Underground Stormwater Detention and Rainwater Harvesting System for Northbrook Park District

Brett Holmes, P.E., CPSWQ

StormTrap®

- Recognized by Storm Water Solutions Magazine as a **Top Project Winner for 2017**.

- Won the **Illinois Section ASCE Outstanding Civil Engineering Achievement under $10 Million**, **ACEC-Illinois Engineering Excellence**, and **Friends of the Chicago River – Green Ribbon.**

Topics to be discussed

- Northbrook stormwater history

- Project overview

- Site constraints and stormwater detention design considerations

- Opportunities to incorporate green infrastructure

- Importance of collaborations, negotiations, and public outreach

- Utilization of technology to maximize project benefits

Wescott Park Stormwater Management Project

Owner: Village of Northbrook and Northbrook Park District

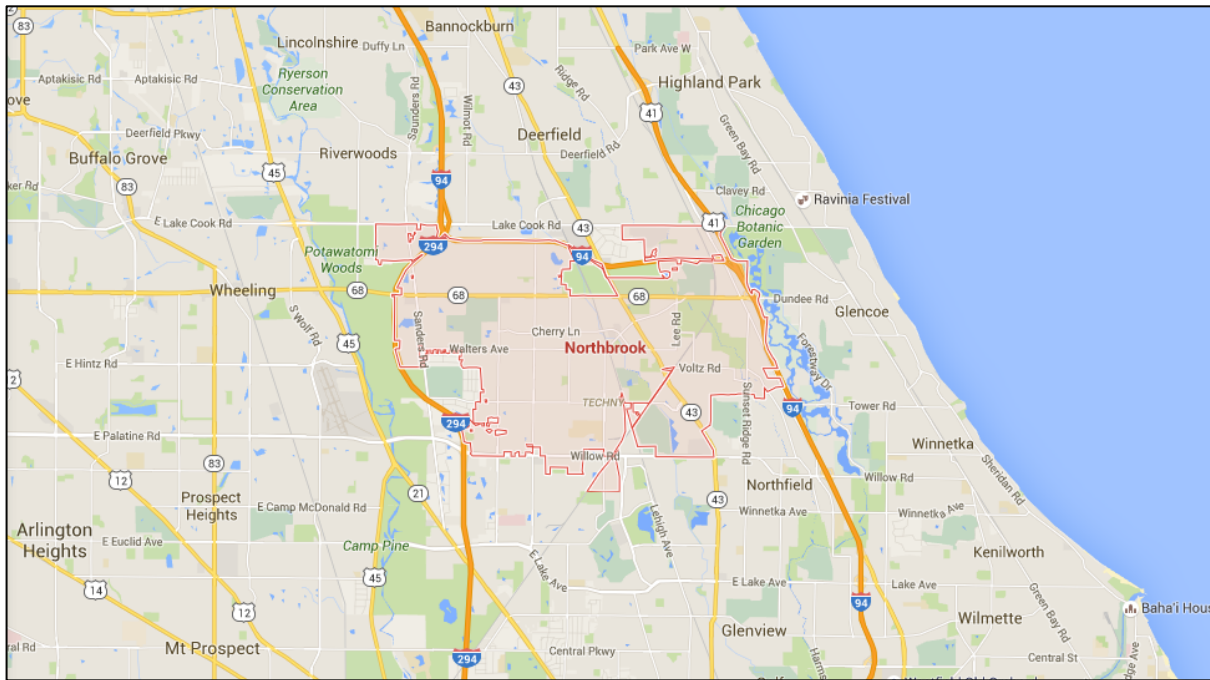**Engineering Firm:** Baxter & Woodman

General Contractor: V3 Companies of Illinois

Location: Wescott Park, located at 1820 Western Avenue, Northbrook, Illinois

Design Features: Stormwater Storage and Rainwater Harvesting

Village of Northbrook

- Cook County, IL

- Population: 33,170

- 13 Square Miles

- 25 Miles NW of Chicago

Master Stormwater Management Plan

1st Edition
- Created in response to 1982 and 1987 flood events
- Approved in 1993

1996 and 2002 Updates
- Included updated costs
- Reflected completed projects

2011 Update
- Addendums added in 2012 & 2015
- In total, 31 potential projects included

Wescott Park Stormwater Detention
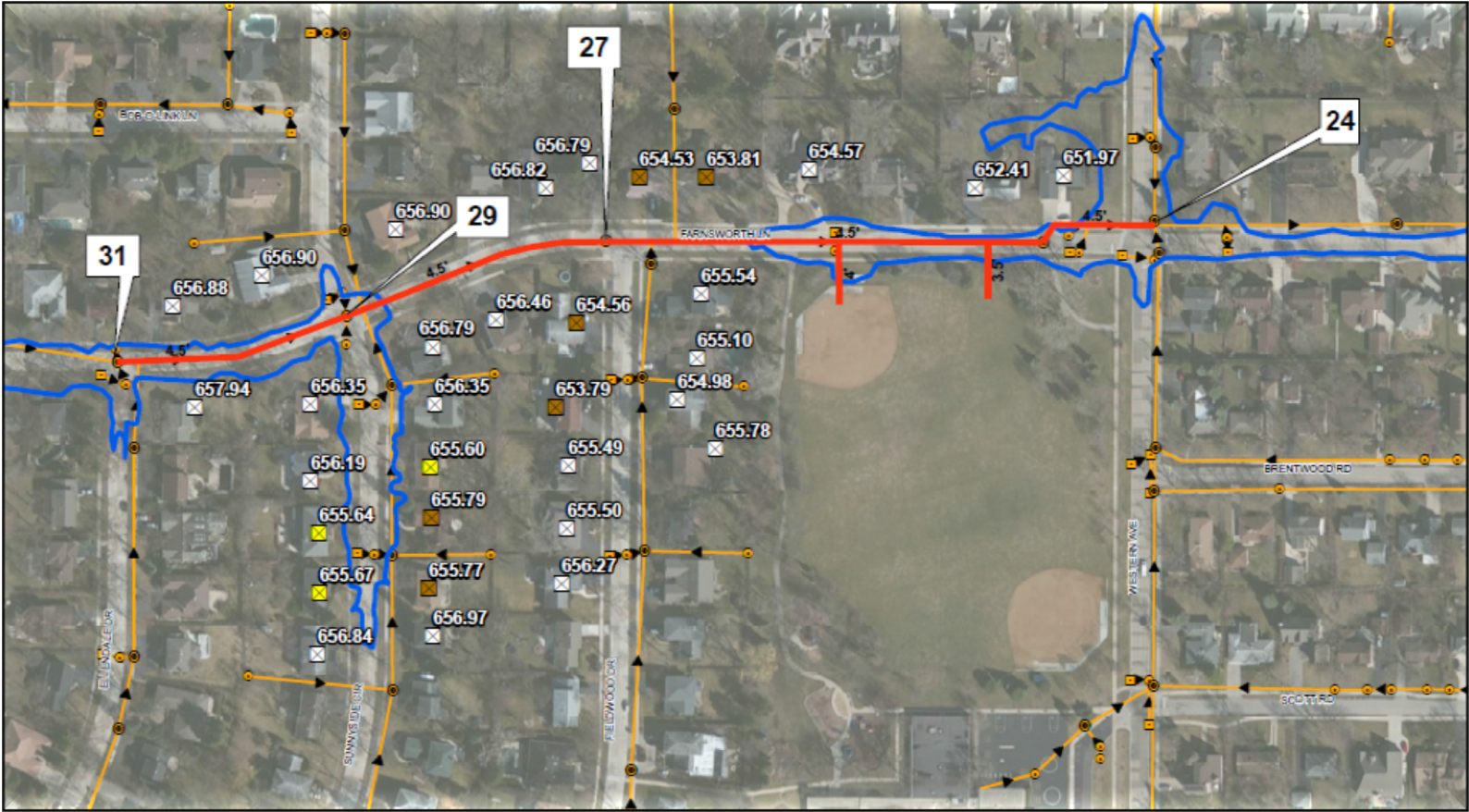
Flooding Issues

Study Phase

Ten homes flood in 25-year storm event

Conclusions

Proposed Detention Location

Proposed Sewer Route

FARNSWORTH LN

SUNNYSIDE CIR

ELLENDALE DR

FIELDWOOD DR

WESTERN AVE

SCOTT RD

Wescott Park

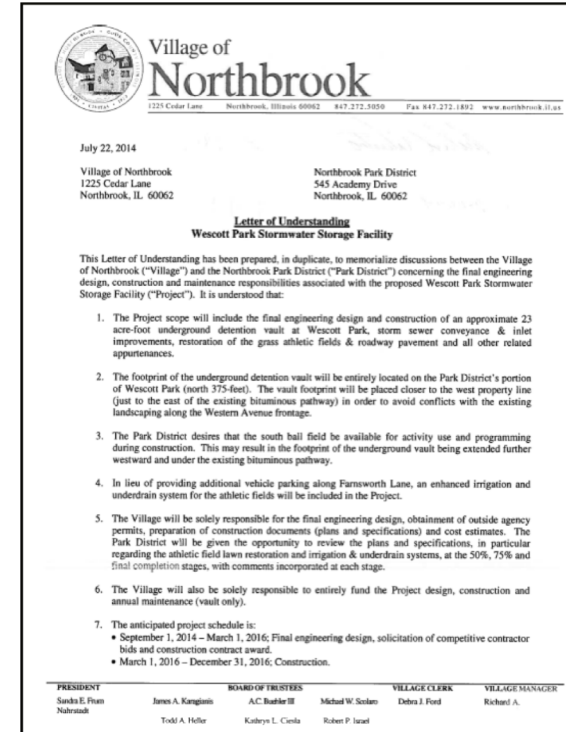Wescott Elementary School

Proposed Conditions

25-year flood protection for all homes

Design and Time Restraints

School and Park District Coordination

- Agreement between Village and Park District

- Defined:

  - Construction limits

  - Project schedule

  - Responsibilities

- Irrigation system to be provided

Project Funding

- MWRDGC applied for funding to Cover Incremental Cost of Rainwater Harvesting System
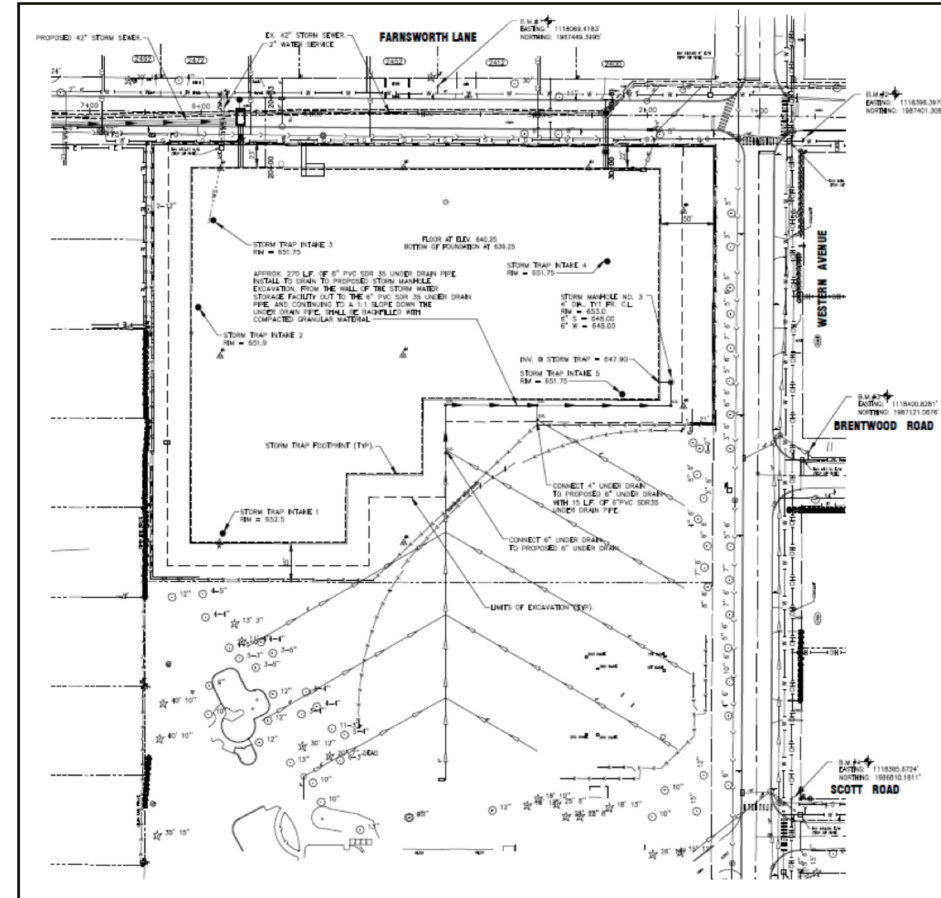
- Intergovernmental Agreement

Design Phase

- Began fall of 2014

- Estimated cost: $10.3M

Main Components

- 23 ac-ft underground detention

- 42-inch diameter storm sewer

- High capacity inlets

- Restrictor
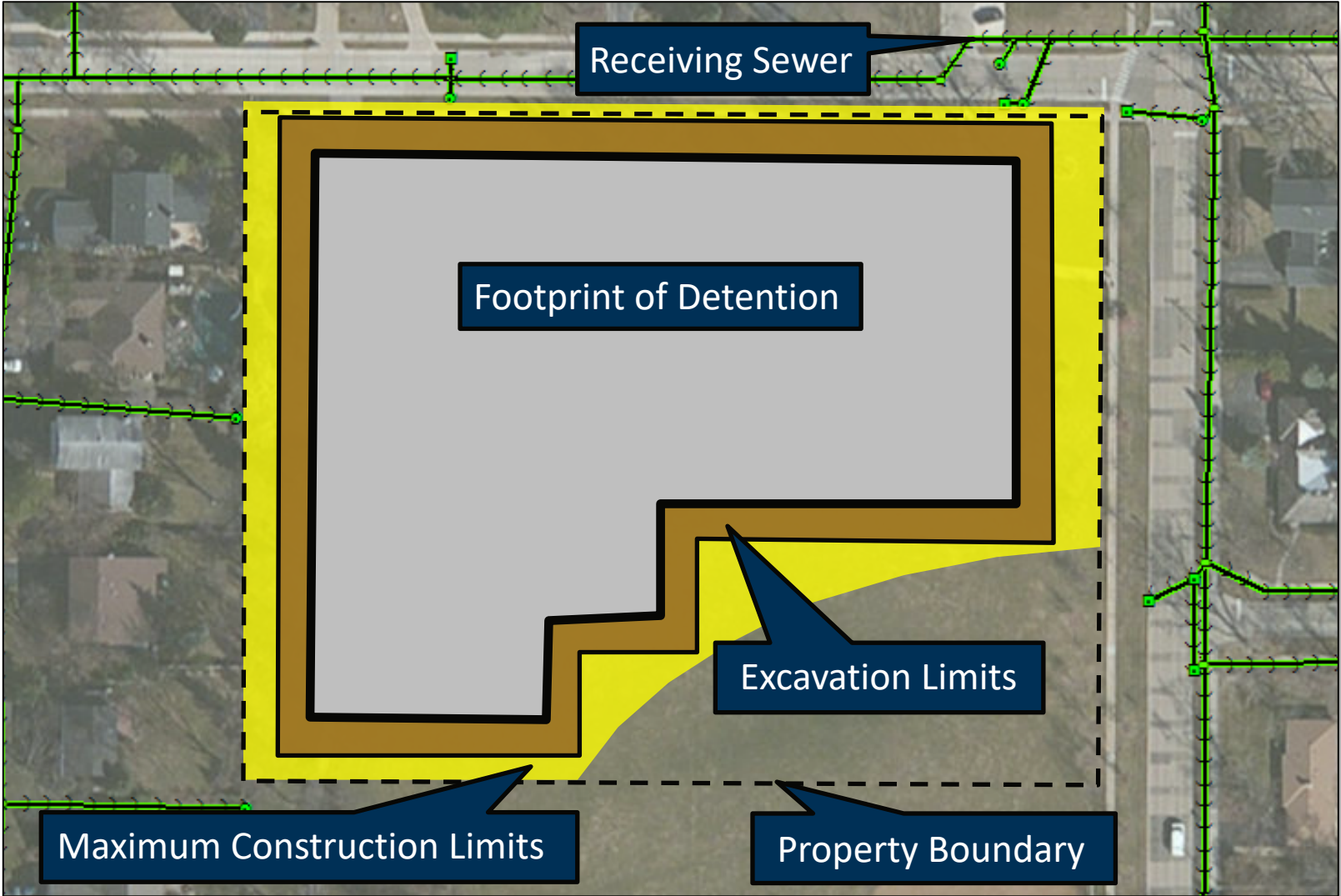
- Irrigation system for ballfield

Underground Detention Design

Design Considerations

•Height and footprint dictated by site constraints

•Minimum HS-20 loading

•8-month construction window

•Expected service life and product warranty

•Cost

Underground Detention Design

Underground System Comparison

StormTrap DoubleTrap

- Modular, precast concrete system
- 93% efficient storage

Corrugated Metal Pipe

- Storage in circular CMP and void space of backfill
- 86% efficient storage
- Durability concerns

Chamber With Reinforced Stone Piers and Walls

- Structurally supported by reinforced stone aggregate
- 64% efficient storage

Cast-in-Place Concrete

- Efficient storage
- Requires structural design
- Longer construction time

Plastic/Resin Systems
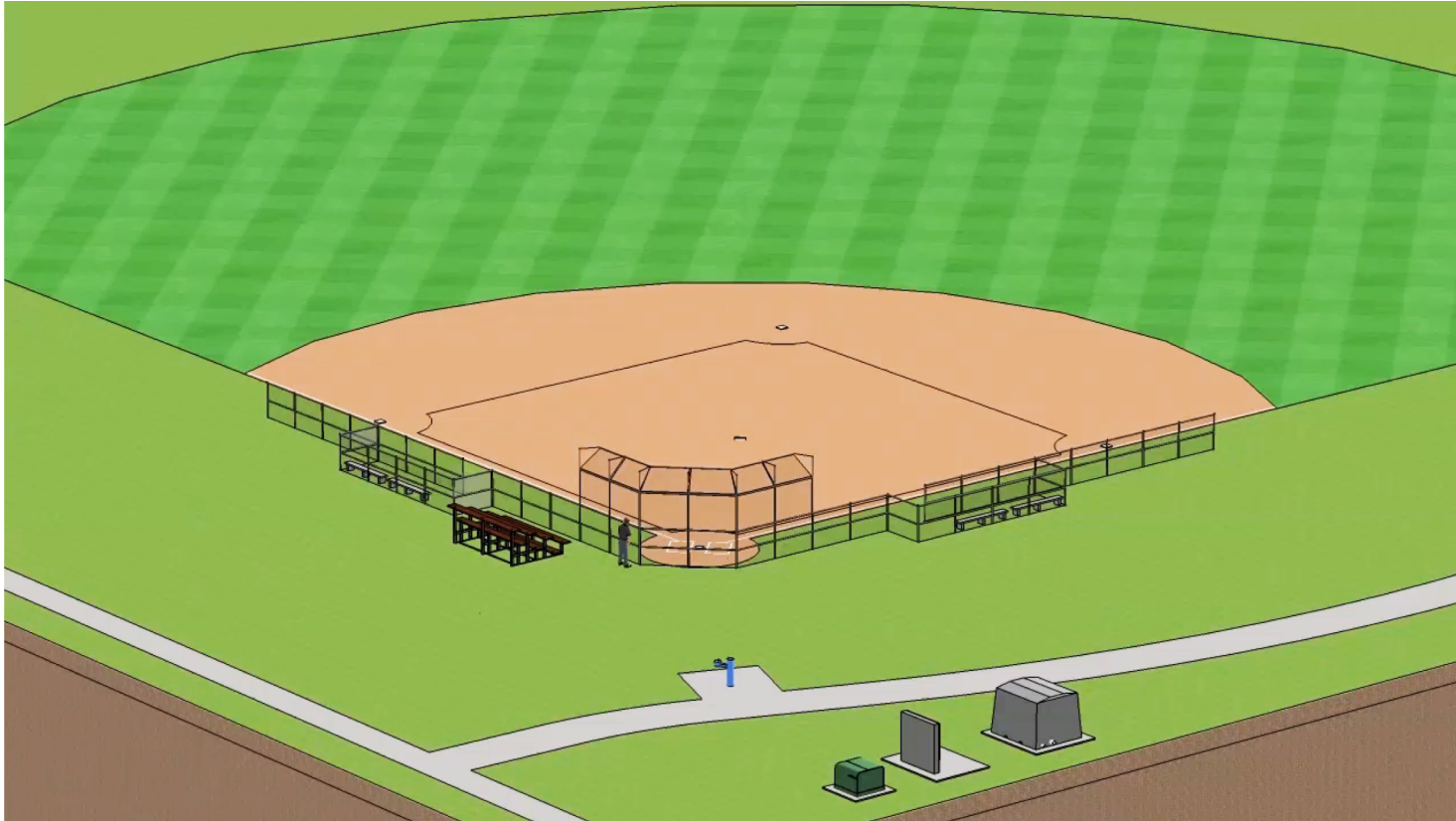
- Modular
- Height limitations

StormTrap DoubleTrap System

- Modular, precast concrete system

- 2'-2" to 15'-0" in height

- Innovative design which facilitates quick and efficient installations and minimizes the detention footprint

- Does not rely on void space storage

- 50-year warranty

Pre-Construction Rendering

Rainwater Harvesting System

• Village authorized B&W to move forward with design in August 2015

•Concept:

Use detained water for irrigation

Automatically drain StormTrap in advance of large storms

Storage in StormTrap

Pump from StormTrap

Irrigation

Illinois Department of Public Health

Requirements for Conditional Approval

- NSF 350 Standards

- Monthly testing for E. coli for one year

- Limited irrigation hours

- Requirements for spigot

NSF 350 STANDARD		
	MAX	**AVG**
Turbidity	5	2
TSS	30	10
CBOD	25	10
E. coli	200	2.2
Odor	Non-Offensive	
pH	6.0 – 9.0	

Stormwater Management System

Pre-Treatment Sedimentation
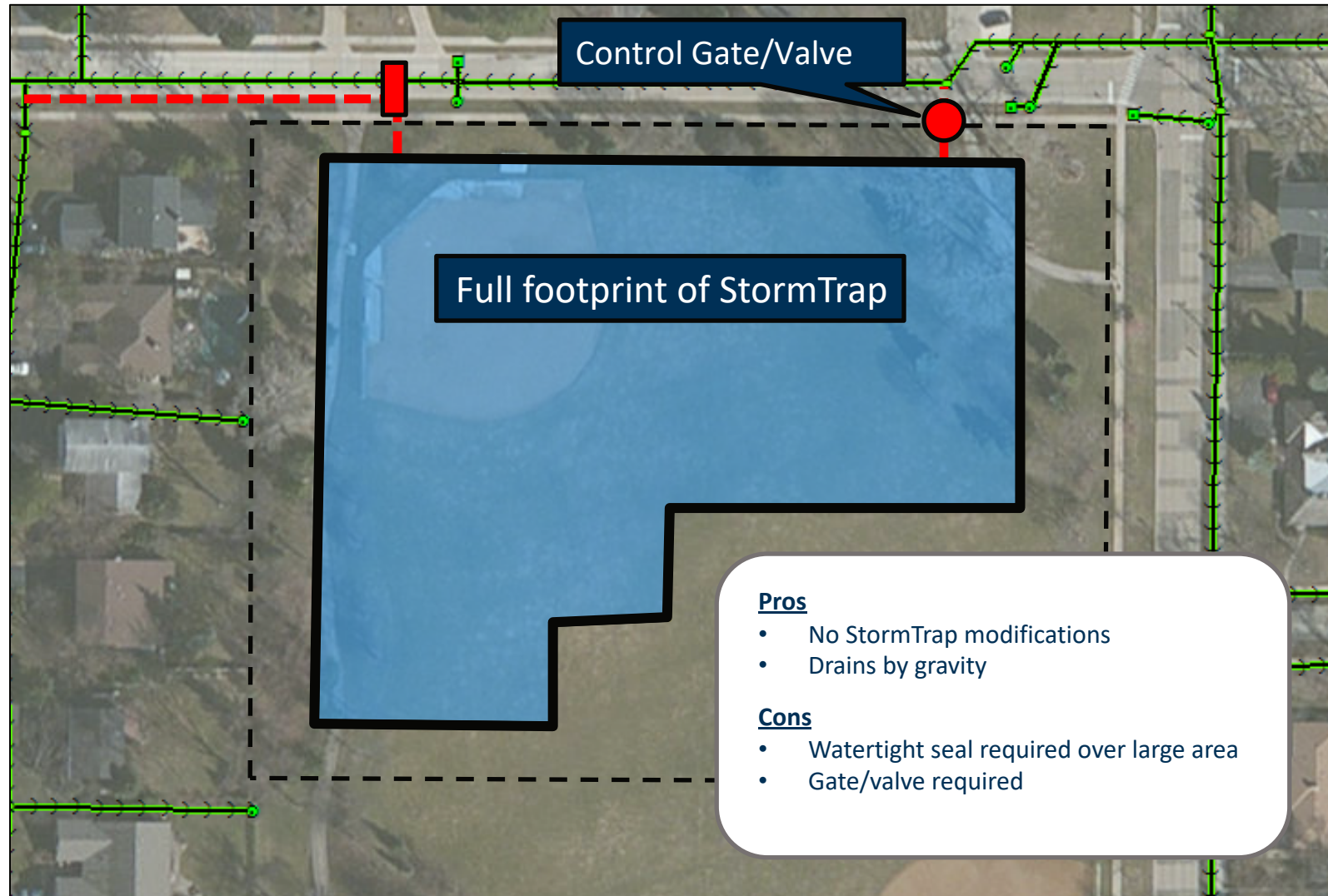
Storage in StormTrap

Pump from StormTrap

UV Sanitization System

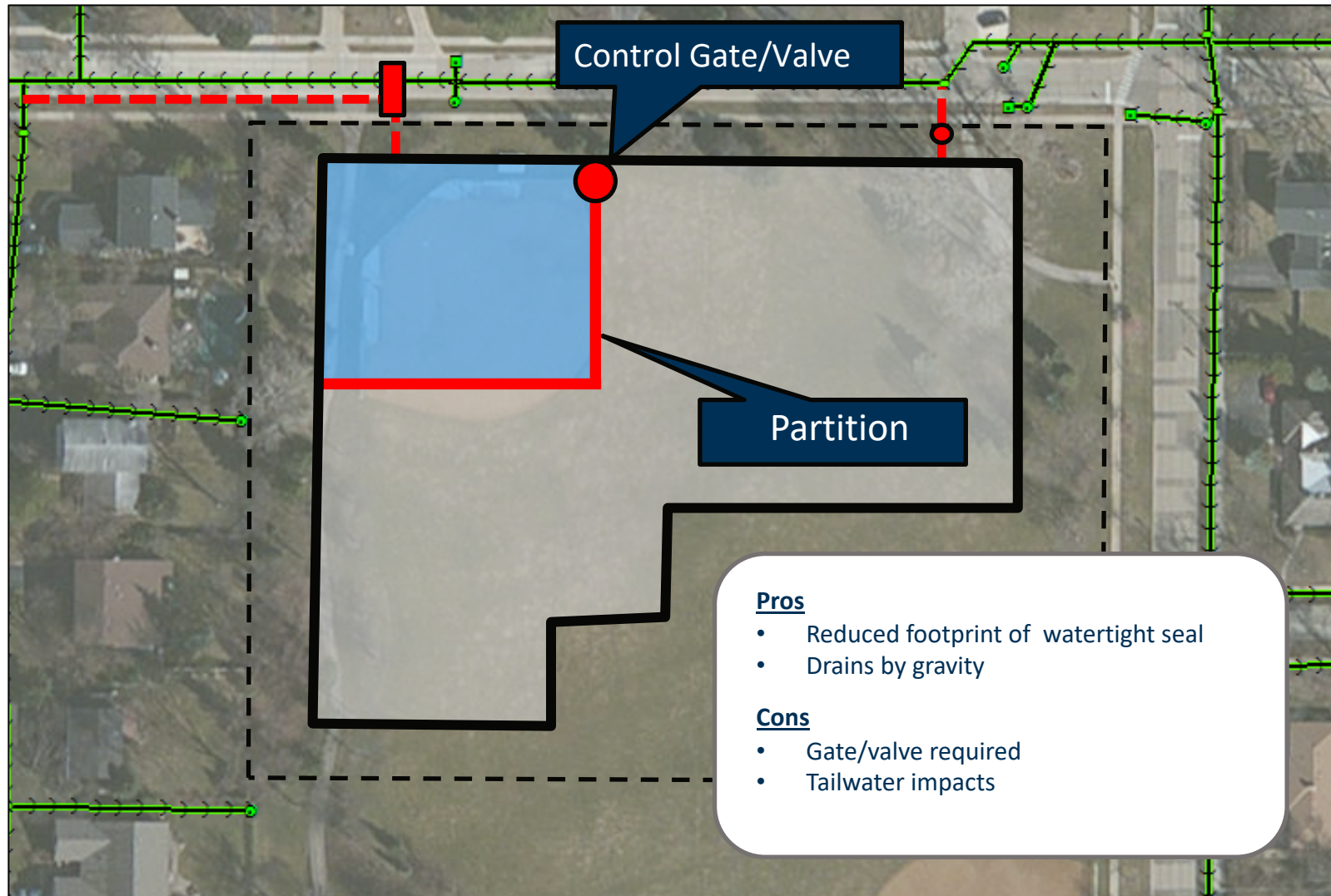Irrigation

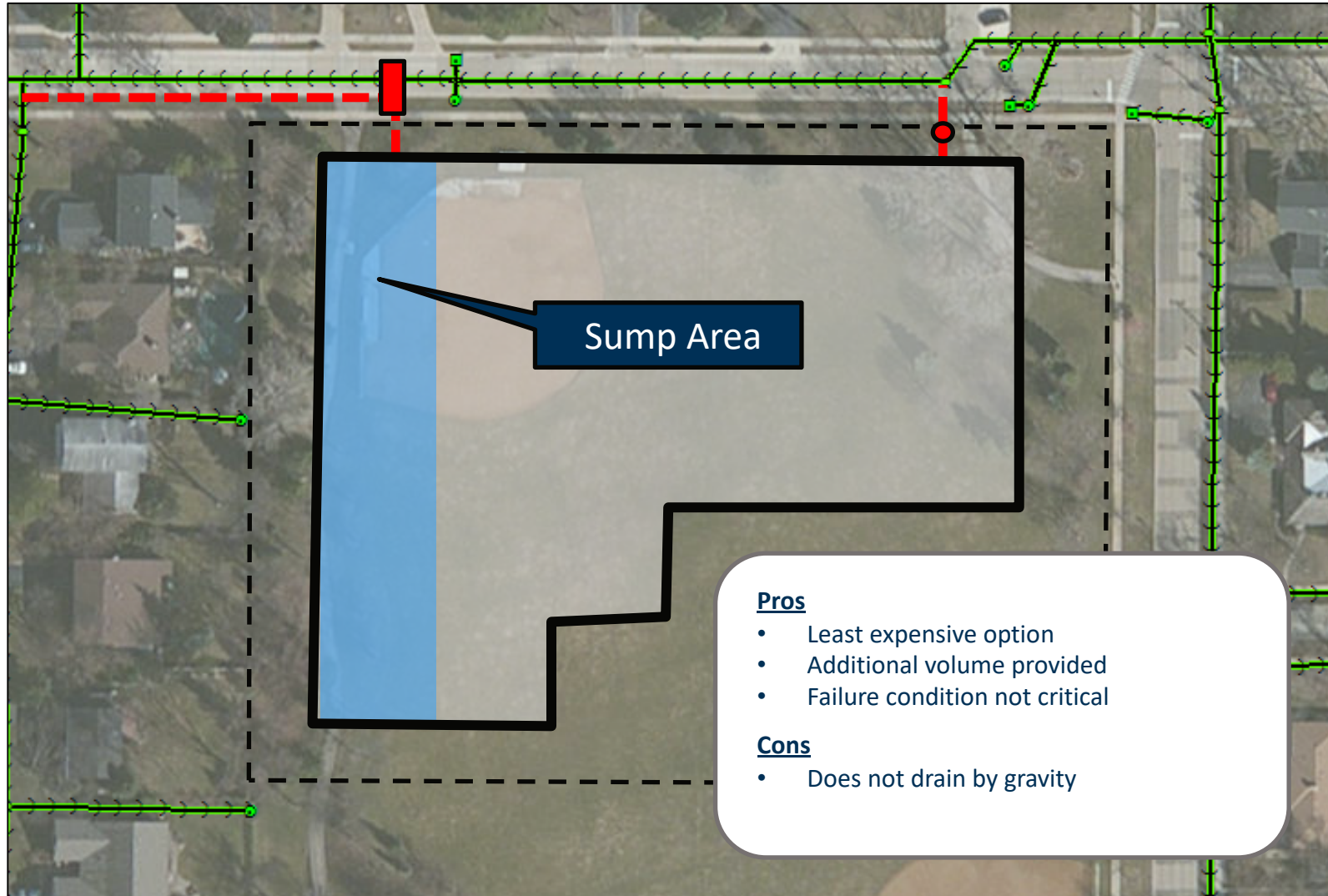# Storage Configuration – Option 1

Control Gate/Valve

Full footprint of StormTrap

Pros
- No StormTrap modifications
- Drains by gravity

Cons
- Watertight seal required over large area
- Gate/valve required

Storage Configuration – Option 2

Control Gate/Valve

Partition

Pros
- Reduced footprint of watertight seal
- Drains by gravity

Cons
- Gate/valve required
- Tailwater impacts

Storage Configuration – Option 3

Sump Area

Pros
- Least expensive option
- Additional volume provided
- Failure condition not critical

Cons
- Does not drain by gravity
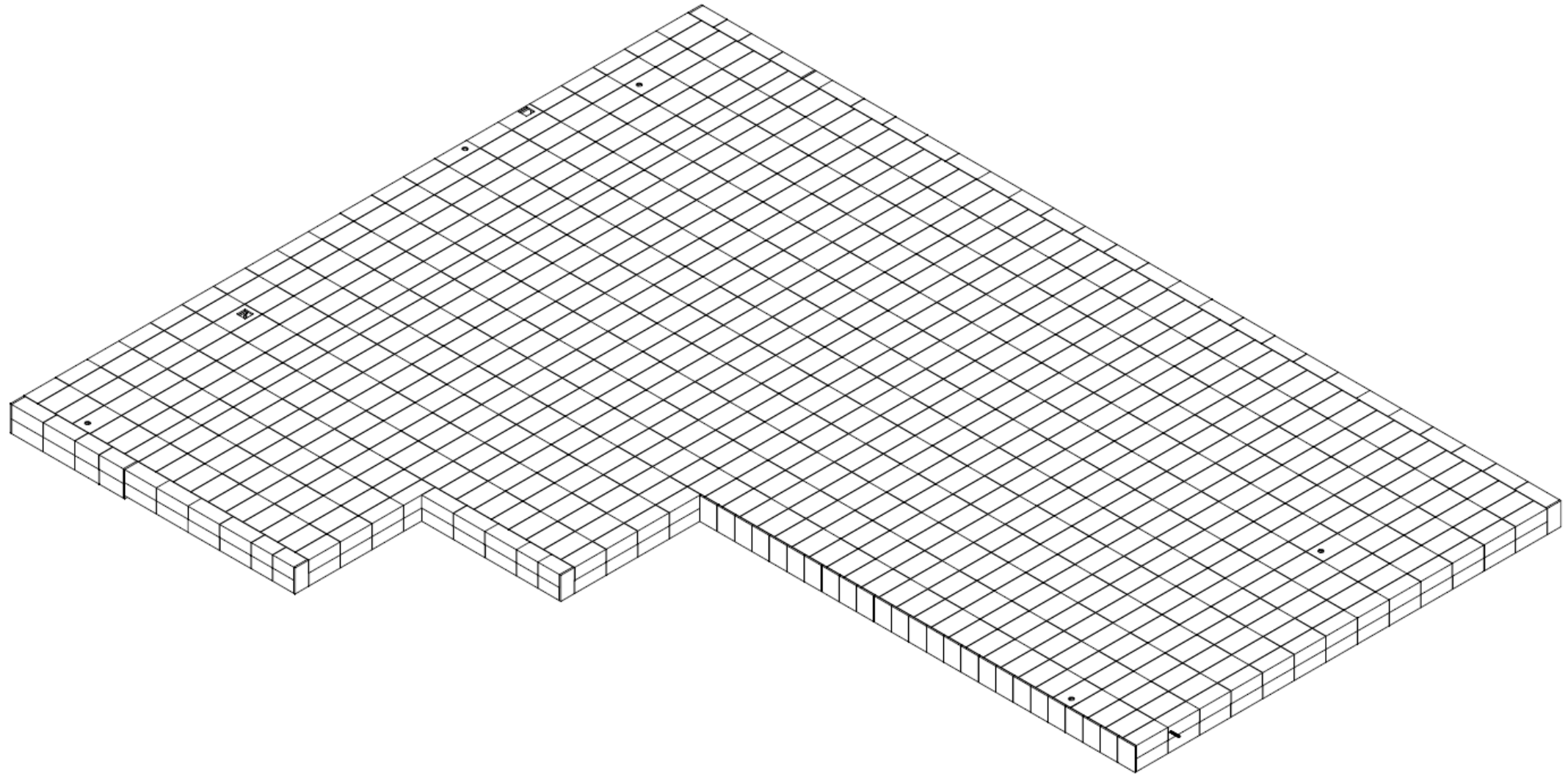
System Design and Functionality

- StormTrap DoubleTrap divided into two sub sections

- 11'- 4'' height in sump area, 10'- 0'' in remainder of structure

- Modular units placed on stone foundation

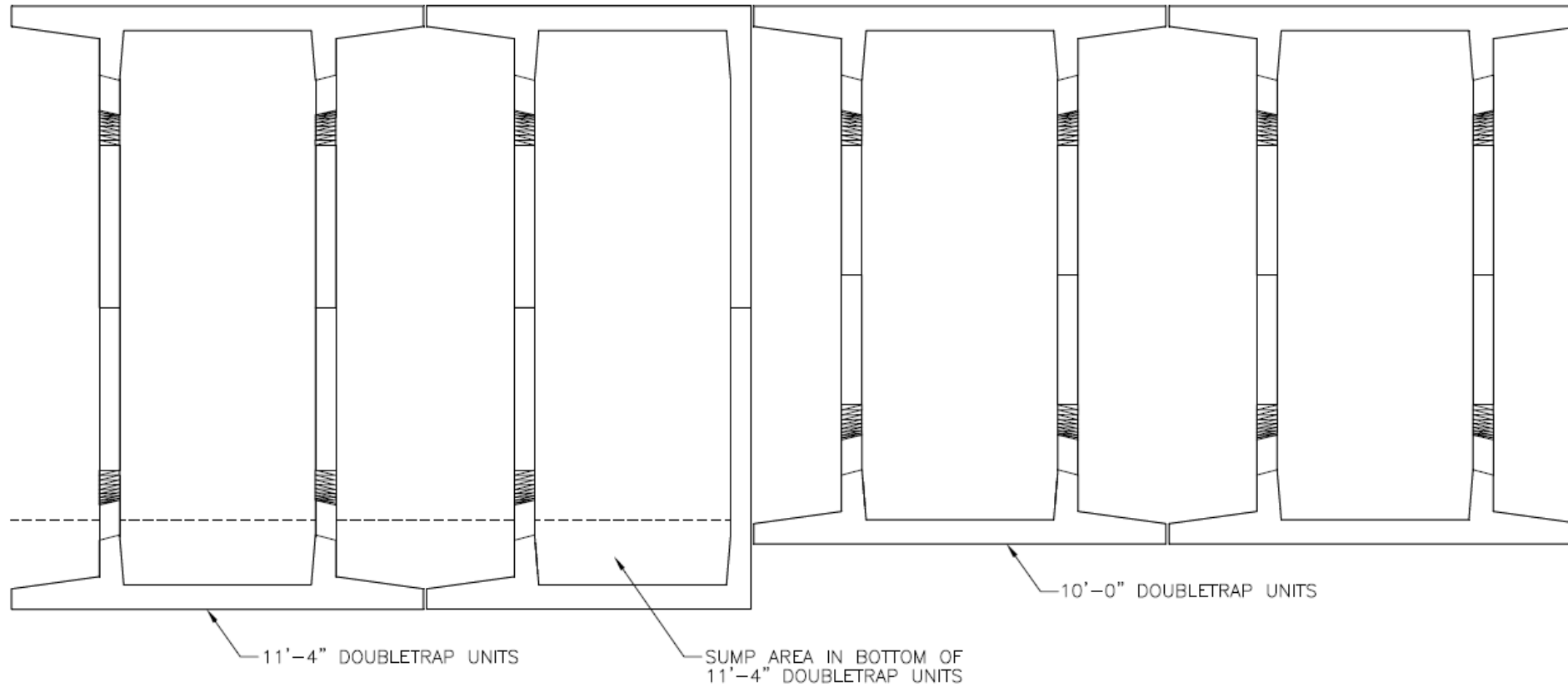- Number of pieces: 1,722

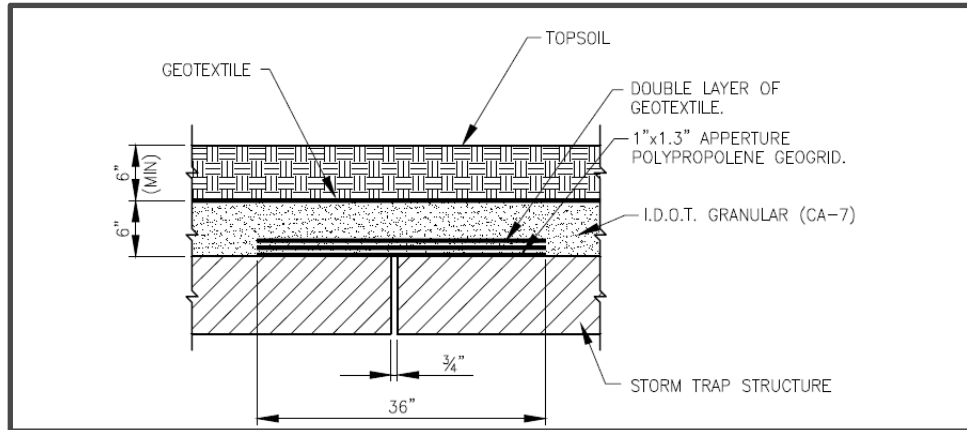- Total water stored: 23.7 acre feet

System Design and Functionality

System Design and Functionality

System Design and Functionality

11'-4" DOUBLETRAP UNITS

SUMP AREA IN BOTTOM OF
11'-4" DOUBLETRAP UNITS

10'-0" DOUBLETRAP UNITS

SECTION A-A

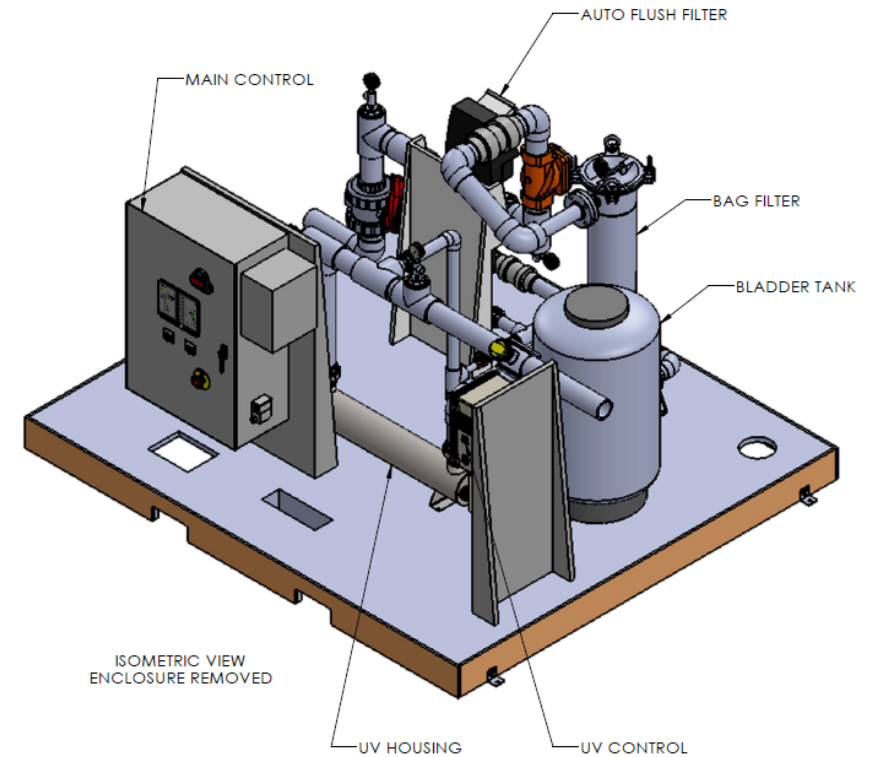# System Design and Functionality – Roof Inflow

System Design and Functionality – Watertight Seal

- System sealant type - joint

- Joints are sealed with Xypex Patch'n Plug hydraulic cement compound

- Sealed joints were tested following construction

UV Sanitization System

- Additional pre-filtration

- UV radiation kills bacteria and pathogens

- Minimal contact time required

- Non-chemical

- No odor

AUTO FLUSH FILTER

MAIN CONTROL

BAG FILTER

BLADDER TANK

ISOMETRIC VIEW
ENCLOSURE REMOVED

UV HOUSING

UV CONTROL

System Controls and Automation

- Automated control system

- Utilizes online weather forecast data

- Pumps stored water to the downstream sewer system in advance of large storms

- Onsite touch screen controls

- Web interface to monitor system remotely

Construction Progress

Construction Progress

Construction Progress

Construction Progress

Construction Progress

Construction Progress

Construction Progress

Wescott Park Time-Lapse

Questions?

Thank you

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StormTrap®