

Really?

Can Rainwater Harvesting Reduce Flooding in Florida?

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Photo credit : Carrie Stevenson, IFAS Extension

How much water can an 80-gallon rain barrel store?

(answer: 80 gallons)

What fraction off a 1000 ft² roof?

The math:

$$80 \text{ gallons} \left(\frac{1 \text{ ft}^3}{7.48 \text{ gal}} \right) = 10.7 \text{ ft}^3 \text{ of storage}$$

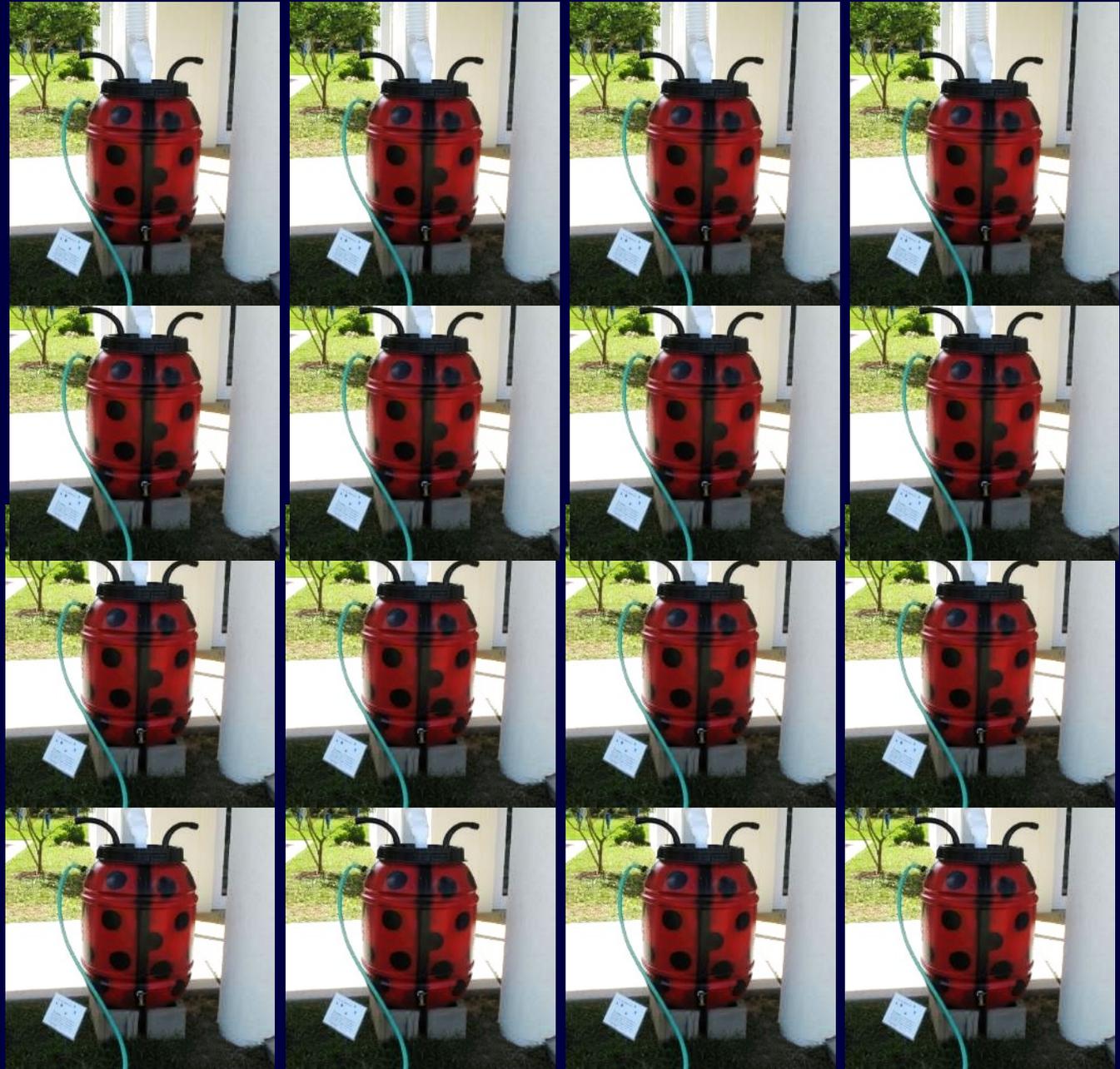
$$\text{Depth} = \frac{\text{Volume}}{\text{Area}} = \frac{10.7 \text{ ft}^3}{1000 \text{ ft}^2} = 0.0107 \text{ ft}$$

$$0.0107 \text{ ft} \left(\frac{12 \text{ in}}{1 \text{ ft}} \right) = 0.13 \text{ inches rain}$$



Photo : Carrie Stevenson, IFAS Extension

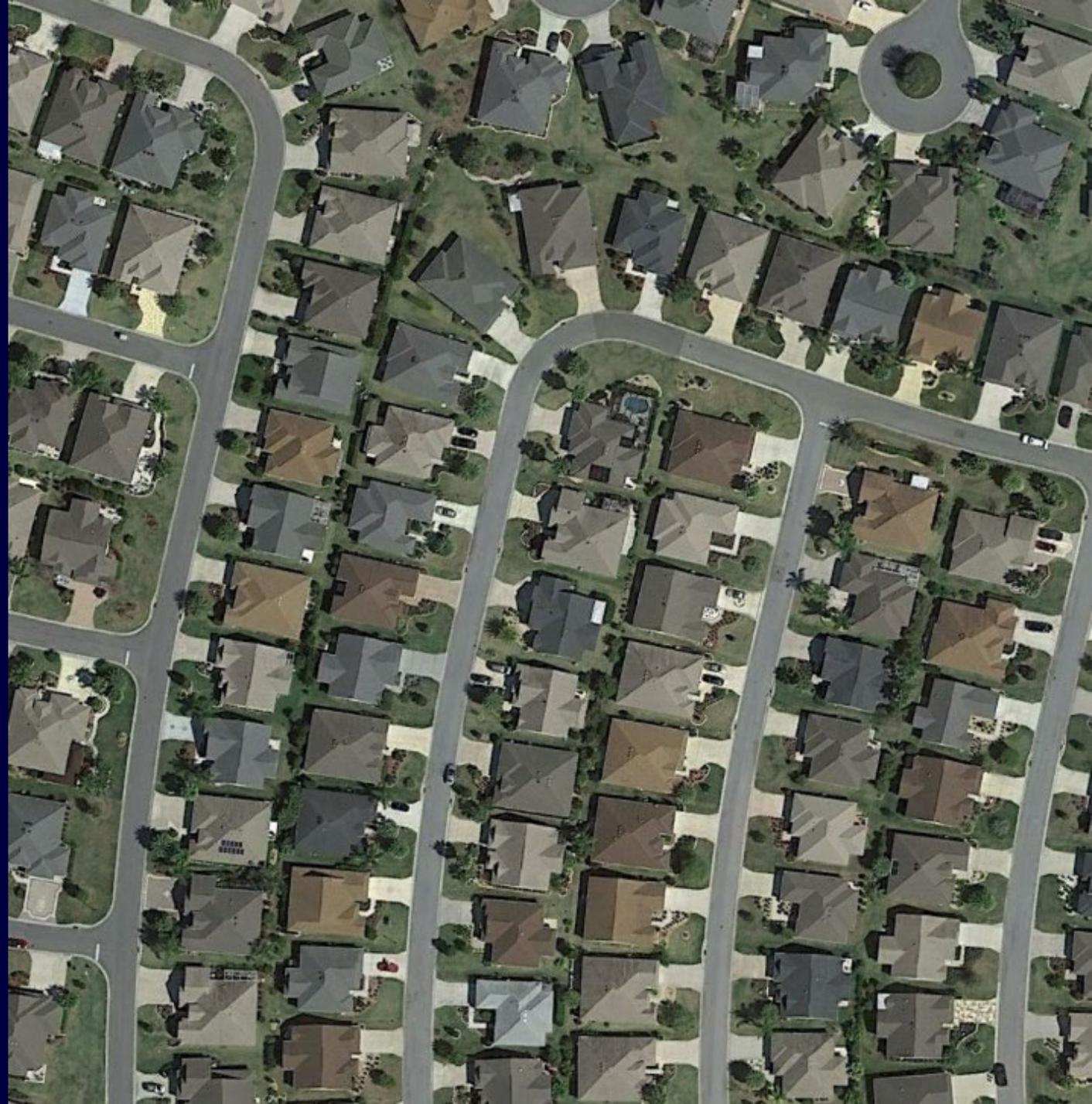
**So, is there a scale where
rainwater harvesting can
store a significant amount
of rainfall?**



So, is there a scale where rainwater harvesting can store a significant amount of rainfall?

Percent rainfall storage is a function of:

- Tank size
- Magnitude of rainfall
- Size of “harvested” area
- Density of harvested areas



Re-claimed septic tanks: potential rainwater cisterns

- Up to 1,500 gallons stored
- Water could be used or passively released

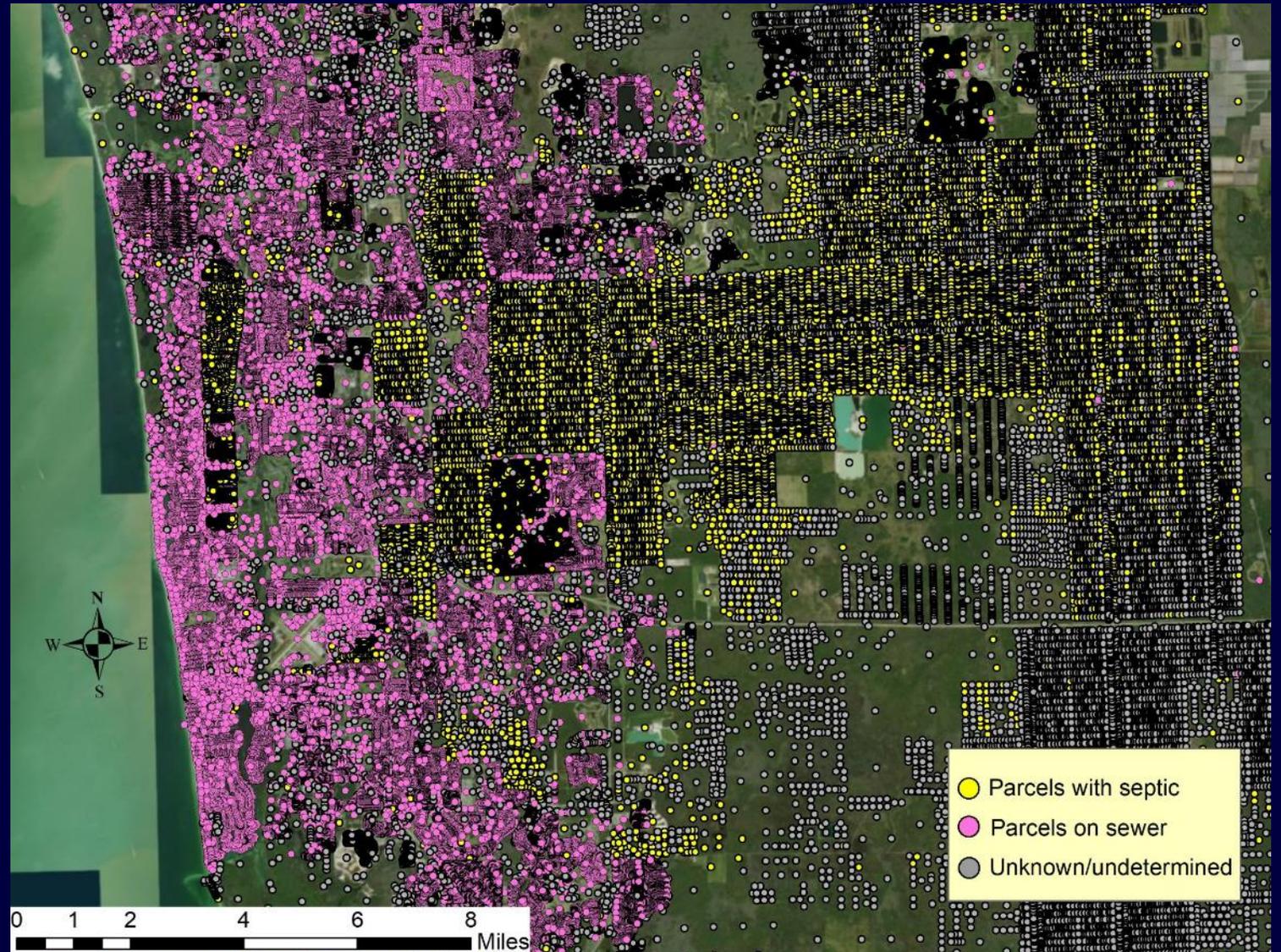
What about
“harvested” area,
density?



Dataset from Florida Department of Health (2016):

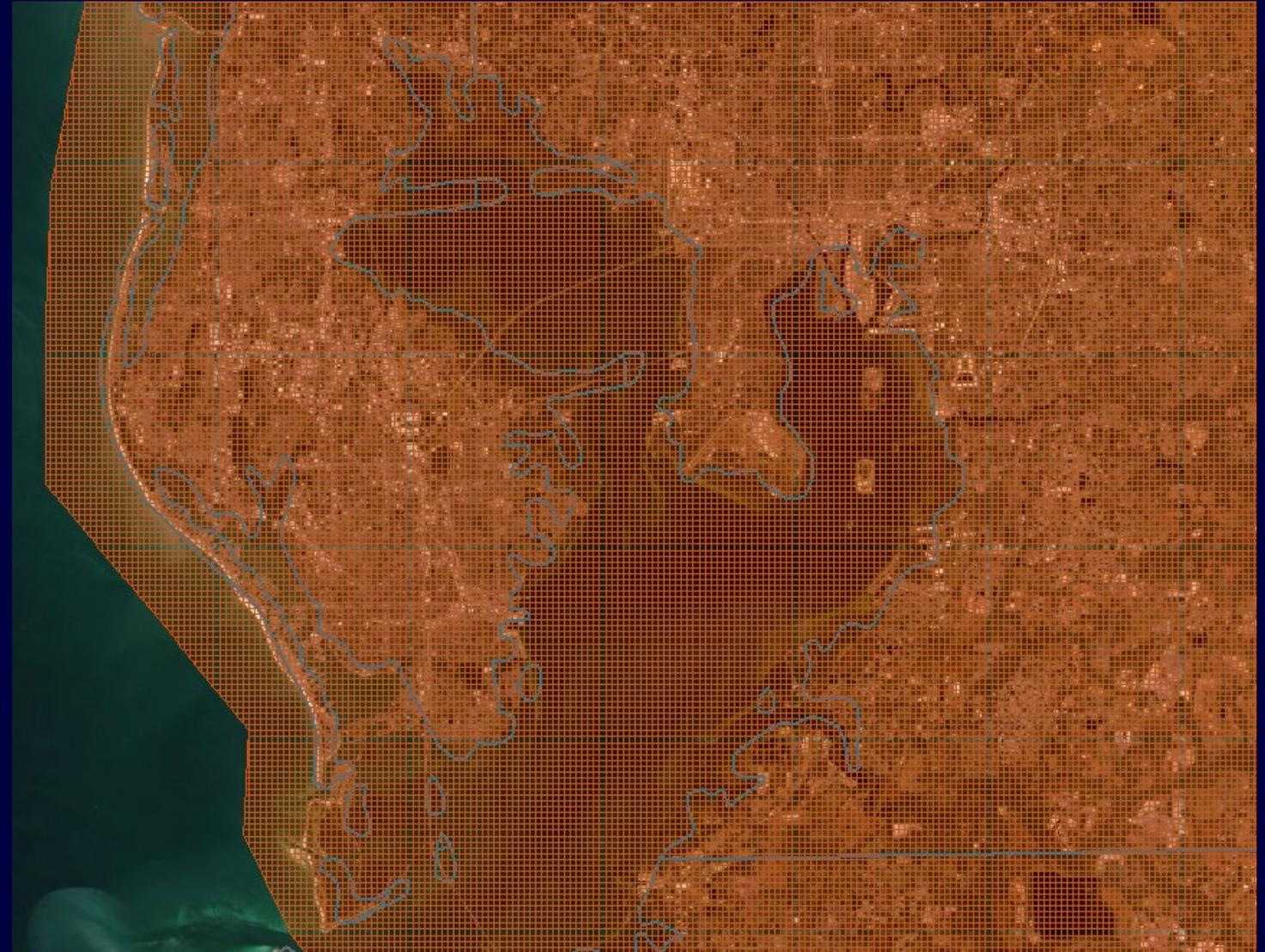
- Wastewater methods for every parcel in Florida (by county)
- (also drinking water methods...)

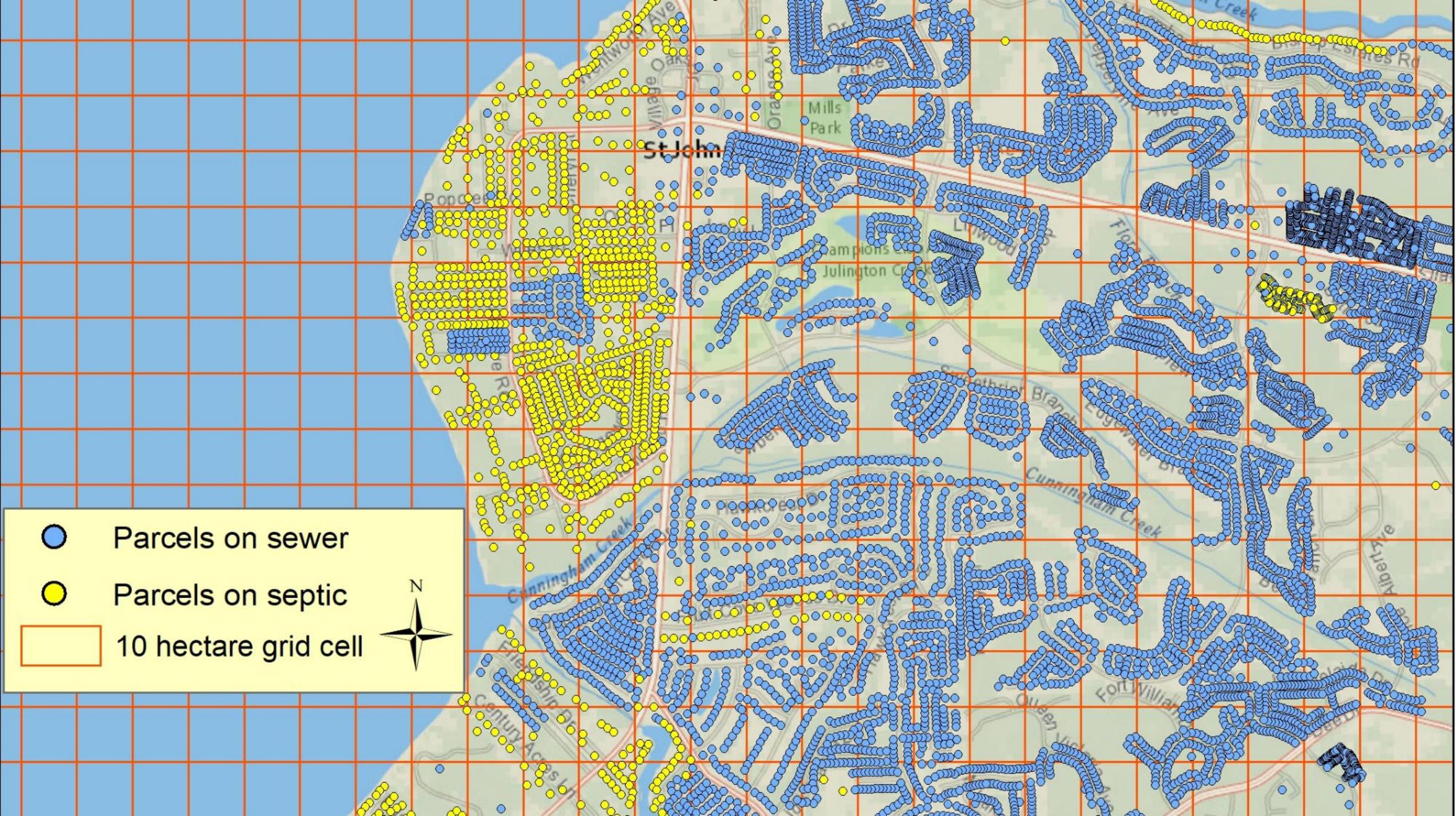
This dataset can inform structure density.



Question 1: What percentage of water can be stored, if septic tanks were reclaimed as rainwater cisterns?

- Divided the state into a 10-hectare grid
- Counted the number of parcels that use septic tanks in each grid
- Assumed a 2,000 square foot harvested (rooftop) area





Parcels on sewer



Parcels on septic

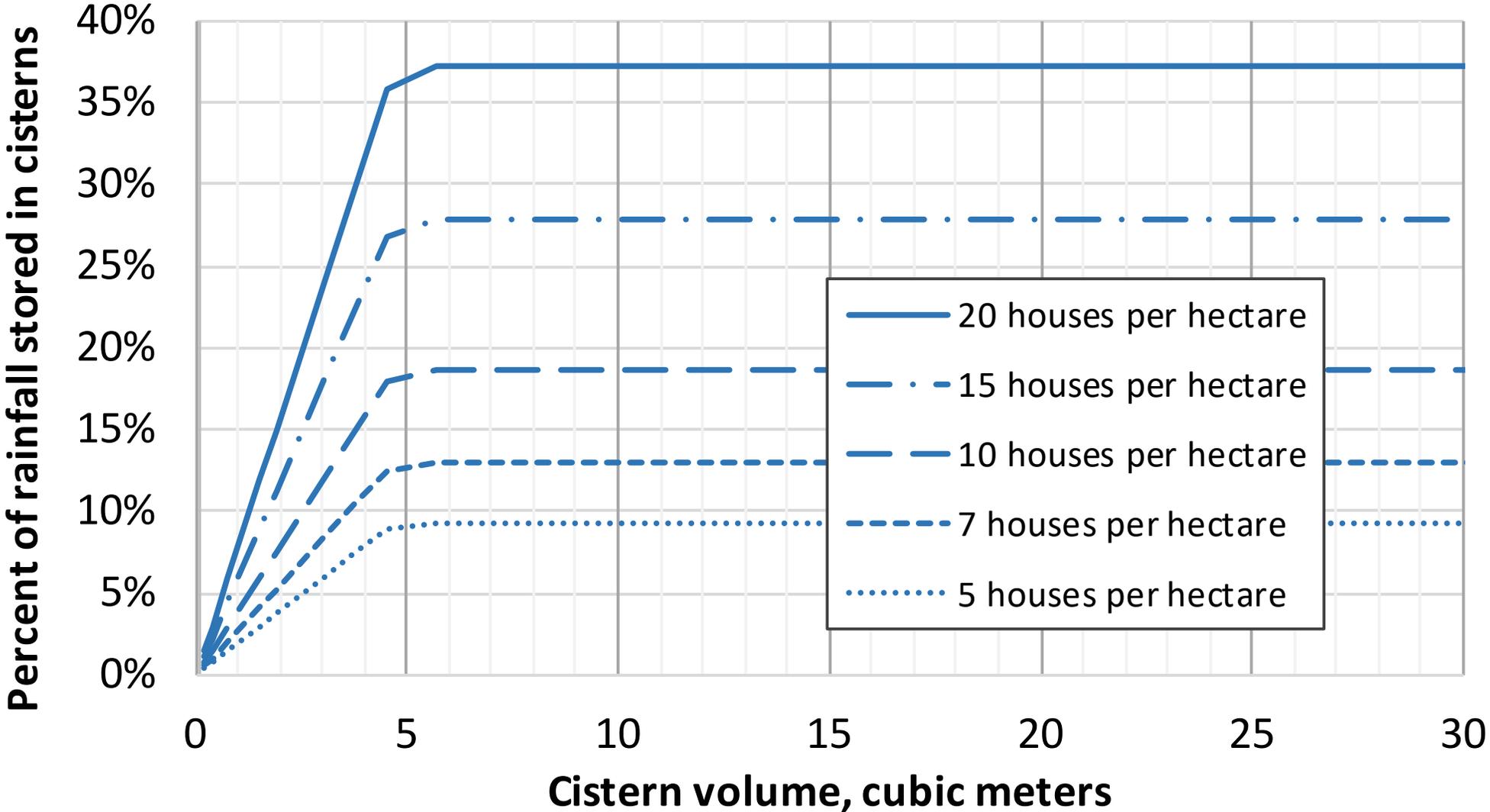


10 hectare grid cell



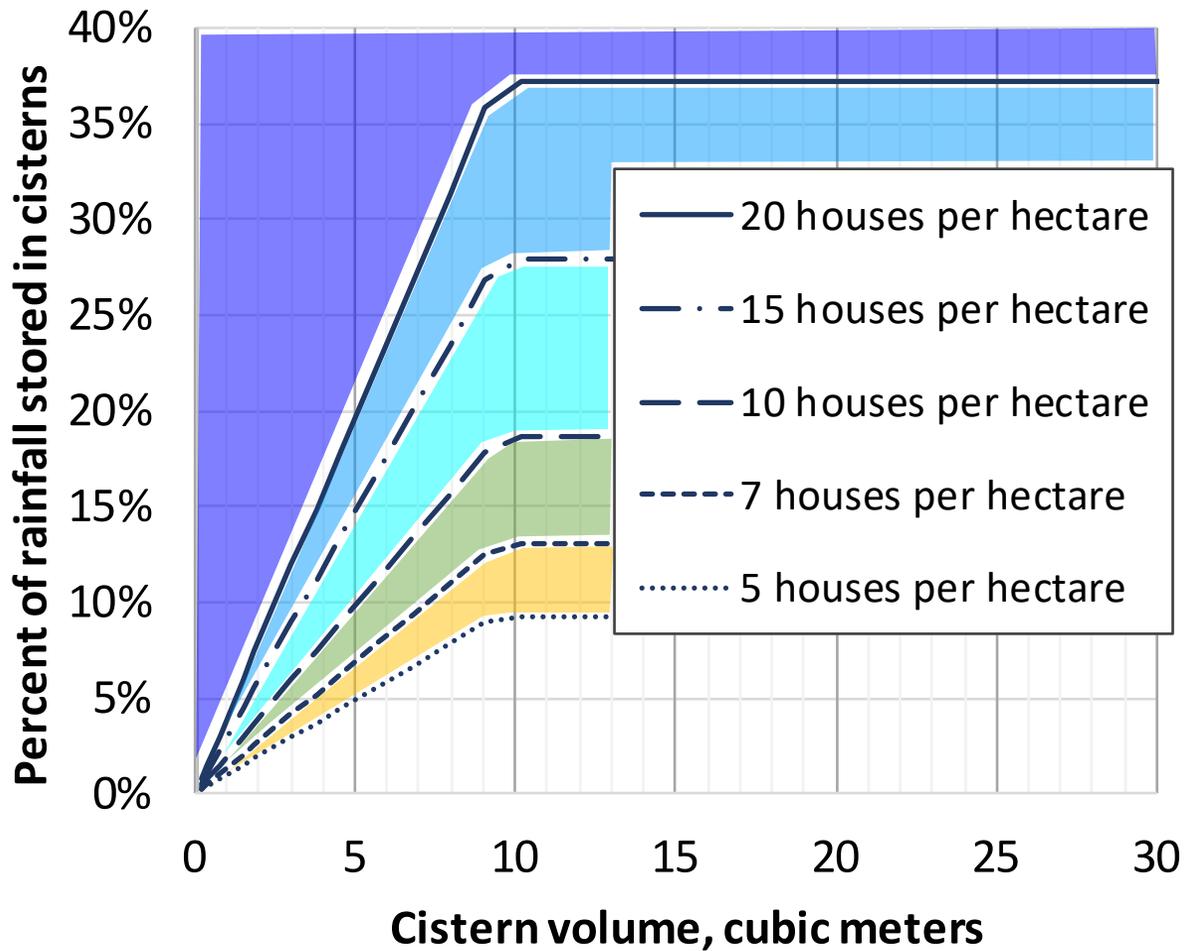
How do I analyze this?

Percent volume captured: 25.4 mm rainfall, 185 m² roof

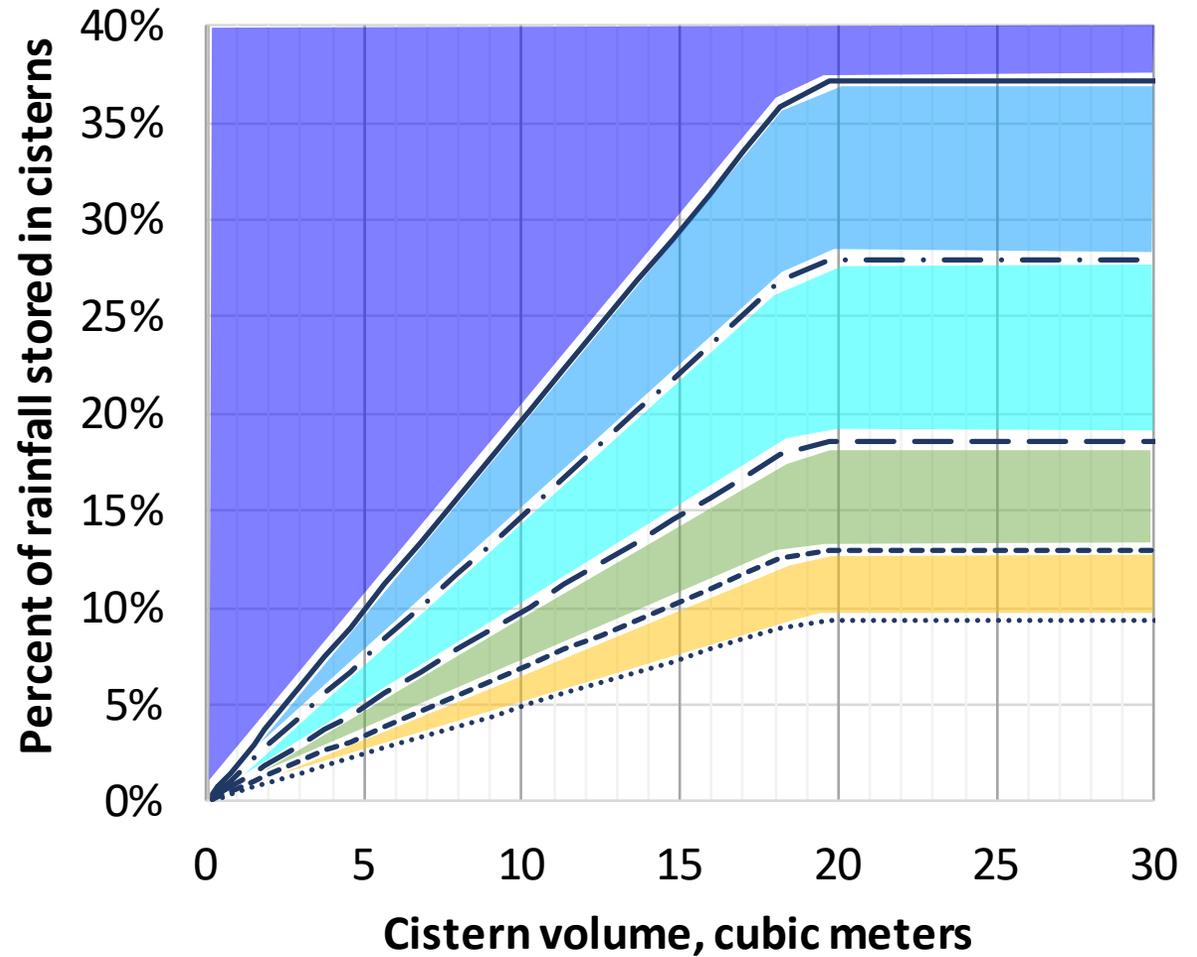


How do I analyze this?

Percent volume captured: 50.8 mm rainfall, 185 m² roof



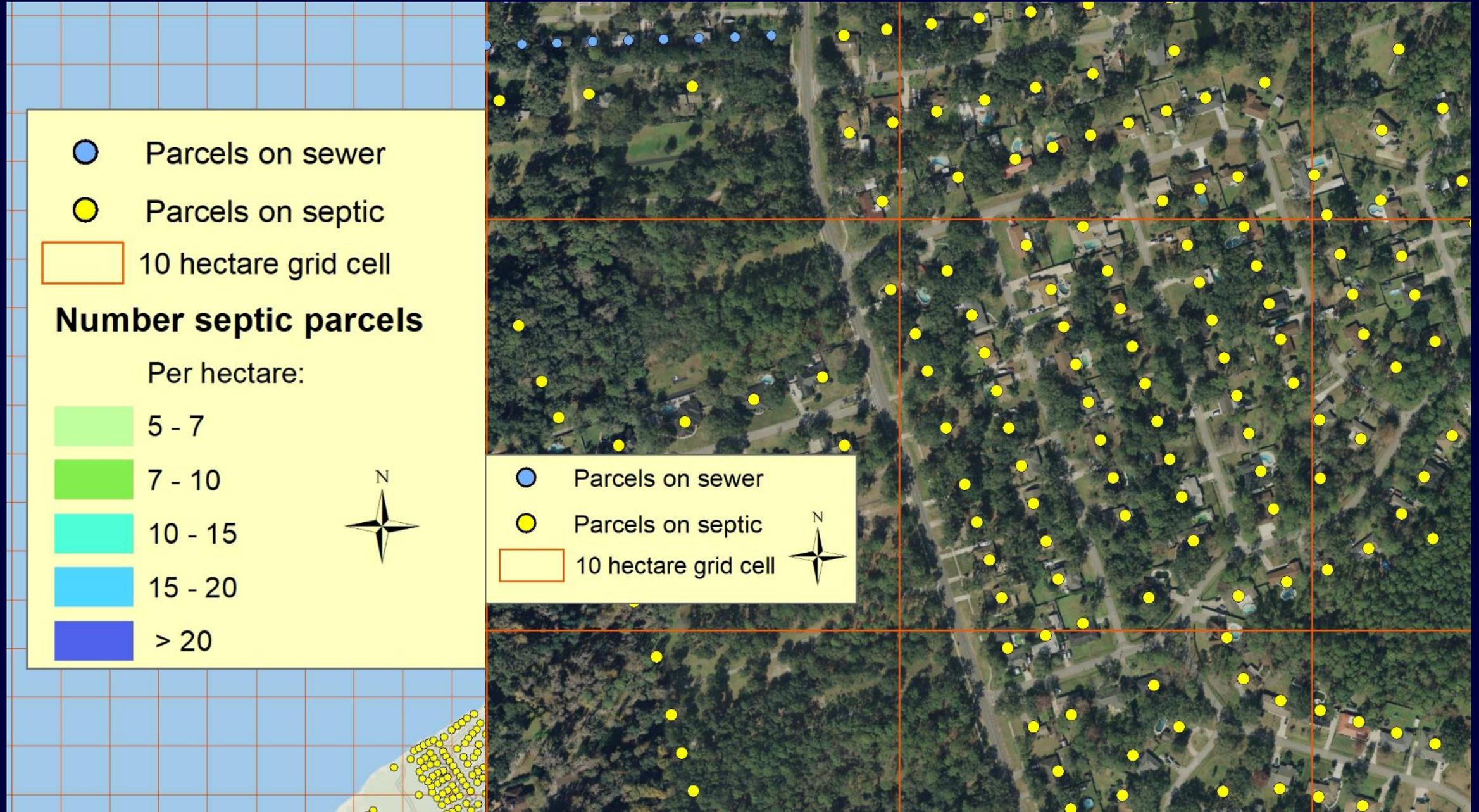
Percent volume captured: 101.6 mm rainfall, 185 m² roof

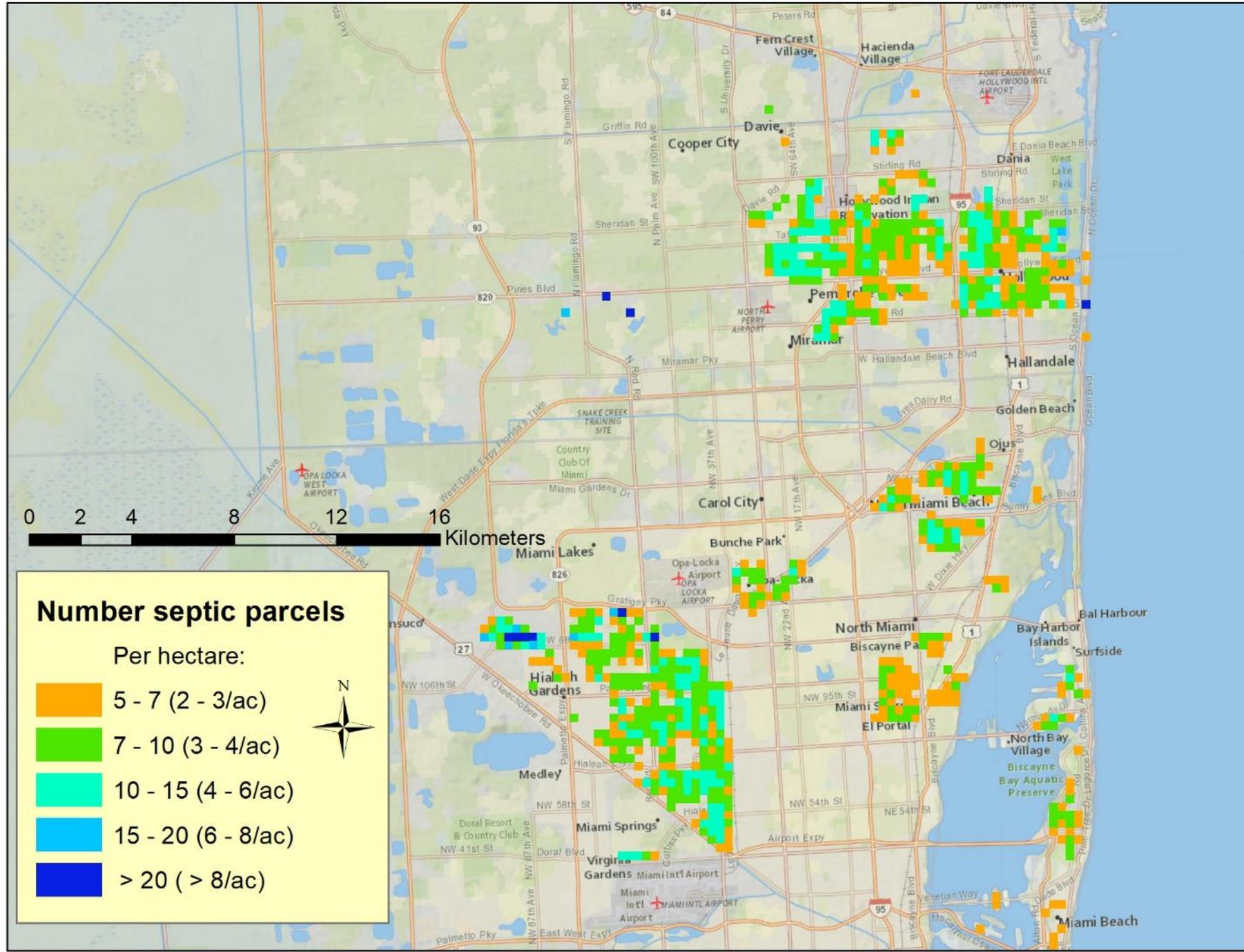
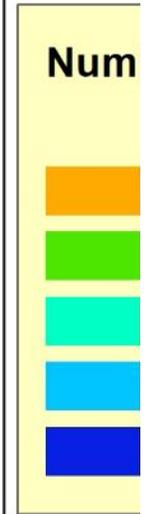
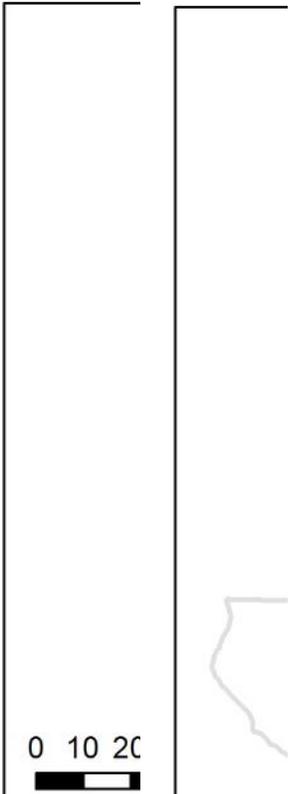
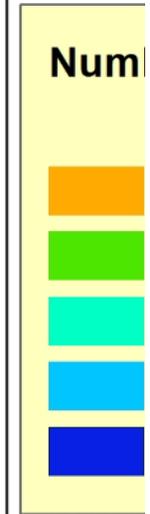
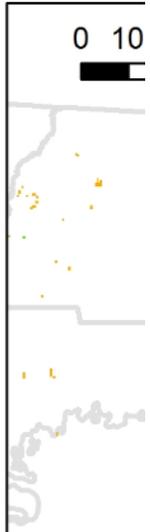


Several assumptions:

- Main source of flooding is rainwater (not high water tables, tides)
- Rainwater harvesting analysis assumes tanks are empty at $t = 0$
- (Impacts on surface water collection/discharge: use the flood routing model of your choice)

Is there any place where we see this density of houses?



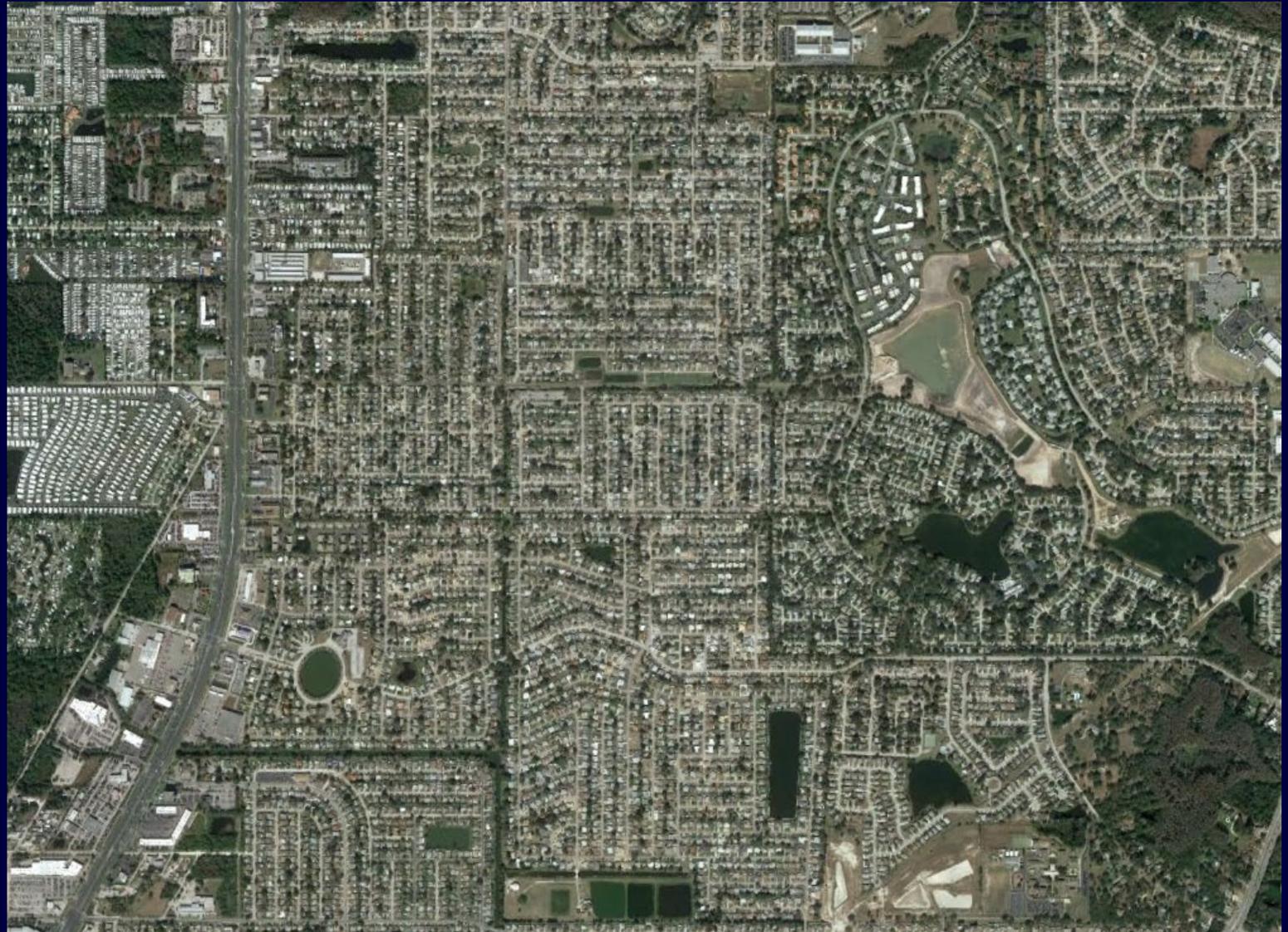


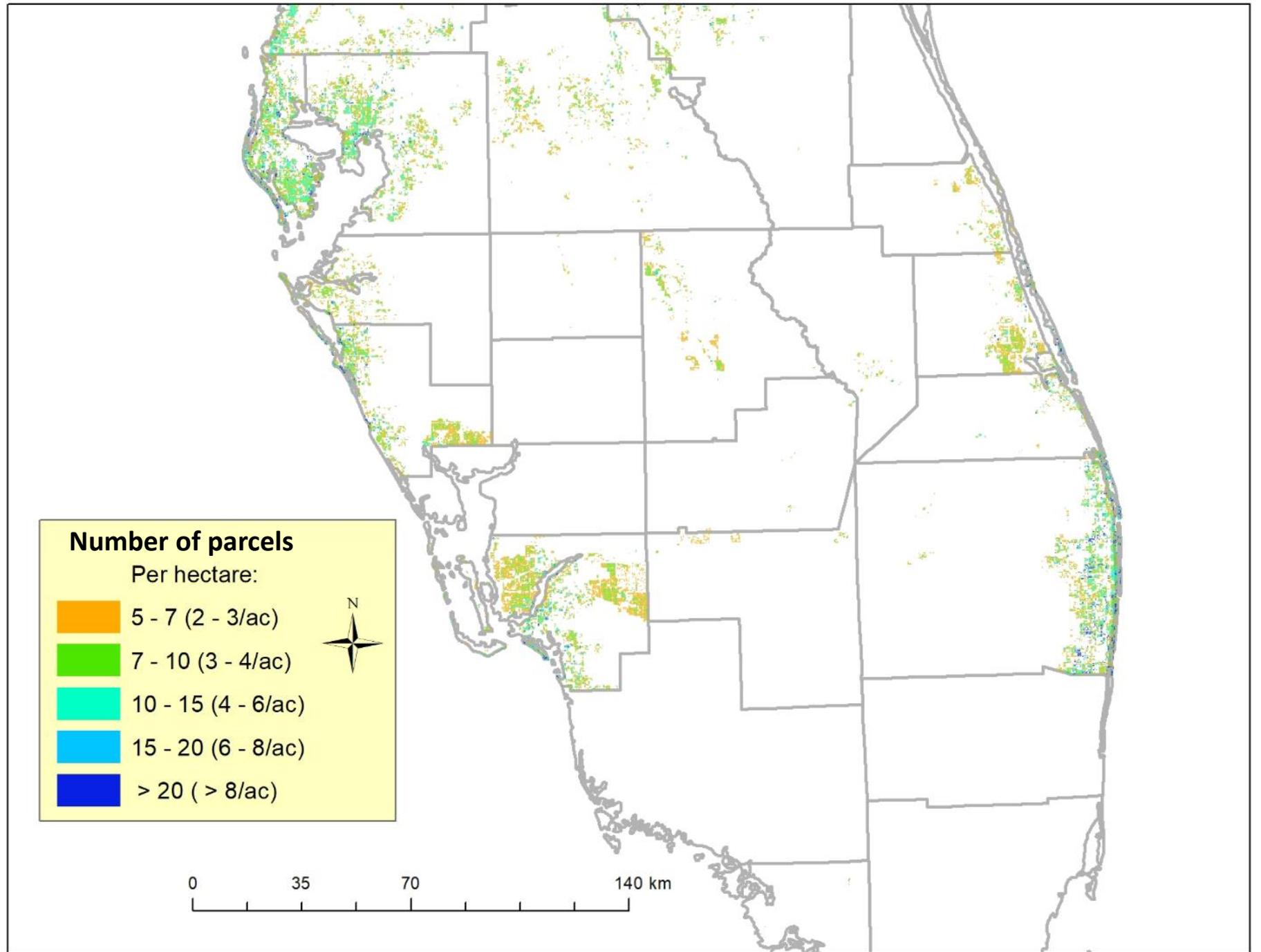
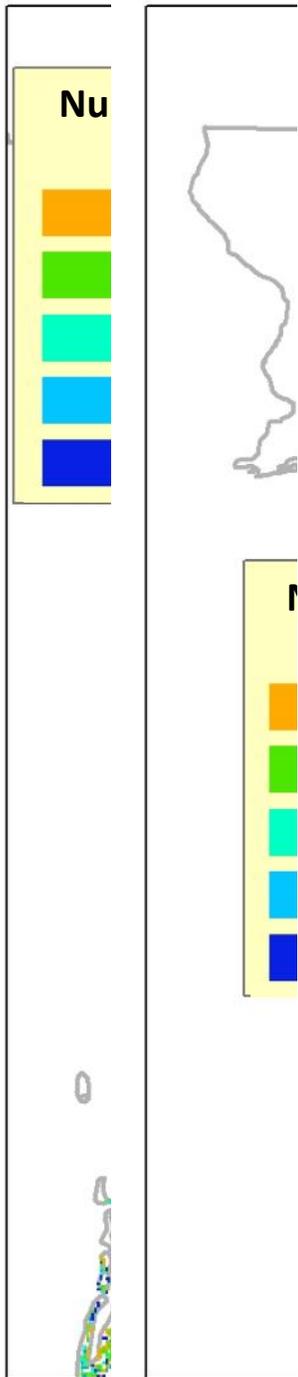
Conclusion 1: Rainwater cisterns via reclaimed septic tanks in general will not have a big impact on flood reduction in Florida.



Question 2: What if everyone were given a 1,500-gallon rainwater cistern?

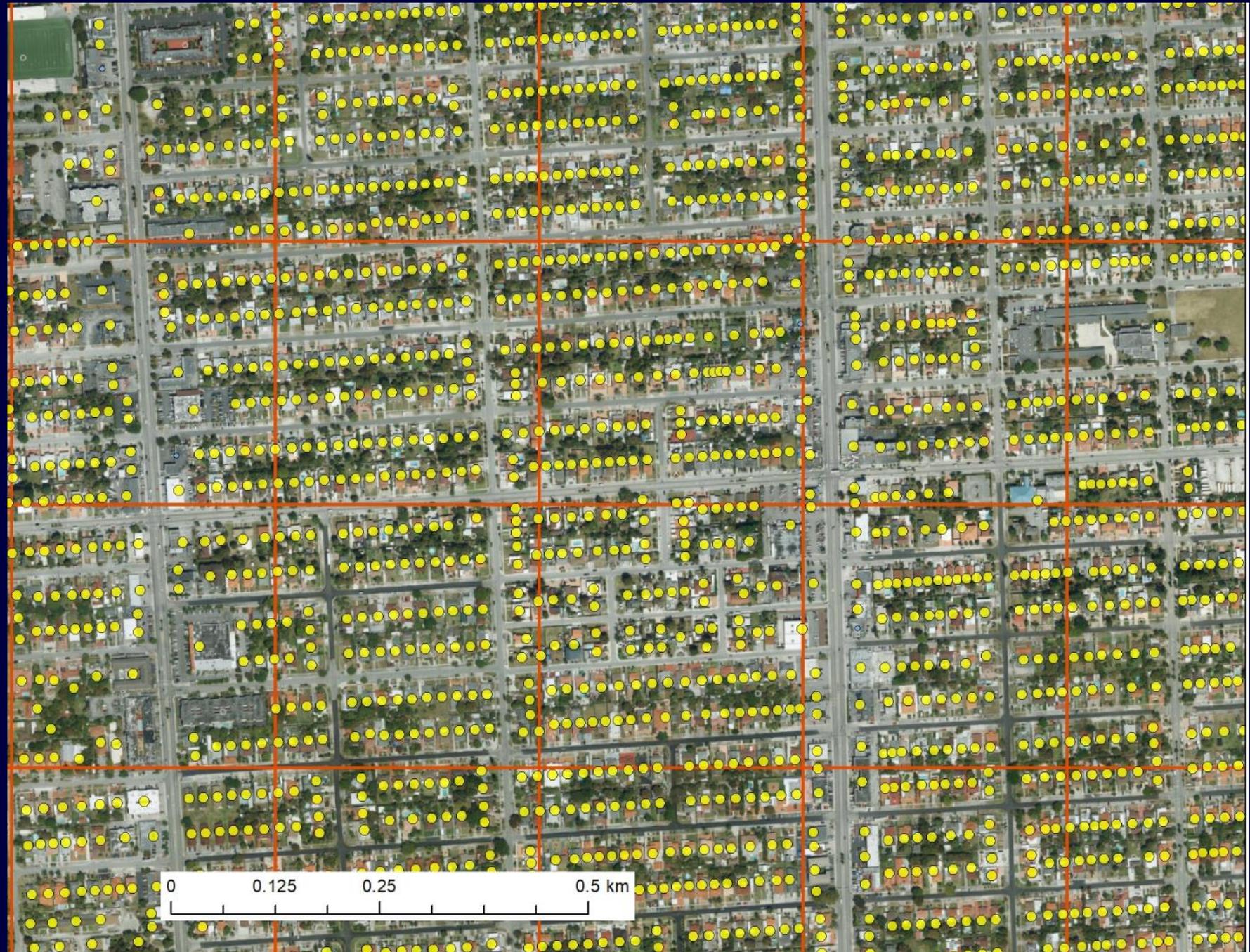
**Or, asked another way,
how much rainwater
could be stored if 1,500-
gallon cisterns were
installed throughout
Florida?**





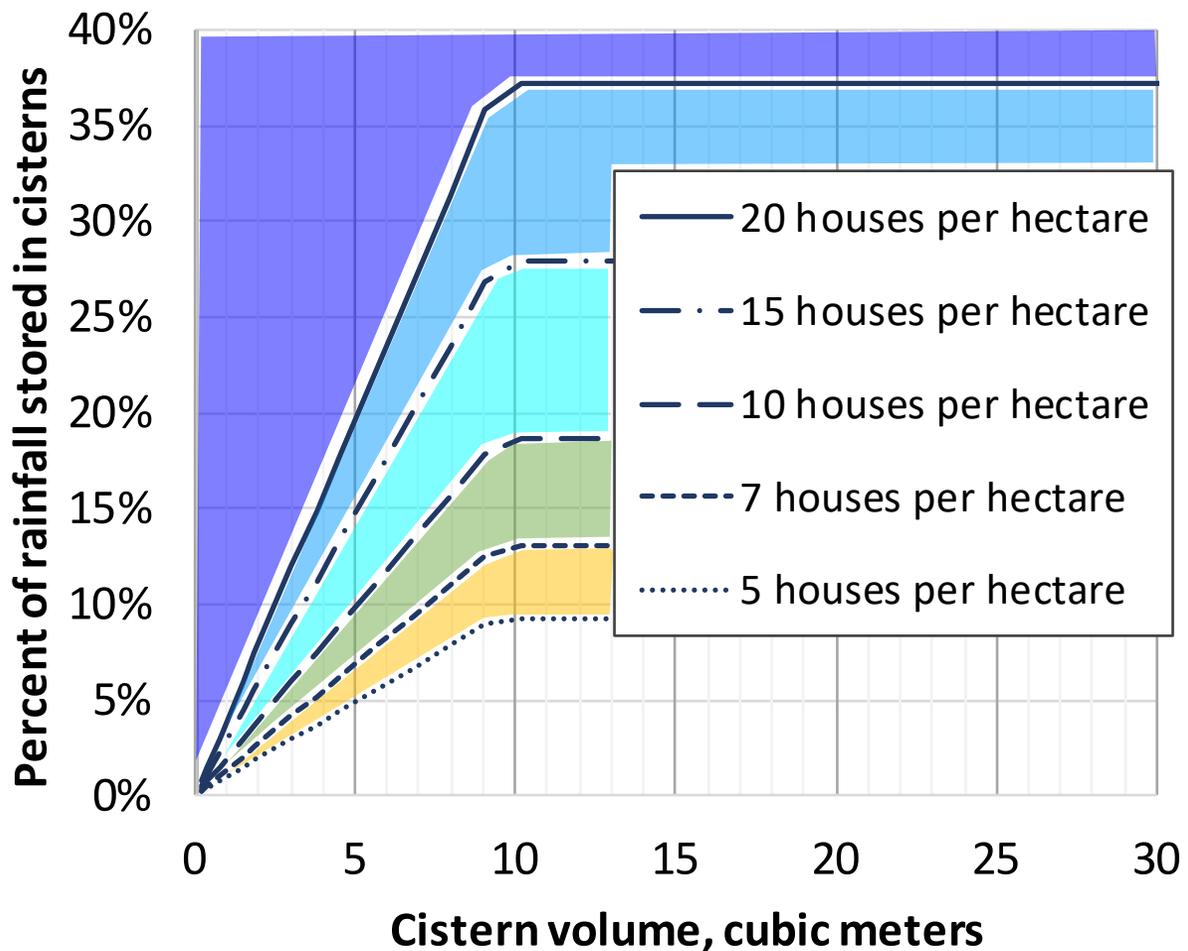
Parts of
Miami-Dade
County (cut
off from GIS
analysis):

Much in the
10-15 houses
per hectare
range

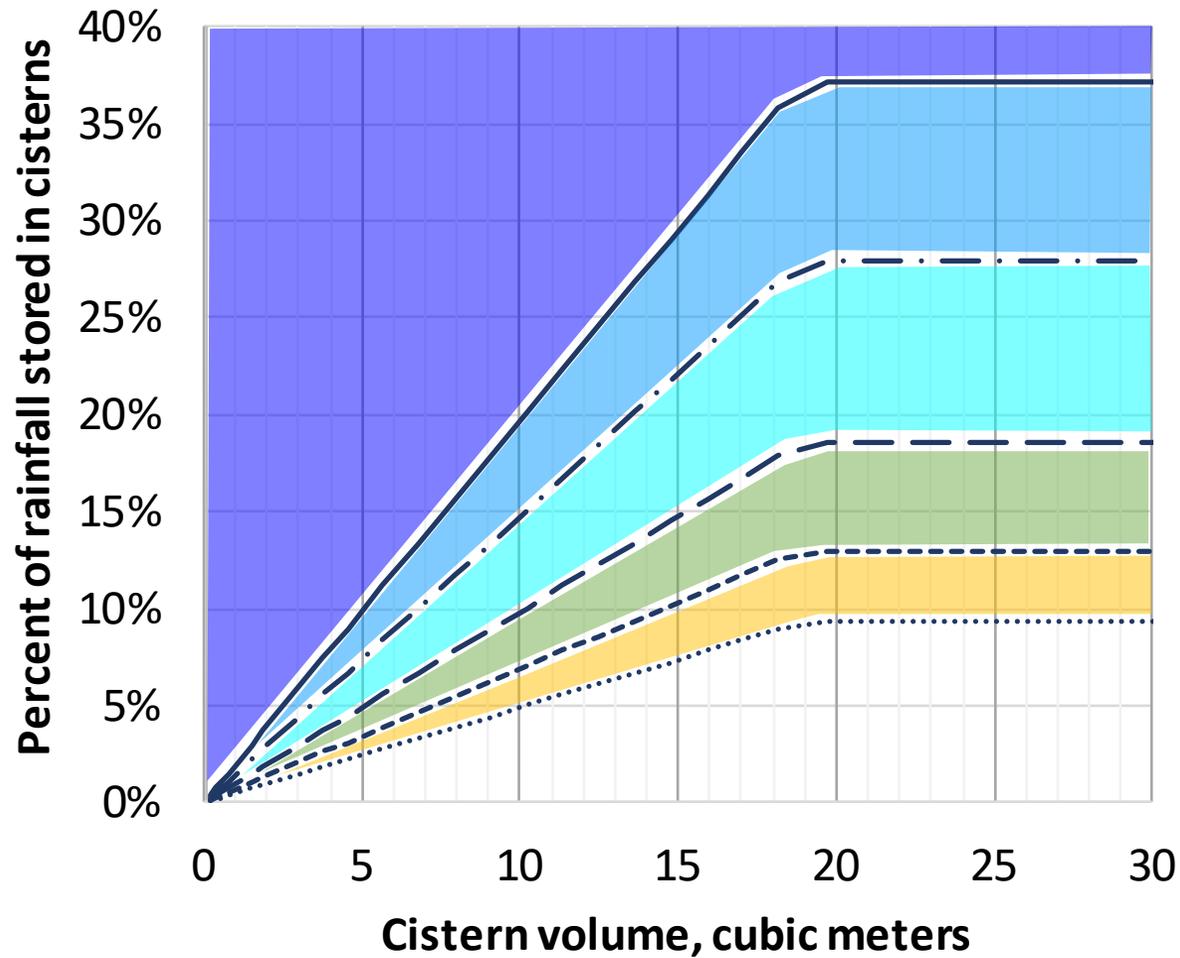


Overall impact on rainfall:

Percent volume captured: 50.8 mm rainfall, 185 m² roof



Percent volume captured: 101.6 mm rainfall, 185 m² roof



Conclusion 2:

- Larger-scale rainwater harvesting (e.g., universal parcel storage, large tank size) has wider but still limited potential for mitigating flooding.
- Decentralized, spatially distributed stormwater management (e.g., rainwater cisterns) may have significant benefits as part of a treatment train.



Photo credit: Brock Dolman, Occidental Arts and Ecology Center

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Acknowledgements:

- Support from USDA CRIS Award FLA-WFL-005577
- WFREC staff
- FDOH, Water Management Districts, FDEP for making data available.

