Documentation in Support of Category 4e
Lake Orlando

Waterbody/Watershed Identification

Organization	City of Orlando Orange County Board of County Commissioner
Point of Contact	Eva "Nicki" Wesson, PE City of Orlando, Project Manager 400 S. Orange Avenue Orlando, FL 32801 Nicki.Wesson@cityoforlando.net 407-246-3264 Julie Bortles, Regulatory Program Compliance Coordinator Orange County EPD 3165 McCrory Pl., Suite 200 Orlando, FL 32803 Julie.Bortles@ocfl.net 407-836-1456
Waterbody(s)	WBID #3004K, Lake Orlando (formerly Lake Wekiva).
No. Waterbody / Pollutant Combinations	Lake Orlando is impaired for nutrients (Group2, Cycle 3) including: total phosphorous (TP), total nitrogen (TN), and chlorophyll-a (Chl-a). There are three other water bodies within the Lake Orlando watershed with adopted nutrient TMDLs for TN and TP loadings. These water bodies are: Lake Lawne (WBID 3004C), Silver Lake (WBID 3004D), and Bay Lake (WBID 3004G)[1]. A fourth water body, the Little Wekiva Canal (WBID 3004), has an adopted TMDLs for biological oxygen demand (BOD), TN and fecal coliform[2].
EPA Completed TMDL	FDEP/EPA have not derived a TMDL for Lake Orlando.

Description of Baseline Conditions

Watershed(s)	Middle St. Johns, Little Wekiva Canal (WBID 3004), Orange County.
Baseline Data	Water quality data collected from Lake Orlando indicates the lake has high alkalinity (> 20 mg/L as $CaCO_3$) and high color (> 40 PCU). Therefore, the minimum NNC water quality standards applicable to Lake Orlando are: 20 ug/L Chl-a, 0.05 mg/L TP, and 1.27 mg/L TN. The following table summarizes the annual geometric mean (AGM) for these parameters provided by IWR Database Run 58.

Annual Geometric Means (IWR58)			
Year	*Chlorophyll a Corrected (ug/L)*	*Total Nitrogen (mg/L)*	*Total Phosphorus (mg/L)*
2007	29	1.42	0.07
2008	20	1.34	0.06
2009	26	1.45	0.05
2010	19	1.36	0.05
2011	16	1.30	0.05
2012	32	1.45	0.07
2013	19	1.25	0.06
2014	30	1.35	0.07
2015	14	1.09	0.05
2016	20	0.97	0.05

Notes:

1) Data retrieved from IWR58 for stations 21FLORL ORLANDO and 21FLORL ORLANDO WEST.

2) Data qualified with a "J" flag was excluded from the AGM calculation.

Map	Figure 1 illustrates the locations of water quality sample collection stations used during the IWR 58 analysis. Figure 1 also illustrates the locations of flow stations LWA and LWB.

Evidence of Watershed Approach

Area of Effort	Lake Orlando is located in a highly-urbanized section of Orange County. The lake is bounded by North Pine Hills Road on the west, Clarcona-Ocoee Road on the north, N. Orange Blossom Trail (US 441) on the east, and Silver Star Road on the south in Section 5, Range 22,Township 29 and Section 8, Range 22,Township 29. Lake Orlando is encompassed by a ±10,000 acre watershed that includes Bay Lake, Lake Lawne, Silver Lake, and the Little Wekiva Canal. Jurisdiction in the watershed is shared between the City of Orlando and unincorporated Orange County. In general, water flows north from Lake Lawne through the Little Wekiva Canal through Lake Orlando toward the Wekiva River. The attached Figure 2 illustrates the watershed boundary thought contribute to the hydrological and nutrient budgets of Lake Orlando. See Figure #2.
Key Stakeholders Involved and Their Roles	The City of Orlando and the Orange County Board of County Commissioners are the key stakeholders that have assessments and existing best management practices in the watershed intended to restore water quality. The Florida Department of Transportation (FDOT) is an additional stakeholder.
Watershed Plan & Other Supporting Documentation	Our watershed plan is to improve the water quality of our lakes by identifying local stakeholders, identify major outfalls, performing source assessments, etc. to determine the best BMP's to implement within the basin.

Point Sources and Indirect Source Monitoring (Sites)	The entire area is regulated by a Municipal Separate Storm Sewer System (MS4) permit. Orange County is the holder of MS4 permit #FLS 000011-004. The City of Orlando is the holder of MS4 permit # FLS 000014-004. No point sources are located within the Lake Orlando watershed. Note: Generic Permits for stormwater discharge from large and small construction activities are considered temporary; therefore, are not included in this listing.
Nonpoint Sources	The nutrient loadings to Lake Orlando are primarily generated from nonpoint sources, including surface runoff, onsite sewage treatment and disposal systems, groundwater seepage entering the lake, precipitation directly on the lake surface, internal recycling associated with sediments in the lake bottom, and birds and other wildlife (through their feces if they feed outside of the waterbody and thus concentrate nutrients from other aquatic systems to Lake Orlando). The preliminary analysis of land use using GIS feature layers obtained from the SJRWMD and the FDEP were slightly difference. Figure 3 illustrates the differences between the two land use feature layers. Figure 4 contains a table containing the percent differences in the layers for each land use category. These differences will be addressed during 4e workflow. See Figure 3 & 4.
Water Quality Criteria	Lake Orlando is expected to meet Class III surface water quality standards as defined in Chapter 62-302, Florida Administrative Code upon successful completion of all projects and to the maximum extent possible.

Restoration Work

Existing water quality improvement projects, also known as best management practices BMPs, consist of street sweeping, curb and grate inlet baskets, improved stormwater retention ponds, a master stormwater system for the existing industrial Packing District area upstream of Lake Lawne (WBID 3004C) and a regional stormwater facility located in Barnett Park adjacent to Lake Lawne (WBID 3004C).

1. Existing City of Orlando BMPs

Basin Name	BASIN	Sweeper Route Length in Miles	Number of Inlet Baskets	Number of Baffle Boxes	Number of Storm-ceptors
Orlando	LW-02	17.64	22		
Bay	LW-03	0.16			
Fairview	LW-04	6.48			
Little Lake Fariview	LW-05	2.73			
Fairhope	LW-07	0.48			
Sarah	LW-08	0.10	3		
Daniel	LW-09	1.47	2		
Silver	LW-10	10.94	6	3	1
Emerald Springs	LW-11				
Kelly	LW-12	0.18		1	
Kristy	LW-13	2.25			
Kasey	LW-14	2.14			
Lawne	LW-15	12.47			
Divot	LW-16				
Marilyn	LW-17				
	LW-20				
	Total	57.05	33	4	1

Street Sweeping: The Lake Orlando Basin, Sarah, Daniel, Silver, Kelly, Kristy, Kasy and Lawne were being swept twice a month - once using a mechanical sweeper and one time with an air vac sweeper. In 2019 the sweeping frequency was increased to three to four times a month after the purchase of a new air vac sweeper. Now, the goal is to sweep these basins twice a month with the mechanical sweeper and twice a month with an air vac sweeper.

The Bay Lake, Fairview and Little Lake Fairview Basins were being swept once a month and now have been increased to two times a month.

For 2019, the City of Orlando's street sweeping effort collected approximately 170,000 cubic feet of material which reduced the Total Nitrogen to the system by over 8,000 lbs and the Total Phosphorus to the system by over 5,000 lbs. Based on the increase in street sweeping occurring in May of 2019, we estimate that in the following years, the material collected will exceed 190,000 CY which would reduce the Total Nitrogen to the system by over 9,000 lbs and the Total Phosphorus to the system by almost 6,000 lbs.

Inlet Baskets, Baffle Boxes and Stormceptors: The city has various inlet baskets, baffle boxes and stormceptors. These BMP's are shown on the attached basin maps. The cleaning schedules vary for each of these based on the history need. The cleaning schedules will continue to be done as needed.

For 2019, cleaning of the City of Orlando's inlet baskets, baffle boxes and stormceptors collected approximately 1,800 cubic feet of material which reduced the Total Nitrogen to the system by over 100 lbs and the Total Phosphorus to the system by over 60 lbs.

See Figures 5-16.

2. Existing Sanitary Sewer Improvements/Activities

In August 2014, the City of Orlando collaborated with Environmental Canine Services (ECS) to conduct targeted bacteria source tracking in the stormwater systems around Lake Orlando. The primary purpose of this project was to identify "hotspots" of human-derived bacterial pollution through canine detection. The canines used during this project were trained to detect only human-source wastewater, not animal-source. In addition, the canines were able to detect human-source wastewater at relatively low concentrations to help with prioritization with further conventional bacterial sampling. The canines tested seventy-seven (77) sites to assist with identifying point sources of human waste at various stormwater drain locations within the Lake Orlando basin. To confirm the presence of human-source wastewater, the City collected pharmaceuticals at seven (7) locations. All seven sites revealed the presence of substances that were indicative of human-source wastewater (e.g. nicotine, caffeine, DEET, antibiotics, plastic residue). The City Wastewater Compliance and Public Awareness section was asked to assist in getting these private sanitary collection sites into compliance.

The City of Orlando has smoke tested LS#85 and LS#83 service area (map attached of the area), all sanitary sewer manholes around Lake Orlando have been inspected and lined if it was needed, all sanitary sewer piping around Lake Orlando was inspected and CIPP Lined if required. All repairs have occurred starting 2014 to present.

LS85 is in design for a new LS that is about 2 yrs from completion.

LS84 is getting an emergency generator in about 2 yrs.

3. Packing District Park Project

This project is currently under construction by the City of Orlando. The proposed project includes construction of a regional park that will house a master stormwater management system serving the redevelopment of the existing industrial Packing District properties in the Lake Lawne Basin. Construction will include park improvements, trails, roadway extensions of New Hampshire Street and Texas Avenue, surface parking lot, associated hardscape and landscaping, and the master stormwater management system. Areas of existing wetlands are to remain within a portion of the site.

The project contains 137 acres that will be served by the master stormwater system and is divided into two primary drainage basins. The Park Basin (53 acres) is within the

currently undeveloped land bounded by John Young Pkwy to the west, Princeton St to the north and the drainage canal on the east and south. The Packing District Basin (84 acres) includes the existing industrial areas that will be redeveloped. As in existing conditions, the project outfalls to Lake Lawne.

The project is expected to have an overall pre vs. post nutrient load reduction to the canal to the south of the project that outfalls into Lake Lawne which then outfalls into Lake Orlando. It has been estimated that the project will have an 80 kg/yr reduction in total nitrogen (540 kg/yr in the pre development and 460 kg/yr in the post developed condition) and a 42 kg/yr reduction for phosphorus (76 kg/yr in the pre development and 34 kg/yr in the post developed condition). We are currently investigating a modification to the design that could greatly decrease the amount of nutrients discharged from the basin by increasing the area of untreated existing industrial properties served by the master system.

See Figure 17.

4. Lake Orlando Basin Study

The City of Orlando and Orange County are working with CDM Smith to develop a comprehensive study of the Lake Orlando basins to help us develop future BMP's to implement in the basin. The biological impairment of the lake will also be included in the Basin Study so the best course of action can be determined to remediate the biological impairment.

5. Biological Impairment Outreach Program

The City of Orlando and Orange County will begin an outreach program to send information to lake front homeowners alerting them to the biological impairment and giving them guidance on how they can help improve the biology of the lake. We will also send information to all residents and businesses in the overall basin informing them of the importance of proper yard waste disposal.

6. Lake Silver Shores:

The City of Orlando is looking to partner with Edgewater High School (EHS) to design and create a joint wet pond on EHS property to provide treatment for the residential neighborhood on the east side of Lake Silver that currently is not being treated.

7. Ardsley Baffle Boxes Retrofit:

The City of Orlando plans to upgrade three (3) existing First Generation baffle boxes to Second Generation baffle boxes with media.

8. Bay Lake Stormwater Improvement Project.

Orange County constructed a BMP to treat stormwater consisting of two modular wetlands fitted with bioactive media (Wekiva BMAP Project OC-18). Construction of the BMP was completed in 2012. BMP TN and TP reductions are 14 lbs TN/yr and 1 lb/yr, respectively.

9. Lake Lawne Stormwater Irrigation Facility at Barnett Park.

This BMP reduces nutrient loading to the Lake Orlando watershed by impounding stormwater and using it for the irrigation of adjacent park green space (Wekiva BMP Project OC-19). Engineering reductions for TN and TP are 650 lbs/yr and 106 lbs/yr, respectively. Construction of this BMP was competed in December 2019.

10. North Lake Lawne Stormwater Treatment Project (CIBs).

The installation of 120 curb and grate inlet baskets designed to capture debris entrained in stormwater (Wekiva BMAP Project OC-21). TN and TP reductions are 46 lbs/yr and 13 lbs/yr, respectively. Figure 18 illustrates the locations of the CIBs. Installation of the CIBs was completed in 2016.

11. North Lake Lawne Stormwater Treatment Project (C-7 Pond).

The C-7 drainage canal was modified by widening a portion of the can effectively impounding stormwater and treating it by retention. TN and TP reductions are 212 lbs/yr and 64 lbs/yr, respectively. Construction of the retrofitted canal was completed in 2012.

12. Lake Lawne Street Sweeping.

Orange County Public Works sweeps fifty curb miles of streets every six weeks. TN and TP removals are 79 lbs/yr and 51 lbs/yr, respectively. Figure 18 illustrates the roads where sweeping occurs in the watershed.

The load reductions achieved by these BMPs will be further evaluated as part of the 4e plan.

Critical Milestones/Monitoring

Anticipated Critical Milestone(s) and Completion Dates:

1. Existing City of Orlando BMP's: Street Sweeping in the basin has recently been increased and cleaning of the baffle boxes, inlet baskets and stormceptors will continue.

2. Investigation of the sanitary sewer system has been completed. LS85 is in design for a new LS that is about 2 yrs from completion. LS84 is getting an emergency generator in about 2 yrs.

3. Packing District Park Pond: This project is currently under construction and expected to be completed in 2022.

4. Lake Orlando Basin Study is expected to begin this year and be completed within the next 5 years.

    a) 4e Plan Support, Data & Gap Analysis and Development of Monitoring Plan – 6 months
    b) Implementation of Monitoring Plan – 2 to 2.5 years after Item a is complete
    c) Watershed and Receiving Water Modeling – 2 years after Item b is complete

5. The Bay Lake Stormwater Improvement Project has been completed.

	6. The Lake Lawne Stormwater Irrigation Facility at Barnett Park has been completed. 7. The installation of 120 curb and grate inlet baskets has been completed. 8. Modification of the C-7 drainage canal has been completed. 9. Outreach program regarding the biological impairment to be completed in 2020. 10. Lake Silver Shores is planned to be designed in 2022 with construction to follow in 2023. 11. Ardsley Baffle Boxes Retrofit is planned for 2021.
Monitoring Component	The City of Orlando performs water quality monitoring within Lake Wekiva (Orlando) on a quarterly basis. We sample in the center of both lobes by capturing numerous field parameters and collecting samples for nutrients and other wet chemistry constituents. The data will be uploaded into WIN on an annual basis. Additional monitoring components will be evaluated as part of the 4e plan.

Other Key Dates

Estimated Date for Delisting from Verified List or Removal from Study List	The WBID is in the state's Group 2 Basin in the DEP Central District. The next review and assessment cycle (cycle 5) is expected in 2026; at which time sufficient data will be acquired to fully assess the WBID, and if not impaired, DEP is expected to request the WBID be delisted from the federal 303(d) list (if applicable).

Financial Commitments

Estimated Implementation Cost	The total project cost, including land acquisition (if applicable) was (is) $TBD. The cost includes a 319(h) Clean Water Act Section grant of $TBD (TBD% of construction and monitoring costs – if applicable) The estimated 20 year operation and maintenance cost is $TBD(if applicable).
Land Acquisition (if applicable)	**Funding Source:** Total……...$_TBD_____
Design and Construction (if applicable)	**Funding Source:** Orange County Capital Improvement Projects Budget Total……...$_±3.5M/yr____

References:

1. FDEP. *TMDL Report. Nutrient TMDLs for Spring Lake (WBID 2987A), Lake Florida (WBID 2998A), Lake Orienta (WBID 2998C), Lake Adelaide (WBID 2998E), Lake Lawne (WBID 3004C), Silver Lake (WBID 3004D), and Bay Lake (WBID 3004C) in the Wekiva Study Area*, FDEP, 2008.

2. FDEP. *TMDL Report. Fecal Coliform TMDL for Little Wekiva River and the Little Wekiva Canal (WBIDS 2987 and 3004.)*, FDEP, 2008.

Figure 1. Lake Orlando Water Quality Sampling Stations (IWR Run 58) and Flow Stations LWA and LWB

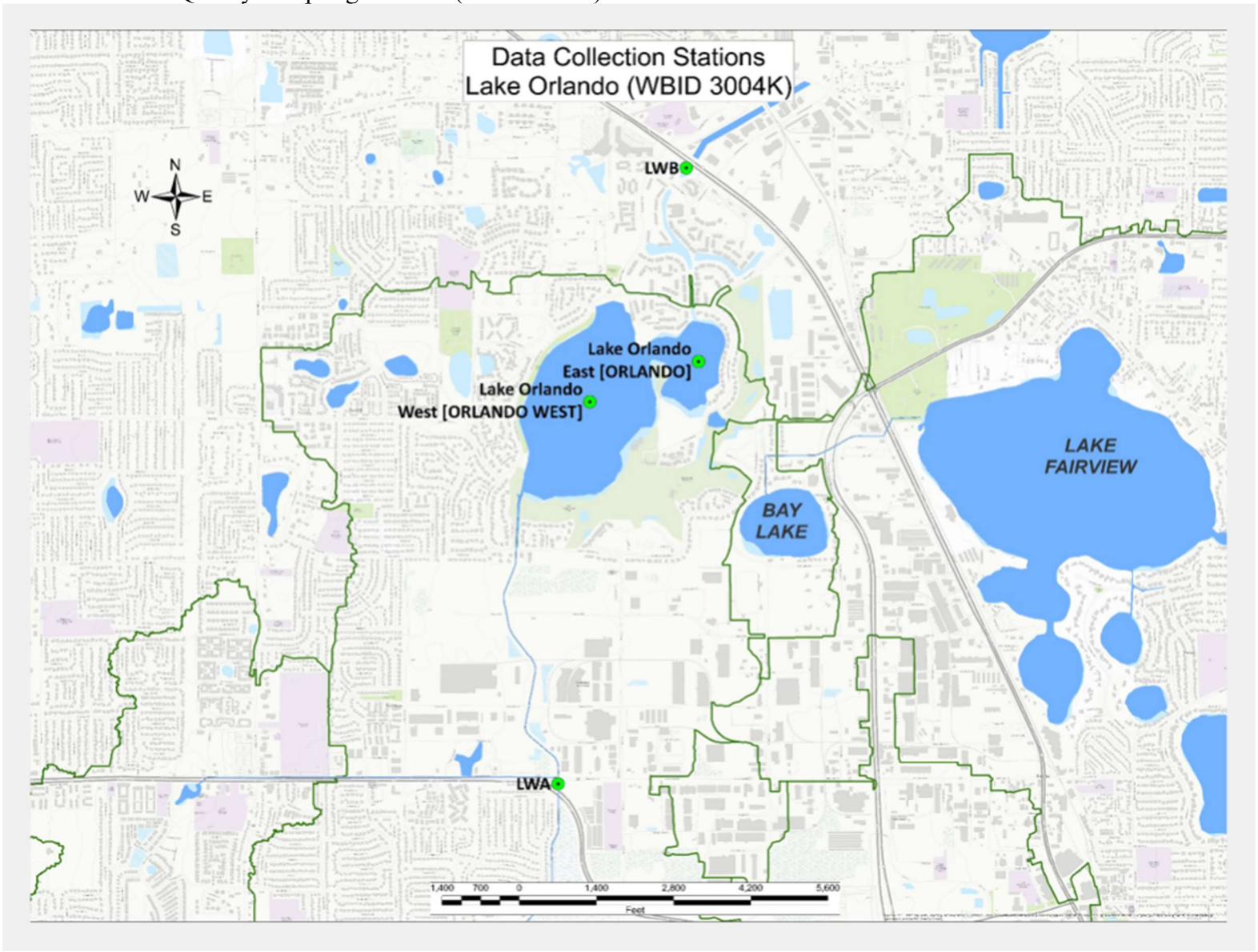

Figure 2. Lake Orlando Watershed (Geosyntec, 2019)

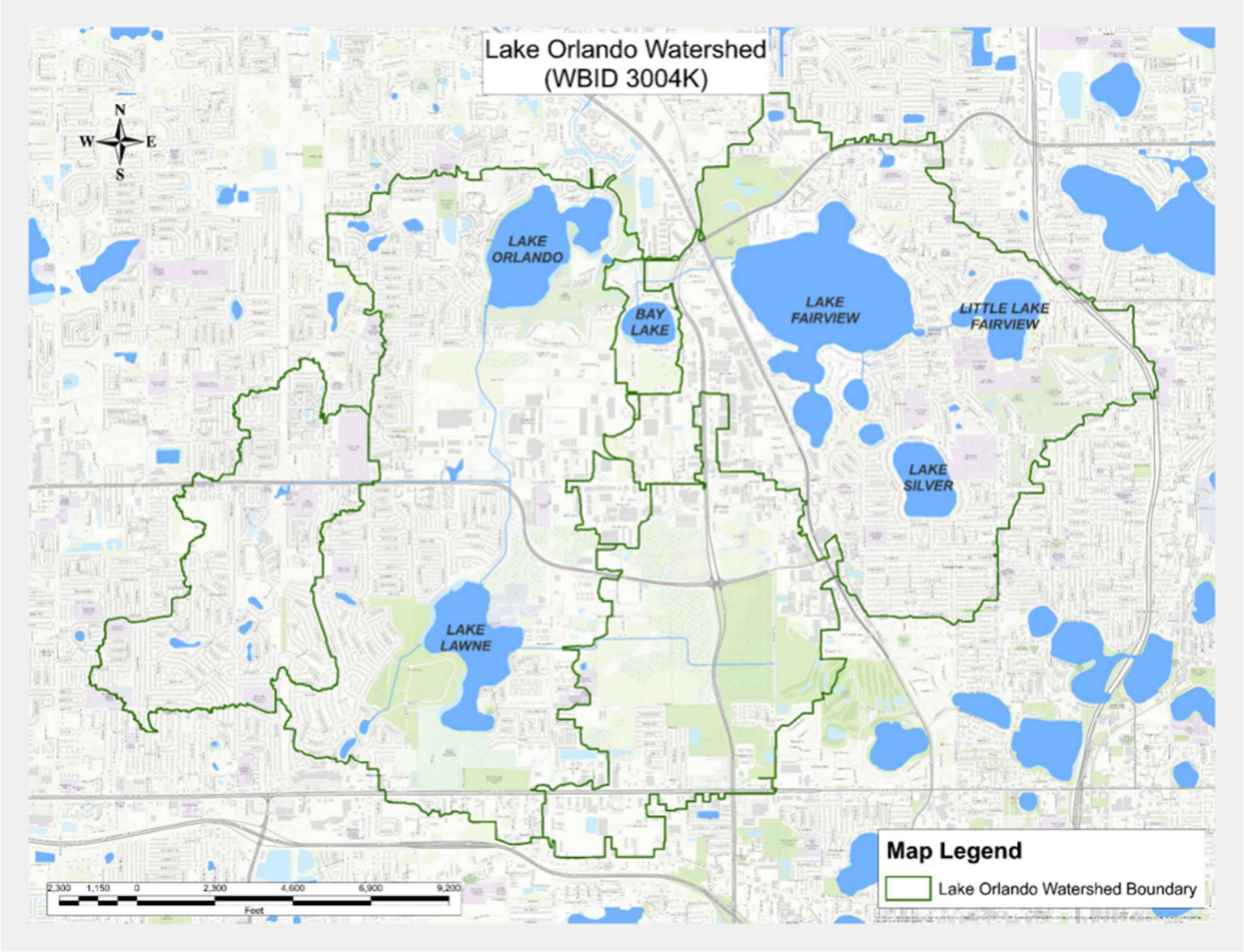

Figure 3. Land Use in the Wekiva River Drainage Basin (Geosyntec, 2019)

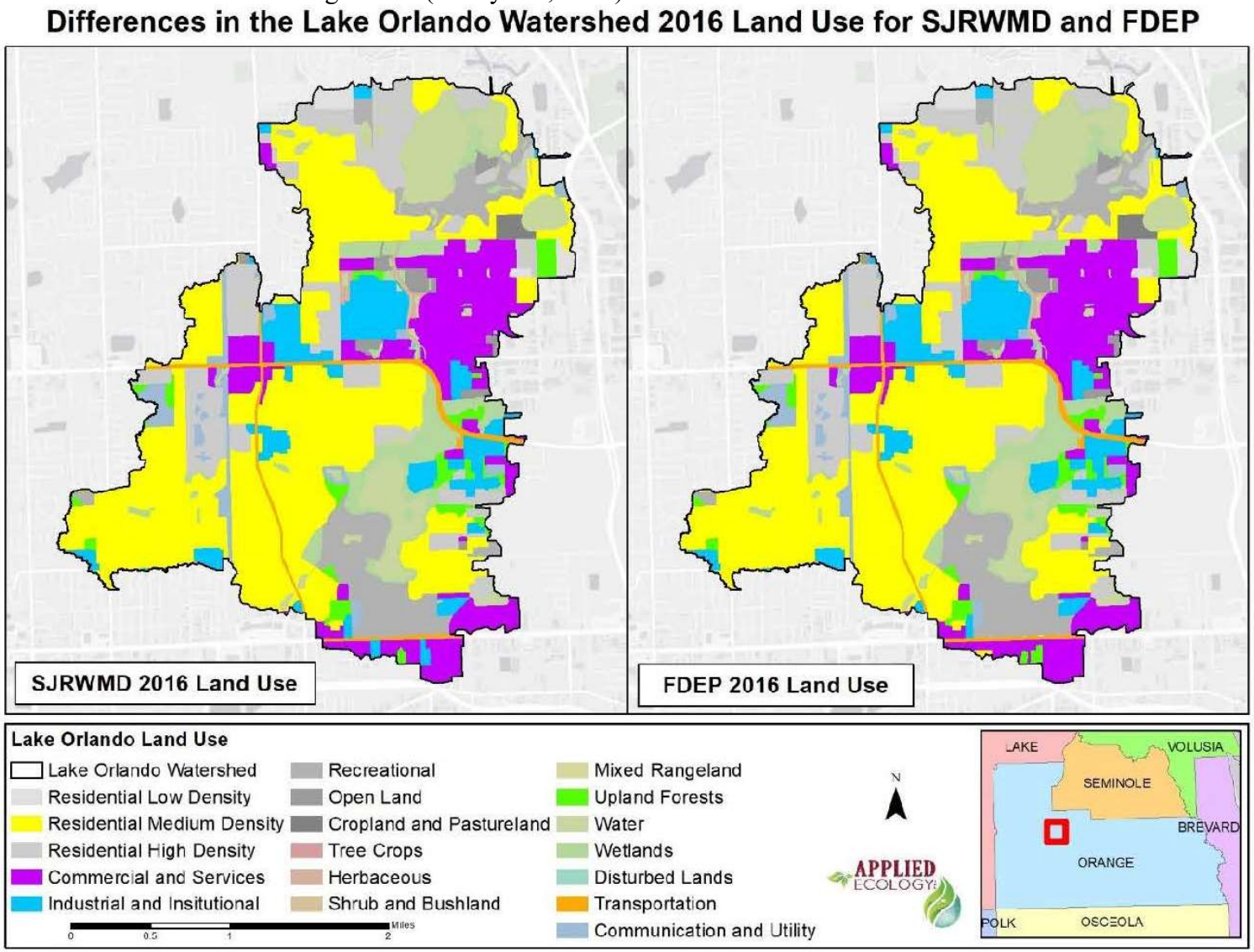

Figure 4. Land US Percentages (Geosyntec, 2019).

Table 1. Percentage of land use for level 2 FLUCCS codes within the Complete Lake Orlando watershed. The top five categories in terms of area representation within the watershed are bolded.

FLUCCS Code Level 2	FLUCCS Description Level 2	PLSM Land Use (%)	SJRWMD 2016 Land Use (%)	FDEP 2016 Land Use (%)
1100	Residential Low Density	1	0.89	0.889
1200	**Residential Medium Density**	**38**	**37.75**	**37.69**
1300	**Residential High Density**	**12**	**11.65**	**11.65**
1400	**Commercial and Services**	**12**	**12.19**	**12.14**
1500	Industrial	3	2.57	2.67
1700	Institutional	5	4.72	4.84
1800	**Recreational**	**7**	**7.32**	**7.32**
1900	Open Land	1	1.21	1.21
2100	Cropland and Pastureland	0	0.43	0.43
3100	Herbaceous	0	0.44	0.44
4100	Upland Coniferous Forests	0	0.19	0.19
4200	Upland Hardwood Forests	0	0.14	0.14
4300	Upland Mixed Forests	2	2.12	2.03
5100	Streams and Waterways	0	0.09	0.09
5200	**Lakes**	**7**	**6.65**	**6.65**
5300	Reservoirs	1	1.32	1.32
6100	Wetland Hardwood Forests	1	0.52	0.52
6200	Wetland Coniferous Forests	1	1.18	1.18
6300	Wetland Forested Mixed	0	0.34	0.34
6400	Vegetated Nonforested Wetlands	4	3.84	3.84
8100	Transportation	2	1.86	1.84
8200	Communications	1	0.76	0.76
8300	Utilities	2	1.84	1.84

Figure 5: City of Orlando Street Sweeping and Inlet Basket Locations

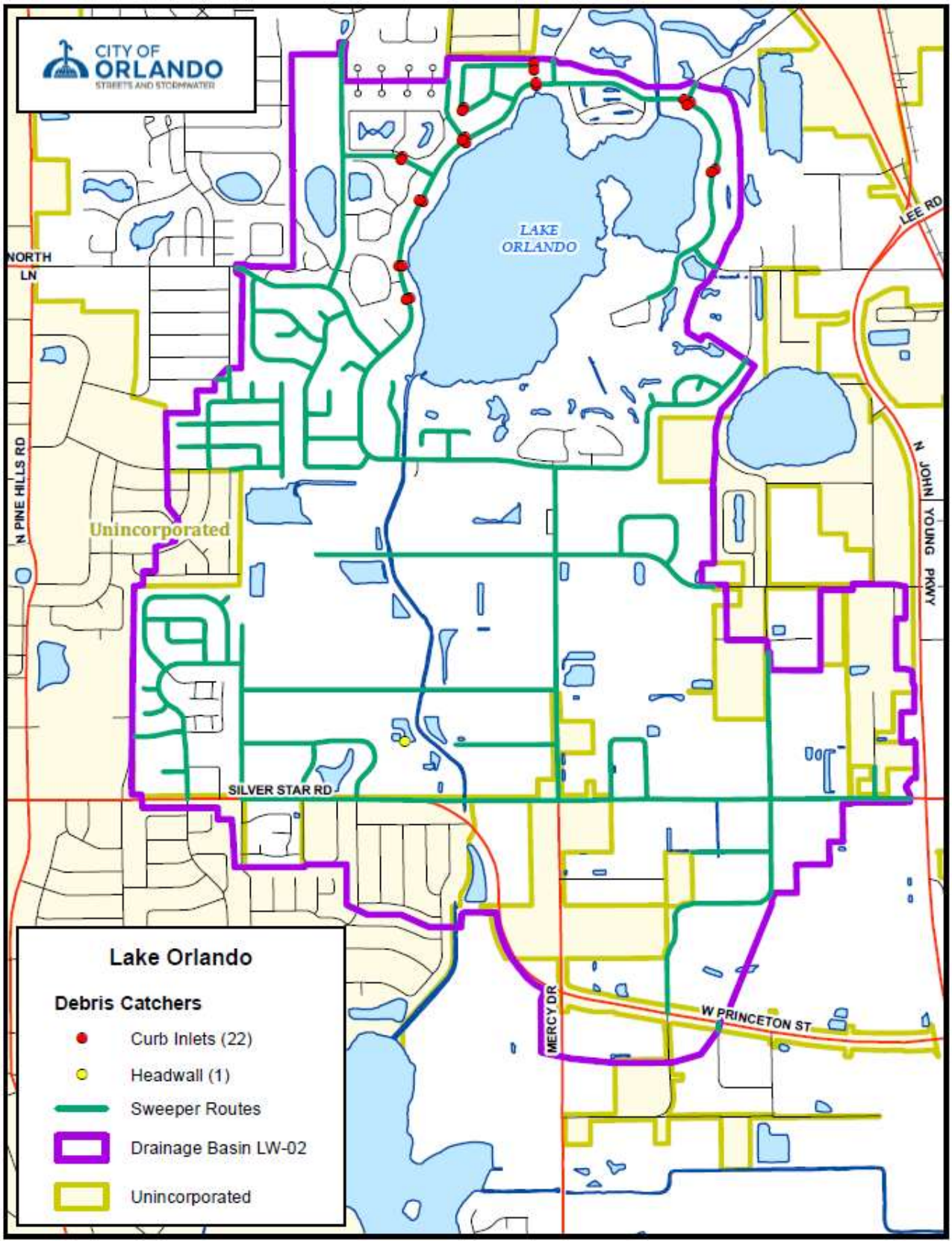

Figure 6: City of Orlando Street Sweeping and Inlet Basket Locations

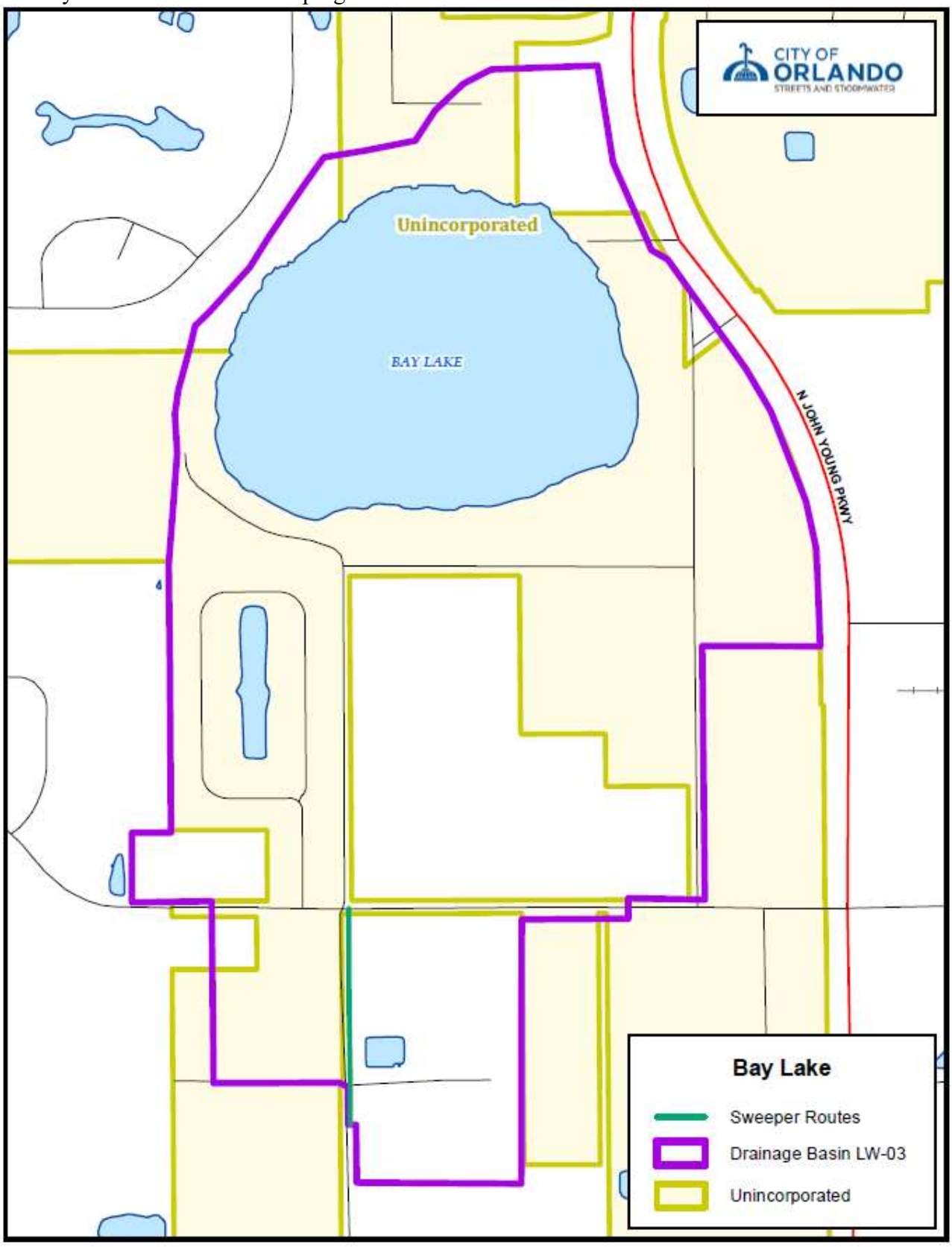

Figure 7: City of Orlando Street Sweeping and Inlet Basket Locations

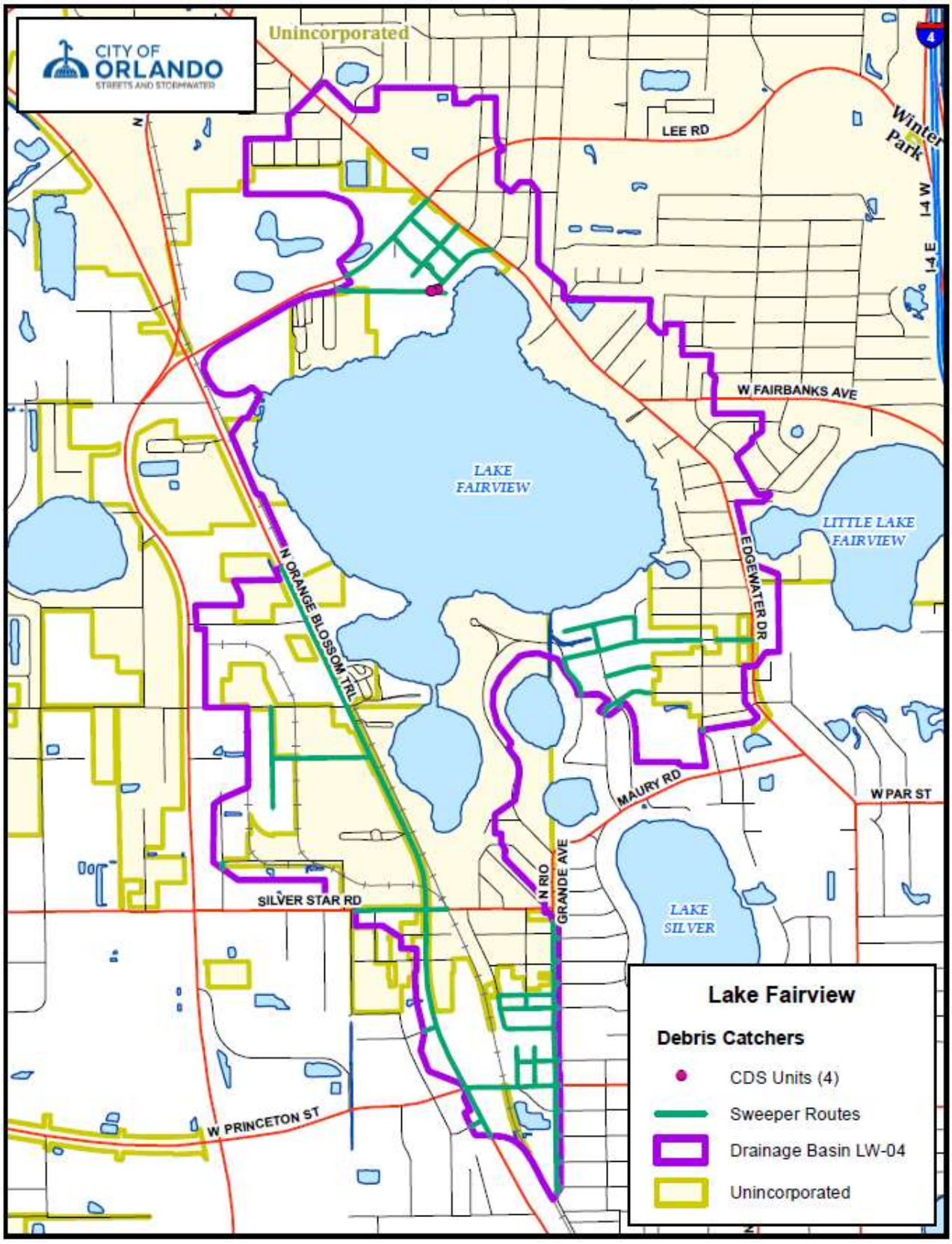

Figure 8: City of Orlando Street Sweeping and Inlet Basket Locations

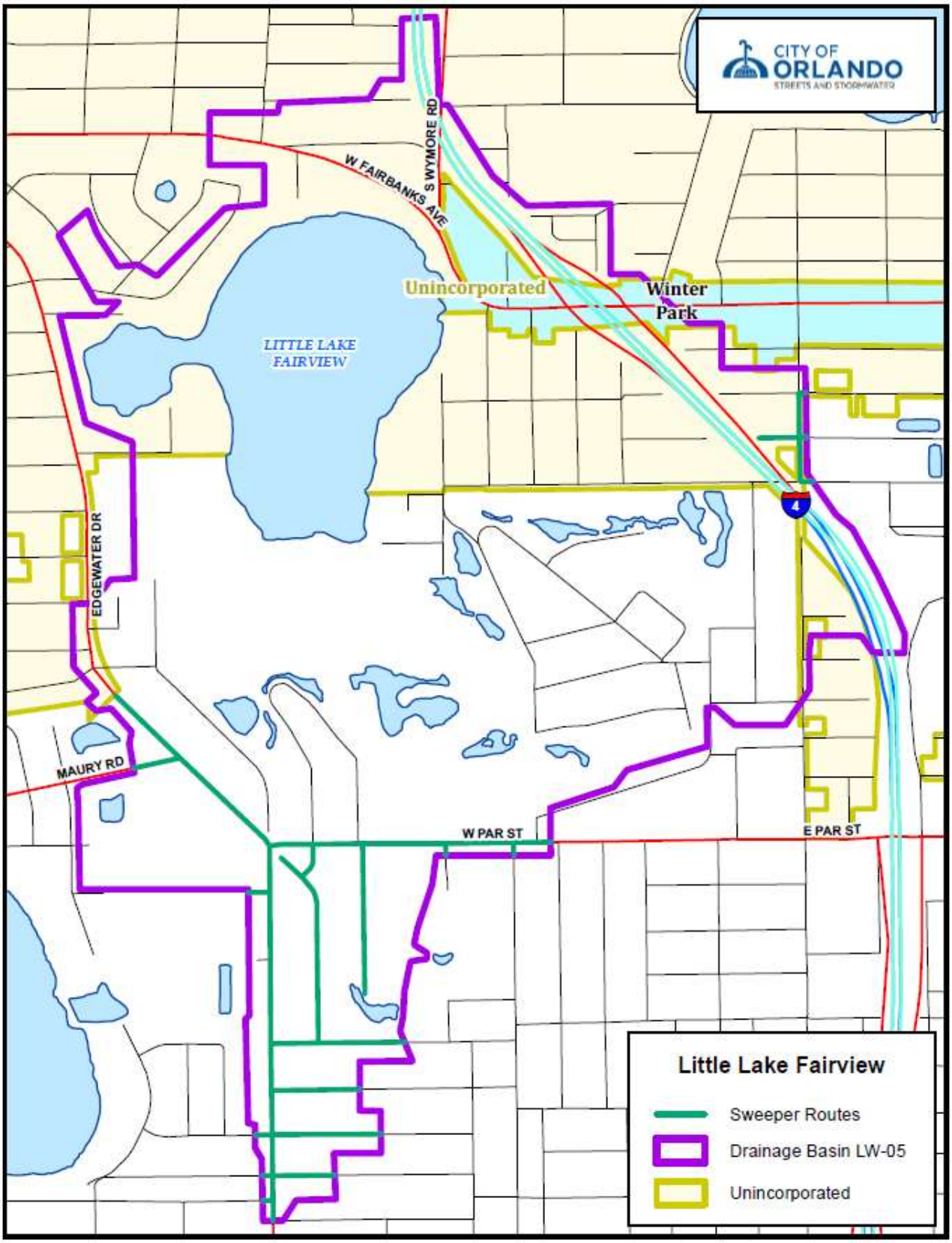

Figure 9: City of Orlando Street Sweeping and Inlet Basket Locations

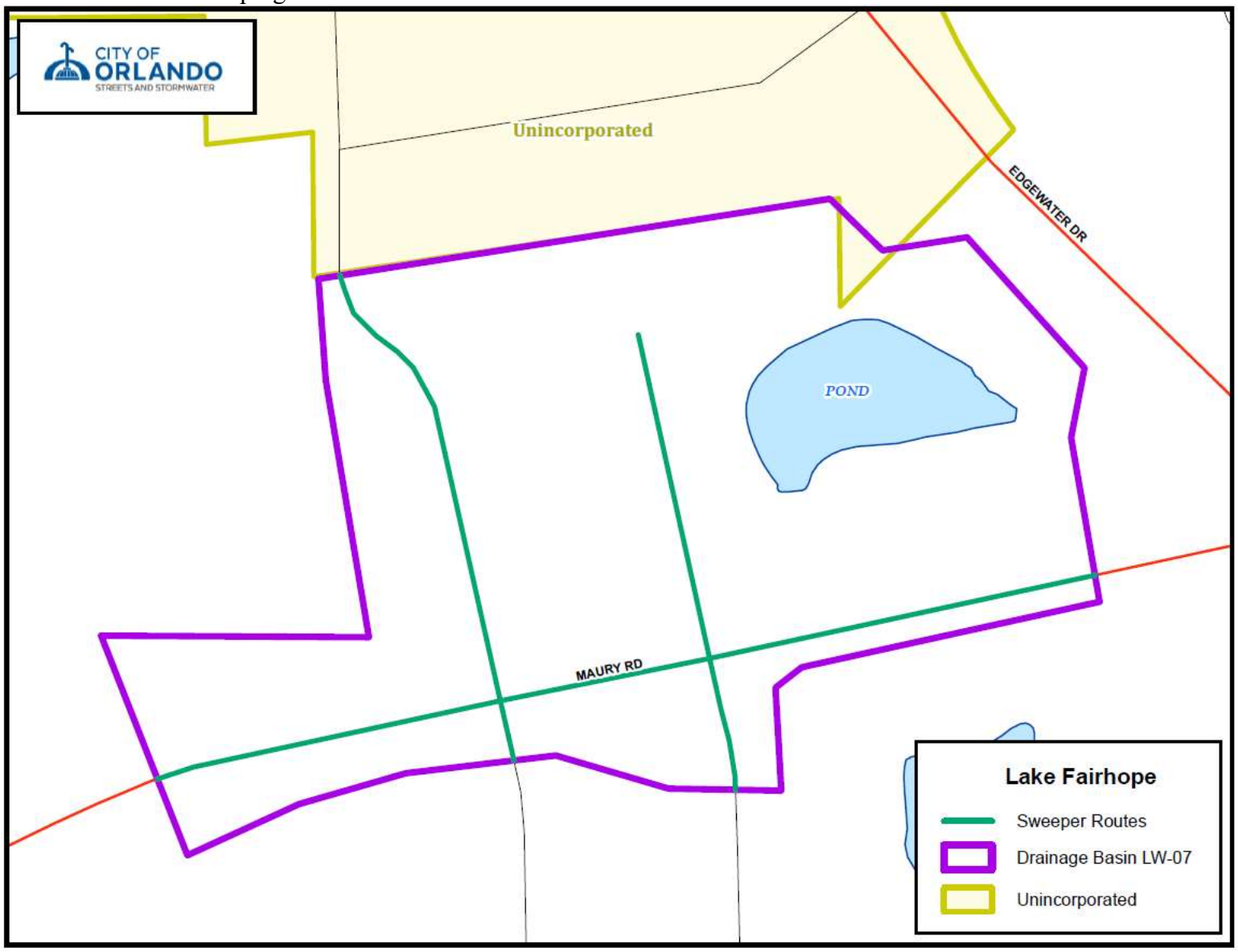

Figure 10: City of Orlando Street Sweeping and Inlet Basket Locations

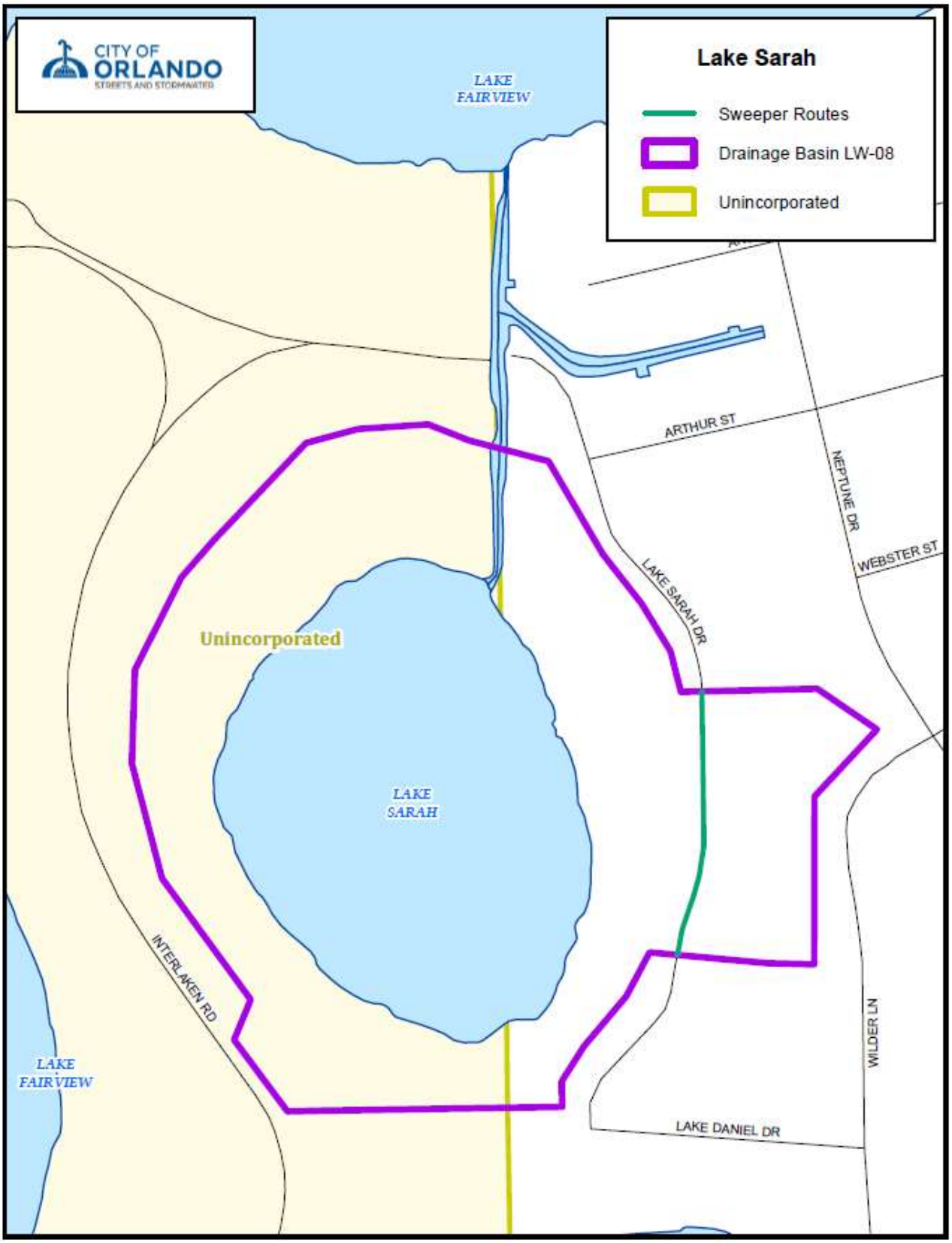

Figure 11: City of Orlando Street Sweeping and Inlet Basket Locations

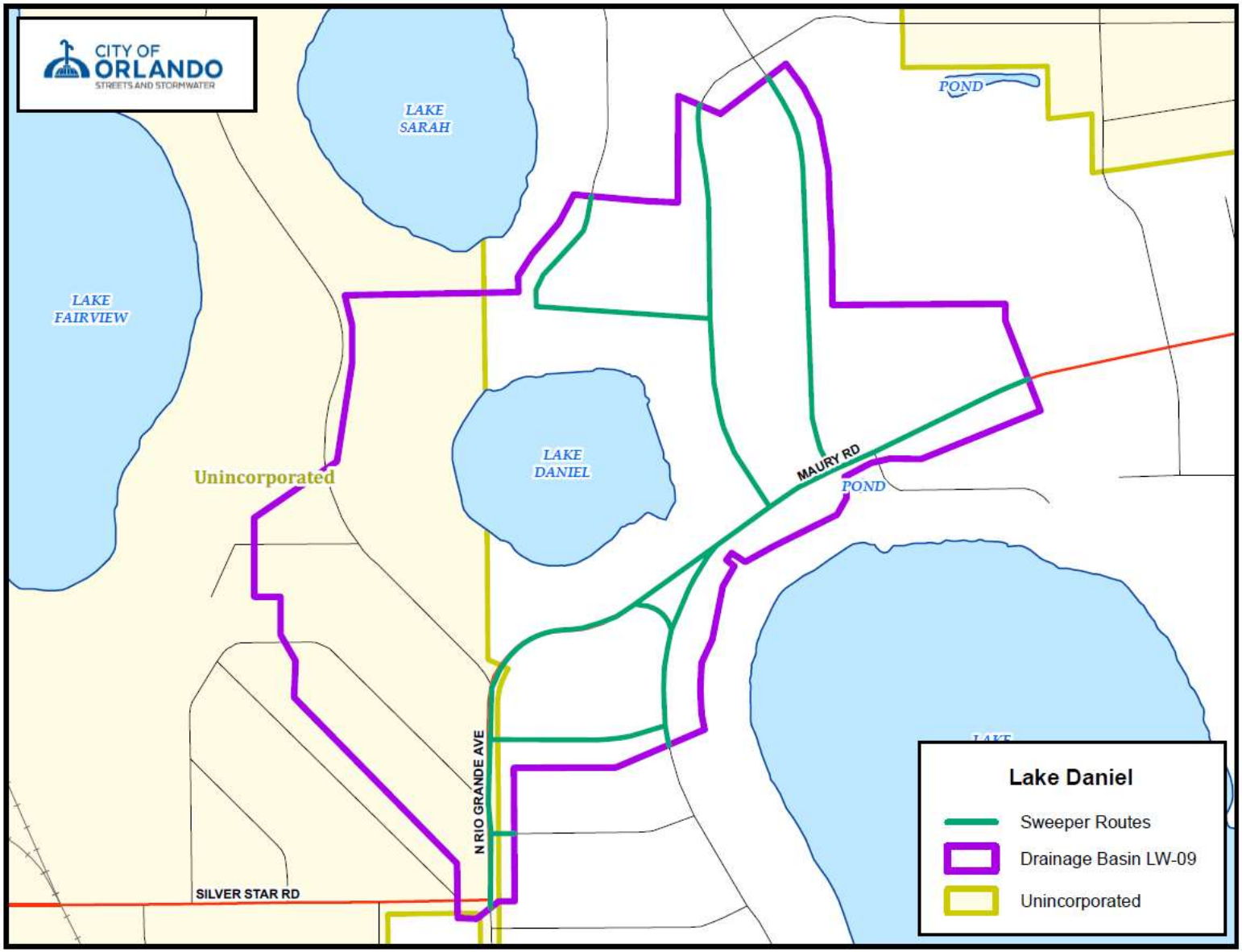

Figure 12: City of Orlando Street Sweeping and Inlet Basket Locations

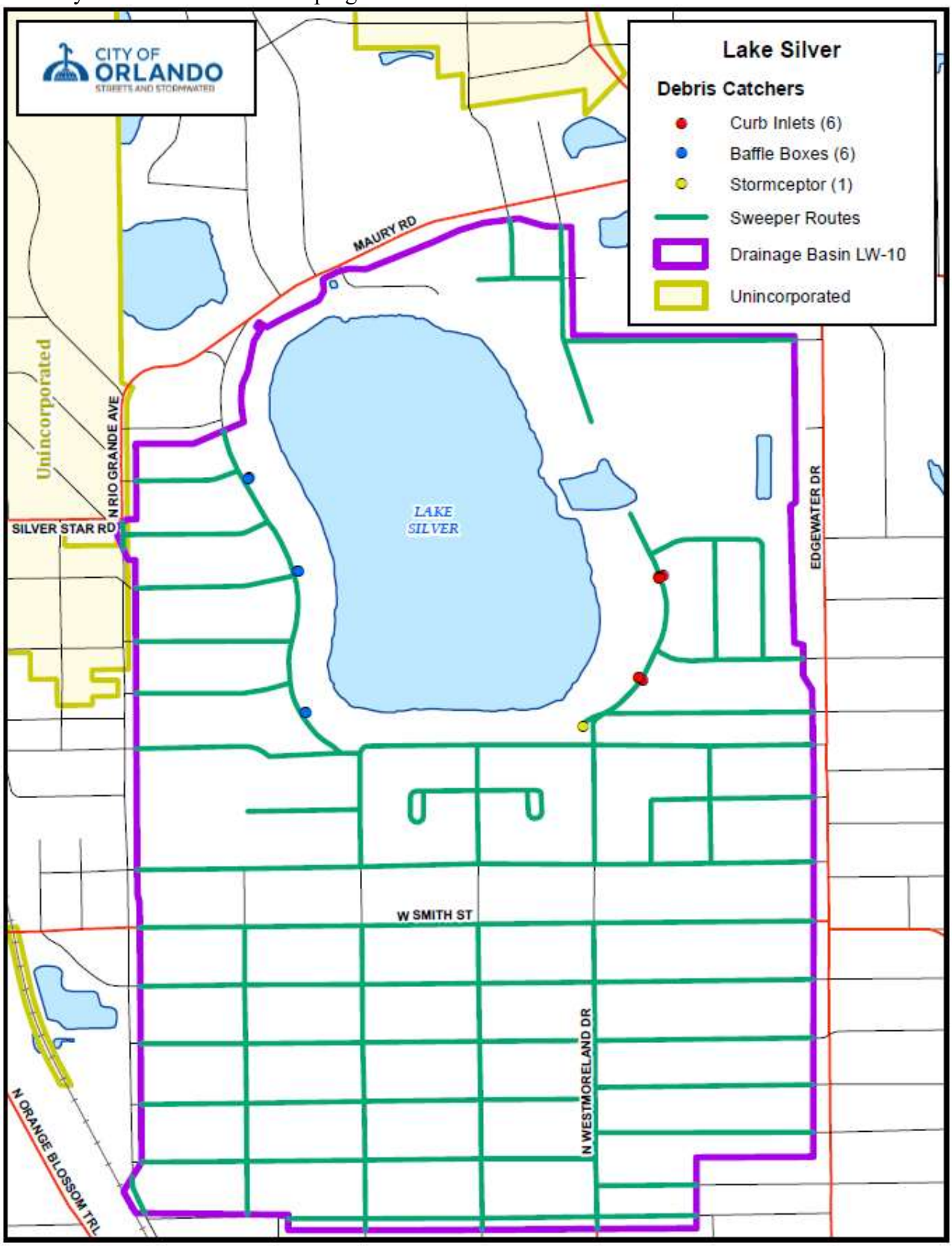

Figure 13: City of Orlando Street Sweeping and Inlet Basket Locations

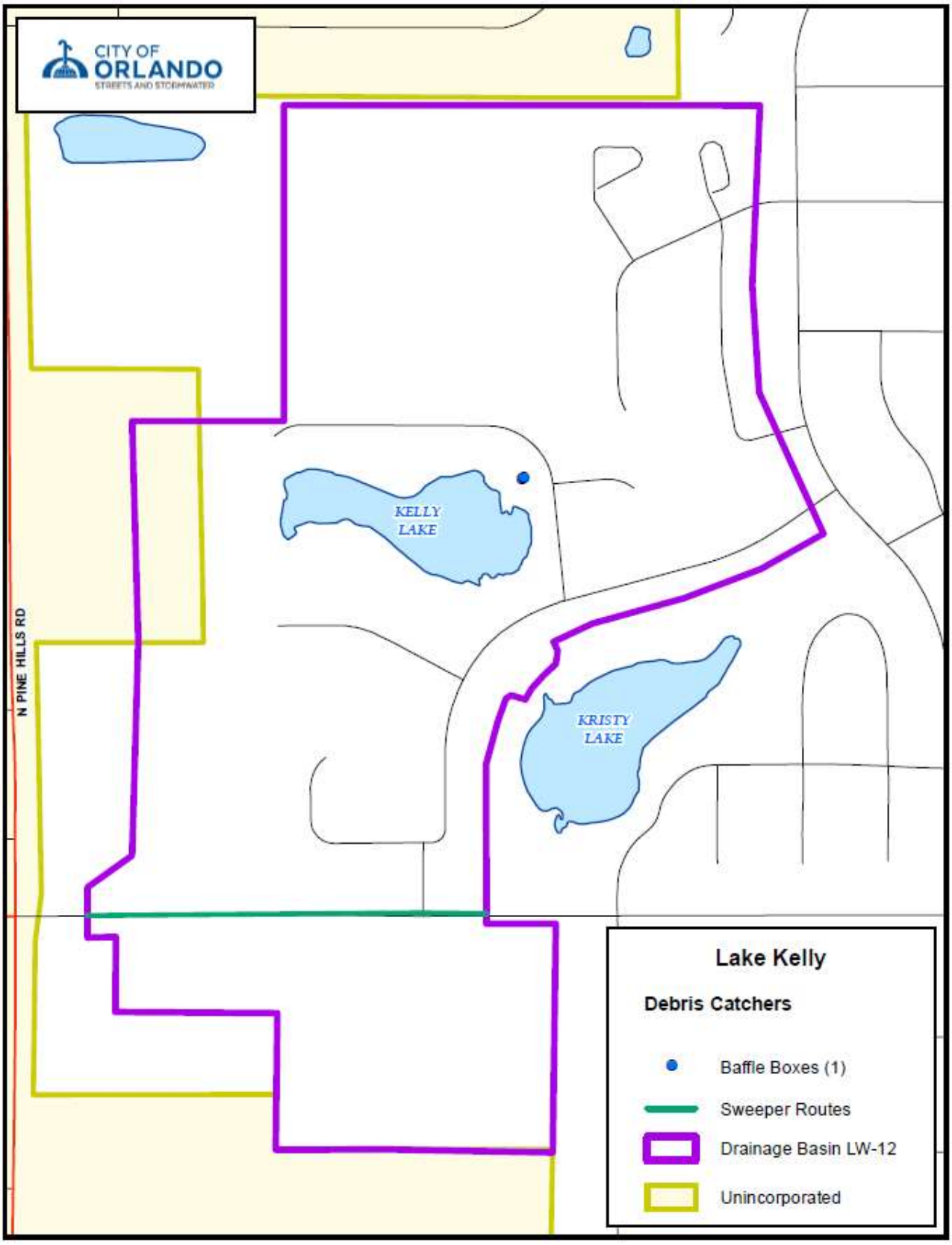

Figure 14: City of Orlando Street Sweeping and Inlet Basket Locations

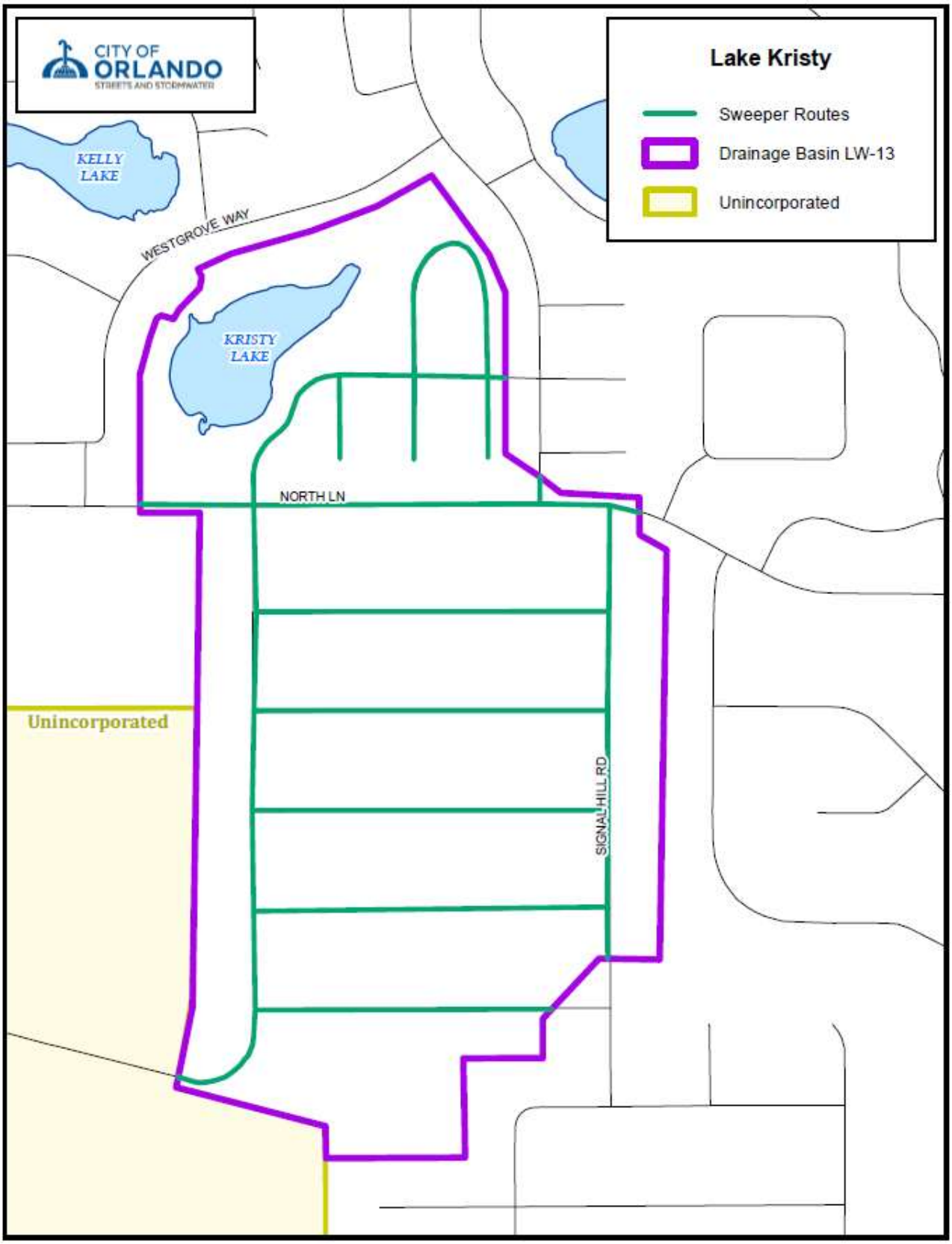

Figure 15: City of Orlando Street Sweeping and Inlet Basket Locations

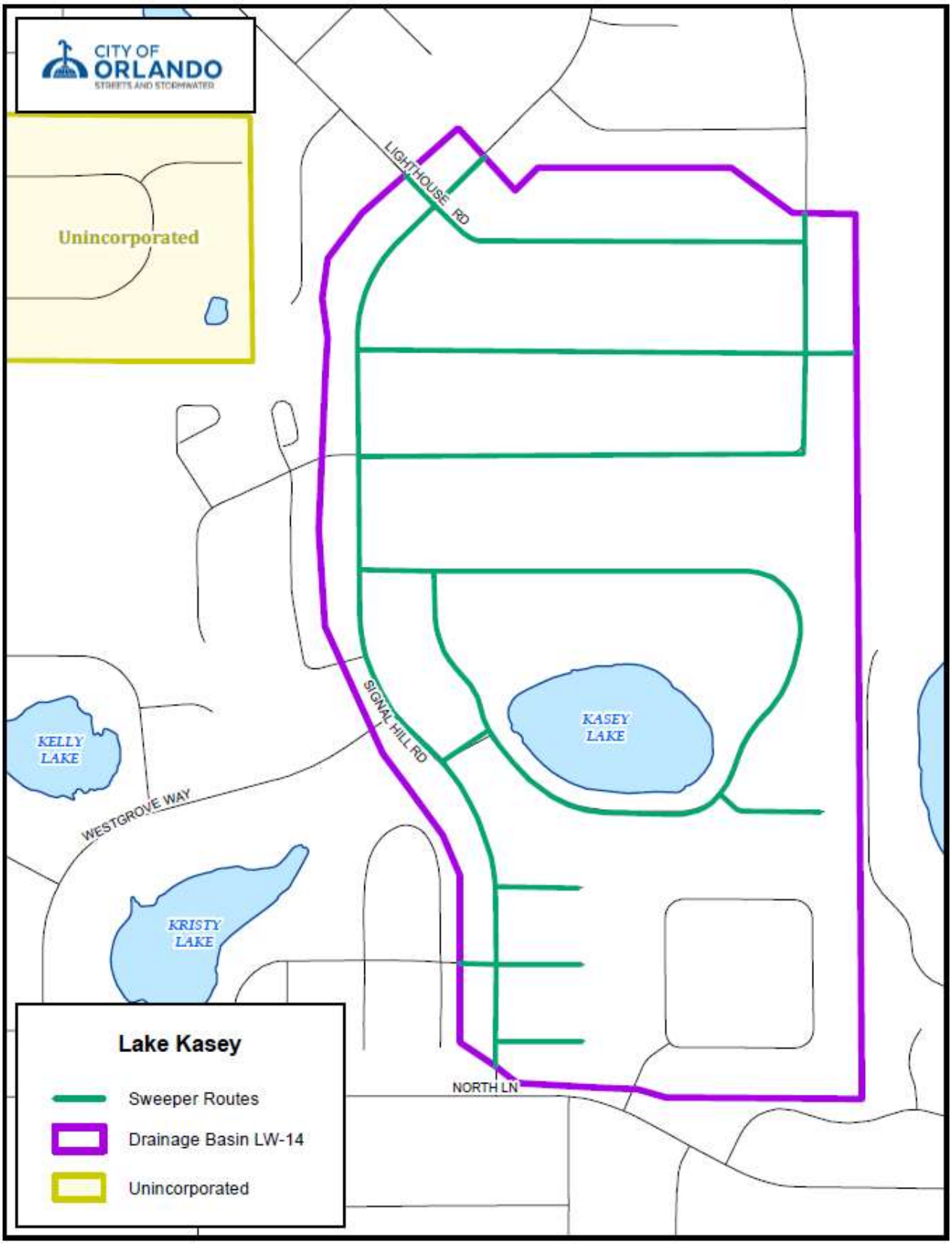

Figure 16: City of Orlando Street Sweeping and Inlet Basket Locations

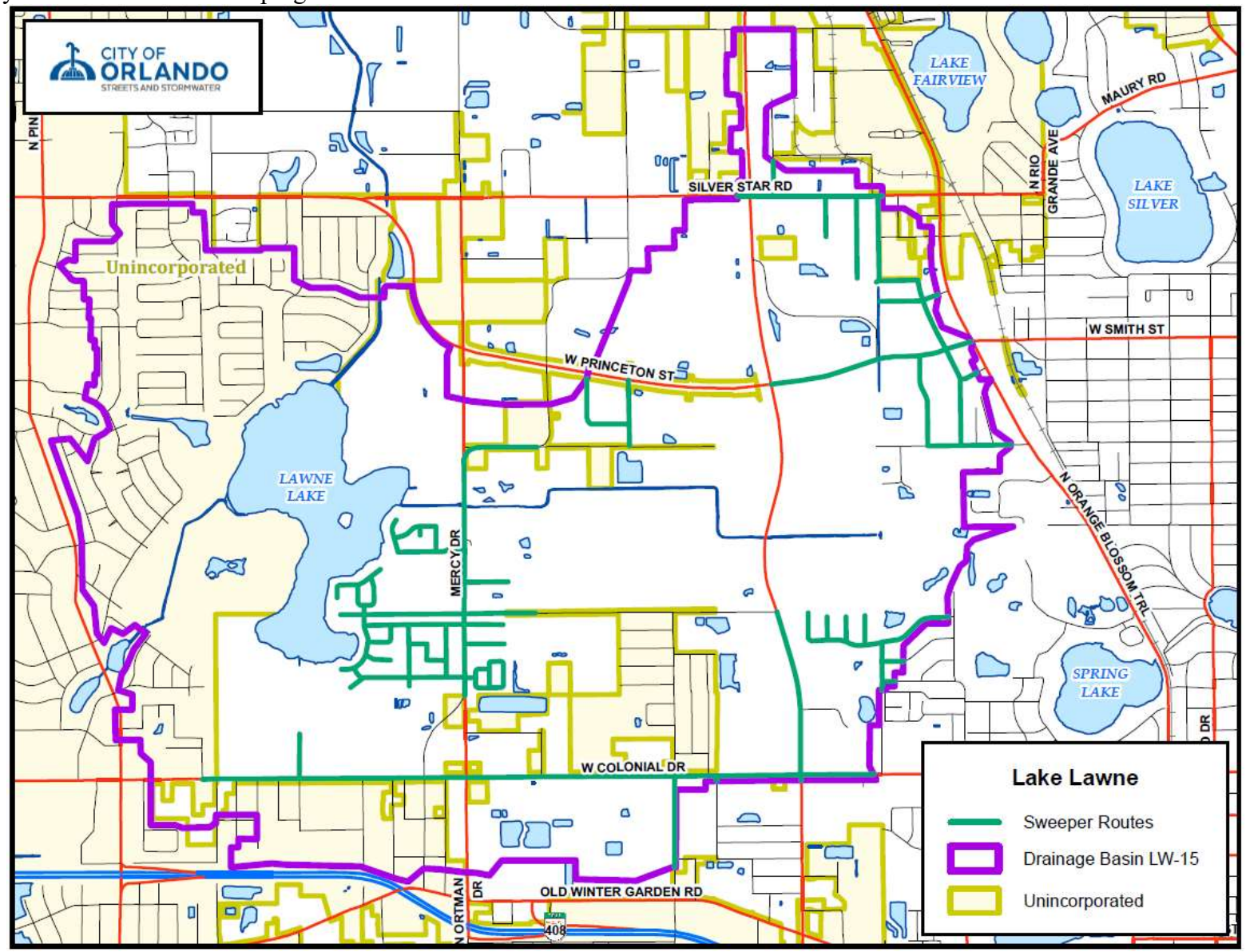

Figure 17


Packing District
Overall Drainage Basins
Silver Star Rd
Packing
District
North
38 ac
Princeton St
OBT
Packing
District
South
46 ac
JYP
Packing
District
Park
53 ac
New Hampshire

Figure 18: Orange County Street Sweeping and Inlet Basket Locations