Andersons Headquarters Bioretention Solutions

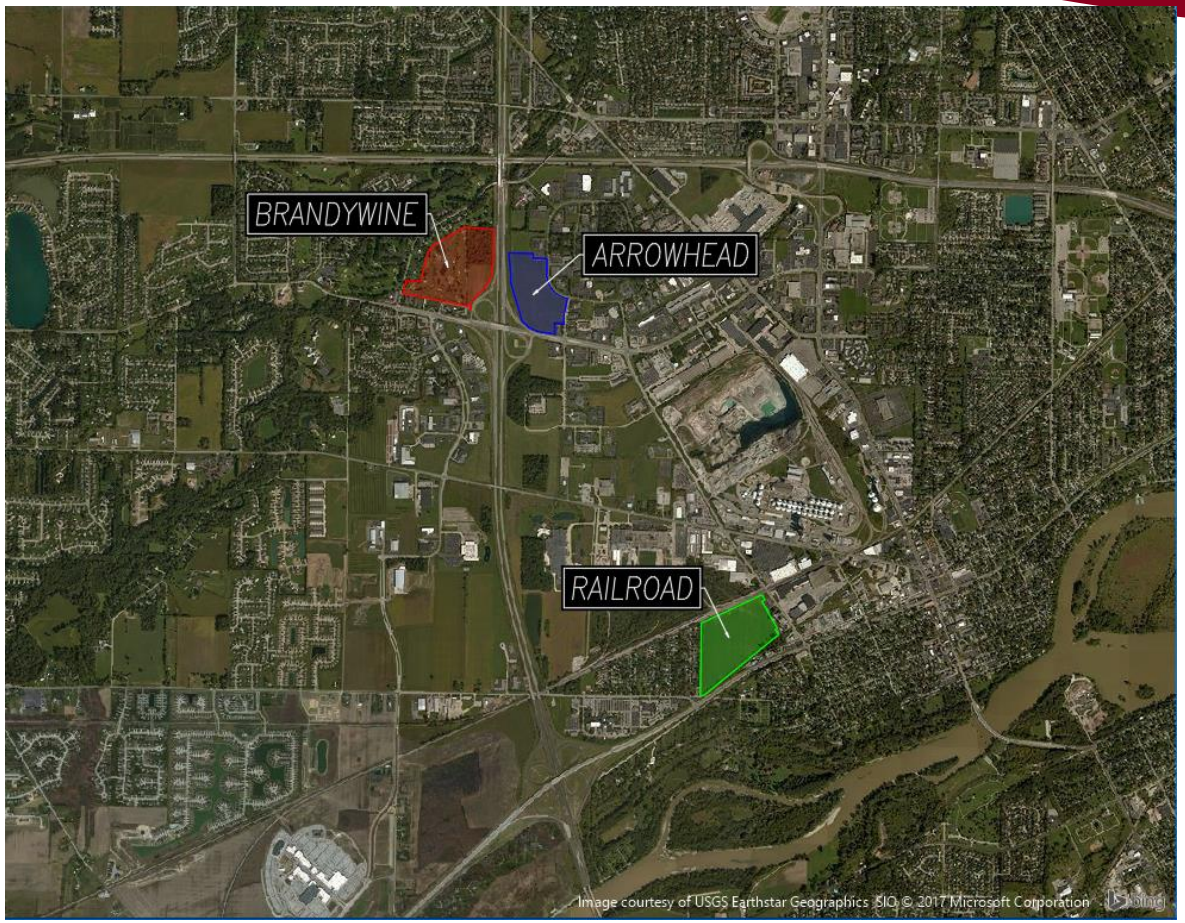
Prepared for:

County Engineers Association of Ohio

Storm Water Management & Drainage Conference

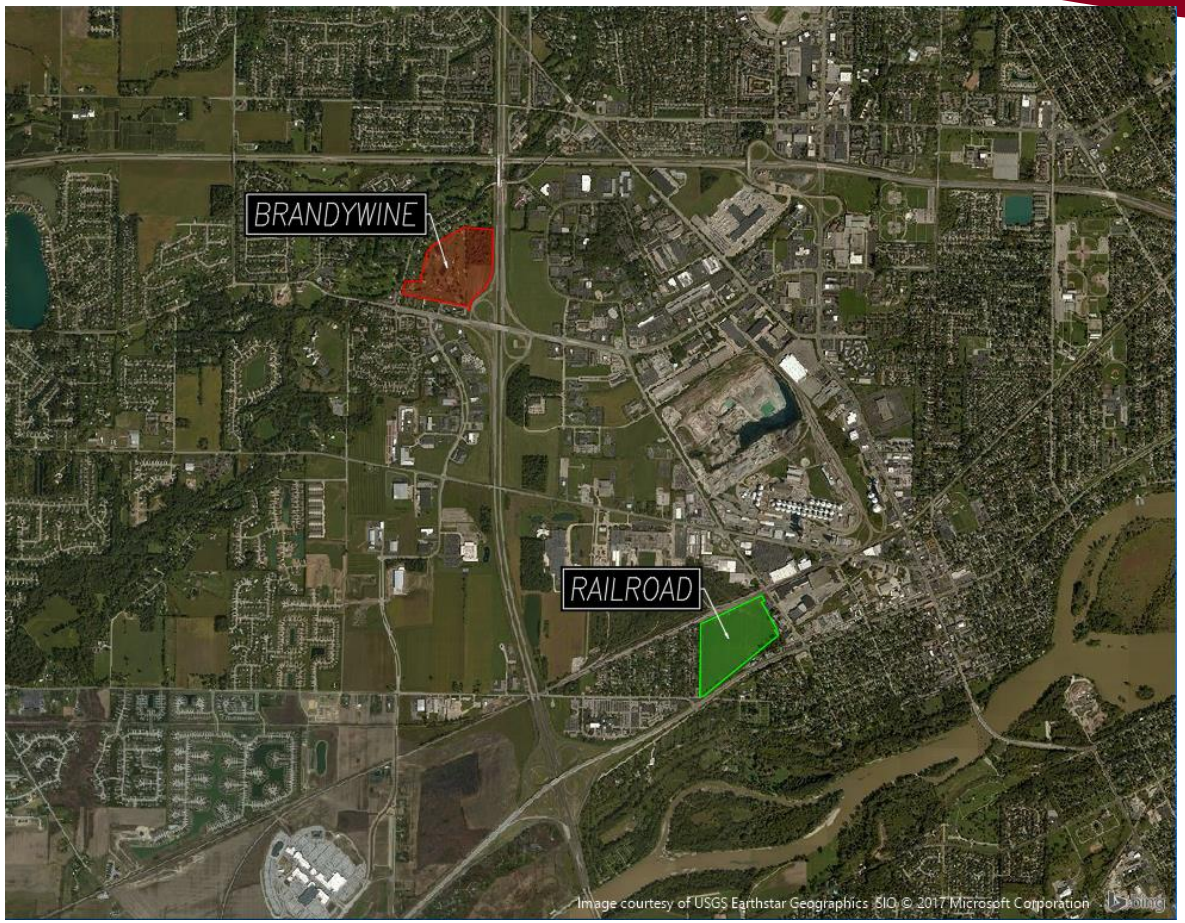
Site Selection

3 OPTIONS



Site Selection

2 OPTIONS



Brandywine Site Concept

Railroad Site Concept

- Do you see any resemblance?

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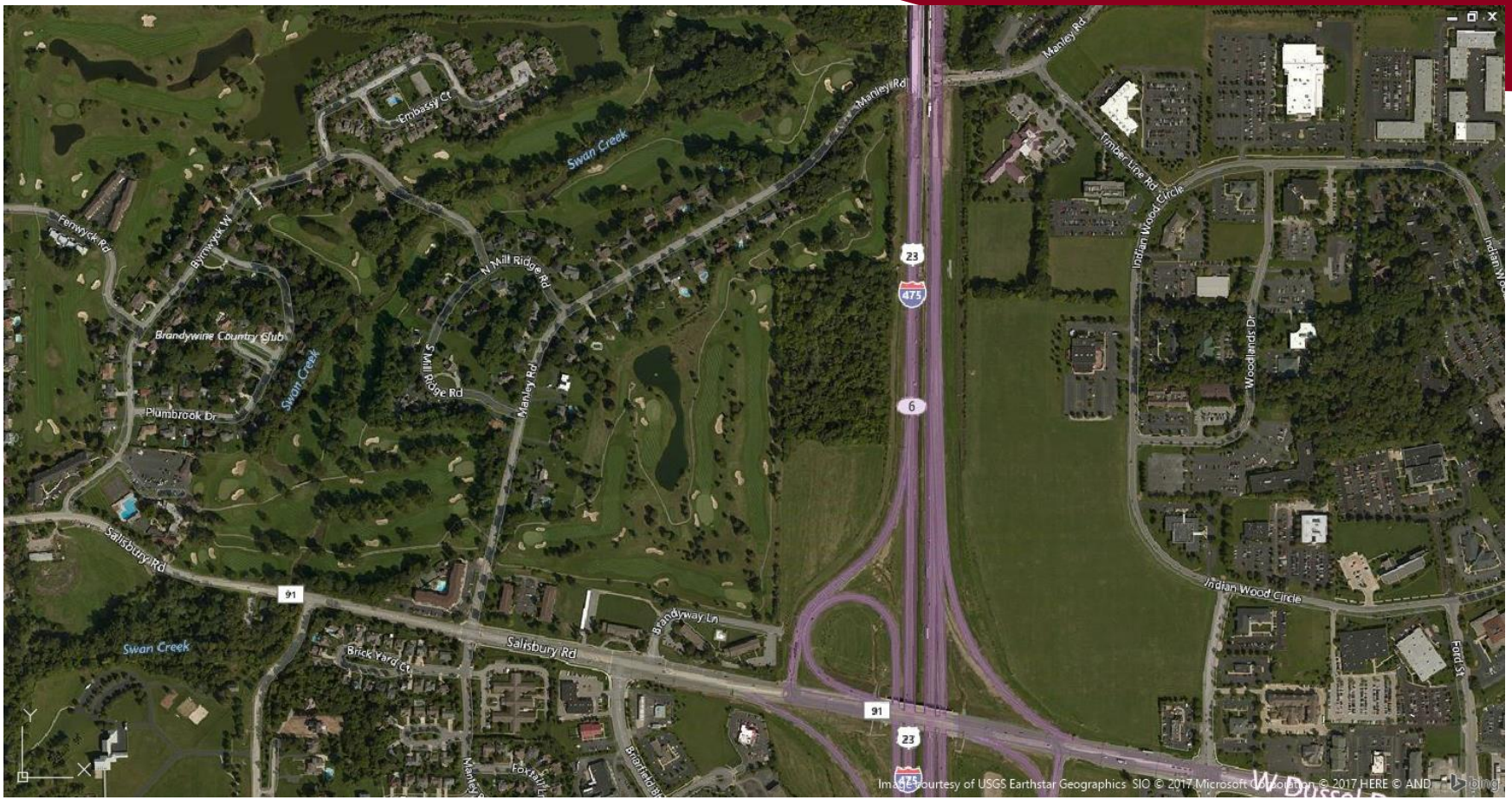
Brandywine Site Features



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Final Concept Plan

The Problem

How do you make a 140,000 Sq. Ft.,

3 Story Office Building

and 700 Car Parking Lot

DISAPPEAR?

The Solution

Raise Grade to Main Entrance

The Solution

Set Building Lower to Reduce Height Impact

The Solution

Use Natural Colors and Materials

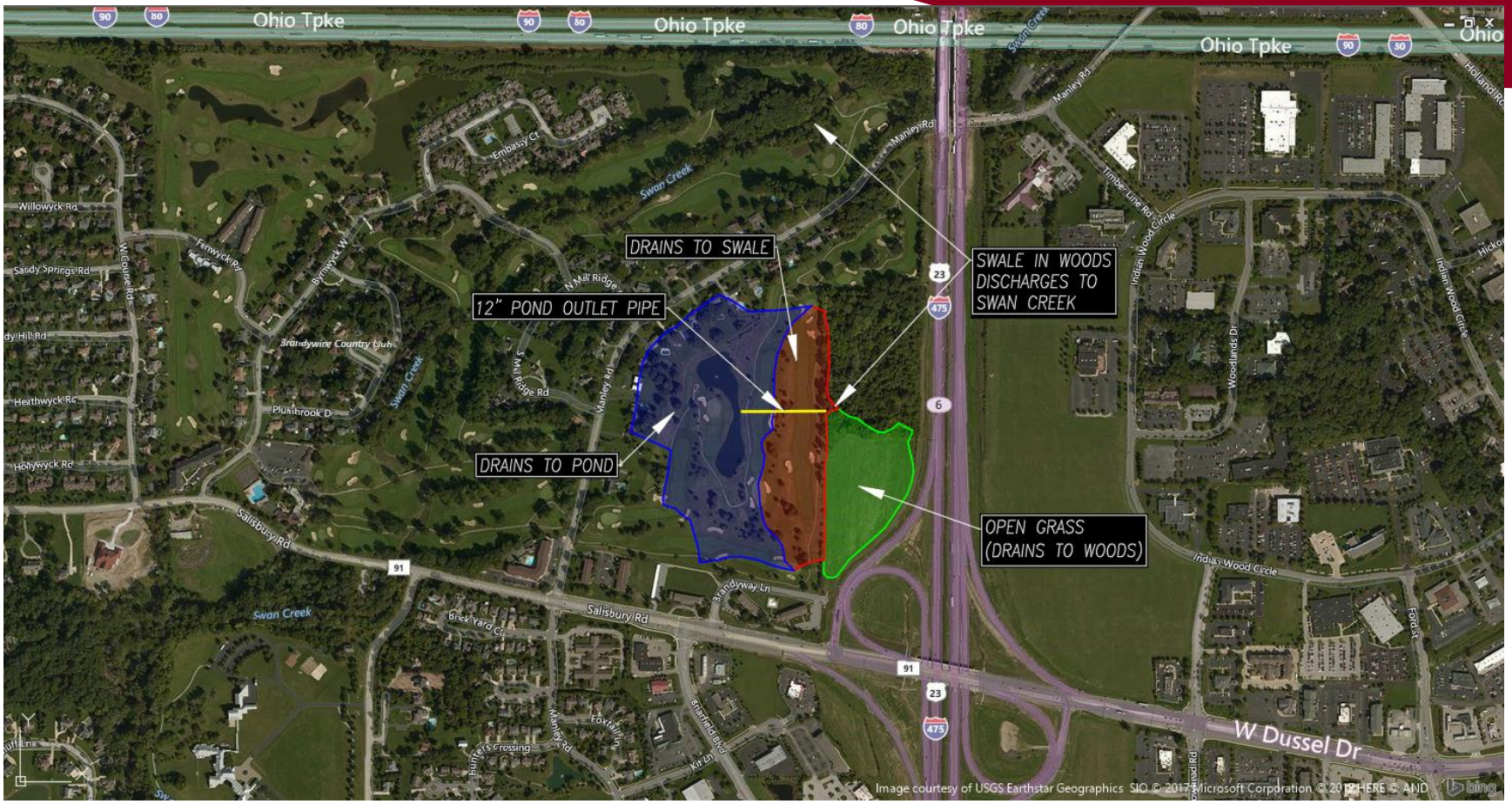
The Solution

Preserve the Existing Pond, Open Space and Woods

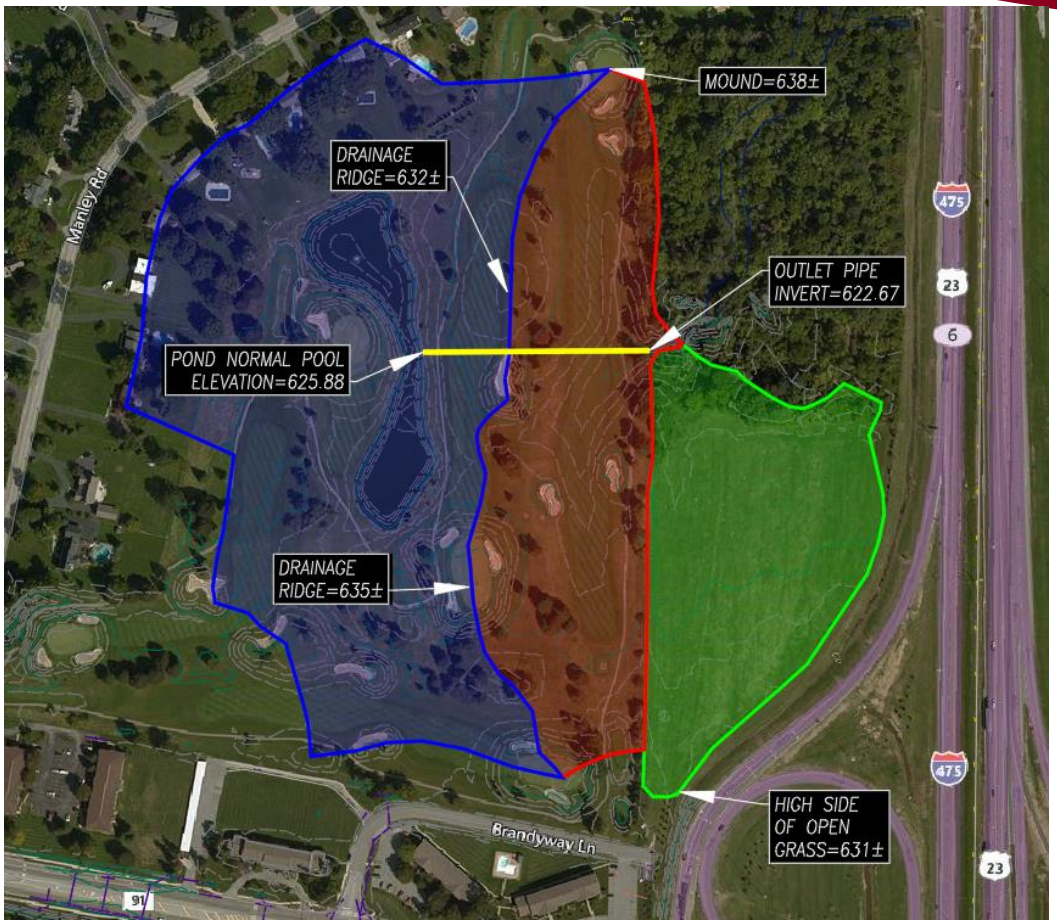
The Solution

Spread Out Parking by Adding Landscaping Islands

Existing Drainage Patterns



Design Criteria
How To Drain The Site?



Design Criteria

Detention

- 25 year post-development storm discharge to 5 year pre-developed storm discharge
- Water quality: per OEPA's NPDES permit

Post-Construction Storm Water

NPDES Construction General Permit (CGP)
#OHC000004

Lynette Hablitzel, P.E.,
Ohio EPA
Division of Surface Water
Northwest District Office
March 8, 2017

Ohio Environmental Protection Agency

Post-Construction Impacts

Increased imperviousness and more efficient drainage leads to…

Degraded streams and

Efficient pollutant conveyance.

Ohio Environmental Protection Agency

Post-Construction Best Management Practices (BMPs)

CGP: Required for all projects where "larger common plan" disturbs one or more acres of land…

Except:

- Projects that do not create impervious area
  - Examples: soccer field, pipeline or utility line installation
  - This is determined on a site-wide basis, not a drainage area basis
- Larger common plan disturbs <5 ac and erosivity factor <5
- Abandoned mine land reclamation activities
- Stream and wetland restoration or mitigation activities
- Projects not subject to NPDES permitting
  - "Routine maintenance" and disturbs <5 ac
    - www.epa.ohio.gov/dsw/storm/routine_maint.aspx
  - Oil & Gas Exploration, Agriculture & Silviculture
  - Discharges to combined sewers
    (Check with sewer authority)

Ohio Environmental Protection Agency

What Does the CGP Require?

Develop complete Storm Water Pollution Prevention Plan (SWP3) before submitting permit application (i.e. NOI)

SWP3

Essential components:

- Sediment & Erosion Controls
- Non-Sediment Pollution Controls
- **Post-Construction Storm Water BMPs**
  - Permanent features of the site which improve the quality of storm water runoff from the developed site
  - Protect receiving waters physical, chemical and biological characteristics
  - Maintain stream functions
  - Site map w/ BMP's delineated drainage area, detail drawings, supporting calculations, rationale for BMP selection, and Long Term Operation & Maintenance Plan

Ohio Environmental Protection Agency

Who Reviews Post-Construction BMPs?

Standard Post-Construction BMPs
Dry Extended Detention Pond
Wet Extended Detention Pond
Constructed Wetland • Includes practice formerly known as Wet Enhanced Swale
Bioretention Area • Includes Turfed Linear Bioretention aka Dry Enhanced Swale
Infiltration Basin or Trench
Permeable Pavement
Sand & Other Media Filters
Pocket Wetlands

Within urbanized areas, the local MS4 operator must review and approve the SWP3.

- This includes Post-C BMPs.
- Use of alternative BMPs on large construction sites, off-site mitigation, and non-structural in lieu of structural BMPs requires approval from Ohio EPA.
    - Do this before submitting NOI & plans for local review.

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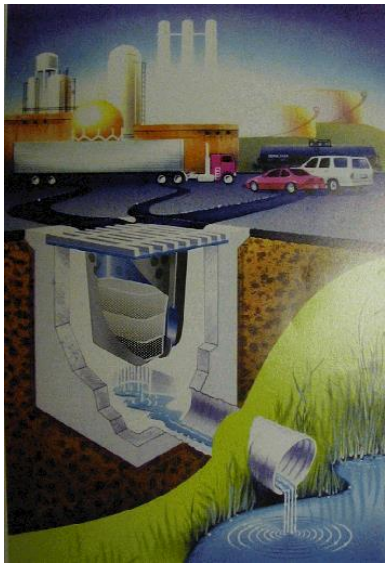
Alternative BMPs

1. Must demonstrate that standard BMPs are <u>technically</u> infeasible
   - Physical site constraint
   - Inability to achieve a functional design



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Alternative BMPs

2. Must show Alternative BMP is equivalent in effectiveness to a Table 2 (Standard) BMP:
   - Must show ≥80% TSS removal for both laboratory & field conditions
   - www.njstormwater.org
     - MTD Certifications and Guidance
   - www.mastep.net
     - Stormwater Technologies Clearinghouse

   - If manufactured system is an "add-on" above and beyond what is required to meet Ohio EPA post-construction requirements, e.g., a hydrodynamic separator preceding a wet extended detention basin, Ohio EPA does not need to provide approval.

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Alternative BMPs

3. WQv discharge rate must be reduced unless negligible hydrological impact.

   It is negligible if:

   - BMP infiltrates the entire WQv
   - <1 acre of imperviousness created within the larger common plan of development or sale
   - Redevelopment in an ultra-urban setting (imperviousness already 100% with discharge to MS4)
   - Direct discharge to a 4th order or larger stream, lake or other large waterbody and development area <5% of watershed area upstream of development, and TMDL doesn't ID problems

   If not, then add a structure to control the discharge rate

   - Target = WQv/24 hours

Ohio Environmental Protection Agency

The Most Popular BMPs …

Water Quality Ponds

Dry Extended Detention Basin
w/Forebay and Micropool

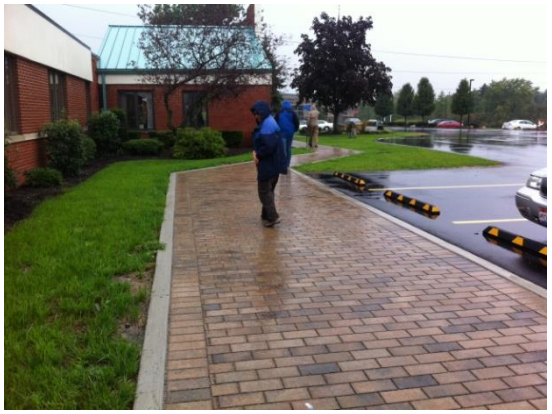
Wet Extended Detention Basin

Ohio Environmental Protection Agency

But There are Other Options…

Turfed Linear Bioretention

Sand Filter



Permeable Pavement

Infiltration Trench

Bioretention Area

Pocket Wetland

The Andersons New HQ

- Purchased 54 acres of the Brandywine Golf Club
- Development plan involves 18 acres
  - Large construction activity
  - Not redevelopment
- What does the CGP say?

Ohio Environmental Protection Agency

Requirements for Large Construction

- Larger common plan disturbs ≥5 ac
- Structural BMPs must be sized to treat the Water Quality Volume (WQv)
  - WQv = C * P * A / 12 [=] ac-ft
    - C = runoff coefficient appropriate for storms <1 inch
    - P = 0.75 inches
    - A = total contributing drainage area [=] acres
- BMP must be designed to drain the WQv (or EDv) in the specified target drawdown time
  - Varies between 24 and 48 hours, depending on the BMP
- Additional storage volume must be provided for pollutants which will collect in the BMP
  - Volume provided must be ≥20% WQv

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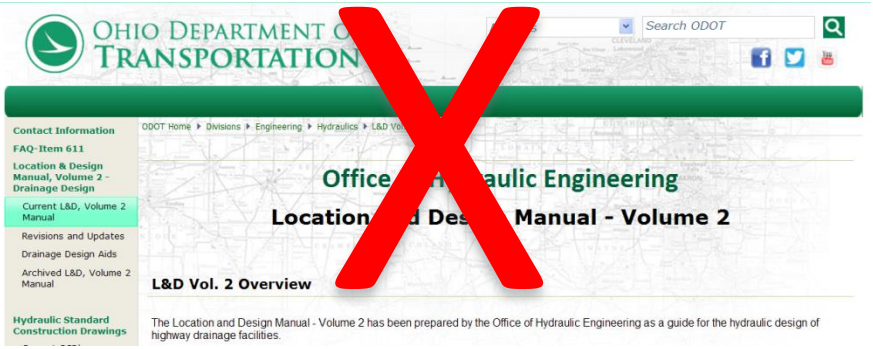
BMP Design Guidance

- ODNR ***Rainwater and Land Development*** manual - Chapter 2

www.dnr.state.oh.us/tabid/9186/Default.aspx

- Public transportation projects only
  - May use ODOT ***Location & Design Vol 2 - Drainage Design*** manual



www.dot.state.oh.us/Divisions/Engineering/Hydraulics/Pages/default.aspx

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Post-Construction BMPs

BMP Discharges to Wetlands:

- Diffuse flow
- Applicant must perform hydrologic analysis
- Attempt to match pre-hydroperiods & hydrodynamics
- Applicant shall assess impacts to hydologic flora/fauna

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The Andersons New HQ

CGP Requirements:

- Maximize the area treated by Table 2 BMPs
- Optimize Alternative BMP design to meet CGP objectives
- Minimize impact to adjacent wetlands and surface waters of the state

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Drainage Solution
Water Quality

- Bioretention cells in parking islands
- Works great for parking, what about the building?
- Address water quality for building with under ground extended detention

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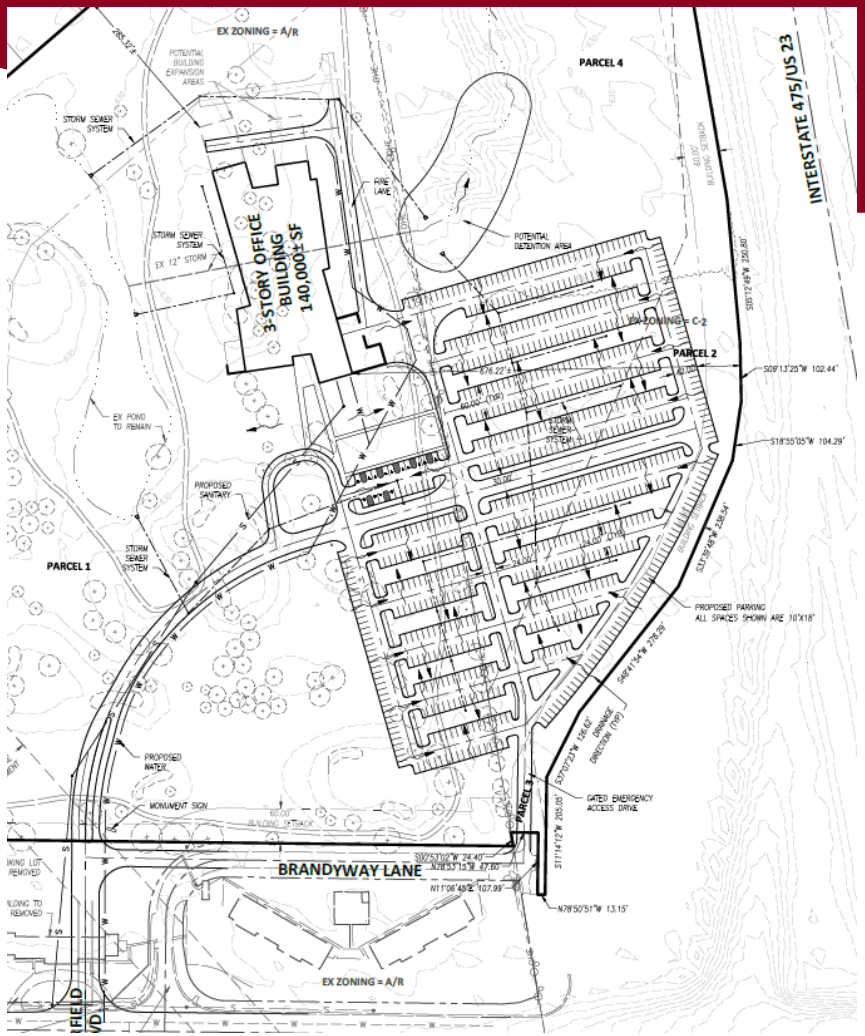
Drainage Solution Detention

- Ultimately, all drainage must discharge to existing stream
- Add catch basin structures to bioretention cells
  - Provides an outlet for underdrains
  - An overflow point for bioretention cells
  - Provides interconnectivity

Backup Plan

Detention basin in woods:

- Environmental report indicated soils conditions conducive to wetlands along swale in woods (not confirmed)
- Would destroy a significant portion of woods
- Conclusion – Last Resort
  - Wetlands impact could delay project
  - Potential waters of US
  - Cost of tree removal and additional earthwork could be significant



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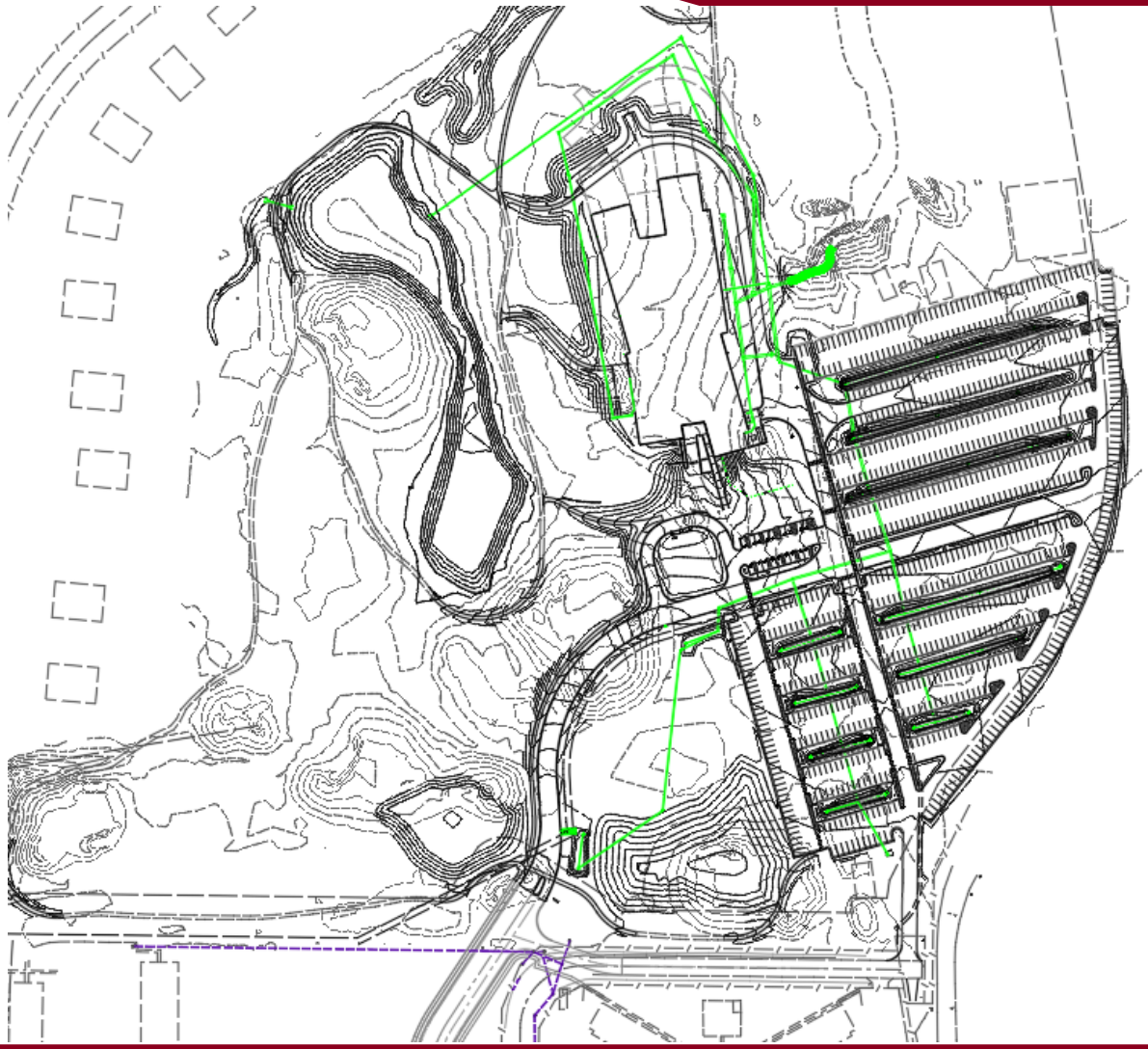
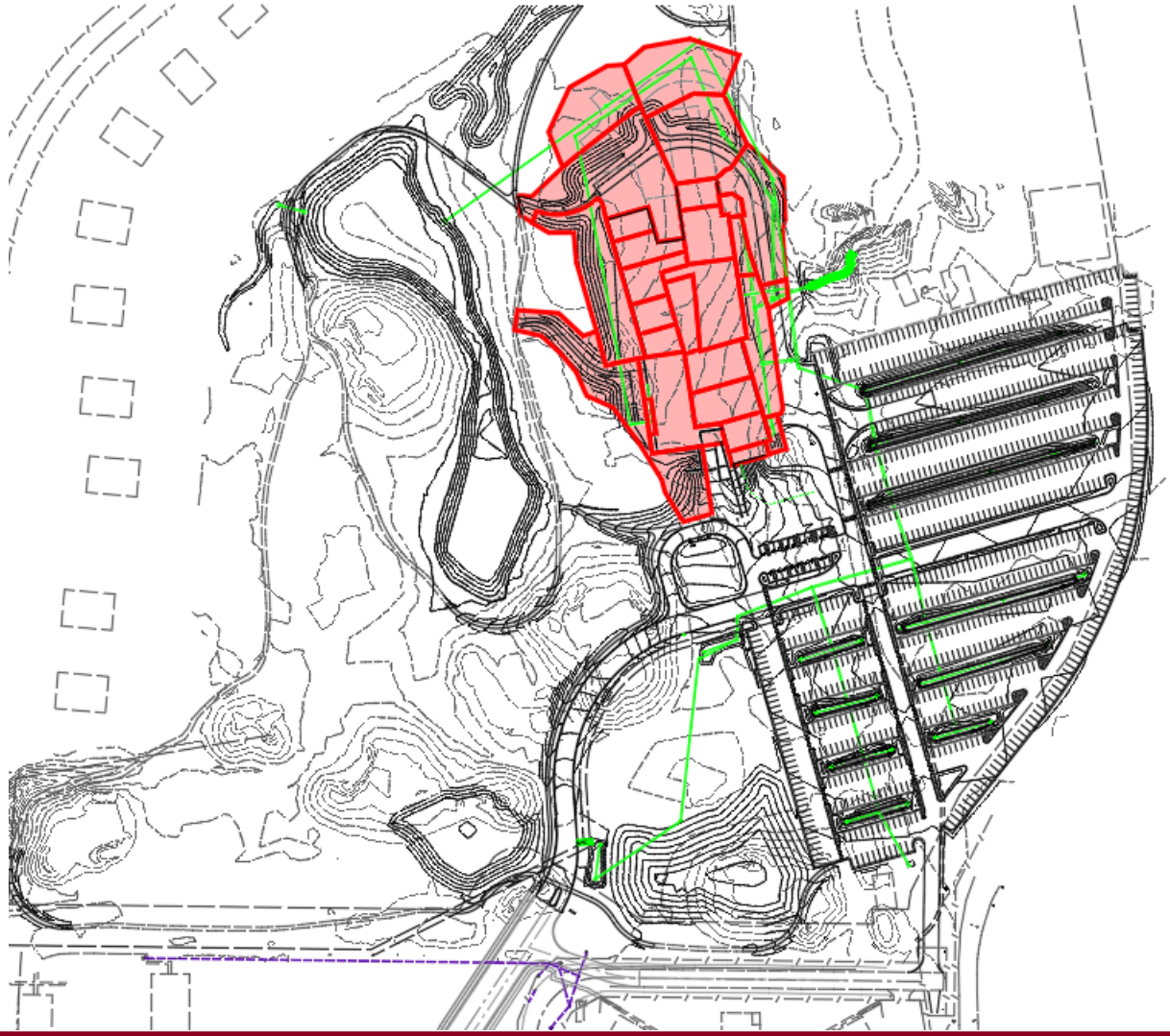
Drainage Patterns

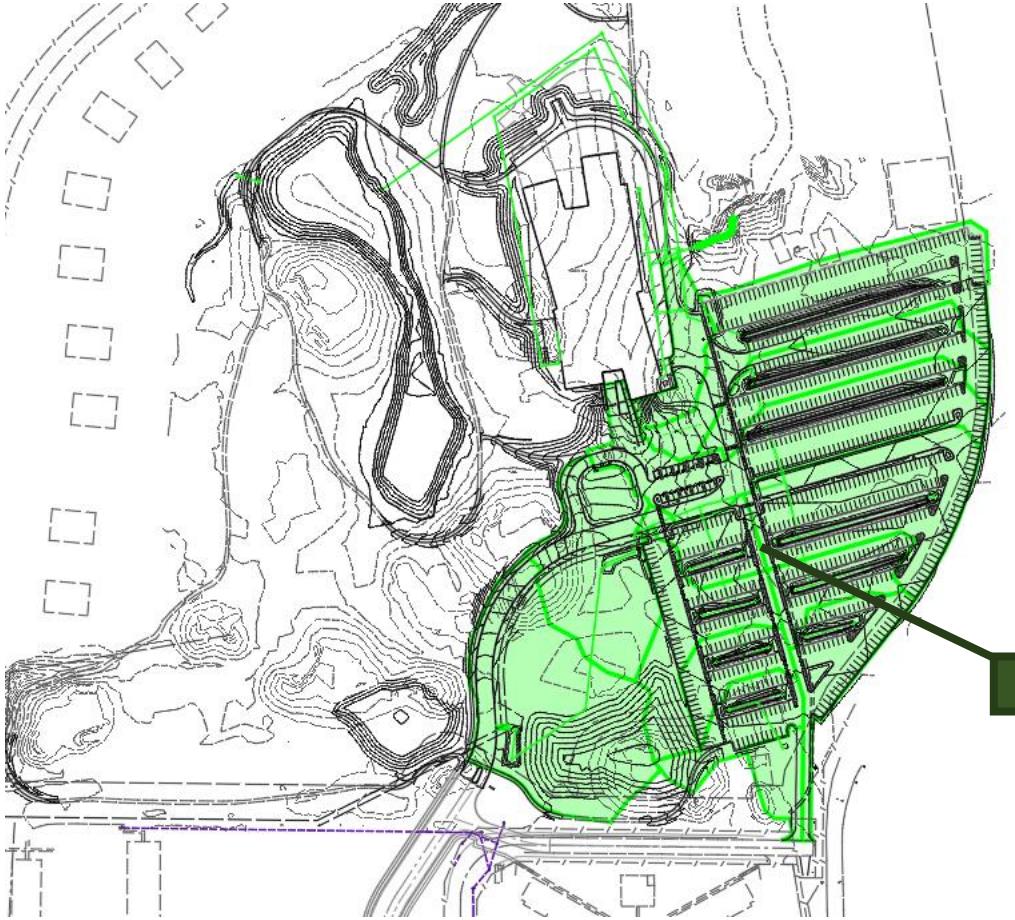


Drainage Patterns
Pond Drainage Areas

Drainage Patterns
Building Drainage Areas

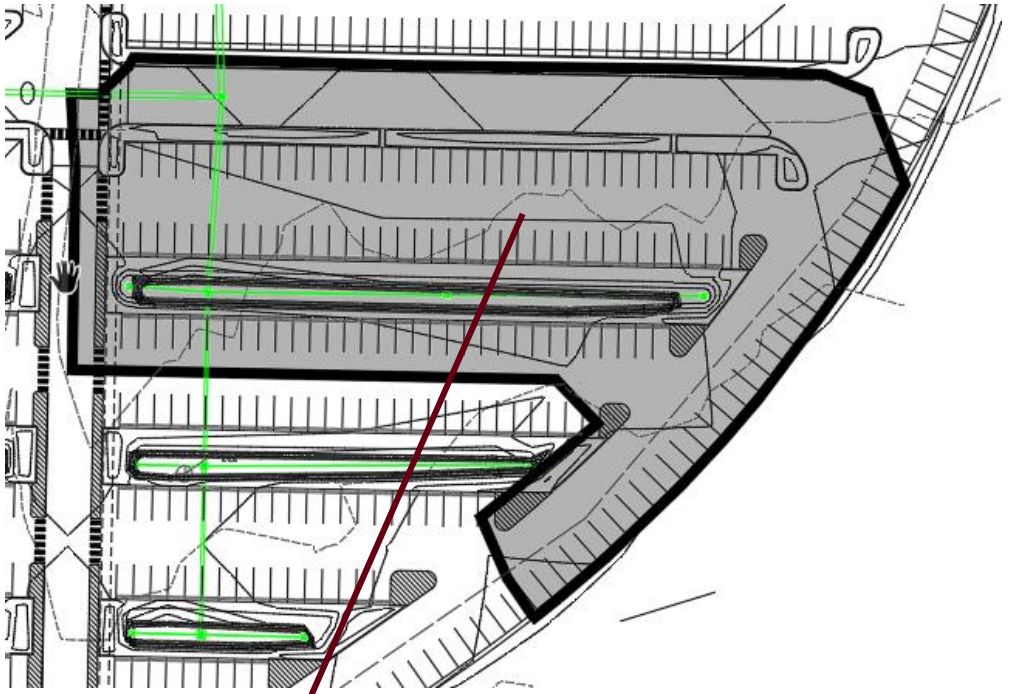


Drainage Patterns
Bioretention Cell Drainage Areas



Typical Bioretention Cell

- Determine impervious area that is tributary to cell
- Set level area of bottom of cell to 5-7% of impervious area
- Design underdrain to be sloped per Lucas County Engineer's Office request (originally proposed level)
- Set cleanouts on underdrains for cleaning, access and ability to monitor, Max 100' spacing
- Replicate process for each cell (12 times)
- Specs for filtration media per ODNR Manual



BIORETENTION G
AREA 21
1.74 ACRES,
1.38 ACRES
IMPERVIOUS

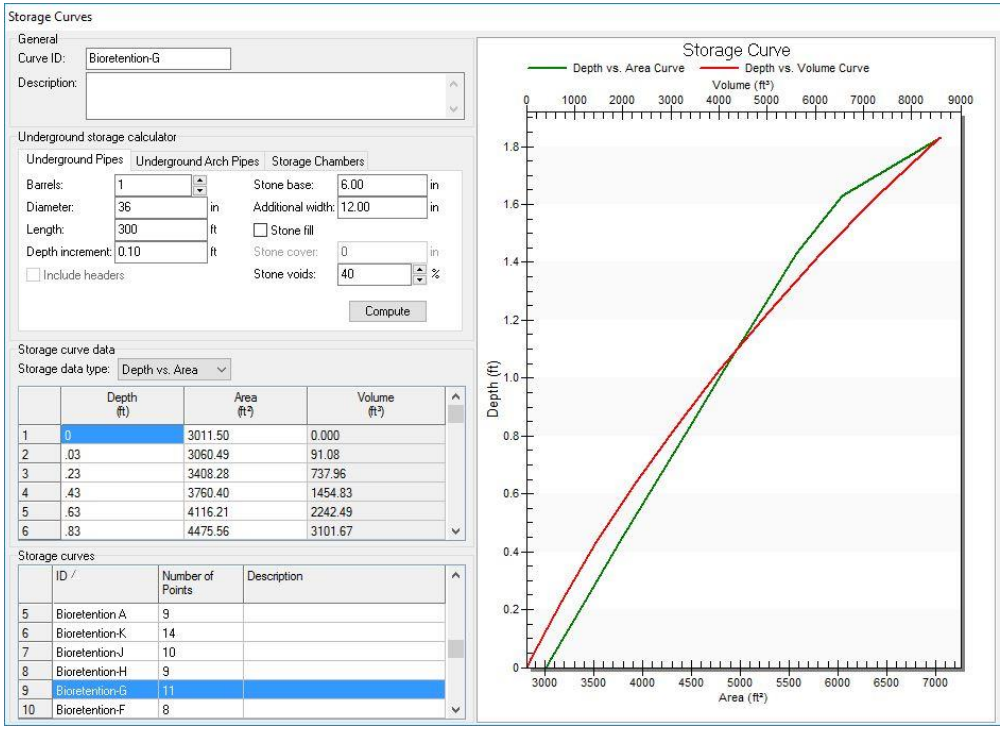
Typical Bioretention Cell

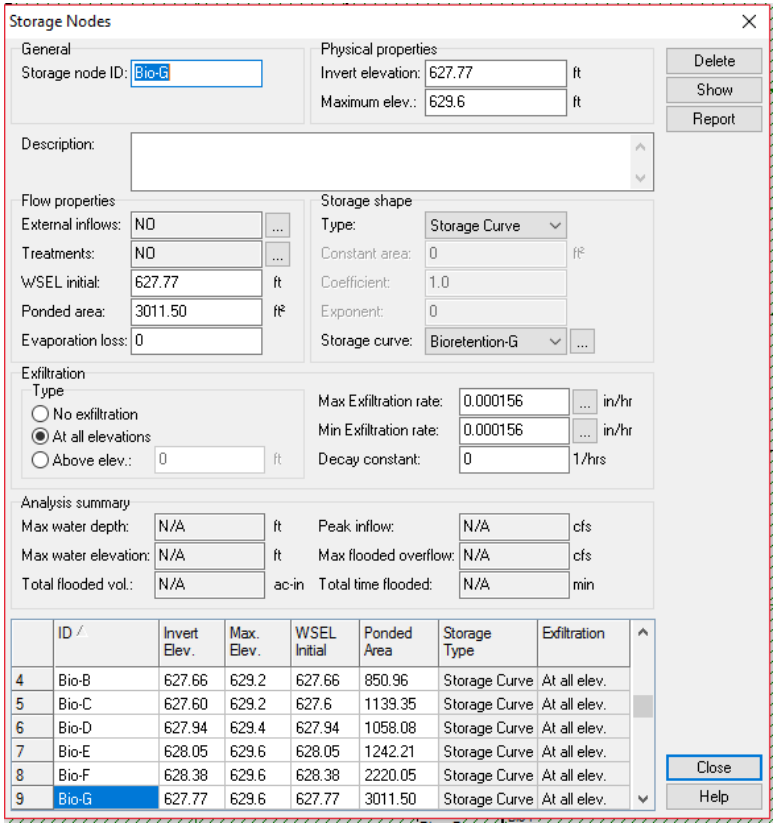
What about Detention?

- Set window in each catch basin 1 ft. above finished grade of bioretention cell
- Recommended max depth per ODNR manual
- Catch basin grate set at lowest edge of pavement elevation (2 ft. above bottom of bioretention cell)

Typical Bioretention Cell

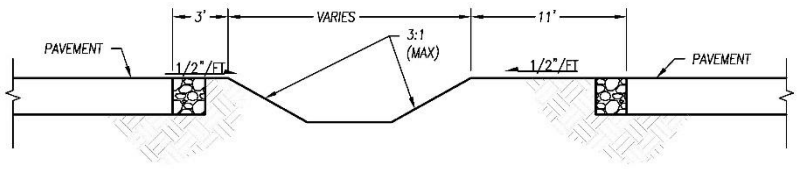
- Volume of bioretention cell determined by grades on adjacent edge of pavement



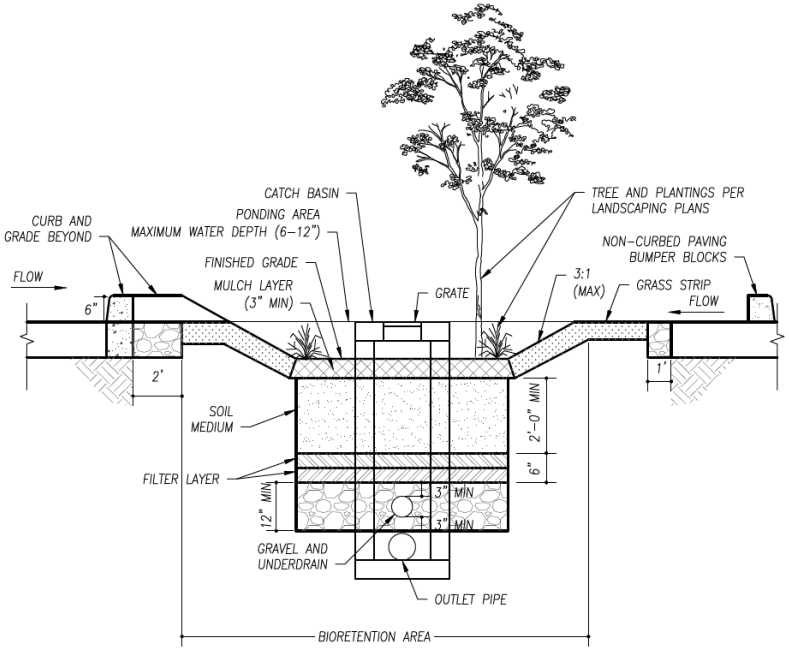


Typical Bioretention Cell

- 10 ft. berms placed along one side for lights and trees



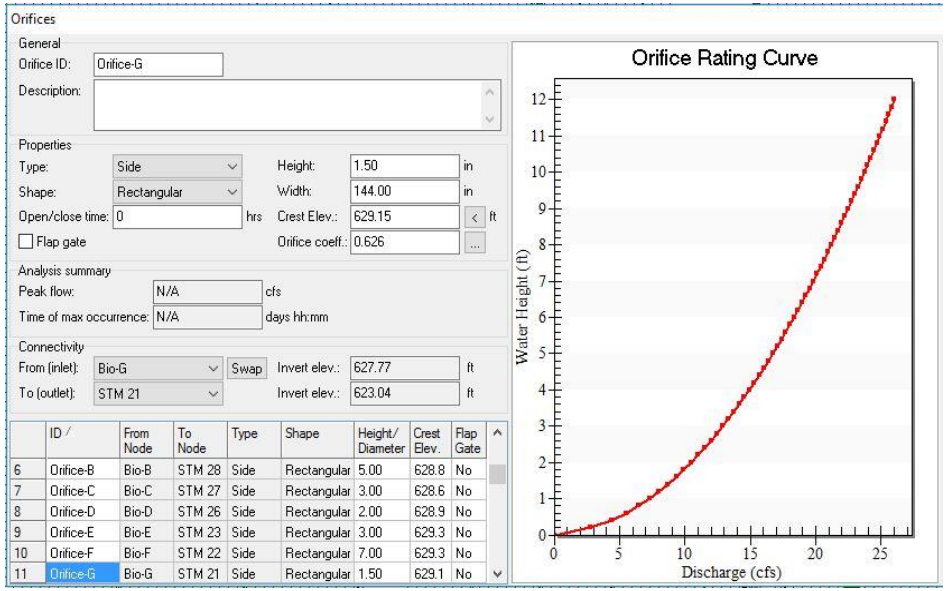
BIORETENTION SCHEMATIC DETAIL
NOT TO SCALE

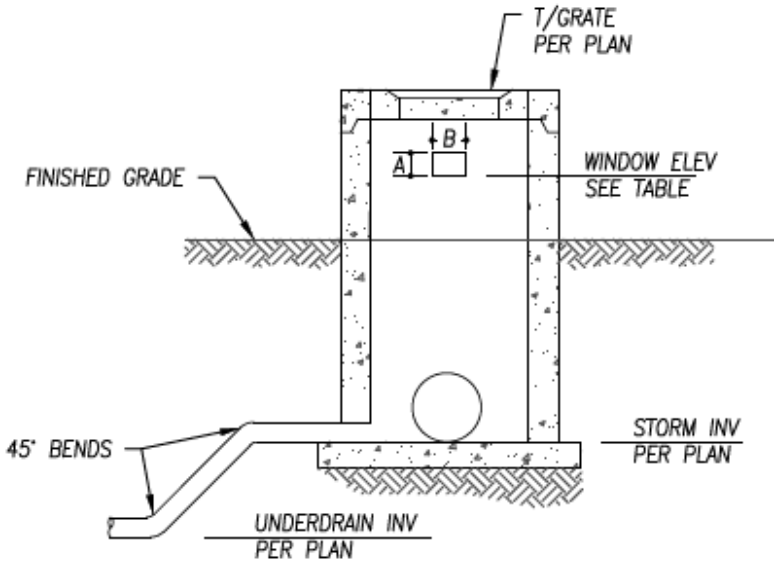


BIORETENTION DETAIL
NOT TO SCALE

Typical Bioretention Cell

- Size windows on each catch basin based on volume and flow rate (drainage area)

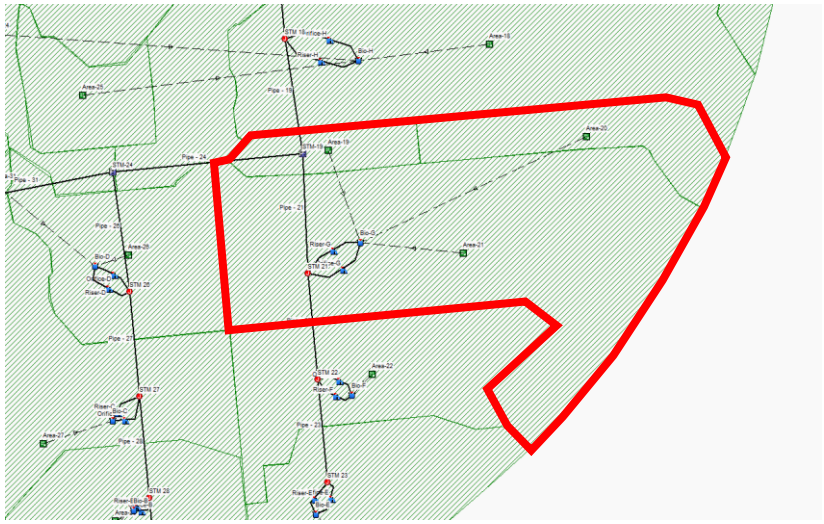




BIORETENTION OUTLET
STRUCTURE DETAIL
N.T.S.

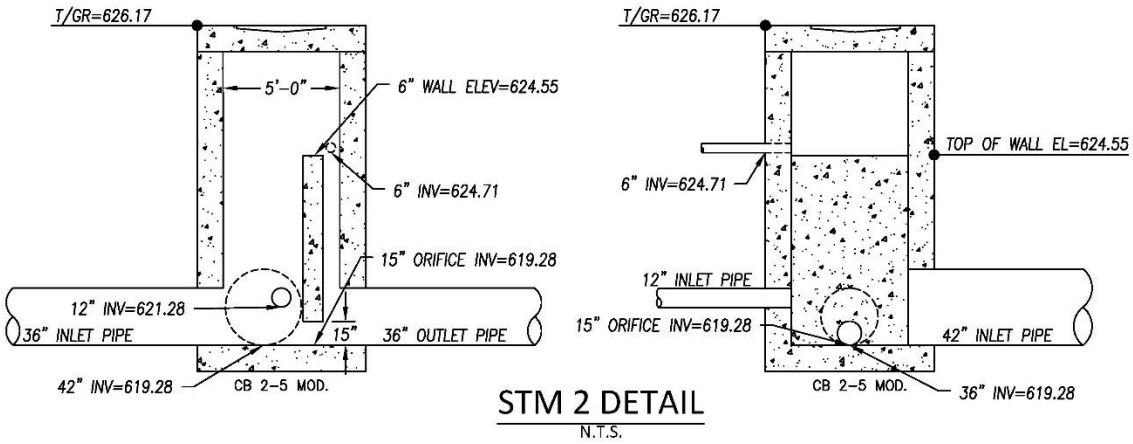
System Design

- Route all flows through storm sewer to determine total outflow of site
- Compare to allowable release rate
- Insufficient
  – Now What?



System Design

- Install an orifice plate on final catch basin to achieve allowable release rate
- Verify HGL is acceptable in storm sewers and bioretention cells
- Set top of orifice plate at 25 year HGL in catch basin as overflow for larger storms



STM 2 DETAIL
N.T.S.

System Design

- Outlet into a shallow water pool as a final protection of downstream swale and potential wetlands
- Rock installed to protect stream bed and dissipate energy

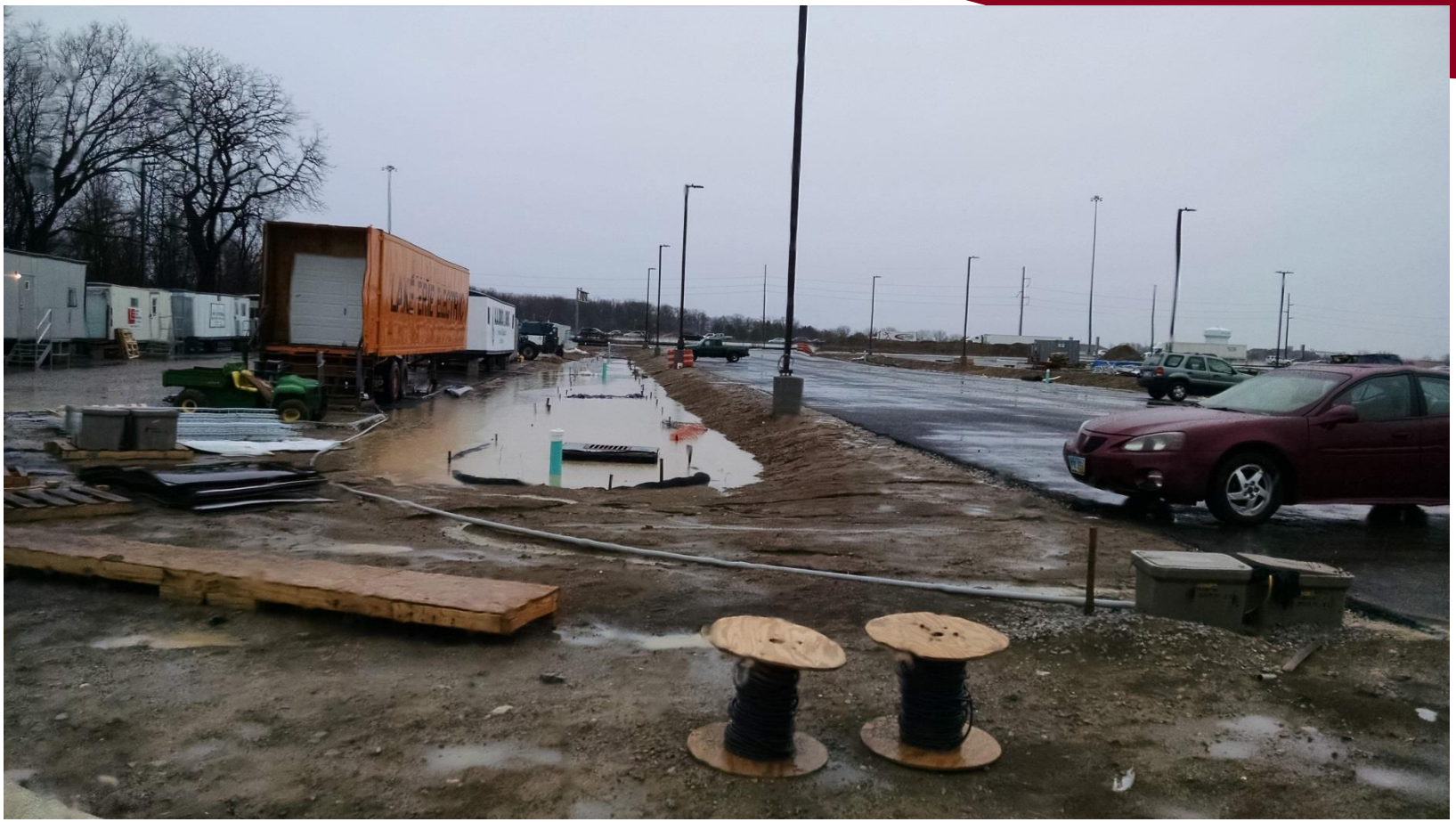
Construction Photos: Underdrain Installation

Construction Photos: Underdrain Installation

Construction Photos: Underdrain Installation

Construction Photos

Construction Photos: Flooding Issue



Construction Photos: Landscaping

Construction Photos: Landscaping

Construction Photos: Functioning Bioswales

Ribbon Cutting Photos

Ribbon Cutting Photos

Ribbon Cutting Photos

Ribbon Cutting Photos