DISTRICT 5 TRUCK PARKING

Phase 2 Final Report

FDOT

September 2021

Executive Summary

In 2018 Florida Department of Transportation (FDOT) completed a Phase 1 Truck Parking Study that evaluated truck parking supply and demand conditions within FDOT District Five. That study recommended a set of action items to address parking shortage issues, including identification of sites which might be suitable for development as truck parking locations. This Phase 2 Study developed an analysis methodology for identifying an initial pool of potential truck parking sites which could serve as the starting point for the PD&E study that is programmed to begin in 2021.

This report describes a GIS-based methodology that objectively identifies potential truck parking locations based on established spatial preference criteria. The GIS process takes place in two stages, referred to as the Tier 1 and Tier 2 analyses. The Tier 1 analysis identifies the geographic areas that appear most suitable for truck parking based on their proximity to I-4, their proximity to existing over-capacity truck parking sites, areas of low crime, and similar objectively defined criteria. The Tier 2 analysis locates areas of suitable land use within the high-preference areas identified by the Tier 1 process using recent parcel data. Both the Tier 1 and Tier 2 analyses rely on GIS models whose functions are transparently described, and that can be employed by anyone with the necessary GIS software.

The PD&E study will evaluate potentially viable sites suitable for public and/or private operators to ensure a complete and objective consideration of alternatives consistent with NEPA process requirements. During the PD&E phase, the District will obtain input from industry stakeholders and other community stakeholders, local government partners, interest groups and the general public.

Contents

Tables

Figures

Appendices

Introduction

In 2018 Florida Department of Transportation (FDOT) completed a Phase 1 Truck Parking Study that evaluated truck parking supply and demand conditions within FDOT District Five. That study recommended a set of action items in order to address parking shortage issues, including identification of potential sites which might be suitable for development as truck parking locations. This Phase 2 Study developed GIS-based techniques for identifying an initial pool of potential truck parking sites which could serve as the starting point for the PD&E Study.

The Phase 2 Study involved development of a comprehensive GIS-based multi-criteria decision-making model. The model would locate land parcels suitable for developing truck parking facilities along the I-4 Corridor in District Five based on established truck parking suitability criteria. This document describes the GIS-based process that could be used to identify potential truck parking candidate locations.

Desktop Scan Methodology

Overview

The desktop analysis methodology for locating potential truck parking sites relies on the use of Geographic Information System (GIS) technology. The GIS process described here takes place in two stages, referred to as the Tier 1 and Tier 2 analyses. The Tier 1 analysis identifies the geographic areas that appear most suitable for truck parking based on their proximity to I-4, their proximity to existing over-capacity truck parking sites, areas of low crime, and similar objectively defined criteria. The Tier 2 analysis locates areas of suitable land use within the high-preference areas identified by the Tier 1 process using recent parcel data.

The analysis steps described here employ ArcGIS Desktop 10.7.1 software using the Spatial Modelbuilder scripting environment and the Spatial Analysis raster analysis extension. The Tier 1 and Tier 2 analyses rely on Spatial Modelbuilder models whose functions are transparently described below, and that can be employed by anyone with the necessary ArcGIS software.

Input Data

Table 1 lists the data sources that would be used in the GIS-based desktop scan analyses.

Table 1. Data Sources

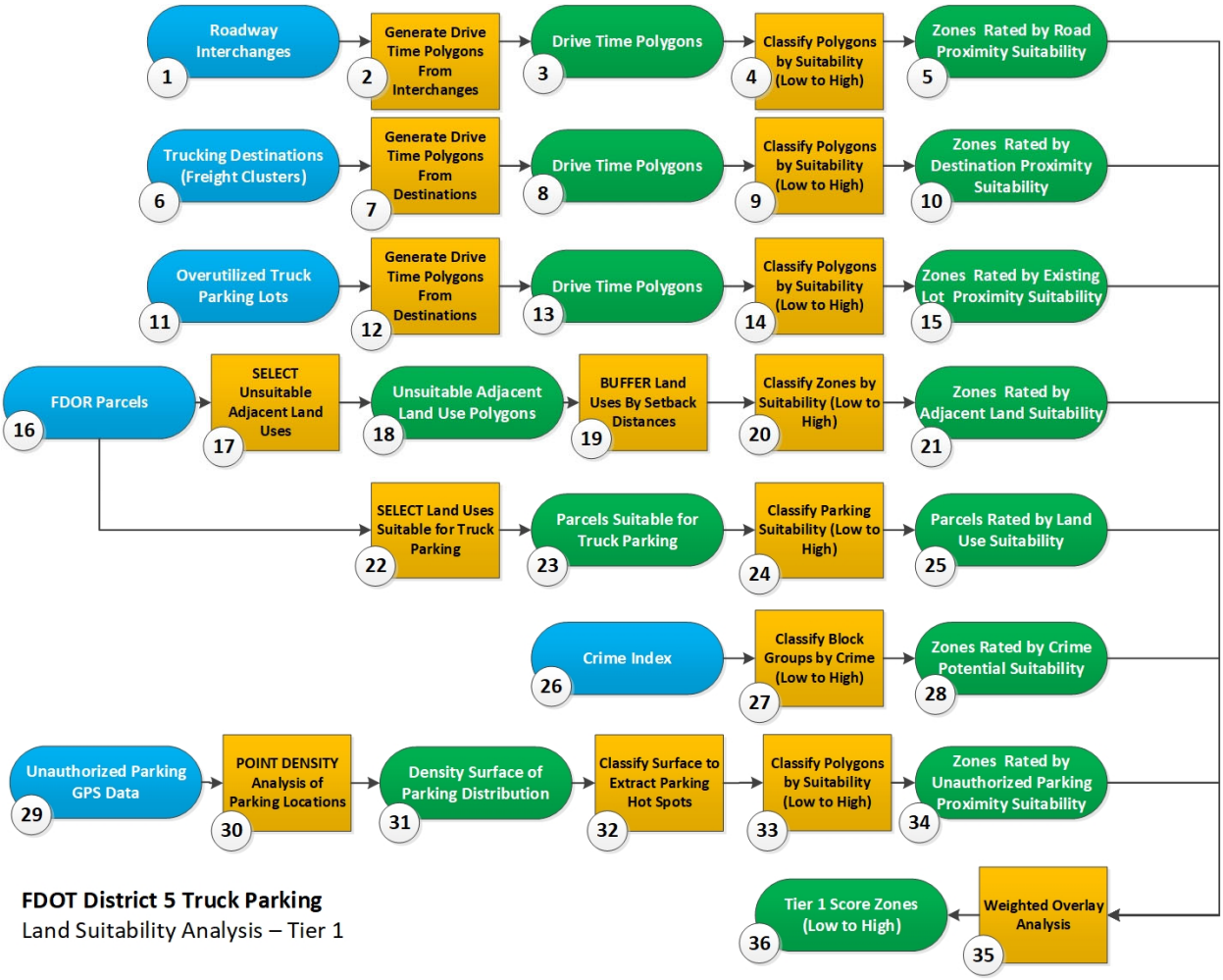
Data Source	Description of Dataset	Update Frequency	Purpose of Dataset	Remarks
Department of Revenue (DOR)	Parcel data with land use information	Annual	Input data to the model	Free
Department of Economic Opportunity (DEO)	Establishment data for employment and wages	Quarterly	Input data to the model	Free, subject to 3-80 rule
FDOT Statewide Truck GPS Study	Over capacity truck parking lots and Unauthorized trucks	-	Input data to the model	Results from the Statewide Truck GPS Study
Crime Index Data	Statistics about major categories of personal and property crime	Annual	Input data to the model	ESRI Demographic Data

Tier 1 Land Suitability Model

The Tier 1 Land Suitability Model would combine seven different criteria with a Weighted Overlay into a single, overall land suitability layer (Figure 1 shows the geo-spatial modeling process). Each criterion defines an area of the study area counties according to its desirability for providing a truck parking facility. Most of the criteria were defined from the perspective of a

truck driver looking for a suitable place to park. The input criteria and the modeling process are described in detail below.

Figure 1. Tier 1 Modeling Flowchart



Road Proximity

When developing the inputs of this multi-criteria decision-making model it was useful to keep in mind the phrase “all else considered equal.” That is, each *individual* factor was evaluated as if it was the only one that would affect the desirability of an area for truck parking. For Road Proximity the most desirable locations would be those within a very short drive from an interchange exit, followed by those only a bit further away, and so on. To develop this input layer a Drive Time analysis would be conducted in ArcGIS Online from the interchange locations on I-4 (Figure 1, Steps 1 – 3). Interchanges within 10 miles of the District boundary would be included in the Drive Time analysis to account for any suitable areas within the District that might be near an I-4 interchange just outside the District’s jurisdiction. The Drive Time analysis should be conducted using the option for actual average traffic for noon on Wednesday to provide more realistic conditions than the default “no traffic” option, while also

avoiding excessively long drive-times that might be associated with peak-hour time periods. The output drive time polygons would be rated on a suitability scale of 1 to 5 (Table 2) before being rasterized to create the Road Proximity raster layer (Figure 1, Steps 4 and 5).

Table 2. Drive Time Suitability Scores

Drive Time (Minutes)	Suitability Rank	Suitability Score
0 – 5	Very High Suitability	1
5 – 10	High Suitability	2
10 – 15	Moderate Suitability	3
15 – 20	Low Suitability	4
20 - 30	Very Low Suitability	5

Destination Proximity

Truck drivers prefer parking sites located near to where they intend to pick up or drop off a load. To identify these areas, the Freight Clusters within District Five previously identified in a study of statewide Freight Activity Areas would be used as the “Trucking Destination” input to a Drive Time analysis (Figure 1, Step 6). Freight Clusters within 10 miles of the District boundary would be included in each District drive time analysis to account for trucking destinations located just outside, but near, to the District. The subsequent Drive Time analysis steps (Figure 1, Steps 7 – 10) and drive time suitability scores (Table 2) would be the same as those used in Roadway Proximity.

Over-utilized Truck Parking Lot Proximity

Several authorized truck parking lots currently exist statewide to support the trucking community. When those existing truck parking lots are over capacity, this indicates a demand for truck parking is not being met. A new truck parking facility in the vicinity of an over-capacity lot would relieve that demand. Over-utilized Truck Parking facilities would be identified as those with ≥ 75% capacity for any hour bin over a 24-hour period (Figure 1, Step 11). Over-capacity truck parking lots within 10 miles of the District boundary would be included in each District drive time analysis to account for parking lots located outside, but near, to the District. The subsequent Drive Time analysis steps (Figure 1, Steps 12 – 15) and drive time suitability scores (Table 2) would be the same as those used in Roadway Proximity.

Adjacent Land Use Suitability

New truck parking lots should be located in appropriately zoned Commercial or Industrial areas. However, some Commercial and Industrial parcels may not be suitable for supporting truck parking since they entail trucks driving through or near areas of unsuitable adjacent land use such as schools, churches or residential areas. To address this concern, land use parcels from the Florida Department of Revenue (FDOR) with unsuitable land use codes (Appendix A)

should be extracted (Figure 1, Steps 16 – 18), converted to raster format, and buffered using the Euclidean Distance tool (Figure 1, Step 19). The Euclidean Distance Tool would determine the distance of each raster pixel from any of the unsuitable adjacent land uses. Those pixels would then assigned a truck parking suitability score based on their proximity to unsuitable land uses, with those closest receiving a poor score and those furthest away assigned a Very High Suitability score (Table 3).

Table 3. Unsuitable Adjacent Land Use Suitability Scores

Distance (Meters)	Suitability Rank	Suitability Score
> 1,200	Very High Suitability	1
800 – 1,200	High Suitability	2
400 - 800	Moderate Suitability	3
200 - 400	Low Suitability	4
< 200	Very Low Suitability	5

Land Use Parcel Suitability

This part of the Tier 1 model would identify those parcels whose existing land use would be compatible with development of a truck parking lot (Figure 1, Steps 22 – 25). Vacant Commercial and Industrial sites top the list of 56 land use types (Appendix B). Each land use type should be assigned a suitability score from 1 (Very High Suitability) to 5 (Very Low Suitability) to reflect its potential for conversion to a truck parking facility. Any land use type not listed in Appendix B would be assigned a Very Low Suitability score of 5.

Crime Potential

All else being equal, truck parking facilities should be located in places where the vehicles and their drivers will not be at high risk for crimes against their persons or property. The Esri Demographics Crime Index layer for Florida should be incorporated into the Tier 1 model for this purpose. The Total Crime Index in those data are tied to the national average crime rate. A Total Crime Index (TCI) value of 100 for a Census Block Group represents the national average crime rate, while a TCI value of 200 indicates a Block Group with twice the amount of crime as the national average, and so on. Each Census Block Group in the District would be assigned a Crime Score ranging from 1 (Very High Suitability) indicating a Crime Index at or below the national average, up to 5 (Very Low Suitability) for Block Groups with more than ten times the national average crime rate. Table 4 shows the relationship between Crime Index values and truck parking suitability scores. The Census Block Groups would be rasterized by their Crime Score suitability values to prepare them for use in the Weighted Overlay analysis (Figure 1, Steps 26 – 28).

Table 4. Crime Index Suitability Scores

Crime Index Value	Suitability Rank	Suitability Score
≤ 100	Very High Suitability	1
100 - 250	High Suitability	2
250 - 500	Moderate Suitability	3
500 - 1000	Low Suitability	4
≥ 1,000	Very Low Suitability	5

Unauthorized Parking Proximity

Lastly, any place where many unauthorized trucks park should be considered an indicator of high demand for legitimate truck parking facilities. To develop this layer, truck parking GPS location data obtained for the District and the area 10 miles beyond the District boundary would be filtered to extract only those trucks that were stationary for 3+ hours . The ArcGIS Point Density tool would be used to develop a raster density surface weighted by the parking duration for each vehicle (Figure 1, Steps 29 – 31), under the presumption that longer-duration immobility represented actual long-term parking, and where many trucks engaged in long-term parking should represent a higher demand for new truck parking facilities. The point density output would be classified using a Quintile (5-class) classifier, and those classes would then be reclassified to the 1 to 5 truck suitability scale (Figure 1, Steps 32 – 34).

Weighted Overlay Analysis

The final step in the Tier 1 analysis would involve combining each of the seven input criteria layers described above using the ArcGIS Weighted Overlay tool (Figure 1, Steps 35 - 36). The Weighted Overlay would perform a weighted average of all the input pixels at each location in the District. Trial runs using several different weighting schemes for the input layers labeled A through D were evaluated, starting with the Tier 1A model that weighted each layer the same. The weights for each of the models appear in Table 5.

The output raster from each alternative model was examined visually in ArcGIS to determine whether known parcels suitable as potential truck parking facilities were flagged as Very High or High Suitability. The Tier 1C and 1D models identified very few locations as Highly Suitable. The equally weighted Tier 1A model performed better, but still missed some suitable parcels even when they were immediately adjacent to another High Suitability parcel. The weights used in the Tier 1B model appeared to be best for identifying potential truck parking sites. Consequently, the Tier 1B weighting model should be used to develop the land suitability layer (Appendix C).

Table 5. Alternative Weighted Overlay Model Weights

Factor #	Factor Description	Tier 1A	Tier 1B	Tier 1C	Tier 1D
1	Interchange Drive Time	15%	19%	20%	5%
2	FAA Drive Time	15%	19%	20%	5%
3	Capacity Parking Drive Time	14%	14%	10%	5%
4	Crime Index	14%	14%	5%	5%
5	Unauthorized Parking	14%	14%	5%	40%
6	Unsuitable Land Use Proximity	14%	10%	20%	35%
7	Suitable Land Use	14%	10%	20%	5%
	Totals	**100%**	**100%**	**100%**	**100%**

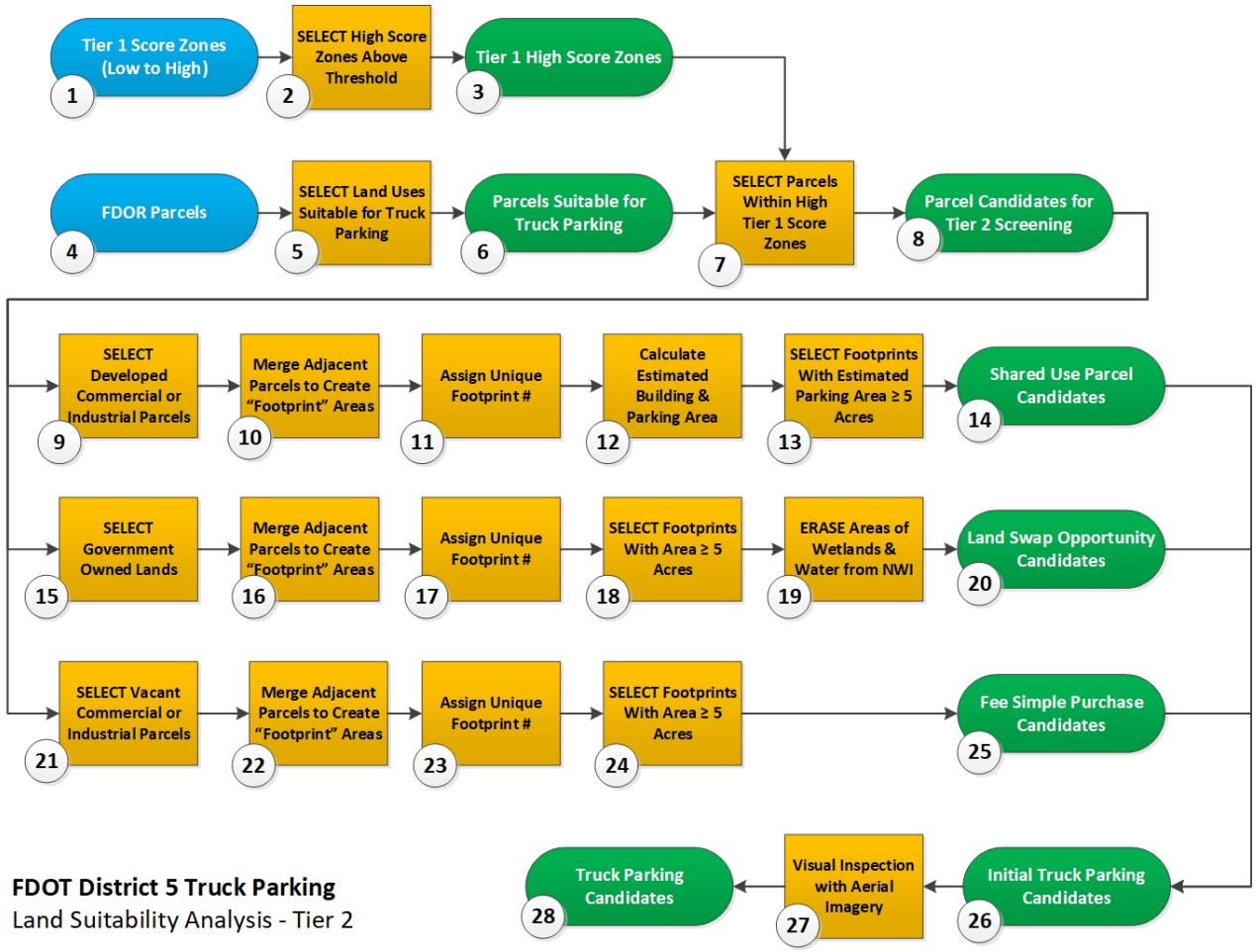
Tier 2 Parcel Suitability Model

The Tier 1 land suitability model described above will identify the broad spatial areas that are most suitable for siting a truck parking facility. The purpose of the Tier 2 models would be to locate specific parcels within those areas of high suitability that would meet the minimum requirements for truck parking sites. There are three kinds of parcels identified by the Tier 2 process:

- Shared Use Parcel Candidates – This group includes existing developed Commercial or Industrial parcels with large parking areas which might be available as part of a shared use agreement for truck parking.
- Land Swap Opportunity Candidates – These include vacant, government-owned parcels that could provide an opportunity for the FDOT to negotiate a land swap or shared use agreement.
- Fee Simple Purchase Candidates – These include vacant Commercial or Industrial zoned parcels that could be purchased for development into truck parking sites.

Figure 2 outlines the Tier 2 modeling process, which begins with selecting out the polygon areas identified as Very High or High Suitability for truck parking by the Tier 1 model (Steps 1 – 3). Those Tier 1 High Score Zones would be used to perform a Spatial Select on suitable FDOR parcels to extract only those parcels with appropriate existing land use located in areas of high suitability for truck parking sites (Figure 2, Steps 4 – 8). From that point the subsequent Tier 2 modeling steps would take a different path depending on which of the three parcel candidate types were identified.

Figure 2. Tier 2 Modeling Flowchart



Shared Use Parcel Candidates

The complete ArcGIS Spatial Modelbuilder Tier 2A model for this process appears in Appendix D, but its key steps appear in Figure 2. This process begins with selecting those already developed Commercial and Industrial parcels from the parcel candidates within the Tier 1 High Score Zones (Figure 2, Step 9). The ArcGIS Dissolve tool would merge adjacent parcels into a single "footprint" polygon which would then be assigned a unique ID number (Figure 2, Steps 10 - 11). This step ensures that no feasible sites are rejected because their individual parcels fall below the minimum size requirement (5 acres) when two or more adjacent parcels would collectively meet or exceed that size limit.

For the Shared Use candidates, the important size criterion was not the overall size of the combined parcels, but the availability of ≥ 5 acres of parking. The size of the parking would be estimated by subtracting the total size of buildings on each parcel from the overall parcel size (Figure 2, Step 12). This calculation assumes that the buildings on the parcel are a single story, so that the total living area of the buildings would be the same as the building footprint. Consequently, some sites with multi-story buildings might be eliminated because the potential

parking area would be underestimated by this method. Conversely, this calculation method cannot account for other uses on each parcel such as internal roads, landscaping, drainage, and water treatment ponds that reduce the total available parking area, so some potential footprint areas might be retained that don't meet the 5 acre minimum in space available for parking. Despite their limitations these steps would filter out most of the Commercial and Industrial parcels whose potential parking areas are too small for further consideration (Figure 2, Steps 13 – 14).

Land Swap Opportunity Parcel Candidates

The ArcGIS Spatial Modelbuilder Tier 2C model for identifying vacant government parcels (Appendix E) involves selecting out the appropriate parcels and merging them into unique footprints ≥ 5 acres in size (Figure 2, Steps 15 – 18). Because many of the government-owned parcels are conservation lands, National Wetlands Inventory data should be used in an ArcGIS Erase of wetlands and water features on each government parcel to leave only the upland areas that might be suitable for establishing a truck parking facility (Figure 2, Steps 19 and 20).

Fee Simple Purchase Parcel Candidates

Finally, the ArcGIS Spatial Modelbuilder Tier 2B model (Appendix F) would identify those parcels ≥ 5 acres in size in High Suitability areas that are vacant but zoned Commercial or Industrial, as outlined in Figure 2 (Steps 21 – 25).

Identification of Potential Truck Parking Candidates

The three Tier 2 models would likely generate dozens of Initial Truck Parking Candidate locations throughout the study area (Figure 2, Step 26). However, many of those candidate sites would be located relatively far from I-4 and would not be useful providing parking options for drivers on that highway. To address this concern a 10-minute drive time polygon around I-4 interchanges should be used to select candidate locations most convenient to the highway. To winnow the number of candidate locations further each footprint polygon should be visually evaluated using recent aerial imagery in ArcGIS Online. Each candidate site could be rated as Good, Fair, or Poor based on the following criteria:

- Shape – A footprint would be rated Poor if it was so narrow or oddly shaped that truck trailers could not be easily parked, and Fair if most of the footprint could accommodate trucks. The footprint would be rated Good if the site had a shape that could be easily configured for parking.
- Location\Access – The footprint should be rated Poor if the access was not adjacent to an arterial or major collector suitable for trucks, or if the access required use of a road with difficult access (e.g., tight turns) or through undesirable land use (e.g., residential). The footprint would be rated Fair if access was through a side street off of an arterial or major collector, and Good if there was direct access from an arterial or major collector.
- Land Use Compatibility – The footprint would be rated Poor if the on-site land use appeared to be incompatible (e.g., fully developed with no shared parking opportunity, or

an obvious wetland). Footprints should be rated Fair if the on-site land use was acceptable (e.g., a vacant lot), but adjacent land uses were extremely incompatible (e.g., adjacent to a school or cemetery, or surrounded by dense residential use). A footprint would be rated Good if both on-site and adjacent land uses were compatible.

Those footprints rated Good by the aerial imagery evaluation would be extracted to create the initial Truck Parking Candidates (Figure 2, Steps 27 – 28).

Next Steps

A PD&E study of truck parking sites is programmed to begin in 2021. The PD&E study will identify potentially viable sites suitable for public and\or private operators to ensure a complete and objective consideration of alternatives consistent with NEPA process requirements. During the PD&E phase, the District will obtain input from industry stakeholders and other community stakeholders, local government partners, interest groups and the general public. The GIS-based desktop screening analysis described here could be a useful tool for identifying the initial pool of candidate sites for the PD&E evaluation process.

Appendix A. List of Unsuitable Adjacent Land Uses for Truck Parking

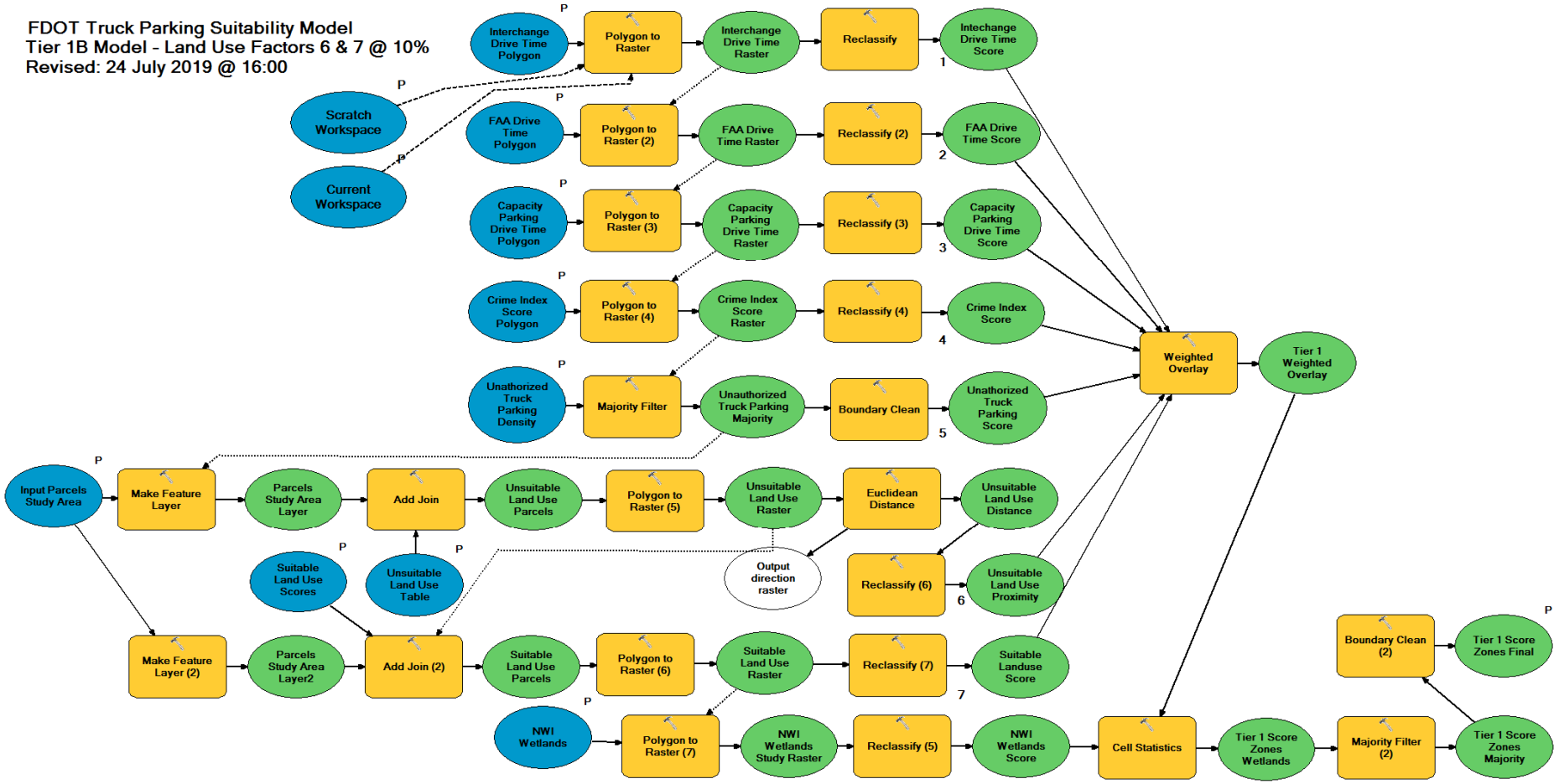
FDOR Use Code	Land Use Description
000	Vacant Residential with/without extra features
001	Single Family
002	Mobile Homes
003	Multi-family - 10 units or more
004	Condominiums
005	Cooperatives
006	Retirement Homes not eligible for exemption
007	Miscellaneous Residential (migrant camps, boarding homes, etc.)
008	Multi-family - fewer than 10 units
009	Residential Common Elements/Areas
012	Mixed use - store and office or store and residential combination
017	Office buildings, non-professional service buildings, one story
018	Office buildings, non-professional service buildings, multi-story
019	Professional service buildings
021	Restaurants, cafeterias
022	Drive-in Restaurants
023	Financial institutions (banks, saving and loan companies, mortgage companies, credit services)
024	Insurance company offices
071	Churches
072	Private schools and colleges
073	Privately owned hospitals
074	Homes for the aged
075	Orphanages, other non-profit or charitable services
076	Mortuaries, cemeteries, crematoriums
077	Clubs, lodges, union halls
078	Sanitariums, convalescent and rest homes
079	Cultural organizations, facilities
082	Forest, parks, recreational areas
083	Public county schools - including all property of Board of Public Instruction
084	Colleges (non-private)
085	Hospitals (non-private)
097	Outdoor recreational or parkland, or high-water recharge subject to classified use assessment

Appendix B. Parcel Truck Parking Suitability Scores

FDOR Use Code	Land Use Description	Suitability Score
010	Vacant Commercial with/without extra features	1
040	Vacant Industrial -with/without extra features	1
041	Light manufacturing, small equipment manufacturing plants, small machine shops, instrument manufacturing, printing plants	1
042	Heavy industrial, heavy equipment manufacturing, large machine shops, foundries, steel fabricating plants, auto or aircraft plants	1
043	Lumber yards, sawmills, planing mills	1
044	Packing plants, fruit and vegetable packing plants, meat packing plants	1
045	Canneries, fruit and vegetable, bottlers and brewers, distilleries, wineries	1
046	Other food processing, candy factories, bakeries, potato chip factories	1
047	Mineral processing, phosphate processing, cement plants, refineries, clay plants, rock and gravel plants	1
048	Warehousing, distribution terminals, trucking terminals, van and storage warehousing	1
015	Regional Shopping Centers	2
020	Airports (private or commercial), bus terminals, marine terminals, piers, marinas	2
028	Parking lots (commercial or patron), mobile home parks	2
029	Wholesale outlets, produce houses, manufacturing outlets	2
031	Drive-in theaters, open stadiums	2
049	Open storage, new and used building supplies, junk yards, auto wrecking, fuel storage, equipment and material storage	2
070	Vacant Institutional, with or without extra features	2
080	Vacant Governmental - with/without extra features for municipal, counties, state, federal properties and water management district (including DOT/State of Florida retention and/or detention areas)	2
086	Counties (other than public schools, colleges, hospitals) including non-municipal government	2
087	State, other than military, forests, parks, recreational areas, colleges, hospitals	2
088	Federal, other than military, forests, parks, recreational areas, hospitals, colleges	2
089	Municipal, other than parks, recreational areas, colleges, hospitals	2
090	Leasehold interests (government-owned property leased by a non-governmental lessee)	2
092	Mining lands, petroleum lands, or gas lands	2

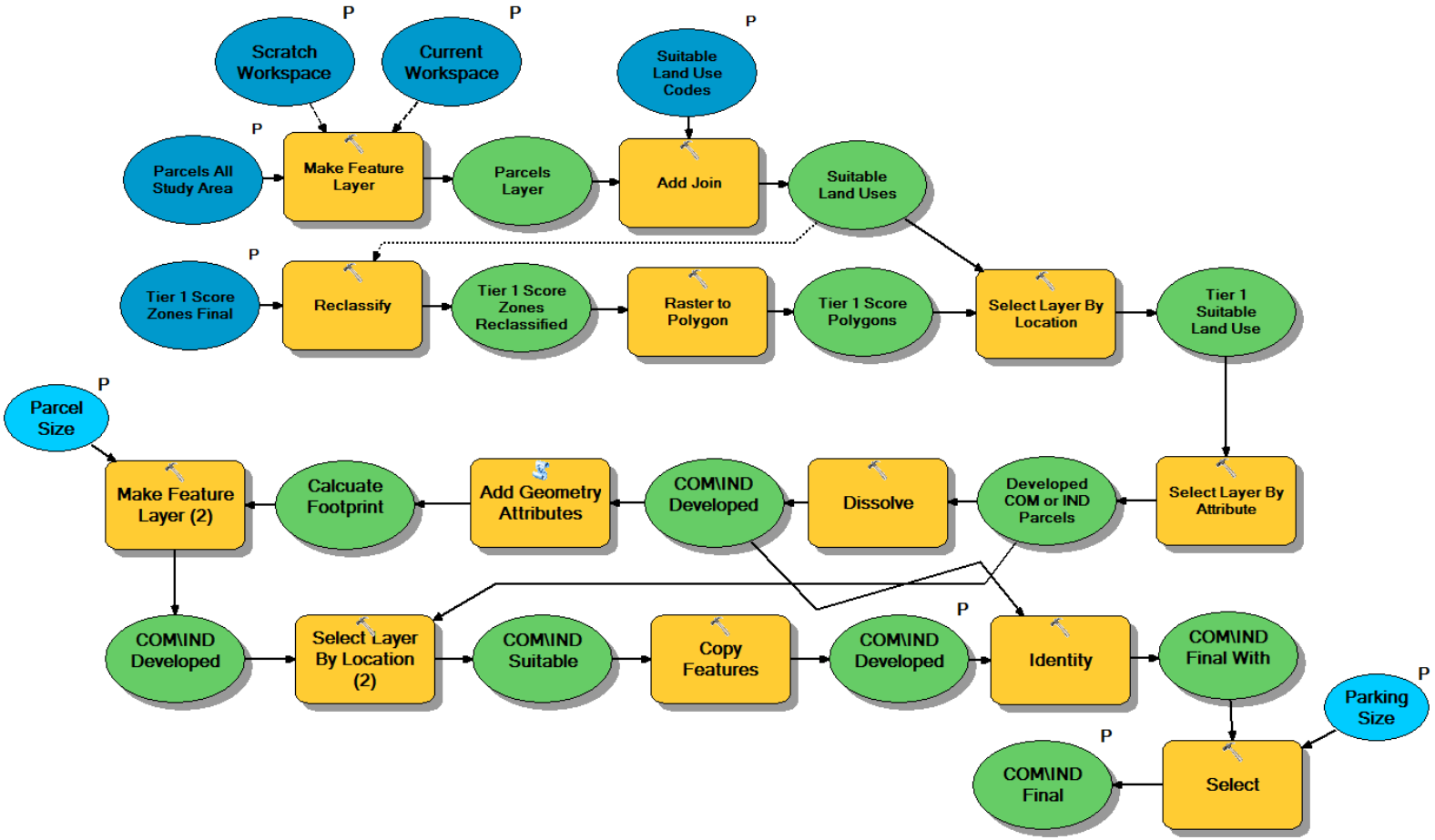
FDOR Use Code	Land Use Description	Suitability Score
013	Department Stores	3
014	Supermarkets	3
016	Community Shopping Centers	3
026	Service stations	3
032	Enclosed theaters, enclosed auditoriums	3
035	Tourist attractions, permanent exhibits, other entertainment facilities, fairgrounds (privately owned)	3
036	Camps	3
050	Improved agricultural	3
051	Cropland soil capability Class I	3
052	Cropland soil capability Class II	3
053	Cropland soil capability Class III	3
054	Timberland - site index 90 and above	3
055	Timberland - site index 80 to 89	3
056	Timberland - site index 70 to 79	3
057	Timberland - site index 60 to 69	3
058	Timberland - site index 50 to 59	3
059	Timberland not classified by site index to Pines	3
060	Grazing land soil capability Class I	3
061	Grazing land soil capability Class II	3
062	Grazing land soil capability Class III	3
063	Grazing land soil capability Class IV	3
064	Grazing land soil capability Class V	3
065	Grazing land soil capability Class VI	3
066	Orchard Groves, citrus, etc.	3
068	Dairies, feed lots	3
069	Ornamentals, miscellaneous agricultural	3
011	Stores, one story	4
039	Hotels, motels	4
067	Poultry, bees, tropical fish, rabbits, etc.	4
099	Acreage not zoned agricultural - with/without extra features	4

Appendix C. Truck Parking Suitability Model Tier 1B



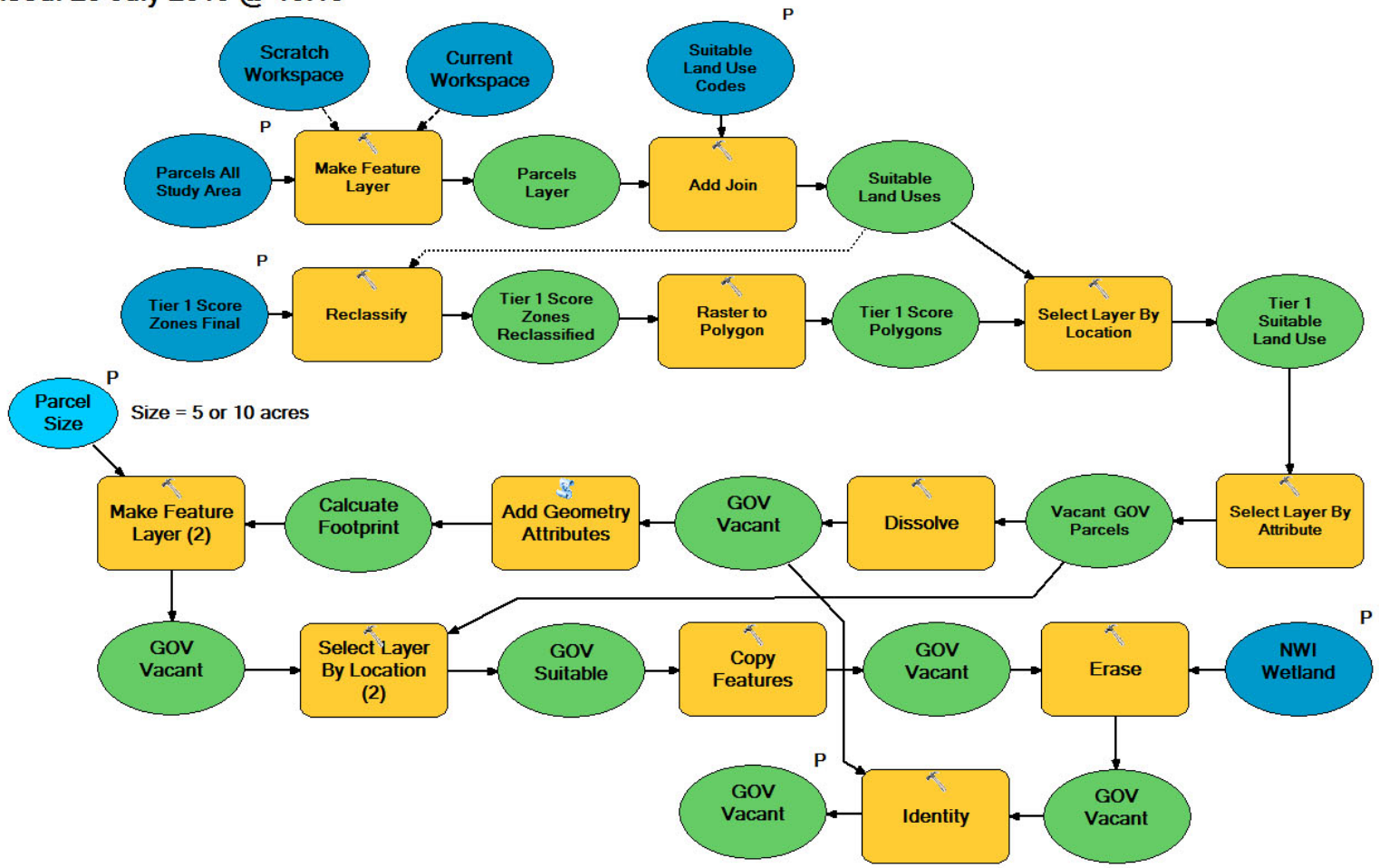
Appendix D. Truck Parking Suitability Model Tier 2A

FDOT Truck Parking Suitability Model
Model: Tier 2 A, Developed COM\IND Land Uses - District 5
Revised: 26 July 2019 @ 17:00



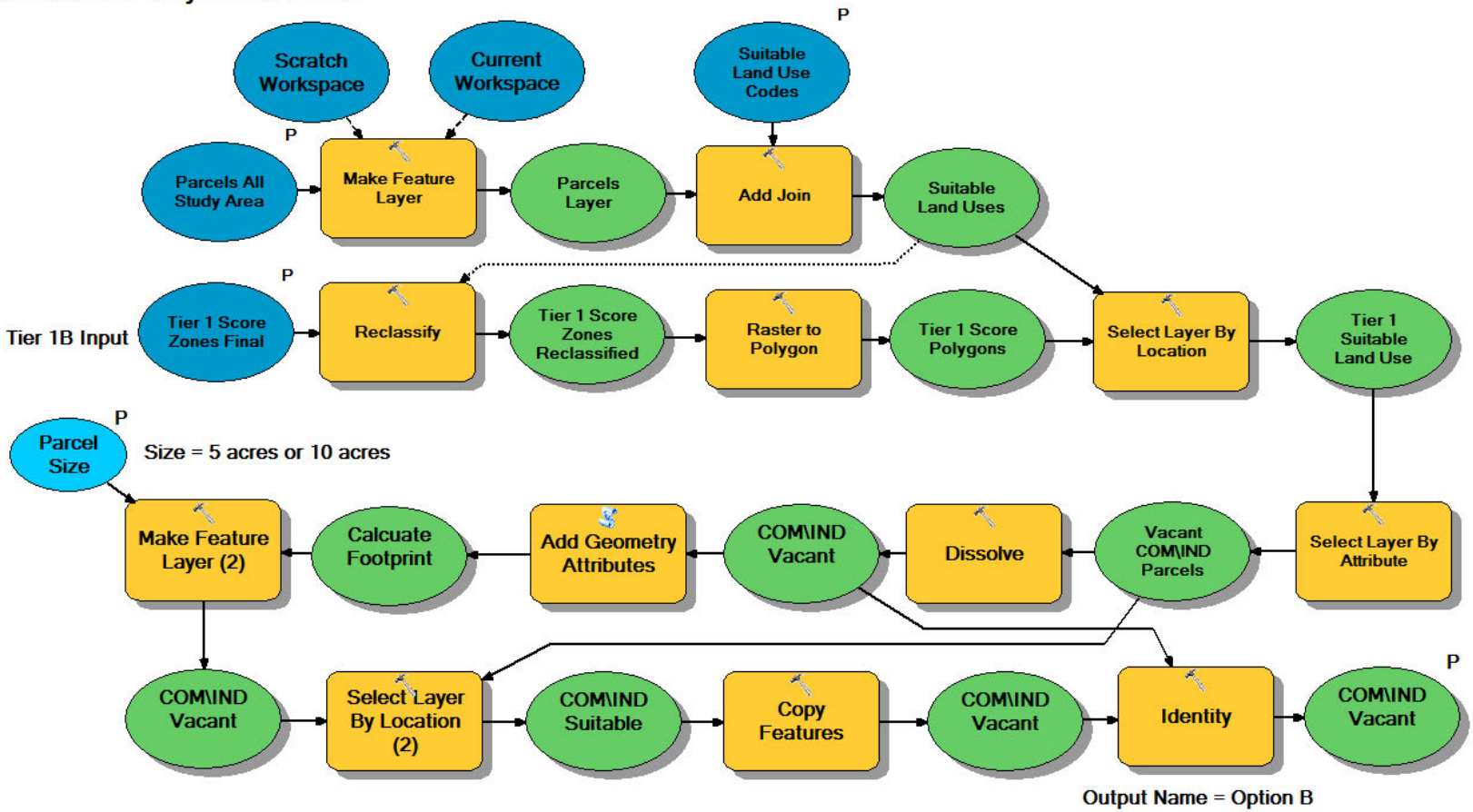
Appendix E. Truck Parking Suitability Model Tier 2C

FDOT Truck Parking Suitability Model
Model: Tier 2 C, Vacant Non-Wetland GOV Land Uses - District 5
Revised: 25 July 2019 @ 15:15



Appendix F. Truck Parking Suitability Model Tier 2B

FDOT Truck Parking Suitability Model
Model: Tier 2 B, Vacant COM\IND Land Uses - District 5
Revised: 25 July 2019 11:43



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