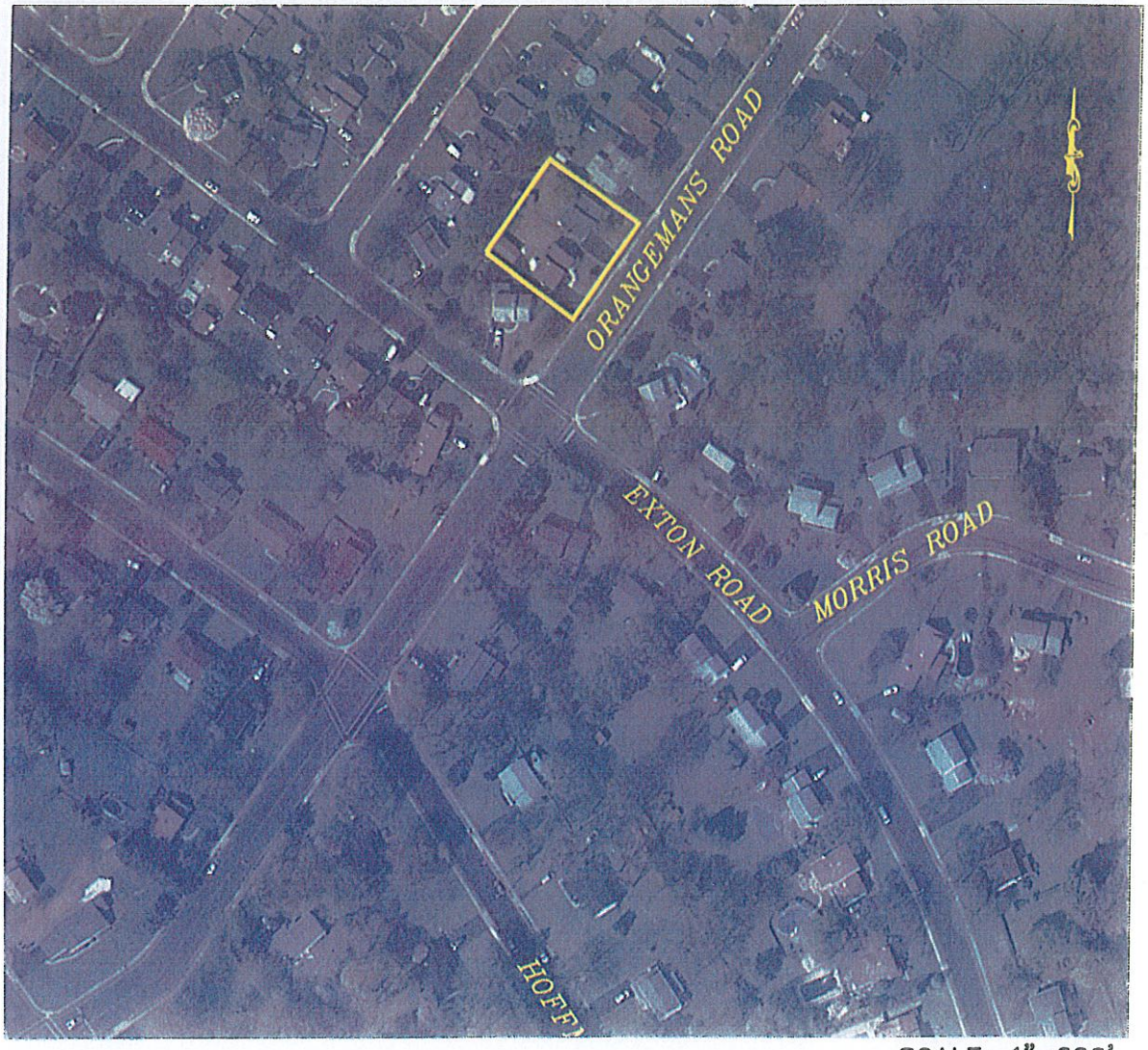
EXHIBIT 5.5

**Project Location:**
Ward 5 – Exton Road & Orangemans Road

**Description of Problem:**
Inlets on Orangemans Road to not provide proper drainage and as a result during heavy rains the ponding water encroaches on the highlighted properties.

**Potential Remedy:**
The storm sewer system and inlets in the area should be inspected to make sure that no inlets or pipes are clogged. The system would need to be analyzed, but the pipes are likely undersized to safely convey runoff from their contributing drainage areas. Increasing pipe size and adding additional inlets could reduce the depth and frequency of flooding in this area. Any increase in pipe conveyance capacity would need to be accompanied with a basin downstream.

**Estimated Project Cost:** $100K - $500K




SCALE: 1"=200'

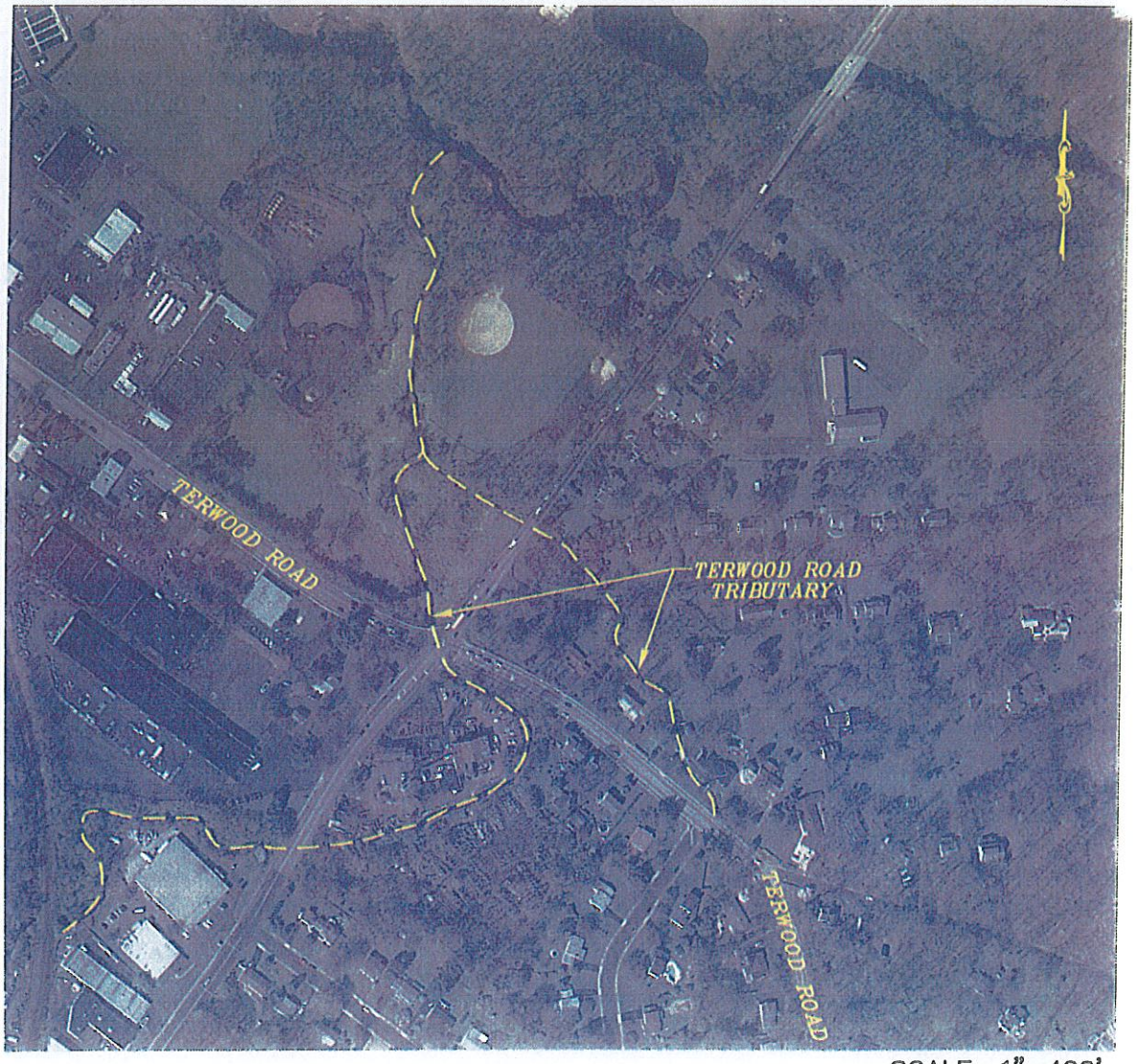
EXHIBIT 6.2

**Project Location:**
Ward 6 – Terwood Road Tributary

**Description of Problem:**
Flooding on private properties and state highways is caused by flooding within the adjacent creek.

**Potential Remedy:**
Flooding within the Pennypack Creek is caused by uncontrolled runoff from upstream areas. Basins and other stormwater facilities need to be installed upstream in order to reduce the flow within the creek.

**Estimated Project Cost:** NA




SCALE: 1"=400'

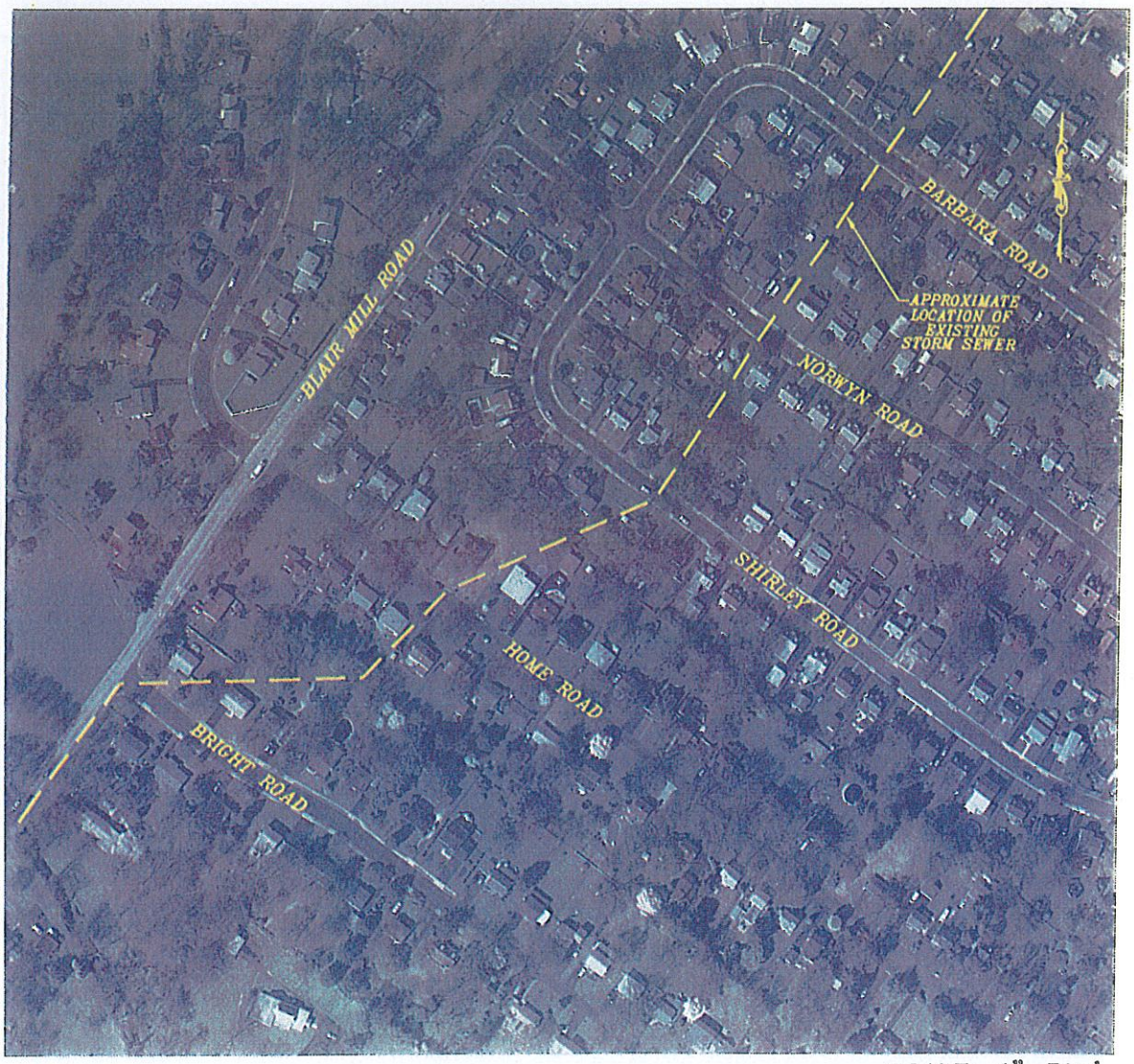
EXHIBIT 2.1

**Project Location:**
Ward 2 – Norwyn Road

**Description of Problem:**
Existing storm sewer system collects runoff from all streets from Bright up to County Line Road. The system runs south and eventually dumps into the Pennypack Creek in the vicinity of Bright Road. Flooding in the creek does not allow for the free outfall of flow from this system. As the creek rises the backup occurs and does not let any additional flow enter the system.

**Potential Remedy:**
Any solution to this problem would have to be done upstream, in neighboring municipalities, in order to reduce the volume of water within the creek and allow the system to function correctly. Further, any additional inlet or pipe capacity would need to be offset with basin construction.

**Estimated Project Cost:** $500K - $1M




SCALE: 1"=300'

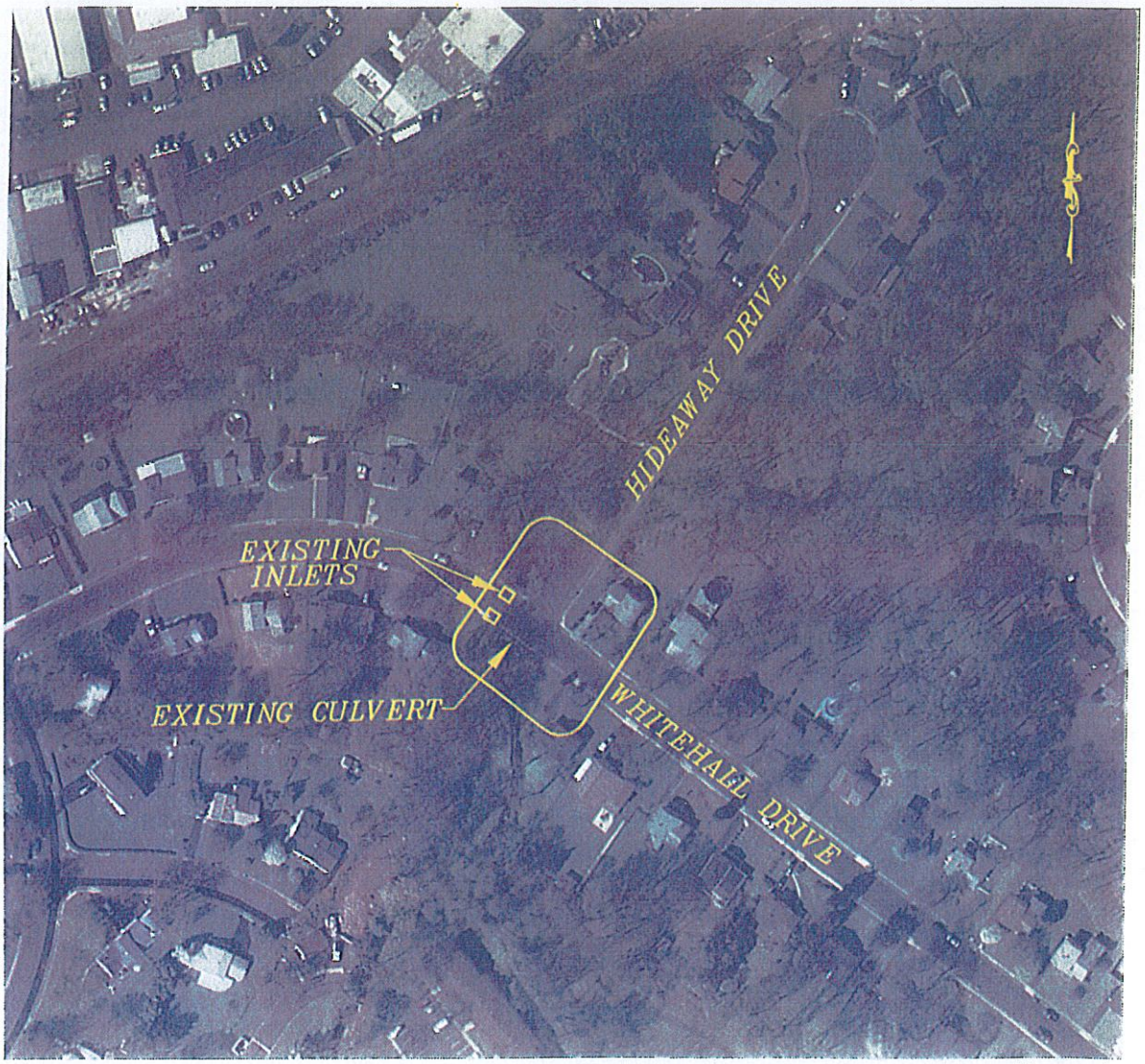
EXHIBIT 4.2

**Project Location:**
Ward 4 – Whitehall Drive near Hideaway Drive

**Description of Problem:**
Intersection of Whitehall and Hideaway Drive floods because it is located at low point and the two inlets discharge directly to the adjacent stream. As the water level in the stream rises the inlets cannot function properly, causing water to pond within the intersection.

**Potential Remedy:**
The high water level within the stream that is causing the problem can only be remedied by implementing stormwater basins upstream in order to reduce the volume of water within the stream.

**Estimated Project Cost:** NA




SCALE: 1"=200'

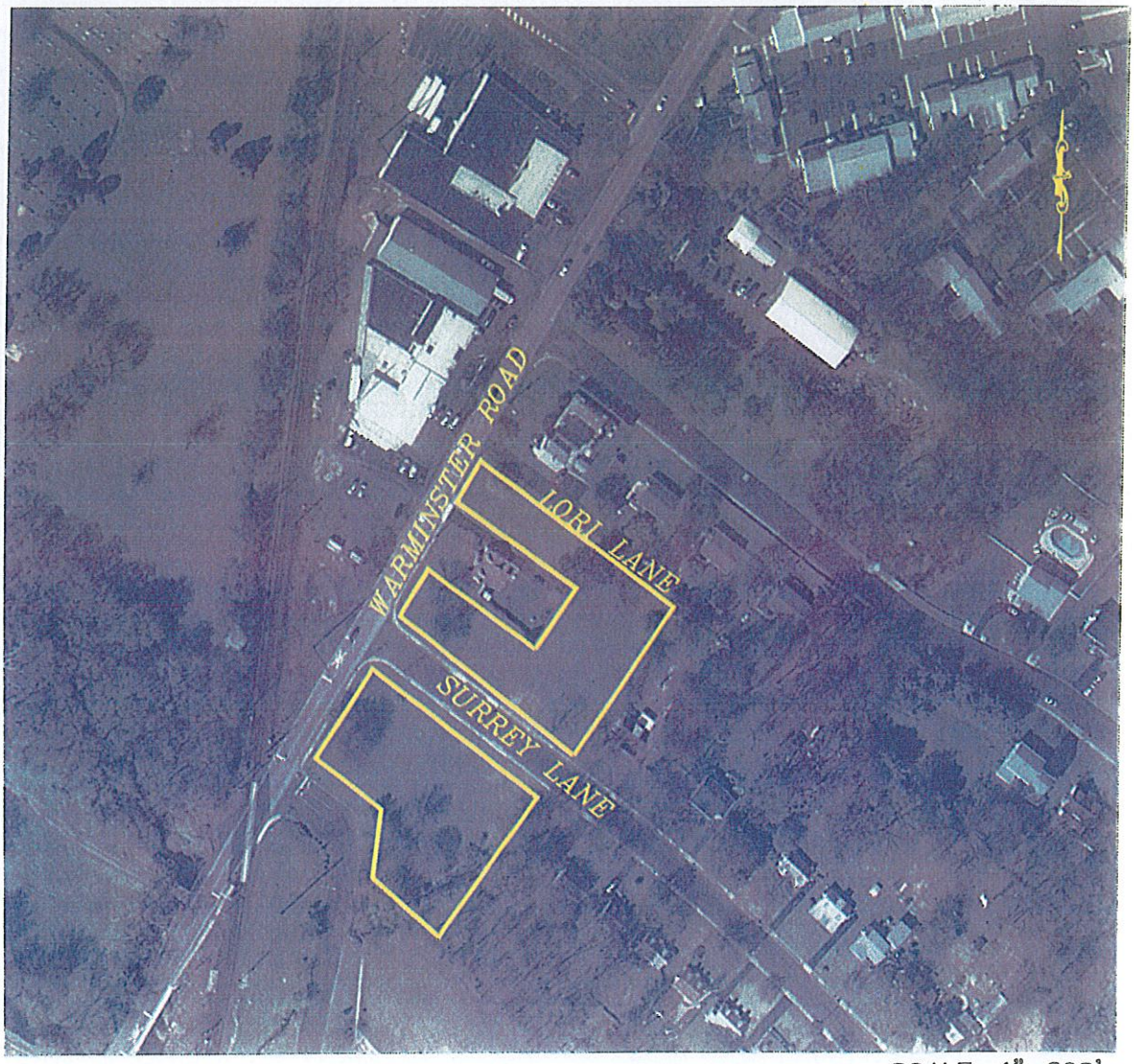
EXHIBIT 5.2b

**Project Location:**
Ward 5 – Warminster Road near Lori Lane & Surrey Lane

**Description of Problem:**
There are no existing inlets or storm sewer system in this area. Roadway flooding occurs due to the lack of a proper drainage system.

**Potential Remedy:**
The Township owns property on both the north and south side of the intersection of Surrey Lane and Warminster Road (highlighted below). This area has been identified as a potential location for the construction of a stormwater basin. If a basin were to be constructed in this area, the project would also need to incorporate a drainage system necessary to convey water to the basin.

**Estimated Project Cost:** NA




SCALE: 1"=200'

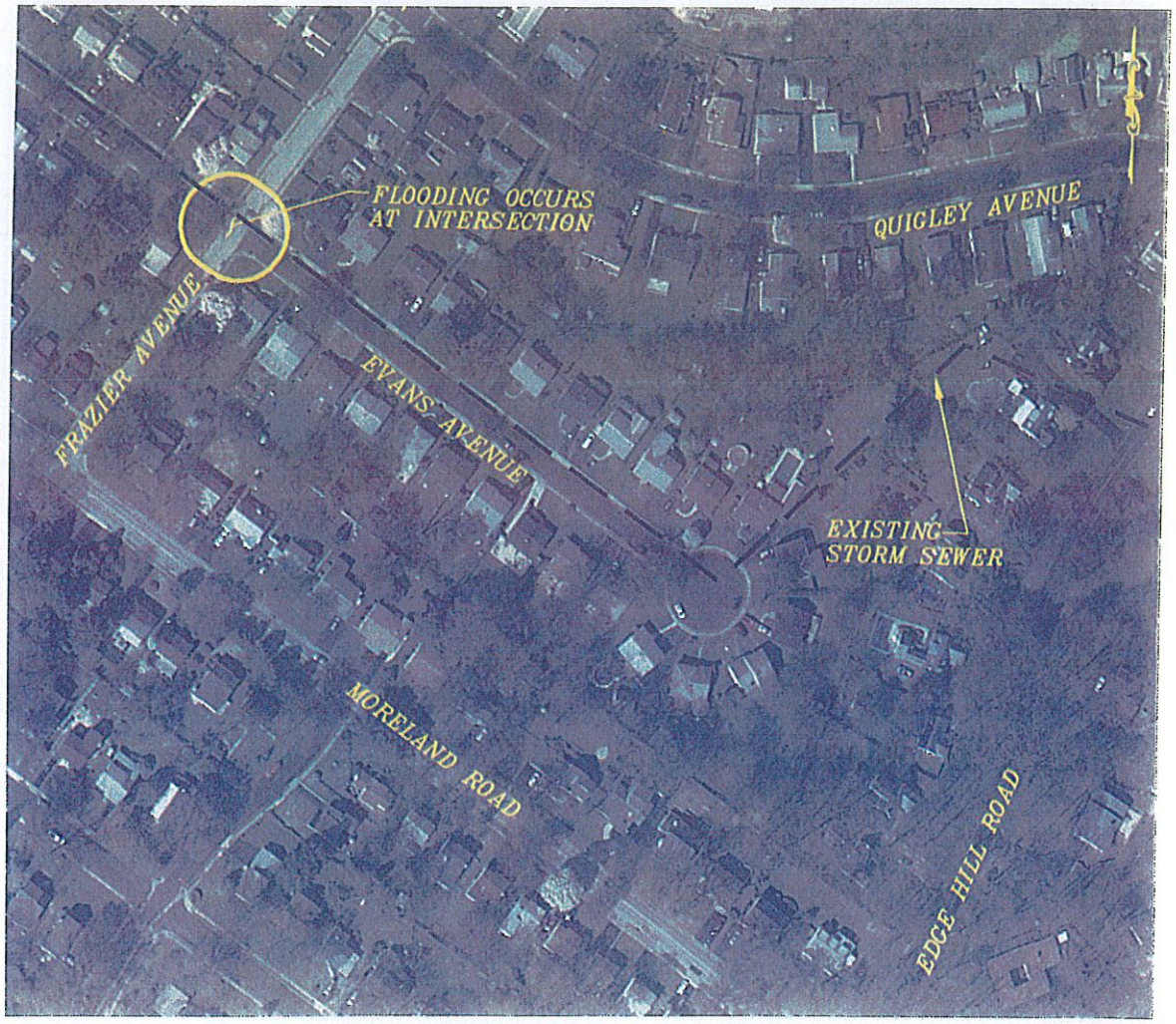
EXHIBIT 1.4

**Project Location:**
Ward 1 – Frazier Avenue & Evans Circle Intersection

**Description of Problem:**
Intersection flooding occurs generally during thunderstorms and other "flash" type events, which generate heavy downpours.

**Potential Remedy:**
Installing additional inlets within the intersection and / or increasing the capacity of the existing storm sewer system within the area are the only viable solutions. Unfortunately, by increasing the flow within the existing system, there is a high probability that downstream residents will experience an increase in flooding depth and frequency. No obvious location downstream exists to install a basin.

**Estimated Project Cost:** $100K - $500K




SCALE: 1"=200'

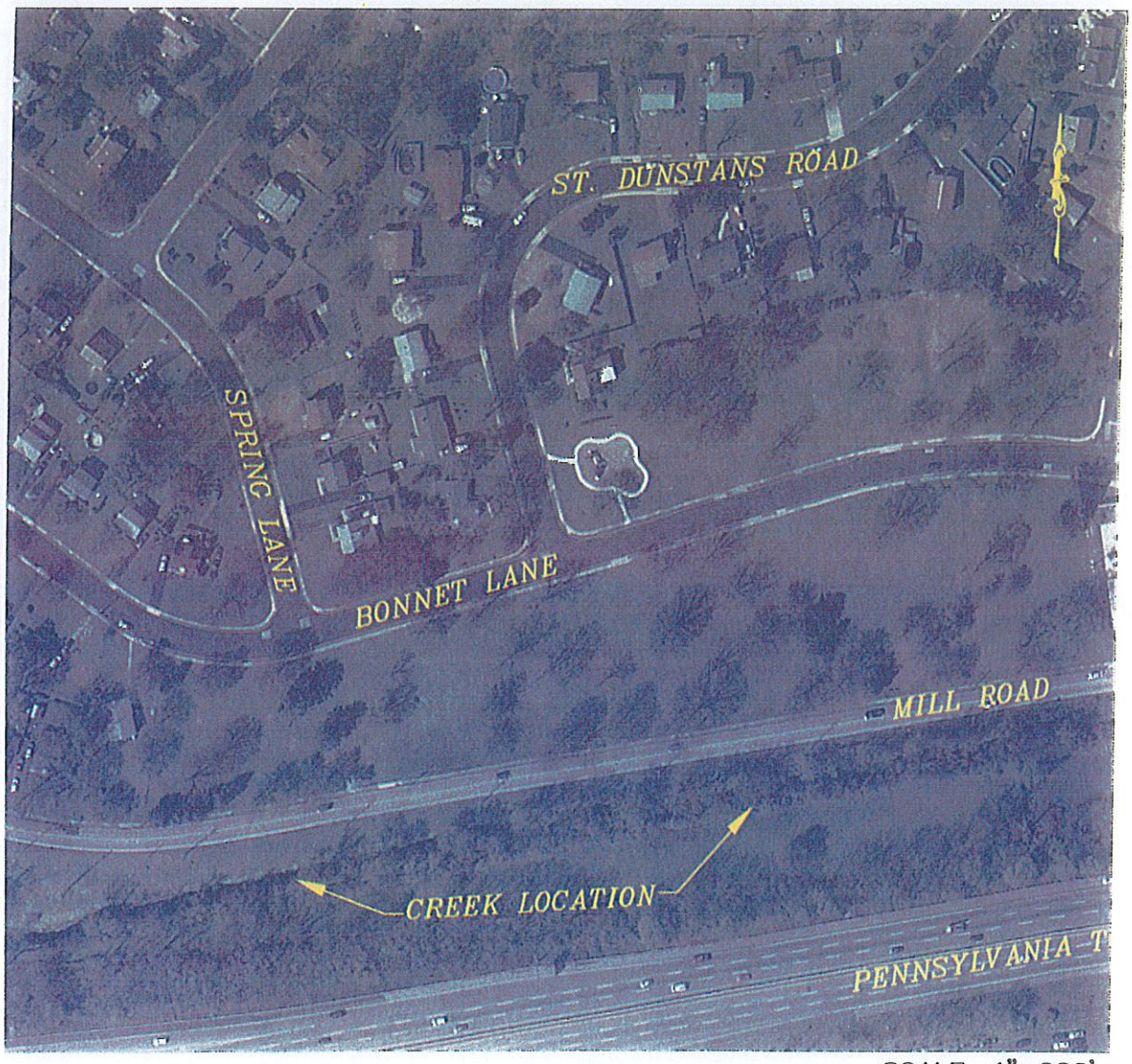
EXHIBIT 5.3

**Project Location:**
Ward 5 – Bonnet Lane & St. Dunstans Road

**Description of Problem:**
Roadway flooding occurs in this area due to flooding in the nearby creek.

**Potential Remedy:**
The Township owns property between Bonnet Lane and Mill Road that has been identified as a potential location for a stormwater basin in the 2009 Pennvest application. Due to the close proximity to the 100-year floodplain in this area, any basin design would need to include measures to allow for flood water from the creek to enter the basin (the increase in storage within the basin could offset flooding in other areas). The area between Bonnet Lane and Mill Road, depicted below, used to be the site of single family homes that were bought out using funding from PEMA / FEMA.

**Estimated Project Cost:** NA




SCALE: 1"=200'

**Project Location:**
Ward 1 – Church Street & Cherry Street between S.R. 611 and S.R. 63

**Description of Problem:**
Road flooding occurs in this area but only during extreme rain events. The existing storm sewer system in the area cuts through residential properties from Church Street to Cherry Street and then runs along Davisville Road before ultimately discharging to Veteran's Memorial Park.

**Potential Remedy:**
Storm sewer capacity would need to be increased. This would be a major undertaking because the pipe size would need to be increased all the way to the discharge at Veteran's Memorial Park. Increasing the discharge to the creek could also cause downstream flooding issues as well as stream bank erosion within the park. A basin in the park would need to be installed to offset the additional stormwater.

**Estimated Project Cost:** $500K - $1M

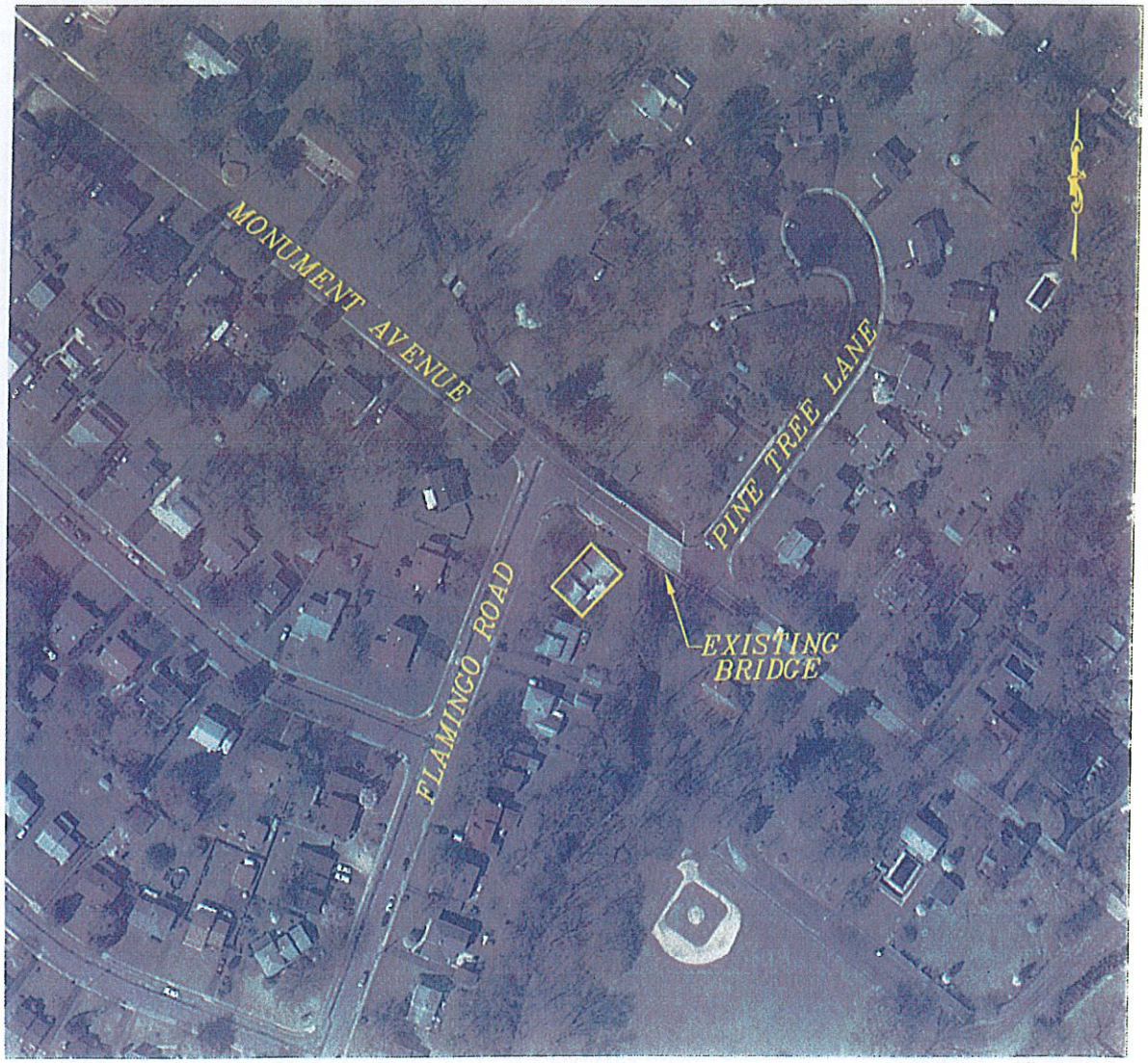

SCALE: 1"=200'

**Project Location:**
Ward 2 – Monument Avenue near Pine Tree Lane

**Description of Problem:**
Flooding occurs when water backs up in the area of the existing bridge. The creek takes a 90 degree turn just prior to going under the bridge, causing an in efficient hydraulic situation. Flooding occurs on the highlighted property and on some properties north of Monument Avenue (Hatboro).

**Potential Remedy:**
Bridge opening should be increased in order to allow for a smoother transition under Monument Avenue. However, this bridge has been replaced within the last 10 years, so the cost of mitigating the flooding issue would be very high, considering that the bridge does not need to be replaced for structural reasons. Also, increasing the opening will "push" the problem downstream.

**Estimated Project Cost:** $1M - $1.5M




SCALE: 1"=200'

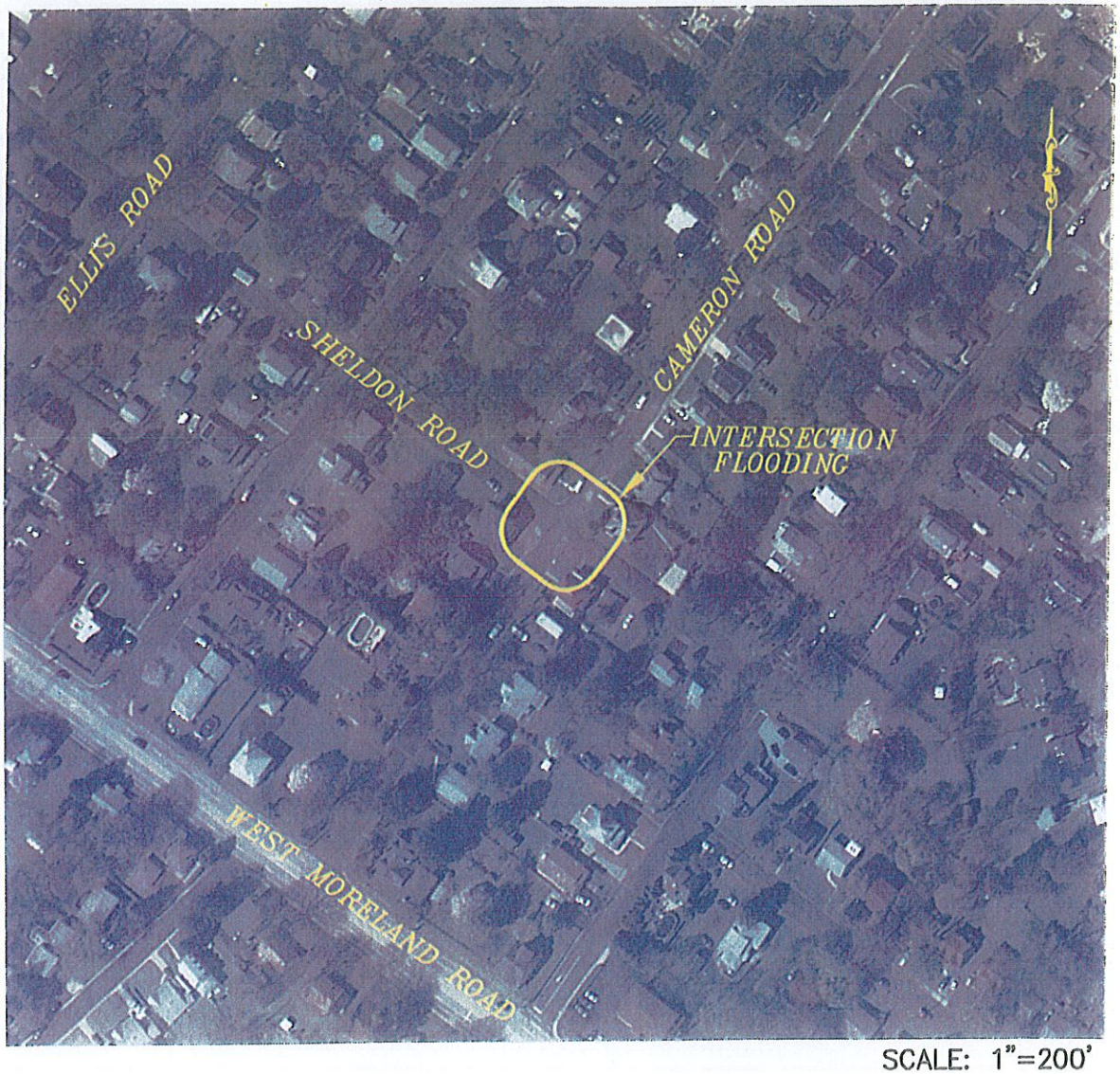
EXHIBIT 4.4

**Project Location:**
Ward 4 – Cameron Road & Sheldon Road

**Description of Problem:**
Intersection and road flooding occurs during heavy rains due to the lack of storm sewer and inlets within the area.

**Potential Remedy:**
Storm sewer needs to be installed within the development to reduce the amount of gutter flow and convey the runoff underground to the nearest stream. The problem with installing storm sewer throughout the area is that the water, currently ponding in yards and intersections, would be conveyed fast to the stream and likely have a negative impact on the downstream areas.

**Estimated Project Cost:** $100K - $500K



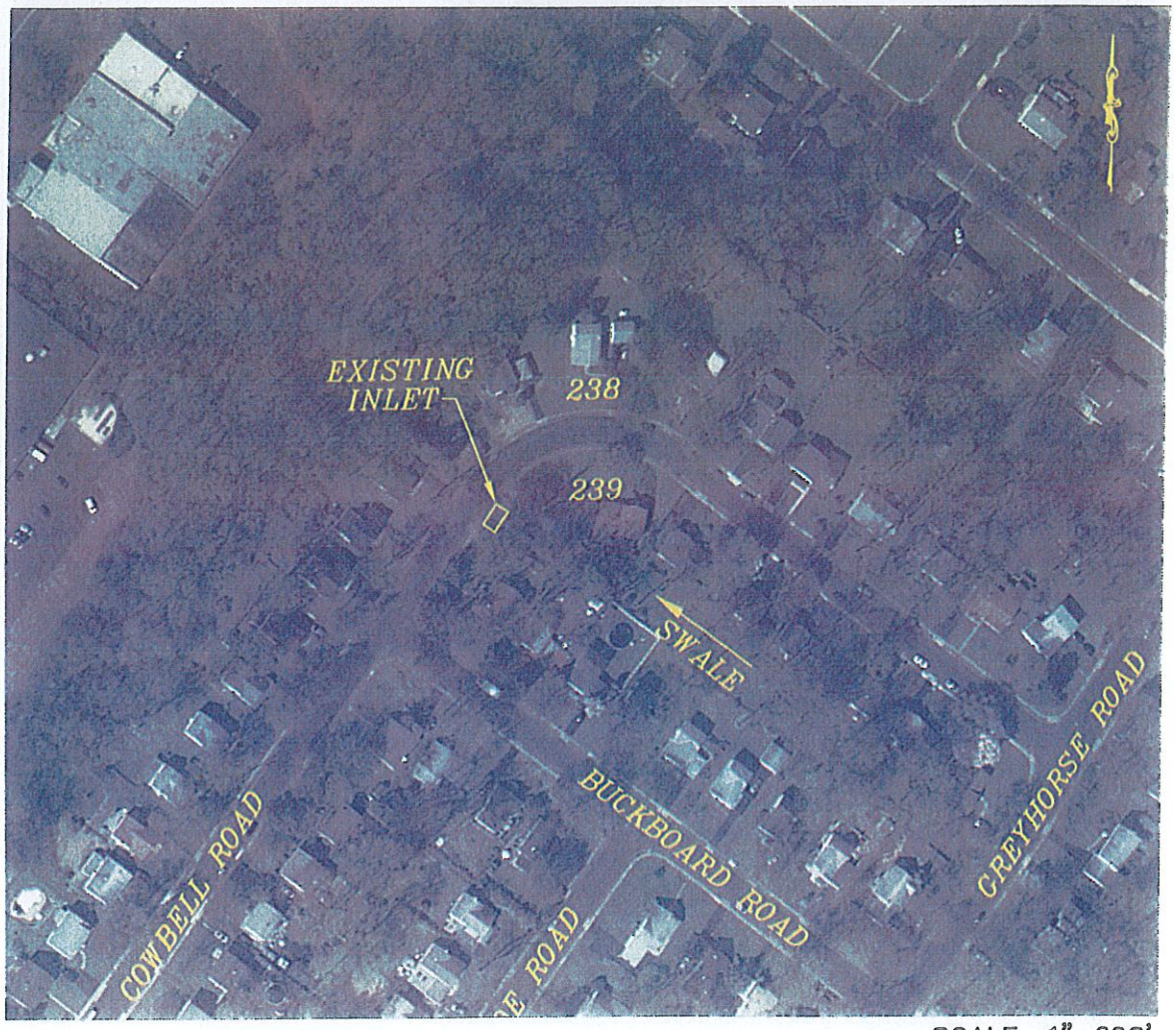

SCALE: 1"=200'

**Project Location:**
Ward 1 – 239 Cowbell Road

**Description of Problem:**
Swale in rear yards is not graded properly and does not allow water to reach the existing inlet as intended. Flooding occurs in the street as a result of overflow from the highlighted inlet. Further investigation is needed to determine if the pipe leaving the highlighted inlet is undersized.

**Potential Remedy:**
Remedial grading needs to be performed on private properties in order to ensure positive drainage towards the existing inlet. Additionally, any obstructions within the swale (i.e. fences, sheds, fallen trees, etc.) that are inhibiting the flow of water should be removed. If the pipe leaving the inlet is undersized and causing the overflow the pipe size may need to be increased. The downstream system would need to be analyzed to ensure that the increased flow will not negatively impact downstream areas.

**Estimated Project Cost:** $100K - $500K




SCALE: 1"=200'

EXHIBIT 3.2

**Project Location:**
Ward 3 – 523 Grant Avenue

**Description of Problem:**
Overflow from inlet near 523 Grant Avenue was designed to utilize a swale between the residences on Grant Avenue and enter into the storm sewer system along Lincoln Avenue. When the lot was subdivided and the house was built at 523 Grant, the grading did not keep a defined swale towards Lincoln Avenue.

**Potential Remedy:**
The proposed development at 501 York Road (Student Housing) should help drainage issues along Lincoln Drive by increasing the pipe size along Lincoln Drive at the York Road crossing. Grading could be performed between 523 and 528 Grant Avenue in order to create a defined swale for overflow from the existing inlet.

**Estimated Project Cost:** Less than $100K


SCALE: 1"=200'

EXHIBIT 3.3

**Project Location:**
Ward 3 – Duffield Street

**Description of Problem:**
An underground spring from the highlighted property used to be piped towards the street and would constantly cause wet and sometimes icy conditions on Duffield Street. The homeowner paid a contractor to direct the flow towards the rear of the property and this has caused wet conditions in the rear yards to the east of the subject property.

**Potential Remedy:**
Spring should be piped into an under drain or small pipe within the ROW to the nearest inlet as part of the next Township paving program of this street. As such, we recommend this street be placed on the paving program in 2014.

**Estimated Project Cost:** Less than $10,000


SCALE: 1"=200'

EXHIBIT 4.5

**Project Location:**
Ward 4 – Sheldon Road between Ellis Road & Fitzwatertown Road

**Description of Problem:**
Intersection and road flooding occurs during heavy rains due to the lack of storm sewer and inlets within the area.

**Potential Remedy:**
Storm sewer needs to be installed within the development to reduce the amount of gutter flow and convey the runoff underground to the nearest stream. The problem with installing storm sewer throughout the area is that the water, currently ponding in yards and intersections, would be conveyed faster the stream and likely have a negative impact on the downstream areas.

**Estimated Project Cost:** Less than $100K


SCALE: 1"=200'

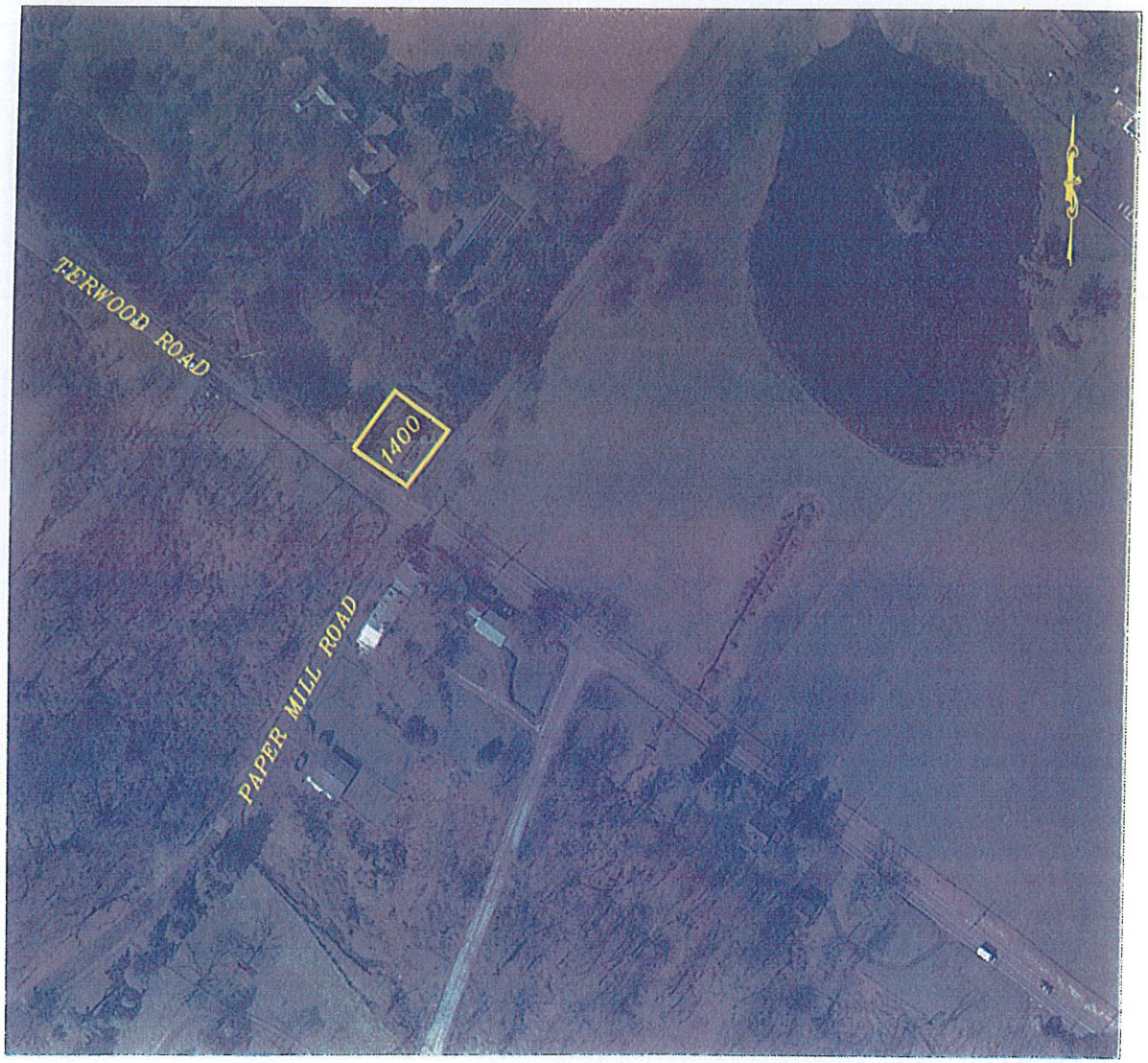
EXHIBIT 6.3

**Project Location:**
Ward 6 – 1400 Terwood Road

**Description of Problem:**
Flooding occurs on the property highlighted below as a result of poor drainage along Terwood Road.

**Potential Remedy:**
PennDOT installed an 18" cross-over pipe under Terwood Road to remedy the drainage issue. The Township public works should monitor the property during rain events to see if PennDOT work solved the problem.

**Estimated Project Cost:** Less than $10,000




SCALE: 1"=200'

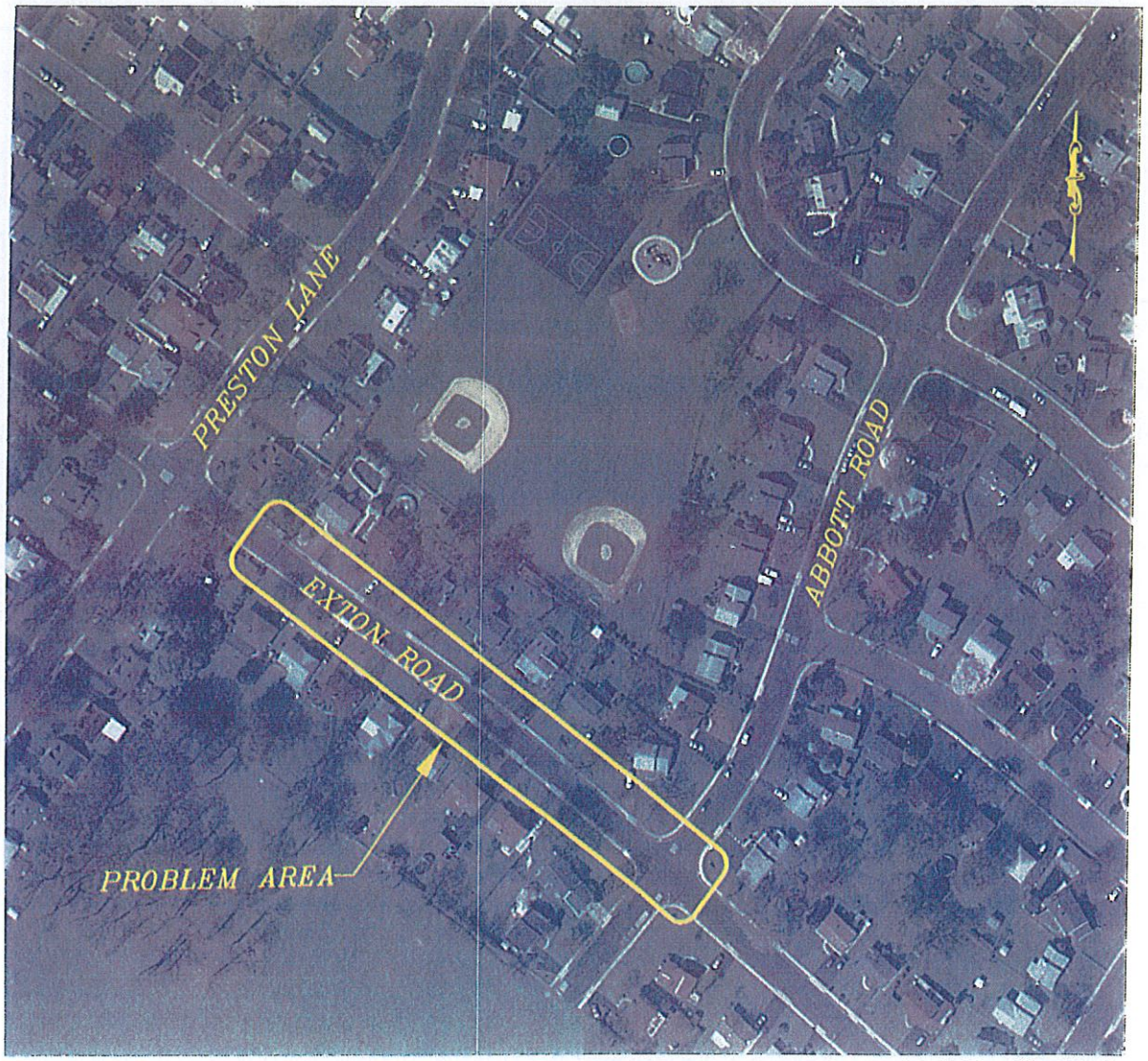
EXHIBIT 7.1

**Project Location:**
Ward 7 – Fern Village Park @ Exton Road

**Description of Problem:**
Road flooding on Exton in the area of Fern Village Park.

**Potential Remedy:**
The stormwater system along Exton Road flows towards Orangmans Road. The Township should investigate to determine if any corrective grading within the park could help prevent the flooding along Exton.

**Estimated Project Cost:** Less than $100K



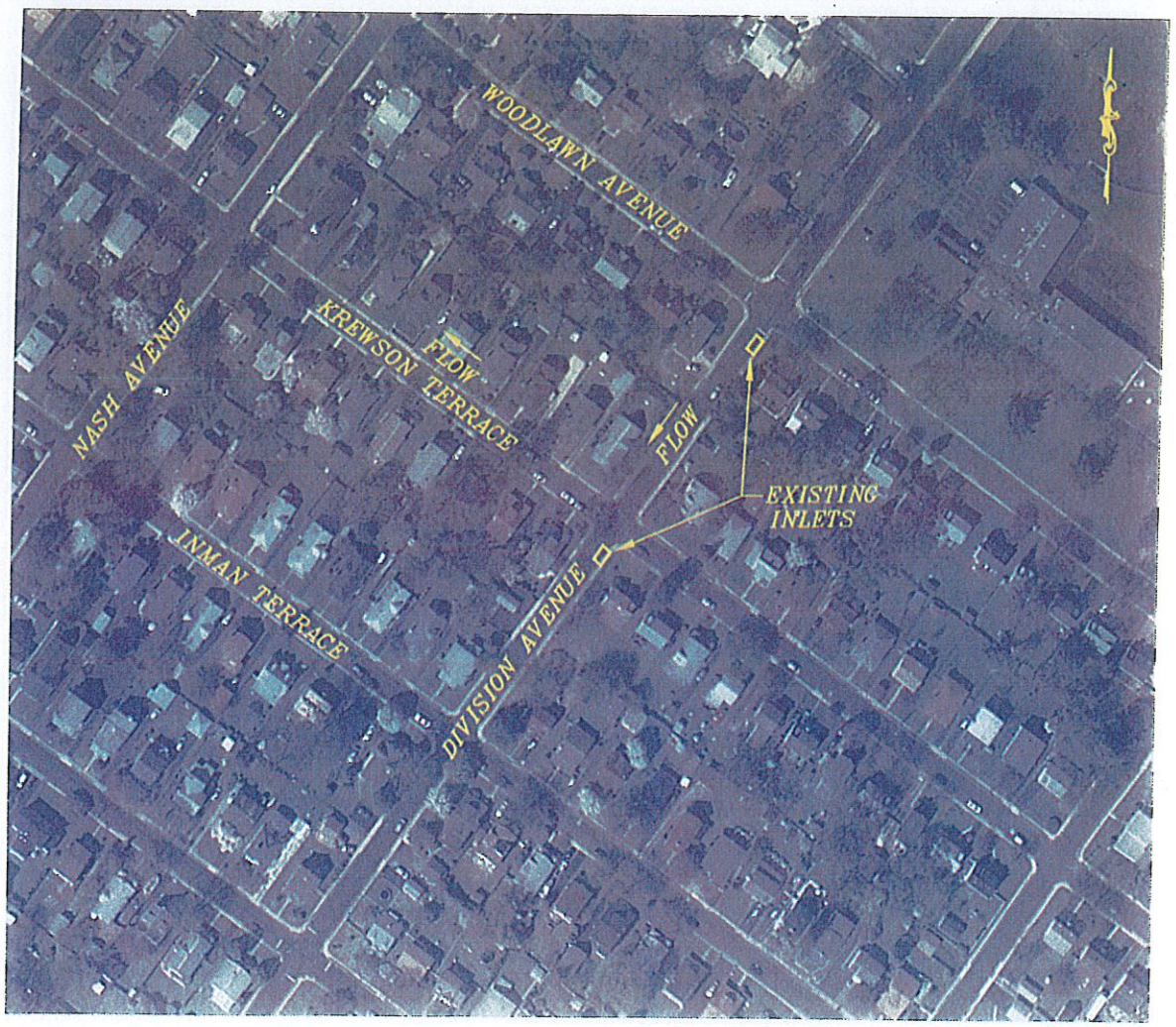

SCALE: 1"=200'

**Project Location:**
Ward 1 – Division Avenue & Krewson Terrace

**Description of Problem:**
Lack of inlets within the area causes deep gutter flow and road flooding along Krewson Terrace in the vicinity of Nash and Division Avenues. Only two inlets exist between Woodlawn and Krewson and they are located along the east curb line. Gutter flow down the west side of Division Avenue turns the corner and runs down Krewson. No inlets exist along Krewson, and deep gutter flow often encroaches into the travel lanes.

**Potential Remedy:**
Additional inlets need to be installed along the west curb line of Division Avenue as well as along Krewson Terrace. These inlets would allow for the excessive gutter flow to be captured and conveyed underground. The existing system along the east side of Division Avenue is more than likely undersized and an analysis would need to be performed to determine if additional flow could be accommodated.

**Estimated Project Cost:** $25,000



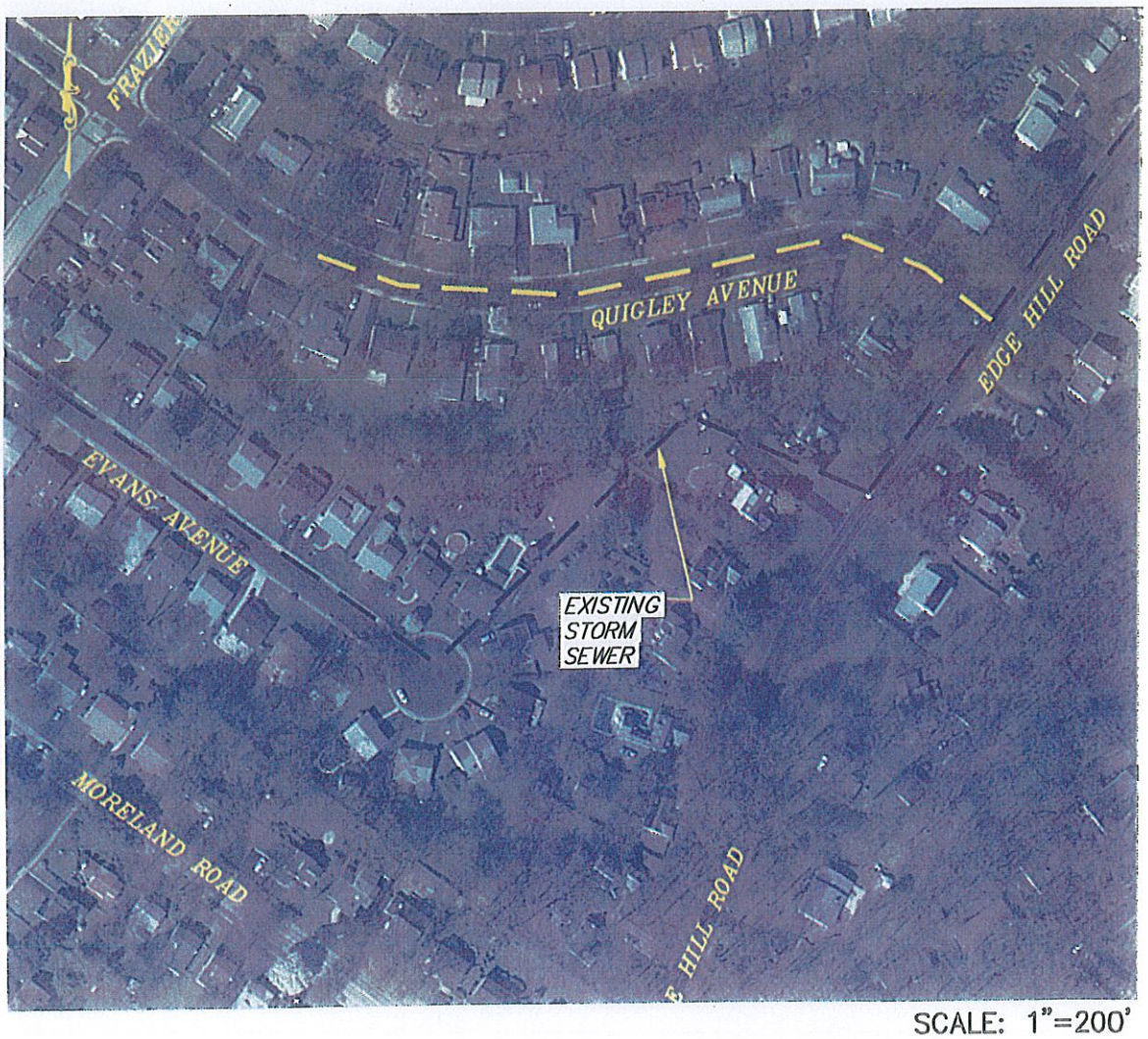

SCALE: 1"=200'

**Project Location:**
Ward 1 – Quigley Road

**Description of Problem:**
Road drainage along Quigley Road is inadequate due to lack of storm sewer. Issue does not result in flooding and the main problem is deep gutter flow along the road that encroaches into the travel lanes.

**Potential Remedy:**
Installation of inlets and storm sewer along Quigley Road would reduce depth of gutter flow; however, the new storm sewer system would have to connect to the existing system along a portion of Quigley and Evans Circle. The addition of flow into the system would have the potential to cause increase flooding downstream along Willow Brook Drive, where stormwater is currently conveyed through roadside ditches.

**Estimated Project Cost:** $100K - $500K




SCALE: 1"=200'

*C. Existing Problems – Category 3*

| Project Location | Report Exhibit # | Priority |
|---|---|---|
| Green Willow Run Apartments | 3.5 | 1 |
| Edge Hill & Moreland Road | 1.1 | 2 |
| Fitzwatertown Road | 3.7 | 2 |
| 4115 Hoffman Road | 5.4 | 4 |
| 3800 Meyer Lane | 5.6 | 4 |
| 2105 Huntingdon Road | 6.7 | 4 |
| Evans Circle & Quigley Road | 1.3 | 7 |
| Inman Road near Frazier | 1.5 | 7 |
| Parkside at Sycamore | 2.6 | 7 |
| Costello Avenue near Lynn | 2.7 | 7 |
| Blair Mill between Broadway & Parkside | 2.9 | 7 |
| Commerce Avenue Apartments | 3.1 | 7 |
| 401 & 403 Crown Street | 3.8 | 7 |
| Huntingdon Road at Mason's Mill | 6.6 | 7 |
| Dogwood Lane Cul-de-sac | 4.3 | 15 |
| Maryland Road (stream erosion) | 4.6 | 16 |

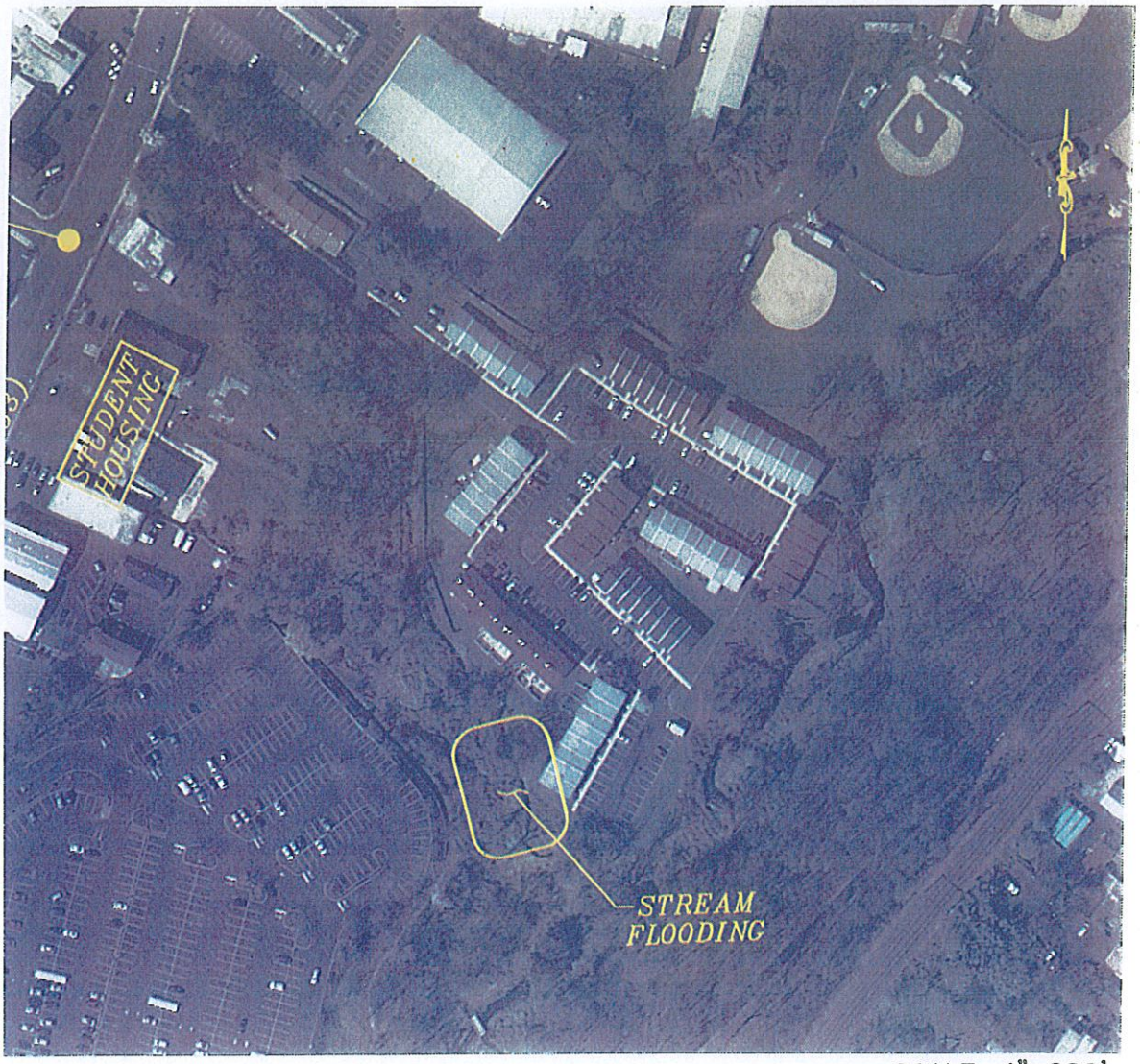
EXHIBIT 3.5

**Project Location:**
Ward 3 – Green Willow run Apartments

**Description of Problem:**
Stream flooding occurs in the apartment complex located adjacent to the Student Housing land development.

**Potential Remedy:**
The stream channel could be cleaned of debris and maintained within the area highlighted below. More than likely this minor maintenance will not fix the problem, stormwater basins must be installed upstream in order to reduce the volume of water within the stream. The Student Housing project may help this situation as they are installing a large underground basin and rain gardens.

**Estimated Project Cost:** NA




SCALE: 1"=200'

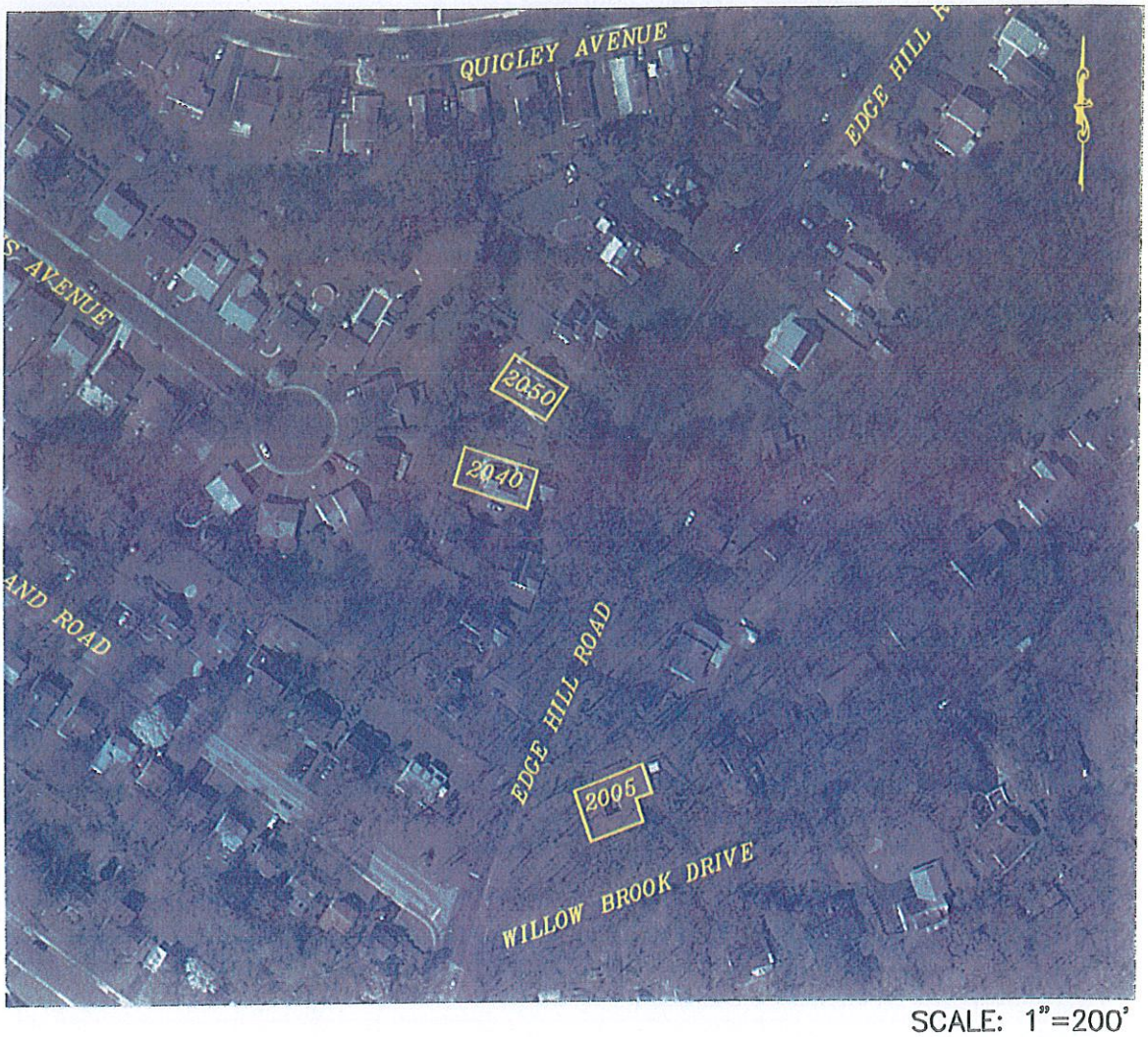
EXHIBIT 1.1

**Project Location:**
Ward 1 – Edge Hill Road & E. Moreland Road

**Description of Problem:**
Low areas on private properties that are highlighted below (2005, 2040 & 2050 Edge Hill Road)

**Potential Remedy:**
Minor grading on private properties could help eliminate ponding water. If yard drains were installed they could be connected to the existing storm sewer system along Quigley Road.

**Estimated Project Cost:** $10,000




SCALE: 1"=200'

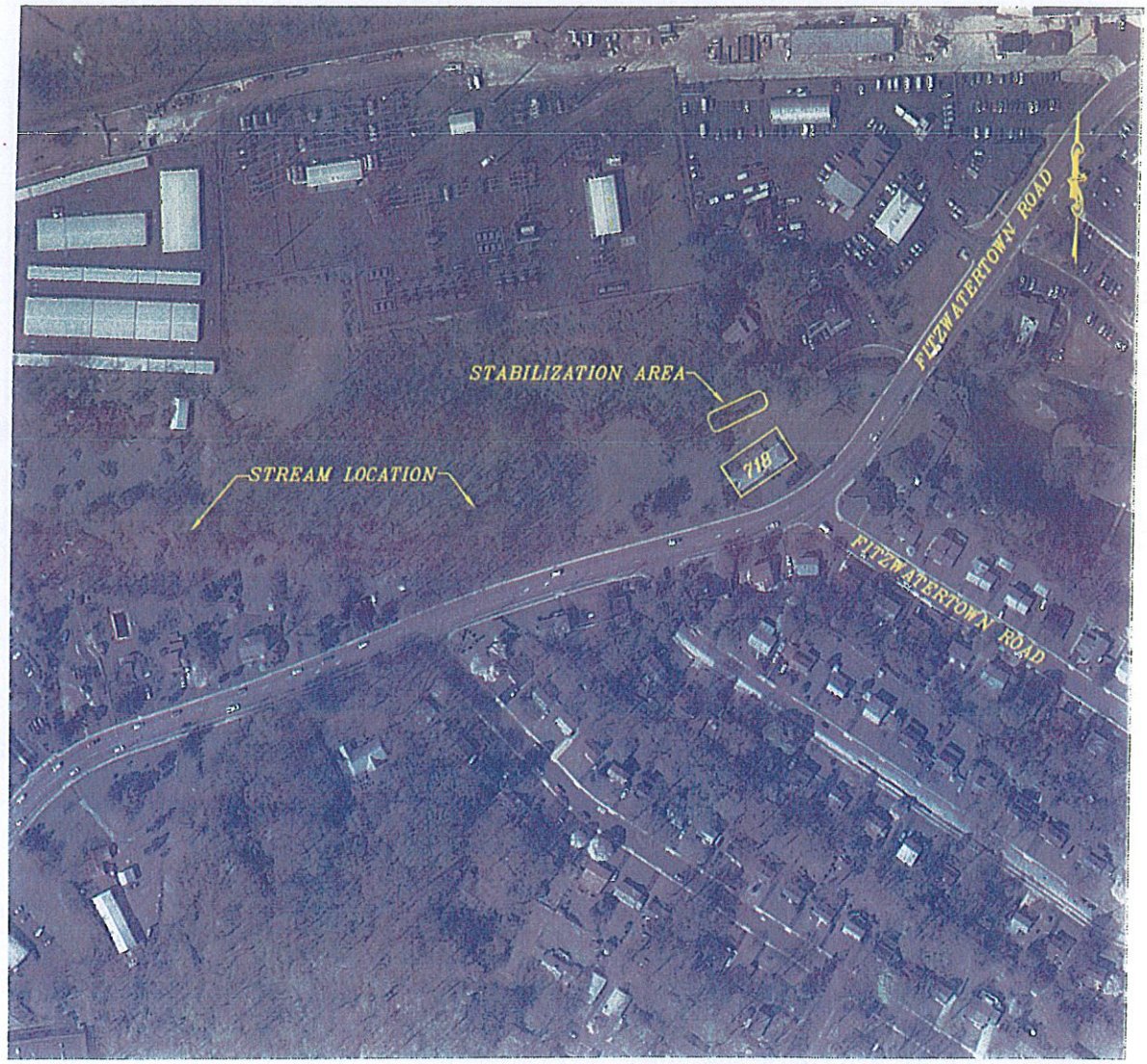
EXHIBIT 3.7

**Project Location:**
Ward 3 – Fitzwatertown Road

**Description of Problem:**
The rear yards of properties on the north side of Fitzwatertown Road have flooding due to flooding in the adjacent stream.

**Potential Remedy:**
Volume of water in the stream must be reduced by implementing stormwater basins upstream to control the flow of water before it reaches the stream. There is an approved land development plan for 718 Fitzwatertown Road and stream bank stabilization will be completed as part of that project. Stabilizing the stream bank will help to reduce the amount of sediment in the stream bed, but will not serve to alleviate the flooding issue.

**Estimated Project Cost:** NA




SCALE: 1"=200'