Andreyev Engineering, Inc.

▼ Groundwater ▼ Environmental ▼ Geotechnical ▼ Construction Materials Testing

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July 28, 2014

TO: City of Winter Garden
251 West Plant Street
Winter Garden, FL 34787

Attention: Donald Cochran, P.E.

SUBJECT: Conceptual Plan for Stormwater Capture, Reuse & Aquifer Recharge
City of Winter Garden, Orange County, Florida

Dear Mr. Cochran:

Andreyev Engineering, Inc. (AEI) has prepared this summary report which presents the development of a conceptual plan to capture stormwater runoff to supplement reclaimed water sources for irrigation and for artificial aquifer recharge.

The conceptual stormwater capture and reuse plan was developed based on our knowledge of the region, available published geologic and hydrogeologic data and the aquifer data included in the existing regional groundwater flow model (ECF model prepared by SJRWMD). No site specific investigations or comprehensive evaluations of the retention ponds or the aquifer recharge areas were made at this time.

The following report presents a summary of the work, evaluation and estimated quantities of stormwater capture and reuse as well as calculations estimating the resulting nutrient load reduction to Lake Apopka. An approximate cost estimate for the various components of the project are also included in this report. If you have any questions or comments, please contact the undersigned.

Sincerely,
Andreyev Engineering, Inc.

NICOLAS E. ANDREYEV
LICENSE
NO. 35459
STATE OF
FLORIDA
PROFESSIONAL ENGINEER

Nicolas E. Andreyev, P.E.
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Purpose

The purpose of this conceptual stormwater capture and reuse plan is to present an approach to capturing stormwater runoff for reclaimed water augmentation and for artificial aquifer recharge when irrigation water is not required.

Artificial Aquifer Recharge Concept

The capture of excess stormwater and artificial aquifer recharge is the least expensive and the most effective option for long term aquifer management and sustainability of water supply in Central Florida region. Aquifer recharge is the natural process of water cycle in the region that has been in effect for thousands of years. As development progresses, drainage improvements are made which increase runoff and effectively decrease the amount of water available for aquifer recharge. Development also increases withdrawal of groundwater from the aquifers creating further imbalance of the natural cycle of balanced aquifer recharge and discharge.

The idea of stormwater capture and artificial aquifer recharge is simply to restore the natural cycle of aquifer recharge or improve aquifer recharge in the available and suitable recharge areas. The aquifer recharge imbalance can be observed through an evaluation of historic decline of groundwater levels and potentiometric surface levels of the aquifers, the historic decline of spring flow rates, and the historical increases in flow rates in rivers and creeks downstream of developed areas. These are the actual field observable indicator parameters that can be monitored and used as a guide to determine the location and the amount of aquifer imbalance. To mitigate the observed aquifer recharge imbalance, the aquifer can be artificially recharged by applying water at specific (strategic) locations. Preferably, these locations are upstream of the impacted areas and are conducive to effective aquifer recharge.

The captured stormwater sources for aquifer recharge can be combined with reclaimed water, surface water from creeks, rivers, drainage ditches, lakes and even groundwater extracted from other regions of the aquifer system. In many cases, the artificial aquifer recharge system can be implemented with minimal initial capital investment by extending or upgrading existing reclaimed water systems and integrating natural depressions and/or existing retention ponds as artificial aquifer recharge areas. A stormwater capture and artificial aquifer recharge system can be continuously upgraded based on the observed aquifer imbalance data and the available opportunities to increase or decrease recharge, as necessary.

Scope of Work

For this conceptual stormwater capture and reuse plan the following scope of work was conducted:

1. Obtained the latest regional groundwater flow model from the SJRWMD (ECF Model) and utilized the aquifer parameter data to identify beneficial artificial aquifer recharge areas for City's water supply wells and for spring flow protection. The scope of work did not include specific modeling scenarios,

regional model updates or analyses of the effects of proposed source water capture and recharge.

2. Identified and reviewed available properties owned by or accessible to the City that can be used for stormwater capture and for artificial aquifer recharge. This was obtained from City's GIS database and discussions with Donald Cochran and Art Miller.

3. Identified and reviewed available surface water bodies, drainage ways, canals, existing stormwater retention areas and other water source areas for potential capture of stormwater runoff that would normally discharge to Lake Apopka. Identification of source water areas were not considered in the areas of closed drainage basins, where excess water will naturally recharge the aquifer. The capture of stormwater runoff was restricted to areas along the southern shores of Lake Apopka, where multiple creeks and drainage ways discharge directly into the lake. Capture of these water sources will be beneficial both for the reclaimed water augmentation, aquifer recharge and for water quality improvement in Lake Apopka.

4. Identified and selected two (2) source stormwater sites along the south shore of Lake Apopka. These include existing stormwater drainage systems and discharge points from the City's downtown drainage basins. The stormwater source sites will require considerable design modifications to convert the existing areas into large stormwater retention and capture systems. The captured stormwater will be filtered and chlorinated and then pumped directly into the City's existing Reclaimed Water System.

5. Identified artificial aquifer recharge site to discharge the excess reclaimed water sources (during wet season period or during period of low irrigation demand), including captured stormwater.

6. Obtained drainage basin data from the City's Drainage Master Plan and estimated the amount of runoff from the two selected basins. Utilizing the land use plans within the basin areas, estimate the annual generation of Nitrogen and Phosphorus and calculated the amount of nutrient load reduction to Lake Apopka that would results from capturing and reusing the stormwater runoff.

7. Estimated the anticipated cost of constructing the stormwater capture ponds, installation of the intake structures, filtration and chlorination equipment, connection and extension pipelines, manholes, valves, electrical equipment and other equipment to allow implementation of this project.

8. Prepared this summary report with conceptual plans to design the stormwater capture, filter, chlorinate and reuse or recharge the aquifer. This report can be used for planning, budgeting, funding alternatives and other purposes.

Conceptual Plan

Source Locations

Based on the data collected and review of existing drainage systems within the city limits and input from City's staff, two (2) specific stormwater runoff sources have been identified. The 2 most reliable stormwater runoff basins were selected based on their potential to capture significant amount of stormwater which currently receive minimal pre-treatment prior to discharge to Lake Apopka. These sites are located near existing reclaimed water transmission lines and can be easily connected to the overall city's reclaimed water supply system. The two (2) selected drainage basins are presented on **Figure 1** and the specific stormwater capture pond areas are presented on **Figures 2 and 3**.

Source #1 – City's Wastewater Treatment Facility Site

The simplest site for stormwater capture is the existing city's wastewater treatment facility (WWTF) site. Currently, the WWTF site has some vacant land on both sides of the facility with drainage canals that provide significant discharge of stormwater from the downtown and adjacent areas. A drainage ditch exists on the western side of the site which discharges directly into Lake Apopka. The wastewater treatment facility also has an associated stormwater retention pond located on the western side of the property. The eastern side of the property is bisected by a drainage canal also discharging to Lake Apopka. East of this drainage canal is a large vacant area.

It is proposed to utilize the existing retention pond, the two drainage canals and the vacant area on the east side for stormwater runoff capture and reuse. The entire site will be designed with new retention ponds and overflow structures to maximize capture of stormwater for reclaimed water augmentation. The captured stormwater will be pumped directly from the retention ponds to the WWTP, filtered/chlorinated and combined with the existing reclaimed water sources of the WWTP.

Source #1 Summary

Source Description	***Existing City's WWTF on East Crest Avenue***
Total Area of Retention Ponds	***4 Acres***
Number of Pump Stations	***1***
Estimated Capture Capacity	***0.8 MGD (292 MGY)***
Description: Convert existing retention pond, the two drainage ditches and the eastern vacant land area into two retention and capture ponds with a control/overflow structures and an interconnected intake structure. Install a pump station and necessary piping to capture stormwater and augment the reclaimed water system, provide reclaimed water sources for irrigation and artificial aquifer recharge during wet season periods and low irrigation demand periods, see **Figure 2**.	

<u>Source #2 - City Park and Existing Pond Site</u>

This site is another viable source of water for the alternative water supply system. The site is a combination of an existing stormwater pond, bordered on the east by a large drainage canal and includes a small park area. The entire site is owned by the city and is available for design and reconstruction for the alternative water supply system proposed in this report. The site is located on south shores of Lake Apopka, at North Lakeview Avenue and Division Street. The existing canal that bisects the site provides a direct connection/discharge to Lake Apopka.

The proposed conceptual plan for this site will include combining the existing retention pond on the west with the drainage canal and the park area into one large pond with an outfall structure. This will minimize or eliminate the direct stormwater discharge to Lake Apopka The captured stormwater will be pumped from the retention pond, filtered and chlorinated and then pumped directly into the City's existing Reclaimed Water System Trunkline located adjacent to the site on North Lakeview Avenue. A conceptual plan showing the general details and layout of the proposed site modification is provided on **Figure 3**.

Source #2 Summary

Source Description	***City Park and Pond Area at North Lakeview Avenue and East Division Street***
Total Area of Ponds	***6 Acres***
Number of Pump Stations	***1***
Estimated Capture Capacity	***1.2 MGD (430 MGY)***
Description: Convert existing retention pond, large drainage ditch and the adjacent city park into a single large retention pond with a control/overflow structure. Install an intake structure, a filtration and chlorination system, electrical system and a pump station to capture stormwater runoff to augment the City's reclaimed water system. This will provide water sources for irrigation and artificial aquifer recharge during wet season periods and low irrigation demand periods, see **Figure 3**.	

Aquifer Recharge Basin

To evaluate the regional beneficial aquifer recharge locations, the location of the city's water supply wells, the boundaries of the springshed, the geology of the area and the hydrogeologic conditions of the aquifers were reviewed. The evaluation included identification of regional significant recharge areas, observed closed drainage basin areas and other obvious indicator parameters that indicate internally drained conditions that would be beneficial for aquifer recharge. For this purpose, we have reviewed the soil boring profiles from various geotechnical investigations by AEI and others in the area, the well logs from water supply wells in the area, the lake levels, the lake overflow elevations, the data included in the regional groundwater flow model and conducted a visual field survey of each property.

Once the regional effective recharge areas were identified, the potential aquifer recharge basins were evaluated and discussed with the City's planning and engineering personnel. The final properties were selected in consultation with Donald Cochran and

Art Miller, based on city owned properties, properties that are accessible for city's use, and/or undeveloped properties that could be acquired by the city. These sites were then evaluated further using available geologic and hydrogeologic data and field observations. Although no site specific testing was conducted at this time, the field observations included assessment of topographic setting and observed depth to groundwater level in lakes and depressional areas, which provide an indication of the groundwater conditions in the area.

The regional geologic/hydrogeologic evaluation revealed that the most beneficial artificial aquifer recharge areas are located in the southwestern portion of the City limits, in the general vicinity of the Conserve II project limits.

The northern and eastern portions of the City limits were determined to have limited benefit for artificial aquifer recharge. The majority of the northern and eastern parts of the City of Winter Garden are characterized by a thick sequence of confining soil layers which hydraulically separate the surficial and Upper Floridan aquifers. Water applied in these areas recharge the shallow aquifer, then perch on top of the confining soil layers and flow laterally towards Lake Apopka. Very little, if any, of the recharging water at the surface reaches the Floridan aquifer in this region.

In contrast, the southwestern portion of the City limits, these confining layers thin out and become highly leaky. A thicker sequence of extremely well drained soils is present in these areas that would allow storage of large quantities of captured stormwater within the surficial aquifer sands with subsequent vertical leakage into the Floridan aquifer. These are the areas that will provide the greatest opportunity for beneficial aquifer recharge. The high soil storage capacity will provide the needed storage of excess captured water during wet season periods and the subsequent vertical leakage will provide for aquifer recharge when captured water is used for irrigation.

The final selection of storage basin sites and potential aquifer recharge sites were reduced to a total of three properties that have the best potential for City's control and implementation. The following are the selected three artificial aquifer recharge sites.

Site #1- Marsh Road Site (City Owned)

Storage & Recharge Type	***Pond, Swales & Wetland Hydration***
Total Area of Property	***40 Acres (+/-)***
Available Storage Capacity	***6 MG***
Effective Recharge Area	***5 Acres***
Estimated Recharge Capacity	***0.4 to 0.6 (146 - 219 MGY)***
Description: This site is owned by the City, located on Marsh Road, it abuts the northeast corner of the Carriage Pointe Subdivision. Observations of the site conditions indicated a significant portion of the site contain wetlands that are surrounded by upland areas on the southeast and northwest. Our assessment of this site indicates some potential for aquifer recharge. This site could also be utilized for wetland hydration, which can improve wetlands and create regionally higher groundwater levels that would help recharge the aquifer. Its proximity to the reclaimed water system and regional recharge areas can be beneficial for storage and recovery and for artificial aquifer recharge. See **Figure 4**.	

Site #2 – Retention Pond at Carriage Pointe Subdivision

Storage & Recharge Type	***Retention Pond & Recharge Basin***
Total Area of Property	***3 Acres (+/-)***
Available Storage Capacity	***3 to 5 MG***
Effective Recharge Area	***3 Acres***
Estimated Recharge Capacity	***0.2 to 0.4 MGD (73 - 146 MGY)***
Description: The existing retention pond is currently used for stormwater retention and treatment. The City will take control of the operation and maintenance of the pond and convert it into a dual use system. Stormwater will continue to be directed to the retention pond. However, this pond is located in an area of very deep groundwater table and highly permeable soils. Captured stormwater or reclaimed water will be applied periodically into the pond for aquifer recharge purposes. An additional benefit of this site will be the recharge to the shallow aquifer, which will first create a mound in the shallow aquifer and then flow laterally towards area lakes and wetlands, including Johns Lake, which is known to recharge the Floridan aquifer system and is an MFL lake. See **Figure 5**.	

Site #3 – Retention Pond at Alexander Ridge Subdivision

Storage & Recharge Type	***Retention Pond & Recharge Basin***
Total Area of Property	***4 Acres (+/-)***
Available Storage Capacity	***4 to 6 MG***
Effective Recharge Area	***4 Acres***
Estimated Recharge Capacity	***0.3 to 0.5 MGD (110 - 182 MGY)***
Description: The existing retention pond is currently used for stormwater retention and treatment. The City will take control of the operation and maintenance of the pond and convert it into a dual use system. Stormwater will continue to be directed to the retention pond. However, this pond is located in an area of very deep groundwater table and highly permeable soils. Captured stormwater or reclaimed water will be applied periodically into the pond for aquifer recharge purposes. An additional benefit of this site will be the recharge to the shallow aquifer, which will first create a mound in the shallow aquifer and then flow laterally towards area lakes and wetlands, including Johns Lake, which is known to recharge the Floridan aquifer system and is an MFL lake. See **Figure 6**.	

Preliminary Cost Estimates

The following are our preliminary cost estimates to construct the two stormwater capture areas (sources) and the three artificial aquifer recharge areas. These estimates are intended for preliminary planning and funding purposes only. The cost estimates were based on other similar projects and were not based on site specific soil and groundwater data. Prior to final construction, each site will need to be investigated and final construction plans will need to be prepared for each site.

Project Cost Estimates

Source 1 Stormwater Capture and Reuse					
Construct Collection Pond at WWTP Site East (combine stormwater ponds)					
	Excavation/Berm Construction (4 ac x 6' deep)		$	120,000	
	Control/Overflow Structures		$	100,000	
	Site Works (sod, landscaping, berm, etc.)		$	100,000	
	Yard Piping (16", 1000 ft @ $80/LF)		$	80,000	
	Wet Well, Pump Station, Connection to WWTP..)		$	250,000	
	Drainage Structures and Manholes		$	50,000	
	Electrical and Instrumentation		$	50,000	
		SUBTOTAL	$	750,000	
		Contingency @ 10%	$	75,000	
		Engineering & CEI Services @ 15%	$	112,500	
	TOTAL FOR SOURCE 1		**$**	**937,500**	
Source 1 - Estimated Stormwater Capture Capacity					
Total Capture Volume				**38,497,527**	**CFY**
Total Capture Volume				**288**	**MGY**
Capture Capacity per Irrigation Day (total of 144 Irrigation days/year)				**2.00**	**MGD**
Equivalent Annual Average Capture Rate (3654 days per year)				**0.80**	**MGD**
Source 2 Stormwater Capture and Reuse					
Reconstruct Park Area into a Collection Pond					
	Excavation/Berm Construction (6 ac x 6' deep)		$	185,000	
	Control/Overflow Structure		$	100,000	
	Site Works (sod, landscaping, berm, etc.)		$	100,000	
	Yard Piping (16", 1,500 ft @ $80/LF)		$	120,000	
	Wet Well, Pump Station, Mech. Filter, Disinfection..)		$	750,000	
	Drainage Structures and Manholes		$	50,000	
	Electrical and Instrumentation		$	100,000	
		SUBTOTAL	$	1,405,000	
		Contingency @ 10%	$	140,500	
		Engineering & CEI Services @ 15%	$	210,750	
	TOTAL FOR SOURCE 2		**$**	**1,756,250**	
Source 2 - Estimated Annual Stormwater Capture					
Total Capture Volume				**57,813,127**	**CFY**
Total Capture Volume				**432**	**MGY**
Capture Capacity per Irrigation Day (total of 173 Irrigation days/year)				**2.50**	**MGD**
Equivalent Annual Average Capture Rate (3654 days per year)				**1.20**	**MGD**

Site 1: Aquifer Recharge Basins on Mash Raod (City owned)				
Construct Infiltration Ponds, Swales, Wetland Hydration Systems				
	Excavation/Berm Construction (Multipe Systems, 5-6 acres)		$	290,400
	Extend Reclaimed Water Lines, connections, discharge Structures)		$	100,000
		SUBTOTAL	$	390,400
		Contingency @ 10%	$	39,040
		Engineering & CEI Services @ 15%	$	58,560
	TOTAL FOR SITE 1		**$**	**488,000**
Site 2: Aquifer Recharge - Existing Retention Pond at Carriage Pointe Subdivision				
	Extend Reclaimed Water Lines, connections, discharge structures)		$	150,000
		SUBTOTAL	$	150,000
		Contingency @ 10%	$	15,000
		Engineering & CEI Services @ 15%	$	22,500
	TOTAL FOR SITE 2		**$**	**187,500**
Site 3: Aquifer Recharge - Existing Retention Pond at Alexander Ridge Subdivision				
	Extend Reclaimed Water Lines, connections, discharge Structures)		$	180,000
		SUBTOTAL	$	180,000
		Contingency @ 10%	$	18,000
		Engineering & CEI Services @ 15%	$	27,000
	TOTAL FOR SITE 3		**$**	**225,000**
GRAND TOTAL			**$**	**3,594,250.00**
	SJRWMD Participation @ 33%		**$**	**1,186,102.50**
	City of Winter Garden Matching Funds		**$**	**2,408,147.50**

Nutrient Capture Estimates

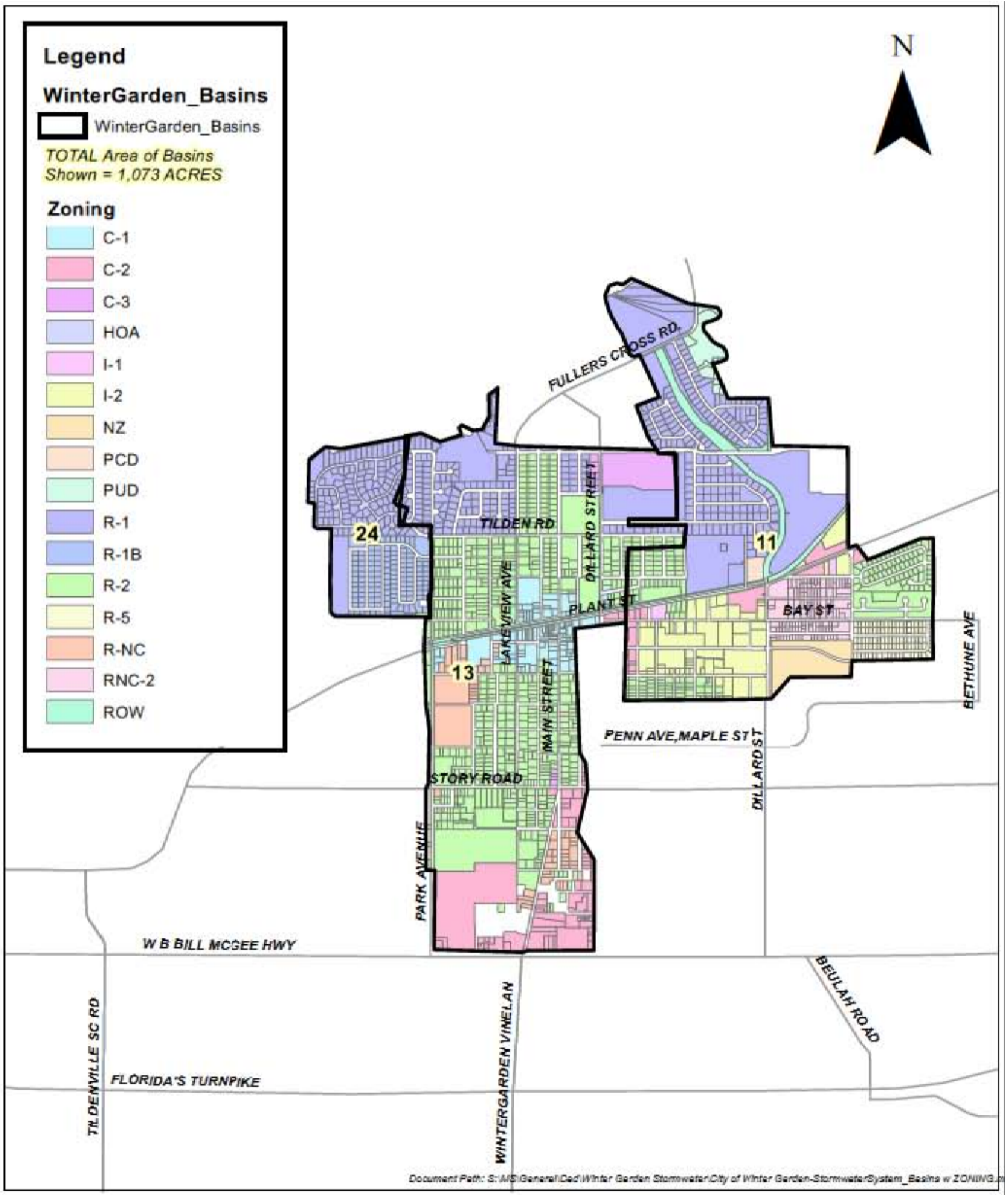
The following calculations show the estimated volume of total nitrogen and total phosphorus that can potentially be captured and diverted from discharging to Lake Apopka, if both drainage basins are included in the stormwater capture and aquifer recharge project. This assumes that the proposed two ponds will be capable of capturing the estimated 1.8 MGD of stormwater on an annual average basis. The calculations indicate that about **10,950 pounds of total nitrogen and about 1,988 pounds of total phosphorus** can be captured. This can be a significant beneficial effect on Lake Apopka.

Table 1 City of Winter Garden Stormwater Improvements - Source 1 Nitrogen (N) and Phosporous(P) Generation per Basin										
Area	**Basin Land Use**	**Drainage Area(ac)**	**Runoff Coefficient - C**	**Annual Rainfall(inches)**	**Annual Runoff Volume (MG)**	**Annual Runoff Volume (m^3)**	**EMC N (mg/L)**	**EMC P (mg/L)**	**TN Generated Annually (lbs)**	**TP Generated Annually (lbs)**
13-R	1200	250.61	0.35	50.70	120.75	457215	2.23	0.32	2248	318.60
13-C	1400	13.97	0.80	50.70	15.39	58271	1.93	0.48	248	61.70
13-I	1550	56.23	0.78	50.70	60.37	228735	1.55	0.15	782	75.70
13-NZ/ROW	1750	149.7	0.60	50.70	123.63	468372	1.80	0.48	1859	495.70
13-Vacant	4100	77	0.25	50.70	26.50	100398	0.70	0.09	155	19.90
Subtotals		**547.49**			**346.64**				**5292**	**971.60**
24-R	1200	86.2	0.35	50.70	41.52	157220	2.23	0.32	773	109.50
24-C	1400	0	0.80	50.70	0.00	0	1.93	0.48	0	0.00
24-I	1550	0	0.78	50.70	0.00	0	1.55	0.15	0	0.00
24-NZ/ROW	1750	0	0.60	50.70	0.00	0	1.80	0.48	0	0.00
24-Vacant	4100	11	0.25	50.70	3.79	14334	0.70	0.09	22	2.80
Subtotals		**97.18**			**45**				**795**	**112.30**
Totals		**644.67**							**6087.00**	**1083.90**

Table 2 City of Winter Garden Stormwater Improvements - Source 2 Nitrogen (N) and Phosporous(P) Generation per Basin										
Area	**Basin Land Use**	**Drainage Area(ac)**	**Runoff Coefficient - C**	**Annual Rainfall(inches)**	**Annual Runoff Volume (MG)**	**Annual Runoff Volume (m^3)**	**EMC N (mg/L)**	**EMC P (mg/L)**	**TN Generated Annually (lbs)**	**TP Generated Annually (lbs)**
11-R	1200	318.52	0.35	50.70	153.47	581098	2.23	0.32	2857	404.90
11-C	1400	109.77	0.80	50.70	120.89	457733	1.93	0.48	1948	484.50
11-I	1550	0.00	0.78	50.70	0.00	0	1.55	0.15	0	0.00
11-NZ/ROW	1750	4.6	0.60	50.70	3.77	14281	1.80	0.48	57	15.10
11-Vacant	4100	0	0.25	50.70	0.00	0	0.70	0.09	0	0.00
Subtotals		**432.85**			**278.13**				**4862**	**904.50**

RUNOFF COEFFICIENTS								
		Soil Type						
FLUCCS	Definition	A	B/D	C	C/D	D	U	W
1100	Residential, low density	0.174	0.342	0.286		0.342		0.258
1190	Residential, low density, under construction	0.160	0.223	0.202			0.223	0.258
1200	Residential, medium density	0.220	0.304	0.389		0.473	0.347	0.347
1300	Residential, high density	0.631	0.662	0.692	0.692	0.733	0.677	0.677
1390	Residential, high density, under construction		0.223	0.202		0.223		0.677
1400	Commercial and services	0.886	0.887	0.888		0.900	0.890	0.890
1460	Tourist services	0.886					0.890	
1510	Food processing		0.793					0.809
1550	Other light industry	0.544	0.577	0.609			0.593	0.593
1600	Extractive	0.220	0.304					0.347
1700	Institutional	0.696	0.741	0.786	0.786	0.856	0.770	0.770
1730	Military	0.680	0.724	0.768			0.752	0.752
1750	Governmental	0.680	0.724	0.768	0.768	0.836	0.752	0.752
1800	Recreational	0.127	0.183	0.182		0.210	0.169	0.169
1820	Golf Course	0.182	0.222	0.258		0.298	0.240	0.240
1840	Marinas and fish camps		0.319	0.407		0.494	0.363	0.363
1860	Community recreational facilities	0.127	0.183	0.182			0.169	0.169
1890	Other recreational	0.499	0.543			0.637		
2110	Improved pasture	0.251	0.405					
2150	Field crops		0.411					
2200	Tree crops	0.251				0.302		
2210	Citrus	0.251	0.268	0.285	0.285	0.302		0.277
2240		0.251	0.268	0.285				
2500	Specialty farms			0.454			0.429	
3100	Herbaceous (Dry Prairie)	0.100	0.411	0.300	0.411	0.411	0.252	0.252
3200	Upland Shrub and Brushland	0.060	0.400	0.287	0.400	0.400	0.231	0.231
3300	Mixed rangeland	0.060	0.400	0.287	0.400	0.400	0.231	0.231
4100	Upland Coniferous Forest		0.413		0.413	0.413		
4110	Pine flatwood	0.102	0.413	0.309	0.413	0.413	0.258	0.258
4130	Sand pine	0.102		0.309		0.413		
4200	Upland Hardwood Forest	0.102	0.413	0.309		0.413	0.258	0.258
4210	Xeric oak	0.102	0.413	0.309		0.413	0.258	0.258
4340	Hardwood - Conifer Mixed	0.102	0.413	0.309	0.413	0.413	0.258	0.258
4370	Australian Pine	0.102	0.413	0.309		0.413	0.258	0.258
4430	Forest Regeneration Areas		0.413	0.309	0.413	0.413		
5100	Streams and Waterways	1.000	1.000	1.000	1.000	1.000	1.000	1.000
5200	Lakes	0.500		0.500		0.500		0.500
5300	Reservoirs	0.500	0.500	0.500	0.500	0.500	0.500	0.500
5340	Reservoirs, <10 acres	0.500	0.500	0.500	0.500	0.500	0.500	0.500
5400	Bays and estuaries	1.000	1.000	1.000	1.000	1.000	1.000	1.000
5430	Enclosed salt water ponds within salt marsh	1.000	1.000	1.000		1.000		1.000
6120	Mangrove Swamp	0.191	0.303	0.266	0.303	0.303	0.247	0.247
6170	Mixed wetland hardwood	0.191	0.303	0.266	0.303	0.303	0.247	0.247
6181		0.124	0.303	0.266	0.303	0.303	0.152	0.152
6182			0.303		0.303	0.303		0.152
6210	Cypress		0.303		0.303	0.303		
6300	Wetland Forested Mixed	0.191	0.303	0.266	0.303	0.303	0.247	0.247
6410	Freshwater Marshes / Graminoid Prairie - Ma	0.191	0.303	0.266	0.303	0.303	0.247	0.247
6420	Saltwater Marshes / Halophytic Herbaceous I	0.191	0.303	0.266	0.303	0.303	0.247	0.247
6430	Wet prairie	0.191	0.303	0.266	0.303	0.303	0.247	
6440	Emergent aquatic vegetation		0.303	0.266		0.303		0.247
6460		0.191	0.303	0.266	0.303	0.303	0.247	0.247
6500	Non-Vegetated Wetlands			0.266		0.303		0.247
7100	Beaches	0.102		0.309		0.413	0.258	0.258
7200	Sand other than beaches			0.309				0.258
7400	Disturbed land	0.160	0.223	0.202		0.223		0.191
7410	Rural land in transition (no indicators of new	0.151	0.234	0.234		0.276	0.255	0.255
7430	Spoil area	0.169	0.169	0.169		0.169	0.169	0.169
8110	Airports	0.326	0.399	0.473		0.546	0.436	0.436
8120	Railroads and railyards	0.200	0.250	0.300		0.350	0.275	0.275
8140	Roads and highways	0.630	0.703	0.777	0.777	0.850	0.740	0.740
8150	Port Facilities	0.630		0.777		0.850	0.740	0.740
8180	Auto parking facilities						0.890	0.890
8200	Communication						0.169	0.169
8310	Electrical power facilities		0.793	0.825				
8320	Electrical Power Transmission Lines	0.127	0.210	0.182		0.210	0.169	0.169
8330	Water Supply Plants - Including Pumping Stat	0.174		0.286			0.258	0.258
8340	Sewage Treatment			0.286			0.258	0.258

FIGURES



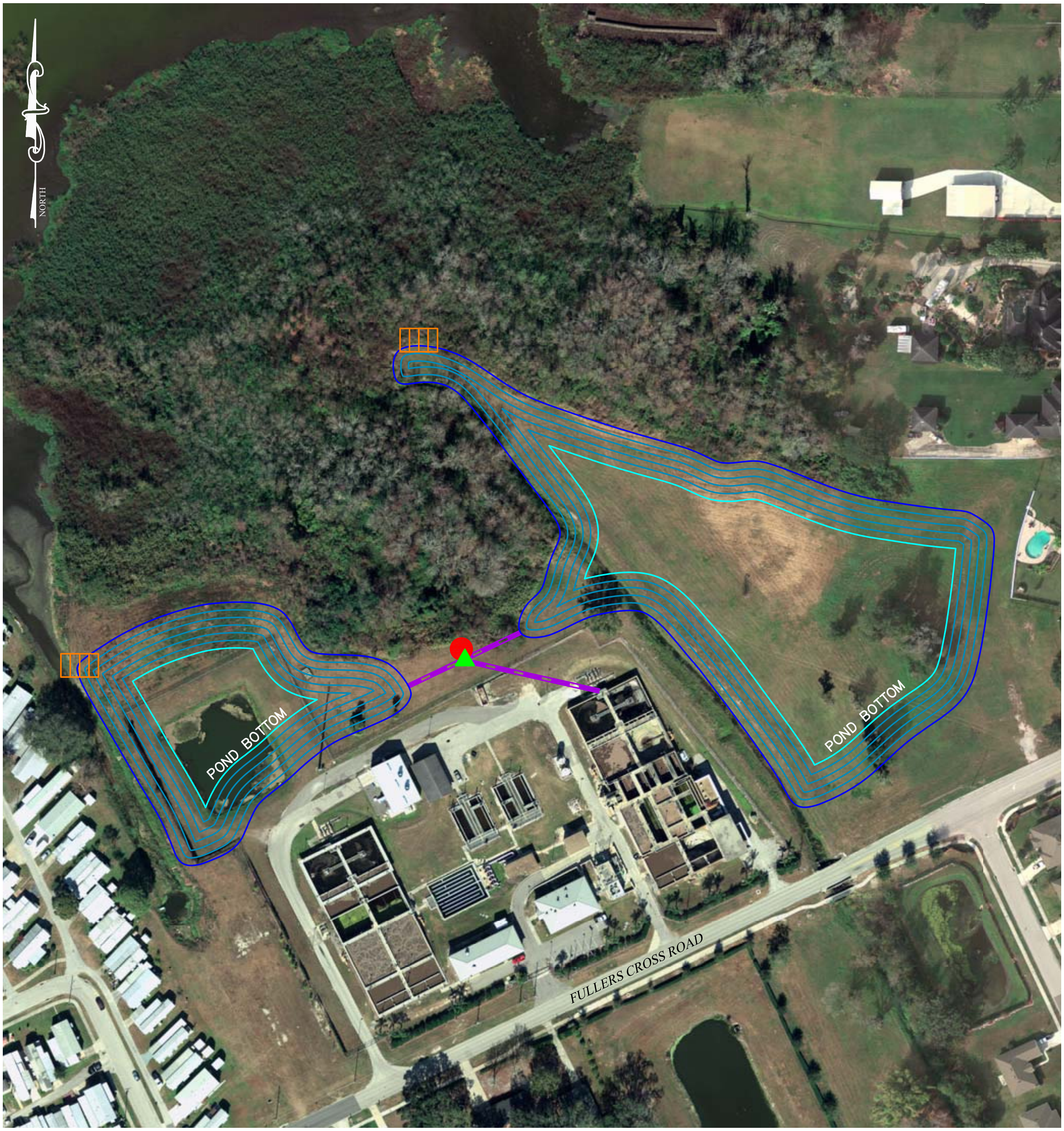
Andreyev Engineering, Inc.

CONCEPTUAL PLAN FOR STORMWATER CAPTURE REUSE & AQUIFER RECHARGE

CITY OF WINTER GARDEN

ORANGE COUNTY, FL

APPROXIMATE SCALE:	DATE: 07/28/14	ENGINEER: NA	CITY OF WINTER GARDEN DRAINAGE BASINS FOR TWO WATER SOURCES
N.T.S.	PN:	DRAWN BY: DLS	FIGURE 1



LEGEND:

- PROPOSED POND AREAS
- PROPOSED OVERFLOW/CONTROL STRUCTURES
- PROPOSED INTAKE STRUCTURE, PUMP & PIPING
- PROPOSED PUMP STATION
- PROPOSED INTERCONNECTION & CONNECTION TO WWTP

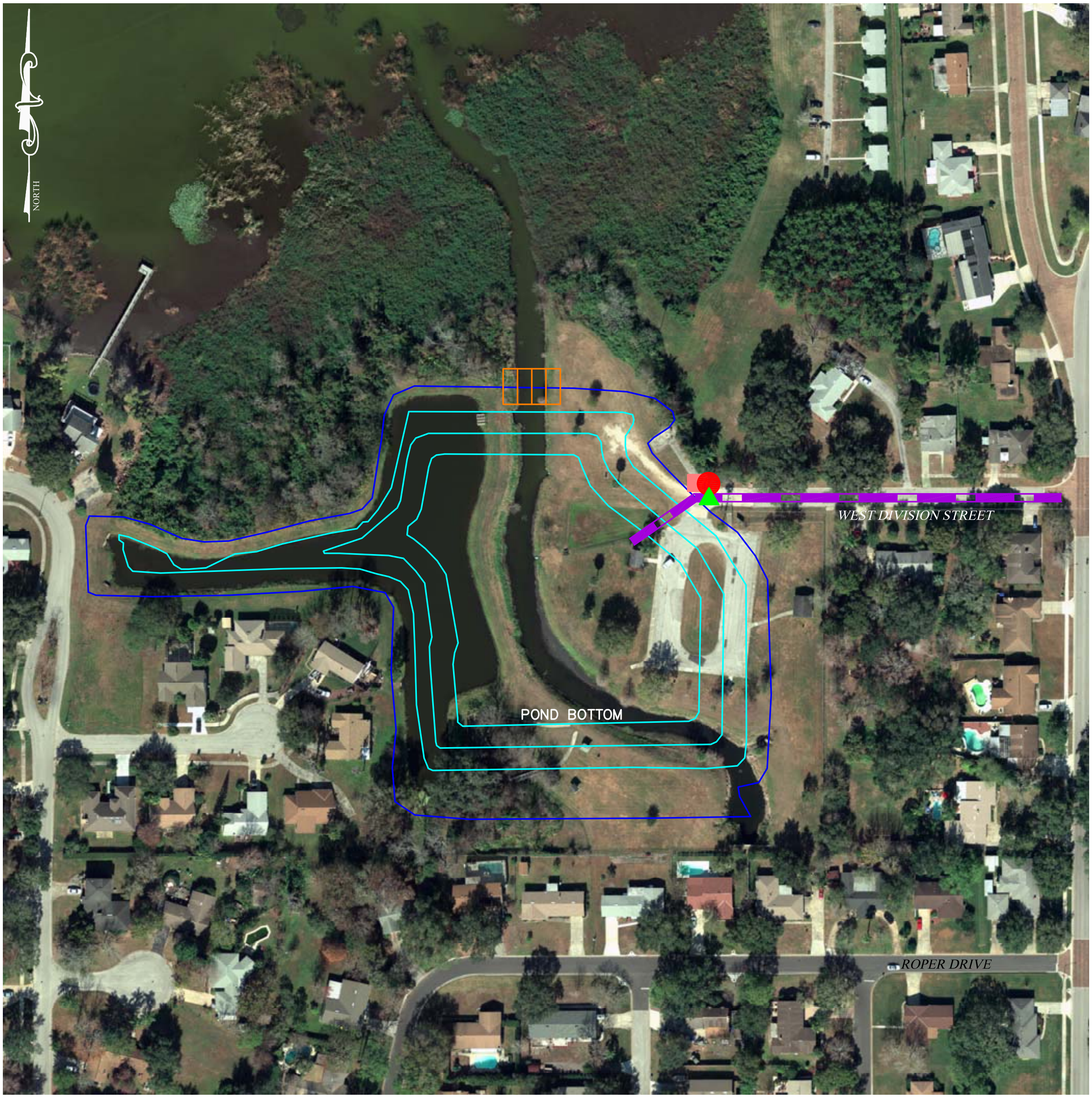
Andreyev Engineering, Inc.

CONCEPTUAL PLAN FOR STORMWATER CAPTURE REUSE & AQUIFER RECHARGE

CITY OF WINTER GARDEN

ORANGE COUNTY, FL

APPROXIMATE SCALE:	DATE: 08/04/14	ENGINEER: NA	SOURCE 1 SITE PLAN AND CONSTRUCTION COMPONENTS
1"=200'	PN: GPGW-13-0210	DRAWN BY: DLS	FIGURE 2



LEGEND:

- PROPOSED POND AREA
- PROPOSED OVERFLOW/CONTROL STRUCTURE
- PROPOSED INTAKE STRUCTURE & PIPING
- PROPOSED PUMP STATION & FILTRATION/CHLORINATION UNIT
- ELECTRICAL UNIT
- PROPOSED DISCHARGE PIPING & CONNECTION TO RECLAIMED WATER LINES

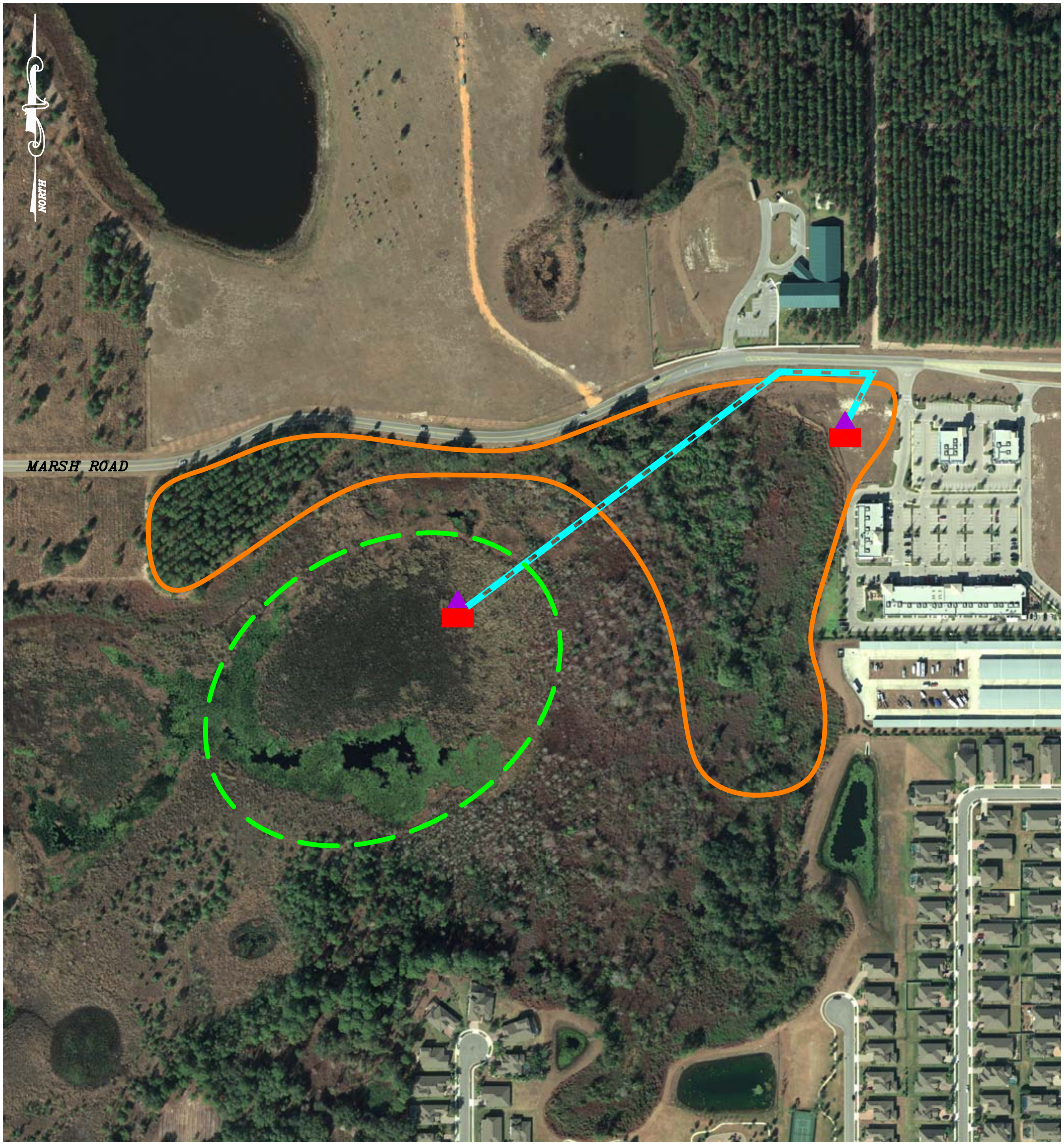
Andreyev Engineering, Inc.

CONCEPTUAL PLAN FOR STORMWATER CAPTURE REUSE & AQUIFER RECHARGE

CITY OF WINTER GARDEN

ORANGE COUNTY, FL

APPROXIMATE SCALE: 1"=200'	DATE: 08/04/14	ENGINEER: NA	SOURCE 2 SITE PLAN AND CONSTRUCTION COMPONENTS
	PN: GPGW-13-0210	DRAWN BY: DLS	FIGURE 3



LEGEND:

PROPOSED STORAGE & AQUIFER RECHARGE AREA

PROPOSED WETLAND HYDRATION & AQUIFER RECHARGE AREA

PROPOSED RECLAIMED WATER DISCHARGE STRUCTURE

PROPOSED EROSION CONTROL PAD/RIP RAP

PROPOSED CONNECTION DISCHARGE PIPING

Andreyev Engineering, Inc.

CONCEPTUAL PLAN FOR STORMWATER CAPTURE REUSE & AQUIFER RECHARGE

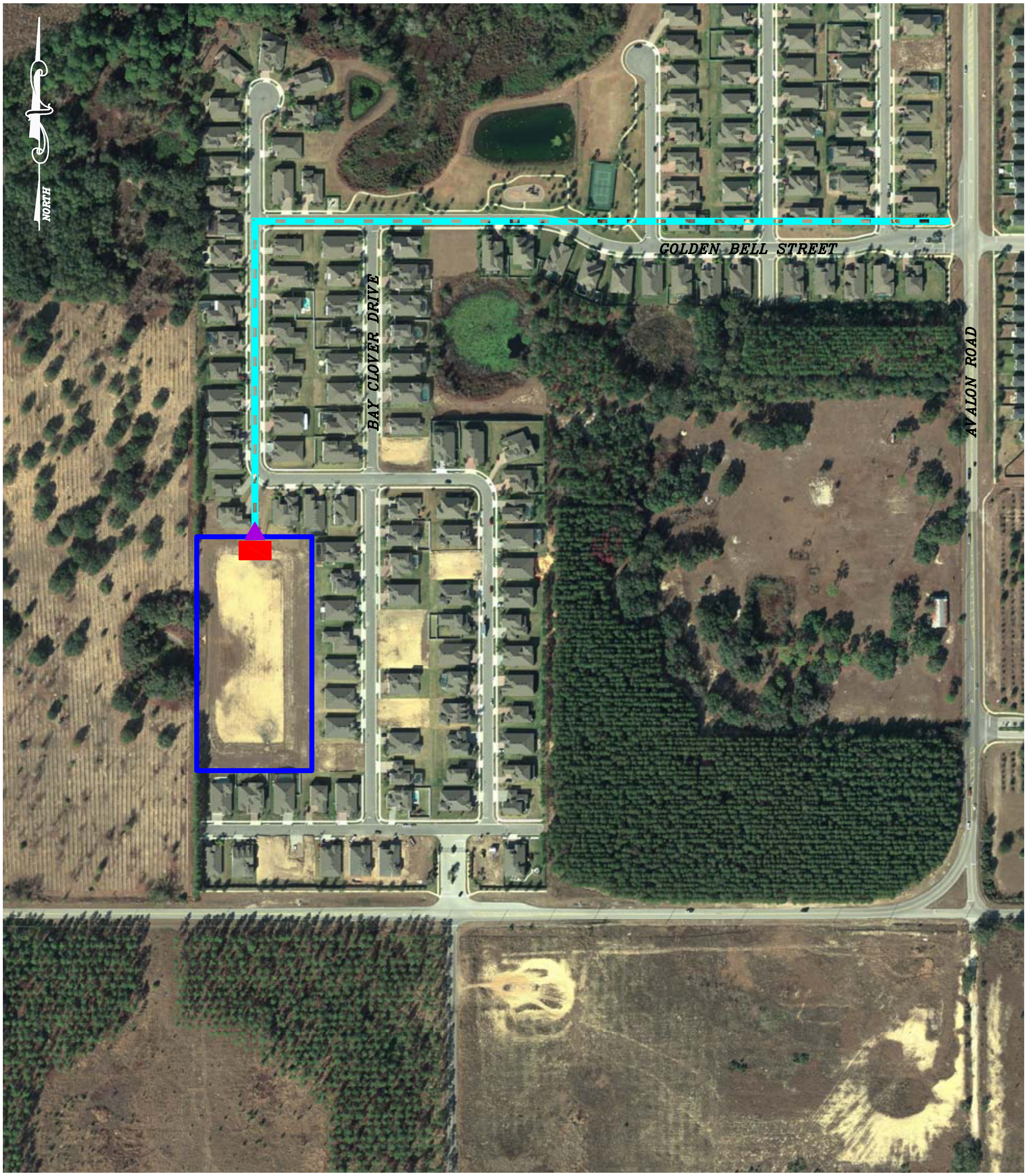
CITY OF WINTER GARDEN

ORANGE COUNTY, FL

SITE 1 – MARSH ROAD STORAGE & AQUIFER RECHARGE PLAN & CONSTRUCTION COMPONENTS

APPROXIMATE SCALE: 1"=400'	DATE: 08/04/14	ENGINEER: NA
	PN: GPGW-13-0210	DRAWN BY: DLS

FIGURE 4

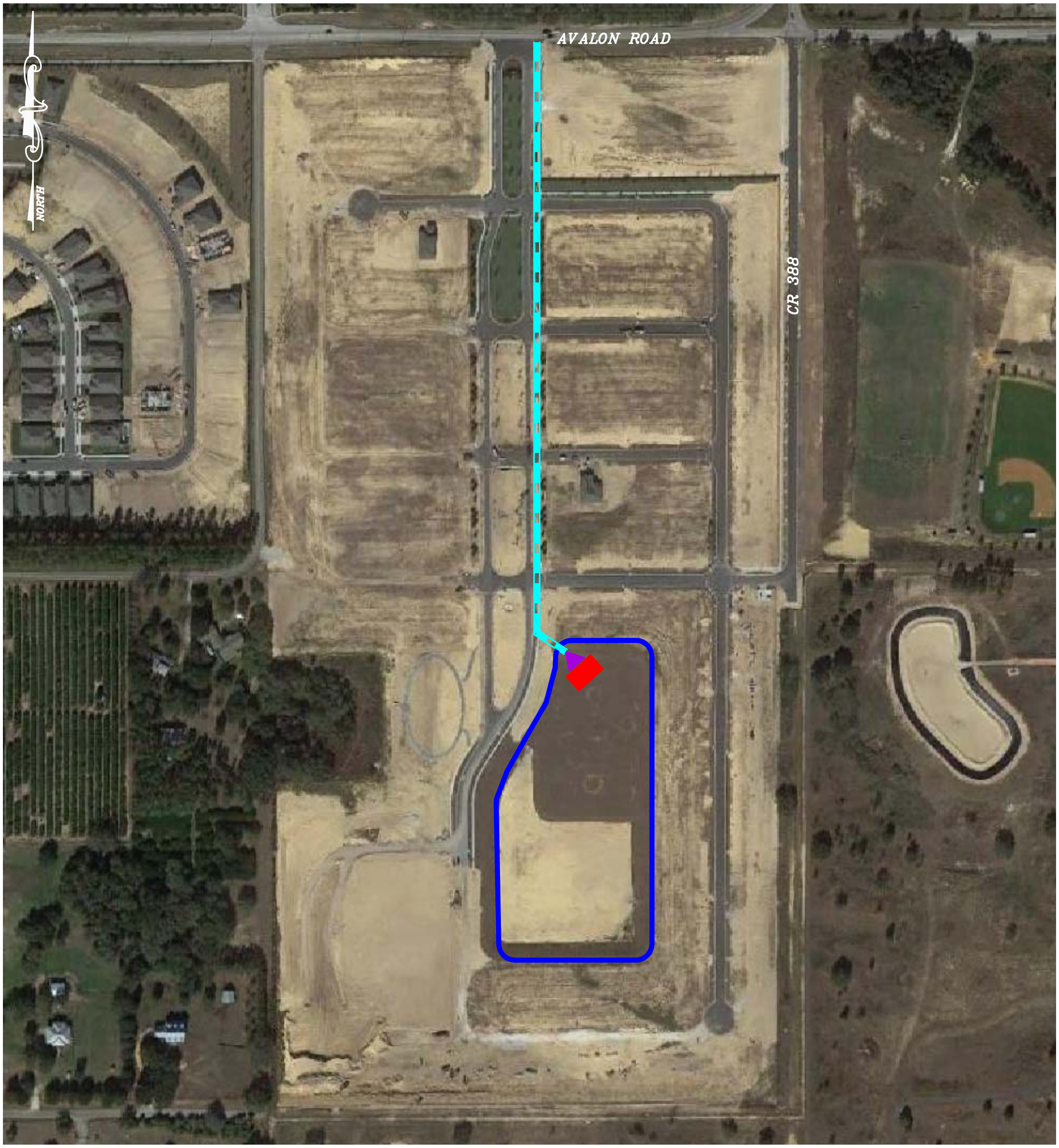


LEGEND:

- EXISTING RETENTION POND – AQUIFER RECHARGE AREA
- PROPOSED STORMWATER/RECLAIMED WATER DISCHARGE STRUCTURE
- PROPOSED EROSION CONTROL PAD/RIP RAP
- PROPOSED CONNECTION DISCHARGE PIPING

Andreyev Engineering, Inc.

APPROXIMATE SCALE: 1"=400'	DATE: 08/04/14	ENGINEER: NA	CONCEPTUAL PLAN FOR STORMWATER CAPTURE REUSE & AQUIFER RECHARGE CITY OF WINTER GARDEN ORANGE COUNTY, FL
	PN: GPGW-13-0210	DRAWN BY: DLS	SITE 2 – CARRIAGE POINTE SUBDIVISION AQUIFER RECHARGE POND & CONSTRUCTION COMPONENTS
			FIGURE 5



LEGEND:

- EXISTING RETENTION POND – AQUIFER RECHARGE AREA
- PROPOSED STORMWATER/RECLAIMED WATER DISCHARGE STRUCTURE
- PROPOSED EROSION CONTROL PAD/RIP RAP
- PROPOSED CONNECTION DISCHARGE PIPING

Andreyev Engineering, Inc.

CONCEPTUAL PLAN FOR STORMWATER CAPTURE REUSE & AQUIFER RECHARGE

CITY OF WINTER GARDEN

ORANGE COUNTY, FL

SITE 3 – ALEXANDER RIDGE SUBDIVISION AQUIFER RECHARGE POND & CONSTRUCTION COMPONENTS

APPROXIMATE SCALE: 1"=400'	DATE: 08/04/14	ENGINEER: NA	FIGURE 6
	PN: GPGW-13-0210	DRAWN BY: DLS	