



## Study Area 1 Report

### Site Visit Summary

Location: Takoma Park, MD

Study Area: 1

Site Visit Date: 2/13/2023

The LID Center visited study area 1 on 2/13/2023 with the Takoma Park DPW and residents of the affected properties. Residents have observed wet backyards. The findings of the site visit are as follows.

There is an area of standing water on the sidewalk in front of 7708 Takoma Avenue. The residents of the nearby properties indicated that this typically occurs after any rain event and takes a few days to evaporate. Residents also mentioned consistently wet yards that do not infiltrate well during and after storms. This is an indication of a high groundwater table, but this has not been confirmed. The residents did not report any water groundwater seepage into their basements, so the impact of the groundwater to structures appears to be minimal. The residents also reported that runoff from the backyards flows between the houses and does not create a flooding risk. There is a stormwater management Bioretention facility located behind Montgomery College building adjacent to the 7708 Takoma Avenue backyard. This Bioretention has been installed recently and according to residents has decreased surface runoff from the Montgomery College lot to the extent that there is minimal, if any, runoff from the lot anymore. According to the City's records, the bioretention has a liner that restricts groundwater seepage out of the bioretention. The facility also has an underdrain that connects to a 15" pipe which connects to the storm main pipe on New York Avenue.

### LID Center Recommendations

The following strategies may be useful for residents looking to address drainage issues in Study Area 1. A professional contractor should be contacted to determine the best approach to the drainage problem on a specific property.

Conservation landscaping and tree planting may be used to reduce yard wetness. Conservation landscaping is the use of planting beds designed to create a more natural vegetative area. Wet areas of a yard may be converted into conservation landscape areas and planted with native species adapted to wet conditions. This type of landscaping provides improved infiltration and

water uptake as compared to grass. Additionally, tree planting can also reduce yard wetness as the roots can soak up a large amount of water from the ground.

French drains can be utilized to help alleviate groundwater issues in this area. A french drain system is comprised of a perforated underdrain pipe within a gravel trench. The area on top of the gravel trench can be covered with topsoil and grass so that the system is not visible in the yard. The French drain would be placed in the area where there is groundwater seeping to the surface. The underdrain pipe should outflow to the public right of way curb or connect into the public storm drain if possible. Permission from the City of Takoma Park is required for these connections. The underdrain can outflow to another area of the yard as long as it is not directed towards another property; however, this method is not preferable.

## Study Area 2 Report

### Site Visit Summary

Location: Takoma Park, MD

Study Area: 2

Site Visit Date: 2/13/2023

The LID Center visited study area 2 on 2/13/2023 with the Takoma Park DPW and residents of the affected properties. There has been flooding where the stream flows into the storm drain headwall. Water would overflow onto Baltimore Avenue properties. The stream brings significant amounts of sediment and leaf litter. The findings of the site visit are as follows.

There is a stream that flows through private homeowners' backyards and into a headwall at the paper street between Baltimore Avenue and Philadelphia Avenue where it enters the city storm drain system. There is a large headwall and weir riser control structure at the inflow point for the stream. Both appear to be functional and in good condition. According to DPW officials, the city rebuilt this inflow structure in 2014. The headwall and its opening were enlarged and the weir riser control structure was added. Since this project there have been no visible signs of flooding and the city has not received any complaints about flooding. The area seems to no longer be flood prone. Some private properties adjacent to the stream have a moderate amount of yard waste and debris piled near the stream which could cause blockage of the weir if they were to be washed into the stream.

### LID Center Recommendations

It was determined from field investigation that the flooding along the Baltimore Avenue lots has likely been resolved through Takoma Park DPW storm drain improvement projects. The area should be monitored for any persistent flooding that may require action by DPW. The weir inflow may require periodic clearing of debris. It may be beneficial for DPW to provide homeowners in the area some educational materials to deter the stockpiling of yard waste near the stream, as such practices can cause storm drain obstructions and organic pollution.

## Study Area 3 Report

### Site Visit Summary

Location: Takoma Park, MD

Study Area: 3

Site Visit Date: 2/13/2023

The LID Center visited study area 3 on 2/13/2023 with the Takoma Park DPW and residents of the affected properties. The location for the area of concern follows the storm pipe in the backyards along Philadelphia Avenue. Findings of the site visit are as follows.

There is a swale valley over the top of the public storm main behind the 302-314 Philadelphia Avenue houses. The swale ends at a curb inlet between 7418 and 7420 Holly Avenue. The curb inlet brick back wall has a small non-conventional opening at the bottom for inflow from the swale. The opening is only a few inches high. There has not been significant flooding of the swale according to residents. However, the inlet opening could be enlarged to provide improved drainage. Additionally, there is some damage to the brick inlet wall that should be repaired. There is a tree planted over top of the storm drain pipe behind the inlet that should be removed as it will interfere with storm drain pipe integrity.

The grading of Birch Avenue lots slopes down towards the Cedar Avenue lots. The resident of 7408 Cedar Avenue reported significant stormwater runoff flows around his house and his neighbors' houses coming from the uphill Birch Avenue lots. He also reported excessive runoff flows along Cedar Avenue during heavy rainstorms. There were no visible indications of flooding or issues with storm drain infrastructure in the area.

### LID Center Recommendations

Takoma DPW may consider rebuilding the storm drain catch basin structure between 7418 and 7420 Holly Avenue. Bricks in the broken sections of the back wall should be replaced. A standard weir opening at the back of the inlet should be included and sized for the 10-year storm. Additionally, the tree over the storm main should be carefully removed in order to prevent roots from damaging the pipe. The City should first check records for a stormwater management easement in this area.

The following strategies may be useful for residents looking to address stormwater issues in Study Area 3. A professional contractor should be contacted to determine the best approach to the drainage problem on a specific property.

Residents of Cedar Avenue could install swales or berms which can direct the flow of stormwater runoff safely through a property and into the public right-of-way where there is suitable storm drain infrastructure. A swale is a shallow channel that conveys stormwater. Swales may be vegetated, filled with stone, or lined with hardened materials such as concrete. A vegetated swale is ideal in most residential areas from a functional and aesthetic standpoint; however, swales situated on steep slopes or in areas that receive large stormwater flows may require more stable materials such as stone or concrete. Berms are small, long mounds and are typically built from earthen materials. Berms act as a barrier to keep water flowing along a desirable path. To assure overland flow paths work effectively, they must always maintain a consistent downhill slope in the desired direction.

It is important that residents collaborate to address stormwater issues in this area. Cedar Avenue residents may need to engage their uphill neighbors on Birch Avenue so that they can work together to direct runoff safely to a public roadway. Birch Avenue residents may consider installing roof downspout leaders directed to the Birch Avenue curb. If a house is downhill of the road, then a downspout leader collection pipe would need to be installed through the downhill neighbor's yard and outlet at the Cedar Avenue curb. Birch Avenue residents could also use a sump pump to move stormwater uphill to the road. Any pipes discharging at the curb will require permission from the City. If feasible, Birch Avenue residents may also consider land grading, which involves directing the slope of their lawns and paved areas toward the roadway.

# Study Area 4 Report

## Site Visit Summary

Location: Takoma Park, MD

Study Area: 4

Site Visit Date: 2/8/2023

The LID Center visited study area 4 on 2/8/2023 with the Takoma Park DPW and residents of the affected properties. The homes on Mississippi Avenue and Elwyn Ct. receive extensive runoff from the properties on the uphill slope along Ritchie Avenue. Many of the homeowners have done drainage projects in their yards to divert water around their houses. The findings of the site visit are as follows.

There is a steep slope down from the Ritchie Avenue lots towards the Mississippi Avenue and Elwyn Ct. lots. The residents reported that stormwater runoff from Ritchie Avenue continuously flows towards their houses. There are several areas where homeowners have installed rock swales and other flow diversion methods to prevent water from flooding their homes and yards.

## LID Center Recommendations

The following strategies may be useful for residents looking to address stormwater issues in Study Area 4. A professional contractor should be contacted to determine the best approach to the drainage problem on a specific property.

Residents of Elwyn Ct. and Mississippi Avenue should continue to install overland flow diversion methods to control the runoff coming from the Ritchie Avenue properties. Some of the residents in the area have already implemented vegetated and stone swales. Swales are shallow channels in the ground which create a flow path through the resident's property to the public right-of-way. Due to steep slopes in this area, it is likely that swales may require hardened materials (e.g. stone or concrete) to prevent soil erosion. Berms, which are small ridges typically built from earthen materials, may also be effective in diverting water around a house.

It is important that residents collaborate to address stormwater issues in this area. Elwyn Ct. and Mississippi Avenue residents may need to engage their uphill neighbors on Ritchie Avenue so that they can work together to direct runoff safely to a public roadway. Ritchie Avenue residents may consider installing roof downspout leader pipes that outlet to the curb. Depending on the slopes of the property, the leader pipes may be able to discharge to the curb in front of their property. If a house is downhill of the road, then a downspout leader collection pipe may need to be installed through the downhill neighbor's yard and outlet at the Mississippi Avenue or Elwyn Ct. curb. Ritchie Avenue residents could also use a sump pump to move

stormwater uphill to the road. Any pipes outletting at the curb will require permission from the City. If feasible, Ritchie Avenue residents may also consider land grading, which involves altering the slope of their lawns and paved areas toward the roadway.

# Study Area 5 Report

## Site Visit Summary:

Location: Takoma Park, MD

Study Area: 5

Site Visit Date: 2/8/2023

The LID Center visited study area 5 on 2/8/2023 with the Takoma Park DPW and residents of the affected properties. The city reported that there is a sloped hillside and gulley that brings a lot of water down to Hilltop Rd. The road can get covered with extensive mud during high-volume events and there is standing water on the street after heavy rains. The findings of the site visit are as follows.

The parking lot of 116 Geneva Avenue slopes downhill towards the lower driveway off Geneva Avenue. The back corner of the asphalt parking lot is undermined and in danger of collapsing. The hillside between the parking lot and driveway is badly eroded. There are indications of water channelizing down the hillside from the corner or the driveway. Behind 122 and 124 Geneva Avenue there is a wood retaining wall that is stabilizing the hillside, although there are some areas above it that appear eroded. The driveway near 210 Geneva Avenue slopes down to a gulley between the 207 and 203 Hilltop Avenue houses and the gulley outlets at Hilltop Rd. The gulley does not appear to have any signs of erosion. Hilltop Rd. is flat at the gulley outlet point and there is no storm drain infrastructure to drain the road in this area.

## LID Center Recommendations

Takoma DPW may consider installing an inlet near the gully outflow point on Hilltop Rd. to facilitate drainage of the roadway. The storm drain inlet would require an outflow pipe under the road and to outfall into Sligo Creek. This work would need to be coordinated with M-NCPPC. DPW may also consider installing a curb along Hilltop Avenue to limit hillside erosion and mud washing into the street between Mississippi Avenue and Geneva Avenue.

Residents of Study Area 5 may use several strategies together to address runoff and erosion along the Geneva Avenue driveway. A professional contractor should be consulted to determine the best approach to the drainage problem in this area.

Residents could install swales and private storm drains to convey runoff from the hillside to the gulley. A swale is a shallow channel that concentrates and conveys stormwater. Swales constructed with stone or concrete may be useful to convey water down the hillside without causing further erosion. Storm drain inlets could also be installed at the downhill edge of the

parking lot and along the driveway to collect stormwater that flows down the hill. A storm drain pipe would need to be connected to any inlet and outflow to the gulley between 203 and 207 Hilltop Avenue or to the curb at Geneva Avenue. Collaboration with the uphill parking lot property owner would be necessary to any facilitate drainage improvements on the property.

Residents may also consider installing additional retaining walls with conservation landscaping to stabilize eroded areas of the hillside. Conservation landscaping is the use of planting beds with native deep-rooted plants that creates a more natural vegetative area. This type of landscaping provides improved soil stabilization as compared to grass. Conservation landscaping alone may not be effective, and thus should be used in conjunction with retaining walls. A structural engineer may need to be consulted depending on the extent of the wall design.

# Study Area 6 Report

## Site Visit Summary

Location: Takoma Park, MD

Study Area: 6

Site Visit Date: 2/8/2023

The LID Center visited Study area 6 on 2/8/2023 with the Takoma Park DPW and residents of the affected properties. There are large amounts of runoff coming from a parking lot onto properties along Kennebec Avenue. The findings of the site visit are as follows.

The commercial parking lot near the corner of Flower Avenue and Erie Avenue behind the businesses appears to slope towards the Kennebec private lots. The commercial buildings at the intersection appear to have downspouts in multiple locations around the building. It is possible some of this water would runoff towards the Kennebec Avenue backyards. Residents of 713 and 711 Kennebec Avenue reported significant stormwater runoff 3-4" high flowing across the backyards of 717 to 711 Kennebec Avenue and then flowing over the 711 Kennebec driveway out to the road. There are no storm drain inlets on Erie Avenue and Flower Avenue in this area so the runoff from these roads continues down Kennebec where it can overtop the curb during large storms. Runoff from the road has entered the 713 Kennebec Avenue driveway. According to DPW, the house at 717 Kennebec Avenue was replaced in 2004. The original property had a slab foundation that cracked, possibly due to poor drainage. The new construction required installation of numerous stormwater features including dry wells and underground water storage. Neighbors report ongoing surface runoff originating from the rear of the property, which seems to be from the parking lots behind the adjacent properties on Erie Avenue.

## LID Center Recommendations

Takoma Park DPW should construct a raised driveway apron to prevent runoff from the public right of way flowing onto the 713 Kennebec Avenue driveway. The driveway apron height should match the 6" curb as closely as possible. This work should be coordinated with the resident.

Takoma DPW may consider facilitating a discussion with the commercial property owners regarding runoff from their properties. Drainage from these properties should be directed towards Erie Avenue so that it does not flow onto the Kennebec Avenue residential properties. All roof downspouts should have leader pipes directed to Erie Avenue. If feasible, the parking lot pavement could be regraded to slope towards Erie Avenue. The commercial lot owners could also install private storm drains to collect runoff along the back edge of their properties. The

storm drains may be able to go through the residential properties and outlet at the Kennebec Avenue curb or connect into a new residential private storm drain system. This type of drainage system would require collaboration between residents and commercial property owners.

The following strategies may be useful for residents looking to address stormwater issues in Study Area 6. A professional contractor should be contacted to determine the best approach to the drainage problem in this area.

The residents along 711-721 Kennebec Avenue can utilize swales or berms to mitigate the runoff flowing from the Flower Avenue & Erie Avenue properties. Swales and berms are two drainage strategies which direct runoff safely through a property and into the public right-of-way. A swale is a shallow channel that concentrates and conveys stormwater. A vegetated swale may be preferable in this area to provide increased water infiltration. Berms are small ridges typically built from earthen materials. Berms act as a barrier to keep water flowing along a desirable path. To assure overland flow paths work effectively, they must always maintain a consistent downhill slope in the desired direction.

Residents may also consider installing private storm drain systems in conjunction with overland flow paths. Private storm drains systems consist of pipes and inlets intended to drain water from the surface and direct it to the roadway or a public storm drain. Any connection into public right of way requires permission from the city. In this area a multi-property private storm drain system may be more effective than individual property storm drains. This cross-property drainage strategy will require coordination between neighboring residents.

# Study Area 7 Report

## Site Visit Summary

Location: Takoma Park, MD

Study Area: 7

Site Visit Date: 1/30/2023

The LID Center visited study area 7 on 1/30/2023 with the Takoma Park DPW and residents of the affected properties. There are reports of flooding on private properties. The findings of the site visit are as follows.

The houses along the west side of Jackson Avenue from Boyd Avenue to Lincoln Avenue experience stormwater runoff flooding and consistent groundwater seepage flows. The stormwater flows downhill from Boyd Avenue and in large storms overtops the driveway apron of 334 Boyd Avenue and continues through the backyards along the 7400 block of Jackson Avenue. The city installed a 5' curb inlet downhill of the 334 Boyd Avenue driveway to better drain the road in this area. The block also receives lots of runoff from the uphill Boyd Avenue properties due to the steep slopes of the surrounding area. The residents have reported groundwater in multiple spots along the block as well. This creates consistent wetness in yards and low flow of water runoff downhill. The wetness compounds the surface stormwater issue by preventing infiltration of rainfall. According to the City, there are small drain pipes installed by private property owners that connect into the storm drain main on Jackson Avenue but they do not seem to be helping to drain the Jackson Avenue lots effectively and may be clogged or collapsed. The private storm drains were not able to be observed during this field visit.

Additionally, residents and city reported considerable runoff from the Mar Thoma Church parking lot onto Jackson-Boyd Park and the 349 Boyd Avenue property. There is a concrete swale at the top of the park that was built to intercept the parking lot runoff, but according to residents it is not particularly effective. The city is developing a plan to build an inlet near the swale and connect it to the nearest storm drain pipe.

## LID Center Recommendations

Takoma Park DPW plans to install an inlet at the end of the concrete swale and pipe it to the nearest storm drain inlet near the top side of the Jackson Boyd playground. This should reduce runoff through Jackson-Boyd Park. DPW may also consider working with the church property owners to address the runoff from the parking lot directly. A public storm drain inlet could be installed directly adjacent to the property line and allow for the church owners to regrade the pavement towards the inlet or install a private inlet and pipe connected into the public inlet.

To improve conditions on the even side of the 7400 block of Jackson Avenue, DPW could raise the driveway apron of 334 Boyd Avenue to prevent roadway runoff from flowing down the driveway during large storms. This work should be coordinated with the resident.

The following strategies may be useful for residents looking to address drainage issues in Study Area 7. Collaboration between uphill and downhill neighbors will increase the effectiveness of any drainage control practice. A professional contractor should be contacted to determine the best approach to the drainage problem on a specific property.

Conservation landscaping and tree planting may be used to reduce yard wetness. Conservation landscaping is the use of planting beds designed to create a more natural vegetative area. Wet areas of a yard may be converted into conservation landscape areas and planted only with native species adapted to wet conditions. This type of landscaping provides improved infiltration and water uptake as compared to grass. Additionally, tree planting functions similarly to soak up excess groundwater.

French drains may be used to reduce groundwater seepages in this area. French drain systems comprise a perforated underdrain pipe within a gravel trench. The area on top of the gravel trench can be covered with topsoil and grass so that the system is not visible in the yard. The French drain would be placed in the area where there is groundwater seeping to the surface. The underdrain pipe should outflow to the public right of way curb or connect into the public storm drain if possible. Permission from the City of Takoma Park is required for these connections. The underdrain can outflow to another area of the yard as long as it is not directly towards another property; however, this method is not preferable.

To mitigate stormwater runoff through the backyards of Jackson Avenue, residents may consider installing swales or berms to safely convey surface flow through a property. Swales are small channels in the ground, that can be vegetated or covered in stone or concrete. Berms are small ridges, typically made from earthen materials, intended to keep runoff from flowing into undesirable areas. Residents may also consider maintenance of any of their existing private storm drains or installing new private storm drain systems. Any connection into public right of way requires permission from the city.

# Study Area 8 Report

## Site Visit Summary

Location: Takoma Park, MD

Study Area: 8

Site Visit Date: 1/30/2023

The LID Center visited study area 8 on 1/30/2023 with the Takoma Park DPW and residents of the affected properties. There are reports of flooding on private properties. The findings of the site visit are as follows.

The houses along the east side of Jackson Avenue from Boyd Avenue to Lincoln Avenue experience stormwater runoff flooding and consistent groundwater seepage flows. The stormwater flows downhill from Aspen Avenue and Boyd Avenue lots and continues downhill along the entire block. The residents reported groundwater springs in multiple spots along the block as well. This creates consistent wetness in yards and low flow of water runoff downhill. The wetness compounds the stormwater issue by preventing infiltration of stormwater runoff. According to the City, there is an old clay private drainpipe along the backyards of the entire block that connects into the storm drain system manhole near the 7411 Jackson Avenue property. The terracotta clay pipe is thought to be broken, collapsed, or blocked by sediment in several locations throughout its length through the backyards. The pipe was not able to be observed.

## LID Center Recommendations

The following strategies may be useful for residents looking to address drainage issues in Study Area 8. Collaboration between uphill and downhill neighbors will increase the effectiveness of any drainage control practice. A professional contractor should be contacted to determine the best approach to the drainage problem on a specific property.

Jackson Avenue residents should consider a maintenance project to repair and upgrade the existing private storm drain. Takoma Park DPW may want to encourage residents to pursue this project. Coordination between neighboring residents will be required. A professional contractor should be consulted to evaluate the condition of the pipe and the extent of the repairs needed as well as any modifications that may be beneficial to create an effective and sustainable drainage system. Additional inlets or trench drains as well as lawn grading may improve drainage.

Conservation landscaping and tree planting may be used to reduce yard wetness. Conservation landscaping is the use of planting beds designed to create a more natural vegetative area. Wet

areas of a yard may be converted into conservation landscape areas and planted only with native species adapted to wet conditions. This type of landscaping provides improved infiltration and water uptake as compared to grass. Additionally, tree planting functions similarly to soak up excess groundwater.

French drains may be used to reduce groundwater seepages in this area. French drain systems comprise a perforated underdrain pipe within a gravel trench. The area on top of the gravel trench can be covered with topsoil and grass so that the system is not visible in the yard. The French drain would be placed in the area where there is groundwater seeping to the surface. The underdrain pipe should outflow to the public right of way curb or connect into the public storm drain if possible. Permission from the City of Takoma Park is required for these connections. The underdrain can outflow to another area of the yard as long as it is not directly towards another property; however, this method is not preferable.

## Study Area 9 Report

### Site Visit Summary

Location: Takoma Park, MD

Study Area: 9

Site Visit Date: 2/8/2023

The LID Center visited study area 9 on 2/8/2023 with the Takoma Park DPW and residents of the affected properties. There are reports of underground springs in backyard of Carroll Avenue houses leading to drainage issues for Davis Avenue houses. The findings of the site visit are as follows.

There were no clear signs of flooding or drainage issues in this area. The City has not had any recent communication with the current homeowners. Initial reports of backyard flooding and groundwater springs occurred many years ago.

### Recommendations

No Recommendations.

# Study Area 10 Report

## Site Visit Summary

Location: Takoma Park, MD

Study Area: 10

Site Visit Date: 2/8/2023

The LID Center visited study area 10 on 2/8/2023 with the Takoma Park DPW and residents of the affected properties. There are reports of runoff flowing onto the paper street dead end of Davis Avenue and Jackson Avenue, eroding the surface along the hill. The findings of the site visit are as follows.

The grading of the intersection of Davis Avenue and Garland Avenue slopes down towards the paper street driveway adjacent to the 7309 property. The driveway slopes directly downhill from the road so any runoff from the road flows down the driveway. The residents reported large flows of water flowing down the driveway creating erosion and flooding problems. The 7309 Garland Avenue property owner installed a rock swale and amended the bottom of the driveway with a curb to divert driveway runoff into this swale. The swale runs to the end of the paper street until it reaches MNCPPC property near the Long Branch Stream.

## LID Center Recommendations

Takoma Park DPW should consider constructing a raised driveway apron to prevent runoff from Garland Avenue flowing down the driveway. The driveway apron height should match the 6" curb as closely as possible. A portion of the paper street driveway would need to be regraded to match the apron elevation. Additionally, DPW could regrade the Davis Avenue and Garland Avenue intersection in order to direct water southeast along Garland Avenue. A valley gutter across Davis Avenue could facilitate flow in this direction and would limit the amount of asphalt that would require replacement. A topographical survey should be done to determine the existing grades at the intersection prior to any construction.

# Study Area 11 Report

## Site Visit Summary

Location: Takoma Park, MD

Study Area: 11

Site Visit Date: 1/30/2023

The LID Center visited study area 11 on 1/30/2023 with the Takoma Park DPW and residents of the affected properties. In this area runoff from surrounding properties concentrates into the backyards on Larch resulting in standing water and wet yards. There is a private clay pipe with some small openings in several yards that discharges out to the nearby stream. The findings of the site visit are as follows.

The houses along the north side of Larch Avenue from Lincoln Avenue to Hayward Avenue experience stormwater runoff flooding and consistent groundwater seepage flows. The stormwater flows downhill from Lincoln Avenue and Colby Avenue lots and continues downhill along the entire block. The residents reported groundwater springs in multiple spots along the block as well. This creates consistent wetness in yards and low flow of water runoff downhill. The wetness compounds the stormwater issue by preventing infiltration of stormwater runoff. According to the city, there is an old clay private drain pipe along the backyards of 806 to 812 Larch Avenue. There is a grate inlet in poor condition in the 812 Larch Avenue backyard. This inlet seems to be an inflow point for the clay pipe, but this could not be confirmed. Water is seeping up from the inlet and creating a small stream flow along the 812 house. This water could present a hazard to the structural foundation of the house. The water continues downhill and dries up once it gets to the property line. There is a small PVC drain outlet near the sidewalk along the stream, but it is unclear if this is from the clay pipe or not. There is a restored stream area adjacent to the 812 property where there are multiple small PVC drain pipe outlets. There is believed to be a perforated PVC pipe from the property at 812 Larch to the Hayward stream outfall. The city has indicated it is willing to allow for private drain outlets to the stream.

## LID Center Recommendations

The following strategies may be useful for residents looking to address drainage issues in Study Area 11. Collaboration between uphill and downhill neighbors will increase the effectiveness of any drainage control practice. A professional contractor should be contacted to determine the best approach to the drainage problem on a specific property.

Larch Avenue residents should consider a maintenance project to repair and upgrade the existing private storm drain. Coordination between neighboring residents would be required because the system spans multiple properties. Additional inlets and lawn grading can reduce

flooding through the backyards. Takoma Park DPW should encourage residents in this effort and provide necessary resources for an outfall into the stream valley. A professional contractor should be consulted to evaluate the condition of the pipe and the extent of the repairs needed as well as any upgrades that may be beneficial.

Conservation landscaping and tree planting may be used to reduce yard wetness. Conservation landscaping is the use of planting beds designed to create a more natural vegetative area. Wet areas of a yard may be converted into conservation landscape areas and planted only with native species adapted to wet conditions. This type of landscaping provides improved infiltration and water uptake as compared to grass. Additionally, tree planting functions similarly to soak up excess groundwater.

French drains may be used to reduce groundwater seepages in this area. French drain systems comprise a perforated underdrain pipe within a gravel trench. The area on top of the gravel trench can be covered with topsoil and grass so that the system is not visible in the yard. The French drain would be placed in the area where there is groundwater seeping to the surface. The underdrain pipe should outflow to the public right of way curb or connect into the public storm drain if possible. Permission from the City of Takoma Park is required for these connections. The underdrain can outflow to another area of the yard as long as it is not directly towards another property; however, this method is not preferable.

# Study Area 12 Report

## Site Visit Summary

Location: Takoma Park, MD

Study Area: 12

Site Visit Date: 1/30/2023

The LID Center visited study area 12 on 1/30/2023 with the Takoma Park DPW. There is ponding that occurs in a yard on Devonshire based on the topography of the area. There is also a lot of underground water surfacing in the area. The findings of the site visit are as follows.

There is a low-lying wetland area on the undeveloped lower lot of the 703 Devonshire Avenue double lot property. There is a grate inlet with a non-standard cover that does not appear to properly drain the area. According to the city, the inlet does have an outflow pipe that connects to the public storm drain system along the road. There appeared to be a small spring emerging from the hillside near 706 Auburn Avenue backyard and forming a small stream downhill to the wetlands area. The 703 house is under construction and the yard appears to be wet and contributing to some runoff towards the wetlands area. It was unclear if the runoff from the 703 lot is related to the construction or not. The 707 Devonshire Avenue property has reported yard and basement flooding. There is very little elevation change from the wetlands area to the 707 house. According to the city, many homeowners in this area have installed sump pumps. This area appears to function as a wetland and drainage could be enhanced. The City could consider approaching the property owner of the undeveloped lot to discuss possible improvements to enable more storage and recharge.

## LID Center Recommendations

Takoma Park DPW may consider facilitating a drainage improvement project on the double lot of 703 Devonshire Rd. The grate inlet should be replaced with a functional inlet and the surrounding area should be graded appropriately. Conversion of the low-lying area into a wetlands BMP could also be useful to reduce flooding in the area.

The following strategies may be useful for residents looking to address drainage issues in Study Area 12. A professional contractor should be contacted to determine the best approach to the drainage problem on a specific property.

French drains can help reduce groundwater impacts in this area. French drain systems are comprised of a perforated underdrain pipe within a gravel trench. The area on top of the gravel trench can be covered with topsoil and grass so that the system is not visible in the yard. The French drain would be placed in the area where there is groundwater seeping to the surface.

The underdrain pipe should outflow to the public right of way curb or connect into the public storm drain if possible. Permission from the City of Takoma Park is required for these connections. The underdrain can outflow to another area of the yard as long as it is not directly towards another property; however, this method is not preferable. Due to the particularly high groundwater in this area, French drains alone may not resolve the problem. In order to prevent groundwater intrusion into the basement of the 707 Devonshire Avenue property and other surrounding properties with similar issues, residents should install exterior waterproofing membranes around their home's foundation. Basement sump pumps connected into to the public storm drain system may also be necessary if not already in place.

Conservation landscaping and tree planting may also be used to reduce yard wetness. Conservation landscaping is the use of planting beds designed to create a more natural vegetative area. Wet areas of a yard may be converted into conservation landscape areas and planted only with native species adapted to wet conditions. This type of landscaping provides improved infiltration and water uptake as compared to grass. Additionally, tree planting can also reduce yard wetness as the roots can soak up a large amount of water from the ground.

# Study Area 13 Report

## Site Visit Summary

Location: Takoma Park, MD

Study Area: 13

Site Visit Date: 1/23/2023

The LID Center visited study flood area 13 on 1/23/2023 with the Takoma Park DPW and residents of the affected properties. Runoff from the uphill properties inundate the downstream properties. The city has installed additional inlets and pipes in the intersection at Elm & Prince Georges to capture street flow that used to pond on the street. The findings of the site visit are as follows.

There is a 15" pipe outfall in the backyard of 6913 Prince George's Avenue. This originates from an inlet along the driveway of 6917 Prince George's Avenue property. A rock swale goes from the outfall through the backyards of 6913 and 6911 lots. This swale appears to be limiting any flooding and erosion for these properties. There were many dead trees observed in the 6903 and 6905 Prince Georges Avenue backyards. Downhill of the swale, the water continues to flow through backyards and eventually out 600 Elm Avenue lot where the city has observed water flowing over the property's brick retaining wall into the public right-of-way. There is GIS record of an inlet on the 6903 property that connects to the public system, but this could not be observed. It is also in line with the swale. Given the reports of flooding downhill from the inlet it is likely that this inlet is not functional.

## LID Center Recommendations

Takoma Park DPW may consider investigating the publicly maintained inlet in the 6903 backyard to determine if it is properly draining the area. The inlet should be sufficient to drain the area and limit runoff through any other properties.

Residents of Prince George's Avenue may consider extending the rock swale though downhill backyards so that the water can outflow near the public right of way rather than into another resident's yard. Neighbor collaboration would be necessary to continue the swale project. The swale can be extended to the public inlet in the 6903 backyard if the inlet is functional or out to Elm Avenue if it cannot be used.

# Study Area 14 Report

## Site Visit Summary

Location: Takoma Park, MD

Study Area: 14

Site Visit Date: 1/23/2023

The LID Center visited flood area 14 on 1/23/2023 with the Takoma Park DPW and residents of the affected properties. A stream channel ends in a few inlets behind the two houses and there is a high water levels during heavy rain events. The findings of the site visit are as follows.

There is a small stream that flows into the public storm drain system behind the 514 Elm Avenue house. The inflow point for the stream is a 24" VCP pipe that appears to have limited capacity for when the stream levels rise. This could create a choke point that would result in the stream overflowing and flooding the downhill areas. There is also a small culvert bridge over the stream about 10 feet from the inflow to storm drain pipe. This is another choke point that would restrict flow and cause overflow. The stream banks are eroding very close to the 514 Elm Avenue deck. The 512 Elm Avenue property has the low point of the entire area and has reports of high flood levels during large storms. There is a public inlet on their property that seems to be functional. According to the Takoma Park DPW, the inflow for the inlet is a 30" box culvert and the outflow is 30" circular pipe. Additionally, the residents of 515-519 Elm Avenue, along the south side of the road, have experienced overflow flooding from road runoff collecting at the Elm Avenue sump. The inlets appear to be functional, so there is likely a capacity limitation with the storm drain pipes in the area. According to the GIS data, the inlet on the south side of the Elm Avenue low point has an inflow pipe that is 42" and an outflow pipe that is 36". This condition should be field confirmed.

## LID Center Recommendations

Takoma Park DPW may consider a few improvements to the existing storm drain infrastructure in this area. At the stream inflow point, a standard headwall and upsized pipe could be installed to limit stream overflow onto the surface of the adjacent properties. Additionally, it may be beneficial to raise the small walking bridge over the stream in order to limit flow restriction when the stream levels rise. All work in this area would need to be coordinated with the property owners. Takoma Park DPW may also consider upsizing the inlets at the low point to limit ponding in the road during large storms. Additional uphill inlets to the west of the Elm Avenue low point could also be beneficial to reduce roadway flooding. Driveway aprons may need to be raised if residents voice concerns about overflow from the road.

Takoma Park DPW may also consider evaluating the storm main from the stream inflow point to the connection with the Prince George's Avenue main. Condition and capacity should be assessed to determine if any upgrades are needed. Pipe sizes should be field verified. Any downstream pipe that is smaller than an upstream pipe should be upsized accordingly. any decrease in pipe sizes at a junction should

# Study Area 15 Report

## Site Visit Summary

Location: Takoma Park, MD

Study Area: 15

Site Visit Date: 1/23/2023

The LID Center visited study area 15 on 1/23/2023 with the Takoma Park DPW and residents of the affected properties. There are wet backyards and lots of subsurface water as well as runoff in rain events. This drains to a City-owned area at the corner of Circle and Prince Georges. The City has done extensive work there to create a catchment basin to receive the piped stormwater flow from the entire area above. The findings of the site visit are as follows.

There were reports from residents of springs in backyards along Elm Avenue although these could not be observed. This creates consistently wet yards and prevents infiltration so that any rain event will cause excessive runoff. The 517 Elm Avenue property has installed a rock swale with an underdrain through their yard and the underdrain has connections from other nearby homeowners' downspouts and sump pumps. The water continues to flow through the backyards towards a small channel near the corner of the 519 lot. There are many small drain pipe outlets near this channel, including the rock swale underdrain pipe. The channel continues in the public area and into a low area with a small pond type BMP near the intersection of Prince George's Avenue and Circle Avenue. There is a 24" pipe inflow from the Prince George's Avenue inlets. The BMP appears to be functional and there are no reports of this area flooding. There is a grate inlet for overflow that appear to be in good condition.

## LID Center Recommendations

The residents in study area 15 can use several of the following strategies to address drainage issues in the backyards. A professional contractor should be contacted to determine the best approach to the drainage problem on a specific property.

Residents may consider working collaboratively to extend the rock swale uphill and downhill along the backyard property lines to better convey outflow from the existing underdrain and many roof leaders to the public BMP at Prince George's Avenue and Circle Avenue. Additionally, the existing French drain type system on the 517 property should be monitored and maintained as needed to continue effective groundwater and stormwater drainage. The underdrain pipe could be replaced with a larger pipe if groundwater problems remain a concern for residents in the area. Additionally, French drains could be installed on other properties and outflow to the backyard swale as well.

Conservation landscaping and tree planting may be used to further reduce yard wetness. Conservation landscaping is the use of planting beds designed to create a more natural vegetative area. Wet areas of a yard may be converted into conservation landscape areas and planted only with native species adapted to wet conditions. This type of landscaping provides improved infiltration and water uptake as compared to grass. Additionally, tree planting can also reduce yard wetness as the roots can soak up a large amount of water from the ground.

# Study Area 16 Report

## Site Visit Summary

Location: Takoma Park, MD

Study Area: 16

Site Visit Date: 1/23/2023

The LID Center visited flood area 16 on 1/23/2023 with the Takoma Park DPW and residents of the affected properties. This area receives a lot of water from the backyards of the properties on Sycamore as well as lots of water down Poplar. The City recently replaced a failed pipe and added inlets at the last 3 houses on Poplar Avenue near Elm Avenue and also put in a back curb and raised a driveway on Poplar to catch run-off and bring it out to the street to an adjacent inlet and of the street. The findings of the site visit are as follows.

There are a series of new inlets and a swale installed by the city in the low-lying area backyards of 7001-7009 Poplar Avenue where there was frequent flooding. These inlets appear to be to provide proper drainage for the area. There is also a new curb along the 7013 driveway that will direct runoff from uphill properties towards the road and further prevent runoff into the low-lying area. The inlets along the road appear to be in good condition and there are no reports of storm drain capacity issues in the immediate area. There are reports of road runoff spilling into the 7001-7009 driveways. The driveway aprons of these properties slope down from the road such that large storms could easily create runoff flowing from public to private property. Poplar Avenue is situated in a stream valley with steep slopes on either side so there will likely continue to be large volumes of runoff from the surrounding properties.

## LID Center Recommendations

Takoma Park DPW has done extensive work to upgrade storm drain infrastructure through the backyards of the Poplar Avenue lots. DPW should monitor the area and take any necessary action if any flooding persists. DPW should consider raising the elevation of the sidewalk, curb and driveway aprons in front of 7001-7009 Poplar Avenue to limit overflow of roadway runoff onto residential properties. Additionally, the inlets on the south end of the block should be evaluated for enlargement to allow for better roadway drainage during large storms.

## Study Area 17 Report

### Site Visit Summary

Location: Takoma Park, MD

Flood Area: 17

Site Visit Date: 1/20/2023

The LID Center visited flood area 17 on 1/20/2023 with the Takoma Park DPW and residents of the affected properties. There is excessive flooding at the low point of Spring Avenue. The findings of the site visit are as follows.

The residents reported that runoff often overflows the inlets at the sump of Spring Avenue and flows onto private property. This mainly occurs onto the 213 Spring Avenue driveway where it creates a flooding hazard on the property. The water flows down the driveway and towards the stream outfall behind the 211 property. The outfall into the stream is a 48" x 60" culvert which conveys runoff from about 22.5 acres and was sized for the 10-yr storm according to DPW. The stream at the outfall appears to be in good condition. There was a stream restoration project previously done that appears to have been a great benefit for the area. It is important to note that Spring Avenue sits at the bottom of a stream valley; the same one that is along Poplar Avenue. Residents also reported runoff coming from the Montessori school parking lot and through Spring Park although this could not be confirmed through field observations.

### LID Center Recommendations

Takoma Park DPW may consider a drainage improvement resiliency project along Poplar Avenue to address flooding concerns in and around Study Area 17. Refer to Project #2 in Appendix A for details. Additional resiliency projects in other areas of the Takoma Branch watershed may further alleviate flooding in Study Area 17. See Appendix A for a list of all proposed resiliency projects. Takoma Park DPW may also consider further upgrades to the inlets at the low point of Spring Avenue to improve roadway drainage.

# Study Area 18 Report

## Site Visit Summary

Location: Takoma Park, MD

Flood Area: 18

Site Visit Date: 1/20/2023

The LID Center visited flood area 18 on 1/20/2023 with the Takoma Park DPW and residents of the affected properties. There is excessive flooding at the low point of Circle Avenue between Poplar Avenue and Cockerille Avenue. The findings of the site visit are as follows.

The stream from the outfall at Spring Avenue continues behind private properties and into a 48" inflow pipe near 316 Circle Avenue. The pipe appears to be relatively small for the stream size and may be susceptible to restricting larger flows. The residents and DPW reported that the inflow does overflow and causes the stream to surcharge the pipe above ground onto the low-lying area adjacent to 316 Circle Avenue and the open WSSC lot. Previously runoff would overflow to Circle Avenue and continue through private properties to 4<sup>th</sup> Avenue until DPW installed a curb along the north side of Circle Avenue to limit the water from flowing out. There is still some outflow from this area so a small culvert type pipe was installed under the Circle Avenue dead end connection walkway. There is a small non-standard inlet at the low point of Circle Avenue that is blocked with debris. This inlet often overflows and, along with the culvert, results in overflow flooding continuing behind the 6507 and 6505 Cockerille Avenue properties according to residents and DPW officials. Additionally, road runoff often spills over the 307 Circle Avenue driveway and contributes further to the flooding behind the 307 Circle Avenue and 6507 and 6505 Cockerille Avenue houses. A manhole on the WSSC lots near the low-lying area is where two branches of the storm drain systems from 2<sup>nd</sup> Avenue and Spring Avenue stream combine. The flooding problems occurring in Area 18 are associated with similar problems in Areas 17 and 19.

## LID Center Recommendations

Takoma Park DPW may consider three resiliency projects to address flooding concerns in and around Study Area 18. Refer to Appendix A for details on each project.

- Project #1 - The Circle Woods stream inflow pipe can be replaced with a larger culvert to limit stream overflow. A wetlands BMP can be built in the open grass space to collect any overflow runoff from the area and provide stormwater storage.
- Project #2 - A small-scale drainage improvement project on Circle Avenue can reduce surface flooding of the surrounding properties.

- Project #3 - A BMP and underground storage system can be installed under Lake St. to increase the capacity of the overall storm drain system and limit downstream flooding.

Additional resiliency projects in other areas of the Takoma Branch watershed may further alleviate flooding in Study Area 18. See Appendix A for a list of all proposed resiliency projects.

# Study Area 19 Report

## Site Visit Summary

Location: Takoma Park, MD

Flood Area: 19

Site Visit Date: 1/20/2023

The LID Center visited flood area 19 on 1/20/2023 with the Takoma Park DPW and residents of the affected properties. There is flooding in this area due to volumes beyond the capacity of the storm drain system. The findings of the site visit are as follows.

The piped stream from Circle Avenue continues to 4<sup>th</sup> Avenue where it combines with another piped stream. This is the bottom of the Takoma Branch storm drain system. According to city provided GIS data, a 6.5'x4' culvert combines with a 7'x4' culvert into a 6.5'x4' culvert. The piped stream outfalls behind 4<sup>th</sup> Avenue into Takoma Branch as a 12'x4' culvert. During large storms there is overland flow from the Circle Avenue area through residential backyards and also down 4<sup>th</sup> Avenue from the west. Large volumes of water flood the sump of 4<sup>th</sup> Avenue and overflow onto adjacent properties including the 6505, 6509, and 6515 4<sup>th</sup> Avenue. The flooding here seems to be due to a mix of general location, pipe capacity limitations, and uphill storm drain inflow deficiencies.

## LID Center Recommendations

Takoma Park DPW may consider three resiliency projects to address flooding concerns in and around Study Area 19. Refer to Appendix A for details on each project.

- Project #2 - A small-scale drainage improvement project on Poplar Avenue and Circle Avenue can reduce runoff downhill to 4<sup>th</sup> Avenue.
- Project #6 - A drainage improvement project on the VFW parking lot can decrease flooding at 4<sup>th</sup> Avenue. DPW would need to engage the property owners to initiate the project.
- Project #7 - A green street project along Orchard Avenue and Sligo Mill Overlook Park can reduce runoff to 4<sup>th</sup> Avenue.

Additional resiliency projects in other areas of the Takoma Branch watershed may further alleviate flooding in Study Area 19. See Appendix A for a list of all proposed resiliency projects.

# Study Area 20 Report

## Site Visit Summary

Location: Takoma Park, MD

Study Area: 20

Site Visit Date: 1/20/2023

The LID Center visited flood area 20 on 1/20/2023 with the Takoma Park DPW and residents of the affected properties. The findings of the site visit are as follows.

This location has experienced rapid flooding during high volume storm events that have resulted in water levels of 18 to 24 inches collecting at the low point of the 2<sup>nd</sup> Avenue between Westmoreland Avenue and Alleghany Avenue. This has created a hazard for vehicles parked along the street or driving through during a high volume rain event. The storm drain pipes in this area do not seem to have capacity to convey large storm events. Flow from Alleghany will often bypass the inlets and flow onto 2<sup>nd</sup> Avenue according to residents. There are multiple features of the storm drain structures and pipes in this area that may be causing head losses and as a result contributing to flooding. The manhole between the 2<sup>nd</sup> Avenue inlets use to “pop up” during large storms, indicating head loss in the pipe system. The manhole cover was replaced with a grate top, so it no longer pops up. The inlet on the south side of 2<sup>nd</sup> Avenue has two outflow pipes. One old 48” pipe is under private property and a newer pipe goes along 2<sup>nd</sup> Avenue towards Alleghany Avenue with a sharp bend. There is a weir wall in the inlet to divert flow towards the public 24” storm drain. The weir wall may be causing head loss within the inlet. According to the DPW the pipe under the private properties also has a non-standard bend. This could be causing head loss as well. The storm drain system from this area combines with the piped stream at Circle Avenue further downstream. The entire system seems to be undersized for large storms.

## LID Center Recommendations

Takoma Park DPW may consider an inlet improvement resiliency project to address flooding concerns in and around Study Area 20. Refer to Project 4 in Appendix A for details.