

**WHITEWATER SPRINGS POA BOARD OF DIRECTORS MEETING
OCTOBER 25, 2016**

**AGENDA ITEM XV
INTERNET/CELL SERVICE**

CELLULAR SERVICE GOALS TO WWS COMMUNITY

GOALS:

1. To provide Cellular service to the WWS Community that can be accessed from all lots in the community.
2. Create a RFP that outlines overall objectives of project, to gather detailed information on pricing, equipment, layouts, design.
3. Locate Cellular providers who will provide cell service with a Db of no more than 55 to the entire WWS area.
4. Locate Cellular tower installers who can install and maintain towers and equipment at a cost that is acceptable to the WWS POA Board and in accordance with the RFP.
5. Create a project plan for the WWS POA that is inclusive of the above information and present it to the WWS POA Board for review.
6. Based on the review of the WWS POA Board either proceed or not with the project.

CELLULAR SERVICES OBJECTIVES TO WWS COMMUNITY

OBJECTIVES:

1. To provide Cellular service to the WWS Community that can be accessed from all lots in the community at a cost that is acceptable to the local community with minimal disruption to the local areas and meet or exceed current services that are used.
2. Create a project plan that outlines overall details of the project and present it to the WWS POA Board for review and acceptance.
3. Implement the project with WWS POA Board approvals.

WWS Technology Committee Report

FAST (Fiber and Sky Transport)

Fiber Optics & Cellular Project

3/3/15

Objectives:

1. To bring High Speed Internet to the WWS development at the best price with the latest technology.
2. To bring Cell service to the WWS Development at the best price with the best quality and technology.

Executive Summary

A fiber optics system is the backbone to support high speed internet, better phone service, improved security systems and higher quality entertainment options such as streaming video. Community wide cell service is possible by installing cell signal repeaters that can use the fiber optic backbone. The capital cost for a complete Microwave-Fiber & Cell system runs less than \$1200 per lot or \$510,000.00.

If all lots were charged a fee of \$1,200 for a total of the 513 lots that would be \$615,600.00 approximately or about \$105,000 more than needed to do both projects with a fiber backbone to all lots with utilities and have funds in the reserve for those in the future when built out.

Total number of lots within the WWS Community is: 513 according to Goodwin Management as of 3/2/2015 with 39 properties for sale within the development according to the Austin MLS.

Operating costs for internet services will be paid by charging competitive rates to at least 40 of the 65 existing homes in the community. Cell service is a "community expense" like roads, with all revenues going to the cellular phone company and all expenses paid by the WWS POA through assessments.

Cost Summary of Project Options

	Capital Cost	Cost per Lot
Fiber Optic Backbone, Microwave tower giving Internet services and WiFi inside home Cell services without cell towers	\$360,000	\$800
Fiber Optic Backbone, Microwave tower giving Internet services, Cell towers & cell service community wide combined	\$510,000	\$1133
Cellular Repeaters & interconnecting fiber optic cable to 3+ towers providing cell service (voice, data, text) community wide.	\$333,000	\$740

Why High Speed Internet?

There are two contributing reasons why people choose not to live in WWS, poor cell service and limited internet connections. Both are communications issues.

Some advantages of high speed internet:

- Grandparents can video conference (Skype & Facetime, AppleTalk) with grandchildren.
- Grandchildren and family & friends will visit because they can still remain in contact with their friends. The days of talking on the phone are long gone. Today, young folks stay connected with text messaging.
- Business owners and consultants can operate a small company remotely.

- Security cameras at the front gate and key locations can be monitored and recorded remotely. Each home can do the same.
- Inside of a home, cell phones can be routed through the internet without the echo and lag associated with satellite internet.
- Internet phone service (VOIP) provides more features at a lower cost than Verizon copper cables. And Verizon is phasing out the copper based landline system over time.
- Movies on demand (Netflix, Hulu, YouTube) are common in urban areas, but require high speed internet without data caps.
- With a microwave internet connection, a localized cell tower configuration could be installed to cover the neighborhood with cell service and 4G data for smartphones.

Advantages to All Lot Owners

Every lot served by high speed internet increases in value. Imagine two contiguous WWS lots. One has high speed internet; the other lot never will. What is the price differential between the two lots? Based on a typical \$35,000 per lot price, we believe that the FAST internet lot is worth \$5000 - \$10,000 more than the current non-internet lot.

The second advantage to all lot owners is liquidity. It takes a long time to sell lots and homes in WWS. We believe this is due to a limited number of buyers that are willing to live without FAST internet services and poor cellular coverage. A small sign on the front gate and at each available lot advertising “Whitewater Springs – a FAST internet community” would be a powerful marketing tool.

The Core Internet Hardware

A high speed internet project is similar to building roads in a community. The road itself is boring and expensive. What people do and how they use the road is interesting and relatively inexpensive. A good road is one that just works, without potholes, has little maintenance and goes where is needed. High speed internet requires a physical backbone for operation. The current standard for new communities is a fiber optic system, called FTTH (fiber to the home). Essentially, it works like the current copper wire telephone system, except that it uses light instead of electricity. The Fiber Optic System Components include:

Existing Conduits

Labor to install the fiber cable is the single largest capital cost. One of the key economic drivers for this project is that the original developer installed a spare underground conduit. This spare conduit essentially parallels the power and Verizon conduits. Some spare conduits are damaged or missing. But, without the spare conduit, this project would not be economically viable.

A contract installation crew spent a day reviewing the location, size and condition of the spare conduits. The community may save money by having the repairs performed by a local construction company.

We cannot find any plans for past conduit routing from Verizon, PEC or WWS files.

Not all areas are served by a spare conduit. Lots without power do not have a spare conduit, including:

- Section 5, 31 lots
- Section II, 46 lots
- Lots 205-215 (10 lots).

The project does not include providing FAST internet to these lots or any other lots that are inaccessible. We estimate that 422-450 lots of the 513 total plotted lots (**Goodwin number**) can be served by FAST fiber optic internet. However, there will be a distribution hub sized to handle the remaining lots if and when they receive utilities and streets.

Fiber Optic Cable

FO cable is a thin glass wire surrounded by a protective coating. Because it uses light instead of electricity, the power consumption is very low. The entire FO system should consume less than three 100W light bulbs. The FO cable is pulled through the conduit. It is a special “bend resistant” design that allows it to curve easily. FO cable does not wear out and is rugged.

Step 1: Microwave Dish to Send/Receive Internet Signals

The nearest fiber optic cable is located miles from WWS. However, high speed internet bandwidth is available via microwave transmission from a Liberty Hill provider about 12 miles East of WWS. A small antenna (Monopole) would be located on the water tank property located on Whitewater Spring Drive. Small electronics for the microwave antenna are housed inside the pump house which converts the microwave signals to an optical signal. A Fiber Optic (FO) cable sends the signal from the water tower building to the pool house (NOC) for distribution, monitoring and the various available options (VOIP, TV, HDTV, Security features and others).

Preliminary talks with the water company leadership show that this is a doable arrangement and that they are open to this idea and willing to move forward. A legal agreement is needed between WWS and the water corporation for the use and/or rental of tower & room space.

Head-End at the Pool House

The “headend” is the heart of the system and provides a point where all active equipment and all power sources would be installed. The HeadEnd center would have three racks of equipment, each 19” wide x 7 ft. high. The equipment includes power supplies, fiber terminals, monitoring and recording devices and the optical switching gear. The center will also support any future video (TV) equipment.

The old men’s shower room inside the pool house will be upgraded and converted to a secure, air conditioned room. It is more than large enough and already contains a HVAC system.

We have received a detailed equipment list and fixed costs for the Head-End equipment, racks and installation.

Internet signals are received from the microwave dish at the water tank and are sent out to the community via the fiber backbone.

Outside Fiber Cable Layout

It is possible to put an individual FO cable to each of 400+ homes, but that is a lot of cable. Our unpaid consultant, Fiber Instrument Sales, spent around 100 hours developing a community cable plan. We have signed a NDA agreement that covers this work. Basically, the community is divided into three “distribution areas” (DA). One FO cable goes from the pool house head-end to each DA. A “splitter” is located at a central spot in each DA. The “splitter” separates the optical signal from one cable into as many as 32 separate FO cables. These new FO cables feed a Local Convergence Point (LCP) which is a much smaller hub that splits the fibers again and feed the individual lots.

Near each lot will be a small, earth colored pedestal similar to the existing Verizon pedestals. Each pedestal can serve up to eight lots. Basically, there will be one FAST FO pedestal wherever there is a Verizon pedestal or a empty conduit line.

This completes the WWS FAST Community fiber optic internet system. Each lot with utilities will have a FAST FO termination point. But we still need to connect existing and future homes to the FO system.

HomeOwner Connection

When a homeowner wants to access the WWS FAST internet system, there are two steps. First, the home needs to run a FO cable from the street pedestal to the outside of the home. The cable is rated for outdoor use and would be “shaken in” a few inches underground by a vibratory plow. An Optical Network Enclosure is attached outside the house (just

like the Verizon box). Then a small 3/16" cable is run into the home and feed the Optical Network Terminal (ONT). The ONT has connection ports for Ethernet, WiFi router, cable TV and VOIP phones (not all services are automatically available). We also suggest that during new home plan submission that the WWS ACC also requires a spare conduit be laid for fiber from the street to the home.

We propose to certify 1-2 local installers to perform all "street to home" connections on behalf of WWS. This ensures consistent quality across the neighborhood, timely installations and local service.

In the second step, the homeowner notifies the Network Operations Call Center (NOCC) 1-800 phone contact number that they desire a connection and which services are needed. The NOCC will tell the local contractor which FO cable to use in the street pedestal and will enable the desired services for the homeowner. They should also handle homeowner billing and technical support questions. Potentially this NOCC could send billing information to Goodwin Management as they have stated that they could also perform the billing function on their system.

This completes the fiber optic "highway" throughout the WWS community. Now let's look at how it can be used.

Homeowner Services

How Many Homeowners Will Subscribe to Internet Services? People who have lived with high speed internet find it difficult to live without. It comes behind water, but close to electricity, and probably ahead of paved roads, as a necessary community utility. People who have never had high speed internet find it difficult to imagine what they are missing. Because WWS has a high percentage of "never had it" homeowners, a certain percentage of residents will not want the services. We estimate that 40+ homeowners of the 65 total homes will subscribe to internet, phone and/or video services over a period of 2-3 years due to current contract obligations with providers.

High Speed Internet

The WWS FAST system will provide internet speeds comparable to Verizon FIOS or cable internet. It will be many times faster than the current Excede/HughesNet satellite internet. A large microwave internet supplier charges \$2000/month for a 100MB/sec bandwidth (upstream and downstream). This is the minimum charge for a minimum bandwidth. This bandwidth is sufficient for 100 users. Additional bandwidth can be added at any point.

There is no reasonable cap on data usage as there is with satellite internet. The homeowner will be able to skype with family and download high definition movies, play online games or perform other time critical transactions like trading stocks.

We propose that FAST internet service charges be comparable to Excede satellite internet monthly charges. This would more than cover the microwave internet cost and NOCC monthly fee.

VOIP Phone Service

VOIP phone service is an alternative to the existing Verizon phone service. The homeowner can have two landlines or change their current phone number to the VOIP system. A VOIP phone works just like a current Verizon phone, except that it has many more options and features at no charge.

The cost for each VOIP phone connection is \$20/month (plus taxes). WWS FAST may wish to sell the VOIP phone service for slightly more. With an internet connection, a homeowner can purchase VOIP phone from any number of providers. Magic jack- \$5.00/mo or \$35/yr + \$40.00 for MJ Plus includes 6 mo free calls US & Canada and long distance, called ID, Voice mail, call forwarding, call waiting, free 411, VOIPO- \$15.00/mo, Ooma- \$129.99, Basic Talk-\$9.88, Net Talk \$42.67, Obihai \$38.89, Vonage 39.88 just to name a few.

Security System

The front gate, pool house and each water pump house would have a FO connection point. Security cameras could be installed and monitored remotely through the FAST system. Presently, the cameras save photos to a local drive that must be manually retrieved to view. With a new system, we could upload the images to the cloud.

The front gate video feed can be viewed on the homeowner computer or TV. They can see who is coming through the gate. The front gate can be opened through a homeowner computer or phone.

The FAST system allows a homeowner to install a real time security system at their house and to monitor it from anywhere in the world.

Video (Television) Services

Video delivery is the most difficult part of the potential services. It is a completely separate sub-project that stands or falls on its own economic merits. There are two options today, bulk delivery and individual delivery. Individual delivery is the current practice. Homeowners contract with DirecTV or Dish Network. Monthly fees range from \$50 to \$120+/mo.

The alternative is bulk purchase and delivery of video streams for resale to community homeowners. Typically, MDU Solutions (or other bulk suppliers) will negotiate a Right of Entry into the community for 3-7 years. They will install two 3-ft. dia. satellite dishes at the pool house along with other "head-end" equipment. This equipment obtains the satellite video channels and feeds them into the FAST fiber optic system (NOC). Another dish obtains signals from local TV stations. Installation takes one day. The video equipment is about \$40,000 installed cost.

Video content comes in multi-channel packages. It is not possible to obtain only selected channels. Basic channels are a set package. ESPN includes 8 sports stations.

The bulk cost for Basic channels, local channels and the ESPN sports package would be \$14.25 per site (or about \$6,400 per month). There is no limit the number of TV's connected in the home. With this being bulk, everyone gets all channels.

Because this is a bulk solution, the billing is on 100% of the property, not just the built and available homes. The billing would be on 450 connected sites. Splitting the total cost between 40 users is \$160/mo. The breakeven point is somewhere around 60-80 users thus the more users the lower the actual cost is to the subscriber.

We are exploring alternative billing arrangements based on number of homeowners, not total sites. We want the up-front equipment cost amortized into the monthly user charges. We suspect that video services will be competitive with satellite TV and more reliable.

Localized Cell Phone Service

Many people have only one phone, their cell phone. Smart phones can send/receive calls through a wireless router. Cell phone service is available within the WiFi boundaries, typically within the house. The technology works with satellite internet, but there is a noticeable lag and poor voice quality. It works very well with high speed internet systems. This service is provided with the smart phone data package.

Tech Support

This is a required service. A company, like MDU Solutions, establishes a remote Network Operations Call Center (NOCC) for the WWS community. They provide a 24/7 tech support center for resident to call into with any support issues. They monitor the entire data network and work with the bandwidth vendor and any on-site technicians to resolve any outages and activate new homeowner ONTs. Support costs generally run \$4 to \$8 per homeowner per month, depending on services provided and volume. A full solution NOCC and tech support, which includes the 24/7 call center, network mon-

itoring and alarming, bandwidth monitoring, service activations and changes, and hosted email service for residents is \$5/home/month. This is for active homes, so costs only go up as we add additional homes. There are additional fees for monitoring and alarming, based on additional devices (routers, switches, OLT's, etc). They can configure any router and OLT as well as design the IP network (IP addresses, subnets, etc).

The NOCC would also handle billing of homeowner services or this could be done by Goodwin Management services.

In other words, the NOCC center handles the routine operation and support of the WWS FAST system. They are the ones that activate the software switch that turns on the homeowner's selected services.

Miscellaneous Information

Restrictions on Broadcasting Signals in the Community

There are no FCC requirements or any State regulatory requirements to own and operate a community wide communication transport system. It is just as if we were in a building or campus. When we transmit over the airwaves, there are restrictions. But we are not building any wireless networks. We are going to utilize a microwave network but that is owned and operated by a company that has its own requirements.

Verizon Copper System

The WWS community owns the conduits. In concept, Verizon has an easement to use one of the three conduits for their copper telephone system. There is a lot of spare capacity in the Verizon conduit. We prefer not to use this conduit to avoid potential damage (both ways). However, if needed, the FO cable can be placed in a small internal conduit located in the Verizon conduit.

Confidentiality Agreement

We have signed a Confidentiality Agreement with Fiber Instrument Sales. They have performed extensive design engineering, equipment selection lists and community cable layout plans. This intellectual property should not be disclosed outside of the WWS Technology Committee and Board of Directors.

This agreement does not lock us into this vendor. It does prevent us from giving FIS information to another vendor. A new vendor needs to develop their own design plan and information.

What Could Go Wrong

This is a list of the areas where we think problems could occur and where more research is required in Phase 2:

- Underground conduits are unusable. We need to become very comfortable with the fiber cable installation phase of this project. At the same time, there seems to be a good possibility that we could save \$100K over estimate on this item.
- It is not clear if video (TV) can be economically implemented with current level of homeowners. But this is a standalone decision that has no impact on the rest of the FAST project. It could be implemented at any time.
- We might find a totally different way to implement a FAST project. A fiber optic cable could magically appear in front of the subdivision. Verizon or ATT could decide to upgrade the community on their dime. But there are limited technologies available today and this appears to best solution today.

APPENDIX A

Capital Costs for Fiber Installation and Hardware

We have a detailed proposal for the Head-End equipment from FIS. They prepared a detailed fiber cable layout plan based on the WWS plot plan layout. Installation costs are estimated, but a three man contractor did inspect the WWS property for their cost estimate.

This provides a fiber optic connection at the street, but does not include connection to each home. It does not include the equipment required by the homeowner.

Equipment Costs	Cost
Fiber cable (65500 ft plus 10%)	\$38,000
Pool house Equipment: GPON components, switching units, power modules, optics, splitters, software.	\$23,000
Pedestals to serve all lots with utilities. Splice enclosures. Three distribution area cabinets. Miscellaneous equipment.	\$33,000
Misc Racking etc for equipment	\$2,000
Upgrade Men's shower area: add electrical outlets. Improve door access. New power surge equipment and battery backup system.	\$5,000
Laptop for NOC & Software \$800.00 FTA (Free To Air Satellite) Hardware \$900.00 OTA Omni Directional outside Antenna & Hardware \$150.00	\$2,000
Security cameras at men's shower area and front gate.	\$4,000
Labor costs to install above equipment (based on contractor estimate)	included
Engineering and Drafting Services	\$15,000
Subtotal Equipment and Hardware	\$122,000
Labor costs to pull fiber through unused conduit and terminate at drop located at each lot. Experienced estimate by FIS.	\$200,000 *
Subtotal	\$322,000
Contingency	\$38,000
Total Installed Capital Cost	\$360,000
Cost per Lot (based on 450 lots)	\$800/lot

Equipment costs are based on a detailed project design and estimate by FIS. It is unlikely that competitive bidding will reduce the GPON equipment cost significantly. A competitive bid requires detailed specifications. This could likely add \$25-50,000 to the overall project cost.

The fiber installation labor costs seem high to us. A labor cost of under \$100,000 seems more reasonable. We believe that the existing conduits could be inspected, cleaned and repaired as required by a local, lower cost contractor. This reduces the uncertainty factor for the fiber installation contractor and should reduce his overall cost. The fiber installation company would be licensed, FIS Certified, insured and bonded.

We propose that the capital cost be covered by a special assessment per lot for the lots that receive a fiber optic internet street connection.

Appendix B

Homeowner Costs - Street to House

Each homeowner, new and existing, is responsible for installing FO cable from the street to his home. Like Verizon phone lines, some may never connect their house. We want to make this process as standard and painless as possible. We will identify and train 1-2 local contractors on the installation process. Usually, a vibratory plow can lay the FO cable a few inches underground along the existing utility easements. WWS FAST will provide the external house and the internal ONT equipment at cost. The Network Operations Call Center will handle the software setup and general troubleshooting.

Installation Costs	\$
External terminal box on the house. Internal ONT (Optical Network Terminal) box	\$200
Exterior rated FO cable (400 ft x \$0.50/ft)	\$200
Cable installation to external terminal box (6hr x \$75/hr)	\$200-\$450
Cabling and connections inside the home. Troubleshooting.	\$0-\$200
Subtotal	\$600-\$1050 per home

These costs would be borne directly by the homeowner whenever they elected to connect to the FAST internet system.

The Technology Committee would work with the ACC Committee to establish minimum standards for the equipment and installation techniques. We suggest that all new homes be required to pull fiber optic cable from the street to the house termination box. We also recommend new home conduit installations include a spare communications conduit and FO cable.

Appendix C

Operating Costs for the WWS FAST Fiber Optic System

Our general philosophy is that the homeowner user fee should cover the cost of the system operation. Excess funds should be generated to cover future capital costs. These excess funds could be used for general WWS community projects as well.

Internet

Fixed Operating Costs	Cost \$/month
Electricity (250 watts continuous). \$0.10/KW	\$200/mo
NOC monitoring fee. \$8/user/month x 40 users	\$320/mo
Microwave Bandwidth Cost. 100MB/sec up/down	\$2000/mo
Subtotal	\$2520/mo
Cost per User (40 users)	\$63/mo/user

Homeowner internet fees would be at least \$65/mo to cover the ongoing operating cost. This is competitive to satellite internet charges.

As the number of subscribers increases, these service charges could become a positive revenue source for the WWS community or monthly rates could be reduced or both.

VOIP Phone

VOIP phone service can be turned on and off at the NOC at any time. The phone fee from MDU Solutions is \$18/user/month. We propose that homeowners be billed at \$25/mo plus taxes.

Video / TV

Equipment Costs	
Onetime Cost for Video Dishes, Head-end Components, Over the Air TV antennae and installation	\$44,000
Operating Costs	
Bulk video charge based on 450 connected lots at \$14.25/lot. Includes head-end equipment and installation	\$6412/mo
Operating Cost per user (40 users)	\$160/mo/user
Operating Cost per user (80 users)	\$80/mo/user

With lots of community homes, video service could be a significant revenue source for WWS. We want bulk video charges based on existing homes (instead of total lots). The capital cost should be rolled into the monthly fee. We need to review alternate costs structures with the video suppliers.

See Appendix D and E for more information.

FAST (Fiber and Sky Transport) Cellular Project

Executive Summary

A cellular repeater grabs a weak cell signal and retransmits it a stronger signal within the community. Cellular voice and 4G LTE data are both broadcast community wide.

The “donor” tower is located at the water tank where it collects the signals. Three repeater towers are located around the perimeter to rebroadcast stronger signals. The four towers must be tied together with fiber optic cable for transfer of data signals; they cannot communicate between towers without a fiber connection.

How It Works

ATT and Verizon have cell towers located within 4 miles of the WWS property (see attached map). A receiving “donor” tower would be installed in WWS. The receiving tower picks up the ATT and Verizon signals and rebroadcasts a stronger signal to four smaller broadcast towers located within the WWS community.

The donor tower (monopole design) would be at the water tank which has better access to power and other utilities. This tower would be 40-50ft high. And alternate repeater tower (monopole design) locations 3-4 would be along the south & west common areas.

The broadcast signal strength is relatively low. It is possible that some homes would require a special receiver inside house to amplify the signal within the house walls, especially if the house has a metal roof or radiant barrier.

Cell repeaters are not Verizon or ATT specific. They amplify and repeat every electronic signal within a targeted bandwidth.

Cell Repeater Advantages

- It is the only way to obtain cell service within WWS. If cell service is a priority over high speed internet, then this technology is the best direction.
- LTE 4G internet will also be broadcast. LTE 4G is primarily marketed by ATT/Verizon as internet for smartphones and tablets, but it can be connected to any wireless device. LTE 4G about the same speed as satellite internet. 4G data usage costs \$10/GB compared to \$4/GB for satellite internet.
- A homeowner can eliminate their Verizon landline and satellite internet service which could save \$100 - \$200/month.

Cell Repeater Disadvantages

- All residents will have “line of sight” to at least one tower. We believe that, if the towers do not have lights, the structures will blend into the landscape. Towers are very prevalent outside of WWS, but we just don’t notice them anymore. All towers over 192’ are required to have lights.
- The cell repeater project will be a WWS capital and operating expense. There is no way to recoup any of the costs from cell users. All contracts are with ATT, Verizon or other major carriers and the company that installs the towers & equipment.
- The cell repeaters require a fiber optic backbone to make all towers work as a single circuit. This is the major project expense.

Cell Tower Locations

The donor tower is located at the NW corner of WWS property (Water Tank property) . From here, it is 3-4 miles to the ATT and Verizon cell towers.

The 2-5 broadcast towers would be located around the property so that every lot can see at least one tower. The towers are 30-40ft high Unipoles without lights. More towers means better coverage and shorter towers that use less power. As a minimum, we need two tower locations at:

- Two along the East corner along the southern WWS boundary. This is on the high south ridgeline located 1 mile East of the donor tower. This covers the south & east side of WWS.
- Water tank - covers Woodhollow, the lake and the north & west side of WWS.

If we do not have a fiber optic backbone; these three locations minimize the amount of fiber cabling to be installed however coverage may not be optimum or complete in all areas of WWS.

If a fiber optic backbone is already in place, three additional broadcast towers are recommended:

- Pool house – covers inner community and downslope areas.
- Front Gate area.
- Low lands between the front gate and pool house.

Interaction with Major Carriers

The major cell carriers have purchased the right to use certain wavelengths in the electronic spectrum. A cell repeater can interfere with the carrier's equipment. This is most common within urban environments where a repeater is installed within a building and it interferes with the carrier signal outside of the building. WWS has a very low risk of creating interference with carrier signals.

Our repeater project will need to file an administrative notice with FCC and major carriers. FCC law says the carriers are supposed to cooperate with repeater clients. Legally, they cannot reject without a solid technical reason. But they could claim as policy that they no longer approve repeaters being deployed. Sprint is notorious for this. If a carrier does not approve, the repeater equipment can reject that specific carrier's signal.

There is a considerable amount of work involved in reaching out to all the service providers to obtain a retransmit agreement. The main reason of getting their permission is simply to ensure they are aware of the deployment, so they could manage the bandwidth drain on their side and, if there are any issues, they know exactly who to contact immediately.

In summary, the major carriers must approve a repeater installation provided that it does not interfere with their signals. If they build a cell tower along 1174, then they would likely shut down a WWS repeater. But we would not care as long as we had cell service.

Likewise, individual homes within WWS that operate small cell repeaters will need to shut them down.

Cell Phone and 4G LTE Data

Cell phones receive cell voice signals. Smartphones receive cell and data signals. They are two separate parts of the spectrum, but most repeater antennas transmit both voice and data frequencies. There is almost no cost savings for repeating voice only signals.

Over time, 4G LTE and better is likely to become the preferred method of wireless internet transmission. We suspect that WWS residents that have smartphones (which includes every person under age 30) will find 4G internet indispensable. If they only access the internet via smartphones, 4G LTE may be the only needed internet service. 4G LTE internet is a viable backup internet provider.

What Could Go Wrong – Cell Repeater Project

- A major carrier installs a nearby cell tower. WWS would shutdown the repeaters and sell off the equipment.
- The repeater cell signal interferes with existing cell service of WWS residents located along the high exterior ridges.
- Cell service is spotty in some areas due to only two broadcast towers.

APPENDIX P1

Cell Repeater with Fiber Optic Backbone

Cost Summary

If fiber optic cables are already installed, the repeater project consists of installing towers, electronics and power supplies.

Equipment Costs	Cost
Engineering, drawings and technical support. WAG	\$35,000
Antennas, repeaters and four 30-40ft towers. JDTech quote x 1.7	\$80,000
Foundations, power cable, general installation costs.	\$25,000
Subtotal – Cell Repeater	\$140,000
Contingency	\$10,000
Total Installed Capital Cost	\$150,000
Cost per Lot (based on 450 lots)	\$333/lot

Operating Costs

Operating costs are minimal. Power consumption is comparable to light bulbs.

Maintenance Costs

For “carrier class” equipment, mean time between failures is around 40000 hours (4-5 years). We would expect a maintenance and monitoring contract similar to the internet NOC center (\$5000 per year).

APPENDIX P2

Cell Repeater – Stand-alone Installation

Cost Summary

A stand-alone cell repeater project using only two repeater towers would require fiber optic cable between the three towers. The FO cable would run the ridgeline along the West and South property boundary.

Equipment Costs	Cost
Engineering, drawings and technical support. WAG	\$35,000
Antennas, repeaters and four 30-40ft towers. JDTech quote	\$48,000
Foundations, power cable, general installation costs.	\$25,000
<i>Fiber Optic cable and installation (JDTech quote. installer visited WWS)</i>	<i>\$195,000</i>
Subtotal – Cell Repeater	\$303,000
Contingency	\$30,000
Total Installed Capital Cost	\$333,000
Cost per Lot (based on 450 lots)	\$740/lot

Once again, the cost to pull fiber optic cable dominates the project economics. This installer’s cost was only slightly less than our previous estimate to wire the entire subdivision. One of these estimates is obviously out of sync.

But it seems reasonable to wire the entire neighborhood instead of just three towers.

If we find a way to install multiple cell towers that do not need fiber optic cable interconnections, then that will be the lowest capital cost for both internet and cell voice. But we have no indication that this is possible.

Financial Plan

Ownership

The fiber optic system and cell repeater system would be owned by the WWS POA. These projects are not major revenue generators. They are essentially common utilities like the roadways. Because they are cost centers, they should not be placed under separate revenue generating corporate structure.

Goodwin Management is best suited to handle assessment bookkeeping.

Management

An operating subcommittee would be established. Their main function would be “point of contact” for outside entities. We do not see any physical work by the committee. The NOCC center would be contracted to monitor the system and call out selected maintenance workers.

The NOCC center also handles billing for internet and VOIP services.

Source of Project Capital

All project funding comes from property assessments. This can be “per lot” or “per acre”. We recommend that only lots served with internet have assessments increased. If the cell repeater project is instituted, one could argue that all lots should see an increased assessment.

We recommend a onetime special assessment or long term financing to spread the costs over a longer period and to share the burden equally among property owners. Normal yearly assessments are low comparatively. The onetime assessment will be approximately \$1200 per lot. This is very affordable for the majority of WWS residents. 15 year loan @4.5% for \$600,000 is a Monthly payment of \$4,589.96 or \$55,079.52/yr. For an additional 10% premium, cash strapped lot owners can spread out payments over three years.

513 lots x \$1,200 = \$615,600.00

Part of the rationale for a onetime assessment is that the property values immediately increase. The beneficiaries of increased lot values should pay for the underlying costs.

Total Capital Funding

- Existing POA funds. Essentially, these are uncommitted funds or reserve accounts.
- One Time Assessments or assessments over a period of 3 years to cover the amount.
- Bank Loan repaid by normal yearly assessments. 15 year loan @4.5% for \$600,000 is a Monthly payment of \$4,589.96 or \$55,079.52/yr.
- We would like to avoid loans simply for the additional hassle factor. And we don't like borrowing money, philosophically. That being said it does spread the costs more equitably over all properties and over time.

Project Initiation Steps

- Decision to move forward or put these projects on hold or work on them as individual projects.
- Technology Committee will find additional vendors and collect additional information. There is a “best way” to do this project.
- BOD to authorize the project execution either by a POA Vote or thru the board directly.

- Nominate a FAST project execution team consisting of WWS volunteer residents and an outside non paid volunteer project manager.
- Prepare a detailed project execution plan.
- Have the WWS Budget committee or appoint a group of people familiar with funding processes to look into various funding options and grants for these amounts and present its findings in public to the POA Board for review.
- BOD should place 100% of the project funding in a dedicated project account.