

Independent Expert Comparative Analysis Evaluation and Site Recommendations CIRC and WLP Radio Sites



**Prepared for Broward County and the City of Hollywood Florida
by**



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1 Executive Summary

Broward County, Florida is developing a County-wide project to implement a new public safety APCO Project 25 (P25) radio system. This P25 project will replace the existing aging Motorola SmartZone trunked radio system. The new P25 system will consist of 14 radio sites, and has been awarded to Motorola Solutions, Inc.

On July 3rd, 2019 Monetti & Associates Consulting and Engineering, LLC (M&A) entered into a contractual agreement with Broward County and the City of Hollywood, Florida. The purpose of this agreement is to execute on a statement of work that calls for an Independent Expert (IE) analysis and report of two potential radio sites being considered for deployment as part of the P25 system. The objective of this IE scope is to make a final recommendation on which site to deploy.

To support this effort the M&A team has received extensive documents from County and City representatives to provide background information on the specifics of both sites, and associated pros and cons of each site from various perspectives. It is understood there are valid reasons for preference of either site; information on these reasons has been provided by City and County representatives and their supporting contractors and consultants. In general, the County team favors the West Lake Park site (WLP) which would consist of a standing 300' tower, while the City team prefers the CIRC Hotel & Apartment Building (CIRC) for deployment which is located about 0.6 miles further inland.

Either site will need to comply with the latest P25, TIA, and other standards to meet requirements for deployment as part of the new public safety APCO Project 25 (P25) radio system. City concerns center on the ability for the WLP site to survive Category 5 hurricanes, and environmental requirements.

County concerns with CIRC are centered on the complexity of the construction at the CIRC facility, and access for repairs and general maintenance post-deployment. It is also noted that the CIRC site is seen as being more expensive to construct and to maintain over the long term and will incur an ongoing monthly lease cost.

We understand that there is citizen opposition to the WLP site. However, we note that there would be significantly greater disruptions to citizens in and around CIRC that affect many more people and would likely recur over the life of the site for resupply events. These impacts are much more direct than impacts to residents near WLP. These CIRC residents have not yet been "activated" by outreach describing the disruptions that they would encounter. If CIRC were selected, strong opposition to the CIRC should be expected when appropriate outreach is performed.



In order to get a thorough understanding of both the City and County perspectives on the two sites, M&A has interviewed 29 combined City and County representatives as provided by the assigned City and County primary points of contact. To further document input from City and County representatives, M&A developed an interview questionnaire for completion by the interviewees prior to their one-on-one interviews. Results of the questionnaire and interviews have been provided as part of this final report deliverable. M&A also conducted site visits of both locations, inspecting each site separately with City and County representatives. These proved to be very informative; findings are documented in this final report.

As part of the evaluation, M&A has developed a scoring system to help determine which site to recommend.

After a thorough and careful analysis of all the data, interviews, site visits and based on our expert experience, our determination is to proceed with the WLP site deployment. We find this to be a very firm conclusion; even if cost is not considered there are many strong advantages to WLP over CIRC. Details that drive the WLP site determination as the best site for deployment are included herein.

Note: In accordance with our defined Scope of Work (SOW), M&A has performed this task under the assumption that no third alternative site has been found to be viable. All analyses are therefore related only to the WLP and CIRC site locations.

2 Summary of Information provided for comparative analysis

Monetti & Associates, Inc. (M&A) has received extensive cooperation from both Broward County (“the County”) and the City of Hollywood (“the City”). Significant efforts have been made by both parties to ensure that M&A has all necessary documentation, as well as access to staff and other appropriate resources. Table 2-1 below provides a list of some of the more significant key documents received. In total, approximately 82 documents have been received for review.

Table 2-1: Key Documents Received

Interlocal Agreement P25 System
Motorola Contract
KCI report-CIRC Feasibility Study
Hypower Report & CIRC Electrical Quote
Selby CIRC Report
Rathgeber/Goss Associates Level 26 Structural Load Analysis
Broward County Coverage Analysis (CERC and WLP)
CIRC Itemized Cost
CIRC Hotel Analysis (Stiles)
City Letter to M & A dated August 10 th , 2019
Various permitting documents

Table 2-2 lists the individuals interviewed by M&A as part of this effort; interview findings are presented in Section 12. In addition, site visits have been conducted at both WLP and the CIRC site, details from these inspections are provided in Section 4.

Table 2-2: Interviews Performed

Broward County
José M. De Zayas, County Radio Administrator
Tracy L. Jackson, Director,
Alphonso Jefferson, Assistant County Administrative
Rene Harrod, County Deputy Attorney
Annika Ashton, Deputy County Attorney
Purvi A Bhogaita, Real Property Director
Hollywood City, Florida
Andria Wingett
Marcy Hofle, Fire Prevention Officer/Plan Reviewer (Jorge Castano)
Guillermo Salazar, Landscape Inspector
Russel Long, Assistant Building Official/Chief Electrical
Dean Decker, Building Official
Sheryl Blasi, City Consultant/Citizen
Shiv Newaldass, Dir. Development Services.
Dimitris Papaikonomou, Vice President Development, Gold Coast Florida Regional Center
Wazir Ishmael, City Manager & Gerald Keller
Doug Gonzales, City Attorney
Leslie Del Monte, Planning Manager,
Alberto Gutierrez, Structural Engineer
Daniel Mendoza, CFE, Director of Construction Administration-
Luis Lopez, City Engineer
Wilford Zephyr, Sr. Engineer,
Chip Able, CIRC Gold Coast
Mission Critical Partners, LLC
Nick Falgiatore, Senior Technology Specialist, (321) 704-5111
GM Selby/Consultants
Alex Gil, SME
G Zadikoff
Motorola Solutions
Jeff Erhardt, (919) 280-5847 (Lead PM)
Harry Kirms, Kirms Communications, LLC, Owner
Tom Flynn, President W Group
HICAPS - Thomas Bradley, Project Manager
KCI TECHNOLOGIES INC. - Eric S. Kohl, Senior Associate / Practice Leader
Hypowerinc - Danny Kaddoch, Electrical Contractor
Aviat Networks - Ronald Pender, Aviat Networks
Ronald Pender, Aviat Networks



3 Independent Coverage Models and Analysis

A predictive RF coverage comparison was conducted between the CIRC Hotel and West Lake Park sites to identify the overall differences that each site offers for public safety radio coverage. The intent of the analysis is not to validate vendor coverage performance, but to examine and compare the individual coverage characteristics, and how each site performs in a working P25 simulcast system. Both sites are located inside a “U” pattern of commercial/industrial type buildings (base on the USFS land-use database) allowing them to adequately provide signal coverage into heavy buildings.

While both sites can provide the required coverage in Hollywood and generally the southeast area of Broward County, we offer the following reasons and recommendation why the West Lake site has the greater advantage over the CIRC location.

3.1 CIRC Hotel Coverage

The CIRC Hotel location is more centrally located in the Hollywood area than the West Lake site. The 330’ building plan is to have antennas mounted along the inner parapet toward the center of the roof. The proposed antenna height is based on the current FAA study, approved July 17th. At this height, the antenna has sufficient roof clearance to reduce obstructed signal in the area around the hotel. Although computer models may simulate loss of coverage due to shadowing caused by a partially obstructed antenna, this is difficult to model in real time as it cannot predict with accuracy where the signal problems occur, only that there could be some degradation.

In the overall system coverage design, these possible coverage shortcomings are resolved by the two surrounding sites (West Hollywood and Channel-2), which can provide coverage inside 25 dB buildings (due to transmitter simulcast design) in most of the CIRC coverage area footprint. As a result, M&A predicts that coverage from the CIRC would be adequate for the overall P25 system, see Figure 2-1.

3.2 West Lake Park Tower Site (WLP)

The proposed 300' self-supporting lattice tower planned for West Lake Park is approximately 1.2 miles north and slightly east of the CIRC hotel. From an RF standpoint, the height is comparable to the CIRC hotel and due to the relatively flat terrain in the County its coverage performance is similar to the CIRC hotel. The major difference is that the coverage pattern is shifted to the north. This may provide less penetration into buildings in the southern area of the county than the CIRC; this is not of concern as the Channel-2 site covers 25 dB buildings in this southern area very well. In the proposed system using transmitter simulcast technology, a signal received by a user from multiple site sources provides increased coverage reliability¹.

The West Lake site is closer to the Fort Lauderdale-Hollywood International Airport (FLL) and as compared to CIRC, provides greater overlapping contribution to coverage at the airport complex where signal attenuation and reliability is a major concern. See Figure 2-2 for WLP coverage.

Figure 2-1: CIRC Coverage

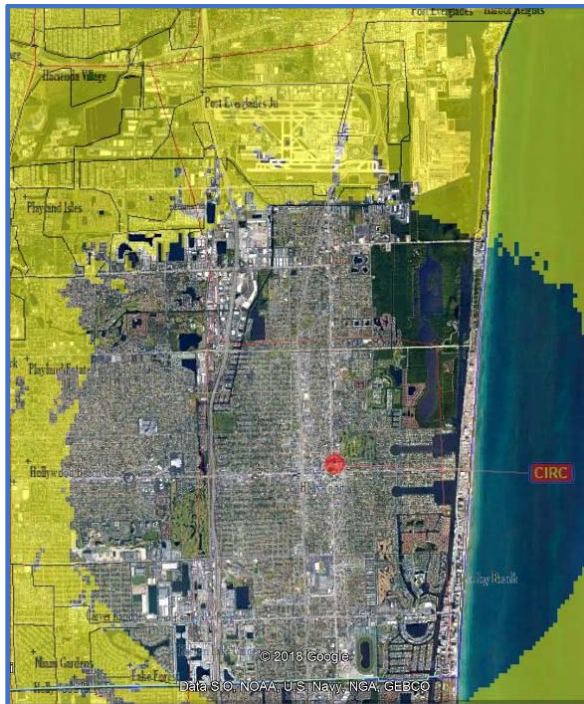


Figure 2-2: WLP Coverage



¹ As an example, if two overlapping circles are designed individually for 70% coverage, the area where that overlap occurs has reliability of 90%.



3.3 Summary of Coverage Evaluation

Figures 2-3 and 2-4 show each site as part of the overall simulcast P25 system. These show that when considered as a “piece of the overall puzzle” both sites offer the necessary contribution to County-wide coverage.

It has been noted that there is potential for new high-rise construction in the area of the CIRC building. This is not a differentiating factor, as any shadowing from new construction would shade transmissions from either CIRC or WLP. However, this is part of a multi-site simulcast system and such shadowing is mitigated via coverage from other sites, such as Channel 2 and West Hollywood. M&A therefore concludes that shadowing from future building construction is not an issue that favors either CIRC or WLP.

Appendix A provides the M&A Coverage Mapbook for additional technical detail. Included in this Mapbook are the propagation predictions shown above in Figures 2-1 through 2-4. It can be seen from these maps that either site will comfortably support the overall primary coverage goals.

Figures 2-1 and 2-2 show coverage predictions from the two sites as if they were independent of the overall system, which allows an understanding of their individual contributions to the system. When comparing coverage of the two, it is clear that WLP provides better coverage in and around FLL, whereas CIRC offers better coverage south of the County border into Miami-Dade County. This is seen as an advantage to WLP, since FLL is more important than is coverage outside of Broward County.

Based on evaluation of radio propagation modelling and other discussions in this report regarding the feasibility of the West Lake site, West Lake is recommended as the better choice to provide reliable coverage for the Broward County P25 system.

Figure 2-3: CIRC Composite Coverage

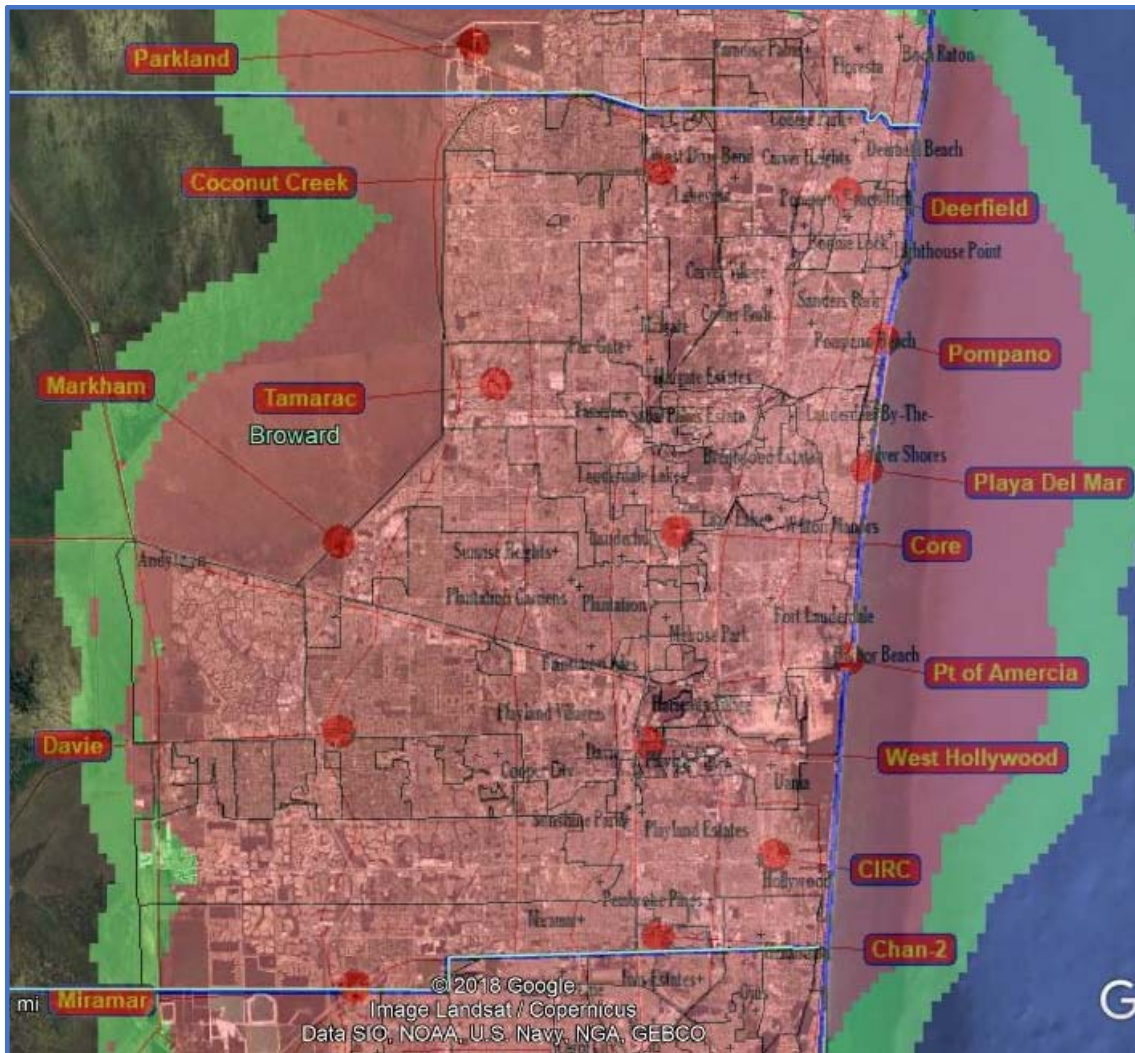


Figure 2-4: WLP Composite Coverage



4 Site Visit Findings and Key Recommendations

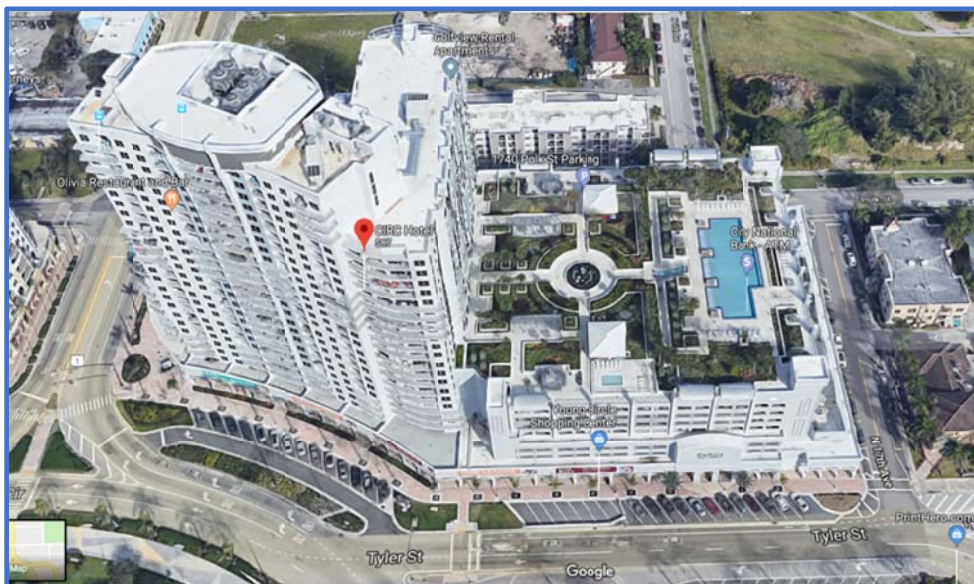
On Tuesday, July 30, 2019, Monetti & Associates, LLC (M&A) conducted on-site surveys of the CIRC Hotel Site and the West Lake Park (WLP) site. The intent was to gain further understanding of the viability of each site for use by the planned APCO Project 25 (P25) system currently in development throughout Broward County. In the case of either site, the following considerations are made:

- Equipment space
- Antenna mounting considerations
- Power supply (primary and backup)
- HVAC/Mechanical
- Site accessibility:
 - “blue sky” (normal weather)
 - “gray sky” (hurricane/post hurricane conditions)
- Equipment transport/installation

Surveys of each site were performed independently on two occasions, once with City of Hollywood (CoH) staff, and once with Broward County (BC) staff. CIRC personnel assisted in both surveys at the hotel. Following are observations & information gained from this effort.

4.1 CIRC Hotel Site Findings

Figure 4-1: CIRC Hotel





This high-rise facility includes both hotel spaces and rental apartments, housing approximately 400 residential units. Site inspection included:

- Roof areas where two-way and microwave antennas are proposed
- Upper floor spaces proposed for equipment installation and power supply routes
- Sample intermediate floors to inspect power & ground routing
- Garage levels for proposed emergency generator installation
- Existing CIRC generator location as potential alternate P25 generator site

4.1.1 CIRC General Suitability

There are aspects to this site that are well-suited to its use for the P25 system. These include the following:

- The height of the facility provides for adequate RF coverage, and the necessary microwave point-to-point links can be established.
- There is rooftop space available for mounting of all necessary antennas.
- There is adequate power available from FPL to support current and future load requirements.
- There is space available that can be fitted out to house the communications equipment
- There is space available for installation of a generator for backup power and its associated fuel tank, in a location suited for installation of a street-level refueling pump station.
- There is support from the building owner to accommodate the necessary facility modifications.
- Preliminary cable routing has been established using ground-penetrating radar (GPR).

There are also aspects to this site that make use of this location more challenging than other high-rise installations:

- There is no elevator that can bring equipment and supplies up to the equipment or antenna locations. Alternative methods and challenges to lifting supplies are noted in subsections below, and may require disruption to residents.
- Significant build-out is necessary to create a suitable equipment room.
- Access to the equipment spaces is not straightforward (see section 4.1.2).
- Equipment installed on the roof may need “stealth” coverings to meet Owner aesthetic goals. We note that the City consultant has provided a sample of stealth coverings available from 3M. It is not clear that this covering is Category 5 hurricane rated. In addition specifications indicate 720 hours survival in 5% salt fog; the overall lifecycle is not clear, nor is the ability/difficulty in installation on the proposed antennas.

- All plans for facility modification, antenna location, stealth design, etc. must be approved by the Owner; such approval can be denied after execution of the lease.
- The planned equipment space in the Boiler Room has been determined to have inadequate floor strength to support the combined weight of communications equipment and new structure; reinforcement will be necessary.
- Additional areas of the Boiler Room may require floor reinforcement to stage supplies and equipment during construction.
- It is not clear that the upper roof has the strength to support the weight of all construction materials and equipment to allow bringing these materials up from the ground.
- Routing of power & ground lines from the equipment space down to the generator location is not direct, and will be a disruption to those tenants that have storage units along the route.
- GPR equipment was unable to take measurements closer than 6" from the walls. Developing final cable routes will require X-ray testing to ensure that no existing conduits or tension cables are damaged. Health & safety regulations for this testing require evacuation of tenants three floors below and one floor above each floor's test activity.

4.1.2 CIRC General Access Issues

There are a series of general access issues to be noted. None of these prohibit use of this facility, but these issues cannot be disregarded when considering this facility.

- Parking in the garage is limited to vehicles no taller than 6' 8". Parking outside the garage may be subject to availability limitations, either in the street or at the valet entrance.
 - i. It will be necessary to ensure a reliable method for coordination with facility management to ensure that any responding vehicle will be allowed access and can remain in place for undetermined time periods while the technician is on-site.
 - ii. There will be a need to hand carry test equipment, spare parts, tools, and any other necessary gear from the responding vehicle to an appropriate elevator location.
- Access into equipment spaces will require pre-vetting background checks of technicians by the hotel, and assignment to repair personnel of one or more security system fobs. While Motorola is the prime contractor, there may be multiple subcontractors involved in repair services that require fobs. Examples include key Motorola staff (engineering, management, etc.), the Motorola service shop, generator repair contractor, microwave equipment maintenance provider, etc.

- i. Each of these entities will need multiple personnel to be vetted
 - ii. Each firm will need one or more security fobs assigned
 - iii. Each firm will need to track and manage the fob(s) to ensure it is available to the on-call staff member(s).
 - iv. If the person holding the fob is working at a different site when response to CIRC is necessary, either that technician must be reassigned or time will be lost as arrangements are made to get the fob to a different staff member. Either option is a degradation of response time. Alternatively, CIRC staff must provide temporary fobs or be assigned as escorts to technicians who respond without a fob; this support may be required from CIRC at any time 24/7 with little notice.
 - v. Speedy response is critical for this public safety system and can be delayed by access issues. In addition, the Motorola contractual terms specify their on-site response time to a failure, these access challenges can impact the ability to respond quickly.
- Once the technician, tools, test equipment, and spare parts have arrived at the elevator with a fob to operate the elevator, the route to the test equipment is not straightforward:
 - i. The elevator goes up to floor 27.
 - ii. At that point, the technician(s) must hand-carry all gear up a two flight stairwell to a door that opens on a lower roof, in the area of facility HVAC equipment.
 - iii. After arriving on the lower roof, it is necessary to walk around this outdoor space to the “Pump Room”.
 - iv. Equipment/gear must then be lifted up over the threshold and into the pump room. It is then carried across the pump room and out a set of doors on the other side, back to another outdoor space.
 - v. From the Pump Room exit back outdoors, gear must then be carried to the Boiler Room entrance, and brought through that doorway into the unconditioned space of the Boiler room.
 - vi. Once inside the boiler room, gear would then be brought into the (yet to be constructed) new equipment space, at which time troubleshooting and repair efforts may be performed.
 - vii. These efforts indicate that efficient response may require multiple technicians, just to carry supplies to the equipment.

These access issues are a disadvantage to support of a public safety site at the CIRC building, both in blue-sky and gray-sky conditions. It is important to note that there are three categories of maintenance response:

- a. Routine preventative maintenance
- b. Emergency repair service, 24/7 in “blue sky” conditions
- c. Emergency repair service, 24/7 in “gray sky” conditions

Access issues noted above will be present in all three categories at CIRC. The vast majority of site visits will be in categories (a) and (b), although the importance of type (c) is seen to be highest.

4.1.3 CIRC Site Security

In general, site security is good, in that the general public will not have access to the equipment. There is a minor concern that there could be hotel facility staff with access to many areas where public safety equipment is present, including the roof, parking garage, and electrical supply routes.

4.1.4 CIRC Antenna Locations & Access

There are two categories in the topic of antenna support at CIRC.

- A. For non-replacement maintenance, the responding technicians will need to access the roof area through the route as described in Section 4.1.2 above. A tower crew is still likely required for antenna maintenance, as they are the group with the tools, training, and supplies to perform antenna and tower-top amplifier work. The overall work effort is on par with WLP, where the crew arrives at the site, drives up to the tower, and uses their truck winch to hoist supplies in a manner that is a routine part of their job. Once arriving at CIRC, the following conditions are present:
 - Access to two-way antenna mounts as proposed is relatively straightforward, although the antenna connections will not be accessible without a ladder – this can be stored on-site in the boiler room.
 - Access to microwave antennas under the current design requires staff trained and equipped to work over the edge of the roof. The City suggests constructing microwave antenna platforms set back from the roof edge to allow easier access; this design would need to be developed and approved by the Owner.
- B. For replacement of antennas or microwave dishes, significantly more planning and effort is required than at WLP, where delivery, hoist, and installation of new antennas on tower top locations is routine. At CIRC, there are several levels of effort depending on the situation. If there is a spare antenna on-site, then it will simply be hoisted into position and installed by the antenna crew, after access per Section 4.1.2. At a convenient time in the future, the larger scale effort of planning a lift from the ground



will be necessary to replace the spare. If no spare is on site, then this ground lift would be needed without regard for convenience. Microwave dish spares are not expected to be housed on-site, so any dish failure would require a ground lift with associated road closures, as well as needing a crew to work out over the edge of the building.

4.1.5 Delivery of Supplies for CIRC Installation/Site Development

It is acknowledged by both City and County that development of this site for use as a public safety communications facility will take careful planning to achieve a successful completion. One primary challenge is simply getting the necessary materials into place. Following is a discussion of these issues and the viability of possible solutions.

4.1.5.1 Delivery of the CIRC Backup Generator & Fuel Tank

A proposed alternate location for the generator is adjacent to the existing CIRC facility generator. Delivery of a generator to this location would require shipment in small sections and assembly on-site; it is not clear that sections would be small enough for the available entryway. Delivery and installation of a fuel tank to this location is even more problematic. For these reasons the alternate location is not considered viable.

The primary location for the generator is on the Parking Garage Level 4. The plan would be to place the generator and fuel tank side-by-side in two parking spaces. Delivery to this location will be limited to the 6'8" ceiling height for the delivery vehicle and for the offload and placement efforts. While challenging, this can be accomplished depending on the physical size of the items.

4.1.5.2 Delivery to the CIRC Roof Level & Equipment Room:

Substantial effort is necessary for delivery to the Boiler Room equipment location and the rooftop. Materials to be delivered include the following:

- Equipment Room construction materials
- Materials for antenna mounting systems
- Electrical & Grounding Materials
- Antenna and transmission line materials
- Microwave dishes, waveguide materials
- DC Power system & battery plant
- P25 Radio site equipment
- Backup simulcast system equipment
- Possible materials for installation of a permanent rooftop hoist for maintenance/future support



Delivery of this equipment cannot be brought through the building, and will need to be lifted up from the outside. A hoist is not viable until the materials needed to construct a rooftop hoist are lifted to the roof. There are therefore two possible methods for this lift: crane and helicopter.

Helicopter Lift:

In the event that a crane lift cannot be performed then a helicopter lift would be necessary. M&A is optimistic that a crane lift is viable and this approach will not be necessary. In the event it were required, it is reported that there would be extensive disruption as the top three floors of all adjacent buildings and the CIRC itself would need to be evacuated per FAA safety regulations.

Crane Lift:

This is the recommended method for equipment delivery at the CIRC facility. A crane operator firm with understanding of the project was brought on-site by the County during site inspections, that expert opinion is represented in this discussion.

The East and West faces of the CIRC are not tenable for a crane lift due to the CIRC building configuration; the North and South faces offer potential.

- Crane use is limited by State DOT regulations to daytime drive only. Therefore we cannot plan on one long day for this effort and cannot plan on late-night operation. It should be expected that road/sidewalk closures for crane operation could take as many as three days:
 - One day for setup
 - One day for lifts (minimum three lifts for the required materials)
 - One day for breakdown.
- The crane lift would not be able to drop equipment from a street-level lift over and down into the space adjacent to the boiler room doors.
 - A rooftop hoist will need to be designed and constructed to drop materials down from the roof into the lower roof space adjacent to the Boiler Room doors. Materials for this hoist would be in the first crane lift package.
 - It will be challenging to drop the building materials down into the narrow space adjacent to the boiler room doors. Insurance requirements may drive a need for CIRC to issue a waiver of damage to the hotel cooling system.
- Once lifted to the roof, packaging will need to be broken down into smaller sizes so that it can safely be dropped to the lower, interior roof near the boiler room using the hoist.
- Supplies will then be hand-carried into the Boiler Room and staged in preparation for construction.
- Residence balconies would need to be closed during material lifts
- Roads and Sidewalks would need to be closed during material lifts



The South face is accessed from N. Young Circle, at the intersections of US Route 1 and Tyler Street.

- There is a parking pod at this face with diagonal parking in front of Publix, which the CIRC controls and can be closed for this effort.
- A long horizontal reach will be needed to clear obstructions.

The North face is accessed from Polk Street.

- Use of this face will require that Polk Street be shut down for the three day duration. It is desired (but *NOT* certain) that a portion of Polk street can remain open to allow access to the CIRC garage. The crane operator has been told upon preliminary inquiry that the entire block of Polk Street will need to be closed. This could leave the CIRC garage inaccessible for up to three days.
- In addition to the large pool seen in Figure 4-1, there is a smaller pool on the North side, west of the valet entrance. This small pool would need to be closed during materials lifts.
- Residence balconies would need to be closed during material lifts
- Sidewalks (both sides) would need to be closed during material lifts

Future Material Deliveries

It may be possible to design and install a permanent hoist to handle lifts for future equipment that could not be brought up inside the building, such as batteries, the 25' two-way antennas and the 8' microwave dishes.

- The initial crane lift can be used to bring up the materials needed to build the permanent hoist to be used in later maintenance efforts.
- It must be understood that the boom must have reach long enough to clear all lower obstructions (such as the glass awning in the valet parking area).
- The live and dead load limits of the roof must be adequate to allow the hoist to have appropriate lift capacity.
- Use of such a hoist would require some road/sidewalk closures. Depending on the time/day of the week, this creates a challenge to fast resupply/restoration, since closure of roads takes time for permit preparation, application, and approval. This could impact response time during an emergency recovery.
 - If installed on the South face, the circle would need to be closed for use of the hoist in order to reach a tagline far enough from the building to control the load.

- If installed on the North face, a portion of Polk Street would need to be closed during any hoist lift; the garage would remain accessible to tenants.

4.1.6 Boiler Room Floor Loading

The Boiler Room Floor is subject to water on the floor, and has appropriate drainage for this condition. The new equipment space must be built above this drainage, requiring a new slab floor as well as walls. The new equipment space therefore incurs significant total weight from the slab, walls, battery system, and equipment racks.

During the on-site survey, an engineer associated with the CIRC facility indicated that the floor load limit in the equipment area is 14,000 pounds. Cohen, Freedman, Encinosa & Assoc. have presented a design establishing need for a 6" slab under the equipment, KCI indicates this needs to be 8" slab. Both options are shown in the loading summary in Table 4-1.

Table 4-1 – Boiler Room Floor Loading

Weight in Pounds			CFE&A Design	KCI Design
Description	Quantity	Unit Weight	Total Weight	Total Weight
Equipment Rack	33	500	16,500	16,500
Battery Rack	4	4,440	17,760	17,760
6" Slab	1	51,590	51,590	
8" Slab	1	38,525		38,525
Walls	1	14,300	14,300	14,300
Total:			100,150	87,085
Total Area (SF):	670	Avg Wt per SF:	149.5	130.0

In either case it is clear that reinforcement is required to support the equipment load. The necessary steps are therefore as follow:

- Crane lift of construction materials necessary for reinforcement of the floor
- Perform floor reinforcement
- Crane lift of equipment and supplies for the communication system & equipment room construction
- Construct the equipment room
- Install the equipment.



As seen, this establishes a need for a second crane lift, with attendant disruptions as noted in Section 4.1.5 above unless the concept can be realized to install a permanent hoist on the roof. That concept will add delay to the project for design, CIRC approval, and implementation.

M&A notes that to perform the Equipment Room construction, the equipment and building materials will need to be brought in and staged prior to that construction. There is no viable place to store all the building materials for construction of the equipment room during preparation other than in the Boiler Room, at the far end of the space.

There appear to be two options for this endeavor:

- a. Ensure that the floor in the far end of the Boiler Room has sufficient strength to support all equipment and building materials during the construction of the Equipment Room.
 - It seems safe to assume that if the floor at the planned installation location cannot support the weight, then the floor at the far end also cannot support the weight to stage all equipment and construction materials, so this option does not appear viable unless the staging area is also reinforced under step (ii) above.
- b. Ensure that the floor in the far end of the Boiler Room has sufficient strength to support building materials during room construction, and then perform a second crane lift for equipment after the equipment room is built.
 - Under this approach, a third equipment lift is required prior to step (iv) above.

4.1.7 Summary of CIRC Findings

There are significant logistical challenges to construction and operation of a public safety communications site at this location. These include the following (Note that as discussed in Section 4.1.6, there is potential for as many as three separate material lifts during construction):

- Disruption to residents
 - Evacuation during X-ray testing
 - Relocation of personal storage (future location not known)
 - Closing of balconies during material lifts
 - Closing of sidewalks during material lifts
 - Closing of streets during material lifts
 - Possible loss of access to the garage during crane operation
- Disruptions to neighbors and neighboring businesses
 - Closing of sidewalks during material lifts
 - Closing of streets during material lifts
- No outreach to CIRC and neighboring residents has been conducted, although this will likely impact more residents, and the impact will be more direct than the WLP site, with

the exception of the aesthetics associated with the standing tower that is visible to neighbors in the area of the WLP site.

- Logistics/planning required for technician access to the site in all conditions
 - Longer time on-site to get to the equipment in all cases
 - Risk of delays in the event the responding technician is not pre-vetted or the security fob is not available to the responding technician
 - Larger vehicles cannot get into the garage, requiring parking further away and potentially limiting delivery capacity
 - Transport of tools, test equipment, parts, and supplies to the equipment site is fairly arduous
- Substantial effort is necessary to deliver materials to the equipment space and rooftop.
- The CIRC may need to waive damage claim to get the equipment delivered to the Boiler Room entrance.
- The equipment space floor is not strong enough to support the equipment and the room build-out.
- It is unclear that the rooftop has adequate strength for the load during staging.
- It is unclear that the other end of the Boiler Room has floor strength to support staging of materials and equipment during construction.

In general, while this may be a suitable site for wireless carrier operation, significant deficiencies exist before it would be viable as a public safety site. Most of these issues can be overcome although time, materials, planning, and disruption will be necessary.

4.2 West Lake Park Tower Site (WLP) Findings

4.2.1 General Suitability

There are aspects to this site that are well-suited to its use for the P25 system. These include the following:

- This is a “greenfield” site, which means that there is no current structure, and a purpose-built public safety communications site can be constructed which will meet all system requirements (including radio coverage). See Figure 4-2.
- There is adequate space at and around the site for staging and development of the site.
- The means and methods for constructing a site suitable for this environment are well understood and appropriately planned.
- The tower as designed is a highly reliable structure, designed to survive a 180 mph Category 5 hurricane with safety margins, even after adding 50% future load beyond the initial requirements.
- The equipment platform as designed places all communications equipment and the emergency generator well above expected flood levels.
- Access to the site will be direct and straightforward in most conditions
- Access to the site in difficult conditions is understood and within County experience and resources.
- There is adequate power available from FPL to support current and future load requirements.
- The County has in place Resolution No. 2019-264 which releases the site from environmental restriction to allow use as a public safety communications site.

There are also aspects to this site that make use of this location more challenging than a high-rise installation:

- There is likelihood of some flooding, and risk of severe flooding at this location.
- There is risk that the access road could become impassable during a gray sky event
- There is citizen opposition to this location

Figure 4-2: Proposed WLP Site



4.2.2 General Access Issues

The WLP site location is located away from the active areas of the park, down a road that is currently unimproved.

4.2.2.1 WLP Roadway

At the time of the site survey this roadway had standing water in some track areas due to overnight rain (Figure 4-3).

*Figure 4-3:
WLP Access
(Overnight
Rain)*



Concern has been noted that there is potential for flooding at this location. It is also noted that in its current unimproved condition and with overnight rain it remains accessible to a large crane, according to the on-site crane operator. The current plan is to grade this road and apply gravel as needed to create a stable long-term access route.

It is noted that there are few large trees, which mitigates concern of road obstruction after a storm.

4.2.2.2 Technician Access

Upon completion of site development, this site will allow for direct and straightforward access by maintenance staff. Responding personnel can simply drive directly to the site, park next to the building, and perform any necessary maintenance. This ease of response will be available for both routine care and emergency repairs in all but the most difficult conditions.

There are concerns as to response in hurricane/flooding conditions. The County has other sites with more difficult access than WLP, and staff are trained and equipped for such conditions.

After review of conditions, M&A would consider it advisable (but not mandatory) for the access road to be paved.



4.2.3 Antenna Location and Access

When tower climbing is necessary, the crew will have direct access to the tower to conduct any necessary inspections and maintenance.

Access is relatively straightforward to two-way and microwave antennas as proposed; this would be a standard public safety radio system installation with receive antenna top-mounted on the tower.

4.2.4 WLP Site Security

This location is fairly remote and will see very few passersby. The site is designed with eight foot high chain link fence topped with concertina wire, and cameras to provide security protection; this is standard procedure for a public safety tower site. No unauthorized persons will have access to the site.

4.2.5 Delivery of Supplies

Delivery of supplies will be straightforward. Light and heavy vehicles necessary can proceed directly to the site location for construction, equipment installation, test, and optimization.

4.2.6 Environmental Impact

Environmental impact is a significant concern for many in the area. There is a conservation area at West Lake Park, although it is some distance from the proposed tower site. Figure 4-4 below shows the conservation easement relative to the site location.

As noted in Section 4.2.1, the County has passed Resolution No. 2019-264 which releases the site from restriction in order to allow use as a public safety communications site. M&A has been retained for our expertise in communications engineering, not conservation science. However, we believe that this location is suitable as it has been set well away from both active in-use parkland and the established conservation area. When taken in the context of mission-critical public safety, this is seen as an appropriate use of the proposed land.

5 Site Development Findings and Comparisons; Construction (including strategy, complexity, and costs)

The two sites have very different development and construction efforts. As noted in Section 4.1, there are extensive interrelated planning, design, and approval efforts necessary to upgrade the CIRC facility to a level appropriate to public safety communications site standards. In contrast, tower construction at WLP is straightforward and direct.

Tower installation is well understood in these conditions. Once the foundation is properly laid, the tower sections are quickly and easily “stacked” using a crane, often in a single day. Figures 5-1 through 5-8 are examples of such construction at other sites.

Figure 5-1: Example Foundation in Very Wet Conditions



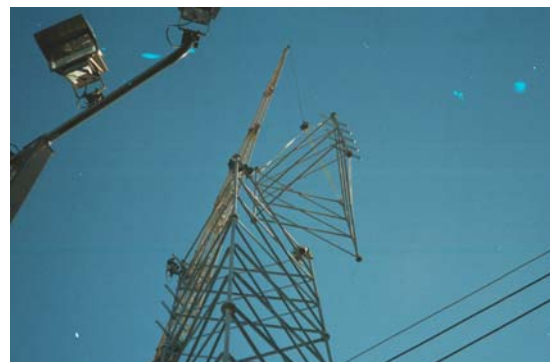
Figure 5-2: Tower Section Staged



Figure 5-3: Stacking Tower Sections



Figure 5-4: Stacking Tower Sections



Figures 5-5 & 5-6: Shelter Package is Simple, Direct Delivery from the Factory



Figure 5-7: Shelter Dropped on Site by Crane, Even in Difficult Conditions



Figure 5-8: Connections from Equipment to Antennas is Standardized and Straightforward



The WLP construction technique is standard and used in many thousands of sites across the world. In contrast, the CIRC development is unique, disruptive, and complex. Concerns are further raised by the fact that it is not a County or City owned site, and not in County or City control.

The final design at the CIRC is not complete, and there are significant issues to be resolved, all of which will take time, adding to program delays. These are described in Section 4.1 and include:

- At least one, and possibly multiple, crane lift events are necessary to bring materials up from the ground to the roof. This is the best-case scenario; worst case is the need for costly and even more disruptive helicopter lifts.
- Two hoists (or some combined-use hoist design) are considered, and
 - a. A crane lift is necessary to bring hoist construction materials to the roof
 - b. One hoist is needed for lifting supplies from the ground to the roof
 - While less disruptive than a crane lift, hoist lifts will require some closures of roads, sidewalks, and balconies.
 - There is no assurance that a rooftop hoist can be designed and implemented for lifts from the ground.
 - Lack of such a hoist will create a need for multiple, disruptive crane lift events during construction as noted in Section 4.1.6.
 - Crane lifts will require road closures. Optimistic estimates indicate that a shorter duration might be achievable, but prudent planning is that each crane lift will require three days of road closures to accommodate DOT regulations.
 - The hoist design must be developed that meets architectural and aesthetic Owner requirements, and must fold down out of sight from the ground when not in use. Design is subject to owner approval.
 - The hoist must have a long reach to clear obstructions
 - c. A second hoist is needed (unless some kind of mobile hoist can be devised) for dropping supplies from the roof down to the boiler room entrance
 - A hoist must be designed and constructed to drop equipment from the roof into the space near the boiler room entrance. There is no design at this time, and there is no assurance that the upper roof can support the associated loads.

- Any changes/updates to the design that require new supplies will require either a challenging hand-carry of those supplies or an additional disruptive crane/hoist lift.
- There is a plan (not yet approved) for strengthening the space that will become the Equipment Room. There is no plan for staging of the various heavy loads of equipment and materials necessary for construction of the Equipment Room and for the radio system itself. It is not clear that potential staging areas have adequate load strength during the construction period.
- There is not yet a lease in place, it is reported that most legal terms are agreed upon but the design aspects remain pending, as does the final cost.
- Design may require stealth material coverings on antennas.
 - This design change could impact RF signal strength;
 - Motorola will not submit a design without materials testing to assure that they can still provide the contracted guarantee of system operation.
 - It is not known how much delay this could create before a final design is established and submitted to CIRC.
 - We note that the City consultant has provided a sample of a stealth covering available from 3M.
 - It is not clear that this covering is Category 5 hurricane rated. If it were to begin to peel off of the antenna, the material flapping in hurricane winds would likely cause antenna failure
 - The specifications indicate 720 hours survival in 5% salt fog; the overall salt-air lifecycle is not clear, nor is the ability/difficulty in achieving installation on the proposed antennas.
- Core drilling will be necessary in some areas for routing of power, ground, and low-voltage connectivity. GPR has provided preliminary routing but X-Rays will be necessary prior to actual work; health & safety codes require mandatory evacuation for three floors down and one floor up at each test location.
- Vehicle access in the garage is limited to a height of 6'8". Work crew and work vehicle access presents a logistical challenge and places personnel further from the work site. This also impacts the delivery method for the generator and fuel tank, as discussed in Section 4.1.5.1.
- The Owner has the right to reject designs after execution of the lease. This further complicates construction planning and implementation.
- There will be at least some, and potentially significant disruption to tenants, neighbors, and businesses in the area. While outreach has been performed at West Lake, none has been conducted at CIRC, yielding a potential for significant protest. It is also noted that the number of residents at CIRC is significant compared to the population near WLP. There are about 400 residential units at CIRC, and about 50 residences within 1,000' of WLP. Examples of these disruptions include:

- Disruption to residents
 - Evacuation during X-ray testing
 - Relocation of personal storage (future location not known)
 - Closing of balconies during material lifts
 - Closing of sidewalks during material lifts
 - Closing of streets during material lifts
 - Possible loss of access to the garage during crane operation
- Disruptions to neighbors and neighboring businesses
 - Closing of sidewalks during material lifts
 - Closing of streets during material lifts
- Part of a CIRC construction effort should include identifying a location and storage method for spare antenna(s). This would need to be clarified, proposed, and authorized by CIRC. It is not clear where a 25' antenna might be stored that would not interfere with access to other rooftop equipments.

Costs associated with the CIRC development as compared to WLP are discussed in Section 10.

The logistics challenges above create delays in the overall schedule. Where the WLP site is virtually “shovel ready”, there are many open questions related to how the CIRC facility preparation will be performed. These will add time delays, as discussed in Section 11.

In conclusion, M&A finds there to be much greater complexity and challenges to proper site development at CIRC than at WLP. If CIRC were to be implemented these challenges will create risk of program delay and for suitability of the site.

6 Site Serviceability

It is appropriate to evaluate and compare the serviceability level of the two sites. This comparison will be approached in three separate service categories:

- a. Routine, planned preventative maintenance
- b. Emergency restoration and repair
- c. Serviceability during “gray sky” conditions, with attention to post-hurricane restoration.

6.1 Routine Maintenance

6.1.1 Routine Maintenance - WLP

For routine maintenance at WLP, the following steps are necessary:

- a. The technician drives up to the site, unlocks the gate, and parks next to the equipment shelter.
- b. A need for an extra tool or part means a quick step outside to the truck and back into the shelter. All tools and supplies are immediately available, requiring a climb up the short staircase into the shelter. Any authorized technician has access to all County sites.

6.1.2 Routine Maintenance - CIRC

For routine maintenance at the CIRC Building, the following steps are necessary:

- a. If the technician is in a vehicle less than 6’8” in height, s/he can drive into the garage and park in the public level, which is managed by the Publix store. It will be necessary for responders to gain special parking access to avoid the two hour time limit. The technician must then carry tools, equipment, spare parts into the elevator.
- b. If the vehicle is greater than 6’8” in height, street parking is required. The technician must then carry tools, equipment, spare parts into the building to an elevator.
- c. Access into equipment spaces will require pre-vetting of technicians by the hotel, and assignment to repair personnel of one or more security system fobs. While Motorola is the prime contractor, there may be multiple subcontractors involved in repair services. Examples include key Motorola staff (engineering, management, etc.), the Motorola service shop, generator repair contractor, microwave equipment maintenance provider, etc.
 - i. Each of these entities will need multiple personnel to be vetted
 - ii. Each firm will need one or more security fobs assigned
 - iii. Each firm will need to track and manage the fob to ensure it is available to the on-call staff member(s).

- iv. If the person holding the fob is working at a different site when response to CIRC is necessary, either that technician must be reassigned or time will be lost as arrangements are made to get the fob to a different staff member. Alternatively, CIRC staff must provide temporary fobs or be assigned as escorts to technicians who respond without a fob; this support may be required from CIRC at any time 24/7 with little notice.
 - v. Speedy response is critical for this public safety system and can be delayed by access issues. In addition, the Motorola contractual terms specify their on-site response time to a failure, these access challenges can impact the ability to respond quickly.
 - d. Once the technician, tools, test equipment, and spare parts have arrived at the elevator with a fob to operator the elevator, the route to the test equipment is not straightforward:
 - i. The elevator goes up to floor 27.
 - ii. At that point, the technician(s) must offload the gear from the elevator into the hallway.
 - iii. Once clear of the elevator, one must hand-carry all gear up a two flight stairwell to a door that opens on a lower roof, in the area of facility HVAC equipment.
 - iv. After arriving on the lower roof, it is necessary to walk around this outdoor space to the Pump Room.
 - v. Equipment/gear must then be lifted up over the threshold and into the pump room. It is then carried across the pump room and out a set of doors on the other side, back to another outdoor space.
 - vi. From the Pump Room exit, gear must then be carried to the Boiler Room entrance, and brought through that doorway into the unconditioned space of the Boiler room.
 - vii. Once inside the boiler room, gear would then be brought into the (yet to be constructed) new equipment space, at which time troubleshooting and repair efforts may be performed.
 - viii. These efforts indicate that efficient response may require multiple technicians, simply to carry supplies to the equipment.
- A need for an extra tool or spare part means returning across the outer roof, through the pump room, back to the outer roof, down two flights of stairs, into the elevator, down to the vehicle, and then repeating steps (a) through (d) above to get back up to the site.



6.1.3 Routine Maintenance - Conclusion

Routine maintenance at WLP is much more direct and straightforward than at CIRC. Everyday access challenges at CIRC represent a hazard to maintenance of the public safety communications system.

6.2 Emergency (Non-Routine) Restoration and Repair

6.2.1 Emergency Restoration and Repair - WLP

Emergency restoration and repair at WLP requires the same straightforward level of access as noted in Section 6.1.1 above for routine maintenance.

- a. Most emergency restoration activities would be performed by direct access to the site as noted for routine maintenance.
- b. In the event that there is a failure of any antenna or Tower Top Amplifier (TTA), then a tower crew responds directly to the site and performs the repair.

6.2.2 Emergency Restoration and Repair - CIRC

Emergency restoration and repair at CIRC is significantly more challenging than WLP.

- a. Emergency response requires all of the access efforts as noted in Section 6.1.2 above for routine maintenance. There is an added opportunity for access challenges during emergency conditions, when it is more likely that responding staff member(s) may not have the security fob in their position. Further, this event may not happen during business hours, and appropriate CIRC staff may be more difficult to reach if there are access problems.
- b. In the event that there is a failure of a Tower Top Amplifier (TTA), then repair may be possible without a tower crew, if responding technicians are appropriately trained and equipped.
- c. In the event that there is a failure of a two-way antenna, then a crane or hoist lift will be necessary to bring a spare unit to the site. Note – It may be possible to store a spare antenna on-site, this would allow the lift to be postponed to a more convenient time to replace the spare unit (this spare storage capability is not confirmed and is part of the outstanding design issues noted in Section 5 above).
- d. In the event that there is a failure of a microwave antenna, then a crane or hoist lift will be necessary to bring a spare unit to the site. Note – it may be possible to store a spare antenna on-site, this would allow the lift to be postponed to a more convenient time to replace the spare unit. Once the new microwave antenna is available installation would require a tower crew, unless a redesign is developed and approved to create a raised platform on the upper roof which meets structural and aesthetic requirements.

6.2.3 Emergency Restoration and Repair - Conclusion

Emergency restoration at WLP is much more direct and straightforward than at CIRC. Access challenges at CIRC represent a hazard to maintenance of the public safety communications system.

This is critically important, as non-routine restoration and repair are not uncommon occurrences, and poor response will have a direct impact on public safety operations. As a rough order magnitude of this service, we note that the current system experiences about one such response per week. If we were to assume one response per week across the 14 new RF sites, a given site would have between three and four such responses per year. Even half that rate, or once every six to seven months represents an important aspect of reliable communications. Challenges to this access are a significant issue to address.

6.3 Gray Sky Serviceability

Hurricane level flooding, storm surge, and wind damage are serious concerns that must be addressed in development of an emergency communications system. Given the rise of sea levels and increasing frequency and severity of storms, it is appropriate to carefully examine the impact of this “Gray Sky” weather on restoration capabilities.

6.3.1 Gray Sky Service Threats Common to WLP & CIRC

There are some issues that are common to both sites, and are therefore not differentiators in this evaluation. These include the following items:

- High Wind Survivability - Antennas: Both sites can be expected to be affected by the same winds, in terms of speed, strength, and duration. Antenna and mounting hardware at both locations are designed for survival during Category 5 hurricane wind levels up to 180 mph. The in event that sustained winds were to exceed the design load of the equipment, there would be significantly more risk to surrounding population and structures at CIRC than at WLP. However, this is a very low risk and not a significant differentiator.
- High Wind Survivability – Structure: The CIRC building is not rated as an emergency structure for survivability in a Category 5 hurricane (157 mph winds). However, this is a well-built structure and survival is not a significant concern. The WLP tower design is built to exceed 180 mph winds with safety margin, even after increasing the load by 50% beyond the current plan. There is no concern that either structure will fail.
- Power systems: Both sites would be equipped with underground power from FPL. Both sites would be equipped with the same generator and same size fuel tank. Concern has been expressed that the County may be challenged in accessing the WLP site for generator refueling; this is discussed below in Section 6.3.3.

6.3.2 Specific Gray Sky Service Concerns at CIRC

CIRC brings the following concerns that relate to gray sky restoration.

- Flooding is certainly possible in this area, although long term access limitations from flooding are a much lower risk than at WLP.
- In the unlikely event that winds exceed the design load, hardware failure resulting in debris flying from the roof would be a much greater threat to life and safety than would such an event at WLP (where the park will be closed).
- Emergency restoration at this location brings all the access challenges and delay risks that have been noted for this building in Sections 6.1.2 and 6.2.2. Logistics become more challenging in these “all hands on deck” conditions. For this reason, simple issues of logistics become of particular concern.
 - It will be necessary to ensure that responding personnel have the right vehicle to fit in the garage.
 - It will be necessary to ensure that responding personnel have access to the appropriate security fob, and that the elevator is functional (it is noted that the elevator is supported by the CIRC facility emergency generator).
 - Delays in response can occur simply because a tool was forgotten in the truck, and a long trip is necessary for retrieval.
 - Delays can occur due to challenges in bringing spare equipment up to the equipment room, even if the outdoor equipment is intact.

6.3.3 Specific Gray Sky Service Concerns at WLP

The significant concern related to WLP is the risk of flooding, due to storm surge, “king” tides, etc. This is a very real risk that must be understood and mitigated. M&A believes that the risks associated with gray skies have been addressed in the proposed design. Two additional improvements are recommended simply as additional safety margins:

- While the proposed gravel road would likely survive most conditions, it is recommended that the access road be paved, to further mitigate risk of the road washing out. This will provide for faster recovery of accessible conditions in the most extreme weather events.
- The design includes a raised slab to support the generator, fuel tank, and equipment shelter. M&A recommends that this platform be raised an additional two feet in elevation. Given the rise of sea levels and increasing frequency and severity of storms, it is appropriate to increase the safety margin for this critical structure.

The suggestion has been made that a second access road be developed at WLP. M&A considers this reasonable, but not recommended for two reasons:



- It is likely that high water conditions on one road would equally impact a second road.
- This would require additional construction and paving through an environmentally sensitive area.

The County has well established experience in accessing remote sites after hurricane conditions. The County's Markham Park site is by far the most difficult to access. At that site, from the entrance of the park it is about a one-mile drive around numerous lakes to access the tower road, and then an additional half mile or so down a dirt road through a heavily wooded area. During hurricane Irma the roadway was heavily obstructed due to downed trees. The County had the roadway clear to access the site the day following the storm. Given County experience and resources for accessing sites in difficult conditions, claims that the WLP site will be inaccessible are not well founded.

M&A also notes that there are few large trees in the area around the planned access road at WLP; this mitigates the risk of the heavy road blockage that occurred at Markham Park. As done in previous storm recovery, the County can send a bulldozer down the access road to clear obstructions and gain access.

6.3.4 Gray Sky Service Conclusions

Challenges to routine access at CIRC will be exacerbated during gray sky responses, but this is not seen as a significant issue. Access to WLP may be limited in the event of severe flooding, although the equipment is not expected to be at risk. The County has sufficient experience and resources to mitigate issues that such flooding may create. On balance, the WLP site design mitigates the most significant risks during gray sky events.

6.4 Site Serviceability Conclusions

After consideration of the various aspects related to serviceability described above, M&A finds that overall serviceability at CIRC is significantly more challenging than at WLP. Both routine and emergency service will be supported much more efficiently and effectively at WLP, while the critical gray sky support concerns at WLP are mitigated by thoughtful and appropriate engineering design. As noted in Section 6.3.3 above, two additional improvements are recommended simply as additional safety margins:

- While the proposed gravel road would likely survive most conditions, it is recommended that the access road be paved, to further mitigate risk of the road washing out. This will provide for faster recovery of accessible conditions in the most extreme weather events.
- The design includes a raised slab to support the generator, fuel tank, and equipment shelter. M&A recommends that this platform be raised an additional two feet in elevation. Given the rise of sea levels and increasing frequency and severity of storms, it is appropriate to increase the safety margin for this critical structure.

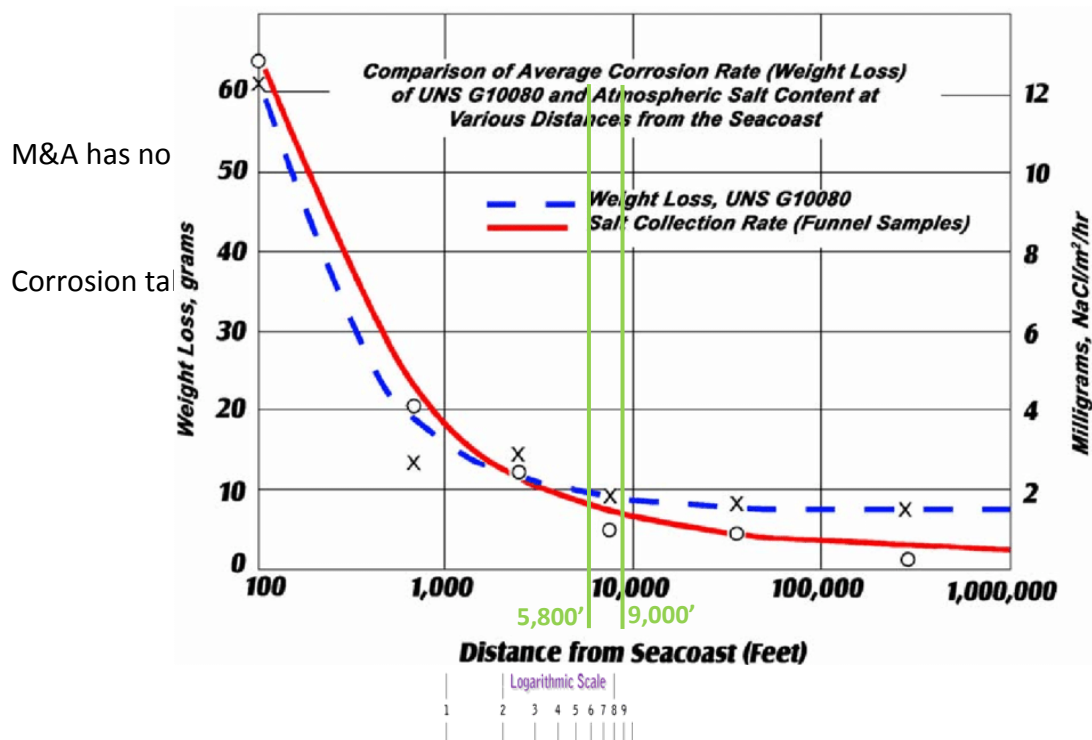
7 Site Survivability

Most site survivability issues are addressed within Section 6 above. In summary:

- Both sites are designed appropriately for high winds and hurricane conditions
- CIRC is protected from extensive flooding, WLP is designed to survive flooding. M&A recommends paving the access road and raising the equipment platform two feet as an extra safety margin.
- Both sites have buried primary power and backup generators
- In a weather event so extreme that an antenna failure occurs, both sites can be repaired although at CIRC resupply is more challenging, and flying debris more dangerous.

One concern noted by the City is related to salt air corrosion. This is a standard maintenance issue throughout any coastline area, and significant research has gone into this issue. Figure 7-1 shows the rate of corrosion for varying distances from the coast. WLP is about 5,800' from the coast, while CIRC is at about 9,000'. Review of this logarithmic chart shows that corrosion rates at these two distances is not substantially different.

Figure 7-1



M&A concludes that the two sites have equivalent survivability; this is not a differentiator in site selection.

8 Site Access & Restoration

The intent of this section is to discuss access and restoration considerations during both blue sky and gray sky events, including in the event of flooding or storm surge. Site access is discussed at length in Section 6 above, as it is an integral component to serviceability in both gray and blue sky conditions.

8.1 Access & Emergency Restoration – Blue Sky

As noted in Section 6.2.3, emergency restoration at WLP is much more direct and straightforward than at CIRC. Access challenges at CIRC represent a hazard to maintenance of the public safety communications system.

8.2 Access & Emergency Restoration – Gray Sky

Under many types of gray sky conditions, access will remain a direct and straightforward drive-up at WLP, while CIRC will always carry with it a time consuming and circuitous access route. There is concern at WLP in the event of heavy, long term flooding. Two additional improvements are therefore recommended at WLP:

- While the proposed gravel road would likely survive most conditions, it is recommended that the access road be paved, to further mitigate risk of the road washing out. This will provide for faster recovery of accessible conditions in the most extreme weather events.
- The design includes an appropriate raised slab to support the generator, fuel tank, and equipment shelter. M&A recommends that this platform be raised an additional two feet in elevation (from 6' to 8' above grade) to improve high-water safety margins.

8.3 Access & Emergency Restoration – Conclusion

M&A concludes that overall, access at CIRC will be more difficult and time consuming, which relates directly to longer response rates for emergency restoration. In the event of severe flooding, there may be delays to support WLP, but these delays will be rare and can be overcome given the County's resources and experience in emergency restoration during gray sky events. M&A therefore considers WLP gray-sky access to be acceptable, and far superior in all other conditions than CIRC.

9 Site Safety of Surrounding Areas

9.1 WLP Tower Failure

Simply put, there is no risk to surrounding communities from the WLP tower “falling over”. Category 5 hurricane is winds above 157 mph. WLP is designed to support 50% increase in load with winds in excess of 180 mph. In addition, radio towers are designed to collapse down and in, not across and over. M&A notes that in the event of a poorly designed or overloaded radio tower there is a risk of collapse – the proposed design at WLP is neither poorly done nor overloaded. Again, for those towers that are overloaded, a collapse is down, not over. An example of such an event is shown in Figure 9-1.

Figure 9-1: An Overloaded Tower Collapsed Down, not “Falling Over”

(The WLP Tower is NOT Overloaded)



9.2 Risk of Loose Debris

The WLP tower is designed to the ANSI/TIA-222-G standard for 180 mph winds. We note that an update of this standard (H) has been released since project inception. The contractor has done an analysis to show that the structure meets all current building codes. This design assures that the structure will remain stable even in hurricane conditions. Significant strides have been made over time to improve equipment survivability and standards. As an example, after Andrew struck southern Florida in 1992, tower and equipment corporations sent engineers in to study failure types and to learn what survived. Lessons taken from this and



later storms have been instrumental in these design improvements over time. Both WLP and CIRC installations are designed to meet this standard.

In the unlikely event of a hardware failure, it is clear that flying debris would pose a much more serious threat to life and safety in the densely populated area of the CIRC Building than it would at West Lake Park (which would be closed during a hurricane).

The only other risk seen would be from falling tools or parts due to careless actions of a technician during a repair. Again, falling debris would be a greater risk at CIRC than at WLP.

9.3 Site Safety Conclusions

M&A concludes that either site can be considered safe, while WLP holds a slight advantage in reduced risk to the populace in the unlikely event of an unforeseen failure (flying debris, etc.).

10 Cost Evaluation

10.1 General Cost Considerations

There are significant disputes related to the costs of the two alternatives. This section provides a review of costs and expectations, while providing some insight into these issues. However, M&A notes two conditions related to cost:

- a. The WLP site is part of the firm fixed price contract from Motorola, as such most costs related to development of this location have no additional impact to the County.
- b. We note that per the ILA (Section 3.2) the City will bear cost increases associated with CIRC development that are above WLP costs as identified by this IE report, thus potentially adding no cost impact to the County program.

Because of these two conditions, M&A concludes that while cost is always an important consideration when spending public funds, it is not a substantial factor in the decision as to which site should be selected – the City would be willing to fund appropriate cost increases.

There are significant challenges in a public safety turnkey system integration program, which yield significantly higher end costs than a simple individual job. This often leads to an impression of inflated costs when in fact a simple labor quote leaves much effort missing. It is important to understand that the complex interdependence of the various activities demands a high standard for management and design to assure appropriate development of a site that meets P25 requirements.

For example, electrical quotes from the City omit many required efforts, as well as omitting the supervision and design support from Motorola that is necessary to meet R56 standards. A crane estimate of \$42,962 shows a simple one-day effort with a 500 pound per-pick limit. We know the battery racks are 1,440 pounds each and total lift just for the Boiler Room is about 100,000 pounds; additional lifts are needed for antennas, mounting structures, etc. That crane quote appears to include a series of unsubstantiated best-case assumptions including but not limited to:

- The only crane lift needed will be for materials to construct a rooftop hoist
- Mobilization, lifting, and demobilization can be achieved in one day
- A hoist can be designed that meets all structural requirements, boom reach needs, and lifting capacity, while still achieving aesthetic acceptance from the building owner
- The roof can support the load of both the hoist and the staging load for the construction materials



- The hoist (or multiple hoists) can handle lifts from the ground to the roof, and from the roof to the boiler room entrance
- Two riggers will be adequate for handling all activities both packing on the ground and unpacking on the roof

10.2 Development/Implementation Cost Analysis

M&A notes that the City objects to many of the individual item quotes that have been presented by the County for CIRC development. There are several reasons for this perception, including:

- Many public safety communications programs are developed under contract mechanisms similar to this project, where the radio manufacturer acts as System Integrator (SI). In these SI contracts, there can be several layers of cost markup, yielding higher than expected costs.
- The SI responsibility is turnkey and fixed price. In a case where there are design unknowns, there is risk of cost over-run for items not foreseen. This most often happens in a complex situation; CIRC is a complex situation. There are many aspects of this implementation that could take longer and be more challenging than initially considered; a turnkey SI contractor must absorb the costs of these activities without recourse of change order for additional funds.
- Lower cost quotes from the City are missing all of these turnkey responsibilities, offering a very limited fixed scope rather than all of the other tasks necessary to perform a turnkey effort that meets public safety standards. In these limited-scope quotes any changes, increases, or oversights would be addressed with a change order for additional funds.

The only realistic option available for significant cost reduction is to take the CIRC development cost out of the SI contract, and relieve the Vendor (Motorola) of turnkey responsibility for this site.

If this route were taken, M&A would recommend that the City act as the General Contractor, overseeing all efforts to secure the necessary multiple bids for each aspect of the job, execute contracts with those individuals' contractors, and provide oversight during construction.

Under this "City General Contractor" role an agreement would need to be established with Motorola as to the level of up-fit to the space and support provided prior to Motorola installing equipment. The potential exists that a substantial completion delay could be realized primarily due to the procurement process. Savings in procurement cost that might be achieved by the



City acting as the General Contractor may not be realized due to delay and the efforts of City employees and/or a contracted CIRC construction manager.

Use of the CIRC site would require a Motorola Change Order. This change could include not only the initial installation but maintenance as well, whether routine or emergency.

10.3 Capital Cost Analysis and Estimates

WLP Capital Cost Estimates – As previously stated all costs associated with West Lake Park are part of the Motorola contract and therefore Change Orders are not anticipated, except for changes made to conform to recommendations from this report.

CIRC Capital Cost Estimates – The costs of implementing the CIRC site include planning, discovery of conditions, added materials and actual installation. In addition to facility construction costs, it should be expected that Motorola will want change orders since factory staging of the CIRC equipment was performed on a shelter design. Intercabling is complete for a standard shelter installation, whereas layout, cabling, and other installation details will be different at the CIRC location.

Table 10-1 below provides cost estimates from the County for development of the CIRC tower. Table 10-2 provides a comparison of County estimates for the two sites. When evaluating these costs, M&A believes that the costs submitted are marginally higher than necessary, especially for the crane and helicopter lifts. M&A comments are provided for the various line items. In addition to those comments, we note several items that may be omitted from the Motorola quote. If in fact they have been omitted they will increase the Motorola quote:

- While a helicopter or crane could lift all of the antennas and lines to the roof, those antennas and their masts can't be manually lifted into place for installation. A roof-top hoist would be required to bring the antenna to its final mounting location. A design may be developed for a permanent hoist. Alternatively, the hoist would need to be removed upon completion of its work, and then there would be a need to reinstall the hoist every time antenna replacements or other work is needed.
- The electrical effort includes a run of CAT 6E cable from the generator to the equipment room. It is assumed that this cable is for monitoring the generator alarms. It is also assumed that by the specification of CAT 6E cable the signaling method would be Ethernet. If these assumptions are correct, we note that the length of cable to the roof (27 floors above) could exceed the Ethernet cable limitation of 100 meters (328 feet).

- It is not clear that the Motorola/County quote includes the necessary design and implementation for the backup fiber link into the Equipment Room from the ground floor.
- It is not clear if fire suppression needs to be designed and installed at the generator location, and if this is included in the quote.

Table 10-1

CIRC Itemized Construction Cost Estimate - 040619 v2 (County Provided Data)		M & A Notes
Category	Itemized Cost	
Room Construction	\$477,500.00	We assume that this is an all conclusive figure for space development including HVAC, etc.
Electrical Work, room prep and grounding	\$326,250.00	We assume that this covers all turnkey electric, grounding, signaling system and specialized parts of the installation to include x-rays and core drilling.
FM200 Install and Materials	\$71,875.00	It is not clear if a new fire protection system is required in the generator and fuel areas.
Generator Install (includes transfer switch)	\$61,875.00	We assume that this item includes the specialized fuel delivery system and installation methods required.
Generator	\$0.00	This item has been deleted for comparison purposes as it should be the same system at WLP.
Engineering design (Site optimization and commissioning, floor plans, etc)	\$10,000.00	This is a low figure. M&A assumes that some costs are included in other line items like room construction.
Project Management Services	\$76,000.00	This is a realistic figure.
Architectural and Engineering consultations and permit preparation	\$25,000.00	This is a realistic figure.
Line and Antenna Install	\$158,500.00	This figure is higher than expected and may include second level hoisting.
Microwave Install	\$139,809.00	We assume that this is the complete microwave install, including power, antennas, mounts, lines and alignment.
Radio Equipment Installation	\$16,000.00	Cost equates to 80 additional hours of labor.
DC system Installation and commissioning	\$58,000.00	We assume this is a turnkey effort to supply and commission the system
Pre-Transportation Subtotal	\$1,420,809.00	CIRC Development (without material lifts)
Crane Transportation	\$708,750.00	Two Lift Alternatives - Delivery Cost
Helicopter Transportation	\$1,290,000.00	
Infrastructure Total (Crane)	\$2,129,559.00	Two Lift Alternatives - Overall Cost
Infrastructure Total (Helicopter)	\$2,710,809.00	

Table 10-2

CIRC and WLP Site Cost Comparison

Category	CIRC Cost Range		WLP Cost
	Low	High	
Construction Total	\$2,129,559.00	\$2,710,809.00	\$770,021.00
20 Year Lease	\$1,516,155.88	\$2,063,644.76	N/A
20 Year Antenna and Supporting Structure Maintenance Costs	\$134,351.87	\$134,351.87	\$134,351.87
Total 20 Year Construction and Operating Costs	\$3,780,066.75	\$4,908,805.63	\$904,372.87
CIRC Cost Higher than WLP by this Amount:	\$2,875,693.88	\$4,004,432.76	
County Negotiates 50% Construction Discount:	-	-	
	\$1,064,779.50	\$1,355,404.50	
Net 20-Year Lifecycle Cost	\$1,810,914.38	\$2,649,028.26	
Discounted cost is above WLP by:	\$906,541.50	\$1,744,655.39	

Leasing rates are calculated to increase 2% to 3% per year

Maintenance rates to include labor are calculated to increase 3% per year

The City has provided several alternate quotes in an attempt to show where County/Motorola pricing is too high. These alternate quotes are limited in scope and are not valid for side-by-side comparison. Examples include:

- The electrical quote is not turnkey and does not include building preparation. For example,
 - GPR tests completed to date are not accurate enough for core drilling through pre-tension or post-tension concrete. X-ray testing will be necessary at each core drilling location. This requires cost and time, as well as planning and management efforts for evacuation three floors down and one floor up for each test.
 - After X-ray testing, a thorough and detailed electrical routing design must be documented and approved by the Owner.
 - After completion of the routing design, the core drilling and other route preparation and management will be necessary (including relocation of tenant storage). Note: There may be a need to construct new storage cages elsewhere as part of this project.
 - The electrical quote does not include design and compliance with the R56 standard for lightning protection and surge protection necessary for a public safety communications site. This is a much higher standard than traditional



building electrical work or for a wireless carrier (“cell phone”) site, and may require additional routing and core drilling to ground level.

The figures in Table 10-2 demonstrate that even if the CIRC estimates are 50% too high the CIRC is still more costly than WLP.

When reviewing overall capital costs, we reach the following conclusions:

- The WLP site development effort within the contract is a firm fixed price of \$770,021
- The CIRC development effort is estimated at a range from \$2,129,559 to \$2,710,809.
- This CIRC development effort omits costs for:
 - Analysis, design, and remediation of roof structure to hold construction materials
 - Identification, design, and remediation of an area on the lower roof to stage equipment and supplies
 - Design, structural analysis, approval, and construction of either one or two rooftop hoists
- It may be possible to negotiate with Motorola for a reduction in the proposed costs, although this is unlikely given the additional tasks identified above. If we assume that a 50% construction reduction is somehow successfully negotiated, then CIRC will still be at an expected initial cost of \$294k higher than WLP for initial construction, and \$906k higher over the 20-year lifecycle. Ongoing lifecycle costs are discussed in Section 10.5.2 below.

10.4 Comparative Analysis and Independent Assessment

Which site proved to provide the best cost benefit?

- WLP is seen as the straightforward selection. Initial costs are lower, ongoing costs are lower, operational benefits are equal or greater in all areas investigated.

Which site did not prove to provide the best cost benefit?

- CIRC is the site with the highest cost, longest completion time, greatest inconvenience to site neighbors and design/construction unknowns. There are not functional benefits to justify the additional costs. CIRC is therefore shown to not be the best cost benefit.



10.5 Operating/Support & Maintenance Cost Analysis

10.5.1 Estimate of Annual Site-Specific Support and Maintenance Cost for CIRC

Both sites will need annual inspection of the outdoor installations to check for corrosion, etc. This is standard maintenance practice for all County sites at \$5,000 per year. This may be slightly lower for CIRC but not a significant difference within the scale of the overall program costs. Other than that, the material and equipment needed during system maintenance is basically same for the two sites, they both will require the same maintenance practices. There are likely to be small cost differences in labor.

All maintenance and support services at CIRC are anticipated to be measurably more expensive than at a tower site due to the added labor effort/time to drive into the garage, locate a parking space, load tools and equipment onto a service cart/dolly, utilize the elevator to travel 20+ floors, climb two flights of stairs and then access the boiler room/radio equipment area. While it may be possible to make this trip in only 15 minutes, we estimate an additional hour per technician will be charged to the project for each on-site trip. As noted in other discussions, contractors will be aware that the need to “run back to the truck for something” will take labor time that cannot otherwise be recovered.

Microwave and land mobile antennas at CIRC are theoretically accessible to inspection without climbing, but in reality, this work is typically performed by a tower crew having appropriate tools, equipment, and training - therefore incurring similar costs to those of WLP and the other sites.

The service elevator is limited in size and weight capacity. System batteries are known to require periodic replacement. These batteries cannot be easily brought up inside the building. Exterior rigging is required to deliver the initial system and may be needed again for future battery replacements. The estimate of labor costs at CIRC over WLP is calculated from Motorola’s hourly labor rates. These rates vary per craft, type of vehicle utilized for travel and crew integrity. Additional costs of delivery support (hoist, crane or helicopter) will be required based on material requirements.

(i) Equipment Support and Maintenance Services

A monthly site visit by a communications technician should be anticipated. Since this would typically be a one-person scheduled event, a small utility vehicle could be parked in the garage and only one trip up and down would be required. The total time a contractor might add to maintenance costs is estimated at 45 minutes to an hour.

If this maintenance event is in response to a failure/emergency event, then several trips to the roof should be anticipated to analyze, troubleshoot, retrieve material and parts from the vehicle, and to secure from the site after completion. This total time could add hours to the



resolution of a failure event. It is also noted that cost estimates must assume premium time rates because unplanned failures can occur any time day or night.

(ii) Microwave System Support and Maintenance Services,

The support of microwave should parallel that of the radio system, although if a companion technician is required at a connecting site, then staging time exists for both parties. For example, a technician at Points of America may have to wait for the CIRC technician to arrive at the equipment before path troubleshooting can begin.

Work on the microwave and P25 antenna systems is generally subcontracted and performed with a crew traveling in a larger vehicle. If an antenna requires replacement or other work rigging is often a necessity. While “spares” could be stored at the roof level, rigging is still required to erect in place. While a daily crew rate for antenna work might be in the thousands of dollars, rigging for the CIRC roof could be in the hundreds of thousands and require an excessive amount of time to facilitate.

(iii) DC Power System Support and Maintenance Services

As previously stated, the batteries in the DC Power System require periodic replacement. Exterior rigging and multiple people in the crew are required. A suggestion has been made that a newer battery technology could be employed both to reduce weight and improve lifetime between replacements. This endeavor is not inappropriate, but it means that the CIRC site would be unique within the County; the other 13 sites would have different equipment. This brings several negative consequences, including:

- Different hardware would need to be identified, vetted, and procured
- Design effort would be necessary to ensure compatibility with the network alarm & diagnostic system
- Spares would need to be supplied and monitored separately
- Service may require different training, or even a different contractor

The benefits of changing the battery system could be a valid pursuit if simply changing the battery design would alleviate all other disadvantages at CIRC. In the context of overall challenges at this site, battery technology is not a substantial issue by itself.

(iv) Civil and Infrastructure Warranty Services, as those terms are used and defined in the Motorola P25 Agreement (including Exhibit C).

Given appropriate design and funding, Motorola will include the CIRC within the overall warranty program. In general, warranty services will be more difficult at CIRC; Motorola may add costs to cover this change. It is also noted that the trips across the open roof areas at CIRC may expose test equipment, tools, and parts to more rain than would occur at the WLP site.

10.5.2 Lifecycle Estimates of Lease Cost Impact

It is well understood that the CIRC will incur monthly lease costs while there is none at WLP. We note that firm lease figures are not established pending final design and acceptance of the CIRC site, to be followed by final definition of lease costs. Estimates in the range of \$6,000 to \$6,200 have been mentioned in informal discussions with CIRC. Based on these estimates, high and low 20-year lifecycle costs for CIRC lease may be estimated:

- At \$5,200 per month, with 2% annual increase, 20 year total cost = \$1,516,156
- At \$6,400 per month, with 3% annual increase, 20 year total cost = \$2,063,645

This cost of \$1.5M to \$2M should be considered when investigating cost differences between the two sites.

10.6 Estimated Comparison of Annual Non-rent Operations Cost:

As previously stated, service costs for labor at CIRC can be expected to be measurably greater due to the inconvenience of access. However, these increases in labor will be negligible in the context of the overall program, with the exception of roof lifts. Deliveries for large/heavy supplies such as batteries and antennas are straightforward at WLP, but will require planning, cost, and disruptions to the public at CIRC.

10.7 Conclusion:

The comparative costs for most items/services between CIRC and WLP are anticipated to be the same. CIRC costs are projected to be higher than WLP for the following items

- Construction/development costs will be higher at CIRC
- Equipment delivery to CIRC will be more complex and time consuming than WLP, delivery cost will be significantly higher for events requiring a lift to the roof
- The costs of service labor at CIRC will be measurably higher due to the greater response time and effort needed.
- Lease costs at CIRC will add up to a significant amount over the life of this system.

As noted above, even if the County were able to negotiate a 50% discount on the CIRC construction costs, both the short term and the long term costs of CIRC are projected to be higher than the WLP site.



11 Other Factors for Consideration

Through the course of this investigation, M&A has identified additional factors that may affect use of a location for the life of the P25 System.

11.1 CIRC Ownership

It is noted that the current owners of the CIRC are cooperative, but it is a business; there is no guarantee that they will not sell the property at some point over the expected 20-30 year life of this site. It cannot therefore be determined how cooperative a future owner might be, and what rate increases may occur in the future.

In addition, we note that no outreach has been made to CIRC residents and neighbors regarding disruptions that would occur during construction and during resupply events over the life of the site. These disruptions will include evacuations, road and sidewalk closures, closures of pool and balconies, relocations of personal storage spaces, etc. Such outreach is likely to bring significant opposition from the residents. *NOTE:* In the event that residents object, there is risk that CIRC ownership could withdraw cooperation and support for the project.

11.2 Permitting

It is noted that Permitting is largely complete for WLP. M&A has identified the following permit status for the WLP site:

- Federal Aviation Administration (FAA) 2/13/18
- National Environmental Policy Act (NEPA) 4/29/19
- State Historic Preservation Office (SHPO) 2/22/18
- FAA Antenna Site Registration (ASR) #1310760
- Permit package submitted to City 3/13/19, on hold pending this IE process

Note: Our understanding is that the NEPA and SHPO permits obviate any need for other environmental permitting at WLP; however this is outside of our expertise.

In contrast, the CIRC Building has the following permits:

- Federal Aviation Administration (FAA) 7/17/19

It has been intended for the CIRC permitting to work in parallel with the WLP Tower site, and this has been an area of understandable frustration for the City. Unfortunately, there are many aspects to the CIRC design that have not yet been addressed; permitting cannot begin until these designs are completed. Most notable among these are related to facility structural load capacity and reinforcement, as well as rooftop hoist design. Some work has moved forward on designs for reinforcement of the Boiler Room floor. Additional designs and analysis pending include:

- Structural load for staging equipment on the roof when lifted from the ground
- Structural load for the far side of the Boiler Room (or other indoor location) for staging of building materials and equipment during the equipment room construction
- Design, mechanism, and acceptable aesthetic appearance for a rooftop hoist to lift materials from the ground
- Structural load for the above rooftop hoist
- Design, mechanism, and acceptable aesthetic appearance for a second rooftop hoist to lift materials from the roof down to the Boiler Room entrance
- Structural load for the above rooftop hoist
- Develop details on design for electrical power, grounding, and lightning protection cable routing, including X-ray testing of cable routes in preparation of building core drilling (requires evacuation of residential areas).
- The City has made suggestions for a revised microwave antenna mounting platform to simplify maintenance; no design or roof loading analysis has been done for this feature.
- Design of stealth coverings for antennas that meets Motorola approval.

M&A understands that the City believes construction time for the two sites would be similar, if they were to both get permitting complete at the same time. Since CIRC still requires significant design efforts this is not considered a differentiator in CIRC's favor.

11.3 Projected Schedule

Table 11-1 shows Motorola's current projection for WLP development. This assumes completion of this IE study on time (August 17 or sooner), and that the County provides a Notice to Proceed (NTP) to Motorola on August 16, 2019. M&A would suggest that the County's NTP may not be quite that instantaneous, but the overall work durations are appropriate. The schedule shows 140 calendar days from NTP to the point where the site is ready for equipment installation.

Table 11-1

Motorola Projected Key Dates		
Description	Start	Finish
County NTP to Motorola for WLP	8/16/19	8/16/19
Order Shelter	8/19/19	8/19/19
Order Tower	8/19/19	9/6/19
Site Civil Work/Prep	9/19/19	9/30/19
Foundations complete	10/10/19	10/10/19
Platform Complete	11/4/19	11/4/19
Manufacture & Ship Shelter	8/20/19	11/21/19
Shelter Install Complete	11/29/19	11/29/19
Manufacture & Ship Tower	9/9/19	12/11/19

Tower Assembly & Stacking	12/13/19	12/24/19
Utility trenching & hookup	12/2/19	1/6/20
Ice Bridge Installed	1/6/20	1/8/20
DC Power System Installed	1/10/20	1/10/20
Antenna & Line Installation	12/26/19	1/2/20
Equipment Installation	1/3/20	1/21/20
Site Restoration	1/2/20	1/14/20
Final Power & Fire Suppression Test	1/10/20	1/21/20
Site Development Complete	1/21/20	1/21/20

In contrast, efforts at the CIRC to complete the effort include the following:

1. Make a series of decisions as to methodology for roof development (hoist vs. crane, how many separate crane lifts, etc.)
2. Develop specifications/Scopes of Work (SOW's) for design efforts
3. Obtain bids from vendors for all design work
4. Manage procurement for the design effort contracts
5. Develop designs for all items above in Section 11.2 (various roof/floor reinforcements, hoist designs, electrical system X-ray test & design, stealth antenna coverings, microwave platform designs)
6. Submit designs to building owner for approval
7. Wait for Owner approval
8. Finalize lease with CIRC Owner
9. Prepare & submit permitting packages for all design efforts
10. Wait for permit approvals, receive permits for all work (45 days if one permit review cycle, 90 day+ if two)
11. Develop specifications/Scopes of Work (SOW's) for construction efforts
12. Obtain bids from vendors for all construction work
13. Manage procurement for the construction effort contracts
14. Coordinate and perform material lift for hoist materials and any necessary roof reinforcements
15. Construction effort to reinforce roof and boiler room, and possibly staging area(s)
16. Construction effort for rooftop hoists
17. Perform lifts of construction materials for equipment room and antenna mounts
18. Perform construction of equipment room
19. Perform facility construction including preparing and implementing cable routes through the building.

The City predicts that after permits are received, items 11-19 above can be complete in two to three months and the facility would be ready for equipment (items 11 and 12 may be started



early via an at-risk development). If we assume that these construction items 11-19 can be done in 70 days, then steps 1-10 above would need to be complete in 70 days to achieve completion as quickly as the 140 day WLP tower schedule. A review of items 1-10 makes it clear that 70-day completion would be extremely challenging.

There are a myriad of details associated with the above list, it is not intended to be comprehensive. The point is that M&A does not see a path by which the CIRC could be completed sooner than WLP.

11.4 Risks for Project Delay

There are many conceivable delays that would impact either site. Following is a discussion of areas in which one site has a greater risk than the other.

- Weather: Severe weather (even untimely periods of heavy rain), could slow down construction at WLP. This might slightly hamper efforts at CIRC, but is not as great a concern.
- Citizen protest: Either site has a potential for protest of the construction. Citizens concerned about WLP are already mobilized, but CIRC residents could become equally challenging to construction efforts.
 - A potential risk to the CIRC is that the Owner could withdraw support for the program in the event that residents object too strongly.
 - Another risk is that on-scene protests could occur at CIRC when a crane is mobilized and roads/sidewalks are shutdown. This would incur cost for remobilization well as schedule delays.
- Permitting: The CIRC could experience delays in permitting; this effort is largely complete for WLP (except for City approvals as addressed in the ILA).
- Owner approval: The CIRC design may not be immediately approved by the Owner; it may take several iterations for a final design to be developed.
- CIRC roof and staging area structure: No investigation has been made into how construction materials will be staged, and what areas of the roof and other areas may need reinforcement.
- CIRC roof damage: in the event that the large amount of materials being moved across the roof causes damage, there may be a need to stop work while repairs are made.
- CIRC Lease: Significant preparation has already been complete, but any lease negotiation is subject to risk of delays.
- CIRC Roof hoist design: Much of the above discussion makes the assumption that appropriate roof hoist design can be achieved, avoiding many separate crane lift efforts. In the event this proves not to be the case, then additional delays, cost, and complexity will occur.

- Stealth covering implementation at CIRC: The example product provided by the City may not be adequate as there is no indication of its survivability in a Category 5 hurricane. Should this material peel loose from an antenna and begin flapping in the wind under those conditions, it is likely to cause antenna failure. There may be delays if a covering is not found that meets both owner approval and survivability requirements. In addition, Motorola may require material RF testing to ensure they will still meet their coverage guarantee.
- Grounding challenges in construction at CIRC: The Motorola R56 standard for communications site electrical systems has very specific requirements that are sometimes challenging to meet in a high rise building environment. Examples include getting low resistance to ground, and avoiding ground loops.
- There is a risk at CIRC of roof damage, given all the material handling. Cost and delay could be incurred in the event of roof damage.
- Challenges in CIRC development have several contractors concerned about liability. Examples include concern about roof damage, HVAC damage when dropping equipment from the upper roof to the Boiler Room entrance, and core drilling through multiple floors for electrical cabling.



12 Interview Summary with Graded Conclusion

To begin the interview process, Monetti & Associates (M&A) developed a 20 question survey based on the ILA and other documents provided by the City and the County. These questions were then grouped together into high level categories and presented in an Interview Questionnaire document under the following topic areas:

1. Site Physical Location
2. Environmental Factors
3. Site Engineering
4. Costs
5. Coverage & Capacity

In order to accommodate comments beyond the above five topic areas, respondents were given opportunity to provide their thoughts in free format in the last (sixth) section "Additional Information" of the questionnaire.

Both the City and the County provided their preferred list of participant's names for this interview process. The City provided a total of 19 individual names and the county provided a total of 14 individual names for a total of 33 names. M&A contacted each individual via email, phone messages or in some cases through the primary representative for the City/County. A healthy overall response to the interview request has been received, as shown in Table 12-1:

Table 12-1: Interview Response

Response Type	Number of Responses	Percent
CITY		
Written responses to the questionnaire	15 out of 19	79%
Phone interview	15 out of 19	79%
Face to face conversation during Site Survey	Remaining 4 out of 19	21%
COUNTY		
Written responses to the questionnaire	14 out of 14	100%
Phone interview	14 out of 14	100%

Given the short timeframe for schedule arrangement this is an extremely robust response to the questionnaires; the level of detail received is documented in this section. Responses include representatives of the City and County as well as contractors and consultants. While some individuals recommended by the City were not available for interview (mostly CIRC building representatives), they were available during the site surveys process. To summarize, a very comprehensive list of viewpoints has been collected from both City and County perspective.

Response Rate

Respondents replied to the questions based on their expertise and knowledge on a topic area. Respondents were instructed to leave a question blank if they had no input or no knowledge of that topic area.

Table 12-2 identifies questionnaire response rates. Section 1: “Site Physical Location” and Section 2: “Environmental Factor” were the most popular topics of discussion and received a response from a majority of respondents; the response rates were 68% and 64% respectively.

Table 12-2: Response Rate by Category

Section	Response Rate
Section 1: Site Physical Location	68%
Section 2: Environmental Factor	64%
Section 3: Site Engineering	35%
Section 4: Costs	33%
Section 5: Coverage & Capacity	23%

At the lower end of the response rate were: Section 3: Site Engineering (35%), Section 4: Costs (33%) and Section 5: Coverage & Capacity (23%). The response rate for these topics were as expected since they tend to be technical in nature.

Each of these topic areas is analyzed in more detail below. There are number of themes that emerge through this analysis of each respondent’s thoughts/comments within each topic area. These themes are summarized the number of respondents that subscribe to those themes is presented under the sub-heading “Interview Analysis”. The final statistical percentage for each summarized theme is then depicted in a pie chart for ease of understanding. For the final statistical pie charts, respondents that had no comment on that topic/theme are not counted. This allows for removal of statistical sample that had no comment or expertise in that topic area to focus attention on the essence of that particular theme.

Finally, M&A’s perspective is presented on each theme based on various factors including:

- M&A’s years of experience in the field
- What is understood from various documentation provided by the City and the County
- Numerous interviews
- Site surveys
- M&A’s independent coverage analysis

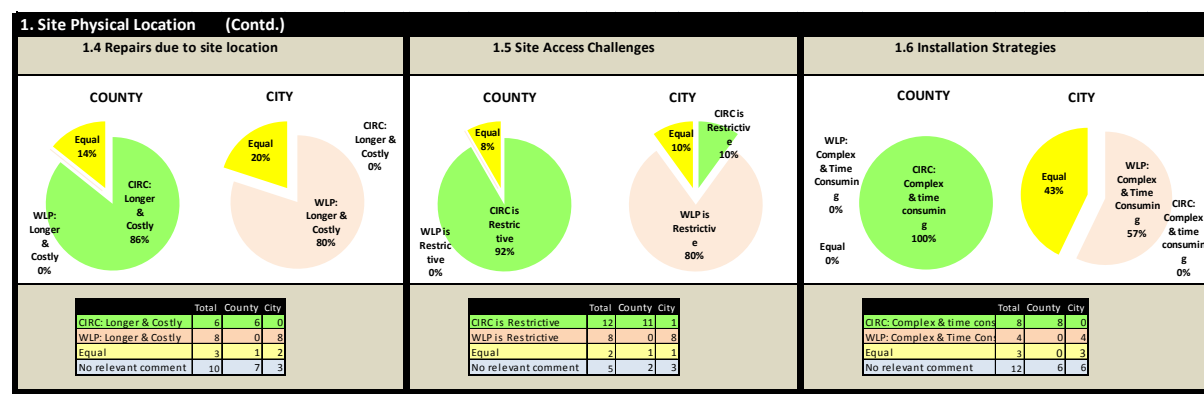
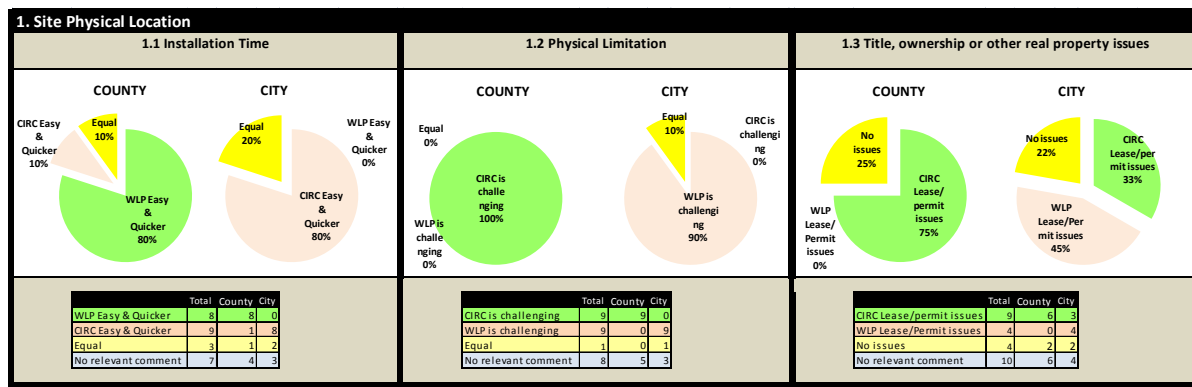
12.1 Interviews - Site Physical Location

This section focuses on the physical characteristics of both sites and received the highest rate of response of all sections. The various physical characteristics dealt with in this section include:

1. Installation time
2. Physical limitation
3. Title ownership or other real property issues
4. Repairs due to site location
5. Site access challenges
6. Installation strategies

The fifth question above dealing with site access challenges received the highest response rate of over 81% of the respondents having something to say. All other questions remained within 60 to 75% response rate.

Interview Analysis



Many issues/comments are offered by the respondents. After conducting interviews, it is generally understood as to the theme of the various contentious sub-topics regarding physical location of the site. The general high level theme is summarized as follows:



City Perspective:

- WLP has only one access road vs CIRC has multiple access roads
- WLP is in environmentally sensitive area vs CIRC is not
- WLP is in an unimproved area and poses logistical issue during extreme weather event
- WLP is so low that maintenance is almost impossible after hurricane
- FEMA requirements are not met at WLP
- Due to bodies of water on both sides and being a wet land there will be problem in construction/foundation at WLP
- Various permits are not approved for WLP
- Being closer to the ocean WLP will have problems with sea level rise and storm surges
- With WLP site residents will protest causing numerous delays
- WLP will take 3-4 months to build tower vs CIRC will take 2-3 months for site preparation and hardening

County Perspective:

- Lease with CIRC is a problem, WLP is owned by county and there are no leasing issues
- CIRC access is restricted being a residential private property
- CIRC has no service elevators
- CIRC will require use of crane, helicopter or hoist
- CIRC rooftops will require reinforcement to bear the weight of the equipment
- CIRC construction will cause significant disruption to the area
- CIRC construction will take longer and be more costly

M&A Perspective

Most of these issues are typical site related issues that have to be dealt with when constructing a tower or any site. Various permits will need to be applied for and obtained from the local agencies. Environmental restrictions have to be honored and accommodated. If the site is in the flood zone then proper engineering designs have to be complied to. All towers or structures have to meet the local zoning and building codes. All towers must comply with latest building standards for the type of structure. If equipment has to be installed in a building then it has to be verified that the building is architecturally sound. From M&A's perspective these are necessary steps for any site.

Most issues raised are valid, but two issues stand out that should be considered for corrective action. These are highlighted below:

- Consideration should be made for improving the access road from the plan for gravel to a paved road, for more reliable access under worst-case conditions.



- It should be acknowledged that recommendation of the WLP site can trigger a protest from the residents

One of the respondents was concerned that the house prices are dropping in the area due to the tower plan and if approved will trigger a protest. We understand that no one wants a tower in view from their residence; M&A notes that the WLP site is approximately 0.25 miles away from the nearest residential building. Towers of the type proposed for WLP exist all across United States and are a necessary structure to support both Public Safety communication requirements and commercial consumption of our constant communications needs. The WLP tower site location currently has nearby both a 150' tower structure and 150' water tower. M&A has not seen evidence of data to suggest that housing values decline at the proposed distance in these conditions.

In contrast, there are nearly 400 residents at the CIRC facility that may be directly impacted by construction at that location, ranging from loss/relocation of their private storage to mandatory evacuations during X-rays and/or equipment lifts to the rooftop. No outreach has been made to these residents.

- CIRC lease could become a problem

M&A believes there is a risk that the recurring lease cost could rise at a rate higher than the average inflation index. Once the equipment is installed the County's ability to relocate to a different site becomes limited. It should be noted at the time of this writing, there is no firm fixed price quote for the leasing arrangement at CIRC Hotel site. This cost is currently being negotiated as a "not to exceed" average based on similar leasing arrangements, until formal pricing is provided by CIRC building management.

- CIRC may require a crane, helicopter or hoist

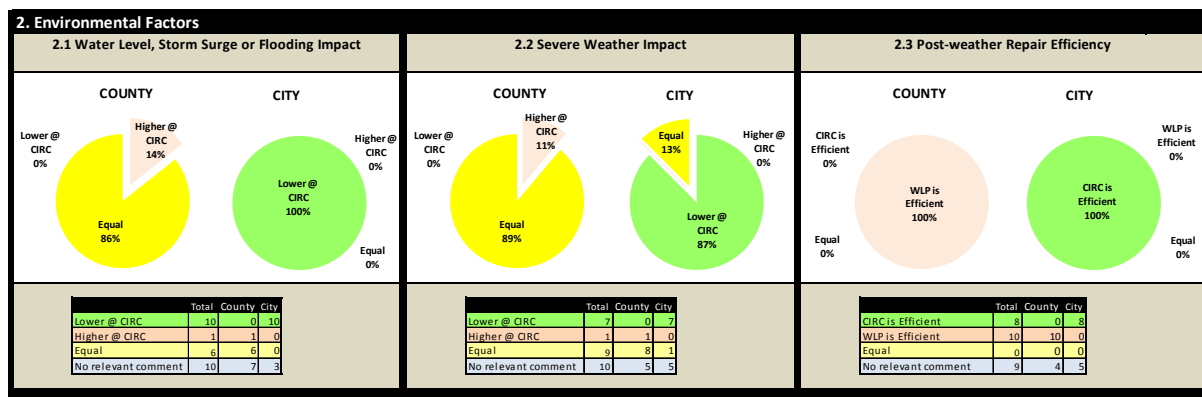
As discussed in more detail in Section 4.1, delivery of major equipment and materials to the CIRC is challenging. This is of particular concern for the equipment racks, which are factory configured and tested prior to shipment. This equipment once staged should not be dismantled in order to keep warranties intact and avoid failures/delays during field installation, optimization, and test. In addition, the microwave dish antennas will not fit existing elevators, nor could they be carried from the elevator up to the roof given the narrow stairway. There are also concerns noted with regard to the ability to hoist or install a permanent hoist on CIRC.

12.2 Interviews - Environmental Factors

This section consisted of three broad questions. First, we needed to hear opinions or experiences on water levels, Storm Surges and Flooding. Second, what do people think about severe weather impacts and Third, post-weather event how much time and effort is required to restore the service to the normal levels.

In general, the response level was healthy with about 63% of the respondents providing response for the first and second question and about 67% responding to the 3rd question in this category.

Interview Analysis



Some of the main concerns expressed were,

1. Flooding at the WLP site and lack of accessibility option during severe weather situation
2. Service restoration delays at the WLP site due to lack of accessibility options
3. Road to the WLP site is not paved
4. Equipment damage at WLP site due to flooding
5. Equipment peeling off from the WLP tower and flying debris hurting nearby residents.
6. Longer response time at CIRC due to restricted access to the building
7. In the event of damage to larger equipment on the CIRC roof, there would be a longer time to repair due to logistical delays associated with delivery of replacement equipment via crane or helicopter. Hoists were another consideration but are seen as challenging to install and operate at this facility.

Other respondents are confident that the tower design conforms to the latest structural codes and complies with the latest TIA standard to withstand the highest wind speeds (up to 185 mph Cat. 5 Hurricane). They are also confident that the County is prepared for response during a flooding event because they have had many towers in the area for many years and have adequate resources and experience with appropriate response protocols during flooding, not just for this tower but also for all other towers.



M&A Perspective

The WLP tower is adequately designed to comply with State code and with EIA/TIA-222 standards and up to 180 mph wind gusts; we also note that Wind Exposure Category C is appropriate for this location as confirmed by a certified Professional Engineer from KCI. Structural design load is appropriate, this site meets standards for the conditions present at the WLP site; fears of collapse are exaggerated.

The equipment at the WLP site is designed to be on a raised platform to appropriately mitigate risk of being impacted by a flooding event. While not required for building code or to meet projected flood levels, M&A suggests that the platform be raised an additional two feet to improve the margin of error and reduce concern of flood damage. We understand that a minor design revision is planned for the platform structure; this increase may be accommodated at the same time.

There is always a possibility of an extreme storm-induced event where equipment can peel off and debris can fly during high winds. While unlikely given proper design, this risk is equal at both the WLP and CIRC sites. In the event that debris does fly off, there is a higher probability for damage or injury from CIRC than WLP due to the proximity and density of population and assets. The closest residential building to the WLP site is at least 0.25 miles away from that site, and the Park is closed during a hurricane; visitors are not expected. In contrast the downtown location of the CIRC building is surrounded by both structures and population.

In case of a storm surge there is a higher probability of access road flooding at the WLP site than the CIRC site, however if the WLP road is paved this risk is mitigated, and the WLP site remains more accessible than some other County sites. The County is prepared, experienced, and equipped to support this situation.

Some respondents were concerned that the tower will fall over like a tree during high winds; this concern is not consistent with communications tower design. With modern engineering advancements it is highly unlikely that the WLP tower could fall over during high winds except in the case of an engineering failure (e.g. poorly laid foundation). In the event of failure, towers are designed to fold in on themselves; at WLP such a failure would fall within the boundaries of the park and not impact the nearby water and wastewater treatment plant. The tower already located at the wastewater treatment plant could pose a greater threat of damage.

In the case of CIRC, some access concerns can be addressed as part of the lease agreement and through pre-vetting staff members. However, there are a series of access challenges for maintenance response as noted in Section 4.1.2 that hamper public safety response during all routine and emergency activities, regardless of the weather. In contrast, storm response at

WLP can be managed, and in most conditions both emergency and routine responses at WLP requires simply driving up to the site.

For the larger equipment that is moved to rooftop using crane, helicopter or a hoist remains a concern due to logistical coordination it requires, this is discussed in Section 4. This coordination requirement can become source of cost and delay for initial installation but more importantly for restoration activity after damage or failure of the equipment.

12.3 Interviews - Site Engineering

This section focused on site engineering aspect of the two sites under 5 topic areas:

1. Compliance to building code, EIA/TIA standards
2. Resiliency
3. Redundancy
4. Maintenance challenges
5. Public safety

The overall response rate was quite low at 35%. This aligns with our expectation as the questions were more technically focused.

Interview Analysis





Numerous comments were made as follows:

- Did not account for proper exposure and topographical category
- Power is not redundant and resilient
- Redundancy should be required for both sites
- Assuming no access issue its easier maintenance at WLP than at CIRC
- Higher maintenance due to closer to proximity to ocean due to salt spray
- WLP is being built at EIA/TIA 222
- WLP is more resilient
- Public Safety:
 - o WLP is isolated and not manned to protect the site
 - o Coverage and shadowing does not provide adequate coverage
 - o Having an antenna or microwave flying off in densely populated area and potentially injuring or killing someone
 - o Shutting down street during installation
 - o WLP has no concern about RF emission safety vs CIRC

M&A Perspective

M&A believes that public safety is of utmost importance and the primary purpose of either of the two sites selected. As per our independent coverage analysis the WLP site provides an overlapping coverage for the International Airport to the north of the county while also providing full coverage for the city of Hollywood. This is an important redundancy and public safety feature inherently built into the site location which makes the whole P25 system resilient. The CIRC site fails to provide this important feature.

With respect to EIA/TIA 222 compliance, it is understood that the WLP site is designed for version G, which was the latest version at the time of project inception. Although an update to version H has since been released, the contractor has analyzed changes in the standard and finds that the design still meets all building codes.

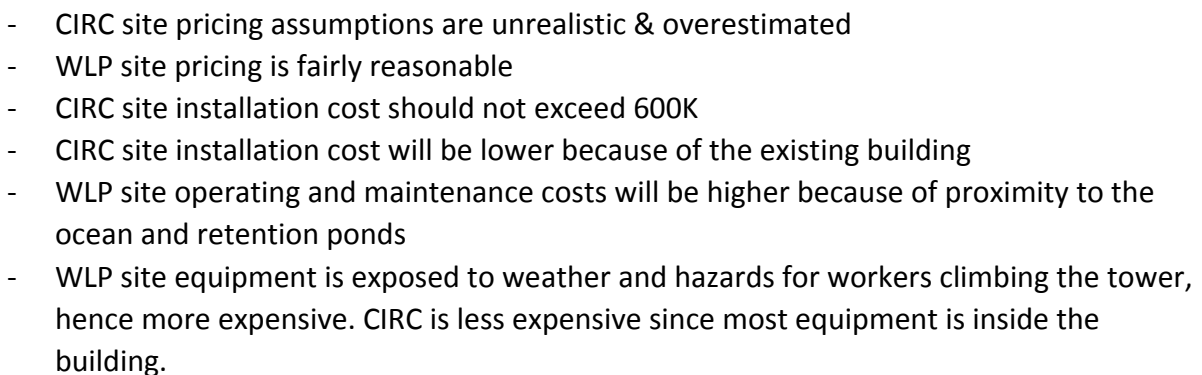
While it is true that antenna flying off from the roof top of CIRC site has high probability of injuring in densely populated areas, this is an extremely unlikely occurrence given the strength of design.

RF emissions safety at the CIRC site would only be a concern for workers on the roof areas of the CIRC building; this is not any risk to the public.



1. Costs of installation, routine repairs, restoration after severe weather events
2. Adequate allocations for capital expenditure increase
3. Annual recurring maintenance costs

Interview Analysis



- Installation at CIRC is more challenging due to the efforts required to bring equipment in, establish and install cable routes, etc..



- Engineering for design and development at WLP is virtually “Off-the-shelf”, whereas there are many unique aspects to CIRC, including antenna mount design, inter-rack equipment cabling, and especially facility construction.
- Routine annual maintenance will be more time-consuming and likely to incur higher cost at CIRC due to the circuitous access as compared to simply driving up to WLP.
- The cost of the communications equipment for both sites is expected to be identical.

However, besides these obvious costs there are other unique costs associated with each site. The WLP site will have a startup cost of construction and annual inspection/maintenance of the WLP tower as an additional line item.

In comparison, the CIRC site will have:

- Building equipment room, Architectural consultations, reinforcing roof-top and other levels, electrical, project management costs
- X-ray testing, evaluation and execution of developing cable routes through the building
- Cost of hauling (e.g. using crane, helicopter or hoist) the equipment to the roof-top and occasionally repeating the process for repairs and/or replacements
- Cost to engineer and construct rooftop hoist(s) for lifting future equipment from the ground to the roof, and from the roof to the Boiler Room entrance.
- Monthly lease payments with associated annual increases.

There may be an opportunity to reduce the cost associated with hauling the equipment to the rooftop through a competitive bid process; costs thus obtained may not be as high as estimated but will still be substantial.

More importantly, any further analysis of cost or construction changes can negatively impact schedule whether it be evaluation of additional quotes for CIRC or additional permitting at either site should significant changes be made. It is our opinion any further delay in schedule can negatively impact the ability for Public Safety and First Responders to do their jobs effectively in support of the County’s population due to the aged radio infrastructure currently in place today.

The cost of maintenance of the site will not be significantly higher or lower due to the proximity to the ocean. The difference in distance from the ocean to the two sites is negligible to consider that to be a significant factor (Reference Corrosion chart, Figure 7-1).

Both sites will be built to provide sufficient protection from the elements and will not have higher or lower exposure to the elements.

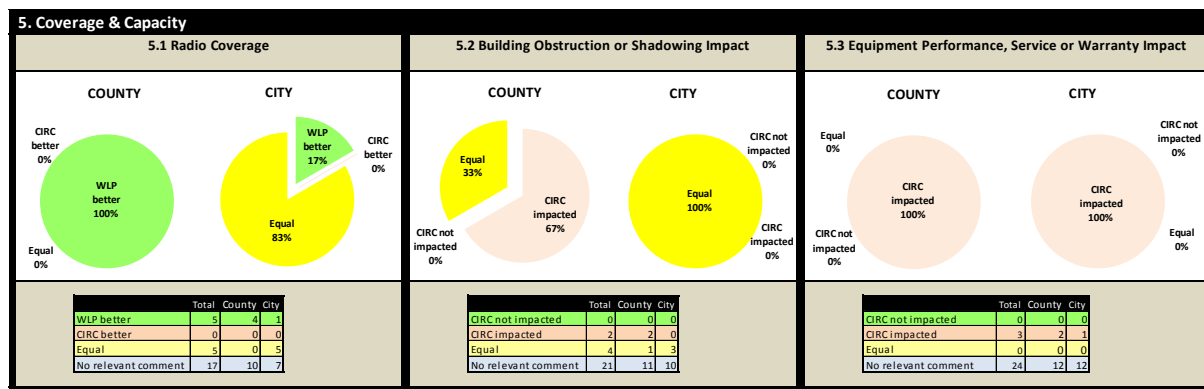
12.5 Interviews - Coverage & Capacity

This topic covers issues related to Radio Frequency (RF) coverage. Three factors were considered covering:

- Expected radio coverage
- Building obstructions & shadowing effect
- Availability of goods & services, requirements to maintain performance

This topic had a low response rate with 37% responding to the 1st question, 22% to the 2nd question and 11% to the third question.

Interview Analysis



In general, there is consensus on the radius of coverage achieved by each site. There also appeared to be consensus that the CIRC installation will impact terms of services and warranty.

On the coverage question, half of the respondents believe that the WLP is a better site, whereas the other half believes that both sites are equal in their coverage.

The respondents perceived coverage as follows:

- For building obstruction and shadowing effect, 1/3rd of the respondents think that the CIRC residence will have shadowing effect which makes it unsuitable site. The other 2/3 believes that both sites will have equal shadowing effect.
- Shadowing at CIRC site will become more problematic due to future high-rise developments
- CIRC site provides better coverage to the south and west and weaker coverage to the north
- Regardless of the site, repeaters and other in-building solutions are required to cover coverage gaps
- No vendor can guarantee 25db in-building coverage without going into each building
- CIRC site can be designed to have better coverage than WLP site



M&A Perspective

The radius of RF coverage will be similar from both sites since the antennas are installed approximately at same elevation.

The WLP site has a few RF coverage advantages that the CIRC Residence does not offer:

- Full overlapping coverage of the International Airport to the north
- Entire coverage is within the County boundary to the south

It is well understood that the RF coverage is never an exact circle nor does it drop-off exactly at the edge of that circle. Certain, engineering assumptions were made when calculating RF coverage for the WLP site. When applying same engineering assumptions to CIRC site, this site falls short in this category. The CIRC site is unable to adequately cover the Airport and will instead have coverage into Miami-Dade County.

13 CIRC and WLP Comparative Analysis

While cost is given much attention, M&A has gained understanding of a variety of factors that need to be considered when comparing the WLP tower site and the CIRC building site. Table 13-1 provides a comparative analysis of these issues.

Table 13-1 (page 1 of 2)

Scoring:	Advantage	1
	Neutral	0
	Disadvantage	-1

		CIRC	WLP
SITE OVERALL CONDITIONS	Purchase/lease arrangement in place	-1	1
	Long-term lease cost	-1	1
	Disruption to the area during construction	-1	1
	Disruption to residents during construction	-1	1
	Proximity, suitability to neighborhood	1	0
	Visible aesthetics	1	-1
	Ease of Equipment/Material Delivery for construction	-1	1
	Ease of Equipment/Material Delivery for operation/maintenance	-1	1
	Ease of access to the site - Regular maintenance	-1	1
	Ease of access to the site - 24/7 emergency maintenance	-1	1
	Ease of access to the site - Grey-Sky maintenance	1	-1
	Ease of access for antenna & battery replacements	-1	1
	Site security	0	1
	Expansion capability	0	1
	Construction Permitting & Approvals	-1	1
	Environmental Permitting & Approvals	1	1
	Wetland constraints	1	0
	Flood zone issue	1	-1
	Power & fuel tanks protected	1	1
	Power feed - underground	1	1
	Emergency and/or backup power	1	1
	Ease of construction	-1	1
	Grounding & bonding; R56 Standards compliance challenges	0	1
	Need for stealth materials/construction, possible RF degradation	-1	1

Table 13-1 (Page 2 of 2)

		CIRC	WLP
EQUIPMENT HOUSING	Sufficient space; now & future	1	1
	Sufficient electrical panel breakers	1	1
	Secure shelter; alarms, cameras	1	1
	Sufficient cable entry ports	1	1
	Reasonable distance: equipment room to antenna structure	1	1
	Temperature control & monitoring	1	1
	Fire/smoke monitoring	1	1
	Lightning & surge protection	1	1
	Sufficient HVAC	1	1
ANTENNA MOUNTING STRUCTURE	Meets FAA requirements	1	1
	Is structure FAA lighted	1	1
	Meets standards for RS222	1	1
	Sufficient tower space for proposed antennas	1	1
	Sufficient tower space for future antennas	1	1
	Cable tray/conduits to equipment shelter	1	1
	Known ground resistance	-1	1
COVERAGE	Coverage meets requirements for County-wide system	1	1
	Coverage provides redundant overlap at FLL airport	0	1
SCORE		12	34

It is believed that costs for CIRC will exceed costs for WLP. Even without cost as a factor, M&A reaches the overall conclusion that there is an overwhelming preponderance of factors which favor WLP over CIRC, and recommend that the project move forward with the WLP Tower Site.

14 Technical Analysis

14.1 Overview

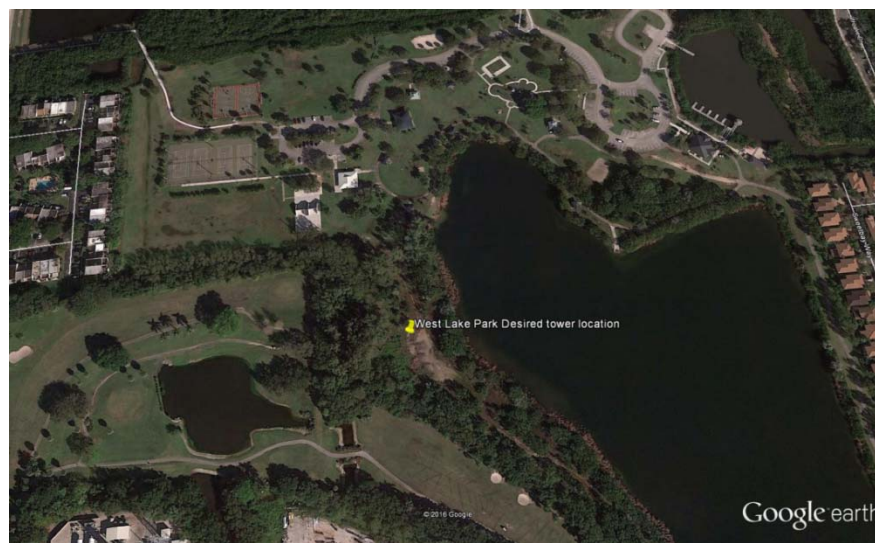
In summary of the technical findings of this report, M&A finds that the WLP Tower Site is either the same or better choice than CIRC for virtually all aspects of design and performance.

- Construction: WLP is straightforward and standard, CIRC is complex and unique
- Accessibility: WLP has easy access, CIRC is circuitous and time-consuming. WLP may suffer from delays in access immediately after a hurricane; County resources ensure these delays will not be substantial.
- Coverage: WLP provides overlap into FLL, CIRC provides coverage into Miami-Dade
- Reliability: Equivalent
- Survivability: Equivalent
- Maintenance: WLP offers easy, reliable maintenance techniques, while CIRC is a challenge simply to bring tools and supplies to the equipment.
- Resupply: WLP is a straightforward drive-up site, CIRC requires disruptive lifts from street level
- Initial Cost: WLP is a known part of the fixed-price contract with Motorola, CIRC has many design and cost unknowns.
- Ongoing cost: CIRC has a monthly lease which will add up to a substantial sum over the life of the site.

14.2 Appearance

The most significant down-side to the WLP site is its appearance in a park. While it would be ideal if this were not the case, M&A notes that there is already another tower nearby, and that there are relatively few homes within sight of the tower. Figure 14-1 shows this layout.

Figure 14-1



Figures 14-2 and 14-3 below provide renderings of the tower appearance from different perspectives.

Figure 14-2: View From Coolidge Street



Figure 14-3: View From Homes on East Side of the Lake





14.3 Alignment with the Motorola P25 Agreement

In an overall comparison of alignment with the P25 Agreement Standards (Motorola contract), M&A finds that either site could meet the primary criteria of supporting the equipment and achieving the necessary coverage. However, the disadvantages and risks associated with the CIRC noted above outweigh the benefits it would offer.



15 Summary of Findings

As described in preceding sections, our findings have been determined after careful investigation and utilizing several methodologies and categorical metrics. These methodologies included:

- Extensive review of all documentation provided to us by City and County representatives
- Conducting 29 individual interviews and collecting 29 questionnaires to understand all stakeholders' perspectives
- Conducting individual site visits while getting an understanding of permitting and approvals for both CIRC and WLP sites.

This data serves as the foundation for the analysis which, when coupled with M&A team experience in P25 networks, yields a conclusion that deployment at West Lake Park is the best alternative.

Though the 44-day process, a considerable amount of misconception has been found about the integrity of the WLP site location and the ability to build a standalone tower in this environment. Having said this, we respect the opinions of those who may disagree with the selection of West Lake Park.

The high-level elements that drive the WLP choice is ease of deployment, accessibility, and the ability for WLP to be deployed quickly based on where the schedule is across various aspects of the permitting, design, final costing, pre-staging approach, build, test and turn up of the site.

The CIRC site has shown risk to the schedule based on the need for a final design, lease agreement, FAA approvals, site access and construction of the site.

It is also noted that approximately 400 city residents could be affected by construction at the CIRC, many of whom may have to be evacuated from their homes during certain aspects of the construction. This is associated with the use of X-Ray systems necessary for pinpointing the location of tension cables/bars in the concrete. Evacuation is also associated with potential safety issues caused by the use of a crane or helicopter operations to bring equipment to the roof and the equipment room, should a reasonable hoist solution not be achieved. It is found the total weight of the equipment to include the concrete to build the raised platform at CIRC equipment room would exceed the maximum load of 14,000 pounds loading for the room in which to deploy the radio, power system and backup batteries. Challenges are also found in generator installation in the garage area.



Having made these points, it is understood that there exist opposing views; if the CIRC was the only choice it could in fact be built. However, based on this analysis and M&A's experience, WLP stands out to be the choice for the reasons highlighted in this report. M&A believes that the current progress made with WLP will introduce less risk to schedule thus providing benefits from the perspectives of public safety, citizen safety, and citizen well-being. The existing network is beyond its reliable service life, thus any program delays introduce public safety operational risk. Failures in the old radio system may negatively impact the ability of public safety responders to perform effective emergency response without reliable communications to drive mission effectiveness and response time to help save lives.



16 Conclusion and Final Recommendations

The M&A conclusion and final recommendation is to move forward with the WLP site deployment. This is based on decades of experience designing, recommending and supporting the deployment of public safety radio networks. As noted throughout this document and summarized in Table 13-1, there are many advantages to WLP over CIRC, even if cost is not considered.

We understand that there is citizen opposition to the WLP site. However, we note that there would be significantly greater disruptions to citizens in and around CIRC that affect many more people. These impacts are much more direct than impacts to residents near WLP. These CIRC residents have not yet been “activated” by outreach describing the disruptions that they would encounter; strong opposition to the CIRC should be expected if they are given the opportunity.

Disasters such as Hurricane Andrew and Irma (and many others) have driven many improvements to the design and standards for deploying standalone radio towers in storm-stricken regions of the United States. WLP construction is designed to these standards; Motorola as the turnkey contractor is taking responsibility for developing a safe site that can be properly maintained during blue sky and gray sky days. M&A has confidence in the WLP design team after having met with the related engineering, contracting and tower construction teams during the site visit.

M&A has two recommendations for consideration to further improve the design safety margin at the WLP site. These include:

- Upgrade the plan for the access road from gravel to paved surface for more assured access during gray sky post storm recovery activities
- Increase the elevation of the raised slab an additional two feet (2') to provide additional protection against storm surge.

While either site can meet overall county-wide coverage goals, WLP offers an advantage in that it provides overlapping coverage of FLL airport in support of airport security and fire operations.

M&A is prepared to brief both City and County commission offices on the findings of this report. It is hoped that this report not only helps to allow the P25 project to move forward, but also provides the City an opportunity to understand the independent assessment and to provide confidence and peace of mind that WLP will work satisfactorily.

M&A understands the repercussions of citizens opposed to this final recommendation who live within view of the WLP tower site. This has been an issue under careful consideration as part of the evaluation. M&A also takes into account the impact of citizens living at and near CIRC, the



disruptions they may encounter during construction/resupply, and concerns they might have with the construction and post deployment site access by non-residents as well of the concerns and strain on building management relocated those citizens while dealing with objections to the build and inconvenience should citizen outreach be organized, with those citizens having their permanent residence at CIRC.

M&A remains available to support both County and City representative as needed to support ongoing efforts. We trust this report helps to alleviate any misconceptions and associated opinions of WLP while providing some evidence of reduced risk in schedule which should reduce the risk of the existing radio network failing, negatively impacting first responder's ability to serve the public.

M&A has addressed all items required in the ILA; the requirement to address "...other factors he or she determines to be material..." are detailed in Section 11 above. Table 16-1 provides a summary of M&A responses to the specific questions raised by the ILA.

Table 16-1 (Page 1 of 2)

ILA Summary Matrix : M & A Response	
ILA Language - Section 2.3	M & A Response
Capital Costs Estimates	
(a) The Independent Expert's estimate of the total reasonable cost of constructing and installing an operational WLP Tower (including all hard and softs costs and all associated equipment; e.g., shelter/environmentally controlled room, 100 kw generator, etc.) after consideration of County's estimates, and in accordance with the P25 Agreement Standards (the "Expert's WLP Capital Cost Estimate") (the Parties stipulate that such reasonable costs shall include but not be limited to expenditures required to maintain Motorola's applicable system performance guarantee(s)); and	\$770,021 As discussed in Section 10, cost is not a substantial factor in the site selection decision. WLP tower site costs offered by the County are appropriate for a system integrator/prime contractor. WLP is lower cost both initially and long term.
(b) The Independent Expert's estimate of the total reasonable cost of constructing and installing an operational system at the Circ Site (the "Circ System") (including all hard and soft costs and all associated equipment e. g., shelter/environmentally controlled room, 100 kw generator, etc.) after consideration of County's and City's estimates, and in accordance with the P25 Agreement Standards ("Expert's Circ Capital Cost Estimate")(the Parties stipulate that such reasonable costs shall include but not be limited to expenditures required to maintain Motorola's applicable system performance guarantee(s)).	\$2,129,559 As discussed in Section 10, cost is not a substantial factor in the site selection decision. CIRC site costs offered by the County may be high in some areas and may be missing some required tasks. Even if those costs were to be negotiated to half of the quoted amounts, WLP is still lower cost both initially and long term.

Table 16-1 (Page 2 of 2)

ILA Summary Matrix : M & A Response	
ILA Language - Section 2.3	M & A Response
Operating/Support and Maintenance Cost Estimates:	
For purposes of this Agreement, "Site-Specific Support and Maintenance" means the goods and services necessary to provide at the applicable site (i) Equipment Support and Maintenance Services, (ii) Microwave System Support and Maintenance Services, (iii) DC Power System Support and Maintenance Services, and (iv) Civil and Infrastructure Warranty Services, as those terms are used and defined in the P25 Agreement including Exhibit C.	As discussed in Section 4-9 of the report, the WLP site is a better selection than the CIRC facility.
(c) The Independent Expert's estimate of the annual Site-Specific Support and Maintenance cost of the WLP Site, based upon the average annual cost per site to County of Site-Specific Support and Maintenance (excluding any rent payment) of the free standing towers in the P25 System, adjusted for any unique conditions at the WLP Site that the Independent Expert determines will affect the Site-Specific Support and Maintenance for the WLP Site (the "Expert's Base Annual Nonrent Operations Cost Estimate")	As discussed in Section 10.5, costs for WLP and CIRC will be similar except for additional labor-hours needed for response to CIRC, and costs associated with any equipment lifts needed for battery replacements at CIRC. We estimate that most services are identical; CIRC will encounter additional labor hours for access time, while WLP may be slightly higher for annual inspection. Estimated cost difference = \$0
The Independent Expert's estimate of the annual Site-Specific Support and Maintenance cost of the Circ System, based upon the average annual cost per site to County of Site-Specific Support and Maintenance (excluding any rent payment) of the other rooftop locations within the P25 System, adjusted for any unique conditions at the Circ Site that the Independent Expert determines will affect the Site-Specific Support and Maintenance for the Circ Site ("Expert's Annual Circ Nonrent Operations Cost Estimate").	As discussed in Section 10.5, costs for WLP and CIRC will be similar except for additional labor-hours needed for response to CIRC, and costs associated with any equipment lifts needed for battery replacements at CIRC. We estimate that most services are identical; CIRC will encounter additional labor hours for access time, while WLP may be slightly higher for annual inspection. Estimated cost difference = \$0
Comparison/Feasibility:	
A comparison, based on the best available information (as determined by the Independent Expert), between (i) the radio coverage and level of service that would reasonably be expected to be provided by the Circ System, in accordance with the P25 Agreement Standards, and (ii) the radio coverage and level of service that would reasonably be expected to be provided by the WLP Tower, in accordance with the P25 Agreement Standards;	Coverage at WLP is preferred over CIRC, as discussed in Section 2.
The Independent Expert's conclusion as to whether (i) the Circ System would meet or exceed the minimum P25 Agreement Standards (including for signal reliability); and (ii) on balance, considering all of the relevant factors including those referenced in this Agreement, other than the overall cost of each option, whether the Circ System would be equal to or better than the WLP Tower in terms of reliably protecting public health, safety, and welfare for the useful life of the P25 System (items (f)(i) and (f)(ii) are the "Circ Conditions").	(i) The CIRC site could be brought up to minimum standards for P25 operation (ii) The CIRC site would not be equal to the WLP site in terms of reliably protecting public health, safety, and welfare for the useful life of the P25 System.



17 About the Independent Expert Company; Monetti & Associates LLC

Monetti and Associates provides Professional Consulting and Engineering services for Public Safety (P25/LMR Radio Systems), State and Local, Smart Cities/IoT, Federal, Commercial and private sectors to include the Oil and Gas, Sea Ports, Aerospace industries and others. Professional Services include Strategic Partnering consulting, Business and Market Development planning and execution, technology scouting for government agencies and proposal development support. Engineering design services cover a broad range of technologies to include P25/LMR Radio systems, Network Engineering, Systems Engineering, IT Architecture, Cloud, Cyber Security and other Telecommunications to include 4G LTE, 5G, CBRS OnGo/Broadband Private LTE, Microwave, satellite and Optical switching (DWDM).

Mr. Monetti is an experienced, self-motivated executive who has worked in the information and communications technology sector for the past 35 years. He has held senior and executive management level positions leading large and small teams working for IT and Telecom equipment providers and systems integrators to include Lucent Bell Laboratories. He is a motivating and inspirational business leader who maximizes team performance.

He has conducted business globally in over 24 countries on 5 continents developing a deep respect and understanding for other cultures and their business practices. He has developed successful indirect channel strategies across U.S. Federal, Enterprise and Service Provider markets worldwide. He was part of a team responsible for the first transfer of technology between the US Government and the Peoples Republic of China.

Gary enjoys evangelizing new disruptive technologies which stems from his background working at Bell Laboratories for 10 years. His clients have consisted of commercial Service Providers, Enterprise, Systems Integrators and US Federal Government agencies. He has led industry research studies and market segment analyses for executive leadership teams and CEO's and led the Cyber Security Business for Bell Labs Internet Research Lab. The most recent years have to serving a wide variety of customers while growing Monetti & Associates LLC which he founded in October, 2014 he founded to focus on bringing experts in the public and private sectors together to provide comprehensive solutions to some of the most difficult problem



Appendix A – Radio Coverage Map Book



CITY OF HOLLYWOOD, FL

700 MHz COVERAGE ANALYSIS MAPBOOK

**Coverage Prediction Maps for
West Lake Park and CIRC Hotel**

August 7, 2019

Coverage Prediction Map Explanation 1 of 4

❖ Mapbook

This Mapbook shows predicted coverage inside large industrial buildings [25 dB] for a handheld portable radio worn at the hip level. Maps are for both talkout and talkback as it is assumed that the system design is balanced. Radio coverage is based on P25 digital modulation.

❖ Introduction

Radio reception is based on where the user is located in the coverage footprint, the terrain, proximity to the transmitter(s), and how well the RF system is designed. Other elements that may affect coverage includes vegetation and buildings [signal shadowing and attenuation]. Other variables affecting coverage may include co-channel, or adjacent channel, interference that a user may receive from neighboring systems that are licensed on the same frequency.

❖ Definitions.

PERCENT RELIABILITY is the message success rate within the predicted coverage area. All radio coverage is based on probability theory as radio coverage cannot be guaranteed 100% of the time. Radio coverage at a specific location from a distant transmitter can be specified as a percentage probability of successful communication. *Public Safety typically specifies 95% reliability.*

DAQ [Delivered Audio Quality] is the coverage performance standard that defines a minimum Channel Performance Criteria [CPC]. CPC requires the performance conditions to provide a certain DAQ. Public Safety typically uses DAQ-3.0 for analog and DAQ-3.4 for digital for system design. DAQ ensures that radio audio is clear and intelligible throughout the 95% coverage area.

❖ Coverage Modeling

- Coverage is modeled using RadioSoft ComStudy software
- Propagation analysis model used is Longley-Rice, which uses terrain roughness to statistically model coverage performance
- Digital terrain used is 3-arc second [400-points per mi² terrain data]
- Coverage performance is 95% reliability with a Delivered Audio Quality [DAQ] of 3.4; these are recommended values for Public Safety communications systems.

Coverage Prediction Map Explanation 2 of 4

❖ Coverage Modeling

- Delivered Audio Quality [DAQ] is per TIA/EIA-TSB88 document as follows

DAQ	Subjective Performance Description
-----	------------------------------------

1	Unusable - speech may be present but unreadable
2	Understandable with considerable effort. Frequent repetition required due to Noise/Distortion - <i>Threshold operation</i>
3.0	Speech understandable with slight effort. Occasional repetition required due to Noise/Distortion
3.4	Speech understandable with repetition only rarely required. Some Noise/Distortion
4	Speech easily understood. Occasional Noise/Distortion
4.5	Speech easily understood. Infrequent Noise/Distortion
5	Speech easily understood

- Portable loss values based on IEEE Transaction on Vehicular Technology, *"Portable Radio Antenna Performance in the 150, 450, 800/900 Bands Outside and Inside Vehicle"*
- Coverage reliability per TIA/EIA-TSB88 document: *"Performance in Noise and Interference-Limited Situations - Recommended Methods for Technology-Independent Modeling, Simulation, and Verification"*
 - ✓ Coverage reliability of 95% is a statistical calculation in time and location; simply stated, if the white area is broken into 100 grids, then 95 of the grids will offer successful communications
 - ✓ For 50% reliability, if the white area is broken into 100 grids, only 50% of the grids will offer successful communications
- The computer coverage model is sensitive to digitized terrain; in certain cases USGS digital terrain data points may not be accurate.
- Path loss prediction DOES NOT include Land Use/Land Cover [LULC] dataset.
- The model does not account for the tower effect on the antenna pattern, actual antenna patterns may affect coverage performance
- Portable radio height is at hip level [3.5-ft], Mobile antenna height is assumed to be 5-ft
- Effective Radiated Power [ERP] of 120 watts is used from the Motorola proposal.

Coverage Prediction Map Explanation 3 of 4

❖ **CLEAR Area of Map / Depicts In Street**

This portion of the map represents locations where the predicted coverage meets or exceeds the minimum performance criteria of 95%, and a DAQ-3.4 for in-street coverage

❖ **GREEN Area of Map / Depicts 20 dB Buildings**

This portion of the map represents locations where the predicted coverage meets or exceeds the minimum performance criteria of 95%, and a DAQ-3.4 for 20 dB buildings

❖ **CLEAR Area of Map / Depicts 25 dB Buildings**

This portion of the map represents locations where the predicted coverage meets or exceeds the minimum performance criteria of 95%, and a DAQ-3.4 for 25 dB buildings

❖ **YELLOW Colored Shaded Area of Map / POOR-NO COVERAGE**

This portion of the map represents locations where the predicted coverage does not meet the minimum coverage performance of 95%, DAQ-3.0 for analog and 3.4 for digital.

❖ **Coverage Map Accuracy**

Is based upon RadioSoft software algorithm, propagation model selected, and the terrain database. Coverage maps provided by other sources may show different results than those provided in this Mapbook based on alternate prediction software and/or prediction models used. We feel that our maps provide realistic coverage.

Coverage maps do not represent or imply any warranty by Monetti & Associates that the definition of 95%/DAQ-3.4 are satisfied at all points in the coverage area

Coverage Prediction Map Explanation 4 of 4

❖ Note on Building Coverage

Radio propagation inside buildings is much more complicated than propagation in free space. A number of factors affect radio coverage inside a building. The building's relative location within the coverage footprint is a factor; for an example, a building located in the coverage fringe area may be more difficult to communicate with one close to the transmitter site. Other factors affecting coverage is the building's size, number of floors, layout and the materials with which the building is constructed.

When propagating into buildings, radio signals pass through various materials before reaching the hand-held portable receiver's antenna. The interaction of these radio signals with building materials results in lower signal strength. Signals entering a building will be partially absorbed and partially reflected by the building materials. To illustrate this concept, a signal traveling through a simple glass window will lose less signal strength than a similar signal traveling through a glass window containing high concentrations of lead or other metals. In a similar scenario, a signal will propagate through concrete more readily than through concrete with steel re-bar.

Building types and related sample building losses

3 dB to 6 dB	Typical wood frame residential building
6 dB to 12 dB	Typical concrete or brick residential building; low rise shopping center; fast food restaurants, gas stations, convenience stores
15 dB to 35 dB c	Typical School, concrete or brick; small apartment building; small single story business; concrete and steel medical office; small to medium factory; city office buildings
20 dB to 40 dB	Large downtown concrete/steel building, high density, large commercial building, large enclosed shopping mall, medium to large hospital or government building

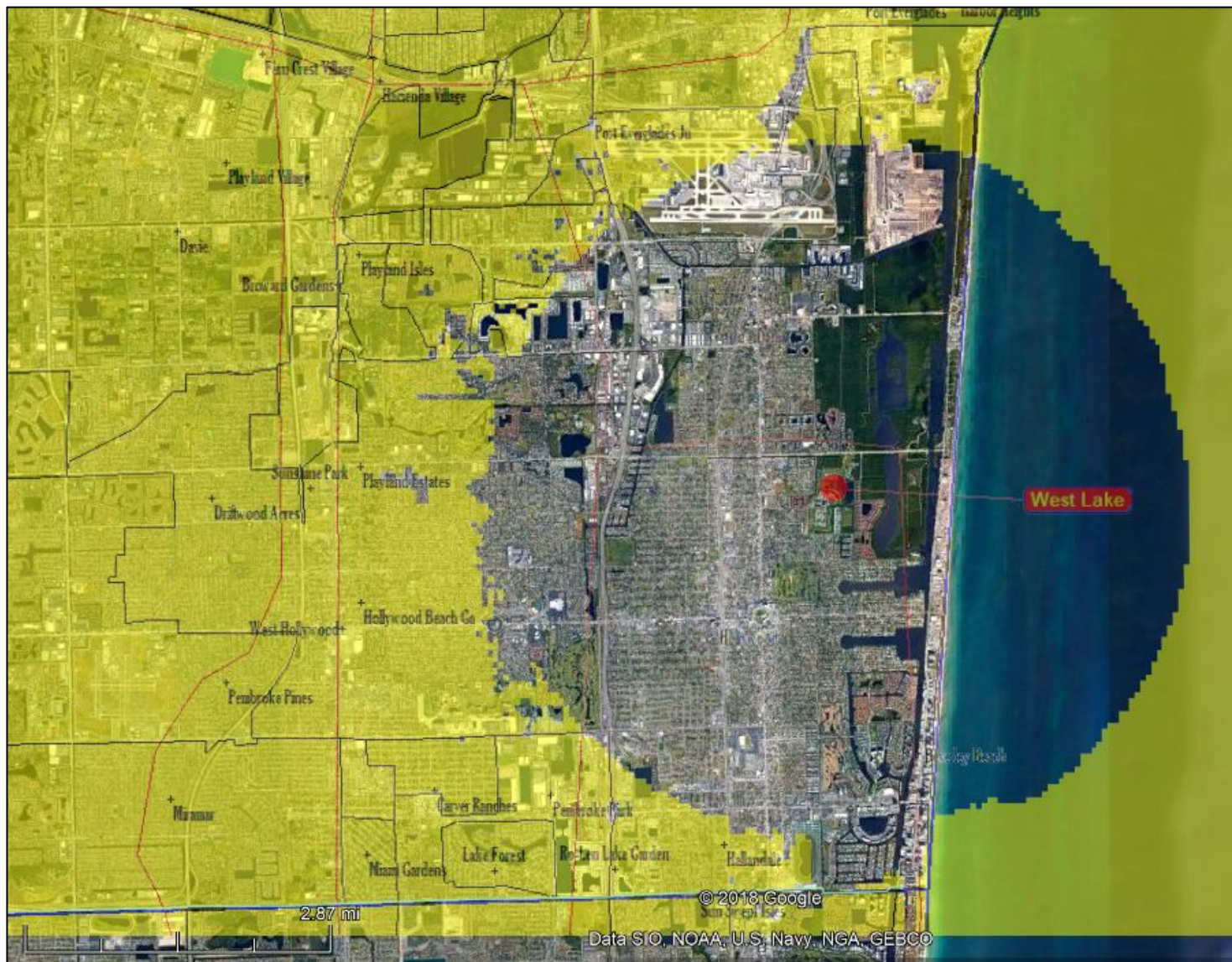
Coverage Map Index

COVERAGE MAPS

Page-7	Map-1	West Lake Park Tower
Page-8	Map-2	CIRC Hotel

COMPOSITE MAPS

Page-9	Map-3	West Lake – Street/20 & 25 dB buildings
Page-10	Map-4	CIRC Hotel – Street/20 & 25 dB buildings



Map-1

West Lake Park

700 MHz

**95% Reliability
DAQ-3.4**

ERP: 120 w

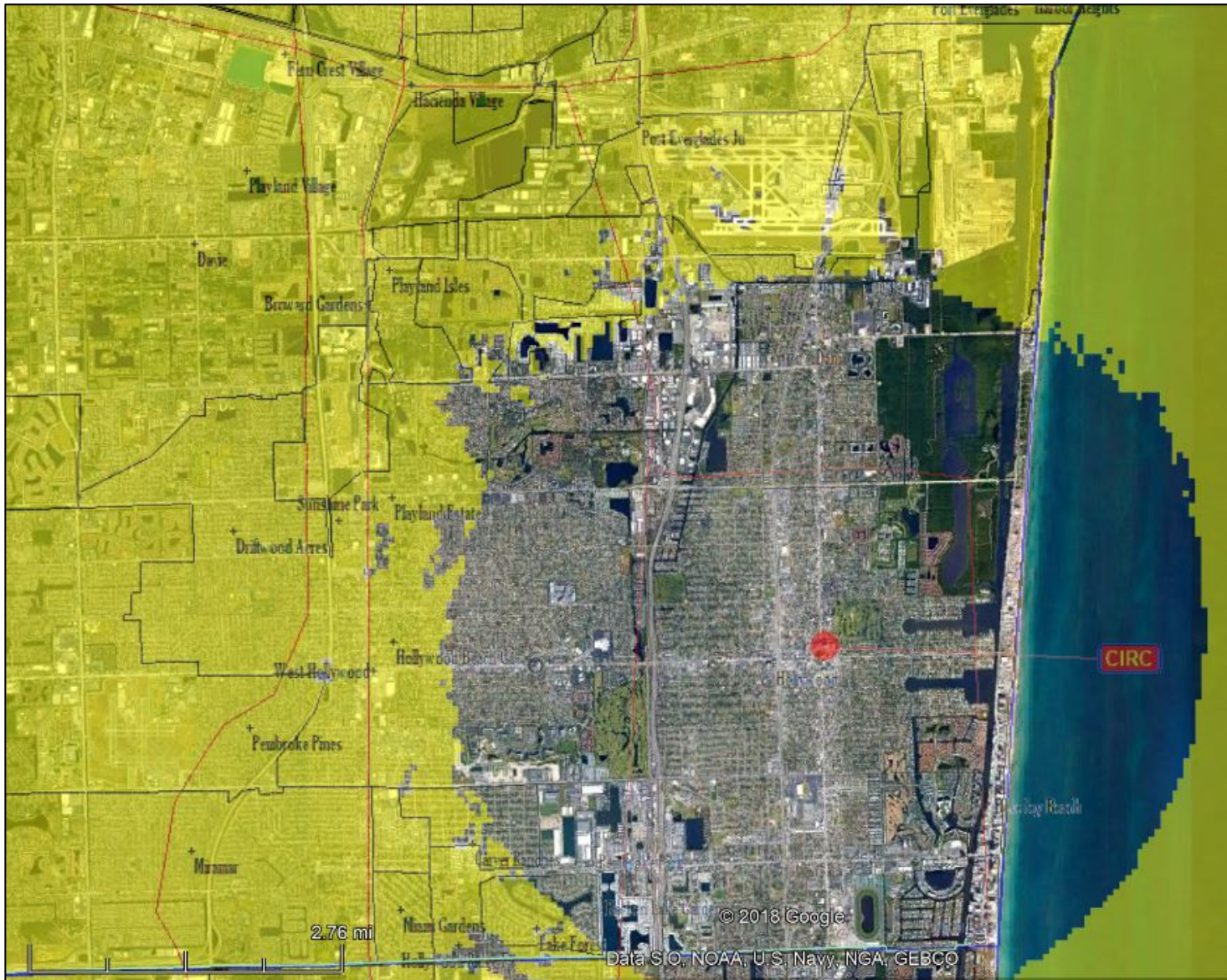
AGL: 310'

CLEAR AREA

Reliable Handheld
Portable [hip level] inside
25 DB buildings

YELLOW AREA

No/poor coverage



Map-2

CIRC Hotel

700 MHz

**95% Reliability
DAQ-3.4**

ERP: 120 w

AGL: 320'

CLEAR AREA

Reliable Handheld
Portable [hip level] inside
25 DB buildings

YELLOW AREA

No/poor coverage

Map-3

West Lake Composite

Clear: In-Street
Green: 20 dB Bldgs
Red: 25 dB Bldgs

700 MHz

95% Reliability
DAQ-3.4

CLEAR AREA

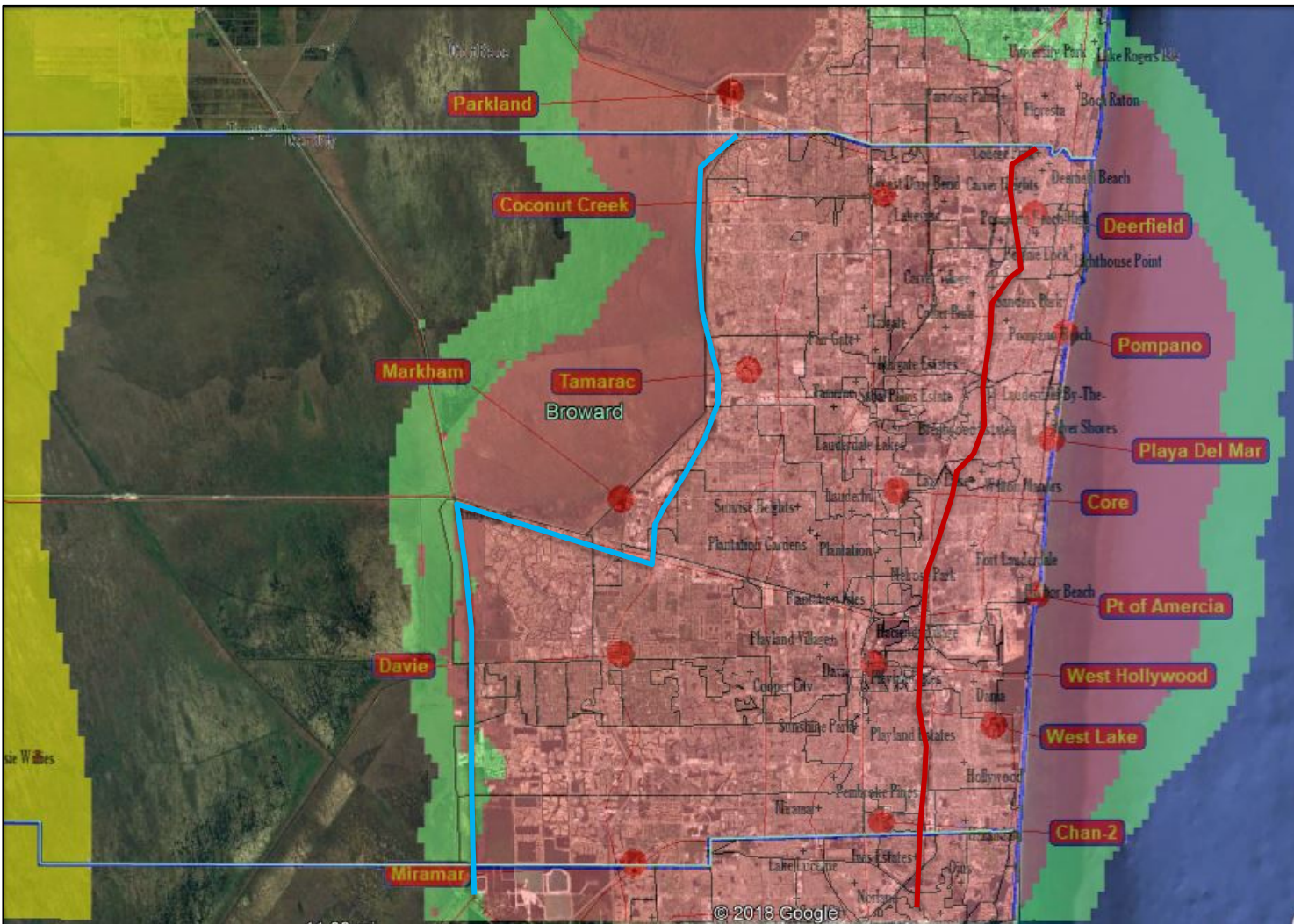
Reliable Handheld
Portable [hip level] inside
25 DB buildings

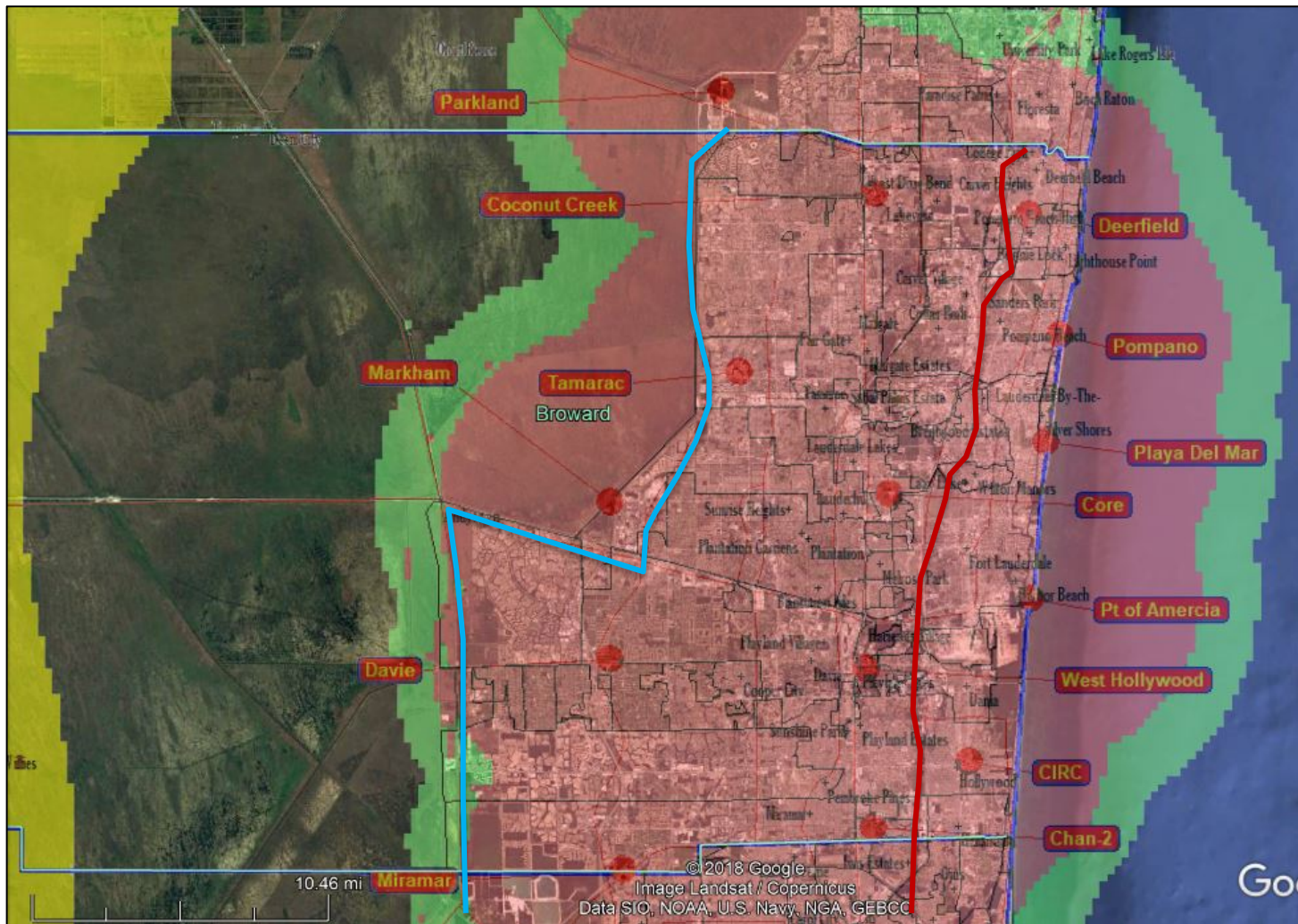
YELLOW AREA

No/poor coverage

RED: 195

BLUE: US27/Sawgrass/595





Map-4

CIRC Composite

Clear: In-Street
Green: 20 dB Bldgs
Red: 25 dB Bldgs

700 MHz

95% Reliability
DAQ-3.4

CLEAR AREA

Reliable Handheld
Portable [hip level] inside
25 DB buildings

RED: I95

BLUE: US27/Sawgrass/595

YELLOW AREA

No/poor coverage