

CoreLogic's Flood Risk Assessment on U.S. Wastewater Treatment Facilities

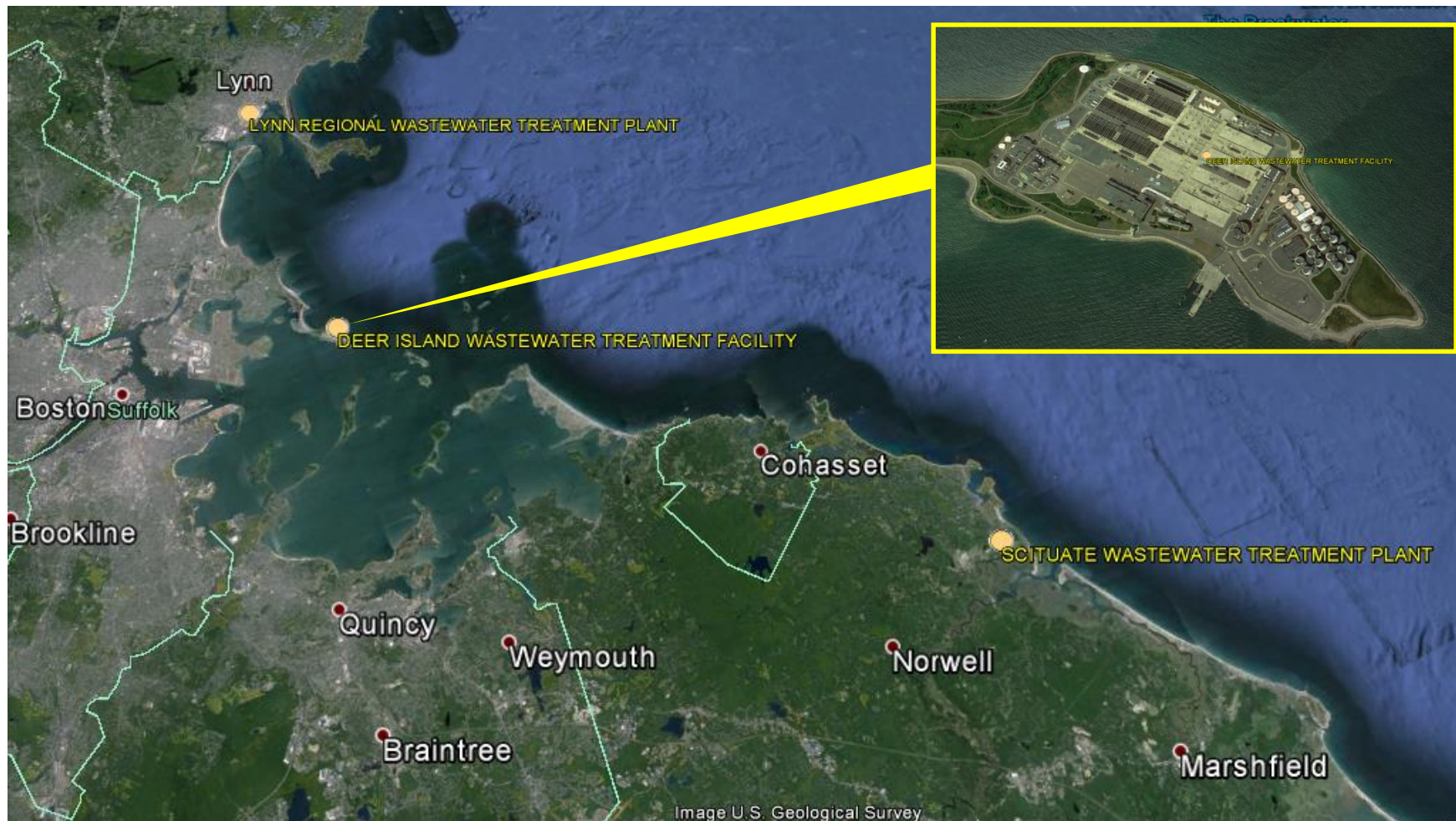
CoreLogic Insurance and Spatial Solutions

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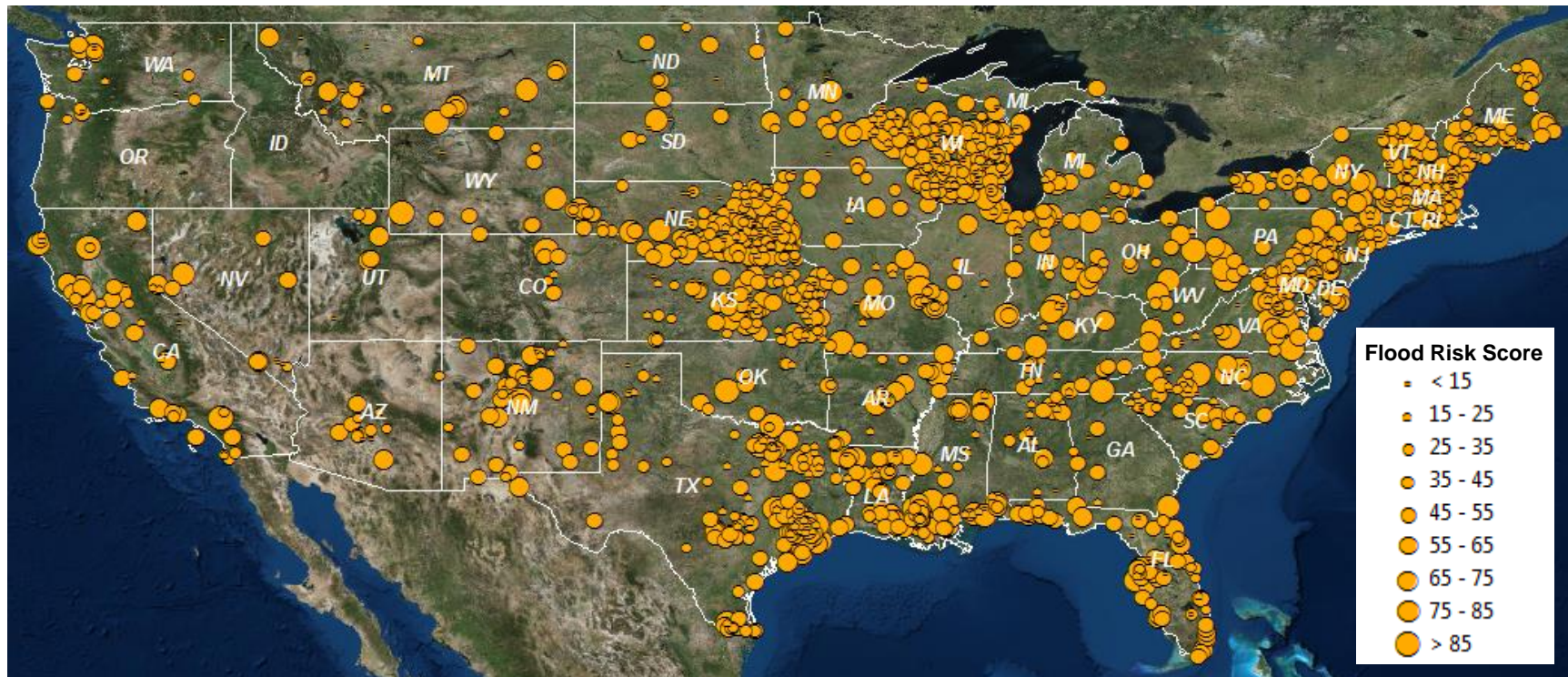
U.S. Wastewater Treatment Facility Study

- The analysis uses wastewater treatment facilities extracted from the EPA Facility Registry Service Database. There are over 1.2 million unique registered facility locations in the EPA database.



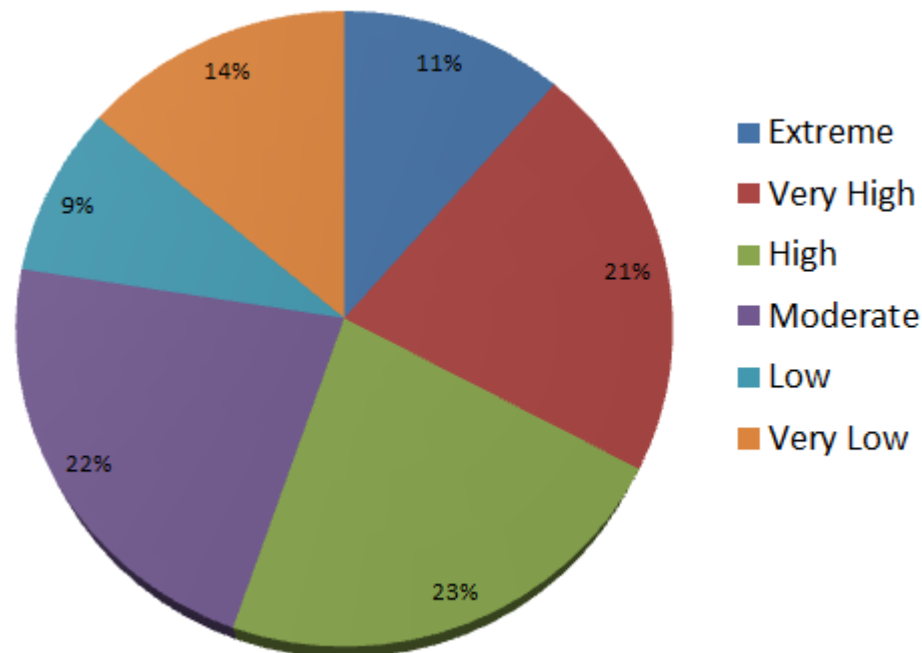
U.S. Wastewater Treatment Facility Study

- Over 1,600 wastewater treatment facilities registered were analyzed.
- The flood risk assessment was targeting all three major flood sources: riverine, coastal and flash floods.
- Overall flood risk scores (1-100) on those wastewater treatment facilities were created by the study as presented in the map below:



U.S. Wastewater Treatment Facility Study

- 55% wastewater treatment facilities were under the High+ flood risk.
- 77% wastewater treatment facilities could be affected by extreme flood events, classified as the Moderate+ flood risk
- To protect these facilities flood risk mitigation should be a high priority.



Top 5 U.S. Largest Wastewater Treatment Plants

A number of U.S. metropolitan areas have the world's largest water treatment facilities:

- Chicago Stickney Water Reclamation Plant: 1.44 billion gallons per day
- Boston Deer Island Sewage Treatment Plant: 1.27 billion gallons per day
- Detroit Wastewater Treatment Plant: 930 million gallons per day
- Los Angeles Hyperion Sewage Treatment Plant: 450 million gallons per day
- Washington D.C. Blue Plains Wastewater Treatment Plant: 370 million gallons per day



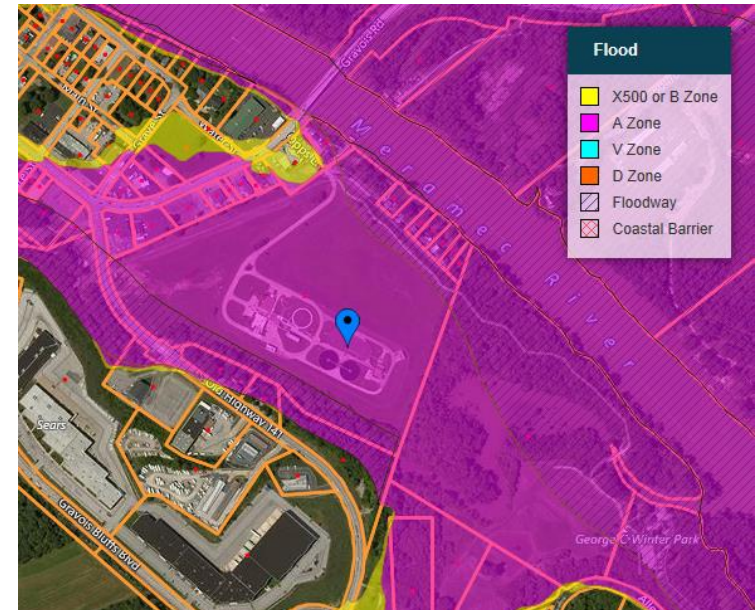
Fenton Sewage Treatment Plant, MO was flooded in December of 2015



- Sewage was diverted into nearby rivers and streams.
- The estimated flood damage on the wastewater treatment plant was \$10 million: <http://fox2now.com/2016/02/03/fenton-wastewater-treatment-plant-could-resume-in-april/#>
- CoreLogic FRS assessment:



<http://environmentalecho.com/2016/01/29/fenton-wastewater-treatment-plant-will-take-months-to-repair/>



Flood Risk Score

Risk Score	70
Risk Rating	VERY HIGH
Flood Zone	AE
Elevation Variance Feet	-3.6
Property Elevation Feet	416.7
Water Surface Elevation Feet	420.3

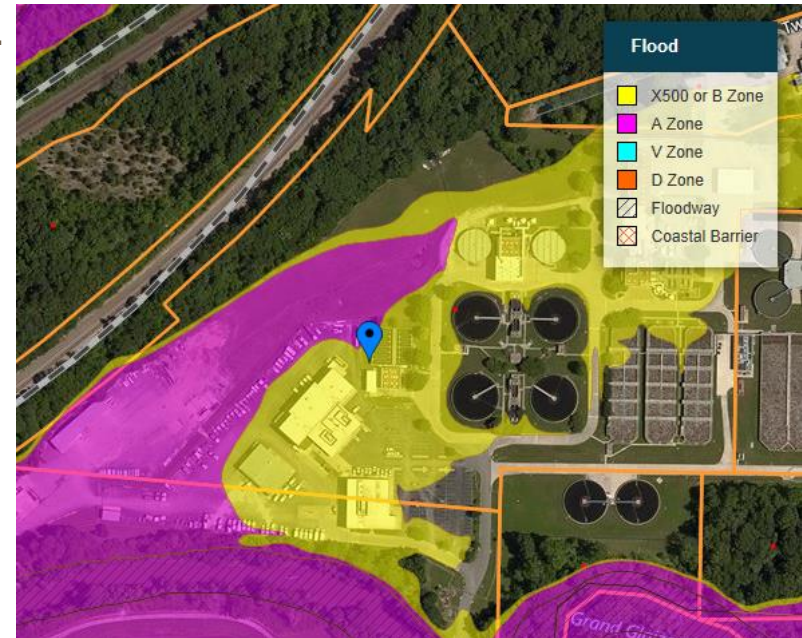
Sewage Treatment Plant in Valley Park, MO was flooded in December, 2015



- 2015 Flood in the area had reached 500 yr. flood level
- Untreated sewage poured into nearby creeks, streams and the Meramec River, with \$16 million damage:
<http://fox2now.com/2016/01/28/msd-says-valley-park-sewage-plant-back-at-full-capacity/#>
- CoreLogic FRS Assessment:



<http://fox2now.com/2015/12/31/flooding-shuts-down-wastewater-treatment-plant-in-valley-park/#>



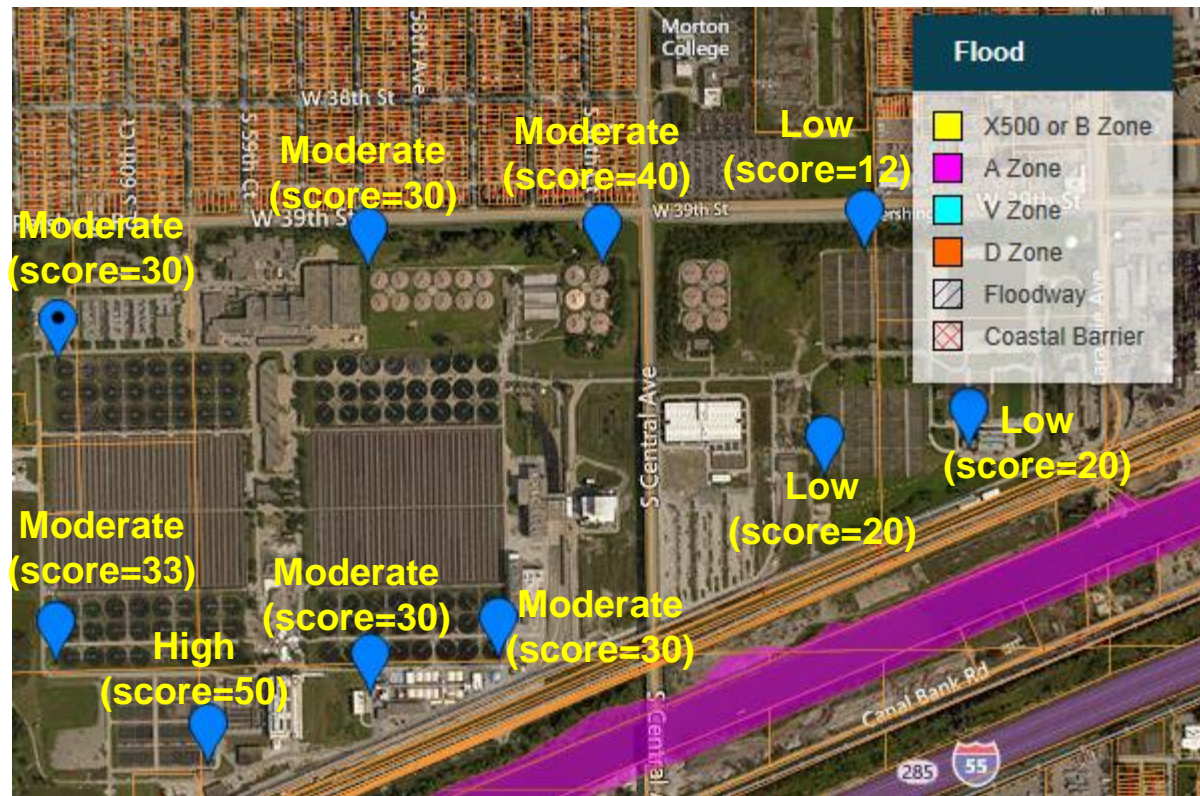
Flood Risk Score

Risk Score	50
Risk Rating	HIGH
Flood Zone	X500
Elevation Variance Feet	2.5
Property Elevation Feet	431.8
Water Surface Elevation Feet	429.3
Distance 100-Year Floodplain Feet	48

Detailed Flood Risk Assessment on Chicago Stickney Water Reclamation Plant

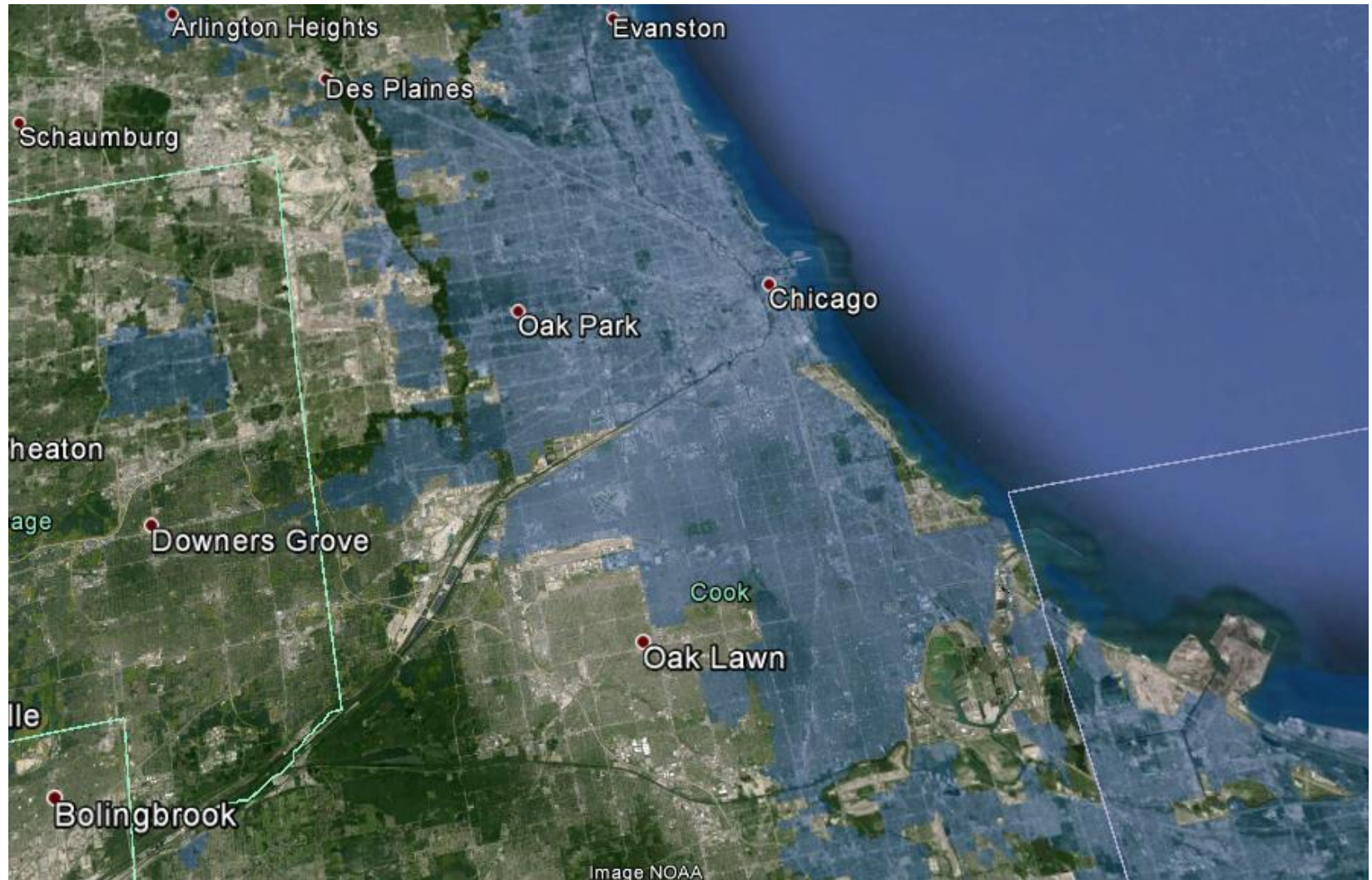


- The Stickney wastewater treatment facility crosses two street blocks over 1 mile long and 0.5 mile wide, serving 2.38 million people in a 260 square mile area including the central part of Chicago and 43 suburban communities.
- Multiple point flood risk assessment was conducted around the facility.
- The facility is in FEMA X zone. However, there is the FEMA Special Flood Hazard Area (SFHA) in the south side of the facility.
- There is a location on the south side of the facility was rated as a High risk.
- Majority of points were under the Moderate or Low flood risk.



Combined Sewer Areas in U.S. Cities

- Understand storm water Impact on the combined sewer areas near Chicago



Detailed Flood Risk Assessment on Chicago Stickney Water Reclamation Plant



- Property distribution around the facility. In the event of the flooding, the inundated structures would become inlets of storm water intrusion into the sewer system and the wastewater treatment facility.



Wastewater Treatment Facilities within the Sandy Inundation Boundary

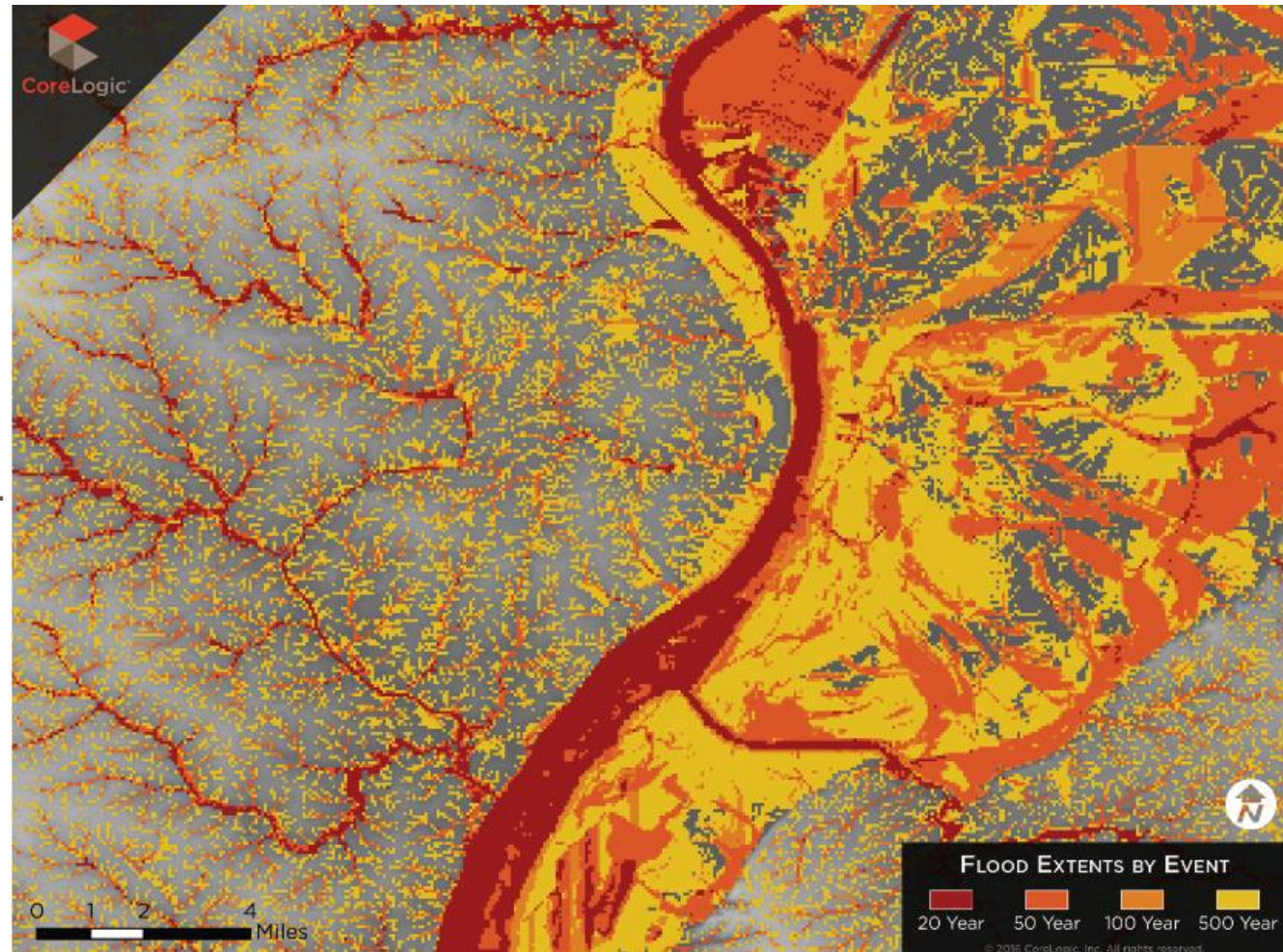


CoreLogic Property Database helps to Identify Properties under the Sandy's Impact



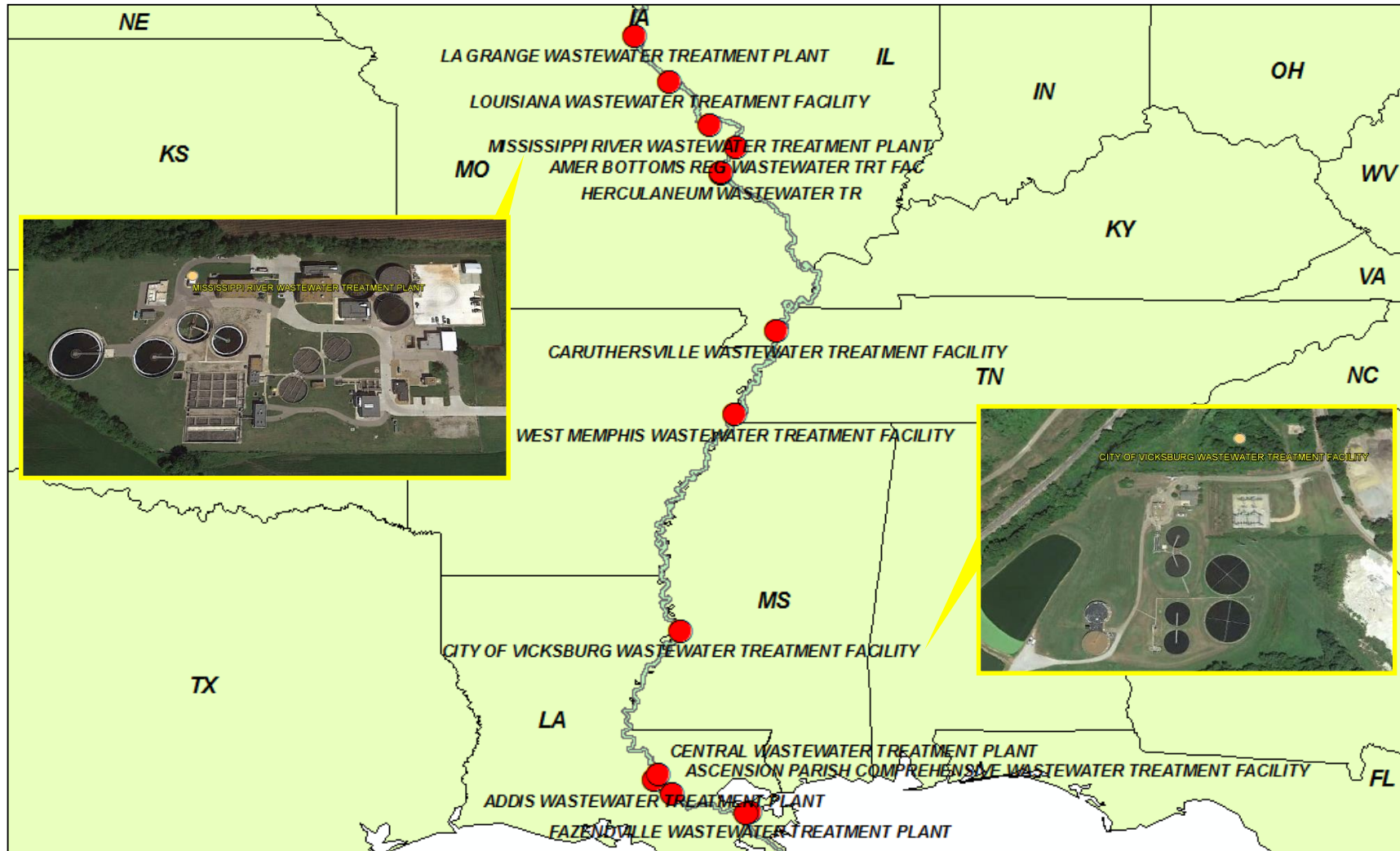
U.S. Wastewater Treatment Facility Study

- An example wastewater treatment facility on multiple frequency flood Map
- The flood map present the impact areas from 20 yr. 50 yr. 100 yr. and 500 yr. flood events.



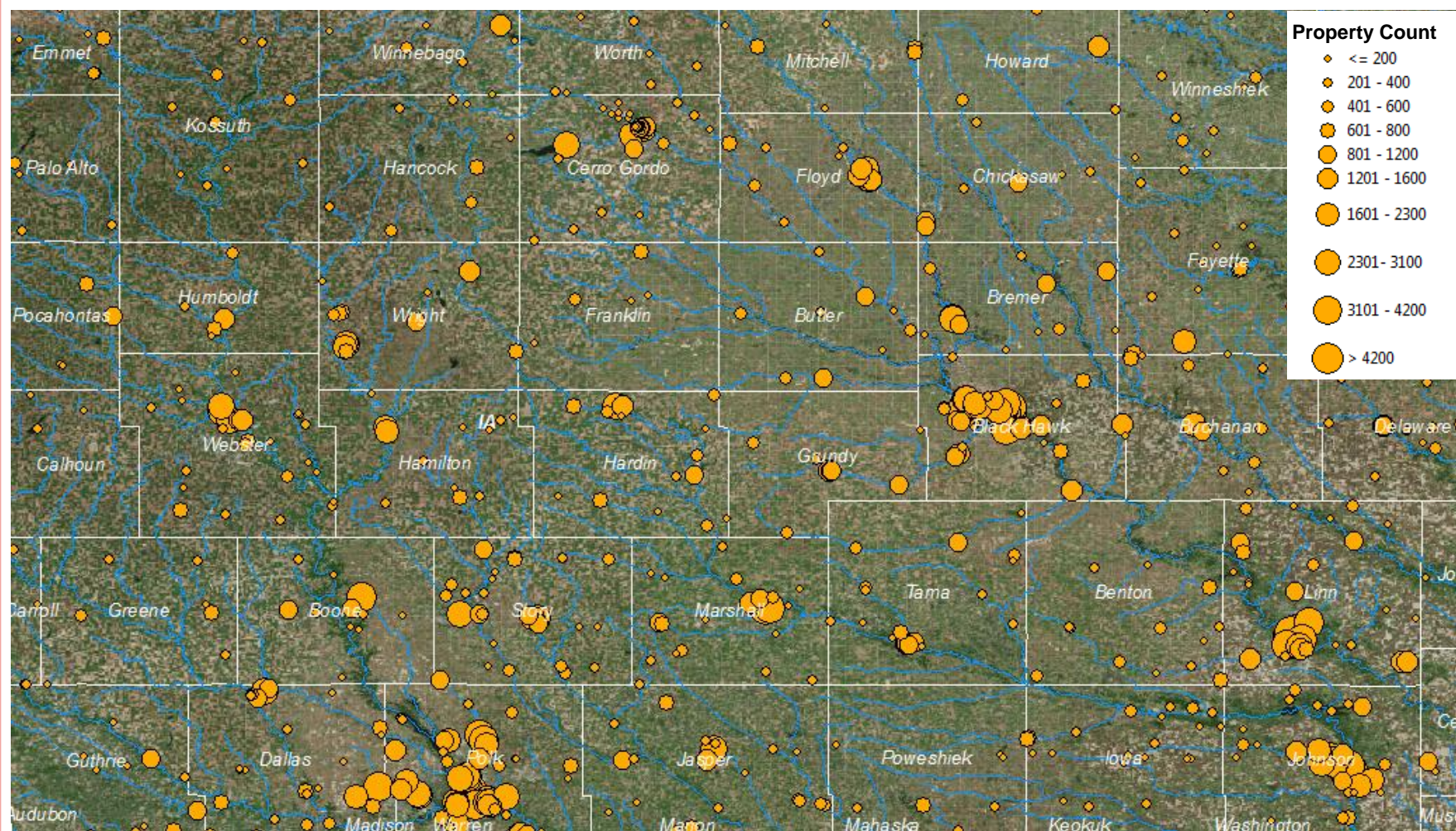
Wastewater Treatment Facilities along National Rivers

- Analyzed wastewater treatment facilities within one mile buffer along national rivers. The map below presents the wastewater facilities along Mississippi River.



Property Impacts from Outfalls to Rivers

- Potential Impacts from wastewater overflow on the nearby population and structures within one mile radius of outfalls in the State of Iowa



Data Source for Outfall Locations: Department of Natural Resources (DNR), Iowa

2015 Storm-Surge Inundation Versus Fresh-Water Flooding



CBSA	(1) TOTAL PROPERTIES EXPOSED TO FLOOD OR SURGE INUNDATION	(2) TOTAL PROPERTIES IN BOTH A SFHA AND A SURGE ZONE	% OF PROPERTIES IN BOTH A SFHA AND A SURGE ZONE	(3) TOTAL PROPERTIES LOCATED ONLY IN A FEHA SFHA	% OF PROPERTIES LOCATED ONLY IN A FEHA SFHA	(4) TOTAL PROPERTIES LOCATED ONLY IN A SURGE ZONE	% OF PROPERTIES LOCATED ONLY IN A SURGE ZONE
Virginia Beach-Norfolk-Newport News, VA-NC	396,030	51,473	13.0	689	0.2	343,868	86.8
Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	231,115	18,095	7.8	16,468	7.1	196,552	85.0
Jacksonville, FL	187,400	30,864	16.5	12,355	6.6	144,181	76.9
Boston-Cambridge-Newton, MA-NH	191,146	33,161	17.3	19,168	10.0	138,817	72.6
Deltona-Daytona Beach-Ormond Beach, FL	108,756	20,533	18.9	6,003	5.5	82,220	75.6
New York-Newark-Jersey City, NY-NJ-PA	721,592	191,035	26.5	364,400	5.0	494,117	68.5
North Port-Sarasota-Bradenton, FL	232,675	84,173	36.2	2,786	1.2	145,716	62.6
Washington-Arlington-Alexandria, DC-VA-MD-WV	24,480	3,707	15.1	6,364	26.0	14,409	58.9
Cape Coral-Fort Myers, FL	311,373	144,100	46.3	1,544	0.5	165,729	53.2
Tampa-St. Petersburg-Clearwater, FL	477,765	198,296	41.5	29,775	6.2	249,694	52.3
Houston-The Woodlands-Sugar Land, TX	341,253	52,188	15.3	121,305	35.5	167,760	49.2
Baton Rouge, LA	127,258	29,784	23.4	36,500	28.7	60,974	47.9
New Orleans-Metairie, LA	383,009	211,807	55.3	2,889	0.8	168,313	43.9
Naples-Immokalee-Marco Island, FL	182,645	106,033	58.1	2,964	1.6	73,648	40.3
Miami-Fort Lauderdale-West Palm Beach, FL	848,023	317,353	37.4	283,110	33.4	247,560	29.2