City of Dublin

Office of the City Manager
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Memo

To: Members of Dublin City Council

From: Community Services Advisory Commission

Date: February 4, 2020

Initiated By: Megan O'Callaghan, Deputy City Manager/Chief Operating Officer
Paul A. Hammersmith, PE, Director of Engineering/City Engineer
Todd A. Garwick, PE, Senior Civil Engineer

Re: Maintenance of Residential Stormwater Management Ponds (Basins)
Recommendation to Dublin City Council

Summary

Dublin City Council requested the Dublin Community Services Advisory Commission (CSAC) review the City's past and current practices regarding the maintenance of stormwater management ponds/basins (either wet or dry) in residential areas. The goal is for CSAC to make a recommendation to Dublin City Council regarding a future policy and guidelines on the maintenance of residential stormwater management ponds. The topic of residential stormwater pond maintenance was on the CSAC's September 10 and November 12, 2019, and January 14, 2020 meeting agendas.

CSAC considered and discussed detailed information, data, and research presented by Dublin staff, including an overview on the design and composition of the City's stormwater management system, the operation and maintenance of the system, the past and current practices regarding the maintenance of the existing stormwater management ponds, and a summary of how other comparable agencies address pond maintenance. As a result of their discussion, the CSAC requested staff provide follow up information regarding planning level estimates if the City assumed maintenance of all stormwater ponds on Dublin owned property, the City of Delaware Stormwater Utility and background on the previous discussions by past Dublin City Councils regarding a Stormwater Utility. The discussions concluded with CSAC voting to forward a recommendation to Dublin City Council for their consideration.

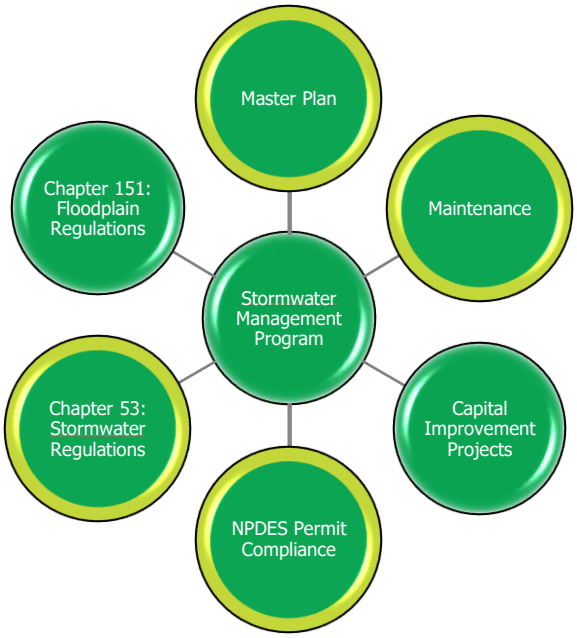
Background

The topic of Stormwater Management and Pond Maintenance was first presented to CSAC at their September 10, 2019 meeting. During this meeting, staff presented an overview of Stormwater Management and Pond Maintenance. The items discussed at this meeting were stormwater systems, stormwater management goals, development of residential stormwater ponds, residential storm basin inventory, maintenance practices, maintenance costs, and benchmarking against other communities. In summary, staff began the presentation with components of Dublin's Stormwater Management Program Goals (see graphic on page 2) that includes the following specific topics:

- Stormwater Master Plan
- Dublin Codified Ordinances Chapter 53, Stormwater Management and Stream Protection

- National Pollutant Discharge Elimination System (NPDES) Permit Compliance
- General Stormwater Maintenance

Stormwater Management Program Goals



The stormwater management program guides and specifies how a residential stormwater basin evolves into existence in the City. Staff discussed the development of the Celtic Crossing Subdivision Retention (Wet) basin as an example and reviewed its components. That was followed by a detention (dry) basin example and its corresponding maintenance components which were presented to demonstrate the complexities and functionality of residential stormwater basins within Dublin.

Staff then presented the residential stormwater basin inventory to demonstrate the locations of the current 305 residential stormwater basins within Dublin. The 305 residential stormwater basins further breaks down into 154 basins located on City of Dublin owned property and 151 privately owned residential stormwater basins, and these two numbers were further deduced into the types of residential stormwater basins, and lastly and most importantly by who performs the maintenance on all 305 residential stormwater basins.

The Dublin GIS inventory of the 154 City of Dublin owned residential stormwater basins indicates homeowners' associations (HOAs) are maintaining 46 City of Dublin owned residential stormwater basins. Dublin maintains the remaining 108 City of Dublin owned residential stormwater basins through the Annual Stormwater Maintenance Program (AF201) approved as part of the Capital Improvements Program (CIP). It is important to note there are another 151 privately owned and maintained residential stormwater basins not reviewed by CSAC as part of this discussion.

Staff indicated a timeframe from roughly 1999 to 2015 when Dublin received ownership of residential stormwater basins while HOAs received the maintenance component for 46 of the 154 residential stormwater basins. The maintenance by HOAs of the 46 residential stormwater basins is

the primary focus of CSAC's review. Presently, the current practice is for the ownership and maintenance of a residential stormwater basin to be determined on a case-by-case basis during the planning and development review process.

Staff itemized and listed the retention (wet) and detention (dry) basin maintenance components with examples for a good sense of the maintenance work and estimated costs for retention (wet) and detention (dry) residential stormwater basins. Staff presented some specific examples of residential stormwater basin maintenance performed through the City's Annual Stormwater Maintenance Program from 2012 until the present day.

Dublin staff reached out to several Central Ohio agencies for feedback on their residential stormwater basin maintenance practices. The following communities at the time responded with placing the residential stormwater basin maintenance on homeowner associations: Grove City, Marysville, Westerville, and Worthington. Staff also found other central Ohio communities funding residential stormwater basin maintenance through stormwater utility fees. Among the 33 Central Ohio communities surveyed, 18 communities had a stormwater utility fee placed on the utility bill ranging from $2.00 to $4.65 per Equivalent Residential Unit (ERU). The ERU is a square footage of impervious area on each parcel separately determined by each municipality. The Dublin funding mechanism is through the CIP annual funding. Dublin currently has no stormwater utility fee.

After presenting the above information to CSAC, Staff developed several options for the residential stormwater basin maintenance moving forward:

<u>Option #1: (this option is to maintain the status quo)</u>

- Dublin continues maintaining existing 108 residential stormwater basins.
- HOAs continue maintaining existing 46 residential stormwater basins.
- New basin maintenance determined on a case-by-case basis during planning process.

<u>Option #2:</u>

- Dublin continues maintaining existing 108 residential stormwater basins.
- HOAs continue maintaining existing 46 residential stormwater basins.
- HOAs would maintain new residential stormwater basins moving forward.

<u>Option #3:</u>

- Dublin continues maintaining existing 108 residential stormwater basins.
- HOAs continue maintaining existing 46 residential stormwater basins.
- Dublin would maintain new residential stormwater basins moving forward.

<u>Option #4:</u>

- Dublin continues maintaining existing 108 residential stormwater basins.
- Dublin would assume maintenance of existing 46 residential stormwater basins that are currently maintained by HOAs.
- Dublin would maintain new residential stormwater basins moving forward.

CSAC members discussed the options and requested some additional information from City Staff, primarily focusing on Option #4, for their November 12, 2019 meeting. No public comments were

received at the September meeting.

The follow-up items from the September 12, 2019 meeting:

1. CSAC requested staff prepare additional information on Option #4 including planning level estimates for 5, 10, and 15 years if the City assumed maintenance of all stormwater basins on Dublin owned property. This would need to include some idea of existing conditions of such ponds and work plans. CSAC wanted to understand the financial impact on the City for Option #4.
2. CSAC requested some examples of existing ponds that are uniquely situated, including examples of both HOA maintained and City maintained ponds.
3. CSAC requested information on Delaware's Stormwater Utility Fee. When was it implemented? What was implemented? Why was it implemented? How did they decide on the fee? How did they go about communicating the need? What maintenance performed? What is the cost? Provide as many details as possible.
4. Information (legislative and other) on any previous discussions in Dublin about a Stormwater Utility Fee.

The topic and discussion continued at the CSAC meeting on November 12, 2019. City staff presented the following additional information as requested by CSAC: Option #4 above, unique residential stormwater basin types, residential stormwater basin maintenance components with associated annualized cost, planning level maintenance cost estimates for residential stormwater basins, City of Delaware, Ohio Stormwater Utility Program and associated fees, previous City of Dublin stormwater utility fee discussion, and funding options for residential stormwater basin maintenance.

Staff provided CSAC a location map of the existing 46 residential stormwater basins currently maintained by homeowner associations to get a better understanding of these basins in question. Staff presented four (4) uniquely situated residential stormwater basins to demonstrate the maintenance components for each basin. The pictures presented and maintenance components demonstrated the amount of effort and maintenance necessary to keep a basin functioning well, aesthetically pleasing, and provide excellent water quality standards.

Staff detailed the general maintenance components and the corresponding maintenance component life cycles estimated for both retention (wet) and detention (dry) residential stormwater basins in developing an annualized cost per basin. The annualized residential detention (dry) basin cost is $3,760. The annualized residential retention (wet) basin cost is $5,370. Applying these costs to the current situation provided the total cost breakdown for the existing Dublin maintained 108 residential stormwater basins at $520,390 per year. If Dublin assumed maintenance of existing 46 residential stormwater basins the cost would be $227,700 per year. The total combined cost applied to all 154 residential stormwater basin amounts to approximately $750,000 per year. Currently, the 2020 – 2024 CIP Annual Stormwater Maintenance (AF201) under, Utilities – Stormwater Management, funds residential stormwater maintenance. The amount budgeted is $575,000 per year for these requests which involve storm structure repair, storm sewer pipe cleaning and televising, stormwater basin maintenance and some new capital stormwater projects.

Staff provided information on the City of Delaware, Ohio Stormwater Utility Program and associated fees as requested. City of Delaware, Ohio (Population 40,000) implemented the stormwater utility program and fees in 2002 and the initial and still current fee is $2.50 per ERU. As discussed earlier, the ERU is a square footage of impervious area on each parcel separately determined by each

municipality. The City of Delaware, Ohio stormwater utility fee applies to the following stormwater maintenance activities:

- Catch basin repair
- Pipe cleaning/televising/replacement
- Stormwater basin maintenance
- New Capital Stormwater Projects

The City of Delaware, Ohio utility fee generated $851,000 in 2018 and $717,000 as of September 2019. This stormwater utility fees, and their general fund dollars provide the funding for the stormwater maintenance program for the City of Delaware, Ohio. Benchmarking against other communities provided the following examples for comparison. The City of Columbus, Ohio collects a stormwater utility fee of $4.65 per ERU on the high end and Shawnee Hills, Ohio collects a stormwater utility fee of $1.98 per ERU on the low end of the rate spectrum.

Staff also researched, as requested by CSAC, the past discussions on a possible stormwater utility fee in Dublin and found the following regarding those previous discussions:

- Dublin City Council – Council Community Development Committee, April 13, 1998
    - Fee discussed as a possible funding source in the Dublin Master Plan.
    - Result: funding discussion in future meetings.
- Dublin City Council – Council Community Development Committee, December 14, 1998
    - Fee discussed again as funding source, with the current funding source being the capital improvement program and general fund.
    - Five other communities listed as having a stormwater utility fee.
    - Two options presented for stormwater utility fee:
        - Option 1: Charge $1.75/mo./unit with no water/sanitary connection fee
        - Option 2: Charge $1.31/mo./unit with a water/sanitary connection fee
    - Result: Discuss later due to lack of Council presence.
- Dublin City Council – Council Community Development Committee, February 8, 1999
    - All Council members present
    - Reviewed different types of funding mechanisms
    - Presented the same two stormwater utility fee options from the December 14, 1998 meeting
    - Result: Council decided not to proceed with stormwater utility fee and maintenance cost to continue to be funded by the Capital Improvement Program.

The last item staff presented to CSAC was the funding options to perform residential stormwater maintenance activities. There are really two options at this point:

1. The 5-Year Capital Improvement Program – status quo with the possibility of future additional funding; and
2. New Dublin stormwater utility fee.

The stormwater utility fee could fund all stormwater maintenance tasks and be explored by a stormwater utility fee rate study.

CSAC summarized the three primary topics of its discussions:

1. Should the City assume maintenance of the 46 City owned and HOA maintained basins?
2. How should the City fund additional maintenance costs?
3. Should the City explore the maintenance of the 151 privately owned and maintained basins?

CSAC received no public comments at their November meeting and concluded their review and discussions with the following recommendation.

Recommendation

CSAC agreed the City is best suited to maintain residential stormwater management basins that are located on property/lands owned by the City of Dublin. The City possesses the technical expertise and equipment to provide the appropriate basin maintenance along with the experience gained from maintaining its 108 stormwater management basins. Additionally considered, the City presently maintains the existing stormwater pipes discharging into and out of the forty-six (46) basins now maintained by HOAs, the future costs for maintenance issues could be extensive, and ultimately the City is legally responsible for meeting state maintenance regulations. Therefore, CSAC makes the following recommendation to Dublin City Council:

> The City of Dublin take over (assume) the maintenance of the forty-six (46) City-owned stormwater basins (ponds) currently being maintained privately (by various homeowner associations).

In consideration of the above recommendation, CSAC also suggests it would make sense for the City to review the funding mechanism to support (provide for) the maintenance of the forty-six (46) City-owned stormwater basins (ponds). Recognizing the incremental cost of the City assuming this maintenance, CSAC explored options for funding, including stormwater utility fees.

Based on the outcome of Council's decision for maintenance and its funding for publicly owned stormwater basins, CSAC members agreed they would be interested in further exploring the funding options of the forty-six (46) City-owned stormwater basins, if Council considers such a review would be helpful.

CSAC appreciates all the work and time dedicated to this discussion by Dublin staff and now better understands the complexities associated with the maintenance of the various stormwater management ponds located throughout Dublin. CSAC members agreed it was a great opportunity to learn about the stormwater management system and about the importance of proper maintenance of stormwater basins, and to give consideration for funding options of such maintenance.

Stormwater System Overview & Stormwater Basin Maintenance for Residential Development

CSAC PRESENTATION

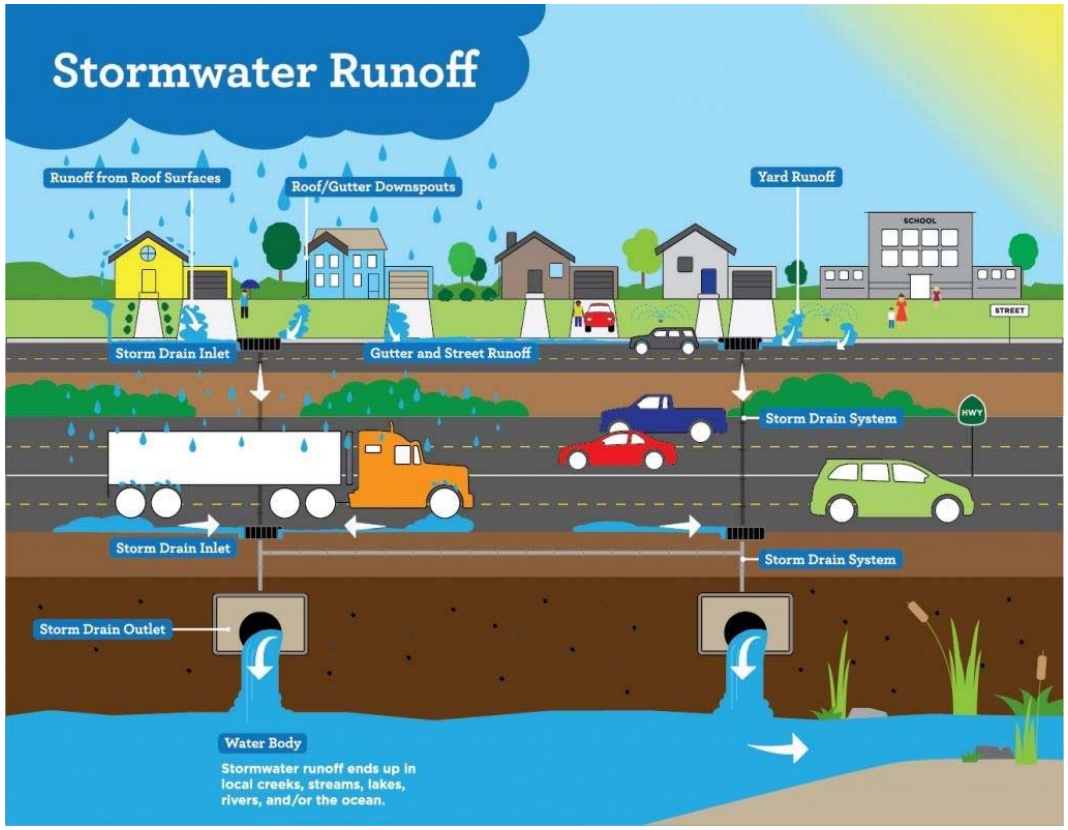
Michael Hendershot, P.E.– Engineering/Review Services
Todd Garwick, P.E. – Engineering - Utilities

SEPTEMBER 10, 2019

AGENDA

I. Stormwater System Overview
II. Stormwater Management Goals
III. Development of Residential Stormwater Basins
IV. Stormwater Basin Overview
V. Residential Stormwater Basin Inventory
VI. Maintenance Practices
VII. Maintenance Costs
VIII. Benchmarking
IX. Options
X. Recommendation

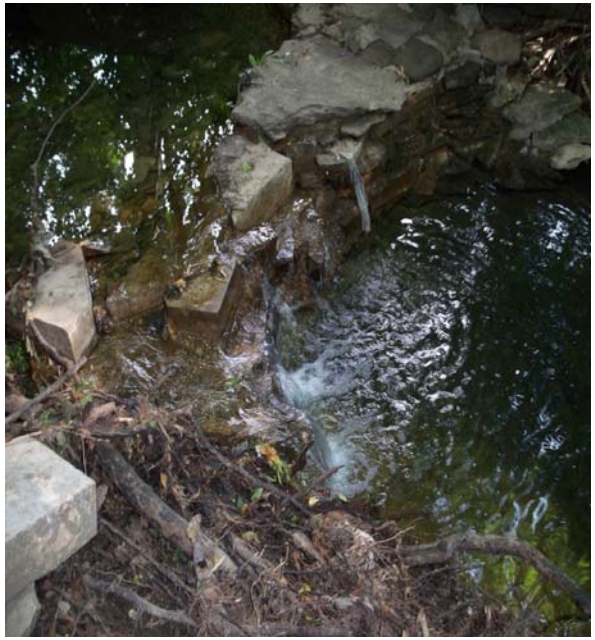
STORMWATER SYSTEM OVERVIEW



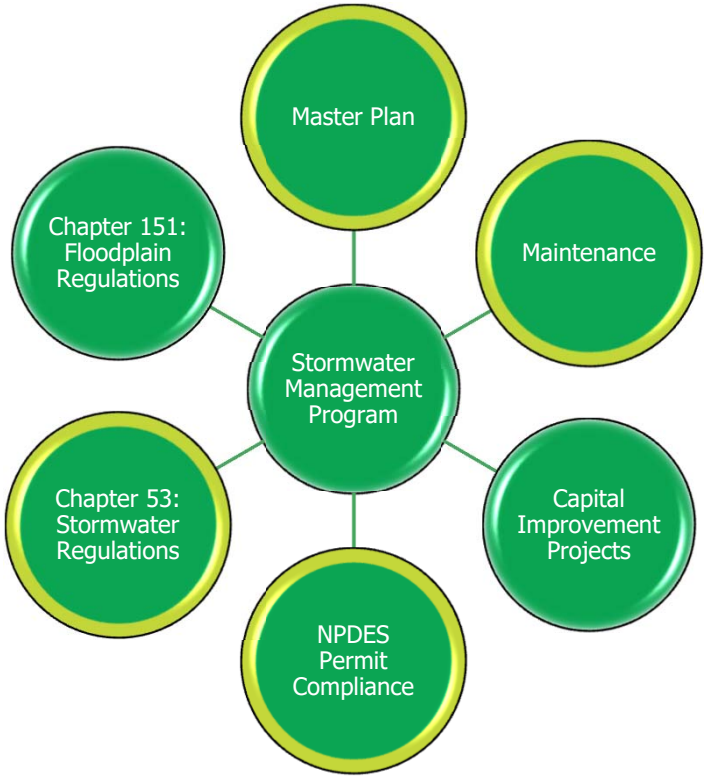
STORMWATER MANAGEMENT GOALS

Stormwater Management Goals

- Manage stormwater runoff – water quantity
- Reduce discharge of pollutants – water quality
- Control of sedimentation and erosion
- Maintain compliance with state and federal regulations



STORMWATER MANAGEMENT GOALS



STORMWATER MANAGEMENT GOALS

Master Plan

- Minimize impacts from development
- Mitigate flooding problems
- Improve overall appearance and environmental quality of streams
- Developed a drainage system map and database
- Identified capital improvement projects

STORMWATER MANAGEMENT GOALS

Chapter 53 – Stormwater Management and Stream Protection

- Regulates stormwater from areas of new development and redevelopment for the purpose of protecting the public health.
- Established the Stormwater Management Design Manual
- Stormwater Management Design Manual includes control for:
  - Water quantity
  - Water quality
  - Erosion and sediment on construction sites

Chapter 53: Stormwater Regulations

STORMWATER MANAGEMENT GOALS

National Pollutant Discharge Elimination System (NPDES) Permit

- Regulated through Environmental Protection Agency (EPA)
- Contains six minimum control measures for Stormwater Management Programs (SWMP)
  1. Public Education and Outreach
  2. Public Participation
  3. Illicit Discharge Detection and Elimination
  4. Management of Construction Site Runoff
  5. Management of Post Construction Site Runoff
  6. Good Housekeeping in Municipal Operations

DEVELOPMENT OF RESIDENTIAL STORMWATER BASINS

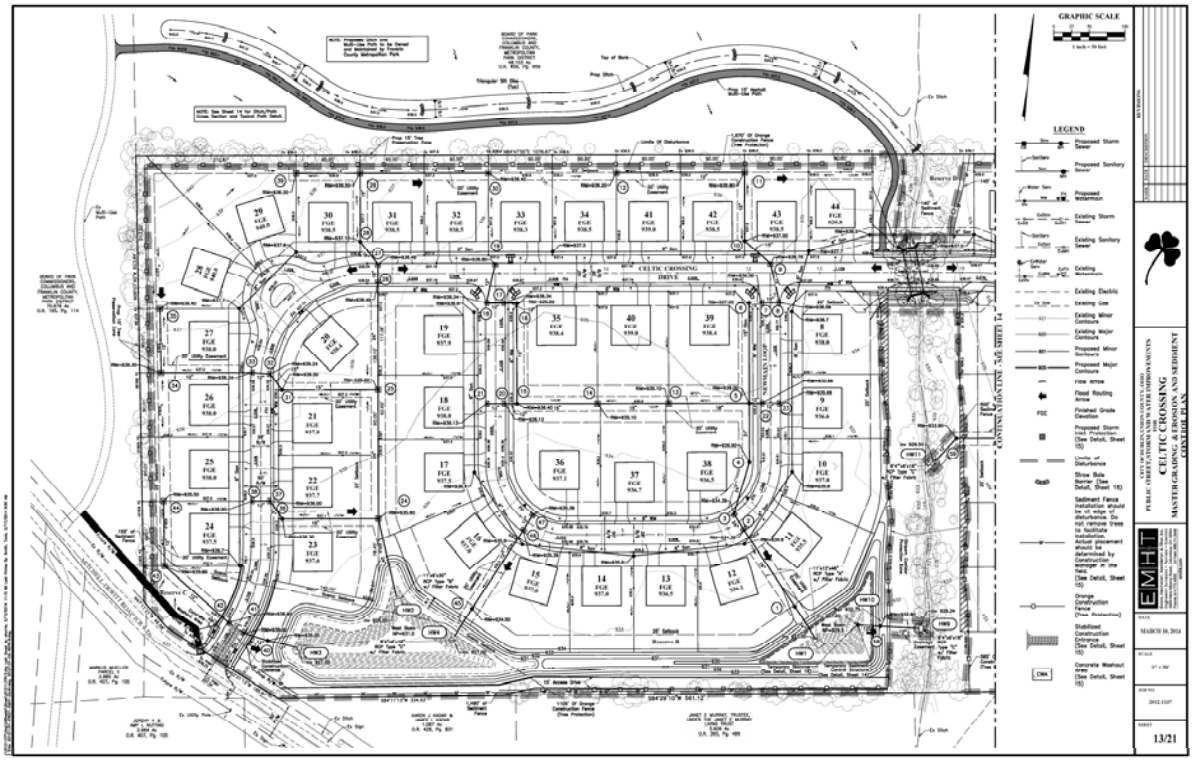
DEVELOPMENT OF RESIDENTIAL STORMWATER BASINS

Development Process for Residential Subdivisions

- Prerequisite Planning Approval
  - Preliminary Development Plan
  - Final Development Plan
- Engineering approval of final construction drawings and stormwater management report
- Construction
- As-built survey and conditional acceptance
- One year warranty period from conditional acceptance
- City maintenance of public infrastructure

DEVELOPMENT OF RESIDENTIAL STORMWATER BASINS

Celtic Crossing – Grading Plan



DEVELOPMENT OF RESIDENTIAL STORMWATER BASINS

Celtic Crossing – Post-Developed

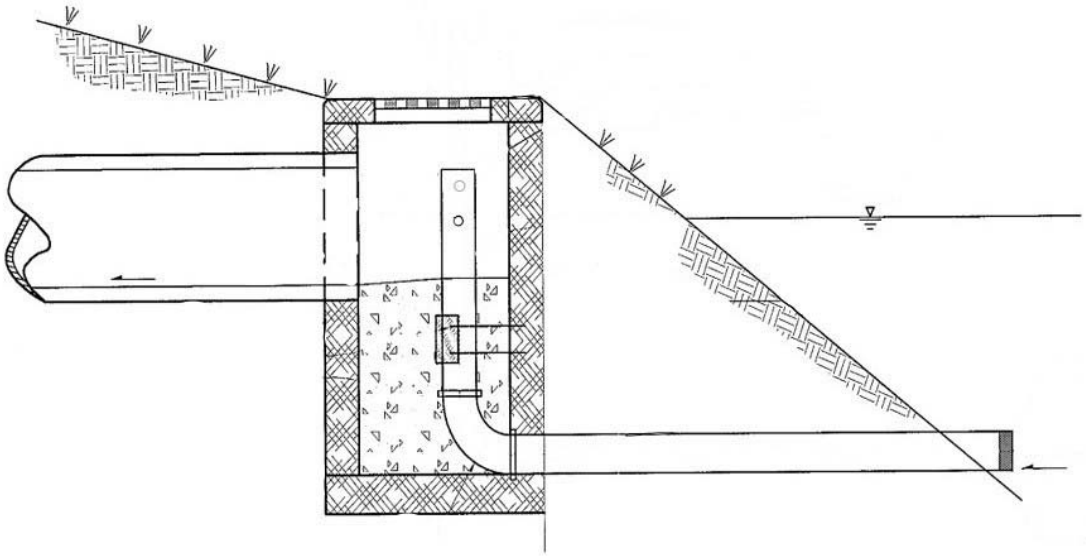
STORMWATER BASIN OVERVIEW

Stormwater Retention (Wet) Basin Components

- Outlet control structure
- Outlet pipe
- Extended detention volume
- Permanent pool/forebay
- 24 hour WQ drawdown time
- Aerator (recommended but not required)

STORMWATER BASIN OVERVIEW

Stormwater Retention (Wet) Basin – Outlet Control Structure



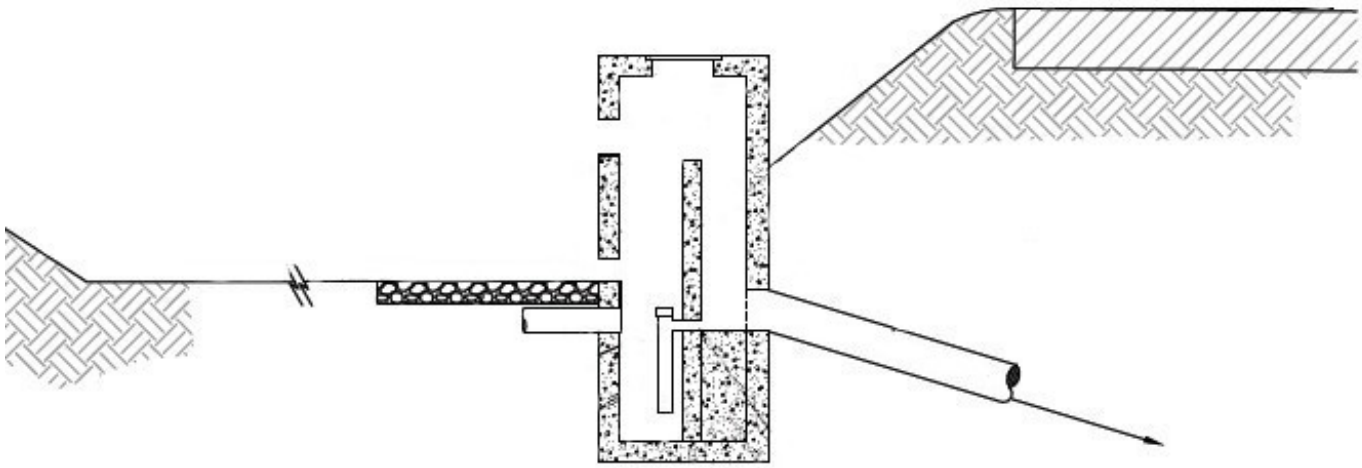
STORMWATER BASIN OVERVIEW

Stormwater Detention (Dry) Basin Components

- Outlet control structure
- Outlet pipe
- Extended detention volume
- No permanent pool
- 48 hour WQ drawdown time

STORMWATER BASIN OVERVIEW

Stormwater Detention (Dry) Basin – Outlet Control Structure



RESIDENTIAL STORMWATER BASIN INVENTORY

Residential Stormwater Basins serve the following:

- Single Family Subdivisions
- Single Family Detached Homes
- Condominiums
- Apartment Complexes

RESIDENTIAL STORMWATER BASIN INVENTORY – *Ownership*

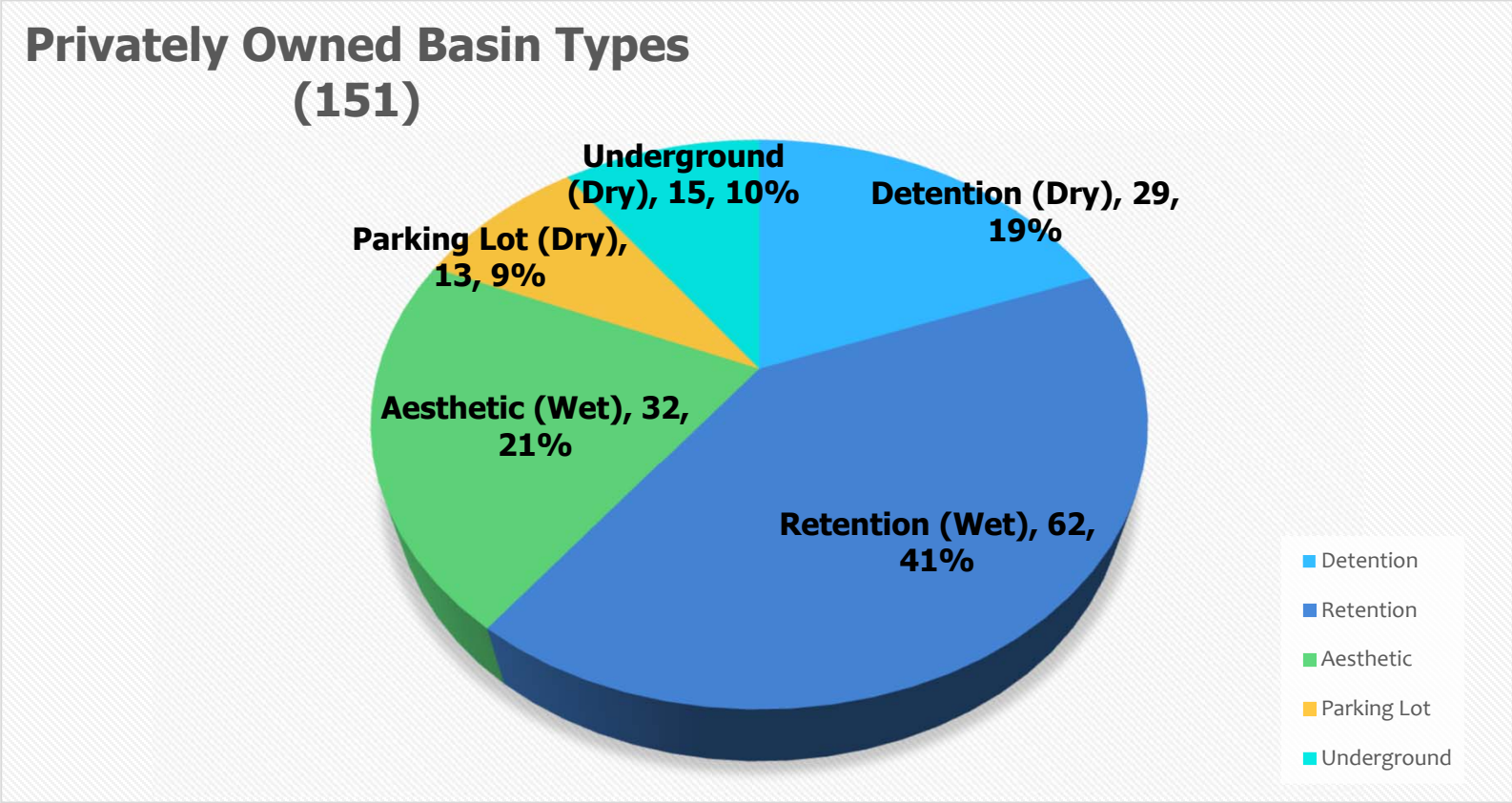
Residential
Stormwater Basins
305* total

City of Dublin Owned
Residential
Stormwater Basins
154

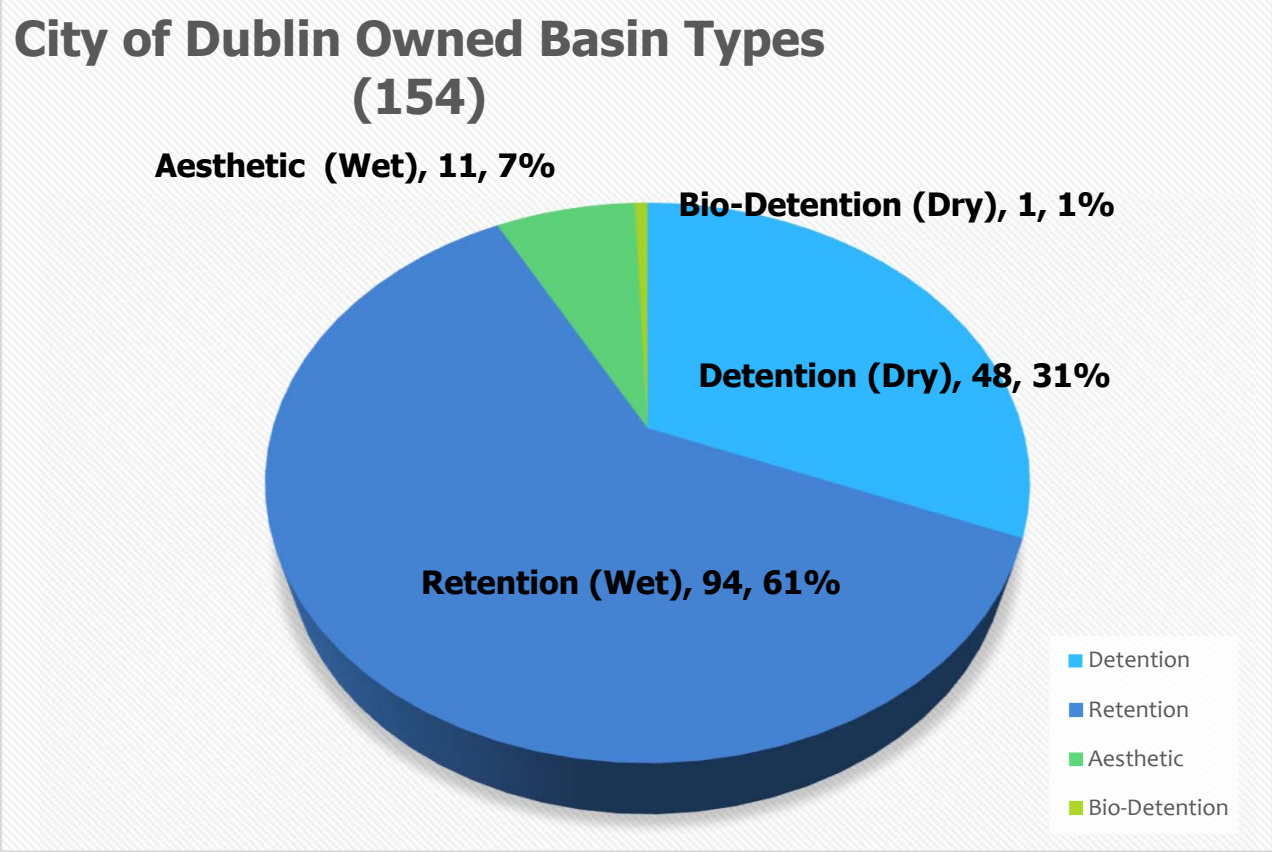
Private Owned
Residential
Stormwater Basins
151

**excludes Commercial*

RESIDENTIAL STORMWATER BASIN INVENTORY -
Privately Owned Basin Types



RESIDENTIAL STORMWATER BASIN INVENTORY –
City of Dublin Owned Basin Types



STORMWATER BASIN INVENTORY – *CITY OF DUBLIN OWNED*
Maintenance Responsibility

	Residential Basin Type				
Maintenance Responsibility	**Detention (Dry)**	**Retention (Wet)**	**Aesthetic (Wet)**	**Bio-Detention (Dry)**	**Maintenance Totals**
Dublin Maintenance	37	60	11	0	108
HOA/Private Maintenance	11	34	0	1	46
Basin Type Totals	48	94	11	1	154

OWNERSHIP AND MAINTENANCE RESPONSIBILITY

History / Past Practices

- Prior to ~1999 – HOA ownership and maintenance
- 1999 to ~2015 – Dublin ownership and HOA maintenance
- ~ 2015 – trended towards Dublin ownership and maintenance

MAINTENANCE PRACTICES

Retention (Wet) Basin Maintenance Components

- Storm sewer pipes and structures
- Pond Dredging
- Basin Aerators
- Mowing banks
- Vegetation removal
- Trash removal
- Chemical control – Algae
- Nuisance animal

MAINTENANCE PRACTICES

Detention (Dry) Basin Maintenance Components

- Storm sewer pipe and structures
- Grading
- Channels – concrete, stone
- Underdrains
- Mowing banks and bottom
- Vegetation removal
- Trash removal

ESTIMATED MAINTENANCE COSTS

Retention (Wet) Basin

- $25,000 – $50,000/basin
  - Frequency: 20 – 25 years

Detention (Dry) Basin

- $15,000 – $20,000/basin
  - Frequency: 5 – 10 years

Routine Aesthetic Maintenance Costs

- Treatment ~$1,000/basin/year
- Aerators:
  - Electrical $2,300/year
  - Replacement $7,000/unit
    - Frequency: 8 years

MAINTENANCE COSTS – Capital Funds Examples

2012 Stormwater Maintenance Contract

- Waterford Village – Longbranch/ Pebble Creek Detention Basin
  - 1 week
  - $18,000 (approx. cost)
- Wedgewood Hills – Lyme Court Detention Basin
  - 1 week
  - $18,000 (approx. cost)

2015 Stormwater Maintenance Contract

- Woodlands - Detention Basin
  - 3 days work
  - $10,800 (approx. cost)

Capital Improvement Program (2020-2024 CIP)
Stormwater Funds

- Storm Structure Repair ($250k/year)
- Stormwater Maintenance Contract ($325k/year)
- Ditch Maintenance ($100k)
- Various Stormwater Improvements ($250K/year)

Total Budgeted Funds = $925k

Street & Utilities Operations/Parks Operations

- Perform routine minor maintenance as needed on Dublin owned basins

BENCHMARKING

Homeowners Association (HOA) Maintenance

- Grove City
- Marysville
- Westerville
- Worthington

BENCHMARKING – Stormwater Utility

How do other agencies or cities fund the stormwater basin maintenance?

Stormwater Utility Fee

- 33 Central Ohio Municipalities Surveyed (2019)
- 56% of agencies have fee
- Central Ohio Average Utility Rate Fee's
  - Single Family Unit – 1 ERU = $3.54/month

Central Ohio Stormwater Utility Rate Comparison

Municipality	Stormwater Utility? Y/N	ERU (S.F.)	SFU ERU Rate (per month)	Commercial Comparative rate using 2000 sf	Current Date of Data	Comments
Ashville	Y	2,000	$3.00	$3.00	5/22/2017	actual rate is #0.0987/day
Athens	Y	NA; Charge Flat fee	$2.00	$4.00	5/22/2017	Flat fee based upon property type; want to institue an ERU system
Bellefontaine	Y	2,500	$3.75	$3.00	5/22/2017	Calculated Commercial rate average (See Note 1)
Bexley	N	2000	$1.98	$1.98	2/5/2016	goes to Columbus for Clean River Fund
Canal Winchester	Y	3,001	$3.00	$2.00	5/12/2014	
Cambridge	Y	-	$1.00	$2.00	2/1/2016	Fixed monthly rate for both
Circleville	N				5/12/2014	
Columbus	Y	2,000	$4.65	$4.65	5/22/2017	($0.1530 per day per ERU based on 366 days due to leap year)
Delaware	Y	2,773	$2.50	$1.80	5/22/2017	**considering future increases**
Dublin	N	-			5/22/2017	
Gahanna	Y	3,064	$4.33	$2.83	5/22/2017	
Grandview Heights	N				1/21/2016	
Grove City	N				5/22/2017	
Groveport	Y	2,760	$2.00	$1.45	5/22/2017	
Hilliard	Y	2,000	**$3.00**	**$3.00**	5/22/2017	**proposing two future increases**
Lancaster	Y	2,600	$7.64	$5.88	1/21/2016	
Marble Cliff	N				5/22/2017	
Marion	N				5/12/2014	
Marysville	Y	2,700	$3.75	$2.78	5/22/2017	
New Albany	N				5/12/2014	
Newark	Y	2,600	$6.80	$5.23	5/22/2017	Annual Increase of $0.15 through 2025; ending rate of $8.01/ERU
Pataskala	N				5/12/2014	
Pickerington	Y	2,530	$4.50	$3.56	5/22/2017	
Plain City	N				5/12/2014	
Powell	N				5/12/2014	
Reynoldsburg	Y	2,530	$4.00	$3.16	1/29/2016	
Riverlea	N				5/12/2014	
Shawnee Hills	N	2000	$1.98	$1.98	5/22/2017	goes to Columbus for Clean River Fund
Sunbury	N				5/22/2017	
Upper Arlington	Y	2,000	$3.75	$3.75	5/22/2017	
Westerville	N				5/12/2014	
Whitehall	N				5/12/2014	
Worthington	N				5/12/2014	
Average for CO Communities		**2391**	**$3.52**	**$2.99**		
Averages Rate	**48%**	**2441**	**$3.54**	**$3.11**		

BENCHMARKING – Stormwater Utility

Benchmarking Residential Stormwater Utility Fee Rates

- Columbus - $4.65
- Pickerington - $4.50
- Gahanna - $4.33
- Reynoldsburg - $4.00
- Upper Arlington - $3.75
- Hilliard - $3.00
- Delaware - $2.50
- Groveport - $2.00
- Canal Winchester - $2.00
- Bexley - $1.98
- Shawnee Hills - $1.98
- Westerville – No fee
- Worthington – No fee
- **Dublin – No fee**

OPTIONS – RESIDENTIAL STORMWATER BASINS

Option #1

- Dublin maintain existing 108 residential stormwater basins
- HOA maintain existing 46 residential stormwater basins
- New basin maintenance determined on a case by case basis during planning process

OPTIONS – RESIDENTIAL STORMWATER BASINS

Option #2

- Dublin maintain existing 108 residential stormwater basins
- HOA maintain existing 46 residential stormwater basins
- HOA maintain new residential stormwater basins moving forward

OPTIONS – RESIDENTIAL STORMWATER BASINS

Option #3

- Dublin maintain existing 108 residential stormwater basins
- HOA maintain existing 46 residential stormwater basins
- Dublin maintain new residential stormwater basins moving forward

OPTIONS – RESIDENTIAL STORMWATER BASINS

Option #4:

- Dublin maintain existing 108 residential stormwater basins
- Dublin assume maintenance of existing 46 residential stormwater basins that are currently maintained by HOAs
- Dublin maintain new residential stormwater basins moving forward

QUESTIONS?

Thank You!

Michael Hendershot, P.E.– Engineering/Review Services

Todd Garwick, P.E. – Engineering - Utilities

Community Services Advisory Commission

September 10, 2019

Minutes

Commission Members:	**Present:**	Marilyn Baker, Thomas Strup, Ann Bohman, Elizabeth McClain, Vivekanandan Arunachalam, Steve Dritz
	Absent:	Stephanie Hall
Staff Members Present:		Matt Earman - Director of Parks & Recreation Alison LeRoy - Director of Community Events Megan O'Callaghan, P.E. - Director of Public Works Todd Garwick, P.E. - Civil Engineer II Michael Hendershot, P.E. - Civil Engineer II Barb Cox, P.E. - Engineering Manager Claudia Husak, Senior Planner Nick Plouck, Management Assistant
Guests:		None

I. Call to Order

Mr. Strup established that a quorum was present and called the meeting to order at 6:32 p.m.

II. Public Comments on Items Not on the Agenda

No public comments

III. Approval of Meeting Minutes

Minutes from the June 11, 2019 meeting were distributed via email for review. Mr. Strup asked if there were any corrections to the minutes. There being no changes, Ms. Baker moved to approve, and Ms. Bohman seconded the motion. All in favor, the June meeting minutes were approved.

IV. Community Events – Final Recommendations (Alison LeRoy, Director of Community Events)

Ms. LeRoy opened by stating that Mr. Dritz posed a few comments in regards to discussion of the Permitted Events Policy from the June 1, 2019 meeting. Please see attachment – **Community Events Permitting Guidelines (PROPOSED)** with notations added.

Mr. Dritz stated his intent was to make certain elements quantitative. He felt some of the items needed more definition along with a scoring mechanism.

Mr. Earman commented that the policy draft was based on certain considerations but those are not binding. Items may be elaborated upon but still need to allow for flexibility.

Mr. Dritz asked who chairs and co-chairs the [internal vetting] committee. Mr. Earman replied there is a facilitator, not a chairperson. Mr. Dritz asked if language should be added to state, "*The Permitted Events Review Committee will be facilitated and organized through the Community Events Division.*"

Ms. LeRoy added that many of the events are recurring - see Recurring Events List – 2019 in Community Events Permitting Guidelines (PROPOSED). Ms. Bohman stated when Community Events allows these events to occur; they need to keep in mind singles, families and the community as a whole with its diversity.

Mr. Dritz proposed adding a column specifying the Tier designation for each event to the Recurring Events List – 2019.

Mr. Earman concluded stating he appreciated the feedback and comments. He added the City has continued to evolve. The Community Events Permitting Guidelines (PROPOSED), with the help of your comments, will help us to continue to evolve. We will need overall permission to take this proposed policy to City Council. Mr. Strup asked for a motion to approve the policy. Ms. Baker moved to approve. Mr. Dritz said he formally approved the guidelines. Mr. Strup asked do we have a motion and a second. All agreed. Mr. Strup moved onto the next topic on the agenda.

V. Stormwater Management Overview & Pond Maintenance (Megan O'Callaghan, Paul Hammersmith, Michael Hendershot, Todd Garwick)

Ms. O'Callaghan introduced herself to the Commission as the Public Works Director for the City of Dublin. She added that she had presented to some, but not all of the Community Services Advisory Commission members and looked forward to meeting all of them. Ms. O'Callaghan said the goal for the evening was to provide an overview of the stormwater system management and to hone in on the stormwater maintenance of ponds. She added the City has ponds that are maintained by HOA's and others that are maintained by the City. Staff will elaborate more on that during the presentation. We will also share information on benchmarking, the inventory of basins in Dublin and some options for moving forward.

According to Ms. O'Callaghan, the topic of storm water maintenance arises in discussions with City Council periodically. Typically, stormwater management is one of the first topics that comes up during development projects as a plat is under review. There are instances when HOA's request relief and request the City take over the pond maintenance. The City deals with those

requests on a case-by-case basis. Mr. Dritz asked if the pond properties are commercial or residential. Ms. O'Callaghan replied they are residential.

Ms. O'Callaghan introduced the team that leads the City's stormwater management program. Representing the City's Engineering Division are Michael Hendershot, Todd Garwick and Barb Cox. Representing the City's Planning Division is Claudia Husak. They are very knowledgeable, experienced and do an awesome job. Please feel free to ask questions along the way.

Mr. Hendershot thanked Ms. O'Callaghan and proceeded with the *Stormwater System Overview & Stormwater Basin Maintenance for Residential Development Agenda*.

Mr. Hendershot opened with an overview of the agenda and covered who would speak on each topic. Mr. Hendershot stated he would explain the City of Dublin's stormwater management goals and the importance of stormwater basins. In addition, he would outline the development process for residential stormwater basins, as well as provide an overview to describe how the basins operate. Mr. Garwick would be providing an inventory of stormwater basins, basin maintenance practices and associated costs, and maintenance benchmarking information of surrounding communities. Ms. O'Callaghan would conclude with proposed options and a recommendation regarding the maintenance of stormwater basins for residential developments.

Referring to the stormwater system overview graphic, Mr. Hendershot stated that it provides a good representation of what happens when it rains in a developed environment. As shown, rain can occur over impervious surfaces such as rooftops, driveways, sidewalks, streets, and parking lots. Rain can also occur over pervious surfaces, such as yards and green space. The rain is considered runoff if it does not soak into the ground. It drains to the stormwater conveyance system instead. This conveyance system consists of catch basins, curb and gutter inlets, manholes, storm sewer, ditches, swales. This runoff ultimately drains to rivers and streams.

As the runoff flows over the surfaces, it accumulates debris, chemicals, sediments, or other pollutants that could adversely affect water quality if the runoff is untreated. Additionally, the flow of runoff accelerates over impervious surfaces that can cause downstream flooding. So, what helps mitigate any adverse effects of runoff in a developed environment? The City of Dublin has the following stormwater management goals.

- Manage stormwater runoff – water quantity
- Reduce discharge of pollutants – water quality
- Control of sedimentation and erosion
- Maintain compliance with state and federal regulations

To manage stormwater runoff by regulating the release rate, which is also called water quantity management. Another goal is to reduce the discharge of pollutants. This is also termed *water quality management*. There are multiple measures that can be utilized to provide water quantity and quality management. These include retention basins, detention basins, permeable pavers,

bio-retention, and underground storage, to name a few. Water quantity management also reduces the likelihood of downstream flooding, streambank erosion, habitat destruction, and infrastructure damage. Water quality management will help protect the environment by reducing pollution and preserving green space.

According to Mr. Hendershot, other stormwater management goals include the control of sedimentation and erosion, as well as maintaining compliance with state and federal regulations for stormwater management.

In order to achieve those goals, the City of Dublin has a comprehensive stormwater management program. These six main components of the program include:

- Master Plan
- Maintenance of the stormwater system
- Capital Improvement Projects
- NPDES Permit Compliance
- Chapter 53: Stormwater Regulations
- Chapter 151: Floodplain regulations.

Stormwater basins mainly fall under the category of these four:

- Master Plan
- Maintenance
- Chapter 53: Stormwater Regulations
- NPDES Permit Compliance.

Mr. Garwick will be discussing the Maintenance component later in this presentation.

The Master Plan is a document originally completed in 1999 and updated in 2009. The purpose of the Master Plan is to minimize impact from development by establishing limits on stormwater discharges through modeling of City watersheds. The Master Plan contains prescribed release rates per acre for all City watersheds that a developed site is not permitted by code to exceed. The sizing and design of stormwater basins is largely based on the prescribed release rates that are defined in the Master Plan. The development and use of the prescribed release rates help mitigate flooding problems and improves the overall appearance and environmental quality of streams. The Master Plan also effectively developed a drainage system map and database as well as identified capital improvement projects associated with stormwater management.

Mr. Dritz asked what a watershed is. Mr. Hendershot responded a watershed is a defined area that drains into a single location.

Mr. Hendershot moved on to describe stormwater regulations and provided background information on Chapter 53, a component of the City of Dublin Code of Ordinances – Stormwater

Management and Stream Protection. This Code was created in 1998 and revised in 2005. Chapter 53 regulates stormwater from areas of new development for the protection of public health.

Mr. Dritz asks where Chapter 53 is located.

Mr. Hendershot replied that Chapter 53 is located in the within the City of Dublin Code of Ordinances. It is the legal backing utilized to enforce the Master Plan and establish the City of Dublin Stormwater Management Design Manual. The Design Manual is a document that sets forth the City standards for stormwater management and provides guidance for engineers in developing plans and stormwater calculations. The Design Manual includes control for water quantity, water quality, erosion and sediment on construction sites. The manual also provides design guidelines for control measures, such as retention and detention basins. It was adopted in 2005, subsequently updated in 2013 and again in 2019. Another component of the City of Dublin Stormwater Management Program is compliance with the National Pollutant Discharge Elimination System (NPDES) Permit. This Permit is regulated through the Ohio Environmental Protection Agency (Ohio EPA) and was created in 1972 under the US EPA Clean Water Act. The Clean Water Act establishes the basic structure for regulating discharges and pollutants into the water of the United States and regulating standards for surface waters.

The six minimum control measures that are part of the NPDES Permit are as follows:

- 1-Public Education and Outreach
- 2-Public Participation
- 3-Illicit Discharge Detection and Elimination
- 4-Management of Construction Site Runoff
- 5-Management of Post Construction Site Runoff
- 6-Good Housekeeping in Municipal Operations

Retention and Detention basins are part of minimum control measures 1, 4, 5, and 6. The City provides education to the public regarding the use and importance of stormwater basins. The management of construction and post construction site runoff can be accommodated by the use of stormwater basins. The maintenance of stormwater basins falls under the category of good housekeeping in municipal operations. As part of this Permit, a required annual report must be submitted every year to the Ohio EPA that summarizes the City's activities for compliance with the Permit.

Mr. Hendershot reiterated that the City makes it a practice to go above and beyond the required six minimum control measures. For example, the City adopted water quality regulations prior to the statewide mandate of water quality regulations by the Ohio EPA. The City of Dublin has been a leader in stormwater management for over 20 years.

Mr. Dritz asked who gets educated about stormwater basins.

Ms. Cox responded stating that information is provided to HOA's. The NPDES Permit requires that information go out to HOA meetings. HOA members receive flyers on pond maintenance and training is provided to developers regarding ponds as well.

Mr. Dritz stated he does not have any information on stormwater.

Ms. O'Callaghan asked if he had seen the information that the City posts/distributes during leaf collection season regarding keeping leaves out of the stormwater drains. Mr. Dritz replied that he had seen that information.

Ms. Bohman asked who HOA's with ponds talk to. Mr. Garwick responded that he has conversations and answers questions regarding debris removal, street drainage issues, and etcetera.

Mr. Garwick added that the City of Dublin also provides Franklin County information and flyers to residents.

Ms. O'Callaghan informed the Commission that the slide presentation was provided to illustrate the importance of stormwater maintenance due to regulations on the state and federal level.

Upon completion of the stormwater system discussion, Mr. Hendershot referenced the presentation outlining the pre-developed condition (2008-2009) for Celtic Crossing, a residential development located on the west side of Hyland-Croy Road, north of Brand Road.

Mr. Hendershot explained that the development process starts with required prerequisite planning approvals. The first approval is the preliminary development plan for the site, which includes preliminary drawings and stormwater calculations. At this stage in the project, details are not finalized, but the general size, location, and type of stormwater management facility is identified. In the Celtic Crossing example, four retention basins were selected to manage the site's stormwater.

Mr. Hendershot added that once the preliminary development plan has been approved, a final development plan and stormwater calculations are generated. The final development plan is equivalent to a 90% level final construction document submittal. Once the prerequisite planning approvals have been obtained, the final construction documents (which consists of construction drawings and a stormwater management report) are submitted to Engineering for approval. The project is constructed once Engineering approval of the construction documents has been obtained. After construction of the project, an as-built survey is required to be submitted to demonstrate compliance with the approved plans. Once the as-built surveys are approved by Engineering, the City of Dublin conditionally accepts the public improvements. Public improvements are the streets, sidewalks, path, and public utilities for the development. There is a one-year warranty period after conditional acceptance in which the developer is responsible for

repairs of the public improvements if deemed necessary by the City. Once the one-year warranty period expires, the City of Dublin maintains the public improvements.

Mr. Hendershot proceeded to provide a stormwater basin overview. He called attention to the outlet control structure, one of four retention basins within the Celtic Crossing development. He referenced the underground outlet pipe, to highlight the different components of the stormwater basin and explained the extended detention volume is the volume above the normal pool of water (volume of water in a non-rain condition) that is available for runoff storage. The permanent pool and forebay are located within the normal pool of the basin. Drawdown time is a water quality requirement to allow collected pollutants to settle down to the bottom of the pond prior to discharge through the outlet control structure. Retention basins have a 24-hour water quality drawdown time requirement. Aerators are recommended, but are not required for stormwater functionality of the basin.

Mr. Hendershot pointed out an outlet control structure for a retention basin and explained how the structure operates during a rain event.

Mr. Dritz asks where the water goes.

Mr. Hendershot stated that the water drains to nearby streams or rivers. He added you want to maintain the natural patterns of water flow. Mr. Garwick refers back to the Celtic Grading Plan. Mr. Hendershot points out the grading area showing the discharge feeding into the stream.

Next Mr. Hendershot referred to a dry stormwater detention basin located in Wellington Reserve. He pointed out a detention basin within the Wellington Reserve residential development and noted the outlet control structure; the control structure, capped at the top and open at the bottom with the outlet pipe underground. He explained the main different between a *detention* basin and a *retention* basin is there is no normal pool in a detention basin. The extended detention volume is the volume within the basin that is available for runoff storage. Detention basins have a drawdown time requirement with the exception that the required time is 48 hours.

Mr. Hendershot proceeded to show an example outlet control structure detail for a detention basin and explained how the structure operates during a rain event.

Mr. Hendershot turned the presentation over to Mr. Garwick who would provide an inventory of stormwater basins for residential developments.

Mr. Garwick proceeded to speak on the stormwater basin inventory with focus on the residential stormwater basins serving the different types of developments in both private and public areas. He explained that residential stormwater basins exist in the following scenarios:

- Single Family Subdivisions – Riviera, Ballantrae, Dublinshire, Wyandot Woods, Brighton
- Single Family Detached Homes – Cottages at Ballantrae, Villas at Ballantrae

- Condominiums – Lakes at Ballantrae, Woodlands at Ballantrae
- Apartment Complexes – Asherton, Tuller Flats, Residences at Scioto Crossings, just to name a few.

Next, Mr. Garwick covered the breakdown of ownership of the residential stormwater basins. He explained within Dublin, there are 305 residential stormwater basins. These numbers exclude all the commercial stormwater basins, roughly 270 stormwater basins. Of the 305 residential stormwater basins, approximately half are City-owned and half are privately owned. The ownership is determined by the property/parcel in which the residential storm basins reside according to Dublin's GIS database. The 154 Dublin-owned residential stormwater basins were dedicated to the City of Dublin as part of reserves, open spaces, and by easements on recorded plats during the development process. The 151 privately owned basins were assigned by plat to the association in Muirfield Village. Other cases like condominiums (Woodlands at Ballantrae), apartment complexes (Asherton), and single-family detached homes (Cottages at Ballantrae), are owned outright by the owners/operators of the parcels.

Mr. Dritz inquired about the categorization of the Golf Club at Dublin.

Mr. Garwick stated the City maintains the basins at that location.

To further breakdown the storage types of residential stormwater basins, Mr. Garwick provided the following:

- 29 Detention (Dry) – The Reserve Subdivision at Reserve Dr. /Dublin Rd.
- 62 Retention (Wet) – Lakes at Dunmere at the southeast corner of Brand/Muirfield
- 32 Aesthetic (Wet) – Muirfield Village Golf Club – No stormwater function, meaning detaining volumes for a specific purpose.
- 13 Parking Lot (Dry) – Villages at Heatherstone – Using stormwater control devices in each of the catch basins in the parking areas for the storage volume.
- 15 Underground Storage (Dry) - Tuller Flats and Hawthorne Condominiums. These use stormwater control devices in storm structures to maintain the underground storage volume in storm pipes, chambers and vaults.
- Privately owned basins are typically on-site spaces dedicated to stormwater management.

Mr. Dritz commented that underground storage sounds like an expensive option. Why do people do that?

Mr. Garwick explained the underground option is often utilized due to limited space.

Mr. Garwick explained the breakdown of the 154 Dublin-owned residential stormwater basins types:

- 94 Retention (Wet) – Riviera, Belvedere, Hawks Nest

- 48 Detention (Dry) – Coffman Reserve at Brenna Court, Wellington Reserve along Brand Rd., Coventry Woods at Coventry Woods Dr./Winchell Ct.
- 11 Aesthetic Ponds (Wet) – Brandon Park by Treetops (No stormwater function with these ponds)
- One Bio-Detention Basin (Dry) – Oak Park along McKitrick Road entrance into Oak Park.

Mr. Garwick noted that the bio-detention basin located in Oak Park is not noticeable to those driving by it.

After outlining ownership and basin types, Mr. Garwick further discussed who is responsible for the residential stormwater basin maintenance.

The maintenance responsibility breakdown is as follows:

- 46 of the 154 Dublin-owned residential stormwater basins are maintained by Private/ Homeowners Associations
- 108 of the 154 Residential Stormwater Basins are maintained by Dublin.

The determination of maintenance responsibility has evolved from HOA/Private to the City of Dublin over the years primarily through the development process and the occasional request from a Homeowners Association for relief of maintenance responsibilities

Ms. O'Callaghan elaborated, when planning and decisions were made, there was a lot of discussion in each case. Pond maintenance is one area where maintenance discussions occur.

Mr. Arunachalam stated that he lives in Muirfield and there seems to be a lot of flooding in the area. Mr. Garwick responded, stating he has not heard about any flooding issues there. Ms. O'Callaghan stated there have been some sanitary sewer issues. Mr. Arunachalam said he would have to get more information.

Mr. Garwick moved on to speak about the history and past practices of ownership and maintenance. He discussed how the Dublin maintenance and HOA/Private maintenance has evolved over the years in Dublin. Prior to 1999, the trend favored HOA ownership and maintenance. From 1999 to 2015, the practice leaned toward Dublin ownership and HOA maintenance. Since 2015, it has trended towards Dublin ownership and maintenance.

Mr. Strup asked, when you say ownership, do you mean deeding it over. Ms. O'Callaghan called on Ms. Husak to respond. Ms. Husak stated much is dependent with the discussion of ownership. Ms. O'Callaghan quantified that staff looks at each situation to see if the greater good of the community is benefiting or not. She added it has been subjective.

Mr. Dritz asked if the HOA pays taxes. Ms. Husak stated that the greenspace tax is paid by the HOA.

Mr. Dritz asked about the parks. Mr. Garwick stated that parks are released to the City.

Ms. O'Callaghan stated in 2015 Ms. Husak was involved in a discussion about the City of Dublin owning ponds that stemmed from a request from an HOA located near City Hall. Development started and then development ended. The property owners were responsible for a lot of open space and at that time, there were few residents. City Council gave those residents temporary relief. From that point forward, ponds that served a stormwater function were the ponds that the City should maintain. If the ponds were aesthetic in nature, the City did not maintain them. This was simply a case of the '*staff listened and implemented'*. It was, merely an informal practice, not documented or voted on. A handful of times per year this topic arises. That is what brought us here tonight. Mr. Garwick will elaborate on who maintains what.

Mr. Garwick said each case is a research project. This is what we want to formalize as part of the discussion for the future.

Mr. Garwick proceeded to cover the maintenance activities for basins. Retention (Wet) basin maintenance is very important to the overall quality of the basin. Some retention basins in Dublin possess buried storm sewer pipes into and out of the basin. Referring to Wellington Place, Mr. Garwick pointed out that there were no visible storm pipes entering or exiting because they are below the water level of the basin. In this case, maintenance consists of cleaning the pipes with a vactor truck, which is a very expensive piece of equipment.

Mr. Garwick described other forms of wet basin maintenance such as pond dredging, vegetation removal, algae control and nuisance animals and fish. Dredging is needed for depth maintenance to prevent algae and plant formation. As a precaution, several retention (wet) basins have safety shelfs of ten feet into the basin in case someone falls in. Depth maintenance is also important for the basin's overall appearance/health. Other maintenance components are basin aerators. Fountains are considered aesthetic. Mowing maintains the side slopes. Cattail, vegetation, trash and the removal of dead fish keep the basin healthy. Chemical control can be used for algae control, although this practice is expected to wane with the next permit cycle per Ohio EPA. Lastly, nuisance animals must be controlled. Beavers, carp or catfish can block the stormwater control structure outlet. Most recently, the Tartan West area experienced beaver activity and Riverside Woods had a carp stuck in the outlet control structure.

Next Mr. Garwick outlined maintenance of the dry detention basin management. Unlike wet retention basins, dry detention basin components are mostly visible. To date, most of the City's work has been performed on detention basins. Storm sewer pipes and structures are visible and in most cases, when there is a problem, the pipe or structures are covered with debris from the storm sewer system. Mr. Garwick referred to the Dublinshire detention basin.

The grading of a detention basin is an important component. Debris, branches, mud, rocks can block the stormwater outlet and change side slopes/bottoms, which in turn, decreases the

volume of water that can be stored in the basin. Debris in (concrete or stone) channels can create maintenance issues for the City and HOA's. Underdrains are a necessary component within detention basins to facilitate drainage in the bottom of the basin and prevent standing water when the slopes within the basin do not remove the stormwater. Mowing and vegetation control is a necessary component. Allowing vegetation to grow can reduce the flow of water and stormwater volume. Finally, trash removal is required so the flow of water at the outlet control structure in not restricted.

Next Mr. Garwick broached the subject of the estimated maintenance cost for each type of stormwater basin.

Retention (Wet) Basin

- $25,000 – $50,000/basin
    - Frequency: 20 – 25 years

Detention (Dry) Basin

- $15,000 – $20,000/basin
    - Frequency: 5 – 10 years

Routine Aesthetic Maintenance Costs

- Treatment - $1,000/basin/year
- Aerators:
    - Electrical $2,300/year
    - Replacement $7,000/unit
    - Frequency: 8 years

Mr. Dritz asked if these costs are over the life of the basin. Ms. O'Callaghan said it was difficult to base the cost. This is the best estimate. *This estimation was based on information from the City of Hilliard.

Mr. Garwick stated that retention basins are more costly to maintain from the information gathered to date. Maintenance elements with the most cost are cleaning storm sewer pipes into and out of the basin (buried in nature) along with outlet storm structure cleaning , and dredging the pond for depth purposes-involves pumping down water level and mucking/material removal in the basin bottom to establish the correct water depth. Regarding detention (dry) basins. They are less costly in general but can require maintenance that is more frequent. The grading, channels, and underdrains are the most costly items Dublin has encountered to date. The City also incurs maintenance costs in Park Operations; however, those costs are associated with maintaining the aesthetics of a pond rather than the stormwater function.

Mr. Garwick shared some examples of maintenance activities and costs associated with residential stormwater infrastructure and residential stormwater basin work.

Waterford Village - Longbranch/Pebble Creek – maintenance work involved grading, tree removal, and outlet control structure repair.

Wedgewood Hills – involved grading of the basin that filled in overtime and developed standing water, material/debris. The expense was incurred due to the use of equipment used for the work that was performed.
Woodlands – Detention (dry) basin – has a concrete channel between the inflow and outlet pipes. Upstream of this basin are bare denuded creek beds on private properties with multiple trees. Leaves from the trees drop and get into the storm sewer system, flow to this basin and create the majority of the work. The Woodlands is worked on most frequently according to Mr. Garwick.

2012 Stormwater Maintenance Contract

- Waterford Village – Longbranch/Pebble Creek Detention Basin
    - 1 week
    - $18,000 (approximate cost)
- Wedgewood Hills – Lyme Court Detention Basin
    - 1 week
    - $18,000 (approximate cost)

2015 Stormwater Maintenance Contract

- Woodlands - Detention Basin
    - 3 days' work
    - $10,800 (approximate cost)

Ms. O'Callaghan said it is important to note that contract work by the City requires the City to pay prevailing wage, therefore HOA's would pay lower costs.

Mr. Garwick gave a breakdown of Dublin's Capital Improvement Program for Stormwater Maintenance for the following work on infrastructure, which includes stormwater basins (currently in place for 2020).

- Storm Structure Repairs – curb/gutter inlets (street drainage structures) work ($250k).
- Stormwater Maintenance Contract – includes the stormwater basin maintenance currently, plus other small storm sewer pipe and storm structure repairs/work ($325k).
- Various Stormwater Improvements – typically includes storm sewer pipe extensions and storm structure installations in response to drainage complaints received from residents ($250k).
- Total stormwater funding equals $925,000.

The Streets and Utilities Division and the Parks Division also perform maintenance and minor repairs such as treatments, debris removal, and cattail removal on the Dublin-owned basins.

Recently, Dublin staff reached out to several Central Ohio agencies for feedback on their residential stormwater basin maintenance practices. The agencies listed have homeowner's associations who are responsible for residential stormwater basin maintenance:

- Grove City
- Marysville
- Westerville
- Worthington

Next Mr. Garwick provided examples of how other agencies or cities fund stormwater basin maintenance. There were 33 agencies surveyed. Fifty-six percent of the 33 agencies have a stormwater utility fee, with the Central Ohio average utility rate fee equaling $3.54 per month.

(1 ERU Unit = $3.54/month) The ERU (Equivalent Residential Unit) is a square footage determined by each municipality based generally on impervious area (hard surface types such as housing footprints, driveways).

Based on the survey the following Benchmarking Residential Stormwater Utility Fee Rates are:

Columbus - $4.65
Pickerington - $4.50
Gahanna - $4.33
Reynoldsburg - $4.00
Upper Arlington - $3.75
Hilliard - $3.00
Delaware - $2.50
Groveport - $2.00
Canal Winchester - $2.00
Bexley - $1.98
Shawnee Hills - $1.98
Westerville – No fee
Worthington – No fee
Dublin – No fee

These stormwater utility fee rates are from the immediate central Ohio area. Mr. Garwick pointed out, Columbus being the most expensive to Shawnee Hills being one of the least expensive. In addition, you can see the Cities not collecting a fee: Westerville, Worthington, and Dublin.

Mr. Dritz asked regarding the benchmarking process, did you find areas where the City did all maintenance on the basins? In response, Mr. Garwick said the City of Delaware was the only one. Ms. O'Callaghan stated Delaware implemented the fee when they took over the maintenance. Street sweeping was funded through stormwater maintenance. The City of Delaware collects around $750,000 per year.

Mr. Dritz asked, as a resident of Dublin, where would one see the fee or billing. Mr. Garwick replied that fees would be on Utility/Water billing.

After discussing funding options, Mr. Garwick introduced the topic of residential stormwater basin maintenance options facing Dublin. Ms. O'Callaghan outlined four options staff developed for discussion.

Option # 1:

- Dublin maintain existing 108 residential stormwater basins
- HOA maintain existing 46 residential stormwater basins
- New basin maintenance determined on a case by case basis during planning process

Option #2:

- Dublin maintain existing 108 residential stormwater basins
- HOA maintain existing 46 residential stormwater basins
- HOA maintain new residential stormwater basins moving forward

Option #3

- Dublin maintain existing 108 residential stormwater basins
- HOA maintain existing 46 residential stormwater basins
- Dublin maintain new residential stormwater basins moving forward

Option #4:

- Dublin maintain existing 108 residential stormwater basins
- Dublin assume maintenance of existing 46 residential stormwater basins that are currently maintained by HOAs
- Dublin maintain new residential stormwater basins moving forward

Ms. O'Callaghan said staff had touched on pond maintenance, provided a baseline and asked the Commission if they would like more detail on what had been presented. She opened the floor for staff to address questions.

Mr. Dritz asked about the maintenance numbers and total. Ms. O'Callaghan responded that the City has not had a documented policy for pond maintenance. It has been determined on a case-by-case basis. See option #1

Ms. Baker asked you are not talking about the 151 private ponds. Ms. O'Callaghan said, just City-owned ponds; ponds on land that the City owns. Mr. Dritz asked if a pond is private land then the HOA maintains it. Ms. O'Callaghan said focus is currently on ponds that are on City-owned land. Status quo. See option # 2 and option # 3 for moving forward.

Ms. Baker asked if there is a pros and cons list.

Ms. O'Callaghan said it comes down to cost and is a big responsibility. There are numerous regulations and of course, we all must do what is best for the environment.

Mr. Dritz asked if there are other options. Ms. O'Callaghan referred to option # 4. She added that the Commission could recommend others. We can have discussions.

Mr. Strup asked if there are waterways or ditches that go through Dublin that the County is responsible for. Mr. Garwick responded no, there are not. Ms. Cox added there is area in the watersheds that lay outside of the City limits and drain into the City limits. The City does not have any Big Darby Creek Watersheds, which have more restrictive regulations regarding stormwater management. Mr. Strup said that is good news.

Ms. Bohman asked if there was any history of HOA's not maintaining their ponds. Mr. Garwick said in his experience, they have done a good job. Ms. O'Callaghan added they want to figure out what to do with algae.

Ms. Cox said the ponds are getting older. As they age, the level of maintenance will increase.

Mr. Dritz asked if the City has access to the City of Delaware report. Ms. O'Callaghan said we could request it. Mr. Garwick added that Mr. Hammersmith had a conversation with the City of Delaware. Ms. Cox said Delaware had shared some of their code language.

Mr. Dritz asked if money were not an issue, which option would be best. Ms. O'Callaghan said the City would be better suited if money was not an option. Ms. Cox said the line between the open space and pond issue, in terms of maintenance responsibilities, is complex. Ms. O'Callaghan replied there is not a one size fits all solution.

Mr. Strup said he is going to need more information, particularly with option # 4. The work needs to be categorized. There may be some caveats. We need to drill down more. Someone has to pay. Ms. Cox said it depends upon preference. Ms. O'Callaghan added that we did not want to throw too much at you. Ms. Cox elaborated stating there is a history of fees and stormwater issues have been in Council conversations since 1998. Ms. Baker asked if staff could provide examples, estimates of costs, the number of houses, effect on residents and some of the typical differences. Ms. O'Callaghan asked if the Commission would like to have City staff do research from 1998 until the present. Ms. Cox said she would have to see if we have that information.

VI. Other Items of Interest

Mr. Dritz asked if the Pedestrian Bridge is still on schedule.

Ms. O'Callaghan said the bridge is still on schedule to open at the end of the year. There is a concrete pour coming up. Supports are coming at the end of the year. Cable systems from Italy arrived. The crew spent days testing those. Once the concrete deck is supported, the handrail will be added, and electric has to be completed. There is still a lot yet to be done, but completion is slated for the end of the year.

Ms. Bohman asked if weather would or could affect the opening. Ms. O'Callaghan said rain could be an issue; a heavy rainfall could cause a two-week delay due to the river rising.

Mr. Strup asked if there are any other items of interest.

Ms. Bohman stated that she had participated in CSAC invitations and other related events since our last CSAC meeting in June 2019. (See below) Also, see the Hyperloop report and the Fall 2019 Booklet distribution report.

VII. October 8, 2019 meeting has been cancelled.
Next meeting: November 12, 2019

VIII. Adjournment

Respectfully Submitted by:

Sandra Pickens

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Sandra Pickens, Administrative Support III

Attachments: Community Events Permitting Guidelines (PROPOSED)-revised
Stormwater Ponds Presentation
September 10, 2019 Guest List
Community Advisory Commission – Other Items of Interest
Virgin Hyperloop One XP-1 Pod information

Community Services Advisory Commission (CSAC)

September 10, 2019 meeting
VI. *Other Items of Interest*
(Participation in CSAC invitations & related events by Ann Bohman)

Tuesday, June 25, 2019, 6-7pm:

Attended Barbara Ray's tour of the Ancient Earthworks of Dublin in the new Ferris-Wright Park site of the Adena-Hopewell ceremonial mounds, including the first timber frame home in Dublin. Volunteer opportunities forthcoming!

Tuesday, August 6, 2019 7:30-9:30am:

Attended with Steve Dritz the Hyperloop Program

(See separate report)

Thursday, August 15, 2019 4-7:00pm:

Attended the Angel Mumma, Dublin City Finance Director's Farewell Ceremony. Angel will now be COTA's finance director. I served as the Dublin COTA representative for three years and I had the opportunity share with her my experiences.

Saturday, August 17, 2019 4pm: AGING IN PLACE

Met with Stephanie Jursek to learn more about the Forever Dublin Hub and to help with the distribution of the Hub flyers in the community.

Stephanie Jursek
Dublin Older Adult Program Specialist and Forever Dublin Hub Coordinator Syntero
sjursek@syntero.org

Dublin Office
299 Cramer Creek Court Dublin, OH 43017 (614) 301-5645 (Mobile) (614) 889-9335 (Fax)
www.syntero.org

Wednesday, August 28, 2019 1-2pm: THE BIG TABLE

Hosted the event at our Dublin Library. Items shared were ones CSAC has been working on. For example: Forever Dublin Hub, transportation, and recycling.

RECYCLERIGHT.org/scroll down to the orange box entitled "Recycle and Reuse Search Tool"
(This Week Dublin Villager newspaper, July 25, 2019, Page A8)

Tuesday, September 3, 2019 6:30-8pm: Renovations of the North Pool

A refined design concept based on public input and approved funding was shared.

Virgin Hyperloop One XP-1 pod
Tuesday, August 6, 2019
7:30am-9:00am

Attended by Ann Bohman and Steve Dritz, Community Service Advisory Commission members

Columbus to Chicago in 41 minutes!!
(Welcome to the Jetsons!)

*Connecting Columbus to Pittsburgh and Chicago.
*A pod designed to travel through metal tubes at speeds in excess of 600 mph.
*The goal is to be one of the first tracks to be built in the United States by the late 2020s.
*The first Hyperloop project in the world was approved by the Indian government, connecting Pune to Mumbai, reducing the commute from 3.5 hours by road to 35 minutes.
*Pressurize pods would be smooth for passengers.
*Hyperloop would be safer than flying.
*It's clean, uses magnets and electricity and no fossil fuels-Not destroying the environment.
*Pods travel in groups, they are not connected, allowing for direct travel to a destination without the need for each pod to drop off and pick up passengers at each station.

Sources:
The Columbus Dispatch, Wednesday, August 7, 2019, p.B4
MORPC: Rapid Speed Transportation Initiative (RSTI) Contact: Dina Lopez 614-233-4149
City of Dublin website Search: Hyperloop
ArchDaily Website, August 16, 2019 posting

Distribution of the
HEALTHY Recreation Services Programs & Activities BOOKLET
by the Community Services Advisory Commission (CSAC) MEMBERS
9/10/19
(4 BUNDLES of 25 copies)

Dublin Chamber of Commerce
Dublin Convention & Visitors Bureau

STEVE DRITZ

Forever Dublin Hub

VIVEKANANDAN ARUNACHALAM

Columbus Metropolitan Library | Dublin Branch

MARILYN BAKER

Ohio University/College of Health Services and Professions
City Hall

ANN BOHMAN

City of Dublin
OHIO, USA

Stormwater Management Design Manual

INTERIM UPDATE: January 2019

NOTE: This interim update has modified the water quality calculations (WQv), rainfall depth (for WQv calculations), and references for the current Ohio EPA Construction General Permit (OHC000005) to comply with the current Ohio EPA Construction General Permit.

STORMWATER MANAGEMENT DESIGN MANUAL

Prepared for:

City of Dublin, Ohio
Department of Engineering
5800 Shier Rings Road
Dublin, Ohio 43016

Prepared by:

Tetra Tech

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APPENDICES

A. Section 53.070 Exemptions

B. Example Stormwater Approach and Calculations

C. Supplemental Rainfall Information

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1. INTRODUCTION

A. Purpose and Intent

The purpose of this Manual is to set forth the City's standards for stormwater management, and to maintain uniformity in the design standards used for stormwater management. It is a further purpose of this Manual to enable the City to provide effective and efficient review of design data, and to provide applicants with clear guidance in preparing Stormwater Management Plans that further the City's goals for community development and stormwater management.

Stormwater management is an evolving science. The City's goal in preparing this Manual is to enact standards reflecting the most innovative, creative, environmentally effective, and cost-effective practices available. To achieve this goal as stormwater science evolves, this Manual will be revised and updated as necessary to reflect accepted new standard stormwater management practices and control measures (commonly called Best Management Practices or "BMPs", but referred to in this Manual as stormwater control measures).

Through the standards and practices incorporated in this Manual, the City encourages the use of stormwater treatment and engineering methods that allow for groundwater recharge and that manage stormwater as close to its source as possible. The use of Environmentally Sensitive Development (ESD) methods such as conservation design, smart growth, green infrastructure, integrated site design and sustainable development are practices and methods that can help achieve these goals, and are reflected in the standards in this Manual. Specifications for stormwater control measures that use vegetation and soil media to filter, treat or infiltrate stormwater, often referred to as "Low Impact Development" or "LID BMPs," have been incorporated into this Manual. These practices are encouraged to be used in Dublin where suited to site and development conditions, and consistent with the standards in this Manual.

This manual rescinds the previous Manual dated January 2007.

B. Applicability

The provisions and standards of this Manual apply to all publicly- and privately-sponsored projects in the City of Dublin, regardless of the size of the project or the amount of area disturbed, unless exempted under the provisions of Chapter 53.070, Exemptions (See Appendix A, Section 53.070 Exemptions). This includes the alteration, construction, redevelopment, installation, demolition or removal of a structure, impervious surface or drainage facility; clearing, scraping, grubbing, killing or otherwise removing the vegetation from a site; or adding, removing, exposing, excavating, leveling, grading, digging, burrowing, dumping, piling, dredging or otherwise significantly disturbing the soil, mud, sand or rock of a site. Specific thresholds and standards for different types of projects, and standards applicable to specific areas of the City, are enumerated in the Manual.

C. Organization of this Document

Chapter 2, Hydrologic & Hydraulic Design Criteria, addresses the specific design criteria required to design stormwater control measures in terms of the rate, volume and water quality. Climatological information is provided on the rainfall patterns and distribution to be used in preparing an application.

Chapter 3, Special Conditions and Constraints, highlights site conditions that require supplemental protection or that potentially represent a hazard to the public health, safety or welfare are identified and protective measures are incorporated into the design of site improvements and storm water management measures. This section also establishes standards and demonstrations for approval that are consistent with other regulatory requirements and procedures applicable to development within the City of Dublin.

Chapter 4, Flow Conveyance, provides standards and criteria to ensure the safe and effective flow of storm water through flow paths, treatment facilities and the physical storm drainage system in a manner consistent with protection of the public health, safety and welfare; the safety and function of properties,

roads and improvements; and maintaining and improving water and environmental quality in the City of Dublin and its surface waters.

Chapter 5, Stormwater Control Measures, defines the approved stormwater treatment and control measures and practices for use in the City of Dublin. Design guidance and requirements for each type of control measure are presented in a table with accompanying figures.

Chapter 6, Bridge Street District Integration with Stormwater Management, defines and describes the manner in which recommended stormwater treatment and control measures (as defined in Chapter 5) may be used in specific areas of the Bridge Street District. This Chapter is intended to support the general purpose, scope and intent of the Bridge Street District by promoting and facilitating the use of recommended stormwater control measures that are consistent with and suitable for particular street families, right-of-way elements, building types, building sites, and open space types, and which contribute to sound stormwater management in a walkable mixed-use development setting.

Chapter 7, Stormwater Management Plan, provides guidelines, standards and requirements for the orderly development, approval, and implementation of Stormwater Management Plans, including provisions for shared systems and ongoing maintenance. This Chapter sets forth the requirements for preparation and submittal of Stormwater Management Plans, and provides a framework by which property owners and public agencies may propose collectively an overall plan for managing stormwater from multiple properties, where such a management plan will enable greater consistency with the City's adopted plans and policies. It is a further purpose of this Chapter to provide sufficient standards and safeguards for associated plans, approvals and agreements to protect the public interest by ensuring long-term management and maintenance of stormwater management facilities.

Chapter 8, Erosion and Sediment Control, provides standards and guidelines for the preparation of erosion and sediment control plans that protect public health, safety and welfare, and the quality of Dublin's waters from excessive erosion and sedimentation resulting from the construction and operation of development.

2. HYDROLOGIC & HYDRAULIC DESIGN CRITERIA

This Chapter addresses the specific design criteria required to design stormwater control measures in terms of the rate, volume and water quality. Climatological information is provided on the rainfall patterns and distribution to be used in preparing an application under this Chapter.

A. Applicability of Stormwater Requirements

1) Site Development Projects

The stormwater management design for site development projects shall comply with the post-construction water quality requirements of the Ohio EPA's NPDES Construction General Permit for storm water discharges for sites disturbing more than one acre, and with the requirements of this Manual:

a) For new development, use Table 2-1. See Figure 2-1 for graphical representation of the locations listed in Table 2-1. The requirements in Table 2-1 will be met on any new development (building, parking, roadways, site improvements, etc.) on a vacant parcel(s).

b) For redevelopment projects disturbing more than one acre, use Table 2-2 to determine the requirements of stormwater management controls for the site. These developments are ones which modify, expand, add, alter, or change an existing site, including and not limited to the building, parking, roadways and other site improvements.

c) For redevelopment projects disturbing less than one acre, use Table 2-3 to determine the requirements of stormwater management controls for the site.

d) The drainage area tributary to the required stormwater controls should include runoff from outside of the site that naturally flows overland onto the site, unless the City Engineer determines otherwise due to unique or site specific circumstances.

TABLE 2-1 STORMWATER MANAGEMENT REQUIREMENTS BY LOCATION

Location	Quantity	Quality
Outside Bridge Street District	Per Dublin Stormwater Master Plan Rates	0.9 inch event
Historic District Parcels < 1 acre	Not applicable	Not applicable
Historic District Parcels > 1 acre	Not applicable	0.9 inch event
River Corridor	Not applicable	0.9 inch event
Bridge Street District West	Not applicable	1.00 inch event
Bridge Street District East A	Not applicable	0.9 inch event
Bridge Street District East B	Per Dublin Stormwater Master Plan Rates	0.9 inch event

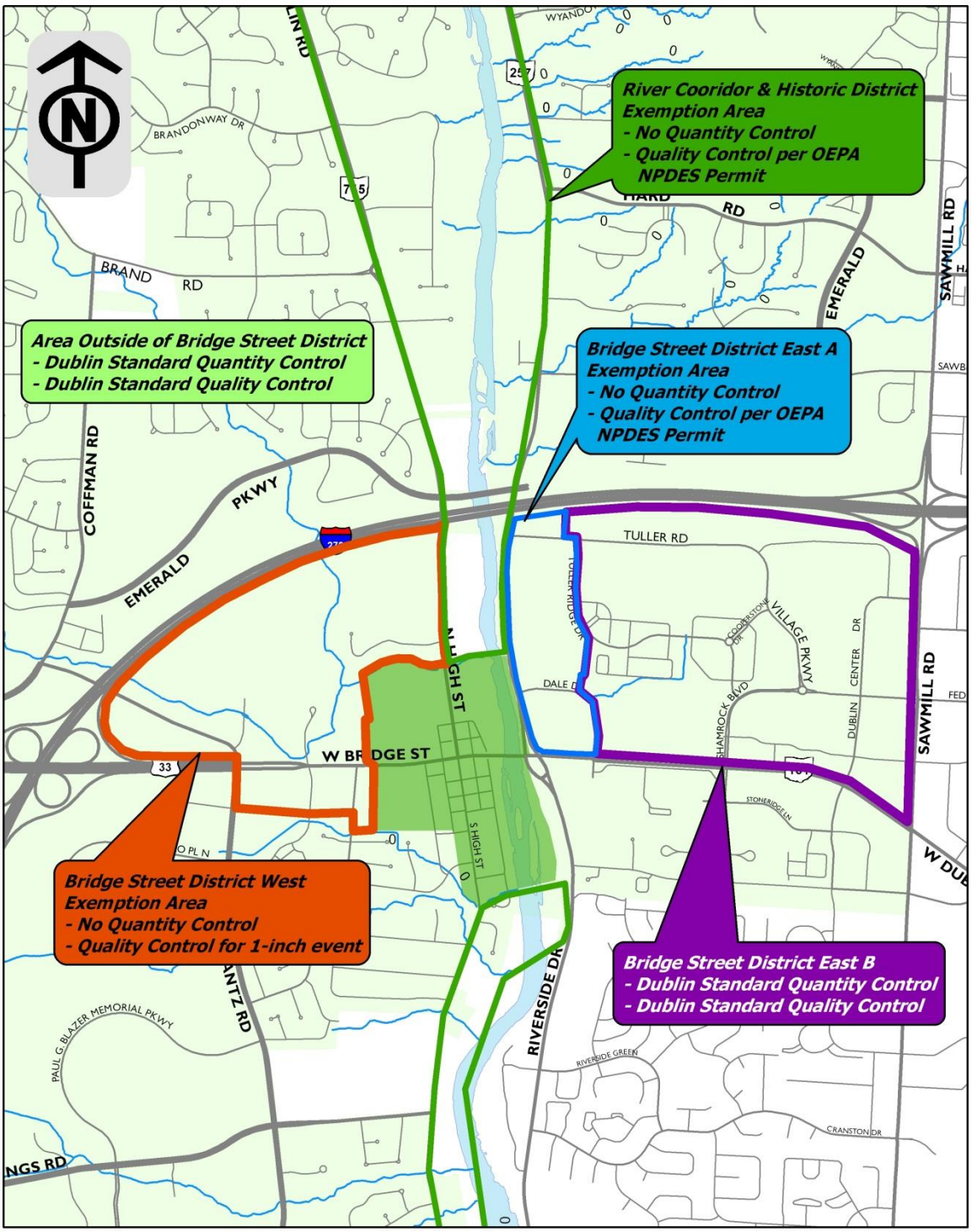

FIGURE 2-1 STORMWATER MANAGEMENT REQUIREMENTS PER LOCATION

TABLE 2-2 REDEVELOPMENT SITES DISTURBING ONE OR MORE ACRES OF LAND

Percent Change of Site Modifications (includes building & site improvements)*	Quantity Control Level	Quality Control Level	Additional Requirements
1 to 25	Stormwater Master Plan rates for the modified area only	OEPA Redevelopment requirements (ie. 20% WQv or reduction of impervious area)	Apply Feasibility Assessment to entire site
26 to 50	Level dependent on location of project for the modified area only; refer to Table 2-1	Provide control for 50% of Standard OEPA requirement (ie. 50% WQv)	None
51 to 100	Entire site must be brought into compliance with the requirements of Table 2-1	Provide control for 75% of Standard OEPA requirement (ie. 75% WQv)	None

*This is calculated based on the percent change of any and all improvements on the property including buildings and pavement. Example: An existing building occupies 55% of a site. It is being torn down and a new building constructed but the parking and rest of site is to remain unchanged, this would be a 55% change of the site and the 75% reduction of water quality volume (WQv) applies.

TABLE 2-3 REDEVELOPMENT SITES DISTURBING LESS THAN ONE ACRE OF LAND

Additional Impervious Area Created (square feet)[1]	Quantity Control Level	Quality Control Level
Less than 2,000 SF	Apply Feasibility Assessment to entire site	
Greater than 2,000 SF	Level dependent on location of project for the new impervious area only; refer to Table 2-1	Level dependent on location of project for the new impervious area only; refer to Table 2-1

[1] This number is the amount of impervious surface added to the site.

2) Right-of-Way Projects

The stormwater management design for projects within the right-of-way shall comply with the post-construction water quality requirements of the Ohio EPA's NPDES Construction General Permit for construction storm water discharges as follows:

a) For complete street reconstruction, all of the requirements must be met for the entire right-of-way.

b) For projects that increase the total area of impervious surfaces within a designated area, such as adding or widening lanes, adding bike facilities, or adding pedestrian facilities, all of the requirements must be met for the entire right-of-way.

c) For projects limited to roadway resurfacing, post-construction quality controls are not required.

d) The drainage area tributary to the required stormwater controls should include for calculation purposes any runoff from outside of the right-of-way that naturally flows overland into the right-of-way. At a minimum, the tributary area shall be defined as the full right-of-way, unless the City Engineer determines otherwise due to unique or site specific circumstances.

e) For new streets, use of the street right-of-way for stormwater management is limited to the management of the runoff from the street right-of-way and any tributary area as described in (d) above.

3) General Provisions

The stormwater management design for site development projects and projects within the right-of-way shall comply with the following general provisions:

a) No person shall:

i. Construct, maintain, operate, and/or utilize any illicit connection to the storm drainage system.

ii. Cause, allow or facilitate any prohibited discharge.

iii. Act, cause, permit, or suffer any agent, employee, or independent contractor to construct, maintain, operate or utilize any illicit connection, or cause, allow or facilitate any prohibited discharge.

b) Outdoor activity areas within the development site shall be delineated on the Stormwater Management Plan, and the activities that will be conducted within them shall be described in the Plan.

c) Runoff from outdoor activity areas shall not be allowed to co-mingle with runoff from the remainder of the site, and shall be directed to separate treatment systems, as approved by the City Engineer.

d) The site shall be designed to direct runoff from areas other than outdoor activity areas to one or more of the following stormwater control measures as described in Chapter 5:

i. Water Harvesting

ii. Filter Strips

iii. Media Filters

iv. Vegetated Stormwater Control Measures

v. Permeable Pavements

vi. Green Roofs

vii. Basins (Note: Detention/retention basins shall not be allowed in the Bridge Street District without prior approval from the City Engineer.)

viii. Underground Retention/Detention (Note: Underground retention/detention shall not be allowed in the Bridge Street District without prior approval from the City Engineer.)

ix. Prefabricated Devices

x. Other approved stormwater control measures

B. Climatological Information

Rainfall depths for Central Ohio shall be used in conjunction with the appropriate hydrologic routing method or peak flow method to determine design runoff volumes and peak flows. Design rainfall hyetographs shall be developed using the 24-hour rainfall depths from Table 2-4, distributed over a 24-hour period with a NRCS Type II distribution. The 24-hour Type II rainfall distribution represents design rainfall intensities over a time of concentration range typical of a small urban watershed, coupled with wet antecedent conditions at the time of peak rainfall intensity. Refer to Section 2.C. for quantity control requirements and Chapter 4 for flow conveyance requirements.

1) Rainfall Depths

TABLE 2-4 RAINFALL DEPTHS (39.972 N, 83.01 W)

Depths, inches						
1-yr	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
2.20	2.63	3.24	3.74	4.44	5.02	5.63

Source: Bonnin, Martin, Lin, Parzybok, Yekta, Riley, *NOAA Atlas 14, Volume 2, Version 3.0*, 2004. and NOAA Precipitation Frequency Data Server http://dipper.nws.noaa.gov/hdsc/pfds/ June 10, 2012

2) Rainfall Distribution

The following are two acceptable methods of generating the NRCS Type II 24-hour design storms. More detail regarding these methods is located in Appendix C.

a) Optimal Rainfall Intensity Equation Coefficients and Time-to-Peak Intensity Ratios found in "Mathematical Formulations of NRCS 24-Hour Design Storms" by David C. Froehlich, Journal of Irrigation and Drainage Engineering, March/April 2009 (Errata 2010)

b) Tabular distribution from Applied Hydrology by Ven Te Chow, David R. Maidment, and Larry W. Mays, 1988.

C. Quantity Control Requirements

The City's Stormwater Master Plan dated February 1999 shall be used to provide design flows and detention requirements for major drainage systems within the City.

For on-site drainage systems, hydrograph routing methods shall be used to design stormwater detention facilities and either hydrograph routing or peak flow methodologies may be used to design stormwater conveyance facilities.

1) Stormwater Control Measures

Stormwater control measures shall be installed on all development projects, unless the applicant demonstrates that the project will not increase the peak rate of runoff, volume, or frequency of the runoff hydrograph of the site prior to development.

Stormwater control measures shall be designed in the following manner:

a) *Studied areas.* Parcels located within drainage sub-basins established in the Stormwater Master Plan, or any subsequent update thereto, shall comply with the runoff release rate for each frequency storm specified in the Stormwater Master Plan. The applicant will need to supply project location information to Engineering Development Group Civil Engineers, who will supply the sub-basin information.

i. *Critical storm controls*. Determine the total volume of runoff from a 1 year, 24 hour storm, occurring over each of the site's drainage areas before and after development. Determine the percent of increase in runoff volume due to development:

Post – Pre /Pre * 100 = Critical Storm

ii. *Select critical storm.* Determine the percent of increase in runoff volume due to development and using this percentage, select the critical storm from the table:

TABLE 2-5 CRITICAL STORM DETERMINATION

If the Percent of Increase in Runoff Volume is		The Critical Storm Runoff Rate Will Be Limited to:
Equal to or Greater than	**And less than**	
--	10	1 year
10	20	2 year
20	50	5 year
50	100	10 year
100	250	25 year
250	500	50 year
500	--	100 year

iii. *Peak rate of runoff.* The peak rate of runoff from the critical storm occurring over the developed site shall not exceed the allowable peak rate of runoff from a 1 year, 24 hour storm occurring over the same area prior to development, as defined in the Stormwater Master Plan. Storms of less frequent occurrence (longer return period) than the critical storm shall have the allowable peak rate of runoff not greater than the allowable peak rate of runoff for the same storm as documented in the Stormwater Master Plan.

b) *Unstudied areas*. Stormwater control measures designed for parcels located outside drainage sub-basins established with the Stormwater Master Plan, or any subsequent update thereto shall comply to the following minimum design criteria:

i. Development of sites other than single-family residences and other development sites of less than or equal to 2.0 acres shall not release stormwater runoff greater than 0.2 cubic feet per second per acre of development. On-site storage shall be provided to achieve these peak flow rates.

ii. Development sites greater than 2.0 acres (including single-family lots) shall provide runoff controls as defined by the MORPC Stormwater Design Manual.

c) *Dam safety laws apply.* Stormwater detention and retention ponds which are considered by Ohio Department of Natural Resources (ODNR) to be dam structures regulated under the dam safety laws of the State of Ohio shall be designed to safely pass the design flood events as defined by ODNR. Where fill berms are proposed, calculations supporting the stability of the fill berms are to be submitted by a licensed professional engineer with demonstrated experience in geotechnical engineering. The applicant shall design all raised bermed stormwater ponds according to current ODNR dam safety criteria.

d) *Multiple drainage basins.* If the site has multiple drainage basins, the drainage basin divides that exist prior to development shall be used to determine predevelopment rates of discharge for each drainage area of the site.

e) *Fences.* Fenced stormwater facilities are strongly discouraged within the City and shall only be permitted if approved by the City. The City will consider fencing stormwater facilities only where steep slopes that potentially endanger human life are unavoidable. If fencing is required, the design shall conform to the City's fence code (Chapter 153 of the Zoning Code) along the right-of-way boundary around the entire perimeter, including maintenance berms with access for maintenance vehicles. Other designs may be permitted subject to the review and approval of the City Engineer.

f) *Grading requirements.* Areas adjacent to stormwater control measures shall be graded to restrict the entrance of stormwater except at planned locations. Where stormwater control measures,

particularly basins, are located on the project periphery, the developer may be required to provide additional landscaping or screening to adequately protect abutting properties.

g) *Maintenance berms.* The minimum requirement for publically-owned maintenance berms is as follows:

TABLE 2-6 MINIMUM REQUIREMENT FOR MAINTENANCE BERMS

PONDS	MINIMUM MAINTENANCE ACCESSWAY REQUIRED
With perimeter fencing	20 feet around perimeter
Without perimeter fencing	15 feet around perimeter
Access easement	20 feet along a designated corridor between the pond and a public right-of-way (lesser accessways are subject to the approval of the City Engineer)

h) *Water quality requirements.* Stormwater control measures shall also be designed to meet the stormwater runoff quality requirements of Section 2.D.

i) *Headwalls.* Headwalls shall be required at all storm sewer inlets or outlets to and from stormwater management facilities. Stone and/or brick material approved by the City Engineer shall be provided on all visible headwalls and concrete structures. Refer to City of Dublin Standard Construction Drawings (Standard Drawings) for details.

D. Stormwater Runoff Quality Requirements

1) The design water quality volume for all stormwater control measures shall be the runoff from the first .9-inch of rainfall of each and every storm event. Refer to OEPA Permit No.: OHC000005 or current version for values.

2) In addition, stormwater control measures shall be designed to accommodate flows exceeding their design capacity, either by bypassing excess flows, conveying excess flows through the facility without disrupting its stormwater quality control effectiveness, or storing excess flows as necessary to achieve the drainage, flood control, and erosion control objectives of this Chapter.

3) The Rainwater and Land Development Manual (Ohio EPA)may be referenced for additional design information.

4) Methodologies that incorporate infiltration and rainwater re-use and/or harvesting techniques are encouraged.

3. SPECIAL CONDITIONS AND CONSTRAINTS

The purpose of this Chapter is to identify a number of common site conditions that require supplemental protection or planning. Any site conditions that potentially represent a hazard to the public health, safety or welfare or require supplemental protection must be identified by the applicant in the Stormwater Management Plan, and protective measures must be incorporated into the design of site improvements and stormwater control measures. It is a further purpose of this Chapter to establish standards and demonstrations for approval that are consistent with other regulatory requirements and procedures within the City of Dublin.

A. Existing Wetlands

Recognizing that jurisdiction for all activities affecting wetlands, including mitigation, lies with the Ohio EPA and U.S. Army Corps of Engineers (Corps), the City supports the preservation of existing wetlands and values the stormwater benefits these provide. Wetlands have been determined to provide flood and storm control by the hydrologic absorption and storage capacity; pollution treatment by nutrient uptake from wetland plants and the filtering of silt and organic matter by settlement; protection of subsurface water resources by recharging ground water supplies; and wildlife habitat in nesting areas, feeding grounds, and cover for many species including migratory waterfowl, rare, threatened, or endangered wildlife species.

Jurisdictional and isolated wetlands on development sites shall be delineated by a qualified professional as required by the Corps and the Ohio OEPA. Wetland boundaries shall be mapped in an acceptable electronic format and submitted to the City. Copies of all permit applications and any associated wetland mitigation plans shall also be submitted with the Stormwater Management Plan. The City may not approve stormwater management reports or plans prior to receipt of copies of approved Federal (404) and State (401) permits if any such permits are required.

Where wetlands protected under federal or state law are located partially within the Stream Corridor Protection Zone, the Stream Corridor Protection Zone shall be extended to include the full extent of the wetland area plus any setback from the wetland required by a Section 404 permit.

For impacted wetlands that fall outside the Stream Corridor Protection Zone, the City encourages the mitigation of proposed impacts to occur within the limits of the development site but not outside the boundaries of the same HUC-14 subwatershed. To encourage onsite or intra-watershed wetland mitigation, the City will consider the location of mitigation projects within the Stream Corridor Protection Zones of properties that are located adjacent to a tributary stream provided that:

1) Impacts to isolated wetlands and associated mitigation plans are approved/permitted by the Corps and/or OEPA, and

2) Wetlands constructed for Section 404/401 mitigation purposes are not used to serve as a stormwater control measures to treat stormwater runoff.

The stormwater system design for the project shall provide that the predevelopment quantity and quality of stormwater flows directed to any protected wetlands is maintained. Constructed wetlands (including bio-retention basins) shall not be considered subject to these requirements. Existing wetlands shall not be used for stormwater management or stormwater runoff quality treatment of the development site.

B. Floodplain Encroachment

Floodplain encroachment calculations shall be presented in the following format:

1) 100-year HGL: The applicant shall demonstrate that development in a FEMA Special Flood Hazard Area (SFHA) flood plain does not increase the 100-year flood elevations. Show calculations or computer model output that demonstrates the pre-development and post-

development flood elevations. The applicant should include an SFHA permit and the appropriate fee with the Stormwater Management Plan.

2) Compensating storage: The applicant shall demonstrate that any volume of fill placed in the 100-year floodplain is compensated with an equal volume of material removed above the ordinary high water table and below the 100-year flood elevation. The applicant shall show the volume calculation for the fill and the compensating storage.

3) Note: Please refer to Chapter 151, City of Dublin Codified Ordinances for further information regarding floodplains and floodways.

C. Stream Corridor Protection Zones

The Stream Corridor Protection Zone (SCPZ) is that which is described in § 53.200 Establishment of a Stream Corridor Protection Zone. The SCPZ is the area of setback along a stream established to protect the riparian area and stream from the impacts of development, and streamside residents from the impacts of flooding and land loss through erosion. Streams or channels to which these provisions apply are those having a well-defined bed and bank, either natural or artificial, which confines and conducts continuous or periodic flowing water in such a way that terrestrial vegetation cannot establish roots within the streambed, including intermittent, ephemeral, and perennial streams; and streams identified by USGS or NRCS maps. Prohibited uses of the SCPZ include construction, disturbance of natural vegetation, and generally any earth-disturbing activity. However, an SCPZ may be used for stormwater management upon approval from the City Engineer and/or all other applicable review authorities. Refer to § 53.200 for more detail regarding the defined width of a SCPZ, permitted uses, and prohibited uses.

D. Karst and Sinkholes

1) Construction in Sinkhole Drainage Areas: The immediate area around a sinkhole should be disturbed as little as possible. The use of mechanized equipment near the sinkhole should be avoided. Sink areas are known to be unstable for construction. Structures placed on soil foundations in sink areas may be subject to both settling and collapse of the sink. Uncontrolled fill placement may present additional settlement hazards. It shall be required that appropriate geotechnical studies be done and measures taken to insure structure foundations are designed to take into account potential sinkhole locations and instability. Such studies shall account for potential foundation problems for both undisturbed sink areas and those previously filled by others.

2) The floodplain line for a sinkhole is defined by the sinkhole lip elevation. Therefore, the storage volume beneath this elevation is the sinkhole floodplain storage volume. *The pre-development floodplain storage volume must be preserved under post development conditions*. If any fill is added in the floodplain outside the no-fill lines, compensating excavation in the floodplain shall be required.

3) The no-fill line shall be established by the contour line or interpolated contour line for the elevation that defines 60% of the floodplain storage volume. The area encompassed by this line shall be defined as a no-fill zone for all construction activities. No construction fill will be allowed in this zone.

E. Contaminated Sites

Direct infiltration on a brownfield site may introduce additional pollutant loads to groundwater and nearby surface waters. Stormwater control measures can be designed to retain, treat and then release stormwater without allowing it to ever come in contact with contaminated soils.

A key component of stormwater management on brownfield sites is the capture, treatment and storage of the stormwater, rather than complete infiltration. Most brownfields that have residual contamination require the use of a cap to prevent water from coming into contact with contaminated areas. Buildings and other impervious surfaces can be strategically located to act as caps over areas with known contamination. Areas with fill caps can include soils and vegetation above the cap in the form of stormwater control measures such as vegetated control measures (see Section 5). If fitted with an underdrain system to release treated stormwater without infiltration, these planted areas can safely allow filtration and evapotranspiration of stormwater. Additional features such as impermeable liners or gravel filter blankets can be coupled with modified stormwater control measures that safely filter stormwater without exposing the water to contaminated soils.

Green roofs are an ideal way to reduce the runoff from building roofs by encouraging evapotranspiration of rainwater. Another option for brownfield sites is the capture and reuse of stormwater for non-potable uses; this can include runoff storage in rain barrels for irrigation of green roofs or landscaped areas, or in cisterns that store rainwater for toilet flushing and other uses.

4. FLOW CONVEYANCE

The purpose of this Chapter is to provide standards and criteria to ensure the safe and effective flow of storm water through flow paths, treatment facilities and the physical storm drainage system in a manner consistent with protection of the public health, safety and welfare; the safety and function of properties, roads and improvements; and maintaining and improving water and environmental quality in the City of Dublin and its surface waters. Refer to Standard Drawings.

A. Storm Sewers

1) Public storm sewers shall be designed such that they do not surcharge from runoff caused by the 5 year, 24 hour storm, and that the hydraulic grade line of the storm sewer stays below the gutter flow line of the overlying roadway, or below the top of drainage structures outside the roadway during a 10 year, 24 hour storm.

2) Private storm sewers shall be designed such that they do not surcharge from runoff caused by the 2 year, 24 hour storm, and that the hydraulic grade line of the storm sewer stays below the gutter flow line of the overlying roadway, or below the top of drainage structures outside the roadway during a 5 year, 24 hour storm. The system shall be designed to meet these requirements when conveying the flows from the contributory area within the proposed development and existing flows from offsite areas that are upstream from the development.

3) Stormwater runoff from offsite areas that discharge to or across a development site shall be conveyed through the stormwater facilities planned for the development site at their existing peak flow rates during each design storm. No Stormwater Management Plan will be approved until it is demonstrated that offsite runoff will be adequately conveyed through the development site in a manner that will not exacerbate upstream or downstream flooding and erosion.

4) The minimum inside diameter of pipe to be used in public storm sewer systems is 12 inches. Smaller pipe sizes may be used in private systems, subject to the approval of the City Engineer.

5) All storm sewers shall be designed and constructed to produce a minimum velocity of 3.0 feet per second (fps) when flowing full. The City Engineer may impose additional hydraulic design criteria for any storm sewer system or portion thereof designed at a supercritical slope and/or with a full-flow velocity in excess of 10 fps.

6) The outlet ends of all storm sewers shall be provided with sufficient energy dissipaters and erosion protection. See Standard Drawings for rock channel protection details; additional measures may be needed depending upon specific site conditions.

7) The following maximum lengths of pipe shall be used when spacing access structures of any type:

TABLE 4-1 STRUCTURE SPACING

PIPE SIZE	STRUCTURE SPACING
12 to 18 inches	300 feet
24 to 36 inches	400 feet
42 inches and larger	500 feet

8) All storm sewer systems shall be designed taking into consideration the tailwater of the receiving facility or waterbody. The tailwater elevation used shall be based on the design storm frequency.

9) The hydraulic grade line for the storm sewer system shall be computed with consideration for the design tailwater on the system defined in the Stormwater Management Plan and the energy

losses associated with entrance into and exit from the system, friction through the system, and turbulence in the individual manholes, catch basins, and junctions within the system.

10) The minimum cover for storm sewers within the right-of-way shall be one foot measured from the top outside of pipe to the bottom of underdrain at the back of curb. Should underdrains not be required, the minimum cover shall be one foot measured from the top outside of pipe to the top of subgrade at the back of curb. Outside the street right-of-way, a minimum two feet of cover shall be provided measured from the top of finished ground surface to the top outside of pipe.

11) All storm sewers shall be backfilled with Item 912 within the right-of-way and the area of influence of pedestrian paths, fire apparatus access roads, and maintenance berms. All others area shall be backfilled with Item 911.

12) The desired maximum distance for overland flow should be 300 feet before entering a storm structure.

13) The desired maximum overland drainage area tributary to the storm structure should be no greater than 1.5 acres.

14) The maximum spacing of curb inlets shall not exceed 300 feet, or that spacing which shall permit a maximum permissible spread. Spread calculations shall be provided with all storm drainage calculations. Maximum permissible spread is 6′ from edge of pavement for streets less than 28 feet measured back to back of curb. A 12-foot clear lane shall be maintained for streets wider than 28 feet. A design storm of 5 years shall be used to determine allowable spread.

15) Within a residential subdivision, catch basins shall be installed in the rear lots approximately every third lot. The property shall be graded in such a way to provide that the stormwater can reach the catch basin through a swale or another measure as approved by the City Engineer.

16) The inverts of all curb and gutter inlets, manholes, catch basins, and other structures shall be formed and channelized.

17) Storm sewer structures shall have grates that permit safe crossing by bicycles as approved by the City Engineer.

18) In areas where public safety and welfare concerns (specifically with children) are an issue, the City Engineer may require that any storm sewer outlet greater than 18 inches in diameter accessible from stormwater management facilities or watercourses shall be provided with safety grates, as approved by the City Engineer. See Standard Drawings.

19) Headwalls shall be required at all storm sewer inlets or outlets to and from open channels or lakes unless otherwise approved by City Engineer.

20) Stone and/or brick approved by the City Engineer shall be provided on all visible headwalls and concrete structures, unless this requirement is specifically waived as part of a Stormwater Management Plan. See Standard Drawings.

B. Culverts and Bridges

1) Roadway stream crossings other than bridges shall be designed to convey the stream's flow for the 25-year, 24-hour storm, with a maximum headwater depth that does not cause flooding or significantly pressurize the culvert, as defined by the Ohio Department of Transportation.

2) The minimum inside diameter of pipes to be used for culvert installations under roadways shall be 12 inches. The minimum inside diameter of pipes to be used for driveway crossings shall be 12 inches.

3) The maximum slope allowable shall be a slope that produces a 10-fps velocity within the culvert barrel. Erosion protection and/or energy dissipaters shall be required to properly control entrance and outlet velocities.

4) All culvert installations shall be designed with consideration for the tailwater of the receiving facility or waterbody. The recurrence frequency of the tailwater elevation shall be the same as the culvert design storm frequency.

5) The determination of the required size of a culvert installation can be accomplished by mathematical analysis or by the use of design nomographs.

6) Headwalls shall be required at all culvert inlets or outlets to and from open channels or lakes. Stone and/or brick approved by the City Engineer shall be provided on all visible headwalls and concrete structures unless specifically waived as part of a Stormwater Management Plan. See Standard Drawings.

7) The minimum cover for culverts within the right-of-way shall be one foot measured from the top outside of pipe to the bottom of underdrain at the back of curb. Should underdrains not be required, the minimum cover shall be one foot measured from the top outside of pipe to the top of subgrade at the back of curb. Outside the street right-of-way, a minimum two feet of cover shall be provided measured from the top of finished ground surface to the top outside of pipe. The structural design of culverts and bridges shall be the same as that required by the Ohio Department of Transportation.

8) Bridges shall be designed such that the hydraulic profile through a bridge shall be below the bottom chord of the bridge for either the 100-year, 24-hour storm, or the peak 100-year flood elevation, whichever is more restrictive.

9) 100-year HGL: The applicant shall demonstrate that the hydraulic grade line resulting from the 100-year, 24-hour storm does not encroach on the roadway above the culvert or above the low chord of bridge. The HGL shall be shown graphically on the storm sewer construction plans or on a tabulation spreadsheet.

10) Velocities: The applicant shall tabulate the culvert flow velocities, and demonstrate that the velocities do not exceed 10 feet per second within the culvert barrel.

11) Tailwater and energy loss: The applicant shall list all tailwater assumptions and their source for applicable design storm events, and the energy loss assumptions at the entrance/exit of the structure.

C. Open Channels

1) Where applicable, streams within the City shall be preserved and protected according to the criteria in § 53.200. Requirements for increasing the conveyance capacity, repairing streambank erosion damage, restoring floodplain storage, and/or rehabilitating aquatic or riparian habitat shall be determined by the City Engineer based on the Stormwater Master Plan or other site-specific criteria necessary to protect the public health, safety and welfare or to satisfy pertinent state and federal regulatory requirements.

2) Wherever possible, drainage tributary to streams, wetlands, lakes, and detention facilities shall be maintained by an open channel with landscaped banks designed to carry the 10-year, 24-hour stormwater runoff from upstream contributory areas. The City Engineer may increase the design storm as conditions require.

3) Alterations to streams and other open channels within FEMA floodplains shall be designed according to the requirements of Chapter 151 of the Dublin City Code along with the requirements contained in this Chapter. All open channels shall be designed with one foot of freeboard above the design water surface elevation of the open channel flowing full.

4) Flood relief channels shall be designed to convey the runoff from the 100-year, 24-hour storm, such that a positive discharge of this runoff to an adequate receiving stream or conveyance system results without allowing this runoff to encroach into proposed or existing residential dwellings or places of business.

5) Roadside ditches along existing roadways may be required to be enclosed if ODOT standards for safety and maintenance cannot be satisfied.

6) Capacity: The applicant shall demonstrate that the hydraulic grade line resulting from the 10-year, 24-hour storm does not rise to within one foot of the top of bank.

7) 100-year HGL: The applicant shall demonstrate that the water elevation resulting from the 100-year, 24-hour storm does not encroach into proposed or existing residential dwellings or places of business. The flood elevation shall be shown on the Stormwater Management Plan and associated maps for the project.

5. STORMWATER CONTROL MEASURES

The purpose of this Chapter is to define the stormwater control measures recommended for use in the City of Dublin. Design requirements for each stormwater control measure are presented in a numbered guidance table with an accompanying figure. It is intended that landscape- or vegetation-based stormwater control measures, when designed in accordance with this Manual, be counted towards applicable landscaping requirements for quantity and spacing of plants under the provisions of the Bridge Street District and Sections § 153.130 - § 139 of the Code, recognizing that landscaping required for screening or installation of street trees [other than those in tree boxes per Section 4).d) below] may require landscaped areas or measures in addition to those used for stormwater control.

A. Common Elements

While there are numerous variations and unique site-specific design elements for each stormwater control measure, several common elements exist that have been included in this section rather than repeated within each guidance table. These common elements include energy dissipation, underdrains, pedestrian areas, setbacks, outlets, and vector control considerations. Note that the discussion of the common design elements covered in this section is not intended to be comprehensive; the designer is expected to use sound engineering principles in the design of all elements of the stormwater control measures.

1) Energy Dissipation

Energy dissipation is expected to be incorporated at all inlets and outlets to prevent erosion, scour, or sloughing of the soil. A typical method used to dissipate energy from water flow is constructing a layer of rock for the water to flow over. The specified size, shape, and weight of the rock are a function of the velocity of the water, the geometry of the protected channel or bank, and the magnitude of wave energy. A geotextile blanket also must be placed beneath the rock. Only Rock Type or Riprap Type C or D shall be used within channels. See Standard Drawings. Forebays also may be used for energy dissipation as well as settling out sediment particles. A hard bottom surface is recommended for forebays.

2) Underdrains

Underdrains shall be a minimum of 6-inch Schedule 40 or SDR 35 smooth wall PVC pipe. Collection laterals shall be placed no greater than 10 feet on center with a minimum of 2 pipes for a given collection system. A minimum of 4 rows of 3/8-inch perforations shall be provided around the diameter of the pipe and the perforations shall be placed 6 inches on center within each row for the entire length of the drainage lateral. The underdrains shall be protected from blockage by including a filtering device. A fine aggregate filter layer is preferred over a filter fabric. A cleanout location shall be included and specified at the terminal ends of underdrains, or another appropriate interval in the case of linear stormwater control measures. Designers are encouraged to incorporate a valve at the underdrain outlet that may be opened for overflow and closed to promote greater infiltration and evapotranspiration from the stormwater control measure.

3) Pedestrian Areas

Care should be taken when designing near pedestrian access points so that pedestrians are able to safely exit from a vehicle onto a level surface without risking a large drop, or stepping into water. Designers are to include a 1.5- to 2-foot safety zone between sloped or uneven surfaces and pedestrian access points, such as sidewalks and curbside parking. Vehicle car doors must be able to be opened.

4) Siting of Stormwater Control Measures

Required setback distances of stormwater control measures from buildings, property lines and other site features are noted within each stormwater control measure guidance table. For stormwater control measures other than the retention basin, pocket wetland, stormwater wetland, rain barrel, and cistern

(SCMs which retain water), it is assumed that the entire facility (surface and subsurface) drains within 72 hours. Exceptions to the required distances are allowed only with approval by the City Engineer as part of a Stormwater Management Plan.

5) Outlet

The outlet to a stormwater control measure shall be designed to meet the hydraulic requirements and minimize vandalism, clogging from trash and debris, and the need for maintenance. Access for maintenance shall be provided. The outlet shall connect to the storm drainage system. Stormwater control measure outlet design should consider the characteristics of the contributing drainage area and the anticipated quantity and type of trash and debris. See Standard Drawings for details.

6) Vector Control Considerations

a) Mosquitoes

Stormwater control measures that are designed to temporarily hold water shall drain within 72 hours to prevent the establishment of mosquito colonies. Rain barrels and cisterns shall be covered and include appropriate screens and other features to prevent the entrance of mosquitoes.

b) Goose Population

Canada Geese are attracted to well-trimmed, urban lawns and shallow ponds where they can browse and roost without fear of predators. To deter geese, basins with a permanent pool shall be constructed with a perimeter buffer incorporating naturalized plantings. Turfgrass and rock edging in and around these stormwater control measures are not allowed, not only to discourage nuisance waterfowl but also to enhance the habitat value of these practices.

7) Naturalized Plantings

Naturalized plantings are encouraged to be incorporated into the design of all stormwater control measures involving vegetation.

8) Construction Staging for Vegetated Stormwater Control Measures

The use of vegetation and soil-based treatment systems as outlined in this Chapter requires careful attention to construction staging and phasing. Protection of soils from compaction and disturbance during site preparation and construction, soil amendment, the installation of soil and filter media, and the timing, placement and techniques used in planting, all affect the ultimate efficacy of these stormwater control measures. Therefore a construction and phasing plan must be included in the Stormwater Management Plan for all vegetated stormwater control measures to ensure proper construction, function, and treatment.

B. Stormwater Control Measure Design Guidance

This section is intended to provide guidance for the design of stormwater control measures. A brief description is provided of each stormwater control measure accompanied by a design guidance table and a diagram. The guidance tables and diagrams follow at the end of this chapter.

1) Rainwater Harvesting (Guidance 1 and 2)

Rainwater harvesting is the practice of collecting rainwater and re-using it for purposes such as irrigation and non-potable building uses. With regard to stormwater, the City's standard does not allow rainwater harvesting systems to be used to meet stormwater requirements. However, rainwater harvesting is encouraged as a water conservation and efficiency practice.

Two rainwater harvesting systems are addressed in this Chapter: rain barrels and cisterns. A rain barrel is an above-ground prefabricated storage receptacle with an automatic overflow diversion system that collects and stores stormwater runoff from the roof of a structure that would have been otherwise routed into a storm drain. A cistern is an underground storage component of a rainwater harvesting system, and is typically larger than 80 gallons.

Pretreatment of rainwater prior to entering a storage tank is necessary to keep debris, particularly leaf litter, out of the rainwater harvesting system. Typically this is some type of leaf screen along the gutter or in the downspout. Regular cleaning of these devices is needed to prevent clogging and the buildup of bacteria housed in the leaf decay. It is also recommended that a first-flush diverter be installed to divert the first flow of water, which is typically laden with dust, leaves, twigs, insect bodies, animal feces, and pesticides, to a planted area. Care should be taken to ensure compliance with any potentially applicable plumbing and building codes.

2) Filter Strip (Guidance 3)

Filter strips are bands of dense, permanent vegetation with a uniform slope, primarily designed to provide water quality pretreatment between a runoff source (i.e., impervious area) and another stormwater control measure. The inflow source for a filter strip must be conveyed as sheet flow. Typically this is accomplished by installing a level spreader system immediately upstream of the filter strip. Filter strips are well suited for treating runoff from roads, parking lots, and disconnected downspouts. They may also be used along streams to treat agricultural runoff and may be referred to as buffer strips. Filter strips provide water quality improvement primarily through vegetative filtering and infiltration. Reductions in runoff volume from small storms can be achieved if the soils are sufficiently pervious, sheet flow is maintained along the entire length and width of the strip, and contact time is long enough for infiltration to occur.

3) Media Filter (Guidance 4)

A media filter preceded by a settling basin is a treatment system that is used to remove particulates and solids from stormwater runoff through settling and filtering. The system may be constructed underground in a concrete vault or above ground using earthen berms. Stormwater diverted to the system travels through a settling basin, across a level spreader, and into the media filter. Media is typically sand, peat, or other amended soil. Often, the water quality volume of runoff is temporarily stored above the filter bed. Once the stormwater flows through the filter, it can infiltrate into the native soils or be collected in an underdrain.

4) Vegetated Stormwater Control Measures

The vegetated stormwater control measures include traditional bioretention, bioretention swale, planter box, tree box, and bioretention curb extension. All are included in this category because they use vegetation as an integral part of the system design. It is expected that the growing layer depth for these facilities be tailored to meet the needs of the selected vegetation with a minimum depth of 12 inches.

a) Traditional Bioretention (Guidance 5)

Traditional bioretention describes a shallow stormwater basin or landscaped area that utilizes a soil media and vegetation to capture and treat runoff. It may also be referred to as a rain garden. There are numerous design applications for bioretention. These include use on single-family residential lots, on commercial/industrial sites, as off-line facilities adjacent to parking lots, and along highways and roads. Bioretention areas are designed primarily for the removal of stormwater pollutants from runoff. These facilities may sometimes be used to partially or completely meet quantity control requirements from smaller tributary areas.

b) Bioretention Swale (Guidance 6)

A bioretention swale is a modified swale that uses a soil media to improve water quality, reduce the runoff volume, and modulate the peak runoff rate while also providing conveyance of excess runoff. Bioretention swales are well suited for use within the rights-of-way of linear transportation corridors. They perform the same functions as grassed swales by serving as a conveyance structure and filtering and infiltrating runoff, but because soil media is used, they provide enhanced infiltration, water retention, and pollutant removal. Bioretention swales may be used in conjunction with pretreatment control measures such as filter strips or other sediment capturing devices to prevent sediment from accumulating in the swale.

c) Planter Box (Guidance 7)

A planter box is a variation of traditional bioretention. It performs the same function but is contained within a concrete box which allows it to be incorporated into tight areas such as along a street corridor or attached to a building along the foundation. Planter boxes are often categorized either as flow-through planter boxes or infiltrating planter boxes. Infiltrating planter boxes have an open bottom to allow infiltration into the underlying soils. Flow-through planter boxes are completely lined and have an underdrain system to convey flow that is not taken up by plants to areas that are appropriate for drainage, typically away from building foundations.

d) Tree Box (Guidance 8)

Tree boxes are urban applications of bioretention systems using the water-uptake benefits of a tree. They are generally installed along street corridors with curb inlets. Tree boxes have the ability to be incorporated immediately adjacent to street and sidewalks with the use of a structural soil, modular suspended pavement, or underground retaining wall to keep uncompacted soil in its place. The uncompacted media allows urban trees to thrive, providing shade and an extensive root system for water uptake. For low to moderate flows, stormwater enters through the tree box inlet and filters through the soil. For high flows, stormwater will bypass the tree box if it is full and flow directly to the downstream curb inlet.

e) Bioretention Curb Extension (Guidance 9)

A bioretention curb extension is another variation of traditional bioretention. It performs the same function as traditional bioretention but is contained at least partially within a curb, usually within a street corridor or in a parking lot. Unlike a planter box, curb extensions do not have retaining walls, and therefore comparatively require more space.

5) Permeable Pavements (Guidance 10)

Permeable pavements contain small voids that allow stormwater to drain through the pavement to an aggregate reservoir and then either infiltrate into the soil, or flow through an underdrain to the storm drain network. Permeable pavement includes permeable concrete, permeable asphalt, interlocking concrete pavers, concrete grid pavers, and plastic grid pavers.

Permeable pavement is typically used to replace traditional impervious pavement for most pedestrian and vehicular applications except high-volume/high-speed roadways. Permeable pavements have been used successfully in pedestrian walkways, sidewalks, driveways, parking lots, and low-volume roadways. Several design options are available for using permeable pavements to intercept, contain, filter, and where appropriate infiltrate stormwater on site. Permeable pavements can be installed across an entire street width or an entire parking area. Alternatively, they can be installed in combination with impermeable pavements to infiltrate runoff; several applications use permeable pavement in parking lot lanes or parking stalls to treat runoff from adjacent impermeable pavements.

6) Green Roof (Guidance 11)

Green roofs are used to introduce vegetation onto sections of roof to reduce imperviousness and absorb and filter rainfall. Green roofs consist of a layer of soil media and vegetation that filter, absorb, and retain/detain the rain that falls upon them. Rainfall that infiltrates into the green roof is lost to evaporation or transpiration by plants, or, once the soil has become saturated, percolates through to the drainage system and is discharged through the roof downspouts. Green roofs may cover large sections of a roof while maintaining access for utilities, maintenance, or recreation. Green roofs are most often applied to buildings with flat roofs, but can be installed on roofs with slopes with the use of mesh, stabilization panels, or battens.

7) Basins

The term "basins" includes pocket wetland, retention basin (wet pond), stormwater wetland, and dry extended detention. Common elements of these basins are the inclusion of a forebay and micropool to help settle out sediment. The basin inlet discharges into the forebay while the micropool is used before water leaves the basin through the outlet.

a) Pocket Wetland (Guidance 12)

Pocket wetlands are small constructed shallow marsh systems designed and placed to use the natural processes of wetland vegetation, soils, and their associated biological activity to provide treatment for stormwater runoff. As engineered facilities, stormwater wetlands have less biodiversity than natural wetlands but still require a base flow to support the aquatic vegetation present. Pocket wetlands rely on a high groundwater table to provide a perennial base flow.

Pollutant removal in these systems occurs through the settling of larger solids and coarse organic material and also by uptake in the aquatic vegetation. Wetlands can also be designed to remove ammonia through nitrification/denitrification processes, which may be particularly useful in agricultural settings. Wetlands can be used to enhance the aesthetics of a site and to increase the available habitat.

b) Retention Basin (Guidance 13)

Retention basins are large facilities designed with a permanent pool of water plus additional storage above the level of the permanent pool. During a storm event, water enters the basin and is stored temporarily as it is slowly released to the storm drain network. A safety bench and planted aquatic bench are required around the perimeter of the wet pool. The presence of a mechanical aerator, such as a fountain in the middle of the pond, may be used to make the site more attractive, deter the growth of unwanted vegetation, and make the habitat more suitable for fish.

c) Stormwater Wetland (Guidance 14)

Stormwater wetlands have a similar design and function as a pocket wetland but they depend on flow from the contributing drainage area rather than groundwater flow as their base flow source. Because of this, they tend to require large contributing drainage areas to obtain adequate base flow to function well.

d) Extended Dry Detention (Guidance 15)

Extended dry detention basins are large facilities designed without a permanent pool of water. The outlets are designed such that stormwater runoff is detained for a period of time, typically 24 hours to 72 hours. The temporary storage allows sediment to settle out; overall, however, extended dry detention basins are minimally effective in removing pollutants compared to other stormwater control measures.

8) Underground Retention/Detention (Guidance 16)

Underground retention/detention achieves the capture and temporary storage of stormwater collected from the tributary drainage area. Curb inlets or surface drains lead stormwater to underground vaults or systems of large diameter interconnected storage pipes. The stormwater is then released directly through an outlet pipe back into a stormwater drainage system or allowed to infiltrate to the groundwater table. The outlet system is designed to meet the quantity control requirements.

Underground retention/detention should not be expected to substantially improve water quality unless preceded by a pretreatment practice such as a swale or prefabricated device. Underground retention/detention may be useful for developments where land availability and land costs predicate against the development of surface stormwater control measures and in retrofit and redevelopment settings. Pretreatment is crucial for minimizing maintenance of the storage unit and should be designed to remove sediment, floatables, and oils if prevalent in the drainage area. Where an opening is provided that could allow the entry of personnel, the opening shall be marked, "DANGER- CONFINED SPACE".

9) Prefabricated Devices

Proprietary devices typically consist of catch basin controls or stand-alone vaults that prevent sediment, oils, floatable trash, and debris from being transmitted through the collection system. For instance, several catch basin insert devices are available that use screens, baffles, filter fabrics, and absorbents to capture and retain pollutants within the catch basin. Oil-water separators, sedimentation tanks, gross solids removal screens, and hydrodynamic separators (flow-through devices with a settling or separation unit) are examples of proprietary devices that can be used to remove sediments and other stormwater pollutants. A variety of devices and manufacturers exist, and new products are continuously emerging.

The use of prefabricated devices, other than for retrofit or redevelopment situations where site limitations limit the use of other stormwater control measures, generally is discouraged. Proprietary devices are recommended to be used in conjunction with other control measures as part of a stormwater treatment train. However, these controls are generally considered pretreatment devices, as they typically provide limited treatment when compared to other control measures.

10) Other Approved Stormwater Control Measures

Other stormwater control measures may be recommended to satisfy stormwater management requirements if the Stormwater Management Plan for the site demonstrates to the satisfaction of the City Engineer that these stormwater control measures achieve effluent quality and runoff volume reduction equivalent to recommended stormwater control measures, and can be adequately maintained.

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Guidance (1) Rain Barrel

1. Siting Setbacks		
Pavement	1	No requirement
Building	2	≤ 1 feet; side or rear of building; if visible from street, it must be screened with landscaping to the top
Property lines/ROW	3	≥ 3 feet
Groundwater/Karst/ Bedrock		Bottom of practice to be ≥ 2 feet above to prevent buoyancy
Septic System/Wells		No requirement
2. Volume		
Surface Area		No requirement
Dimensions		≤ 6 feet above grade including any supporting frame
Bottom slope		Not applicable
Side slopes	4	Not applicable
Freeboard	5	No requirement
3. Vertical Component		
Storage	6	≤ 80 gallons
Growing Layer	7	Not applicable
Filter Layer	8	Not applicable
Drainage Layer	9	Not applicable
Native Material	10	Not applicable
4. Drainage		
Inlet	11	One or more downspouts from roof drainage only; No materials treated with fungicides or herbicides
Underdrain	12	Not applicable
Outlet	13	No requirement
Overflow	14	Required; Must be directed away from the building foundation; Must not cause excessive erosion or water damage, or must be diverted to the public storm sewer or other approved location
Evapotranspiration		No requirement
Infiltration		No requirement
Dewatering		No requirement
5. Composition		
Surface Treatment		Not applicable
Vegetation		Not applicable
Soil Media		Not applicable
Side Slopes		Not applicable
Mulch		Not applicable
6. Pollutant		
Pretreatment	15	Must include a debris excluder prior to entering the storage tank
Sediment Storage		No requirement
7. Maintenance		
Access		Rain barrels shall be covered and protected from unintentional entry by humans, vermin, or insects
Requirements		1) Harvested rainwater may only be used for irrigation and water features; 2) Drain and thoroughly clean at least once annually to avoid freezing in winter temperatures; 3) Rain barrels are not permitted as water quality controls
Aesthetics		1) Plastic rain barrels must be neutral in color, painted to match the body or trim color of the home or match as closely as possible the attached building. Any connector hoses from the downspout to the rain barrel must match the color of the downspout 2) Rain barrels constructed of natural material or designed to appear similar to a wood barrel, planter, stone boulders, or similar may remain as constructed and are not required to match in color the attached building
8. Calculations		None

Notes: Preferably located to the side or rear of residence. No platform or raising structure is permitted to elevate the rain barrel forward of the residence (§ 153.071) Notes: There shall be no direct connection of any rainwater harvesting system and any domestic potable water system except when protected from cross-contamination in accordance with all applicable codes and requirements.

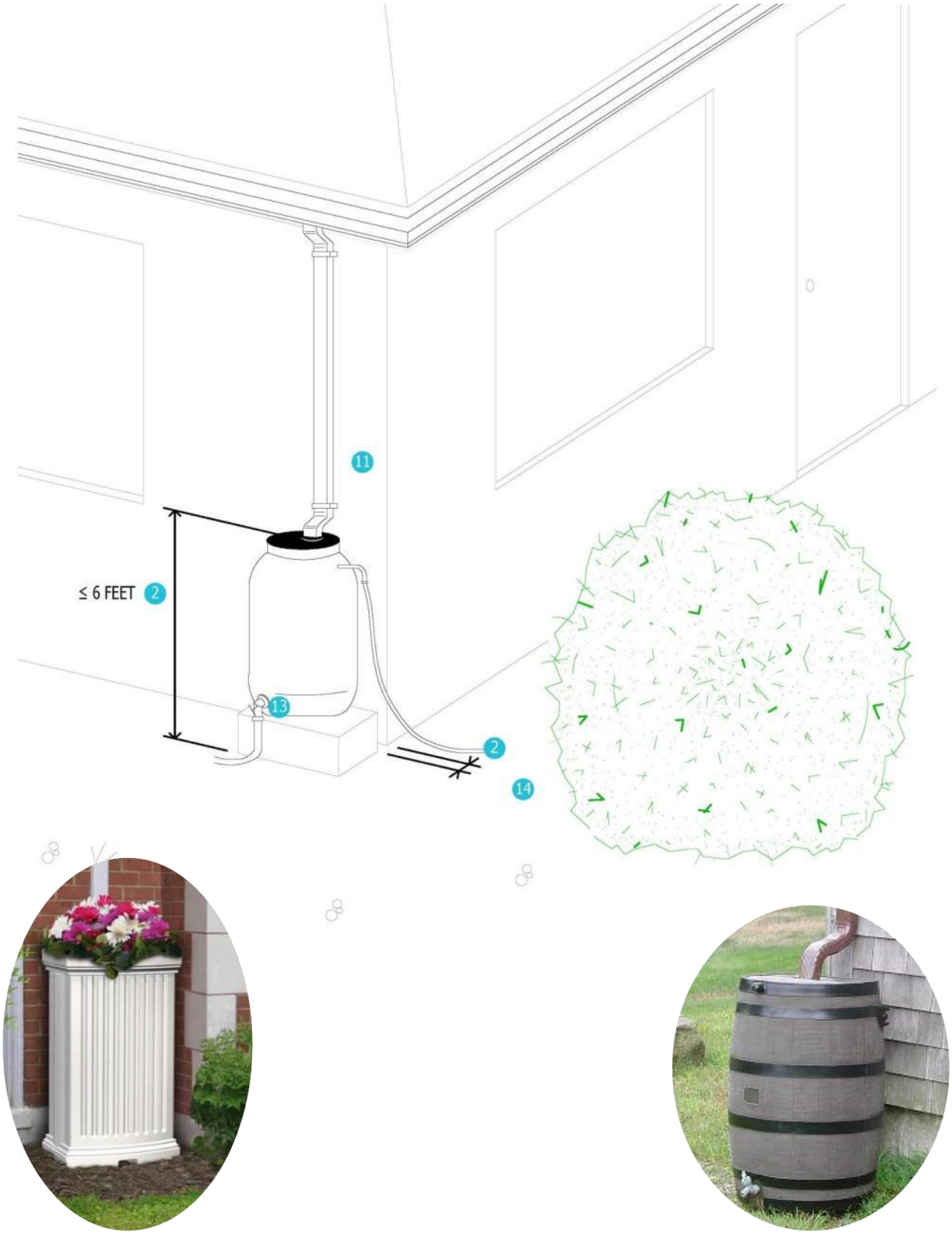


FIGURE 5-1 RAIN BARREL DIAGRAM

Guidance (2) Cistern

1. Siting Setbacks		
Pavement	1	No requirement
Building	2	Basement: ≥ 10 feet No Basement: ≥ 5 feet
Property lines/ROW	3	≥ 3 feet
Groundwater/Karst/ Bedrock		Bottom of practice to be ≥ 2 feet above to prevent buoyancy
Septic System/Wells		No requirement
2. Volume		
Surface Area		No requirement
Dimensions		No requirement
Bottom slope		Not applicable
Side slopes	4	Not applicable
Freeboard	5	No requirement
3. Vertical Component		
Storage	6	No requirement
Growing Layer	7	Not applicable
Filter Layer	8	Not applicable
Drainage Layer	9	Not applicable
Native Material	10	Not applicable
4. Drainage		
Inlet	11	Gutters and downspouts from roof drainage only; No materials treated with fungicides or herbicides
Underdrain	12	Not applicable
Outlet	13	Designed to meet hydraulic requirements; minimize vandalism and maintenance.
Overflow	14	Required; Must be directed away from the building foundation; Must not cause excessive erosion or water damage, or must be diverted to the public storm sewer or other approved location
Evapotranspiration		No requirement
Infiltration		No requirement
Dewatering		No requirement
5. Composition		
Surface Treatment		Not applicable
Vegetation		Not applicable
Soil Media		Not applicable
Side Slopes		Not applicable
Mulch		Not applicable
6. Pollutant		
Pretreatment	15	Must include a debris excluder prior to entering the storage tank
Sediment Storage		No requirement
7. Maintenance		
Access		Able to be accessed by a vehicle; Cisterns shall include manhole risers a minimum of 8 inches above surrounding grade; Cisterns shall be covered and protected from unintentional entry by humans, vermin, or insects; Manhole covers shall be provided and shall be secured and locked to prevent tampering; Where an opening is provided that could allow the entry of personnel, the opening shall be marked, "DANGER- CONFINED SPACE".
Requirements		1) Harvested rainwater may only be used for irrigation and water features. Other usages may be allowed with City approval 2) Maintenance Plan shall be submitted w/ Stormwater Mgmt. Plan; 3) Cisterns are not permitted as water quality controls without prior approval from City Engineer
8. Calculations		None

Notes: There shall be no direct connection of any rainwater harvesting system and any domestic potable water system except when protected from cross-contamination in accordance with all applicable codes and requirements.

Only below-grade cisterns are permitted.

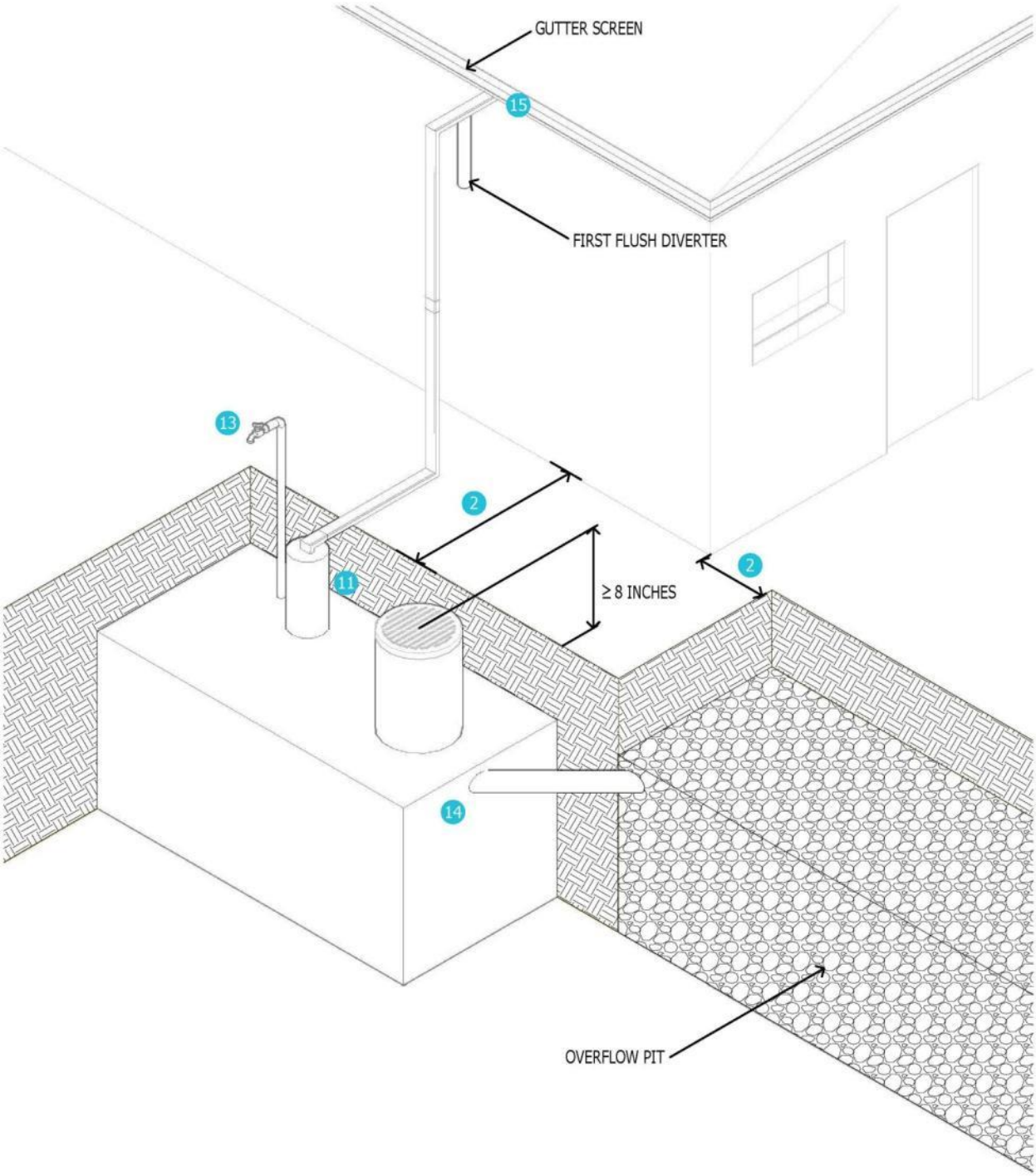


FIGURE 5-2 CISTERN DIAGRAM

Guidance (3) Filter Strip

1. Siting Setbacks		
Pavement	1	No requirement
Building	2	Basement: ≥ 10 feet No Basement: ≥ 5 feet
Property lines/ROW	3	≥ 2 feet / ≥0 feet
Groundwater/Karst/ Bedrock		Bottom of practice to be ≥2 feet above or use liner
Septic System/Wells		≥ 50 feet / ≥ 100 feet
2. Volume		
Surface Area		No requirement
Dimensions		Minimum length of 30 feet; Length must be less than that at which sheet flow concentrates; Depends on surface slope; Width is 10 to 100 feet
Surface slope		Filter Strip (longitudinal): 1% to 5% Blind Swale/Level Spreader: 0%
Side slopes	4	Not applicable
Freeboard	5	Not applicable
3. Vertical Component		
Surface Storage	6	Depth of flow ≤ 3 inches
Growing Layer	7	≥ 6 inches of soil media
Filter Layer	8	Not applicable
Drainage Layer	9	Not applicable
Native Material	10	Conduct soil analysis to determine if it is suitable soil media
4. Drainage		
Inlet	11	Blind swale and level spreader required
Underdrain	12	Beneath blind swale; Drain to bypass
Outlet	13	Catch basin, swale; receiving stream
Overflow	14	High flow bypass upstream of blind swale
Evapotranspiration		No requirement
Infiltration		For BSD exemption areas, meet groundwater recharge requirement
Dewatering		≥ 24 hours

5. Composition		
Surface Treatment		Dense vegetation; able to withstand relatively high velocity flows and both wet and dry conditions; usually kept as lawn, 3 to 4 inches in height
Vegetation		Required
Soil Media		Must be able to sustain a grass cover and allow some infiltration
Side slopes		Not applicable
6. Pollutant		
Pretreatment	15	Sediment forebay or Riprap-lined blind swale
Sediment Storage		Not applicable
7. Maintenance		
Access		Able to be accessed by a vehicle
Requirements		Designed and maintained to improve water quality; Maintenance Plan shall be submitted w/ Stormwater Management Plan

8. Calculations

Convey Water Quality Vol. (WQv) Hydrograph:

$WQ_v = R_v * P * A / 12$

where:

WQ_v = water quality volume in acre-feet

R_v = the volumetric runoff coefficient calculated using equation 2

P = 0.9 inch precipitation depth

A = area draining into the BMP in acres

$R_v = 0.05 + 0.9i$ (Equation 2)

where i = fraction of post-construction impervious surface

Determine Design Flow Depth (≤ 1.5 inches):

Hydrograph Duration = 2 hours

Hydrograph Intensity (in/hr) = WQv*6/A

Design Peak Flow Rate = Use Rational Formula Method

Geometry = Use Manning's Equation to demonstrate that the flow depth is ≤ 1.5 inches while conveying the WQv hydrograph.

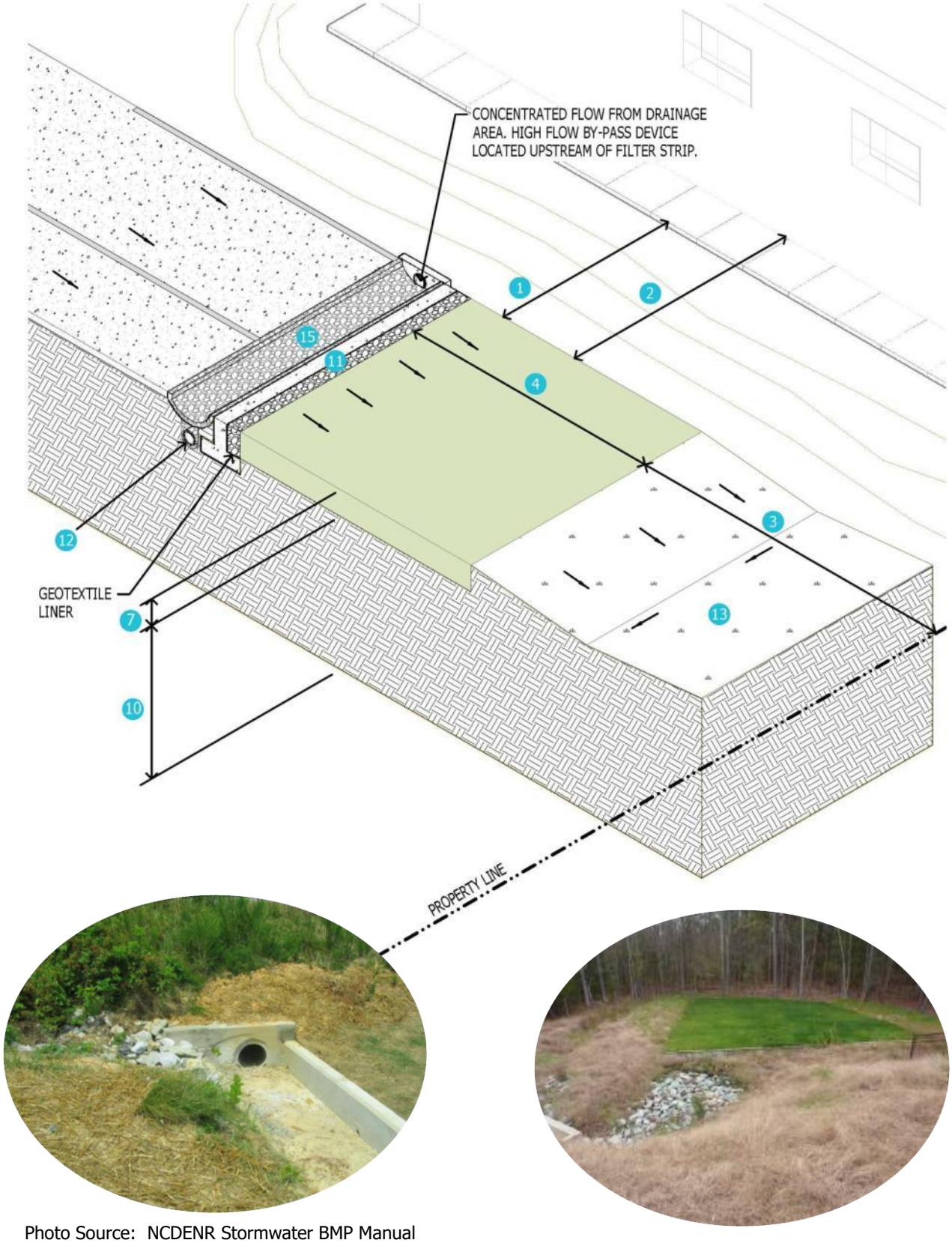
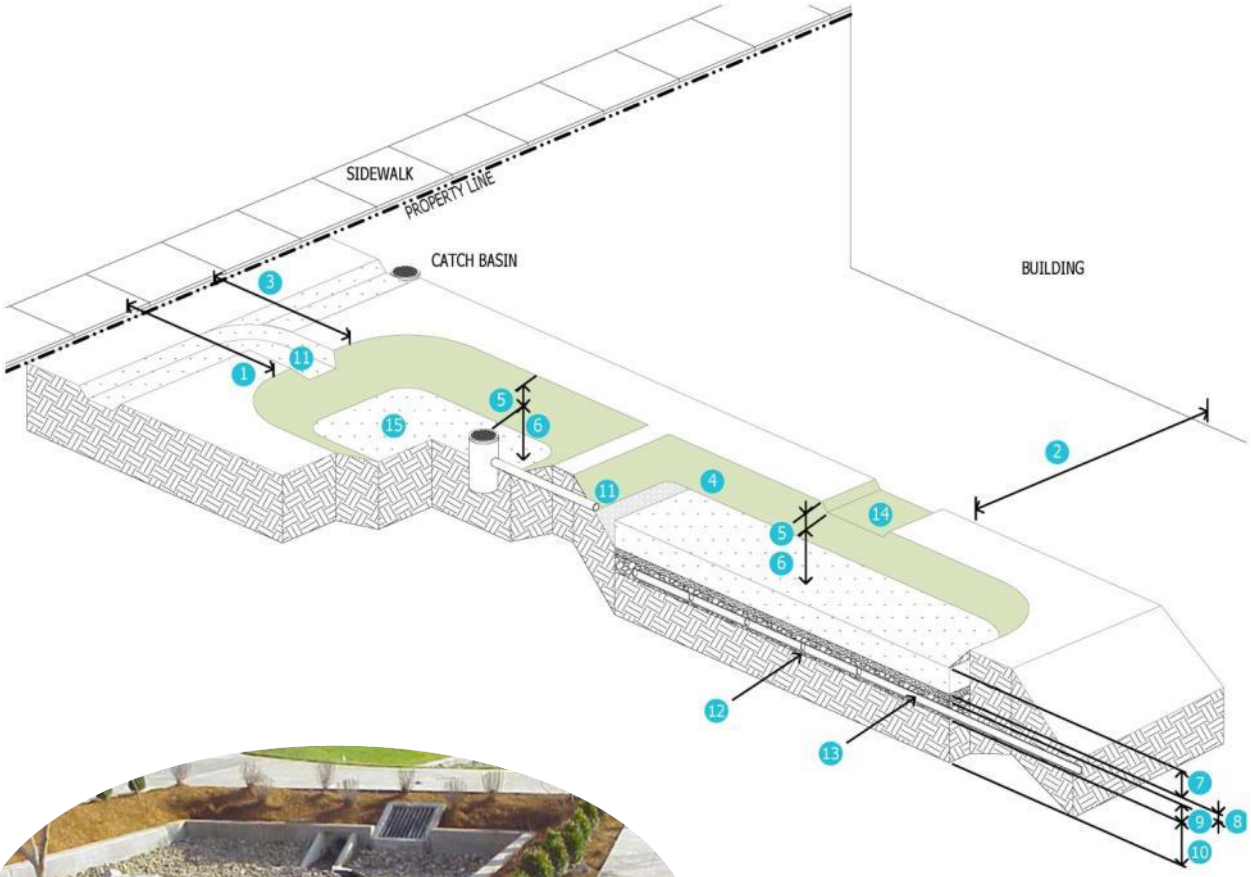


Photo Source: NCDENR Stormwater BMP Manual

FIGURE 5-3 FILTER STRIP DIAGRAM

Guidance (4) Media Filter

1. Siting Setbacks		
Pavement	1	No requirement
Building	2	No requirement with lined bottom; otherwise, Basement: ≥ 10 feet No Basement: ≥ 5 feet
Property Lines/ROW	3	≥ 2 feet / ≥0 feet
Groundwater/Karst/ Bedrock		Bottom of practice to be ≥ 2 feet above or use impermeable liner
Septic System/Wells		≥ 50 feet / ≥ 100 feet
2. Volume		
Surface Area		Settling Basin: Min. length to width ratio of 2:1 or use baffles Media Filter: 600 ft^2 per tributary impervious acre
Dimensions		Total system requires 4 to 8 feet of elevation drop
Bottom slope		Settling Basin: No requirement Media Filter: Flat
Side slopes	4	4H:1V or flatter and vegetated or vertical concrete walls
Freeboard	5	Settling Basin: ≥ 0.5 foot Media Filter: ≥ 1 foot
3. Vertical Component		
Surface Storage Layer	6	Settling Basin: 3 to 10 feet Media Filter: 1 to 4 feet
Filter Media Layer	7	≥ 1.5 feet of sand, peat, amended soil, or other media w/ a diameter of 0.02 to 0.04 inches
Filter Stone Layer	8	3 to 4 inches of #8 or #78 washed stone
Drainage Layer	9	≥ 8 inches of clean coarse aggregate AASHTO #4, #5, or equivalent
Native Material	10	No requirement
4. Drainage		
Inlet	11	≤ 2 ft/sec into settling basin; Uniformly spread across filter from settling basin to filter
Underdrain	12	6-inch perforated PVC placed to meet dewatering requirement; cleanout at terminal ends
Outlet	13	Required
Overflow	14	Weir; Adhere to ODNR dam safety laws as applicable
Evapotranspiration		No requirement
Infiltration		For BSD exemption areas, meet groundwater recharge requirement
Dewatering		Settling basin releases volume to the filter within 24 hours; Media Filter provides a filtration time of no less than 24 hours and no more than 40 hours
5. Composition		
Surface Treatment		None
Vegetation		Side slopes only (typically grass)
Filter Media		Meets dewatering requirement
Mulch		Not applicable
6. Pollutant		
Pretreatment	15	Settling basin is required
Sediment Storage		Equal to 20% of water quality volume within settling basin
7. Maintenance		
Access		A stable vehicular access way shall be provided
Requirements		1) Designed and maintained to improve water quality; Maintenance Plan shall be submitted w/ Stormwater Management Plan 2) Install a fixed vertical sediment depth marker in settling basin
8. Calculations		
Water Quality Volume (WQv) = $WQ_v = R_v * P * A / 12$ where: WQ_v = water quality volume in acre-feet R_v = the volumetric runoff coefficient calculated using equation 2 P = 0.9 inch precipitation depth A = area draining into the BMP in acres $R_v = 0.05 + 0.9i$ (Equation 2) where i = fraction of post-construction impervious surface		
Settling Basin = WQv +0.2*WQv		
Quantity Control Requirements = Refer to Chapter 2 and Chapter 7.		



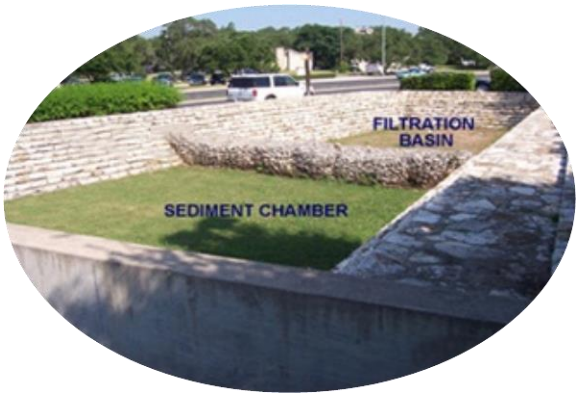


Photo Source: www.austintexas.gov

FIGURE 5-4 MEDIA FILTER DIAGRAM

Guidance (5) Traditional Bioretention

1. Siting Setbacks		
Pavement	1	No requirement
Building	2	No requirement with lined bottom; otherwise, Basement: ≥ 10 feet No Basement: ≥ 5 feet
Property lines/ROW	3	≥ 2 feet / ≥0 feet
Groundwater/Karst/ Bedrock		Bottom of practice to be ≥ 2 feet above or use impermeable liner
Septic System/Wells		≥ 50 feet / ≥ 100 feet
2. Volume		
Surface Area		No requirement
Dimensions		No requirement
Bottom slope		Flat
Side slopes	4	2H:1V or flatter
Freeboard	5	6 to 12 inches
3. Vertical Component		
Surface Storage	6	6 to 12 inches
Growing Layer	7	≥ 12 inches soil media; 3 inches of mulch, max
Filter Layer	8	2 to 4 inches of clean medium sand (ASTM c-33) over 2 to 3 inches of #8 or #78 washed stone when drainage layer is used
Drainage Layer	9	Recommended 12 to 30 in. of clean coarse aggregate AASHTO #4, #5, or equivalent
Native Material	10	Test infiltration; ≥1/2 in/hr if designing with infiltration
4. Drainage		
Inlet	11	Curb inlet or sheet flow through grass filter strip
Underdrain	12	6-inch perforated PVC placed to meet dewatering requirement if needed; cleanout at terminal ends
Outlet	13	Required
Overflow	14	Catch basin set 6 to 12 inches above soil surface and connected to storm drainage network; Weir in berm placed to minimize property damage
Evapotranspiration		No requirement
Infiltration		For BSD exemption areas, meet groundwater recharge requirement
Dewatering		Between 24 and 56 hours; No more than 1/2 of the WQv is released in less than 1/3 of the minimum drawdown period of 40 hours
5. Composition		
Surface Treatment		Vegetation and mulch
Vegetation		Required
Soil Media		With or without an underdrain, meets dewatering requirement; supports plant growth
Side Slopes		Grass or mulch, no stone
Mulch		Triple-shredded hardwood
6. Pollutant		
Pretreatment	15	Required. May include grass filter strip, stone trench, forebay, sump inlets
Sediment Storage		No requirement
7. Maintenance		
Access		Accessible from a vehicle
Requirements		Designed and maintained to improve water quality; Maintenance Plan shall be submitted w/ Stormwater Management Plan
8. Calculations		
Water Quality Volume (WQv) = WQv = Rv * P * A / 12where: WQ_V = water quality volume in acre-feet R_V = the volumetric runoff coefficient calculated using equation 2 P = 0.9 inch precipitation depth A = area draining into the BMP in acres $R_V = 0.05 + 0.9i$ (Equation 2) where i = fraction of post-construction impervious surface		
Ponding Area = $WQv*d_s/[k*(h_s+d_s)*t_s]$ d_s=soil media depth k=coefficient of permeability of soil media (ft/day). Use lab values or projected values after settling and use. h_s=average height of water above soil media and mulch, feet t_s=facility drain time (days)		
Quantity Control Requirements = Refer to Chapter 2 and Chapter 7		

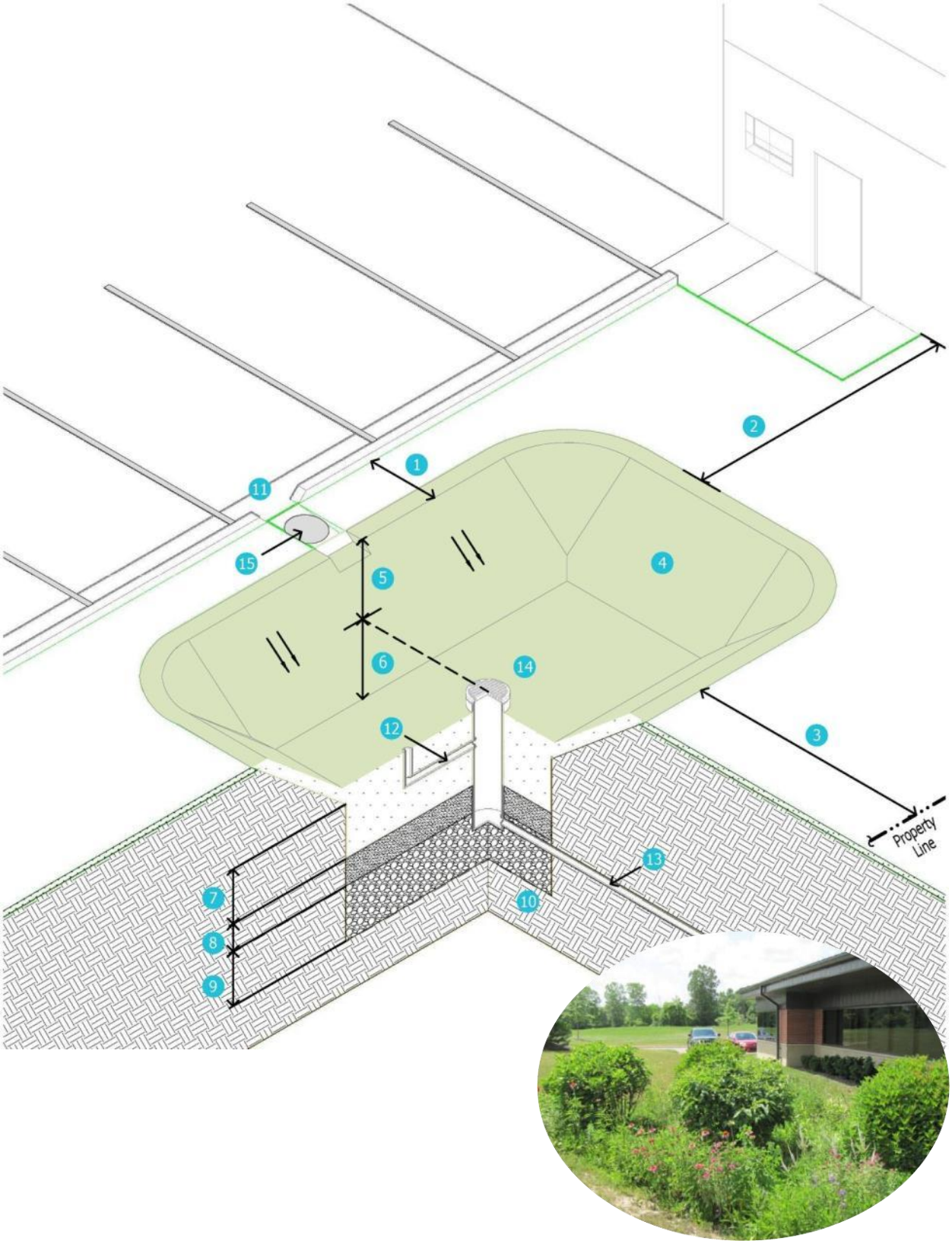


FIGURE 5-5 TRADITIONAL BIORETENTION DIAGRAM

Guidance (6) Bioretention Swale

1. Siting Setbacks		
Pavement	1	No requirement
Building	2	No requirement with lined bottom; otherwise, Basement: ≥ 10 feet No Basement: ≥ 5 feet
Property lines/ROW	3	≥ 2 feet / ≥0 feet
Groundwater/Karst/ Bedrock		Bottom of practice to be ≥ 2 feet above or use impermeable liner
Septic System/Wells		≥ 50 feet / ≥ 100 feet
2. Volume		
Surface Area		No requirement
Dimensions		Minimum length of 25 feet
Bottom slope		≥ 1%; Maximum slope is limited to that which does not cause scour
Side slopes	4	2H:1V or flatter above the surface
Freeboard	5	6 to 12 inches
3. Vertical Component		
Surface Storage	6	6 to 12 inches
Growing Layer	7	≥ 12 inches soil media
Filter Layer	8	*Optional:* 2 to 4 inches of clean medium sand (ASTM c-33) over 2 to 3 inches of #8 or #78 washed stone
Drainage Layer	9	*Optional:* 12 to 30 in. of clean coarse aggregate AASHTO #4, #5, or equiv.
Native Material	10	Test infiltration; ≥1/2 in/hr if designing w/ infiltration
4. Drainage		
Inlet	11	Curb inlet or sheet flow through grass filter strip
Underdrain	12	*Optional:* 6-inch perforated PVC; cleanout at terminal ends
Outlet	13	Required
Overflow	14	Catch basin set 6 to 12 inches above soil surface and connected to storm drainage network; Weir in berm placed to minimize property damage
Evapotranspiration		No requirement
Infiltration		For BSD exemption areas, meet groundwater recharge requirement
Dewatering		Between 24 and 56 hours; No more than 1/2 of the WQv is released in less than 1/3 of the minimum drawdown period of 24 hours
5. Composition		
Surface Treatment		Vegetation, no mulch
Vegetation		Required
Soil Media		With or w/o an underdrain, meets dewatering requirement; supports plant growth
Side slopes		Grass, no mulch, no stone
6. Pollutant		
Pretreatment	15	Required. May include grass filter strip or sump inlets
Sediment Storage		No requirement
7. Maintenance		
Access		Able to be accessed by a vehicle; Possibly adjacent to parallel parking for convenience
Requirements		Designed and maintained to improve water quality; Maintenance Plan shall be submitted w/ Stormwater Management Plan
8. Calculations		

Water Quality Volume (WQv) = $WQ_v = R_v * P * A / 12$

where: WQ_v = water quality volume in acre-feet

R_v = the volumetric runoff coefficient calculated using equation 2
P = 0.9 inch precipitation depth
A = area draining into the BMP in acres

$R_v = 0.05 + 0.9i$ (Equation 2)
where i = fraction of post-construction impervious surface

Ponding Area = $WQv*d_s/[k*(h_s+d_s)*t_s]$
d_s=soil media depth
k=coefficient of permeability of soil media (ft/day). Use lab values or projected values after settling and use.
h_s=average height of water above soil media and mulch, feet
t_s=facility drain time (days)

Quantity Control Requirements = Refer to Chapter 2 and Chapter 7

Notes:
[1]Use weirs, check dams, or equivalent to detain and treat the water quality volume for a minimum of 24 hours, promote pooling and infiltration, and aid in maintaining non-erosive flow velocities.

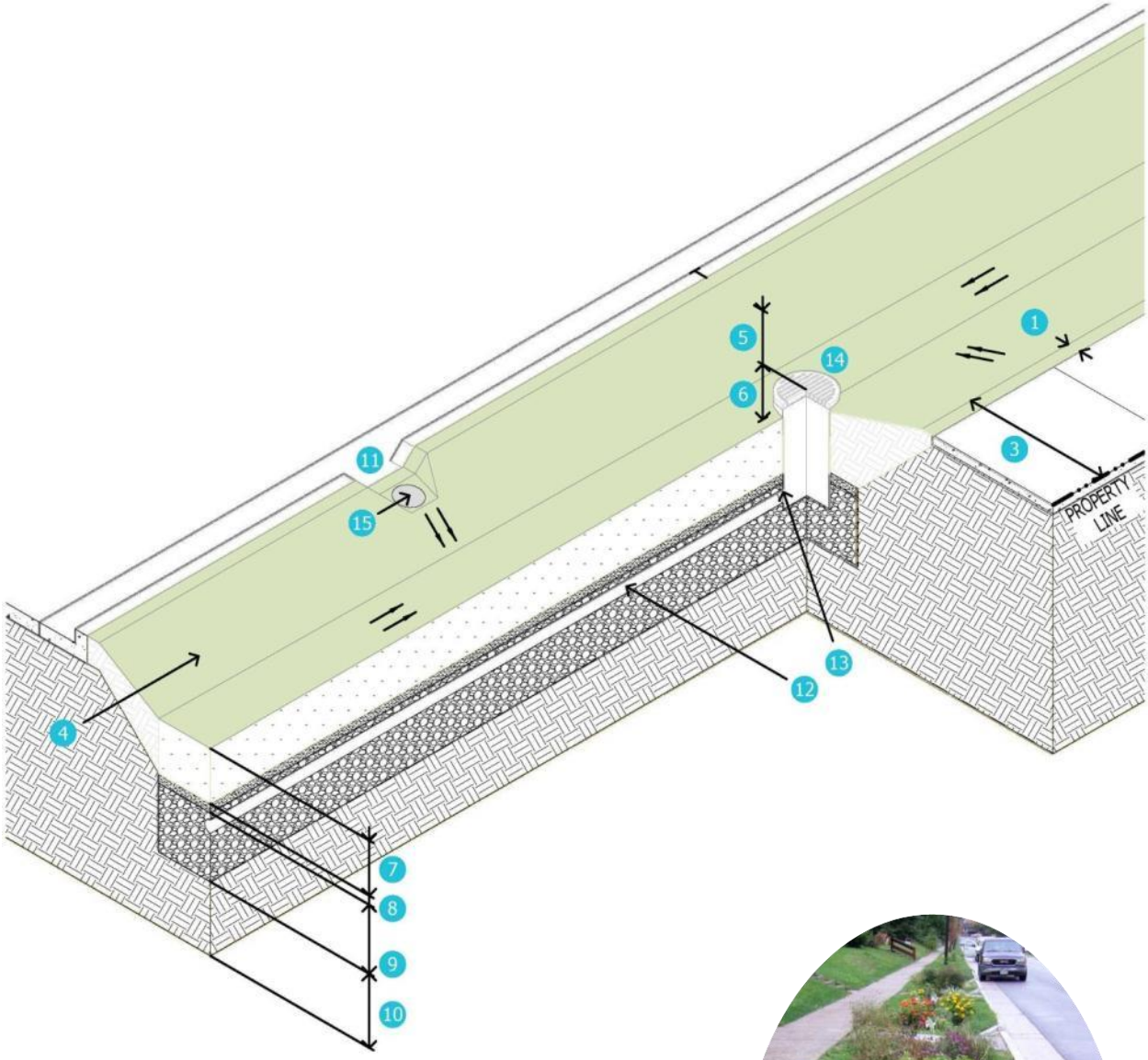


FIGURE 5-6 BIORETENTION SWALE DIAGRAM

Guidance (7) Planter Box

1. Siting Setbacks		
Pavement	1	No requirement
Building	2	No requirement w/ solid or lined bottom; otherwise, Basement: ≥ 10 feet No Basement: ≥ 5 feet
Property lines/ROW	3	≥ 2 feet / ≥0 feet
Groundwater/Karst/ Bedrock		Bottom of practice to be ≥2 feet above or use liner
Septic System/Wells		≥ 50 feet / ≥ 100 feet
2. Volume		
Surface Area		No requirement
Dimensions		No requirement
Bottom slope		Flat
Side slopes	4	Vertical retaining wall
Freeboard	5	2 to 6 inches
3. Vertical Component		
Surface Storage	6	6 to 12 inches
Growing Layer	7	≥ 12 inches soil media; 3 inches of mulch, max
Filter Layer	8	*Optional:* 2 to 4 inches of clean medium sand (ASTM c-33) over 2 to 3 inches of #8 or #78 washed stone
Drainage Layer	9	*Optional:* 12 to 30 in. of clean coarse aggregate AASHTO #4, #5, or equivalent
Native Material	10	Test infiltration; ≥1/2 in/hr if designing with infiltration
4. Drainage		
Inlet	11	Curb inlet; downspout w/ energy dissipation
Underdrain	12	6-inch perforated PVC placed to meet dewatring-requirement if needed; cleanout at terminal ends
Outlet	13	Required
Overflow	14	Downstream inlet or stand pipe set 4-6 in. above soil
Evapotranspiration		No requirement
Infiltration		For BSD exemption areas, meet groundwater recharge requirement
Dewatering		Between 24 and 56 hours; No more than 1/2 of the WQv is released in less than 1/3 of the minimum drawdown period of 40 hours
5. Composition		
Surface Treatment		Vegetation; Mulch-optional
Vegetation		Required
Soil Media		With or w/o an underdrain, meets dewatering requirement; supports plant growth
Retaining Wall		Coordinate with building materials.
Mulch		Triple-shredded hardwood
6. Pollutant		
Pretreatment	15	Required for street or parking lot runoff; may include sump inlets
Sediment Storage		No requirement
7. Maintenance		
Access		Able to be accessed by a vehicle
Requirements		Designed and maintained to improve water quality; Maintenance Plan shall be submitted w/ Stormwater Management Plan
8. Calculations		

Water Quality Volume (WQv) = $WQ_v = R_v * P * A / 12$
where:

WQ_v = water quality volume in acre-feet

R_v = the volumetric runoff coefficient calculated using equation 2
P = 0.9 inch precipitation depth
A = area draining into the BMP in acres

$R_v = 0.05 + 0.9i$ (Equation 2)
where i = fraction of post-construction impervious surface

Ponding Area = $WQv*d_s/[k*(h_s+d_s)*t_s]$

d_s=soil media depth
k=coefficient of permeability of soil media (ft/day). Use lab values or projected values after settling and use.
h_s=average height of water above soil media and mulch, feet
t_s=facility drain time (days)

Quantity Control Requirements = Refer to Chapter 2 and Chapter 7

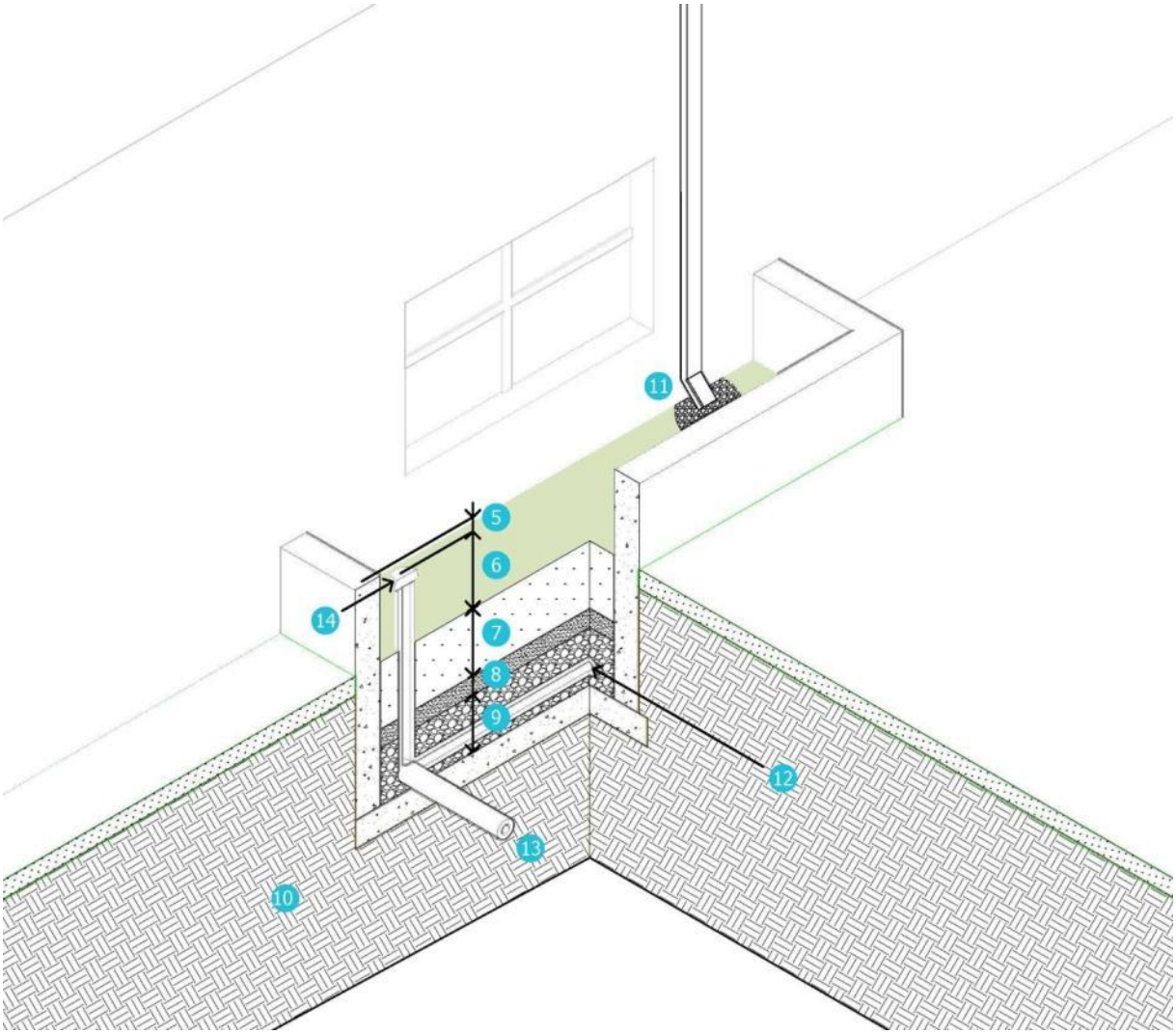


FIGURE 5-7 PLANTER BOX DIAGRAM

Guidance (8) Tree Box

1. Siting Setbacks		
Pavement	1	≥0 ft with structural soil, retaining wall, or modular suspended pavement
Building	2	No requirement with lined bottom; otherwise, Basement: ≥ 10 feet No Basement: ≥ 5 feet
Property lines/ROW	3	≥ 2 feet / ≥0 feet
Groundwater/Karst/ Bedrock		Bottom of practice to be ≥2 feet above or use liner
Septic System/Wells		≥ 50 feet / ≥ 100 feet
2. Volume		
Surface Area		Variable
Dimensions		1) ≥1000 ft^3 planting volume for single tree; 2) ≥600 ft^3 planting volume per tree for multiple trees
Bottom slope		Not applicable
Side slopes	4	Not applicable
Freeboard	5	Not applicable
3. Vertical Component		
Surface Storage	6	≤ 6 inches
Growing Layer	7	≥3 feet root zone depth Use: 1) Uncompacted soil w/ retaining wall 2) Structural soil, or 3) Modular suspended pavement
Filter Layer	8	*Optional:* 2 to 4 inches of clean medium sand (ASTM c-33) over 2 to 3 inches of #8 or #78 washed stone
Drainage Layer	9	*Optional:* 12 to 30 inches of clean coarse aggregate AASHTO #4, #5, or equivalent
Native Material	10	Test infiltration; ≥1/2 in/hr if designing with infiltration
4. Drainage		
Inlet	11	Curb inlet
Underdrain	12	*Optional:* 6-inch perforated PVC placed to meet dewatering requirement; cleanout at terminal ends
Outlet	13	Required
Overflow	14	Downstream inlet or stand pipe set 4-6 in. above soil
Evapotranspiration		No requirement
Infiltration		For BSD exemption areas, meet groundwater recharge requirement
Dewatering		Between 24 and 56 hours; No more than 1/2 of the WQv is released in less than 1/3 of the minimum drawdown period of 40 hours
5. Composition		
Surface Treatment		Tree approved by City; 2 to 4 in. of Mulch-*optional*
Vegetation		Required
Soil Media		With or w/o an underdrain, meets dewatering requirement; supports plant growth
Retaining Wall		Concrete
Mulch		Triple-shredded hardwood
6. Pollutant		
Pretreatment	15	Required for street or parking lot runoff; may include sump inlets
Sediment Storage		No requirement
7. Maintenance		
Access		Able to be accessed by a vehicle
Requirements		Designed and maintained to improve water quality; Maintenance Plan shall be submitted w/ Stormwater Management Plan
8. Calculations		
Water Quality Volume (WQv) = $WQ_V = R_V * P * A / 12$ where: WQ_V = water quality volume in acre-feet R_V = the volumetric runoff coefficient calculated using equation 2 P = 0.9 inch precipitation depth A = area draining into the BMP in acres $R_V = 0.05 + 0.9i$ (Equation 2) where i = fraction of post-construction impervious surface		
Planting Soil Stormwater Storage = Soil Volume*Water Capacity Factor Water Capacity Factor: silt loam=0.3; loam=0.25; clay loam=0.2; clay=0.15		
Quantity Control Requirements = Refer to Chapter 2 and Chapter 7		

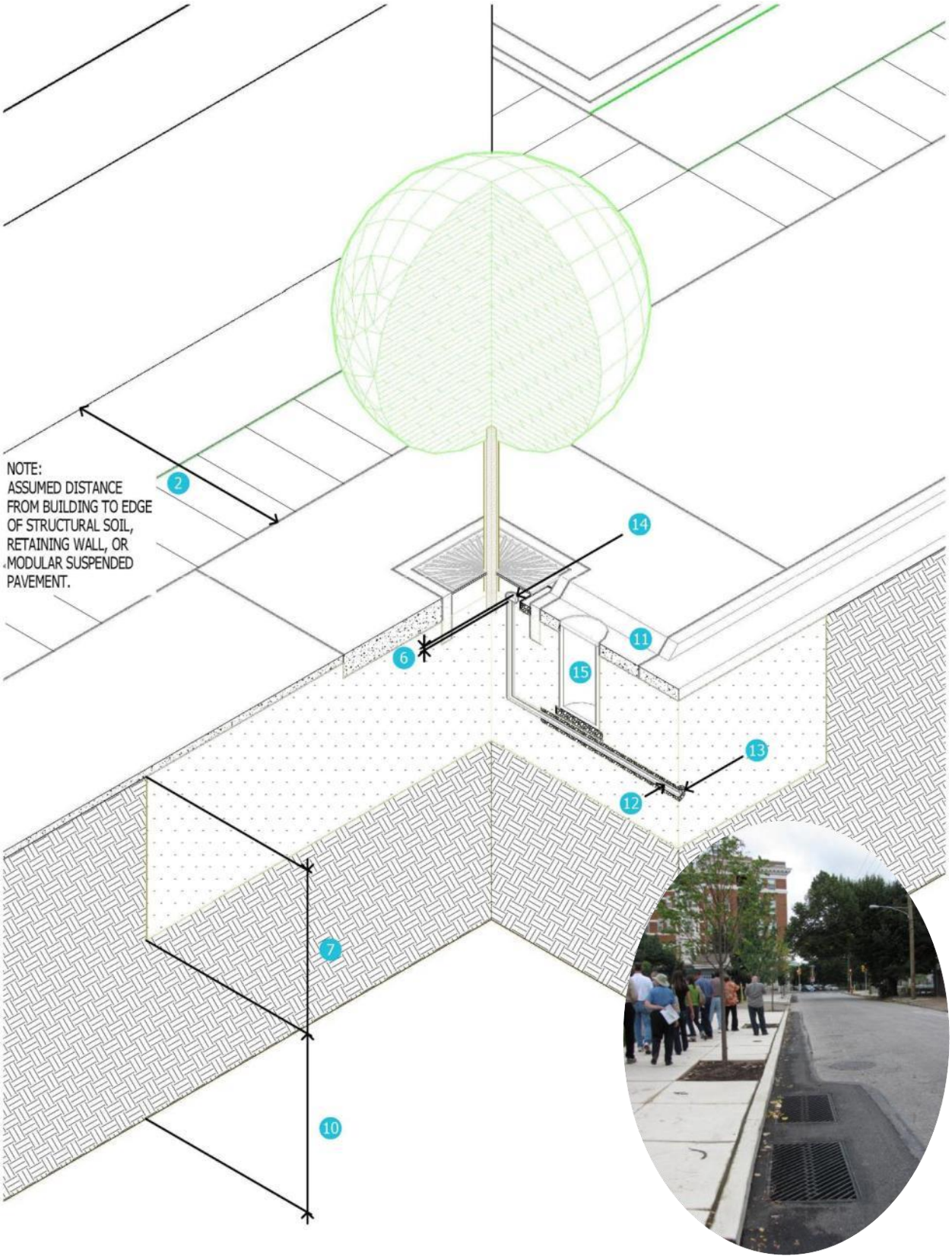


FIGURE 5-8 TREE BOX DIAGRAM

Guidance (9) Bioretention Curb Extension

1. Siting Setbacks		
Pavement	1	No requirement
Building	2	No requirement with lined bottom; otherwise, Basement: ≥ 10 feet No Basement: ≥ 5 feet
Property lines/ROW	3	≥ 2 feet / ≥0 feet
Groundwater/Karst/ Bedrock		Bottom of practice to be ≥2 feet above or use liner
Septic System/Wells		≥ 50 feet / ≥ 100 feet
2. Volume		
Surface Area		No requirement
Dimensions		No requirement
Bottom slope		Flat
Side slopes	4	2H:1V or flatter
Freeboard	5	2 to 6 inches
3. Vertical Component		
Surface Storage	6	6 to 12 inches
Growing Layer	7	≥ 12 inches soil media; 3 inches of mulch, max
Filter Layer	8	2 to 4 inches of clean medium sand (ASTM c-33) over 2 to 3 inches of #8 or #78 washed stone
Drainage Layer	9	12 to 30 in. of clean coarse aggregate AASHTO #4, #5, or equivalent
Native Material	10	Test infiltration; ≥1/2 in/hr if designing with infiltration
4. Drainage		
Inlet	11	Curb inlet
Underdrain	12	6-inch perforated PVC placed to meet dewatering requirement if needed; cleanout at terminal ends
Outlet	13	Required
Overflow	14	Downstream inlet or stand pipe set 4-6 in. above soil
Evapotranspiration		No requirement
Infiltration		For BSD exemption areas, meet groundwater recharge requirement
Dewatering		Between 24 and 56 hours; No more than 1/2 of the WQv is released in less than 1/3 of the minimum drawdown period of 40 hours
5. Composition		
Surface Treatment		Vegetation and mulch
Vegetation		Required
Soil Media		With or w/o an underdrain, meets dewatering requirement; supports plant growth
Side Slopes		Grass or mulch, no stone
Mulch		Triple-shredded hardwood
6. Pollutant		
Pretreatment	15	Required for street or parking lot runoff; may include sump inlets or forebay
Sediment Storage		No requirement
7. Maintenance		
Access		Able to be accessed by a vehicle
Requirements		Designed and maintained to improve water quality; Maintenance Plan shall be submitted w/ Stormwater Management Plan
8. Calculations		
Water Quality Volume (WQv) = $WQ_V = R_V * P * A / 12$ where: WQ_V = water quality volume in acre-feet R_V = the volumetric runoff coefficient calculated using equation 2 P = 0.9 inch precipitation depth A = area draining into the BMP in acres $R_V = 0.05 + 0.9i$ (Equation 2) where i = fraction of post-construction impervious surface		
Ponding Area = $WQv*d_s/[k*(h_s+d_s)*t_s]$ d_s=soil media depth k=coefficient of permeability of soil media (ft/day). Use lab values or projected values after settling and use. h_s=average height of water above soil media and mulch, feet t_s=facility drain time (days)		
Quantity Control Requirements = Refer to Chapter 2 and Chapter 7		

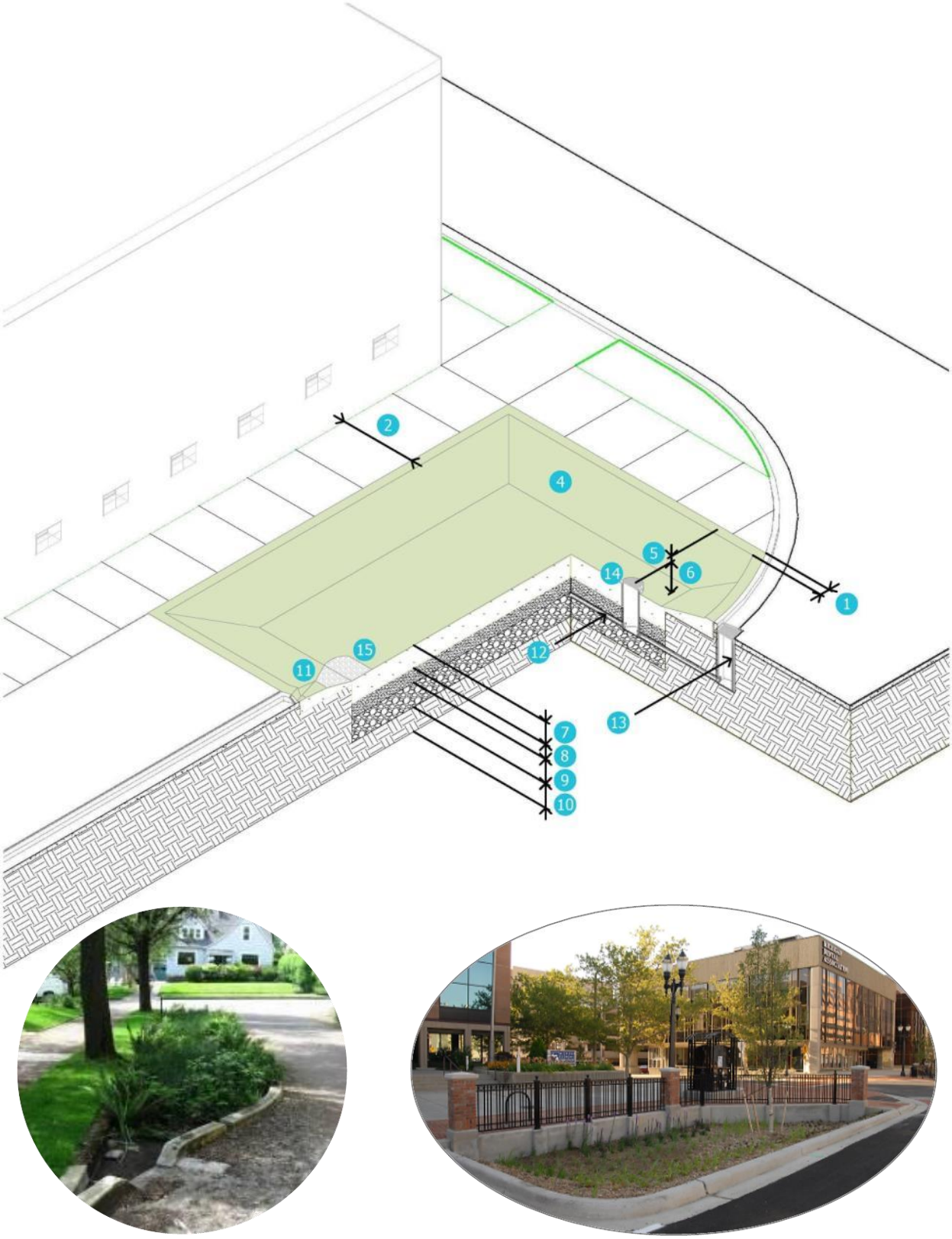


FIGURE 5-9 BIORETENTION CURB EXTENSION DIAGRAM

Guidance (10) Permeable Pavement

1. Siting Setbacks		
Pavement	1	No requirement
Building	2	No requirement with lined bottom; otherwise, Basement: ≥ 10 feet No Basement: ≥ 5 feet
Property lines/ROW	3	≥ 2 feet / ≥0 feet
Groundwater/Karst/ Bedrock		Bottom of practice to be ≥2 feet above or use liner
Septic System/Wells		≥ 50 feet / ≥100 feet
2. Volume		
Surface Area		No requirement
Dimensions		No requirement
Bottom slope		Minimal slope
Side slopes	4	Not applicable
Freeboard	5	Not applicable
3. Vertical Component		
Surface Layer	6	Interlocking Concrete Pavers; Concrete Grid Pavers; Plastic Grid Pavers; Concrete; Asphalt
Growing Layer	7	No requirement
Filter Layer	8	1) Perm. Interlocking Conc. Pavers: 1.5 to 3 inches of #8 or #78 washed stone 2) Concrete and Plastic Grid Pavers: 1 to 1.5 inches of bedding sand 3) Permeable Concrete and Asphalt: None
Base Layer	9	12 to 30 in. of clean aggr. AASHTO #56 or equivalent; thickness depends on strength/storage needed; install geotextile separator where aggregate meets soil
Native Material	10	Compacted as sub-base
4. Drainage		
Inlet	11	Pavement surface
Underdrain	12	6-inch perforated PVC; cleanout at terminal ends
Outlet	13	Required
Overflow	14	Downstream inlet
Evapotranspiration		No requirement
Infiltration		48 hours per OEPA
Dewatering		Less than 24 hours per OEPA
5. Composition		
Surface Treatment		For interlocking or grid-type pavers use fine aggregate, coarse sand, or top soil & grass in openings
Vegetation		Not applicable
Soil Media		Not applicable
Side Slopes		Not applicable
Mulch		Not applicable
6. Pollutant		
Pretreatment	15	Divert runoff from sediment sources away from pavement
Sediment Storage		Not applicable
7. Installation and Maintenance		
Installation		Per manufacturer's recommendation
Load Bearing		1) As directed by City Engineer 2) Designed for projected traffic loads using AASHTO methods
Requirements		Designed and maintained to improve water quality; Maintenance Plan shall be submitted w/ Stormwater Management Plan

8. Calculations

Water Quality Volume (WQv) = $WQ_V = R_V * P * A / 12$
where:

WQ_V = water quality volume in acre-feet

R_V = the volumetric runoff coefficient calculated using equation 2
P = 0.9 inch precipitation depth
A = area draining into the BMP in acres

$R_V = 0.05 + 0.9i$ (Equation 2)
where i = fraction of post-construction impervious surface

Base Layer Storage = assume 40% void space

Quantity Control Requirements = Refer to Chapter 2 and Chapter 7

Notes: A reinforced concrete header width is required where permeable pavement meets adjacent non-concrete pavement or soil. Use ODOT Type 6 curb.

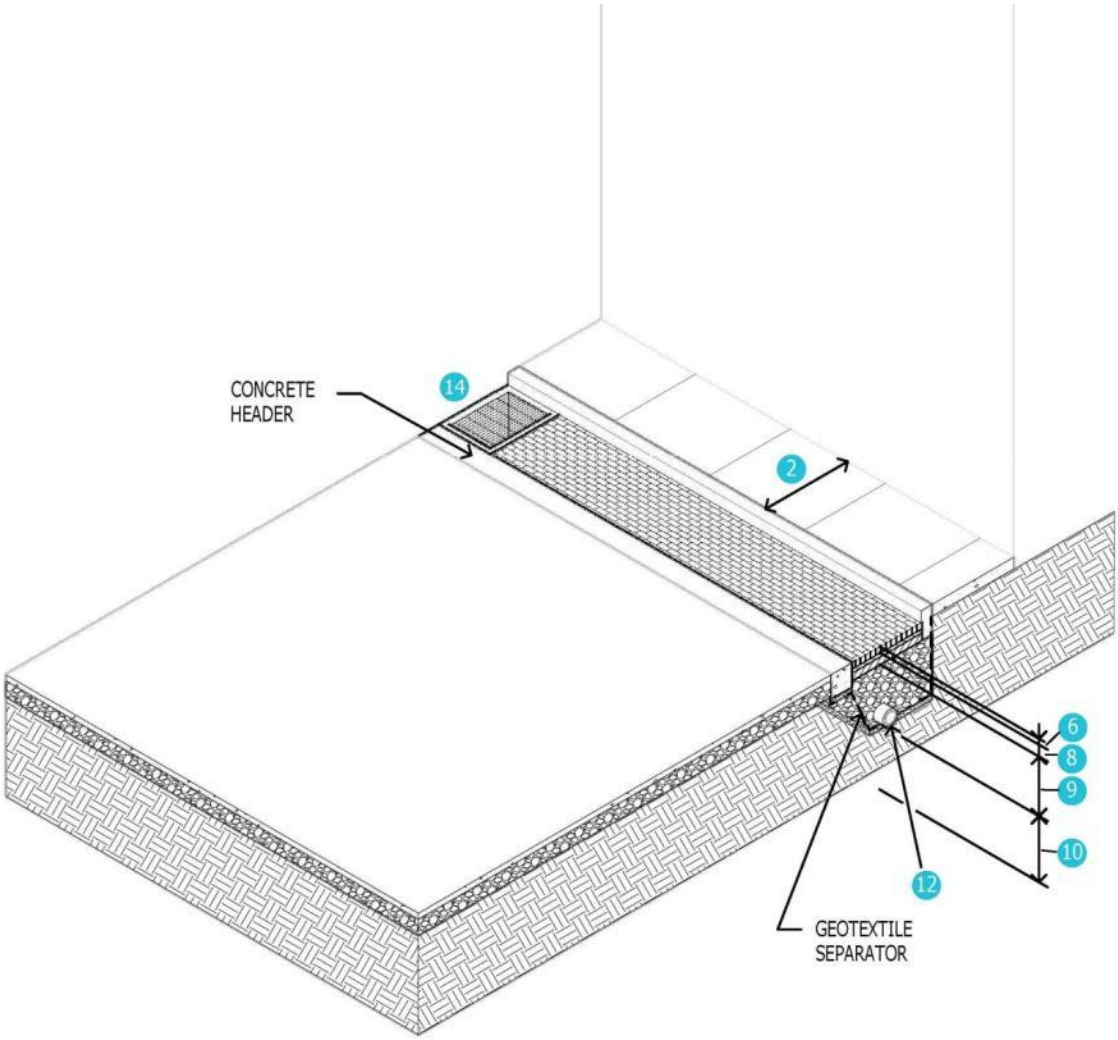


FIGURE 5-10 PERMEABLE PAVEMENT DIAGRAM

Guidance (11) Green Roof

1. Siting Setbacks	
Pavement (1)	Not applicable
Building (2)	Not applicable
Property lines/ROW (3)	Not applicable
Groundwater/Karst/ Bedrock	Not applicable
Septic System/Wells	Not applicable
2. Volume	
Contributing Drainage Area	Roof coverage
Surface Area	Roof coverage
Dimensions	Dependent on green roof use and manufacturer's specs
Bottom slope	Same as pitch of roof; Refer to manufacturer's specs for maximum pitch
Side slopes (4)	Not applicable
Freeboard (5)	Not applicable
3. Vertical Component	
Surface Layer (6)	Wind blanket as needed
Growing Layer (7)	Minimum 2.5-inch thick; Dependent on green roof use and manufacturer's specs
Filter Layer (8)	No requirement
Drainage Layer (9)	Dependent on green roof use and manufacturer's specs
Native Material (10)	Not applicable
4. Drainage	
Inlet (11)	Not applicable
Underdrain (12)	Perforated conduit and/or drainage layer per manufacturer's specs
Outlet (13)	Roof drain
Overflow (14)	Roof drain installed to protect roof from flooding per manufacturer's specs
Evapotranspiration	No requirement
Infiltration	May discharge to infiltrating BMP
Dewatering	≤ 24 hours
5. Composition	
Surface Treatment	Vegetation
Vegetation	Dependent on green roof use and manufacturer's specs
Soil Media	Meets dewatering requirement; supports plant growth
Side Slopes	Not applicable
Mulch	Not applicable
6. Pollutant	
Pretreatment (15)	Not applicable
Sediment Storage	Not applicable
7. Installation and Maintenance	
Installation	Per manufacturer's recommendation
Access	Able to be accessed from the building
Requirements	Designed and maintained to improve water quality; Maintenance Plan shall be submitted w/ Stormwater Management Plan
8. Calculations	

Water Quality Volume (WQv) = $WQ_v = R_v * P * A / 12$
where:

WQ_v = water quality volume in acre-feet

R_v = the volumetric runoff coefficient calculated using equation 2
P = 0.9 inch precipitation depth
A = area draining into the BMP in acres

$R_v = 0.05 + 0.9i$ (Equation 2)
where i = fraction of post-construction impervious surface

Green Roof Storage = per manufacturer's specs
Quantity Control Requirements = Refer to Chapter 2 and Chapter 7

Notes: The building roof must be designed to safely support the saturated weight of the green roof.
An irrigation system is optional.

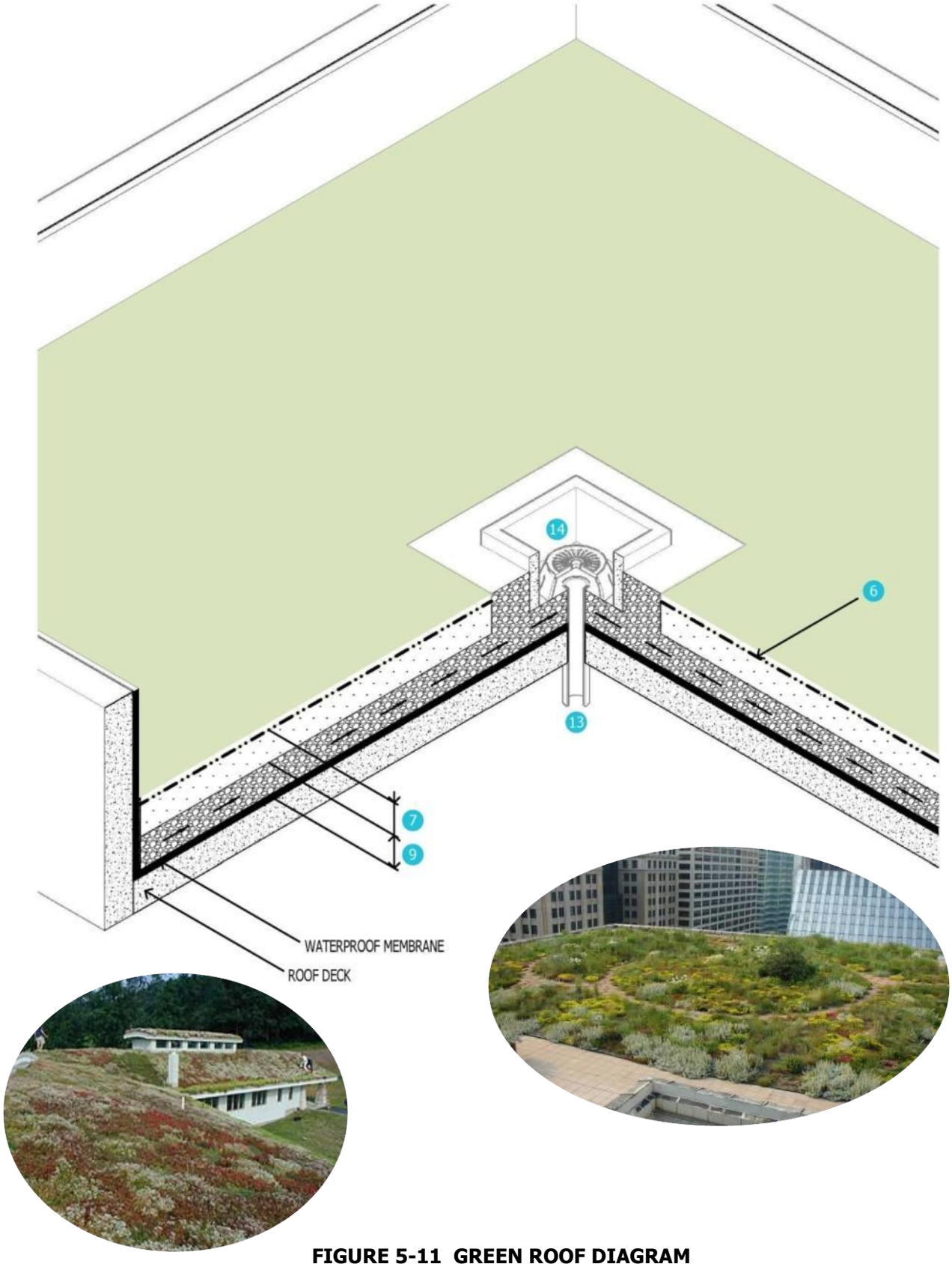


FIGURE 5-11 GREEN ROOF DIAGRAM

Guidance (12) Pocket Wetland

1. Siting Setbacks	
Pavement (1)	≥ 10 feet
Building (2)	Basement: ≥ 50 feet No Basement: ≥ 20 feet
Property lines/ROW (3)	≥ 10 feet / ≥ 50 feet
Groundwater/Karst/ Bedrock	Requires perennial base flow from groundwater
Septic System/Wells	≥ 50 feet/100 feet
2. Volume	
Surface Area	1) Min. 35% of surface area w/ a depth ≤ 6 inches (marsh); 2) 10- to 20% of surface area to be 1.5- to 6-ft deep (pool) 3) provide irregular contours for a natural appearance
Dimensions	Min. flow path of 2L:1W; may use internal berms
Bottom slope	< 8%; 2- to 3- foot elevation drop from inlet to outlet
Side slopes (4)	3H:1V or flatter; deep pool areas require a perimeter safety bench
Freeboard (5)	6 to 12 inches above the 100-year return frequency storm level
3. Vertical Component	
Surface Storage (6)	≤ 3 feet above permanent pool
Permanent Pool and Sediment Storage Volume (7)	See Calculations
Extended Detention Volume (8)	See Calculations
Quantity Control Level (9)	See Calculations
Native Material (10)	Test to ensure low permeability soil and perennial high water table
4. Drainage	
Inlet (11)	Curb inlet with energy dissipation and/or grass swale
Outlet (13)	Required; Bottom drain required
Overflow (14)	Weir; Standpipe
Evapotranspiration	No requirement
Infiltration	Not applicable
Dewatering	24 hours; No more than ½ of the extended detention volume in the first 8 hrs.; Provide method to drain the permanent pool to facilitate maintenance
5. Composition	
Surface Treatment	Vegetation
Vegetation	Wetland vegetation
Soil Media	Typically "C" or "D" soils
Side Slopes	Vegetation
Mulch	None
6. Pollutant	
Pretreatment (15)	Required. May include grass filter strip, swale, sump inlets
Sediment Storage	Equal to 20% of water quality volume
7. Maintenance	
Access	A stable vehicular access way shall be provided to deep pools
Require-ments	1) Designed and maintained to improve water quality; 2) Maintenance Plan shall be submitted w/ Stormwater Management Plan 3) Install a fixed vertical sediment depth marker
8. Calculations	
Water Quality Volume (WQv) = $WQ_v = R_v * P * A / 12$	
where: WQ_v = water quality volume in acre-feet	
R_v = the volumetric runoff coefficient calculated using equation 2 P = 0.9 inch precipitation depth A = area draining into the BMP in acres	
$R_v = 0.05 + 0.9i$ (Equation 2) where i = fraction of post-construction impervious surface	
Allocation of WQv: Pool: 25% Marsh: 75% Pool allocation may include forebay and micropool volume.	
Permanent Pool Volume = WQv + groundwater table	
Extended Detention Volume = WQv	
Sediment Storage Volume = 0.2*WQv	
Forebay/Micropool Volume = 0.1 in.*impervious area	
Quantity Control Requirements = Refer to Chapter 2 and Chapter 7	
Note: If constructed within navigable waters of the U.S., a Section 404 permit under the Clean Water Act is required along with a state permit.	

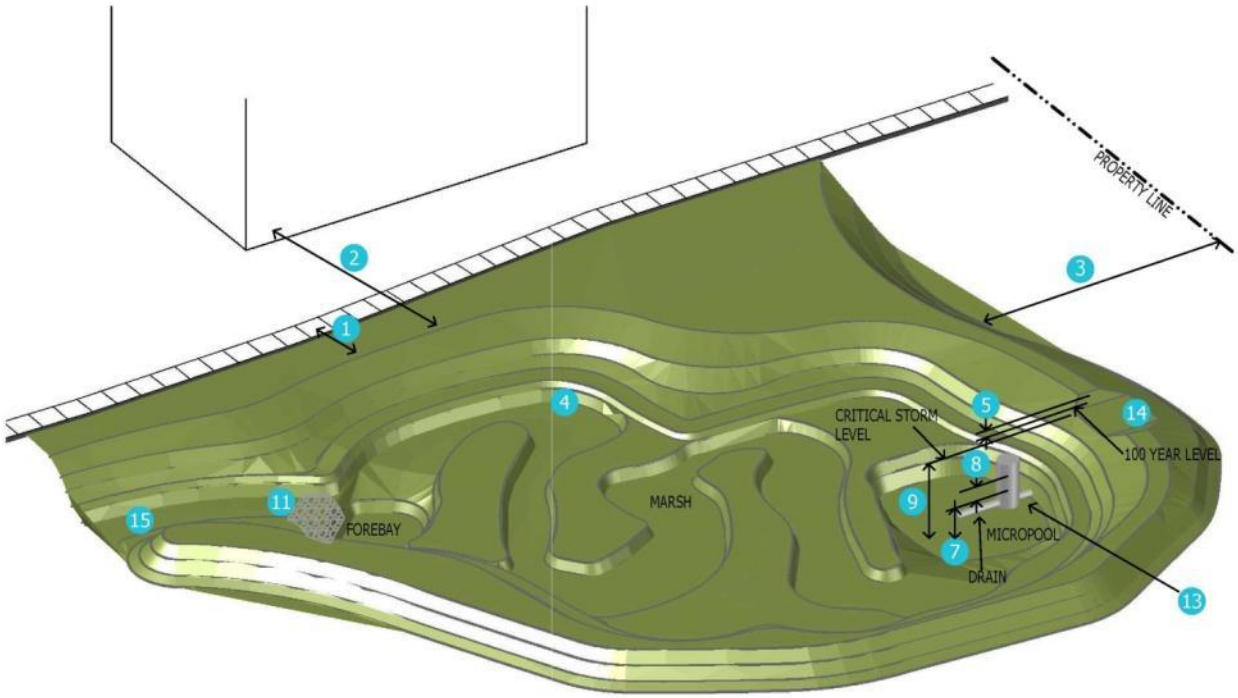


FIGURE 5-12 POCKET WETLAND DIAGRAM

Guidance (13) Retention Basin

1. Siting Setbacks	
Pavement (1)	≥ 10 feet
Building (2)	Basement: ≥ 50 feet No Basement: ≥ 20 feet
Property Lines/ROW (3)	≥ 10 feet / ≥ 50 feet
Groundwater/Karst/ Bedrock	Depending on underlying geology, may need liner to ensure water retention.
Septic System/Wells	≥ 50 feet/ ≥ 100 feet
2. Volume	
Surface Area	Inlet and outlet separated by at least 2 times the width of the pond
Dimensions	Aquatic bench over 25% to 50% of pond surface area with 10:1 side slopes and a max. depth of 18 in.; Min. width of 5 feet
Bottom slope	Flat
Side slopes (4)	4H:1V or flatter above the permanent pool; 2H:1V or flatter below the permanent pool
Freeboard (5)	6 to 12 inches
3. Vertical Component	
Surface Storage (6)	Basin depths in open water areas shall not exceed 12 feet; The mean depth shall be 3 to 6 feet
Permanent Pool and Sediment Storage Volume (7)	See Calculations
Extended Detention Volume (8)	See Calculations
Quantity Control Level (9)	See Calculations
Native Material (10)	Low permeability
4. Drainage	
Inlet (11)	Include forebay or other sediment removal device
Underdrain (12)	None
Outlet (13)	Required; Bottom drain required
Overflow (14)	Weir; Standpipe; Adhere to ODNR dam safety laws as applicable.
Evapotranspiration	No requirement
Infiltration	Not applicable
Dewatering	24 hours; No more than ½ of the extended detention volume in the first 8 hours; Provide method to drain the permanent pool to facilitate maintenance
5. Composition	
Surface Treatment	Open water
Vegetation	Aquatic bench planted with wetland vegetation.
Soil Media	Typically "C" or "D" soils
Side Slopes	Vegetation
Mulch	None
6. Pollutant	
Pretreatment (15)	Forebay; Hard bottom forebays required for facilities maintained by the City
Sediment Storage	Equal to 20% of WQv
7. Maintenance	
Access	A stable vehicular access way shall be provided to forebays and outlets
Requirements	1) Designed and maintained to improve water quality (oxygen levels); 2) Maintenance Plan shall be submitted w/ Stormwater Management Plan; 3) Install a fixed vertical sediment depth marker in forebay
8. Calculations	
Water Quality Volume (WQv) = $WQ_v = R_v * P * A / 12$ where: WQ_v = water quality volume in acre-feet R_v = the volumetric runoff coefficient calculated using equation 2 P = 0.9 inch precipitation depth A = area draining into the BMP in acres $R_v = 0.05 + 0.9i$ (Equation 2) where i = fraction of post-construction impervious surface	
Permanent Pool Volume = WQv	
Extended Detention Volume = WQv	
Sediment Storage Volume = 0.2*WQv	
Forebay Volume = 0.1*WQv	
Flood Control Requirements = Refer to Chapter 2 and Chapter 7.	

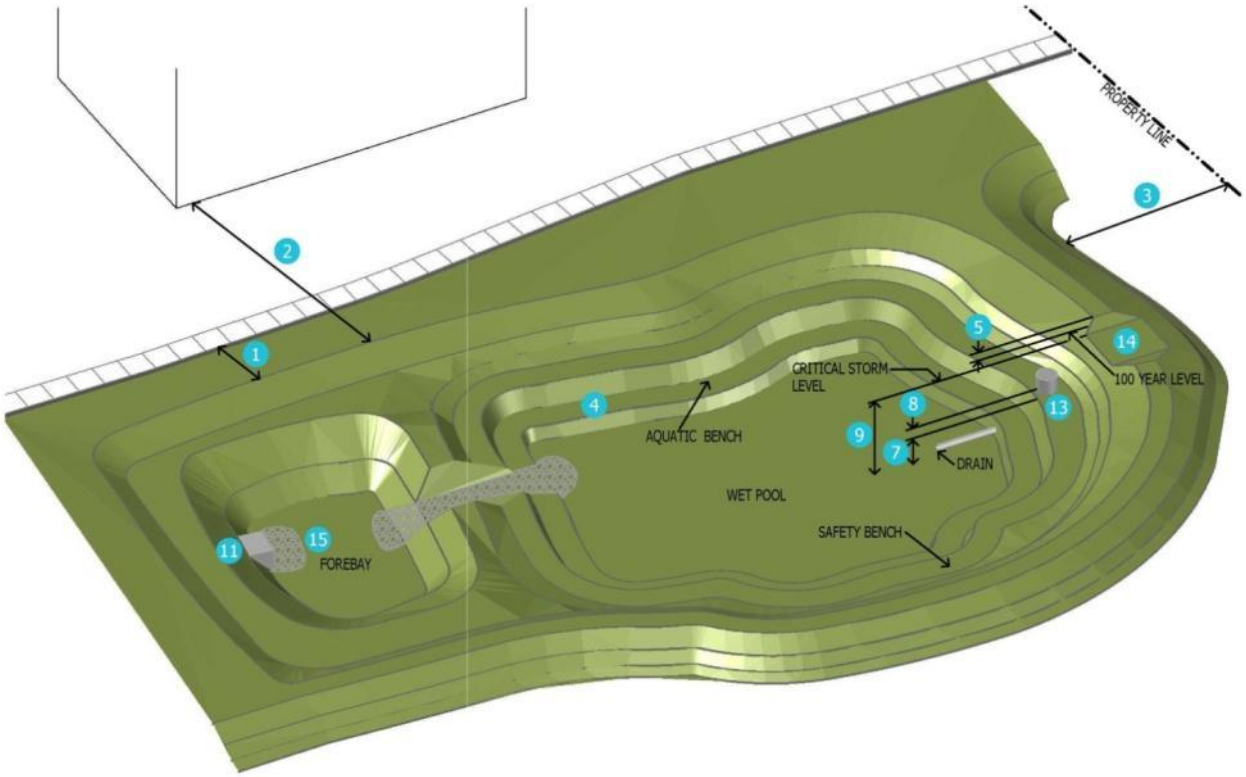


FIGURE 5-13 RETENTION BASIN DIAGRAM

Guidance (14) Stormwater Wetland

1. Siting Setbacks	
Pavement (1)	≥ 10 feet
Building (2)	Basement: ≥ 50 feet No Basement: ≥ 20 feet
Property Lines/ ROW (3)	≥ 10 feet / ≥ 50 feet
Groundwater/Karst/ Bedrock	≥2 feet
Septic System/Wells	≥ 50 feet / ≥ 100 feet
2. Volume	
Surface Area	1) Min. 35% of surface area w/ a depth ≤ 6 inches (marsh); 2) 10- to 20% of surface area to be 1.5- to 6-ft deep (pool) 3) provide irregular contours for a natural appearance
Dimensions	Min. flow path of 2L:1W; may use internal berms
Bottom slope	< 8%; 3- to 5-foot elevation drop from inlet to outlet
Side slopes (4)	3H:1V or flatter; deep pool areas require a perimeter safety bench
Freeboard (5)	6 to 12 inches
3. Vertical Component	
Surface Storage (6)	≤ 3 feet above permanent pool
Permanent Pool and Sediment Storage Volume (7)	See Calculations
Extended Detention Volume (8)	See Calculations
Quantity Control Level (9)	See Calculations
Native Material (10)	Test to ensure low permeability soil and perennial high water table
4. Drainage	
Inlet (11)	Curb inlet with energy dissipation and/or grass swale
Underdrain (12)	None
Outlet (13)	Required; Bottom drain required
Overflow (14)	Weir; Standpipe; Adhere to ODNR dam safety laws as applicable.
Evapotranspiration	No requirement
Infiltration	Not applicable
Dewatering	24 hours; No more than ½ of the extended detention volume in the first 8 hours; Provide method to drain the permanent pool to facilitate maintenance
5. Composition	
Surface Treatment	Vegetation
Vegetation	Wetland vegetation
Soil Media	Typically "C" or "D" soils
Side Slopes	Vegetation
Mulch	None
6. Pollutant	
Pretreatment (15)	Forebay; Hard bottom forebays recommended for maintenance
Sediment Storage	Equal to 20% of water quality volume
7. Maintenance	
Access	A stable vehicular access way shall be provided to deep pools
Require-ments	1) Designed/maintained to improve water quality; 2) Maintenance Plan shall be submitted w/ Stormwater Management Plan 3) Install a fixed vertical sediment depth marker
8. Calculations	
Water Quality Volume (WQv) = $WQ_v = R_v * P * A / 12$ where: WQ_v = water quality volume in acre-feet R_v = the volumetric runoff coefficient calculated using equation 2 P = 0.9 inch precipitation depth A = area draining into the BMP in acres $R_v = 0.05 + 0.9i$ (Equation 2) where i = fraction of post-construction impervious surface	
Allocation of WQv: Pool: 70% Marsh: 30% Pool allocation may include forebay and micropool	
Permanent Pool Volume = WQv	
Extended Detention Volume = WQv	
Sediment Storage Volume = 0.2*WQv	
Forebay/Micropool Volume = 0.1 in.*impervious area	
Quantity Control Requirements = Refer to Chapter 2 and Chapter 7	

Note: If constructed within navigable waters of the U.S., a Section 404 permit under the Clean Water Act is required along with a state permit.

A water balance must be performed to demonstrate that the wetland can withstand a 30-day drought at summer evap. rates without completely drawing down.

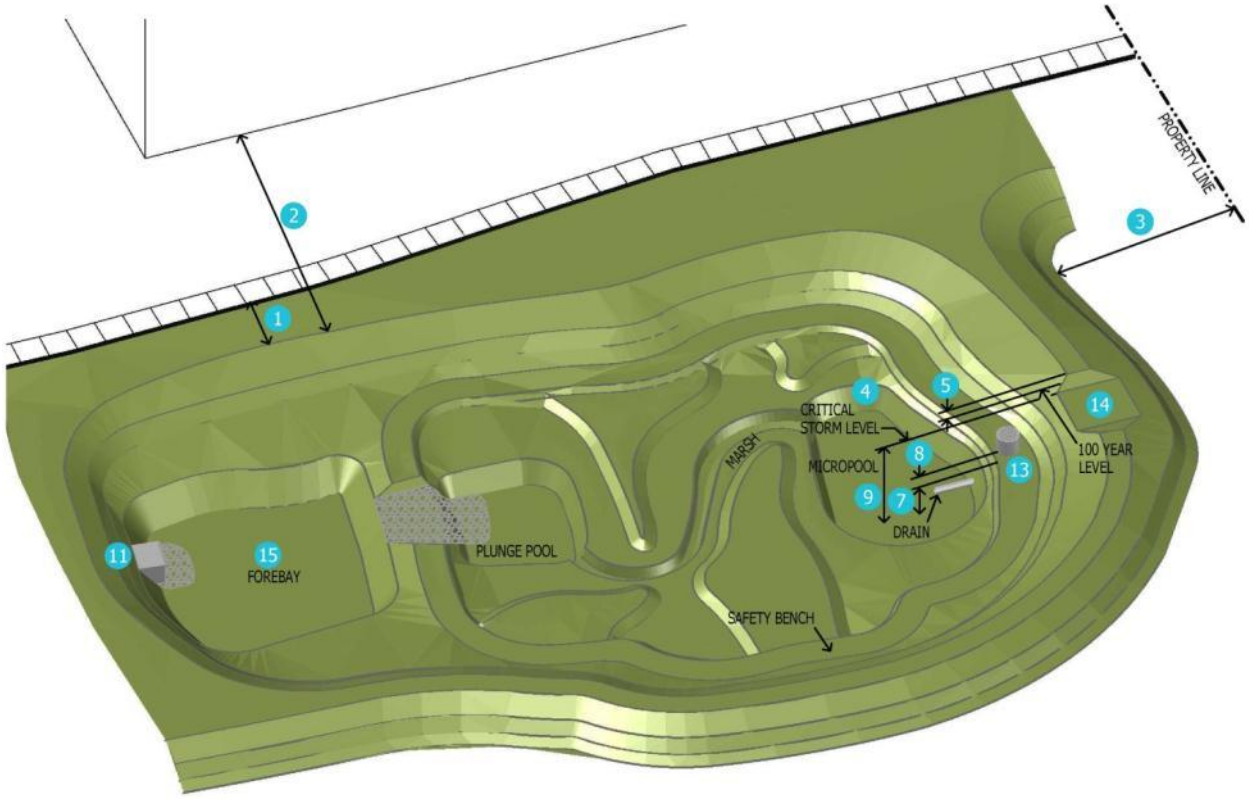


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FIGURE 5-14 STORMWATER WETLAND DIAGRAM

Guidance (15) Extended Dry Detention

1. Siting Setbacks		
Pavement	1	No requirement
Building	2	No requirement w/ solid or lined bottom; otherwise, Basement: ≥ 10 feet No Basement: ≥ 5 feet
Property Lines/ROW	3	≥ 2 feet / ≥0 feet
Groundwater/Karst/ Bedrock		None
Septic System/Wells		≥ 50 feet / ≥ 100 feet
2. Volume		
Surface Area		No requirement
Dimensions		Inlet and outlet separated by at least 2 times the width of the pond
Bottom slope		No requirement
Side slopes	4	4H:1V or flatter and vegetated
Freeboard	5	6 to 12 inches
3. Vertical Component		
Surface Storage	6	The mean depth shall be 3 to 6 feet
Sediment Storage Volume	7	See Calculations
Extended Detention Volume	8	See Calculations
Quantity Control Level	9	See Calculations
Native Material	10	Test infiltration; ≥1/2 in/hr if designing with infiltration
4. Drainage		
Inlet	11	Include forebay or other sediment removal device
Underdrain	12	No requirement
Outlet	13	Required; Micropool recommended
Overflow	14	Weir; Standpipe; Adhere to ODNR dam safety laws as applicable.
Evapotranspiration		No requirement
Infiltration		No requirement
Dewatering		48 hours; No more than ½ of the extended detention volume in the first 16 hours; Provide method to drain pools to facilitate maintenance

5. Composition		
Surface Treatment		Vegetation
Vegetation		Aquatic bench planted with wetland vegetation.
Soil Media		Not applicable
Mulch		Not applicable
6. Pollutant		
Pretreatment	15	Forebay; Hard bottom forebays required for facilities maintained by the City
Sediment Storage		Equal to 20% of water quality volume
7. Maintenance		
Access		A stable vehicular access way shall be provided to forebays and outlets
Requirements		1) Designed and maintained to improve water quality; Maintenance Plan shall be submitted w/ Stormwater Management Plan 2) Install a fixed vertical sediment depth marker in forebay
8. Calculations		

Water Quality Volume (WQv) = $WQ_v = R_v * P * A / 12$
where:

WQ_v = water quality volume in acre-feet

R_v = the volumetric runoff coefficient calculated using equation 2
P = 0.9 inch precipitation depth
A = area draining into the BMP in acres

$R_v = 0.05 + 0.9i$ (Equation 2)
where i = fraction of post-construction impervious surface

Extended Detention Volume = WQv
Sediment Storage Volume = 0.2*WQv
Forebay/Micropool Volume (each) = 0.1*WQv
Quantity Control Requirements = Refer to Chapter 2 and Chapter 7.

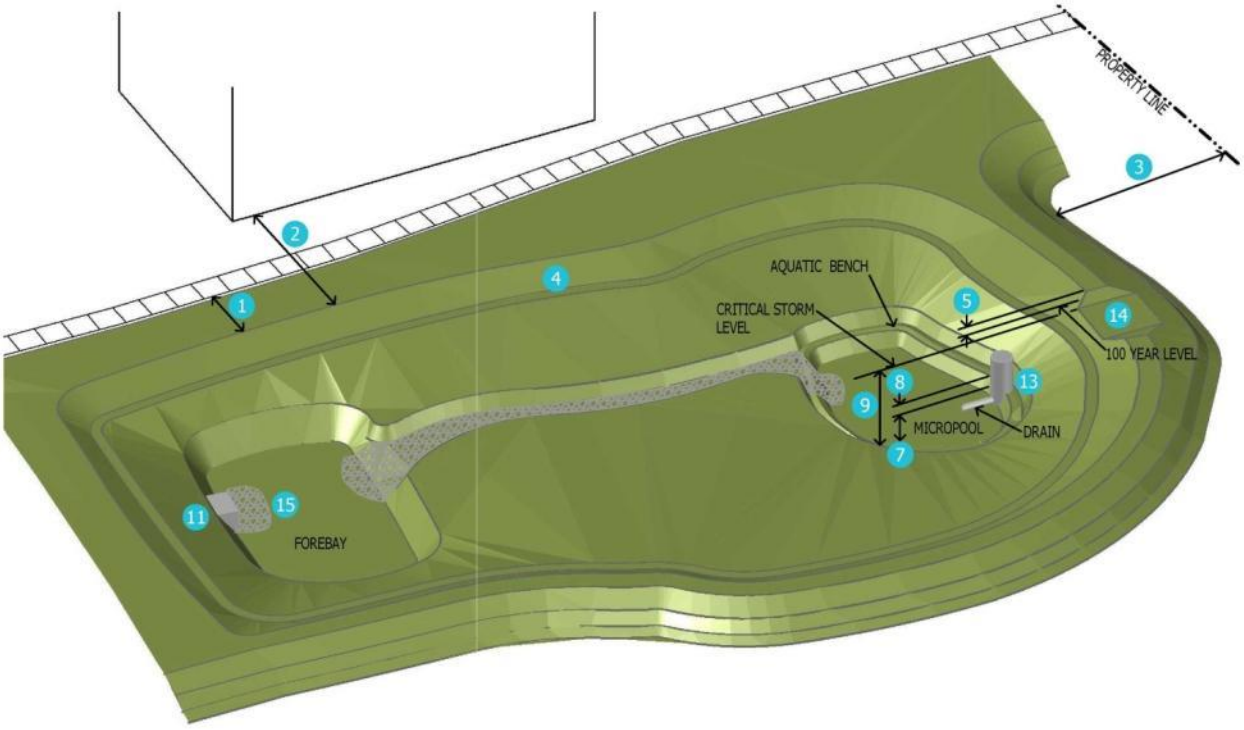


FIGURE 5-15 EXTENDED DRY DETENTION DIAGRAM

Guidance (16) Underground Retention/Detention

1. Siting Setbacks		
Pavement	1	No requirement
Building	2	No requirement w/ solid bottom; otherwise, Basement: ≥ 10 feet No Basement: ≥ 5 feet
Property Lines/ROW	3	≥ 2 feet / ≥0 feet
Groundwater/Karst/ Bedrock		No requirement w/ solid bottom; otherwise, ≥ 2 feet
Septic System/Wells		≥ 50 feet / ≥ 100 feet
2. Volume		
Surface Area		No requirement
Dimensions		No requirement
Bottom slope		Positive slope toward outlet
Side slopes	4	No requirement
Freeboard	5	No requirement
3. Vertical Component		
Surface Storage	6	The mean depth shall be 3 to 6 feet
Sediment Storage Volume	7	See Calculations
Extended Detention Volume	8	See Calculations
Quantity Control Level	9	See Calculations
Native Material	10	Test infiltration; ≥1/2 in/hr if designing with infiltration
4. Drainage		
Inlet	11	Include sediment removal device
Underdrain	12	No requirement
Outlet	13	Required
Overflow	14	Back-up aboveground; Weir; Standpipe
Evapotranspiration		No requirement
Infiltration		No requirement
Dewatering		48 hours per OEPA; No more than ½ of the extended detention volume in the first 16 hours

5. Composition		
Surface Treatment		Not applicable
Vegetation		Not applicable
Soil Media		Not applicable
Mulch		Not applicable
6. Pollutant		
Pretreatment	15	Required; May be swale, prefabricated device, or forebay
Sediment Storage		Equal to 20% of water quality volume
7. Maintenance		
Access		At a minimum, access points are to be installed near each inlet and outlet; Where an opening is provided that could allow the entry of personnel, the opening shall be marked, "DANGER-CONFINED SPACE".
Requirements		1) Designed and maintained to improve water quality; Maintenance Plan shall be submitted w/ Stormwater Management Plan 2) Install a fixed vertical sediment depth marker
8. Calculations		

Water Quality Volume (WQv) = $WQ_V = R_V * P * A / 12$
where:

WQ_V = water quality volume in acre-feet

R_V = the volumetric runoff coefficient calculated using equation 2
P = 0.9 inch precipitation depth
A = area draining into the BMP in acres

$R_V = 0.05 + 0.9i$ (Equation 2)
where i = fraction of post-construction impervious surface

Extended Detention Volume = WQv

Sediment Storage Volume = 0.2*WQv

Quantity Control Requirements = Refer to Chapter 2 and Chapter 7.

Notes:
If the facility is designed to infiltrate via a subsurface fluid distribution system, it is likely considered a Class V well and will need a permit. The Class V permitting agency for Ohio is the Ohio EPA.

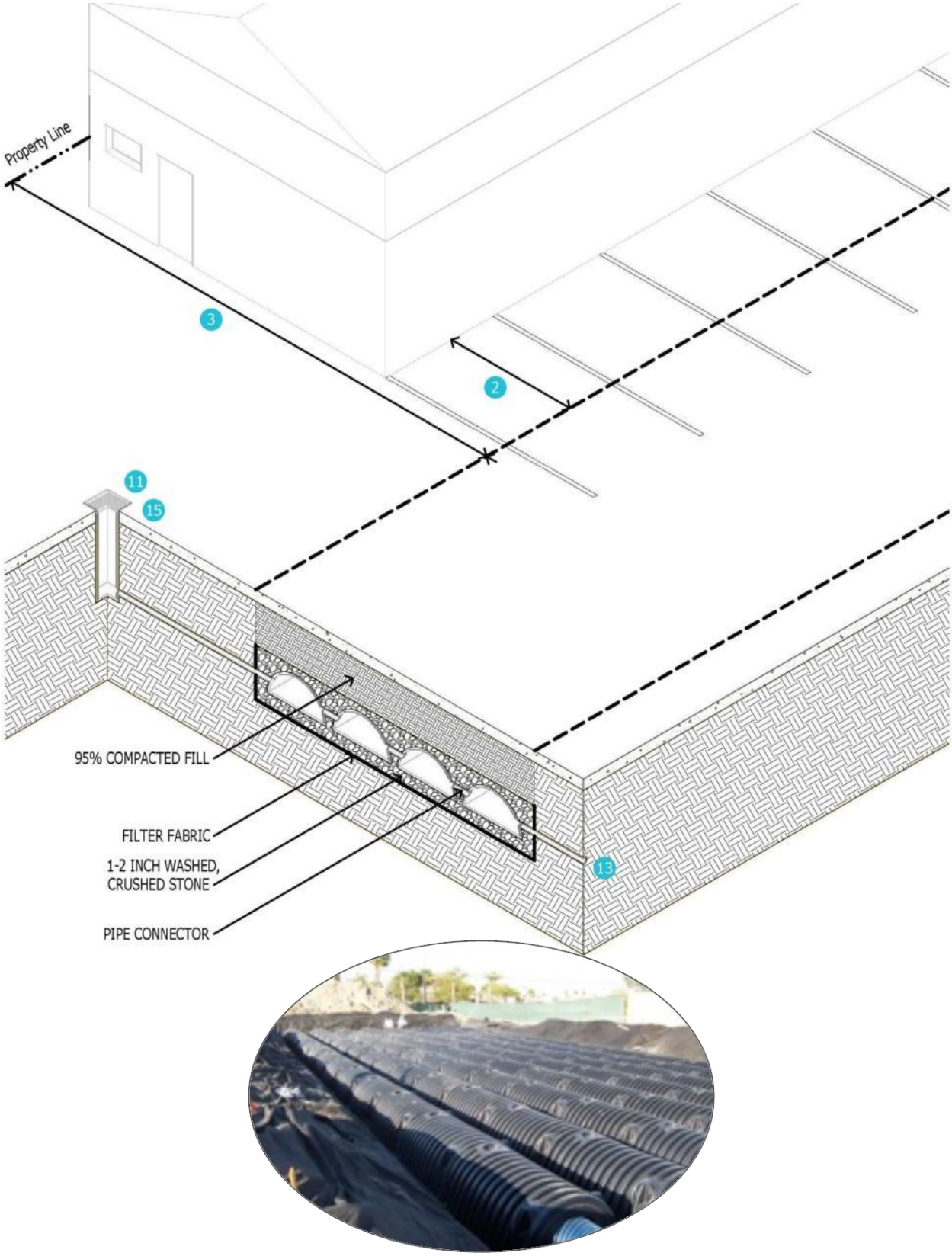


FIGURE 5-16 UNDERGROUND RETENTION/DETENTION

6. BRIDGE STREET DISTRICT INTEGRATION WITH STORMWATER MANAGEMENT

A. Purpose

The purpose of this Chapter is to define and describe the manner in which recommended stormwater control measures as defined in Chapter 5 may be used in specific areas of the Bridge Street District, and to provide flexible and effective standards for the integration of these practices into new development, redevelopment, and public improvement projects within the Bridge Street District. This Chapter is intended to support the General Purpose, Scope and Intent of the Bridge Street District and associated development areas by promoting and facilitating the use of recommended measures that are consistent with and suitable for particular street families, right-of-way elements, building types, building sites, and open space types, and which contribute to sound stormwater management in a walkable mixed-use development setting.

B. General Provisions

For purposes of this Chapter, the term "effective impervious area" shall mean those impervious surfaces from which stormwater runoff is conveyed directly to surface water or the storm drainage system, without an opportunity to be infiltrated or otherwise retained.

From a stormwater management perspective, minimizing the amount of effective impervious area is preferred because it helps to minimize the extent of stormwater infrastructure that must be constructed and maintained, and to reduce water quantity and water quality impacts on receiving waters. Therefore, it is the intent of this Chapter to promote design techniques that reduce the total impervious area and effective impervious area in public rights-of-way and on developed sites, but to do so in the context of creating a walkable, urban mixed-use area and without compromising pedestrian, bicycle and vehicle safety. It is also recognized that minimum widths, areas and structural requirements of impervious surfaces will in many cases be required to meet other standards such as Americans with Disabilities Act (ADA) and emergency vehicle accessibility. Therefore, while an important goal for water quality, the directive to minimize the total area of impervious surfaces and effective impervious area does not in and of itself supersede other planning goals, objectives and standards adopted by the City of Dublin.

FIGURE 6-1 BRIDGE STREET DISTRICT

In presenting the recommended integration of stormwater control measures with development within the Bridge Street District, the tables in this Chapter identify those stormwater control measures that are most

feasible for the District. Common reasons a control measure may *not* be considered "most feasible" may include an inability to contribute to quantity control requirements, the lack of a treatment mechanism, lower cost-effectiveness in terms of cost per volume unit of stormwater controlled, and the need for more space than typically available. Table 6-1 provides guidance for the consideration of recommended stormwater control measures. Note that the information provided in Table 6-1 is not meant to discourage use but rather provide an explanation as to why a recommended stormwater control measure is generally not noted as "most feasible" in the following tables. It is recognized that each development is unique and there are many possible stormwater control measures that might meet the code and design criteria.

TABLE 6-1 STORMWATER CONTROL MEASURE FEASIBILITY

		COMMON REASONS FOR LACK OF FEASIBILITY			
		Inability to Contribute to Quantity Control Requirements	**Limited Treatment Mechanism**	**Not Cost-Effective**	**Need for More Space than Available**
RECOMMENDED STORMWATER CONTROL MEASURES	**Water Harvesting**				
	Rain Barrels	●	●		
	Cisterns	●	●		
	Filter Strips	●			
	Media Filter				
	Vegetated Bioretention				
	Traditional				
	Bioretention Swales				
	Planter Boxes				
	Tree Boxes			●	
	Curb Extension				
	Permeable Pavements				
	Green Roofs			●	
	Basins				
	Pocket Wetland				●
	Stormwater Wetland				●
	Retention Basin		●		
	Extended Dry Detention		●		
	Underground Retention/Detention		●		
	Prefabricated Devices				
	Hydrodynamic Devices	●			
	Inlet Traps	●			
	Gross Solids Removal	●			

C. Lots and Blocks

The section of the Bridge Street District Code (Code) applicable to lot and block layouts (§ 153.060) is intended to promote the establishment of a network of interconnected streets with walkable block sizes and continuous pedestrian-oriented block faces, and to promote multiple modes of transportation through street design and connectivity. Irrespective of lot and block type, stormwater management will be addressed at the site level either on an individual site or project basis or through a cooperative Stormwater Management Plan among multiple properties per the guidance in Section 7.E. For more detailed guidance on stormwater management design in specific street settings, refer to the subsequent sections in Section 6 on Street Types, Buildings Types, Open Space Types, and Site Development Standards.

D. Street Types

This section addresses the requirements and opportunities for incorporating stormwater management within the street right-of-way. Provisions are made for incorporating stormwater control measures into specific street families and street types as defined in § 153.061 and the suitable placement of stormwater control measures within the right-of-way.

1) Right-of-Way Impervious Surfaces

For street projects, opportunities to minimize the total area of impervious surface constructed may include designing with minimum or reduced travel lane, parking lane, pedestrian (sidewalk) and bike facility widths where deemed appropriate by the City Engineer.

2) Recommended Stormwater Control Measures

Street families, as defined in the Code, are comprised of multiple street types, each configured to accommodate specific transportation needs while reinforcing the intended character and function of the applicable street family. Street families, street types, and the street network within the Bridge Street District are defined in § 153.061. The street types within each street family are distinguished by the absence or presence of right-of-way elements such as parking lanes, planting zone medians, curb extensions, and bike facilities. Figure 6-2 illustrates the potential elements of the right-of-way; specific street type configurations will be determined as part of the development review process.

Stormwater shall be managed using one or more of the control measures applicable to that street family as shown in Table 6-2. It is important to note that some control measures may be applicable only to a certain street type within a given street family.

3) Placement of Stormwater Control Measures

The following section provides guidance on the placement of stormwater control measures within the street right-of-way. Refer to Table 6-3 accompanied by Figure 6-2 for appropriate placement of stormwater control measures.

TABLE 6-2 RECOMMENDED STORMWATER CONTROL MEASURES BY STREET FAMILY[1]

		STREET FAMILIES			
		Corridor Connector Streets	**District Connector Streets**	**Neighborhood Streets**	**Alleys & Service Streets**
RECOMMENDED STORMWATER CONTROL MEASURES	**Water Harvesting**				
	Rain Barrels	**NOT APPLICABLE**			
	Cisterns				
	Filter Strips				
	Media Filter	●			
	Vegetated Bioretention				
	Traditional	●			
	Bioretention Swales	●	●	●	
	Planter Boxes	●	●	●	●
	Tree Boxes	●	●	●	
	Curb Extension	●	●	●	●
	Permeable Pavements[2]	●	●	●	●
	Green Roofs	**NOT APPLICABLE**			
	Basins				
	Pocket Wetland				
	Stormwater Wetland				
	Retention Basin	NOT PERMITTED			
	Extended Dry Detention				
	Underground Retention/Detention				
	Prefabricated Devices				
	Hydrodynamic Devices	●	●	●	●
	Inlet Traps	●	●	●	●
	Gross Solids Removal	●	●	●	●

[1] While SCMs with a ● are all permissible for a given street family depending on the street type, the most feasible and cost-effective SCMs are denoted with a ●. A blank cell indicates that the SCM is not suitable.
[2]Within the street right-of-way, the proposed type of permeable pavement must be approved by the City Engineer.

TABLE 6-3 PLACEMENT OF STORMWATER CONTROL MEASURES WITHIN THE STREET RIGHT-OF-WAY

		TYPICAL ELEMENTS OF THE RIGHT-OF-WAY							
		Median	**Travel Lane**	**Parking Lane**	**Curb/ Gutter**	**Curb Extension**	**Bike Facility**	**Planting Zone**	**Pedestrian Facility**
RECOMMENDED STORMWATER CONTROL MEASURES	**Water Harvesting**								
	Rain Barrels								
	Cisterns								
	Filter Strips	●							
	Media Filter	●							
	Vegetated Bioretention								
	Traditional	●							
	Bioretention Swales	●							
	Planter Boxes								
	Tree Boxes	●						●	
	Curb Extension					●			
	Permeable Pavements		● (alley/ service)	●			●	●	●
	Green Roofs								
	Basins								
	Pocket Wetland								
	Stormwater Wetland								
	Retention Basin	NOT PERMITTED							
	Extended Dry Detention								
	Underground Retention/Detention								
	Prefabricated Devices[1]								
	Hydrodynamic Devices	●			●	●	●		●
	Inlet Traps	●			●				
	Gross Solids Removal	●			●	●	●		●

[1] With verification that no other suitable location exists, Hydrodynamic Devices and Gross Solids Removal may be located within the travel lane and parking lane with prior approval by the City Engineer.

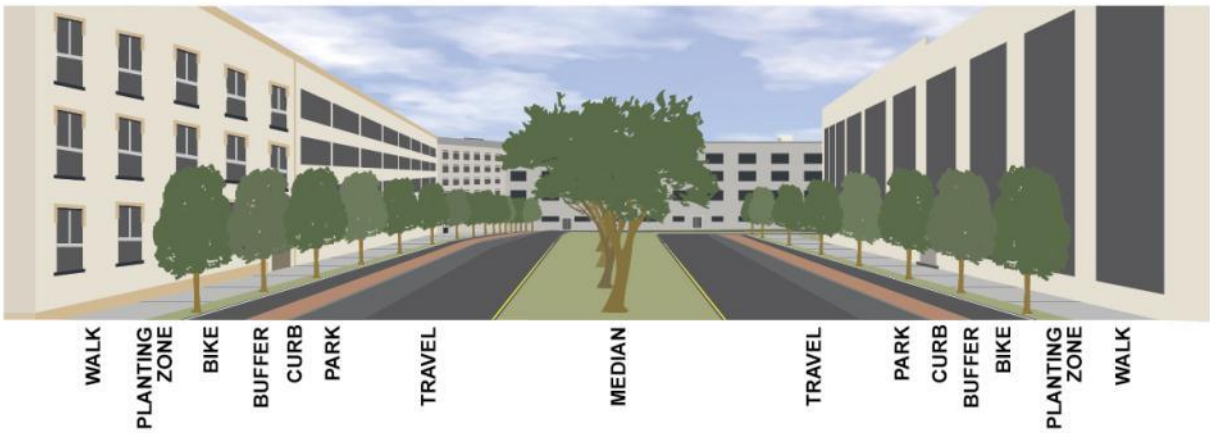


FIGURE 6-2 POTENTIAL ELEMENTS OF THE TYPICAL STREET RIGHT-OF-WAY

E. Building Types

This section addresses the requirements and opportunities for incorporating stormwater management within a Bridge Street District development site and the suitable placement of stormwater control measures within that site. There are thirteen defined building types within the code and stormwater management for each type is addressed in this section.

1) Building Type and Impervious Surfaces

Applicants are encouraged to use available opportunities to reduce effective impervious surface related to buildings (e.g., minimizing building and parking lot footprints, promoting disconnection of rooftops and other impervious surfaces from directly discharging into the stormwater drainage system). The Stormwater Treatment and Control Feasibility Assessment for Redevelopment in Appendix D offers guidance on site techniques that are potentially applicable in new development settings as well as for redevelopment. Applicable design techniques may include, as appropriate:

- designing for the minimum number of parking stalls, incorporating compact parking spaces, and maximizing the use of shared parking arrangements or other methods to reduce surface parking;
- using permeable surfacing for all or portions of parking areas, walkways, and driveways as appropriate; and
- minimizing the extent and length of interior driveway networks without compromising circulation and connectivity requirements.

2) Permitted Stormwater Control Measures

The Code defines various building types, with each having specific requirements as defined in § 153.062. While keeping within the building type requirements, a stormwater management system meeting the applicable requirements shall be incorporated into the site design. Figure 6-3 illustrates the elements of a typical site layout. Stormwater shall be managed using one or more of the control measures applicable to each building type as shown in Table 6-4. Note that some control measures are more appropriate for certain building types than others. Refer to Table 6-5 for appropriate placement of control measures within the site.

3) Placement of Stormwater Control Measures

The following provides guidance on placement of stormwater control measures within a building site. Refer to Table 6-3 accompanied by Figure 6-3 for appropriate placement of stormwater control measures.

TABLE 6-4 RECOMMENDED STORMWATER CONTROL MEASURES BY BUILDING TYPE[1]

RECOMMENDED STORMWATER CONTROL MEASURES	BUILDING TYPES												
	Single Family Detached	Single Family Attached	Apartment	Loft	Corridor	Mixed Use	Commercial Center	Large Format Commercial	Historic Mixed Use	Historic Cottage Commercial	Civic	Parking Structure	Podium Apartment
Water Harvesting													
Rain Barrels	●	●											
Cisterns	●	●	●	●	●	●	●	●	●	●	●	●	●
Filter Strips	●	●	●	●	●	●	●	●	●	●	●	●	●
Media Filter		●	●	●	●	●	●	●	●	●	●	●	●
Vegetated Bioretention													
Traditional	●	●	●	●	●	●	●	●	●	●	●	●	●
Bioretention Swales	●	●	●	●	●	●	●	●	●	●	●	●	●
Planter Boxes	●	●	●	●	●	●	●	●	●	●	●	●	●
Tree Boxes		●	●	●	●	●	●	●	●	●	●		●
Curb Extension		●	●	●	●	●	●	●	●	●	●		●
Permeable Pavements	●	●	●	●	●	●	●	●	●	●	●	●	●
Green Roofs		●	●	●	●	●	●	●			●	●	●
Basins													
Pocket Wetland		●	●	●	●	●	●	●	●	●	●	●	●
Stormwater Wetland		●	●	●	●	●	●	●	●	●	●	●	●
Retention Basin	NOT PERMITTED												
Extended Dry Detention													
Underground Retention/Detention		●	●	●	●	●	●	●	●	●	●	●	●
Prefabricated Devices													
Hydrodynamic Devices		●	●	●	●	●	●	●	●	●	●	●	●
Inlet Traps		●		●	●	●	●	●	●	●	●		
Gross Solids Removal		●	●	●	●	●	●	●	●	●	●	●	●

[1] While SCMs with a ● are all permissible for a given building type depending on the details of that development, the most feasible and cost-effective SCMs are denoted with a ●. A blank cell indicates that the SCM is not suitable.

TABLE 6-5 PLACEMENT OF STORMWATER CONTROL MEASURES WITHIN A BUILDING SITE

		TYPICAL ELEMENTS OF A BUILDING SITE					
		Side Yard	**Rear Yard**	**Required Building Zone (RBZ)[1]**	**Roof**	**Attached to Building**	**Surface Parking Lot**
RECOMMENDED STORMWATER CONTROL MEASURES	**Water Harvesting**						
	Rain Barrels[3]	●	●	●		●	
	Cisterns	●	●	●	●		
	Filter Strips	●	●	●			●
	Media Filter	●	●	●			●
	Vegetated Bioretention						
	Traditional	●	●	●			●
	Bioretention Swales	●	●	●			●
	Planter Boxes			●		●	
	Tree Boxes			●			●
	Curb Extension						●
	Permeable Pavements[2]	●	●	●			●
	Green Roofs				●		
	Basins						
	Pocket Wetland	●	●				●
	Stormwater Wetland	●	●				●
	Retention Basin	NOT PERMITTED					
	Extended Dry Detention						
	Underground Retention/Detention	●	●				●
	Prefabricated Devices						
	Hydrodynamic Devices	●	●	●			●
	Inlet Traps	●	●	●			●
	Gross Solids Removal	●	●	●			●

[1] Filter Strips, Traditional Bioretention, Bioretention Swale, Planter Boxes, and Tree Boxes are permissible in landscape RBZ treatments as described in § 153.065(D)(6).
[2] Permeable Pavements are permissible in the side yard and rear yard subject to parking location (as applicable) and setback requirements of § 153.062(N)(1)(C).
[3] Rain Barrels are permissible in the side yard and rear yard subject to setback requirements of § 153.071(B)(1)(f).

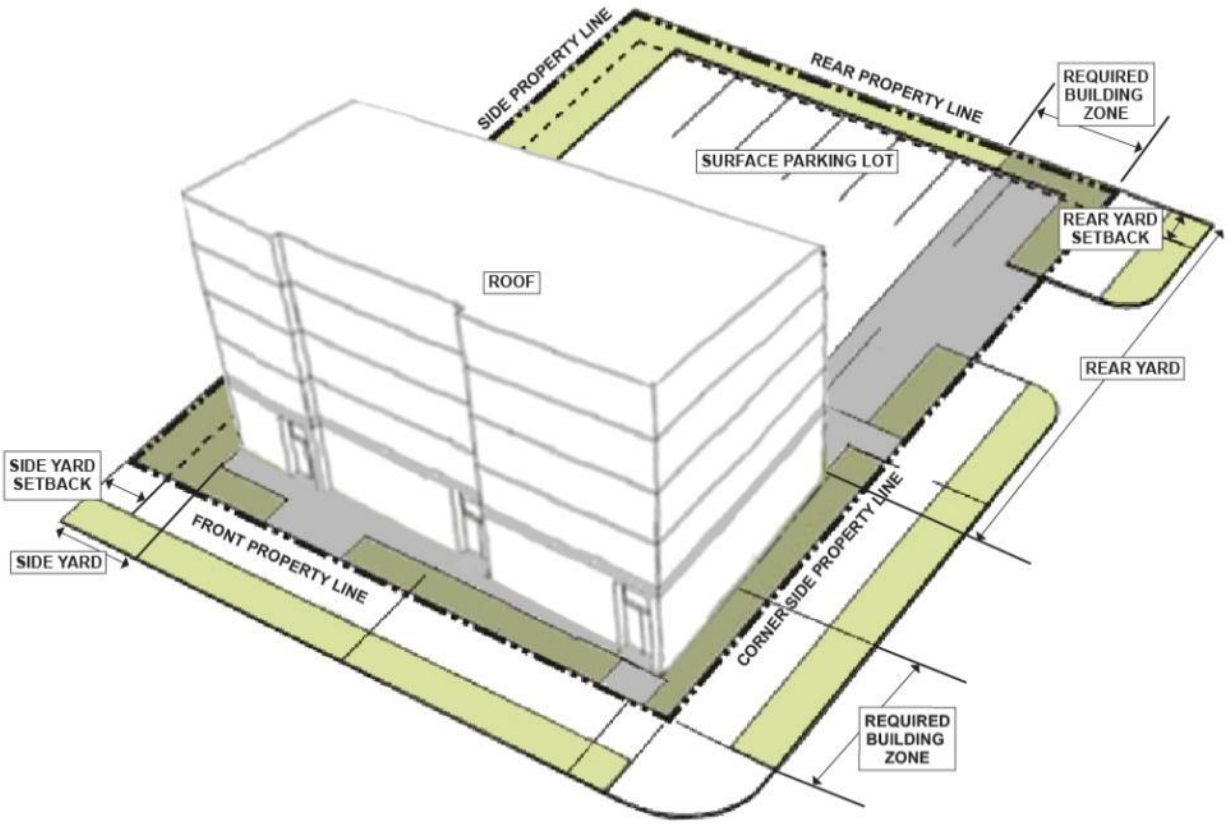


FIGURE 6-3 POTENTIAL ELEMENTS OF A BUILDING SITE

F. Neighborhood Standards

The section of the Code applicable to neighborhood standards (§ 153.063) is intended to promote the creation of signature places in the City consistent with the Bridge Street Corridor Vision Report. The neighborhood standards guide the development of streets, buildings, and open spaces, although not to the extent that precise location is dictated. Guidance on specific allowable stormwater control measures is provided within this Section for the fundamental elements of neighborhood districts including street family, building type, and open space. However, detailed stormwater control measure correlation with neighborhood districts is not presented. By following the guidance on allowable stormwater control measures by element (street family, etc.) the overall placement of stormwater control measures should be consistent with the objectives of the Code.

G. Open Space Types

This section addresses the requirements and opportunities for incorporating stormwater management within open space as defined in § 153.064, Open Space Types. The Code include provisions for incorporating one or more of the defined open space types within a site development as a function of neighborhood district and building type. The intent is to create a variety of functional, well-designed open spaces carefully distributed throughout the Bridge Street District to enhance the quality of life for residents, businesses, and visitors.

There are seven defined open space types within the Code and stormwater management for each is addressed in this section, including recommended stormwater BMPs for each open space type and the suitable placement of stormwater BMPs within the open space.

1) Open Space and Impervious Surfaces

Including open space within a development provides an opportunity to decrease the effective impervious surface of a site or project by directing runoff from impervious surfaces such as roofs, parking lots, and sidewalk into an open space area. Care should be taken during construction and maintenance activities to maintain soil permeability by keeping heavy equipment out of the designated open space as much as possible.

2) Recommended Stormwater BMPs

The Code defines various open space types and presents the requirements for each in § 153.064. While staying within the open space type requirements, a stormwater management system meeting the applicable requirements of a site development project shall be incorporated into the site design. Stormwater shall be managed using one or more of the stormwater control measures applicable to each open space type as shown in Table 6-6.

3) Placement of Stormwater Control Measures

The permitted stormwater control measures may be placed anywhere within the open space as long as it follows the guidance in Chapter 5 for siting.

TABLE 6-6 RECOMMENDED STORMWATER CONTROL MEASURES IN EACH OPEN SPACE TYPE[1]

		OPEN SPACE TYPE						
		Pocket Plaza	**Pocket Park**	**Green**	**Square**	**Plaza**	**Park**	**Greenway**
RECOMMENDED STORMWATER CONTROL MEASURES	**Water Harvesting**							
	Rain Barrels	●	●	●	●	●	●	●
	Cisterns	●	●	●	●	●	●	●
	Filter Strips		●	●	●		●	●
	Media Filter		●	●	●		●	●
	Vegetated Bioretention							
	Traditional		●	●	●		●	●
	Bioretention Swales		●	●	●		●	●
	Planter Boxes	●	●	●	●	●	●	●
	Tree Boxes	●	●	●	●	●	●	●
	Curb Extension	●	●	●	●	●	●	●
	Permeable Pavements	●	●	●	●	●	●	●
	Green Roofs	●	●	●	●	●	●	●
	Basins							
	Pocket Wetland			●			●	●
	Stormwater Wetland			●			●	●
	Retention Basin	NOT PERMITTED						
	Extended Dry Detention							
	Underground Retention/Detention	●	●	●	●	●	●	●
	Prefabricated Devices							
	Hydrodynamic Devices	●	●	●	●	●	●	●
	Inlet Traps	●	●	●	●	●	●	●
	Gross Solids Removal	●	●	●	●	●	●	●

[1] While SCMs with a ● are all permissible for a given open space type depending on the details of that development, the most feasible and cost-effective SCMs are denoted with a ●. A blank cell indicates that the SCM is not suitable.

H. Site Development Standards

An important aspect of this Manual is to promote the integration of stormwater control measures into the design of each site and its site development features, as defined in Section § 153.065 of the Code. The provisions below for integrating stormwater control measures with site development features is intended to maximize water quality treatment through recommended stormwater control measures, eliminate the future use of retention/detention ponds, and create multi-functional landscapes in the Bridge Street District.

This Section describes the recommended approaches and opportunities for integrating stormwater management with specific required site features, including parking and loading, landscaping area and street tree requirements, and Required Building Zones (RBZs); and for the coordination of stormwater management with site features such as fencing, walls and screening, exterior lighting, utility undergrounding, and signs.

1) Parking

The use of permeable pavement and surfacing, bioretention, and other stormwater control measures for surface parking as listed in Table 6-5 is encouraged. Stormwater control measures meeting the standards in this Manual may be incorporated into parking areas, drive aisles, landscaped islands, required pedestrian walkways, landscaped edges, and turn-around or other access areas, except for driveway aprons as provided in § 153.065(B)(c)(5). Specific design standards and review guidance on design standards for parking are listed in Table 6-7 Below:

TABLE 6-7 PARKING AND STORMWATER STANDARDS

Code Sections (153.065)	Code Provision	Stormwater Control Measure Objectives and Standards
(B)(1)(a)(4)(a)	Parking areas that cannot be finished due to weather or other conditions shall be 'adequately surfaced' to accommodate stormwater	Surfacing of parking areas with permeable pavement shall follow City Standard Construction Drawings and shall be designed for projected traffic loads using AASHTO methods.
B(1)(b)(2)	Surfacing of off-site parking	Same as for on-site parking
B(6)(b)(1) and (2)	Surfacing of parking areas	Surfacing of parking areas with permeable pavement shall follow City Standard Construction Drawings and shall be designed for projected traffic loads using AASHTO methods.
B(6)(c)(5)	Driveway aprons connecting parking lots to public roadways may not be constructed with permeable materials.	
B(6)(d)(1)	Raised or rolled concrete curbs or wheel stops at least five inches high shall be installed where necessary to prevent vehicle conflicts with abutting landscape areas, sidewalks, streets, buildings or lot lines. The minimum distance from a curb or wheel stop to a property line or protected area shall be two and one-half feet.	Breaks in curbing shall be designed to enable flow to be directed into landscaped areas or stormwater control measures that are designed and installed to manage stormwater runoff. The design and location of curb breaks should not convey sheet flow or concentrated drainage into landscaped areas that would be damaged or dislodged by the flow. Energy dissipation measures that may be incorporated into curb breaks are described in Section 5(a), Common Elements.
B(6)(d)(2)	If a curb is located at the edge of a landscaped area, planted areas shall be installed at a lower grade than the parking lot pavement and curbing shall have openings or gaps allowing drainage from the pavement to	

Code Sections (153.065)	Code Provision	Stormwater Control Measure Objectives and Standards
	enter and percolate through the landscaped areas.	
B(8)(a)(5)	All permeable paving materials shall be maintained in an unbroken condition and shall be regularly swept and vacuumed to prevent blockages of sand, sediment, or other materials that would impair their permeability to water as originally designed.	Maintenance standards or a maintenance plan will be submitted with the Stormwater Management Plan. Where a proprietary product is used, the manufacturer's specifications shall be submitted with the Stormwater Management Plan.

2) Landscaping

The integration, co-location and integrated design of stormwater control measures indicated in Table 6-2 through Table 6-6 with required landscaping areas is strongly encouraged in order to promote high-density development patterns, maximize the utility, aesthetic and environmental function of landscaped areas in the City and District. This Manual provides for the review of stormwater control measures in required landscape areas, including landscape planting plans, plant and ground cover materials, and landscaped buffers in a holistic manner that provides guidance on appropriate waivers and other discretionary approvals under Section § 153.065(D) and the applicable provisions of Section § 153.132 through § 153.148.

a) Interpretation of Code and Manual Landscaping Requirements for Stormwater Features

Stormwater features counting towards required landscaping. Any approved Filter Strips, Vegetated Bioretention, Traditional Bioretention Swales, Planter Boxes, Tree Boxes and surrounding planted areas, planted Curb Extensions, and Constructed Wetlands that are designed and approved in accordance with the standards in this Manual shall be considered 'rain gardens' or 'vegetated site features created to meet stormwater management requirements' as described in section § 153.065(D)(2)(f) of the Code (at right).

In evaluating potentially conflicting landscape requirements applicable to the same area under the provisions of section § 153.065D(2)(i), if the area in question has been designed as a Filter Strip, Vegetated Bioretention, Traditional Bioretention Swale, Planter Box, Tree Box and surrounding planted area, planted Curb Extension, or Constructed Wetland, consideration shall be given to the design requirements of the specific stormwater practice in determining the amount of required landscaping so that stormwater management objectives are not compromised or adversely affected by specific plant material, quantity or spacing requirements.

§ 153.065(D)(2)(f)

Areas included in rain gardens or vegetated site features created to meet stormwater management requirements may be counted towards any landscaping required by § 153.065(D)(4) - (6) if landscaped to meet the requirements.

§ 153.065(D)(2)(i)

If two or more conflicting landscape requirements apply to the same area, the one requiring the most landscaping shall apply.

TABLE 6-8 LANDSCAPING AND STORMWATER CODE PROVISIONS

Code Sections (153.065)	Code Provision	Stormwater Control Measure Objectives and Standards
D(1)	Unless otherwise specified, these requirements should not be interpreted as requiring regular, symmetrical or standardized intervals of vegetation within landscape areas. Required landscaping should be creatively and architecturally designed to add visual interest and preserve natural integrity, as appropriate to the character of the surrounding area.	A plan sheet showing the integration of stormwater treatment features with required landscaping shall be submitted with the application package at each stage of plan review. For Basic Plan Review and Development Plan Review, general locations for landscaping and stormwater treatment, and the general approach to stormwater treatment, shall be indicated on the plan. Site Plan Review submittals shall include details of all proposed plant materials for stormwater treatment and landscaping areas. Sheets shall include a landscape plan with detail, a grading and drainage plan, and a combined plan showing the integration of these features.
D(2)(b)	Each application for development or redevelopment shall include a landscape plan showing compliance with the provisions of § 153.065(D).	
D(2)(e)	In all areas where landscaping is required, a minimum of 80% of the surface area of any landscape bed shall be covered within four years after installation by living materials, rather than bark, mulch, gravel or other non-living materials. Areas included in rain gardens or other vegetated site features to meet stormwater management requirements are excluded from this requirement with prior approval from the Director	Landscaping and surface area coverage shall be consistent with the standards for each stormwater control measure per Section 5 of this Chapter.

3) Perimeter Landscape Buffering

Perimeter Landscape Buffering areas represent a potential area of opportunity for the integration of recommended stormwater control measures. § 153.065(D)(4) states: "The buffering is intended to obscure the higher-intensity land use from view and block potential negative impacts related to noise, lighting levels, and activity through the use of denser landscape screening and/or a fence or wall visually softened by clustered plantings, creatively and architecturally designed, as appropriate to the character of the surrounding area." The integration of stormwater control measures specified for perimeter landscape buffering areas is encouraged, provided the primary visual and buffering functions of the Perimeter Landscape Buffer are achieved.

4) Street Trees and Tree Preservation

a) Purpose

The integration of trees as functional components of a site or area Stormwater Management Plan is strongly encouraged. Street trees are recognized in this Manual as an integral and essential feature of stormwater management, aesthetic enhancement and environmental protection in the City of Dublin and the Bridge Street District. The intent of this Section is to provide guidance for determining where deviation from the strict dimensional and numeric requirements for street trees, including but not limited to standards for tree protection, removal, replacement, spacing, and tree lawn planting areas, supports the integration of recommended stormwater treatment measures with high quality site design supporting the City's goals for the District.

b) Tree and Stormwater Standards

This section of the Manual is intended to provide guidance on specific technical issues related to the incorporation of trees into specific stormwater control measures, and overall Stormwater Management Plans. The standards in this Manual are intended to provide guidance for varying the calculation of street tree planter box requirements, spacing, removal and replacement, species and calipers in service of an integrated overall street tree and Stormwater Management Plan.

In the event an application is made to modify an approved stormwater system that affects any tree, shrub or tree radius for which approval is required pursuant to § 153.065(D)(3), verification to the City Engineer that the amended Stormwater Management Plan meets the standards and requirements of this Manual shall be provided in addition to the required City Forester approvals.

TABLE 6-9 TREE PRESERVATION AND STORMWATER STANDARDS

Code Sections (153.065)	**Code Provision**	**Stormwater Control Measure Objectives and Standards**
D(2)(b)	The siting of buildings shall avoid the removal of desirable trees in good or fair condition where alternatives consistent with the provisions of § 153.062 are available	In the event tree removal represents the only feasible option for siting a recommended stormwater treatment measure rather than a wet pond, consideration shall be given to options for replacement that accommodate the recommended method.
D(2)(c)	Protected trees, as defined in this Chapter, removed from any portion of a lot consistent with an approved Site Plan Review shall be replaced in accordance with § 153.146 except as provided by § 153.065(D)(9)	
D(2)(d)	Existing trees which are incorporated into the landscape plan shall be protected during construction as required by § 153.145	Standards for protecting trees and soils during construction shall be observed; areas of the site where soils are to be protected from compaction during construction shall be indicated on the tree preservation plan and grading plan or an equivalent per the provisions of Section § 153.140.

7. STORMWATER MANAGEMENT PLAN

The purpose of this Chapter is to provide guidelines, standards and requirements for the orderly development, approval, and implementation of Stormwater Management Plans, including provisions for shared systems and ongoing maintenance, that will enable development consistent with the vision for the City. This Chapter sets forth the requirements for preparation and submittal of Stormwater Management Plans, and provides a framework by which property owners and public agencies may propose collectively an overall plan for managing stormwater from multiple properties, where such a management plan will enable greater consistency with the City of Dublin's adopted plans and policies. It is a further purpose of this Chapter to provide sufficient standards and safeguards for associated plans, approvals and agreements to protect the public interest by ensuring long-term management and maintenance of stormwater management facilities.

A. General Requirements

1) A Stormwater Management Plan shall be prepared by the applicant for each proposed development activity and approved by the City Engineer in accordance with § 53.120 if the plan demonstrates that the proposed development activity has been planned and designed, and shall be implemented and maintained, to meet the performance criteria described herein.

2) For concept plans in stormwater management areas, possible methods of management and applicable Stream Corridor Protection Zones shall be included and represented.

3) Subdivision Development - Preliminary stormwater management plans (drawings and calculations) shall be submitted with preliminary development plans and preliminary plats for planning commission review. Stream corridor protection plans shall also be determined at this time. With submission of final development plan and plats, updated stormwater management plans shall be submitted. Stormwater Management shall be approved prior to approval of public improvement plans by the City Engineer.

4) Commercial sites – Preliminary stormwater management plans (drawings and calculations) shall be submitted with preliminary development plans and updated preliminary stormwater management plans with final development plans for planning commission or Administrative Review Team review. Stream corridor protection plans shall also be determined at this time. Stormwater Management plans shall be approved prior to approval of the private site improvements by the City Engineer and issuance of the building permit.

5) If applicable, the feasibility assessments shall be submitted with first submission of any documents to the City for review.

6) This Stormwater Management Plan shall be part of the overall submitted improvement plan and not a separate submittal. Supporting calculations for each design storm specified in § 53.090 hereof shall be submitted (hard copy and electronic copy) and will contain, at a minimum, a runoff hydrograph for the undeveloped and developed site, stage-storage calculations for the stormwater control measure, stage-discharge calculations for the outlet structure, and a runoff hydrograph after routing through the proposed stormwater control measure. All routing calculations shall account for tailwater conditions of the receiving facility, and shall be submitted to the City.

7) The stormwater management plan shall be a bound report containing all pertinent stormwater calculations for detention/retention basins, storm sewers, culverts, open channels, and other stormwater management system features, including stormwater control measures specified in this Manual. The report shall be signed and sealed by a Professional Engineer registered in the

state of Ohio. A stormwater management map shall be included in a sleeve page or pocket of the plan. The construction plans shall be submitted with the report, but not attached to it. The plan shall contain divider pages with labeled tabs that clearly identify the calculations contained in each section.

8) Stormwater Pollution Prevention Plans (SWP3) as required by OEPA shall be submitted to the City prior to the start of construction.

B. Map Content

The project engineer shall include in the construction plans a master stormwater management map showing all existing and proposed features, including trees and, where integrated with the stormwater management design, landscaping. The map is to be prepared on a 22-inch by 34-inch sheet on a scale not to exceed 1-inch equal's 400-feet (1"=400'). The map shall be based on state plane coordinate system. Listed below are the features that are to be included on the map.

1) Existing and proposed contours at one-foot intervals.

2) North arrow and scale.

3) Pre-development and post-development sub-basins overlaid on the same map including on and offsite contributory area. The acreages shall be shown.

4) Downstream receiving waterway of drainage system.

5) Pre-development and post-development overland flow paths to and from the management basins.

6) Soil type by sub-basin including hydrologic soil group designation of A, B, C or D.

7) Hydrologic boundaries, including all areas flowing to the proposed project.

8) Project boundaries and area.

9) Sufficient topographical information with elevations to verify the location of all ridges, streams, etc. (one-foot contour intervals within the project's boundaries and for proposed offsite improvements).

10) High water data or critical flood elevations on existing structures upstream of, within, and downstream of the project.

11) Notes indicating sources of high water data and critical flood elevations.

12) Notes pertaining to existing standing water, areas of heavy seepage, springs, wetlands, streams, and hydrologically sensitive areas.

13) Existing stormwater management features (ditches, pipes, roadways, ponds, and control measures). Existing stormwater management features are to be shown a minimum of 1,000

feet downstream of the proposed development unless the ultimate outfall system is a lesser distance.

14) Subdivision layouts with horizontal and vertical controls.

15) Proposed and existing stormwater management features, including locations of inlets, swales, pipes, detention/retention facilities, control measures, ponding areas, and all works.

16) Delineation and area of pre-development and post-development sub-basins.

17) Delineate retention/detention facilities and ingress/egress areas for facilities maintenance.

18) General type of soils by sub-basin and location of soil borings.

19) 10-, 25-, and 100-year flood elevations for any areas in or within 100 feet of the property. The source of these elevations shall also be shown on the plans.

20) Description of current ground cover, land use, and landscaping, and an estimate of the impervious area and percent imperviousness created by the construction activity by sub-basin.

21) Delineated stream corridor protection zone along any streams within or adjacent to the site.

C. Calculations

Stormwater calculations (hard copy and original copy) shall be signed and sealed by a professional engineer registered in the State of Ohio indicating that the plan has been prepared in accordance with the regulations of the Manual, and in accordance with good engineering practices and principles for all stormwater works, including design high water elevations for all applicable storm events. Software/models that utilize this methodology and technique and which are deemed acceptable to the City include but are not limited to SWMM, TR-55, PONDPAK, HEC-1, etc. The City will not accept methodologies that do not perform dynamic routing of hydrographs, which include but are not limited to the Bowstring Methodology, Mass Diagram Analysis, etc. The calculations shall include the following:

1) If quantity control is required;
   a) Pre- and post-development stormwater flows and stages for the stormwater control measures for all design storm frequencies pertinent to the project based upon the requirements of the stormwater regulations, including, but not limited to, the following:
   b) Critical Storm Calculation: Show the calculation of the total volume of runoff from a 1-year, 24-hour storm, before and after development for the entire site. Show the calculation of percent increase in runoff volume, and reference Table 2-5 to determine the critical storm.
   c) On-Site and Off-Site Area Allocation(s): Contact Engineering Development Group Civil Engineers for the applicable Stormwater Master Plan peak flow rates. Show the allocation of on-site and off-site area contributory to the facility for each Stormwater Master Plan sub-basin as shown in Table 7-1:

TABLE 7-1 EXAMPLE SUB-BASIN ON-SITE AND OFF-SITE AREA ALLOCATIONS

Sub-Basin Identifier #	On-Site Area (acre)	Off-Site Area (acre)	Total (acre)
2150	4.9	3.5	8.4
2030	0.2	0.0	0.2
2020	1.4	0.0	1.4
Total (acre)	6.5	3.5	10.0

d) Pre-development runoff hydrograph, post-development runoff hydrograph to each stormwater control measure, and the routed post-development hydrograph discharged from each stormwater control measure.

e) Pre-development and post-development runoff volumes.

f) Stage-area-storage calculations for each stormwater control measure.

g) Stage-discharge calculations for the outfall control structure, including tailwater assumptions.

h) *Release rate calculation*: Calculate the maximum release rate for each design storm using the critical storm criteria and referencing Appendix C of the Stormwater Master Plan and the Area Allocation table. Include a summary of the release rates as shown in Table 7-2:

TABLE 7-2 STORMWATER MANAGEMENT SUMMARY TABLE

	1-year	2 year	5 year	10 year	25 year	50 year	100 year
Predeveloped Q							
Postdeveloped Q							
Allowable Release							
Actual Release							
Control Measure Depth/Elev							

i) Show the calculation that is used to determine the maximum release rate for each storm.

j) Stormwater control measure volumes and recovery calculations. Show calculations or model output that demonstrates the storage and release of the water quality and quantity volumes over the time period specified in Chapter 5.

k) Show the calculation adding together the volume required for quantity control and quality control. Stormwater control measure shall be sized to contain both volumes.

l) Soil storage or curve number calculations per sub-basin, including impervious calculations.

m) Time of concentration calculations per sub-basin.

n) 100-year floodplain compensating calculations, if applicable.

o) Storm sewer, culvert, open channel and stormwater control measure tabulations, including, but not limited to, the following:

   i. Location and type of structures.

   ii. Length of facility and dimensions, including diameter, height, and/or width for pipes.

   iii. Cross-sections for-open channels.

   iv. Sub-basin areas tributary to each structure.

   v. Runoff coefficients or curve numbers per sub-basin for both the pre-construction and post-construction site conditions.

   vi. Time of concentration to the inlet of each structure.

   vii. Stormwater flow to and from the stormwater structure or junction point.

   viii. Hydraulic gradient for the applicable storm event, including losses through structures with friction and local loss coefficients.

   ix. Estimated receiving water elevation with sources of information, if available.

x. Velocities for all facilities and details for provisions to control erosion.

p) Construction plans including, but not limited to, the following:

i. Overall project plan of roads, lots, and stormwater control measures.

ii. Staging and sequencing of construction of stormwater control measures.

iii. Cross-section of stormwater control measures.

iv. Typical swale, ditch, or canal sections.

v. Drainage rights-of-way.

vi. Road plan and profile with groundwater elevation shown in profile.

vii. Overall project grading plan (at 1-foot contours) and individual lot grading plans.

viii. Density of the project.

2) If quantity control is not required:

Refer to Chapter 2 for an explanation of when quantity control is not required.

a) Stormwater control measure volumes and recovery calculations. Show calculations or model output that demonstrates the storage and release of the water quality volume over the time period specified in Chapter 5.

b) 100-year floodplain compensating calculations, if applicable.

c) Storm sewer, culvert, open channel and stormwater control measure tabulations, including, but not limited to, the following:

i. Location and type of structures.

ii. Length of stormwater control measure and dimensions, including diameter, height, and/or width for pipes.

iii. Cross-sections for-open channels.

iv. Sub-basin areas tributary to each structure.

v. Runoff coefficients per sub-basin for both the pre-construction and post-construction site conditions.

vi. Time of concentration to the inlet of each structure.

vii. Stormwater flow to and from the stormwater structure or junction point.

viii. Hydraulic gradient for the applicable storm event, including losses through structures with friction and local loss coefficients.

ix. Estimated receiving water elevation with sources of information, if available.

x. Velocities for all facilities and details for provisions to control erosion.

d) Construction plans including, but not limited to, the following:

i. Overall project plan of roads, lots, and stormwater control measures.

ii. Staging and sequencing of construction of stormwater control measures.

iii. Cross-section of stormwater control measures.

iv. Typical swale, ditch, or canal sections.

v. Drainage rights-of-way.

vi. Road plan and profile with groundwater elevation shown in profile.

vii. Overall project grading plan (at 1-foot contours) and individual lot grading plans.

viii. Density of the project.

D. Maintenance Plans

Maintenance Plans shall be submitted to the City prior to occupancy or acceptance of public improvements. The maintenance plan shall contain:

1) A designated entity for stormwater inspection and maintenance responsibilities;

2) The routine and non-routine maintenance tasks to be undertaken;

3) A schedule for inspection and maintenance;

4) Any necessary legally binding maintenance easements and agreements; and

5) A map showing all access and maintenance easements.

E. Shared Systems Allowed

The City of Dublin finds that enabling the coordination of shared stormwater treatment facilities between two or more properties may be desirable in cases where shared systems promote greater efficiency in land use, support the design goals of the Bridge Street District, reduce the total area of land consumed by stormwater treatment areas, or enable greater use of recommended treatment approaches, including vegetation-based control measures.

1) Design Standards Apply

All design standards and requirements in this Manual shall apply to the design, approval and construction of shared stormwater treatment facilities.

2) Consent of All Property Owners Required

Any group of two or more property owners may apply for approval of a shared system. The record owner of each property whose improvements would discharge into the proposed system, or whose land would be utilized for any component of the treatment system, including surface or underground conveyance or discharge, shall be required to sign the application for a Stormwater Management Plan that involves a shared system.

3) Use of the Public Right-of-Way Prohibited

Use of the public right-of-way to meet water quality and quantity requirements, as described in Chapter 2, in conjunction with a shared system solely serving privately-owned properties, is prohibited.

4) Allocation of Capacity in the Shared System.

The allocation of capacity in the shared stormwater system, described in terms of the amount of impervious area discharging to the system from each property and any rights-of-way, shall be stated in the Stormwater Management Plan application and incorporated into the written approval of the Stormwater Management Plan and associated development(s).

In the event of an application to amend any approval for a property or properties party to the shared stormwater system that would increase or decrease the system capacity used by one or more property owners, a revised Stormwater Management Plan application shall be submitted stating the proposed change in the allocation of capacity, and all property owners party to the Stormwater Management Plan shall sign the application indicating consent to the change.

At the time of application for a Stormwater Management Plan, a shared stormwater treatment system may be designed for a greater capacity than would be required to treat the existing and proposed development(s) utilizing the system. In the event such an application is made, the applicants shall state clearly the total design capacity required to manage runoff from existing and proposed development, and the capacity proposed to be constructed that would serve future development. At such time as additional development is proposed to utilize the system, amendment of the Stormwater Management Plan shall be required in conjunction with other development approvals.

5) Recording of Agreement and Required Terms and Conditions

A binding agreement in a form suitable to the City Attorney shall be recorded in the land records prior to issuance of any permit to construct the system and associated improvements. Such an agreement shall, at a minimum:

a) State that the property owners consent to the terms and conditions of the Stormwater Management Plan and conditions of development approval relevant to the shared system;

b) Bind the parties to make the land available for, and maintain the system as intended per its approved design, in perpetuity, unless the land development permits attached thereto are amended by the applicable City or State authorities upon the written consent of all property owners using the shared system;

c) Stipulate the terms and conditions under which the parties shall be responsible for maintenance of the system, and the penalties and remedies in the event one or more parties damages the system or otherwise violates the terms of the agreement; and

d) Authorize the City, upon written notice to the property owners, to enter, repair and maintain the system and recover all associated costs in the event the system deteriorates in the sole judgment of the City Engineer to the point of posing a threat to surface waters, public improvements, health, safety or property.

8. EROSION AND SEDIMENT CONTROL

A. Purpose

It is the purpose of this Section to provide standards and guidelines for the preparation of erosion and sediment control plans that protect public health, safety and welfare, and the quality of Dublin's waters from excessive erosion and sedimentation resulting from the construction and operation of development.

B. Applicability

When required by this regulation, a soil erosion and sediment control plan shall be prepared for the earth disturbance activities. Furthermore, in accordance with the appropriate requirements of § 53.310, the plan shall be prepared, submitted to the City, and approved by the City, prior to any earth- disturbance.

The plan shall serve as a basis for all subsequent grading and stabilization and be incorporated as part of the final construction drawings.

C. Plan Content

1) Any person seeking approval of an earth disturbance proposal shall, on a map rendered from a base derived from the site Stormwater Management Plan or site grading plan, at a scale not to exceed 1" – 100', provide the following information:
   a) A description of the nature and type of the construction activity (e.g., low density residential, shopping mall, highway, etc.)
   b) Total area of the site and the area of the site that is expected to be disturbed (i.e., grubbing, clearing, excavation, filling or grading, including off-site borrow areas).
   c) Existing data describing the soil and, if available, the quality of any discharge from the site.
   d) A description of prior land uses at the site.
   e) An implementation schedule which describes the sequence of major construction operations (i.e., grubbing, excavating, grading, utilities and infrastructure installation) and the implementation of erosion, sediment and storm water management practices or facilities to be employed during each operation of the sequence.
   f) The name and/or location of the immediate receiving stream or surface water(s) and the first subsequent named receiving water(s) and the aerial extent and description of wetlands or other special aquatic sites at or near the site which will be disturbed or which will receive discharges from disturbed areas of the project.

2) For subdivided developments where the Stormwater Management Plan does not call for a centralized sediment control capable of controlling multiple individual lots, a detail drawing of a typical individual lot showing standard individual lot erosion and sediment control practices. This does not remove the responsibility to designate specific erosion and sediment control practices in the Stormwater Management Plan for critical areas such as steep slopes, stream banks, drainage ways and stream corridor protection zones.

3) Location and description of any storm water discharges associated with dedicated, on-site asphalt and concrete plants covered by this permit and the best management practices to address pollutants in these storm water discharges.

4) A description of the intended maintenance plan with associated frequencies shall be required for the site.

5) Site map showing:
   a) Limits of earth-disturbing activity of the site including associated off-site borrow or spoil areas that are not addressed by a separate NOI and associated Stormwater Management Plan.
   b) Soils types for all areas of the site, including locations of unstable or highly erodible soils.
   c) Existing and proposed contours.
   d) A delineation of drainage watersheds expected during and after major grading activities as well as the size of each drainage watershed, in acres.
   e) Surface water locations including springs, wetlands, streams, lakes, water wells, etc., on or within 200 feet of the site, including the boundaries of wetlands or stream channels and first subsequent named receiving water(s) the permittee intends to fill or relocate for which the permittee is seeking approval from the Army Corps of Engineers and/or Ohio EPA.
   f) Existing and planned locations of buildings, roads, parking facilities and utilities.
   g) The location of all erosion and sediment control practices, including the location of areas likely to require temporary stabilization during the course of site development.
   h) Sediment and storm water management basins noting their sediment settling volume and contributing drainage area.
   i) Permanent storm water management practices to be used to control pollutants in storm water after construction operations have been completed.
   j) Areas designated for the storage or disposal of solid, sanitary and toxic wastes, including dumpster areas, areas designated for cement truck washout, vehicle fueling, and lay down areas.
   k) The location of designated construction entrances where the vehicles will access the construction site.
   l) The location of any in-stream activities including stream crossings.

6) Additionally, the plan, as part of the overall Stormwater Management Plan, shall provide space for signatures of City of Dublin officials. These signature blocks shall be placed on the Stormwater Management Plan drawings.

7) Statement identifying the name, address, and telephone number of the person(s) preparing the plan, the owner of the property where the grading is proposed and the developer and/or person responsible for the development area.

8) A statement indicating that the owner will notify the City forty-eight (48) hours before commencing any earth-disturbing activity. At the time this notice is given, the owner shall identify the site manager.

9) The City Engineer may waive specific requirements for plan detail or may require additional information to show that work will conform to basic requirements of this regulation.

D. Calculations

Any person seeking approval of an Erosion and Sediment Control Plan (ESCP) shall submit design computations and applicable assumptions for all structural measures for erosion and sediment control. Volume and velocity of flow shall be provided for all surface water conveyance. This information shall also be provided for surface water outlets. Specific guidance for Erosion and Sediment Control Plan calculations referenced in § 53.320.

E. Standards and Criteria

1) Non-Structural Preservation Methods

The ESCP must make use of practices that preserve the existing natural condition as much as feasible. No construction shall be allowed within the Stream Corridor Protection Zone defined by these regulations unless explicitly allowed under Section § 53.210. In addition, construction operations shall be phased in order to minimize the amount of disturbed land at any one time. Within zones designated for active construction, tree preservation areas under § 153.140 through § 153.148, soil preservation areas, or other protective clearing or grubbing practices shall be designated.

2) Timing of Sediment-Control Practices

Sediment control practices shall be functional throughout earth-disturbing activities. Sediment ponds (including sediment basins and traps) and perimeter controls intended to trap sediment shall be implemented as the first step of grading and within seven days from the start of grubbing. They shall continue to function until the upslope development area is re-stabilized.

3) Stabilization

Disturbed areas must be stabilized as specified in the sections that follow.

PERMANENT STABILIZATION	
Area requiring permanent stabilization	**When to implement controls**
Any areas that will lie dormant for one year or more	Within seven days of the most recent disturbance
Any areas within 50 feet of a stream and at final grade	Within two days of reaching final grade
Any other areas at final grade	Within seven days of reaching final grade within that area

TEMPORARY STABILIZATION	
Area requiring temporary stabilization	**When to implement controls**
Any disturbed areas within 50 feet of a stream and not at final grade	Within two days of the most recent disturbance if the area will remain idle for more than 14 days
For all construction activities, any disturbed areas that will be dormant for more than 14 days but less than one year, and not within 50 feet of a stream	Within seven days of the most recent disturbance within the area For residential subdivisions, disturbed areas must be stabilized at least seven days prior to transfer of permit coverage for the individual lot(s).
Disturbed areas that will be idle over winter	Prior to the onset of winter weather

Where vegetative stabilization techniques may cause structural instability or are otherwise unobtainable, alternative stabilization techniques must be employed.

4) Construction Access Routes

Measures shall be taken to prevent soil transport onto surfaces or onto public roads where runoff is not checked by sediment controls. Off-site tracking of sediments and dust generator shall be minimized, as required under the City's Ordinance, § 97.38.

5) Sloughing and Dumping

No soil, rock, debris, or any other material shall be dumped or placed into a stream or into such proximity that it may readily slough, slip, or erode into a stream, unless such dumping or placing is authorized by the City Engineer and when applicable, the U.S. Army Corps of Engineers, for such purposes as, but not limited to, construction of bridges, culverts, and erosion control structures.

Unstable soils that, in the opinion of the City Engineer, are prone to slipping or landsliding shall not be graded, excavated, filled or have loads imposed upon them unless the work is done in accordance with a qualified professional engineer's recommendations to correct, eliminate, or adequately address the problems.

6) Cut and Fill Slopes

Cut and fill slopes shall be designed and constructed in a manner that will minimize erosion. Consideration shall be given to the length and steepness of the slope, soil type, upslope drainage area, groundwater conditions, and slope stabilization.

7) Stabilization of Outfalls and Channels

Outfalls and constructed or modified channels shall be designed and constructed to withstand the expected velocity of flow from a post-development, five-year frequency storm without eroding.

8) Establishment of Permanent Vegetation

Permanent vegetation shall not be considered established until ground cover is achieved which, in the opinion of the City Engineer, provides adequate cover with a density of at least 70% and is mature enough to control soil erosion satisfactorily and to survive adverse weather.

9) Sediment Deposition

Sediment deposition caused by accelerated stormwater runoff over a development site or by accelerated erosion due to the sloughing or sliding of surface soil that has been exposed by grading, dumping, stockpiling or any other excavation-related earth disturbances shall be retarded and confined to within the boundaries of the development site, during site development.

10) Sediment Control Practices During Construction

The ESCP shall include a description of structural practices that shall store runoff during construction, allowing sediments to settle and/or diverting flows away from exposed soils or otherwise limiting runoff from exposed areas. Structural practices shall be used to control erosion and trap sediment from a site remaining disturbed for more than 14 days. Such practices may include, among others: sediment settling ponds, silt fences, earth diversion dikes or channels which direct runoff to a sediment settling pond and storm drain inlet protection. All sediment control practices must be capable of ponding runoff in order to be considered functional. Earth diversion dikes or channels alone are not considered a sediment control practice unless those are used in conjunction with a sediment settling pond. The ESCP must contain detailed drawings for all structural practices.

11) Timing

Sediment control structures shall be functional throughout the course of earth-disturbing activity. Sediment basins and perimeter sediment barriers shall be implemented prior to grading and within seven days from the start of grubbing. They shall continue to function until the up slope development area is restabilized according to requirements in Section § 53.320(C)(1) As construction progresses and the topography is altered, appropriate controls must be constructed or existing controls altered to address the changing drainage patterns.

12) Sediment Settling Ponds

Concentrated storm water runoff and runoff from drainage areas, which exceed the design capacity of silt fence or inlet protection, shall pass through a sediment settling pond. For common drainage locations that serve an area with 10 or more acres disturbed at one time, a temporary sediment settling pond must be provided until final stabilization of the site. The permittee may request approval from Ohio EPA to use alternative controls if it can demonstrate the alternative controls are equivalent in

effectiveness to a sediment settling pond. It is recommended that smaller sediment basins and/or sediment traps be used for drainage locations serving less than 10 acres.

The sediment settling pond shall be sized to provide at least 67 cubic yards of storage per acre of total contributing drainage area. When determining the total contributing drainage area, off-site areas and areas which remain undisturbed by construction activity must be included unless runoff from these areas is diverted away from the sediment settling pond and is not co-mingled with sediment-laden runoff. The depth of the sediment settling pond must be less than or equal to five feet. The configuration between inlets and the outlet of the basin must provide at least two units of length for each one unit of width (> 2:1 length:width ratio). Sediment must be removed from the sediment settling pond when the design capacity has been reduced by 40 percent (This is typically reached when sediment occupies one-half of the basin depth). When designing sediment settling ponds, the permittee must consider public safety, especially as it relates to children, as a design factor. Alternative sediment controls must be used where site limitations would preclude a safe design. The use of a combination of sediment and erosion control measures in order to achieve maximum pollutant removal is encouraged.

13) Silt Fence and Diversions

Sheet flow runoff from denuded areas shall be intercepted by silt fence or diversions to protect adjacent properties, streams, and stream corridor protective zones from sediment transported via sheet flow. Where intended to provide sediment control, silt fence shall be placed on a level contour. The use of other sediment barriers designed to control sheet flow runoff shall be at the discretion of the City Engineer. The relationship between the maximum drainage areas to silt fence for a particular slope range is shown in the following:

SILT FENCE CRITERIA	
Maximum drainage area (in acres) to 100 linear feet of silt fence	Range of slope for a particular drainage area (by percent)
0.5	< 2%
0.25	> 2% but < 20%
0.125	> 20% but < 50%

Stormwater diversion practices shall be used to keep runoff away from disturbed areas and steep slopes where practicable. Such devices, which include swales, dikes or berms, may receive storm water runoff from areas up to 10 acres.

14) Inlet Protection

Inlet protection control measures shall minimize sediment laden water entering active storm drain systems, unless the storm drain system drains to a sediment settling pond. Sediment shall be removed from the storm sewer, to the extent possible, prior to final approval.

15) Other Controls

Non-Sediment Pollutant Controls. No solid (other than sediment) or liquid waste, including building materials, shall be discharged in storm water runoff. The permittee must implement all necessary control measures to prevent the discharge of non-sediment pollutants to the stormwater management system of the site or surface waters of the state. Under no circumstance shall concrete trucks wash out directly into an open channel, storm sewer or surface waters of the state. No exposure of storm water to waste materials is recommended.

16) Compliance with Other Requirements

The Stormwater Management Plan shall be consistent with applicable State and/or local waste disposal, sanitary sewer or septic system regulations, including provisions prohibiting waste disposal by open burning and shall provide for the proper disposal of contaminated soils to the extent these are located within the permitted area.

17) Trench and Ground Water Control

There shall be no turbid discharges resulting from dewatering activities. If trench or ground water contains sediment, it must pass through a sediment settling pond or other equally effective sediment control device, prior to being discharged from the construction site. Alternatively, sediment may be removed by settling in place or by dewatering into a sump pit, filter bag or comparable practice. Ground water dewatering which does not contain sediment or other pollutants is not required to be treated prior to discharge. However, care must be taken when discharging ground water to ensure that it does not become pollutant-laden by traversing over disturbed soils or other pollutant sources.

18) Disposition of Temporary Practices

All temporary erosion and sediment control practices shall be disposed of within thirty days after final site stabilization is achieved or after the temporary practices are no longer needed, unless otherwise authorized by the City Engineer. Trapped sediment shall be removed or permanently stabilized to prevent further erosion.

19) Maintenance

All temporary and permanent erosion and sediment control practices shall be designed and constructed to minimize maintenance requirements. They shall be maintained and repaired as needed to assure continued performance of their intended function. The person or entity responsible for continued maintenance of permanent and temporary erosion controls shall be identified on the Stormwater Management Plan to the satisfaction of the City.

9. REFERENCES

A. Books, Manuals and Reports

Bonnin, Martin, Lin, Parzybok, Yekta, Riley. 2004. *NOAA Atlas 14, Volume 2, Version 3.0*

Chow, V. T., Maidment, D. R., Mays, L. W. 1988. *Applied Hydrology.*

England, G. and Stein, S. 2007. *Stormwater BMPs: Selection, Maintenance, and Monitoring*. Santa Barbara, CA: ForesterPress

Froehlich, D.C. (March/April 2009, Errata 2010). Mathematical Formulations of NRCS 24-Hour Design Storms. *Journal of Irrigation and Drainage Engineering.* ASCE. Vol. 135, No. 2, pp. 241-247

North Carolina Department of Environment and Natural Resources. March 2010. *Stormwater BMP Manual: Chapter 8 Level Spreader – Vegetative Filter Strip System.*

North Carolina Division of Water Quality. 2007. *Stormwater Best Management Practices Manual.*

Texas Water Development Board. 2005. *The Texas Manual on Rainwater Harvesting, Third Edition.*

B. Web Sites

NOAA Precipitation Frequency Data Server http://dipper.nws.noaa.gov/hdsc/pfds/ June 10, 2012

APPENDIX A
Section 53.070 EXEMPTIONS

§ 53.070 Exemptions

With the approval of the City Engineer, the following activities may be exempted from on-site stormwater runoff control. An exemption shall apply only to the requirement for on-site stormwater detention or retention facilities. All other design elements such as the storm sewer system, road culverts, erosion and sedimentation control, and runoff quality shall not be exempted.

(A) *Emergency exemption.* Emergency maintenance work performed for the protection of public health and welfare, however, if the earth-disturbing activity would have required an approved erosion and sediment control plan, if the activity were not an emergency, then the land area disturbed shall be shaped and stabilized in accordance with the requirements of the city.

(B) *Maintenance exemption.* Any maintenance to an existing system made in accordance with plans and specifications approved by the City Engineer.

(C) *Development-related exemptions.* The applicant shall provide to the City Engineer in writing a request for exemption which shall include a scaled site map, property tax number, and street address if applicable.

(1) Single-family or duplex exemption. Single-family or duplex residential construction on a single lot that is not part of a larger common plan of development.

(2) Any construction which adds less than 500 square feet through expansion of a building, structure or pavement which results in new impervious area on a project site.

(3) It is conceivable that development situations not automatically subject to exemption may exist such that development will have none of the harmful effects of sediment deposition. Such development situations, subject to city concurrence, are eligible for a waiver from this regulation. Waiver requests shall be made in writing to the City Engineer and shall include sufficient detail to support that granting a wavier will not be detrimental to abutting properties or to watercourses, public waters, or to the sewer system.

(D) *Scioto River Corridor Exemption.* Parcels that are located between State Route 745 (Dublin Road) and State Route 257 (Riverside Drive) which are directly tributary to the Scioto River.

(E) Regular farming activities on land intended for such use, except when these activities involve practices which increase storm water runoff and exacerbate erosion and sedimentation.

(F) Tilling, planting or harvesting of agricultural, horticultural, or forest crops that employ soil conservations related to agriculture as follows: construction of terraces, terrace outlets, check dams, desilting basins, dikes, ponds, ditches, strip cropping, lister furrowing, contour cultivating, contour furrowing, and land drainage and land irrigation which does not cause an increase in stormwater runoff and does not exacerbate erosion and sedimentation.

(G) Minor earth-disturbing activities such as home gardens and individual home landscaping, repairs, service connections and maintenance work.

(H) Installation, maintenance or repair of any underground public utility lines when such activity occurs on an existing hard surfaced road, street or sidewalk (provided the earth-disturbing activity is confined to the area of the road, street or sidewalk that is hard surfaced), and does not involve dewatering operations that produce sediment-laden effluent discharging to surface-lands and/or surface-waters.

(I) Septic tank lines or drainage fields unless included in an overall plan for earth-disturbing activity relating to the construction of the building to be served by the septic tank system.

(J) Repair or rebuilding of the tracks within the right-of-way of a railroad company.

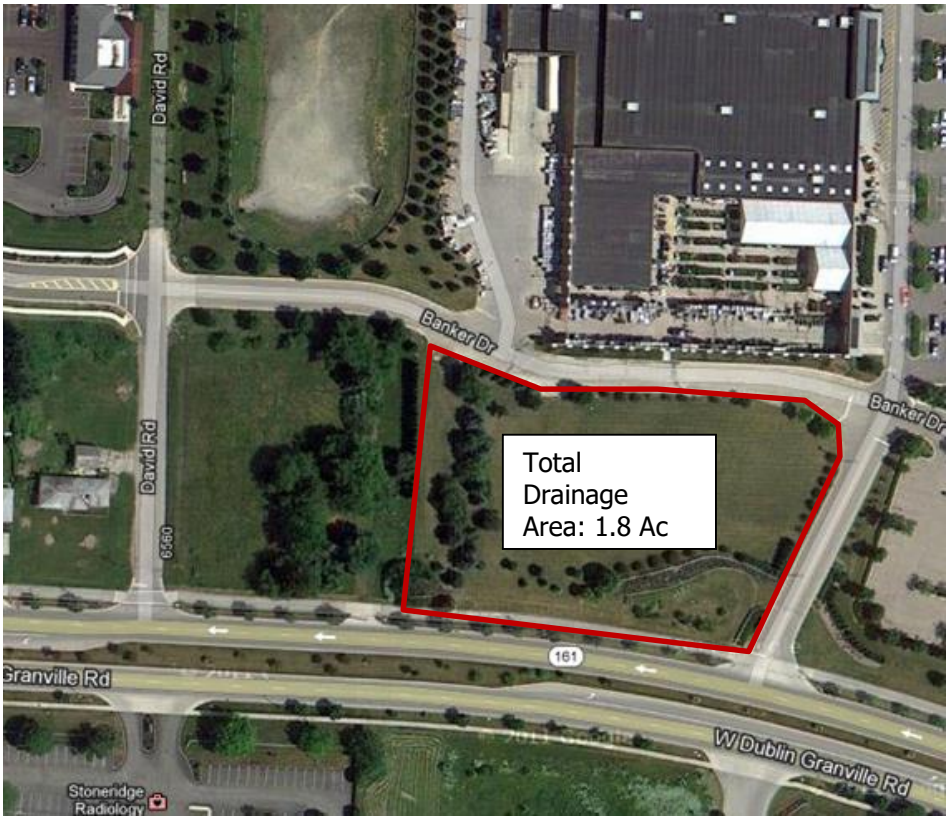
(K) *Stream Corridor Protection Zone.* Stream corridor protection zones are not required if a preliminary plan has already been approved for a site at the time this chapter is passed.

(L) *Historic Dublin.* Development within this area, as defined in the Zoning Code, shall be exempt from compliance with the city's stormwater quantity regulations but shall be held in compliance with the city's storm water quality regulations, described in § 53.090, if the construction activities disturb one or more acres of total land.

(Ord. 48-05, passed 9-6-05)

APPENDIX B
EXAMPLE STORMWATER APPROACH AND CALCULATIONS

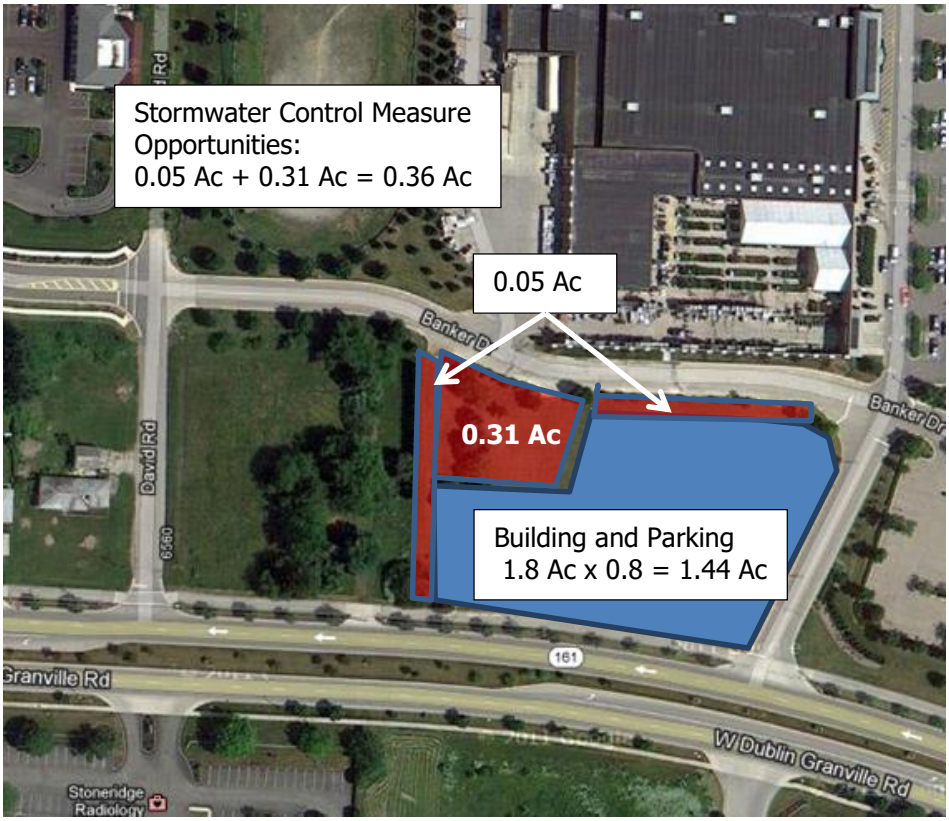
EXAMPLE 1: NEW DEVELOPMENT



<u>Pre-Development Data</u>
Site Area = Total Drainage Area (A) = 1.8 Ac
Impervious Area = 0%
Soils Type "D" http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm

Land Use = Urban | Open Space (lawns, parks, golf, cemeteries) | Good (grass cover >50%)
Curve Number = 80 (NEH Part 630, Chapter 9, Table 9-1 and Table 9-5)

Compute Time of Concentration: (NEH Part 630, Chapter 15, Velocity Method)
Sheet Flow: 300 feet at 0.019 ft/ft, Dense grasses
Shallow Concentrated Flow: 105 feet at 0.019 ft/ft, Grassed waterways
Tc = 0.66 hours



<u>Post-Development Data</u>
Site Area = Total Drainage Area (A) = 1.8 Ac
Building Type: Corridor Building
Impervious Area = 80% = 1.44 Ac (maximum for Corridor Building)
Pervious Area:
Assume 5-foot side yard and rear yard = 0.05 Ac
Assume "Green Space" = 0.31 Ac
Soils Type "D" http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm

Land Use = Urban | Commercial and Business (est. 85% imperv.)
Curve Number = 95 (NEH Part 630, Chapter 9, Table 9-1 and Table 9-5)

Compute Time of Concentration: (NEH Part 630, Chapter 15, Velocity Method)
Sheet Flow: 65 feet at 0.019 ft/ft dense grasses
Tc = 0.19 hours

Critical Storm Calculation

This example uses a unit hydrograph approach as described in the National Engineering Handbook (NEH) Part 630, Chapter 16, Hydrographs. Per City standards, a NRCS Type II 24-hour design storm is used. The curve number method is used to estimate runoff volume per NEH Part 630, Chapter 10, Estimation of Direct Runoff from Storm Rainfall.

Pre-development: 1-year, 24-hour storm runoff volume = 4,538 CF
Post-Development: 1 year, 24 hour storm runoff volume = 10,645 CF

(Post – Pre)/Pre x 100 = Percent of Increase in Runoff Volume = Critical Storm
(10,645 – 4,538)/4,538 x 100 = 135%
Critical Storm = 25-year storm

TABLE B-1 CRITICAL STORM DETERMINATION

If the Percent of Increase in Runoff Volume is		The Critical Storm Runoff Rate Will Be Limited to:
Equal to or Greater than	**And less than**	
--	10	1 year
10	20	2 year
20	50	5 year
50	100	10 year
100	250	25 year
250	500	50 year
500	--	100 year

On-Site and Off-Site Area Allocation

Supply project location information to Engineering Development Group Civil Engineers, and they will supply the sub-basin information.

Supplied Information:
Studied Area = East Unconsolidated Watersheds Sub-Basin 2600

TABLE B-2 EXCERPT FROM CITY OF DUBLIN STORMWATER MASTER PLAN

	Design Storm (CFS/Ac)						
Sub-basin	1	2	5	10	25	50	100
2600	0.1	0.2	0.3	0.4	0.6	0.8	1.1

Allowable release rate for the critical storm is 0.1 CFS x 1.8 Ac = 0.18 CFS

Show the allocation of on-site and off-site area contributory to the facility for each applicable Stormwater Master Plan sub-basin as follows:

TABLE B-3 ON-SITE AND OFF-SITE AREA ALLOCATION

Sub-Basin Identifier #	On-Site Area (acre)	Off-Site Area (acre)	Total (acre)
2600	1.8	0	1.8

Total (acre)	1.8	0	1.8

Stormwater Control Measure (SCM) Design

This section describes several stormwater management alternatives that could be used to meet the water quality and quantity requirements as described in Chapter 2. The three alternatives are provided explicitly for these example calculations and are not to imply a requirement for submittal of design alternatives.

Alternative 1: Traditional Bioretention

***Please note that the following example is utilizing the previous method of calculating water quality volume that would not be applicable today.**

Available construction area: 0.36 acres = 15,682 SF
Water Quality Volume (WQv): C*(P/12)*A = (1.6)*(0.75/12)*1.8 = 0.18 (ac-ft) = **7,841 CF**

C=runoff quality coefficient (Refer to OEPA Permit No.: OHC000003 for values) or use
$C=0.858i^3-0.78i^2+0.774i+0.04 = 1.6$
where i=fraction of post-const. impervious surface = 0.8
P=0.75 Precipitation depth, inches
A=area tributary to the basin, acres

In this example, storage volume is calculated assuming vertical movement of water within the bioretention facility is ignored. Hence the time required for the water to filter through a soil or aggregate layer is ignored. Infiltration rates are only used at the bottom of the bioretention facility to release the water back into the native soil. The facility is sized to control the allowable peak rate of runoff from the critical storm and the less frequent storm events. Allowable peak rates are included in Table B-4. Following the determination of the size of the bioretention facility to meet the peak rate of runoff requirements, a cross-check is performed to ensure that the facility volume is at least as great as the water quality volume.

Model Results Summary: (see results tables and graphs below)
Bioretention surface area required: 11,449 SF (98 ft x 98 ft)
Bioretention total water storage volume: 19,905 CF
Surface Storage: 10 inches (3H:1V side slope)
Growing Layer: 24 inches (1H:1V side slope)
Drainage Layer: 30 inches (Vertical side slope)
Orifice 1 Offset: 3 inches from bottom of storage layer
Orifice 1 Area: 0.015 SF (1.7-inch diameter)
Orifice 2 Offset: 63.5 inches from bottom of storage layer
Orifice 2 Area: 0.5 SF (9.6-inch diameter)
Evapotranspiration: 0.1 inches/day
Infiltration through bottom of SCM: 0.06 inches/hr

TABLE B-4 TRADITIONAL BIORETENTION STORMWATER DATA

	1-year	2 year	5 year	10 year	25 year	50 year	100 year
Predeveloped Q (cfs)	0.86	1.26	1.88	2.42	3.21	3.89	4.62
Postdeveloped Q (cfs)	3.74	4.64	5.88	6.92	8.35	9.54	10.8
Allowable Release (cfs)	0.18	0.18	0.18	0.18	0.18	1.44	1.98
Actual Release (cfs)	0.08	0.09	0.10	0.10	0.11	0.49	1.96
Surface Water Dewater Time (hr)	Before end of storm	Before end of storm	1.5	8.5	18	20.4	20.5
Total Dewater Time (hr)	25.1	31.2	39.4	46.3	56	58.3	58.4

EXAMPLE CALCULATIONS

Stormwater Control Measure 1

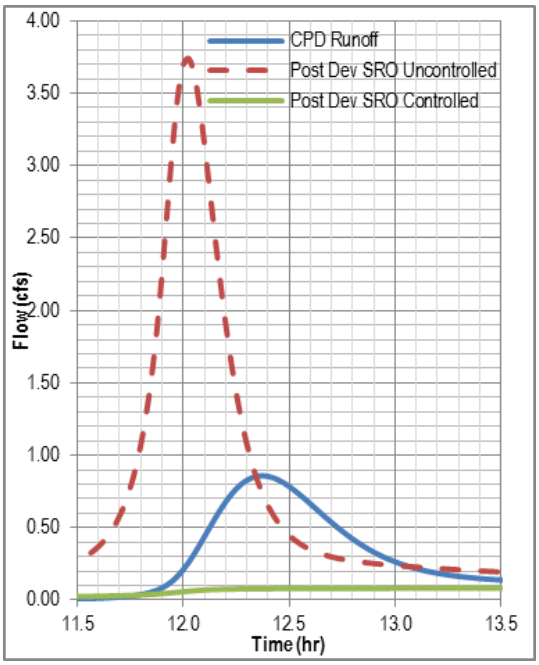
Practice Type	Bioretention
Drainage Area (ac)	1.8
Discharge To	Offsite
Len:Width (xL:1W)	1

	Allowed	Area (sf)
Evaporation	Yes	11449
Infiltration (through bottom)	Yes	9604

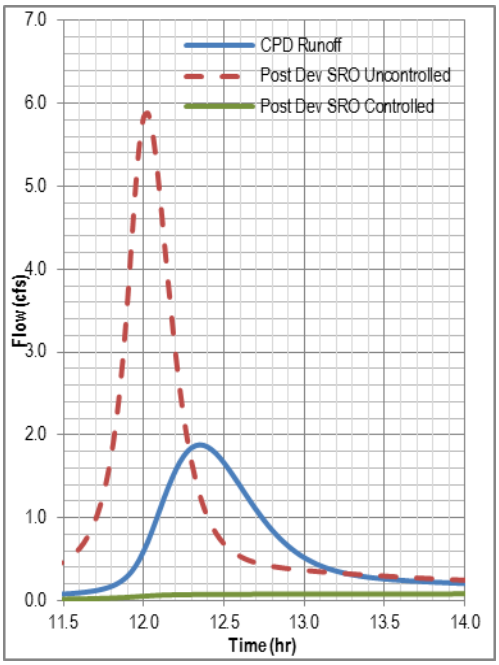
	Cross Section Media	Layer (in)	Side Slope xH:1V	Width (ft)	Len (ft)	Surface Area (sf)	Void Ratio	Total Vol (cf)	Water Storage Vol (cf)
Top				107.0	107.0	11,449			
	NA		0	107.0	107.0	11,449	100%	0	0
	NA		0	107.0	107.0	11,449	100%	0	0
	Surface Storage	10	3	102.0	102.0	10,404	100%	9,102	9,102
	Planting Soil Sandy Loam	24	1	98.0	98.0	9,604	30%	20,003	6,001
Bottom	Planting Soil Sandy Clay Loam	30	0	98.0	98.0	9,604	20%	24,010	4,802
	Total	**64**					**Total**	**53,115**	**19,905**

Outlet Type	Orifice	Orifice	None	None	None
Offset from bottom (in)	3	63.5			
coefficient c	0.6	3			
Area (sf) or Length (ft)	0.01	0.5			
Volume below the offset (cf)	480.2	19429	NA	NA	NA

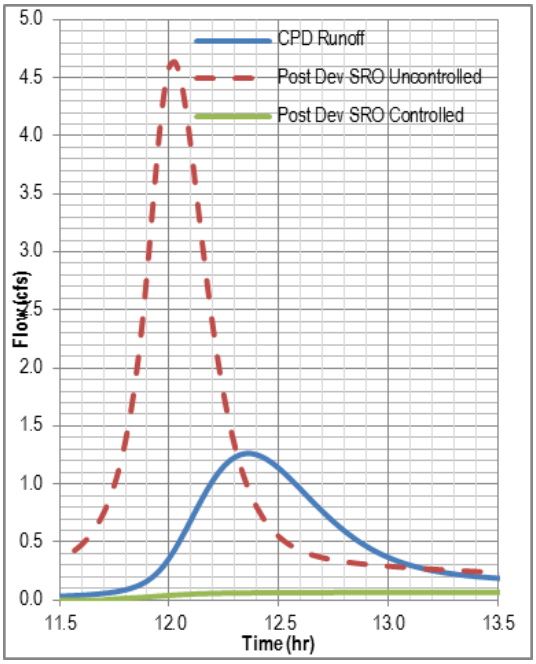
Surface Storage (in)	10



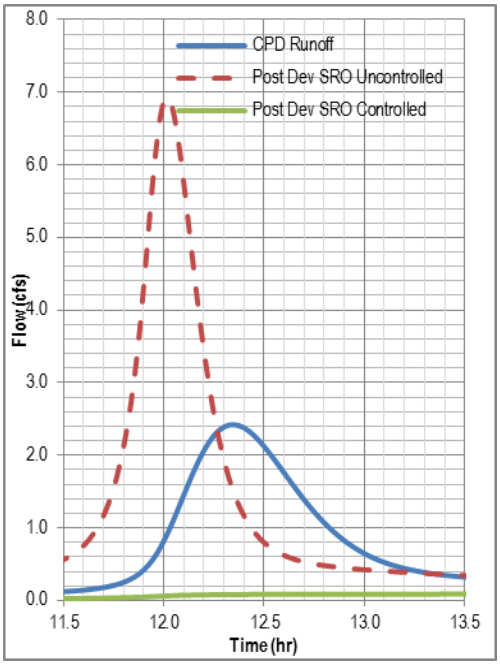
1-year 24-hour Runoff Hydrographs



5-year 24-hour Runoff Hydrographs



2-year 24-hour Runoff Hydrographs

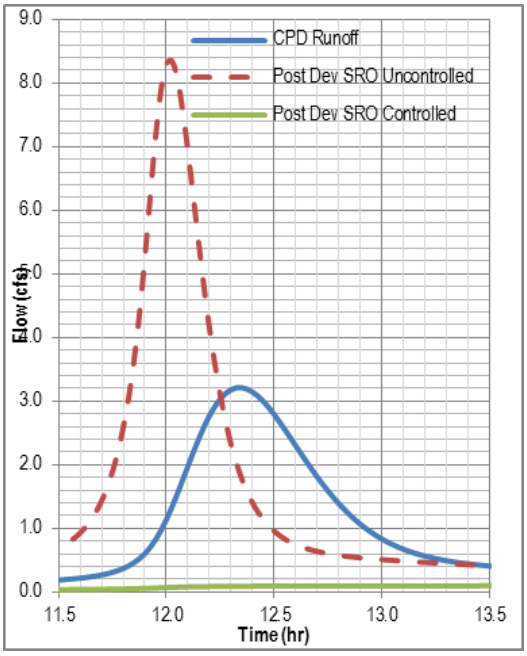


10-year 24-hour Runoff Hydrographs

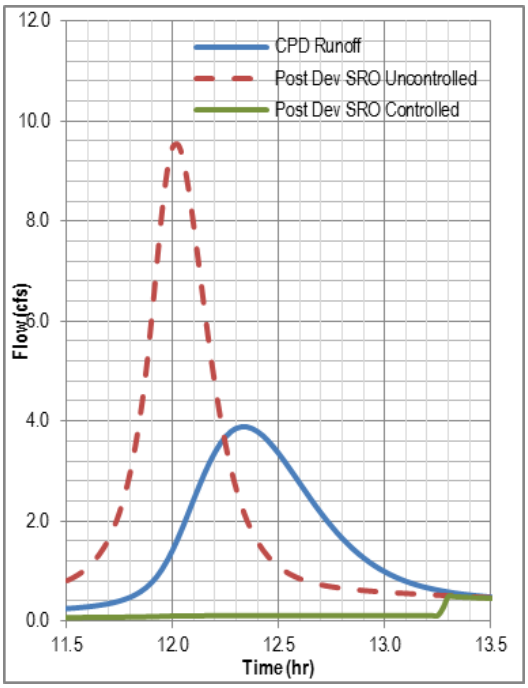
TOTAL SYSTEM RESULTS

	Recurrence Interval	1-year	2-year	5-year	10-year
PEAK FLOW	CPD Runoff (cfs)	0.86	1.26	1.88	2.42
	Post Dev SRO Uncontrolled (cfs)	3.74	4.64	5.88	6.92
	Post Dev SRO Controlled (cfs)	**0.08**	**0.09**	**0.10**	**0.10**
	Difference CPD - Post Dev (cfs)	0.8	1.2	1.8	2.3
	Criteria	Qpost<= 0.18 cfs	Qpost<= 0.18 cfs	Qpost<= 0.18 cfs	Qpost<= 0.18 cfs
	Criteria Met (Y/N)	**Yes**	**Yes**	**Yes**	**Yes**
VOLUME	CPD Runoff (cf)	4,538	6,449	9,362	11,950
	Post Dev Runoff (cf)	10,645	13,337	17,138	20,331
	ET (cf)	215	242	277	306
	Infiltration (cf)	2,541	2,877	3,312	3,673
	Outflow (cf)	7,889	10,218	13,548	16,352
	Remaining Storage (cf)	0	0	0	0
	Continuity	0.00%	0.00%	0.00%	0.00%
	Criteria	Okay	Okay	Okay	Okay
	Criteria Met (Y/N)	NA	NA	NA	NA
DEWATER TIME[1]	Surface Water Dewater Time (hr)	-24.0	-24.0	1.0	8.8
	Criteria	<= 24 hrs	<= 24 hrs	<= 24 hrs	<= 24 hrs
	Criteria Met (Y/N)	**Yes**	**Yes**	**Yes**	**Yes**
	Complete Drainage Dewater Time (hr)	32.7	40.8	51.0	58.9
	Criteria	<= 72 hrs	<= 72 hrs	<= 72 hrs	<= 72 hrs
	Criteria Met (Y/N)	**Yes**	**Yes**	**Yes**	**Yes**

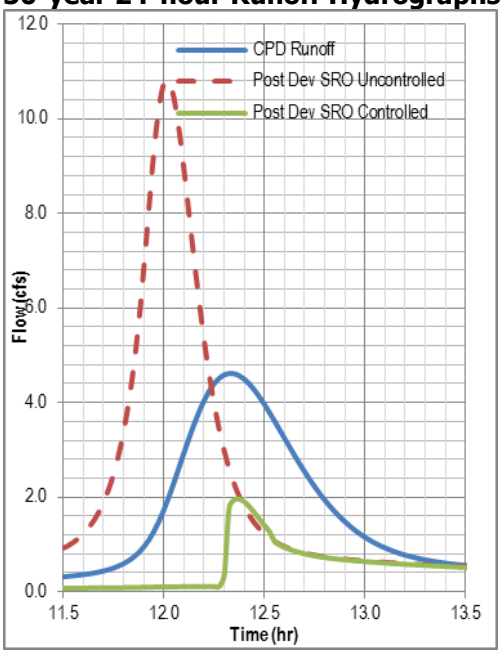
[1]Duration since the end of the rainfall event. Rainfall events are set at 24 hours. Negative values mean that the dewatering is completed before the rainfall ends.



25-year 24-hour Runoff Hydrographs



50-year 24-hour Runoff Hydrographs



100-year 24-hour Runoff Hydrographs

TOTAL SYSTEM RESULTS

	Recurrence Interval	25-year	50-year	100-year
PEAK FLOW	CPD Runoff (cfs)	3.21	3.89	4.62
	Post Dev SRO Uncontrolled (cfs)	8.35	9.54	10.80
	Post Dev SRO Controlled (cfs)	**0.11**	**0.49**	**1.96**
	Difference CPD - Post Dev (cfs)	3.1	3.4	2.7
	Criteria	Qpost<= 0.18 cfs	Qpost<= 1.44 cfs	Qpost<= 1.98 cfs
	Criteria Met (Y/N)	**Yes**	**Yes**	**Yes**
VOLUME	CPD Runoff (cf)	15,750	19,016	22,595
	Post Dev Runoff (cf)	24,828	28,568	32,577
	ET (cf)	346	356	357
	Infiltration (cf)	4,159	4,286	4,302
	Outflow (cf)	20,323	23,926	27,917
	Remaining Storage (cf)	0	0	0
	Continuity	0.00%	0.00%	0.00%
	Criteria	Okay	Okay	Okay
	Criteria Met (Y/N)	NA	NA	NA
DEWATER TIME[1]	Surface Water Dewater Time (hr)	19.0	21.8	21.9
	Criteria	<= 24 hrs	<= 24 hrs	<= 24 hrs
	Criteria Met (Y/N)	**Yes**	**Yes**	**Yes**
	Complete Drainage Dewater Time (hr)	69.1	71.9	72.0
	Criteria	<= 72 hrs	<= 72 hrs	<= 72 hrs
	Criteria Met (Y/N)	**Yes**	**Yes**	**Yes**

[1]Duration since the end of the rainfall event. Rainfall events are set at 24 hours. Negative values mean that the dewatering is completed before the rainfall ends.

Alternative 2: Permeable Pavement

Available construction area: (1.8 ac*0.9) – (1.8 ac*0.8) = 0.18 ac = 7,841 SF (This is the additional 10% of semi-pervious coverage allowed for a Corridor Building Type.)

***Please note that the following example is utilizing the previous method of calculating water quality volume that would not be applicable today.**

Water Quality Volume (WQv): C*(P/12)*A = (1.6)*(0.75/12)*1.8 = 0.18 (ac-ft) = **7,841 CF**

C=runoff quality coefficient (Refer to OEPA Permit No.: OHC000003 for values) or use

$C=0.858i^3-0.78i^2+0.774i+0.04 = 1.6$

where i=fraction of post-const. impervious surface = 0.8

P=0.75 Precipitation depth, inches

A=area tributary to the basin, acres

In this example, permeable pavement storage volume is calculated assuming vertical movement of water within the permeable pavement facility is ignored. Hence the time required for the water to filter through a soil or aggregate layer is ignored. Infiltration rates are only used at the bottom of the facility to release the water back into the native soil. The facility is sized to control the allowable peak rate of runoff from the critical storm and the less frequent storm events. Allowable peak rates are included in Table B-5. Following the determination of the size of the permeable pavement facility to meet the peak rate of runoff requirements, a cross-check is performed to ensure that the facility volume is at least as great as the water quality volume.

Initially, the available storage is calculated within the additional 10% of semi-pervious coverage, which is allowed per the Corridor Building within §153.062(O)(5).

In this case, the semi-pervious area is not large enough to meet the requirements, so it is assumed that semi-pervious coverage will extend into the area reserved for surface parking (assuming this development will have surface parking).

To meet the requirements, the permeable pavement storage must equal 18,818 SF. The design will require an extra 18,818 SF – 7,841 SF = 10,977 SF of permeable pavement beyond the additional 10% of semi-pervious space allowed. (~96 parking spaces)

Model Results Summary:

Permeable Pavement total water storage: 18,818 CF
Surface Storage: 0 inches
Growing Layer: 0 inches
Drainage Layer: 30 inches (vertical side slopes)
Orifice 1 Offset: 0 inches from bottom of storage layer
Orifice 1 Area: 0.025 SF (2.1-inch diameter)
Orifice 2 Offset: 28 inches from bottom of storage layer
Orifice 2 Area: 0.27 SF (7-inch diameter)
Infiltration through bottom of SCM: 0.06 inches/hr

TABLE B-5 PERMEABLE PAVEMENT STORMWATER DATA

	1-year	2 year	5 year	10 year	25 year	50 year	100 year
Predeveloped Q (cfs)	0.86	1.26	1.88	2.42	3.21	3.89	4.62
Postdeveloped Q (cfs)	3.74	4.64	5.88	6.92	8.35	9.54	10.8
Allowable Release (cfs)	0.18	0.18	0.18	0.18	0.18	1.44	1.98
Actual Release (cfs)	0.11	0.13	0.14	0.16	0.18	0.46	1.76
Surface Water Dewater Time (hr)	NA	NA	NA	NA	NA	NA	NA
Total Dewater Time (hr)	14.8	18.7	23.8	27.8	32.9	34.8	35.4

Stormwater calculations must be included per Chapter 7. See Alternative 1 for example calculations.

Alternative 3: Planter Box (attached to building)

Available construction area: Assume 4-foot width around 450 feet of building perimeter = 1,800 SF
***Please note that the following example is utilizing the previous method of calculating water quality volume that would not be applicable today.**

Water Quality Volume (WQv): C*(P/12)*A = (1.6)*(0.75/12)*1.8 = 0.18 (ac-ft) = **7,841 CF**
C=runoff quality coefficient (Refer to OEPA Permit No.: OHC000003 for values) or use
$C=0.858i^3-0.78i^2+0.774i+0.04 = 1.6$
where i=fraction of post-const. impervious surface = 0.8
P=0.75 Precipitation depth, inches
A=area tributary to the basin, acres

In this example, planter box storage volume is calculated assuming vertical movement of water within the planter box facility is ignored. Hence the time required for the water to filter through a soil or aggregate layer is ignored. With a planter box attached to a building, infiltration to the underlying soil is not allowed. The facility is sized to control the allowable peak rate of runoff from the critical storm and the less frequent storm events. Allowable peak rates are included in Table B-6. Following the determination of the size of the facility to meet the peak rate of runoff requirements, a cross-check is performed to ensure that the facility volume is at least as great as the water quality volume.

Initially, the available storage is calculated within the planter box.

In this case, the planter box alone is not enough to meet the requirements, so for this example, bioretention will be added to the site. It is assumed that runoff from the impervious area will first discharge to the planter box, which will overflow to a bioretention area.

Model Results Summary:
Planter Box surface area available: 1,800 SF
Planter Box total water storage: 4,410 CF
Drainage Area: 1.44 Ac
Surface Storage: 12 inches (vertical side slope)
Growing Layer: 18 inches (vertical side slope)
Drainage Layer: 30 inches (vertical side slope)
Orifice Offset: 0 inches from bottom of storage layer
Orifice Area: 0.09 SF (4-inch diameter)
Evapotranspiration: 0.1 inches/day
Infiltration through bottom of BMP: Not allowed

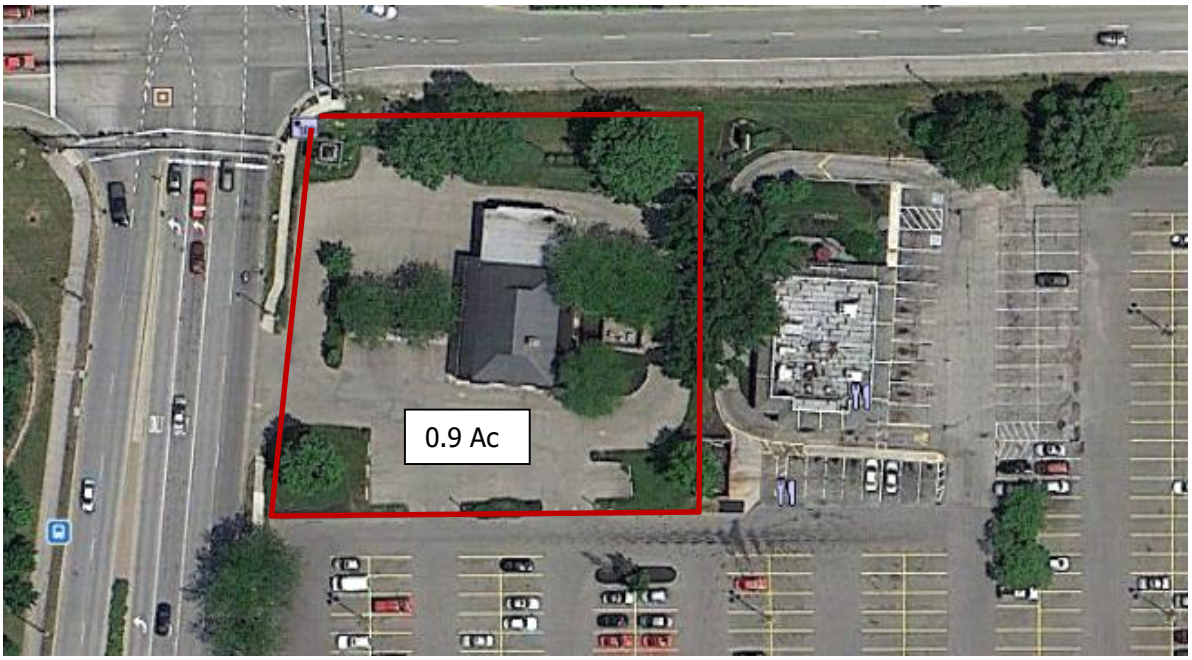
Bioretention surface area required: 9,604 SF
Bioretention total water storage: 20,492 CF
Drainage Area: 0.36 Ac
Surface Storage: 10 inches (3H:1V side slope)
Growing Layer: 24 inches (1H:1V side slope)
Drainage Layer: 30 inches (vertical side slope)
Orifice 1 Offset: 0 inches from bottom of storage layer
Orifice 1 Area: 0.016 SF (1.7-inch diameter)
Orifice 2 Offset: 60 inches from bottom of storage layer
Orifice 2 Area: 2 SF (1.6-foot diameter)
Evapotranspiration: 0.1 inches/day
Infiltration through bottom of SCM: 0.06 inches/hr

TABLE B-6 PLANTER BOX AND BIORETENTION STORMWATER DATA

	1-year	2 year	5 year	10 year	25 year	50 year	100 year
Predeveloped Q (cfs)	0.86	1.26	1.88	2.42	3.21	3.89	4.62
Postdeveloped Q (cfs)	3.74	4.64	5.88	6.92	8.35	9.54	10.8
Allowable Release (cfs)	0.18	0.18	0.18	0.18	0.18	1.44	1.98
Actual Release (cfs)	0.11	0.13	0.15	0.17	0.17	0.82	1.06
Surface Water Dewater Time (hr)	Before end of storm	Before end of storm	Before end of storm	Before end of storm	4.2	5.1	5.8
Total Dewater Time (hr)	20.8	25.3	30.6	34.6	40.7	41.6	42.2

Stormwater calculations must be included per Chapter 7. See Alternative 1 for example calculations.

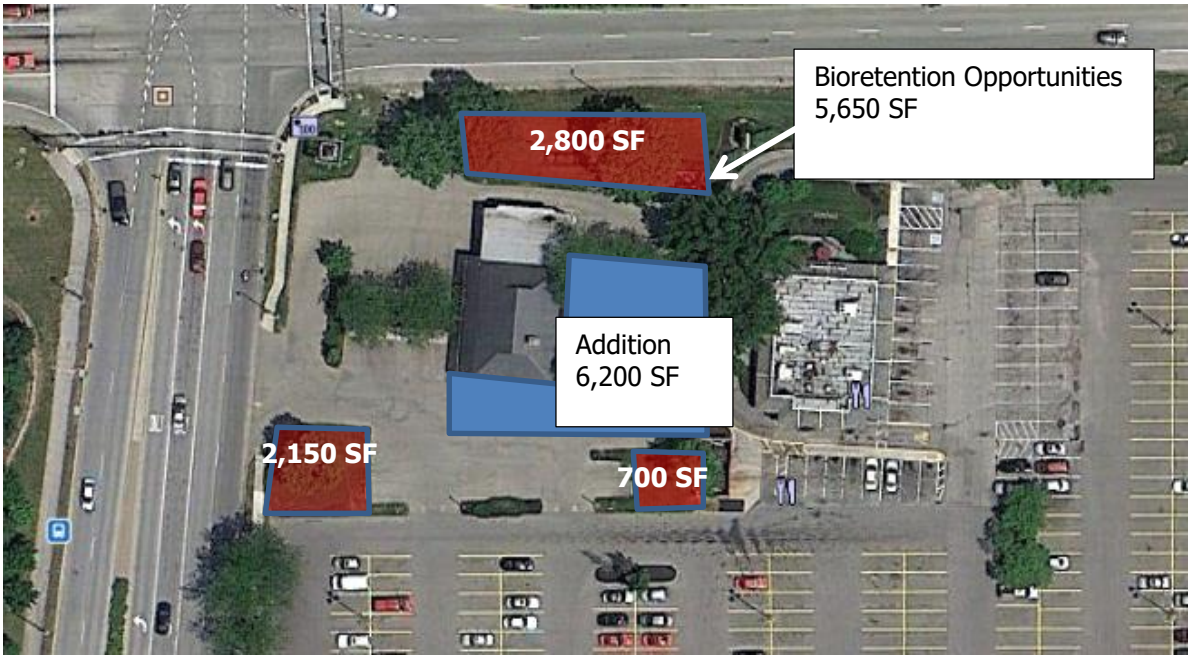
EXAMPLE 2: REDEVELOPMENT



<u>Pre-Development Data</u>
Site Area = Total Drainage Area (A) = 0.9 Ac
Impervious Area = 72% = 0.65 Ac
Soils Type "D" http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm

Urban | Paved Parking, Roofs, Driveways (excl. ROW) | 100% impervious = 0.65 Ac
Urban | Open Space (lawns, parks, golf, cemeteries) | Good (grass cover >50%) = 0.25 Ac
Curve Number = 93 (NEH Part 630, Chapter 9, Table 9-1 and Table 9-5)

Compute Time of Concentration: (example uses NEH Part 630, Chapter 15, Velocity Method)
Sheet Flow: 175 feet at 0.019 ft/ft smooth surface
Tc = 0.1 hours



The redevelopment on this site constitutes reconstruction of more than fifty percent of an existing building or structure. Therefore, all of the stormwater requirements, including quantity and quality control, must be met for the entire site.

Post-Development Data

Site Area = Total Drainage Area (A) = 0.9 Ac
Impervious Area = 74% = 0.67 Ac
Soils Type "D" http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm

Urban | Paved Parking, Roofs, Driveways (excl. ROW) | 100% impervious = 0.67 Ac
Urban | Open Space (lawns, parks, golf, cemeteries) | Good (grass cover >50%) = 0.23 Ac
Curve Number = 93.4 (NEH Part 630, Chapter 9, Table 9-1 and Table 9-5)

Compute Time of Concentration: (example uses NEH Part 630, Chapter 15, Velocity Method)
Sheet Flow: 175 feet at 0.019 ft/ft smooth surface
Tc = 0.1 hours

Critical Storm Calculation

This example uses a unit hydrograph approach as described in the National Engineering Handbook (NEH) Part 630, Chapter 16, Hydrographs. Per City standards, a NRCS Type II 24-hour design storm is used. The curve number method is used to estimate runoff volume per NEH Part 630, Chapter 10, Estimation of Direct Runoff from Storm Rainfall.

Pre-development: 1-year, 24-hour storm runoff volume = 4,927 CF
Post-development: 1-year, 24-hour storm runoff volume = 5,038 CF

(Post – Pre)/Pre x 100 = Percent of Increase in Runoff Volume = Critical Storm
(5,038 – 4,927)/ 4,927 x 100 = 2.2%
Critical Storm = 1-year storm

TABLE B-7 CRITICAL STORM DETERMINATION

CRITICAL STORM DETERMINATION		
If the Percent of Increase in Runoff Volume is		**The Critical Storm Runoff Rate Will Be Limited to:**
Equal to or Greater than	**And less than**	
--	10	1 year
10	20	2 year
20	50	5 year
50	100	10 year
100	250	25 year
250	500	50 year
500	--	100 year

<u>On-Site and Off-Site Area Allocation</u>

Supply project location information to Engineering Development Group Civil Engineers, and they will supply the sub-basin information.

Supplied Information:

TABLE B-8 EXCERPT FROM CITY OF DUBLIN STORMWATER MASTER PLAN

	Design Storm (CFS/Ac)						
Sub-basin	1	2	5	10	25	50	100
80	1.8	2.4	3.1	3.7	4.6	5.5	6.4

Allowable release rate for the critical storm is 1.8 CFS x 0.9 Ac = 1.62 CFS

Show the allocation of on-site and off-site area contributory to the facility for each applicable Stormwater Master Plan sub-basin as follows:

TABLE B-9 ON-SITE AND OFF-SITE AREA ALLOCATION

Sub-Basin Identifier #	On-Site Area (acre)	Off-Site Area (acre)	Total (acre)
80	0.9	0	0.9
Total (acre)	0.9	0	0.9

<u>Maximize Treatment Opportunities</u>

Convert turf areas to bioretention.

Available construction area: 0.13 acres = 5,650 SF

***Please note that the following example is utilizing the previous method of calculating water quality volume that would not be applicable today.**

Water Quality Volume (WQv): C*(P/12)*A = (1.4)*(0.75/12)*0.9 = 0.079 (ac-ft) = **3,441 CF**

C=runoff quality coefficient (Refer to OEPA Permit No.: OHC000003 for values) or use

$C=0.858i^3-0.78i^2+0.774i+0.04 = 1.4$

where i=fraction of post-const. impervious surface = 0.74

P=0.75 Precipitation depth, inches

A=area tributary to the basin, acres

In this example, bioretention storage volume is calculated assuming vertical movement of water within the bioretention facility is ignored. Hence the time required for the water to filter through a soil or aggregate layer is ignored. Infiltration rates are only used at the bottom of the facility to release the water back into the native soil. The facility is sized to control the allowable peak rate of runoff from the critical storm and the less frequent storm events. Allowable peak rates are included in Table B-10. Following the determination of the size of the bioretention facility to meet the peak rate of runoff requirements, a cross-check is performed to ensure that the facility volume is at least as great as the water quality volume.

Note that the bioretention total water storage required to control the allowable peak rate of runoff from the critical storm and the less frequent storm events is less than the water quality volume. Therefore, the bioretention facilities will need to be designed with an additional 3,441 CF – 1,903 CF = 1,538 CF of added storage to meet the water quality requirement.

Model Results Summary:

Bioretention surface area required: 1,225 SF
Bioretention total water storage: 1,903 CF
Surface Storage: 8 inches (3H:1V side slope)
Growing Layer: 18 inches (1H:1V side slope)
Drainage Layer: 30 inches (vertical side slopes)
Orifice 1 Offset: 0 inches from bottom of storage layer
Orifice 1 Area: 0.2 SF (6-inch diameter)
Orifice 2 Offset: 55 inches from bottom of storage layer
Orifice 2 Area: 1.6 SF (1.4-foot diameter)
Evapotranspiration: 0.1 inches/day
Infiltration through bottom of SCM: 0.06 inches/hr

TABLE B-10 TRADITIONAL BIORETENTION STORMWATER DATA

	1-year	2 year	5 year	10 year	25 year	50 year	100 year
Predeveloped Q (cfs)	2.05	2.58	3.31	3.92	4.77	5.47	6.21
Postdeveloped Q (cfs)	2.09	2.62	3.35	3.96	4.8	5.5	6.24
Allowable Release (cfs)	1.62	2.16	2.79	3.33	4.14	4.95	5.76
Actual Release (cfs)	1.38	1.65	1.95	2.03	3.84	4.88	5.67
Surface Water Dewater Time (hr)	Before end of storm	Before end of storm	Before end of storm	Before end of storm	Before end of storm	Before end of storm	Before end of storm
Total Dewater Time (hr)	0.2	0.2	0.2	0.2	.02	.02	.02

Stormwater calculations must be included per Chapter 7. See Example 1: New Development, Alternative 1 for example calculations.

APPENDIX C
SUPPLEMENTAL RAINFALL INFORMATION

TABLE C-1 RAINFALL INTENSITIES (39.972 N, 83.01 W)

Duration		Intensity, inches/hour						
		1-yr	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
Minutes	5	4.25	5.06	6.06	6.84	7.85	8.62	9.37
	10	3.30	3.95	4.71	5.28	6.00	6.53	7.06
	15	2.70	3.22	3.86	4.33	4.94	5.39	5.84
	30	1.78	2.16	2.64	3.01	3.49	3.85	4.22
Hours	1	1.09	1.32	1.66	1.91	2.26	2.54	2.82
	2	0.636	0.771	0.966	1.12	1.34	1.51	1.70
	3	0.450	0.542	0.678	0.789	0.943	1.07	1.20
	6	0.269	0.322	0.401	0.467	0.560	0.638	0.722
	12	0.156	0.187	0.232	0.270	0.323	0.368	0.416
	24	0.092	0.110	0.135	0.156	0.185	0.209	0.235

Source: Bonnin, Martin, Lin, Parzybok, Yekta, Riley, *NOAA Atlas 14, Volume 2, Version 3.0*, 2004. and NOAA Precipitation Frequency Data Server http://dipper.nws.noaa.gov/hdsc/pfds/ June 10, 2012

OPTIMAL RAINFALL INTENSITY EQUATION COEFFICIENTS AND TIME-TO-PEAK INTENSITY RATIOS

Source: Froehlich, D.C. (March/April 2009, Errata 2010). Mathematical Formulations of NRCS 24-Hour Design Storms. *Journal of Irrigation and Drainage Engineering.* ASCE. Vol. 135, No. 2, pp. 241-247

$i_{p*} = 39.261$	$rainfall\ intensity\ equation\ coefficient\ (dimensionless)$
$i_{o*} = 0.311$	$rainfall\ intensity\ equation\ coefficient\ (dimensionless)$
$\eta = 0.0522$	$rainfall\ intensity\ equation\ coefficient\ (dimensionless)$
$\eta' = 1 - \eta$	$rainfall\ intensity\ equation\ coefficient\ (dimensionless)$
$m_1 = 0.264$	$rainfall\ intensity\ equation\ coefficient\ (rainfall\ depth\ units/hr)$
$m_2 = 4.098$	$rainfall\ intensity\ equation\ coefficient\ (rainfall\ depth\ units/hr)$
$r = 0.493$	$time - to - peak\ rainfall\ intensity\ ratio\ (dimensionless)$
t	$time\ (hours)$
t_d	$design\ storm\ duration\ (hours)$
$\hat{P}_*$	$cumulative\ design\ storm\ precipitation\ depth$

$$\hat{P}_*(t) = \begin{cases} r\left(i_{p*} - i_{o*}\right)\left[\eta \dfrac{e^{\frac{(-m_1)(rt_d - t)}{r}} - e^{-m_1 t_d}}{m_1 t_d} + \eta' \dfrac{e^{\frac{(-m_2)(rt_d - t)}{r}} - e^{-m_2 t_d}}{m_2 t_d}\right] + i_{o*}\left(\dfrac{t}{t_d}\right) & for\ 0 \le t \le rt_d \\ (1-r)\left(i_{p*} - i_{o*}\right)\left[\eta \dfrac{1 - e^{\frac{(-m_1)(t - rt_d)}{1-r}}}{m_1 t_d} + \eta' \dfrac{1 - e^{\frac{(-m_2)(t - rt_d)}{1-r}}}{m_2 t_d}\right] + i_{o*}\left(\dfrac{t}{t_d} - r\right) + r & for\ rt_d < t \le t_d \end{cases}$$

TABULAR DISTRIBUTION

Distribution Source: Chow, V. T., Maidment, D. R., Mays, L. W. (1988). Applied Hydrology.

Rainfall Depth Source: Bonnin, Martin, Lin, Parzybok, Yekta, Riley, *NOAA Atlas 14, Volume 2, Version 3.0*, 2004. and NOAA Precipitation Frequency Data Server http://dipper.nws.noaa.gov/hdsc/pfds/ June 10, 2012

TABLE C-2 NRCS TYPE II DESIGN STORM HYETOGRAPH

Hour	Type II Mass Curve	Delta Rain	Type II 24-Hour Distribution Rainfall (inches)						
			Frequency (Depth in inches)						
			100yr (5.63)	50yr (5.02)	25yr (4.44)	10yr (3.74)	5yr (3.24)	2yr (2.63)	1yr (2.20)
0:00	0		0.000	0.000	0.000	0.000	0.000	0.000	0.000
0:15	0.002	0.002	0.011	0.010	0.009	0.007	0.006	0.005	0.004
0:30	0.005	0.003	0.017	0.015	0.013	0.011	0.010	0.008	0.007
0:45	0.008	0.003	0.017	0.015	0.013	0.011	0.010	0.008	0.007
1:00	0.0108	0.0028	0.016	0.014	0.012	0.010	0.009	0.007	0.006
1:15	0.014	0.0032	0.018	0.016	0.014	0.012	0.010	0.008	0.007
1:30	0.017	0.003	0.017	0.015	0.013	0.011	0.010	0.008	0.007
1:45	0.02	0.003	0.017	0.015	0.013	0.011	0.010	0.008	0.007
2:00	0.023	0.003	0.017	0.015	0.013	0.011	0.010	0.008	0.007
2:15	0.026	0.003	0.017	0.015	0.013	0.011	0.010	0.008	0.007
2:30	0.029	0.003	0.017	0.015	0.013	0.011	0.010	0.008	0.007
2:45	0.032	0.003	0.017	0.015	0.013	0.011	0.010	0.008	0.007
3:00	0.0347	0.0027	0.015	0.014	0.012	0.010	0.009	0.007	0.006
3:15	0.038	0.0033	0.019	0.017	0.015	0.012	0.011	0.009	0.007
3:30	0.041	0.003	0.017	0.015	0.013	0.011	0.010	0.008	0.007
3:45	0.044	0.003	0.017	0.015	0.013	0.011	0.010	0.008	0.007
4:00	0.0483	0.0043	0.024	0.022	0.019	0.016	0.014	0.011	0.009
4:15	0.052	0.0037	0.021	0.019	0.016	0.014	0.012	0.010	0.008
4:30	0.056	0.004	0.023	0.020	0.018	0.015	0.013	0.011	0.009
4:45	0.06	0.004	0.023	0.020	0.018	0.015	0.013	0.011	0.009
5:00	0.064	0.004	0.023	0.020	0.018	0.015	0.013	0.011	0.009
5:15	0.068	0.004	0.023	0.020	0.018	0.015	0.013	0.011	0.009
5:30	0.072	0.004	0.023	0.020	0.018	0.015	0.013	0.011	0.009
5:45	0.076	0.004	0.023	0.020	0.018	0.015	0.013	0.011	0.009
6:00	0.0797	0.0037	0.021	0.019	0.016	0.014	0.012	0.010	0.008
6:15	0.085	0.0053	0.030	0.027	0.024	0.020	0.017	0.014	0.012
6:30	0.09	0.005	0.028	0.025	0.022	0.019	0.016	0.013	0.011
6:45	0.095	0.005	0.028	0.025	0.022	0.019	0.016	0.013	0.011
7:00	0.1	0.005	0.028	0.025	0.022	0.019	0.016	0.013	0.011
7:15	0.105	0.005	0.028	0.025	0.022	0.019	0.016	0.013	0.011
7:30	0.11	0.005	0.028	0.025	0.022	0.019	0.016	0.013	0.011
7:45	0.115	0.005	0.028	0.025	0.022	0.019	0.016	0.013	0.011

Hour	Type II Mass Curve	Delta Rain	Type II 24-Hour Distribution Rainfall (inches)						
			Frequency (Depth in inches)						
			100yr (5.63)	50yr (5.02)	25yr (4.44)	10yr (3.74)	5yr (3.24)	2yr (2.63)	1yr (2.20)
8:00	0.1203	0.0053	0.030	0.027	0.024	0.020	0.017	0.014	0.012
8:15	0.126	0.0057	0.032	0.029	0.025	0.021	0.018	0.015	0.013
8:30	0.133	0.007	0.039	0.035	0.031	0.026	0.023	0.018	0.015
8:45	0.14	0.007	0.039	0.035	0.031	0.026	0.023	0.018	0.015
9:00	0.1467	0.0067	0.038	0.034	0.030	0.025	0.022	0.018	0.015
9:15	0.155	0.0083	0.047	0.042	0.037	0.031	0.027	0.022	0.018
9:30	0.163	0.008	0.045	0.040	0.036	0.030	0.026	0.021	0.018
9:45	0.172	0.009	0.051	0.045	0.040	0.034	0.029	0.024	0.020
10:00	0.1808	0.0088	0.050	0.044	0.039	0.033	0.029	0.023	0.019
10:15	0.191	0.0102	0.057	0.051	0.045	0.038	0.033	0.027	0.022
10:30	0.203	0.012	0.068	0.060	0.053	0.045	0.039	0.032	0.026
10:45	0.218	0.015	0.084	0.075	0.067	0.056	0.049	0.039	0.033
11:00	0.236	0.018	0.101	0.090	0.080	0.067	0.058	0.047	0.040
11:15	0.257	0.021	0.118	0.105	0.093	0.079	0.068	0.055	0.046
11:30	0.283	0.026	0.146	0.131	0.115	0.097	0.084	0.068	0.057
11:45	0.387	0.104	0.586	0.522	0.462	0.389	0.337	0.274	0.229
12:00	0.6632	0.2762	1.555	1.387	1.226	1.033	0.895	0.726	0.608
12:15	0.707	0.0438	0.247	0.220	0.194	0.164	0.142	0.115	0.096
12:30	0.735	0.028	0.158	0.141	0.124	0.105	0.091	0.074	0.062
12:45	0.758	0.023	0.129	0.115	0.102	0.086	0.075	0.060	0.051
13:00	0.776	0.018	0.101	0.090	0.080	0.067	0.058	0.047	0.040
13:15	0.791	0.015	0.084	0.075	0.067	0.056	0.049	0.039	0.033
13:30	0.804	0.013	0.073	0.065	0.058	0.049	0.042	0.034	0.029
13:45	0.815	0.011	0.062	0.055	0.049	0.041	0.036	0.029	0.024
14:00	0.825	0.01	0.056	0.050	0.044	0.037	0.032	0.026	0.022
14:15	0.834	0.009	0.051	0.045	0.040	0.034	0.029	0.024	0.020
14:30	0.842	0.008	0.045	0.040	0.036	0.030	0.026	0.021	0.018
14:45	0.849	0.007	0.039	0.035	0.031	0.026	0.023	0.018	0.015
15:00	0.856	0.007	0.039	0.035	0.031	0.026	0.023	0.018	0.015
15:15	0.863	0.007	0.039	0.035	0.031	0.026	0.023	0.018	0.015
15:30	0.869	0.006	0.034	0.030	0.027	0.022	0.019	0.016	0.013
15:45	0.875	0.006	0.034	0.030	0.027	0.022	0.019	0.016	0.013
16:00	0.881	0.006	0.034	0.030	0.027	0.022	0.019	0.016	0.013
16:15	0.887	0.006	0.034	0.030	0.027	0.022	0.019	0.016	0.013
16:30	0.893	0.006	0.034	0.030	0.027	0.022	0.019	0.016	0.013
16:45	0.898	0.005	0.028	0.025	0.022	0.019	0.016	0.013	0.011
17:00	0.903	0.005	0.028	0.025	0.022	0.019	0.016	0.013	0.011
17:15	0.908	0.005	0.028	0.025	0.022	0.019	0.016	0.013	0.011
17:30	0.913	0.005	0.028	0.025	0.022	0.019	0.016	0.013	0.011
17:45	0.918	0.005	0.028	0.025	0.022	0.019	0.016	0.013	0.011

Hour	Type II Mass Curve	Delta Rain	Type II 24-Hour Distribution Rainfall (inches)						
			Frequency (Depth in inches)						
			100yr (5.63)	50yr (5.02)	25yr (4.44)	10yr (3.74)	5yr (3.24)	2yr (2.63)	1yr (2.20)
18:00	0.922	0.004	0.023	0.020	0.018	0.015	0.013	0.011	0.009
18:15	0.926	0.004	0.023	0.020	0.018	0.015	0.013	0.011	0.009
18:30	0.93	0.004	0.023	0.020	0.018	0.015	0.013	0.011	0.009
18:45	0.934	0.004	0.023	0.020	0.018	0.015	0.013	0.011	0.009
19:00	0.938	0.004	0.023	0.020	0.018	0.015	0.013	0.011	0.009
19:15	0.942	0.004	0.023	0.020	0.018	0.015	0.013	0.011	0.009
19:30	0.946	0.004	0.023	0.020	0.018	0.015	0.013	0.011	0.009
19:45	0.95	0.004	0.023	0.020	0.018	0.015	0.013	0.011	0.009
20:00	0.953	0.003	0.017	0.015	0.013	0.011	0.010	0.008	0.007
20:15	0.956	0.003	0.017	0.015	0.013	0.011	0.010	0.008	0.007
20:30	0.959	0.003	0.017	0.015	0.013	0.011	0.010	0.008	0.007
20:45	0.962	0.003	0.017	0.015	0.013	0.011	0.010	0.008	0.007
21:00	0.9653	0.0033	0.019	0.017	0.015	0.012	0.011	0.009	0.007
21:15	0.968	0.0027	0.015	0.014	0.012	0.010	0.009	0.007	0.006
21:30	0.971	0.003	0.017	0.015	0.013	0.011	0.010	0.008	0.007
21:45	0.974	0.003	0.017	0.015	0.013	0.011	0.010	0.008	0.007
22:00	0.977	0.003	0.017	0.015	0.013	0.011	0.010	0.008	0.007
22:15	0.98	0.003	0.017	0.015	0.013	0.011	0.010	0.008	0.007
22:30	0.983	0.003	0.017	0.015	0.013	0.011	0.010	0.008	0.007
22:45	0.986	0.003	0.017	0.015	0.013	0.011	0.010	0.008	0.007
23:00	0.9892	0.0032	0.018	0.016	0.014	0.012	0.010	0.008	0.007
23:15	0.992	0.0028	0.016	0.014	0.012	0.010	0.009	0.007	0.006
23:30	0.995	0.003	0.017	0.015	0.013	0.011	0.010	0.008	0.007
23:45	0.998	0.003	0.017	0.015	0.013	0.011	0.010	0.008	0.007
0:00	1	0.002	0.011	0.010	0.009	0.007	0.006	0.005	0.004

APPENDIX D

STORMWATER TREATMENT AND CONTROL FEASIBILITY ASSESSMENT FOR REDEVELOPMENT

The objective of the feasibility assessment is to achieve the maximum practicable degree of treatment and control for Water Quality Volume and Peak Rate of Runoff, while accommodating the space, development, and natural resource constraints on previously-developed sites, and supporting the City of Dublin's community development objectives.

In preparing a Stormwater Management Plan, applicants for redevelopment will evaluate the degree to which stormwater treatment and control can be incorporated to treat runoff from existing and proposed impervious surfaces using the stormwater control measures outlined in this Manual. The final feasibility assessment shall reflect the assessment of the degree to which the treatment and control goals in Table D-1 (as further defined in Chapter 2) can be achieved using the design approaches in Table D-2. In no case shall any applicant be required to undertake any of the measures listed in Table D-3 in developing a Stormwater Management Plan.

TABLE D-1 TREATMENT AND CONTROL OBJECTIVES

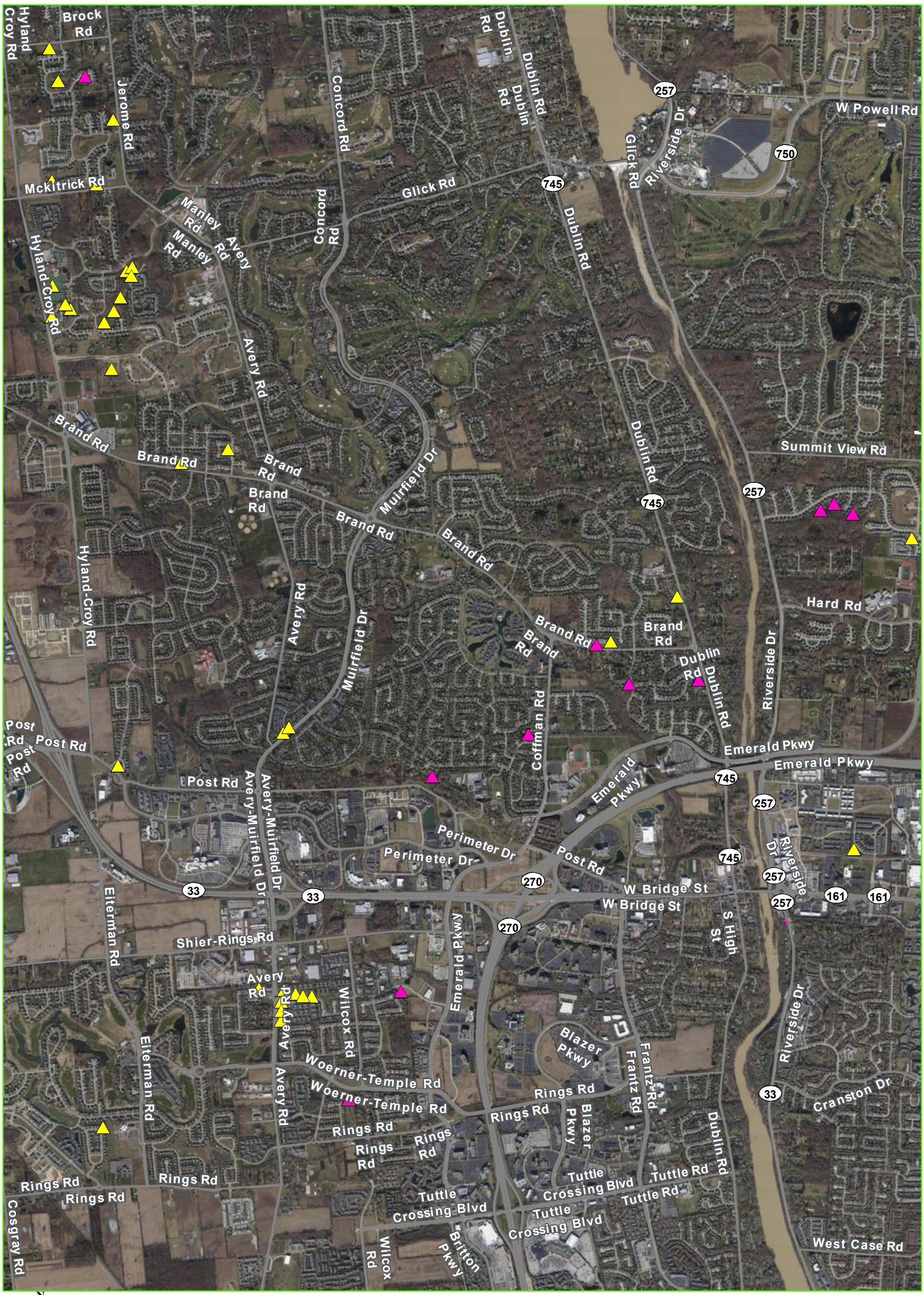
Water Quality Volume (WQv)	Provide treatment of the water quality volume.
Peak Rate of Runoff Control	Provide peak rate of runoff control of the critical storm and the less frequent storms.

TABLE D-2 ANALYSIS REQUIREMENTS

The objective of the analysis is to identify opportunities to treat and control impervious surface runoff through the use of stormwater control measures, including consideration of the following design techniques: Refer to Example 2: Redevelopment in Appendix B.	
1.	Disconnection or redirection of rooftop drainage or gutters into infiltration areas or vegetated stormwater control measures.
2.	Substitution of vegetated stormwater control measures for curb-and-drain systems, or installation of vegetated stormwater control measures where runoff currently drains overland into surface waters, particularly at edges of impervious surfaces such as parking lots, sidewalks, patios, or buildings.
3.	Substitution of permeable surfacing for impervious surfacing for parking areas, patios, driveways, or public safety access areas.
4.	Substitution of engineered and designed vegetated stormwater control measures for existing turfgrass or other landscaped areas that do not function as stormwater treatment areas.
5.	Maximize treatment by routing flows through bioretention swales whenever possible.
6.	Maximize control of runoff from the critical storm and the less frequent storms through the above techniques and through re-design, retrofit and/or expansion of existing detention structures. If there are no existing detention structures or modification is infeasible, this standard is met.

TABLE D-3 DESIGN, TREATMENT AND CONTROL MEASURES NOT REQUIRED

	The following measures are NOT required to be utilized for redevelopment sites:
1.	Installation of sub-surface storage or treatment structures.
2.	Purchase or acquisition of additional land.
3.	Demolition of buildings or removal/substitution of existing impervious surfaces to point of interference with either the existing land use or material conditions of any existing land use permits.
4.	Substitution of existing impervious surfaces that are not otherwise planned to be renovated or replaced as part of the redevelopment plan.
5.	Off-site treatment of stormwater.
6.	Site re-grading or site re-contouring to the point of permanent interference with either the existing use of the site or the material conditions of any existing land use permits.
7.	Pumping or otherwise mechanical re-routing of stormwater runoff.
8.	Mechanical or chemical treatment of stormwater.
9.	Infiltration where basement flooding or subsurface pollutant plume transport will occur.
10.	Construction of any infrastructure within the Fluvial Erosion Hazard area of any receiving water or within any wetland or its 50-foot buffer zone.
11.	Removal of mature trees.



City of Dublin Owned Residential Basins
Private Stormwater Basin Maintenance (46)
Detention (11) - Retention (34) - Bio-Detention (1)

N
W E
S

1 inch = 2,500 feet

Legend

Ownership, Business Name

Dublin-Detention-Private

Ownership, Business Name

Dublin-Retention-Private

Virgin Hyperloop One XP-1 pod
Tuesday, August 6, 2019
7:30am-9:00am
Attended by Ann Bohman and Steve Dritz, Community Service Advisory Commission members

Columbus to Chicago in 41 minutes!!
(Welcome to the Jetsons!)

*Connecting Columbus to Pittsburgh and Chicago.

*A pod designed to travel through metal tubes at speeds in excess of 600 mph.

*The goal is to be one of the first tracks to be built in the United States by the late 2020s.

*The first Hyperloop project in the world was approved by the Indian government, connecting Pune to Mumbai, reducing the commute from 3.5 hours by road to 35 minutes.

*Pressurize pods would be smooth for passengers.

*Hyperloop would be safer than flying.

*It's clean, uses magnets and electricity and no fossil fuels-Not destroying the environment.

*Pods travel in groups, they are not connected, allowing for direct travel to a destination without the need for each pod to drop off and pick up passengers at each station.

Sources:
The Columbus Dispatch, Wednesday, August 7, 2019, p.B4
MORPC: Rapid Speed Transportation Initiative (RSTI) Contact: Dina Lopez 614-233-4149
City of Dublin website Search: Hyperloop
ArchDaily Website, August 16, 2019 posting

Community Services Advisory Commission (CSAC)
September 17, 2019 meeting
Other Items of Interest
(Participation in CSAC invitations & related events by Ann Bohman)

Tuesday, June 25, 2019, 6-7pm:
Attended Barbara Ray's tour of the Ancient Earthworks of Dublin in the new Ferris-Wright Park site of the Adena-Hopewell ceremonial mounds, including the first timber frame home in Dublin. Volunteer opportunities forthcoming!

Tuesday, August 6, 2019 7:30-9:30am:
Attended with Steve Dritz the Hyperloop Program (See separate report)

Thursday, August 15, 2019 4-7:00pm:
Attended the Angel Mumma, Dublin City Finance Director's Farewell Ceremony. Angel will now be COTA's finance director. I served as the Dublin COTA representative for three years and I had the opportunity share with her my experiences.

Saturday, August 17, 2019 4pm: AGING IN PLACE
Met with Stephanie Jursek to learn more about the Forever Dublin Hub and to help with the distribution of the Hub flyers in the community.

Stephanie Jursek
Dublin Older Adult Program Specialist
and Forever Dublin Hub Coordinator
Syntero
sjursek@syntero.org

Dublin Office
299 Cramer Creek Court
Dublin, OH 43017
(614) 301-5645 (Mobile)
(614) 889-9335 (Fax)
www.syntero.org

Wednesday, August 28, 2019 1-2pm: THE BIG TABLE
Hosted the event at our Dublin Library. Items shared were ones CSAC has been working on, for example:Forever Dublin Hub, transportation, and recycling.

RECYCLERIGHT.org/scroll down to the orange box entitled "Recycle and Reuse Search Tool"
(This Week Dublin Villager newspaper, July 25, 2019, Page A8)

Tuesday, September 3, 2019 6:30-8pm: Renovations of the North Pool
A refined design concept based on public input and approved funding was shared.

Stormwater Basin Maintenance for Residential Development

CSAC PRESENTATION

Paul A. Hammersmith, P.E. – Director of Engineering/ City Engineer
Todd Garwick, P.E. – Engineering - Utilities
Michael Hendershot, P.E.– Engineering/Review Services

NOVEMBER 12, 2019

AGENDA

I. Introduction

II. Option 4 – Planning Level Maintenance Cost Estimates

III. Basin Examples – Dublin and Privately Maintained

IV. Stormwater Utility Fee Benchmarking

V. City of Delaware Stormwater Utility Overview

VI. Previous City of Dublin Stormwater Utility Fee Discussion

VII. Funding Options

VIII. Discussion and Questions

RESIDENTIAL STORMWATER BASIN INVENTORY

Residential Stormwater Basins serve the following:

- Single Family Subdivisions
- Single Family Detached Homes
- Condominiums
- Apartment Complexes

RESIDENTIAL STORMWATER BASIN INVENTORY – *Ownership*

Residential Stormwater Basins
305* total

City of Dublin Owned
Residential Stormwater Basins
154

Focus

Private Owned
Residential Stormwater Basins
151

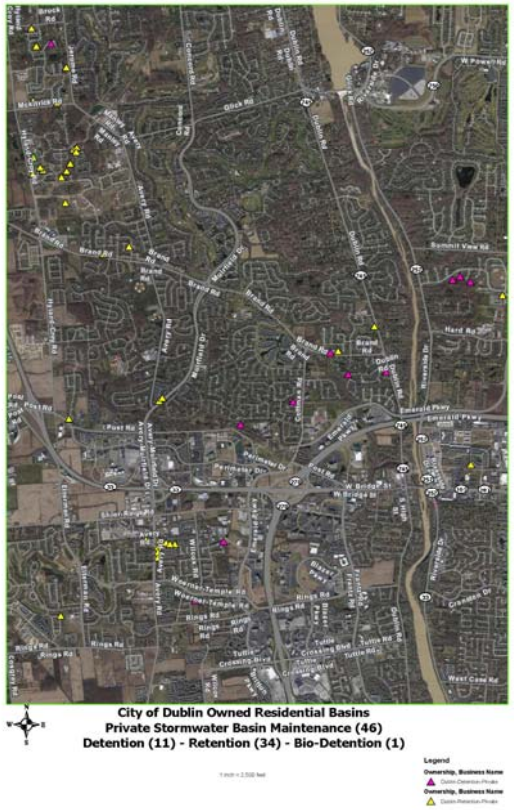
**excludes Commercial*

OPTIONS – *RESIDENTIAL STORMWATER BASINS*

Option #4:

- Dublin maintains existing 108 residential stormwater basins
- Dublin assume maintenance of existing 46 residential stormwater basins that are currently maintained by HOAs
- Dublin maintain new residential stormwater basins moving forward

RESIDENTIAL STORMWATER BASIN INVENTORY –
Locations of 46 Privately Maintained Basins



STORMWATER BASIN INVENTORY –
City of Dublin Owned/Maintained Detention (Dry) Basin

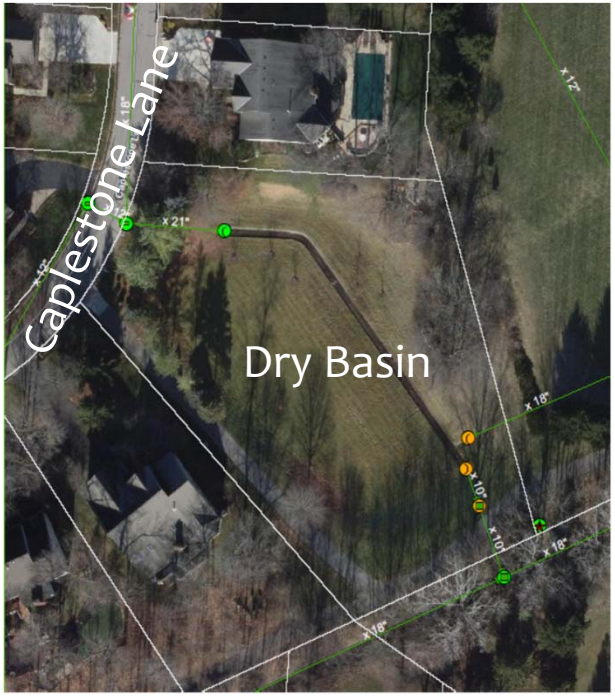
Maintenance Components

- Trash Removal
  - Monthly
- Vegetation Removal
  - Typical 5-year cycle
- Outlet Structures
  - 10-year cycle
- 4" Underdrains – Repair/Replace
  - 10-year cycle
- Channel Cleaning
  - 10-year cycle
- Bank Erosion Repair
  - 10-year cycle
- Excavation
  - Sediment Removal – 30-year cycle

STORMWATER BASIN INVENTORY -
Privately Owned/Maintained Detention (Dry) Basin

Maintenance Components

- Trash Removal
  - Monthly
- Vegetation Removal
  - Typical 5-year cycle
- Outlet Structures
  - 10-year cycle
- Channel Cleaning
  - 10-year cycle
- Underdrains
  - 10-year cycle
- Bank Erosion Repair
  - 10-year cycle
- Excavation
  - Sediment Removal – 30-year cycle



STORMWATER BASIN INVENTORY –
City of Dublin Owned/Maintained Retention (Wet) Basin

Maintenance Components

- Trash Removal
  - Monthly cycle
- Water Quality (Copper Sulfate)
  - Yearly cycle
- Vegetation Removal
  - Typical 5-year cycle per basin
- Submerged Inlets/Outlets
  - 10-year cycle
- Aeration (Fountain)
  - 8-year cycle
- Bank Erosion Repair
  - 10-year cycle
- Outlet Control (Orifice Plate)
  - Orifice Plate
- Dredging
  - 30-year cycle

STORMWATER BASIN INVENTORY -
Privately Owned/Maintained Retention (Wet) Basin

Maintenance Components

- Trash Removal
  - Monthly cycle
- Water Quality (Copper Sulfate)
  - Yearly cycle
- Vegetation Removal
  - Typical 5-year cycle per basin
- Aeration (Fountain)
  - 8-year cycle
- Submerged Inlets/Outlets
  - 10-year cycle
- Bank Erosion Repair
  - 10-year cycle
- Dredging
  - 30-year cycle
- Outlet Control (Orifice Plate)
  - 30-year cycle

MAINTENANCE COST – *Detention (Dry) Basin*

Detention (Dry) Basin Maintenance Components w/ Cycles

- Trash removal (monthly)
- Vegetation removal (5-year)
- Storm sewer pipe and structures (10-year)
- Channels cleaning (10-year)
- Underdrains (10-year)
- Bank Erosion (10-year)
- Excavation (30-year)

Annualized Cost per Detention (Dry) Basin = **$3,760**

MAINTENANCE COST – *Retention (Wet) Basin*

Retention (Wet) Basin Maintenance Components w/ Cycles

- Trash removal (monthly)
- Chemical control – Algae (yearly)
- Vegetation removal (5-years)
- Basin Aerators (8-years)
- Storm sewer pipes and structures (10-years)
- Pond Dredging (30-years)
- Outlet Control (30-years)
- Nuisance animal (as needed)

Annualized Cost Per Retention (Wet) Basin = **$5,370**

MAINTENANCE COSTS – *108 Dublin Maintained Basins*

Detention (Dry) Basins

- 37 Basins
- Annualized Cost per Basin = **$3,760**
- Planning level cost = **$139,120/year**

Retention (Wet) Basin & Aesthetic Basin

- 71 Basins
- Annualized Cost per Basin = **$5,370**
- Planning level cost = **$381,270/year**

Total Yearly Estimated Basin Cost = **$520,390 (108 Basins)**

MAINTENANCE COSTS – *46 Privately Maintenance Basins*

Detention (Dry) Basins

- 12 Basins
- Annualized Cost per Basin = **$3,760**
- Planning level cost = **$45,120/year**

Retention (Wet) Basin & Aesthetic Basin

- 34 Basins
- Annualized Cost per Basin = **$5,370**
- Planning level cost = **$182,580/year**

Total Yearly Estimated Basin Cost = **$227,700 (46 Basins)**

MAINTENANCE COSTS – *Long Term City Cost Impacts*

Dublin Maintains all **154 Basins**

- 1 year cost = **$748,090**
- 5 year cost = **$3,740,450**
- 10 year cost = **$7,480,900**
- 15 year cost =$**11,221,350**

Maintenance Costs - *Capital Improvement Program (2020-2024 CIP)*

CITY OF DUBLIN | 2020-2024 | FIVE-YEAR CAPITAL IMPROVEMENTS PROGRAM 11-1

UTILITIES - STORMWATER MANAGEMENT

(MUNIS) PROJECT NO.	DESCRIPTION	2019	2020	2021	2022	2023	2024	TOTAL 2020-2024 ($000)	BEYOND 2024 ($000)	TOTAL BUDGETED
CAPITAL MAINTENANCE										
AF201	Annual Stormwater Maintenance	575	575	575	575	575	575	2,875	575	3,450
AF202	Ditch Maintenance	0	0	100	0	100	0	200	100	300
	TOTAL	**575**	**575**	**675**	**575**	**675**	**575**	**3,075**	**675**	**3,750**
CAPITAL ENHANCEMENTS / NEW CAPITAL INFRASTRUCTURE										
EF181	Rings Farm Stream Relocation	150	1,240	0	0	0	0	1,240	0	1,240
EF200	Allocation for Various Stormwater Improvements	250	250	250	250	250	250	1,250	250	1,500
	TOTAL	**400**	**1,490**	**250**	**250**	**250**	**250**	**2,490**	**250**	**2,740**
2020-2024	**TOTAL - STORMWATER**	**975**	**2,065**	**925**	**825**	**925**	**825**	**5,565**	**925**	**6,490**

2019-2023	**TOTAL - STORMWATER**	1,485	825	925	825	925	n/a
	$$ Difference	(510)	1,240	0	0	0	n/a
	% Difference	-34.3%	150.3%	0.0%	0.0%	0.0%	n/a

STORMWATER UTILITY FEE BENCHMARKING

How do other communities fund the stormwater basin maintenance?

Stormwater Utility Fee

- 33 central Ohio communities surveyed (2019)
- 56% of communities have fee
- Central Ohio average utility fee rate
  - Single Family Unit – 1 ERU = $3.54/month

Central Ohio Stormwater Utility Rate Comparison

Municipality	Stormwater Utility? Y/N	ERU (S.F.)	SFU ERU Rate (per month)	Commercial Comparative rate using 2000 sf	Current Date of Data	Comments
Ashville	Y	2,000	$3.00	$3.00	5/22/2017	actual rate is #0.0987/day
Athens	Y	NA; Charge Flat fee	$2.00	$4.00	5/22/2017	Flat fee based upon property type; want to institue an ERU system
Bellefontaine	Y	2,500	$3.75	$3.00	5/22/2017	Calculated Commercial rate average (See Note 1)
Bexley	N	2000	$1.98	$1.98	2/5/2016	goes to Columbus for Clean River Fund
Canal Winchester	Y	3,001	$3.00	$2.00	5/12/2014	
Cambridge	Y	-	$1.00	$2.00	2/1/2016	Fixed monthly rate for both
Circleville	N				5/12/2014	
Columbus	Y	2,000	$4.65	$4.65	5/22/2017	($0.1530 per day per ERU based on 366 days due to leap year)
Delaware	Y	2,773	$2.50	$1.80	5/22/2017	**considering future increases**
Dublin	N	-			5/22/2017	
Gahanna	Y	3,064	$4.33	$2.83	5/22/2017	
Grandview Heights	N				1/21/2016	
Grove City	N				5/22/2017	
Groveport	Y	2,760	$2.00	$1.45	5/22/2017	
Hilliard	Y	2,000	**$3.00**	**$3.00**	5/22/2017	**proposing two future increases**
Lancaster	Y	2,600	$7.64	$5.88	1/21/2016	
Marble Cliff	N				5/22/2017	
Marion	N				5/12/2014	
Marysville	Y	2,700	$3.75	$2.78	5/22/2017	
New Albany	N				5/12/2014	
Newark	Y	2,600	$6.80	$5.23	5/22/2017	Annual increase of $0.15 through 2025; ending rate of $8.01/ERU
Pataskala	N				5/12/2014	
Pickerington	Y	2,530	$4.50	$3.56	5/22/2017	
Plain City	N				5/12/2014	
Powell	N				5/12/2014	
Reynoldsburg	Y	2,530	$4.00	$3.16	1/29/2016	
Riverlea	N				5/12/2014	
Shawnee Hills	N	2000	$1.98	$1.98	5/22/2017	goes to Columbus for Clean River Fund
Sunbury	N				5/22/2017	
Upper Arlington	Y	2,000	$3.75	$3.75	5/22/2017	
Westerville	N				5/12/2014	
Whitehall	N				5/12/2014	
Worthington	N				5/12/2014	
Average for CO Communities		**2391**	**$3.52**	**$2.99**		
Averages Rate	**48%**	**2441**	**$3.54**	**$3.11**		

STORMWATER UTILITY FEE BENCHMARKING

Benchmarking Residential Stormwater Utility Fee Rates

- Columbus - $4.65
- Pickerington - $4.50
- Gahanna - $4.33
- Reynoldsburg - $4.00
- Upper Arlington - $3.75
- Hilliard - $3.00
- **Delaware - $2.50**
- Groveport - $2.00
- Canal Winchester - $2.00
- Bexley - $1.98
- Shawnee Hills - $1.98
- Westerville – No fee
- Worthington – No fee
- **Dublin – No fee**


Belvedere

CITY OF DELAWARE STORMWATER UTILITY OVERVIEW

City of Delaware – Pop. Approx. 40,000

- Implemented in 2002
- Reasons for Stormwater Utility Fee
  - CIP project funding
  - Ongoing maintenance
  - Upcoming National Pollutant Discharge Elimination System (NPDES) compliance
- Communication Plan
  - Public Works Committee
  - City Council
  - Delaware Gazette

CITY OF DELAWARE STORMWATER UTILITY OVERVIEW

City of Delaware

- Stormwater Utility Fee Rate Establishment
  - Based on benchmarking of surrounding communities
  - Average rate was utilized
    - $2.50/month per 1 E.R.U.
    - 1 E.R.U. = 2,773 SF of impervious area
- Current Maintenance
  - Catch basin repair
  - Pipe cleaning/televising/replacement
  - Stormwater basin maintenance
  - Street sweeping
- Stormwater Utility Fee Revenue
  - $851,000 in 2018
  - $717,000 to date in 2019
- 2019 Stormwater Management Expenditures - $1.4 Million
  - Funded by stormwater utility fee and general fund

PREVIOUS CITY OF DUBLIN STORMWATER UTILITY FEE DISCUSSION

Dublin City Council – Council Community Development Committee

- April 13, 1998
  - Purpose of meeting was to review the recently completed Master Plan and provide a recommendation to City Council for adoption.
  - Master Plan identified funding needs – Stormwater utility fee was discussed as possible funding source.
  - Funding issues would be discussed in subsequent meetings.
  - Financial recommendations of the Committee will be to consider imposing impact fees on developers to pay for the capital improvements. Maintenance and operation will be recommended to be paid for with general funds.

PREVIOUS CITY OF DUBLIN STORMWATER UTILITY FEE DISCUSSION

Dublin City Council – Council Community Development Committee

- December 14, 1998
  - Purpose was for consultants to present a recommendation on funding for Master Plan.
  - Current method for stormwater funding was through the capital improvement fund and general fund.
  - At the time, five other communities in Ohio have a stormwater utility fee:
    - Wooster ($2.90/ERU)
    - Upper Arlington ($2.75/ERU)
    - Columbus ($1.64/ERU)
    - Forest Park ($3.00/ERU)
    - Cincinnati ($2.11/ERU)
  - Presented two option for this stormwater utility fee
    - Option 1: Charge $1.75/mo/unit with no water/sanitary connection fee
    - Option 2: Charge $1.31/mo/unit with a water/sanitary connection fee

Outcome of meeting was to discuss this topic at a future meeting because five Council members were not present.

PREVIOUS CITY OF DUBLIN STORMWATER UTILITY FEE DISCUSSION

Dublin City Council – Council Community Development Committee

- February 8, 1999
  - Purpose was for consultants to present a recommendation on funding for Master Plan with all City Council members present.
  - Reviewed different types of funding mechanisms
    - Tax increment financing
    - Impact fees
    - Voted taxes
    - Special assessments
    - Stormwater utility fee
  - Presented two option for this fee
    - Option 1: Charge $1.75/mo/unit with no water/sanitary connection fee
    - Option 2: Charge $1.31/mo/unit with a water/sanitary connection fee

The consensus from City Council was to not proceed with implementing stormwater utility fees at that time.

City Council suggested putting maintenance costs in the CIP.

FUNDING OPTIONS

Funding Options

- 5 Year Capital Improvements Program – Status Quo with Additional Funding
- Stormwater Utility – New

Maintenance Costs - *Capital Improvement Program (2020-2024 CIP)*

CITY OF DUBLIN | 2020-2024 | FIVE-YEAR CAPITAL IMPROVEMENTS PROGRAM 11-1

UTILITIES - STORMWATER MANAGEMENT

(MUNIS) PROJECT NO.	DESCRIPTION	2019	2020	2021	2022	2023	2024	TOTAL 2020-2024 ($000)	BEYOND 2024 ($000)	TOTAL BUDGETED
CAPITAL MAINTENANCE										
AF201	Annual Stormwater Maintenance	575	575	575	575	575	575	2,875	575	3,450
AF202	Ditch Maintenance	0	0	100	0	100	0	200	100	300
	TOTAL	**575**	**575**	**675**	**575**	**675**	**575**	**3,075**	**675**	**3,750**
CAPITAL ENHANCEMENTS / NEW CAPITAL INFRASTRUCTURE										
EF181	Rings Farm Stream Relocation	150	1,240	0	0	0	0	1,240	0	1,240
EF200	Allocation for Various Stormwater Improvements	250	250	250	250	250	250	1,250	250	1,500
	TOTAL	**400**	**1,490**	**250**	**250**	**250**	**250**	**2,490**	**250**	**2,740**
2020-2024	**TOTAL - STORMWATER**	**975**	**2,065**	**925**	**825**	**925**	**825**	**5,565**	**925**	**6,490**
2019-2023	**TOTAL - STORMWATER**	1,485	825	925	825	925	n/a			
	$$ Difference	(510)	1,240	0	0	0	n/a			
	% Difference	-34.3%	150.3%	0.0%	0.0%	0.0%	n/a			

DISCUSSION AND QUESTIONS

Thank You!

Paul A. Hammersmith, P.E.-Engineering/Director of Engineering

Todd Garwick, P.E. – Engineering – Utilities

Michael Hendershot, P.E.– Engineering/Review Services

City of Dublin
OHIO, USA

EVERYTHING GROWS HERE.

OWNERSHIP AND MAINTENANCE RESPONSIBILITY

History / Past Practices

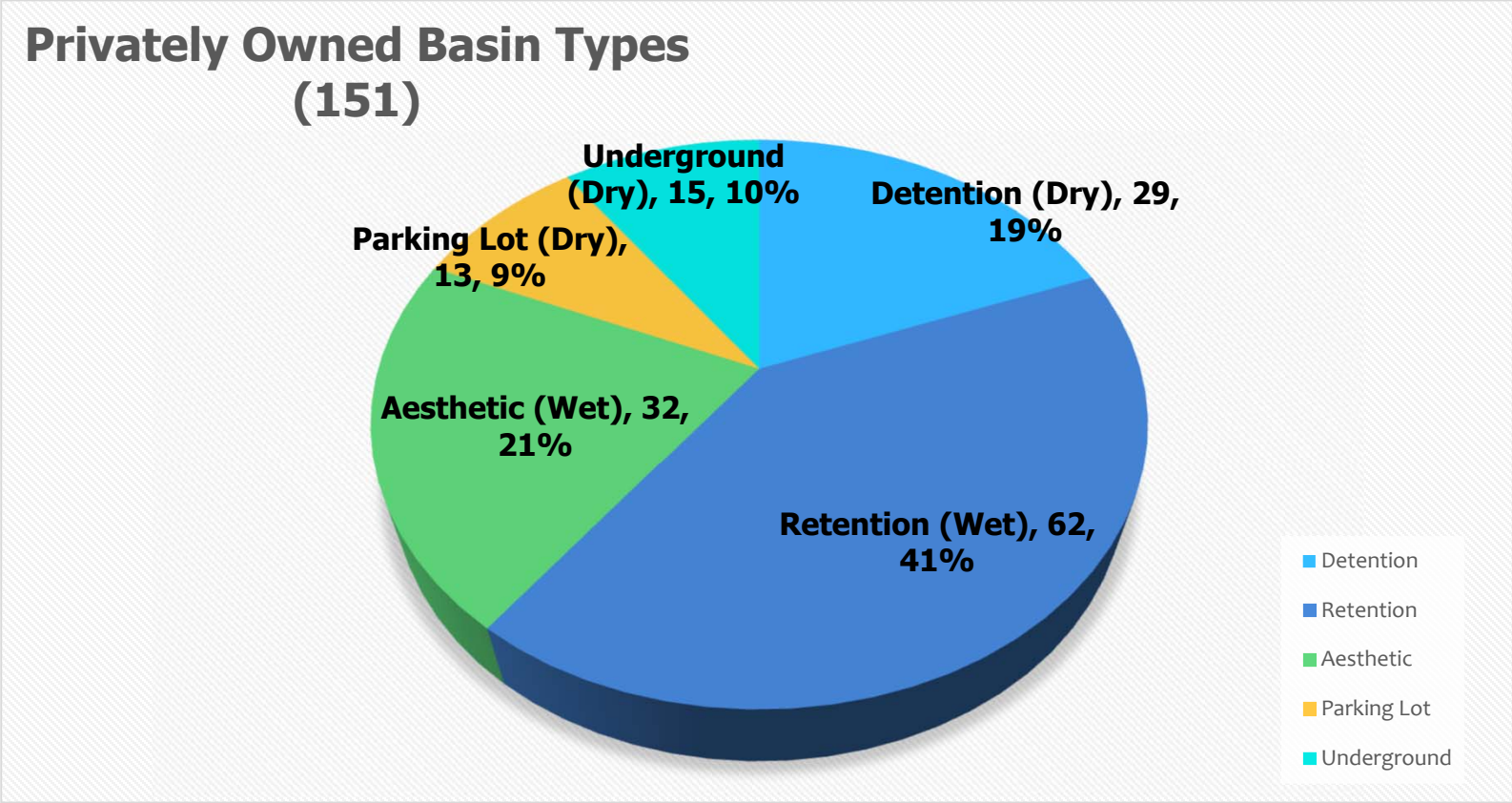
- Prior to ~1999 – HOA ownership and maintenance
- 1999 to ~2015 – Dublin ownership and HOA maintenance
- ~ 2015 – trended towards Dublin ownership and maintenance

BENCHMARKING

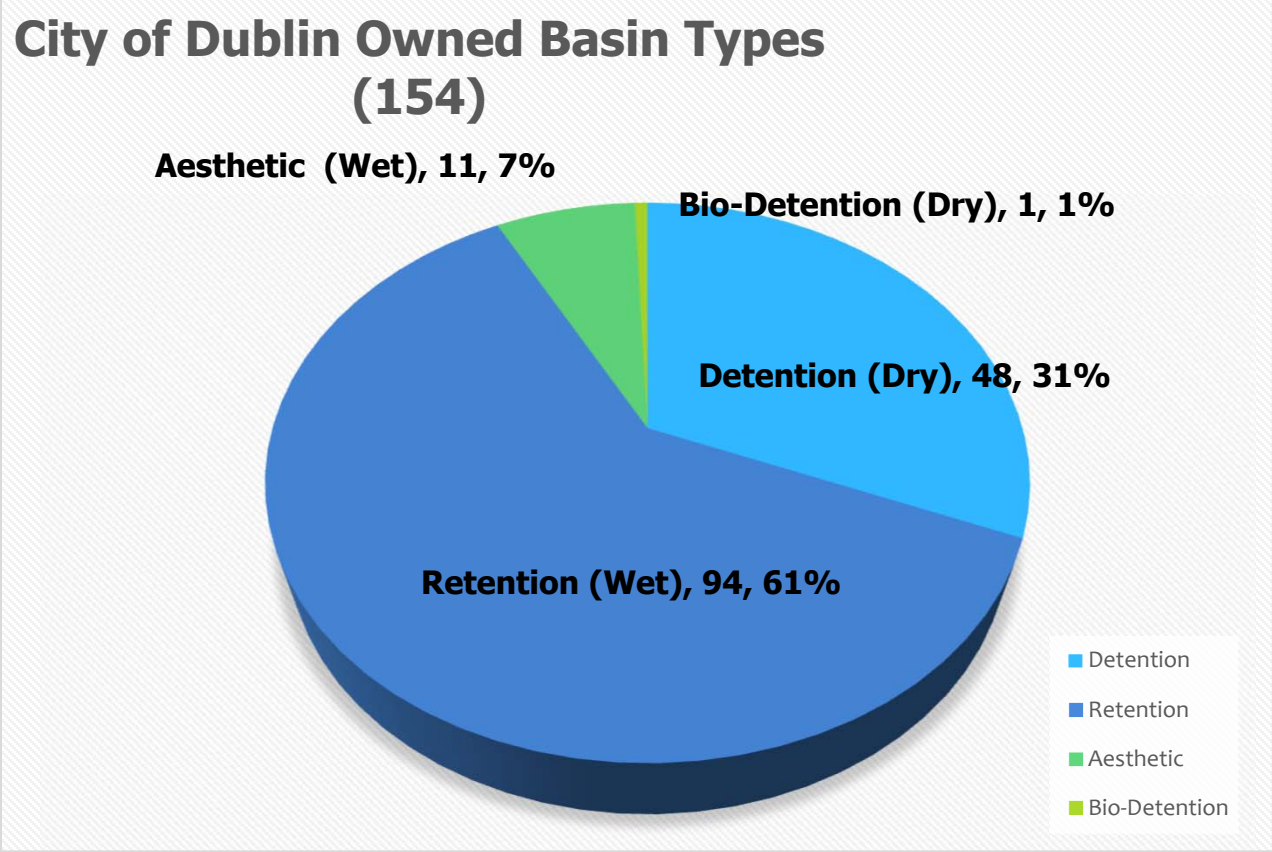
Homeowners Association (HOA) Maintenance

- Grove City
- Marysville
- Westerville
- Worthington

RESIDENTIAL STORMWATER BASIN INVENTORY -
Privately Owned Basin Types



RESIDENTIAL STORMWATER BASIN INVENTORY –
City of Dublin Owned Basin Types



STORMWATER BASIN INVENTORY – *CITY OF DUBLIN OWNED*
Maintenance Responsibility

	Residential Basin Type				
Maintenance Responsibility	**Detention (Dry)**	**Retention (Wet)**	**Aesthetic (Wet)**	**Bio-Detention (Dry)**	**Maintenance Totals**
Dublin Maintenance	37	60	11	0	**108**
HOA/Private Maintenance	11	34	0	1	**46**
Basin Type Totals	48	94	11	1	**154**

OPTIONS – *RESIDENTIAL STORMWATER BASINS*

Option #1

- Dublin maintain existing 108 residential stormwater basins
- HOA maintain existing 46 residential stormwater basins
- New basin maintenance determined on a case by case basis during planning process

OPTIONS – *RESIDENTIAL STORMWATER BASINS*

Option #2

- Dublin maintain existing 108 residential stormwater basins
- HOA maintain existing 46 residential stormwater basins
- HOA maintain new residential stormwater basins moving forward

OPTIONS – *RESIDENTIAL STORMWATER BASINS*

Option #3

- Dublin maintain existing 108 residential stormwater basins
- HOA maintain existing 46 residential stormwater basins
- Dublin maintain new residential stormwater basins moving forward

Community Services Advisory Commission

November 12, 2019

Minutes

Commission Members:	**Present:**	Marilyn Baker, Thomas Strup, Ann Bohman, Vivekanandan Arunachalam, Steve Dritz
	Absent:	Elizabeth McClain
Staff Members Present:		Michelle Crandall, Assistant City Manager Nick Plouck, Management Assistant Paul Hammersmith, Director of Engineering Todd Garwick, P.E. – Senior Civil Engineer Michael Hendershot, P.E. - Civil Engineer II Claudia Husak, Senior Planner Matt Earman - Director of Parks & Recreation
Guests:		None

I. Call to Order

Mr. Strup established that a quorum was present and called the meeting to order at 6:30 p.m.

II. Public Comments on Items Not on the Agenda

No public comments

III. Approval of Meeting Minutes

Minutes from the September 10, 2019 meeting were distributed via email for review. Mr. Strup asked if there were any corrections to the minutes. There being no changes, Ms. Baker moved to approve, and Ms. Bohman seconded the motion. All in favor, the September meeting minutes were approved.

IV. Stormwater Management Overview & Pond Maintenance (Paul Hammersmith, Michael Hendershot, Todd Garwick)

Mr. Hammersmith introduced himself to the Commission as the Director of Engineering/City Engineer for the City of Dublin. He apologized for not being able to attend the October meeting, as he was out of town for an American Public Works Association Congress. He also explained that

Megan O'Callaghan could not be here tonight due to a prior commitment to present at another meeting this evening. Barb Cox, who also attended last month's meeting, is on vacation this week.

Mr. Hammersmith introduced Todd Garwick, Senior Civil Engineer and Michael Hendershot, Civil Engineer II. They will both assist with the continued discussion from last month in regards to stormwater and basin maintenance throughout the City of Dublin for residential developments.

Mr. Hammersmith opened with an overview of the agenda. There were several follow-up items requested based on the conversation from the September meeting. In regard to Option 4, the Commission requested some maintenance cost estimates, which staff will provide this evening. The cost estimates provided are on an annualized basis, which was the easiest point of comparison. Staff will explain some examples of basin maintenance for the Dublin maintained areas and privately maintained areas.

There will be some continued discussion in regard to stormwater utility fee benchmarking, including the City of Delaware stormwater utility overview per the request of the Commission. Mr. Hammersmith added that he happen to be the Public Works Director in Delaware when the legislation was adopted in 1998 by City Council, but it did not go into effect until January 2002. It took several years to get the utilities setup and get the fees established. Staff will provide some information on previous City of Dublin stormwater fee discussions and some additional funding options.

Mr. Hammersmith turned the presentation over to Mr. Garwick who would further discuss residential stormwater basins.

Mr. Garwick recapped that residential stormwater basins serve the following scenarios:

- Single Family Subdivisions
- Single Family Detached Homes
- Condominiums
- Apartment Complexes

At the September meeting, staff discussed the breakdown of ownership of the residential stormwater basins. He explained within Dublin, there are 305 residential stormwater basins. There are 151 privately owned residential basins and 154 Dublin-owned residential stormwater basins, which is our primary focus for discussion.

Mr. Garwick said at the last meeting, staff outlined four different options for stormwater basin maintenance. The discussion took place around Option #4:

- Dublin maintain existing 108 residential stormwater basins
- Dublin assume maintenance of existing 46 residential stormwater basins that are currently maintained by HOAs
- Dublin maintain new residential stormwater basins moving forward

Mr. Garwick said we will further discuss the maintenance components and the cost associated with these elements. A map was distributed that reflects the 46 stormwater basins that are currently maintained privately. Eleven of those are detention basins, thirty-four are retention basins and one is a bio-detention basin. These areas started being maintained privately from 1999 through 2015 throughout Dublin.

The presentation provided some examples explained by Mr. Garwick of the different detention (dry) basins:

- Wyandotte woods - City of Dublin owned/Maintained
- Caplestone Lane - Privately Owned/Maintained

Ms. Baker asked who maintains the privately owned detention basins. Mr. Garwick replied this specific example of Caplestone is privately owned/maintained. Mr. Hammersmith also added that staff wanted to provide some examples of both dry and wet basins that are both City maintained and privately maintained. Some are uniquely situated but have the same components in a dry basin regardless of who maintains it. The embankment, outlet control structures and water channels may have a little different design but function the same.

Ms. Baker asked if the City typically inspects after the Homeowner's Associations (HOA) do excavation work to the basins. Mr. Hammersmith said typically the City does not go out and do a requested inspection. Staff might inspect if there is a maintenance concern brought to our attention. They are not too difficult to maintain. Usually the biggest culprits are volunteer trees or vegetation that grows and blocks the inlet or outlets structures.

Ms. Baker asked who educates the HOA on how to maintain these areas. Mr. Hammersmith said staff would handle this through our public education campaign. We will also go out, meet with the HOAs, and provide them with the basic documentation on pond maintenance. Ms. Baker asked if staff repeats education HOAs when there is a turnover in home ownership. Mr. Hammersmith replied that typically when there is a turnover in the HOA board, then staff will re-educate the HOA board.

Ms. Bohman asked who planted the trees for the Caplestone Lane detention basin. Mr. Hammersmith said the HOA planted those trees. Ms. Bohman asked if the City would provide recommendations for which contractor to use. Mr. Hammersmith said staff can provide a list of different contractors, but staff does not make recommendations.

Mr. Dritz asked if the Caplestone basin concrete channel is unique or common. Mr. Garwick commented that this was installed in 1993 and it was more common, but now they are rarely used. Mr. Hendershot also added that there are now water quality requirements and this type of channel would not meet the current water quality drawdown time requirements.

Mr. Garwick went on to discuss the examples of the retention (wet) basins maintained privately and by the City. Some examples are:

- Villas at Glenealy – Privately Owned/Maintained
- Wellington Place – City of Dublin Owned/Maintained

Mr. Dritz asked if these maintenance components for privately owned basins are suggestions or are they required guidelines. Mr. Hammersmith said these are suggestions based on common practices. Some of these maintenance components are obvious, but we may need to provide more assistance when it comes to the outlet control structures.

Ms. Crandall added that staff is providing the examples and the breakdown of the maintenance components to help this Commission understand what the cost estimates will cover. Some of the privately-owned basins may not be maintained at the recommended service level, but if the City were to take these over, staff would maintain them at this level.

Mr. Garwick explained that the annual maintenance cost for a detention (dry) basin would be $3,760 per year to include the maintenance components discussed. This would be an accumulation of costs over 30 years if all of the required maintenance components were complete according to the cycle.

Ms. Baker asked if this cost would increase after 30 years. Mr. Garwick said more than likely the cost would increase. This only takes into consideration present year cost.

Mr. Garwick provided the breakdown for the cost for retention (wet) basins based on the same accumulation of costs over 30 years. This annualized cost would be $5,370. He explained the difference in annualized cost between the two types of basins is the additional cost for pond dredging.

Maintenance Costs - 108 Dublin Maintained Basins:

Detention (Dry) Basins

- 37 Basins
- Annualized cost per basin = $3,760
- Planning level cost = $139,120/year

Retention (Wet) Basins

- 71 Basins
- Annualized cost per basin = $5,370
- Planning level cost = $381,270/year

Total Yearly Estimated Basin Cost = $520,390 (108 Basins)

Maintenance Costs – 46 Privately Maintained Basins:

Detention (Dry) Basins
- 12 Basins
- Annualized cost per basin = $3,760
- Planning level cost = $45,120/year

Retention (Wet) Basin & Aesthetic Basin
- 34 Basins
- Annualized cost per basin = $5,370
- Planning level cost = $182,580/year

Total Yearly Estimated Basin Cost = $227,700 (46 Basins)

Maintenance Costs – Long Term City Cost Impacts

Dublin maintains all 154 Basins
- 1 year cost = $748,090
- 5 year cost = $3,740,450
- 10 year cost = $7,480,900
- 15 year cost = $11,221,350

Mr. Garwick gave a breakdown of Dublin's 2020-2024 Capital Improvement Program for Stormwater Maintenance for the following work on infrastructure, which includes stormwater basins

- Storm Structure Repairs – curb/gutter inlets (street drainage structures)
- Stormwater Maintenance Contract – includes the stormwater basin maintenance currently, plus other small storm sewer pipe and storm structure repairs/work
- Various Stormwater Improvements – typically includes storm sewer pipe extensions and storm structure installations in response to drainage complaints received from residents
- Total stormwater funding equals $575,000.

Ms. Baker asked if the figures explained are budgeted per year. Mr. Garwick said they are per year. Mr. Hammersmith noted that at the top of each column the green band signifies the annual budget for the five-year CIP program.

Mr. Dritz asked why the budgeted amount does not reflect the $520,000 for the basins the City is currently maintaining instead of the $575,000 budget. Mr. Hammersmith explained that the City does not necessarily spend $520,000 per year currently on the 108 ponds. Staff uses what budget is available annually to maintain them. The $575,000 also includes a catch basin program, which cost approximately $225,000 per year.

Mr. Dritz asked what the catch basin program consists of. Mr. Hammersmith replied there is a list of the existing catch basins that are deteriorating and are in need of replacement. Dublin recently bid this project out for the replacement of these catch basins and restoration of the areas in which the catch basins are replaced.

Mr. Garwick also provided a breakdown of Dublin's 2020-2024 Capital Improvement Program for capital enhancements and new capital infrastructure:

- Rings Farm Stream Relocation – relocating a stream just north of Shier-Rings Road
- Allocation for Various Stormwater Improvements – include catch basin and pipe extensions, basically to help improve the drainage along the City's right-of-way areas and easements

Ms. Baker asked who is ultimately responsible with issues regarding stormwater management. If an HOA does not maintain their basins correctly, will the City be responsible for maintaining it? Mr. Hammersmith commented that according the Chapter 53 of the Codified Ordinance, the City is given the authority to take action to maintain anything accordingly that is not up to standard and under State permitting Dublin is responsible for management of publicly owned stormwater.

As far as maintaining the basins, Mr. Garwick stated that the City provides the resources to educate the HOA's on how to maintain their basins.

Mr. Hammersmith also commented that one of the common questions staff receives is that a resident has standing water in their backyard and they want the City to come out and fix the issue. The City's response would be to let the resident know there is a storm sewer in a public easement adjacent to the property with the issue. Staff would let the resident know they can put their own pipeline in to connect to that storm sewer line, but the City will not extend the storm sewer line onto private property to fix the problem unless there is some greater public benefit to it.

Mr. Dritz commented that he does not understand what the total budget represents. If $575,000 is not a real number and based upon estimates, why wouldn't that budget amount be decreased and reflect actual numbers. Mr. Hammersmith replied that the $575,000 is a real budgeted amount annually. $225,000 is used for catching basin maintenance and the other $350,000 is used for other projects that needed completed annually. Even if we take that number and try to allocate it, it would be difficult to provide a point of comparison for exactly what it would take to maintain the 46 basins. Ms. Crandall also commented that every year during budget review, this particular line item always comes in requesting a higher budget amount, but due to other projects and the limited amount of funding available; stormwater maintenance is an area that keeps being reduced. Ideally as these areas of infrastructure age and need more maintenance, this approved budget does not reflect the funding that is actually needed.

Next Mr. Hendershot provided a recap of the stormwater utility benchmarking. There were 33 agencies surveyed in the Central Ohio area. Fifty-six percent of the 33 agencies have a stormwater utility fee, with the Central Ohio average utility rate fee equaling $3.54 per month per 1 E.R.U. The E.R.U. (Equivalent Residential Unit) is a square footage determined by each municipality based generally on impervious area (hard surface types such as housing footprints, driveways).

These stormwater utility fee rates are from the immediate central Ohio area. Mr. Hendershot pointed out, the City of Columbus being the most expensive to the Village of Shawnee Hills being one of the least expensive. In addition, you can see the Cities not collecting a fee: Westerville, Worthington, and Dublin.

At the September meeting, this Commission requested more information regarding the City of Delaware stormwater utility fee:

- City of Delaware population is approximately 40,000
- Implemented their fees in 2002
- Reasons for stormwater utility fee
    - CIP project funding
    - Ongoing maintenance
    - Upcoming National Pollutant Discharge Elimination System (NPDES) compliance
- Communication Plan
    - Public Works Committee
    - City Council
    - Delaware Gazette

- Stormwater Utility Fee Rate Establishment
    - Based on benchmarking of surrounding communities
    - Average rate was utilized
        - $2.50/month per 1 E.R.U.
        - 1 E.R.U. = 2,773 SF of impervious area

The City of Delaware has not increased their stormwater utility fee from its inception in 2002. If the $2.50/month per 1 E.R.U. was brought to present value assuming a 2% annual increase, the rate would be $3.57/month per E.R.U., which is $0.03 more than the surveyed Central Ohio average rate.

- Current Maintenance Practices include
    - Catch basin repair
    - Pipe cleaning/televising/replacement
    - Stormwater basin maintenance
    - Street sweeping

- Stormwater Utility Fee Revenue

    - $851,000 in 2018
    - $717,000 to date in 2019

- 2019 Stormwater Management Expenditures -$1.4 Million
    - Funded by stormwater utility fee and general fund

Mr. Strup asked how the City of Delaware collects this fee. Mr. Hammersmith said they add it to their monthly utility bill.

Mr. Hendershot commented that the City of Delaware also follows an incentive program offered by the City of Columbus. If a commercial property has onsite stormwater management control measures in place, then the City of Delaware provides a 20% credit of the stormwater utility fee.

Mr. Hendershot supplied information in regards to previous stormwater utility fee discussion in the City of Dublin. The Dublin City Council Community Development Committee discussed this topic in three separate meetings in 1998 and 1999.

April 13, 1998

- Purpose of meeting was to review the recently completed Master Plan and provide a recommendation to City Council for adoption
- Master Plan identified funding needs –Stormwater utility fee was discussed as possible funding source
- Funding issues would be discussed in subsequent meetings
- Outcome of the meeting
    - Financial recommendations of the Committee will be to consider imposing impact fees on developers to pay for the capital improvements. Maintenance and operation will be recommended to be paid for with general funds

December 14, 1998

- Purpose was for consultants to present a recommendation on funding for Master Plan
- Current method for stormwater funding was through the capital improvement fund and general fund
- At the time, five other communities in Ohio have a stormwater utility fee to include Wooster, Upper Arlington, Columbus, Forest Park and Cincinnati
- Presented two option for this stormwater utility fee
    - Option 1: Charge $1.75/mo/unit with no water/sanitary connection fee
    - Option 2: Charge $1.31/mo/unit with a water/sanitary connection fee
- Outcome of the meeting
    - Further discussion of this topic at a future meeting because five Council members were not present

February 8, 1999

- Purpose was for consultants to present a recommendation on funding for Master Plan with all City Council members present
- Reviewed different type of funding mechanisms again with all City Council members present
- Presented two option for this stormwater utility fee
    - Option 1: Charge $1.75/mo/unit with no water/sanitary connection fee
    - Option 2: Charge $1.31/mo/unit with a water/sanitary connection fee

Mr. Hendershot said that City Council had discussion and took into consideration that the five communities that have stormwater utility fees, the majority seem to be located by large bodies of water. City Council thought that might be a reason why some of those communities have stormwater utility fees. They did not feel those communities may be a good comparison since Dublin is fairly flat compared to some of those other communities. In the meeting minute discussion, City Council felt that stormwater maintenance is a service to residents that the City should provide free of a stormwater utility fee based on the City's financial health. The consensus from City Council was not to proceed with implementing the stormwater utility fee at that time. One Council member suggested that it might need to be revisited if the cost escalates to a point where a funding gap is evident. City Council also suggested including maintenance cost into the CIP budget.

Next Mr. Hammersmith explained the funding options. After discussing this topic with the Interim Finance Director, Matt Stiffler, it really comes down to two different funding options. In our five year CIP budget that we update, we could remain at status quo with the request for some additional funding as necessary based on annual needs for maintenance.

The second option would be to re-evaluate a stormwater utility fee. Staff currently has a rate consultant contracted to review our water and sanitary sewer rate. That could be a task that could possibly be added to the contract.

Mr. Dritz commented that if he lives in a neighborhood that has a privately maintained basin and the City implements this new fee for everyone in the City of Dublin, then his expectation would be that the City would then maintain all of the basins in the City. Mr. Hammersmith replied that based on Option #4, yes, the City could plan to take over the 46 City owned and privately maintained basins in the City. Mr. Dritz said he is referring to the privately owned/maintained. Mr. Hammersmith said the City would not take over "privately owned" infrastructure. Based on the City of Delaware fee structure all of the commercial properties still maintain their own infrastructure. In some cases of their new developments, the City of Delaware will maintain the pond areas.

Ms. Baker asked if the City maintains any of the commercial stormwater basins. Mr. Hammersmith said the City does not maintain any privately owned stormwater infrastructure. Ms. Baker asked if the City is responsible if they are not maintained correctly. Mr. Hammersmith

commented that the owners of commercial stormwater basins are responsible. The City of Dublin has a general permit and Dublin is responsible for providing the public education and outreach, but ultimately Dublin is not responsible for the actual maintenance of commercial stormwater basins. However, if there is any infrastructure that is in neglect or disrepair, according the Chapter 53 of the Codified Ordinance, Dublin has a mechanism in place to enforce maintenance.

Mr. Dritz asked if all 151 privately-owned stormwater basins are residential or are some of them commercial. Mr. Hammersmith replied that most are residential but some of them are condominium-based, which are considered commercial.

Mr. Dritz asked if the residents that live in the condominiums have separate water bills. Mr. Hammersmith replied that most have a master bill for everything. A part of the policy discussion that will need to take place is what is the cut-off for who is invoiced for storm sewer fees and who is not. Commercial property owners might want to argue about the City maintaining their private basins, but commercial owners benefit from the public infrastructure.

Mr. Dritz asked if staff has a recommendation on how to move forward. Mr. Hammersmith replied that staff does not have a recommendation. At this time, we can open it up for discussion. Mr. Hammersmith did ask the Commission to keep in mind that the assignment from Council was to review the 46 publicly owned, but privately maintained, basins that have been in question for quite a while. Council asked this Commission to provide Council with some feedback only on these basins. If the Commission is interested in discussing the storm sewer utility topic overall, this Commission should probably ask Council for additional guidance and direction on what involvement this Commission should have on any further discussion.

Ms. Crandall confirmed Mr. Hammersmith's comments. This Commission was only given the task of reviewing the City owned and privately maintained storm sewer basins and to follow-up with a recommendation. If this Commission would decide to make a recommendation on the City taking over the maintenance of these 46 City owned basins, the question could also be asked to look further into the possibility of stormwater utility fee.

Mr. Dritz said he does not feel comfortable with the budget numbers that staff discussed for annual CIP budget requests. He asked Ms. Crandall if this Commission should make a recommendation to Council to take over the additional basins based on the budget that was discussed, even though staff truly spends less than the estimated amount per year. Ms. Crandall said that Mr. Hammersmith brought up a good example of when the City of Delaware performed a study for stormwater utilities and they were behind and needed infrastructure improvements because they did not really have anything in place or a cycle in place to maintain them appropriately. Dublin starts to see this as our infrastructure starts to age. It has been interesting to watch our CIP budget over the years shift from budgeting for a large percentage of new or enhanced infrastructure to maintenance. Even though staff may not utilize all of those funds now, in the future they will be concentrating more and more on maintenance.

Mr. Strup commented that he was uncomfortable making a recommendation to take over the maintenance of the 46 basins, if we are not sure on how it will be funded. Mr. Hammersmith replied that the Commission could make the recommendation to take over the 46 basins and further discuss the funding portion of the recommendation. Mr. Strup also does not want to have the same thing happen in regard to discussions about stormwater fees and have the Commission spend more time discussing it if then Council decides not to follow-through with it. The Commission understands projects and budgets are deferred, but if the City keeps doing that with maintenance there will come a point, they will not be able to continue doing it.

Ms. Baker said the first question the Commission needs to answer is "Should the City be responsible for the 46 basins?" She is ready to say that the City should be responsible for maintaining all of them. If Dublin is ultimately responsible for maintaining them, then the City should take them over. Although the City provides guidance for the HOA's, the HOA's do not have the expertise the City has in place already. These basins may be easy to maintain when they are new, but as they age and require more maintenance, it will be more difficult for the HOA to maintain them properly. From an environmental standpoint, it is critical that they are maintained properly. The second question is "How will it be funded?" The City will need to decide if it will continue to be a part of the CIP budget or should there be a fee in place.

Mr. Dritz asked what the rationale is behind the City taking over the maintenance of the 46 basins. Mr. Hammersmith said the HOA's do not have the funding structures in their HOA fees to pay for the large expenditures that will take place as the basins age. Ms. Crandall also added that the reason Council asked this Commission to review this topic is because staff is getting requests one at a time from HOA's to take over their maintenance due to the hardship for the HOA's to continue to maintain.

Mr. Strup said his neighborhood has a privately owned and maintained basin and it has never been maintained, so he started to maintain it. There are going to be issues in the long term if not all of the stormwater basins are maintained properly. Mr. Hammersmith commented that the City typically does not have issues with the privately owned and maintained basins. Mr. Garwick commented that most of them have fees structures in place to maintain them and some are professionally maintained.

Mr. Dritz suggested adding the 151 privately owned and maintained stormwater basins in the recommendations so they are all being maintained consistently. Mr. Hammersmith reiterated that Council only asked the Commission to discuss the 46 City owned and privately maintained basins.

Mr. Strup believes only looking at the 46 basins will cause issues in the future. If Council agrees to maintain the 46 basins and then decides to look at the fees structure in the future, then the residents that reside in neighborhoods with privately owned/maintained are going to have an issue if they are paying a stormwater fee. Those 151 privately owned/maintained are going to want the City to take over their basins. Mr. Hammersmith said staff could provide the breakdown of the 151 basins. It may help the Commission to see how many single-family subdivisions versus

condominium or apartment complexes are. Mr. Hammersmith suggested that the Commission start with whether or not they want to make the recommendation for the City to maintain the 46 basins.

Mr. Strup said he does not feel comfortable making a recommendation with the information the Commission has been presented. He asked if staff could come up with some other recommendations that the Commission can further discuss in December.

Ms. Baker asked if anyone was uncomfortable making a recommendation on the City maintaining the 46 basins; all members noted they were not uncomfortable making a recommendation. Mr. Strup said he was comfortable making a recommendation on maintenance of the 46 basins, he just does not feel that a recommendation of the 46 basins is enough.

Mr. Arunachalam asked if there would be any future development over the next five years that could increase the stormwater basins. Mr. Hendershot said there is potential development on the southeast of Cosgray and Shier-Rings that will be submitted for rezoning and annexation so this topic could be discussed for that development.

Ms. Baker noted since the discussion keeps going back and forth as far as what is understood Council wants the Commission to consider, is there an opportunity to ask Council what it wants the Commission to discuss, so we do not keep discussing this topic if we should not be. Ms. Crandall said Council asked this Commission to review and discuss the 46 City owned but privately maintained basins, but beyond that, the Commission can provide further comments to Council based on your discussion.

Mr. Dritz said the unknown part of the recommendation is how to ask to proceed with the funding portion of the recommendation. Ms. Crandall suggested if the Commission recommends the City take over the maintenance of the 46 basins, then it may need to look into a utility fee structure to accommodate funding for these basins.

Ms. Baker and Mr. Strup noted there seems to be three parts to this discussion:

1. Should the City maintain the 46 City owned/privately maintained basins?
2. How should the City fund additional maintenance costs?
3. Should the City explore the maintenance of the 151 privately owned/maintained basins?

Mr. Hammersmith agrees with discussion. Ms. Crandall asked the rest of the Commission if they would like to move forward with a recommendation and wait for Council's response on the additional 151 basins. The Commission agreed to move forward.

Ms. Baker and Mr. Strup jointly worded and Ms. Baker moved to recommend the City of Dublin take over the maintenance of the 46 City owned stormwater basins that are currently being maintained privately. Based on the recommendation to take over these basins, the Commission suggests it would make sense for the City to also review the funding mechanism to support the

maintenance. Based on the outcome of Council's decision for maintenance and its funding for publicly owned stormwater basins, the Commission would be interested in further exploring the maintenance of the 151 privately owned/maintained basins if Council considered that would be helpful. Mr. Dritz seconded the motion. All in favor, the motion was unanimously approved.

Ms. Crandall said she would look at Council's agenda and meetings and see if there is availability to discuss this topic in December or to wait until the January Council meeting.

V. Other Items of Interest

Ms. Crandall would like staff to provide some updates for this Commission at the December meeting on topics this Commission has been involved with, such as the Aging in Place program, Bicycle Task Force and sustainability.

Ms. Bohman provided a report to the Commission on the 2019 Summit on Sustainability that Mr. Dritz, Ms. Baker and Ms. Bohman all attended. Each attended different topic sessions. The report provides some highlights from each session attended.

VI. Next meeting: December 10, 2019.

VIII. Adjournment

Respectfully Submitted by:

Marja Keplar

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Marja Keplar, Administrative Support III

Attachments: Stormwater Basin Maintenance Presentation
City of Dublin Owned Residential Basins Map
Central Ohio Stormwater Utility Rate Comparison
Utilities – Stormwater Management CIP Budget
Shaping Resilient Communities – Training Report

Stormwater Basin Maintenance for Residential Development

CSAC PRESENTATION

Paul A. Hammersmith, P.E. – Director of Engineering/ City Engineer
Todd Garwick, P.E. – Engineering - Utilities
Michael Hendershot, P.E.– Engineering/Review Services

NOVEMBER 12, 2019

AGENDA

I. Introduction

II. Option 4 – Planning Level Maintenance Cost Estimates

III. Basin Examples – Dublin and Privately Maintained

IV. Stormwater Utility Fee Benchmarking

V. City of Delaware Stormwater Utility Overview

VI. Previous City of Dublin Stormwater Utility Fee Discussion

VII. Funding Options

VIII. Discussion and Questions

RESIDENTIAL STORMWATER BASIN INVENTORY

Residential Stormwater Basins serve the following:

- Single Family Subdivisions
- Single Family Detached Homes
- Condominiums
- Apartment Complexes

RESIDENTIAL STORMWATER BASIN INVENTORY – *Ownership*

Residential Stormwater Basins
305* total

City of Dublin Owned
Residential Stormwater Basins
154

Focus

Private Owned
Residential Stormwater Basins
151

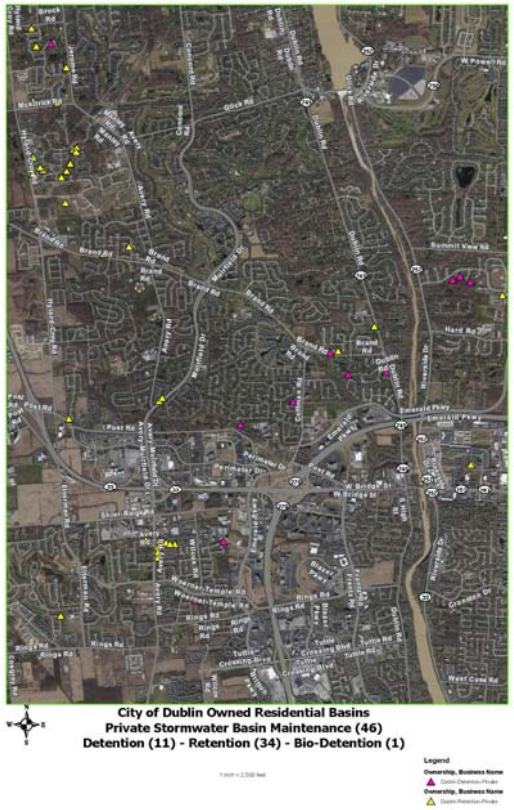
**excludes Commercial*

OPTIONS – *RESIDENTIAL STORMWATER BASINS*

Option #4:

- Dublin maintains existing 108 residential stormwater basins
- Dublin assume maintenance of existing 46 residential stormwater basins that are currently maintained by HOAs
- Dublin maintain new residential stormwater basins moving forward

RESIDENTIAL STORMWATER BASIN INVENTORY –
Locations of 46 Privately Maintained Basins



STORMWATER BASIN INVENTORY –
City of Dublin Owned/Maintained Detention (Dry) Basin

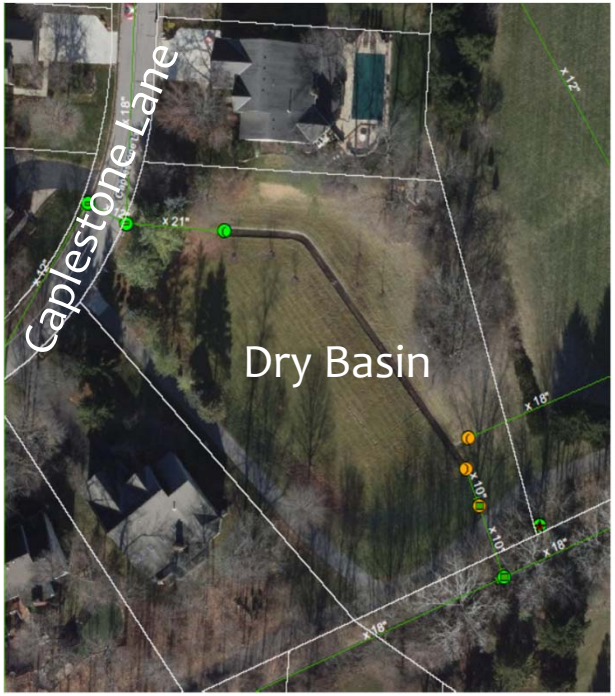
Maintenance Components

- Trash Removal
  - Monthly
- Vegetation Removal
  - Typical 5-year cycle
- Outlet Structures
  - 10-year cycle
- 4" Underdrains – Repair/Replace
  - 10-year cycle
- Channel Cleaning
  - 10-year cycle
- Bank Erosion Repair
  - 10-year cycle
- Excavation
  - Sediment Removal – 30-year cycle

STORMWATER BASIN INVENTORY -
Privately Owned/Maintained Detention (Dry) Basin

Maintenance Components

- Trash Removal
  - Monthly
- Vegetation Removal
  - Typical 5-year cycle
- Outlet Structures
  - 10-year cycle
- Channel Cleaning
  - 10-year cycle
- Underdrains
  - 10-year cycle
- Bank Erosion Repair
  - 10-year cycle
- Excavation
  - Sediment Removal – 30-year cycle



STORMWATER BASIN INVENTORY –
City of Dublin Owned/Maintained Retention (Wet) Basin

Maintenance Components

- Trash Removal
  - Monthly cycle
- Water Quality (Copper Sulfate)
  - Yearly cycle
- Vegetation Removal
  - Typical 5-year cycle per basin
- Submerged Inlets/Outlets
  - 10-year cycle
- Aeration (Fountain)
  - 8-year cycle
- Bank Erosion Repair
  - 10-year cycle
- Outlet Control (Orifice Plate)
  - Orifice Plate
- Dredging
  - 30-year cycle

STORMWATER BASIN INVENTORY -
Privately Owned/Maintained Retention (Wet) Basin

Maintenance Components

- Trash Removal
  - Monthly cycle
- Water Quality (Copper Sulfate)
  - Yearly cycle
- Vegetation Removal
  - Typical 5-year cycle per basin
- Aeration (Fountain)
  - 8-year cycle
- Submerged Inlets/Outlets
  - 10-year cycle
- Bank Erosion Repair
  - 10-year cycle
- Dredging
  - 30-year cycle
- Outlet Control (Orifice Plate)
  - 30-year cycle

MAINTENANCE COST – *Detention (Dry) Basin*

Detention (Dry) Basin Maintenance Components w/ Cycles

- Trash removal (monthly)
- Vegetation removal (5-year)
- Storm sewer pipe and structures (10-year)
- Channels cleaning (10-year)
- Underdrains (10-year)
- Bank Erosion (10-year)
- Excavation (30-year)

Annualized Cost per Detention (Dry) Basin = **$3,760**

MAINTENANCE COST – *Retention (Wet) Basin*

Retention (Wet) Basin Maintenance Components w/ Cycles

- Trash removal (monthly)
- Chemical control – Algae (yearly)
- Vegetation removal (5-years)
- Basin Aerators (8-years)
- Storm sewer pipes and structures (10-years)
- Pond Dredging (30-years)
- Outlet Control (30-years)
- Nuisance animal (as needed)

Annualized Cost Per Retention (Wet) Basin = **$5,370**

MAINTENANCE COSTS – *108 Dublin Maintained Basins*

Detention (Dry) Basins

- 37 Basins
- Annualized Cost per Basin = **$3,760**
- Planning level cost = **$139,120/year**

Retention (Wet) Basin & Aesthetic Basin

- 71 Basins
- Annualized Cost per Basin = **$5,370**
- Planning level cost = **$381,270/year**

Total Yearly Estimated Basin Cost = **$520,390 (108 Basins)**

MAINTENANCE COSTS – *46 Privately Maintenance Basins*

Detention (Dry) Basins

- 12 Basins
- Annualized Cost per Basin = **$3,760**
- Planning level cost = **$45,120/year**

Retention (Wet) Basin & Aesthetic Basin

- 34 Basins
- Annualized Cost per Basin = **$5,370**
- Planning level cost = **$182,580/year**

Total Yearly Estimated Basin Cost = **$227,700 (46 Basins)**

MAINTENANCE COSTS – *Long Term City Cost Impacts*

Dublin Maintains all **154 Basins**

- 1 year cost = **$748,090**
- 5 year cost = **$3,740,450**
- 10 year cost = **$7,480,900**
- 15 year cost =$**11,221,350**

Maintenance Costs - *Capital Improvement Program (2020-2024 CIP)*

CITY OF DUBLIN | 2020-2024 | FIVE-YEAR CAPITAL IMPROVEMENTS PROGRAM 11-1

UTILITIES - STORMWATER MANAGEMENT

(MUNIS) PROJECT NO.	DESCRIPTION	2019	2020	2021	2022	2023	2024	TOTAL 2020-2024 ($000)	BEYOND 2024 ($000)	TOTAL BUDGETED
CAPITAL MAINTENANCE										
AF201	Annual Stormwater Maintenance	575	575	575	575	575	575	2,875	575	3,450
AF202	Ditch Maintenance	0	0	100	0	100	0	200	100	300
	TOTAL	**575**	**575**	**675**	**575**	**675**	**575**	**3,075**	**675**	**3,750**
CAPITAL ENHANCEMENTS / NEW CAPITAL INFRASTRUCTURE										
EF181	Rings Farm Stream Relocation	150	1,240	0	0	0	0	1,240	0	1,240
EF200	Allocation for Various Stormwater Improvements	250	250	250	250	250	250	1,250	250	1,500
	TOTAL	**400**	**1,490**	**250**	**250**	**250**	**250**	**2,490**	**250**	**2,740**
2020-2024	**TOTAL - STORMWATER**	**975**	**2,065**	**925**	**825**	**925**	**825**	**5,565**	**925**	**6,490**
2019-2023	**TOTAL - STORMWATER**	1,485	825	925	825	925	n/a			
	$$ Difference	(510)	1,240	0	0	0	n/a			
	% Difference	-34.3%	150.3%	0.0%	0.0%	0.0%	n/a			

STORMWATER UTILITY FEE BENCHMARKING

How do other communities fund the stormwater basin maintenance?

Stormwater Utility Fee

- 33 central Ohio communities surveyed (2019)
- 56% of communities have fee
- Central Ohio average utility fee rate
  - Single Family Unit – 1 ERU = $3.54/month

Central Ohio Stormwater Utility Rate Comparison

Municipality	Stormwater Utility? Y/N	ERU (S.F.)	SFU ERU Rate (per month)	Commercial Comparative rate using 2000 sf	Current Date of Data	Comments
Ashville	Y	2,000	$3.00	$3.00	5/22/2017	actual rate is #0.0987/day
Athens	Y	NA; Charge Flat fee	$2.00	$4.00	5/22/2017	Flat fee based upon property type; want to institue an ERU system
Bellefontaine	Y	2,500	$3.75	$3.00	5/22/2017	Calculated Commercial rate average (See Note 1)
Bexley	N	2000	$1.98	$1.98	2/5/2016	goes to Columbus for Clean River Fund
Canal Winchester	Y	3,001	$3.00	$2.00	5/12/2014	
Cambridge	Y	-	$1.00	$2.00	2/1/2016	Fixed monthly rate for both
Circleville	N				5/12/2014	
Columbus	Y	2,000	$4.65	$4.65	5/22/2017	($0.1530 per day per ERU based on 366 days due to leap year)
Delaware	Y	2,773	$2.50	$1.80	5/22/2017	**considering future increases**
Dublin	N	-			5/22/2017	
Gahanna	Y	3,064	$4.33	$2.83	5/22/2017	
Grandview Heights	N				1/21/2016	
Grove City	N				5/22/2017	
Groveport	Y	2,760	$2.00	$1.45	5/22/2017	
Hilliard	Y	2,000	**$3.00**	**$3.00**	5/22/2017	**proposing two future increases**
Lancaster	Y	2,600	$7.64	$5.88	1/21/2016	
Marble Cliff	N				5/22/2017	
Marion	N				5/12/2014	
Marysville	Y	2,700	$3.75	$2.78	5/22/2017	
New Albany	N				5/12/2014	
Newark	Y	2,600	$6.80	$5.23	5/22/2017	Annual increase of $0.15 through 2025; ending rate of $8.01/ERU
Pataskala	N				5/12/2014	
Pickerington	Y	2,530	$4.50	$3.56	5/22/2017	
Plain City	N				5/12/2014	
Powell	N				5/12/2014	
Reynoldsburg	Y	2,530	$4.00	$3.16	1/29/2016	
Riverlea	N				5/12/2014	
Shawnee Hills	N	2000	$1.98	$1.98	5/22/2017	goes to Columbus for Clean River Fund
Sunbury	N				5/22/2017	
Upper Arlington	Y	2,000	$3.75	$3.75	5/22/2017	
Westerville	N				5/12/2014	
Whitehall	N				5/12/2014	
Worthington	N				5/12/2014	
Average for CO Communities		**2391**	**$3.52**	**$2.99**		
Averages Rate	**48%**	**2441**	**$3.54**	**$3.11**		

STORMWATER UTILITY FEE BENCHMARKING

Benchmarking Residential Stormwater Utility Fee Rates

- Columbus - $4.65
- Pickerington - $4.50
- Gahanna - $4.33
- Reynoldsburg - $4.00
- Upper Arlington - $3.75
- Hilliard - $3.00
- **Delaware - $2.50**
- Groveport - $2.00
- Canal Winchester - $2.00
- Bexley - $1.98
- Shawnee Hills - $1.98
- Westerville – No fee
- Worthington – No fee
- **Dublin – No fee**


Belvedere

CITY OF DELAWARE STORMWATER UTILITY OVERVIEW

City of Delaware – Pop. Approx. 40,000

- Implemented in 2002
- Reasons for Stormwater Utility Fee
  - CIP project funding
  - Ongoing maintenance
  - Upcoming National Pollutant Discharge Elimination System (NPDES) compliance
- Communication Plan
  - Public Works Committee
  - City Council
  - Delaware Gazette

CITY OF DELAWARE STORMWATER UTILITY OVERVIEW

City of Delaware

- Stormwater Utility Fee Rate Establishment
  - Based on benchmarking of surrounding communities
  - Average rate was utilized
    - $2.50/month per 1 E.R.U.
    - 1 E.R.U. = 2,773 SF of impervious area
- Current Maintenance
  - Catch basin repair
  - Pipe cleaning/televising/replacement
  - Stormwater basin maintenance
  - Street sweeping
- Stormwater Utility Fee Revenue
  - $851,000 in 2018
  - $717,000 to date in 2019
- 2019 Stormwater Management Expenditures - $1.4 Million
  - Funded by stormwater utility fee and general fund

PREVIOUS CITY OF DUBLIN STORMWATER UTILITY FEE DISCUSSION

Dublin City Council – Council Community Development Committee

- April 13, 1998
  - Purpose of meeting was to review the recently completed Master Plan and provide a recommendation to City Council for adoption.
  - Master Plan identified funding needs – Stormwater utility fee was discussed as possible funding source.
  - Funding issues would be discussed in subsequent meetings.
  - Financial recommendations of the Committee will be to consider imposing impact fees on developers to pay for the capital improvements. Maintenance and operation will be recommended to be paid for with general funds.

PREVIOUS CITY OF DUBLIN STORMWATER UTILITY FEE DISCUSSION

Dublin City Council – Council Community Development Committee

- December 14, 1998
  - Purpose was for consultants to present a recommendation on funding for Master Plan.
  - Current method for stormwater funding was through the capital improvement fund and general fund.
  - At the time, five other communities in Ohio have a stormwater utility fee:
    - Wooster ($2.90/ERU)
    - Upper Arlington ($2.75/ERU)
    - Columbus ($1.64/ERU)
    - Forest Park ($3.00/ERU)
    - Cincinnati ($2.11/ERU)
  - Presented two option for this stormwater utility fee
    - Option 1: Charge $1.75/mo/unit with no water/sanitary connection fee
    - Option 2: Charge $1.31/mo/unit with a water/sanitary connection fee

Outcome of meeting was to discuss this topic at a future meeting because five Council members were not present.

PREVIOUS CITY OF DUBLIN STORMWATER UTILITY FEE DISCUSSION

Dublin City Council – Council Community Development Committee

- February 8, 1999
  - Purpose was for consultants to present a recommendation on funding for Master Plan with all City Council members present.
  - Reviewed different types of funding mechanisms
    - Tax increment financing
    - Impact fees
    - Voted taxes
    - Special assessments
    - Stormwater utility fee
  - Presented two option for this fee
    - Option 1: Charge $1.75/mo/unit with no water/sanitary connection fee
    - Option 2: Charge $1.31/mo/unit with a water/sanitary connection fee

The consensus from City Council was to not proceed with implementing stormwater utility fees at that time.

City Council suggested putting maintenance costs in the CIP.

FUNDING OPTIONS

Funding Options

- 5 Year Capital Improvements Program – Status Quo with Additional Funding
- Stormwater Utility – New

Maintenance Costs - *Capital Improvement Program (2020-2024 CIP)*

CITY OF DUBLIN | 2020-2024 | FIVE-YEAR CAPITAL IMPROVEMENTS PROGRAM 11-1

UTILITIES - STORMWATER MANAGEMENT

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DISCUSSION AND QUESTIONS

Thank You!

Paul A. Hammersmith, P.E.-Engineering/Director of Engineering

Todd Garwick, P.E. – Engineering – Utilities

Michael Hendershot, P.E.– Engineering/Review Services

City of Dublin
OHIO, USA

EVERYTHING GROWS HERE.

OWNERSHIP AND MAINTENANCE RESPONSIBILITY

History / Past Practices

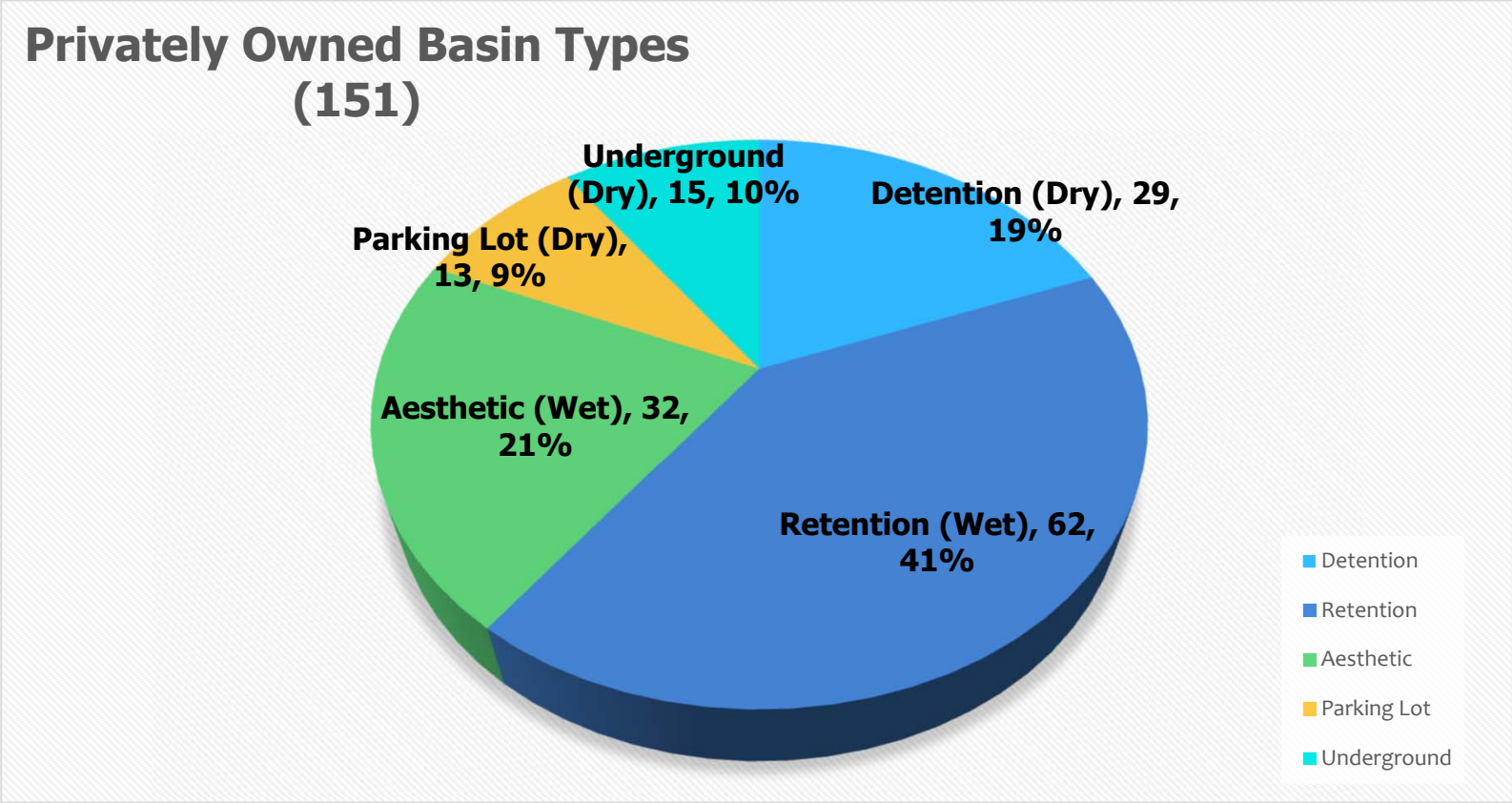
- Prior to ~1999 – HOA ownership and maintenance
- 1999 to ~2015 – Dublin ownership and HOA maintenance
- ~ 2015 – trended towards Dublin ownership and maintenance

BENCHMARKING

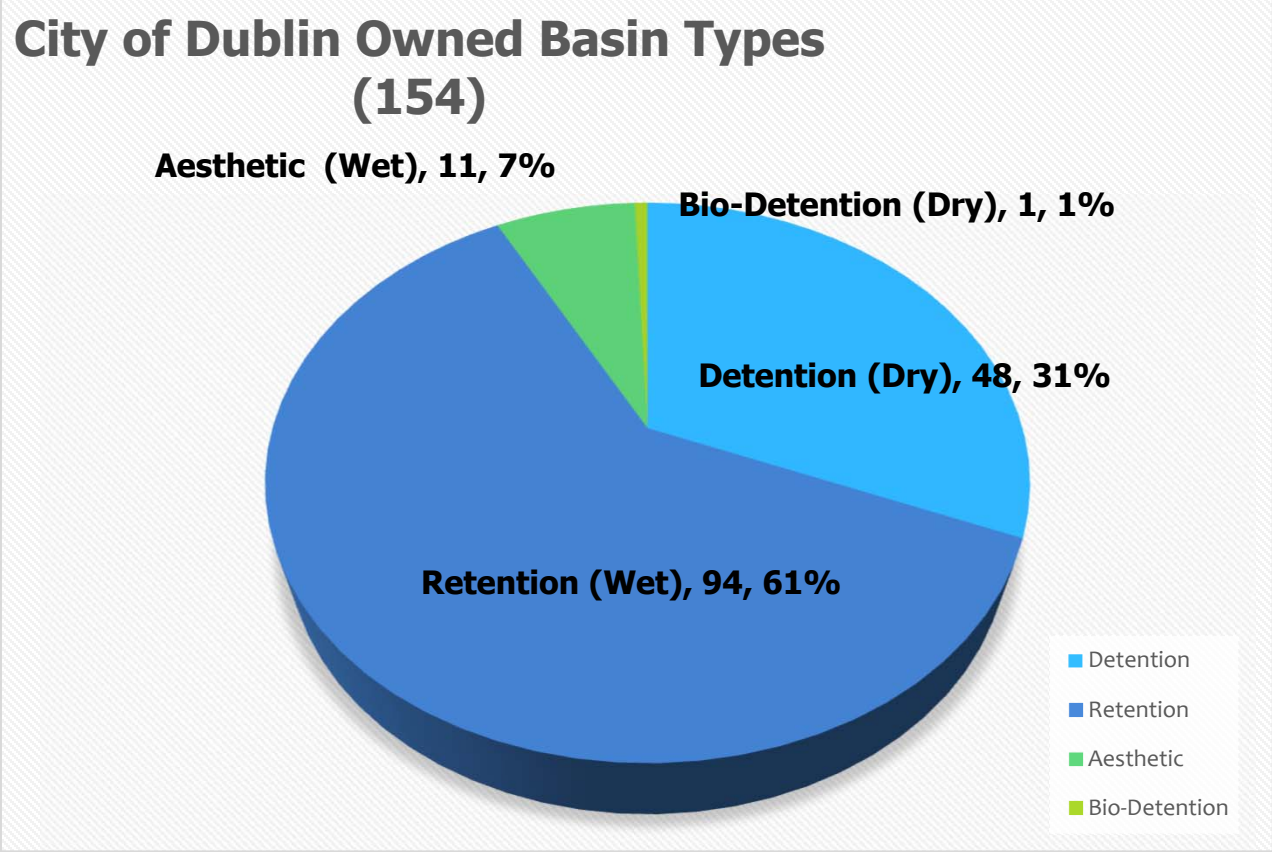
Homeowners Association (HOA) Maintenance

- Grove City
- Marysville
- Westerville
- Worthington

RESIDENTIAL STORMWATER BASIN INVENTORY -
Privately Owned Basin Types



RESIDENTIAL STORMWATER BASIN INVENTORY –
City of Dublin Owned Basin Types



STORMWATER BASIN INVENTORY – *CITY OF DUBLIN OWNED*
Maintenance Responsibility

	Residential Basin Type				
Maintenance Responsibility	**Detention (Dry)**	**Retention (Wet)**	**Aesthetic (Wet)**	**Bio-Detention (Dry)**	**Maintenance Totals**
Dublin Maintenance	37	60	11	0	**108**
HOA/Private Maintenance	11	34	0	1	**46**
Basin Type Totals	48	94	11	1	**154**

OPTIONS – *RESIDENTIAL STORMWATER BASINS*

Option #1

- Dublin maintain existing 108 residential stormwater basins
- HOA maintain existing 46 residential stormwater basins
- New basin maintenance determined on a case by case basis during planning process

OPTIONS – *RESIDENTIAL STORMWATER BASINS*

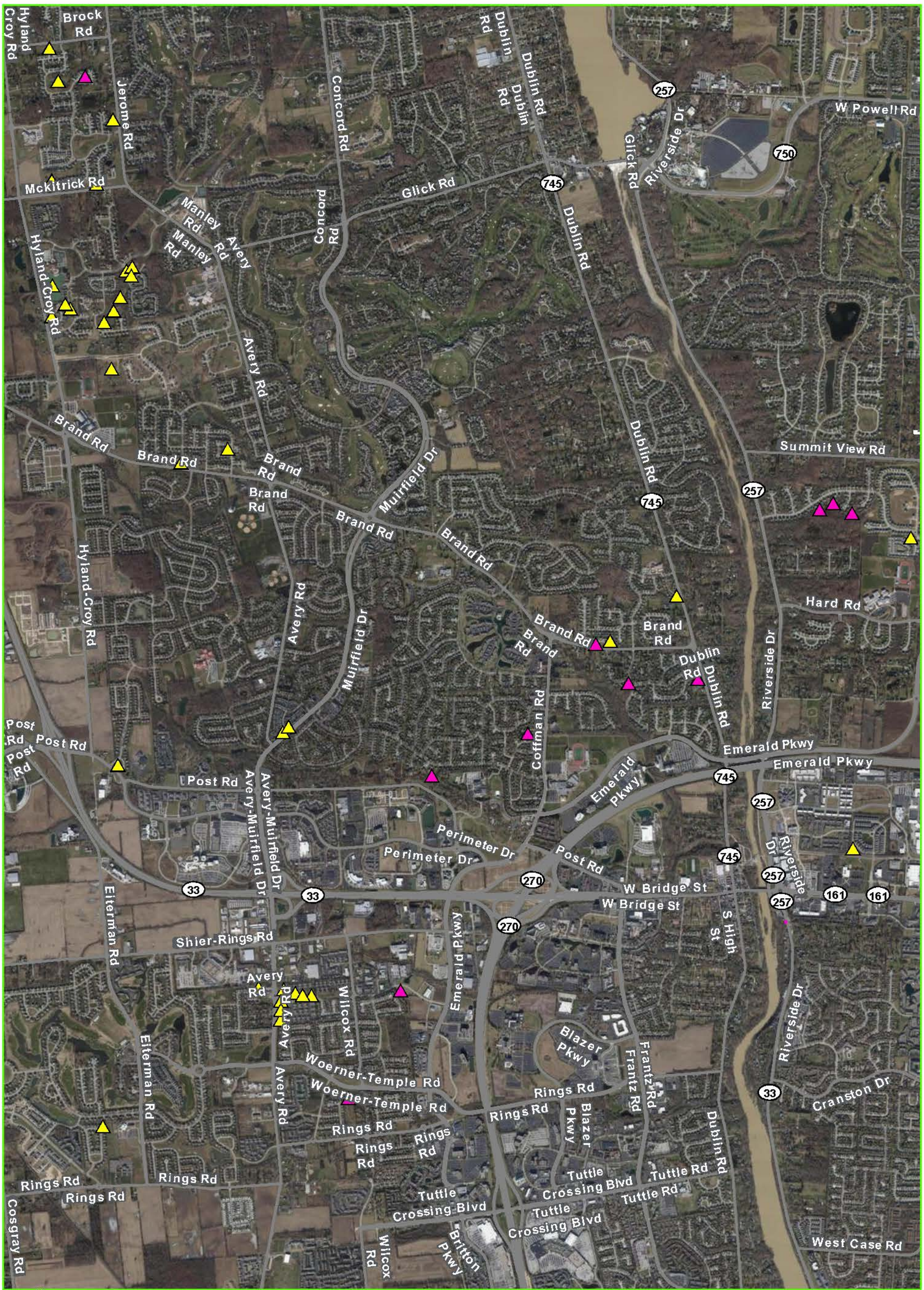
Option #2

- Dublin maintain existing 108 residential stormwater basins
- HOA maintain existing 46 residential stormwater basins
- HOA maintain new residential stormwater basins moving forward

OPTIONS – *RESIDENTIAL STORMWATER BASINS*

Option #3

- Dublin maintain existing 108 residential stormwater basins
- HOA maintain existing 46 residential stormwater basins
- Dublin maintain new residential stormwater basins moving forward



N
W E
S

City of Dublin Owned Residential Basins
Private Stormwater Basin Maintenance (46)
Detention (11) - Retention (34) - Bio-Detention (1)

1 inch = 2,500 feet

Legend

Ownership, Business Name

Dublin-Detention-Private

Ownership, Business Name

Dublin-Retention-Private

9/8/2019

Original survey May 12, 2014
Updated January 29, 2016
Current Update May 22, 2017

Central Ohio Stormwater Utility Rate Comparison						
Municipality	**Stormwater Utility? Y/N**	**ERU (S.F.)**	**SFU ERU Rate (per month)**	**Commercial Comparative rate using 2000 sf**	**Current Date of Data**	**Comments**
Ashville	Y	2,000	$3.00	$3.00	**5/22/2017**	actual rate is #0.0987/day
Athens	Y	NA; Charge Flat fee	$2.00	$4.00	**5/22/2017**	Flat fee based upon property type; want to institue an ERU system
Bellefontaine	Y	2,500	$3.75	$3.00	**5/22/2017**	Calculated Commercial rate average (See Note 1)
Bexley	N	2000	$1.98	$1.98	2/5/2016	goes to Columbus for Clean River Fund
Canal Winchester	Y	3,001	$3.00	$2.00	5/12/2014	
Cambridge	Y	-	$1.00	$2.00	2/1/2016	Fixed monthly rate for both
Circleville	N				5/12/2014	
Columbus	Y	2,000	$4.65	$4.65	**5/22/2017**	($0.1530 per day per ERU based on 366 days due to leap year)
Delaware	Y	2,773	$2.50	$1.80	**5/22/2017**	**considering future increases**
Dublin	N	-			**5/22/2017**	
Gahanna	Y	3,064	$4.33	$2.83	**5/22/2017**	
Grandview Heights	N				1/21/2016	
Grove City	N				**5/22/2017**	
Groveport	Y	2,760	$2.00	$1.45	**5/22/2017**	
Hilliard	Y	2,000	**$3.00**	**$3.00**	**5/22/2017**	**proposing two future increases**
Lancaster	Y	2,600	$7.64	$5.88	1/21/2016	
Marble Cliff	N				**5/22/2017**	
Marion	N				5/12/2014	
Marysville	Y	2,700	$3.75	$2.78	**5/22/2017**	
New Albany	N				5/12/2014	
Newark	Y	2,600	$6.80	$5.23	**5/22/2017**	Annual increase of $0.15 through 2025; ending rate of $8.01/ERU
Pataskala	N				5/12/2014	
Pickerington	Y	2,530	$4.50	$3.56	**5/22/2017**	
Plain City	N				5/12/2014	
Powell	N				5/12/2014	
Reynoldsburg	Y	2,530	$4.00	$3.16	1/29/2016	
Riverlea	N				5/12/2014	
Shawnee Hills	N	2000	$1.98	$1.98	**5/22/2017**	goes to Columbus for Clean River Fund
Sunbury	N				**5/22/2017**	
Upper Arlington	Y	2,000	$3.75	$3.75	**5/22/2017**	
Westerville	N				5/12/2014	
Whitehall	N				5/12/2014	
Worthington	N				5/12/2014	
Average for CO Communities		**2391**	**$3.52**	**$2.99**		
Averages Rate	**48%**	**2441**	**$3.54**	**$3.11**		

% with SWU **56%**

Note 1 : For Commercial & Industrial Bellefontaine has a graduated fee schedule: $11.74- 1-10,000 s.f., $27.34-10,001-25,000 s.f., $58.61-25,001-50,000 s.f., $117.19-50,001-100,000 & $234.38 over 100,000

UTILITIES - STORMWATER MANAGEMENT

(MUNIS) PROJECT NO.	DESCRIPTION	2019	2020	2021	2022	2023	2024	TOTAL 2020-2024 ($000)	BEYOND 2024 ($000)	TOTAL BUDGETED
CAPITAL MAINTENANCE										
AF201	Annual Stormwater Maintenance	575	575	575	575	575	575	2,875	575	3,450
AF202	Ditch Maintenance	0	0	100	0	100	0	200	100	300
	TOTAL	**575**	**575**	**675**	**575**	**675**	**575**	**3,075**	**675**	**3,750**
CAPITAL ENHANCEMENTS / NEW CAPITAL INFRASTRUCTURE										
EF181	Rings Farm Stream Relocation	150	1,240	0	0	0	0	1,240	0	1,240
EF200	Allocation for Various Stormwater Improvements	250	250	250	250	250	250	1,250	250	1,500
	TOTAL	**400**	**1,490**	**250**	**250**	**250**	**250**	**2,490**	**250**	**2,740**
2020-2024	**TOTAL - STORMWATER**	**975**	**2,065**	**925**	**825**	**925**	**825**	**5,565**	**925**	**6,490**
2019-2023	**TOTAL - STORMWATER**	1,485	825	925	825	925	n/a			
	$$ Difference	(510)	1,240	0	0	0	n/a			
	% Difference	-34.3%	150.3%	0.0%	0.0%	0.0%	n/a			

UTILITIES - STORMWATER MANAGEMENT CAPITAL MAINTENANCE

Note: The Capital Improvement Tax Fund is the source of funding for all of the stormwater projects.

AF201 Annual Stormwater Maintenance

This project provides for annual funding of maintenance for the City's stormwater system as identified in the Stormwater Master Plan. This program was initiated in 2000 to maintain the stormwater management system, to convey stormwater, and prevent flooding. The funding is utilized to maintain and repair existing storm sewer lines, curb inlets, catch basins, man-made channels and other structures that discharge stormwater runoff. This is an important component of the City's efforts to meet National Pollutant Discharge Elimination System (NPDES) Phase II regulations. The annual allocations will be used to fund two projects: Inlet maintenance and miscellaneous maintenance on a task order basis.

Funding is allocated annually in the five-year program period to continue the repair of curb inlets in the storm structure maintenance program.

AF202 Ditch Maintenance

The ditch maintenance program was initiated in 2017. This project provides funding for maintenance of the City's roadside ditches and waterway systems. Funds will be utilized to maintain and repair existing ditches, man-made channels, and waterways that convey stormwater runoff. This is another important component of the City's efforts to meet National Pollutant Discharge Elimination System (NPDES) Phase II regulations.

Funding is programmed in the five-year program period on a biennial basis.

SHAPING RESILIENT COMMUNITIES
2019 Summit on Sustainability
October 11, 2019
Hilton Columbus Downtown
Columbus, Ohio 43215

Mid-Ohio Regional Planning Commission MORPC
Report from: Ann Bohman, Steve Dritz and Marilyn Baker
Community Service Advisory Commissioners (CSAC) for the
City of Dublin, Ohio

COMMUNITY REVITALIZATION AND SUSTAINABLE AND EQUITABLE ECONOMIC DEVELOPMENT – Keynote Speaker Christopher Coes, Smart Growth America Real Estate Programs (for profit subsidiary of SGA)

How to create places that are from our memories (senses, experiences, places that are healthy, prosperous, & resilient. Competition over place and private capital: Young professionals look for place before jobs.

How to attract and retain talented workers: walkable, where people want to meet, supports creative collaboration, built brand identity and community culture, to be close to customers and other businesses, centralized operations.

Social benefits of resilient communities – cut infrastructure costs.
We need a National Infrastructure Plan/Vision: We don't need more $ spent on more lanes; We need to prioritize safety, more walkable, and repairs.

Housing – 32%; Transportation 19%; Disposable 48%; if less than 50% walkable – may be paying up to 50% more in Transportation and housing;

Walkable urban – 9% transportation costs; Suburban – 25%; 20-30% of costs go up for poor when move from urban core to suburbs.

Developers and Investors need: 1. Clear, articulated vision, 2. Predictability/ what is possible over 5-10 years, 3. Give and take, 4. Create political will.

Develop collaboration for Workable solutions: New rail, adopt complete streets with pedestrian experiences, adapt for base costs and environmental review of standards; establish priority corridors; identify and preserve existing affordable housing stock; create place management; Value in open space & common space**:** place for people to get connected – how to get real estate people to make more open space? Density - need human scale development; smaller size lots or garden units; affordable housing; walkable areas.

PLANNING FOR ENVIRONMENTAL HEALTH EQUITY

64% of college graduates choose the city they want to live in before they decide on a job offer.

Walking Score-average is 70! Check your score!

(My community: **Hemingway Village** is a not walkable neighborhood in Dublin with a **Walk Score** of 17)

Recommend that you don't spend more than 50% of your income on housing and transportation.

COMMUNITY CONNECTIONS: THE WIDER IMPACTS OF ENERGY PROGRAMS

Be Air Awareness Program

Suggested putting air quality sensors in our Little Libraries.

Capital Area Council of Governments www.capcog.org

Four out of 10 people breathe unhealthy air according to the World Health Organization (WHO).

BOUNTIFUL OHIO

Planting green - improves soil and water quality.

Sunflowers planted in fields brings butterflies.

Obesity numbers are the same as the number that are hungry.

A DISCUSSION ON HB6: AN UNCERTAIN FUTURE FOR OHIO'S ENERGY STANDARD

Note: All presenters were against HB6.

No presentation for the pros f HB6.

Highlights of HB6 were presented including subsidies being made by Ohio consumers

- Eliminated energy efficiency and renewable energy programs
- One plus of HB6 is increased funding to cover energy expenses for low income households

In Ohio, use of natural gas to generate electricity still the least expensive means

Cleanup of the two nuclear plants, when decommissioned, is still an unknown as First Energy has filed bankruptcy

Status of HB6 referendum was not known, pending court ruling

IMPROVING WATER QUALITY OUTCOMES FROM DEVELOPMENT - EFFECTIVENESS OF STORMWATER MANAGEMENT PRACTICES AT IMPROVING WATER QUALITY

Creation of wetlands is good way to manage stormwater - - Westerville has implemented a model wetland program

Ohio has loss 90% of its natural wetlands – 2nd most in US

Effective stormwater management leads to documented water quality improvements
Many areas in Central Ohio like homes east of Sawmill, north of Rt 161, have no stormwater management system in place - - natural erosion is occurring from water run offs after rain
Grove City Police Station is a model for stormwater management using state of the art technologies like retention tanks

INSIGHTS ON THE STATE RECYCLING AND THE ROLE OF COMMUNITIES

Panel discussion with reps from Rumpke, SWACO, Ohio EPA and P&G
When China stopped importing US recyclables due to contamination a couple of years ago, market for recyclables in US dropped
Rumpke has plants to reuse recycled paper and glass
Landlords are terrible at offering recycling to their tenants
Curbside food waste recycling next big thing–SWACO putting together guidelines to have standard processes for Central Ohio
P&G in 2030 wants all packaging to be recyclable or reusable

WE'RE GONNA HAVE 500 MILES OF BIKE TRAILS; HERE'S HOW WE'LL GET IT DONE

In 2018, the Central Ohio Greenways Board (under MORPC) make up of 11 county-region of jurisdictions, published a trail vision map through extensive community collaboration, to add 500 new trail miles to the existing network of over 230 trail miles, with a $250M vision – vision is huge. How region's leaders, advocates, and planners believe trails can positively impact transportation options in region and what is needed to do this.

Feasibility study: if half of funds could be garnered thru philanthropy.
Issue of awareness: a. not aware of trails under MORPC; b. unclear difference between local and regional trails; c. private sector wants to spend $ but ask why expect philanthropists to contribute to what public has historically funded? d. internally not a 501(3)(c); externally is this where we want to put our money?
Identity: Is it for health or transportation? How to prioritize the issue, who owns the land? who maintains the trails? Private sector enthusiastic, but public needs to be first. How to frame the value by 4 pillars: Social Equality, Environment, Economy, Health.
Scale of effort: other parts of country dealing with single trails and much small efforts; on microscale – like Eisenhauer's vision of road across America: need political will. Metro parks: 8 fundamentals for levy – building trails was top of list – value of trails appreciated; most favorable vote. Trails are 24-hour operation-can't have a day off, which is why Metro Parks will maintain the trails.
Need to create a narrative the people: 1. Understand and can get excited

about, 2. is believable (can happen) so people support thru 3. Initial steps with certain sense of urgency, and 4. Then need successes – demonstrate value in narrative; then will develop life of its own.

Smart Columbus – Transportation is the great equalizer; most valuable to residents; what is % of population within 10 min walk to greenspace of trails and walk-ways.

Collaboration/integration of bike lanes/coco bikes/COTA – common payment system; Trails are important integrative part of discussion with jaded half-million increase in population.

Need to re-prioritize what is important to region. Political will = community social activism. Need to build momentum - to keep energy around issue if going to be sustainable; can't meet goals without trails. There is need for sense of urgency in small groups of people to be successful; then get something done.

Currently transportation $ are used only for transportation trails; not health (economic and community health; need greater investment need. Signs that say "no motorized vehicles" is the wrong message.

FROM CONCEPT TO ACTION: CREATING SUSTAINABLE COMMUNITIES THROUGH FOCUSED GROWTH

Insight2010 Corridor Concepts study shows us, through collaboration and regional vision, how focused growth, walkable neighborhoods, and high-capacity transit can have positive impacts on transportation, infrastructure, housing, and the environment. Central Ohio communities working with regional partners to put the Corridor Concepts recommendations into practice. Working together to improve mobility and housing options along the East Main Street corridor (Reynoldsburg, Whitehall).

How do we grow as a region? What drives our choices? Taking right steps forward to grow smart. What are the costs?

One million people coming to this region by 2050; 420,000 houses; 610,000 jobs;

Need tools to understand trends and how to accommodate; several organizations and communities need to come together. Need to incorporate compact, walkable, mixed-use areas.

How to meet 2.7 billion fewer miles driven in 2050; 260,000 cars off roads; what are water use impacts, greenhouse gas emissions, fiscal impacts? How to lower infrastructure costs by 27%.

HIGH COMFORT NETWORKS: MOVING THE NEEDLE ON INCREASING BICYCLING IN CENTRAL OHIO

Large percentage of Central Ohio residents are interested in bicycling but are concerned for their safety. This is real, often cyclists are forced to ride in traffic with no protective barrier. Many international cities have long created low-stress networks for pedestrians and bicyclists. Stateside, similar efforts are starting in Houston, New Orleans, Providence, and Austin. Could Central Ohio be next? Some current strategies have limited return on investment and fail to move the needle in attracting more riders, and how complete low-stress networks help maximize bicycle friendly potential.

Sharrows in 35 mph traffic; don't work; car speed is one reason it does not work; changing signs doesn't change behavior
Protective bike lanes – i.e., pilons/planters; in Amsterdam from 2005-2017 increased riders from 7,000 to 70,000
Remove parking spaces/vehicle lane – but need political will to do this
Average rt of way 6-8 feet, or 3' distance
Tough decisions in critical corridors – we all want to use that space; Rt 23 No. of I-270 has sidewalks, but along side of seven lanes of traffic – who wants to walk there? Complete streets focusers on narrow vehicle lanes with setbacks for bicycles
Land use – transportation – health: traditional zoning exacerbates health disparities
Need to think about Transportation – not just bicycling routes; spaces within your community; need dedicated space for transit.
Need to find success areas to start (like vehicle lanes wider than need to be or too fast)
Need test community area/demo project; existing processes are road builders
Design the message; make friends with communications
[From earlier session: Vision – understandable – believable – sense of urgency]
Package the massage tightly (like Denial OH, Got Milk); Brand it like People for Bikes; Be the Example; Bikes are for regular people
Do communities know about insight 2010? Be short, sweet, and funny. Not a lot of packaging and sharing AFTER zero budget for an issue.
How to get employers on board? (San Francisco is example)
How do you reach out when communities have adverse reactions to higher density development and apartments? How much engagement is needed? – triple it! Need to educate.
Amazon looked serious at Columbus – one concern was about transit; that changed the discussion
To do: 1. Demo, 2. Protect a lane/beautiful, therefore, comfortable, 3. First mile – last mile; we have pieces, networks but need the first and last barriers addressed; fill the on-road to off-road for connection

Community Services Advisory Commission

December 10, 2019

Minutes

Commission Members:	**Present:**	Marilyn Baker, Thomas Strup, Ann Bohman, Vivekanandan Arunachalam, Steve Dritz, Alice Kanonchoff, Elizabeth McClain
	Absent:	None
Staff Members Present:		Nick Plouck, Management Assistant J.M. Rayburn, Planner I
Guests:		Mayor Greg Peterson

I. Call to Order

Mr. Strup established that a quorum was present and called the meeting to order at 6:39 p.m.

II. Oath of Office for Alice Kanonchoff

Mayor Greg Peterson administered the Oath of Office for Alice Kanonchoff. Mayor Peterson welcomed Ms. Kanonchoff. She has been highly recommended from a number of groups that she has been involved in.

Mayor Peterson shared with the Commission that he had a visit with his daughter at her college on parent's weekend and they rented Lime scooters. He discussed the benefits of using the scooters, such as seeing more the campus utilizing the scooters. They drove the scooters on the sidewalks throughout campus and the cost to rent them was very reasonable. The scooters were battery powered and after using them for four hours, then never came close to dying. He would like the Commission to discuss more possibilities of utilizing them in Dublin.

Ms. Baker commented that the Commission discussed this topic and one issue is that the City has an Ordinance that prohibits their use on sidewalks. Mayor Peterson said there would definitely be some work involved to determine how Dublin could utilize them, but the City can't shy away from continued discussion, as they are out there everywhere.

Mayor thanked the Commission for dedication and time to serve on this Commission. He said Council would like to see this Commission become more energized and involved, similar to how the Planning and Zoning Commission operates. He encouraged the Commission members to let Council know if there were any topics, they would like to discuss.

III. Public Comments on Items Not on the Agenda

No public comments. Mr. Strup asked all Commission members to take a few minutes to introduce themselves. The Commission members all introduced themselves to the group.

IV. Approval of Meeting Minutes

Minutes from the November 12, 2019 meeting were distributed via email for review. Mr. Strup asked if there were any corrections to the minutes. There being no changes, Ms. Baker motioned to approve, and Mr. Dritz seconded the motion. All in favor, the November meeting minutes were approved.

V. Approval of the 2020 Meeting Dates

The 2020 meeting schedule was distributed via email for review. Mr. Strup asked if there were any issues with the meeting dates for 2020. There being no changes, Ms. Kanonchoff motioned to approve, and Ms. Baker seconded the motion. All in favor, the 2020 meeting dates were approved.

VI. Stormwater Management

Mr. Plouck said the Engineering staff is still working on a draft memo for this Commission to review. Mr. Plouck commented that Paul Hammersmith asked if the memo could be reviewed at the January meeting. The draft memo will be sent to this Commission prior to the January meeting for review.

VII. Sustainability Update

Mr. Plouck said this Commission has been involved in the Sustainability Plan over the last year. Some of the Commission members may recall when we finalized the Sustainability framework with this Commission, staff also asked to bring forward a proposal to establish a Sustainability Advisory Team. The team would be comprised of residents and different community members that could provide community input to help meet the goals that were established in our Sustainability Framework and to start to think about what a community plan might look like as a part of the Sustainability Framework. This team was established, and we had our fourth meeting of the year on December 10, 2019. There are currently between 20-25 active members. Mr. Plouck said at the meeting was more of a work session and the group established categories of focus for a future sustainability framework that will stretch from 2021-2025.

Mr. Strup commented that everyone in the group has been somewhat involved but there was a lot of interaction at the last meeting. They want everyone to be involved, not just the City of Dublin, but also the schools, the private sector and the community has a whole to come together and be prepared.

Mr. Plouck highlighted some of the topics of the Sustainability Framework such as mobility, diversion, Dublin Sustainability Advisory Team, Complete Streets and Fleet. Mr. Plouck shared some statistics for diversion from the Dublin Irish Festival from 2019. The landfill diversion percentage increased to 41.5 percent. The City also received a small grant from SWACO that funded a group that was present from the beginning until very end of the festival to sort every

bag of trash they could and pulled out all of items that could be recycled. Mr. Plouck said staff is also working with the Community Events Division to review their policies for all aspects of the festival to protect our environment.

Ms. Baker asked if the 41% diversion rate for the festival is comparable to the City's overall conversion rate. Mr. Plouck said the City's overall conversion rate is around 49%, so they are very similar.

Mr. Plouck commented that the City passed a Resolution in support of the Complete Streets Program. Mr. Dritz asked if Mr. Plouck could reiterate what the Complete Streets Program is. Mr. Rayburn replied that the Mid-Ohio Regional Planning Commission (MORPC) has best practices for Complete Streets. There are different components of Complete Streets such as the roadway, right-of-way, shared-use path, sidewalks and accessible paths for everyone regardless of individual disabilities. In addition, with the Complete Streets program comes the Smart Streets, which includes the intent of having fiber optics. MORPC will be proving guidance on Complete Streets and Smart Streets.

Mr. Plouck said in 2020 staff is going to start working on the future framework along with the Sustainability Advisory Team. Once we have, some language drafted then staff would like to bring that draft, when ready, back to this Commission for review. In addition, we realize that there may be some budget implications as a part of this framework, so we want to make sure we have the appropriate timelines in place to coordinate with the budget process.

Mr. Dritz asked Mr. Plouck if staff could provide an update on the status of Sustainability Framework 1.0 before bringing 2.0 to the Commission to review. There was a lot of information in the first framework and it would be great to have an update on it. Mr. Plouck said he would work on putting together some type of summary of the status.

VIII. Bicycle Update

Mr. Plouck said as some may recall we had the Lime Bike share pilot program in place for a year. We received all of the data from Lime Bikes and based on that data, staff asked for some dedicated money for a docked bike share program in the City's CIP budget. The budget request was approved by City Council in the CIP budget. Staff is looking into different vendors at this time.

Mr. Dritz asked why money was requested in the City's CIP budget. He thought the vendor supplied the bikes and docking stations. He asked what the City needs to do to move forward. Mr. Plouck said the City needs to have the infrastructure in place for a docking station. A good example is CoGo bikes. The actual docking station is paid for by the City. Mr. Rayburn commented that every few years MORPC has additional funds to invest transportation dollars in different communities. Bexley, Columbus, and Grandview Heights all collaborated to help get funds to pay for that system. So, although there are costs associated with these programs, there are also opportunities to get support from grants to help pay for these programs.

Mr. Plouck said there is no update on scooters at this time. The City has not had anyone reach out to the City, in regards to placing scooters in our community. One of the encouraging things we continue to see, is allowing other communities to drive some of the change that need to take place around the management of these programs that are currently in place.

Mr. Strup said he thought that statewide they are looking into legislation for scooter laws. Mr. Strup commented for Mr. Arunachalam and Ms. Kanonchoff that this Commission discussed scooters extensively and made a recommendation to Council not to do anything at this time, but to leave the door open to discuss again at some point. This Commission discussed the possibility of doing a pilot program and once we discussed the areas that made the most sense to do them in, we realized that connection was another factor in using scooters.

Ms. Kanonchoff asked if anyone discussed using scooters on the new walking bridge when it is complete. Mr. Strup commented that the bridge would be a shared-use path and scooters are currently not allowed on shared-use paths.

Mr. Plouck commented that as staff sees this topic move forward in other communities, we will continue to update this Commission.

Mr. Plouck said one topic that came out of the discussions this Commission has had on scooters has been etiquette. It has been determined that residents already seem to be experiencing some general etiquette concerns that need answered and addressed. We have been working with our planning and engineering staff in coordination with wayfinding and hope to address some of the concerns. After discussing this topic with our engineering staff, it has been determined that they are discussing the appropriate etiquette signage for the new pedestrian bridge. When it opens, residents will be excited to use it and staff wants to make sure the proper etiquette is used so the bridge is safe and fun for all users.

Mr. Plouck commented that wayfinding is a specific area that staff has been working on, not only from the bicycling side but also from a mobility standpoint. Mr. Plouck said that Mr. Rayburn would discuss this as a part of the mobility update.

IX. Mobility Study Update

Mr. Rayburn shared some information regarding mobility. He started by discussing the bikeshare and wayfinding. The City had a bikeshare pilot program with Lime, which was valuable because they provided some data for staff to work with to identify some other opportunities. The City is looking at ROAM for a doc bikeshare program. The City has to bid out anything over $75,000, so it could possibly be CoGo Bikeshare based on cost, but we will go through the bidding process and see what happens. Mr. Rayburn said the said the City also had a pilot program for wayfinding in 2019. Staff adhered foil stickers to the shared-use paths. Due to feedback, we used pavement markings instead of more signage on the path. Riders said pavement markers were more convenient. Also, from a cost perspective, it is easier for the City to maintain the pavement markings and foil adhesives. Staff is finalizing the design of the

markings. Staff is evaluating the different path users and see what make the most sense based on the users. We are evaluating different routes based on visitors, families and workforce mid-day routes to use for lunch breaks.

Mr. Dritz asked what the ROAM docked bikeshare is. He also asked what the bike in the photo to the right of the presentation was. Mr. Rayburn replied that the photo on the right in the presentation is a ROAM product. It is an electric bike, so it has the batteries and hardware on it. It has fat tires, which is supposed to be for convenience and comfort. Mr. Plouck said ROAM focuses on working with hotels and some tourism, so their bikes do have some novelty aspects to them, such as the fat tires and larger seat for comfort.

Mr. Dritz asked if there are peddles on the ROAM bikes. Mr. Plouck replied that there are. There are different settings on the bikes. At a maximum, these bikes can get up to approximately 15 miles per hour. Ms. Baker commented that they do not seem to be conducive to those wearing skirts and dresses.

Ms. Bohman asked if they are capable of having two riders on each bike or just one. Mr. Plouck commented they are for individual riders.

Ms. Kanonchoff asked if there are shorter/smaller bikes for shorter people. Mr. Plouck said he was not sure if there are different dynamics and sizes, but he could reach out to the representative and they would be more than happy to present some information at a future meeting.

Ms. Baker commented that the design seems as though it could be problematic for a senior person or arthritic person that would be interested in riding it. In addition, if someone were wearing formal attire, it would not be easy to ride. She noted some traditional and newer styles of bicycles are designed with a much easier step-through to get on the bike.

Mr. Strup asked if ROAM is geared more for tourism and CoGo is more for community function. Mr. Plouck replied that CoGo is more community based and in Central Ohio. It has been sustainable and expanding out to other suburbs across Central Ohio, which is very encouraging for our community. Mr. Plouck commented that he and Mr. Rayburn were connected with ROAM through mobility groups they have been involved. We are always happy to encourage people to come and check out Dublin for program opportunities.

Ms. Kanonchoff commented that if the City wants to involve some cultural or historical attention to this project, staff might consider involving the Historical Society. In addition, you could consider involving Leadership Dublin since they work on different types of projects and they might be able to assist with putting together a plan on how to get around the City.

Mr. Rayburn commented also that ROAM focuses on hospitality and CoGo focuses on a larger variety of users such as lunchtime users, recreational users and visitors. Typically, their docks

are spaced about a half mile to a quarter mile based on time increments, which their users on average use the CoGo bikes in half hour increments.

Mr. Rayburn said as a part of the City's mobility program there were two microtransit pilot programs launched in 2019. Staff determined there was a need for a micro transit program. COTA serves as a transit authority, but there are transit needs that are not being met.

Senior/Disabled Circulator

- Transitioned from three fixed routes to dynamic scheduling shuttle service. Started in October
- Available to older adults aging in place – Build opportunities for residents to stay in Dublin, but have the mobility independence to get where they need to be
- Rides can be requested 24 hours in advance
- Community Impact – January to November 2019
- 3,462 rides
- Popular destinations – Walmart, Dublin Plaza Kroger, Food Pantry
- 9 local retailers offer discounts to shuttle riders

Mr. Rayburn commented that they require funding. There are funds available through Section 53 funding through MORPC. The City received a grant for $65,000 in 2018 and we are requesting $100,000 in 2020. We have the information on the needs that are currently not being met based on demand. The City has had numerous requests for transportation to places of worship and some have requested transportation to visit the zoo, which is technically outside of the City.

Mr. Dritz asked what the hours of operations are for this service. Mr. Rayburn commented that currently the hours are Monday through Saturday from 10:00 a.m. until 3:00 p.m. If we can get more funding, then the City can expand those hours.

Ms. Baker asked if the circulator is available for medical appointments. Mr. Rayburn said there has been requests for non-ambulatory medical appointments and if we are able to secure the grant funds then we can look at adding that additional service.

Ms. Bohman asked if there is a cost for the rider at the time of service. Mr. Rayburn replied that there is no cost for the ride. The circulator program is completely subsidized by the City from grants and partners of the City. The cost per hour is approximately $80 per hour, which includes the vehicle, the driver and the benefits in coordination with the service. Dublin City Council has approved $250,000 in 2020 for the CIP budget to continue these services.

Mr. Dritz asked if the circulator transports directly from an individual's home. Mr. Rayburn commented that as of October the service transitions to any senior or person with disabilities that lives with the City of Dublin borders. Mr. Dritz also asked what locations are on the

transportation routes. Mr. Rayburn commented that the top three destinations are Walmart on Sawmill Road, Dublin Plaza Kroger, and the Dublin Food Pantry.

Mr. Arunachalam asked how an individual could acquire services. Mr. Rayburn said there is a phone number to call and there is an application on the smart phone to use. Although this service is for our senior and disabled residents, there are some residents that have facility coordinators and caregivers that schedule the rides for individuals.

Ms. Bohman asked if the Forever Dublin Hub is involved in this program. Mr. Rayburn said they are. Staff has been working with Christine Nardecchia in Outreach and Engagement, so you can request rides to Forever Dublin for appointments.

Mr. Rayburn briefly commented on the second pilot program.

Workforce Shuttle

- Last mile/first mile service to and from COTA bus stops
- Shift 1% of the current workforce to shared mobility
- Promote mobility as a workplace benefit
- Findings from pilot
    - Employees were taking COTA and then spending between $200/$400 per month for the first/last mile for trips through Uber/Lyft
    - The workforce shuttle on average saves 28 minutes in commute time
    - AC Marriott at Bridge Park has the highest ridership followed by Friendship Village of Dublin and Stanley Steemer

Mr. Rayburn commented that the City is trying to promote mobility as a workplace benefit. The City is asking large corporations to contribute towards transportation as well as other benefits. The larger corporations are benefiting from this service so we would like them to help with funding.

Mr. Dritz asked if there is a cost for the employee. Mr. Rayburn replied that there is no cost. Mr. Rayburn commented that the City of Dublin contributes towards the cost. The City has also collaborated through COTA to get grant funds through the Ohio Department of Transportation (ODOT). ODOT has $40,000,000 for 2020 to go towards transportation and transit throughout the state. There is a program called the Ohio Transit Partnership Program (OTP2). We collaborated with COTA and were given $338,000 in grant funds for 2020. $250,000 will be used towards the workforce shuttle, which matches the $250,000 that Dublin City Council also approved in the 2020 budget. The goal is to get $400,000-$500,000 per year in funds to take these from pilot programs to full mobility programs. We have met that goal for 2020. We will continue to apply for grants annually, but we cannot rely on them annually, which is why we need the private sector to contribute towards this benefit.

Ms. Kanonchoff asked if the City is encouraging the private sector to make this an employee benefit. Mr. Rayburn replied that the City is working with the private sector. An example is that

City is meeting with United Health Care on mobility services. The City is partnering with them on a job fair that is occurring in their Dublin office this month, to bring prospects from the COTA bus stops to the job fair to provide the opportunity that they may otherwise not have.

Mr. Rayburn continued to discuss the $338,000 received through ODOT from the City's partnership with COTA, still has a remaining $88,000, which will be used by COTA to expand service in our community. Two different changes will happen to help benefit our community.

1. The COTA route 21 has the highest origination of ridership from our community. We are able use some of this money to expand service hours so that second shift employees can take advantage of this route.
2. The COTA route 73 that runs along Riverside Drive from downtown Columbus. COTA is going add their first ever, reverse mid-day express route. The request was made by Crawford Hoying. This route is going opposite of normal traffic during a specific time of day. The route will be between noon and 2pm, which is the timeframe that employees are commuting from downtown to the Bridge Street district for work that starts in the afternoon. In addition, by being an express route there will be very few stops in between.

Ms. Baker said that COTA is looking more into having routes across suburbs, instead of just using basic hub routes between suburbs and downtown. Mr. Rayburn also commented that COTA's new leader has been phenomenal to work with and their economic development team has been wonderful to work with on these grants.

Mr. Dritz asked if the City is involved with the 33 Smart Corridor project. Mr. Rayburn commented that he has not been involved in that project, but he is aware of a $6 million grant that the City has received in partnership with the City of Marysville and Union County to add fiber optic broadband infrastructure for connection. Mr. Plouck said he can follow-up with the City Manager and get some information to follow-up with this Commission.

X. Other Items of Interest

None

XI. Next meeting: January 14, 2020

Mr. Plouck said the agenda for the January meeting should include reviewing the draft stormwater memo that the Engineering staff is finalizing. He also will be reaching out to Christine Nardecchia to see if she can provide an update about the Forever Dublin Program at the January or February meetings. Also, within the first few months of 2020, there will be some new members on this Commission, so the Commission will need to consider nominations for Chair and Vice Chair, so members were asked to start thinking about that for the upcoming meetings.

XII. Adjournment

The meeting was adjourned at 8:14 p.m.

Respectfully Submitted by:

Marja Keplar

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Marja Keplar, Administrative Support III

Attachments: 2020 Meeting Schedule
Project Update PowerPoint Presentation

City of Dublin

Meeting Schedule – 2020

Community Services Advisory Commission

January 14, 2020
February 11, 2020
March 10, 2020
April 14, 2020
May 12, 2020
June 9, 2020
**July 14, 2020
**August 11, 2020
September 8, 2020
October 13, 2020
November 10, 2020
December 8, 2020

All meeting dates are subject to change and represent the second Tuesday of the month unless otherwise noted.

Meetings are held at **6:30 p.m**. at City Hall located at 5200 Emerald Parkway, Dublin, Ohio 43017.

**The Commission plans to "recess" during July and August but will be available to meet if needed.

City of Dublin
OHIO, USA

SUSTAINABILITY UPDATE

NICK PLOUCK, MANAGEMENT ASSISTANT
JM RAYBURN, PLANNER

DUBLIN SUSTAINABILITY ADVISORY TEAM

- Meets Quarterly
- 20 – 25 Active Members
- Dec 10 Meeting

"Consists of residents, businesses, and other community leaders who provide input and feedback on an ongoing basis to update the Dublin Sustainability Framework and accelerate sustainability efforts throughout the community."

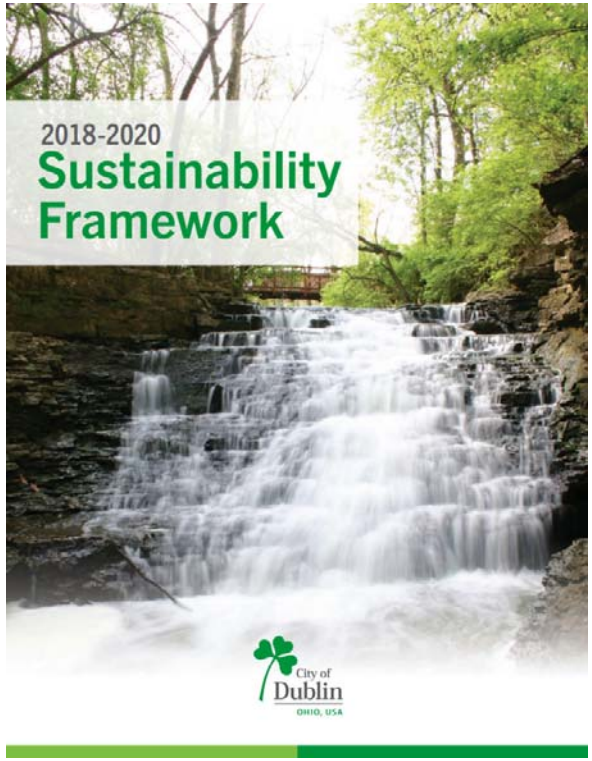
Jeremy Druhot | Columbus-Franklin County Finance Authority
Zack Griffin | Evolved Lighting Solutions
Dave Zehala | Plug Smart – Intelligent Energy Solutions
Craig Kasper | HULL & Associates
Kathya Mahadevan | Goken America
Janna Bidwell | Nestle Quality Assurance Center
Jennifer Noll | MORPC
Johnathan Gioffre | Modern Energy
Kevin Klingler | Dublin City Schools
Peter Nowell | Donegal Cliffs HOA
Derek Kauneckis | Ohio University
Jenny Amorose | Dublin Chamber of Commerce
Greg Waina | Hawks Nest Homeowners Association
Tom Strup | Community Services Advisory Commission
Evan Davis | Dublin City Schools – Student
Nelson Yoder | Crawford Hoying
Warren Fishman | Planning and Zoning Commission
Allegra Wiesler | OhioHealth
Jason Marhover | IGS Energy
Alex Burke | Cardinal Health
Kyle Gumto | Cardinal Health

SUSTAINABILITY FRAMEWORK

- Mobility
- Diversion
- Dublin Sustainability Advisory Team
- Complete Streets
- Fleet

SUSTAINABILITY FRAMEWORK 2.0

- 2020 Goals
- Timeline
- Categories of Focus



City of Dublin
OHIO, USA

BICYCLE FRIENDLY UPDATE

NICK PLOUCK, MANAGEMENT ASSISTANT

BICYCLING UPDATES

- Bike Share
- Scooters
- Etiquette
- Wayfinding

City of Dublin
OHIO, USA

MOBILITY UPDATE

JM RAYBURN, PLANNER

EVERYTHING GROWS HERE.

DUBLIN MOBILITY STUDY: BIKESHARE & WAYFINDING

- Bikeshares & Bike Path Markers
  - Lime Bikeshare Pilot (2018-2019)
  - ROAM dockless bikeshare (2020)
  - Docked bikeshare (2020)
  - Citywide shared use path wayfinding (2020)

DUBLIN MOBILITY STUDY: SENIOR/DISABLED SHUTTLE

- Senior/Disabled Circulator Pilot
  - Transitioned from 3 fixed routes to dynamic scheduling shuttle service in October 2019
  - Available to older adults aging in place
- Community impact from January to November 2019:
  - 3,462 rides
  - Popular destinations include Walmart, Dublin Plaza Kroger, and the Food Pantry
  - 9 local retailers offer discounts to shuttle riders

MOBILITY STUDY

City of Dublin OHIO, USA

DUBLIN MOBILITY STUDY: WORKFORCE SHUTTLE

- Workforce Shuttle Pilot
  - Last mile/first mile service to and from COTA bus stops
  - Shift 1% of the current workforce to shared mobility
  - Promote mobility as a workplace benefit

- Findings from pilot
  - Employees were spending between $200 to $400 a month in first/last mile trips (Uber/Lyft)
  - The workforce shuttle on average saves 28 minutes in commute time
  - AC Marriott at Bridge Park has the highest ridership followed by Friendship Village of Dublin and Stanley Steemer