Town of Meridian Hills
Drainage Study Report

Prepared for:
Town of Meridian Hills

Prepared by:
The Schneider Corporation
Project No. 4918.002

July 12, 2004

Background

The Town of Meridian Hills has experienced a number of drainage and erosion problems at various locations within the town limits. Standing water at nine problem areas were identified by the Town. They are:

1. 71st Street and Williams Creek Drive: One of three reported problem areas for drainage.

2. 73rd Street and Williams Creek Drive: Standing water occurs on a portion of the street. A stone road exists as well within the town right-of-way.

3. 730 Sherwood: The drainage problems appear at this location.

4. 7520 Morningside: This area has been a focus of past drainage work, but standing water and flooding continue to occur on a somewhat regular basis.

5. Penn Ridge and Washington: Improvements to area with an additional home may be causing backups within the drainage way.

6. 7200 North Pennsylvania: Icy road conditions occur during the winter creating a road hazard.

7. SE corner of 75th Street and Illinois Street: Water ponds at this corner and the ditches south of the area have been enclosed.

8. 7975 North Illinois Street: A box culvert has collapsed and is causing erosion that undermines additional sections of the culvert and threatens the guardrail and portions of Illinois Street.

9. 7401 Holiday Drive East: Two problems exist at this location. There is significant standing water in the drainage way, and a pipe has plugged behind a house.

The Town of Meridian Hills retained the Schneider Corporation to conduct a drainage study for planning purposes. The drainage study is intended to assess the identified drainage problems and to estimate the probable cost of addressing them.

The drainage study consists of two parts: The first part is a drainage basin characterization that examines general drainage characteristics in the Town and immediately adjacent areas. It provides the proper context for problem assessment. The second part consists of site-specific recommendations and associated cost for each of the identified drainage problems. A tabulated summary of the cost estimates is included at the end of the report.

Drainage Basin Characterization

GIS data for the Town of Meridian Hills, available from the City of Indianapolis, was used to determine general drainage patterns and drainage areas in the town and immediately adjacent areas. A drainage area map including drainage divides and drainage patterns was prepared. Drainage Basins A through H were identified. The basins were further divided into smaller areas as needed for closer examination of the nine identified drainage problems. The locations of drainage problem areas are shown on the drainage map. For planning and initial assessment purposes, the acreage and runoff coefficients, as well as estimates of surface flow at various locations of interest are included on the map. They were estimated using the City of Indianapolis standards.

The drainage areas may fall under one or more of the following categories described below:

Well Drained

These are areas with generally moderate to steep slopes with adequate topographic relief for good surface drainage as well as gravity storm sewers and emergency overflow. Erosion problems are often encountered, especially near areas of abrupt flow changes such as stream bends, pipe outlets and roadway culverts.

Poorly Drained

These areas are mostly flat with little topographic relief, poor surface drainage, inadequate outlets, and/or lack of access to an engineered drainage system. Periodic drainage and flooding problems are generally due to poor drainage. Standing water problems in those areas are common, and most can be addressed with site-specific grading and additional inlets and storm sewers.

Floodplain

These areas are subject to inundation from a major stream or river, although not frequently. A local, but impractical remedy to prevent inundation of this area is to raise it through the placement of fill. A regional solution involving changes in the entire upstream watershed may theoretically be possible, but it is not realistic. Local drainage can sometimes be improved to reduce the duration of inundation and to allow standing water to drain as soon as flood levels in the flooding source recede.

Direct Flow

These are relatively small areas adjacent to a well defined waterway and they generally drain directly to the waterway with little or no public storm drainage infrastructure. Drainage problems encountered in those areas are generally addressed by individual property owners.

Off-site Areas

These areas are mostly outside the town limits, but the outlet is geographically located within the town limits. Flow from these areas must be accommodated by the town's drainage system as it can potentially cause erosion and drainage problems in the town.

Following is a brief description of drainage basins A through H, as well as drainage areas I and J.

Drainage Basin A

Basin A was divided into Area A1 within town limits and area A2 outside town limits. A1 can be considered Well Drained. It drains south through existing storm sewers and surface flow to an unnamed tributary of the White River in Area A2. None of the nine identified drainage problems are located in Basin A.

Drainage Basin B

Basin B can be considered Well Drained. This area is entirely within town limits and is bisected by Meridian Street. It includes portion of a golf course and drains to the White River through a combination of surface flow and storm sewers. None of the nine identified drainage problems are in Basin B.

Drainage Basin C

Basin C is the largest basin and includes seven of the nine identified drainage problems. It was divided into Areas C1-C8 to allow for closer examination of the identified problems. Except for Area C4 which contains the majority of the golf course, most of the basin if fully developed with moderate to steep slopes. Stormwater conveyance is provided through a combination of storm sewers and surface flow. Areas C1, C2, C3, C5 and C6 are generally Well Drained. Problem #9 is in Area C1. Problems # 5 and 7 are in Area C2. And problem #6 is in Area C5. Area C4 is partly Off-site, with the golf course appearing to be Well-Drained. Area C7 includes flat areas in the open fields that may be Poorly Drained. Area C8 is a mix of small Well Drained and Poorly Drained areas. Most of C8 is also Floodplain. Problems #1, 2 and 3 are in this Area.

Drainage Basin D

Basin D is generally Well Drained. It includes identified drainage problem # 4. It was divided into Areas D1 and D2 to allow for closer examination of the identified problem.

Drainage Basin E

More than half of this basin is west of the town limits and drains east to a tributary to Williams Creek within the town. Areas E1 through E4 are mostly Off-site. The portion within town limits is Well Drained. Areas E5 and E6 are completely within the town limits are also generally Well Drained. Problem #8 is in Area E6 near the outlet of the entire basin.

Drainage Basin F
This Basin is mostly within town limits. It is bisected by Meridian Street and Williams Creek. Basin F is generally Well Drained. Moderate to steep slopes with storm sewer along the road appear to provide adequate drainage. None of the nine identified drainage problems are in Basin F.

Drainage Basin G
Most of this basin is Off-site in Area G3 outside town limits. G3 drains directly to Williams Creek near the town's north limit. The remaining smaller areas G1 and G2 are primarily Direct Flow areas that drain to Williams Creek through surface flow within the town. Parts of G1 and G2 are also Poorly Drained and Floodplain. None of the nine identified drainage problems are in Basin G.

Drainage Basin H
Area H is a Direct Flow area that drains directly to Williams Creek primarily through surface flow. The developed portion of this area is generally Well Drained with steeps slopes and adequate relief for drainage. The undeveloped area is primarily Poorly Drained and Floodplain. None of the nine identified drainage problems are in Area H.

Drainage Area I
Area I is a small Direct Flow area that drain away from the town into the river. None of the nine identified drainage problems are in Areas I1-I4.

Drainage Area J
Area J consists of small areas on the fringes of the town that are situated near the drainage divide. They drain away from the town into the existing drainage system outside the Town. None of the nine identified drainage problems are in Area J.

The planning information is used to guide the evaluation of individual drainage problems. Although the problems manifest as standing water or erosion, their causes and potential solutions can be significantly different. The planning information and characteristics of the drainage basins provide the engineer with basic data regarding potential sources of the drainage problem, general conditions that may have contributed to the problem, and opportunities for appropriate solutions. For example, standing water that occurs near the drainage divide is most likely caused by a local drainage problem. Conversely, standing water near the outlet of a large drainage area may be caused by excess runoff volumes generated upstream.

The planning information includes a delineation of drainage divides and identification of flow direction and drainage basins that contribute runoff to the town’s drainage system. Some basins are further divided into drainage areas to allow focusing on the identified drainage problems.

Key elements for quantifying surface hydrology are the acreage and land cover of each area, travel time of flow, surface flow direction, and interconnectivity of drainage areas. Acreage is measured from the map based on the drainage divide and drainage area delineations. Land cover is accounted for in the Runoff Coefficient. For urban areas with single family lot sizes > ½ acre, C=0.35 was used. Travel time of surface flow is estimated using an average flow velocity of 2 ft/s and is reflected as Time of Concentration. The direction of surface flow and interconnectivity of drainage areas are derived from the topographic maps and available storm sewer GIS layer. These parameters are used to estimate flow rates at points of interest. The City of Indianapolis rainfall data for the 10-year design storm were used to estimate rainfall intensity (i_{10}.)

Preliminary Estimates of 10-year Peak Discharge (Q_{10})
for Individual Drainage Areas*

DA	Acres	L (ft)	C	Tc (min)	i_{10} (in/hr)	Estimated Q_{10} (cfs)
A1	21	1200	0.35	10	5.5	40
A2	32	2200	0.35	18.3	4.1	46
B	108	1800	0.35	15	4.5	170
C1	36	1500	0.35	12.5	5	63
C2	82	2500	0.35	20.8	3.8	109
C3	45	2500	0.35	20.8	3.8	60
C4	205	3000	0.35	25	3.4	244
C5	14	900	0.35	7.5	6.1	30
C6	27	2000	0.35	16.7	4.3	41
C7	32	1500	0.35	12.5	5	56
C8	28	1500	0.35	12.5	5	49
D1	28	3000	0.35	25	3.4	33
D2	84	4000	0.35	33.3	2.9	85
E1	62	3200	0.35	26.7	3.3	72
E2	46	2300	0.35	19.2	4	64
E3	23	3400	0.35	28.3	3.2	26
E4	45	3400	0.35	28.3	3.2	50
E5	29	1700	0.35	14.2	4.7	48
E6	42	1800	0.35	15	4.5	66
F	83	2200	0.35	18.3	4.1	119
G1	24	800	0.35	6.7	6.4	54
G2	14	800	0.35	6.7	6.4	31
G3	103	4100	0.35	34.2	2.9	105

***** Q_{10} values may not be added arithmetically.

Site-Specific Assessments

1. 71st Street and Williams Creek Drive

Periodic flooding is due to inadequate conveyance capacity in the existing drainage system. This area is located at the downstream end of Basin C. A relatively large area, approximately 470 acres, drains to this point, with a potential to produce an estimated 10-year peak flow of 280 cfs if flow is unimpeded upstream. Large volumes of storm runoff generated upstream must either be temporarily stored in detention ponds or effectively conveyed to Williams Creek. Since storage requires additional real estate and does not appear to be an option, adequate conveyance is essential to minimize flooding of adjacent properties. Due to the relatively large drainage area, serious flooding can occur if flow conveyance capacity in the stream channel is deficient or if it has been reduced by obstructions, poor maintenance, or encroachments.

Recommendation:

The current outlet is a 230 ft long, 38” x 60” structural plate pipe arch that daylights in the Williams Creek. It appears to be undersized, with flows frequently overtopping the road. The capacity of this pipe flowing full is approximately 95 cfs at 1% slope, and it is not likely to exceed 150 cfs without major backups. At a minimum, a second outlet of comparable size would be required to alleviate street flooding. This would reduce roadway flooding as long as flow is not backed up due to high flood stages in Williams Creek. This area is a designated regulatory floodplain with a base flood elevation of 722 NGVD. Infrequent, but serious inundation of this area as a result of increased flood levels in Williams Creek can be expected to occur regardless of the additional outlet.

A detailed design should address both the conveyance and floodplain issues to confirm the cost-effective solution.

Approximate cost: $ 34,000.


06/29/2004


06/29/2004

2. 73rd Street and Williams Creek Drive

Williams Creek Drive north of 73rd Street is a gravel road approximately 200 feet long. Approximately 5 acres drain to the intersection, producing an estimated peak 10-year flow of 12 cfs. Standing water in the northwest corner of the intersection has been reported. It appears that construction of a driveway across an existing ditch west of the gravel road may have created or exacerbated the drainage problem.

Recommendation:

Local drainage may be improved to allow standing water to drain to Williams Creek. This will require reestablishing a flow line in the ditch west of the gravel road and may require installing a driveway culvert. Drainage in the gravel road will require roadway improvements such as grading and paving.

Note:

This is a floodplain area and infrequent, but serious inundation as a result of increased flood levels in Williams Creek can be expected to occur regardless of local drainage improvements.

Approximate cost: $ 4,600.

3. 730 Sherwood

Periodic standing water in the front yard appears to be due to flat slopes and a lack of storm conveyance system.

Recommendation:

With less than 3 acres draining directly to this area, this problem can be addressed with local improvements. This can be achieved by installing a modified French drain where ponding in the front yard and roadway shoulders occurs, and by providing conveyance through 4" field tile along Sherwood Drive extending approximately 175 feet west to an existing waterway. Also, grading the front yard and roadway shoulder area to provide positive drainage to the road or existing storm inlets should be considered during engineering design.

Approximate cost: $ 4,300.

4. 7520 Morningside

Approximately 30 acres drain to the problem area. A steep drainage swale was filled and replaced with a private road and covered storm sewer. Periodic standing water and flooding at this location appear to be a conveyance issue. Generally slopes are moderate to steep. Drainage problems encountered appear to be due to insufficient conveyance and local construction.

Recommendation:
The drainage area that contributes runoff to the problem area is capable of potentially producing an estimated peak 10-year discharge of 35 cfs, and large runoff volumes. The actual peak discharge at the problem area may depend on the capacity of the existing storm system. A detailed design is required to make that determination. A survey during design would determine if existing conveyance deficiencies other than undersized storm pipes or inlets may be contributing to the problem.

Brush and vegetation overgrowth observed in the field appear to impede flow and should be cleared. Based on preliminary estimates, it is recommended that the existing 48 ft long, 24" culvert across 75th Street, and the 35 ft long, 15" culvert across Morningside Drive each be supplemented with a 24" cross culvert to improve conveyance capacity and reduce the frequency and extend of roadway flooding. At the time of detailed design, adequate analysis should be conducted to verify that the downstream impacts of proposed improvements are acceptable.

Approximate cost: $ 18,500.

5. Penn Ridge and Washington

The area west of Penn Ridge and north of the waterway was reported by others to flood periodically. Approximately 118 acres drain to this problem area. The drainage area can potentially produce an estimated 10-year peak flow rate of 130 cfs, but the actual value may depend on the capacity of the existing system upstream. The existing culvert is a twin 36" CMP and the channel is roughly 6ft x 2.5ft rectangular in shape. It appears that the existing culvert and channel may not have sufficient capacity to convey the runoff without flooding. Without sufficient capacity in the culverts and downstream channel, it is likely that some water backup will continue to occur upstream (west) of the drive. However inadequate channel maintenance east of the culverts is creating problems.

It was observed that the existing culverts under Penn Ridge are silted, and the channel downstream (east) of Penn Ridge has not been properly maintained. Based on visual field observations, it is estimated that at least one third of the conveyance capacity has been lost due to lack of maintenance.

Recommendation:

It is recommended that conveyance capacity in the channel and existing culvert under Penn Ridge be restored by cleaning the pipes and restoring the flow line in the channel downstream of the drive. It is also recommended that the entire system be periodically inspected and maintained as needed, especially after heavy rainfall events. It has been reported that the property owner was to maintain the system on his property. They should be required to do so promptly.

Conveyance capacity in the culverts may need to be increased. However, simply upgrading the size of the pipe may not be sufficient because the conveyance problem may also be present downstream (east) of the drive. Care should be taken not to transfer the flooding problem to downstream properties. Due to the size of the contributing area and potential impacts of various possible remedies, the Town should request a copy of the drainage plan submitted for the home and compare it to what was constructed.

Approximate cost: The only cost to the Town at this point would be the notification to the property owner and any costs to research drainage permits.

6. 7200 North Pennsylvania

Icy road conditions occur during the winter creating a road hazard. Although moderate to steep slopes on most of Pennsylvania Avenue generally allow for adequate drainage, poor drainage of the roadway surface in this relatively flat area appears to have resulted in shallow standing water in the roadway pavement and shoulder. Based on observations by others, the source of excess water is drainage from surrounding lots near 7200 Pennsylvania Avenue, and it does not include backwater from stream flooding. Approximately 14 acres (Area C5), with moderate to steep slopes, drain to the problem area, producing an estimated peak 10-year discharge of approximately 30 cfs.

Recommendation:

To avoid standing water, and assuming that additional real estate is not available for stormwater storage, runoff must be effectively conveyed to the nearest waterway just south of the problem area.

Adequate conveyance can be addressed comprehensively if the road is rebuilt or repaved. The drainage inlets could then be properly sized to

prevent water from ponding on the pavement or shoulders. Until then, a storm sewer system along the road between 7200 Pennsylvania Avenue and an existing drain just south of 7150 Pennsylvania Avenue would improve drainage and reduce water ponding. The storm system would consist of a 30” to 42” RCP storm pipe approximately 420 feet long with several storm inlets placed at low points.

Approximate cost: The approximate cost of constructing a storm sewer system is $ 58,000.

7. SE corner of 75th Street and Illinois Street

Water ponds near this corner and the ditches south of the area have been enclosed. The general area is flat. The drainage area that contributes surface runoff to this point is about 2 acres, and it generates relatively small runoff volumes. Periodic standing water in the roadway ditch appears to be due to flat slopes and lack of storm outlet.

Recommendation:

A combination of ditch grading and new inlets connecting to the existing storm sewer along Illinois Street can address this problem. The ditch area to be graded varies in width between 5 and 10 feet. It extends from the northeast corner approximately 250 feet south along the east side of Illinois Street. Longitudinal and side slopes of 5% are desirable, and they should not be less than 2%. Standing water may still occur if the existing storm sewer capacity is limited, but it will drain, probably within hours, if the ditch grading and inlet locations are properly designed.

Approximate cost: $ 6,000.

8. 7975 North Illinois Street

A box culvert has collapsed and is causing erosion that undermines additional sections of the culvert and threatens the guardrail and portions of Illinois Street. The drainage area contributing flow to this point is approximately 240 acres. Unlike storm sewers and driveway culverts that are typically designed to handle a 10-year design flow, major roadway cross culverts are typically designed to handle the 100-year design flow. The drainage area can produce an estimated 100-year flow of 250 cfs if upstream flows are unimpeded. The culvert is a 4 ft x 4 ft rectangular box, and the estimated 100-year flow velocities at the culvert could potentially reach 15 ft/s.

Recommendation:

The broken pieces of the culvert should be relocated on the bottom of the channel away from the end of the culvert. Riprap gabions should be placed in unstable areas of the bank to reduce erosion. Work should clear only the vegetation necessary to place riprap and relocate broken culvert pieces. Access to the project area should be obtained from Second Presbyterian Church if possible.

Approximate cost: $ 15,300.

9. 7401 Holiday Drive East

Two problems exist at this location -significant standing water in the drainage way, and a broken tile in the backyard. Field observations indicate that standing water is primarily due to poor surface drainage, excess runoff from other areas, and inadequate outlet capacity.

The excess runoff and outlet capacity may be explained by the broken tile in the backyard. The tile takes flow from underground into a small surface ditch behind the home. The broken tile is only 6" deep, and has resulted in excess water on the property.

Poor surface drainage in the yard is due primarily to flat slopes.

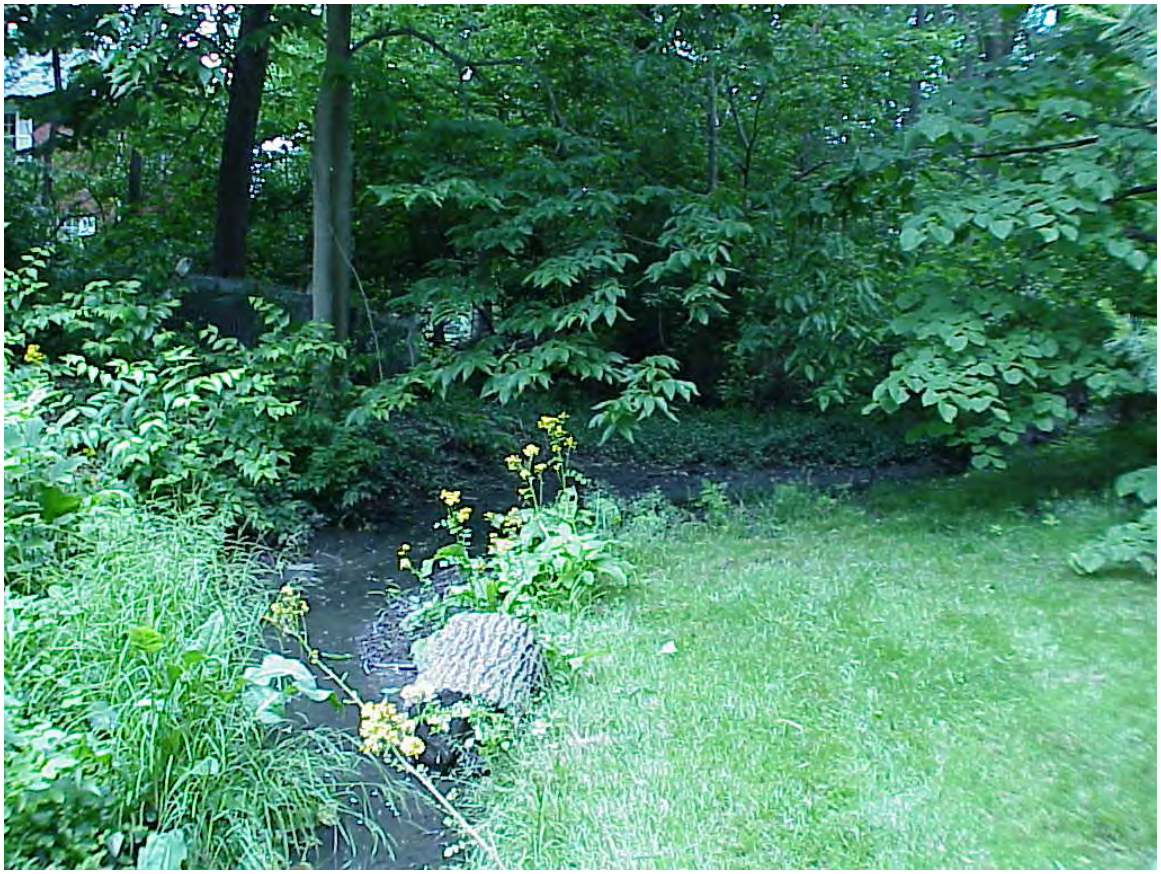
The drainage area tributary to the drain at the problem area is approximately 36 acres. The 10-year peak flow can potentially be as high as 55cfs, although the actual flow may be lower due to limited capacity in the upstream sewer system. Overland flow likely conveys most of the flow, but it is clear that the broken pipe impedes some of the drainage.

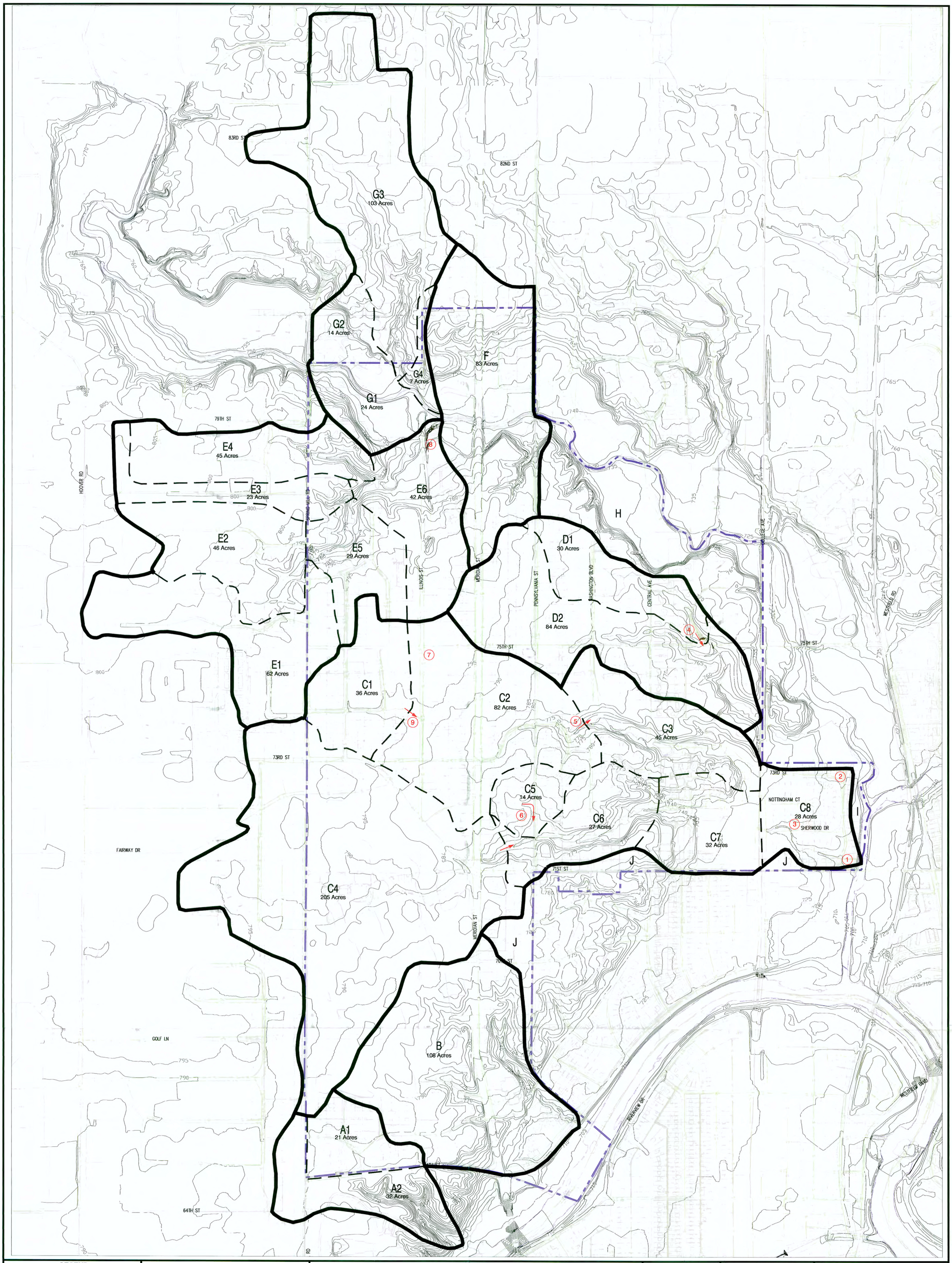
Recommendation:

The broken tile should be replaced and designed to daylight into the open ditch.

Poor surface drainage in the yard can be improved by regarding and stabilizing flat area to provide a positive slop towards the swale or inlets. Instead of a wide U-shaped area, a defined ditch line with ground side slopes of at least 1 % should be constructed to eliminate standing water.

Approximate cost: $ 13,300.





LEGEND

- TOWN LIMITS
- BUILDINGS
- PARCELS
- WATER FEATURES

TOWN OF MERIDIAN HILLS
MARION COUNTY, INDIANA
BASIN MAP

SCALE	1" = 400'
Date	05-28-04
Project No.	4918.002
Drawn	BAB
Revised Date	07-12-04

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