Homeowner's photo shows water discharging from a lawn grade during a flooding event. This indicates that the pipes in the lower portion of the drainage system must be blocked or collapsed.

Photo 3.6.2 View looking east towards the City-owned property which drains onto these properties.

Section 3.6.5 – East Mountain Road Site Photographs

Photo 3.6.3 The existing stormwater inlet for this drainage system is located under this small bridge.

Photo 3.6.4 Existing headwall draining stormwater runoff into the drainage system behind the homes on East Mountain Road.

Section 3.6.5 – East Mountain Road Site Photographs

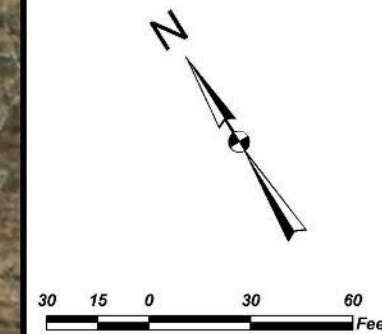
Photo 3.6.5 View looking east across the rear yards of the homes on East Mountain Road.

Photo 3.6.6 Low spot which runs through the backyards where the new drainage system is proposed.

PROPOSED DRAINAGE IMPROVEMENTS EAST MOUNTAIN ROAD (CONCEPTUAL)

East Mountain Stormwater and Drainage Study

City of Scranton
Lackawanna Co., PA



MAP LEGEND:

EXISTING STORM SEWERS
- STORM SEWER STRUCTURES
- STORM SEWER PIPES
- STORMWATER SWALES

PROPOSED IMPROVEMENTS
- INLET
- MANHOLE
- HEADWALL
- STORM SEWER
- UNDER DRAIN
- DRAINAGE SWALE
- INSTALL CURB
- DRAINAGE SWALE
- FRENCH DRAIN
- STORMWATER BASIN
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SECTION 3.7 – LINWOOD AVENUE

Section 3.7.1- Description of the Drainage Problem

The existing drainage system for Seymour Avenue and Ariel Street discharges into the undeveloped right of way at the end of Ariel Street (See Figure 3.7.1). With a drainage area of approximately 50 acres, this drainage system is discharging a large volume of stormwater, but the conveyance system below this discharge is minimal and in disrepair (See Photos in Section 3.7.5). As a result, stormwater floods Linwood Avenue and the driveway into the Linwood Nursing and Rehabilitation Center.

Section 3.7.2 – Proposed Drainage Improvements

Based upon our evaluation of this drainage problem, HRG has concluded that the entire drainage system from the end of Ariel Street to the culvert under State Route 307 should be rebuilt (See Figure 3.7.2). Beginning at the discharge of the two stormwater pipes at the end of Aerial Street, a stable swale should be constructed to convey the runoff downhill. The existing driveway culvert should be replaced by a new collection system along the Nursing Home driveway down to Linwood Avenue. At the discharge from Linwood Avenue, another drainage swale is needed to direct the runoff to the Route 307 culvert.

Appendix B of this report contains the Preliminary Drainage Improvement Plans developed by HRG for this project.

Section 3.7.3 – Final Design and Permitting Requirements

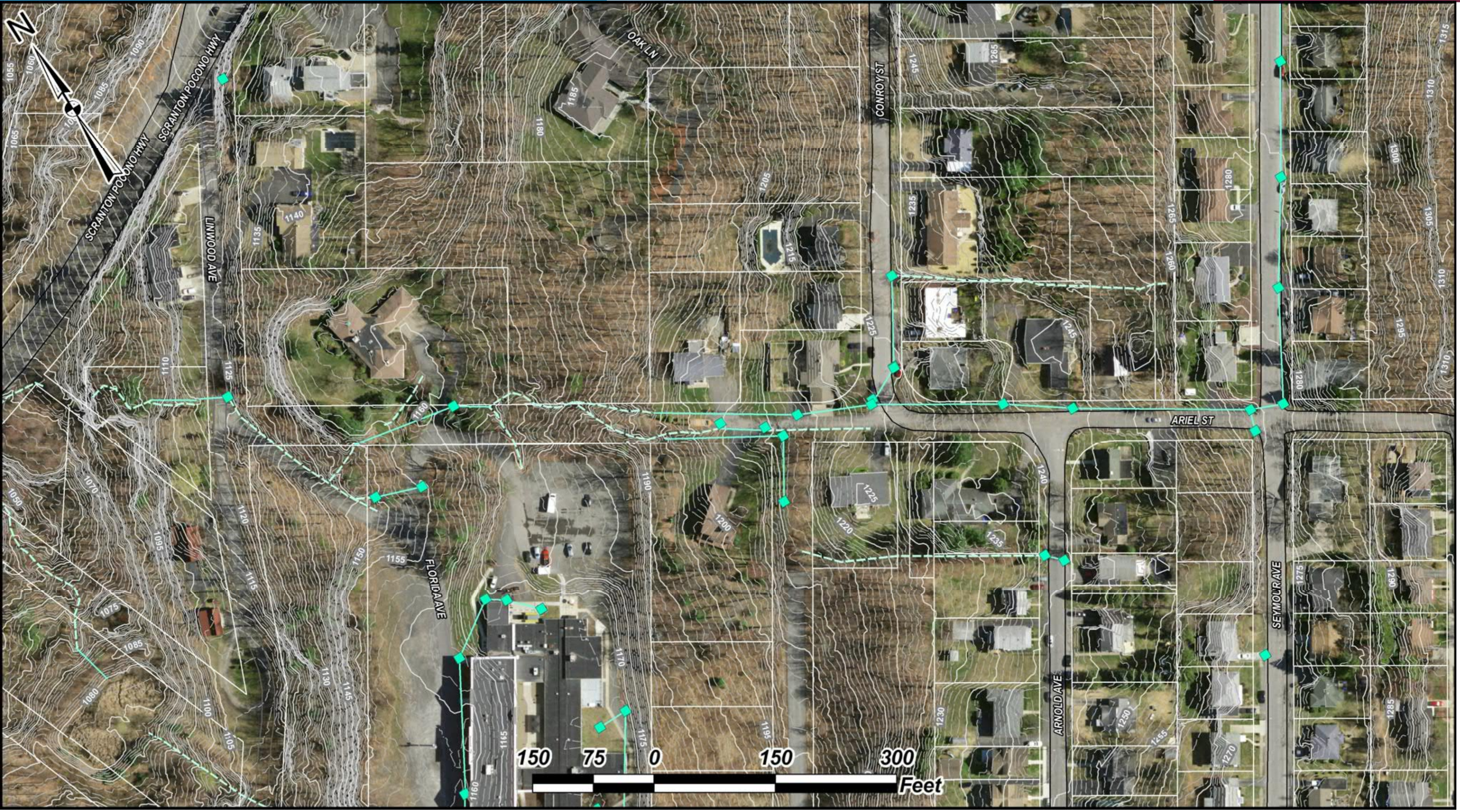
Since portions of the new drainage system will be built outside of the public right of way, drainage easements may be required from the affected property owners to allow for construction of the improvements and future maintenance. Once the required drainage easements have been obtained, additional Civil Survey and Engineering will be required to complete the design for construction. A PA-1 Call inquiry should be submitted to locate all utilities around the work areas. If underground utilities are located within the proposed limits of disturbance, additional Subsurface Utility Engineering (SUE) may be necessary to determine the precise location and depth of the pipes. Survey should be completed to create topographic mapping around the proposed improvements, and identify existing features in the area (i.e. structures, landscaping, etc.).

Additional drainage calculations will be required to assure that all new drainage features are stable and sized appropriately. Drainage details, soil erosion control measures, standard notes and details, and construction specifications will be required for final designs. If the earthwork required for the new drainage system exceeds one (1) acre, a National Pollutant Discharge Elimination System (NPDES) permit would be needed for this project.

Section 3.7.4 – Preliminary Cost Estimate

Based upon our preliminary design, we estimate that completion of the construction required to mitigate this drainage problem will cost approximate $300,000. Our Preliminary Design – Engineer's Project Cost Opinion has been included in Appendix C of this report.

LINWOOD AVENUE



- *Washouts on Linwood & Florida Avenues*
- *Residential Flooding*
- *Existing drainage system on Ariel Street*

Section 3.7.5 – Linwood Avenue Site Photographs

Photo 3.7.1 View looking down Ariel Street towards the dead end where the stormwater drainage system discharges.

Photo 3.7.2 View looking uphill from the end of Ariel Street.

Section 3.7.5 – Linwood Avenue Site Photographs

Photo 3.7.3 One of two stormwater discharges at the end of Ariel Street

Photo 3.7.4 Stormwater discharges into this unmaintained drainage swale which had eroded and is filled with debris.

Section 3.7.5 – Linwood Avenue Site Photographs

Photo 3.7.5 View of the unstable conditions that have developed within the drainageway of the Ariel Street stormwater runoff.

Photo 3.7.6 This is the existing driveway culvert below Ariel Street. It is both undersized and in disrepair.

Section 3.7.5 – Linwood Avenue Site Photographs

Photo 3.7.5 The downstream end of the driveway culvert shows the structural failure of the corrugated metal pipe.

Photo 3.7.6 The swale downstream of the driveway culvert has been blocked by these large boulders.

Section 3.7.5 – Linwood Avenue Site Photographs

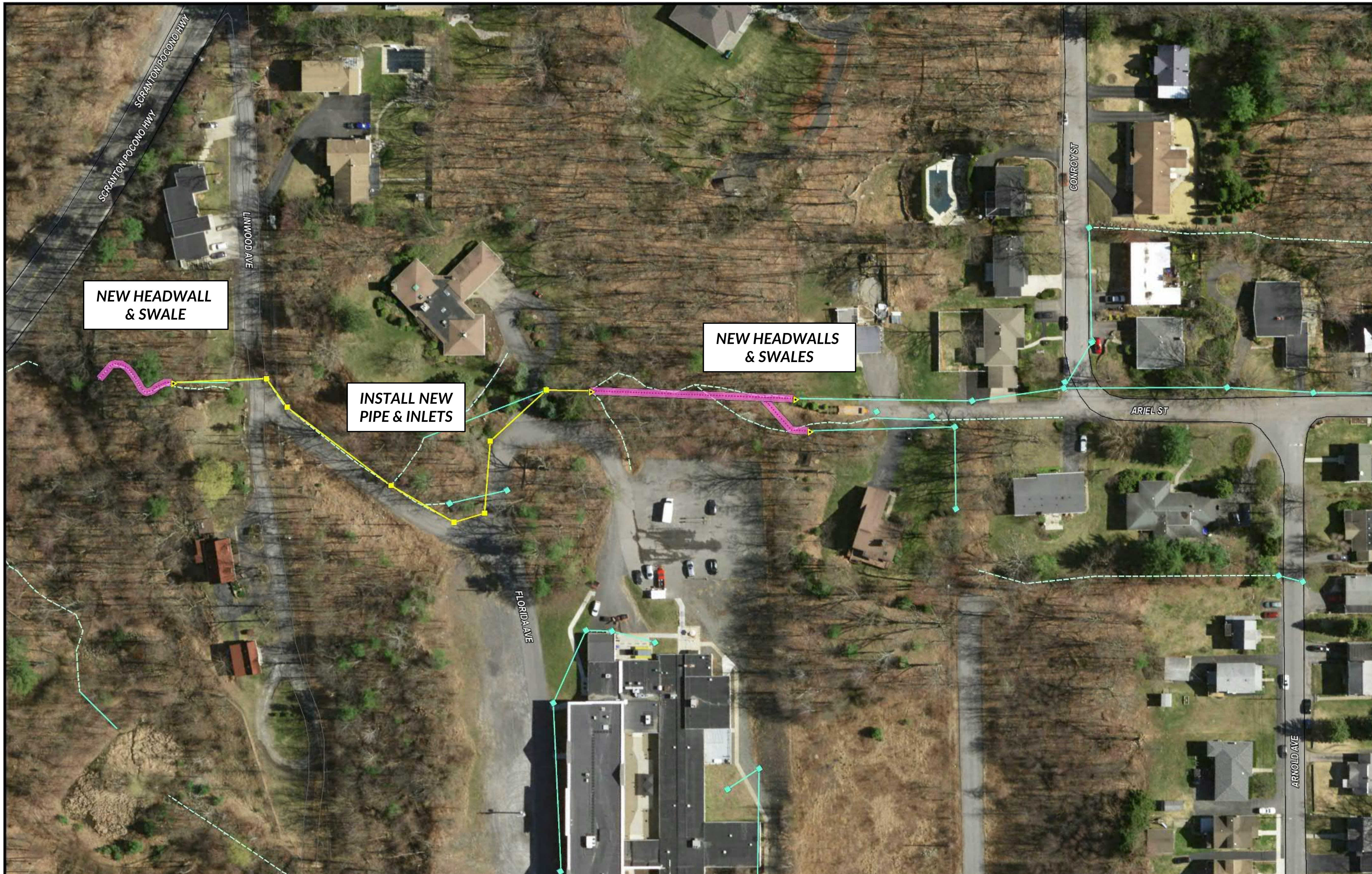
Photo 3.7.7 The concrete gutter along the Nursing Home driveway is insufficient to convey flow from larger storm which results in flooding of the cartway.

Photo 3.7.8 Inlet for the cross drain under Linwood Avenue is filled with silt and debris, and not functioning.

Section 3.6.5 – Linwood Avenue Site Photographs

Photo 3.7.9 Discharge from the Linwood Avenue culvert has no outlet protection or downstream drainage swale .

Photo 3.7.10 Drainage from the Linwood Avenue culvert is allowed to free-flow downhill towards the Route 307 culvert.



PROPOSED DRAINAGE IMPROVEMENTS LINWOOD AVENUE (CONCEPTUAL)

East Mountain Stormwater and Drainage Study

City of Scranton
Lackawanna Co., PA

MAP LEGEND:

EXISTING STORM SEWERS
- STORM SEWER STRUCTURES
- STORM SEWER PIPES
- STORMWATER SWALES

PROPOSED IMPROVEMENTS
- INLET
- MANHOLE
- HEADWALL
- STORM SEWER
- UNDER DRAIN
- DRAINAGE SWALE
- INSTALL CURB
- DRAINAGE SWALE
- FRENCH DRAIN
- STORMWATER BASIN
- PAVE APRON AROUND EX. INLET

- Contours based upon 2019 PASDA LiDar
- Property Lines base upon Lckawanna County GIS Parcel Mapping
- 2021 PEMA Aerial Imagery

Mapping derived from data provided by PASDA, Lackawanna County GIS, and City of Scranton GIS and GPS field locations by HRG.

10/10/2023	PM: GW	GIS: GW	QA: SS	004441.0436

HRG
369 East Park Drive
Harrisburg, PA 17111
717.564.1121 [phone]
717.564.1158 [fax]
www.hrg-inc.com

SECTION 3.8 – FLORIDA AVENUE

Section 3.8.1- Description of the Drainage Problem

Ponded water has been a longtime problem along a low-lying section of Florida Avenue. Although three roadway drainage inlets were observed during a field evaluation, it was noted that the southern catch basin, adjacent to 125 Florida Avenue, is not connected to the drainage system (See Figure 3.8.1). Roadside discharge from several small lawn drains was also observed (See Photos in Section 3.8.5).

In addition, there was a report by the residents of 101 Florida Avenue about flood water flowing down the hill behind their home. Our field evaluation found that this was most likely caused by drainage from Oswald Avenue. Although there is a catch basin on that street which flows into the drainage system for the Linwood Nursing and Rehabilitation Center, a section of missing curb along Oswald allows stormwater runoff to bypass the inlet. Therefore, much of the runoff from the low spot on Oswald Avenue drains down the hillside towards 125 Florida Avenue.

Section 3.8.2 – Proposed Drainage Improvements

To prevent ponding on Florida Avenue, HRG recommends the installation of two new stormwater catch basins on the eastern side of Florida Avenue (See Figure 3.8.2). These new inlets are to be tied into the existing drainage system which discharges into the woodland behind 120 Florida Avenue. New curbing along the western shoulder of Oswald Avenue is recommended to keep runoff from bypassing the existing inlet.

Appendix B of this report contains the Preliminary Drainage Improvement Plans developed by HRG for this project.

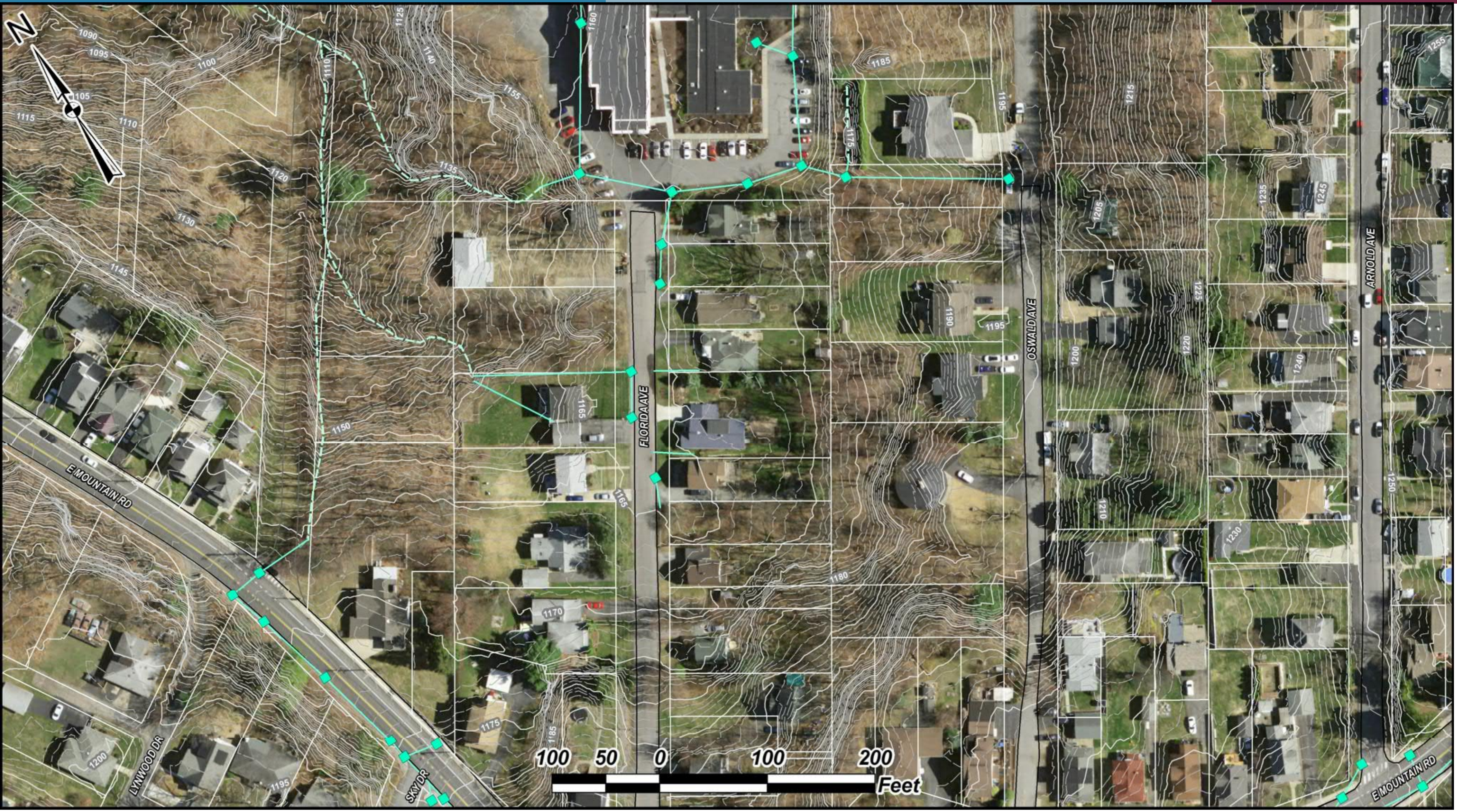
Section 3.8.3 – Final Design and Permitting Requirements

Based upon our preliminary analysis of this drainage problem, additional engineering design can be kept to a minimum. A PA-1 Call inquiry should be submitted to locate all utilities around the work areas. If underground utilities are located within the proposed limits of disturbance, additional Subsurface Utility Engineering (SUE) may be necessary to determine the precise location and depth of the pipes. A Civil Survey should be completed to record spot elevations around each inlet, and identify existing features in the areas (i.e. mailboxes, landscaping, etc.). Drainage details, standard notes and details, and construction specifications will be required for final designs. Additional drainage calculations will be required to assure that all new drainage features are stable and sized appropriately. Due to the minimal area of disturbance, no permits from outside agencies are anticipated.

Section 3.8.4 – Preliminary Cost Estimate

Based upon our preliminary design, we estimate that completion of the construction required to mitigate this drainage problem will cost approximate $58,000. Our Preliminary Design – Engineer's Project Cost Opinion has been included in Appendix C of this report.

FLORIDA AVENUE



- *Ponding water on Florida Avenue*
- *Runoff from Oswald Avenue*

HRG

Section 3.8.5 – Florida Avenue Site Photographs

<u>Photo 3.8.1</u> View looking north on Florida Avenue towards the Linwood Nursing and Rehabilitation Center.

<u>Photo 3.8.2</u> These two stormwater inlets have been insufficient to eliminate the ponding of stormwater in a low-lying section of Florida Avenue.

Section 3.8.5 – Florida Avenue Site Photographs

<u>Photo 3.8.3</u> The existing Florida Avenue drainage system discharges into the woodland behind 120 Florida Avenue.

<u>Photo 3.8.4</u> Missing curb along a low section on Oswald Avenue has allow stormwater runoff to bypass a catch basin on that road, and has resulted in flooding at 101 Florida Avenue.

PROPOSED DRAINAGE IMPROVEMENTS FLORIDA AVENUE (CONCEPTUAL)

East Mountain Stormwater and Drainage Study

City of Scranton
Lackawanna Co., PA

N

30 15 0 30 60 Feet

MAP LEGEND:

EXISTING STORM SEWERS

- STORM SEWER STRUCTURES
- STORM SEWER PIPES
- STORMWATER SWALES

PROPOSED IMPROVEMENTS

- INLET
- MANHOLE
- HEADWALL
- STORM SEWER
- UNDER DRAIN
- DRAINAGE SWALE
- INSTALL CURB
- DRAINAGE SWALE
- FRENCH DRAIN
- STORMWATER BASIN
- PAVE APRON AROUND EX. INLET

- Contours based upon 2019 PASDA LiDar
- Property Lines base upon Lckawanna County GIS Parcel Mapping
- 2021 PEMA Aerial Imagery

Mapping derived from data provided by PASDA, Lackawanna County GIS, and City of Scranton GIS and GPS field locations by HRG.

10/10/2023	PM: GW	GIS: GW	QA: SS	004441.0436

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SECTION 3.9 – SNOOK STREET

Section 3.9.1- Description of the Drainage Problem

Drainage problems have plagued the residents in the area around the intersection of Snook Street and Seymore Avenue. Irregular slopes, shallow bedrock, groundwater outcrops and the lack of a municipal drainage system have all contributed to this drainage problem. Numerous complaints have been filed by the residents of this neighborhood, and City officials have been looking for ways to improve the drainage. Problem areas include roadway flooding at the intersection of Seymour Avenue and Batluck Street; residential property flooding at 44 Snook Street; residential flooding on Grand Avenue; structure flooding at 25 Snook Street; and roadway flooding at the intersection of Snook Street and State Route 307 (See Figure 3.9.1).

Recent development on Grande Circle has made the situation worst. It appears that grading for the new homes increased groundwater seepage, which flows behind the homes on Snook Street. The water ponds in a low-lying area but is not able to infiltrate into the ground due to shallow bedrock (See Photos in Section 3.9.5).

Section 3.9.2 – Proposed Drainage Improvements

Based upon our evaluation of this drainage problem, HRG has concluded that a new roadway drainage system is needed for the area from Batluck Street down to Snook Street (See Figure 3.9.2). Undulating topography makes it impossible to drain water away from this area without a storm sewer system. Therefore, a series of catch basins and drainpipes are proposed within the public right of way. Roadway paving and curbing is also recommended to convey the runoff into the inlets and away from private property. The new drainage system will discharge into the existing Route 307 stormwater management system. The proposed system will not change the current drainage area which feeds into the Route 307 storm sewer. Rather than overland flow, the water will be conveyed via the proposed pipe system. Although this may result in a minor change in the time of concentration, no significant impact is expected in the volume of runoff conveyed by the Route 307 storm sewer.

In addition, to better control groundwater seepage behind the homes on Snook Street, a sub-surface drain is proposed within a narrow public right of way that is located behind these homes. Groundwater which is captured by this drain will be piped into the new inlets on Snook Street.

Appendix B of this report contains the Preliminary Drainage Improvement Plans developed by HRG for this project. The preliminary drainage calculations which were used to develop the preliminary plans have been included in Appendix D of this report.

Section 3.9.3 – Final Design and Permitting Requirements

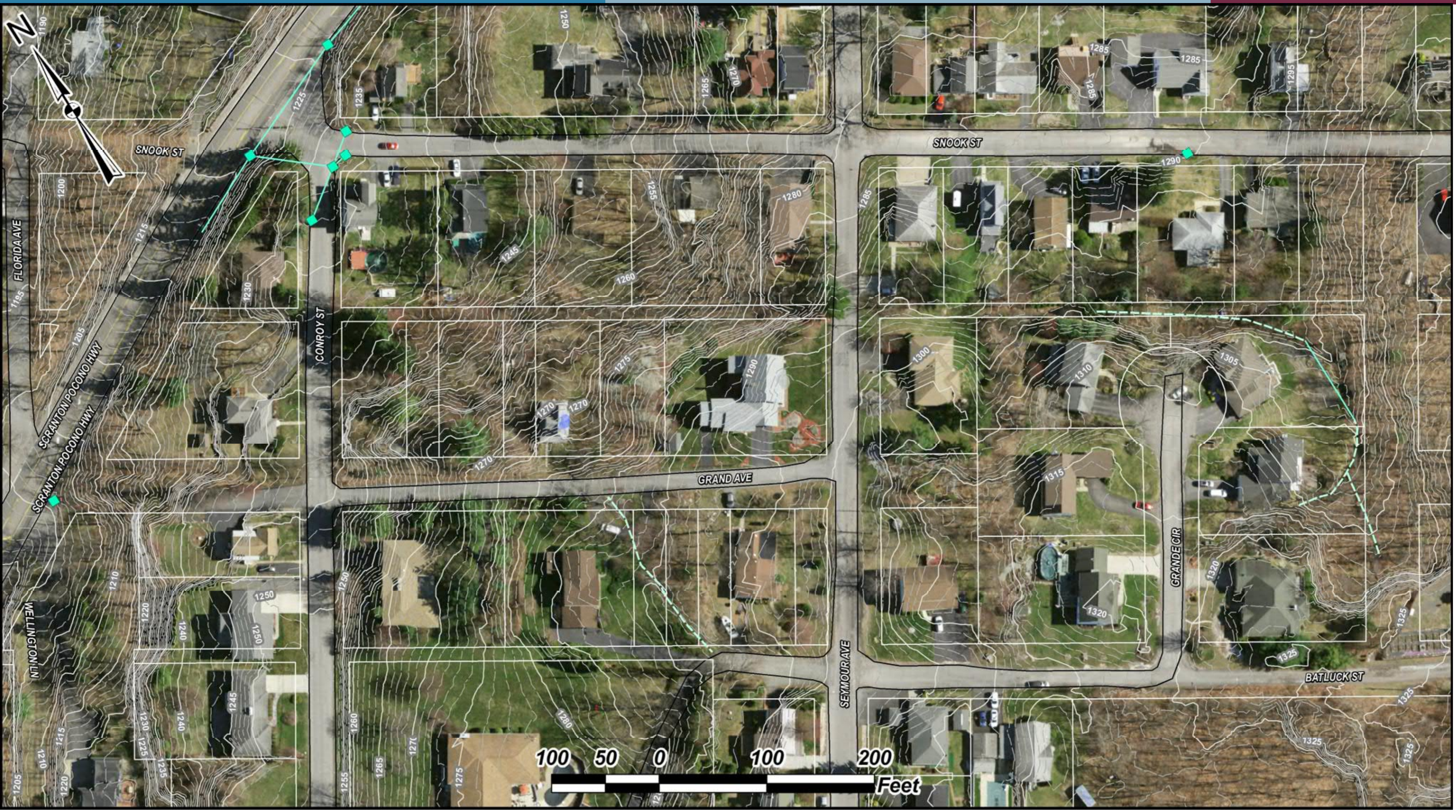
Since portions of the new drainage system will be built outside of the public right of way, drainage easements may be required from the four (4) affected property owners to allow for construction of the improvements and future maintenance. Once the required drainage easements have been obtained, additional Civil Survey and Engineering will be required to complete the design for construction. A PA-1 Call inquiry should be submitted to locate all utilities around the work areas. If underground utilities are located within the proposed limits of disturbance, additional Subsurface Utility Engineering (SUE) may be necessary to determine the precise location and depth of the pipes. Survey should be completed to create topographic mapping around the proposed improvements, and identify existing features in the area (i.e. structures, landscaping, etc.). Since portions of the new drainage system will be built outside of the public right of way, drainage easements may be required from the affected property owners.

Additional drainage calculations will be required to assure that all new drainage features are stable and sized appropriately. Drainage details, soil erosion control measures, standard notes and details, and construction specifications will be required for final designs. If the earthwork required for the new drainage system exceeds one (1) acre, a National Pollutant Discharge Elimination System (NPDES) permit may be needed for this project.

Section 3.9.4 – Preliminary Cost Estimate

Based upon our preliminary design, we estimate that completion of the construction required to mitigate this drainage problem will cost approximate $1,370,000. Our Preliminary Design – Engineer's Project Cost Opinion has been included in Appendix C of this report.

SNOOK STREET



- ***Residential Flooding on Snook St. & Grand Ave.***
- ***High Groundwater Table***
- ***Street Ponding on Seymour Avenue***
- ***Runoff crossing Moosic Street***

HRG

Section 3.9.5 – Snook Street Site Photographs

Photo 3.9.1 Groundwater seepage near the new development on Grande Circle has led to increased residential flooding on Snook Street.

Photo 3.9.2 Groundwater seepage flows around areas filled for construction of the new homes on Grande Circle.

Section 3.9.5 – Snook Street Site Photographs

Photo 3.9.3 Runoff from Grande Circle ponds in the rear yard of homes along Snook Street where it is unable to infiltrate into the ground due to shallow bedrock.

Photo 3.9.4 View looking down Snooks Street at an area which is often flooded by stormwater runoff. Undulating topography makes it impossible to drain water away from this area without a storm sewer system.

Section 3.9.5 – Snook Street Site Photographs

Photo 3.9.5 The proposed stormwater drainage system will drain water off of Snook Street and discharge the runoff into the existing Route 307 drainage system.

Photo 3.9.6 The new drainage system will also alleviate flooding at the intersection of Batluck Street and Seymour Avenue.

Section 3.9.5 – Snook Street Site Photographs

Photo 3.9.5 New roadway curbing will convey the runoff into the inlets and away from private property.

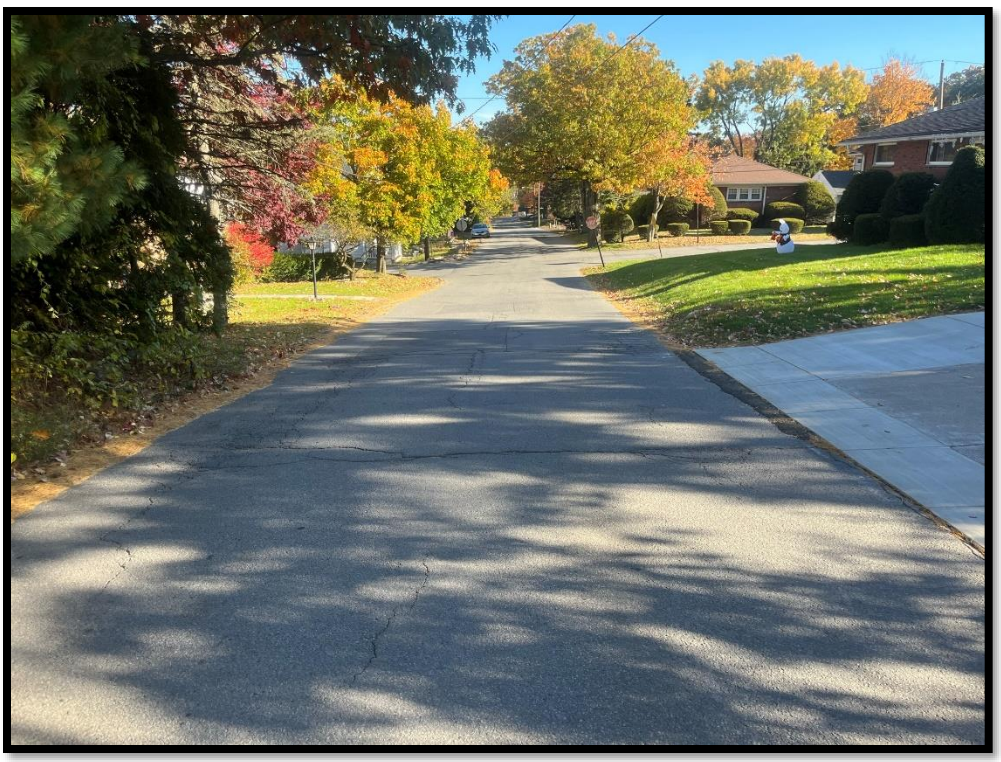


Photo 3.9.6 View looking down Seymour Avenue towards the intersection with Snook Street.

Section 3.9.5 – Snook Street Site Photographs

Photo 3.9.7 View looking northwest on Snook Street towards Route 307. In the past, stormwater runoff has flooded this area.

Photo 3.9.8 View of the intersection of Snook Street and Route 307. Better management of stormwater runoff on Snook Street will reduce the amount of water which runs onto the highway.


PROPOSED DRAINAGE IMPROVEMENTS SNOOK STREET (CONCEPTUAL)
East Mountain Stormwater and Drainage Study
City of Scranton
Lackawanna Co., PA
REDUCE RUNOFF CROSSING MOOSIC ST
INSTALL NEW INLETS & PIPES
SUBSURFACE DRAIN
REDUCE RUNOFF TO GRAND AVE
NEW CURBS & PAVEMENT
REDUCE RUNOFF TO BATLUCK ST.
SNOOK ST
SCRANTON POCONO HWY
SCRANTON POCONO HWY
CONROY ST
GRAND AVE
SEYMOUR AVE
GRANDE CIR
BATLUCK ST
N
50 25 0 50 100
Feet
MAP LEGEND:
EXISTING STORM SEWERS
- STORM SEWER STRUCTURES
- STORM SEWER PIPES
- STORMWATER SWALES
PROPOSED IMPROVEMENTS
- INLET
- MANHOLE
- HEADWALL
- STORM SEWER
- UNDER DRAIN
- DRAINAGE SWALE
- INSTALL CURB
- DRAINAGE SWALE
- FRENCH DRAIN
- STORMWATER BASIN
- PAVE APRON AROUND EX. INLET
- NEW CURBS AND PAVEMENT
- Contours based upon 2019 PASDA LiDar
- Property Lines base upon Lckawanna County GIS Parcel Mapping
- 2021 PEMA Aerial Imagery
Mapping derived from data provided by PASDA, Lackawanna County GIS, and City of Scranton GIS and GPS field locations by HRG.
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SECTION 4: MS4 PERMIT IMPLICATIONS

The Study Area is divided between two drainage areas, the southern portion of the community drains to Stafford Meadow Brook, and the northern side drains to Roaring Brook. Both of these waterways have been classified as Impaired, Non-Attaining Waterways due to Pathogens from Urban Runoff and Storm Sewers. They are both tributaries of the Lackawanna River which is also an Impaired, Non-Attaining Waterway due to: Pathogens from Combined Sewer Overflow and Urban Runoff / Storm Sewers; Flow Regime Modification, Siltation, PH & Metals from Acid Mine Drainage. As such, all of the drainage from the East Mountain area falls within the City of Scranton's Municipal Separate Storm Sewer Systems (MS4) Permit.

Among the recommendations in the **2013 Stormwater Management (MS4 & CSO) System Review for the City of Scranton & Scranton Sewer Authority** were these two suggestions for the East Mountain area:

- *Opportunities to detain and infiltrate separate storm flows from East Mountain Rd, Mountain Lake Run and Route 81 should be investigated in the context of the Route 81 widening project proposed over the next 15 to 20 years.*

- *An outreach program to property owners with open channel portions of Stafford Meadow Brook should be organized with the objective of debris removal, invasive species control and bank stabilization.*

The **2020 Chesapeake Bay Pollution Reduction Plan (PRP) for the City of Scranton** estimated that the Existing Pollution Loading for the Lackawanna River within Scranton is approximately 1,985,456 pounds per year. Under their current MS4 permit, the City is required to reduce the loading rate by ten percent (10%), or 198,456 pounds per year. Under the current PRP, the City has proposed five (5) stream restoration projects along Keser Creek, and a combination of street sweeping and catch basin cleaning to meet the MS4 requirements in the Lackawanna River drainage area.

The nine (9) drainage improvement projects which have been proposed to mitigate the drainage problems in East Mountain will also provide some water quality improvement in stormwater runoff from the area. Appendix E of this report contains the PADEP BMP Effectiveness Value table which outlines various best management practices (BMPs) which can be used for credit in MS4 Pollution Reduction Plans.

Although there is close to 1000 feet of new drainage swales proposed within the drainage improvement projects, most of them are designed for stabilization and are too steep to provide water quality credits. However, the small basin which is proposed as part of the Mountain Lake Creek improvements could be enhanced to provide additional water quality credits. It may also be possible to use catch basins with a 12" sediment trap sump to facilitate Storm Sewer System Solids Removal.

Further analysis of the potential water quality benefits can be completed during the Final Design Phase of these projects once final grades have been established for the stormwater collection systems.

SECTION 5: RECOMMENDATIONS

The nine (9) drainage improvement projects which have been outlined above will help mitigate the drainage problems that have been reported in those areas. However, in some cases they may also help solve drainage problems further downhill. Once these improvement projects have been implemented, drainage problems throughout East Mountain should be reassessed to see if other improvements are needed.

Final Design and permitting for these projects should begin as soon as possible. Due to the variation of design and permitting required for each project, and to accelerate completion of the projects, it is recommended that each project should be bid and constructed individually. As the final work is completed for each project, the City can determine if some of the projects can be grouped together for bidding and construction.

Other measures that can be taken by the City to reduce flooding problems on East Mountain include:

- **Maintenance:** Many drainage structures in the area have not been regularly cleaned and maintained resulting in lower capacity or failure. This is especially true of drainage swales which have become overgrown or filled with debris.

- **Roadside Swales:** Some of the roadside drainage swales have been filled with stone and/or cobbles which has significantly reduced their capacity. The bulk of this stone should be removed to restore the flow capacity. If there are traffic safety concerns about these open ditches, guiderails may be added along the edge of the cartway.

- **Drainage Modifications:** Before making changes in drainage features, consideration should be made to the impact that this may make in downhill drainage.

- **Flow Efficiency:** Many of the drainage systems are inconsistent in both structure and finish. Each time the flow changes from a ditch to a pipe, a headwall or flared-end section should be installed to assure that all of the runoff drains into the pipe.

APPENDIX A
PUBLIC COMMENTS

INTRODUCTION

PUBLIC SUBMISSION OF FLOOD AND STORMWATER ISSUES

As part of the East Mountain Stormwater and Drainage Study, the City of Scranton created an online site where members of the public could submit their "Flood and Stormwater Issues".

(*https://scrantonpa.viewpointcloud.com/categories/1072/record-types/6525*).

At the November 30, 2022 Public Meeting which was held at the Howard Gardner Multiple Intelligence Charter School, HRG and the City announced this online reporting service and encouraged the public to submit their information for inclusion in the Study. To date, twenty-six (26) submissions have been made to this site to express concern about local flooding and drainage issues. Narratives describing the problems were accompanied by sketches, photographs and videos.

The location of each site has been identified in HRG's Geographic Information System (GIS) mapping of the community and labeled accordingly. Public comments and documentation were reviewed for each submission so that this information could be included in the Stormwater and Drainage Study. Four of the sites fall outside of East Mountain, so they were not included in the Study.

AREAS OF CONCERN

HRG is currently assessing drainage patterns throughout the East Mountain community. As directed by the City, five (5) areas with a history of flooding problems within East Mountain are being addressed for flood mitigation. These areas are:

- Cherry Street Drainage and Stormwater Management Issues
- Blucker and Wintermantle Avenue Drainage Problems
- Mountain Lake Creek
- Roaring Brook Tributary
- Snook Street Area (3 sites)

ISSUES ADDRESSED BY DRAINAGE STUDY

HRG has made recommendations for drainage improvements in each of the Areas of Concern. Public Comments were then re-reviewed to determine which reported drainage issues would benefit from the proposed drainage improvements. To summarize our findings, a colored status bar was added to each submission to indicate if improvements could be expected at that site. Sites were broken down into four categories:

- Site is not located within East Mountain

- Site is located within East Mountain, but not within an Area of Concern

- Issues will be partially addressed by the Drainage Improvements

- Flooding issue could be improved by the proposed drainage improvements

PUBLIC COMMENT: FLD-01

IS THIS ISSUE ADDRESSED BY THE DRAINAGE STUDY?
PARTIALLY – New culverts at Derby Ave will help, repair of curb required

Date Submitted: 11/2/2022 21:43

Address: 1434 E ELM ST, Scranton, PA 18505

Name: Thomas Bohn

Phone Number: 5708409006

Email Address:

Date Witnessed: 10/31/2022

Type of Issue: Street Flooding

Reoccurring Issue?: Yes, regularly

Nearest intersection: Rollin Ave

Describe flooding issue in detail: After paving project this past summer water from the street runs into my driveway and garage because the curb was damaged and never replaced.

Submitted Photos:

(1)

PUBLIC COMMENT: FLD-02

IS THIS ISSUE ADDRESSED BY THE DRAINAGE STUDY?
NO – Site is not located within East Mountain

Date Submitted: 11/7/2022 17:07

Address: 310 MIFFLIN AVE, Scranton, PA 18503

Name: Craig Beavers

Phone Number: 570-348-4193

Email Address:

Date Witnessed: 11/7/2022

Type of Issue: Missing Storm Drain

Reoccurring Issue?: Yes

Nearest intersection: Linden St and Hallstead Ct

Describe flooding issue in detail: There is large ponding at Hallstead and Linden, near St. Mary's. There is no storm drain or catch basin nearby, and water pools into the road.

Submitted Photos:

PUBLIC COMMENT: FLD-03

IS THIS ISSUE ADDRESSED BY THE DRAINAGE STUDY?
NO – Site does not fall within an identified Study Area within East Mountain

Date Submitted: 11/10/2022 17:13

Address: 518 RIVER ST, Scranton, PA 18505

Name: Fran Cutter

Phone Number: 215-834-3827

Email Address:

Date Witnessed: 11/8/2022

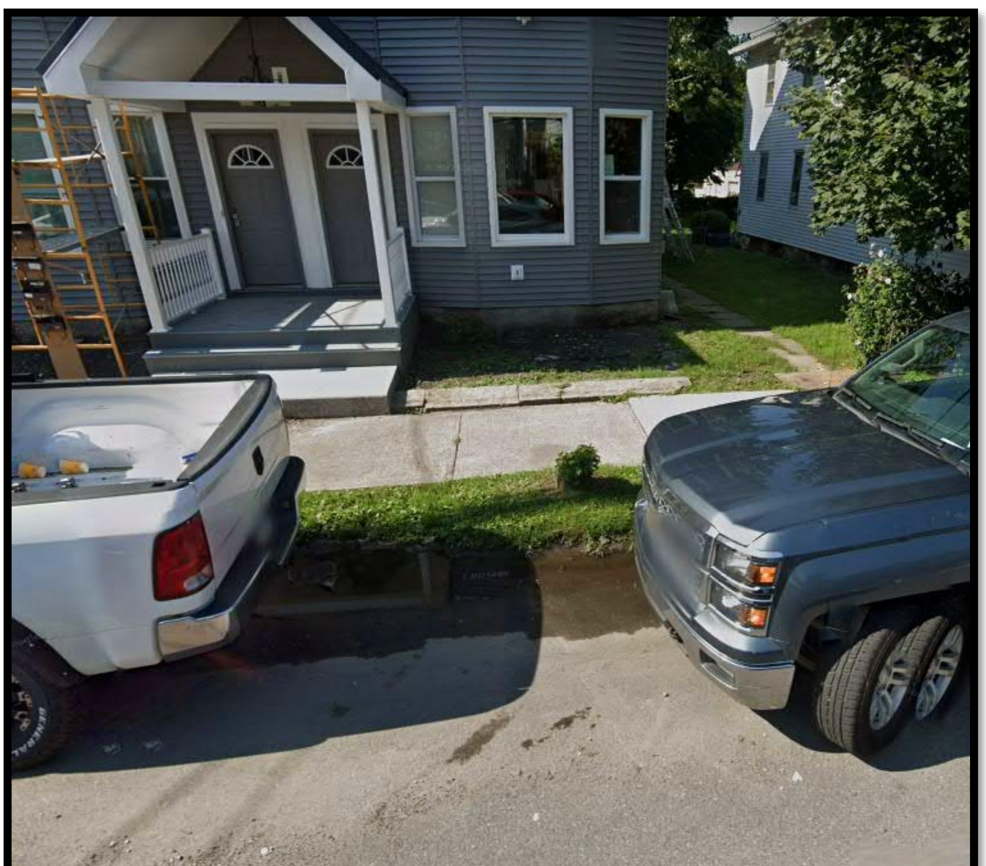
Type of Issue: Street Flooding

Reoccurring Issue?: Yes, regularly

Nearest intersection: Hamm Ct

Describe flooding issue in detail: no curb, street floods property. Concerned about upcoming storms!

Submitted Photos:



PUBLIC COMMENT: FLD-04

IS THIS ISSUE ADDRESSED BY THE DRAINAGE STUDY?
YES – Proposed drainage improvements on Florida Ave. would improve this drainage issue.

Date Submitted: 11/25/2022 19:56

Address: 123 FLORIDA AVE, Scranton, PA 18505

Name: santo quatra

Phone Number: 5703622631

Email Address: quatras@gmail.com

Date Witnessed: 11/1/2022

Type of Issue: Entire Street Flooding

Reoccurring Issue?: Yes, regularly

Nearest intersection: east mtn road

Describe flooding issue in detail: Water coming down the mtn has been increasing since the late 1990’s. I have installed 3 - 150' ft pipes over the years. A 6" and a 4" in the last 3 years. Runnoff control was not addressed as they were building on wooded lands even though I had a city engineer here for two sites and nothing was done. There is also several underground pipes over 100 years old that are still functioning and I would like to make you aware of. 2 culverts have been covered over by a previous property owner and I would like to make their locations known for future issues. They handle a lot of water. Most of people familiar with these lines are retired or deceasd. Thank you.

I am retired and I can meet at any time.

Submitted Photos:

PUBLIC COMMENT: FLD-05

IS THIS ISSUE ADDRESSED BY THE DRAINAGE STUDY?
NO – Site is within East Mountain, but not within an area studied.

Date Submitted: 11/26/2022 18:48

Address: 1407 E LOCUST ST, Scranton, PA 18505

Name: Paul & Eileen Miller

Phone Number: 570-881-1740

Email Address: paulpacattack@msn.com

Date Witnessed: 7/29/2022

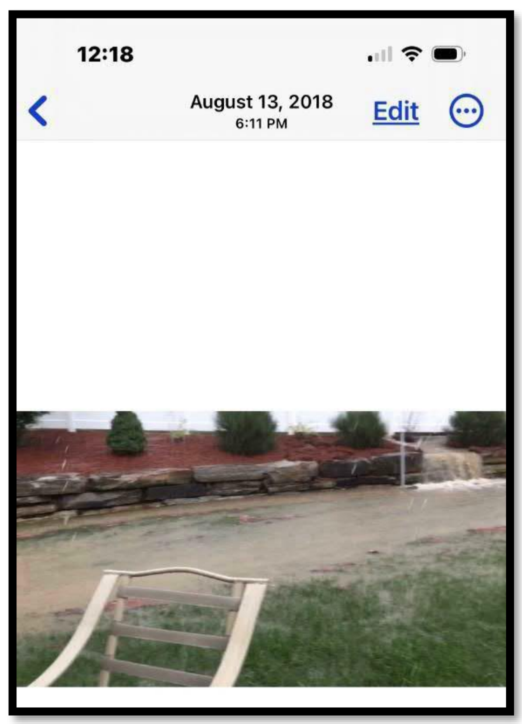
Type of Issue: Other Date is approximately

Reoccurring Issue?: Yes, on occassion

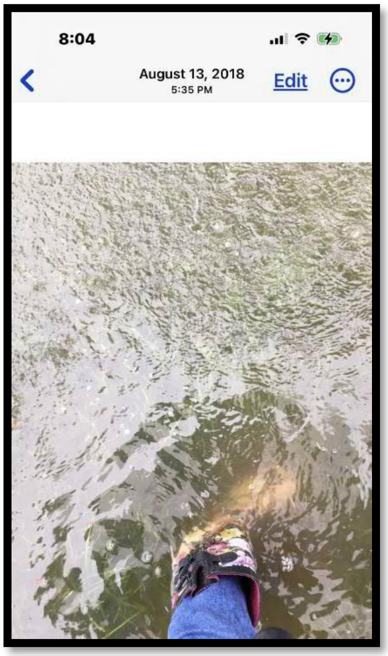
Nearest intersection: Froude Ave. & East Locust Street

Describe flooding issue in detail: When the ground water table is saturated, and we get downpours. The water runoff from the neighbors above us, and the neighbors on East Elm Street come into our yard like a running creek. Including the runoff from Howard Gardner School, and above. Make its way to our side and back yard. Which has flooded our basement, inground pool, and sunk some of our pool side pavers. The city has a 15 foot right of way on both sides of our property, and behind our property.

Submitted Photos: *(see file for video)*



FLD-05 *(continued)*



PUBLIC COMMENT: FLD-06

IS THIS ISSUE ADDRESSED BY THE DRAINAGE STUDY?
PARTIALLY – New culverts at Derby Ave will help, clean-out of existing sewer may be required

Date Submitted: 11/30/2022 23:56

Address: 1515 E ELM ST, Scranton, PA 18505

Name: Amanda Conti

Phone Number: 6466700709

Email Address: amanda.conti@rocketmail.com

Date Witnessed: 6/1/2022

Type of Issue: Storm Drain Clogged

Reoccurring Issue?: Yes, on occassion

Nearest intersection: Derby and E Elm

Describe flooding issue in detail: The storm drains clog/covered as soon as the rain becomes strong and is unable to flow down into the drains. My neighbors and I have needed to go and shovel out the drains to allow the water to flow down.

Submitted Photos: *(see file for video)*

PUBLIC COMMENT: FLD-07

IS THIS ISSUE ADDRESSED BY THE DRAINAGE STUDY?
NO – Site is within East Mountain, but not within an area studied.

Date Submitted: 12/1/2022 0:20

Address: 19 E MOUNTAIN RD, Scranton, PA 18505

Name: Jeff Kisel

Phone Number: 5702412717

Email Address: sigon33@aol.com

Date Witnessed: 6/1/2022

Type of Issue: Missing Storm Drain

Reoccurring Issue?: Yes, regularly

Nearest intersection: 19 East Mountain Rd & Waldorf Ln

Describe flooding issue in detail: Storm drain needed at my house do to run off of Waldorf lane . When it storms the Woldorf Ln Â turns into a water shoot . There are no drain at bottom of road . Water shoots across East Mountain Rd & into my yard , carrying dibree & staring to wash away my foundation.

Submitted Photos: *(see file for video)*

PUBLIC COMMENT: FLD-08

IS THIS ISSUE ADDRESSED BY THE DRAINAGE STUDY?
YES – Proposed drainage improvements on East Mountain Road would improve this drainage issue.

Date Submitted: 12/1/2022 2:22

Address: 1774 E MOUNTAIN RD, Scranton, PA 18505

Name: Kyle Evans

Phone Number: 570-594-6924

Email Address: kevans1774@gmail.com

Date Witnessed: 11/19/2022

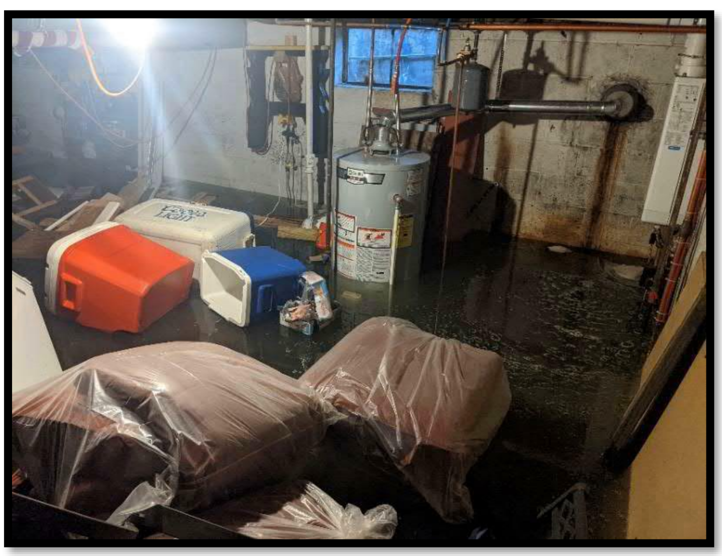
Type of Issue: Other Lack of proper storm water management causes flooding in our basement and yard. Only needs to be a moderate rain. Well over $15,000 in damage over 9 years

Reoccurring Issue?: Yes, regularly

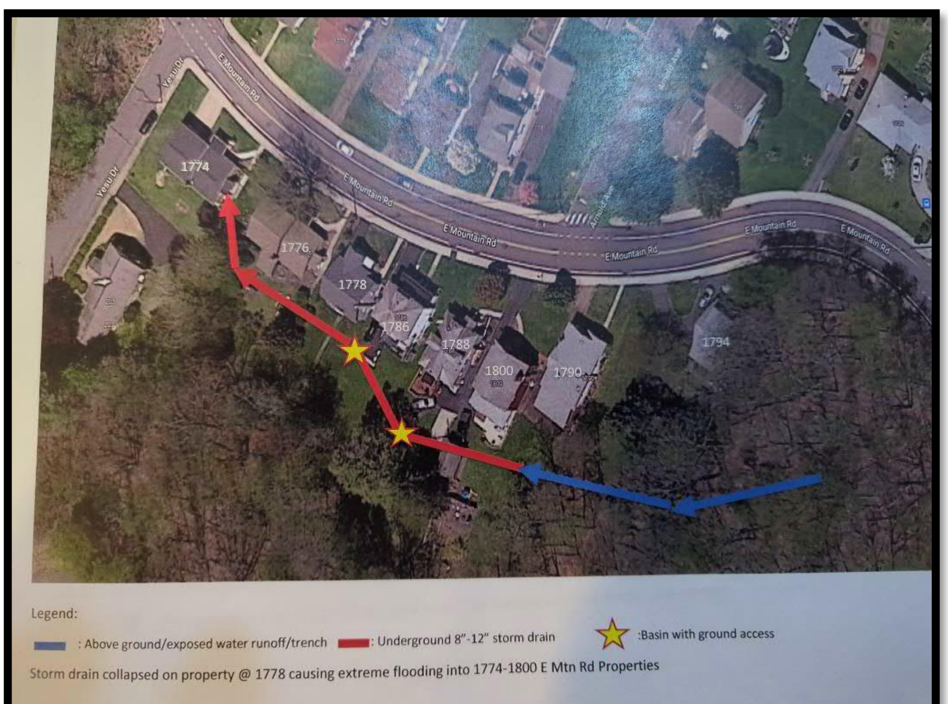
Nearest intersection: East Mountain Road and Yesu Drive

Describe flooding issue in detail: Water runoff from city owned Robinson Park travels downhill through a drain pipe in the backyards of the homes on the even numbered side of the 1700 block of East Mountain Road. Â The drain pipe is blocked/collapsed/inadequate and causes flooding to the inside of the homes on this block as well as the backyards. Â This flooding occurs in only moderate rain conditions. Heavy rain is devastating. We have incurred, at minimum, $15000+ in damages/losses from this flooding over 9 years. In September 2021 the flood conditions were so bad that we had nearly 3 feet of water in our basement. We had seven pumps running simultaneously, nonstop for hours (with a total discharge capacity of around 30,000 gallons of water per hour/500 gallons per minute) and even with seven pumps the water continued to rise in our basement until Scranton DPW arrived with an industrial pump.

Submitted Photos:



FLD-08 *(continued)*



PUBLIC COMMENT: FLD-09

IS THIS ISSUE ADDRESSED BY THE DRAINAGE STUDY?
NO – Site is within East Mountain, but not within an area studied.

Date Submitted: 12/1/2022 11:17

Address: 1205 MOLTKE AVE, Scranton, PA 18505

Name: Ronald Alongi

Phone Number: 5704995816

Email Address: iwilcuffu2@comcast.net

Date Witnessed: 8/15/2021

Type of Issue: Other Stormwater runs through the yard

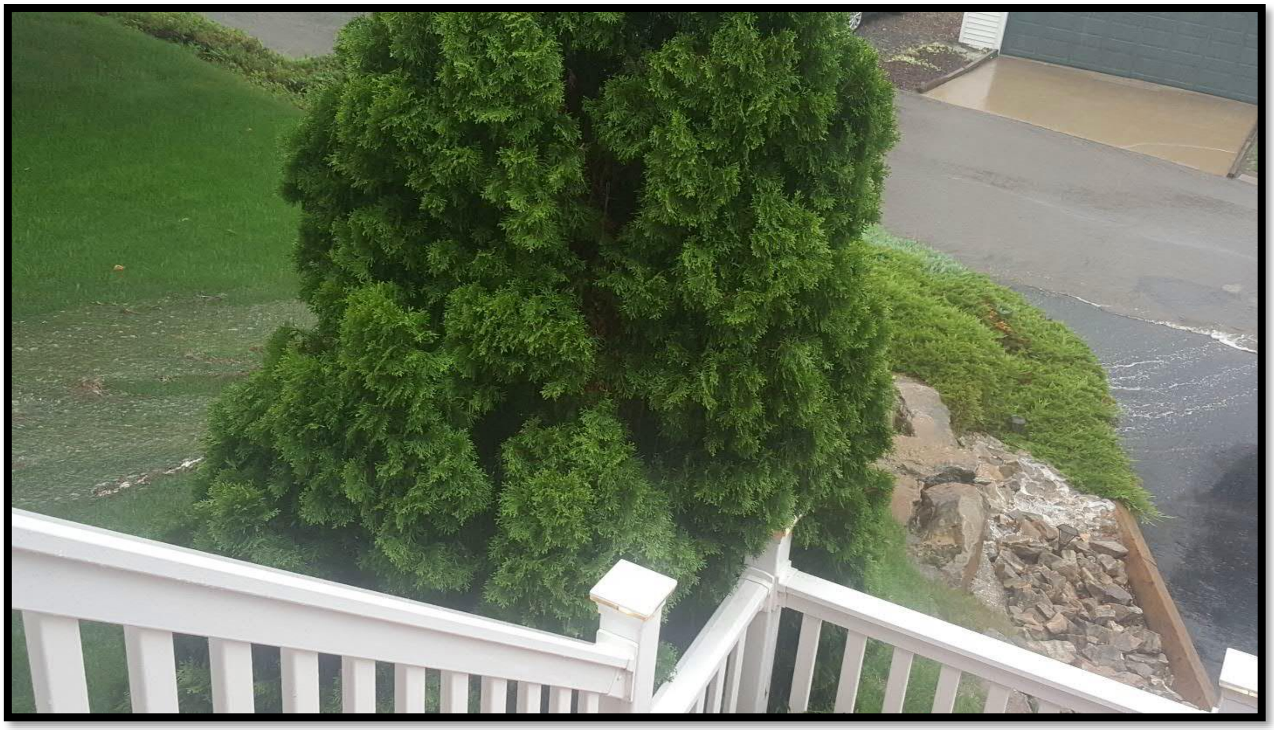
Reoccurring Issue?: Yes, regularly

Nearest intersection: Moltke Ave / E Locust St

Describe flooding issue in detail: Every heavy or long term rain, stormwater runs through the backyard up against the deck and house. On 08/13/2018 NEPA received 7 inches of rain in a 24 hour period. I had a rock ditch installed when the home was first purchased to pipe the water away from the yard/home. During this storm the ditch couldn't handle it and the water jumped the ditch, hit the back of the house for a extended period until it came through patio doors at each end of the house flooding the first floor and basement/garage. Since then I have to use a pump against the rear of the home to try and pump the water in between the houses. Â Insurance did not cover any of the damages. I do have pictures and video's of the incident.

Submitted Photos:

FLD-09 *(continued)*



FLD-09 *(continued)*

FLD-09 *(continued)*

PUBLIC COMMENT: FLD-10

IS THIS ISSUE ADDRESSED BY THE DRAINAGE STUDY?
NO – Site is not located within East Mountain

Date Submitted: 12/1/2022 12:12

Address: 917 919 MONROE AVE, Scranton, PA 18510

Name: Raines Derek - 919 Monroe Ave

Phone Number:

Email Address: derekrainman@gmail.com

Date Witnessed: 11/30/2022

Type of Issue: Missing Storm Drain

Reoccurring Issue?: Yes, regularly

Nearest intersection: Monroe Ave and Ash Street

Describe flooding issue in detail: A storm drain has been removed from the middle of the block and water sits in front of the driveway at 919 Monroe Ave. Water drains through Mallard and has washed away countless tons of gravel and has left litter and debris in the yard and in front of my house. David Decadmo did a story on channel 22 about the flooding issue. The city has done nothing to improve the situation by continuously, adding pavement to the middle of the road raising the middle of the road. Also, they have removed all of the curbs, which intern increase the issue that has been in the newspaper numerous times I have been to City Council numerous times to no avail. I have sent numerous letters photographs to the mayors 311 program to no avail. The city employees from DPW service stated they do not have the money to fix the problem Â simple task grind down the road and slope the road so it's flat and drains properly down Ash Street

Submitted Photos: *(see file for video)*

FLD-10 *(continued)*

FLD-10 *(continued)*

PUBLIC COMMENT: <u>FLD-11</u>

IS THIS ISSUE ADDRESSED BY THE DRAINAGE STUDY?
NO – Site is within East Mountain, but not within an area studied.

Date Submitted: 12/1/2022 14:36

Address: 1622 BIRCH ST, Scranton, PA 18505

Name: James Petrucci

Phone Number: 5709097093

Email Address: Jpetrucci79@yahoo.Com

Date Witnessed: 12/1/2022

Type of Issue: Other Water coming from Howard Gardner rear parking lot and rushing to the back of my house. I have had to put in 2 drainage pipes so far which still has not helped the issue much

Reoccurring Issue?: Yes, regularly

Nearest intersection: Birch St and David Terrace

Describe flooding issue in detail: Water coming from Howard Gardner rear parking lot and rushing to the back of my house. I have had to put in 2 drainage pipes so far which still has not helped the issue much. My neighbor tells me that this was not always a problem and arose during the last few years

Submitted Photos:

PUBLIC COMMENT: FLD-12

IS THIS ISSUE ADDRESSED BY THE DRAINAGE STUDY?
NO – Site is within East Mountain, but not within an area studied.

Date Submitted: 12/1/2022 14:37

Address: 17 LESLIE DR, Scranton, PA 18505

Name: Bob Miscavage II

Phone Number:

Email Address: mrpavette@comcast.net

Date Witnessed: 6/1/2022

Type of Issue: Other Storm Drains can't handle torrential rain storms

Reoccurring Issue?: Yes, on occasion

Nearest intersection: Moosic Street

Describe flooding issue in detail: My house is on the bottom/middle of Leslie Drive. During torrential rains which may happen six time a year. Storm water comes down from both ends of Leslie Drive from Pen Y Bryn and Laurel Drive area. Their are two storm drains, one by my driveway and the other across the street. Which is like a basket that collects everything by poor design. Both storm drains cannot handle storm water from these torrential rains. Plus depending on the time of the year get blocked with leaves and debris. My neighbor across the street at 16 Leslie Drive and I both do our best to keep these drains clean. When the torrential rains happen if I'm home I am out unclogging these Scranton storm drains while lightning as well as the Pa American Water Company storm drain in front of 15 Leslie Drive. These storm drains cannot handle the storm water during Â torrential rainstorms, than storm water runs down my driveway thru my back yard and erodes the hill/bank. I've had instances when the storm water almost entered my garage. Because leaves and debris dammed the small drain at the bottom right of my driveway. I've since had to put a small overflow ditch to try and divert water going in garage. In front of 15 Leslie Dr there is a Pa American Storm Drain. The poor installation of this storm drains allows most storm water to go around the drain and during torrential rain storms flow over the curb. When this happens storm water flows down Mrs McDonalds driveway and my yard. Previously between the Scranton Sewer Authority and the storm water damaged the manhole covers top structural. Which Pa American Water Company claims is a Private sewer system and I had to repair since it was a safety issue. There is a spring in back of 10 Leslie Drive that storm water runs from onto Leslie Drive during rainstorms. I am getting to old as well as health issues to be out during rainstorms and lighting in torrential rainstorm's. That if this issue isn't resolved I may have to address it legally plus contact the Chesapeake Bay Commission.

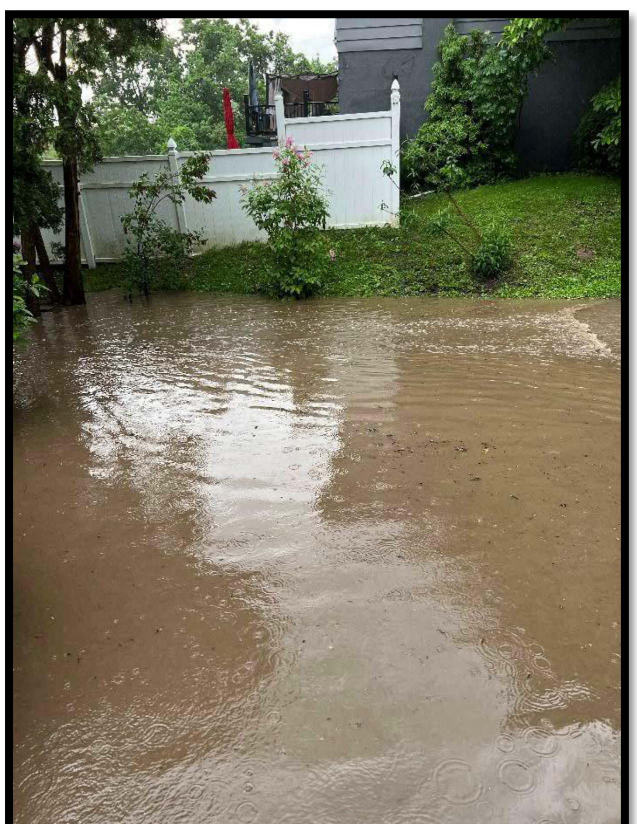
FLD-12 *(continued)*

Submitted Photos:

FLD-12 *(continued)*

FLD-12 *(continued)*

FLD-12 *(continued)*



FLD-12 *(continued)*

FLD-12 *(continued)*

FLD-12 *(continued)*

FLD-12 *(continued)*

PUBLIC COMMENT: FLD-13

IS THIS ISSUE ADDRESSED BY THE DRAINAGE STUDY?
YES – Proposed drainage improvements on Beech Street would improve this drainage issue.

Date Submitted: 12/2/2022 14:34

Address: 1301 BEECH ST, Scranton, PA 18505

Name: Stacy Nivert

Phone Number: 570 800 1937

Email Address: mydiscoverypreschool@gmail.com

Date Witnessed: 11/30/2022

Type of Issue: Other Crumbling stormwater ditch / channel

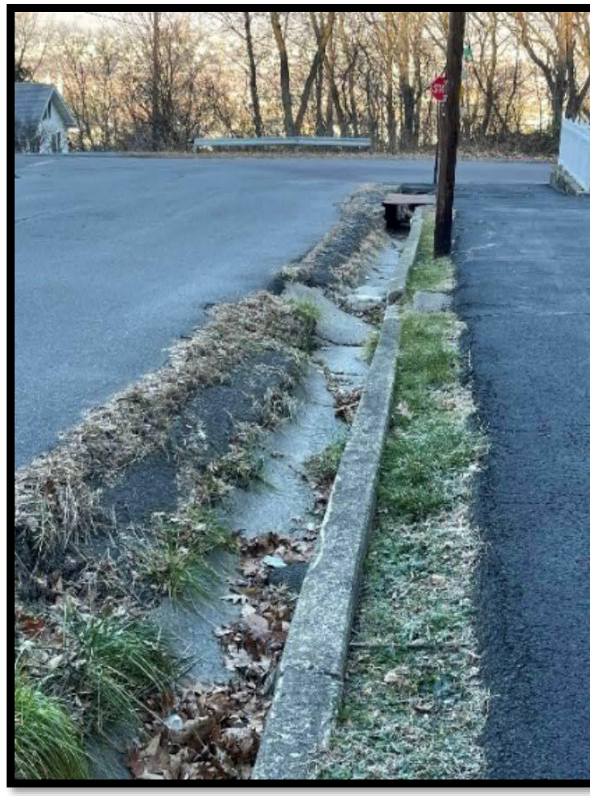
Reoccurring Issue?: Yes, regularly

Nearest intersection: Beech St / Wintermantle Ave

Describe flooding issue in detail: This is an open concrete stormwater ditch that runs down E Elm St, turns the corner at Blucher and connects with the storm water channel on Beech St before entering a stormwater tunnel under the road. The stormwater ditch is in considerable disrepair and is crumbling on the sides, causing the road bed to erode and narrowing the safe drivable area of the road. This corner is already a safety hazard, especially during winter when snow and ice force cars into the middle of the intersection. The unsafe passage of the stormwater is making this issue worse. Â Many cars get stuck in the stormwater ditch when they slide off the road. The open nature of the ditch means it is not possible to put a guard rail up to keep cars from sliding off the road. The crumbling nature of the storm water ditch means the concrete walls are falling into the ditch. As the ditch fills with the crumbling concrete cars are more likely to skid off the road and into the adjoining property - which is our preschool housing 60 children aged 3-6. Managing the storm water in this location - preferably through drainage tunnels under paved road - would allow for more safe traffic management as well as better storm water management.

Submitted Photos:

FLD-13 *(continued)*



FLD-13 *(continued)*

PUBLIC COMMENT: <u>FLD-14</u>

IS THIS ISSUE ADDRESSED BY THE DRAINAGE STUDY?
YES – Proposed drainage improvements on Snook Street would improve this drainage issue.

Date Submitted: 12/3/2022 2:57

Address: 106 GRAND AVE, Scranton, PA 18505

Name: Tom Taddonio

Phone Number: 5703446763

Email Address: mttaddonio@aol.com

Date Witnessed: 12/2/2022

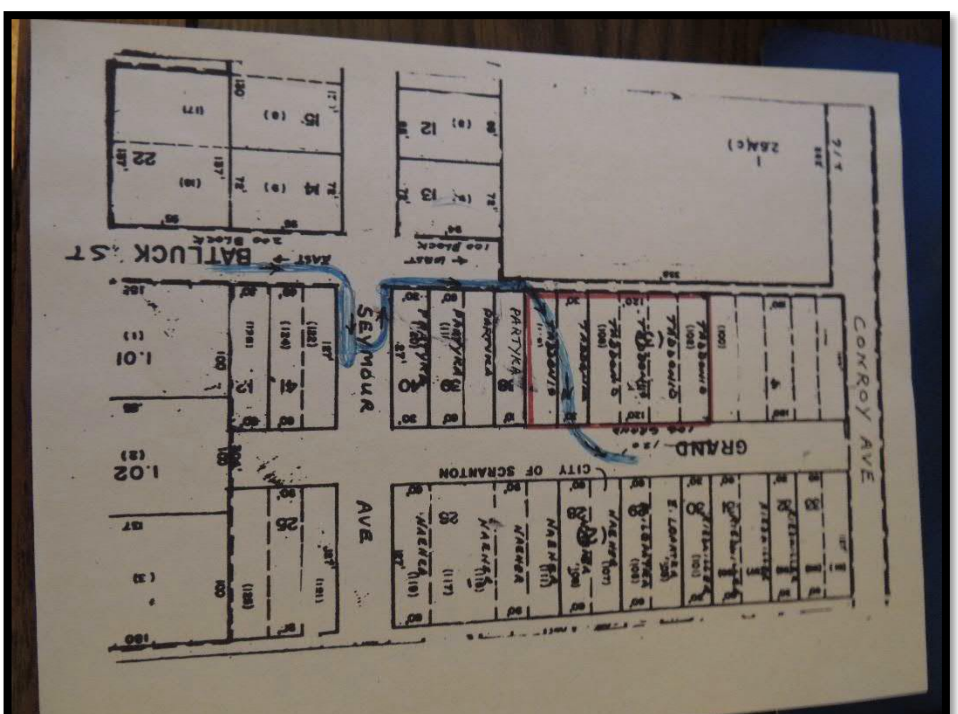
Type of Issue: Missing Storm Drain

Reoccurring Issue?: Yes, regularly

Nearest intersection: Seymour Ave & Batluck St

Describe flooding issue in detail: There is no stormwater drain to collect rain water so it continues down Batluck St and enters the rear of my property and continues across my property and exits on the front of Grand Ave. Â After storm there is some water left in ditch and creates a breeding ground for mosquitos. I have a professional exterminator come throughout the summer every year to spray for mosquitos and insects because of problem with stormwater.

Submitted Photos:



FLD-14 *(continued)*

FLD-14 *(continued)*

PUBLIC COMMENT: FLD-15

IS THIS ISSUE ADDRESSED BY THE DRAINAGE STUDY?
NO – Site is within East Mountain, but not within an area studied.

Date Submitted: 12/3/2022 18:12

Address: 1307 ROLLIN AVE, Scranton, PA 18505

Name: Carl Abraham

Phone Number: 5708812378

Email Address: rollq@comcast.net

Date Witnessed: 10/30/2022

Type of Issue: Other some street flooding... in the winter... street ices up and DPW has to salt the area

Reoccurring Issue?: Yes, on occasion

Nearest intersection: Cherry Street

Describe flooding issue in detail: 1300 block of Rollin Ave my house has dug out storm water system.. other part of block (the other half) does not and has a tendency to flow onto the roadway.. slope of yard next door was changed a few years ago to more of a hill. Â During heavy rains.. lots of water ends of flowing down the street. pipe (like installed recently one block away on Froude) would help.

Thank you for your time.

Submitted Photos:

FLD-15 *(continued)*

PUBLIC COMMENT: FLD-16

IS THIS ISSUE ADDRESSED BY THE DRAINAGE STUDY?
YES – Proposed drainage improvements on East Mountain Road would improve this drainage issue.

Date Submitted: 12/4/2022 17:04

Address: 1786 E MT RD, Scranton, PA 18505

Name: John Paul Guse

Phone Number: 5709043501

Email Address: jpguse@hotmail.com

Date Witnessed: 9/1/2021

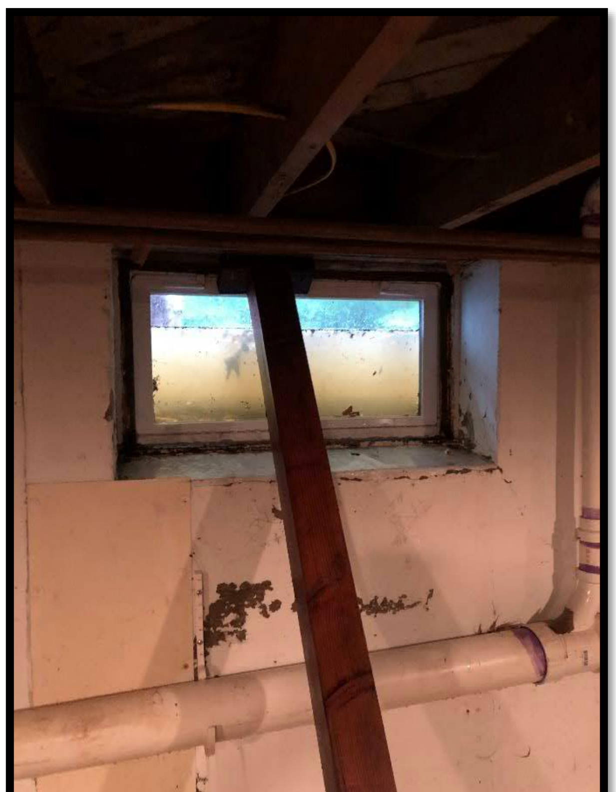
Type of Issue: Missing Storm Drain

Reoccurring Issue?: Yes, regularly

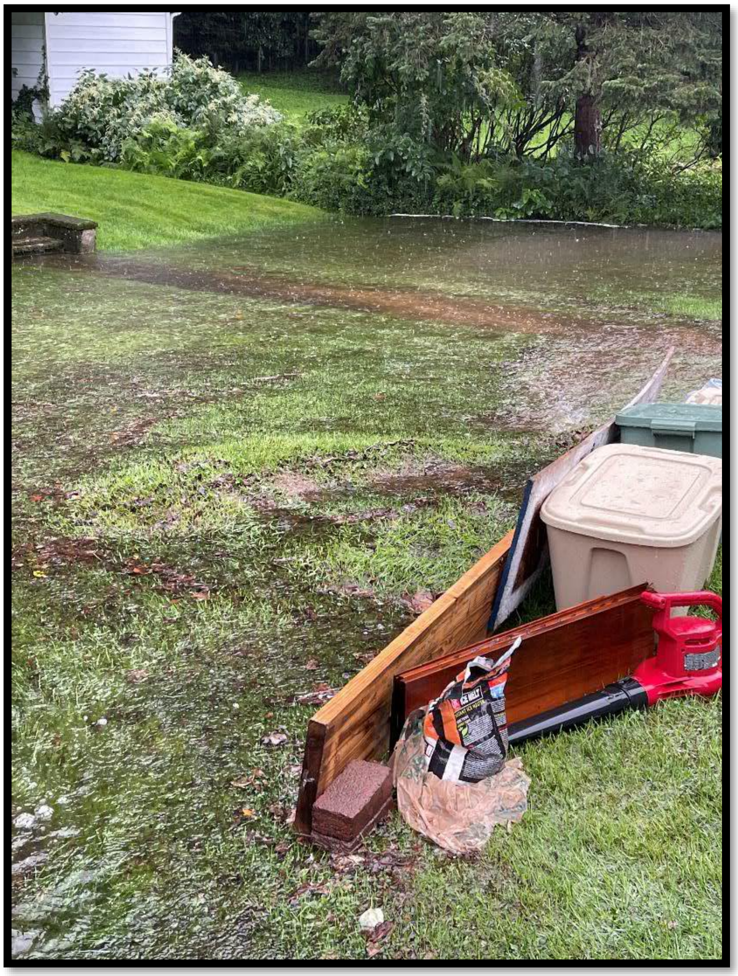
Nearest intersection: East Mountain Rd & Arnold Ave

Describe flooding issue in detail: During heavier rainfall, the storm drain that runs along the back property lines of houses located 1774-1800 E Mtn Rd, back up and the resulting water causes property damage in the basements and foundations of these houses. We have had several thousands of dollars of damage each time these storm waters reach my basement. I have several photos and videos for documentation.

Submitted Photos: *(see file for video)*



FLD-16 *(continued)*



FLD-16 *(continued)*

PUBLIC COMMENT: FLD-17

IS THIS ISSUE ADDRESSED BY THE DRAINAGE STUDY?
YES – Proposed curb improvement Oswald Ave. would improve this drainage issue.

Date Submitted: 12/5/2022 0:48

Address: 101 FLORIDA AVE, Scranton, PA 18505

Name: Richard Olechna

Phone Number: 570 840-6391

Email Address: richardolechna@gmail.com

Date Witnessed: 11/30/2022

Type of Issue: Other

Reoccurring Issue?: Yes, regularly

Nearest intersection: Florida and Lynwood Ave.

Describe flooding issue in detail: water floods property from Oswald Ave which is in rear or above 101 Florida Ave. The wooded lot on 114 Oswald is the lowest point with no curb so ends up flowing to rear of garage and yard of 101 florida ave. Water enters from 114 Oswald Ave., hits the back of our garage, enters rear of 101 Florida Ave., yard gets flooded, swampy, doesn't dry out, neighbors are affected also. It killed our 150 year old oak tree.

Submitted Photos:

FLD-17 *(continued)*

PUBLIC COMMENT: FLD-18

IS THIS ISSUE ADDRESSED BY THE DRAINAGE STUDY?
NO – Site is within East Mountain, but not within an area studied.

Date Submitted: 12/5/2022 6:15

Address: 52 ELMHURST BLVD, Scranton, PA 18505

Name: Steven Kurland

Phone Number: 570-346-8823

Email Address: stevenkurland52@comcast.net

Date Witnessed: 12/1/2022

Type of Issue: Missing Storm Drain

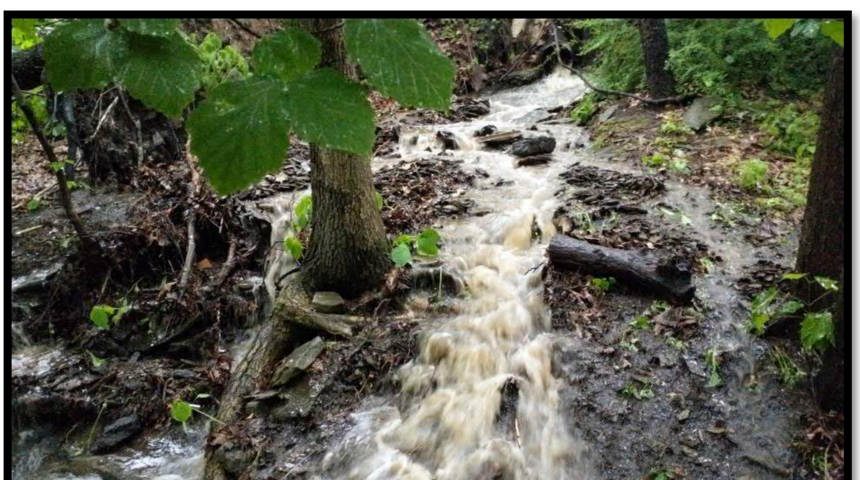
Reoccurring Issue?: Yes, regularly

Nearest intersection: Elmhurst Blvd and Rhonda Drive

Describe flooding issue in detail: Many of the storm drains on Leslie Drive are not tied into anything. They empty on to a vacant lot via a large discharge pipe which is right next to my property on 52 Elmhurst Blvd. The pipe extends out of the hill from a neighbor behind me. This lot also belongs to me. Every time there is a heavy rain, which has been more often than in the past, the lot floods, and much of the runoff floods a section of my lot as well. It also uproots trees, washes mud into the ditch in the front of my home so it cannot drain and in general is destroying everything on this lot. I've called the city's mayor's office and public works to no avail! I have 7 pictures showing this problem, but I can't seem to download them. I would be happy to meet and show them to you at your convenience.

Thanks, Steven Kurland

Submitted Photos: *(see file for video)*



PUBLIC COMMENT: FLD-19

IS THIS ISSUE ADDRESSED BY THE DRAINAGE STUDY?
YES – Proposed drainage improvements on East Mountain Road would improve this drainage issue.

Date Submitted: 12/10/2022 19:27

Address: 1778 E MT ST, Scranton, PA 18505

Name: Donna Weinschenk

Phone Number: 5709098347

Email Address: donna1122@verizon.net

Date Witnessed: 5/21/2022

Type of Issue: Other Pipe in my yard collapsed due to water pressure from above

Reoccurring Issue?: Yes, on occasion

Nearest intersection: East Mountain Road and Arnold Avenue

Describe flooding issue in detail: My property is one of the four homes on East Mountain Road that receives a large amount of storm water through our back yards. When it rains very hard the storm water flows back behind our houses and the pipes cannot handle the amount of water that flows down. The pipe in my neighbor above is larger and flows into a smaller pipe in my yard which collapsed during our last big storm. Â During all the big storms, the water flows like a river down through our yards and I get a lot of water in the basement and all the overflow runs down the yards causing damage to the homes and basements. During our last big storm, DPW guys brought an industrial sum pump and set it up to pump the water from the back yards to the street. It ran for hours. If not for their help, it would have been a disaster. Even with the help we received that night I did get a lot of water in my basement. The last storm in May 2022 was the worst scenario so far. However we have been having problems for quite a few years.

Submitted Photos: NONE

PUBLIC COMMENT: FLD-20

IS THIS ISSUE ADDRESSED BY THE DRAINAGE STUDY?
YES – Proposed drainage improvements on Wintermantle Ave would improve this drainage issue.

Date Submitted: 12/20/2022 12:03

Address:

Name: Kaitlyn Drumheller

Phone Number: 5706141164

Email Address: kadrumhell@pa.gov

Date Witnessed: 12/20/2022

Type of Issue: Other Stormwater Runoff

Reoccurring Issue?: Yes, regularly

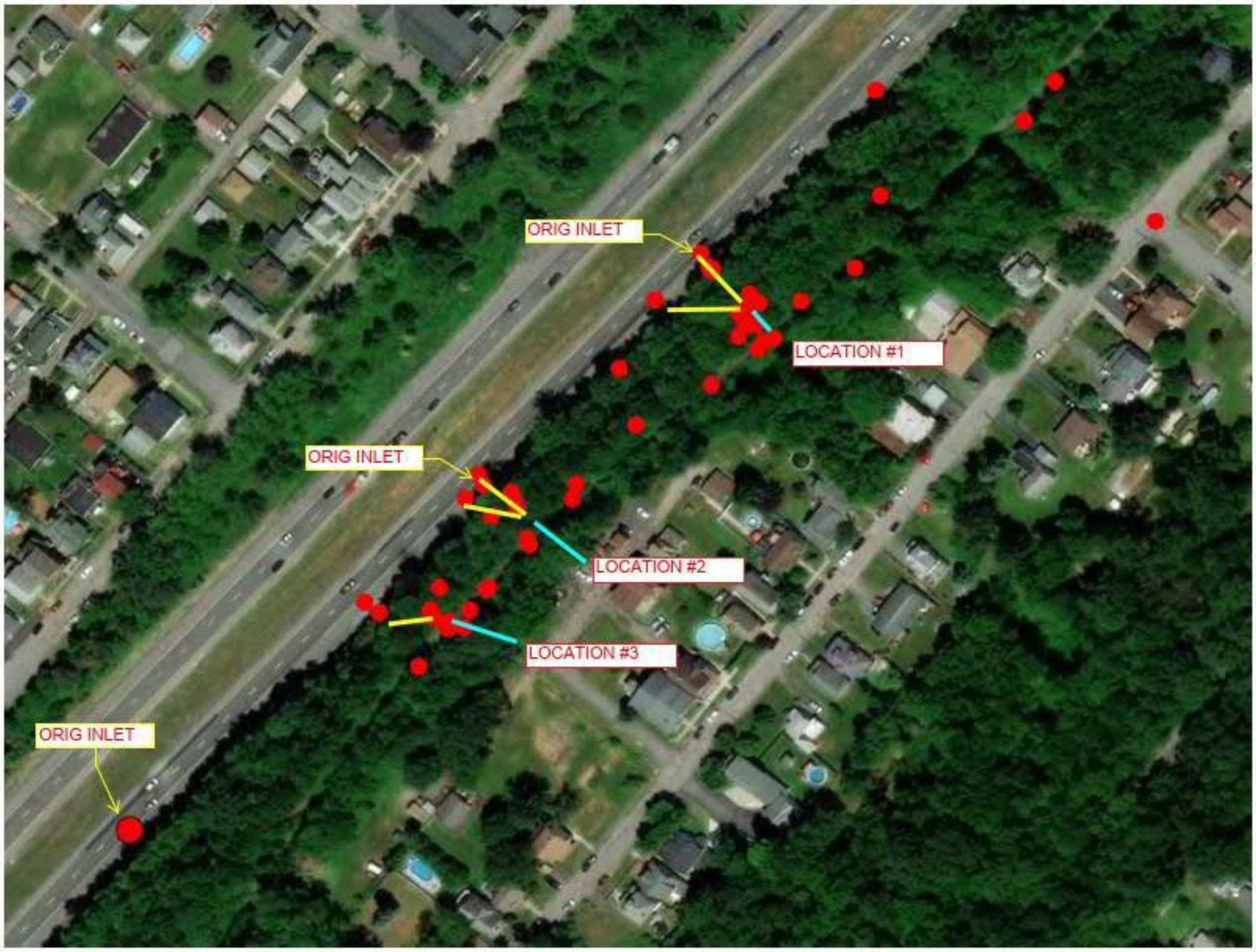
Nearest intersection: Exit 184 on I-81

Describe flooding issue in detail: During rain events Interstate 81 experiences large amounts of stormwater runoff, below the East Mountain area, from mile marker 183.5 to mile marker 183.9 south of the River Street exit. In the winter months, drivers can see substantial amounts of ice buildup along the rock cut due to the amount of water this area receives. After the August 2018 flooding event, the Department regraded the shoulder and placed rock in the washout areas. This area continues to fill with sediment from the stormwater runoff. The original drainage system from the East Mountain area to Interstate 81 consisted of a series of drainage pipes that would collect the stormwater runoff and direct it into inlets or a swale located on Interstate 81 northbound shoulder. The attached photos indicate the original outlet of the stormwater to where the stormwater now outlets. At all of these locations the outlet has moved away from the original location causing the water to pond on the shoulder. This creates a flooding concern for the Department and traveling public. With the City of Scranton looking at the drainage for the East Mountain area the outlet and downstream area of this drainage system need to be considered as Interstate 81 is at the outlet of this water. Some recommendations for the drainage would consist of replacing the existing pipe system where pipes have failed, resizing pipes as needed, and re-establishing drainage swales and channels. An additional area the Department has experienced runoff would be from mile marker 185.2 to 185.3 on Interstate 81 northbound. PennDOT is willing to meet with the City and hired engineering company to review our concerns and provide our knowledge of the drainage in this area.

Submitted Photos:

FLD-20 *(continued)*

I-81 NB SOUTH OF RIVER ST EXIT



PUBLIC COMMENT: FLD-21

IS THIS ISSUE ADDRESSED BY THE DRAINAGE STUDY?
YES – Proposed drainage improvements on Snook Street would improve this drainage issue.

Date Submitted: 12/21/2022 23:24

Address: 44 SNOOK ST, Scranton, PA 18505

Name: Robert Eskra

Phone Number: 5705618146

Email Address: reskra622@gmail.com

Date Witnessed: 12/21/2022

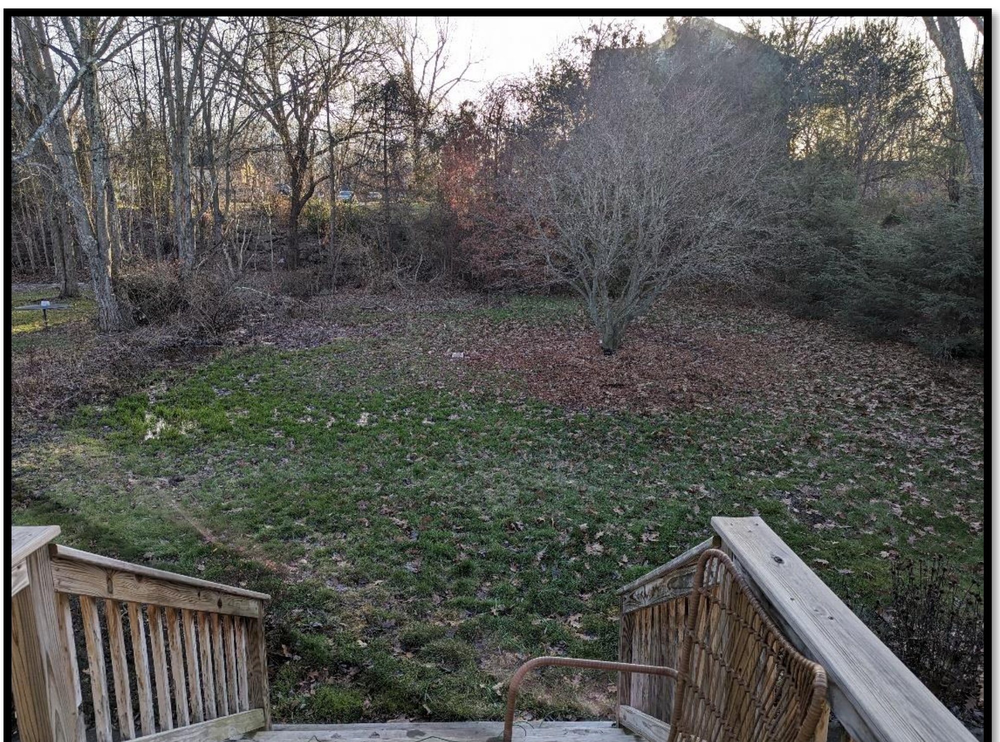
Type of Issue: Other Neighbor has directed storm water runoff onto my property

Reoccurring Issue?: Yes, regularly

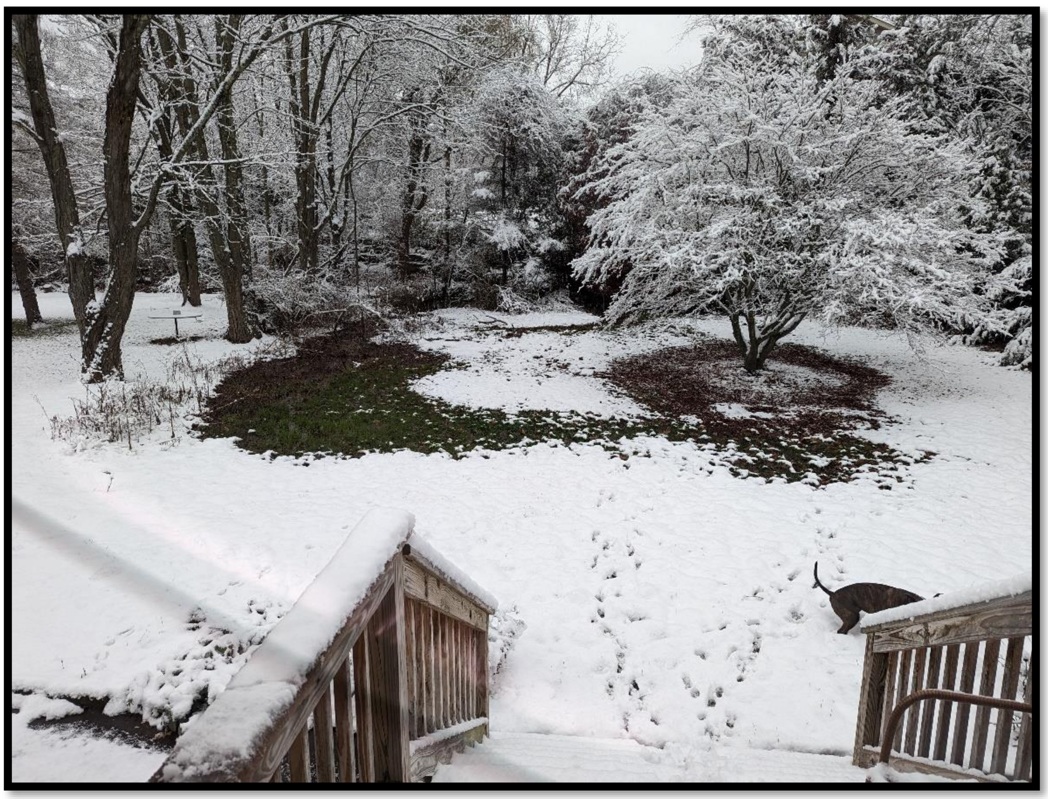
Nearest intersection: Seymour and Snook

Describe flooding issue in detail: Next door neighbor has dug a channel that directs all storm water run off on his property onto my property, which has flooded my yard and turned it into a swamp rendering food property essentially unusable.

Submitted Photos:



FLD-21 *(continued)*



FLD-21 *(continued)*

PUBLIC COMMENT: FLD-22

IS THIS ISSUE ADDRESSED BY THE DRAINAGE STUDY?
NO – Site is within East Mountain, but not within an area studied.

Date Submitted: 1/2/2023 22:28

Address:

Name: Martina Soden

Phone Number: 5708782613

Email Address: soden.martina@gmail.com

Date Witnessed: 12/23/2022

Type of Issue: Missing Storm Drain

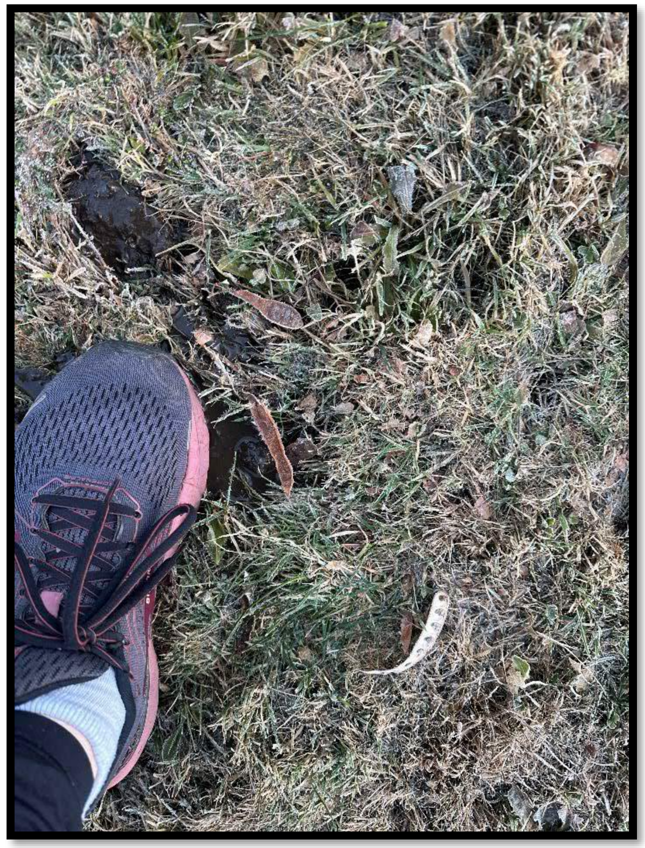
Reoccurring Issue?: Yes, regularly

Nearest intersection: Birch St and Mountain Lake Road

Describe flooding issue in detail: We have no drainage system in front of Mountain Lake. We get water from behind our houses and travels down our lawns to the road where it pools in our lawns and in the street. During the winter it ices over and everyday DPW needs to salt. Our front lawn is level with the road and its always wet. We can sink right in and becomes mud after mowing. When our lawn is soaking wet it allows water to back up into our basement and when it rains we get water. We moved into our house in July 2021 and since then we have had floods in our basement four times. There should be stormwater or ditches to pull the water away from our houses. Most of the city has some kind of stormwater system but we don't have any.

Submitted Photos:

FLD-22 *(continued)*



PUBLIC COMMENT: FLD-23

IS THIS ISSUE ADDRESSED BY THE DRAINAGE STUDY?
YES – Proposed drainage improvements on Cherry Street would improve this drainage issue.

Date Submitted: 1/8/2023 4:01

Address: 1515 CHERRY ST, Scranton, PA 18505

Name: Lee Gruen

Phone Number: 570-407-3030

Email Address: Leedgruen@gmail.com

Date Witnessed: 12/23/2022

Type of Issue: Other Drain pipe that crosses road and empties into the woods is blocked in the street (Rossi Rooter indicated)

Reoccurring Issue?: Yes, regularly

Nearest intersection: Cherry St and Rollin Ave

Describe flooding issue in detail: Run off redirected and now flows through my yard, bringing debris into drainage pipe. Resulted in blockage in Cherry St (According to Rossi Rooter). This is not a storm drain or sewer. Pipe was installed by city. Blockage under Cherry St caused water to back up and flood basement and garage.

Submitted Photos:

FLD-23 *(continued)*

PUBLIC COMMENT: FLD-24 *(same as FLD-10)*

IS THIS ISSUE ADDRESSED BY THE DRAINAGE STUDY?
NO – Site does not fall within an identified Study Area within East Mountain

Date Submitted: 2/1/2023 1:58

Address: 917 919 MONROE AVE, Scranton, PA 18510

Name: Raines Derek

Phone Number: 5708784015

Email Address: derekrainman@gmail.com

Date Witnessed: 1/11/2023

Type of Issue: Missing Storm Drain

Reoccurring Issue?: Yes, regularly

Nearest intersection: Monroe and Ash

Describe flooding issue in detail: The water company took out a storm drain, it was across the street and now it continuously floods, much worse than it did before. The reoccurring problem was the road was not paved properly when the water company ripped up the water pipes and changed everything. The pavement job was done just horribly. the middle of the road is so much higher than the rest of the road. The water does not flow the right direction. It is often easier for the water to flow down my driveway into my yard leaving behind a tremendous amount of garbage, bacteria, debris, etc.

Submitted Photos:

PUBLIC COMMENT: FLD-25

IS THIS ISSUE ADDRESSED BY THE DRAINAGE STUDY?
NO – Site is within East Mountain, but not within an area studied.

Date Submitted: 2/19/2023 19:26

Address: 1219 BIRCH ST, Scranton, PA 18505

Name: Shanna Holmes

Phone Number: 5703091717

Email Address: slholmes337@gmail.com

Date Witnessed: 2/19/2023

Type of Issue: Missing Storm Drain

Reoccurring Issue?: Yes, regularly

Nearest intersection: Jones Court

Describe flooding issue in detail: When first purchasing this property I noticed that the storm drain is completely missing, and dilapidated at the start of the alley way where my property is located, down to the end of the street where it intersects with Moltke avenue (approximately 1/2 a street long). This issue is causing the street and the lot to break a part, creating a huge ditch (approximately 1.5-2 ft. deep, and 2.5-3ft wide) that may become a danger if someone falls. The accumulation of garbage has also been an issue because of this. I would greatly appreciate if someone can come and check this out for me. If this is not something that can be rectified through this department I would be so appreciative if you would kindly direct me to someone that has the ability to assist. I have contacted the city of Scranton several times since purchasing the property, and I have not received any assistance so far.

Best wishes, Shanna Holmes

Submitted Photos:

FLD-21 *(continued)*

PUBLIC COMMENT: FLD-26

IS THIS ISSUE ADDRESSED BY THE DRAINAGE STUDY?
YES – Proposed drainage improvements on Snook Street would improve this drainage issue.

Date Submitted:	3/29/2023 11:01
Address:	203 BATLUCK ST, Scranton, PA 18505
Name:	David Dolphin
Phone Number:	570 862-3096
Email Address:	ddolphin29@gmail.com
Date Witnessed:	3/29/2023
Type of Issue:	Entire Street Flooding
Reoccurring Issue?:	Yes, regularly
Nearest intersection:	Batluck Street

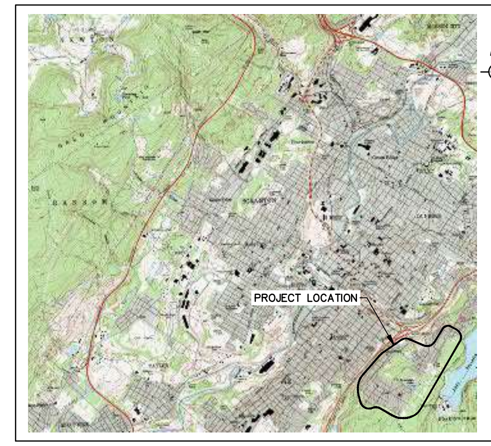
Describe flooding issue in detail: No drainage water pools on Seymour Ave. no proper drainage. Driving hazard. Reported countless times.

Submitted Photos: **NONE**

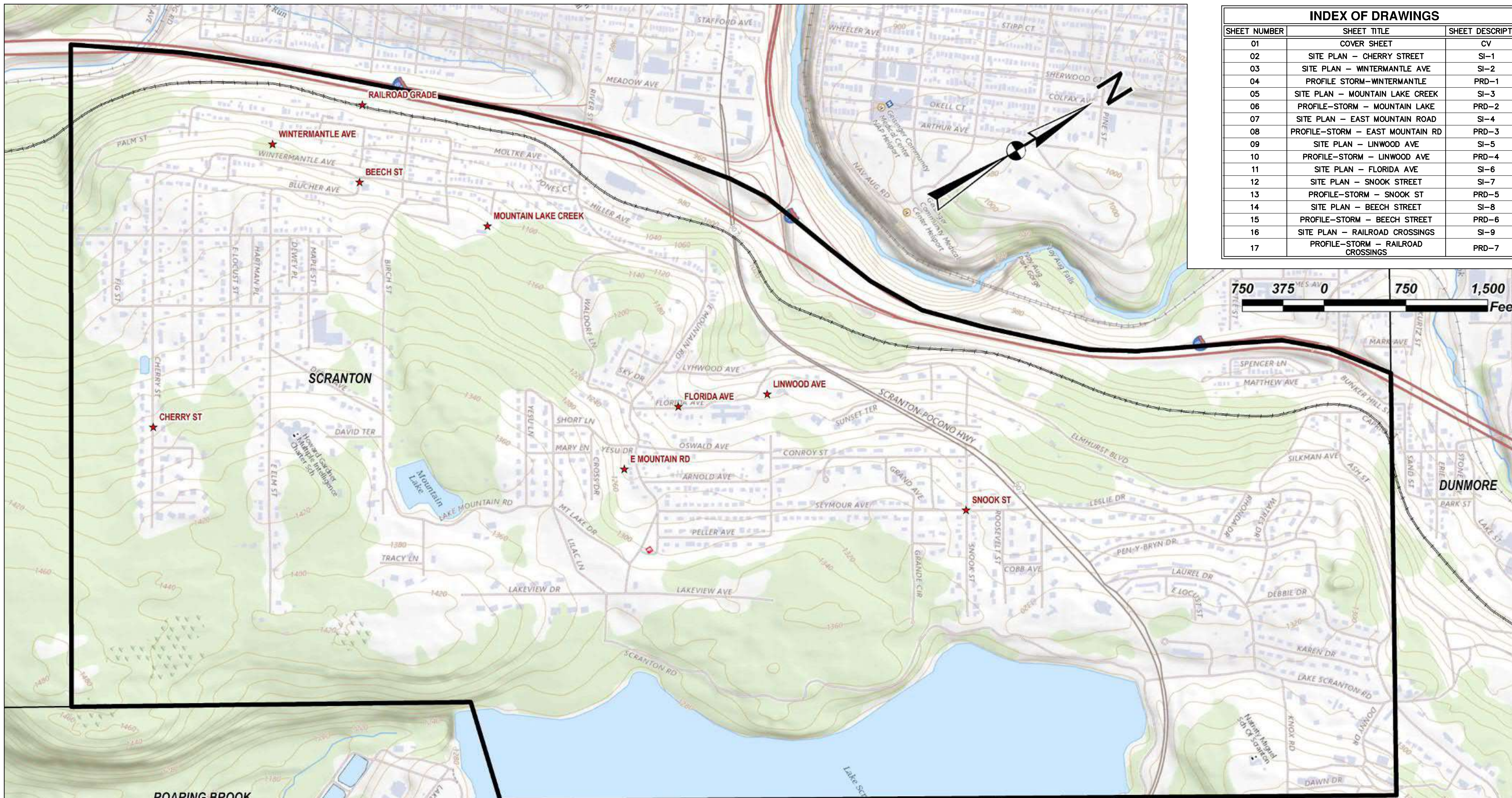
APPENDIX B
PRELIMINARY DRAINAGE IMPROVEMENT PLANS

PRELIMINARY STORMWATER IMPROVEMENTS
FOR
EAST MOUNTAIN STORMWATER & DRAINAGE STUDY

SCRANTON, LACKAWANNA COUNTY, PENNSYLVANIA



LOCATION MAP
SCALE: 1"=2000'



INDEX OF DRAWINGS

SHEET NUMBER	SHEET TITLE	SHEET DESCRIPTION
01	COVER SHEET	CV
02	SITE PLAN – CHERRY STREET	SI–1
03	SITE PLAN – WINTERMANTLE AVE	SI–2
04	PROFILE STORM–WINTERMANTLE	PRD–1
05	SITE PLAN – MOUNTAIN LAKE CREEK	SI–3
06	PROFILE–STORM – MOUNTAIN LAKE	PRD–2
07	SITE PLAN – EAST MOUNTAIN ROAD	SI–4
08	PROFILE–STORM – EAST MOUNTAIN RD	PRD–3
09	SITE PLAN – LINWOOD AVE	SI–5
10	PROFILE–STORM – LINWOOD AVE	PRD–4
11	SITE PLAN – FLORIDA AVE	SI–6
12	SITE PLAN – SNOOK STREET	SI–7
13	PROFILE–STORM – SNOOK ST	PRD–5
14	SITE PLAN – BEECH STREET	SI–8
15	PROFILE–STORM – BEECH STREET	PRD–6
16	SITE PLAN – RAILROAD CROSSINGS	SI–9
17	PROFILE–STORM – RAILROAD CROSSINGS	PRD–7

HRG
HERBERT, ROWLAND & GRUBIC, INC.
P.O. BOX 504
CLARKS SUMMIT, PA 18411
570.851.2804 | hrg-inc.com

PRELIMINARY STORMWATER IMPROVEMENTS
FOR
EAST MOUNTAIN STORMWATER & DRAINAGE STUDY

CITY OF SCRANTON
340 N WASHINGTON AVE
SCRANTON, PA 18503
SCRANTON, LACKAWANNA COUNTY, PENNSYLVANIA

PROFESSIONAL SEAL:

HRG PROJECT NUMBER:	100444136.0436
PLAN DATE:	08.11.2023
DRAWING SCALE:	AS NOTED
PROJ. MANAGER:	MWS

REVISIONS

NO.	DATE	DESCRIPTION
1		
2		
3		
4		
5		
6		
7		
8		
9		

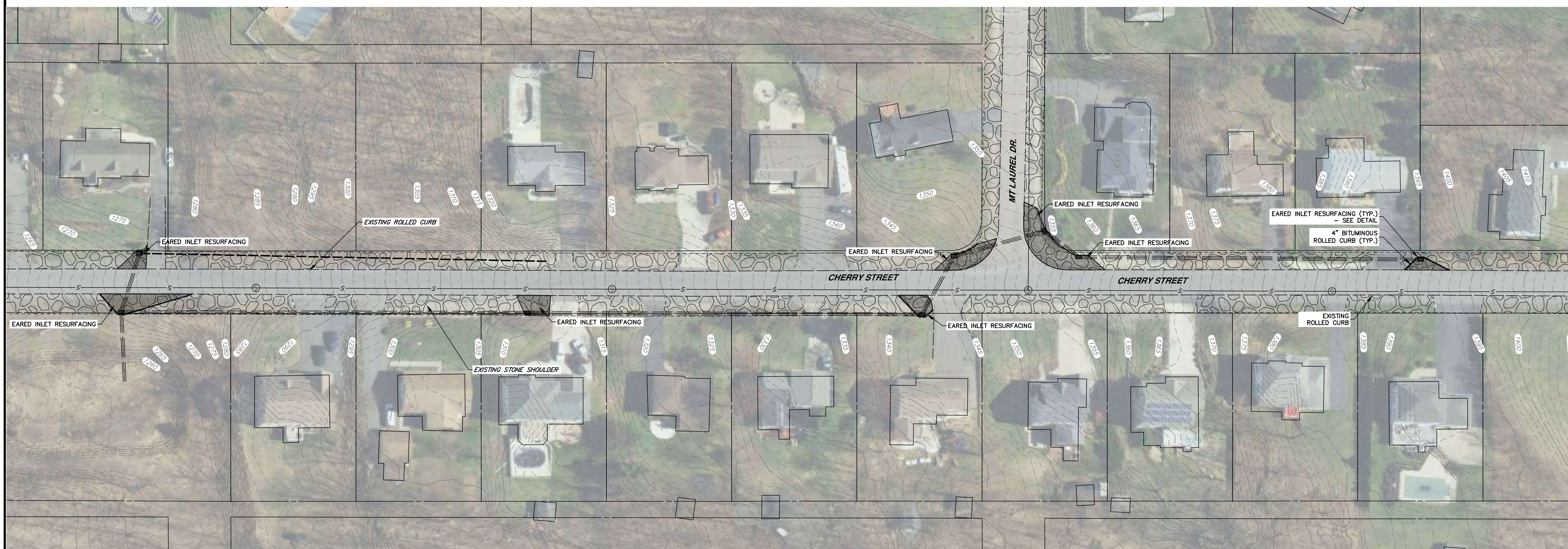
SHEET TITLE:
COVER SHEET

SHEET: CV 01

HRG
HERBERT, ROWLAND & GRUBIC, INC.
P.O. BOX 504
CLARKS SUMMIT, PA 18411
570.851.2804 | hrg-inc.com

PRELIMINARY STORMWATER IMPROVEMENTS FOR EAST MOUNTAIN STORMWATER & DRAINAGE STUDY

CITY OF SCRANTON
340 N WASHINGTON AVE
SCRANTON, PA 18503
SCRANTON, LACKAWANNA COUNTY, PENNSYLVANIA



GRAPHIC SCALE
40' 20' 0' 40'

PROFESSIONAL SEAL:

HRG PROJECT NUMBER:	L00444136.0436
PLAN DATE:	08.11.2023
DRAWING SCALE:	
PROJ. MANAGER:	MWS

REVISIONS

NO.	DATE	DESCRIPTION
1		
2		
3		
4		
5		
6		
7		
8		
9		

SHEET TITLE:
SITE PLAN - CHERRY STREET

SHEET: SI-1 | 02

GRAPHIC SCALE

40' 20' 0' 40'

HRG

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PRELIMINARY STORMWATER IMPROVEMENTS
FOR
EAST MOUNTAIN STORMWATER & DRAINAGE STUDY

CITY OF SCRANTON
340 N WASHINGTON AVE
SCRANTON, PA 18503
SCRANTON, LACKAWANNA COUNTY, PENNSYLVANIA

PROFESSIONAL SEAL:

HRG PROJECT NUMBER:	1.00444136.0436
PLAN DATE:	08.11.2023
DRAWING SCALE:	
PROJ. MANAGER:	MWS

REVISIONS

NO.	DATE	DESCRIPTION
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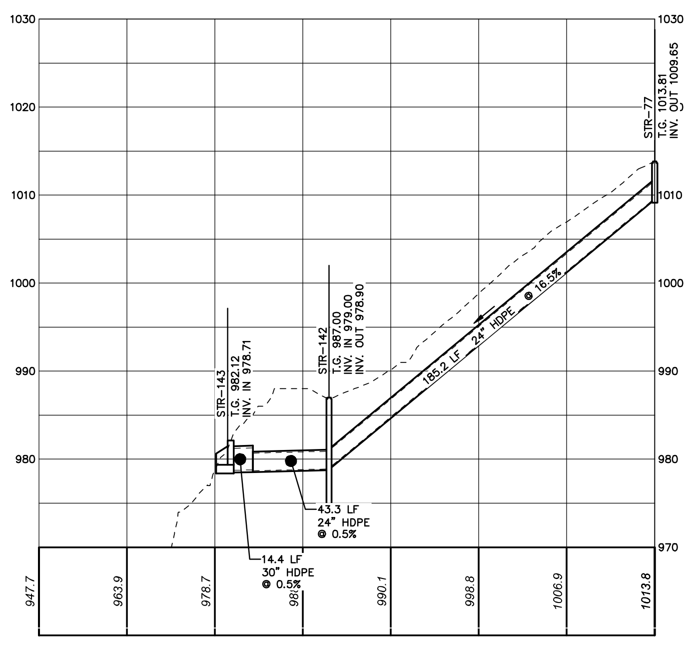
SHEET TITLE:
SITE PLAN - WINTERMANTLE AVE

SHEET: SI-2 | 03



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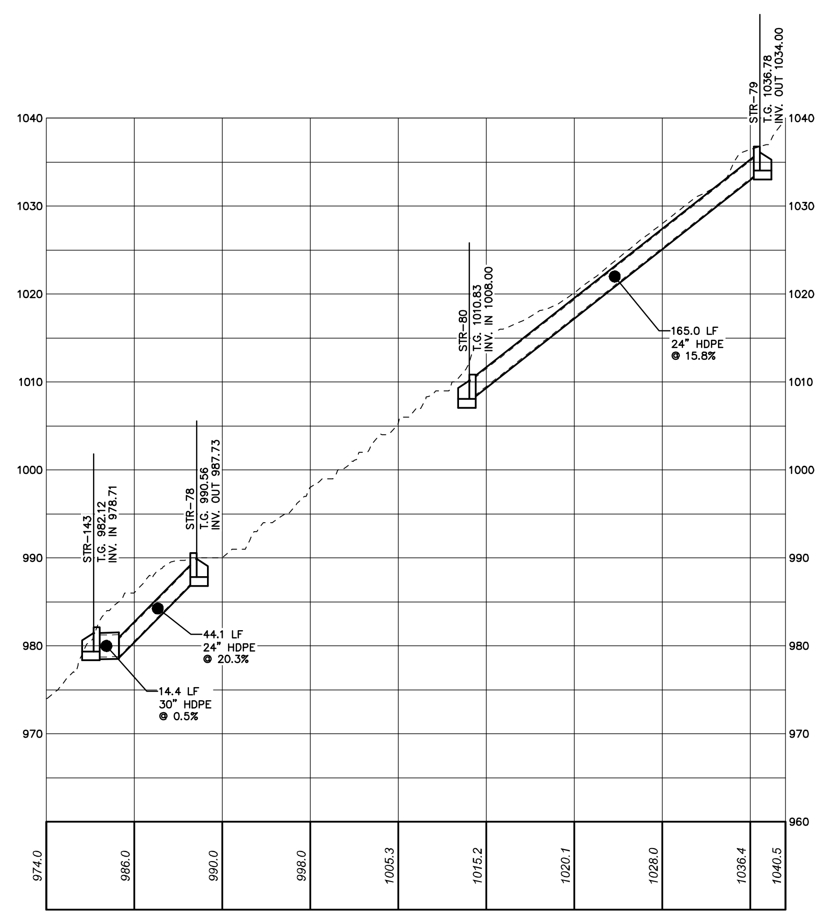

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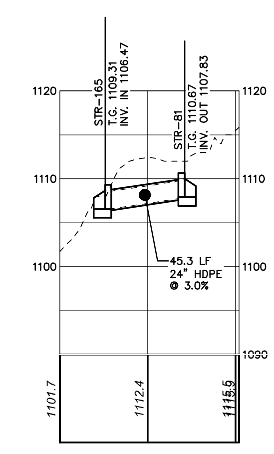
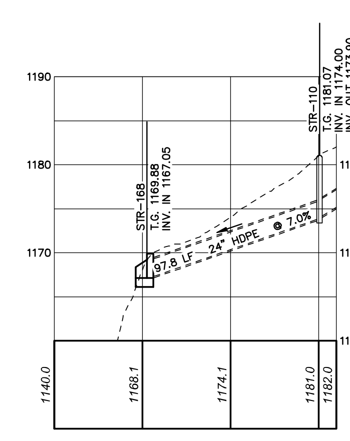


WINTERMANTLE AVE



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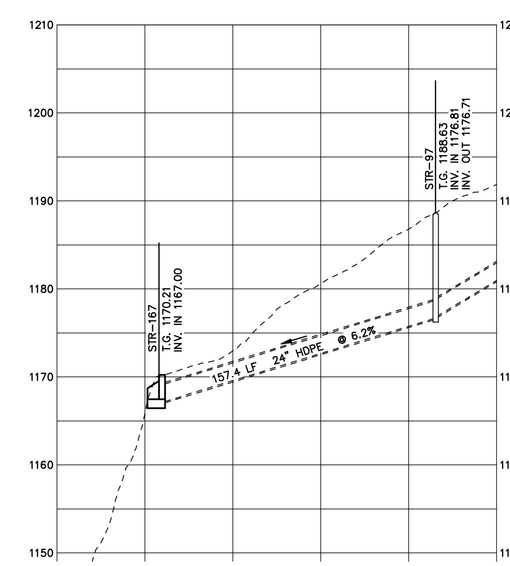

E ELM ST

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PRELIMINARY STORMWATER IMPROVEMENTS
FOR
EAST MOUNTAIN STORMWATER & DRAINAGE STUDY

CITY OF SCRANTON
340 N WASHINGTON AVE
SCRANTON, PA 18503

SCRANTON, LACKAWANNA COUNTY, PENNSYLVANIA

PROFESSIONAL SEAL:

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PLAN DATE:	08.11.2023
DRAWING SCALE:	AS NOTED
PROJ. MANAGER:	MWS

REVISIONS

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SHEET TITLE:
PROFILE
STORM-WINTERMANTLE

SHEET: PRD-1 | 04

GRAPHIC SCALE
40' 20' 0' 40'

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PRELIMINARY STORMWATER IMPROVEMENTS FOR EAST MOUNTAIN STORMWATER & DRAINAGE STUDY

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DRAWING SCALE:	
PROJ. MANAGER:	MWS

REVISIONS

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SHEET TITLE:
SITE PLAN - MOUNTAIN LAKE CREEK

SHEET: **SI-3** **05**

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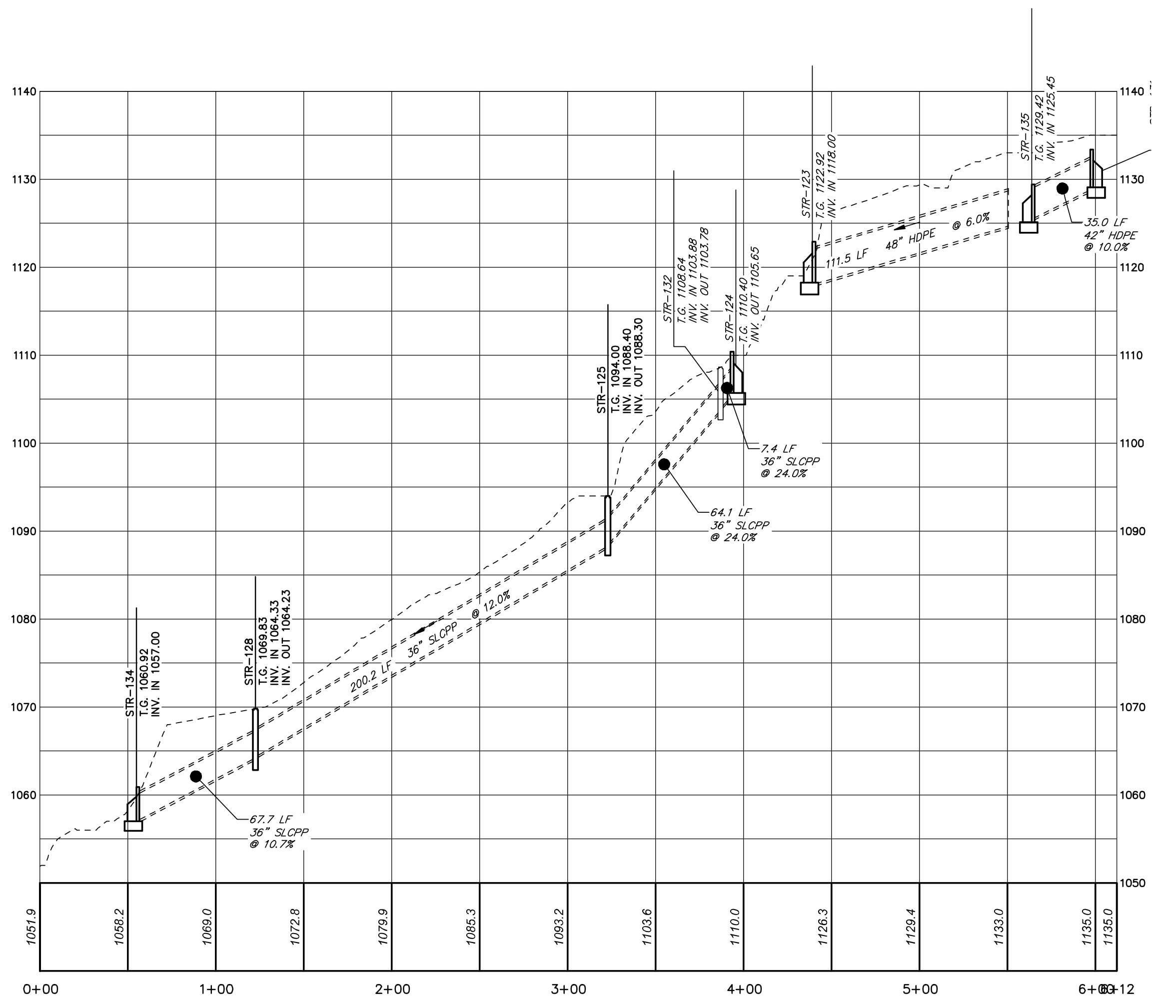
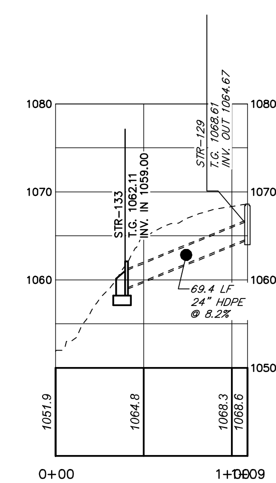


MOUNTAIN LAKE CREEK



MOUNTAIN LAKE CREEK

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CITY OF SCRANTON
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SCRANTON, LACKAWANNA COUNTY, PENNSYLVANIA

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PROJ. MANAGER:	MWS

REVISIONS

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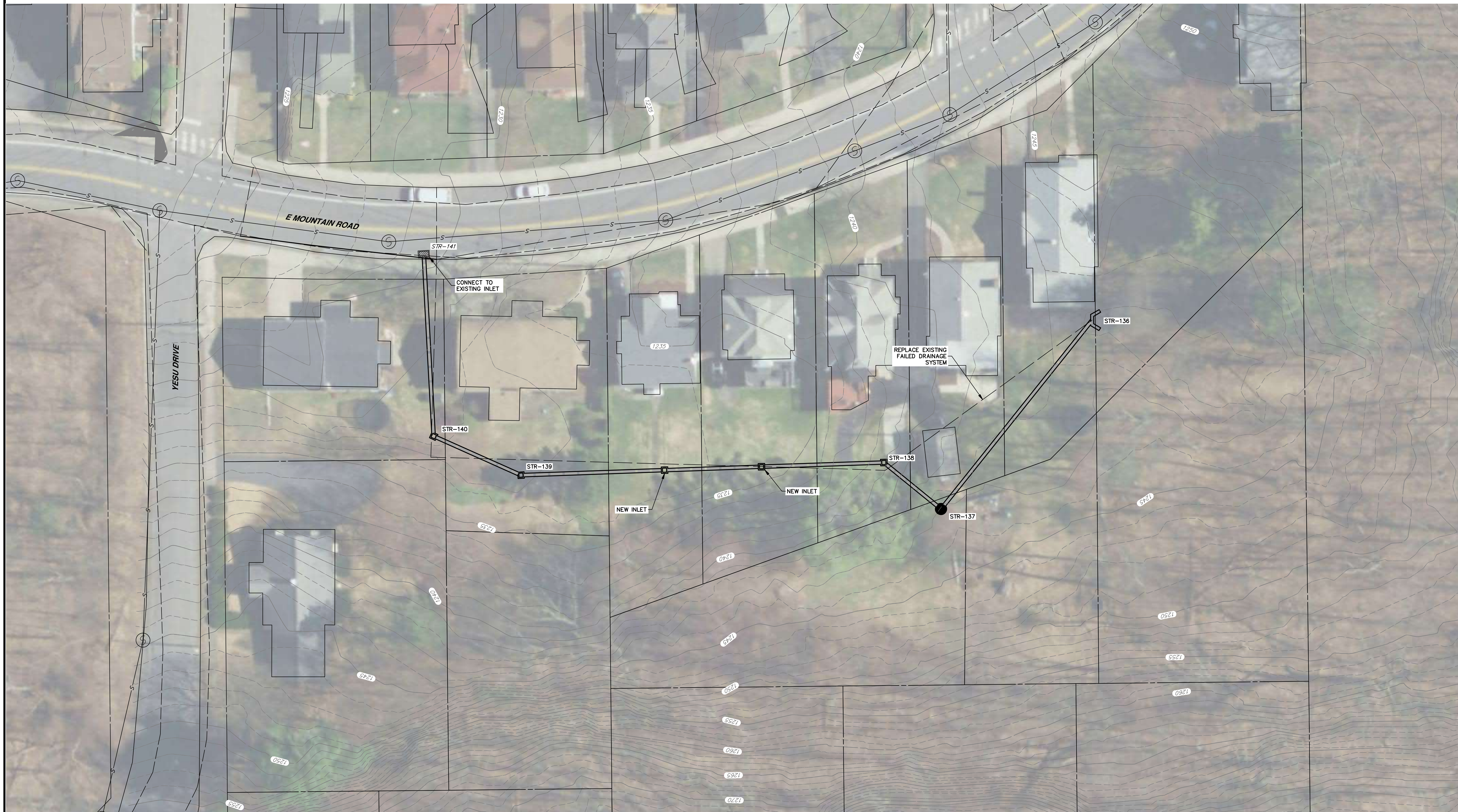
SHEET TITLE:
PROFILE-STORM - MOUNTAIN LAKE

SHEET: **PRD-2** | **06**



GRAPHIC SCALE
20' 10' 0' 20'

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PRELIMINARY STORMWATER IMPROVEMENTS FOR EAST MOUNTAIN STORMWATER & DRAINAGE STUDY

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DRAWING SCALE:	
PROJ. MANAGER:	MWS

REVISIONS

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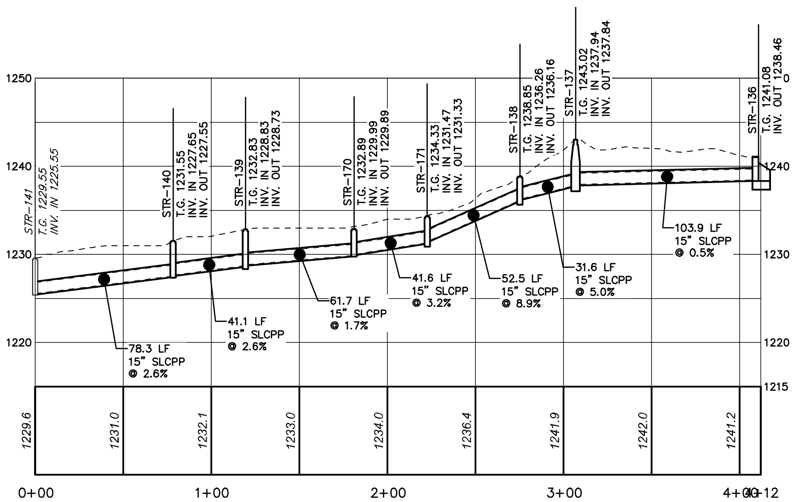
SHEET TITLE:
SITE PLAN - EAST MOUNTAIN ROAD

SHEET: SI-4 | 07



EAST MOUNTAIN ROAD

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PRELIMINARY STORMWATER IMPROVEMENTS
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CITY OF SCRANTON
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DRAWING SCALE:	
PROJ. MANAGER:	MWS

REVISIONS

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SHEET TITLE:
PROFILE-STORM - EAST MOUNTAIN RD

SHEET: **PRD-3** | **08**

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PROFESSIONAL SEAL:

HRG PROJECT NUMBER: 100444136.0436
PLAN DATE: 08.11.2023
DRAWING SCALE:
PROJ. MANAGER: MWS

REVISIONS

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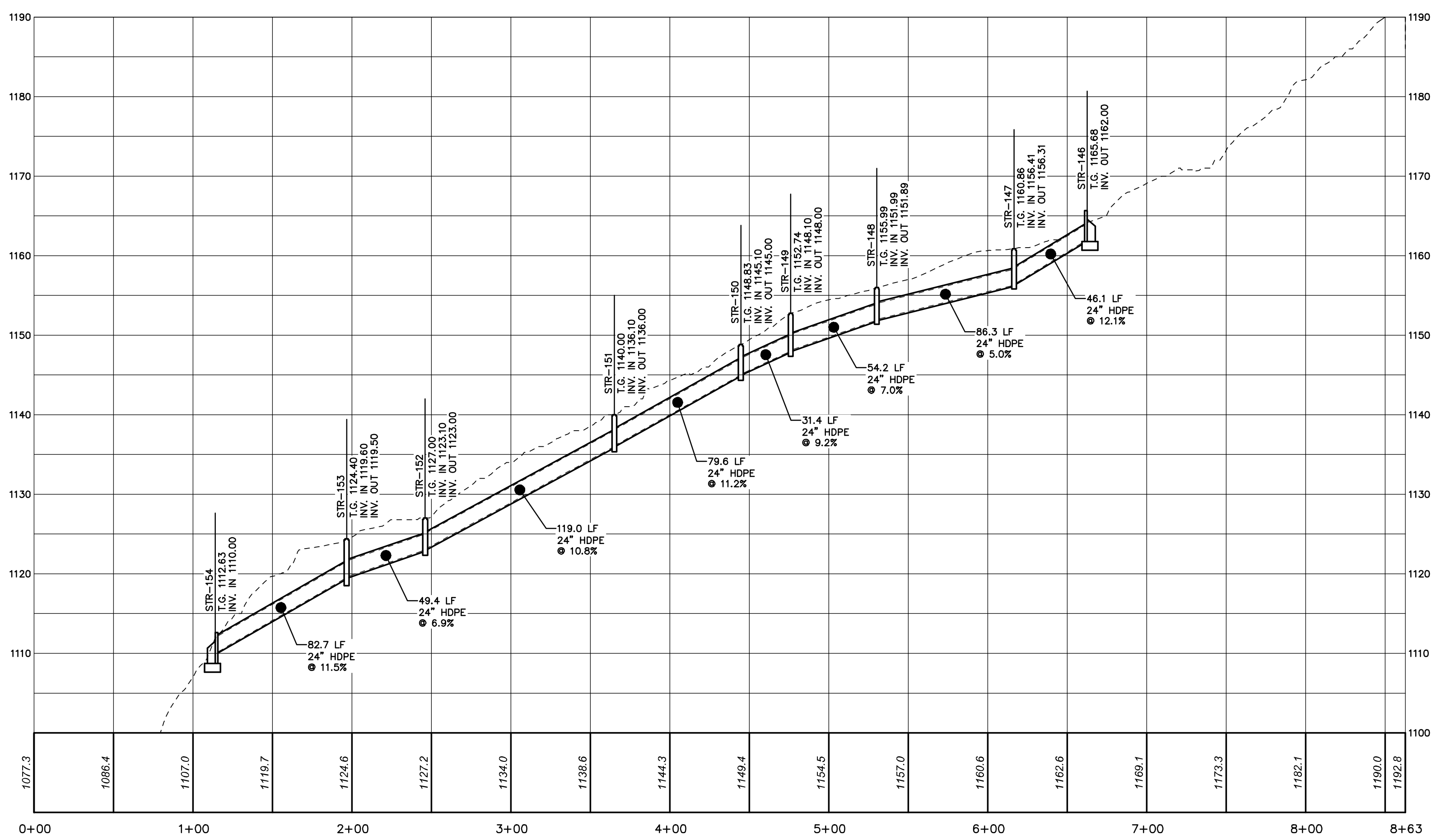
SHEET TITLE:
SITE PLAN - LINWOOD AVE

SHEET: SI-5 | 09



LINWOOD AVE

HRG

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PROJ. MANAGER:	MWS

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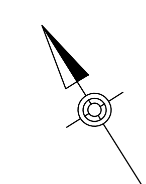
SHEET TITLE:
PROFILE-STORM - LINWOOD AVE

SHEET: PRD-4 | 10



GRAPHIC SCALE

40' 20' 0' 40'

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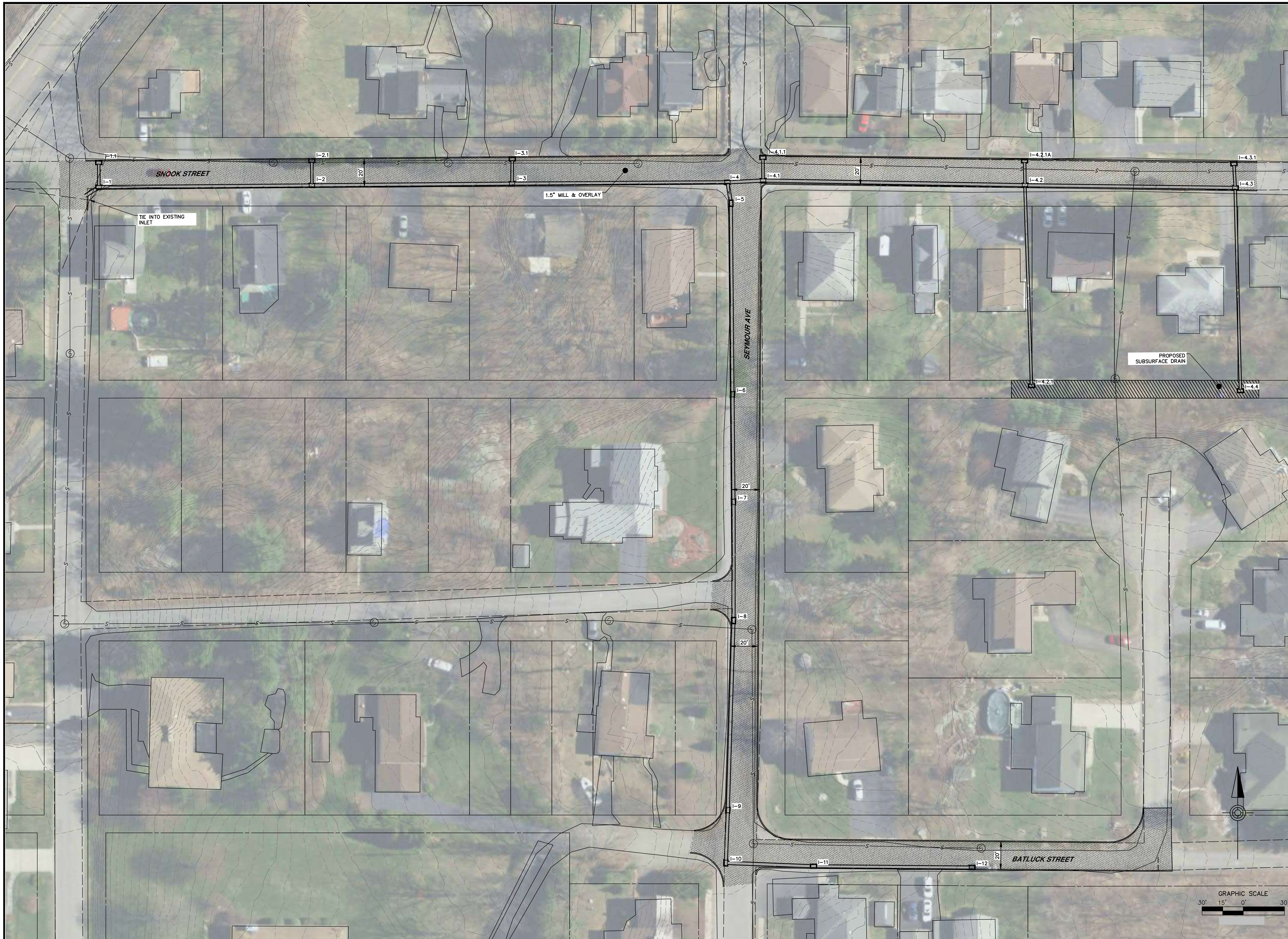
SHEET TITLE:

SITE PLAN - FLORIDA AVE

SHEET: SI-6 | 11



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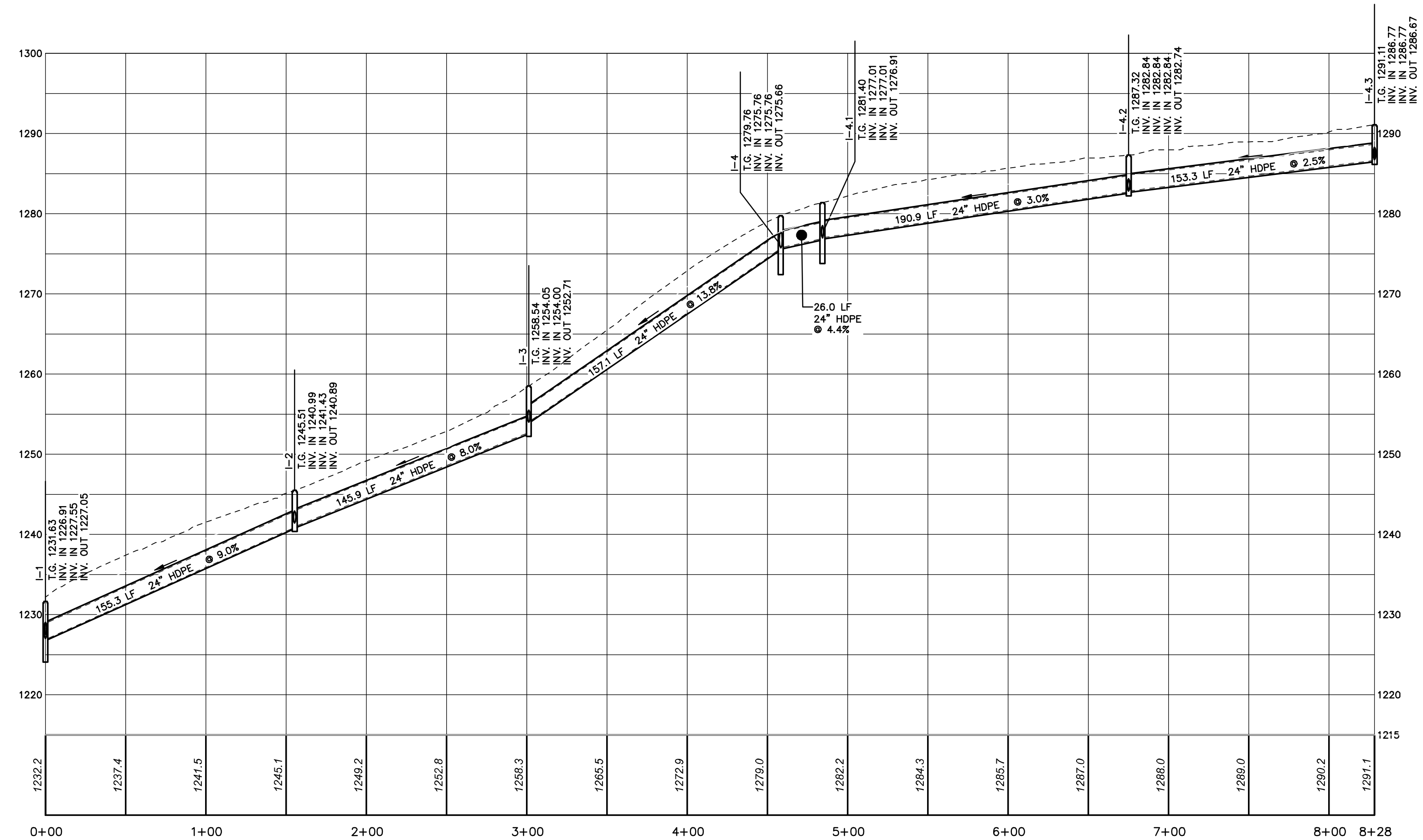
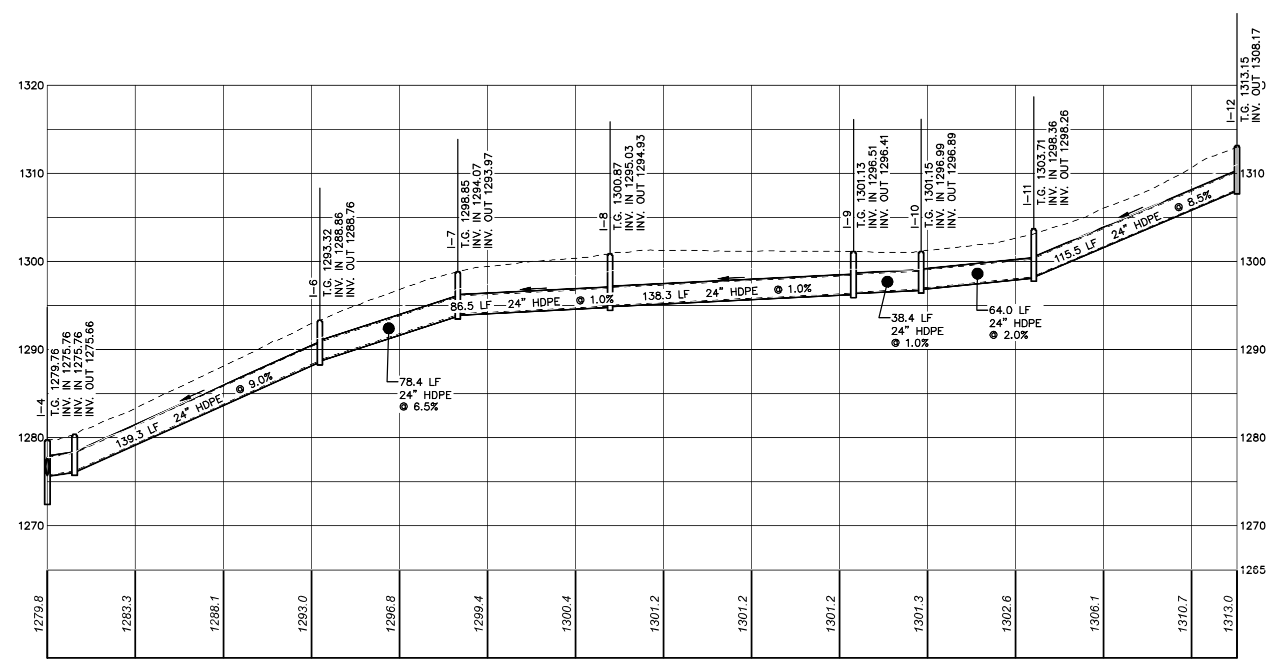
SHEET TITLE:

SITE PLAN - SNOOK STREET

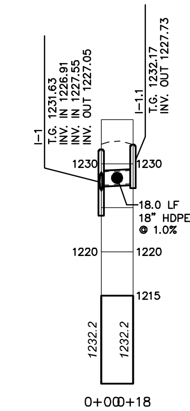
SHEET: SI-7 | 12



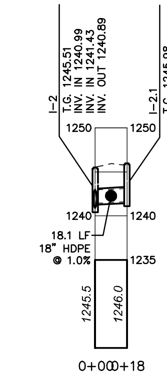
I-4.3 TO I-1



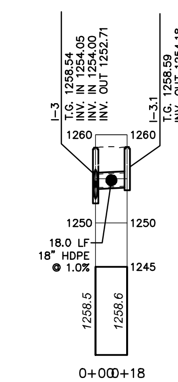
I-12 TO I-4



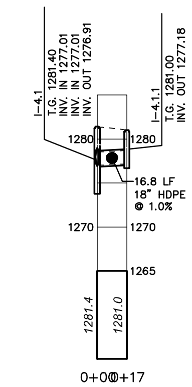
I-1.1 TO I-1



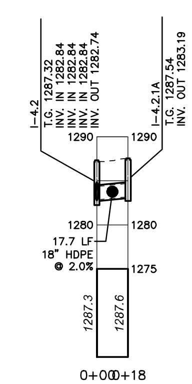
I-2.1 TO I-2



I-3.1 TO I-3



I-4.1.1 TO I-4.1



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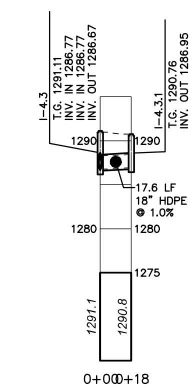

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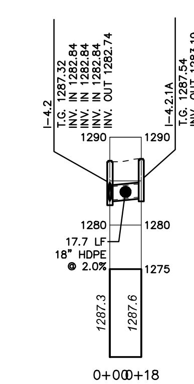
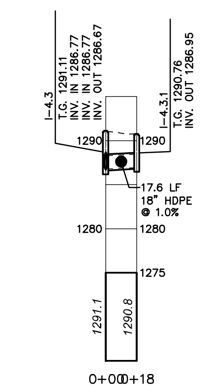
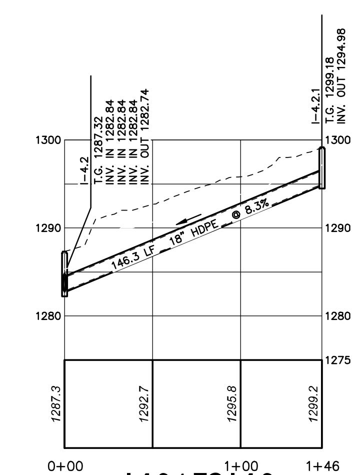


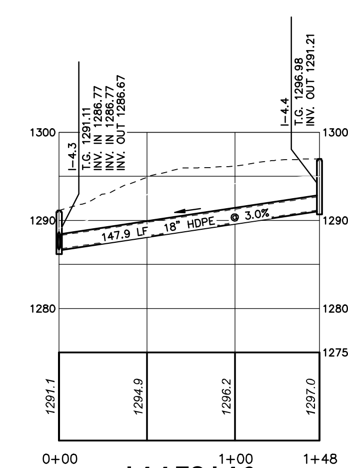
I-4.2.1A TO I-4.2



I-4.3.1 TO I-4.3



I-4.2.1 TO I-4.2



I-4.4 TO I-4.3

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PRELIMINARY STORMWATER IMPROVEMENTS FOR EAST MOUNTAIN STORMWATER & DRAINAGE STUDY

CITY OF SCRANTON
340 N WASHINGTON AVE
SCRANTON, PA 18503

SCRANTON, LACKAWANNA COUNTY, PENNSYLVANIA

PROFESSIONAL SEAL:

HRG PROJECT NUMBER:	004441.36.0436
PLAN DATE:	08.11.2023
DRAWING SCALE:	AS NOTED
PROJ. MANAGER:	MWS

REVISIONS

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SHEET TITLE:

PROFILE-STORM - SNOOK ST

SHEET: PRD-5 | 13

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PRELIMINARY STORMWATER IMPROVEMENTS FOR EAST MOUNTAIN STORMWATER & DRAINAGE STUDY

CITY OF SCRANTON
340 N WASHINGTON AVE
SCRANTON, PA 18503
SCRANTON, LACKAWANNA COUNTY, PENNSYLVANIA

GRAPHIC SCALE
40' 20' 0' 40'

PROFESSIONAL SEAL:

HRG PROJECT NUMBER:	00444136.0436
PLAN DATE:	08.11.2023
DRAWING SCALE:	
PROJ. MANAGER:	MWS

REVISIONS

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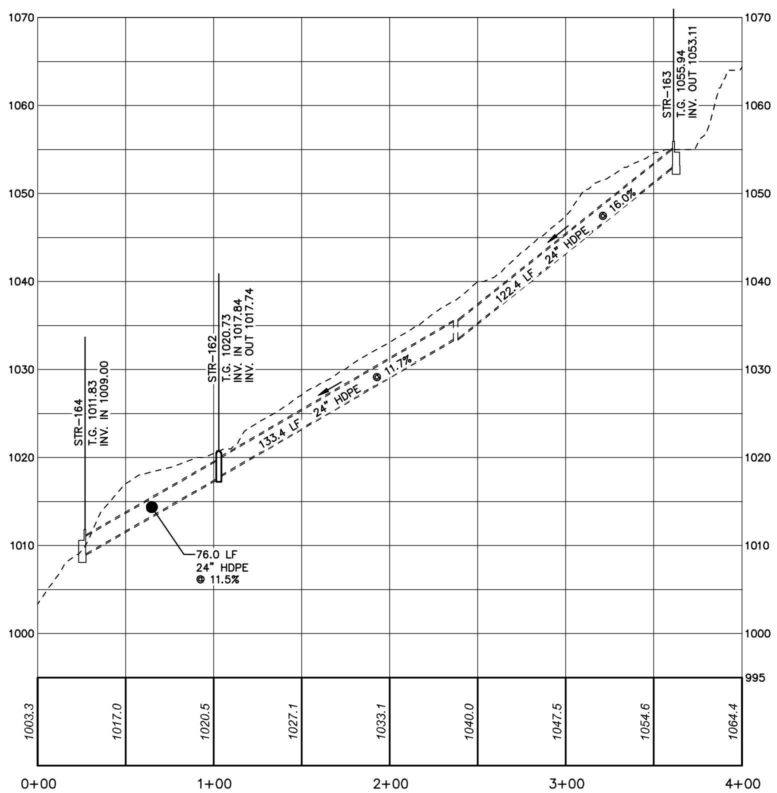
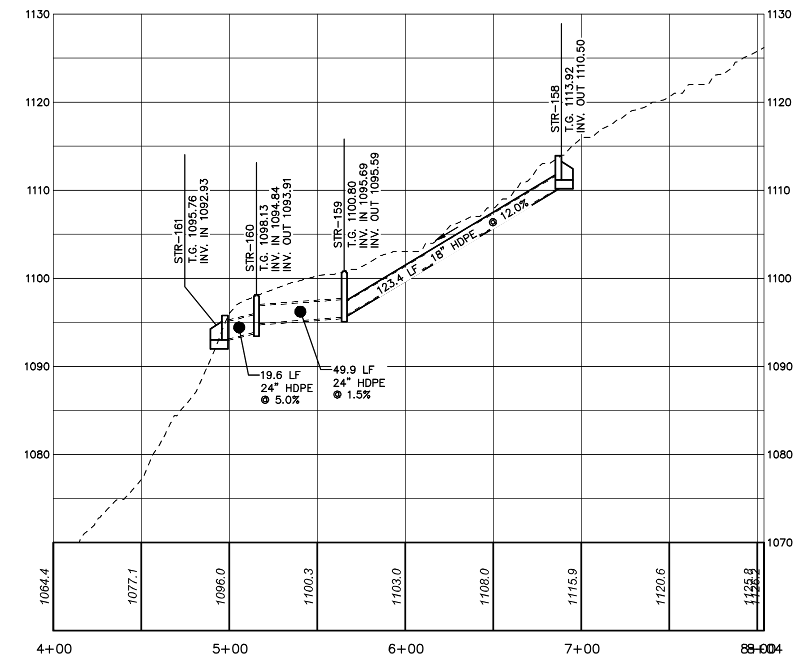
SHEET TITLE:
SITE PLAN - BEECH STREET

SHEET: SI-8 | 14



BEECH ST



BEECH ST

HRG

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REVISIONS

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SHEET TITLE:
PROFILE-STORM - BEECH STREET

SHEET: **PRD-6** | **15**

GRAPHIC SCALE

50' 25' 0' 50'

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SHEET TITLE:

SITE PLAN - RAILROAD CROSSINGS

SHEET: SI-9 | 16

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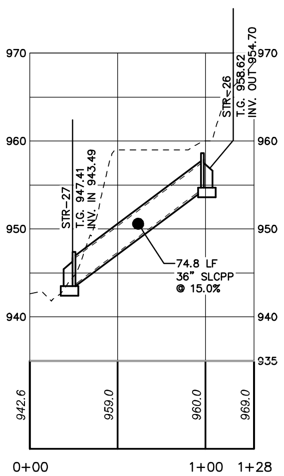

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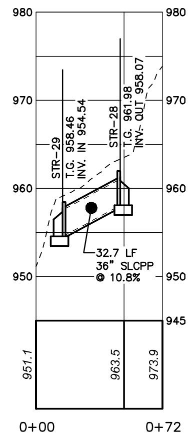

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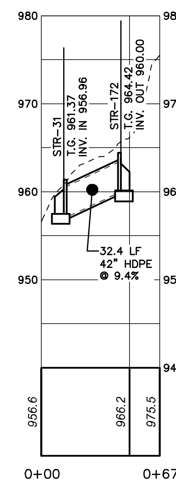

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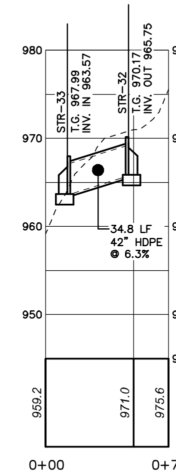

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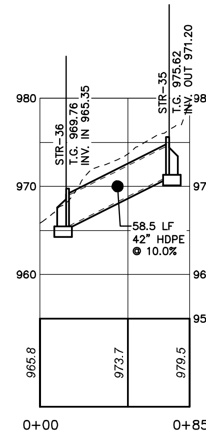

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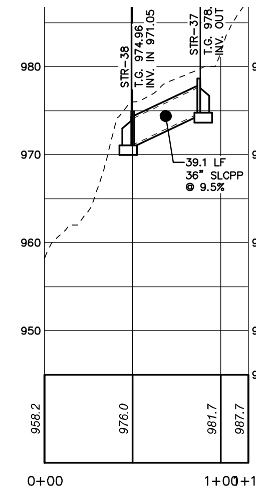

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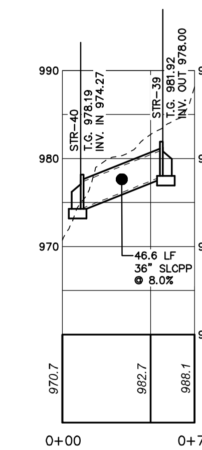

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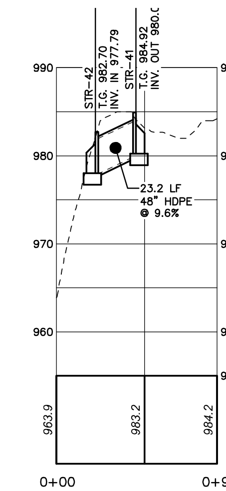

RAILWAY CULVERT-8

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CITY OF SCRANTON
340 N WASHINGTON AVE
SCRANTON, PA 18503
SCRANTON, LACKAWANNA COUNTY, PENNSYLVANIA

PROFESSIONAL SEAL:

HRG PROJECT NUMBER:	00444136.0436
PLAN DATE:	08.11.2023
DRAWING SCALE:	
PROJ. MANAGER:	MWS

REVISIONS

NO.	DATE	DESCRIPTION
1		
2		
3		
4		
5		
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8		
9		

SHEET TITLE:
PROFILE-STORM - RAILROAD CROSSINGS

SHEET: PRD-7 | 17

APPENDIX C

ENGINEER'S PROJECT COST OPINION - PRELIMINARY DESIGN

Preliminary Design - Engineer's Project Cost and Duration Opinion Summary

Project Name:	East Mountain Stormwater Study	**Estimated Site Cost**	**Estimated Site Duration**
HRG Proj. No.	004441.0436		
Calc'd By:	SJS		
Calc'd Date:	01/05/24		
Site 1	Cherry Street	$ 42,690.00	
Site 2	Wintermantle Avenue	$ 204,720.00	
Site 3	Mountain Lake Creek	$ 434,070.00	
Site 4	E Mountain Road	$ 128,720.00	
Site 5	Linwood Avenue	$ 300,660.00	
Site 6	Snook Street	$ 1,370,460.00	
Site 7	Railroad ROW	$ 299,970.00	
Site 8	Florida Ave	$ 58,140.00	
Site 9	Beech Street	$ 45,150.00	

Total Project Cost = $2,884,580.00

Total Project Duration = ____________ **Days**

Items List Updated: 3/21/23

CALC'D BY:	SJS
CALC'D DATE:	01/05/24
CHK'D BY:	
CHK'D DATE:	

Preliminary Design - Engineer's Project Cost Opinion
for
East Mountain Stormwater Study
Cherry Street
004441.0436

ITEM NO.	ITEM DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	TOTAL
100-001	MOBILIZATION	1	LS	$ 1,500.00	$ 1,500.00
100-002	MAINTENANCE AND PROTECTION OF TRAFFIC	1	LS	$ 1,500.00	$ 1,500.00
400-004	MILLING, 9" TO 12" DEPTH	400	SY	$ 15.00	$ 6,000.00
400-018	2A SUBBASE, 6" DEPTH	400	SY	$ 16.00	$ 6,400.00
400-033	BASE REPAIR SUPERPAVE ASPHALT MIXTURE DESIGN, BASE COURSE, PG 64S-22, 0.3 TO <3 MILLION ESALS, 25.0 MM MIX, 4" DEPTH	400	SY	$ 25.00	$ 10,000.00
400-062	SUPERPAVE ASPHALT MIXTURE DESIGN, WEARING COURSE, PG 64S-22, 0.3 TO <3 MILLION ESALS, 9.5 MM MIX, 1 1/2" DEPTH, SRL-E	400	SY	$ 17.00	$ 6,800.00
400-151	ASPHALT ROLLED CURB	225	LF	$ 15.00	$ 3,375.00
				Subtotal	$ 35,575.00
				20% Contingency	$ 7,115.00
				TOTAL	$ 42,690.00

CALC'D BY:	SJS
CALC'D DATE:	01/05/24
CHK'D BY:	
CHK'D DATE:	

Preliminary Design - Engineer's Project Cost Opinion
for
East Mountain Stormwater Study
Wintermantle Avenue
004441.0436

ITEM NO.	ITEM DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	TOTAL
100-001	MOBILIZATION	1	LS	$ 11,800.00	$ 11,800.00
100-002	MAINTENANCE AND PROTECTION OF TRAFFIC	1	LS	$ 7,400.00	$ 7,400.00
100-004	CLEARING AND GRUBBING	1	LS	$ 5,000.00	$ 5,000.00
300-026	TYPE M CONCRETE INLET TOP UNIT AND GRATE	2	EA	$ 1,300.00	$ 2,600.00
300-045	STANDARD INLET BOX	2	EA	$ 4,000.00	$ 8,000.00
300-097	18" SMOOTH LINED CORRUGATED POLYETHYLENE PIPE	225	LF	$ 150.00	$ 33,750.00
300-101	42" SMOOTH LINED CORRUGATED POLYETHYLENE PIPE	110	LF	$ 225.00	$ 24,750.00
300-325	TYPE D-W ENDWALL, 18" PIPE OR EQUIVALENT PIPE SIZE	6	EA	$ 4,000.00	$ 24,000.00
300-331	TYPE D-W ENDWALL, 42" PIPE OR EQUIVALENT PIPE SIZE	4	EA	$ 6,300.00	$ 25,200.00
500-005	SEEDING AND SOIL SUPPLEMENTS - FORMULA B, RESIDENTIAL MIX	1	LS	$ 5,000.00	$ 5,000.00
900-001	8' Drainage Swale	385	LF	$ 60.00	$ 23,100.00
				Subtotal	$ 170,600.00
			20%	Contingency	$ 34,120.00
				TOTAL	$ 204,720.00

CALC'D BY:	SJS
CALC'D DATE:	01/05/24
CHK'D BY:	
CHK'D DATE:	

Preliminary Design - Engineer's Project Cost Opinion
for
East Mountain Stormwater Study
Mountain Lake Creek
004441.0436

ITEM NO.	ITEM DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	TOTAL
100-001	MOBILIZATION	1	LS	$ 15,000.00	$ 15,000.00
100-002	MAINTENANCE AND PROTECTION OF TRAFFIC	1	LS	$ 6,000.00	$ 6,000.00
100-004	CLEARING AND GRUBBING	1	LS	$ 10,000.00	$ 10,000.00
200-001	GENERAL EROSION AND SEDIMENT POLLUTION CONTROL	1	LS	$ 7,500.00	$ 7,500.00
300-026	TYPE M CONCRETE INLET TOP UNIT AND GRATE	2	EA	$ 1,300.00	$ 2,600.00
300-045	STANDARD INLET BOX	2	EA	$ 4,000.00	$ 8,000.00
300-100	36" SMOOTH LINED CORRUGATED POLYETHYLENE PIPE	38	LF	$ 250.00	$ 9,500.00
300-101	42" SMOOTH LINED CORRUGATED POLYETHYLENE PIPE	35	LF	$ 275.00	$ 9,625.00
300-330	TYPE D-W ENDWALL, 36" PIPE OR EQUIVALENT PIPE SIZE	1	EA	$ 6,000.00	$ 6,000.00
300-331	TYPE D-W ENDWALL, 42" PIPE OR EQUIVALENT PIPE SIZE	3	EA	$ 6,300.00	$ 18,900.00
500-005	SEEDING AND SOIL SUPPLEMENTS - FORMULA B, RESIDENTIAL MIX	1	LS	$ 7,500.00	$ 7,500.00
900-001	8' Drainage Swale	385	LF	$ 60.00	$ 23,100.00
900-002	Basin Excavation	2	LS	$ 80,000.00	$ 160,000.00
900-003	Basin Outfall Structure	1	EA	$ 8,000.00	$ 8,000.00
900-004	Basin Berm and Spillway	1	LS	$ 70,000.00	$ 70,000.00
				Subtotal	$ 361,725.00
			20%	Contingency	$ 72,345.00
				TOTAL	$ 434,070.00

CALC'D BY:	SJS
CALC'D DATE:	01/05/24
CHK'D BY:	
CHK'D DATE:	

Preliminary Design - Engineer's Project Cost Opinion
for
East Mountain Stormwater Study
E Mountain Road
004441.0436

ITEM NO.	ITEM DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	TOTAL
100-001	MOBILIZATION	1	LS	$ 7,550.00	$ 7,550.00
100-002	MAINTENANCE AND PROTECTION OF TRAFFIC	1	LS	$ 4,800.00	$ 4,800.00
300-026	TYPE M CONCRETE INLET TOP UNIT AND GRATE	5	EA	$ 1,300.00	$ 6,500.00
300-034	STORM SEWER MANHOLE FRAME AND COVER	1	EA	$ 2,000.00	$ 2,000.00
300-045	STANDARD INLET BOX	5	EA	$ 4,000.00	$ 20,000.00
300-056	STORM SEWER MANHOLE, 4' DIA	1	EA	$ 2,000.00	$ 2,000.00
300-097	18" SMOOTH LINED CORRUGATED POLYETHYLENE PIPE	400	LF	$ 138.54	$ 55,416.67
300-325	TYPE D-W ENDWALL, 18" PIPE OR EQUIVALENT PIPE SIZE	1	EA	$ 4,000.00	$ 4,000.00
500-005	SEEDING AND SOIL SUPPLEMENTS - FORMULA B, RESIDENTIAL MIX	1	LS	$ 5,000.00	$ 5,000.00
				Subtotal	$ 107,267.00
			20%	Contingency	$ 21,453.00
				TOTAL	$ 128,720.00

CALC'D BY: SJS
CALC'D DATE: 01/05/24
CHK'D BY:
CHK'D DATE:

Preliminary Design - Engineer's Project Cost Opinion
for
East Mountain Stormwater Study
Linwood Avenue
004441.0436

ITEM NO.	ITEM DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	TOTAL
100-001	MOBILIZATION	1	LS	$ 17,500.00	$ 17,500.00
100-002	MAINTENANCE AND PROTECTION OF TRAFFIC	1	LS	$ 11,000.00	$ 11,000.00
100-004	CLEARING AND GRUBBING	1	LS	$ 5,000.00	$ 5,000.00
300-026	TYPE M CONCRETE INLET TOP UNIT AND GRATE	9	EA	$ 1,300.00	$ 11,700.00
300-045	STANDARD INLET BOX	9	EA	$ 4,000.00	$ 36,000.00
300-097	18" SMOOTH LINED CORRUGATED POLYETHYLENE PIPE	125	LF	$ 150.00	$ 18,750.00
300-098	24" SMOOTH LINED CORRUGATED POLYETHYLENE PIPE	555	LF	$ 190.00	$ 105,450.00
300-325	TYPE D-W ENDWALL, 18" PIPE OR EQUIVALENT PIPE SIZE	1	EA	$ 4,000.00	$ 4,000.00
300-327	TYPE D-W ENDWALL, 24" PIPE OR EQUIVALENT PIPE SIZE	3	EA	$ 3,800.00	$ 11,400.00
400-151	ASPHALT ROLLED CURB	75	LF	$ 50.00	$ 3,750.00
500-005	SEEDING AND SOIL SUPPLEMENTS - FORMULA B, RESIDENTIAL MIX	1	LS	$ 5,000.00	$ 5,000.00
900-001	8' Drainage Swale	350	LF	$ 60.00	$ 21,000.00
				Subtotal	$ 250,550.00
				20% Contingency	$ 50,110.00
				TOTAL	$ 300,660.00

CALC'D BY:	SJS
CALC'D DATE:	01/05/24
CHK'D BY:	
CHK'D DATE:	

Preliminary Design - Engineer's Project Cost Opinion
for
East Mountain Stormwater Study
Snook Street
004441.0436

ITEM NO.	ITEM DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	TOTAL
100-001	MOBILIZATION	1	LS	$ 38,000.00	$ 38,000.00
100-002	MAINTENANCE AND PROTECTION OF TRAFFIC	1	LS	$ 24,000.00	$ 24,000.00
300-026	TYPE M CONCRETE INLET TOP UNIT AND GRATE	21	EA	$ 1,300.00	$ 27,300.00
300-045	STANDARD INLET BOX	21	EA	$ 4,000.00	$ 84,000.00
300-080	18" SMOOTH LINED CORRUGATED POLYETHYLENE COMBINATION STORM SEWER/UNDERDRAIN	200	LF	$ 115.00	$ 23,000.00
300-097	18" SMOOTH LINED CORRUGATED POLYETHYLENE PIPE	845	LF	$ 150.00	$ 126,750.00
300-098	24" SMOOTH LINED CORRUGATED POLYETHYLENE PIPE	1150	LF	$ 190.00	$ 218,500.00
400-004	MILLING, 9" TO 12" DEPTH	4100	SY	$ 15.00	$ 61,500.00
400-018	2A SUBBASE, 6" DEPTH	4100	SY	$ 10.00	$ 41,000.00
400-033	BASE REPAIR SUPERPAVE ASPHALT MIXTURE DESIGN, BASE COURSE, PG 64S-22, 0.3 TO <3 MILLION ESALS, 25.0 MM MIX, 4" DEPTH	4100	SY	$ 20.00	$ 82,000.00
400-062	SUPERPAVE ASPHALT MIXTURE DESIGN, WEARING COURSE, PG 64S-22, 0.3 TO <3 MILLION ESALS, 9.5 MM MIX, 1 1/2" DEPTH, SRL-E	4100	SY	$ 10.00	$ 41,000.00
400-148	CONCRETE CURB	3700	LF	$ 100.00	$ 370,000.00
500-005	SEEDING AND SOIL SUPPLEMENTS - FORMULA B, RESIDENTIAL MIX	1	LS	$ 5,000.00	$ 5,000.00
				Subtotal	$ 1,142,050.00
			20%	Contingency	$ 228,410.00
				TOTAL	$ 1,370,460.00

CALC'D BY:	SJS
CALC'D DATE:	01/05/24
CHK'D BY:	
CHK'D DATE:	

Preliminary Design - Engineer's Project Cost Opinion
for
East Mountain Stormwater Study
Railroad ROW
004441.0436

ITEM NO.	ITEM DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	TOTAL
100-001	MOBILIZATION	1	LS	$ 12,500.00	$ 12,500.00
100-002	MAINTENANCE AND PROTECTION OF TRAFFIC	1	LS	$ 7,650.00	$ 7,650.00
300-100	36" SMOOTH LINED CORRUGATED POLYETHYLENE PIPE	200	LF	$ 250.00	$ 50,000.00
300-101	42" SMOOTH LINED CORRUGATED POLYETHYLENE PIPE	95	LF	$ 1,000.00	$ 95,000.00
300-330	TYPE D-W ENDWALL, 36" PIPE OR EQUIVALENT PIPE SIZE	8	EA	$ 5,500.00	$ 44,000.00
300-331	TYPE D-W ENDWALL, 42" PIPE OR EQUIVALENT PIPE SIZE	4	EA	$ 6,300.00	$ 25,200.00
500-005	SEEDING AND SOIL SUPPLEMENTS - FORMULA B, RESIDENTIAL MIX	1	LS	$ 7,000.00	$ 7,000.00
900-001	8' Drainage Swale	115	LF	$ 75.00	$ 8,625.00
				Subtotal	$ 249,975.00
				20% Contingency	$ 49,995.00
				TOTAL	$ 299,970.00

CALC'D BY:	SJS
CALC'D DATE:	01/05/24
CHK'D BY:	
CHK'D DATE:	

Preliminary Design - Engineer's Project Cost Opinion
for
East Mountain Stormwater Study
Florida Ave
004441.0436

ITEM NO.	ITEM DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	TOTAL
100-001	MOBILIZATION	1	LS	$ 1,500.00	$ 1,500.00
100-002	MAINTENANCE AND PROTECTION OF TRAFFIC	1	LS	$ 1,500.00	$ 1,500.00
300-045	STANDARD INLET BOX	4	EA	$ 4,000.00	$ 16,000.00
300-098	24" SMOOTH LINED CORRUGATED POLYETHYLENE PIPE	155	LF	$ 190.00	$ 29,450.00
				Subtotal	$ 48,450.00
				20% Contingency	$ 9,690.00
				TOTAL	$ 58,140.00

CALC'D BY:	SJS
CALC'D DATE:	01/05/24
CHK'D BY:	
CHK'D DATE:	

Preliminary Design - Engineer's Project Cost Opinion
for
East Mountain Stormwater Study
Beech Street
004441.0436

ITEM NO.	ITEM DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	TOTAL
100-001	MOBILIZATION	1	LS	$ 1,750.00	$ 1,750.00
100-002	MAINTENANCE AND PROTECTION OF TRAFFIC	1	LS	$ 1,750.00	$ 1,750.00
300-045	STANDARD INLET BOX	3	EA	$ 4,000.00	$ 12,000.00
300-097	18" SMOOTH LINED CORRUGATED POLYETHYLENE PIPE	125	LF	$ 115.00	$ 14,375.00
300-325	TYPE D-W ENDWALL, 18" PIPE OR EQUIVALENT PIPE SIZE	1	EA	$ 3,750.00	$ 3,750.00
300-327	TYPE D-W ENDWALL, 24" PIPE OR EQUIVALENT PIPE SIZE	1	EA	$ 4,000.00	$ 4,000.00
				Subtotal	$ 37,625.00
			20%	Contingency	$ 7,525.00
				TOTAL	$ 45,150.00

APPENDIX D
PRELIMINARY DRAINAGE CALCULATIONS

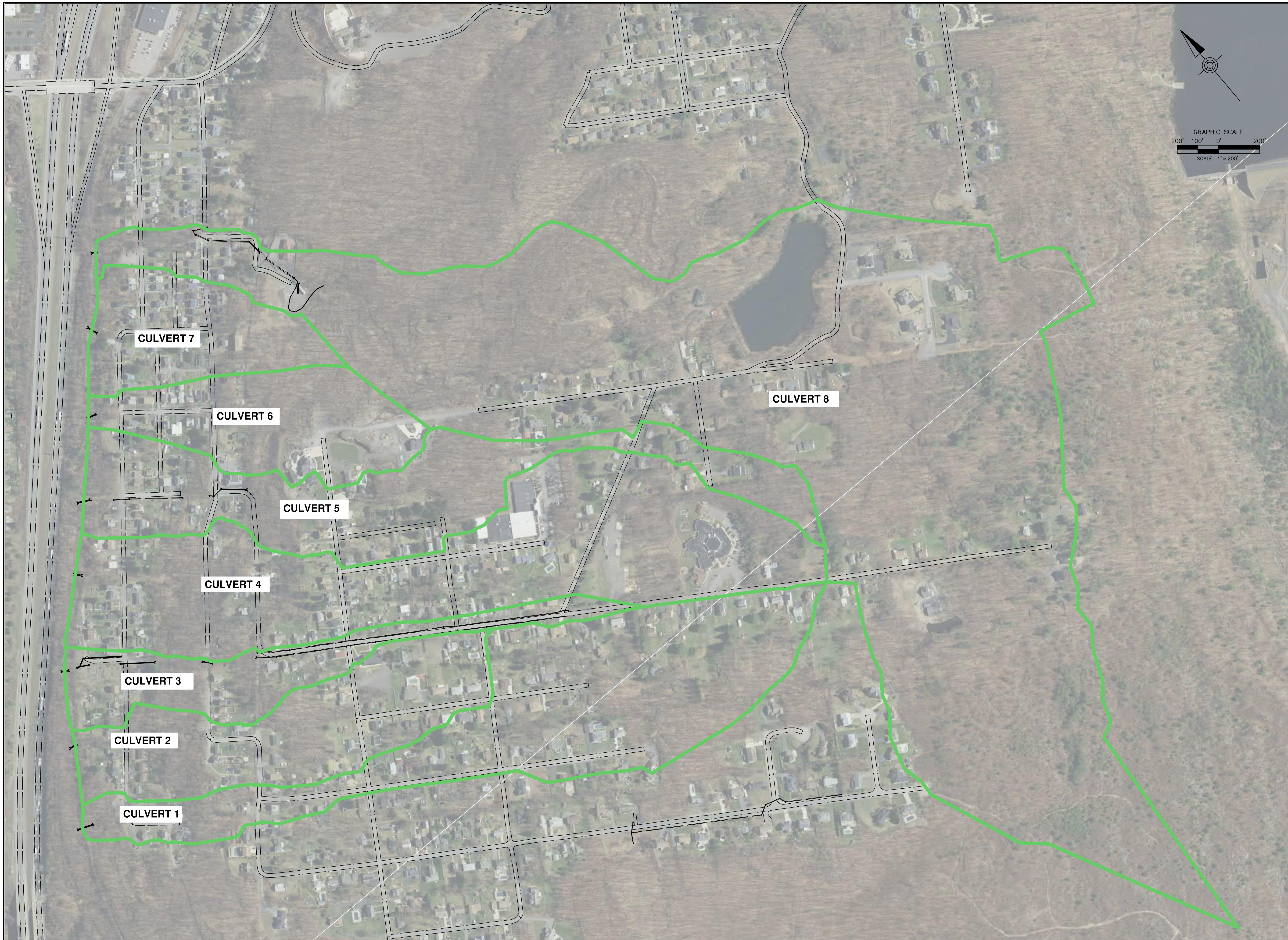
HRG

East Mountain Abandoned Road Grade Culverts

The conveyance system and culverts were designed using the rational method. Runoff Coefficients (C) were generated based upon a combination of impervious cover provided by the City and satellite imagery. Once drainage areas were delineated, an average runoff coefficient was determined. Rainfall intensity was generated using NOAA Atlas 14. Runoff Coefficients and Time of Concentrations were then input into Hydraflow Storm Sewers to analyze the proposed Conveyance system for the 25-YR storm event. The 25-YR storm event was chosen as it is the most typical design storm for conveyance systems across the industry.

The rational method was utilized to determine the flow rates for the culverts. Time of concentrations for the preliminary design of the culverts were conservatively estimated, ranging from 15 minutes to 60 minutes. Runoff Rates for the 100-YR storm were calculated based upon this information, then imported into Hydraflow Express to size the culverts for the 100-YR storm event. The 100-YR storm event was chosen to avoid any erosion or overtopping during the 100-YR event.

Culvert Design Data						
Culvert No.	Drainage Area (AC.)	Rational Runoff Coefficient	Design TC (min)	Design Storm	Design Storm Intensity	Design Flow Rate (CFS)
1	34	0.33	30.0	100-YR	3.560	**39.94**
2	20	0.36	15.0	100-YR	4.940	**35.57**
3	10	0.31	15.0	100-YR	4.940	**15.31**
4	28	0.41	15.0	100-YR	4.940	**56.71**
5	20	0.41	15.0	100-YR	4.940	**40.51**
6	26	0.34	15.0	100-YR	4.940	**43.67**
7	15	0.33	15.0	100-YR	4.940	**24.45**
8	148	0.22	60.0	100-YR	2.380	**77.49**



HRG
HERBERT, ROWLAND & GRUBIC, INC.
P.O. BOX 504
CLARKS SUMMIT, PA 18411
570.851.2804 | hrg-inc.com

DRAINAGE AREA EXHIBITS FOR EAST MOUNTAIN STORMWATER & DRAINAGE STUDY

CITY OF SCRANTON
340 N. WASHINGTON AVE
SCRANTON, PA 18503
SCRANTON, LACKAWANNA COUNTY, PENNSYLVANIA

PROFESSIONAL SEAL:

HRG PROJECT NUMBER:	004441.0436
PLAN DATE:	01/05/2024
DRAWING SCALE:	1"=200'
PROJ. MANAGER:	GAW

REVISIONS

NO.	DATE	DESCRIPTION
1		
2		
3		
4		
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9		

SHEET TITLE:
CULVERT DRAINAGE AREAS

SHEET: DRN-1 | 1

Culvert Report

CULVERT 1

Invert Elev Dn (ft)	= 943.49
Pipe Length (ft)	= 74.80
Slope (%)	= 14.99
Invert Elev Up (ft)	= 954.70
Rise (in)	= 36.0
Shape	= Cir
Span (in)	= 36.0
No. Barrels	= 1
n-Value	= 0.012
Inlet Edge	= Sq Edge
Coeff. K,M,c,Y,k	= 0.0098, 2, 0.0398, 0.67, 0.5

Embankment

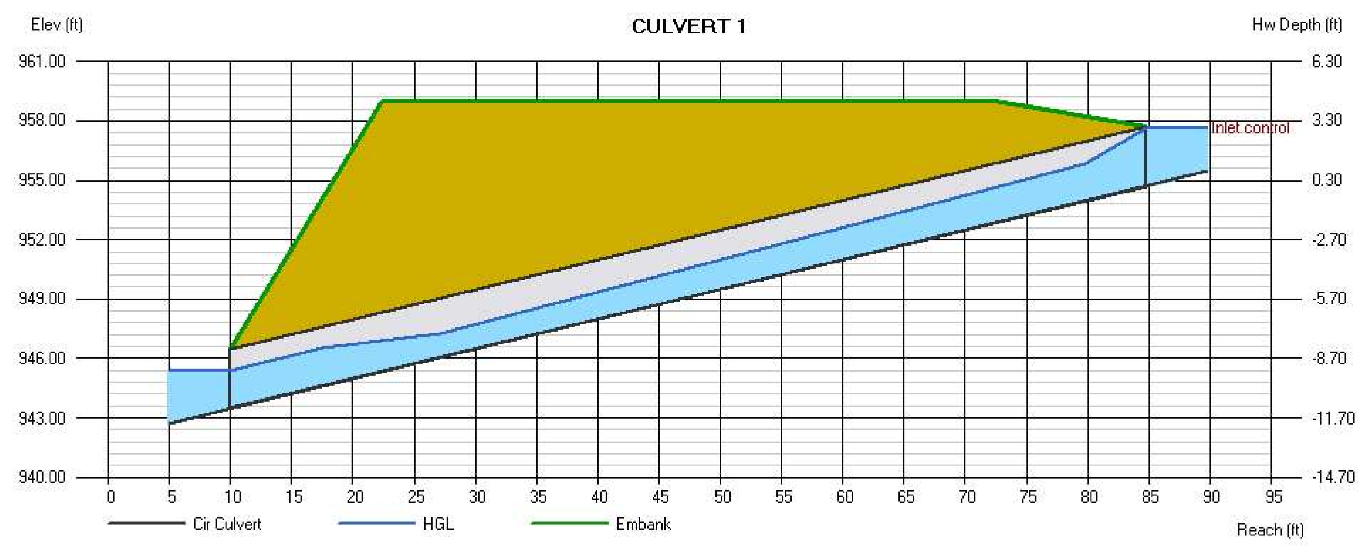
Top Elevation (ft)	= 959.00
Top Width (ft)	= 50.00
Crest Width (ft)	= 1000.00

Calculations

Qmin (cfs)	= 35.00
Qmax (cfs)	= 40.00
Tailwater Elev (ft)	= 0

Highlighted

Qtotal (cfs)	= 35.00
Qpipe (cfs)	= 35.00
Qovertop (cfs)	= 0.00
Veloc Dn (ft/s)	= 7.29
Veloc Up (ft/s)	= 7.29
HGL Dn (ft)	= 945.42
HGL Up (ft)	= 956.63
Hw Elev (ft)	= 957.66
Hw/D (ft)	= 0.99
Flow Regime	= Inlet Control



Q			Veloc		Depth	
Total	Pipe	Over	Dn	Up	Dn	Up
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(in)	(in)
35.00	35.00	0.00	7.29	7.29	23.13	23.13
36.00	36.00	0.00	7.37	7.37	23.48	23.48
37.00	37.00	0.00	7.45	7.45	23.82	23.82
38.00	38.00	0.00	7.53	7.53	24.16	24.16
39.00	39.00	0.00	7.61	7.61	24.50	24.50
40.00	40.00	0.00	7.69	7.69	24.83	24.83

HGL			
Dn	Up	Hw	Hw/D
(ft)	(ft)	(ft)	
945.42	956.63	957.66	0.99
945.45	956.66	957.72	1.01
945.47	956.68	957.78	1.03
945.50	956.71	957.85	1.05
945.53	956.74	957.91	1.07
945.56	956.77	957.97	1.09

Culvert Report

Culvert 2

Invert Elev Dn (ft)	=	954.54
Pipe Length (ft)	=	32.70
Slope (%)	=	10.80
Invert Elev Up (ft)	=	958.07
Rise (in)	=	36.0
Shape	=	Cir
Span (in)	=	36.0
No. Barrels	=	1
n-Value	=	0.012
Inlet Edge	=	Sq Edge
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

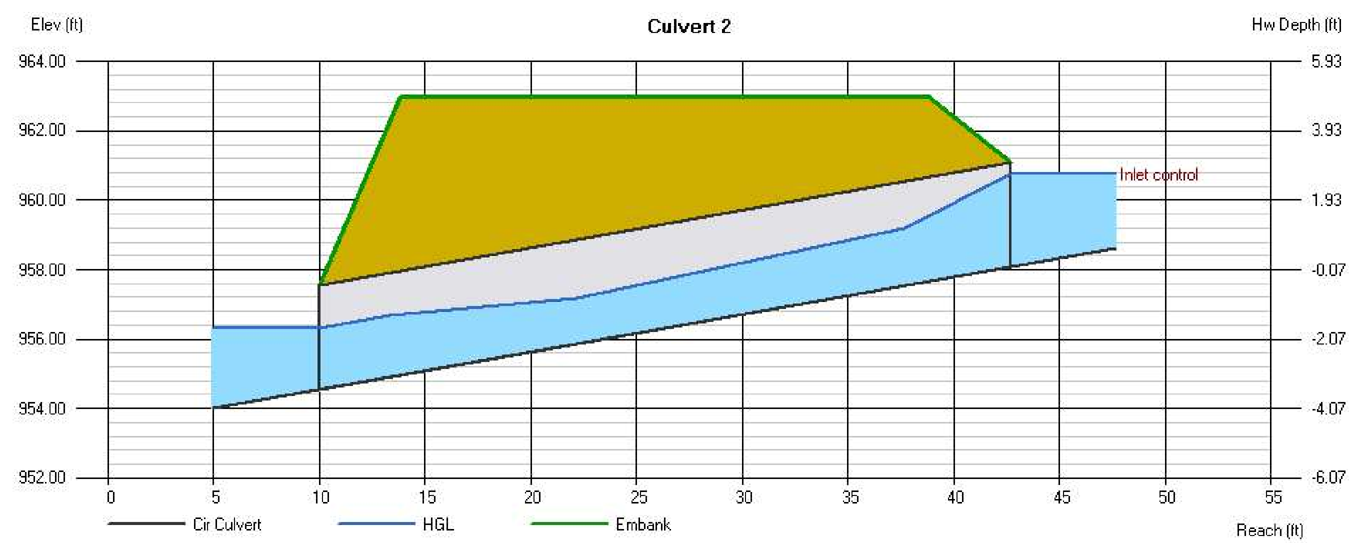
Top Elevation (ft)	=	963.00
Top Width (ft)	=	25.00
Crest Width (ft)	=	1000.00

Calculations

Qmin (cfs)	=	30.00
Qmax (cfs)	=	36.00
Tailwater Elev (ft)	=	0

Highlighted

Qtotal (cfs)	=	30.00
Qpipe (cfs)	=	30.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	6.86
Veloc Up (ft/s)	=	6.86
HGL Dn (ft)	=	956.32
HGL Up (ft)	=	959.85
Hw Elev (ft)	=	960.74
Hw/D (ft)	=	0.89
Flow Regime	=	Inlet Control



Q			Veloc		Depth	
Total	Pipe	Over	Dn	Up	Dn	Up
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(in)	(in)
30.00	30.00	0.00	6.86	6.86	21.39	21.39
31.00	31.00	0.00	6.95	6.95	21.74	21.74
32.00	32.00	0.00	7.04	7.04	22.09	22.09
33.00	33.00	0.00	7.12	7.12	22.44	22.44
34.00	34.00	0.00	7.21	7.21	22.79	22.79
35.00	35.00	0.00	7.29	7.29	23.13	23.13
36.00	36.00	0.00	7.37	7.37	23.48	23.48

HGL			
Dn	Up	Hw	Hw/D
(ft)	(ft)	(ft)	
956.32	959.85	960.74	0.89
956.35	959.88	960.80	0.91
956.38	959.91	960.86	0.93
956.41	959.94	960.92	0.95
956.44	959.97	960.99	0.97
956.47	960.00	961.05	0.99
956.50	960.03	961.11	1.01

Culvert Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc. Friday, Jan 5 2024

Culvert 3

Invert Elev Dn (ft)	= 956.96
Pipe Length (ft)	= 32.40
Slope (%)	= 9.38
Invert Elev Up (ft)	= 960.00
Rise (in)	= 42.0
Shape	= Cir
Span (in)	= 42.0
No. Barrels	= 1
n-Value	= 0.012
Inlet Edge	= Sq Edge
Coeff. K,M,c,Y,k	= 0.0098, 2, 0.0398, 0.67, 0.5

Embankment

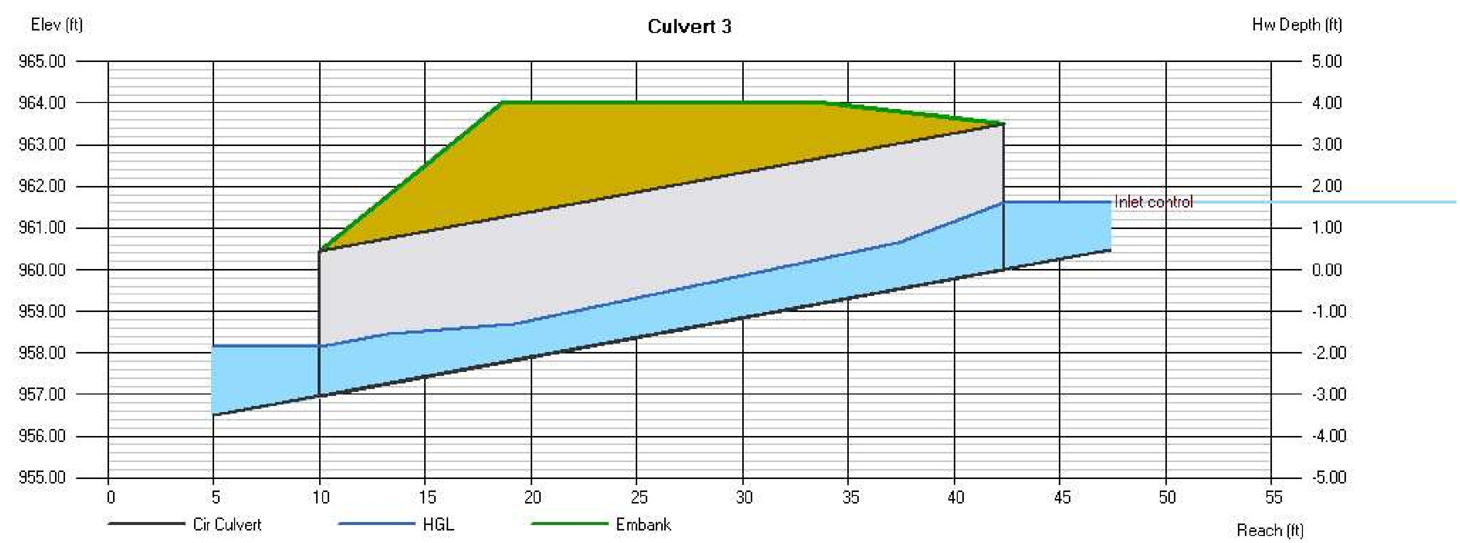
Top Elevation (ft)	= 964.00
Top Width (ft)	= 15.00
Crest Width (ft)	= 1000.00

Calculations

Qmin (cfs)	= 15.00
Qmax (cfs)	= 20.00
Tailwater Elev (ft)	= 0

Highlighted

Qtotal (cfs)	= 15.00
Qpipe (cfs)	= 15.00
Qovertop (cfs)	= 0.00
Veloc Dn (ft/s)	= 5.20
Veloc Up (ft/s)	= 5.20
HGL Dn (ft)	= 958.15
HGL Up (ft)	= 961.19
Hw Elev (ft)	= 961.62
Hw/D (ft)	= 0.46
Flow Regime	= Inlet Control



Q			Veloc		Depth	
Total	Pipe	Over	Dn	Up	Dn	Up
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(in)	(in)
15.00	15.00	0.00	5.20	5.20	14.28	14.28
16.00	16.00	0.00	5.29	5.29	14.78	14.78
17.00	17.00	0.00	5.42	5.42	15.18	15.18
18.00	18.00	0.00	5.49	5.49	15.69	15.69
19.00	19.00	0.00	5.60	5.60	16.09	16.09
20.00	20.00	0.00	5.70	5.70	16.50	16.50

HGL			
Dn	Up	Hw	Hw/D
(ft)	(ft)	(ft)	
958.15	961.19	961.62	0.46
958.19	961.23	961.68	0.48
958.23	961.27	961.74	0.50
958.27	961.31	961.80	0.51
958.30	961.34	961.85	0.53
958.34	961.38	961.91	0.54

Culvert Report

Culvert 4

Invert Elev Dn (ft)	= 963.57
Pipe Length (ft)	= 34.80
Slope (%)	= 6.26
Invert Elev Up (ft)	= 965.75
Rise (in)	= 42.0
Shape	= Cir
Span (in)	= 42.0
No. Barrels	= 1
n-Value	= 0.012
Inlet Edge	= Sq Edge
Coeff. K,M,c,Y,k	= 0.0098, 2, 0.0398, 0.67, 0.5

Embankment

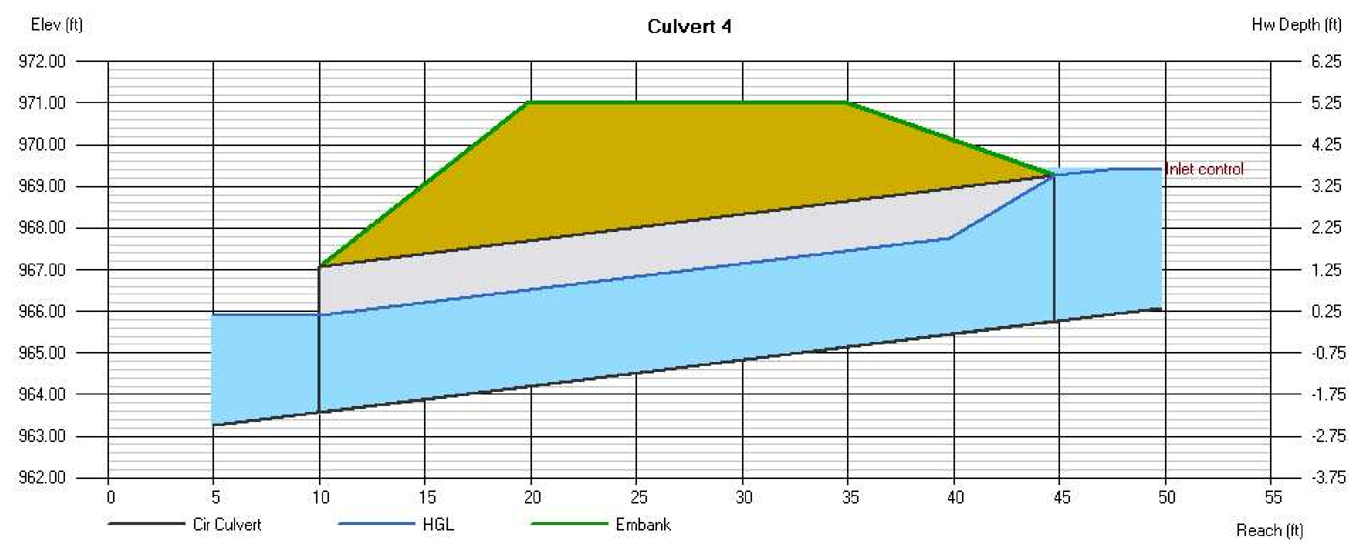
Top Elevation (ft)	= 971.00
Top Width (ft)	= 15.00
Crest Width (ft)	= 1000.00

Calculations

Qmin (cfs)	= 55.00
Qmax (cfs)	= 60.00
Tailwater Elev (ft)	= 0

Highlighted

Qtotal (cfs)	= 55.00
Qpipe (cfs)	= 55.00
Qovertop (cfs)	= 0.00
Veloc Dn (ft/s)	= 8.08
Veloc Up (ft/s)	= 8.08
HGL Dn (ft)	= 965.90
HGL Up (ft)	= 968.08
Hw Elev (ft)	= 969.41
Hw/D (ft)	= 1.05
Flow Regime	= Inlet Control



Q			Veloc		Depth	
Total	Pipe	Over	Dn	Up	Dn	Up
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(in)	(in)
55.00	55.00	0.00	8.08	8.08	27.99	27.99
56.00	56.00	0.00	8.16	8.16	28.19	28.19
57.00	57.00	0.00	8.21	8.21	28.48	28.48
58.00	58.00	0.00	8.26	8.26	28.77	28.77
59.00	59.00	0.00	8.34	8.34	28.97	28.97
60.00	60.00	0.00	8.38	8.38	29.26	29.26

HGL			
Dn	Up	Hw	Hw/D
(ft)	(ft)	(ft)	
965.90	968.08	969.41	1.05
965.92	968.10	969.46	1.06
965.94	968.12	969.51	1.07
965.97	968.15	969.56	1.09
965.98	968.16	969.61	1.10
966.01	968.19	969.66	1.12

Culvert Report

Culvert 5

Invert Elev Dn (ft)	= 965.35
Pipe Length (ft)	= 58.50
Slope (%)	= 10.00
Invert Elev Up (ft)	= 971.20
Rise (in)	= 42.0
Shape	= Cir
Span (in)	= 42.0
No. Barrels	= 1
n-Value	= 0.012
Inlet Edge	= Sq Edge
Coeff. K,M,c,Y,k	= 0.0098, 2, 0.0398, 0.67, 0.5

Embankment

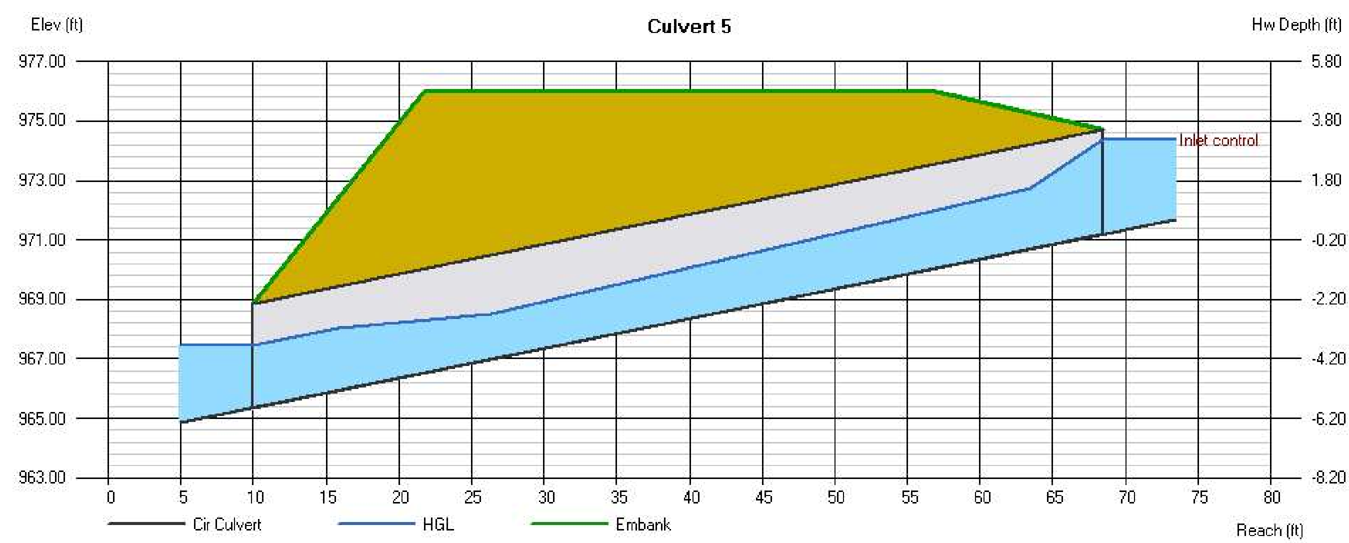
Top Elevation (ft)	= 976.00
Top Width (ft)	= 35.00
Crest Width (ft)	= 1000.00

Calculations

Qmin (cfs)	= 40.00
Qmax (cfs)	= 45.00
Tailwater Elev (ft)	= 0

Highlighted

Qtotal (cfs)	= 45.00
Qpipe (cfs)	= 45.00
Qovertop (cfs)	= 0.00
Veloc Dn (ft/s)	= 7.45
Veloc Up (ft/s)	= 7.45
HGL Dn (ft)	= 967.45
HGL Up (ft)	= 973.30
Hw Elev (ft)	= 974.36
Hw/D (ft)	= 0.90
Flow Regime	= Inlet Control



Q			Veloc		Depth	
Total	Pipe	Over	Dn	Up	Dn	Up
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(in)	(in)
40.00	40.00	0.00	7.15	7.15	23.71	23.71
41.00	41.00	0.00	7.21	7.21	24.02	24.02
42.00	42.00	0.00	7.27	7.27	24.33	24.33
43.00	43.00	0.00	7.33	7.33	24.64	24.64
44.00	44.00	0.00	7.39	7.39	24.95	24.95
45.00	45.00	0.00	7.45	7.45	25.26	25.26

HGL			
Dn	Up	Hw	Hw/D
(ft)	(ft)	(ft)	
967.33	973.18	974.12	0.83
967.35	973.20	974.17	0.85
967.38	973.23	974.22	0.86
967.40	973.25	974.27	0.88
967.43	973.28	974.32	0.89
967.45	973.30	974.36	0.90

Culvert Report

Culvert 6

Invert Elev Dn (ft)	=	971.05
Pipe Length (ft)	=	39.10
Slope (%)	=	9.49
Invert Elev Up (ft)	=	974.76
Rise (in)	=	36.0
Shape	=	Cir
Span (in)	=	36.0
No. Barrels	=	1
n-Value	=	0.012
Inlet Edge	=	Sq Edge
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

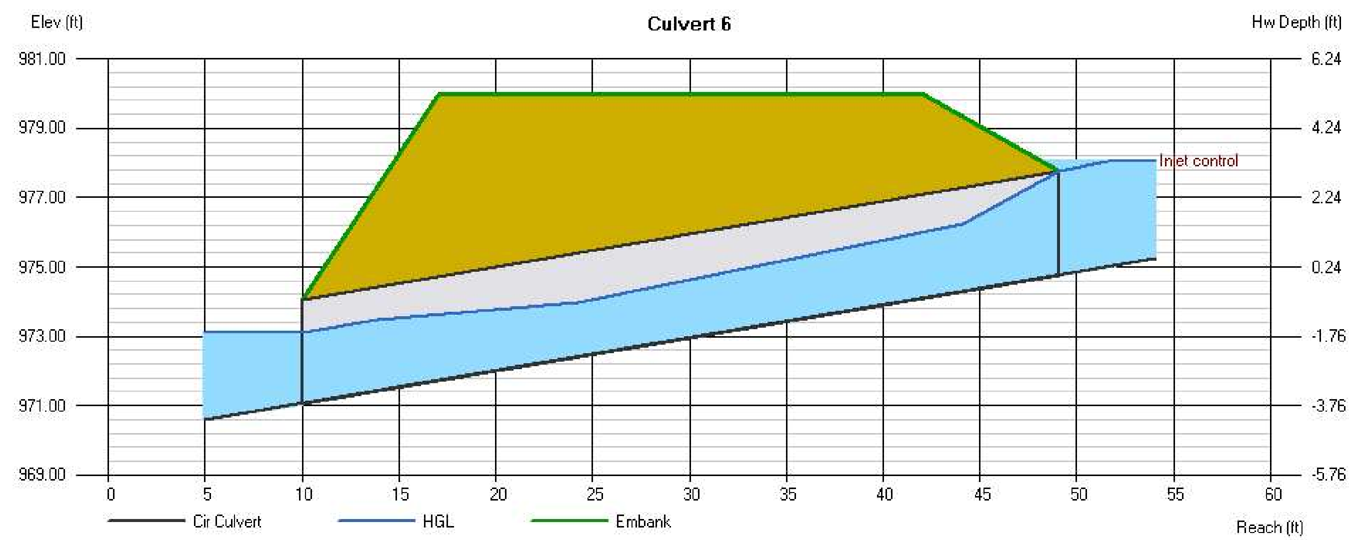
Top Elevation (ft)	=	980.00
Top Width (ft)	=	25.00
Crest Width (ft)	=	1000.00

Calculations

Qmin (cfs)	=	40.00
Qmax (cfs)	=	45.00
Tailwater Elev (ft)	=	0

Highlighted

Qtotal (cfs)	=	40.00
Qpipe (cfs)	=	40.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	7.69
Veloc Up (ft/s)	=	7.69
HGL Dn (ft)	=	973.12
HGL Up (ft)	=	976.83
Hw Elev (ft)	=	978.05
Hw/D (ft)	=	1.10
Flow Regime	=	Inlet Control



Q			Veloc		Depth	
Total	Pipe	Over	Dn	Up	Dn	Up
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(in)	(in)
40.00	40.00	0.00	7.69	7.69	24.83	24.83
41.00	41.00	0.00	7.80	7.80	25.08	25.08
42.00	42.00	0.00	7.88	7.88	25.41	25.41
43.00	43.00	0.00	7.95	7.95	25.74	25.74
44.00	44.00	0.00	8.06	8.06	25.98	25.98
45.00	45.00	0.00	8.13	8.13	26.30	26.30

HGL			
Dn	Up	Hw	Hw/D
(ft)	(ft)	(ft)	
973.12	976.83	978.05	1.10
973.14	976.85	978.11	1.12
973.17	976.88	978.17	1.14
973.19	976.90	978.24	1.16
973.21	976.92	978.30	1.18
973.24	976.95	978.36	1.20

Culvert Report

Culvert 7

Invert Elev Dn (ft)	=	974.27
Pipe Length (ft)	=	46.60
Slope (%)	=	8.00
Invert Elev Up (ft)	=	978.00
Rise (in)	=	36.0
Shape	=	Cir
Span (in)	=	36.0
No. Barrels	=	1
n-Value	=	0.012
Inlet Edge	=	Sq Edge
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

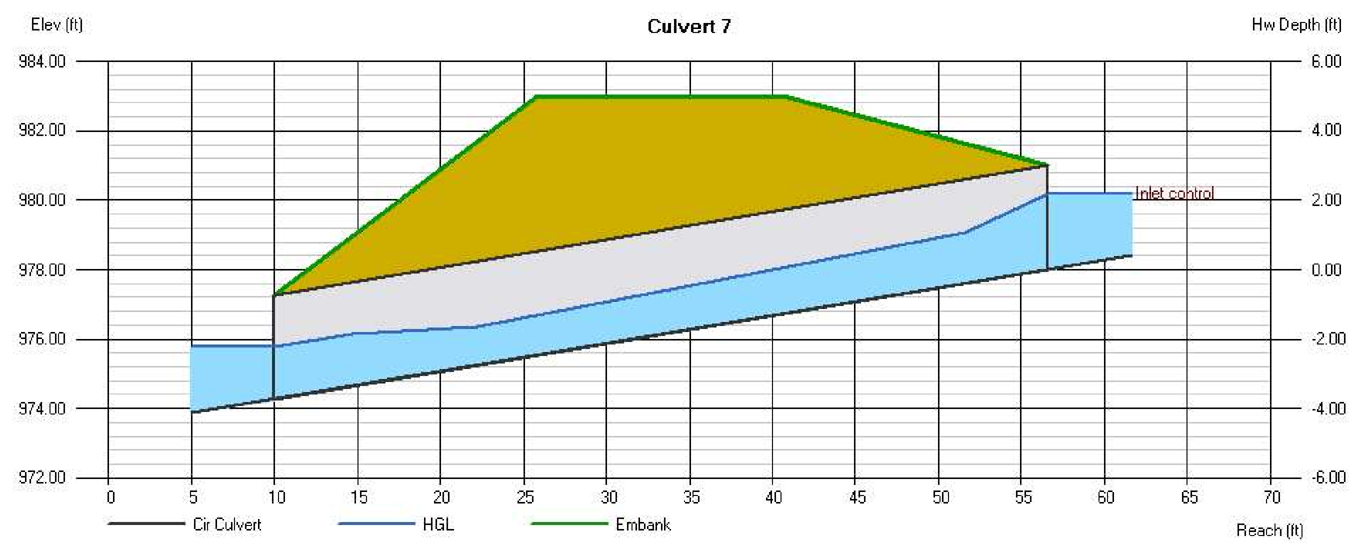
Top Elevation (ft)	=	983.00
Top Width (ft)	=	15.00
Crest Width (ft)	=	1000.00

Calculations

Qmin (cfs)	=	22.00
Qmax (cfs)	=	28.00
Tailwater Elev (ft)	=	0

Highlighted

Qtotal (cfs)	=	22.00
Qpipe (cfs)	=	22.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	6.15
Veloc Up (ft/s)	=	6.15
HGL Dn (ft)	=	975.78
HGL Up (ft)	=	979.51
Hw Elev (ft)	=	980.19
Hw/D (ft)	=	0.73
Flow Regime	=	Inlet Control



Q			Veloc		Depth	
Total	Pipe	Over	Dn	Up	Dn	Up
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(in)	(in)
22.00	22.00	0.00	6.15	6.15	18.17	18.17
23.00	23.00	0.00	6.24	6.24	18.62	18.62
24.00	24.00	0.00	6.32	6.32	19.06	19.06
25.00	25.00	0.00	6.43	6.43	19.42	19.42
26.00	26.00	0.00	6.50	6.50	19.87	19.87
27.00	27.00	0.00	6.60	6.60	20.23	20.23
28.00	28.00	0.00	6.67	6.67	20.68	20.68

HGL			
Dn	Up	Hw	Hw/D
(ft)	(ft)	(ft)	
975.78	979.51	980.19	0.73
975.82	979.55	980.25	0.75
975.86	979.59	980.31	0.77
975.89	979.62	980.37	0.79
975.93	979.66	980.44	0.81
975.96	979.69	980.50	0.83
975.99	979.72	980.56	0.85

Culvert Report

Culvert 8

Invert Elev Dn (ft)	=	977.79
Pipe Length (ft)	=	23.20
Slope (%)	=	9.61
Invert Elev Up (ft)	=	980.02
Rise (in)	=	48.0
Shape	=	Cir
Span (in)	=	48.0
No. Barrels	=	1
n-Value	=	0.012
Inlet Edge	=	1
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

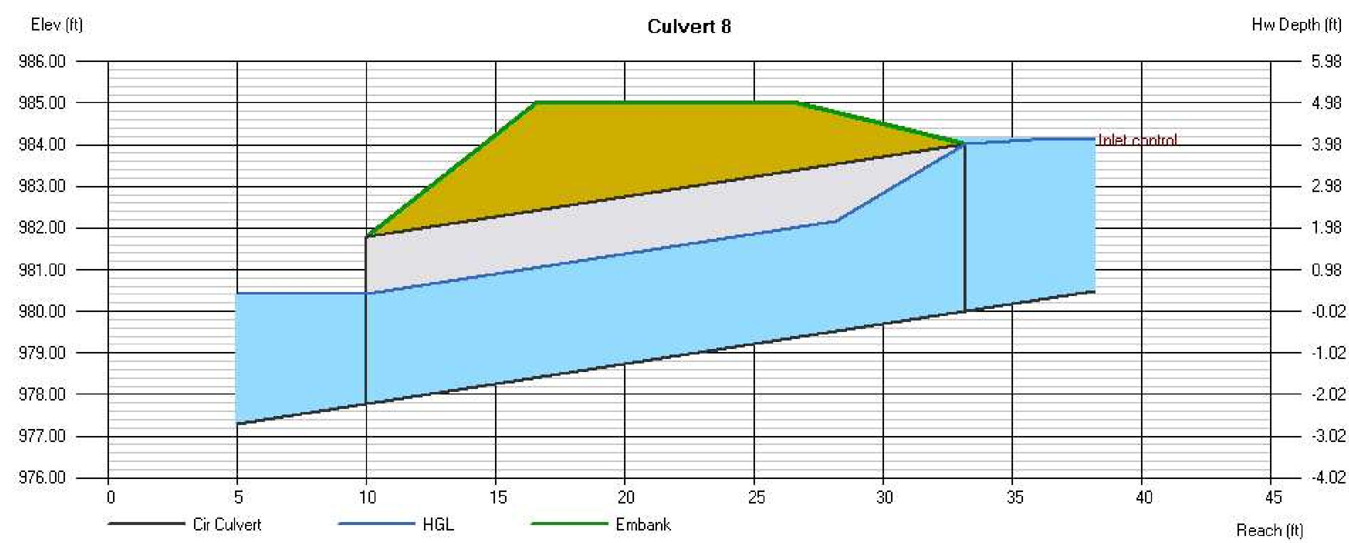
Top Elevation (ft)	=	985.00
Top Width (ft)	=	10.00
Crest Width (ft)	=	1000.00

Calculations

Qmin (cfs)	=	75.00
Qmax (cfs)	=	80.00
Tailwater Elev (ft)	=	0

Highlighted

Qtotal (cfs)	=	75.00
Qpipe (cfs)	=	75.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	8.57
Veloc Up (ft/s)	=	8.57
HGL Dn (ft)	=	980.42
HGL Up (ft)	=	982.65
Hw Elev (ft)	=	984.12
Hw/D (ft)	=	1.02
Flow Regime	=	Inlet Control



Q			Veloc		Depth	
Total	Pipe	Over	Dn	Up	Dn	Up
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(in)	(in)
75.00	75.00	0.00	8.57	8.57	31.53	31.53
76.00	76.00	0.00	8.61	8.61	31.76	31.76
77.00	77.00	0.00	8.66	8.66	31.99	31.99
78.00	78.00	0.00	8.70	8.70	32.21	32.21
79.00	79.00	0.00	8.74	8.74	32.44	32.44
80.00	80.00	0.00	8.79	8.79	32.66	32.66

HGL			
Dn	Up	Hw	Hw/D
(ft)	(ft)	(ft)	
980.42	982.65	984.12	1.02
980.44	982.67	984.16	1.03
980.46	982.69	984.20	1.04
980.47	982.70	984.24	1.06
980.49	982.72	984.28	1.07
980.51	982.74	984.32	1.08

HRG
HERBERT, ROWLAND & GRUBIC, INC.
P.O. BOX 504
CLARKS SUMMIT, PA 18411
570.851.2804 | hrg-inc.com

DRAINAGE AREA EXHIBITS FOR EAST MOUNTAIN STORMWATER & DRAINAGE STUDY

CITY OF SCRANTON
340 N. WASHINGTON AVE
SCRANTON, PA 18503
SCRANTON, LACKAWANNA COUNTY, PENNSYLVANIA

PROFESSIONAL SEAL:

HRG PROJECT NUMBER:	004441.0436
PLAN DATE:	01/05/2024
DRAWING SCALE:	1"=200'
PROJ. MANAGER:	GAW

REVISIONS

NO.	DATE	DESCRIPTION
1		
2		
3		
4		
5		
6		
7		
8		
9		

SHEET TITLE:
SNOOK STREET DRAINAGE AREAS

SHEET: DRN-2 | 2

NOAA Atlas 14, Volume 2, Version 3
Location name: Scranton, Pennsylvania, USA*
Latitude: 41.3965°, Longitude: -75.6342°
Elevation: 1258 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**3.65** (3.29-4.04)	**4.33** (3.90-4.81)	**5.12** (4.61-5.69)	**5.75** (5.17-6.37)	**6.56** (5.87-7.27)	**7.24** (6.43-8.04)	**7.92** (7.00-8.81)	**8.68** (7.62-9.67)	**9.80** (8.50-11.0)	**10.7** (9.18-12.1)
10-min	**2.84** (2.56-3.14)	**3.38** (3.05-3.75)	**3.98** (3.58-4.42)	**4.43** (3.99-4.92)	**5.02** (4.48-5.56)	**5.48** (4.88-6.09)	**5.96** (5.26-6.63)	**6.48** (5.68-7.22)	**7.21** (6.24-8.07)	**7.81** (6.68-8.78)
15-min	**2.32** (2.09-2.57)	**2.76** (2.48-3.06)	**3.26** (2.93-3.62)	**3.64** (3.27-4.04)	**4.13** (3.69-4.58)	**4.52** (4.02-5.02)	**4.94** (4.36-5.49)	**5.37** (4.71-5.98)	**6.00** (5.20-6.71)	**6.50** (5.57-7.32)
30-min	**1.53** (1.38-1.70)	**1.84** (1.66-2.05)	**2.23** (2.01-2.48)	**2.53** (2.27-2.80)	**2.92** (2.61-3.23)	**3.23** (2.88-3.59)	**3.56** (3.15-3.96)	**3.92** (3.44-4.37)	**4.44** (3.85-4.97)	**4.88** (4.17-5.48)
60-min	**0.936** (0.844-1.04)	**1.13** (1.02-1.26)	**1.40** (1.26-1.56)	**1.61** (1.45-1.78)	**1.89** (1.69-2.10)	**2.13** (1.89-2.37)	**2.38** (2.10-2.65)	**2.66** (2.33-2.96)	**3.07** (2.66-3.44)	**3.42** (2.93-3.85)
2-hr	**0.553** (0.502-0.615)	**0.666** (0.605-0.742)	**0.831** (0.750-0.924)	**0.965** (0.870-1.07)	**1.17** (1.05-1.30)	**1.35** (1.20-1.50)	**1.56** (1.37-1.73)	**1.79** (1.56-2.00)	**2.16** (1.86-2.43)	**2.49** (2.12-2.82)
3-hr	**0.407** (0.370-0.451)	**0.489** (0.444-0.542)	**0.607** (0.551-0.672)	**0.706** (0.639-0.782)	**0.858** (0.770-0.948)	**0.994** (0.886-1.10)	**1.15** (1.02-1.28)	**1.33** (1.16-1.48)	**1.62** (1.39-1.82)	**1.88** (1.59-2.12)
6-hr	**0.259** (0.234-0.287)	**0.309** (0.280-0.343)	**0.380** (0.344-0.421)	**0.442** (0.399-0.488)	**0.536** (0.479-0.593)	**0.622** (0.552-0.688)	**0.720** (0.632-0.797)	**0.835** (0.725-0.928)	**1.02** (0.869-1.14)	**1.19** (0.996-1.33)
12-hr	**0.156** (0.141-0.175)	**0.187** (0.169-0.209)	**0.231** (0.208-0.258)	**0.269** (0.242-0.300)	**0.330** (0.293-0.366)	**0.384** (0.339-0.427)	**0.448** (0.390-0.498)	**0.522** (0.449-0.582)	**0.641** (0.541-0.719)	**0.750** (0.624-0.845)
24-hr	**0.091** (0.083-0.101)	**0.110** (0.100-0.122)	**0.136** (0.124-0.151)	**0.159** (0.145-0.176)	**0.197** (0.178-0.216)	**0.232** (0.207-0.253)	**0.273** (0.242-0.297)	**0.322** (0.283-0.349)	**0.403** (0.348-0.434)	**0.477** (0.408-0.512)
2-day	**0.054** (0.049-0.059)	**0.064** (0.059-0.071)	**0.080** (0.073-0.088)	**0.093** (0.085-0.102)	**0.115** (0.104-0.126)	**0.136** (0.122-0.147)	**0.160** (0.142-0.173)	**0.189** (0.166-0.203)	**0.236** (0.204-0.253)	**0.279** (0.239-0.299)
3-day	**0.038** (0.035-0.042)	**0.045** (0.042-0.050)	**0.056** (0.051-0.061)	**0.065** (0.060-0.071)	**0.080** (0.073-0.087)	**0.094** (0.085-0.102)	**0.110** (0.099-0.119)	**0.130** (0.115-0.140)	**0.161** (0.141-0.173)	**0.191** (0.164-0.204)
4-day	**0.030** (0.027-0.033)	**0.036** (0.033-0.039)	**0.044** (0.040-0.048)	**0.051** (0.047-0.056)	**0.063** (0.057-0.068)	**0.073** (0.066-0.079)	**0.086** (0.077-0.092)	**0.100** (0.089-0.108)	**0.124** (0.109-0.133)	**0.147** (0.127-0.157)
7-day	**0.020** (0.018-0.022)	**0.024** (0.022-0.026)	**0.029** (0.027-0.032)	**0.034** (0.031-0.037)	**0.041** (0.037-0.045)	**0.048** (0.043-0.052)	**0.055** (0.050-0.060)	**0.065** (0.058-0.070)	**0.079** (0.070-0.085)	**0.093** (0.081-0.099)
10-day	**0.016** (0.015-0.018)	**0.019** (0.018-0.021)	**0.023** (0.021-0.025)	**0.027** (0.025-0.029)	**0.032** (0.029-0.035)	**0.037** (0.034-0.040)	**0.042** (0.038-0.046)	**0.049** (0.044-0.052)	**0.059** (0.052-0.063)	**0.068** (0.060-0.073)
20-day	**0.011** (0.010-0.012)	**0.013** (0.012-0.014)	**0.015** (0.014-0.016)	**0.017** (0.016-0.018)	**0.020** (0.018-0.022)	**0.023** (0.021-0.024)	**0.026** (0.023-0.027)	**0.029** (0.026-0.031)	**0.034** (0.031-0.036)	**0.038** (0.034-0.041)
30-day	**0.009** (0.008-0.010)	**0.011** (0.010-0.011)	**0.012** (0.011-0.013)	**0.014** (0.013-0.015)	**0.016** (0.015-0.017)	**0.018** (0.016-0.019)	**0.020** (0.018-0.021)	**0.022** (0.020-0.023)	**0.025** (0.023-0.027)	**0.028** (0.026-0.030)
45-day	**0.008** (0.007-0.008)	**0.009** (0.008-0.009)	**0.010** (0.010-0.011)	**0.011** (0.010-0.012)	**0.013** (0.012-0.013)	**0.014** (0.013-0.015)	**0.015** (0.014-0.016)	**0.017** (0.016-0.018)	**0.019** (0.018-0.020)	**0.021** (0.019-0.022)
60-day	**0.007** (0.006-0.007)	**0.008** (0.008-0.008)	**0.009** (0.009-0.010)	**0.010** (0.009-0.011)	**0.011** (0.011-0.012)	**0.012** (0.012-0.013)	**0.013** (0.013-0.014)	**0.015** (0.014-0.016)	**0.017** (0.015-0.018)	**0.018** (0.017-0.019)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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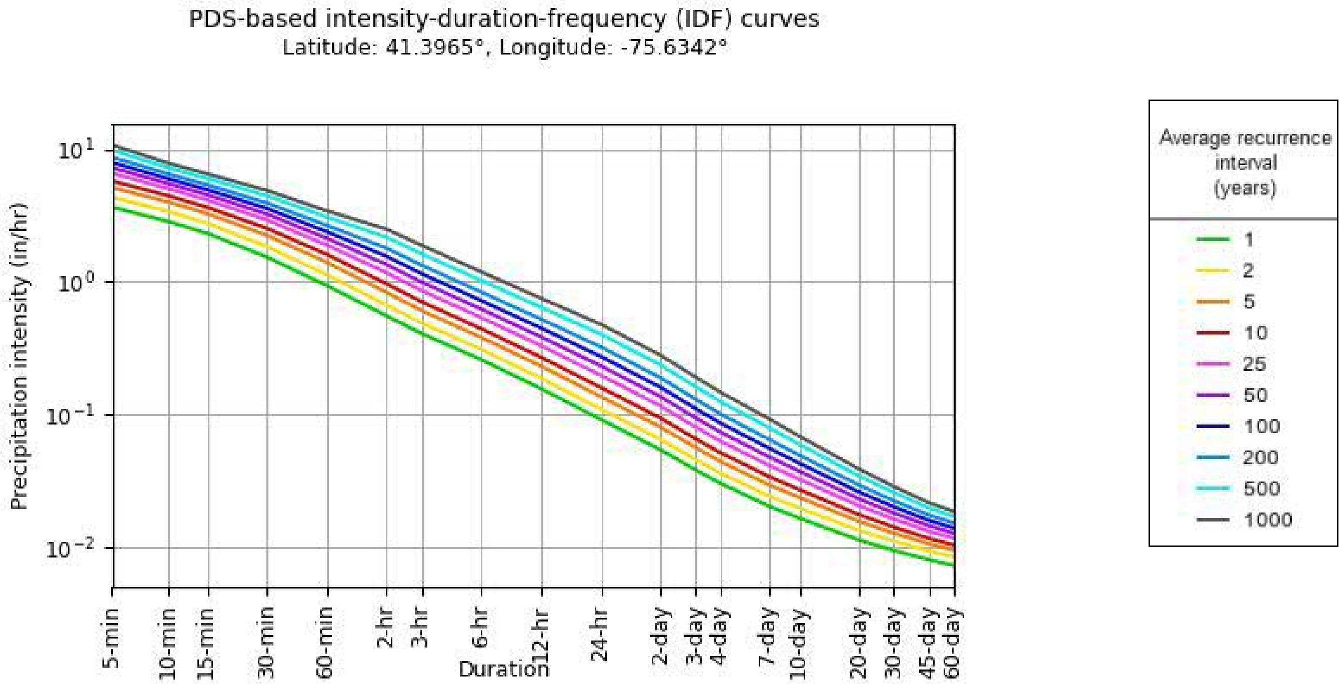
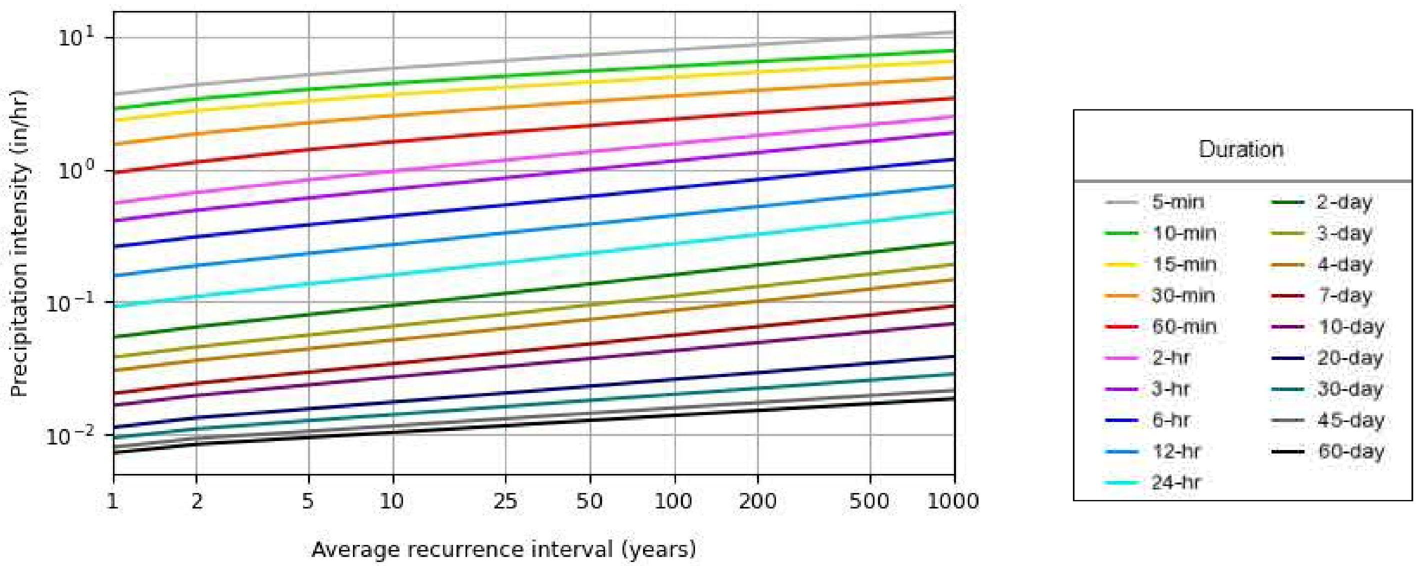
PF graphical





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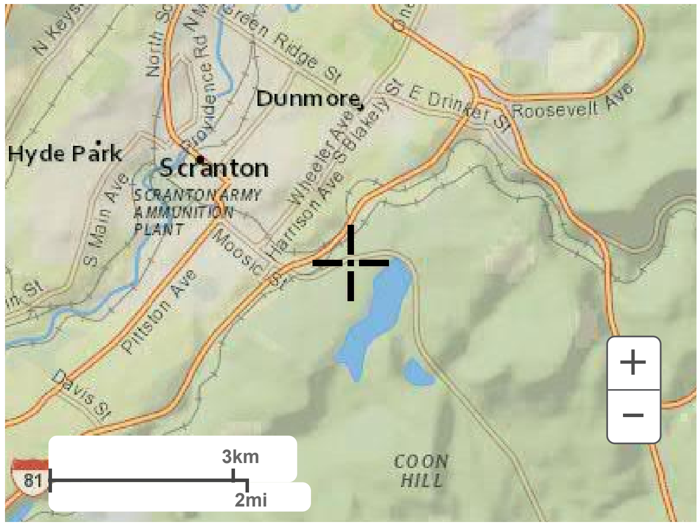
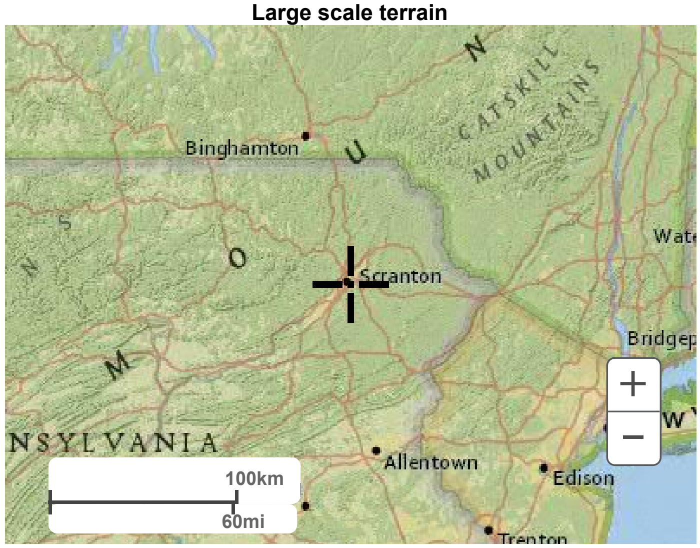
Maps & aerials

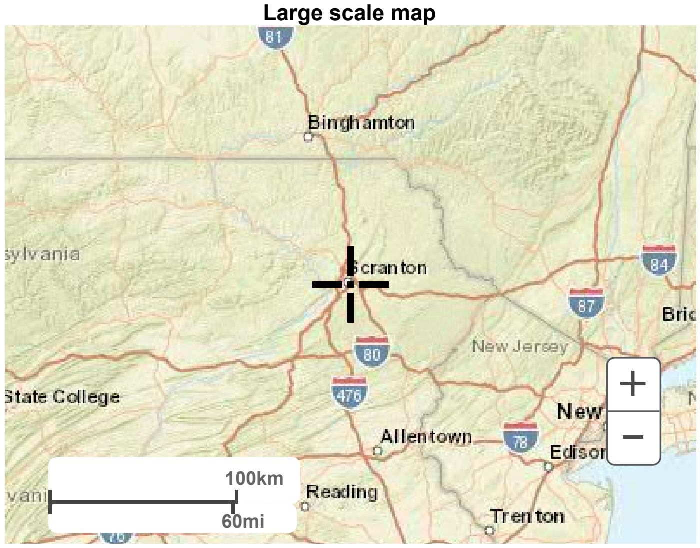
Small scale terrain



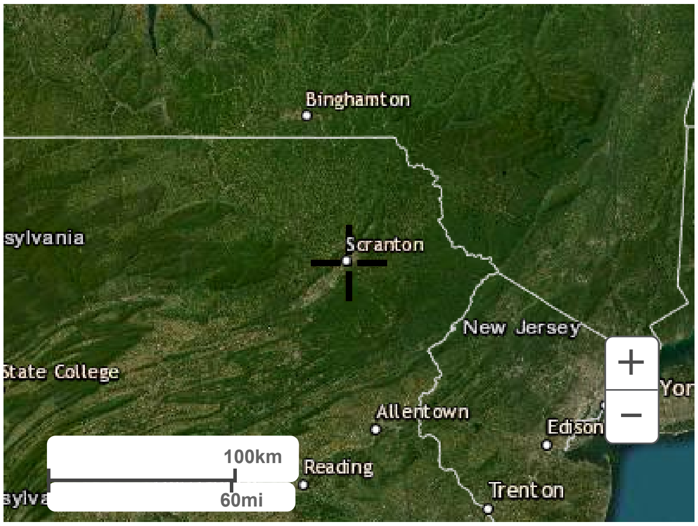
Large scale terrain



Large scale map



Large scale aerial



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1325 East West Highway
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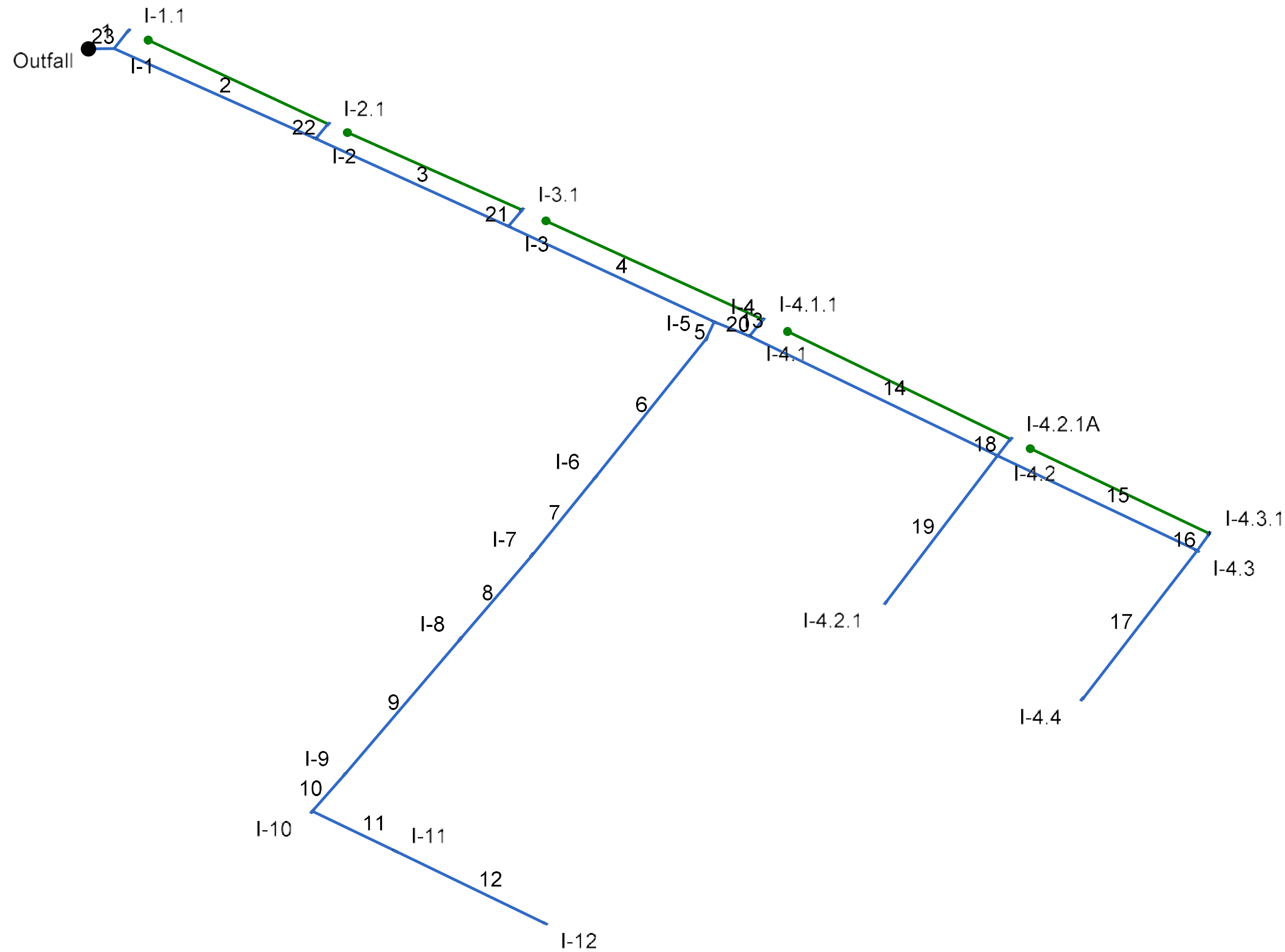
Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Project File: L004410436STORM-SNOOK STREET.stm	Number of lines: 23	Date: 1/9/2024

Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr Line No.	Line Length (ft)	Defl angle (deg)	Junc Type	Known Q (cfs)	Drng Area (ac)	Runoff Coeff (C)	Inlet Time (min)	Invert El Dn (ft)	Line Slope (%)	Invert El Up (ft)	Line Size (in)	Line Shape	N Value (n)	J-Loss Coeff (K)	Inlet/ Rim El (ft)	
1	End	16.538	-0.862	Comb	0.00	0.24	0.46	5.0	1226.89	0.97	1227.05	24	Cir	0.012	1.31	1231.63	PIPE-14
2	1	152.304	31.498	Comb	0.00	0.78	0.28	5.0	1227.55	9.05	1241.33	24	Cir	0.012	1.50	1245.51	I-2 TO I-1
3	2	145.954	0.532	Comb	0.00	0.26	0.49	5.0	1241.33	7.80	1252.71	24	Cir	0.012	1.50	1258.54	I-3 TO I-2
4	3	157.035	0.491	Comb	0.00	0.04	0.53	5.0	1254.05	13.76	1275.66	24	Cir	0.012	1.59	1279.76	I-4 TO I-3
5	4	15.592	78.109	Comb	0.00	0.23	0.57	5.0	1275.76	3.01	1276.23	24	Cir	0.012	0.50	1280.42	I-5 TO I-4
6	5	139.220	11.285	Comb	0.00	0.07	0.71	5.0	1276.23	9.00	1288.76	24	Cir	0.012	0.50	1293.32	I-6 TO I-5
7	6	78.541	0.353	Comb	0.00	0.19	0.27	5.0	1288.86	6.51	1293.97	24	Cir	0.012	0.50	1298.88	I-7 TO I-6
8	7	86.449	1.371	Comb	0.00	0.38	0.46	5.0	1294.07	0.99	1294.93	24	Cir	0.012	0.50	1300.73	I-8 TO I-7
9	8	138.334	0.000	Comb	0.00	1.16	0.46	5.0	1295.03	1.00	1296.41	24	Cir	0.012	0.50	1301.13	I-9 TO I-8
10	9	38.462	0.517	Comb	0.00	0.03	0.95	5.0	1296.51	1.01	1296.90	24	Cir	0.012	1.50	1301.16	I-10 TO I-9
11	10	63.667	-90.611	Comb	0.00	0.19	0.60	5.0	1296.99	1.99	1298.26	24	Cir	0.012	0.50	1303.71	I-11 TO I-10
12	11	115.411	0.000	Comb	0.00	0.46	0.35	5.0	1298.36	8.50	1308.17	24	Cir	0.012	1.00	1313.15	I-12 TO I-11
13	4	25.976	-2.844	Comb	0.00	1.28	0.36	5.0	1275.76	4.43	1276.91	24	Cir	0.012	1.50	1281.40	I-4.1 TO I-4
14	13	190.886	3.814	Comb	0.00	1.48	0.28	5.0	1277.01	3.00	1282.74	24	Cir	0.012	2.25	1287.32	I-4.2 TO I-4.1
15	14	153.258	-0.301	Comb	0.00	1.01	0.44	5.0	1282.84	2.50	1286.67	24	Cir	0.012	2.25	1291.11	I-4.3 TO I-4.2
16	15	16.789	-93.570	Comb	0.00	0.28	0.52	5.0	1286.77	1.01	1286.94	18	Cir	0.012	1.00	1290.76	I-4.3.1 TO I-4.3
17	15	147.930	87.791	DrGrt	0.00	3.36	0.23	5.0	1286.77	3.00	1291.21	18	Cir	0.012	1.00	1296.98	I-4.4 TO I-4.3
18	14	16.504	-91.902	Comb	0.00	0.12	0.58	5.0	1282.84	2.00	1283.17	18	Cir	0.012	1.00	1287.54	I-4.2.1A
19	14	146.274	87.101	DrGrt	0.00	0.96	0.42	5.0	1282.84	8.30	1294.98	18	Cir	0.012	1.00	1299.18	I-4.2.1 to I-4.2
20	13	16.809	-87.764	Comb	0.00	0.09	0.63	5.0	1277.01	1.01	1277.18	18	Cir	0.012	1.00	1281.00	I-4.1.1 TO I-4.1
21	3	16.576	-89.116	Comb	0.00	0.06	0.76	6.0	1254.00	1.03	1254.17	18	Cir	0.012	1.00	1258.60	I-3.1 TO I-3
22	2	14.805	-89.088	Comb	0.00	0.68	0.50	5.0	1241.43	1.01	1241.58	18	Cir	0.012	1.00	1245.97	I-2.1 TO I-2
23	1	18.010	-58.163	Comb	0.00	0.31	0.40	5.0	1227.55	0.94	1227.72	18	Cir	0.012	1.00	1230.47	I-1.1 TO I-1

Project File: L004410436STORM-SNOOK STREET.stm	Number of lines: 23	Date: 1/9/2024

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
1	PIPE-14	18.91	24	Cir	16.538	1226.89	1227.05	0.968	1228.73	1228.61	n/a	1228.61	End	Combination
2	I-2 TO I-1	18.19	24	Cir	152.304	1227.55	1241.33	9.048	1228.61	1242.87	n/a	1242.87	1	Combination
3	I-3 TO I-2	16.22	24	Cir	145.954	1241.33	1252.71	7.797	1242.87	1254.16	n/a	1254.16 j	2	Combination
4	I-4 TO I-3	15.72	24	Cir	157.035	1254.05	1275.66	13.761	1254.61	1277.09	1.06	1277.09	3	Combination
5	I-5 TO I-4	4.87	24	Cir	15.592	1275.76	1276.23	3.014	1277.09	1277.01	n/a	1277.01 j	4	Combination
6	I-6 TO I-5	4.51	24	Cir	139.220	1276.23	1288.76	9.000	1277.01	1289.51	n/a	1289.51 j	5	Combination
7	I-7 TO I-6	4.40	24	Cir	78.541	1288.86	1293.97	6.506	1289.51	1294.71	n/a	1294.71	6	Combination
8	I-8 TO I-7	4.29	24	Cir	86.449	1294.07	1294.93	0.995	1294.71	1295.66	n/a	1295.66	7	Combination
9	I-9 TO I-8	3.72	24	Cir	138.334	1295.03	1296.41	0.998	1295.66	1297.09	n/a	1297.09	8	Combination
10	I-10 TO I-9	1.40	24	Cir	38.462	1296.51	1296.90	1.014	1297.09	1297.31	n/a	1297.31 j	9	Combination
11	I-11 TO I-10	1.37	24	Cir	63.667	1296.99	1298.26	1.995	1297.31	1298.66	0.07	1298.66	10	Combination
12	I-12 TO I-11	1.06	24	Cir	115.411	1298.36	1308.17	8.500	1298.66	1308.52	n/a	1308.52	11	Combination
13	I-4.1 TO I-4	15.84	24	Cir	25.976	1275.76	1276.91	4.427	1277.09	1278.34	1.01	1278.34	4	Combination
14	I-4.2 TO I-4.1	13.36	24	Cir	190.886	1277.01	1282.74	3.002	1278.34	1284.06	n/a	1284.06 j	13	Combination
15	I-4.3 TO I-4.2	8.51	24	Cir	153.258	1282.84	1286.67	2.499	1284.06	1287.71	n/a	1287.71 j	14	Combination
16	I-4.3.1 TO I-4.3	0.95	18	Cir	16.789	1286.77	1286.94	1.012	1287.71	1287.30	n/a	1287.30	15	Combination
17	I-4.4 TO I-4.3	5.06	18	Cir	147.930	1286.77	1291.21	3.001	1287.71	1292.08	n/a	1292.08 j	15	DropGrate
18	I-4.2.1A	0.46	18	Cir	16.504	1282.84	1283.17	2.000	1284.06	1283.42	n/a	1283.42	14	Combination
19	I-4.2.1 to I-4.2	2.64	18	Cir	146.274	1282.84	1294.98	8.299	1284.06	1295.60	n/a	1295.60 j	14	DropGrate
20	I-4.1.1 TO I-4.1	0.37	18	Cir	16.809	1277.01	1277.18	1.012	1278.34	1277.41	0.08	1277.41	13	Combination
21	I-3.1 TO I-3	0.28	18	Cir	16.576	1254.00	1254.17	1.026	1254.16	1254.37	0.07	1254.37	3	Combination
22	I-2.1 TO I-2	2.23	18	Cir	14.805	1241.43	1241.58	1.013	1242.87	1242.14	n/a	1242.14	2	Combination
23	I-1.1 TO I-1	0.81	18	Cir	18.010	1227.55	1227.72	0.943	1228.61	1228.06	0.12	1228.06	1	Combination

Project File: L004410436STORM-SNOOK STREET.stm | Number of lines: 23 | Run Date: 1/9/2024

NOTES: Return period = 25 Yrs. ; j - Line contains hyd. jump.

Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q Byp (cfs)	Junc Type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp Line No
							Ht (in)	L (ft)	Area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
1	I-1	0.72	0.00	0.61	0.12	Comb	3.5	4.00	0.00	4.00	2.00	0.040	2.00	0.020	0.020	0.013	0.09	4.56	0.05	2.29	0.0	Off
2	I-2	1.43	0.38	1.31	0.51	Comb	3.5	4.00	0.00	4.00	2.00	0.069	2.00	0.020	0.020	0.013	0.12	5.81	0.07	3.61	0.0	Off
3	I-3	0.83	0.69	1.14	0.38	Comb	3.5	4.00	0.00	4.00	2.00	0.069	2.00	0.020	0.020	0.013	0.11	5.45	0.06	3.25	0.0	2
4	I-4	0.14	2.11	1.55	0.69	Comb	3.5	4.00	0.00	4.00	2.00	0.079	2.00	0.020	0.020	0.013	0.12	6.14	0.08	3.95	0.0	3
5	I-5	0.86	0.00	0.84	0.02	Comb	3.5	4.00	0.00	4.00	2.00	0.047	2.00	0.048	0.048	0.013	0.13	2.73	0.03	0.63	0.0	4
6	I-6	0.33	0.04	0.37	0.00	Comb	3.5	4.00	0.00	4.00	2.00	0.089	2.00	0.048	0.048	0.013	0.08	1.76	0.00	0.00	0.0	5
7	I-7	0.34	0.82	1.11	0.04	Comb	3.5	4.00	0.00	4.00	2.00	0.052	2.00	0.048	0.048	0.013	0.14	2.99	0.04	0.87	0.0	6
8	I-8	1.15	1.25	1.57	0.82	Comb	3.5	4.00	0.00	4.00	2.00	0.044	2.00	0.020	0.020	0.013	0.14	7.01	0.09	4.70	0.0	7
9	I-9	3.50	0.03	2.28	1.25	Comb	3.5	4.00	0.00	4.00	2.00	0.004	2.00	0.020	0.020	0.013	0.25	12.71	0.17	8.61	0.0	8
10	I-10	0.19	0.17	0.32	0.03	Comb	3.5	4.00	0.00	4.00	2.00	0.021	2.00	0.020	0.020	0.013	0.08	3.94	0.03	1.58	0.0	9
11	I-11	0.75	0.19	0.77	0.17	Comb	3.5	4.00	0.00	4.00	2.00	0.061	2.00	0.020	0.020	0.013	0.09	4.64	0.05	2.44	0.0	10
12	I-12	1.06	0.00	0.86	0.19	Comb	3.5	4.00	0.00	4.00	2.00	0.085	2.00	0.020	0.020	0.013	0.09	4.56	0.05	2.40	0.0	11
13	I-4.1	3.02	1.65	2.58	2.09	Comb	3.5	4.00	0.00	4.00	2.00	0.046	2.00	0.020	0.020	0.013	0.18	8.93	0.13	6.61	0.0	4
14	I-4.2	2.72	1.12	2.19	1.65	Comb	3.5	4.00	0.00	4.00	2.00	0.023	2.00	0.020	0.020	0.013	0.19	9.45	0.14	6.88	0.0	13
15	I-4.3	2.91	0.00	1.79	1.12	Comb	3.5	4.00	0.00	4.00	2.00	0.028	2.00	0.020	0.020	0.013	0.16	8.21	0.11	5.75	0.0	14
16	I-4.3.1	0.95	0.00	0.76	0.19	Comb	3.5	4.00	0.00	4.00	2.00	0.039	2.00	0.020	0.020	0.013	0.10	5.08	0.06	2.78	0.0	18
17	I-4.4	5.06	0.00	5.06	0.00	DrGrt	0.0	0.00	8.00	4.00	2.00	Sag	2.00	0.020	0.020	0.000	0.27	29.03	0.27	29.03	0.0	Off
18	I-4.2.1A	0.46	0.19	0.56	0.08	Comb	3.5	4.00	0.00	4.00	2.00	0.058	2.00	0.020	0.020	0.013	0.08	4.08	0.04	1.90	0.0	20
19	I-4.2.1	2.64	0.00	2.64	0.00	DrGrt	0.0	0.00	8.00	4.00	2.00	Sag	2.00	0.020	0.020	0.000	0.18	19.52	0.18	19.52	0.0	Off
20	I-4.1.1	0.37	0.08	0.42	0.04	Comb	3.5	4.00	0.00	4.00	2.00	0.053	2.00	0.020	0.020	0.013	0.07	3.64	0.03	1.45	0.0	21
21	I-3.1	0.28	0.04	0.32	0.01	Comb	3.5	4.00	0.00	4.00	2.00	0.139	2.00	0.020	0.020	0.013	0.05	2.67	0.01	0.57	0.0	22
22	I-2.1	2.23	0.01	1.55	0.69	Comb	3.5	4.00	0.00	4.00	2.00	0.078	2.00	0.020	0.020	0.013	0.12	6.14	0.08	3.95	0.0	23
23	I-1.1	0.81	0.69	1.17	0.33	Comb	3.5	4.00	0.00	4.00	2.00	0.118	2.00	0.020	0.020	0.013	0.10	4.89	0.06	2.77	0.0	Off

Project File: L004410436STORM-SNOOK STREET.stm	Number of lines: 23	Run Date: 1/9/2024

NOTES: Inlet N-Values = 0.016; Intensity = 43.32 / (Inlet time + 7.70) ^ 0.74; Return period = 25 Yrs. ; * Indicates Known Q added. All curb inlets are throat.

Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
	(in)	(cfs)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	(ft)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)	(K)	(ft)
1	24	18.91	1226.89	1228.73	1.84	2.63	6.25	0.80	1229.53	0.000	16.538	1227.05	1228.61	1.56**	2.63	7.18	0.80	1229.41	0.000	0.000	n/a	1.31	n/a
2	24	18.19	1227.55	1228.61	1.06	1.70	10.72	0.77	1229.38	0.000	152.304	1241.33	1242.87	1.53**	2.59	7.03	0.77	1243.63	0.000	0.000	n/a	1.50	n/a
3	24	16.22	1241.33	1242.87	1.53	2.44	6.27	0.69	1243.55	0.000	145.954	1252.71	1254.16 j	1.45**	2.44	6.65	0.69	1254.85	0.000	0.000	n/a	1.50	1.03
4	24	15.72	1254.05	1254.61	0.56*	0.73	21.65	0.67	1255.28	0.000	157.035	1275.66	1277.09	1.43**	2.40	6.55	0.67	1277.76	0.000	0.000	n/a	1.59	1.06
5	24	4.87	1275.76	1277.09	1.33	1.13	2.20	0.29	1277.38	0.000	15.592	1276.23	1277.01 j	0.78**	1.13	4.32	0.29	1277.30	0.000	0.000	n/a	0.50	0.15
6	24	4.51	1276.23	1277.01	0.78	1.07	4.00	0.28	1277.28	0.000	139.220	1288.76	1289.51 j	0.75**	1.07	4.22	0.28	1289.78	0.000	0.000	n/a	0.50	n/a
7	24	4.40	1288.86	1289.51	0.65	0.88	5.01	0.27	1289.78	0.000	78.541	1293.97	1294.71	0.74**	1.05	4.19	0.27	1294.98	0.000	0.000	n/a	0.50	n/a
8	24	4.29	1294.07	1294.71	0.64	0.86	4.99	0.27	1294.98	0.000	86.449	1294.93	1295.66	0.73**	1.03	4.16	0.27	1295.93	0.000	0.000	n/a	0.50	n/a
9	24	3.72	1295.03	1295.66	0.63	0.84	4.42	0.25	1295.90	0.000	138.334	1296.41	1297.09	0.68**	0.93	3.99	0.25	1297.33	0.000	0.000	n/a	0.50	n/a
10	24	1.40	1296.51	1297.09	0.58	0.46	1.87	0.14	1297.23	0.000	38.462	1296.90	1297.31 j	0.41**	0.46	3.04	0.14	1297.45	0.000	0.000	n/a	1.50	n/a
11	24	1.37	1296.99	1297.31	0.32	0.32	4.24	0.14	1297.45	0.000	63.667	1298.26	1298.66	0.40**	0.45	3.02	0.14	1298.81	0.000	0.000	n/a	0.50	0.07
12	24	1.06	1298.36	1298.66	0.30	0.30	3.51	0.12	1298.79	0.000	115.411	1308.17	1308.52	0.35**	0.37	2.82	0.12	1308.65	0.000	0.000	n/a	1.00	n/a
13	24	15.84	1275.76	1277.09	1.33	2.22	7.15	0.67	1277.76	0.000	25.976	1276.91	1278.34	1.43**	2.41	6.57	0.67	1279.02	0.000	0.000	n/a	1.50	1.01
14	24	13.36	1277.01	1278.34	1.33	2.19	6.01	0.58	1278.92	0.000	190.886	1282.74	1284.06 j	1.31**	2.19	6.10	0.58	1284.63	0.000	0.000	n/a	2.25	n/a
15	24	8.51	1282.84	1284.06	1.21	1.65	4.26	0.41	1284.47	0.000	153.258	1286.67	1287.71 j	1.04**	1.65	5.16	0.41	1288.12	0.000	0.000	n/a	2.25	0.93
16	18	0.95	1286.77	1287.71	0.94	0.33	0.82	0.13	1287.84	0.000	16.789	1286.94	1287.30	0.36**	0.33	2.88	0.13	1287.43	0.000	0.000	n/a	1.00	n/a
17	18	5.06	1286.77	1287.71	0.94	1.06	4.35	0.36	1288.07	0.000	147.930	1291.21	1292.08 j	0.87**	1.06	4.80	0.36	1292.43	0.000	0.000	n/a	1.00	0.36
18	18	0.46	1282.84	1284.06	1.21	0.19	0.30	0.09	1284.14	0.000	16.504	1283.17	1283.42	0.25**	0.19	2.36	0.09	1283.51	0.000	0.000	n/a	1.00	n/a
19	18	2.64	1282.84	1284.06	1.21	0.68	1.72	0.23	1284.29	0.000	146.274	1294.98	1295.60 j	0.62**	0.68	3.87	0.23	1295.83	0.000	0.000	n/a	1.00	n/a
20	18	0.37	1277.01	1278.34	1.33	0.17	0.22	0.08	1278.42	0.000	16.809	1277.18	1277.41	0.23**	0.17	2.23	0.08	1277.48	0.000	0.000	n/a	1.00	0.08
21	18	0.28	1254.00	1254.16	0.16*	0.10	2.74	0.07	1254.23	0.000	16.576	1254.17	1254.37	0.20**	0.14	2.08	0.07	1254.43	0.000	0.000	n/a	1.00	0.07
22	18	2.23	1241.43	1242.87	1.43	0.61	1.28	0.21	1243.07	0.000	14.805	1241.58	1242.14	0.56**	0.61	3.67	0.21	1242.35	0.000	0.000	n/a	1.00	n/a

Project File: L004410436STORM-SNOOK STREET.stm | Number of lines: 23 | Run Date: 1/9/2024

Notes: * depth assumed; ** Critical depth.; j-Line contains hyd. jump ; c = cir e = ellip b = box

Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
	(in)	(cfs)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	(ft)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)	(K)	(ft)
23	18	0.81	1227.55	1228.61	1.06	0.29	0.61	0.12	1228.73	0.000	18.010	1227.72	1228.06	0.34**	0.29	2.76	0.12	1228.17	0.000	0.000	n/a	1.00	0.12

Project File: L004410436STORM-SNOOK STREET.stm	Number of lines: 23	Run Date: 1/9/2024

Notes: * depth assumed; ** Critical depth.; j-Line contains hyd. jump ; c = cir e = ellip b = box

APPENDIX E

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES)
STORMWATER DISCHARGES FROM
SMALL MUNICIPAL SEPARATE STORM SEWER SYSTEMS
BMP EFFECTIVENESS VALUES

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF CLEAN WATER

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) STORMWATER DISCHARGES FROM SMALL MUNICIPAL SEPARATE STORM SEWER SYSTEMS BMP EFFECTIVENESS VALUES

This table of BMP effectiveness values (i.e., pollutant removal efficiencies) is intended for use by MS4s that are developing and implementing Pollutant Reduction Plans and TMDL Plans to comply with NPDES permit requirements. The values used in this table generally consider pollutant reductions from both overland flow and reduced downstream erosion, and are based primarily on average values within the Chesapeake Assessment Scenario Tool (CAST) (www.casttool.org). Design considerations, operation and maintenance, and construction sequences should be as outlined in the Pennsylvania Stormwater BMP Manual, Chesapeake Bay Program guidance, or other technical sources. The Department of Environmental Protection (DEP) will update the information contained in this table as new information becomes available. Interested parties may submit information to DEP for consideration in updating this table to DEP's MS4 resource account, RA-EPPAMS4@pa.gov. Where an MS4 proposes a BMP not identified in this document or in Chesapeake Bay Program expert panel reports, other technical resources may be consulted for BMP effectiveness values. Note – TN = Total Nitrogen and TP = Total Phosphorus.

BMP Name	BMP Effectiveness Values			BMP Description
	TN	TP	Sediment	
Wet Ponds and Wetlands	20%	45%	60%	A water impoundment structure that intercepts stormwater runoff then releases it to an open water system at a specified flow rate. These structures retain a permanent pool and usually have retention times sufficient to allow settlement of some portion of the intercepted sediments and attached nutrients/toxics. Until recently, these practices were designed specifically to meet water quantity, not water quality objectives. There is little or no vegetation living within the pooled area nor are outfalls directed through vegetated areas prior to open water release. Nitrogen reduction is minimal.
Dry Detention Basins and Hydrodynamic Structures	5%	10%	10%	Dry Detention Ponds are depressions or basins created by excavation or berm construction that temporarily store runoff and release it slowly via surface flow or groundwater infiltration following storms. Hydrodynamic Structures are devices designed to improve quality of stormwater using features such as swirl concentrators, grit chambers, oil barriers, baffles, micropools, and absorbent pads that are designed to remove sediments, nutrients, metals, organic chemicals, or oil and grease from urban runoff.
Dry Extended Detention Basins	20%	20%	60%	Dry extended detention (ED) basins are depressions created by excavation or berm construction that temporarily store runoff and release it slowly via surface flow or groundwater infiltration following storms. Dry ED basins are designed to dry out between storm events, in contrast with wet ponds, which contain standing water permanently. As such, they are similar in construction and function to dry detention basins, except that the duration of detention of stormwater is designed to be longer, theoretically improving treatment effectiveness.

BMP Name	BMP Effectiveness Values			BMP Description
	TN	TP	Sediment	
Infiltration Practices w/ Sand, Veg.	85%	85%	95%	A depression to form an infiltration basin where sediment is trapped and water infiltrates the soil. No underdrains are associated with infiltration basins and trenches, because by definition these systems provide complete infiltration. Design specifications require infiltration basins and trenches to be built in good soil, they are not constructed on poor soils, such as C and D soil types. Engineers are required to test the soil before approval to build is issued. To receive credit over the longer term, jurisdictions must conduct yearly inspections to determine if the basin or trench is still infiltrating runoff.
Filtering Practices	40%	60%	80%	Practices that capture and temporarily store runoff and pass it through a filter bed of either sand or an organic media. There are various sand filter designs, such as above ground, below ground, perimeter, etc. An organic media filter uses another medium besides sand to enhance pollutant removal for many compounds due to the increased cation exchange capacity achieved by increasing the organic matter. These systems require yearly inspection and maintenance to receive pollutant reduction credit.
Filter Strip Runoff Reduction	20%	54%	56%	Urban filter strips are stable areas with vegetated cover on flat or gently sloping land. Runoff entering the filter strip must be in the form of sheet-flow and must enter at a non-erosive rate for the site-specific soil conditions. A 0.4 design ratio of filter strip length to impervious flow length is recommended for runoff reduction urban filter strips.
Filter Strip Stormwater Treatment	0%	0%	22%	Urban filter strips are stable areas with vegetated cover on flat or gently sloping land. Runoff entering the filter strip must be in the form of sheet-flow and must enter at a non-erosive rate for the site-specific soil conditions. A 0.2 design ratio of filter strip length to impervious flow length is recommended for stormwater treatment urban filter strips.
Bioretention – Raingarden (C/D soils w/ underdrain)	25%	45%	55%	An excavated pit backfilled with engineered media, topsoil, mulch, and vegetation. These are planting areas installed in shallow basins in which the storm water runoff is temporarily ponded and then treated by filtering through the bed components, and through biological and biochemical reactions within the soil matrix and around the root zones of the plants. This BMP has an underdrain and is in C or D soil.
Bioretention / Raingarden (A/B soils w/ underdrain)	70%	75%	80%	An excavated pit backfilled with engineered media, topsoil, mulch, and vegetation. These are planting areas installed in shallow basins in which the storm water runoff is temporarily ponded and then treated by filtering through the bed components, and through biological and biochemical reactions within the soil matrix and around the root zones of the plants. This BMP has an underdrain and is in A or B soil.

BMP Name	BMP Effectiveness Values			BMP Description
	TN	TP	Sediment	
Bioretention / Raingarden (A/B soils w/o underdrain)	80%	85%	90%	An excavated pit backfilled with engineered media, topsoil, mulch, and vegetation. These are planting areas installed in shallow basins in which the storm water runoff is temporarily ponded and then treated by filtering through the bed components, and through biological and biochemical reactions within the soil matrix and around the root zones of the plants. This BMP has no underdrain and is in A or B soil.
Vegetated Open Channels (C/D Soils)	10%	10%	50%	Open channels are practices that convey stormwater runoff and provide treatment as the water is conveyed, includes bioswales. Runoff passes through either vegetation in the channel, subsoil matrix, and/or is infiltrated into the underlying soils. This BMP has no underdrain and is in C or D soil.
Vegetated Open Channels (A/B Soils)	45%	45%	70%	Open channels are practices that convey stormwater runoff and provide treatment as the water is conveyed, includes bioswales. Runoff passes through either vegetation in the channel, subsoil matrix, and/or is infiltrated into the underlying soils. This BMP has no underdrain and is in A or B soil.
Bioswale	70%	75%	80%	With a bioswale, the load is reduced because, unlike other open channel designs, there is now treatment through the soil. A bioswale is designed to function as a bioretention area.
Permeable Pavement w/o Sand or Veg. (C/D Soils w/ underdrain)	10%	20%	55%	Pavement or pavers that reduce runoff volume and treat water quality through both infiltration and filtration mechanisms. Water filters through open voids in the pavement surface to a washed gravel subsurface storage reservoir, where it is then slowly infiltrated into the underlying soils or exits via an underdrain. This BMP has an underdrain, no sand or vegetation and is in C or D soil.
Permeable Pavement w/o Sand or Veg. (A/B Soils w/ underdrain)	45%	50%	70%	Pavement or pavers that reduce runoff volume and treat water quality through both infiltration and filtration mechanisms. Water filters through open voids in the pavement surface to a washed gravel subsurface storage reservoir, where it is then slowly infiltrated into the underlying soils or exits via an underdrain. This BMP has an underdrain, no sand or vegetation and is in A or B soil.
Permeable Pavement w/o Sand or Veg. (A/B Soils w/o underdrain)	75%	80%	85%	Pavement or pavers that reduce runoff volume and treat water quality through both infiltration and filtration mechanisms. Water filters through open voids in the pavement surface to a washed gravel subsurface storage reservoir, where it is then slowly infiltrated into the underlying soils or exits via an underdrain. This BMP has no underdrain, no sand or vegetation and is in A or B soil.
Permeable Pavement w/ Sand or Veg. (A/B Soils w/ underdrain)	50%	50%	70%	Pavement or pavers that reduce runoff volume and treat water quality through both infiltration and filtration mechanisms. Water filters through open voids in the pavement surface to a washed gravel subsurface storage reservoir, where it is then slowly infiltrated into the underlying soils or exits via an underdrain. This BMP has an underdrain, has sand and/or vegetation and is in A or B soil.

BMP Name	BMP Effectiveness Values			BMP Description
	TN	TP	Sediment	
Permeable Pavement w/ Sand or Veg. (A/B Soils w/o underdrain)	80%	80%	85%	Pavement or pavers that reduce runoff volume and treat water quality through both infiltration and filtration mechanisms. Water filters through open voids in the pavement surface to a washed gravel subsurface storage reservoir, where it is then slowly infiltrated into the underlying soils or exits via an underdrain. This BMP has no underdrain, has sand and/or vegetation and is in A or B soil.
Permeable Pavement w/ Sand or Veg. (C/D Soils w/ underdrain)	20%	20%	55%	Pavement or pavers that reduce runoff volume and treat water quality through both infiltration and filtration mechanisms. Water filters through open voids in the pavement surface to a washed gravel subsurface storage reservoir, where it is then slowly infiltrated into the underlying soils or exits via an underdrain. This BMP has an underdrain, has sand and/or vegetation and is in C or D soil.
Stream Restoration	0.075 lbs/ft/yr	0.068 lbs/ft/yr	44.88 lbs/ft/yr	An annual mass nutrient and sediment reduction credit for qualifying stream restoration practices that prevent channel or bank erosion that otherwise would be delivered downstream from an actively enlarging or incising urban stream. Applies to 0 to 3rd order streams that are not tidally influenced. If one of the protocols is cited and pounds are reported, then the mass reduction is received for the protocol.
Forest Buffers	25%	50%	50%	An area of trees at least 35 feet wide on one side of a stream, usually accompanied by trees, shrubs and other vegetation that is adjacent to a body of water. The riparian area is managed to maintain the integrity of stream channels and shorelines, to reduce the impacts of upland sources of pollution by trapping, filtering, and converting sediments, nutrients, and other chemicals. Effectiveness credit for TN is for 4 upslope acres for each acre of buffer (4:1), and 2 upslope acres for TP and sediment (2:1). Additional credit is gained by converting land use from current use to forest. (Note – the values represent pollutant load reductions from stormwater draining through buffers).
Tree Planting	10%	15%	20%	The BMP effectiveness values for tree planting are estimated by DEP. DEP estimates that 100 fully mature trees of mixed species (both deciduous and non-deciduous) provide pollutant load reductions for the equivalent of one acre (i.e., one mature tree = 0.01 acre). The BMP effectiveness values given are based on immature trees (seedlings or saplings); the effectiveness values are expected to increase as the trees mature. To determine the amount of pollutant load reduction that can credited for tree planting efforts: 1) multiply the number of trees planted by 0.01; 2) multiply the acreage determined in step 1 by the pollutant loading rate for the land prior to planting the trees (in lbs/acre/year); and 3) multiply the result of step 2 by the BMP effectiveness values given.
Street Sweeping	3%	3%	9%	Street sweeping must be conducted 25 times annually. Only count those streets that have been swept at least 25 times in a year. The acres associated with all streets that have been swept at least 25 times in a year would be eligible for pollutant reductions consistent with the given BMP effectiveness values.

BMP Name	BMP Effectiveness Values			BMP Description
	TN	TP	Sediment	
Storm Sewer System Solids Removal	0.0027 for sediment, 0.0111 for organic matter	0.0006 for sediment, 0.0012 for organic matter	1 – TN and TP concentrations	This BMP (also referred to as "Storm Drain Cleaning") involves the collection or capture and proper disposal of solid material within the storm system to prevent discharge to surface waters. Examples include catch basins, stormwater inlet filter bags, end of pipe or outlet solids removal systems and related practices. Credit is authorized for this BMP only when proper maintenance practices are observed (i.e., inspection and removal of solids as recommended by the system manufacturer or other available guidelines). The entity using this BMP for pollutant removal credits must demonstrate that they have developed and are implementing a standard operating procedure for tracking the material removed from the sewer system. Locating such BMPs should consider the potential for backups onto roadways or other areas that can produce safety hazards. To determine pollutant reductions for this BMP, these steps must be taken: 1) Measure the weight of solid/organic material collected (lbs). Sum the total weight of material collected for an annual period. Note – do not include refuse, debris and floatables in the determination of total mass collected. 2) Convert the annual wet weight captured into annual dry weight (lbs) by using site-specific measurements (i.e., dry a sample of the wet material to find its weight) or by using default factors of 0.7 (material that is predominantly wet sediment) or 0.2 (material that is predominantly wet organic matter, e.g., leaf litter). 3) Multiply the annual dry weight of material collected by default or site-specific pollutant concentration factors. The default concentrations are shown in the BMP Effectiveness Values columns. Alternatively, the material may be sampled (at least annually) to determine site-specific pollutant concentrations. DEP will allow up to 50% of total pollutant reduction requirements to be met through this BMP. The drainage area treated by this BMP may be no greater than 0.5 acre unless it can be demonstrated that the specific system proposed is capable of treating stormwater from larger drainage areas. For planning purposes, the sediment removal efficiency specified by the manufacturer may be assumed, but no higher than 80%.