



# NATURAL SYSTEMS UTILITIES

*A Sustainable Water Company*

Project Partners:



The material in this document is confidential and may not be distributed or reviewed without the written permission of Natural Systems Utilities.

Hopewell Planning Board Presentation – 3/14/13

Zach F. Gallagher, P.E., LEED AP

Vice President, NSU

Board of Directors, US Green Building Council - NJ

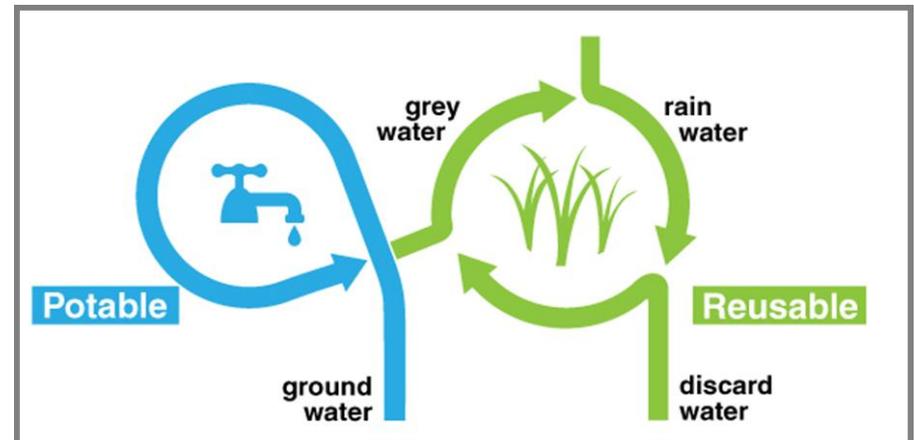
# Goals & Scope of Services

## ➤ Goals

- Assess alternative water resource strategies, technologies and layouts to advance concept phase planning initiatives and serve as the base for the next phase of design and permitting.
- Provide developer guidelines or specifications to be used during detail design and permitting.

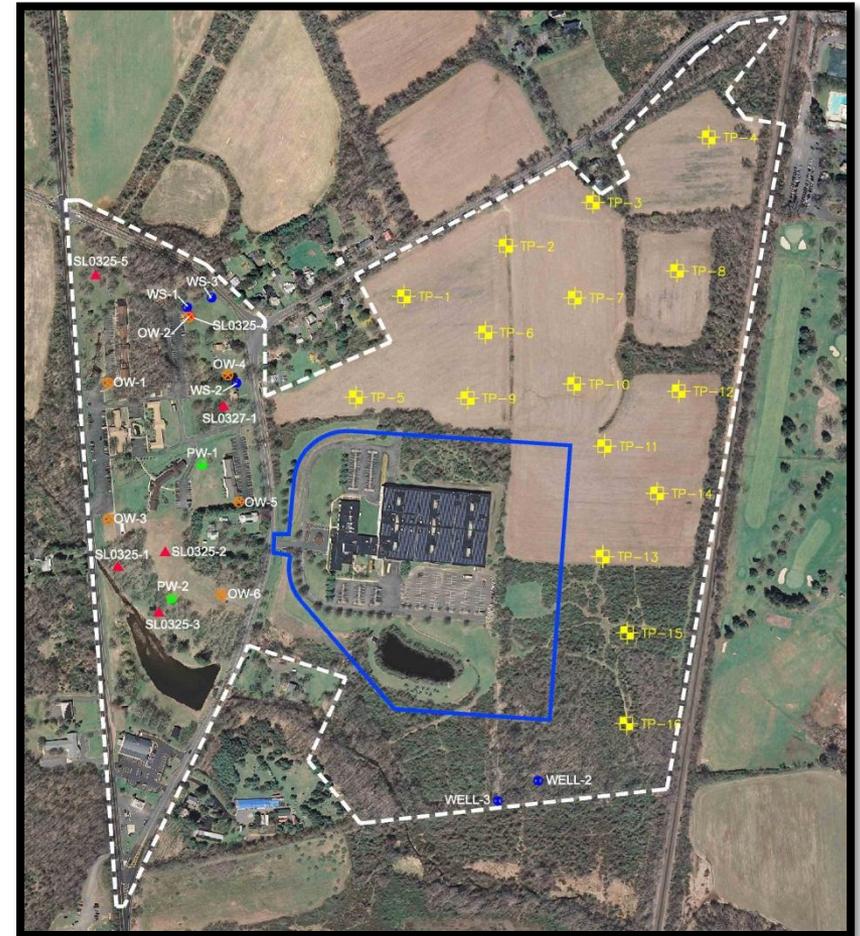
## ➤ Scope of Services

- Background Investigation Review (next slide)
- Treatment System and Disposal Evaluation
  - Geophysical Surveys/Test Pits
  - Infiltration Testing
- Water Balance Alternatives



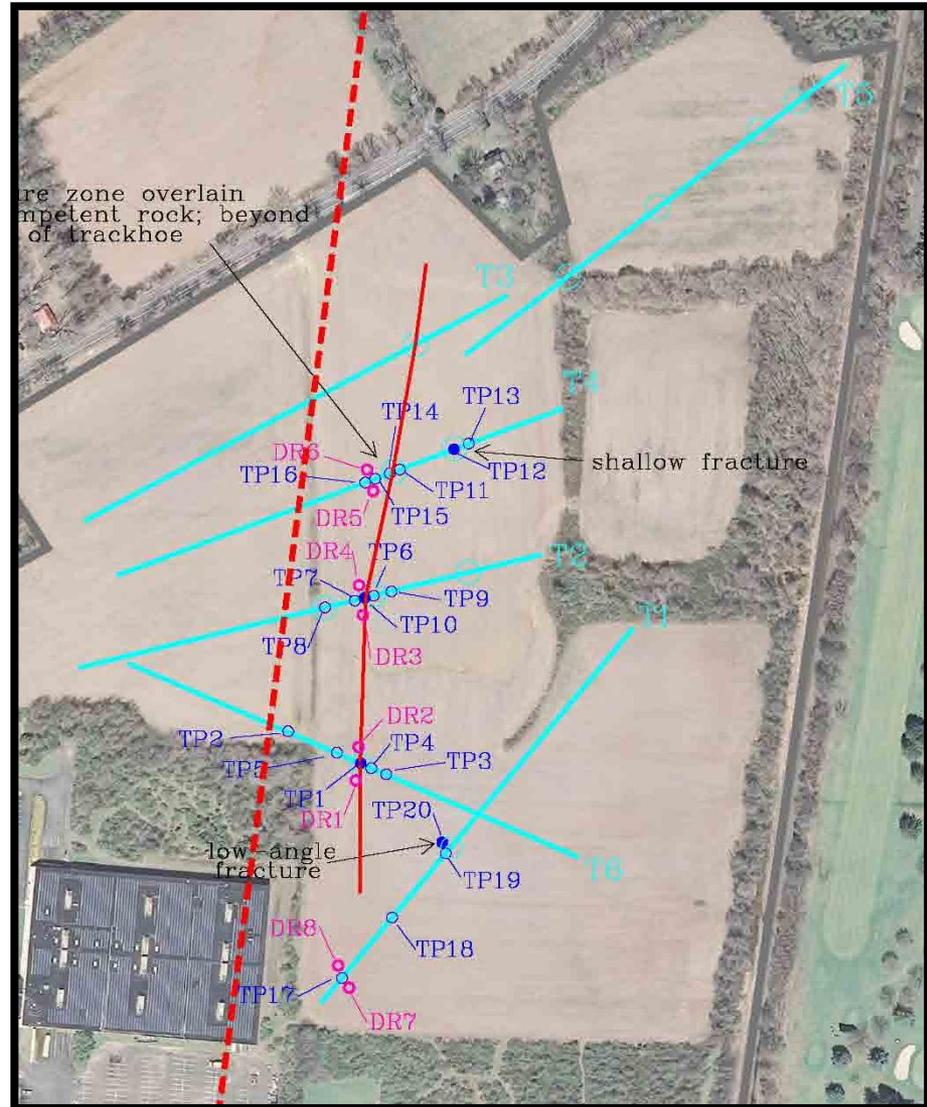
# Background Data Review

- M2 Associates Letter Reports dated May 21, 2009 and January 17, 2013 (Water Supply)
- Alliance Environmental Pennytown Evaluation dated July 14, 2009 (Pennytown Wastewater)
- Birdsall Services Group Wastewater Treatment & Disposal Assessment dated January 11, 2013 (Primarily Soil Test Pits)
- Additional published data including Bedrock and Geologic Mapping of Central and Southern New Jersey



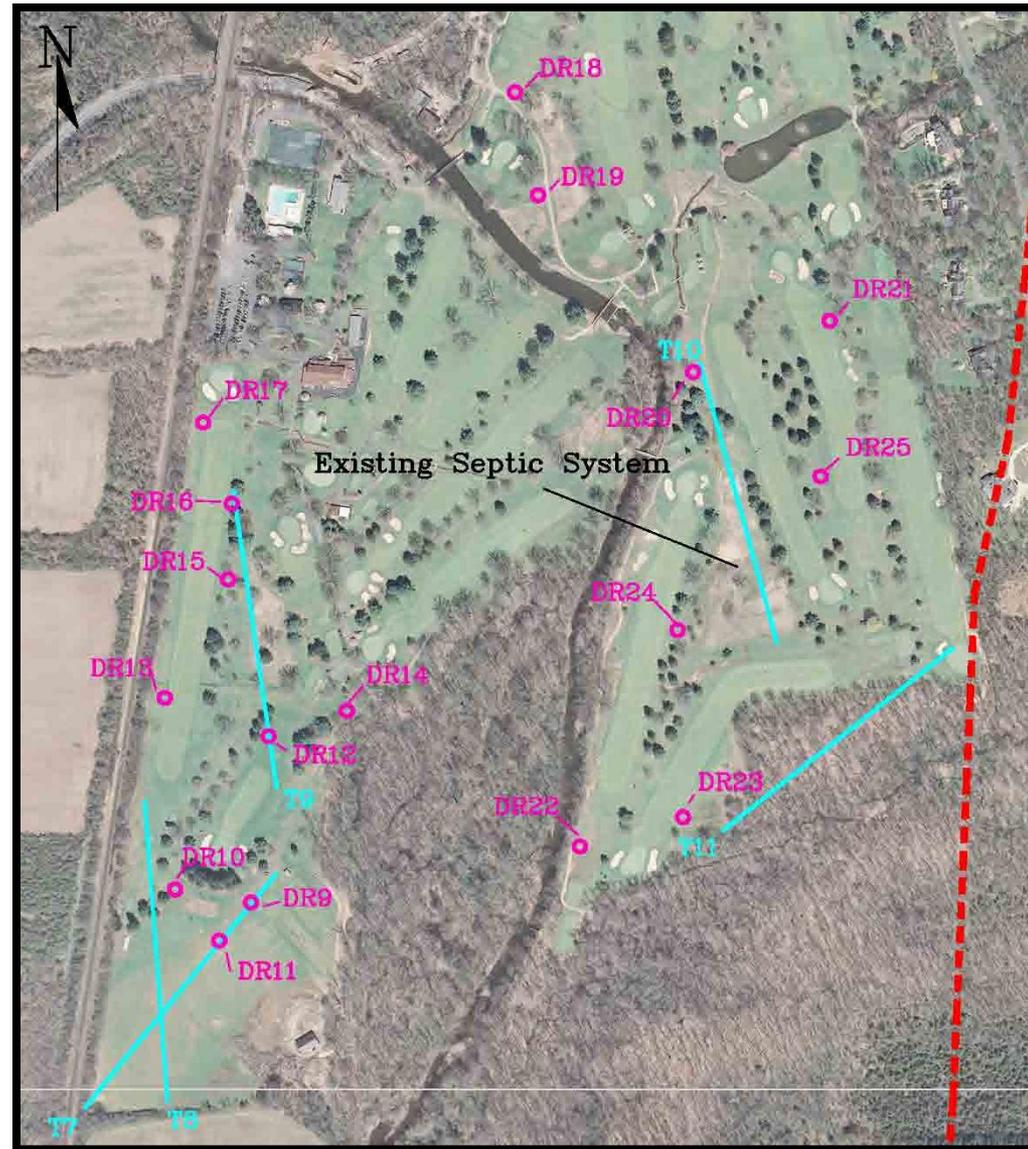
# Site Work Overview - Kooltronic

- Geophysical surveys identify areas of concentrated bedrock fractures.
- Fractures identified which previous test pits would have missed.
- Test pits (TP) excavated over these fracture zones.
- Double Ring (DR) infiltration test locations shown



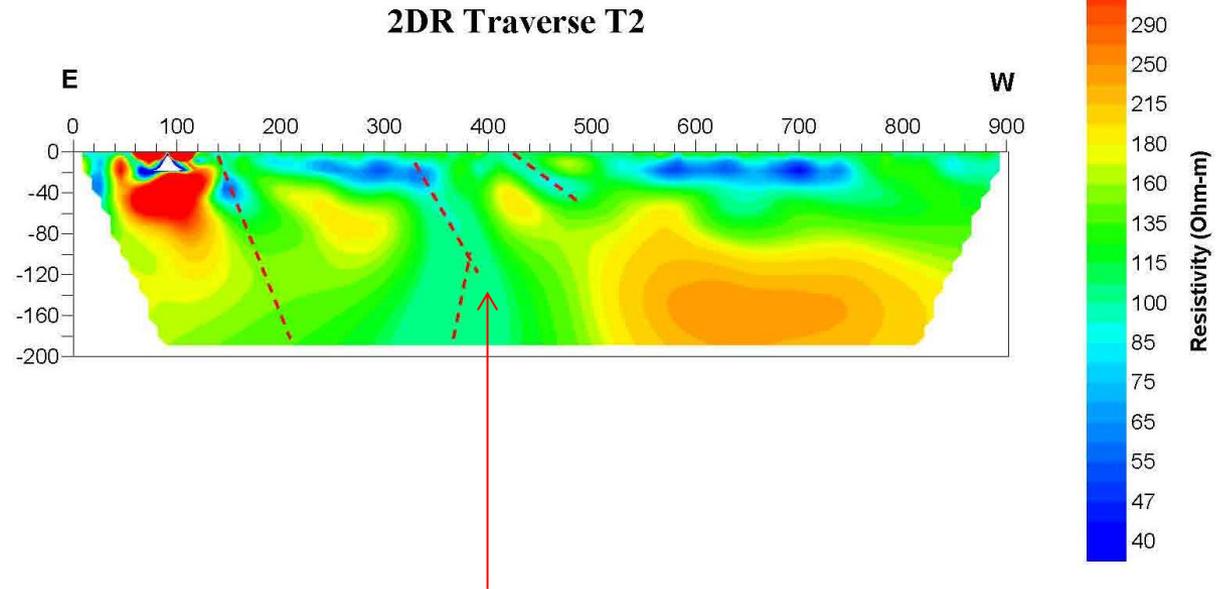
# Site Work Overview - HVGC

- Geophysical surveys conducted to identify areas of concentrated bedrock fractures.
- Double Ring (DR) infiltration test locations shown



# Highly Fractured Zone Identified on Kooltronic Tract

- Picture: TP 10 on Traverse T2



- At test pits TP1 and TP10 a highly fractured zone appears to be approximately 20-30 ft wide. It is representative of a more expansive regional fracture zone.

# Double Ring Infiltration Test Results

Test	Location	Depth (ft)	Soil Type	Rate (ft/d)
DR1	Kooltronics TP1	1.8	Silt/Clay	0.1
DR2	Kooltronics TP1	1.5	Silt/Clay	0.1
DR3	Kooltronics TP10	2.0	Silt/Clay	0.0
DR4	Kooltronics TP10	1.8	Silt/Clay	0.1
DR5	Kooltronics TP15/TP16	2.0	Silt/Clay	0.0
DR6	Kooltronics TP15/TP16	1.8	Silt/Clay	0.0
DR7	Kooltronics TP17	1.5	Weathered Shale	0.0
DR8	Kooltronics TP17	2.0	Weathered Shale	0.0
DR9	HVGC Driving Range	Surface	Silty Sand with Shale Gravel	55.6
DR10	HVGC Driving Range	Surface	Silty Sand with Shale Gravel	28.9
DR11	HVGC Driving Range	Surface	Crushed Shale and Clayey Sand	9.8
DR12	HVGC Fairway 18	Surface	Silty Sand with Shale Gravel	18.8
DR13	HVGC Fairway 18	Surface	Silty Sand with Shale Gravel	29.1
DR14	HVGC 17 Tee Box	Surface	Clay with Shale	0.8
DR15	HVGC Fairway 18	Surface	Silty Sand and Shale Gravel	26.2
DR16	HVGC Fairway 9 and 18	Surface	Silty Sand with Shale	11.4
DR17	HVGC Hole/Fairway 18	Surface	Silty Sand with Shale Gravel	15.4

Not suitable for drip/spray

Suitable for drip/spray

# Water Balance Based Approach – Baseline

Potable Water Supply

91,175 gpd

Site Precipitation



Evapotranspiration & Infiltration

Stormwater Discharge

Wastewater Discharge/Disp  
91,175 gpd

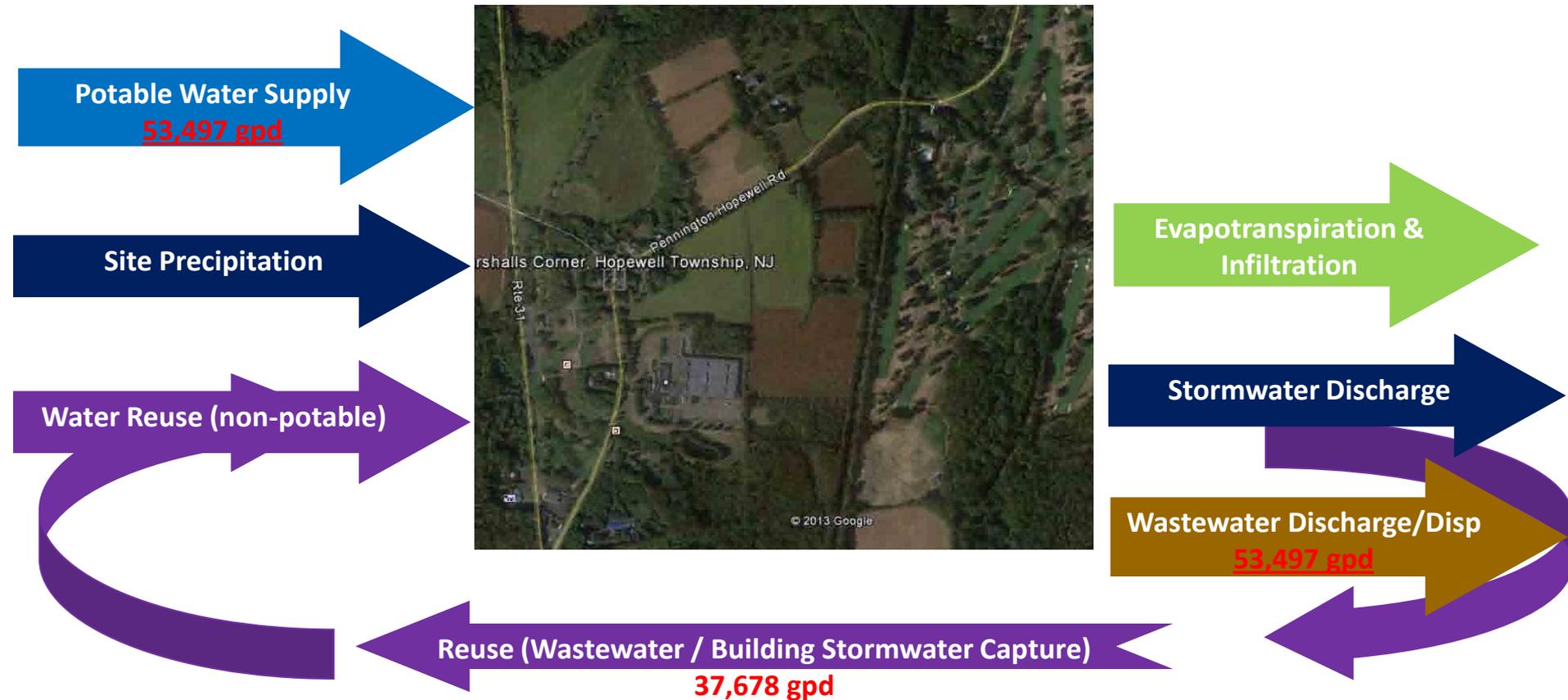
## Assumptions:

- 365 units (SF, TH & MF)
- 22,000 SF Non-Residential
- 25,000 SF Civic/Institutional

## Other Notes (Applies to slides 4-7):

- *Figures for site precipitation, infiltration and stormwater discharge are not shown on the above water balance in order to focus on water supply and wastewater dispersal needs. Based on the current concept plans stormwater run-off from impervious cover is estimated to be approximately 50,000 gpd (~450,000 gpd overall site). LID stormwater practices are recommended to minimize or eliminate off-site stormwater discharge including pervious cover, bioswales, etc).*

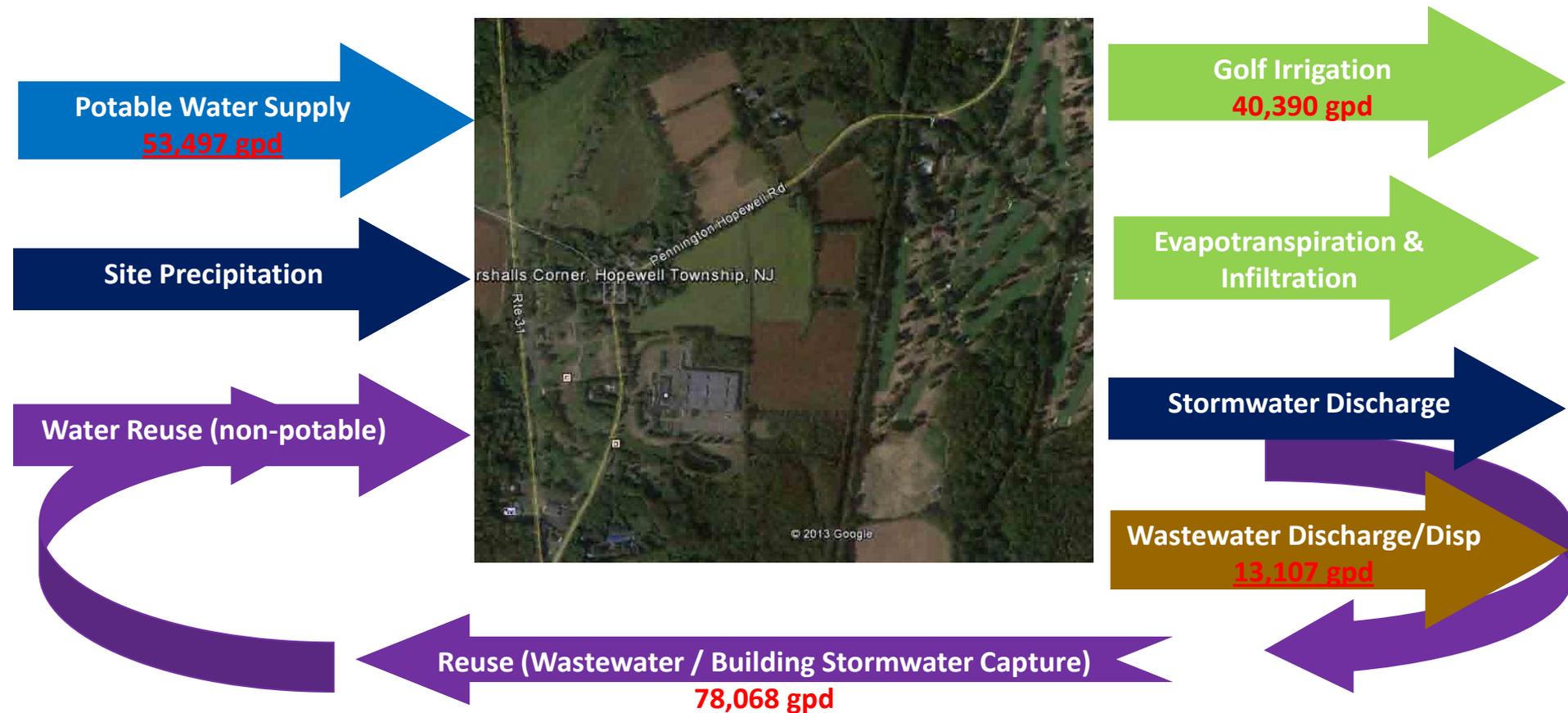
# Water Balance Based Approach – Alt 1 On-site Reuse



## Assumptions:

- 365 units (SF, TH & MF)
- 22,000 SF Non-Residential
- 25,000 SF Civic/Institutional
- Reuse On-site for water closets and laundry

# Water Balance Based Approach – Alt 2 On-site & Golf Reuse



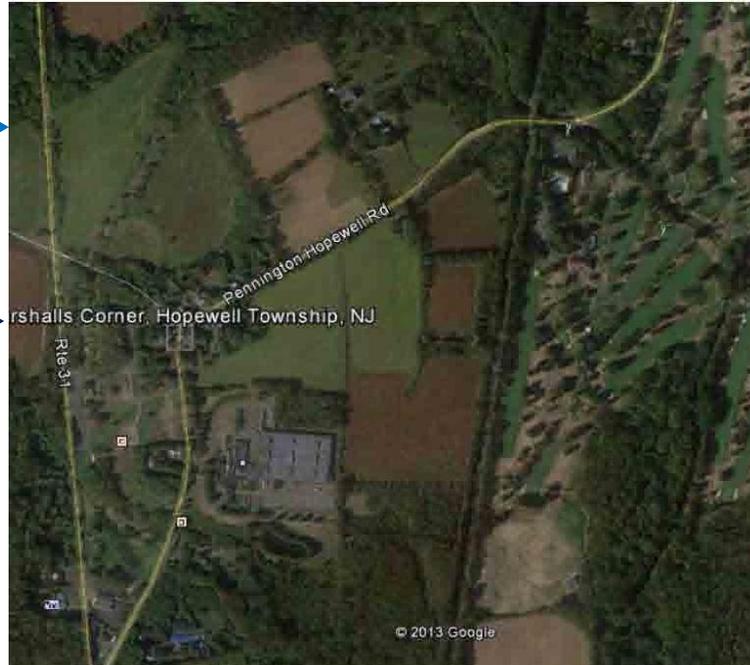
## Assumptions:

- 365 units (SF, TH & MF)
- 22,000 SF Non-Residential
- 25,000 SF Civic/Institutional
- Reuse for water closets, laundry and golf course irrigation

# Water Balance Based Approach – Alt 3 Pennytown Only

Potable Water Supply  
15,750 gpd

Site Precipitation



Evapotranspiration &  
Infiltration

Stormwater Discharge

Wastewater Discharge/Disp  
15,750 gpd

## Assumptions:

- 70 unit Affordable Housing Development
- No water reuse

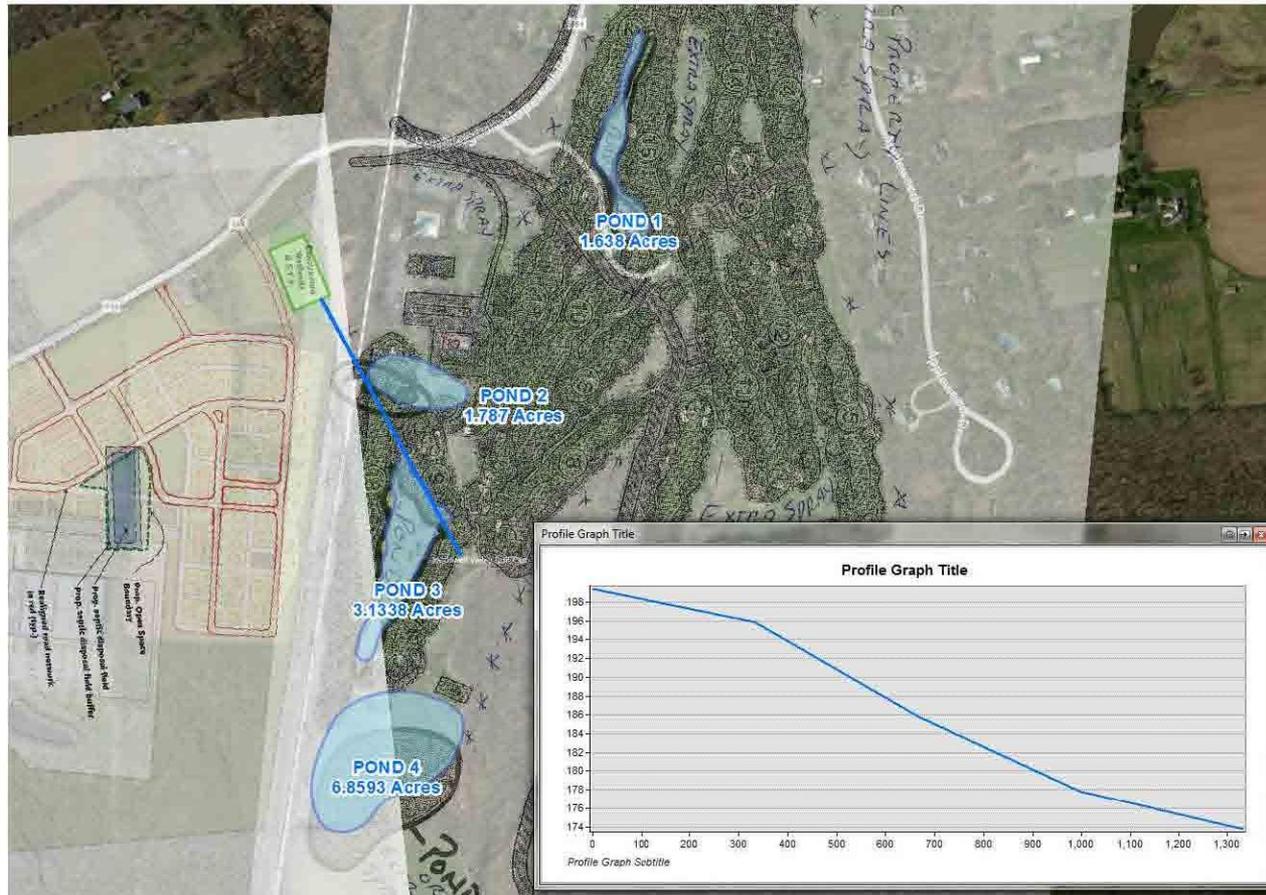
# Concept Plan A with Recommended Dispersal Area

- Base design flow 91,175 gallons per day (gpd)
- Infiltration rate of ~2 gallons per day per square foot (gpd/sf)
- 42,500 sf dispersal area shown centered over identified fracture zone
- Preliminary mounding analysis could not be completed using the background data due to variability of subsurface conditions.

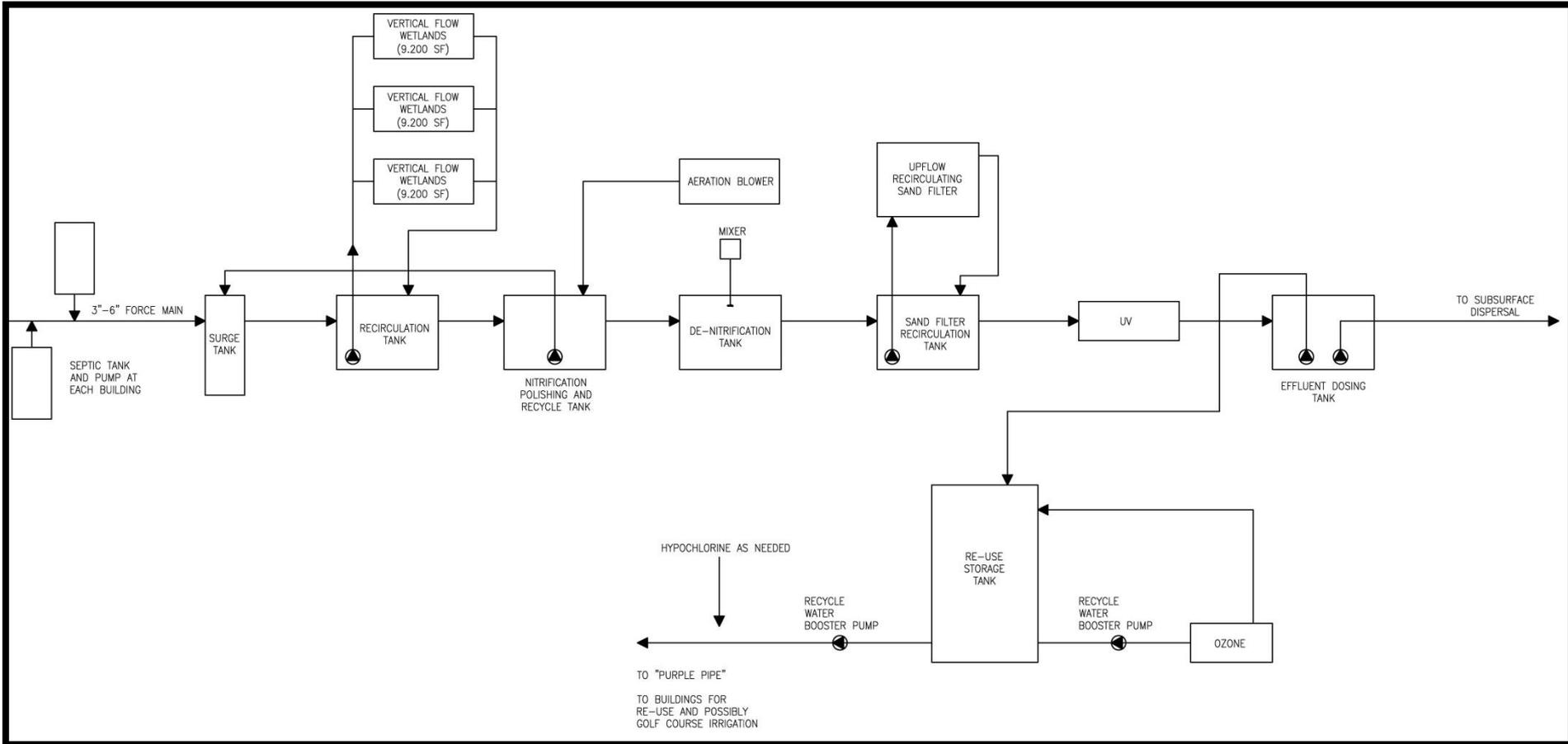


# HVGC Working Session

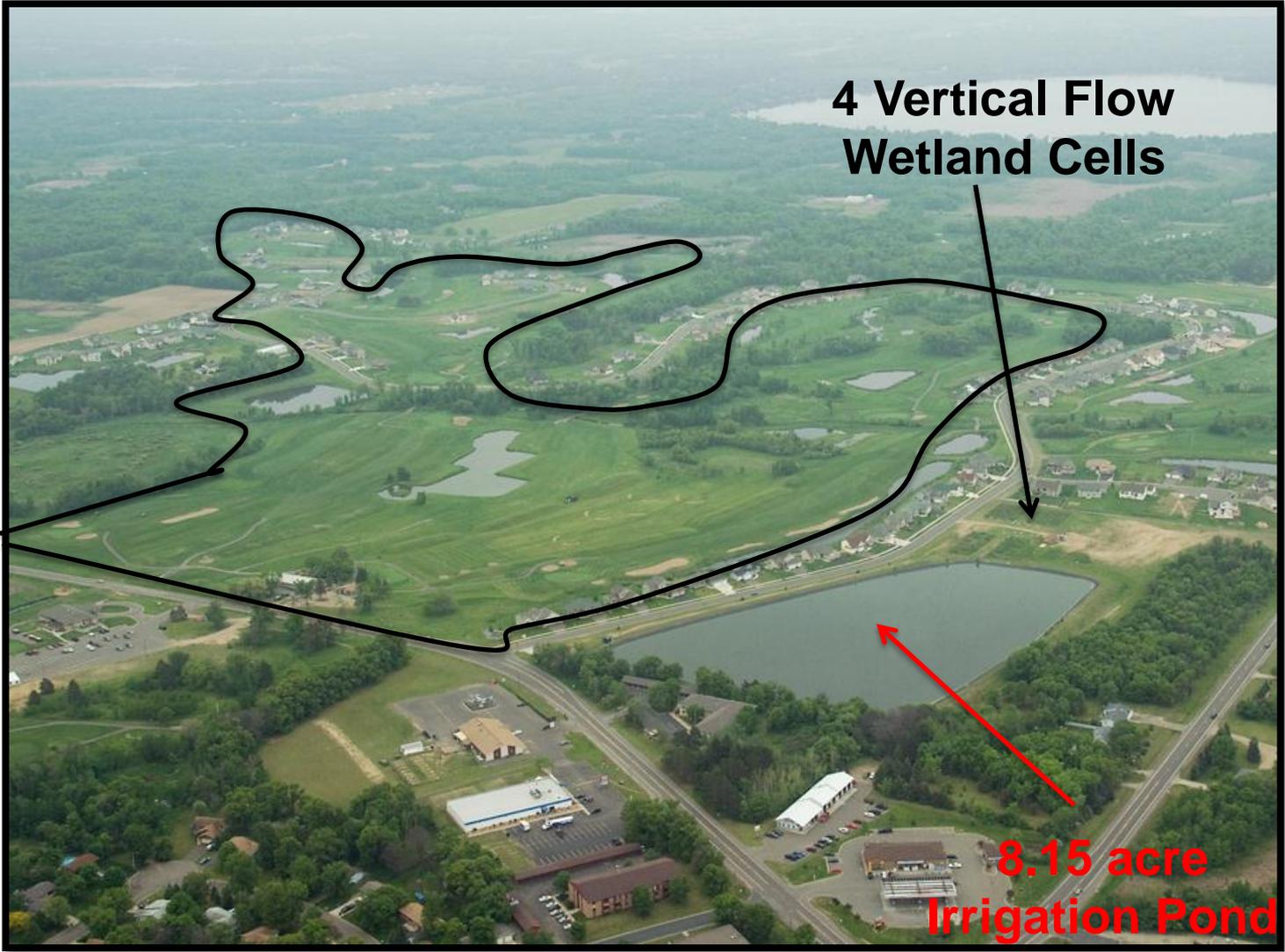
Map of Treatment Location Footprint (green box = 1.2 acres) and Potential Pipe Path to Reuse Location on Golf Course



# Proposed Treatment Process Flow Diagram



# Similar Installed Project – The Ponds, MN



# Similar Installed Project – The Ponds, MN



# Engineers Opinion of Capital Cost

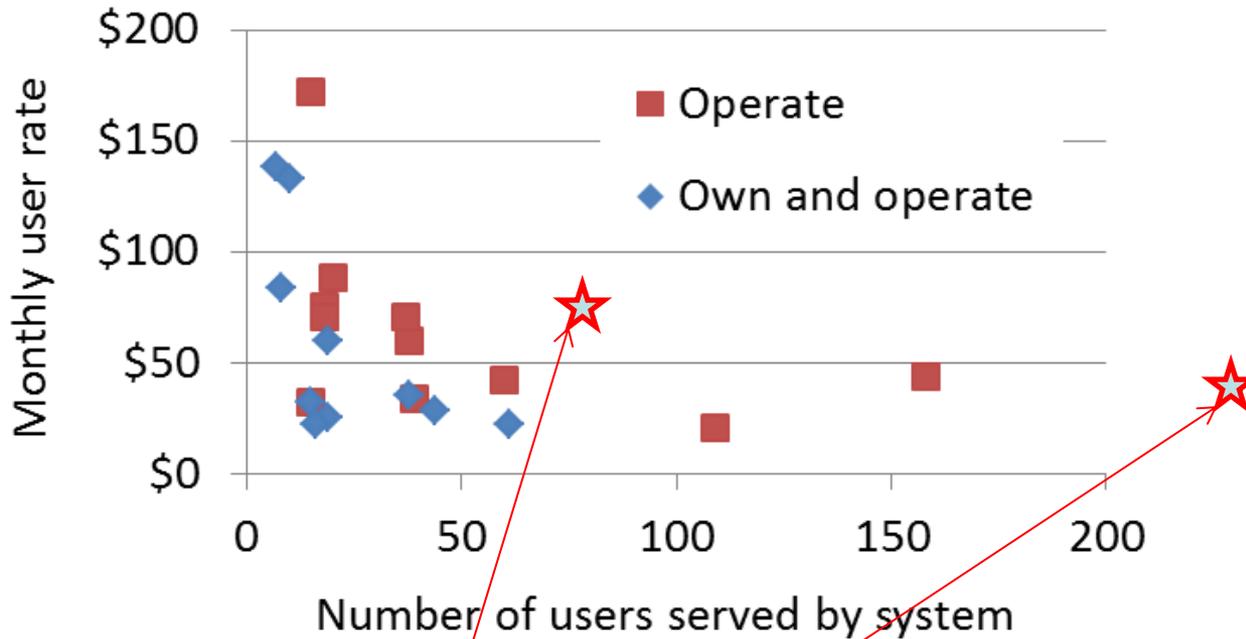
	GPD	#EDUs	Cost (\$)
<b>Baseline</b>	91,175	365	3,580,000
<b>Alternative 1 – Onsite Reuse</b>	91,175	365	3,306,000
<b>Alternative 2 – Reuse Onsite &amp; Golf</b>	91,175	365	3,980,000
<b>Alternative 3 – Pennytown Affordable Housing</b>	15,000	70	1,449,000

## Assumptions/Notes:

- Opinion of cost assumes vertical flow wetland technology with nitrogen reduction, filtration and disinfection.
- Opinion of cost for Alternative 2 includes estimated costs for forcemain and additional storage pond for reuse at the golf course.
- Opinion of cost is +/- 20-50% at concept phase and includes 20% contingency
- Cost assumes developer is responsible for STEP collection network
- EDU count shown is for residential use only

# Estimated End User Fees

- Figure below shows estimated wastewater user fees using wetland technology (MN).



- Redevelopment Zone Project Estimated User Fees:

- 70 Unit Pennytown - \$70/month/EDU
- 365 Unit Mixed Use Development - \$45/month/EDU
- Fees shown utilize wetland technology, more advanced/mechanical technologies will increase rates by as much as 100%.
- Comparison to ELSA proposal - \$149/month/EDU

# Conclusions/Recommendations

## ➤ **Background**

- Previous investigations identified challenging soils on the Pennytown-Kooltronic tracts which would not allow for conventional dispersal technologies to recharge the groundwater system.

## ➤ **Key Study Results**

- Geophysical surveys and associated test pits confirmed a highly fractured zone on the Kooltronic tract allowing for the opportunity of concentrated groundwater dispersal.
- Golf course feasibility assessment and infiltration testing confirmed the opportunity for beneficial reuse on the golf course and reduction or elimination of the Stony Brook surface water withdrawal.

## ➤ **Recommendations**

- Integrated water resource management strategy advancing both on-site dispersal and beneficial reuse for golf course irrigation to detail design and permitting.
- Inclusion of LID stormwater strategies within the developer guidelines/specifications



# NATURAL SYSTEMS UTILITIES

*A Sustainable Water Company*

Project Partners:



The material in this document is confidential and may not be distributed or reviewed without the written permission of Natural Systems Utilities.

Hopewell Planning Board Presentation – 3/14/13

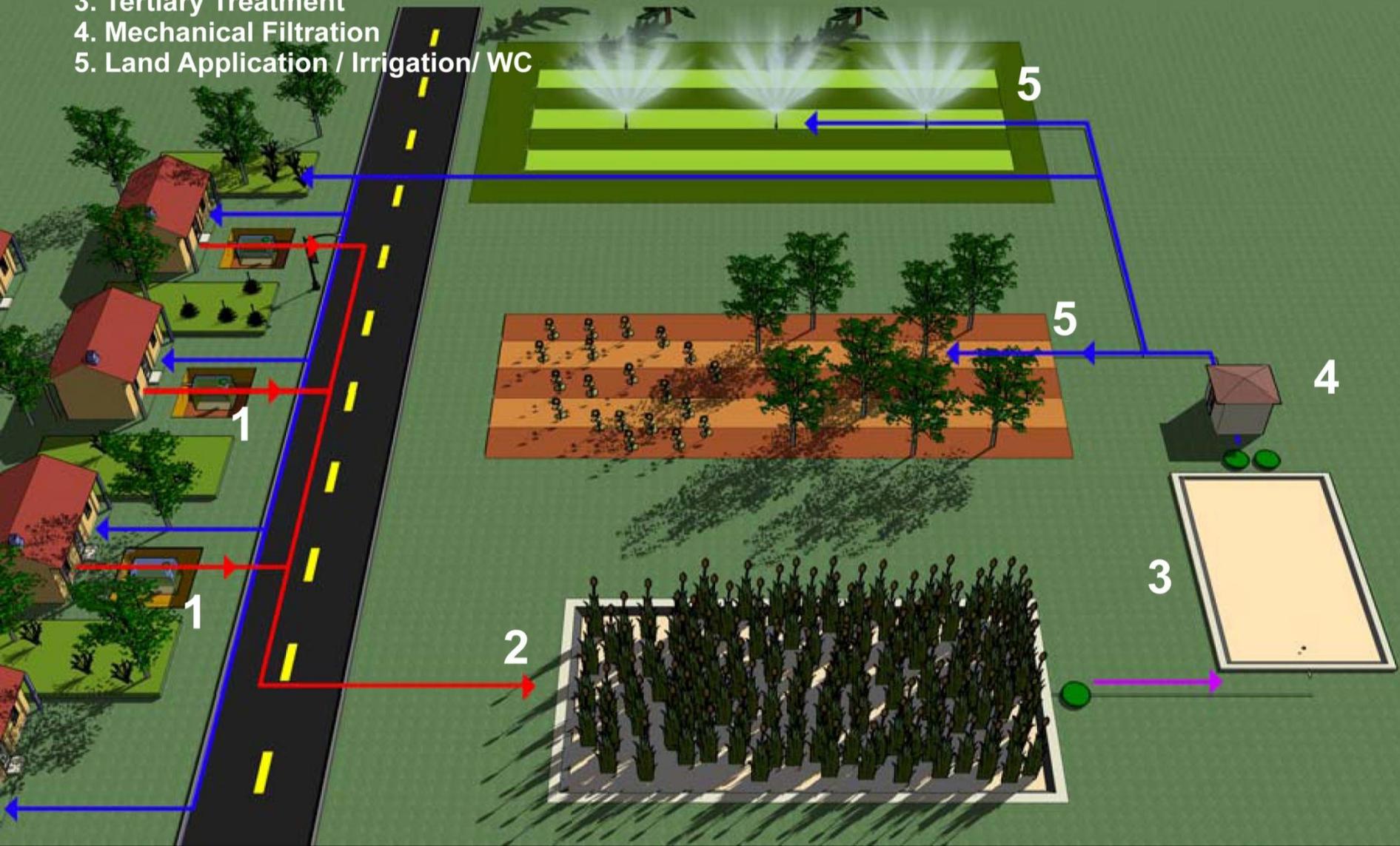
Zach F. Gallagher, P.E., LEED AP

Vice President, NSU

Board of Directors, US Green Building Council - NJ

# Engineered Wetland Reuse System - Concept

1. Collection & Primary Treatment
2. Secondary Treatment
3. Tertiary Treatment
4. Mechanical Filtration
5. Land Application / Irrigation/ WC



# Water Reuse Performance Standards

## NJDEP Category 1 RWBR Public Access Systems

Parameter	RWBR Requirement	Sample Type
Flow Rate		Continuous
Total Nitrogen	<10 mg/L*	Grab
Total Suspended Solids (TSS)	5 mg/L	Grab
Fecal Coliform	14 col/100 mL (2.2 weekly avg.)	Grab
Turbidity	2 NTU**	Continuous
Disinfection	100 mJ/cm <sup>2</sup> (UV) / 1 mg/L (CPO)	Continuous

### Notes:

\* The NJDEP may impose a total nitrogen concentration limitation greater than 10 mg/L if the permittee can demonstrate that a concentration greater than 10 mg/L is protective of the environment.

\*\* A statistically significant correlation between turbidity and TSS shall be established prior to commencement of the RWBR program. For UV disinfection, in no case shall the level of turbidity exceed 2 NTU while still maintaining the 5 mg/L maximum level for TSS.

## NYC Department of Buildings Performance Standards for Reuse

Parameter	Standard
pH	6.5-8
BOD	<10 mg/L
Total Suspended Solids (TSS)	<10 mg/L
Total Coliform	<100 / 100 mL
Turbidity	<2 NTU (95%) / <5 NTU (Max)

- **No federal regulations governing water reclamation & reuse**, regulated at the state level.
- 26 states with adopted regulations
- 16 states have guidelines
- 9 states without regulations or guidelines
- No states with regulations that cover all potential uses of reclaimed water.

WaterReuse Association estimates that **2.6x10<sup>3</sup> Mgal/day** of municipal wastewater are reclaimed and reused currently and reclaimed water on a volume basis is growing at an estimated **15% per year**.

# Distributed Systems Allowing Phasing

Small-scale systems can be installed 'just-in-time' and at 'just-the-right-size' to reduce one-off capital costs

